

# **LEED in Residential Construction**

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Sustainable building has been an aspect of the construction industry for over 30 years and over the past decade has been a major emphasis in Architecture, Engineering, and Construction (AEC) industries. Leadership in Energy and Environmental Design (LEED) leads the push in creating a standard for building sustainably with a certification system that tracks the achievements. A point system has been created that gives builders criteria to follow to receive a LEED certification. This certification has been used widely in commercial construction but not as commonly in residential construction. This study aims to look at LEED in the residential building sector through four semi-structured interviews to see whether homebuilders see the need for it and whether homeowners understand its value. Three themes came out of the interviews including the similarities of California Building Codes and LEED practices, homeowners desires for sustainable construction, and the internal desire for many builders to build sustainably even without a certificate. The study found that homebuilders don't see the need for LEED certified homes due to the sustainability standards that they already follow, and since it isn't what homeowners want. However, homebuilders did feel that there are ways to improve upon sustainability in residential construction.

**Key Words:** LEED Certification, Residential Construction, Homeowners, Sustainability, Homebuilders

## **Introduction**

The construction industry is one that has continuously changed and adapted to the world that exists around it. Whether this is through technology, project management techniques, or work being done remotely, construction continues to push limits and adapt over time. While it pushes to be better in what it produces, the industry must be held accountable for the ways that it affects the environment that it is building in. This is why sustainable building practices and more eco-friendly ways of building have been created and encouraged throughout the industry.

For each of the different types of construction there are aspects of each that allow for the industries to have a certain uniqueness. A unique aspect of commercial construction is that there is a way for buildings to have a certification that allows them to be considered sustainable and eco-friendly which is called LEED Certification. LEED is defined as “provides a framework for healthy, efficient, carbon

and cost-saving green buildings” and “is a globally recognized symbol of sustainability achievement and leadership” (“LEED Rating System”). LEED Certification is given to buildings that fulfill certain requirements that allot them points and the more points that they have, the higher their certification. LEED is mainly utilized in commercial buildings and those that were built by large general contractors, but over time it has been adapted in residential construction as well. Residential construction is defined as single-family units, townhomes, and neighborhood developments that maintain a standard design for each unit or have the ability to be customized to what the client wants or have a base standard across each building.

LEED Certification in residential construction has just recently become more widely used and now has a more detailed list of criteria since it was created in 2008 (“Redline: LEED V2008 for Homes - Current Version”). This study takes a look at whether LEED Certification is beneficial in residential construction as compared to commercial construction. This study specifically will be focusing on how the builder sees LEED as a positive addition to the project and if homeowners want to invest in it for their own homes.

## **Literature Review**

LEED Certification has been recently implemented in residential construction with the board of LEED creating a criterion and point system for the sector (“LEED Rating System”). While this change is being brought about, the criteria that is needed to be achieved for a building to be LEED certified is similar for both commercial buildings and residential homes. The nine criteria that make up the LEED scorecard include: “integrative process, location and transportation, sustainable sites, materials and resources, indoor environmental quality, water efficiency, energy and atmosphere, innovation, and regional priority” (“LEED Rating System”). Each criterion has specific characteristics that need to be met in order for the building to get points and be certified. According to the U.S. Green Building Council Report in 2019 there are currently “more than 400,000 units located in the United States” that are LEED certified residential homes with 39,296 being in California (Stanley, 2019). California leads the country in the highest amount of LEED certified homes it has along with its standards for sustainable building that homebuilders in California hold themselves to. With the homes that have been built in recent years the focus has been shifted onto how to make the building sustainable and better for the environment. “Multiple residential LEED studies have been investigated in the literature, mainly focusing on case studies,” this relating to how the house functioned and if it was successful as a LEED certified home (Rakha, 2018). The studies that have been done regarding LEED relate to how well a project turned out when it was made to be LEED certified. Most of the research done to date does not look at whether those who are building these homes feel the need to have them be LEED certified and if there is an added value to it. This study will focus on whether residential builders and homeowners have the same desire to make the homes they build LEED certified.

Builders have continued over the years to make homes more reliable, environmentally friendly, and up to date on all the building codes as they continue to change. In California there have been many

changes to codes and the way buildings are expected to be built in order to be more environmentally friendly. One major code improvement that has been recently added in California is Title 24, which is “designed to reduce wasteful and unnecessary energy consumption in newly constructed and existing buildings” (California Energy Commission). This specifically includes “mechanical, electrical, and plumbing standards that affect energy use in the state of California” (“8 Keys to Understanding Title 24 in California”, 2016). Also, builders have had to continuously update the ways that they build to be in accordance with these codes and regulations along with the extra elements added to the homes that allow for a more energy efficient and sustainable living spaces. Some elements that can be used in order to make homes more environmentally friendly include choosing materials that are without chemicals, insulating the homes correctly to reduce heat loss, using energy star windows and appliances, protecting the site that the home is built on, using eco-friendly lighting, and using plants native to the area the home is being built in (“13 Tips for Building an Environmentally Friendly House”). All of these elements have become a standard for newly built homes in a continued effort for builders to make living spaces more environmentally friendly and allow for homeowners to have homes that function in the best way for them.

Along with the codes that are required to be followed by builders, what the owner specifically wants for their home has to be taken into account in a custom home environment. The National Association of Home Builders conducted a study in 2021 regarding what homeowners want in their home whether they are new builds or purchased homes. Within this study it was determined what homeowners felt was essential for their home, what they saw as most desirable, what they were indifferent about, and what they did not want at all in their homes (Emrath, 2022). The parts of a home that many owners felt are most important to them include laundry room, ceiling fan, exterior lighting, double kitchen sink, along with other specific kitchen features (Emrath, 2022). The biggest difference that was noticed between those that wanted to buy was the “absence of energy saving features on the first-time buyers’ top ten list” (Emrath, 2022). This shows that many homeowners do not place energy efficient aspects of their homes as top priority when building and or buying their first home. Since builders are putting in the effort to make homes more green and environmentally friendly the issue becomes that homeowners may not be wanting this. Since some homeowners are not fully aware of the benefits that come from adding certain green features to their homes without the builders showing them these options, they may not add them. Overall, it is the builder’s responsibility to build a home that is up to the homeowner’s standards while giving them the option to make their home even more efficient.

Studies have been done to show what worked best in the homes that have been LEED certified along with what homeowners are wanting. The goal of this paper is to look more into what the builders feel is or isn’t important regarding LEED in residential construction. Along with this, this paper will evaluate if LEED is essential to building a new residential home, if LEED certification should be used in residential construction, and the most efficient way to implement LEED.

## **Methodology**

The data that was collected for this study was gathered by interviews and used a qualitative analysis approach to evaluate all of the opinions of those involved in the study. The study included four interviews from individuals that work in residential construction in California. The interviews were specifically conducted with semi-structured questions in order to gain knowledge on the homebuilder's experience in the residential building sector, building residential homes, and their knowledge and opinion about LEED certification in residential construction. The individuals that were chosen for this study were chosen based on the criteria to best fit the focus of this study. The requirements included:

1. Must work in residential construction
2. Must be involved in the planning and/or construction of residential buildings
3. Must have knowledge regarding LEED and/or sustainable building practices
4. Annual construction revenue between \$10-\$100 million

### *Interview Structure*

The interviews were done using Zoom and were recorded to allow for further study into the research topic. In each interview the structure that was followed included the use of open-ended questions which allowed for those being interviewed to fully discuss their views on the subject along with allowing for further discussion to come from their answers. The interview questions that provided a structure to the focus of this study are the following:

- Should LEED certification be used in residential construction/ how feasible is it?
- What would be the most efficient way to do this?
- What parts of LEED certifications would be easiest to be done in a home?
- What green factors that LEED requires do home buyers seem to be prioritizing?
- Would this drive up the cost of the builder (due to time or materials)?
- Would the cost be larger for the home buyer initially but be worth it over time?
- If LEED isn't able to be fully integrated into residential homes on a large scale what is being done in the building of these that is making homes more sustainable?
- As a builder do you see or don't see a value that a LEED certification could bring?

## **Results and Discussion**

After transcribing all four interviews and taking notes from each of the interviews three themes were able to be found. These three themes included (1) California Building Codes; (2) homeowner desires; and (3) implemented sustainable and green building. Throughout all of the interviews these three

themes were discussed along with each of the interviewees having some differing opinions regarding each of them. All the themes are discussed in more detail in the following sections.

### *California Building Codes*

In each of the four interviews the codes that California home builders must abide by were discussed at length. The discussions were mainly focused on the topic of Title 24 and codes related to water usage. These discussions were then able to relate to LEED certification and if the interviewees felt that it was beneficial to be used in residential construction.

Every participant discussed how California's building codes are so stringent in general that they feel the codes are better overall specifically due to the level of sustainability they require. Every interview discussed to some degree the energy code requirements dealing with how to save energy, how to store it for later use, and the requirement of having to use solar panels. Along with this, the interviewees talked about the use of smart technology with lighting and shade controls allowing for energy to be saved throughout the day when residents are at home or away. Some participants also discussed that in their companies it has become a standard to implement the ability for homeowners to later add charge ports for electric cars. The company does this by constructing everything until the placement of the actual power unit made by the company of the specific car will be installed. With each of these aspects of energy saving the homeowners are able to know that the companies that they choose to build their home are ones that are conscious of the energy that their home will be using along with how it affects the environment as a whole.

All participants along with discussing the energy that the homes use discussed the ways that they implement aspects that save water and use it more efficiently. Water saving devices can be installed in toilets, showers, and sinks in the home. Two companies also discussed the use of a drip system irrigation along with one discussing water storing under the home. With water storage under the home the interview participant discussed how they have placed a cistern under the basement of the home that collects rainwater in order for it to be used for the landscaping. They also mentioned how the home can use a chemical that will make the water used in the sink into potable water. With the discussion of both water and energy usage in homes the homebuilders also discussed the ways that they felt the industry as a whole can work on other aspects of the home that LEED certification specifically discusses. They all stated that they understand it is their responsibility to make the homes that they build more sustainable while showing the homeowners all the ways that these sustainable parts of their homes are beneficial.

In regard to water and energy in homes the participants of the study collectively felt that their companies by following the California Building Codes along with implementing some of their own sustainable practices, are building to a standard that is at LEED level or even better. While they are not specifically aiming to be LEED certified, the work that they do and implement they are working towards homes that are more sustainable and provide a greener way of living.

### *Homeowner's Desires*

Throughout each of the four interviews, it was highlighted that one of the major goals that each homebuilder aims to achieve is to build homes that homeowners want to buy and invest their money into. They all stated in some form that what drives what they include in their homes and the ways they build are what the homeowners want and feel that they need in their homes.

When interviewing the contractors, they stated how they work closely with the homeowners so that they are giving the client what they want. In relation to this study some of the sustainable and LEED aspects of the homes that the participants build are done at the client's request. Some of these aspects include making the home a smart home so they are able to control their energy and water usage, knowing where the materials that are being used come from, the addition of solar panels, windows that protect from UV rays, and having window shades that can be programmed to come down when the sun is streaming in them. Along with those aspects the study also found that homeowners prioritize other things in their homes rather than LEED certification. This is due to the fact that homeowners are not aware of what LEED is and that it is even an option for them to have. Also, homeowners prefer to spend their money on aspects of their home that they are able to enjoy including pools, extra space in the home, nice floors and counters, and outdoor space, rather than spending money to make it LEED certified. The homebuilders did feel that if there was a way that whole housing developments could be made LEED certified then it would make more sense than just LEED certifying single family homes. This though would be related more to homes that would be similar to each other and not custom homes. Overall, the builders emphasized that what they build is to give the owner what they are wanting and to make it a good quality product.

The participants of the study were also asked if they themselves would want their homes to be LEED certified and the overall consensus was that they would not. This is due to the fact that they feel it is not needed and they do not want to take the time to get their homes LEED certified. They stated throughout the study that their companies take the time to build homes that are high quality for their customers and something that they know will last for a long time.

### *Implemented Sustainable and Green Building*

In each of the interviews a big focus was on if homebuilders felt that LEED was able to be fully implemented in the building process. From there it was discussed that if LEED couldn't be implemented what the builders felt could be added to further the sustainability of homes that are built. Each of the four participants in the study discussed the different ways that their respective companies are already implementing sustainable and green building along with some aspects that they feel can be approved on since they feel LEED does not need to be implemented into all homes.

All of the participants stated that they do feel that it is their responsibility as the expert in their field to use sustainable practices for their clients and to show homeowners the benefits of having a home that is sustainable. The homeowners hire them for their knowledge and are expecting to get a quality, sustainable product. Through the interviews it was found that by following the California Building Codes the homebuilders feel that they are building to a standard that is at LEED certification level and most of them mentioned how they go above that standard with elements that their own companies choose to include. The codes that the homebuilders have to abide by are ones that include areas that

are already more sustainable and green than has been done in the past, these including water, energy, etc. The homebuilders also discussed how they aim to have higher standards of sustainability in their homes through HVAC systems that control air quality, radiant heating that can sense the temperatures of rooms and set them to what the homeowner wants, using engineered hardwood floors or laminated veneer lumber, and even using materials for the outside of the home that protects the home from water intrusion. Another way that the homebuilders are able to implement sustainable building practices is through discussing with their clients how much they would save over time and that it can outway the cost that they have to incur in the beginning to install them. Throughout each of the interviews the participants discussed that because they hold the responsibility to push for more sustainable and green ways of building and they feel that there are areas that can continue to be improved upon.

The biggest way that the homebuilders know that they can work on building in a more sustainable way is through trying to produce the least amount of waste as possible. They all stated that the biggest issue that the construction industry has is how wasteful it is and then explained some ways that their companies try to work on making as little waste as possible. One company discussed that they take every plan for a home that they make and make it into a 3D model in order to see the exact materials that they will need. They are then able to put all of those dimensions into a computer saw and get the exact size and quantity of materials that they need for every project. This in itself reduces the waste on the project, saves time, and stops the needs of saws on site that helps with controlling the air quality on site. Some of the other ways that the homebuilders felt they could help with the overall sustainability of the homes they build include focusing on having less hardscapes, implementing green roofs when possible, and continuing to use more electric appliances.

Overall, the participants of the study feel that through the work that they continue to do and push for in regards to sustainability in the residential construction industry will allow for changes and growth to continue to happen. They also feel that it may one day be possible to use LEED in residential construction if the process to get certified is easier and it is what homeowners want.

## **Conclusion**

The goal of this study was to see the feasibility and need for the use of LEED certification from the homebuilder's view and if homebuilders are wanting this for their homes. Through the use of semi-structured interviews with four individuals that work in residential construction the study was able to find that overall, they do not see the need to use LEED certification in residential construction and that it is not something that is of top priority for the homeowners.

Through this study it was found that while LEED certification is not something homebuilders feel needs to be used, they do feel that they are building in sustainable and green ways while giving the homeowners what they are wanting. All participants stated that through following California Building codes and implementing their companies own sustainable practices they are building to LEED standards and even above. They stated that through the use of solar panels, lighting controls, water saving devices, cisterns to store and use water, windows that protect from UV light, the use of only electric appliances, and many other sustainable elements they have been able to produce homes that are sustainable. By including all of these aspects and what the homeowners want the homebuilders

feel that since they are making the clients happy then they are fulfilling their duty. It was found that LEED certification is not something that is wanted by homebuilders and that sustainable and green building is what is leaned more towards. Overall, the study was able to conclude that while LEED certification is used widely in commercial construction, in residential construction it is not at the forefront of what is wanted and happening in the industry now.

Some future research that could be done on this topic would be to look into a way that would allow it to be easier for homebuilders to get LEED certification for their homes or a way to make it more wanted by buyers. Furthermore, some future research could look into California specific building codes and see how well they align with LEED construction or research a specific company that is up and coming with the ways that they are building homes in regards to being more sustainable and green.

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