

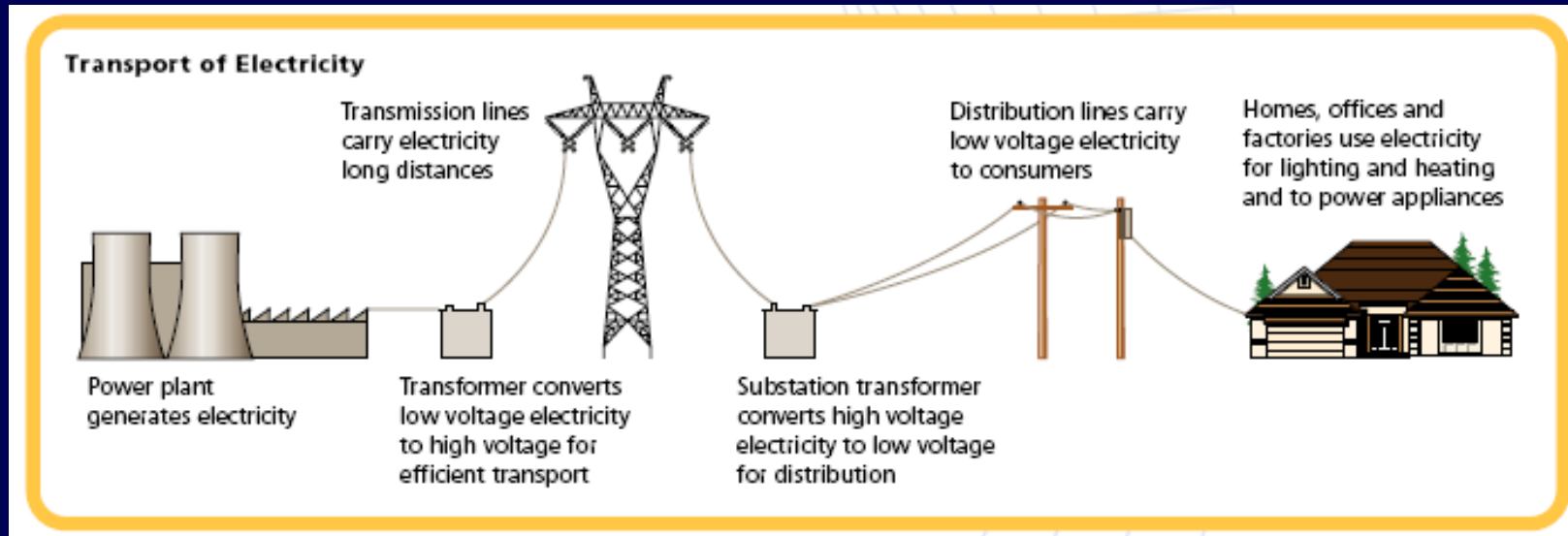
Physical Market Overview

(commercial-in-confidence)

Sonia Kolar
Gas and Electricity Operations
Manager

Commercial – in - confidence

How is Electricity Transported



One Megawatt (MW)

Is equal to one million watts (W).

One Gigawatt (GW)

Is equivalent to one thousand megawatts.

One megawatt hour (MWh)

IS the energy required to power ten thousand 100 W light globes for one hour.

A 100 MW generator

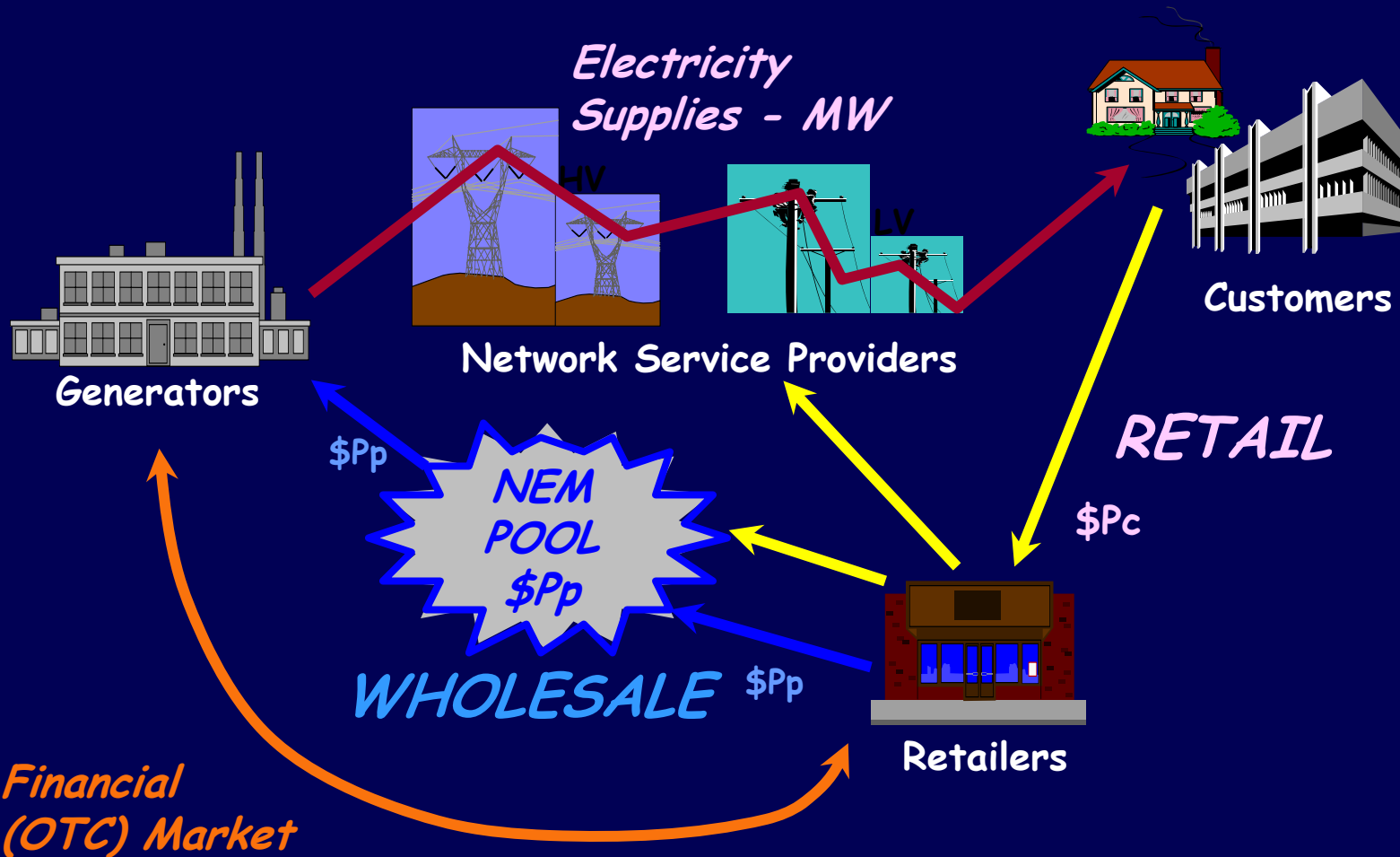
Will power one million 100 W light globes simultaneously.

A 600 MW generator

Has sufficient capacity to service 200,000 domestic customers.

Market Structure Overview

Electricity Supply & the Markets



Ministerial Council on Energy (MCE)

Single energy market governance body:

- Determines market reform agenda e.g. transmission planning, governance and greenhouse issues.

Australian Energy Market Commission (AEMC)

Market development body:

- Manage Rule changes
- Market reviews

Australian Energy Regulator (AER)

Responsible for market regulation:

- Rule enforcement
- Part of ACCC, but separate legal entity.

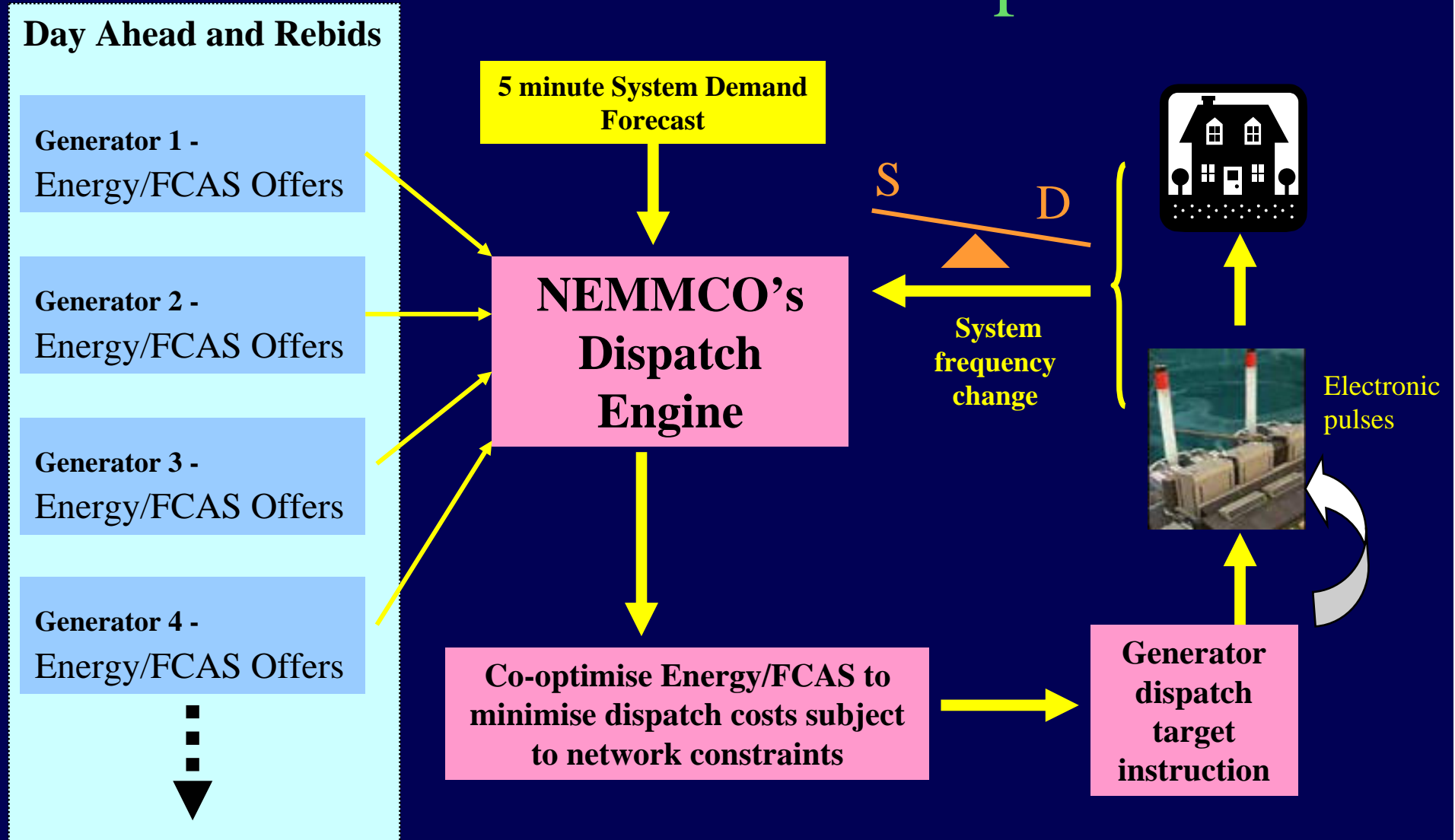
National Electricity Market Management Company (NEMMCO)

Responsible for market operation and system security and reliability.

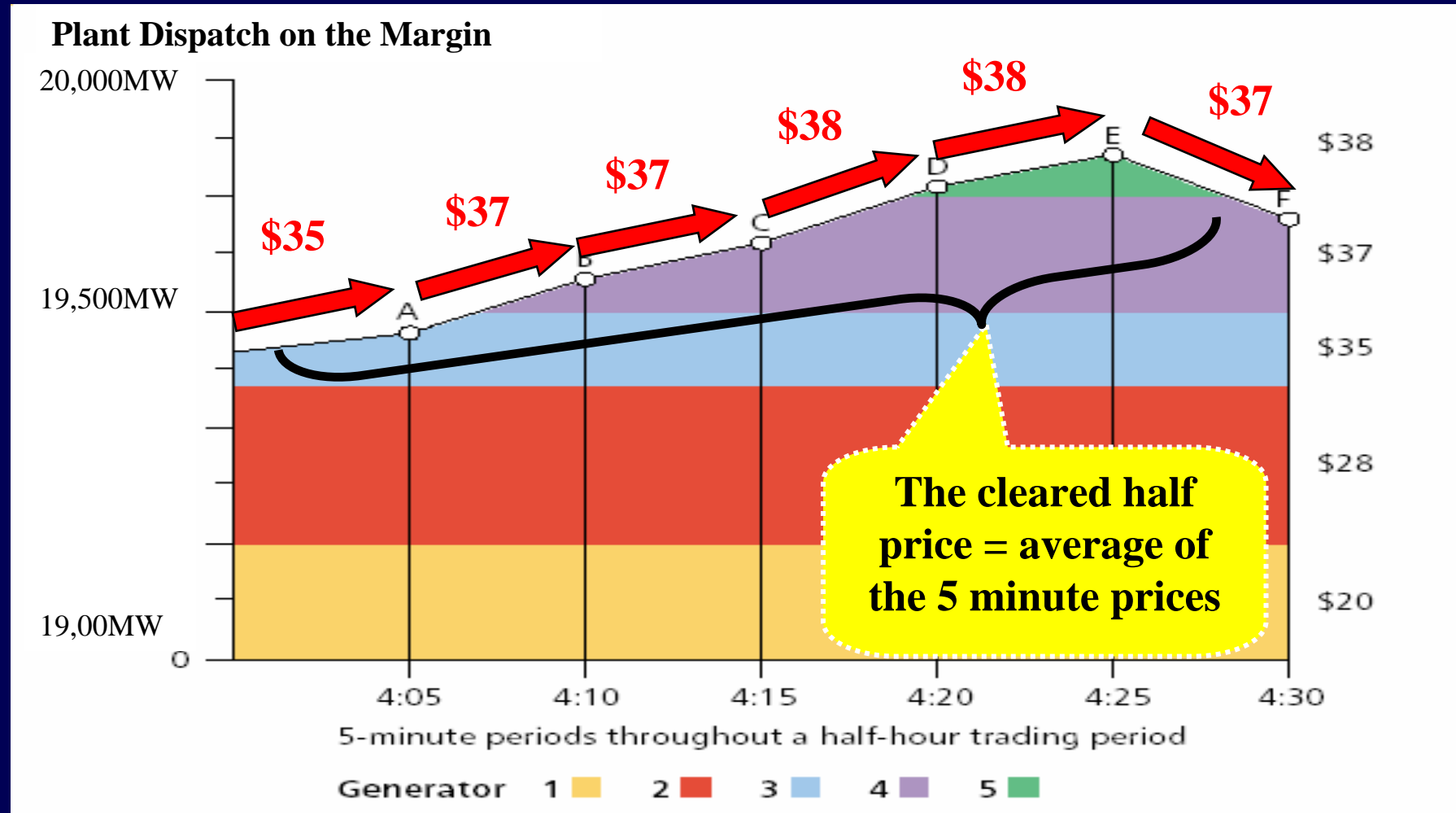


NEMMCO's Dispatch Process

Physical Market Dispatch Process

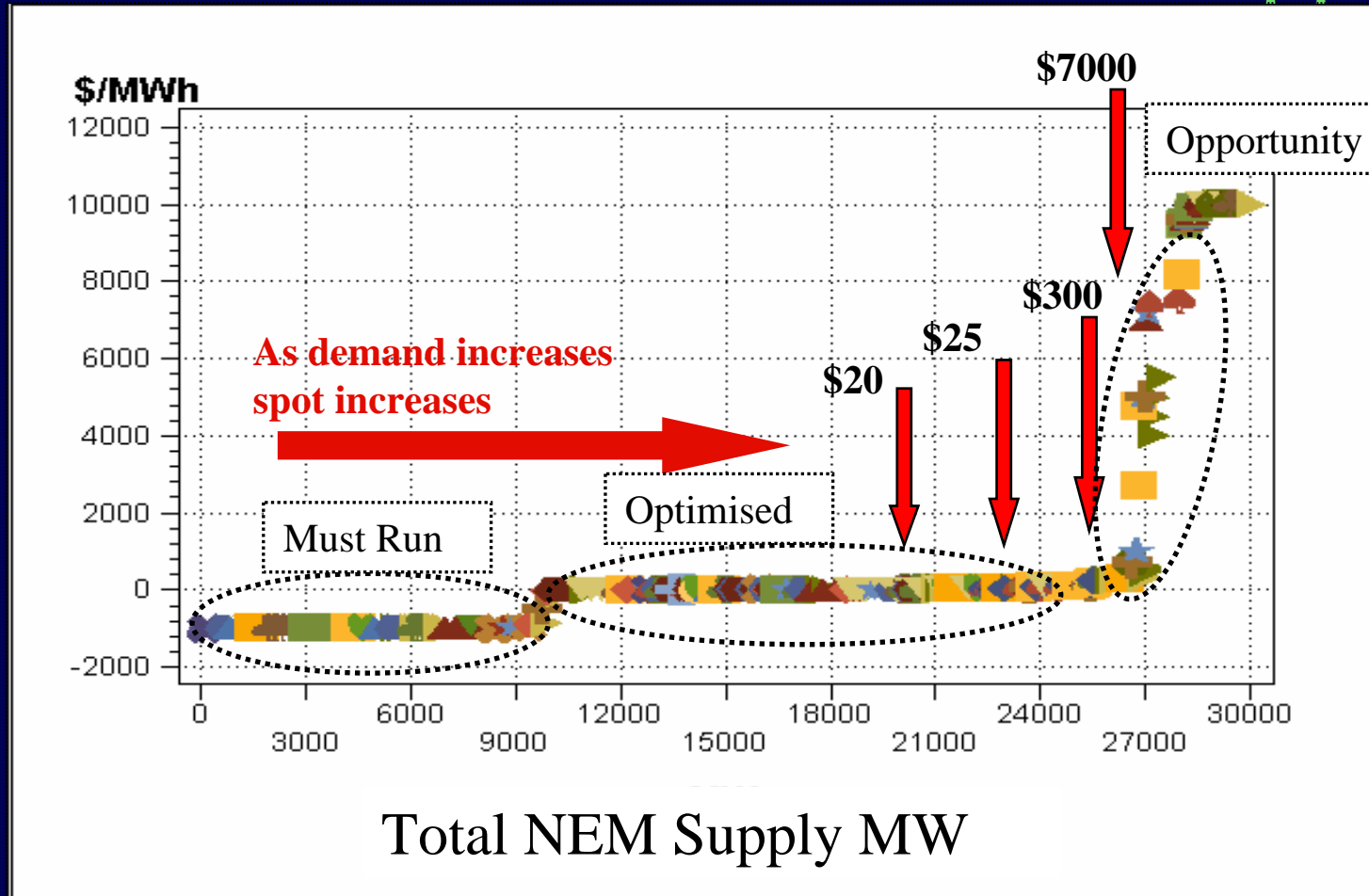


Physical Market NEM Spot Price Formation



Generator Bid Structure and NEM Supply Curves

Physical Market NEM Supply Curves



On any day, during any trading period there will be a unique supply curve.

Ancillary Services

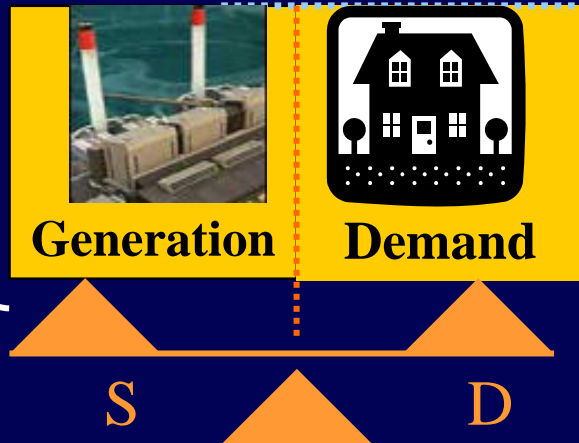
NEMMCO must ensure that the electrical system is, at all times, controlled within standards set by the AEMC reliability panel.

NEMMCO purchases ancillary services (e.g. FCAS) to manage system security.

Physical Market Ancillary Services

Frequency Control Ancillary Services (FCAS):

Spot Market



Demand > Generation Generators slow up

↓ *Frequency Drops*

Demand < Generation Generators speed up

↑ *Frequency Increases*

Frequency must remain within limits for the unexpected loss of generation or load.

Contract Market

Network Control Ancillary Services (NCAS)

Voltage on the network is controlled to within limits by dispatching voltage control capability from generators.

Black Start

Black start capability is the ability to restart the system in the case of a whole or partial system shut down (e.g from self starting hydro and gas turbine units) which then supply auxiliary power to thermal power stations.

Physical Market Ancillary Services

Frequency Control Ancillary Services:

- NEMMCO pays for all enabled services in the FCAS spot market.
- Generators/Retailers pay for the services based usage.
- Highly oversupplied market – very low prices.

Network Control Ancillary Services (NCAS) and Black Start:

- NEMMCO contracts with suppliers of these services.
- Retailers pay for total cost of NCAS.
- Generators/Retailers pay 50:50 for Black Start.

NEM Regions and Transmission

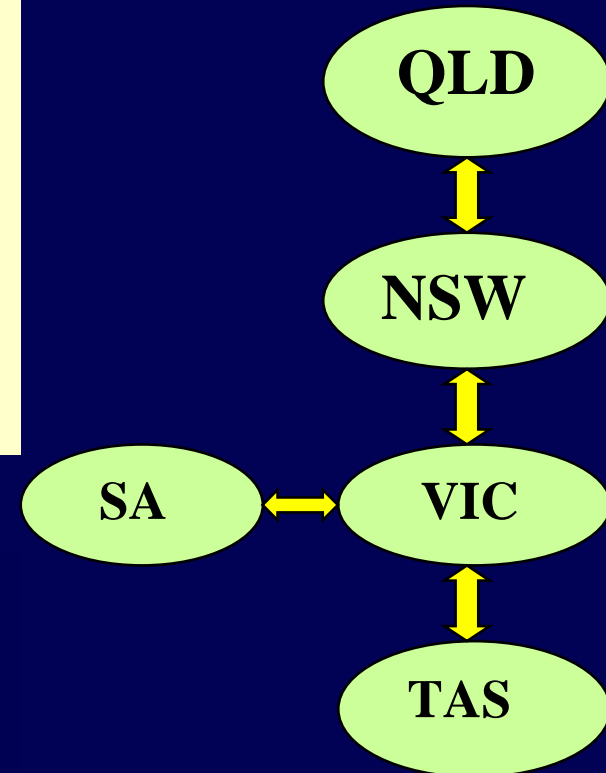
Market Regions

Why have NEM regions?

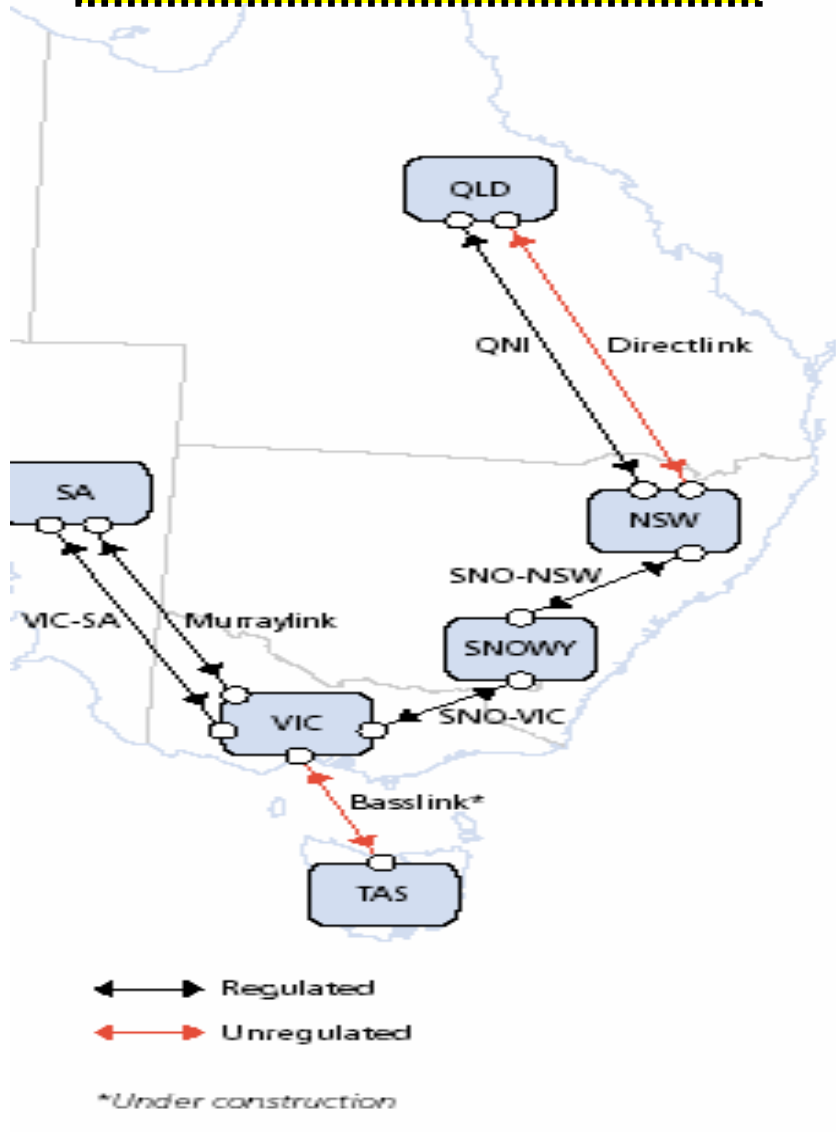
- Limited connection between state based regional networks.
- Inter-regional congestion efficiently priced.

Price differences between regions provides a location signal for efficient investment in:

- *new generation,*
- *new transmission,*
- *new load, and*
- *demand side initiatives.*



If there are no constraints regional prices only vary by transmission losses.



Physical Market Regional Structure

Price Separation Example:

