

RESILIENT CITIES AND ARCHITECTURE IN THAILAND

ARCASIA Committee on Social Responsibility (ACSR)

Round Table Conference

September 14, 2019



L'Hotel Causeway Bay (CWB) Harbour View, Hong Kong

Hosted by **Hong Kong Institute of Architects (HKIA)**



Association of Siamese Architects under Royal Patronage



WHAT IS RESILIENCE?

- Crawford S. Holling (1973: 17) may have been the first to use the term 'resilience' from an *ecological perspective*. Gunderson and Holling (2001 in Jabareen, 2013: 220) then further developed the term as "the **persistence** of relationships within a system," "the ability of these systems to **absorb** changes of state variables, driving variables, and parameters, and **still persist**" and "the capacity of a system to **undergo disturbance** and maintain its functions and controls."

smart-resilient-low-carbon-eco-knowledge cities; making
sustainable urbanization. Journal of Cleaner Production,
December 2015.

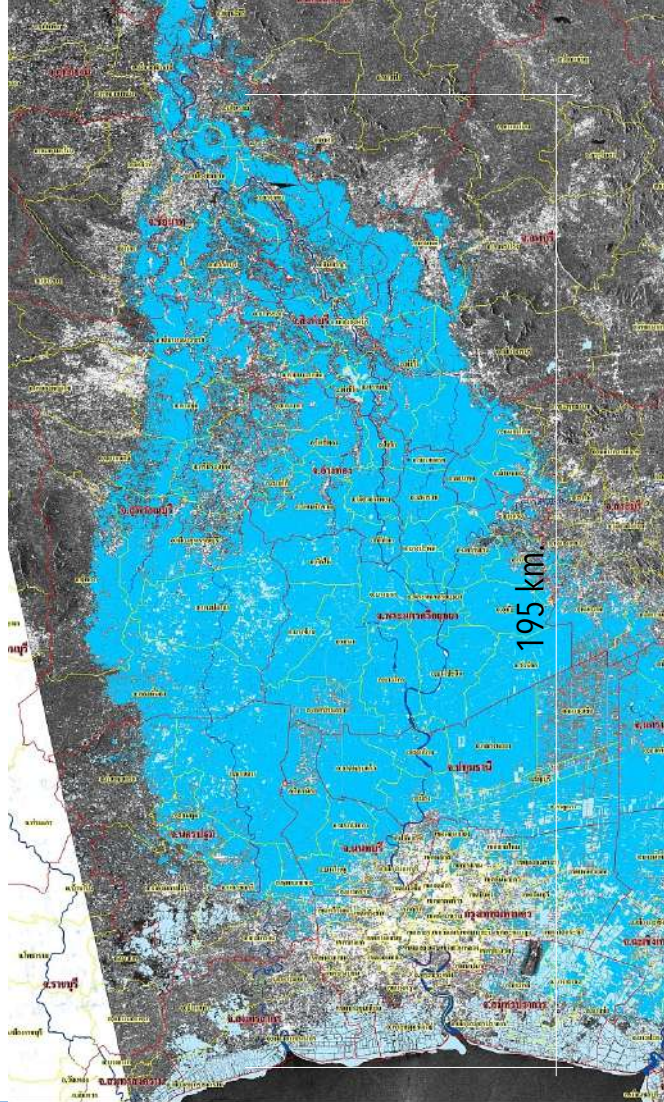
THAILAND'S RECENT EXPERIENCES

2011: The Great Flood

Northern Bangkok



Central Region of Thailand



Industrial Estate in Ayutthya



THAILAND'S RECENT EXPERIENCES

2014 Earthquake in Chiang Rai, Northern Thailand



THAILAND'S RECENT EXPERIENCES

2017 Flood: Ten Northeastern Provinces

Sakon Nakhon



Nakhorn Phanom



Petchabun



THAILAND'S RECENT EXPERIENCES

2019 Flood: LAST WEEK UNTIL NOW

Ubon Ratchathani



Sukhothai



Khon Kaen

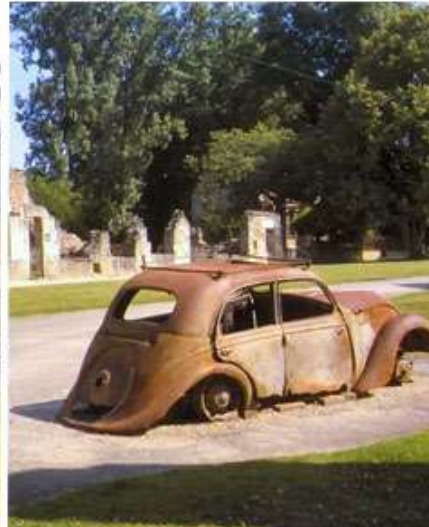


NON-RESILIENT CITIES

Oradour-sur-Glane, France (War)



Humberstone, Chile (Economy - Deindustrialization)



NON-RESILIENT CITIES

Kadykchan, Russia (Politics – Soviet Union collapsed) Balestrino, Italy (Earthquake – geological instability)



WHY RESILIENT CITY?



Lucky!
I'm a resilient building.

A home in Gilchrist, Texas, designed to resist flood waters survived Hurricane Ike in 2008.
Photo courtesy of FEMA/Joselyne Augustino
https://share-ng.sandia.gov/news/resources/news_releases/motivating-business-to-design-a-more-resilient-nation-one-building

WHY RESILIENT CITY?



A home in Gilchrist, Texas, designed to resist flood waters survived Hurricane Ike in 2008.
Photo courtesy of FEMA/Joselyne Augustino
https://share-ng.sandia.gov/news/resources/news_releases/motivating-business-to-design-a-more-resilient-nation-one-building

WHY RESILIENT CITY?



I'm not-so-good architecture!

No architect designed me...

Baan Khu Village, Noan Daeng District, Nakorn Rajchasi, Thailand
August 1, 2017

WHY RESILIENT CITY?



Baan Khu Village, Noan Daeng District, Nakorn Rajchasima, Thailand
August 1, 2017

5 RESILIENCE DIMENSIONS

Dimension	Sub-Categories
Social	Human Capital, Lifestyle and Community Competence, Society and Economy, Community Capital, Social and Cultural Capital, Population and Demographics Environmental, Risk Knowledge
Economic	Economic Development, Society and Economy
Institutional	Governance, Governmental Services, Coastal Resource Management, Warning and Evacuation, Emergency Response, Disaster Recovery
Physical	Physical Infrastructure, Infrastructural, Land Use and Structural Design
Natural	Ecosystem

Patel, R., Nosal, L. (2016). Defining the Resilient City. United Nations University Centre for Policy Research, Working Paper 6. December 2016.

RESILIENT DESIGN STRATEGIES

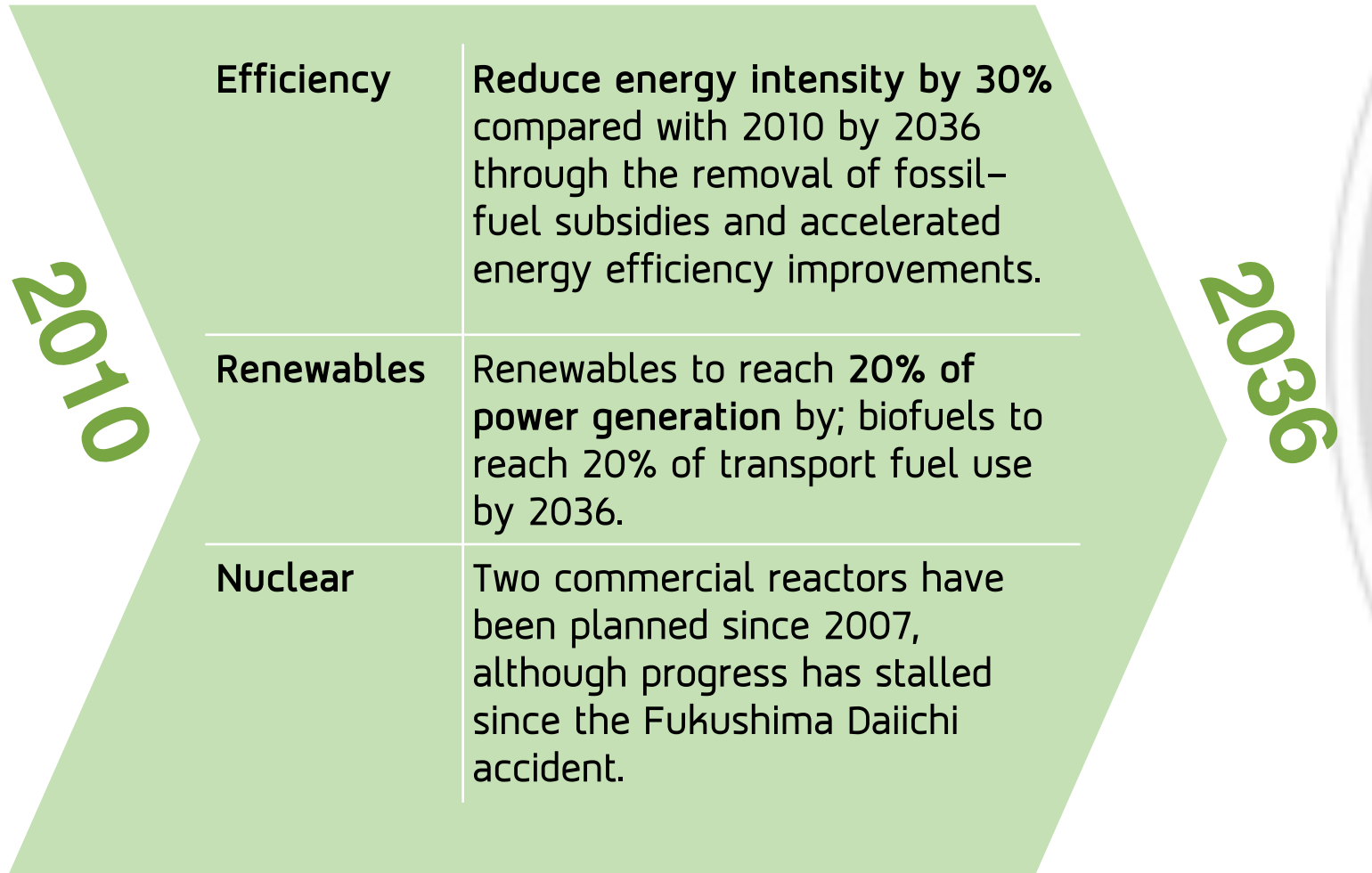
- Achieving Resilience at the **Building Scale**
- Achieving Resilience at the **Community Scale**
- Achieving Resilience at the **Regional and Ecosystem Scales**

RESILIENT DESIGN
I N S T I T U T E

<http://www.resilientdesign.org>

① Thailand's Key Policies and Trends

Paris Agreement and Thailand



Thailand Integrated Energy Blueprint (TIEB)

• PDP2015

แผนพัฒนากำลังผลิตไฟฟ้าของประเทศไทย พ.ศ. 2558 - 2579 (PDP2015)
 สำนักงานนโยบายและแผนพลังงาน กระทรวงพลังงาน 01

• EEP2015 Energy Efficiency Plan (EEP2015)

02 แผนอนุรักษ์พลังงาน พ.ศ.2558-2579 (EEP2015)
 สำนักงานนโยบายและแผนพลังงาน กระทรวงพลังงาน

• AEDP2015 Alternative Energy Development Plan (AEDP2015)

03 แผนพัฒนาพลังงานทดแทนและพลังงานทางเลือก พ.ศ. 2558 - 2579 (AEDP2015)
 กรมพัฒนาพลังงานทดแทนและอนุรักษ์พลังงาน กระทรวงพลังงาน

• Oil Plan 2015 Oil Plan 2015

04 แผนบริหารจัดการน้ำมันเชื้อเพลิง พ.ศ. 2558-2579 (Oil Plan 2015)
 กรมธุรกิจพลังงาน กระทรวงพลังงาน

• Gas Plan 2015 Gas Plan 2015

05 แผนบริหารจัดการก๊าซธรรมชาติของประเทศไทย พ.ศ. 2558-2579 (Gas Plan 2015)
 กรมเชื้อเพลิงธรรมชาติ กระทรวงพลังงาน

UN: Sustainable Development Goals and Disaster Risk Reduction

Sustainable Development Goals



571 cities, representing 441,665,392 people worldwide, have committed to the Compact of Mayors to reduce greenhouse gas emission and risk and to adapt through the climate changes

<https://sustainabledevelopment.un.org>

Power Development Plan (PDP2015)

Fuel	Percentage in 2014	Percentage in 2026	Percentage in 2036
Imported hydro power	7	10 - 15	15 - 20
Clean coal including lignite	20	20 - 25	20 - 25
Renewable energy including hydro	8	10 - 20	15 - 20
Natural gas	64	45 - 50	30 - 40
Nuclear	-	-	0 - 5
Diesel/Fuel oil	1	-	-



Energy Efficiency Plan (EEP2015)

High Energy Performance Standards (HEPs) + Minimum Energy Performance Standards (MEPs)	<ul style="list-style-type: none"> •Vehicles–high EE vehicles, mandatory energy labeling, enforcement of MEPs •Enforcement of MEPs for appliances, buildings and vehicles
Building Energy Code (BEC)	<p>Energy Conservation Promotion Acts (1992, 2009) Royal Decree on designated buildings (1995)</p> <p>> 2000 m2: 5 majors: OTTV–RTTV, Lighting, A/C, hot water, whole building compliance and Renewable energy</p>
Energy Efficiency Labeling	<p>Mandatory of Labeling for appliances, buildings and vehicles, Environmental Impact Assessment (EIA)</p> <p>EGAT's electrical appliance labeling</p> <p>Thai Green Building Institute labeling (TGBI)</p>
Monetary Incentives	<p>Funds for amount of energy saved, R&D technologies, HR, ESCO, low interest rate, tax, EE product cost subsidy 20% and < 3M Baht</p> <p>Standard offer Program (SOP)</p> <p>Technical assistance for EERS</p>
Energy Efficiency Resource Standards (EERS)	<p>Large scale energy business is required for minimum EERS</p>

a revised Building Energy Code to be effective in 2017 for large buildings > 10,000 sqm., new and old. In 2019 will apply to buildings > 5,000 sqm., and to > 2,000 sqm. in 2022.

Key Policies and Trends –

12th National Economic and Social Development Plan (2017–2022)

- identifies "Green City" project and carbon reduction plan in its sustainable development strategy.
- enacts laws requiring Strategic Environmental Assessment (SEA) in public policies, plans, programs.

Office of Natural Resources and Environmental Policy and Planning (ONEP)

- develops "Low-Carbon City" strategies and collaborates with municipalities to plan and implement district development programs.



② Thailand's Resilient City Projects

Low Carbon Municipality Projects (2012–2015)

- Initiated by National Municipality League of Thailand (NMT) with support from European Union from 2012–2015
- Total 175 cities (N 61, NE 56, Central 20, E 14, S 24) participated to gain awareness, knowledge, changes toward low carbon cities under 4 strategies.
- Implemented with measurable KPIs, follow up procedures and PR
- Results from potential cities to be further developed have been fully implemented in 2015–2017



Resilient Projects –

Developing 15 Low Carbon–Bike–Resilient Prototype Cities (2015–2017)

Local vision, mission, policies and strategic action with objectives and time frame

Assigned tasks to responsible teams with policies to strengthen and drive organization and public

Create activities to build understanding, potential and knowledge with database system

Communicate and PR to all stakeholders through participatory processes and follow up procedures for lesson learned.

Low
Carbon
City

Bike City

Resilient
City

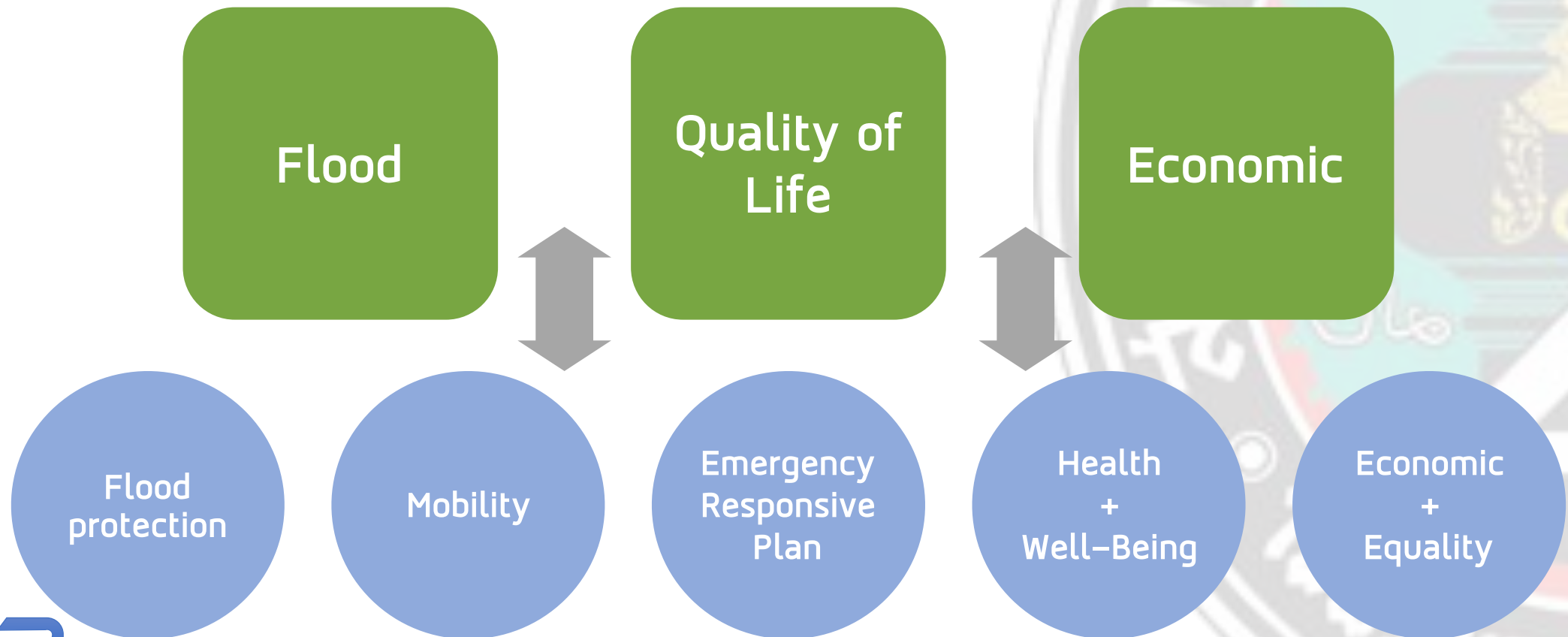
Happy, Well–Being People
Sustainable Environment



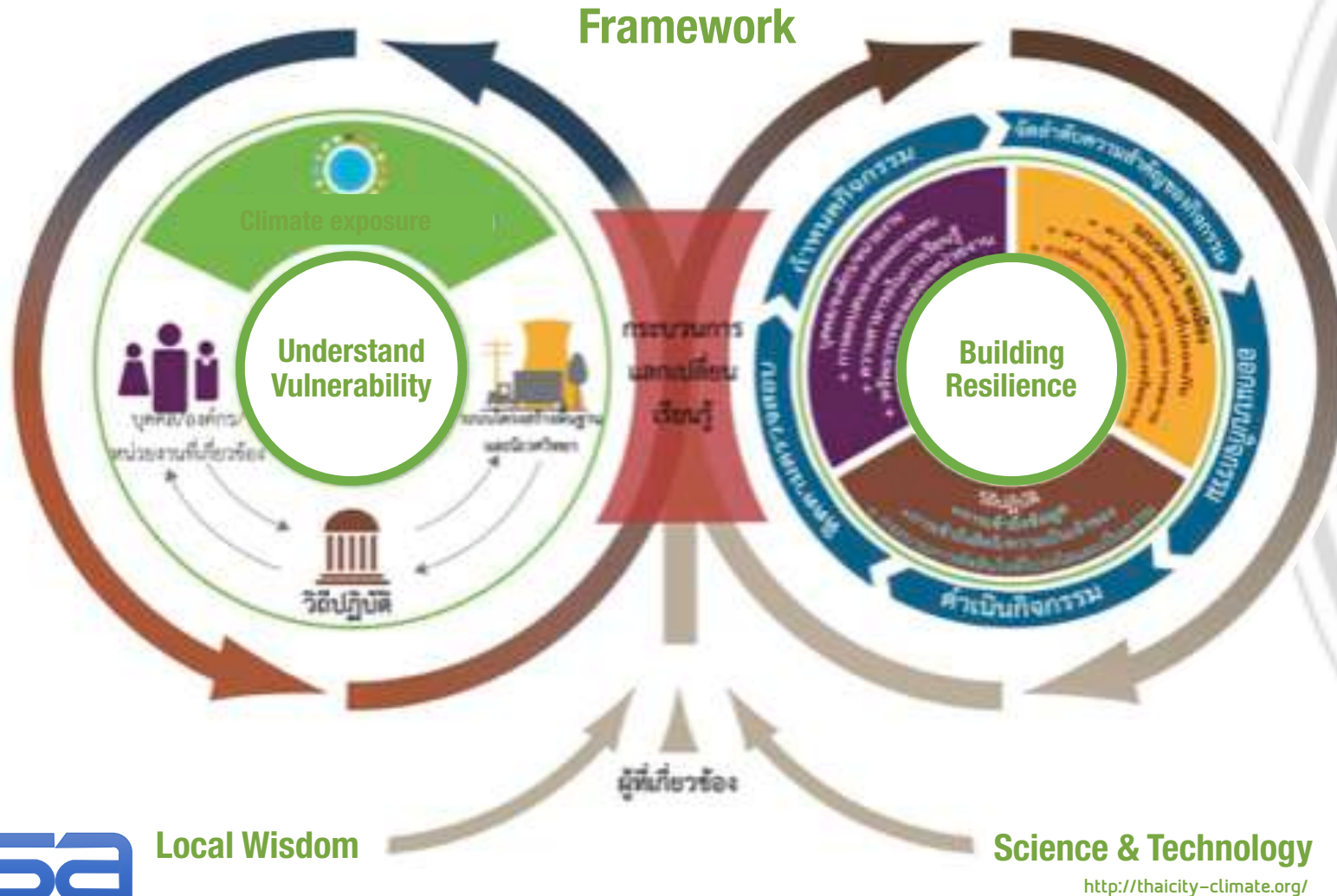
Bangkok Resilient City: 3 Strategic Pillars

Bangkok Strategic Plan Objectives

100 Resilient Cities–Pioneered by the Rockefeller Foundation (100RC)



Thai Environment Institute: Urban Climate Resilience in Southeast Asia



Urban Climate Resilience in Southeast Asia Partnership is supported by a five-year International Partnerships for Sustainable Societies (IPaSS) grant, funded by the International Development Research Centre (IDRC) and the Social Sciences and Humanities Research Council of Canada (SSHRC).

Expected outcomes

- Advance knowledge
- Shape policy and inform practice
- Train a new generation of scholars and leaders
- Develop innovative research partnerships across the region

③ Resilient Architecture In Thailand

Coping with Flood: current development

Thai settlement in the river basin and low-lying coastal cities cope with flood in **traditional ways** by *elevating floors and traveling by boats*. When there are effects from climate changes, floods and rising sea level, as well as changes in life style in the new urban context, cities and architecture must be adapted.

In Thailand, urban areas are located in vulnerable low-lying coastal areas and river deltas, with the poor communities often either temporary flooded or waterlogged. Two-trended affordable solutions are raised according to the two flood types: **adaptive house and amphibious house**

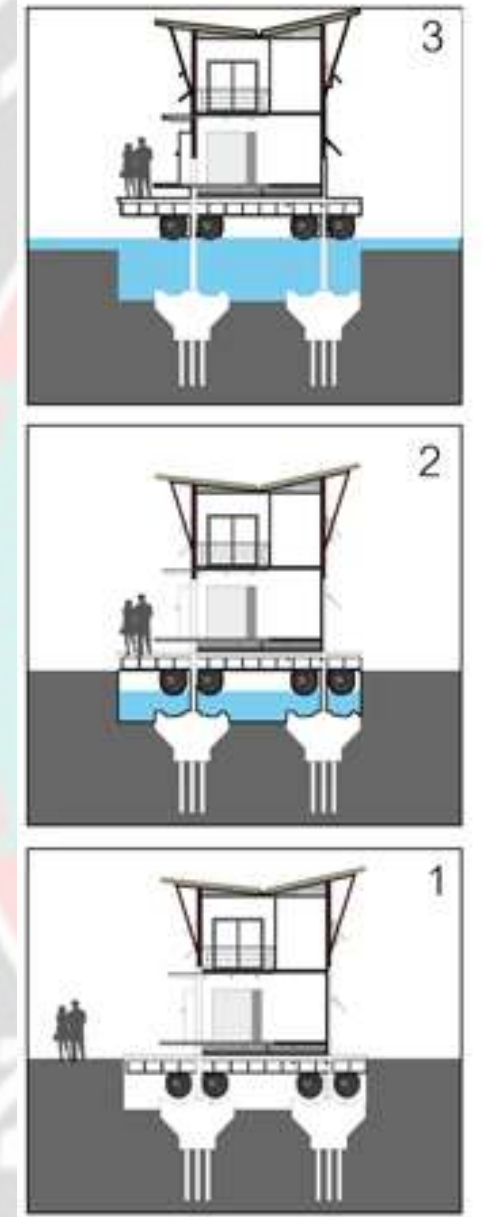
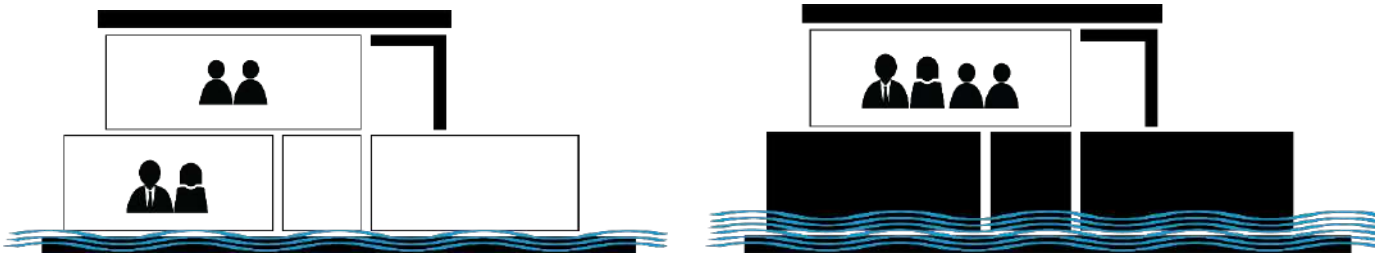
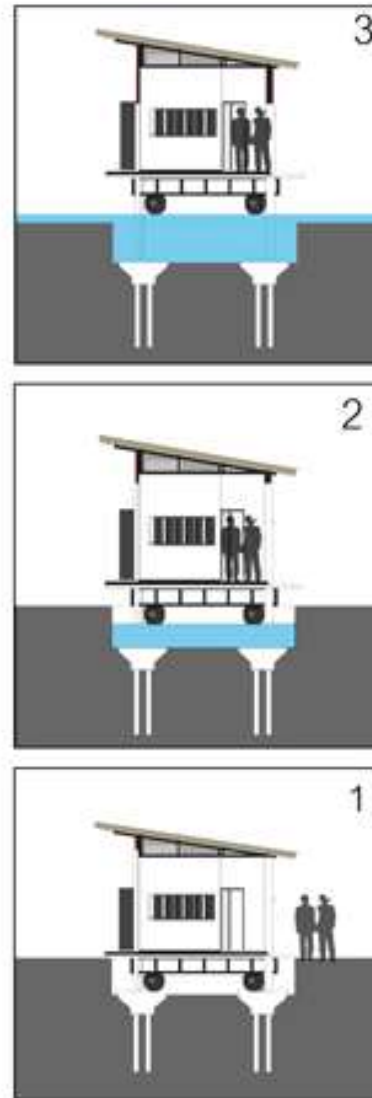


Image: Site-Specific

Amphibious House

The house is located at Baan Eua Athorn Rojana, Ayuthaya. It was completed and tested in 2013 by Building Technology Research and Development Division, National Housing Authority (NHA), designed by Site Specific.



The house rose 85 cm (2.8 feet) as the large dugout space under the house was filled with water.

- Usable area 68.50 m²
 - 1st Floor: Living–dining area, kitchen, wc
 - 2nd Floor: 2 br and wc
 - Outdoormulti–purpose around 60 m²
- Construction time: 8 months
- Budget: 2 Million Baht or 15,500 B/m²
- Construction technology: combination of prefabrication and on–site construction
- Target group: low income people that require more than 100 m² that can withstand or be adapted to flood
- Structure: amphibian system with pontoon

Resilient Architecture – Amphibious House



Image: Site-Specific

Adaptive House: Baan Chaan



Given Thailand's hot and humid climate zone, **traditional vernacular architecture** effectively uses passive design to achieve comfortable living conditions. With recent flood disasters, new urban and architectural design for self-sufficient living has been used as a design inspiration for Baan Chaan.

Passive Design Strategy

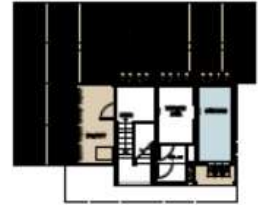
Baan Chaan is designed to maximize natural contexts and environmental aspects such as water, sun, wind, light, and visual connections.

Passive design strategies include orientation and zoning, architectural form, adapted openings, shading design, and an optimized PU-insulated wall thickness of 10cm for airtightness.

Besides energy reduction, waste water is also minimized with rain water collection and waste water treatment.

Architectural Concepts

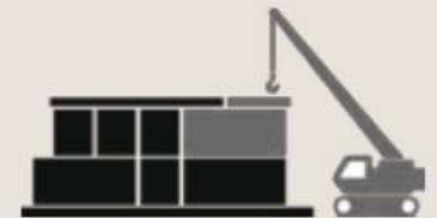
The KMUTT prototype house or “Baan Chaan” (My house / Terrace House) is designed and re-configured from traditional Thai vernacular architecture. The terrace, as a main house element, increases the awareness of nature and reduces energy loads for active design systems commonly practiced today. On occasions that climate conditions exceed the tolerable heat and humidity levels that natural ventilation alone cannot cope, air conditioner will be used as a supplement.



Concept

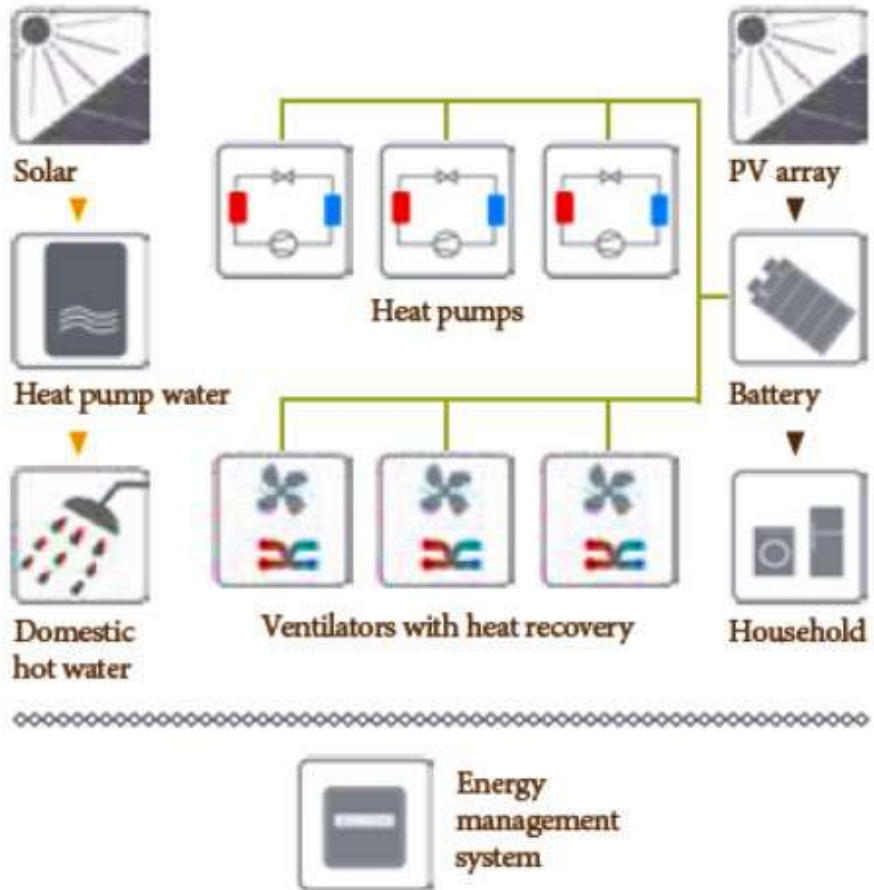
Baan Chaan house was designed to be a net-positive energy house in a tropical hot and humid climate.

The house aims to provide the inhabitants with good living comfort and to ascertain simultaneously the optimal energy balance that can be achieved. Following figures show the configuration and floor plans of the house.

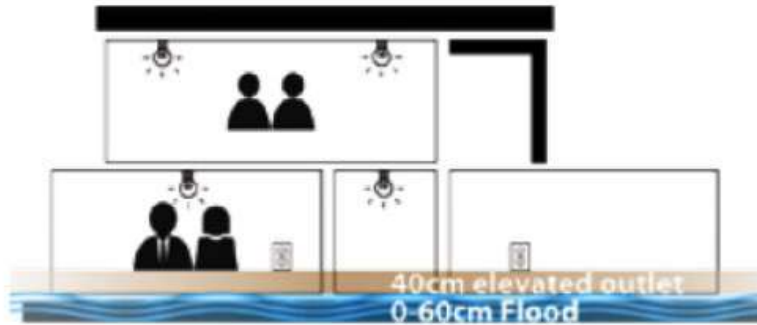


Baan Chaan's structure uses modular container-sized units, providing varied outcomes and sizings of Baan Chaan. The prototype designed for the competition is one of many possible configurations.

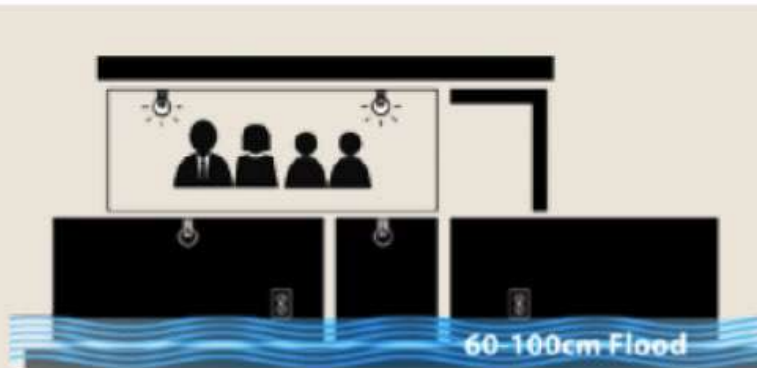
Adaptive House: Baan Chaan



• A schematic diagram of the technical energy concept of the house



• At 60 cm flood level, the house can still operate with a raised ground floor of 60 cm



• At 100cm flood level, users have to evacuate to the second floor with provided electricity and sanitary.

Design for Flood

The house can withstand flooding up to 60 cm high due to the lifted platform design. Once the flood reaches a height of 100 cm, electricity on the ground floor will be cut off for safety. In this worse case scenario, the second floor is still operable as an evacuation space with electricity and water. Interior and exterior materials were selected for ease in maintenance and reusability.

COPING WITH EARTHQUAKE BAMBOO TEMPORARY SHELTER PROTOTYPE

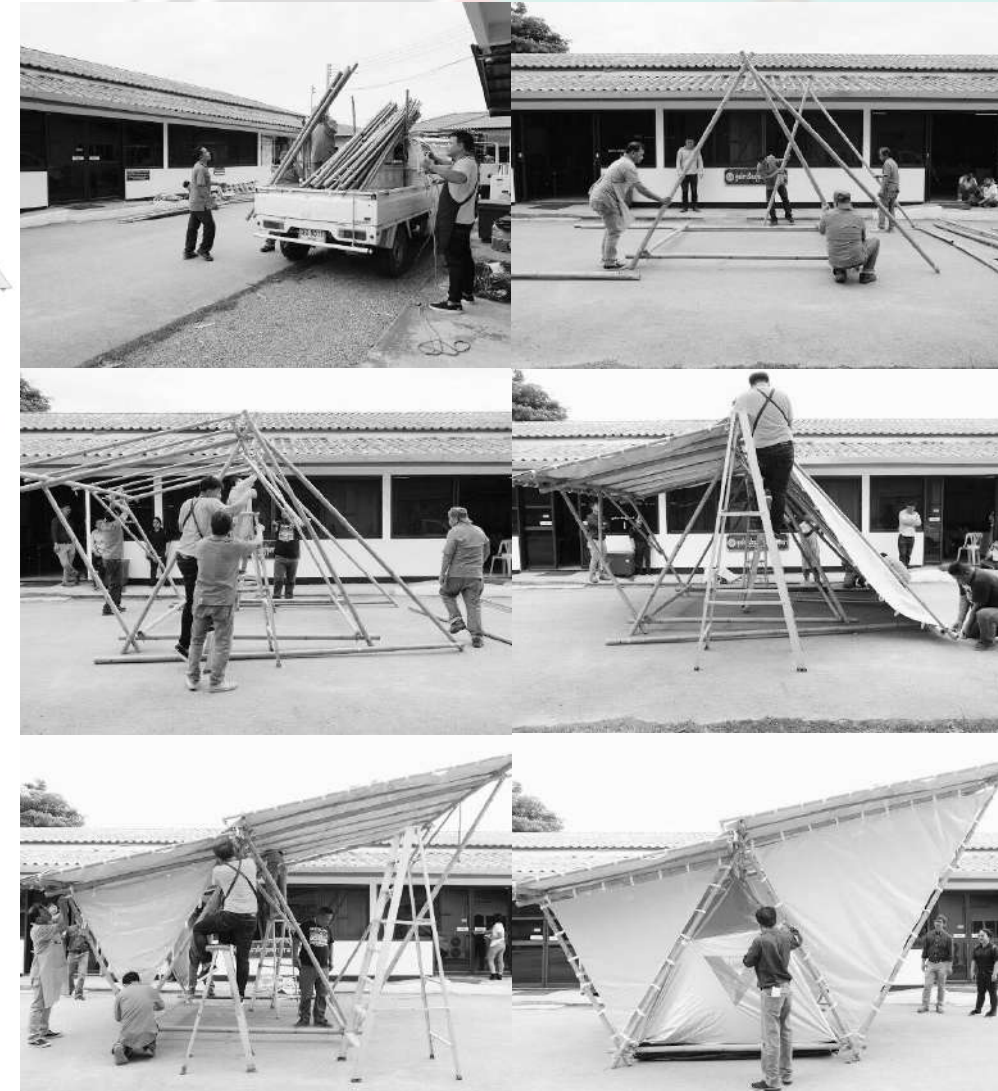
Each unit of the bamboo temporary shelter prototype could be assembled by steps as follows.



Roof Structure



Cover with canvas as a roof





Resilient Architecture –

ASA EMERGENCY SHELTERS

CONSTRUCTION DRAWINGS FOR FREE

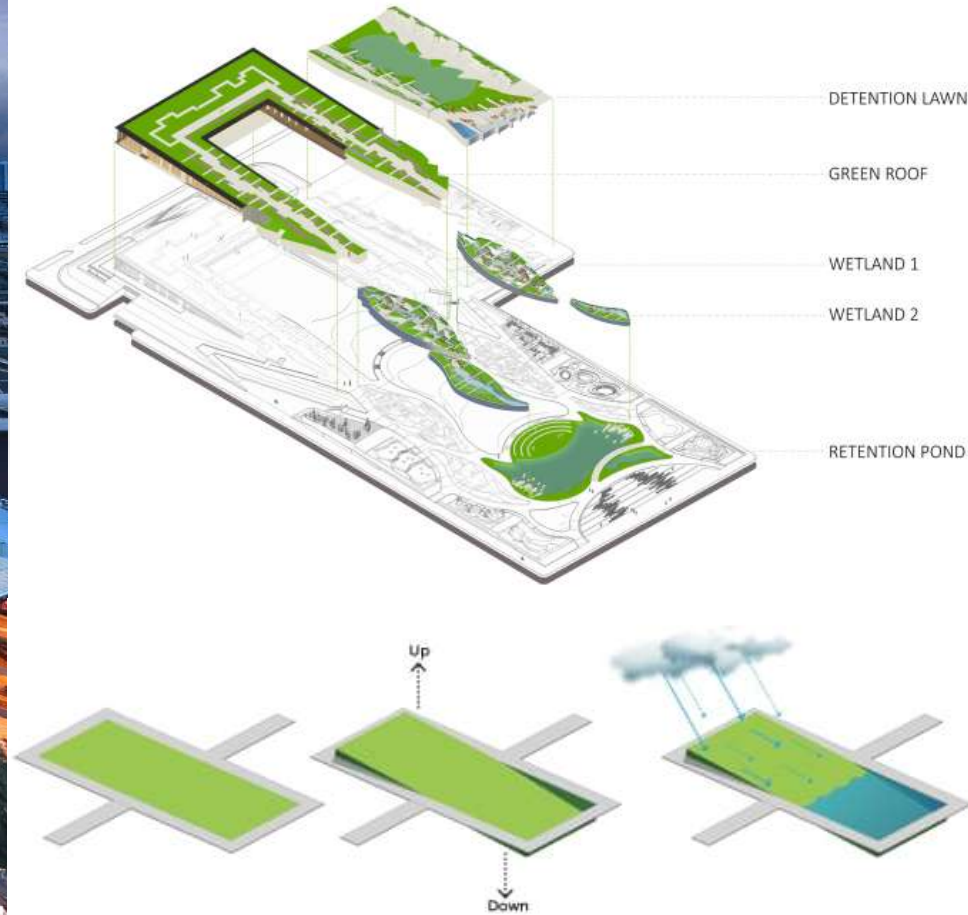


Resilient Architecture –

Chulalongkorn University Centenary Park

ASA Architectural Design Silver Award 2018

Park to perform as retention pond for 100-year flood with capacity of up-to 4 hours water retention.



Thank you