



## DE policy and regulatory requirements

*The Role of PV in Smart Grids: Integration of Renewable Energy Systems and Distributed Energy in Electricity Grids Opportunities and Issues for PV*  
Sydney, 24 November 2008

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## CEEM established ...

- *to provide a formal interdisciplinary framework* for joint work between UNSW researchers in Engineering, Business, Social Sciences, Environmental Sciences...
- *through UNSW Centre* providing Australian research leadership in interdisciplinary design, analysis + performance monitoring of energy + environmental markets, associated policy frameworks
- *in the areas of*
  - Energy markets
    - spot, ancillary services and derivative markets, **retail markets**
    - *Primary focus on the Australian NEM*
  - Energy related environmental markets
    - Eg. National Emissions Trading, MRET, Energy Efficiency Certificate Trading, Renewable energy support...
  - Broader policy frameworks and instruments to achieve desired societal energy and environmental outcomes

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# Decision-making in the electricity industry: *... as a centralised engineering optimisation problem*

- Given:
  - An inventory of all existing & potential future generation, network & demand-side electrical equipment:
  - All their technical parameters, operating constraints, operating & capital costs, and derived ‘energy service’ benefits of demand
  - All externality costs and benefits associated with operation and investment of all these options
  - Uncertainties in all of the above – most of these without understood probabilities
  - ... and the ability to control all generation, network & end-use equipment
- Calculate a strategy to maximise overall societal benefit:
  - Solve a stochastic non-linear dynamic optimisation problem for operating & investment decisions in generation, network and demand side equipment accounting for the special characteristics of electricity and electrical networks

# Decision-making in the electricity industry: *... as decentralised commercial optimisation problem*

- Given industry ‘market’ participants who in aggregate know:
  - all existing & potential future generation, network & demand-side electrical equipment:
  - All their technical parameters, operating constraints, operating & capital costs, and derived ‘energy service’ benefits of demand
  - All externality costs and benefits associated with operation and investment of all these options
  - Uncertainties in all of the above – most of these without understood probabilities
  - ... and who have the ability to control their own generation, network & end-use equipment
- Establish markets that maximise overall societal benefit:
  - Spot and future prices for markets in energy and ancillary services and externalities that incentivise profit-maximising market participants to undertake decisions that contribute to maximising societal welfare over the long term

# Decision-making in the 'real world' EI

- Some centralised decision-making inevitable:
  - Instantaneous & continuous energy flow
  - Network, generation & end-use services hard to separate
- Some decentralised decision-making inevitable:
  - Demand-side of the industry largely privately owned
- Traditional industry structure centralised supply-side
- Some industries worldwide have undertaken restructuring to provide a greater role for market-based competition
  - Requires 'designer' markets as special characteristics of electrical flows not amenable to traditional commodity markets:
  - Possible wholesale, ancillary service and retail energy markets
  - Some decision making still centralised – security & networks
  - *Not so much deregulation as re-regulation*

# Challenges and opportunities for Distributed Energy

- How well do restructured industry arrangements establish and allow DE to suitably receive
  - Energy and network values
    - Locational, time varying + contingent value of energy and necessary network flows: *spot but also future prices b/c decisions now impact on later decisions*
  - Environmental values
    - ‘command and control’ regulation yet also possible schemes incl. ETS, MRET and feed-in tariffs that internalise environmental & social externalities
- A question of wholesale & retail market design, network regulation and surrounding policy frameworks
  - Challenges of technology and participant neutrality for emerging DE options that have very different technical & economic characteristics, location near and ownership by end-users
  - *Retail markets where DE resides are the ‘unfinished’ business of many electricity industry restructuring processes*
  - *Intersection of regulated network and competitive supply/demand options invariably complex and imperfect*
  - No serious efforts yet in most jurisdictions to address environmental, energy security and wider social externalities of energy markets

# One perspective on Smart grids and DE

(Outhred, 2008)

- The key objective for the “smart grid” concept is:
  - Coordinated, decentralised investment in & operation of distributed resources to deliver net societal benefits
- Key requirements in achieving this objective are:
  - A protocol for interfacing “smart grid” elements to create an effective technological system (electricity industry)
  - An associated communications system
  - A formal decision-making framework to allocate authority & accountability to decentralised decision-makers
  - A formal incentive/penalty regime to align the incentives of decentralised decision-makers with societal objectives
  - A robust migration path to a “smart grid future”

# Present retail market design in Australia

- Retail market design for large end-users:
  - Competitive retail market (not yet mature)
  - Regulated network pricing (not yet mature)
- Retail market design for small end-users:
  - Regulated or partially competitive retail market
  - Simplified tariff structure; immature metering; profiling
  - Network charges usually passed through retailer
  - Little support for informed end-user decision making
- Some social policy objectives internalised
- Some environmental objectives internalised
- Limited opportunities for distributed energy

# Current Full Retail Competition limited

“. an important reason there is effective competition in Victoria is “Because the provision of energy is viewed as a homogenous, low engagement service... “  
AEMC, *Effectiveness of Competition in Victoria, 2008*

The screenshot shows the EnergyAustralia website for NSW. The browser title is "EnergyAustralia - NSW home - Mozilla Firefox". The address bar shows the URL "http://www.energyaustralia.com.au/energy/ea.nsf/Content/NSW+home". The page has a blue header with the EnergyAustralia logo and a search bar. Below the header is a navigation menu with links for "NSW Home", "Residential", "Business", "Your Account", and "About Us", along with "Contact us" and "Sitemap".

The main content area features three promotional banners:

- Want cheaper gas and electricity bills?** with an image of a gas stove and a light bulb. A button says "Find out how we can help." with a right arrow.
- EARN QANTAS FREQUENT FLYER POINTS.** with an image of a Qantas plane. A large green button says "CLICK HERE".
- NATURE-FRIENDLY POWER.** with an image of a green plant growing from a wooden post. A button says "Click here for details".

Below the banners are four columns of content:

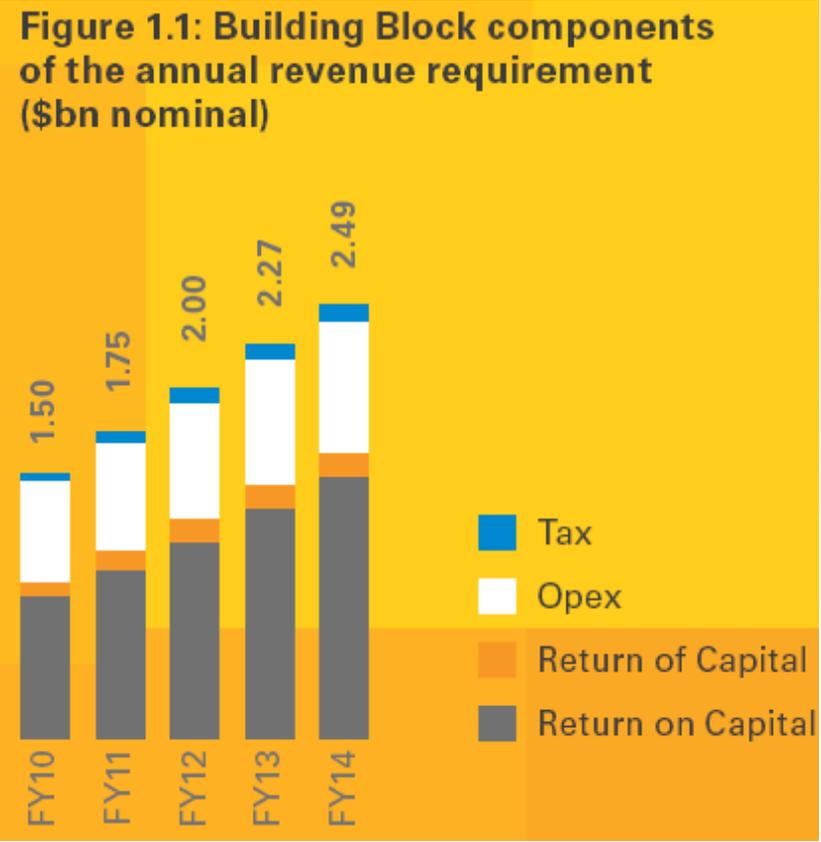
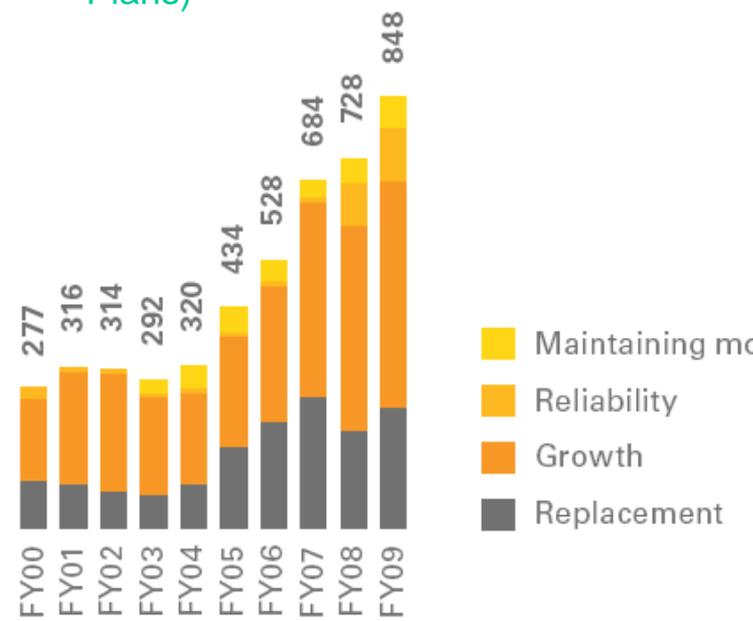
- ONLINE SHOP:** "Buy energy efficient products, delivered at less than the regular retail price." with an image of a compact fluorescent bulb. A button says "Start shopping now".
- ARE YOU MOVING?:** "If you're moving home, you can easily arrange to connect or disconnect your electricity online." with an image of a smiling couple. A button says "Find out more.".
- QUICK LINKS:** A list of links including "Newsroom", "Careers", "Annual report", "Choose a recipe", "EnergyKidz", "Safety Advice", "Dial before you dig", "Spare Fridge buy-back", "Home Energy Saver".
- OUR ENERGY NETWORK:** "We operate the electrical distribution network for Sydney, the Central Coast and Hunter region." with a button "Find out more.".

The footer contains copyright information: "© Copyright EnergyAustralia 2004", a note "You are in the NSW section of our website. Click here to change your state.", and links for "Privacy policy" and "Disclaimer".

# Load growth driving major network expenditure

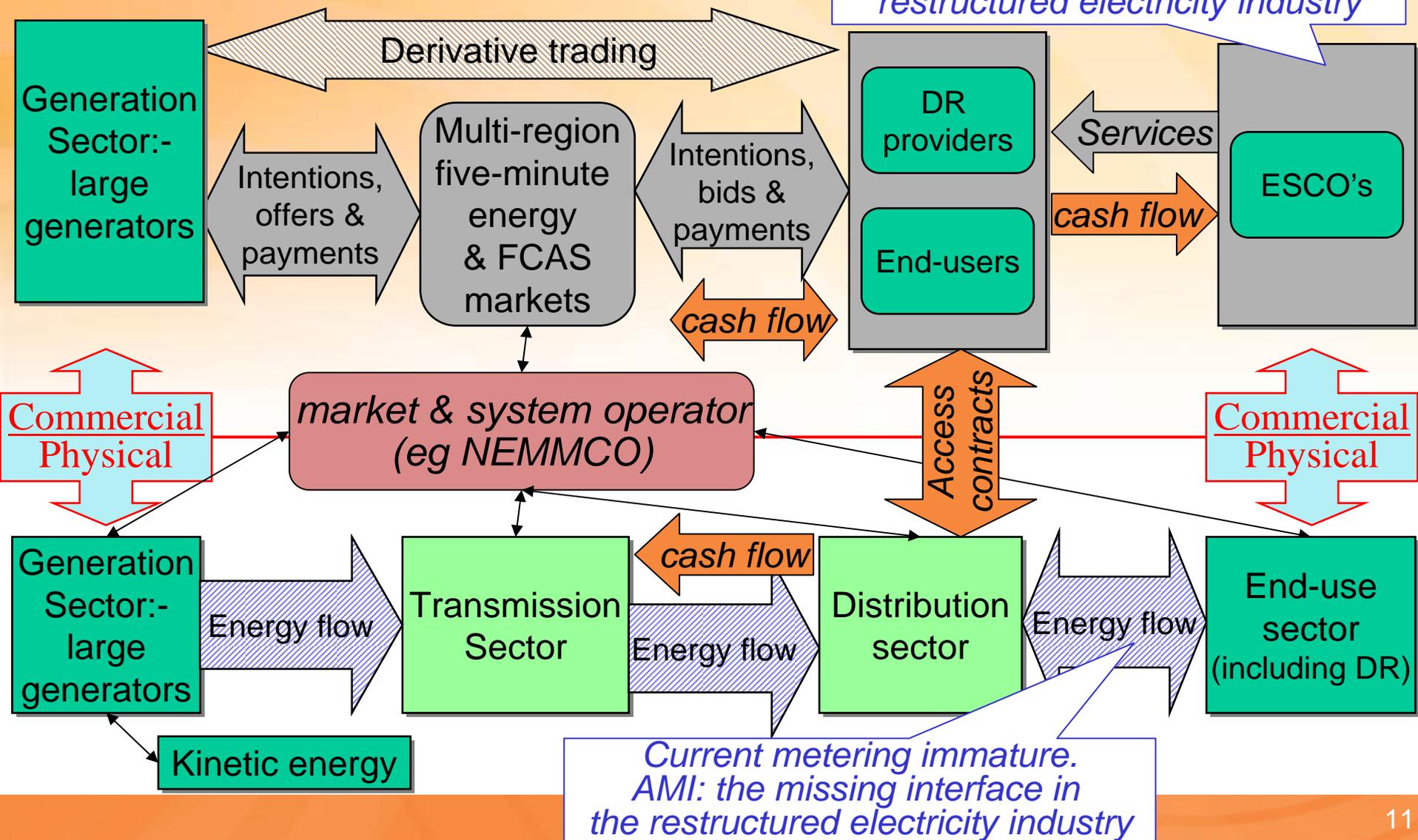
**Figure 5.5: Capital expenditure by driver (FY07 \$m real)**

(Energy Australia, 20010-14 Expenditure Plans)



# Enhanced NEM structure with active end-user participation

*Current retail markets dysfunctional  
ESCOs the missing players in the  
restructured electricity industry*



# Wider policy frameworks to address externalities

- Emissions trading to date largely a debacle
  - EU ETS has had very limited impact on emissions yet sending extraordinary cashflows to large emitters and other major energy market participants
    - Little support for DE beyond higher energy prices
- Renewables deployment
  - Some measures have achieved far greater success in reducing emissions, establishing new industries & beginning transformation of electricity industries
  - Challenge of finding policy approaches that maximise electricity industry value of these renewables while driving transformation
    - Mixed experience with some Green Certificate schemes
    - Feed-in tariffs demonstrated success but ‘hide’ energy market signals
- Distributed Energy
  - Diversity of technologies and opportunities will require comprehensive & coherent policies wrt information, regulation & incentives sufficient to overcome existing barriers



Centre for Energy and  
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Thank you... and *questions*

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