FINANCE AND THE MACROECONOMICS OF ENVIRONMENTAL POLICIES

Cambridge Trust for New Thinking in Economics
St Catharine's College, Cambridge
10 April 2014

Financing Energy Infrastructure

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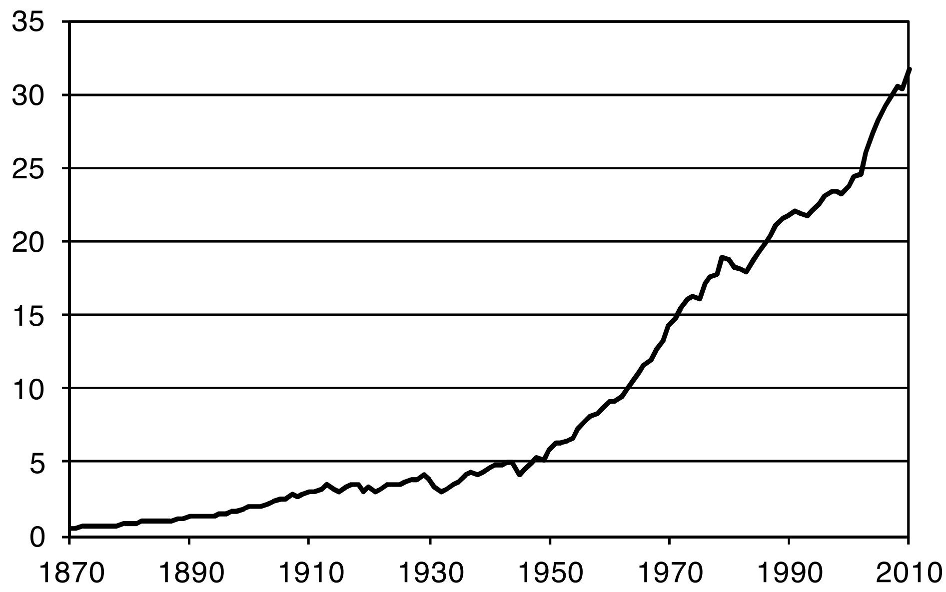
Outline

- ❑ Background
- ❑ Public versus private finance
- ❑ Demand-side solutions
- ❑ Financing energy in low income countries
- ❑ Implications and conclusions

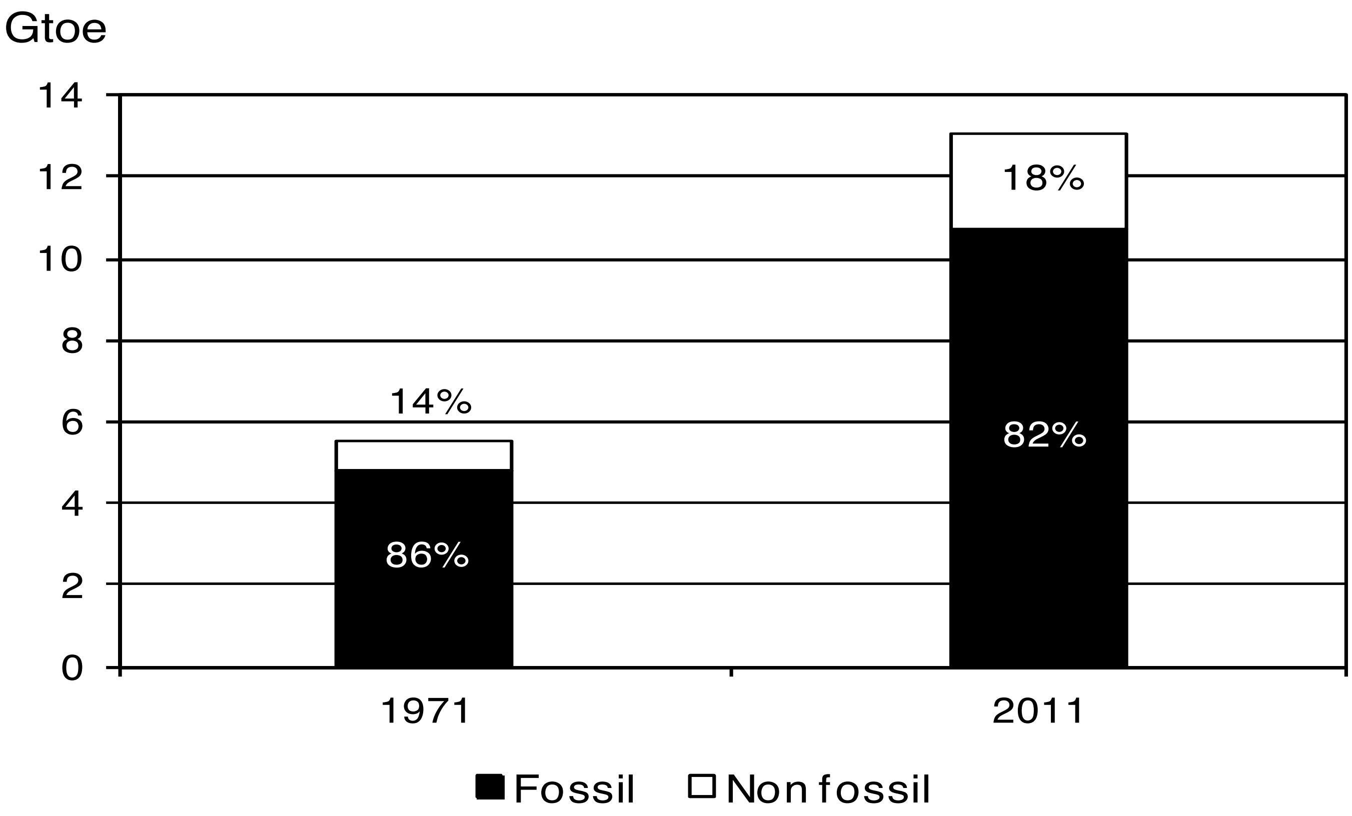
Background: Impacts of fuel generation

- Fuel generation a major contributor to GHGs



CO_2 emissions from fossil fuel combustion – 1870-2010
Source: IEA (2013*a*)

Dependence on fossil fuels: not changing rapidly

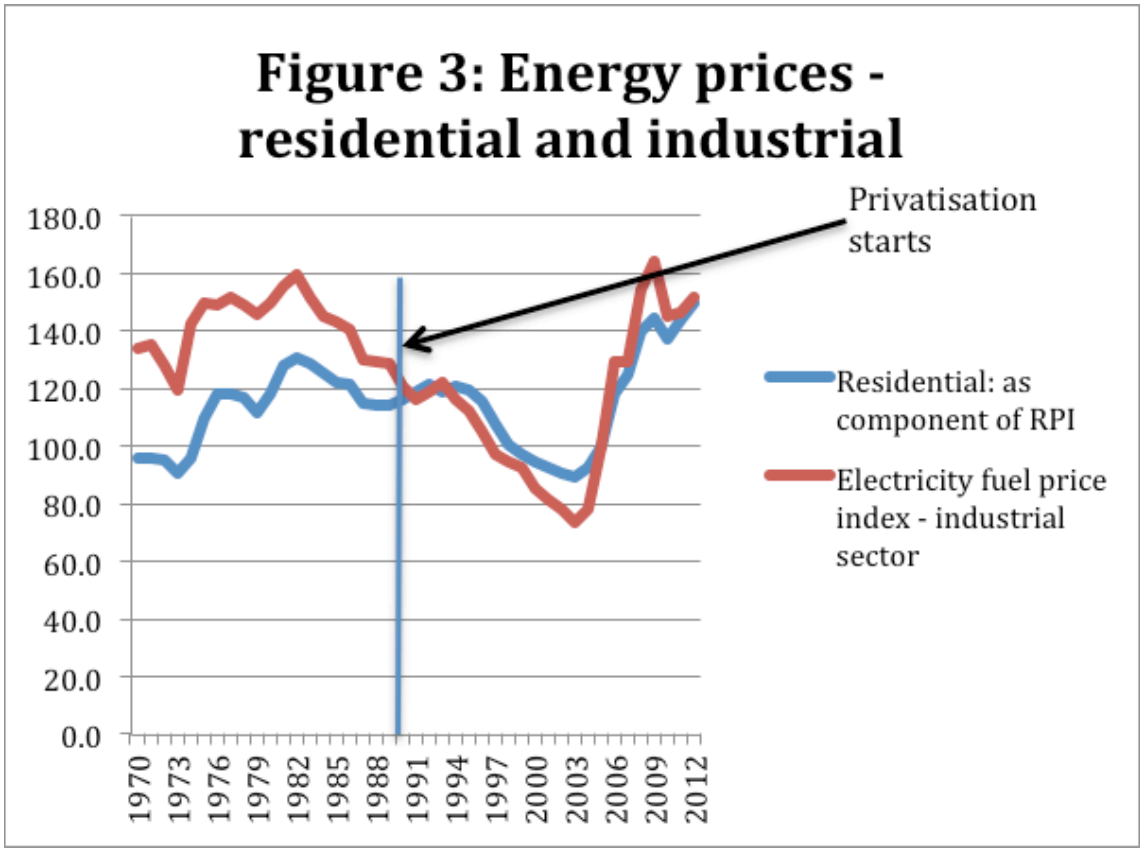


World primary energy supply (Source: IEA 2013*a*)

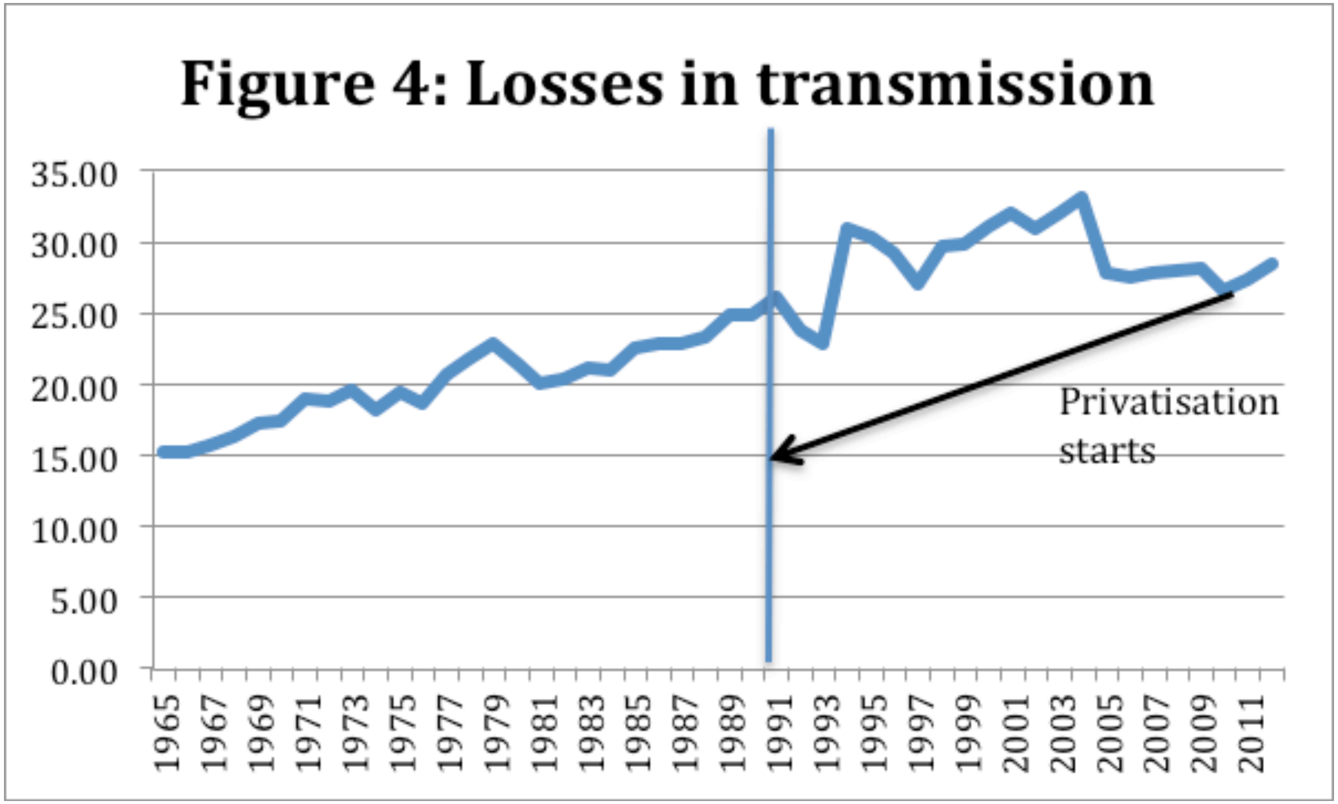
Public vs Private: A case history of UK electricity

- 1882 Electric Lighting Act → first energy supply companies
- Early 20th century: increased central control
  - Weir Report 1926 → Central Electricity Board
  - 1938: regional grids integrated into National Grid
  - 1957: Central Electricity Generating Board (CEBG) established
- 1990 onwards:
  - Privatisation, initially government retains 40% equity
  - Splitting of CEGB assets → generation vs transmission companies

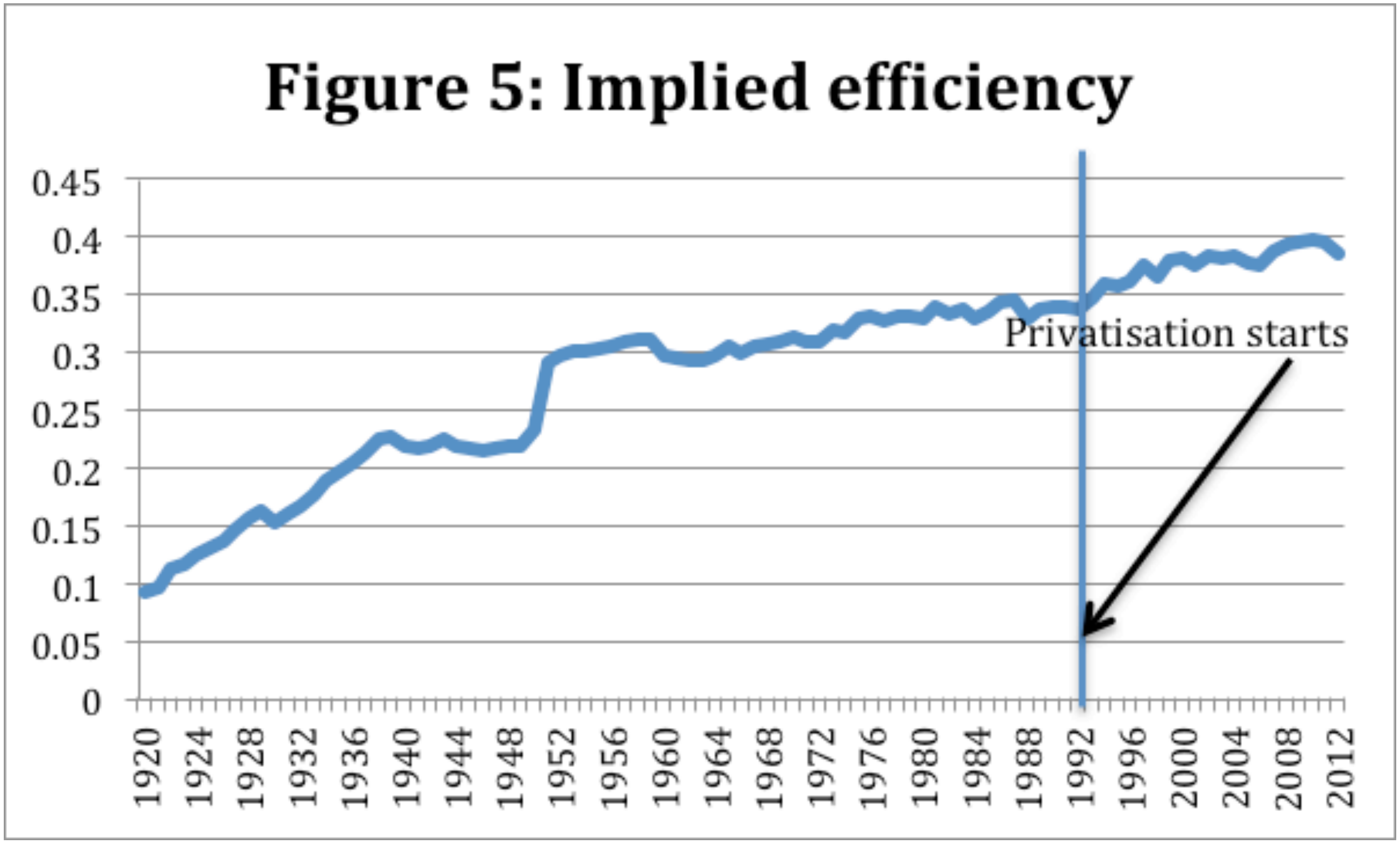
Performance before and after privatisation: prices



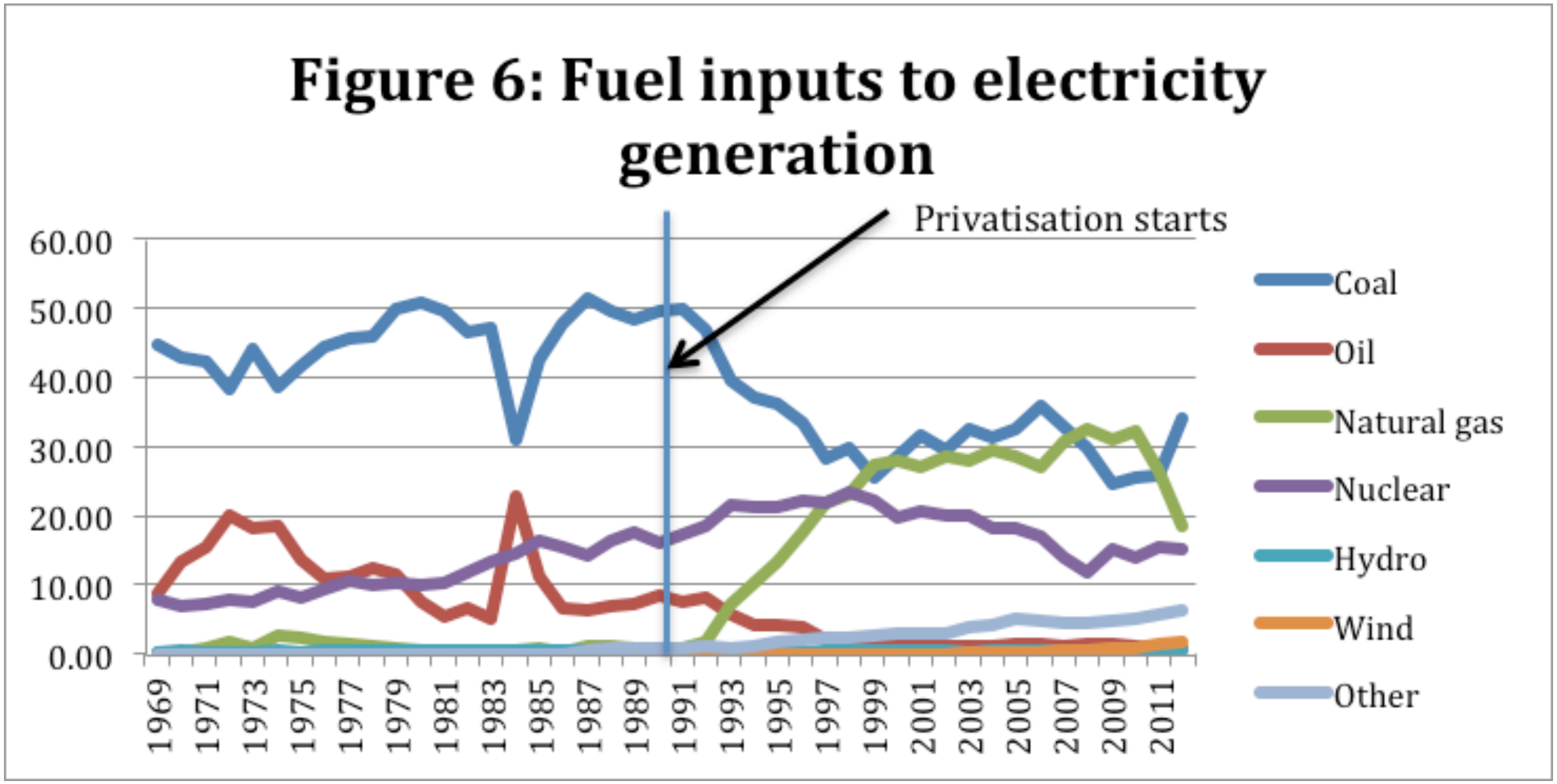
Losses in transmission and generation



Implied efficiency: energy supply as proportion of fuel input



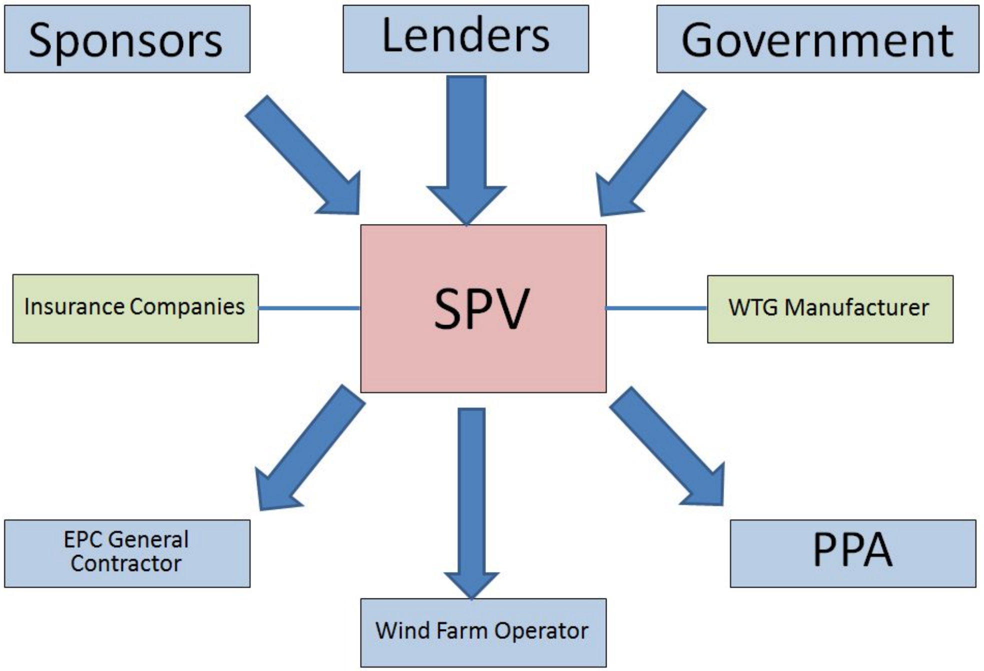
Impacts on fuel source: innovation and risk?



Energy infrastructure financing: constraints

- Energy infrastructure market failures
  - Common good, networked
  - Natural monopolies: low marginal costs, large and falling average costs
  - Significant externalities, positive and negative
- Market failure → distorted incentives for private provision
- Private financing: constrained by expectations of future revenue streams

Project finance for energy infrastructure: a windfarm Special Purpose Vehicle (SPV)



Source: windfarmbop.com

Is project finance fit for purpose?

- Sponsors/lenders invest for the revenue streams but problems quantifying these
- Business cases built on calculations of NPV and IRR, using past information
- Project risks difficult to quantify. Also policy risk.
- Rewards delivered over long time horizons: problem of high or unstable discount rates
- Principal agent problems, asymmetric information, transaction costs → contractual tensions
- Uncertainty and irreversibility → slows investment

Impacts of uncertainty and irreversibility

- Real options theory - analogous to financial options: have a choice about timing
- Irreversible investment – opportunity cost of investment includes information forgone → will wait to exercise option to invest when information is valuable
- ↑Uncertainty ➔ information valuable ➔↓ investment

- Uncertainty affects innovative investments more → potentially strong negative impacts on innovative renewable energy infrastructure investment

Evidence about managing demand

- Social influences, group learning have positive impacts e.g. EcoTeams and Environmental Champions programmes
- Social influences are important → normative signals affect energy demand
- Pre-payment and savings commitment devices have potential to enable people to plan energy consumption more effectively, especially those facing fuel poverty

Energy infrastructure in low income countries

- Energy poverty: access to electricity likely to fall from 50% to 33% by 2030
- Large numbers of off-grid energy consumers: large scale energy infrastructure unlikely to arrive soon
- Greater access to electricity would enable:
  - Schooling outside daylight hours
  - Productivity increases
  - Cleaner cooking facilities

Innovative solutions to energy poverty

- Most households occasionally have small savings → potential for microsaving. May be a better solution than microcredit
- Constraints on microsaving
  - Financial/banking infrastructure underdeveloped
  - Procrastination, self-control problems
- Solutions
  - Mobile technologies e.g. mobile payment systems via MPESA or mobile phone bills
  - Savings commitment devices based on insights from behavioural economics

Other solutions: reducing demand

- Manage day-to-day demand for energy via
  – Carbon labelling to inform
  – Smart meters for feedback
  – Behavioural nudges e.g. social, normative influences to encourage energy savings
  – Group learning initiatives to encourage energy-saving behaviours

Rethinking housing infrastructure

- Sustainable design, construction and maintenance e.g. green buildings
- Building Information Modelling (BIM) to quantify and monitor environmental impacts
- Energy saving improvements for householders e.g. the Green Deal

Encouraging energy investment and savings

- Encourage self-reliance via "prosumption" → fewer drains on the grid
- Incentivise microgeneration via feed-in tariffs
- Devise savings instruments to enable energy self-reliance at micro level → microgeneration investments
- Savings commitment devices → reducing exposure to fuel poverty via better management of winter fuel bills

Implications and conclusions

- Energy infrastructure not provided in a perfect market → private financing has limits
- Financing innovative energy infrastructure investment problematic
  - Complex political and institutional contexts
  - Disproportionate focus on the short-term
- Need to find a way to unify the relative strengths of the public and private sectors via innovative designs for public-private partnerships