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Pakistan Risks Locking in Long-Term Overcapacity and Expensive Power

Imported Coal and LNG Power Plants Are Stranded According to New Power Plan

Executive Summary

Pakistan's new long-term power capacity plan largely fails to live up to its identified salient features and the government's stated principles of sustainability and affordability.

The National Transmission and Despatch Company (NTDC) published its latest long-term power plan – the Indicative Generation Capacity Expansion Plan 2047 (IGCEP) – in April 2020. According to the IGCEP, its salient features include significantly increased use of renewable energy and domestic coal-fired power, and reduced fossil fuel imports and carbon emissions.

Future Power Demand Growth Overestimated

As the IGCEP report notes, "Energy and demand forecast provides the basis for all planning activities in the power sector." This is quite correct and the result of the IGCEP's over-optimistic power demand growth forecasts is that more power capacity than needed may be planned and built.

The Medium growth forecast is the foundation of the IGCEP's Base Case power capacity addition scenario. This forecast assumes that GDP growth increases from 4% in 2020 to 5.5% by 2025, and remains at that level out to 2047. This is despite 2019 GDP growth of just 3.3% according to the IMF. In addition, the IGCEP forecasting was completed before the COVID-19 pandemic pushed the world into an economic slump so therefore does not take subsequently reduced GDP forecasts and power demand growth into account.

More power capacity than needed may be planned and built

The IGCEP's Medium demand growth forecast was too optimistic even before COVID-19 but the pandemic has made it even more obsolete.

Other nations, including China, India, Bangladesh and Indonesia, that have over-estimated power demand growth are also dealing with the issues of overcapacity, declining utilisation rates, increasing capacity payments to idle plants and rising subsidies and tariffs to cover the cost of excessive, expensive power plants.

The Pakistan government's principle of affordability cannot be met if the power system is locked into long-term overcapacity – capacity payments to plants lying idle are already an issue and would become even more unsustainable if more overcapacity is locked in.

IGCEP Demonstrates Overcapacity, Stranded Assets by 2030

Under the Base Case scenario, the 5.3GW of coal-fired power plants fuelled by imported coal expected to be operational by 2030 have a collective utilisation of just 14%. Under this scenario these coal plants are stranded – they cannot operate commercially at such a low utilisation rate without very generous capacity payments paid to them whilst they sit idle.

According to the IGCEP, the three operational imported coal-fired power plants – which have all become operational since 2017 – as well as coal and LNG plants yet to be completed, will only have a few years of high utilisation before their use drops to unsustainable levels and they are stranded.

If Pakistan's power capacity and generation figures resemble this model at 2030, this will be as a result of the nation building too much thermal power capacity. With the Base Case using the over-estimated Medium power demand growth forecast, there is a significant risk that actual utilisation rates for thermal power will be even lower, and stranded assets even higher than predicted by this model.

If the 14% utilisation rate for imported coal-fired power plants by 2030 is anything close to reality by that date, there will be significant implications for the Asian seaborne thermal coal market. Pakistan has previously been identified as one of the last few remaining growth markets for thermal coal exporters like South Africa, Indonesia and Australia, which would be needed to prop up demand as the more established, major coal importers move away from the fossil fuel.

There is significant risk that actual utilisation rates for thermal power will be even lower, and stranded assets even higher

IGCEP Ignores Power Technology That is Set to Dominate Globally Beyond 2030, Locks in More Stranded Assets

Although the IGCEP includes additions of renewable energy to meet the government's draft renewables target by 2030, renewable energy is neglected in the model after 2030 with no further wind power additions at all. The overall contribution of renewables to power capacity drops from 31% in 2030 to 23% in 2047 according to the model. Modelling declining contribution from renewables post-2030 makes the IGCEP look very out of touch with current power trends.

Any concerns about the ability of the power grid to cope with high levels of renewable energy can be resolved by planning grid upgrades now – something that

the IGCEP process should itself be enabling through accurate forecasts of how future, least-cost power sources can meet demand growth.

The lack of renewable energy focus comes despite the fact that Pakistan has excellent renewable energy resources and that wind and solar – which are already the cheapest source of new power generation in Pakistan – will be even cheaper throughout the 2030s and 2040s. Newer technology such as batteries that can store renewable energy will also be significantly cheaper by that time.

Instead, reduced reliance on fossil fuel imports is achieved via a major focus on more expensive domestic coal-fired power. As a result of the neglect of the cheapest source of power and focus on coal with its financially unsustainable capacity payments, the IGCEP fails to live up to the government's affordability principle.

The IGCEP fails to live up to the government's affordability principle

In addition, the IGCEP strangely models the addition of 20,000MW of LNG-fired power capacity between 2030 and 2047 with utilisation at virtually zero by 2047, stating that these are needed as reserve capacity to complement the intermittent nature of renewable energy.

The idea that a total 31,000MW of LNG-fired power is needed to balance the intermittency of 37,000MW of wind and solar power in 2047 is, at best, wildly inaccurate, especially given how cheap energy storage solutions will be by that time. In reality, tens of thousands of megawatts of LNG-fired power would be built at great cost and would then sit idle and stranded under this scenario.

The IGCEP models the addition of more than 35,000MW of hydro power between 2030 and 2047. With such large and complicated projects, significant cost and schedule overruns are almost guaranteed. Although major dams are planned in Pakistan for reasons other than power generation, the very long development timeframes and huge costs involved seem hard to justify given the presence of cheaper and quicker-to-build alternatives.

The IGCEP attempts to justify its focus on domestic coal and hydro by highlighting the need for the "indigenisation" of Pakistan's power mix. Certainly, a move away from reliance on imported fossil fuels makes sense, but the IGCEP is not putting anywhere near enough emphasis on wind and solar power which can increase indigenisation of the power system and improve energy security at a lower cost.

A focus on domestic coal-fired power also means the IGCEP doesn't meet the government's sustainability principle. Under the IGCEP's Base Case scenario carbon emissions almost triple by 2047 compared to 2020 levels. The IGCEP attempts to justify this by claiming that Pakistan's emissions intensity will be lower than the **current** average emissions intensity of OECD nations – a statement that completely

misses the certainty that the emissions intensity of OECD nations will be significantly lower by 2047 as modern power systems transition to renewable energy over the next two decades.

The EU is already considering the imposition of a carbon border tax on imports into the union. There is a high chance that such mechanisms will be commonplace by the 2040s as the world continues to make efforts to decarbonise. A power future that involves the expansion of both domestic coal-fired power and hence carbon emissions as suggested by the IGCEP would create significant carbon risk for Pakistan.

Modern power systems will transition to renewable energy over the next two decades

Pakistan would be far better off reducing reliance on fossil fuel imports via an appropriate emphasis on renewable energy. By switching focus from expensive and polluting domestic coal-fired power to renewables, the IGCEP would be better able to live up to the government's principles of affordability and sustainability.

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Introduction

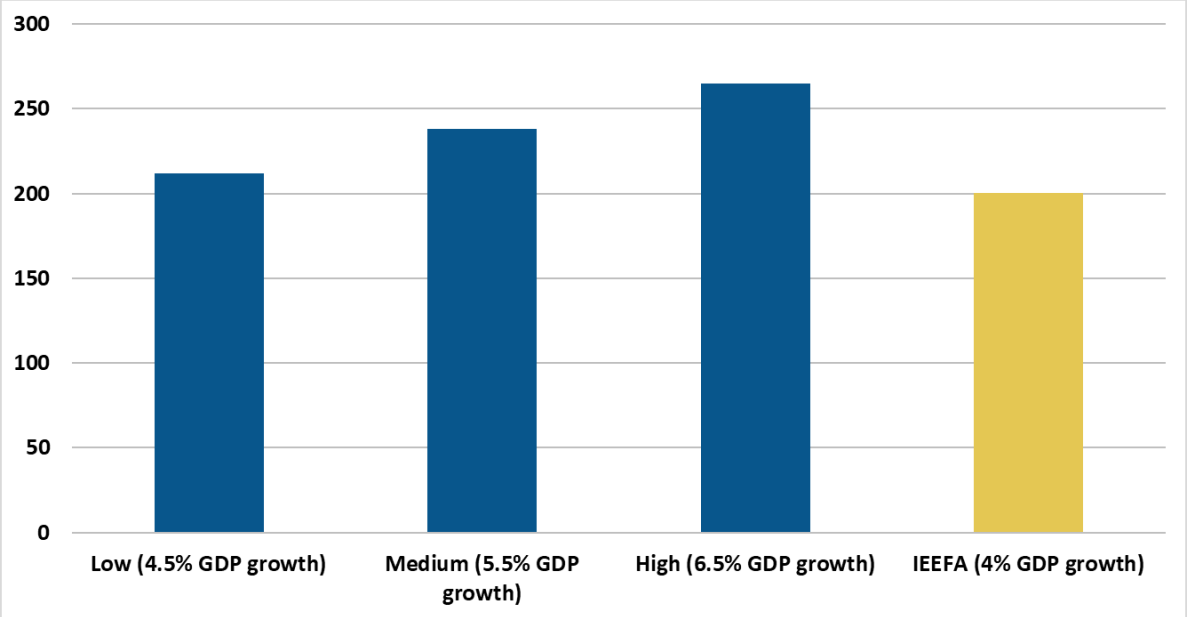
Pakistan's National Transmission and Despatch Company (NTDC) published its latest long-term power plan – the Indicative Generation Capacity Expansion Plan 2047 (IGCEP 2047) in April 2020.

The IGCEP models power demand, and power capacity additions to meet that demand, out to 2030 and 2047 under various scenarios with the central scenario known as the 'Base Case'. This report examines the output of the IGCEP's modelling.

IGCEP Power Demand Growth Forecasts Are Too High

With overcapacity in the Pakistan power sector already an issue and getting worse amid the COVID-19 induced economic downturn,[1] accurate power demand growth forecasts in the IGCEP 2047 are imperative if long term overcapacity is to be avoided. However, Figure 1 suggests that the IGCEP 2047 is over-estimating future power demand growth, a situation that risks locking in overcapacity into the long term.

Figure 1: IGCEP 2047 Forecast Power Demand 2029-30 vs IEEFA 2029-30 Forecast (TWh)



Source: IGCEP 2047, IEEFA calculations.

Figure 1 shows the 2029-30 power demand forecasts under the IGCEP's Low, Medium and High growth scenarios which correspond to GDP growth of 4.5%, 5.5% and 6.5% respectively. The Medium growth forecast is the foundation of the IGCEP's

[1] IEEFA. Thar Coal Locking Pakistan Into Unsustainable Capacity Payments. June 2020.

Base Case power capacity addition scenario discussed below. This forecast assumes that GDP growth increases from 4% in 2020 to 5.5% by 2025, and remains at that level out to 2047. This is despite 2019 GDP growth of just 3.3% according to the IMF.

In addition, the IGCEP forecasting was completed before the COVID-19 pandemic pushed the world into an economic slump so therefore does not take subsequently reduced GDP forecasts and power demand growth into account. In its April 2020 World Economic Outlook, the IMF forecast Pakistan GDP growth in 2020 at -1.5% followed by 2% in 2021.[2] The World Bank's more recent June 2020 Global Economic Prospects report had an even less optimistic view for Pakistan GDP growth, -2.6% in 2020 and 0.2% in 2021.[3]

The IGCEP's Medium demand growth forecast was too optimistic even before COVID-19 but the pandemic has made it even more obsolete.

Figure 1 also includes IEEFA's own high-level demand growth forecast in yellow. IEEFA's forecast is a far simpler calculation than those of the IGCEP but likely to be more realistic not least because it takes the economic impact of COVID-19 into account. We assume GDP growth of just 1% in fiscal year 2019-20 and 2% in 2020-21 due to the impacts of the pandemic. Thereafter, we assume growth of 4% per annum out to 2029-30 – a more conservative estimate than the IGCEP Medium scenario's 5.5%. We also assume energy efficiency gains of 1% per annum and for transmission and distribution (T&D) losses to reduce 0.2% per annum. IEEFA's forecast of gross power demand takes into account the fact that additional generation is needed beyond net power demand to account for T&D losses (Annexure I).

IEEFA's 2029-30 power demand growth forecast is lower even than the IGCEP's Low demand forecast. There is a risk that the Medium demand forecast used in the IGCEP's Base Case scenario is a significant over-estimate.

Over-optimistic Demand Forecasting Leads to Poor Planning Decisions

As the IGCEP 2047 report notes, "Energy and demand forecast provides the basis for all planning activities in the power sector." This is quite correct and the result of the IGCEP's over-optimistic power demand growth forecasts is that more power capacity than needed may be planned and built.

Prime Minister Imran Khan noted in April 2020 that total capacity payments to public, private and CPEC power generators could reach an entirely unsustainable Rs1.5 trillion (US$9bn) in the next few years as more power capacity is added.[4] With an increased risk of overcapacity, Pakistan is faced with the prospect of increasing capacity payments being made to power plants lying idle much of the time.

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[2] IMF. World Economic Outlook. April 2020.
[3] World Bank. Global Economic Prospects. June 2020.
[4] IEEFA. Thar Coal Locking Pakistan Into Unsustainable Capacity Payments. June 2020.

Overcapacity was an issue in Pakistan even before the coronavirus pandemic. Slow economic growth in Pakistan prior to COVID-19 meant that power demand growth was lower than expected. Electricity consumption for fiscal year 2018-19 rose only 2.3% nationally.[5] Across Pakistan as a whole, the utilisation rate of gas-, oil- and LNG-fired power plants declined to 39% in FY2018-19, down from 43% in the previous year, despite no more capacity additions of this type during the year. The overall thermal power capacity utilisation (including coal plants) was just 40% in FY2018-19 according to National Electric Power Regulatory Authority (NEPRA) data.

Other nations that have over-estimated power demand growth are also dealing with the issues of overcapacity, declining utilisation rates, increasing capacity payments to idle plants and rising subsidies and tariffs to cover the cost of excessive, expensive power plant construction.

China has experienced coal plant utilisation rates under 50% due to its excessive coal power build out whilst India's coal power fleet was suffering with utilisation of only 55% even prior to the worst impacts of COVID-19.[6]

Despite strong recent economic growth, Bangladesh now has significant excess power capacity that has required increased capacity payments to plants lying idle much of the time. Overall power capacity utilisation in Bangladesh for 2018-19, prior to COVID-19, was just 43%, while capacity payments to idle plants reached Tk90bn (US$1.1bn) in 2018-19 as power demand growth has lagged behind capacity additions.[7]

PLN, Indonesia's state-owned power utility, has seen its misguided reliance on new coal-fired independent power plants (IPPs) lead to the need for rapidly escalating government subsidies. The subsidy reached an enormous US$5bn in 2018.[8] With more of these projects set to come online, PLN's IPP payments are set to increase further still. IEEFA has forecast that government subsidy payments to PLN may reach US$7.2bn in 2021.[9]

The Indonesian power systems' dire financial situation has been driven in part by poor demand forecasting. The latest iteration of Indonesia's power development plan includes a power demand growth forecast for 2019-2028 of 6.4% a year. This is despite the fact that actual power demand growth in 2018 was only 5.1% and the average for 2013 to 2018 was 4.6%.[10] A former interim chief executive of PLN publicly acknowledged in July 2019 that the plan for a fleet of new coal-fired power

[5] NEPRA. State of the Industry Report 2019.
[6] IEEFA. Who Would Still Fund a New Coal Plant in India? Stranded Asset Risks Continue to Rise as Solar Deflation Continues. May 2020.
[7] IEEFA. Bangladesh Power Review: Overcapacity, Capacity Payments, Subsidies and Tariffs Are Set to Rise Even Faster. May 2020.
[8] IEEFA. PLN's Fractured Finances Require Real Leadership. 30 May 2019.
[9] IEEFA. PLN in Crisis – Time for Independent Power Producers to Share the Pain? April 2020.
[10] IEEFA. 2019 Energy Plan Falls Short. 4 March 2019.

plants should be re-evaluated due to lower-than-expected electricity demand growth.[11]

IGCEP Demonstrates Overcapacity, Stranded Assets by 2030

The IGCEP models a number of future power addition scenarios but the central scenario is the Base Case which is founded on the Medium power demand forecast discussed above. Details of power capacity and generation as modelled under the Base Case scenario by 2030 are shown in Figure 2. From these figures, utilisation rates of each power source have been calculated.

Figure 2: IGCEP 2047 Base Case Capacity, Generation and Utilisation at 2030

	Base Case Capacity 2030 (MW)	Base Case Generation 2030 (GWh)	Base Case Utilisation
Imported coal	5,297	6,557	14.1%
Domestic coal	6,055	31,927	60.2%
LNG	10,882	21,128	22.2%
Gas	1,504	682	5.2%
Nuclear	4,407	30,221	78.3%
Bagasse	913	4,068	50.9%
Solar	12,793	21,073	18.8%
Hydro	20,737	86,759	47.8%
Imports	1,000	1,987	22.7%
Wind	10,327	33,537	37.1%
Oil	2,475	58	0.3%
Total	**76,390**	**237,997**	
Renewable %	31%	25%	

Source: IGCEP 2047, IEEFA calculations.

Figure 2 shows that the Base Case scenario sees renewable energy making up 31% of overall power capacity by 2030, in line with the government's draft renewable energy policy which targets 30% by 2030. Modelled utilisation rates for solar and wind power are 19% and 37%. Recent actual solar and wind power utilisations rates have been 21% and 30% respectively so the modelled wind power utilisation in the Base Case seems rather optimistic.

Most striking however, is that modelled utilisation rates for some other power sources are very low. In particular, under the Base Case the 5.3GW of coal-fired power plants fuelled by imported coal expected to be operational at 2030 have a

[11] IEEFA. The Case for System Transformation in Indonesia. November 2019.

collective utilisation of just 14%. Under this scenario these coal plants are stranded – they cannot operate commercially at such a low utilisation rate without very generous capacity payments paid to them whilst they sit idle.

Under the Base Case scenario, the 1,320MW Sahiwal coal plant, which became operational in 2017, is modelled to have utilisation of just 6% in 2024, down from 84% in 2022. Similarly, the 1,320MW Port Qasim coal plant's utilisation will drop from 84% in 2024 to just 22% in 2027. The Port Qasim plant only became fully operational in 2018. The 1,320MW Hubco plant is even newer, becoming operational in 2019. Under the Base Case model, it will see utilisation drop to just 10% by 2026.

The under-construction Jamshoro coal plant will only see two years of viable operation according to the model. After seeing utilisation of 83% in 2022 and 2023, the rate will plunge to 14% the following year and 5% in 2026. The proposed 300MW Gwadar coal plant has not even begun construction yet but, according to the Base Case scenario, it will only see three good years of operation before its utilisation rate drops to unsustainable levels.

The results of the IGCEP's Base Case reflect a growing trend in Pakistan away from reliance on imported coal and towards plants fuelled by domestic Thar coal deposits. A significantly weakened Pakistan rupee has made coal imports all the more expensive in the recent past.

The Base Case models Pakistan's domestic coal plants operating at a significantly higher overall utilisation rate of 60% in 2030. Whilst this is a more sustainable rate, it is still a less than optimal overall rate for the domestic coal fleet, indicating the overcapacity that is built into this model.

A preference for domestic fuel and improved energy security is also evident in the figures for LNG capacity and generation at 2030. The Base Case scenario sees 11GW of LNG-fired power capacity operating at an average 22% utilisation in 2030. Within the LNG fleet there is significant disparity of utilisation. The relatively new Balloki, Bhikki and Haveli plants, representing around 3.6GW, are all modelled to be operating at 67% utilisation in 2030 with the rest of the fleet effectively shut down. This includes the under-construction 1.2GW Trimmu LNG power plant which is modelled to operate at 92% in 2021 before crashing to 16% the following year and effectively zero thereafter.

By 2030, the Base Case sees domestic gas- and oil-fired plants, amounting to around 4GW, operating at or close to zero utilisation. However, by that time most if not all of these plants are likely to be at or close to the end of their intended operating lives.

Unlike the oil- and domestic gas-fired plants, some of the large and expensive imported coal- and LNG-fired plants are new and effectively stranded according to the IGCEP's Base Case scenario. If Pakistan's power capacity and generation figures resemble this model at 2030, this will be as a result of the nation building too much thermal power capacity. With the Base Case using the over-estimated Medium power demand growth forecast, there is a significant risk that actual utilisation rates

for thermal power will be even lower, and stranded assets even higher than predicted by this model.

Implications for Seaborne Thermal Coal Market

If the 14% utilisation rate for imported coal-fired power plants by 2030 is anything close to reality by that date, there will be significant implications for the Asian seaborne thermal coal market.

Pakistan is currently the second largest destination for South African coal exports.[12] With South Africa's main export destination (India) taking redoubled action to reduce reliance on coal imports,[13] coal exporters will have been hoping for coal import growth in Pakistan. If the IGCEP's 2030 forecast is anything to go by then that hope is badly misplaced.

Pakistan has previously been identified as one of the last few remaining growth markets for thermal coal exporters which would be needed to prop up demand as the more established, major coal importers move away from the fossil fuel. The resources minister of Indonesia – the world's largest thermal coal exporter – has recently stated that the nation will seek to expand exports to Pakistan, Bangladesh and Vietnam as exports to its biggest markets such as China and India decline.[14] Bangladesh is now planning a significant curtailment of its coal power build-out with the cancellation of 13GW of coal power projects.[15] At the same time, Vietnam is facing increased difficulty raising finance for its coal power plans. Vietnam's National Steering Committee for Power Development has recommended that 15GW of planned coal power plants be scrapped.[16] With Pakistan shifting away from coal imports as well, the potential growth markets look increasingly likely to disappoint coal exporters.

IGCEP Ignores Power Technology That is Set to Dominate Globally Beyond 2030

Under the Base Case, the IGCEP models that Pakistan's total power capacity will reach 168,246MW by 2047 (Figure 3). Between 2030 and 2047, the Base Case sees almost all domestic gas- and oil-fired capacity shut down. In addition, there are no more capacity additions for imported coal-fired, nuclear, bagasse or wind power.

The lack of any wind power additions after 2030 is particularly strange given Pakistan's wind resources, the fact that renewables are already the nation's

[12] Business Day. Bad Weather and Falling Demand Put a Damper on Coal Exports. 4 February 2020.
[13] Economic Times Energyworld. CIL Mandated to Replace At Least 100 MT of Imports With Domestic Coal in FY21. 14 May 2020.
[14] Reuters. Indonesia's 2020 Coal Exports Seen at 435 million T – Energy Ministry. 10 June 2020.
[15] The Business Standard. Bangladesh Plans to Abandon Coal, Go for LNG. 25 August 2020.
[16] Bloomberg. Coal's Sell-By Date Just Moved Closer. 12 March 2020.

cheapest source of new power generation and the certainty that renewable energy will only get cheaper into the future.

The Base Case does include solar additions between 2030 and 2047 but the overall contribution of renewables to power capacity drops from 31% in 2030 to 23% in 2047. Presumably, the lack of any proposed government renewable energy target beyond 2030 is being incorporated into the IGCEP model as meaning the focus on renewables will drop significantly beyond that year – a highly unlikely eventuality given the technology's continually declining cost. Despite the lack of a post-2030 target, it would have made far more sense for the IGCEP to model at least the maintenance of a 30% renewable energy contribution to overall capacity (the 2030 target) out to 2047.

Figure 3: IGCEP 2047 Base Case Capacity, Generation and Utilisation at 2047

	Base Case Capacity 2047 (MW)	Base Case Generation 2047 (GWh)	Base Case Utilisation
Imported coal	5,297	6,964	15.0%
Domestic coal	32,948	199,715	69.2%
LNG	30,577	2,212	0.8%
Gas	20	11	6.3%
Nuclear	4,407	30,298	78.5%
Bagasse	913	4,246	53.1%
Solar	26,921	44,551	18.9%
Hydro	55,836	234,805	48.0%
Imports	1,000	2,853	32.6%
Wind	10,327	34,112	37.7%
Oil	-	-	0.0%
Total	**168,246**	**559,767**	
Renewable %	23%	15%	

Source: IGCEP 2047, IEEFA calculations.

Modelling declining contribution from renewables post-2030 makes the IGCEP 2047 plan look very out of touch with current power trends. Presumably this is in part due to misplaced concerns about the intermittency of wind and solar power, despite the fact that energy storage solutions like batteries, pumped hydro storage and hydrogen will be commonplace and inexpensive throughout the 2030s and 2040s. In addition, solar and wind power complement each other well in terms of utilisation as wind resource tends to peak away from the middle of the day when solar generation is highest. Intermittency of renewable energy would be reduced in the model if it had continued to add wind power capacity after 2030.

Furthermore, concerns about the ability of the power grid to cope with high levels of renewable energy can be resolved by planning grid upgrades now – something that

the IGCEP process should itself be enabling through accurate forecasts of how future, least-cost power sources can meet demand growth.

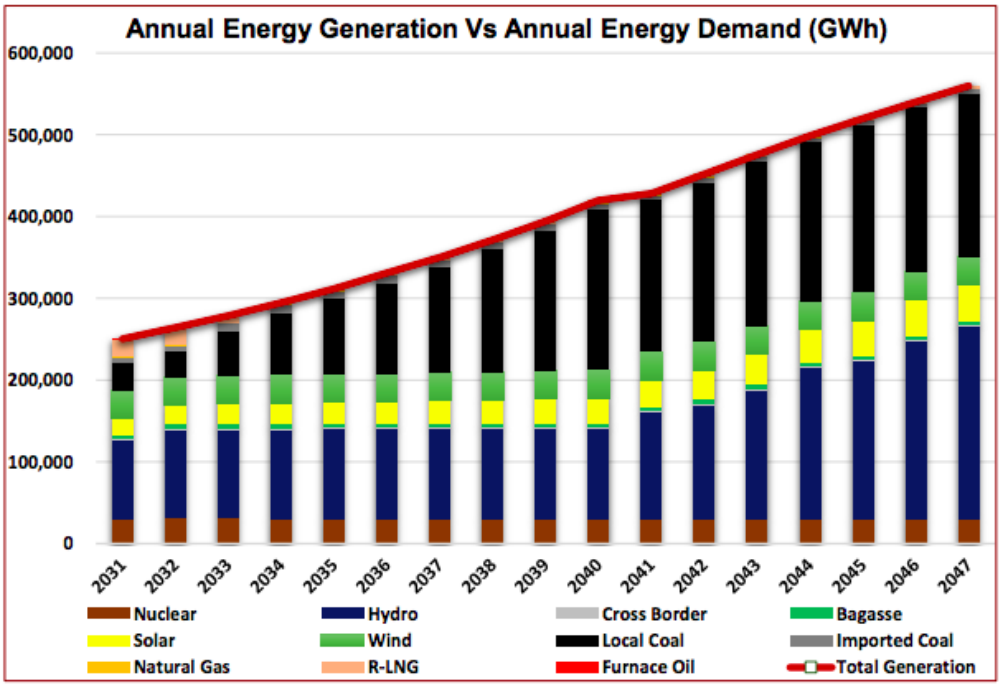
IGCEP Focus on Domestic Coal and Hydro

Whilst largely ignoring the many benefits of renewable energy, the IGCEP focus post-2030 is largely on domestic coal-fired power and hydro (Figure 4).

In addition, the IGCEP strangely models the addition of 20,000MW of LNG-fired power capacity between 2030 and 2047 despite the fact that it also foresees generation from this source collapsing 19,000GWh over the same period. At 2047, the Base Case model has the nation's 31,000MW of LNG plants producing virtually no power (utilisation rate of 0.8%). The IGCEP states on page 97 that the reason for these LNG-fired power additions is so that they can act as reserve generation capacity to complement the intermittent nature of renewable energy.

The idea that 31GW of LNG-fired power is needed to balance the intermittency of 37GW of wind and solar power in 2047 is, at best, wildly inaccurate. Such a ratio of LNG to renewable capacity would not be required even today, let alone in 17 years' time when energy storage solutions will be cheap and widespread. If the IGCEP's forecast became reality, tens of gigawatts of LNG-fired power would be built at great cost and would then sit idle and stranded.

Figure 4: IGCEP 2047 Base Case Power Generation and Power Demand 2031-2047



Source: IGCEP 2047.

Both hydro and domestic coal plants are expensive to build relative to wind and solar. Domestic coal-fired power projects are also contributing to the unsustainable rise in capacity payments to generators.[17] With the IGCEP's over-estimated Medium power demand growth forecast forming the foundation of the Base Case capacity modelling, the risk is that such capacity payments will increasingly be made to plants standing idle much of the time.

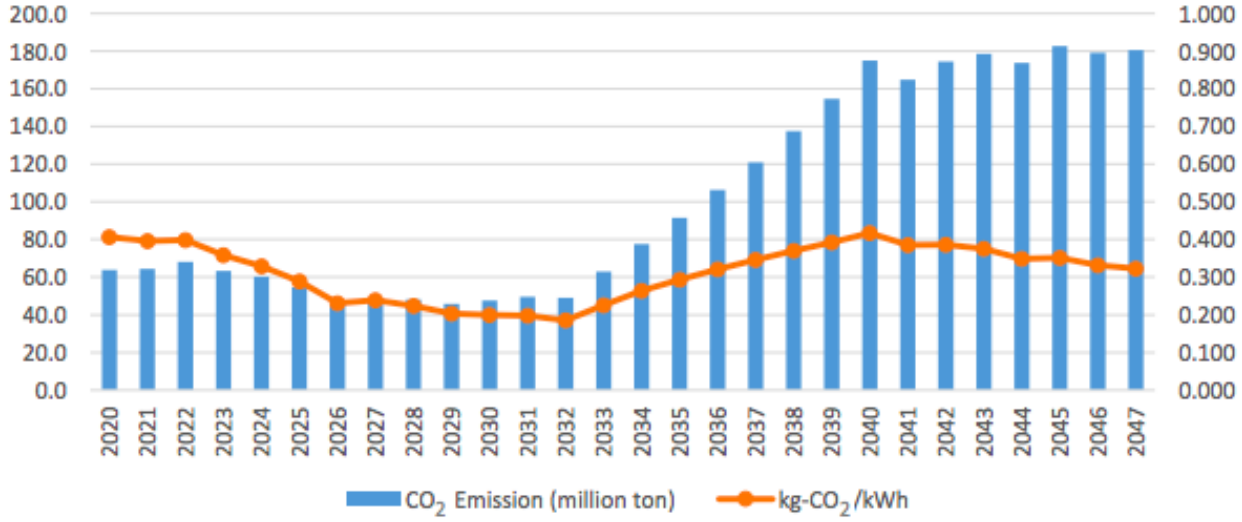
The IGCEP models the addition of more than 35,000MW of hydro power between 2030 and 2047. The Diamer-Bhasha Dam project, which the IGCEP models will start generating in 2043, is expected to cost around Rs2.3 trillion (US$14 billion).[18] With such large and complicated projects, significant cost and schedule overruns are almost guaranteed. Given work on the Diamer-Bhasha Dam officially 'started' in July 2020, there are calls for the IGCEP to bring forward the plant's completion date in its model. However, given that the dam has been in development for decades, and that a foundation stone for the project was laid back in 1998[19], it could be argued that the IGCEP is being suitably conservative with its 2043 introduction. Although major dams are planned in Pakistan for reasons other than power generation, the very long development timeframes and huge costs involved seem hard to justify given the presence of cheaper and quicker-to-build alternatives.

The IGCEP attempts to justify its focus on domestic coal and hydro by highlighting the need for the "indigenisation" of Pakistan's power mix. Certainly, a move away from reliance on imported fossil fuels makes sense, but the IGCEP is not putting anywhere near enough emphasis on wind and solar power which can increase indigenisation of the power system and improve energy security at a lower cost.

An emphasis on renewable energy would also lead to lower air pollution and carbon emissions than from domestic coal-fired power. Under the IGCEP's Base Case scenario – with its emphasis on domestic coal-fired power – annual carbon emissions almost triple by 2047 compared to 2020 levels (Figure 5). The IGCEP attempts to justify this by claiming that emissions per kilowatt hour will be lower in 2047 than they are in 2020. It is also highlighted that Pakistan's emissions intensity will be lower than the **current** average emissions intensity of OECD nations – a statement that completely misses the certainty that the emissions intensity of OECD nations will be significantly lower by 2047 as modern power systems transition to renewable energy over the next two decades.

[17] IEEFA, Thar Coal Locking Pakistan Into Unsustainable Capacity Payments, June 2020
[18] The Interpreter. Obstacles Remain for Pakistan Dam Backed by China. 14 July 2020.
[19] The Nation. India Lodges Protest Against Pakistan, China Over Diamer-Bhasha Dam. 16 July 2020.

Figure 5: IGCEP Base Case Power Generation Annual Carbon Emissions and Emissions Intensity



Source: IGCEP 2047.

A power future that involves the expansion of both domestic coal-fired power and carbon emissions as suggested by the IGCEP would create significant carbon risk for Pakistan. The EU is already considering the imposition of a carbon border tax on imports into the union.[20] This would protect European producers that have taken steps to lower emissions from cheaper imports from nations that have taken less action to reduce carbon emissions.

It seems unlikely that the EU will be the only region or nation to consider a carbon border tax and there is a high chance that such mechanisms will be commonplace by the 2040s as the world continues to make efforts to decarbonise. This would have a significant impact on world trade.[21] Exporters in nations that have made less effort to reduce carbon emissions will be at a significant disadvantage in such circumstances.

Regulatory Feedback on the IGCEP

It is reported that NEPRA has instructed NTDC to review and change elements of the IGCEP.[22] Amongst the instructions was a directive to review the need for large capacities of LNG power additions to back up renewable energy. NEPRA also noted that the overall system capacity utilisation being planned by the IGCEP was only 35% – a clear indication of overcapacity. It requested that an overall utilisation of 40%-50% be planned.

Given that the IGCEP as it stands does not plan for least-cost power generation and

[20] Argus Media. EU Leaders to Consider Carbon Border Tax. 30 June 2020.
[21] BCG. How an EU Carbon Border Tax Could Jolt World Trade. 30 June 2020.
[22] Dawn, Nepra returns power expansion plan to NTDC, 23 August 2020

is based on over-estimated and out-of-date power demand growth forecasts, revisions to the plan as requested by NEPRA are inadequate. The planning process needs to be begun again based on a more realistic demand growth forecast if Pakistan is to avoid increasing overcapacity. Meeting forecast demand with least-cost capacity additions will also ensure affordability.

Conclusion: Salient Features of the IGCEP

According to the IGCEP report, the model's "salient features" are as follows:

a. Aggressive induction of REs (renewable energy)

b. Massive utilisation of indigenous coal-based power

c. Balancing the overall basket price with increased share of hydro power

d. Optimal indigenisation: less reliance on imported fuel i.e. coal, oil, etc

e. Substantial reduction in carbon emissions owing to huge induction of REs and hydro

Furthermore, the Pakistan government has stated that the IGCEP is based on the principles of sustainability and affordability.[23]

The IGCEP's Base Case scenario has largely failed to live up to these salient features and principles.

Although the model includes additions of renewable energy to meet the government's draft renewables target by 2030, modern clean energy is neglected in the model after 2030. Indeed, the model includes no wind power additions at all after 2030. This is despite the fact that Pakistan has excellent wind resources and that wind and solar – which are already the cheapest source of new power generation in Pakistan – will be even cheaper throughout the 2030s and 2040s. Newer technology such as batteries that can store renewable energy will also be significantly cheaper by that time.

"Massive utilisation" of domestic coal-fired power is a key feature of the IGCEP as part of the indigenisation of power sources, but this cannot be argued to be "optimal indigenisation". Renewable energy can also reduce reliance on fossil fuel imports and can do so far more cheaply than domestic coal power. This is true today and will be even more so into the future. As a result of the neglect of the cheapest source of power, the IGCEP fails to live up to the government's affordability principle.

The introduction of large amounts of domestic coal power will also lead to a significant increase in the overall carbon emissions of Pakistan's power system according to the IGCEP, not decreases. The IGCEP fails the government's sustainability principle as it stands.

[23] Dawn. Future Energy Plan Finalised Amid Provinces' Reservation. 16 July 2020.

Moreover, by focussing on large additions of hydro and domestic coal power, the IGCEP plans for very significant levels of stranded assets by overestimating power demand growth and including the addition of more LNG-fired power capacity despite modelling that it effectively won't be utilised at all by 2047. This would add more than 30,000MW of stranded LNG assets to the 5,000MW of imported coal-fired power capacity that is stranded according to the IGCEP. Given that the IGCEP's power demand forecast is too high, the level of overcapacity and stranded assets would be even higher in reality if this plan was enacted.

Annexure I

IEEFA Modelled Pakistan Electricity Demand Growth

GDP Growth (%)	4.0%
Electricity to GDP multiplier pre-EE	1.35
Electricity Demand Growth (%)	5.4%
Energy Efficiency (%)	-1.0%
Electricity to GDP multiplier	1.10
Reduced grid T&D losses	-0.2%

Year ended June	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30
Gross Production (TWh)	120.6	133.7	137.0	137.2	139.1	144.9	150.9	157.1	163.6	170.3	177.3	184.7	192.3	200.2
Gross Production Growth (%)		10.8%	2.5%	0.1%	1.4%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%
T&D Losses (TWh)	26.1	27.9	28.8	28.6	28.7	29.6	30.5	31.5	32.5	33.5	34.5	35.5	36.6	37.7
T&D Losses (%)	21.6%	20.9%	21.0%	20.8%	20.6%	20.4%	20.2%	20.0%	19.8%	19.6%	19.4%	19.2%	19.0%	18.8%
Reduced Grid losses				-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
Real GDP Growth (%)	5.2%	5.5%	3.3%	1.0%	2.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Electricity Multiplier (x)				1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
Electricity Growth (%)				1.3%	2.7%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%
Energy Efficiency				-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Net Demand Growth (TWh)	94.5	105.8	108.2	108.6	110.4	115.3	120.3	125.6	131.1	136.9	142.9	149.1	155.7	162.5
Net Demand Growth (%)		11.9%	2.3%	0.3%	1.7%	4.4%	4.4%	4.4%	4.4%	4.4%	4.4%	4.4%	4.4%	4.4%

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The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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