Submission on *Measures for Transition to an Expanded and Highly Renewable Electricity System*

Name	
Organisation (if applicable)	Wise Response Society Inc.
Contact details	

Release of information

Please let us know if you would like any part of your submission to be kept confidential.

☐ I would like to be contacted before the release or use of my submission in the summary of submissions that will be published by MBIE after the consultation.

☐ I would like my submission (or identified parts of my submission) to be kept confidential, and **have stated below** my reasons and grounds under the Official Information Act that I believe apply, for consideration by MBIE.

I would like my submission (or identified parts of my submission) to be kept confidential because [Insert text]

[To check the boxes above: Double click on box, then select 'checked']

Responses to questions

Part 1: Growing Renewable Generation	
1.	Are any extra measures needed to support new renewable generation during the transition? Please keep in mind existing investment incentives through the energy-only market and the ETS, and also available risk management products. Any new measures should add to (and not undermine or distort) investment that could occur without the measures.
	We recommend to commence work on a vision of how New Zealand will look without fossil fuels and then to develop a pathway how to get there. This consultation document assumes a great manufacturing effort over the next decades of power lines, power pylons, windmills, PV panels, electric cars, rail tracks and other infrastructure. This will all be done predominantly by using fossil fuels with associated emissions. It will also be done on the backdrop of diminishing resources of raw materials including crude oil. In terms of energy we are also dealing with a reduction of the ratio of Energy Returned On Energy Invested (EROI) while aiming to produce new infrastructure and trying to maintain or replace existing infrastructure all built with fossil fuels at a high EROI ratio. It is very likely that globally and nationally the current underlying assumptions of resource availability and emissions future are overoptimistic, but the proposed workstream should clarify that. We also recommend to face up to the reality that growth, even green growth, is associated with increased emissions, because economic growth and emissions are not uncoupled. We should therefore consider an economy of “enough” or even well managed degrowth. This could lead to a demand side response of not engaging in wasteful economic activities of overconsumption but still providing the necessities of life for everyone.
2.	If you think extra measures are needed to support renewable generation, which ones should the government prioritise developing and where and when should they be used? What are the issues and risks that should be considered in relation to such measures?

The institution of half hourly price auctions to determine the electricity price is not supporting renewable generation, because power generators get all paid the price of the highest bidder. In these days this is usually a fossil fuel based generator, who are dearer than the renewables based generators. That leads to everyone being interested to also have a fossil fuel based generator in the supply mix.

We recommend to move to a model that is based on the actual production costs of power companies. After all large energy consumers, like the NZ Aluminium Smelter buy at a fixed price.

Another extra measure we recommend is to move away from the reliance on the ETS price to encourage renewable generation. We support the ongoing review of the ETS system and like to see more policy settings towards renewables than just leaving it to the market.

3. If you don't think further measures are needed now to support new renewable generation, are there any situations which might change your mind? When and why might this be?

n/a

4. Do you think measures could be needed to support new firming/dispatchable capacity (resources reliably available when called on to generate)? If yes, which kind of measures? What needs do you think those measures could meet and why?

We should build more renewable generation in advance, which would save on hydro generation for base load and hydro will then be available for a "rainy day".

5. Are any measures needed to support storage (such as battery energy storage systems or BESS) during the transition? If yes, what types of measures do you think should be considered and why?

Batteries have a limited life, especially in relation to power investments in general. First priority should be with a smart grid and the roll out of vehicle to grid technology, because batteries of electric cars don't require an extra investment.

6. If you answered yes to question 4 or 5 above, should the support be limited to renewable generation and renewable storage technologies only or made available across a range of other technologies?

   Keep in mind that fossil fuels are generally the cheapest option for firming, though this may change over time as renewable options (particularly batteries) become more efficient and affordable.

It should be limited to renewables.

7.	If you answered yes to question 6 above, what are the issues and risks with this approach? How could these risks and issues be addressed?
	The risk can be minimised by overbuilding renewables as it has been done with the hydro schemes of the last century. The demand side should also be addressed through improved housing insulations and the promotion of solar hot water heating.
8.	Are any measure(s) needed to support existing or new fossil gas fired peaking generation, so as to help keep consumer prices affordable and support new renewable investment?
	No, see answers to questions above.
9.	If you answered yes to question 8 above, what measures should be considered and why? What are the possible risks and issues with these measures?
	n/a
10.	If you answered yes to question 8 above, what rules would be needed so that fossil gas generation remains in the electricity market only as long as needed for the transition, as part of phase down of fossil gas?
	n/a
11.	Are there any issues or potential issues relating to gas supply availability during electricity system transition that you would like to comment on?
	n/a
12.	Do you agree that specific measures could be needed to support the managed phasedown of existing fossil fuel plants, for security of supply during the transition?
	Yes.
13.	If you answered yes to question 12 above, what measures do you think could be appropriate and why? What conditions do think you should be placed on plant operation? For example, do you have any views on whether there should be a minimum notice period for reductions in plant capacity, and/or for placing older fossil fuel plant in a strategic reserve?
	It will require a departure from the current market driven model, but notice periods are not required. We have a climate emergency already, who has to be notified?
14.	If you answered yes to question 12 above, what are the issues and risks with these measures and how do you think these could be addressed?

	The market will obviously not work, but a central authority has a chance to manage the transition well.
15.	What types of commercial arrangements for demand response are you aware of that are working well to support industrial demand response?
	No comment.
16.	What new measures could be developed to encourage large industrial users, distributors and/or retailers to support large-scale flexibility?
	No comment.
17.	Do you have any views on additional mechanisms that could be developed to provide more information and certainty to industry participants?
	The industry needs certainty that fossil fuel based generation will be phased out and further investment therefore discouraged. On the contrary private households require more certainty that their renewable investments will be supported.
Part 2: Competitive Markets	
18.	Do you agree that the key competition issue in the electricity market is the prospect of increased market concentration in flexible generation, as the role of fossil fuel generation reduces over time?
	No, the competitive market has not worked for the environment thus far, why should it work now.
19.	Aside from increased market concentration of flexible generation, what other competition issues should be considered and why?
	See answer above.
20.	What extra measures should or could be used to know whether the wholesale electricity market reflects workable competition, and if necessary, to identify solutions?
	See answer above.
21.	Should structural changes be looked at now to address competition issues, in case they are needed with urgency if conduct measures prove inadequate?
	The only structural change required is the move to a single operator and an overall control of the whole system.
22.	Is there a case for either vertical separation measures (generation from retail) or horizontal market separation measures (amending the geographic footprint of any gentailer) and, if so, what is this?
	See answer above.

23.	Are measures needed to improve liquidity in contract markets and/or to limit generator market power being used in retail markets? If yes, what measures do you have in mind, and what would be the costs and benefits?
	See answers above.
24.	Should an access pricing regime be looked at more closely to improve retail competition (beyond the flexibility access code proposed by the Market Development Advisory Group or MDAG)?
	See answers above.
25.	What extra measures around electricity market competition, if any, do you think the government should explore or develop?
	See answers above.
26.	Do you think a single buyer model for the wholesale electricity market should be looked at further? If so, why? If not, why not?
	Yes, the market can't deliver. The new generation system is complex and requires a design that integrates all elements.
Part 3: Networks for the Future	
27.	Do you consider that the balance of risks between investing too late and too early in electricity transmission may have changed, compared to historically? If so, why?
	Yes, the periods of no or low demand growth are over. All forecasts are indicating increased demand in the future.
28.	Are there any additional actions needed to ensure enough focus and investment on maintaining a resilient national grid?
	No
29.	Do you agree we have identified the biggest issues with existing regulation of electricity distribution networks?
	No
30.	Are there pressing issues related to the electricity distribution system where you think new measures should be looked at, aside from those highlighted in this document? How would you prioritise resolving these issues to best enable the energy transition?
	No

31.	Are the issues raised by electricity distributors in terms of how they are regulated real barriers to efficient network investment? Please give reasons for your answer. Is there enough scope to address these issues with the current ways distributors are regulated? If not, what steps would you suggest to address these issues?
	We require more long term holistic thinking.
32.	Are there other regulatory or practical barriers to efficient network investment by electricity distributors that should be thought about for the future?
	The split between generators and retailers creates different commercial interests. One entity could be more forward looking.
33.	What are your views on the connection costs electricity distributors charge for accessing their networks? Are connection costs unnecessarily high and not reflective of underlying costs, or not? If they are, why do you think this is occurring?
	No opinion.
34.	If you think there are issues with the cost of connecting to distribution networks, how can government deliver solutions to these issues?
	No opinion.
35.	Would applying the pricing principles in Part 6 of the Code to new load connections help with any connection challenges faced by public EV chargers and process heat customers? Are there other approaches that could be better?
	No opinion.
36.	Are there any challenges with connecting distributed generation (rather than load customers) to distribution networks?
	Of course, but there are other people than us with more specialist engineering expertise in this area.
37.	Are there different cost allocation models addressing first mover disadvantage (when connecting to distribution networks) which the Electricity Authority should explore, potentially in conjunction with the Commerce Commission?
	A single operator would overcome the issue.
38.	Should the Electricity Authority look at more prescriptive regulation of electricity distributors' pricing? What key things would need to be looked at and included in more prescriptive pricing regulation?
	The costs should be averaged across the entire network. The current attitude of favouring commercial customers over households requires reversing.

39.	Do current arrangements support enough co-ordination between the Electricity Authority and the Commerce Commission when regulating electricity distributors? If not, what actions do you think should be taken to provide appropriate co-ordination?
	Co-ordination between the Electricity Authority and the Commerce Commission is not the issue, but the number of 29 retailers is.
40.	Will the existing statutory objectives of the Electricity Authority and Commerce Commission adequately support key objectives for the energy transition?
	Obviously not.
41.	Should the Electricity Authority and/or the Commerce Commission have explicit objectives relating to emissions reduction targets and plans set out in law? If so, · should those objectives be required to have equal weight to their existing objectives set in law? Why and how might those objectives affect the regulators' activities?
	Yes, and they should have at least equal weight to the existing objectives. These objectives would provide a mandate.
42.	Should the Electricity Authority and/or the Commerce Commission have other new objectives set out in law and, if so, which and why?
	Yes
43.	Is there a case for central government to direct the Commerce Commission, when dealing with Electricity Distributors and Transpower, to take account of climate change objectives by amending the Commerce Act and/or through a Government Policy Statement (GPS)?
	Yes.
44.	If you answered yes to question 43, please explain why and indicate: · What measures should be used to provide direction to the Commerce Commission and what specific issues should be addressed? How would investment in electricity networks be impacted by a direction requiring more explicit consideration of climate change objectives? Please provide evidence.
	Direction should be provided to ensure the climate crisis is being dealt with. A GPS would be appropriate. Most important is an upgrade of the network to a smart grid.
Part 4: Responsive Demand and Smarter Systems	
45.	Would government setting out the future structure of a common digital energy infrastructure (to allow trading of distributed flexibility) support co-ordinated action to increase use of distributed flexibility?

	Yes.
46.	Should central government see how demonstrations and innovation to help inform how trade of flexibility evolves in the New Zealand context, before providing direction to support trade of distributed flexibility? If yes, how else could government support the sector to collaborate and invest in digitalisation now?
	No, central government should act now, because we are in a climate emergency.
47.	Aside from work already underway, are there other areas where government should support collaboration to help grow and develop flexibility markets and improve outcomes? If yes, what areas and actions are a priority?
	Flexibility markets are not the solution, but government should look overseas for learning opportunities. Vehicle to grid technology in Japan is an example.
48.	Could co-funding for procurement of non-network services help address barriers to uptake of non-network solutions (NNS) by electricity distributors?
	Yes.
49.	Would measures to maximise existing distribution network use and provide system reliability (such as dynamic operating envelopes) help in New Zealand? If yes, what actions should be taken to support this?
	Yes, we should copy what is underway overseas.
50.	What do you think of the approaches to smart device standards and cyber security outlined in this document? Are there other issues or options that should be looked at?
	Yes, appropriate feed-in tariffs should encourage investments. In addition to smart car chargers, vehicle to grid technology should be promoted.
51.	Do you think government should provide innovation funding for automated device registration? If not, what would best ensure smart devices are made visible?
	Yes.
52.	Are extra measures needed to grow use of retail tariffs that reward flexibility, so as to support investment in CER and improved consumer choice and affordability?
	Appropriate feed-in tariffs and off-peak tariffs should be introduced.
53.	Should the government consider ways to create more investment certainty for local battery storage? If so, what technology should be looked at for this?
	Yes, but in all of this, battery storage should be the last resort because of their relatively short lifetime.

54.	Should further thought be given to making upfront money accessible to all household types, at all income levels, for household battery storage or other types of CER?
	Yes, the priority should be on other types of CER and battery storage should be the last resort.
55.	Should government think about ways to reduce ‘soft costs’ (like the cost of regulations, sourcing products, and upskilling supplier staff) for installing local battery storage with solar and other forms of CER/DER storage? If so, what technology should be looked at?
	Yes, work on training and regulations should start straight away and not just “thought about”.
56.	Is a regulatory review of critical data availability needed? If so, what issues should be looked at in the review?
	Yes, total data transparency from the generator to the smart meter should be achieved.
Part 5: Whole-of-system considerations	
57.	What measures do you consider the government should prioritise to support the transition?
	More centralised planning, regulation and coordination is required as well as more data transparency.
58.	Are there gaps in terms of information co-ordination or direction for decision-making as we transition towards an expanded and more highly renewable electricity system and meeting our emissions goals? Please provide examples of what you’d like to see in this area.
	Yes, the market driven system is obviously not leading to zero emissions. More planning, coordination and regulations at government level are required.
59.	Are there significant advantages in adopting a REZ model, or a central planning model (like the NSW EnergyCo), to coordinate electricity transmission investment in New Zealand? Would a REZ model for local electricity distribution be an effective means of addressing first mover disadvantage with connecting to electricity distribution networks?
	A REZ model could be the first step to overcome disadvantages of the current market driven model in NZ. It would also be an effective means to addressing first mover disadvantage.
60.	Should MBIE regularly publish opportunities for generation investment to enable informed market decision-making?

	Yes.
61.	How should the government balance the aims of sustainability, reliability and affordability as we transition to a renewable electricity system?
	This is the wrong question. Distributed renewables are the answer to the above three aims.
62.	To what extent should wholesale, transmission, distribution or retail electricity pricing be influenced by objectives beyond the (affordability-related) efficiencies achieved by cost-reflective pricing, such as sustainability, or equity?
	The half hourly auctions do not support affordability nor sustainability, but renewables will.
63.	Are the current objectives for the system's regulators set in law (generally focusing on economic efficiency) appropriate, or should these also include more focussed objectives of equity and/or affordability?
	No, current objectives are not appropriate. Equity, affordability and the zero carbon act require consideration and action.

General Comments:

For a more detailed explanation of our reply to Question 1 please read the article of one of our members, which was published by interest.co.nz:

Murray Grimwood assesses future energy options for New Zealand off the back of the Ministry of Business, Innovation & Employment's energy transition consultation

31st Aug 23, 11:31am by powerdownkiwi

Murray Grimwood*

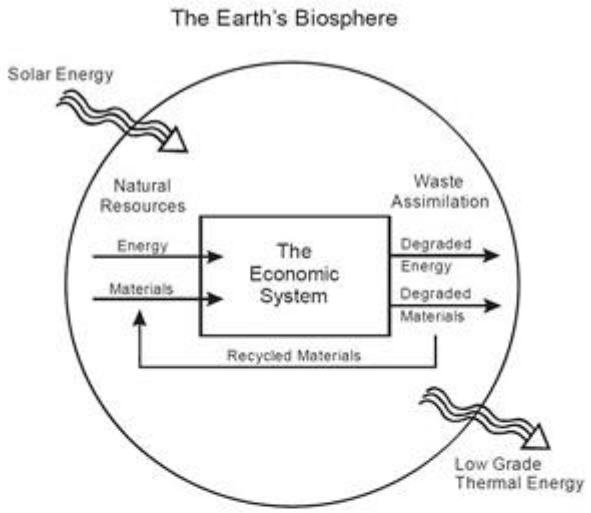
The Ministry of Business, Innovation & Employment (MBIE) is running a series of webinars, consulting on future energy options. It takes energy to build infrastructure, energy which will not come again, making it crucial that we get our next moves right. Unfortunately, most of the spectrum of submitters (and the host itself) belong to a culture steeped in a still-taught falsehood, thus threatening to render the exercise obsolete.

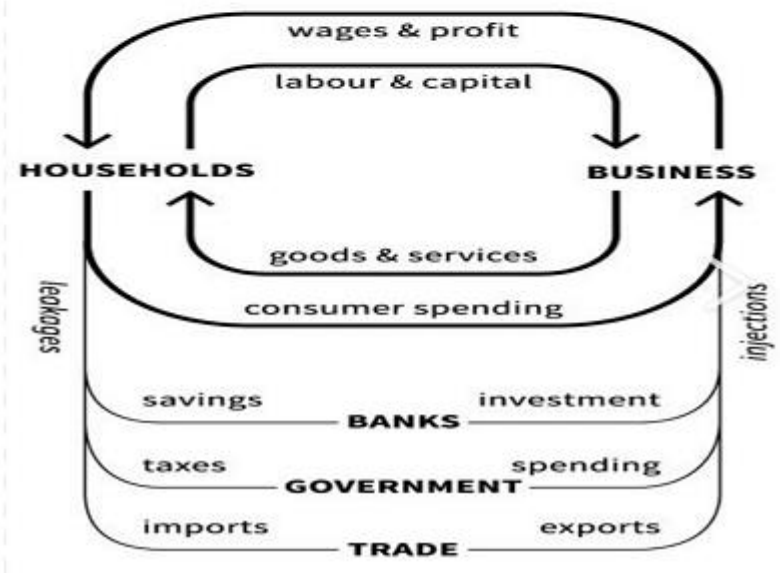
Salient points

• **Most folk** – MBIE included – **use the Samuelson/Econ101 circular graphic of an 'economy'**. It is steeped into everything; politics, other academia, business. It is fatally flawed because there is no accounting for essential inputs (energy being one) or outputs. Put differently; it measures flows (albeit somewhat remotely) but not stocks. Much of the Green New Deal (GND) is flawed for the same reason. It is planetary stocks – of finite resources, of renewable and sink capacities, but crucially of the half-gone one-off bonanza of fossil energy – which are our predicament.

• Confusing matters more, words are used which convey incorrect meanings; **oil is not 'produced', it is extracted**. Electricity is not 'generated'; kinetic energy is transformed into electrical energy (and we don't 'consume' it, either; we dissipate it).

• **The graphic to use** – the one which does not lie – **is the Nicholas Georgescu-Roegen one (below)**. The two in-arrows and the two out-arrows are the ALL of it, in terms of energy and the economic system. That simple diagram covers everything, Climate included. The one on the right – a version of which every economics-intake is taught…… does not.





• **Flows and entropy.** The flows are always from left to right, across that first diagram, every stage is dissipative, every stage one move towards entropy.

• **Relativity.** In that diagram, fossil energy is a one-off stock of historic sunlight being injected into the energy flow between the circle and the square. Fossil energy is orders of magnitude more potent that any alternative, but the remaining fossil energy is reducing exponentially both in potency and in volume. The potency ratio is generally reckoned as the energy in a barrel of oil being equal to 4.5 years of human labour; labour is therefore 'noise' statistically.

• **Productivity.** The above ratio – unaccounted in economics unless by default – means it is energy efficiencies, not human labour, which have increasingly driven productivity-gains for 200 years (it's not the digger driver, it's the digger, and that comes back to the diggers' energy efficiency).

Energy efficiencies run into hard Thermodynamic limits after having run a course of diminishing returns, usually via an increase in technological complexity (the latter usually associated with diminished resilience).

• **Energy Return on Energy Invested** (EROEI) is an important concept, an unavoidable constraint, and should appear in MBIE's final report. All life- forms and all machines are energy-dissipative;

they require more energy in than they expend (in muscles, pistons or thrust); the loss is always low- grade heat (ejected via sweat, radiators, exhausts, cooling-fans), of too low a grade to be re-usable. We are traversing ever-lower EROEI energy options, needing more energy to obtain energy, with implications for total work-doable in the future.

• It needs to be remembered that **food is energy** (energy cannot be created; the question needing asked of all lab-food is: where does the energy come from?) and currently we require several calories of fossil energy to produce one calorie of food. Where will the replacement energy come from?

Which sunlit acre (that is not already being used)?

• **Surplus energy** (energy over and above food-production) allowed specialisation. It is reasonable to presume that a reduction of surplus energy will curtail specialist activities, with knock-on societal implications.

Most folk make personal decisions at a remove - or many removes - from the energy-flow, yet their activity is almost certainly dependent on some level of surplus energy. This remoteness can make long-term appraisal difficult.

Where to from here?

We have an existing collection of physical infrastructure – roading, pipework, wiring, buildings, vehicles, tools – all reliant upon and built by/of fossil fuels (as energy and as feedstock). We passed peak energy-per-head (globally) in 1980, and seem to have passed peak energy all-in, yet the collection of existing infrastructure has never been bigger; never more cumulatively demanding of maintenance energy, and as time goes on, will demand ever-more. Atop that, we are attempting to replace much of it like-for-like (as in the GND promoting EVs).

The energy and resources for the change must come from somewhere, and there are two obvious curtailments; (1) we are already extracting energy and materials full-noise, using all we've got – meaning we will have to increasingly triage both.

(2) Our construct is already overshot, so we need to reduce anyway.

Accounting properly

Our accounting system (through whose lens we don't see the above) is not designed to accommodate a permanent reduction of energy (and resource availability). Put differently, a growth-requiring system (profits, interest, return) cannot survive permanent energy reduction (permanent degrowth); who pays, how, by doing what, and who gets to buy the output of the ever-reducing production?

Submissions to MBIE suggesting 'jobs', therefore, might be correct in that folk will be busy, but not in the sense that they will represent buying-power, even at existing levels. This point is not on anyone's radar – officially, at least - but an assessment of our energy future which fails to address the needed alterations/replacement of our valuation-mechanism, will be invalid by definition; nothing is produced (and therefore no money is underwritten) without the use of energy.

The yardstick

We will end up (whether we go there voluntarily or involuntarily) at a sustainable rate of resource consumption and running on renewable energy. Building - or even maintaining - anything which

does not fit those parameters, is a waste of the remaining energy (and resources and time). That is a high bar; bitumen is out; hydro dams run their lifetime course, unfixable electronics gets junked, the current-form internet is moot (that 'cloud' is just server-farms, a significant percentage powered by coal). Yes, the knock-on societal-implication questions are hard; yes, they need to be asked.

Questions

Now we ask the energy-specific questions; is Onslow worth the effort (forget the myopic environmental implications, we all impact by being alive and there are always best-of-the-bad options)? Back one stage, can we actually maintain the Grid sans fossil energy (we won't be making PV panels using PV energy, ever; with that in mind, how are we going to maintain substations; pylons; undersea cables?).

Before we advocate public transport, ask: Over what surface? To where? For what purpose? (Most folk think in terms of getting into a 'city' for 'work'; firstly what they do mostly isn't work in the physics sense; secondly, in a power-down world, what activities will be in demand?). Before fossil fuels there were no cities of over 1 million, so the GND types advocating urban crowding are almost certainly on the wrong track. We are likely to see an exodus from cities, and a massive increase in people per food-producing acre (living closer to the original – sun/photosynthesis - energy source); a logical reversal of the fossil-energised shift from rural to urban. That suggests a more-dispersed electricity – and overall energy - demand in the future. How do we accommodate that?

There will be a period – perhaps a century – where existing processed material (steel, copper, aluminium) can be adapted/used. Old-school mechanical windmills and micro-hydro (both physical and electric) are energy-collation systems we can reuse existing materials to create locally; what other options should be investigated?

Solar

Ultimately, all renewables are solar-originated. The rule of thumb is that the closer to source (to the left in the first diagram), the better the energy quality; the less it has been dissipated. Direct solar – food-production (the vegetarians have a point; plants are closer to the energy source than animals), passive-solar housing, direct water-heating, reflector/boiler systems – should therefore be priorities. A passive-solar house requires less eternally-supplied energy for the whole of its life; anathema to the Econ101-taught where's-the-profit? brigade perhaps, but a physical reality. Direct solar/water is low-tech and locally buildable; heat- sink/storage will be important.

The existing fleet of PV panels will most likely decay over time; a transition format like gas.

Wind

Big wind is likely unmaintainable ex fossil support; as those carbon blades age and those gearboxes wear, they will likely be retired. MBIE – shades of Econ101 – are suggesting a bond to cover the retiring of offshore wind; they should be demanding the earmarking of a certain amount of energy and materials; bank- held historic digits cannot shift offshore tonnage, that forward betting works until it doesn't.

Small wind – both old-school direct-drive and low-tech electric – are do-able; locally buildable and locally fixable. They are a 'fit' for the re-localisation of food-production and the exodus from urban cramming. We cold do worse than encouraging this industry ahead of time.

Gas

Initial ideas at MBIE seem to be that gas will be used as a 'transition', that electricity will be almost everything else. Gas already has infrastructure, and skills.

It is a lesser carbon criminal than oil and coal, and probably has a transition role to play. Unfortunately, this will be exploited by those standing to profit or lose; propaganda and spin can be expected.

Hydrogen

One expectable move, particularly globally, will be to continue the fossil burn, using it to separate hydrogen and tout the process as green. Carbon implications aside, hydrogen is a negative-EROEI proposition; we would be better using the electricity directly in every possible application. Hydrogen doesn't have existing infrastructure, has containment issues and – like PV – will never be buildable/maintainable beyond the fossil-energy system. The idea of exporting energy for dollars is a prima facie example of that 'steeped in a falsehood' mantra mentioned earlier; at the low EROEI represented by shipped hydrogen, there is no longer an 'economy' as we have come to understand it.

Nuclear

Not covered by MBIE, but all things should be considered. Despite the Rickover-led application to submarines, nuclear really does best at grid-scale, transforming atomic energy into electrical, plus some local heat. The disposal issues have never been adequately addressed, and impact many yet-to-be-born generations, the resource source is also finite; thus nuclear is unsustainable, big-picture. If we find we cannot maintain the grid ex fossil energy, nuclear has eliminated itself as an option.

Geothermal

Geothermal works in some locations, within geology-limiting parameters. Grid-supplying in current form, we may well see local activities gravitating to locations where it is viable. As with all technologies, geothermal can be expected to struggle with maintenance, beyond fossil energy.

Hydro

The best big-hydro sites have been taken, and we can assume that lead-times and environmentalist opposition will preclude any more. Small and micro-hydro, though, fits 'local', and is locally buildable/do-able. We may even see direct hydro again (mill-wheels, Hayes workshop). Small hydro is 24/7, even, controllable, locally maintainable.

Wave/tide

Few NZ sites stack up, the environment is hostile, most academic investigations seem to be unfavorable.

Storage

Storage is a major question, rightly being tackled head-on. We owe those who went ahead – the Bardsley/Onslow initiative particularly. Water-at-height is the most benign battery possible, and long after supply-chains fail, water held uphill will still be potential energy waiting to be turned into useful work at a time of our choosing, smoothing (if not eliminating) intermittency.

Whether to proceed with Onslow, depends on grid-related questions; can it be upgraded? Can it be maintained? Smaller, more local water-at-height storage, should be explored, discussed and supported; no activity can claim zero environmental impact but local water is lesser-impacting than most.

Batteries, so far, rely on the fossil-energised economy; their potential cessation of supply is yet to be seriously contemplated. Few folk contemplate the energy required to recycle stuff – we will never separate the materials in the current crop of cell-phones for this reason – and that the majority of recycling energy, currently, is fossil-originated. Like PV, batteries could be a decaying-over-time technology.

Firewood is, of course, stored solar energy (just not for as long, or as compactly, as fossil energy), gathered close to source. The danger is that if fossil supplies curtail quickly – think: geopolitics/war, pandemic, financial collapse – there could be a rapid decimation of standing timber.

Environmental and carbon implications aside, burning forest faster than the rate of regrowth is a temporary arrangement. Locally-grown/coppiced firewood is essentially carbon-neutral and has incidental benefits (shade, water-retention, land stability, biodiversity). Given lead-times, we should be contemplating it now.

Resilience

It is reasonable to assume that ex fossil energy, we will experience longer, more frequent outages of energy-supply. It is also reasonable to anticipate moves to circumvent logistical supply-stages (each being a potential failure-point, and each being a source of energy dissipation (leakage) in the left-to-right entropy traverse.

We cannot move the sun closer but we can – and will - move our harvesting of energy as close to solar input as possible. The word defining close, is ‘local’, so we can predict local energy harvesting, local clusters, local food-production.

While the global internet is likely to falter, fragments may continue to function for years. That format points the way to resilience; multiple stand-alone hubs have more chance of continuance, than does a monolith. Put another way; resilience improves with multiple redundancies. The recent flood/weather events have taught us this lesson (cell communication down; power out; petrol and gas supplies not getting through), but energy-reduction will encourage corner-cutting rather than capacitance-building; the latter must be prioritised.

Displacement

For the last 200 years we have been spatially cheating by digging up compressed historical sunlit acres – the fossil energies. Falling back on real-time sunlit acreage, augmented by the minor reach-backs of firewood, hydro storage and prior-season food, will inevitably involve competition for acreage. We are seeing that already; tree-planting vs farming vs urban encroachment; aerial space in cities, offshore space being contemplated. The real-time energy-capture will be orders-of-magnitude short of our current expectations; apportioning such on the basis of ‘the market’ will not work; physical strategies - and social ones resulting from those – will require Churchillian leadership and a mature societal discussion.

Conclusion

Attending the first online ‘consultation’ (a question re the overarching Limits to Growth, was the first one they answered); one sensed that MBIE are less sure about the Samuelson/Econ101 version of the world, than they were. That parallels a growing portion of society trying to answer resource depletion and overshoot with virtue-signalling wokeness. As a personal comment (the writer has spent a main lifetime evaluating energy-efficiencies for the greater good), admirable sentiments don’t change the physics/chemistry/biology of our poly crisis; those are not solvable by redressing colonialism and/or emission- cessation alone – although both are part of the needed dialogue.

Admittedly the discussion has moved a long way in recent times, but obviously it has further to go given that MBIE’s stated goal is to ‘encourage productivity and economic growth’; dinosaur territory at this point in the human irruption-trajectory. If by productivity they mean efficiencies, fine, but say so; call it what it is. But the goal should be: To ascertain what energy infrastructure we are capable of maintaining beyond fossil energy. Throw in a desired capacitance/resilience factor, and that is it; that is the all of it, and we are late already; very, very late.

Let’s get on with it.