

## Passive Survivability

### What is Passive Survivability?

Passive survivability is a building's ability to maintain critical life-support conditions in the event of extended loss of power or water; or in the event of extraordinary heat spells, storms, or other extreme events. Passive survivability should include strategies such as storm resilience, cooling-load avoidance, natural ventilation, a highly efficient building envelope, passive solar heating, natural daylighting, renewable energy, and onsite water collection and storage.<sup>1</sup>

Major human-made and natural disasters making news around the world and across the United States have raised awareness about the need to consider a concept like passive survivability in design and construction. Both the frequency and the magnitude of tropical storms affecting the Gulf Coast and coastal Atlantic states increased dramatically in the decade 1995 to 2004 compared with the previous decade. The potential for rising sea levels has also been in the news a great deal recently. With 53% of the population of the United States living on land defined as the coastal zone, rising sea level is a major concern. Low-lying areas prone to tropical storms and flooding are not alone in being vulnerable. A heat wave in Chicago killed more than 700 people in their homes or apartments in 1995. The risk of terrorism, the extensive power outage in the Northeast in 2003 and Hurricane Katrina all increased the urgency to incorporate passive survivability into design and construction.<sup>2</sup>

### How to Incorporate Passive Survivability

Buildings should be designed to maintain survivable thermal conditions without air conditioning or supplemental heat.<sup>3</sup> Providing back-up generators and adequate fuel to maintain the critical functions of a building during outages are conventional solutions to power-supply interruptions. Indeed generators need to be part of the answer in some situations, such as hospitals. However, unless they are very large, generators support only basic needs for a short amount of time and may not power systems such as air conditioning, lighting, or even heating or ventilation during extended outages. Back-up generators are also expensive both to buy and maintain. Storing significant quantities of fuel on-site to power generators during extended outages has inherent environmental and

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<sup>1</sup> Building Green. <http://www.buildinggreen.com/press/passive-survivability.cfm> (accessed April 23, 2010).

<sup>2</sup> Building Green. <http://www.buildinggreen.com/auth/article.cfm/2006/5/3/Passive-Survivability> (accessed April 23, 2010).

<sup>3</sup> The New Orleans Principles. [http://green-reconstruction.buildinggreen.com/documents.attachment/305068/NewOrleans\\_Principles\\_LowRes.pdf](http://green-reconstruction.buildinggreen.com/documents.attachment/305068/NewOrleans_Principles_LowRes.pdf) (accessed April 23, 2010).

safety risks, particularly during storms. Passive solutions, such as designing highly efficient building envelopes, providing natural ventilation and daylighting, and incorporating passive solar design can also contribute to a facility's passive survivability. Renewable energy systems can provide power during an extreme event (see *Renewable Energy* section). For example, photovoltaic (or solar electric) power systems, when coupled with on-site battery storage can provide electricity when the grid loses power.<sup>4</sup>

Emergency water supply systems such as rooftop rainwater harvest systems can provide water for toilet flushing, bathing and other building needs in the event of water supply interruptions (see *Rain Barrels and Cisterns* strategy). The list below outlines aspects of a building's design that should be taken into consideration when planning for passive survivability.

#### Passive Survivability: A Checklist for Action:<sup>5</sup>

- Create storm-resilient buildings
- Limit building height
- Create a high-performance envelope
- Minimize cooling loads
- Provide for natural ventilation
- Incorporate passive solar heating
- Provide natural daylighting
- Provide solar water heating
- Incorporate renewable energy systems such as photovoltaic (PV) power
- Configure heating equipment to operate on PV power
- Where appropriate, consider wood heat
- Store water on site; consider using rainwater to maintain a cistern
- Install composting toilets and waterless urinals
- Provide for food production in the site plan
- Provide emergency access

#### **Benefits**

- Reduce human discomfort and suffering through designing buildings that serve as livable refuges in the event of crisis or the interruption of electricity, heating fuel, water, or sewer systems.
- Reduce operating costs through designing and constructing more efficient buildings.<sup>6</sup>

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<sup>4</sup> Building Green. <http://www.buildinggreen.com/press/passive-survivability.cfm> (accessed April 23, 2010).

<sup>5</sup> Building Green. <http://www.buildinggreen.com/auth/article.cfm/2006/5/3/Passive-Survivability-A-New-Design-Criterion-for-Buildings/?checklist=1> (accessed April 23, 2010).

## Costs

Passive survivability strategies are closely aligned with green building principles and sound design practices. If implemented in an integrated fashion, passive survivability strategies should not significantly increase construction costs.<sup>7</sup>

## Resources

Environmental Building News Calls for "Passive Survivability"

<http://www.buildinggreen.com/press/passive-survivability.cfm>

Passive Survivability: A New Design Criterion for Buildings

<http://www.buildinggreen.com/auth/article.cfm/2006/5/3/Passive-Survivability>

Whole Building Design Guide – Optimize Energy Use

[http://www.wbdg.org/design/minimize\\_consumption.php](http://www.wbdg.org/design/minimize_consumption.php)

*The New Orleans Principles*

<http://green-reconstruction.buildinggreen.com/documents>

PLANYC

[http://www.nyc.gov/html/planyc2030/html/plan/climate\\_citywide.shtml](http://www.nyc.gov/html/planyc2030/html/plan/climate_citywide.shtml)

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<sup>6</sup> The New Orleans Principles. [http://green-reconstruction.buildinggreen.com/documents.attachment/305068/NewOrleans\\_Principles\\_LowRes.pdf](http://green-reconstruction.buildinggreen.com/documents.attachment/305068/NewOrleans_Principles_LowRes.pdf) (accessed April 23, 2010).

<sup>7</sup> The New Orleans Principles. [http://green-reconstruction.buildinggreen.com/documents.attachment/305068/NewOrleans\\_Principles\\_LowRes.pdf](http://green-reconstruction.buildinggreen.com/documents.attachment/305068/NewOrleans_Principles_LowRes.pdf) (accessed April 23, 2010).