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Progress with Carbon Markets

Michael G. Pollitt

Cambridge Judge Business School

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Basic Thesis

- The policy solution to excessive emissions of GHGs is well established:
  - In theory
  - In (very large scale) experiments
- The policy community (a.k.a. climate scientists) should stop suggesting that we do not know what to do about climate change. In 2014 we spent $11.7bn p.a. on RES RD+D and in power global RES investment is closing in on global fossil investment (UNEP/BNEF, 2015).
- We should (simply!) implement a reasonably comprehensive set of quantity restrictions on CO2e, building on EUETS experience.

Outline

- A global carbon market?
- The EU ETS: Progress and Prospects
- The Australian Carbon Tax Lessons
- US Regional carbon market initiatives and recent EPA announcements
- Chinese carbon markets

Basic facts of carbon markets

- Carbon markets have most value in the early stages of decarbonisation. They help with:
  - the mix of sectors to decarbonise
  - the mix of existing low carbon technologies per sector
  - the mixing demand side reduction and substitution
  - guiding consumer and climate NGO pressure.

- They are about identification of low cost decarbonisation within a general equilibrium (i.e. multiple interconnected markets) setting.

Basic facts of carbon markets

- Many don't like carbon markets precisely because they deal so effectively with the general equilibrium issues.
- They are transparent and highlight:
  - Differences between included and non-included parties
  - Incidence of final costs and prices, especially to consumers
  - Financial flows within and between countries
  - The cost impact of political interventions
  - Lowest cost interventions and restrain special interests
- Basically, political opposition to the use of carbon markets is based on the fact that they do work in a predictable way.

A global carbon market?

- What are the characteristics of a global market?
- All that needs to be true is that markets are interconnected enough for major price differences between significant regions to be arbitraged.
- This does not require a single trading platform or integrated regional platforms (as for oil, or foreign currency).
- It can involve a combination of markets and administered prices (i.e. taxes).
- Over time price convergence is likely, though not certain, if costs of non-alignment are large.

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A Global Carbon Market?

Basic parameters:

- Global carbon market:
- 49,000 m tonnes CO_2e in 2014
- *$100 per tonne CO_2e (true cost of carbon?)
- =$4900 bn per year
- *In reality perhaps 10,000 m tonnes at $80 per tonne, with 10% traded = $80 bn p.a. traded (memo: Aid budget: $135bn)*
- For comparison: Global oil market:
- 85 million barrels per day
- * 365 days * $100 per barrel
- = $3102 bn per year

Basic Numbers for carbon markets

- There are c.190 states in the world
- G20 + Spain = 85% of world GDP
- G20 + Spain = 77% of world CO_2e (exc LUCF)
- Plus next 10 country emitters =85% of world CO_2e

- The EUETS has 31 countries participating.
- Of the G21, 6 (inc. EU) are in the EUETS.
- Of the OECD-34, 21 are in the EUETS.
- Of the rest many are in the spheres of influence of the largest 31 emitting countries.
- This is not primarily a problem of negotiation.

Why coordinating on price is better than on quantities

- If the slope of the MC curve is steeper than the slope of the MB curve, then better to set tax than set quantity if there is uncertainty in MC curve (Weitzman, 1974).
- ***But…***
- There is a lot of uncertainty in the marginal benefit curve (i.e. we don't know where the climate damage effects exactly kick in or how world society would adjust if they did).
- If the marginal cost of abatement is actually well defined / lower than we predict then unlikely that mistake in quantity worse than in price.
- The Weitzman thesis ignores the fact that quantities would be tightened over time, leading to incorporation of learning on position of curves.

Why coordinating on quantities is better than on prices

- *Some different theory:*

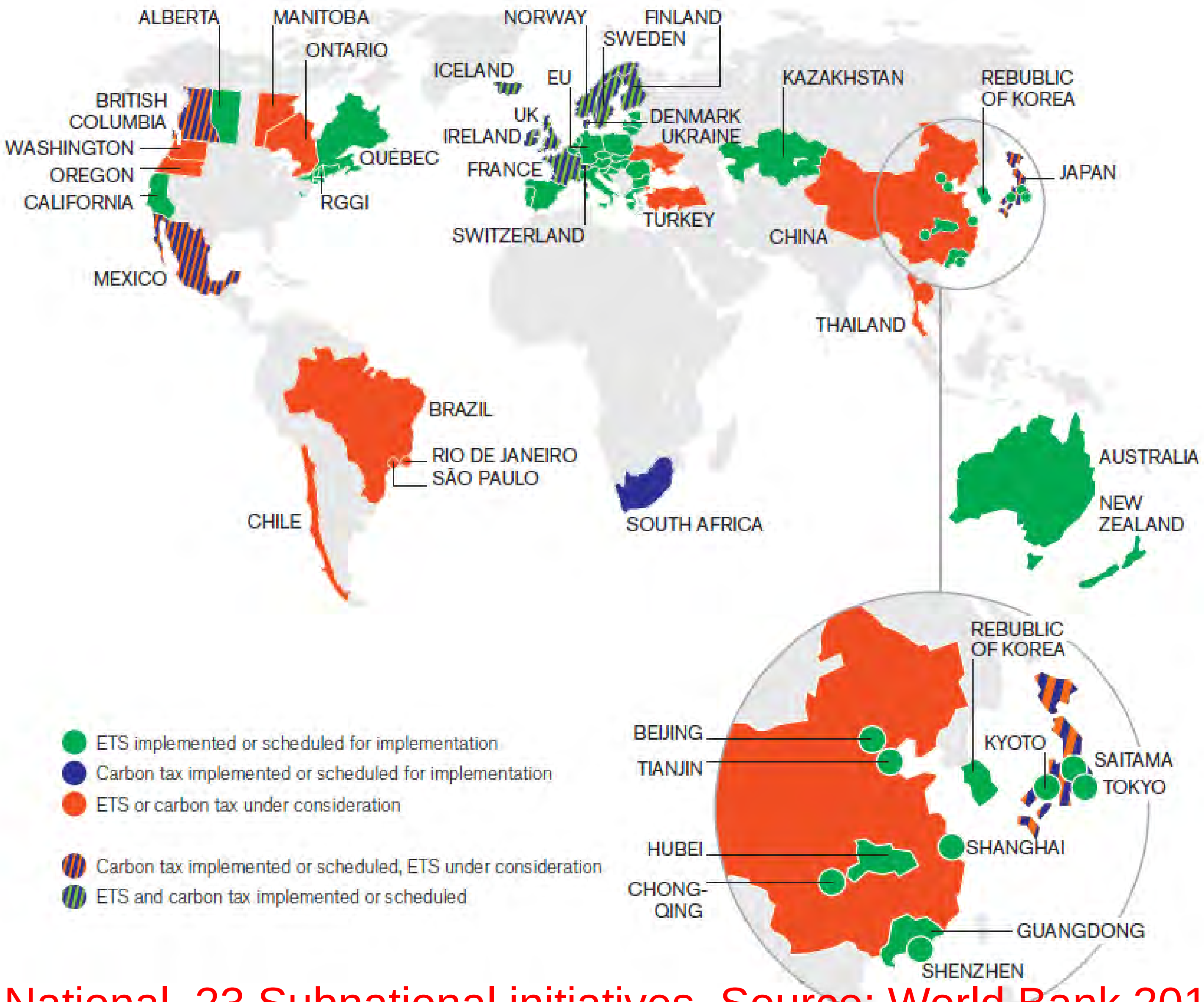
- *Climate Science* can and does frame the problem as being about the specific quantity of GHGs emitted (e.g. Max = c.1000 GTC) (e.g. Allen et al., 2009). Quantity limitation coordinates the economic framing and the scientific framing.
- *Legal precedents* especially on ownership and sovereignty must be respected. Tradable quantities with initial allocations of pollution rights are consistent with the current basis of property rights and trade in a way that a coordinated tax rate is not.

Why coordinating on quantities is easier than prices

- *A lot of evidence:*

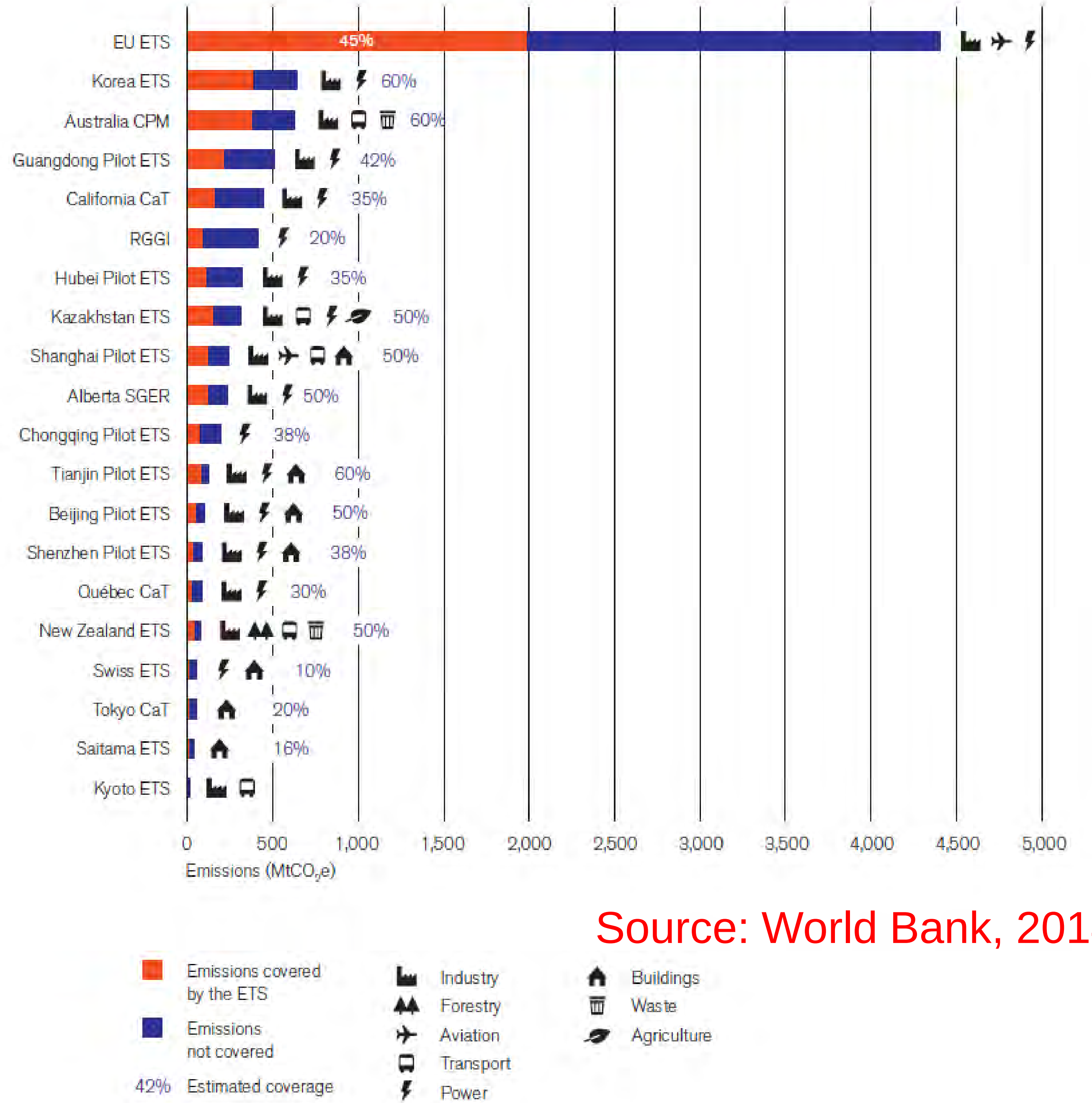
- The EU could not agree on a carbon tax but could on a trading system.
- No example globally of any exact coordination on taxes.
- Taxes difficult to adjust and coordinate within countries.
- Energy taxation on different fuels shows wide variance within and between countries…
- Specifically vested interests find it easy to keep taxes at a low level or gain lots of exemptions, due to lack of transparency…
- Carbon taxation has had only limited application and proved domestically controversial…

Figure 4 Summary map of existing, emerging, and potential regional, national and sub-national carbon pricing instruments (ETS and tax)



39 National, 23 Subnational initiatives, Source: World Bank 2014, p.26.

Figure 13 Regional, national, and sub-national emissions trading schemes: scope



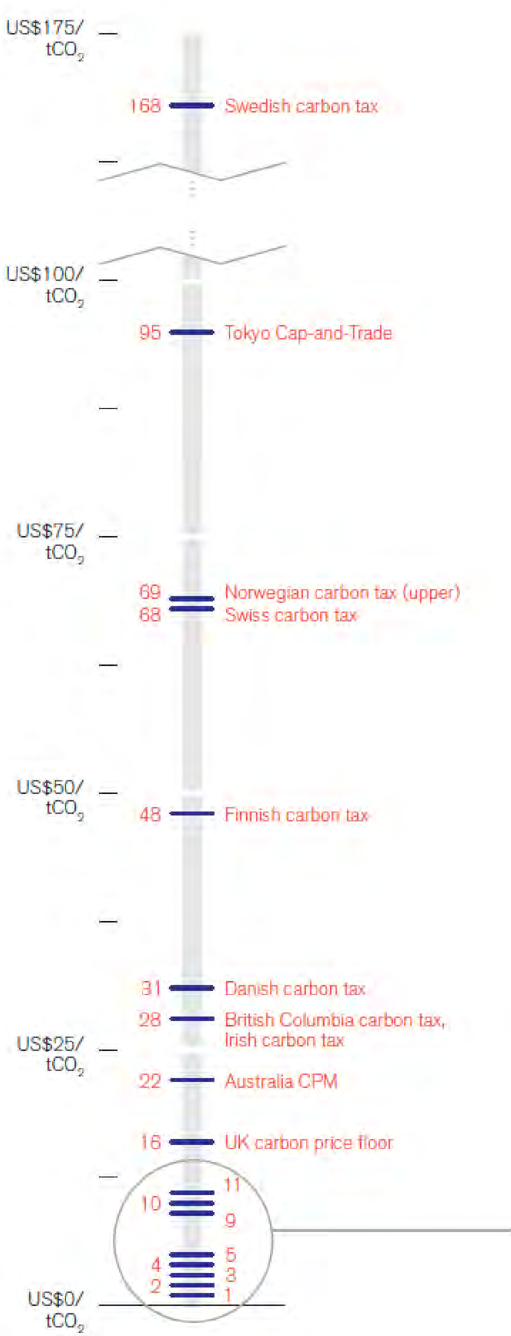
Source: World Bank, 2014, p.52.

Carbon markets – coverage 2013

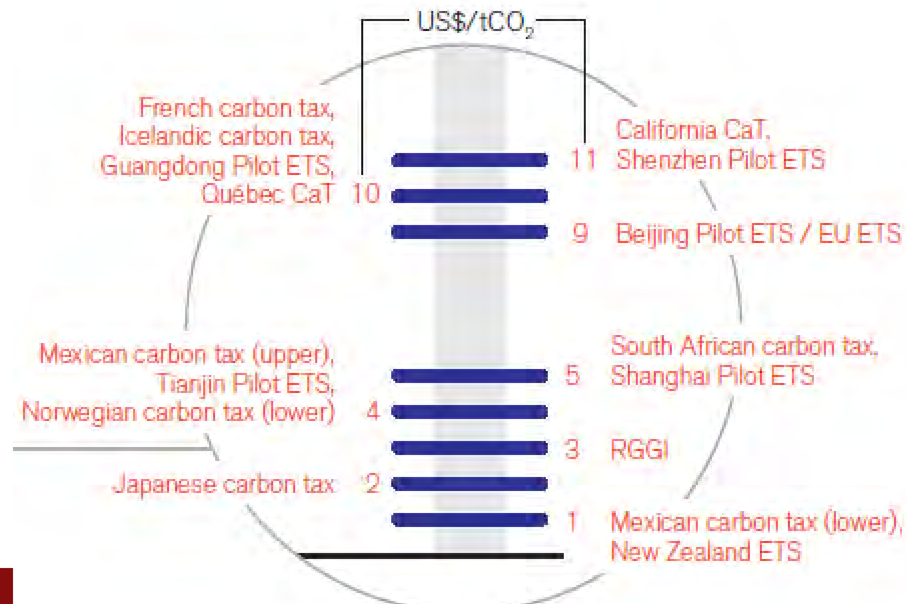
• EUETS	2084 mt p.a. (2013)
• China	1115mt p.a. (2013-14)
• Australia (tax)	283 mt p.a. (2012-13)
• California-Quebec	184 mt p.a. (2013)
• RGGI – Eastern US	165 mt p.a. (2013)
• Kazakhstan	147mt p.a. (2013)
• New Zealand	31 mt p.a. (2011)
• Switzerland	3 mt p.a. (2013)
• UNFCC – CDMs	350 mt p.a. (2013)
• Total:	c.9% of global emissions

World Carbon Prices

Figure 5 Prices in existing carbon pricing schemes



Source: World Bank, 2014, p.32.



Carbon markets – prices (as of 01/07/15)

- EUETS 7.46 Euros / tCO_2
- California-Quebec 12.29 USD / tCO_2e
- RGGI 5.50 USD / tCO_2

- Total coverage of all carbon pricing 12% CO_2e
- Total value of all carbon pricing c.$30bn p.a.

- Memo:
  - Fossil Fuel subsidies globally, $548bn in 2013.
  - Renewable Subsidies globally, $121bn in 2013.

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EU ETS – price history

Source: http://www.eea.europa.eu/data-and-maps/figures/eua-future-prices-200520132011/eua-future-prices-200520132011-eps-file/image_original.

Evolution of EU ETS rules

- Now an EU wide cap with allocations of auction shares.
- Free allocations, now only residual to trade impacted sectors.
- Increasingly using linkage rather than offsets.

- However substantial overhang of allowances, banked for future use.

EU 2030 Targets

- from EU Commission:
  - 40% reduction in GHG emissions (relative to 1990)

    = 25% reduction from 2020 target in 10 years

    ⇒43% reduction of ETS sector relative to 2005
  - EU-wide RE target of 27%
    - Unclear enforcement; Delivered by GHG reduction

    (with Energy price + premium and auctioning)
  - Energy Efficiency target of 27% relative to business as usual (up from 20% in 2020)

A setback in the outback: Australian carbon tax

- Introduced in July 2012 at AUD 24.15 (c.16 Euros) per tonne CO2e, with view to move to cap and trade in July 2015. Coverage: 60%.
- Conservative led government wins with mandate to abolish carbon tax.
- Robson (2014) gives an interesting analysis of the failure of the Australian carbon tax, suggesting that other measures (such as subsidies to renewables) might have been more effective.
- Taxes clearly not superior to cap and trade: no policy certainty and the basic economics was not effected by price volatility.
- Starting at low carbon prices has political advantages. The initial price was high for an energy intensive open economy.
- Although the fiscal transfers were poorly targeted.

US progress? Under Clean Air Act (Palmer, 14)

- 2007 Mass v. EPA – Supreme Court affirms EPA authority to regulate under Clean Air Act
- 2009 Endangerment and Cause or Contribute Findings
- 2010 Settlement Agreement Between State Petitioners, Environmental Petitioners, and EPA
- 2011 (I) Mobile source standards -- 5%/yr improvement to 35.5mpg fleet avg. in 2016; 54.5 mpg by 2025
- 2011 (II) Construction permitting -- implementation by the states
- 2014 (III) Stationary sources -- performance standards for new and existing (proposed) electricity generators (32% of emissions). Proposes State level Goals (Adjusted MWh-Weighted-Average Pounds of CO_2 per Net MWh) covering all Affected Fossil Fuel-Fired units
- In the meantime local, state and regional initiatives.

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US EPA Implementation…

- Policy is implemented by the States
- State plans due to EPA by 2016 (1 yr. extension allowed)
- Compliance period begins in 2020
- Multiple pathways for State
  - Rate-based or mass-based standard
  - Trading is possible but up to states
  - Must show equivalence to BSER
- Multi-state budget programs allowed
  - Two-year deadline extension for multi-state plan

US EPA Analysis…

- EPA's internal analysis finds the following:
  - Power sector CO_2 emissions fall 25-30% below 2005 levels in 2025 – a reduction of 18-25% relative to business-as-usual baseline.
  - Social costs of tCO_2: \$13, \$46, \$68, and \$137 (2011\$), under different discount rate assumptions.
  - Monetized benefits (3% discount) of B\$35 - 58 in 2020 & B\$58 - 93 in 2030 (2011\$)
  - Significant health benefits (more than half) attributed to other local and regional pollutants…
  - Total Compliance costs are \$6-9 billion; average costs of \$11-20 per tonne CO_2.

Chinese progress on carbon trading…

- China is now the World's biggest emitter of GHGs.
- NDRC (National Development and Reform Commission) indicates that China's climate change-related goals for 2020 include the following:
  - Reduce CO2 per unit of GDP by 40-45% relative to 2005.
  - Increase the ratio of non-fossil energy to the consumption of primary energy to 15%.
- In addition, goals to be achieved by FYP (five year plan) 12's completion, or the end of 2015, include:
  - Relative to the end of the end of FYP 11, reduce CO2 per unit of GDP by 17%.
  - Reduce national energy consumption per unit of GDP by 16% relative to the end of FYP 11.

- The intention is to move from local pilots to a national carbon market by 2016.

Table 16 Key characteristics of the Chinese ETS pilots

	Shenzhen	Shanghai	Beijing	Hubei	Guangdong	Tianjin	Chongqing
Carbon Intensity Target (2011–2015)	-21%	-21%	-18%	-17%	-19.5%	-19%	-17%
Total emissions of the region in 2010[399] $MtCO_2e$	83.4	230	110	306	541	155	131
Threshold	>20,000 tCO_2e	>20,000 tCO_2e	>10,000 tCO_2e	>60,000 tSCE	>20,000 tCO_2e	>20,000 tCO_2e	>20,000 tCO_2e
Entities covered in 2013[400]	635	191	490	138	242	114	N/A
Initial year allowances[401]	33 Mt	160 Mt	50 Mt	324 Mt[402]	388 Mt	160 Mt	N/A
Emissions covered %	38%	50%	50%	35%	42%	60%	35%–40%
Allocation (main approaches)	Bench-marking	Historical emissions + bench-marking (power)	Historical emissions + historical intensity + bench-marking	Historical emissions + bench-marking	Historical emissions + bench-marking	Historical emissions + historical intensity + bench-marking (power)	Historical emissions
Penalties	3x market price	10K–100K CNY	3–5x market price	3x market price	3x market price	N/A	2x market price
Offsets	10%	5%	5%	10%	10%	10%	N/A

Source: World Bank 2014, p.122.

Conclusions

- The idea of using the market to deliver carbon reductions is an potent one relative to the alternatives (of subsidies to low carbon technologies).
- It has had significant *apparent* setbacks in the EU ETS and in Australia.
- However the apparently intractable problems of getting US and China to participate in global emissions reduction are being addressed by locally delivered solutions which emphasise non-climate benefits.
- The policy instrument to solve the climate problem is not rocket science; economists worked out the policy answer to excessive emissions years ago. It is time for nation states to actually agree it is a problem and participate in a global market…

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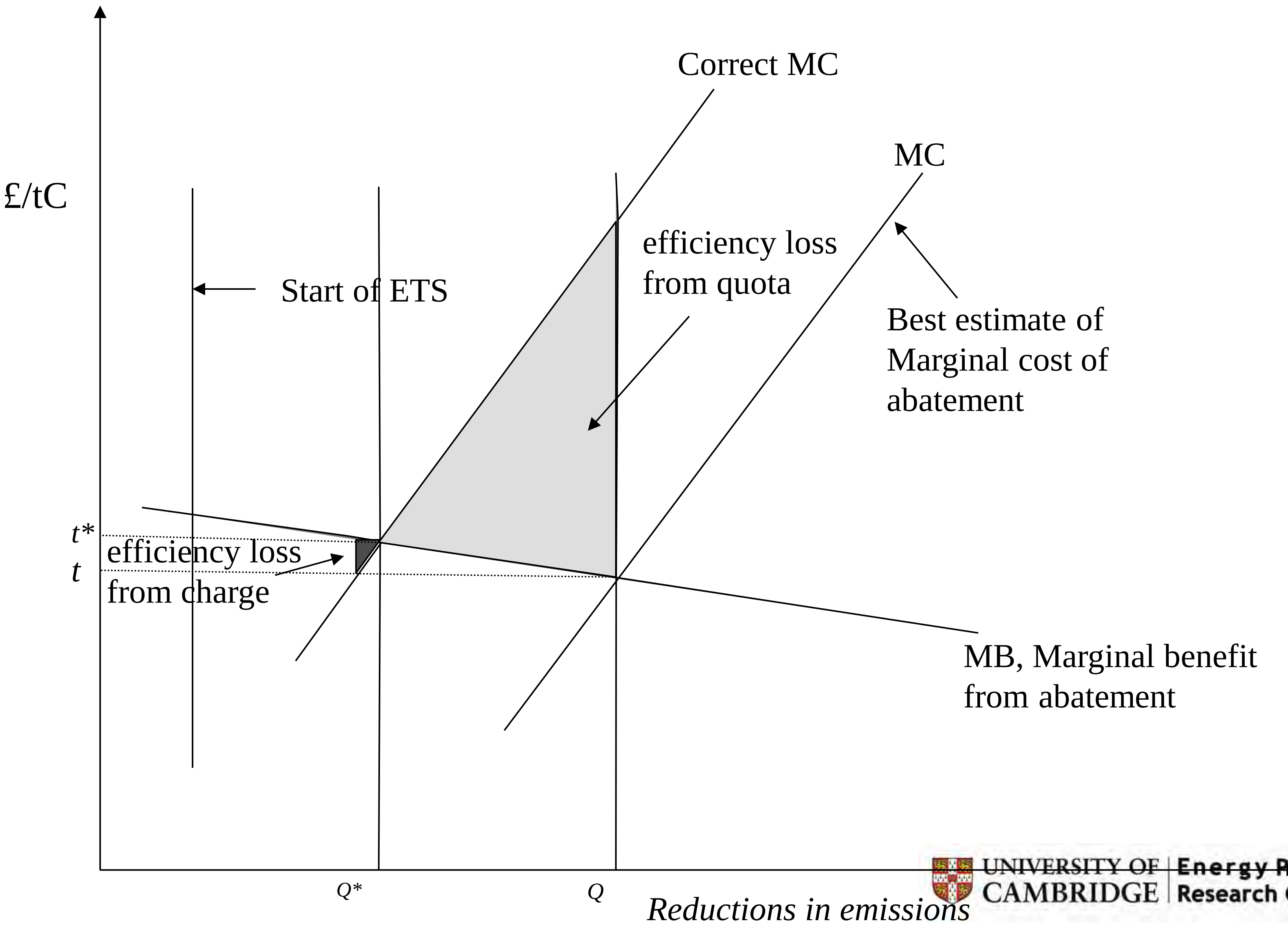
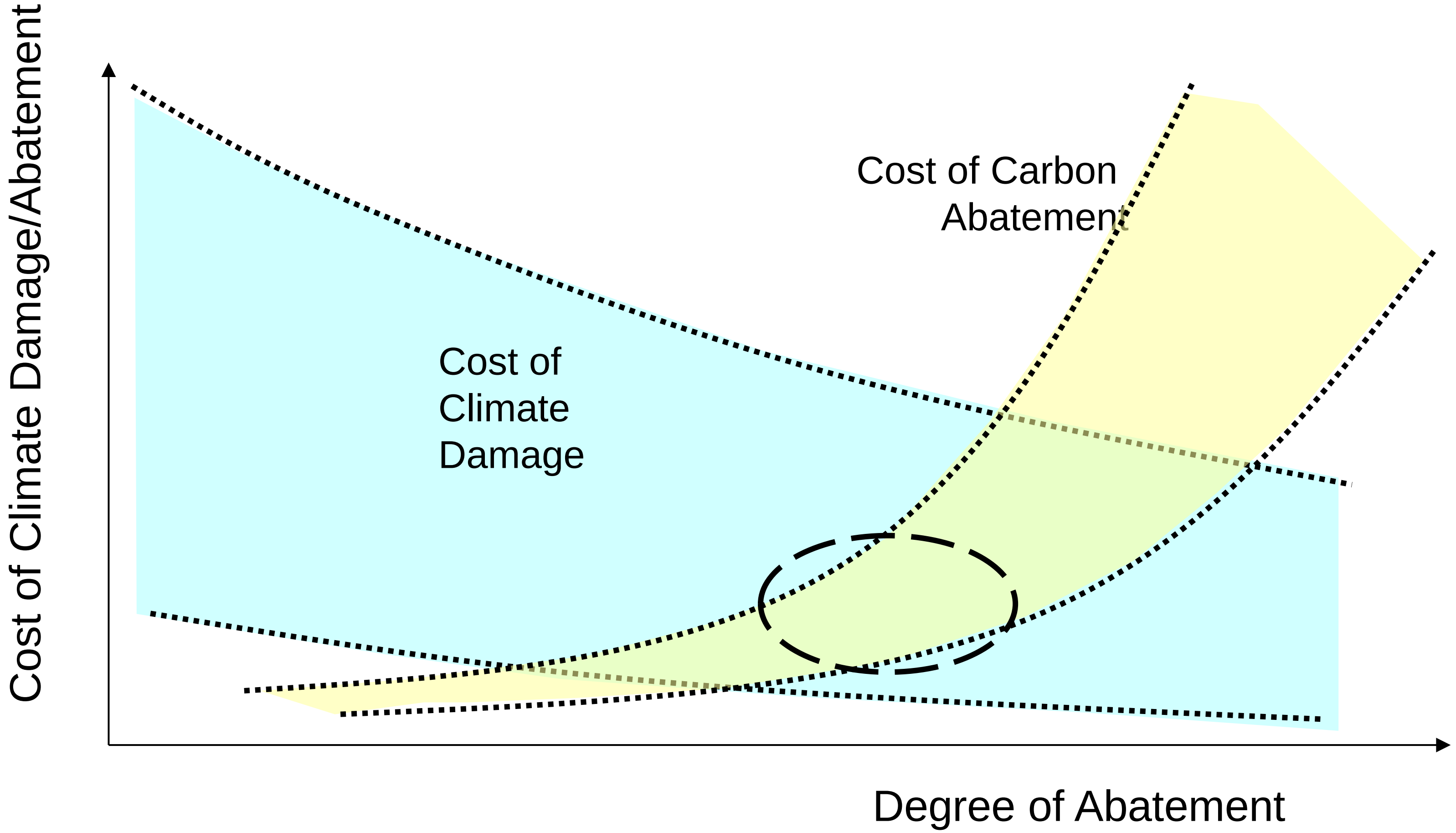
Reading

- Allen, M., D. Frame, C. Huntingford, C.D. Jones, J.A. Lowe, M.Meinshausen & N.Meinshausen, (2009) 'Greenhouse-gas emission targets for limiting global warming to 2^{o}C', *Nature* 458, 1163-1166. doi:10.1038/nature08019
- Environmental Protection Agency (2014), *Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants*, Washington D.C.: EPA.
- Grubb, M., Jamasb, T. and Pollitt, M. (2008) (eds), *Delivering a low carbon electricity system*, Cambridge: Cambridge University Press.
- National Development and Reform Commission (2013), *Market Readiness Proposal (MRP): Establishing a National Emission Trading Scheme in China*, February 2013, Beijing: NDRC.
- Palmer, K. (2014), *Climate Regulation in the United States*, Presentation at IAEE New York 17 June 2014.
- Robson, A. (2014), 'Australia's Carbon Tax: An Economic Evaluation', *Journal of Economic Affairs*, Vol.34, No.1, pp.35-45.
- UN Environment Programme and Bloomberg New Energy Finance (2015), *Global Trends in Renewable Energy Investment 2015*, UNEP and BNEF.
- Weitzman, M. (1974), 'Prices vs.Quantities', *Review of Economic Studies,* 41 (4): 477-491.
- World Bank (2014), *State and Trends of Carbon Pricing*, Washington DC: Ecofys, World Bank.
- World Resources Institute data at: http://www.wri.org/resources/data-sets/cait-historical-emissions-data-countries-us-states-unfccc

Weitzman argument: Costs of errors setting quantities

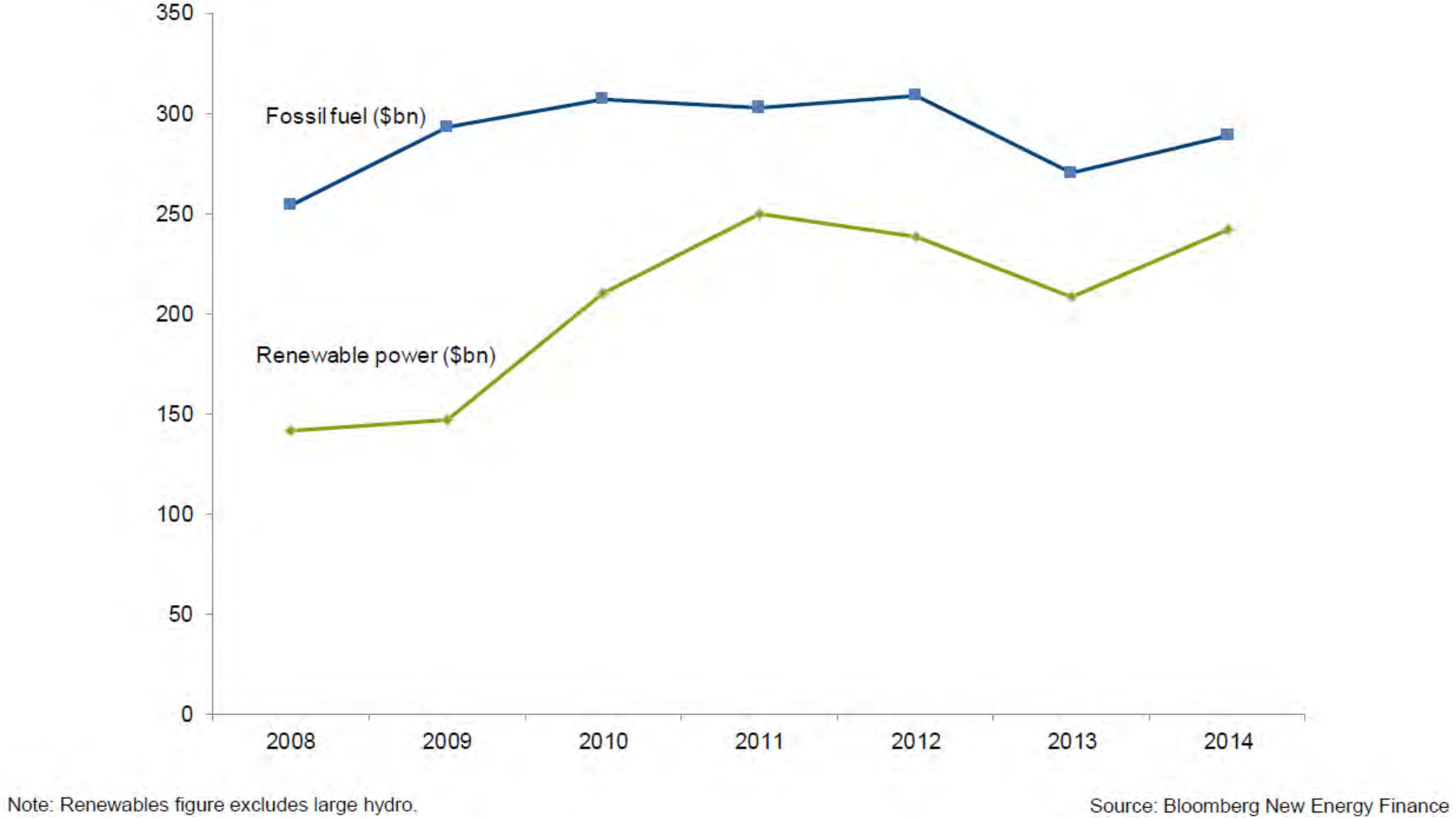


A better argument?
Prices harder to identify than dangerous quantity



Source: Grubb et al., 2008., p. 282, Fig 11.1

An energy transition: global trends in power sector investment



Source:
UNEP/BNEF (2015) *Global Trends in Renewable Energy Investment*, 2015, Slide Pack, slide 13.

Global R&D in Renewables

Figure 54

R&D investment in renewable energy, 2004-2014
$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CorpR&D	3	3	3	3	4	4	4	5	5	7	7
GovR&D	2	2	2	3	3	5	5	5	4	5	5
Total	5.1	4.9	5.3	6.2	6.8	9.4	8.9	9.8	9.4	11.5	11.7
% Growth	-	-4%	8%	15%	10%	38%	-4.8%	9%	-4%	22%	2%

Footnote:
<none>

Source: **Bloomberg, Bloomberg New Energy Finance, IEA, IMF, various government agencies**

Source:
UNEP/BNEF (2015) *Global Trends in Renewable Energy Investment*, 2015, Chart Pack, Figure 54.