

Contents

1 4th National DG Workshop

2 Decentralising Networks

Walt Patterson

6 Short Articles

Housepower

Price Trends since 1974

The Power of Collaboration: What's going on at EPRI

DG Market Size in the States

Small is Big

First RPZ Announced

NZ Reference Group

DG and Demand Side Reductions

9 Contact E21

10 News Items

Net Metering Initiative

California DG Initiatives

Battery Storage Record

FERC Standard Rule for Small Generator Interconnection

MED Consultation on NPS

California Clean Energy Fund to Create Energy Efficiency Center

Venture Capitalists Show Increasing Interest in Demand Response Technologies

Flywheel Storage for Frequency Regulation & Grid Stability

12 On the Web

DTI

Ofgem

German Renewable EnergySources Act

12 Events Calander

International Symposium on Distributed Energy Resources

CHP/DE in US and World Energy Markets

Wide Area Monitoring and Control

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4th National DG Workshop

Following on the success of three previous annual workshops, the 4th National DG Workshop held on 16 June at the SkyCity Convention Centre, Auckland, was another resounding success greatly contributing to the understanding of the subject needs.

As with the previous workshops the audience were rewarded with high profile international speakers to set the tone for the day's proceedings. On this occasion Jeff Bell from the Edinburgh-based World Alliance for Decentralised Energy (WADE) organisation spoke of the renewable energy and combined heat and power opportunities.

WADE has recently undertaken a number of Country Analysis investigations using its proprietary software, which has shown the lower overall economic cost of decentralised energy forms compared with normal Transmission and Distribution reinforcement combined with increased Centralised Generation. Although the capital, operation and maintenance and fuel costs are not significantly different between centralised and decentralised plant, the savings were significant smaller for transmission and distribution with decentralised plant.

The second international speaker, Dr Dragana Popovic from the UK Energy Networks Association, emphasised the absolute need for intelligent network architecture to allow Distributed Generation to make its presence felt. Without intelligent network architecture the present network design is severely handicapped in its ability to assimilate DG. The UK government's commitment to renewable energy targets is a big driver for bringing DG into mainstream, particularly with the bold plans for major off-shore wind farming to meet the UK's Kyoto targets for electricity generation from renewables of 20% by 2020.

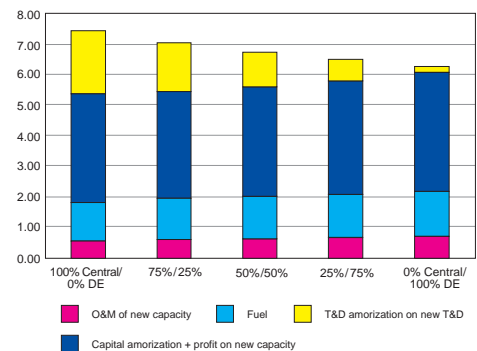


Figure 1: Variation in electricity cost (c/kWh) against percentage of DG penetration (0-100%)

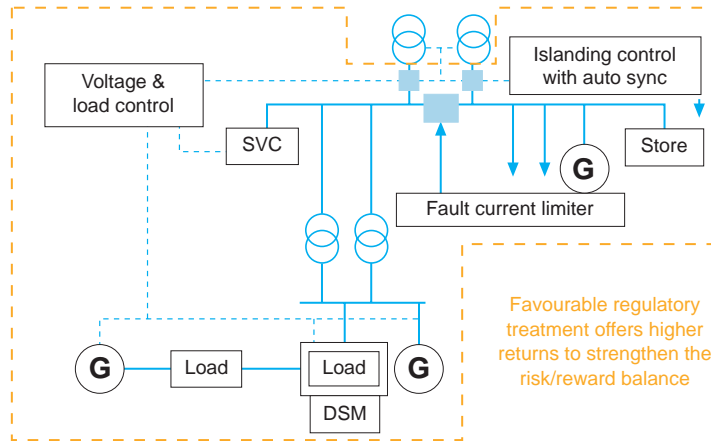
Other speakers were Ray Pannam from ENERGEX, Queensland; Gareth Wilson, Ministry for Economic Development; Greg Skelton, Alpine Energy; Chris Sadler, Vector Networks; Ken Mitchell, Network Waitaki; and, George Paterson from Power Hire.

The power point presentations of all speakers are available for download in pdf format from www.caenz.com/DistGen/DistGen.html

CAE will be in continuing its research of DG opportunities and producing DG Guidelines for different applications.

Post workshop education and networking will continue through CAE's *Energy21* bulletins and stakeholder development of the regional analysis for DG opportunities to provide a comprehensive catalogue of regional energy resources throughout New Zealand.

Advantages of a 'Power Zone'?



- ✓ Special regulatory treatment
- ✓ Nursery for innovation, suited to demonstrator projects
- ✓ Enhanced Quality of Supply
- ✓ Benefits of 'badging' as a form of endorsement
- ✓ May attract external grant funding
- ✓ May foster Regional Development joint projects
- ✓ Signals a generation friendly network to developers
- ✓ 'Club rules' protect customers and ensure information sharing

Figure 2: Diagram of possible embedded network technologies to deal with DG on a network together with advantages of designating the network as a Registered Power Zone for RD&D purposes

Decentralising Networks

Walt Patterson, Royal Institute of International Affairs in London

The very existence of old, one-way, radial electricity networks is an obstacle to the development of more efficient, distributed generation. Existing networks need to be reconfigured quite radically in order to unlock the many benefits of decentralised energy - an alternative place to start is in countries without a 'legacy' electricity network. In both cases, it is up to governments and regulators to encourage the growth of distributed generation.

What is so special about decentralised energy? Nature isn't centralised. Natural energy is everywhere, in sunlight, wind, water, plants and animals. It runs the planet. We take all that decentralised energy pretty much for granted. What we notice is the centralised energy we ourselves distribute. We extract coal, oil and natural gas from concentrated central sources - coal seams, oilfields and gasfields. We then move it from place to place - distribute it - in mobile transport such as ships, trains and trucks, and in infrastructure networks such as pipelines. We use energy from fuel where and when we wish, converting it into more useful forms such as heat, light, sound, and kinetic energy of movement. We likewise gather, convert and distribute some natural energy flows, notably those of water, wind

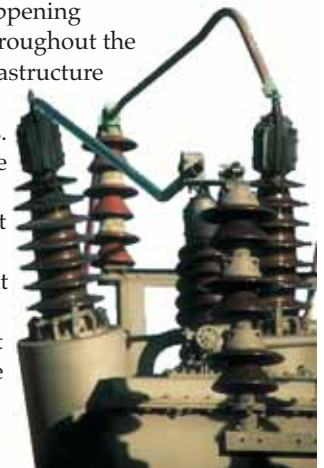
and sunlight. To distribute both fuel and natural energy flows we also convert them into one particularly versatile form of energy: electricity.

We can generate electricity anywhere, over a vast range of scales, from watch batteries to turbo-alternators, in almost any quantity from imperceptible to overwhelming

Like natural gas, electricity requires an infrastructure network. Unlike natural gas, however, electricity is not a physical substance, not a fuel nor a commodity. Electricity is different. It is a process, happening simultaneously throughout the whole system infrastructure

- generators, network and loads.

Indeed without the infrastructure electricity does not even exist. We don't actually want electricity itself. But we can convert it in turn into all the forms of useful energy, easily, cleanly and



conveniently. Furthermore, we can generate electricity anywhere, over a vast range of scales, from watch batteries to turbo-alternators, in almost any quantity from imperceptible to overwhelming; and we do.

Centralised Generation, Distributed Loads

We pay, however, particular attention to one form of electricity, in which large central stations generate synchronised alternating current and send it out to users over a network that includes long, high-voltage transmission lines. Since the 1880s, electricity systems based on this common technical model have spread all over the world, bringing electric light, motive power and other benefits on which modern society now depends. Large-scale centralised generation of electricity has become so important, and so dominates our thinking, that we have long tended to discount the many alternative forms of electricity generation that are smaller in scale and less centralised.

In recent years, however, these forms of generation have become harder to overlook. Based, for instance, on wind turbines, micro hydro, diesel engines, gas engines, Stirling engines, microturbines, fuel cells and solar photovoltaics, they tend to come in unit sizes much smaller than central station generators, usually less than 5 MW. Since individual units or clusters of units may be widely dispersed across an electricity system, rather than being centralised, these technologies have come to be called 'distributed generation', a key form of decentralised energy.

Although traditional electricity generation is centralised, the loads that use the electricity, such as lamps, motors, heaters, chillers and electronics, have always been widely distributed and dispersed. Except for the very largest loads, such

as pot lines in aluminium smelters, loads are much smaller than central station generators, usually by many orders of magnitude. This mismatch in scale between generation and loads requires the network to divide up the large output of a generator into flows

appropriate to the loads – that is, to distribute the electricity.

Alternatively, of course, generation itself could be distributed, closer to loads in both location and scale.

Although traditional generation is centralised, the loads using the electricity have always been

widely dispersed.

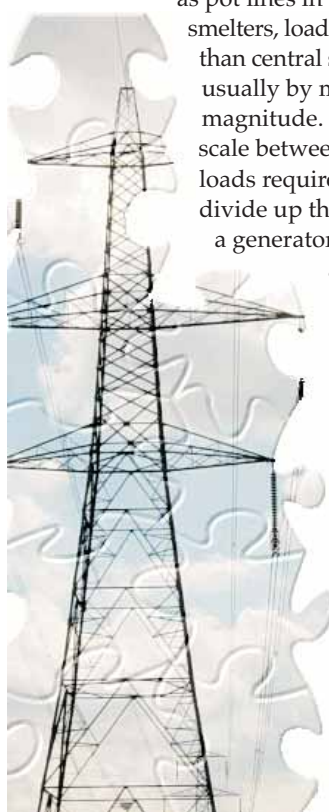
The reason why it is not is historical, and overdue for reassessment. In the early decades of electricity, generating technologies were based on water power and steam power. The economies of unit scale of steam engines and turbines, water turbines and alternators meant that a bigger generator produced cheaper electricity. That was the premise on which Edison and his competitors set up the first central station systems. The savings on investment in larger generators more than made up for the extra investment in the necessary network. In the subsequent century this premise continued to prevail, up to generators of gigantic size and networks to match, entailing likewise gigantic investments. The investments were possible because the monopoly franchise made captive customers carry the risks which, by the 1980s, sometimes proved equally gigantic. Nevertheless the arrangement made electric light and other electric services available and affordable over much of the world.

It was so successful that, by the end of the 1980s, free-market enthusiasts decided that electricity, too, was a commodity that should be bought and sold in a marketplace. In a rapidly expanding list of countries they abolished the monopoly franchise, broke up traditional integrated systems, separated generation from networks and made generators compete to sell their output to users. One of the many unexpected consequences of this 'electricity liberalisation' was to make distributed generation look distinctly more promising. Introducing competition made investment in traditional large-scale generation much riskier; and abolishing the monopoly franchise transferred the risk of investment from captive electricity users to skittish shareholders and bankers.

At the same time, technical innovation widened the range of generating options. Cheap and abundant natural gas made gas turbine generation the new favourite, breaking at last with the long presumption that a better power station was always a bigger one farther away. Gas turbine generation could be at once cheaper, cleaner, more efficient and closer to users. Other, yet smaller generating technologies, some likewise fuelled by natural gas and others based on renewable energy, also began to attract attention. Compared with traditional generation, they were easier to site, quicker to build and commission, and much cleaner. But they still faced problems.

One-Way Radial Networks

Some arose from existing networks. Traditional electricity regards the network as a 'natural monopoly'. Natural or not, it has long been a political monopoly almost everywhere. Its essential configuration is radial, from the centre outward. One-way flows carry electricity from large-scale remote central generation along high-voltage transmission and lower-voltage distribution lines to dispersed users. This radial, one-way configuration is less appropriate, however, for distributed generation, which is



smaller and closer to users, often most usefully connected at lower voltages. Distributed generation has more in common in scale and in attributes with loads than it has with centralised generation - connecting a 500 kW microturbine has much the same effect on the system as disconnecting a 500 kW motor. But generation connected at low voltage may cause current to flow in the opposite direction through the neighbouring circuits, confusing protective devices and potentially endangering maintenance staff.

On the other hand, such local generation may provide voltage support and reduce the need to reinforce the network itself. Such trade-offs are now under intensive consideration by electrical engineers and system planners. The ideal arrangement would be technical protocols such as those for loads. A local generator complying with the protocol could then be connected just as loads already are, effectively by plugging it in and turning it on. But such convenient arrangements are still mostly under negotiation in Europe, North America and elsewhere. One point of dispute is the usual one: who is to pay for the requisite reconfiguration of networks?

Before liberalisation, network investment and running cost tended to be aggregated with those of generation, and paid for by the aggregate revenue from users, as mediated by government or regulator. After liberalisation, governments and regulators expected the network to function also as a market place, linking sellers and buyers of electricity. In other respects, however, it was expected to operate as before, and with the same configuration. In the new market framework, the regulator would impose charges for using the network to carry electricity between buyers and sellers. In effect, despite liberalisation, the network would continue to be a regulated monopoly.

In practice, despite the rhetoric of free market enthusiasts, close to half the price of a unit of electricity was thus determined not by a market but by fiat. It still is.

Some policy people nevertheless cite the purported cost of a unit of electricity from different generating technologies, often stated in fractions of a cent per unit, to claim, for instance, that large-scale, remote, fossil-fired generation is 'cheaper' than smaller-scale renewable or cogeneration closer to loads. With no qualification as to the accounting or financial framework, tax treatment, subsidies, risks, system and network effects or other essentials, such cost comparisons are meaningless. They should have no influence whatever on policy. Policy determines costs – not the other way round.



Electricity is not a Commodity

This further underlines a crucial point about electricity. You can generate electricity without fuel, but not without infrastructure. Electricity depends absolutely on an infrastructure of physical assets. However, by treating electricity as a commodity, the 'electricity market' makes the price of an ephemeral unit of electricity the determinant of all the financial relationships involved, including – crucially – investment.

The revenue paid to a generator depends on the number of units sold and the price per unit. That in turn depends on whether the generator can connect to the system – be 'dispatched' by the network operator. For distributed generation of many kinds this is a serious constraint. A wind turbine generates when the wind is

blowing, not when a dispatcher invites it to. A cogenerator responds to requirement for heat, not for electricity. Distributed generators are penalised for not being dispatched. But no fundamental law of electricity says that distributed loads should always be independent, while distributed generators, often of much the same size, have to respond accordingly. The problem of network stability arises not because a wind turbine or cogenerator fails to deliver a few megawatts; what triggers instability and causes blackouts is much more likely to be the abrupt loss of a traditional 500 MW unit, or of the network circuit carrying its output. Replacing centralised with diverse and dispersed distributed generation on a system enhances rather than undermines its stability. Far from being penalised, distributed generators ought to be paid extra for the stability insurance they provide.

For these and other reasons, including environmental issues, planners and policymakers in both OECD and non-OECD countries are at last paying much closer attention to the potential for decentralised energy technologies such as distributed generation. In particular, they have begun to re-examine the interactions between distributed generation and electricity networks.

Their efforts to date are undoubtedly helping to foster the expansion of distributed generation; but they have yet to overcome a key problem. Existing networks, their configuration and mode of operation, came into being as a necessary complement to central station generation. If we were starting now to establish an electricity system based, not on central generation but on distributed generation, it would require a very different network – different in configuration, function and operation.

Legacy Networks and Avoiding Constraints

Consider two situations – one with and one without an existing traditional network.

Remember that traditional electricity, for all its historical success, has failed to reach two billion people – one third of humanity. It may even be losing ground, as population outstrips expansion of traditional systems. Much of the world is indeed still waiting to establish electricity systems. The contrast between the two situations is straightforward.

An existing network represents what has come to be called 'legacy' technology, already in place and operating. Any change will be constrained by the need to keep the system operating through the change, to keep the lights on. It also implies legacy institutions and a legacy mindset, committed to a certain way of thinking, acting and interacting – assuming, for instance, the primacy of centralised electricity. Where no network now exists, these constraints are absent. These parts of the world, however, usually have either limited competence or a tendency to aspire to the traditional central-station model, even when a decentralised alternative might be more effective. Moreover, because electricity infrastructure represents major investment and employment, it also brings with it significant political power, a potent centralising factor.

In both situations, therefore, realising the potential of decentralised energy will require positive policy measures to overcome these obstacles. Consider, first, an OECD country with a highly developed existing network. Why might it benefit from more decentralised energy, and what measures would foster this? In recent years one issue above all has come to dominate electricity thinking in OECD countries – that of reliability. Spectacular blackouts in wealthy neighbourhoods grab attention. People demand that something be done, and that governments do it. But people and governments alike have yet to realise that a traditional, synchronised AC electricity system is, in effect, a single giant machine, extending perhaps for thousands of kilometres. It is operating in real time; and like any other machine it can also shut down in real time.

The possibility is inherent in the configuration and operation of a centralised system; and no amount of hand-wringing can change this. The obvious remedy is therefore to loosen the centralisation, to reduce the interaction between widespread parts of the system; and distributed generation is the key.

Governments and Regulators

Those with sensitive loads are already making the initial moves, to gain control of their own electricity and to keep their own lights on. But governments and regulators can accelerate the process. Governments can recognise that electricity is an infrastructure issue. Their most appropriate tax leverage is tax treatment of system

assets - not only generation and networks but also, and most importantly, loads. Favourable tax treatment for integrated, optimised local systems, possibly including cogeneration, would give a powerful boost to the requisite reconfiguration.

Government procurement for its own buildings and other facilities can set an example. That would also prime the pump for energy service companies able to deliver the complete package – installing, operating and maintaining local systems on the basis of contracts for services.

Regulators can recognise that the radial, one-way configuration of networks must evolve, into a meshed, two-way network, with the requisite technical protocols. Private wires, as adjuncts of local generation, can show the way. Regulators can acknowledge, belatedly, that infrastructure is paramount – that treating electricity purely as a commodity cannot deliver investment, reliability or stable business relationships.

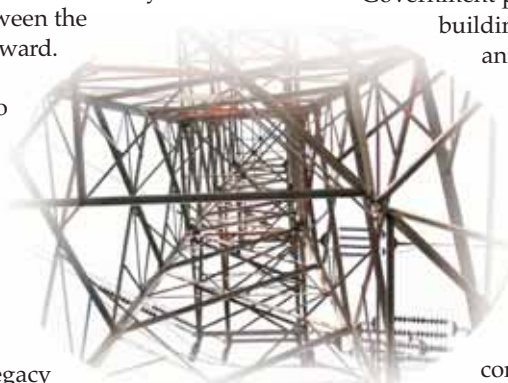
Regulators also need to rethink the nature of transactions. They can incorporate and endorse appropriate payments for generation assets – for availability, for access and for use – just as they already do for networks. That would greatly enhance the attraction of small-scale generation, both renewables and cogeneration. Increasing the proportion of electricity so provided will also, of course, produce a corresponding reduction in carbon emissions, not by coercion or trade-off but as a welcome corollary of other benefits.

Successful implementation of measures such as those in OECD countries would greatly improve the likelihood that they would also be adopted elsewhere. Given the comparative freedom from legacy constraints, localities around the world still eager for electricity services will find that decentralised systems can be established even more rapidly and effectively, using small-scale technologies and local resources, under local control and locally financed, perhaps by micro-credit. Many examples already exist. Appropriate commitment by international agencies and technology suppliers can dramatically expand these activities. Those with outdated systems and those with no systems at all now have the opportunity for genuinely fruitful and mutually beneficial collaboration.

Who knows? Over time, decentralised energy might even become the norm, in human society as it is in nature.



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Short Articles

Housepower

Molly Melhuish

“Housepower” is a concept of providing energy services to householders, aimed to reduce power bills, provide more comfort, and create better resilience, both physical and financial. The concept stems from New Zealanders’ dissatisfaction with household energy supply:

- electricity retailers are able to hike power prices without notice, or change your tariff type or even switch you to another retailer
- Tariffs do not reward investments in night storage heaters and large day-night HWCs
- Threats of hot water cuts or rolling blackouts
- Threats of disconnection for non-payment, often without consultation on whether or why
- Arms-length communication through call centres, often unsatisfactory, on billing and faults.

A parallel service for non-residential energy supply would be provided by “Energy Brokers”. However, unlike Housepower, Energy Brokers would provide a basically competitive service. The Housepower service would sell electricity plus other energy services. Its objective would be “to provide more service for less cost for longer”. (This is the short definition of “sustainability” in the Parliamentary Commissioner for the Environment’s report “Electricity, Energy and the Environment”).

Housepower would be an alternative to the customer’s present retailer. The services offered would be tailored to individual households taking account of their actual needs, their financial resources and the actual cost of supply at their location (often network costs are actually greater than wholesale electricity costs). Therefore a core service of Housepower would be individual energy audits.

For Housepower to succeed, the provider must have access to the wholesale electricity market, risk management services, and the network service providers. The provider would aggregate the benefits that energy efficiency, load shifting and alternative fuels provide throughout the supply chain. This will require significant changes to the Electricity Market Rulebook, and a means of meeting the essential prudential requirements of an electricity market trader. Also, any levy



charged by the new Electricity Commission to support reserve capacity (for very dry years, or other extreme energy or network failures) should be waived by those Housepower customers who choose to take on those risks themselves.

Such risks become acceptable with use of equipment supplied through Housepower which allows customers to switch electricity off at times of very high spot prices, without losing essential services. The Housepower concept recognises that electricity supply to small consumers is not a competitive business. Therefore the means to govern the new service providers should not be along standard profit-seeking lines, but rather should be along least-cost service principles.

Arguably the best form of administration of this would be a trust, with governance by a Board elected by the consumers who contract for the services. The policy underpinning for this concept comes from the Parliamentary Commissioner for the Environment’s report, “Electricity, Energy and the Environment”, download from www.pce.govt.nz/reports/allreports/1_877274_10_0.shtml

Theoretical underpinning comes from a discussion paper by Hugh Outhred, “A services model of the electricity industry with particular attention to network services”, Nov 2002, download from <http://www.ergo.ee.unsw.edu.au/>. Outhred describes options adapted to both fully competitive and franchised electricity supply systems; the latter of course is not available in New Zealand.

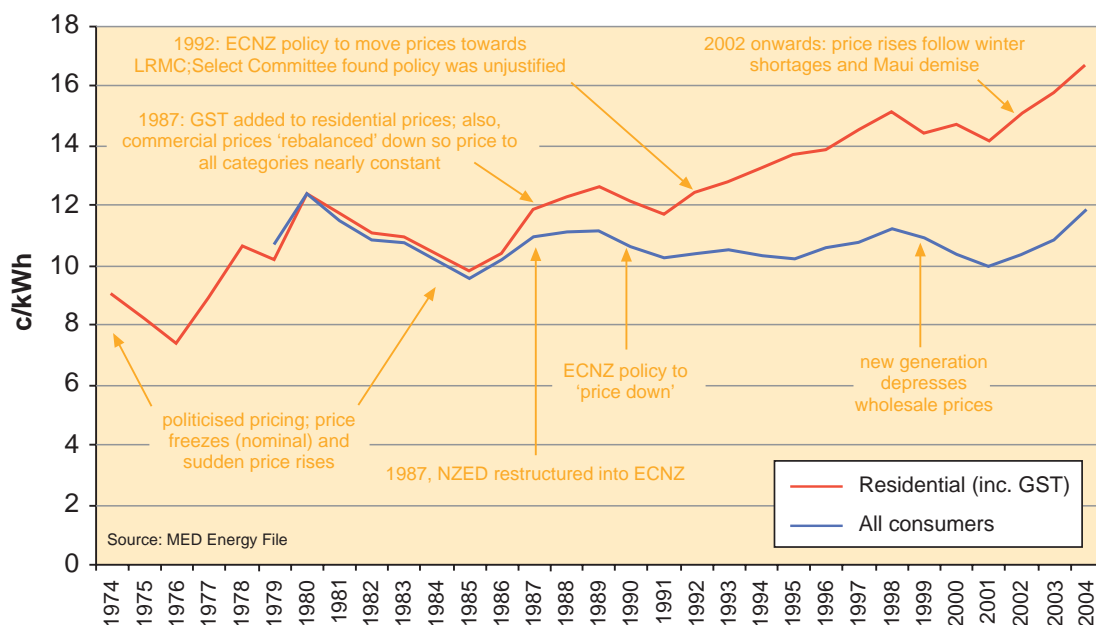
Price Trends since 1974

The graph on page 7 shows trends in residential prices, and aggregated prices from all consumers, from 1974 to 2004. Price increases from 2002 are attributed to the market power of the five big generator-retailers in both the wholesale and retail sectors.

This is hard to prove as New Zealand has no useable test to determine whether market power exists (Minutes, Hedge Market Development Steering Group, 24 March 2005, item 6).

Exactly the same question was the subject of an Inquiry into Wholesale and Retail Electricity Prices by the Commerce and Marketing Select Committee, which reported back in 1992. ECNZ (then known as Electricorp) told the Committee that its earlier policy was to “price down”, but it proposed to replace that by a policy to charge prices rising progressively to the cost of power from a new power station. The Committee concluded that the proposed price rise was unjustified. ECNZ did so nonetheless, as the graph shows. The arguments recently put by Contact and others exactly match the various arguments of 1991-92.





Market power has indeed been abused, and the most effective way to challenge it is to overcome the many barriers to demand-side participation and small-scale energy supply. Otherwise the electricity industry's dominance in energy supply to small consumers will ensure that price hikes will continue.

Worse, the supply-side focus of barriers to more sustainable energy options is likely to compromise the viability of the New Zealand economy as a whole. The return to Think Big power stations and transmission lines will lock in the present inefficiencies of generation, transmission and distribution, and require huge imports of coal and/ or gas to feed the habit. As environmental constraints bite, costs will go out of control.

Repeated submissions to the Electricity Commission have not led to any acknowledgement that retail markets are important. This is not surprising as the Electricity Commission is funded by and largely accountable to its Wholesale Market Participants, and reports to the Minister of Energy not Parliament as a whole.

In contrast, the Commerce Commission is nominally independent, and ought to take a broader view. It needs to ask not only whether the wholesale electricity sector is internally competitive, but whether the generator-retailers are sufficiently open to real competition from energy efficiency, small-scale energy supply and price-responsive demand.

The Power of Collaboration: What's going on at EPRI

Theodore U Marston, Senior Vice President and Chief Technology Officer with EPRI

During the heyday of electric power industry restructuring, in the late 1990s, serious questions were raised about the suitability of collaborative research in a more competitive business environment. As the industry's research arm,

EPRI responded to changing circumstances by introducing new programmes aimed at meeting our members' specific needs, but we never lost sight of our primary goal: to provide a nexus for collaboration in addressing the most pressing issues of the times. Now, the emergence of new challenges facing the industry as a whole is once again proving the value of making a collaborative response-while also stimulating some of the most exciting research in EPRI's 30-year history.

Three of today's most important challenges particularly demand a broadly based, industry-wide R&D effort. First, the strong potential for climate change regulation has become well enough established that prudent steps should be taken to provide electric utilities with generation options that reduce carbon dioxide (CO₂) emission. Second, the power reliability demands of an increasingly digital economy require development of a "smart grid" that is more easily automated and self-healing. Finally, the security of the electricity infrastructure must be assured in a time of increasing vulnerability, both to physical attack and cyber intrusion.

Among the generation options that could provide new approaches to reduce emissions, clean-coal technologies present the most urgent need for near-term deployment. As rising natural gas prices and concerns about energy independence combine to renew interest in coal-based power plants, EPRI is reaching out to a broad range of stakeholders with a new collaborative initiative that will help make coal technology more responsive to environmental constraints, including reduction of carbon emissions. Known as CoalFleet for Tomorrow, this initiative brings together domestic and international utilities, equipment suppliers, coal companies, regulators and government agencies to accelerate commercial deployment of advanced coal plants. The immediate focus of CoalFleet is to develop new plant design guidelines for integrated gasification combined-cycle (IGCC) plants and to expedite

regulatory approval for their construction and operation. In addition to high efficiency and low emissions of conventional pollutants, IGCC has the potential to remove CO₂ from the combustion process into a separate stream for sequestration.

To prepare for a more climate-sensitive future, EPRI has also launched a carbon management portfolio designed to inform technical and business decision-making, support effective policymaking and accelerate technology innovation. This portfolio will complement existing programmes related to development of generation options with low or no carbon emissions by emphasising related areas, such as carbon sequestration research and more efficient use of energy resources—for example, through introduction of plug-in electric-hybrid vehicles. Another key component of the portfolio is to determine the policy implications of various carbon management strategies. One of the most important results of this area of research is an analysis demonstrating that more flexible policies on where, when and how to reduce greenhouse gas emissions could save billions of dollars, compared with more rigid, poorly designed policies.

Meeting the challenge of power reliability is the task of EPRI's IntelliGrid Consortium, which brings together diverse industry stakeholders to find ways of integrating and managing combined utility information technology and control systems.

In 2004, a major step toward facilitating such integration was taken with the publication of the IntelliGrid Architecture—the first comprehensive technical framework for linking communications and electricity into a smart grid that will offer the unprecedented flexibility and functionality required by an increasingly digital society.

Next, the consortium will develop a consumer portal that can provide a critical link between electricity customers and the integrated energy-communications network, enabling utilities to offer demand-response programmes that operate at the level of individual appliances.

Finally, strengthening the security of the nation's vital electric power infrastructure has been a concern of EPRI since well before the terrorist attacks of September 11, 2001. This initial effort focused primarily on the threat of cyber attacks against operations systems, but following 9/11, it was expanded to address a wide range of infrastructure security issues.

The current focus of EPRI's Infrastructure Security Initiative (ISI) is a joint programme with the US Department of Homeland Security to create a new type of "recovery" transformer that can be



easily stored, transported and installed for emergency use. ISI is also providing utilities with information on immediate countermeasures they can take to protect their own power systems. In addition, EPRI's Enterprise Information Security programme has provided security enhancements for industry-standard communications protocols and is currently developing fast encryption and intrusion detection technologies specifically for utility monitoring and control systems.

overview has shown, the power of collaborative R&D is being reassessed as the electricity industry faces new challenges. Under its new president, Steven Specker, EPRI intends to broaden the scope of collaboration by actively engaging more industry stakeholders in its research programmes. The result will be a stronger, more reliable power system, which will be better positioned to meet the urgent environmental, economic and security challenges ahead.

DG Market Size in the States

The number of distributed generation (DG) units will grow significantly according to a report by the Resource Dynamics Corporation. Organisations seeking to be successful players in the DG market must have market intelligence – understanding the size of the potential new market and specifically where DG will be adopted. New DG technologies and recent changes in fuel prices will have a profound effect on the marketplace.

A carefully defined model framework was used to generate the results. The DIstributed Power Economic Rationale SElection (DISPERSE) model estimates the market potential for DG. DISPERSE has been developed and enhanced over ten years, and has been used for numerous projects for utilities, equipment manufacturers, government agencies, and research organisations.

Base Case DG Market Potential Total US	
Number of Units	49,500
Capacity (MW)	28,300
Generation (GWh)	204,000
Thermal Output (Billion Btu)	600,000
DG Equipment Sales (Million \$)	13,100
Natural Gas Consumption (Million ft ³)	1000

The report examines fossil fuel-fired DG technologies and examines baseload, combined heat and power (CHP), and peaking applications.

Market potential varies considerably depending on the underlying assumptions. To address this, five different cases were prepared, starting with the Base Case market potential given today's DG technology price and performance, current gas prices, and expected escalations in gas and electricity prices. Four additional cases examine the sensitivity to capital cost, gas prices and competing electric prices. Each case projects whether DG can economically beat the electric grid price for a particular user, including recovery of capital investment in the DG unit. The analysis considers actual tariffs from the utility where the user is located, and is not based on average electricity prices.

Small is Big



At a time when it seems that large wind farms are getting all the glory (and ire) in the UK, the government is keenly aware, and growing more vocal about, the possibilities that small, distributed generation projects can bring.

Many UK households could one day be self-sufficient in energy needs and routinely make money by selling surplus electricity from home generators such as solar panels and micro-wind turbines. This is among the possibilities raised by UK Energy Minister Malcolm Wicks as the Department of Trade and Industry asks for views on the development of "micro-generation" of low-carbon energy by homes, businesses and public buildings.

The DTI is developing a cross-Government strategy for the development of micro-generation, including micro-hydro, micro-wind, solar power, fuel cells, micro-combined heat and power, and ground and air source heat pumps.

First RPZ announced

Central Networks is the first distribution network operator (DNO) to have part of its network designated as a Registered Power Zone (RPZ) by Ofgem. RPZ status is given to areas of a network where DNOs employ innovative approaches to connect new generators to their systems. While the project is the first of its kind, Ofgem is confident that other 'power zones' around the country will follow.

The RPZ scheme provides a financial incentive for DNOs to offer innovative options for generators wanting to connect to their network. The scheme covers the Bicker Fen, Boston and Skegness areas in the Central Networks East Midlands distribution area. The amount of renewable generators requesting connections in the local area currently outstrips the capacity of the network. Therefore the proposal will involve developing a control system to ensure that

generation output can be maximised, without exceeding the network's circuit ratings. This will in turn minimise the connection costs for the generators and environmental impacts by avoiding the need to build a new overhead line.

NZ Reference Group

A second information sheet prepared by the reference group considering the scope of national guidance for electricity generation can be found at: www.med.govt.nz/ers/environment/nps/electricity-generation/info/002/index.html

The reference group, comprising relevant government departments and key stakeholder groups, has been established to develop a detailed outline of what a National Policy Statement (NPS) might cover (and not cover); confirm whether an NPS would likely be beneficial; and identify and scope related National Environmental Standards.

The reference group will post regular information sheets at: www.med.govt.nz/ers/environment/nps/electricity-generation

To keep stakeholders informed of progress and specific feedback on a draft report will be sought in due course.

DG and Demand Side Reductions

Distributed Generation and reliable Demand Side reductions are very valuable in meeting demand peaks even when made available for very short time periods.

For example, in Britain in 2003, the top 5000MW of system peak (55,000MW) used central generation which only operated for 170 hours in that year. In Spain in 2004, the top 2000MW of system peak (35,000MW) used central generation which only operated for 9 hours per year. In warm winter years, this generation would be used less with the converse also true. New Zealand is no different in this respect.

The use of residential demand side and small scale generation to meet system peaks is being studied as part of an International Energy Agency project dealing with time of use pricing and demand side bidding. Six countries currently participate in this work.

Contact Information

Comments and questions are welcomed!
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(see under "Special Links")

Net Metering Initiative

McKenzie Bay International Ltd has issued a public statement applauding the voluntary statewide net metering program approved by the Michigan Public Service Commission (PSC).

The net metering initiative is the result of a consensus agreement signed by 11 utilities serving customers in Michigan. As a result of the decision Michigan customers will be able to generate renewable energy for on-site use with McKenzie Bay's next-generation WindStorSM wind power system. The decision also empowers Michigan customers to further maximize savings by transmitting excess power into the public grid. In exchange for the power generated by the customer the utility will issue a credit to that customer commensurate with the power metered.

Michigan-based McKenzie Bay subsidiary WindStor Power Co is the owner and developer of WindStorSM, a wind energy system designed to integrate distributed generation wind power installed on or near a building with grid power. WindStorSM will feature WindStor Wind Turbines, a proprietary system integrator and, if applicable, a battery. www.mckenziebay.com

Update on California DG Initiatives

California is one of the most active DG states in the US. Their regulatory response to market forces and in meeting public policy needs has been significant. Continuing concerns about power reliability, quality and costs, plus evolving technology have all contributed to the use of DG. DG activity has increased in California since Rule 21 was issued in December of 2000. Aside from more transparent regulations, the market is also responding to the perceived risk of power shortages. Despite a slowdown in DG installations across the country during 2001 and 2002, California experienced real increases in the installation of both large and small DG units.

Battery Storage Breaks World Record

A \$30m storage system has won a Guinness World Record for being the 'world's most powerful battery'. Developed by battery manufacturer Saft, the so-called BESS (battery energy storage system) provides back-up power to the Golden Valley Electrical Association (GVEA) in Fairbanks, Alaska.

The new world record was set during the commissioning phase, in which the BESS was tested to its ultimate limits, when it delivered 46MW for five minutes. In practice it will provide 27MW for a minimum of 15 minutes to stabilise the local power grid and reduce the chance of unexpected outages in Fairbanks.

Saft won the contract to design and build the battery, which comprises 13,760 rechargeable nickel-cadmium cells in four parallel strings, as part of a BESS consortium led by Swiss power and automation technology group ABB. ABB

provided the system concept and the DC to AC power converter system. Saft is providing a 'cradle to grave' service by taking responsibility for the recycling of each cell.

FERC Issues Standard Rule For Small Generator Interconnection

The Federal Energy Regulatory Commission has issued standard procedures for the interconnection of generators no larger than 20 megawatts, removing barriers to the development of needed infrastructure by reducing interconnection uncertainty, time and costs. The rule (Order No. 2006) will help preserve grid reliability, increase energy supply, and lower wholesale electric costs for customers by increasing the number and types of new generators available in the electric market, including development of non-polluting alternative energy resources.

The rule reflects input from a broad-based group of utilities, small generators, state commission representatives, and other interested entities who came together to recommend a unified approach to small generator interconnection. This rule reflects many of these consensus positions as well as those of the National Association of Regulatory Utility Commissioners (NARUC). The rule harmonizes state and federal practices by adopting many of the best interconnection practices recommended by NARUC. It should help promote consistent, nationwide interconnection rules for small generators.

The rule directs public utilities to amend their Order No. 888 open access transmission tariffs to offer non-discriminatory, standardized inter-connection service for small generators. The amendments should include a Small Generator Interconnection Procedures (SGIP) document and a Small Generator Interconnection Agreement (SGIA).

The SGIP contains the technical procedures that the small generator and utility must follow in the course of connecting the generator with the utility's lines. The SGIA contains the contractual provisions for the interconnection and spells out who pays for improvements to the utility's electric system, if needed to complete the interconnection.

The rule applies only to interconnections with facilities already subject to the jurisdiction of the Commission; the Commission emphasized that it does not apply to local distribution facilities.

In July 2003, the Commission issued a final rule for facilities larger than 20 megawatts (Order No. 2003). At that time, the Commission proposed the rule for small generators. Approximately 70 entities commented on the proposed rule; they generally supported the Commission's efforts to remove barriers to the development of small generators.

MED Consultation on NPS

A second information sheet prepared by the

reference group considering the scope of national guidance for electricity generation can be found at:

www.med.govt.nz/ers/environment/nps/electricity-generation/info/002/index.html

The reference group, comprising relevant government departments and key stakeholder groups, has been established to:

Develop a detailed outline of what a National Policy Statement (NPS) might and might not cover; confirm whether an NPS would likely be beneficial; and identify and scope related National Environmental Standards.

The reference group will post regular information sheets at to keep stakeholders informed of progress and specific feedback on a draft report will be sought in due course.

California Clean Energy Fund to Create World's Leading Energy Efficiency Centre

The California Clean Energy Fund, a \$30 million public benefit investment fund created as part of the Pacific Gas and Electric bankruptcy settlement, says it intends to award a \$1 million grant to establish and maintain the world's leading university centre on energy efficiency. The grant will be awarded to a Northern California university which aspires to international leadership in the development of energy efficiency technologies and the removal of barriers to their rapid commercialization.

By creating a university-based centre for energy efficiency, CalCEF will bring together its diverse Board of Directors, partnerships with leading venture capital firms, and academic leaders from multiple disciplines to advance innovation and accelerate the commercialization of energy efficient products, services and practices. The centre will also reinforce California's standing as a national and international leader in energy efficiency, while seeding the state's marketplace with promising new products and services that provide its citizens with a clean environment and economic benefits.

Venture Capitalists Show Increasing Interest in Demand Response Technologies

Providers of demand response technologies are increasingly finding a receptive audience from venture capitalists.

There are several reasons why emerging demand response technology companies are being seen as attractive investments. The technology is beginning to be actively promoted by the federal government. The General Accountability Office (GAO) in the States recently concluded that if electric markets are to work reliably, then it is vital that consumers understand that the price of such power is tied to supply and demand, and that so-called demand response plans be more widely implemented. To achieve that outcome, federal regulators must consider the programmes when designing wholesale markets.

Additionally, the technology has the capability to

save both utilities and consumers money. Demand response technology gives utilities an alternative to building expensive generation plants, and consumers the ability to make smarter choices regarding their power usage. A FERCC-commissioned study reported that a moderate amount of demand response could save about \$7.5 billion annually by 2010. The GAO's findings support that conclusion. It looked at four programmes including one in Florida that it says is saving consumers 11 percent per year, all since 2002. Demand response plans have also helped California mitigate power scarcity since its crisis in 2000-2001 while the General Services Administration has said it has saved nearly \$2 billion in the last five years by applying the technology to just a few of its buildings.

The trend toward demand response seems inevitable. The cost of advanced metering infrastructure is steadily declining and becoming on par with those that run on traditional technologies. At these prices and with documented response of customers to critical peak pricing rates, expect regulators, lawmakers and utilities to come to a meeting of minds and move forward with demand response programmes.

Some of the companies that venture capitalists are finding promising include:

- **EnerNOC** (www.enernoc.com) allows energy users to reduce their demand for electricity during periods of peak demand or supply shortfalls to create a more robust and reliable electricity grid, and get paid for doing so.
- **Comverge Inc.** (www.comverge.com) will own and operate wireless infrastructure to regulate power use and create systems that can guarantee a certain amount of relief to stressed generating assets at times of peak.
- **Electric City Corp.** (www.elccorp.com) is a developer, manufacturer and integrator of energy savings technologies and building automation systems.
- **Distribution Control Systems Inc.** (www.twacs.com) is a subsidiary of ESCO Technologies Inc. The TWACS® system is a fixed network utility communication system that uses patented technologies to communicate over electric power lines or via short hop radio frequency (RF), providing low-cost, highly-reliable, two-way communication between the utility and the consumers of electricity, gas, and water meters.

Flywheel Prototype for Frequency Regulation/Grid Stability

Power stored by flywheels, long a mainstay for uninterruptible power systems (UPS), has never been used for grid applications. That could change with flywheel technology, if proven viable, as an alternative to keeping power plants on spinning reserve in order to balance the grid.

Beacon Power Corp. is to demonstrate an advanced flywheel-based solution for frequency regulation and grid stability in California.

On the Web...

DTI/Ofgem Distributed Generation Coordinating Group

(www.distributed-generation.gov.uk)

- 1 A study by the University of Strathclyde for WS4 'An Investigation of DC Injection Levels into Low Voltage AC Power Systems'
- 2 The project profile for a DTI supported on-going study "Control of Windfarm Grids with a HVDC Link" by AREVA T&D Technology Centre
- 3 The project Profile for a DTI supported on-going study "Grid Compliant AC Connection of Offshore windfarms using STATCOMs" by National Grid Transco
- 4 An Investigation into the Development of Consolidation of Distributed Generation within the Wholesale Electricity Trading Arrangements.
- 5 The Tradable Value of Distributed Generation.
- 6 'The Contribution to Distribution Network Fault Levels from the connection of Distributed Generation'
- 7 Distributed Generation Connected to the Local Network- A Guide: A report to the DTI's DG programme by Power Planning Associates
- 8 Technical Architecture: A First Report - The Way Ahead: A report on the future of our electricity networks by the IEE Power Systems and Equipment Professional Network to the DGCG. This is a new link to the DTI Energy web site where the report has been available for some time.

Please note recent additions in the 'Whats New' section located at www.distributed-generation.gov.uk/index.php.

This website is to be taken over by the newly constituted Electricity Networks Strategy Group (ENSG). The ENSG will use the site to publish notes of meetings, work programme reports and documents in the same way as the DG Coordinating Group and Technical Steering Group did. All historic DGCG and TSG information will continue to be accessible from the website.

Ofgem

www.ofgem.gov.uk

Ofgem has published the following documents:

- 142/05 Decision and direction in relation to consultations H/04, "Grid Code Changes to Incorporate New Generation Technologies and DC Inter-connectors (Generic Provisions)" and SA/2004, "Consultation on Technical Requirements for Windfarms"
- 136/05a Ofgem Open letter: Long Term Development Statements for Electricity Distribution Networks (electronic format only)
- 136/05b Long Term Development Statements (LTDS) Usability Questionnaire (electronic format only)
- 135/05 Structure of electricity distribution charges - Consultation on the longer term charging framework

Renewable Energy Sources Act

The official translation entitled: *Act on Granting Priority to Renewable Energy Sources* (Renewable Energy Sources Act) of the new German feed-in law, the Erneuerbare-Energien-Gesetz, effective from 01 August 2004 can be downloaded from www.bmu.de/files/pdfs/allgemein/application/pdf/res-act.pdf

Events Calendar

Wide Area Monitoring and Control

30 August - 1 September 2005, Zurich, Switzerland

Organised by the Swiss Federal Institute of Technology (ETH), this course is part of the series given by EES - UETP (see www.eesuete.unibo.it). The course will cover the fundamentals of phasor measurement techniques and applications of wide area measurements in power systems.

The 6th Annual International Symposium on Distributed Energy Resources

7-9 September, 2005, Santa Clara, California

The 6th Annual Conference "Distributed Energy Resources: All Power is Local" brought to you by CADER and CALSEIA. Look at CADER's website at www.cader.org or at www.calseia.org for details.

Small Power in the Big Apple: CHP/DE in US and World Energy Markets

25-27 October 2005, Park Central Hotel, New York City, USA

World Alliance for Decentralized Energy (WADE) & US Combined Heat & Power Association (USCHPA) 6th Annual CHP / Decentralized Energy Conference and Workshop "US and Global Best Practice for CHP & Decentralized Energy"

The main conference themes are: National market assessments and outlooks; Global policy & regulatory best-practice; International project case-studies; and MUS National CHP Roadmap Review.

For registration, sponsorship opportunities and further information, visit the conference website at www.internationalchp-de.net.

International Gasification Seminar

28 November 2005, Christchurch

University of Canterbury Chemical & Process Engineering/CAE - details to be announced.