Impact of distributed generation
on utility business model

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Thank you

- Always a pleasure to be back at UNSW
- Annual pilgrimage to CEEM
- Thanks to Iain MacGill for the invite
- Look forward to future collaborations
Suppose people cut back on drinking milk …
- Perhaps due to rising prices/alternatives

… and everyone raises a goat or a cow …
- Perhaps due to backlash against centralized forming

… produce more milk than consumed …

… supermarket obliged to buy excess milk …
- Perhaps due to new legislation to support distributed milk

… and pay a credit for every excess gallon
- At price equal or better than retail price of milk
Under such a scenario

- What would happen to
  - Commercial dairy farmers & processing plants?
  - Dairy delivery network?
  - How would milk be priced in such an environment?
Consumers use less electricity …

- … because energy efficiency is a relative bargain …
- … many are putting PV panels on the roof …
- … produce more electricity than consumed …
- … utility is obliged to buy excess electricity …
- … pay a credit for excess kWhrs
- It gets worse
  - Price of self-generation keeps on falling; tariffs rise
  - New technologies allow storage/micro-grids, HEM, etc
What happens to …

- Generators with large thermal plants?
- Grid operator?
- Distribution company?”
  - Especially in markets such as Australia where dis-integrated
- To “utility” industry?
  - Which ever way we define it?
Not drinking more milk
US per capita electricity consumption 1990-2011, kWh/pp

Source: Smart Grid Watch, *How fast is U.S. electricity consumption growing?* April 6 2012
Not growth in any sector

Source: Americans are buying less electricity. That’s a big problem for utilities Brad Plumer, The Washington Post, 23 Dec 2013 based on data from EIA
Australia’s demand growth
Elect. consumption in Australia’s NEM, 2005-12, in TWhrs

Source: AEMO data; graph courtesy of greenmarkets.com.au
Negawatts cheaper than megawatts

*Includes current federal & state level incentives, natural gas price is assumed at $4.50/MMBTU
Goat on every roof

Residential Retrofit

New Production Homes

Commercial & Public

Power Plants
Decentralized
Next: solar tiles

Source: Mike Swanston, Energex
Credit for excess milk

Net metering spreading across the land

Net Metering
www.dsireusa.org / March 2013

State policy
Voluntary utility program(s) only
* State policy applies to certain utility types only (e.g., investor-owned utilities)

Source: DSIRE USA
Main message

- **Revenue erosion** **serious & imminent**
  - Today: QLD, Germany, HI, CA
  - Tomorrow: Virtually all high tariff OECD countries

- **Traditional business model** **unsustainable**
  - Fixed tariff applied to volumetric usage inappropriate

- **Regulation** **out of synch with reality**
  - System is broke & not clear how to fix it
  - Regulators in a no-win position
Fighting solar lobby *not* good strategy
Regulators were “invented” to protect consumers against abusive monopolies.

They find themselves “saving” monopolies.

Taxis vs. Uber

- Will same fate apply to solar PVs?
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Problem?

Source: The economics of grid defection: When & where distributed solar generation plus storage competes with traditional utility service, Rocky Mountain Institute et al, 2014
Australian PV uptake
Cumulative installed capacity of solar PVs in Australia, 2001-2012, in MW

Source: Clean Energy Council of Australia
PVs 4th largest source of capacity in QLD
Capacity in MW, April 2014

Source: Mike Swanston, Energex
Main drivers

- Grid parity
- Renewable/DG subsidies; FiT policies
- EE/Zero net energy/passive buildings/codes
- Storage technology & cost
- Home energy management
Solar PV prices keep falling
Price of solar PVs, 1977-2013, in $/W

Source: Bloomberg New Energy Finance

*Forecast
Falling costs, rising installations

Solar grid parity
Energy Potential from Unsubsidized $3/W
Commercial Solar (Capacity and % of Sales)

Source Commercial Rooftop Revolution, Institute for Local Self-Reliance (ILSR), Dec 2012
Key NEM battlegrounds
States where net energy metering (NEM) laws are challenged

FREEDOM TO GENERATE UNDER FIRE
States facing recent challenges to distributed generation

Sources: Renewable Energy World, Greentech Media, IREC, Vote Solar and many more
Zero Net Energy
Applies to *new* residential buildings in 2020; commercial 2030

- on-side electricity demand
- distributed renewable generation
- zero net energy
Big customer, no revenues
Apple’s new office building under construction in Cupertino, CA
NREL is ZNE

Source: NREL
More to come

Source: NREL
Tesla
Looks pretty, travels far, not as expensive as Lamborghini

Source: www.tesla.com
Home energy management

Source: Google.com
Why US utilities are in panic?
Edison El. Inst.: NEM “Largest near term threat to industry”

Add to your vocabulary: Disruptive Energy Resources (DER)
Vicious Cycle from Disruptive Forces

Source: Disruptive challenges: Financial implications and strategic response to a changing retail electric business, Edison Electric Institute, Jan 2013
Consumers become prosumers

Source: Evaluating the benefits and costs of NEM laws in California, prepared for Vote Solar, Jan 2013
Vanishing revenues
For ZNE/DG customers bills vanish, the costs don’t

Source: Net energy metering, RMI, Mar 2012
New value proposition

- What do prosumers want?
- How much are they willing to pay?
- Telecom analogy
  - Ubiquity/universal coverage
  - Bandwidth/speed
- Prosumer equivalent?
  - Capacity to upload/download to grid
  - Reliability/backup/balancing service
New regulatory paradigm?

- **First**: Re-align revenues & costs
  - Over 60% for US residential consumers
  - Currently little or no fixed monthly fees
- **Second**: Electrons flow in all directions
  - Collect a toll at the gate, regardless of flow
- **Third**: Back-up & reliability highly valuable
  - Stand-by fees based on value derived/cost imposed
- **Fourth**: Action on customer side of meter
  - Don’t stifle product & service innovation
Back to basics

Source: Energy Costs & Prices in Europe, EC, 2014, Brussels
Transactive tariffs
Who buys/sells what from/to whom & when?

Source: ISO
Future is transactive

Transactive Energy

A Sustainable Business and Regulatory Model for Electricity

Stephen Barrager, Ph.D.
Edward Cazalet, Ph.D.
Transactive Energy

♦ Check websites below
  ♦ http://www.slideshare.net/barrager/transactive-energy-keystone-of-sustainable-electricity-markets
Future volume?

- Utility 2.0
- Disruptive technology
- Future business models
- Distribution company of the future
- Interface between ISO/Dist. Company
- New regulatory models/paradigms
Thank you

- Happy to answer questions
Lower consumption, solar & non-solar
Residential consumption in QLD, solar (blue) and non-solar (green) customers

Source:
Where is the Mid-day peak?

Hourly Average of Renewable Resources: Sunday, March 16, 2014

System Peak Demand (one minute average): 27,286 MW

(from the California Independent System Operator)

Instantaneous Peak Solar: 4,143 megawatts at 14:28

Source: ISO
First:
- $60+/mo Min monthly connection fee regardless of usage

Second:
- 5 cents/kWh crossing customer meter in both directions

Third:
- A service charge based on maximum in/out capacity

Fourth:
- Technology neutral regulation
25% of load cut in half

Source: US Energy Information Administration, Annual Energy Outlook 2014 Early Release
Future US demand growth?
Flat or declining

Source: IEE white paper, May 2011
Price responsive demand
13 GW ramping in 3 Hrs

Distributed Energy Resources

- Two sided coin
  - Head: Consumers use fewer kWhrs
    - Negawatts cheaper than megawatts
  - Tail: Consumer becoming “prosumers”
    - Self-generation feasible & cost-effective
- Outcome?
  - Revenue erosion
  - Unsustainable business model
  - “Utilities” & “Regulators” caught off-guard
Traditional paradigm
4 key words

- Generation
- Flow
- Tariff
- Demand

Centralized
One way
Volumetric
Inflexible
Utility centric paradigm

Source: The integrated grid: Realizing the full value of central & distributed resources, EPRI, Feb 2014
# Emerging order

6 key characteristics

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<th>Old</th>
<th>New</th>
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Tomorrow’s grid

Source: The integrated grid: Realizing the full value of central & distributed resources, EPRI, Feb 2014
Challenged
SOS signal from an art gallery in Brussels

Source Utilities CEO’s of top European utilities at the unprecedented joint press conference, 11 Oct 2013: Powerhouses of innovation, Eurelectric, May 2013
Falling share prices

Source: Thomson Reuters Datastream

Source: Financial Times, 14 Feb 2014
Depressed wholesale prices

Source
World’s largest CSP

Source: California Energy Commission (CEC)
Sunny Queensland

Rooftop solar PVs 6th largest generation source in QLD
Global solar

Source: Graph appeared in numerous publications in Dec including Renew Economy on 9 Dec 2013