Case Study: Development of the Climate Change Resilient Pilot House (CCRPH)

Country: Philippines  
City: Naga City  
Key Sectors: Low-cost housing, Resilient Building

Local & Regional Partner Organization
- City Government of Naga
- Department of Science and Technology (DOST) Regional Office V
- Philippine Association of State Universities and Colleges (PASUC) V
- Commission on Higher Education (CHED) Regional Office V

Geography and Population
BISCAST is located in Naga City serving the Bicol Region and accommodates 5,000 students. It is mandated to provide advanced and higher education, research, and extension services.

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Summary
In 2014, the Bicol State College for Applied Sciences and Technology (BISCAST) in Naga City, Philippines has been selected as a meso-level organization partner of the GIZ Urban Nexus Project to help the City in the implementation and promotion of the nexus approach in the Bicol Region. Naga City is one of the Nexus project’s pilot cities.

Committed to integrate the Nexus approach into the development of a resilient housing, BISCAST initiated the design and development of a pilot house which encapsulates an integrated approach. The Climate Change Resilient Pilot Housing (CCRPH) has the capacity to resist, absorb, and respond to the adverse effects of climate hazards without significant changes to its basic functions and structures.

In June 2016, the CCRPH was inaugurated in the presence of key project partners, including Mayor John Bongat of Naga City and other city representatives, GIZ Nexus staff, representatives from the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), ICLEI Southeast Asia Secretariat, Santa Rosa City Government, and other national government agencies in the country.
Rationale

Naga City, dubbed as the “Heart of Bicol,” is a regional center for education, culture, religion, investment, and tourism. The City takes pride on its good governance as well as the strategic stance it takes in the development of Metropolitan Naga. However, the City is prone to severe typhoons and floods being located along the typhoon belt and flanked by Mt. Isarog in the east and the Bicol River Basin, Luzon’s major flood zone, to the west. Moreover, Naga is facing the impacts of rapid urbanization, with its population expected to double within the next two decades (Naga City Comprehensive Development Plan 2011-2020). As such, the city government takes an integrated approach by partnering with different institutions in order to strengthen resilience to address urban development issues which are further exacerbated by climate change impacts.

One example, initiated by BISCAST, is the development of a Climate Change Resilient Pilot House (CCRPH) that can withstand potential hydro-meteorological and geological hazards such as typhoons while remaining sustainable and cost-effective. With 10% of the country’s population living below the poverty line, low-cost socialized housing is considered a pressing issue. Alongside the CCRPH’s climate change resilient features, the said technology proves to be a practical adaptation strategy for a country that is highly vulnerable to the impacts of climate change.

Project Description

The BISCAST Nexus Task Force was established to serve as a body providing both policy and implementation support to nexus activities. The Task Force, chaired by the BISCAST President, drafted a three-year implementation plan for the Integrated Resource Management Program to ensure feasibility and sustainability of Nexus Projects. The CCRPH is one of the targeted outputs of this implementation plan.

To support this initiative, the Urban Nexus project provided BISCAST with short-term experts specializing on low-cost housing technologies to assist in the design and construction of the CCRPH. The pilot house is designed to withstand major hazards in the country including severe typhoons, heavy flooding, landslides, and earthquakes. Furthermore, the CCRPH also applies a low-cost housing technology (i.e., pre-fabricated beams and hollow blocks) and utilizes climate-adaptive and energy-efficient devices. Standing at 71 square meters (m²), the CCRPH is half as expensive as the conventional socialized housing which usually amounts to approximately PHP17,000 (EUR 279) per m².
CCRPH Costing (for labor and materials)*

<table>
<thead>
<tr>
<th>Features</th>
<th>Cost (PHP/m²)</th>
<th>Total Cost for 71 m² house (PHP)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Affordable Housing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Features: sub and super structure, roofing; door and windows; water and electricity supply; and staircase.</td>
<td>5,492.48</td>
<td>389,966.08</td>
</tr>
<tr>
<td><strong>BISCAST Housing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Features plus: tiles; plaster; skin coat; paint; shading roof; and dual flush toilet.</td>
<td>9,221.25</td>
<td>654,708.75</td>
</tr>
<tr>
<td><strong>CCRPH Green Housing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BISCAST Housing Features plus: rainwater harvester; photovoltaic electricity supply; and grey water and effluent treatment.</td>
<td>10,827</td>
<td>768,721.26</td>
</tr>
</tbody>
</table>

*Average cost per sqm of house construction in Naga City is PHP17,000

The CCRPH passed all six climate change resiliency indicators of the Philippine Green Building Initiative (PGBI): soundness of structure; water and wind tightness; spatial flexibility; own emergency provisions; emergency egress; and disaster risk management plan. The CCRPH also has passive lighting and ventilation which is a prerequisite under the PGBI. BISCAST also conducted an internal assessment of the CCRPH using the Excellence in Design for Greater Efficiency (EDGE) Standards. Results revealed that the CCRPH is 60.7% energy efficient, 34.1% water efficient, and 41.7% material efficient as compared to a standard house with the same dimensions and occupancy.

One year continues monitoring reports prepared by BISCAST also show that 73% of the water consumption and 10% of electricity consumption were sourced from the rainwater harvester and photovoltaic system installed in the building.

Features of the CCRPH:

- Modular architectural system reduces the number of different building parts, leading to a reduction of different types of formwork
- Reduction of waste materials and waste water on site by up to 30%
- Approximately 50% reduction of mortar due to the Hollow Concrete Block (HCB) concept of “closed bottom”
- Reduction of 40% of concrete and 30% of steel works for slab construction due the HCB-slab system
- Natural ventilation (cross ventilation throughout the building)
- Natural illumination with a window/wall ration of 40% and roof lights
- Reduction of electricity consumption by over 25% through use of photovoltaic system and energy efficient appliance
- Water conservation via rainwater harvesting water efficient appliance
- Re-use of clarified waste water for urban gardening
- Three chamber septic tank with effluent drain field

**Stakeholders / Target groups**

**Stakeholders:**
- Naga City Planning and Development Office
- Naga City Urban Poor Affairs Office
- Department of Science and Technology (DOST) Regional Office V
- Other state colleges and universities (SUCs) in Region V
Target groups:
- BISCAST instructors and students
- BISCAST Academic and Administrative Departments
- Commission on Higher Education (CHED) Regional Office V

Methodology

The BISCAST Nexus Task Force was established to serve as a body providing both policy and implementation to support Nexus activities. The task force is composed of the President of BISCAST as the Chairperson with members consisting of the Vice President for Academic Affairs, Vice President for Administration and Finance, and officers of Academic and Administrative Departments of the College. The Task Force created a three-year implementation plan for the Integrated Resource Management Program at BISCAST to ensure feasibility and sustainability of Nexus Projects which includes the CCRPH that is built within the premises of their campus.

Results (Impact)

- The CCRPH can be used as an alternative model for low-cost socialized housing projects in the country. Continued monitoring of water and electricity consumption proves that the CCRPH has economic savings.
- BISCAST developed “low-cost housing building design system”, is in the final stages to receive “Accreditation of Innovative Technologies for Housing” (AITECH) from the National Housing Authority (NHA)
- The CCRPH received the highest rating (KAMAGONG) from PGBI for green building standards as well as for “Climate Change Resiliency”
- The project showcases a good example of South to South dialogue, knowledge exchange, and technology transfer through the GIZ expert and use of German construction technologies.
- Architecture and Engineering students of BISCAST were equipped with the knowledge and trained on-the-job along with their instructors in the application of the Nexus approach thru the CCRPH.
- Naga City Government has a new project with Maronite (Australian-Lebanese religious group) where a total of 166 families around the Balatas Dumpsite will be provided with new housing. The city government envisions that the row houses will follow the CCRPH design. The CHED Regional Office V also signified intention to replicate the CCRPH design for adoption of local communities and LGUs. At present, BISCAST is preparing the institutional mechanisms concerning technology transfer to other stakeholders.

Costs / Financing

PHP 950,000 (EUR 15,564) includes the cost for the CCRPH house model 768,721 PHP (EUR 12,594) and the development and production of the two vibrating machines with diverse molds 181,279 PHP (EUR 2,970).

Ref. Exchange rate September 2017
http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/index_en.cfm