The Climate Institute

Boosting Australia's Energy Productivity

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Policy Brief
July 2013

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Acknowledgements

This report was written by Olivia Kember, National Policy and Research Manager at The Climate Institute, with guidance from Erwin Jackson, Deputy CEO of The Climate Institute. It draws on research by Vivid Economics and ClimateWorks Australia. We would like to thank Anna Skarbek, Ben Waters, John Connor, Robin Smale, Tim Nelson and Thomas Kansy for their advice and comments. All views and any errors in this paper remain those of The Climate Institute.

This and other materials produced for The Climate Institute's Energy Productivity Project 2013 are available at **www.climateinstitute.org.au**

This project was conducted with support from GE.

Cover Image:
Michael Hall, Creative Fellow of The Climate Institute

The Climate Institute

Summary

Energy efficiency is both the single most cost-effective way of lowering greenhouse gas emissions, and an essential component of any strategy to reach long-term emission reduction goals. Under a limited global carbon budget, the right to produce emissions becomes a scarce and valuable resource. In this carbon-constrained world, prosperity depends on maximising ‘carbon productivity’: generating maximum value for each tonne of carbon emitted. [1] The two main drivers of greater carbon productivity are reducing the emission intensity of energy production, and improving the efficiency of energy use.

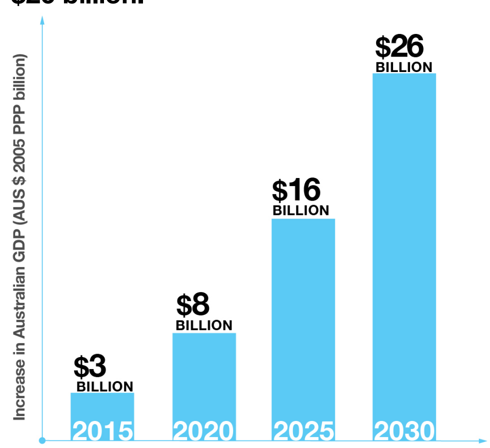
However, energy efficiency has many other benefits. Many countries are pursuing energy efficiency to achieve goals other than emissions reduction. These include boosting economic productivity, improving energy security, reducing expenditure on fuels and energy infrastructure, reducing health-damaging air pollution and developing the energy services industry.

Energy efficiency is an important element of energy productivity: reducing the amount of energy required per unit of output lowers the production cost per unit. (Other factors driving energy productivity are energy prices and economic composition; see Box 1. Definitions, p. 4.) Energy efficiency is about producing the same set of products and outputs with less energy; energy productivity is about producing more outputs and products with the same amount of energy. In the face of a long-term rise in fuel and carbon prices, cutting input costs through more efficient energy use can become an important source of productivity and competitive advantage for companies. Similar benefits accrue to national economies: energy efficiency decreases spending on fuel and energy infrastructure, can suppress energy prices and stimulates economic growth.

New research by Vivid Economics has found that a 1 per cent increase in the level of a country’s energy efficiency causes a 0.1 percentage point increase in the rate of economic growth per person in that year. This relationship was quantified using statistical analysis of energy and economic data from 28 diverse countries over a 30-year time period, controlled for sectoral composition, country and time-specific factors, and using energy prices and their relationship with energy efficiency.[2] Applying this energy efficiency effect to forward projections of GDP growth for most of the sampled countries[3], an annual 1 per cent increase in energy efficiency would increase their combined projected 2030 GDP by 1.8 per cent over the business-as-usual forecast, resulting in approximately $US 600 billion additional GDP.

These findings complement recent research by the International Energy Agency (IEA), which used a bottom-up approach to identify the costs and benefits of globally implementing economically viable energy efficiency improvements. The IEA found that investment of $11 trillion would boost world economic output by around US$18 trillion to 2035, avoid $US 7 trillion of investment in coal, oil and gas extraction, new power stations and energy transmission networks, and save nearly $17 trillion in fuel costs.[4]

For Australia, a 1 per cent increase in energy efficiency would boost 2030 GDP per capita by 2.26% or $1,200 per person, and total GDP by $26 billion.[5]



Analysis shows that Australia appears to waste more energy than other developed nations.

Symptoms of energy wastage include:

+ A slower rate of energy productivity improvement than peers, including other energy intensive economies. For example, the IEA found that Australia's rate of energy efficiency improvement since 1990 has been around 0.5 per cent per year, below the annual average for assessed countries of 1 per cent, and well below that of many comparable economies such as the United States and Canada.[6] This is similar to analysis by ABARES.[7]

+ Significant energy efficiency potential identified in multiple sectors. Analysis of EEO data by ClimateWorks finds large industrial companies could cut their energy use by 11 per cent and save more than $3 billion in avoided energy costs every year.[8] Other sectors such as commercial buildings and passenger transport also have major potential for energy savings.[9]

+ A fragmented policy framework, with gaps and inconsistencies in energy efficiency incentives and regulations.[10]

For Australia to realise the economic benefits of energy efficiency, we recommend expanding and strengthening the current patchwork of energy efficiency measures to boost 2010 energy productivity levels by 30 per cent by 2020.

Box 1. Definitions

Energy efficiency measures the amount of energy used in the production of a specific service, such as a unit of residential lighting. Energy efficiency is one determinant of the overall energy productivity in an economy.

Energy productivity is defined as GDP per unit of energy used and is a measure of the economic value associated with energy use. As well as energy efficiency, determinants of energy productivity include energy efficiency, energy prices, which influence the allocation between energy and other production resources, and the composition of the economy.

Energy intensity is defined as energy used per unit of GDP and is the inverse of energy productivity.

Policies to achieve this could include:

+ Expanding state-based energy saving schemes into a nationally consistent and robust Energy Saving Initiative covering the whole country. This could drive major savings in commercial and residential energy use. By way of example, the the UK energy saving scheme in operation during 2005-8 saved 3,900 GWh of electricity and 6,300 GWh of gas per year, with consumer benefits estimated at GBP 9 for every GBP 1 spent.[11]

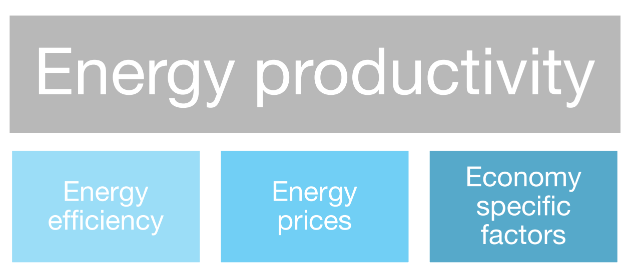
+ Implementing ambitious emissions or efficiency standards for vehicles equivalent to United States standards by 2015 and European standards by 2020. Europe requires light vehicle manufacturers to meet increasingly stringent limits on CO_2 emissions: for example, new car fleets must average 130 g CO_2/km by 2015 and 95g/km by 2020. In terms of energy efficiency, this translates to a 2020 target of 4.1l/100km (petrol) or 3.6l/100 km (diesel). Net benefits to consumers from reduced fuel usage over the vehicle life are estimated at $A 2500.[12]

+ Using the new national framework for regulating Minimum Energy Performance Standards (MEPS) to drive more ambitious equipment standards. One method would be to adapt Japan's "Top Runner" program, where continually higher performance standards are set by the most energy efficient products, leading to efficiency almost doubling in some categories.[13]

+ Pricing that more accurately reflects the true costs of energy use: time-of-use and critical peak electricity pricing; removal of fossil fuel subsidies; pricing of externalities like pollution.

+ Bipartisan support for maintaining the carbon price mechanism, which contributes to shorter payback periods for energy efficiency investments. Maintaining the carbon price also suppresses sovereign risk premiums attached to financing of investments.

The constituents of energy productivity



Energy efficiency is essential to long term emissions reduction

1

"Energy efficiency is the hidden fuel that increases energy security and mitigates climate change"

International Energy Agency
2012

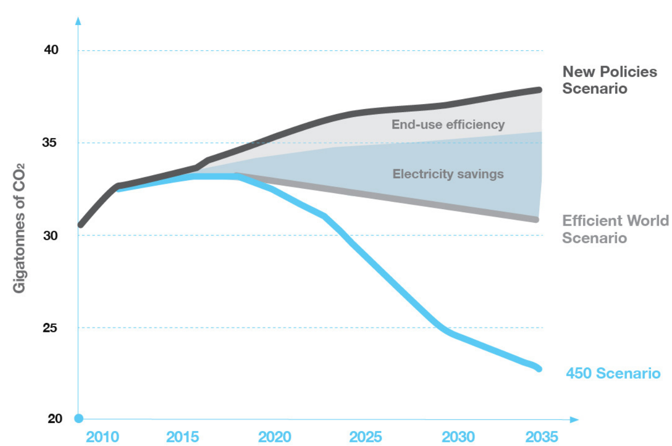
The IEA's examination of trends in global energy-related carbon emissions presents three possible futures for the world: continuation of past policies, which leads to global temperatures rising six degrees Celsius (above pre-industrial levels); achievement of all existing pledges and commitments, which sets the world on a trajectory toward a four degree rise; and comprehensive, ambitious mitigation to limit global warming to two degrees or below.

Limiting global temperature rise to no more than two degrees is a goal underpinned both by scientific research and political commitments. Temperature above this threshold will place unsustainable pressure on natural and human systems. In a report for the World Bank, the Potsdam Institute for Climate Impact Research warns "given that uncertainty remains about the full nature and scale of [climate change] impacts, there is …no certainty that adaptation to a 4°C world is possible."[14]

Under the United Nations Framework Convention on Climate Change (UNFCCC) countries have repeatedly affirmed their commitment to keeping warming at no more than two degrees. This requires total emissions between 2000 and 2050 to not exceed 1500 billion tonnes CO_2-e.[15] Prudent management of this "carbon budget" necessitates no delay in peaking emissions and sustained ongoing emissions reduction. Under a limited global carbon budget, the right to produce emissions becomes a scarce and valuable resource – like minerals, fertile soil, water, financial capital and skilled workers. In this carbon-constrained world, prosperity depends on generating maximum value for each tonne of carbon emitted. Combined with reducing the emission intensity of energy production, a country's energy productivity is a key component of a nation's "carbon productivity"[16] and its ability to remain prosperous in a world limiting pollution.

Energy efficiency is necessary but not sufficient to achieve this ongoing emissions reduction. IEA modelling found that unlocking economically viable energy efficiency measures ("Efficient World Scenario") would halve the increase in energy consumption expected under current targets and commitments ("New Policies Scenario"), and result in a gradual decline in carbon emissions. However, energy efficiency alone cannot achieve the abatement needed to avoid dangerous climate change (represented by the 450 Scenario trajectory in Figure 1, below).

Figure 1. *IEA projections of energy-related CO_2 emissions by scenario and abatement measures*[17]



Nonetheless, energy efficiency is an essential component of any long term abatement strategy. By reducing energy demand and its associated emissions, energy efficiency is the single most effective means of buying extra time and reducing reliance on other, riskier abatement tools (such as carbon capture and storage and ambitious policy action by major emitting countries). The IEA estimates that almost 80 per cent of the CO_2 emissions allowable by 2035 are already locked in by existing power plants, factories, buildings, etc. Under current policies all allowable CO_2 emissions would be locked in by energy infrastructure existing in 2017. The Efficient World Scenario postpones this complete lock-in to 2022.[18] Analysis by Switzerland's Institute for Atmospheric and Climate Science, Austria's International Institute for Applied Systems Analysis and Unviersity of Technology, and the United States National Center for Atmospheric Research found in the absence of reduced energy demand the combined effects of other key abatement instruments would likely be insufficient to achieve the two degree target, due to capacity constraints.[19]

Energy efficiency also has major economic and other benefits

2

Importantly, energy efficiency offers significant financial and economic benefits as well as emissions reduction. Energy plays a significant role in the economy as a major factor in production. The efficient use of energy can therefore contribute positively to economic growth. Although much research has identified the financial benefits of investing in energy efficiency, relatively little research to date has investigated the extent to which energy efficiency influences growth.

New research by Vivid Economics finds that an improvement in energy efficiency can indeed contribute to higher economic output. Based on advanced statistical analysis of 28 OECD countries over the last three decades, Vivid Economics found that a 1 per cent increase in the level of energy efficiency in a year causes a 0.1 percentage point increase in the rate of economic growth in that year.

Estimate	Significance level	Interpretation
0.10	**<1 per cent**	a 1 per cent increase in the level of energy efficiency causes a 0.1 percentage point increase in the growth rate of GDP per capita in that year (for example from a growth rate of 2 per cent per annum to 2.1 per cent per annum)

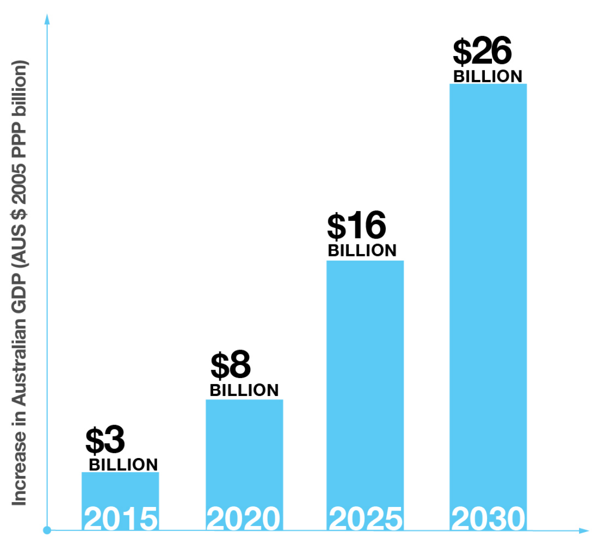
Note: *Significance level means the likelihood this estimate has been obtained by chance and that there is no relationship. A lower number implies a higher statistical significance of the estimate.*

Source: *Vivid Economics*

Applying the average energy efficiency effect to forward projections of GDP growth for most of the sampled countries[20], an annual 1 per cent increase in energy efficiency results in their combined GDP in 2030 being 1.78 per cent greater than currently projected. This additional growth is worth roughly $US 600 billion.

In the case of Australia, if energy efficiency levels increase each year by one additional percentage point, GDP per capita would be 2.26 per cent higher in 2030 than currently projected. This works out at an extra $1,200 per person. Cumulative real GDP gains of $A 25 billion[21] would be realised (see Figure 2, below).

Figure 2. *Contribution to Australian GDP from 1% annual improvement in energy efficiency.*



Note: *This scenario assumes the OECD forecast for GDP per capita until 2030 and compares it with an additional one percentage point gain in energy efficiency levels per year and the effect on GDP per capita growth rates and levels.*

Vivid Economics notes that one of the main factors influencing the beneficial effects of energy efficiency measures on growth is the cost-effectiveness of energy efficiency measures. As economies become more efficient over time, economically feasible energy efficiency gains might decline. Countries at the frontier of energy efficiency will likely have fewer opportunities for improvement than laggard countries. Low local energy prices may also limit the economic attractiveness of energy efficiency improvements. In addition, the prevalence of energy-intensive industries like mining can act as a limit on the potential to reduce economy-wide energy intensity. On the other hand, new opportunities for energy efficiency may be revealed by advances in technology, or behaviour changes, while governments can affect the value placed on energy efficiency improvements through policies such as emissions pricing or efficiency standards.

Box 1: Vivid Economics' analysis

The data set spans 28 OECD countries in various states of development, over the period 1980-2010. This data set allows the analysis of idiosyncratic effects between countries and over time. The analysis controls for the sectoral composition of the economy, both between countries as well as within a country over time, and thus accounts for the changing nature of energy use as economies mature.

Each of the 28 countries has undergone changes and transitions over the period, such as the transition from communism to a market economy in the case of Eastern European countries or the rapid industrialisation and subsequent switch to a growing service sector in countries like South Korea.

The methodology allows causality to be established and enables the identification of the direction and maximum size of the effect of energy efficiency on economic growth. Instrumental variable techniques are used to determine the effect of energy efficiency gains on output by using energy price indices as proxies. Output is measured as GDP per capita in US$2005 and adjusted for purchasing power parity (PPP). Energy price movements are used to obtain an estimate of the causal effect of energy efficiency on economic growth. The ratio of the share of the service sector, which is often the most energy productive, to the share of industry, which is the least energy productive, is included to account for difference in countries' economies.

The IEA has found that global investment of $11.8 trillion in more efficient end-use technologies (ie excluding efficiency improvements in energy generation) would cut global emissions by 2.6 billion tonnes of CO_2-e in 2020 (and 6.5 billion tonnes in 2035), and produce the following economic gains:

+ World economic output boosted by around US$18 trillion to 2035. This is equivalent to the combined current size of the economies of Canada, Chile, Mexico and the US.
+ Avoided investment of $US 7 trillion dollars in coal, oil and gas extraction, new power stations and energy transmission networks
+ Oil import bills for the world's five largest importers cut by 25 per cent.
+ Nearly $17 trillion saved globally in avoided fuel costs

This does not include the unquantified benefits associated with avoiding 25 million tonnes of toxic air pollutants which contribute to acid rain, urban air pollution and respiratory diseases.

For Australia, analysis by ClimateWorks has found that economically viable energy efficiency could drive emissions reduction of 61 million tonnes in 2020, achieving about two-fifths of Australia's emissions reduction target of five per cent below 2000 levels by 2020, and one-fifth per cent of Australia's conditional 25 per cent target. Even before factoring in a carbon price, energy efficiency provides an average profit to investors of $110 per tonne of CO2-e abated. [22]

However, viable energy efficiency improvements may be not taken up, due to competing investment priorities and non-price barriers. Key price barriers identified in the literature include: prices that do not accurately reflect the costs of energy use; short payback periods required by individuals or organisations; lack of available capital for improvements; Key non-price barriers include lack of information or skills to identify and implement energy efficiency improvements; split incentives; regulations that distort pricing or behaviour.[23]

These may be addressed through various policy tools. Performance standards and disclosure requirements (eg. for vehicles, equipment, buildings) address split incentives and information barriers. External costs can be internalised through carbon prices or fuel taxes. Energy efficiency obligations can reduce payback times as well as split incentives. Similarly removal of policies such as fuel subsidies or regulated flat electricity tariffs can also remove barriers that discourage energy efficiency. (See section 5 for discussion of policy priorities for Australia.)

Figure 3. *Global gains from investing in energy efficiency.*

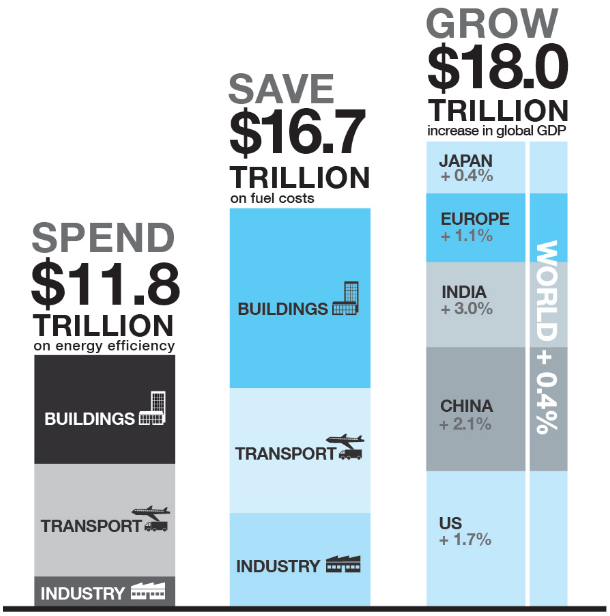
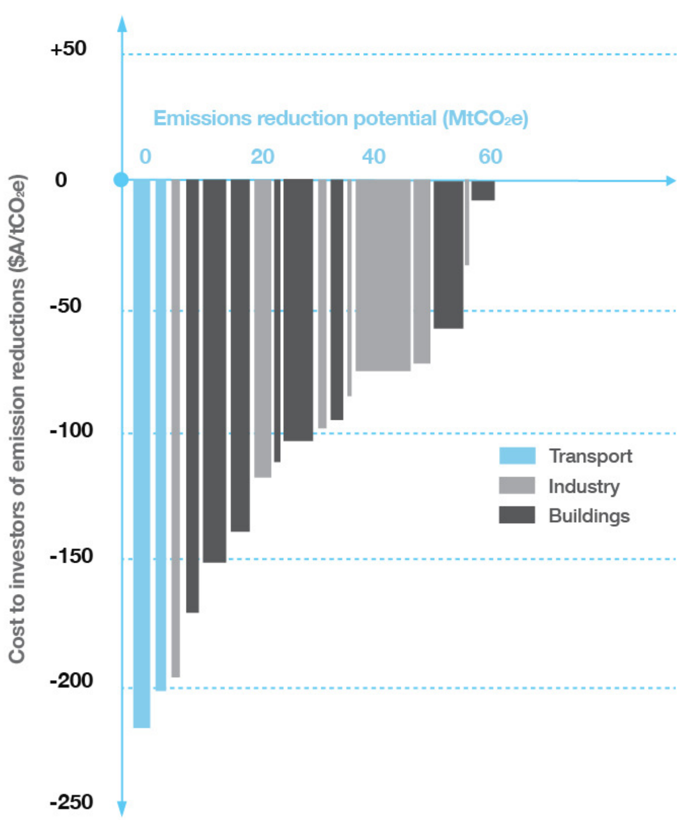


Figure 4. *Energy efficiency component of emissions reduction cost curve for Australia.*



Global attention to energy efficiency is rising

3

“Let’s cut in half the energy wasted by our homes and businesses over the next twenty years.”

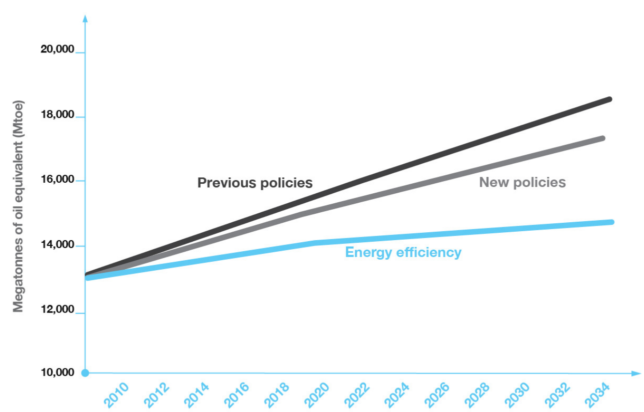
President Obama
State of the Union
12 February 2013

Recognition of the multiple benefits of energy efficiency has seen many nations establish policies to boost the productivity of their energy use. The following examples from recent years are not exhaustive, but illustrate the scale and breadth of recent action. The EU passed a binding energy efficiency directive that requires member states’ energy companies to help customers save energy worth 1.5 per cent of annual sales.[24] India implemented an energy savings target and obligations (‘Perform-Achieve-Trade’) for energy intensive companies across nine industrial sectors.[25] The US set efficiency standards for new light vehicles in 2017-2025 to be no more than 100g CO_2/km by 2025 (more than twice as ambitious as Australia’s current voluntary standard).[26] South Korea began implementing vehicle efficiency standards aimed at achieving 140g CO_2/km by 2015.[27] China has established energy targets for the nation’s top 10,000 energy using businesses as well as mandatory energy standards of buildings, appliances, vehicles and industrial motors.[28] Japan has set incentives to encourage more efficient technologies in the residential sector and, to a lesser extent, the industrial sector.[29]

Overall investment in energy efficiency in 2011 was estimated to be in the order of US$180 billion with the largest investments in the EU (US$76 billion), China (US$31 billion) and the US (US$20 billion).[30]

The IEA has assessed the effect of recent policy changes as a reduction in global demand growth to 30 per cent by 2035, rather than an otherwise projected 43 per cent (Figure 5, below).[31] This is encouraging but demonstrates that governments have barely scratched the surface of energy efficiency’s potential.

Figure 5. *Global primary energy demand under different IEA scenarios*



What is Australia's energy efficiency potential?

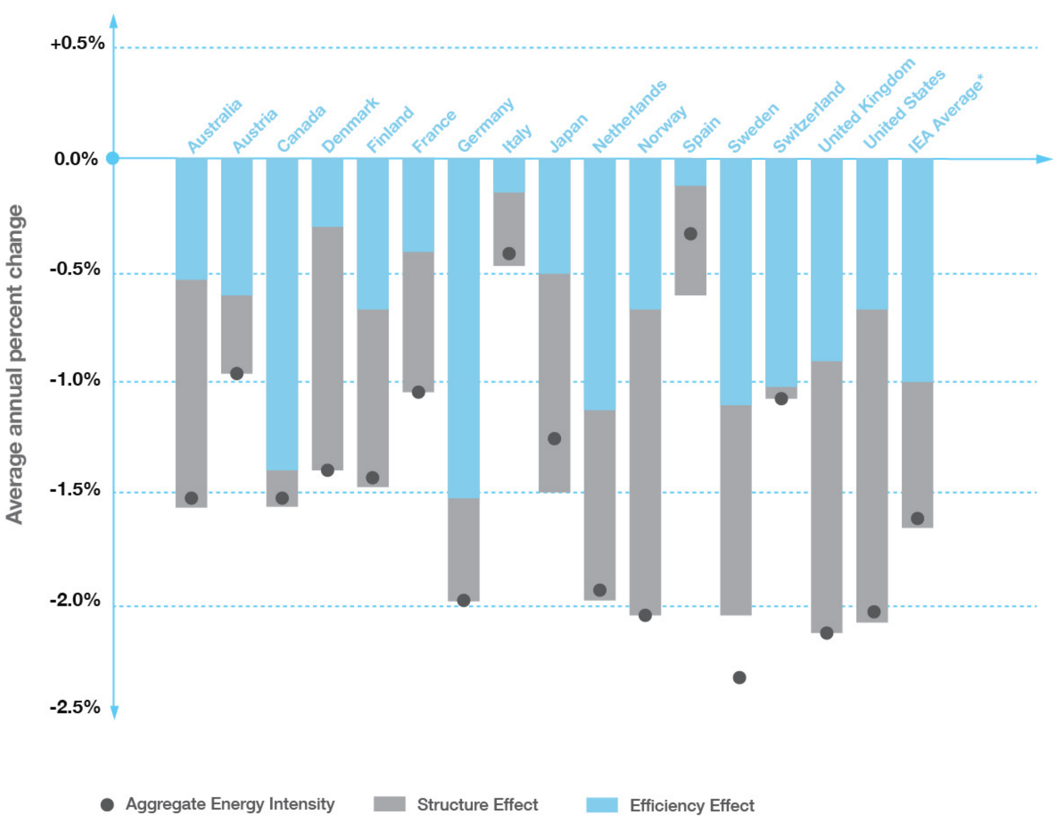
4

4.1 Australia's energy productivity is lagging

Energy productivity has improved (or energy intensity has declined) decade on decade for many countries. There are two key ways in which energy productivity may improve: through advances in energy efficiency, and through a shift in the sectoral composition of the economy toward less energy-intensive industries. While energy productivity tends to be higher in countries whose service sectors comprise a larger share of the economy, it is also higher in countries that appreciate the benefits of extracting as much economic value from every unit of energy used.

The IEA's *Energy Efficiency Scoreboard 2011* breaks down the contributions of efficiency and sectoral change to 16 countries' improvement in energy productivity (Figure 6, below). Australia's annual energy efficiency improvement of about 0.5 per cent is below the IEA average of 1 per cent per year (for countries assessed), and well below that of many comparable economies such as the United States and Canada.[32] This is similar to analysis by ABARES, which found that over the period 1990 to 2004, energy efficiency improvements contributed to improved energy productivity by 0.4 per cent per year, around half that of in the United States and Canada.[33]

Figure 6. *Changes in energy intensity decomposed by structure and efficiency effect, 1990-2008 (IEA).*



**IEA average is limited to countries on graph*

4.2 There is significant potential for energy efficiency across the economy

Research by ClimateWorks has found potential for major energy efficiency improvements in many sectors of the economy. Analysis of Energy Efficiency Opportunities data for the mining (including oil and gas), manufacturing and commercial transport sectors, collectively responsible for 27 per cent[34] of Australia's annual energy consumption, showed that each sector could cut its energy use by about 11 per cent. This would save the sectors a combined total of $3.2 billion annually in avoided energy costs, and reduce emissions by 15 Mt CO_2-e each year.[35]

Current policy settings enable about 40 per cent of those savings – worth $1.2 billion per year - to be implemented, primarily through operational improvements such as implementation of process controls and measurement, improved process design or optimisation or changes to staff behaviour and maintenance practices. (See section 5 for discussion of policy drivers of existing energy efficiency efforts.) This results in annual abatement of 6 Mt CO_2-e. [36]

Table 1. *Untapped energy savings potential in 2020 under BAU and associated emissions reduction and financial savings potential*[37]

Sector	Untapped energy savings available in 2020		Potential emissions reduction (ktCO2-e)	Potential financial savings ($million per annum
	Percentage of total	Amount (TJ)		
Mining, oil and gas	5.14	45,433	3,386	1,325
Manufacturing	7.70	116,611	10,336	2,366
Electricity, gas, water, waste	2.78	579	87	39
Construction	5.54	838	103	42
Freight and air transport	8.26	20,793	1,682	719
TOTAL	**6.86**	**184,256**	**15,594**	**4,491**

However, savings worth about $2.1 billion per year, equivalent to 6 per cent of current energy consumption across these sectors, are not expected to be implemented. Meanwhile, energy use is forecast to increase: resource extraction energy consumption is projected to grow by 180-250 per cent by 2020, while manufacturing energy use will roughly double.[38] Under projections of equivalent proportions of energy saving potential and implemented savings, untapped savings in 2020 could total 184,000 TJ, with a value of $4.5 billion, and associated carbon emissions of 15 Mt CO_2-e.

Analysis of other sectors also reveals significant potential gains from energy efficiency. Australia's retail sector, for example, could reduce its energy use by 18 per cent, saving $1 billion annually. Nearly half of this comes from removing, recalibrating or downsizing unnecessary equipment to reduce energy waste and retrofitting HVAC, activities with payback periods of two years or less.[39] At 11.3 litres/100km, the fuel efficiency of Australia's passenger vehicles fleet is among the lowest in the developed world, and has failed to improve over the last decade.[40] European cars, in contrast, average 7.1 litres/100 km, with new cars averaging 5.6 litres/100 km.[41]

4.3 There will (almost) always be room for improvement

The concept of the energy productivity frontier is used to describe the limit of a country's energy efficiency. The frontier is defined globally by the country using the least energy per unit output, given its geography, economic composition, energy carriers and other inputs. These factors also define each country's individual frontier: Australia cannot expect to have the same ratio of energy to output as Luxembourg, for example. Countries at the frontier of energy efficiency may have fewer opportunities for improvement than laggard countries, simply because they have already utilised many of those opportunities.

However, the frontier is not static. Over time it has receded and is highly likely to continue to recede. The multiplicity of energy uses means that technological advances and changes in behaviour, and the interaction between these drivers, may push out the frontier long into the future. This does require a change in approach: from seeking out individual sources of waste to recognition and optimisation of complex systems, enabled by advances in information, communication and computational infrastructure.[42]

4.4 Current policies leave gaps or are unambitious

> *"Australian governments' approaches to energy efficiency to date have often been piecemeal and not obviously designed to capture the most cost-effective energy efficiency opportunities."*
>
> **Report of the Prime Minister's Task Group on Energy Efficiency**
> 2010

At each level of government Australia has policies and regulations that explicitly or implicitly affect the efficiency of energy use. Many policies with explicit energy efficiency goals continue to be effective in reducing energy waste by addressing one or more of the barriers identified above.

Among these policies are national performance standards and energy ratings for appliances, equipment; construction codes and, in some cases disclosure requirements for buildings; the Energy Efficiency Opportunities program; the carbon price; and possibly the state-based energy saving obligations of NSW, Victoria, SA and ACT.

Many areas are not included within the scope of these policies, and, combined with limitations on each policy's ambition, the existing policy set fails to capture the full potential for energy efficiency across the economy.

While Australia's history of easy access to low cost, high-polluting fuel meant that the country could afford to place little value on energy efficiency in the past, this attitude becomes an increasing liability in a future of rising and volatile fuel and carbon prices and increasing global emission constraints.

Overall, the failure to maximize our energy productivity imposes needless costs throughout the economy. Decoupling productivity from energy consumption becomes even more important in a world limiting pollution: it reduces emissions from existing polluting energy sources *and* reduces the amount of clean energy investment needed to achieve climate goals.

Table 2. *Strengths and weaknesses of existing policies driving energy efficiency in Australia.*

Policy mechanism	Strengths	Key gaps or weaknesses
Energy saving obligations (NSW ESS, Vic ESI, SA REES, ACT EEIS)	• Addresses many barriers • Drives wide range of improvements • Predictability of achieving targets	• Not operating in Qld, WA, Tas, NT • Tendency for piecemeal approach to energy efficiency activities; deeper savings not addressed by existing schemes • Difficulty in establishing additionality
Mandatory reporting (EEO program)	• Enables wide range of savings in key sectors • Builds industry-specific expertise	• Does not address barriers that prevent half of identified savings being implemented
Carbon price	• Potentially strong investment signal • improves payback periods	• Some energy uses uncovered (eg passenger vehicles) • Volatility may lead to underpricing of carbon emissions
Performance standards (eg. MEPS, building codes)	• Effective in driving market transformation • Clear investment signal	• MEPS program not as ambitious as world's best standards • Not applied to all potential products • Building standards inconsistent and do not address existing buildings
Disclosure requirements (eg. Commercial Building Disclosure scheme, Energy Star ratings)	• Effective in addressing some information gaps	• Mandatory for limited range of products • In buildings sector, only applied to large commercial buildings
Grants to improve energy efficiency (eg. Low Income Energy Efficiency program, Clean Technology Program)	• Can target groups most in need of assistance • Can enable demonstration projects	• Piecemeal • Provides no forward investment signal
Clean Energy Finance Corporation (CEFC)	• Potential to unlock major energy efficiency investments through up to $5 billion worth of financing for low emissions technology and energy efficiency	• Lack of bipartisan support puts long-term future of CEFC in doubt.

How Australia can best improve its energy productivity

5

To enable Australia to realise the economic benefits of energy efficiency, we recommend expanding and strengthening the current patchwork of energy efficiency measures to boost 2010 energy productivity levels by 30 per cent by 2020.

Policies to achieve this step-change could include:

- Expanding state-based energy saving schemes into a nationally consistent and robust Energy Saving Initiative covering the whole country.

- Implementing ambitious emissions or efficiency standards for vehicles equivalent to United States standards by 2015 and European standards by 2020. Europe requires light vehicle manufacturers to meet increasingly stringent limits on CO_2 emissions: for example, new car fleets must average 130 g CO_2/km by 2015 and 95g/km by 2020. In terms of energy efficiency, this translates to a 2020 target of 4.1l/100km (petrol) or 3.6l/100 km (diesel). Net benefits to consumers from reduced fuel usage over the vehicle life are estimated at $A 2500.[43]

- Using the new national framework for regulating Minimum Energy Performance Standards (MEPS) to drive more ambitious equipment standards. One method would be to adapt Japan's "Top Runner" program, where continually higher performance standards are set by the most energy efficient products.

- Pricing that more accurately reflects the true costs of energy use: time-of-use and critical peak electricity pricing; removal of fossil fuel subsidies; pricing of externalities such as pollution.

- Bipartisan support for maintaining the carbon price mechanism, which contributes to shorter payback periods for energy efficiency investments. Maintaining the carbon price also suppresses sovereign risk premiums attached to financing of investments.

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