# SUBMISSION TO CLIMATE CHANGE AUTHORITY REGARDING *SPECIAL REVIEW SECOND DRAFT REPORT ON AUSTRALIA'S CLIMATE POLICY OPTIONS*

**Alan Pears AM** **February 2016**

**Senior Industry Fellow, RMIT University**

**Submitted via email to:** submissions@climatechangeauthority.gov.au

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## Summary

It is laudable that the CCA has produced this draft report and invited comment. It includes a lot of useful information, and progresses some aspects of the climate policy discussion. But the weighting and focus of the draft report is heavily towards a simplistic 'pricing or regulation' path that fails to adequately discuss both strengths and weaknesses of options. Many important options are not considered, or dismissed with superficial comment. We need a much more sophisticated approach. I have provided some input on policy options, and how they can be tailored to specific applications.

The paper needs to discuss the political, scientific, economic and social dimensions of policy options, and consider the transition issues associated with them. In this submission I have tried to flag some aspects of this context, and to explain their relevance to development of effective climate policy.

A key element of future climate policy, which is briefly touched on by CCA, is the need to modify many existing non-climate policies across the economy to support climate response instead of ignoring it or conflicting. As government adjusts taxation and housing policies, for example, many options to send appropriate signals to encourage climate response appear. The criteria proposed for policy selection seem limited. They fail to discuss the significance of assumptions that underpin analysis, such as selection of appropriate discount rates for investment decisions relating to long-lived assets. They also fail to acknowledge the need for policy development to factor in the subtleties of real world circumstances.

As usual, in Australia, the importance of effective energy efficiency policy is under-emphasised. On the other hand, it is pleasing to see at least some consideration of the role of voluntary action in climate policy. The significance of innovation in reducing climate response costs and accelerating abatement needs more detailed consideration: it is critically important.

The submission concludes with a number of suggestions for policy measures from high level action to sector and activity specific approaches. I have also included as an attachment the slides and speaking notes from the talk I gave on the future role of clean energy to APEC Energy Ministers at their conference in the Philippines last October. I believe it is very relevant to development of effective low carbon energy policies.

# Introduction

This draft report's approach is dated and narrow in regard to Australia's climate policy options. It could be described as 'very 2011' due to its focus on carbon pricing and limited recognition of the value of many policy alternatives in today's non-optimal policy context.

On page 2, the CCA states:

> "The Authority considers that the terms of reference for the Special Review are best met by considering emissions trading in context with a range of other policy tools, and considering their relative merits in reducing emissions across different sectors of the economy."

I agree, but the weighting of content in the draft report shows a lack of understanding of the potential significance of a number of other policy tools. The paper allocates 12 pages to carbon pricing policies, 5 pages to regulation, and only 4 pages to information and innovation. It fails to even consider a range of other potentially powerful policy options.

This focus of the draft report on carbon pricing is a serious problem. While carbon pricing is a valuable component of a comprehensive and effective climate policy it is necessarily just one element of an effective policy package, as acknowledged by the CCA. Indeed, the failure of the previous Labor government to recognise the limitations of carbon pricing contributed to the unfortunate removal of Australia's carbon pricing scheme.

The fundamental challenges for carbon pricing are:

- At least in the short to medium term, a politically acceptable price will be far below what is really needed to drive sufficient action unless stringent science-based targets can be set at national and global levels
- Conventional approaches to carbon pricing disempower key groups, including state and local government, progressive businesses and households, who must be empowered and mobilised to act if we are to achieve success in climate response.
- Heavy reliance on pricing has limited impact on many areas of the economy

The draft report also seems to reinforce the false dichotomy between regulation and market mechanisms such as carbon pricing. Carbon pricing could be described as a form of performance-based regulation.

This submission reviews key elements of the CCA's draft report, then explores practical policy paths.

# International Context

The CCA draft report provides a useful review of international trends. It is clear that, as climate change impacts increase, the only uncertainties about international response and adaptation action are how quickly they ramp up and the level of cooperation and coordination. It is also clear that many communities are demanding faster action than their leaders are able to deliver. This creates significant risk for countries that are moving slower or are heavily dependent on fossil fuel exports and use. Our core challenge is to position Australia to succeed in a low carbon global economy.

# Australian Context

The draft report provides a useful summary of present Australian climate policies.

Australia's stabilisation and following overall decline in emissions resulted largely from a dramatic decline in emissions from land use change and forestry. Until 2009 Australian fossil fuel emissions had been increasing. This creates a significant challenge for future emission reduction, because emissions associated with production, export and use fossil fuels now comprise almost three-quarters of Australian emissions, up from 55 percent in 1990, the base year for the Kyoto Protocol. And the post-2009 decline in energy-related emissions seems to have stalled due to recent policy reversals.

So future Australian climate response will rely heavily on reduction in demand for and changed sourcing of energy, as well as management of fugitive emissions from the energy supply sector. This requires a cultural revolution in the Australian energy and resources sector. Policy makers, regulators and the industry itself face enormous challenges. Other aspects of climate policy, including carbon storage and adaptation issues are not addressed in detail in the draft report. The following comments offer some perspectives on these issues.

## Energy

Australian clean energy policy has been less than successful.

Energy efficiency, the biggest, most cost-effective option, has been grossly under-funded and lacking in high level leadership. While the recently announced National Energy Productivity Plan includes some useful measures, it lacks resources and high level leadership. The responsible leadership agency, CoAG's Energy Council, plans to review the NEPP's progress 'before 2020': not exactly strong momentum. My recent article at www.theconversation.edu.au discusses the shortcomings of the NEPP. State level energy efficiency schemes show some positive outcomes, but are modest in scale.

Renewable energy has suffered stop-start policies, with the past two years reaching a nadir.

At the same time, climate deniers and vested interests occupy powerful positions within politics and industry, constraining scope for effective leadership.

The debacle over carbon pricing policy has created significant barriers to comprehensive and optimal climate policy in Australia. In particular, it will limit the short to medium term potential to implement an effective carbon pricing scheme. Even though Labor has committed to reintroduce carbon pricing, it seems likely that any new scheme will be seriously compromised in terms of the 'acceptable' level of the carbon price, and will need to offer generous transitional compromises.

A glimmer of hope is that Australia now has a number of energy ministers and political leaders who are not captive to the fossil fuel and resources sectors, whose claims of being the backbone of the economy are increasingly being seen as exaggerated. And a combination of technology change, consumer activism and emerging agile, diverse and, in some cases very well resourced, competitors

is already driving rapid change. The global financial sector has now recognised the scale of change that climate response requires: it is moving fast to reposition itself to profit in a very different future.

## Adaptation

Clearly, accelerating climate change is driving a greater need for effective adaptation policy.

However, the artificial separation of adaptation from mitigation means that the benefits of some policy measures are not being adequately valued or optimised. For example, improved energy performance of buildings not only reduces emissions, but also offers significant adaptation benefits including improved health, amenity, resilience and productivity. These benefits are not factored into cost-benefit analysis for building policy.

The realities of adaptation will create some challenges for policy makers. For example, factors such as coastal erosion, flooding, expanding areas and increasing intensity and frequency of bushfires, and changing availability of water create serious pressures. An increasing need for relocation increases potential for conflict and financial loss due to loss of asset value for individuals and communities, land use conflicts, and emotional trauma. Climate-proofing buildings, infrastructure and industry can add to capital and operating costs.

Nevertheless, such challenges also offer opportunity to integrate adaptation with long term mitigation policy by carefully managing the related investment and capturing synergies.

## Other abatement and storage action

I am not as familiar with emissions associated with other sectors as with energy. However, a number of key issues are emerging.

- There is a need for climate policy to focus more attention on understanding, protecting and enhancing existing carbon storage and sinks such as existing forests. For example, Beyond Zero Emissions' (2014) *Zero Carbon Australia – Land Use: Agriculture and Forestry Discussion Paper* suggests that allowing south eastern Australia's forests to recover from logging would lead to storage of 7500 million tonnes of CO2 equivalent, a substantial contribution with multiple environmental and economic benefits.
- The present focus on Kyoto gases and application of 100-year Global Warming Potentials is important in addressing long term climate change. However, our global failure to act effectively on climate means we also need to focus policy more on reducing emissions of short-lived gases such as methane, and non-Kyoto factors such as aircraft contrails, which are driving short term climate impacts. The recent study by Beyond Zero Emissions (2014) mentioned above suggested that methane's warming effect over 20 years is three times its impact averaged over 100 years, while black carbon's 20 year impact is 3.5 times its 100 year impact. IPCC studies suggest that the overall warming effect from aircraft is 2 to 5 times that estimated under Kyoto methods. And policy implementation on international air travel (and shipping) is weak.

# Future Action

As CCA notes, Australia seems to be on track to meet its weak 2020 target. But even meeting the government's present modest 2030 target, let alone a globally responsible target, will require much stronger action and, probably, engagement with international carbon markets.

## Policy options and criteria for selection

Chapter 2 of the draft report focuses on criteria for selection of policies. It would be preferable to discuss the range of policy options first, so that stereotypes about the characteristics and outcomes from different tools do not distort exploration of options. For example, many policy makers believe that market mechanisms are efficient and effective, and that regulation is crude and costly. In practice the actual outcome depends greatly on the quality of design and implementation, the matching of policy tools to each sector's characteristics, and the cultures and practices of those whose behaviour is to be influenced.

In practice, governments can apply many policy tools to drive change. The list of options I use in my lectures includes:

- Strategies and targets – visions
- Information, promotion, training
- Voluntary agreements, public reporting
- Regulation, standards
- Taxes and levies, pricing
- Incentives, subsidies and financial facilitation
- Market mechanisms
- Innovation, RD&D, commercialisation
- Government purchase and example
- Institutional frameworks and resourcing
- Managing access to markets and resources
- Management of perceived risks and opportunities
- **Other policies adapted to achieve energy goals too**

While it may be argued that many of these categories can be summarised into the CCA's categories, this oversimplifies the differences between the above policy categories.

In particular, the broadening of many existing policy mechanisms and institutional arrangements to incorporate a climate change dimension offers substantial potential to drive effective action. I discussed this in a recent article in ReNew magazine, where I described it as 'Indirect Action'. For

example, governments apply many policies to housing that could be adapted to incorporate climate response, such as:

- Incentives for first home buyers could shift support to higher thermal performance, smaller dwellings. This would be a powerful driver of change in the building industry, as builders compete to use such assistance packages to minimise the size of the deposit needed by first home buyers
- Subsidies on energy bills for vulnerable households could be shifted to provision of building and appliance upgrades, and even installation of on-site energy production and storage, which can reduce the level of subsidy for energy bills
- Owners Corporations managing apartment buildings could be required to upgrade building fabrics and common area energy using equipment, while also requiring members to upgrade fixed appliances and equipment over time. The use of Energy Upgrade Agreements could provide the finance to avoid the need for up-front capital.
- Infrastructure investment decisions could focus more on facilitating reduction in car dependence, which would reduce living costs and time wasted travelling
- Urban and regional planning could drive low carbon urban design and development much more effectively than it does at present
- Access to existing incentives such as negative gearing and discounts on capital gains tax could be linked to compliance with climate-related performance

The draft report's discussion of policy options can only be described as very limited. This issue is discussed further later in this submission.

## Criteria for policy selection

Chapter 2 provides a good overview of many of the issues to be considered in policy selection and development. However, it suffers from an excessive focus on the presumed cost of action rather than potential benefits, while ignoring some of the key subtleties that can make the difference between effective and ineffective policies.

For example, the evaluation of costs and benefits is subject to many assumptions. If long-term costs are to be considered, very low or even negative discount rates must be applied, given that the social cost of emitting carbon is expected to increase significantly over time. Also, many of the costs and impacts of mitigation actions and allowing climate change to occur are difficult or impossible to quantify: this undermines strong climate response. Professor Garnaut's 2008 review addressed these issues in some detail.

The discussion fails to discuss the significant potential for many measures to increase understanding and awareness of opportunities to improve competitiveness and potential for innovation. Well-designed measures can facilitate such positive change and capture large benefits. For example the International Energy Agency, in its 2014 report on the multiple benefits of energy efficiency found that these benefits could be worth up to 2.5 times as much for a business as the value of the energy saved. The growth of the clean energy sector has driven technical and business model innovation, as

well as capturing economies of scale and 'learning by doing' benefits. We need to work harder to build capacity in the industries that deliver emission abatement.

The discussion also places greatest emphasis on a number of features that favour selection of carbon pricing mechanisms, such as the economic efficiency benefits of permit trading and the generation of revenue for government. While these are valid, there is little balancing discussion about the challenges and limitations, such as transition compromises, the political difficulty of setting science-based and globally-equitable emission targets and other factors that can undermine effectiveness of such policy measures.

The discussion on international competitiveness focuses on cost impacts on Australian businesses relative to international competitors and risk of emission leakage. While these are legitimate issues, they must also be seen in context. Weak policy can also drive 'abatement leakage' as businesses that profit from abatement action shift overseas and Australians invest in international permits instead of local action. It also slows our repositioning for success in a low carbon global economy.

With regard to 'emission leakage' in practice, shifting some industries offshore may drive a net reduction in global emissions if the new location uses more efficient industrial plant and/or lower emission energy. And if the present Australian industry is subsidised, relocation may benefit our economy by reducing subsidy costs. Aluminium smelting is a particularly interesting example of this, as discussed in studies by the Australia Institute and others.

Some policies that governments actively support can impact adversely on key sectors of the economy, yet government is reluctant to apply those policies to climate action. For example, the sudden increase in local gas prices due to new Qld LNG plants is having a significant economic and competitiveness impact on many Australian businesses, but this is seen as acceptable by government. While it is claimed this development delivers a net economic benefit to Australia, analysis of the modelling shows that the gas industry (which has significant overseas ownership) and construction sectors are the main beneficiaries and other sectors of the economy, especially manufacturing, suffer. The selective use and support for some policy tools by governments across different issues is a significant distortion. In many cases, this selectivity adversely impacts on climate policy effectiveness.

The perceived net economic outcome of a policy measure is sensitive to many assumptions. Policy analysts must do much better at identifying and analysing them, and improving transparency and confidence in the rationales underlying the values assumed.

Policy selection criteria need to be broadened to include consideration of factors such as:

- Transition issues and their potential impact on long-term outcomes
- Avoidance of 'lock-in' of emissions above our globally responsible level
- Flexibility mechanisms to adjust over time to the need for more aggressive action, and
- Consideration of the potential to enhance benefits through factors such as innovation, economies of scale, reduction of subsidies, etc

## Policy Options

As noted earlier, there are many policy options available. Many have not been considered in the CCA draft report.

The CCA's approach is presented as:

> "To promote investment and other decisions that are consistent with meeting Australia's emissions reduction goals, it is necessary to change incentives so that taking up cost-effective opportunities to reduce emissions is a matter of self-interest. There are essentially four ways that policies can do this. They can make low-emissions activities more attractive by using:
>
> - penalties to drive up costs for relatively high emissions activities
> - subsidies to lower the private costs for relatively low emissions activities
> - a combination of penalties and subsidies
> - regulation to limit the range of emitting activities that are lawful."

To these, I would add:

- Drive innovation in business models, technologies and culture
- Engage in marketing, communication and engagement to make emission-reducing action more attractive to decision-makers, market intermediaries and individuals

The CCA also fails to acknowledge the pervasive distortions that exist across our economy due to perceptions of businesses and individuals regarding what actions are actually in their own 'self interest'. For example, an owner of an existing asset with low marginal production costs has a very strong incentive to block change. So implementation of effective policies can be very challenging. Mobilising 'consumer pull', using media to reframe perspectives, and reducing the level of perceived risk (or increasing level of perceived benefit) are fundamental to successful policy.

### Pricing

Table 3 in the draft report gives a high profile to use of pricing mechanisms, as noted earlier. However, the reality is that many sectors of the economy (including many businesses) are not very responsive to pricing of carbon and energy, which are typically a small component of total input costs, even for some industries that claim to be carbon intensive. For example, many are not even well-informed about energy costs – even when they claim they are! They may also tend to over-estimate the cost of change for many reasons. Many participants in a supply chain see little or no financial signal from changes in their customers' costs, and their focus on their own self interest can be very costly to their customers and have significant adverse climate impacts, including delaying and diluting climate policies.

Impacts of policy action on the psychology of markets can be significant. On one hand, if agents do not see practical and affordable ways to change, or they are not convinced of the importance of a change, they may feel like 'victims', get angry and aggressively oppose change. On the other hand, if

they believe change is inevitable, necessary or beneficial, they may act strongly to insulate themselves from risk of future higher costs, to capture perceived benefits, or to avoid 'missing out' or being seen as 'behind the game' by customers, peers or friends.

The CCA seems to be falling into a common policy trap: the assumption that decision-makers are well-informed and will act in an economically rational manner within the narrow area where a policy applies. The world is much more complex than this. Decision makers look at the overall costs and benefits of delivery of a service. In this context, energy cost is usually a very minor factor. For example, relative to the cost of TV program and content download or DVD hire services, the capital cost of the product, and the status associated with owning a 'cool' new TV, energy costs to run a TV are 'in the noise'. When buying new business equipment, the importance of delivery of the core business service, cost of consumables, staff time savings and other factors can overwhelm consideration of future energy costs, even where they are significant.

The electricity industry is an example of a sector that has failed to grasp that it just provides one of many inputs to services, and that consumers have many choices beyond which supplier of electricity they will use. Emerging competitors from the IT industry and other more customer-focused sectors reflect a much more sophisticated understanding of the role of energy (and associated carbon emissions) in business success. It is no surprise that internet and IT businesses are at the forefront of driving energy efficiency improvement and investment in renewable energy to drive their infrastructure. Extreme energy efficiency is fundamental to reducing the size and extending battery life of portable and modular equipment. And being seen to be supporting a shift to a low carbon energy future is not only an important reputational issue, but it opens up new business opportunities as staff develop a better understanding of the opportunities through participation.

The lengthy discussion of mandatory carbon pricing schemes is useful. But the fundamental issue of the political acceptability of a carbon price sufficiently high to meet a scientifically based and globally responsible target is not considered. The discussion of baseline and credit trading schemes does not address in detail the difficulties in setting 'fair' baselines, and adjusting them over time.

It might also be useful to include discussion here of the Renewable Energy Target and the state level energy efficiency trading schemes as examples of bounded certificate trading schemes that already operate without destroying the economy. Alternatively, reference could be made to the discussion on these measures later in the draft report.

## Voluntary abatement and offsets

Section 3.2 offers an interesting discussion of the potential roles of voluntary carbon pricing schemes, including offsets schemes. Given the slow progress of mandatory action, these are becoming increasingly important for organisations and individuals who want to take mitigation action in a responsible manner. This is an important area that deserves much more policy focus. As a board member of the Voluntary Carbon Markets Association (www.vcma.org.au) for many years, I have been extremely frustrated by the failure of policy makers to recognise the significance of this element of policy.

I was heartened to see Former Treasury head and architect of past climate policy, Martin Parkinson (now Secretary of the Department of Prime Minster and Cabinet), interviewed recently (Gareth Hutchins Age online 30 6 15):

> He also admitted that he never gave enough weight to the fact, when designing the trading scheme, that voters wanted to feel they were making a contribution to emissions reductions, and emissions trading systems do not provide them with that feeling because they are too abstract.
>
> "We got so hung up on the [idea that] we've got this really big problem that we have to deal with, and we've got to do it at least cost to the economy, so we delivered a least-cost way of doing it," he said.
>
> "It is unarguable that the RET is more expensive, and Direct Action is more expensive, than emissions trading ... but we never had a mechanism in there which says that this is how the punters feel that they can contribute."

I would suggest that the need to feel they can contribute (and to be able to take credit for it and demonstrate accountability through suitable accounting mechanisms) extends well beyond voters, to include state and local governments and businesses interested in maintaining a positive public image in the eyes of customers and investors. For example conservative state governments used the existence of national carbon pricing as an excuse when cutting their climate response programs.

The discussion about offsets is also useful, and potentially very important in the framing of future policy. The credibility of offsets is fundamental to attempts to incorporate them into future policy.

Community, business and government attitudes to use of offsets and international permits, which will influence the extent of adoption, are influenced by several factors:

- Whether they are genuine abatement projects and 'additional' to abatement action that would have taken place anyway.
- Their value for money: on one hand, market intermediaries often charge high premiums that undermine perceptions of 'value for money'. On the other hand, if offsets are 'too cheap' how can they be valid abatement action in a context where governments and media have consistently claimed that cutting emissions is expensive?
- Additional social, environmental and economic outcomes can enhance perceived value
- Potential loss of revenue to the Australian government and/or permit creators within Australia can undermine perceived value and motivation to encourage use of international mechanisms.
- Whether they replace local action – if they are used as an excuse to avoid reasonable local abatement this may be seen as irresponsible and even 'cheating', especially if the offsets purchased are not highly credible. The lost local action can also undermine development of emerging low carbon businesses and reduce the focus on cost-effective or socially worthwhile local actions such as energy efficiency improvement. Yet, for many emitters it is simpler to pay for permits than to implement energy efficiency or other abatement measures, even when they are economically viable.

- How the international community deals with the glut of international credits will significantly affect future confidence in their use. On one hand, the glut has depressed prices to absurdly low levels. On the other hand, if large numbers of credits are cancelled by administrators to drive up prices and tighten criteria, this would be a retrospective policy change with enormous implications for those who have been utilising them, and for project implementers.

Overall, voluntary mechanisms and the offsets that make them possible are useful for those who wish to demonstrate individual achievement of net zero C performance – but they need some kind of incentive to act, whether it is reputation, moral imperative or compliance. And they need to be confident of the credibility of the scheme administration and additionality of the offsets they buy. Their actions also create revenue streams for abaters, including a secondary market that can reduce dependence on the vagaries of government policies. Australia could play a valuable role here.

### Other mandatory price-based policies

CCA uses the Renewable Energy Target and state energy efficiency certificate schemes as examples of this approach. Yet it implies they are 'second best' alternatives to carbon pricing.

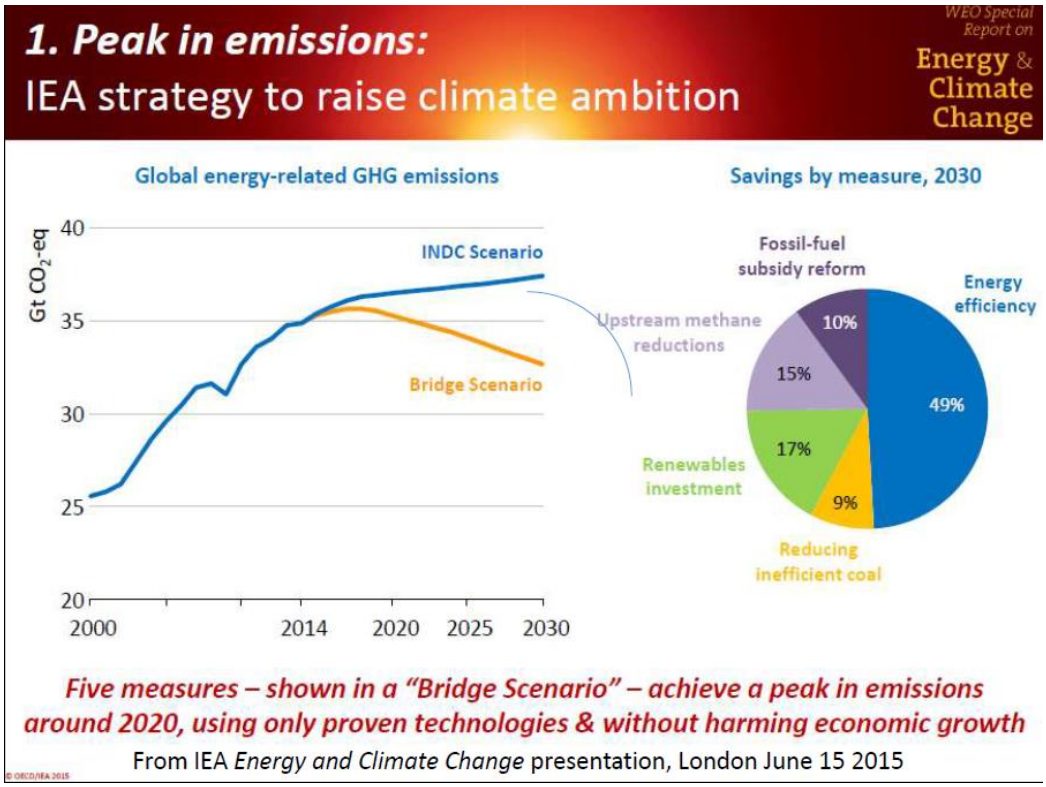
Certainly the experience we have gained in operating these programs provides useful insights into the challenges, potential impacts, limitations and other aspects of such schemes.

But it is important that we recognise that these schemes often have multiple objectives, so valuation of their economic efficiency based only on cost of emission abatement is inadequate. Both of these approaches have been implemented to overcome failures and distortions in our energy market. For example, the RET was primarily designed to develop the renewable energy industry, which it has done. It has also depressed wholesale electricity prices to the extent that costs to consumers have been largely offset. Energy efficiency trading schemes have been introduced to overcome distortions in energy markets and non-financial barriers to adoption of cost-effective energy efficiency to gain net economic benefit for society.

Indeed, these schemes show how complementary mechanisms can target specific areas and barriers to change. They also show how powerful capture of economies of scale and creative business models can be in driving down costs of emission reduction (and other policy objectives). At the same time, their focus on lowest cost in today's market means they are not particularly efficient at driving technology innovation and commercialisation. The emergence of ARENA and the CEFC has demonstrated effective models of how to complement certificate schemes by supporting development of emerging technologies and facilitating financing, educating the financial sector, reducing perceived risks for investors, as well as identifying new opportunities for them.

In its discussion of the potential for energy efficiency improvement, the CCA shows some ambivalence about its significance. Unfortunately, this is a common problem with many Australian energy policy makers. They simply do not grasp the subtleties, nor the enormous potential of energy efficiency improvement, especially when its multiple benefits are considered. This position is very different from that of the traditionally conservative International Energy Agency, who have recently

proposed that energy efficiency improvement could deliver half of the global energy-related abatement needed up to 2030, as shown below.




CCA, along with a lot of other policy makers, needs some serious education about energy efficiency! Failure to capture its potential will simply mean higher costs and greater practical difficulty to achieve emission targets. It is also clear that development of low carbon energy solutions requires an integrated approach that captures the synergies between a range of technologies and very different business models. My presentation (with speaking notes) to APEC Energy Ministers in October 2015 is attached to this submission: it discusses this emerging path.

## Overview of price based policies

Table 5 provides a useful summary of many attributes of price-based policy options. However it would benefit from two extra columns: one on the issues affecting transition/introduction, and one on the limits on the scope of application.

## Regulation

The CCA risks falling into the trap many Australian policy makers slip into: the stereotyping of regulation as a blunt and inefficient policy instrument – in contrast to market based solutions that are stereotyped as elegant and efficient.

The reality is that well-designed and competently implemented policy is essential, whatever the policy option(s) selected. In any case, market-based schemes inevitably involve substantial regulation, to set the rules, manage compliance, etc. For example, Australia's energy markets have over 1500 pages of regulation (Productivity Commission, 2013 networks report).

Poorly designed market based policies can be disastrous. For example, a 2015 study for the Brotherhood of St Laurence into electricity retail charges in Victoria, the most 'deregulated' retail market in Australia, found that retail charges had increased by 212 percent between 2008 and 2014 (ABC online 7 July 2015 Electricity retail charges triple in Victoria, urgent review needed: Brotherhood of St Laurence). Many vulnerable households pay substantially higher 'standing' tariffs than other consumers who actively pursue discounts and can meet retailer requirements regarding timely repayment or other factors. The industry seems to capturing unusually high returns, while the market is failing on equity considerations.

Both the 2012 Senate Inquiry and the 2013 Productivity Commission Inquiry concluded that electricity reform is seriously flawed. For example, the Productivity Commission (page 6) commented with regard to network policy:

> "There is, in effect, no point in simply fixing a punctured tyre if the car has no engine."

And the need to introduce the RET and various energy efficiency schemes arises from the poor design of energy market models, so they block these competitors instead of welcoming them. Clearly, energy market models must be dramatically revised if they are to support climate response instead of undermining it.

Further, packages of measures (as briefly acknowledged by CCA) are essential if policy is to be effective. For example, Australia's appliance labelling scheme provides a powerful market incentive for manufacturers to provide more efficient appliances: it requires regulations and enforcement to operate effectively. Labelling is complemented by mandated minimum performance standards, which remove the poorest performers from the market. The two work together. Indeed, the poor outcome from residential building energy regulation is, in my view, an example of poor outcomes from an attempt to rely primarily on regulation to drive change. Several building industry organisations maintain strong opposition to these measures, even to the extent of describing them as 'discrimination against new home buyers'.

Key benefits of competent regulation are that it can increase certainty for innovators and investors, accelerate innovation through 'learning by doing', increase competition in emerging technologies, and help capture of economies of scale from mass production and supply chains. For example, at present, double glazing, a basic energy efficiency feature, is much more expensive in Australia than in many other countries. This is because our building energy standards are so low that most new homes can comply without using double glazing. Stronger standards, or even mandating of double glazing as the base window type, would dramatically reduce the cost of double glazing. The Australian glazing industry has geared up to deliver double glazing, but regulators have failed to use effective policy to grow demand. Shows such as *Grand Designs* demonstrate the normality of use of double glazing in some other countries.

Regulation is not just a 'second-best' option when market mechanisms fail. Properly used, it offers powerful drivers that can capture large societal benefits. Instead of stereotyping it, policy makers should learn how to use it effectively.

## Other policy tools

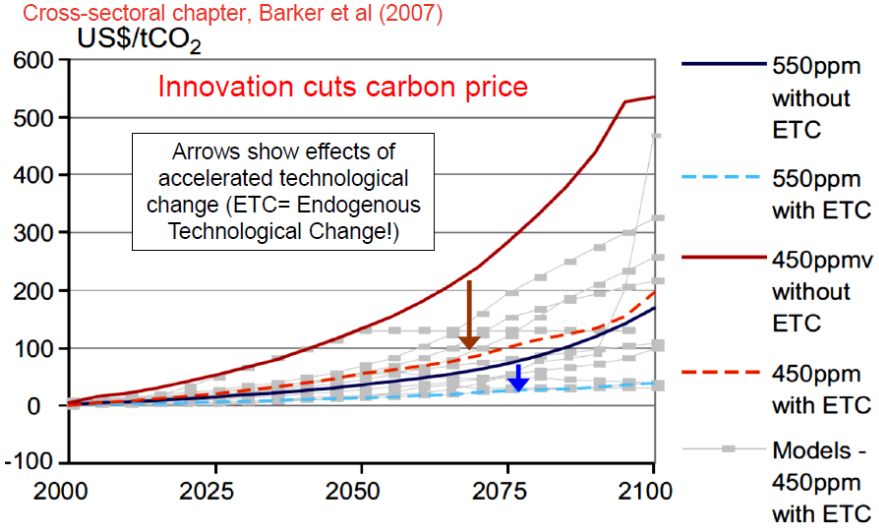
As noted earlier in this submission, a wide range of potentially useful policy tools exists. CCA's cursory consideration of information and innovation support highlights the depth of our problem in developing effective policy in many areas, not just climate.

For example, information provision (even where it is misleading or emotive) is clearly effective: otherwise we would not have a multi-billion dollar advertising industry that specialises in management and communication of information. Our media can raise the profile of an issue or kill it, depending on their approach and who is paying them. But information is a very complex area that must form part of a package of measures. Unfortunately economic policy makers are the last people you would engage to deliver an effective information campaign. Yet they hold the purse strings.

Information programs, including training and associated certification (with other tools) are essential in building supply chain capacity. But participants in the supply chain tend to focus attention on activities that will deliver them short term profit and make their lives easier: so strong incentives that they can capture, as well as regulation and 'customer awareness and demand' are all needed.

There is increasing recognition that driving innovation is a key factor in cost-effective, rapid climate response. Again, Australian economists have a poor track record in recognising, forecasting and supporting innovation. Classical economics is simply not very good at dealing with 'outside the box' creative change. The consideration of innovation in just one paragraph of this draft report simply confirms this. A key factor that is typically ignored in Australian climate policy analysis is the potential of accelerated innovation to drive down the cost of future emission abatement. The graph below shows the results of a major study that explored this using nine economic models. Given the limitations of economic models regarding innovation, this should be seen as a very conservative estimate of the potential role of innovation.

Range of future costs of emission permits for 450 and 550 ppm scenarios showing impact of accelerating technological change – average of 9 models (IPCC WG3 Contribution to 4th Assessment Report, Cross-sectoral chapter, Barker et al (2007)

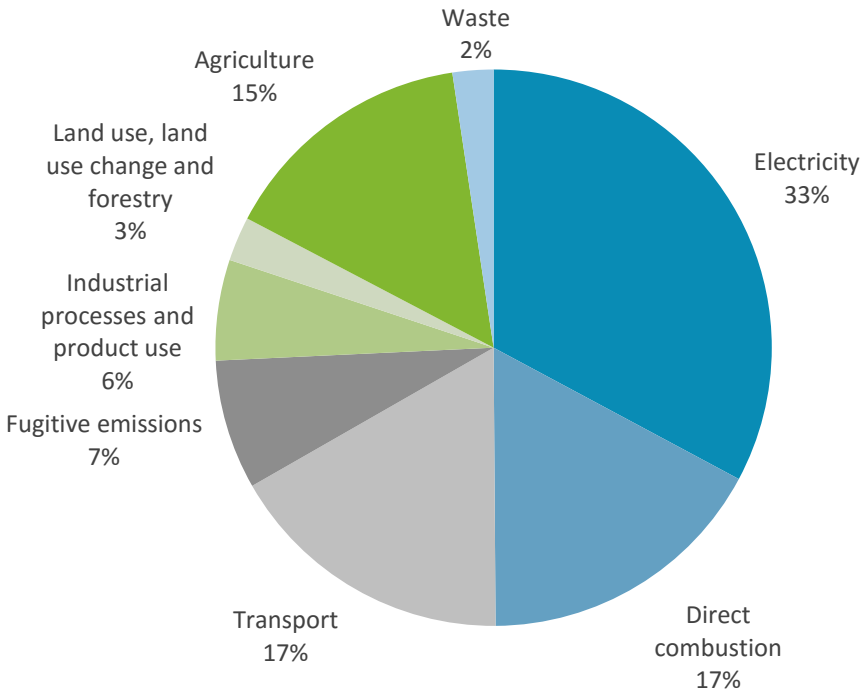


We do have some interesting examples of policy mechanisms that promote innovation through various industry programs, as well as ARENA and CEFC. We can and should build on these.

## Matching sectors and policies

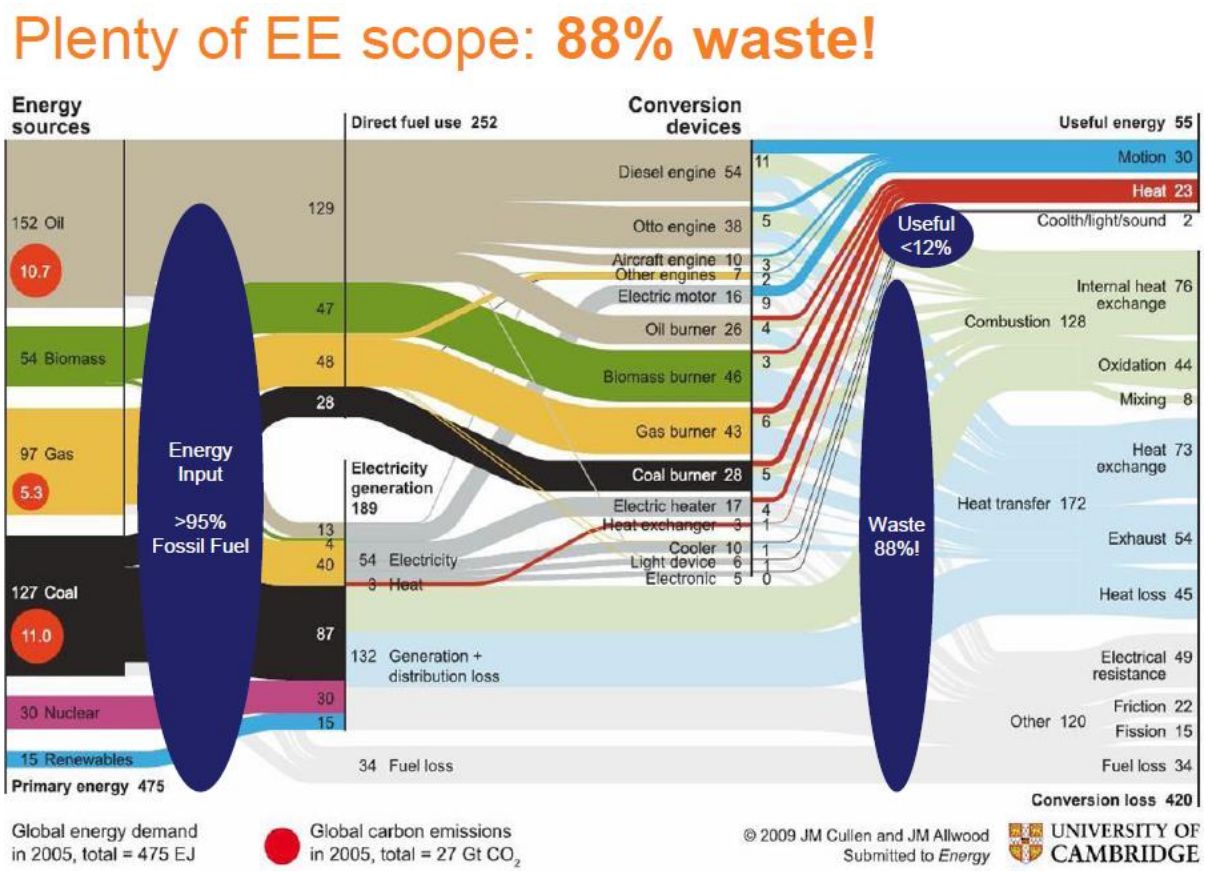
Presumably this chapter is intended to provide a basis for selection of appropriate climate response policies. It is certainly useful, but the choices made in choosing the breakdown in Figure 3 of the report (shown below) can constrain policy development. For example, electricity use is a third of Australia's emissions. But electricity (and indeed, other energy sources) are not wanted for their own sake. Energy is just one input to the provision of useful services across all sectors of our economy. These services can be delivered in an increasing variety of ways. For example, residential electric water heating consumes 4 percent of Australian electricity and 14 percent of residential electricity. Water efficiency improvement through technology and behaviour change can reduce this. Best practice heat pumps and/or solar thermal could cut this electricity use by three quarters and on-site PV and smartly managed storage of heat (in the form of hot water in an insulated tank) could eliminate the rest of the emissions.

But focusing on the energy supply sectors shifts policy thinking from end-use and distributed solutions to large scale (and often more expensive) supply side solutions. The design of our energy markets reflects this supply side focus.




A useful UK study (Cullen and Allwood, 2009), shown below, shows a more thorough approach to analysis of energy flows, and provides a much better understanding of the various points where intervention could make a difference. Importantly, it shows that 88 percent of all energy used

globally is wasted in the supply chain that delivers energy services. Maybe these authors could be commissioned to produce a similar flow chart for Australia?




But the impact of how we view energy and emissions is not limited to supply chains for services. The time dimension, based on the use of 20 year or 100 year Global Warming Potentials can also change our perspective. As noted earlier, the 20 year impact of methane is three times its 100 year impact.

Figure 3.21 from page 80 of the BZE (2014) report *Zero Carbon Australia – Land Use: Agriculture and Forestry Discussion Paper* shows how the timeframe (and range of gases considered) can affect our perspectives in relation to emissions from the agricultural sector, keeping in mind that total Australian emissions under Kyoto accounting are around 550 Mt pa.

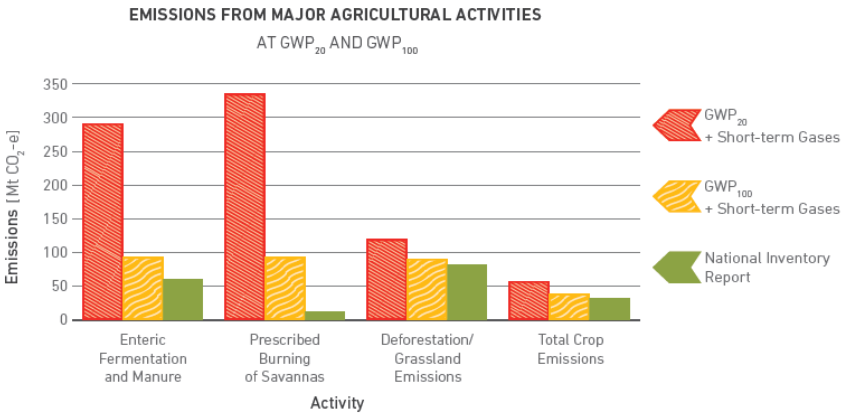


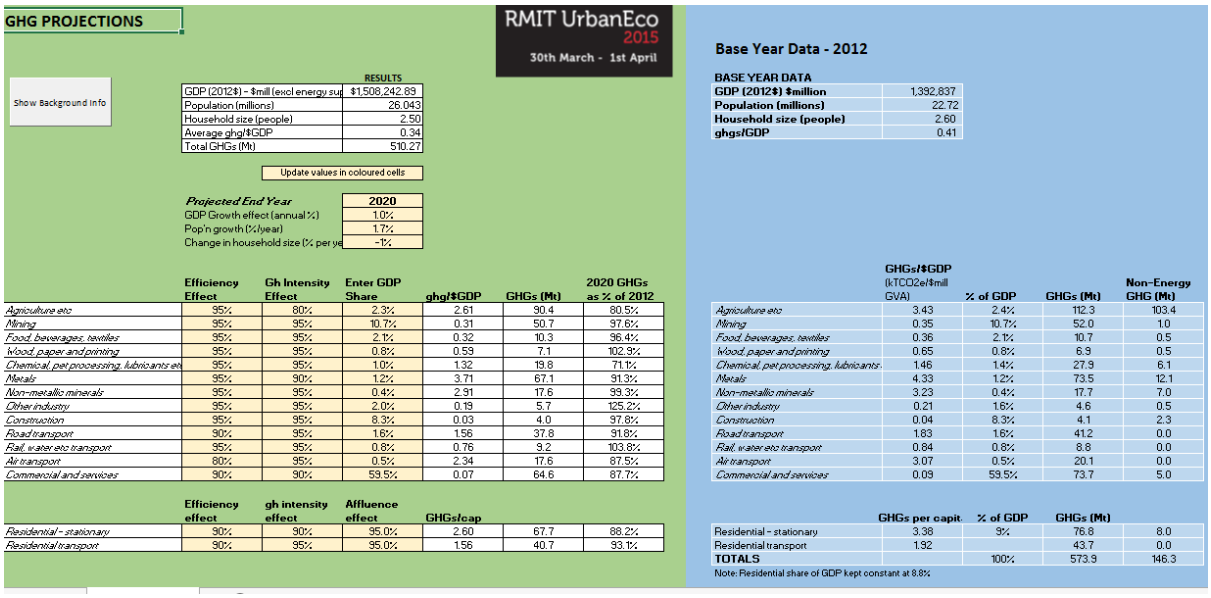

**Figure 3.21** Grouping of agricultural emissions (2006–2010; Mt $CO_2$-e/yr) by agricultural activity.

The summary of sector characteristics and policy choice in Table 7 is a useful approach. However, it is not comprehensive. There are many different reasons to focus attention on a given sector or activity, and many creative ways of addressing emissions. It is good to see inclusion of co-benefits from policies with policy objectives other than climate response recognised in the draft report as reasons for considering modification of existing or planned policies. Substantial expansion of this discussion is needed, though.

# A Policy Path

## A vision with detail to facilitate debate

It would be useful if government would develop a model of Australia's emissions and economy that is user friendly and allows people to explore the implications of a wide range of options. There are several such models around, such as the recently launched ClimateWorks Australia one, and CSIRO's energy models. Shown below, as an example, is a model I developed for a 2015 Urban Symposium at RMIT University. I would be happy to make available a working copy of this spreadsheet tool, as it is a public document. This allows users to explore impacts of changing shares of the economy, improving energy efficiency, using low emission energy sources, population and GDP growth, etc over a range of time periods. It is important to have informed debate.



**GHG PROJECTIONS**

RMIT UrbanEco 2015
30th March - 1st April

Show Background Info

| | RESULTS |
|---|---|
| GDP (2012$) - $mill (excl energy sup | $1,508,242.89 |
| Population (millions) | 26.043 |
| Household size (people) | 2.50 |
| Average ghg/$GDP | 0.34 |
| Total GHGs (Mt) | 510.27 |

Update values in coloured cells

| *Projected End Year* | 2020 |
|---|---|
| GDP Growth effect (annual %) | 1.0% |
| Pop'n growth (%/year) | 1.7% |
| Change in household size (% per ye | -1% |

| | Efficiency Effect | Gh Intensity Effect | Enter GDP Share | ghg/$GDP | GHGs (Mt) | 2020 GHGs as % of 2012 |
|---|---|---|---|---|---|---|
| *Agriculture etc* | 95% | 80% | 2.3% | 2.61 | 90.4 | 80.5% |
| *Mining* | 95% | 95% | 10.7% | 0.31 | 50.7 | 97.6% |
| *Food, beverages, textiles* | 95% | 95% | 2.1% | 0.32 | 10.3 | 96.4% |
| *Wood, paper and printing* | 95% | 95% | 0.8% | 0.59 | 7.1 | 102.9% |
| *Chemical, pet processing, lubricants etc* | 95% | 95% | 1.0% | 1.32 | 19.8 | 71.1% |
| *Metals* | 95% | 90% | 1.2% | 3.71 | 67.1 | 91.3% |
| *Non-metallic minerals* | 95% | 95% | 0.4% | 2.91 | 17.6 | 99.3% |
| *Other industry* | 95% | 95% | 2.0% | 0.19 | 5.7 | 125.2% |
| *Construction* | 95% | 95% | 8.3% | 0.03 | 4.0 | 97.8% |
| *Road transport* | 90% | 95% | 1.6% | 1.56 | 37.8 | 91.8% |
| *Rail, water etc transport* | 95% | 95% | 0.8% | 0.76 | 3.2 | 103.8% |
| *Air transport* | 80% | 95% | 0.5% | 2.34 | 17.6 | 87.5% |
| *Commercial and services* | 90% | 90% | 59.5% | 0.07 | 64.6 | 87.7% |

| | Efficiency effect | gh intensity effect | Affluence effect | GHGs/cap | | |
|---|---|---|---|---|---|---|
| *Residential - stationary* | 90% | 90% | 95.0% | 2.60 | 67.7 | 88.2% |
| *Residential transport* | 90% | 95% | 95.0% | 1.56 | 40.7 | 93.1% |

**Base Year Data - 2012**

| BASE YEAR DATA | |
|---|---|
| **GDP (2012$) $million** | 1,392,837 |
| **Population (millions)** | 22.72 |
| **Household size (people)** | 2.60 |
| **ghgs/GDP** | 0.41 |

| | GHGs/$GDP (kTCO2e/$mill GVA) | % of GDP | GHGs (Mt) | Non-Energy GHG (Mt) |
|---|---|---|---|---|
| *Agriculture etc* | 3.43 | 2.4% | 112.3 | 103.4 |
| *Mining* | 0.35 | 10.7% | 52.0 | 1.0 |
| *Food, beverages, textiles* | 0.36 | 2.1% | 10.7 | 0.5 |
| *Wood, paper and printing* | 0.65 | 0.8% | 6.9 | 0.5 |
| *Chemical, pet processing, lubricants* | 1.46 | 1.4% | 27.9 | 6.1 |
| *Metals* | 4.33 | 1.2% | 73.5 | 12.1 |
| *Non-metallic minerals* | 3.23 | 0.4% | 17.7 | 7.0 |
| *Other industry* | 0.21 | 1.6% | 4.6 | 0.5 |
| *Construction* | 0.04 | 8.3% | 4.1 | 2.3 |
| *Road transport* | 1.83 | 1.6% | 41.2 | 0.0 |
| *Rail, water etc transport* | 0.84 | 0.8% | 8.8 | 0.0 |
| *Air transport* | 3.07 | 0.5% | 20.1 | 0.0 |
| *Commercial and services* | 0.09 | 59.5% | 73.7 | 5.0 |

| | GHGs per capit. | % of GDP | GHGs (Mt) | |
|---|---|---|---|---|
| Residential - stationary | 3.38 | 9% | 76.8 | 8.0 |
| Residential transport | 1.92 | | 43.7 | 0.0 |
| **TOTALS** | | 100% | 573.9 | 146.3 |

Note: Residential share of GDP kept constant at 8.8%

The model could work within specified targets such as meeting our cumulative carbon budget in 2050, a net zero emission economy by 2050, etc. It should also be designed to work at several levels of detail, so users can explore the subtleties.

## Broad Signals

We need to be clear about who we want to send signals to, and what kinds of signals they respond to. For example, investors in new factories or infrastructure risk locking-in long term costs and constraints on their activities, so there is value in helping them to understand realistic scenarios of the future policy context, including likely future carbon costs.

## Pricing

At a minimum, a shadow price for carbon similar to that used by the US EPA is needed, as shown below.

**Social Cost of $CO_2$, 2015–2050 [a] (in 2007 Dollars per metric ton $CO_2$)**
Source: Technical Support Document (PDF, 21 pp, 1 MB): Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (May 2013, Revised July 2015)

| | Discount Rate and Statistic | | | |
|---|---|---|---|---|
| **Year** | **5% Average** | **3% Average** | **2.5% Average** | **3% 95th percentile** |
| **2015** | $11 | $36 | $56 | $105 |
| **2020** | $12 | $42 | $62 | $123 |
| **2025** | $14 | $46 | $68 | $138 |
| **2030** | $16 | $50 | $73 | $152 |
| **2035** | $18 | $55 | $78 | $168 |
| **2040** | $21 | $60 | $84 | $183 |
| **2045** | $23 | $64 | $89 | $197 |
| **2050** | $26 | $69 | $95 | $212 |

[a] The SC-$CO_2$ values are dollar-year and emissions-year specific.

NOTES: from http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html

> Some studies, such as this one, suggest higher prices are justified. In this case, a social carbon cost of US$220/tonne for emissions in 2015 are considered appropriate
> http://news.stanford.edu/news/2015/january/emissions-social-costs-011215.html

A shadow carbon price should be applied to decision-making about all government investments in infrastructure and other assets purchased. Financiers and developers of greenfield projects could be incentivised to ensure that the shadow price was included in decisions regarding their investments, so they reduce the risk of financial loss. Where a major project proposal did not incorporate a shadow price, government could fund independent analysts to model a scenario with a shadow carbon price and make it publicly available.

As an alternative or in parallel, Australia could exploit the present low CER price to dramatically reduce the cost of compliance with a carbon pricing scheme in the short term, while linking our industries' carbon costs to international prices into the future. Given the international focus of many businesses, it would be difficult to argue against this. Of course, this would not send a strong price signal in the short term, but as global action accelerates, it may. An even weaker and cheaper approach would be to allow businesses to use international permits to offset any emissions above their 'safeguard' threshold under the Direct Action policy. This may help to facilitate setting of effective safeguard levels and introduction of a mechanism to tighten them over time.

This is a pragmatic means of introducing a price on carbon, but pragmatism seems to be the only likely successful implementation path for climate policy in modern Australia.

Government must also create a substantial revenue stream to fund climate action, whether it is an ERF, an ETS or some other mix of policies. This could be implemented as part of the present tax changes. This would make the cost (and allocation of the cost) of climate action transparent, regardless of the detail of the approach(es) taken. There may be scope to use some of this levy to fund the National Energy Productivity Plan, which is expected to deliver significant net economic benefit in return, making the levy an investment, rather than a cost. Revenue from the profits of the CEFC and/or savings captured from cost-effective energy efficiency measures or other policy action could potentially contribute to this funding: to help to justify introduction of the revenue stream.

It seems most likely that any ETS that emerges in the near future will be based on the ERF 'safeguard' thresholds. While most policy analysts do not support this approach (for good reasons), it at least introduces a price signal, even if it is small in the short term. The stringency of the scheme can be ramped up over time, and the experience gained in tracking emission intensity of major emitters over time will help with the setting of fair baselines.

### Zero carbon sector strategies

Government must also fund preparation of zero carbon 2050 scenarios for key sectors of the economy. For example, a zero emission strategy for the gas industry should be a priority: the gas industry seems to have no idea of how risky their present approach to development of unconventional gas and growth of gas demand is.

### Remove subsidies that encourage higher emissions

There is widespread international agreement that removal of existing subsidies for fossil fuels and other sources of emissions should be removed. As can be seen in the IEA graphic earlier in this submission, they see this as a key element of an effective climate response. Australia has resolutely refused to address this obvious option to date. At a minimum, a phase-out schedule should be proposed and implemented.

### Exploit unexpected opportunities

As time progresses, there are many opportunistic possibilities that make application of climate response policies easier. Government must be ready for these, and they must be put in context. For example, the recent decline in the Australian currency exchange rate has improved export competitiveness and would offset the impact of a carbon price in the hundreds of dollars per tonne of CO2 for most exporters. There should be room in there for some financial contribution to abatement! The recent drop in oil price has been used by the Indonesian government to remove fossil fuel subsidies without public backlash. Australia has similar opportunities, although they may involve increasing taxes or levies where there are no subsidies.

In some cases, external forces can have a similar price impact to a carbon price: this should be used to encourage action to cut emissions. For example, if industrial gas prices increase by A$5/gigajoule due to the new Queensland LNG plants, it is equivalent to a carbon price of around $80/tonne of CO2 and gas! Assistance for large gas users to cut their gas use helps them to cope with a significant cost impact while reducing emissions, building long term competitiveness and protecting jobs.

Often we see specific new technologies appear or achieve price targets that can allow them to dramatically cut emissions, such as LED lighting, heat pumps, NBN, advanced materials, 'smart' management systems, etc. Strategies that support their rapid adoption (subject to meeting performance standards) can improve competitiveness and cut emissions.

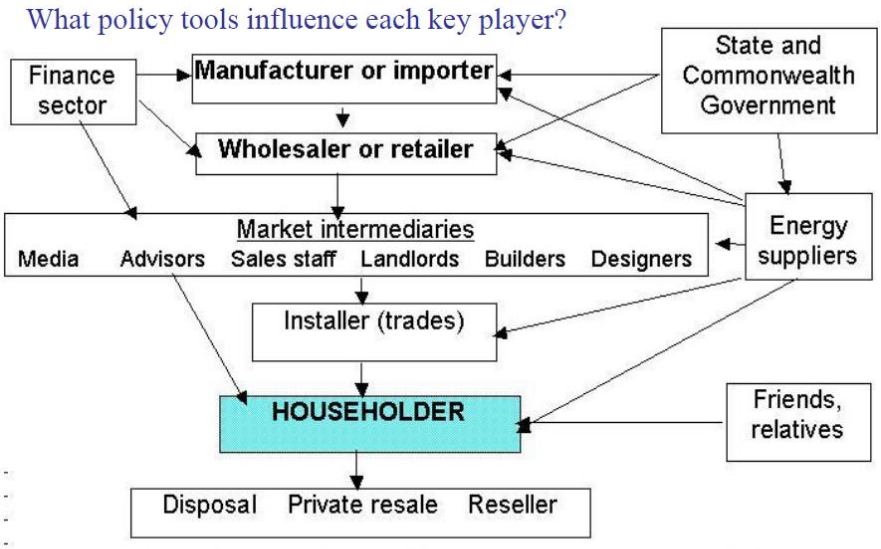
The recent failure of the BassLink cable provides another opportunity to achieve emission reductions. It has highlighted the need for Tasmania to be able to function independent of the national grid. This creates an incentive for more aggressive (and cost-effective) state level energy efficiency improvement and smart energy management measures, and diversification of Tasmanian renewable energy production. When the cable is fixed, this will mean Tasmania can export more zero emission electricity to the mainland than it otherwise would, while potentially reducing its overnight dependence on Victorian brown coal-fired electricity.

Increasing bushfire risk provides an incentive for pursuit of energy independence in many rural communities as well.

## Sectoral and targeted measures

These kinds of policy mechanisms require a detailed understanding of the characteristics, cultures and behaviours of agents in the targeted area. In particular, they require an understanding of the chains and networks of decisions that influence outcomes. Agents who play key roles in these 'systems' can block or accelerate action, so policy tools that are effective in influencing them must be applied. Below is an example of this approach for new appliance efficiency. The first graphic shows a simplistic model of the decision makers who influence the availability and purchase of an efficient appliance. The following Table shows how it is possible to identify key drivers for each agent, then select policy tools likely to influence their actions.

This is difficult work, and requires significant resources if it is to be done well. It also requires high level support, so that relevant regulatory and incentive mechanisms can be introduced.




Overview of household appliance market system – each link in the chain of decisions must be considered

Partial example of a matrix of policy options responding to 'chain' of decision-making for an appliance

| **Participant** | Designer (technical, aesthetic) | Manufacturer<br>Importer | Advisers (sales, friends, consultants, architects, etc) | Buyer (for own use or others) |
|---|---|---|---|---|
| **Roles** | Selects materials, components, operating efficiency | Sets design parameters<br>Chooses RD&D priorities | Information<br>Linkages<br>Frame choice criteria | Selects, pays!<br>Organises installation<br>Uses |
| **Drivers** | Consumer expectations<br>Image<br>Profitable | Market position<br>Profit<br>Compliance<br>Interpretation of consumer, retailer expectations | Their reputation<br>Perceived user needs/priorities<br>Aesthetics<br>Minimum hassle<br>Experience with | Cost (upfront, operation)<br>Reliability<br>Convenience<br>Service quality<br>Image |
| **Policy tools or programs** | Training<br>Accountability<br>Awards | RD&D incentives<br>Consumer pull | Training<br>Incentives<br>Consumer pull | Information<br>Standards<br>Social norms |

## Energy

The electricity sector is a particularly challenging area for policy. Angry consumers are very sensitive to any price increases, due to any cause. And a fundamental challenge in closing down old coal plants is that it is likely to drive up wholesale prices: someone or everyone will be blamed! So governments must ensure that a glut of generation capacity is maintained, to hold down wholesale electricity prices. But, to do this it will have to assist investments in new zero emission plant – and/or drive energy efficiency much harder to drive down demand.

The supply glut will shift the focus from the RET to individual contracts that provide builders of new plants secure revenue streams for at least 10 years. The approach being taken by the ACT government and various consortia like the one led by the City of Melbourne seem to offer an attractive package for everyone. Also, strong commitment to demand side bidding, energy efficiency, storage and 'smarts' will help to avoid high peak prices.

As noted earlier, electricity network policy is in meltdown, driven by the tensions between reality and an ongoing sense of entitlement among network operators, regulators and policy makers. And consumers are outraged by high network charges and a shift towards fixed charges that disempower them. It is bemusing that economic policy makers and the ACCC have not stepped in to require the industry to base their pricing on long run marginal costs, not guaranteed recovery of sunk capital. The focus of the National Electricity Objective on the long term interests of consumers seems to have been forgotten.

Also noted earlier, energy efficiency offers enormous potential to cost-effectively manage costs and infrastructure needs. Yet it continues to be largely ignored.

## International competitiveness and carbon leakage

These are certainly important issues. However, as noted earlier, there is a tendency to overstate their significance and ignore countervailing factors. This reflects the enormous political power of some Australian industry sectors, as well as narrow analysis and hysterical media reporting.

As noted earlier:

- Impacts of carbon pricing are typically small compared with other factors such as currency exchange rates and global economic factors: we need to put them into perspective
- 'Carbon leakage' can actually lead to a reduction in global emissions. And any claimed increase in global emissions due to this effect needs to be balanced by analysis of the risks and impacts of 'abatement leakage' that results from lack of effective climate policy response. Given that our focus should be on competing in a low carbon global economy, the long term impacts of abatement leakage on our economy are likely to be increasingly significant.

## ATTACHMENT 1

APEC Energy Ministers' Conference, Cebu-Mactan, Philippines

Alan Pears AM TALK 13 October 2015:  slides and speaking notes.

Given my limited time, my talk highlighted the key messages and themes of my slides, which contained detailed explanatory material and case studies.


Our efficient, smart, flexible, distributed and diverse energy future

Presentation at APEC Energy Ministers' Meeting 13 October 2015

Alan Pears AM
Senior Industry Fellow RMIT University, Melbourne Australia
Associate Consultant Buro North

Extreme energy efficiency transforms our thinking about reality: world record holding human powered vehicle – 137.9 km/h
http://gosporttimes.com/2015/09/20/crazy-fast-human-powered-vehicle-sets-new-world-speed-record/

Good afternoon distinguished Ministers and delegates. I would like to thank APEC and the Philippine government for the opportunity to speak to you, and for looking after me so well while I have been here.

In my talk, I will outline my thoughts on clean energy options, and suggest some options for APEC action. I will not attempt to go through my slides in detail. Instead I will summarise key messages.

We live in a time of astounding change, illustrated by examples like the extreme energy efficiency of this 138 km/h Human Powered Vehicle, smart phones and many other innovations. These are transforming our thinking about everything in our lives – including energy.

Change in energy reflects broader disruptive changes in technology and society such as:

- Internet, 'virtual' solutions, dematerialisation
- Green chemistry and alternatives to process heat
- New materials – nanotech, graphene etc
- Computerised design, control, monitoring
- Modular, decentralised technologies, 3-D printing etc
- Urbanisation
- Growth of services economy
- Globalisation

- Energy, resources industries are among the last to face culturally disruptive change and major 'substitution' risk

Indeed, it is important to recognise that many changes in the energy sector are being driven by technology, social change and innovation across industry, business and society.

## Key Energy Drivers

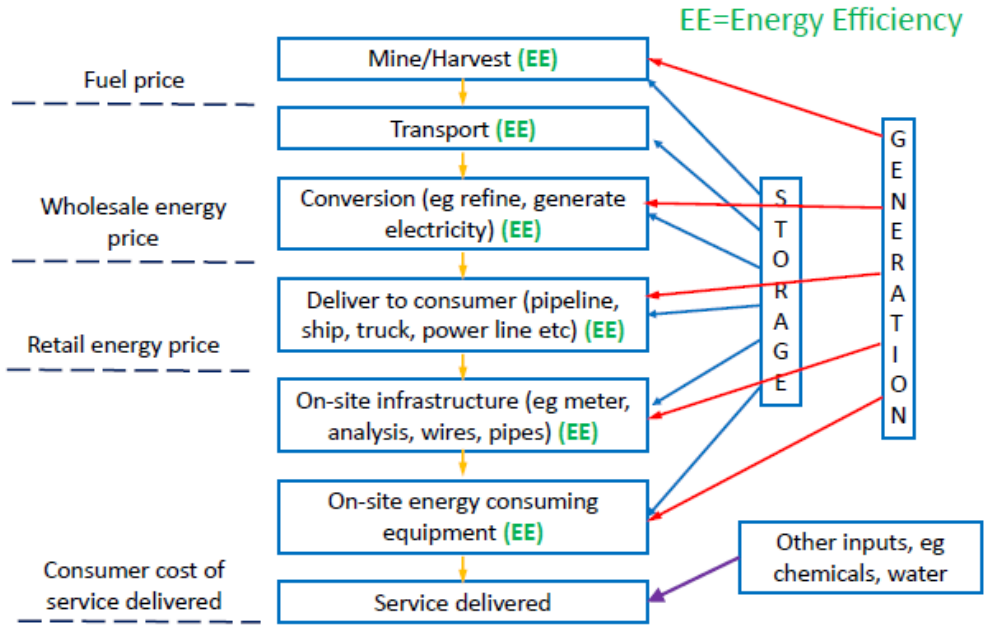
- Our 'need' for energy flows from 'needs' for services like nutrition or economic output and the materials, products, services and business models used to satisfy them
- Recent innovation dramatically increases options to satisfy 'needs' – **substitution** by radically different alternatives
- These involve *integrated* use of combinations of:
  - Innovative reframing of what our needs are (eg virtual solutions)
  - Diverse business models, markets and technology supply chains
  - More efficient energy and resource use
  - Smart management of demand
  - Storage of energy in many forms (heat, coolth, electricity, chemical, gravitational potential, movement)
  - Distributed and diversified energy production or conversion

We must keep in mind that our energy requirements flow from the services people and business want, and how they interpret their needs. Energy is just one, admittedly important, input into complex services. **People and businesses do not want energy for its own sake.**

Recent developments have allowed consumers of services to substitute other ways of providing their needs that involve very different energy inputs. We have moved from a fairly simple, linear energy supply model to many options that interact in complex ways.

If we are to respond effectively, we must look at these as integrated systems, not individual technologies or business models. They work together.

The ‘energy’ service delivery system – many options of very different kinds now exist and compete in different markets.




In this slide I have tried to summarise an emerging energy model.

First, we see that much of the infrastructure investment is on the consumer side of the meter.

And the price that a given technology competes with varies with its location in the system.

Indeed, a consumer will make decisions not on the energy price or cost, but on the total cost of delivery of a service relative to the value they perceive they will gain from that service.

Energy efficiency measures (shown in green), which often also reduce peak energy demand, can apply at any point in the system – driven by quite different factors, only one of which is energy cost.

Similarly storage, which frees us from the need to match supply and demand in near real time, and energy generation/conversion can also occur at any point in the system. So the conventional energy price they compete against also varies. I have often been puzzled by graphs in energy studies that compare the cost of rooftop solar and coal-fired electricity at the power station. **They compete in completely different markets and against very different electricity prices.**

Diverse energy service solutions are emerging. Centralised systems still have a role, but distributed ones are gaining. Combinations of solutions often work best, and there will be ongoing transition

| FACTOR | CENTRALISED | DISTRIBUTED |
|---|---|---|
| **Economies of scale** | Through larger size | Through mass production |
| **Flexibility of roll-out** | Limited | Large |
| **Capital required, risk, subsidies** | Large lumps, long-term, subsidies on-going | Small lumps, early cash flow, subsidies up-front |
| **Innovation and 'learning from experience'** | Slow | Fast, from diverse markets and technologies |
| **Planning, construction timeframes** | Long, limited flexibility | Short, responsive |
| **Resource suitability** | Fossil fuels, dams | Renewable energy, diverse water sources, end-use technologies |
| **Resilience to failures, changing conditions** | Limited | Diversity, modularity help |
| **Environmental, social impacts** | Local, regional, global | Local, linked to beneficiaries |
| **Overall system efficiency** | Significant losses in conversion, distribution | Variable – near point of use, so consumer pays |

Many (but not all) emerging energy solutions are more like cars or appliances than traditional energy technologies. They are modular and distributed, not centralised.

They gain economies of scale through mass production, not size, and the learning curve can be very fast, based on early field experience.

The rate of roll-out can be adjusted to conditions, and they can generate cash flows sooner because each unit starts working as soon as it is installed.

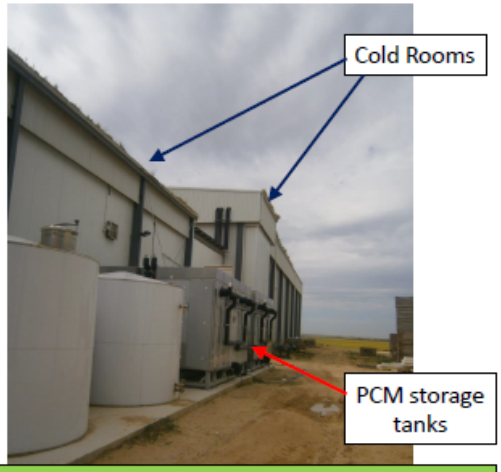
These, and other features in this table, make them nimble. In contrast, traditional large scale energy systems are slow to change.

This difference partly explains why we are seeing so many surprises.

I will now look at some practical examples of how emerging new energy solutions can drive change.

## Example – Cold Storage:

University of South Australia / Glaciem demonstration project




- **120 kWe Refrigeration system**
- **1.4 MWhrs e thermal storage (1% floor area)**
- **200 kWp of solar PV planned**
- **20% IRR for both storage and PV**

**Potential Integrated Energy Solution**

On-site energy efficiency:

- Building: heat reflective paint, insulation, air locks
- High efficiency chillers, smart controls

On-site energy storage:

- Thermal ('coolth' using phase change materials - PCMs)
- Electricity

On-site energy production:

- Rooftop solar PV
- Use waste chiller heat to dehumidify, cool, heat (eg cleaning water)

Integrated energy management

- Optimise operating cost
- Optimise exports and imports of electricity
- Maybe go 'off-grid' or micro-grid?
- Maybe cooperate with other local generation, storage and energy users?

This experimental cold storage facility is already using less energy from the grid and has lower peak electricity demand by using energy efficiency, thermal storage and (soon) rooftop solar. And it's making more profit at the same time, through a 20% pa internal rate of return on these investments.

It has many more options to transform its energy management, as shown.

## Aluminium smelting: strategies and research projects to cut energy use

- **Big picture options to cut aluminium energy use per unit service:**
  - 'virtual' solutions replace physical ones
  - Design of products for optimal material use
  - High strength alloys, 3-D printing use less material
  - Switch to other materials, eg carbon fibre
  - Use recycled aluminium

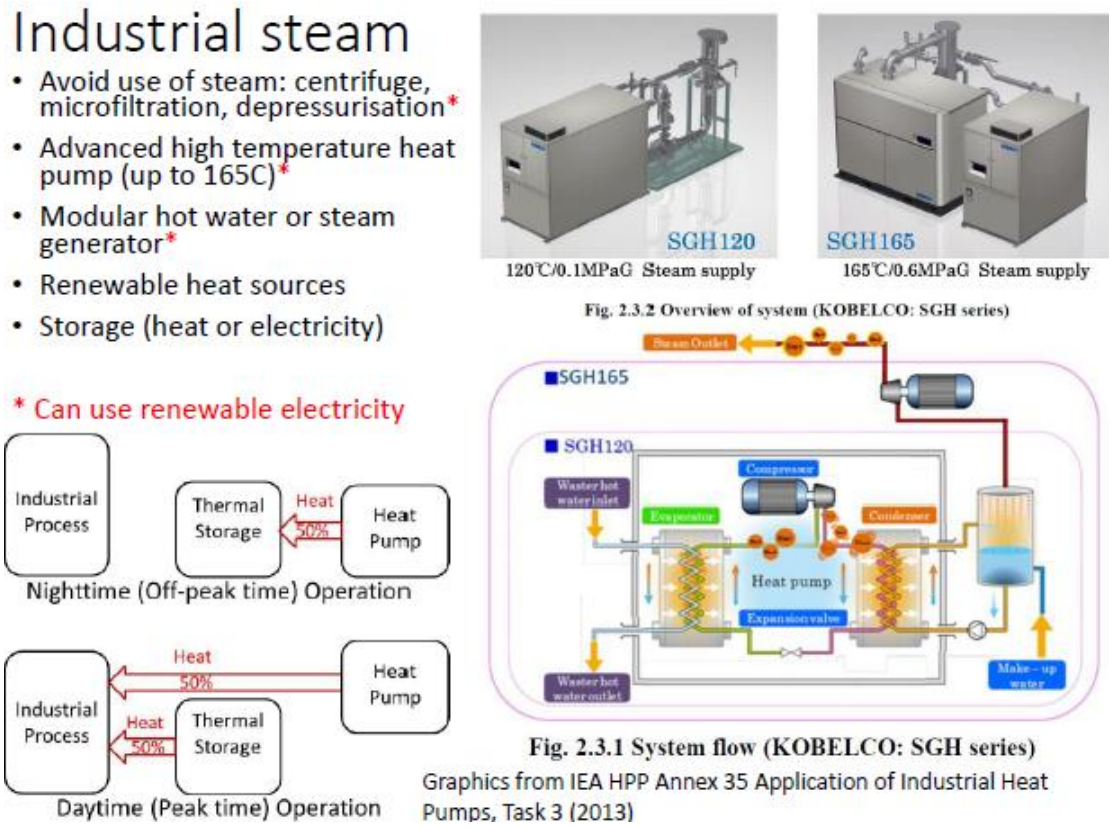
Aluminium smelting uses 3.3% of global electricity

- **R&D, eg ARPA-E projects (US government R&D program)**
  - **Alcoa:** heat exchanger (using molten glass or salt) built-into pot casing improves insulation, provides flexibility in electricity demand (using heat storage); improved electrodes – **50% saving target**
  - **Gas Technology Institute:** use reusable solvents (chemical dissolution) at near room temperature; could be located near bauxite mines – **44% cost reduction target**
  - **Infinium:** new electrochemical cell, much better insulated and high value by-product (pure oxygen); drop-in retrofit – **50% net saving target**
- **Shift to renewable electricity**

Aluminium smelting is just one example of a traditional high temperature, energy intensive process served by large baseload power generation. But this could change.

First there are increasing options to substitute demand away from virgin aluminium.

Second, research such as these projects funded by the US government, could transform the amount, energy source and timing of energy requirements.



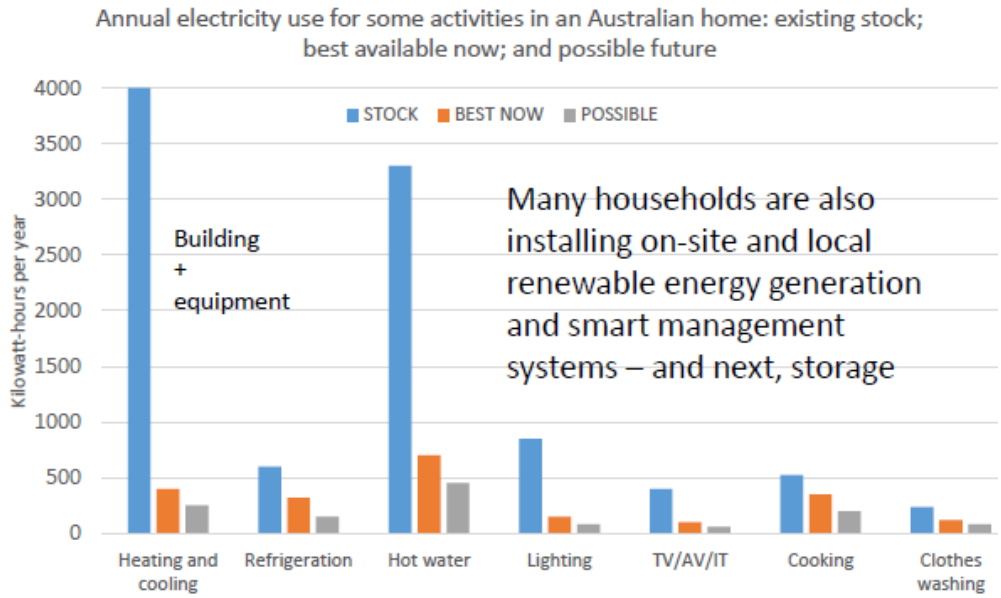
Graphics from IEA HPP Annex 35 Application of Industrial Heat Pumps, Task 3 (2013)

A boiler producing steam that is distributed around a site is a common ‘workhorse’ in industry. But like the horse did, it faces competition from many new technologies, including new chemistries that lower process temperatures as well as the advanced Japanese heat pumps and thermal storage shown here.

In some ways the boiler can be compared with the central steam engine that used to drive all the separate machinery in factories using shafts and pulleys.

## Residential: Technology transformation

(Based on Pears presentation to Sydney A2SE Workshop, April 2014)




In homes, we are finding that new technologies combining elements, such as the building shell and the heating or cooling system, can deliver very large savings relative to the average existing situation: and even larger savings relative to the most inefficient homes.

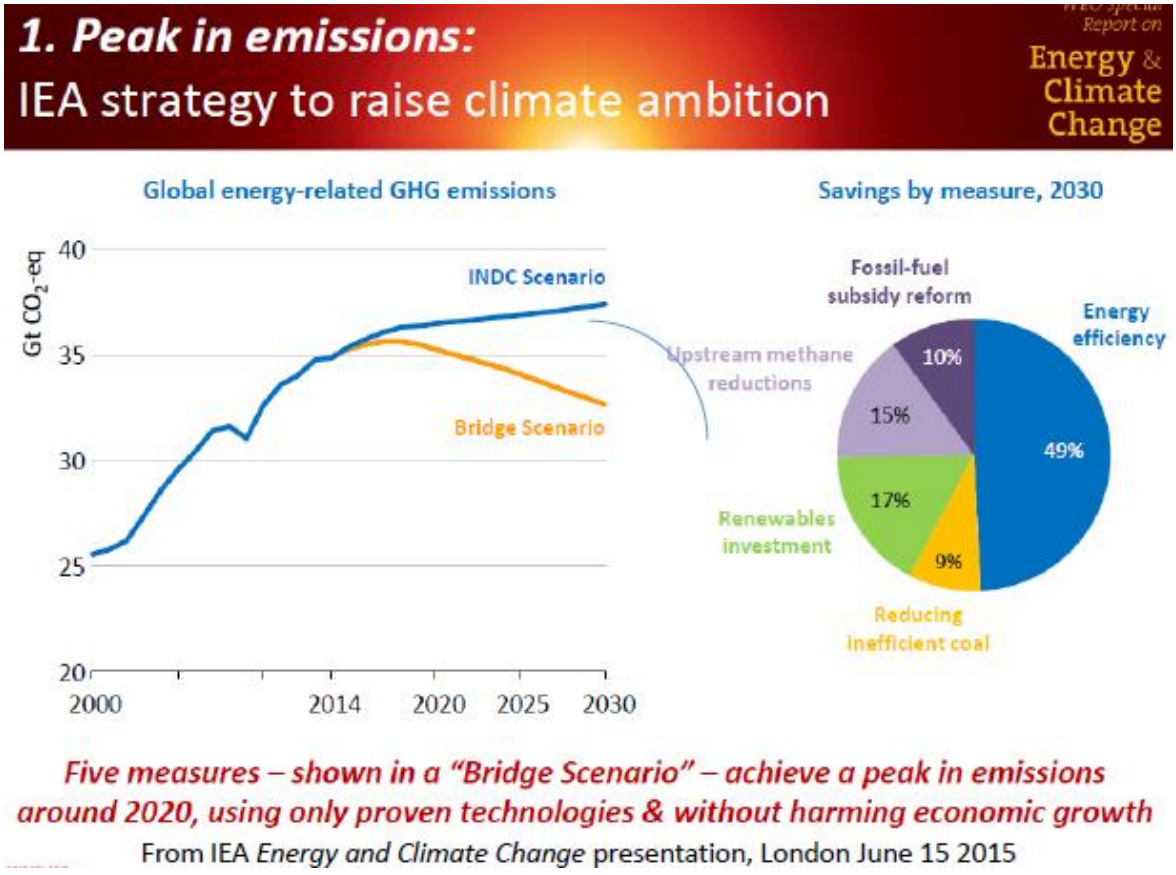
Replacing or upgrading existing stock of inefficient appliances and buildings can free up surprising amounts of existing energy supply capacity to cope with population growth and (efficient) economic development.

## Energy policy tools

- Strategies and targets – visions
- Information, promotion, training
- Voluntary agreements, public reporting
- Regulation, standards
- Taxes and levies, pricing
- Incentives, subsidies and financial facilitation
- Market mechanisms
- Innovation, RD&D, commercialisation
- Government purchase and example
- Institutional frameworks and resourcing
- Managing access to markets and resources
- Management of perceived risks and opportunities
- **Other policies adapted to achieve energy goals too**

I'm not going to talk about the wide range of policy tools available to the energy sector: but we do tend to under-use some of them: we need to take broader policy approaches, including using packages of tools more.

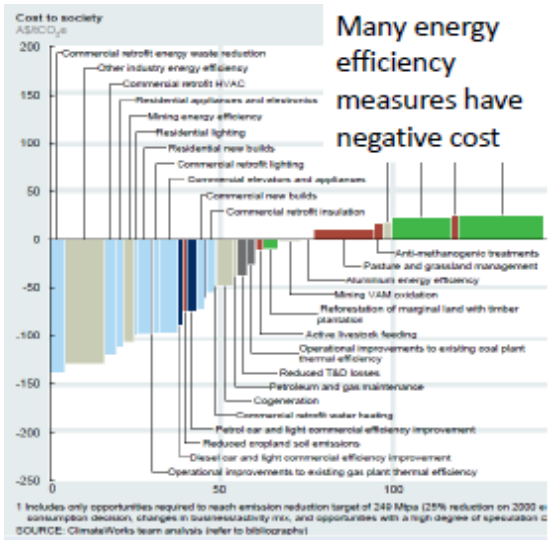
We also need to engage much more with other sectors, so that policies not directly focused on energy, but which influence energy use, also help to address our energy issues. Building policy, social welfare policies, traffic congestion management and business innovation are just a few examples.

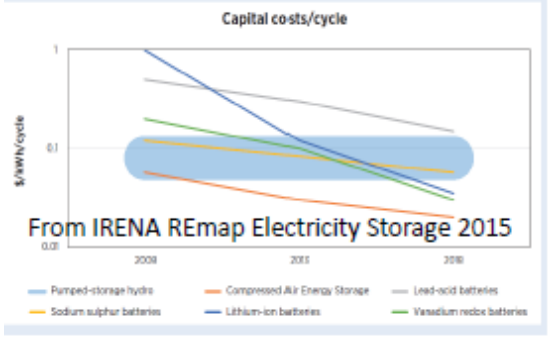


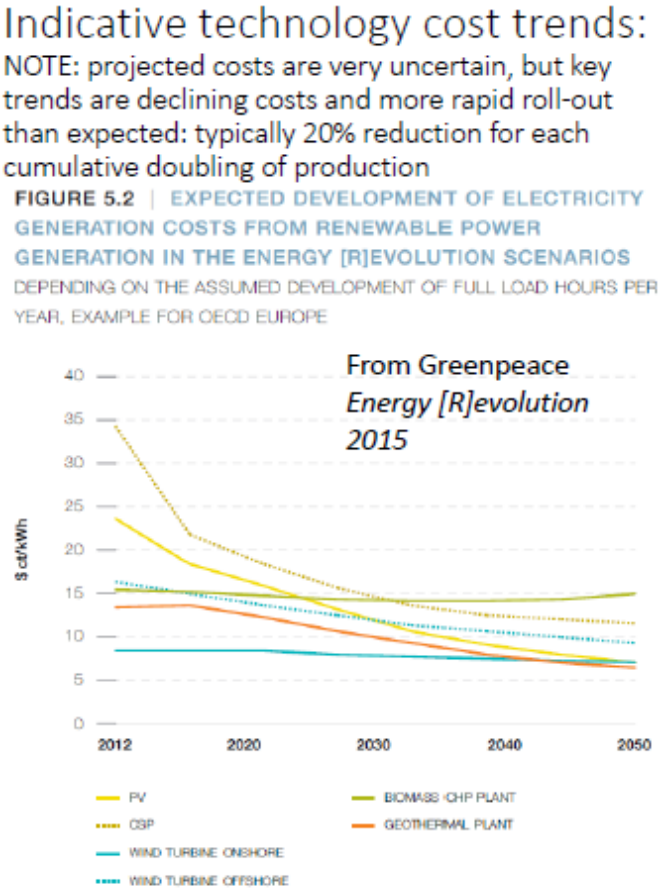

*Five measures – shown in a "Bridge Scenario" – achieve a peak in emissions around 2020, using only proven technologies & without harming economic growth*

From IEA *Energy and Climate Change* presentation, London June 15 2015

Looking at specific policies, the International Energy Agency has done some excellent work in this area. This recent slide of theirs summarises their policy priorities to drive down climate impacts. Note that energy efficiency is half of the game, and much bigger than renewable energy. Yet our energy policy institutional structures don't always reflect that.




If we look at costs, and cost trends for emerging energy solutions, we find a wide range of views, depending on differing assumptions and local circumstances. But the common threads are:

- There is a lot of negative cost (that is beneficial) opportunity, much of it in energy efficiency and smart management
- Most emerging technologies are becoming cheaper and working better
- These trends are expected to continue and may accelerate – especially if we encourage them!

## Evaluation of Costs and Benefits

- **Sophisticated evaluation of cost-effectiveness must consider many factors:**
  - Local circumstances
  - What price does it compete with: wholesale, retail energy price? And what will those prices be?
  - For efficiency measures, what total service cost does it compete with?
  - What non-energy market(s) does it compete in?
  - What other costs does it avoid: avoided infrastructure costs; distribution/delivery costs and losses; peak loads
  - What other benefits: avoided blackouts; improved productivity, health, product quality etc (see IEA *Multiple Benefits of EE* report); benefits for rural and other disadvantaged groups
  - Impacts on total level of energy subsidies, energy security, social systems
  - Impact of likely future levels of carbon prices or equivalent policies on cost relative to competitors

A major barrier to emerging energy solutions is narrow, short-term focused economic analysis. We need to consider the complex range of circumstances, and include the multiple benefits identified by the IEA and others. We need to understand the synergies captured as new solutions interact with and help each other.

My remaining slides focus on what APEC could do to support our emerging energy revolution.

## Where to Now for APEC?

- **No-one knows which options will be winners, so we need:**
  - Flexible strategies, quality information and detailed monitoring of change
  - To encourage innovation, trials, knowledge sharing, creative finance models
  - To support emerging options to compete with powerful incumbent businesses
  - To manage disruption, inefficiencies and mistakes
- **Different solutions will be best in different circumstances, depending on service requirements, available options and local cultures and policies**
- **There will be winners and (often powerful and noisy) losers**
- **Climate response and adaptation will be overarching drivers**

I don’t think anyone can predict our energy future at the moment. There is just too much happening. We need to be flexible and not just responsive, but pro-active. We need to imagine the unimaginable and develop ways of managing it.

We need to recognise that climate change is an overarching driver of change – and communities are becoming impatient with the energy sector and governments.

So here are some suggestions:

**NOTE: refer to ‘member economies’ not countries**

## APEC Actions?

- **Encourage APEC members to develop and implement energy strategies that:**
  - Are consistent with decarbonisation by 2050 or earlier
  - Are flexible and adaptable to unexpected changes, innovation
  - Factor into energy option evaluation factors such as reframing of ‘energy needs’, economies of scale, learning by doing, ‘multiple benefits’, innovation in and from other sectors, etc
  - Incorporate clean energy elements into policies across the economy and society (eg housing, social welfare, taxation)
- **Work with member countries, IEA etc to:**
  - Track and share actual costs, benefits, experience and progress of emerging technologies and underlying policies and measures
  - Develop, trial and implement planning methodologies, institutional arrangements and funding systems (eg through ABAC) that support integrated energy solutions
- **Ensure emerging technologies are not blocked by institutional inertia or incumbent power**

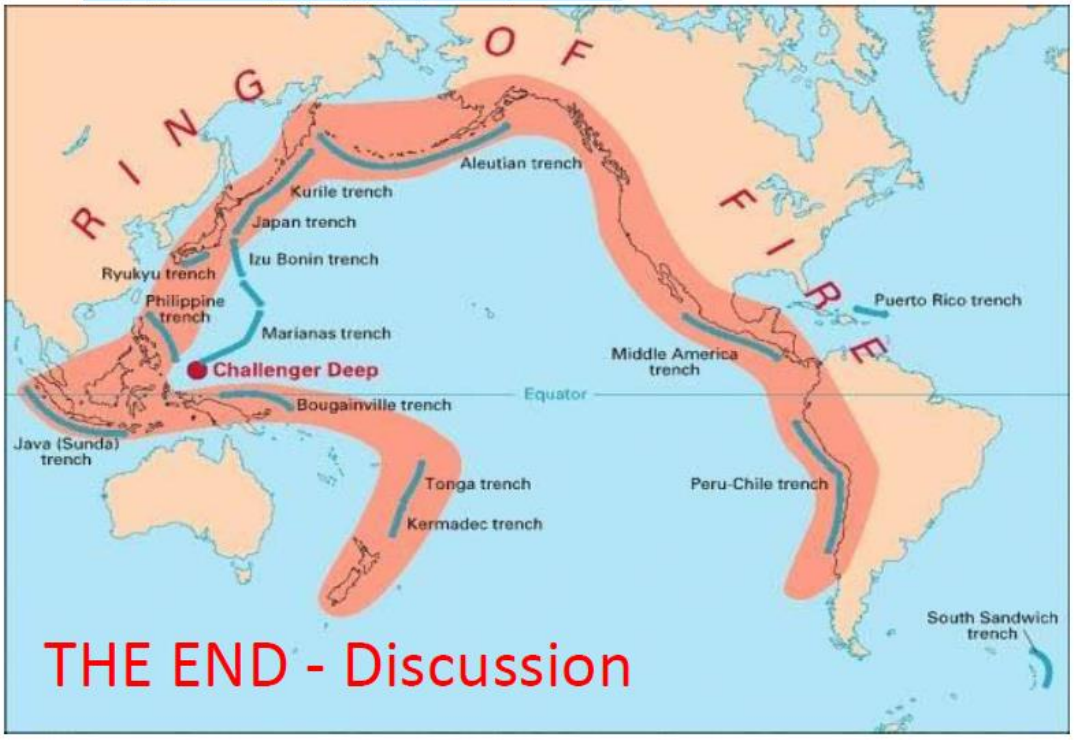
Key measures will involve:

- Facilitating innovation and action across all sectors of APEC member economies to support integrated energy solutions
- Creative financing mechanisms
- Overcoming institutional inertia and incumbent power.

## The international energy scene will change

Will new 'energy giants' emerge, eg countries leading in smart, efficient energy solutions; with major renewable energy resources such as solar, geothermal resources using advanced drilling techniques from the oil industry?

Source: http://pubs.usgs.gov/gip/dynamic/fire.html




My final slide is not just about the geothermal potential shown in the slide. It is intended to highlight the likelihood that global energy trade will also be transformed by new energy –. This transformation will be great for the energy security and balance of payments of energy importers, but it creates new challenges for existing energy exporters.

THANKYOU FOR YOUR TIME. I HOPE I HAVE PROVIDED A WINDOW INTO AN EXCITING ENERGY FUTURE. I look forward to our discussion.