



## **BARRIERS AND INCENTIVES FOR AFFORDABLE MULTI-FAMILY GREEN BUILDING CONSTRUCTION IN CALIFORNIA**

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**Abstract:** Concerns over the energy consumption and environmental impacts of the built environment have been recently growing more than ever. States and local agencies in California make every effort to set rules and regulations to curtail depletion of resources and promote efficient construction and facility management. Policy efforts to deal with these issues have mainly focused on sustainable architecture, green technologies, and renewable energy and efficiency in the energy sector. Previous studies on California state green building policies have used empirical information extracted from secondary sources such as comparison of conventional and green building approaches, barriers to green buildings, energy saved per square foot for green buildings, and incentives. This paper presents the analysis of responses collected through a recent online survey on the barriers and incentives of green affordable housings construction in California. The total of 75 respondents include a broad range of subject matter experts such as architects, civil engineers, project managers, contractors, faculty members, interior designers, and real estate agents. 76% have been engaged in planning or construction of green buildings. Analysis of answers to the 12 questions presents strong indicators about the barriers and enablers of green building in California. Considering the fact that California is in the frontline of sustainability and energy efficiency policy development, results of this study are valuable to researchers and decision makers in other states and scalable to the federal level.

### **1 INTRODUCTION**

Adverse environmental impacts of building construction and the built environment are growing rapidly. Therefore, the need for state and local government initiatives to regulate consumption and improve resource efficiency is on the rise. Historically, policy efforts to deal with these issues have been focused on the energy sector especially renewable part. Moving towards sustainability is a universal principle that requires national and international laws and planning to alter lifestyles for correct energy consumption patterns. Living more sustainable can start from reorganizing living conditions, taking account of economic sectors or work practices, and developing and designing new technologies or systems in a responsive manner (Johnson et al. 1997).

Green building design is the initial phase of construction of high performance buildings that employ resources more wisely than traditional ones. In addition, green buildings offer a variety of social and economic benefits. Therefore, policies, strategies, and practices on design and construction of green buildings have to be encouraged. California is known as one of the pioneer states in developing green building initiatives. In 2012, California Governor Brown issued an executive order directing all state agencies, departments, and other state entities to reduce their grid energy use by 20 percent by 2018 (compared to a 2003 baseline). This research tries to focus on the barriers and incentives for constructing green multi-family affordable housings in California, cost of an average green building and their short and long term return of investments.

## **2 LITERATURE REVIEW**

### **2.1 Barriers to design and construction of green buildings**

The benefits of design and construction of green buildings and sustainable developments have been emphasized upon during the last few decades. Nevertheless, there are barriers that prohibit widespread implementation of green building practices. At the local, national and international levels, efforts are underway to systematically identify and address such limitations. Significant operational barriers to green building design and construction are economic perceptions, industry awareness challenges, unavailability of green design technical capacities, and relatively slow growth of knowledge familiarity about green building practices. Craig (2008:7) quotes from Stuart Tyler, Victorian Branch manager of Dutch based green exterior builder Fytogreen that “Developers all want to say their building is ‘Green’, and lots of them are looking at us now for their upcoming buildings. But the truth of the matter is they want to have a profit. We need more local evidence to show them that green roofs pay in the long run.” Hydes and Creech (2010) argued that both initial and operation cost of the building can be less expensive if high-technology and low technology solutions are combined in a right way. Saving even more energy tunnels through the cost barrier, thus results in cost reduction and increase in return on investment (Hawken et al. 199). Many obstacles to green building are problems that are more widely relevant for the construction industry, for sectors producing materials and other inputs to construction. According to Arbutnott (2009), making decisions based on sustainability principles requires control over the available options. Moreover, for a mature market like the one in the U.S., the pull from customers can rapidly accelerate a market, making owner engagement critical to growth.

### **2.2 Incentives**

Governments’ involvement in green building market mainly includes providing financial and nonfinancial incentives and acting as a supporter (Olunmi et al., 2016). One of the most effective strategies to encourage design and developments of green buildings is using financial and structural incentives. In this respect the state and local governments are using effective incentives to advance the construction and overcome the barriers of building green. The incentives on green buildings in the literature are mainly divided in to two main groups: structural incentives, and financial incentives. Structural incentives are put into action with a low or no cost to governments to promote building green design and construction. For example, expedited permitting processes are one of the structural incentives that can cause major cost savings for the developers. Another example is providing density bonuses for developers who are active in green building practices. A density bonus is an allowance to build higher number of units than what is typically allowed to be sold at a lower price for lower-income occupants. Financial incentives are also used for encouraging developers to follow green building business. One of the most common ones are the tax incentives where some state governments offer tax incentives in form of tax credits or reductions which exclude property owners from paying taxes for a period of time. Fee reductions or waivers, grants, and revolving loan funds are other types of financial incentives that promote green buildings by providing reductions in cost or monetary awards.

## **3 Expert Survey**

### **3.1 Methodology and Data collection**

The literature on project management for green buildings was studied to understand the factors that impact the management processes in sustainable construction projects. Previous studies mainly focus on the differences between conventional and green buildings, barriers affecting the growth of green building projects, return on investments for green construction (with a glance at multi-family green buildings), states and local government’s regulations to reduce the consumption of resources, and incentives to encourage building green. The term high-performance green buildings, or simply, green buildings refers to the outcome of employing sustainable methodologies in construction that result in a responsible built environment (Kibert 2016). Recent studies have proposed ways to promote sustainable construction, to overcome implementation barriers and promote incentives to encourage investment in sustainable buildings. Hwang and Tan (2012) also identified lack of credible research as an important barrier. Other studies analyzed

ways to alter the opinion of the public and find ways to overcome the myths associated with higher price of green buildings than the conventional ones. Not being able to determine the potential performance of green building technologies, the need to change site behaviors and practices, the usage of different procurement and contract forms of project delivery suggest that stakeholders would have to adopt new technologies and practices in the face of uncertainties and risks (Zhang et al. 2011). While there is a considerable amount of information associated with commercial green buildings, the information on multi-family buildings is scarce.

This research project aims to further understand the processes that act as a barrier to the construction of sustainable multi-family buildings, and to find the elements that positively promote the delivery of such building on time and within budget. Previous research has shown that collaboration among stakeholders is the key for a project success. Therefore, our study collected information through a survey that was used to obtain opinions of a vast array of subject matter experts such as: architects, civil engineers, developers, interior designers, real estate agents, faculty members, contractors, project managers, and others. Our survey assessed the barriers, incentives, and return of investment associated to sustainable multi-family buildings. Some of the questionnaires were based on the findings of the studied literature reviews, and the results from this project will be compared to existing research.

The survey started with a series of questions about the participants, to assess their project roles, and experience. The survey consisted of 12 questions, which covered the most important impacts and factors in regards to the value of green buildings and also important features of green buildings to buyers and stakeholders.

A section in the survey asked the participant's personal experience in sustainable construction, and asked about the major barriers and incentives for sustainable buildings that they have come across. Finally, the last part of this survey includes questions about the top three states in the U.S. and California counties with the most successful green building incentives. The survey was delivered to participants using a web-based interface and the link was emailed to experts. Sources used to identify the experts include: The American Institute of Architects, American Society of Civil Engineers, Associated General Contractors of America, American Society of Interior Designers (ASID), and faculty members with relevant research interests. Over 320 invitations were sent out and 76 individuals participated in the survey.

### **3.2 Results**

The opening question assessed the profession or role of the participant within the industry, academia or in construction projects. As shown in Table 1, the majority of respondents were contractors/project managers (25.3%) followed by building consultants (21.3%). Next were the Architects (14.7%) and civil engineers (8.0%). A broad range of professions participated in the survey supports the reliability of the survey.

In addition to the participants' role, data was also collected regarding their experience. As shown in Table 2, 76% of the participants were highly experienced with more than 10 years of experience in their fields of work and 17.3% had between 5 to 10 years of experience. It is noticeable that only 6.7% of the participants had less than 5 years of experience, which confirms that the majority 93.3% of the respondents have at least 5 years of experience in this field. Also, using another question it was found that 75.7% of the participants had worked, were working or were planning to work on green projects. This confirms that the vast majorities of the participants were subject matter experts and have been/will be working on green projects of different scales, which enhances the reliability of this survey.

After assessing the roles and experience of the participants, we analyzed the aspects that have the greatest potential impact on the market value of green buildings. Participants could choose among different options as shown in Figure 2. The first selected choice was being more "energy efficient". Buildings are some of the largest energy users in the world. As we discussed before, saving on energy can help compensate for the initial cost of constructing sustainable buildings. The second answer was "reducing operating costs", which is consistent with previous research as such costs significantly affect the life cycle cost of a green building. While green buildings can have slightly higher construction costs, much of this initial cost is overcome by savings during operations. Additionally, through marketing the "greenness" as a desirable feature of the project, buyers or tenants can be persuaded to pay a premium. That is why "better market

positioning” was the third choice of the participants. For their fourth and fifth choices they selected “attracting good quality tenants” that will give the owners an opportunity to “command higher rentals”.

Table 1: Jobs dispersions of the participants

<b>Question: I am a/an:</b>			
<b>Available Options</b>	<b>Response Percent</b>	<b>Response Count</b>	
Architect	14.7%	11	
Civil Engineer	8.0%	6	
Developer	6.7%	5	
Interior Designer	1.3%	1	
Real Estate Agent	2.7%	2	
Faculty Member	4.0%	3	
Graduate Student	0.0%	0	
Contractor/Project Manager	25.3%	19	
Green Building Consultant	21.3%	16	
Other (Planner, MEP Engineer, Environmental Manager for a City)	16.0%	12	
<b>Number of Participants Answered the Question</b>			<b>75</b>
<b>Number of Participants Skipped the Question</b>			<b>1</b>

Table 2: Experience level of participants in their field of expertise

<b>How many years of experience do you have in your field of expertise?</b>			
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>	
Less than 5 years	6.7%	5	
Between 5-10 years	17.3%	13	
More than 10 years	76.0%	57	
<b>Number of Participants Answered the Question</b>			<b>75</b>
<b>Number of Participants Skipped the Question</b>			<b>1</b>

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Question 5 asked “Please indicate your degree of agreement on the following statements about green buildings”. The degree of agreement given by the respondents for each of the mentioned statements is as follows:

**S1 – Effective maintenance and operations of a green building can increase the value of the property.** This statement was agreed upon as important – strongly important by majority of the participants. Considering

a building's operating plus maintenance concerns during the initial design phase will help to make the working environments better, increases the production rate and reduces energy costs. 52.63% of the respondents strongly agreed and 39.47% agreed with this statement.

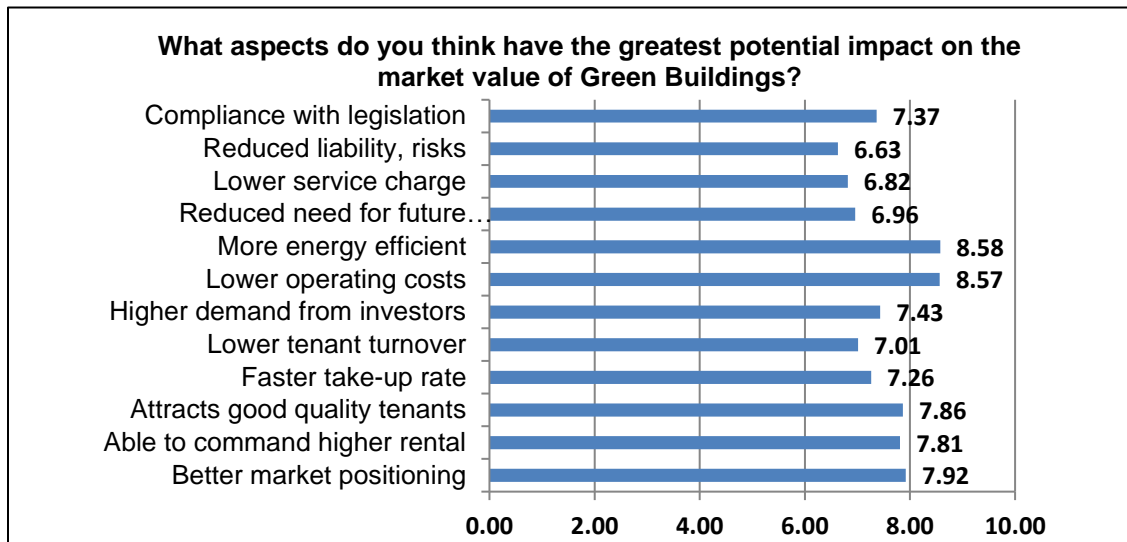


Figure 1: Comparison of aspects that have potential impact on market value of green building

**S2** – *A green building's sustainability performance provides a competitive advantage*: It was rated second in importance – a very important statement selected by the participants. They believed that the sustainability performance of a green building like optimizing the energy use, material use, and building space plus improvement of indoor environmental quality, reduction of need for maintenance and so forth has provided competitive advantage over conventional buildings. 38.16% of respondent strongly agreed and 53.95% agreed with this performance of green buildings. **S3 & S4** – *“Investment performance of green buildings would outperform conventional buildings over the mid to long term”* and *“typically higher initial capital outlays can be recouped through lower operating cost in the mid to long term”* have been equally scored by the respondents. 43.42% of people strongly agreed and 43.42% of them agreed on each statement. **S5** – *Buildings with higher certifications achieve better operational performance*. Sustainable buildings from a whole building perspective cost less to operate, have excellent energy performance, and have occupants that are more satisfied. So the higher the certification will result in better operational performance. 27.63% indicated that they neither agree nor disagree and 35.53% agreed with this statement. **S6** – *Green buildings require a premium to lease or invest in*. 25.68% of the respondents disagreed, 28.38% of people were uncommitted and 27.03% of them agreed with this statement. Summary of the responses to this question is depicted in Figure 2.

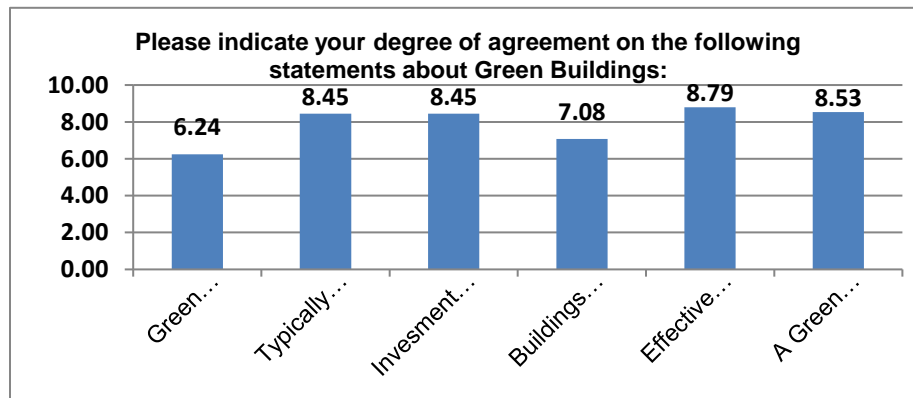


Figure 2: Answers to the Question 5

In Question 6 the participants were asked to indicate the factors that they consider as most important to assessing the value of a green building. As shown in the diagram in Figure 6, the most important factors scored by the respondents were operating costs and sustainability features. Operating cost was considered as an important factor by 50% and as the most important factor by 45.95% of the participants. Sustainability features were ranked as an important factor by 70.27% and as the most important factor by 24.32% of the respondents. The third place was for the designs/features factor which 56% of the survey contestants ranked it as important and 30.67% of them ranked it as highly important. In this question size was the last factor among all. 50% of the respondents believed it was a neutral factor and 24.32% of them ranked it as important. Detailed information is provided in Figure 3.

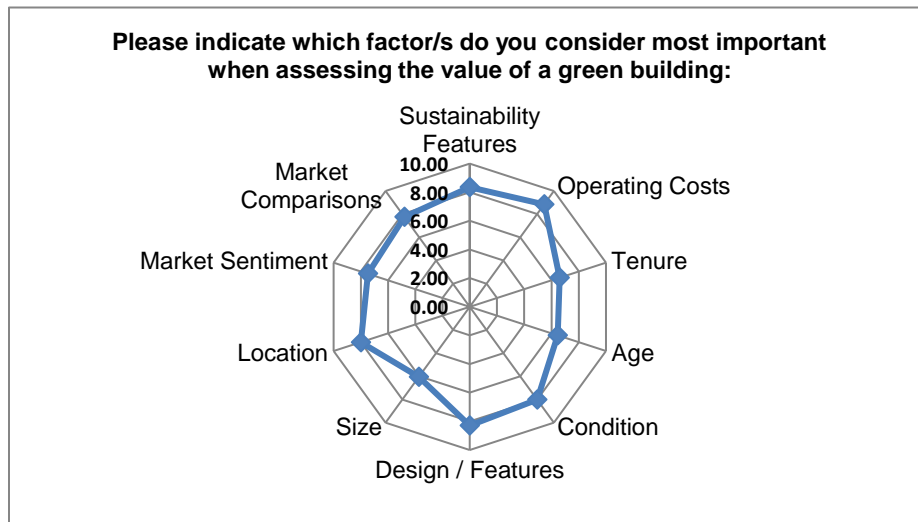


Figure 3: Degree of importance for factors used for assessing the value of a green building

As shown in Figure 4, question 7 and question 8 analyzed the impacts of features of green buildings on stakeholders (other than buyers) and buyers, respectively. According to the respondents, the feature that both stakeholders and buyers agreed upon to be the most important was: "to provide a healthier and more comfortable environment for occupants". The indoor environment pollution is caused by a number of factors such as poor internal air quality and the poor quality materials that we use for the interior of the building. Items such as ventilation, paints, floor coverings and so forth, can help to promote our quality of health. The United States Environmental Protection Agency (EPA) 2008 studies indicate "indoor levels of pollutants may be up to ten times higher than outdoor levels". A research by Lawrence Berkeley National Laboratory shows significant associations exist between low ventilation levels and higher carbon dioxide concentrations—a common symptom in facilities with sick building syndrome. The potential "Higher resale value" was assessed by stakeholders and buyers. Green buildings may bring benefits for the owners by way of better tenants, higher rents or longer term leases which then can be referred to as higher resale value. This feature was ranked number 2 and 3 by buyers and stakeholders, respectively. The "Improvement of long term economic performance" was ranked third for buyers and fourth for the stakeholders. Reducing construction and demolition waste was the least important feature of the green buildings to both buyers and stakeholders. It seems that because it is not a direct cost so any changes to it will not be noticeable for them.

Question 9 assessed the current major barriers that hinder the rapid growth of green building projects. The following barriers were proposed: People usually resist changes because of excess of uncertainty. Owners/developers - clients are often risk opposing to use newer structural materials and systems over those with a proven track record in other buildings for the same reason. To overcome it a sense of safety as well as an inspiring vision is needed. 42.62% of the respondents selected this as the major barrier to rapid growth of green buildings. A higher investment cost was the second choice in accordance with the selection of 25.49% of the respondents. As it was discussed in section 2.1 of this research, it cannot be true. Lack of demand and Lack of public awareness is due to lack of public training about benefits of green

buildings. 10.82% of the respondents scored lack of public awareness and 10.42% of them scored for lack of demand. A summary of this information is provided in Figure 5.

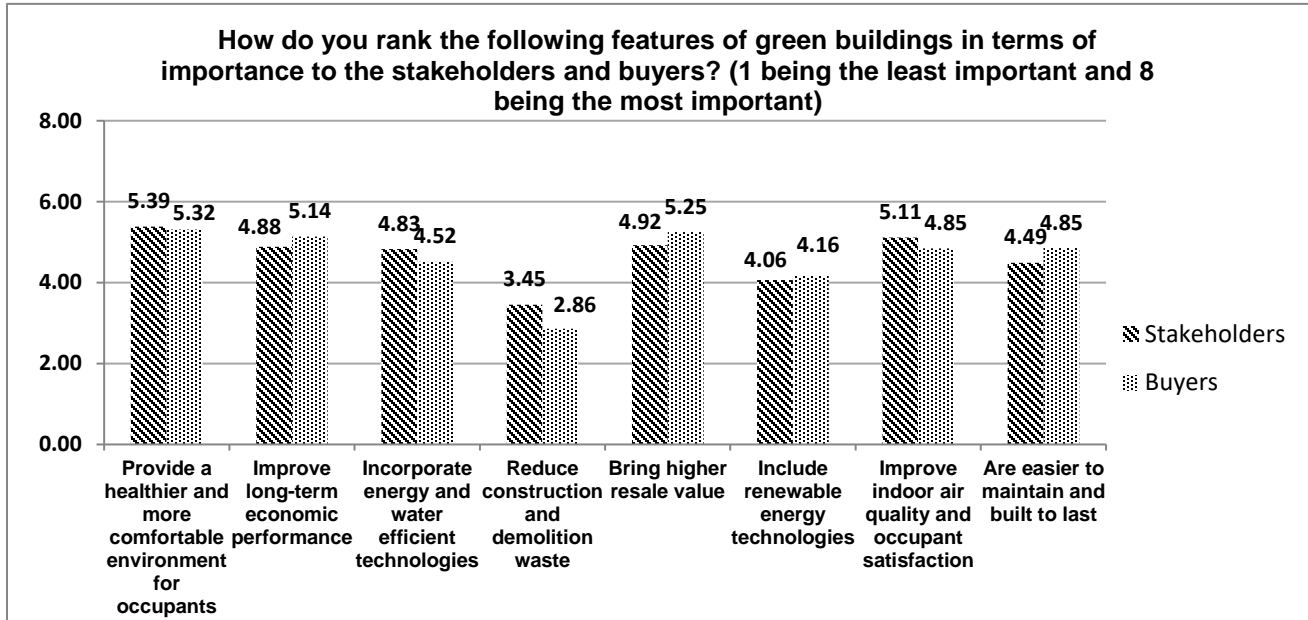


Figure 4: Ranking of features according to their importance to stakeholders and buyers

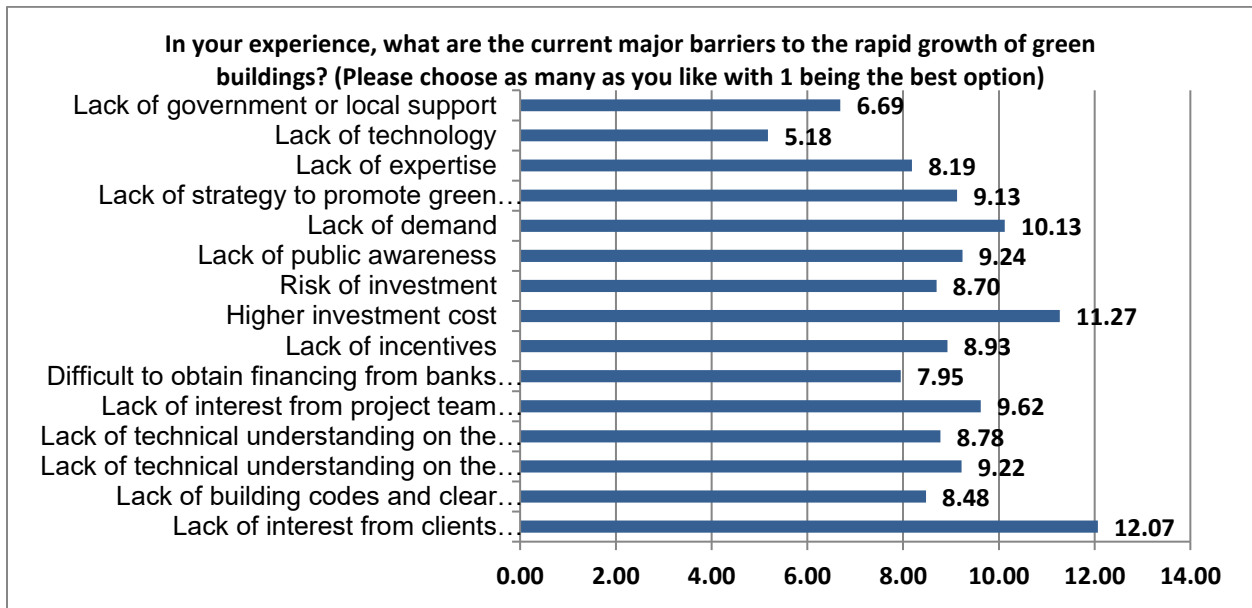


Figure 5: The major barriers to growth of green buildings

Incentives can be an effective way to promote sustainable construction. In question 10 the participants were asked: "According to your knowledge and experience, what are the top 3 states with the most successful green incentives". Sixty eight responses were received, and 86.76% of the respondents chose California as the first state with the most successful green incentives. Also, 9.52% and 3.70% ranked California as second and third, respectively. (The incentives that distinguished this state are as follows: According to DSIRE® which was established in 1995 and is operated by the N.C. Clean Energy Technology Center at N.C. State University and is funded by the U.S. Department of Energy, there are 215 incentive programs

for California State. Only 39 programs are concerning Multi-family residential. 31 of them are related to the energy efficiency category and 18 of them are related to the renewable energy category. 37 are financial incentives and 2 of them are regulatory policy. 3 of the programs are federal, 7 of them are state, 8 of them are local and 21 of them are utility incentives. In relevance to programs, 2 of them concern building energy code (regulatory policy), 1 of them concerns corporate tax exemption (financial incentive), 1 of them concerns green building incentive (financial incentive), 6 of them concern loan programs (financial incentive), 5 of them concern PACE financing (financial incentive), 1 of them concerns performance-based incentives (financial incentive), 1 of them concerns personal tax exemptions (financial incentive) and 22 of them concern rebate programs (financial incentive). According to the respondents, New York and Washington are also ranked in the top 3 states as shown in Figure 6.

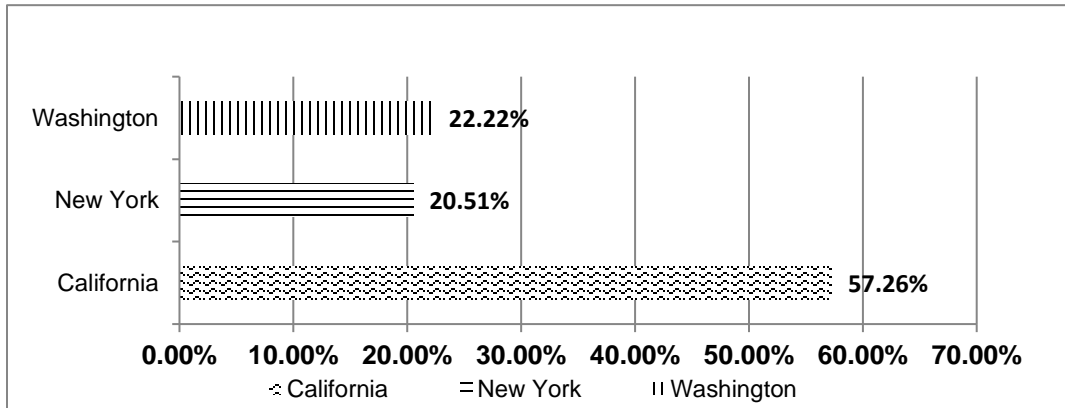


Figure 6: The most successful states in terms of green building incentives

In order to analyze the effect of successful green building initiatives, respondents were asked in question 11: "According to your knowledge and experience, what are the top 3 counties in California with the most successful green building incentives". 62.30% of respondents identified San Francisco as the first most successful county. This is consistent with DSIRE® which identifies 42 incentive programs for San Francisco County, yet only 5 programs cover Multi-family residential buildings. The five programs cover energy efficiency and two of them also include renewable energy. All five of them are financial incentives and none of them are regulatory policy. Three of them are federal, and two of them are state incentives. Also, as shown in Figure 7 Los Angeles and San Diego County were ranked second and third, respectively.

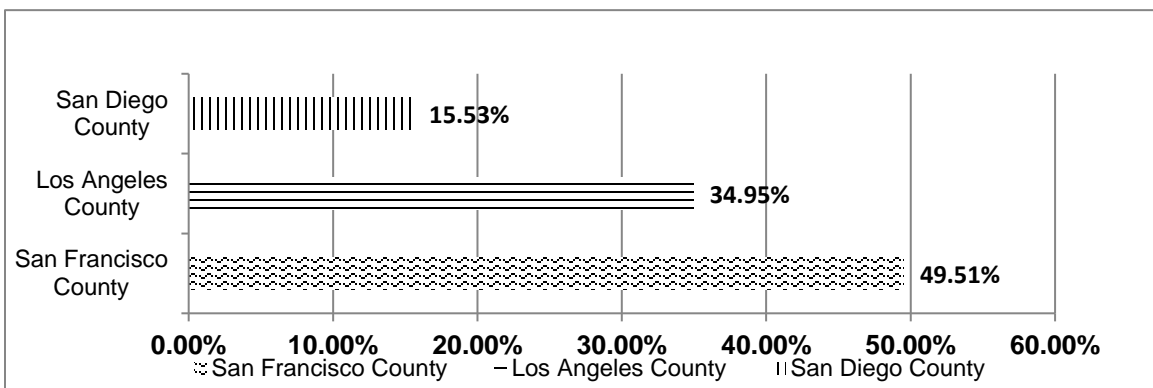


Figure 7: The most successful California counties in terms of green building incentives

The final question in the survey (question 12) assessed the incentives that encourage the private development of multi-family green buildings. Fifty nine respondents identified (I) *Tax incentives* – as the most important tool to promote green construction. This option scored 8.86 out of 10. Other desired programs include: (II) *Grants (including fee subsidization)* which was identified by 50 respondents and scored 7.30 out of 10; (III) *Permit/ zone fee reduction* identified by 55 survey respondents, and scored at



6.85 out of 10; (IV) *Expedite permitting* - allows a municipality to offer an incentive with little or no financial investment. Participants scored it 6.80 out of 10; (V) *Bonus density* - permits developers to build more housing units or taller buildings than normally allowed; It was scored 6.57 out of 10; (VI) *Rebates and discounts on environmental products (e.g. Energy Star)* - rebates and other incentives to support energy efficiency, encourage the use of renewable energy sources. 52 respondents scored it 5.52 out of 10; (VII) *Loans* it was scored 5.17 out of 10. (VIII) *Technical assistance / Design assistance* – the score was it 4.69 out of 10. (IX) *Net metering* – in this system when the produced power becomes surplus, it flows into the service network and as the result the meter runs in reverse as the excess power is redirected into the network. It was scored 4.49 out of 10. (X) *Marketing assistance* – offered in order to encourage green building. It scored 3.49 out of 10. More details in (Figure 8).

#### 4 SUMMARY AND CONCLUSION

Participants identified that sustainable buildings are more energy efficient, have lower operating cost and better market positioning have the greatest potential impact on the market value of green buildings. Respondents determined that important features of a green building for stakeholders are: providing healthier and more comfortable environment to occupants, improving indoor air quality and occupant satisfaction and improving long-term economic performance. The important features are the same for buyers except the second one which is bring higher resale value. The reason that owners are considering this option seems to be if they want to sell it again, they make profit from it. They determined the major barriers as lack of interest from owners/developers, higher investment costs and lack of demand which is the perception of higher construction cost. The distinctive incentives for overcoming the barriers are tax incentives, grants (including fee subsidization) and permit / zone fee reduction. The distinct states with the most successful green building incentives were respectively named as California State, New York State and Washington State. The top three California counties with the most successful green building incentives were stated as San Francisco County, Los Angeles County, and San Diego County. Based on this study, the following recommendation can be drawn:

1. Offering more tax incentives for multi-family residential sector can be a great help to encourage more constructions and requests for green buildings.
2. Educating new generation with benefits of green building construction.
3. Encouraging more R&D.
4. By the analysis of driven data from the survey and according to DSIRE® it is evident that San Francisco, Los Angeles and San Diego counties have exactly the same incentives for multi-family residential sector but this much dispersed views for ranking them needs a future research and study.

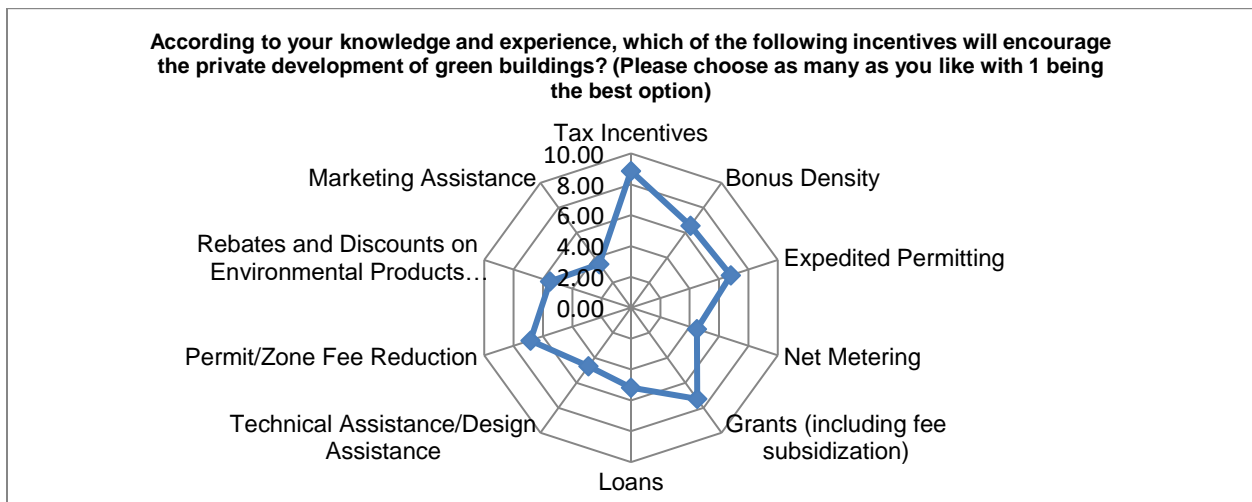


Figure 8: The encouraging incentives for private developers of green buildings

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