CENTRE FOR ADVANCED ENGINEERING ▸ UNIVERSITY OF CANTERBURY CAMPUS ▸ CHRISTCHURCH ▸ NEW ZEALAND

Submission to the Ministry of Economic Development (Resources and Networks Branch)

on the Discussion Paper

"Facilitating Distributed Generation"

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Mail: Private Bag 4800, University of Canterbury Campus
Street Address: 39 Creyke Road, Ilam
Phone: 03 364 2478 Fax: 03 364 2069 e-mail: cae@cae.canterbury.ac.nz www.caenz.com

This submission has been prepared by Ken Mitchell, Distributed Generation Project Leader, and reviewed by industry participants in the recent CAE DG study on behalf of the Industry. Ken Mitchell has experience in electricity retailing, generation, and network operation. Specifically he has experience at the implementation of a distributed generation strategy to overcome issues of transmission and distribution constraints. He currently provides infrastructure development planning consultancy services to the industry.

Contact through:

Centre for Advanced Engineering
University of Canterbury Campus
Private Bag 4800
Christchurch

Phone: 64 3 364 2478 ext 7129
Fax: 64 3 364 2069

www site: www.caenz.com

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Introduction

CAE seeks to advance sustainable development for New Zealand by improving best practise and levels of resource stewardship, and promoting technology development and uptake to ensure the delivery of desired environmental and economic outcomes. Our focus is on stimulating collaborative action and research on the identified knowledge gaps, and raising awareness of the underlying technology and science opportunities.

Energy is one of the central issues for sustainable development because our modern society depends on it and it touches all aspects of our lives. Environmental sustainability requires a progressive transition towards renewable sources of energy, continued improvement in our energy usage, changes in patterns of energy use and more effective technological development.

CAE programmes aim to give practical effect to these imperatives. Public policy initiatives to avoid wasteful use of energy in this country have languished and despite government policy objectives for sustainable economic growth, the market share of consumer energy provided by renewables has reduced. As an energy-rich country the challenge is to assertively manage the transition from dependence on Maui gas to other primary energy supplies and to manage the transformation to promote improved energy outcomes. This submission is made by CAE as an independent commentator on the broader energy sector with regard to technical and strategic issues. Specifically CAE has been involved in studies on distribution generation in very recent times.

Focus of Submission

With pending large-scale investments required in the electricity sector to meet New Zealand's increasing energy demand driven by economic growth and the implementation of a new industry governance structure, it is timely that the Ministry of Economic Development is seeking input into the role that Distributed Generation might contribute.

As an organization established with purpose of supporting business and policy makers with quality knowledge, CAE is very pleased to have the opportunity to make a submission to Ministry in an area where it has undertaken significant research.

CAE has no vested interests in the industry. Its strategic view of the industry is non-partisan and broad across the whole energy sector.

This submission attempts to provide comments across the industry at the macro level and so addresses issues of practicality at a detail level. It is noted that the discussion paper has a line company regulation focus. CAE has attempted to add balance to this focus, which should not be confused with taking a line company position. In fact we argue that the current focus of the discussion document omits from the DG equation important stakeholders who have a significant influencing factor in facilitating the uptake of DG.

The primary focus of this submission is to establish what DG actually is, identify the change in industry strategic thinking that will be required for DG to make a meaningful contribution to New Zealand's power system, and to suggest possible actions that might enhance the take up of investment in DG.

These suggestions are qualified by CAE's opinion that they should be backed up by adequate investigation.

Structure of Submission

The remainder of this submission is sectioned into a summary of key points. A discussion follows and then a section which is directly referenced to the structure of the Ministry's Discussion Paper.

CAE would be pleased to arrange for further follow up our comment on the various issues it raises in the submission should the Ministry wish to seek more detailed analysis.

Summary of Key Findings

- DG investment must be viewed across the whole power system (from the national grid through to customer load management), from a business and economic standpoint.
- A useful distinction should be made between distributed generation and embedded generation
- Lack of DG investment represents significant under-development in an efficient national power supply system.
- DG can be a significant contributor to New Zealand's future electricity generation needs.
- DG is a major economic development opportunity for regional New Zealand.
- DG competes on the basis of least cost delivered energy for a desired reliability and quality standard.
- Present regulatory environment treats generation as an energy market issue resulting in impediments to those wanting to use DG for its non-energy market benefits.
- Large-scale grid-connected generation investment continues ahead of more efficient DG.
- DG often presents a scenario that devalues the existing line company solution or competes with new line investment.
- The prospect of significant levels of investment in DG is unlikely without the support of line companies.
- Existing industry structure has failed to deliver DG investment.
- Contractual relationship for connection of DG should remain indirect via the retailers "Use of System Agreement". However for larger, *embedded generation*, use of direct connection contracts with the line company may be more appropriate.
- Current network extension and ownership regulations are adequate to address issues of cost reapportionment.
- The realization of benefits by investors is dependent on their pass through by companies to whom DG represents a competitive threat to their current core business.
- Deriving maximum benefit from DG requires cooperation between energy, distribution and transmission sectors.
- The viability of DG is related to exploitation of niche opportunities on distribution networks and consequently can best be realized by line companies.
- Quasi-regulation in the form of industry rules, contractual structures, and pricing methodologies is impacting the development of DG.
- There are no controls on line companies investing in higher cost line solutions when a DG alternative is more economic.
- For DG investment to improve in New Zealand line companies need to be encouraged (possibly even incentivised), and fairness issues addressed with regulatory control on retailers.
- DG investors cannot negotiate terms and conditions with Transpower or fix the term of contracts to get certainty, as grid connected generators can.
- Line companies have no obligation or commercial need to minimize Transpower's charges.
- Average costing in general reduces the investment signal for DG.
- Transpower's security standards are more stringent than their customers require and there is limited opportunity for line companies to use DG alternatives to manage the service levels they offer customers.
- Transpower is not permitted to invest in generation as a lower cost alternative to transmission upgrade.
- Availability of standard terms and conditions for connection are a customer service issue and not a significant barrier to DG.

- Consideration of the benefits of controls on retailer generation portfolios may be of merit.
- A fundamental decision that needs to be determined is whether the DG owner is to be contracted with the retailer or line company.
- Customers need the technical support to champion their interests with line companies and pricing analysis support to negotiate contracts with retailers.
- The connection voltage is a better indicator of the technical difficulty/cost of connecting DG than capacity.
- Connection of relatively small generation capacities can be beyond the technical capability of the network.
- To place controls on deep connection charging would potentially be very intrusive on line company management.
- Shallow connection charging is not recommended for larger *embedded generation* scenarios.
- Grid connected generation that connects to the core grid essentially benefits from a shallow connection charging mechanism.
- When DG is relatively large compared to the GXP base load, export to the grid may occur.
- When a line company has no direct contract with a generation owner then it has no legal right to disconnect for breach of contract terms.

Overview

CAE comments that in order to establish a robust regulatory environment to facilitate DG investment it is important to first understand the business and economic rationale for investment in DG at a total system level. Lack of investment in DG is a direct result of an industry that has maximized its position in terms of pricing and cost/risk pass through against a structure that has developed in response to a regulated environment. It is a telling fact that incumbent line and retail companies own nearly all the DG existing in NZ. Clearly the investment environment for DG is predicated upon the behaviours of these major players. Yet the regulatory framework proposed by the discussion document examines just one facet of this equation; the relationship between a potential DG owner and a lines company.

In this respect the discussion document misses the opportunity to properly define DG as a business opportunity, potentially involving a number of different stakeholders and, most likely, involving a lines company as the enabling business partner in the generation investment opportunity. Moreover, based on current DG investment it is most likely that the generator will not be the facilities owner or even the site occupier. A regulatory framework limited by the assumption there is a direct linear relationship between Lines Company and generator, will fail to deliver the desired increase uptake.

A further example of the complexity of DG is the issue of a lines company ultimately exporting back into the grid, as occurs now from time-to time. Energy exported from a network is done so on a net basis after the diversity of existing loads have been exploited through load management activity. The benefits thus derived have a broader number of stakeholders across which they might be shared.

We believe that much greater consideration needs to be given to adequately defining the exact business circumstance intended to be covered by the regulation, leaving other opportunities to be exploited by individual treaty and economic rational behavior.

Key Issues and Recommendations Raised in this Submission

CAE recommends that a distinction be made between *distributed generation* and *embedded generation*. Doing so would permit independent rule sets to be developed for the two different types of generation overcoming many of the compromises proposed that are needed to cater for very diverse circumstances, for example, when the DG owner is in fact the incumbent lines company or a third party provider.

CAE suggests defining *distributed generation* as generation of relatively small scale in comparison to the network it is connected to such that it can be connected at voltages no higher than the primary distribution voltage without the need for deep network reinforcement. Distributed generation would not need to export to the grid and the network load will be capable of consuming all surplus output. Generation of this nature primarily competes on the basis of delivery cost and non-energy related benefits.

Embedded generation, on the other hand, is seen as network connected generation of relatively larger scale that requires connection at sub-transmission level, e.g. a wind farm. This will present greater technical challenges in terms of management and integration to the network, often involving significant dedicated asset and/or deep network reinforcement. Generation of this nature primarily competes on the basis of energy market opportunities.

Lack of DG investment represents significant under-development in an efficient national power supply system. DG is a major economic development opportunity for regional New Zealand.

DG competes on the basis of least cost delivered energy for a desired reliability and quality standard. Its costs and economic efficiency need to be assessed, when being compared to grid connected generation, in terms of energy cost and the cost of its transportation to the load it supplies.

The regulatory environment treats generation as an energy market issue resulting in impediments to

those wanting to use DG for its non-energy market benefits.

While large-scale grid-connected generation investment continues ahead of more efficient DG solutions there is a case to be argued that the investment environment created by the industry's structure is artificially protecting less efficient entrenched interests of the benefiting sectors.

A cynical view of the Industry at present is that companies can maximize their value by keeping supply short and the options for meeting demand limited to expensive options.

CAE suggests that formal analysis of economic efficiency be added as an objective when developing policy and regulation.

A much broader scope to the DG strategy is needed to deliver the optimum national outcome in terms of total integrated power supply system cost efficiency. In particular the role of firming plant, peaking plant, energy switching and load management needs more considered analysis when developing new industry rules. Industry protocols for dealing with transmission charges and asset valuations need to be established independently, especially in the case where the beneficial owner of the DG investment is a lines company.

The realization of benefits by investors is dependent on them being passed through by companies to whom DG represents a competitive threat to their current core business. DG is often competing with the retailers own generation, hence a retailer will be reluctant to offer favourable energy purchase terms. DG often presents a scenario that devalues the existing line solution or competes with new line investment. A company facing such a loss is unlikely to be prepared to recognize the benefits of a DG proposal.

Generally the dominant players in the industry will all have some competitive exposure to DG and thus, at an enterprise level, have an element of monopoly position to protect. DG therefore changes the paradigm on which much of the industry's regulation is based

The prospect of significant levels of investment in DG is unlikely without the support of line companies. The main impediment is the regulatory environment they operate in.

The CAE study into DG supported the hypothesis that a paradigm shift in thinking is required to realize opportunity. Existing industry structure has failed to deliver DG investment. It is unlikely that cosmetic change to regulations will achieve the required change to meet policy objectives.

It is suggested that some in-depth economic and technical analysis to support the Governance Board's rule making would prove an effective strategy. Keeping this work independent of the industry's vested interests would avoid repeating some of the failings of the past.

Much of the industries rules and contractual structures have the Transpower pricing methodology at their epicenter. Given that DG competes on the basis of transportation efficiency, close examination of this pricing methodology is needed to ensure that competition is fair.

CAE recommends that the contractual relationship for connection of DG to a network remains indirect via the retailers "Use of System Agreement" as for most consumers. However for larger, more heavily interconnected embedded generation, use of direct connection contracts with the line company may be more appropriate.

Separate approaches to the rules governing terms and conditions, pricing methodology, etc. could then be more accurately applied.

It is suggested that obtaining a contract for the purchase of the generation output is the biggest hurdle for a DG investor. In the case of embedded generation it is not necessary for the investor to be the facility owner or occupier .

The mechanisms by which benefits derived in the different industry sectors are able to be identified and passed through to the DG investor have not been established. Rules governing the requirement to pass

through benefits will be ineffective until this foundation has been laid.

There is a lack of regulatory pressure (and often discouragement) for companies to seek the efficient solution in power system development. Efficiency targets with respect to load management are missing. Investors are unaware of the opportunities that might exist for DG.

It is suggested that it might be in the national strategic interest, where it is exposed to risks associated with variability of supply, to increase the capability in managing demand. DG would be a significant contributor. Responsibility in the industry for load management needs to be established, with targets set to encourage the adoption of DG solutions where they deliver a more economic response to the risk management initiatives than are currently being implemented.

If line companies were to publish forecasts and identify investment opportunities then there would be little issue with them being an investor in order to deliver on targeted positions.

Access to the technical skills needed to analyse opportunity and engineer DG integration into networks are not readily accessible in remote regional areas, or in the traditional areas of expertise, for the existing industry players. Regulating application processes will be ineffective if the parties involved don't have the skill base or in-house capability. It is suggested that the industry as a whole considers funding an independent resource for this purpose.

This may be an underlying factor in the lack of DG penetration in NZ. Companies that lack corporate knowledge on DG are unlikely to develop innovative solutions and strategies around its inclusion in their business. There is a role for a provider and distributor of such knowledge. This may be a more positive approach to stimulating change than a focus purely on regulatory incentive.

Capital costs can be spread out from borrowing funds. There is no necessity for line companies to offer favourable banking terms to DG investors at the risk of their captive electricity consumers.

Current network extension and ownership regulations are adequate to address issues of cost reapportionment.

With regard to safety rules, an industry standard approach to operating protocols at the interface between network management and generation would be beneficial.

There are currently minimal guidelines on acceptable impacts DG is permitted to have on the security and quality experienced by other network users. Without established industry standards line companies will be exposed to criticism about the hurdles standards will inherently present.

Careful consideration of how disconnection regulations will work in practice is recommended as there has been great difficulty with customer disconnection practices by network operators to date. In particular, coverage for connections that provide dual functions of injection and off-take points. The extent of line company control ends at the point of connection while generation may be deeply embedded within the installation or a secondary network (in which case its disconnection may affect multiple consumers).

Response to Discussion Paper by Paragraph Reference

The Ministry of Economic Development has produced a discussion paper titled "Facilitating Distributed Generation". This section of CAE's response is structured with reference to the paragraph numbers given in that paper.

Distributed Generation Defined – para. 1-3

One result that came forward from the CAE study on Distributed Generation was that generation competes on a different set of priorities once it exceeds a certain size. The defining feature that distinguished distributed generation from embedded generation was essentially a matter of scale. True Distributed Generation is typically below 5MW in terms of capacity.

This is a practical limitation related to the capacity of the distribution network the generation is connected to for the following reasons:

- A major benefit of DG is the avoidance of investment in line upgrade to overcome capacity, voltage, and security issues. The capacity of 11kV lines in rural networks, where these issues are most likely to present attractive DG opportunities, are typically in the order 3-6MW and can be as low 200kVA. If a significant amount of investment is need to allow these lines to distribute the generation output then this benefit is negated.
- Larger load blocks trigger more stringent security standards. Managing generation outage becomes an issue for networks with low levels of interconnection. DG opportunities such as wind and hydro tend to be located at the extremities of network infrastructure. Investment to cope with non availability of the generation is again a limitation on economic efficiency. The capacity of generation needs to be kept in proportion with the load diversity on the network.
- Similarly, if generation is a large component of the load profile presented at the Grid Exit Point then it will tend to dominate the load management cost drivers at that GXP. It is suggested that capability to manage load profile via a combination of DG and traditional load control beyond approximately 35% of peak demand (actual figure dependent on system load profile) becomes inefficient from a transmission cost avoidance perspective.
- If the generation output exceeds the local base load then export to the grid becomes a possibility with associated increased transmission costs.

CAE recommends that generation of a scale that cannot be connected at the primary distribution voltage or requires sub-transmission capacity upgrade be defined as "embedded generation" as distinct from distributed generation. Generation at this larger scale is primarily focused on delivering benefits from energy production as compared to savings associated with a more efficient infrastructure configuration.

Benefits of Distributed Generation for NZ para. 4-11

Distributed generation can directly deliver on all the policy objectives listed in para. 4 and 5. In fact it is arguably the most effective means of delivering these outcomes. The current lack of DG represents under-development in New Zealand's power supply and is a constraint on the overall electricity supply systems efficiency.

DG is a significant economic development opportunity in regional NZ where local natural resources are very high relative to population size and energy demand. This should be delivering a competitive advantage to these regions stimulating their economy. The economic utilization of these resources would make a major contribution to broader government objectives on regional economic growth. As it is large users and line companies that constitute the local business champions of regional development, removing impediments to their cooperation and delivery should be a focus of policy objectives.

The potential for DG in New Zealand can more than meet our medium term demand forecasts, transmission, and security constraints in a more efficient, renewable, and green manner than continued development of traditional large-scale, grid connected generation.

It is however important to recognize that DG competes on the basis of least cost delivered energy. Its costs and economic efficiency need to be assessed, when being compared to grid connected generation, in terms of energy cost and the cost of its transportation to the load it supplies.

For example, Project Aqua is considered to be the most attractive grid connected generation opportunity and is expected to generate electricity at between 5.0 and 5.5 c/kWh. When it is considered that transmission cost adds approximately another 1.7 c/kWh and that Transpower is signaling the need for investment of approximately 20% of its asset value, then comparison with distributed generation, which is delivering costs in the order of 5.5 to 6.5 c/kWh, suggests that DG is a more economic option.

Given the other advantages of DG, delivery on government objectives would demand that while there is a total of 500MW of DG opportunity able to deliver this level of cost efficiency it should be exploited in preference to continued grid connected generation developments. The fact that these developments are occurring and DG isn't suggests that the investment environment created by the industry's present structure is artificially protecting less efficient entrenched interests.

The national economic impact of increased electricity costs resulting from traditional responses to meeting demand growth has not been adequately investigated and incorporated into strategic planning.

Lack of investment in DG is a direct result of an industry that has maximized its position in terms of pricing and cost/risk passed through to customers against a structure that has developed in response to a regulated environment. To date the large industry players (particularly the SOE's) have tended to resource and drive industry development. Some independent contribution would be preferable provided the quality of knowledge can be sustained.

Regulation is protecting the competitive position in some cases and presenting hurdles to innovation e.g. compare the recovery of sunk costs by Transpower to the risks that would exist in a competitive market. DG provides a competitive alternative to transmission but is required to contribute to sunk costs through pricing policy.

It is telling fact that nearly all the DG existing in NZ is owned by incumbent line and retail companies. Clearly the investment environment is likely to be determined by the behaviour of the major industry players. A question remains as to whether the current proposed regulatory framework will change these behavioural patterns, but instead simply enable those threatened by new investment to adopt a "compliance" mentality.

Para. 7 and 8 identifies transmission and distribution benefits that can result from the implementation of DG solutions. However, there is a mechanism lacking by which these benefits are passed through or shared with the consumer and investor.

CAE suggests that formal analysis of economic efficiency be added as an objective when developing policy and regulation.

A broader scope to the DG strategy is needed to deliver the optimum nation outcome in terms of total integrated power supply system cost efficiency. In particular the role of firming plant, peaking plant, energy switching and load management needs more considered analysis in the development of industry rules. DG can be significant contributor in these areas.

Industry governance rules with regard to DG should be based on a set of objectives derived from research work which ideally should have independence from political and industry interference.

Existing Distributed Generation para. 12 -20

This section of the discussion paper highlights the issue that existing DG investment is almost entirely taken up by existing line and energy retail companies. There is clearly a lack of a market for independent DG investors at present.

The realization of benefits by investors is dependent on their pass through by companies to whom DG

represents a competitive threat to their current core business.

Potential independent investors complain that they can't get contracts with retailers for the purchase of their output. This is related to the fact that it is often competing with the retailer's own generation. A complaint is that they can't get favourable distribution and transmission terms. This relates to the fact that they are often presenting a scenario that devalues the existing line solution or competes with new line investment.

The subtlety of this is that those in the industry considered to be monopolies have some competitive exposure to DG and those generally considered to be operating in a competitive market would appear to have an element of monopoly position to protect.

Attention is drawn to the issue that the bulk of the generation schemes listed the discussion paper would not qualify as distributed generation (per CAE's more narrow definition) but are consider to be examples of embedded generation i.e. the impact of DG is much less than represented, highlighting that the existing DG investment environment is a failure.

Embedded generation is more typically justified on the basis of the value of the energy it produces, while some DG applications are viable even if they don't sell the energy output (e.g. security and peaking applications, such the Orion example para. 13). The distinction is important because one set of rules governing both scenarios is unlikely to be successful.

Deriving maximum benefit from DG requires cooperation between energy, distribution and transmission sectors. Currently there is a tendency for these players to be maximizing their commercial position at the expense of each other through shifting of costs and risks.

Potential New Distribution Generation para. 21-23

CAE believes that the potential for DG is much higher than currently publicly disclosed possibly for the following reasons:

- Companies act to protect the value of the investment already made in investigation of viability and to keep the strategic opportunity secrete from competitors.
- Line companies have been sitting on opportunities since regulation placed barriers on their ownership.
- DG application is opportunistic i.e. it must wait until timing is right in terms of demand/need. Past investment is no indicator of likely future investment.
- DG alternatives provide a negotiating tool for seeking lower charges. Some benefit can be accessed without having to build.
- The regulatory environment is not stable creating uncertainty for investors. The latest Commerce Commission pricing controls have not helped. With hostile regulation there can be little complaint about companies adopting a "work to rule" attitude. Regulation that stifles innovation denies the delivery of the objectives it is intended to support.

With few exceptions the opportunities listed in the discussion paper are enabled by line companies. Typically the viability of DG is related to exploitation of niche opportunities on distribution networks and consequently can only be realized by line companies. For retailers, operating small geographically diverse schemes is difficult and costly compared to line companies with an existing local presence.

The prospect of significant DG investment is unlikely without the support of line companies. The main impediment is the regulatory environment they operate in.

Existing Regulatory Framework for DG para 32-35

The design of New Zealand's electricity system is intended to take power in a single direction of flow from its large distant generating stations to the end consumer. It is not designed as a high developed mesh

able to support power flow in multiple directions. To some degree the industry structure and regulatory framework reflects this. DG will require a change in thinking related to the change in physical structure of the power system.

The regulatory framework proposed approaches DG investment from solely an energy perspective. DG competes largely on the basis of delivery cost and not energy cost. Regulation target the prevention of line companies competing in energy markets yet most of the opportunities listed in the discussion paper are transportation and security related. That is why DG will emerge from this market place.

While there is an open environment for others to invest in DG, these investors have no mechanism for accessing the markets/benefits without dependence on existing players. DG will often represent either a threat to the business of these companies or be seen as an opportunity for their own investment.

Why isn't there More Investment in DG? Para 36-48

It has been suggested that an industry structure and regulatory framework that views all generation as an energy market issue is an underlying factor in the low level of DG investment. The assumptions that industry reforms have been based on with regard to the pure competition and monopoly positions aren't necessarily accurate when viewed from a DG perspective. Industry rules and policy objectives that reflect the value of the DG contribution to the cost of delivered energy in their formulation would be preferable.

In particular it is the quasi-regulation in the form of industry rules, contractual structures, and pricing methodologies that is impacting the development of DG. This is discussed for each industry sector below.

Transmission issues are as follows:

- Transmission pricing methodology is not transparent to individual end customers therefore a DG investor cannot determine the level of transmission benefit their investment would deliver.
- DG investors cannot negotiate terms and conditions with Transpower or fix the term of contracts to get certainty as grid connected generators can.
- The pricing methodology is favourable to grid connected generators in that significant costs may be average costed and therefore funded by other users. If this increases line company charges then a DG operator may actually see a cost penalty for their competitor connecting.
- Average costing in general reduces the investment signal for DG.
- Transpower's "12 peaks demand charge" is unnecessarily harsh on variation in availability of DG. This harsh regime results in peak management dominating the DG operating strategy or a degraded recognition of the savings. Power systems are more robust (particularly at DG capacity level) to peak loading than the methodology recognizes with its half hour period. Twelve daily peaks would be more than adequate to deliver on Transpower's pricing objectives and allow more efficient management of generation resources.
- Transpower's security standards are more stringent than their customers require and there is limited opportunity for line companies to use DG alternatives to manage the service levels they offer customers. For example, Transpower's standards seek to maintain full security during a planned maintenance shutdown. A line company may consider this outage as the first contingent event and not expect security provisions to cope with a fault during a maintenance outage.
- If DG results in the by-pass of a transmission asset then Transpower's asset value should be reduced. This is normal commercial risk. Transpower's sunk cost recovery protects their inefficient position.
- The nodal pricing system does not pass through the benefits of relieving a transmission constraint to DG investors but gives it to their competitors.
- Transpower is not permitted to invest in generation as lower cost alternative to transmission upgrade. This perversely protects investment in more expensive line solutions. There is case for Transpower to utilize generation for relieving constraints during peaks or improving security which could double as the nation's dry year contingency.

Line company issues are as follows:

- Availability of standard terms and conditions for connection are a customer service issue and not a significant barrier to DG as suggested. The connection of DG is no more technically complicated or difficult to negotiate terms for than say a large irrigation pump which appears to be happening without special terms and rules, etc.
- The real issue is the terms that a DG investor might expect to negotiate. This type of generation targets niche applications and therefore will be dependent on the existence of those benefits. Recognition of niche benefits will require a certain level of individualized agreement.
- To realise transmission benefits requires management of the load profile at the GXP. This process, which optimizes diversity of existing load and the DG output, is a control function managed by the line company. The amount of benefit that can be realized is dependent on the diversity with the existing load and therefore should be shared with all users. There also needs to be some recognition of the line company's effort and agreement of who has control priority.
- Contractually if DG connections were treated in the same manner as load connections, the contract would exist between the DG owner and the retailer with line charges bundled into the retail pricing. Given that DG investors will need an energy purchase contract with retailers the current contractual relationships can continue.
- A more appropriate contractual framework for the industry might be for the retailers to hold supply contracts with Transpower directly for transmission, line companies directly for distribution, generators/the market for energy, and manage all risk via a single contract with the end users (consumers and DG owners).
- The issue of how a direct input contract might impact those with network off-take contracts needs to be thought through.
- There is potential for regulatory conflict with rules regulating the pass through transmission savings to consumers as distinct from generators. These rules have the potential to remove the investment signal for a line company to make DG investments.
- There are no controls on line companies investing in higher cost line solutions when a DG alternative is more economic. Perhaps a System Security Forecast like Transpower's which is intended to identify investment opportunity with sufficient lead time for independent investors would be an improvement. An enhancement (which Transpower could also adopt) is a clear statement of the benefits that the line company will contract for.
- Another possibility to consider is a requirement for networks to demonstrate delivery on load management targets in relationship to their load factors to deliver on efficiency targets. For example, a network with a load factor of 65% might be expected to have the capability of managing uncontrolled peak demand by 35%. If load control could only meet 20% of this target then they could be expected to look at other alternatives, such as DG.

Retail issues are as follows:

- There are currently no requirements for retailers to contract for the generation output at the same price they apply to their generation.
- Consideration of the benefits of controls on retailer generation portfolios may be of merit. For example, targets on the proportion of renewables, diversity of generation type, a requirement to match any increase in sensitivity to dry years with hydro firming plant, a requirement to sell/buy a certain amount of hedge coverage to/from others, etc. Balance and diversity are key issues to achieving greatest economic benefit and minimizing risk.
- There are no "last resort" rules placed on the incumbent retailer which leads to the possibility of a DG owner not being able to secure any contract.
- Metering is a retail issue but still being viewed as a line company responsibility by customers. Line charges don't include the provision of metering, which is more commonly owned by retailers.
- Line company pricing may no longer be based on ICP meters but on GXP load profile. In this scenario

the pass through of transmission benefits is automatically shared by retailers. There isn't necessarily a retail pricing mechanism that passes this benefit directly through to the DG investor.

Public Policy Objectives para 49-51

It is a policy objective to ensure electricity is delivered efficiently. Regulation that protects the status quo in the face of more efficient alternatives is counter-productive to this objective.

Care is needed in the establishment of standard terms as they have the potential to conflict with the other objectives listed. DG is used in niche applications and so a certain amount of flexibility is necessary. The use of rules as a shelter for avoiding the negotiation of individual contracts is a tactic commonly employed in the industry by all players i.e. standard terms can be a two-edged sword.

If there are to be common pricing methodologies then there will need to be a relatively broad choice of options for the different types of generation and their specific application.

A fundamental decision that needs to be determined is whether the DG owner is to be contracted with the retailer or line company. It is suggested that obtaining a contract for the purchase of the generation output is the biggest hurdle for a DG investor.

A line company cannot refuse connection i.e. it has an obligation to supply, and this can be extended to cover DG. Connection issues are bound by the physical reality in terms of the engineering necessary and consequently the cost. In short it costs what it costs. Regulation won't make the costs any cheaper. It is suggested that concern over line company opposition to DG is a reaction to costs being higher than expected.

Pricing methodologies that result in the development of uneconomic connection via the subsidized support from existing consumers has been a primary concern with regulation seeking to restrict line company investment in generation in the past. Care needs to taken that regulation doesn't transfer risk to electricity consumers via line company pricing methodology controls.

Regulation will not make companies enthusiastic about connection of DG. Customers need the technical support to champion their interests with line companies and pricing analysis support to negotiate contracts with retailers. Neither line companies or retailers necessarily have the resources/skill base or obligation to provide this consultancy, yet there still exists an expectation that this is so leading to public frustration.

In practical terms regulated line company contract terms are likely to prove a good public relations exercise with little impact on the level of DG investment. An advantage is that their preparation will have established within line companies some pre-thought into the technical issues that will need to addressed when an application is made.

Application for Interconnection para. 52-53

It is suggested that some minimum protection for existing consumers be included in connection standards. Inadequate engineering in the interest of cost savings is likely to create issues of electrical disturbance and quality.

There is an assumption in the proposed regulations that existing connection applications don't already cover the possibility of DG or are already compliant. Regulation may not result in a noticeable change which raises the question about whether its upside out-weighs the downside.

Interconnection Approval para. 54-58

It is suggested that the connection voltage is a better indicator of the technical difficulty/cost of connecting DG than capacity. This inherently incorporates issues associated with distance from load, etc. Rural 11kV distribution feeders can have very small capacities (i.e. below 100kV). Connection of relatively small generation capacities can be beyond the technical capability of the network.

How long an application takes to approve is a matter of the process a company adopts. The network owner may not provide any technical design input into the process themselves. They simply require the applicant to demonstrate that the engineering is adequate to comply with their Connection Standards.

Similarly many network owners do not offer contracting services and therefore don't provide quotes on the cost of establishing a connection. The contractor has the responsibility for ensuring their proposal in compliant with the networks connection standards.

It is common for the customer to have no direct contact the lines company at all. They contact their retailer to make application for connection and if a connection is needed they would contact an electrical contractor of their choice who manages the approval process on their behalf from that point. The retailer will often add their own connection requirements, such as metering standards, during this process.

Some connection standards require the customer to have a signed agreement with a retailer before they are permitted to connect to a network. This is because the lines company has no direct contract with the customer and must procure compliance with its standards and charges via its Use of System Agreement with the retailer and their contract for supply with the customer.

In this scenario a DG investor would run into barriers if they couldn't find a retailer willing to sign them up (for which there is no obligation on the retailers behalf) or they couldn't find a contractor with generation experience willing to do the job. This is a very real issue in provincial NZ where such capabilities aren't readily available and unlikely to ever be a sustainable business. Similarly there may be only one retailer for the customer to choose from.

For example, on the East Cape customers have difficulty hiring an electrician and they end up as price takers to achieve a satisfactory response.

It should also be recognized that neither a line company or a retailer are actually required to have any technical capability themselves. They are equally dependent on external resources when required to deal with technical issues beyond their normal scope of operation. Where response is slow it is more likely to be a case of inability to respond rather than deliberate non-cooperation.

Dispute Resolution para 59-62

It should be recognized that companies will already have processes for dispute resolution compliant with the Electricity Complaints Commission requirements. As this covers both retailers and line company there is merit in preserving consistency with industry practice.

Paying for Connection para. 63-86

The fixed charges a consumer pays is a combination of transmission, line company, and retailer fixed cost recoveries and not the "line charge" as is commonly misunderstood. For some line companies the bulk of the revenue is recovered by variable charges and there is regulatory pressure applied to encourage this.

When a connection is shared as both a point of supply and energy injection, then effectively the generation results in a reduction in variable revenue for suppliers (retailers and line companies). Inevitably this will be compensated for by increases to other consumers.

There are wide a range of price control issues associated with the proposed regulation that will need some more thorough investigation to avoid conflict with other regulatory objectives.

Again contractual issues will need to be clarified. Currently it is the retailer that charges the consumer and pays the line company. The proposed regulation assumes this relationship remains. There are no obligations for retailers to pass through lines charges and in many instances the line company charges to them are not structured as retail tariffs able to be directly reconciled down to ICP level.

Which entity has operational control increasingly becomes an issue as the scale of DG increases or the

extraction of benefits is maximized. Network operation changes from distributing capacity to managing power flow in much the same way as Transpower operates the grid. This is more complicated requiring different control systems and management practices.

With regard to the costs associated with connection of DG listed in Table 1 the following comments are made:

- Dedicated assets up to the point of connection are essentially no different to the cost of establishing service connection for a point of supply. The same costs, ownership, establishment processes can continue without the need for reinvention.
- Control equipment in general is likely to require upgrade. As a minimum DG needs to be automatically disconnected in the event of network faults. Reconnection then requires synchronization equipment, the ability to stage the connection of cold load, etc.
- Customers using DG may require it to be backed up (secured) by the network. This will tend to negate avoided costs it may deliver but also raises the issue of how the costs of providing the backup are to be recovered if charges continue to be based on energy sales volume.
- The depth of network upgrade (including sub-transmission) that may be required to accommodate even relatively small quantities of DG should not under estimated. Under recovery would result in subsidized support from existing consumers and uneconomic investment decisions.
- The risk of stranding assets is normal commercial risk faced by networks. It only arises when asset investment is no longer optimum and value/pricing hasn't been adjusted to compensate. Charging losses resulting from asset stranding is only possible in monopoly situations and would, in CAE's opinion, distort economic price signals.

The following comments are made with regard to the benefits of DG listed in Table 1:

- To realize maximum transmission benefits requires an operating regime driven and dominated by Transpower's pricing methodology. Similarly the scheduling of generation may need to be highly coordinated with other load management activity. The pass through of benefits therefore should recognize that without line company management effort the benefits are unlikely to be accessible. If existing load has contributed or enabled benefits to be derived then there is a case for sharing those benefits with consumers. More investigation into the relative fairness of benefit sharing is recommended.
- While transmission benefits are often quoted there are not clear mechanisms for tangible benefits reach to the DG investor.
- Benefits such as improve asset utilization and avoided upgrade only exist where there is an issue of constraint. While the benefit can be large they only exist in niche circumstances and therefore regulating their pass through cannot be achieved on consistent basis. The focus should be placed on ensuring the least cost solution is implemented and has included an assessment of the contribution DG could make to the solution.
- Doing nothing is easier for a lines company as innovation has potential to be stifled by the regulatory environment. For DG investment to improve in NZ line companies need to be encouraged (possibly even incentivised), and fairness issues addressed with regulatory control on retailers.
- Where the retail market is captive by a single retailer competition is imperfect and retailers have the ability to maintain a monopoly premium on their pricing. Despite DG being more efficient and therefore worthy of a higher place in the merit order, retailers can use their existing customer base to hedge their existing generation.
- Large consumers exposed to the spot market can use DG as a form of physical hedge. As they are competing against supply from their retailer in this scenario they will require regulatory controls to level the playing field.

To place controls on deep connection charging would potentially be very intrusive on line company management.

Shallow connection charging needs to meet a basic test that the introduction of a DG proposal actually delivers an economic "common good" benefit that can be shared by all contributors to the average costed component of the proposal.

A major concern is the cost impact associated with sub-transmission upgrade, which may be very large in some circumstances. Shallow connection charging would see this cost being average costed across all users. Large consumers are likely object to the cost burden (which may incentivise by-pass) and retailers are likely to object when the DG is owned by a competitor.

Shallow connection may prevent the unbundling and pass through of transmission benefits. This issue can be addressed by requiring Transpower's pricing methodology to treat grid and non-grid connected generation more equitably such that transmission charges are treated as a separate issue.

Shallow connection charging is not recommended for larger embedded generation scenarios.

Grid connected generation that connects to the core grid essentially benefits from a shallow connection charging mechanism. Core grid costs are average costed and paid for by all end users (including DG owners via line charges) even though they may not use the transmission system at all.

Attention is drawn to para. 74. This statement is factually incorrect as DG is likely to trigger substantial sub-transmission upgrade wherever the primary necessity for higher voltage is a matter of distance as opposed to the size of the load at the end of a line. This is common in rural networks.

An extreme example is Te Araroa on the East Cape. This township is supplied via a 200km long 50kV line but only presents a peak demand of 500kVA. The line is not capable of distributing generation exceeding 1.5MW.

When DG is relatively large compared to the GXP base load, export to the grid may occur. This adds further complexity to pricing, charging retailers and calculation of benefits.

Some networks have no sub-transmission system i.e. they are supplied from the grid at 11kV. In these circumstances, not only is the next highest voltage likely to be 110kV, which would be very expensive to connect to, but there would be inconsistency with pricing terms between customers connecting to a distribution network or to Transpower's network.

The question is should generation connecting at voltages higher than the primary distribution voltage (typically 11 or 22kV) be considered as distributed generation or transmission (i.e. including sub-transmission) connected generation, in which case different pricing rules might be appropriate.

Assessment of economic viability clearly needs incorporate all transportation costs particularly when benefits associated with competitive position resulting from lower delivery costs are being used to justify the project.

The proposed regulation suggests that connection payments be spread over a 15 year period. Companies with high debt levels may struggle with this condition particularly if the cost of capital increases from current rates. This assumes the company can obtain funds and service debt on sufficient terms for its investment to prove economic. If not then value loss will result contrary to company, shareholder, and ultimately consumer interests. The issue is why should a power company forced to provide banking services? If the investment is economic the DG investor can borrow the capital to spread costs.

The issues raised in para 84 are exactly the same that are required to be resolved every time a service line in built for a new connection.

Firstly it is noted that these lines can be very expensive. For a 33kV costs can easily exceed $50,000/km.

Strict interpretation of ownership law would assume that if a line is dedicated to the use of a single connection and that they have fully paid for its cost then the customer owns the asset from the point of its connection to the existing network or until they agree to a change in ownership. When the line

company accepts ownership the point connection shifts to the new ownership boundary and the line company then has an obligation to connect any new customer, making such a request, to that line which now forms part of its network. Neither party has a right to force an ownership change and the terms of transfer is made as a matter of private transaction. Often transfer is made at nil cost to reflect the liability of ownership.

There is no necessity for a network to be involved to reapportionment of costs when a new user wishes to connect. If the owner believes there is some potential for future benefits they can choose to retain ownership or negotiate up front value in their sale price.

Recognition of Benefits para. 87-91

This submission has outlined some of the practicality difficulties with accessing benefits, identifying them, and passing them through to the DG investor. In addition only some of the benefits are related to line issues.

Contracting long term positions on pricing to add certainty for investors would require some equivalent surety over Transpower's pricing position. The issue is who takes the risk; line companies or the investor? When line companies carry risk it is really the power consumer that bears the consequences given that in most cases the shareholders of NZ line companies are communities not private investors.

The discussion paper suggests that 85% of avoided transmission cost be passed through. The question is how are the savings to be calculated and by whom? A difficulty with regulation is that unless it is extremely prescriptive its objectives are easily defeated in practice.

Line companies have no obligation or commercial need to minimize Transpower's charges. Technically they are just collect Transpower's revenue, which they are required to do will minimal added costs. This is a result of the contractual structures in the industry. If charges go up they pass them through. They have no input into setting of those charges and even the setting of the pricing methodology is a unilateral exercise.

Very few networks have a contracted position with Transpower and pay posted terms as a matter of regulatory obligation.

Any action on the line companies behalf to reduce charges is a matter choice driven by an interest in their local economy. The Commerce Commission's proposed pricing controls may not let companies keep the 15% benefit suggested and acts to discourage line companies attempting to innovate and create dynamic efficiency but removing the returns that they require from their investment.

An approach might be for line companies to disclose any opportunity they have identified along with the benefits they are prepared to pass through (which are required to be the same they would pay themselves) to any investor. If no investor came forward then the line company could make the investment as the last resort without restriction on ownership, etc.

Interconnection Safety Requirements para. 92-96

Safety requirements are a matter of legislative compliance and are accordingly already disclosed in the Electricity Regulations. The issue is whether there is any justification for connection standards to be more onerous than regulation.

Line companies as HV operators (and more specifically their staff) carry the ultimate legal responsibility for safety of on a network. It is not reasonable to expect them to be accountable for safety if their better judgment is over ruled.

Operating protocols at the interface between network management and generation will need to be agreed.

There are currently minimal guidelines on acceptable impacts DG will be permitted to have on the security

and quality experienced by other network users. Without established industry standards line companies will be exposed to criticism about the hurdles standards inherently present.

Disconnection para. 97-99

When a line company has no direct contract with a generation owner then it has no legal right to disconnect for breach of contract terms. This has proved to be an issue for off-take contracts and is complicated by the obligation to supply.

Careful consideration of how these regulations are drafted is needed to cover connections that provide dual functions as injection and off-take points. The extent of line company control ends at the point of connection while generation may be deeply embedded within the installation or a secondary network (in which case its disconnection may affect multiple consumers).