# Electricity Demand-Supply in Bangladesh

and The State of Reality

M Tamim

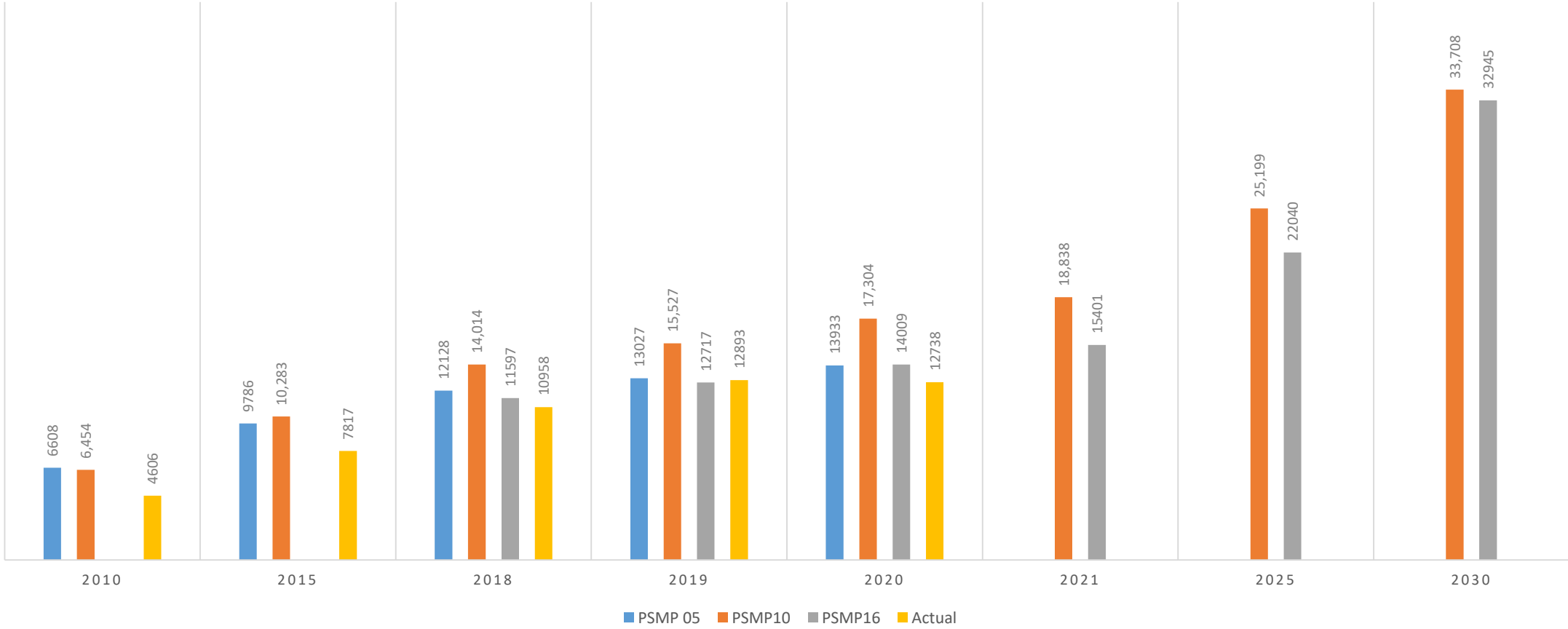
PMRE Dept, BUET

mohammad.tamim@gmail.com

# Current issues in power sector

- Supply demand mismatch hence excess generation capacity (forecasting error?)
- Dilemma over future fuel mix
- Decarbonization of power sector and the world energy transition
- Pricing and subsidy

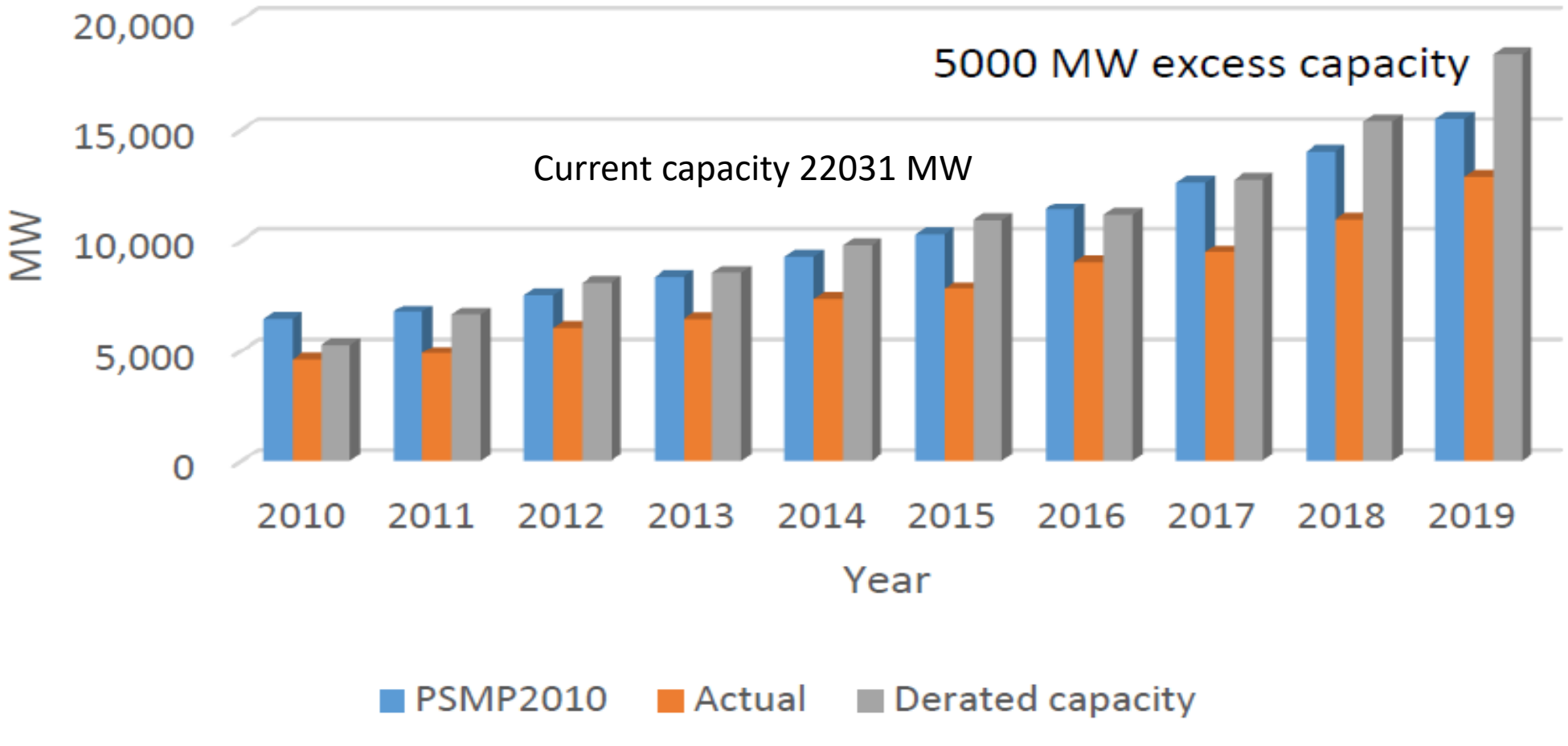
# Forecast and actual demand



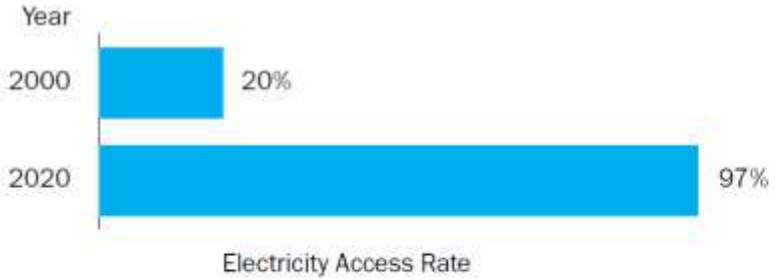
# Demand forecast and supply plan

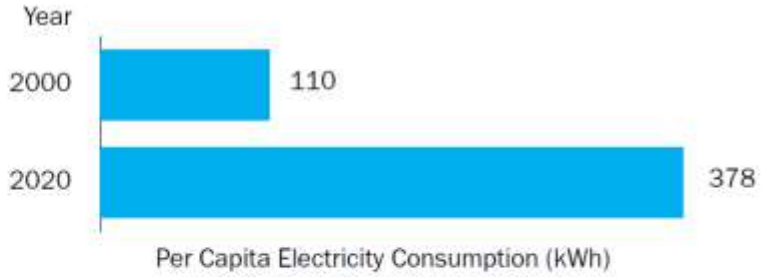
| Policy Document | 2015 | 2020-2021 | 2025 | 2030-2031 |
|---|---|---|---|---|
| | Demand Forecast (MW) | | | |
| PSMP 2010 | 10,283 | 17,304 | 25,199 | 33,708 |
| PSMP 2016 | | 12,949 | 19,191 | 27,437 |
| | Supply Planning (MW) | | | |
| 2015-2016 Budget and 7th Five Year Plan (2016-2020) | 14,943 | 23,000 | | |
| 8th Five Year Plan (2021 -2025) | | 24,000 | 30,000 | |
| BPDB (under the government policy) | | 24,000 | | 40,000 |

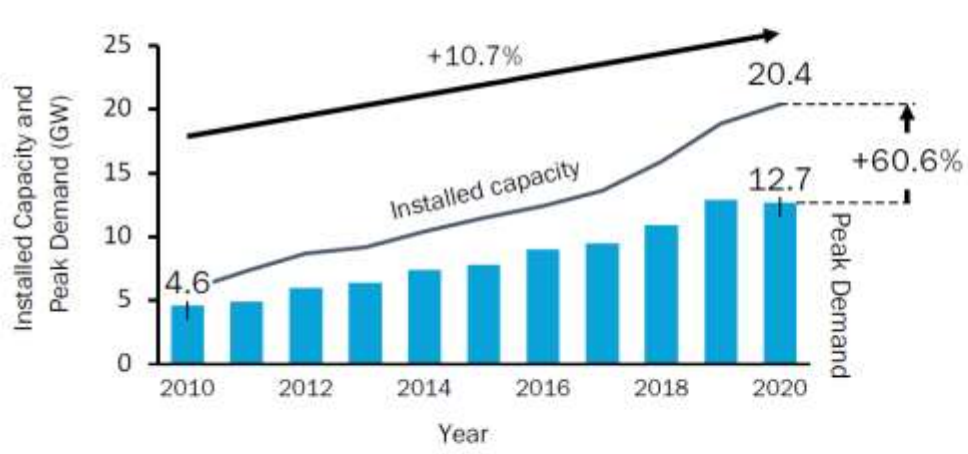
# Excess capacity dilemma

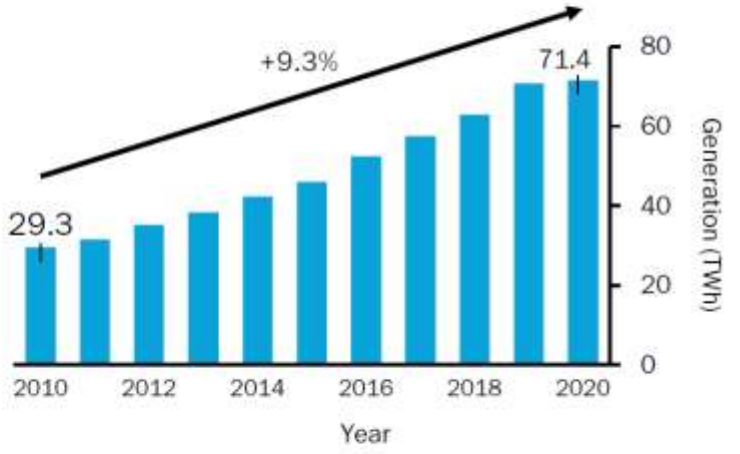


# Success since 2000




System losses (FY 2020) 8%

SAIDI (FY 2020) 1,136 minutes

SAIFI (FY 2020) 47 interruptions

Source: Power Sector Reform in Bangladesh, USAID, May 2021

# Findings

- About 10000 MW over estimate in short term
- PSMP 2016 made most realistic prediction
- The revised supply plan was based on revised PSMP 2016 (in 2018)
- Planning and the supply numbers do not mention actual delivery capacity and hence confusing
- Current 25000 MW includes 2800 MW captive, about 500 MW renewable (including SHS)
- Energy (MWh) and capacity (MW) are used as equivalent. Capacity increased 3.64 times and generation increased 2.36 times during 2010-2020

# Electricity generation report (in MW) of Sept 6, 2020 (understanding excess capacity)

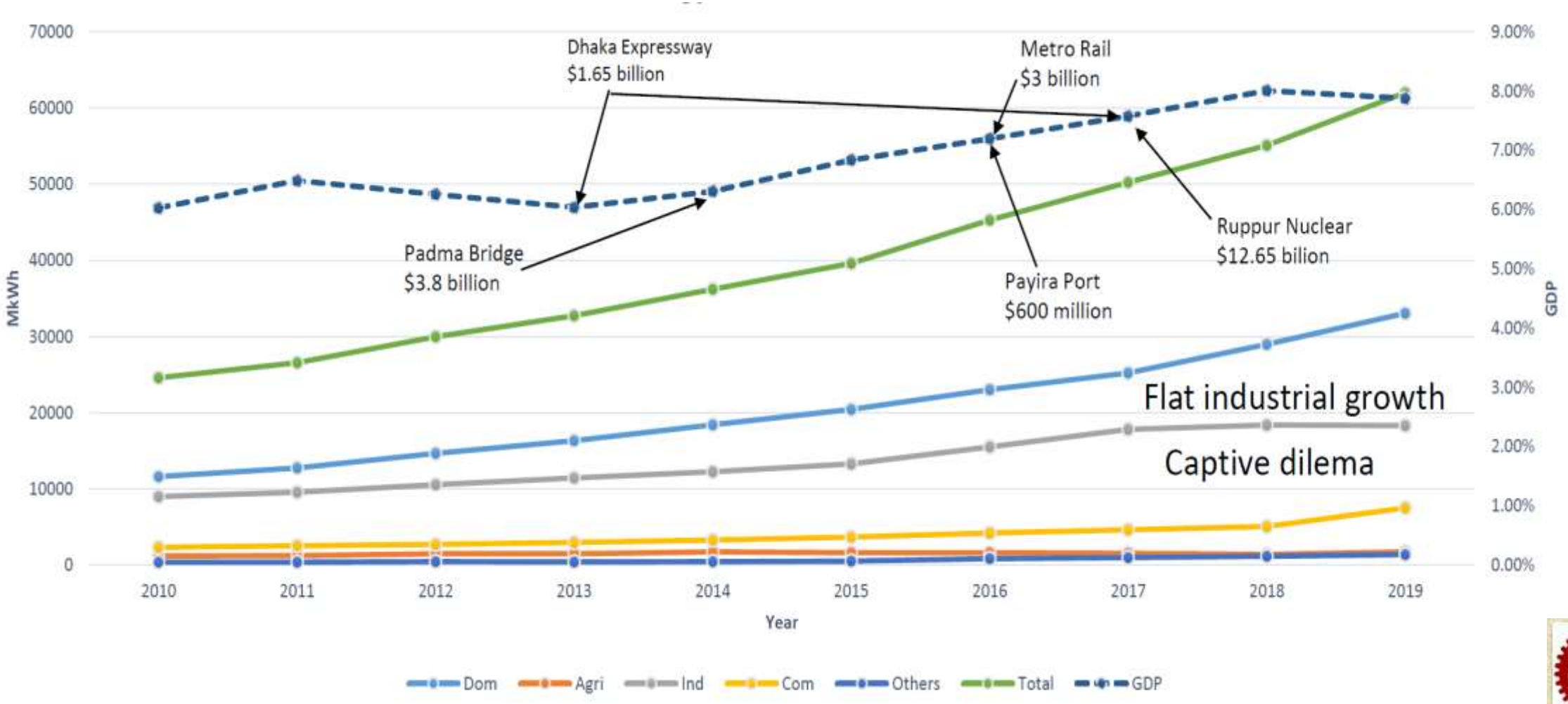
| Installed capacity | De-rated capacity | Probable max generation | Peak generation | Gas/water/coal shortage | Shutdown/ Maintenance |
|---|---|---|---|---|---|
| **20383** | 19892 | (19892-3607) x 0.9 =14859 | 12892 | 1969 + 1638 = 3607 | |

- A total of 3607 MW (1969+1638) was not producing any electricity due to fuel shortage or forced/scheduled shutdown leaving 16285 MW capacity for delivery
- Out of this a maximum of 14859 MW electricity could be generated with an average plant availability of 90%.
- **The maximum expected demand was 13000 MW keeping only about 13% excess capacity**
- The key to the excess capacity is the 3607 MW

# Seasonal Variation

- With the same generation capacity during the winter, the excess looks even worse.
- The lowest demand in 2020 was on January 4$^{th}$ with an evening demand of 7537 MW.
- If one looks at the highest and lowest demand of 2020, an enormous gap of 5500 MW between summer and winter is noted.
- **Although the average seasonal peak demand variation is more in the range of 3000-3500 MW.**
- This difference is principally due to cooling load from air-conditioning and fans and also lower efficiency of generation during the hot summer months.
- **Currently, Bangladesh has no other option but to keep this excess capacity standby during the 4/5 months of colder period.**

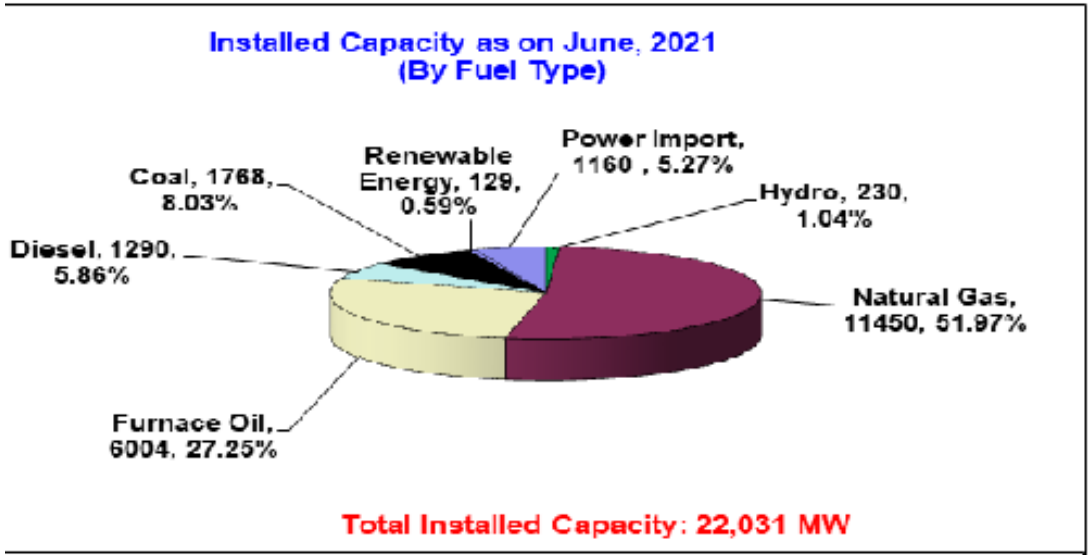
# GDP and sectoral power growth

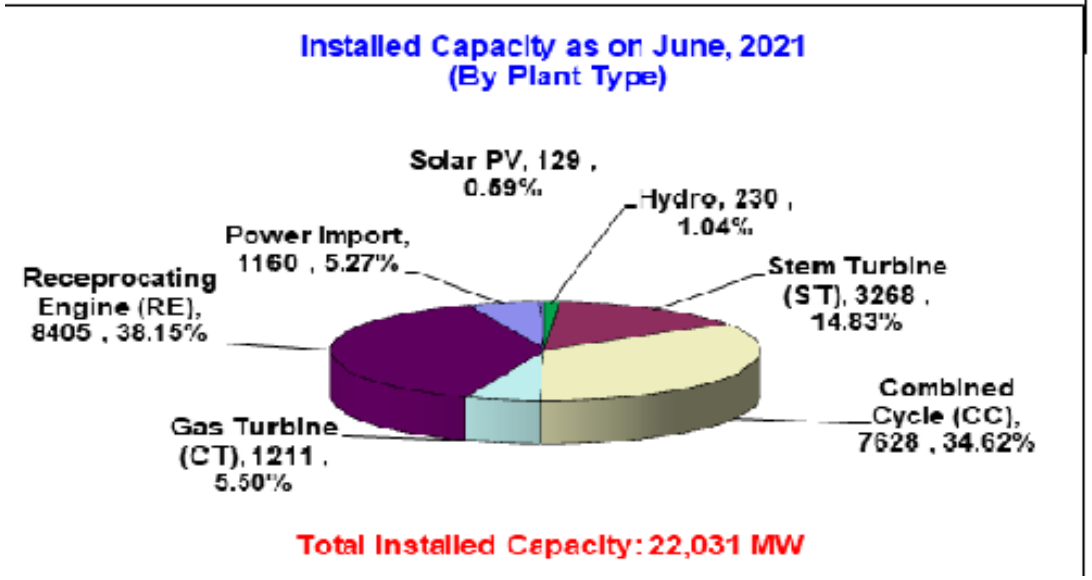


# Growth analysis from past performance

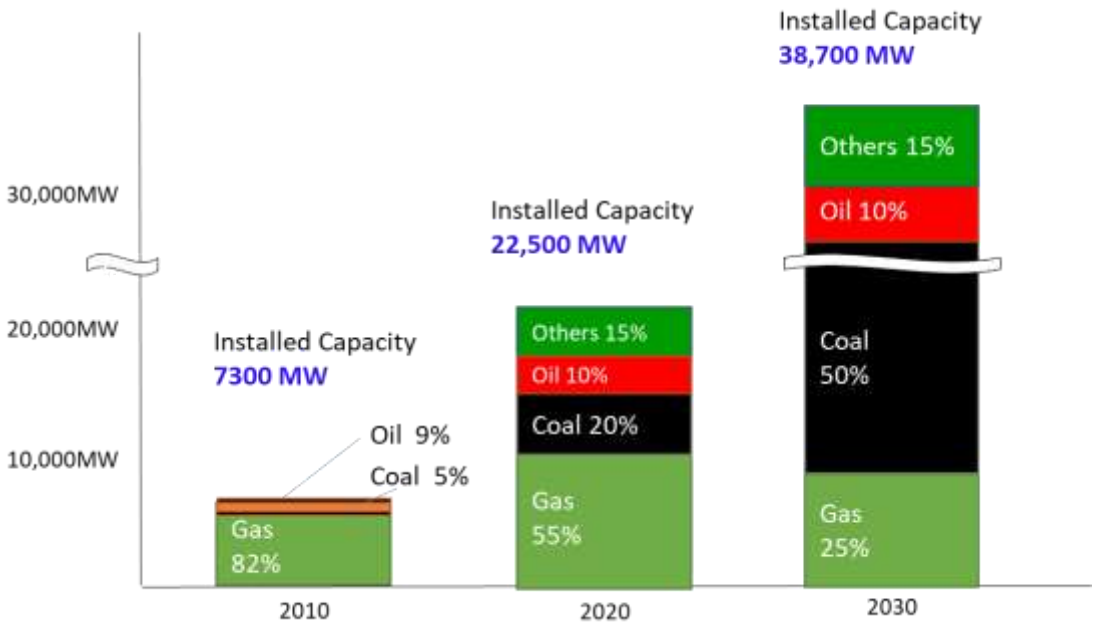
- Electricity growth forecast must be decoupled from economic growth
- Power growth must be predicted sector wise independently
- Since 2017, the industry's percentage share of grid electricity is stagnant
- Massive power demand from industry is essential for grid power demand growth
- Currently the highest growth is in domestic sector and its peak can be predicted and will taper off at one point
- Potential growth in commercial sector
- Short term accurate forecast is required

# The fuel dilemma

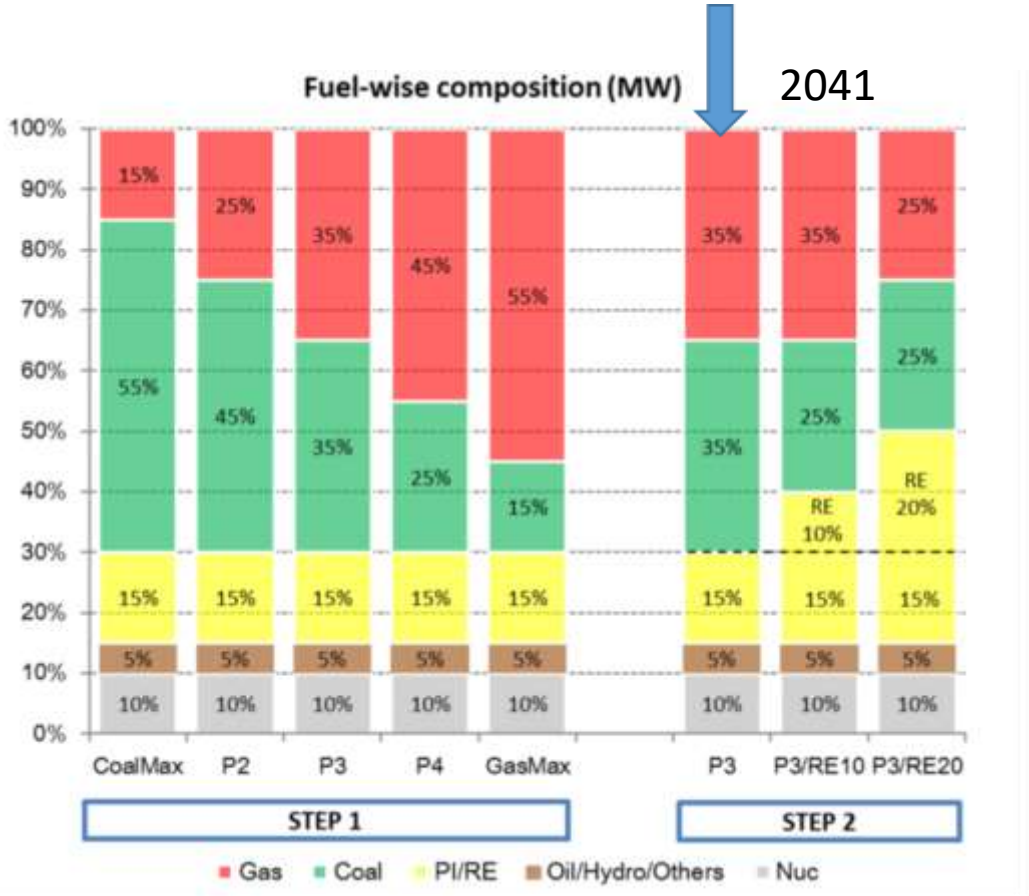


# Fuel mix (changing every 5 years)




**PSMP 2010**

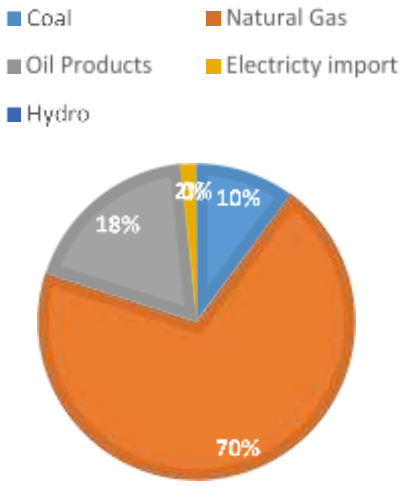



**PSMP 2016**

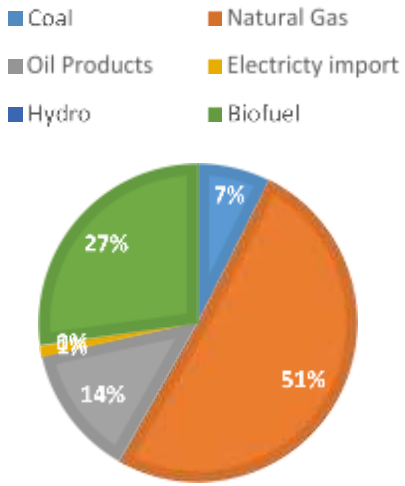
# Energy Transition

- Global warming and green house gas effect (Limiting temperature rise to 1.5° C by 2050). Bringing emission down to pre industry era
- Bangladesh NDC commitment of 5% to 15% emission reduction by 2030 from BAU scenario
- 10% electricity coming from RE by 2030 (currently 140 MW grid solar)
- Bangladesh carbon footprint about 0.5 ton/person/year. No obligation of emission reduction under Paris Accord
- Shortage of fund, technology, RE resource, land and capacity
- Can we compromise with economic growth?

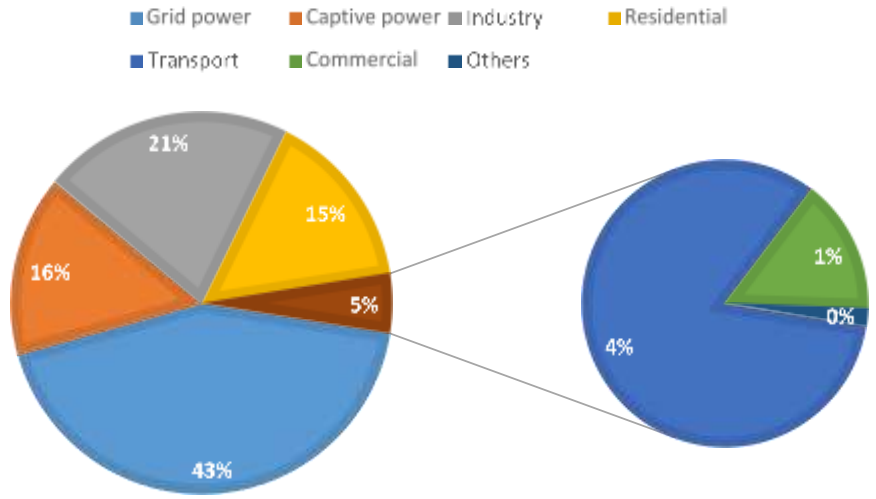
# Case for gas as transition fuel




Primary Energy without biofuel (2018-19)

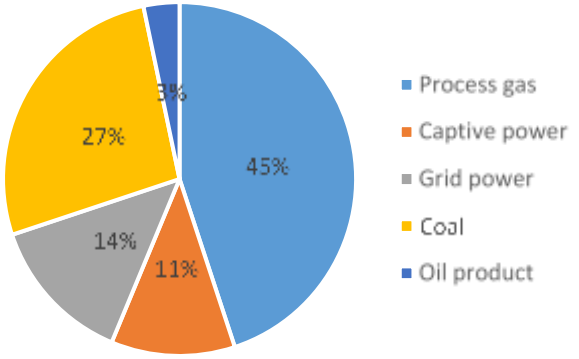



Primary Energy with biofuel (2018-19)

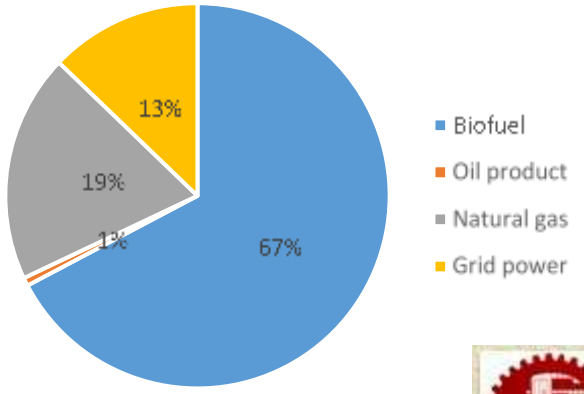



Sector-wise gas distribution in percentage

- Economy heavily dependent on gas (non-power sector)
- Massive gas based infrastructure
- Half carbon emission than coal in power production
- 22% gas use in transport sector




Energy use in Industries




Energy use in domestic sector

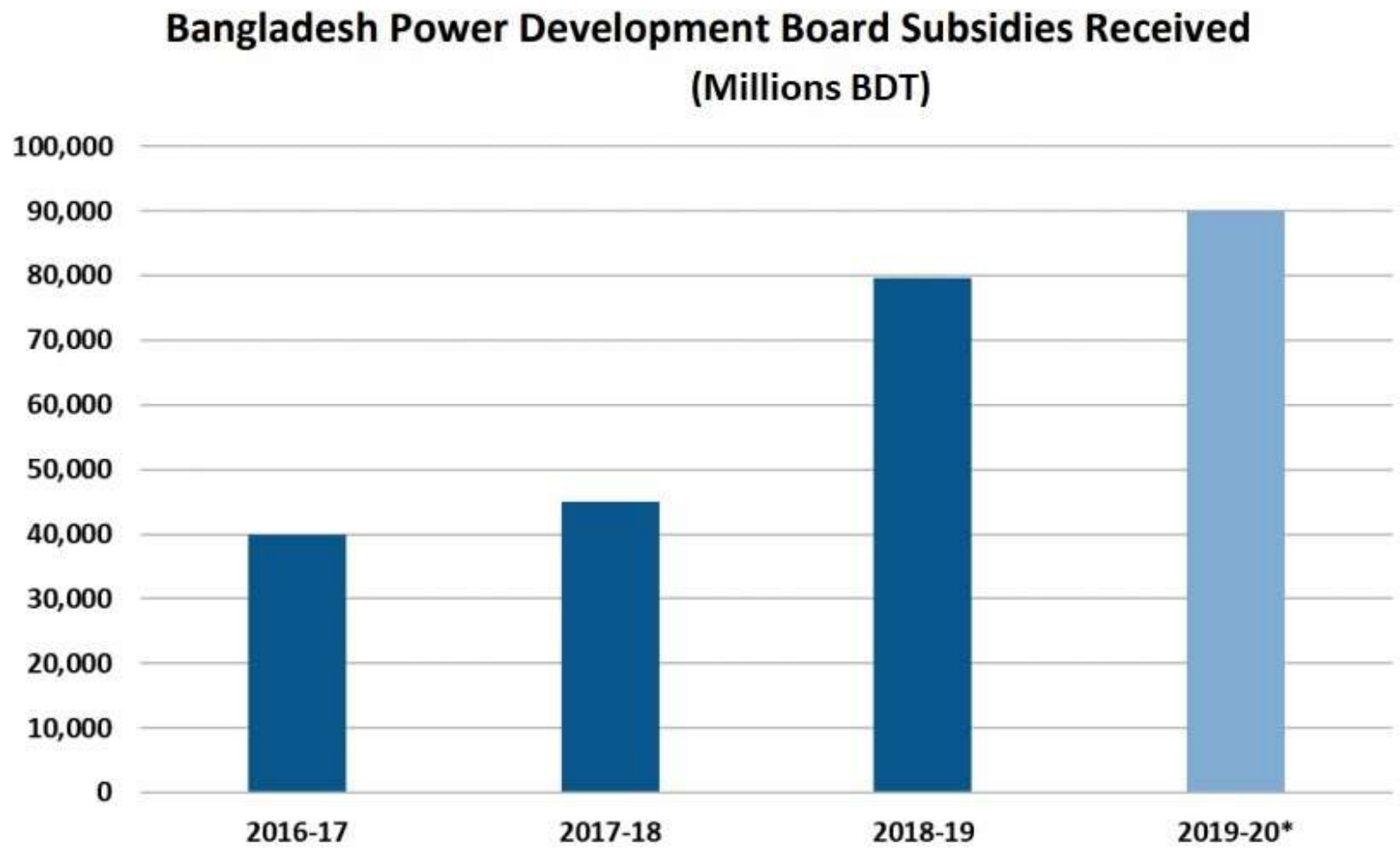
# Deficit in unit generation cost (2020)

| Fuel Type | Plant Factor | Fuel Cost | Variable Cost | Fixed Cost | Generation Cost |
|---|---|---|---|---|---|
| Imported power | 66% | - | 1.66 | 4.3 | 6.01 |
| Hydro | 41% | - | 0.42 | 1.4 | 1.82 |
| Renewable (solar & wind) | 19% | - | 9.89 | 1.9 | 11.82 |
| Gas | 52% | 1.15 | 0.15 | 2.0 | 3.26 |
| Coal | 30% | 4.66 | 0.07 | 1.9 | 6.62 |
| Furnace oil | 19% | 7.90 | 0.29 | 6.7 | 14.89 |
| High-speed diesel | 1.2% | 19.28 | 1.02 | -- | -- |
| Total | 39% | 2.13 | 0.32 | 3.13 | 5.58 |

| | |
|---|---|
| Interest on budgetary support | 0.19 |
| Maintenance and development fund | 0.15 |
| Average generation cost, FY 2020 | 5.91 |
| Average bulk supply tariff (BERC), effective March 2020 | 5.17 |
| Actual bulk supply cost | 4.86 |
| Loss (BDT/kWh) | 1.05 |

Source: Power Sector Reform in Bangladesh, USAID, May 2021

# Subsidy




*Expected 2019-20 subsidy.

# Current Rates for Industry

## Tariff projection by PSMP(2015 ref)

| | Tk/kWh |
|---|---|
| 2021 | 8.52 |
| 2031 | 11.02 |
| 2041 | 12.79 |

## Electricity Price (Tk/kWh) 2020

| | Small Ind | 11 kV (Ind) | 33 kV (Ind) |
|---|---|---|---|
| Flat | 8.53 | 8.55 | 8.45 |
| Off peak | 7.68 | 7.70 | 7.69 |
| Peak | 10.24 | 10.69 | 10.56 |

| | |
|---|---|
| **Captive Power (gas price Tk13.8/m3)** | **Tk.4.25/kWh** |

Average gas sales price $3.3/Mcf but need to be $5/Mcf to offset LNG import

# Probable base load options

| Fuel Cat | $/MMBTU | Fuel Cost (C/kWh) | Capacity Charge (C/kWh) | F&V O&M | Total (C/kWh) | Total Tk/kWh |
|---|---|---|---|---|---|---|
| Domestic Coal | 4.77 | 3.74 | 2.80 | 0.80 | **7.50** | **6.00** |
| Imported Coal | 5.82 | 4.81 | 3.50 | 0.80 | **9.00** | **7.20** |
| Nuclear | 0.91 | 0.94 | 5.80 | 1.30 | **8.10** | **6.45** |
| CC (LNG) | 14.00 | 9.37 | 1.80 | 0.65 | **11.80** | **9.40** |
| Cross Boarder | | | | | **8.00** | **6.40** |

Source: BPDB

# Conclusion

- Over capacity will be very expensive, so short, mid and long term planning should be accurate and 2, 5 and 10 year long based on bottom up sector wise demand growth forecast
- Power forecast must be decoupled from economic forecast
- Industrial electricity usage must be increased
  - Uninterrupted quality power must be ensured
  - Captive and grid power tariff gap has to be reduced
- Natural gas (LNG and indigenous) will be the transition fuel for both power and non-power sector for the next twenty years
  - Land based LNG facility must be developed rapidly along with exploration

# Conclusion (contd.)

- For oil based power plants
  - Most should be phased out at the earliest
  - Depending on the capacity and the seasonal demand gap, some extension of the efficient plants can be granted on ‘no electricity no payment ‘ basis
  - No new oil based power plant should be installed
  - HFO is highest Sox and Nox producer and emits just 20% less CO2 than coal
- For coal
  - Keep the existing ongoing projects without any expansion plan
  - Plan to phase them out in 20-30 year time horizon
- Renewable
  - Full effort for solar grid, rooftop, wind, biogas with a 30 to 40% power generation share target by 2050
- Major drive for both supply and demand side efficiency improvement

# Conclusion (contd.)

- Should import as much electricity as possible and expand regional cooperation
- Electricity price increase is inevitable. A realistic tariff predictor based on fuel mix must be developed
- Subsidy should be minimized with an aim to abolish it. Targeted subsidy model on household income can be implemented