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**Input methodologies review, Invitation to contribute to problem definition,** 16 June 2015

**Submission, Molly Melhuish**, 24 Aug 2015 04 568 4873, 027 230 5911

I appreciate the opportunity to submit on the review of Input Methodologies (IM), and to have made a statement at the IM Forum earlier this month.

My approach is regulatory, NOT political, nor even as an advocate for consumers or sustainable energy businesses.

As convenor of DEUN (now in recess) I am well aware of the political nature of electricity regulation: politics is about winners and losers. Regulation in contrast aims to control conduct towards some declared purpose; its success or failures are to be measured by some declared methodology or criteria, for example benefit to society as a whole, and/ or economic efficiency, and/ or (in the case of electricity) reliability of supply.

Part 4 of the Commerce Act relates to markets where there is little or no competition and little likelihood of a substantial increase in competition. The purpose of subpart 3, Input Methodologies, is to promote certainty. However where disruptive technologies are destroying certainty by competing with network services, to the degree that network asset values are at risk the pure application of subpart 3 is in question.

The proper response is to revert to the purpose of Part 4 itself. In brief, suppliers of regulated lines services need to be given incentives:

a) to innovate as well as to invest in their own assets.
b) To improve efficiency
c) To be responsive to consumer demand including price
d) To share with consumers the benefits of efficiency gains
e) To be limited in ability to make excessive profits.

I suggest that this purpose needs to be extended to include situations where non-network services – the Electricity Authority would call them "network alternatives" – are in fact competing with supply from the (formerly) monopoly assets. Local generation embedded in distribution systems clearly compete with transmission assets – especially where they can reduce peak demands. More widespread and therefore important, household insulation and heating with wood burners reduce peak demands when they matter the most, in winter.

At the IM Forum, I spoke of two priority problems involving the IM, and a third problem that applies to all electricity regulation.

First problem: Residential electricity prices are now higher than the market will bear. Figure 1 is taken directly from MBIE's electricity data sheets: the squares are the long-term series of average residential prices in nominal terms, the second is the Quarterly Series of domestic

electricity prices, also nominal, and corrected recently by MBIE back to 2004. The two are remarkably similar, even though one is based on sales, the other on tariffs.

Many consumers are able to invest to reduce their power bills; many of those who can't are living in cold damp houses and suffering illness, even death, or arguing about whether to heat or eat, or forgoing other budget essentials such as quality food or medical expenses. In recent years, transmission prices have contributed the most to the price rises. Some distribution prices have risen already; for others, price rises are likely to be ahead.

These problems are enabled or exacerbated by gaps in responsibilities between the different relevant agencies:

a) The Electricity Authority (EA) considers price levels to be the full responsibility of the Commerce Commission; the EA only considers price structures. Questioned whether consumers should pay for surplus transmission capacity that will not be used for many years, even decades: "Sunk costs, nothing to do with us!"
b) Social and environmental impacts of electricity supply and demand are considered by the EA to be the responsibilities of other government agencies, including social development, health, environment, climate change, and others.
c) The Electricity Authority appears to consider monopoly profits to be a benefit to consumers.[1] In contrast, the Commerce Commission must at the very least consider the impact on consumers of regulation that allows or even supports regular price rises. In recent years, transmission prices have been the largest contributor to the rise in average NZ residential electricity prices.
d) This treatment in silos of this essential service has so far made public consultation a sham: "it's the other guy's job".

Second problem: The Commerce Act requires the Commission to consider energy efficiency, also innovation. Providers of sustainable end-use energy services wonder whether "innovation" includes provision of "network alternatives" as well as innovation by the lines companies themselves.

How does IM treat end-consumer investment in existing? new? technologies which reduce demand or add supply, or which change timing of demand on the system? How about lines company investment in battery storage, or even PV? Are these in competition with consumer investment in the same? Should such investments become part of their regulated asset bases?

Most important, can regulation give incentives for cooperative investment, even if that reduces the lines company's sales base? (e.g. revenue caps not price caps, as discussed in a meeting with consumers at the MEUG premises)

e) The single type of consumer investment that (I believe) has most influenced residential demand is home insulation. How much has Government's withdrawal of insulation subsidies led to reduced residential demand? How

[1] https://www.ea.govt.nz/dmsdocument/9494 (Interpretation of Statutory Objective, Electricity Authority, especially sections A5 ff.

much has peak demand reduction affected cost of supply of distribution services? Transmission?

f) Costs to a network company (including Transpower) are mainly caused by peak demands, while revenues, at least of local lines companies, are mainly (fully?) dependent on kWh demands. Almost all NZ has winter peak demands, with only rural areas with irrigation loads peaking in summer. Thus the most important type of consumer investment is non-electric heating – of which wood burning is the most widely relevant, and preferred by many consumers. (Natural gas is not very widely available, especially as their high fixed charges have led many consumers to disconnect from the gas grid. LPG heating is cheap in capital cost but expensive to run, and nasty (on health).
g) Rooftop photovoltaics, especially in combination with either batteries or electric vehicles, seems to be seen as the biggest "disruptive" consumer investment. That may be true in future; it certainly is not yet.

Third problem: Direct representation of residential consumers is virtually absent in Commerce Commission consultations. The Major Electricity Users' Group has made a point of analysing impacts of regulatory proposals on residential consumers, and has invited me and occasionally other residential consumer advocates to some of their meetings with regulators (thank you Ralph). But their agenda largely relates, as it must, to industrial consumption and transmission pricing.

Energy service and distributed energy providers have even scantier representation. They have not (until very recently) put their heads around the legal and economic issues surrounding their poorly competitive positions, either for kWh or for kW, much less for supply of ancillary services. Yet distributed energy resources (DERs) are capable of deferring lines company investments, often (perhaps usually) at lower cost. Just three examples:

i) Small-scale hydro was the original New Zealand electricity resource; it is still important, and offers much needed competition especially where regional electricity markets are not the subject of aggressive competition between retailers. Embedded hydro generation can often provide energy, especially peak energy, at lower prices than those offered from central power stations plus network prices.
j) Home wood burning reduces peak demands. It could even become a realistic dry-year supply through use of "advanced gasifier burners" (I attach a description of these that I prepared for Environment Canterbury's Air Plan.) These differ from normal "approved" wood burners by passing the combustion gases through incandescent charcoal (in a down-draft configuration), and having the secondary chamber extensively insulated. Their emissions are reliably a tenth or less those of an approved wood burner; more importantly once started on seasoned wood, they are able to accept partly seasoned or even green wood. They can enable even landscaping wastes to be burnt cleanly so long as branches are straight enough to drop down the fuel bin without hanging up. The prospect of "urban forestry" has just acquired a new meaning! This technology is over a hundred years old, but largely forgotten.
k) Battery storage could detect changes in system frequency and inject (or withdraw) energy programmed to mimic true spinning reserve from high-inertia turbines. At the

same time, such a system would protect a household or a home-based business in case of a major power outage (for that, the storage quantity would need to be far greater than a standard Uninterruptible Power Supply).

**Discussion**

More than one presenter in the IM Forum described today's electricity regulation as facing "a fork in the road" – for example, Orion Networks. That's because the regulatory arrangements that protect investor asset values invariably sideline competing embedded and end-user investments, especially those that reduce peak demand. For the IM analysis, it is reduction of peak demand that is most important.

I request that the economic issues be described in terms of what I call "fork-in-the-road" analysis, as described in the papers by Rocky Mountain Institute[2]. Once either the business-as-usuaI path or the distributed resources path is chosen, the cost of switching to the other is increased. Transmission and generation assets have each expanded by some $3 billion or more in the last few years. The possible stranding of these assets is perhaps the major underlying concern in recent consultations including the current one.

Further, I'm keen to examine legal impediments to regulatory change (by the way the much-loved Low Fixed Charge regime is at present protected by the Electricity Act, but the Electricity Authority is engaged on an initiative to remove Low Fixed Charges).

So here's my framework for describing problems with IM as it is now.

1. Differing purposes of Commerce Commission and the Electricity Authority: The Part IV purpose is much more inclusive of issues residential consumers care about, including lower prices. The EA Consultation Charter (section 2.2) specifically protects investors against "unpredictable and ill-founded amendments" to the Electricity Code, so as to maximise investor certainty.
2. Differing scope of what the two regulators may consider: EA specifically excludes climate change and social impacts.
3. Differing emphasis on aspects of economic efficiency; EA gives high priority to "dynamic efficiency" (implying ability to expand the business by use of monopoly profits which they claim are a benefit to consumers). ComCom analysis gives some weight to other efficiency measures.
4. Regarding consultation: Both regulators are highly technocratic, and fail to incorporate preferences and choices of residential consumers. Residential users use a third of NZ's electricity, and pay half the industry's revenues (it appears this figure, total revenues, which used to be on the electricity statistics page of the Energy Data File, is no longer available??). What process is correct for New Zealand to take account of consumers' views – is a slow-down of power price rises sufficient? Or do residential consumers have a legitimate expectation of being offered tariffs that allow them to actually reduce their power bills, perhaps dramatically, by offering valuable flexibility? It is distributors who can make best use of flexibility offered by residential users to reduce their own costs.

[2] http://blog.rmi.org/blog_2015_07_01_the_grid_is_at_a_fork_in_the_road

5. Identify winners and losers from each path. In particular: residential consumers, major electricity users, large-scale generators (from gentailers?), Transpower, lines companies, central government's take in form of tax and dividends. Also, businesses providing end-use energy services to householders and small commercial users, especially energy audits. And home insulation. And firewood merchants who can ensure dry wood is available through the winter (kilns), and manufacturers especially of advanced gasifier burners which can be used in any airshed. And of course suppliers of PV and batteries, being viewed as a major disruptive technology to the electricity sector's growth agenda. In fact, home insulation and firewood appear to have been the main factor in reducing per-household demand to date.

**Economic methodology**

The Electricity Commission, just before its replacement by the Electricity Authority, commissioned NZIER to prepare an integrated cost-benefit analysis of its market development programme.[3] This was never opened to consultation, but it has underpinned some unconventional features of the Authority's economic methodology, especially the ignoring of transfers of wealth.

In my experience, the Authority has followed this methodology to the letter, ever since. To a scientist, its main feature seems to be its reliance on an often arcane representation of reality by an economic model, and a total reliance on that model to calculate, often to four significant figures, costs, benefits, and net present values, without reference to real-world experience.

A more conventional approach has been taken by Andrew Shelley (ASEC) in his reports supporting submissions on Transmission Pricing Methodology (TPM) by Electra and the Independent Electricity Generators' Association. [4]

Shelley finds that distributed generation is a true competitor to expansion of transmission assets: for example,

> The [Shelley] report of January 2014 developed a hypothetical example based on the costs of real-world distributed generation projects and Transpower's cost estimates for the Woodville-Mangamaire-Masterton A line. That analysis concluded that for a load of 125MW growing at 2% per annum, meeting demand growth by way of distributed generation rather than transmission could provide an NPV benefit of $7m.

[3] An integrated cost-benefit analysis of the market development programme , Prepared by the Electricity Commission 13 August 2010 Updated Feb 15 2011: https://ea.govt.nz/dmsdocument/9530

[4] Andrew Shelley (ASEC) for the Independent Electricity Generators Association on the Transmission Pricing Methodology Options consultation https://www.ea.govt.nz/development/work-programme/transmission-distribution/transmission-pricing-review/consultations/ Click on Independent Electricity Generators Association - supporting ASEC document - IEGA-submission-supporting-ASEC-document.pdf (PDF, 425 KB) See also his report attached to the Electra submission

He found that the proposed removal in the TPM proposal of payments to local generation for "Avoided Cost of Transmission" (ACOT payments) would favour transmission and inhibit competition from local generation.

In my view, the TPM would therefore impact strongly on distribution companies' asset management plans, which in turn would seem to determine their annual revenue requirement (whether or not the company actually spends the full allowance permitted by the input methodology). I have repeatedly raised the issue of poor consultation processes on distributors' asset management plans, which would seem the ideal locus for integrated resource planning that incorporates distributed resources whenever they are more cost-effective than expansion of the transmission system.[5]

The Rocky Mountain Institute has published an extensive paper which offers economic analysis of "load defection" – a much more sensible result than defection from the grid itself.[6]

The present regulatory environment requires investors to rely primarily on a price signal as an incentive to expand network capacity, rather than a consultative planning process. Pricing methodology that is designed for consumer benefit, as is appropriate in most United States regulatory systems, is described by the Regulatory Assistance Project. [7]

Shelley says:

> The conceptual economic issues raised in this report suggest that the starting point for settling upon a TPM option is to agree a model of the optimal development of the electricity industry over time (local generation, distribution, transmission, and remote generation), and then establish the prices that are consistent with that model. **This may require a joint determination process involving both the Authority and the Commerce Commission** [our emphasis] so that industry participants can be assured that the two regulators are not working at cross-purposes.

## Two scenarios for New Zealand

My first scenario is a continuation of the Business as Usual development and regulation to support it. The Input Methodology Review to date is founded on this model, but its fourth task is to identify whether that needs to be modified in view of the penetration, which could increase rapidly, of "disruptive" distributed energy resources (DERs).

My second scenario enables DERs to cooperate rather than compete with traditional network investment. This type of scenario has seldom been described in any detail. It relies on energy resources over and above electricity, including direct heat from fuel, solar water heat, etc. In doing so it could make a great difference in how electricity is developed in future. It could,

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[5] Those who abhor the "planning" concept in the phrase "integrated resource planning" may prefer to contemplate "integrated resource trading" as suggested by Laun at the World Energy Conference 2002 – slide 26, of my presentation
http://www.sef.org.nz/papers/melhuish2002.pdf
This presentation describes a great variety of distributed resources that could be deployed to improve reliability, rather than to compete for provision of kilowatt-hours.

[6] http://blog.rmi.org/blog_2015_04_07_report_release_the_economics_of_load_defection

[7] www.raponline.org/document/download/id/7680 (Smart Rate Design for a Smart Future)

perhaps would, also significantly, perhaps greatly, erode the asset values of any overbuilt network (and also generation) assets.

It would be worth requesting ASEC to conduct a full economic analysis of these two scenarios in the New Zealand context.

**Vision**

In an ideal world where DERs would work in cooperation with existing network assets, the overbuilt generation assets and network assets would be utilised as fully as possible – PV rooftops would be less relevant than household battery installations which enable the potentially costly peaks – 7-9 am and 5:30-8:30 pm, to be avoided. This would displace the eight open-cycle gas turbines that MBIE's "green growth scenario" says would be needed by 2050. Of course it would also displace planned network investment – as well as existing investment such as the 400kV Waikato to Auckland line. Regulation to promote rather than suppress DERs might also enable dry year hydro generation to be supplemented by efficient wood burning.

The most dramatic benefit of the second scenario is its impact on climate change – no need for coal as a dry-year reserve, no effort needed to expand gas storage in depleted reservoirs (Contact's Ahuroa project). Little need to transport domestic firewood resources from the central North Island to Wellington (but need to develop technology to convert branchwood from landscaping into straight pieces of uniform length to drop smoothly down the hopper of a wood burner). Thus the transport component of household wood burning would be almost eliminated.

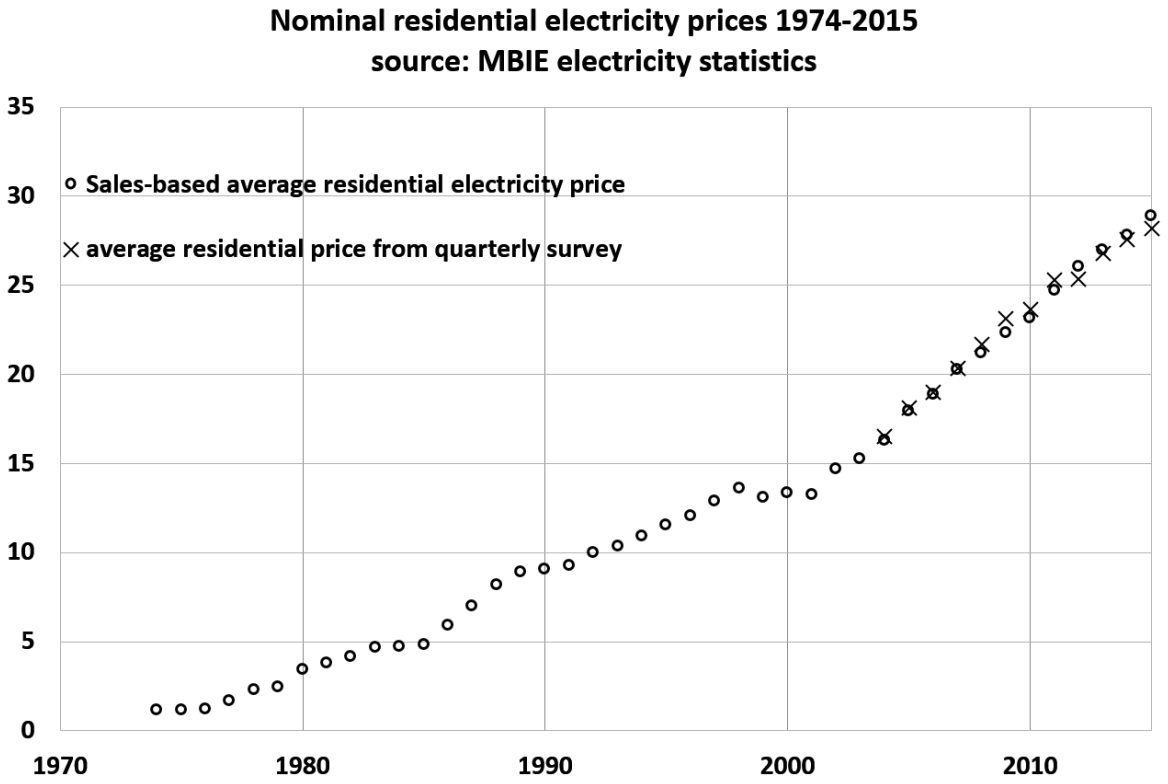
There is no need for hundreds of thousands of households to invest in such wood burners, or even in rooftop PV. NZ's reserves of flexible hydro are sufficient to arbitrage the remaining variability, so long as peaks and dry years are addressed through efficient wood burning by the heaviest-use households, and summer peaks are addressed through solar + battery systems, especially of the higher-use householders. Remaining issues including wind generation ramp rates would be managed through the existing hydroelectricity resource.

The remaining householders should enjoy lower, not higher, power bills as any remaining near-zero-cost hydro flexibility is available to smooth out their required demand peaks.

And of course, the distribution of jobs in distributed generation and energy service industries is exactly what benefits the NZ economy the most.

Most important, climate change impacts of both the electricity sector and transport will be dramatically reduced by substitution of gas-fired peaking, and oil-fired transport – by truly renewable firewood and solar energy used in electric cars, delivery trucks, short-range "shopping vehicles", motorbikes, and especially electric-assist bicycles. All this could be enabled by a transmission and distribution system designed through integrated resource planning, and operating through integrated resource trading.

**Figure 1**




**Attachment: Advanced Gasifier Burner for residential use**

Melhuish submission to Canterbury Air Resource Plan, 1 May 2015

**About the Advanced Gasifier Burner (AGB)**

Advanced gasifier burners (AGBs) are a step-change beyond low- and ultra-low emissions wood burners (LEBs and ULEBs). AGBs are able to burn even green wood once combustion is fully established, with no more particulate emissions than when they burn seasoned wood. Fuel quality depends not on moisture content, but on shape and size, as awkward shapes could hang up inside the fuel bin; you want straight pieces of even length.

AGBs establish a layer of incandescent charcoal on a grate where the pre-heated primary air enters, and let the firewood warm gradually as it drops onto the burning zone. First the resins and moisture in the wood, then the cellulose, are vapourised and drawn downwards to react with the charcoal to form hydrogen and carbon monoxide. This burns cleanly, with the hydrogen quickly burning up any smoke particles that might remain in the secondary chamber.

This requires the secondary chamber to be insulated so it becomes hot enough to ignite the fuel gas. In the Cave burner, the fuel bin is also heavily insulated and fully sealed, but the top of the fuel bin and secondary chamber are simply heavy steel plate acting as a stove top and space heater, like the well known Pyroclassic. The Best burner will take most of its heat off as hot water.

Both types of AGB are far less subject to operator error than LEBs and existing ULEB designs, but both could be abused by burning unsuitable materials such as treated timber, plastics, or old socks. What matters for the Air Plan is whether AGBs would create more or less pollution than LEBs or ULEBs when unsuitable fuel is used.

On the face of it, the fact that all the combustion in AGBs occurs in the gas phase means the heavy metals are likely to stay in the ash. But the arsenic will go up the flue – a complete no-no, as are any chlorine-containing plastics. And boron-containing older treated timber will corrode the refractory linings. The operator is unlikely to trust treated timber or plastics in a burner in which the combustion surfaces are contained deep within the burner itself, lest they become clogged. Any abuse therefore is sure to be less of a problem in AGBs than LEBs.

AGBs however are likely to have a very different effect – they will be a serious competitor to electricity in the home heating market. The ease of burning landscape arisings, whether dry or green, will make fuel supply very cheap for those people who can be bothered to collect it locally. The very high efficiency means less firewood to cart and store, and the ease of burning wood with high moisture content means less management of firewood storage. Their automated operation will be attractive to busy owners who are not skilled in laying a fire – the Cave burner can leave a deep layer of charcoal which cools down gradually over two or three days, and this can simply be re-lit, if necessary with barbecue fuel.

If AGBs cost on the order of $10,000-15,000, as has been suggested in some quarters, this is still no more than the installed cost of many solar rooftop systems, though the price of those is falling as the market develops. The market for rooftop PV is growing rapidly, and that will be the case for AGBs as well. Unlike solar electricity, AGBs give extra value as they will displace electricity generated from gas-fired stations at times when transmission and distribution loses are high.

The electricity industry labels solar as a “disruptive technology” because it reduces their sales and profits. Meridian cut its solar buyback rate from the retail 25 c/kWh to 7c in summer and 10c in winter, and Contact Energy also slashed its buyback rate. This made solar rooftops uneconomic for many or most – until Vector and Solar City entered the market with some very attractive financing deals.

Environment Canterbury’s PM10 rule limiting the lifetime of LEBs will make them uneconomic for many people. Instead of banning wood burning outright, ECan is requiring them to be replaced by ULEBs that cost twice as much or more, and still require high quality firewood to burn cleanly. This is an economic attack far, far outside of the requirements of the RMA which require the purpose of reglation to be identified (protecting health from air pollution) and the most cost-effective solutions identified.

Both Government and industry have heavily promoted heat pumps since about 2000. Yet Government’s Warm Homes/ Clean Heat scheme found that 70% of the clean heat applicants chose wood burners over heat pumps. But these make a householder even more captive than before to the electricity industry and more vulnerable to electricity price rises.

The most exciting potential of AGBs will be realized if the industry stops punishing disruptive technologies with low buyback rates and a move to increased fixed charges. Instead they should contract with householders to supply a dual-fuel system that reduces the overall cost of electricity supply.

Unlike solar energy, AGBs can provide energy whenever the householder, or the electricity supply industry, chooses. Best's AGBs are particularly suited to storing excess energy as hot water in thermal buffer tanks, as they will capture the heat of combustion in hot water. An electric element could be added to absorb surplus electricity – while a thermoelectric element in the burner could provide around a kilowatt of electricity at times when centralised supply is short. Cave has designed his burner at a very low 3-4 kW output, suitable for smaller houses, and has less need for heat storage.

If only the electricity industry approached wood burning using a cooperative rather than a competitive pricing model, AGBs could benefit both centralized suppliers and consumers. Thermal storage at consumers' premises is considered by IEA to be the most cost-effective way to integrate solar and wind intermittency into an electricity grid. But those benefits will not be realized until or unless the current electricity surplus disappears, or else the Electricity Authority's pricing models are changed to reflect long term benefit to the national economy, including environmental sustainability and climate change.