A BIG problem with many diverse decision-makers and levels of decisionmaking

- The valuation problem
- Energy and emissions – some context
- Pricing carbon – our historical experience
- Three Domains and Three Pillars
- Policy stability and integration
- Strategic implications and conclusions
… drawing on a big book that tries to develop an integrating approach to climate policy

- Nature of the challenge
- Some key observations in energy & climate
- The Three Domains and Three Pillars of Policy
  - Pillar I: Standards and Engagement
  - Pillar II: Markets and Pricing
  - Pillar III: Strategic investment
- Policy Integration
- Strategic implications and conclusions

http://climatestrategies.org/projects/planetary-economics/
for information and register of related events.
Energy involves multiple decision-makers taking diverse decisions for quite different reasons

<table>
<thead>
<tr>
<th>Type of investment</th>
<th>Organisational or behavioural change</th>
<th>Product/Project</th>
<th>Strategic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision-maker</td>
<td>Principal decision factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individuals and consumer-facing organisations</td>
<td>Attention, habits, anchoring</td>
<td>Price &amp; payback, Values or Brand</td>
<td>Expectations</td>
</tr>
<tr>
<td>Corporate</td>
<td>Outside drivers (Consumer, competitor, regulator)</td>
<td>Price &amp; payback time / market discount rates</td>
<td>Strategic competition / market trends and scale expectations</td>
</tr>
<tr>
<td>Public authority</td>
<td>Political priorities, targets or legal mandates</td>
<td>Price, hybrid public-private discounting</td>
<td>Strategic targets, public discounting or sustainability assessment</td>
</tr>
</tbody>
</table>
Prelude: three levels of risk conception ..

<table>
<thead>
<tr>
<th>Risk Conception</th>
<th>Basic Belief</th>
<th>Typical Strategy</th>
<th>Societal process</th>
<th>Time-scale of climate change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indifferent or disempowered</td>
<td>Not proven, or “What you don’t know can’t hurt you”</td>
<td>“Ignorance is bliss”</td>
<td>Environmental group campaigns vs. resistance lobbying</td>
<td>First few decades of climate change</td>
</tr>
<tr>
<td>Tangible and attributed costs</td>
<td>Weigh up costs and benefits</td>
<td>Act at costs up to “social cost of carbon”</td>
<td>Technocratic valuation and politics of pricing</td>
<td>As impacts rise above the noise – next few decades</td>
</tr>
<tr>
<td>Disruption and securitization</td>
<td>Personal or collective security at risk, climate change as a “threat multiplier”</td>
<td>“Containment and defence”</td>
<td>Mitigate as much as practical and adapt to the rest</td>
<td><strong>Ultimately</strong>, for all (systemic and global risk) <strong>Most vulnerable</strong>, sooner, with international spillover</td>
</tr>
</tbody>
</table>

UCL Institute for Sustainable Resources
### Climate change economics 101: trying to quantify the value of emission reductions?

**Severity & Impact costs:** increase with wider perspectives on *scope, discounting & risk aversion* (*Weitzman’s Dismal Theorem*)

<table>
<thead>
<tr>
<th>What kinds of climate changes?</th>
<th>Market</th>
<th>Non-market</th>
<th>Multiple stresses and socially contingent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projection (trend)</td>
<td>Coastal protection; Dryland loss; Energy (heating and cooling)</td>
<td>Heat stress; Wetland loss; Ocean acidification; Ecosystem migration/termination</td>
<td>Displacement from coastal zones; Regional systemic impacts</td>
</tr>
<tr>
<td>Climate variability &amp; (bounded) extremes</td>
<td>Agriculture; Water; Storms</td>
<td>Loss of life; Biodiversity; Environmental services</td>
<td>Cascading social effects; Environmental migration</td>
</tr>
<tr>
<td>System changes &amp; surprises</td>
<td>‘Tipping point’ effects on land, resources, coastal cities</td>
<td>Higher order effects of eg ocean current changes or forest loss; Irreversible losses</td>
<td>Regional collapse; Famine; War</td>
</tr>
</tbody>
</table>

*Figure 1.8 The risk matrix: an assessment framework for evaluating the social cost of climate change*

*Source: Developed by the author from Downing et al. (2007), Jones, R. and G. Yohe (2008), Downing and Dyszynski (2010).*

*Note: ‘Socially contingent’ costs may be understood as those that may be amplified by the inability of society to respond to impacts effectively, such as failures of governance, inability to act collectively, or the frictions associated with migration or deeper disturbances. See also Parker (2014) in American Historical Review 113:4.*
Can we solve it?

• A mega-problem of risk management under deep uncertainty
  – Not the primary science but the consequences
  – .. And how to value them, act, and coordinate response
• “The biggest market failure in history” (Stern)
• “The perfect moral storm”
• A “Super-Wicked” problem

And we have not been doing very well globally ...
• “Current emission trends are at the high end of levels that had been projected ... growing on average at 2.2%/yr since 2000” [IPCC 2014]
• Energy remains an important development challenge
• Pattern of local to regional to global pollution displacement extending
• Negotiations remain mired in ‘blame-and-burdens’ mentality

Laurence Tubiana’s Question
- perspectives on valuing and pricing carbon

Talk to Cambridge Transitions Town meeting
Cambridge, 2nd March 2015

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Last few decades, largely stable per-capita emissions in industrialised countries, recent declines with little convergence

Figure 1.7 Per-capita CO2 emission trends in relation to wealth - trends of major countries from1990-2008

Data from World Bank (2011) and IEA (2010)
Prices Matter! – but effects are more subtle than they seem

National energy intensity approx inversely proportional to long-run prices - across countries the % of GDP spent on energy is remarkably constant

Figure 6-1 The most important diagram in energy economics
Note: The graph plots average energy intensity against average energy prices (1990-2005) for a range of prices. The dotted line shows the line of constant energy expenditure (intensity x price) per unit GDP over the period

Source: After Newbery (2003), with updated data from International Energy Agency and EU KLEMS
Planetary Economics

- perspectives on valuing and pricing carbon

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Three Domains – an Economic Interpretation

1st Domain
“Satisficing” behaviour

2nd Domain
“Optimising” behaviour

3rd Domain
“Transforming” behaviour

1. Real-world individual and organisational decision-making

2. Economic Interpretation

3. Innovation & evolution of complex systems

“Business as usual” innovation

Accelerated low carbon innovation

Purely carbon-price-driven innovation

Economic Output / Consumption

Resource Use / Energy & Emissions

Fig. 2-3b Resource trade-offs with the other two domains

UCL Institute for Sustainable Resources
Three Domains of decision-making involve different processes with different theoretical foundations, operating at different scales:

<table>
<thead>
<tr>
<th>Domain</th>
<th>Characteristics</th>
<th>Theoretical foundations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisficing</td>
<td>Habits, myopia, inattention to incidental / intangible costs; endemic ‘contractual failures’, principal-agent failures, risk aversion to change or investment</td>
<td>Behavioural and organisational economics</td>
</tr>
<tr>
<td>Optimising</td>
<td>Economic optimisation based on relative prices, ‘representative agents’ with ‘rational expectations’, stable preferences and tech trends</td>
<td>Neoclassical economics</td>
</tr>
<tr>
<td>Transforming</td>
<td>Structural, technological, institutional and behavioural change, typically from strategising, innovation, infrastructure investment</td>
<td>Evolutionary and institutional economics</td>
</tr>
</tbody>
</table>
Solutions need to harness corresponding policy pillars based on the Three Domains, to transform energy systems.

To deliver:
- Smarter choices
- Cleaner products & processes
- Innovation & infrastructure

**Policy pillars**

1. Standards & Engagement
   - Domain: Satisfice
   - Highest relevance (H)

2. Markets & Prices
   - Domain: Optimise
   - Medium relevance (M)
   - Highest relevance (H)

3. Strategic Investment
   - Domain: Transform
   - Lowest relevance (L)
   - Medium relevance (M)
   - Highest relevance (H)
- perspectives on valuing and pricing carbon

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Taxing energy/carbon is obvious approach, but after 25 years..

- Only a handful of countries have done so – mostly Scandinavia dating back to early 1990s
- Environmental taxes remain small share of economy in Europe and elsewhere, and ..
.. And have been in long-term slow decline

Environmental taxes - detailed analysis

From Statistics Explained

Data from October 2012. Most recent data: Further Eurostat information, Main tables and Database.

This article presents the latest developments of four different types of environmental taxes (energy, transport, pollution and resource taxes) in the European Union (EU). The EU-27 raised around EUR 292 billion from environmental taxes corresponding to 2.4% of gross domestic product (GDP) and 6.2% of taxes and social contributions (TSC) in 2010.

As a percentage of TSC, the trend of environmental taxes has been downward throughout the period 1995 to 2008 with environmental tax revenue dropping by 1 percentage point of TSC to 5.95% in 2008.

Figure 1: Environmental tax revenue by type, EU-27, 1995-2010 (million EUR and % TSC) - Source: Eurostat (env_ac_tax) (http://ec.europa.eu/eurostat/product?code=env_ac_tax&language=en&mode=view)

Various interpretations are possible, of course..
Emissions trading seen as the answer, with EU ETS

*Murphy’s law: “If anything can go wrong, it will”*

**Fig. 7.2** Evolution of the EU CO₂ (spot) price

*Data Source: European Climate Exchange*
... and the Clean Development Mechanism (CDM) delivered pretty much what had been asked, & paid for ...!

Figure 7–10 Project volumes – from validation to issuance of Certified Emission Reductions
Source: Based on data from UNEP Risoe CDM/JI Pipeline Analysis and Database, July 1st 2012
## Carbon Hopes? carbon-related pricing

<table>
<thead>
<tr>
<th>Bright spots</th>
<th>.... and the Dark</th>
</tr>
</thead>
<tbody>
<tr>
<td>• [Portugal Commission]</td>
<td>• ... 2015 fantasies</td>
</tr>
<tr>
<td>• Scandinavia, British Colombia, California ..</td>
<td>• Waxman-Markey</td>
</tr>
<tr>
<td>• Korean ETS survival, Chinese pilots</td>
<td>• The French carbon tax</td>
</tr>
<tr>
<td>• World Bank survey of carbon pricing</td>
<td>• .. And EU ETS reality</td>
</tr>
<tr>
<td>• ‘Business leaders’</td>
<td>• Japan</td>
</tr>
<tr>
<td></td>
<td>• Australian repeal</td>
</tr>
<tr>
<td></td>
<td>• Canadian woes</td>
</tr>
<tr>
<td></td>
<td>• G77 realities??</td>
</tr>
<tr>
<td></td>
<td>• ‘Business opposers’</td>
</tr>
</tbody>
</table>
“There appears to be a nearly inverse relationship between those policies that policy analysts tend to endorse as holding the greatest promise .. and political feasibility ..”
- Rabe 2008, 106

As cited in Grubb et al.,
*Planetary Economics, Chapter 6: ‘Pricing pollution: of Truth and Taxes’*

‘Carbon pricing is political suicide’
- Stephan Dion,
former Canadian Environment Minister
and (briefly) leader of the Liberal Party
Comment after losing the General Election to Stephen Harper
One definition of the art of taxation

‘Plucking feathers from the goose with the minimum of squawking’

It looks like relevant consumers & resource owners can squawk very effectively:

• whether the proposition is viewed as ‘taxing bads’ or as sources of revenue (or both)
• Whether the instrument is carbon taxation or ETS
- perspectives on valuing and pricing carbon

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A reconstructed narrative around carbon pricing must include positive interactions between pillars which also separates prices from bills.
Price stabilisation mechanisms are essential for credibility – and also for revenue *utilisation* and linkages to other domains.

**Figure 7-8 Steadying mechanisms for emissions trading systems**

*Note:* The Figure illustrates mechanisms to help emissions cap-and-trade systems deal with deep uncertainties, so as to maintain a reasonable balance of price and quantity objectives. The mechanisms are most simply illustrated with respect to price floors and ceilings, in which case the shaded area indicates the likely region of price and quantity for a system with substantial surplus allowances. However the same principle could apply to other ‘threshold’ triggers, for example based on the level of cumulative surplus.
... but just maybe could design a ‘First among Equals?’

A **rising base** carbon price *could* contribute *across* domains:

| 1. Attention effects and funding | • rising steadily enables efficiency to keep pace and stop much rise in total bills  
|                                 | • efficiency programmes may counter regressive concerns? |
| 2. Rising price differential     | • steadily reduce use of coal in power generation without huge asset stranding  
|                                 | • help to move renewables over time from transitional subsidies into mainstream market |
| 3. Long term visibility and leverage | • increased investment stability  
|                                     | • time and leveraged funding for innovation, infrastructure and tech transfer programmes |

- Embedding in international agreement could enhance stability and credibility
- Social and political support would be crucial
On slaying some sacred cows

- Environmental pricing is struggling in practice
  - *re-invigorating it requires revision of theory*
- Environmental pricing is not the *uniquely best* way
  - *it is the most efficient instrument for important aspects of tackling environmental problems*
- ‘Earmarking’ has been widespread in practice and should not be taboo in theory
  - revenues have been the theoretical attraction but the practical problem; politics requires turning that around
- Efficiency of tax vs trading etc are almost irrelevant
  - *Design, credibility, linkages and narrative are as important as price*
Conclusion: on ‘interdisciplinary economics’

• The answer to Laurence’s question is that economics can help when it respects the boundaries of a given theory, but hinder when it tramples across them
  – Understanding complementary roles and synthesis and the motivations and concerns of different actors are key

• Fully understanding the Three Domains inevitably must draw also on other disciplines
  – *Social and psychological* dimensions of risk perceptions and First Domain behaviours
  – *Engineering and physical determinants of* Third Domain innovations and infrastructure
  – *The regulatory and institutional* dimensions of both

• For theorists, there is a wider analogy to be drawn ..
Planetary Economics:
Energy, Climate Change and the Three Domains of Sustainable Development

1. Introduction: Trapped?
2. The Three Domains

Pillar I
• Standards and engagement for smarter choice
• 3: Energy and Emissions – Technologies and Systems
• 4: Why so wasteful?
• 5: Tried and Tested – Four Decades of Energy Efficiency Policy

Pillar II
• Markets and pricing for cleaner products and processes
• 6: Pricing Pollution – of Truth and Taxes
• 7: Cap-and-trade & offsets: from idea to practice
• 8: Who’s hit? Handling the distributional impacts of carbon pricing

Pillar III
• Investment and incentives for innovation and infrastructure
• 9: Pushing further, pulling deeper
• 10: Transforming systems
• 11: The dark matter of economic growth

12. Conclusions: Changing Course

Kindle: http://www.amazon.co.uk/Planetary-Economics-Sustainable-Development-sustainable-ebook/dp/B00JQFBWDO/ref=tmm_kin_swatch_0?_encoding=UTF8&sr=8-1&qid=1415625933

http://climatestrategies.org/projects/planetary-economics/ for information and register of related events.