

# New directions for energy and behaviour: whither organizational research?

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## Abstract

This paper provides practical, theoretical, and structural grounding for research on organizations in the energy system. The paper begins by demonstrating the importance of organizations in the energy system, as illustrated through engagement with two of the leading frameworks for structuring behavioural research in energy. The paper then briefly reviews some of the existing energy-related research on organizations, with an emphasis on the action-orientation of the organization studied (specifically, organizations that consume energy-using goods and services and organizations that create such goods and services through value chains). The paper also reviews both internally-oriented and externally-oriented theories related to the behaviour of organizations, outside the energy domain, and provides two energy domain examples where a theory-driven approach – either internally- or externally oriented – led to novel insights. The paper concludes by providing a structure that ties together organizational actions in the energy system with organizational theory orientations, in the hopes that this structure will provide a guide to both current and future research, making it more accessible and exposing important knowledge gaps.

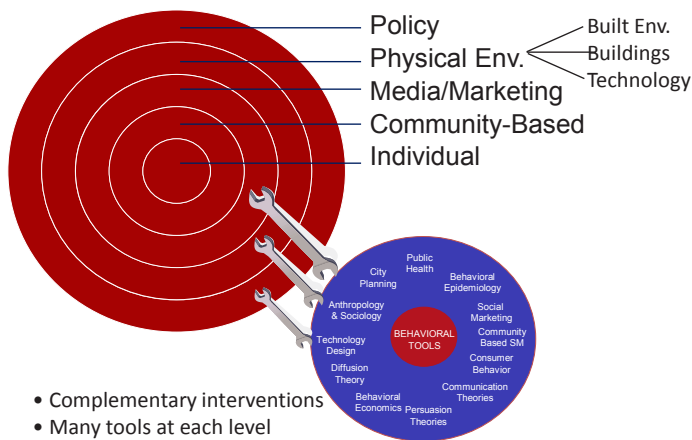
## Introduction

Behavioural research in energy, which has provided particularly valuable knowledge regarding the dynamics of energy consumption, has a tradition dating back at least to the 1970s

(for reviews of the earlier literature, see, e.g., Stern and Aronson 1984; Stern 1992; Lutzenheiser 1993). This type of research, which uses social science methods to understand decisions related to energy use, is currently growing in strength, judging from several developments. These include new government programmes aimed at using behavioural insights to inform policy broadly (i.e., not only in energy), such as the United Kingdom's "Behavioural Insights Team," founded in 2010 within the Cabinet Office and later spun out into a limited company, as well as similar efforts in New South Wales, Australia since 2012, as well as the U.S. White House Office of Science and Technology Policy's "Social and Behavioural Sciences Initiative" that began ramping up in 2013. In the energy policy space specifically, new developments over the last ten years have included the growth of relevant conferences, such as three biennial European BEHAVE conferences (the most recent in 2014), the annual (from 2007 on) Behaviour, Energy, and Climate Change (BECC) conference held in the U.S., and the first annual BECC Japan conference held in 2014. Other signs of a flourishing of behavioural research in energy include the 2014 start of a new journal, *Energy Research and Social Science*, the strength of sub-conference focus areas on behaviour in larger energy conferences, the acceptance of behaviour-based efficiency programmes by a growing number of energy regulators, and the success of relevant energy and social science research programmes (see Janda 2009).

There is a sense in which behavioural research is still emerging as a field, however, in that it is not yet mature, nor is it quite established regarding what should be studied and how. In general, it has tended to have an "action-orientation," in which insights discerned primarily from the social sciences are

## Behavioural Tools Application Framework



## Help the Behaviour Changers Framework

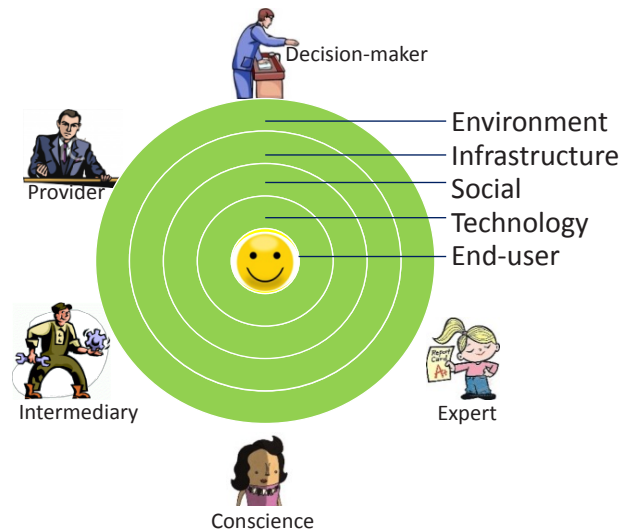


Figure 1. Two current multi-level frameworks for behavioural research in energy.

considered in the applied context of energy system decision-making, with an eye to solutions for some of the major public problems associated with the use of energy. In addition, an important ethos of the research community engaged in behavioural research in energy is that it is open to many disciplines and interdisciplinary approaches to research. Although this is an important source of the rich insights that can be obtained from the behavioural research tradition, it has inherent trade-offs regarding the efficiency with which knowledge can accumulate over time. Since at least Lutzenheiser (1993), it has been clear that “the behavioural literature is ... sparse and difficult to access – being spread thinly across academic disciplines and applied interdisciplinary areas.”

Two of the frameworks that researchers have created to structure behavioural research in energy are presented in Figure 1. The framework on the left uses the graphics that helped establish the basic structure of the tracks in the BECC conference mentioned above (Armell 2008, “the BECC framework”). It is based on the “socio-ecological model of health behaviour” used in the field of public health, and it tries to show that multiple, complementary behavioural tools – drawn from the many areas of scholarship, both within the circle and outside of it – can work on many levels that influence an individual user of energy.<sup>1</sup> The framework on the right presents the energy system diagram used to guide recent efforts in the International Energy Agency Demand Side Management Task 24 on Behaviour Change (Rotmann and Mourik 2014, “the IEA framework”).<sup>2</sup> At the centre is an end-user who has a need for an energy service and acts through “his/her energy behaviours and practices.” This indi-

vidual – for purposes of illustration, a person with cats living in a cold home near the Antarctic – is affected by cultural norms, geography/climate, housing stock, technology, etc. (Rotmann and Mourik 2014). Instead of emphasizing behavioural tools, the IEA framework highlights important “actor types” who are the main “behaviour change agents” – specifically, decision-makers, providers, intermediaries, conscience, and experts – that play multiple active, overlapping roles in the energy system. These agents “depend on each other, on end- users and on the conditions set by the particular social, institutional, physical and political context in which they work.” Both frameworks are a far cry from how the energy system is traditionally portrayed, as energy-supply focused, flowing from energy generation through transmission and distribution to a passive end-user.

These frameworks, and others like them, have led to important insights about the dynamics of consumption, and show the value of intellectually engaging with the way a system is framed in order to be able to see new directions for development and change. In keeping with this spirit, in this paper we consider what an organization-theory driven approach to energy research might allow us to see with respect to the dynamics of consumption and how those dynamics can shift or push back on efforts to change the energy system.

Organizations matter throughout the energy system. This is readily illustrated by leveraging the two energy system representations depicted in Figure 1. In both frameworks, the individual end-users at the centre of the concentric circles of influence have some degree of “agency” and “capacity”<sup>3</sup> to employ energy behaviours and practices in the satisfaction of needs. By way of analogy, it is not difficult to think of energy-using sectors of the economy (e.g., industry, commercial buildings,

1. The fields outside the blue circle are: public policy, medicine, sociology, marketing, education, economics, communication, and social cognitive and perceptual psychology. They are not depicted in the figure due to space constraints.

2. The IEA framework figure could not be directly imported, so this is a replica with slightly different graphics to represent the behaviour changers. The original also has connections between the behavior changers.

3. Following the practice in Parag and Janda (2014), we define agency using the sociological definition of “the willingness and ability of actors to make their own free choices” and define capacity as the “ability of actors to execute or perform these choices.”

etc.) in which organizations have agency and capacity to employ energy behaviours and practices in the satisfaction of needs. Meanwhile, in one or both frameworks, the influences that shape behaviour, whether in circles of influence or in the form of actor types, include: (1) technology and other aspects of the physical environment such as infrastructure, the built environment, and buildings; (2) social/media/marketing information; (3) community actions; and (4) government policy and the broader socio-political environment. When thinking about the energy system from the perspective of organizations, however, we see that (1) for-profit organizations (i.e. firms) produce technology and other aspects of the physical environment through value chains; (2) for-profit, non-profit, and public organizations shape social, media, and marketing information, as absorbed through the broader culture; (3) non-profit organizations, in particular, foster and represent the public interest in communities; and (4) policies are implemented by governments, which are often large organizations in their own right.

This exercise shows that organizations play many roles in the energy system, including, but not limited to, consuming energy and producing energy-using goods and services. The societal dynamics of consumption will only grow richer through a better understanding of the behaviour of organizations in the energy system, as it is widely recognized in literatures such as organizational behaviour and public choice that organizations, firms, and social groups do not behave like individuals (Perrow 1970; Schein 1985; March 1988). Disciplines such as economics, sociology, psychology, anthropology, and more each have insights to offer, particularly with regard to: (1) theory development that guides research and practice; (2) empirical observation, built on research design; and (3) perspectives on practical application.

In the second section of this paper, we define organizations and review a selection of energy-related research on organizations, as grouped by the type of role the organization studied played in the energy system. In the third section, we review some of the broader literature on organizations, outside the energy context, with a particular focus on theory. This literature, which we believe has untapped potential as a guide to new directions of energy research, naturally tends to have one of two orientations: first, on the influence of the inner workings of an organization; and second, on the organization in relationship to its external environment. In the last part of the third section, we briefly discuss how a theory-driven approach in the energy context can lead to new insights by calling on two recent examples, one with an internal orientation and the other with an external orientation. In the final section of the paper, we try to pull these threads together to tie theory on the behaviour of organizations to the action-orientation of behavioural research in energy. We hope that this will lay the groundwork for building a new knowledge base on these topics that is organized and accessible, and will also expose remaining knowledge gaps to more scrutiny.

## Organizations in energy research

As defined by Shafritz and Ott in *Classics of Organization Theory*,

Organizations (or their important constituencies) have purposes (which may be explicit or implicit), attract participants, acquire and allocate resources to accomplish goals, use some form of structure to divide and coordinate

activities, and rely on certain members to lead or manage others. ... their purposes, structures, ways of doing things, and methods for coordinating activities have always varied widely ... organizations are 'open systems' that are influenced by and have an impact on the world around them. The world around organizations includes, for example, their sources of inputs (like raw materials, capital, and labour), markets, technology, politics, and the surrounding society's culture and subculture. (Shafritz and Ott 1996)

Although probably not at levels proportionate to their importance to the energy system, organizations have been an important subject of study by the energy research community over the last thirty years. Late in his review of research on the social and behavioural aspects of energy use, Lutzenheiser (1993) briefly reviewed organizational research, dating it back to a 1984 U.S. National Academy of Sciences panel on the human dimensions of energy use, which "concluded that organizations frequently fail to optimize their energy-efficiency because of lack of precise information and conflicting internal interests." (Lutzenheiser 1993). Other authors have made similar observations about organizations and a low level of energy efficiency implementation, with the recognition that a contributory factor may be dynamics unique to organizations (see, e.g., Cebon 1992; DeCanio 1993; DeCanio and Watkins 1998). Examples of organization-specific barriers to energy efficiency that have been identified in the energy literature include: imperfect information, split incentives, bounded rationality, hidden costs, risk aversion, access to capital, strategic approaches to investment, conflicting internal interests, imitation of other organizations, coordination problems both internal and external (such as with outside actors like architects and vendors), and more (see, e.g., discussions in deCanio 1993; Lutzenheiser 1993; Blumstein, Goldstone et al. 2000; Sorrell, O'Malley et al. 2004; Cooremans 2011).

A number of authors have called for more systematic research on organizational behaviour and energy use.<sup>4</sup> In the review article mentioned above, Lutzenheiser highlighted the diversity of the research that occurred between 1984 and 1993, such as:

organizational influences on commercial building and system design, the role of power and incentives in industrial efficiency decision-making, barriers to capital investment in large manufacturing firms, organizational and energy-efficiency considerations in the design of household appliances, intra-organizational dynamics in implementing DSM programs, builder/government conflicts in the implementation of energy-efficiency building regulations ... the impacts of federal appliance standards on manufacturers ... organizational efficiency program success ... inter-organizational dynamics in the implementation of efficiency building codes ... [and] an institutional model of conservation decision-making in large organizations as an alternative to strictly economic explanations. (Lutzenheiser 1993)

4. According to Cebon (1992) an interesting example of such a systematic approach was conducted by EPRI which used "firmographic" variables "to allocate an organization to one of nine different market segments" with the expectation that all firms in a segment will "respond similarly to a given programme."



Figure 2. Word cloud of keywords from 24 Dynamics of Consumption papers from eceee 2013 Summer Study.

In the limited review that follows, we provide more detail on some of the energy-related research to date on organizations as consumers of energy-using goods and services and organizations as actors in value chains in the production of energy-using goods and services. Space constraints necessitate that we consider other types of organizations in the energy system another day.

#### ORGANIZATIONS AS CONSUMERS OF ENERGY-USING GOODS AND SERVICES

Moezzi and Janda (2013; 2014), in their critique of the state of behavioural research in energy today, find that three themes seem to be disproportionately dominating behavioural research in energy. These themes are (1) an excessive stress on feedback and information as tools to overcome the so-called information-deficit disorder; (2) the expectation that monetary incentives and moral exhortations will be sufficient to inspire energy users to care more about saving energy; and (3) a dominant emphasis on energy-using activities in residential buildings. Figure 2, conducted for the current paper, supports this third critique. It presents the results of a word-cloud analysis of the keywords of the 24 papers presented in the 2013 eceee Summer Study Dynamics of Consumption Panel 9, the only 2013 panel to explicitly discuss behaviour change as part of its basic description. Household consumption and behaviour clearly dominate other research subjects in this figure.<sup>5</sup>

This third critique appears particularly resonant when confronted with data on the major uses of energy in a developed economy. Figure 3 illustrates the major uses of energy in the U.S. economy, based on author calculations from several data-sources. (Unfortunately, comparable data were not readily available for Europe,<sup>6</sup> but based on the resonance with less disaggregated global assessments, the energy situation in other developed nations is likely to be similar.) The “centre pie” of U.S. energy use presents a first-order comparison of the major

energy-using sectors of the economy, with the following “slices”: industry (31 %), transportation (28 %), residential buildings (22 %), and commercial buildings (19 %). The “ancillary pies” break down industry energy use, transportation energy use, and buildings energy use into smaller segments.

To have greatest impact, behavioural research in energy should address all of the slices of the energy use centre pie, including those devoted to industry and commercial buildings, as well as a broader segment of the transportation slice than is typical (i.e., more than just light-duty vehicles). And indeed, a number of authors have considered organizations as the decision-makers in energy consumption, including: Sorrell, O'Malley et al. (2004), which considered universities, process industries (specifically breweries), and light industry (specifically mechanical engineering firms); Cebon (1992), which considered universities; Cooremans (2012), which considered metal-working, clock- and watch-making, the chemical industry, the pharmaceutical industry, chain stores, parking lots, shopping malls, and conference/exhibition centres; and Taylor and Fujita (2012), Sourani and Sohail (2011), and Simcoe and Toffel (2014), all of which focused on different governments in the U.S. and the U.K. Note that many of these cases involve qualitative research tied to the structures of these organizations, which establish how task allocation, coordination, supervision, etc., occur and align with organizational goals.

The effort involved in conducting some of this research can be daunting, requiring a balance between the degree of coverage of an energy-using sector and the degree of insight that can be gained. For example, the U.K. Valuation Office Agency (VOA) identifies as many as 400 categories of non-domestic premises (Bruhns and Wyatt 2011). Most of the energy end-use attention to non-domestic buildings focuses on the first two high-level categories (i.e., office and retail), and there are specialists who focus on such “major” building types as hotels, schools, and hospitals.<sup>7</sup> But the complete picture of the non-domestic market includes a much more diverse mix of activities including abattoirs (slaughterhouses), dry ski slopes, museums, village halls, and zoos (UK VOA 2014). In a 2012 report sponsored by the UK

5. To make this cloud, we removed the word “energy,” then grouped three mentions of “households” and two mentions of “domestic” into the word “household.” We kept “housing” as a separate word category, as well as house-owner. We note — but did not alter — the fact that one paper used the key words “household”, “appliances” and also “household appliances” as separate keywords.

6. This problem may be data-driven in some countries. Strachan and Janda (2015) explore energy data confidence in the non-domestic stock, as does research conducted by the Global Building Performance network, which shows that data confidence is lower in Europe, Asia, and India than in the U.S.

7. “Major,” in this instance, is often defined in terms of: percentage of floor area; social or economic importance; or energy intensity.



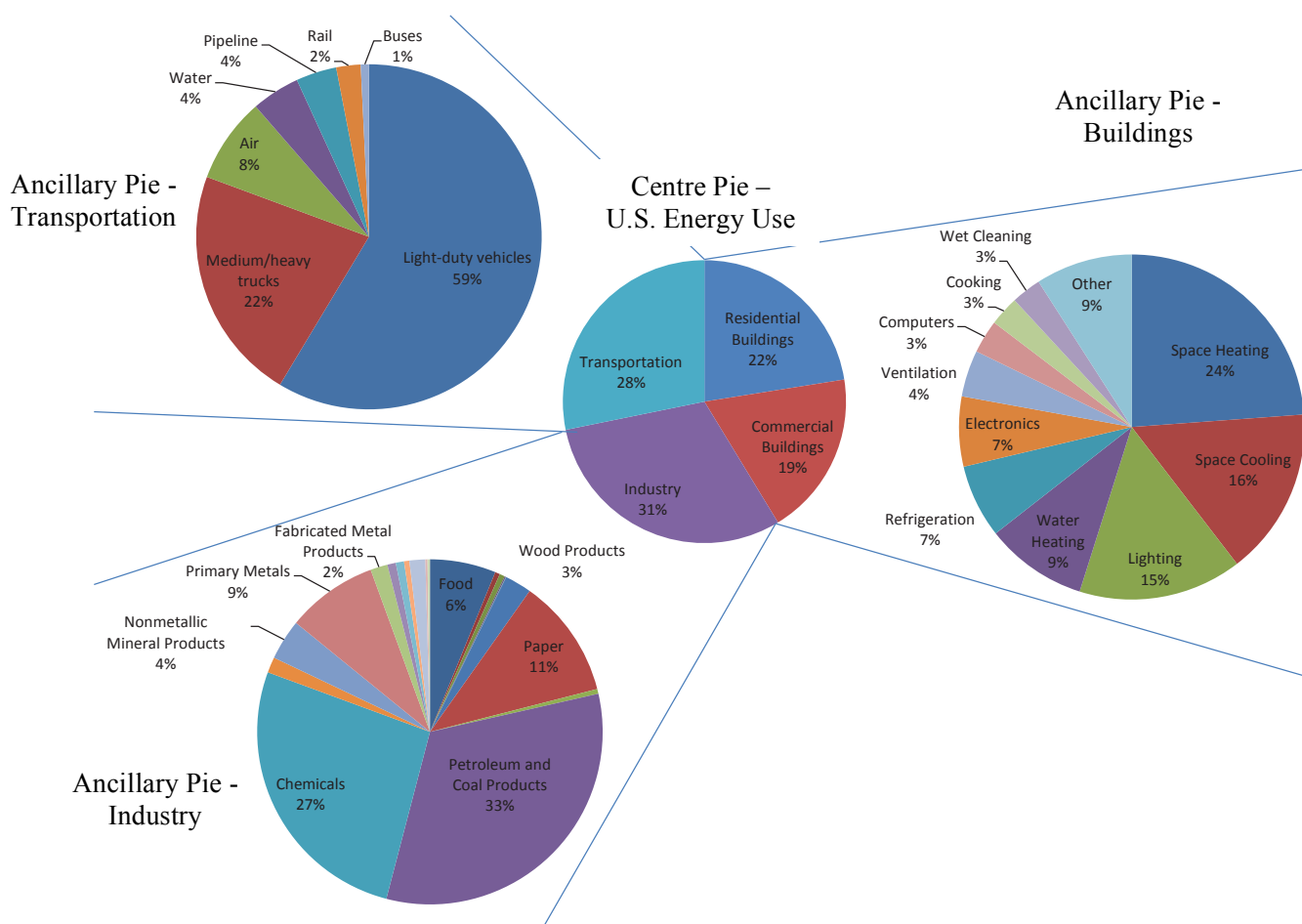


Figure 3. Energy use in the U.S., disaggregated by sector. Source: U.S. Transportation Energy Book Table 2.5: Domestic Consumption of Transportation Energy by Mode and Fuel Type (2012); U.S. Buildings Energy Data Book: Table 1.1 Buildings Sector Energy Consumption (March 2012); U.S. Buildings Energy Data Book: Table 1.1.3 Buildings Sector Energy Consumption (2012); and U.S. Manufacturing Energy Consumption Survey First Use of Energy for All Purposes, Fuel and Nonfuel (2010): Table 1.1.

Department of Energy and Climate Change on the factors that influence energy behaviours and decision-making in the non-domestic sector that reviews 56 past studies of organizations as energy consumers, however, certain commonalities emerge (CSE and ECI 2012). Barriers to energy efficiency include “perception of risk; unwillingness to replace equipment before end-of-life; energy efficiency not being a strategic issue; a host of various “hidden” costs; and businesses not really being the rational profit-maximizers of classical” economic theory (CSE and ECI 2012). In addition this study calls for future research on such factors as firm size, industrial sector, and the interactions between the two as they relate to energy behaviour.

Although such insights and suggestions for new research emerge here as lessons-learned from case studies, they are also very resonant with the leading approaches to organization theory, as will be discussed below.

#### ORGANIZATIONS AS ACTORS IN THE CREATION OF ENERGY-USING GOODS AND SERVICES

An industry value chain is the sequence of value-adding activities that are involved in bringing a good or service from its rawest material to a valuable product (Porter 1985). In the exam-

ple of a building with a number of attributes, including energy consumption, the value chain can include many organizations, including architecture firms, project developers, financiers, owner/investors, real estate service providers, engineers, contractors, and more. In the example of an appliance, which also has a number of attributes, including energy consumption, the organizations in the relevant value chain include manufacturers, component suppliers, retail distribution channels (physical or online), and more.

In Guy and Shove (2000), the authors demonstrate that value chains for insulation, housing, and commercial buildings consist of professional and industrial organizations which exist in distinct social and political contexts. The field of industrial organization economics also points to firms, big and small, existing in unique competitive environments with important influences from suppliers and customers – the two closest neighbours in a value chain – as well as substitutes, complements, and government regulation. These competitive influences combine to establish the degree of perfect/imperfect competition in a market for a good or service.

A number of authors have considered the role of organizations along value chains that provide energy-using goods and

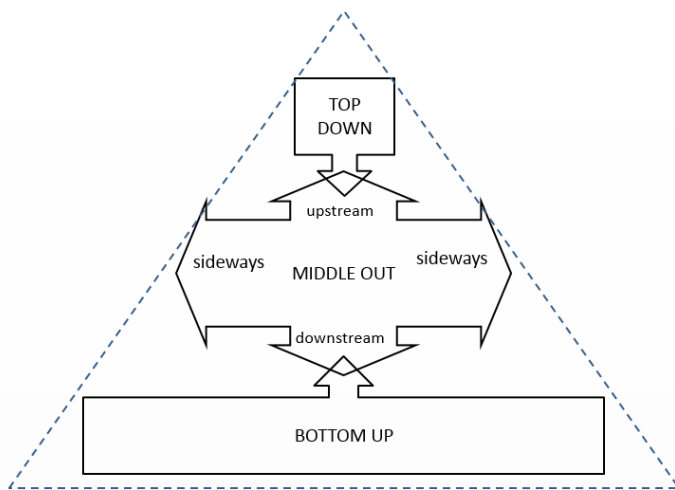


Figure 4. A “middle-actor” oriented framework.

services, including: Lovins (1992) and Lutzenheiser and Woolsey Biggart (2001), which both focused on the construction of commercial buildings; and de Almeida (1998), which focuses on the value chain for high efficient motors in France. Four of the papers in Panel 9 in 2013 were also oriented toward organizations along value chains. First, Olexsak and Meier (2013) looked at responses to Earth Hour at the electricity system level, including, but not distinguishing between, individuals, businesses, governments and communities. Second, Labanca and Bertoldi (2013) focused on issues at the interface of production and consumption. Third, Maneschi (2013) considered the role of banks in influencing household energy efficiency opportunities. Finally, Blumstein and Taylor (2013) considered appliance manufacturers and other organizations on the “supply side of the energy efficiency gap” which affect the choices of energy users. This latter paper’s emphasis aligns with the IEA framework’s highlighting of “Intermediaries” as “Behaviour Changers,” where the term is defined as any one of a number of actors, including real-estate agents, landlords, appliance salesmen, tradespeople, car dealers, mechanics, etc.

Along a similar line of reasoning, Janda and Parag (2013) and Parag and Janda (2014) identify building professionals as particularly important, yet understudied, agents for initiating, delivering and promoting infrastructure changes. Horne and Dalton (2014: 2) agree, arguing that there is “little research on the supply side of housing renovations,” particularly about the characteristics of what they call “eco-renovation businesses.” Building professionals have been shown through ethnographic research and situated work studies to have their own habits, practices, ways of thinking about problems and ways of working that affect their ability to provide (and interest in promoting) energy efficiency in buildings. This effect has been identified in property agents (Schiellerup and Gwilliam 2009), chartered surveyors (Hill and Lorenz 2011), builders (Killip 2008; Killip 2011; Janda, Killip et al. 2014), and architects and engineers (Janda 1998; Janda 1999). At a collective scale, Eames, Dixon et al. (2014) recently looked at how urban retrofit activities at the city scale could be collectively organized to deliver significant environmental, social and economic benefits.

Janda, Killip et al. (2014) recently usefully employed a “middle actor” lens to show how small-and-medium sized enterprises (SMEs) involved in low carbon refurbishment in the UK and France shape and are shaped by evolving market opportunities. This term, “middle actor,” has been used since Janda and Parag (2011; 2013) and Parag and Janda (2014) to emphasize the active role of building professionals and other groups in energy transitions. Such middle actors form the heart of the model portrayed in Figure 4, where they foster their own forms of innovation from the “middle-out” rather than merely reacting to policy pushes from the top-down or market pulls from the bottom-up. They also affect change upstream to top actors (e.g., policy makers), downstream to bottom actors (e.g., homeowners and clients), and sideways to other middle actors (e.g., other participants in the energy system). And they play an explicit and central role in enabling, mediating, and aggregating change in the energy system, actively influencing that system with their own cultures, norms, etc. Note that this model depicts organizations of various kinds besides building professionals, including religious congregations, community groups, and commercial real estate companies (for more detail, see, e.g., Parag and Janda 2014).

### Organizations more broadly

In the first two sections that follow, we review, briefly, two important traditions in the study of organizations – industrial organization economics and organization theory – with a particular emphasis on how these traditions differ in their internal and external orientations to the analysis of organizations. In the third section, we provide two examples of how a theory-driven approach to organizational research can lead to valuable insights.

#### INTERNAL ORIENTATION

Somewhat ironically, organization theory (“org theory”) is not particularly well organized. This section follows the general outline of the major schools of thought in org theory followed in Shafritz and Ott (1996), which is primarily chronological, given the embeddedness of org theory in its contemporaneous society and culture, although some of the schools coexist at various points in time. The schools we describe here and underline for emphasis are: classical, neo-classical, “modern” structural theory, organizational behaviour, systems theory, and organizational culture. Before proceeding, a general definition of org theory may be helpful: here we also follow Shafritz and Ott (1996) in defining org theory as a set of propositions that seek to explain or predict “how groups and individuals behave in varying organizational structures and circumstances” (Shafritz and Ott 1996).

The particular interest of early org theory was in management issues related to factories during industrialization, which revolved around the expense of power-driven equipment (Shafritz and Ott 1996). Expensive equipment had significant acquisition and maintenance costs that required in-flows of capital and an ability to plan and organize for reliable production at large scale, as the equipment had to produce enough output to justify its cost. This posed coordination, control, and motivation problems regarding the large human workforce that was required to operate the equipment, and the response to these

problems generated a considerable amount of so-called “classical” org theory (org theorists who are considered to be classical include Frederick Winslow Taylor, Henri Fayol, and Max Weber, who famously studied bureaucracy). *Classical org theory* “dominated organization theory into the 1930s, remains highly influential today,” and has the following “fundamental tenets”:

- (1) Organizations exist to accomplish production-related and economic goals; (2) there is one best way to organize for production, and that way can be found through systematic, scientific inquiry; (3) production is maximized through specialization and division of labour; (4) people and organizations act in accordance with rational economic principles. (Shafritz and Ott 1996)

*Neoclassical org theory*, which dominated org theory in the 1940s and 1950s, reacted against the classicists in part because of the lack of empirical justification for some of their assumptions, but more generally “for minimizing issues related to the humanness of organizational members, coordination needs among administrative units, internal-external organizational relations, and organizational decision processes” (Shafritz and Ott 1996). The neo-classicists looked to findings in the behavioural sciences for ways to improve org theory, with Chester Barnard focusing on how cooperation holds an organization together, Herbert Simon introducing a new science of administration and a definition of org theory as “the theory of the bounded rationality of human beings who ‘satisfice’ because they do not have the intellectual capacity to maximize,” and Philip Selznick concentrating on how “organizations consist of individuals whose goals and aspirations might not necessarily coincide with the formal goals of the organization.” Note that although much of neoclassical org theory retained the general internal focus of org theory, “one of the major themes of the neoclassical organization theorists was that organizations did not and could not exist as self-contained islands isolated from their environments.” (Shafritz and Ott 1996)

The neoclassical critiques were influential in shaping several other prominent perspectives on org theory today, including: human relations/organizational behaviour; the so-called “modern” structural theory; systems theory; and organizational culture. Here we provide a brief background on each of these perspectives, with the exception of “modern” structural org theory, which is fairly similar to classical org theory.<sup>8</sup>

*Organizational behaviour* is typically focused on the internal dynamics of the organization, including the role of human behaviour within the organization.<sup>9</sup>

The perspective of organizational behaviour is to redefine the relationship between organizations and people “from dependence to co-dependence” (Shafritz and Ott 1996). Typical research topics in organizational behaviour include “motivation, group and intergroup behaviour [e.g., avoiding “group-

think”], leadership, work teams and empowerment; effects of the work environment on individuals; power and influence; and organizational change processes” (ibid.). As summarized in Shafritz and Ott (1996), organization behaviour draws on:

- a body of research and theory built around the following assumptions: (1) organizations exist to serve human needs; (2) organizations and people need each other; (3) when the fit between the individual and the organization is poor, one or both will suffer: individuals will be exploited, or will seek to exploit the organizations, or both; (4) a good fit between individual and organization benefits both: human beings find meaningful and satisfying work, and organizations get the human talent and energy that they need.

*Systems theory* is perhaps the most prominent organization theory today. It is also the most externally-oriented, as it envisions an organization as “a complex set of dynamically intertwined and interconnected elements, including its inputs, processes, outputs, feedback loops, and the environment in which it operates and with which it continuously interacts” (Shafritz and Ott 1996). Systems theory, sometimes known as management science or administrative science (with origins stemming from operations research), often shares with the much earlier scientific management of Taylor an interest in quantitative methods, in this case to “identify cause-effect relationships and to find optimal solutions.” (Shafritz and Ott 1996) An important concept in systems theory is the organization as an “open system” that includes organizations and their environments,” rather than the earlier classical org theory perspective of organizations as “rational but closed systems that pursued the goal of economic efficiency” and were “not subject to influence from the external environment.” Note that Shafritz and Orr (1996) see several close cousins to systems theory, including contingency theory, the population ecology of organizations, and organizational economics. This latter perspective on organizations, which includes both agency theory<sup>10</sup> and transaction cost theory<sup>11</sup>, has previously been influential in energy efficiency policy.

Finally, the *organizational culture* perspective on org theory rejects the concept of a rational organization, and instead sees the culture of an organization as having the potential to be so strong that it “predetermines organizational behaviours and decisions” (Shafritz and Ott 1996). An organization’s culture, which includes such things as “values, beliefs, assumptions, perceptions, behavioural norms, artefacts, and patterns of behaviour,” stems from basic assumptions that are held by and influence members of an organization in large part because

8. “Modern” structural theory focuses on the “relationships among the positions, groups of positions (units), and work processes” of an organization. It sees organizations as “rational institutions” whose objectives are best met through “defined rules and formal authority” that maintain organizational control and coordination. Vertical differentiation (i.e. hierarchy) and horizontal differentiation (i.e., organizational units like product or service lines) are key themes.

9. The roots of organizational behaviour are in organizational psychology, which is today a field of psychology with practitioners based in organizations who research how employee behaviours and attitudes can be improved through various interventions (e.g., hiring practices, training programs, etc.).

10. Agency theory “defines managers and other employees as ‘agents’ of owners (‘principals’) who out of necessity must delegate some authority to agents. Price theory has been concerned with how to structure organizations for the free interplay of markets among agents and principals ... There is good reason to believe that agents will not always act in the best interests of principals. ... Agency theory thus examines the combined use of price theory mechanisms and hierarchy mechanisms that principals can use ‘to limit the aberrant activities of the agent’” (Shafritz and Ott 1996). In the context of energy efficiency policy, agency theory has contributed to the understanding of the principal-agent problem in contexts in which the owner of an energy-using good is not the same as the agent who uses that good (e.g., the landlord-tenant problem).

11. Transaction cost theory is “interested in the costs of maintaining the principal-agent relationship and how to minimize them.” In the energy efficiency context, transaction cost theory has been applied as a potential source of some of the hidden costs that may contribute to the energy efficiency gap.

they “worked in the past” and “with repeated use [they] slowly drop out of peoples’ consciousness.” (ibid.) In general, proponents of the organizational culture school of org theory argue that although an organization’s culture is shaped, in part, by such factors as “the societal culture in which it resides; its technologies, markets and competition; and the personality of its founder(s) or dominant early leaders,” knowledge about these and other factors (i.e., structure, information systems, strategic planning processes, goals, etc.) will not “accurately or reliably” “identify or measure” organizational culture due to its basis in “unconscious, virtually forgotten basic assumptions.” In general, qualitative research methods like ethnography and participant observation are considered more helpful in the study of organizational culture than the more quantitative methods favoured by other org theory schools.

#### EXTERNAL ORIENTATION

As mentioned above, systems theory and other perspectives on organizational theory that focus on the organization as an open system share a stronger external orientation than other aspects of org theory. This is also true of industrial organization (I/O), a field of economics that builds on the theory of the firm by considering limitations to the notion of perfect competition that stem from the real-world characteristics of firms and markets, such as market power, transaction costs, and imperfect information. It tends to infer organizational behaviour from external conditions, and has been influential in a variety of policy settings, such as antitrust law and economic regulation.

The “first wave” of I/O grew out of a variety of descriptive courses taught at Harvard and elsewhere that were not integrated with economic theory, but instead focused on case studies of industrial institutions as they “appeared in such fields as utilities, trusts, corporations, financial organization, agriculture, and marketing.” (Grether 1970). Although this tradition of industry studies persists today,<sup>12</sup> by the 1930s, a combination of factors led to the development of a “more basic theoretical-empirical approach,” a central aspect of which was, and remains, the conceptualization and definition of market structures (i.e. the number of firms producing identical, homogenous products; with few firms in a market, those firms tend to dominate and have the ability to price discriminate, restrict quality, block new entrants, etc.). Most regression analysis followed a “market structure-conduct-performance” flow, where “conduct” refers to business behaviour that was generally inferred from the performance results observed in studies focused on market structure.<sup>13</sup> Relevant characteristics of market structure for purposes of regression analysis were:

- (1) the economic characteristics of the product; (2) cost and production characteristics of the firm’s operations [includ-

ing issues of vertical integration]; (3) numbers and relative sizes of buyers and sellers and relative ease of entry of new firms; (4) demand conditions; and (5) differences in distribution channels. (Grether 1970)

Inference regarding firm behaviour was required in the first wave due to a lack of explicit analysis on internal organization and decision-making, despite recognition at least as early as 1938 that “firms are not, regardless of what economic theory may suppose, undifferentiated, profit-maximizing agencies which react to given market situations in ways which are independent of their organization ... management ... is influenced not only by market pressures, but also by considerations internal to the firm” (Grether 1970). By 1970, one of the most important issues facing the field was “how to bring the large diversified corporation within the framework of analysis” (Grether 1970).

At around the same time, a “second wave” of I/O emerged with a more theoretical focus (Tirole 1988). The drivers of this second wave included “dissatisfaction with the limits of ... cross-sectional empirical analysis,” a new attention to I/O by economic theorists, who had previously felt that it “did not lend itself to elegant and general analysis,” and the emerging strength of non-cooperative game theory in the analysis of strategic conflict (Tirole 1988).

#### EXAMPLES OF THEORY-DRIVEN RESEARCH IN ENERGY

##### Internal Example

The U.S. government’s energy efficiency procurement program requires that 95 % of new contract actions, task orders, and delivery orders for a list of products and services be energy and/or water efficient. The research design of a recent effort to assess the savings associated with the program was helpfully grounded in organization theory. In as large an organization as the U.S. federal government, “modern” structural theory points to the importance of formal rules as a way of exercising control and ensuring coordination. This guided the research team to focus in great detail on the U.S. government’s Federal Acquisition Regulation (FAR), which contracting officers are technically responsible to uphold all in all of its 2,000+ page glory (and receive significant amounts of training to help them do so).<sup>14</sup> By focusing on the FAR, the team learned that of the roughly 80 products on the program’s list, 48 are too inexpensive to be bought by highly trained contracting officers, and are instead likely to be bought by the holders of more than 260,000 government purchasing cards (p-cards), which are estimated to account for more than 80 % of federal procurement transactions and almost \$20 billion in expenditures (Gordon 2011a, Gordon 2011b). Not only are compliance rates with the procurement program likely to be much lower for products purchased by p-cards than for products purchased by trained contracting officers, the team concluded that the procurement program’s communications efforts were likely targeting actors who did not buy the products responsible for 42–58 % of the program’s potential energy savings.

12. According to an analysis of the standard method of classifying scholarly literature in the field of economics, the Journal of Economic Literature (JEL) codes, the subject of a large proportion of industry studies research today covers many organizations of relevance to the energy system, including the appliance industry, the construction industry, the transportation industry, many manufacturing industries, electric utilities, etc.

13. These studies typically focused on three “elements of structure” – firm size and size distribution, conditions of market entry, and product differentiation – although there was “wide variation” about “other conditions affecting behavior and performance,” including “every conceivable objective aspect of the physical, economic, technological, and social universe that might conceivably affect decision making” (Grether 1970).

14. According to SEAD (2013), the EU equivalent to the FAR is two main directives governing public procurement – 2004/17/EC and 2004/18/EC, each approximately 100 pages long – as well as national implementing legislation, “principles derived from the EU Treaty, and a large body of case law decided at national and European level”.



Table 1. An Organization Theory-Driven approach to Organizational Research in Behaviour and Energy.

Theoretical Orientation of Analysis	Role in the Energy System		
	Organizations as Consumers of Energy-Using Goods and Services	Organizations in Value Chains	Other Organizations
Internal	Box 1 Example: Government Purchasers	Box 2	Box 3
External	Box 4	Box 5 Example: Appliance Manufacturers	Box 6

### External example

Fischer (2005) pointed out that the appliance manufacturing industry is highly concentrated in the U.S. This empirical finding immediately signals to researchers versed in I/O that leading appliance firms are likely to conduct themselves in certain, predictable ways that affect appliance price and quality. Fischer (2005) presents a theoretical model in which energy intensity can be used by a monopolist to segment consumer demand so that low-end consumers are offered products at a low price point with “inefficiently high levels of energy intensity,” and high-end consumers are offered products at a high price point with “all the energy efficiency for which they are willing to pay.” In recent years, at least two empirical papers have followed up on this work using very granular data. First, in his doctoral dissertation, Houde (2012) uses a unique U.S. point-of-sale dataset from a major retailer to provide empirical evidence in support of theory in the specific appliance industry of refrigerators. In a follow-up working paper, Houde (2014), focuses on Energy Star, the U.S. government-sponsored high-efficiency policy label, and shows that firms strategically offer products on the market whose energy-use bunches at that level,<sup>15</sup> charging a price premium for those models. Second, Spurlock (2014) uses a different U.S. point-of-sale dataset, a different appliance (clothes washers), and a focus on minimum efficiency standards to arrive at conclusions that are similarly supportive of theory. Of particular interest is Spurlock’s demonstration of discontinuous price drops in clothes washer models when a standard came into effect. This finding, which is driven largely by the low-to-mid efficiency (and income) segments of the market; is consistent with organizational conduct under conditions of market concentration, but contrary to the usual expectation that appliance prices would rise when a standard came into effect.

### Conclusion

In this paper, we discussed the important roles that organizations play throughout the energy system and we briefly reviewed the energy research on the more directly “action-oriented” organizational roles of consuming energy-using goods and services

and creating such goods and services. We also reviewed both internally-oriented and externally-oriented theories related to the behaviour of organizations, and provided examples where a theory-driven orientation led to insights that would likely not have been generated by, for example, standard approaches to market transformation.

In order to be most useful as a guide to future research, however, it is important that these threads of theory and action be tightly tied together. Table 1 presents our attempt to provide a framework that reflects this. It is inspired by the 2-by-2 matrices employed in the management literature, with two rows for the theoretical orientation of analysis (internal versus external) and two columns for the action-orientation of the organizations of interest.<sup>16</sup> It adds a third column, however, for the many organizations in the energy system that play a role outside of the consumption and production of energy-using goods and services, such as those represented in the “Conscience” actor type in the IEA framework, or the congregations in (Parag and Janda 2014).

We hope that Table 1 will be a starting-off point for developing a structured knowledge base of organizational research in energy that will help scholars and practitioners engage with this area of research. Ideally, each box could be filled with the leading themes, findings, and knowledge-needs related to that theory-and-action orientation, perhaps on an ongoing basis, as sort of a “living library.” This would address some of the calls for a more systematic exploration of organizations in energy use, and hopefully deepen all of our knowledge of the societal dynamics of consumption.

To illustrate how we might work toward that end, we place the two examples presented in the previous section inside two of the relevant boxes in Table 1. Several of the papers we reviewed earlier would make excellent candidates for placement in this matrix, including: in Box 1, Cooremans (2012) and Cebon (1992); in Box 2, Guy and Shove (2000), Schiellerup and Gwilliam (2009), Hill and Lorenz (2011), Janda and Parag (2013), Janda (1998; 1999), Janda, Killip et al. (2014), and Killip (2008; 2011); and in Box 3, Parag and Janda (2014). But we do not make these placements now, both in deference to the

15. A similar bunching occurs at the government-mandated minimum efficiency standard level.

16. The roles illustrated in the first two columns facilitate linking energy-related organizational research to data on energy end-use, while all three columns can be connected to leading frameworks for behavioural research in energy, such as the BECC framework, the IEA framework, and the middle actor framework.

clarity of presentation in Table 1 and because we are unable to provide a complete review and assessment of the literature at this time. We expect to perform such an assessment in future work.

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