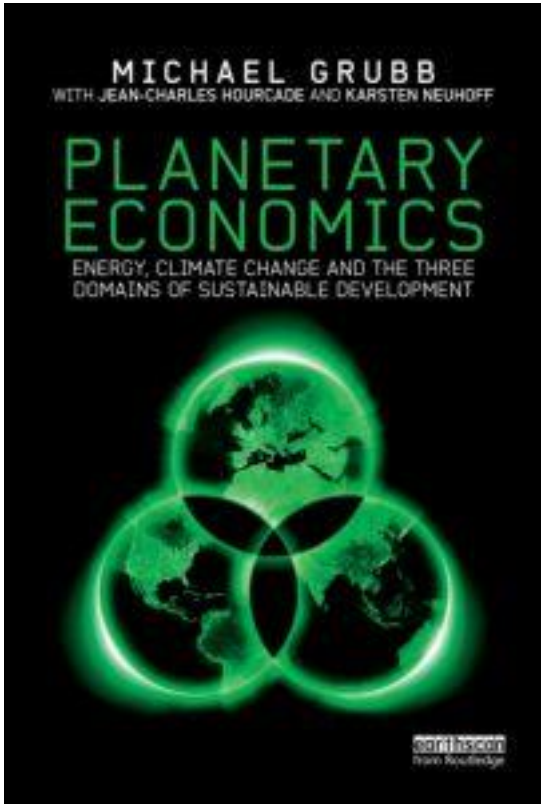
Planetary Economics

Energy, Climate Change and the Three Domains of Sustainable Development



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With

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Presentation to BIEE Annual Conference,
Oxford 17th September 2014

Planetary Economics

BIEE Presentation

- When The Economist gets it wrong on energy – and Why

- Two energy offerings from *The Economist*
- The Three Domains and Three Pillars of Policy
- A Three Domains perspective on the offerings
- Three apparent Laws of Energy Economics
- So what is so different between the Second and Third Domains, and why is it so important w.r.t. energy-climate policy?
- On the need for integrated packages and interdisciplinarity

The Economist on oil prices, 1999

" **$10 might actually be too optimistic. We may be heading for $5** ... Thanks to new technology and productivity gains, you might expect the price of oil, like that of most other commodities, to fall slowly over the years. A "normal" market price might now be in the $5-10 range. Factor in the current slow growth of the world economy and the normal price drops to the bottom of that range.

…. it would pay [the Gulf producers] to abandon all attempts to boost oil revenues by propping up prices, and instead increase production. The result would be a world in which supply and demand were determined not by geopolitics and cartels, but by geology and markets—meaning that, in today's conditions, the price would head down towards $5.

Nor is there much chance of prices rebounding… "

The Economist, Drowning in Oil, March 1999

The Economist on renewable energy, 2014

- If all the costs and benefits are totted up using Mr Frank's calculation, solar power is by far the most expensive way of reducing carbon emissions …. the carbon price would have to rise to $185 a tonne before solar power shows a net benefit.
- … governments should target emissions reductions from any source rather than focus on boosting certain kinds of renewable energy.

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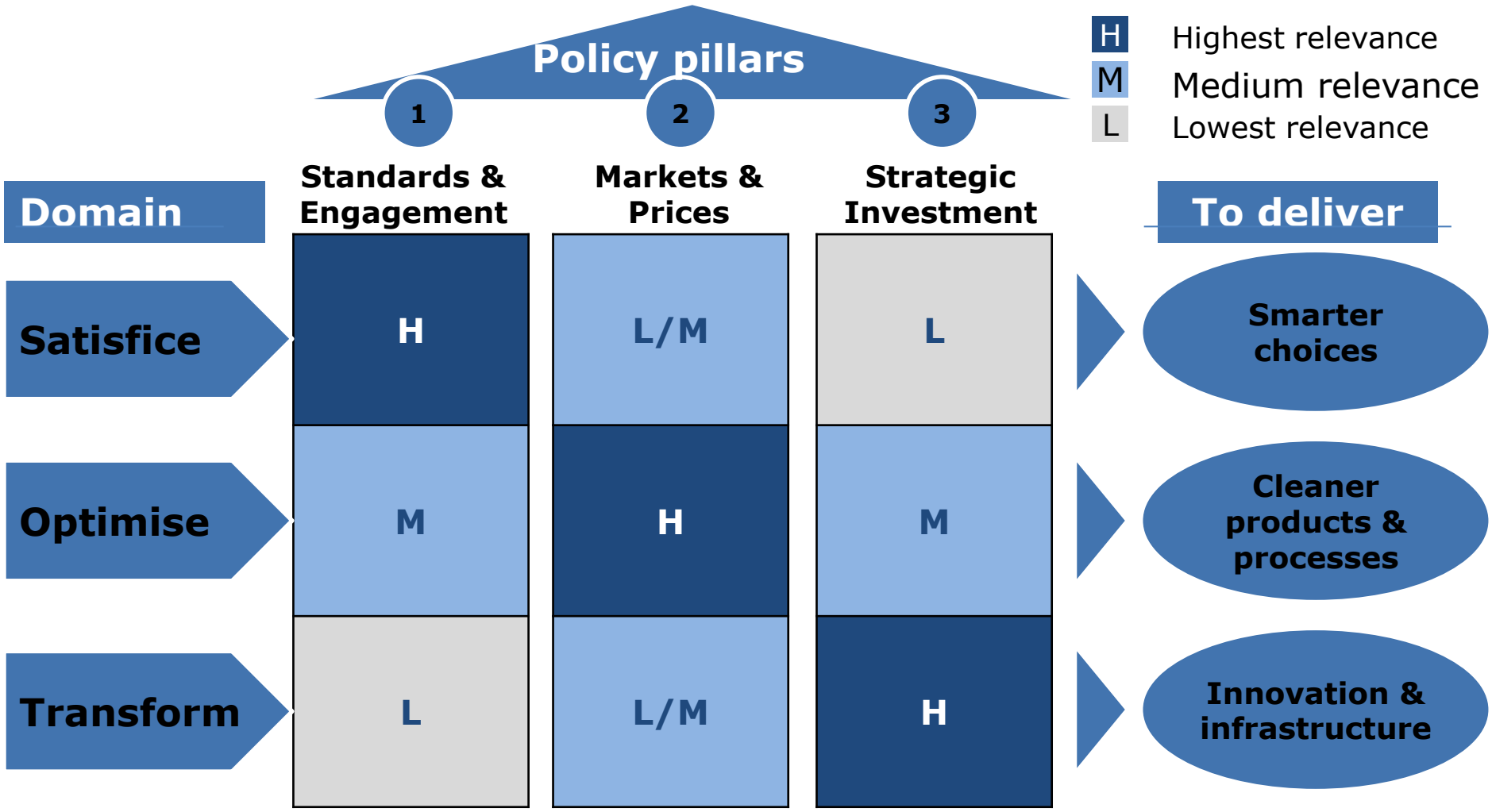
Three Domains of decision-making involve different processes with different theoretical foundations which operate at different scales

SOCIAL SCALE

TIME HORIZON

DOMAIN	Characteristics	Theoretical foundations
Satisficing	Habits, myopia, inattention to incidental / intangible costs; endemic 'contractual failures', principal-agent failures, risk aversion to change or investment	**Behavioural and organisational economics**
Optimising	Economic optimisation based on relative prices, 'representative agents' with 'rational expectations', stable preferences and tech trends	**Neoclassical and welfare economics**
Transform-ing	Structural, technological, institutional and behavioural change, typically from strategising, innovation, infrastructure investment	**Evolutionary and institutional economics**

Solutions need to harness corresponding policy pillars based on the Three Domains, to transform energy systems



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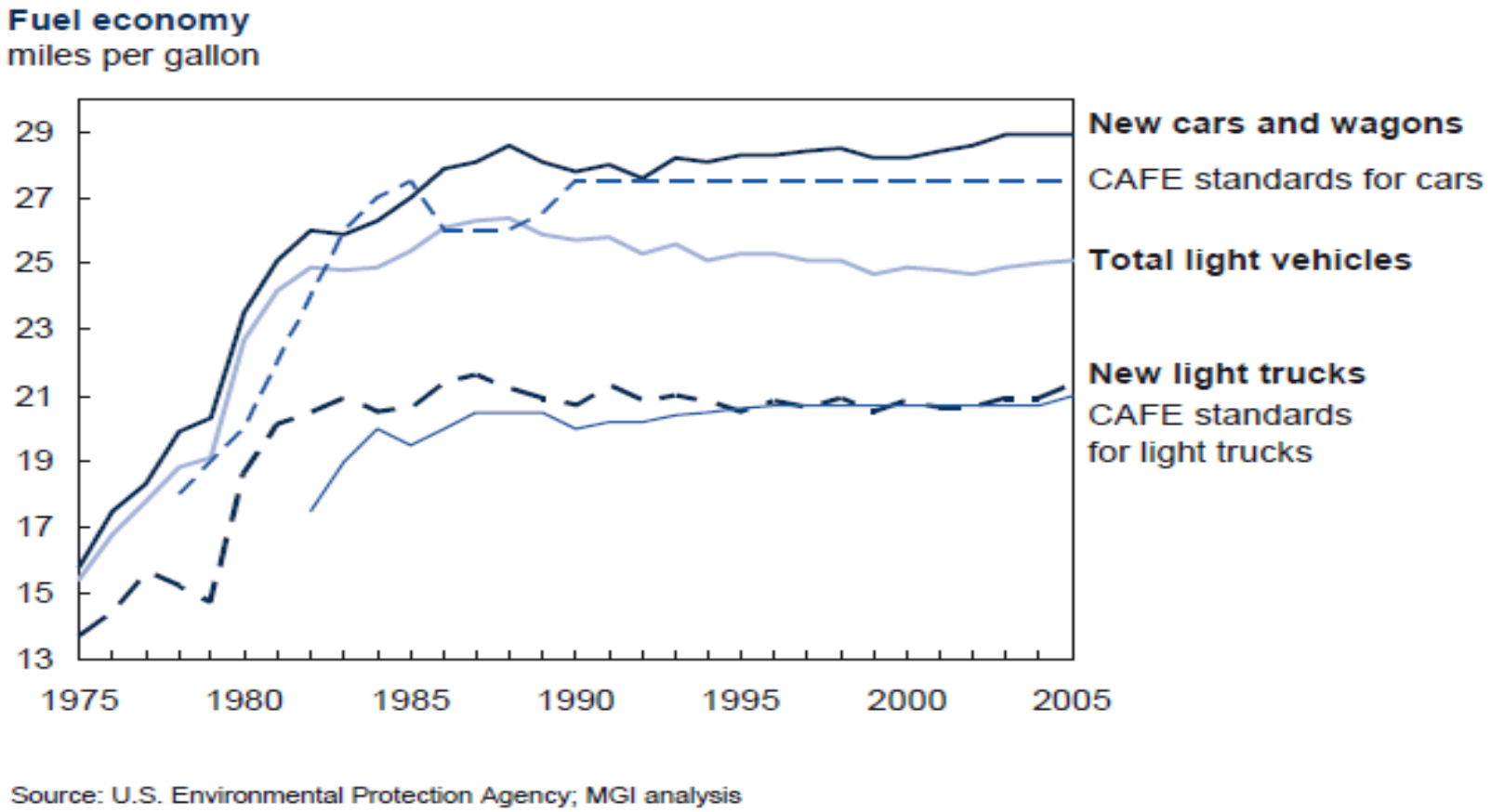
US Fuel Economy Standards – 30 years of stasis

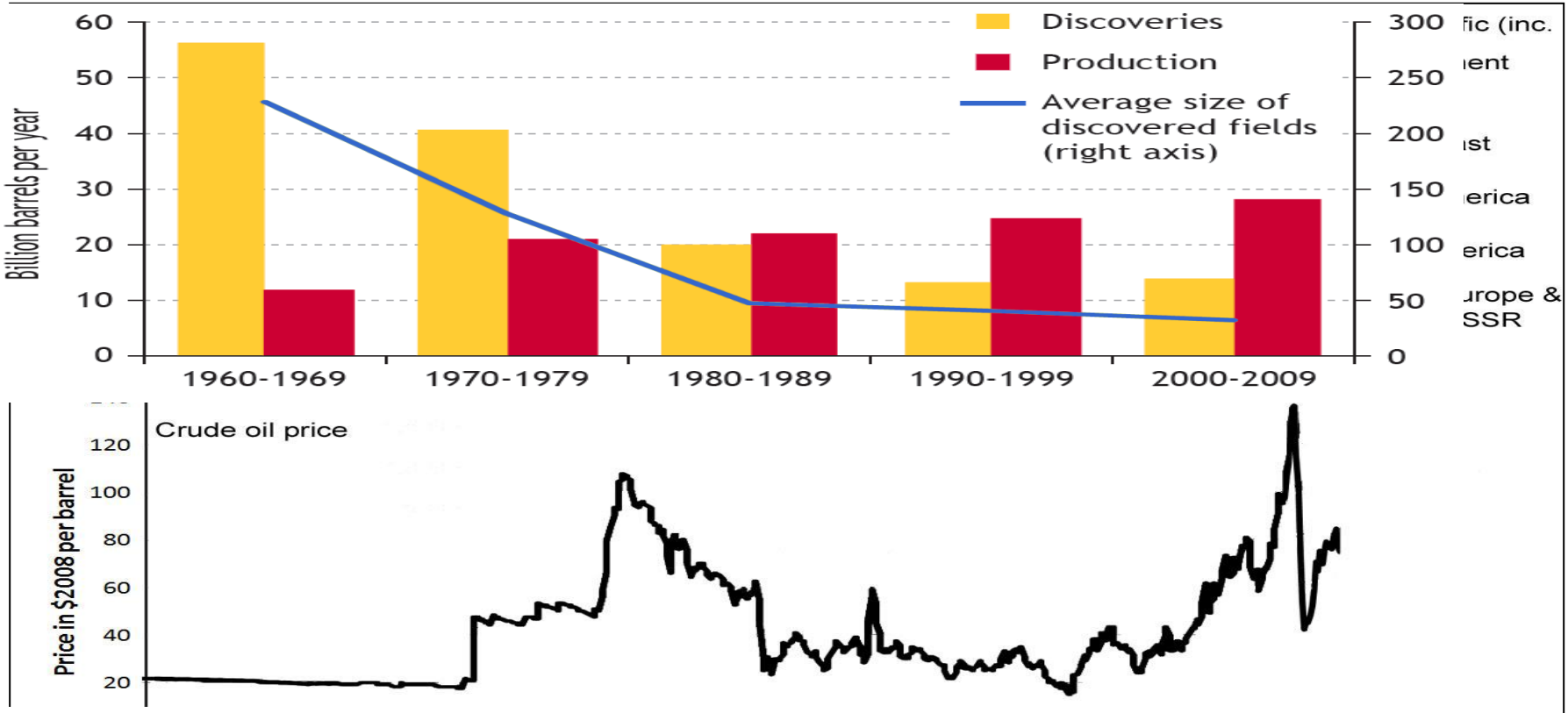
- Many regions slacked Pillar 1 efforts, rate of global efficiency improvement declined to < 1%/yr



Source: U.S. Environmental Protection Agency; MGI analysis

.. Whilst 1970s & 80s Third Pillar public & private investment in offshore oil *etc* and alternatives declined

- Leaving depleting resource of 'conventional oil' and hence …



The ‘Solar surprise’

- Explosive uptake by consumers culminated with large cost reductions

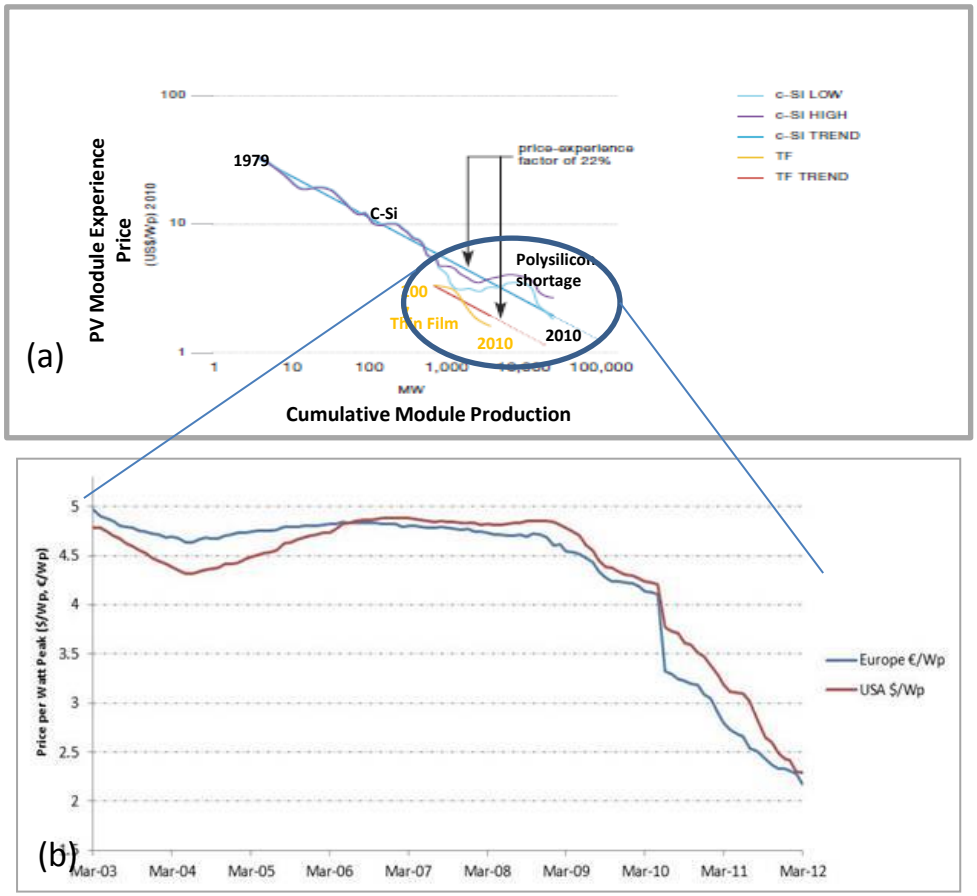


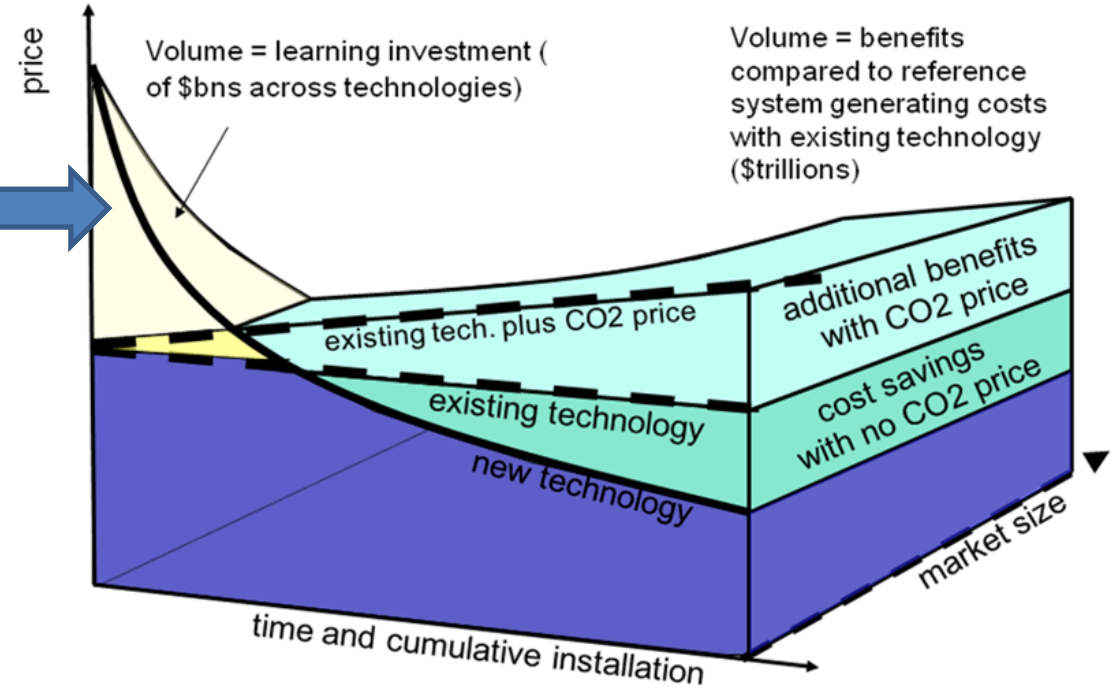
Figure 3-7 : (a) and (b) Declining Solar PV Module Costs
Source: Adapted from Figure 4, Solar Photovoltaics: On the Road to Competitiveness, EPIA, September 2011

Emerging themes

- Radical structural and infrastructural change in the electricity sector

Strategic investment can be very costly but the returns can be huge …

North-Sea oil investments in the 1970s cost UK c.£10bn/yr; full *direct* costs >> $100/bbl



Backup costs?

- Balancing Mechanism and Capacity Auctions starting to reveal wholly untapped sources of potential reserve
- Storage options – including electric vehicles developing rapidly
- Interconnectors serve to increase overall regional efficiency of the system

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On energy forecasting ..

1. ‘Energy forecasting was invented to make economic forecasting look good ’

- Anon

2. We tend to be much too strongly influenced by recent trends …

- First Domain biases are *intrinsic to how Second Domain markets value the future*

3. The "Bashmakov-Newbery Constant"

- The proportion of national income spent on energy has remained surprisingly constant, *given sufficient time to adjust*
  - for more than a century
  - for most countries
- *Despite* huge variations in energy prices (Bashmakov)

- This cannot be explained through the classical measures of in-country consumer price response (elasticities) but needs also to invoke:
  - **Energy efficiency** regulation and related policy responses
  - **Innovation** throughout energy supply and product chains

Challenge is to accelerate efficiency & decarb-innovation for several decades *without politically untenable policy-driven price shocks*

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First and Third Domains have important characteristics in common

- *Non-linear* responses
- Not inherently optimising
- Substantial divergence between private and public returns
- Dependent on primarily government policy
- Progress largely irreversible (for implications of this, see Annex to book)

But they are very different in:

- Underlying processes and key actors
- Timescales & Scale of investment risks

For the mathematically minded seeking optimal climate policy, key differences between Second and Third Domains ...

- Minimise: $C_{ff} + C_{nff} + C_{cd} + C_{ad} + C_{lap+}$

Second Domain:

- Universal, market-oriented discount rate
- Equalise marginal costs
- Based on assumption of *separability*
- *i.e. Optimum defined in in terms of partial derivatives of components*

Third Domain:

- Hyperbolic discount rate, or separate private & public for 2nd & 3rd Domain type investments
- Minimise scenario-based total costs, focus on option values & risks
- Component (or subcomponent) costs may be *inseparable*
- Decisions at margin need to be based on *total derivative* not *Partial derivative*

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- One in series of "Application" talks

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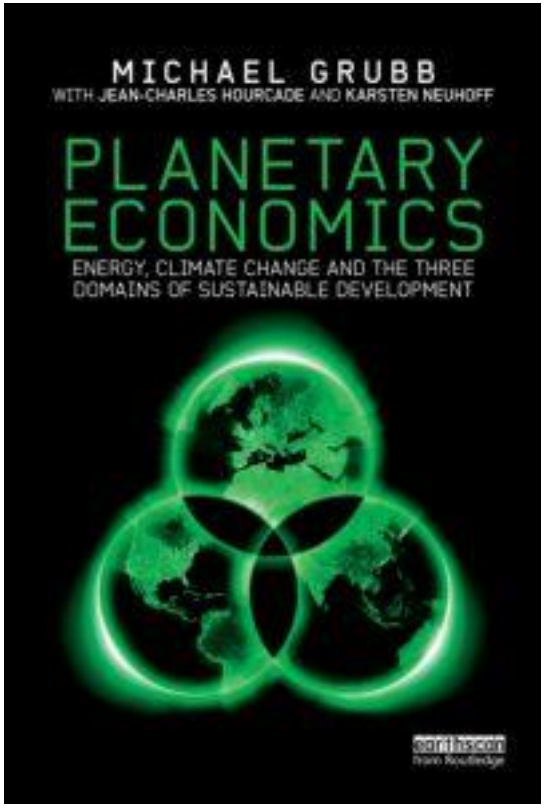

1. **Introduction: Trapped?**
2. **The Three Domains**

Pillar 1

- **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**

Next book lecture: London School of Economics, 6 November 2014

www.climatestrategies.org/events/2014-events/book.html for information and register of related events.