The National Party should be lobbying for Locational Marginal Pricing in the National Electricity Market | David Heard

When considering the future energy system, a lot of column inches are devoted to the 'what' (in terms of technology, cost or emissions intensity) and the 'when' (in terms of the speed of the transition), but relatively little thought seems to be given to the 'where'.

As a party largely defined by 'where', the Nationals should be taking a keen interest in Locational Marginal Pricing (LMP) – also known as the Congestion Management Model – for its potential in shaping where investment in the decarbonising energy system occurs.

Among the smorgasbord of Post 2025 Market Design proposals from the Energy Security Board (ESB), this dish is notable for its ability to provide clear economic incentives for complementary regional investment in assets (like batteries) and activities (like flexible energy demand) close to burgeoning, regionally-located renewable energy zones.

That would mean even greater capital investment and construction benefits in the regions, but in the case of demand-responsive industry, it would also imply durable ongoing economic activity and employment. A far cry from mowing the lawn underneath the solar panels!

This would seem to be entirely consistent with the National Party's focus on securing protection and opportunity for the regions in the face of the climate and energy transitions – 'jobs and growth' – as well as mitigating sensibly-held concerns about ensuring a reliable and low-cost electricity service for regional (and indeed, all) Australians.

LMP as a reform could seemingly do with the help. Despite strong evidence-based and theoretical support (including application in other energy markets) it seems to have attracted few friends from within the Australian generation industry.

In common with many other solutions to complex problems, some incumbents (principally, renewable energy developers) perceive they may be worse off, and they have not been shy in sowing opposition. The many who would benefit – especially energy consumers, but also other classes of asset investors – have been quieter.

What on earth is Locational Marginal Pricing?

The ESB's proposal is to devolve the NEM's current reference prices for wholesale electricity (essentially, one price per State, set every five minutes) into a greater number of local wholesale prices.

These would reflect local supply, local demand and the constraints imposed when transmission congestion (the limitation on how much electricity any cable can carry) prevents the full transfer of surplus energy to serve more remote demand elsewhere in the State or the NEM.

On the face of it, this may seem like an obscure bit of policy detail – but as renewables are built out in the regions, this reform has the potential to strongly drive complementary energy-related and energy-intensive investment to locate regionally too (rather than in or near the cities, where most electricity demand is currently centralised).

It isn't really intended as such, but in many respects LMP is a decentralisation policy for the emerging energy economy – presumably, good news for voters in regional electorates, and their representatives.

The Integrated System Plan balances the cost of transmission against spilled renewables

Transmission capacity is a scarce resource for moving energy around the NEM, and this is the key driver behind LMP.

The Integrated System Plan developed by the Australian Energy Market Operator is a biennial modelling of the least-cost future energy system. It was instigated by the June 2017 Finkel report, with versions delivered in 2018 and 2020, and with the 2022 version well underway. Its task is to plan the least-cost future energy system including generation, transmission and the complementary assets required to ensure reliability: energy storage and so-called 'firming' from flexible, but firmly-reliable generation capacity.

The most striking feature of the ISP is its blueprint for a future world of numerous Renewable Energy Zones scattered across the eastern states. Each of these REZs offers variable energy output, and requires connection with demand centres (especially the large cities and associated ports and industrial zones on the coast) via new and enhanced investments in transmission lines.

Despite the preferences of some renewable energy industry advocates, these transmission connections to residential and industrial demand centres cannot be sized to accommodate anything close to the occasional peaks of renewable generation output without creating prohibitive costs for consumers. Rather than renewable generators (or any other generators) it is consumers who pay for transmission investment in their bills, via the regulated tariffs of the monopoly transmission asset-owners.

Since consumers do not place an infinite value on marginal improvements in reliability, an economically-efficient transmission system will always have periods of congestion, for the same reason all our highways cannot be 12 lanes wide.

That reality implies large quantities of 'spilled' renewable energy at particularly windy or sunny times. This is a disbenefit for the system, and the impact is not just borne by generators. The larger the amount of such energy that is wasted, the higher the average wholesale prices needed for renewables projects to make an acceptable return, when they sell the residual quantity of energy they can actually deliver to market.

There is clearly an important balance to be struck in optimising between transmission capacity costs, renewable generation costs and the electricity prices consumers must pay to recover them as a whole.

In essence, that is exactly what the ISP seeks to do: to deliver the lowest combined cost of generation and transmission investment over time, including the necessary firming and storage, to meet customers' demand in real time with negligible reliability concerns.

If the ISP is successful in guiding the transition of the energy system, it should mitigate against another era of 'gold-plating' in energy investment and associated unacceptable price rises for consumers.

There's more to the system than just renewables and transmission

So far so good, but why should the technocratic detail be of critical interest to regional Australians and their political representatives?

It comes down to the assets and investments which will be needed to buffer large quantities of variable renewables against volatile demand – in particular, where that investment (and the associated economic activity, jobs and growth) will be located.

To support a least-cost system of generation and transmission, the other large-scale assets which can balance variable supply against unpredictable demand are:

1. energy storage (such as large-scale batteries and pumped hydro) which are able to soak up excess energy at times of abundance, then provide it into the grid 'when the wind don't blow and the sun don't shine';
2. firming capacity (such as methane- or hydrogen-burning generation) which can rapidly respond to fill gaps related to the ups and downs of both supply and demand; and

3. flexible demand – users of electricity who have some ability to lower their needs when the supply-demand balance is tight, and raise them when energy is plentiful (and be compensated for doing so).

The least-cost future energy system is an optimised combination of all these things: renewables, transmission, storage, firming and flexible demand.

Market design needs to provide the answer to "where"

Perhaps the 'where' seems obvious – where it is windy and sunny, we build turbines and solar farms. To make it even simpler the ISP has now largely defined those REZs and therefore, the transmission routes.

The regions will already secure the benefits of much of the generation and transmission investment, but what about the rest – where will it be built? Where should the batteries go? Where should large-scale flexible demand be located – refrigeration, manufacturing, minerals processing, data centres, or even bitcoin mining?

With the Federal Government's Technology Roadmap in hand, boosted by enthused state governments, where should hydrogen electrolysers be built? Electrolysis of water into hydrogen is a potentially very, very large source of new demand. By their nature, electrolysers can offer very flexible demand by ramping up and down depending on the abundance of necessarily-cheap electricity available to them to make hydrogen at a competitive cost.

So, when we think about the 'where' for these types of assets and investments, it is clear investors will be strongly driven by the (local) electricity price they are exposed to:

- **For energy storage (batteries):** locate 'where prices are highly volatile' – allowing the assets to charge up cheaply, and discharge into high prices regularly.
- **For firming capacity (turbines):** locate 'where prices are relatively high, relatively often, even if for short periods' – conditions where they may dispatch their energy fairly regularly, and receive high revenues when doing so.
- **For flexible demand:** locate 'where prices are cheap on average, and high at times' – allowing the energy-using business to enjoy low input costs, but also the opportunity to monetise the value of their flexibility by – in effect – selling unused wholesale electricity back into the grid when prices are high.

And therein lies the rub. At the moment (and without reform) the wholesale electricity price is set every five minutes, but is identical everywhere within each State in the NEM.

Where it can all go wrong

Imagine it is a hot, sunny afternoon in NSW.

Today, it doesn't matter whether your battery or electrolyser is located just across the road from a regional solar farm in Broken Hill (which we can assume is spilling surplus energy due to transmission constraints) or embedded in the heart of Sydney, a city experiencing high demand in the middle of the heatwave as the air conditioners fire up. The NSW wholesale electricity price is the same for both locations.

The implications are somewhat alarming. In such a circumstance, common sense very strongly suggests the Broken Hill battery should be charging up, soaking up some of the surplus solar PV that would otherwise be spilled because it cannot be sent east towards Sydney (due to congestion in transmission). Clearly, the marginal value of electricity in Broken Hill is zero at that time, and you would expect the battery to see the advantage of that.

However, Sydney's high demand means a high NSW price for wholesale electricity. The economic incentive for the Broken Hill-located battery may actually be to discharge and 'earn' this price.

In doing so, the current market rules mean it would gain a share of the scarce resource – the constrained transmission capacity to send its stored energy out of Broken Hill. It would do so at

the expense of the nearby solar farm, further reducing the PV asset's saleable output, adding insult to injury.

All this silliness is abstracted away by the ISP when it plans the least cost system – by assuming investments are undertaken where it provides the least-cost outcome, it implicitly assumes LMP applies – which in our example, would mean a zero wholesale price in Broken Hill, but a high price in Sydney.

Unfortunately, this tells us that without the LMP reform, the ISP will be blithely planning a least cost system only in theory, because the market design will not provide the right signals to build it.

Time to get serious about energy market incentives

Importantly for Broken Hill and all the other renewables-rich regions throughout the NEM, LMP would provide a clear economic incentive for regional investment in assets like batteries, and activities like flexible demand, located close to the renewables. These would then benefit from these periods of surplus via low charging or input costs.

As a reform, LMP has been controversial among the broad church of energy stakeholders, despite its rigorous theoretical foundation in lowering overall costs, its use in other energy markets globally, and its support from the ESB and the Australian Energy Markets Commission (whose expert role it is to assess these things).

That is because any worthwhile but challenging reform implies some incumbents may be worse off – in this case, existing and proposed renewable energy project developers who would prefer to continue accessing their proportional share of the limited transmission capacity resource by default (even if sometimes constrained), because they can capture wholesale prices that may be wholly divorced from the value of the energy they produce.

Arguments that LMP would stymie the necessary levels of investment in the energy transition are self-serving. It is true that LMP would disincentivise renewables investment in places where transmission capacity is or will become constrained – but so it should! In doing so, it would also protect the value of existing generation capacity in those areas, already sharing a limited capacity of transmission.

On the other hand, there is a very strong and positive investment signal created for the type of investment the overall system needs, but to date has struggled to attract: storage and flexible demand, located where it makes most sense – where energy is often very cheap.

It would be in The Nationals' interest to get on board, help push the reform through, and claim it as a victory under their newfound net zero 2050 platform.

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