

Climate Change Economics & Policy

ECO3CCE

Global and Strategic Issues

Week 8 International Perspective

La Trobe Business School

COMMONWEALTH OF AUSTRALIA

Copyright Regulations 1969

WARNING

This material has been reproduced and communicated to you by or on behalf of La Trobe University pursuant to Part VB of the *Copyright Act* 1968 (**the Act**).

The material in this communication may be subject to copyright under the Act. Any further reproduction or communication of this material by you may be the subject of copyright protection under the Act.

Do not remove this notice.

Intended Learning Outcomes

At the completion of this topic, students should be able to:

- Understand that emissions can be calculated to adjust for population size, historical emissions and consumption emissions
- Describe international agreements on climate change
- Explain the success or failure of international agreements in curbing CO₂ emissions
- Evaluate domestic mitigation policies

Outline

- Background
- Different pictures of emissions
- The UNFCCC and the Kyoto Protocol
- Kyoto mechanisms, carbon trading, CDM and JI
- The Paris Agreement
- Australian policies ([separate powerpoint](#))
 - Carbon Tax
 - Emission reduction fund

Introduction

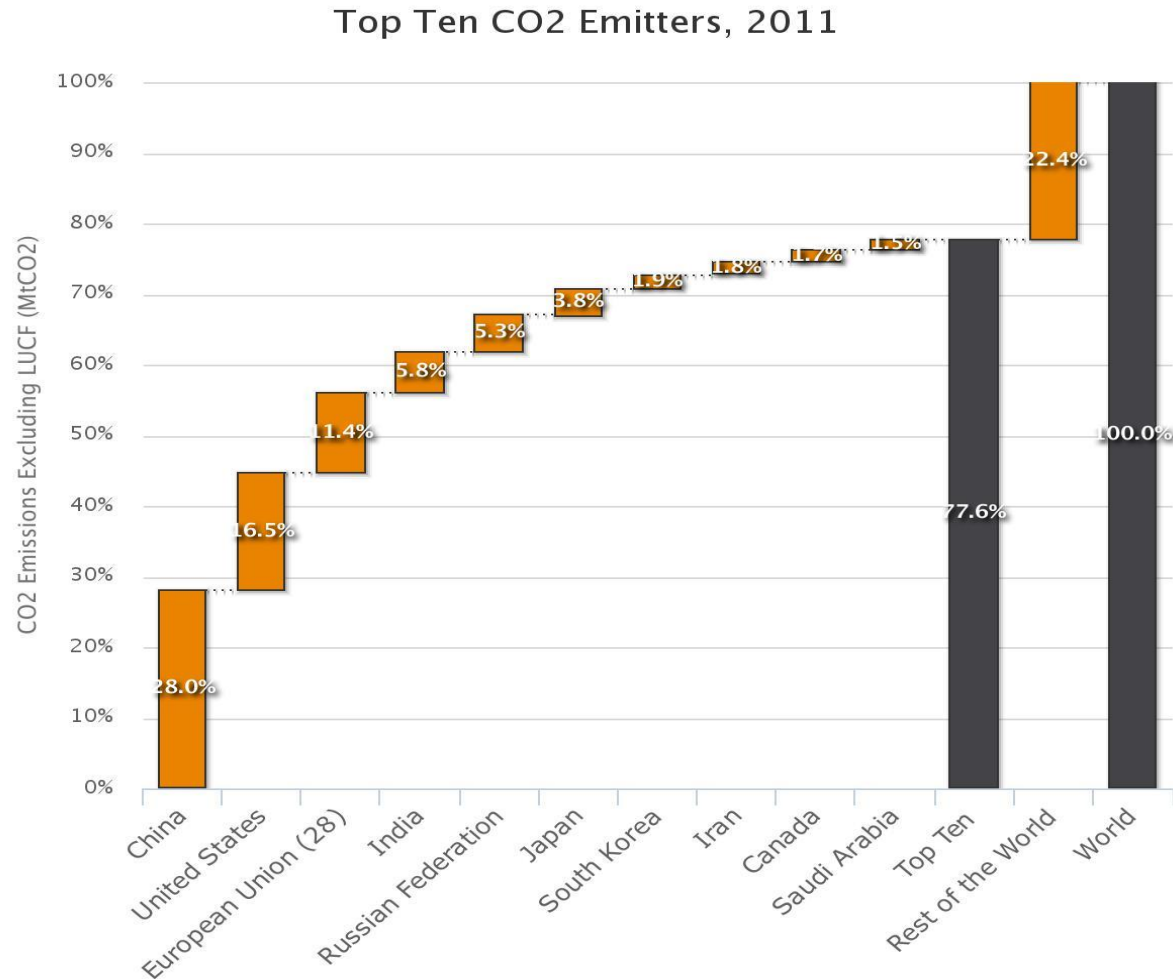
- A few countries contribute most GHGs emissions
- But some (like China and India) that emit a lot in aggregate have low per capita emissions
- Moreover, some big emitters have only done so far for a historically brief period
- Also countries like China produce goods (and therefore emissions) for international trade. So in consumption terms GHGs fall.
- Consumption emissions – carbon footprint (see <https://www.theguardian.com/environment/2011/apr/21/countries-responsible-climate-change>)

Emissions (total) by big emitters

- In 2011, the top 10 emitters contributed 78 per cent of global CO₂ emissions
- The first graph above shows the top 10 emitters for CO₂ emissions excluding land use change and forestry (LUCF)
 - China and the U.S. account for 44.5 per cent
- In the second graph including LUCF, the top 10 falls to 68.5 per cent and the list of countries change:
 - Notably, Indonesia and Brazil rank in the top 10 emitters, as a significant part of their national emissions come from LUCF, mainly deforestation

Top Ten emitters of CO₂ in 2011 excluding LUCF

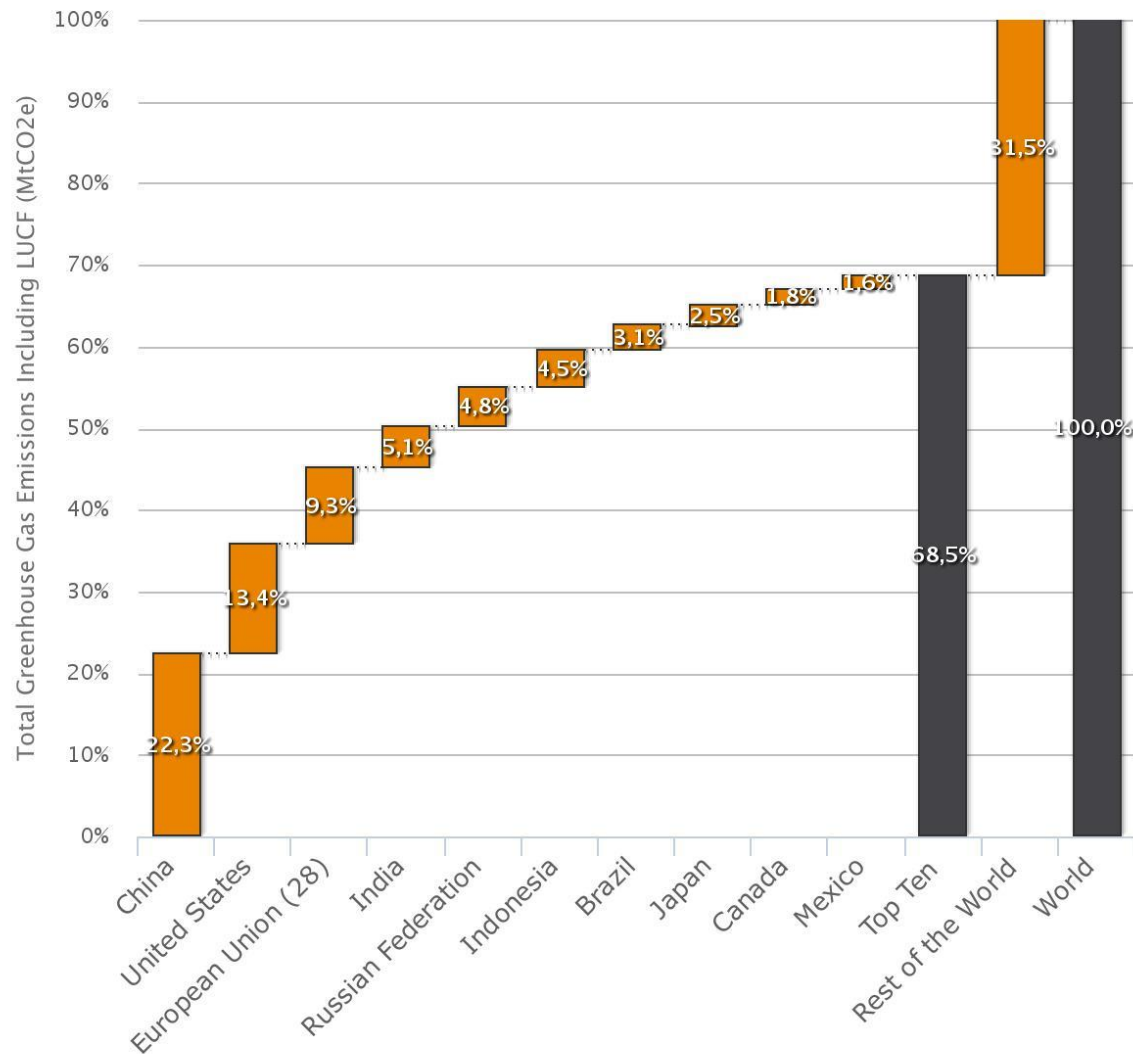
Source (CAIT, WRI)



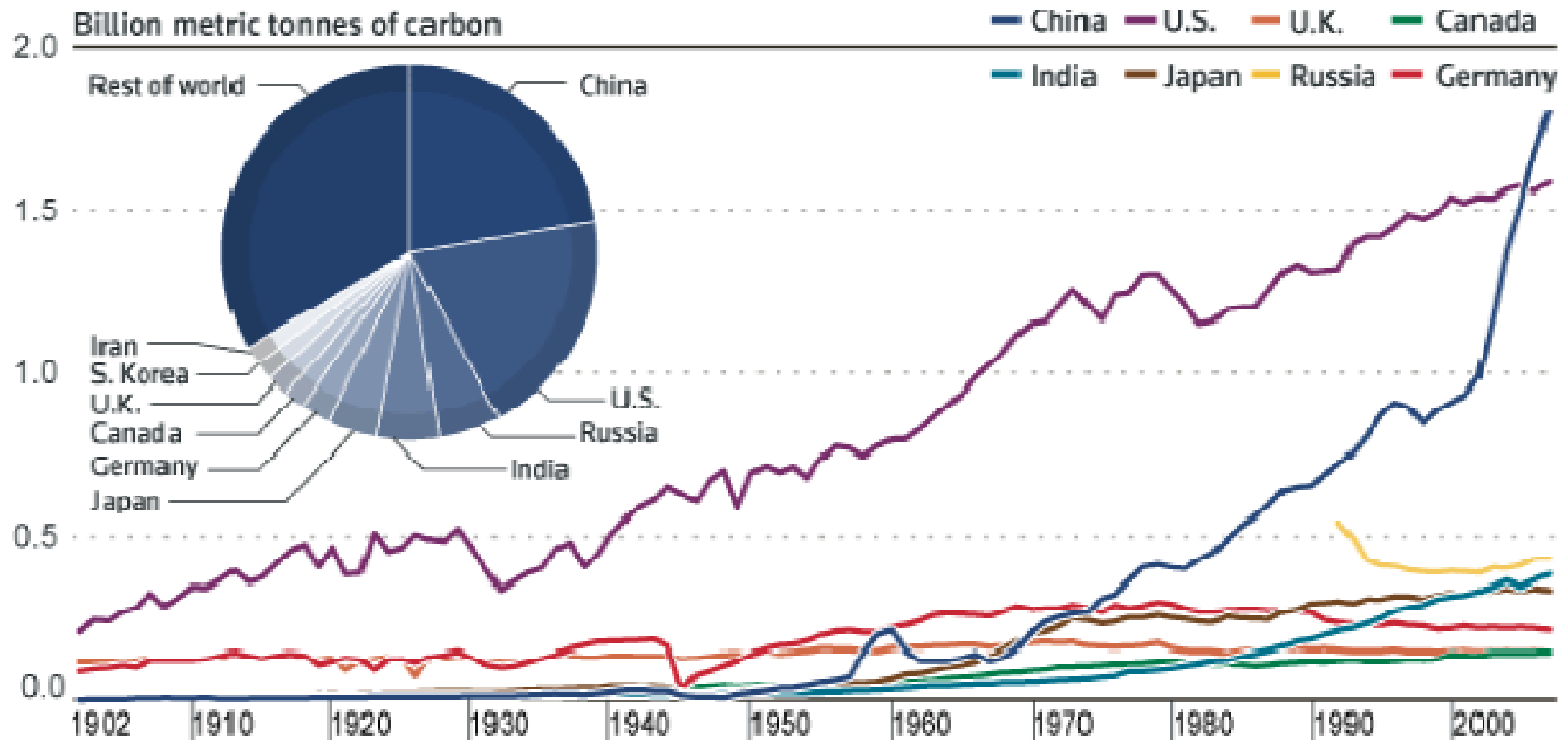
Top Ten emitters of CO₂ in 2011 with LUCF

Source (CAIT. WRI)

Top Ten Greenhouse Gas Emitters, 2011

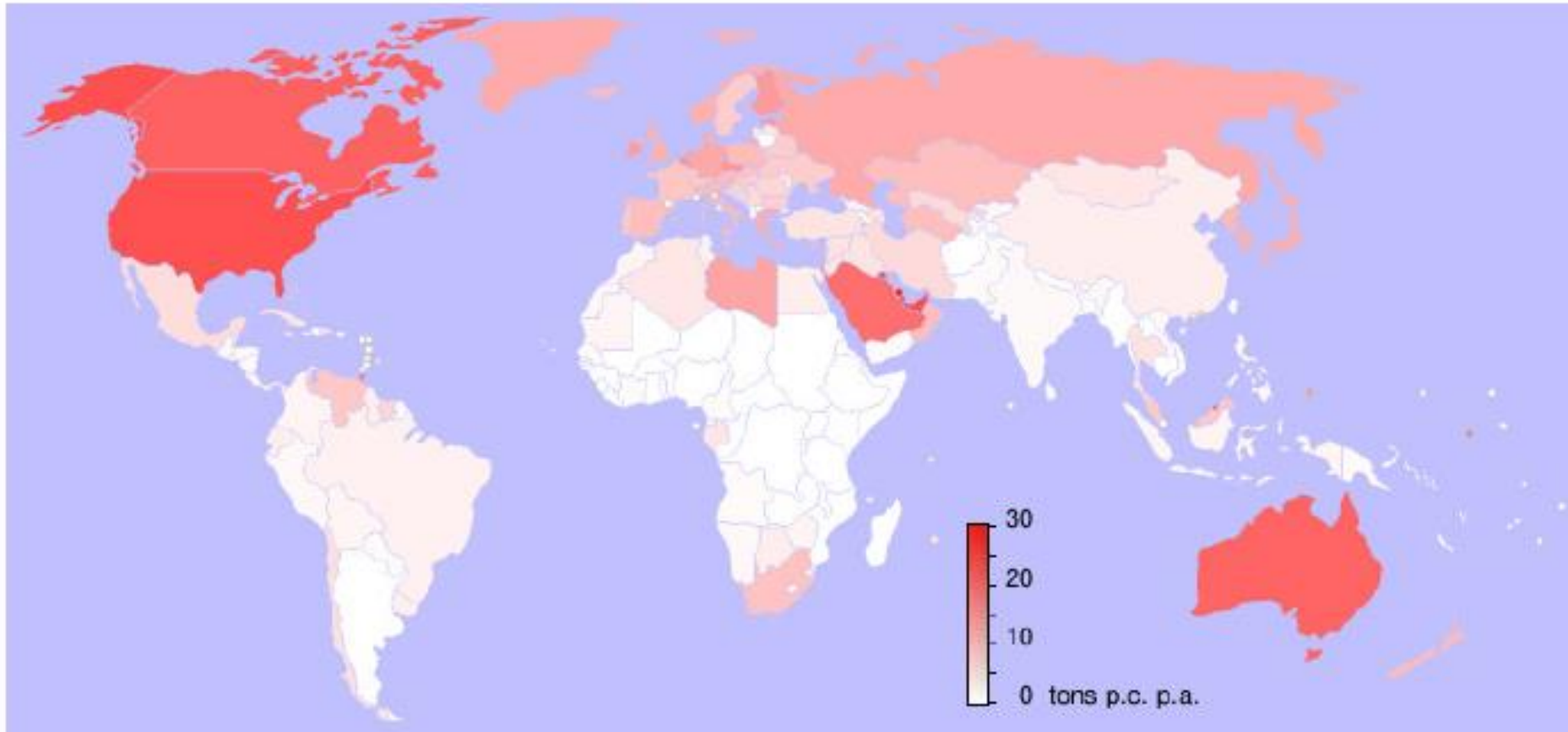


China – the sleeping giant, India not too far behind!



Source: Reuters

But per capita, China & India are amongst the lowest emitters



Source: ClimateBridge

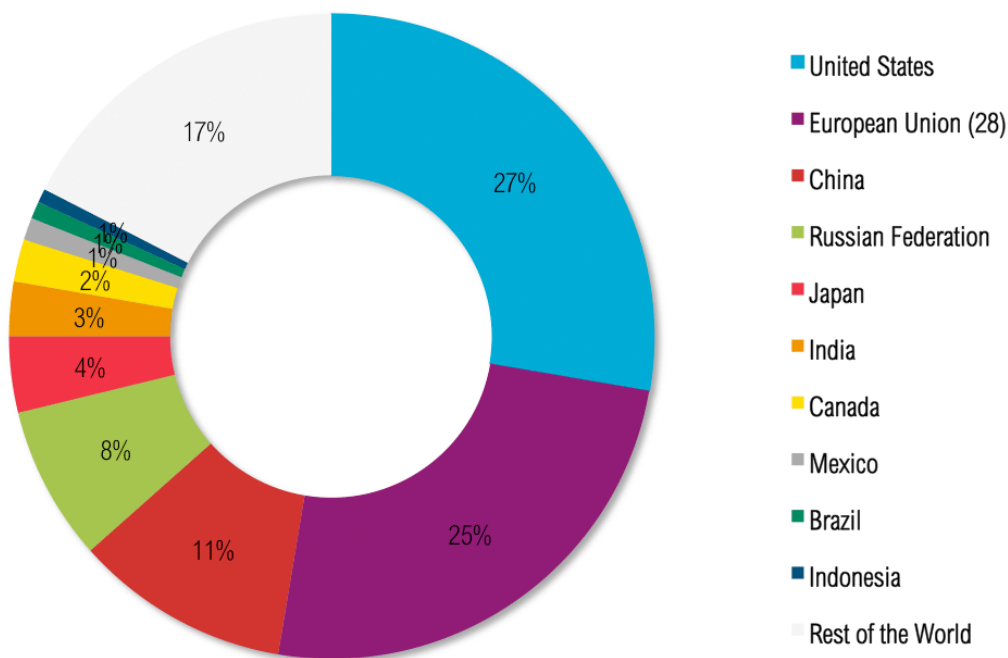
Negotiating position of the West: 'Why bother?'



7-20-09 THE PHILADELPHIA INQUIRER, UNIVERSAL UCLICK

Position of the Developing Countries: “you caused the problem, you fix it”

Cumulative CO₂ Emissions 1850–2011 (% of World Total)



<http://bit.ly/11SMpjA>

International Policy

- The U.N. Environmental Programme and the World Meteorological Organisation established the IPCC in 1988.
 - The role of IPCC is to assess the scientific basis, the socio-economic impacts and potential options for mitigation and adaptation to climate change
 - The first assessment report was published in 1990 – the last being the 5th in 2013/14, the major source of the science presented in Module 1.
- This laid the foundation for international policy on climate change

International Policy

- The United Nations Framework Convention of Climate Change (UNFCCC) was established in 1992 and ratified by most countries. The stated objective:
 - To stabilise concentrations of carbon dioxide within a timeframe that would prevent dangerous human damage to the climate system
- This seems a reasonable goal – but what does it mean in practice e.g. what is considered ‘dangerous’ and what is meant by ‘stabilise emissions’, is it zero net emissions?
- The UNFCCC also established a Conference of Parties (COP) to meet each year to review implementation and effectiveness

International Policy

- The COP-1 in Berlin in 1995 – recognised non-binding commitments would be insufficient to limit concentrations of CO₂
- This led to a mandate to strengthen commitments of developed countries beyond 2000
- At COP-3 in 1997 the Kyoto protocol to the UNFCCC was agreed
 - Specified limits on GHGs for **developed countries** (Annex 1 countries) & duty to report on emissions for emerging economies (Non-Annex 1 countries)

Kyoto Protocol (1997)

- Developed country to cut emissions by an average of 5.2% of 1990 levels by 2008-2012 (1st commitment period)
 - See Table 1 for country targets, Australia signed on for an 8 per cent increase in emissions
 - 2013-2020: 2nd commitment period (drafted but not legally binding)
- Sanctioned emissions trading - International cap and trade system
- Australia signed and eventually ratified by Dec 2007

Table 1: Countries included in Annex 1 to the Kyoto Protocol and their emission targets

Country	Target (2008-2012 relative to 1990) %
EU-15 ^a , Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco	-8
Romania, Slovakia, Slovenia, Switzerland, United States	-7
Canada, Hungary, Japan, Poland	-6
Croatia	-5
New Zealand, Russian Federation, Ukraine	0
Norway	+1
Australia	+8
Iceland	+10

Kyoto Protocol (1997)

- Design criticised on the grounds it is ineffective:
 - Weyant and Hill (1999) concluded that emission reductions prescribed by the Kyoto Protocol neither optimal in balancing costs and benefits nor effective in stabilising the atmospheric concentration of CO₂
 - Target not based on an economic rationale e.g. balance costs and benefits
 - Target has no environmental goal e.g. limit GHG concentration or temperature increases
- Does not address LDC increasing emissions
- However, did initiate emissions trading and some mechanisms to provide flexibility.

Three Kyoto Mechanisms to control GHGs

Three mechanisms to initiate trading (carbon pricing)

1. International Emission Trading

- Cap-and-Trade between industrialised (Annex 1) countries
- Traded unit: [Assigned Amount Units \(AAU\)](#)

2. Project-based abatement: *Joint Implementation (JI)*

- Emission reduction projects in industrialised (Annex 1) countries
- Traded unit: [Emission Reduction Unit \(ERU\)](#)

3. Project-based abatement: *Clean Development Mechanism (CDM)*

- Emission reduction projects in developing countries (Non-Annex 1)
- Traded unit: [Certified Emission Reduction \(CER\)](#)

CDM – Clean Development Mechanism

- The CDM allows a developed country (Annex 1 Party) to implement an emission-reduction project in a developing country (Non-Annex 1 party)
- Such projects can earn tradeable “Certified Emission Reductions” (CERs)
- Stimulates emission reductions in LDCs whilst giving industrialised countries the flexibility on how they meet their targets

CDM Project Types

Renewable energy – wind, solar, biomass, biofuel, hydro

Methane capture from landfill

Fuel switching – coal to natural gas

Industrial gases – modification of production process (HFCs, N₂O)

Agricultural – methane reduction from animal waste, reduced fertilizer use

Energy efficiency – buildings, industrial

Transport

Forestry – only afforestation and reforestation (but not eligible in EU scheme)



Renewable
energy



Energy efficiency



Industrial processes



Waste



Afforestation &
Reforestation

JI – Joint Implementation

- Companies in Annex I Countries with a Kyoto target (the investor company) or Investor Country itself can undertake GHG abatement projects in another Annex I Country
- Such projects are then credited with Emissions Reduction Units (ERUs)
 - The investor company can use ERUs for compliance or for trading

JI Example

- The Netherlands Govt investing in a 91 MW Wind Farm in Palmerston North Island, NZ
- The Project will generate 530,000 ERUs, annually over 2008-2010



Carbon leakage

- Occurs when emissions increase in one country as a result of emission control by a second country
- Controlling emissions but driving industry to countries like China – no emission advantage
 - Enact controls in Australia and industry exits overseas where controls not in place
- Best evidence so far from EU trading scheme where studies suggest low effects
- Policies to offset leakage –
 - Tax consumption not production & levy taxes at border on imports non-mitigators (complex)
 - Conflicts with Article 1 of WTO rules – the ‘Most-favoured Nation article’

Kyoto Protocol ultimately a seen as a 'failure'

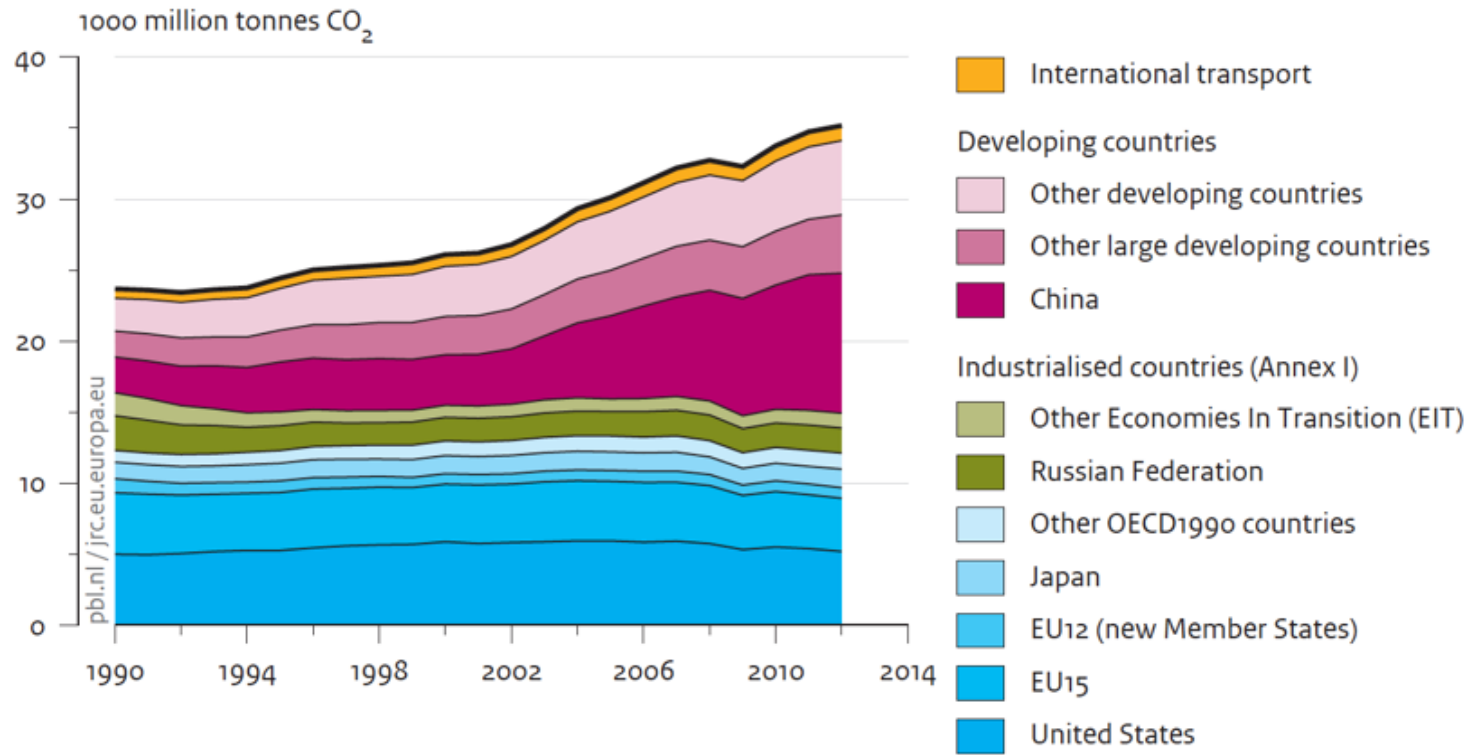
- Why a failure?
 - Largest emitters (e.g. U.S. did not ratify)
 - Emissions from all countries have increased, particularly from China and other developing regions (not included in targets)
 - The headline result from Annex 1 countries shows a decrease in emissions
 - **BUT** this is mainly due to reduction already underway in Russia and the Ukraine not as a result of policies to reduce emissions in Annex 1 countries
 - Kyoto 'legally' binding targets but countries did not comply e.g. Canada

Total emissions increased

Source: Hoexter, M (see <http://neweconomicperspectives.org/2015/11/road-to-cop21-and-beyond-the-missing-analysis-of-the-kyoto-protocol-and-its-failure.html>)

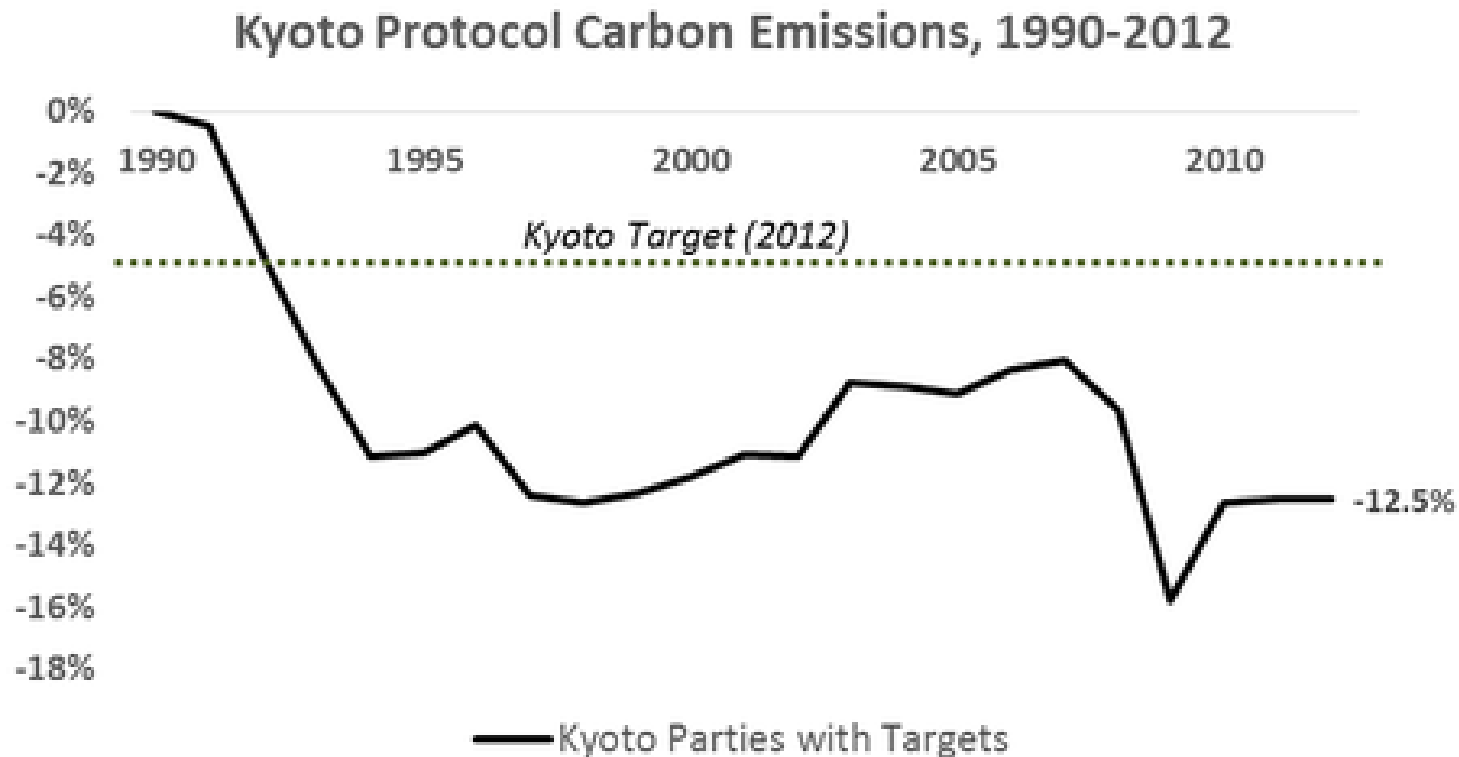
Figure 2.1

Global CO₂ emissions per region from fossil-fuel use and cement production



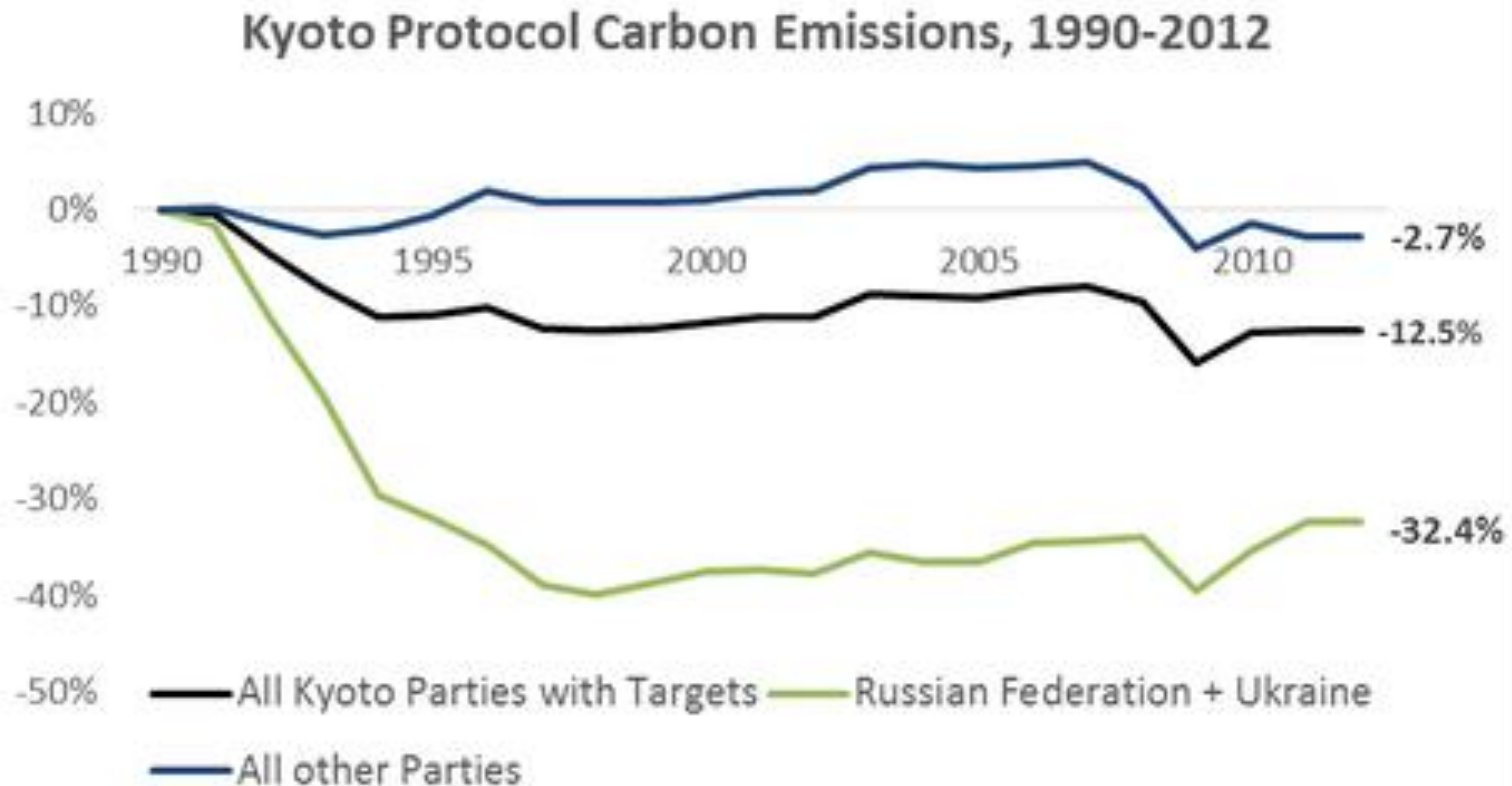
Kyoto Parties emissions decreased

Source: Jones, G. (see <http://www.circularecology.com/news/the-kyoto-protocol-climate-change-success-or-global-warming-failure#.V8TofU19670>)



Kyoto Protocol emissions decreased BUT due to reduction from Russia and Ukraine

Source: Jones, G. (see <http://www.circularecology.com/news/the-kyoto-protocol-climate-change-success-or-global-warming-failure#.V8TofU19670>)



Kyoto Protocol ultimately a seen as a 'failure'

- Individual countries and Australia
 - Many countries that signed the treaty reduced emissions - see <https://www.theguardian.com/environment/blog/2012/nov/26/kyoto-protocol-carbon-emissions> (Australia is shown to have increased emissions)
 - However Australia had a clause inserted into the Kyoto text for inclusion of emissions from land clearing in the baseline
 - This would make the 1990 base artificially high so achieving the 8 per cent increase was easily achieved (see <https://theconversation.com/australia-hit-its-kyoto-target-but-it-was-more-a-three-inch-putt-than-a-hole-in-one-44731>)
 - Free-rider problem ever present in these international agreements

Kyoto Protocol ultimately a seen as a 'failure'

- Not surprising given the difficulties involved:
 - International negotiations concern benefits (mitigating climate change) that is a public good rather than a private good
 - A large number of countries affected and the benefits of climate change control unevenly distributed
 - Mitigation is costly – particularly for developing countries
- In addition given the public goods nature of abatement the **free-rider** problem is ever present in these international agreements
 - Thus in game theory terms the dominant strategy is **do nothing**

International Policy Post-2012

- Copenhagen Accord 2009:
- For the first time ever, pledges by all of the world major economies to reduce GHGs
 - Annex 1 (DCs) - economy wide emission targets by 2020
 - Non-Annex 1 (LDCs) – ‘nationally appropriate mitigation actions



Paris Agreement

- At COP-21 in Paris a new global agreement was established
- Unlike the Kyoto Protocol the Paris Agreement is based on an environmental target of limiting warming
- No binding targets but pledges to act on emissions by ALL countries



Paris agreement

- The aim is:
 - *Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change.*
- Achieved through individual countries Intended Nationally Determined Contributions (NDCs)
 - See interactive map <http://cait.wri.org/indc/>
- Scale up contributions over time
- Financial support for LDCs

Paris agreement analysis

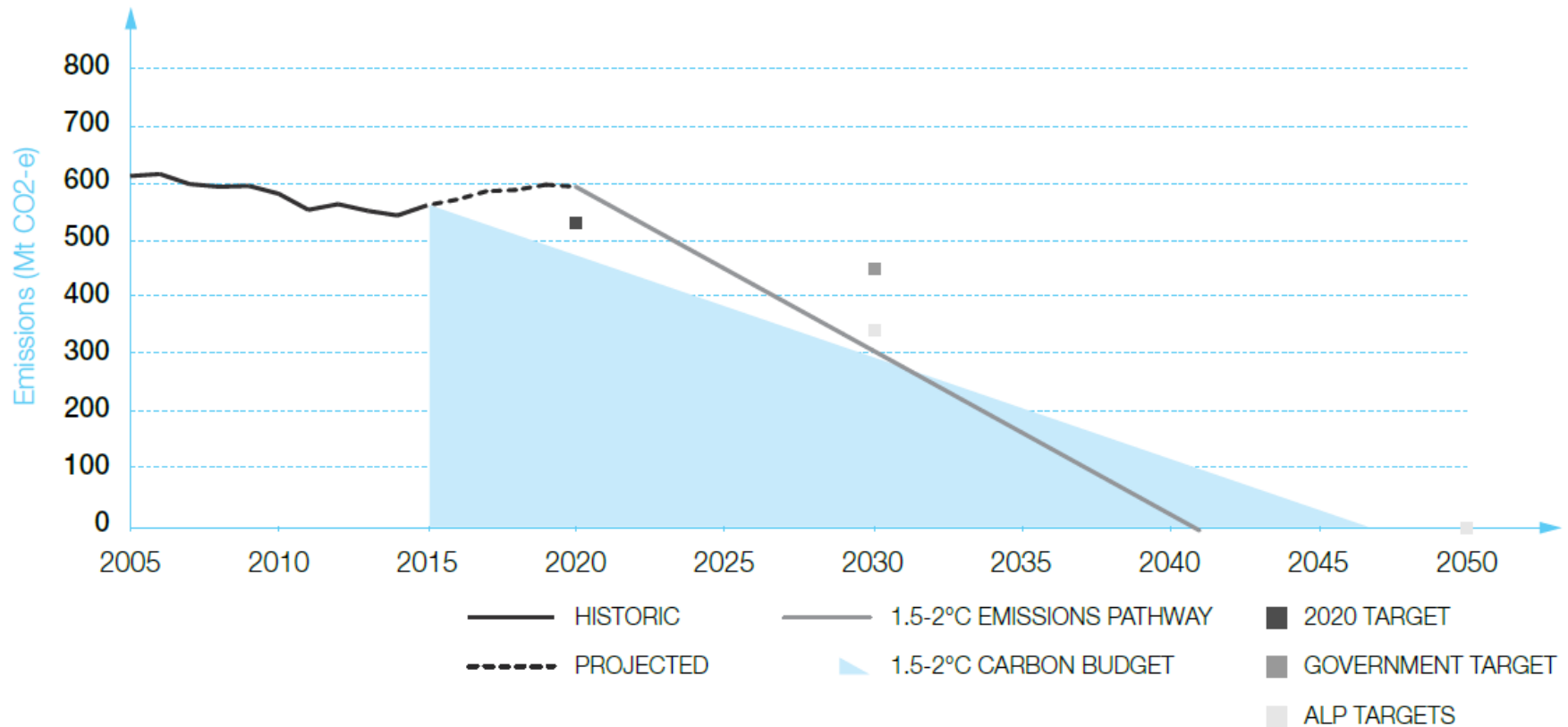
- Research has indicated that the NDCs are not enough to meet the 2°C target (see <https://theconversation.com/paris-climate-targets-arent-enough-but-we-can-close-the-gap-61798>)
 - Existing Paris pledges – 2.3-3.5 C warming by 2100
 - It is suggested that to reach the target the remaining carbon budget is between 750 billion and 2 trillion tonnes of carbon
 - This calls for dramatic cuts approaching zero net emissions in 2050.
- The Climate institute – maps out Australia's carbon budget which it suggests needs to reach zero net emissions by around 2050

Climate Institute and Australia's Carbon Budget for 1.5 to 2°C

Source: The Climate Institute (2016) p.5

FIGURE 2

Mid range Australian emissions budget and pathway consistent with limiting warming to 1.5-2°C. Current and proposed emissions targets are also illustrated.²²



China

- It is important that China the worlds largest emitter signs on to any agreement
- The Chinese governments targets are the same as those in Europe: 20% renewables by 2020
- China is already the world leader in solar hot water heaters!



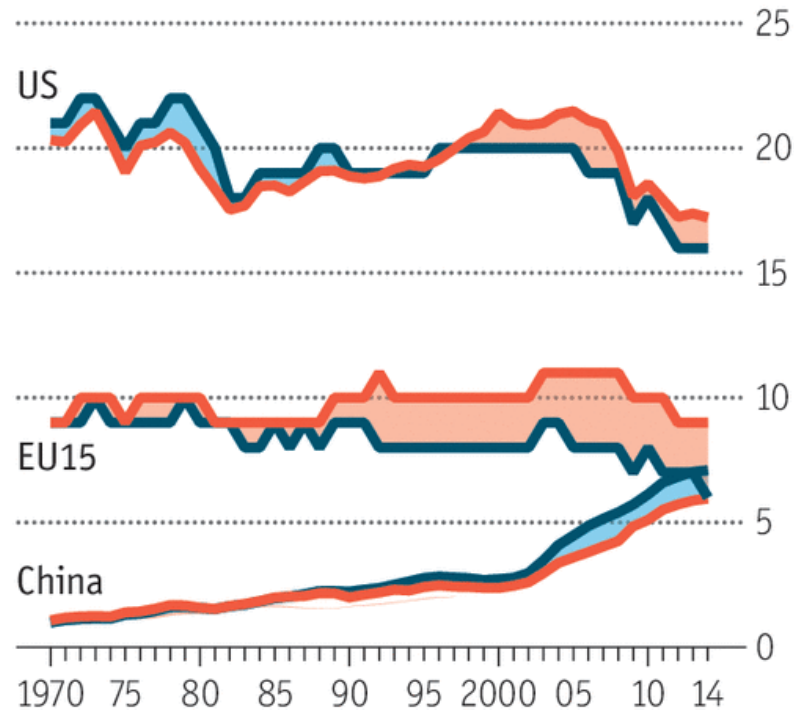
China's emissions per capita are lower after adjusting for traded goods

Source: Economist 2016

Learning curves

CO₂ emissions per person, tonnes

— Domestic production
— Adjusted for effect of traded goods



Source: Michael Grubb

Economist.com

Summary

- Many ways to view the contribution (and liability) of countries to reduce GHG emissions
- International agreements not perfect
- Kyoto protocol established targets but ultimately seem as a 'failure'
- Kyoto offered project-based flexible mechanisms (CDM, JI) and achieved a some success
- The Paris agreement offers hope – but more needs to be done to achieve the goals of limited temperature to increases to 2°C

Climate Change Economics & Policy

ECO3CCE

Global and Strategic Issues

Week 8 Domestic Perspective

La Trobe Business School

Outline

- Australia's response to Climate Change
- A brief history of climate change policy in Australia
- The Carbon Tax
- The Direct Action Plan
- The costs of abatement

Australia's emission targets

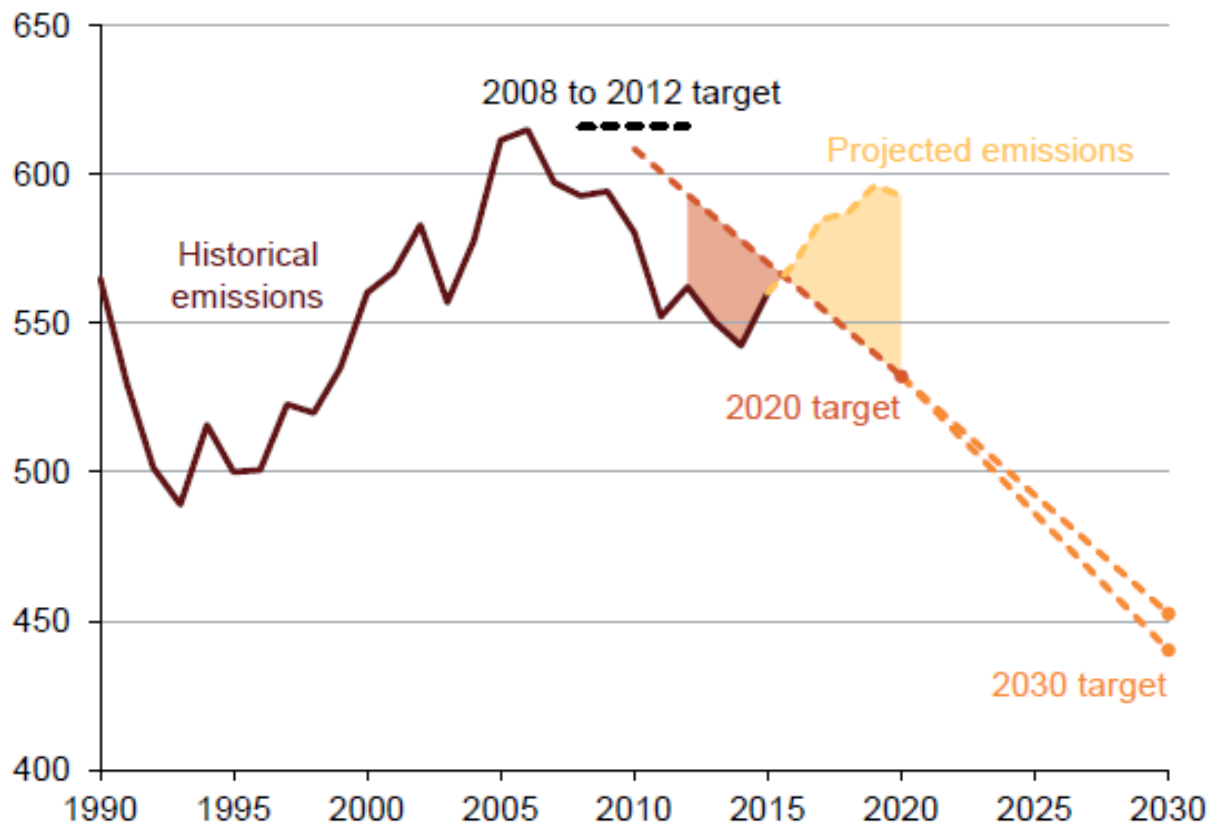
- The second Kyoto commitment period Australian target is:
 - Reduce emissions by 5 per cent below 2000 levels in 2020
- However estimates of the abatement task have fallen (see Figure):
 - Increased renewables, downturn in coal industries, less deforestation and carry-over emission credits from 1st Kyoto commitment period
- In the Paris agreement this has increased to:
 - Reducing GHG emissions by 26-28 per cent below 2005 levels by 2030
- The Paris agreement is a much larger commitment than previous targets.

Australia's Targets

Source: Grattan Institute 2016, p.5

Figure 1: Australia met its first reduction target, but emissions are projected to increase

Emissions, millions of tonnes of carbon dioxide equivalent (Mt CO₂-e)

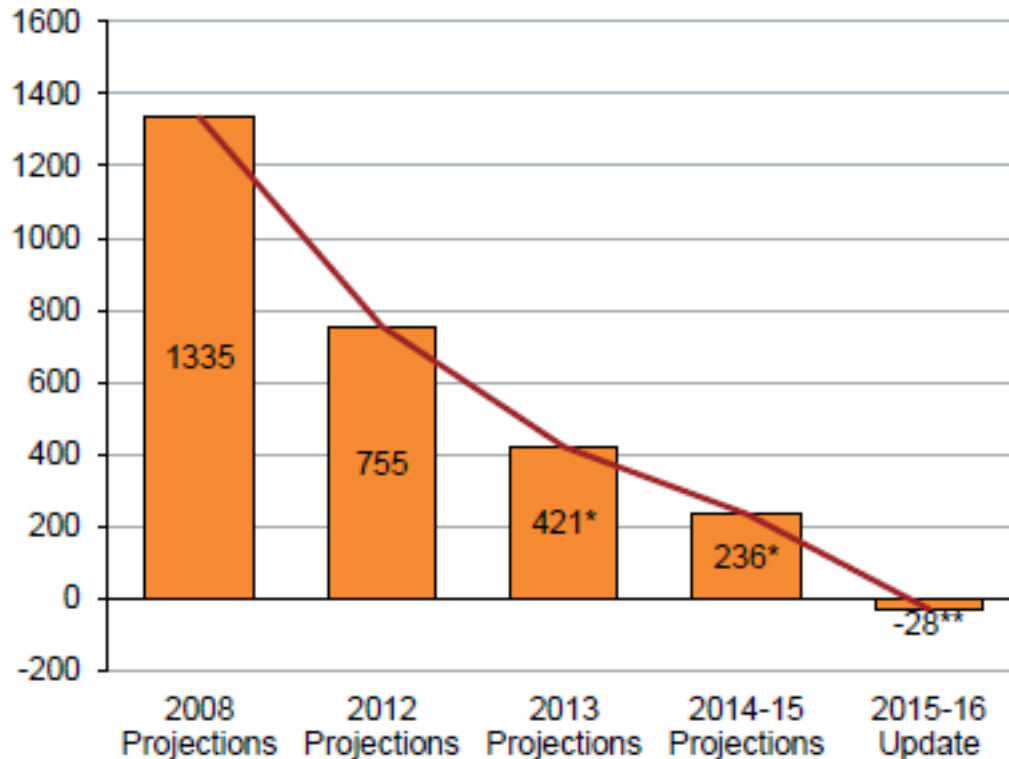


Sources: Department of Environment (2015a); Department of Environment (2015c); Grattan analysis.

Australia's Targets

Source: Grattan Institute 2015, p.8

Figure 1.3: Estimates of Australia's 2013 to 2020 abatement task have fallen over time
Mt CO₂-e



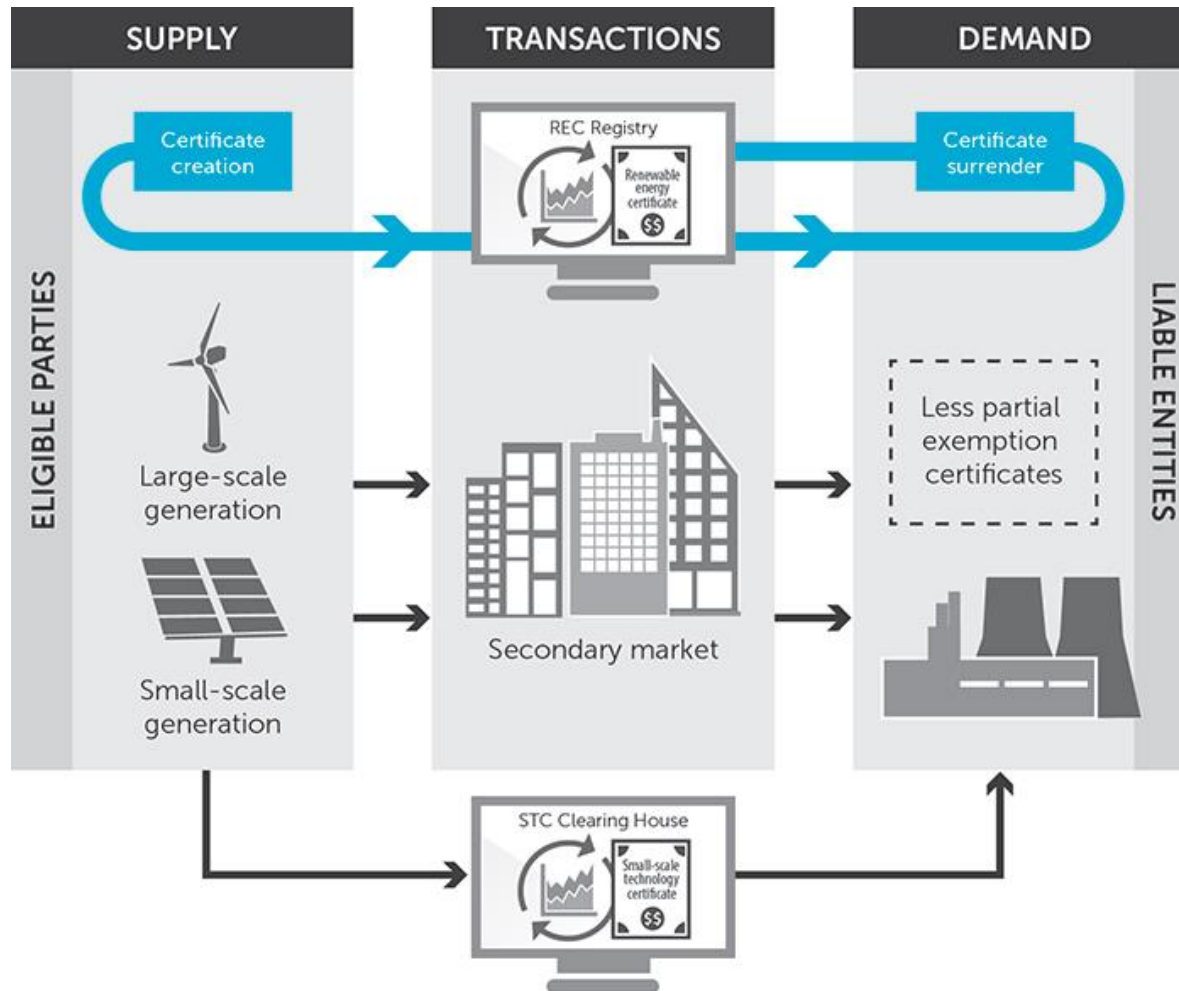
Notes: *Inclusive of Kyoto carryover and voluntary action. Voluntary action is additional to the abatement task. **Inclusive of Kyoto carryover, Emissions Reduction Fund abatement, waste protocol international units and voluntary action.
Source: Department of the Environment (2015a)

A brief history of climate change policy in Australia

- Reducing emissions on the agenda – but little action for much of the past 25 years
- In 2001 the Commonwealth introduced the Mandatory Renewable Energy Target
 - Initially a target of 9,500 GWh of new generation or doubling of renewable generation from 1997 levels by 2020
 - Increased in 2009 to a 20 per cent share of supply by 2020
 - Operates through the creation of tradable renewable energy certificates (see market diagram)
 - Demand - wholesale purchasers of electricity (retailers) need to surrender a certain amount of certificates
 - Supply – large and small scale renewable energy projects

The renewable energy certificate market

See <http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/The-certificate-market>



A brief history of climate change policy in Australia

- In 2003 the New South Wales Government introduced the Greenhouse Gas Reduction Scheme
 - Intensity baseline and credit scheme for electricity retailers
 - Tradeable certificates created – NSW greenhouse gas abatement certificates (NGACs)
 - The target designated in per capita terms decreased from 8.65 t/CO₂-e in 2003 to 7.25 t/CO₂-e in 2007
 - If electricity retailers could not meet target they had to purchase NGACs or pay a penalty

A brief history of climate change policy in Australia

- In 2008 the Rudd Government attempted to implement the Carbon Pollution Reduction Scheme (CPRS)
 - Based on the Garnaut Climate Change Review (2008) recommendation of a cap and trade scheme
 - The target 5 per cent below 2000 by 2020
 - Auction of permits
 - Allowed offsets and permits created under Kyoto mechanisms
 - The scheme failed to become legislation three times during 2009 and 2010
 - This policy was a contributing factor in the Coalition leadership spill of Malcom Turnbull for Tony Abbott

A brief history of climate change policy in Australia

- In 2011, The Labor Government announced plans for a new cap and trade scheme, with an initially fixed price of carbon – the so call ‘carbon tax’
 - The fixed price of \$23 per tonne of carbon come into force in July 2012
 - Repealed in 2014
- This was replaced in 2014 with the Direct Action Plan funded by the Emission Reduction Fund (ERF)
 - A subsidy scheme to buy emissions reductions
- Carbon farming initiative 2011 (CFI) a policy designed to allow landholders the ability earn credits for storing carbon or reducing GHGs

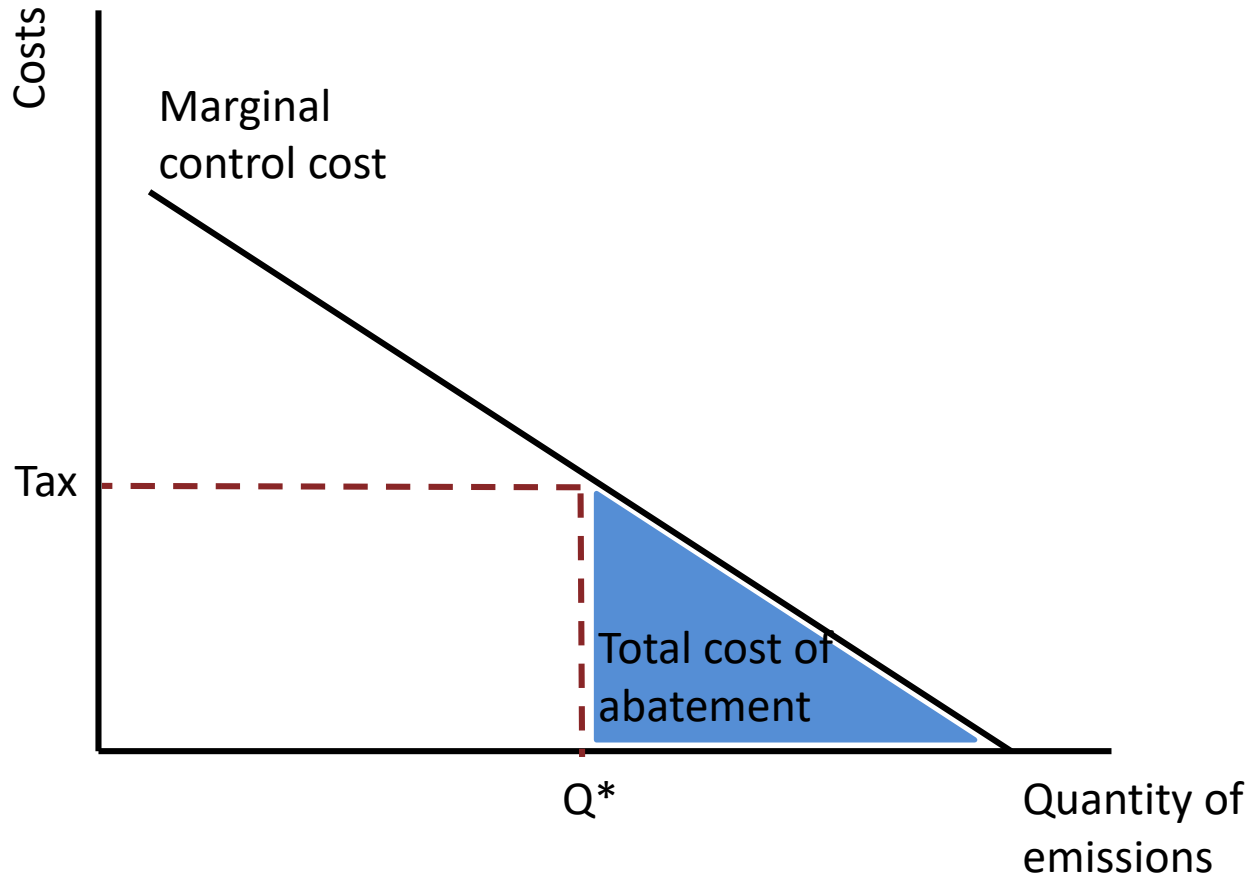
The Carbon 'Tax'

- In Australia a fixed price of carbon ('Tax') was applied between 2012 and 2014, although the original plan was a fixed price to 2015
- The fixed price was a precursor to a cap and trade scheme
 - \$23 per tonne of CO₂e rising by 2.5 cent per year
- After the fixed price period – prices determined in an emissions trading scheme
 - Price ceilings and price floors in the first 3 years to avoid price volatility
- Business liable to pay the tax:
 - Those emitting >25,000 tonnes of CO₂-e per year
 - Those importing and producing certain types of gas

The Carbon 'Tax'

- Other features of the scheme included using the tax revenue to compensate low income households for higher prices. This involved:
 - Income tax cuts, including an increase in the tax free threshold
 - Increases in pensions, allowances and benefits
 - In addition assistance to industry and a fund to invest in renewable clean energy
- A market based instrument leads to low cost reductions
 - Firms reduce emissions up to Q^* and pay the tax to pollute for further emissions,
 - That is firms abate up to the point where the marginal control (abatement) cost is equal to the tax

Carbon tax and cost minimizing reductions



The Carbon 'Tax'

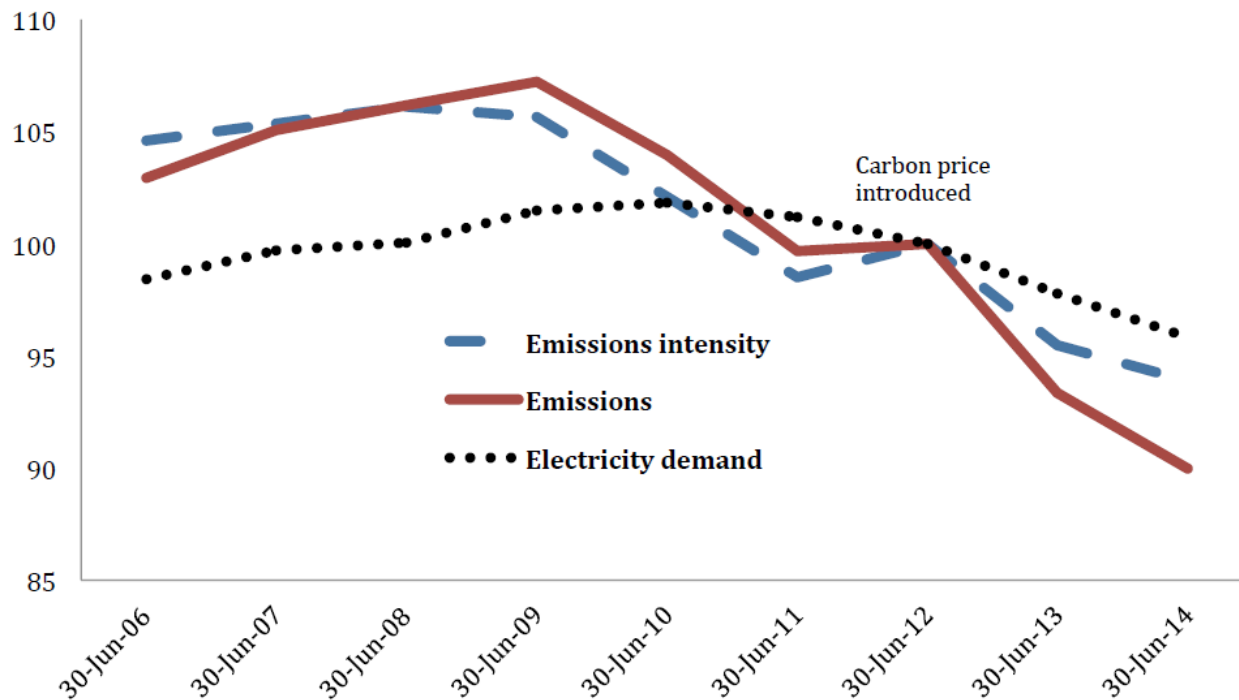
- Impact on emissions complicated as other factors also played a role.
- ANU report suggests the carbon tax increased (see <https://ccep.crawford.anu.edu.au/publication/ccep-working-paper/4388/impact-carbon-price-australias-electricity-demand-supply-and>):
 - Average 10 per cent increase in nominal retail household electricity prices
 - Average 15 per cent increase in industrial electricity prices
- The report estimates demand reduction attributable to the carbon price between 1.3 to 2.3 per cent of total electricity demand

Electricity Demand

Source: O’Gorman and Jotzo (2014) p.8

Figure 2: Electricity demand, emissions intensity of supply and emissions, 2005/6 to 2013/14

Index, 2011/12 = 100



The Carbon 'Tax'

- Estimates a reduction in the emissions intensity of power supply
- The impact attributable to the carbon price:
 - In 2012/13 between 5 to 8 million tonnes of CO₂ emissions or 3.2 to 5 per cent
 - In 2013/14 between 6-9 million tonnes of CO₂ emissions or 3.5 to 5.6 per cent
- The impact on investment in power generation has been limited as a result of uncertainty over the future of the policy

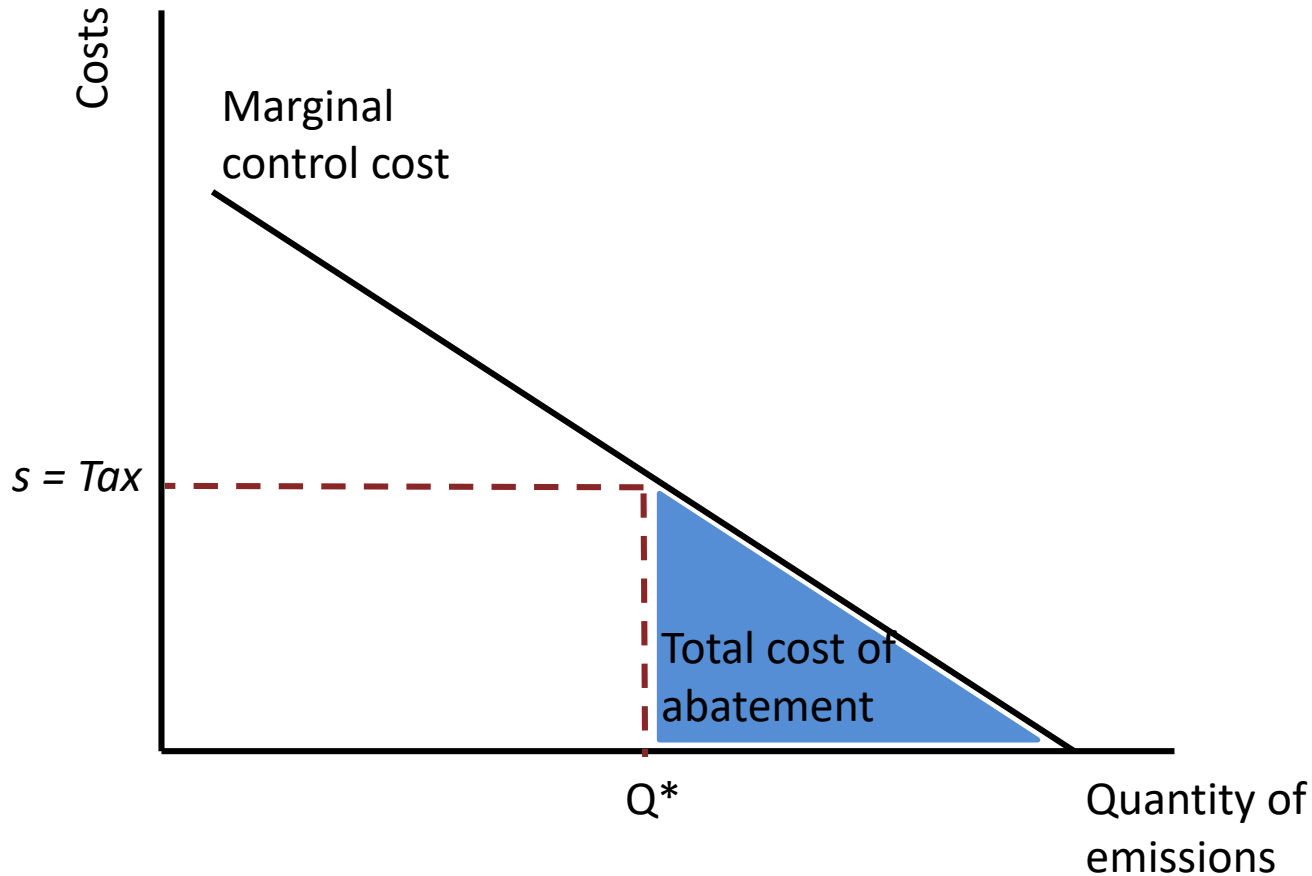
The Direct Action Plan (DAP)

- The DAP requires the government to buy emissions
- Following the repeal of the carbon tax the DAP become the main policy to reduce emissions
- The government committed \$2.55 billion to purchase emission reductions to meet the 2020 target (this is the size of the ERF)
- The Plan has three elements:
 - Emissions crediting by regulator
 - Emissions purchasing by auction of lowest cost reductions
 - Safeguarding emissions by establishing a baseline

The Direct Action Plan

- There have been three auctions so far:
 - The first in April 2015 – 47 millions tonnes of CO₂-e at an average price of \$13.95
 - The second in November 2015 purchased 45 million tonnes of CO₂-e at an average price of \$12.25
 - The third in April 2016 purchased 50.5 million tonnes of CO₂-e at an average price of \$10.23
- Theoretically it is expected that the emission reductions are achieved at the lowest cost.
 - Firms sell emission reductions to the government for the subsidy payments
 - They will continue to cut emissions up to the point where the marginal control (or abatement) cost is equal to the subsidy s

DAP and cost minimizing reductions



Efficiency revisited

- The diagram shows that a tax or subsidy should lead to the same level of abatement
- But note the level of abatement at Q^* depends on a number of assumptions:
 - No transaction costs
 - Firms and the government have complete information
 - Firms are profit maximisers
- In practice these assumptions will not hold but will also vary with the instrument choice – e.g. a tax, and ETS or a subsidy scheme like the DAP

Subsidy v Tax

- Economists typically favour a tax over a subsidy (see: <http://www.harryrclarke.com/2014/06/07/emissions-reduction-fund-analytics/>):

- The reasons:

1. Fiscally

- A tax yields revenue whereas the subsidy (DAP) costs government revenue.
- However the carbon tax claimed to be revenue neutral, that is higher prices as a result of carbon tax offset by income tax cuts etc
- Double dividend of taxes, that is, taxing a bad like pollution and reduce distorting taxes on income

Subsidy v Tax

2. Implementation

- Both require monitoring costs but a subsidy requires the establishment of a baseline
- The baseline requires emissions be additional to business as usual and not just emissions that would have happened in any case

3. Time frame

- Concerns over whether firms sustain reductions in emissions in the future

4. Non-equivalence

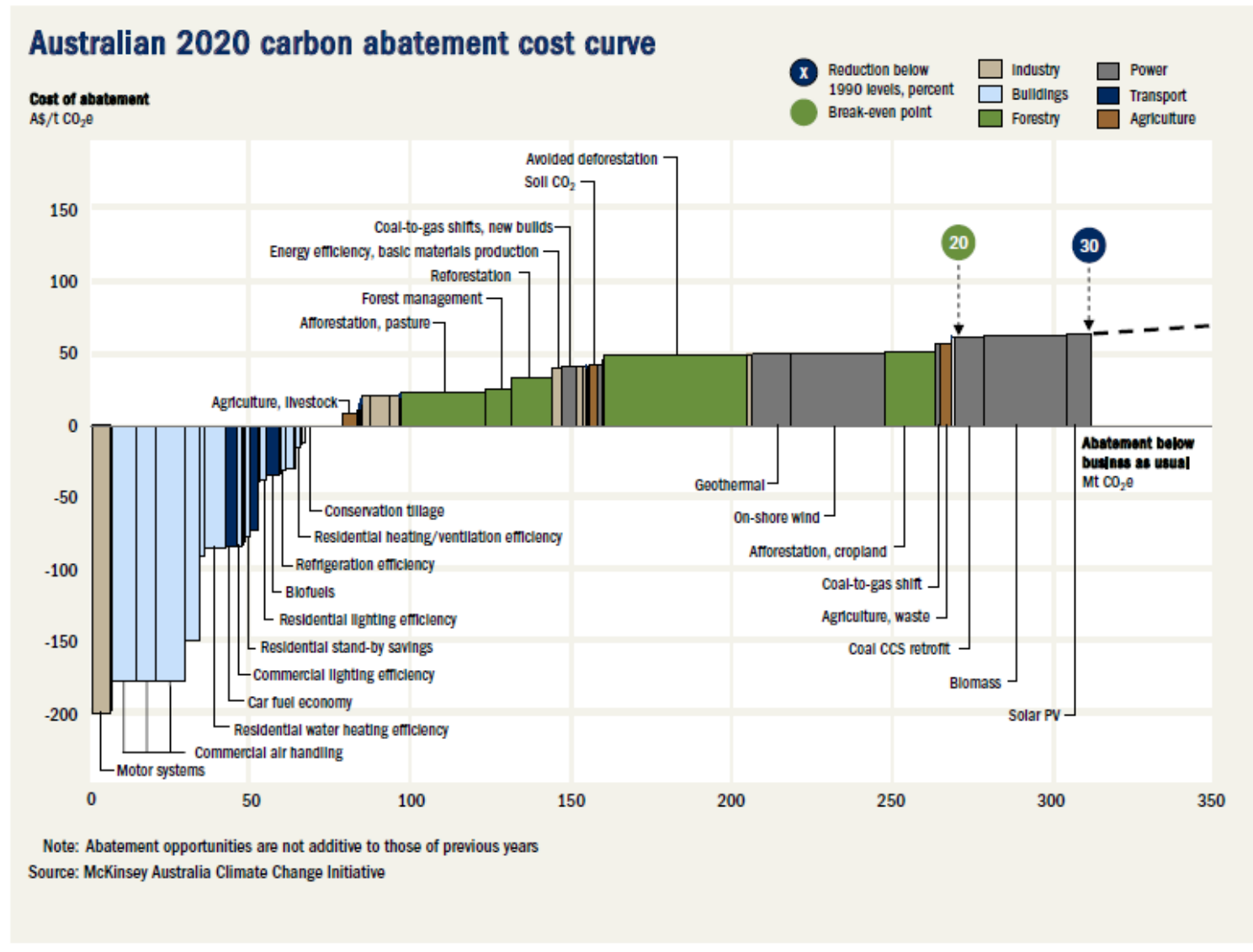
- Under a subsidy scheme there are reduced incentives to exit an industry compared to incentives under a tax

The Direct Action Plan Criticism

- A key criticism is the extent to which projects funded provide additional abatement as the regulator cannot know true counterfactuals (see Burke 2016)
- It is argued that *anyway* projects such as (see carbon abatement cost curve):
 - Upgrading lighting in supermarkets
 - Committing to not clear land (when no intention existed)
 - Updating a car fleet with fuel efficient cars (to save fuel costs)
- These project would have occurred *anyway* but are funded because of an information asymmetry
 - The key problem is the government's ability to accurately estimate baseline emissions

Costs of GHG abatement 2020 (Source: McKinsey and Company 2008)

Exhibit 4



The costs of greenhouse reduction

- The abatement cost curve indicates:
 - Significant reduction in GHG reductions are achievable
 - Many opportunities for 'negative-cost' reductions
 - The long-term marginal cost of abatement is likely to be around \$60-\$70 per tonne of CO₂-e
- A more recent cost curve shows:
 - Social costs, that is costs to the whole Australia economy are estimated
 - Still significant opportunities for negative social cost reductions mostly in transport and electricity

Costs of GHG abatement 2030 (Source: Energetics 2016)

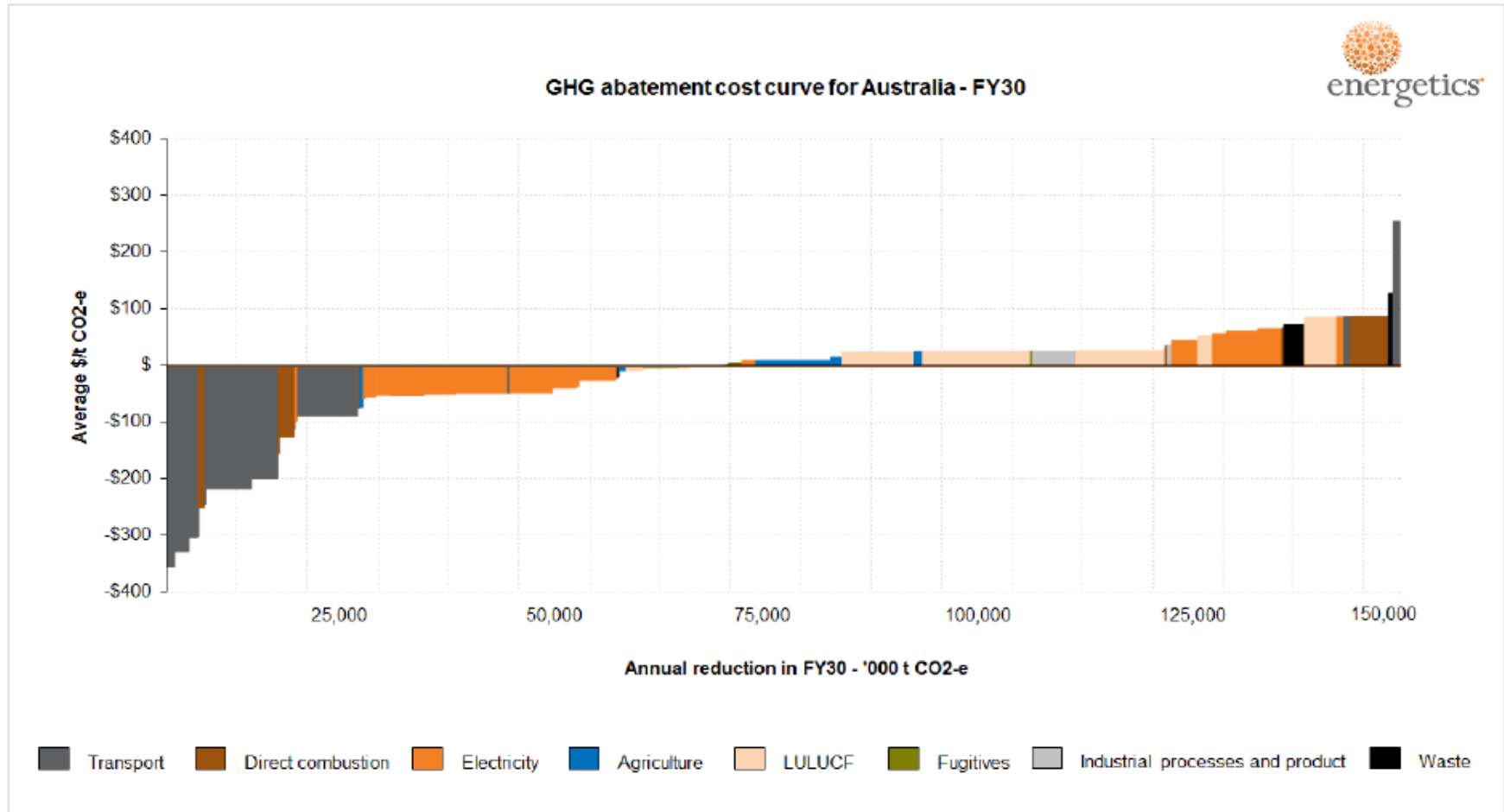


Figure 13: Australian 2030 abatement cost curve

Thank you