Emission Trading Schemes

Energy Economics Summer School
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Externality

• Recall problems associated with horse-based transport, then air pollution associated with coal use, and today global concern with climate change associated with GHG emissions.

• Economists recognised problem of “uncompensated impacts” (external costs) associated with production and consumption
  - Pigou proposed taxation
  - Coase proposed defining rights
Basically two approaches

Tax

Rights based

Emissions

$\quad$ marginal cost

Tax

Price ?

Cap

Emissions

marginal cost
Policy built around international commitment

- 1st Commitment period 2008-2012. Covered about 18% of global emissions. Participating countries committed to reduce their emissions by an average of 5% below 1990 levels. New Zealand's Kyoto Protocol target for the first commitment period (CP1) (2008–2012) was to return its GHG emissions excl. LULUCF to 1990 levels.
- 2nd Second commitment 2013-2020. NZ did not sign up to phase two and agreed to make voluntary reductions.
- Kyoto Protocol replaced by Paris Agreement in 2016.
UN Climate agreements

- The United Nations Framework Convention on Climate Change (UNFCCC)
- UNFCCC meet annually at the Conference of the Parties (COP) to confer on further reductions of emissions and increase environmental protection.
- Most recent COP 26, Glasgow
Government’s carbon tax proposal

Proposed a tax at NZ$15 a tonne CO2-equivalent emissions with a limit of $25 during the first commitment period.
Agriculture not initially included

OPPs! Public opposition

- In 2003 government planned to impose a methane tax on farmers
- Carbon tax abandoned
Dealing with acid rain - externality

- Sulphur dioxide (SO$_2$) and nitrogen oxides (NO$_x$) are primary precursors of acid rain, an externality associated with the power sector.
Tackling acid rain using cap & trade

• US EPA’s Acid Rain Program: initiated 1995, phased in with final cap 2010, sets a permanent cap on the total amount of SO\(_2\) that may be emitted by electric generating units
• World’s first large-scale cap and trade program – 3,200 power plants & created market for firms to buy and sell government issued allowance
• Final 2010 SO\(_2\) cap set at 8.95 million tons, a level of about one-half of the emissions from the power sector in 1980.
• Establish cap, allowance defined as a right to emit one ton of SO\(_2\), rules on banking, bilateral trades, brokers, any individual can participate, …
Outcomes of acid rain program

Annual Sulfur Dioxide Emissions, 1990–2020

1991-1994 data are not available for Sulfur Dioxide.
Turning to GHG emissions

- Cap & trade requires a common unit = CO₂ equivalence or CO₂-e
- Three main greenhouse gases (along with water vapour) and their 20-year global warming potential (GWP) compared to carbon dioxide are:
  - Carbon dioxide (CO₂): hangs around for 300 to 1,000 years.
  - Methane (CH₄): 100-year GWP is about 28 x CO₂ & persists for ~ decade
  - Nitrous oxide (N₂O): 1 kg of N₂O is about equivalent to releasing about 298 kg of CO₂, persists for around a century
- Water vapour is not considered to be a cause of man-made global warming because it does not persist in the atmosphere for more than a few days.
- Other GHG: sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs)
Marginal abatement cost

Positive marginal abatement costs: cost in $ per unit CO$_2$e removed – balance this up against market price of allowance unit

Negative marginal abatement costs: options provide net economic benefits => cost not likely to be a barrier to adoption.
CO₂-e marginal abatement cost curves for NZ

Cap-and-trade system

Source: https://www.solidarity-us.org/files/CapAndTrade.jpg
Benefits of cap-and-trade systems

- **Clear target of GHG emission quantity**
- **Cost-effectiveness**
- **Income from auctions**
- **Financial risk minimisation**
Initial allocation of emission rights

- CAP: freely handout, uniform allocation, etc.
- Auction:
  - One of oldest form of markets
  - Prominent role in public policy
  - Internet auctions – eBay, Trademe
  - Radio spectrum – NZ, US
  - Carbon emissions permits – NZ, EU
- Auction design
  - Carefully think about: mechanism, expected number of bidders, property rights being auctioned
Global growth in carbon pricing initiatives

2006

2021
Dynamic auction – ascending bid auction

- Ascending clock
- Bidders revise their bid based on information from previous round
- Open competition, reliable process for price discovery
- Auctioneer announces price (electronic) & bidders respond
Market design

• Scope and coverage of market
  – All sectors? Forestry? All gases?
• Participants trade rights to emit CO$_2$-$\text{eq}$
• What other options available to government?
  – Price ceiling
  – Reserve price
History of the EU ETS

• Phase 1 (2005-2007): Monitoring, reporting and verifying emissions

• Phase 2 (2008-2012): the first commitment period under the Kyoto Protocol (CDM and JI projects)

• Phase 3 (2013-2020): the second commitment period under the Kyoto Protocol
Early days: EU carbon emission permits

- Previously 10% of EU member permits were given out free
- In 2008 member state governments were allowed to sell off up to 10% of their allocation of permits
- UK government decided to auction 7%, covering the emissions of the power sector
- Buyers were largely banks which sell the permits to companies - such as electrical utilities - needing to top up their emissions quotas.
Price history of EU allowances & surplus

Source: Federal Environment Agency (UBA), DEHSt, based on Data from Thomson Reuters Eikon, ICE, EU KOM.
02.05.2018

Britain to restart auctions

- Despite Brexit Britain remained a member of Europe’s ETS during the transition period.
- Auction volumes set for calendar years 2019 and 2020
- Power stations, airlines and factories need to comply with regulations under the scheme which charges polluters for each tonne of carbon dioxide they emit.
- Analysts estimate Britain has around 110 million EU Allowances to be auctioned.
- The benchmark EU carbon contract 2019 was ~ €23.30/tonne
Auctioning under EU ETS (Phase 3)

- **88%** of the allowances to be auctioned in 2013 to 2020 are distributed to the EU Member States.
- **10%** are allocated to the least wealthy EU Member States as an additional source.
- The remaining **2%** is given as a 'Kyoto bonus' to Bulgaria, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia.
Phase 4 (2021-2030)

• **90%** of the allowances to be auctioned will be distributed to the EU Member States on the basis of their share of verified emissions.

• **10%** will be allocated to the less wealthy EU Member States.
Total revenues from selling ETS allowances

- **2012-2017**: 21 billion EUR (~ 3.5 billion per year)
- **2018**: 14 billion EUR
- **2019**: 14.6 billion EUR
Usage & approach by sectors

- From 2013-2018, up to 80% of revenues were used for climate- and energy-related purposes.
- Three main sectors:
  - **Power** generators had to buy all their allowances from 2013.
  - The **manufacturing** industry received 80% of its allowances for free in 2013 (annual decrease proportionately down to 30% in 2020).
  - The **aviation** sector had 15% of allowances in circulation.
Auction platforms

- 28 countries = 25 EU Member States + 3 EEA/EFTA countries auction their allowances on a shared platform (a joint procurement agreement was signed)
- Available/active platforms:
  - European Energy Exchange (EEX) in Leipzig
  - Poland is planning to have its own platform (using EEX in the meantime)
  - ICE Futures Europe (ICE) in London, UK
NZ ETS

- Key tool for meeting our domestic and international climate change targets, including the 2050 target
- The New Zealand Emissions Trading Scheme helps reduce emissions by doing three main things:
  - Businesses measure and report on their GHG
  - Businesses surrender one NZU to the Government for each one tonne of emissions they emit
  - Limits the number of NZUs available to emitters (supply)
- The Government sets and reduces the number of units supplied into the scheme over time.
- Minister considers price ceiling
NZ’s net position 2013-2020

<table>
<thead>
<tr>
<th>Total units</th>
<th>647.3</th>
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</thead>
<tbody>
<tr>
<td><strong>Emissions</strong></td>
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<tr>
<td>Stationary energy</td>
<td>17.9</td>
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<tr>
<td>Transport</td>
<td>14.41</td>
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<tr>
<td>Industrial processes</td>
<td>4.8</td>
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<td>Agriculture</td>
<td>39.4</td>
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<td>Waste</td>
<td>3.6</td>
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<tr>
<td>Tokelau</td>
<td>0.004</td>
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<tr>
<td><strong>Gross emissions</strong></td>
<td>78.6</td>
</tr>
<tr>
<td><strong>Net position</strong></td>
<td>6.3</td>
</tr>
</tbody>
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Future limits

Minister to consider price floor & Price ceiling

- Auction managed by NZX and EEX. The NZ Emissions Trading Scheme
- Auctions for New Zealand Units (NZU) are held quarterly.
- Any NZ Emissions Trading Register Account Holder can participate in the auctions
- Price floor is the minimum price (NZ$20) that NZUs will be sold for at auction.
- Cost containment reserve (currently $50) aimed at dampening the overall NZU auction price => offering more units (supply) if exceeded.
Auction results

• Confidential reserve price

• Clearing price of $53.85

• Entire CCR volume 7.0 million NZUs was purchased with a consequent increase in the clearance price above the $50 trigger price.
Price history through 2018

https://www.carbonnews.co.nz/tag.asp?tag=Carbon+prices#

Summary

• Until recently NZ’s path characterized by uncertainty, carbon tax that failed, cap & trade system with no cap, limited coverage, free allocations, tied to international markets, ...
• Recent legislation has greatly improved design with finite caps, forward looking limits, auctions to allocate rights,...
• Cost containment measures in place.
• Introduction of complementary laws & institutions, such as CCC.