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SOLAR THERMAL ENERGY
RESEARCH GROUP

# 2030 - 2050
# Dispatchable Power Requirement

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# — Integrated Resource Plan – (IRP)

- The first IRP was developed in 2010, covering the period up to 2030.
- The IRP has been updated several times , but not published since the 2010 IRP.
- Latest update was 2018, with an additional report released in 2019 with some changes due to Eskom difficulties.
- The updated plans covered the period up to 2050. However, the 2018 report recognized the uncertainty that this period brings and declared that the later years were “indicative”.
- The IRP developed “scenarios” for the Grid requirements based on fixed parameters.

# IRP Renewable Generation Plan

- The IRP supports a significant growth in renewable supply from wind and PV
- This growth is supported by dispatchable power to handle intermittency and replacing aging base generation

- In 2018 Wind and PV varied from meeting 0.1% to 11% of the hourly generation – showing the need for dispatchable backup

| IRP 2018 Base Scenario Renewable Plan | | | | |
|---|---|---|---|---|
| Resource - GW | 2018 | 2030 | 2040 | 2050 |
| Wind | 2 | 13 | 27 | 50 |
| PV | 1.5 | 7 | 18 | 35 |
| Min Supply | 0.1% | 0.7% | 1.2% | 1.9% |
| Max Supply | 11% | 51% | 101% | 161% |
| Dispatchable | 5 | 10 | 25 | 40 |

# Dispatchable need

- The purpose of this analysis is to verify the premises of the IRP to determine whether the predicted dispatchable power need is reasonable and the likely range.
- The analysis is a sensitivity to understand the effects of the major premises for the forecast.
- The analysis also looks at the impact of increased, or decreased, generation from wind and PV.
- The sensitivity analysis doesn’t include any economic sensitivity nor recommendation on technology – it only relates to feasibility of meeting the need.

# Sensitivity Analysis 2030 – 2050

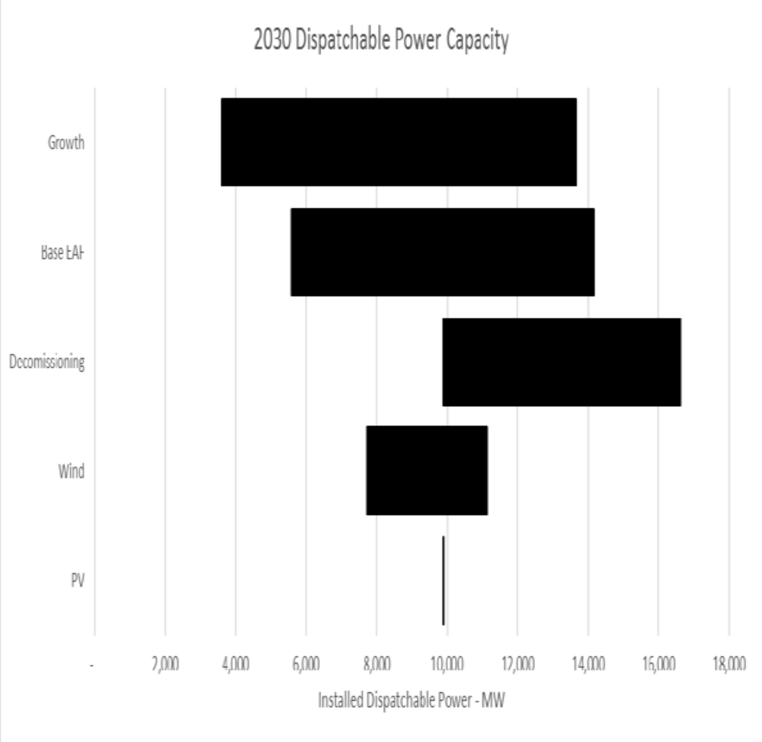
# Premises for analysis

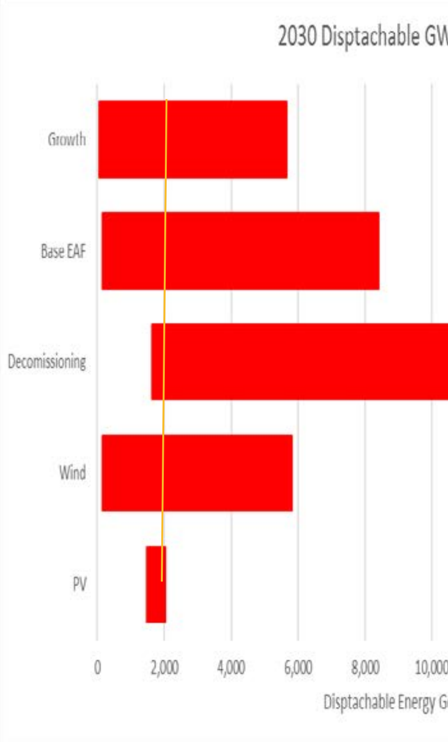
- The base information for demand and renewable supply is from Eskom for 2017 (verified for consistency with 2016 and 2018 data).
  - Forecast demand profile is as per 2017, increased by the growth factor analysed.
  - Wind and PV hourly CF's from 2017 were used and adjusted by installed capacity
- Base Generation capacity was taken from the IRP assumptions.
  - Base generation was assumed to be one unit of generation, not broken down
  - No attempt was made to cycle any of the base load (multiple daily cycling would be required). It was assumed that base generation was used or wasted.
- Existing CSP and pumped hydro storage were used as per 2017 data without change of hourly timing or capacities. (the IRP makes no provision for growth)

# Factors affecting dispatchable requirement

- Demand Growth
- Base Fleet EAF
- Decommissioning
- Wind
- PV

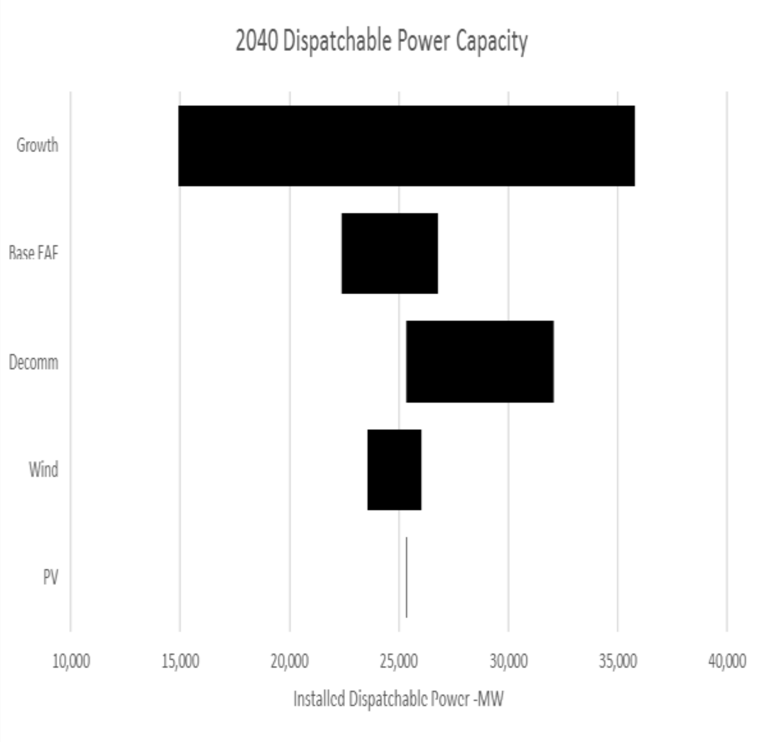
# 2030 sensitivities

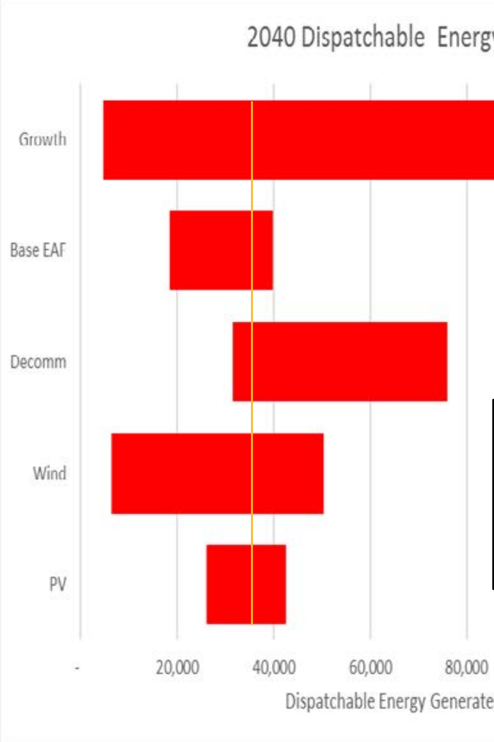



Growth = 0.5 to 2.5% (1.8)
Base EAF = 0.85 to 0.7 (0.75)
Decomm.= -12 to -21 GW (-12)
Wind = 3 to 53 GW (13)
PV = 2 to 27 GW (7)

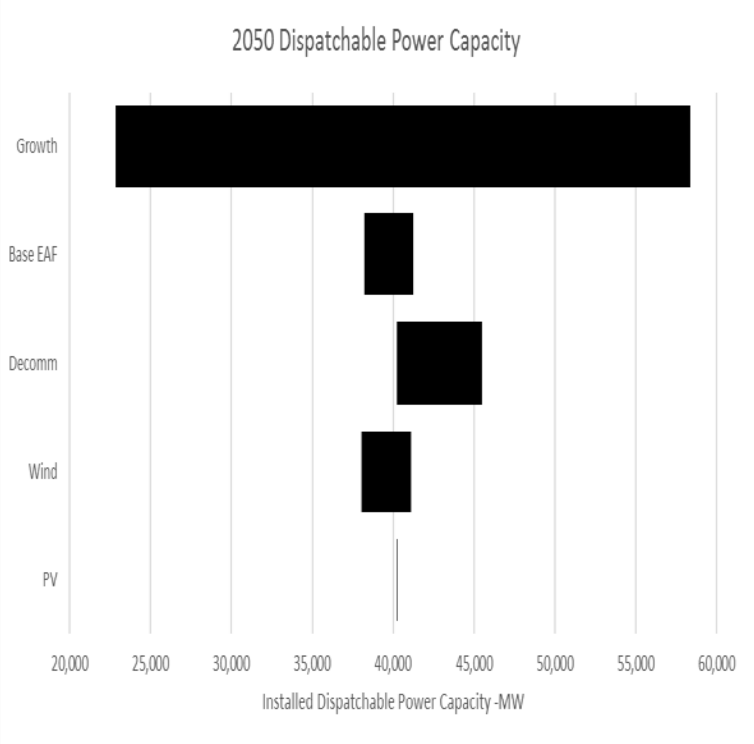
# 2040 sensitivities

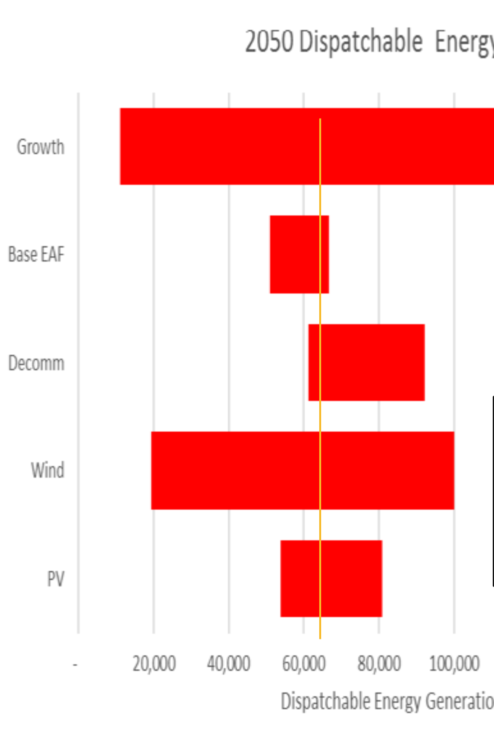



Growth = 0.5 to 2.5% (1.6)
Base CF = 0.85 to 0.7 (0.75)
Decomm.= -27 to -36 GW (-27)
Wind = 17 to 67 GW (27)
PV = 8 to 48 GW (18)

# 2050 sensitivities




Growth = 0.5 to 2.5% (1.6)
Base CF = .85 to .5 (0.75)
Decomm.= -35 to -42 GW (-35)
Wind = 30 to 100 GW (50)
PV = 15 to 75 GW (35)



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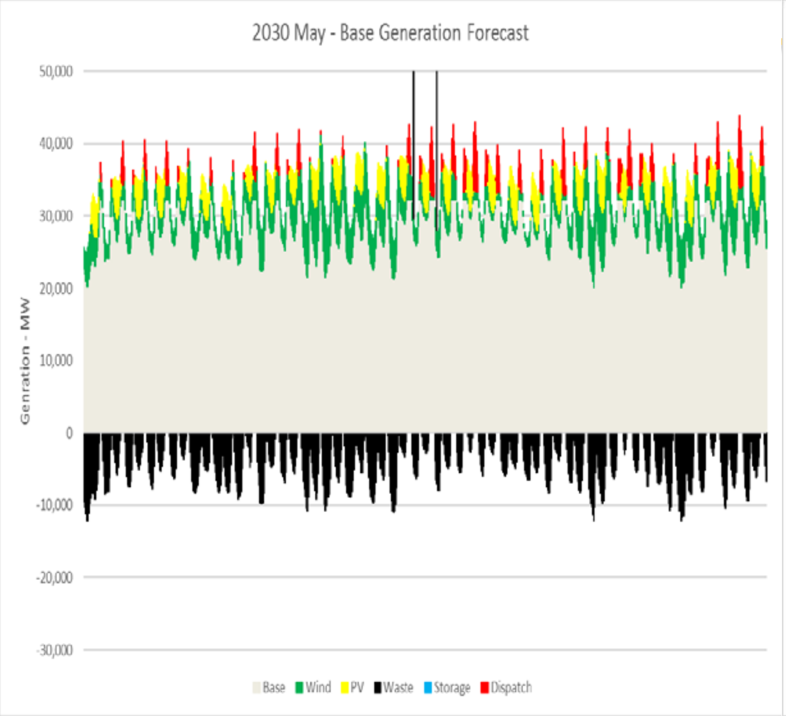
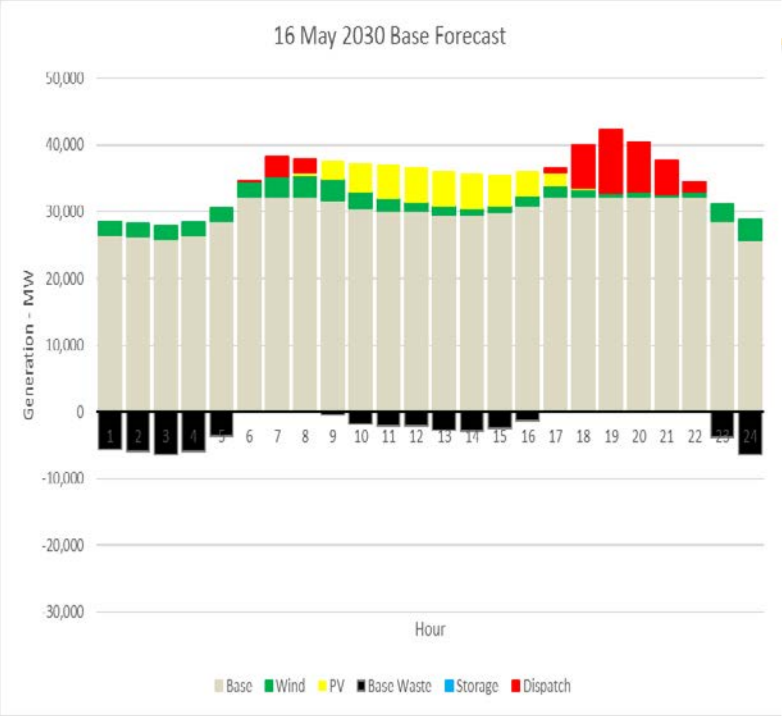
# 2030 dispatchable requirement forecast

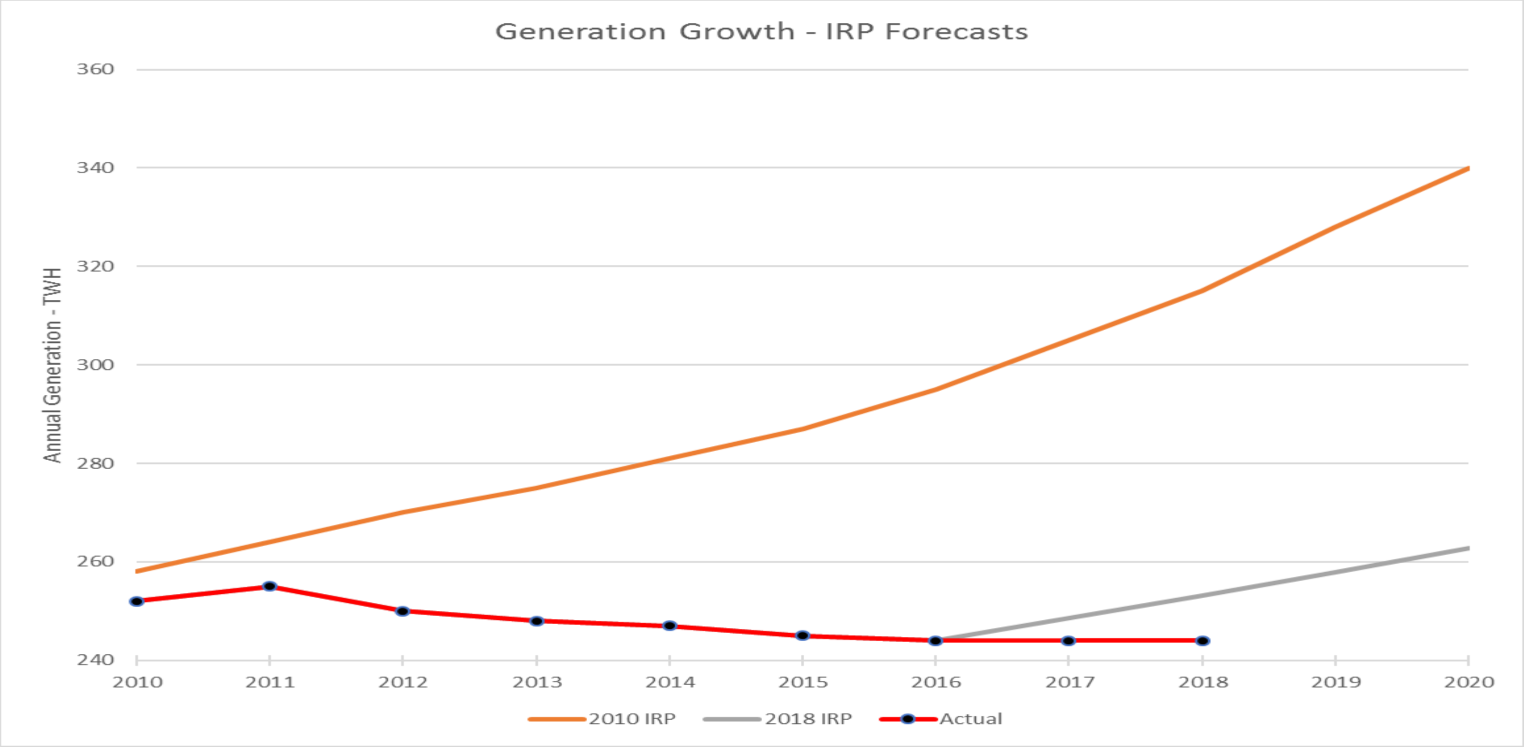
# Base forecast for “May 2030”



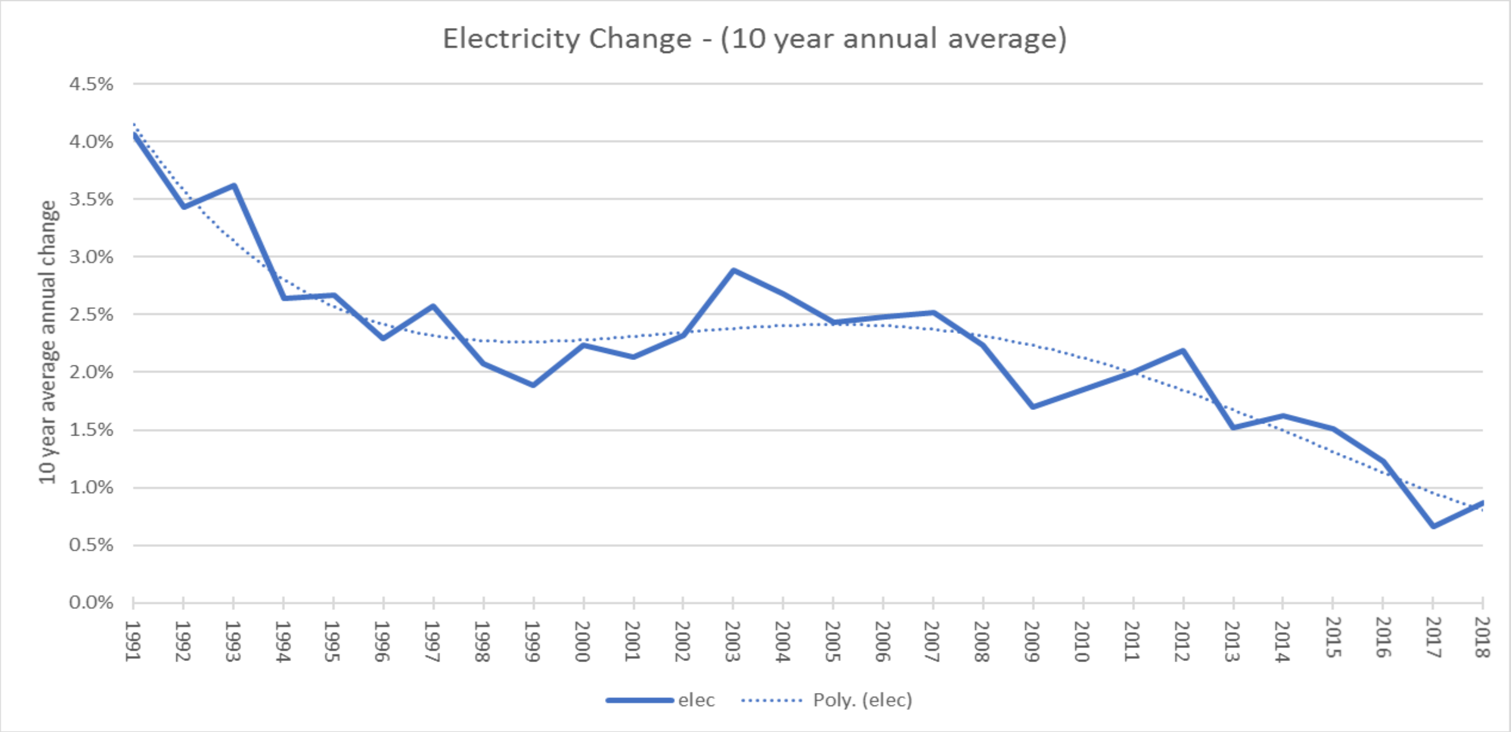



# Demand growth

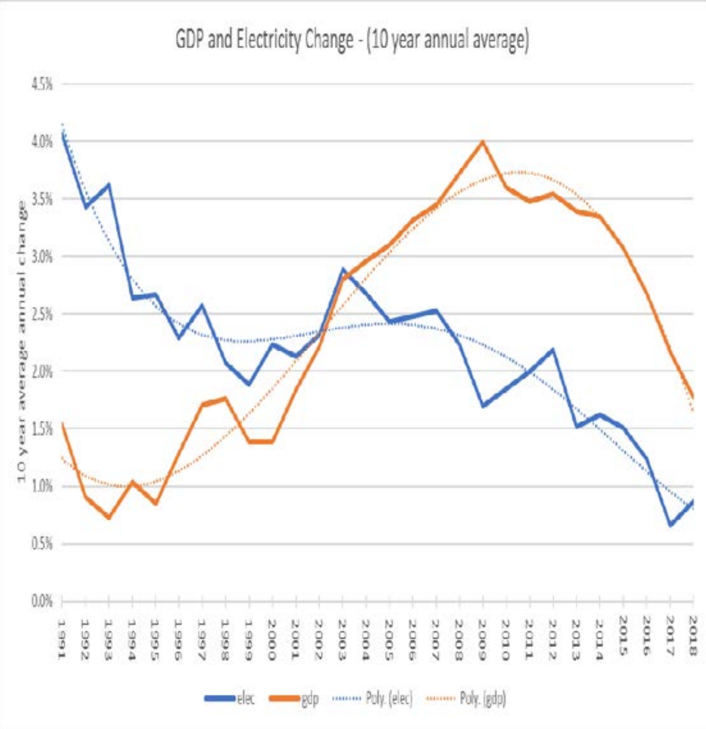
# IRP demand growth forecast

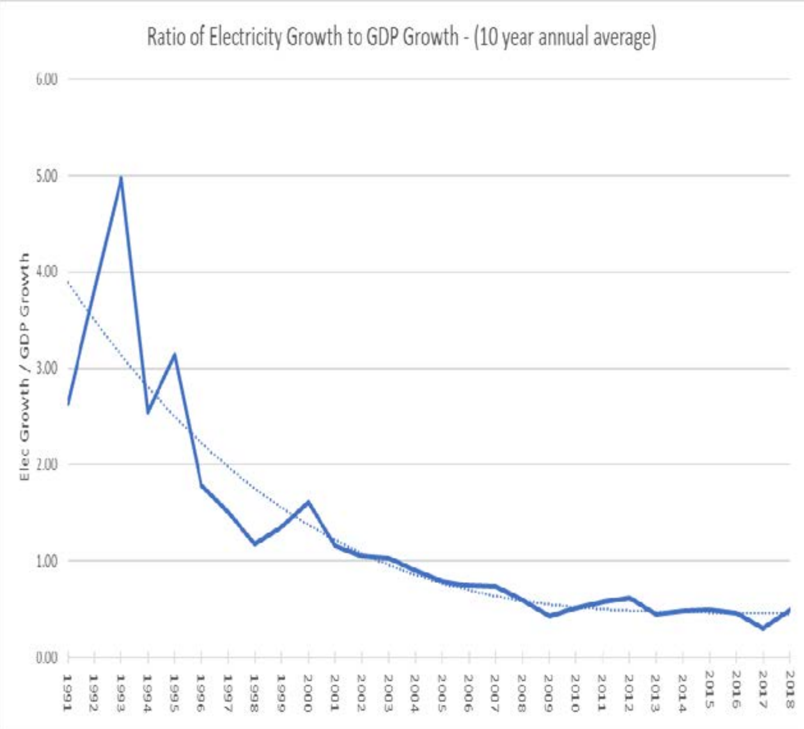


# Rate of demand growth since 1991



# — GDP growth effect

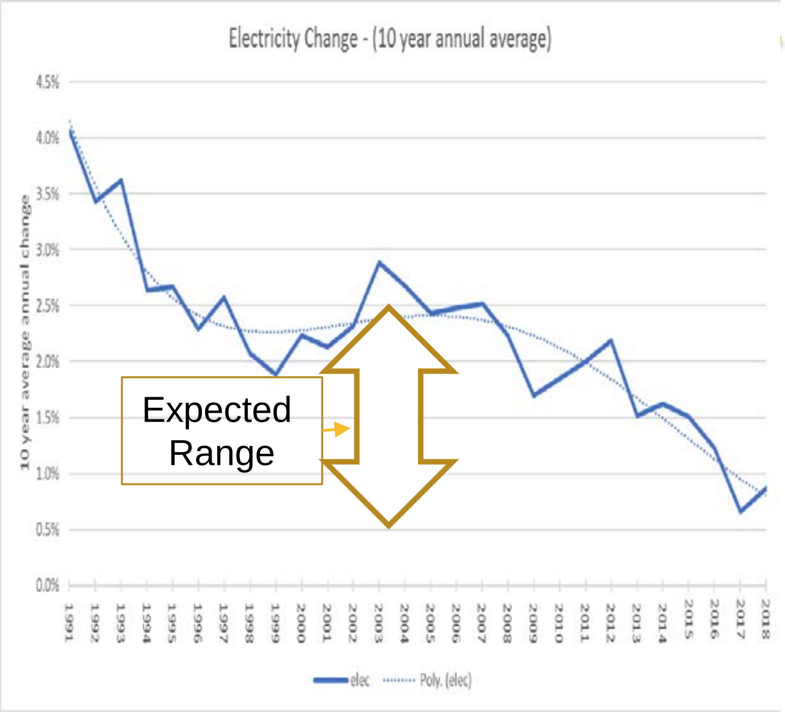


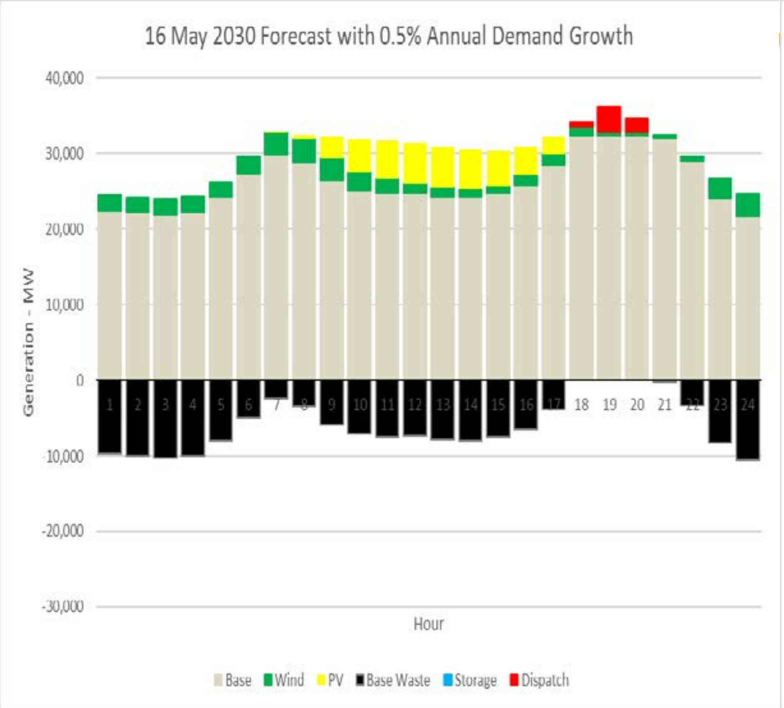
# Growth forecast

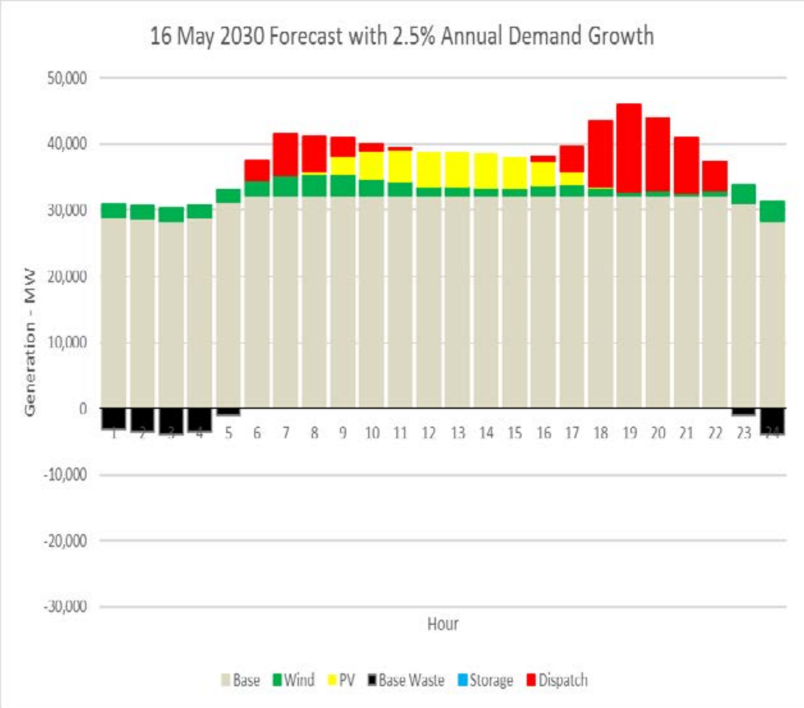
- IRP Growth Forecast – 1.8%
- GDP – 1% to 4%, average 2.3%
- Ratio – Electricity Growth in the range of 50% of GDP

- Likely range – 0.5% to 2.5%
- Expected - approx. 1.2%



# Effect of growth on dispatchable need

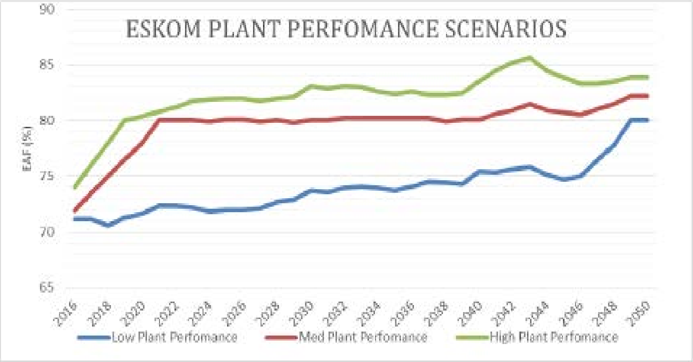


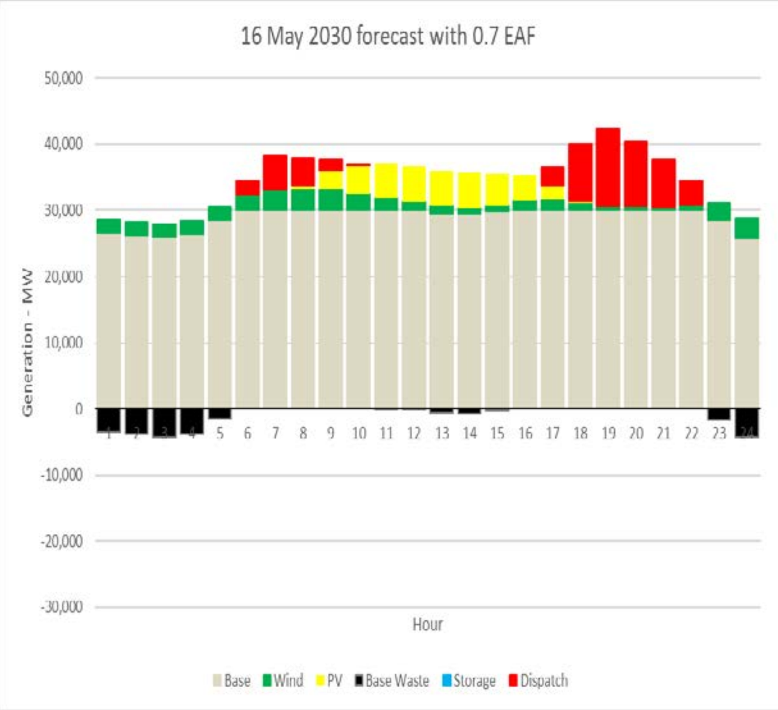
# Capacity factor (EAF)

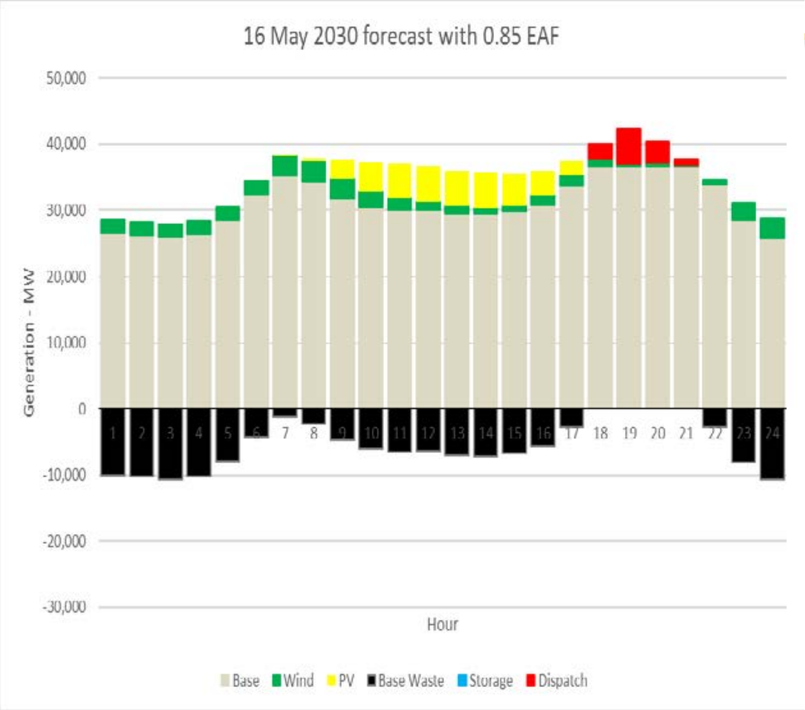
# — EAF plan

- Internationally, an EAF for the Base Facilities is expected to be about 85%
- The Eskom plants have operated at or below 70%.
- The IRP indicated expectations that this would increase to over 80%
- A low EAF effectively removes a portion of the generating fleet.



# Effect of EAF

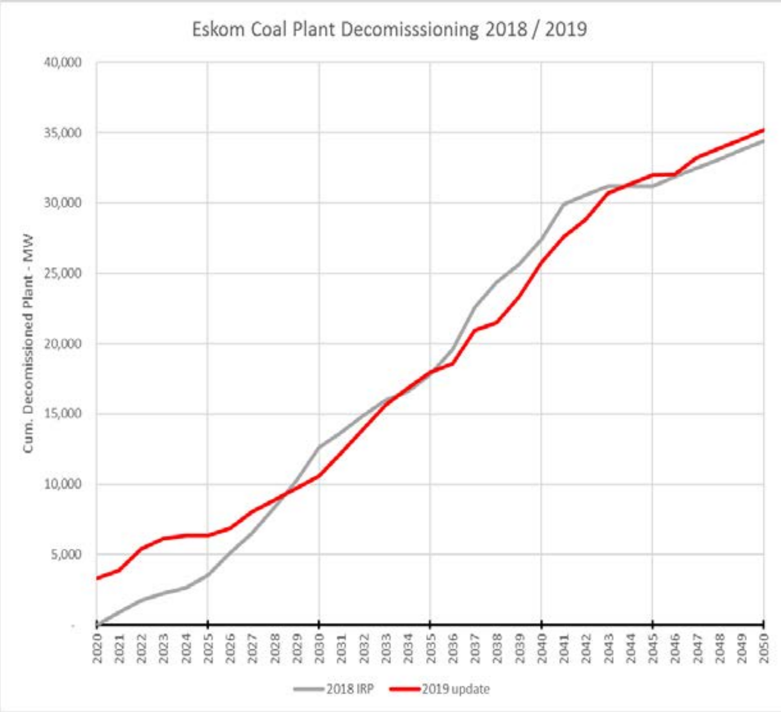


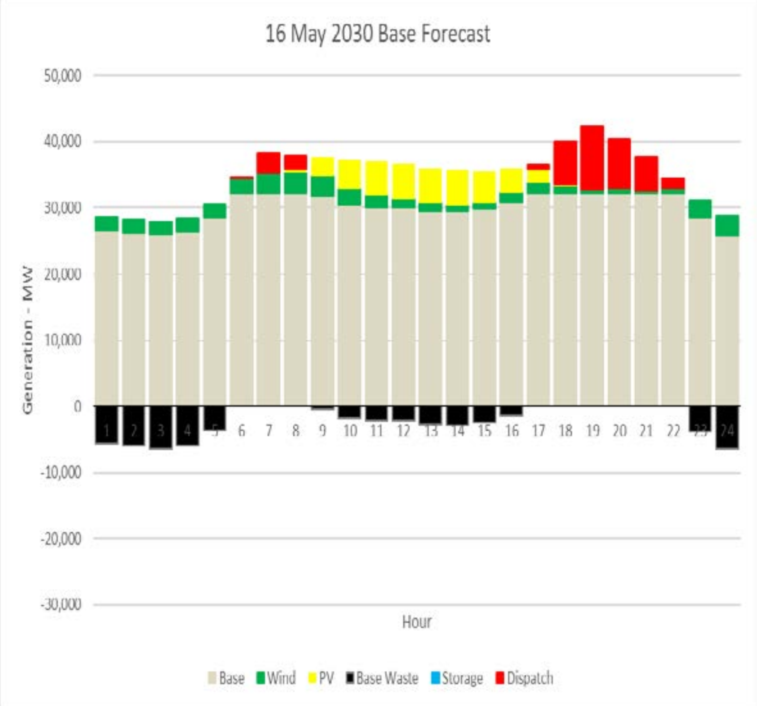
# Decommissioning

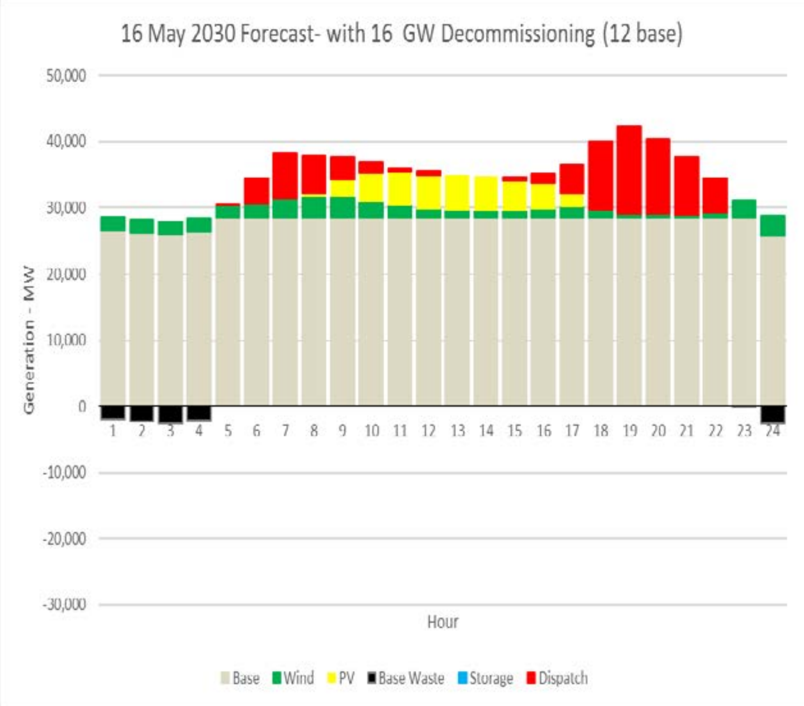
# Decommissioning plan

- The average age of the Eskom coal generation fleet is 37 years.
- Eskom anticipates a 50 -year life per plant and most plants shutdown in planning period.
- Cycling causes pre -mature aging which is not captured in plan.
- Major change is short term activity, which should be the most defined
- Leads to doubt about long term plan.



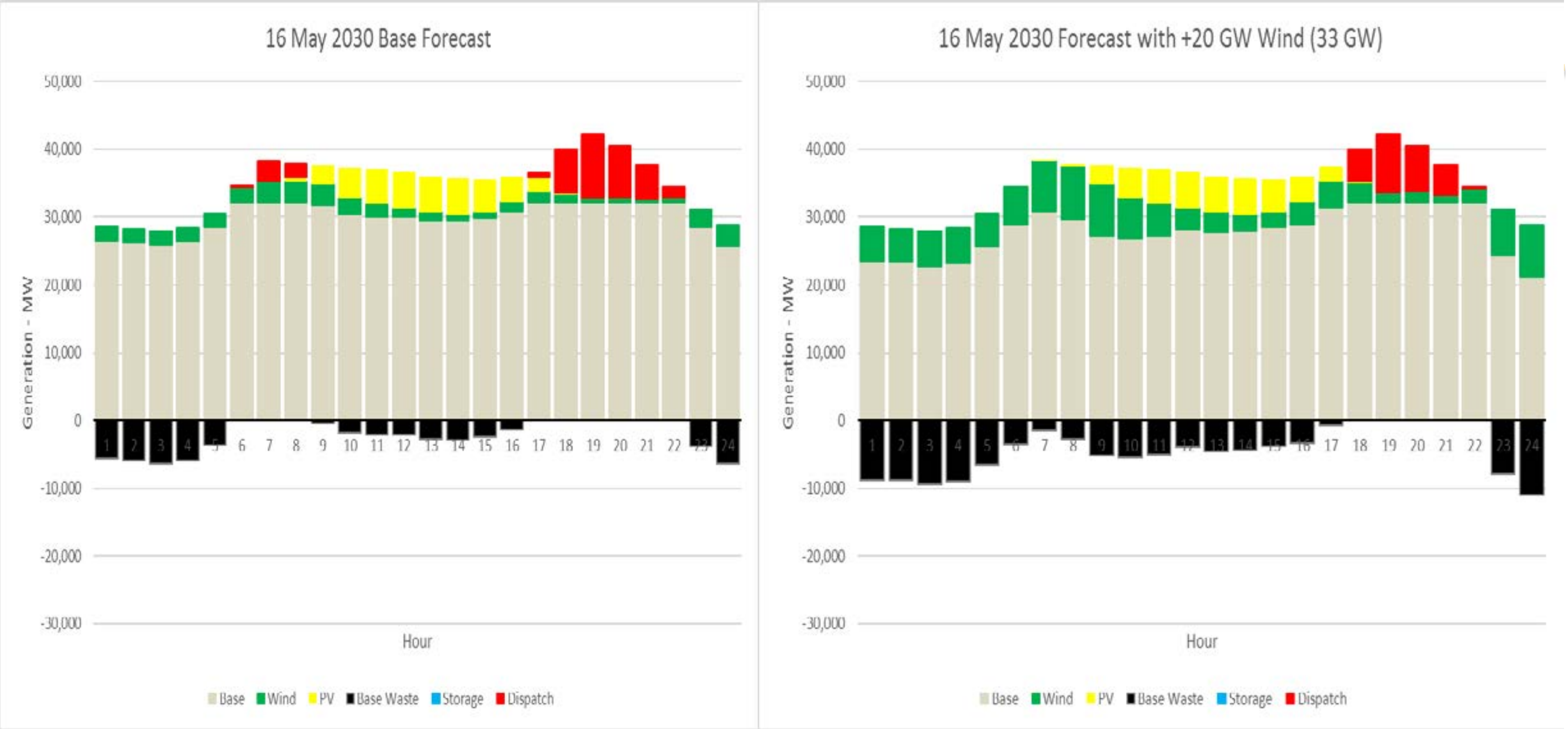
# Effect of 4 GW extra decommissioning



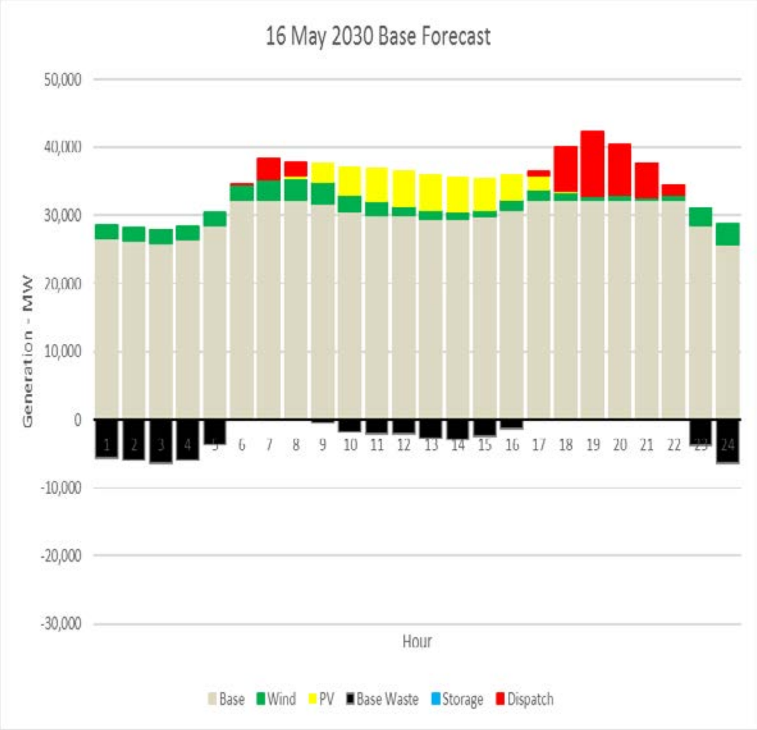



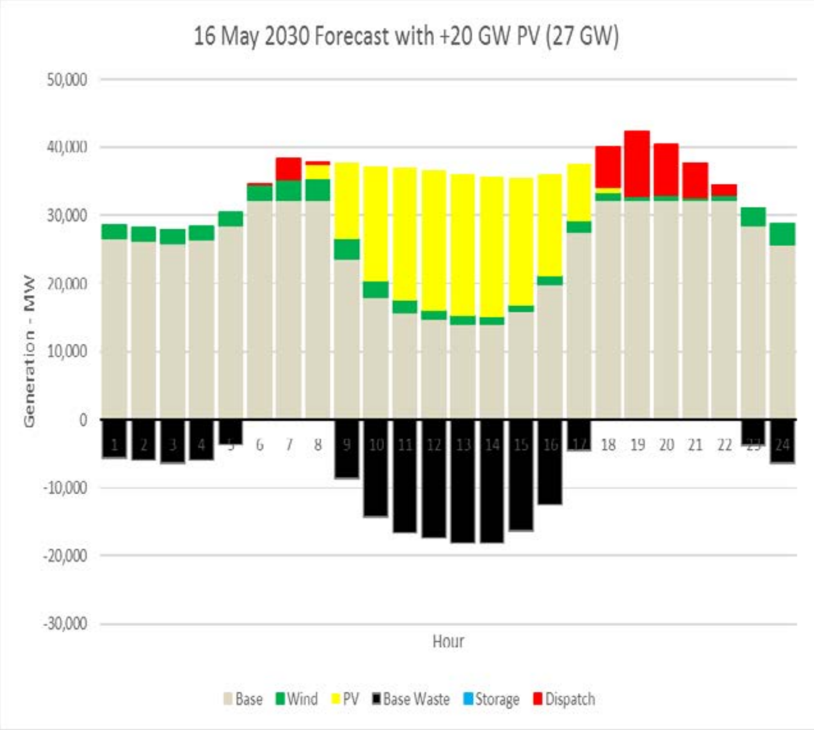
# Wind / PV

# Effect of 20 GW additional wind

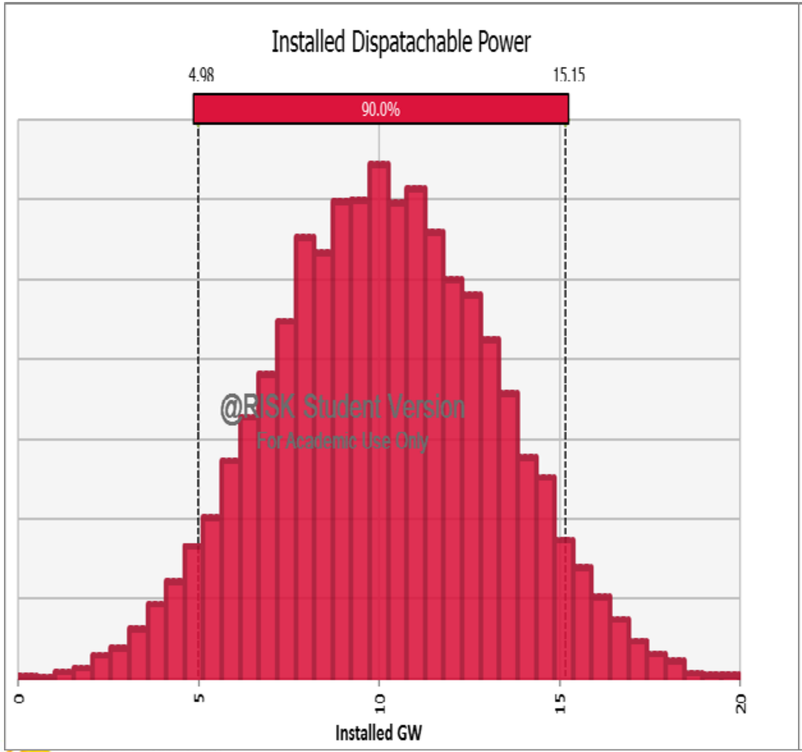


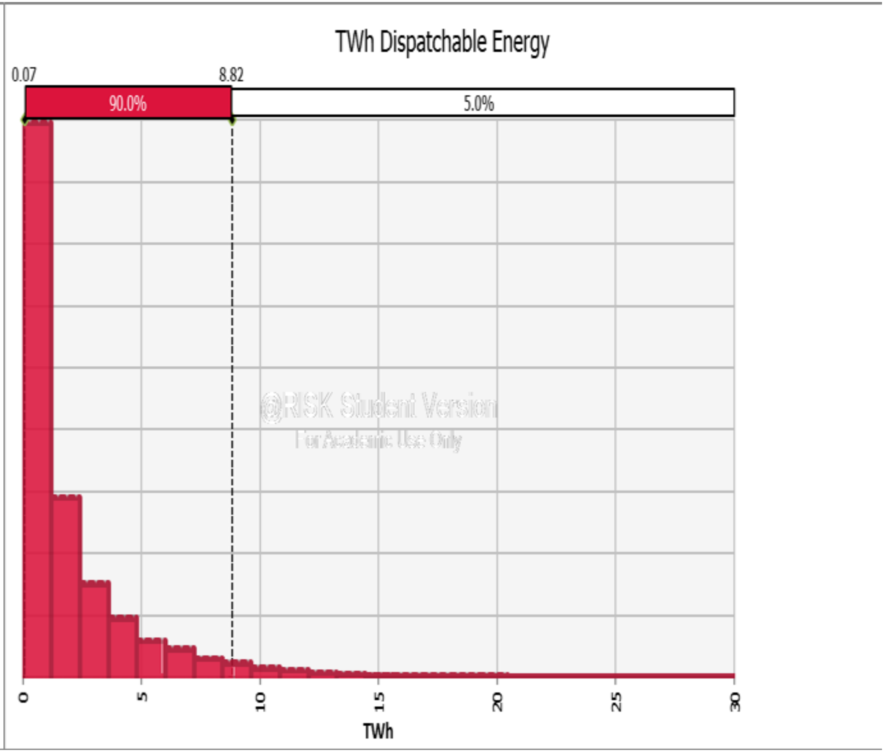
# effect of 20 GW additional PV



# Resulting uncertainty



# Recommendations

- Change orientation of IRP from a “definitive” plan to a response plan to react to the developing situation going forward
- Structure the business to facilitate shorter term and flexible planning – eliminate large scale base generation in favour of modular renewable generation, storage and dispatchable backup
- Take advantage of improved technology and costs as they develop
- Monitor changes to conditions to allow the plan to adjust as needed

# Thank You for Your Attention

## ACKNOWLEDGEMENTS:

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