Technology Builds on ‘Passive Measures’ that Increase Energy Efficiency

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GUAYNABO, Puerto Rico – The raw beauty of Puerto Rico is striking—the azure sea, the ragged coastline, its lush mountainous interior—beauty that is only eclipsed by the appeal of its Old World architecture.

It is seen in the soles truncos, the semicircular ventilated transom windows of Arecibo. It is found in the aljibes (pronounced al HEE behs), cisterns of San Juan that gather rainwater, and in balcones a vuelta redonda, those wraparound balconies that embellish the façades of buildings dotting Puerto Rico’s landscape.

Engineered within these design features is function. They are examples of “green” building that have incorporated beauty and energy efficiencies into the architecture of Puerto Rico dating back to antiquity.

“They represent what we call passive measures that do not require the use of energy,” said Jesús Garay Vega, president of the U.S. Green Building Council, Caribbean chapter, and an engineer with FEMA. “They also increase the survivability of occupants when energy fails.”

Survivability, as an architectural strategy, builds in features enabling people to live in buildings without electricity for several days.

FEMA is working with government agencies in Puerto Rico to create an energy-efficient construction approach to recovery from hurricanes Irma and María. This partnership leverages available resources to help Puerto Rico build back stronger. Puerto Rico’s Industrial Development Company and its Public Buildings Authority are the newest partners.

Energy-efficient measures are increasingly applied domestically and internationally. For instance, the government of Puerto Rico’s Green Building Standard for Public Buildings must be met for construction and renovation

projects. Leadership in Energy and Environmental Design ratings, set by the U.S. Green Building Council, certify buildings as environmentally sound.

International standards and building codes such as the International Green Construction Code are designed to increase efficiencies in energy use, water and materials.

All of these represent great opportunities to build and rebuild—with an environmentally sound approach. “The technology already exists in Puerto Rico. There’s a cost benefit to employing these technologies,” according to Patrick Briggs, chief of FEMA’s Public Buildings sector.

Passive measures have been used in Puerto Rico since the 1500s. Taíno villages featured circular thatch-roofed homes called bohíos made of reeds and grasses for airflow. Knotted hamacas (hammocks) afforded cool and comfortable sleep. Soles truncos in artful designs of wood, glass or metal, allow airflow and light through the arched doorways they ornament (https://www.fema.gov/media-library/assets/images/166143 and https://www.fema.gov/media-library/assets/images/166144). Aljibes underneath the El Morro and San Cristobal forts in Old San Juan were made of limestone built to collect and hold clean water for the public in the event of an attack.

Interior walls, built lower than the ceiling, contribute to improved air circulation. In larger public buildings, patios interiores, or indoor patios, increase fresh air circulation from the inside and provided a social space. On the outside, the balcones made of stone with decorative balustrades shielded buildings from the sun. Thick masonry perimeter walls protect structures from fire and heat.

Today, passive measures continue to find novel implementations. Concrete sunbreakers, or quiebrasoles, as seen at the La Concha resort in San Juan’s Condado neighborhood, feature patterned, vented designs that filter sunlight. Hanging gardens like the ones adorning the walls of the Banco Popular Foundation headquarters building in Hato Rey provide insulation and can lower heating and cooling costs.

Rooftop gardens increase efficiencies by reducing stormwater runoff, improving air quality, lowering the urban heat and providing a habitat for wildlife. Work is underway to restore the Jardín Mirador Ballajá at Cuartel de Ballajá, which was destroyed by María. The gardens once were home to 67,000 plants and included 720 photovoltaic panels. The panels cut energy consumption by almost half, according to the State Historic Preservation Office which led the installation in 2011.

Passive measures and smart-technology improved materials like impact-resistant windows help make Puerto Rico more resilient. Backup and renewable energy in buildings are also essential, according to Cristina Algaze Beato, a senior architect with the Martínez & Algaze Sustainability Studio in San Juan.

Green building will represent one of the greatest contributions we can make for future generations of Puerto Rico, according to Garay Vega.

“Our mission is to transform the way design and construction operate to enable environmentally sound building,” he said. “Resiliency is the new green.”

For information on Puerto Rico’s recovery from Hurricane Maria, visit fema.gov/disaster/4339.

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