

# Integrated System Planning: All that is old is new again

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# Outline

- ▶ Context
- ▶ The challenges in “least cost” modelling
- ▶ Are “roadmaps/blueprints” better than nothing ?
- ▶ Some suggestions

# The NEM 1998 to 2018: Laissez faire(ish)

- ▶ 1998: mandatory, centrally settled, energy-only, multi-regional market is born.
- ▶ Price based on generator offers, to organize efficient dispatch and remunerate investment.
- ▶ NECA then AEMC to maintain market rules; Reliability Panel to recommend Market Price Cap based mainly on assumption that higher prices drive investment and hence reliability. Various supplementary reliability mechanisms later developed.
- ▶ AEMO to operate power system.
- ▶ Regional monopolies for transmission investment and planning.
- ▶ “National” transmission co-ordination not formalized; but Inter-regional Planning Committee to debate interconnection expansion; AEMO’s “National Transmission Network Development” annual reports provide information.
- ▶ Various grumbles about wholesale market power. Authorities (and governments) huff and puff but mostly sit on their hands.
- ▶ Renewable policy support outside the market (mostly opposed by electricity market authorities on account of its market distortion).



# The NEM 2018 to present: ever grander (central) plans

- ▶ In 2017 the Australian Government commissioned the Finkel Review. Finkel recommends “integrated system plan” – “*whole of system plan*’ for supplying affordable and reliable electricity to homes and businesses in the NEM, while supporting Australia’s net zero ambitions”. ISP intended to be advice, but many engineers and bureaucrats discover the words “integrated” and “system” as if for the first time.
- ▶ By end of 2020, “actionable ISP” rule changes urged by bureaucrats and accepted by ministers: ISP become an executive plan for transmission.
- ▶ And now, through the Australian Government’s “Capacity Investment Scheme”, subsidy for renewables and storage is (perhaps) being directed in ways that fit with the ISP.
- ▶ The ISP (now its fourth iteration) is, predictably, failing (as grand plans do). AEMO is blaming others for not doing what AEMO said its plan says they should do.
- ▶ Bureaucrats and ministers seem to be digging in: a 2022 review of the ISP (only now released) Ministerial Council says “*there is considerable scope for the ISP framework to be ‘supercharged’ to become .., a genuine whole of system plan*”.
- ▶ But broader Parliamentary support is not clear (Senate Inquiry yet to report) and a change of federal Government is very likely to result in major evolution (possibly termination) of the ISP.

# (Insurmountable) challenges in modelling electricity markets

1. **Indivisibility and lumpiness:** transmission capacity rises as square of voltage, voltage increments are large but demand increases are typically small.
2. **Scale economy:** capital cost of transmission rises linearly with voltage but the capacity of transmission rises as square of voltage.
3. **Substitutes, complements and joint products:** Batteries (provided in markets) can substitute/complement transmission (a regulated monopoly).
4. **Network usage spill-overs:** electrical currents in networks obey Ohms Law - capacity increases in one part of a network can reduce capacity in other parts of the network.
5. **Network characterisation in modelling:** the physical system of conductors and generators is extremely complicated and detailed. Impossible to effectively represent in market models.
6. **Market characterised in modelling:** Market itself is extremely complex – 10 price/volume pairs; co-optimised ancillary services; re-bidding, ramp rates and minimum stable generation constraints,. Constrained-on directions; regional (not nodal) prices. “Least cost” model output unlikely to correspond to market outcome.
7. **Externalities:** transmission lines & some generators have a large impact on landholders and on the local environment. Information on these externalities often only arises in implementation, not when planning
8. **Uncertainty:** electrical generation and storage technologies are evolving extremely quickly. Modellers need to make many assumptions on how these will evolve in future in order to develop their plans.

# Writing ~2,400 years ago, Plato anticipated the argument for (and limitations of) electricity market modelling

- ▶ “Well then, it seemed to me next, since I’d wearied of studying the things that *are*, that I must take care not to incur what happens to people who observe and examine the sun during an eclipse; some of them, you know, ruin their eyes, unless they examine its image in water or something of that sort. I had a similar thought: I was once afraid I might be completely blinded in my soul, by looking at objects with my eyes and trying to lay hold of them which each of my senses. So I thought I should take refuge in theories, and study in them the truth of the things that *are*.”

(Plato, *Phaedo*, 1975. p. 51 Clarendon Press.)

# Are (executive) “blueprints/roadmaps” for the electricity transition better than nothing?

- ▶ **The claim of central blueprints/roadmaps:** co-ordination, certainty.
- ▶ **The counter-claim:** *“In a world of uncertainty, national plans and planning agreements can achieve co-ordination only at the expense of freedom to initiate and respond to change.”* (S.C Littlechild, ‘The Fallacy of the Mixed Economy’, IEA, 1978.

Orthodox economists are sceptical of central planning. “Austrian” economists (Von Mises, Hayek, Coase, Kirzner) lead the critique:

“ ... the economic order of any large society rests on a utilization of the knowledge of particular circumstances widely dispersed among thousands or millions of individuals ... the market and the competitive determination of prices have provided a procedure by which it is possible to convey to the individual managers of productive units as much information in the condensed form as they need in order to fit their plans into the order of the rest of the system. The alternative of having all the individual managers of businesses convey to a central planning authority the knowledge of particular facts which they possess is clearly impossible – simply because they never can know beforehand which of the many concrete circumstances about which they have knowledge or could find out might be of importance to the central planning authority” (C.F. Hayek, ‘The New Confusion about “Planning”’, *The Morgan Guarantee Survey*, 1976.



# How then should things be arranged in order to expand emission-free electricity more quickly than is likely in a market in which emission externalities are not internalised in market prices?

1. Minimise conflicts of interest and vested interest in planning body: *independent* expertise must come to be valued.
2. Encourage rivalry amongst planners: avoid planning monopolies wherever possible.
3. In context of rapid technology change, seek to keep options open for as long as possible – prefer solutions that are quick to implement and short-lived, to capital-intensive long-lived solutions.
4. As far as possible leave decisions on capital investments to be made by investors, not planners.
5. Decentralise and regionalise, so cultivating many opportunities to find new and different solutions from which we can then learn, innovate and improve.