

Developing DECC’s Evidence Base: A commentary from the DEMAND Centre

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Background

DEMAND (Dynamics of Energy, Mobility and Demand) is one of six End Use Energy Demand Research Centres, and is funded by the Research Councils UK, ECLEER (EDF R&D), Transport for London and the International Energy Agency. DEMAND, which runs from 2013-2018, is led by Elizabeth Shove (Lancaster); Gordon Walker (Lancaster); Greg Marsden (Leeds) and Sylvie Douzou (ECLEER, EDF R&D, Paris), and involves researchers from 9 universities across the UK and from EDF R&D, Paris. See WWW.DEMAND.AC.UK for more details.

This document shows how the DEMAND centre's research and its future plans relate to the priorities outlined in "Developing DECC's Evidence Base" (2014) – hereafter, DEB. In mapping points of connection and difference this commentary contributes to ongoing dialogue between DEMAND and DECC. In what follows, our aim is to identify the types of contribution that the DEMAND centre could make to the evidence base and to underlying understandings of energy and demand. As well as giving specific examples of how DEMAND contributes to the DECC evidence strategy we identify what seem to us to be gaps, tensions and opportunities for further development.

The DEMAND centre's research is informed by a distinctive theoretical approach, recognising that energy is not used for its own sake but as part of accomplishing social practices at home, at work and in moving around. This has a number of practical consequences: for example, we are interested in how shared conventions and expectations of daily life develop and in what these mean for energy demand. We focus on the unit of the practice (heating, laundering, office working, daily showering, cooking, lighting, etc.) rather than on individual behaviour. We analyse the technologies and infrastructures that sustain contemporary patterns and rhythms of energy-related practices, showing how these arrangements change and how understandings of normality, entitlement and need evolve (for further information about the DEMAND Centre's approach visit <http://www.demand.ac.uk/what-is-demand/>).

DEB contends that "People are the agents of change in the energy system" and goes on to emphasise the importance of improving "our understanding of how people behave, whether as individuals at home or work, or as part of communities, businesses or whole supply chains or workforces" (DEB p14). In general terms, there is no part of the DEMAND programme that is not, in some way relevant to this ambition – not necessarily as a source of data, but as a source of fresh ideas, concepts and ways of thinking about 'people', 'institutions' and to a lesser extent 'markets'.

That said, there are important points of difference. For example, DEMAND research views people as the carriers rather than the agents of change, it acknowledges the extent to which technologies/infrastructures and social practices co-evolve (this is not simply a question of how technologies are used), and it recognises that policy making is itself implicated in reproducing and shaping conventions and practices of daily life at work and at home. In taking this approach, DEMAND brings new theories and concepts into view. Whilst this is consistent with DECC's ambition to "directly engage researchers working in the wider social sciences including those working outside the topic of energy" (DEB p14) it is also a source of productive tension. Our commentary does not shy away from the fact that there are real and potentially controversial differences of approach

Before going into detail we provide a brief outline of the DEMAND centre's research, and a summary of key themes arising from our comparison of DEB's priorities and DEMAND's agenda.

Introducing the DEMAND Centre's research

The DEMAND Centre's research is organised into 5 themes and 15 projects, summarised in Table 1.

Table 1: The DEMAND Centre’s research: themes and projects

| Theme | Project | Dates | Further Information |
|---------|---|--|---|
| Theme 1 | Trends and patterns in energy demand | May 2013 - April 2016 | http://www.demand.ac.uk/research-themes/theme-1-trends-and-patterns-in-energy-demand/ |
| Theme 2 | How end use practices change 2.1 Domestic IT use 2.2 Business travel 2.3 Older people and mobile lives 2.4 The dynamics of energy use in daily life | June 2014 - Dec 2016 Nov 2014 - May 2016 Nov 2014 - Oct 2016 May 2015- May 2017 | http://www.demand.ac.uk/research-themes/theme-2-how-end-use-practices-change/ |
| Theme 3 | Managing infrastructures of supply and demand 3.1 Adapting infrastructure for a lower carbon society 3.2 Negotiating needs and expectations in commercial buildings 3.3 Infrastructures for online shopping: integrating supply and demand 3.4 Monitoring and controlling demand | May 2013-May 2017 Sep 2014- Jan 2016 Nov 2015-Oct 2017 May 2015- April 2017 | http://www.demand.ac.uk/research-themes/theme-3-managing-infrastructures-of-supply-and-demand/ |
| Theme 4 | Normality, need and entitlement 4.1 Energy, need and justice 4.2 Beyond elasticities: affording mobility 4.3 Implicit energy governance | May 2013- May 2016 Nov 2014 – Oct 2016 Oct 2015 – Sep 2016 | http://www.demand.ac.uk/research-themes/theme-4-normality-need-and-entitlement/ |
| Theme 5 | Integration and application | May 2013-May 2018 | http://www.demand.ac.uk/research-themes/theme-5-integration-and-application/ |

In brief, projects in Theme 1 integrate and analyse existing data (e.g. time use surveys, energy data and national travel data) to identify trends and variations in the social practices that underpin energy demand. As part of this work, Theme 1 has developed methods that enable more sophisticated analyses of spatial, temporal and social variations in end use practices. These techniques and the insights that follow are relevant for current policy initiatives (e.g. smart metering), and for developing models of future energy demand that take account of the temporal ordering of daily life and of the fixity/flexibility of different end-uses of energy .

Projects in Theme 2 explain how and why specific practices are changing. Our focus is on aspects of everyday life that are evidently in transition: domestic IT use, business travel and the travel of older people. The aim is to assess the implications of these changing practices for energy use and for current and new forms of demand management.

Theme 3 focuses on the systems and infrastructures on which end use practices depend. This set of projects uses methods and ideas from history, sociology and geography to show how infrastructures have been adapted, modified and layered on top of one another, and how contemporary systems of provision are operated and managed. Projects in this theme concentrate on domestic energy, personal mobility, office work and online shopping. In all cases, the aim is to identify possible paths for the future adaptation and reconfiguration of infrastructures *and* end-use practices.

Theme 4 tackles fundamental questions of justice, need and entitlement, doing so in order to generate and inform public policy and national and international debate about how much energy consumption and mobility is required to participate effectively in society, and how these needs might change.

Theme 5 'Integration and application' involves the production and promotion of academic and non-academic output that synthesises cross-project findings relating to the constitution of demand, (how energy demanding practices vary, how are they enacted, by whom, when and where), the dynamics of demand (how technological innovations such as smart grids, electric vehicles, better management and control systems, shape and are shaped by innovations in end use practices), and opportunities for steering demand (how evolving patterns of energy demand might be confronted and steered).

The following paragraphs summarise six key themes arising from our detailed analysis of points of connection and difference between DEMAND's research programme and DEB's priorities.

Summary of key themes

- **Peak load and the timing of energy demand**

DEMAND research provides detailed insight into of the social distribution and temporal patterning of energy-demanding practices; showing when in the day, week or year specific energy-using practices occur and when related equipment is in use. Further analysis of sequences and rhythms of practice is important for understanding the forms of fixity and flexibility that follow, and for assessing the social viability of undertaking specific practices at other times of the day, the week or the year. (see section 1.1 of this document).

This research is relevant to those in DECC working on Smart Meters and Smart Grids, DECC's evidence base on Energy Saving Products, the Fuel Poverty Team and the Big Energy Saving Network Team, Customer Insight Team, Consumers and Household Directorate, those working on electricity demand and technical energy analysis.

- **Informing longitudinal analysis**

Our work on the histories of home infrastructures and domestic energy use shows, in detail, how different energy using practices have changed from the 1940s to the present day. Another project follows the full range of practices that make up daily life (at home, work, leisure), showing how these change over the life course (See section 1.2 of this document).

This work will help situate policy interventions within and as part of longer term trajectories of change. It will also provide useful insight into the relation between infrastructures (buildings) and social practices – relevant for future longitudinal analyses of cohorts and their energy demands.

- **Adapting infrastructure**

DEMAND recognises that domestic and non-domestic energy demand depends on the changing infrastructures of homes and offices and on related opportunities to consume (See section 2.2 of this document). DEMAND's research shows how and why expectations of 'normal' provision – for instance of heating, lighting and hot water – have changed. As DEMAND's research indicates, professional organisations, standards bodies, local authorities and developers continue to shape the extent and character of domestic and non domestic energy consumption.

This work could feed into DECCs plans for promoting lower carbon methods of heating as set out in the Heat Strategy and 2050 Pathways Analysis.

- **Non-domestic energy use**

DEMAND takes a distinctive approach to non-domestic energy use. Rather than focusing on individual decision makers within organisations, we consider the trends in which such people are caught, including local conditions and contexts (See section 2.3 of this document). Our non-domestic work focuses on how commercial/office life develops and on the many organisations, technologies and infrastructures involved. Another project looks at how building and local network managers reduce and manage energy demand in practice, and at how their strategies, including the use of Energy Management systems, are shaped by competing performance goals and expectations (See section 1.3 of this document).

These analyses are relevant to those working on the non-domestic evidence base in the Energy Efficiency Deployment Office particularly those concerned to understand the behaviours of businesses and their implications for energy reduction. This work is also relevant to the Smart Meters team working on Smart Grids and those in Science and Innovation who work on 'technological solutions'.

- **Energy demand and energy efficiency**

There is nothing wrong with increasing efficiency but it is important to recognise that such measures are not merely technical: they shape interpretations of a normal way of life, they promote some practices and undermine others, and in so doing they are of consequence for the future. For example, modern central heating systems are clearly more efficient than their predecessors but if we take a longer term view central heating systems have contributed to the decline of much more efficient, much lower carbon methods of keeping warm (e.g. through clothing). Second, focusing on the efficiency with which services are provided inadvertently reproduces the status quo, sidestepping more fundamental questions about how concepts of service and of need develop and change.

DEMAND research reveals the extent to which energy policy is itself implicated in constructing future energy demand. In addition it shows how interpretations of the need for energy evolve.

- **Non-Energy Policy**

Energy policy is not the only area of policy that has consequences for energy demand (see section 2.4 of this document). Many non-energy policies have unintended energy consequences. Our project on 'implicit energy governance' (See section 1.3 of this document) examines the implications of non-energy policies for energy demand in health care, higher education and the military: three of the largest non-commercial users of energy. In each case, our research is designed to reveal the energy and mobility implications of high level shifts in policy agendas over the past 30 years. These analyses will be used to explore methods of extending the scope of 'energy policy' and of influencing non-energy policy initiatives that impact on how energy is used and what it is used for.

This analysis could help DECC in its collaboration with other departments, including the Department for Education, Department of Transport, Department of Health and Ministry of Defence.

A detailed response to ‘Developing DECC’s evidence base’

We have organised our more detailed comments on the relation between DEMAND’s research and DEB’s priorities in two parts. Part 1, ‘points of connection’ engages with the sections of DEB that relate to:

- 1.1 energy use and efficiency
- 1.2 energy use in homes
- 1.3 energy use in non-domestic settings

Part 2, ‘points of difference and productive debate’, consists of a rather broader discussion of how DEB approaches the following topics:

- 2.1 energy demand and energy efficiency
- 2.2 behaviour and technology
- 2.3 terms and units of evaluation and analysis
- 2.4 understanding and promoting change.

Part 1: points of connection

1.1 Energy use and efficiency

DEB places considerable emphasis on energy efficiency. In the section on ‘Energy use and efficiency’ DEB calls for more research and evidence (particularly from the social sciences) to inform methods of promoting the uptake and use of efficiency measures and to understand and remove barriers that prevent people from acquiring lower energy technologies or from using existing technologies more efficiently.

DEMAND research engages with different aspects of this agenda.

Projects in Theme 1 are directly relevant for understanding *when* energy is consumed – e.g. when in the day, week or year specific energy-using practices occur and hence when related equipment is in use. Our work on the temporal fixity and/or flexibility of different practices (e.g. laundry, eating) is important in anticipating potential ‘barriers’ to change (DEB 4.14, p19, and DEB 4.7, p17). In addition, our work on the social distribution and patterning of energy-demanding practices reveals relevant trends and differences that are disguised by generic analyses of average energy consumption.

More specifically:

- We are using time-use data to better understand the timing of energy-demanding practices (cooking, heating, laundry, using IT, travelling by car) across society. For example, when do such practices take place? Which energy demanding practices are enacted at the same time? Which practices generally occur in a patterned sequence? Which are more flexible?
Outputs: DEMAND seminars for DECC on time use and energy demand (December 2013: <http://www.demand.ac.uk/15/01/2014/presentation-given-at-decc-10-december-2013/>); and on smart meters (May 2014); workshop on rhythms of demand <http://www.demand.ac.uk/events/event/shifting-routines-changing-demand-workshop-28-29-may/>). Papers to be published in 2015 include: Ben Anderson on the flexibility of laundry; Mathieu Durand-Daubin on the rhythms of cooking and eating and Jillian Anable/Giulio Mattioli on car-dependent practices. Contacts: Ben Anderson, (B.Anderson@soton.ac.uk);

Mathieu Durand-Daubin (mathieu.durand-daubin@edf.fr) and Jillian Anable (jillian.anable@abdn.ac.uk).

- Other research in Theme 1 will provide further insight into where people are at different times of the day, the week and the year, and hence where energy-demanding practices are enacted. For example, patterns of being at home or at work are significant for understanding which equipment is turned on and off, and when this happens. This work also shows how patterns of mobility and energy demand interact.
Outputs: papers to be published in 2015 on where people are at peak hours, what they are doing, and what this means for energy demand. Contact: Jacopo Torriti (j.torriti@reading.ac.uk).
- We are examining variations in a range of energy-demanding practices (by social class, age, life course), again showing how these variations impact on the extent, timing and distribution of energy demand.
Outputs: paper to be published in 2015: contact Ben Anderson (b.anderson@soton.ac.uk)
- Project 2.1, 'Domestic IT use' will provide detailed insight into the changing uses of home IT (broadly defined). It will show when, how and for how long different types of home IT/entertainment related equipment are used – and what impact this is having on what else people do. This project starts in July 2014 and will collect new empirical data through detailed case studies of a diverse sample of households and individuals.
Outputs: due from mid 2015 will include papers on changes in home IT and its uses, and on what such changes mean for other energy-related practices. Contact Mike Hazas (m.hazas@lancaster.ac.uk).

Links with DECC

In combination these research outputs could help inform DECC's work on Smart Meters and Smart Grids, for example, identifying the potential impact of smart metering on different practices, the scope for temporal flexibility, and the implications this would have on load shifting etc. DEMAND's research could also contribute to DECC's evidence base on Energy Saving Products. Research on differences and patterns within and between social groups will be potentially relevant for the Fuel Poverty Team and the Big Energy Saving Network Team in DECC. Finally, DEMAND's work in this area could be of interest to Customer Insight team and more generally the Consumers and Households Directorate, to help form a better understanding of social variation and difference.

1.2 Energy use in homes

DECC is interested in evidence that "will continue to improve our understanding of actual energy use in homes..." in order to improve energy efficiency and move towards lower carbon methods of heating (DEB p5).

DEMAND research approaches the topic of 'energy use in homes' from different points of view. As discussed above, Theme 1 deals with questions of timing and of when energy use occurs. DEMAND research also provides important insight into how homes, what people do at home, and heating practices co-evolve. Two projects specifically address issues of home heating:

- Project 2.4: 'The dynamics of energy use in daily life', considers and compares experiences and related patterns of energy demand over the life course. The methodological focus is not on the home as such, but on the full range of practices enacted by people of different ages

(planned sample of around 24 households in the UK, 24 in France). The idea is to ‘follow’ the energy demand entailed in all aspects of daily life (at work, at school, leisure, etc.), including the home and home heating. This method will allow us to understand the consequences of everyday practice for energy-related actions including end-use ‘behaviour’ and investment. The comparative approach will help determine shared and culturally specific features of social practices and associated energy demands, and reveal a range of higher and lower energy versions of ‘normal’ ways of life.

Output: This project starts in mid 2015. For further details contact Gordon Walker (g.p.walker@lancaster.ac.uk) or Sylvie Douzou (Sylvie.Douzou@edf.fr).

- Project 3.1: ‘Adapting infrastructure for a lower carbon society’, shows how and why different energy using practices have changed across the decades, from the 1940s to the present day. This project has to do with the changing infrastructure of the home and the opportunities it affords to consume energy. We are focusing in particular on how ideas of ‘normal’ standards –of heating (e.g. room temperature), bathing and laundering (hot water) – evolved alongside the introduction of gas and electricity and the relative decline in solid fuel between the 1920s and 1970s. We are also looking at how visions of future living are made real in building design and planning, and at how existing buildings are adapted as conventions and practices develop.

Output: This project will produce a series of papers to be published in 2015, some focusing more on the historical data, others on the role of professions and planners, and on the ways in which infrastructures and social practices shape each other. Contact: Elizabeth Shove (e.shove@lancaster.ac.uk); Frank Trentmann (f.trentmann@bbk.ac.uk) and Matt Watson (m.watson@sheffield.ac.uk.)

Links with DECC

These parts of the DEMAND programme contribute to the DECC agenda by showing how and why methods and habits of heating vary and persist across the life course and between cohorts, and how this affects energy demand. This work is critical for understanding actual energy use in homes. It shows that demand depends on the changing infrastructure of the home and on the ways of life that such technologies enable. Outputs from this work could feed into DECCs plans for promoting lower carbon methods of heating as set out in the Heat Strategy and 2050 Pathway Analysis. They could also inform scenarios and methods of anticipating future energy demand.

1.3 Energy use in non-domestic settings

DEB notes that the “The evidence base for energy efficiency and low carbon heat is less developed in business, industry and the public sector, due to the heterogeneity of the sectors...” and observes that “We want to understand more about how different types of organisations make energy-related decisions...” (DEB p5). DEMAND’s work in the non-domestic sector provides an understanding not of individual decision-makers, but of the trends in which such people are caught, again underlining the significance of local conditions and contexts. There are three projects which consider non-domestic energy use.

- Project 3.2, ‘Negotiating needs and expectations in commercial buildings’, will show how office buildings, office technologies and associated forms of energy demand are tied into the nature of office work itself. This research focuses on the changing meaning and nature of office work and on the different organisations (facilities managers, developers, standards bodies, business organisations etc.), technologies and infrastructures involved. We address these issues through case studies of office buildings of different vintage, concentrating on moments of renewal and upgrading.

Output: This project starts in September 2014. We expect to publish in 2015, and are likely to be writing about the part that standards play in stabilising and changing expectations, about the energy implications of different rates and styles of refurbishment, and about moments and opportunities for intervention. Contact John Connaughton (j.connaughton@reading.ac.uk) and James Faulconbridge (j.faulconbridge@lancaster.ac.uk).

- Project 3.4, 'Monitoring and controlling energy demand', looks at how building and local network energy managers reduce and manage energy demand in practice, how their strategies, including use of Energy Management systems, are shaped by competing performance goals and expectations, and the types of skill, intuition and judgement involved
Output: this project starts in May 2015. For more information contact Gordon Walker (g.p.walker@lancaster.ac.uk).

- Project 4.3, 'Implicit energy governance', examines the implications of non-energy policies on energy demand in health care, higher education and the military. These are three of the largest non-commercial consumers of energy, and as such provide revealing sites in which to identify the energy and mobility implications of high level shifts in policy agendas over the past 30 years.

Output: this work starts in October 2015. In addition, we are planning to organise a series of seminars, developing this part of the DEMAND agenda and exploring different aspects of non-energy policy. We have produced on short article on this topic: <http://www.demand.ac.uk/24/10/2013/school-holiday-shakeup-brings-unintended-consequences-article-in-the-conversation/>. Contact Elizabeth Shove (e.shove@lancaster.ac.uk) or Jan Selby (j.selby@sussex.ac.uk).

Links with DECC

Our work on needs and expectations in commercial offices contributes to an understanding of changing energy demand in the non domestic sector. This is relevant to those working on the non-domestic evidence base in the Energy Efficiency Deployment Office, particularly those concerned with the 'behaviours' of businesses and their implications for energy reduction.

Our work on monitoring and controlling energy demand will provide insight into the ongoing balancing of energy supply and demand. This project is important in assessing the limits of 'technological' solutions in specific situations and in determining future prospects for the design and operation of institutional scale smart 'micro-grids'. It will be relevant for the Smart Meters team working on Smart Grids as well as those in Science and Innovation who work on technological solutions.

DEMAND's research on the topic of 'implicit energy governance' and non-energy policy more broadly provides an opportunity to acknowledge and engage with policy initiatives that have a high level impact on how energy is used and what it is used for. This analysis could help DECC in its collaboration with other departments, including the Department for Education, Department for Transport, Department of Health and Ministry of Defence.

Part 2: Points of difference and debate

In this part we comment on how questions of energy demand and efficiency are addressed within DEB. We discuss and challenge some of the assumptions DEB makes about the relation between behaviour and technology, the terms and units of evaluation and analysis, and what is involved in understanding and promoting change. In what follows we highlight dominant themes and omissions but acknowledge that DEB contains different interpretations and views of all these issues.

2.1 Energy demand and energy efficiency

DEB is quite clear about where the priorities lie: “We need to make sure our networks are reliable as we decarbonise our supplies, and as demand changes as a result of new technologies” (DEB p6). As DEB explains, the challenge is that of consistently meeting present levels of demand in a manner that is secure and ‘decarbonised’. DEB repeatedly argues for a focus on “increasing the share of electricity and heat supplied from low carbon technologies” (DEB p11), and on the uptake and effective use of energy efficiency measures (DEB p16). In taking this approach, DEB does not address questions about need, including the ‘need’ for electricity.

The history of evolving energy demand (and the parallel histories of practices that use energy) suggests that needs - or in DEB’s terms “present levels of demand” - are dynamic.¹ This is important on two counts. First, thinking in terms of present levels of demand obscures the point that ‘needs’ continue to change and that there are quite different ‘needs’ for energy across society. Second a focus on the efficiency with which services are provided inadvertently reproduces the status quo, sidestepping more fundamental questions about the nature of energy-related services/needs and how they evolve.

Unlike DEB, DEMAND takes the production of need and demand as a central topic of analysis and enquiry. This takes various forms.

- DEMAND’s historical work (project 3.1) demonstrates the rate at which expectations of ‘normal’ provision, for instance of heating in the home, have developed. Since the 1970s, indoor temperatures have risen by about 4 degrees Celsius and the insulation value of what people wear has dropped accordingly. It is true that central heating systems have become more efficient but in the meantime, and in part because of central heating, previously *more* efficient methods of keeping warm (e.g. through clothing) have declined. By keeping the dynamic relation between technology and practice in view DEMAND keeps sight of these longer term trends in energy demand.
- Within Theme 1 we have reviewed interpretations and assumptions about ‘present ways of life’ as reproduced in a range of recent energy and transport policy documents. This exercise has allowed us to identify and discuss tensions and differences in taken-for-granted interpretations of need embedded in coexisting policy strategies. A working paper on this topic is due in 2014: contact Greg Marsden (g.r.marsden@its.leeds.ac.uk).
- Rather than taking the status quo for granted, the DEMAND centre’s research focuses on instances in which the practices on which energy demand depends are themselves expanding, contracting and changing (e.g. business travel, home IT use etc.). This strategy allows us to compare *processes* of change across these domains.
- Project 4.1, ‘Normality, need and entitlement’, is designed to promote an informed debate about the range and extent of energy services that households have come to expect and that current energy measures/policies suppose and imply.

Links with DECC

There is nothing wrong with increasing energy efficiency but it is important to recognise that such measures are not merely technical: they shape interpretations of present ‘standards’, they promote some practices and undermine others, and in so doing they are of consequence for the future. In

¹ See, for example, E. Shove (2003) *Comfort, Cleanliness and Convenience: the social organization of normality*, Oxford: Berg.

taking present needs for granted efficiency agendas reproduce the status quo. In reproducing current ways of life they legitimise and perpetuate demand for certain levels of heating, hot water, lighting, cooking, home entertainment etc., overlooking the point that present standards of living have a short social history, and that future needs are unlikely to be the same as those that pertain today.

DEMAND research can help energy and energy-related policy acknowledge the negotiability of future needs and services and identify opportunities for shaping these so as to reduce rather than perpetuate future demand. Good examples already exist. For instance, the Japanese 'Cool Biz' programme, launched in 2005, explicitly challenged the 'need' to maintain 22°C indoors and the 'need' to wear a business suit through the summer months. Rather than organising models of energy demand around standardised, 'present' ways of life, there is scope to explore and exploit the diversity and the dynamics of social practices as revealed by DEMAND research.

2.2 Behaviour and technology

DEB is not alone in highlighting the relationship between behaviour and technology. A common formulation is that behaviour needs to change if low carbon technologies are to be adopted and used, or if people are to make 'better' i.e. more efficient use of existing infrastructures and appliances (DEB p14). A variant of this approach is to look at how technologies 'perform' in use (DEB p18). The goal of understanding how technologies are adopted in practice makes sense, but it is important to recognise that this formulation of the problem rests on a rather clear distinction between technological potential on the one hand, and 'use' on the other.

DEMAND research focuses not on individual/user behaviour but on shared conventions and social practices. This might sound like a small semantic difference, but it is not. For DEMAND, figuring out 'how people heat their homes' is a matter of figuring out what homes are heated for. The spatial and temporal patterns of domestic heating have to do with changing interpretations of comfort, and with what goes on when and within different parts of the home (See project 3.1). Understanding these interactions is a matter of tracking and potentially steering changing concepts and practices – for example, of comfort and well-being. DEMAND consequently looks at how technologies, infrastructures and social practices co-evolve. For example, instead of asking how individuals use heating controls, we ask how heating systems and controls are themselves implicated in changing and shaping shared understandings of comfort (See projects 3.1 and 3.2).

In DEB, the technologies discussed range from heating controls through to the grid itself. Since technology is taken to be a coherent topic in its own right there is no attempt to differentiate between appliances and infrastructures. By contrast projects within DEMAND (e.g. project 3.1 and 3.2) distinguish between these different scales in order to develop more nuanced understandings of the potential to steer energy demand through significantly different forms of 'technological' intervention.

In short, DEMAND extends the DEB agenda, researching 'behaviour' and 'technology' at different scales and across different time frames, by:

- Collecting evidence about change and variation in the social distribution of relevant social practices and showing how this does and does not relate to the existence of specific technologies, infrastructures and systems of provision (Theme 1).
- Looking at how old and new infrastructures and technologies coexist and at how these material arrangements configure what people do and the energy demand that follows (Theme 3).

- Looking at how analyses of co-existing technologies and co-evolving practices could be used to inform assessments of future demand, and to identify potential opportunities to for demand reduction (Theme 3).
- Showing how policy and other actors influence interdependent systems of technology/infrastructure and social practice (Themes 1-4) in order to identify potential sites for intervention and draw attention to opportunities that are overlooked by strategies that treat technology and behaviour as separate topics.

Links with DECC

DEMAND contends that technologies of supply and systems of provision are integral to patterns of consumption and demand. In taking this approach we contribute, indirectly, to DEB's interest in 'Energy Production, Processing, Distribution and Markets'. For instance, Theme 1 provides insights into the timing of demand that are crucial for 'Electricity networks and system balancing' (DEB p33). This could be very useful for the Electricity Reform team as well as those working on smart grids within DECC.

DEB recognises that infrastructures and technologies endure: "the long economic and physical lives of many assets that produce or use energy mean that impacts of today's choices need to be considered in relation to possible future trajectories" (DEB p.15). As indicated above, DEMAND's research suggests that this observation should be turned into a topic of analysis and enquiry. Are certain practices, technologies and infrastructures more enduring than others, and what do these configurations mean for energy demand now and in the years ahead?

Third, DEMAND offers a more sophisticated account of the behaviour – technology relation. If taken to heart, this would reframe key aspects of DEB's approach and the research priorities that follow.

2.3 Terms and units of analysis

Within DEB there is an interest in collecting evidence about "people/behavioural drivers", "buildings and technologies" and "energy use". These categories are significant because the way the field is carved up relates to an understanding of the nature and scope of policy intervention. Some of DEMAND's research is useful to the policy system as it is presently configured but as illustrated below, DEMAND research calls for and works with different methods and units of analysis.

- DEB seeks "to improve our understanding of how *people behave*, whether as individuals at home or work, or as part of communities, businesses or whole supply chains or workforces" (DEB p14). Organisations are approached in the same terms, hence: "We want to understand more about how different types of organisations make energy-related decisions..." (DEB p17), and again on p24: "Getting a better understanding of how investment decision-making works in practice, understanding what drives behaviour, including the role of key individuals, organisational culture, customers..." (DEB p24). As these extracts demonstrate, the purpose is to learn more about individual decision makers/decision-making on the grounds that they constitute possible subjects and sites of intervention.

By contrast, DEMAND's research takes questions of institutional and organisational change as the topic of enquiry, and does not reduce these to the beliefs and actions of individual 'decision-makers'. For example, project 3.2 will be looking at how office life is shaped and changed through the shared and interlocking practices of facilities management, office

development, standards bodies etc., and through the circulation of specific technologies and appliances – e.g. air-conditioning; server rooms, computers etc. This approach allows us to show how policy has a bearing not (only) on individual choices, but on the longer term development of what are taken to be normal working practices.

- DEB is interested in studying *buildings and technologies* in use. Examples referred to include the Energy Follow Up Survey which “looks in detail at the dwelling and occupant characteristics”, plus “a study looking at the real world savings of solid wall insulation...” (DEB p20). Such enquiries preserve the basic idea that people use technologies to meet pre-existing needs. As described above (section 2.2 of this document), sharp distinctions between technology on the one hand, and user behaviour on the other close off critical lines of enquiry. Such approaches obscure the fact that that patterns of use are part of longer term trajectories and webs of social practice, and that technologies are consistently involved in making and not just meeting consumers’ needs (See DEMAND research across Themes 1-4).
- DEB outlines the potential for collecting and exploiting (smart) metered data about domestic and non-domestic *energy use*. The hope is that more detailed data on electricity demand will help “refine policy” (DEB p22). However, knowing how much energy is used and when, does not of itself, provide much insight into the range and characteristics of the energy-using practices involved, or into how they are changing. In response, DEMAND (Theme 1) has developed methods of showing how practices are sequenced and linked in space and time. By working with new units of data collection and analysis (e.g. by focusing on practices rather than on energy as such) DEMAND’s research reveals new sites and opportunities for intervention. For example, many areas of non-energy policy (employment/working hours; education policy; planning) have a bearing on the temporal order of the day and hence on peaks in travel and in electricity demand.
Outputs include DEMAND working paper 4 “Categories, Concepts and Units: Energy in and Through Time” <http://www.demand.ac.uk/category/working-papers/>. For other relevant papers see section 1.1 above.

Links with DECC

DEMAND research could be used to develop and inspire wide ranging debate about the terms and units of analysis and about how problems of energy demand are conceptualised and framed.

2.4 Understanding and promoting change

Interpretations of policy relevant evidence reflect underlying theories about how change comes about and whether and how it can be steered. DEB represents a variety of different perspectives. In some places, DEB assumes that the energy system will simply respond to policy intervention: “In order to achieve our objectives, and as a result of our policies, our energy mix will change, and different energy vectors will be used for different purposes” (DEB p35). Similar ideas underpin the view that energy supplies will be decarbonised and that new technologies will be taken up – hence “We need to make sure our networks are reliable as we decarbonise our supplies, and as demand changes as a result of new technologies” (DEB p6).

In other parts of DEB the energy system appears to have a dynamic of its own, for example, “... people at home consume nearly a third of total UK energy and this share is rising over time” (DEB p18). Similarly, “We expect that electricity will have an increasing role in meeting our needs... Our needs vary daily and annually – and these characteristics will also change in the future...”. (DEB p32).

Elsewhere, DEB implies that policy is capable of influencing the drivers and barriers that affect purchasing decisions made by individuals in domestic and non-domestic settings. This is consistent with the view that successful interventions (what works) at one place and time might be applied again in other times and places. DEB explains that “We need evidence to help us see what really works...” (DEB p4), arguing that such an understanding can be used “to inform future policy development” (DEB p13). Because the emphasis is on ‘what’ worked, not on ‘how’ and ‘why’ it worked, research/evaluation in this vein is unlikely to identify the historically and contextually specific mechanisms involved. The project of identifying ‘transferable’ conclusions rests on a specific (but unstated) theory of change involving driving factors, barriers, etc. As such it takes the mechanisms of policy influence for granted and does not enquire further into how change actually comes about, or the role of policy within those processes.

DEMAND is in a position to make a potentially important contribution by challenging and questioning these understandings of change and related assumptions about knowledge, transferability and the role of policy.

- Across the DEMAND research programme we are looking at how energy-demanding practices come to be as they are, how they change, and how different forms of policy making have a bearing on these processes. Our approach is to focus on core questions about what energy is for. This leads us to adopt and develop forms of analysis and evaluation rooted in fundamentally different methods of understanding how social practices and related patterns of energy demand emerge, persist and disappear.

The relation between different areas of policy is of concern to DECC and to DEMAND. For example, DEB says there is interest in “understanding how our policies interact from the perspective of people and institutions: for instance, identifying risks and opportunities with the delivery of smart metering, the Green Deal and the Renewable Heat Incentive” (DEB p15). There is further recognition of the need to understand how policy portfolios intersect: “how we can look across our and other government departments’ policy portfolios to understand the interactions” (DEB p.13-14), and “...we need to understand the interactions between different sectors (such as how action on heat influences the requirements for electricity generation); [...] In understanding these trade-offs we also need to understand how policies interact – for example on a national and European level.” (DEB p15).

- DEMAND’s approach allows and in a sense requires us to consider changes in what energy is for where ever and however they occur. As such our research is likely to reveal points of connection between and beyond the sectors and policy divisions around which DEB is organised. One obvious example relates to transport. Within DEB, the policy to switch from petrol to electric vehicles is mentioned, but only in relation to the potential for electric vehicles to act as an ‘energy storage technology’. From DEMAND’s point of view, questions of transport and mobility are much more significant for energy demand than this analysis would imply. For example, daily and seasonal variations in energy demand map on to differences in what people do and where such practices are enacted through the day, the week and the year. These issues of spatial and temporal organisation are even more important for energy demand if transport is increasingly dependent on electricity. More broadly DEMAND’s research will identify opportunities for using ‘non-energy policy’ as a means of significantly transforming energy demand.

Links with DECC

DEMAND research could be used to develop and inspire wide ranging debate about how policy has effect, and about how change comes about.

Questions for DECC

We conclude this document with four specific questions for DECC:

- When and how can the outputs from these different parts of our research programme feed into research and policy processes within DECC?
- How does other research and evidence on domestic and non domestic energy demand produced within or for DECC complement (or complicate) DEMAND's research programme?
- What links does DECC have with other government departments (in relation to the energy implications of non-energy policy) and how might DEMAND research feed into, or support the development of these links?
- How might we promote longer term debate and discussion of the conceptual and methodological challenges raised in Part 2 of this document?