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Integrating Renewables: Regulatory, Policy & Commercial Issues

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Sustainable Energy Ireland, Dublin, 23/11/06

www.ceem.unsw.edu.au

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Outline

- Sustainability context
- Electricity industry decision-making frameworks
- Implications of renewable energy
- Key regulatory, policy & commercial issues

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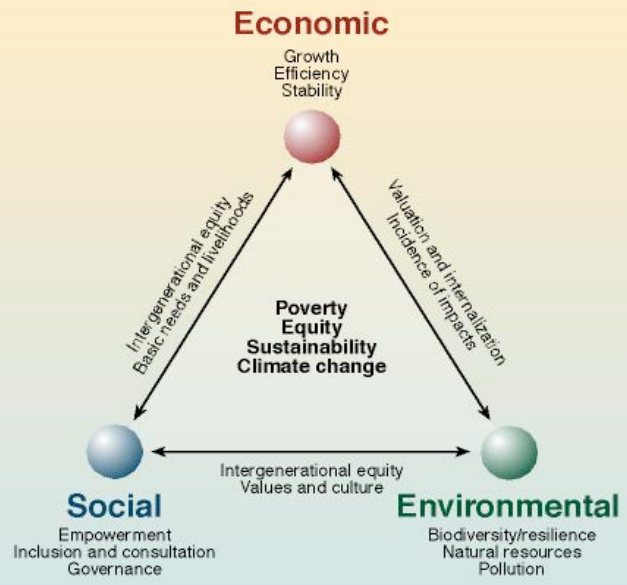
Key elements of sustainable development and interconnections

The broader sustainability context for electricity industry restructuring
(IPCC COP7)

Engineering criteria must also be met:
Availability & Quality of supply



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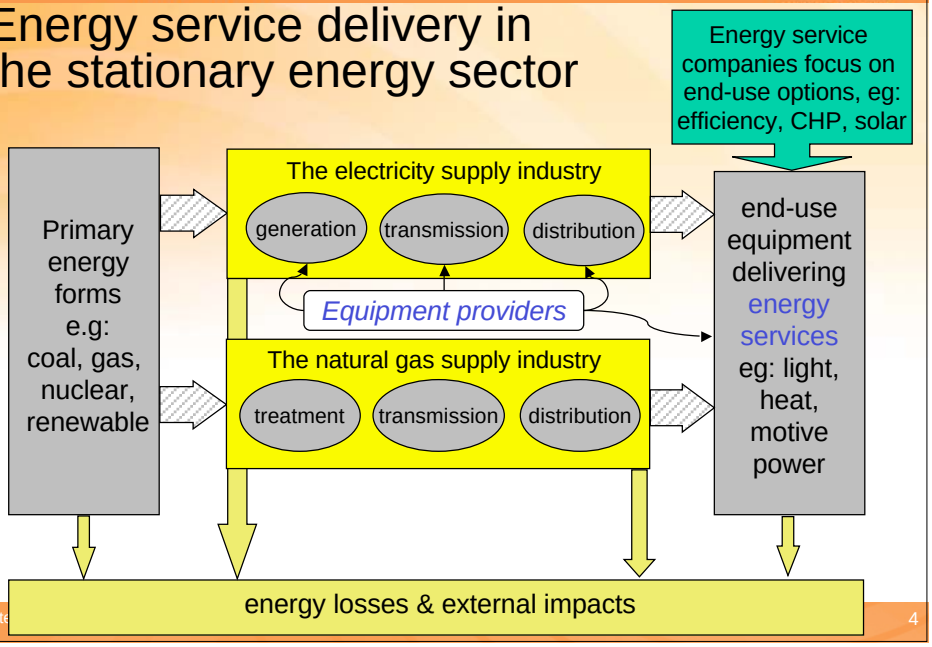
Energy service delivery in the stationary energy sector



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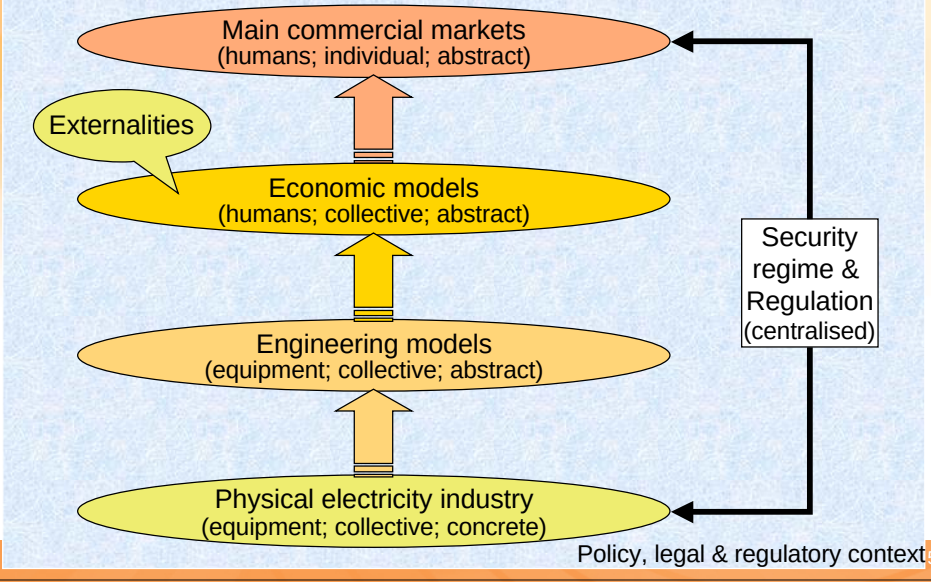
Trading in electricity:- an abstraction from reality



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Decision making framework for the electricity industry

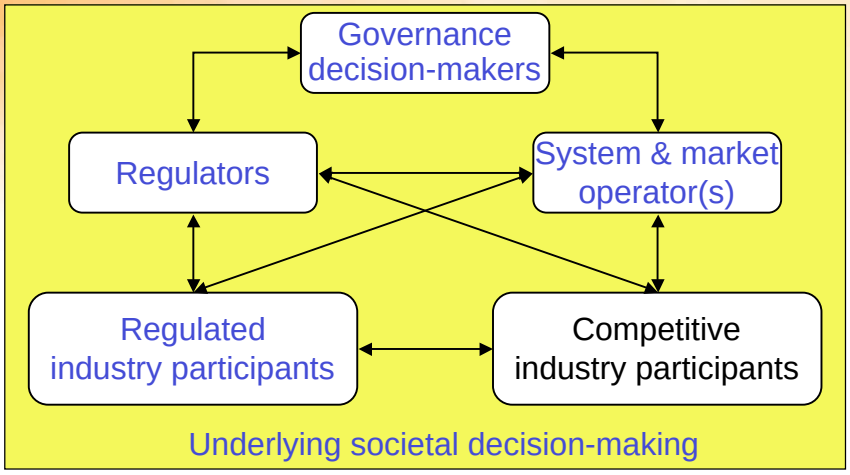

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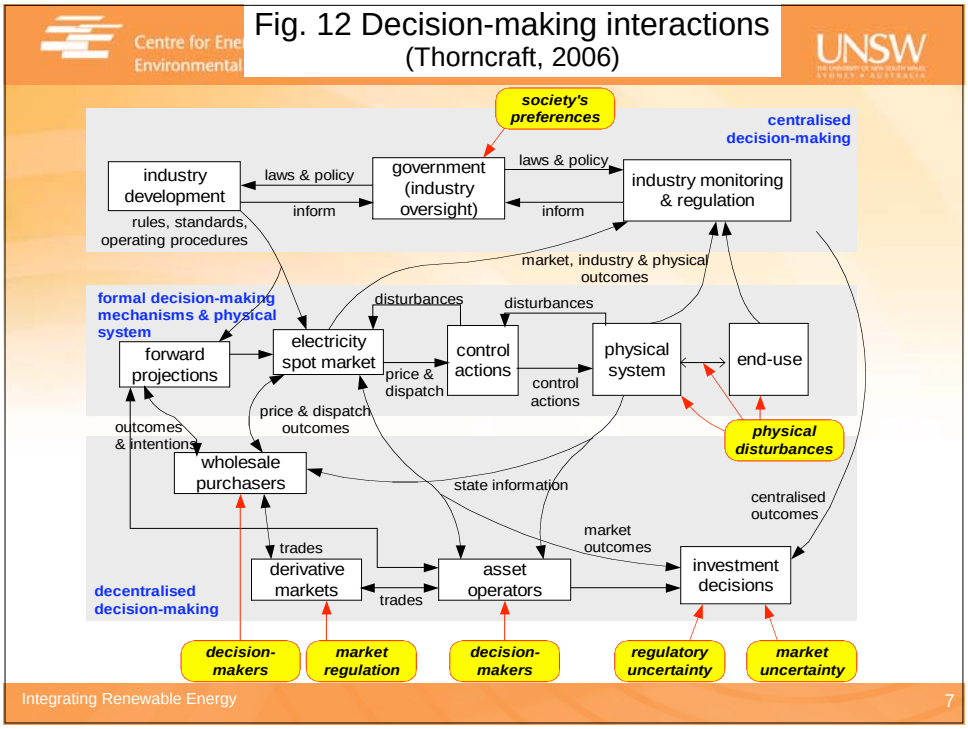
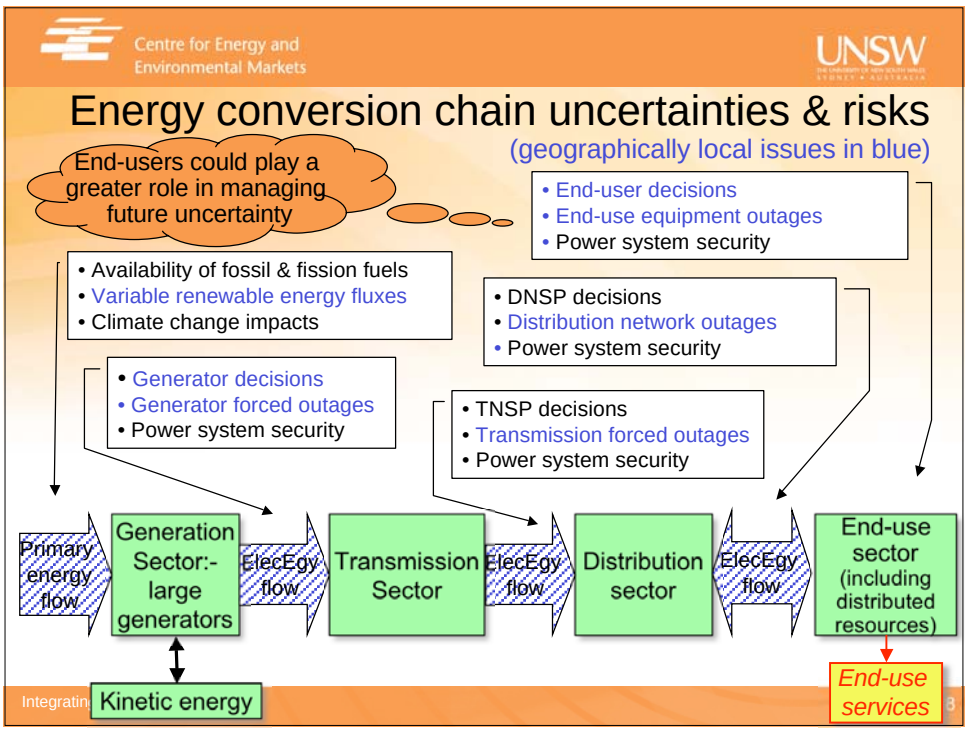
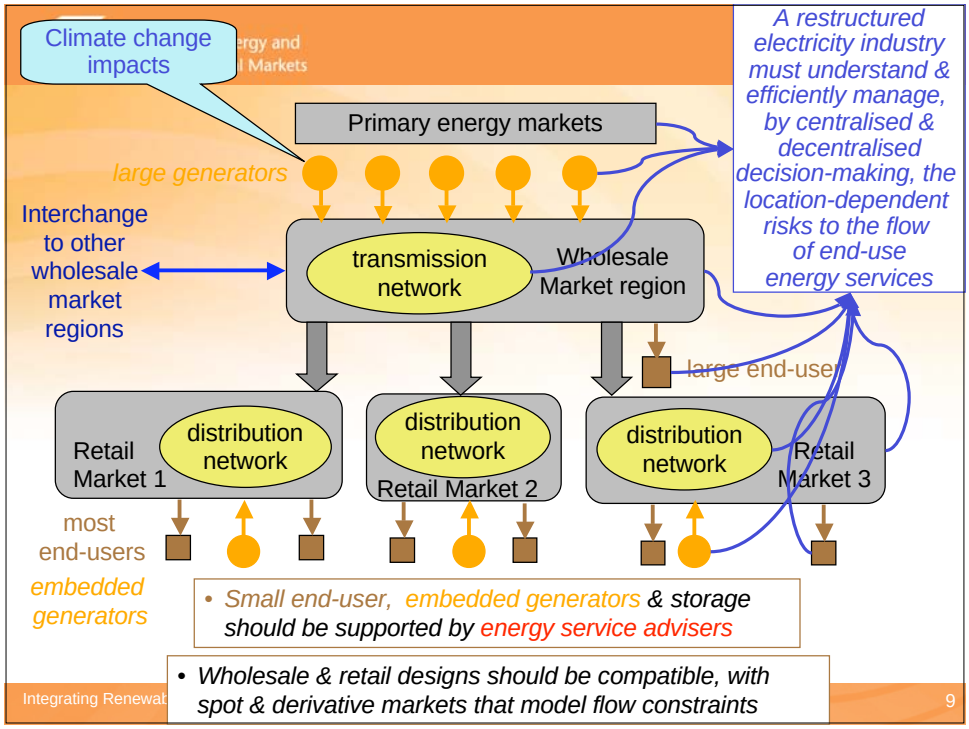
Fig. 12 Decision-making interactions
(Thorncraft, 2006)







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Contributors to unavailability of electricity supply for small end-users (USA data, AEMC, 2006)

Contributor	Average unavailability per customer year	
	(minutes)	(%)
Generation/transmission	0.5	0.5
132 kV	2.3	2.4
66kV and 33kV	8.0	8.3
11kV and 6.6kV	58.8	60.7
Low voltage	11.5	11.9
Arranged shutdowns	15.7	16.2
Total	**96.8 minutes**	**100.0**

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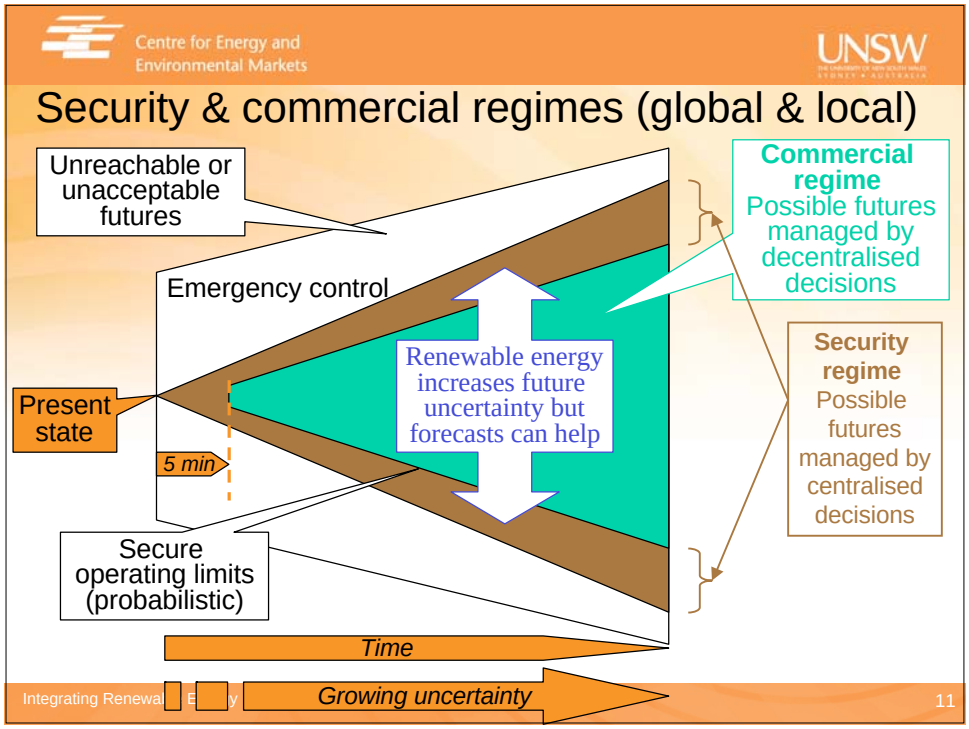
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Security & commercial regimes (global & local)
Unreachable or unacceptable futures
Emergency control
Present state
5 min
Secure operating limits (probabilistic)
Renewable energy increases future uncertainty but forecasts can help
Commercial regime
Possible futures managed by decentralised decisions
Security regime
Possible futures managed by centralised decisions
Time
Growing uncertainty
11

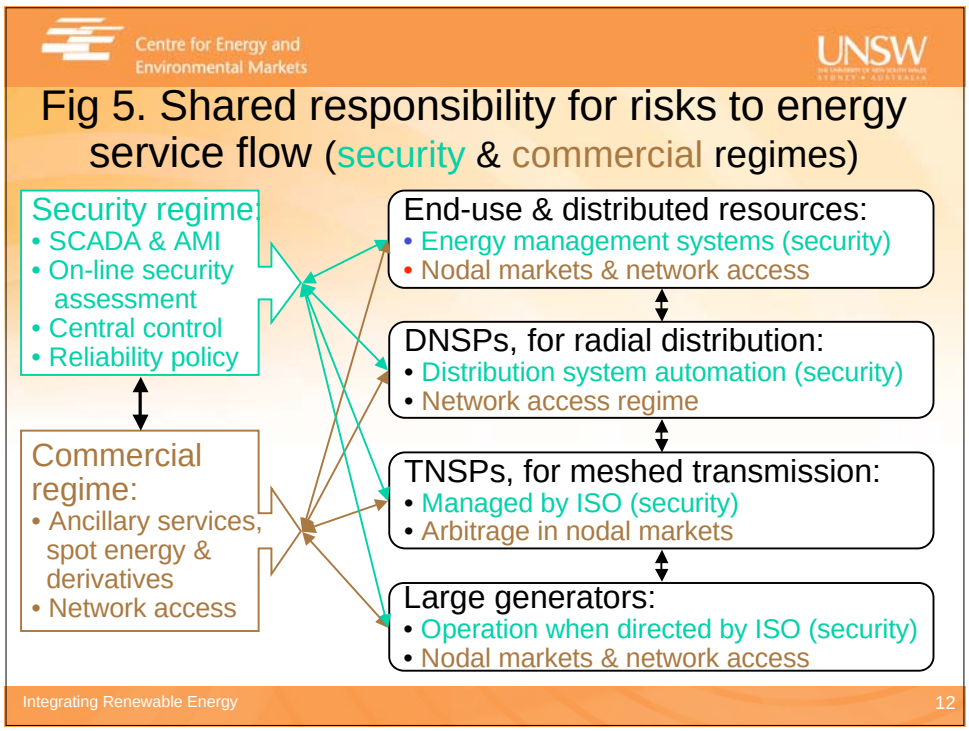
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Fig 5. Shared responsibility for risks to energy service flow (security & commercial regimes)
Security regime:
• SCADA & AMI
• On-line security assessment
• Central control
• Reliability policy
Commercial regime:
• Ancillary services, spot energy & derivatives
• Network access
End-use & distributed resources:
• Energy management systems (security)
• Nodal markets & network access
DNSPs, for radial distribution:
• Distribution system automation (security)
• Network access regime
TNSPs, for meshed transmission:
• Managed by ISO (security)
• Arbitrage in nodal markets
Large generators:
• Operation when directed by ISO (security)
• Nodal markets & network access
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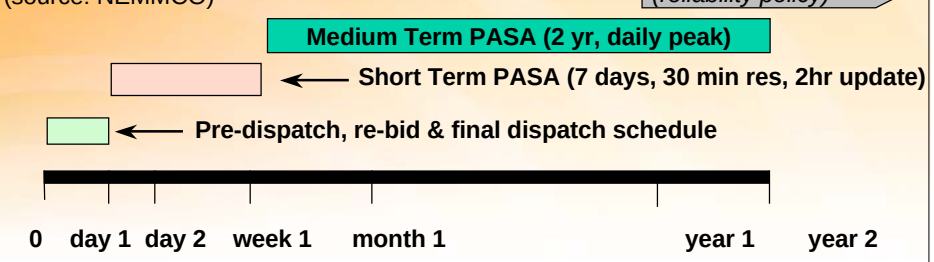
Dispatch, Pre-dispatch, PASA, SOO & ANTS to manage supply-demand balance

(source: NEMMCO)



- ST & MT Projected Assessment of System Adequacy support reserve assessment & participant operating decisions. ST PASA projects region demand & reserve for 7 days @ 30 min resolution, updated every 2 hours. MT PASA projects daily peak demand & reserve for 2 yrs, updated weekly.
- Statement of Opportunities (SOO) & Annual National Transmission Statement (ANTS) are intended to inform generation, demand & network investment decisions (10 year horizon, issued annually)

Integrating Rene *These procedures all rely heavily on demand forecasts* 13

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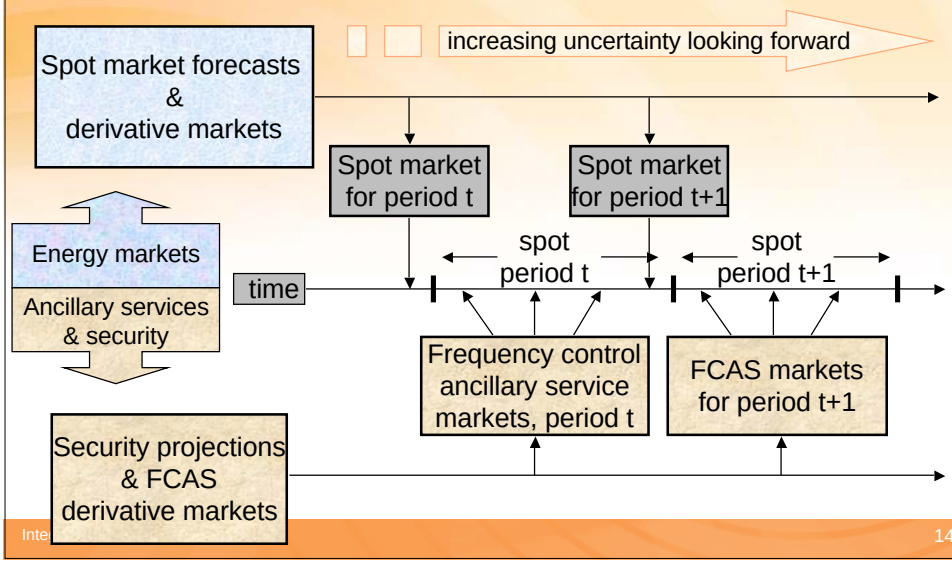
Managing supply-demand balance in NEM



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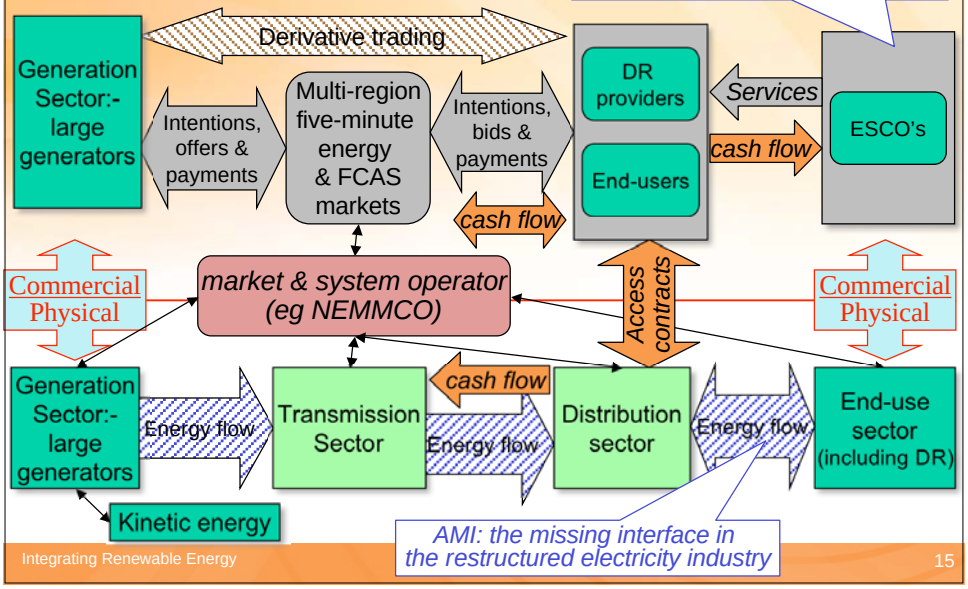
Enhanced industry structure



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Key technical issues for high-penetration renewable energy

- Design & demonstration of distributed resource systems (generation, storage, end-use response)
- Advanced metering, communication & control for distributed resources
- Improved power electronic devices
- Compact, high-capacity & cost-effective reversible energy storage
- Mathematic modelling & forecasting for renewable energy generation & distributed resources

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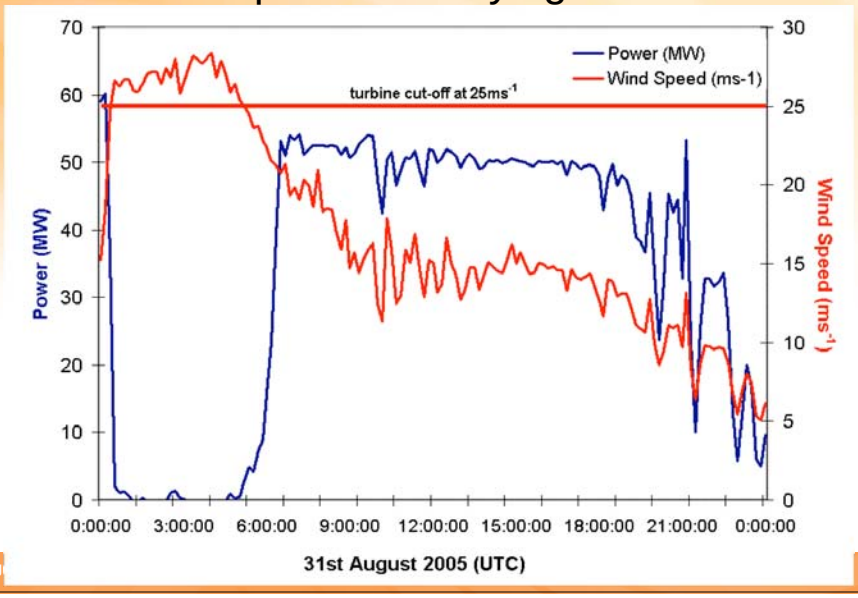
Wind farm response to varying wind conditions



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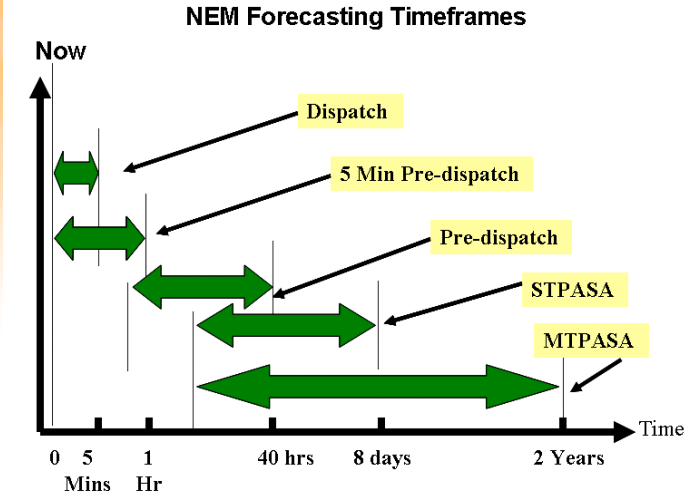
NEMMCO Forecasting Timeframes



(AWEFS functional requirements, www.nemmco.com.au)

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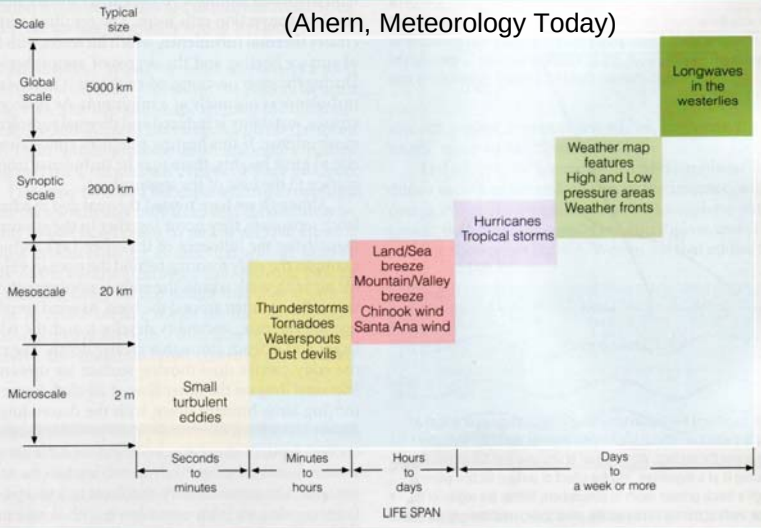
•TABLE 9.1

The Scales of Atmospheric Motion with the Phenomena's Average Size and Life Span*

(Ahern, Meteorology Today)



*Because the actual size of certain features may vary, some of the features fall into more than one category.

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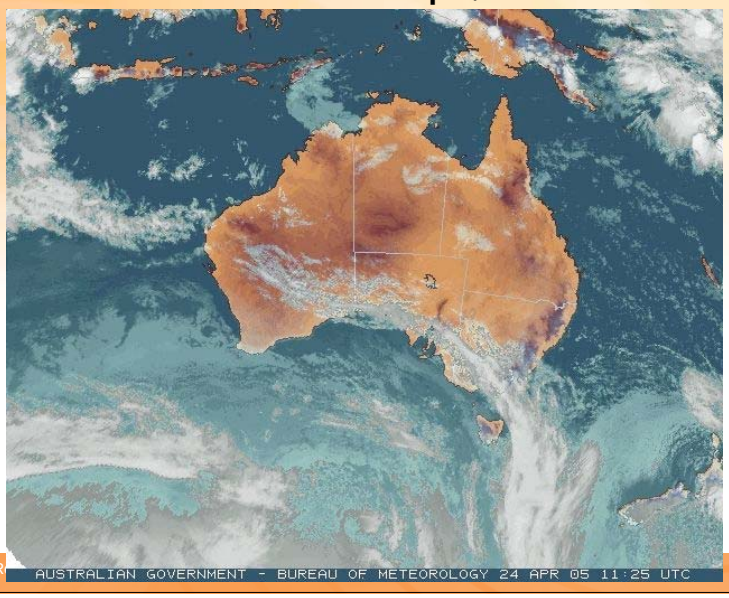
S1: Infra-red satellite map (BoM Aust,1125 UTC 24/4/05)



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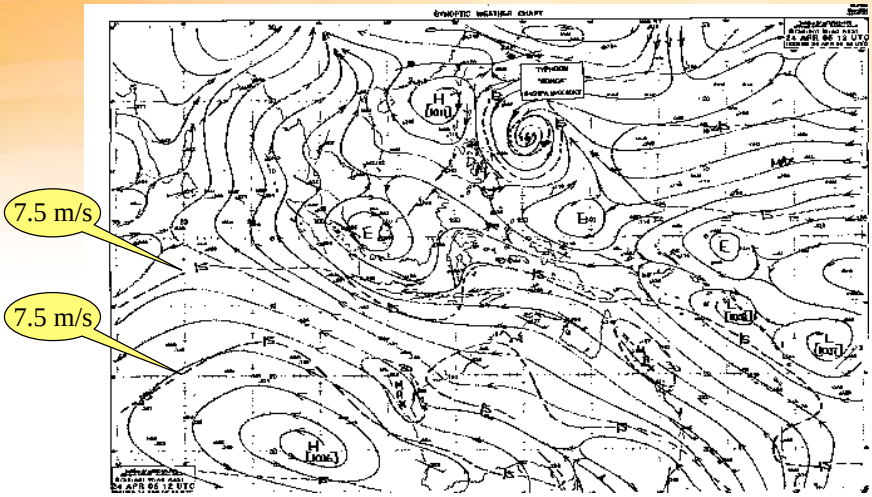
S1: Gradient level (~1km) wind map, produced twice daily (BoM Aust, 12 UTC 24/4/05)



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Low-pressure cell over southern Australia

(BoM, 2006)

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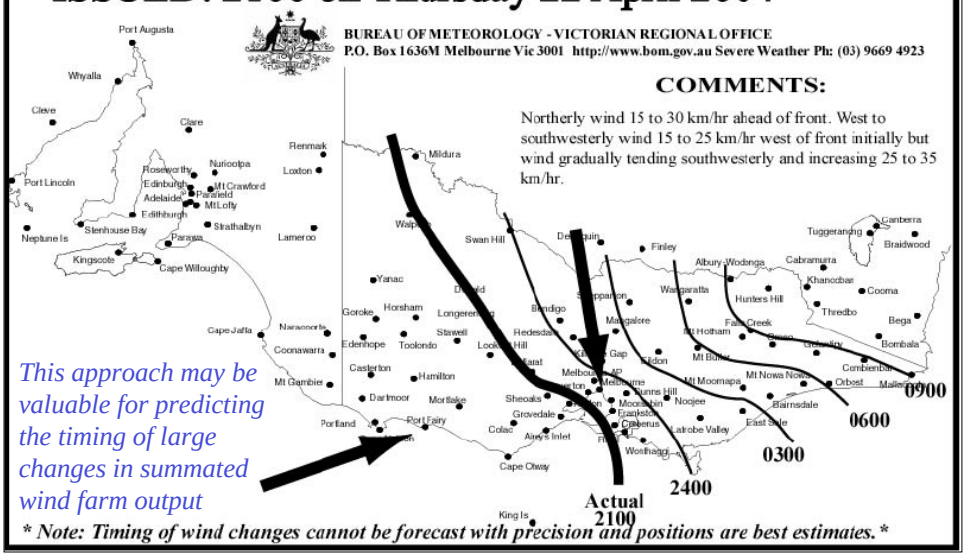
WIND CHANGE FORECAST CHART

ISSUED: 2100 on Thursday 22 April 2004



This approach may be valuable for predicting the timing of large changes in summated wind farm output

** Note: Timing of wind changes cannot be forecast with precision and positions are best estimates. **

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Key regulatory & policy issues for high-penetration renewable energy

- Institutional issues:
  - Robust security regime with security-constrained dispatch
  - Efficient commercial regime (operation & investment)
  - Effective regulatory framework (network services)
  - Compatible arrangements for gas industry
- Policy issues:
  - Appropriate innovation in renewable energy technologies
  - Correct location & timing for investment in renewables
  - Forecasting for security & commercial regimes
  - Active end-user participation (value, timing, efficiency)
  - Skill development in all relevant areas

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Key commercial issues for high RE

- Advanced auction-style electricity markets:
  - Spot & derivative energy; ancillary services
    - Within continually updated security constraints
    - With active end-users supported by ESCOs
    - With attention to equity issues
- Efficient network access regimes:
  - Availability & quality; active end-user participation
- Renewable energy forecasting tools for:
  - Renewable energy generators
  - Other generators and end-users
  - System operators & policy-makers
- Efficient financial mechanisms to counter un-costed fossil fuel externalities

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