

# Forecasting the long term emissions intensity factor for electricity markets: An Australian case study.

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# Outline of this presentation

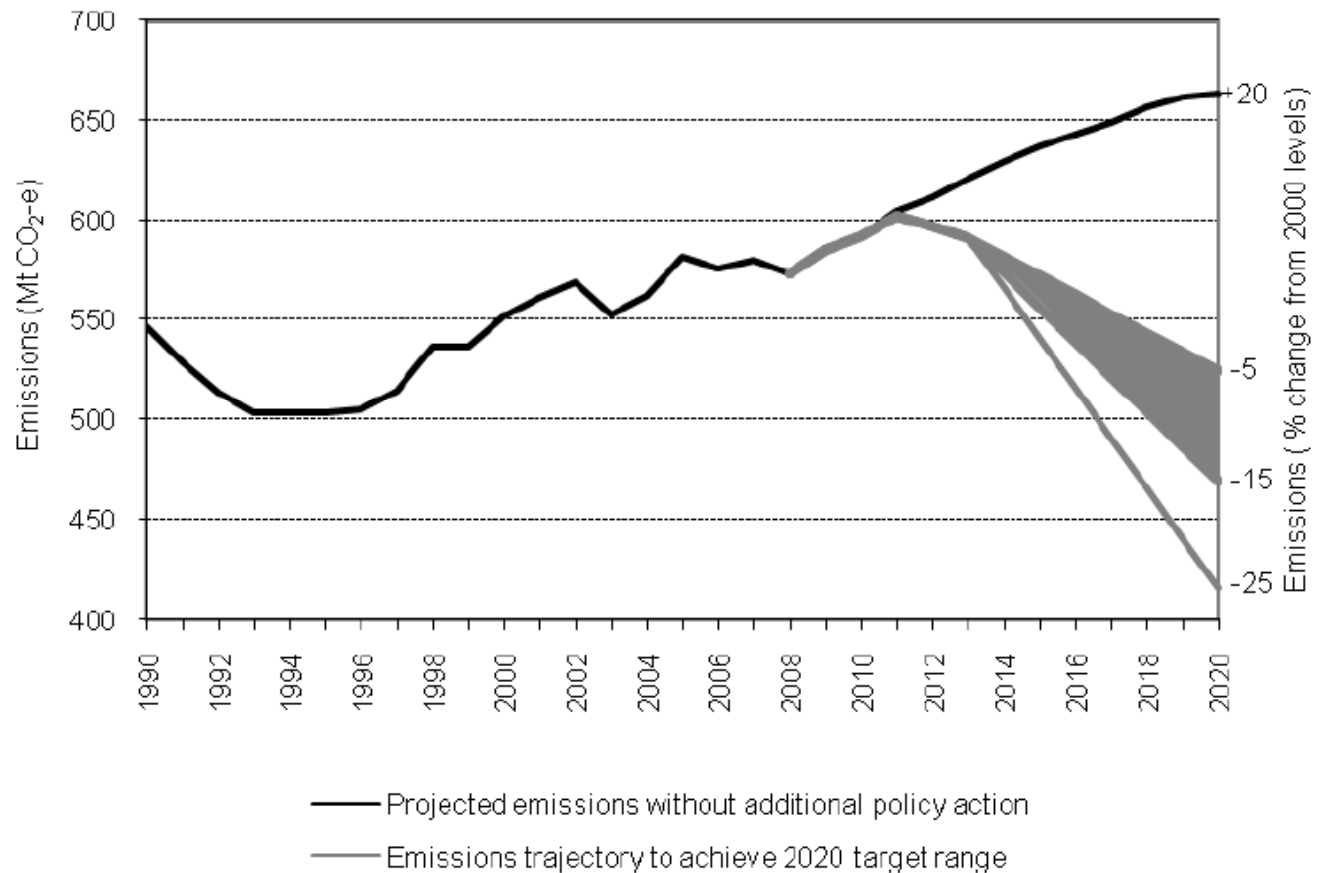
- Australia's Energy Policy
  - Carbon Pollution Reduction Scheme and
  - Mandatory Renewable Energy Target
- The National Electricity Market
- Optimal Technology Mix
- Modelling Platform
- Results: Will Australia Meets its Climate Change Policy Targets?
- Conclusion

# Carbon Pollution Reduction Scheme

## Draft Legislation

- Cap and Trade Model
- Monthly Auctions of Credits
- Unlimited Importation of international credits
- Initial commitment to a minimum 5% cut in emissions with an extension to -25% if the world agrees at COP15
- Assistance to stationary energy production for 5 years
  - 130million credits (~26mill/year) will be allocated to higher emitting generators
  - Equalized emissions intensity factor
    - Brown and less efficient black coal will have a reduced EIF down to 0.86 t e-CO<sub>2</sub>/MWH

## 2020 target range: 5-15 and 25 per cent reductions on 2000 levels



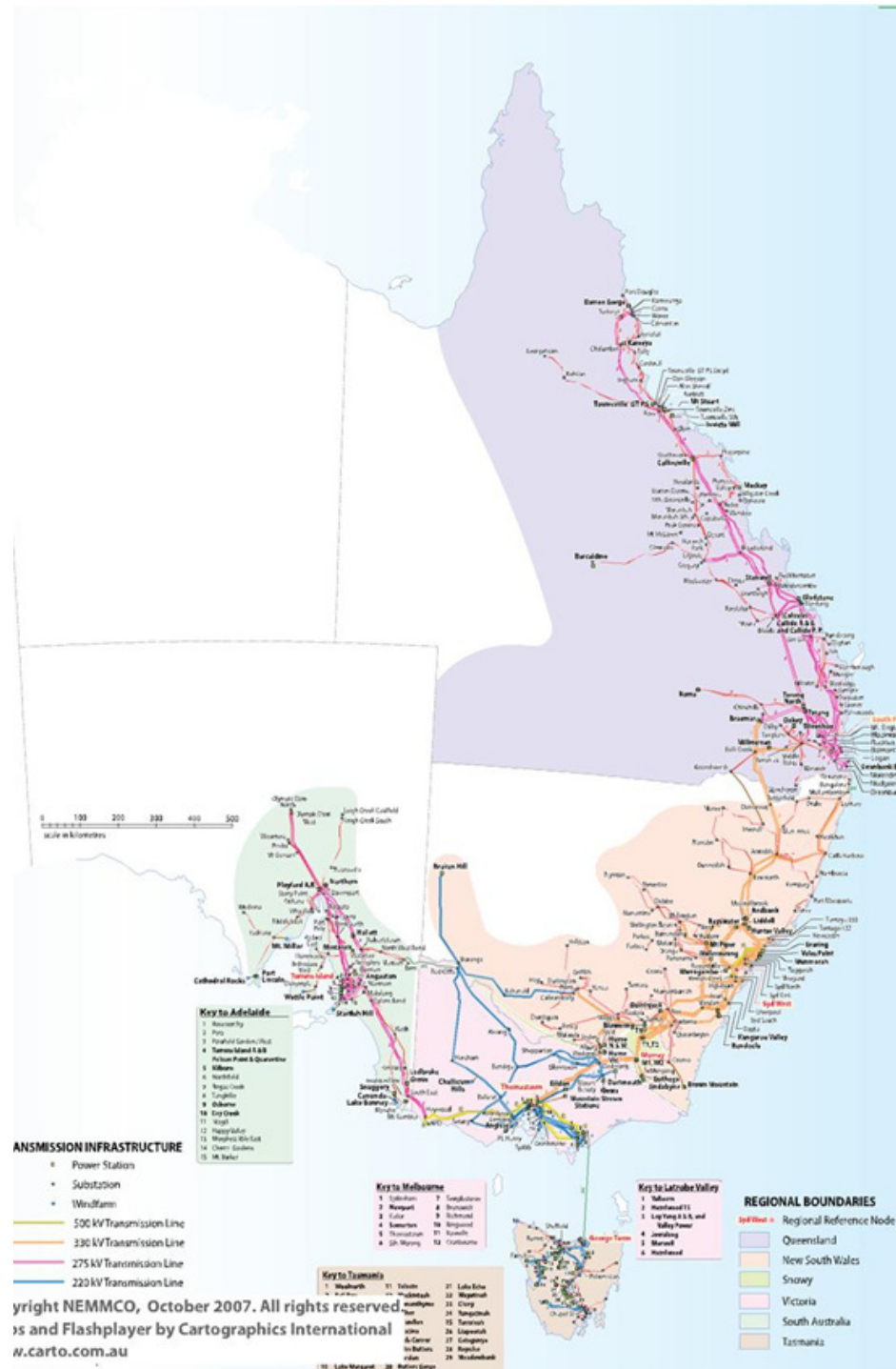
Source: Department of Climate Change, Australian Government 2009

# Mandatory Renewable Energy Target

- The expanded Renewable Energy Target was just recently enacted to require 20% of electricity generated in Australia to come from renewable sources.
  - Represents 45000 GWh of energy production
  - Previous target was only 9000GWh
- Wholesale market customers are required to purchase Renewable Energy Certificates equivalent to their liabilities under the scheme.
- The price of the certificates is primarily a function of the cost of supply of renewable generation

# The National Electricity Market

- NEM began operating in December 1998 as a wholesale market for the supply of electricity to retailers and end-users in 5 integrated regions
- Dec 1998: Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia.
- 29 May 2005: TAS joined NEM, 28 Apr 06 Basslink started operation (connects TAS with NEM)



Source: NEMMCO Statement of Opportunities 2007

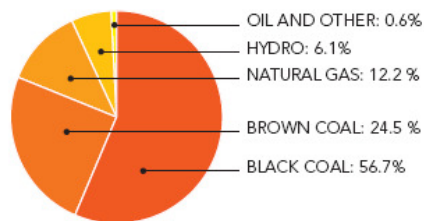
## The 41,000MW supply-side covers all of eastern Australia:

- Queensland 10,400MW
- New South Wales 12,300MW
- Snowy Mountains 3,700MW
- Victoria 8,600MW
- South Australia 3,500MW
- Tasmania 2,500MW

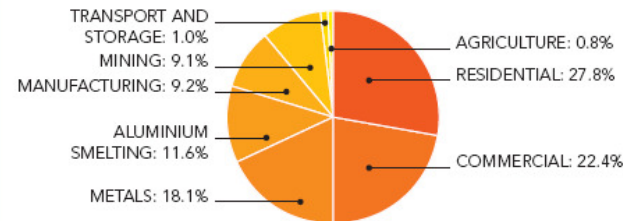
## The demand-side:

- Aggregate demand (simultaneous) 32,000MW
- Aggregate energy 205,000GWh
- CO2 emissions at approx 180Mt, about 35% of the national total

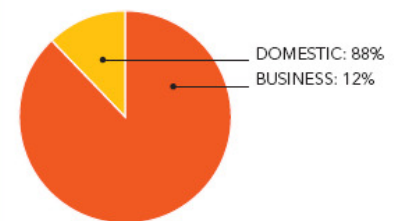
GENERATION BY FUEL TYPE



ELECTRICITY CONSUMPTION BY SECTOR



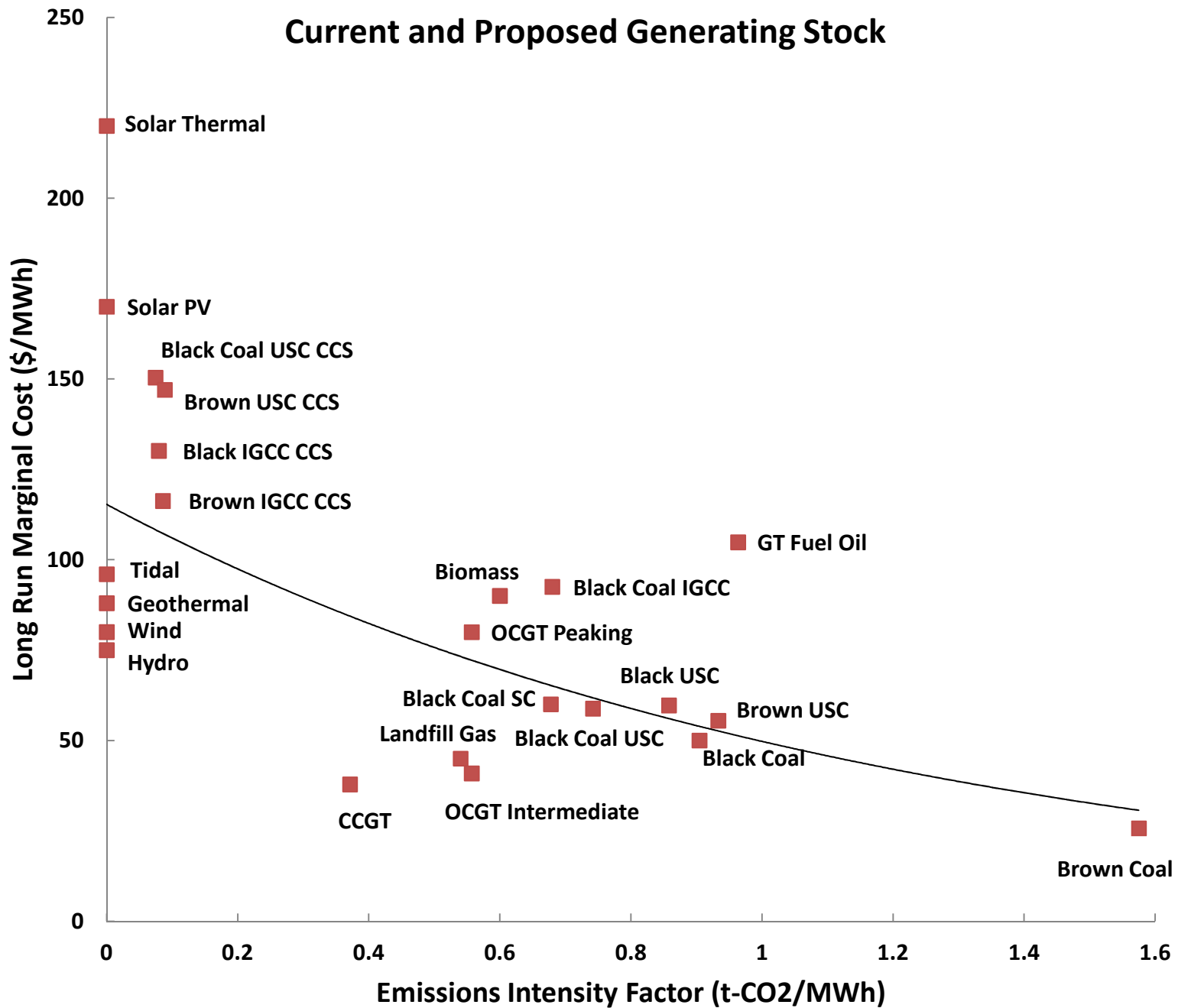
NUMBER OF CUSTOMERS BY SECTOR



Source: An Introduction to Australia's National Electricity Market, July 2009  
Australian Energy Market Operator (AEMO)



### Current and Proposed Generating Stock

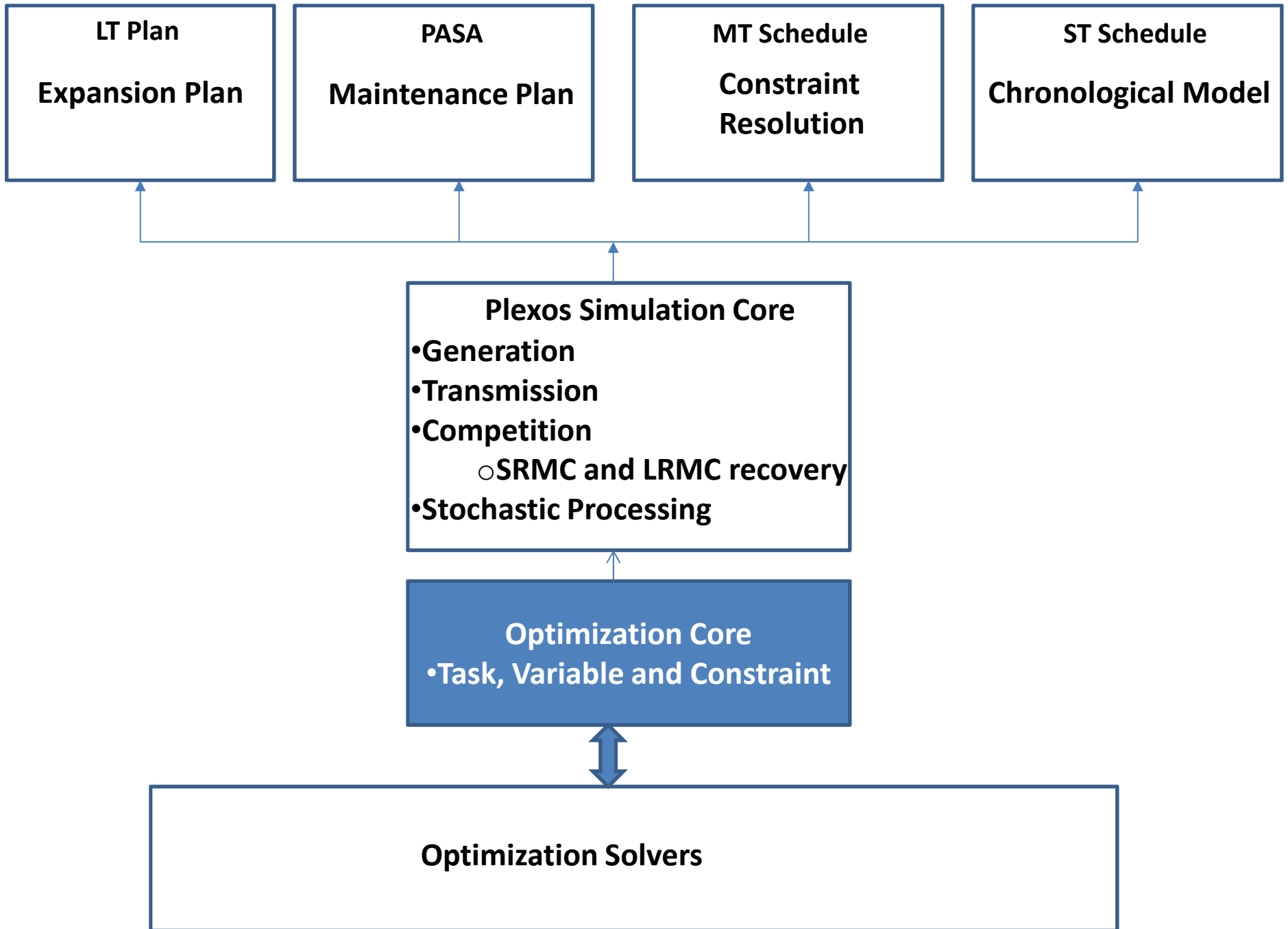


# Modelling Assumptions

- Carbon Forward Curves for 15% and 25% reduction targets from Government Treasury modelling
  - \$50/tCO<sub>2</sub> (CPRS -15%)
  - \$61/tCO<sub>2</sub> (CPRS -25%)
- Renewable Energy Certificate Prices from Department of Climate Change forecasts.
  - \$55/MWh
- Fuel and Technology cost data obtained from Australian Energy Market Operator (AEMO)
- Performance of renewable technologies based on historical climatic data obtained via the Bureau of Meteorology, Commonwealth of Australia.

## Plexos Simulates

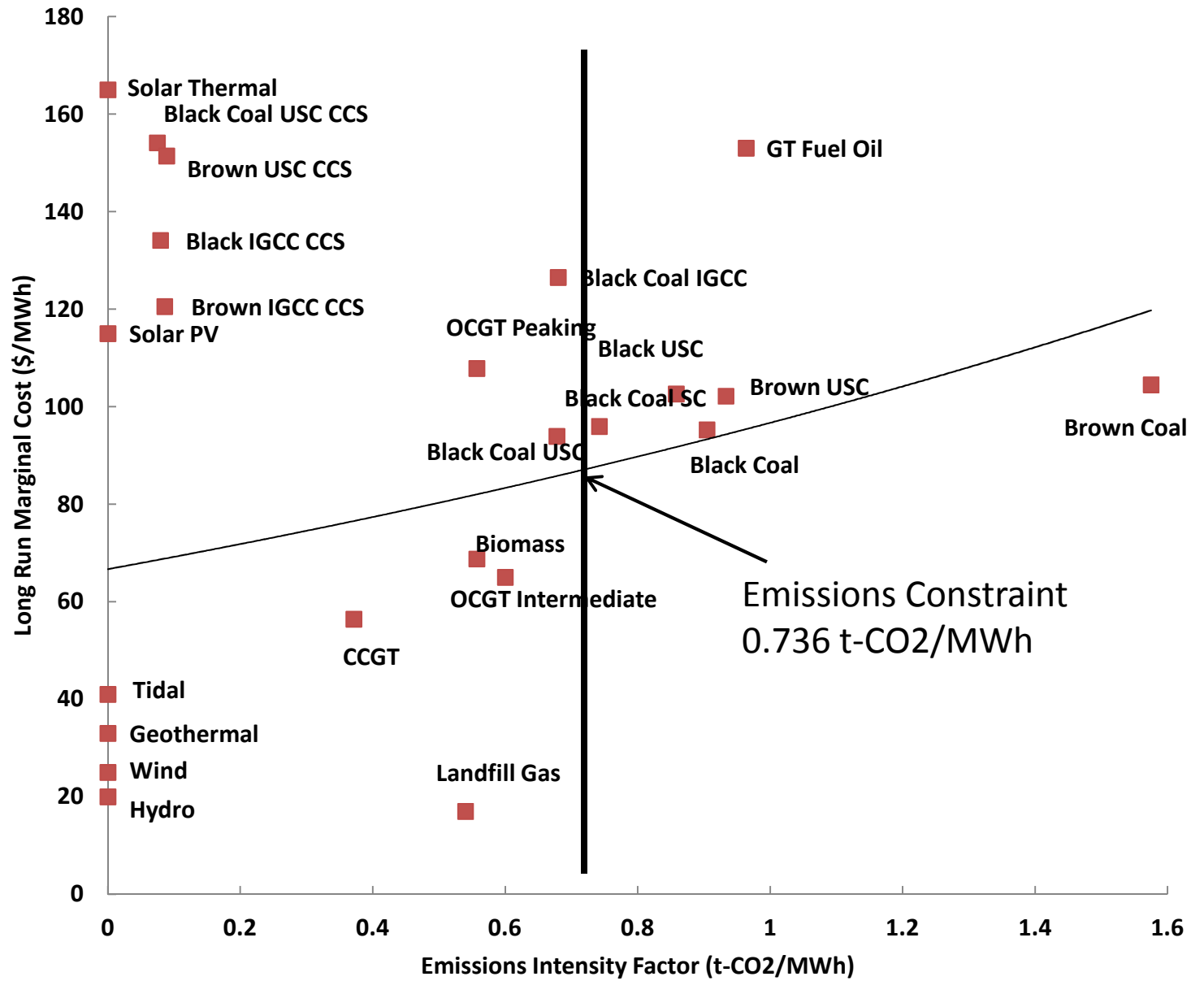
- Optimal dispatch of generators across the NEM.
- Optimal bid stack formulation for each station for Short Run and Long Run Marginal Cost (SRMC and LRMC) recovery.
- Merit order of dispatch formulated based on bid stack.
- Physical operating characteristics of each generating unit
- Portfolio optimization and emissions profiles
- Transmission and Interconnector flows.



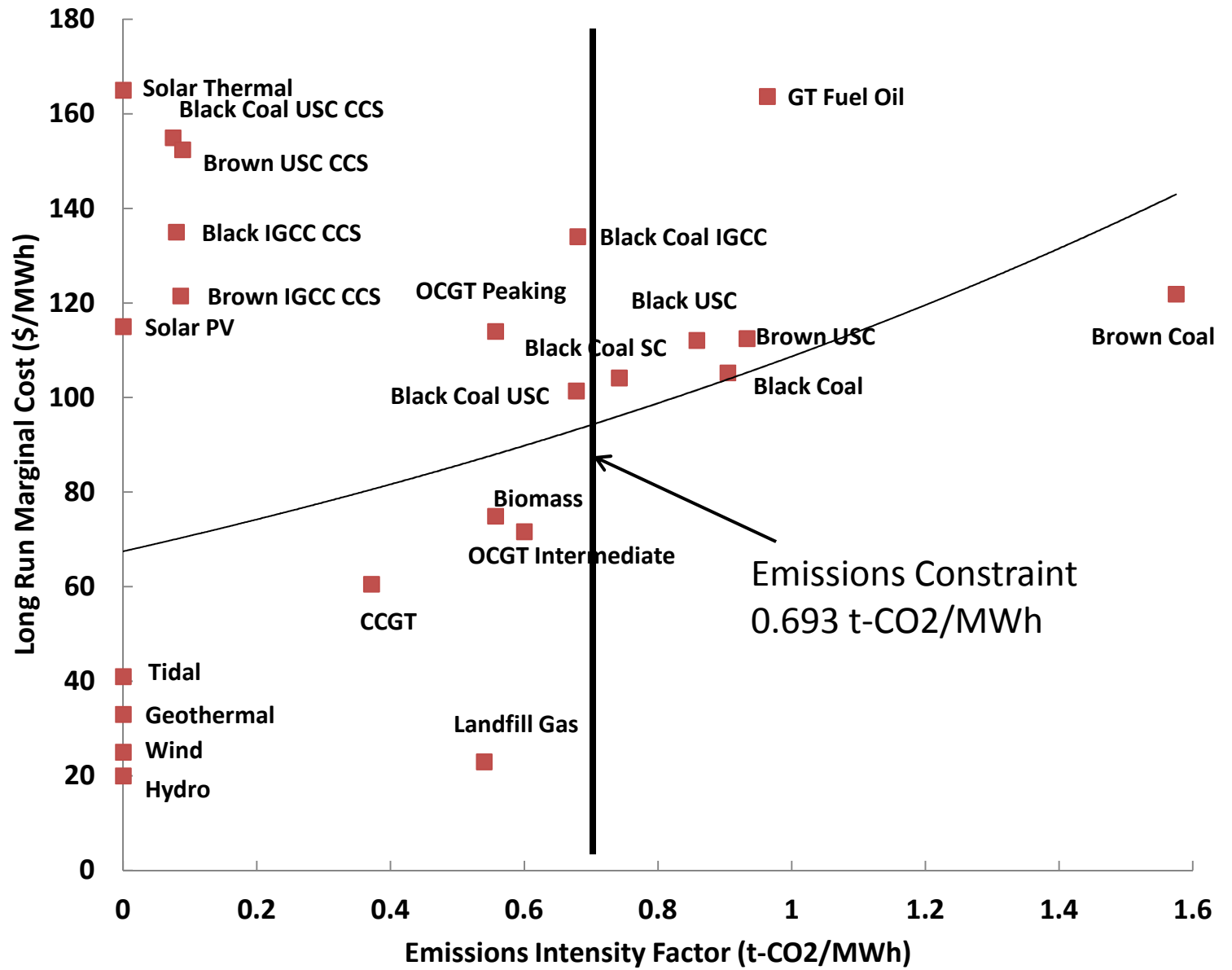
# Summary of Results

- Emissions reduction objectives imposed by the CPRS are met.
- The Renewable Energy Target presents more difficulties.
  - With lower emissions reduction targets the carbon price is suppressed.
  - The pass through of the carbon price onto the spot market delays the incentive for renewable investment.

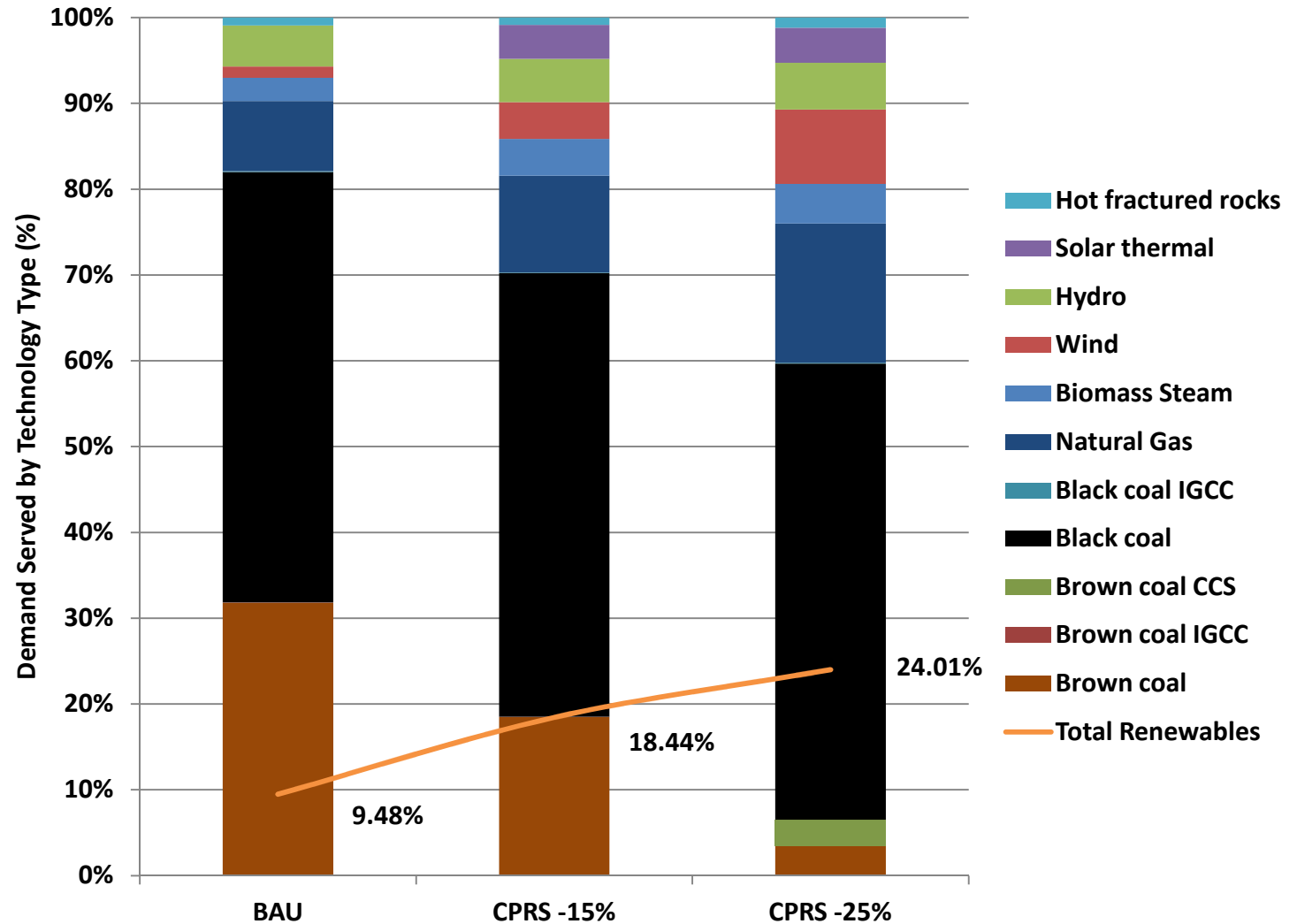
### CPRS -15%



CPRS -25%

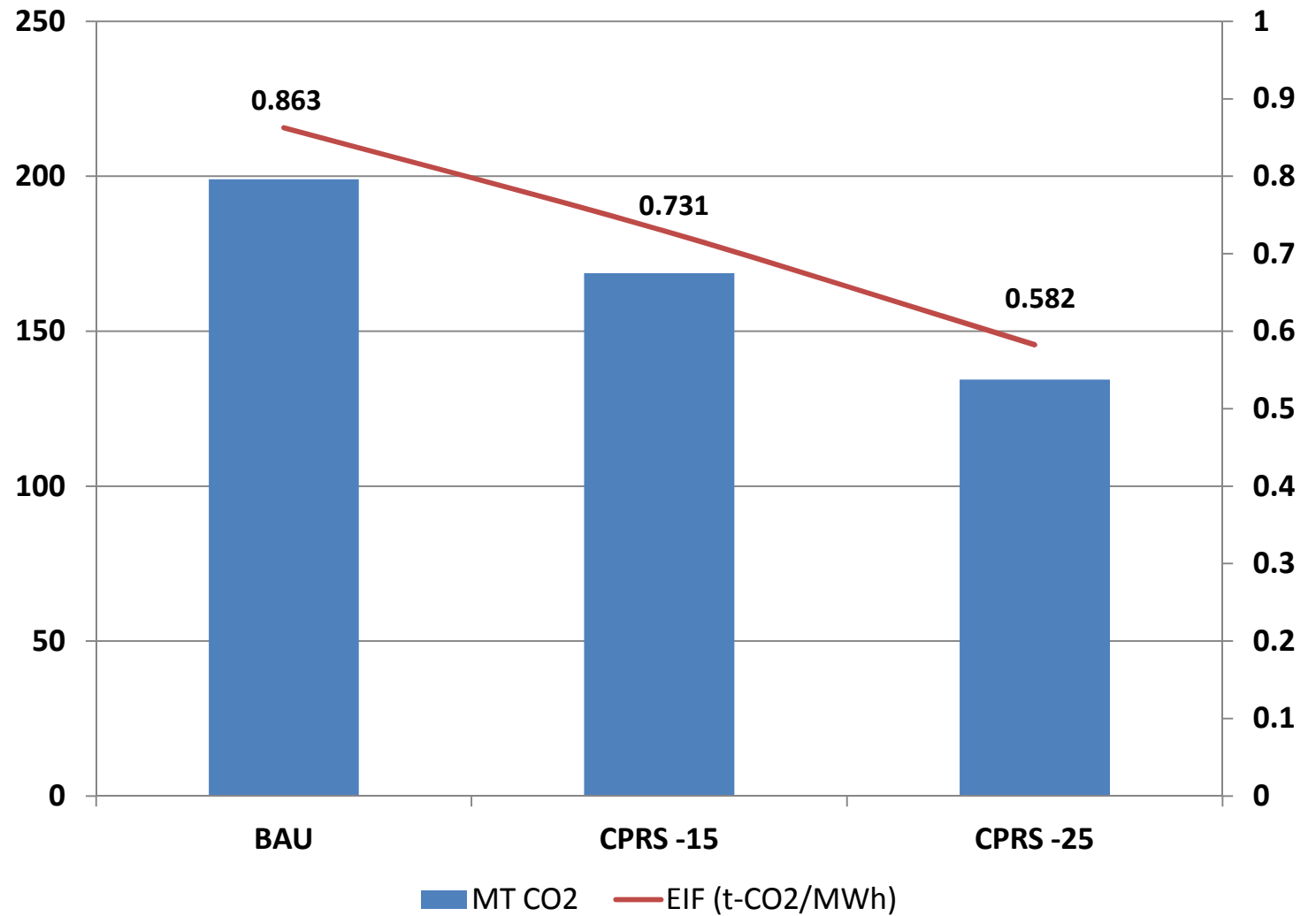


# Results: Generation Profile

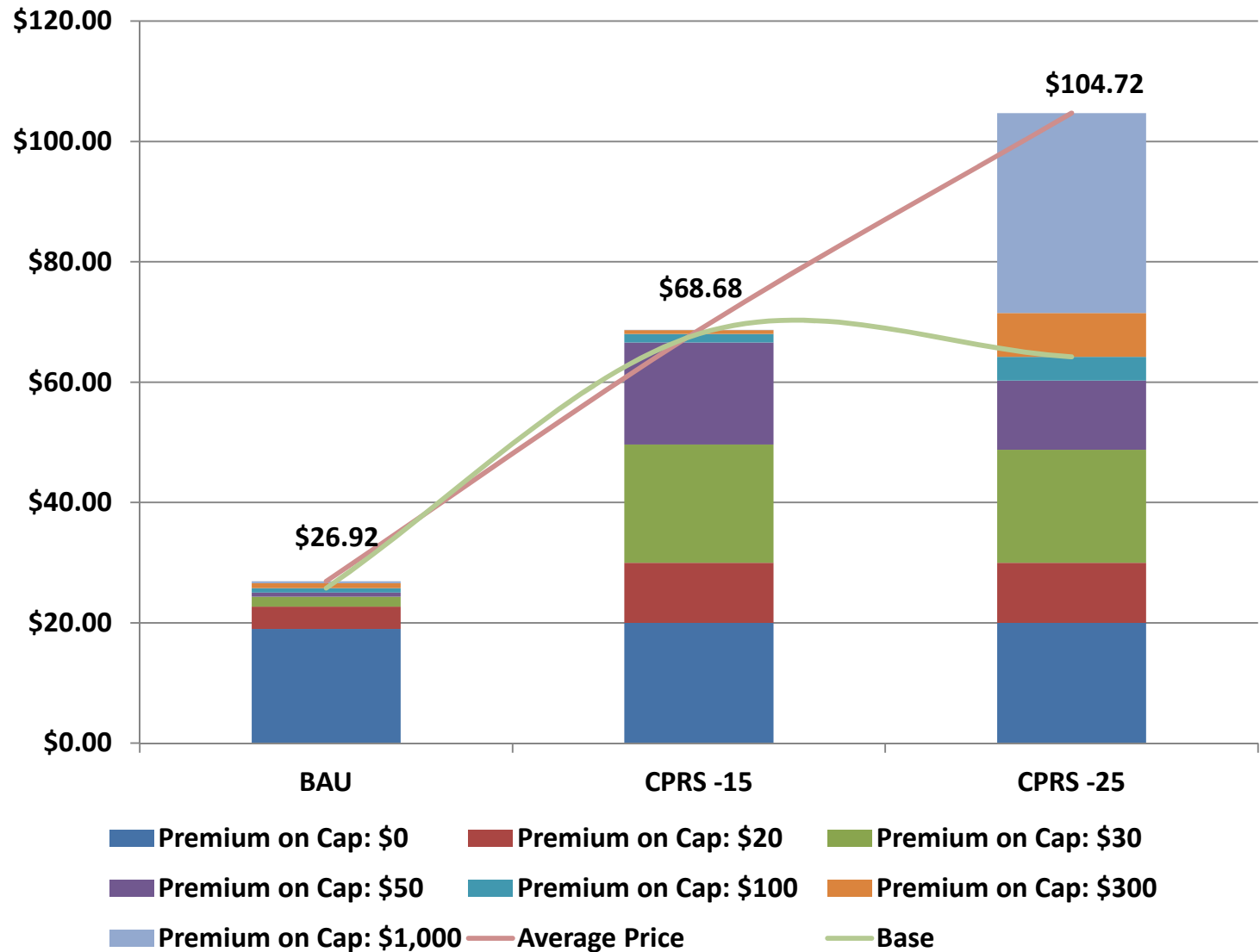




# Results: Emissions



# Results: Spot Market



# Conclusions

- Deeper cuts in the carbon trajectory would stimulate further increases in spot market prices.
- Higher spot market volatility encourages renewable generation investment by ensuring LRMC recovery.
- Without higher carbon prices renewable generation is unlikely to be deployed.
- The EIF targets while met given medium forecasted demand, higher demand levels will result in dirtier generation types being used.

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