


Small is Sustainable: Diverse Energy Options for a Reliable Electricity Supply



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Seminar: Will the power crisis lead to more sustainable
energy solutions?

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The burning questions



- Will the May 20 security decision lead to large-scale power generation and transmission crowding out small-scale sustainable energy options?
- What Key Performance Indicators could be devised to ensure the Commission creates a level playing field for sustainable energy options?

Outline



- NZ's electricity market has led to power crises, as happened in several other countries
- Distributed energy resources are the most cost-effective as well as sustainable way to avert crisis
- New Zealand security decision specifically excludes DERs from crisis management
- Recommendations to restore balance

“Power crises” have happened in restructured electricity systems world-wide



- Auckland blackout: EECA campaign for consumers to help prevent total blackout
- Winter 2001, 2003: NZ campaigns to save 10%
- California Crisis, 2000, 2001 and a series of network failures stalled US restructuring
- UK, Power pool replaced by new electricity trading system
- Following California crisis, much research and debate - demand side management most cost-effective way to mitigate market power
- Three demand-side techniques reduce price volatility and make electricity supply more reliable. NZ adds a fourth.

Contrast- 2 approaches to a more reliable supply



- Supply side - investment needed simultaneously in fuel supply, new generators, augmented transmission and distribution
 - economies of scale no longer apply
 - persistent subsidies e.g. incentives for gas exploration
- Demand-side - investment to provide critical needs close to customer premises
 - standby generators, power conditioners, smart houses, smart appliances, solar water heaters, wood burners
 - like PCs, technology improving fast
 - largely unsubsidised

Demand side approach has four elements



- Efficient Reliability
 - Peak Load Response (both customer-driven and automatic)
 - Distributed generation of electricity
 - Alternative fuel substituting for electricity
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- Ref. New England Demand Initiative
 - <http://nedri.raabassociates.org/Articles/Report%20Final%20Draft.doc>

“Efficient Reliability”

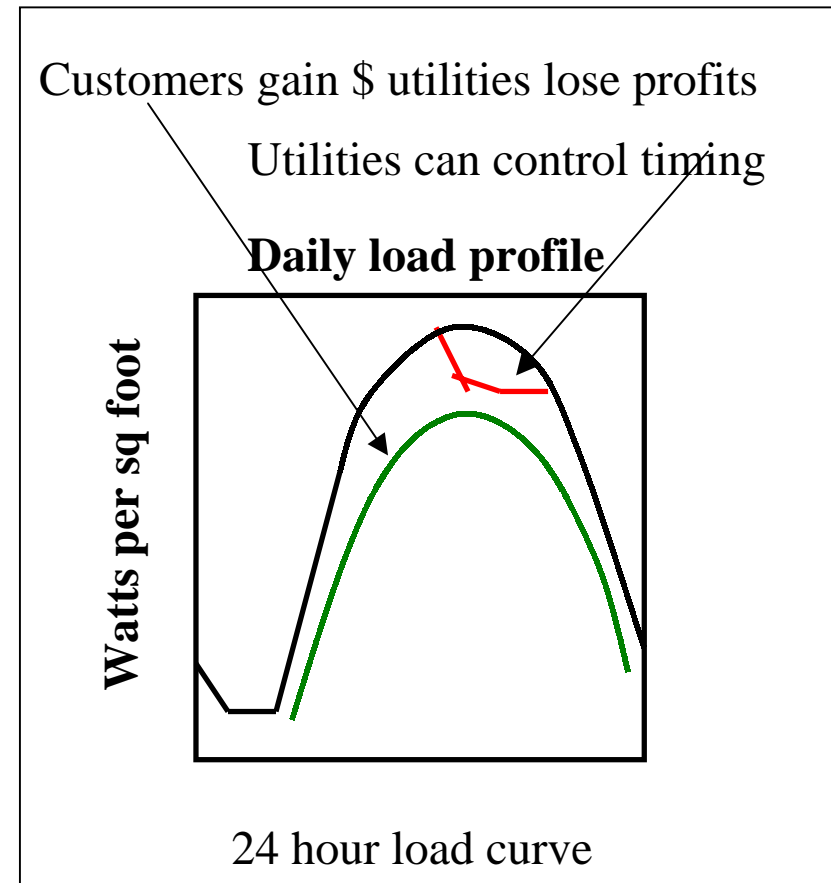


- Concept arose from analysis of California Crisis
- Targeted energy efficiency is the most cost-effective way to avert power crises -
- saving energy in peak times cheaper than expanding generating and network capacity and fuel supply
- targeted energy efficiency serves multiple objectives - augments capacity, improves quality of end use services, reduces power bills, reduces env'l impacts
- Ref: www.naruc.org/5.7g.pdf

Targeted energy efficiency gives peak as well as energy savings

Examples

- insulation, draught stopping for winter peaks, where networks are constrained
- efficient lighting and HVAC for summer peaks, where networks are constrained
- Retailers and generators both lose profits from reduced sales
- Retailers prefer peak load response especially where they control its deployment



U.S. estimates of energy efficiency potential

- In U.S., energy efficiency programmes throughout U.S. saved 29,000 MW capacity from 1980-1995 at cost of 2-3c(US)/kWh (out of around 700,000 MW)
- Programmes cut in half after restructuring began in 1996
- EPRI: low cost energy efficiency could reduce demand by 15%
- ACEEE: energy efficiency could displace half demand growth over next 15 yr
- 51 Energy Service Companies (ESCOs) completed \$2.5 billion projects 1990-2000
- Project revenues were growing 24%/yr; growth reduced to 9%/yr after 1996

“Peak load response” -customer response to spot prices



- Encouraging consumers to switch off in response to high spot prices
- Requires real-time knowledge of spot prices
- Requires tariff that rewards this response
- Is most cost-effective way to mitigate the market power of generators that caused the high spot prices.

“Peak load response”, automated

- Examples, ripple control to shift hot water demand out of peak times; night storage
- Requires mechanism to store heat (or cold)
- Very large HWCylinders recharged night rates
- Ice bank storage for air conditioning etc. being developed
- Also, frequency-sensitive appliances switch off a few minutes = “spinning reserve”

Distributed generation




- Generators embedded in lines company networks or on customer premises
- Add diversity - wind and hydro back each other up; wood burning can provide dry year energy
- Mass production is reducing costs continually
- May add security to customer premises
- Can provide network service e.g. reactive power
- Augments primary energy supply
- Ref: www.electricpowergroup.com/pres/ICEPAG_Presentation_4-5-00.pdf

Alternative fuel substituting for electricity



- Christchurch 1991, 1992: Southpower paid large consumers to use LPG and diesel
- Potential for domestic consumers to use extra coppice eucalypt in wood burners in dry years
- Wood could supplement coal at Huntly
- Dry-yr solutions cheaper if they use existing equipment (installed for other objectives such as security or lifestyle)
- Solar water heat

Definition: DERs = "Distributed Energy Resources"



- DERs are any energy resources or energy management systems embedded in local networks or on customer premises
- Appropriate DERs are different for each region, each network location, each customer
- Appropriate DERs are considerably cheaper than new electricity supply
- DERs are invisible to power system planners

DERs are suppressed in the NZ electricity market



- Wholesale prices driven down to SRMC (2-6c/kWh in normal years), DERs can't compete
- Development of wholesale electricity market rules dominated by generators
- Generators and Transpower consider consumers as price takers; assume (want) them to be passive.
- No link between wholesale and retail markets

DERs fare poorly (continued)



- Energy efficiency programs once run by retailers ceased or reduced to token status. Because profits increase with increased sales
- EECA and Meridian have joint project for peak load response - but for large users only
- Lines companies and Transpower suppress interconnection of wind power and cogeneration
- Most overseas countries recognise market barriers to DERs and therefore subsidise them

Government's re-think on electricity market



- Government's Security Decision (May 20) aims -
- to reduce volatility and excessive spot prices that harm large industrial users exposed to spot prices
 - would cure the symptom not the problems - shortage of primary energy, unregulated retailers
- to assure investment in dry year firming stations
 - Could cure dry yr problem but at higher cost than DERs
- to assure investment in transmission
- **Investment in large scale supply will crowd out small-scale competitors**

Security decision sets up a return to hands-on management



- Electricity Commission has far greater powers than a Crown Electricity Governance Board
- Commission will intervene in “reserve market”, contracting for reserve generating capacity and fuel stores
- Reserve capacity expected to be called on only in “very dry years” (indicatively drier than 1 in 20), but also for emergency conditions leading to very high spot prices

Security decision excludes DERs from reserve market



- “Will demand management be counted as reserve capacity? No.” (Ref: May 20 Q&A)
- Unfortunate because reserve market is most lucrative, operates when spot prices are highest
- Demand response to dry year spot price fluctuations “will be factored into the Commission's modelling of supply and demand trends” (MED's approach in Energy Outlook) - treated as passive not active player in market

Subsequent decisions show interventions favour large players




- Demand-side response to be subsidised, \$2.9m, but only for large industrial users
- Energy audits for major electricity users to be subsidised, \$1.6 million
- Feasibility study, not action, to see if financial assistance for general energy efficiency is warranted - only \$65k

Interventions favour large players (continued)



- Major electricity users welcomed the return to “sustainable low [wholesale] electricity prices”
- Subsequent announcement of Genesis 8-yr contract for NZ coal to be used in normal, not dry, years confirms aim is low wholesale price at expense of Kyoto obligation
- Continued subsidies for gas exploration = favourable royalties and government research

How the Decision treats renewable energy



- Government expects renewables to be “competitive”, 1900 MW available at <7c/kWh
- Ref: www.med.govt.nz/ers/electric/supply-demand/supply-demand.pdf
- This includes 525 MW Project Aqua, costed now at 4 - 4.5c/kWh excl. transmission and firming
- Return to coal generation in normal yrs will set normal spot prices back to 5-6c/kWh
- New gas would flood market with CCGT, 6c/kWh
- Wind and solar heat cannot compete with these prices and quantities, will be crowded out

How to put DERs on equal footing with large projects?



- Explicit barriers e.g. exclusion from reserve market must be removed or offset
- Government objectives require subsidy; DERs should get no less subsidy than large-scale
- Electricity Commission's dual roles - intervenor and regulator, must be fully separated
- Market rule development must be carried out with full stakeholder consultation - including DER practitioners, small consumers, env'ists

Market surveillance to identify and negate abuse of market power



- Costs of each generating station are well known
- “Fair” wholesale market bids can be identified
- “Scarcity profits” should not be kept by generators, but dedicated to overcoming the scarcity
- Investment to overcome scarcity will be in hands of Electricity Commission
- Demand-side should have at least equal call on “scarcity profits” as supply-side

Is power planning a better alternative than competitive market?



- DERs work equally in planned or market systems
- Integrated resource planning in a planned system can be replaced by integrated resource trading in a market system
- Original aim of competitive electricity market was a level playing field for all suppliers large and small
- Market Rules were progressively biased in favour of big market players
- May 20 decision removes benefits of competitive market but retains its costs

Is power planning a better alternative than competitive market (cont'd)?



- In the past NZ planners could not cope with “many tiny increments” of energy supply or efficiency
- But many DERs could compete in a fair market on cost alone; even more of them if environmental costs counted
- Market design debate exposed bitter differences between market players
- In a planned system this debate does not go away but goes behind closed doors