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ABSTRACT

This paper identifies likely drivers of building efficiency over the next ten years and expectations for how efficiency markets may evolve over this period. To prepare these predictions, we conducted an extensive literature review, interviewed 22 experts, reviewed legislation and executive orders in 12 states, and implemented a detailed questionnaire completed by 41 efficiency practitioners. The two most important drivers revealed by our research are (1) public policies and regulations, particularly those associated with climate change mitigation and adaptation and (2) the cost of energy relative to the cost of delivering efficiency. Other important drivers are technology changes, economic conditions, social priorities, and industry (including utility) business practices for increasing the uptake of efficiency in buildings. Our research indicates that efficiency markets will increasingly focus on supporting building decarbonization and enabling demand flexibility through the use of controls in grid-interactive efficient buildings and communities. Efficiency improvements for specific technologies (e.g., heat pumps, controls, and windows) and technological advances not specific to energy technologies (e.g., interoperability, artificial intelligence, and universal internet access) will improve the efficacy of efficiency measures and actions. Marketing of efficient products and services will increasingly focus on grid services, decarbonization, non-energy benefits for consumers, and integration with other distributed energy resources (DERs). We anticipate increased investment in disadvantaged and historically underserved communities, recognizing the social, health, and safety benefits of efficient energy usage and remediating historical biases. Lastly, we predict that while state and local government actions will vary, jurisdictions will increase their efficiency goals overall.

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Introduction

This paper identifies and describes drivers that have the potential to define the future of energy efficiency markets for U.S. buildings over the next decade. Energy use in buildings accounts for 40% of the nation's energy use and 35% of U.S. carbon dioxide emissions.

Residents and businesses spend over $400 billion each year to heat, cool, light and power homes and commercial buildings. Much of this money and energy are wasted due to inefficient energy use – at least 30% of the energy they consume. The energy efficiency market that addresses this waste supports over two million jobs across the country (U.S. Department of Energy 2021a, 2021b).

Understanding efficiency market drivers, their relative influence, and possible future efficiency market attributes can help policymakers, utility regulators, utilities, the efficiency industry, and others make informed decisions—for example, by informing policies and investments in building efficiency in order to best support the desired scope and scale of impacts.

Our research prioritized identifying drivers rather than making specific predictions about the future of building efficiency. We believed the drivers could be reliably identified. In contrast, the future is harder to predict.

Following are terms we use in this paper:

- *Energy efficiency*: Using less energy to provide the same or an improved level of service for energy consumers, or using less energy to perform the same function.[1]
- *Total efficiency*: All efficiency actions, including naturally occurring efficiency and incremental efficiency.
- *Naturally occurring efficiency*: Efficiency actions that result from (1) codes and standards and (2) routine market adoption (actions that customarily occur without a rebate, unique financing option, or other types of incentives).
- *Incremental efficiency*: Actions beyond naturally occurring efficiency, including actions caused by rebates, unique financing options, or other types of incentives.
- *Energy efficiency markets*: The private, public, and nonprofit mechanisms or venues that allow buyers and sellers to exchange energy efficiency-related products, services, and information. We identified five efficiency market attributes:
  - Buyers and sellers (market actors) including utilities and other private-sector, public and nonprofit entities;
  - Products (e.g., energy-saving technologies) and services that are bought and sold in efficiency markets and affect end-uses in buildings;
  - Delivery mechanisms to implement efficiency products and services in buildings;
  - The level of integration/interaction of efficiency with other types of DERs (e.g., demand response, electrification, distributed generation, and distributed storage); and
  - Scale of market (e.g., measured by dollars invested or annual units of energy saved).

Research Approach

Our information collection consisted of four steps:[2]

1. Conducting a literature review of nearly 100 documents, from academic and government publications to blog posts (including the subset of publications referenced herein);

[1] One aspect of predicting drivers and future efficiency market attributes is understanding that efficiency is a relative term. An efficient product, system, or practice today may be regarded as conventional in the future as technologies improve. Thus, product- and system-specific definitions of efficiency are moving targets.

[2] We conducted our survey of legislation, regulations and executive orders in November-December 2020; structured interviews with experts November 2020-January 2021; questionnaires with efficiency practitioners August-September 2021; and literature review throughout 2021.

2. Reviewing regulatory, executive, and legislative actions related to 12 states' demand-side management activities and energy efficiency portfolios;[3]
3. Interviewing 22 experts in efficiency and energy markets spanning the energy efficiency industry, utilities, research groups, and academics; and
4. Carrying out an extensive questionnaire completed by 41 energy efficiency practitioners.

We did not seek to identify specific predictions of the future, such as what will be the next "hot" efficiency technology or business model. We also did not ask interviewees or questionnaire participants about their individual *preferences* for the future of energy efficiency in buildings. Instead, our objective was to ascertain what a broad sample of people engaged in the efficiency markets believe will be the future attributes of the efficiency market and what will determine those attributes. We do not attribute any input to specific individuals, per interview and questionnaire protocols.

Drivers of Efficiency Markets

We identified six interacting and overlapping categories of drivers of building energy efficiency markets (Figure 1).

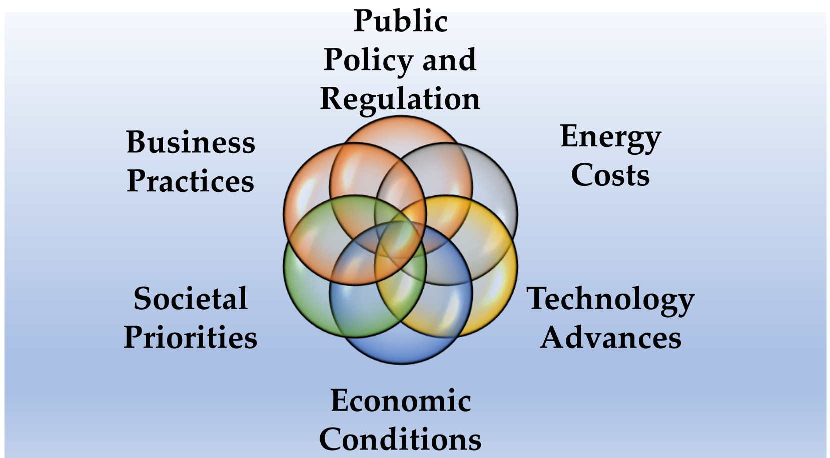

Figure 1. Six interacting and overlapping categories of market drivers of building energy efficiency

Our research indicated that two drivers will *likely be most important*: (1) public policy and regulation and (2) energy costs. The first category includes federal, regional, state, and local energy and environmental (e.g., climate) policies and regulations influenced by societal priorities. Examples include building energy codes, appliance standards, efficiency incentives or mandates—including building and economy-wide decarbonization and performance-based utility regulation. Cost of energy is a driver in terms of its magnitude relative to the cost of

[3] We selected the 12 states to represent a range of efficiency activity levels: Arizona, Arkansas, California, Colorado, Georgia, Massachusetts, Michigan, North Carolina, New Jersey, New York, Ohio, and Virginia. Our review prioritized state actions in 2019 and 2020, but considered all state actions from 2015 to 2020. Review included activities related to DERs to the extent that they integrated with efficiency and other relevant demand-side management strategies. E9 Insight conducted this review.

implementing efficiency or other options (e.g., other DERs) for reducing the energy cost burden of buildings.

According to our research, three additional drivers are *likely to be influential*, but probably not as important as policies, regulations, and energy costs: technology advances, economic conditions, and societal priorities. Technology advances refer to incremental and disruptive technology change. Economic conditions refer to the status of the national and local economies and demographic changes—for example, changes in family size, housing density, commercial building occupancy and use patterns, and population migration. Societal priorities include practices and norms as well as how society as a whole and individuals value efficiency's benefits.

Another driver that *may be important* is the efficiency industry's business practices. Business practices refer to the means for providing and maintaining products and services and providing information. Examples of such practices include the use of performance contracting; utility business models for customer-funded efficiency programs; market consolidation among contractors, retailers and manufacturers; online buying preferences; the use of behavior-based programs; strategies for workforce resources and training; and environmental, social, and governance (ESG) investment criteria.

Interactions among these six driver categories are complex. One publication describes the myriad of drivers for efficiency markets: *"Significant opportunities for clean energy innovation are presented by the changing U.S. energy supply profile; by advances in platform technologies such as digitalization and big data analytics; by expansion of electrification in the transportation and industrial sectors of the U.S. economy and the resulting electricity dependence of these sectors; by increases in urbanization and the emergence of smart cities; and by broad social and economic forces pushing to decarbonize energy systems in response to the risks posed by global warming and associated climate change."* (IHS Markit and Energy Futures Initiative 2019)

Public Policy and Regulations

Looking back, a review by several efficiency-focused organizations concluded that: *"Six key energy efficiency policies and programs (fuel economy standards, appliance and equipment energy efficiency standards, ENERGY STAR®, utility sector efficiency programs, federal research and development, and building energy codes) saved an estimated 25 quadrillion British thermal units of energy in 2017 – without these savings, annual U.S. energy use would have been about 23% higher."* (Alliance to Save Energy, Business Council for Sustainable Energy, and American Council for an Energy-Efficient Economy 2020)

Looking forward, our literature review, review of state activities, interviews, and questionnaires show near-universal agreement that energy and climate policies and regulations will continue to be crucial drivers of energy efficiency investments in buildings. Specifically, our research indicates broad agreement that greenhouse gas (GHG) emission reduction policies will be the most important policy driver for energy efficiency in buildings over the next decade. Appliance and equipment standards are also expected to be key drivers of efficiency. Building energy codes are an important driver, as well; they potentially will be less significant, however, as they only apply to new construction and major retrofits. Thus, building energy codes are likely to have less impact over our timeframe for this study—the next ten years—although a more substantial impact in the long term.

Following are three illustrative quotes from our research:

- *"As we begin this new decade, a major front line for combating climate change will be through increasing building energy efficiency."* (Dockser 2020)
- *"Cost is important, but climate is the driver; cost closes the deal, but climate is what generates excitement/leadership."* (Questionnaire respondent)
- *"Policy and regulations can be an effective way to shape markets and encourage the adoption of technologies and behaviors that will change how energy is used. These include building codes, energy sales taxes and financial incentives."* (DNV GL 2020)

Figure 2 illustrates the level of support we found for policy and regulatory drivers being critical for the future of energy efficiency in buildings.[4] The effectiveness of efficiency policies and regulations as drivers depends on successful implementation and whether requirements keep pace with technology and market innovations.

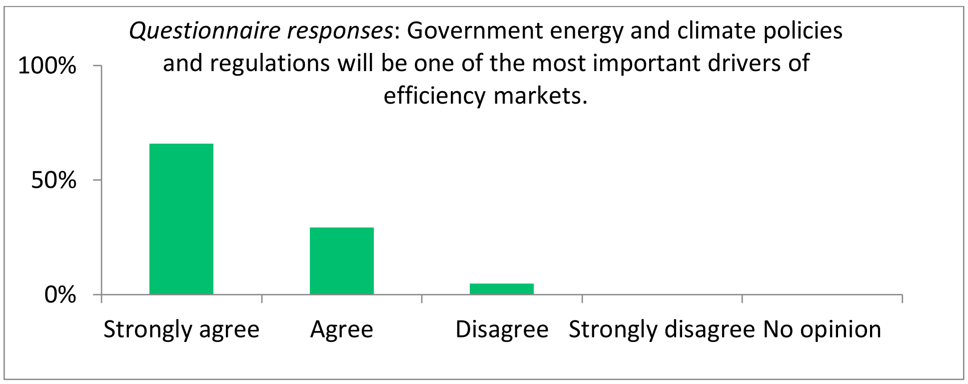

Figure 2. Questionnaire responses regarding the role of energy and climate policies and regulations

Cost of Energy

As one would expect, basic economics matter, with higher energy prices (more expensive energy bills) leading to reduced consumption, in part due to efficiency actions motivated by higher energy prices. Most questionnaire respondents agreed that consumers' energy costs are expected to be a critical driver of efficiency markets (Figure 3). Considerations associated with energy costs as a driver include the following:

- The general inelasticity of building energy consumption (U.S. Energy Information Administration 2021a) is partly due to classic efficiency barriers, such as first costs, that can thwart cost-effective efficiency actions.
- The role of energy prices as a driver of efficiency actions depends on consumers "seeing" the price signal in order to make reasoned economic decisions. However, price signals may be hidden by tariff or energy bill designs, landlord/tenant split incentives, and other factors.

[4] In this paper, we include a number of results and quotes from our questionnaire. However, these results and quotes should be understood as illustrative, as our respondents may not be representative of the entire efficiency industry. Moreover, the questionnaire was only one of several sources of data (as noted above).

- The structure of retail electricity rates may change significantly, with major implications for electricity efficiency. Fixed electricity system costs may increase,[5] and utilities are likely to continue to seek increases in fixed charges compared to volumetric (per kWh, per kW) rate components of electricity bills. The cost-effectiveness of conventional efficiency investments may decrease if consumers cannot avoid high fixed charges in electricity bills. Alternatively, increased adoption of time-varying rates can effectively address electricity system costs driven by peak demand and improve integration of renewable resources. These trends will increasingly focus efficiency actions on peak savings, demand flexibility, and measures that deliver these benefits (e.g., advanced cooling systems).[6]
- Locational, as well as time value of electricity savings, will be increasingly important to relieve congestion on distribution systems.
- The importance of energy costs as a driver is relative to the cost of implementing efficiency. Implementation costs include material and labor costs (which in turn can be affected by economic conditions, another driver), business strategies, and technology advances.

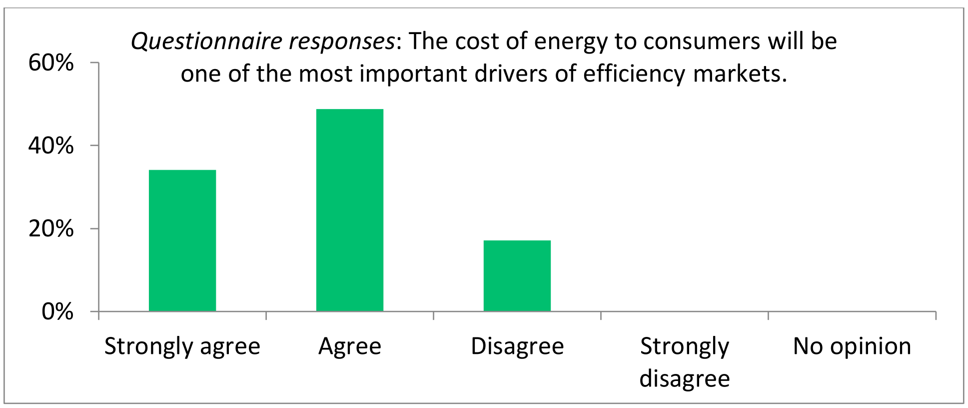

Figure 3. Questionnaire responses regarding the importance of energy costs

While energy bill savings are a significant factor for most consumers, they are not the only benefits consumers consider when making investments. Our research indicates that other direct consumer benefits (e.g., reliability and resilience benefits, comfort, environmental protection) will likely remain important and will increasingly be included in energy efficiency benefit-cost analyses. Some of the questionnaire respondents reinforced the perspective that non-energy benefits are important to consumers:

- *"Non-energy co-benefits are typically worth much more [than energy costs]."*
- *"[more] often than not, [non-energy benefits] far exceed the energy benefits."*

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[5] For example, due to more wind and solar, with lower capacity factors than traditional power plants, and greater investment in transmission and distribution systems to increase capacity, reliability, safety, and resilience.

[6] "*If, and more likely when, the electricity system's cost of providing service is dominated by fixed cost, then the economically appropriate price signal should focus on capacity (kW), not kWh..."* (Interview comment) *"Strongest drivers for EE and demand flexibility are becoming their impact upon peak loads and ability to protect reliability and resiliency, not old kWh energy goals."* (Questionnaire respondent)

Technology Advances

Incremental and disruptive technology change and competition between technologies are important drivers of efficiency actions. The relevance of technology advancement is not limited to efficiency technologies, such as more efficient motors, light-emitting diodes, control systems, and building commissioning. Other technologies—both within the energy sector (such as distributed generation and energy storage) and beyond (such as advances in data accessibility and data science, universal internet access, and artificial intelligence)—can have spillover impacts on efficiency technologies and their prospects.

Technology advances are most important as a driver for reducing the cost of efficiency implementation and improving performance by (1) making efficiency more cost-competitive as compared to the cost of energy consumption and non-efficiency solutions for reducing energy costs and (2) providing other utility system, participant, and societal benefits, such as improving grid resilience and indoor air quality. However, technological advances are typically not self-realizing. Instead, they are driven by consumer needs and demand. Consumers of all types are not always aware of new technologies and may not be able to purchase them easily. New business models can help bring new technologies to consumers to address this barrier. Thus, the rate of technology advances is associated with business practices, energy costs, and government policies and regulations—an example illustrating that all six driver categories described in this paper are interrelated.

Economic Conditions (Economy and Demographics)

We define economic conditions as encompassing several economic factors: expansion or contraction of the economy, employment and inflation levels, interest rates, and ease of access to capital. Economic conditions also depend on whether those factors influence investment activity, including efficiency-based investments.

As with other forms of investment, poor economic conditions have historically resulted in less efficiency activity. For example, the COVID-19 pandemic led to an 11.4% decline in energy efficiency employment (down to 2.1 million jobs) with many, but not all, of those jobs recovering in 2021 (U.S. Department of Energy 2021a and E4TheFuture 2021). It is beyond the scope of this research to predict the status of economic conditions over the next decade. Thus, while we indicate the state of the economy as a driver, we do not know whether its influence on efficiency investments will be positive or negative.

Building demographics (e.g., occupancy, density, and energy use patterns) are another aspect of economic conditions and a driver of efficiency activity. Two demographic factors that may be particularly relevant to the level of efficiency activity are current population migration to states with different (e.g., warmer) climates and potentially long-lasting COVID-19 impacts. For example, as a result of population shifts, the U.S. Energy Information Administration predicts that overall U.S. heating needs will decrease and cooling needs will increase, likely resulting in more cooling-related efficiency and demand management opportunities (U.S. Energy Information Administration 2021b). Concerning potential COVID-19-related shifts in energy use and efficiency activity, *"The COVID-19 pandemic … caused a significant decrease in demand for electricity, with a load shift from the commercial sector to the residential sector. As economies reopen, it is expected that this shift will partially remain…"* (DNV GL 2020).

Societal Priorities

The wants and needs of consumers, collectively as a society, drive markets. Societal priorities, or social norms, are a "meta" driver of the five other categories of efficiency market drivers, from public policy and regulations to business practices. Below are several examples of how changes in societal priorities—new social norms—can impact efficiency markets:

- *Practices* – Increasing use of air conditioning and consumer (energy-consuming) products;
- *Equity* – Higher prioritization for reducing energy burdens for disadvantaged and historically underserved households and communities, along with changing expectations of governments' role in advancing energy equity;
- *Societal energy and environmental benefits* – Greater value applied to resilience and reliability of energy supply, as well as addressing externalities associated with energy use (e.g., mitigating pollution, decarbonization);
- *Individual preferences* – Increased interest in energy choices that are flexible (e.g., dynamic, intelligent, and connected energy solutions), autonomous (e.g., local, distributed assets and democratized control over energy use), and individualized (e.g., highly personalized energy products and services); and
- *Individual and company benefits* – Changing value applied to comfort, satisfaction/pride, health, asset value, and internal corporate mandates (e.g., use of ESG criteria for investments).

Business Practices to Increase Uptake of Efficiency in Buildings

The efficiency industry features a diverse set of business practices (models). These differences in practices can be summarized across at least three market determinants:

- *Efficiency market sector(s)* – These may be defined by geography (for example, rural or urban) or consumer type (for example, residential, commercial, MUSH (municipal buildings, universities, schools, and hospitals), low-income, and multi-family).
- *Range of energy measures* – Many firms aspire to provide a broad range of efficiency (and other DER) measures, while some focus on specific types of measures.
- *Product and service models* – Models range widely, from conventional product and construction sales contracts, to long-term performance contracts, to efficiency-as-a-service offerings (and end-use service offerings—e.g., heating, cooling, lighting), to packaged financing.

Business practice innovation, in response to other drivers identified in this paper, may significantly influence a particular market sector. In addition, any changes in the role of utilities and utility customer funding for efficiency programs might have significant implications for business model innovation.

Such innovation may be focused on specific markets and not have an overarching impact on all building efficiency markets due to the diversity in market sectors, energy measures, and product and service models. While our research suggests a wide range of potential future efficiency business models, we did not identify any dominant models or any consensus on how these models may influence the efficiency market going forward (Figure 4).

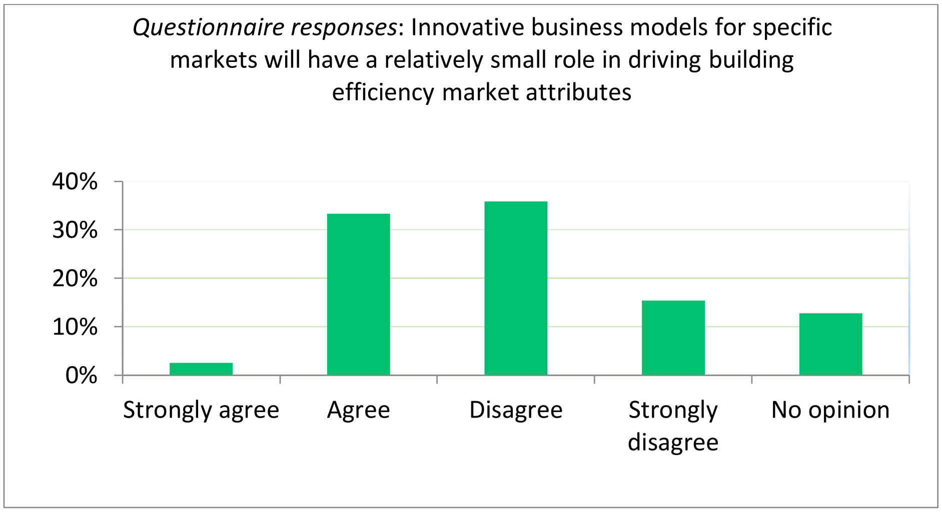

Figure 4. Questionnaire responses regarding the importance of innovative business models

The Efficiency Market: Future Scenarios and Expectations

While our research focused on market drivers, as a secondary objective we delved into predictions for the future of energy efficiency in buildings. We acknowledge the Danish proverb: *it's tough to make predictions, especially about the future.* Still, based on our research, we draw conclusions about several aspects of future efficiency markets: growth rate, scope, technology advances and adoption rates, low-income programs, and business practices. Overall, we do not expect energy efficiency in buildings to have a singular future. Instead, its attributes will vary by market sector. These attributes will be defined primarily by the divergent characteristics of these market sectors and the six categories of identified drivers discussed above.

Expectations for Growth Rate of Building Efficiency Markets

While actions by specific states and local jurisdictions (including utility regulators and municipal utilities) likely will continue to vary widely, our research suggests they generally will increase efficiency goals, measured by dollars invested or units of energy saved (Figure 5).

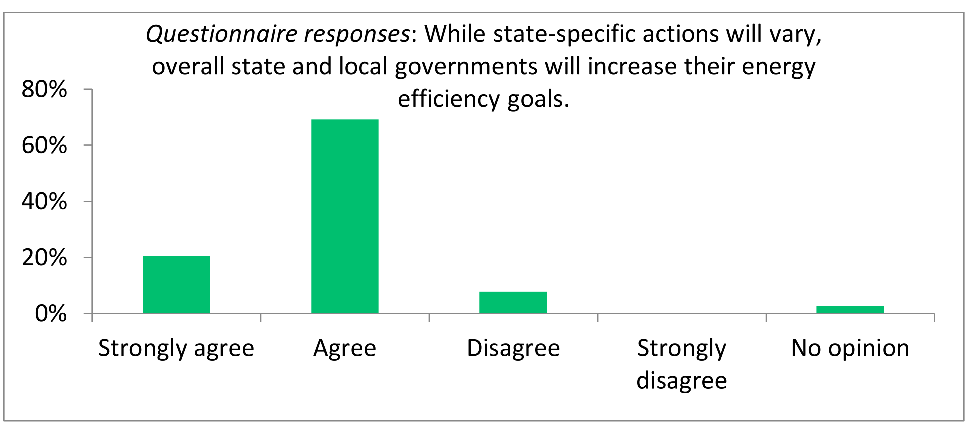

Figure 5. Questionnaire responses regarding increasing efficiency goals

We identified two potential scenarios for the growth rate of building efficiency over the next ten years. The first scenario features accelerated efficiency impacts with moderate-to-high levels of national savings growth, driven primarily by strong public and private sector policies and regulations aimed at reducing GHG emissions. GHG policies also may drive higher natural gas prices (if the impact of GHG emissions is embedded in the commodity cost) and possibly electricity retail rates (for electric utilities with high carbon footprints), as well as technology and business model innovation, all of which can reinforce accelerated efficiency actions. The second scenario features low-to-moderate growth in efficiency impacts due to (a) static or declining federal climate-related interventions and status-quo levels of efficiency-related policies in many states and (b) economy-wide factors (e.g., inflation and ongoing labor constraints), but with technology and business model innovation and strong GHG emission reduction targets in some states and parts of the private sector. See Figure 6 for questionnaire responses on expectations for the rate of efficiency savings growth by market sector.

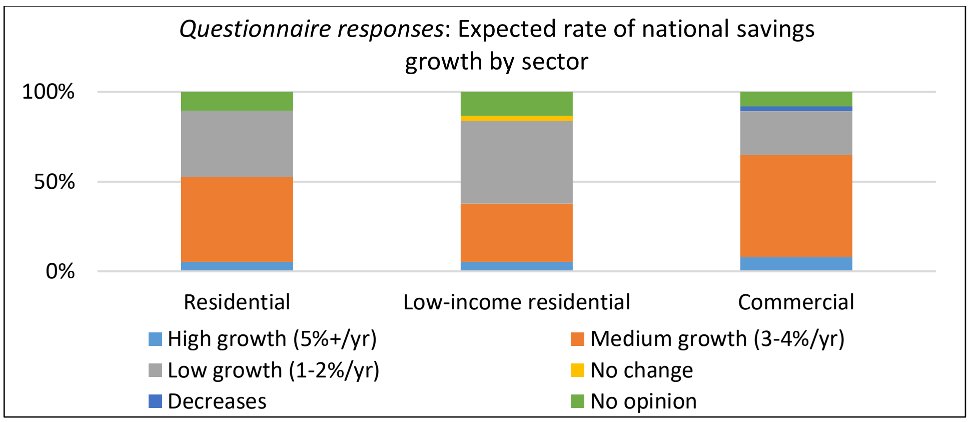

Figure 6. Questionnaire responses regarding rate of efficiency savings

Another expectation of our respondents is that investments for electricity efficiency will grow faster than efficiency investments for natural gas and other direct-use fossil-based fuels, largely the result of building decarbonization through electrification. That trend will increase the market share of electricity-consuming equipment, motivating greater efforts to make this equipment as efficient as possible (Figure 7). Among the related responses from our interviews:

- *"The focus will shift to electrification vs. increasing gas efficiency."*
- *"Focus will be on decarbonization, not gas efficiency. For example, remove gas appliances, don't spend public money on replacing them."*

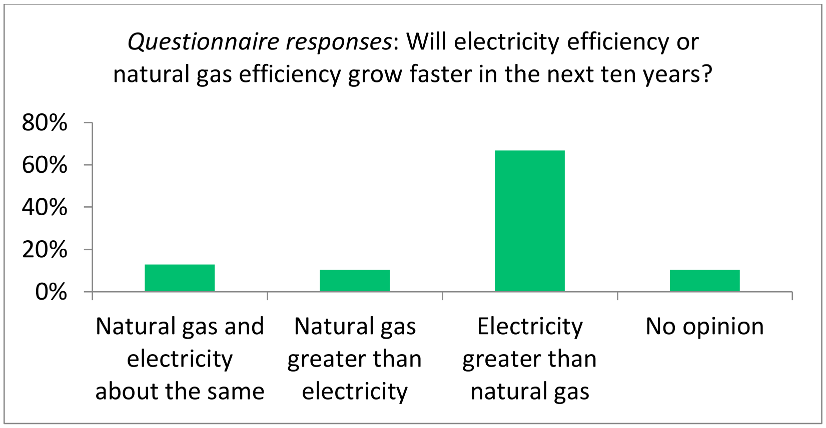

Figure 7. Questionnaire responses regarding relative growth of electricity and natural gas efficiency

Expectations for Scope of the Building Efficiency Market

We expect that efficiency investments will continue to consist of incremental (incentive-driven) and naturally occurring (primarily driven by consumer interest, building energy codes and appliance and equipment standards—C&S) efficiency. This mix will continue because markets are not likely to be transformed to entirely naturally occurring investments in a ten-year timeframe. Thus, while C&S (both existing and future) will represent a substantial source of energy savings from efficiency actions in the next decade, incentive-driven efficiency initiatives will continue to play an important role.

Our research found robust agreement that electricity efficiency will become more focused on demand flexibility and reductions in energy usage during specific times (e.g., weekday evenings). The market will thus increase its focus on grid-interactive efficient buildings.[7] Figure 8 illustrates these expectations, along with the following representative questionnaire responses:

- *"As the grid continues to modernize, timing of consumption will be increasingly important. The value of efficiency actions will be greatly impacted by these timing needs."*
- *"With technological improvements and cost reductions, flexibility will increasingly become a standard feature of electricity using equipment."*

In addition, some interviewees and questionnaire respondents noted that electric efficiency actions will focus more on reducing load in specific locations (likely distribution-constrained areas).

[7] A grid-interactive efficient building is an energy-efficient building that uses smart technologies and on-site DERs to provide demand flexibility while co-optimizing for energy cost, grid services, and occupant needs and preferences in a continuous and integrated way.

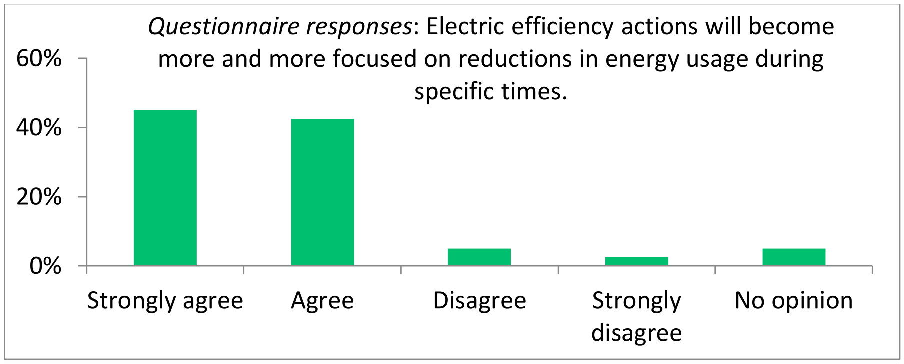

Figure 8: Questionnaire responses regarding focus on savings during specific times

Expectations for Technology Advances and Adoption Rate of Efficiency

Two key components of technology advances are: (1) improvements in equipment/system performance and (2) the rate at which energy consumers adopt improved equipment/systems. Based on our research, we expect significant efficiency improvements in some technologies—for example, heat pumps for space and water heating, building energy controls, and building shell components (e.g., windows)—yielding near-term, substantive increases in cost-effective efficiency savings. For other end-uses and technologies (e.g., lighting, motors, and boilers), we do not expect to see efficiency advances at the rate they have occurred in the past, given the existing high efficiency levels for these technologies. Irrespective of the pace of efficiency technology advances, there is a collective expectation for higher penetrations of efficient technologies and advanced building energy controls and metering in new and existing buildings.

In addition, we find strong indications that the overall efficiency of energy consumption over the next ten years will benefit from technological advances that are not efficiency-specific, as well as technology cost reductions (Figure 9). Examples include advances in sensor technologies, advances and application of artificial intelligence (e.g., smart thermostats), improvements in equipment and systems interoperability, data accessibility and data science, manufacturing (e.g., 3-D printing) and installation (e.g., prefabricated construction) practices, and universal internet access. These trends will give rise to new and better energy management options and improved efficiency performance. Among the examples are the following:

- Grid modernization, including technology changes, will enable greater utility-to-customer engagement and market adoption of utility digital communications that will support DERs, including efficiency; and
- New data-gathering and analytical methods present opportunities for the efficiency market, from marketing to delivery of customized projects that can be targeted to timing and location needs at a potentially lower cost.

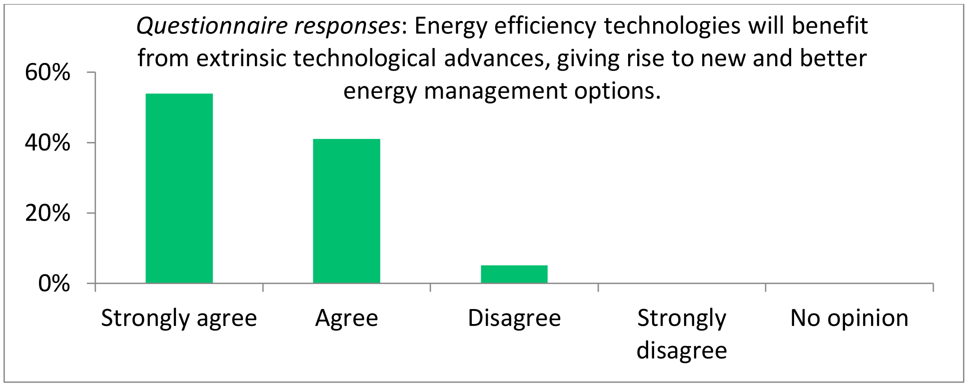

Figure 9: Questionnaire responses regarding benefits of extrinsic technology advances

In addition, improvements in the cost-effectiveness and performance of other DER technologies (storage, generation, demand response)—which, like efficiency, can reduce consumer energy costs and provide reliability and resilience benefits—may have a neutral, supportive, or deterrent impact on efficiency markets.

Expectations for Low-Income Building Efficiency Programs

Energy policy is increasing its focus on diversity, equity, inclusion, and environmental justice, particularly for disadvantaged and historically-underserved communities. Efficiency investments in these communities are growing. For example:

- The Consortium for Energy Efficiency estimates that low-income programs constituted the largest single category in total spending in 2019 among efficiency programs funded by utility customers. For comparison, during the previous five years, commercial and industrial mixed offerings were the highest-funded program types (Consortium for Energy Efficiency 2021).
- The 2021 Bipartisan Infrastructure Investment and Jobs Act will invest $3.5 billion in the Weatherization Assistance Program for low-income households (White House 2021).

Per a U.S. Department of Energy web posting accessed in 2021, about 44% of U.S. households, or about 50 million, are defined as low-income. The national average energy cost burden—the percent of income spent on energy—for low-income households is 8.6%. That is three times higher than other U.S. households. Depending on location and income, the energy burden can be as high as 30% (U.S. Department of Energy 2021c). Moreover, historically-underserved communities, including rural areas, and those without the means to invest in new technologies, may experience higher energy cost burdens from unequally distributed benefits of clean energy infrastructure, exacerbating inequality (Farley et al. 2021).

Our respondents expect that policy and programmatic efforts to assist disadvantaged and historically-underserved communities will continue to be a vital component of national, state and local efficiency actions. For example, respondents and the reviewed literature held the following viewpoints:

- *"… low-income and disadvantaged communities will be targeted first to repair some of the environmental and financial disadvantages they have suffered …"* (Questionnaire respondent).
- *"Commissioners have expressed concern that electrification will exacerbate low-income households' energy burdens"* (Interview comment).
- *"[Regional energy efficiency organization leaders see the] …particular value of targeting programs to customers with the highest energy burdens, often in rural areas or underserved communities of color"* (Gold, 2019).
- *"… there are real risks that the gains of clean energy might be unequally distributed, while the costs fall on rural communities and non-adopters of new technologies, thus exacerbating inequality while greening the grid"* (Welton and Eisen 2019).

Based on these perspectives and others we reviewed, we expect low-income programs will receive increased funding and continue to take a separate route from other residential and commercial programs, with a segment of the efficiency industry continuing to focus on direct install/no-cost retrofits (e.g., weatherization). In addition, we expect low-income program design, implementation, and evaluation will increasingly emphasize the social benefits of reducing energy bills; the value of improving the health, safety, and comfort of program participants; and the importance of addressing historical discrimination and lack of attention to such communities.

Expectations for Efficiency Business Practices

Our research indicates a wide range of opinions about the direction of efficiency business practices over the next ten years, as well as the impact that changes and innovation in such practices will have on efficiency markets. The following are a few consensus or near-consensus expectations for business practice changes:

- Efficiency product and service businesses will increasingly focus their marketing on:
    - Grid services, demand flexibility and time value of efficiency;
    - Building decarbonization and carbon metrics;
    - Efficiency's non-energy benefits for consumers, such as comfort, reliability, resilience, and indoor health benefits; and
    - Efficiency in a package of other DERs (demand response, distributed generation, storage, electrification of space and water heating, and managed electric vehicle charging).
- Business practices will increasingly focus on systems rather than individual building components, and communities rather than individual buildings—for example, addressing an entire downtown business district. Such optimization could be encouraged through increased:
    - Capability and cost-effectiveness of integrated system packages, given improved controls and data collection; and
    - Demand for grid services and building reliability, resilience, and carbon neutrality by integrating efficiency with other DERs.

Conclusions and Implications

Over the next decade, as in the last 50 years, building efficiency markets will likely see significant swings in investment and uncertainty regarding the focus of that investment. For example, goals for climate-related building decarbonization and integration of renewable resources could raise the focus on reducing electricity consumption during certain time periods.

Achieving all viable and cost-effective efficiency impacts requires effective development and implementation of supportive policies, regulations, and programs. Meaningful stakeholder engagement, including environmental, consumer, utility, other efficiency product and service providers, and community-based organizations, is critical.

As energy transitions occur, those with the heaviest energy burdens—and the fewest resources to address them—will likely need increased support for efficiency investments using public and utility customer funds.

Research, development, demonstration, and deployment and related technical assistance can support all of these efforts. Areas to focus technical assistance on include:

- Technical assistance for state utility regulators and other government decision-makers to support their energy efficiency activities;
- Technological advances, both intrinsic and extrinsic to efficiency;
- Building decarbonization strategies;
- Rate design;
- Equity;
- Market transformation, including increasing consumer demand for efficiency through building energy disclosure and benchmarking, as well as consumer education on the multiple benefits of energy efficiency in buildings;
- Innovative business practices, including demand flexibility and DER integration, system/community approaches, financing, and efficiency as a service options; and
- Labor force development, including workforce education and training.

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