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The role of indicators in improving the performance of urban energy systems

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Outline

- Indicators and the urban energy systems (UES) project
- A review of existing UES indicators
- The service niche approach to indicators
- The role of UES indicators in promoting innovation in local energy systems

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Why are we interested in indicators?

- Project goal
  - "to identify the benefits of a systematic, integrated approach to the design and operation of urban energy systems, with a view to at least halving the energy intensity of cities"

- Indicators are therefore needed:
  - To describe and compare cities and their energy systems
  - To summarise the state and (hopefully) causalities of complex systems
  - To compare alternative prospective systems
  - To support transparent debate on policy criteria
  - To support communication and decision making

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Literature review

- Urban energy systems can be assessed from many different perspectives:
  - Technological, economic, social, environmental
- And by many different stakeholders
  - Urban and national governments, industry, civil society, academics

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Literature review

Current practice in urban sustainability indicators

Similarities	Differences
• Desire for 'objective' inputs to decision-making, i.e. goal-oriented indicators • Emphasis on trustworthiness, e.g. transparent selection process • Limited resources for data collection	• Many alternative frameworks (as many as 675[1]) • Many alternative metrics (186 for transport alone[2]) • Different underlying theories used (if any)

1. Walton, J. S., El-Haram, M., Castillo, N. H., Horner, R. M. W., Price, A. D. F., & Hardcastle, C. (2005). Integrated assessment of urban sustainability. *Engineering Sustainability, 158*(ES2), 57-65.
2. Mihyeon Jeon, C., & Amekudzi. (2005). Addressing sustainability in transportation systems: definitions, indicators, and metrics. *Journal of Infrastructure Systems, 11*(1), 31-50.

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Literature review

- Two conclusions
  - It is not possible or sensible to have a single urban sustainability metric[1]
  - Existing urban sustainability indicators emphasise **measurability and policy relevance** at the expense of **analytical validity**
- We developed a custom UES approach to address these shortcomings[2]

1. Gasparatos, A., El-Haram, M., & Horner, M. A critical review of reductionist approaches for assessing the progress towards sustainability. *Environmental Impact Assessment Review, In Press, Corrected Proof*.
2. Keirstead, J. 2007. *Towards UES indicators*. http://www3.imperial.ac.uk/pls/portallive/docs/1/24897696.PDF

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The service niche approach to urban sustainability indicators

- Basic premises
  - General ‘urban sustainability’ indicators are too broadly defined
  - Certain urban services cut across urban sustainability issues but provide the opportunity for a narrower focus
  - Strategic niche management suggests these services could act as a protected space for indicator design and innovation

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Choosing a service niche

- Three criteria
  - *Pervasiveness*, e.g. is the proposed service relevant to multiple sustainability domains?
  - *Goal-orientation*, e.g. can clear goals be articulated for the proposed service?
  - *Heuristic-value*, e.g. does the proposed service facilitate a discussion of wider sustainability principles[1]?
- Example service niches
  - Water, transport, energy, waste, etc.

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1. Haughton, G. (1999). Environmental Justice and the Sustainable City. Journal of Planning Education and Research, 18(3), 233-243.

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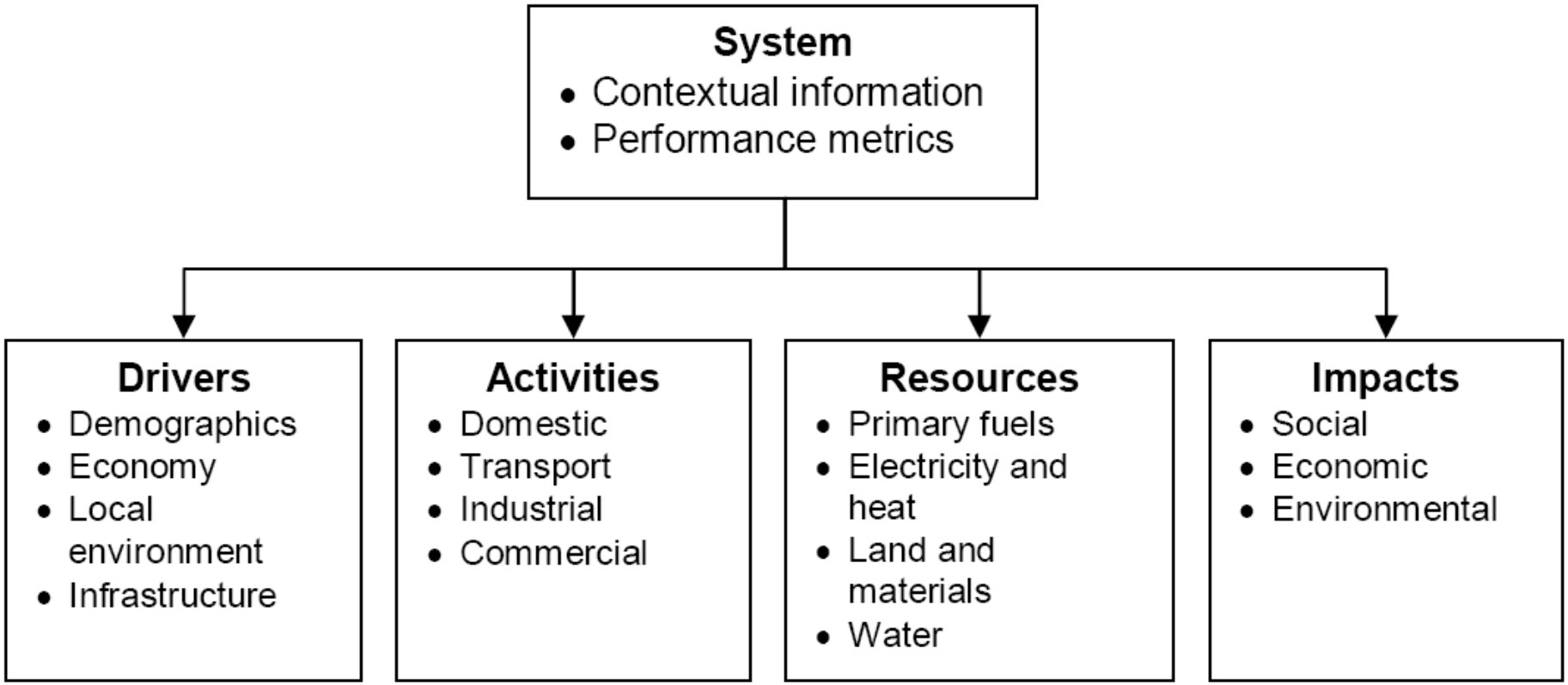
The indicator framework



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Based on Ravetz, J. (2000). Integrated assessment for sustainability appraisal in cities and regions. Environmental Impact Assessment Review, 20(1), 31-64.

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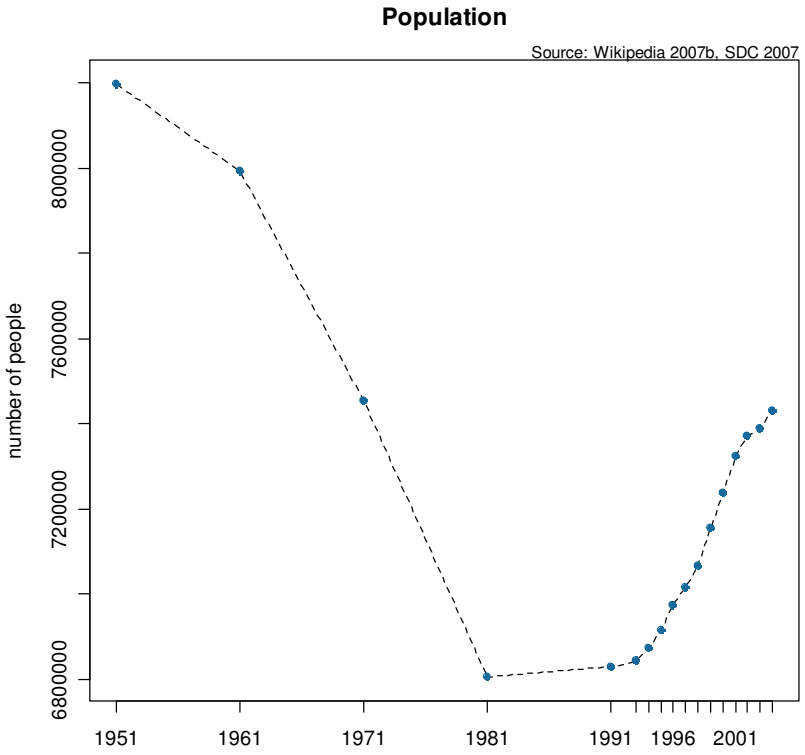
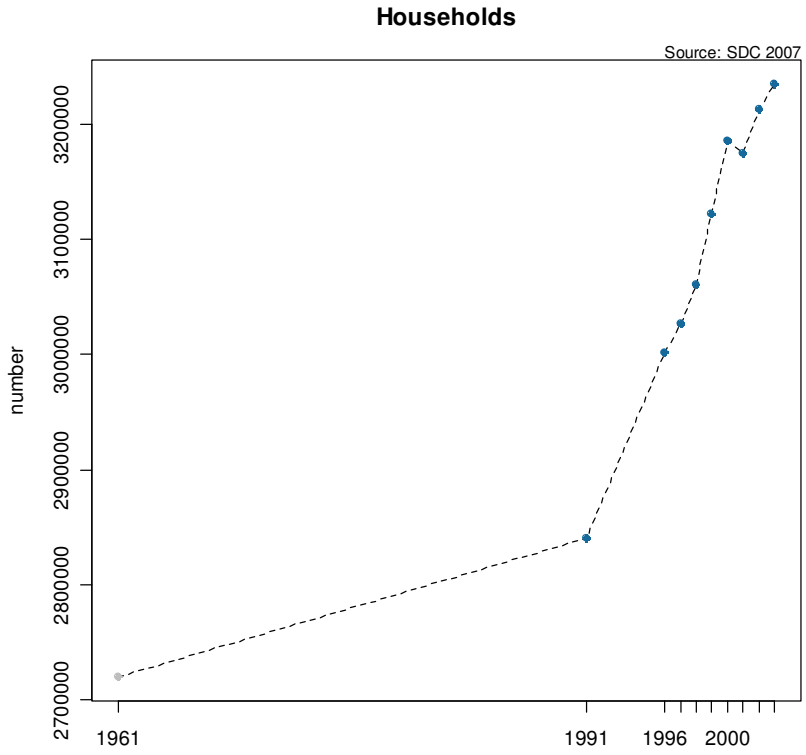
Drivers





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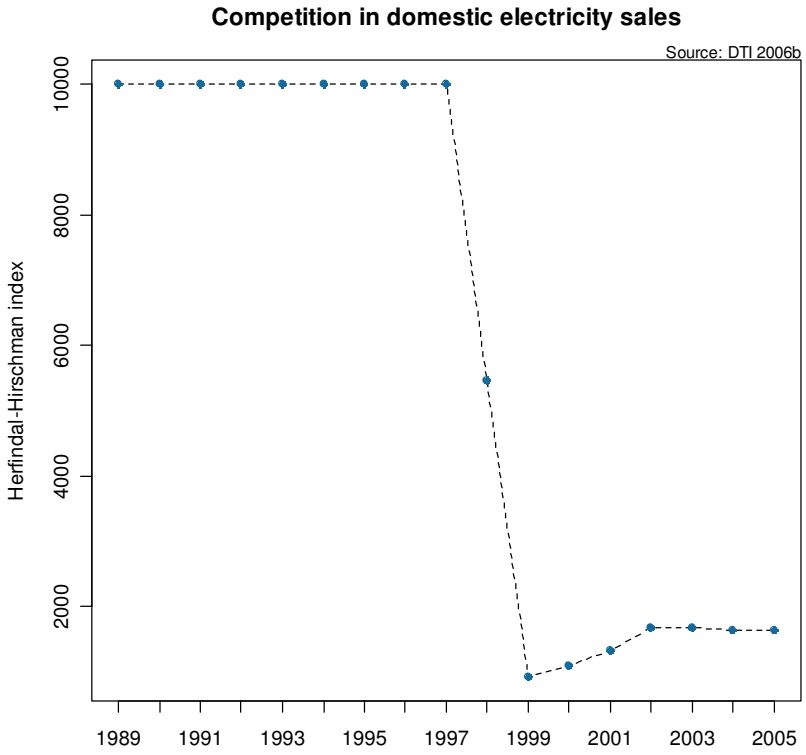
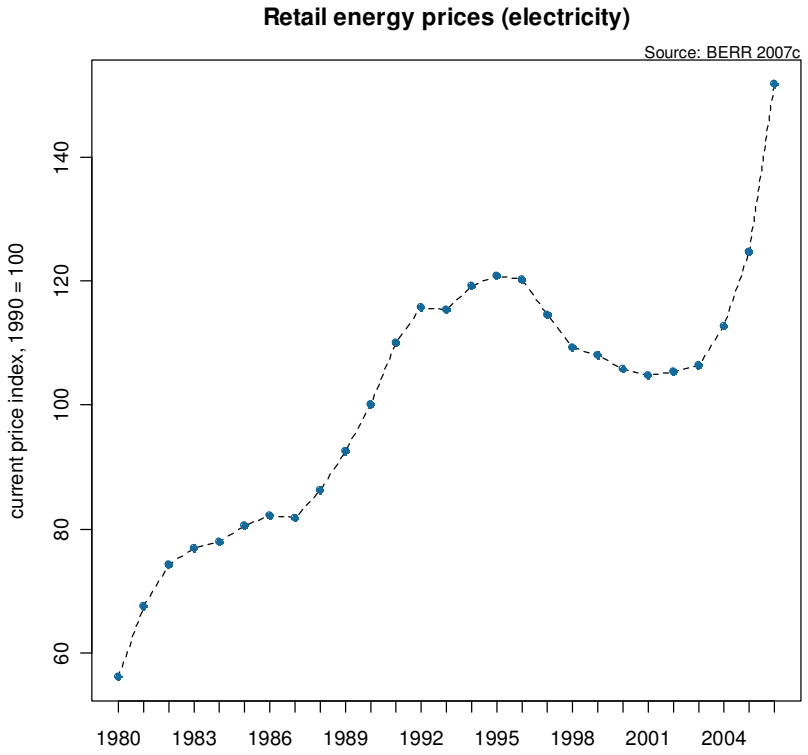
Drivers





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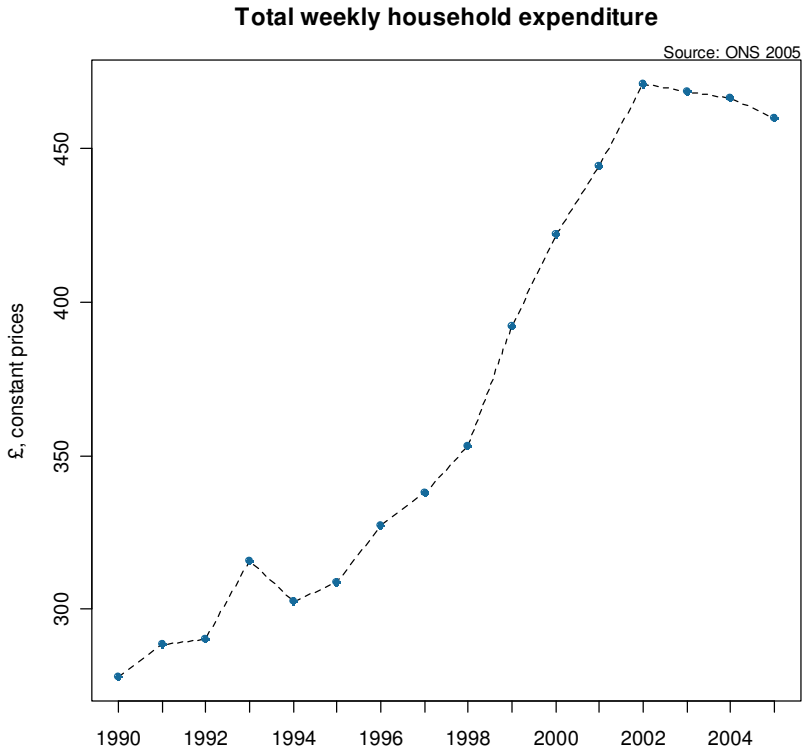
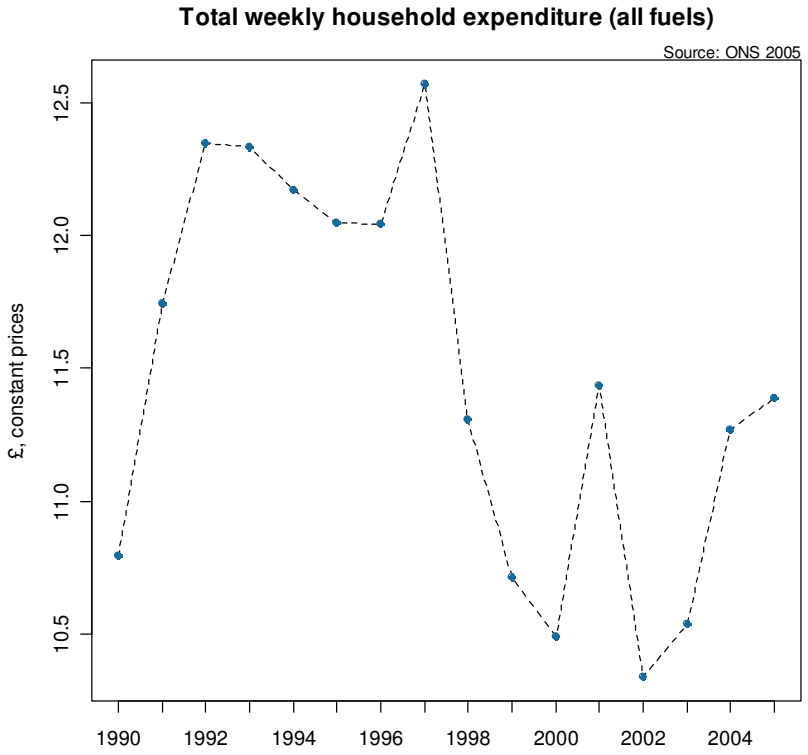
Activities





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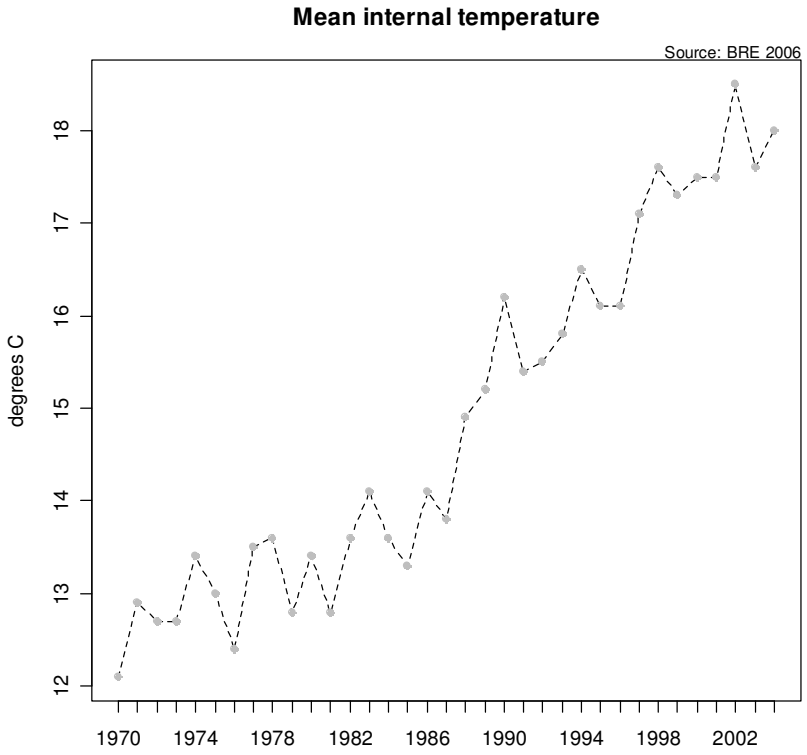

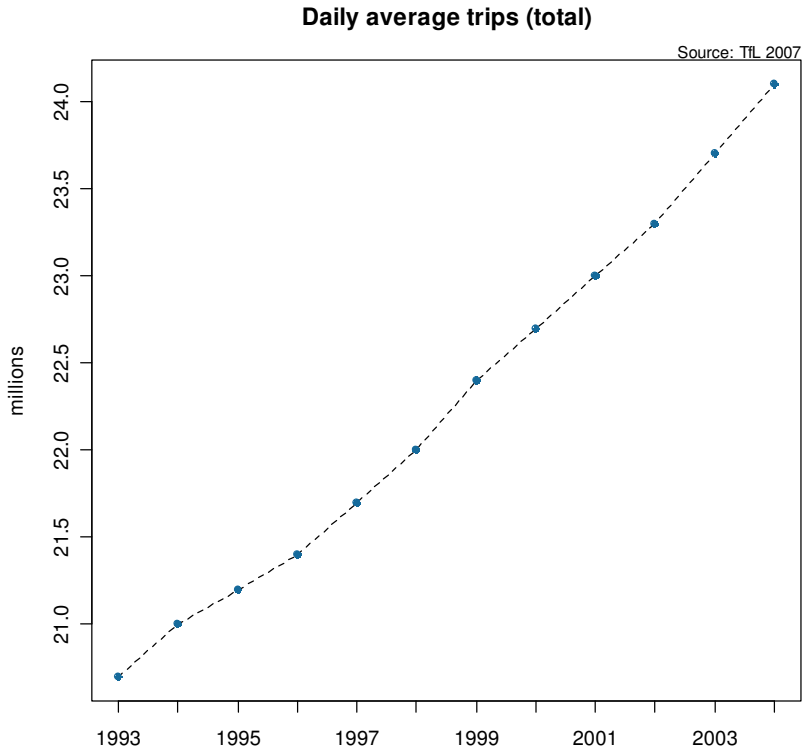

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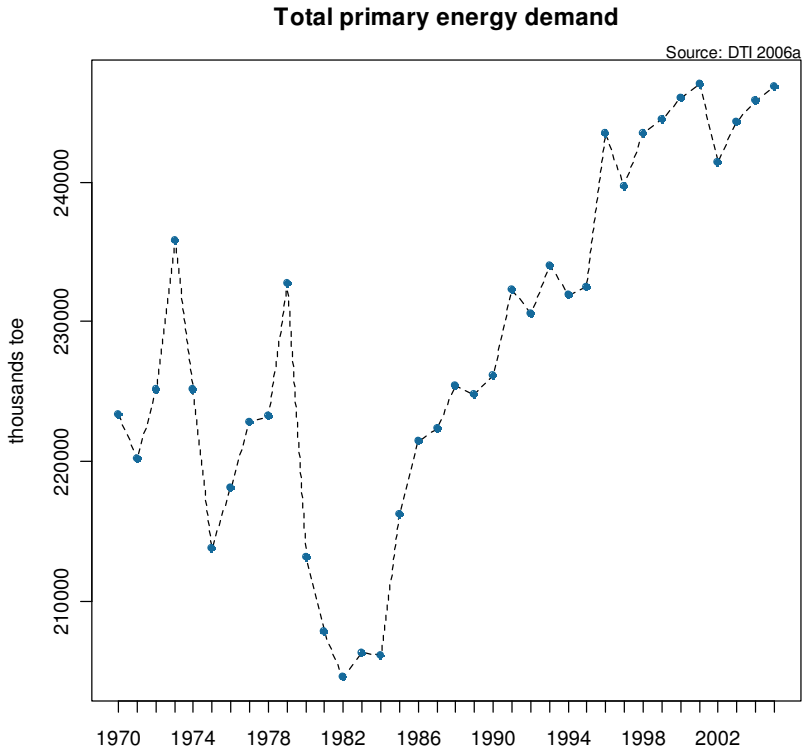
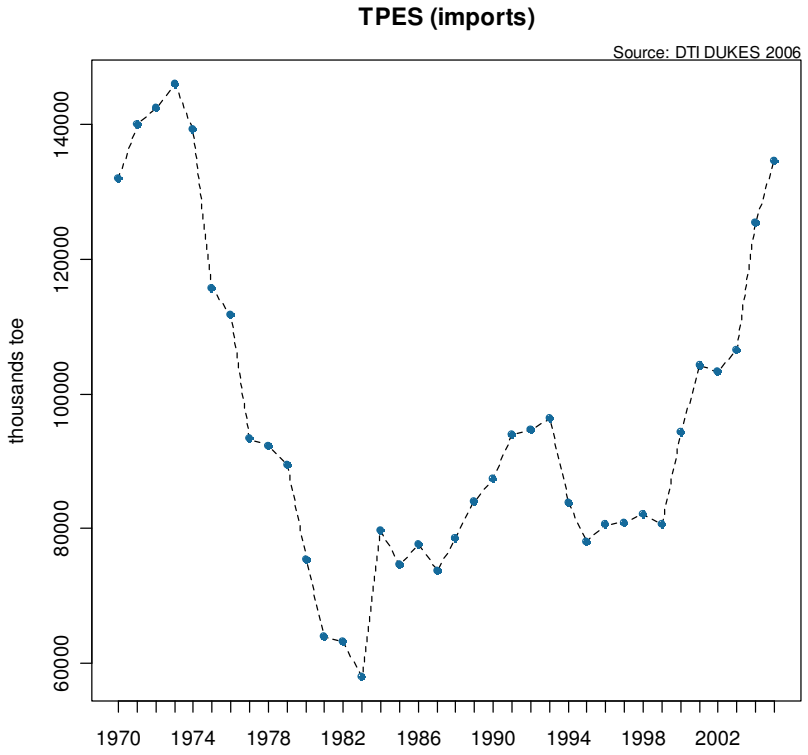
Resources





Both figures represent UK data

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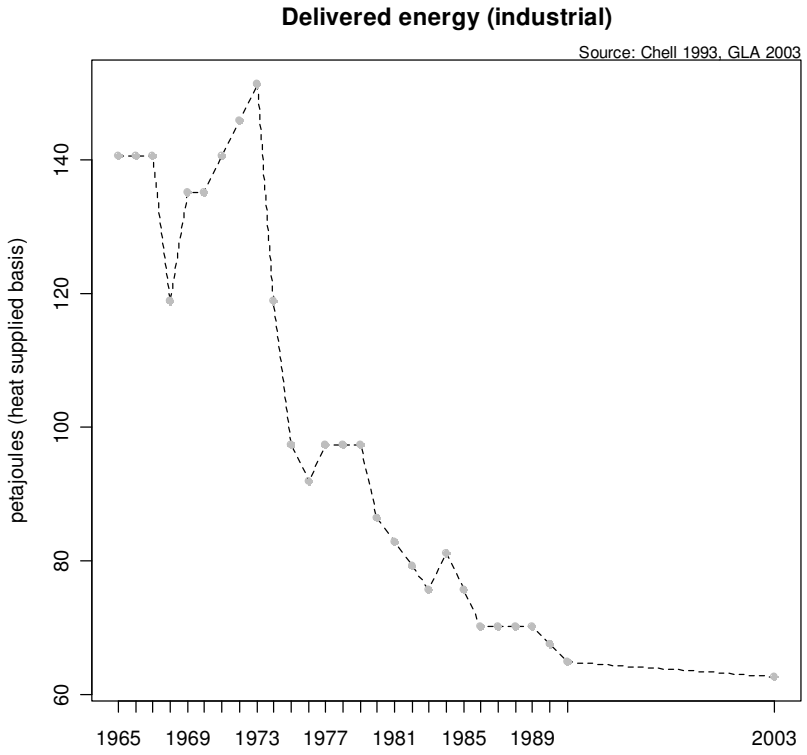
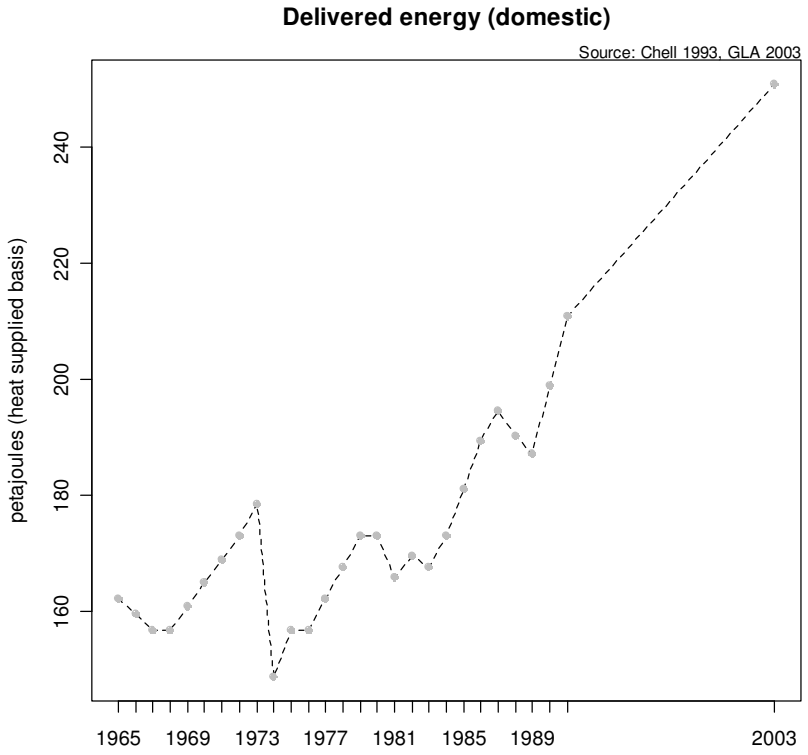
Resources





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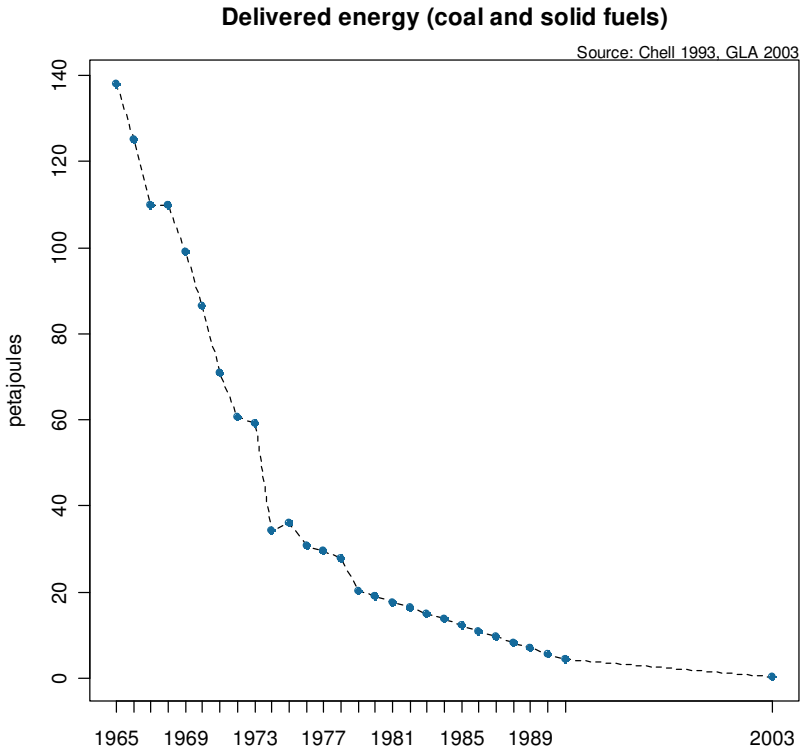

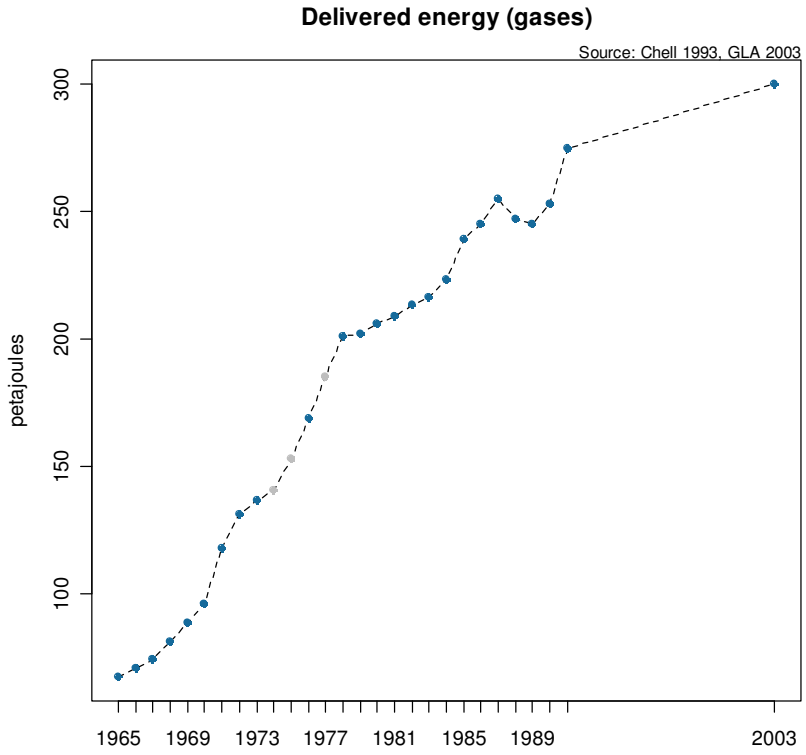

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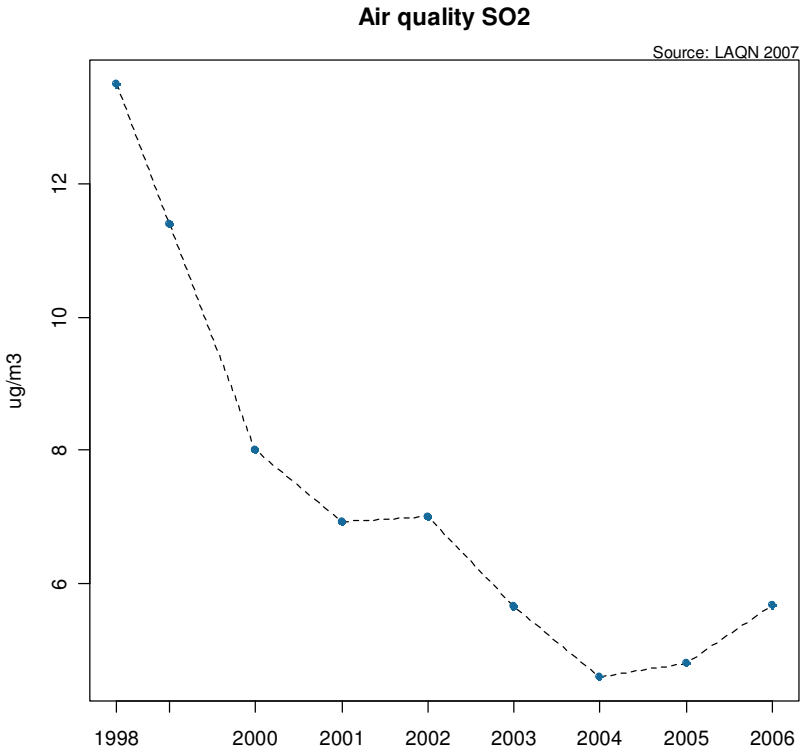
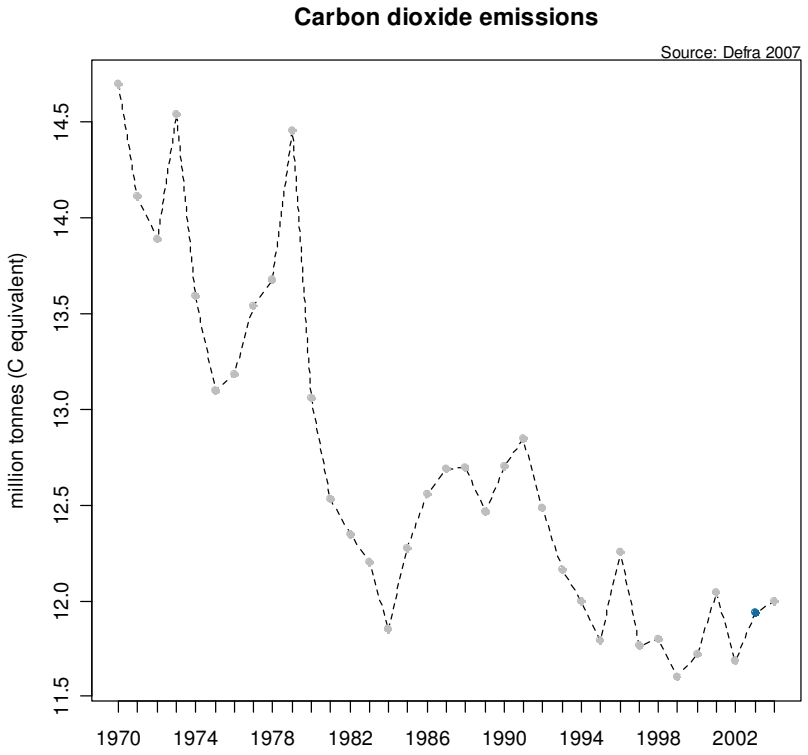
Impacts





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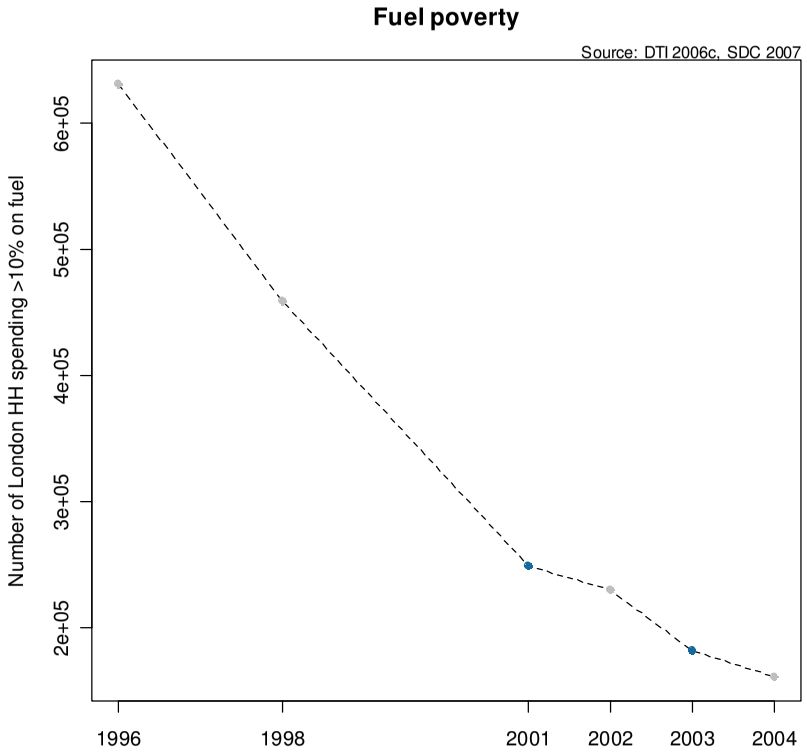

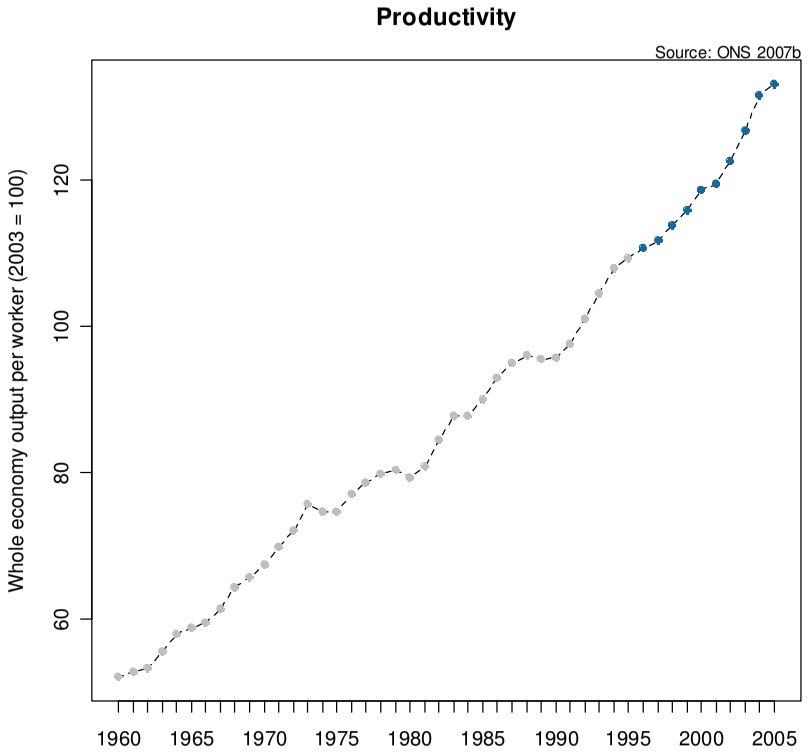

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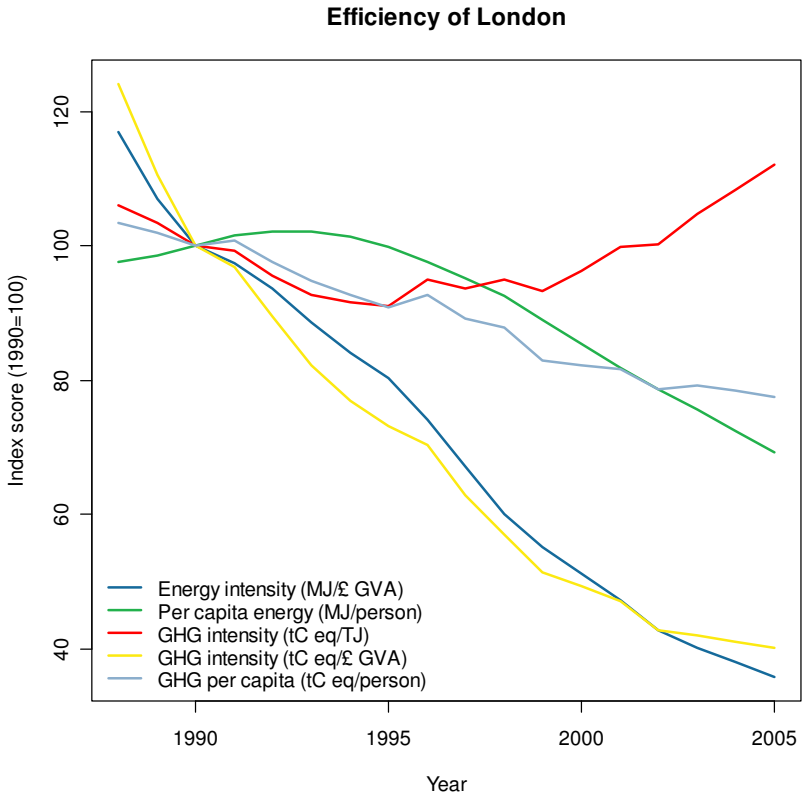
System metrics

- Combine core metrics to give overall picture
- Very sensitive to choice of denominator
  - London: 75 GJ per cap or 5.3 MJ per $GVA
  - Singapore: 136 GJ per cap or 5.5 MJ per $GVA
- Potential for innovative metrics
  - E.g. solar footprint



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Identifying the policy gap

- Indicators demonstrate issues on a range of scales
  - Local, e.g. air quality
  - National, e.g. market regulation
  - International, e.g. energy security

- Framework helps to suggest opportunities for policy engagement
  - Fuel poverty driven by income, energy prices and housing stock
  - Local government has control of housing stock
    - Could improvements to housing stock alone reduce fuel poverty?
    - If so, what stakeholders are needed to deliver the improvements?
    - If not, how might local actors reach out to other policy makers to attack problem from another angle?

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Acting at the local level

- The Merton Rule
  - Local authorities encouraging installation of microgeneration
  - Boosts industry when central government support wanes
- London Energy Strategy
  - Aims to address fuel poverty, climate, and economic development goals
  - Foster partnerships between policy makers, technology innovators and businesses to attract funding and try new ideas
- In such contexts, indicators can:
  - Identify the policy gap
  - Monitor progress
  - Highlight related sustainability issues

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Open questions

- How are indicators actually used within policy debates?
  - Public relations or decision-support?
- The 'If a tree falls in a forest' question
  - Are indicators necessary to promote these kinds of innovation activities?
- How much indicator plurality/sophistication can policy processes support?

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Conclusion

- Urban energy systems provide a unique opportunity for indicator development
- Range of indicators needed to understand system's performance
- Urban governments can use these indicators to support energy systems innovation

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Related publications

- Keirstead, J. (2007) *Selecting sustainability indicators for urban energy systems.* Paper presented at the International Conference on Whole Life Urban Sustainability and its Assessment Glasgow.

- Keirstead, J (2007) *Towards UES indicators*. Report available from http://www.imperial.ac.uk/urbanenergysystems

- Keirstead, J., & Leach, M. (in press) Bridging the gaps between theory and practice: a service niche approach to urban sustainability indicators. *Sustainable Development*.

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