To: Ministry of Business, Innovation & Employment
Email: energymarkets@mbie.govt.nz

Date: 22 February 2019

From: Engineers for Social Responsibility Inc
9(2)(a) [redacted]
[redacted]
[redacted]
www.esr.org.nz
President: Professor Thomas Neitzert 9(2)(a) [redacted]

Engineers for Social Responsibility Inc. is an independent group of engineers who consider that being knowledgeable in the field of technology means that they also have a special obligation to the public at large. This includes raising the awareness of the engineering profession to the consequences of its activities and explaining and discussing the ramifications of developments in engineering and engineering works to the public.

Submission in response to: Process Heat in New Zealand: Opportunities and barriers to lowering emissions Technical paper January 2019

General

The key authors of this report are Thomas Neitzert and Peter Whitmore. Thomas Neitzert is a professor emeritus of mechanical engineering at Auckland University of Technology and has a background of leadership positions in industry as well as academia in New Zealand and overseas. Peter Whitmore holds a PhD in chemical engineering from the University of British Columbia in Canada. He has experience working in glass manufacturing and metal processing industries and then later ran his own business.

One of the aims of the 2015 Paris Agreement is: “Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.” New Zealand ratified this agreement and therefore needs to play its part in achieving the agreement’s aims.

The recent IPCC report, (Special Report on Global Warming of 1.5 °C, October 2018) very strongly drives home the need for urgent action to stay within the 1.5 °C threshold, with its statement that governments around the world must take "rapid, far-reaching and unprecedented changes in all aspects of society" to avoid disastrous levels of global warming.

The report also says that to retain the possibility of holding global warming to under 1.5 °C above pre-industrial levels, overall global emissions need to fall by around 45% and coal emissions by around 68% below 2010 levels by 2030, with net emissions falling to zero by 2050. However, these are global reduction figures. Since New Zealand is a developed country with strong professional expertise and resources, it needs to aim considerably higher than this: perhaps for a reduction over the 2010 to 2030 period of 60% for overall non-agricultural emissions and 100% for coal-based emissions.

Note that the IPCC reductions are based on comparing net emissions in the future year with net emissions in the base year. The New Zealand Government has a history of defining emissions reductions by comparing net emissions in future years with gross emissions in base years. This is highly confusing, particularly since the difference in measurement methods is generally not made clear, and it makes the target reductions look

greater than they actually are when determined on a consistent basis. We need to move away from this comparison of apples with oranges immediately.

There are two key ways the government can drive reductions in emissions: (i) by legislative methods; and (ii) by carbon pricing. It has so far chosen primarily the second route, but carbon prices under our ETS are still too low to have much effect, and only recently reached the $25 per tonne CO_2-e that was signalled when the ETS was first legislated in 2008. Also, many trade exposed industries receive some free units, so the average price they pay per unit is less than $25.

While the Process Heat in New Zealand report covers a lot of useful points, and while a few organisations have already achieved significant reductions in their emissions, for many others fossil fuels remain the simplest, least expensive and best understood option to provide heat. Moving away from them would require capital funding, installation of new equipment and processes, and the expertise to achieve this.

Our conclusion is that, in general, it is not the cost, the expertise required and the potential risks involved in moving away from fossil fuels that are holding us back, but rather the fact that for many users these fuels remain the simplest, least expensive and best understood options to provide heat. If the carbon price were sufficient to drive change, then this change would happen.

(Dollar conversion rate used from 19-2-19, US$1 equivalent to NZ$1.46.)

Carbon pricing.

(This covers some of the points raised under Q1-Q4, but is broader than this.)

In order to achieve the reductions in emissions of 45% in overall global emissions and around 68% in coal emissions, the IPCC says in its recent report that carbon prices (CO_2-e prices) need to be in the range of US$135 (NZ$197) to US$5,500 (NZ$8030) by 2030. As stated earlier, it is appropriate for New Zealand to aim for higher reductions than this, perhaps a 60% reduction in non-agricultural emissions and a 100% reduction in coal emissions by 2030.

If we are going to rely primarily on carbon pricing to drive change, then in order to have phased out of coal by 2030, our understanding is that the carbon price needs to rise very rapidly, within say 2-3 years, to well over $100 a tonne so that options other than coal become economically viable. Based on the IPCC figures, further price increases will also be necessary beyond that.

The free emissions units currently provided to trade exposed industries also have to be rapidly phased out. As noted in the Process Heat report, currently highly EITE activities (emissions intensity greater than 1,600 tCO_2-e / $1 million revenue) are covered for 90% of the ETS cost exposure with gifted NZU's while moderate EITE activities (emissions intensity greater than 800 tCO_2-e / $1 million revenue) receive a 60% free allocation. This means, for example, that highly EITE activities are currently paying an average price of around $2.50 a unit.

These free units are a gigantic blockage to achieving change. A far more effective way of proceeding would be for the government to provide some financial assistance to businesses that make the change away from fossil fuels. For example, this could be financial assistance with moving to new operating equipment or a short-term subsidy on the renewable energy source that was replacing fossil fuels.

Beyond the points above, the cost of the damage that carbon emissions are causing, often referred to as the social cost of carbon (SCC) also needs to be considered. There is a wide range of figures for this, probably partly because entities with an interest in retaining fossil fuel use want the damage cost to be seen as low. However, a recent paper (Moore F and Diaz D, Nature Climate Change, **5**, 127-131, 2015) has placed this cost at US$220 (NZ$321) / tonne CO_2.

When users are paying less than the damage cost, the cost of the damage their emissions are causing is being subsidised by others. This does not make economic sense because it reduces the financial incentive for

emitters to take the damage cost into account when deciding how they should operate. It is also grossly unfair to others who have to bear this cost.

It needs to be noted that higher carbon charges are going to result in higher prices for some goods and services. To be both fair and politically viable, a significant part of the revenue from the carbon charges will need be to returned to the general population, for example via a citizen's dividend. People will then generally not be left worse off by the carbon charges, but will face changes in prices that will be a driver in their assessment of what goods and services they choose to use.

Electricity

(This covers some of the points raised under Q15–Q18, but is broader than this.)

Electricity is potentially an energy source that can meet some of the demand for those moving away from fossil fuels, but there are several significant issues in this area that need to be addressed. (See for example, Bertram, I G, Submission 1 and Submission 2 to the Electricity Price Review Panel, September 2018.)

From a price point of view, the electricity market currently works well for the major electricity suppliers, but not for customers. The electricity price is set by the marginal producer (the highest bidder who is able to enter the market), and the infra-marginal producers (those who entered the market with lower bids) then all receive this same price, even though they could supply profitably for a lower price.

This has several adverse effects;

- First, the producers have a strong incentive to keep more expensive suppliers like the Huntly power plant in the market. The result has been that, while many consents have been granted for windfarms, for example, over the past several years, often to existing major producers, these have mostly not been built, while fossil fuel fired stations remain regular suppliers.
- Second, electricity consumers are paying what amounts to a rent component for their power because most suppliers are being paid more than their offer price.
- Third, when the grid price is set by a fossil fuel powered station, as is currently often the case, then the rent component is partly the result of that station's carbon charges. This means that carbon charges are effectively being applied to all the electricity sold, even though most of this is coming from renewable sources. These charges flow to the renewable electricity suppliers, not to the government.

New Zealand could move very rapidly to essentially 100% renewable electricity, supplied at a lower price to users, if these issues were properly addressed.

From a demand point of view, we need to move to an electricity system that has the capacity to meet demand using renewable energy sources, both during peak periods and also when some sources are unable to supply as much power as normal, for example when flow in rivers with hydro dams is significantly below normal. Fossil fuel fired stations have been useful for this purpose in the past, but there are also other ways of providing power during these types of periods.

For example:

- In a renewably powered electricity system, hydro stations would be ideal to use as batteries to store energy for periods when wind or solar was low or not available, but at the moment this is not happening effectively because of the way the market operates.
- The government itself could build back-up wind farms, or other forms of generating capacity. Alternatively, it could provide some financial incentive for other parties to do this, even though these generating units were only feeding into the grid during limited periods.
- A consent was granted some time back for a trial turbine in Cook Strait, but the test never proceeded. We are told that tidal currents in this area can considerably contribute to New Zealand's electricity supply, though there would be brief periods during tide changes when the electricity would have to come from elsewhere.

- A tidal station was consented to be established in the Kaipara Harbour some years ago, but never went ahead. We understand that this was because of uncertainty about what might happen in the electricity market.

As with the pricing issues covered previously, being able to meet electricity demand reliably using renewable resources, when demand is high or when some generation sources are limited, is also going to require major changes in how the electricity market operates.

Biomass

(This covers some of the points raised under Q19–Q22, but is broader than this.)

Biomass can be regarded as a renewable energy source provided the trees or other material used is re-planted. In particular, it provides an alternative option to coal, for example in firing boilers. It is proven technology, already used by some timber processing and paper making organisations in New Zealand. It is also widely used overseas, including in Sweden to generate combustible gas that is fed into the gas distribution system.

We understand that there is currently a large quantity of biomass available from forestry operations that could be used as a fuel source but is discarded and goes to waste. At least one large dairy organisation has done some research on this potential fuel source and its availability near their plants, but so far coal has remained a lower cost option.

The potential benefits from this fuel could probably be substantially increased if there were facilities to chip and dry it before it was sent to customers. This would reduce shipping costs and increase calorific value. However, our understanding is that demand has so far been too low for these sorts of facilities to come into existence. Supply of this material using electric powered trucks would also assist in reducing emissions.

Again, this is a fuel whose uptake by many potential users is on hold because their existing facilities are designed to be powered by fossil fuels, which are currently simpler to obtain and less expensive to use.

Geothermal energy

(This relates to Q25-Q27.)

Although geothermal energy does not come from fossil fuels, its production does result in some CO_2 production. Hence, we recommend that emphasis be placed on development of other energy sources such as wind, solar and tidal to meet our energy requirements.

Further work

Please contact the authors if you are seeking further information.

Thomas Neitzert 9(2)(a) [redacted]
Peter Whitmore, 9(2)(a) [redacted]

****