Effects of the 2022 California Building Energy Efficiency Standards on New Construction in San Luis Obispo County

Christopher Hoefer
California Polytechnic State University
San Luis Obispo, California

California released the first Building Efficiency Standards, or Energy Code, in 1976 and has updated them every three years. These standards aim at limiting the amount of energy use and greenhouse gas emissions by buildings in the state. California claims that these standards have saved consumers billions on utility bills, but there is limited information on the upfront impact the Efficiency Standards have had on new construction. This study sought to evaluate the impact that the 2022 California Building Energy Efficiency Standards had on new construction in San Luis Obispo County.

Interviews were conducted with local specialty contractors in order to provide quality data on some of the impacts the standards have had on construction as well as how the contractors track the Energy Code changes. Through the interviews it was concluded that contractors in the area don’t have the means to track specific cost and schedule associated with the Energy Code, but it was a general consensus that there would be a increase in cost and schedule of projects. It was also concluded that there was limited effect on the county due to the codes not having enough time to be implemented on the majority of new construction projects.

Key Words: Energy Code, Specialty Contractors, Electrical, Plumbing, HVAC

Introduction

Reducing the amount of energy used is an ever-prevalent issue around the nation, and this includes trying to find ways to reduce the amount of energy that buildings use. In California, the Building Energy Efficiency Standards or Energy Code was introduced in 1976 in order to better mandate buildings use of energy in the state. The standards are contained in Part 6 of the Title 24 California Building Standards Code, which is included in the overall California Code of Regulations. The California Energy Commission is the agency in charge of regulating and planning the standards and they state that, “The Building Energy Efficiency Standards serve to reduce wasteful, uneconomical, and unnecessary uses of energy for the state” (Building Energy, 2022). These standards address both residential and commercial buildings and are updated once every three years to address the changing needs of construction and consumers. The most recent standards were released in 2022 and they are
used by any project that has been permitted since January 1st, 2023. This means that the 2022 Building Energy Efficiency Standards will be used in permitting building construction starting from the beginning of 2023 to the end of 2025. The 2022 Standards are broken down into 11 subchapters which cover non-residential, single family residential, and multifamily residential construction for the 16 climate zones located in California. They are further broken down into mandatory requirements that all projects must comply with as well as prescriptive requirements that are determined during the design phase of the project.

This study provides results and analysis of the cost and schedule impacts due to the changes in the 2019 vs. 2022 Building Efficiency Standards on new single family residential construction in San Luis Obispo (SLO) County. With the scope of the regulations covering so many aspects of the building, the study was narrowed to cover the mandatory requirement changes regarding mechanical and electrical systems contained in the building. The mechanical section covers the changes to plumbing and HVAC (Heating, Ventilation, and Air Conditioning) systems and the electrical section will cover changes to photovoltaic, lighting, and power system. Local contractors that work on construction of new single family residential buildings in San Luis Obispo were interviewed to collect data on how these systems were changed in the latest revision of the code. The primary purpose of this study was to present cost and schedule data that will help explain the impact the new standards have had on contractors and construction of single-family homes in the region.

Literature Review

Effectiveness of Energy Efficiency Standards

With the Building Energy Efficiency Standards going into effect in 1976, numerous amounts of studies have been performed to determine what the effect of the standards has been and whether these standards have provided the desired result. The results of these studies have provided varying conclusions on the effects of the standards and the main take away from most of these studies is that it is difficult to ascertain the effectiveness of the energy efficiency standards due to so many outside influences on the consumption of energy. In 2015, California passed Senate Bill 350 which, per section 454.52, mandates a 40 percent statewide reduction in greenhouse gas emissions from the 1990 emissions by 2030. (De Leon, 2015) Growth in building size, demographic changes, and consumer demands are all outside impacts that make it difficult to assess the standards to determine their effectiveness as described below.

While the Standards address specific systems and methods to implement that will limit the energy use of buildings, they don’t address any control on the sizing of buildings. This means that even if energy efficient standards limit the amount of energy used by a specific building, if the overall trend of building size is going up the demand and use of energy will rise due to this as well. In Los Angeles County a study was performed by Institute of the Environment and Sustainability at the University of California Los Angeles, where 1.3 million houses built from 1900 to 2010 were studied for growth change patterns compared to energy efficiency reduction. The study concludes that, “there remains a need to address the persistent growth in the size of new residential buildings. This growth, if continued unabated, will significantly constrain the feasibility of achieving the State’s broader GHG (greenhouse gas) emissions reductions goals” (Fournier, et al., 2019). The study showed that the rate of building growth was 60% higher than the corresponding rates of combined per square foot energy usage reduction. This doesn’t mean that the efficiency standards have failed at reducing energy use in the state, but instead it suggests that a trend in the growth of building sizes could make it difficult to see the overall energy reduction goals of 40% reduction in greenhouse gas emissions by 2030 met.
A possible way for the state to even further help meet their energy goals would be to not only regulate the means and methods of construction with the energy efficiency standards, but the standards might also need to address and regulate the sizing of buildings to meet efficiency and energy reduction goals.

One of the main selling points that policy makers have used for setting efficiency standards is the cost savings that implementing the changes have on consumers’ energy bills. The California Energy Commission claims that the building energy standards and cost-effective appliance standards have saved consumers over $100 billion in utility bill costs. They also state that the building efficiency standards alone have saved consumers billions of dollars (Achieving energy, 2024). In reality, these claims are very difficult to back up and several studies have shown these savings can be attributed to many other factors besides just the standards the state has set. In a study done for the Journal of Economic Behavior & Organization in 2014, Author Arik Levenson looks at electricity use in the state of California compared to other states over the years, to determine if California energy efficiency policies present lessons for the rest of the world or not (Levenson, 2014). The main figure studied showed that for the past 40 years residential electricity consumption has remained relatively constant in California while growing by around 75 percent in the rest of the country. This statistic has been a key piece of evidence that supports Government implemented efficiency standards, but the study showed that the difference in consumption could not be entirely contributed to government policies. The study concludes that the lower energy consumption per capita in California stems from a shift in population to more mild climates, changing demographics of people in California vs other states, and the low income-elasticity of energy demand in California. (Levenson, 2014)

How the Standards are Applied to Projects

The standards are set up in a way that gives flexibility in how they are applied to each specific project. As described earlier the Code is broken down into 12 subchapters covering the various types of projects. These chapters are then broken down into two different types of standards as described in the 2022 Energy Code as, “a prescriptive option, allowing builders to comply by using methods known to be efficient, and a performance option, allowing builders complete freedom in their designs provided the building achieves the same overall efficiency as an equivalent building using the prescriptive option” (Single-Family, 2022). This means that the code doesn’t lay out any one specific way that a building must be designed and built in order to meet the requirements set in the Energy Code. It instead is laid out in a way that allows the design team freedom in choosing systems and methods to implement in order for the building to meet the standards. Subchapter 2 of the code is also universal to all building types and sets requirements for the manufacture, construction, and installation of various building components. This is the only section in the code that applies to all buildings and the rest of the sections address the various types of new construction, renovation, and additions on buildings.

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The changes in the 2022 Energy Code covered in study

The changes in the code for the 2022 standards don’t affect the mandatory requirements that were set in subchapter 2 related to the construction of all buildings, but there are changes in all of the other subchapters. The California Energy Commission website states that, “The 2022 Energy Code encourages efficient electric heat pumps, establishes electric-ready requirements for new homes, expands solar photovoltaic and battery storage standards, strengthens ventilation standards, and more” (CEC, 2022). Since the changes implemented in 2022 affected 11 out of the 12 subchapters in the code, that was too large of a scope to cover in this study. In order to narrow the scope, the changes analyzed are included under subchapter 7 of the code which addresses mandatory features and devices for single family residential buildings. The changes covered were further narrowed down into changes that would affect the work of the target specialty contractors that would be interviewed for the project. This was broken down into four categories including Electrical, Plumbing, HVAC, and Windows, and the revised and new standards that were discussed by contractors during the interviews conducted for this study will be described below.

Standard Changes Regarding Electrical Work

The changes in the 2022 Energy Code that encompass the work that electrical contractors perform are both new and revised requirements. The first changes cover electrical ready requirements, and these are found in the new sections 150.0 (s) (t) (u) and (v) of the code. New section 150.0 (s) covers the Energy System Ready requirement and dictates that the main panel board must be rated at 225 amps, a subpanel must be installed for a future battery system, four branch circuits shall be installed to provide power to various house systems from the future energy storage equipment, and sufficient space must be provided for future installation of a battery storage system and system isolation switch.
Section 150.0 (t), (u), and (v) all address similar new requirements. If a gas or propane system is used for the heating, cooktop, or clothes dryer in the house, then per the new requirements a 240V branch circuit and outlet must be supplied to each of these locations so they can be converted into electrical systems in the future. A revised regulation that is discussed is the lighting control requirements under section 150.0 (k). These were revised from the 2019 standards and now include dimming requirements for lighting in habitable spaces including living rooms, bedrooms, kitchens, and dining rooms that allow for manual control of the up and down of the lighting. The independent controls requirements under this section were also expanded from the 2019 standards. Previously the standards just required independent control for undercabinet lighting, but this was revised to include undershelf lighting, lighting in exhaust fans, and interior lighting of display cabinets (Single-Family, 2022) (Low-Rise, 2019).

Standard Changes Regarding Plumbing Work

The changes in the 2022 Energy Code that encompass the work that plumbing contractors perform are all revised requirements from the 2019 Energy Code. Section 150.0 (j) was revised in the new version and is related to insulation of water system components. The 2019 version of the Energy Code dictated water system insulation based off of both the requirements in the Energy Code and the California Plumbing Code section 609.11 but were revised in the 2022 version to remove the language in the Energy Code and makes the piping insulation strictly dictated by section 609.11 of the Plumbing Code. The exceptions for the insulation requirements are the same for both versions of the code (Single-Family, 2022) (Low-Rise, 2019). Section 150.0 (n) was also revised in the 2022 version of the Energy Code and refers to providing space for a future heat pump water heater system if a gas or propane system is serving the building. The section in the 2019 code only allowed for the space to be provided within three feet of the existing water heater system but this was revised, and new language was added to allow the future space to be located further than three feet from the current water heater location. The hot and cold-water pipes must also be brought to the future location if it is more than three feet from the current water heating system.

Standard Changes Regarding HVAC Work

The changes in the 2022 Energy Code that encompass the work that HVAC contractors perform are both new and revised requirements. Section 150.0 (m) deals with Air-Distribution and Ventilation System Ducts, Plenums, and Fans and several subsections in this were revised from the 2019 version of the Energy Code. The first revision was regarding the insulation of ducts located entirely in conditioned space of the building. The 2019 Energy Code requires that all ducts be insulated with greater than R-4.2 value insulation that are located entirely in conditioned space of a building. The 2022 code revises this to have no insulation required on these ducts if they are entirely within conditioned spaces and instead clarifies that the penetration where the duct enters the conditioned space must have a draft stop insulation value greater than R-6.0. The air filtration subsection was also revised in this section as well. Under the design and installation requirements of the air filtration section a new requirement was added to require that filter racks or grilles shall use gaskets, sealing or other means to close gaps around inserted filters to and prevent air from bypassing the filter. (Single-Family, 2022) (Low-Rise, 2019). These changes are focused on maximizing the efficiency of the indoor air quality of buildings.

Standard Changes Regarding Window Work
The changes in the 2022 Energy Code that encompass the work that window contractors perform are located in a single revised section of the code dealing with U factor requirements of fenestrations. In section 150.0 (q) of the 2019 Energy Code the requirement is that fenestrations including skylights must have a maximum U factor of 0.58 with the exception of up to 10 sq ft of fenestration that doesn’t have to meet this requirement. The weighted average of all fenestrations must still meet the maximum U factor of 0.58. In the 2022 Energy Code the wording was kept the same and the revision was lowering the maximum U-factor from 0.58 to 0.45 (Single-Family, 2022) (Low-Rise, 2019).

Methodology

This study was performed using semi-structured interviews, to provide qualitative data for analysis. The original intent was to provide both qualitative and quantitative data on the code changes, but after interviewing the contractors it was not possible to accurately provide cost and schedule data with the time and resources allotted for this study. Instead, these interviews were conducted with local contractors to provide qualitative data on the effects that the new 2022 Building Energy Efficiency Standards will have on new construction in San Luis Obispo. In total, 10 interviews were conducted with specialty contractors that work on projects in the region. Three interviews were conducted with each of the three main areas of work that were changed by the new standards. These contractors specialized in electrical, plumbing, and HVAC (Heating, Ventilation, and Air Conditioning) work. The other interview was conducted with a local window contractor since one of the changes in the standards was regarding the U-factor of exterior windows changing. These interviews were conducted in a mix of in person interviews and over the phone interviews. In a few instances follow-up questions were asked over email to clarify or confirm information. The specific questions asked varied per interview, but the base set of questions asked to all contractors are listed below.

1. Have you done work on any jobs that have used the 2022 Building Energy Efficiency Standards?
2. Does your company track any cost or schedule associated with Energy Efficiency Standards? Why or why not?
3. How does your company track Energy Efficiency Standards on a project? Is it typically through the plans and project documents or do you use the code for this?
4. Have you noticed any significant difference in projects within different cities of SLO county?
5. Are there any significant or unique changes your company has had to make because of the new standards?

These questions were used to determine the extent to which the contractors had worked with the new standards and what effects these standards have had on the work they perform. Specific questions that were tailored to the contractor’s work were then asked to see what impact that the standard changes brought about. An example of the type of question that was asked is as follows, “How much cost and time does it add to install the 240V branch circuits for the Clothes Dryer, Cooktop and Heat Pump Space Heater in a newly constructed home? For uniformity say they are all 50 ft from the main panel board.” These questions were geared towards providing the quantitative data for the study but instead ended up leading to more qualitative data as described further in the analysis and conclusion.

Interview Results/Analysis

When asked about working on projects that were using the 2022 Energy Efficiency Standards in San Luis Obispo County the results across the interviews were consistent. In regard to question one, out of
the ten interviews, only one of the contractors interviewed was actively working on a project using the new standards. Most of the contractors reported that the majority of projects they were working/bidding on were still using the 2016 or 2019 versions of the standards with one contractor saying that he was finishing up a job still using the 2013 standards. This is possible because the version of the code a project uses for compliance is based on the year that the project is entitled through the city or county agencies. Due to this if a project starts construction year after year, even though there are not a lot of active projects using the new standards, three of the contractors reported that they have started to see a few projects come across for bidding that are using the new standards incorporated into the design. One of the electrical contractors had recently bid on two phases of a project that had been entitled in different years so one of the projects was using the 2019 version of the energy standard while the other phase was using the 2022 version of the standards. They also said that the phase using the 2022 standards was significantly more expensive than the other phase. This study didn’t aim to find the reason that more projects haven’t started that use the 2022 standards but there are a few conclusions that can be drawn about the effects of the standards since they have been released for over two years now.

In regard to tracking cost or schedule associated with energy efficiency standards the results from the interviews were also consistent. Out of all of the interviews, none of the contractors or their companies had any means to track the costs associated with the standards nor did they feel a need that they should be doing this. The reasons they didn’t chose to track any costs associated with the standards vary but there were a couple consistent reasons that they didn’t. The first of the reasons is that when they are pricing a project, the numbers they receive from material and equipment suppliers doesn’t break out enough information in order for them to track specific costs to the codes. For example, when one of the electrical contractors was asked why they don’t track the costs their response was, “We know that the new code changed the lighting control requirements, but when we get our pricing from the suppliers all we see is a general cost increase since they don’t break out the pricing for specific controls rather the system as a whole is priced.” This was further explained that in order to track the specific costs they would have to ask for pricing for each item, which would not be efficient and lead to any overall benefits for their work. Another reason that was highlighted by several contractors for not tracking the costs associated with the code changes is how variable the pricing will be from project to project based on how the engineer designs the project to meet the code. This was summed up well by one of the plumbing contractors who stated that, “An overall tracker of costs associated with code is not important to us since each project is unique in how the engineer designs it to meet code. Since the code has both mandatory and prescriptive requirements there is no way to accurately predict the cost until the project is designed and we have building plans to price in front of us.” It was a general consensus among the contractors interviewed that due to the difficulty obtaining specific costs on the required systems and components per the standards, and the immense variance in systems and pricing of projects, that there is no reason or efficient means for them to track the costs and schedule associated with Energy Efficient standards.

For the question asked about how the contractors track just the Energy Efficiency standards that are in place on a specific job the answers were relatively consistent. Every contractor interviewed said that the main way they track requirements on the project is not by applying the code but rather using the project specific plans and documents in order to track the work. In a few instances the contractors acknowledged that they use their knowledge of the code to ask questions to the design engineers on the project to confirm that the standards are being met, but contractors will let the engineer do the overall tracking of how the project is meeting the requirements set forth in the state standards. This means that the contractors interviewed weren’t concerned with the specific code changes and tracking those but are instead looking at each project individually when it comes to tracking how the standards are implemented.
When asked about how projects vary within the cities of San Luis Obispo County the results were surprising. This question was geared at discovering what effect varying performance requirements have between climate zones. Paso Robles and Atascadero are in climate zone 4, while San Luis Obispo is in climate zone 5 which have varying performance standards described in the Energy Code. (Building Energy, 2022). The responses from the electrical and plumbing contractors were that even though projects varied and where unique from city to city none of they didn’t believe that there were any consistent differences in the projects that could be traced back to the Energy Code requirements. They credited the differences in projects were mostly due to how they were designed. This was the expected answer from these contractors since the climate specific performance requirements in the SLO county area are primarily focused on indoor air quality and heating and cooling systems for the building. This would mean that the HVAC contractors interviewed were the ones dealing with the majority of the requirements that would vary from city to city within the counties. However, the responses from these contractors didn’t reflect this and instead responses similar to the electrical and plumbing contractors’ answers were given. They all agreed that some projects are unique in the systems that are incorporated, but across the county they have seen the same types of systems used in all the cities. One of the HVAC contractors interviewed stated that, “the different designers are usually where the differences in systems come in not the different cities… the designers and engineers will try and use the same systems job to job so it makes the similarities in projects trackable more to the specific design company rather than a specific city.” After this interview, this answer was repeated to a few of the other contractors and all of them agreed that this was something that they had noticed as well. Even though there are different climate zones in within SLO County, the general consensus of the contractors interviewed was that there were no significant differences that could be tracked because of the differing climate zone designations within SLO county.

For the last question five the majority of contractors interviewed reported that they didn’t need to make any changes due to the new standards being released in the work they are doing. Several reasons were given for this with the main one being that the contractors had not done any work with the new standards incorporated yet. Another reason that they hadn’t made any changes related to the release of the new Energy Code was that the new code requirements don’t dictate the work that they will be doing, rather the design of each project dictates the work they will be doing. This means that they don’t make changes based on a new code being released but instead it’s based on the projects they are doing. For the one contractor interviewed that was actively working on a multifamily residential project that uses the new standards, they said that they didn’t see any major changes on their scope of work. The water heater system on the project used to comply with the Energy Code was a heat pump system, but the contractor said that this is a system they have, “seen for almost 10 years being used SLO county.” Three of the ten contractors did report having to make some changes because of the new standards. Two of the electrical contractors reported having to make similar changes when it comes to bidding on projects. They both reported that recently when they have received numbers from their lighting suppliers that they found that the controls for the lighting system had been over engineered and that too many components had been included. One of them stated that, “we found that they had included around 10 extra astronomical time switches in the controls which when removed ended up bringing the total price down by about $1,000.” They said that they didn’t know for sure if suppliers were doing this to ensure compliance with code, but they now have to spend more time going over their numbers to ensure they don’t have extra equipment that will make them less competitive at getting the work. The other change was reported by one of the plumbing contractors interviewed. They reported having to increase the amount of work they do in conjunction with other companies on the project to install more complicated heat pump systems that the designer incorporated to comply with the energy code. Not only when it comes to installation did they have to change, but when it comes to servicing the systems they have to coordinate with the owner to decide
which of the contractors that helped install the system would be in charge of maintenance. In the case of the plumbing contractor, they had actually found a decrease in the amount of servicing they had to do because the HVAC contractor is the one that is typically handling the maintenance due to the refrigerant used in the heat pump water heater systems. None of these changes that the contractors reported making can be contributed directly to the changes in the Energy Code, but it can be concluded that the changes in the code are one factor that led to the contractors having to make these changes within their companies.

Analysis of Code Specific Changes in SLO County

With the lack of exposure that the contractors have had to the new 2022 Energy Efficiency standards it is difficult to analyze what effects the changes have had in the region. When asked about the code changes as a whole and what effects that they would have it was general consensus that they would lead to an increase in cost for construction, but without project specific information the extent to which the cost would increase was not possible to track accurately using the methodology in this study. Contractors said that this was because the majority of the information needed to price a project comes not from the code language but instead comes from the design of a specific project. On top of this since a majority of the contractors interviewed had not worked on projects with the new code changes, limited amounts of data were collected on what effects the Energy Code changes have had.

Conclusion

The original intent of this study was to examine the effects of the 2022 Energy Code in San Luis Obispo County by providing cost and schedule data related to the code changes and new construction. The conclusion reached through the interviews in this study is instead, that local specialty contractors do not have a need or the current means necessary to track any cost and schedule data associated with the new 2022 Energy Code or any version of the Energy Code in general. As described in the analysis, there are several reasons why local contractors could not provide the cost and schedule data. The main reason that data was not available on the 2022 Energy Code was that six out of the ten contractors interviewed had not had the opportunity to price and or work on any projects that were using the code. These were not the expected results when the study was conceived but it does suggest that when codes are implemented it takes much more time to actually see the changes in the code implemented on new construction in the region related to these codes. It is also difficult to gauge the effects that a single year of code changes has had when new projects being built in SLO County are using multiple versions of the Energy Code.

For the contractors interviewed that had worked with the new standards it can be concluded that there are cost and schedule increases associated with the new standards, but due to several reason these prices could not be accurately presented during the interviews. The main reason for this is that when the contractors would receive pricing for a project from suppliers the costs that would be associated with the code changes was intermixed with other components and systems that were not derived from the Energy Code changes. This means that the pricing would not be representative of the code changes and instead representative of a specific project that is designed using the standards. Another conclusion that can be reached based on the interviews is that cost and schedule can’t be tracked accurately related to the code because of the flexibility and uniqueness in the design of each building. The Energy Code is set up in a way that multiple different designs can be used on the same building in order for it to be in compliance with the standards. Since contractors are instead focused on the design of each project rather than the code language when it comes to tracking requirements on a job, they in turn don’t track the cost associated with codes.
It is important to emphasize that this study did not determine that the costs and schedule associated with the changes incorporated in the 2022 Energy Code are not possible to track. Instead, this study concludes that specialty contractors in SLO county don’t track costs and schedule associated with the changes. Due to the fact that contractors don’t track the costs associated with the new standards the interviews that were conducted didn’t provide any data on the cost of these changes, and instead the data provided was a quality analysis of the Energy Code in SLO County that can still be used to analyze the effects of the 2022 Energy Code.

The biggest conclusion that can be drawn about how the 2022 Energy Code has impacted SLO County is that there has not been enough time for the code to be used on active construction projects in the county. This means that the current impact the code had in SLO County is very limited since not many buildings are being built yet using the current standards. It was also determined through the interview that several of the changes to the code won’t end up impacting SLO county even when the code is implemented more across the county. The window U-factor requirement changes won’t impact any of the projects in SLO because the windows that are being installed on projects using different code years would still meet the lower U-factor requirement in the 2022 version of the Energy Code. The vast majority of projects use windows and fenestrations with U-factors in the .30’s and with the new requirement only dictating that it be lower than 0.45 this change in the code won’t affect the county at all. Another code change that won’t be perceived as affecting the county would be the changes to the plumbing insulation requirements. Even though the language was removed from the code the contractors interviewed said the federal regulation that replaced the code language still requires similar insulation for plumbing insulation. This was further reinforced in the interview with the contractor who was actively working on a project using the 2022 Energy Code, since he stated that they would be using the same foam insulation they had used on previous projects using older versions of the code. It is difficult to draw any conclusion on the rest of the standard changes since limited discussion was had on what the impacts of the changes would be, but the final overarching conclusion that will be drawn is that the 2022 Energy Code will have an increase in cost and schedule associated with them it was just not determinable using the methods in this study. All contractors interviewed said that they anticipate some sort of increase whenever the new standards are released, but as stated multiple times it is difficult to track the specific magnitude that these changes will bring.
References


