

# CLIMATE AND ENERGY. POLICY, REGULATION AND MARKETS.

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# CLIMATE POLICIES. WHAT DOES ECONOMICS TELL US?

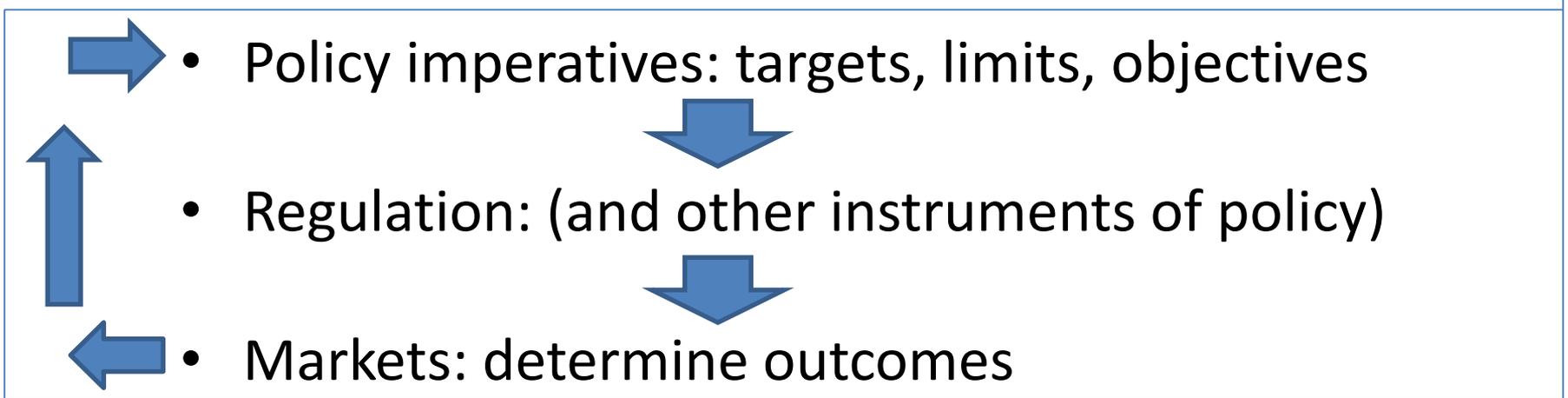
Policies often fail. Climate challenges may not offer “a second chance” in many instances, so what does economics have to tell us?

In particular **about ...** the potential for

Conflict, Blunder and Trainwreck



# CONTEXT: CLIMATE AND ENERGY POLICIES



**Conflicts:** real and imagined, with other objectives

*Blunders of our Governments.* Ivor Crewe and Anthony King.

**Trainwrecks** : blunders that get out of hand – poll tax, PFI, IT failures, ... Large and visible.



# CAUSES OF POLICY AND REGULATORY FAILURE

*Just a few of the more important*

- Cultural disconnect
- Operational disconnect
- Lack of flexibility
- Inconsistency
- Unpredictability
- Vested interest
- Complexity

- Market distortions + unintended outcomes
- Perverse incentives
- Failure to align objectives and targets
- Ideology



# THE PARTICULAR CHALLENGES OF CLIMATE POLICY

1. Scale of the externality. Potentially catastrophic.
2. Central and essential nature of energy implies multiple vested interests
3. Cumulative CO<sub>2</sub> makes choices irreversible. Option theory.
4. Very long time lags. Myopic tendencies and discount rates. The baked in effect..
5. Solutions necessarily collective and global. Creates political **and** ideological tensions at the outset.
6. Uncertainty plays badly with all the above. We are bad at comprehending and comparing risks.



# SIX PROBLEM AREAS

- **Carbon markets.** Taxes or cap and trade.
- Valuation of CO<sub>2</sub> for public policy. Werner Sinn and the **Green Paradox.**
- Competition law and climate **priorities.**
- **Discount rates** and the cost of capital.

..... and if we have time

- **Electricity wholesale markets.** Security and compatibility with low carbon technologies.
- Competition in **electricity retail supply.**



# 1. CARBON MARKETS.

- Problems in **costing** the externality
- Problems in **pricing** the externality
- Targeting price (taxes) or quantity ?
- Gain without pain ?
- Objectives. Less carbon intensive use of existing assets and low carbon investment.
- Should incentivise CCS – canary in the mine ?
- Border problems and leakage.
- Defining the market – scope and timescale.



# CARBON MARKETS. THE ETS

- Lobbying by special interests made initial targets too weak
- Lack of ability to respond flexibly to recession
- Further undermined by plethora of further national and EU wide initiatives
- Arguably time periods too short for investors
- Political inertia inhibits rapid adjustment
- Success on (undemanding) short term targets but failure to incentivise investment or initiate transformation.
- Vested interest, inflexibility, uncertainty, non-alignment of objectives and targets, market distorting initiatives, conflicting objectives ...



## 2. VALUATION OF CO2 FOR PUBLIC POLICY CHOICES

2014 Treasury Guidance continues to split valuation of emissions between:

- “market sectors” governed by ETS price expectations (assumptions)
- “non-market sectors” loosely based on social cost of carbon and significantly higher in short term.
- A logical approach for UK plc, but, for example, results in inconsistent treatment as between gas and electric heating choices



# AN IMPORTANT CHOICE



*Do I let go now or in ten years time ?*

# A POLICY CONUNDRUM

- *Suppose I have a large store containing thousands of tonnes of CO<sub>2</sub>, held under pressure in large corroding metal vessels. Technical experts have advised me that there is no means of permanently sealing the vessels, other than at prohibitive cost, but that I can at some modest expense treat the seals of the vessels in a way that will prolong their expected life from 6 months to 20 years, at which point there will be a slow leakage into the atmosphere, perhaps over a 10 year period. What should I do, given an objective of minimising adverse climate impact? Release now or delay ?*



# RELEASE IT NOW !

- *As carbon concentration in the atmosphere rises towards the long-term level implied by the stabilisation target, **the damage at the margin caused by further emissions – the social cost of carbon – will inevitably increase.** .... the appropriate price of carbon will rise over time. ... both the public and the private sector will need to take a view on the likely future path of the price of carbon when taking investment decisions regarding long-lived capital.*

Better Regulation Commission 2007

**WRONG**

- Getting rid of it now will also make it easier to meet future targets for **annual** emissions.

**IF CORRECT THEN WRONG OBJECTIVE.**



## BUT THE MARKET APPEARS TO AGREE

- the traded price of CO2 permits slumped to around € 10 a tonne or less in the current recession;
- proposed carbon floor prices indicate at least c. €35 - €50 a tonne to promote low carbon power generation.
- So we might assume that policies require a steeply rising carbon price, as caps progressively tighten.
- One interpretation. This answer- to produce a slowly rising price - was assumed in the design of the ETS and planned limits! Policy, regulation and markets intertwined!



# ADVANTAGES OF DELAY

- Adverse outcomes are lesser and later. Front end loading of reductions could postpone concentration milestones by decades.
- Lower emissions short term also create option value, both in mitigation and adaptation.
- Measures of social value, eg DECC/ Treasury, even with a relatively **low** 3.5% discount rate, attach a higher value to saving current emissions. (based on and confirmed by integrated assessment modelling).
- **Hence we should attach higher value to near term reductions in CO<sub>2</sub> emissions**



# THE GREEN PARADOX. A RESOLUTION.

- If producers/ users anticipate rising tax on carbon they will accelerate production/ consumption. (Werner Sinn/ Green paradox)
- Just so but a more “correct” valuation of emissions to reflect the science would be disincentive to current production/ consumption, and resolve the paradox.

.....

- Lessons from all the above. The dangers of bad economics, inconsistency, a science disconnect, market distortions.



# 3. COMPETITION KILLS CLIMATE POLICY



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PLAN, OR DOES IT?**

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# COMPETITION LAW. PUBLIC INTEREST DEFENCE

- Netherlands. closure of five coal power plants ... as part of a ... move towards cleaner energy
- ...in violation of the cartel prohibition.
- **Finding:** ... would not reduce CO2 emissions, as claimed, as the redundant emission rights would be sold on the open market and would therefore only be relocated.
- Correct analysis ? Or an unhappy synergy with a flawed ETS ?
- Policy conflict, unintended consequences, or ideology?



## 4. DISCOUNTING AND THE COST OF CAPITAL

### *Theory*

- In principle discounting should be about the time value of money (or utility/ welfare) and nothing else !
- Finance theory. Harry Markowitz and portfolio theory. Impact of risk on cost of capital should depend **only** on market-correlated or non-diversifiable “beta” risk. (Colloquially the CAPM model)
- Leveraging and debt/ equity ratios matter, and discussion often confuses return on equity with weighted average CoC (WACC).

# DISCOUNTING AND THE COST OF CAPITAL

## *practice and consistency*

- Use of higher rates as a tool to ration (public) capital (past UK Treasury practice) - intellectually lazy and will distort technology choices.
- Frequent use (including private sector) of high hurdle rates or payback to discount appraisal optimism, with similar potential to distort choices.
- But, policy application has to reconcile discount rate used for policy with “real” WACC rate demanded by markets.
- Stern attacked for choosing ultra-low discount rates.



# DISCOUNTING AND THE COST OF CAPITAL

## *Implications for low carbon projects*

- But decarbonisation as essential/ legally binding
  - ➔ market-uncorrelated zero beta
  - ➔ CAPM risk-free rate = govt. borrowing rate
- Government further removes non-diversifiable risk with contract guarantees
- So actual CoC for technology comparison and funding **ought** to be close to a (risk-free) government borrowing rate: currently  $\ll 2\%$



# DISCOUNTING AND THE COST OF CAPITAL

## *Implications for low carbon projects*

- Only residual risk for companies is construction risk
- So how do we square with high reported RoR negotiated for nuclear for example?
- Governments have poor record in managing risk transfer. Risk remains public; returns are privatised.
- Examples. PFI projects. Modernisation of London Underground and Metronet.
- **A policy worry and potential trainwreck. Factors in play: ideology, inconsistency, disconnects**



## 5. ISSUES IN ELECTRICITY WHOLESALE MARKETS

First the capacity problem:

- Wholesale markets build on concept of system marginal cost SRMC; price = SRMC
- SRMC revenue insufficient to pay for capacity
- Leads to scarcity market price or intervention
- Interventions; eg capacity auctions.
- But who determines capacity need and security standard? Additional issue for ETS



# POWER SYSTEMS IN A MARKET FRAMEWORK

- Large elements of real time central control retained.
- But in key areas of optimising, and deciding what plant runs, reliance on the functioning of a wholesale market
- The **merit order** ranks plant by variable cost
- Wholesale price “ought” to equate to “system marginal cost”, most expensive plant called on to generate
- Process relies on bids to “discover” costs
- Price gives right incentive signals to generate or not
- Merit order is a very simple optimisation algorithm, and a very simple “linear program”



# ASSUMPTIONS IMPLICIT IN CURRENT WHOLESALE MARKETS

## Big simplifying assumptions of merit order:

- each optimisation period, usually taken as a half-hour, independent of all past and future periods.
- The only relevant costs are the short term operating costs, essentially fuel costs.
- Those costs vary continuously and are linear in relation to level of output.
- In fact the merit order is an almost trivially simple example of linear programming optimisation
- But these assumptions all depend on the particular technical and cost characteristics of fossil-fired generation



# SOME MAJOR CHANGES IN THE LOW CARBON WORLD

- Plant with complex constraints and cost structures. Inflexibility. Higher cost penalties for load following. Examples in nuclear and possibly CCS.
- Storage options, such as large scale pumped storage or thermal storage, will grow in importance on the supply side.
- Demand side innovations mean that some consumer demands do not need to be met in real time, eg water or storage heating, or battery charging. So some demand can be postponed, equivalent to storage capacity on the supply side.
- Some plant, notably wind, may have stochastic characteristics; this too needs to be embodied in the operational decision making to ensure instantaneous balancing of supply and demand.



## IMPLICATIONS FOR OPTIMISATION ... ... AND HENCE FOR WHOLESale MARKETS

- No longer single period (quasi instantaneous) optimisation
- Non-linear constraints require much more complex algorithms to optimise.
- No longer a dual value that sets a price on the main constraint
- No meaningful prices ... an existence theorem; no prices exist that do what prices are supposed to do
- No means of discovering such prices even if they did exist

OPERATIONAL DISCONNECT



# RETAIL ELECTRICITY MARKETS

- Form of retail competition is a product of an imposed regulatory and market design
- Current framework is electricity as a pure commodity. Is competition working?
- Future power systems likely to be designed around demand management.
- Real value of competition will be in promoting innovative supply and service packages



# CONCLUSIONS

- Effective policy should depend on careful economic analysis, not on ideology.
- Markets as powerful instruments; avoid poor alignment between instruments and objectives
- Climate issues pose unique challenges in terms of scale, externality, timescale, irreversibility, **and** analysis

