



# Future Outlook of Engineering Practices in O&G and Energy

Presented by:

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# Outline of Presentation

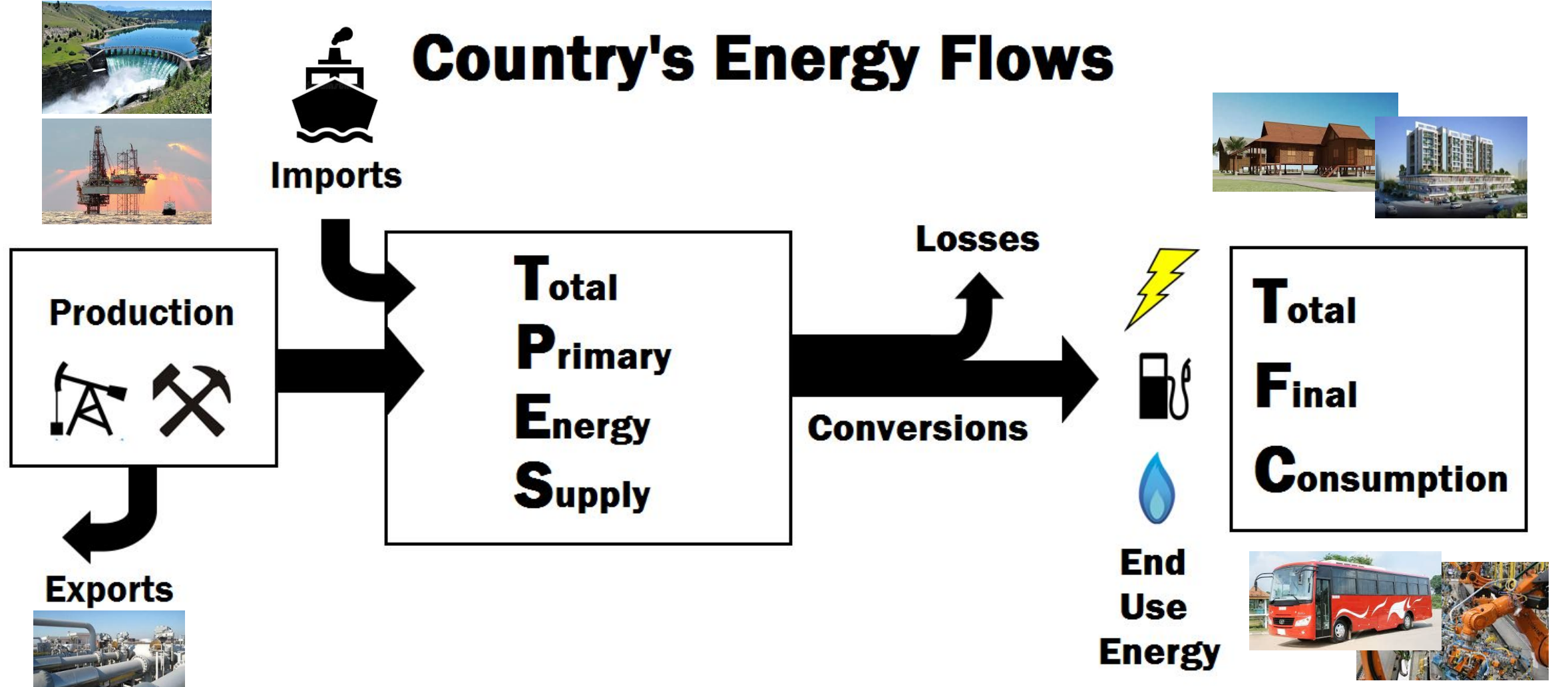
National Energy Balance 2019 & Energy Data

Electricity Demand Outlook and RE & EE Deployment

Challenges and Conclusion

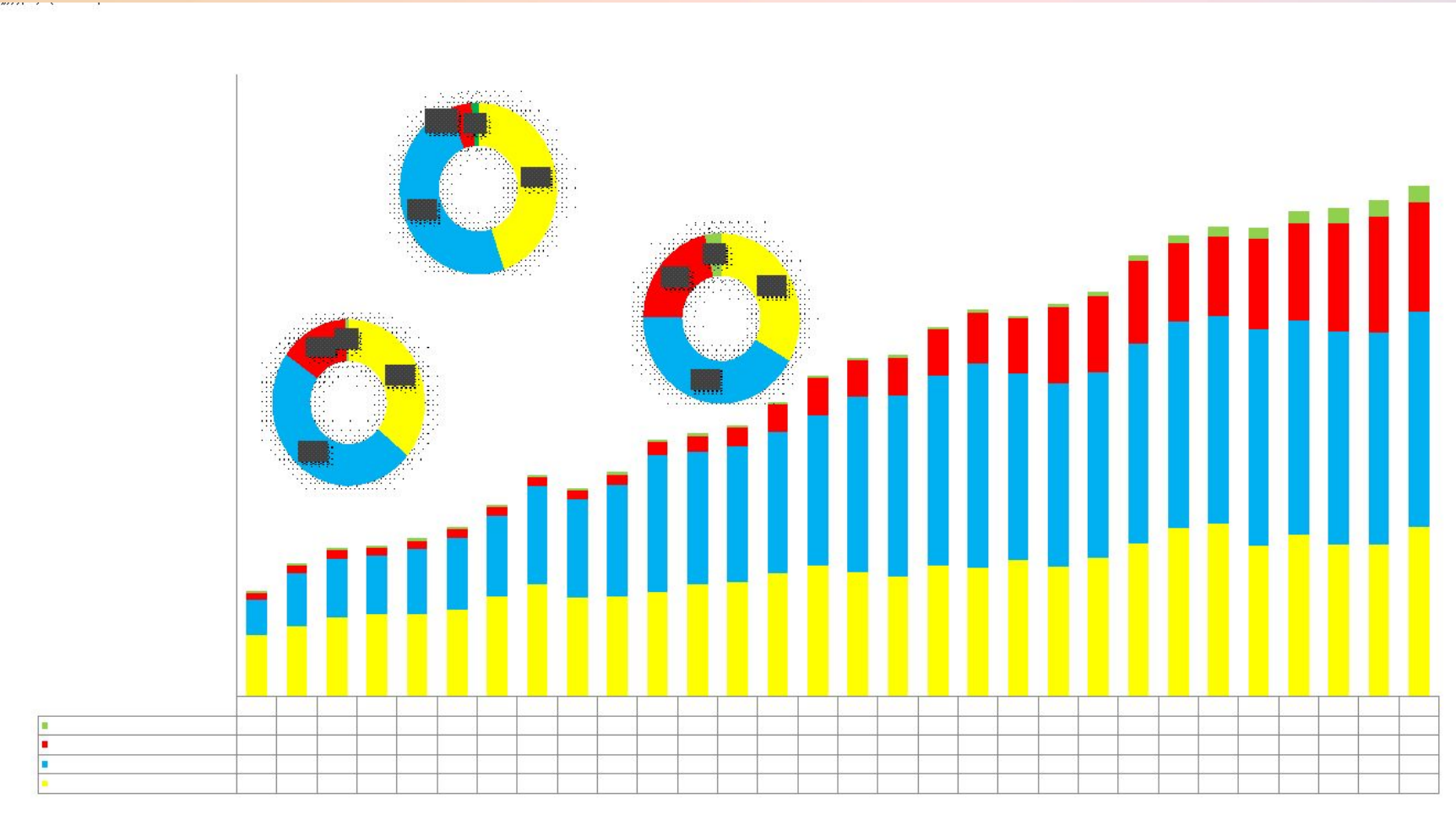
# Energy Balance Concept

## Primary Energy Vs Energy Consumption





Total Primary Energy Supply in 2019 (98,681 ktoe)



Hydro and RE: 3,349 ktoe ( 3.4 %)



Natural Gas: 41,401 ktoe ( 41.9 %)



Coal & Coke: 21,057 ktoe ( 21.34 %)

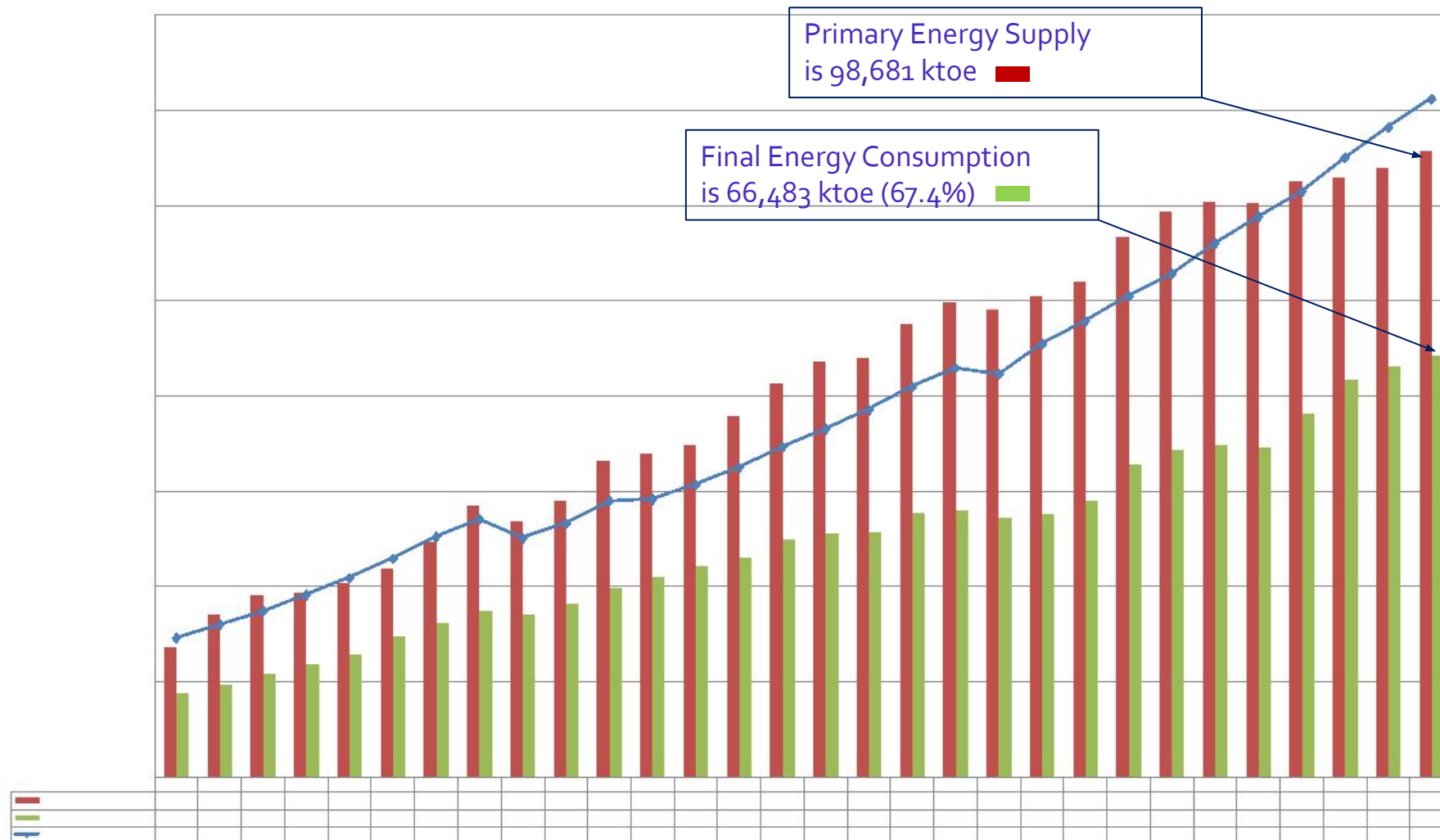


Crude Oil, Petroleum & Others: 32,813  
ktoe ( 33.25 %)



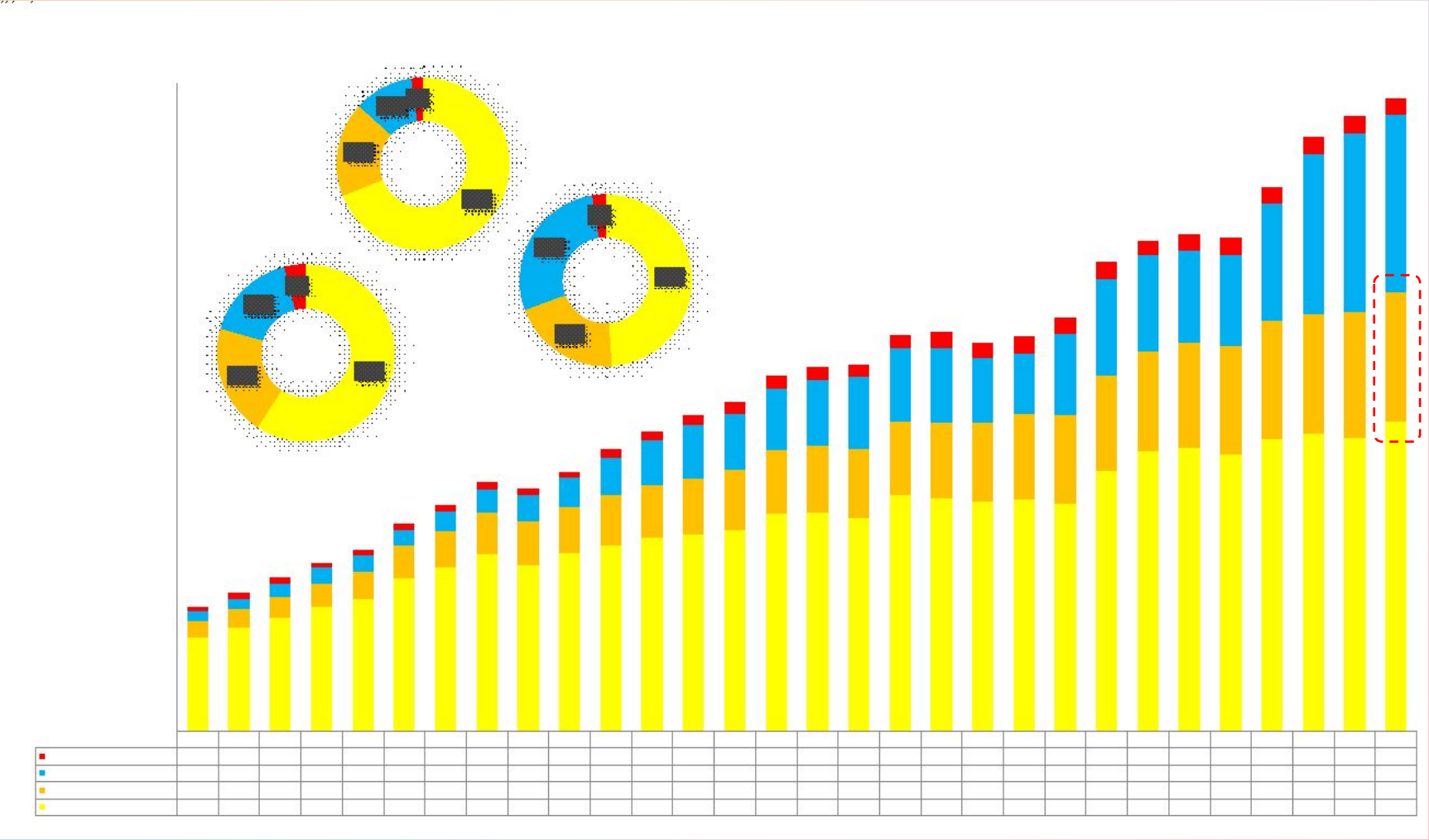


# Trends in GDP, Primary Energy Supply and Final Energy Consumption, 1990-2019





Final Energy Consumption by Type of Fuels in 2019 was 66,483 ktoe (67.4% of TPES)



Coal & Coke 1,706  
ktoe ( 2.6 %)



Gas 18,647 ktoe  
( 28.0 %)



Electricity 13,647 ktoe  
( 20.5 %)

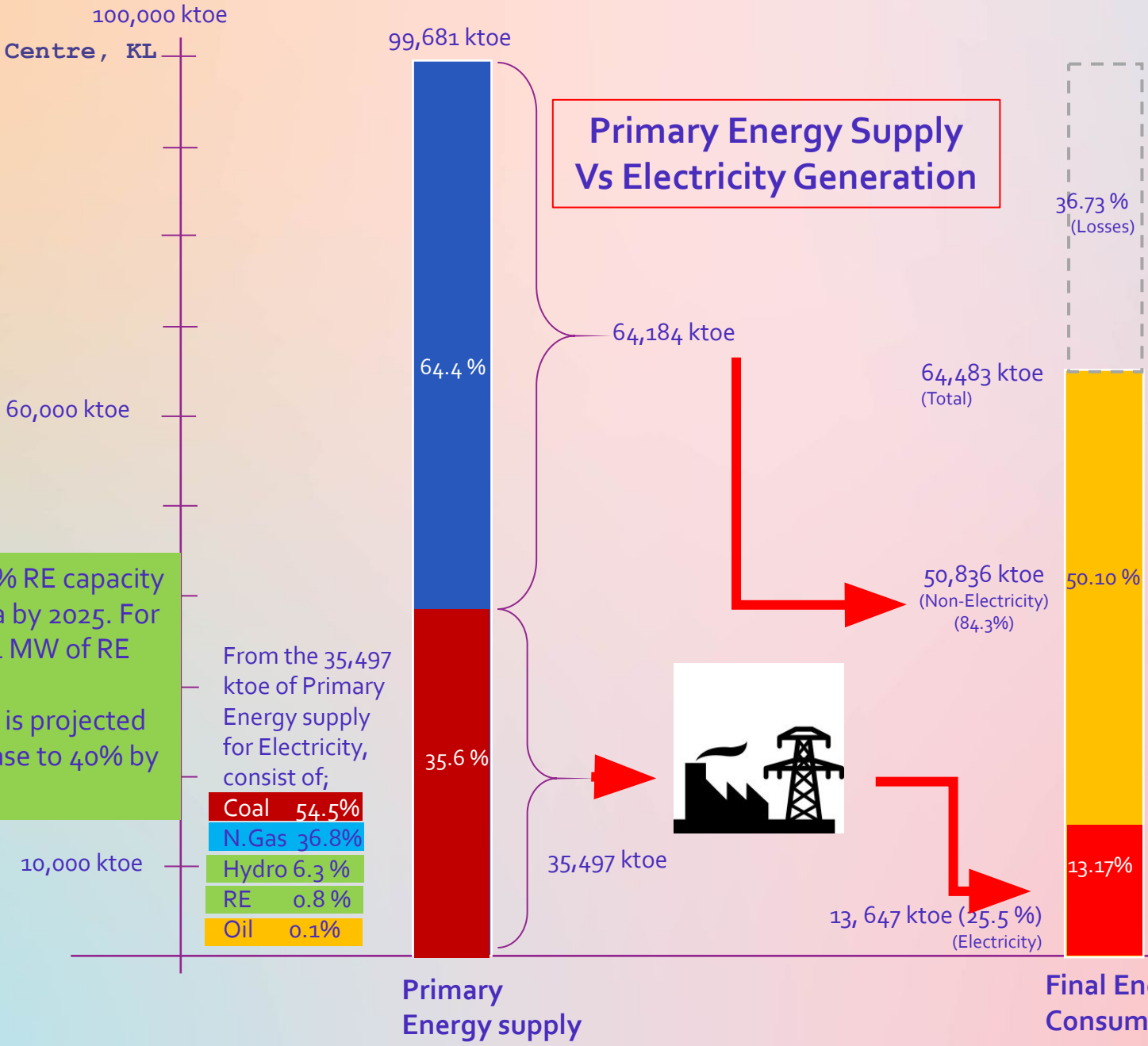


Petroleum Products:  
32,483 ktoe ( 48.8 %)

Electricity : 13,647 ktoe  
Non-Electricity: 50,836 ktoe



It is targeted 31% RE capacity mix for Malaysia by 2025. For Peninsular 8,531 MW of RE capacity. RE capacity mix is projected to further increase to 40% by 2035



Primary Energy Supply  
99,681 ktoe (2019)

Final Energy Consumption  
64,483 ktoe (64.7 %)

Each unit of electricity produced will required about 3 unit of Primary Energy Supply at Power Plant

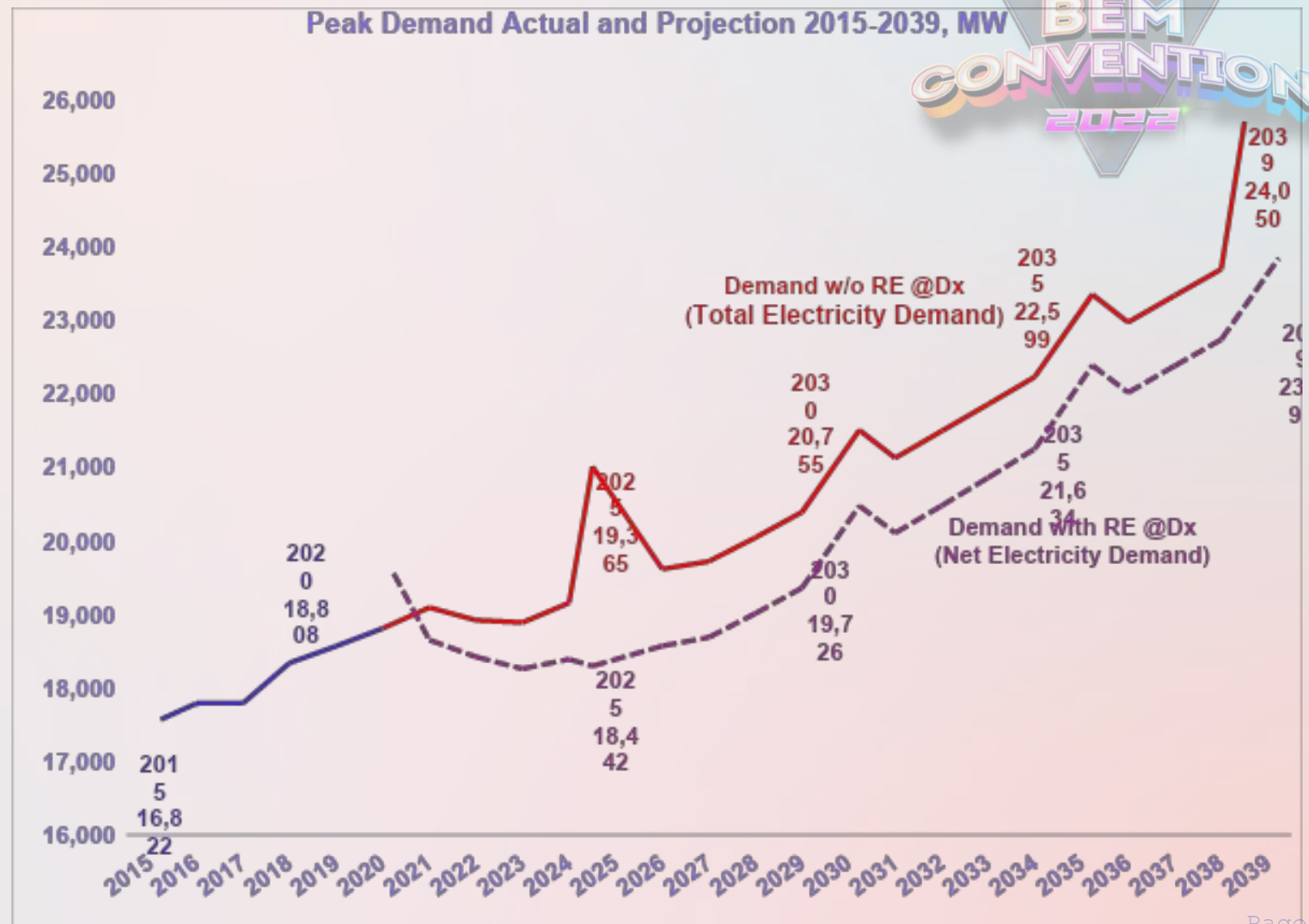
Implementing Energy Efficiency (EE) plus advance technology will reduced energy demand, hence will reduce CO2 emission.

Producing own source of energy form RE will also reduced demand and CO2 emission.

# Demand Outlook (2021 to 2039)



- Total Electricity Demand is projected to grow by:
  - 0.9% (2021 to 2030)
  - 1.7% (2031 to 2039)
- Net Electricity Demand is projected to grow by:
  - 0.6% (2021 to 2030)
  - 1.8% (2031 to 2039)
- Net Electricity Demand will be used for the Pen. Malaysia Generation Development Plan.

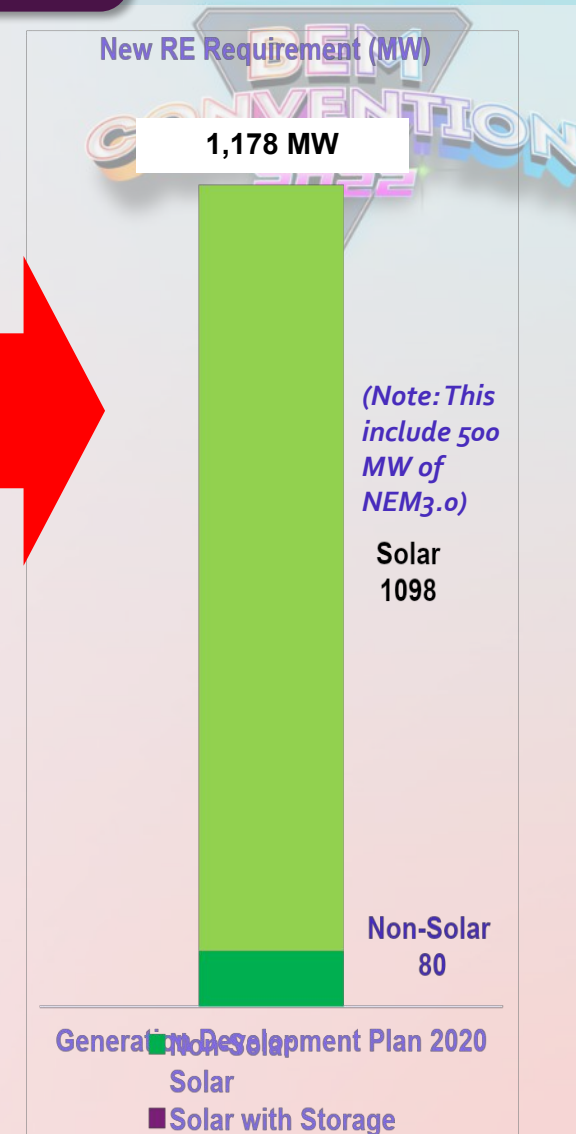
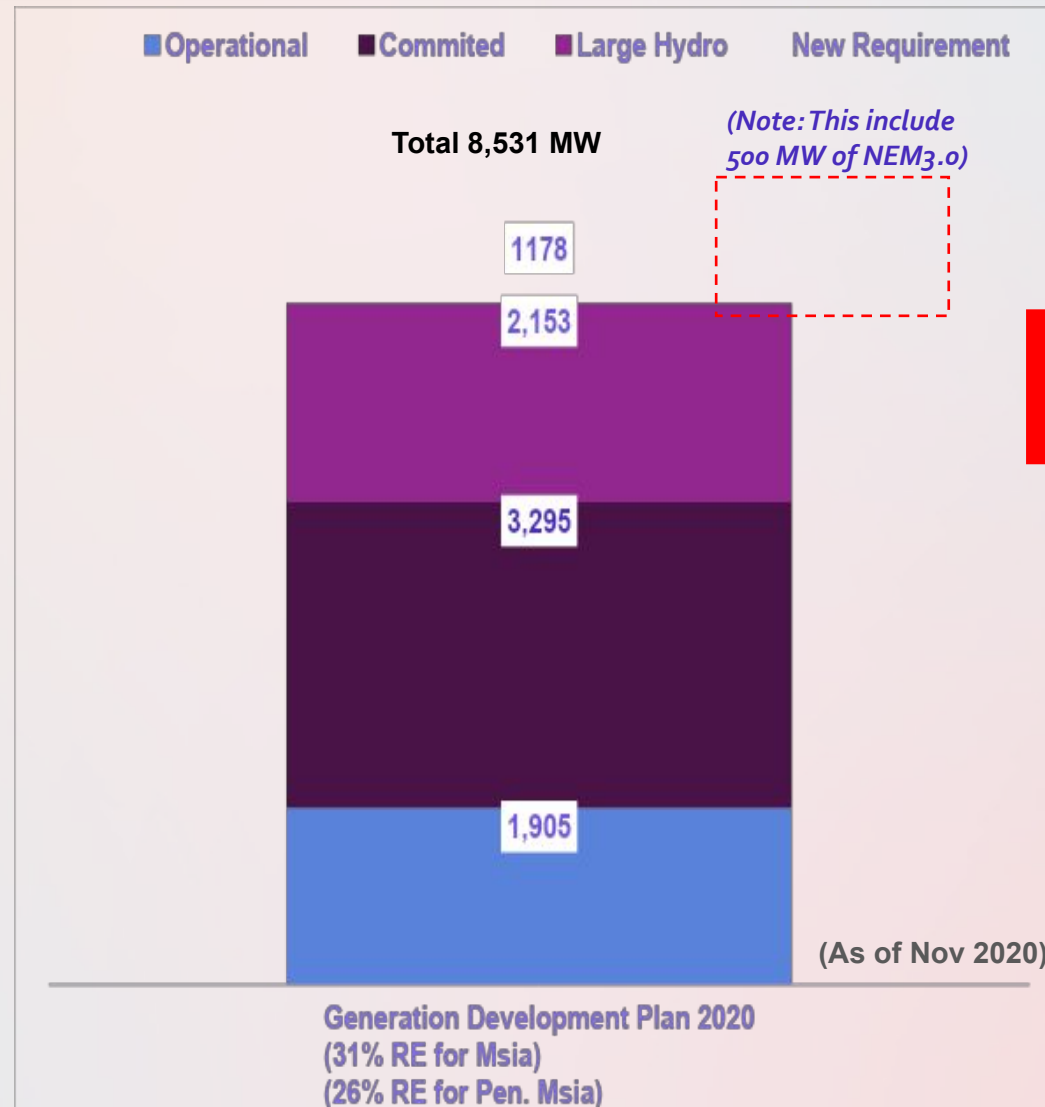




# New RE requirements to meet the 31% RE Capacity Mix by 2025 for Malaysia



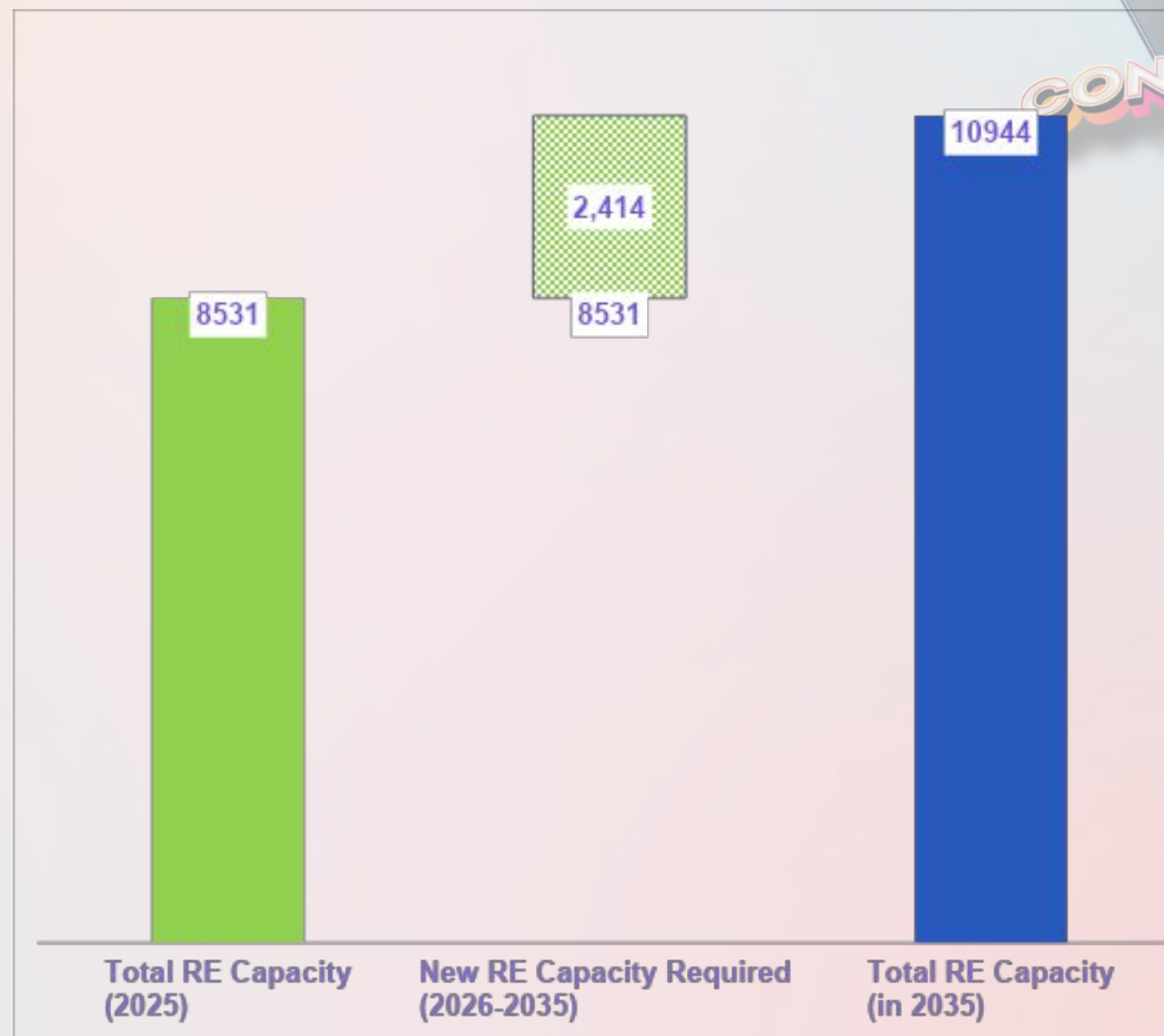
- To meet 31% RE capacity mix for Malaysia by 2025 (Pen. Malaysia will contribute 26% of RE),
- A total of 1,178MW of new RE capacity will be developed from 2021 to 2025
  - ❑ 1,098 MW of solar (incl. NEM3.0)
  - ❑ 80 MW of non-solar
- Large hydro capacity is also included as part of RE resources,
- A study to examine and identify the flexibility and threshold of RE penetration in the system is currently being conducted.



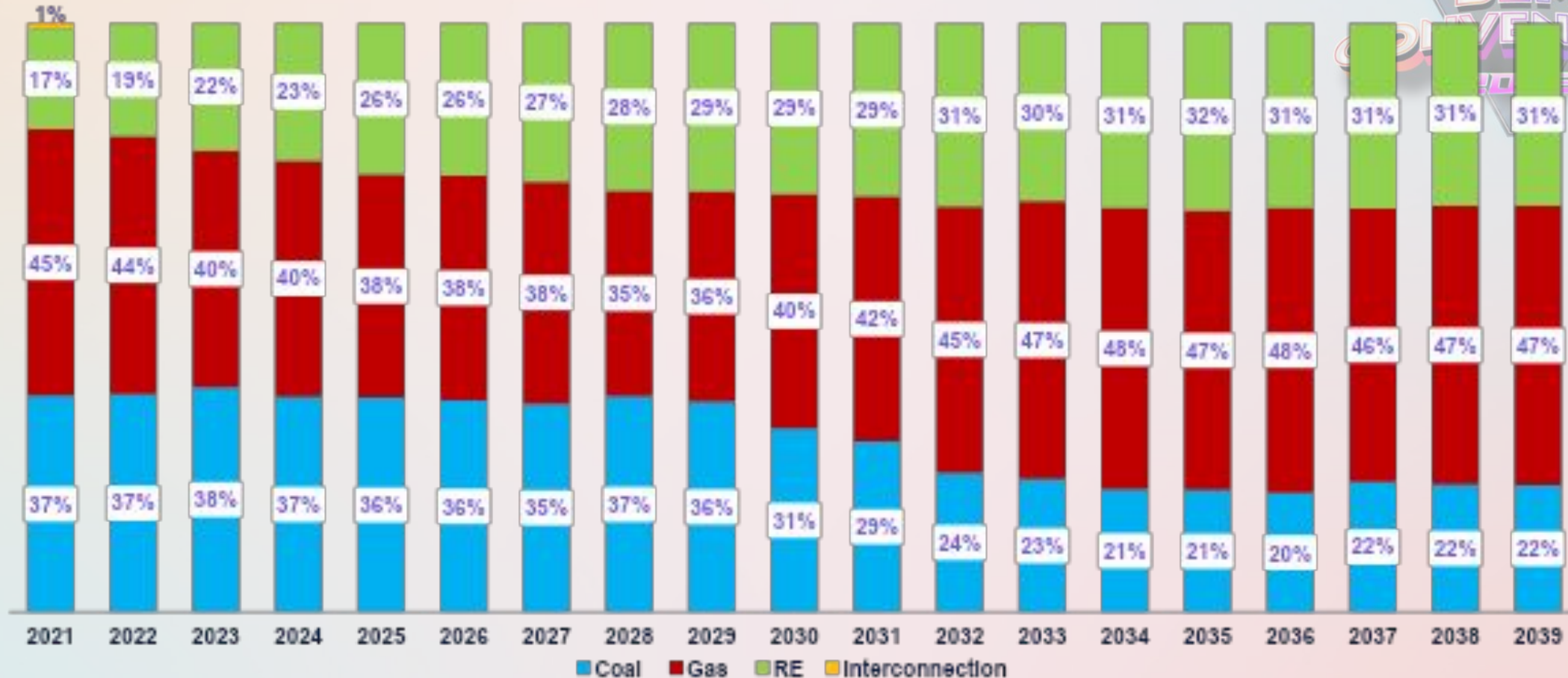
# The RE Capacity Mix for Malaysia is further increased to 40% by 2035



- RE capacity mix is projected to further increase to 40% by 2035 (Pen. Malaysia will contribute 31% RE capacity),
- To meet this target additional 2,414 MW of RE capacity will be developed from 2026 to 2035,
- Grid infrastructure will be further strengthened and enhanced with energy storage.



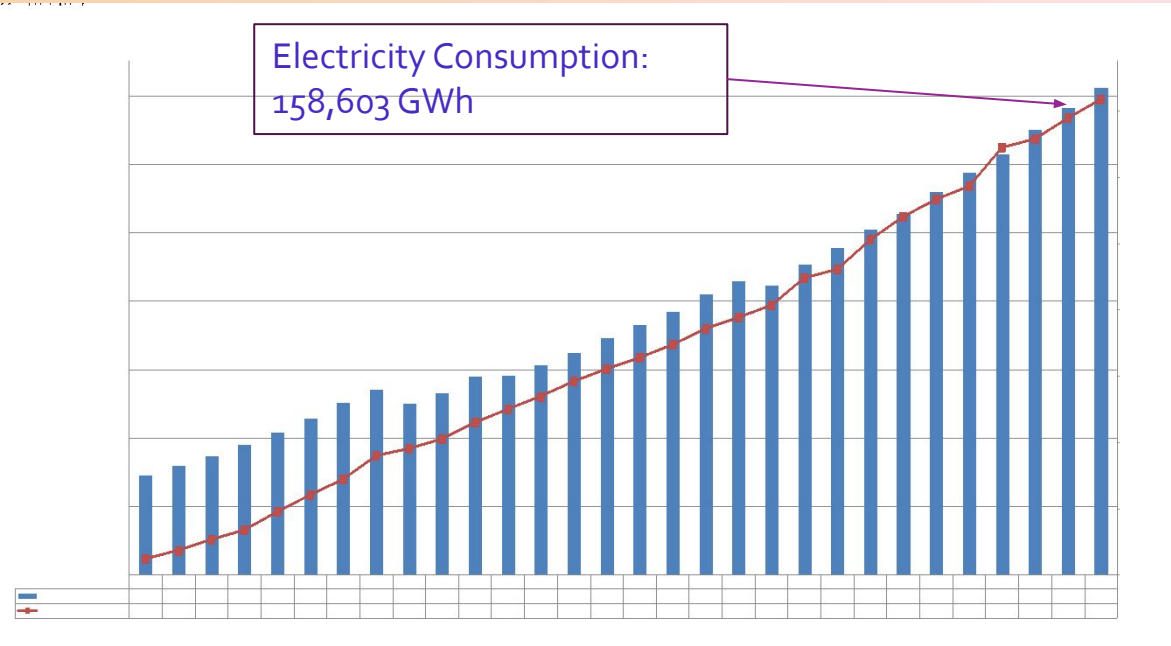
# The RE Capacity Mix is expected to increase to 31% by 2039 in Pen. Malaysia



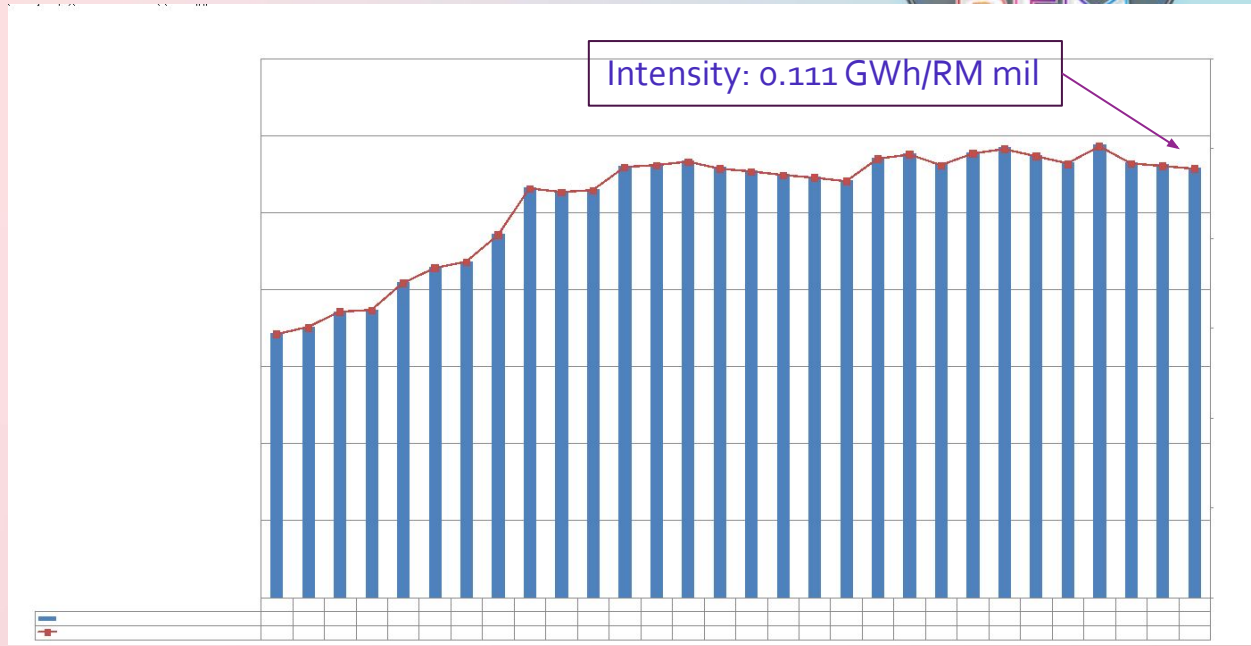
- Share of Renewable Energy (RE) capacity is projected to increase from 17% to 31% by 2039.
- Share of thermal capacity will reduce from 82% to 69% by 2039, with coal reducing from 37% (2021) to 22% (2039).



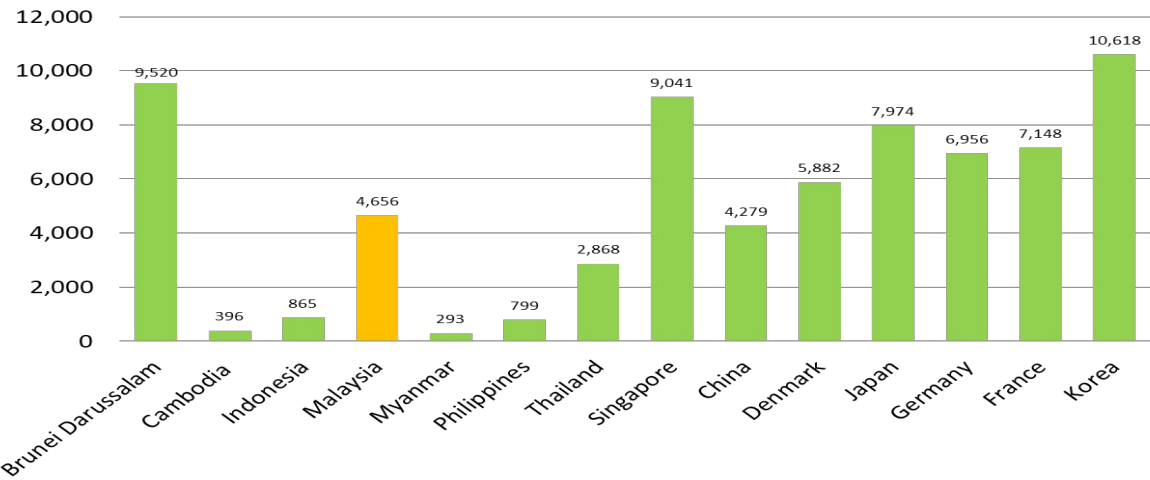
Trends in GDP and Electricity Consumption (GWh)



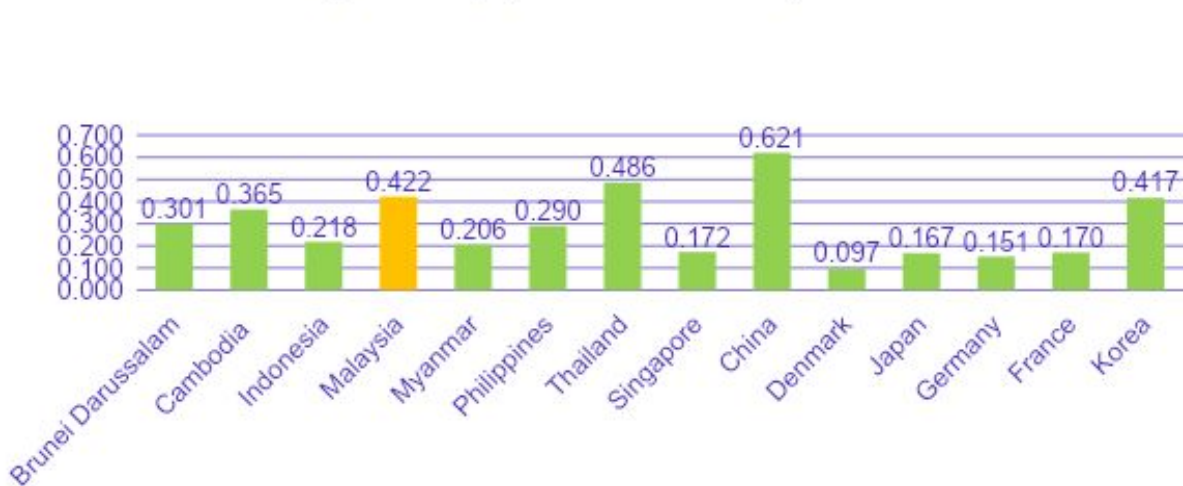
Trend of Electricity Intensity (GWh/RM Million GDP at 2015 prices)



Electricity Consumption per Capita (kWh/capita) in 2016

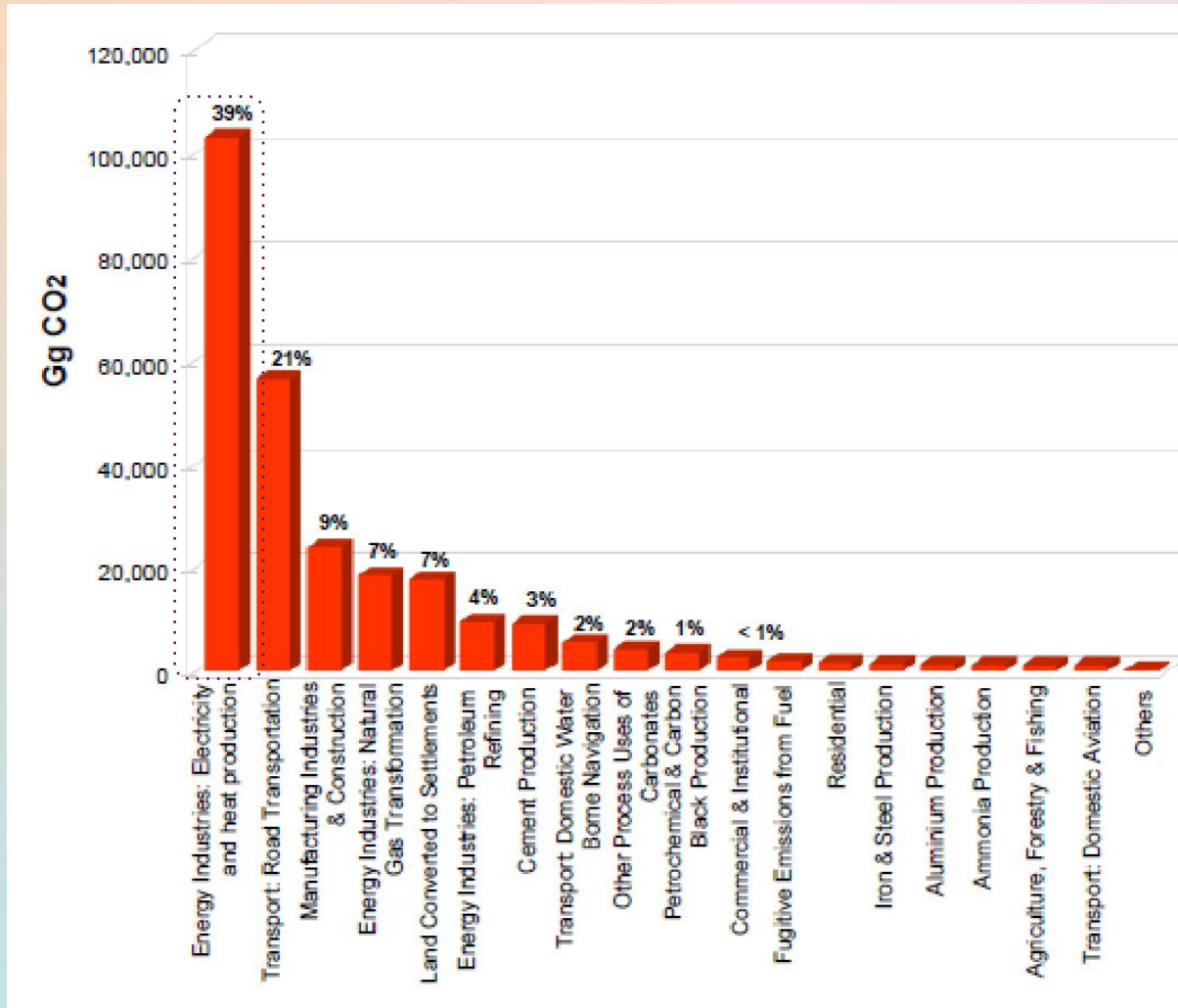


Electricity Intensity (GWh/GDP mil.USD) in 2016



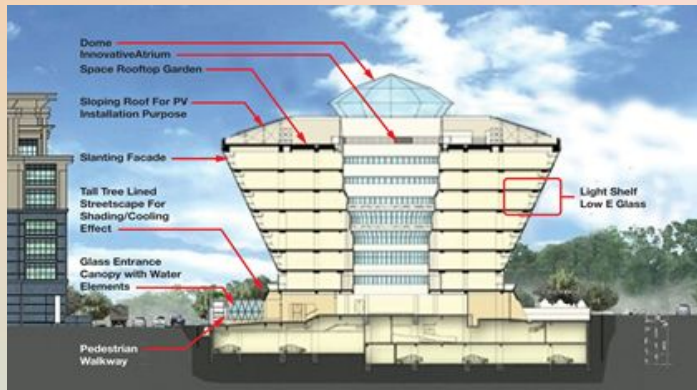


# Greenhouse Gas (GHG) Inventory



- In 2016, CO<sub>2</sub> emissions accounted for a total of 263,577 Gg CO<sub>2eq</sub>.
- CO<sub>2</sub> emission from electricity and heat production was the highest contributor at 103,047 Gg CO<sub>2</sub> (39%), followed by emissions from road transportation at 55,188 Gg CO<sub>2</sub> (21%).
- Manufacturing industries and construction was the third largest contributor of CO<sub>2</sub> emissions at 23,856 Gg CO<sub>2</sub> (9%).

# Energy Efficiency (EE) Promotion Initiatives In Malaysia



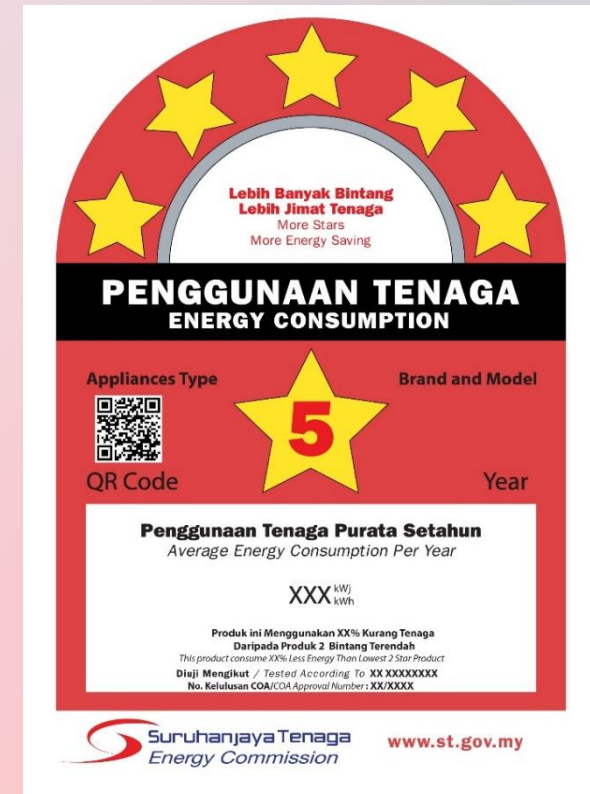
- High Efficiency Technology for new generation capacity plant-ups (2011)
- EE equipment rebate scheme (2011)
- UNDP-GEF Building Sector Energy Efficiency Project (BSEEP) (2011)
- MS 1525 provisions in Uniform Building By-Laws (2012)
- Minimum energy performance standards (MEPS) regulations (2013)
- UNIDO-GEF industrial energy efficiency project (2013)
- Energy Performance Contracting (EPC) for industrial and commercial buildings (since 2016)
- 5% energy reduction target for 25 ministries' buildings (2014)
- **National Energy Efficiency Action Plan (NEEAP) (since 2016)**
- **To introduce Energy Efficiency and Conservation Act**
- EE equipment rebate scheme 2.0 (2021) and 3.0 (2022)

# MINIMUM ENERGY PERFORMANCE STANDARDS (MEPS)



Electricity Regulation 1994 (Amendment 2013) gazette on 3<sup>rd</sup> May 2013 requires Minimum performance to be met by appliances as determined by the Energy Commission.

Applied for 5 appliances – television, refrigerator, air-conditioner, fan, washing machine & lamp.





# EQUIPMENT WITH ENERGY EFFICIENT LABEL



TELEVISION



FAN



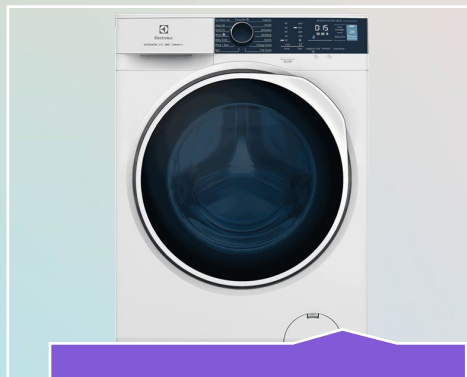
REFRIGERATOR



LAMP



AIR-COND



WASHER



RICE COOKER



MICROWAVE OVEN



FREEZER



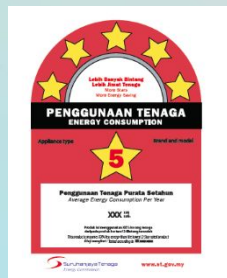
# National Energy Efficiency Action Plan (NEEAP)

## KEY INITIATIVES POTENTIAL SAVING



### Promotion of 5-Star Rated Appliance

- ☐ Star energy rating of appliances and mandatory labelling.
- ☐ Promotion of 5-star appliance
  - 5-Star Refrigerator Campaign
  - 5-Star Air Conditioner Campaign
- ☐ Potential Saving From Refrigerator Campaign = 2,706GWh in 10 yrs
- ☐ Potential Saving From Air Conditioner Campaign = 7,014GWh in 10 yrs



### Minimum Energy Performance Standards (MEPS)

- ☐ Review of MEPS
- ☐ Promotion of Efficient Lighting
  - EE lighting Campaign
  - Potential Saving = 2,216GWh in 10 yrs
- ☐ Development of MEPS for new equipments and appliances
  - High Efficiency Motors
  - Potential Saving = 2,175GWh in 10 yrs



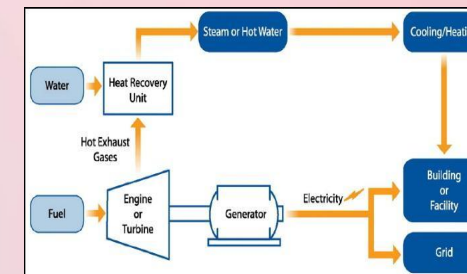
### Energy Audits and Energy Management in Buildings and Industries

- ☐ Facilitating energy audits and implementation of energy saving measures and energy management initiatives
  - Energy Audit and management in Large Commercial Buildings
  - Energy Audit and management in Medium Commercial Buildings
  - Energy Audit and management in Large & Medium Industries
  - Energy Audit Government Facility

- ☐ Total Potential saving = 34,819GWh in 10 yrs

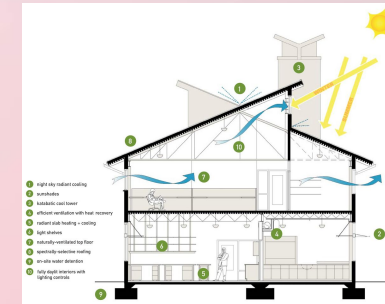
### Cogeneration

- ☐ Promotion of cogeneration through the removal of barriers
- ☐ Cogeneration in Industries and commercial buildings
  - Potential saving = 3,150GWh in 10 yrs

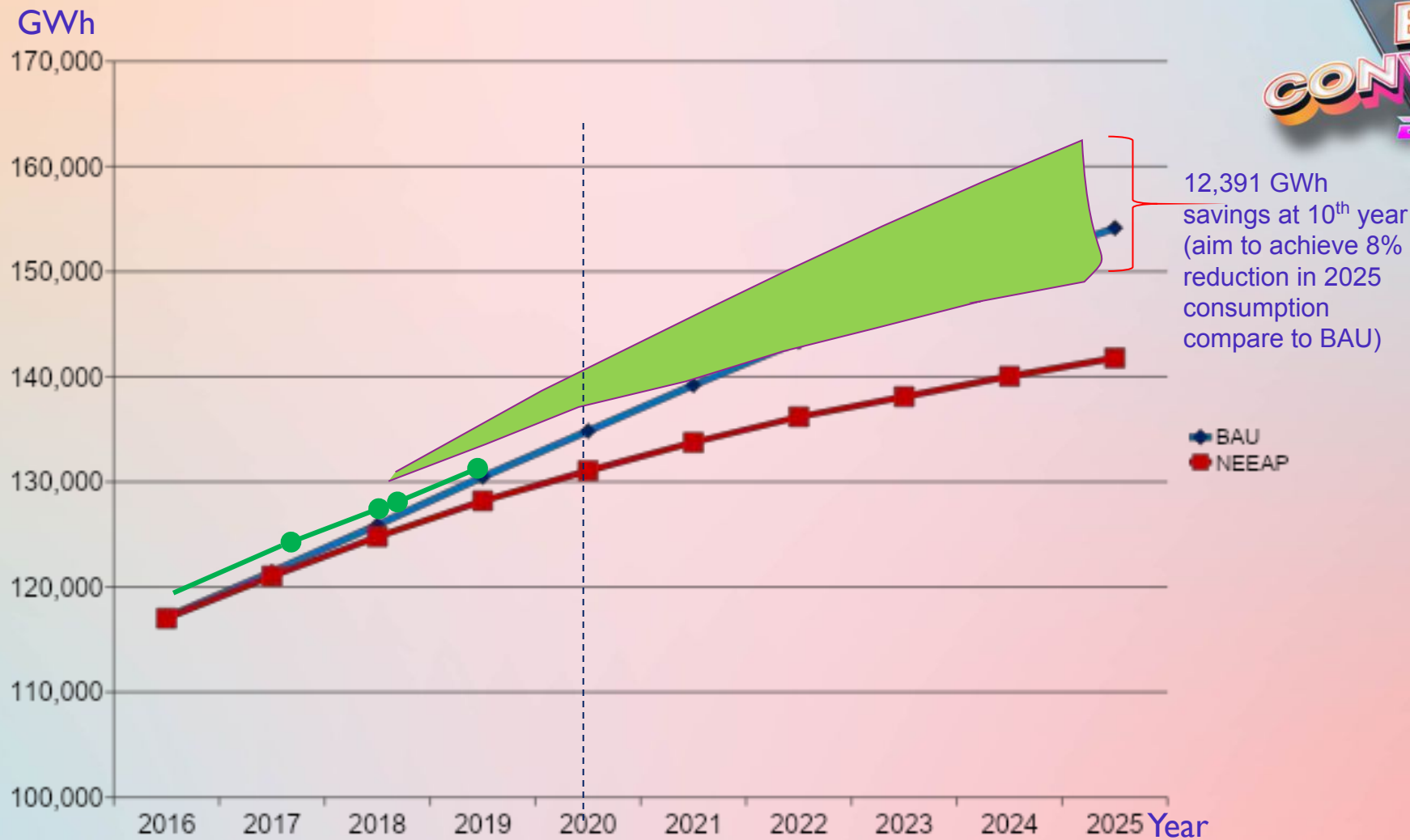


### Energy Efficient Building Design

- ☐ Incorporating Energy Efficiency in new building designs and constructions
- ☐ Potential saving = 15GWh in 10 yrs



# ENERGY DEMAND : BAU vs NEEAP



# CHALLENGES



## CHALLENGES IN RE DEVELOPMENT

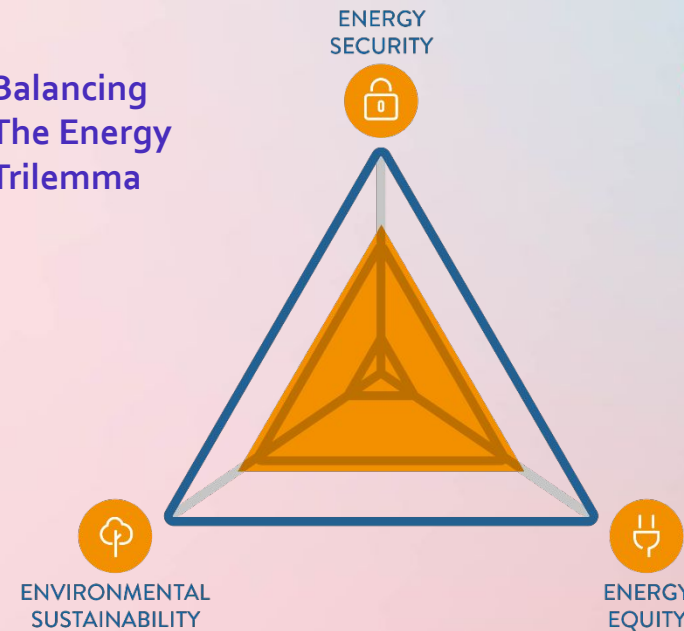
- Natural Resources dependence
- Land use intensity
- Intermittency of variable RE
- Technology cost & pricing
- Limited injection points



## CHALLENGES IN EE DEVELOPMENT

- Wholesome regulatory framework (Not only cover one type of energy)
- Public awareness and perception of EE vs RE
- Attractive financial support for the EE project
- Appropriate method required to measure the impact of EE

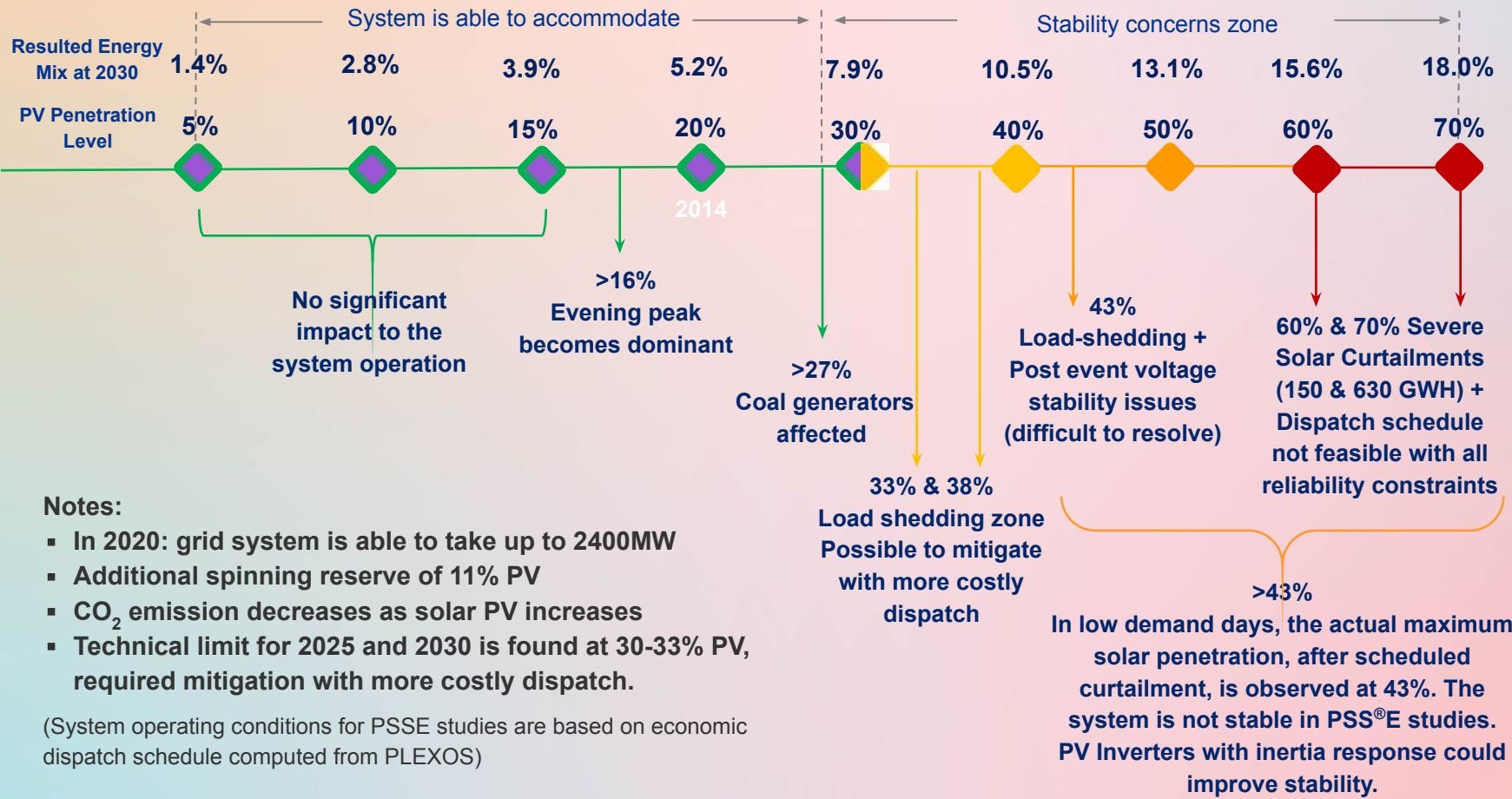
### Balancing The Energy Trilemma



- **Energy security** – management of primary energy supply from domestic and external sources, reliability of energy infrastructure, ability to meet current and future demand
- **Energy equity** – accessibility and affordability of energy supply across the population
- **Environmental sustainability** – reduction in energy and CO<sub>2</sub> intensity, transition to renewable and low-carbon energy sources



# Penetration Limit Assessment for Peninsular Malaysia





## In Summary



- The planning for generation development takes into account The Energy Trilemma (i.e. Energy Security, Energy Affordability and Energy Sustainability).
- By 2030, 6,077 MW of new generation capacity is required to meet demand growth, replacing retiring plants and ensuring system reliability.
  - ❑ Share of Renewable Energy (RE) capacity in Pen. Malaysia is projected to increase from 17% (2021) to 31% (2039)
  - ❑ NEEAP aims to achieve 8% reduction of energy demand in 2025
  - ❑ Carbon emission intensity target in Pen. Malaysia is expected to meet the target of 45% reduction in 2030, and further decreased to 65% by 2039
- A study to assess the solar penetration limits and possible impacts to the Grid stability is currently ongoing.
- Mitigation plans and network reinforcement works are actively being done to ensure the power system remains strong and resilience.
- The Generation Development Plan is reviewed annually to take into account the latest economic, electricity demand, emerging technologies and development status of the planned projects.



# THANK YOU



Committed to Engineering Excellence

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