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Theorizing the Behavioral Dimension of Energy Consumption[1]

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ABSTRACT

This chapter focuses on the well-documented misalignment between energy-related behaviors and the personal values of consumers, which has become a major source of angst among policymakers. Despite widespread pro-environmental or green attitudes, consumers frequently purchase non-green alternatives. The chapter identifies 50 theoretical approaches that can be divided almost equally into two types: those that emphasize beliefs, attitudes, and values; and those that also consider contextual factors and social norms. Three principles of intervention are recommended: provide credible and targeted information at points of decision; identify and address the key factors inhibiting and promoting the target behaviours in particular populations; and rigorously evaluate programes to provide credible estimates of impact and opportunities for improvements. The chapter recommends that research on the value-action gap be expanded beyond the traditional focus on individuals to include decision-making units such as households, boards of directors, commercial buying units, and government procurement groups.

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Theorizing the Behavioral Dimension of Energy Consumption

Energy Efficiency and the Value-Action Gap

Much of the public has become increasingly aware and concerned about global climate change, yet patterns of consumption have failed to drive down greenhouse gas (GHG) emissions. Understanding and closing this value-action gap is essential to realizing the ambitious GHG reduction commitments of the 2016 Paris Agreement. This chapter focuses intently on human behavior and energy efficiency, notably the "gap" that often occurs between values and actions concerning energy consumption.

Abundant evidence shows that consumers are gaining greater understanding of the value and need for sustainable energy practices, as repeatedly demonstrated in numerous surveys over the past decade (Brechin & Bhandari, 2011; Capstick et al., 2014; Frederiks, Stenner, and Hobman, 2015; McCright et al., 2016). This trend is fortuitous because of the urgent need to understand and enable household and societal engagement in GHG mitigation. National pledges will be more achievable if interventions take into account beliefs, attitudes, and values that influence energy choices, along with contextual factors and social norms (Stern et al., 2016). Recognizing this, policy initiatives are increasingly focused on the facilitation of sustainable individual behaviors, motivated by the fact that households make purchases and decisions that are responsible for a large portion of the national energy and carbon emission budgets. In the United States and Europe, about one-third of total energy use and carbon emissions results from direct household energy use (Bertoldi, Hirl, & Labanca, 2012; Dietz et al., 2009; Vandenbergh et al., 2010).

Many homes in the industrialized world boast an inventory of equipment to meet household "needs," including microwaves, ovens, dishwashers, water heaters, refrigerators, washers, dryers, tropical fish tanks, massage chairs, ice makers, stereos, electric can openers, electric blankets, electric clocks, and the hallowed "beer fridge." Worldwide, households own approximately one billion personal automobiles, requiring material inputs such as steel, plastic, and glass that must be manufactured and assembled in energy-intensive processes (Sovacool, Brown, & Valentine, 2016). The energy requirements for the production, transportation, and disposal of appliances, food, goods, and services for households amount to about half of total household energy use in Europe (Kok, Benders, & Moll, 2006). Choices made in the purchase of such goods and services can be more or less energy-polluting, depending on the selections made and how they are used (UNEP, 2008).

Despite consistently high levels of reported concern, there exists a well-documented misalignment between energy-related behaviors and the personal values of consumers, challenging analysts and policymakers. Even with adequate knowledge of how to save energy and a professed desire to do so, many consumers still fail to invest in cost-effective energy-efficienct purchases and behaviors. While expressing strong beliefs about the negative consequences of global warming and dependence on fossil fuels, and while strongly approving alternative and renewable energy sources, people do not seem to have translated these opinions

into practical actions to limit the fossil energy used in their domestic consumption, lifestyles, and travel behaviors. Despite widespread pro-green attitudes, consumers frequently purchase non-green alternatives. The significant gap between the public's level of concern about climate change and the actions taken by individuals to address climate change appears to be a major impediment to achieving more sustainable consumption patterns (Stoknes, 2014).

This chapter examines the literature on the value-action gap to determine its implications for improving household energy efficiency. We begin by defining the value-action gap and characterizing what is known about its size.

Definition and Evidence of Energy Efficiency's Value-Action Gap

The *value-action gap* refers to the discrepancy between the values and attitudes of an individual and his or her actions. More colloquially, it is the difference between what people say they value and what they do.

Our focus in this chapter is on energy efficiency's value-action gap: the difference between the values and attitudes of individuals and their energy-efficient actions—that is, behaviors that affect the quantity of energy consumed to deliver a given level of energy services (Brown & Wang, 2015). Energy efficiency can be increased by purchasing appliances, equipment, and cars that are more efficient, or by modifying practices and behavior. Energy-efficient purchases might involve replacing an incandescent or fluorescent bulb with a light emitting diode (LED) lamp or buying a hybrid-electric car. Energy efficiency can also be increased with practices and behaviors such as using smart thermostats with motion sensors to reduce space heating and cooling when homes are empty, and carpooling or substituting walking for driving. We are not focusing on energy conservation, which involves reducing energy consumption at the expense of comfort or convenience—the warm beer and cold shower phenomenon—because these actions typically produce a loss of utility. In contrast, energy efficiency encompasses investments and actions that achieve a stream of energy-bill savings and pollution-emissions reductions in the future, with no sacrifice of comfort or convenience.

Evidence of an energy-efficiency value-action gap can be deduced from the broader environmental literature that has relied primarily on self-reported environmental values and self-reported environmental actions (Chung & Leung, 2007). For decades, economists, engineers, and policy analysts have described a phenomenon in energy markets that came to be known as the "energy paradox" or the "efficiency gap" (Golove & Eto, 1996; Hirst & Brown, 1990; Jaffe & Stavins, 1994). Engineering/economic analyses showed that technologies exist that could potentially reduce the energy use of consumer durables (light bulbs, air conditioners, water heaters, furnaces, building shells, and automobiles) and producer goods (motors, HVAC, and heavy duty trucks). Several major research institutions estimate that there is a large (20%–30%) technically feasible and economically practicable potential to reduce the energy consumption of most households, including electricity, natural gas, gasoline, and diesel (Gold et al., 2009; McKinsey & Company, 2009; National Research Council, 2009; Wang & Brown, 2014). The

reduction in operating costs more than offsets the initial costs of the technology, resulting in substantial potential net economic benefits. Yet consumers do not choose to purchase the more efficient goods that result in net economic savings.

At an aggregate scale, statistics document the value-action gap by showing a discontinuity between increasingly strong environmental values and a growing concern over climate change in combination with the persistence of unsustainable behaviors such as the dominance of automobile travel, wasteful water consumption, and the purchase of energy-inefficient appliances. While vehicle use has declined among younger populations in the United States, it has not decreased in most other cohorts despite higher levels of general public understanding and concern about climate change (Waitt & Harada, 2012). In farming communities, Gilg (2009) has documented a disconnect between people's perceptions of the land use damage that they are causing and their willingness to change agricultural practices.

A lack of knowledge has been shown to be a strong barrier to pro-environmental behaviors, including energy-efficient products and practices. In general, consumers have limited understanding of the cost and consequences of their energy use. Many citizens are unaware that electricity generation is a principal cause of air pollution. When asked about ways to expand the supply of electricity, consumers have been known to suggest adding more plugs to their home! Consumers are also unaware of the energy imbedded in the products they buy—their "indirect energy use."

It is therefore not surprising that options for reducing energy consumption are also poorly understood (Brown & Wang, 2015), which can cause energy-efficiency and carbon-reduction strategies to fail. For example, Whitmarsh, Seyfang, and O'Neill (2011) found that the concept of a "personal carbon budget" was difficult to communicate to consumers. Pesonen, Josko, and Hämäläinen (2013) examined the pro-environmental actions taken by staff and customers of a swimming facility. They found that the lack of knowledge about the facility's environmental impacts and possible mitigation options was the greatest obstacle to pro-environmental behavior. In businesses and industry, workers lack specialized knowledge about how to install, operate, maintain, and evaluate energy-efficient technology, and facility managers often distrust hired experts (Prindle, 2010). In addition to being incomplete, information is also often asymmetric, which is why "lemons" can be sold by used car dealers, and leaky apartments can be leased by landlords. Such asymmetries undermine trust in marketplace signals.

This review suggests that research (and policies) should focus on "information deficits." Indeed, policy assessments have shown that "standard" information tools such as appliance labeling and benchmarking can motivate consumers to buy more energy-efficient products (Coller & Williams, 1999; NMR, 2012). Real-time feedback about energy consumption, enabled by new information and communication-enabled gadgets, has shown particular promise. When coupled with information about air pollution and health consequences, information feedback can be even more effective at promoting energy efficiency (Asensio & Delmas, 2015).

However, addressing information deficits has not delivered large-scale impacts in terms of reductions in energy demand or changes in energy related practices. In a world that needs deep decarbonization, broader and mass-scalable behavioral solutions are needed. Policies must be multifaceted, by integrating information tools with pricing instruments and financing programs, grounded by the results of sound social science theories, conceptual frameworks, and empirical research (Brown & Wang, 2015). Blake (1999)'s analysis of sustainable communities in the United Kingdom highlighted tensions between policies focused on the "information deficit" and those that reflected the complex relationships between individuals and institutions. Information alone is insufficient to catalyze transformational behavioral change. As a case in point, while information and concern about climate change and clean energy options are expanding, behavioral engagement is still relatively limited. A broader conceptual framework is needed to explain and address the value-action gap.

Theories and Conceptual Frameworks

A plethora of theories of practice have been used to analyze the greening of consumption (Spaargaren, 2011). Several of these conceptual frameworks and theories have also been applied to the energy-efficiency value-action gap, including Fishbein and Ajzen's theory of reasoned action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980); attitude-behavior connection models (ABC) (Stern, 2000); consumer-motivation theories (Hargreaves, Nye, & Burgess, 2008; Shove, 2010); and the U.K. Global Action Plan (GAP)'s group-based approach (Hargreaves, Nye, & Burgess, 2008). Indeed, one meta-assessment of the theoretical literature looking at behavior and energy technology choices identified no less than 95 potentially applicable theories, cutting across disciplines ranging from behavioral science to marketing and political science (Sovacool, 2016; Sovacool & Hess, 2017). The most relevant are 50 "agency-centered" conceptual frameworks and theoretical approaches. We divide these in two tables (Tables 11.1 and 11.2), depending on their emphasis.

The 27 approaches shown in Table 11.1 emphasize the beliefs, attitudes, and values of the individual decision-maker. Concepts include rational deliberation; expected gains, losses and utility; habit, lifestyle, and self-concept; and communication, persuasion, and messaging.

Table 11.1 Theoretical Approaches to Energy Technology Choices and Behavior That Emphasize Beliefs, Attitudes, and Values

Name and Discipline	Key Author(s)	Application
Cognitive Dissonance Theory—Behavioral science	Leon Festinger	Argues that people in general are motivated to avoid internally inconsistent (dissonant) beliefs, attitudes, and values, including when they adopt new technologies or practices

Consumer Preference Theory—Behavioral science	George Homans, Jon Elster	The underlying basis of most economic theories of consumer preference and several other social-psychological theories of behavior. Suggests that behavior is the outcome of rational deliberations in which individuals seek to maximize their own expected "utility." Suggests that people will adopt new technology when they can afford its price, it aligns with tastes and preferences, and it maximizes the purchaser's utility.
Deficit Model—Behavioral science	J. Burgess, C. Harrison, P. Filius	Understanding about technology is based on the linear progression of knowledge leading to awareness and concern (attitudes), which in turn is assumed to link to behavior
Expectancy-Value Theory—Behavioral science	Martin C. Fishbein, Icek Azjen	A broad class of theories based on the idea that behavior about purchasing new technologies or changing behavior is motivated by the expectations we have about the consequences of our behavior and the values we attach to those outcomes
Four Dimensions of Behavior (4DB) Framework—Behavioral science	Tim Chatterton, Charlie Wilson	Attempts to characterize multifaceted behaviors related to technologies (in this instance, in the domains of energy, electricity, and transport) along the four dimensions of an actor, a domain, durability, and scope
Integrated Framework for Encouraging Pro-environmental Behavior (IFEP)—Behavioral science	Jan Willem Bolderdijk, Kees Keizer, Goda Perlaviciute	Pro-environmental or sustainable behavior often involves a conflict between different goals. People may be motivated to adopt new technologies for hedonic reasons (e.g., because it is enjoyable), for gain reasons (e.g., because it saves money), or for normative reasons (e.g., because they think protecting the environment is the right thing to do).
Lifestyle Theory—Behavioral science	Anthony Giddens, Jonn Axsen	Social acceptance of new technology is mediated by lifestyle, a package of related behaviors, objects, and skills that both expresses and shapes consumer identity
Motivation-Ability-Opportunity Model—Behavioral science	Folke Ölander, John Thøgersen	An integrated behavioral model that combines both internal motivational variables—usually based on the theory of reasoned action (TRA)—with external contextual variables of ability including habit and task knowledge and opportunity

Means End Chain Theory—Behavioral science	Jonathan Gutman, Thomas J. Reynolds, Jerry C. Olson	A qualitative form of expectancy-value theory which posits that preferences for behavior—including new technology adoption—are based on a "laddered" relationship between attributes, consequences, and values
Persuasion Theory—Behavioral science	Carl Hovland, Richard E. Petty	A set of theoretical approaches to the "art of persuasion" that identifies (1) the credibility of the source, (2) the message, and (3) the thoughts/feelings of the receiver as critical. When these three elements align, users and consumers can be convinced to change their behavior or adopt new technical systems.
Protection Motivation Theory—Behavioral science	R. W. Rogers, M. Bockarjova, Linda Steg	Attempts to explain pro-environmental or sustainability choices by employing a wide set of predictors, such as the costs and benefits of current (maladaptive) behavior as well as prospective adaptive behavior
Self-Discrepancy Theory—Behavioral science	E. Tory Higgins	Suggests that people are motivated to act—to change behavior, or adopt new technology—according to feelings aroused by the perceived gap between their actual and "ideal" selves.
Self-Perception Theory—Behavioral science	Daryl Bem	Proposes that people infer their attitudes and willingness to engage in pro-environmental or sustainable behaver by observing themselves
Subjective Expected Utility (SEU)—Behavioral science	Martin C. Fishbein, Icek Azjen. A. H. Eagly, S. Chaiken	A form of expectancy value theory closely related to the rational choice model, it suggests that change in behavior is a function of the expected outcomes of the behavior and the value assigned to those outcomes.
Symbolic Self-Completion Theory—Behavioral science	Robert A. Wicklund, Peter M. Gollwitzer	A symbolic interactionist theory which suggests that people create their sense of identity through the appropriation of symbolic resources to complete the "self- image"
Transtheoretical Model—Behavioral science	James Q. Prochaska, Carlo C. DiClemente	People's attempt to change is viewed as a process of increasing readiness. People move through five stages when attempting to change a behavior: pre-contemplation, contemplation, preparation, action, and maintenance

Domestication Theory—Consumption studies	Roger Silverstone	The integration of technological objects into daily life involves a taming of the wild and a cultivation of the tame in which such novel technologies must be transformed from unfamiliar and exciting to familiar
Bounded Rationality—Economics	Herbert Simon	In decision-making situations, actors face both uncertainties about the future and costs in acquiring information about the present. People therefore make satisfactory rather than truly optimal choices about new technologies.
Prospect Theory—Economics	D. Kahneman, A. Tversky	According to this theory, adopters base their decisions on subjective values that can be modeled by a function that is concave for gains, convex for losses, and steeper for losses than for gains; low probabilities are often over-weighted and moderate to high probabilities under-weighted. Potential adopters will often mis-estimate the costs and benefits of new technologies.
Rational Choice Theory—Economics	Gary Becker, James S. Coleman, Thomas Fararo	People are rational economic actors, assessing costs and benefits, and will seek to maximize their own welfare when making informed decisions about new technologies.
Initial Trust Model—Information science and management studies	D. H. McKnight, N. L. Chervany	The willingness of persons to adopt a new technology is explained by their ability to take risks in order to fulfill a need without prior experience, or credible, meaningful information. New technologies will be accepted based on their convenience, flexibility, or perceived benefits.
Motivational Model—Information science and management studies	F. D. Davis, Viswanath Venkatesh, Cheri Speier, R. J. Vallerand	The adoption of new technology is mediated by extrinsic motivations (instrumental value) and intrinsic motivations (desire to perform an activity).
Task Technology Fit Model—Information science and	Dale L. Goodhue, Ronald L. Thompson	Users will adopt a new technology based on four constructs: task characteristics, technology characteristics, task technology fit, and use.

management studies		
Technology Acceptance Model (TAM)—Information science and management studies	F. D. Davis, Viswanath Venkatesh	Technology acceptance and usage will be based on perceived usefulness, perceived ease of use, and subjective norms.
Theory of Buyer Behavior—Marketing	John A. Howard, Jagdish N. Sheth	Effective marketing programs that convince consumers to adopt a new product (or technology) rely on a mix of perceptual constructs such as information and bias, learning constructions such as attitudes and confidence, previous behaviors such as past purchases, and current intentions and attitude.
Action Theory—Sociology	Max Weber	Social action to achieve a new goal (or accept a new technology) can be based on value-rational actions or value relational (instrumental) ones.
Reflexive Layers of Influence—Transport studies	Jonn Axsen, Kenneth S. Kurani	Identifies and integrates three processes of influence pertaining to new products: diffusion, translation, and reflexivity. Respectively, these processes describe increasingly complex forms of social interaction, ranging from communicating awareness of the product to integrating the product's perceived benefits into lifestyle and self-concept.

The 23 approaches shown in Table 11.2 emphasize contextual factors and social norms, in addition to beliefs, attitudes, and values. Concepts include social norms and expectations; institutions and social systems; networks and stakeholder influence; copying and conformity; and constraints beyond one's personal control.

Table 11.2 Theoretical Approaches to Energy Technology Choices and Behavior That Include Contextual Factors and Social Norms

Name and Discipline	Key Author(s)	Application
Attitude-Behavior-Context (ABC) Theory—Behavioral science	Paul C. Stern, Stuart Oskamp	A kind of field theory for behavior intended to be environmentally sustainable, inclusive of accepting environmentally friendly technologies. Behavior (B) is an interactive product of "internal" attitudinal variables (A) and "external" contextual factors (C).
Attribution Theory—Behavioral science	Kelvin Lancaster, F. Heider	Attempts to explain why ordinary people explain events as they do, including the adoption of new technology, and it suggests that the two most influential factors are internal attribution to characteristics of the individual or external attribution to a situation or event beyond personal control.
Comprehensive Technology Acceptance Framework—Behavioral science	N. M. A. Huijts, Linda Steg	Proposes a complex model of technological diffusion predicated on experience and knowledge, which are then mediated by trust, issues of procedural and distributive fairness, social norms, attitudes, and perceived behavioral control
Field Theory—Behavioral science	Kurt Lewin	Influential early social-psychological theory positing behavior and agency as a function of a dynamic "field" of internal and external influences. Behavioral change relies on unfreezing (existing behaviors), shifting to a new level, and then refreezing.
Interpersonal Behavior (TIB)—Behavioral science	Harry C. Triandis	Attempts to explain why people behave the way they do. It includes both expectancy-value and normative belief constructs as well as the influence of habitual, social, and affective factors on behavior.
Norm Activation Theory/Model—Behavioral science	S. H. Schwartz	One of the better known attempts to model pro-social or altruistic behaviors: a personal norm to behave in a pro-social way is activated by awareness of the consequences of one's actions and the ascription of personal responsibility for them.
Focus Theory of Normative	Robert B. Cialdini	Proposes that behavior is guided by social norms that are either descriptive (what is done) or injunctive (what should be done) in nature. The strength or "salience" of these

Conduct—Behavioral science		different kinds of norms in a given context depends on a variety of dispositional and situational factors.
Social Learning Theory—Behavioral science	Albert Bandura	Rewards or punishments influence the likelihood that a person will perform a particular behavior in a given situation. People will learn to adopt a new technology by observing others, in addition to learning by participating. Moreover, individuals are most likely to copy and mimic behavior observed by others they identify strongly with.
Theory of Reasoned Action (TRA)—Behavioral science	Martin C. Fishbein, Icek Azjen	Perhaps the best-known social-psychological attitude-behavior model, TRA adjusts expectancy value theory to incorporate normative social influences on behavioral intention.
Theory of Planned Behavior (TPA)—Behavioral science	Icek Azjen	Adjusts the TRA to incorporate the actor's perceived control over the outcomes of his or her behavior
Values-Beliefs-Norms Theory—Behavioral science	Paul C. Stern, Thomas Dietz	An attempt to adjust Schwartz's Norm Activation theory to incorporate a more sophisticated relationship between values, beliefs, attitudes and norms
Critical Stakeholder Assessment—Conflict resolution and project management	R. K. Mitchell, B. R. Agle, D. J. Wood	Identifies relevant stakeholders for a specified project or policy, maps out their relative power, influence, and interests, and assesses the broader context in which they interact. New technologies are likely to succeed when they can garner the support of broad constellations of stakeholders
Energy Cultures Framework—Energy studies	Janet Stephenson	Behaviors related to adopting new, more sustainable energy systems or choices are defined by the interactions among the materials, energy practices, and norms over which an individual or collective has agency.
Social Cognitive Theory—Information science and management studies	Deborah Compeau, Christopher Higgins, Sid Huff, Robert Wood,	Proposal that knowledge acquisition of new innovations could be connected to observing others within the context of social interactions, experiences, and outside media influences

	Alberto Bandura	
Theory of Human Behavior—Information science and management studies	Ronald L. Thompson, Christopher A. Higgins, Jane M. Howell	Individual acceptance of new technologies or practices at the workplace will be based on a mix of job-fit, complexity, long-term consequences, affect towards use, and social factors.
Unified Theory of Acceptance and Use of Technology (UTAUT)—Information science and management studies	Viswanath Venkatesh	In the adoption of new technology, perceived usefulness (performance expectancy), perceived ease of use (effort expectancy), and social influence (norms) affect use via behavioral intention, whereas facilitating conditions directly antecede behavior. Hedonic motivation, price value, and habit are later added as factors.
Diffusion of Innovations Theory—Innovation studies	Everett M. Rogers	Four essential factors influence the diffusion of new technologies: the innovation itself, communication channels, time, and a social system. Moreover, adopters can be categorized into different typologies: innovators, early adopters, early majority, late majority, and laggards.
Initiative-Based Learning—Innovation studies	C. Argyris, Rob Raven, P. Reason, H. Bradbury	Sustainable transitions require that relevant actors are involved in defining and legitimizing new technologies and practices. Understanding the motives and strategies of actors on the ground is critical to making transitions socially robust and sustainable.
Theory of Institutional Entrepreneurship—Organization studies	Paul DiMaggio, Raghu Garud, Cynthia Hardy, Steve Maguire, Julie Battilana	Activities of actors who have an interest in particular institutional arrangements and who leverage resources are able to create new institutions or to transform existing ones.
Advocacy Coalition Framework—	P. A. Sabatier	Major policy change in technically complex issue areas occurs when strong groups of advocates or stakeholders align to create coalitions.

Political science and public policy		
Social Action Theory—Sociology	Talcott Parsons	Individual decisions to act are based on the structure of social order as well as micro factors related to agency.
Social Capital Theory—Sociology	Pierre Bourdieu, James S. Coleman, Robert Putnam	Social capital has been defined as the connections and relationships among and between individuals. These consist of the networks, norms, relationships, values, and informal sanctions that shape society's social interactions.
Perspectives of Interpersonal Influence—Transport studies	Jonn Axsen, Kenneth S. Kurani	A synthetic framework that proposes the adoption of new technologies is based on diffusion and contagion, conformity, dissemination, translation, and reflexivity.

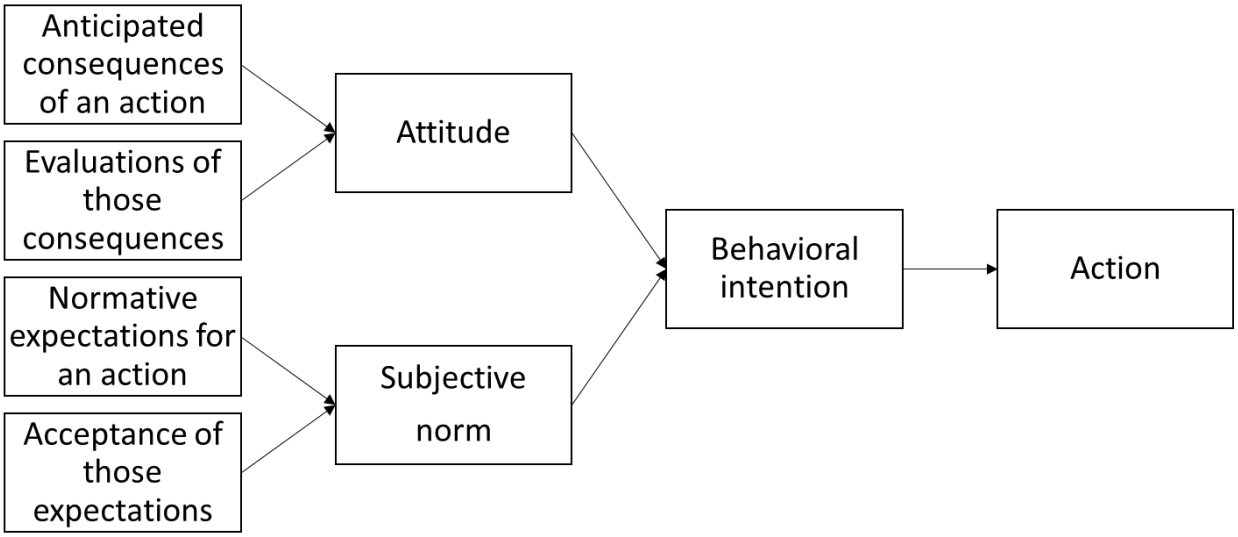
Of these 50 total approaches across both tables, the theory of reasoned action (TRA) has a particularly strong publication record focused on household energy-efficienct behavior (Barr, 2004, 2006; Barr & Gilg, 2005; Brown, 1984; Brown & Macey, 1983, 1985; Gadenne et al., 2011; Macey & Brown, 1983). TRA links behavior with several psychological antecedents that include both attitudes and social norms (Ajzen & Fishbein, 1980). By moving backward from behavior to intention, from intention to the corresponding attitude and subjective norm, and from these to underlying beliefs, values, and expectations, increasing understanding of the factors influencing behavior can be gained (Figure 11.1).

The theory of reasoned action links behavior with several psychological antecedents (Ajzen & Fishein, 1980). It does not explicitly link broad energy and environmental attitudes to energy-efficient behaviors, but rather focuses on the attitudes of individuals toward their adoption of specific energy-efficient purchases and practices. Such specificity is employed, for instance, by Brown and Macey (1983, 1985) in their analysis of repetitive household behaviors such as changing furnace filters, nighttime thermostat setback, and caulking. Using panel data, repetitive behavior was found to be strongly influenced by past behavior (e.g., "habits") and also by concerns about comfort, reducing energy bills, and home values. This research also underscored the fact that people vary in the extent that intrinsic states (such as attitudes) and extrinsic influences (in particular, the views of spouses) influence behavior.

Using TRA, Barr (2004) concluded that the factors influencing stated intention and behavior are significantly different so as to suggest that public rhetoric toward environmental action may be influenced by different antecedents from those of actual behavior (Barr, 2004).

Employing a similar conceptual framework of consumer environmental behavior and its antecedents, a survey of green consumers showed that both intrinsic and extrinsic environmental drivers, together with social norms and community influence, are associated with environmental attitudes and behavior (Gadenne et al., 2011; Lukman, et al., 2013).

Figure 11.1 The Theory of Reasoned Action



The salience of behavioral economics in contemporary analysis must be highlighted. Increasingly, non-financial factors are being considered and are found to be important in influencing energy use in buildings (Claudy & O'Driscoll, 2008; Wilson & Dowlatabadi, 2007), as was found to be the case with pro-environmental values in the adoption of energy-efficienct measures (Asensio & Delmas, 2015). In this approach, many of the structural, endemic, and transaction costs are identified as filtering through the behavioral determinants of action to produce the outcome observed in the market. Consumers and firms highly value their time. As a result, the effort required for them to research available options, bargain with vendors, and process incentive payments can easily convert enthusiasm for finding the best option into exhaustion and acceptance of a standard (and often sub-optimal) fix (Brown and Wang, 2017).

As shown below, the findings of behavioral economics can be usefully divided into four categories—motivation, influence, perception, and calculation. Each of these, in turn, can be described at two levels, foundational and advanced (Cooper, 2017; Wilkinson, 2008).

Motivation: **Foundational:** values, attitudes, preferences, and choice;

Advanced: fairness, social preferences

Influence: **Foundational:** reference points, nature and measurement of utility;

Advanced: signaling, learning

Perception: **Foundational:** decision-making under risk and uncertainty, utility theory, prospect theory, loss aversion, decision weighting;

Advanced: behavioral game theory, bargaining

Calculation: **Foundational:** mental accounting, framing and editing, budgeting and fundability, choice bracketing

Advanced: discounted utility model, alternative intertemporal choice.

Other Personal Drivers and Trade-offs

In addition to attitudes, TRA and other theories of technology choice and behavior highlight the role of subjective norms in determining an individual's behavioral intentions and subsequent behavior. Subjective norms are influenced by the awareness of a norm to act (e.g., noticing that most people purchase high-efficiency light bulbs) and the acceptance of that norm (e.g., internalizing the norm to purchase high-efficiency light bulbs). According to TRA, the immediate determinants of subjective norms are the individual's beliefs that relevant referents approve or disapprove of his or her performing the behaviors and his or her motivation to comply with these referents. However, these components appear to be the most controversial elements in the theory and are thus not elaborated upon here. More recent literature has emphasized the role of social groups and community systems.

The salience of environmental and climate change issues varies across social groups; for some, there are other more significant priorities. For example, a study of UK citizens who have adopted lower-carbon lifestyles found that concerns about social justice, community, frugality, and personal integrity were more influential motivations for low-carbon actions compared with concerns about the environment per se. Reinforcing this finding, participants' narratives about their climate actions revealed strong links to human rights groups as well as environmental organizations (Howell, 2013).

Energy-efficient products often force trade-offs on their users, such as higher prices, risks associated with novelty, and inconveniences of nascent distribution systems (Olson, 2013). All of these trade-offs can expand the value-action gap. Waitt and Harada (2012) highlight the trade-off between traveling less to cut fuel consumption, which compromises the pleasure and passion of driving. Similarly, car attributes, such as cost, reliability, brand, and design, often outweigh environmental performance (Mairesse et al., 2012). Only "dark green" consumers are willing to buy green products that have negative trade-offs and few compensatory qualities. In contrast, a broader array of consumers will purchase green products if they have strong compensatory advantages over conventional attributes such as attractiveness and convenience (Olson 2013).

Situational Variables, Institutional Context, and Infrastructure

Socio-psychological and personal drivers operate within a system of constraints and conditions that are largely beyond the participants' immediate control. These include policies, programs, and other institutional arrangements, as well as markets, product distribution systems, broadband assets, fuel cost and availability, and other physical infrastructure. Underscoring such factors, residents have been found to drive less and walk or bike more in areas with high residential density, land use mix, connectivity, and transit access (Brown, Southworth, & Sarzynski, 2009; Frank et al., 2010; Saelens, Sallis, & Frank, 2003). The influence of these structural conditions and infrastructures is moderated by personal circumstances. Thus, it is helpful to contextualize consumption practices (Farrelly & Tucker, 2014; Spaargaren, 2011), recognizing that socio-psychological frameworks are most valuable in explaining the value-action gap within the limits of structural constraints. This argues against taking an excessively narrow focus on the individual, as Fudge and Peters (2011) argue has occurred over the last decade in UK government debates. This can oversimplify the discussion and obscure some of the wider institutional and infrastructure issues.

The discovery of "inadvertent environmentalists" by Hitchings, Collins, and Day (2015) underscores the importance of context. Sometimes the situation of everyday life can cause people to cut back on their energy consumption. They may just happen to live close to work, to occupy an energy-smart apartment, to have an abundance of day light, and so on, without consciously choosing a resource-efficient lifestyle. In this case, there could be a fortuitous gap between their attitudes and their behavior.

A fuller explanation of the value-action gap requires an understanding of situational and external factors that influence behavior. Recognizing this need, a wide-spanning approach that adds depth to the behavioral analysis framework is offered in a detailed analysis of efficiency in the building sector prepared by McKinsey & Company (2010). The McKinsey conceptualization of barriers and obstacles to energy efficiency uses three broad categories—behavioral, structural, and availability. Put another way, it cuts across or synthesizes multiple dimensions from Table 11.1. About two dozen specific barriers are described. Moreover, McKinsey identifies nine different clusters of activity in the building sector. The manifestation of the barriers is different in the clusters, so McKinsey ends up with 50 discrete barriers.

Situational variables describe the circumstances of the individual within his or her behavioral setting, which in general are a function of the characteristics of the individual (socio-demographics). It has long been known that households engaging in more energy-efficienct behaviors tend to be better educated and wealthier, and they participate in more energy-efficiency programs (Brown & Macey, 1983). Their greater education and wealth result in a higher "carbon capacity," or individual ability to reduce GHG emissions (Whitmarsh, Seyfang, & O'Neill, 2011). The strong positive association between wealth and consumption complicates this relationship.

In the area of energy consumption, there is a need to take into account the social, cultural, and institutional contexts that shape and constrain people's choices (Owens & Driffill, 2008). Evidence suggests the existence of forms of excitement generated by shared practices of sustainable consumption (Spaargaren, 2011). Such experiences may provide consumers with the drive to act more consistently on their moral attitudes. Consistent with this notion, it has been suggested that while individual-level theories offer the best explanation of the value-action gap, community-level theories may offer the best solution (Antimova, Nawijn, & Peeters, 2012). Several studies have found social interaction to be strongly linked to energy-saving behaviors. Community-based activities, in particular, can be influential (Hori et al., 2013).

Numerous studies highlight ease of action and convenience as facilitating factors (Pruneau et al., 2006). These are strongly influenced by such infrastructure characteristics as the density of retail and service providers. The level of effort required to undertake an energy-efficienct action can have a dominant influence. This is illustrated by the strong association between recycling and the availability of recycling facilities as a contributor to sustainable living (Chaplin, Gareth, & Wyton, 2014).

Without lapsing into technological determinism, it is clear that such situational, institutional, and infrastructure variables can make crucial contributions to climate governance (Spaargaren, 2011). As Orr (1994) astutely noted, infrastructure such as buildings serve as an important cognitive constraint that acts as a hidden curriculum or "crystallized pedagogy," influencing how occupants think and behave. Hassler (2009) adds that since infrastructure can last hundreds of years, it can lock in patterns of development and growth, foreclosing some choices while opening up others.

Overcoming the Value-Action Gap

The value-action gap has become a major area of both angst and soul-searching for policymakers. The discrepancy between verbal and actual commitment to sustainable environmental behavior appears to have undermined the effectiveness of many environmental policies and measures. The mobilization of pro-environmental attitudes to address this "value-action gap" has so far had limited success.

Stern et al. (2016) suggest seven design principles for energy-efficiency policies and programs at the household level. Three of them are particularly pertinent to the value-action gap:

1. Provide credible and targeted information at points of decision;
2. Identify and address the key factors, many of them non-financial, inhibiting and promoting the target behaviors in particular populations;
3. Rigorously evaluate programs to provide credible estimates of their impact and to decide where improvements can be made.

Provide Credible and Targeted Information at Points of Decision

Many local, state, and national policies are based on an "information deficit" model of participation, which is undoubtedly effective in some situations where knowledge is limited. Providing credible and readily usable information on the "carbon footprints" of consumer products (Cohen & Vandenbergh, 2012), the energy efficiency of homes and buildings (Cox, Brown, & Sun, 2013), and levels of indirect consumption are promising examples. But to help break out of established ways of thinking and to instigate changes in behavior that are sustained over time, new ways of achieving transformative learning may be required (Sharpe, 2016).

Identify and Address the Key Factors, Many of Them Non-Financial, Inhibiting and Promoting the Target Behaviors in Particular Populations

Understanding the socio-psychological concerns and drivers can lead to the creation of cost-effective and mass-scalable behavioral solutions to encourage household energy efficiency and sustainable energy use (Flynn, Bellaby, & Ricci, 2009). The research and experience reviewed here suggests the need to develop differentiated public policy interventions that effectively reach different subgroups with messages and assistance that motivate change (Blake, 1999). The timing of such interventions can also be key, by exploiting "transformative moments" in the lives of individuals (Hards, 2012). For example, in response to blackouts in the summer of 2001, California utilities were able to quickly transform markets for high-efficiency appliances by exploiting high levels of public concern. By the following summer, peak electricity demand had been significantly shaved, the grid was stabilized, and high-efficiency appliances were mainstreamed.

Rigorously Evaluate Programs to Provide Credible Estimates of Their Impact and to Determine Where Improvements Can Be Made

Without effective program evaluation, it is difficult to identify and remedy weaknesses in program designs. For example, it has been suggested that financial incentives may impair energy-efficiency efforts by changing the frame from a social to a monetary one, undermining the pro-social satisfaction of participants and crowding out other energy-efficiency investments (Rode, Gómez-Baggethun, & Krause, 2015). Incentives may also create a "moral license" effect, where consumers who adopt energy-efficient devices feel that this gives them moral license to increase their electricity consumption in other areas, leading to a rebound effect (McCoy & Lyons, 2016). Progam evaluation can identify such unanticipated consequences and help to identify solutions.

Suggestions for a New Research Paradigm

Despite the rich empirical record produced by social science research, several issues remain. Why is much relevant social theory so marginalized? Limited data availability and access to

resources for survey research are undoubtedly one barrier to the advancement of social theory. How can we make better use of existing intellectual resources pertinent to the value-action gap? (Shove, 2010). Perhaps the existence of so many alternative modeling approaches does not convey consensus on key concepts that need to be understood for the value-action gap to be shrunk.

With these issues in mind, we close by suggesting five fruitful themes that future researchers may want to explore.

First, reconciling the numerous concepts, frameworks, and theoretical platforms that have been applied to this field of research would be useful. Different theories are associated with disparate epistemological assumptions, explanatory power, and applicable scope, but some may yield greater insights when utilized together. Exploring which theories match well—and which do not—would be a clear contribution to the literature.

Second, and critically, focusing on behaviors, actions, and practices together as key methodological units for research and governance provides a way to avoid the pitfalls of the individualistic paradigms that have dominated the field of sustainable consumption studies. These paradigms have often measured purchasing intentions or stated preferences, but not actual actions. In colloquial terms, they measure what people say, but not what they do.

Third, exploring the concept of carbon capability to capture the contextual abilities and motivations of individuals to reduce emissions would help to productively focus information outreach, incentives, and other types of "nudges." Mapping the distribution of carbon capabilities would help show how individual preferences and lifestyles relate to carbon footprints and consequences for climate-change mitigation, and environmental sustainability in general.

Fourth, expanding the examination of the energy-efficiency value-action gap beyond individuals to include households, boards of directors, commercial buying units, government procurement groups, and other decision-making entities would yield different yet important insights. The energy-efficiency gap undoubtedly exists in the business, industrial, and public sectors, but little has been done on the organizational dimension of these decisions.

Fifth and finally, focusing on how and why the value-action gap varies in magnitude across populations, time and space, and policy contexts is essential. This type of research would better capture the heterogeneity and contextual specificity of interventions, data that are needed as programs are tailored up (or down) to accommodate smaller scales.

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