ABSTRACT

Affordable housing is a persistent and world-wide need. However, most recently, in the face of growing public awareness and concern for global warming and potential climate change, the challenge has been intensified with a resurgence of interest in sustainability and green building. Nowhere is the intersection of these two interests more intense than in the recovery programs following a housing disaster situation such as that of a major earthquake or extreme weather event. No longer is it sufficient to simply temporarily house victims of a disaster, sustainability goals demand that this be accomplished using community processes and that the new housing result in better and stronger structures that will mitigate damage from future events and that it be culturally appropriate—all within the bounds of that which is affordable.

Hurricane Katrina devastated the US Gulf Coast in August 2005, inflicting major damage to housing, commercial property and infrastructure. While the US had previous experience with hurricanes, Hurricane Katrina was the first to impact the central urban area of a major city. Working through the recovery following Katrina, the US developed a workable post-disaster housing prototype, but not soon enough to address their immediate housing needs. However inadvertently in the process, they found a successful model for affordable housing. This research briefly examines the new challenges for post disaster recovery housing then it explores the response to Hurricane Katrina and the implications for affordable housing.
Key words: Affordable housing, sustainability, post-disaster recovery.

Introduction

Finding solutions to the creation of affordable housing is an imperative that has been faced by most countries around the globe for decades. Common strategies have included subsidy, reducing quality, simplification and self-help; none with universal applicability or success (FAS 2008). Subsidy, involving agency payment for part or all of the costs of housing (and seeking to recovery) has been challenged by issues relating to internal objectives and external taming initiatives (FEMA 2008). Quality has been compromised by issues relating to longevity, generosity, politics and lack of agreement about the minimum acceptable level of service to be provided (FEMA, CDC 2008). Simplification refers to the stripping of any superfluous details such as decoration, outdoor spaces and methods of construction and delivery. Self-help refers to potential for self-build and in some cases self-financing (HUD 2007). These issues have been explored to differing degrees of success, but fundamentally have not changed (RAND 2008).

Similarly, disasters both natural and manmade, involving the massive destruction of habitats have been with us since the beginning of time. While responses have varied by country, population and wealth and while the magnitude of disaster has also varied as does the capacity for a country to respond, each community still seeks to restore to the same or marginally better than what they had before. These issues have not changed. The new cloud on the horizon is climate change, bringing with it and increase in the number and severity of extreme weather events as well as a resurgence of interest in sustainability and green building. The new imperative of sustainable construction demands that any new housing be able to weather and mitigate damage from future extreme weather events, be culturally appropriate, strengthen community structures all within the confines of what is affordable.

This paper explores the intersection of post disaster recovery housing and affordable housing, prompted by the emerging sustainable construction strategies adopted by US government agencies following Hurricane Katrina. We begin with a description of the response to the hurricane, as well as the unexpected new housing issues that it created; then explore the conflicting agendas of post-disaster recovery housing providers with the providers of affordable housing all within the context of a ‘sustainability aware’ design community. Finally, we identify a convergence of the apparently different realms of affordable housing and post-disaster recovery and identify the implications, some lessons learned and some new challenges.
Hurricane Katrina and the Housing Market

Hurricane Katrina devastated the US Gulf Coast in August 2005 inflicting major damage on housing, commercial property and infrastructure. (FAS 2008) While the US has had previous experience with hurricanes Hurricane Katrina was the first to impact the central urban area of a major city. Prior to Katrina, the housing stock consisted of a mix of single family dwellings, multi dwelling units and mobile homes, the majority of which were owner occupied. Rental housing was largely privately owned as opposed to state owned and consisted of both single family homes, but more commonly, multi-unit dwellings purpose-built for rental. During the hurricane, as could be expected, poorly constructed housing was found more likely to sustain greater damage then housing of better construction. Lower income families more commonly occupied poorly constructed housing. Rental housing was generally more poorly constructed when compared with owner-occupied housing. Despite the widespread nature of the damage done to the housing stock throughout the region, there were significant differences in the extent and intensity of that damage in various submarkets. The most severely affected was the multifamily rental submarket—almost 80 percent of such units were damaged, and one-third of all multifamily rental units suffered severe or moderate damage. About one-half of the single-family residences (owned and rented) suffered damage, and almost 20 percent of all single-family units were severely or moderately damaged. (RAND 2008)

Following the hurricane, there was a significant increase in demand for affordable rental housing. While the US had typically relied on market forces to supply the bulk of its rental housing requirements, in this instance, the market did not respond as expected. Instead of rushing to rebuild rental housing, many private investors delayed or indefinitely deferred the decision to rebuild. This was evidenced in the rates of recovery by housing type. The rate of recovery moved more rapidly for single family dwellings than for multifamily units and was higher for moderately damaged buildings than for severely damaged units. It was also especially true for properties most severely damaged, un/under insured home owners and landlords (for example those with multiunit rental properties). Landlords with severely damaged buildings, faced with overheated construction costs and financing shortfalls had the ability to ‘take their investment money elsewhere’, delaying rebuilding until the market cooled off. This was deemed to have been particularly true for the ‘mom and pop’ landlords who depend heavily on the cash flow from rents. In addition to those homeowners seeking to restore their housing, some homeowners were not happy with the direction that their former neighborhood was taking in the rebuilding process and took the cash from their insurance to rebuild elsewhere, out of state. As a result, the number of private landlords dropped significantly following the hurricane, the number of renters (compared to owners) increased, the demand for affordable housing increased (also inflated by the influx of low paid construction workers—many of which were migrants) and the ‘market’ showed signs of not recovering fast enough to meet
demand, putting added pressure on the state to provide affordable housing—fast (Gulf Renewal 2007).

Federal Emergency Management Response to Hurricane Katrina

Shortly after Hurricane Katrina struck, the Federal Emergency Management Association (FEMA) provided temporary emergency housing, drawing from their existing inventory of temporary trailers and purchasing 102,000 travel trailers. The FEMA trailers were a mix of new and used small trailers (18.5 m²) larger travel trailers (37 m²) and larger still mobile homes (see fig 1).

Figure 1 FEMA travel trailer types

Designed for mobility and rapid deployment, the trailers were provided on wheels for ease of deployment in both trailer park settings as well as on individual lots. To meet the massive demand, the new trailers were manufactured using least expensive and most readily available materials and methods, then constructed in haste with little time spent drying out in the factory. This was to backfire later when trailers were found to not only be unsustainable due to their relative expense and short life expectancy, but that they were unhealthy for the occupants.

In addition to the FEMA trailers, FEMA had also ordered 25,000 Building America Structural Insulated Panel (BASIP) homes (see Figs 2 and 3). The program for the house design was developed in the 1970’s and like the travel trailers; they were designed for temporary shelter, not to exceed 18 months. These houses differ from the travel trailers both in terms of size and construction. Seeking a more sustainable housing option, the proposed BASIP home design uses prefabricated insulated panels for walls and the roof, resulting in greater energy efficiency as well as improved durability. The units all have 3 bedrooms and 2 bathrooms and have been designed for expansion through the joining of a second unit to create a ‘double wide’. Other proposed features include special shutters to provide future hurricane protection and solar shading, a retractable awning for solar shading and additional square area.
Some of the other sustainable features include the potential for integration of photovoltaics to generate peak power requirements for situations where utilities have not been restored or during times when service is interrupted (Thomas-Rees, 2006). In terms of external appearance however, the BASIP’s homes look very much like a larger version of the FEMA trailer only with a pitched roof.

Overall, the FEMA travel trailers were widely criticized for providing less than desirable temporary housing. The web is filled with personal accounts of unhappy occupants, reports of unhealthy living conditions and overall dissatisfaction. Although the travel trailers were never intended to be used long term, (use was limited to 18 months), the extended use of travel trailers following disasters of this nature were well documented in the southern US, with people continuing to live in them for many years. As of mid August 2007—two years after the hurricane, 60,000 people were still living in ‘temporary’ shelter FEMA trailers in Louisiana and Mississippi (Blueprint for Gulf Renewal, Institute for Southern Studies)

**State Response to Loss of Housing**

While the federal response was to providing emergency shelter, the state response looked further to the future seeking a more holistic and sustainable ‘housing’ approach encompassing urban/community. The state had fast realized that the so-called temporary shelters had out-of-necessity become more permanent fixtures. With their interest in affordable housing models, they sought to go beyond the temporary solutions previously utilized for disaster recovery. They realized that shelter is not enough, that a sustainable model had to be fast, flexible and able to transition
temporary shelter to temporary housing through to permanent housing. Only through this transition capability were they able to keep costs reasonable.

![The original Katrina Cottage](Image)

**Figure 4** The original Katrina Cottage

The Katrina cottages were developed first as temporary shelter but were designed to evolve into the beginnings of either new communities in the case of green field development or alternatively, in the case of buildings sited at the back of an existing property, as additional dwelling spaces for guests or aging relatives. Initial affordability was achieved largely through size – seeking a bridge between the 18.5 m² and 27.8 m² trailers, the first cottage was designed to 27.8 m². The cottages were kitset, using prefabricated panels specially designed for hurricane conditions, able to withstand high wind load conditions and excessive moisture without incurring damage or destruction. In sum, to meet with new objectives, the cottages had to be sustainable, to be able to mitigate damage from future storms, to be appropriate to regional condition, culture and climate and deliverable by all major delivery methods. This vision extended beyond simple cottage design to an all encompassing community design, avoiding the less than desirable temporary community plans formerly employed.

Designers continued to develop their ideas, expanding the original Katrina cottage idea to 20 different cottage models, including among them the Kernel House, which is specially designed to grow from an initial 46.4 m² module to a 120.7 m² home with added wings. (see Fig 5).

![Kernel cottages designed for expansion](Image)

**Figure 5** Kernel cottages designed for expansion (Image)
Projects demonstrated varying attempts at sustainable housing, but the most sustainable and most interesting is the most recent Green Mobile Project, which ‘represents a blend of key emergency housing needs with energy efficient and affordable housing that can serve as a temporary or permanent dwelling--emphasizing innovative site design features, green building technologies, durability, expandability with an open interior design that can e adapted to varied family needs. The units, therefore, result in reduced energy consumption and affordable living.’ (FEMA website)

![Figure 6](image)

**Figure 6** MSU architecture professor Michael Berk shows a model of GreenMobile.

Post-disaster recovery housing becomes affordable (and desirable)

Meanwhile the prototype Katrina cottage had caught the imagination of designers throughout the southern US, eliciting a host of Katrina copies with varying degrees of sustainable construction. Since the original cottage, multiple ‘clones’ have been developed all across the US. Currently there are dozens of listings on the internet for Katrina cottages available for rent. They are being used for long-term housing and for uses including vacation homes, Granny cottages and home offices (Green, 2008). The trailers arrived on site ready to inhabit, flexible for use in a variety of situations and as temporary dwellings, they did not require building consent.

"The Katrina cottage - with living quarters about the size of a McMansion bathroom - is now appealing to people well beyond the flood plain. Californians want to build one in their backyards to use for rental income to help with the mortgage payment. Modestly paid kayakers in Colorado see it as a way to finally afford a house. Elsewhere, people envision building one so a parent can live nearby."
(M Cusato, K cottage designer)

"We have lot sizes that are too small for a ... single-family, detached household, so the idea is to bring in these extremely attractive dwellings to provide affordable housing," (City councilor, Connecticut)
"A developer in Virginia wants to do some as affordable houses. People see it and realize it's a dignified way to live." (Cusato)

Almost inadvertently, the US had found a desirable housing model suited not only to post-disaster recovery, but to the wider development of sustainable, community oriented, affordable housing.

Conclusion

Katrina showed us the importance of; advance design, at both the scale of the individual dwelling as well as the community; the advance testing of that design and; advance planning in terms of technologies to be used; as well as the importance of leadership from government. Working backwards from a sustainable housing model that is suited to the needs for current rental housing but adaptable for situations of disaster, then developing the technologies to manufacture and deliver in large numbers in short time frames are initiatives that are best resolved prior to emergency. The experience of the post disaster recovery in the US following Hurricane Katrina suggests that the new imperative of sustainable construction is achievable in affordable housing. If we look for universal lessons from the particular events of the aftermath of Hurricane Katrina, we see:

1. there is no temporary with respect to housing(as opposed to shelter) post-recovery or otherwise sustainable housing is more than a discrete ‘product’ it must considered in the context of a cultural art effect within a community
2. significant cost and waste result from non-cooperation between agencies, conflicting organizational objectives must be aligned to achieve sustainable solutions.
3. even in a capitalist society, the government will be forced to lead with researched solutions, facilitating a desirable outcome that will allow the market to follow.

The convergence of post-disaster recovery needs (and research) with those for sustainable affordable housing have created new directions and opportunity. While the solutions for the situation in the Gulf Coast of the US are vastly different from those appropriate for 3rd world countries or other cultural settings, the process for ‘getting to sustainable, affordable housing’ is more universal in its application. Any new housing must be able to weather and mitigate damage from future extreme weather events, be culturally appropriate, strengthen community structures all within the confines of what is affordable. Which leaves us with only one major remaining challenge—the issue of who is deserving.

"One of the problems that I see with it, and I probably shouldn't say this, is that it looks nice. I think the government has a very hard time giving things away to people or underwriting things that go beyond some sort of bureaucratically understood minimal gesture."
In a post-disaster recovery situation this socio-cultural hurdle is mitigated by a combination of public sympathy to widespread loss and the benchmark of the pre-existing housing. Overall, replacement housing should be of equal or only marginally better ‘value’ than that which existed before. In the circumstance of the extreme poor, the homeless, or those without property, these benchmarks are not so easily established.

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