Integrated decision-making about housing, energy and wellbeing (HEW)

Workshop 2
Wednesday 5th November 2013
Welcome

• Complex Built Environment Systems group (CBES) at UCL
  • Bartlett School of Graduate Studies
  • UCL Energy Institute

• EPSRC Platform Funded Group – ‘Unintended Consequences of Decarbonising the Built Environment’

• HEW project is a small pilot project – seed funded by the Platform Grant

• Recap

• What have we been doing since the first workshop in June?

• Housekeeping
Our starting point

• What will be the overall impact of polices aimed at reducing the energy demand and carbon emissions of dwellings?

• We know from history that single focus policies lead to ‘unintended’ effects

• Lots of examples
What can we learn from such examples?

- It is inevitable that policies such as the Green Deal and Energy Company Obligation (ECO) will lead to ‘unintended consequences’

- Some will be positive and others negative

- Shrubsole C, Macmillan A, Davies, M., May N. 100 unintended consequences of policies to improve the energy efficiency of the housing stock. *Indoor and Built Environment* (under review).
## Example: consequences of increasing dwelling airtightness

<table>
<thead>
<tr>
<th>No</th>
<th>Policy Impact on Buildings</th>
<th>Impacts on People/Nature</th>
<th>Unintended Consequence</th>
<th>Domain</th>
<th>+/-</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Airtightness</td>
<td>Quieter Environment</td>
<td>Peace/Wellbeing / Security</td>
<td>Mental Health</td>
<td>+</td>
<td>Sanz et al., 1993; Van Kempen 2012</td>
</tr>
<tr>
<td>2</td>
<td>Airtightness</td>
<td>Quieter Environment</td>
<td>Isolation/ Disconnection</td>
<td>Psychological Well Being</td>
<td>-</td>
<td>Lorenc et al., 2012</td>
</tr>
<tr>
<td>3</td>
<td>Airtightness</td>
<td>Quieter Environment</td>
<td>Anxiety: real and perceived threats</td>
<td>Psychological Well Being</td>
<td>-</td>
<td>Lorenc et al., 2012</td>
</tr>
<tr>
<td>4</td>
<td>Airtightness</td>
<td>Quieter Environment</td>
<td>Reduction in Noise</td>
<td>Mental Health</td>
<td>+</td>
<td>Evans, 2003; Kempen et al., 2012</td>
</tr>
<tr>
<td>5</td>
<td>Airtightness</td>
<td>Quieter Environment</td>
<td>Absence of sound</td>
<td>Mental Health</td>
<td>-</td>
<td>Evans, 2003; Kempen et al., 2012</td>
</tr>
<tr>
<td>6</td>
<td>Airtightness</td>
<td>Quieter Environment</td>
<td>Improvements in physical health; social, emotional, and behavioural outcomes</td>
<td>Child Development</td>
<td>+</td>
<td>Leventhal and Newman 2010</td>
</tr>
<tr>
<td>7</td>
<td>Airtightness</td>
<td>Lower air change rate</td>
<td>Increased RH Timber decay</td>
<td>Physical Health</td>
<td>-</td>
<td>Ucci et al., 2011; Viitanen et al., 2010</td>
</tr>
<tr>
<td>8</td>
<td>Airtightness</td>
<td>Lower air change rate</td>
<td>Increased RH Clothes drying issues</td>
<td>Physical Health</td>
<td>-</td>
<td>Porteous et al., 2012; Ucci et al., 2011</td>
</tr>
<tr>
<td>9</td>
<td>Airtightness</td>
<td>Lower air change rate</td>
<td>Changes in indoor air quality (IQA)</td>
<td>Mould-microbiological growth</td>
<td>-</td>
<td>ADF 2010</td>
</tr>
<tr>
<td>10</td>
<td>Airtightness</td>
<td>Lower air change rate</td>
<td>Changes in indoor air quality (IQA)</td>
<td>Increased exposure to indoor sourced pollutants. Decrease in external sourced pollutants (e.g. PM$_{2.5}$)</td>
<td>Physical Health</td>
<td>+/-</td>
</tr>
<tr>
<td>11</td>
<td>Airtightness</td>
<td>More water tight</td>
<td>Prevention of impacts from excess rainfall</td>
<td>Mitigation benefits, less water damage, mould risk</td>
<td>Physical Health</td>
<td>+</td>
</tr>
</tbody>
</table>

**Notes:**
- Unintended Consequence: + indicates positive impact; - indicates negative impact; +/- indicates mixed impact.
- Reference: List of references for each consequence and impact.
The complex links arising from the policy of promoting airtightness in the domestic stock and the impact on buildings, people and the wider environment.
“…progress on sustainable construction is slipping behind on all fronts – largely because there is lack of drive and focus in the Government, with clear tensions and differing priorities between The Department of Energy and Climate Change, Department for Communities and Local Government, Department for Business, Innovation and Skills and Treasury…” p.12
So, how to proceed?

• How to predict the possible future states of such complex systems?

• A different approach

• One that will provide insights regarding decarbonisation

• But, vitally, moving beyond this ‘single issue’ to also allow insights regarding integrated decision making about the wider system of housing, energy and ‘wellbeing’.
HEW: Integrated decision-making about Housing, Energy and Wellbeing

“When we point to outside shocks and side effects to excuse the failure of our policies, we think we are describing a capricious and unpredictable reality. In fact, we are highlighting the limitations of our mental models. . ..What thwarts us is our lack of a meaningful systems thinking capability.”
Sterman 2002
• A useful set of integrated maps and policy simulations

• And a policy assessment tool to support decision-making
Developing the maps, the simulation and the assessment tool

- Desired outcomes
- Problem identification

Representation of system structure and behaviour

- Dynamic models

Scenario experimentation
- Policy design

Adapted from Saeed 1992 System Dynamics Review
“Wellbeing” and housing

- Social and cultural wellbeing and community connection
- Physical health
- Mental health, homelessness and happiness, stress
- Local economic thriving, household income and employment, a stable economy
- Adaptation and mitigation of climate change
- Sustainable resource use

Fair distribution of these, including by income, ethnicity and generation/life stage
Criteria for assessing policies about housing

1. carbon emissions from housing
2. community social connection
3. fuel poverty
4. housing adaptation to climate change
5. housing affordability
6. mental and emotional wellbeing
7. physical wellbeing / health
8. policy coherence
9. social and income equity
Themes from the interviews

VENTILATION AND INDOOR AIR POLLUTION

HOUSEHOLD CROWDING

FUEL POVERTY AND INDOOR TEMPERATURE

HOUSING AFFORDABILITY

ENERGY EFFICIENCY AND CLIMATE CHANGE

COMMUNITY CONNECTION AND QUALITY OF NEIGHBOURHOODS

LAND OWNERSHIP, VALUE AND DEVELOPMENT PATTERNS
Workshop 1
What have we done since Workshop 1?

• Listened to feedback in order to shape today
  – e.g. spend some time considering the draft collaborative maps and the draft report

• Refined the collaborative maps
• Developed a simplified overall model
• Developed and circulated the draft report
• Finalised and agreed policy assessment criteria
• Begun to scope out data sources to develop concept models
• Started to get the concept modelling underway
• Continued to bring in new stakeholders
### Stakeholders

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Government/Institution</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>AECOM</td>
<td>Department for Communities and Local Government</td>
<td>New Economics Foundation</td>
</tr>
<tr>
<td>Affinity Sutton</td>
<td>Department for Environment, Food and Rural Affairs</td>
<td>Parity projects</td>
</tr>
<tr>
<td>Age UK</td>
<td>Department of Energy and Climate Change</td>
<td>Positive Money</td>
</tr>
<tr>
<td>ARUP Consultancy</td>
<td>Department of Health</td>
<td>Public Health England</td>
</tr>
<tr>
<td>Centre for Regional Economic and Social Research, Sheffield Hallam University</td>
<td>EDF Energy</td>
<td>Sheffield City Council</td>
</tr>
<tr>
<td>Centre for Sustainable Energy (CSE)</td>
<td>Energy Institute, University College London</td>
<td>Shelter</td>
</tr>
<tr>
<td>Centre for Sustainable Planning and Environments University of the West of England</td>
<td>Environmental Change Institute and UKCIP, University of Oxford</td>
<td>Sustainable by Design</td>
</tr>
<tr>
<td>Chartered Institute of Building Services Engineers</td>
<td>Good Homes Alliance</td>
<td>Sustainable Healthcare Network/Sustainable Development Foundation</td>
</tr>
<tr>
<td>Community roots group</td>
<td>Government Fuel Poverty Advisory Group</td>
<td>Usable Buildings Trust</td>
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<tr>
<td>Consumer Focus</td>
<td>Greater London Authority</td>
<td>Willmott Dixon</td>
</tr>
<tr>
<td>Core Cities</td>
<td>Homebuilders Federation</td>
<td>Zero Carbon Hub</td>
</tr>
<tr>
<td>Department for Business, Innovation and Skills</td>
<td>Leeds Sustainability Institute, Leeds Metropolitan</td>
<td></td>
</tr>
</tbody>
</table>
Shape of the day

1:30 Welcome and recap

2:00 Developing recommendations for the report

2:45 What can we learn from small simulations?

3:15 Break for tea, coffee and snacks

3:30 Using the collaborative maps to assist with decision-making

4:50 Summary, evaluation, next steps

5:00 Join us for drinks and networking until 6:00
Guidelines for today

1. We will stick to time
2. Please switch your mobile off
3. We would like everyone to participate
   – Short contributions, one at a time
4. All ideas are valid
   a. We want to hear a wide range of opinions
   b. Listen to each other – disagree agreeably
5. We will use the discussion
   a. We want to capture the essence of what you have to say
   b. We will summarise the workshop on the website and to stakeholders
   c. Everyone should feel free to use and debate things discussed today
      **but** without attaching what’s been said to any individual
Dynamic systems thinking
biscuits in the shop

Stock
biscuits in the shop

biscuits being bought and taken away

Flow
Changing customers leads to a change in biscuits being bought in the same direction.
Biscuits in the shop

Biscuits being bought and taken away

Customers

New customers

Losing customers
biscuits in the shop

biscuits being bought and taken away

customers

new customers

existing customers telling their friends how great my biscuits are

losing customers

Reinforcing feedback loop
biscuits in the shop

biscuits being bought and taken away

customers

new customers

losing customers

existing customers telling their friends how great my biscuits are

baking more biscuits

R
biscuits in the shop

baking more biscuits

biscuits being bought and taken away

customers

existing customers telling their friends how great my biscuits are

new customers

losing customers

how many biscuits I think I need so I don't run out
biscuits in
the shop

how many biscuits I
think I need so I don’t
run out

gap between how many I
think I need and how many
I currently have

baking more biscuits

biscuits being
bought and taken
away

customers

new customers

existing customers telling
their friends how great my
biscuits are

losing customers

Changing the stock
level of biscuits in
the shop leads to a
change in the gap
IN THE OPPOSITE
DIRECTION

how many biscuits I
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gap between how many I think I need and how many I currently have

Balancing loop
biscuits in the shop

baking more biscuits

biscuits being bought and taken away

customers

existing customers telling their friends how great my biscuits are

new customers

losing customers

how many biscuits I think I need so I don’t run out

gap between how many I think I need and how many I currently have

Delay
Session 2

Developing recommendations for the report
Places to intervene in a system

5. Numbers, constants and rates of flow

4. Feedback loops, time and information delays

3. The system rules

2. Capacity of actors to change and evolve

1. Paradigms and ideological constraints

Adapted from Donella Meadows 1997
Example recommendation

With a specific focus on the decarbonisation of the housing stock:

The rapid establishment of a cross Government group (including at least DECC, DCLG, BIS and Treasury) to enable the development of a relevant and meaningful systems thinking capability. The group would be supported by an Advisory Committee which could perhaps fall under the Green Construction Board (if it is to continue*).

• Process recommendation to government departments
• Recommendation for within the next 4-6 months
• Increases the capacity for policy actors to change and evolve

* “If it is to continue, the Green Construction Board needs to be reconfigured and given real teeth in order to genuinely impact policy.” (APPG for Excellence in the Built Environment, 2013)
Session 3

What can we learn from small simulations?
Behaviour over time

- Exponential growth
- Goal-seeking
- Oscillation
Exponential growth
state of the system

gap between current state and goal
corrective action

goal

gap between current state and goal

corrective action

Goal-seeking
state of the system

gap between current state and goal

corrective action

Oscillation

Time

goal
Predicting (divining stick)
Convincing (big stick)
Explaining (pointing stick)
Exploring (walking stick)

Increasing understanding
Supporting better action
Different kinds of information to help with simulations

Census
Community life survey/citizenship survey
English housing survey
British household panel survey

Studies analysing these surveys
Different kinds of studies collecting and analysing new data
The small simulation model

- Median tenure length
- Proportion of households trying to move
- Quality of neighbourhoods
- Pulling together for improvement
- Change in social connection
- Bridging social connection and sense of security
neighbourhood
social connection
and sense of
security
ownership, pride and
responsibility for local
place
bonding between
people who are alike
territorial exclusion,
prejudice and
marginalisation
presence and strength of
neighbourhood organisations
aimed at the public interest
investment of resources
into neighbourhood and
housing quality
neighbourhood
social connection
and sense of
security
ownership, pride and
responsibility for local
place
length of tenure
investment of resources
into neighbourhood and
housing quality
energy efficiency of low
income housing stock
tenure security
household
running costs
ability to successfully
gain external resources
What can be learnt from the community connection simulation so far?

- Missing balancing loops
- Links that could be refuted
- Strength of links based on current knowledge
- Gaps in knowledge

- Current trends in tenure length are likely to be working against what could potentially be helpful feedback loops for other housing objectives, including carbon emissions
Session 4

Practical use of the collaborative maps
Policy for consideration

“Outlaw” poor energy performing properties from being rented in the private rental sector

Announcement Jan 2014, with 12 months to bring into force
Starting with an energy performance rating below D
Summary of the day

• Revisited the project background
• Developed recommendations for the report
• Learnt about what we might use simulation for and how we would do it
• Explored how the current work can be used to support your roles and move onto a policy assessment tool
Next steps

• Producing the next draft of the report
• Continual causal map refinement
• Insightful pieces of simulation
• Policy development and assessment work 2014

• Using the work so far
• …..with specific stakeholder organisations

• Programme of research (putting together transdisciplinary groups – support from Stakeholders)
Thank you all for participating