SOLAR PV GENERATION IN QUEENSLAND

HOW CAN THE LAW ASSIST IT TO SAVE THE GRID?

Contents

A. Approach taken in this paper

The Federal Department of Industry reports that *Australians are using energy more productively, as energy prices rise, as new technologies are adopted, and as our economy changes.....Our use of gas, wind and solar energy continued to rise.*[1]

The Federal government has a commitment to generation of electricity with renewables under its Renewable Energy Target (RET), which promotes solar PV uptake. Recent evidence suggests that the solar PV uptake in Queensland is about to cause significant technical problems for the grid, and it is contributing to a reduction in demand. In addition, Queensland is currently considering ways to increase the share of renewables in its energy mix[2]. Accordingly, Queensland it is likely that it must accommodate further solar PV.

Therefore there is a policy collision between RET and Queensland's sovereign entitlement to protect its grid within the National Electricity Market (NEM). The grid involves generation, transmission and distribution lines, retailers and customers, all of whom are affected.

This demonstrates the unpredictable outcome of competing public policies. On the one hand NEM promotes *reliable electricity supply and protection of its infrastructure at a reasonable price under the NEL*, and on the other hand the Federal Government is promoting *the need to reduce carbon emissions under the RET*.

Research included consideration of recent data about the explosion of solar PV worldwide, particularly in emerging economies, together with consideration of the power industry from a strategic perspective for first world economies. In addition, recommendations of the International Energy Agency (IEA) for mature economies for solar PV were considered.

An authoritative text about solar in Australia helped conceptualise the complexity associated with solar PV, and assisted to distinguish some of the *facts* from the *hype* regarding solar PV.

After putting the electricity market in context, the research attempted to discern which initiatives could be applied in Queensland and determine if the law *(legal levers)* through government policy, the national electricity law and/or the marketplace can assist Queensland's grid to survive. In addition, up to the minute commentary from Australian sources is included, so that the current debate on this topic is provided to ascertain which policy options are feasible.

The issues are particularly complex and this paper has only been able to touch the surface, and significant further debate is needed across the community in order to accelerate Australia's adoption of solar PV, whilst preserving its grid to provide cheaper electricity.

B. Background

<u>The NEM – (Co-operative legislation between most states)</u>

The Queensland grid is part of the NEM, regulated by the National Electricity Law ("NEL"), and Queensland adopted the NEL which is found in the *National Electricity (South Australia)*

[1] Innovation and Science Australian Government: Department of Industry, *Australian Energy Update* Department of Industry and Science <http://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Australian-energy-statistics.aspx#> *Foreward,* page 3

[2] Queensland Government: The Queensland Cabinet and Ministerial Directory, *Have your say about Queensland's renewable energy future* <http://statements.qld.gov.au/Statement/2016/5/10/have-your-say-about-queenslands-renewable-energy-future>

Act 1996 through its *Electricity – National Scheme (Queensland) Act 1997*.[3] The NEL regulates the generation, transmission and distribution of electricity.

s7 —***National electricity objective*** of the NEL[4] *is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to—*

(a) price, quality, safety, reliability and security of supply of electricity; and
(b) the reliability, safety and security of the national electricity system.

Federal Government legislation

At the same time, climate change has emerged as a significant global problem and Australia agreed to its Renewable Energy Target (RET) to reduce its CO_2 emissions by ensuring that 20% of its power will come from renewables. It provides incentives to the market under the *Renewable Energy (Electricity) Act 2000 (Cwth)* ("REE") to facilitate this.

The REE Objects in s3 are:

(a) to encourage the additional generation of electricity from renewable sources; and
(b) to reduce emissions of greenhouse gases in the electricity sector; and
(c) to ensure that renewable energy sources are ecologically sustainable.

This is done through the issuing of certificates for the *generation* of electricity using eligible renewable energy sources[5]. Retailers purchase these certificates in order to meet their obligations, and this policy has been very successful in achieving and uptake of solar PV in Australia – 1.5 million households between 2009 and 2015[6] and 25% in SE Queensland[7]. Their incentive is to reduce costs, by dropping demand from the grid, but households are also selling power back to it (HH SOLGEN)

Technical distribution grid issues

Electricity is produced at the same time as it is consumed, and a balance between production and consumption is required for stability (constant frequency and voltage).[8]

Hibbert[9], in March 2016 said that the 30% solar PV penetrations in Queensland's low voltage (LV) distribution lines, with an average household power generation of 4 kWh, is causing the voltage to approach the 10% upper statutory limit. He advised that, *storage will be a solution in time.*[10] With the expected further uptake of household solar PV, it is evident that voltage rises beyond allowable limits are likely to be exceeded as 50% and greater solar penetration occurs.

Solar PV supply to grid

AER reported that Solar PV installations supplied 2.7 per cent of electricity requirements in the NEM in 2014-5[11] and reported that the Australian Energy Market Operator (AEMO) forecast solar installations will more than triple over the next decade, with capacity to

[3] Mark Carkeet, 'LAWS 7850: Electricity Law' (Paper presented at Brisbane 14 – 17 April 2016 2016)
[4] National Electricity (South Australia) Act 1996
[5] Renewable Energy Act 2000
[6] Australian Energy Regulator, *State of the Energy Market 2015* Australian Competittion and Consumer Commission, page 6
[7] Professor Paul Simhauser, 'Power Industry Challenges' (Paper presented at Brisbane, 2015), slide 4
[8] Ergon Energy Standatd STNW3355 Ver 3, paragraph 6.8, page 31
[9] Mark Hibbert, 'The impact of residential solar PV' (Paper presented at the EA and EESA conference, Brisbane, 21 March 2016)
[10] Ibid oral presentation supplementing his slides
[11] Regulator, above n

contribute around 7.5 per cent of the NEM's energy requirements at that time. Queensland has the highest forecast growth in solar PV installations over the next decade, with installed solar capacity in 2024–25 forecast to be one third of all generation capacity.

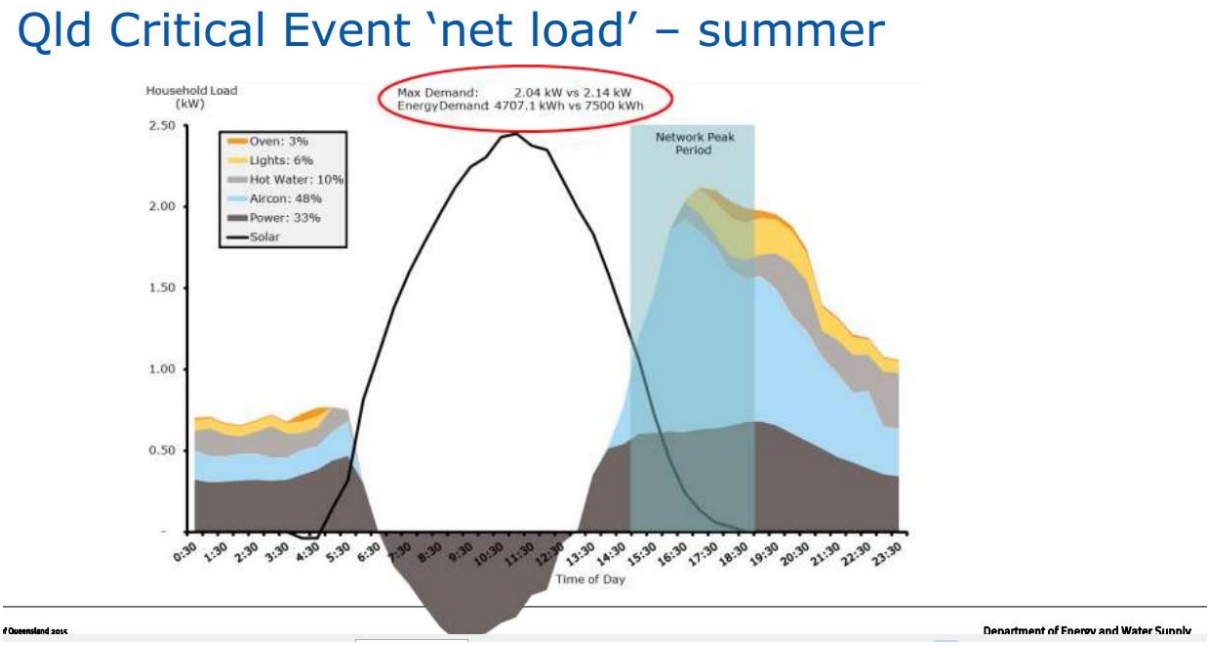
At the same time AEMO has forecast for the regulatory period 2016–17 to 2021–22 in Queensland, that no capacity-driven investment is identified[12]. This is due to overcapacity, which means that solar PV will progressively displace current generators in the future, because demand is currently being satisfied without the need for solar PV. That must be of concern to the generators in the grid.

Drop in demand

In addition, electricity demand over the last two years in Australia has been reducing, which must make generator investment less attractive Energy use in Australia is dropping[13] and Households use 26% of the energy market[14], and they have reduced demand recently because AER reports that residential and commercial consumers have reduced demand through efficiencies and solar PV[15]. This must also be of concern to generators in the grid.

Queensland grid:

Is also ageing and needs replacing[16]; but HH SOLGEN power being provided to the grid at times that do not match peak demand[17] as can be seen from the figure below. Simhauser's figure[18] demonstrates a critical event.



Simhauser's Slide 11[19]

[12] AEMO, 'National Electricity forecasting report', 2015 <http://www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report>Independent Planning review - Technical Assessment December 2015, page 8

[13] Australian Government: Department of Industry, above n

[14] Australian Bureau of Statistics, *Australian Social Trends* <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4102.0Main+Features10Sep+2012>

[15] Regulator, above n

[16] Professor Simon Bartlett, 'Planning in the NEM' (Paper presented at Brisbane, 15 April 2016)

[17] Ibid

[18] Ibid Slide 11

This figure demonstrates the need for HH SOLGEN to shift to the right to satisfy peak demand, and this can only be done with storage, with battery technology currently providing this.

Simhauser says that HH SOLGEN's signed up to Feed-in-tariffs (Fit)and the Small scale Renewable Energy Scheme (SRES) benefits in good faith, and so those commitments must be honoured, but they are benefitting from a tariff structure which may produce an over-investment in solar PV and an under-investment in the adjacent technology of battery storage[20]

A solution needs to be found to the HH SOLGEN dilemma because the average consumer (and therefore voter) would find it incredible that Australia as a 1st world country with overwhelming amounts of sunshine and a sophisticated electricity network with N -1 redundancy, could be inhibited from allowing solar PV to continue to develop rapidly to *allow them cheaper electricity*.

C. Solar PV – Queensland's present position and legislation affecting the NEM

The NEM

The NEM involves wholesale generation that is *transported* via HV transmission lines to electricity distributors, who deliver it to homes and businesses on LV lines. The *transport* of electricity from *generators* to *consumers* is facilitated through a 'pool', or *spot market*, to meet demand. The pool is a set of procedures that AEMO manages in line with NEL and the National Electricity Rules (the *Rules*)[21].

Grid

The participants in the grid are the:

1. Generators – subject to market Chapter 3 of the *Rules* which are competitive
2. Network Transmission and distribution – regulated income with need to preserve grid Chapters 6 and 6A of the *Rules*– have become inefficient
3. Retail – subject to market Chapter 6B of the *Rules* and competitive market
4. Customer – Chapter 5A of the *Rules* subject to market, but have a fall-back in the *National Energy Retail Law*[22] (NERL) already exists.

Solar PV as an energy

Palmer's load factor and generation capacity factor is very useful to put solar PV in context[23] because in the Gemasolar discussion below, this figure provides a visual depiction of efficiencies from various technologies. Whilst Gemasolar is 75% efficient, it is enormous, and that issue appears to be forgotten in the solar PV debate in Australia.

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[19] Simhauser, above n

[20] Ibid

[21] Australian Energy Management Operator, *National Electricity Market* <http://www.aemo.com.au/About-the-Industry/Energy-Markets/National-Electricity-Market>

[22] Retail Energy Retail Law 2011

[23] Graham Palmer, *Energy in Australia Peak Oil, Solar Power, and Asia's Economic Growth* SpringerBriefs in Energy (2014)

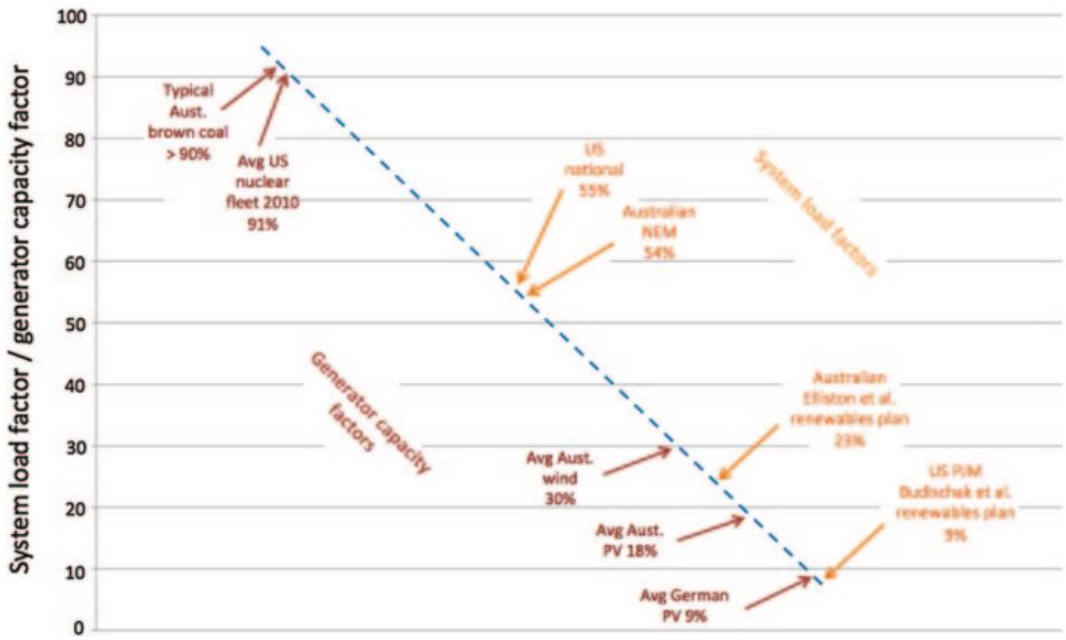


Fig. 3.2 Stylized graph of system load factor and generator capacity factors

The NEL

The ***Revenue and pricing principles*** of the NEL are found in s7A, and they allow transmission and distribution providers to recover *efficient* costs to operate [s7A(2)], incentives to operate efficiently [s7A(3)] having regard to their regulatory asset base (RAB) [s7A(4)]. There is a recognition that prices charged are to provide a reasonable return for risk [s7A(5)], as well as the economic cost of over or underinvestment [s7A(6)], together with over or underutilisation of the system [s7A(7)].[24]

This means that NEM revenue and pricing is legislated, and the AER is involved in "policing" the participants' pricing and income on a regular basis. AER's 2015 benchmarking study found productivity in networks declining for several years[25]This is an area of current controversy because in Queensland's Ergon Energy and Energex are government owned, and neither political party will privatise them, perhaps because they are particularly useful cash generators because of their Regulated Asset Base, which assists in formulating their regulated income.

The AER reports that Queensland is unique, as it has recorded increases in electricity prices in 2014-5 at an average of $61 per MWh, whereas other states have dropped. Two state owned generators control 64% of generating capacity, and recent spot market volatility raised contract prices[26].

Power costs to the consumer

Australia has the highest power costs in the developed world[27] (see Fig 20 below), and the figure below demonstrates that half of the power bill is used to pay for the network poles and wires, i.e. the *distribution* and *transmission* components of the NEM. These are regulated in

[24] National Electricity (South Australia) Act 1996
[25] AER, page 17
[26] Regulator, above n
[27] Deutsche Bank, *Deutsche Bank's 2015 solar outlook: accelerating investment and cost competitiveness* <https://www.db.com/cr/en/concrete-deutsche-banks-2015-solar-outlook.htm>

Chapters 6 and 6A of the *National Electricity Rules Version 79*, which are made pursuant to Part 4 of the *NEL*

The makeup of a power bill is shown in the figure below.

Those transmission costs are borne by each consumer, but those with solar PV, generate some of the own electricity, thereby reducing their power bill. In addition, however, if they are HH SOLGEN's they can sell power back to the grid for which they are paid a FiT, further reducing their power bill. If SOLGEN is likely to damage the grid, that could increase network costs, because of the distribution risk, consumers without solar PV are being disadvantaged.

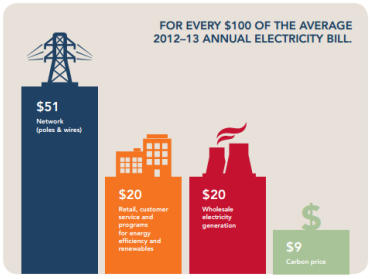
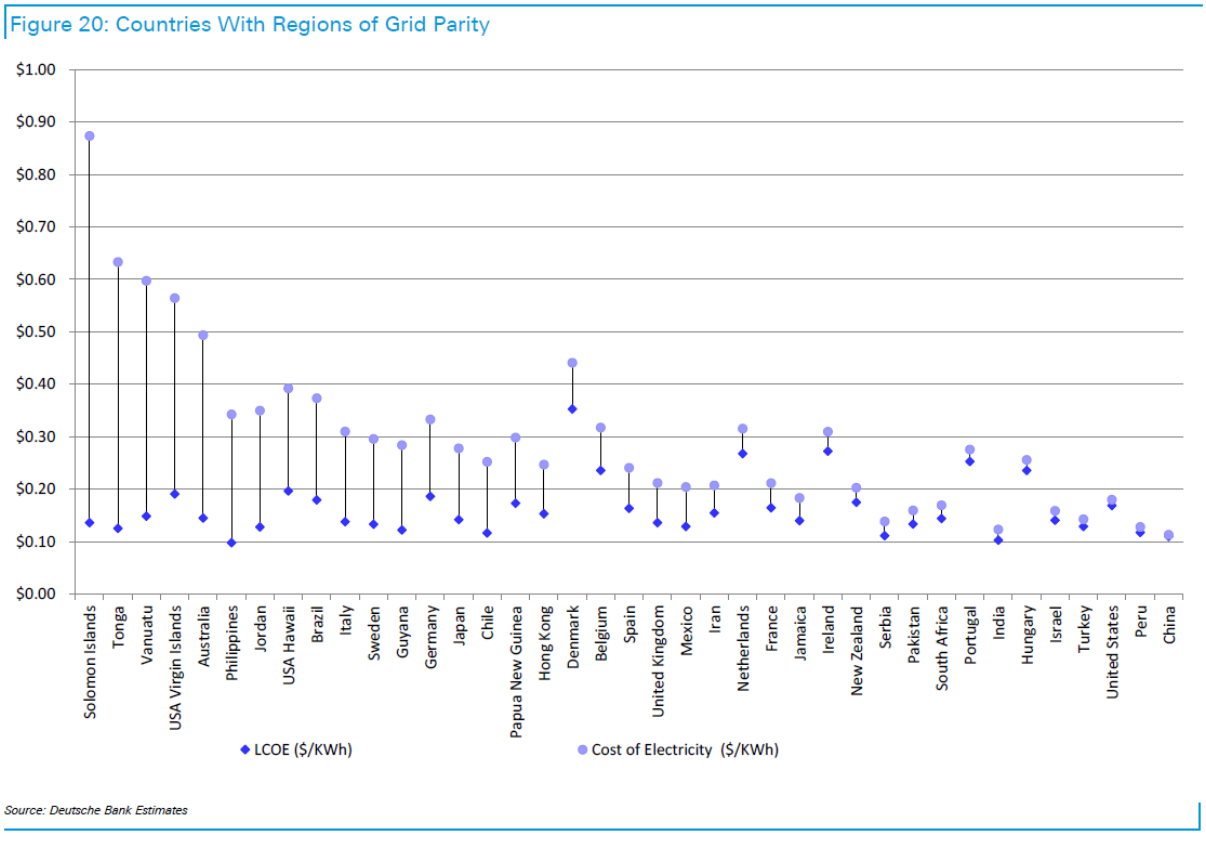


Fig from Fact Sheet *National Electricity Market* (page 4)[28]

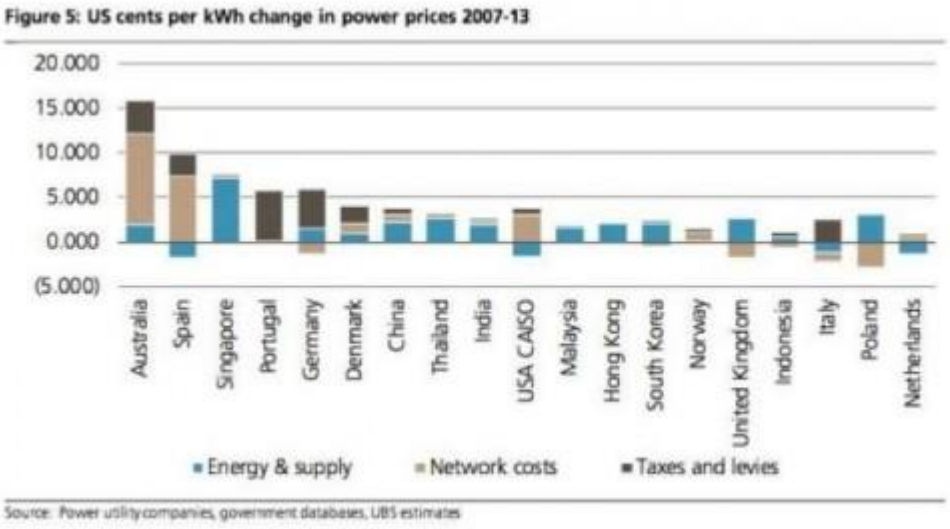
Australia's power costs shown below.



Deutsche Bank Chart under Key Themes of Grid Parity[29]

[28] Operator, above n
[29] Bank, above n

REneweconomy reported on Hugh Grant's report of *ResponseAbility* stating that if the regulated asset base (RAB) was reduced then consumer costs could fall by nearly half in Queensland with its inflated RAB and cost of their networks. It argued that the networks would be in a better position to compete with, and have an incentive to integrate, new technologies, such as solar and storage and the push towards micro-grids. [30] Their figure below demonstrates these costs, and it is apparent that network costs are significant. However, this is not surprising for a first-world economy with the longest grid in the world, and with an inbuilt N-1 redundancy.



Interestingly, it highlighted that RAB reductions were not only in the electricity networks' long-term interests, but were also imperative for the viability of other participants in energy supply chain, including the generators and retailers[31].

This suggests that the market should be governing solar PV, but this issue needs to be explored further after solar PV is put in context in this grid and the world.

D. Contextualising Solar PV data and its influence in Australia

There is a vast amount of information about solar PV worldwide, and validation was difficult. A leading text by Palmer suggested that too much research is focussed on the "Simulation layer" which requires many theoretical critical assumptions, and little thought is given to the deeper first and second order layers [32]. This text was used as a guide to contextualise the data, and his useful model showing the hierarchy of renewable energy plans, shown below was of great assistance.

[30] REneweconomy, *Why Australia Networks neeed to slash asset values by nearly half* <http://reneweconomy.com.au/2016/why-australia-networks-need-to-slash-asset-values-by-nearly-half-96499>
[31] Ibid
[32] Palmer, above n

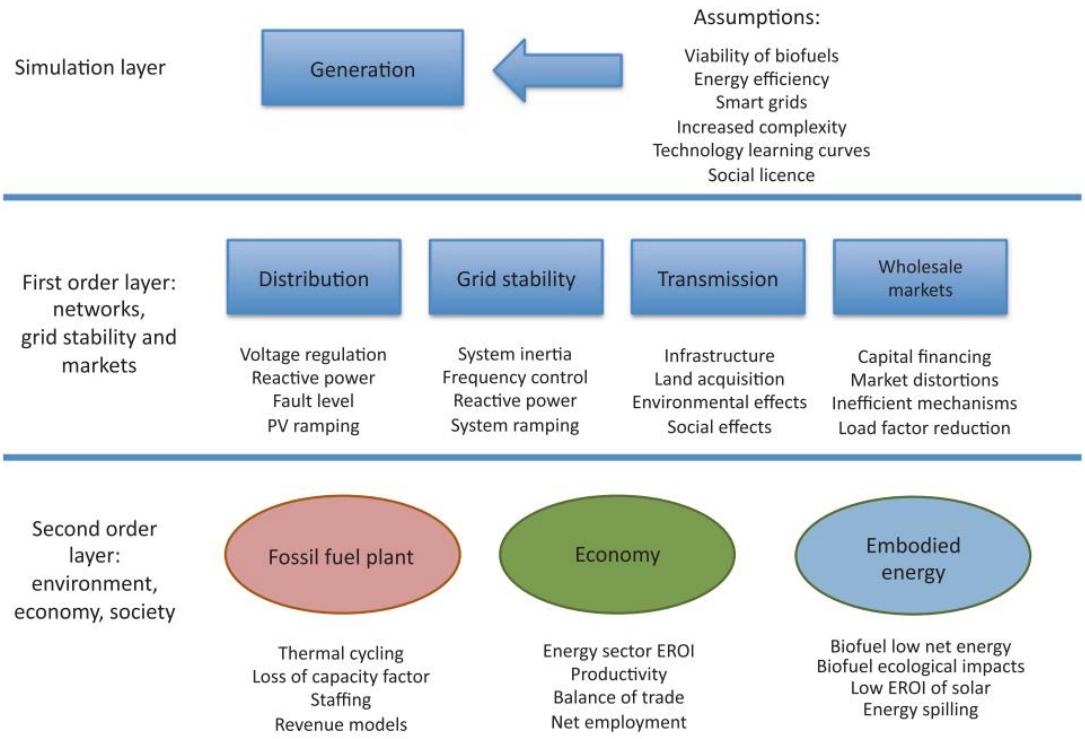


Fig. 3.1 The hierarchy of renewable energy plans. Palmer p 13[33]

At the simulation layer regarding *Generation*, it was thought useful to put HH SOLGEN in Australia in context by carrying out some simple order of magnitude calculations. The latest published ABS statistics in 2006 identified that there were nearly 8 million households in Australia[34]. Therefore:

1. If every household had a 5kW solar panel installed, this results in an estimated 21KWh per day being generated by the solar PV[35].
2. A typical Australian house consumes around 18 kilowatt hours (kWh) per day and Solar panels produce more energy in summer than they do in winter[36], and assuming one can attenuate demand with storage.
3. Assuming one could balance power production with consumption with a battery storing at least 6.4kWh[37], per household, theoretically each household could be an exporter of electricity, i.e. a solar generator ("HH SOLGEN"), after its own electricity consumption (21kWh – 18kWh = 3kWh).
4. At this point, one could accept these households could at least be self sufficient, and leave the analysis there, and that presupposes that households install batteries.
5. However, significant assumptions have already been made to even get to this point, let alone calculating the total HH SOLGEN power available to the grid.
6. The sun may not shine over an area with high population density, batteries are expensive, there are significant seasonal variations and there will be:

[33] Ibid
[34] Australian Bureau of Statistics, '1301.0 - Year Book Australia, 2012'
[35] Clean Energy Council, *Consumer guide to buying household solar panels (photovoltaic panels)*
[36] Ibid
[37] Energy Australia, *Join the solar power revolution* <https://www.energyaustralia.com.au/residential/home-services/batterystorage?cid=sol%7csem%7cgg%7csolbat%7c%7cqld&gclid=CICgu-Hh7MwCFYTZvAods1YJjg&gclsrc=ds>

a. Connection costs
b. safety issues
c. a need to find a place to position the batteries.

7. Accordingly, this paper suggests that across the country the best possible outcome that could be achieved with HH SOLGEN is that households could be self sufficient, provided they had a battery to allow for storage to provide power when the sun does not shine. The variability's contained within these assumptions suggest that realistically HH SOLGEN could not realistically provide *Generation*.

If this theoretical model was applied, and households were self sufficient, and remained connected to the grid as they are entitled under Chapter 5A of the *Rules* and as protected by the NERL but as a matter of policy could not export to the grid, the local grid would not be subject to the voltage rises and the issue of solar PV households being subsidised by other consumers, would also not arise. In this example, it is assumed that the REE incentives to support RET have no interest in whether households are connected to the grid.

That is a possible Palmer *second order layer* solution to the problem, and appears deceptively simple, but whilst it may satisfy s7 of the NEL, for future *efficient investment*, and the *reliability, safety and security of the national electricity system,* it fails to take into account the stranding risk in abandoning the income generating capacity of the HH SOLGEN, because those participants vote, at both federal and state elections.

A scheme for those HH SOLGEN could be to provide incentives to buy batteries, but unless the Queensland Government then prohibited them from exporting to the grid, particularly at peak times, the voltage rise on the grid, and the subsidy by those without solar PV may remain.

This paper identifies *first order layer* complexity, particularly regarding *Grid stability* and *Distribution* from Hibbert[38] and market distortions through Fit and SRES's caused by Federal Government policy improving (?) *market* outcomes[39] because of the RET agenda. It has assessed the data of Solar PV but concludes that HH SOLGEN cannot do so within the NEM, which means the implementation of measures (essentially the levers of government policy) should focus on other Generators, for example large scale solar PV (LS SOLGEN) and Solar Thermal (SOLTHERM) if solar is the preferred energy source. Those other technologies are outside the scope of this paper.

At the first order layer this paper identifies a realistic and imminent *grid stability* problem, caused by voltage increases at the end of *distribution* lines due to solar PV uptake, which it is suggested is a second order layer regarding the *environment* and *society*.

E. Drivers for Solar PV in the Grid

There is a vast amount of information available about solar PV. Australia, which is the 12 largest world economy is developed, whereas India as 7th and China 2nd[40]largest are developing/emerging. The *Economist* (April 16-22 2016)[41] stated that solar power is hitting its

[38] Hibbert, above n
[39] N Gregory Mankiw, *Principles of macroeconomics,* International student edition (3rd ed, 2004)
[40] Austrade, *Why Australia: Benchmark Report 2016*
<https://www.austrade.gov.au/ArticleDocuments/.../Australia-Benchmark-Report.pdf.as...>
[41] Economist, *Solar energy: Follow the sun* The Economist
<http://www.economist.com/news/business/21696941-solar-power-reshaping-energy-production-

stride in the developing world. It referred to China and India's government-facilitated uptake of solar PV causing global solar-energy capacity to rise by 26% last year. Currently China's solar is just 3% of the electricity mix, and India's is less than 1%. However, the latter's energy mix is expected to rise to 12.5% by 2025. At page 51 it reported that Cédric Philibert of the IEA said that in *sunny places solar power is now "shoulder to shoulder" with gas, coal and wind*[42].

a) Climate change/Global warming

This is the primary driver which has influenced the Australian Government's Renewable Energy Target (RET). Australia is one of the 29 member countries of the IEA which now deals with energy security, climate change and economic growth and provides statistics and practical recommendations through its *Roadmaps* to advance innovative energy technology[43].

Its 2014 **Solar PV roadmap** ("SPCR") was considered invaluable for recommendations for Australia's developed economy.

The SPCR" identified one solar PV advantage which was particularly apposite to Australia, and that was the fact that it consumed no or little water in generation, compared to extensive use of fresh water to cool thermal power plants[44].

Australia recognises the connection between energy consumption and water[45] and, whilst it is outside the scope of this paper, an exploration as to whether this synergy of solar PV consuming little water in dry Australia, could dovetail into other government environmental initiatives of drought-proofing Australia, and Queensland in particular. Currently, Queensland has a Department of Energy and Water Supply, which would at least allow the state to consider such incentives.

The SPCR provides policy/incentive suggestions in mature markets, some of which are now listed in the search for appropriate *legal levers*, numbered SPCR 1, 2 etc, will be considered later.

1. *Progressively increase short-term market exposure of PV electricity while ensuring fair remuneration of investment, for example with sliding feed-in premiums and/or auctions with time-of-delivery and locational pricing.*
2. *Provide incentives for generation at peak times through time-of-delivery payments.*
3. *Provide incentives for self-consumption during peaks through time-of-use electricity rates.*
4. *Design and implement investment markets for new-built PV systems and other renewables, and markets for ancillary services.*
5. *Progressively reform rate structures to encourage generation and discourage consumption during peak times, ensuring the recovery of fixed costs of the transmission and distribution grids while preserving the incentives for efficiency and distributed PV.*
6. *Avoid retroactive legislative changes.*

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developing-world-follow-sun?cid1=cust/ednew/t/bl/n/20160414n/owned/n/n/nwl/n/n/AP/n> Print version April 16-22 2016, pages 51-52

[42] Ibid Print version April 16-22 2016, pages 51-52

[43] International Energy Agency, *Technology Roadmap Solar Photovoltaic Energy* <https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapSolarPhotovoltaicEnergy_2014edition.pdf>

[44] Ibid

[45] Alan Smart and Adam Aspinal, 'Water and the electricity generating industry' (2009) (Waterlines Report Series No. 18, August 2009) *Australian Government: National Water Comission*

7. *Work with financing circles and other interested parties to reduce financing costs for PV deployment, in particular involving private money and institutional investors.*[46]

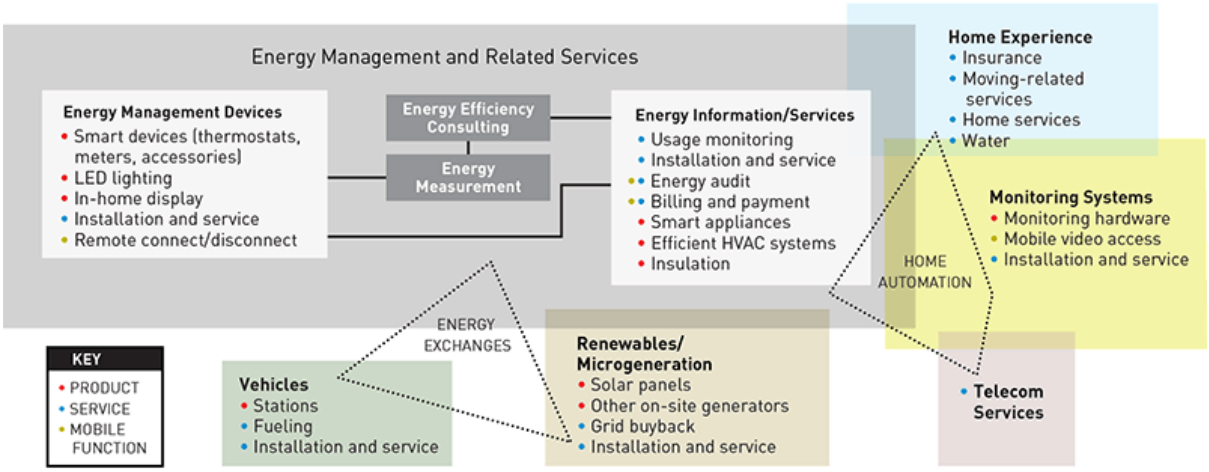
b) Developed economies

In a recent Strategy & Business article about the power industry [47] the authors explained that the traditional *utility model* in a developed economy is being challenged by new competitors focussing on small segments in the value chain.

Their Exhibit 2 below (PwC's model) showed the complexity associated with the entire electricity market value chain, to demonstrate where opportunities were available. A lot is dependent on technology maturity or the speed of its evolution, and it is not easy for government to predict when technology (disruptive, or otherwise) is sufficiently mature to allow a competitive market to establish itself.

Exhibit 2: **Expanding Energy Ecosystems**

Innovations in technology, business models, and regulation schemes are fostering new businesses and even industry sectors while encouraging cross-sector collaboration.



Source: Strategy&, PwC

c) Energy markets

responsAbility Investments AG finances Solar PV development in the developing world[48], and in *public private partnership* with German, EU and UK Government Departments to reduce greenhouse gas emissions.[49] They said that the IEA had suggested that investments in renewable energy technologies would need to increase from USD 270 billion in 2014 to USD 400 billion in 2030.[50] This puts the market in context.

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[46] Agency, above n Roadmap, *Key actions in next 5 years*, page 6

[47] Norbert and Tom Flaherty Scwieters, 'A Strategists Guide to Power Industry Transformation' (2015) (ISSUE 80, AUTUMN 2015) *Strategy & Business* <http://www.strategy-business.com/issue80-autumn2015>

[48] responsAbility, *Innovative investment fund launched to accelerate access to off-grid energy solutions* <http://www.responsability.com/investing/en/750/Innovative-investment-fund-launched-to-accelerate-access-to-off-grid-energy-solutions.htm?Article=25674>

[49] Ibid

[50] responsAbility, *Climate change: Private sector investments for developing countries and emerging economies* <http://www.responsability.com/investing/en/750/Climate-change-Private-sector-investments-for-developing-countries-and-emerging-economies.htm?Article=28256&ArticleReturn=750>

Furthermore, **Deutsche Bank's** 2015 Solar Outlook[51], provides useful comparative data regarding electricity costs in countries worldwide. In its figure 20 shown elsewhere, Australia has the highest cost of energy in the developed world, and it has a well-developed grid, but it is the longest in the world.

The Courier Mail (11 May 20916) stated that Australia is back as the 10th most attractive renewable energy markets, but the lack of long-term power purchase agreements means that a "mountain of global cash is being held back"[52]

If Government expects the market to step into a particular area of economic activity shown in PwC's model, the market needs stability in to do so, and changing government policy, policies on the run, and policies that collide are not conducive to investment.

For example, the dilemma already faced in this paper is how to manage HH SOLGEN which is due to damage the grid, by means of incentives or regulation. Neither approach is guaranteed to introduce the level of comfort needed for investment. Furthermore, the assertion that battery back-up will allow HH SOLGEN, at least to store power for use when the sun is not shining, and possibly to shift the SOLGEN generation curve to match peak demand, pre-supposes that even with this known technology, and an expectation (even without disruption) that as more batteries are marketed, the costs can come down by 20%[53], there is no guarantee that consumers with adopt this technology.

d) Technology

Palmer (preface page vi) explains that *techno-renewables*, have dramatically reversed energy density and utility. He referred to the state-of-the-art 75% efficient Spanish Gemasolar solar plant which has achieved the holy grail of solar—24 hour electricity generation with built-in storage and natural gas backup. He said to replace one of Australia's large coal-fired power stations would require 100 Gemasolars on the edge of the desert, along with a 1,000 km of transmission infrastructure. The question to be asked is the economic and energy cost to society or the energy-return-on investment (EROI).

How can 100 Gemasolars currently support NEL's s7's need to promote *efficient investment* in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect *to price?* That is a dilemma with this emerging technology that has captivated the hearts and minds of governments supporting Co_2 reduction all over the world. The developing world has adopted it, with market incentives from investment, and it is not constrained by a first-world grid, but adoption in Australia is not of this magnitude.

However, some examples of Australian adoption are provided, but it is evident, that there is a degree of "wait and see" where the technology is going, particularly with batteries.

F. Recent Australian initiatives and commentary about the issue

Mini grid

In Melbourne an energy distributor AusNet Serv is using a solar-powered "mini grid" in a suburban street to generate and share its own electricity under a new trial program, with the

[51] Bank, above n

[52] Paul Gilder, 'Future is sunny in energy markets', *Courier Mail* (Brisbane), 2016

[53] Adam Aspinall, 'Energy storage technologies and Development in Battery storage' (Paper presented at UQ Brisbane, 15 April 2016 2016)

expectation that battery costs will come down. They want to get ahead of the curve and learn about what our customers are actually going to want." [54]

Large scale

The first Australian local government, the Sunshine Coast Regional Council, has recently contracted for a 15 MW solar farm for $49million to offset its energy usage. Its utility scale solar farm will offset its entire electricity consumption with more than 57,000 solar panels generating electricity into Energex's electricity network. The solar farm will, at its peak, generate 15,000 kilowatts of electricity from the sun.[55] This is not HH SOLGEN, but provides an example for the future.

Wardill[56] reported this week that the Queensland Government is considering forcing households to time-of-use electricity tariffs in a bid to fast-track the take up of new technology and lower power prices. It is not clear how it will deal with HH SOLGEN stranding risk.

Furthermore, the Courier Mail reported on 1 June 2016[57] that the Premier had committed to double Queensland's commitment to large-scale solar farms. It identified that those proponents who secure federal support will also get state funding. This is an example of incentives, but not for HH SOLGEN.

A Senate's Committee reported that "Electricity prices, largely driven by network costs, have risen significantly while the demand for electricity has declined which leads to a concern about a death spiral; that is, high prices are causing demand to decline while also encouraging consumers and businesses to engage in their own generation activities. Remaining customers would be required to pay an increasing share of the network costs."[58] This is one of the unforeseen outcomes of the REE initiative, which has already been discussed.

Amy Bainbridge reported that, *Red tape and a lack of technical expertise are preventing community groups from setting up renewable energy projects, according to consumer advocates who have launched a new campaign to make it an election issue.* [59] One of the pervading themes from the research is the uncertain or conflicting political messages that are being delivered, sometimes without thought as to cost.

For example

[54] ABC, 'Suburban Melbourne street to share electricity with solar 'mini grid'', 1 May 2016 2016 <http://www.abc.net.au/news/2016-04-19/melbourne-street-to-share-electricity-with-solar-mini-grid/7337196>

[55] Sunshine Coast Regional Council, *Sunshine Coast Solar Farm* <https://www.sunshinecoast.qld.gov.au/Council/Planning-and-Projects/Major-Regional-Projects/Sunshine-Coast-Solar-Farm>

[56] Stephen Wardill, 'Households face forced power tariff to cut costs', *Courier Mail* (Brisbane), 31 May 2016 2016

[57] Unknown, 'Costs eclipse solar's bright outlook', *Courier Mail* 1 June 2016 2016

[58] Jessica Marszalek, 'An energy 'death spiral' could result in electricity prices skyrocketing as more consumers go 'off-grid'', *Courier Mail* 21 April 2015

[59] Amy Bainbridge of ABC News, 'Local renewable energy projects being stifled by red tape, consumer advocates say', (Melbourne Victoria), 26 May 2016 <http://www.abc.net.au/news/2016-05-26/red-tape-stifling-local-renewable-energy-projects/7447296>

G. Gathering the research together for the law to assist:

HH SOLGEN's influence:

1. Is likely to damage the LV grid, if batteries are not introduced, and quickly if the solar PV adoption remains
2. Is being subsidised by those without it.
3. On the grid is considered below, and some high level policy responses (legal levers) are identified. However, within each solution, are a whole lot of policy issues that arise, which are beyond the scope of this paper.
4.

<u>Solar PV's influence on the grid</u>.

e) A HH SOLGEN are generators

Issue

HH SOLGEN's are *generators* of electricity, but they are not subject to Chapter 3 of the *Rules* market rules of spot market. Could the law help?

Solution

Create a special spot market for HH SOLGEN within Chapter 3, or
Alternatively, if consumers had batteries and exported to the grid, arguably they are generators under definition of generator in the *Rules*[60], and therefore subject to regulation under the NEL. If uncertain change the definition to include them. However, that will affect HH SOLGEN's in all states who are part of the NEM

Advantages

1. This may reduce the unfair benefit of the tariff structure on them, and if they wished to sell electricity they may invest heavily in battery technology to be able to satisfy peak demand.
2. Base-load generators may then come on board, particularly if the Rules could <u>require</u> them, as a generator, to satisfy the RET – and participate in the RET spot market.

Speculation

It is unlikely that the REE could compel participation, because there is no constitutional power to do so. However, the Corporations Act could be invoked?

f) Effect on generators

1. With reduction in demand and increased over-capacity, generators which compete in the current spot market have little incentive to invest, particularly when they are confronted with solar PV a "disruptive technology" which is being subsidised by government.
2. Whilst there is further reduction in overall demand, demand remains for their base-load power because solar PV is such a small generator, and is not for base-load (apart from expensive Gemasolar), and that market is very competitive and not profitable for solar PV.
3. Furthermore, whilst adoption of solar PV has significantly increased, a contribution of solar PV generation (SOLGEN) of approximately 2% in 2013-2014 (author's calculations) may not be considered a threat to base-load generators (GEN) in the foreseeable future.

[60] NER # 79 Chapter 10, p1165 http://www.aemc.gov.au/getattachment/b845f474-9958-45f4-bb2a-26774d3d33db/National-Electricity-Rules-Version-79.aspx, definition of generator

g) **Technical**

Issue- Increasing voltage causing network instability affecting transmission which would justifiably support Ergon and Energex argument that prices should rise because of the risk to the network s7A(5) of the *Rules*.
Accordingly, if prices rise that would exacerbate the non solar PV customer complaint.
Solution
HH SOLGEN go off grid – therefore not subject to NEM, and therefore subject to the regulatory regime under the *Electricity Act 1994*
Danger
HH SOLGEN then abandon their solar PV, thereby reducing possibility of satisfying RET

H. Conclusion

Whilst the paper has grappled with the complexity of the topic, the legal levers may be disappointingly ineffective, demonstrating the difficulty of the task ahead.

It is hoped, however, that it has added to the debate, by putting the issue in practical context.

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