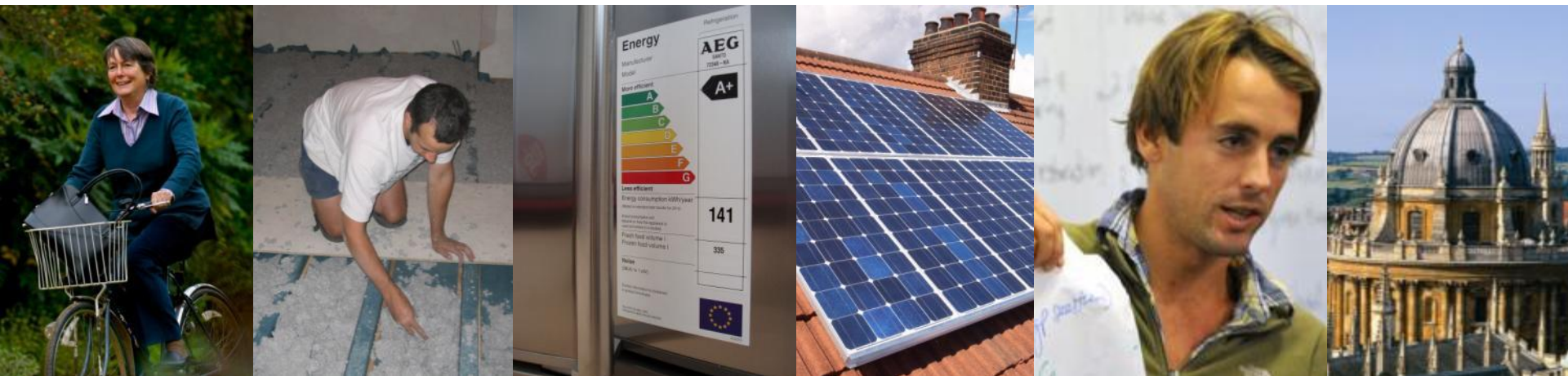




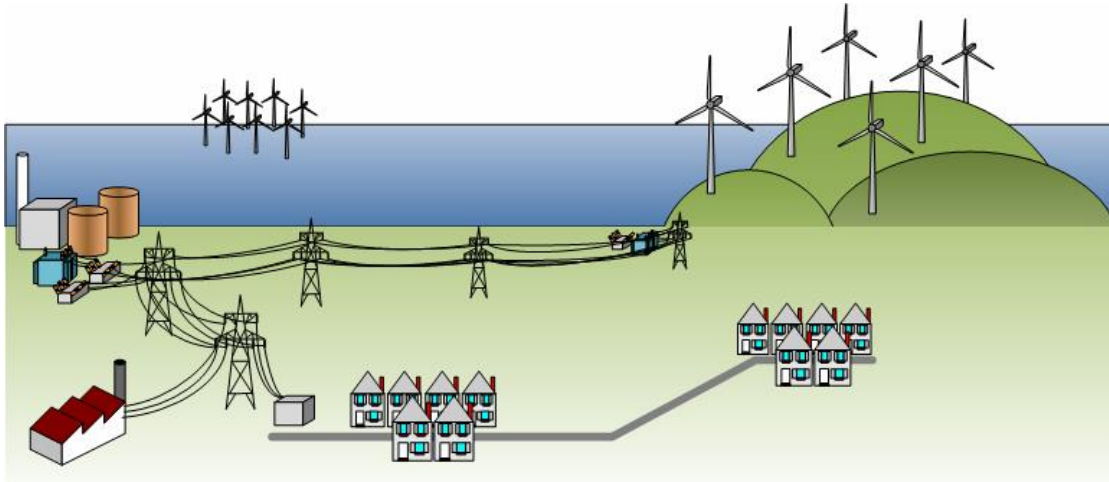
Research on behaviour and decision-making in energy systems

Sarah Darby



IEA workshop, influencing business behaviour and decision-making towards increased energy efficiency. 12th November 2015

Energy systems: where are the people?



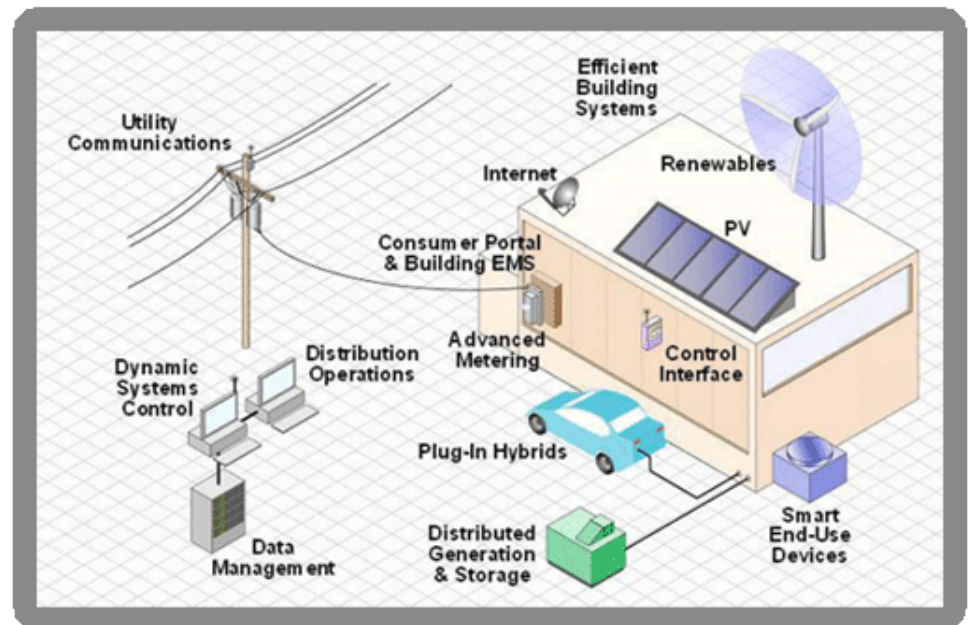
Designing markets and tariffs
Operating infrastructure
Inventing, installing and
repairing software and
hardware
*Advising, lobbying, trading,
training, regulating ...*

Keeping warm, fed, clean,
productive, connected, entertained
and mobile

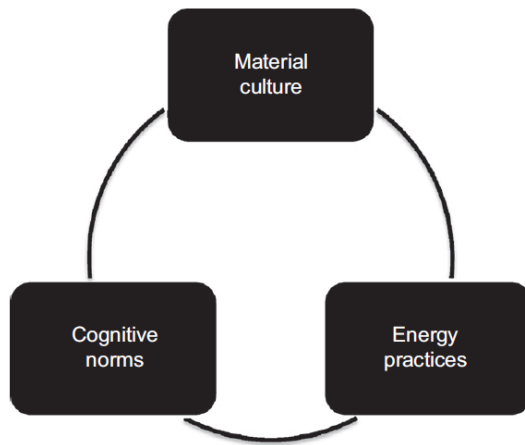
Adopting and adapting technologies

Buying, refurbishing and maintaining
buildings, vehicles and appliances

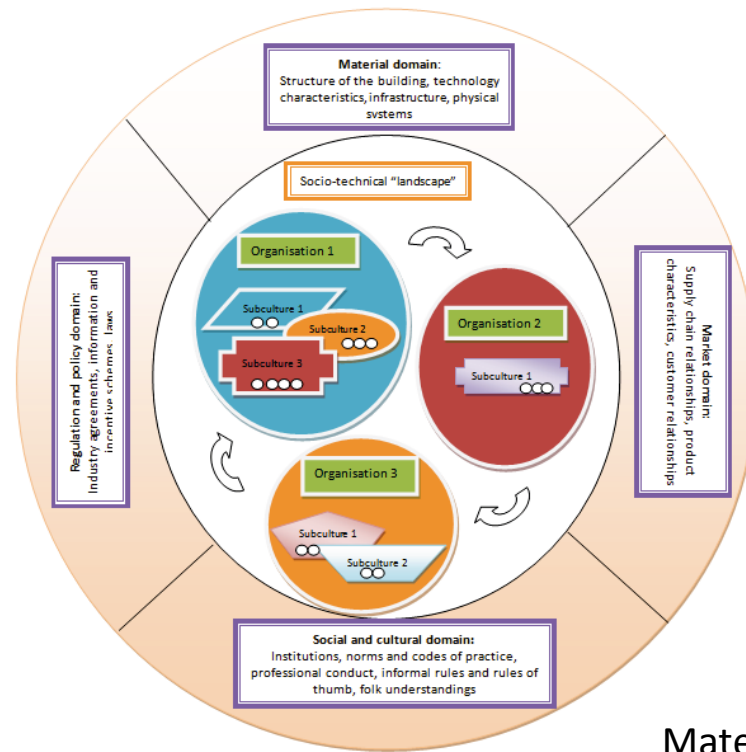
*Taking part in network management
through consumption, storage, load-
shifting, generation ...*



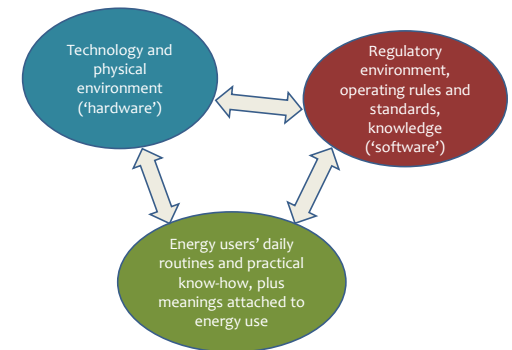
Energy systems as technological, social and dynamic



Stephenson et al.(2010)
Energy Policy



Other examples include
Bartiaux; Gram-Hanssen;
Janda; Rotmann, Goodchild
and Mourik...



Darby

Material, market,
regulation+policy and
social+cultural domains
(Banks and Fawcett, 2012)

Most of our data and understanding about energy demand comes from households...



... where purposes and dynamics of daily life are different from most organisations...

Wordle comes from abstracts for a 'dynamics of consumption' panel at a recent ECEEE Summer Study. See Taylor, M., & K. B. Janda. 2015. *New Directions for Energy and Behaviour: Whither Organizational Research?* Proceedings, ECEEE pp. 2243-2253

... and organisations themselves differ widely in what they are there for and how they operate

Sector	Sub-Sector	Sector	Sub-Sector
Education	Nursery	Retail	Small Shops (Food & Non-Food)
	Primary School		Large Shops (Food & Non-Food) (>750m ²)
	Secondary School		Hypermarket/Superstore (>2,500m ²)
	University (residential & non-residential)		Showrooms (Vehicle & Non-Vehicle)
Health	Health Centres (private doctors)		Retail Warehouse
	Hospitals (NHS & Private)		Hairdressing/Salon
Emergency Services	Police Stations	Community	Community Halls
	Prisons		Places of Worship
	Courts		Nursing Home
	Fire/Ambulance Stations	Leisure	Libraries/Museums/Galleries
Military	MOD Buildings		Theatres/Cinemas/Concert Halls
Offices	Commercial Offices (incl Central & Local Gov)		Clubs (not Sports)
		Sports	Sports Centres (with/without pools)
Hospitality	Restaurant	Storage	Stores, Warehouses
	Pub		Cold Stores
	Hotel (e.g., B&B)	Factories & Industrial Buildings	Workshops
	Takeaway		Factories (manufacturing)
	Café		Large Industrial Buildings

Categories used in the DECC (UK) Building Energy Efficiency Survey

An example of practice-based research: Oxford 'Midnight Oil' project (2010)

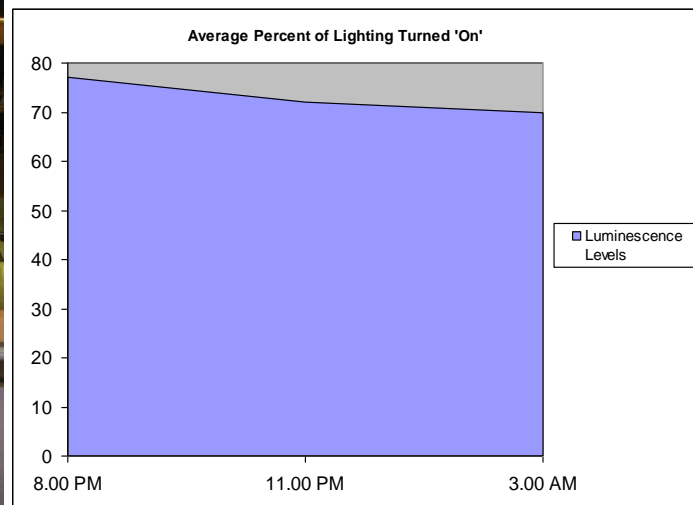
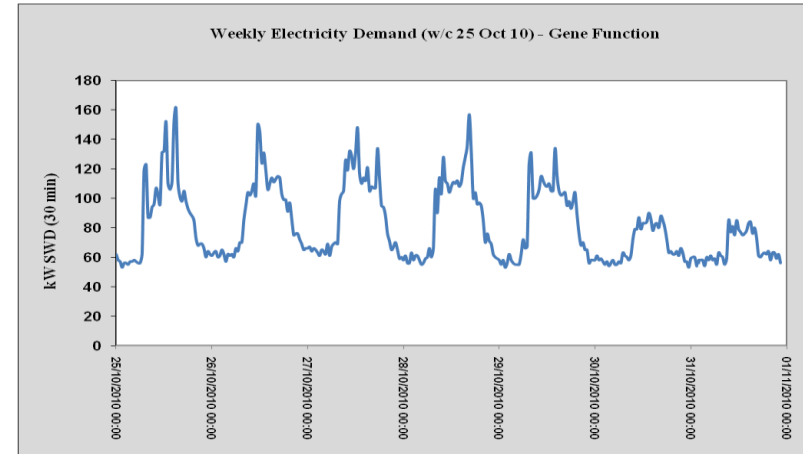
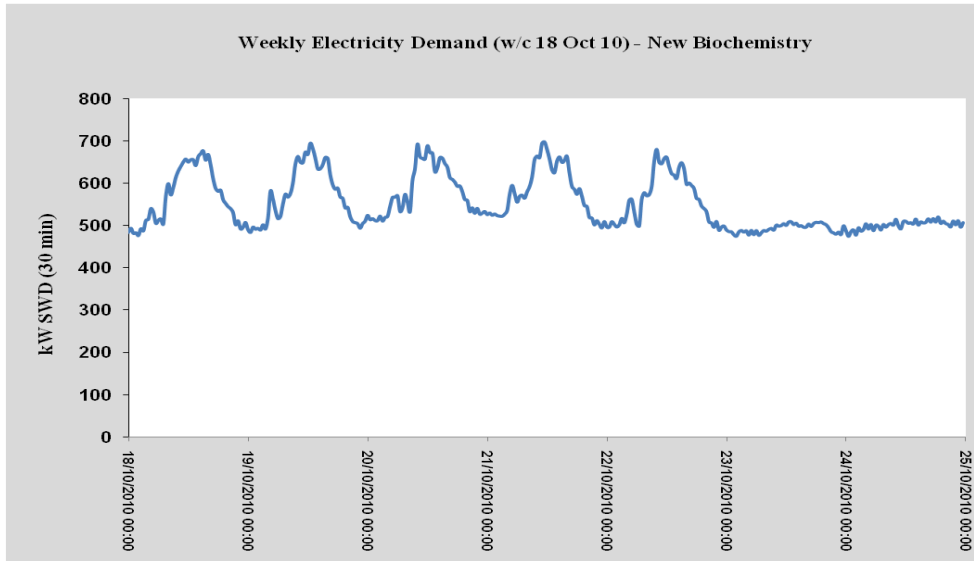
Gather data on overnight usage of four
energy- intensive **24 hour research**
buildings

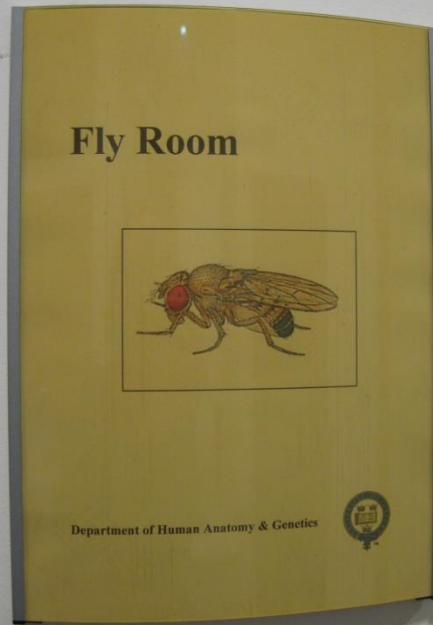
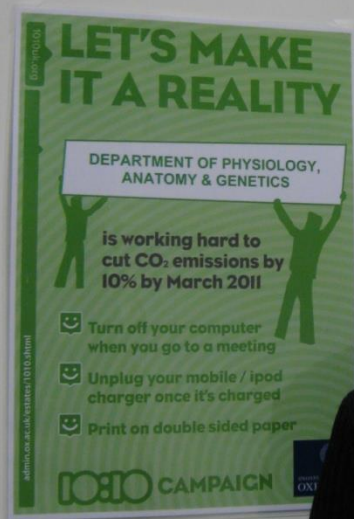
Identify, implement and assess
measures to reduce emissions
relating to overnight use, whilst
maintaining user-friendly
environment for out-of-hours work

Build closer links between academic
staff and University sustainability
team



The problem of midnight electricity: two sample weekly load curves





The special purposes



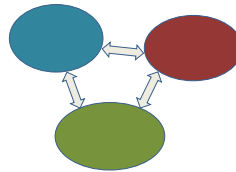
The challenge!

The rules ... and the controls

‘Practice’-based analysis of a new research building: summary



Consumption 645.09 kWh/m²/yr



Routines – very little night-time usage; energy not usually seen as an issue.

Formal knowledge rests with building manager. No departmental reporting requirement for energy use; no forum for building managers to share knowledge

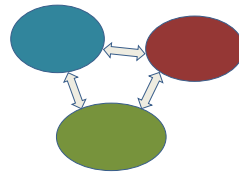
[EPC rating is D, implying less than half that level of consumption; reference/‘normal’ figure is 500-1000kWh/m²/yr for a ‘complex’ lab.]

Technology/materials: mixed-mode ventilation, but no opening windows; HVAC run at 12 airchanges/hr, humidifiers (not in use), automated lighting, now with LEDs

Meanings/priorities: ‘prestige building’. Solar PV and rainwater harvesting lend ‘green’ feelgood factor. Variable satisfaction with working conditions. Incessant lighting is demoralising.

Midnight Oil recommendations included

- review functioning of HVAC, esp. air change rates.
- develop sub metering
- allow fluctuations in temperature
- check server-room temperatures (25°C acceptable)
- alter automated light settings to default 'off'



- educate about what '24 hour access' means in operational terms
- encourage and support 'green champions'
- Consider expanding temp. range
- have building manager(s) on design committees for new buildings
- set up forum for building managers
- develop system of high expectations and accountability among occupants
- budget for post-occupancy review
- build 'institutional memory' of lessons from commissioning, construction and use of research buildings
- support departmental IT officers

Summary

Behaviour and decision-making take place in dynamic socio-technical systems;

Need to start from first principles:

- what is an organisation for?
- how is it connected to other elements in an energy system?

Broaden out from engineering, economic + psychology approaches to include insights from sociology and from learning, design, organisational and systems theories.

Develop common language on energy issues for use in organisations, including M&E by users as well as managers.

Close feedback loop to designers/ architects/developers via approaches like ‘Soft Landings’.

