



Measure, Application, Segment,
Industry (MASI):
Integrated Design for New
Construction Buildings

Prepared for:
Southern California Edison



Navigant Consulting, Inc.
One Market Street | Spear Street Tower, Suite 1200
San Francisco, CA 940105
415.399.2109



www.navigant.com
Reference No.: 170661

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1 Executive Summary

The State of California is using building code revisions to advance the energy efficiency of commercial buildings in order to help address statewide emissions goals. In 2007, The California Energy Commission endorsed a set of goals in the Integrated Energy Policy Report of achieving zero net energy (ZNE) buildings for all new residential and commercial construction by 2020 and 2030, respectively. ZNE buildings are achieved through a set of design, construction, and operational practices that promote efficient materials, architecture, and maintenance. The concept of integrated design (ID) has long been promoted as a method to ensure all key stakeholders are involved and committed to ZNE goals. ID has been used in building design and constructions outside of ZNE projects, as a way of ensuring common goals are achieved.

This study begins by presenting the definitions and background of ZNE and ID in California. In order to understand how the current market perceives and understands ZNE and ID concepts, the study reports on the results of a survey of California Architecture, Engineering, and Construction firms regarding their understanding of ZNE and ID concepts, as well as their views on relevant California investor-owned utility (IOU) programs. Major findings indicate that the IOU programs can aid the promotion and penetration of ZNEs and the use of ID through information dissemination, training on the concepts, and by streamlining the IOU programs themselves. In conclusion, open-ended questions are presented to further aid in understanding the state of ZNE commercial building development in California.

2 MASI Description

2.1 Overview of this Study

California is in the process of implementing Title 24 building code revisions that will move California’s residential and commercial buildings toward zero net energy (ZNE). For the purpose of this study, a ZNE building is one that consumes as much energy as it generates over an entire year. Integrated design (ID) is crucial to achieve ZNE; ID brings together relevant players at the start of a building project to comprehensively analyze and optimize energy strategies, helping drive deep energy savings in pursuit of ZNE construction. ID can also be used outside of the ZNE process. The California Energy Commission (CEC) set a goal in the 2007 *Integrated Energy Policy Report* (IEPR) of achieving ZNE code buildings for all new residential and commercial construction by 2020 and 2030, respectively. The California Public Utilities Commission (CPUC) set similar goals in their 2008 Long-Term Energy Efficiency Strategic Plan.

This study begins by defining ZNE and ID. Next, it explores the drivers and barriers in the construction of extant ZNE buildings, across different non-residential/non-industrial building classes. The study survey captures the current attitudes and perspectives in Architecture, Engineering, and Construction (AEC) to better understand ZNE building design and construction, identifying the barriers and drivers and the ways California’s utilities can support the transition to ZNE buildings in the non-residential/non-industrial sector. The report concludes by presenting strategic findings, identifying questions for further research and highlighting the role investor-owned utilities (IOUs) can play in promoting the use of ID and developing ZNE buildings.

2.2 Scope of Work

This Measure, Application, Segment, Industry (MASI) is applicable to all commercial non-residential/non-industrial new construction buildings, and it is described as:

“Research on lessons learned from integrated design of zero net energy designs including (1) What is the process of designing and constructing a ZNE building? (2) What are the drivers and barriers to ZNE building construction in California? (3) How can utilities California stakeholders create programs or incentives that promote ZNE building development? (4) What are ways that utilities and Architecture, Engineering, Construction (AEC) firms and other stakeholders firms can work together to promote ZNE buildings? (5) What are ways that ongoing performance of ZNEs can be monitored, maintained and assured in operations?”¹

This study relied on interviews with IOU program staff, key AEC firms active in ZNE, other states’ ZNE program staff, and an online survey of 200 respondents from California-based AEC firms.

This market assessment study supports the MASI referred to as “Integrated Design for New Construction Buildings.” The scope of the research has been revised to include additional recommended

¹ Measure, Application, Segment, Industry (MASI): Integrated Design for New Construction Buildings Proposed Scope of Work, July 29, 2014. Presented to Program Coordinating Group.



areas relevant to this topic. For example, upon request of key MASI stakeholders and the CA IOUs, the case study collation has been removed from the scope of the study, with additional focus placed on the AEC firm survey and developing questions for further research.

3 Zero Net Energy Buildings & Integrated Design Overview

3.1 Zero Net Energy Buildings

During the past decade, the State of California, led by the Public Utilities Commission (CPUC) and the Energy Commission (CEC) in coordination with the US Department of Energy (DOE), has been spearheading the effort to use ZNE design and implementation as a way of reducing net energy use from buildings. In 2007, as a part of the Energy Independence and Security Act of 2007 (EISA 2007), the US Department of Energy (DOE) created the Net-Zero Energy Commercial Building Initiative which supported a ZNE goal for all new commercial buildings by 2030, a 50% target for U.S. commercial buildings by 2040 and a 100% ZNE target for all U.S. commercial buildings by 2050. Many states have not addressed the goals. Inspired by the American Institute of Architect's 2030 ZNE goal, the CPUC adopted this goal in numerous filings, workshops, reports and strategic plans.^{2 3 4 5} The CPUC's Zero Net Energy Building's website⁶ includes the historical filings and reports, presentations from workshops, case studies and facts about the ZNE program. The most recent addition to these resources is the Zero Net Energy Case Study Buildings report highlighting six ZNE case studies carefully monitored under the PG&E ZNE Pilot Program.⁷

The CPUC and CEC publicly vetted and established the following regulatory definition for ZNE Code Buildings in California through the 2013 Integrated Energy Policy Report proceeding (Docket# 13-IEP-01):

“A Zero Net Energy (ZNE) Code Building is one where the net of the amount of energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building, at the level of a single “project” seeking development entitlements and building code permits, measured using the California Energy Commission's Time Dependent Valuation (TDV) metric. A ZNE Code Building meets California an Energy Use Intensity (EUI)

² Long-Term Energy Efficiency Strategic Plan, http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/91068.htm, accessed January 28, 2015.

³ Interim Opinion on Issues Relating to Future Savings Goals and Program Planning to 2009-2011 Energy Efficiency and Beyond; - http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/74107.htm, accessed January 28, 2015

⁴ California Energy Commission, “2013 Integrated Energy Policy Report,” <http://www.energy.ca.gov/2013publications/CEC-100-2013-001/CEC-100-2013-001-CMF.pdf>, accessed October 15, 2014.

⁵ New Buildings Institute, Getting to Zero database, <http://newbuildings.org/high-performance-buildings>, accessed December 15, 2014.

⁶ California Public Utilities Commission, Zero Net Energy Buildings, <http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Zero+Net+Energy+Buildings.htm>, accessed January 28, 2015.

⁷ Zero Net Energy Case Study Buildings, <http://energydesignresources.com/resources/publications/case-studies/case-studies-zne-non-residential-buildings.aspx>, accessed January 28, 2015.

value designated in the Building Energy Efficiency Standards by building type and climate zone that reflect best practices for highly efficient buildings.”⁸

From a Federal perspective, there is currently a congressionally sanctioned definitional effort underway through the National Institute for Building Science to come to a consensus on the definition of ZNE.

“A broadly accepted market definition of ZEB boundaries and metrics is foundational to efforts by governments, utilities, or private entities to recognize or incentivize zero energy buildings. DOE seeks comments and information related to the zero energy definitions, nomenclature, and implementation guidelines.”⁹

Feedback is being accepted through February 20th, 2015.

3.2 *Integrated Design*

Integrated Design is a collaborative method of designing buildings so that all the stakeholders’ needs can be accounted for in the finished product. Using ID, the connected and interacting parts of a building are incorporated, so that the level to which one system (e.g. lighting) has an effect on another (e.g. cooling) is accounted for and made visible. This concept has been extended to include not just the design process, but the construction and operational phases of a new building. For ZNE buildings, this last component is critical, as most buildings are not operated as modeled or designed and a ZNE building (like LEED buildings) will need to maintain performance levels. It has been suggested that ID is critical to a successful ZNE project.¹⁰ While this would be hard to prove, as the ID process itself is up to much interpretation, most ZNE pilots to date have included some degree of openness and collaborations among the building stakeholders.

The challenge facing California is making the ZNE goals a reality. Numerous cases studies have demonstrated that ZNE projects are both technically¹¹ ¹² and financially feasible.¹³ The CPUC and the CEC have engaged with the buildings community to develop goals. The Investor Owned Utilities (IOUs) administer rate-payer funded programs to promote energy efficient design (e.g. Savings by Design program) and the deployment of renewable energy (See Appendix E). The California IOUs have also promoted pilot programs for ZNE in their regions. The American Institute of Architects has encouraged their members to pursue carbon neutral designs by 2030 (See Appendix D). What is not clear, however,

⁸ California Energy Commission, Integrated Energy Policy Report, <http://www.energy.ca.gov/2013publications/CEC-100-2013-001/CEC-100-2013-001-CMF.pdf>, accessed February 18, 2015.

⁹ Department of Energy, RFI for Definition for Zero Energy Buildings, <http://www.gpo.gov/fdsys/pkg/FR-2015-01-06/html/2014-30927.htm>, accessed January 28, 2015.

¹⁰ Energy Codes for Ultra-Low-Energy Buildings: A Critical Pathway to Zero Net Energy Buildings, <http://www.aceee.org/sites/default/files/publications/researchreports/a1403.pdf>, accessed January 28, 2015.

¹¹ Zero Net Energy Case Study Buildings, <http://energydesignresources.com/resources/publications/case-studies/case-studies-zne-non-residential-buildings.aspx>, accessed January 28, 2015.

¹² The Technical Feasibility of Zero Net Energy Buildings in California, CALMAC Study ID - PGE0326.01 <http://www.cpuc.ca.gov/NR/rdonlyres/8DC39CB6-A29C-4789-B888-A9556F500BE5/0/CaliforniaZNETechnicalFeasibilityReport.pdf>, accessed January 28, 2015.

¹³ Net Zero and Living Building Challenge Financial Study, https://living-future.org/sites/default/files/reports/140411_DCRReport_FINAL%20full%20cover.pdf, accessed January 28, 2015.

is how the market, that is, the people who design, build, and operate buildings, understand the concepts of ZNE and ID, and the degree to which the current IOUs are influencing their decisions to implement ID or pursue a ZNE project. This study provides a preliminary examination of the market perspectives and awareness of these concepts and IOU programs. Performing a more complete ZNE market characterization study could further inform how IOU programs can help California meet its ZNE goals.

4 California Program Activity to Date

Addressed in numerous rulings, strategic plans and most recently the 2013 IEPR, California has a policy goal of achieving ZNE building standards by 2020 for low-rise residential buildings and by 2030 for commercial buildings. Executive Order B-18-12 requires all new state buildings and major renovations that begin design after 2025 to be constructed as ZNE facilities.¹⁴ According to the New Building Institute's "Getting to Zero" database, over 55 ZNE projects have been completed in California to date.¹⁵ California utilities have developed programs to help facilitate the design and construction of ZNE buildings.

4.1 Savings By Design (SBD)

The SBD program is a currently active major energy efficiency program offered through California's IOUs that aims to transform the non-residential new construction market toward energy efficiency. The SBD program promotes energy-efficient building design and construction by offering design and financial assistance rewarding those non-residential buildings that go at least 10% above the minimum standard set by California's Title 24 code.¹⁶ It encourages using a team approach to design energy-efficient buildings.

To qualify for Design Team Incentives, the team must use the Whole Building Approach, a computer model that optimizes an energy-efficient building design and calculates the energy savings of the building compared to the Title 24 baseline. Design team incentives range from \$0.033-\$0.13 per annualized kilowatt-hour (kWh) savings and \$0.333 per annualized therm savings. The maximum incentive per project is \$50,000. Design teams submitting projects that perform at least 30% better than Title 24 are now eligible to receive 50% of the incentive upon utility acceptance of the proposed design, with the balance of the incentive paid upon construction completion and verification. Figure 4-1 details the escalating design team incentives based on building efficiency.

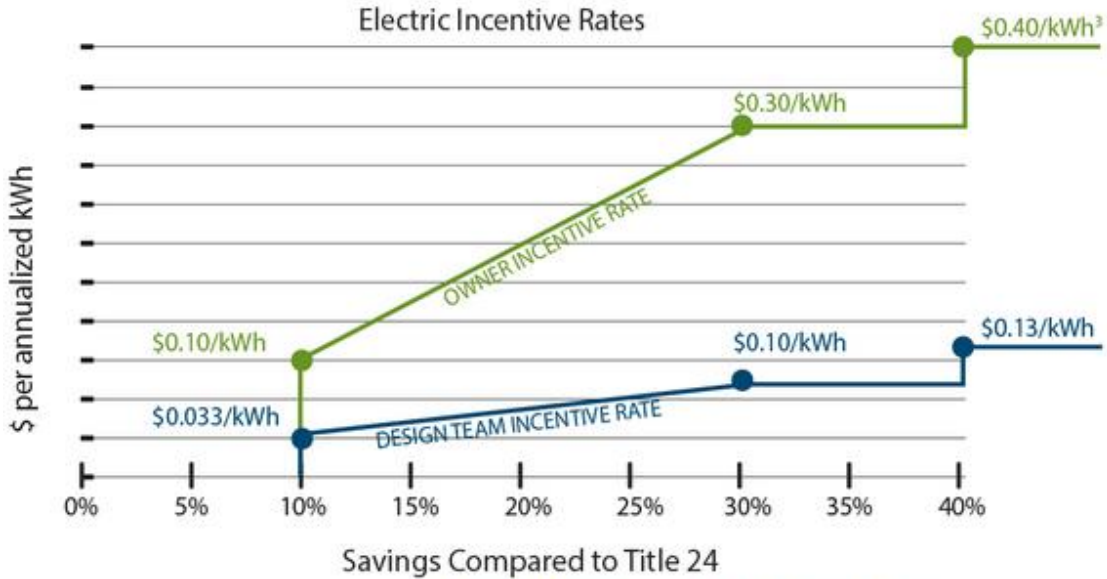
14 California Energy Commission, "2013 Integrated Energy Policy Report,"

<http://www.energy.ca.gov/2013publications/CEC-100-2013-001/CEC-100-2013-001-CMF.pdf>, accessed October 15, 2014.

15 New Buildings Institute, Getting to Zero database, <http://newbuildings.org/high-performance-buildings>, accessed December 15, 2014.

16 Savings By Design, "Design Team Incentives," <http://www.savingsbydesign.com/design-team>, accessed October 15, 2014.

Figure 4-1. Savings By Design Incentives



Peak Demand Incentive Rates: **\$100/kW Owner** **\$33/kW Design Team¹**
²Therm Incentive Rate: **\$1.00/therm Owner** **\$0.33/therm Design Team¹**

¹Design Team Assistance to be offered in lieu of Design Team Incentives in SDG&E service territory.
²SCE therms incentive, offered in partnership with SCGC.
³Not available in PG&E service territory

The program is funded through the Public Purpose Programs surcharge, which is applied to both gas and electric services throughout the state of California. Utilities that participate in this program include Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), Southern California Edison Company (SCE), Southern California Gas Company (SoCalGas), Sacramento Municipal Utility District, and Los Angeles Department of Water and Power.

In February 2014, Navigant evaluated the historic market penetration and savings potential of the Savings By Design Program for each of the California IOUs, with the goal of determining the two market sectors with the highest savings potential for each IOU. The Savings By Design future potential is detailed in Table 4-1 and the key study findings and conclusions are published in *The Savings By Design Market Potentials, Characterization and Past Practices Enhanced Program Participation Study*.¹⁷

¹⁷ Navigant, "The Savings by Design Market Potentials, Characterization and Past Practices Enhanced Program Participation Study," http://www.calmac.org/publications/Savings_By_Design_Final_Report.pdf.

Table 4-1. Savings By Design Future Potential, Building Type by Rank and IOU

IOU	Rank	Building Type	2013-15 Remaining Potential			2013-15 Score (Percent of total future potential savings)			
			MWh	MW	MTherm	MWh	MW	MTherm	Average Percent ³
PG&E	1	Office and Bank Buildings	254,857	37	5,959	32%	18%	41%	30%
PG&E	2	Stores and Restaurants	194,689	46	456	24%	23%	3%	17%
SDG&E	1	Manufacturing Plants, Warehouses, Labs	23,317	5	545	9%	7%	51%	23%
SDG&E	2	Schools, Libraries, and Labs (nonmfg)	28,943	15	281	11%	21%	27%	20%
SDG&E	3	Stores and Restaurants	92,493	22	-110	35%	31%	-10%	18%
SCE	1	Stores and Restaurants	262,970	52	0	33%	29%	0%	31%
SCE	2	Schools, Libraries, and Labs (nonmfg)	103,648	32	0	13%	18%	0%	16%

4.2 Sustainable Communities Program (SCP)

The SCP was designed to encourage and support the construction of ZNE buildings and sustainable community developments in SCE, SDG&E, and SoCalGas territories.¹⁸ The program was developed in August 2006, with a program cycle running from 2010-2012 for SDG&E and SCG, and continuing through the 2013-15 cycle for SCE.. This program was funded by California utility ratepayers and administered by SCE under the auspices of the CPUC, through a contract awarded to KEMA Services, Inc.

The pilot program focused on commercial, mixed-use, and/or multiple building new construction projects willing to commit to aggressive energy efficiency and sustainable design goals. Once operational, projects must purchase their electric service from SCE and be on a rate that pays into the Public Goods Charge Fund.

The SCP staff provided projects with design assistance at no cost to support energy efficiency, renewable energy, and sustainable building design. As detailed on the program website, technical assistance included any of the following:

- » Design charrettes and team integration support
- » Zero net energy road-mapping and planning assistance
- » Consultant identification and Request for Proposal support
- » Project-specific green building support

¹⁸ Southern California Edison, "The Sustainable Communities Program," <http://www.sce-scp.com/Projects/Default.aspx?tabid=1087>, accessed October 22, 2014.

- » Energy benchmarking and modeling
 - Innovative energy system design assistance
 - Assistance with commissioning plans, specifications, and manuals
 - Education and training
 - Economic assessment of energy efficiency measures and LEED certification
 - LEED specifications and documentation support
 - Coordination with other incentive programs
 - Customized policy assistance for community initiatives

4.3 PG&E Zero Net Energy Pilot Program

The ZNE Pilot Program ran from 2010-2012 and provided guidance supporting the ZNE goals for residential and commercial construction by 2020 and 2030.¹⁹ The program was focused on achieving energy efficiency and load reduction through advanced design and construction before adding on-site renewable generation. The program targeted the market through three main avenues: Education and Outreach Activities, Technical Studies and Research, and Design and Technical Assistance Consultations. Among other activities, the program did the following:

- » Funded and supported the development of “The Road to ZNE: Mapping Pathways to ZNE Buildings in California”,²⁰ a broad-based policy inquiry on pathways forward to the 2020 and 2030 ZNE goals, and “The Technical Feasibility of Zero Net Energy Buildings in California,”²¹ which investigated the technical feasibility of ZNE buildings for various building types but specific to the California climate.
- » In coordination with the PG&E Pacific Energy Center, developed and funded the courses “Zero Net Energy for Non-Residential Buildings”, consisting of an eight-part series taught by experts on energy efficiency, distributed generation, and ZNE, and the six-part “ZNE Homes” course.

¹⁹ Pacific Gas and Electric, “PG&E Zero Net Energy Pilot Program,” <http://www.pge.com/myhome/saveenergymoney/energysavingprograms/znepilotprogram/>, accessed October 15, 2014.

²⁰ Heschong Mahone Group, Inc., “The Road to ZNE: Mapping Pathways to ZNE Buildings in California”, <http://www.cpuc.ca.gov/NR/rdonlyres/0474B6C9-2288-4EA0-B3B1-83ECBD4C70A4/0/TheRoadtoZNEReport.pdf>.

²¹ ARUP, “The Technical Feasibility of Zero Net Energy Buildings in California,” http://www.energydataweb.com/cpucfiles/pdadocs/904/california_zne_technical_feasibility_report_final.pdf.

Although the pilot program ended in 2012, PG&E continues to promote ZNE buildings through the following multi-pronged approach.

Education and Outreach Activities

- » Workshops and educational series offered through PG&E's Pacific Energy Training Center and Stockton Energy Training Center
- » Collaborated with the San Francisco Chapter of the AIA (2011, 2012, and 2013) and the AIA Foundation (2014) to develop an annual ZNE design competition, Architecture at Zero.²² The competition began in 2011 and PG&E plans to support it for the fifth straight year in 2015.

Technical Studies and Demonstration Projects

- » Published *Zero Net Energy Case Study Buildings*,²³ highlighting six non-residential buildings that were designed and built to perform at ZNE over the course of a year. Provides valuable sources of insights and information about design process, design strategies, post-occupancy building issues, and corrective measures taken to ensure actual ZNE performance.
- » Held a demonstration showcase at the Honda Smart Home in Davis, CA (May 2014)

Design and Technical Assistance Consultations

- » At a variety of phases throughout participating projects, PG&E provides technical advisory teams that help project teams, owners, and builders meet ZNE goals through design and technical assistance. Consultation activities include the following:
 - PG&E is funding ongoing energy performance monitoring at the University of California Davis West Village.
 - PG&E is supporting California state government projects trying to meet the State ZNE targets for government buildings.
 - PG&E is working with production builders to develop, build, and monitor the performance of ZNE homes prototypes.

4.4 SoCalGas Commercial Sustainable Development Program

The Commercial Sustainable Development Program ²⁴ is a commercial non-resource program focusing on passive and low-energy strategies to assist the non-residential market in achieving ZNE and improved thermal comfort. Passive systems use nature and climate to provide heating, cooling,

²² Architecture at Zero, Competition for Zero Net Energy, <http://www.architectureatzero.com/>, accessed October 15, 2014.

²³ Edward Dean and Peter Turnbull, September 2014, "Zero Net Energy Case Study Buildings," http://energydesignresources.com/media/19864463/zne_case_study_buildings.pdf, accessed October 15, 2014.

²⁴ Commercial Sustainable Development Program Implementation Plan Template, <http://eestats.cpubc.ca.gov/EEGA2010Files/SCG/PIP/Clean/SCG3795%203P-IDEEA365-CSDP%20PIP%209-15-14%20Final.pdf>.

ventilating, and lighting to meet the thermal comfort needs of the occupants. This program fills a key gap by providing a sustainability initiative with a focus on natural gas savings. A goal of this program is to develop methodologies and metrics to quantify energy savings and low-energy and passive energy measures not recognized by the Database for Energy Efficient Resources or Title 24. This program was launched in 2014 in the SoCalGas territory and focuses on the following objectives:

- » Implement passive and low-energy strategies
- » Create white papers and metrics to support passive and low-energy strategies in new and existing IOU programs
- » Develop six sustainable projects (three retrofit and three new construction) in SoCalGas territory to serve as case studies
- » Deliver three workshops on passive design and low-energy strategies to educate students and professionals on these concepts
- » Fund and coordinate a research grant with the University of Southern California to implement passive design and low-energy research strategies
- » Work with utility energy efficiency programs to record measurable therm energy savings

4.5 ***2015 Proposition 39 Zero Net Energy Schools Pilot Program***

The Prop 39 ZNE Schools Pilot (Pilot) leverages Prop 39 funding to assist schools in retrofitting existing facilities to ZNE and prove that ZNE retrofits of schools is feasible across California.²⁵ The budget for the Pilot is approximately \$8.8M from 2015 to 2019, \$825,000 of which is anticipated to be needed in 2015. The details of the program include:

- Targeting 13-18 retrofit projects in 13-18 school districts or community colleges
- Disseminate learnings, processes and materials germane to ZNE to the many stakeholders in the California schools community. These efforts would involve training classes and webinars, publications, design guides and recognition events as dissemination vehicles.
- Finally, the IOUs would learn from the Pilot to explore the feasibility of a larger-scale program for future years.

²⁵ Public Utilities Commission of the State of California Energy Division, Zero Net Energy Pilot for Local Educational Agencies and Community Colleges Pursuant to OP 7 of Energy Efficiency Decision 14-10-046, https://www.socalgas.com/regulatory/tariffs/tm2/pdf/4759__et_al_.pdf, accessed February 13, 2015.

5 Survey Results

5.1 Overview

For the survey, a data set of 200 was collected from a panel of people who work for California-based AEC firms. Results for the survey are based on an online questionnaire administered under the direction of a panel company, ResearchNow in November 2014. For the survey, ResearchNow used a pre-recruited and profiled pool of respondents. ResearchNow actively curates the respondent pool to ensure applicability and relevancy of the survey pool. Respondents are verified through the use of additional third-party databases. The panel company constantly evaluates the quality of the respondents themselves, removing those who produce conflicting information and/or low-quality responses. In their greater pool of applicable respondents, ResearchNow has a pool of relevant architectural, engineering, and construction company employees at all management levels. For this study, only respondents that were well-qualified, according to the questions provided in Appendix D, were able to complete the survey. The survey was terminated once 200 qualified respondents completed the survey.

The survey questionnaire contained 54 questions that respondents were required to complete. The survey questionnaire is presented in Appendix D. As you can see in the appendix, survey questions included open text and multiple choice questions. In some cases, survey respondents could select all answers that applied.

The goal of the survey was to collect insights from AEC firms on the following topics:

- » Awareness of ZNE and ID concepts
- » Experience with ZNE projects
- » Promotion of ZNE and ID concepts
- » Awareness of ZNE and ID utility programs
- » Recommendations for utility program improvement

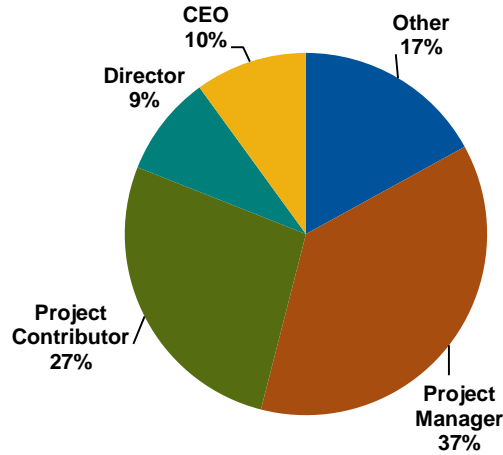
The survey indicated that the definitions of ZNE and ID vary across the industry. Although most surveyed AEC firms expressed interest in pursuing ZNE projects, just over half of the respondents had experience with ID or ZNE projects and just under half had success convincing their customer to build a ZNE building. Only about 20% of respondents indicated awareness or use of utility ZNE and ID programs. Making ZNE and ID websites easier to find ranked as the highest priority for respondents. The largest percentage of participants indicated that rebates and educational programs would provide them with the most value in terms of promoting ZNE buildings and the ID process.

5.2 Survey Respondents

As shown in **Error! Reference source not found.** through **Error! Reference source not found.**, the majority of respondents were either project managers or project contributors, who work for firms of various sizes and varying annual revenue. Fifty-four percent of respondents' firms work at the local or state level, while 13%, 14%, and 21% do business at the regional, national, and international scales,

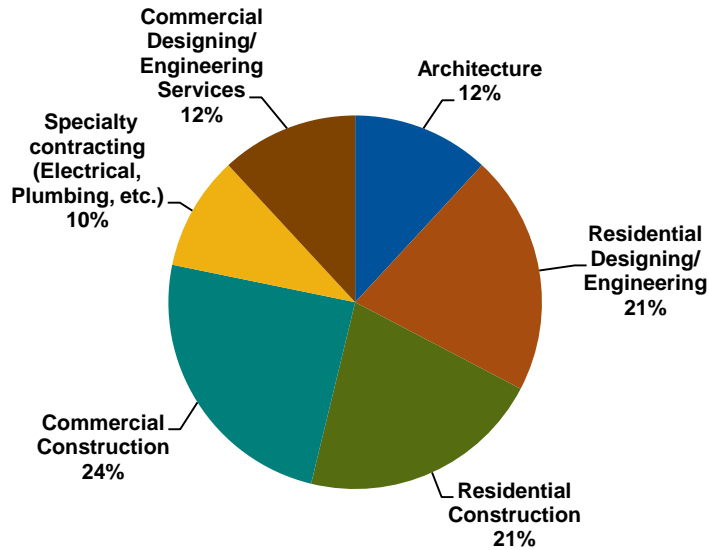
respectively. All 200 of the firms that responded to the survey do business in California, with other popular states including Arizona, Nevada, Texas, and New York.

Figure 5-1. Respondent Role



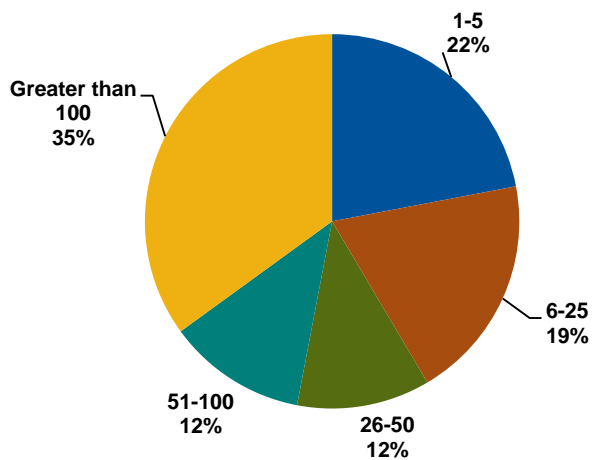
Survey Question 50A: What is your role at your company?

Figure 5-2. Firm Type



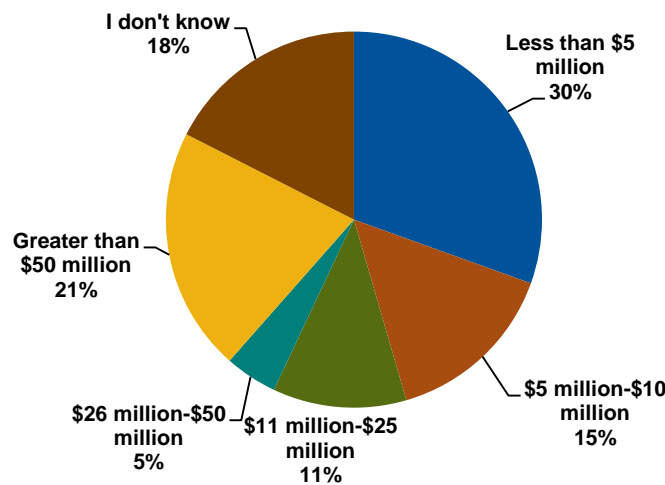
*Survey Question: S4. Which of the following best describes the type of company you work for?
(Select all that apply)*

Figure 5-3. Number of Employees



Survey Question 53: How many employees does your company have (all locations)?

Figure 5-4. Company's Annual Revenue



Survey Question 52: What is your company's annual revenue?

5.3 Understanding of ZNE and Integrated Design Concepts

The survey asked respondents to indicate both their familiarity and their perception of their firm's familiarity with the concepts of ZNE and ID. In general, those surveyed were more familiar with the concept of ID than the concept of ZNE and when asked to define the concepts, had richer responses to the concept of ID.

Table 5-1. Familiarity with ZNE and ID

Familiarity	Very Familiar	Familiar	Somewhat Familiar	Not Aware	Do not Know
Zero Net Energy					
Survey Respondent	11%	19%	33%	37%	0%
Respondent's Company	13%	23%	27%	23%	14%
Integrated Design					

Familiarity	Very Familiar	Familiar	Somewhat Familiar	Not Aware	Do not Know
Survey Respondent	6%	24%	55%	16%	0%
Respondent's Company	13%	25%	41%	14%	8%

See Survey Questions Q1 and Q5

As highlighted in the Zero Net Energy Buildings Overview section, the definitions of ZNE and ID vary across the industry. When asked to define a ZNE building or project in their own words, the most common response was best characterized by one respondent as “the amount of energy used by the building is equal to that of which it produces on-site.” Similarly, when showed a list of common definitions, most survey respondents identified with describing ZNE as, “A building whose net energy use and renewable power is net zero over the course of the year, verified with data,”; however, responses were fairly distributed across the provided definitions.

Table 5-2. ZNE Definition

Definition	Percentage
A building whose net energy use and renewable power is net zero over the course of the year, verified with data	42%
A building design that employs all cost-effective energy efficiency measures before incorporating renewable energy resources	24%
A building that offsets electricity, gas, propane, and other non-electric fuel use	23%
A building whose energy charges (not demand charges) are zero over the course of a year, due to net energy metering	17%
A building that is not connected to the electric grid (i.e., islanded)	7%
A building that only offsets electricity use	7%
Other	1%

Survey Question 3: We understand there are a number of ways to define Zero Net Energy. Which of these building design characteristics fit within the definition you use to describe a ZNE project? (Choose as many as apply)

When showed a list of common options used to define the concept of “energy offset” within the definition used to describe a ZNE project, responses were mainly distributed across four of the six options.

Table 5-3. Energy Offset Definition

Definition	Percentage
A building whose energy use is offset with a combination of “on-site” and “off-site” or nearby renewables	31%
A building whose energy use is offset with only “on-site” renewable energy resources	25%
A building whose energy use is offset with Renewable Energy Credits or Carbon Offsets	21%
A building whose energy use is offset with Clean Energy purchases on the grid (electrical or gas)	15%
A building whose energy use is offset with only “off-site” or nearby renewable energy resources	6%
Other	1%

*Survey Question 4: Which of these **energy offset** options fit within the definition you use to describe a Zero Net Energy project (choose as many as apply)*

When asked to define ID in their own words, it was defined by one individual as “a cohesive design and building structure and comprehension for the construction process.” Another respondent defined ID as “A holistic approach to design with all consultants and team players involved.” Others characterized the ID concept as a “buzzword,” “taking all aspects into consideration,” “the future,” “a cooperative group team,” and “a holistic design.” When shown a list of common definitions and asked to identify all definitions that applied to ID, the responses were evenly distributed across the seven definitions provided, indicating no one can agree on the definition of ID.

Table 5-4. ID Definition

Definition	Percentage of Respondents
The process of gathering input from the many stakeholders in building design, construction, and operations, ideally through multiple joint review sessions	49%
Working with collaborators to identify pathways to optimize the energy efficiency options of a project	41%
Working with collaborators to identify pathways to include renewable power in a project	35%
The process of designing a building that captures renewable power, and then uses it	33%
A computer-aided design that uses models to simulate building energy use and renewable potential	33%
The process of gathering inputs from stakeholders at the design stage of a project	33%
The process of gathering inputs from stakeholders to manage operations of a facility	21%
Other	1%

Survey Question 7: Which of these characteristics fit within the definition you use to describes the concept of Integrated or Integrative Design (choose as many as apply)

5.4 Experience with ZNE Projects

The survey encompassed responses from individuals who work at firms that have been involved in roughly 318 ZNE projects, 75 of which were reported to have been constructed in California. This number included ZNE projects that may have been postponed or cancelled, which is why this number is greater than the number reported by NBI, in Section 4, above. The majority of respondents (65%) indicated that

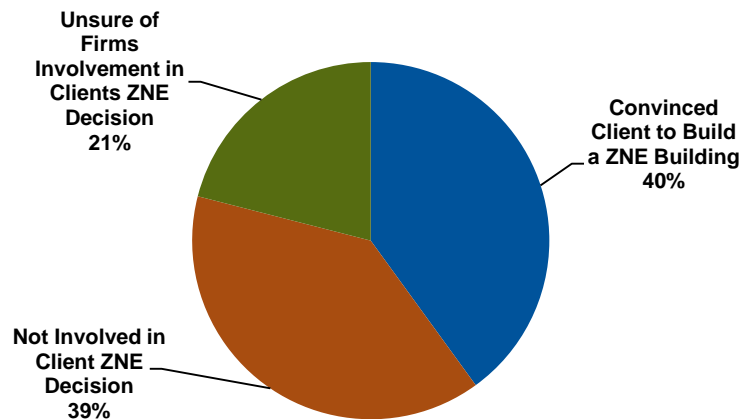
their company had experience with three or fewer ZNE projects. With 23% of respondents unable to quantify the number of projects their firm has been involved with to date, only 12% of respondents' firms had experience with four or more projects.

5.5 Promoting ZNE and ID

Of the 200 individuals surveyed, 58% indicated that their firm had used the “Integrated Design” process in the development or execution of a project and 62% indicated that their firm tries to pursue ZNE design and/or ZNE performance on new projects.

Of the 82 respondents that indicated they had worked on a ZNE project, not all firms were involved in promoting ZNE as indicated in **Error! Reference source not found.**

Figure 5-5. Of AEC Firms with ZNE Experience, Firm’s Influence on ZNE Construction



Survey Question 22: Did you or your firm ever convince a customer to pursue building a ZNE building that wasn't initially aware or interested in ZNE?

Of those 82 respondents that reported they had worked on a project with the initial goal to be ZNE, 52% of them indicated that the project reduced that goal due to a constraint, while the other 48% indicated this had not happened to them.

When asked to explain in a text response why there are not more ZNE projects under construction in California, by far the most common response was “cost.” Other popular responses included: “local planning,” “red tape,” and “lack of knowledge.” When asked about the main barriers to ZNE projects in California, “cost” was still the most consistent response with additional responses including all those listed above plus “local laws,” “government,” “economy,” “lack of client desire,” “taxes,” and “time.”

Additionally, the survey indicated that there was no consensus on the value of a ZNE certification aiding adoption, with 55% of respondents believing a certification would aid adoption and the remaining respondents feeling otherwise.

5.6 Awareness of Utility Programs

Regarding utility program awareness, the survey indicated that respondents are aware of solar and renewable energy and energy-efficient building programs; however, they are much less aware of ZNE and ID programs.

Table 5-5. Utility Program Awareness

Program Type	Percentage
Solar and renewable energy	54%
Energy-efficient buildings	44%
ZNE buildings	21%
The use of integrative design	16%
I am not aware of any utility programs that can be used on my projects.	4%
Other	1%

*Survey Question 39: Please select the areas where **you are aware of** utility programs that can be used on your projects (check all that apply)*

The 129 respondents who indicated they were aware of utility programs were asked how much value current California utility programs provided across five program categories.

Table 5-6. Value of Current Utility Programs

Value	Extreme Value	Much Value	Average Value	Limited Value	No Value	Not Sure/NA
ZNE Buildings	16%	26%	29%	19%	0%	9%
Use of ID	15%	26%	36%	11%	4%	9%
Solar and Renewable Energy	20%	41%	25%	9%	0%	5%
Energy- Efficient Buildings	22%	38%	25%	10%	0%	5%

Survey Question 40: How much value do you think current California utility programs in the following areas provide to you and your projects through education or rebates

Additionally, respondents were asked “where they have used” and “where they have received any education or training” from California utility programs. Respondents’ perception of utility program value aligned closely with the programs and education firms had received in the past from the utilities, with solar and renewable energy and energy-efficient buildings leading under all evaluation metrics.

Table 5-7. Utility Program Use Responses

Program Type	Percentage
Energy-efficient buildings	53%
Solar and renewable energy	52%
ZNE buildings.	22%
The use of integrative design	16%
I am not aware of any utility programs that can be used on my projects.	15%
Other	1%

*Survey Question 41: Please select the areas where **you have used** California Utility programs for assistance on your project (check all that apply)*

Table 5-8. Utility Program Education or Training

Program Type	Percentage
Solar and renewable energy	43%
Energy-efficient buildings	40%
I am not aware of any utility programs that can be used on my projects.	33%
The use of integrative design	18%
ZNE buildings	15%
Other	2%

Survey Question 42: Please select areas where you have received any education or training from California Utility programs (check all that apply)

Of the 104 participants that indicated they had used a California ZNE or ID utility program, 58% found the program useful. Rebates/funding for efficiency options and renewable power was reported as the most valuable component of utility programs.

Table 5-9. Most Valuable Utility Program

Program Type	Percentage
Rebates/funding for efficiency options	36%
Rebates/funding for renewable power	31%
Education about concepts	17%
General awareness of ZNE innovation	10%
Training on software	7%
Other	0%

Survey Question 48: What was most valuable from the utility programs?

When asked “what was missing from the utility programs,” the most frequent responses included: “building owner education,” “qualified instructors,” “advertising,” “more money,” “case studies/real world examples,” “legislative planning,” “nothing,” and “not sure.”

Additionally, survey participants ranked the four most important factors in order of importance that would improve their use of both renewable energy and energy efficiency programs for ZNE projects. Opinions differed across respondents; however, “making the utility websites easier to find” received the most “Rank 1” votes and “Guidance on program websites for describing concepts” and “more education/training session sponsored by utilities” received the most “Top 4 Rank” votes, followed by “outreach to potential customers.” Table 6-10 ranks the improvement options from most important to least important based on the number “Rank 1” values.

Table 5-10. Utility Program Improvement Options

Improvement Options	Rank 1	Rank 2	Rank 3	Rank 4	Total Top 4 Ranks
Make the websites easier to find	16	4	2	6	34
Guidance on program websites for describing concepts like renewable energy, energy efficiency, and ZNE to customers	11	13	8	10	52
More education/training sessions sponsored by utilities	11	10	16	6	49
Integrate utility-based renewable and energy efficiency programs	10	8	8	7	40
Make the websites easier to use	9	8	5	3	28
More directed individual outreach from utilities	7	7	6	2	24
Guidance on program websites for methodologies for pursuing renewable energy, energy efficiency, and ZNE to your customers	5	9	9	10	43
Outreach to potential customers	3	11	7	12	45
Availability of basic marketing materials about ZNE, renewable energy, and energy efficiency for distribution to current or potential customers	2	3	7	13	38
Availability of more case studies on existing ZNE projects	1	2	7	5	20
Other	0	0	0	1	1

Survey Question 50: For ZNE projects in California that you have been involved in, what would improve your use of both renewable energy and energy efficiency programs? Please rank your top 4 in order of importance.

Note: 75 respondents ranked the utility program improvement option

5.7 Program Improvement and Suggestions from Respondents

Out of the 200 respondents, 19% indicated they had visited a California Utility ZNE website and 22% indicated they had visited a California Utility Integrated Design website.

Respondents were asked to rate a list of programs they would like California utility programs to implement to better promote ZNE buildings. The largest percentage of participants indicated that rebates and education would provide extreme value.

Table 5-11. Utility Program Value Ranking

Value	Extreme Value	Much Value	Average Value	Limited Value	No Value	Not Sure/NA
Rebates	58%	27%	13%	1%	0%	0%
Education	43%	35%	20%	2%	0%	0%
Project Assistance	30%	48%	18%	4%	0%	0%
Free or Discounted Software	30%	32%	26%	8%	1%	2%
Outreach	24%	40%	28%	8%	0%	1%

Survey Question 44: Please rate which of the following programs would you like California Utility programs to implement to better promote ZNE buildings? Please select all that apply.

6 Strategic Findings

The survey conducted for this study provided insight into the state of understanding ZNE and ID in California, and the potential IOU program role in promoting their development. From phone interview and online survey analysis, Navigant provides the following findings which try and answer the question: How can IOU's design their programs to increase ID and ZNE adoption in non-residential/non-industrial new construction buildings?

ZNE Awareness

The survey results suggest that there is no market consensus as to what constitutes a ZNE building. The cause of the discrepancy is not clear, nor is its effect on ZNE adoption. Navigant suggests that further study be conducted to understand:

- 1) Is lack of clarity by market actors about the market definition of a ZNE project (according to the survey results), and the different code definitions from Federal and State agencies, an inhibitor of ZNE adoption? If so, to what degree?
- 2) What would aid in improving market understanding of a consistently used ZNE definition?
- 3) To what extent does the depth of the customers' understanding of ZNE impact ZNE adoption?
- 4) How well understood is the concept of TDV by end-users? Does that definition affect ZNE adoption? Do the state energy agencies and IOUs need to clarify the definition for market actors?

Integrated Design

The survey suggests there is similar confusion on the use and implementation of the concepts of Integrated Design. Navigant suggests that further study be conducted to understand:

- 1) How is ID used in current ZNE projects, green building projects, and "ordinary" development projects? What are the ID best practices that have allowed leading ZNE designers to deliver attractive, high performing ZNE buildings on budget and on time? What tools and practices provide for success?
- 2) Will promoting the ID approach along with ZNE tools and resources increase ZNE building adoption rates?

Designing ZNE Buildings

The survey suggests that AEC firms are well aware of energy efficiency and renewable energy programs. But their depth of understanding regarding options for offsetting consumption via renewable power is unclear. Navigant suggests that further study (surveys and interviews) be conducted to understand:

- 1) How open are designers to methods of offsetting onsite consumption with off-site renewable energy sources, including but not limited to those identified in this project?
- 2) How are these concepts being introduced to clients?
- 3) What are the differences in ZNE design approaches between different building sectors (e.g. retail, education, office)?

IOU Programs

The survey suggests that AEC firms that operate in California may not be well informed as to the existence or ZNE and ID resources provided by IOU programs. Navigant suggests that further study be conducted to understand:

- 1) How can IOU programs be integrated to provide the needed guidance and incentives for AEC firms across existing domains (e.g. renewable power and energy efficiency)?
- 2) As design assistance is a non-resource activity, under the current savings / Total Resource Cost paradigm, yet ID is a key component of ZNE success, does the IOU incentive structure for commercial new construction programs need to change to promote the 2030 ZNE goal?
- 3) What kinds of IOU programs are or could be successful in increasing ZNE adoption? How is that success measured?

Rebates and incentives

The survey suggests that rebates are very well known by AEC firms. The degree to which they drive ZNE adoption is not clear. Navigant suggests that further study be conducted to understand:

- 1) Given the relatively small value of traditional commercial new construction rebates compared to overall cost of a building, how effective are rebates at promoting ZNE buildings?
 - a. Is there a more effective method of financially incenting ZNE adoption?
- 2) When in the building process should stakeholders be incentivized?
 - a. Which stage is most impactful (design, construction, operations, etc.)?

Outlying Questions

A series of questions arose that are beyond the scope of this study but important to consider when addressing California's ZNE goals. These include:

- 1) How do retrofits fit into California's ZNE plan? Will developing a ZNE retrofit market aid new construction, and vice-versa?
- 2) How does ZNE for commercial differ from residential? Are there similar market actors who could drive adoption of both?
- 3) As energy efficiency implementation increases, via improvements in technology and code, how can IOU programs change to address the shrinking margin of efficiency gains? How will this change impact ZNE incentives?
- 4) How well aligned are the ZNE goals for California and the periodic code upgrades? Are they in sync?
- 5) What is the best mechanism for gathering and synthesizing additional information for a full commercial new construction ID/ZNE market characterization?

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Appendix B ZNE Building Forecast

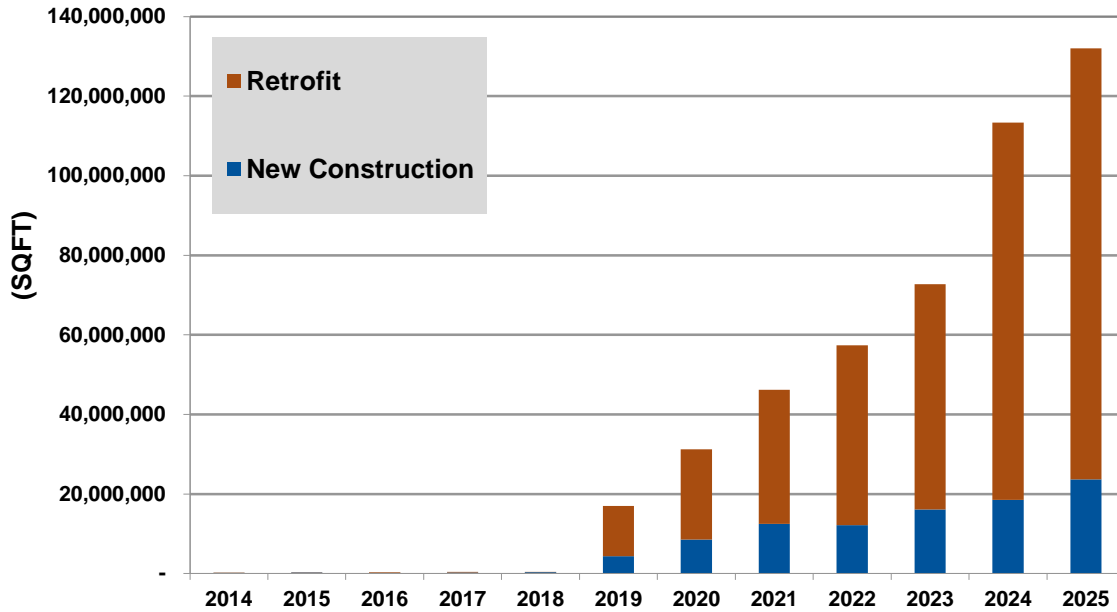
In 2014, Navigant Research published a report entitled “Zero Energy Buildings”²⁶ that provided global forecast for zero energy commercial buildings (ZEB). That forecast was based on a projected change in overall commercial building stock, policy drivers, and technology innovation. Navigant Research forecasts are influenced by over 20 interviews of market players, including manufacturers, AEC firms, and policy makers. For this MASI Study, Navigant modified the ZEB estimates from the North American market to capture the projected size and rate of growth of the ZNE commercial market in California. The downscaling assumed that the 50% ZNE commercial building goal would be reached by 2030; this forecast can be viewed as a “ramping up” to that adoption.

Navigant estimates that in California, the floor space of new commercial ZNE buildings is expected to reach 203,000 square feet in 2014, largely from demonstration and pilot projects. Estimates of total ZNE commercial building square footage was estimated from NBI listings and case studies of ZNE buildings²⁷, as well as other sources. California’s ZNE building growth will be influenced greatly by Title 24. As 2030 approaches, Title 24 will continue to become more stringent the gap between minimum requirements and ZNE will narrow. As the gap narrows, the additional design and energy efficiency measures needed to achieve ZNE will seem less of an impediment and more building owners will take the steps necessary to get to ZNE status. By 2025, the commercial square footage of new ZNE projects is anticipated to reach 23,704,000 square feet, representing a Compound Annual Growth Rate (CAGR) of 49% from 2014. This comprises 7% of all commercial building stock. The jump in square footage between 2018 and 2019 is anticipated due to the number of ZNE projects in the planning stages now, which will be completed in the next five years.

²⁶ <http://www.navigantresearch.com/research/zero-energy-buildings>

²⁷ <http://newbuildings.org/getting-to-zero-buildings-database>

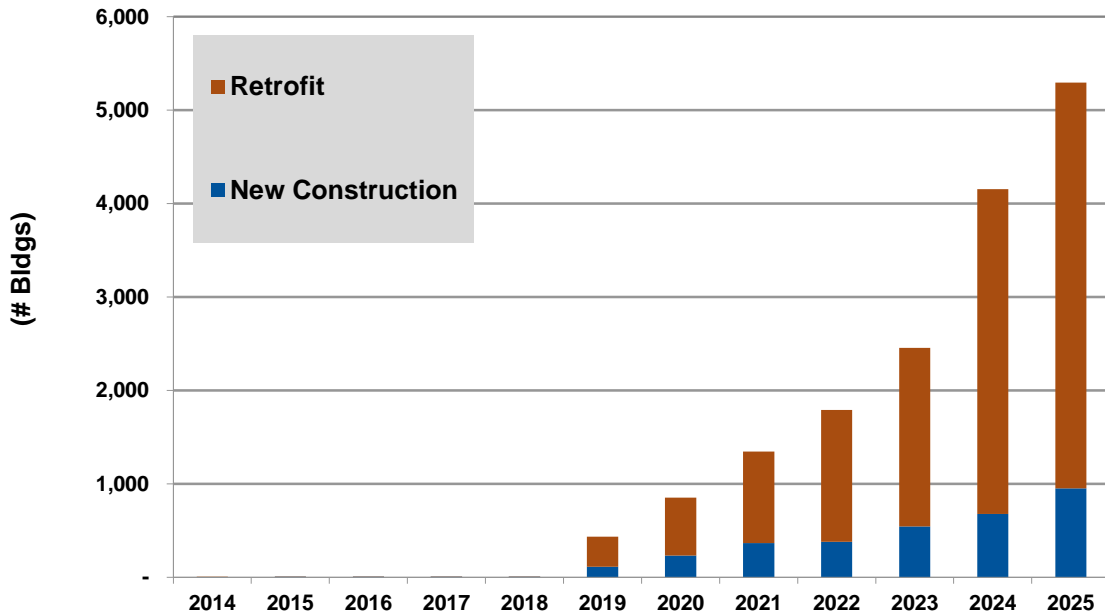
Figure B-1. Commercial Zero Energy Buildings in California (sq. ft.), 2014-2025



Source: Navigant Research

As the retrofit and new commercial ZNE building industries gain more experience and share best practices, ZNE commercial retrofits are expected to become more commonplace. Currently, a small market estimated at 51,000 square feet, the retrofit floor space, is expected to grow to 108,294,000 square feet by 2025, at a CAGR of 89%. This comprises 25% of all retrofit commercial space.

Figure B-2. Commercial Zero Energy Buildings in California (#), 2014-2025



Source: Navigant Research

Based on the interviews performed for the Navigant Research report, the number of ZNE buildings are expected to grow, while square footage of individual ZNE projects is anticipated to decrease between 2014 and 2025. This is due to the increasing relative ease of reaching ZNE status in smaller buildings in the next decade. This is in part due to their small loads and relatively large rooftop available area for PV (compared to multi-story large commercial buildings). Large commercial ZNE buildings will continue to proliferate, but not at the rate of smaller buildings.

Appendix C Program Manager Interview Guide

1.1.1 Program Manager Introduction Questions

- (1) We are currently refining the scope of the ZNE / Integrated Design (ID) study. Can you tell us what you hope to gain from this research we are conducting?
- (2) What information about ZNE buildings in California would be most useful to you? How would you use this information?
- (3) Do you think AEC community knows about ID and its links to ZNEs?

1.1.2 Market Assessment and Program Activities Questions

- (4) Can you describe any current or recent programs promoting ZNE commercial buildings?
 - a. Program history, design and implementation
 - b. Baseline assumptions
 - c. Program participation
- (5) Do you use the concept of integrated design? Is it part of the any of the programs mentioned previously?
- (6) *Data: Do you have any data on these programs you can share? Do you have any case studies on ZNE buildings completed in your utility territory?
- (7) Tell us about any lessons learned or best practices developed during current and/or historical program activities.
- (8) How are you marketing your programs?
- (9) Do you have any suggestions for financing mechanisms to help promote ZNE adoption?
- (10) Do you know of any out of state investor owned utility programs promoting ZNE commercial buildings?

1.1.3 Identify New Opportunities Questions

- (11) Do you have ideas for ZNE programs that would be applicable across California?
- (12) Do you have any programs you envision launching in the near future?

1.1.4 Market Actors

- (13) *Data: Can you identify additional interview candidates for each sub-sector:
 - a. Regulators, State and Federal organizations, Trade organizations
 - b. Active ZEB innovators at AEC firms
- (14) Can you tell us about any other specific resources (market actors or other) you use to support your work in this area?

1.1.5 Concluding Questions

- (15) Do you have any additional comments or concerns?

Appendix D ZNE/Integrated Design Survey

Introduction

Thank you for participating in this market research study! Individual responses will remain anonymous, and you will not be contacted further as a result of this survey.

This survey should last approximately **15-20** minutes. Thank you for your help!

Qualifying questions

Please select next to continue.

S1. Which of the following best describes where your company does business?

- a. Local
- b. State
- c. Regional
- d. National
- e. International

If S1=a/b

S2. In what state does your company do business? **[MUST SELECT CA TO CONTINUE, OTHERWISE TERMINATE]**

If S1=c/d/e

S3. What are the top 3 states where your company does business? **[MUST SELECT CA TO CONTINUE, OTHERWISE TERMINATE] Include option for "Mostly international", which should terminate.**

S4. Which of the following best describes the type of company you work for? (Select all that apply)

RANDOMIZE- ANCHOR F, KEEP C/D/E TOGETHER AND RANDOMIZE WITHIN

- a. Architecture
- b. Residential Designing/engineering services
- c. Commercial Building Designing/engineering services
- d. Residential construction
- e. Commercial construction
- f. Specialty contracting (Electrical, Plumbing, etc.) **[TERM]**
- g. None of the above **[TERM]**

Your Familiarity with ZNE and Integrated Design

Q1: How familiar are you and your company with Zero Net Energy (ZNE)?

	Very familiar	Familiar	Somewhat familiar	Not aware	I do not know
You	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Your Company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If “you” = “not aware” skip to Q5.

Q2: How do you define a Zero Net Energy building or project? (OPEN-ENDED) (NOTE: Do not show question with ZNE definition choices until this question is answered and submitted.)

- a. Open text entryp

Q3: We understand there are a number of ways to define Zero Net Energy. Which of these building design characteristics fit within the definition you use to describe a ZNE project? (Choose as many as apply): **RANDOMIZE- ANCHOR G**

- a. A building design that employs all cost effective energy efficiency measures before incorporating renewable energy resources
- b. A building whose net energy use and renewable power is net zero over the course of the year, verified with data
- c. A building whose energy charges (not demand charges) are zero over the course of a year, due to net energy metering
- d. A building that is not connected to the electric grid (i.e. islanded)
- e. A building that only offsets electricity use
- f. A building that offsets electricity, gas, propane, and other non-electric fuel use
- g. Other (please enter text)

Q4: Which of these energy offset options fit within the definition you use to describe a Zero Net Energy project (Choose as many as apply): **RANDOMIZE- ANCHOR F**

- a. A building whose energy use is offset with only “onsite” renewable energy resources
- b. A building whose energy use is offset with only “offsite” or nearby renewable energy resources
- c. A building whose energy use is offset with a combination of “onsite” and “offsite” or nearby renewable energy resources
- d. A building whose energy use is offset with Renewable Energy Credits or Carbon Offsets
- e. A building whose energy use is offset with Clean Energy purchases on the grid (electrical or gas)
- f. Other (please enter text)

Q5. How familiar are you and your company with the concept of **Integrated or Integrative Design**?

	Very familiar	Familiar	Somewhat familiar	Not aware	I don't know
You	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Your Company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If "you" = not aware skip to Q9.

If "you" not aware" both Q6 and Q1, terminate

Q6: Please describe how you would define **Integrated Design**

- a. Open text

Q7: Which of these characteristics fit within the definition you use to describes the concept of Integrated or Integrative Design (chose as many as apply) **RANDOMIZE-**

- a. The process of designing a building that captures renewable power, and then uses it.
- b. The process of gathering input from the many stakeholders in building design, construction, and operations, ideally through multiple joint review sessions.
- c. A computer-aided design that uses models to simulate building energy use and renewable potential.
- d. The process of gathering inputs from stakeholders at the design stage of a project.
- e. The process of gathering inputs from stakeholders to manage operations of a facility.
- f. Working with collaborators to identify pathways to include renewable power into a project.
- g. Working with collaborators to identify pathways to optimize the energy efficiency options of a project.
- h. Other (please enter text)

Q8: How many **ZNE** projects has your firm ever worked on (please include those that may have been proposed as ZNE, or were cancelled)? (enter a number)

INTRO 2. Congratulations! You have fully qualified to take this survey.

Thank you for participating in our survey on architecture and engineering of commercial buildings.

These results will be used to better understand the perception of Zero Net Energy (ZNE) Building design and implementation in the State of California, as well as the use of Integrated Design in the ZNE and energy efficient building project process.

Q9: Does your firm try to pursue **ZNE design and/or ZNE performance** on new projects?

- a. Yes, both design and performance
- b. ZNE design
- c. ZNE performance
- d. NO / NA

Q10: SHOW IF Q9=D Why doesn't your firm try to pursue ZNE design and/or ZNE performance on new projects?

- a. Open text entry

IF Q8=a (0) OR m (I don't know), SKIP TO Q25

Q11: SHOW IF Q8>0 Of the ZNE projects you have worked on in the past 5 years, how many were in California? (Capture a less than or equal to the total number of projects, above)

- a. 0
- b. 1
- c. 2 **Display IF Q8>=2**
- d. 3-5 **Display IF Q8>=3**
- e. 6-10 **Display IF Q8>=6**
- f. >10 **Display IF Q8>=11**

Q12: SHOW IF Q8>0 Previously you indicated that your firm has worked on [NUMBER FROM Q8] ZNE projects. What year were the ZNE projects completed? (only if the previous question (Q11) is a positive number, must sum to total of previous question (Q8)) **(ENTER # PER OPTION) FORCEFORCE SUM=Q8,**

- a. In construction phase now
- b. In development / design phase now
- c. 2014
- d. 2013
- e. 2012
- f. 2011
- g. 2010
- h. Before 2010

– drop down for each answer option,

Project information

[Only display page if Q8 is not "zero"] – the question "How many ZNE projects has your firm ever worked on? (enter a number)"

Q13: SHOW IF Q8>0 Previously you indicated that your firm has worked on [NUMBER FROM Q8] ZNE projects. Please distribute the number of ZNE projects your firm worked on across the following building sizes. Enter a number for each building size range, sum of which is less than or equal to the number of projects, above) **FORCE SUM=Q8, DO NOT FORCE INPUT FOR ALL OPTIONS**

- a. Less than 5,000 Square Feet
- b. 5,000-10,000 Square Feet
- c. 10,00 – 20,000 Square Feet
- d. 20,000 – 100,000 Square Feet
- e. Greater than 100,000 Square Feet

– drop down for each answer option,

Q14: SHOW IF Q8>0 What percent of the ZNE projects your firm worked on are actively monitored for adherence to the ZNE goals?

- a. 1% to 30%
- b. 31% to-49%
- c. 50% to 99%
- d. 100%
- e. I don't know

Q15: SHOW IF Q8>0 Previously you indicated that your firm has worked on [NUMBER FROM Q8] ZNE projects. Please enter how many ZNE projects your firm has worked on for each of the following sectors/building types: [Randomize answer choices]

- a. Education
- b. Office
- c. Retail
- d. Healthcare
- e. Government
- f. High-rise Multi Family
- g. Other - Please write in the kind of "other" building

– drop down for each answer option,
ZNE implementation

Q16: SHOW IF Q8>0Of the ZNE projects that you pursued, which of the following are applicable?
RANDOMIZE- group A & B, and group c & d – randomize within the groups.

- a. The pursuit of ZNE came from the customer
- b. The pursuit of ZNE was suggested by the designer / architect / construction firm
- c. The customer wanted an efficient building, but had not thought about ZNE
- d. The customer had thought about solar, but not about ZNE
- e. Other (insert text)

Q17: SHOW IF Q8>0What are reasons you or your firm pursued a ZNE project for the customer? Please select all that apply. [Randomize answer choices]

- a. Fits with your corporate sustainability goals
- b. Fits with your customer's' sustainability goals
- c. Long-term cost savings of the project
- d. Your firm's desire to demonstrate equipment or technical ability

- e. Customer’s desire to demonstrate equipment or technical ability
- f. Customer’s desires to use renewable energy
- g. Customer’s desires to have a highly energy efficient building
- h. Other (Please specify)

Q18: SHOW IF Q8>0 How important were the following factors in designing and implementing the project?

Pipe options selected in Q18	Very Important	Somewhat Important	Neutral	Somewhat Unimportant	Very Unimportant	Unsure
Fits with your corporate sustainability goals						
Fits with your customers’ sustainability goals						
Long-term cost savings for the customer						
Your firm’s desire to demonstrate equipment or technical ability						
Customer’s desire to demonstrate equipment or technical ability						
Customer’s desires to use renewable energy						
Customer’s desire to have a highly efficient building						

Q19: SHOW IF Q8>0: Did you ever work on a project with the initial goal to be ZNE, but reduced that goal due to a constraint? [Randomize answer choices]

- a. Yes
- b. No [SKIP TO Q23]

Q20: SHOW IF Q8>0&IF Q19=A Please describe the constraint and consequent goal reduction: **(fill in the blank cell)**

Q21: SHOW IF Q8>0&IF Q19=A Was that project in California? [Randomize answer choices]

- a. Yes
- b. No

Q22: SHOW IF Q8>0 Did you or your firm ever convince a customer to pursue building a ZNE building that wasn't initially aware or interested in ZNE?

- a. Yes
- b. No
- c. I don't know

Q23: Has your firm ever used the "**Integrated Design**" process in the development or execution of a project?

- a. Yes
- b. No [**SKIP TO Q27**]

Q24: Have any of the projects where your firm used **Integrated Design** been in California?

- a. Yes
- b. No

Q25: How often does your firm promote the use of **Integrated Design** on energy efficient projects

- a. Always (100% of the time)
- b. Often (50%-99% of the time)
- c. Sometimes (31-49% of the time)
- d. Rarely (1%-30% of the time)
- e. Never (0% of the time)
- f. I don't Know

Q26: Which of the following factors influence whether your firm **encourages** using **Integrative Design**? Check all that apply. **RANDOMIZE-**

- a. Long-term savings
- b. Client Desires
- c. Logistics
- d. Low-Carbon impacts
- e. Empowering stakeholders
- f. Client's Corporate Culture
- g. Other (enter open text)

Q27. Which of the following factors influence whether your firm **discourages** using **Integrative Design**? Check all that apply. **RANDOMIZE-**

- a. Additional Cost of project
- b. Additional Time
- c. Not well known with partners

- d. Client Desires
- e. Logistics
- f. Client's Corporate Culture
- g. Other (enter open text)

Q28. Which of the following factors influence whether your firm **encourages** using **Zero Net Energy**?

Check all that apply. **RANDOMIZE-**

- a. Long-term savings
- b. Client Desires
- c. Logistics
- d. Low-Carbon impacts
- e. Empowering stakeholders
- f. Client's Corporate Culture
- g. Other (enter open text)

Q29 Which of the following factors influence whether your firm **discourages** using **Zero Net Energy**?

Check all that apply. **RANDOMIZE-**

- a. Additional Cost of project
- b. Additional Time
- c. Not well known with partners
- d. Client Desires
- e. Logistics
- f. Client's Corporate Culture
- g. Other (enter open text)

Design Promotion

Q30: How often does your **company promote** the use of the following approaches:

[Randomize rows]

	Always (100% of the time)	Often (50%-99% of the time)	Sometimes (31-49% of the time)	Rarely (1%- 30% of the time)	Never (0% of the time)
Renewable power					
Backup batteries / microgrids					
Highly Efficient lighting					
Highly Efficient HVAC / alternative heating or cooling design					
Building Shell enhancements					
LEED Certification					

Customer Demand

Q31: How often do your **customers ask** for the following:

[Randomize rows]

	Always (100% of the time)	Often (50%-99% of the time)	Sometimes (31-49% of the time)	Rarely (1%- 30% of the time)	Never (0% of the time)
Renewable power					
Backup batteries / microgrids					
Highly Efficient lighting					
Highly Efficient HVAC / alternative heating or cooling design					
Building Shell enhancements					
LEED Certification					

Q32: Why do you think there are not more **ZNE** projects underway in California?

- a. (Open text Box)

Q33: What do you think are the main barriers to **ZNE** projects in California?

a. (open text box)

Q34: Consider the following activities that for California Utilities could do to help with the low adoption rate. Please rank them in order of effectiveness, where 1 is the item you think would be the most effective and 7 is the item you think would be the least effective. **RANDOMIZE-**

- a. Educate the public on ZNE
- b. Educate the AEC community more
- c. Fund more programs that promote ZNE's potential for cost savings
- d. Fund more programs that illustrate how ZNE is not cost prohibitive
- e. Fund more programs that promote the benefits of Integrated Design
- f. Give more rebates for pursuing ZNE
- g. Make software solutions cheaper and / or easier to use
- h. Other (Insert your own answers)

Q35: Which of the following parts of the process are most important to a building achieving ZNE? Please rank your top 3 in order of importance. **RANDOMIZE-**

- a. Upfront collaboration between architects and energy engineers
- b. Building commissioning at project completion
- c. Ongoing building commissioning
- d. Monitoring performance
- e. Other (enter text)

Q36: Do you think a ZNE certification by a third party would aid in the adoption of ZNE building?

- a. Yes
- b. No

Q37: Are you aware that there are utility programs that can be used to help your projects through rebates?

- a. Yes
- b. No (**IF NO – Skip this section**)

Q38: Which utility-based Integrated Design or ZNE utility programs are you aware of: (please click as many as apply) **RANDOMIZE-**

- a. PG&E
- b. SDG&E
- c. Southern California Edison
- d. SoCal Gas
- e. LADWP
- f. SMUD
- g. Palo Alto Municipal
- h. None
- i. Other (Please state)

Q39: Please select the areas where **you are aware of** utility programs that can be used on your projects (check all that apply): [Randomize answer choices]

- a. ZNE buildings
- b. The use of integrative design
- c. Solar and renewable energy
- d. Energy Efficient buildings
- e. Other (Please specify)
- f. I am not aware of any utility programs that can be used on my projects.

Q40: How much value do you think current California utility programs in the following areas provide to you and your projects through education or rebates

[Randomize rows]

	Extreme Value	Much value	Average value	Limited value	No value	Not sure/NA
ZNE buildings						
The use of integrative design						
Solar and renewable energy						
Energy Efficient buildings						
LEED Certification						

[Display page if answer to Q39 is not “I am not aware of any utility programs that can be used on my projects.”]

Q41: Please select the areas where **you have used** California Utility programs for assistance on your project (check all that apply): [Randomize answer choices]

- a. ZNE buildings
- b. The use of integrative design
- c. Solar and renewable energy
- d. Energy Efficient buildings
- e. Other (Please specify)
- f. I have never used California Utility programs for assistance on my projects.

Q42: Please select areas where **you have received any education or training** from California Utility programs (check all that apply): [Randomize answer choices]

- a. ZNE buildings
- b. The use of integrative design
- c. Solar and renewable energy
- d. Energy Efficient buildings
- e. Other (Please specify)
- f. I have never received any education or training from California Utility programs.



Q43: SHOW IF Q41 a-e, OR Q42 (a-e)How do you think California Utility programs can better promote ZNE buildings?

[Open text entry]

Q44: SHOW IF Q41 a-e, OR Q42 (a-e)Please rate which of the following programs would you like California Utility programs to implement to better promote ZNE buildings? Please select all that apply.

[Randomize answer choices]

	<i>Extreme Value</i>	<i>Much value</i>	<i>Average value</i>	<i>Limited value</i>	<i>No value</i>	<i>Not sure/NA</i>
Education						
Outreach						
Project assistance						
Rebates						
Free or discounted software						
Other (Please specify)						
None of the above						

Q45: Have you ever visited a California Utility ZNE Website?

- a. Yes
- b. No

Q45A. Have you ever visited a California Utility Integrated Design Website?

- a. Yes
- b. No

IF NO to 45 and 45A skip Q46

Q46: Which topics have you seen mentioned on utility websites? (Check all that apply)

COLUMNS

- Savings By Design
- ZNE
- Using Integrated Design
- Deploying renewables
- Energy Efficient Buildings
- Other (insert)

ROWS

- California Utility ZNE Website (IF YES @ Q45)
- California Utility Integrated Design Website (IF YES @ Q45A)

Q47: IF ANY PROGRAMMED USED @ Q41 If you participated in using a California ZNE or Integrated Design utility program, did you find the program helpful?

- a. Yes

- b. No

Q48: SHOW IF Q41 a-e, OR Q42 (a-e)What was most valuable from the utility programs **RANDOMIZE**

- a. Education about concepts
- b. Rebates/funding for efficiency options
- c. Rebates/funding for renewable power
- d. Training on software
- e. General awareness of ZNE innovation
- f. Other (please specify)

Q49: SHOW IF Q41 a-e, OR Q42 (a-e) What is missing from the programs?

- a. Open text entry

Q50: SHOW IF Q1>0 For ZNE projects in California that you have been involved in, what would improve your use of both renewable energy and energy efficiency programs? Please rank your top 4 in order of importance. [randomize]

- a. Make the websites to easier to find
- b. Make the websites easier to use
- c. Guidance on program websites for describing concepts like renewable energy, energy efficiency, and ZNE to your customers
- d. Integrate utility-based renewable and energy efficiency programs
- e. More education/training sessions sponsored by utilities
- f. More directed individual outreach from utilities
- g. Outreach to potential customers
- h. Availability of basic marketing materials about ZNE, renewable energy and energy efficiency for distribution to current or potential customers
- i. Availability of more case studies on existing ZNE projects
- j. Other (add text)

50A. What is your role at your company

- a. Project Contributor
- b. Project Manager
- c. Director
- d. CEO
- e. Other (insert Text)

Q51: How many employees does your company have (all locations)?

- a. 1-5
- b. 6-25
- c. 26-50
- d. 51-100
- e. Greater than 100

Q52: What is your company's annual revenue?

- a. Less than \$5 million
- b. \$5 million – \$10 million
- c. \$11 million – \$25 million
- d. \$26 million –\$ 50 million
- e. Greater than \$50 million
- f. I don't know

Q53: What proportion of your company's business relates to projects in California, in terms of number of projects?

- a. None
- b. Few (less than 25%)
- c. Many (25-50%)
- d. Most
- e. All

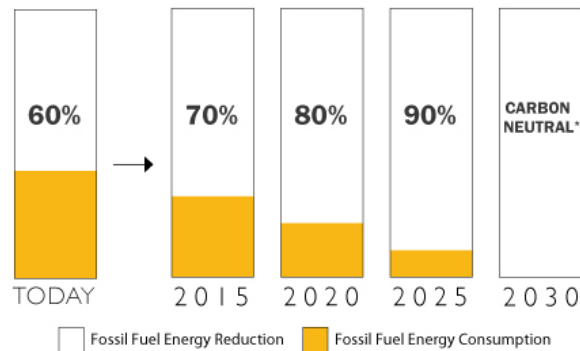
Q54: Finally, please leave any additional comments below. (Optional) **[free text box]**

Thank you for your participation.

Appendix E Architecture 2030

Buildings are a major source of global demand for energy and materials that produce by-product greenhouse gases. Architecture 2030's "2030 Challenge" asks the global architecture and building community to adopt the following targets to reduce greenhouse gases produced by buildings, addressing the threat of climate change.

- » All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 60% below the regional (or country) average/median for that building type.
- » At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 60% of the regional (or country) average/median for that building type.
- » The fossil fuel reduction standard for all new buildings and major renovations shall be increased to: 70% in 2015, 80% in 2020, 90% in 2025 and Carbon-neutral in 2030.



The 2030 Challenge

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 *Using no fossil fuel GHG-emitting energy to operate.

These targets may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power and/or purchasing (20% maximum) renewable energy.²⁸

The 2030 Challenge has made a significant national impact since it was first launched in 2006, shaping national energy code and being accepted by states, cities and organizations across the United States.

²⁸ Architecture 2030, "The 2030 Challenge," http://architecture2030.org/2030_challenge/the_2030_challenge.

Appendix F Other US State ZNE Programs

In addition to existing programs in California targeted at achieving zero net energy building standards by 2020 for low-rise residential buildings and by 2030 for commercial buildings, Oregon, Massachusetts, Vermont and Minnesota all have developed programs promoting net zero non-residential buildings.

F.1 Energy Trust of Oregon: Net Zero Design Strategies Pilot Program

Energy Trust of Oregon launched a pilot Net Zero Design Strategies program in May 2009 funded by customers of Portland General Electric, Pacific Power, NW Natural and Cascade Natural Gas. The pilot program enrolled 15 projects within the first six months of launch and was one of the first programs in the country to offer structured incentives to net-zero buildings to push innovative design and offset costs.

To be eligible for the Path to Net Zero pilot, project owners has to commit to designing and constructing a building at least 50 percent better than Oregon's 2007 energy code through energy efficient design and 60 percent better than code through a combination of energy efficiency and on-site renewable energy generation. Projects in the pilot included school buildings, a high-rise office building, a community center, dormitory housing and multi-use residential and retail buildings. The projects ranged in size from 1,500 sq. ft. to nearly 500,000 sq. ft.. Since then eight projects have completed construction, five are on hold or have been cancelled due to funding issues and two left the pilot program.

Program incentives were as follows:

- » **Early Design:** \$10,000 for integrated design charrette.
- » **Design:** \$0.10/kWh and \$0.80/therm, up to \$50,000 for energy modeling and energy related technical studies.
- » **Construction:** \$0.20/kWh and \$1.60/therm, up to \$500,000; commissioning required
- » **Post-Occupancy:** Up to \$5,000 for whole-building monitoring and \$0.20/sq. ft. for subsystem monitoring, up to \$30,000.
- » Projects in this pilot program demonstrated that net zero is within reach for a variety of building types and more information about these projects can be found in the complete study.²⁹

Currently, Energy Trust of Oregon has a program providing the following design incentives:

- » Design Workshop: \$2,500
- » Design 2 Day Charrette: \$7,500
- » Computational Fluid Dynamics Analysis: 50% of cost covered

²⁹ Walker, Becky, Rowe, Erin, Truax Sarah, and Rose, Jessica, PEI and Trust of Oregon. Notes form the Trail: Checking in on the Path to Net Zero, <http://www.aceee.org/files/proceedings/2012/data/papers/0193-000070.pdf>

Energy Trust of Oregon is in the process of developing a Zero Net Energy initiative scheduled to launch in Q4-2014.

F.2 Massachusetts Pathways to Zero Net Energy Program

In March 2008, Governor Patrick of Massachusetts issued a challenge to transform the building sector and help put the state on a path toward zero net energy buildings. The Governor developed a ZNEB Task Force, comprised of 70 experts in the field. The Task Force published a report titled Getting to Zero³⁰, which identified the following ways to move Massachusetts toward ZNEB:

- » Improve energy codes
- » Create a system for benchmarking, reporting and tracking energy use
- » Develop incentives
- » Enhance workforce development and public education initiatives; and
- » Construct zero net energy buildings in the state portfolio

Currently, the state has the Pathway to Zero Grant Program providing funding to support feasibility, design and construction efforts for projects targeting a zero net energy outcome. Released in May 2014, the program was shaped with input from the Massachusetts Zero Net Advisory Council, which includes members from the Massachusetts utilities. The program provides the following grants:

- Single family homes: Up to \$10,000
- Multi-family residential buildings: Up to \$400,000 (with a tiered incentive structure based on number of units)
- Commercial and institutional buildings: Up to \$500,000

All projects are eligible to receive funding for construction costs. Multi-family residential, commercial and institutional projects are also eligible for funding for feasibility studies and integrated design services.

The grants are funded by the Alternative Compliance Payments (ACP) received from retail electricity suppliers for the 2010 and 2012 compliance year. Suppliers use Alternative Compliance Payments as a way to meet their obligations for the state Renewable and Alternative Portfolio Standard programs.

Buildings applying to the program submitted proposals by July 15, 2014. Building applicants must indicate how they intend to leverage the support of the Mass Save® energy efficiency program. In October, the Patrick Administration awarded \$2.95 million in the Pathways to Zero Grant Program Grants to assist 25 projects in various stages of development seeking to achieve advanced zero net energy usage. A list of the projects receiving grants can be found on the Massachusetts state website.³¹

30 Massachusetts Zero Net Energy Buildings Task Force, "Getting to Zero Final Report of the Massachusetts Zero Net Energy Buildings Task Force," <http://www.mass.gov/eea/docs/eea/press/publications/zneb-taskforce-report.pdf>, March 11, 2009.

31 Pathways to Zero Grant Program Grants Awardees, <http://www.mass.gov/eea/pr-2014/advanced-energy-efficiency-grants.html>.

Projects that receive funding must follow this timeline:

- » Feasibility Study Completion: April 30, 2015
- » Integrated Design Phase Completion: October 31, 2015
- » Construction Begin: December 31, 2015

F.3 Vermont Net Zero Pilot Program

The Efficiency Vermont Net Zero Pilot Program ³² launched in February 2014 at the Annual Efficiency Vermont Conference. Initially a one year pilot, the program has already been extended through 2015. To date, just over 20 projects have participated in the program comprised of small office buildings, state park buildings, welcome centers and rec centers all under 10,000 sq. ft. Efficiency Vermont is a utility funded program that handles the energy efficiency programs for the state of Vermont.

Every project that participates in the program receives funding in the range of \$25,000-\$30,000, which is broken up across the following incentive categories:

- » Energy Charrette: \$2,500
- » Energy Simulation: 50% of cost (~\$5,000)
- » Energy Monitoring Equipment: 50% of cost (\$10,000)
- » Commission: 25% of cost (\$10,000)
- » Performance: Based on building performance after 1 year of operation and additional building efficiency costs

Although the program has gained traction and been extended for a second year, it is too early to draw conclusions about its overall success.

F.4 Minnesota B3 Sustainable Building 2030 Energy Standards

Beginning in July 2010, all state bonded projects, new and renovated, are required to meet the Minnesota Sustainable Building 2030 (SB 2030) energy standards. Based on the national Architecture 2030 program ³³, when compared to 2003 building construction, new buildings are required to reduce carbon producing fuel used for building energy by the following levels:

- » 2010 - 60% reduction
- » 2015 - 70% reduction
- » 2020 - 80% reduction

³² Efficiency Vermont, Net Zero Pilot Memorandum of Agreement, http://www.encyvermont.com/docs/for_my_business/new_construction/CNCNetZeroPilot_MOU.pdf

³³ Architecture 2030, "The 2030 Challenge," http://architecture2030.org/2030_challenge/the_2030_challenge.

- » 2025 - 90% reduction
- » 2030 - 100% reduction

Minnesota is one of nine states that have accepted the Architecture 2030 Challenge, including California, Illinois, Massachusetts, New Mexico, Ohio, Oregon, Washington, and Vermont. A step-by-step process is available on the program website.³⁴

³⁴ Minnesota SB 2030 Energy Standard, <http://www.b3mn.org/2030energystandard/download/SB2030Process.pdf>.