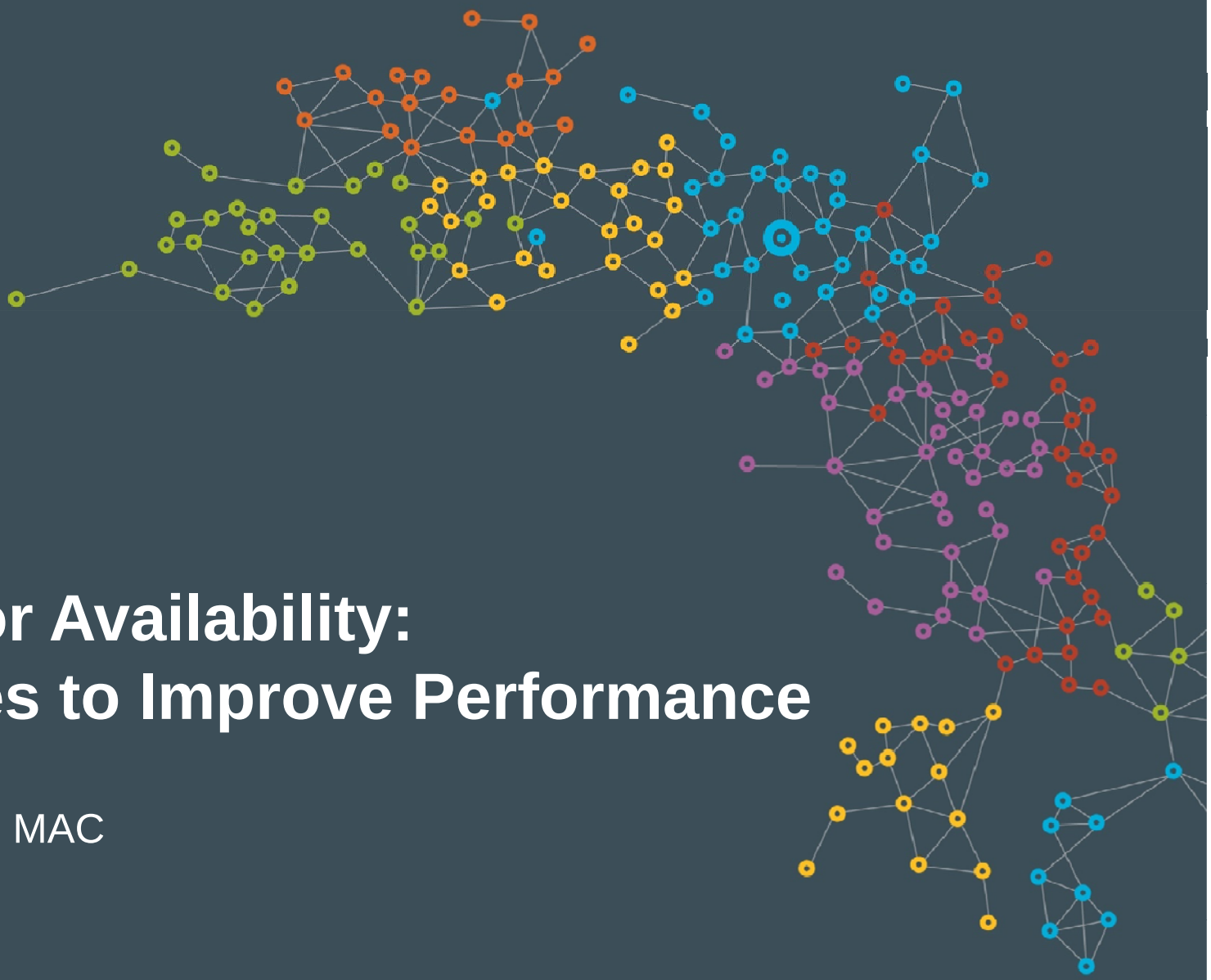
INDEPENDENT MARKET OPERATOR



Generator Availability: Incentives to Improve Performance

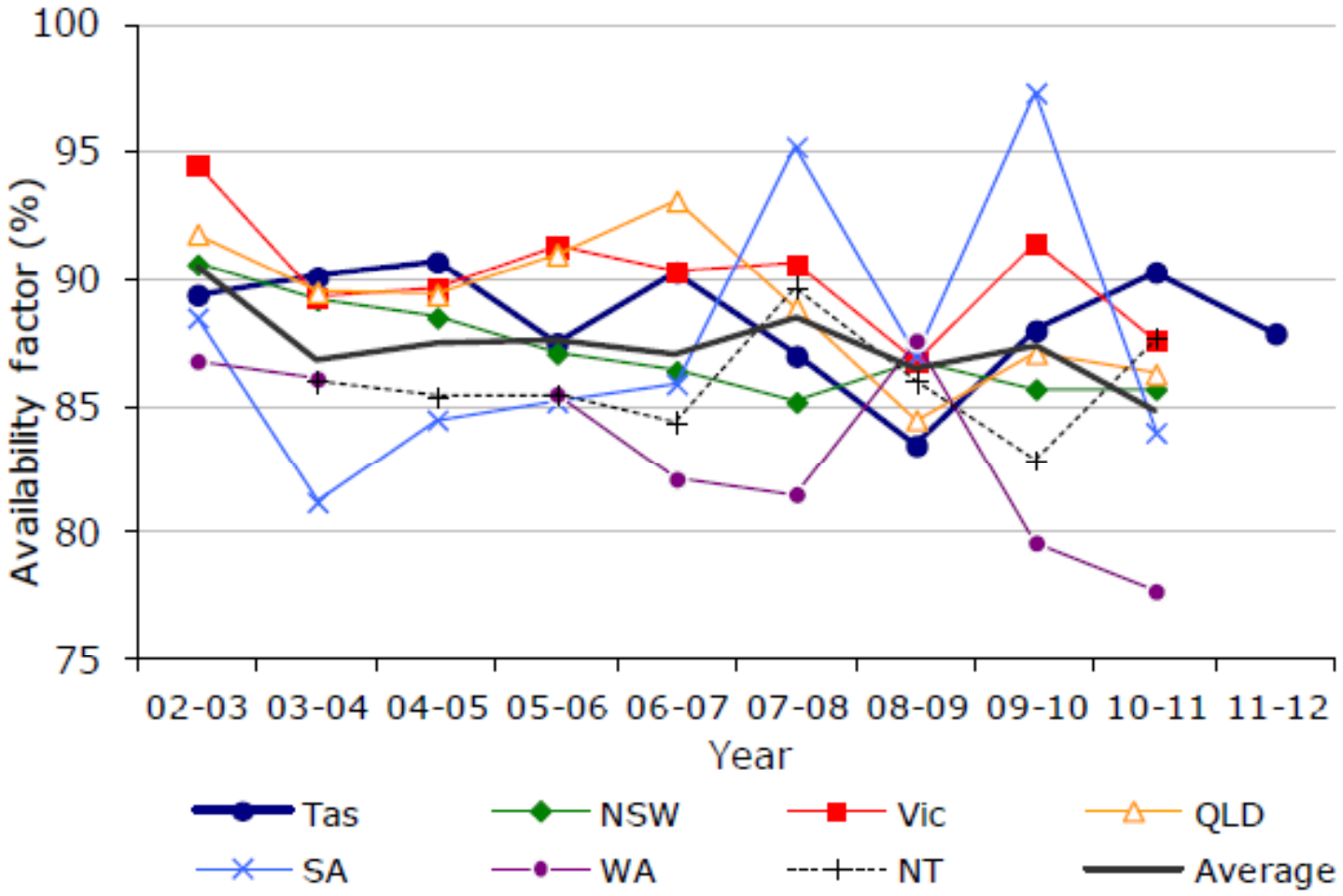
Presentation to MAC

20 March 2013

Anne Hill

Western Australian Generation Performance

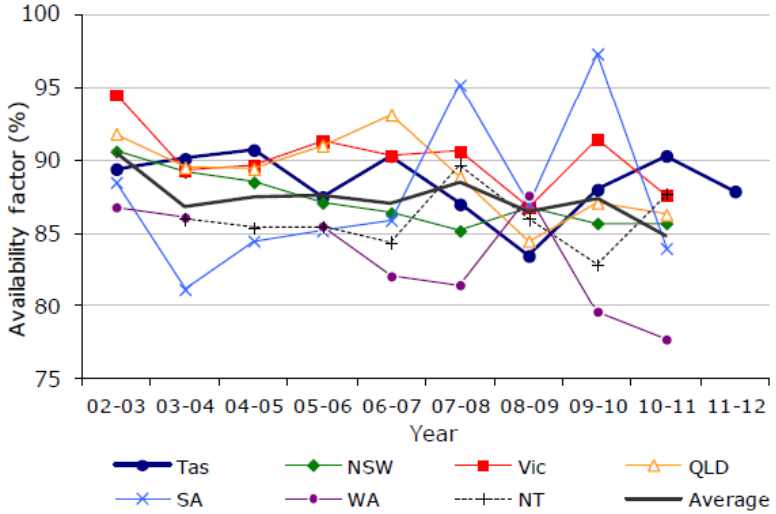
WA generation fleet performance has deteriorated since the start of the market, with its average Availability Factor now the lowest in Australia, while the Planned Outage Factor is the highest.

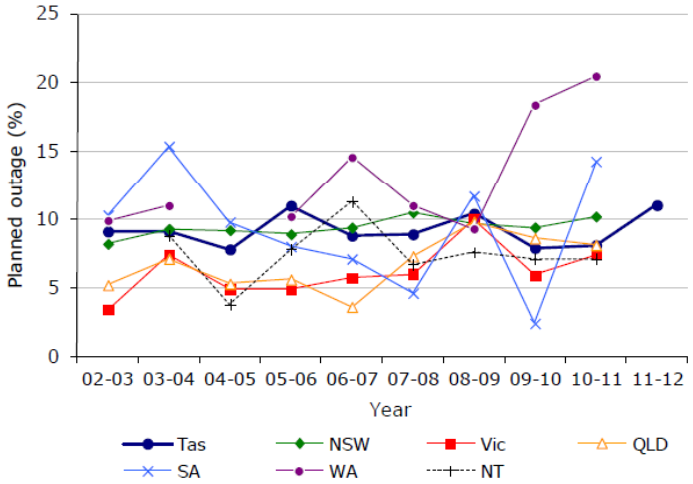


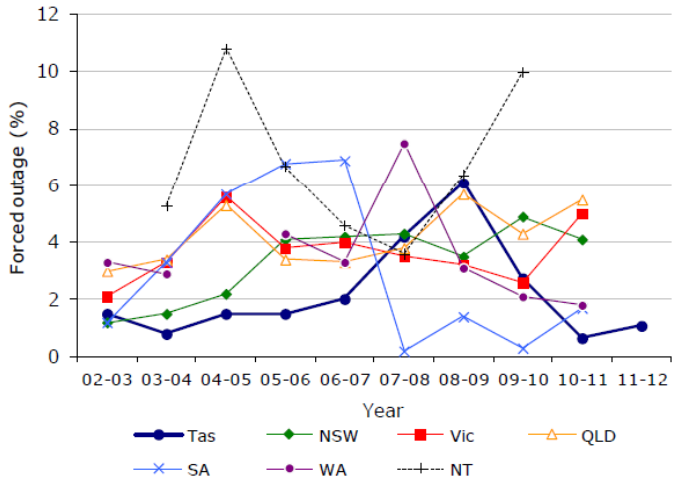
ESAA statistics as quoted by the Office of the Tasmanian Economic Regulator Energy in Tasmania Performance Report 2011-12

Western Australian Generation Performance

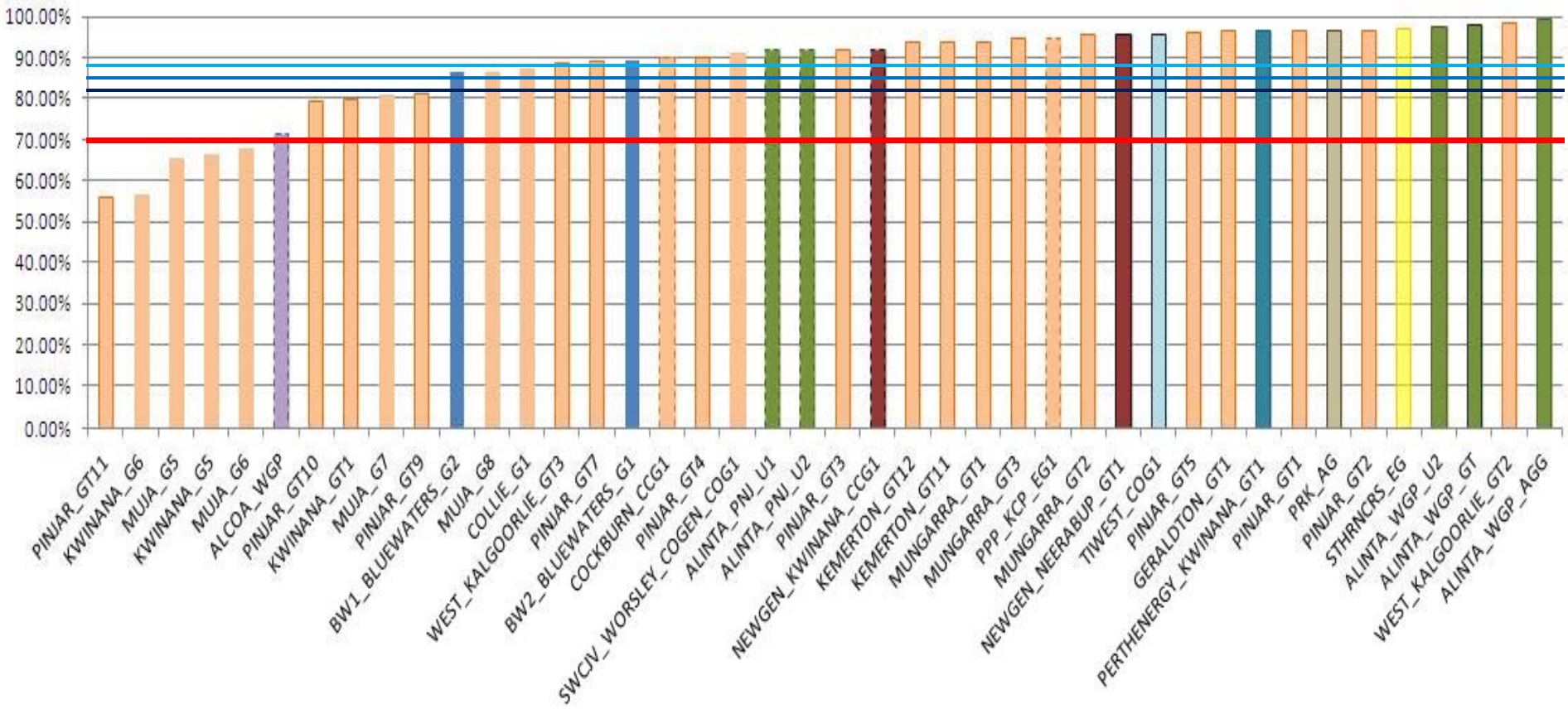
WA generation fleet performance has deteriorated since the start of the market, with its average Availability Factor now the lowest in Australia, while the Planned Outage Factor is the highest.







Availability Factors - WA Generating Units Nov 2009 - Nov 2012



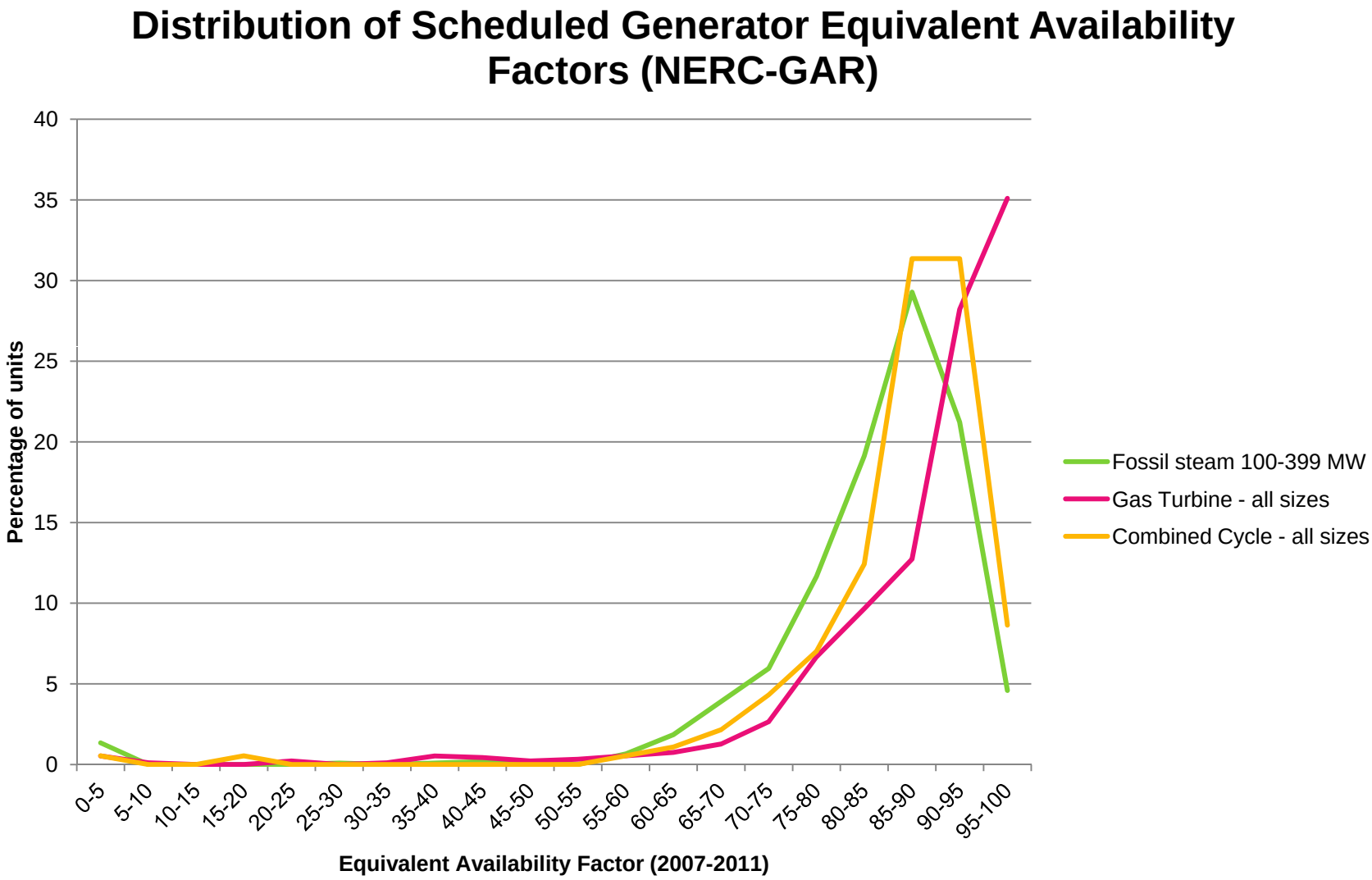
Threshold for MR 4.11.1(h) (30% Combined Outage Rate = 70% Availability Factor)

NERC-GAR 2007-11 average EAF for fossil thermal plant (84.01%)

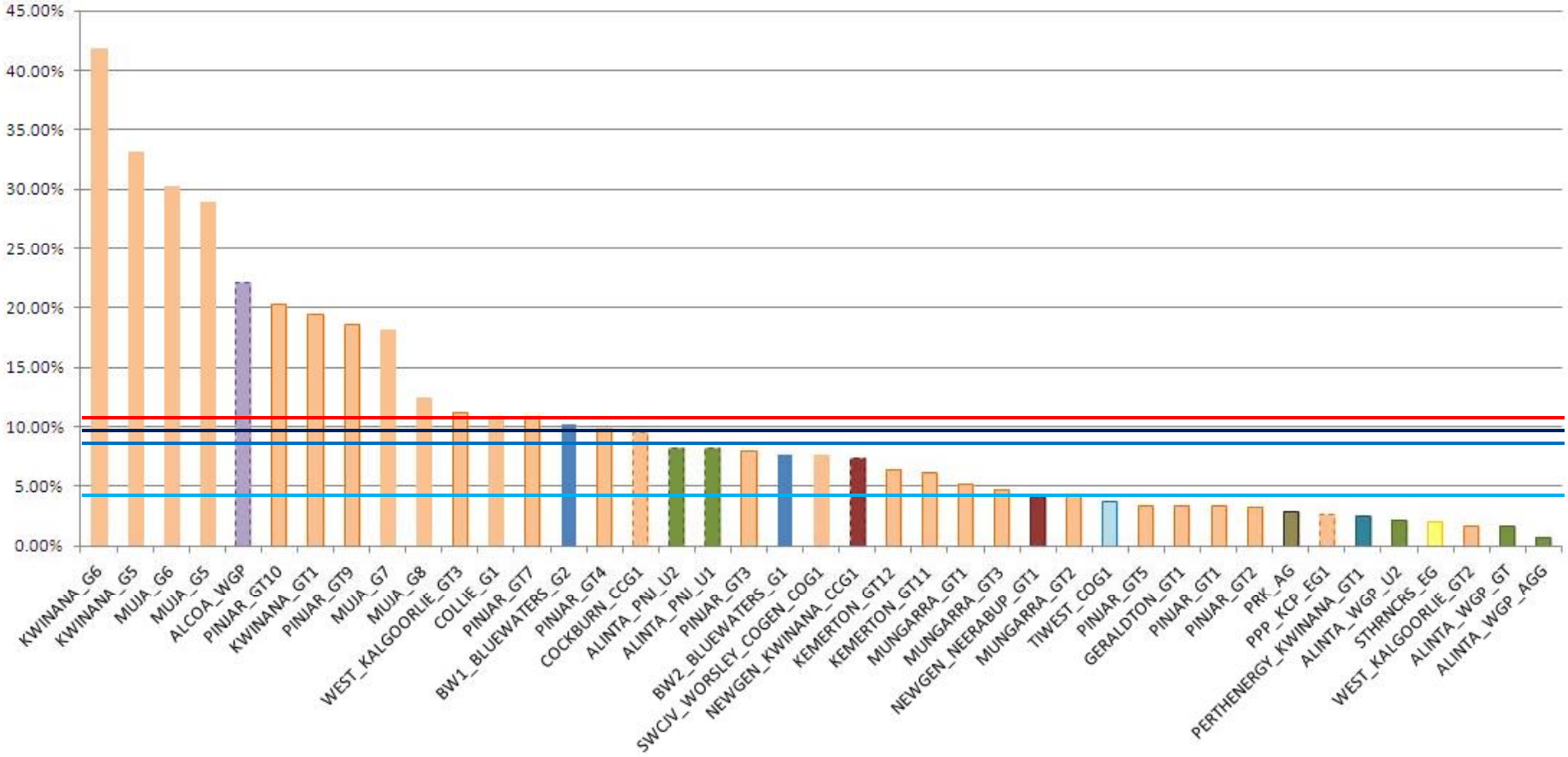
NERC-GAR 2007-11 average EAF for CCGT (86.76%)

NERC-GAR 2007-11 average EAF for gas turbines (89.35%)

Generator availability distribution is highly skewed



Planned Outage Rates - WA Generating Units Nov 2009 - Nov 2012



Threshold for clause 4.27.3 (1,000 hours = 11.4% POR)

NERC-GAR 2007-11 average SOF for fossil thermal plant (9.16%)

NERC-GAR 2007-11 average SOF for CCGT(8.48%)

NERC-GAR 2007-11 average SOF for gas turbines (4.8%)

Incentives are required to maximise availability

- No Market Rules have been breached by Market Participants with low-availability Facilities taking excessive Planned Outages.
- Existing Market Rules permit and encourage a ‘high Planned Outage / low Forced Outage’ strategy.

However:

- An energy-only market has inherent incentives to maximise availability because ‘not available’ = ‘not earning revenue’.
- In the WEM, a high Planned Outage strategy is subsidised by capacity revenue.
- Outcome is inconsistent with the Market Objectives.
- A capacity market should not deliver lower incentives for availability than an energy market.

The aim of these proposals is to adjust the incentives in the Market Rules to encourage high availability among Scheduled Generators allocated Certified Reserve Capacity.

Reason for capacity market

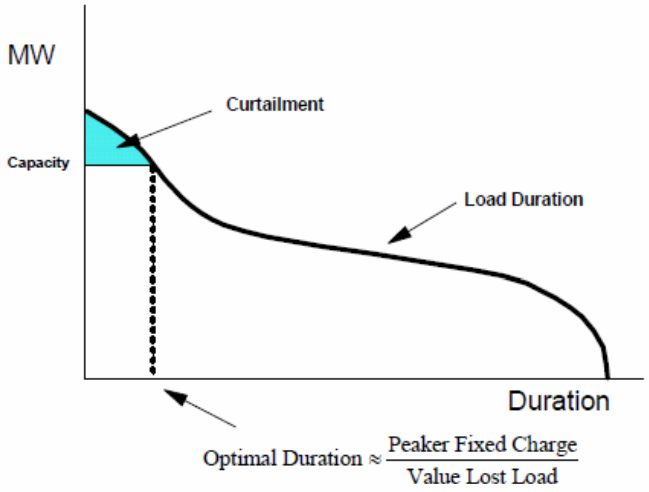
Customers don't use capacity – they use energy

Economic theory says that a competitive energy-only market will induce the optimal level of capacity, provided:

- **the market always clears at the competitive price, and**
- **consumers accept the economically optimal amount of load shedding.**

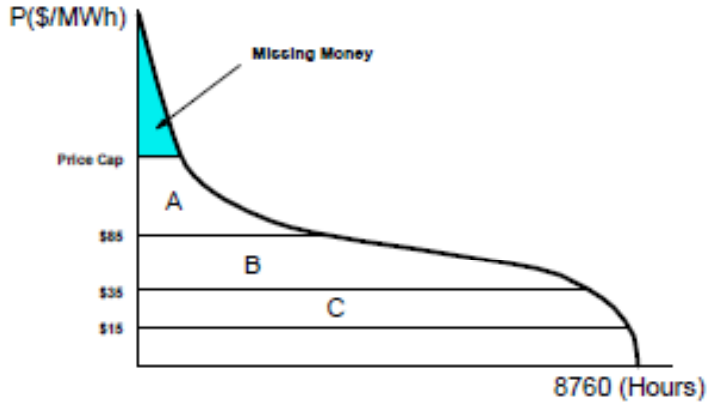
In practice, Governments generally try to limit both load shedding and prices.

A Simple Reliability Model



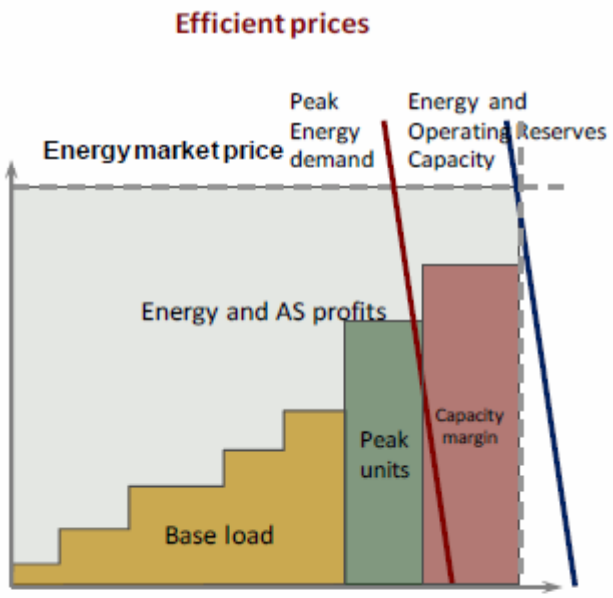
(Steven Stoft, Power System Economics, IEE Press, Wiley Interscience, 2002,

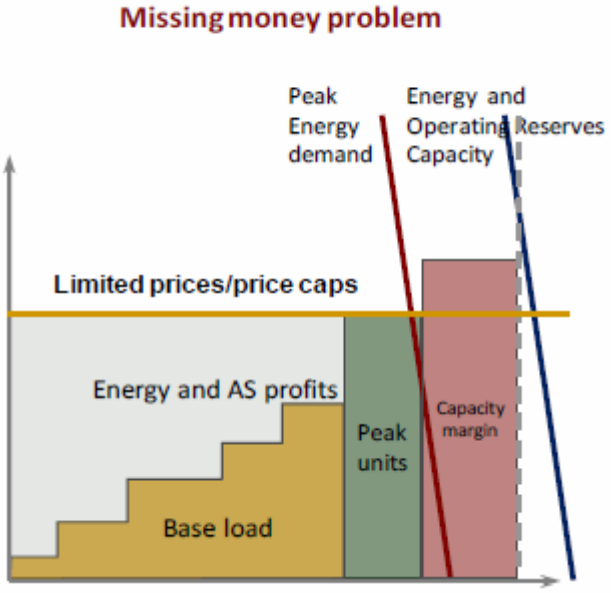
A Price Cap Results in "Missing Money"



Missing money reduces the payments to all types of generation.

The Missing Money (1)





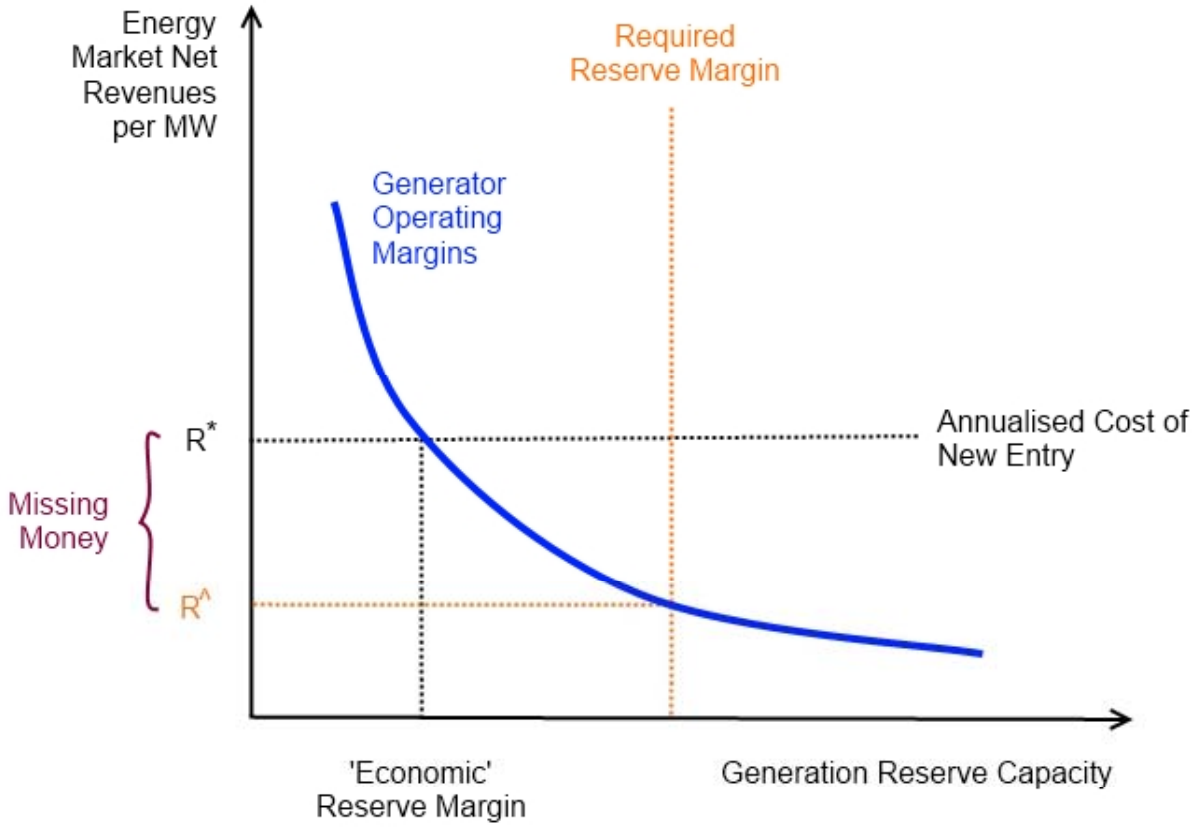
If energy prices are permitted to reach scarcity levels, even infrequently run generators can recover their fixed costs.

If energy prices are capped, infrequently run generators may not earn enough revenue from energy sales to recover fixed costs. The market will not attract sufficient investment to ensure reliability.

Capacity market is one solution

Source: Cervigni & Niedrig 2011

The Missing Money (2)



'Missing money' in an energy-only market may arise from:

- administrative/regulatory energy price caps, or
- high reserve margins (excess capacity => scarcity prices for energy rare)

WEM capacity market designed when WA acutely short of generation for peak periods, and RCM is heavily focused on system security, but …..

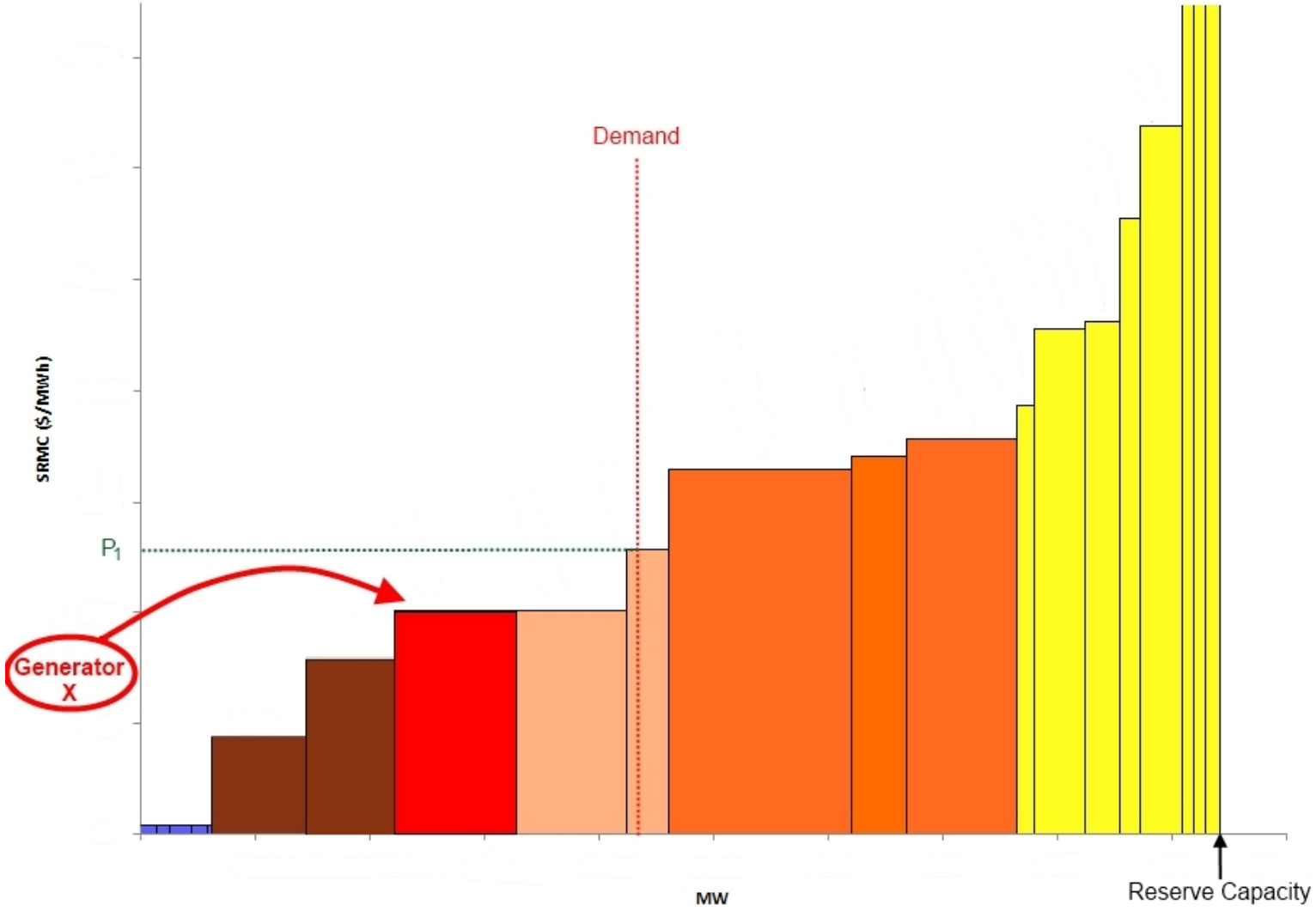
Customers use energy 8760 hours per year

Scheduled Generators in receipt of capacity revenue are expected to maximise their participation in the energy market(s)

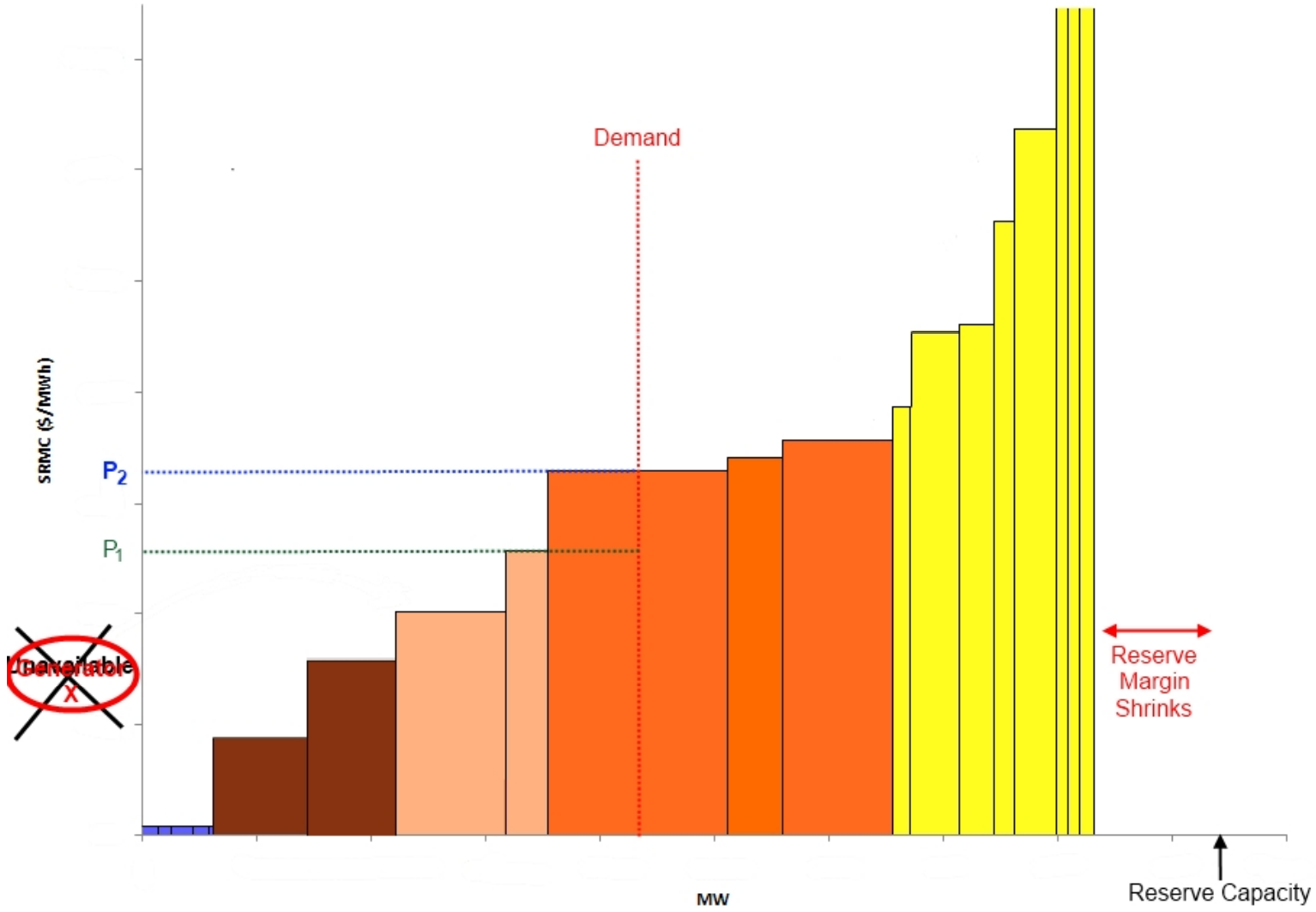
The capacity and energy markets in the SWIS comprise a single integrated system with common objectives, including:

- Economically efficient, safe and reliable
- Encourage competition
- Minimise long-term cost

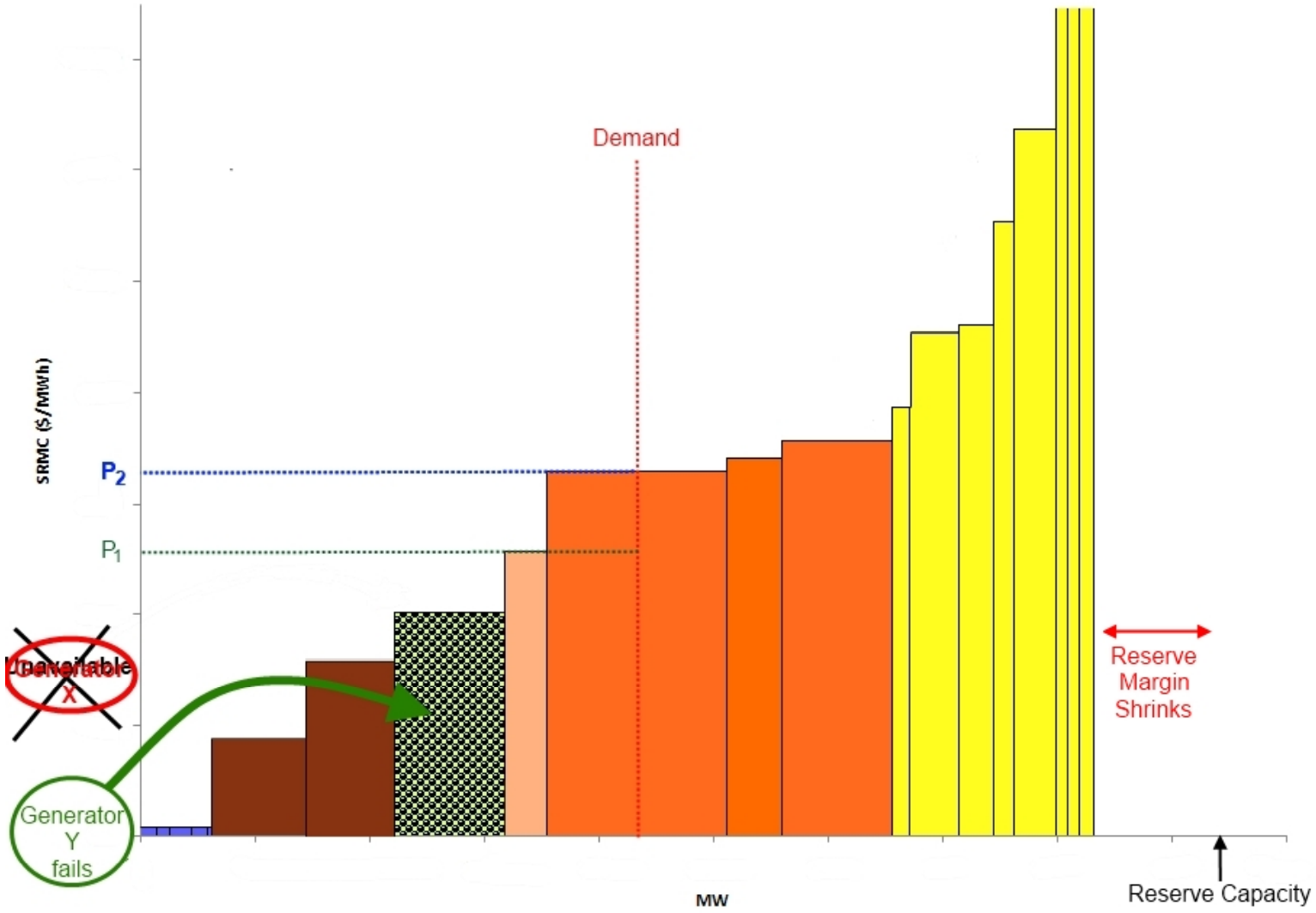
Scheduled Generators are expected to be available



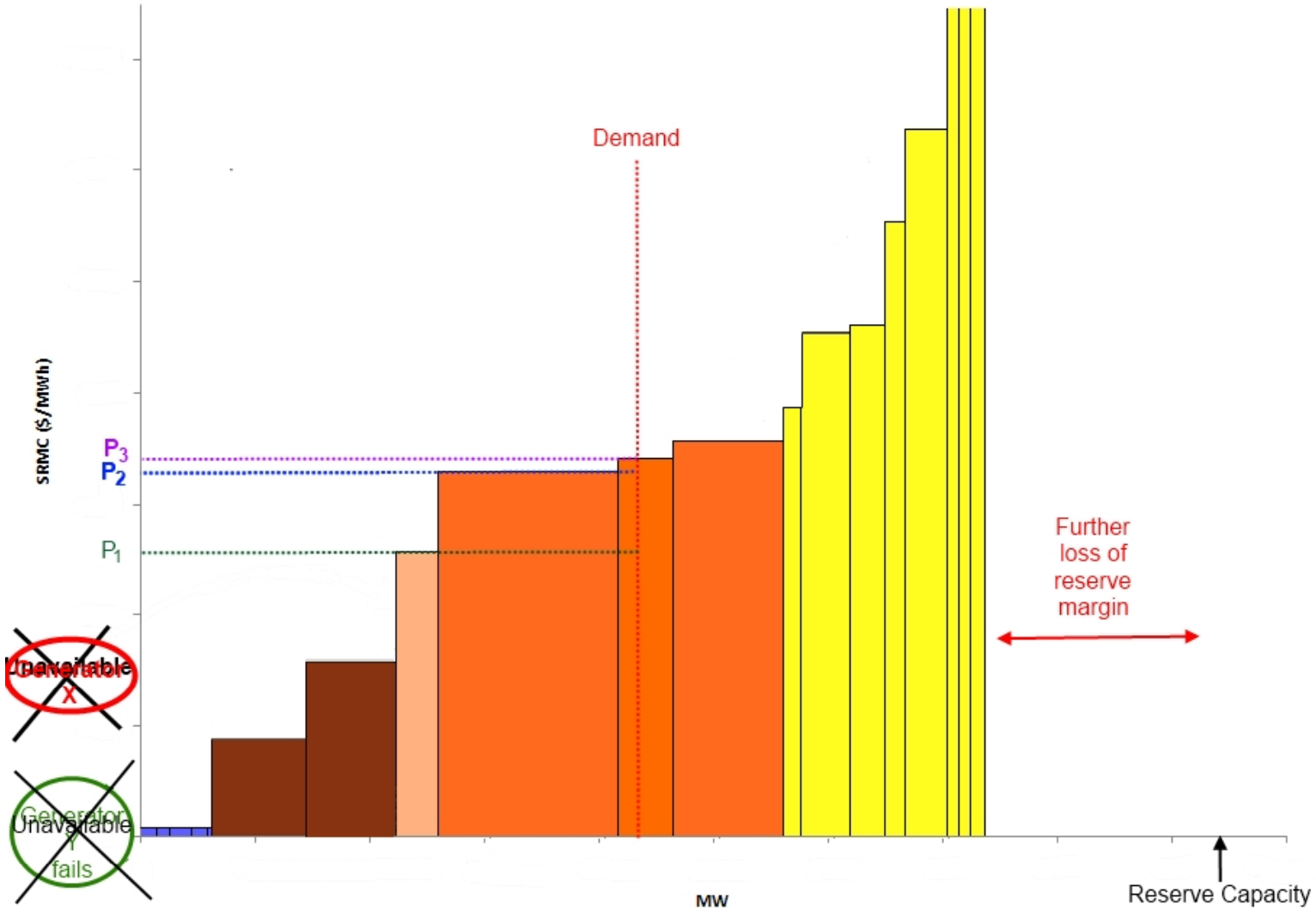
Scheduled Generators are expected to be available



Scheduled Generators are expected to be available



Scheduled Generators are expected to be available



The existing Market Rules regarding Reserve Capacity

- Focus on summer system security, not energy market efficiency;
- give the IMO little flexibility to consider reliability in allocating Certified Reserve Capacity;
- do not link capacity revenue to availability associated with outages, other than outages not approved by System Management;
- apply no consequences to excessive use of Planned Outages but impose high consequences for Forced Outages;
- constrain the IMO's ability to monitor the performance of individual unreliable Facilities; and
- give the IMO only one sanction against frequently unavailable Scheduled Generators – exclude them from the Reserve Capacity market entirely for the next Capacity Cycle.

Consequences of ineffective availability incentives

- Unreliable Scheduled Generators are paid more per available hour of capacity than reliable Facilities
  - 2010/11, $35.49 (53.6% outage) vs $16.51 (0.3% outage)
  - 2012/13, $30.33 (30% outage) vs $22.35 (5% outage)
- Sub-optimal competitive pressure and diversity in energy markets leads to inefficiency;
- Higher risk of price spikes resulting from unforeseen events;
- Capacity revenue masks normal commercial retirement signals for high-maintenance, unreliable plant.

Overall, failure to address frequent unavailability means:

THE MARKET IS NOT GETTING VALUE FOR MONEY

Three-step Approach

Unreliable Facilities may be allocated less Reserve Capacity at the IMO's discretion

- Allow IMO to assign between zero and full reserve capacity to a persistently unreliable Facility, and specify the factors IMO must take into account in decision.

Closer performance monitoring of unreliable Facilities

- Provide for IMO to require reports from Facilities with excessive Planned Outages, and to impose an independent monitoring regime on poor performers at its discretion.

Portion of Reserve Capacity revenue 'at risk' based on reliability over previous 3 years

- Provide for a Reserve Capacity Performance Adjustment of subsequent capacity revenue if the Facility is chronically unreliable over 36 months.

Clause 4.11.1(h) of the Market Rules

- **Existing**:
  - All or nothing decision.
  - Purpose of clause unclear and no guidance to IMO on decisions.
  - Outage thresholds are very high by industry standards.
  - IMO concerned about using past performance statistics to predict probability of future reliability.
- **Proposed**:
  - Provide for three certification options for the IMO for an eligible Facility: no Reserve Capacity; full Reserve Capacity; or a specified level.
  - IMO may specify a level of Reserve Capacity to reflect its reasonable expectations of Facility availability and resultant market impacts.
  - Retain full discretion for IMO, but clarify factors to be considered.
  - IMO may obtain information from a range of sources.
  - Progressively tighten total outage thresholds that trigger clause 4.11.1(h), from 30% to 20% over 5 years, then review.
  - Market Procedure for Certifying Reserve Capacity to be amended as necessary to support Rule Change.

Clause 4.27 of the Market Rules

- **Existing**:
  - IMO must require a report from all Facilities taking more than 1,000 hours of Planned Outages in the previous 12 months, but ONLY IF the availability of total system capacity has been severely impaired for more than 40 days in that 12 months.
  - Only one report can be required for each Facility in each 12 months.
  - No discretionary power for the IMO to more closely monitor Facilities that are chronically unreliable unless the system-wide criteria are met.
- **Proposed**:
  - IMO will have discretion to require a report from any individual Facility taking more than 1,750 hours of Planned Outages in 12 months (20% Planned Outage Factor), regardless of system capacity availability.
  - On the basis of the report, the IMO will have discretion to impose an independent monitoring regime at the Market Participant's expense until availability levels are aligned with good industry practice.
  - These reports will inform the IMO's decisions under clause 4.11.1(h).

New clause 4.27A of the Market Rules

- **Existing Market Rules**:
  - Certified Reserve Capacity is set for Scheduled Generators without regard for the Facility's reliability, and
  - Clause 4.12.6(b) permits a Facility to take unlimited Planned Outage hours without losing any capacity revenue.
  - Once Certified Reserve Capacity has been allocated to an existing Scheduled Generator for a Capacity Cycle, that revenue is guaranteed regardless of performance. There is no 'at risk' component, other than Reserve Capacity Refunds for Forced Outages.
- **Proposed new Market Rule**:
  - A portion of Certified Reserve Capacity revenue will be at risk for chronically under-performing Scheduled Generators.
  - Scheduled Generators that breach the total outage thresholds set in clause 4.11.1(h) will have the following year's capacity revenue adjusted by the previous 36-month total outage rate.
  - This adjustment will be automatic and independent of the IMO's decision under clause 4.11.1(h) concerning Reserve Capacity for the next Reserve Capacity Cycle.

Three Incentives to Improve Availability

Option	Type of consequence	Lag between performance and consequence	Market Rules affected	Could commence
Allocation of amount of Certified Reserve Capacity between zero and 100%	Financial – revenue foregone	26 months	4.11.1 and relevant Market Procedure	2014 for 2016/17 Capacity year
Reporting requirement	Increased scrutiny	Immediate (at IMO's discretion)	4.27	2013
Reserve Capacity Performance Adjustment	Financial – revenue adjustment	Year following breach of 3-year threshold	New rule	2013/14 for 1st Performance Adjustment in 2016/17

imo

Other Matters for Future Consideration (1)

- **Limit level of consequence-free Planned Outage rate**
  - **Clause 4.12.6(b)** allows unlimited Planned Outages without consequences.
    - Imposing an annual or three-yearly limit on the number of Trading Intervals where a reduction of Reserve Capacity Obligation Quantities can be claimed would strengthen incentives to use Planned Outages more effectively.
    - Planned Outages above the limit would attract Reserve Capacity Deficit Refunds.
    - Broad application to all Scheduled Generators exceeding limit (20% POR).
  - Under **Clause 4.27.9**, IMO must cease adjusting Reserve Capacity Obligation Quantities for Planned Outages above a predicted or imposed limit for high-outage Facilities – **IF** the system-wide capacity is impaired for >80 days in a 12 month period.
    - Decoupling this power from system-wide capacity would allow IMO to take a targeted, discretionary approach for individual Facilities.
    - Targeted application (eg to Facilities breaching clause 4.11.1(h) criteria **AND ALSO** exceeding 20% POR in the year).

Other Matters for Future Consideration (2)

- **Address non-industry standard definitions of outages** – eg. up to 23 hours withdrawal from service can be taken at an hour's notice as a Planned Outage (Opportunistic Maintenance).
  - Non-standard performance indicators make benchmarking against industry standard performance difficult.
    - Exacerbates asymmetry of information among Market Participants.
  - Equivalent Demand Forced Outage Rate ($EFOR_d$) is a measure of the probability of a Scheduled Generator being available when needed (eg for resource adequacy planning or UCAP allocations of Capacity Credits).
    - Such performance indicators facilitate incentives for maximising availability and improve reserve capacity planning accuracy.
    - This tool is not available to the IMO because of current non-standard definitions.

Other Matters for Future Consideration

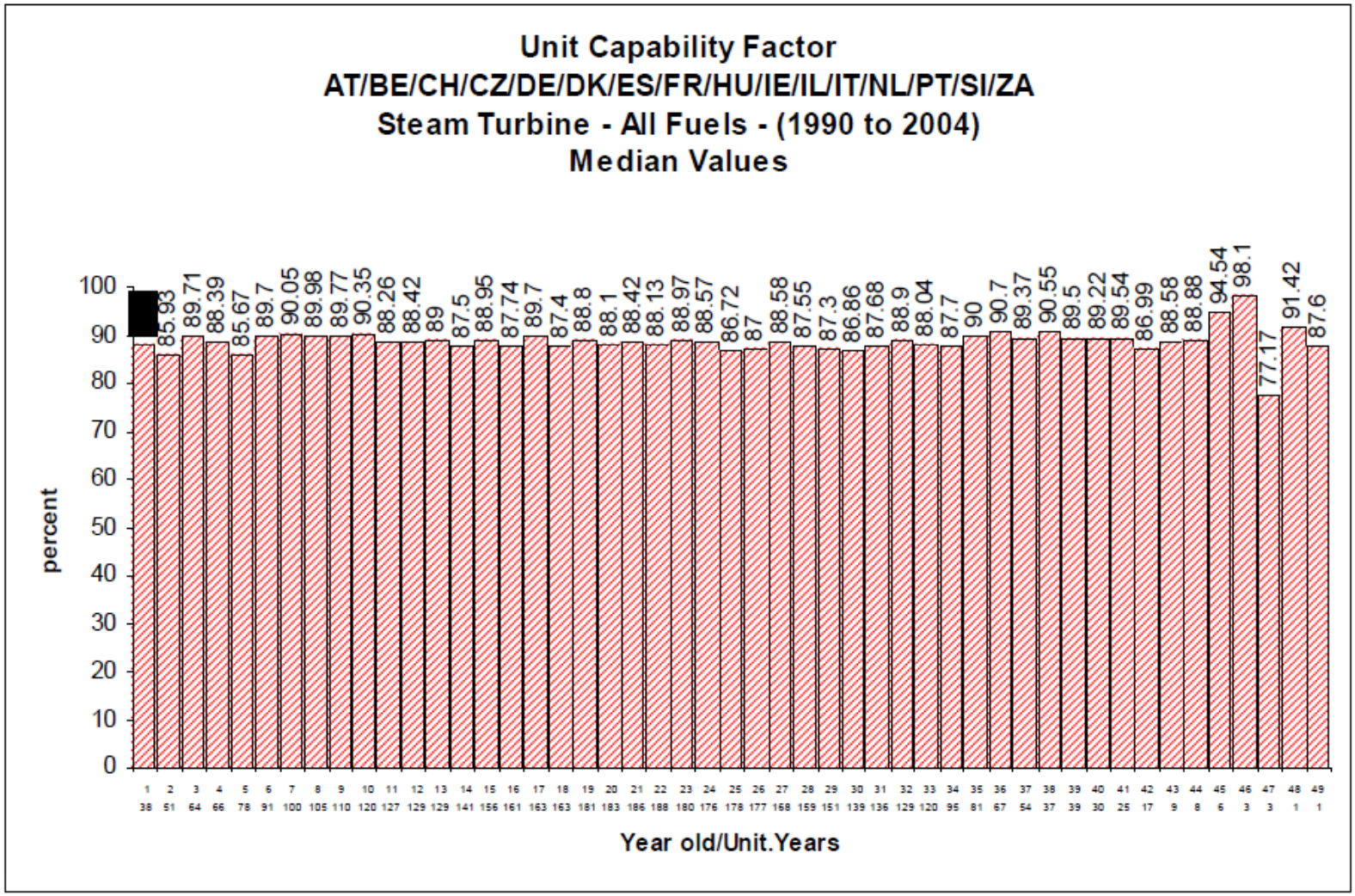
- **Minimum generator availability standard** –
  - Clause 4.11.1(h) appears to have been intended to be available for use as a performance floor for the capacity market.
  - If proposed incentives do not lead to improvement in availability, then a performance floor could be imposed.
    - One mechanism may be to add a 36-month minimum availability factor to the eligibility criteria in clause 4.8.1. Failure to meet the standard would automatically make a Facility ineligible to apply for allocation of Certified Reserve Capacity.
    - Facilities ineligible to apply for allocation of Certified Reserve Capacity may continue to compete in the energy market and may bid if the IMO seeks Supplementary Reserve Capacity.
    - (Last resort measure?)

Next steps

- April 2013 – Proposed industry forum
- April 2013 – Pre-Rule Change Proposal to MAC
- April 2013 – Rule Change Proposal published
- May 2013 – Draft Rule Change Report
- July 2013 – IMO Board approval
- August 2013 – Final Rule Change Report
- Transition period for Reserve Capacity Performance Adjustment (three years?)

INDEPENDENT
MARKET
OPERATOR

Questions?



Source: Eurelectric-VGBPowerTech: **TherPerf data base: Evaluation of Performance Indicators 1990-2004**

IEEE Standard Definitions for Use in Reporting Electric Generating Unit Reliability, Availability, and Productivity

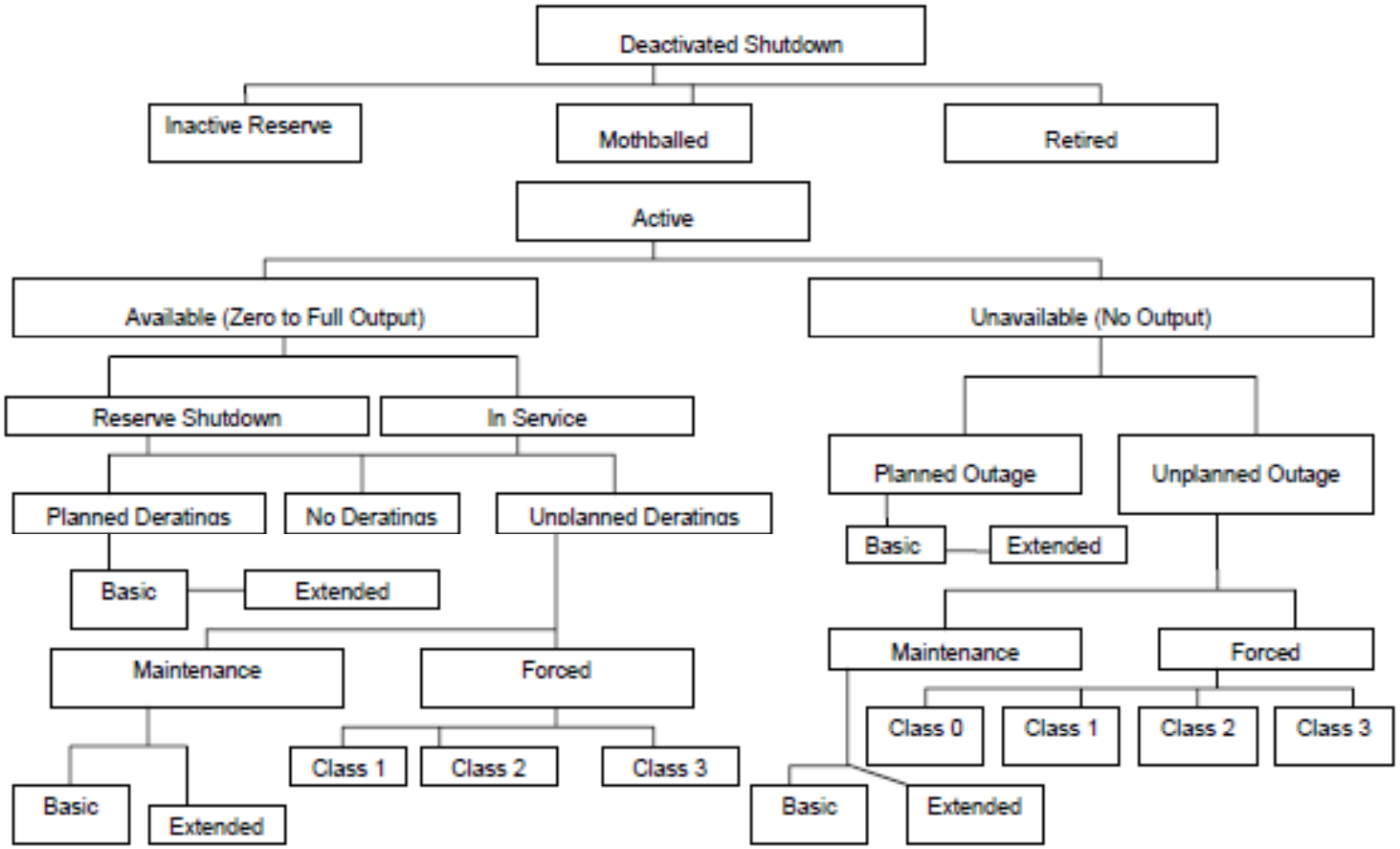


Figure 1—Relation between unit states

Source: IEEE std 762-2006

imo

INDEPENDENT
MARKET
OPERATOR