# GENERATION OPTIMIZATION

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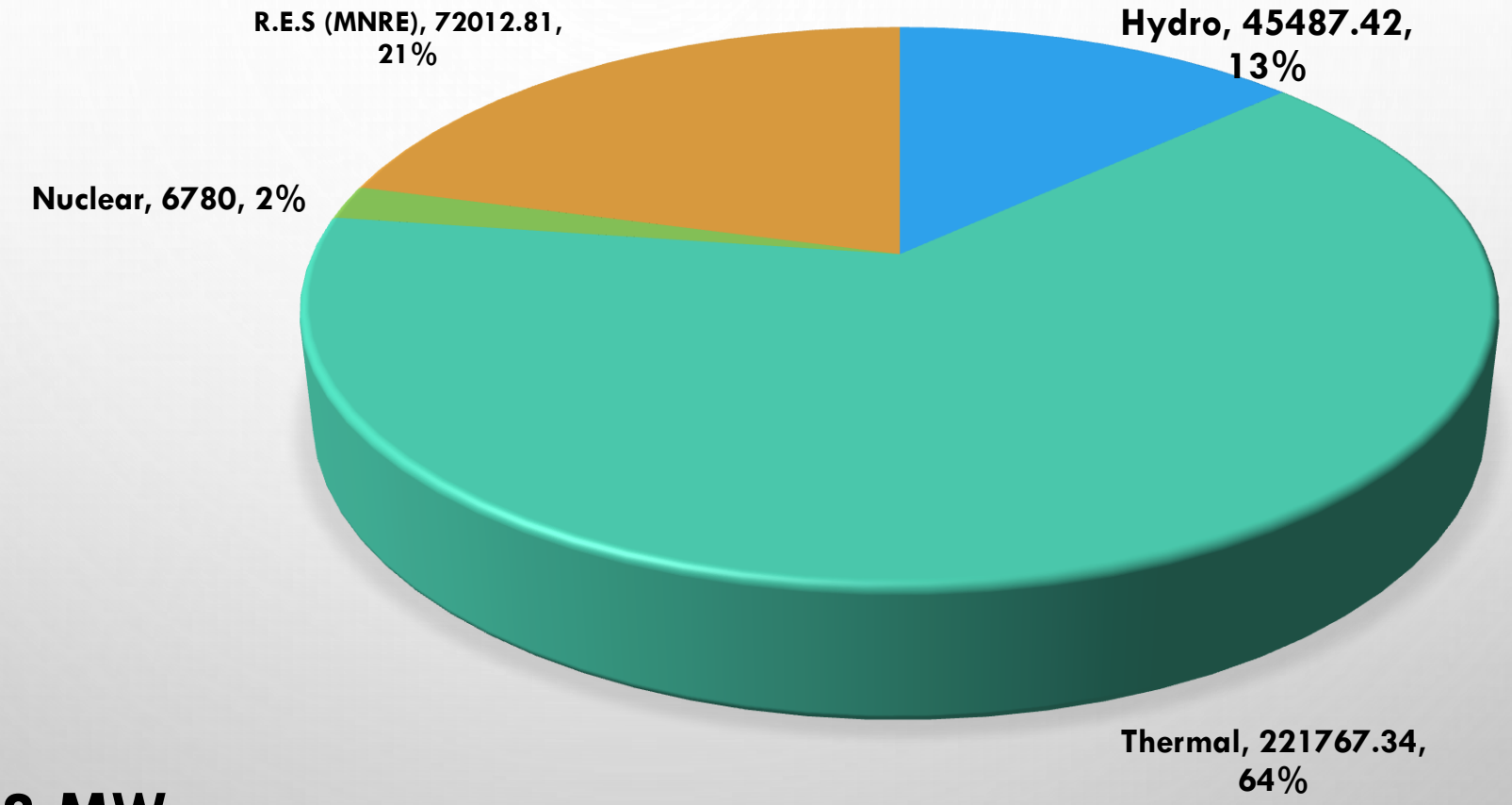
CENTRAL ELECTRICITY AUTHORITY

16th March, 2019

# ALL-INDIA INSTALLED CAPACITY (IN MW) AS ON 31.12.2018

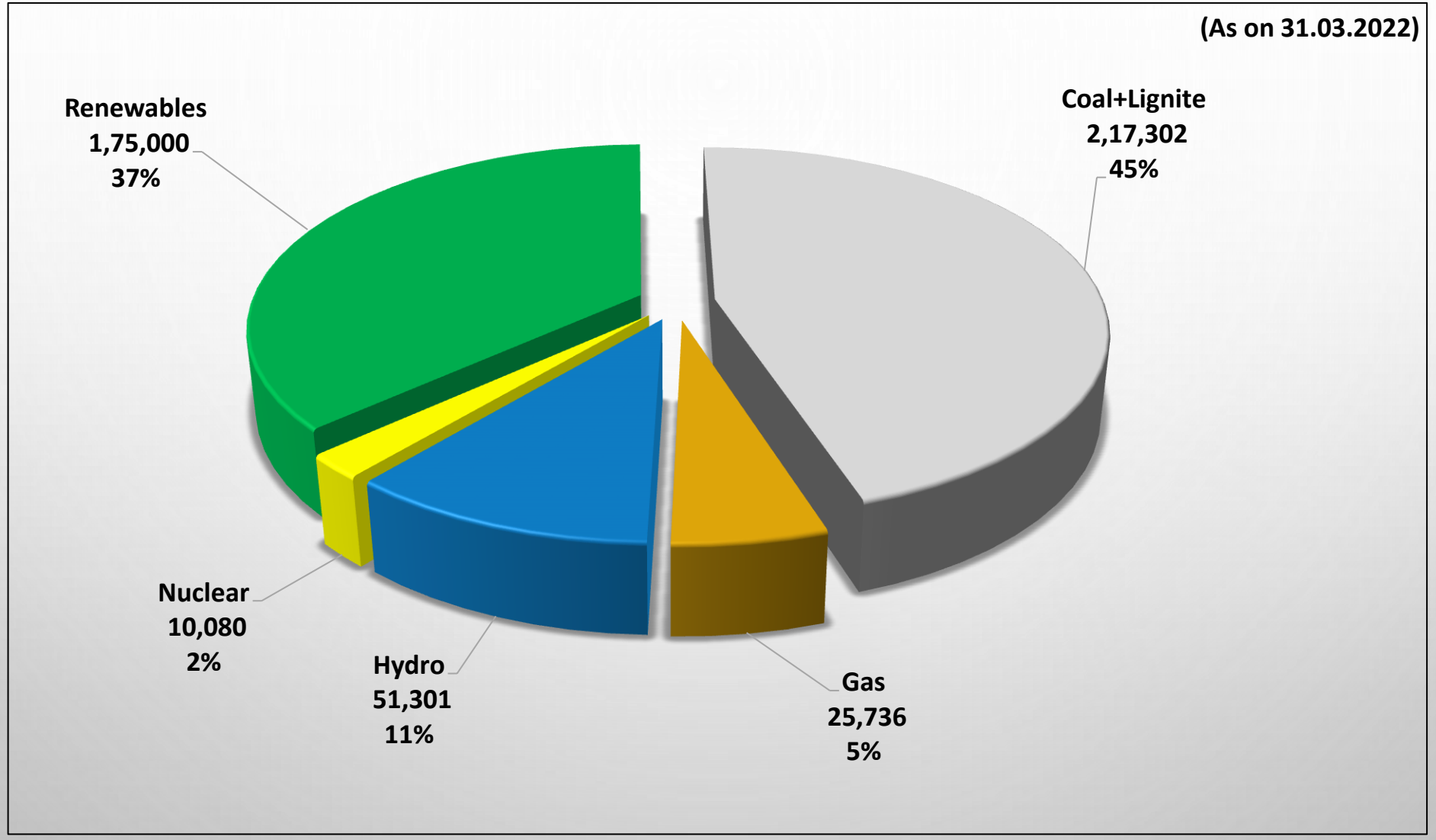



**Total 3,49,288 MW**

# PROJECTED DEMAND AS PER 19TH EPS

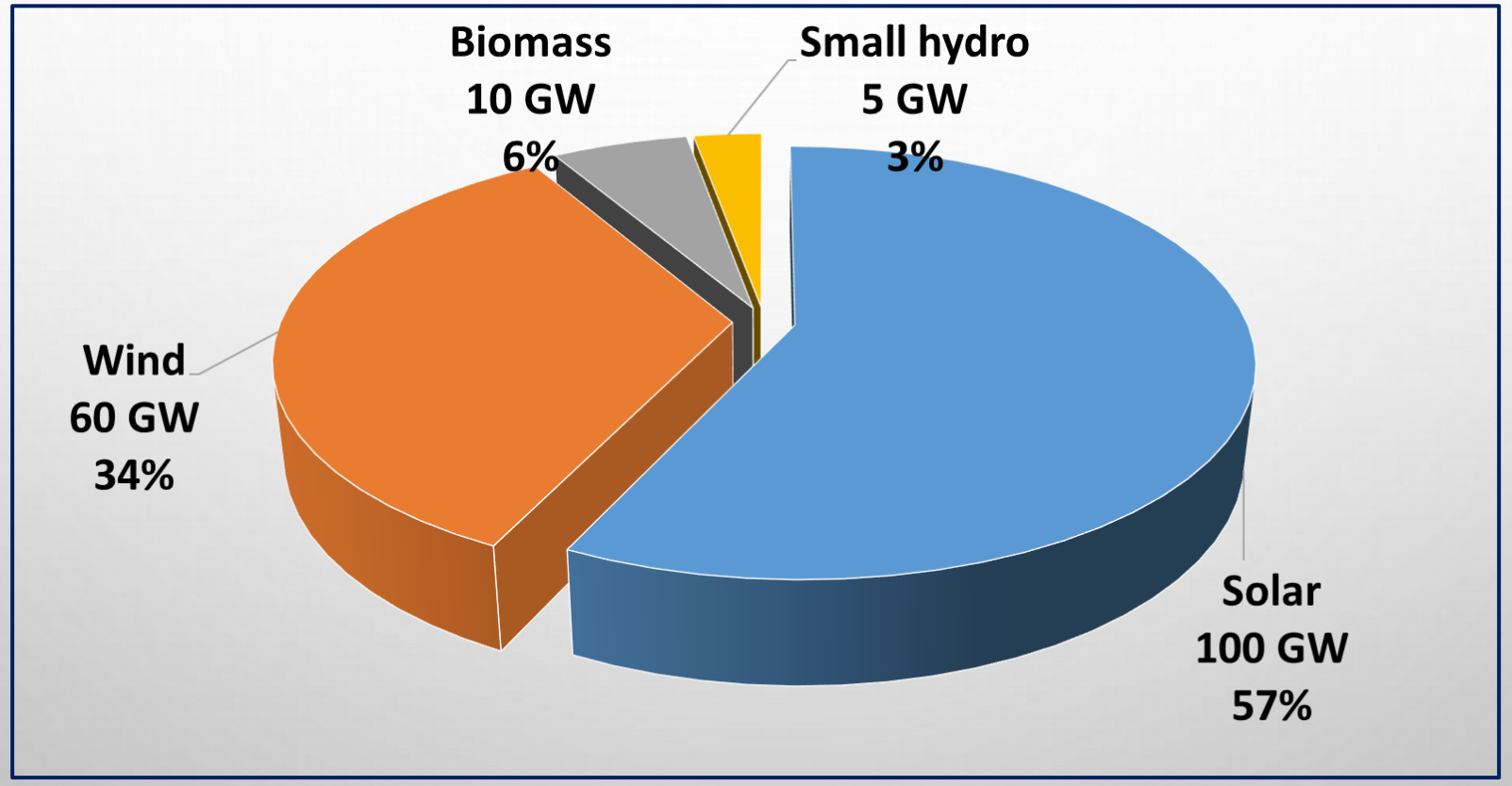
| Year | Electrical Energy Requirement (BU) Ex Bus | Peak Electricity Demand (GW) |
|---|---|---|
| 2021-22 | 1566 | 225.751 |

# PROJECTED ALL INDIA INSTALLED CAPACITY ( MARCH 2022 NEP)

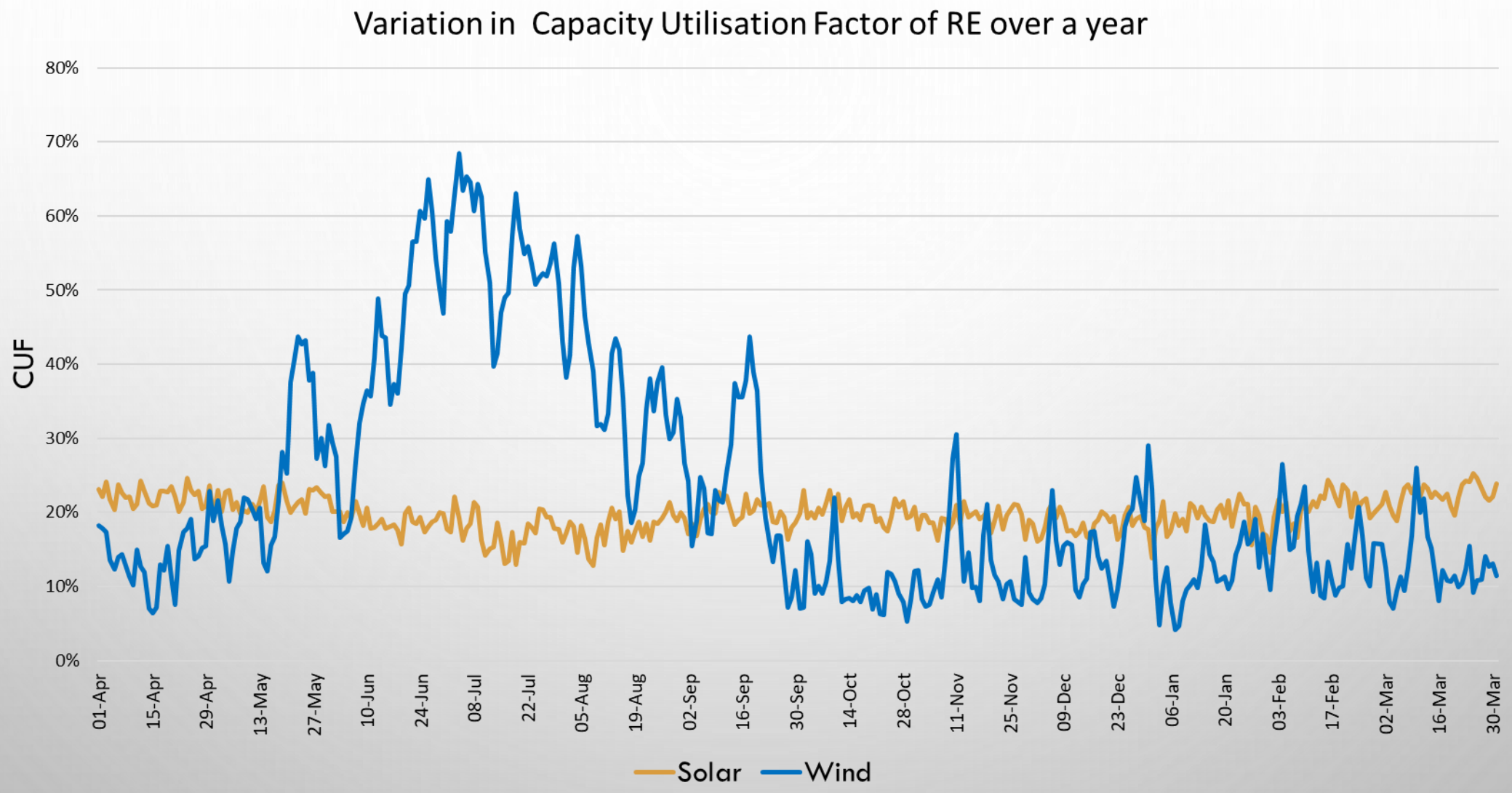



**TOTAL 4,79,419 MW**

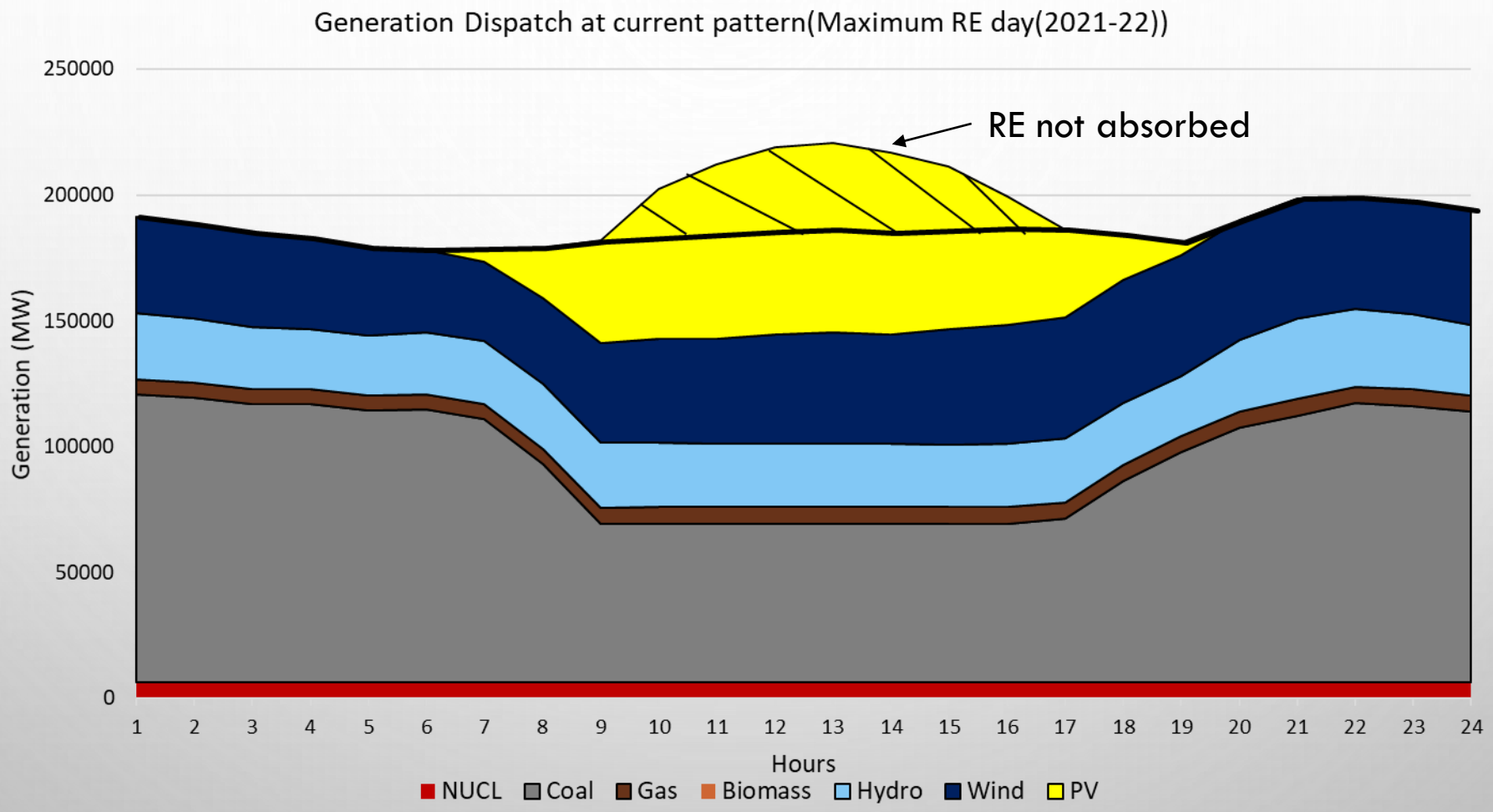
# LIKELY RENEWABLE INSTALLED CAPACITY IN MARCH 2022



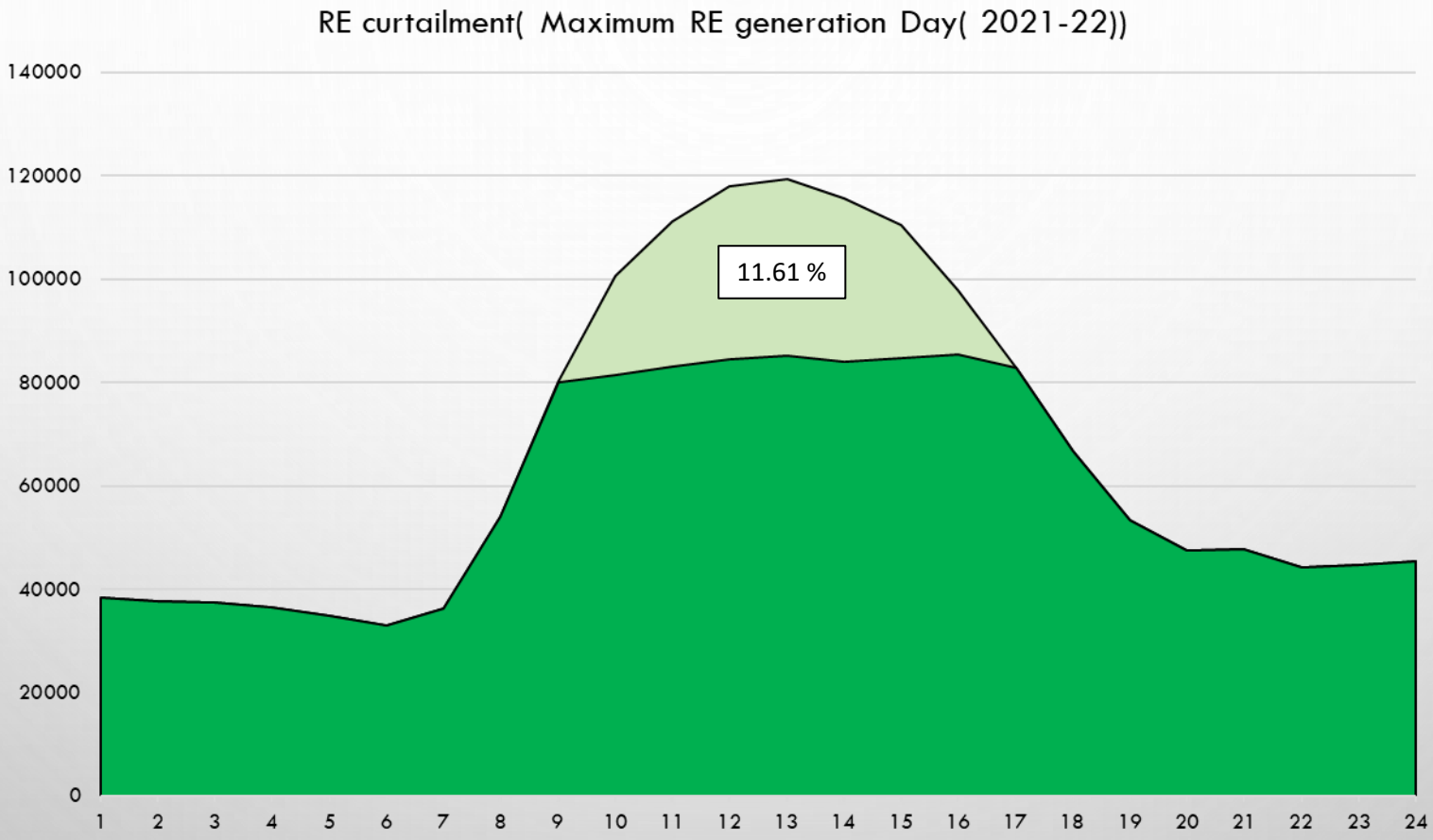
# VARIATION OF RE (SOLAR + WIND)



# GENERATION DISPATCH IN 2021-22



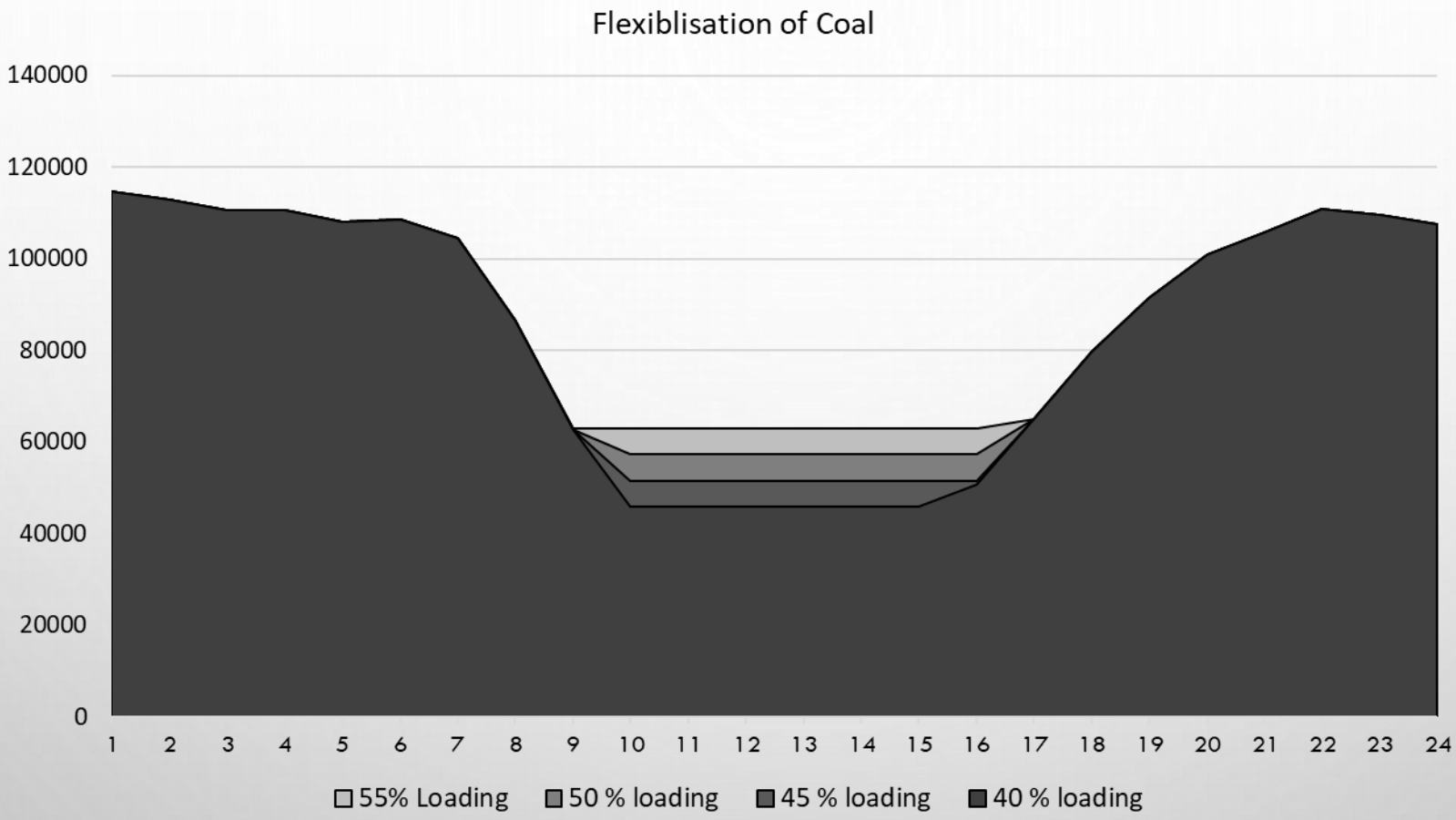
# RENEWABLE ENERGY CURTAILMENT



# TECHNOLOGIES SUITABLE FOR OPTIMIZATION

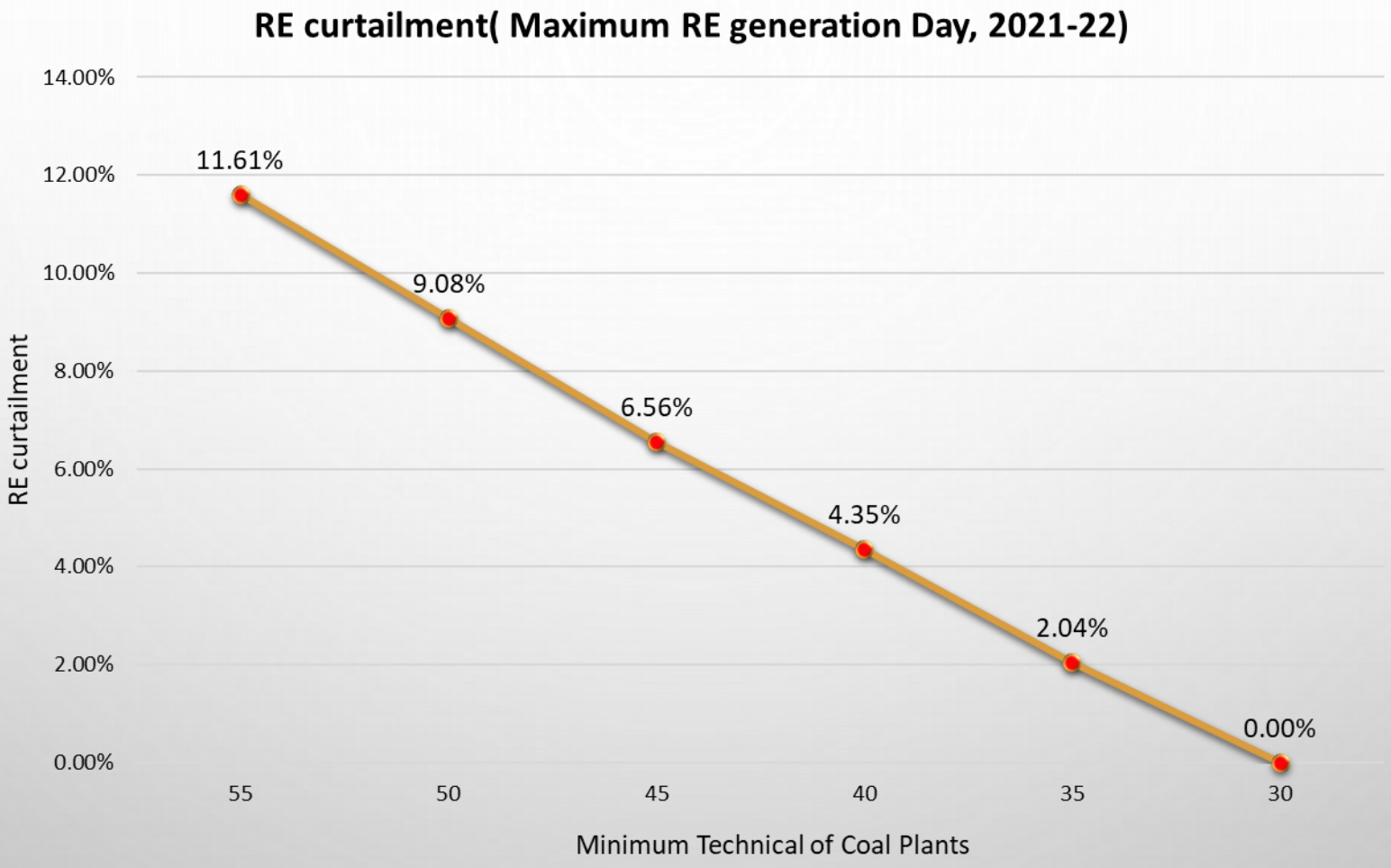
| Conventional Technologies | Renewable Technologies |
|---|---|
| Coal | Hydro Power (with Storage Reservoir) |
| Gas | Pumped Storage System |

# OPTIMIZATION OF COAL




Coal can back down to 55 % technical minimum level only

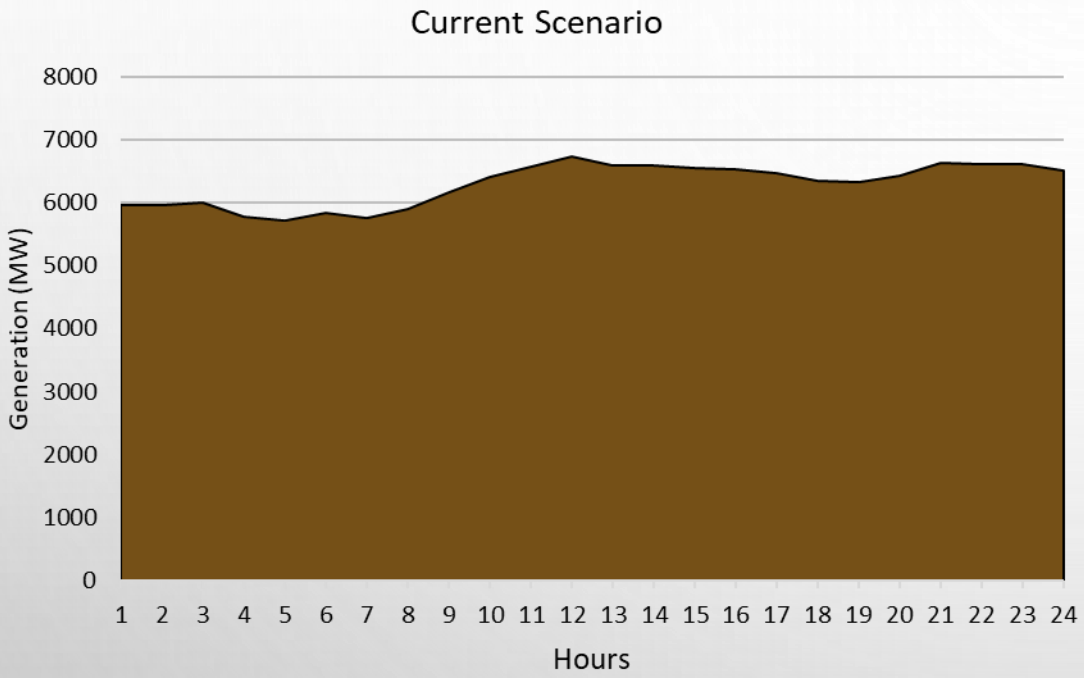
# IMPACT OF MINIMUM TECHNICAL OF COAL ON RE CURTAILMENT

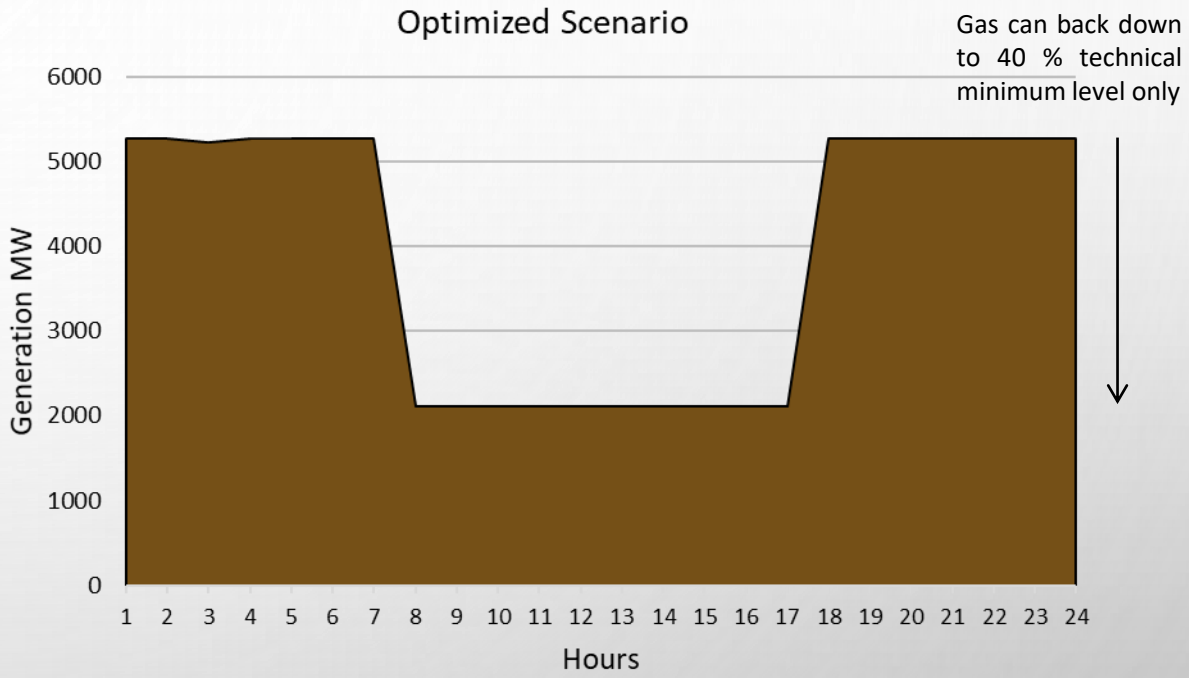


# ISSUES ASSOCIATED WITH FLEXIBILITY IN COAL PLANTS

- ADDITIONAL INVESTMENT TOWARDS RETROFITTING TO RUN PLANTS AT LOW LOADS
- LIMITED RAMP UP AND RAMP DOWN RATES
- REDUCTION IN LIFE - HIGHER O&M COSTS DUE TO FREQUENT LOAD VARIATIONS.
- LOSS IN EFFICIENCY AT PARTIAL LOADING.
- HIGHER EMISSION OF $CO_2$

# OPTIMIZATION OF GAS GENERATION



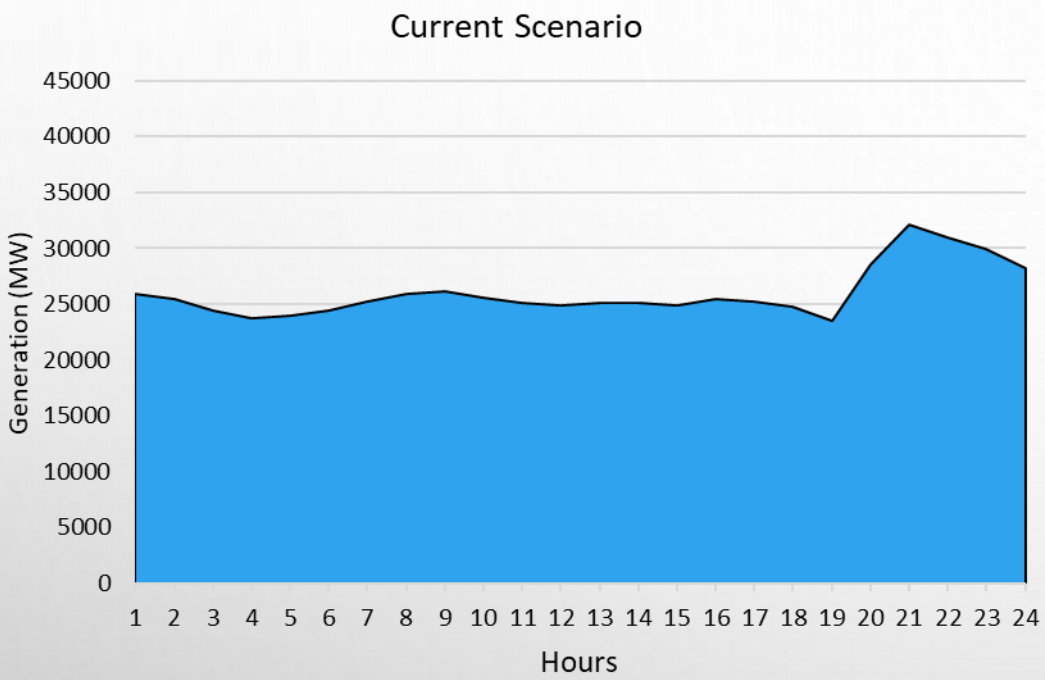
# ISSUES ASSOCIATED WITH OPTIMIZING GAS BASED GENERATION

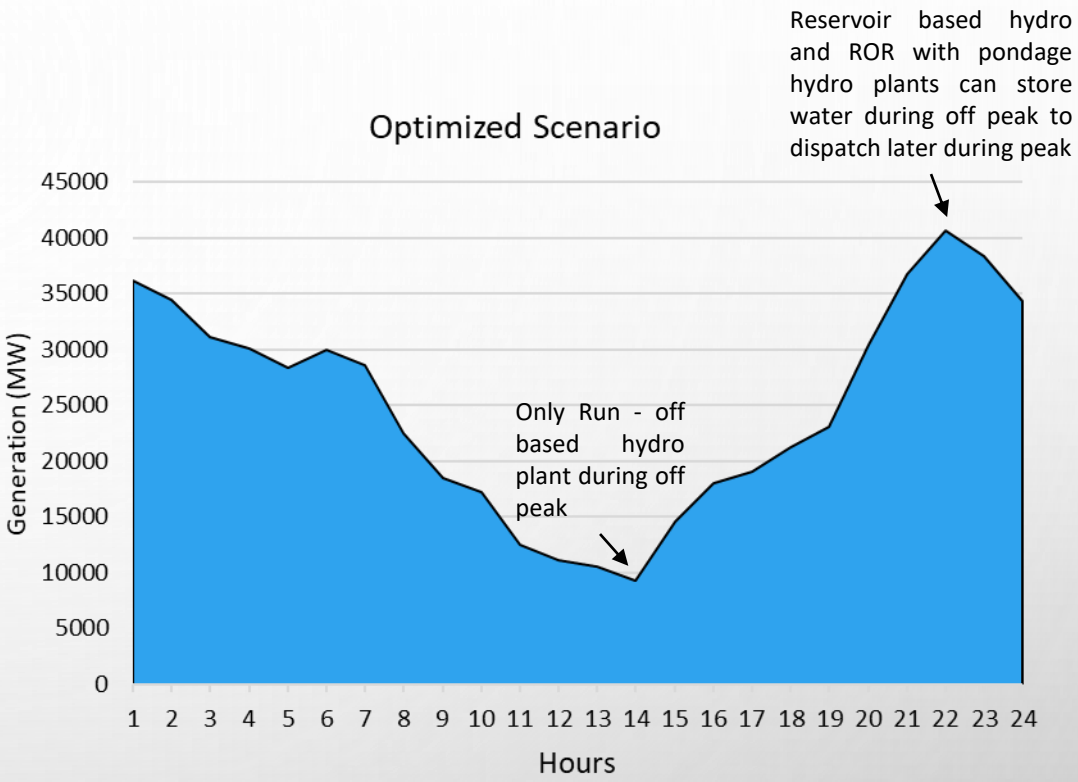
- HUGE SHORTAGE OF DOMESTIC GAS
- CONSTRAINTS DUE TO GAS SUPPLY CONTRACTS
  - GAS SUPPLY CONTRACTS ARE GENERALLY FOR A FIXED AMOUNT OF GAS DURING THE ENTIRE DAY. TO HAVE GAS SUPPLY ONLY DURING PEAK HOURS MAY POSES PROBLEMS
- CONSTRAINTS OF THE GAS PIPE LINE
  - POWER PLANTS ARE NOT THE ONLY CONSUMERS OF THE GAS. THERE ARE OTHERS LIKE FERTILIZER PLANTS ON THE GAS PIPE LINE WHICH NEED GAS SUPPLY AT A CERTAIN PRESSURE TO BE MAINTAINED
- CONSTRAINTS OF THE PRICING OF IMPORTED RLNG
  - IMPORTED LNG PRICE IS DUAL DEPENDENT ON GAS PRICE FLUCTUATIONS IN THE INTERNATIONAL MARKET AND THE DOLLAR EXCHANGE RATE
- CONSTRAINTS OF THE IMPORTED RLNG TERMINALS AND REGASIFICATION PLANTS
  - IMPORTED RLNG TERMINALS IN OPERATION ARE LOCATED IN WEST COAST AND MANY GAS BASED PLANTS LOCATED IN THE EAST COAST CAN NOT GET IMPORTED RLNG THROUGH THE PIPE LINE

# OPTIMIZATION OF HYDRO GENERATION

| Year | ROR | % | ROR(P) | % | Storage | % | Mul. Pur | % | PSS | % | Total | Import | SHP | Gr. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2021/22 | 4039 | 8.0% | 19985 | 39.7% | 8646.7 | 17.2% | 11910 | 23.7% | 5746 | 11.4% | 50327 | 4356 | 5000 | 59683 |

# OPTIMIZATION OF HYDRO



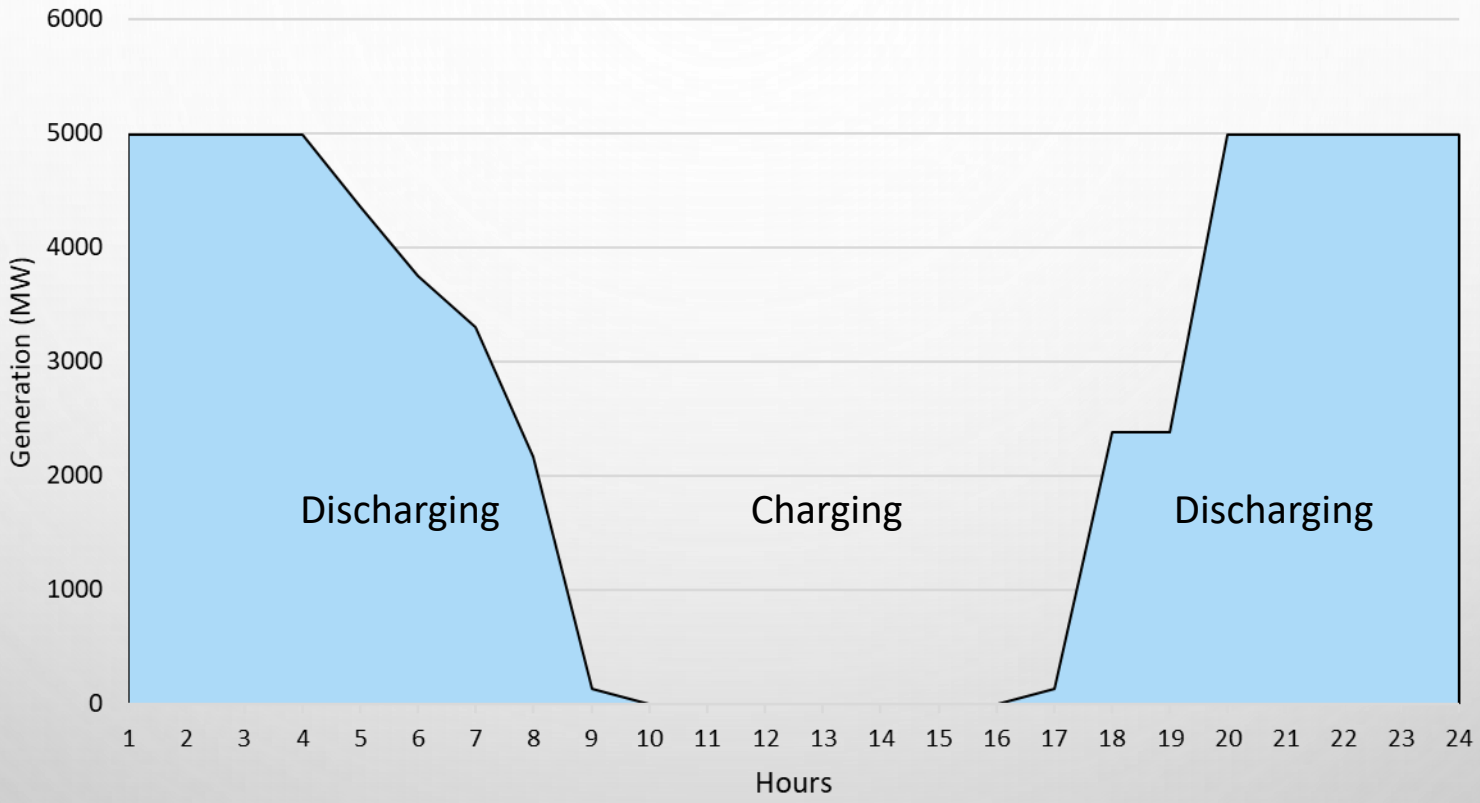
# ISSUES ASSOCIATED WITH OPTIMIZING HYDRO BASED GENERATION

- SEVERAL HYDRO PROJECTS ARE RUN OFF RIVER AND MULTI-PURPOSE PROJECTS- SO HAVE TO RUN DURING OFF PEAK HOURS
- NO COMMERCIAL MECHANISM TO PROMOTE OPERATION DURING PEAK HOURS, PARTICULARLY IN STATES.
- HYDRO PROJECTS FACING PROBLEMS OF SILT WHICH REDUCES THE RESERVOIR CAPACITY OF PROJECT.

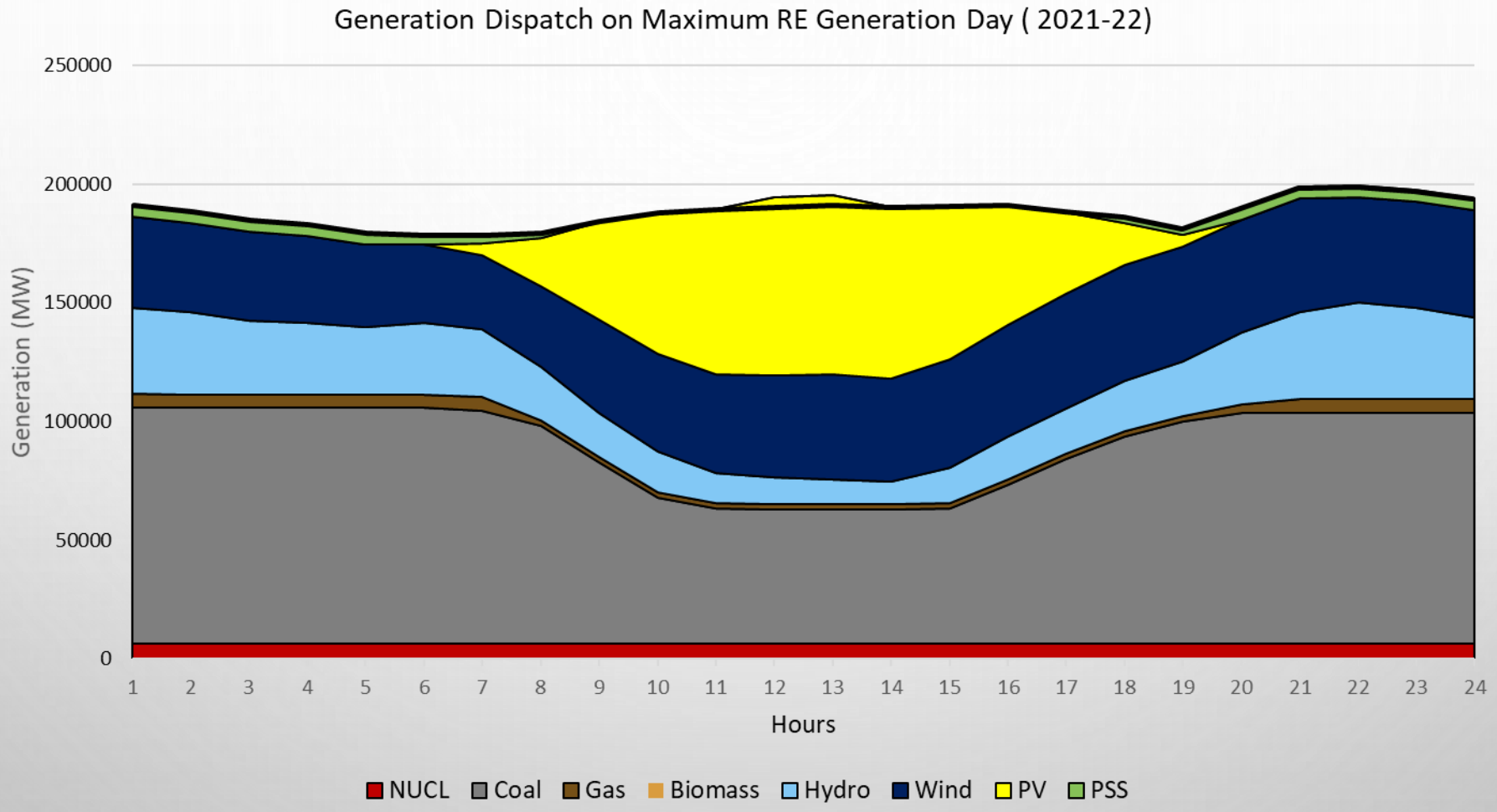
# OPTIMIZATION OF PUMPED STORAGE HYDRO PLANTS

Current PSP capacity – 2760 MW

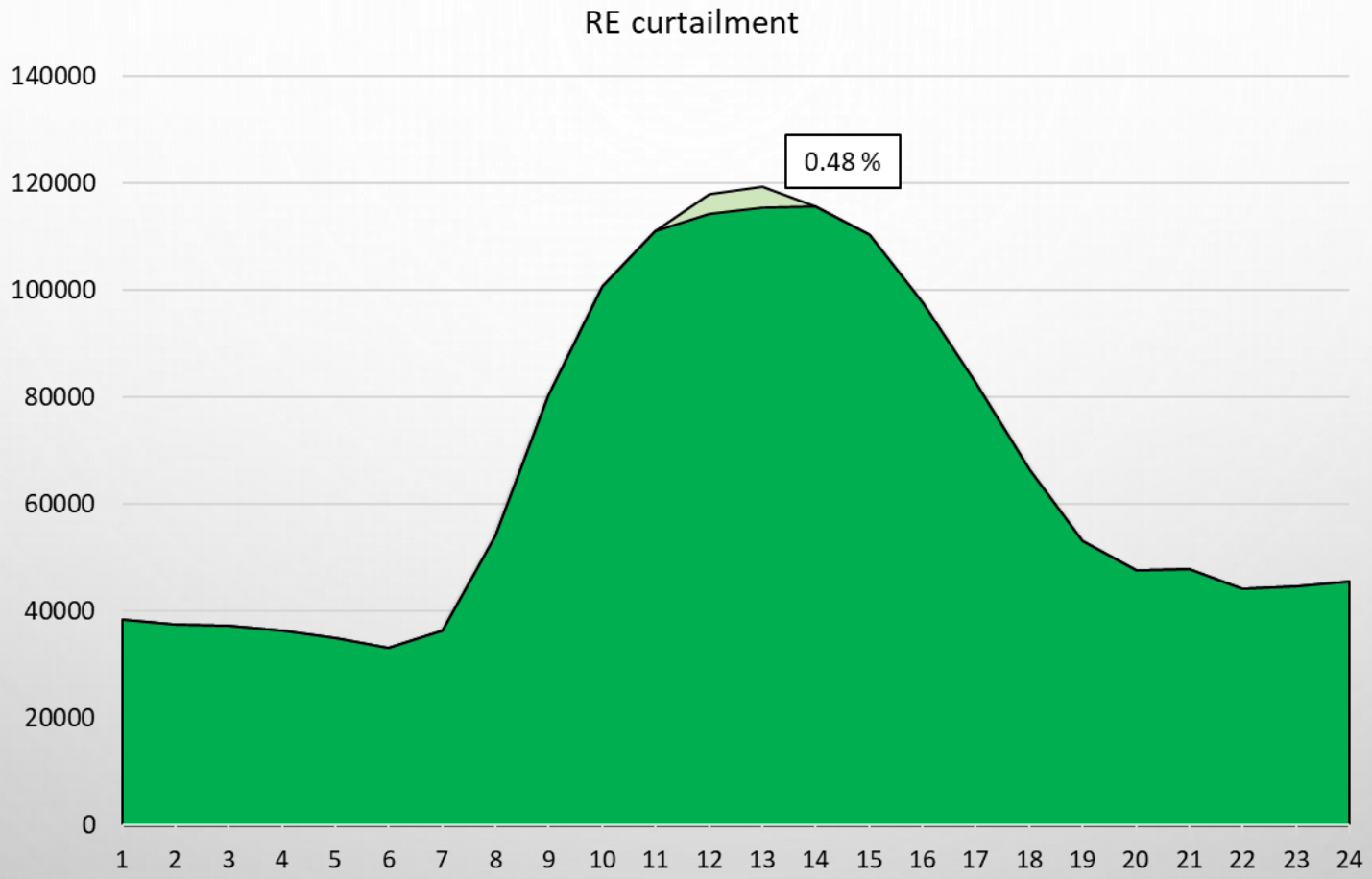
PSP capacity in 2021-22 – 5746 MW



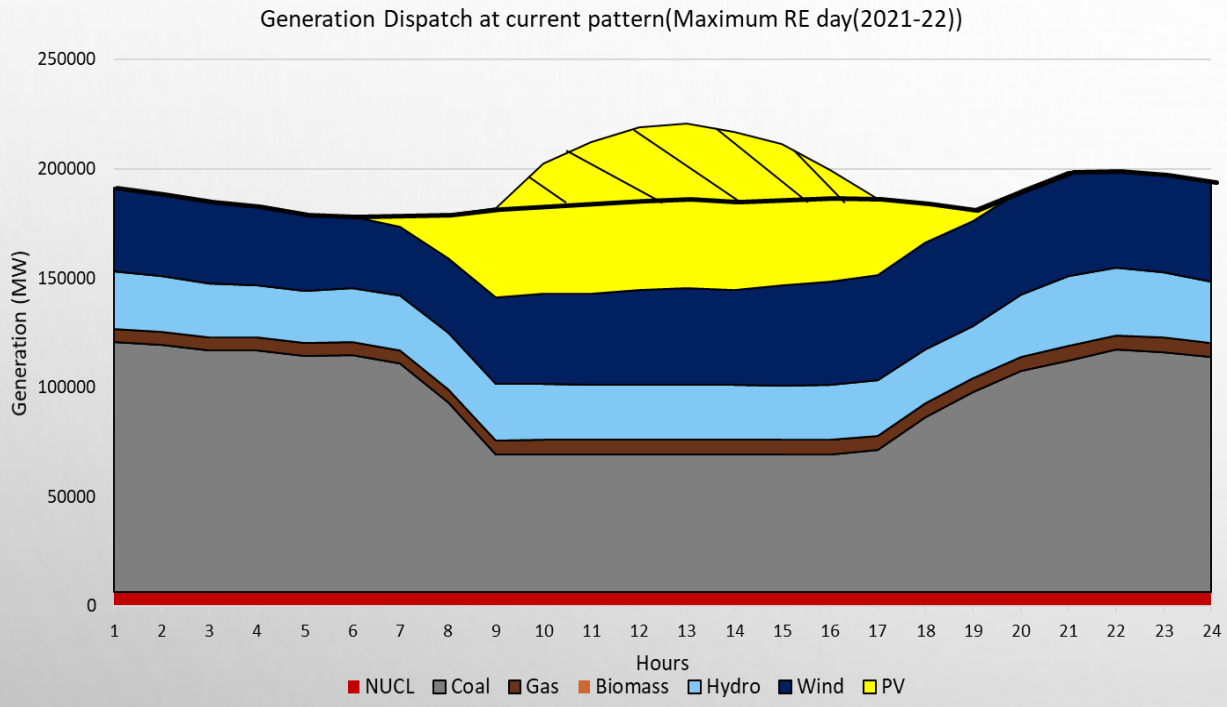
# OPTIMIZED GENERATION

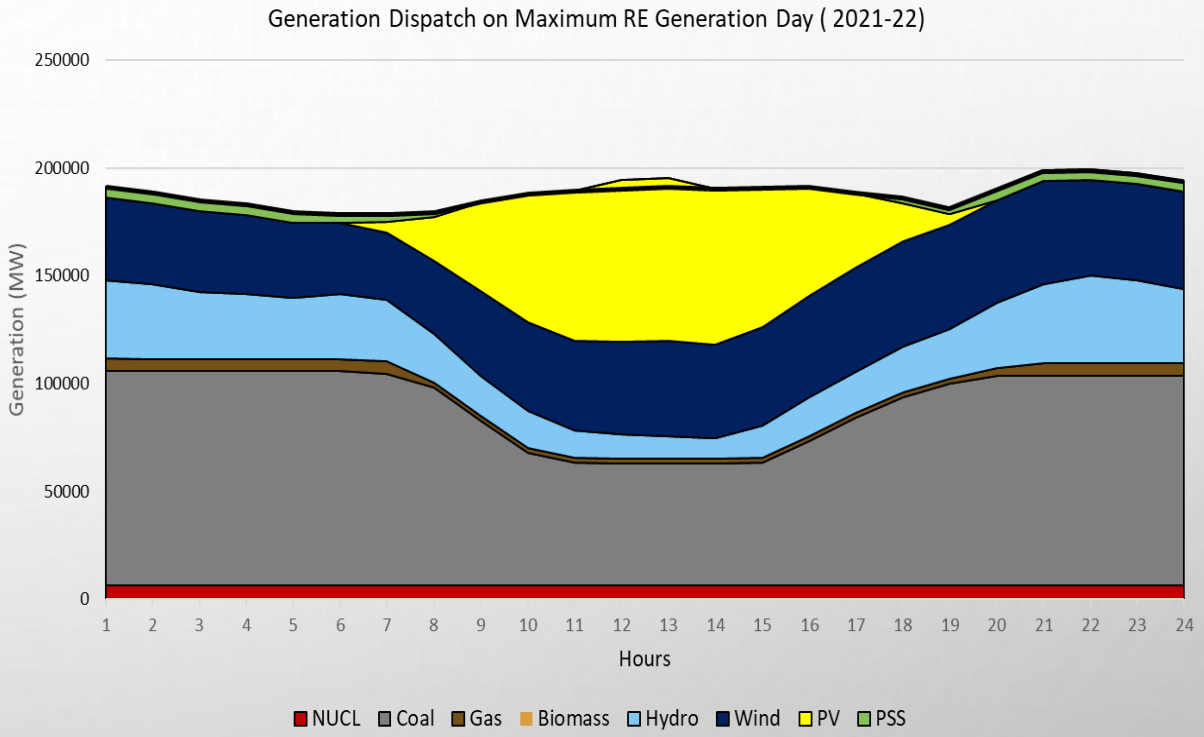


# RE CURTAILMENT AFTER OPTIMIZATION



# COMPARISON


Generation Dispatch at current pattern(Maximum RE day(2021-22))
250000
200000
150000
100000
50000
0
Generation (MW)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours
NUCL Coal Gas Biomass Hydro Wind PV


Generation Dispatch on Maximum RE Generation Day ( 2021-22)
250000
200000
150000
100000
50000
0
Generation (MW)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours
NUCL Coal Gas Biomass Hydro Wind PV PSS

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danke
謝謝
ngiyabonga
teşekkür ederim
Баярлалаа
спасибо
thank you
gracias
tapadh leat
dank je
mochchakkeram
хвала
bedankt
dziękuję
hvala
mauruuru
obrigado
sukriya
kop khun krap
go raibh maith agat
arigatô
takk
dakujem
merci
grazie
terima kasih
감사합니다
ありがとう
ευχαριστώ
merci
merci
merci