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Energy Security for Australia:

Crafting a comprehensive energy security policy

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Abstract

Australia needs a much broader understanding of energy security than the one that policy makers currently use. The existing definition is too narrowly focused on economic harm arising from a loss of supply, and gives insufficient attention to the fact that energy security is a multi–dimensional concept intertwined with issues across the social, political, economic and environmental spectrum. The consequence of this restricted definition means that energy security is framed in a narrow way, limiting energy security policy attention to a few issues. This also reduces the opportunity for systematic engagement with other policy areas that can both worsen energy insecurities or build security. This is because the areas of energy–related concern for these areas, such as agriculture, water, sustainability and social policy, do not commonly fall within the boundaries of what is deemed to be energy security.

Instead, Australia needs a comprehensive understanding of energy security that explicitly recognises both sides of the demand–supply relationship, and that energy insecurities arise across the four key domains of 1) national economic and national security, 2) food and water security, 3) sustainable development and environmental security, and 4) social stability and energy stress.

Supply and demand, which reflect the producers' and consumers' perspectives respectively, can be both tightly and loosely coupled. Sometimes, both demand and supply are within the control of domestic government policy and it is then logical to develop policy that influences both simultaneously. However, sometimes the Australian Government cannot have a significant influence on one side of the demand–supply equation and it makes sense to develop policy for each separately. The four key domains are the lens that stakeholders use to identify how energy insecurities arise or how energy security can be obtained in relation to their areas of concern. The domains shape how the stakeholders frame and identify energy security threats, likelihoods, consequences and solutions.

Using a comprehensive understanding of energy security that incorporates these two issues – the supply–demand relationship and the four key domains – policy makers will better balance the often competing and conflicting interests involved in energy issues. Such a comprehensive approach to energy security policy development has a far greater chance of developing policies that are both successfully implemented and enduring. Conversely, it will reduce the chance of unintended consequences and the formation of coalitions that seek to undermine policy decisions because of adverse effects on their interests.

This report makes a series of recommendations aimed at implementing a comprehensive approach to energy security policy through the following initiatives:

Adopting a comprehensive energy security definition relevant to Australia

- Treating energy security as a 'wicked problem'
- Broadening the understanding of threats to energy security
- Reducing energy consumption
- Securing the energy wealth for future Australians
- Integrating energy security and defence policy
- Integrating energy security and foreign diplomacy
- Addressing liquid fuel insecurity
- Addressing energy poverty
- Moving beyond energy infrastructure protection
- Engaging the community.

Specific recommendations in each initiative are:

Adopting a comprehensive energy security definition relevant to Australia

1. Australian governments and energy security stakeholders should adopt the following comprehensive definition of energy security: Energy security is the adequate, reliable and competitive supply of sustainable, low–carbon energy and energy services at global, national and local scales; across short, medium and long–term timeframes; and in the context of minimising consumption and demand, maximising energy intensity, and balancing the trade–offs and complementaries between energy and other security referents of value, notably the four key domains of 1) national economic and national security, 2) food and water security, 3) sustainable development and environmental security, and 4) social stability and energy stress.

2. Australian policy makers in both the energy sector and other sectors that affect energy supply or demand should adopt the definition and apply the set of Energy Security Principles that reflect the intent of the comprehensive definition of energy security.

Treating energy security as a 'wicked problem'

3. Australian energy security policy makers should adopt a more collaborative approach to policy making as this is the most effective method to manage such complex and uncertain issues.

4. Key energy security–related government strategies and information gathering processes, such as National Energy Security Assessment, Energy White Paper, Defence White Paper, and environmental strategies, should adopt a collaborative approach to solving the 'wicked problem' of energy security.

Broadening the understanding of threats to energy security

5. Australian energy security policy makers should use in their analyses a comprehensive list of risks that reflects the varied perspectives of energy stakeholders who each view the threats, likelihoods, consequences and solutions relating to energy security differently due to their unique domains of interest.

6. Australian energy security policy makers should ensure that their policy prescriptions do not unnecessarily increase vulnerabilities, threats and risks in areas directly outside their policy interest in both the energy sector and other sectors that affect energy supply or demand. This approach necessitates a coordinated 'whole of government' response.

Reducing energy consumption

7. Australian energy security policy makers should give far greater emphasis to reducing energy consumption through energy efficiency, reducing energy intensity and decoupling economic growth with energy use.

Securing the energy wealth for future Australians

8. Australian energy security policy makers should argue for an energy sovereign wealth fund to improve intergenerational national economic security, and enforce fiscal discipline so that income from non–renewable resources is spent on productive human and infrastructure activities.

Integrating energy security and defence policy

9. The upcoming Defence White Paper should reflect a more comprehensive understanding of energy security issues including:

- Greater attention to the protection of Australian maritime exports in the context of tensions in Asia and the desire by energy importing countries to ensure that Australian supplies are reliable
- The adoption of energy efficiency and smart energy solutions, along with accelerating the Defence Energy Integration Framework, by the Australian Defence Force to reduce energy security vulnerabilities.

Integrating energy security and foreign diplomacy

10. The Australian Government and other Australian stakeholders should enhance their energy diplomacy efforts through greater incorporation of energy security issues into regional interactions including multilateral forums. This could include joint government, private sector and professional association missions concentrating on advancing energy security.

Addressing liquid fuel insecurity

11. The Australian Government in partnership with the petroleum industry, users and other stakeholders should develop a liquid fuel strategy that includes the following components:

- Rigorously and publically investigating what are acceptable levels of emergency self–sufficiency in oil supplies in the context of the international agreement to maintain supplies of at least 90 days, and implementing the most effective approach to achieving these levels
- Ensuring through innovation the sustainability of the domestic refining, storage and distribution industry so that it can supply essential civil and military needs in the event of crises
- Commissioning a detailed analysis of the costs, benefits and timelines for the redirection of currently exported Australian crude oil to be refined domestically in times of crises.
- Accelerating activities to substitute low–carbon fuels for fossil liquid fuels.

Addressing energy poverty

12. As energy poverty can be a driver of insecurity that has strategic and social stability implications:

- Australian security policy makers, and Australian government and private sector aid development organisations should make reducing energy poverty in Australia's region of interest a priority, and this should be done in conjunction with Australian industry to engage them in producing fit–for–purpose energy solutions for the region
- Australian governments, including regulators and other stakeholders, should explicitly seek to minimise energy poverty and reduce energy stress while minimising the generation of other energy insecurities such as under–investment in electricity infrastructure or inhibiting of the development of distributed and multi–directional flow energy systems [1].

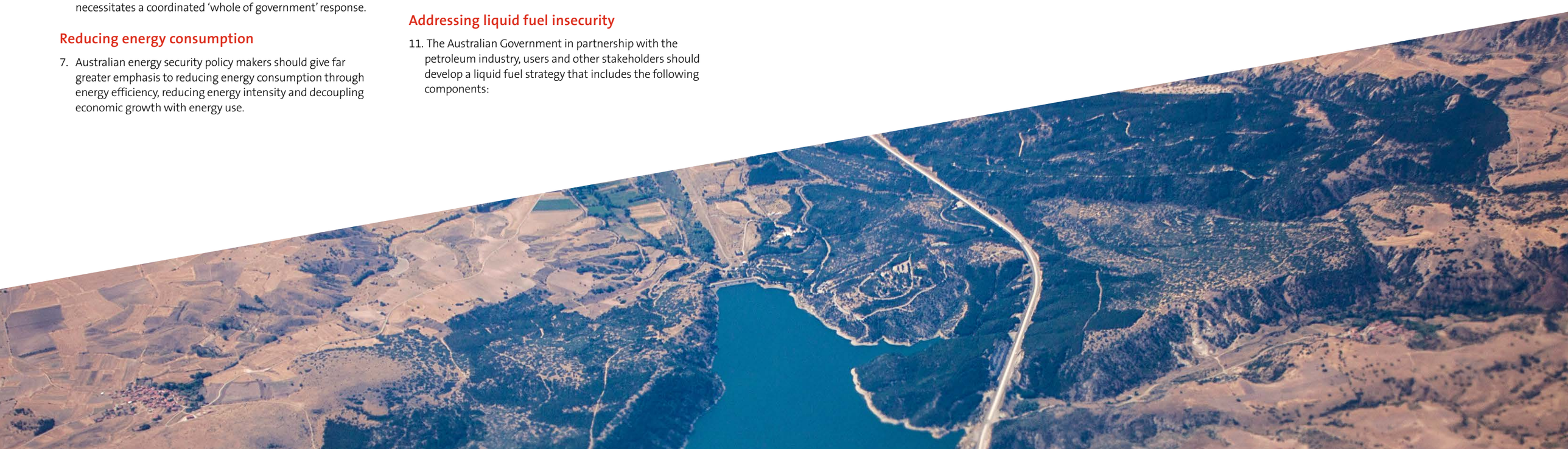
Moving beyond energy infrastructure protection

13. Australian energy security policy should incorporate energy sector and energy user resilience alongside infrastructure protection in energy security and resilience policies and strategies.

14. All Australian jurisdictions should incorporate the building of improved resilient energy systems as part of disaster risk reduction programs and post–disaster 'build back better' programs.

Engaging the community

15. The Australian Government, supported by peak energy bodies, academia and industry should develop a strategic narrative for Australia's energy security, and through the active promotion of storylines in the narrative, advance the development of energy literacy.



Abbreviations

- ACCC
  Australian Competition and Consumer Commission
- ACE
  ASEAN Centre for Energy
- ADF
  Australian Defence Force
- AER
  Australian Energy Regulator
- APEC
  Asia–Pacific Economic Cooperation Forum
- ARENA
  Australian Renewable Energy Agency
- ASEAN
  Association of South East Asian Nations
- ASIO
  Australian Security Intelligence Organisation
- ASPI
  Australian Strategic Policy Institute
- ASTEC
  Australian Science and Technology Council
- bpd
  Barrels per day
- CAS
  Complex Adaptive Systems
- CEFC
  Clean Energy Finance Corporation
- CSG
  Coal Seam Gas
- DFAT
  Department of Foreign Affairs and Trade
- EAS
  East Asia Summit
- EEZ
  Exclusive Economic Zone
- EKONID
  German–Indonesian Chamber of Industry and Commerce
- EPIA
  Energy Policy Institute of Australia
- ERIA
  Economic Research Institute for ASEAN and East Asia
- ESI
  Energy Security Initiative
- FTA
  Free Trade Agreement
- GDP
  Gross Domestic Product
- GIZ
  Gesellschaft für Internationale Zusammenarbeit
- HVAC
  Heating, Ventilation and Air Conditioning
- IEA
  International Energy Agency
- IPCC
  Intergovernmental Panel on Climate Change
- LPG
  Liquid Petroleum Gas
- LVEN
  Low Voltage Exchange Network
- MSIC
  Maritime Security Identification Card
- NCTC
  National Counter–Terrorism Committee
- NEM
  National Electricity Market
- NESA
  National Energy Security Assessment
- OGSF
  Oil and Gas Security Forum
- PEP SEA
  Project Development Program Southeast Asia
- PLC
  Programmable Logic Controllers
- PNG
  Papua New Guinea
- QER
  Queensland Energy Resources
- RET
  Renewable Energy Target
- SCADA
  Supervisory Control and Data Acquisition
- TISN
  Trusted Information Sharing Network for Critical Infrastructure Protection
- UK
  United Kingdom
- UN
  United Nations
- USA
  United States of America
- WEO
  World Energy Outlook

1. An inadequate definition of ‘energy security’

Chapter summary

This report rejects the current Australian Government’s definition of energy security. It considers that it is too narrowly focused on economic harm arising from a loss of supply, and gives insufficient attention to the fact that energy security is a multi–dimensional concept intertwined with issues across the social, political, economic and environmental spectrum. The consequence of this restricted definition means that energy security is framed in a narrow way, limiting energy security policy attention to a few issues. This also reduces the opportunity for systematic engagement with other policy areas that can both worsen energy insecurities or miss opportunities to build security. This is because the energy–related concerns for these areas, such as agriculture, water, sustainability and social policy, do not commonly fall within the boundaries of what is deemed to be energy security.

This chapter demonstrates that different stakeholders have different perceptions of what energy security is, how energy insecurity arises or how energy security can be achieved. Despite this variation and the changing circumstances that have faced Australia over the last three decades, Australian energy policy white papers and the definition of energy security have remained constantly narrow and relatively unchanged.

1.1 Diversity of perspectives

Energy security is a broad concept which can mean many things depending on how it is defined. Like the term ‘security’, energy security is a contested concept. It can be used to mean a policy objective, to justify military action, to compensate owners for closing carbon intensive power plants, and to encourage foreign investment in energy resource developments.

Since the term was first used in the Australian Parliament in 1973 (see Box 1: The first use of energy security in the Australian Parliament), it has been used in a variety of contexts including justifying uranium mining, the need to price domestically produced petrol at global price levels, the benefits of energy conservation, the need to support biofuel development, and to explain why collaboration on regional energy security initiatives can generate trade benefits. From the 1970s to the 1990s, energy security was infrequently used in Australian political discourse. In the early 2000s, its use skyrocketed. There are two reasons for the explosion in use. Firstly, since the 2001 terrorist attacks in the USA, Australians have become more sensitised to security issues. Consequently, issues that previously were not seen as security issues are now more frequently being conceptualised in terms of security. For example, news coverage of major power outages from accidental causes often include a discussion about the incident ‘revealing’ the networks’ vulnerability to deliberate attacks. Secondly, the definition of security has broadened to encompass many threats, vulnerabilities and objects to be protected. A few decades ago, national security was principally focused on protecting the state itself, notably territorial integrity and sovereignty. The actors responsible for this were primarily the military and diplomats. Nowadays, security encompasses non–traditional threats such as water, food and energy security. And even within the discourse of energy security, the issues considered to be security related have also broadened. For example, two decades ago energy security planning focused on protecting oil import continuity, while today it includes all energy forms such as domestically produced and consumed electricity and gas, as well as many perspectives including environmental and human security. The result of the broadening of the definition of security has meant that more and more issues are being linked to energy security.

Because of the broadening of the term ‘security’, multiple meanings of the term ‘energy security’ have arisen that reflect the perspectives of the users. These perspectives vary depending on factors as diverse as geospatial level (e.g. household, regional, national or global), timeframe (e.g. minutes, days, years or decades), sector (e.g. national security community, energy exporter, energy producer, energy retailer or consumer), and trade–offs (e.g. the consequence for edible food production by switching to agricultural biofuel cropping). This diversity of perspective is reflected in Figure 1 which identifies what stakeholders along the energy supply chain identify as their key concern of energy security.

Figure 1: Perspectives of energy security by stakeholders along the energy supply chain

Stakeholder	Primary energy security concern
National economic policy makers	Obtaining liquid fuel supplies that are reliable, adequate and affordable
Energy export producers	Ensuring reliable, long–term contracts for their product so that they can obtain the investments required to exploit their energy resources
State disaster management committees	Responding to unexpected disruptions to the liquid fuel supply chain and implementing a fuel rationing system that minimises economic and social damage
Electricity generators	Maximising financial returns through entering and leaving the market based on real time prices
Planners of electricity transmission and distribution operations	Ensuring the duplication or redundancy of electricity infrastructure to meet network planning policies and criteria by energy authorities
International NGOs and welfare groups	Preventing energy poverty
Border security agencies	Protecting offshore oil and gas assets
Defence facility managers	Ensuring that defence bases have continual access to energy to enable their military capabilities to remain effective
Domestic security intelligence agency	Providing intelligence on threats to critical energy infrastructure
Certain community groups	Advancing sustainable energy as part of the energy mix
Households	Having continuous, affordable, stably priced petrol, natural gas and electricity
Renewable energy sector	Maintaining security of demand and financial support
Foreign affairs	Using energy security dialogue as a mechanism for international cooperation and advancing Australia's interests

An additional perspective of energy security relates to the evocation of the term by political actors who seek to take advantage of the public's security sensitivity, particularly in the post–2001 world. By linking energy with the concept of security, and particularly national security, threats to energy security can become 'elevated' on the political stage. This can give the term a powerful symbolic value which can be employed to win highly contentious political debates. If an issue is accepted as a 'national security' issue, governments often gain licence to make extraordinary decisions in the name of securing the nation (see Box 2: Energy security as a rhetoric tool). At various times over the last three decades in Australia, energy security has been an issue, as seen in Box 3: Energy security as an election issue. Recognising that the term 'energy security' is used as a rhetorical tool rather than just as a focus for policy analysis is important in distinguishing its alternative meanings.

1.2 Energy white papers and the definition of 'energy security'

In 1988, the Australian Government released its first formal energy policy white paper. Subsequent versions were released in 2004 and 2012. The Australian Government has stated that it will release a revised white paper in 2014. Prior to 1988, there was no comprehensive statement of energy policies as these were announced singly or as a package of measures through budgets, ministerial statements, legislation or as the government of the day saw fit.

All of the white papers have advanced a very similar definition of energy security which reflects a supply security, macro–economic perspective. This can be seen in the Australian Government's current definition which is:

Energy security is the adequate, reliable and competitive supply of energy and energy services to support the nation's economic and social development, where:

- adequacy is the provision of sufficient energy to support economic and social activity
- reliability is the provision of energy with minimal disruptions to supply
- competitiveness is the provision of energy at an affordable price that does not adversely affect the competitiveness of the economy and that supports continued investment in the energy sector.

This definition has its roots in the 1970s oil crises where the greatest energy security risk was the lack of reasonably priced, reliable and available imported oil. This was despite the fact that Australia was not being directly affected by the 1973 oil crisis, as it was almost self–sufficient in oil. The only reason that Australia was affected by the price shock of the 1979 crisis was because of government policy which pegged the price of Australian produced oil to the international price. Over time, this definition has remained mostly unchanged with the term 'oil' being replaced by 'energy'.

This definition of energy security has two notable limitations. Firstly, it ignores the converse of supply, which is demand. Security of energy (export) demand is a priority for Australia as it is for other energy exporting nations. These exports generate a nation's essential foreign earnings and government revenue. In the case of Australia, the primary energy exports are coal, natural gas and uranium. Australian resource exports are in the hands of investor–owned entities that make investment decisions based on potential profit. To secure the billion dollars of investments required to bring resources to market requires confidence in long–term demand, as well as other factors such as regulatory certainty. Thus for individual companies and for the nation as a whole, any definition of energy security relevant to Australia must consider security of energy (resource export) demand.

Secondly, the existing definition only links energy with a nation's economic and social development, thus ignoring the full range of sectors and issues interconnected with energy. It does not mention the threat that energy supply or demand shocks, or enduring changes can have on other things of value (known as the security referent) such as political stability, individual financial energy stress, quality of the environment and sustainability. In other words, the definition lacks consideration of a broader range of referents valued by Australia's citizens, and does not consider issues including geopolitics, excise/taxation policy, ecology, industrial development and innovation.

Reviewing how the issue of energy security is addressed within the white papers, it became apparent that it is primarily framed within a national economic and national security context. This reflects the importance given to economic growth and the demand for continuous, reliable and lowest cost energy supply to power it. In the 1988 paper, the source of energy insecurity that threatened the economy was identified as the growing need for imported oil supply due to both demand growth and declining oil production in Australia. To mitigate this risk, as well as to improve the national balance of trade, policy emphasis was placed on encouraging increased foreign investment and development of domestic and export energy sources. Although this white paper encompassed all fuels, only oil was discussed in terms of security. Discussions on continuity or reliability of electricity, gas and coal was not framed as a security issue. Instead, it was characterised as either engineering or market risk.

Following the 2001 terrorist attacks, the need for protecting the energy infrastructure from malicious attacks was emphasised in the 2004 White Paper. To a lesser but still significant degree, this white paper also introduced an environmental security perspective. It emphasised the link between harm to the environment and burning of fossil fuels, and recommended policies to reduce greenhouse gas production. In the 2012 White Paper, the environmental security perspective became more prominent as the government pursued its expansive clean energy reform program.

The demand side oil crisis of the 2005–08 period (see Box 4: 2008 oil crisis) which pushed oil prices very high and created rising electricity and gas costs, ensured that energy costs and their ability to undermine economic growth were key features of the 2012 White Paper. This white paper was the first to include an energy stress perspective when it noted issues of energy poverty and the damaging effect of increased household energy prices.

Other perspectives such as food and water security, sustainable development and social stability, were not reflected to any noticeable degree in any of the energy white papers. Issues of energy export and domestic demand were addressed but not in terms of the flipside of security of supply. Instead, demand issues were seen purely in terms of market risks where the supply–demand balance is not synchronised.

The discussions in the white papers on energy security have consistently reflected the economic policies of Australia pursued since the early 1980s. Prior to the 1980s, Australia was a heavily regulated economy with high trade barriers, fixed exchange rate and government owned infrastructure. The merits of replacing such a government–dominated, closed economy with an open, competitive one was being advocated in the USA, the UK and other developed economies, and this philosophy was adopted by the main political parties in Australia. Towards the end of the decade and into the 1990s, the market liberalisation agenda was applied to infrastructure, including energy infrastructure. This resulted in government owned energy infrastructure being privatised, breaking up vertically integrated systems into energy supply chain organisations, restructuring public monopolies to facilitate competition, and allowing third party access to infrastructure. These changes were predicated on the idea that the private sector and competition, rather than government, generates growth and wealth, and that markets are the best mechanism to drive efficiencies, create innovation and enhance productivity.

This philosophy is reflected in energy policy and energy security policy in particular over the last few decades, such as in the following principles:

- Free market and competition, coupled with well–regulated markets, are the most effective means to deliver energy security in Australia and globally
- Encouraging private sector and foreign investment in energy export projects increases the amount and diversity of energy supply, thus enhancing energy security
- Removing market impediments to energy exploration and production, and expanding cross–border energy trade improves energy security
- Globally freer markets in energy products and investment in energy projects can effectively balance supply and demand, thus increasing energy security.

The dominance of economic thinking is reflected in how the 2012 White Paper categorised energy security causes into two types: non–market and market causes. Non–market causes create short–term disruption to energy production and distribution due to hazards such as storms, industrial accidents, strikes, terrorist attacks, and inadequate maintenance. Market causes are where disruption occurs due to markets and regulatory system failures such as inadequate market development, inadequate information or regulatory certainty to justify energy infrastructure investment, and price signals that do not reflect the cost of supply.

The dominance of the economic perspective over others can be seen in how Australian governments have for decades continuously rejected the politically popular idea of self–sufficiency in crude oil. This rejection is based on an economic argument that it is cheaper to get oil from overseas than process the oil currently extracted in Western Australia in Australian refineries. The advocates for the position support it by highlighting that the global oil market has been a reliable supplier since the 1970s. In addition, Australia's refineries are not designed to process the oil from Western Australia meaning that they would need to be upgraded to process this oil cost effectively.

The dominance of the economic perspective has not meant that other policy objectives were not considered at all. There has always been recognition that energy policies need to be integrated with other policy objectives, such as carbon and financial market developments. The approach has been that these policy objectives should be achieved in a way that they enhance the market–based energy approach or minimise any effect but only when there is overwhelming benefit from distorting the market. The existing supply orientated, macro–economic approach to energy security fails to develop a holistic understanding of energy security. This inhibits the chances of developing an effective and enduring energy security policy.

Box 1. The first use of the phrase 'energy security' in the Australian Parliament

The first use of the phase 'energy security' in the Australian Parliament was in 1973. This was the time of the first oil crisis when the oil embargo against Israel's allies dominated political discussions around the world. However, the Hansard speech was not about this. Unlike America, Japan and other oil importing nations who were concerned with security of energy supplies, Australia, being mostly self–sufficient in oil, was focused on opportunities for export energy. This points to Australia's long–term focus on obtaining reliable markets for energy exports, or in other words, an enduring policy focus of security of energy (export) demand.

Australia is in a position to contribute significantly to international energy security

On 23 October 1973, the Minister for Minerals and Energy, Rex Connor, spoke in the Australian Parliament about the possibility of enriching uranium in Australia which Connor claimed would 'maximise Australia's financial returns from uranium while providing full energy security in this resource from Japan'[2]. Through all of the 1970s and for 80% of the 1980s, Hansard's recorded uses of the phrase 'energy security' all related to nuclear sector issues with many of them about how exporting uranium can contribute to global energy security.

The focus on nuclear energy was because, at that time, there was a strong social movement against nuclear weapons and the domestic mining and exporting of uranium. Australia had become sensitised about nuclear issues starting in early 1970s following French nuclear testing in the Pacific in 1972–3. Arguments over uranium mining in Australia intensified from 1976–77 and concern over the threat of nuclear war increased in the late 1970s and early 1980s. It was an election issue in the 1983 election, and despite the commitment by the Labor Opposition to cease uranium mining, when it won power it failed to implement that policy position.

A justification for Australia's involvement in the nuclear fuel cycle as a producer or enricher of uranium was that it increased global energy security and hence would reduce international tensions. This is reflected in the Ministerial Statement by Prime Minister Bob Hawke on 6 June 1984 when he referred to a study by the Australian Science and Technology Council (ASTEC) that 'concluded that Australia, through being a reliable, long–term supplier of uranium, is in a position to contribute significantly to international energy security'[3].

The ASTEC report, Australia's Role in the Nuclear Fuel Cycle, explained the logic of the link between energy security and nuclear industry. It stated that 'disruptions in the supply of resources of any sort have been a cause of international tension and, through human history, have led to war' and that the supply of energy through nuclear power can reduce international tensions. In particular 'countries which do not have indigenous energy resources are most concerned to ensure reliability of supplies' and 'have turned to nuclear energy for electricity generation out of concern about reliability of oil supplies both in the short and long–term'. Australia, 'a reliable, long–term supplier of uranium, is in a position to contribute significantly to international energy security'.

Box 2. Energy security as politics

In a political environment, energy security is a contested term. Its meaning as defined by one politician can be challenged by another for political advantage. An example of this was seen following the release of the Australian Government's Energy White Paper in June 2004. Senator Lyn Allison, future leader of the Australian Democrats, in her evaluation of the strategy stated that:

'The Prime Minister talks about energy security, but his idea of energy security is how well our infrastructure is secured against terrorism. I think he misses the point here because energy security is about security of supply, not about the security of something we have already got. As we all know, it is the case that fuel supply will peak in the next few years, and peaking means that you cannot keep increasing consumption, which is what we are currently doing worldwide [4].'

Her perspective of energy security concerns oil supplies, and reflects a peak oil view. Consequently, this perspective leads to solutions based on reducing consumption.

The term 'energy security' is also a common political rhetorical tactic. In a post–2001 world which is one more sensitised to national security threats, the phrase 'energy security' rhetorically can have more gravitas than 'energy policy', 'energy conservation' or other energy–related phrases. This is because energy becomes linked with the 'higher' goals of protecting national interests, national security and, depending on the situation, even community and individual security. By invoking the symbolic power of security of the nation, the advocate can take the moral high ground by referring to national interests. This frames the debater as one who is against national interest.

Linking an issue with energy security because of its value can be seen in numerous political advocacy statements. It is normally seen as a justification of, or a subsidiary benefit arising out of, some proposed policy. For example, in arguing that liquid petroleum gas (LPG) should remain excise–free, Ian James, Chairman, Autogas Committee, Australian Liquefied Petroleum Gas Association, stated at a 1999 Senate Committee inquiry that this situation was justified as 'the outcome is community benefits – less smog, less carbon dioxide, less health risk and greater energy security' [5].

Similarly, in a 1999 House of Representatives inquiry into increasing value–adding to Australian raw materials, Robert Gordon, Executive Director of the Fuel Ethanol Association of Australia, linked energy security to the need for greater development biomass feedstocks in Australia. He stated that 'the positive effect for our nation in terms of future energy security, economic and social revival in rural and regional Australia, greenhouse gas abatement and other benefits would be enormous and would place Australia in a leadership role in our region in terms of renewable energy development'. He explicitly linked the national biofuels industry with addressing energy insecurity and national security when he noted the 'slow but growing realisation that oil is the weakest link in Australia's energy portfolio, and that Australia's domestic oil reserves are expected to reach a point of exhaustion within 10 to 15 years ... [and] ... this development has major implications for our country's balance of payments, economy and national security' [6].

A final example illustrates coincident, rather than conflict, of interests. In 1991, the Peter McGauran, Shadow Minister for Science and Technology, argued that the taxation regime applying to the two energy explorers, BHP and Esso, should be changed. 'Providing a balanced and rational economic environment for the industry is therefore critical – not just for its own commercial viability, but for the energy security of the nation [7].'

The employment of the term 'energy security' can frame an issue. This is best illustrated in the formation in the mid–2000s of the Energy Security Fund as part of the Australian Government's climate change plan. By using this term, it creates an impression that this fund will significantly advance energy security in a comprehensive manner. In reality, the fund was narrowly focused on ensuring that highly greenhouse gas emitting coal–fired power stations in Australia were financially compensated following the introduction of a carbon price.

Box 3. Energy security as an election issue

Over the last three decades, energy security has been an election issue in Australia following significant energy price rises.

The first instance where the phrase 'energy security' featured in a party policy document was in 1980. The Deputy Prime Minister and Minister for Trade and Resources, Rt Hon JD Anthony, Leader of the National Country Party of Australia, in a printed political statement, stated when referring to the policy of import parity price that 'Energy security was the purpose of the policy'. The import parity price involved the government introducing an oil levy so that the cost of domestically produced oil was at the same cost as buying Saudi Arabian oil.[8] The Labor Opposition a few months later at their Energy Policy Launch challenged that this policy was not necessary to ensure long–term energy security. Instead, 'It is the only policy the Government has, and in reality it is a tax policy not fuel supply security', according to the background paper jointly authored by the Leader of the Opposition Bill Hayden and the future Prime Minister Paul Keating [9]. This exchange is reflective of what was to be a long–running argument over the purpose of internationalising the pricing of oil – was it really about securing the supply of oil, or about increasing the tax take by government?

Energy security also featured in the 2013 federal election, principally due to rising electricity prices. Each of the main parties referenced energy security. The Coalition's Policy for Resources and Energy stated that 'The Rudd–Gillard Government also failed to address the critical issues of national energy security and energy market transparency'. The election policy of the Nationals expanded on this and justified its position of supporting a particular fuel for energy security reasons. Its policy platform stated that 'considerable environmental and energy security benefits attach to continuing to encourage the use of LPG'. The Labor Party's National Platform made a commitment that it would 'make a national effort to maximise our energy security, capacity, efficiency and the lowest practicable and sustainable energy prices for Australian industry and consumers'.

Box 4. 2008 oil crisis

The 2008 oil crisis was fundamentally different from the 1973 and 1979 oil crises. Unlike the 1970s crises which were driven by a curtailment of supply, the 2008 oil crisis was caused by soaring demand coupled, due to the booming global and particularly Asian economies, with other factors including changes in the US dollar, production uncertainties from some oil producing countries, and financial speculation. The mid 2000s saw a weakening of the US dollar compared to other currencies, resulting in the increase in US dollar denominated oil prices. It also saw considerable fluctuations in the US dollar resulting in investors in US dollars seeking safer havens including investing in stronger currencies and commodities including oil. The situation in a number of oil producing countries, notably Iraq and to a lesser extent Saudi Arabia, which were experiencing conflicts and terrorist threats to their oil producing infrastructure, increased uncertainty about oil production reliability. Finally, financial speculation was a significant factor in oil price increases, particularly between August 2007 and July 2008. This time period saw large volumes of speculative commodity trades. For example the ratio of 'paper' barrels of oil traded on futures exchanges compared to physical barrels supplied in July 2008 was 25. In 2003 it was only six. The speculation was fuelled by loose monetary policies of reserve currency central banks and the provision of easy credit which also contributed to exchange rate instability. Speculators from hedge and pension funds poured huge volumes of funds into the commodity markets, which drove commodity price inflation.

2. A comprehensive understanding of energy security

Chapter summary

Australia needs a comprehensive understanding of energy security that reflects the reality that it is a multi–dimensional concept intertwined with issues across the social, political, economic and environmental spectrum.

Such a perspective must incorporate the two sides of the demand–supply relationship, and its interrelationship with four key domains. The supply and demand reflect both consumers' and producers' perspectives, and are sometimes tightly coupled while other times loosely coupled. Sometimes both demand and supply are within the control of domestic government policy and then it is logical to seek to influence both simultaneously. However, sometimes the Australian Government cannot have a significant influence on one side of the demand/supply equation and it makes sense to treat each issue separately in a policy sense.

The four key domains are the lens used by stakeholder groups to analyse the threats, likelihoods, consequences and solutions relating to energy security and represent the domains where energy security issues are discussed. It is in these domains that stakeholders identify how energy insecurities arise or how energy security can be obtained. The four domains are 1) national economic and national security, 2) food and water security, 3) sustainable development and environmental security, and 4) social stability and energy stress.

By using a comprehensive understanding of energy security that incorporates these different perspectives, policy makers will better balance the often competing and conflicting interests involved in energy issues. Such a comprehensive approach to energy security policy development has a far greater chance of policies being successfully implemented and therefore being more enduring. Conversely, it will reduce the chance of unintended consequences and the formation of coalitions that seek to undermine policy decisions because of their adverse effects on narrow stakeholder interests.

2.1 Supply and demand dimensions of energy security

Integral to energy security is the concept of supply and demand. Only when there is a possible or actual mismatch between supply and demand can insecurities arise. A supply/demand imbalance can occur from either supply or demand shifts. The Australian Government's assessment of energy security, as detailed in the National Energy Security Assessment (NESA), is based on assessing the supply and demand situation. This market–based assessment considers factors including:

- Supply–side factors, including drivers affecting the mix of energy sources
- Demand–side factors that relate to the demand for energy by fuel source market and institutional arrangements that affect individual sectors or all sectors
- The investment environment, including incentives for investment in energy infrastructure in the various sectors, and interactions between the sectors that affect on investment outcomes
- Technological change in the development of new, renewable and/or more efficient energy technologies
- Publicly–available information on climate change policies, including the carbon pricing mechanism and the Renewable Energy Target
- Conditions in the domestic economy
- International factors, such as the "global financial crisis" and Middle East unrest and vulnerabilities, that affect the global oil market and domestic energy market.

The NESA was carried out in 2009 and 2011, and an updated version is expected in the near future. The 2009 NESA stated that Australia's level of energy security had decreased by historical standards due to a range of market and policy pressures, with the most important being:

- Investment uncertainty and structural change
- Tighter demand and supply balances
- Increases in energy costs due to climate change policies and system investment and refurbishment
- Increases in capital, skills and component costs
- Reduced availability of global capital due to effects from the global financial crisis.

The 2011 NESA found that these pressures still remained, and additionally included:

- The Carbon Pollution Reduction Scheme
- A 5% emissions reduction target on 2000 levels by 2020
- A 20% Renewable Energy Target.

Its conclusion was that the overall energy security situation is expected to remain adequate and reliable. The NESA only examines three main energy sources – liquid fuels, natural gas and electricity. Box 5: Assessment of energy source security, details its conclusions.

Box 5. Assessment of energy source security

Liquid fuels

Australia's liquid fuels energy security is assessed as **high** trending to moderate in the long term, as we have continued access to highly adequate and reliable supplies of liquid fuels at price levels that are manageable within the broader economy. The moderate assessment rating in the long term recognises a likely trend of high crude oil prices driven by increasing global demand and an increased reliance on more expensive sources of supply; the significant global investment challenge required to meet rising demand; and the continued risks of geopolitical uncertainty in key oil producing countries.

Natural gas

Australia's natural gas energy security overall remains **moderate** over the assessment period, reflecting a rapidly developing market – particularly driven by the growth of coal seam gas production – with distinct regional differences and challenges within Australia. The moderate assessment recognises the mixed influences on gas security brought about by the development of the coal seam gas to the liquid natural gas (LNG) export industry on the east coast, due to commence from around the middle of this decade. While this has increased the identified gas reserve levels in Australia, it also introduces a degree of competitive tension between the domestic and LNG export markets, and is likely to affect domestic gas prices in future years. The moderate assessment also reflects the evolving supply–demand balance in Western Australia. While increasing demand has placed upward pressure on prices, the market is responding with increased supply from a greater diversity of sources that are planned to come on line in the short to medium term. Despite this, there is a risk that some downstream projects may be challenged in sourcing gas at historical prices, and this could lower the gas security rating.

Electricity

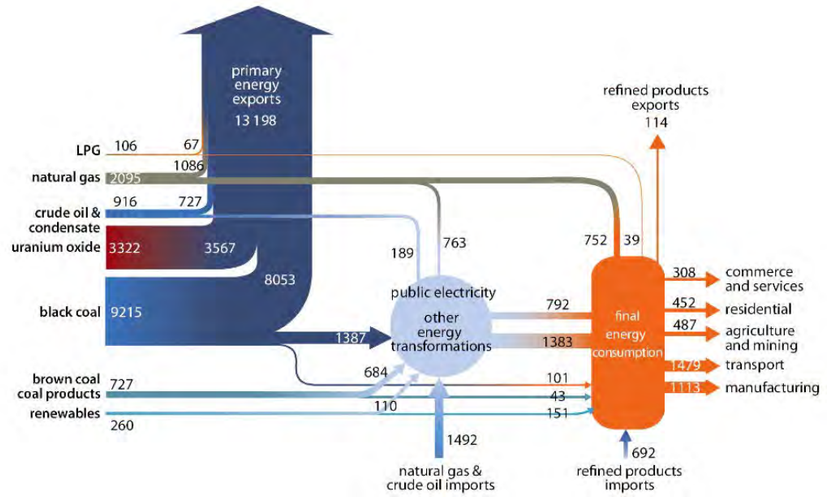
Australia's electricity energy security overall remains **moderate** over the assessment period. The electricity sector faces significant challenges during the assessment period, most notably the significant investment task required to maintain reliability while transforming the sector to reduce greenhouse gas emissions, with this investment driving associated price pressures. Market maturity and ongoing market reforms, together with assistance mechanisms associated with the Australian Government's Clean Energy Future package, should allow the market to respond appropriately and flexibly to such challenges [10].

The NESA assessment, while probably accurate for domestically consumed energy, is reflective of a view that energy security is ensuring sufficient supply to meet the demand of domestic consumers. However, there is another perspective that is not reflected in the NESA: this is the perspective of energy producers that are more concerned with having sufficient energy demand given the supply. This second perspective completes the two sides of the supply/demand balance. That is, energy security has to have constituent parts – security of supply and security of demand.

Security of demand is the dominant perspective for those enterprises across the production, transformation, transmission and distribution spectrum. For those whose output is consumed in Australia, their issues are factored into the NESA. However, for those whose output is consumed outside Australia, they are not considered by the NESA.

Energy exports are a huge component of Australia's energy chain, and constitute a major source of foreign exchange earnings and national economic stability. Figure 2 shows the energy flows in Australia for the year 2010–11, and highlights the relative importance of primary energy exports. Specifically, it shows the massive exports of uranium oxide and black coal, as well as identifying that natural gas, LPG, and crude oil/condensate are also exported. All the uranium is exported as is the vast majority of black coal. With the increase in gas export facilities in Queensland over the next few years, the volume of exported LNG will also increase significantly.

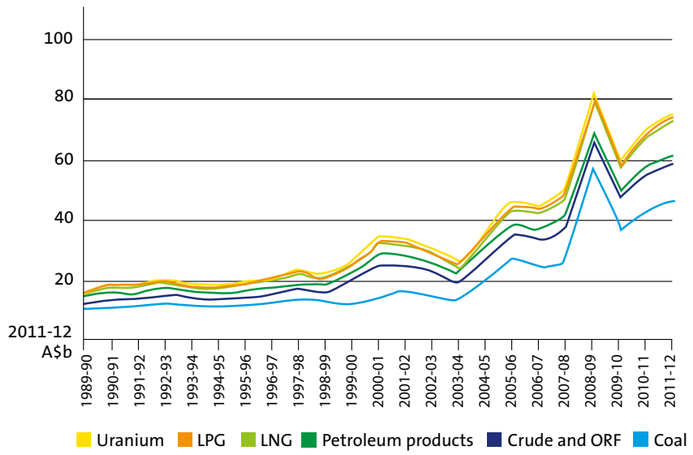
Figure 2: Australia's energy flows, 2010–11 (PJ)[11]



Australia is a massively rich energy country having almost 40% of the world's uranium, almost 10% of the world's coal resources and 2% of the world's natural gas. Australia is the world's ninth largest energy producer, and produces almost 3% of the world's energy production. It exports over 60% of its total energy production with the remainder consumed within the country. Coal is the most exported energy commodity, and Australia is the world's largest exporter. It is one of world's largest uranium exporters and currently the sixth largest LNG exporter.

Australia has been exporting energy resources for decades, and all forms of its primary energy are exported. See Figure 3, Australia's energy exports, 1990–2012.

Figure 3: Australia's energy exports, 1990–2012



Note: ORF is other refinery feedstock.
Source: BREE 2013, Resources and Energy Quarterly.

The supply of energy exports is important for two reasons. Firstly, it benefits Australia through export earnings, tax revenues, employment and flow–on effects through the construction and heavy engineering sectors. While Australia is not in the same position as some Middle Eastern countries where over 80% of their governments' revenue comes from energy exports, energy exports in Australia have been essential to its economic position for decades. Today, about 35% of Australia's total commodity exports are energy exports, or about 20% of total export value. The energy export sector provides over 50,000 direct jobs and multiple times that for indirect jobs.

The benefits for Australia are not only economic. Being a large energy exporter, Australia has been able to deploy energy as a tool of diplomacy. Energy diplomacy has become one of Australia's pillars for strategic engagement with regional trading powers, notably China, Japan, South Korea and India. The ability to supply energy has also enabled Australia to have a position of influence in regional political institutions such as the Asia–Pacific Economic Cooperation Forum (APEC) and the East Asia Summit (EAS).

The second reason that Australia's energy exports are important is that they benefit global energy security. By being a reliable, competitively priced, large energy exporter, energy importing countries have sourced energy from Australia as a way to diversify their sources of supply. Australia's energy exports have also increased the total pool of energy, thus contributing to a better balance between global demand and global supply. As it can also bring on additional supply, albeit small, following some significant global disruption to the energy supply chain, Australia's energy exports can provide a limited smoothing ability to demand–supply fluctuations.

Energy exports have been a priority for national development and to the economy since the 1960s. To increase exports, Australian governments have sought to facilitate private sector investment, create an international market–based energy trading system, and seek to ensure that Australia is viewed as a highly reliable, competitively priced supplier of bulk energy. These policy settings across successive Australian governments are aimed at achieving diverse investment in Australia's energy industries.

Investing in energy infrastructure is an expensive and long–term proposition. Consequently, to be able to develop this infrastructure, the hugely capital intensive, multi–decade energy export industries require producers to have security of demand. Without having demand security, investors, whether government or private sector, will not have the confidence to justify the investment. Once the upfront investment is made, producers are concerned about demand shocks resulting in idle plant and equipment, and hence decreasing their financial returns.

Thus for actual energy exporters, the priority is long–term stable demand sufficient to justify the investment and preferably with no demand shocks. The typical method to manage this risk is through multi–year contracts. For energy producing nations, the priority is to ensure that demand is not artificially affected by political decisions of energy importing nations.

Australia's export demand–driven place within the global energy market reflects a significant change in the energy security posture of the country since 1970. Australia as a largely self–sufficient oil user rode out the effects of the oil crises in the 1970s, but 40 years of increased globalisation have markedly changed that position. The NESA values and manages the importance of security of supply through market–based actions, but given the importance of energy exports for Australia, Australia's approach to energy security must also consider security of export demand.

2.2 The four key dimensions of energy security

There are four different dimensions of energy security considered in this report, these are:

- National economic and national security
- Food and water security
- Sustainability and environmental security
- Social stability and energy stress.

The dimensions represent the domains where energy security issues are discussed. It is in these domains that stakeholders identify how energy insecurity arises or how energy security can be obtained.

The domains reflect the lens through which energy security is viewed, and the chosen lens is a function of the stakeholder's interests and mandates. For example, examining energy security through an environmental lens means that energy insecurity can arise due to the production of greenhouse gases and other pollutants, and a source of increased energy security is reduced reliance on fossil fuels. For the military tasked with protecting offshore petroleum facilities, energy insecurity arises from the facilities' remote locations. From this perspective, energy security can be increased by providing greater vigilance against intrusion, and improved capability to respond to incidents. A final example is the perspective of national agricultural management. As conventional farming depends on natural–gas–produced fertilisers and liquid fuels, this is a source of energy insecurity. Thus energy security can be increased by creating less fossil–fuel–dense farming.

A factor that guides focus and policy solutions across all the dimensions is time. If only a short time period is considered, there is a focus on shocks in energy supply or demand, or other rapid onset consequences. For example, in the case where off–shore platforms are a source of energy insecurity, a short–term solution to improving energy security would be by providing greater protection, while a long–term solution would be to replace the surface facility with sub–sea infrastructure. The time factor is often described in terms of short–, medium– and long–term energy security risk factors, and these are defined in the NESA. For petroleum products for example, sources of increased security for short–term risks are building up or accessing oil reserves, rationing of petrol, and emergency energy conservation initiatives. If medium–term risks are considered, sources of security improvement including building additional generation plants, augmenting existing transmission lines to meet predicted summer peak load, or introducing new product energy efficiency standards. If long–term risks are the focus, sources of security could include decoupling energy consumption and economic growth, decarbonising the economy, or bolstering energy diversity through nuclear power.

A multi–dimensional view recognises that there is often a conflict between stakeholders in different dimensions over the sources of increased energy security. More importantly, the identification of competition between domains of energy security leads to active negotiation between parties and management of conflict instead of accepting entrenched disagreements and continuation of 'stovepiped' solutions. The dimensions are not mutually exclusive but invariably overlap and are interrelated. In some dimensions, sources of energy insecurity are sources of security in other dimensions and vice versa. For example, a source of security from an environmental perspective is introducing a global greenhouse gas taxation regime; however, this conversely is a source of energy insecurity for Australia's energy export producers.

2.2.1 Energy security, national economic security and national security

National economic security, national security and energy security are highly interrelated and can reinforce and undermine one another. Both national economic security and national security are concerned with protecting sovereignty and independence as well as advancing national interests and

values internationally. Economic security focuses on sources of economic harm whereas national security focuses on foreign powers and increasingly non–state actors.

The importance of energy to economies is reflected in the fact that large economies can spend up to 5% of their GDP on importing oil while smaller energy–importing countries can average 10%. The amount varies considerably with the global price of energy as the USA spent over 8% during the 1979 oil crisis. The energy industry in Australia is worth 6% in terms of gross value added.

The last few decades have seen growing globalisation where national economies have become increasingly integrated into the international economy through trade, foreign direct investment, capital flows, and the spread of technology. Globalisation has provided enormous benefits including allowing cross–border trade to grow, resulting in lower prices for consumers, larger export markets for domestic manufacturers, and economies of scale through being able to specialise in certain goods. It also allows foreign investment and resources to flow into the country. Globalisation also has its negative effects including unemployment in industries that cannot compete globally, inequity as benefits are not evenly spread, and loss of governmental control of certain organisations and trade flows. Globalisation in general and economic development in particular has delivered improvements in living standards, health and longevity, as well as funding the priorities of the government and its citizens. In terms of national security, growing economic development has also generally delivered societal and political stability.

However, economic globalisation carries significant attendant risks. The very nature of integrating into an international system involves introducing vulnerabilities through economic dependencies. Unexpected interruptions to exports and import supply chains are a fundamental vulnerability and need to be actively risk managed. If the supply chain is not well managed, it can lead to economic and social dislocations such as losses in jobs and industries that are priced out of the market due to cheaper imports, inequity, inflation due to the internationalising of domestically produced inputs, and trade imbalances.

For energy intensive and energy importing countries, such as China, Japan and the USA, reliance on foreign countries' supplies can be viewed as a significant national security risk as it grants other countries the potential to apply undue pressure. The dependence on foreign energy can also mean that an importing nation can suffer collateral damage as a result of a dispute along the energy supply chain. One example of this relates to the natural gas pipeline from the gas fields in Russia across Ukraine to Europe. In 2009, a dispute over payments between Russia and Ukraine escalated and resulted in Russian gas flows through Ukraine being halted for 13 days. The consequence was that supplies to south–eastern Europe were cut.

Dependence on international supplies of energy also results in an importing country's economy being affected by price changes due to global shifts in supply and demand. For countries that have import pricing parity, energy price changes pass through the economy rapidly affecting inflation, and demand and supply of goods and services. For countries that regulate energy prices, price rises can be mitigated by increasing energy subsidies which over the longer term can become a huge burden on an economy and distort economic activity. The alternative is removing the subsidies; however, the consequence can be politically contentious and even lead to physical violence. An example was the violent protests following the decision by the Indonesian government to cut fuel subsidies in July 2013.

Concern by energy importing nations over a lack of resources can be a contributing cause to tensions between countries, sometimes even leading to war. An historic example from our region was in 1940 when the United States placed an embargo on all oil exports to Japan, which was a contributing factor to the invasion of oil–rich Indonesia (then Dutch East Indies).

Within countries, the distribution of wealth from resources has been a prime cause of struggles, rebellions and even civil wars. Figure 4 shows regional examples of past and current flashpoints where energy resources have been a contributing factor to tensions or conflicts. Protection of energy security has been a major driver for US foreign policy as seen in the Carter Doctrine which states that any outside force seeking to control the Arabian oil producing region would be deemed to be an attack on America. It is worth noting that a 2012 Australian Government report into offshore oil and gas security drew parallels between the Carter Doctrine and how it may apply in the Australian context; likewise, how a similar doctrine by Australia's energy purchasing countries might intervene in Australia's region to guarantee supply. The report noted that:

'Energy supplies from the Persian Gulf have been protected for decades by the major importing nations, including the US, to ensure ongoing reliability of supply. It is not difficult to extrapolate that major importers of Australian energy may adopt a similar approach in protecting the supply route from Australia to their shores [12]*.'*

Figure 4: Locations where ownership of energy resources is a contributing factor to regional flashpoints

1. Aceh conflict: A driver of the Free Aceh Movement is to gain more equal distribution of profit between the central government and native people of Aceh, including of its substantial oil and natural gas resources.

2. East China Sea: China, Japan, and Taiwan each claim a Japan–administered island group that Japan calls the Senkakus, China the Diaoyu Islands, and Taiwan the Diaoyutai Islands.

3. Sea of Japan: Japan and South Korea contest this area.

4. Yellow Sea: China and South Korea contest this area.

The link between energy and economic development is not only a concern for energy importing nations. For nations that depend on energy export income as a substantial component of their government revenue and foreign exchange, there is an obvious link between energy security of (export) demand and national economic security. Some Middle Eastern countries obtain up to 80% of their governmental income from oil exports, and any disruption will have enormous economic ramifications. For these countries, disruptions to their oil income can lead to unpleasant options: ballooning budget deficits as they continue to maintain their welfare and economic growth, or widespread joblessness, poverty and even political protests that can lead to regime change.

As Australia is both an exporter and a consumer of energy, over the last four decades governments have constantly linked energy with national economic security. An historical illustration of this link from a security of (export) demand can be seen in the Australian Parliament in June 1987 when Senator Gareth Evans, the Minister for Resources and Energy, was asked what

effect would the North West Shelf project 'have on Australia's future balance of payments and our energy security?' As well as highlighting the employment benefits, he noted that 'the project will have a number of significant long–term benefits for Australia's balance of payments ... [and] ... rival the traditional great earners of foreign exchange in this country, namely, coal, wheat, iron ore and wool' [13].

The phenomenal growth in China in the last few decades has resulted in it today being the world's second largest economy, the largest exporter of goods, the second largest importer of goods, and the holder of the highest foreign exchange reserves in the world. This makes Australia vulnerable to changes in China's demand, whether it is driven by market–based demand by the country or deliberate strategic purchasing decisions used to advance other policy agendas.

Since the terrorist attacks in the US on 11 September 2001, a new focus of energy security has arisen globally. It has been the protection of energy production infrastructure from malicious attacks. In the decades prior to 2001, the threat of a malicious attack on energy infrastructure was seen as a low risk or intermittently considered in Australia. After 2001, protection of energy infrastructure against terrorist attacks became a priority.

Nowadays, there is a much greater threat spectrum being considered in relation to energy infrastructure. Threats now include politically motivated violence, abduction and hostage–taking, cyber–attacks, blackmail, and theft of valuable materials such as copper wire.

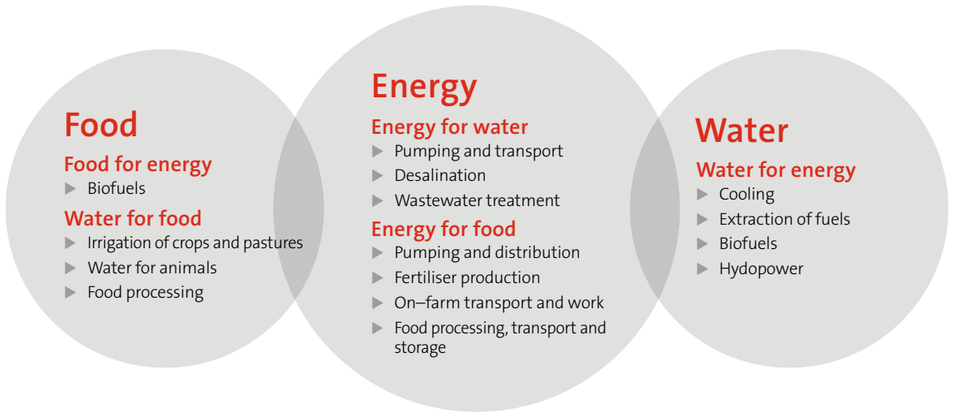
In summary, from a national economic and national security perspective, key sources of energy insecurity arise due to:

- The globalised nature of the economy exposing Australian energy exporters to demand side risks
- The global pricing parity of liquid fuels, and increasingly natural gas, meaning that Australia has limited influence in managing supply side risks
- The politicisation of Australian energy supplies by importing nations, thus affecting demand
- The location of Australia's offshore energy facilities
- The dependence on foreign oil, needed for military operations
- The 'protection' of Australia's energy supplies by importing nations affecting Australia's sovereignty and territorial independence.

2.2.2 Energy security, and food and water security

While national security and economic security are well understood tools of the nation state in globalised activities, there are rising challenges to security. Climate change, food security, water security and energy security are interrelated, as reflected in Figure 5.

Figure 5: The climate, food, water and energy security nexus



Increase in food production has been one of the world's greatest achievements in the past century as the population has grown from 1.6 billion in 1900 to over 7 billion in 2014. This has required massive direct water inputs, notably for irrigation and water intensive processes. Modern food production is also heavily energy intensive in terms of fertiliser, on–farm transport, food processing and storage and transporting. In Australia, 52% of water consumed is in domestic agricultural produce. Almost 5% of Australia's domestic energy consumption is used in agriculture.

Water production, both for agricultural and non–agricultural purposes, requires enormous energy inputs. This includes the pumping and use of ground water, production of desalinated water, and treatment of wastewater. Energy is also used in potable water treatment, transport and distribution.

Energy production requires substantial volumes of water. In Australia, the electricity and gas sector consumes about 1.4% of Australia's total water consumption. Around 300GL is used annually for cooling thermal power plants where it is used to generate steam to drive steam turbines, for cooling the exhaust steam, and for other operations including emissions control and ash disposal. Water is also used in the extraction, transport and processing of both fossil and synthetic fuels. Water is also the primary input to the production of one form of energy – hydroelectric power.

The use of water in energy production can have a significant effect on freshwater resources. It not only affects the availability of water downstream but it can also affect both groundwater and surface water in terms of its physical and chemical properties. An example of the multiple consequences can be seen in the extraction or use of water in fracking: high–pressure hydraulic fracturing of underground rock formations for natural gas and oil. The injection of chemicals can cause their leaching or movement of contaminates into the surrounding aquifers. Water withdrawn from the coal beds can also cause water loss from surrounding aquifers. Both can reduce the agricultural potential of the area that is dependent on ground water. In addition, the water extracted from the coal bed is contaminated and if released without the proper environmental consideration, can have a negative effect on surrounding water courses, land and coastal areas [14].

Most renewable power requires far less water than thermal power plants in the production of energy, but as with conventional energy sources, renewable energy requires considerable quantities of water to process raw materials to build turbines, solar panels, wave generators and steel/concrete supporting infrastructure. Finally, water is used extensively in the growing of biofuels. Globally, the International Energy Agency (IEA) predicts that water consumption to produce energy will double in the next 25 years, primarily due to the increase in coal–fired power plants and increased biofuel production.

The effect on climate change as a result of energy consumption is well identified. The burning of fossil fuels, principally coal for power generation and refined oil products for transport, is the dominant source of anthropic carbon generation. Climate change also affects demand for energy due to increased cooling and heating, as well as driving additional engineering work to develop a more resilient built environment. It also affects the availability of water, due to changes in precipitation and evaporation. Climate change also affects food production, through changing growth rates, and water consumption.

From a food and water security perspective, key sources of energy insecurity arise from:

- Dependence on inorganic fertilisers that consume vast amounts of natural gas in their production
- Heavy reliance on liquid fuels and electricity across the food supply chain
- Dependence on energy for producing desalinated and running potable and wastewater systems
- Reliance of hydropower on rainfall and runoff.

2.2.3 Energy security, and sustainable development and environmental security

While national economic, national security, food, water and human security are all interrelated with sustainable development and environmental security, these latter two issues can be treated discretely, as unlike the former where the focus is on human related referents, the latter two focus on the environment itself as the referent.

Environmental security involves the minimisation of anthropogenic threats to the functional integrity of the biosphere, while sustainable development values maintaining environment quality as a way of meeting the present without compromising the ability of future generations to meet their own needs.

A priority of both sustainability and environmental security in relation to energy is to prevent the degradation of local ecosystems and other global systems. Examples include preventing the depletion and degradation of aquifer and surface water sources, over–exploitation of agricultural land for biofuel production, air pollution from fossil fuel burning, and greenhouse gas production from fossil fuel burning.

Sustainable development and environmental security recognises that the environment needs to be protected for its own sake as well as for utilitarian reasons. It also recognises that environmental change can intensify or trigger threats to other referents of value including social, economic, and political stability. Issues of environment transcend borders, as abuse of a country's natural resources can have global effects. This perspective of energy places a priority on energy resource management that prevents ecosystem damage, as well as the sustainable generation and consumption of energy.

Energy–related issues for sustainable development and environmental security over the long term have been air pollution and carbon gas production. Air pollution has the longest history due to the burning of coal and transport fuels. As flue gas, vehicle fuel emissions and other fossil fuel pollution standards have improved, this issue has become less important than carbon gas emissions from these fuels. Since the late 1980s, greenhouse gas concerns have become important globally. In Australia, the largest carbon emitter is the stationary energy sector, notably coal and gas powered plants.

Another growing energy issue linked with energy security is unconventional gas energy extraction such as fracking. It is controversial because of its potential affect on aquifers, agricultural production and people's health and welfare in mining areas. Opponents have linked it to environmental security. Advocates instead argue that it increases the supply of gas which in turn holds down prices for individual consumers and bolsters economic output, all of which speak to different perspectives of energy security – security of supply, reducing energy stress and national economic security.

From a sustainable development and environmental security perspective, key sources of energy insecurity arise due to:

- Global damage to the biosphere due to greenhouse gas emissions
- Increase in water consumed in extracting and transforming energy
- Environmental damage caused by the extraction of oil and gas
- Coupling of economic growth and energy consumption.

2.2.4 Energy security, and social stability and energy stress

The social stability and energy stress dimension encompasses what in security studies is termed 'human security', as it places people and society, rather than nation states, as the referent to be protected from harm. The focus of the dimension is on people and ensuring their security across the physical, employment, social and lifestyle spectrum. It recognises that people's security is essential for societal and political stability, thus providing the bedrock for equitable, sustainable, and peaceful economic growth.

The availability of affordable energy is a key source from which human security can be obtained, but conversely, a lack of it can be a source from which insecurity originates. Rapid changes in prices are also a source of insecurity. For energy consumers, in the short term it is difficult to adjust rapidly to increased prices. This is because demand is often inelastic and can only be reduced by major purchases such as more energy efficient equipment, insulation, or equipment that uses another energy source.

Over the long term, the new price can be accommodated by most people. However, this is not the case for people who have limited financial means. People in lower socio–economic groups often have higher proportional energy costs and restricted financial means to adjust to the new changes. These people often live in areas underserved by public transport, meaning they have limited ability to switch from their car to public transport, and they live in poorer housing stock which is less energy efficient. These people often have limited incomes, meaning that they can be energy stressed or experience energy poverty. Energy poverty can be defined in a number of ways. One is where households actually lack physical energy sources, such as having no electricity or gas connections. Another is where households spend more than a certain percentage of their household expenditure on energy.

In Australia, the average household spends less than 3% of their household expenditure on energy. However, for low income households it can be high, sometimes up to 10% of their disposable income. Energy poverty, as with other forms of poverty, prevents people from developing to their full potential as it denies them opportunities. It also may be a human rights and social justice issue as they are not free from want. From this perspective, it can be argued that energy security is a fundamental human right of all Australians.

Issues of energy prices for consumers have long been a political issue. The political desire to hold down prices partially explains the regulatory decisions in the 1990s and early 2000s which drove underinvestment in electricity assets, the continual price capping of certain retail energy products, and the moves to remove the carbon pricing system. The political pressure is unlikely to decline as electricity prices will continue to grow, after doubling over the last decade, and natural gas prices are likely to double in the next two years.

From a social stability and energy stress perspective, key sources of energy insecurity arise due to:

- A high percentage of household expenditure on energy
- Growing numbers of people who are energy stressed or experiencing energy poverty
- Significant energy price changes that have political consequences
- Politically expedient decisions to hold down energy prices that degrade medium and long–term energy security.

3. Energy policy issues that shape energy security

Chapter summary

Many of the key energy security issues are shaped, if not determined, by energy policy decisions. This chapter discusses the most important energy policy issues that drive energy security policy. These are innovation, forecasts, sustainability, the link between economic growth and energy use, energy supply chains, and energy sector reform and regulation. Policy development relating to these issues needs to simultaneously consider how they will affect energy security.

3.1 Innovation

Effective investment in Australian energy infrastructure by government and private investors is essential to delivering a secure and reliable supply of energy to the Australian economy, while delivering return to capital investors. The required investment in Australia's energy generation and distribution networks is immense. The 2012 Energy White Paper noted that the domestic energy sector may require up to $240 billion by 2030 while the proposed energy resource and related infrastructure development projects could require as much as $250 billion of investment by 2030.

For investors who will invest billions in capital development, it is not uncommon for them to expect revenues of hundreds of millions in the first five years of operation, and during the life of operation wish to earn 10 times the investment. To mitigate the risks to these projects, investors want a stable and predictable environment. Common tools they use to achieve this are obtaining long–term contracts, keeping costs down and using proven low risk technology. However, it may be unrealistic to expect that costs can be lowered to countries that have much lower wage rates, lifestyles and economies of scale. Conversely, an overemphasis on using proven low risk technology may result in huge loss in potential opportunities for both new projects and extracting greater value from existing projects. As demonstrated by the turnaround in US oil and gas production over the last decade, new technology has the potential to radically alter a country's energy landscape. Such rapid innovation requires a significant investment in research and development. Australia has not got a record of significant innovation in energy projects by either the private or public sector. In fact, it appears that innovation may be declining as reflected in the slowing of investment in alternative energy sources, smart grids, energy storage, ocean energy and smart cities. The lack of an innovation culture and decreasing investment in energy research and development reduces the potential for major advances in energy security.

Policy and technological innovation together should be driving forces in transforming the energy sector. Together, they have the potential to radically transform energy supply and end use. However, these developments have to occur in a collaborative process that considers economic, technical and social issues.

3.2 Forecasts

Improving energy security has historically rested on identifying future energy supply and demand, and the likelihood and consequences of situations that affect it. Forecasts have also been central to broader energy planning and policy. However, due to the globalisation, geopolitical developments, and interactions such as between energy and economic growth, forecasting energy supply and demand is fraught with difficulties. Major forecasting errors are not uncommon. Global examples are the ever receding date of peak oil, and the unexpected turnaround of the USA from being an importer to an exporter of oil and gas. Within Australia, the last few years have seen a number of energy developments which were not forecast by most energy experts. These include the reduction in demand for electricity, the development of unconventional gas, and the unsustainability of solar feed in tariffs. Of these the most surprising has been the decline in electricity consumption. The conventional wisdom has been that energy use was inelastic because it was an essential service. However, price rises have dampened domestic demand while the collapse in manufacturing and other industrial sectors has added to consumption falls.

While more money can be spent on improving forecasts, it may be unrealistic to expect that forecasting accuracy will actually improve. Instead of forecasts, an alternative source of policy input on futures could be scenarios that generate policy awareness of the importance of flexibility and adapting to developments continuously. Scenarios need to represent both shared and radical views of futures. The greatest strength of scenario–based activities lies in the robust testing of alternative pathways and decision points through a process of wargaming. Given the limited reliability of forecasts, relying on them as a key input to energy policy may actually increase energy insecurity.

3.3 Sustainability

Australia has reaped significant benefits from the ready availability of cheap and abundant fossil fuel. It has given a competitive advantage to energy–intensive industries as well as to other sectors of the economy and society. The ready availability of energy resources is driving the massive exports of coal, oil and gas. For some states, such as Western Australia and Queensland, these exports will be a critical part of their economies. Their importance is reflected in the 2012 statement by the Queensland Premier when he stated, '... we are in the coal business. If you want decent hospitals, schools and police on the beat we all need to understand that'[15].

The reliance on fossil fuel based energy because of its availability introduces a major economic vulnerability in the economy. If significant global action on greenhouse gas reductions occurs, the consequences for Australian energy exports and even Australian goods and services due to their high carbon footprints may be severe.

The other vulnerability arising from a fossil fuel based economy is the environmental damage it causes. While Australia is a low–carbon emitter compared to other nations in terms of total output, per capita it is very high. The magnitude of the carbon emissions in comparison to others is a relevant issue at a moral level as it is important to reduce them as much as feasible. Consequently, policy decisions that do not seek to accelerate a switch away from a fossil fuel economy are undesirable.

A sustainable and prosperous future can be achieved through low–carbon energy sources as reflected in the IEA 2014 Assessment of Energy Technologies. The IEA specifically says that support for policies such as loan guarantees and financing, and support of demonstration projects is needed to alleviate the risk for investors. 'Without this support, these projects have the potential to be severely delayed or may not be developed', it notes. The long–term viability of fossil fuel energy powered investments is also actively being challenged by the finance industry. An example is the Asset Owners Disclosure Project, chaired by Dr John Hewson, whose objective is to protect members' retirement savings from the risks posed by climate change by improving the level of disclosure and industry best practice [16].

The effect of climate change is a fundamental vulnerability for the future energy security of Australia. The United Nation's Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report has highlighted the need for action to future–proof Australian communities from the effects of climate change. Australia's climate is measurably changing, with increasing atmospheric temperature, changes to rainfall patterns, rising sea levels and increasing extreme weather events. The IPCC has found that Australia's predominantly thermal power generation is vulnerable to drought–induced water restrictions, which could require dry–cooling and increased water use efficiency where rainfall declines. The report describes further that without additional adaptation, distribution networks in most Australian states will be at high risk of failure by 2031–2070 under non–mitigation scenarios due to increased bushfire risk and potential strengthening and southward shift of severe cyclones in tropical regions [17]. While the report finds that some of these risks from climate change are now unavoidable, the costs of adaptation can be reduced by early and effective action to reduce greenhouse gas emissions. Recognising climate change as a vulnerability and closely linking it with energy strategies will reduce risks and create new economic opportunities.

Australia may not have a sustainable future if the nation remains tied to a fossil fuel based energy system which can rapidly become marginalised by global society and undermines the environmental health of future generations. Such a situation does not enhance Australia's long–term energy security.

3.4 The link between economic growth and energy use

In Australia, economic growth is tightly coupled to energy use. The more the economy grows, the more energy is used. Such a situation is not inevitable, and from a security perspective is not desirable. This is because it means that greater energy supply is continually needed and any disruption to energy supply has an immediate effect on the economy.

There are many ways to decouple growth and energy demand, with the most common being improved energy conservation and energy efficiency. For instance, in the transport industry there could be greater incentives to encourage the purchase of energy–efficient vehicles. Building tenants could be encouraged to demand more energy efficient buildings due to their cost savings. Energy generators can pay large energy users to reduce their energy consumption on high demand days so that they can sell this available power for higher prices on the spot market.

In 2012 the Australian Government released a report on the Prime Minister's Taskforce on Energy Efficiency. This report argues for step change in Australian industry to achieve inspirational targets in energy efficiency. The report encouraged innovative measures in concert with market forces to achieve the desired efficiencies [18]. It is acknowledged that this is not extant policy for the 2014 Abbott government and there is speculation that a less demanding approach to energy efficiency may be taken by Australia into the future. This could undermine energy security.

3.5 Supply chains

Supply chain risk is a persistent energy security risk, as Australia is reliant on liquid fuel imports and export of energy resources. However, the NESA assessment dismisses this risk in its statement that supply chains have a proven ability to reliably deliver affordable energy and does not indicate a likely catastrophic supply failure, although the potential for the effect of short–term or specific constraints have been identified [19]. There are many areas of supply chain risk not examined in the NESA including the potential large scale global disruptions (conflict/pandemics); complex risk interdependencies (interdependencies of food, electricity, fuel and water supply chains forming robust–fragile systems); the deliberate disruption of supply chains arising from a conflict in the waters in north east Asia; and a collapse in demand for Australian energy exports arising out of severe economic and political turmoil in China.

Diversification of supply and demand is one of the most important mitigation activities for supply chain risks, and due to the continually changing environment needs to be constantly monitored and adjusted from a national perspective.

3.6 Energy sector reform and regulation

The role of regulation is critical in the application of energy security. In Australia, the Australian Energy Regulator (AER) regulates energy markets and networks under national energy market legislation and rules. Its functions include setting the prices charged for using energy networks; monitoring wholesale electricity and gas markets; regulating retail energy markets which includes enforcing compliance, publishing information on energy markets; and assisting the Australian Competition and Consumer Commission (ACCC) with energy–related issues [20].

Recently, Australian domestic electricity and gas prices have escalated rapidly, driven by market factors to some degree but more by energy policy decisions. The federal and state/territory governments have all contributed to price escalation through a range of policy and regulatory interventions. While most were well intentioned, they were pursued with little consideration of their cumulative effect or effectiveness.

In April 2013, the Productivity Commission released a report on Electricity Network Regulatory Frameworks, which found significant failings in regulation:

'These flaws require a fundamental nationally and consumer–focused package of reforms that removes the interlinked regulatory barriers to the efficiency of electricity networks. Reforms made in late 2012, including improvements to the regulatory rules, better resourcing of the regulator and greater representation of consumers, have only partly addressed these flaws ... Delays to reform cost consumers across the National Electricity Market (NEM) hundreds of millions of dollars ... There is, in effect, no point in simply fixing a punctured tyre if the car has no engine [21].'

Federal and state/territory governments need to improve their energy sector reform and regulatory approach. One approach would be to adopt the 'precautionary principle'[22] to address the rising challenge of environmental protection. Applying the precautionary principle is now commonplace internationally and domestically, which is testament to its usefulness when devising environmental management and protection strategies. An example of the precautionary principle in practice is the pursuit of clean energy as an insurance policy against environmental degradation. Another approach would to build a consensus with industry and users before decisions on energy market reform or regulation are made. At the very least, a more robust decision making process is needed that considers how the proposed changes affect not only energy security but broader energy supply and demand issues.

An inhibiting factor in such an approach is a lack of energy literacy. Many stakeholders in energy security policy have a very limited understanding of energy issues. There is a general lack of understanding of the energy system, energy technology options, the challenges in changing energy systems, the consequence of human behaviour and energy, the environmental effects of energy, the energy supply chain, the pros and cons of each technology, and what the possible alternatives might be for achieving a secure, affordable and low–carbon energy future. Without improving energy literacy, it is difficult to have an informed and rational discussion of energy sector reform and regulation.

Identifying a desired energy future is outside the scope of this paper. However, below is a list of some of the key questions that would need to be answered in determining it. The answers would contribute significantly to developing an integrated, coherent energy policy based on a triple–bottom–line framework that would be enduring.

- What should be level of reliance on fossil fuels given the environmental consequences?
- How best can the rising energy demand, in particular the growing electricity demand, be met?
- What is the role of renewables and nuclear energy?
- What should be the nature of centralised and decentralised energy production and consumption systems?
- How should the economy be decarbonised?
- Is energy an essential service and how should the energy poor best be supported?
- Should the price of Australian–produced energy be internationalised or should these resources provide a competitive advantage to Australians?
- Should the use of Australia's energy exports be a factor in who is allowed to purchase energy exports?
- Should foreign ownership of Australian energy resources and, in particular, foreign state ownership, be encouraged or discouraged and what should this assessment be based on?
- What are the best ways to reduce energy intensity and increase energy conservation?
- How can the potential of demand management be realised?
- What structural changes to the Australian economy and lifestyle are desirable to change energy use?

4. Addressing the key energy security policy challenge

Chapter summary

This chapter presents a series of recommendations that seek to implement a comprehensive and integrated approach to energy security policy. Currently, policy approaches reflect a limited definition of what energy security is and the ways to achieve it. The proposed policy approach represents integrating the multiple perspectives and dimensions of energy security across domains. This chapter makes recommendations aimed at implementing a comprehensive approach to energy security policy through the following initiatives:

- Adopting a comprehensive energy security definition relevant to Australia
- Treating energy security as a 'wicked problem'
- Broadening the understanding of threats to energy security
- Reducing energy consumption
- Securing the energy wealth for future Australians
- Integrating energy security and defence policy
- Integrating energy security and foreign diplomacy
- Addressing liquid fuel insecurity
- Addressing energy poverty
- Moving beyond energy infrastructure protection
- Engaging the community.

4.1 Adopting a comprehensive energy security definition relevant to Australia

Australia needs to adopt a definition of energy security that reflects the multiple perspectives of energy security. To pursue policies that address only a limited set of perspectives will invariably lead to significant unintended consequences. For instance, a massive reduction in food production could occur in the pursuit of biofuel. From a national, societal and individual perspective, to exclude different perspectives means privileging certain interests over others, rather than balancing competing and conflicting interests. In other words, it fails to factor in trade–offs which are intrinsic to energy policy and inhibit positive management of the evolving energy security needs.

The Australian Government's definition of energy security should be replaced by one that embraces a comprehensive approach to energy security. Comprehensive energy security essentially represents a switch from a supply security, macro–economic perspective to one which recognises that both energy supply and demand security are equally important, as well as incorporating the full spectrum of valued referents.

A new definition

This report proposes that the existing definition used for energy security be replaced by the following more comprehensive one:

Energy security is the adequate, reliable and competitive supply of sustainable, low–carbon energy and energy services at global, national and local scales; across short–, medium– and long–term timeframes; and in the context of minimising consumption and demand, maximising energy intensity, and balancing the trade–offs and complementaries between energy and other security referents of value, notably the four key domains of 1) national economic and national security, 2) food and water security, 3) sustainable development and environmental security, and 4) social stability and energy stress.

Such a broad definition does not provide detailed guidance in energy policy decisions, nor for other sectors that generate an effect on energy supply or demand. Each decision involves competing and often conflicting interests that are frequently context specific. However, broad policy coherence can be achieved if a well–conceived set of principles is followed in reaching decisions.

Energy security principles

Below are the Energy Security Principles that allow the operationalisation of the above definition:

- Energy security policy must consider both supply and demand relationships; however, extra emphasis should be given to demand security for both energy exports

and domestic energy consumers as demand security has generally not received sufficient policy attention in the past. Priority areas for demand security attention are energy efficiency, conservation, demand management and innovation

- Energy insecurities expressed as undesirable changes to energy supply or demand can generate threats in multiple areas with the main ones being national security, economic security, food and water security, sustainable development, environmental security, social stability and energy stress. The areas that experience the negative effect arising from an energy disruption, and need to be protected, are known as the security referents. Different stakeholders have different referents. Energy security policy development must recognise that there are multiple referents, and that these referents have complex interrelations with other referents. Operationalising this means that energy security policy proposals should be tested for their affect on other referents
- Energy forecasts are inherently unpredictable due to technological development, complex global interrelationships between energy supply and demand, unintended consequences, and geopolitical developments. Consequently, a risk–based, flexible approach to energy security policy development is essential with a recognition that energy security policy needs to be continually monitored and adapted to meet changing circumstances
- Technological and innovation provide an essential pathway to improve energy security supply and demand
- Energy security can be best met through encouraging efficient energy markets, augmenting this with societal, governmental and international intervention when markets fail to deliver sustainable outcomes.

Recommendations

1. Australian governments and energy security stakeholders should adopt the following comprehensive definition of energy security: Energy security is the adequate, reliable and competitive supply of sustainable, low–carbon energy and energy services at global, national and local scales; across short–, medium– and long–term timeframes; and in the context of minimising consumption and demand, maximising energy intensity, and balancing the trade–offs and complementaries between energy and other security referents of value, notably the four key domains of 1) national economic and national security, 2) food and water security, 3) sustainable development and environmental security, and 4) social stability and energy stress.

2. Australian policy makers in both the energy sector and other sectors that affect energy supply or demand should adopt the definition and apply the set of Energy Security Principles which reflect the intent of the comprehensive definition of energy security.

4.2 Treating energy security as a 'wicked problem'

The pervasive nature of energy in the 21st century poses special challenges to governments. Some policy areas have clear boundaries where changes only affect specific people or issues, and do not cause significant cascading effects outside their boundaries. Problems in such policy areas can be solved by implementing targeted actions. Energy security is not an example of such an issue. Energy security is socially and physically complex with its involvement of numerous stakeholders, each with different perspectives and often competing and conflicting interests. Energy security cannot be 'solved' in the standard sense. Instead, it must be continually managed to balance the different perspectives and stakeholder needs which change over time and circumstances. In terms of public policy problems, the complexity of energy security means that it falls within the classification of 'wicked problems'. These problems are highly resilient to resolution and invariably have the characteristics of being intractably complex and uncertain.

As it is very difficult, if not impossible, to control the system to any degree, the best course of action is to establish the desired direction of a system and monitor and seek to correct it when it does not deliver the desired individual, sectorial or national outputs, outcomes or processes, providing there is a strong likelihood that the intervention will have success from a multiple referent perspective.

The key approaches to managing the 'wicked problem' of energy security are:

- Applying the comprehensive energy security definition and energy security principles as in energy security decision making
- Building a shared understanding of different perspectives among stakeholders
- Developing a collaborative approach to policy making.

Shared understanding

Chapter 2 demonstrates the different perspectives and dimensions of energy security. These are the lens used by stakeholder groups to analyse the threats, likelihoods, consequences and solutions relating to energy security. Each lens represents defining energy security in a different context. The consequence of a limited understanding of the domains is that it inhibits agreement across stakeholders of what energy security is, what the actual problems and effects are, and how the effectiveness of potential solutions should be measured.

A shared understanding of viewpoints is essential to crafting a response that balances the often competing and conflicting demands, while maximising the mutually beneficial outcomes. Such an understanding is achieved through a true dialogue between all parties, which should include between stakeholders in bilateral and multilateral forums and processes. This will build cooperation which is essential for developing shared goals and successful implementation of energy security policies.

A collaborative approach

The dominant decision making paradigms in the energy sector are authoritative and competitive ones. These need to be replaced by a collaborative one.

The authoritative approach is one where a select group makes top–down decisions with those affected being mostly powerless to influence decisions. The decision making group generally has the knowledge and expertise, with organisational or coercive power to control the decision making and implementation process. This approach normally sees energy problems disaggregated and treated on a sectoral or energy type basis. The benefits of this approach are that it is efficient and rapid compared to a more negotiated decision making process. Its key disadvantage is that it often disregards important issues and considerations, as the decision making group tends to search for solutions within their narrow bandwidth of experience and interests.

The other common approach is a competitive one. This involves stakeholders following a win–lose strategy. Key advantages of the competitive approach are the creation of new ideas and innovation, and different choices, while key disadvantages include conflict and stalemates that occur when stakeholders have enough power to block one another but not enough to achieve their agenda. Competition can also consume resources that could be spent on problem solving.

The collaborative approach is a far superior strategy for dealing with problem spaces, such as energy, which normally have numerous stakeholders among whom power is dispersed. It is particularly relevant where part of the solution to the problem involves sustained change by many stakeholders, for instance in achieving a shift to clean energy. At the core of collaboration are partnerships, joint ventures, whole of government, and international cooperation. Key advantages of the collaborative approach include higher stakeholder commitment, more comprehensive and effective solutions, and fewer resources having to be used by any one stakeholder. The key disadvantages are increased transaction costs (these costs can be significant) and, in the worst case, collaboration can end poorly – dialogue can turn into conflict, hardened positions and stalemate [23].

Recommendations

3. Australian energy security policy makers should adopt a more collaborative approach to policy making as this is the most effective method to manage such complex and uncertain issues.

4. Key energy security–related government strategies and information gathering processes, such as National Energy Security Assessment, Energy White Paper, Defence White Paper, and environmental strategies, should adopt a collaborative approach to solving the 'wicked problem' of energy security.

4.3 Broadening the understanding of threats to energy security

The energy system in Australia faces a myriad of threats. These include disruptions in the physical supply from the Middle East, collapse in the demand for Australia's exported LNG following a conflict in the disputed waters of the South China Sea, and cyber–attacks simultaneously destabilising the synchronisation of multiple electricity generators on the east coast.

Some threats pose major risks and others far less. All security threats cannot and should not be addressed. The ones that should be addressed are those that pose a higher risk as identified in a risk assessment process. This involves examining each threat's likelihood and negative consequences on referents of value, after considering their vulnerability to harm and existing mitigation measures. While the Australian Government uses a risk assessment process for energy security risks, it is inadequate due to its implementation.

Firstly, it fails to recognise that there are actually multiple referents, each of which is critical to Australia. Currently the approach gives disproportionate weight to national economic security. As identified in Chapter 2, these referents can be categorised into the four dimensions of 1) national economic and national security, 2) food and water security, 3) sustainable development and environmental security, and 4) social stability and energy stress. Any assessment of threats must consider all the referents of value, not just those that are the primary concern of one group of stakeholders or the agency undertaking the risk analysis. Without this comprehensive approach to risk assessment, too much attention is given to too few referents. Conversely, other referents of value are not given the appropriate level of attention.

Secondly, the current approach focuses mainly on risk mitigation measures aimed at the supply side rather than the demand side. Thus attention arises because the priority has become ensuring a continuous, low cost supply of energy rather than managing the risks that arise due to the energy users' demand. The risk facing the users depends on how vulnerable they are to disruptions in energy supply. For users, whether commercial or individual, who have developed processes, procedures, lifestyles etc. based on low cost energy–intensive products and services, they are particularly vulnerable. For example, modern agriculture depends on energy–intensive fertilisers, crop management, and supply chain cooling which means that disruptions in energy supply can have a major effect on production costs and outputs, compared to a farming system that is dependent on lower energy inputs.

The vulnerability is not only at the energy user's level. Aggregate demand from a sector of users also creates a vulnerability for the entire energy system. For example, energy–intensive agriculture has enabled the food needs of billions to be met, and as the population increases, so too will the energy demand if the energy intensity does not change. This means that the food sector's ever–growing demand for energy will increase competition for energy resources, which, if there is inadequate supply, leads to price rises.

The agricultural example illustrates the complexity of the energy system. Energy creates vulnerabilities for both its users and its suppliers at an aggregate level, and the use of energy in one sector affects other sectors, and while the energy decisions made by individual users have negligible effect, collectively they have a huge effect. In analysing energy security risks it is essential that multiple dimensions of energy security and diverse vulnerabilities across the sectors are considered.

Recommendation

5. Australian energy security policy makers should use in their analyses a comprehensive list of risks which reflects the varied perspectives of energy stakeholders who each view the threats, likelihoods, consequences and solutions relating to energy security differently due to their unique domains of interest.

6. Australian energy security policy makers should ensure that their policy prescriptions do not unnecessarily increase vulnerabilities, threats and risks in areas directly outside their policy interest in both the energy sector and other sectors that affect energy supply or demand. This approach necessitates a coordinated 'whole of government' response.

4.4 Reducing energy consumption

Reducing the total consumption of energy is the most cost–effective method of improving energy security. By consuming less energy, it reduces vulnerability to both demand and supply shocks, it increases national economic security through reducing the national energy bill and increasing productivity through lowering the energy cost per unit of output, it improves environmental security through reducing energy pollution, and it reduces energy stress by lowering the amount that individuals spend on energy. However, despite governments worldwide identifying reducing energy consumption as one of their top energy policy strategies, few countries have actually achieved any significant progress towards this goal.

There are two ways to reduce energy consumption – energy conservation or energy efficiency. Energy conservation involves reducing energy use while energy efficiency involves using less energy to achieve the same outcome. Of the two, energy conservation is more important as it is better to eliminate the use of energy when it generates no benefit than to reduce the amount used. Perversely, improving energy efficiency can actually increase total energy consumption and thus potentially reduce energy security if the energy supply or demand is vulnerable. The increase in consumption arises because the efficiency measures reduce the cost of a good or service, thus making it more competitive and hence more in demand and thus supplied. Common energy reduction measures include:

- Utilising waste heat
- Redesigning processes to eliminate transport tasks
- Preventing heat and cooling loss
- Switching off lighting, air conditioners, compressors etc. when not needed
- Introducing high efficiency machinery and fuel efficient cars
- Introducing transportation equipment with high transportation capacity and consolidating transport tasks to reduce frequency of transport tasks
- Enforcing performance and prescriptive energy codes for commercial buildings which covers insulation of the building envelope, and efficiency improvements in heating, ventilation and air conditioning (HVAC), lighting, water heating, and vertical transport or lifting equipment
- Increasing ambient temperature of air conditioned environments
- Substituting mechanical air conditioning with natural or green air conditioning
- Developing mandatory energy conservation and efficiency targets
- Providing low–interest financing for energy reduction activities
- Funding subsidised advisory services to encourage the introduction of leading–edge energy conservation technologies
- Offering financial support to those who introduce leading–edge energy conservation equipment
- Offering tax incentives to encourage investment in high energy efficiency activities
- Awarding, disseminating and publically promoting activities on energy conservation
- Implementing an energy efficiency appliance labelling system
- Promoting eco–driving
- Supporting demonstration sites and exhibitions of energy conservation technologies and systems.

The need for energy conservation and energy efficiency has been identified as a priority in all Australian energy white papers, and numerous programs have been introduced in achieving this. These include short–term energy conservation measures, such as rationing during fuel crises, to long–term structural measures, such as developing an energy efficiency appliance labelling scheme, and ones focusing on proactive energy management, such as incorporating energy efficiency targets into the performance agreements of agency heads in the Australian Public Service.

While many of these have had short–term benefits in reducing consumption, they have generally failed to make a substantial and sustained difference. There are many reasons for this. One key reason is a failure of market forces to drive significant changes in behaviour of both consumers and suppliers. Markets are based on the idea that actors will respond to price signals and act in their own rational interest. However, there are many examples where people do not appear to make rational decisions based on price signals alone. For example, despite the financial benefit of household insulation, low energy appliances and rationalising travel trips to reduce travel expenses, many people do not do these things. These examples show that in some circumstances, price signals may not be the most critical factor in driving change or simply not strong enough.

Reasons that prevent financially–driven rational decision making include a lack of knowledge, lack of available products, lack of certainty about obtaining the financial benefits (such as installed insulation not being reflected in an increased house price), and lack of recognising the value of accumulated small financial benefits from reducing energy consumption. Another reason is that energy conservation and efficiency invariably require time–consuming active management, whether it is turning off appliances when not in use, selecting the cheapest time of day for energy–intensive operation, optimising HVAC based on season and weather conditions, or implementing complex demand management practices such as generators paying the owners of high energy consuming factors to shut down their operations during periods of extraordinary peak demand. Active management requires up–to–date knowledge, skill and diligence which impose a considerable cost to either the energy consumer or supplier. Another reason is that energy costs have been relatively low since the 1980s with the exception of occasional peaks, and, significantly, due to the fact that the energy prices fail to factor in all externalities such as air and noise pollution. The low cost removes incentives to change behaviours. A final reason is that conservation measures are commonly delegated to the energy utilities. Utilities have an overriding objective of maximising profits, and while they are often keen to reduce demand during peak periods (to reduce the need for infrastructure that sits idle except for a few times a year) outside of these rare peak periods their objective is to maximise energy use and thus are little interested in conservation.

Increasing the price of energy rapidly can drive a change in demand. However, as a policy instrument, raising prices is a blunt instrument that leads to social inequity. It is blunt because for some consumers, energy demand is inelastic as they cannot reduce their consumption in the short–term. This is commonly due to a lack of alternatives because they do not have the funds or knowledge to invest in more energy efficient capital goods. It is inequitable because while wealthier people can afford the increase in energy costs with little effect on their quality of life, this is not the case for poorer people who have to choose to forego the energy service or sacrifice some essential expenditure such as rent or food.

...their objective is to maximise energy use and thus are little interested in conservation.

While Australia, the US and a number of other developed countries have not sustained energy conservation achievements in the long–term, this is not the case for some other countries. Circumstances for their success vary, but common reasons in these countries appear to be that the drive to reduce energy consumption is widely supported by the public and industry because it contributes to the achievement of other policy priorities, it is facilitated with simultaneous major economic structural change with the explicit goal being to reduce energy use, and it is enabled through mandatory measures being introduced with short lead–times. Japan illustrates all of these factors.

Prior to the 1973 oil crisis, the Japanese economy was totally dependent on imported oil and much of its economic power could be attributed to its massive energy–intensive industries. During the crisis, the nation was shocked to learn of its energy vulnerability. Consequently, Japan embarked on both supply and demand changes. An example of supply side changes was the diversification of the sources of energy, notably to include natural gas and nuclear power, while a demand side measure was shifting industrial focus from steel making and shipping building to lower energy–intensive industries based on knowledge and high technology. There was considerable public and political support for these radical changes as they simultaneously addressed one of the country's most pressing community concerns – air, water and soil pollution. Pollution from heavy industry and the coal–fired generating plants that were needed to power heavy industry had resulted in multiple instances of community poisoning. The huge community concern about pollution was reflected in the enactment of a raft of major environmental protection legislation such as during the famous 1970 Pollution Session of the Diet. Given the confluence of the pollution agenda and the vulnerability of the economy due to energy imports, energy reduction in Japan has remained politically popular, and thus actively and continuously pursued for four decades.

Australia has never experienced energy shocks to the degree of Japan, and this is one of the reasons why there has been no enduring support for energy conservation. Instead, the focus of energy security has been on producing more energy and ensuring that there is increased infrastructure to meet the ever–growing demand, rather than reducing energy consumption and improving efficiency.

Given the advantage for energy security through reducing energy consumption, and recognising that past efforts have failed to deliver enduring change, the Australian Government needs to not discard the notion that energy conservation and efficiency is too difficult to achieve. The fault does not lie with the goals but with the fact that there are a host of structural, cultural and organisational factors that limit the achievement of these goals. Instead, policy makers need to recognise that these goals are an essential and critical component of energy security policy which can only be advanced by taking an integrated approach that involves both introducing conservation and efficiency measures alongside removing structural, cultural and organisational barriers that limit their success.

Recommendation

7. Australian energy security policy makers should give far greater emphasis to reducing energy consumption through energy efficiency, reducing energy intensity and decoupling economic growth with energy use.

4.5 Securing the energy wealth for future Australians

Australia's non–renewable energy resources are considerable. Australia has huge reserves of thermal black coal in NSW and Queensland, while Victoria has enormous brown coal (lignite) reserves.

At current production levels, there are sufficient black coal reserves to last for over 100 years and for brown coal over 500 years. In terms of conventional gas, Australia has about 1.5% of the world's reserves. At current levels of production, this supply will last for many decades. However, if unconventional gas (i.e. coal–seam gas also known as coal–bed methane, shale gas and tight gas) is included, gas production will continue for generations. Australia also has around one third of the world's uranium resources, meaning that it may export this energy source for centuries.

However, while these resources are huge, they are finite. There is also no guarantee that they will continue to generate significant export earnings into the future. Demand for them may collapse for a host of reasons including technological breakthroughs resulting in alternative energy sources becoming cheaper than fossil fuels, new global sources of cheaper fossil fuels, reduced global economic growth and hence demand for energy, and the introduction of carbon pricing policies which increase the relative price of certain non–renewable energy resources.

All of Australia's energy resources are owned by the Australian, State or Territory Governments, and hence by all Australians. Governments give organisations licences to exploit these resources which in turn generate income for governments through a variety of mechanisms. These include royalty payments (commonly a royalty is paid to government by the resource developer either based on a percentage of the value of the resource or a flat rate per tonne/volume of the resource), resources rent taxes (a tax based on the profits generated from the exploitation of a resource), general taxes and charges levied on developers, and finally through the taxes generated from the flow on benefits across the economy arising from the resource development and exploitation.

Invariably, governments consolidate this income with other income streams and spend it as they consider appropriate. This arrangement means that the generation that digs up the finite resources spends the resources. In doing so, future generations do not have the opportunity to develop the resources and generate income from them. It can be argued that the resource income earned and spent today actually results in a bigger economy which future generations inherit. However, this is generally only true if the spending is on capacity and capability improvements such as creating more educated citizens and building productivity–enhancing infrastructure rather than being spent on consumption and transfer payments, or in generating future costs that subsequent generations have to pay for, such as degraded environments or long–lasting social problems.

A more equitable and socially responsible approach to sharing the finite resource wealth with future generations is to allocate the resource income to a sovereign wealth fund. Such a fund would provide greater intergenerational fairness, as the current generation could only access a proportion of the fund leaving the rest to future generations as compensation for the loss of their natural resources.

Many countries now have sovereign wealth funds including Norway, Brazil and Kuwait. Australia has two, the Australian Government Future Fund and the Western Australia Future Fund. These funds have many benefits. A key one is forcing greater fiscally responsible and prudent behaviour on governments as they no longer have the income from the resources boom to mask poor policy decisions such as industry subsidies, unjustifiable tax concessions and unwarranted social transfers. Another is that they can moderate financial bubbles appearing in the economy due to spending in excess of the capacity of the economy to adjust. Funds could be used as a source of budget stability, and provide a buffer against commodity price shocks. Another benefit is to create through example societal appreciation of the need and benefits of long–term savings. Finally, sovereign wealth funds can grow into hundreds of billions and so create diversity in sources of investment funds.

There are of course weaknesses with such funds. These include that they can lack transparency and can be used to advance national political issues rather than be driven by commercial considerations. However, these can be overcome by both good governance and a political consensus that includes not only political parties but also the Australian community given that it is their descendants' money. Another potential problem is that the funds may provide poorer returns than if the funds were used today for other purposes such as investing in productivity–enhancing infrastructure or allowing the removal of inefficient taxes. This problem could be addressed by allowing a proportion of the funds to be spent today on such activities providing they meet triple bottom line, long–term cost/benefit benchmarks.

There are many different types of sovereign wealth funds including those that seek to stabilise economies from volatility, invest in strategic developments to diversify economies, and fund specific outcomes such as pensions, education and socially desired goals. Australia should consider the establishment of a sovereign wealth fund built on Australia's finite energy resource income with the express purpose of meeting the needs and aspirations of both current and future generations.

If a longer term perspective is taken on the wealth of energy resources, it will force a policy debate about whether it is better to dig up and export/use the resource today at today's market price or to conserve the resource and use it when its value is far higher. Progressive resource–rich countries, such as the United Arab Emirates, recognise that selling all of its oil as rapidly as it can does not maximise the value of their resource. Instead, it is selling oil at a regulated rate, and substituting domestically consumed gas and oil with nuclear power and renewables to preserve its petroleum resources for the future.

Recommendation

8. Australian energy security policy makers should argue for an energy sovereign wealth fund to improve intergenerational national economic security, and enforce fiscal discipline so that income from non–renewable resources is spent on productive human and infrastructure activities.

4.6 Integrating energy security and defence policy

Energy security has been a key but little acknowledged driver of Australia's defence policy. The ADF has long been involved directly or indirectly in securing Middle East oil supply chains through the military operations of the first Gulf War (1990–91), the Iraq War (2003–2010) and the continuing anti–piracy operations off the Horn of Africa which started in 2005 (see Box 6: Australian defence policy and the security of Middle East oil supply chains). However, it would be unfair to characterise the sole reason for the ADF's involvement in the Middle East operations as being to protect oil security. Instead, a key reason is to support the US alliance. But as the US interest in the region is significantly driven by oil security, it is reasonable to link Australia's involvement with being indirectly driven in part by oil security issues.

Domestically, the ADF has also long been involved in security of Australian oil and gas offshore facilities and maritime exports (see Box 7: Australian defence policy and the security of Australian offshore oil and gas facilities and maritime exports). It should be noted that Defence also supports, when authorised, other government agencies' efforts to address energy insecurities, such as critical infrastructure protection, counter–espionage efforts to protect Australian energy producers, and foreign intelligence collection on energy related issues.

Defence White Papers also recognise the potential for tensions over resources. The 2009 White Paper noted that regional conflicts such as in the Middle East are likely to arise for diverse reasons including access to energy. The assessment that access to energy will be a driver for major conflicts was played down in the 2013 White Paper when it stated that 'This increased demand for imported commodities is unlikely to lead to major interstate conflict as long as the global market operates freely, since it is cheaper to pay for a commodity than to go to war for it' [24].

Defence White Papers are ambivalent about the role of climate change, which is primary driven by fossil fuel energy use, as a security issue. However, the government–funded defence think tank, the Australian Strategic Policy Institute (ASPI), in its 2013 report Heavy Weather Climate and the Australian Defence Force highlighted the climate change threats to water, food and energy security, as well as a likely increased frequency of natural disasters. The report makes a number of recommendations that question traditional defence thinking and challenges Australia to adopt measures similar to the UK's Ministry of Defence Climate Change Delivery Plan. ASPI noted that the one very positive development in the Australian context was the November 2012 workshop convened by the Joint Capability Co–ordination Division of the Department of Defence on defence, national security, global change and energy sustainability. The workshop brought leading climate scientists together with defence planners to examine climate risks and their effect on operational capability [25].

Box 6. Australian defence policy and the security of Middle East oil supply chains

Australian defence policy makers have long recognised the importance of having open sea lanes in the Indian Ocean to facilitate global oil trade from the Middle East to Europe, Asia, the US and Australia. Its importance in defence strategic thinking can be seen in the 1976 White Paper which noted that 'Some seventy percent of Western Europe's oil imports cross parts of the Indian Ocean; approximately seventy– five percent of Japan's and eighty percent of Australia's oil imports (and about one–third of our total oil requirements) transit the Ocean' [26]. The most recent white paper (2013) continued this emphasis noting that 'One–third of the world's bulk cargo and around two–thirds of global oil shipments now pass through the Indian Ocean' [27]. Over this time, the threat to Indian Ocean oil transit has changed, as has Australia's involvement. In the 1976 White Paper, the threat posed was the Soviet Union through its deployments to the region 'backed by the USSR's military installations in Somalia'. Fast forward to today, the threats are now pirates around the Horn of Africa, instability within oil producing states, and consequences of geopolitical tensions such as Iran closing the straits of Hormuz.

In 1976, Australia did not have naval or air force capability that was significant enough to be involved in the region and even if it did, Australia's involvement would 'make no difference to strategic balance between East and West' [28]. Today this is not the case. Australia does have the capability to respond and as noted in the 2013 White Paper Australia, 'has a strategic interest in supporting Middle East stability, which is reflected in Australia's commitment to United Nations (UN) and US–led operations and our continuing participation in a range of regional peacekeeping missions and maritime security tasks' [29].

The first Middle Eastern operational involvement by Australian forces since the end of the Second World War followed Iraq's invasion of Kuwait in August 1990. Australia sent three naval ships to join the US–led Multinational Naval Force. These Australian ships intercepted civilian ships suspected of smuggling oil and other products out of Iraq in defiance of sanctions [30]. Since 1991, the Australian Defence Force has deployed forces to the Arabian Peninsula region. For the majority of this period the forces deployed were part of the naval blockade enforcing UN sanctions on Iraq. Now, the RAN continues to rotate a major fleet unit on operations to support coalition operations in the Arabian Gulf, the Gulf of Oman, the Indian Ocean and the Somali Basin. These ships are tasked with protecting shipping, anti–smuggling operations and counter piracy operations, which are essential to maintaining the unhindered passage of oil tankers.

The 2009 White Paper recognised the importance of oil security in defence's strategic thinking when it noted that 'Australia has a range of national security interests in the Middle East, including ... helping to ensure global access to Middle East energy reserves' [31].

Box 7. Australian defence policy and the security of Australian offshore oil and gas facilities and maritime exports

Since the beginning of developing offshore oil and gas facilities in Australia, the ADF has been involved in protecting them. The first offshore facilities were in Bass Strait and from the 1970s, the Navy regularly visited them and the Air Force's aircraft patrolled them. In the early 1980s, the Army's Special Forces practised counter terrorist operations with them, such as exercises involving retaking facilities captured by terrorists or other politically motivated groups. With the growth of the North–West Shelf and Timor Sea offshore facilities and their critical importance to national economic security, the military have placed greater emphasis on protecting these facilities.

The ADF's attention to these facilities recognises that their exports are important to regional energy security. This is reflected in the 2012 Defence Posture Review which stated that 'Australia makes an important contribution to regional energy and resource security through our role as a major supplier ... [and this] ... highlights the importance of the security of Australia's energy and mineral resource assets, and perceptions of our ability to provide this security' [32]. The implicit recognition that if Australia does not secure these assets and the maritime export lanes, then importing countries might intervene in Australia's region to guarantee supply, is explicitly stated in the Offshore Oil and Gas Resources Sector Security Inquiry as seen below.

'Energy supplies from the Persian Gulf have been protected for decades by the major importing nations, including the US, to ensure ongoing reliability of supply. It is not difficult to extrapolate that major importers of Australian energy may adopt a similar approach in protecting the supply route from Australia to their shores [33].'

Defence recognises the relationship between its assets near energy export sites, as seen in Figure 6, and is placing greater emphasis on protecting north western facilities. Defence is also increasing surveillance of these assets using the new P8 Maritime Surveillance Aircraft to replace the aging P3 C fleet and an increasing fleet of remotely piloted vehicles. In March 2014, Defence announced the multi–billion dollar purchase of Triton remotely piloted vehicles to be located at Edinburgh, SA.

Figure 6: Map of significant ADF facilities, ADF training areas, selected civil ports and offshore resources [34].

Defence's energy needs

The area where Defence has failed to appreciate energy security risks is in its own consumption of energy. Defence is a huge consumer of energy, principally liquid fuels and electricity. Without it, its ships cannot sail, planes cannot fly, vehicles cannot drive, and its enabling functions such as logistics, intelligence and administration, cannot work. However, concern about the vulnerability of the supply chain to provide the energy for both its military and enabling operations has not been a consistent feature of defence policy. This may be unsurprising in the 1970s and 1980s when Australia was growing in oil self–sufficiency, meaning a period of low oil vulnerability. By the 1990s when oil self–sufficiency was in decline, the 1994 White Paper noted the need for government intervention to ensure that Defence has reliable suppliers of consumable items, such as fuel and ammunition. Since then, no white paper has mentioned the supply chain vulnerability arising from the need to import liquid fuel, the decline in local oil refineries, and other energy security vulnerabilities.

Defence's strategic policy only once mentioned energy efficiency and reducing greenhouse gas emissions from its operations. This was in the 1994 White Paper. It identified that Defence had a comprehensive Energy Management Plan which sought 'to ensure efficient use of resources, elimination of waste and avoidance of damage to the environment ... [and] ... seeks to implement Government policy for stabilising greenhouse gas emissions, in particular, by setting a goal of stabilising emissions of such gases by 2000 at the 1988 level' [35].

Unlike other major military forces including the USA, the UK and NATO, the Australian Department of Defence has not pursued alternative energy solutions to any significant degree nor integrated energy considerations into military concept development, future force design, preparedness and operational planning. Recently, Defence recognised the need to upgrade the approach to energy through the Defence Energy Integration Framework. This framework seeks to provide Defence with effective energy management so as to reduce risk for future Defence capability and operations. This is increasingly important as within the next 20 years, the introduction of new capabilities is expected to double the ADF energy requirements, and Defence needs to improve its ability to measure operational energy consumption, and reduce demand while increasing combat effectiveness [36].

A glimpse into the future

Defence is currently updating its policy with a white paper to be delivered in 2015. In March 2014 in an address to the National Security Institute the then Chief of Defence General David Hurley gave insights to the White Paper strategy. He stated, 'Australia's national interests require that for its prosperity and future stability, it must be able to shape its strategic environment and respond to threats ... This is not, for example, merely the protection of Sea Lines of Communications and freedom of navigation, but rather the protection of trade itself' [37].

Energy is critical to Australia's trading interest, and geopolitical protection of energy supply is a key issue for the future. As highlighted earlier, energy supplies from the Arabian Gulf have been protected for decades by the importing nations to ensure ongoing reliability of supply. Consequently, at some time in the future, major importers of Australian energy may adopt a similar approach in protecting the supply route from Australia to their shores which will shock many Australians. This needs to be factored into future defence planning.

Recommendation

9. The upcoming Defence White Paper should reflect a more comprehensive understanding of energy security issues including:

- Greater attention to the protection of Australian maritime exports in the context of tensions in Asia and the desire by energy importing countries to ensure that Australian supplies are reliable
- The adoption of energy efficiency and smart energy solutions, along with accelerating the Defence Energy Integration Framework, by the Australian Defence Force to reduce energy security vulnerabilities.

4.7 Integrating energy security and foreign diplomacy

Energy security is every country's problem due to the high level of global energy interdependence and interconnectedness. This is despite the fact that different parts of the world have unique energy systems that have evolved in response to local and regional politics, culture and history. No longer can any one country treat energy supply and demand as a local issue. The interconnectedness of energy can be clearly seen in globalised oil system where an impact in a producer country can cause effects in importing countries. Increasingly, it is also being seen for gas, coal, electricity and other energy products. The growing interconnectedness is increasing the importance of international collaboration to improve energy security [38].

The rising influence of energy security in foreign affairs policy

The Australian Government occasionally produces foreign affairs white papers. The most recent three were the 1997 In the National Interest, the 2003 Advancing the National Interest and the 2012 Australia in the Asian Century.

The 2003 White Paper described Australia as a crucial supplier of energy to East Asia. It stated that 'In the mid–1990s the Government alerted Australian business to emerging opportunities in China's energy market which offered scope for a strategic energy partnership with China on a par with that between Australia and Japan'. While energy exports were identified as an opportunity to advance Australia's strategic and economic agenda, the 1997 and the 2003 White Papers identified that the security of energy sources was one of the issues that will threaten the security and sovereignty of nations in Australia's region. The 1997 document argued that the best approach to 'contain and manage energy–related security risks [was] by promoting open energy markets and through its support for regional mechanisms which address the underlying security issues' [39].

The 2012 Australia in the Asian Century White Paper continued the emphasis on the opportunities for Australia in being a reliable energy supplier to countries in Asia. It noted that countries in the region 'will become increasingly focused on energy security in coming decades' due to the growth in the economies, increasing dependence on imported oil and natural gas, and meeting the huge latent demand for energy–intensive goods and services. It also noted that 'energy security risks will be more diverse and more complex than in the past – technology change, social and political unrest and extreme weather all have the potential to disrupt markets'.

Due to the region's emissions–intensive energy mix, this increased demand will lead to increased emissions. It noted that climate change is creating pressures to restrict and alter patterns of energy use. It noted that many regional countries are pursuing energy efficiency, energy performance and renewable energy targets. Australia can assist by supporting countries to implement energy efficiency measures, as well as enhancing cooperation on technology, research, deployment and commercialisation including for clean energy technology. The document also highlighted the export perspective when it stated, 'The Asian century offers a wealth of opportunities ... in mining and resource related sectors [due to] the continued economic development in the region [which] will drive demand for energy and mineral resources' [40].

The Asian century offers a wealth of opportunities in mining and resource related sectors

Since 2000 Australia has ramped up its energy diplomacy to advance its national interest. Energy diplomacy recognises that due to global interdependent energy markets, cooperation on energy issues is generally attractive at a multilateral and bilateral level. For energy importing nations, such as India and China, energy diplomacy to obtain energy resources is a vital component of their foreign policy. For supplier nations, supplying energy resources can generate strategic and trade benefits. The energy discussions themselves can generate benefit but they can also act as a mechanism to build confidence that delivers other political and policy dividends for participating countries, such as advancing Free Trade Agreements (see Box 8: Australian perspectives of energy security diplomacy).

Box 8. Australian perspectives of energy security diplomacy

Energy security diplomacy involves integrating energy security interests into foreign policy decision making, which in Australia's case includes advancing national interests relating to energy security of both supply and demand. Energy security diplomacy has been practised in Australia for decades as illustrated by the signing in 1988 of a memorandum of understanding between Australia and the United States on alternative energy supplies which the Minister for Resources, Senator Peter Cook, stated was 'to expand and enhance both countries' efforts to improve energy security' [41].

In the 1990s, energy security diplomacy was focused on Australia's energy exports gaining markets in Asia through being recognised as a reliable energy supplier. At that time, the rapidly increasing demand for energy by China, Japan, South Korea and India as well as other Asian countries saw energy issues becoming common in regional diplomatic forums. As an indication of the diplomatic effort put by Australia into influencing these, in 1996, the inaugural meeting of APEC energy ministers was held with the Australia's Minister for Resources and Energy, Senator Warwick Parer, chairing this meeting. He described this forum as one which could deliver valuable mutual benefits for strong cooperative action 'to address the three fundamental energy issues facing the region, commonly known as the three Es; that is, economic growth, energy security and the environmental effects of these energy measures' [42].

A significant regional initiative, led by Australia, was the APEC Energy Security Initiative (ESI), which was endorsed by APEC Economic Leaders in October 2001. This had two main tracks. The first included short–term measures to respond to temporary energy supply disruptions such as improving global oil market transparency, enhancing maritime security in relation to countering terrorism, implementing a real–time emergency information sharing system following an oil crisis, and encouraging Member Economies to have contingency arrangements to respond to crises. The second included measures to address longer–term energy challenges facing the APEC region such as facilitating investment, trade and technology cooperation in energy infrastructure, natural gas (including LNG), energy efficiency, clean fossil energy (including carbon capture and geological sequestration), renewable energy and hydrogen and fuel cells [43].

A key part of energy security diplomacy has been to advance Australia's security of energy export supply agenda into multilateral arrangements. An illustration of this is the Asia–Pacific Partnership on Clean Development and Climate. Promoted by Australia in partnership with United States, Japan, China, India and South Korea, this initiative seeks to ensure that environmental issues can be advanced simultaneously with improving energy security and economic growth, rather than at the expense of the latter. When it was announced in 2005 by the Minister for Foreign Affairs, Alexander Downer, he highlighted Australia's role and the underlying philosophy of the Australian Government's approach. He stated that 'The partnership represents a significant achievement for Australian diplomacy [as] Australia played an instrumental role in attracting regional countries to the concept and in drafting the partnership vision statement'. He also noted that 'The partnership also represents a new way of approaching global environmental challenges. It is reflective of a mindset that appreciates that such issues cannot be looked at in isolation. It recognises that economic development and energy security are legitimate national goals and that actions to address climate change should complement rather than frustrate the pursuit of these goals. It is an approach that values results and eschews ideology' [44].

Energy security in regional architectures

The 2014 IEA's Southeast Asia Energy Outlook identifies energy security as an elevated foreign policy issue as reliance on oil imports increases across the region. It will be critical that energy supplies are affordable, in order to support continued economic growth and development across the region. The removal of barriers to energy efficiency and cleaner sources of energy also looks set to become a major imperative, given the region's fast–rising energy demand, the expanding role of coal in its energy mix, and its growing urban population.

The IEA Report identifies that strategies that attract investment will be vital for enhancing energy security, affordability and sustainability. Around $1.7 trillion of cumulative investment in energy–supply infrastructure to 2035 is required in South East Asia, with almost 60% of the total in the power sector. Implementation of long–standing projects to interconnected markets, namely the ASEAN Power Grid and the Trans–ASEAN Gas Pipeline, can underpin more efficient exploitation of the region's energy resources, while enhancing its collective energy security [45].

This outlook means that there is enormous opportunity for Australia to engage regionally in energy security and advance Australian interest for the benefit of the region. It is a diplomatic and business opportunity. Innovative Australian energy solutions across all energy sectors can be introduced to these markets. Australian engineering innovations in the solar industry may be able to advance business in Asia. For instance, the UNSW School of Photovoltaic and Renewable Energy Engineering, which is internationally recognised for its research in the area of photovoltaics, may be able to partner with Asian business interests to compensate for the uncertainty surrounding renewable energy investment in Australia

The EAS is a regional leaders' forum for strategic dialogue and cooperation on key challenges facing the East Asian region. It is a comprehensive regional architecture being used to advance energy security by Australia. The countries of the EAS collectively represent 56% of the world's population and account for around 55% of global GDP. With 73% of Australia's goods and services exports bound for the 17 other EAS member countries, the grouping is of key economic and strategic importance to Australia [46]. The EAS region is particularly vulnerable to energy supply risks as many countries are highly dependent on energy imports.

The 8th EAS Summit recognised the importance of sharing medium– to long–term outlooks for energy supply and demand across the EAS region, given the growing energy demand in the region and the probable implications of natural disasters and extreme weather on existing energy infrastructure. The summit encouraged the close collaboration of the ASEAN Centre for Energy (ACE), the IEA, the Economic Research Institute for ASEAN and East Asia (ERIA), and other parties in conducting energy outlook studies for the South East Asia and the EAS regions [47].

Recommendation

10. The Australian Government and other Australian stakeholders should enhance their energy diplomacy efforts through greater incorporation of energy security issues into regional interactions including multilateral forums. This could include joint government, private sector and professional association missions concentrating on advancing energy security.

4.8 Addressing liquid fuel insecurity

Australia's logistic operations are almost wholly dependent on oil. In the near and medium term, there are no alternatives to substitute fossil liquid fuels used for transport with other fuels. Consequently, liquid fuel supply poses an enduring risk to Australia's economic security, national security, food security and social stability. The key mitigation strategies are to have strong liquid fuel supply chains, hold emergency oil stocks, have a domestic refinery capability, and maintain an emergency fuel distribution system for times of shortage. Australia undertakes all of these actions to various degrees but it is questionable if they actually achieve liquid fuel security.

Strong liquid fuel supply chains

Australia imports the majority of its liquid fuel as about 90% of Australian's transport fuel is imported. At any one point in time, Australia's stockholdings of oil and liquid fuel consists of two weeks of stocks at sea, five to 12 days of supply at refineries, 10 days of refined stock at terminals and three days of stocks at service stations [48]. Australia obtains most of its oil from a range of sources including the Middle East, South America and Latin America.

There are significant geopolitical issues affecting liquid fuel security supply chains. For example, conflicts and disasters in oil producing and refining countries could disrupt supply lines. Another issue is National Oil Companies, such as Petro China and Saudi Aramco, which are beginning to dominate the production and refining of oil at the expense of private oil companies. National Oil Companies as their name suggests have strong strategic and political links to their governments and almost 80% of the world's proven–plus–probable reserves of conventional and unconventional oil are controlled by National Oil Companies or their host governments [49]. China's net crude oil imports continue to grow and could reach 8.0 million barrels per day by 2025 with the greatest volume coming from the Arabian Gulf. A key approach by China to managing its energy security risks is to expand its National Oil Companies' role in global supply chain risks. Australia's persistent faith in global supply chain stability could be sorely tested in the future if such National Oil Companies make decisions based on national energy security interests rather than commercial interests [50].

The House of Representatives' Standing Committee on Economics report on Australia's oil refinery industry in January 2013 stated that 'There are reliable, mature and highly diversified international fuel supply chains, which provide Australia with economic security. The Australian Institute of Petroleum and refiners were also confident about the reliability of Australia's supply chains and infrastructure to continue to meet local fuel demands, as it has done over many decades' [51]. However, other groups are concerned about liquid fuel supply and seek to improve it. For example, the 2014 NRMA Study into Australia's Liquid Fuels Security stated that 'Australia's combined dependency on crude and fuel imports for transport has grown from around 60% in 2000 to over 90% today. In an ever–changing world, we need to plan to stop our import dependency growing to 100% in the future if we are to have an acceptable level of fuel security' [52].

Domestic refinery capability

On 2 April 2014, BP announced that it intends to halt refining operations at its 102,000 bpd Bulwer Island refinery in Brisbane by mid–2015. By the close of 2015, there will be only four refineries operating in Australia – Vitol operating at Geelong, BP at Kwininna, Caltex's Brisbane (Lytton) refinery and Exxon–Mobil's Altona operation in Melbourne. This change reflects structural change within the fuels supply chain in Australia due to the growth of very large, and far more cost efficient, refineries in the Asia–Pacific region [53]. Cost pressures on small Australian refineries are likely to continue as oil refining capacity is expanding in Asia, and the development of super refineries in the Middle East. Australia's aging refineries without renewal cannot compete effectively against these newer more technically advanced and large scale refineries. The ongoing decline in domestic refining capability will continue to increase Australia's reliance on imported refined products.

Since 2002, the proportion of refined petroleum, oils and lubricants sourced from overseas has risen from 11% to 37% in 2012, and it is estimated that this will reach 43% in 2014 with the closure and conversion of the NSW refineries [54]. This increases Australia's vulnerability to the influences of the global market in terms of availability of refined products. However, the House of Representatives' Standing Committee on Economics report on Australia's oil refinery industry appears to not be concerned as it stated that 'The changes in domestic refining capacity to date will not affect on Australia meeting its liquid fuel requirements' [55]. This is also the view of the Australian Government.

Emergency oil stocks

As a member of the IEA, Australia is obligated to maintain reserves of crude oil and/or product equivalent required to sustain consumption for 90 days, based on the prior year's average net oil imports. The IEA has put the 90–day requirement in place to assist member nations in ameliorating global oil shocks. Australia has not met the IEA targets for 90–day net oil import stockholding level, and Blackburn in the 2014 NRMA

Study into Australia's Liquid Fuels Security identifies that the level of stockholding is as low as 60 days [56]. The Australian Government acknowledges the shortfall but argues that Australia meets the requirement when contracted shipping of products is taken into account. Nevertheless, the Australian Government has acknowledged this issue and is investigating options to address Australia's non–compliance [57].

An emergency fuel distribution system

The Australian Government has long had an emergency response capacity to deal with the effect of a sudden oil supply shortage. The Liquid Fuel Emergency Act 1984 provides the Australian Government with the authority to prepare for and manage a national liquid fuel emergency. In an emergency, the Minister for Industry can activate the Act to control the industry's stocks of crude oil and liquid fuels, Australian refinery production, and the distribution of fuel stocks. In such a situation, the Minister would be advised by the National Oil Supplies Emergency Management Committee. Each state and territory is responsible for liquid fuel emergencies at their jurisdictional level and ensures that arrangements are in place for dealing with the emergency [58].

The Liquid Fuels Act aims 'to minimise the total effect on the community ... and minimising economic dislocation' [59]. In fact, the Act provides a level of economic insurance to industries with a heavy reliance on fuel. The detailed actions or plans of the National Oil Supplies Emergency Management Committee are not publicly available as they contain sensitive information and are event driven.

However, there are concerns about the distribution system. For example, in 2013, White, writing for Kokoda Foundation's Security Challenges Journal, raised concerns that the policy, plans and committees implementing the Liquid Fuels Act may not sufficiently address Defence fuel security needs. White argues that the 2007 amendments to the Act de–emphasise Defence's needs and questions the robustness of testing the approaches to fuel shortage scenarios in exercises [60]. Australia's heavy dependence on liquid fuel imports means that any unexpected shocks to the system will test the nation's resilience, both collectively and individually.

Adapting and innovating

The key to adapting to the changing liquid fuel situation, including the decline of Australia's refining operations, is to develop a strategic approach to creating a sustainable and risk–based liquid fuel sector. This involves seeing this sector as a national capability with people, skills and education that can generate innovative products and services, rather than a commodity supplier where the location of the production is irrelevant. Encouragement is required for Australia's refining operations to become more innovative, particularly in processes, markets, products, services, delivery and business and management models identified as essential in the Australian Government's Manufacturing Workforce Study of April 2014. The industry needs to be better engaged in research and development, design, production of prototypes, and the small–scale manufacture of complex, high value added goods [61].

To achieve this, **the liquid fuels industry needs to reverse its declining research and design capabilities as well as its technical skills base. Specifically, greater effort is required to encourage deeper engagement between industry and universities to obtain skilled graduates, and policy attention to transition the industry to a sustainable state.** A sustainable liquid fuel sector also needs greater innovation from resource developers. Such innovation provides a feedstock for the refineries. For example, the development of tight oil offers such a source although this has had limited success in Australia. Finally, as liquid fuels are a major source of greenhouse gas pollution, it is necessary to transition to low–carbon fuels which the refining industry should seek to produce. Thus the liquid fuel sector should also prepare to shift into low–carbon fuels including the substitution of fossil fuels.

Recommendation

11. The Australian Government in partnership with the petroleum industry, users and other stakeholders should develop a liquid fuel strategy that includes the following components:

- Rigorously and publically investigating what are acceptable levels of emergency self–sufficiency in oil supplies in the context of the international agreement to maintain supplies of at least 90 days, and implementing the most effective approach to achieving these levels
- Ensuring through innovation the sustainability of the domestic refining, storage and distribution industry so that it can supply essential civil and military needs in the event of crises
- Commissioning a detailed analysis of the costs, benefits and timelines for the redirection of currently exported Australian crude oil to be refined domestically in times of crises
- Accelerating activities to substitute low–carbon fuels for fossil liquid fuels.

4.9 Addressing energy poverty

In Chapter 2, the relationship between energy security, social stability and energy stress was outlined. As the concept of national security has evolved since World War II, the drivers of international power paradigms are now more complex. The national interests of states are no longer 'national.' September 11 underscored the realities of a globalised world: that security can no longer be guaranteed by a strong military, and territorial borders are highly permeable and increasingly trivial when defending the quality of life for domestic populations. In the National Security Strategy of the United States of 2002 Secretary of State Colin Powell noted that 'sustainable development is a security imperative. Poverty, destruction of the environment and despair are destroyers of people, of societies, of nations, a cause of instability as an unholy trinity that can destabilize countries and destabilize entire regions [62].'

Traditionally poor states were unable to exert power that threatened wealthy states, and in this paradigm addressing poverty was seen as an altruistic goal and economic in nature. Now it is understood that poverty destabilises societies, deprives human beings of dignity, and is a crucial factor in the creation of social tension, which in some cases leads to illegal activities, internal conflict and terrorism. While poverty is not a simple phenomenon to address, it is clear that access to energy is fundamental to addressing poverty. Thus energy security and energy poverty are twined in a mutually reinforcing cycle. The following short examination discusses energy poverty both through an international development perspective and through the rise of the 'energy stressed' in Australia created by rising costs of energy.

Energy poverty in the international development context

Successful international development requires a multi–dimensional approach as reflected in the United Nations eight Millennium Development Goals to address poverty. The Millennium Development Goals were formulated to reduce global poverty while increasing education, empowering women, and improving child and maternal health. Access to modern energy and development is implicit in the Millennium Development Goals.

The IEA defines energy poverty as a lack of access to modern energy services. These services are defined as household access to electricity and clean cooking facilities (e.g. fuels and stoves that do not cause air pollution in houses)[63]. Access to affordable and reliable energy services is crucial in reducing poverty and improving health, increasing productivity, enhancing competitiveness and promoting economic growth. The lack of access to modern forms of energy often tends to go hand in hand with a lack of provision of clean water, sanitation and health care. Inefficient and unsustainable cooking practices also have serious implications for the environment, such as land degradation and contributing to local and regional air pollution.

In 2011 the Australian Agency for International Development (now the Department of Foreign Affairs and Trade) with the World Bank released the report One Goal Two Paths with the purpose of addressing energy access and related developmental issues in the East Asia Pacific region. Encouragingly, the report found that achieving universal access to modern energy is within the reach of countries in the East Asia Pacific region in the next two decades. This report outlined an ambitious program for the eradication of energy poverty across the region by 2030 by urging governments to work simultaneously on two paths:

- Firstly, achieving universal electricity access by accelerating both grid and off–grid programs while employing appropriate policies and innovative technical solutions to reduce costs, improve reliability, and provide timely service to all households
- Secondly, a major push to increase access to clean cooking fuels (natural gas, liquefied petroleum gas, and biogas) and advanced cooking stoves, particularly for biomass in poor rural areas [64].

The report acknowledges that the East Asia Pacific region is diverse and this means that energy poverty solutions are not 'one size fits all'. Therefore, there are a number of varying initiatives to tackle energy poverty in the East Asia Pacific region (see Box 9: South East Asia and energy poverty initiatives and Box 10: Energy Poverty in the South West Pacific). A current issue in the consideration of energy poverty is the role that coal plays (see Box 11: The role of coal in energy poverty).

Box 9. South East Asia and energy poverty initiatives

The IEA 2013 South East Asia Outlook estimated that 134 million people in South East Asia, or 22% of the region's population, currently do not have access to electricity and around 280 million people rely on the traditional use of biomass for cooking, almost half of the region's population. Access to modern energy services is low in South East Asia relative to most other parts of the world, with the exceptions of Brunei Darussalam, Malaysia, Thailand and Singapore which have reached high levels of access. Indonesia accounts for almost half of the population of those living in the region who lack access to electricity, partly reflecting the difficulties involved in providing access to modern energy services in the largest and most populous archipelago in the world. Rural areas are home to 80% of the people in South East Asia without access to electricity, primarily reflecting the added difficulties of providing electricity in communities with low population densities [65].

Nevertheless, significant progress has and is being made in improving access to modern energy services across the region. For example, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the German–Indonesian Chamber of Industry and Commerce (EKONID) have jointly implemented the 'Renewables – Made in Germany' initiative under the Project Development Program South East Asia (PEP SEA). Renewables are of particular importance in countries such as Indonesia where some 16.8 million Indonesian households are off the grid including those on some 7,000 inhabited islands [66].

Box 10. Energy poverty in the South West Pacific

Energy poverty is widespread in the South West Pacific. It is estimated that 70% of households in the region don't have access to electricity and 85% don't have access to clean cooking energy technology. Unlike South East Asia, the situation does not appear to be improving. There has been limited progress in increasing access to electricity in rural areas of the Pacific, which is where the vast majority of non–electrified households are situated. This is particularly true in Papua New Guinea, the Solomon Islands and Vanuatu, where electrification rates are lowest.

Unfortunately, government resources that are dedicated to rural electrification in the Pacific are limited, with subsidies directed toward electricity consumption in urban areas far outstripping government funding for installation of off–grid systems in rural areas. These priorities should be reversed. Increased funding needs to be directed towards rural electrification using off–grid systems, and at the same time, universal subsidies for power consumption among (primarily) urban households should be abolished and replaced by lifeline tariffs that protect low income households [67].

Box 11. The role of coal in energy poverty

In January 2014, the IEA released the report Current and Future Importance of Coal in the World Energy Economy. It stated that 'the importance of coal in the global energy mix is now the highest since 1971 ... It remains the backbone of electricity generation and has been the fuel underpinning the rapid industrialisation of emerging economies, helping to lift hundreds of millions of people out of energy poverty' [68]. The question of whether coal is the answer to energy poverty is not new, but after the release of the report, coal industry proponents were quick to proclaim coal as the victor in an ideological battle against renewable energy over the moral 'high ground' issue of energy poverty. Since energy poverty is a complex challenge with a direct relationship to energy security, there is no one direct lever that provides the magical solution to energy poverty; however, coal does have a part to play in addressing global energy poverty.

Coal, as the cheapest, most versatile and abundant fuel in the world, has two major advantages in addressing poverty – cost and capacity. A recent working group report to the IEA concluded that world energy consumption trends showed that 'inexpensive coal serves to decrease the price of electricity, when the price–setting plant is a coal–fired one'. Secondly, other energy sources without coal simply cannot meet the projected future demand. The IEA reports that over the period 1990 to 2011, world electricity demand has grown by a compound annual growth rate of 2.9% per annum, which is an average of 405 terawatt hours per year. Over the period to 2035, the IEA expects electricity demand to grow by an average of 548 terawatt hours per year [69].

The alternative view is that while coal may address raw financial aspects of poverty, it does in turn aggravate other social drivers of poverty. The One Goal Two Paths report by AusAID and the World Bank found that the use of solid fuels (including coal) for cooking, even in countries that have significant access to electricity, contributes to ongoing poor health. Women and children in particular are exposed to indoor cooking smoke from incomplete burning of biomass fuels in inefficient stoves, with strong evidence of causal linkages to acute respiratory illnesses, heart disease, cataracts, and cancer.[70] Decentralised renewable energy may be a safer, cleaner and viable source of energy for the rapidly developing societies in the coming decades.

Energy poverty in the Australian context

As noted in section 2.2.4, energy poverty can be defined as households spending more than 10% of their after–tax income on energy. It is likely that between 5 and 10% of Australian households exceed this threshold. Energy poverty often goes hand in hand with housing stress – the combined effects commonly result in people unable to feed themselves adequately, poor nutrition, psychological stress such as anxiety and depression, inability to replace essential items including motor vehicle repairs, and social isolation due to having insufficient money for transport and activities outside the home.

Residents of different Australian jurisdictions experience varying degrees of energy poverty. This difference can only be partially explained by differences in energy prices. Other factors include different energy pricing regimes and concessional systems. In some jurisdictions, the fixed supply charges are higher which disadvantage low energy volume users. And in some jurisdictions, the concessional system uses eligibility criteria that exclude many of the energy stressed, as these people often fall outside traditional income support and concessional regimes.

Ideally a national framework for energy concessions should be introduced that ensures assistance is targeted at households in need including after considering their housing stress. The concessions should not only focus on those in energy poverty but also those who are energy stressed. These measures could result in significant cross subsidies so issues of fairness and equity must be considered. Regardless of which measures are adopted, it is essential that they minimise the creation of other energy insecurities such as under–investment in electricity infrastructure or inhibiting the development of the new distributed and multi–directional flow energy systems.

Recommendations

12. As energy poverty can be a driver of insecurity that has strategic and social stability implications:

- Australian security policy makers, and Australian government and private sector aid development organisations should make reducing energy poverty in Australia's region of interest a priority, and this should be done in conjunction with Australian industry to engage them in producing fit–for–purpose energy solutions for the region
- Australian governments, including regulators and other stakeholders, should explicitly seek to minimise energy poverty and reduce energy stress while minimising the generation of other energy insecurities such as under–investment in electricity infrastructure or inhibiting of the development of distributed and multi–directional flow energy systems.

4.10 Moving beyond energy infrastructure protection

Since the terrorist attacks in the USA on 11 September 2001, a new focus of energy security has arisen: the protection of energy production infrastructure from malicious attacks. An example in Australia was the planned terrorist attack on the NSW electricity grid.

Prior to 2001, the threat of malicious attack on energy infrastructure in Australia was seen as a low risk. Consequently, mitigating the risk was a low priority for the owners and operators of the infrastructure, who were and still are today primarily responsible for their own security. Energy infrastructure protection was also not a high priority from the military, security agencies and government energy organisations, with the notable exception of offshore oil and gas infrastructure. Onshore interaction was sporadic. Police and security intelligence involvement with energy infrastructure was limited to individual cases of investigating intended or actual criminal acts. Government agencies responsible for energy issues also had involvement with security issues but this was typically within their safety, health and environment frameworks, which gave priority to these issues rather than security.

Following the 2001 attacks, governments rapidly elevated the importance of enhancing the protection of energy infrastructure and its services. There were two main thrusts of this approach. The first involved increasing the protection of off shore oil and gas infrastructure, and the second involved developing a national, coordinated business–government approach to enhancing critical infrastructure protection.

The focus on offshore maritime security came at a time of increased attention given to maritime border security, as the arrival of irregular migrants by boats had become a political issue starting with the 2001 election. Key military–related changes to maritime protection in Australia's Security Forces Authority zone which includes the Exclusive Economic Zone (EEZ), consisted of increasing the frequency of maritime and air patrols, establishing the Border Protection Command, and increasing the frequency of offshore counter–terrorist training activities. The Border Protection Command (previously known as the Joint Offshore Protection Command) was established in 2005 as a multi–agency taskforce to provide an overarching capability for offshore civil maritime protection. While it does not have assets in its own right, it uses those of the Australian Customs and Border Protection Service and the Department of Defence. The Australian Government identified that one of the reasons for purchasing new naval vessels, such as obtaining two new Armidale Class Patrol Boats in 2005, is to protect the Australia's offshore oil and gas facilities on the North West Shelf.

Activities to increase maritime security in the offshore oil and gas industry environment were propelled by the Maritime Transport and Offshore Facilities Security Act 2003 and its subsequent amendments. Amongst other requirements, it mandated that Australia's offshore oil and gas facilities must provide a security plan modelled on the arrangements that apply to Australia's larger ports and ships. It also introduced the Maritime Security Identification Card (MSIC). This system requires people to pass security checks before they can work in maritime security zones, including on offshore oil and gas facilities.

State and Federal governments also increased their involvement in protecting onshore energy infrastructure as part of a broader agenda to protect critical infrastructure such as water, transport and telecommunications. Most governments established critical infrastructure protection units within their police services, as well as in both line and coordinating agencies. For line agencies, the energy related groups were often within the jurisdiction's energy, resources and police departments, while in coordinating agencies they were often within the premier's, prime minister's, justice and attorney–general's departments. These groups were all predicated on the notion that security for energy infrastructure primarily rests with the energy infrastructure owner and operator; however, for security to be most effective, it requires a partnership between business and government. Key national initiatives that reflected this approach included the formation of the Trusted Information Sharing Network for Critical Infrastructure Protection (TISN) and critical infrastructure related work of the National Counter–Terrorism Committee (NCTC). The TISN was formed in 2002[71] to focus on policy issues of significance, sharing information on threats and vulnerabilities, and collaborative risk mitigation issues.

It has sub–groups specifically focused on the energy sector, which includes oil and gas. While originally the TISN focused on the threat of terrorism, it has since broadened to focus on all hazards, whether natural, technological or malicious. In 2003, the Energy Security Group of TISN was established, and in 2008 the sub–group of the Oil and Gas Security Forum (OGSF) was established. Collaborative government–private sector information sharing arrangements are also mirrored at the State/Territory level such as the Pilbara Security Collective, the Queensland (Oil & Gas) Security Coordination Group and the Central Gippsland Essential Industries Group. Another government initiative was undertaking risk assessments of all critical energy infrastructure, including major stationary and transport energy assets that are critical to national, state and territory governments, and developing appropriate risk mitigation treatments.

While in the immediate aftermath of the 2001 terrorist attacks, attention was focused on countering terrorist threats to energy infrastructure, over time the focus broadened to protecting infrastructure from other man–made threats and natural hazards. The last decade has also recognised that the actual risk of terrorist attacks is low based on an assessment of capability and intent of potentially hostile groups, and the lack of indicators of specific threats to offshore facilities. The more likely sources of malicious threat are disgruntled employees, trusted insiders or lone perpetrators.

We rely on complex and interdependent infrastructure to go about our daily lives

The NCTC develops Australia's national counter–terrorism arrangements and in 2011 released the National Guidelines for Protecting Critical Infrastructure from Terrorism. These guidelines establish a nationally consistent approach of how Australian governments would work with owners and operators of critical infrastructure to protect their assets from terrorism. state and territory governments generally follow the National Guidelines which involve police liaising with owners and operators to better provide security advice, and disseminate threat information (which could flow from ASIO, other infrastructure owners or from the community). Some states introduced legislation mandating minimum requirements for the owners and operators of infrastructure, such as Victoria which specified that they would have to review their risk management plans annually and participate in exercises to test the plans.

While physical security still forms an integral part of all Australian governments' critical infrastructure protection and resilience efforts within the energy sector, the rise of more technologically connected energy systems created an emerging area of vulnerability. This has led to an important focus of critical infrastructure protection on cyber security. Cybersecurity refers to the technologies and processes designed to protect computers, networks and data from unauthorised access, vulnerabilities and attacks delivered via the internet by cyber criminals. Energy infrastructure is heavily dependant on cyber systems such as computer, SCADA (Supervisory Control And Data Acquisition) and PLCs (Programmable Logic Controllers) systems using network connectively through wireless, internet, dark fibre, microwave, satellite or priority local area networks. The widespread use of these systems has heightened the energy sector's dependence on computer and information technology to monitor consumption and to drive production, transformation, transmission and distribution of supply.

While these systems have reduced operating costs, increased reliability and enhanced transparency, opportunities to exploit weaknesses have increased, particularly where systems are open networked and operate across networks. Online electronic systems can be vulnerable to remote attacks, as physical proximity is no longer needed to inflict damage on infrastructure. Such attacks could pose significant risks to the reliability of physical energy networks. The significance of the cyber security threat is reflected in the inclusion of a cyber case study in the 2011 NESA.

Failure of infrastructure is inevitable at some point, whether it is done maliciously, accidentally or occurs as a result of some natural hazard. Consequently, it is necessary to not only protect infrastructure, but also to develop resilience in both the infrastructure and the users of energy. Since the mid–2000s, the policy goal of critical infrastructure protection has shifted to become critical infrastructure resilience. The Australian Government defines resilience as being better able to adapt to change, having reduced exposure to risk, and being better able to bounce back from any type of hazard, including natural disasters, pandemics, accidents, negligence, criminal activity and terrorist attacks. The UK Department of International Development defines resilience as 'The ability of countries, communities and households to manage change by maintaining or transforming living standards in the face of shocks or stresses without compromising their long–term prospects'[72]. Thus a highly resilient community can withstand considerable disruption before failing. The importance of resilience is recognised by the Australian Government as seen in the 2011 National Strategy for Disaster Resilience and the work of the TISN in the Attorney General's Department whose resilience mandate includes:

- Developing and promoting an organisational resilience body of knowledge and a common understanding of organisational resilience
- Supporting the critical infrastructure resilience programs delivered by Australian States and Territories [73].

The National Strategy for Disaster Resilience provides strategic guidance on the approach to community resilience and highlights the challenges in developing coherent and consistent resilience programs. In the consideration of risk in the built environment, community resilience is seen as reliant on national infrastructure. It states, 'We rely on complex and interdependent infrastructure to go about our daily lives ... Our ability to live day to day relies on these systems operating efficiently. The consequences of emergencies are demonstrated by the effects on the infrastructure we rely on' [74].

As Australia's population grows and its economy expands, dependence on electricity in particular will increase. This can result in more people and assets becoming vulnerable to the effects of extreme weather events. This means ensuring that electrical infrastructure is robust, reliable and resilient is critical to community resilience. A key goal of the resilience agenda should be to reduce vulnerability by constantly improving energy systems and the integration with critical infrastructure. Critically, development of resilient energy systems starts before the disaster, through 'disaster risk reduction' programs which build community resistance [75]. It is always difficult for Australian governments to invest in preparedness programs, but in light of recent disasters, the Queensland Government has instigated improved preparedness action across the community. For example, one of the core functions of the Queensland Reconstruction Authority, established after the 2010–11 natural disasters, was to ensure that Queensland learns and improves asset resilience. With electricity infrastructure, the authority released planning for stronger, more resilient electrical infrastructure – Improving the resilience of electrical infrastructure during flooding and cyclones which indicates the importance that it gives to making energy infrastructure more resilient [76].

Recommendations

13. Australian energy security policy should incorporate energy sector and energy user resilience alongside infrastructure protection in energy security and resilience policies and strategies.

14. All Australian jurisdictions should incorporate the building of improved resilient energy systems as part of disaster risk reduction programs and post–disaster 'build back better' programs.

4.11 Engaging the community

A fundamental goal of a nation state is to be stable and secure, and this requirement is clearly articulated in national security and defence policy statements. Without security, all other elements of society are at risk. A narrative of this need for a strong defence has been built up over decades of evolving threats with a constant theme of protecting Australian citizens. It is a powerful narrative which becomes even stronger in the sense of protection against terrorism in light of '9/11' and, closer to home, the Bali bombings. The narrative of terrorism threatening Australians' security has allowed for significant advancements in the powers of the intelligence and policing communities to protect Australia's security in the face of terrorism. However, if a community does not perceive any threat, people will not express any desire for security. The role of energy security suffers from a lack of community interest except when direct livelihoods may be threatened.

The community has the widest and perhaps most vulnerable stake in energy security. In Australia, as in most modern economies, access to secure and affordable energy is a basic expectation of society. Most Australians expect that the light or appliance will work every time, quite often without any thought of how the energy has been generated, where it has come from or what it might have cost. Blackouts during extreme weather events are widely considered as poor contingency management by power companies and the government. People have come to regard energy as a fundamental economic right, with political ramifications arising when the supply of cheap and abundant energy stops. The political campaigning in recent times in relation to rising energy prices plays to the populist expectations, fuelling fears, but ignores the global complexities of energy supply and demand.

Yet how can the wider Australian community be expected to understand the complexities of the science, engineering and economics of energy? While not every Australian is interested in being engaged on the topic of energy, it is apparent that many Australians are confused about the interrelationships of energy, such as the climate change/energy mitigation nexus, and have 'low energy literacy'. That is, they possess little understanding of the energy supply chain, how energy is generated, what the pros and cons of each technology are, and what the possible alternatives for achieving a secure, affordable and low–carbon energy future are [77]. The Energy Policy Institute of Australia (EPIA) asserts that 'a nationally agreed energy vision is the central, indispensable requirement for an integrated, coherent energy policy, in order to secure acceptance of the key principles of energy policy, reduce the excessive level of politicisation of energy issues, and build community trust. Its starting point should be the commencement of a genuine process of stakeholder participation' [78].

Stakeholder participation is critical for achieving radical shifts in energy, such as energy conservation, clean energy, Coal Seam Gas (CSG) and nuclear energy. The narrative for nuclear power in Australia is considered by many to be a lost cause in the eyes of the public, but the information battle over CSG is a current example of the clash of energy security narratives (see Box 12: Coal Seam Gas and 'Lock the Gate').

Box 12. Coal seam gas and 'Lock the Gate'

The exploration and development of unconventional gas is controversial because of its effect on aquifers, agricultural production and the affected people's health and welfare. Advocates of unconventional gas have argued that improving gas supply will improve energy security and broader national economic security due to its export earning potential. The CSG industry promotes that an expansion of CSG will create a large number of jobs, reduce gas prices dramatically, and reduce Australia's greenhouse gas emissions [79]. The public tends to be sceptical of the claimed benefits and often perceives that proponents have scant regard for the local community or that governments may have a vested interest in supporting projects. The 'Lock the Gate' campaign is one opposition group and it concentrates on community concerns such as health.

What is clear is that meaningful engagement, with clearly defined expectations and outcomes, helps to build trust. In Australia, policymakers have been slow to engage communities in discussions about energy and climate change. The efficient management of the flow and content of information is vital to promoting shared understanding. Effective information management relies on the understanding of the complex multi–dimensional information requirements across both cultural and technical boundaries. As such, effective communication relies on a commitment by stakeholders to share information as much as possible, and to use common language, avoiding jargon and contested terminology, promoting open communication and mitigation of internal and external silos. Building a coherent consistent energy security narrative that facilitates this communication is an imperative that can no longer be ignored.

Recognising this, the UK Energy Research Partnership provides an example of what needs to be to be done to address failed community engagement on energy issues. It made a call for a strategic narrative in its Report on Public Engagement in May 2014 [80]. The report identifies that the public will play an important role in the success of the transition to a secure, affordable and low–carbon energy system. However, while the public is largely supportive of the need for transformation, trust in the government and energy industry is low. A strategic narrative would address this by creating a common understanding of the long–term objectives, helping those involved to define their roles and learn how they can contribute to the transition. Crucially, the strategic narrative must resonate with its audiences and address the issues that they regard as important.

Recommendation

15. The Australian Government, supported by peak energy bodies, academia and industry, should develop a strategic narrative for Australia's energy security, and through the active promotion of storylines in the narrative, advance the development of energy literacy.

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