Australian Renewable Energy Policy: Barriers and Challenges

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Abstract: Australia's renewable energy policy has taken significant steps towards encouraging the deployment of lower carbon emissions energy generation. Effective policy and regulatory frameworks are paramount to incentivising the deployment of renewable energy to achieve long term reductions in carbon emissions. However significant policy barriers still exist at the federal and state levels, which have reduced the effectiveness of a concerted national effort to deploy renewables. The current policy landscape has largely favoured mature technologies which present the lowest investment risk at the expense of emerging options which may present greater efficiency and emissions reduction gains. The lack of support for emerging technologies delays their effective deployment and the accumulation of highly skilled human capital, until the medium to long term. This paper outlines the key policy frameworks, incentives and regulatory environment which encompasses the renewable energy sector, and presents a critical analysis of the barriers faced by the industry.

Keywords: Australia; Renewable Energy; Energy Policy

JEL Classification: Q42, Q28, Q50

1. Introduction

The development of renewable energy in Australia is important to address concerns about climate change and energy security. The State of the Climate 2012 report concluded that rising CO_2 emissions from the burning of fossil fuels has affected global temperatures much more than natural climate variability during the past century [1]. Electricity generation in Australia is the single largest contributor, producing 38% of total emissions [2]. The use of fossil fuels in Australia has largely arisen as a result of the abundant resources of coal and gas. However, both international and national concerns regarding the environmental impacts of fossil fuel use has led to governments committing to increase the amount of renewable energy used for electricity generation. This paper examines the existing policy frameworks, incentives and regulatory environment as they relate to renewable energy and presents a critical analysis of the barriers faced by the industry. Australian energy policy has been considered extensively in prior literature, including more recently in: [3-13]. However, following the release of the Energy White Paper in 2012 it is important to revisit energy policy, especially as it relates to renewables.

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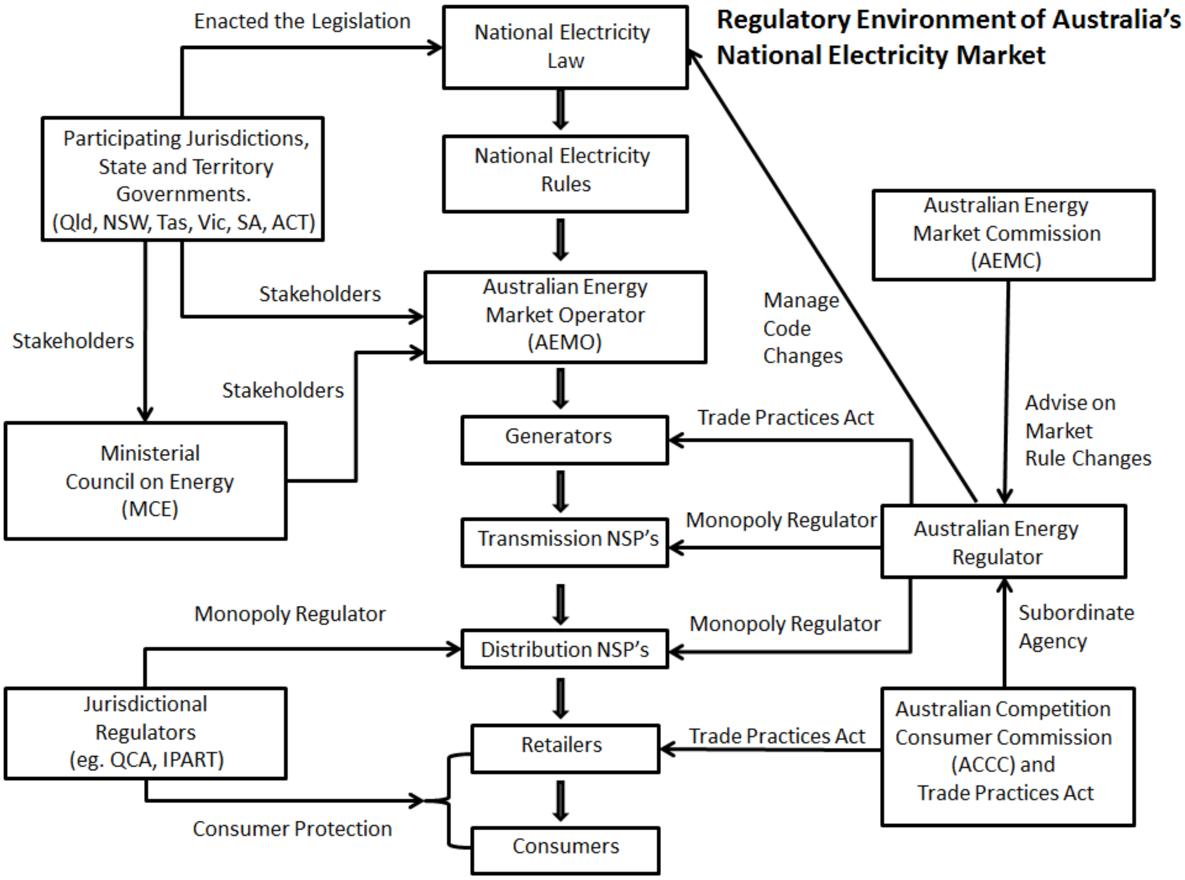
The article is structured as follows. The second section outlines background information on the Australian governmental system and how it affects energy, the operation and changing structure of the electricity networks, especially with respect to generation. Section three considers the key policy frameworks that affect renewable energy development and deployment including carbon pricing, the renewable energy target, feed in tariffs and the Clean Energy Finance Corporation. The following section deals with important policy challenges that remain. This discussion is made in the context of facilitating renewable energy development and considering both the efficacy of existing mechanisms and the further design of policy responses to accelerate the development of the renewables industry without causing socially suboptimal consequences.

2. Background

2.1 The Australian governmental system

Australia is a federal parliamentary democracy consisting of Federal, State and local governments, all of which have different, but at times overlapping jurisdictions. Consequently, it can be extremely difficult to achieve united policy structure between the jurisdictions given competing priorities between State and Federal governments. [14] considers policy and competing priorities in the context of the management of the Murray Darling Basin. Energy policy reflects a combination of constitutional responsibilities, intergovernmental agreements (mainly State and Federal) and market agreements. This can lead to complex regulatory and policy frameworks as **Figure 1** demonstrates in the electricity context. This results in similar issues to those described by [14] though in the renewable energy context, they can be exacerbated by the need to achieve a united policy structure in the context of strong political differences. Different priorities among governments result in an incentive structure that leads to socially suboptimal decisions. State governments generally have limited ability to capture future revenue (compared with their Federal counterpart) and this can result in divergent incentives and motivations for policy amendment and intervention. This complexity can lead to conflicting, policy and onerous compliance requirements for electricity market participants and make it difficult for new participants and technologies to be integrated.

Figure 1: Regulatory environment

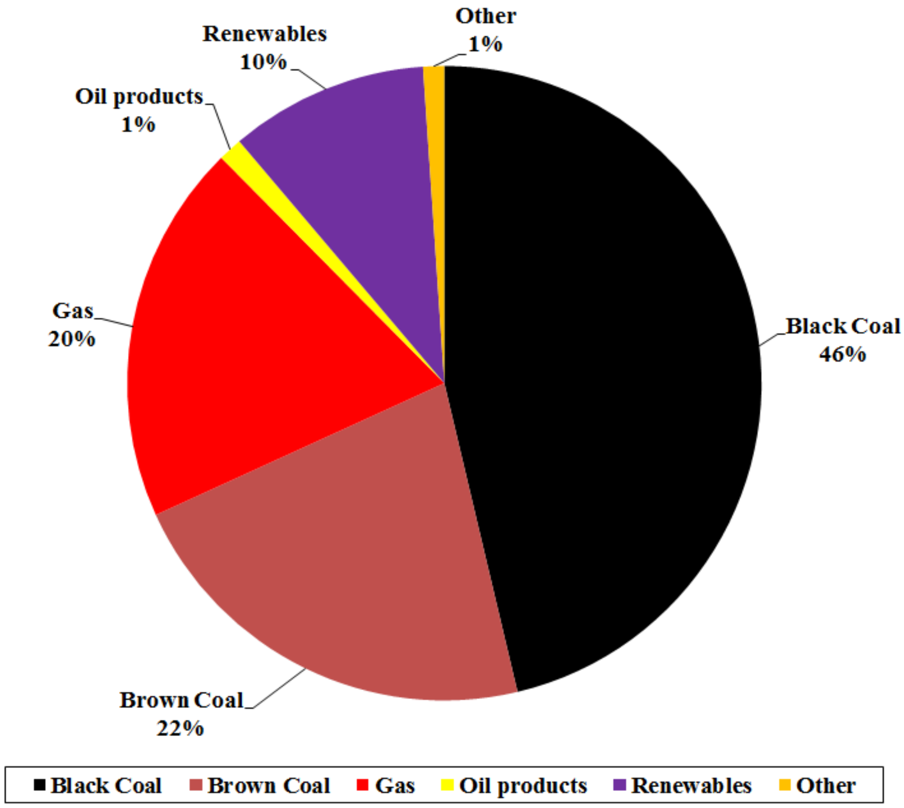


Source: [15] adapted from [16]

2.2 The Australian electricity industry

Figure 2 shows that approximately 90% of Australian electricity is generated from the burning of fossil fuels, primarily coal and gas and oil [2, 17]. Coal provides approximately 68% of Australia's electricity needs [2] which reflects the relatively low cost and abundance of coal reserves along the eastern seaboard where the majority of electricity is generated and consumed [18]. There has been a modest shift towards renewable energy (primarily wind) and small household photovoltaic installations in Australia, though as a proportion of Australia's total electricity production this is limited in scale. **Figure 3** demonstrates this shift in the National Electricity Market (NEM) which is fairly representative of Australia's total electricity use.

Figure 2: Electricity Production by Source 2010-2011



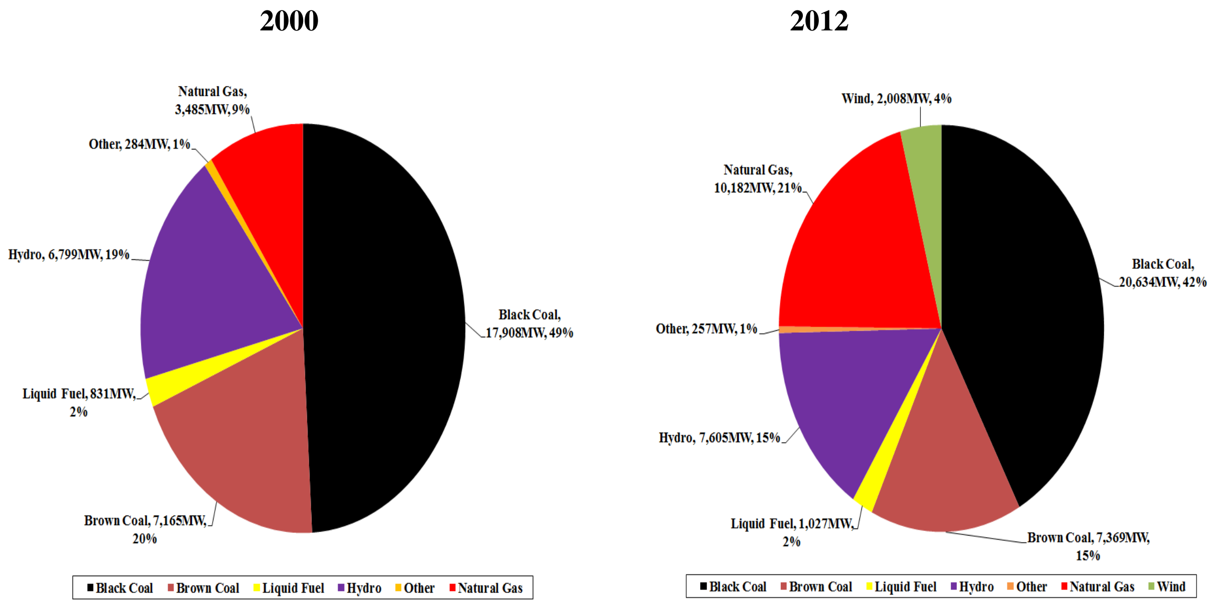
Source: [2, 19]

Electricity is generally provided by large centralised generators from which electricity is transmitted at high voltage through transmission networks, transferred to distribution networks and then provided to energy consumers. This centralised supply model developed historically as a result of relatively cheap and abundant fossil fuels and the comparative efficiency and amenity of electricity transmission compared to localised generation. There is no national electricity grid. Instead, the majority of the population is serviced by three separate electricity markets, the National Electricity Market (NEM) which services Queensland, New South Wales, Victoria, Tasmania, and South Australia and accounts for approximately 90% of Australia's electricity demand, the Wholesale Electricity Market (WEM) which incorporates the South West Interconnected System and the North West Interconnected System which together service Western Australia, and the Darwin Katherine Interconnected System (DKIS) which services the Northern Territory. Together, these networks service all capital cities and most major towns. However, a substantial geographical area falls outside their scope.

This electricity supply model is facing major challenges due to changing patterns in demand, aging generation, transmission and distribution infrastructure and the need to respond to environmental challenges including climate change. In order to respond to climate change, and reduce greenhouse gas (GHG) emissions, the Australian Government aims to reduce Australia's total greenhouse gas emissions by 5% on 2000 levels by 2020 and by 80% on 2000 levels by 2050. Electricity generation is a key component of reducing emissions as approximately 38% of Australian GHG emissions are the result of electricity generated [2].

Figure 2 demonstrates the change in generation mix on the NEM from 2000 to 2012 with a shift away from coal towards gas and a moderate increase in wind power.

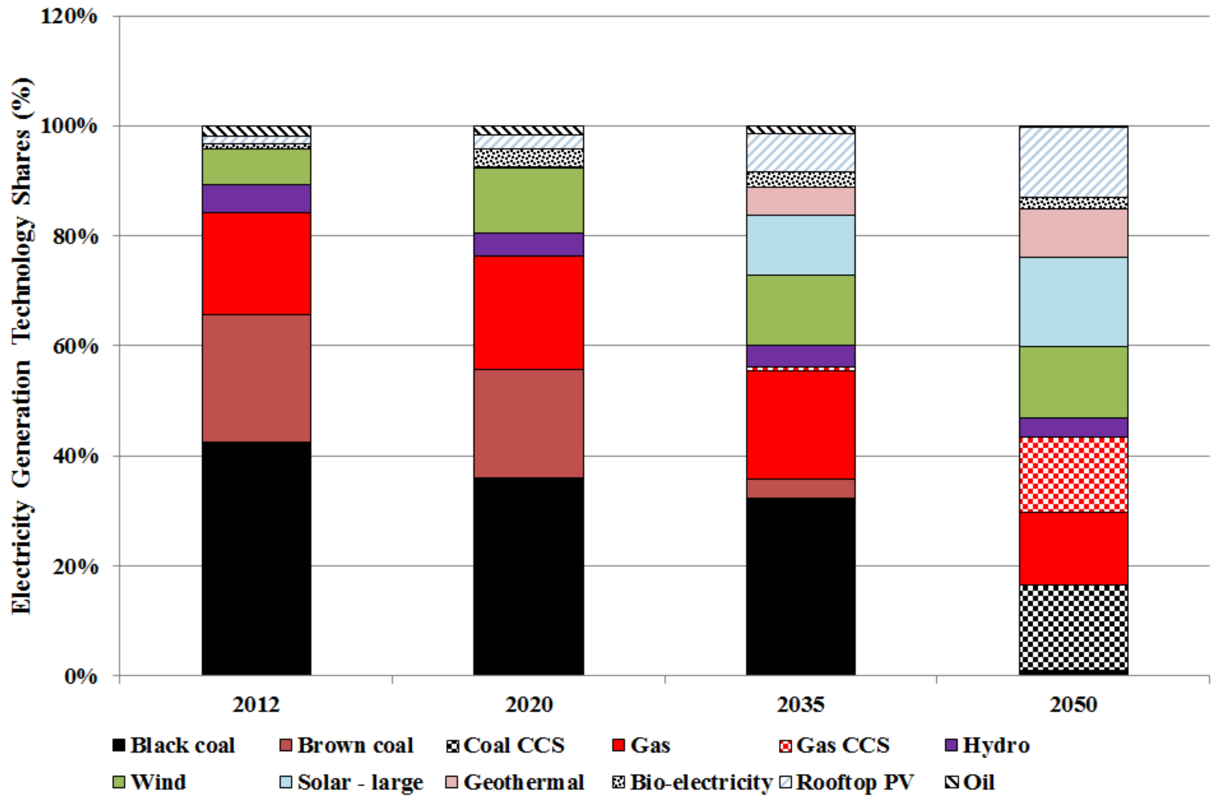
Figure 3: NEM Generation Capacity by Fuel Source



Source: [20]

This transition is likely to continue over the coming decades if Australia is to achieve its present goal of GHG emissions being 80% of 2000 levels by 2050. **Figure 4**sets out a likely generation mix in 2050 according to [2, 19]. As can be seen, renewable energy is a major component of future generation requirements. This will require a focus on renewable technologies rather than a reliance on gas as a 'cleaner' alternative. To facilitate deployment of renewable energy, policy support and adaptation is required. Federal and State/Territory Governments have already taken steps to achieve greater integration of renewable energy, and overcome market, and non-financial barriers.

Figure 4: Electricity Generation Technology Shares to 2050



Source: [2, 19]

3. Policy Discussion

The transition to renewably sourced electricity will allow Australia to exploit some of the world's best renewable energy resources including the highest average solar radiation of any continent, high class wind resources on the southern coast, and substantial hot-rock geothermal resources. However, exploiting these resources can be a major challenge due to generally higher costs than non-renewably sourced electricity, compatibility with existing transmission and distribution networks, remoteness from key electricity markets and demand centres, technological immaturity and institutional inexperience.

To facilitate greater uptake of 'clean' energy, the Federal Government developed the 'Clean Energy Framework' aimed at increasing deployment and innovation of renewable energy. This policy framework is underpinned by the desire to efficiently deploy renewable technologies based on market signals, help through the innovation cycle and policy measures to address potential non-price market barriers. Consequently, the framework encourages competitive support of lowest cost technologies which favours more established and mature technologies such as on sure wind.

Cost is a major hurdle for renewable technologies, due to high up-front capital costs per unit of electricity compared to traditional generators. Cost issues are exacerbated because historically many costs and risks of fossil fuel generators have been externalised. The development and deployment of renewable energy in Australia faces barriers that also exist internationally, including:

- Administrative hurdles such as lengthy, regulatory approval and permit procedures [21-23],
- Non-transparency and costly procedures for grid connection [23, 24],
- Support policy instability with sudden policy changes and stop-and-go situations [23, 25, 26],
- Lack of social acceptance [23, 27]
- Cost competitiveness
- Government support for existing electricity sources
- Institutional familiarity and acceptance

The low cost of electricity from non-renewable generators is in part due to a range of costs being externalised. This results in non-renewables having low private costs but high social costs (which are externalised) whereas renewables have comparatively high private costs but low social costs. Investment and project funding is provided primarily with respect to private costs and this puts renewables at a disadvantage. Measures have been introduced to increase competitiveness of renewable energy (and thereby reduce emissions), including pricing carbon which is designed to internalise environmental costs associated with emissions; the Renewable Energy Target which aims to increase the penetration of renewable generators; and the Clean Energy Finance Corporation which is designed to provide capital assistance. In addition, other measures such as feed-in tariffs and direct subsidies (especially for domestic solar PV) have been introduced. These have led to reasonable uptake in medium to large-scale wind generation, and small-scale PV (largely the result of feed-in-tariffs (FITs) and direct subsidies). However, medium to large scale solar and other technologies (of all types) are yet provide a substantial share of electricity generated.

The key policy measures to facilitate renewable energy integration in Australia are divided into two categories (innovation and deployment) and discussed below.

4.1 Innovation

4.1.1 The Clean Energy Finance Corporation

The Australian Government will invest $10 billion to create the Clean Energy Finance Corporation (CEFC) which will leverage private sector financing for renewable energy and clean technology projects. The CEFC will be independent from Government and run by a Board of experts in banking, investment management, clean energy and low emissions technologies. Investment decisions will be based on rigorous case-by-case analysis of projects at arm’s length from Government. The CEFC was created to identify suitable projects and remove barriers that would otherwise prevent the financing of large scale renewable energy projects. It is mandated to assist with the commercialisation and deployment of renewable energy and enabling technologies, commercialisation and deployment of energy efficiency and low emissions technologies and the transformation of existing manufacturing businesses to re-focus on making the inputs for these sectors [28].

The Australian banking system tends to take a conservative approach to the provision of business finance which can mean that less certain and less mature technologies can struggle to obtain capital funding. The CFEC is designed to help overcome this barrier through the provision of targeted finance. However, under the current regime different renewable technologies will have to compete with other, more mature and familiar technologies such as wind. The inclusion of low emissions technologies is likely to lead to substantial investment in gas which has fewer emissions than coal but is a reasonably mature and scalable technology that benefits from growing institutional experience and understanding. Indeed, only 50% of CEFC funds are committed to renewable energy projects (including hybrids).

The CEFC is structured similar to a (large) venture capital fund, and it remains to be seen whether financing issues traditionally associated with renewable energy development and commercialisation will persist. That is, it is unclear what types of renewable energy projects will obtain funding and whether that funding will be confined to more mature renewable technologies because they may be perceived as less risky. In Australia, hydro and onshore wind are substantially more mature and developed than solar (especially medium to large scale solar), geothermal, wave and tidal power. Investment in more mature technologies may be regarded by the CEFC as more viable notwithstanding that investment in less mature technologies is precisely the type of investment that may increase viability and accelerate renewable energy deployment.

Further, deep grid connection costs, uncertainty of returns, intermittent supply/voltage variation and resulting network reinforcement, network stability issues, distributed generation, smart and micro-grids are all associated with renewable technologies. Low emission technologies such as gas do not have to contend with many of these issues and consequently, renewable technologies may be relegated down the investment pecking order. This effect would be more acute for renewable technologies that are less mature than others.

It remains to be seen how effective the CEFC will be. The underlying rationale is sound, and there is evidence that as deployment rates increase, there is downward pressure on capital costs over time [29]. Nevertheless, in its current form it is likely to have a greater impact on more mature renewable technologies such as onshore wind. There remains a risk that this will be at the expense of less mature technologies that would receive greater benefit from CEFC assistance. The lack of government and industry coordination regarding grid connection costs, intermittency of power and the focus on project returns with limited consideration of network benefits, and matching supply/demand may be too simplistic. A renewable generator that provides electricity during peak periods may be more 'valuable' from a network perspective, but less 'valuable' when viewed as an individual project separate from its role in the electricity network.

4.2 Deployment

4.2.1 The Renewable Energy Target (RET)

The RET requires 20% of electricity generated to be sourced from renewable sources by 2020. [12] considered the mandatory renewable energy target, the precursor to the RET, and concluded that the scheme had only succeeded in stimulating the least cost renewable energy technologies and the big losers under the scheme were solar photovoltaic and solar thermal (with the exception of small scale solar water heating). The authors were critical that certificates were available (sometimes at multiples of the actual energy supplied) for solar hot water heaters and other small residential generation though this has been phased out from 1 July 2012. Under the RET, certificates are divided into STCs and LGCs (small and large scale certificates respectively). The effectiveness of the RET in stimulating renewable energy deployment is undermined by regulatory intervention that allow "eligible waste coal mine gas (WCMG) power stations" to apply for accreditation under the Large-scale Renewable Energy Target (LRET). The eligibility period is limited to 1 July 2012 – 31 December 2020 and is said to reflect the Government's policy to provide transitional assistance for existing waste coal mine gas fueled power stations that would be affected by the cessation of the NSW Greenhouse Gas Reduction Scheme on commencement of a carbon price." Making WCMGs eligible for LRETs undermines the effectiveness of the RET, by misrepresenting the amount of renewable energy produced thereby falsely attributing renewable energy generation to clearly non-renewable sources, and impacting the tradable price of the certificates.

Providing LRETs to non-renewable technologies effectively acts as a subsidy to the cost of that technology and dis-incentivises investment in alternatives. Indeed, in the final report of its review of the RET, the Climate Change Authority concluded that here is no strong rationale for new WCMG to be eligible, especially given the impact of carbon pricing though it curiously recommended maintaining support for existing WCMG [30].

The RET aims to achieve its 20% target by producing 45,000 GWh in 2020 the bulk of which will be provided by LRETs including WCMGs). Such a target leaves open the possibility that if electricity demand and supply increase, the target will not actually equate to 20% of electricity generated unless regular and careful modeling is performed to adjust the target (Buckman and Diesendorf 2010). Further, there are a number of emissions intensive trade exposed industries that qualify for partial exemption from participating in the RET. These concessions alleviate cost pressures for non-renewable electricity thereby imposing a further cost barrier to renewable energy integration. It is imperative that careful modeling be performed to monitor and ensure an appropriate balance between governmental priorities of protecting trade exposed industries and jobs, and incentivising them to adapt their electricity needs. The existing

RET system provides credits per MWh of electricity produced. This system favours more established and cheaper technology options such as wind and hydro. Less mature, more expensive technologies such as solar are unlikely to obtain as much benefit from the RET in the absence of additional support mechanisms such as feed-in-tariffs, direct capital subsidies or banding/distinguishing between different technology types when determining certificate eligibility and supply. Buckman and Diesendorf (2010) identified concerns similar to these.

4.2.2 The Carbon Price

As part of steps to reduce GHG emissions, a national carbon price has existed from 1 July 2012. For 3 years carbon will be priced at a fixed (indexed) rate commencing at $23, and increasing to $25.40 in 2014. During this period, the amount of emissions will be unlimited. After 3 years the government will cap emissions (the cap to be determined on advice from the Climate Change Authority). The annual cap will be set with the aim of reducing Australia's total greenhouse gas emissions by 5% on 2000 levels by 2020, and 80% reduction on 2000 levels by 2050 and will therefore get tighter as reduction targets increase. The rationale for the carbon price is to support the development of an effective global response to climate change in a way that encourages investment in clean energy, while supporting jobs, competitiveness and economic growth and reducing pollution [31].

The legislation requires the 500 heaviest emitters to purchase carbon credits per tonne of emissions. Trade exposed industries and coal fired power stations are eligible for free credits to sustain competitiveness (and jobs) whilst international competitors are not subject to carbon pricing. The extent of this support is substantial. $9.2b has been allocated to the 'Jobs and Competitiveness Program' to support emissions intensive trade exposed industries. Emissions intensive and trade exposed industries such as steel and alumina receive free carbon unit allocations starting at 94.5% of their carbon emissions (meaning they will only have to pay 5.5% or $1.265 for every tonne emitted in the first year). In the case of the steel industry, further direct assistance is provided through the 'Steel Transformation Plan' which provides $300m to support innovation. Lower levels of support are available for industries with lower emissions intensity and trade exposure, starting at 66% of their emissions. LNG projects also receive a free allocation of carbon units representing 50% of the expected carbon emissions while Coal fired generators receive free carbon credits, and highly polluting plants will be progressively closed at a cost of $5.5b over the period 2011-2017. The coal industry receives other direct support through the $1.3b Coal sector Jobs Package, which is to assist coal mines to implement carbon abatement technologies (principally coal seam gas sequestration). The quantity of free carbon units allocated will gradually reduce over time.

The problem with pricing carbon in the manner legislated is that the nature of government intervention means that the external (environmental) costs that are intended to be internalised are not, or not fully. Emissions intensive trade exposed industries source their electricity (almost exclusively) from non-renewable generators. The cost of this electricity will be minimally impacted by the carbon price. Governments must balance social concerns regarding jobs and competitiveness with their desire to internalise environmental costs. Providing substantial concessions to particular industries (at the expense of others) redistributes wealth across the economy and is an attempt to balance competing policy priorities. However, it undermines the potential economic and social and environmental contributions of new and emerging industries (such as the renewables industry) through profits, taxes, job creation and reduced emissions. Providing support through free credits and direct subsidies undermines the effectiveness of pricing carbon by artificially lowering the cost of electricity and distorting the market in which renewable technologies must compete.

Further, government support for increased efficiency from existing generators shifts the onus of increasing efficiency from the generator itself to the tax-payer and distorts the electricity price as efficiency improvement costs are socialised and do not form part of the cost of production.

Much of the assistance provided to the energy industry is not transparent. For example, eligible coal powered generators enjoy access to short term Federal government finance, and refinancing if alternate market finance is not economically available. It is difficult to ascertain how much (if any) of this support has been provided, for how long, and on what terms.

Ultimately, the scale of support for non-renewables is unsurprising. After considering the Australian energy regulatory framework [32] concluded that industry and other affiliated special interest groups seem to have a significant impact on policy direction. [32] noted a range of measures need to be taken including the phasing out of fossil fuel subsidies to help the renewable energy industry overcome the challenges posed by the incumbent power of fossil fuel industries. [33] estimated that $6.54 billion/annum in financial subsidies for fossil fuel production and consumption were provided. Further, it was estimated that in 2005-2006 subsidies in the energy sector amounted to $10b annually while only 4% went to support renewable energy and energy efficiency [34]. This is not a uniquely Australian context, see for example [35]. The Australian Federal Government expressly denied providing subsidies for the production of fossil fuels that encourage the inefficient or wasteful consumption of fossil fuels and noted that the ability to deduct business expenses does not in itself constitute a subsidy. Instead, it is said to be a normal and necessary step in determining business profit and therefore tax liabilities. The rationale is that particular tax treatments recognise the different risk factors and project circumstances applicable [2]. These subsidies pose substantial challenges to the development of renewable energy in Australia and mean that renewables must compete on an unequal playing field. Irrespective of the type of government intervention, policy makers must be careful to recognise any market distortions, especially when the renewables industry is trying to be stimulated using market and price signals.

It remains to be seen how effectively the carbon pricing scheme will stimulate the renewables industry. It attempts to balance social and strategic interests with environmental concerns. Carbon pricing has the potential to internalise costs associated with non-renewable electricity generation and thereby increase the cost competitiveness of renewable energy and so is an important step in the development of the renewables industry. However, governments must be careful not to intervene and support excessively, and to nature and amount of support is presented transparently so that the utility of other policy goals is not undermined.

4.2.3 Feed in Tariffs

Feed-in Tariffs (FITs) for small-scale renewables vary in different States and Territories across Australia. There is no federal FIT. FITs were a popular mechanism over the previous decade but have been progressively reduced and/or phased out.

With the exception of the Northern Territory, all FITs operate at a net metered rate which substantially reduces the value of the tariff if the rate paid is a premium to the retail electricity price. FITs have been criticised due to the way they socialise costs associated with the connection of renewables to the network (such as network reinforcement), whilst only providing direct (monetary) benefits to the owners of the installed technologies see [7, 36]. It was said that this has an adverse impact on individual welfare and therefore should be abandoned in favour of other measures. However, this analysis was of a static nature and failed to take into account inter-temporal effects.

These FITs focus the renewables industry on small-scale technologies at the expense of medium to large-scale generation. This focus creates issues regarding equity, network stability, and efficiency. Generally, only home owners have the capacity to afford and install household scale renewables which can disadvantage people who cannot afford them or are prevented from installing due to their living arrangements (e.g. renting). This imposes additional networks costs that are borne by people who have not caused them and (generally) have a lesser capacity to pay. A FIT that covered medium to large scale projects with the FIT adjusted depending on technology maturity and deployment may provide a more efficient and practical way to accelerate the development of renewables in Australia through increased investment certainty regarding potential revenues, resulting in reducing technology process and more effective (and fair) grid integration. It may also facilitate greater network protection through islanding, and taking advantage of microgrids at times of network interruption and instability.

With limited exceptions, renewable energy requires government support for further development. A FIT system that is reviewed regularly to ensure that market distortions are not excessive, that artificial markets are not created, and that FITs are reduced once technology maturity and integration increases can help provide investment certainty.

5 Policy Challenges

5.1 Grid Connection costs

Grid connection costs are a significant barrier to the development of the renewable energy industry and can substantially increase the capital expenditure required for a project. There is no national standard for grid connection in Australia. New generators have to pay the costs associated with connecting the generator to the grid which can range from shallow, to deep depending on the condition and capacity of the network. Connection challenges are rarely technical, but predominantly concern the allocation of costs especially if connection costs constitute a significant share of the project cost [24].

The Australian distribution network is predominantly unidirectional, with significant use of Single Wire Earth Return (SWER) lines covers vast distances and services relatively sparse populations (outside capital cities). The Australian regime is a mixture of different rules depending on the jurisdiction in which the connection happens. These characteristics can result in both a disincentive to invest, and a first mover disadvantage. A generator that reinforces the network when connecting may bear all the costs whilst subsequent generators who take advantage of the reinforced network do not. A possible solution to the 'first mover' disadvantage is a requirement that other generators who wish to take advantage of network upgrades must pay a proportion of the upgrade costs already paid. This would allow some of the capital costs to be recovered by the first mover. To address these issues with respect to off-shore wind, the German government took measures to stimulate development by imposing very shallow connection costs (to overcome the barrier), and increasing the feed in tariff premium for off-shore wind generators [24].

The Federal Government has recognised the importance of connection costs in determining the least-cost and most efficient combination of generation and network investment noting that investment should be firmly based on market and technology-neutral locational signals [2]. However, this may be difficult when some technologies create challenges for connection and grid management. For example, intermittent supply and distributed generation can contribute to localised network and congestion can place stress and costs on distribution networks that have not been developed to handle large two-way power flows. These problems are currently being managed case by case, by distribution businesses [2].

Connection costs are likely to become more important in the future if Australia's electricity supply system continues to transition towards renewable energy resulting in greater use of intermittent technologies distributed generation and Smart Grids. The Smart Grid project in Newcastle, New South Wales is Australia's first commercial scale smart grid designed to gather information about the costs and benefits of smart grids to inform decisions by government, electricity providers, technology suppliers and consumers across Australia. The Federal government has committed up to $100m to the project, which could potentially provide valuable insight into alternate electricity supply models.

The existing regime requires a compromise between optimal resource location and grid quality and proximity. Consequently, projects may be developed in sub-optimal locations, purely because the existing regulation operates as a disincentive to grid connection. The German government took measures to stimulate the development of offshore wind, by adopting a 2 pronged approach, imposing only very shallow connection costs (to overcome the barrier), and increasing the feed in tariff premium [24]. The extent grid connection costs should be socialised across the network as opposed to borne by the connecting generator needs to be closely examined and is presently being considered by governments, electricity market operators and market participants. High connection costs act as a barrier to connection, especially for medium scale projects where they can form a relatively large percentage of up-front capital costs. The level of costs payable should be adjusted with reference to the immaturity and penetration of technologies as has happened in Germany see (Swider et al., 2008).

5.2 Regulatory and policy uncertainty

Regulatory and policy uncertainty is a substantial barrier that must be addressed. The regulatory structure poses a substantial barrier to renewable energy development [21-23]. In a recent analysis of Queensland, administrative hurdles and delays in project approvals, high capital costs, insufficient financial incentives, infrastructure deficiencies, shortfalls in technology, technical workforce capacity and high levels of complex multi-tiered regulation were identified as barriers to renewable energy development [8]. Streamlining legislative processes, both within and across jurisdictions is essential for renewable energy supply and investment projects.

Conflicting political priorities operate to undermine the effectiveness of existing policy. For example, following the change of government in the Queensland election in March 2012, almost all state renewable energy funding was cancelled with the exception of the solar feed-in-tariff which was substantially decreased. This decision appears to have been made with little, if any industry consultation, and will obviously impact the renewables industry which had relied on the measures in place. Government support measures (at all levels of government) have constantly changed, been refined and adjusted. At the federal level, the (opposition) coalition government has developed an alternate plan and committed to removing carbon pricing and replacing it with an alternate policy if it wins the next federal election scheduled for 14 September 2013. Compounding this issue is the problem of short term policy horizons which can cause difficulty in setting policy frameworks to effectively achieve longer term policy goals and encourage greater confidence by market participants allowing them to plan and respond more efficiently [37, 38].

Participants in the renewable energy industry that rely on government support for viability are likely to be severely discounting the value of the support provided to reflect the risk (perceived or otherwise) that the support will dissolve. Because the renewable energy industry is developing, it is particularly vulnerable to policy shock compared to other industries with more established access to capital and institutional experience. Commercial viability of a range of technologies in Australia (e.g. solar) still largely depends on regulatory intervention and is likely to continue to do so, at least until institutional experience increases, support for non-renewable energy is addressed, technology maturity increases, connection costs are addressed and deployment is accelerated. It is therefore important from both a planning and a financing perspective that policy and regulatory certainty be enhanced, so industry participants can rely on measures when planning projects over the project timeframe. Key stakeholders should be involved in any reviews of regulation and policy, both for input, but also to identify issues that may result, particularly adaptation timeframes and proposals to remove support. This process should be integrated into intergovernmental co-operation and co-ordination mechanisms to ensure policy changes are made cognisant of their potential consequences.

5.3 Network effect and social/institutional acceptance

A key challenge facing renewables, particularly technologies other than wind/hydro is similar to a ‘network effect’. Because the use of large scale renewable technologies is a relatively new phenomenon, particularly in Australia, institutions, and consumers face the choice between two competing networks, renewables, and non-renewables. One network they are familiar with and its inputs and issues are predictable; the other, due to its immaturity, is somewhat unknown. Businesses that have traditionally been involved in coal/gas electricity generation are more likely to stay with technologies and skills with which they are familiar. The literature indicates that where markets fail to give consumers the correct incentives to join a network instead of another (for example because a range of costs are externalised) the success of the network is likely to be determined by consumers’ expectations about which network will prevail and by choices made in the past. [39-41]. Once renewables provide a significant proportion of electricity generated, consumers, institutions (such as banks) will be more willing and supportive of them. Further, solutions to issues unique to renewable technologies (such as voltage variation, and intermittency of supply) are likely to be developed.

Social acceptance is an important component in the development of the renewables industry. The “not in my backyard” phenomena exists, particularly with respect to wind farms that have at times been vehemently opposed. A number of examples internationally, and fewer in Australia, have demonstrated that community participation in deployment facilitates social acceptance and support. As renewable energy begins to have a larger role in electrification, and stakeholders become more familiar with the technologies it is likely that institutional development and social acceptance will accelerate.

5.4 Rural/not grid connected communities

Smaller regional or community scale projects face additional barriers due to their low population density and significant distance from major supply and demand centres. The distances covered by Australian distribution and transmission networks result in losses in the order of 11%, the majority of which are thermal in nature [17]. Rural networks generally use overhead power lines and cost effective conductors such as galvanised steel which are characterised by high losses, although underground power lines are becoming the preferred option for new installations or where the existing overhead power lines may be susceptible to faults [17]. These can make network maintenance and development challenging due to the low population density and large geographical area covered. The Australian Electricity Market Operator (AEMO) which operates the NEM has identified that it requires $4b to $9b network investment supporting $35b to $120b in new electricity generation investment over the next 20 years [42].

Renewable energy can be used to either substitute or supplement existing electricity supply. The Northern Territory Government aims to replace diesel generation in remote areas with renewable or low emission technologies and has identified solar as the most suited renewable technology across the Territory. In Queensland, renewable energy (wind, solar and geothermal) has been incorporated into a small number of remote communities [43]. Partnerships between governments and industry, and direct support for the integration of renewables in rural electrification are necessary to facilitate the transition from diesel generation. Renewable generation can both improve reliability (especially during extreme weather events that can cut road access for months at a time) and potentially provide a more viable alternative. Efficient use of renewables will reduce the need to rely on diesel in remote communities (typically subsidised by government) and reduce emissions.

6. Conclusion

Governments across Australia have taken significant steps towards the development of the renewable energy industry. Nevertheless, substantial regulatory and market barriers persist. Section 4 above highlights some of the key measures, their effectiveness, and key barriers that persist. Support for conventional electricity supply, grid connection costs, availability of capital, social/institutional acceptance, regulatory and policy uncertainty, and different levels of support required by different technologies all continue to frustrate industry development.

Australia has very substantial renewable energy assets, particularly solar energy, and is well placed to exploit those assets. However, to do so requires a re-think of existing policies that have tended to limit investment in renewables and to drive investment in renewables towards particular technologies at the expense of others. It is very difficult for emerging technologies to properly compete on price when the price of electricity is distorted by government support for conventional generation and greater integration of other non-renewable sources such as gas.

A balanced policy framework will of course not focus entirely on renewables at the expense of efficiency improvements and integration of more efficient technologies such as gas. However, at present, the framework is not balanced and favours low cost, more mature renewable technologies (e.g. onshore wind) and fossil fuel generators (e.g. gas). Gas is likely to play a major transitionary role in replacing coal generation and significant investment is already directed towards it. However, renewables also require significant investment. Support and momentum can be difficult to sustain in circumstances where technological maturity, and commercial viability may be in the mid to long term. Major barriers to renewable energy must be addressed through policy that focuses on short, medium and long-term priorities.

Unless steps are taken to address barriers to renewable energy development, Australia will miss the opportunity to rapidly increase renewable electrification that will yield social, environmental and economic benefits.

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