Addressing Barriers to Passive House Construction in New Orleans
A Tool for Overcoming Obstacles and Market Transformation

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Abstract

The research in this paper takes an opportunity to examine the feasibility of developing properties in New Orleans, Louisiana which conform to the Passive House Standard. To date, New Orleans has yet to see a single building built to the energy-efficiency standard. This report begins by describing the concept, the history, and benefits of the Passive House Standard. The report uses the same certification definition of Passive House as Passive House International Standard (PHI). By framing the need for Passive House buildings in light of mounting global and regional consequences resulting from anthropogenic climate change, the report argues that Passive House is the best solution to turning the New Orleans built environment into a carbon-neutral zone and achieving many of the energy reduction commitments made by the Landrieu administration under the Climate Action Strategy for a Resilient New Orleans. The report then examines the feasibility of Passive House from a single-family perspective in one of New Orleans’ hottest neighborhoods, ‘The Irish Channel’ and then overlays the barriers which are specifically hindering the investment logic of Passive House in New Orleans. It is shown that the barriers ultimately align to limit the financial attractiveness of Passive House investment to debt and equity investors as well as developers. Additionally, complications relating to the design, development and construction of Passive House structures are also identified as barriers unique to New Orleans. The final section of this analysis specifically considers how to overcome market barriers by applying opportunistic solutions which are unique to the New Orleans real estate development market.
Introduction

New Orleans is more vulnerable to the adverse effects of climate change than any other city in the United States. In a recent study conducted by scientists at Louisiana State University, findings stated that, “within this century, at least 70 percent of the coastal salt marshes that protect New Orleans from the brunt of storms may be buried by rising sea levels.” In fact, as seas rise, waters warm, and storms become more frequent, higher levees, and green infrastructure can only be so efficacious. Realizing the need for action, Mayor Mitch Landrieu helped the city of New Orleans to proactively join an international movement of 680 cities known as the United Nations Compact of Mayors. The movement addresses climate change as a fundamental threat to the city and is formally manifested in a 90-page publication called the Climate Action Strategy. The strategy articulates a three-pronged plan to achieve, “greenhouse gas reduction targets of 50% reduction by 2030.”¹ One notable directive in the plan states that the city will work to “promote sustainability as a growth strategy, seeking ways to increase energy efficiency and renewable energy sources.”² The plan is unspecific as to how to practically implement these strategies in the built environment despite the fact that nearly 20% of the cities GHG emissions came from residential and commercial buildings.³ The most significant way to reduce emissions is to reduce the energy used to light, heat and cool our buildings. In the Tri-Centennial year of New Orleans history, the reality is that the city is

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now threatened by the very forces which gave it birth and it must coordinate an aggressive focus on reducing emissions in buildings in order to guarantee another 300 years.

High-performance buildings offer a strategy which could fit under several of the New Orleans climate action initiatives while offering co-benefits related to health, economic impact and quality of life. According to the Energy Policy Act of 2005, a high-performance building is defined as any building which, “integrates and optimizes all major high-performance building attributes, including energy efficiency, durability, life-cycle, performance, and occupant productivity.”

High performance buildings can take many forms and conform to many different energy standards. However, the most robust and flexible among the high-performing building types is the Passive House standard, also known as PassivHaus.

The Passive House standard is a, “rigorous, voluntary standard for energy efficiency in a building which reduces its ecological footprint” and results in ultra-low energy buildings which use up to 90% less energy than their traditional counterparts.”

Passive House applies physics and common-sense to provide a basic understanding of the man-made processes occurring in buildings in order to “ensure comfort conditions and to deeply reduce energy costs.”

The 5 main principles of Passive House are air-tightness, thermal bridge free design, continuous insulation, balanced air recovery systems and high-efficiency windows. Ultimately, Passive House delivers a predictable product which fundamentally addresses the climate imperative “by means of insulation and draught-free construction.”

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6 Ibid., 8.
7 Ibid., 12.
“incorporate local climate and building tradition specific optimizations”, making the standard a proven way to realize “the perfect conditions for living comfortably, healthily and cheaply with minimal energy demands.”

Passive House enables nearly net zero buildings in many different types and can lock in energy savings for generations.

Literature Review

The Passive House Standard is particularly understudied in the United States and even less so in the context of hot-and-humid sub-tropical and tropical climates. Advanced economic and scientific research in Europe has shown that the Passive House standard can be viable in a consumer driven economic context, usually through state sponsored measures to enhance the energy efficiency of the built environment. Notable examples include the IEE PassREg publications which describe the critical factors of existing success models in “front-runner regions” like Brussels, Belgium and Hannover, Germany. Notably, these success regions are all located in the Northern European climate zone where the PH standard was initially designed and developed to accommodate minimal cooling demands. American research on the Passive House standard has mainly focused on explaining how the standard can work in economically prosperous Northeastern cities with climates similar to northern Europe. This paper will address the research gap in an attempt to understand if Passive House could help reduce emissions in a warm, humid city like New Orleans which also faces issues of social equity and financial health. The research in this paper was focused mainly on finding answers to associated questions: (1) what are the main barriers restricting Passive House construction

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8 Ibid., p. 13

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in New Orleans and (2) what types of solutions would be most effective to transform the market. In the context of this paper, successful adoption of the Passive House standard would be seen as the full use of the standard across a range of property types. It is hypothesized that the Passive House standard could be viable as a mainstream building standard if the price of energy reflected externalities, private-sector market incentives were created alongside promotional grants and pilot programs, alternative pathways were created to meet higher performance codes, and local and state incentives were created to facilitate the development of new materials and processes.

**Passive House Requirements**

Prior to being able to address obstacles to Passive House construction in New Orleans, it is necessary to understand what criteria a building must meet for a building to meet the Passive House standard. Passive House certification consists of four basic criteria. First, the space heating annual cooling demand must not exceed more than 12.3 kBTu/sf-iCFA.yr and the annual heating demand must not exceed 2.2 kBTu/sf-iCFA.yr\(^9\). Second, the Renewable Primary Energy Demand (PER, according to PHI method), or the total energy to be used for all domestic applications (heating, hot water and domestic electricity) must not exceed 60 kWh per square meter of treated floor area per year for Passive House Classic\(^10\). The building must be airtight, allowing a maximum of 0.6 air changes per hour at 50 Pascals pressure (ACH50), as verified with an onsite pressure test (in both pressurized and unpressurized states) is also required\(^11\).

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\(^10\) Ibid., p. 3

\(^11\) Ibid., p. 5
Finally, thermal comfort must be met for all living areas during the winter as well as in summer, with not more than 10% of the hours in a given year over 75 degrees Fahrenheit. All of the above criteria can be achieved through intelligent design and implementation of the 5 Passive House principles: thermal bridge free design, superior windows and doors, ventilation with heat recovery, quality insulation and airtight construction. See the Passive House diagram in the appendix for further reference to technical design criteria.

Passive House buildings are planned, optimized and verified with the Passive House Planning Package (PHPP). The package provides results for heating demand per year, cooling demand per year, and summer comfort in the case of passive cooling. However, translation of the Passive House standard from central Europe to the New Orleans climate is not a simple comparison because of the dramatic effect that the increased latent loads have on the typical ventilation and distribution strategies of cool air in the home. Corey Saft of the University of Louisiana at Lafayette has done the most extensive research on how Passive House buildings performs in southern climates. In the research, Saft uses a home he built as a rental home for students near campus. In his article, “Does Passive House have a Home in the Deep South?”, he explains that the ventilation air and the energy demand caused

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Figure 1 – The Debois House, Corey Saft’s 800 sf Passive House project located in Lafayette, Louisiana. The project was certified through Passive House US.
by the latent load within the building is of fundamental importance when designing an
efficient strategy to maintain comfort in the hot-and-humid climate zones.

One of the basic insights of the Passive House strategy Saft uses is the separation of the
heating and cooling from the ventilation of the house. In the south, where cooling demand
surpasses heating demand for most of the year, the most efficient system of cooling would
have the “conditioning come from a point source heat pump and the ventilation be a balanced
system with recovery.”\textsuperscript{13} Saft says that, this “insight holds partially true for the humid South
but to refine the system and optimize it for a humid climate requires the minimizing of the
required ventilation air (cfm)”.\textsuperscript{14} Saft concludes by saying that, “this strategy will go a long way
to capturing the possible benefits that the Passive House strategy” offers to New Orleans and
the climate zone of southern Louisiana. So if Passive House offers so many benefits, why is it
not prevalent in New Orleans? What are the barriers to the standard and how can they be
addressed?

Cheap Energy

The social and environmental advantages of the Passive House Standard exist in the
way that the standard uses scientific methods to minimize energy use in buildings, in some
cases up to 90% of traditional buildings. The standard was pioneered in Europe where the
political climate encouraged implementation of policies meant to curb fossil fuel consumption
and increase renewable energy production. Effectively, the opportunity for Passive Houses
was in the path of a direct benefit of larger public policies regarding energy use in buildings.

\textsuperscript{14} Ibid., p. 163.
Since the 1980’s, the PH Standard has proven itself to be a sustainable, long-term strategy with clear environmental and social benefits in Europe, but the question remains - what is the true economic value of a Passive House? When considering constructing a low-energy building the typical formula for determining economic value is evaluated through the Whole Life Costs (WLC) numerical concept. The WLC is defined as “the systematic consideration of all relevant costs and revenues associated with the acquisition and ownership of an asset.”\(^\text{15}\) It is important to note that, “there is a point up to which intense thermal insulation ensures the maximum efficiency of the investment, which, if exceeded, leads to over-investment.”\(^\text{16}\) The whole life costs formula is defined as the following:

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\text{Whole Life Costs} = \text{Initial Cost} + \text{Future Costs (Energy Bills + Non-Energy Bills + Maintenance Costs)}
\]

In the formula, initial costs include hard and soft costs, loan fees and real-estate agent commissions. The future costs include all operating costs such as maintenance, repairs, replacements, management, energy and utility use, and rent or mortgage payments. In order to understand the full economic proposition, the timing of the costs must be considered to discount future cash flows to present values. In Europe, research has concluded that, “Passive House buildings are financially viable in all situations except in a scenario where very high bank interest rates negative the substantial energy savings.” (p.29) However, the economic value of Passive House construction is harder to decipher in an energy-rich state like Louisiana. The


very assumption that a building owner or developer would make in adopting the Passive House standard for their project is that energy is a cost which is either a hindrance to the quality of the investment return, or either provides an attractive amenity to the market or represents a burdensome cost to the end-user. In other words, Passive House can only make economic sense in any unsubsidized real estate market if the price of energy is steep or is expected to climb at a significant rate over a certain period of time. If energy is either too easy to produce or so cheap that consumers have little reason to curb their energy use, then energy efficiency in buildings has no market incentive and no financial return, meaning the market will not produce high-performance buildings.

In Louisiana, a fortune of hydrocarbon resources exists below the surface in the form of natural gas and crude oil. The majority of the resources exist just offshore and because of the proximity of these large deposits, energy prices in Louisiana are the lowest in the entire country. Louisiana’s 18 oil refineries account for nearly one-fifth of the nation’s refining capacity and are capable of processing more than 3.3 million barrels of crude oil per day.\textsuperscript{17} At 8.37\$/kWh, residential electricity prices in Louisiana are 29.5\% less than the national rate of 11.88\$/kWh.\textsuperscript{18} In 2017, Louisiana had the highest annual electricity consumption at 14,881 kWh per residential customer, likely a direct correlation to both the constant need for cooling units and the cheapness of the energy.\textsuperscript{19} Residential electricity consumption in Louisiana averages 1,254 kWh/month which means the average bill is approximately $123.\textsuperscript{20} In New

\textsuperscript{18} Ibid.
\textsuperscript{19} Ibid.
\textsuperscript{20} Ibid.
Orleans, the average electricity rate is only slightly higher at $9.82 \text{¢/kWh}$ but still 18.4% less than the national average.\(^{21}\) Comparatively, the average price per kwH in the 28 states European Union was $25.0\text{¢}$ cents in 2017 and runs as high as $37.0\text{¢}$ in Denmark and Belgium which means monthly utility bills can run as high as $500 or more.\(^{22}\)

Using the Whole Life Costs equation, the average expected payoff period for a 2,500 square foot house in the Irish Channel in New Orleans was calculated. A single family home was chosen because nearly 44.5% of the city’s housing stock is single-family homes.\(^{23}\) The average cost per square foot in the Irish Channel is proving to be about $255 per square foot for standard single-family home construction as of May 2018. Using a 6% initial construction cost premium for the Passive House home resulted in a purchase price of $700,000 for the Passive House. Taxes, insurance and maintenance costs were expected to be the same for both property types. Energy bills were expected to be $1,400 in year one for the standard construction home while the passive house was expected to use 90% less energy and therefore annual bills would total $140. The interest amortization period was estimated to be 30 years, which is typical of most residential home purchases.

\(^{21}\) Ibid.
\(^{22}\) Ibid.
The chart below explains that equilibrium, or the point at which the cost of ownership is the same over the same time period, is reached when energy increases at 6.97% every year for 30 years. If energy prices increase above 6.97% over a 30 year time period, then Passive House is more economically feasible. Given that energy prices in Louisiana increased 12% from January 2017 to January 2018, this does not seem out of the realm of possibility.

Unfortunately, the market is time sensitive and cannot build to adopt to future possibilities.
The best strategy to proliferate single-family Passive House construction in New Orleans would be a broad-bush policy which increased the per kilowatt-hour price of energy directly to residential consumers. A policy like this would no doubt be incredibly unpopular but it would make owners aware that energy efficiency is something to be invested in and perhaps would drive investment into upfront energy efficiency measures. Ultimately, by choosing the Passive House as an energy standard, the ownerships benefits could be amortized over the ownership time-frame, ensuring the home will save energy into the future.

**Gap in Workforce Training**

An additional barrier to Passive House construction is the state of flux in which the construction industry finds itself on a national scale. Currently, the construction industry is...
plagued with a severe shortage of skilled workers. According to the Bureau of Labor Statistics, more than 190,000 construction jobs sit vacant. In a study published by the U.S Chamber of Commerce, it was reported that 90% of contractors are worried about workforce readiness in the near future. Further complicating matters are the new politics of immigration and an administration that is cracking down on undocumented workers, many of whom work in the construction services industry. One bright spot in the construction industry, however is green construction’s rapid growth rate. According to a recent report released by the U.S. Green Building Council, “green construction’s growth rate is rapidly outpacing that of conventional construction, and by 2018, green construction will support more than 3.3 million U.S. jobs – more than one-third of the entire U.S. construction sector – and generate $190.3 billion in labor earnings.” While the knowledge and labor required to build these projects is currently a key barrier to Passive House, the continued growth in the green construction will perhaps dissolve this barrier as the industry moves further towards mainstreaming sustainable practices.

An additional consideration when building in New Orleans are the employment initiatives implemented by the city. In New Orleans, a program called Hire Nola could be having unintended consequence of stymying green construction. Hire Nola is the first mechanism to link employment opportunities with local workforce. Essentially, the program works to assign city construction contracts and economic development projects to a pre-registered pool of local workers.

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workers. The new policy, which began in 2016, requires contractors and their subcontractors to demonstrate good faith efforts to cause the following:

- At least fifty percent (40%) of all work hours completed Louisiana workers to be performed by Local Workers;
- At least twenty percent (20%) of all work hours completed by Local Workers to be performed by Disadvantaged Local Workers and;
- At least twenty percent (20%) of all designated apprentice work hours performed by Louisiana apprentices to be completed by Disadvantaged Local Workers.

An additional consideration of the Hire Nola program is that prime contractors and their subcontractors are required to use the Office of Workforce Development as their “first source for recruitment, referral and placement of all new hires for employment opportunities created by the applicable contract”. While Hire Nola is a policy with good social intentions it could have the unintended consequence of narrowing skilled labor for green construction jobs, if actions are not taken to include suitable training. In light of the rapid growth of green construction jobs, the program needs to be careful not to limit work to local contractors when national providers can potentially provide services that are more sustainable or more environmentally conscious. As the pool of green construction workers is broadened in New Orleans, the specialized labor required to build to the Passive House industry will no doubt become cheaper.

Ultimately, the city of New Orleans needs to help address how to supply basic skills to the next generation of skilled workers while also providing new knowledge for how to do work in a “green” way. Revised hiring initiatives coupled with green policies can help boost employment while also adding new jobs in the carbon free work sector.
**High Construction and Retrofit Costs**

New Orleans is an old city with an old housing stock. In fact, 77.9% of New Orleans housing stock was built before 1980 and 31.1% were built before 1939\(^26\). In a city with a well-defined urban footprint, it is likely that most buildings will need to be retro-fitted to meet the energy requirements of Passive House. There is significant cost in retro-fitting an older wood-frame home. Recognizing this need, the city of New Orleans created the Energy Smart NOLA program to help property owners save energy on a variety of property improvements. Currently, the Energy Smart NOLA program offers rebates of $0.40 per square foot for attic insulation, air infiltration sealing up to $0.13 per cfm reduced and up to $200 for duct sealing.\(^27\) This is clearly not enough free money to property owners to come even close to the Passive House standard. If Passive House is to be well-received in New Orleans, it is important that owners and tenants must not be burdened with excessive financial charges, while sensible investments to create energy-efficient buildings must not be prevented.

In research sponsored by the New York State Energy Research and Development Authority, a pilot-program paid for a deep-energy retro-fit to four wood-frame houses in Utica, New York, in order to meet near Passive House energy standards. The average cost for the work was $112,000 per building, or $89,783 per housing unit. The third house in the experiment was a 2,754 square foot duplex with a total project cost of $144,001.\(^28\) The average annual energy savings was 393 therms of natural gas (11,486 kWh) per housing unit.

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Since the cost of natural gas in Utica is $1.65 per therm, the average annual energy savings are $647 per housing unit. While significant energy savings were realized, the payback period for these retro-fits would be roughly 139 years, according to the whole life costs analysis. The report concluded that, the “energy savings alone can’t possibly justify the very high costs of this type of retrofit”.

Ultimately, converting a leaky wood-frame house into an energy miser is a herculean task which requires sophisticated mobilization and an unreasonable cash outlay. In the Utica example, the project attempted but did not achieve energy reductions of 75%. By all energy metrics set for the project, the project failed. Additionally, a house seeking a deep-energy retrofit would also likely require significant code updates thus further adding to the project costs. However, this project does indicate that there is a point on the curve where a return on investment does make sense. If homes in New Orleans can achieve this minimal investment, with the help of the Energy Smart NOLA program, then perhaps the cost barrier can be dissolved.

**Product Gap**

Another barrier in the Passive House market is the lack of proximally available building products such as windows, doors, and insulation, which are fundamentally required to achieve Passive House. Currently, there are very few suppliers in the United States that build the required triple-pane windows and doors. Typical projects in the north-east will ship products

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30 Ibid.
31 Ibid.
from northern Germany, however for normal developers and contractors this means that the purchasing process for windows and doors is a burdensome cost. An unavailability of products in the market likely indicates that the market for manufacturing Passive House products does not allow firms to earn economic profits.

Recognizing the disconnect between the demand for Passive House and the availability of products, some building professionals have taken to build to the Passive House standard through pre-fabricated systems. Adam Cohen of Build SMART has created a pre-fabricated panel system built to the Passive House Standard. The Build SMART panels provide a building envelope system that is an “affordable solution to construct multi-family, high-performance residences with long-term benefits for landlords and residents alike.”32 The advantage of the Build SMART panels is that the windows and doors come pre-installed and are air-tight. The panels have the potential to simplify the design and construction process while also reducing expenses and on-site waste.

The product gap in Passive House building materials is still very much a chicken or the egg scenario. If developers are to make money on Passive House buildings in New Orleans, then they need to be able to cheaply source products within Louisiana or somewhere nearby.

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However, if manufacturers are going to be able to make a profit then they need to know that the market for products exists. It will likely take a manufacturing subsidy from the state of Louisiana to jump-strat a manufacturer who is willing and able to make these parts.

**Individual Solutions**

Significant barriers to the widespread market adoption of the Passive House standard exist in New Orleans. A gap in workforce training, high construction costs, and a product gap have all combined to completely rule out the economic viability of Passive House. The remainder of this paper will categorize potential solutions, which if adopted could begin to shift the investment logic of Passive House in New Orleans. The three categories of solutions are market education, policy and regulatory initiatives, and financial subsidies and incentives.

**Market Education**

In any market transformation, market education is a key component to product diffusion. In order to transform the market, it will first be necessary to easily articulate the “what” and the “why” of Passive House through information campaigns and direct engagement. The goal of a market education strategy should be to provide information, raise awareness and ultimately re-align the personal choices of consumers. The education solution offered in this paper is to enlighten all stakeholders in the city of New Orleans on what Passive House requires, how it functions, and how the benefits of Passive House can not only be realized at scale but will serve to further their own personal gain.

The first group to be targeted should be contractors and developers who are the actual actors in the built environment. By initially targeting those in charge of forming the built environment, a market education program will guarantee that it is communicating to those
most able to comprehend the benefits of Passive House. When communicating to contractors, the benefits of Passive House should not be “moralized” but rather it should be shown to them that it is in their long-term competitive interest to begin to construct buildings in this way. As an early leader in the Passive House building sector, they may gain an expertise which will place them in a category above their competition. When discussing Passive House with developers however, it should be explained that Passive House has been shown to require only a minimal cost increase which can be made up in increased rents. Ultimately, at the very heart of Passive House is good construction techniques, which if articulated in the correct manner to the correct individuals could lead to a more sustainable building stock in New Orleans.

Second, it will be necessary to educate the consumer as to the “what” and “why” of Passive House. When considering a complete market transformation it is important to consider how to explain to the consumer what role they play in the adoption of the standard. Since the consumer is the actual end-user of the buildings, a market education program through the city of New Orleans’ Office of Sustainability and Resilience could help convince people that energy efficient technologies actually make life more comfortable, more secure, healthier and cheaper. These “side effects” of sustainability are no doubt important for attracting the interest of a majority of property owners, and ultimately making Passive House mainstream.

The final piece of market education would be specifically tailored to contractors and subcontractors. The city of New Orleans should begin to offer qualifications to contractors and sub-contractors which certify their special knowledge of Passive House construction practices.
thereby distinguishing them from their colleagues. By ultimately promoting sufficient knowledge among all stakeholder parties, the city of New Orleans could be a key player in eliminating the education barrier to Passive House construction in New Orleans.

**Policy and Regulatory Initiatives**

Local governments are in a unique position to influence the behaviors of those they govern. In 2007, nearly 4% of the city's emissions came from the City of New Orleans and government buildings emitted 27,015 tons of green-house gases. A strategy to reduce the emissions of the city of New Orleans’s building could also topple barriers to Passive House construction in New Orleans. For example, if the city required all new buildings to be built to the Passive House standard, then government buildings could serve as focal points, built not just for today but with the thought of generations of New Orleanais to come. With the city taking the lead on projects, it could increase visibility and potentially increase public support for the Passive House standard. While increasing visibility for others to see that the Passive House innovation is in fact achievable, it has the dual purpose of debunking the myth that Passive House is exorbitantly more expensive. The city should seek policies which enable it to be a role-model in the process of Passive House adoption.

The second regulatory initiative would be to award points to development proposals seeking Low Income Housing Tax Credits (LIHTCs) in the Louisiana Qualified Allocation Plan. Pennsylvania Housing Finance Agency for example awards 10 points for developments that meet the energy standard of Passive House. Quality LIHTC projects built to the Passive House standard.

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standard help to debunk the prevailing myth that Passive buildings are a luxury only reserved for the rich. Additionally, lower utility bills are a benefit to low-income households living in state-sponsored buildings.

**Remunerative Incentives**

State and local municipalities, namely the state of Louisiana and Orleans Parish, could help the Passive House standard by creating a climate of competition driven by remunerative incentives. A set of remunerative incentives, where a material reward is given in exchange for adopting the Passive House standard, could be a healthy and expedient way to change the market.

The first remunerative incentive would be a low interest loan and grant program for a limited number of new construction homes built to the Passive House standard. To be eligible for the funds, the project must be located in metropolitan New Orleans, and be a new build, a retro-fit or a combination of both. The loan would be considered a “soft second mortgage” and would be due on sale. Ideally, the city of New Orleans could find this program for a maximum of 5 years in order to get a healthy supply of Passive Houses out into the marketplace.

The second remunerative incentive would be to provide developers who meet certain energy and sustainability factors a density bonus on multi-family project. This subsidy scheme aims to promote larger projects that have distinctive Passive House energy efficiency, sustainability and organizational innovations throughout the building process. The projects should could again be able to serve as role models and sources of inspiration.
The final remunerative incentive would be to fast-track all buildings conforming to the Passive House standard directly through the permitting process. A fast-track process would enable developers to cut costs and save time in the pre-development stages.

Promotional measures should be put in place in order to facilitate the implementation of Passive House buildings. The overall purpose of these promotional measures will help minimize potential additional costs by reducing learning costs and to help ensure and will ensure through improved knowledge, that the final product is viable in the marketplace.

**Conclusion**

Given current market realities in New Orleans, the Passive House standard is not a building standard which makes sense as an economically viable energy standard. Primarily, the market affords cheap energy to end-users effectively negating the financial advantages of energy conservation. While the environmental benefits of Passive House cannot be overstated, it is unlikely the standard will appear in the market until energy prices are higher, construction professionals are more knowledgeable about the standard and Passive House building products are locally available. Overcoming market barriers to Passive House construction in New Orleans will take a multi-pronged approach involving the spectrum of market participants working together across the public and private realms in a long-term, cooperative arrangement. The need for more lateral market collaboration which spans the public and private spheres in the form of public-private partnerships will also be an important factor enabling the development of Passive House buildings in New Orleans and the broader United States. A success model does exist in American and European case studies, showing how the barriers, if addressed one by one through market solutions, can be overcome. If we can understand how the Passive House
standard could be adopted in a market like New Orleans, we can better understand how other climate vulnerable regions across the global south could adopt similar high-performance standards.
Appendix

Client Biography of David Salamon

As an architect, David is motivated to design architecture of consequence that improves the lives of individuals and their communities. Prior to earning his Bachelor of Arts in Architecture at the University of New Mexico and a Master of Architecture with a Certificate in Ecological Architecture at the University of Pennsylvania, David designed and built off-grid and passive solar homes. With this background, David approaches architecture through the eyes of a designer, ecologist, craftsperson, and builder. David is a Certified Passive House Designer, the first elected President of the Greater Philadelphia Passive House Association, and Adjunct Assistant Professor at Temple University where he teaches energy modeling seminars. At his firm, Re:Vision, David provides architectural design and high-performance as well as Passive House consulting services.

Questions for Further Research

1. What is the best building use type - multi-family, facility, single-family or institutional - to enter the market with a Passive House building?
2. How can developers and investors post a positive, long-term return using PH standard? What technologies are helping or lacking from building to the PH standard?
3. How can energy policy be used as a driver to mainstream adaptation? What are major hindrances in policy?
4. How can local and state incentives be structured to encourage mainstream adaptation by developers and the public?
5. How can developers and designers be further educated or encouraged to adopt the standard?
6. Could Passive House be realized at scale through the delivery of Zero Energy District technology?
Figure 5 - Summary of featured actions (own diagram)
Figure 6 - Passive House Diagram (http://www.passiv.de/en/02_informations/02_passive-house-requirements/02_passive-house-requirements.htm)
“The knowledge that we have defines the knowledge that we can have.”
~Marcelo Gleiser
Resources


