Designing National Housing Programmes: Risks and Opportunities for the Environment

June 5-8 2017 – WSBE17, Hong Kong
% Population Urban: China and India, 1989-2015

- China
- India

- 1989: 25.5%
- 1990: 26.4%
- 2015: 55.6%
- 2014: 32.7%
Housing Needs and Challenges

Urban Population (Total)

- 2011 Census: 377m
- 2017: 403m
- 2021: 433m
- 2041 (tentative): 700m
Economically Weaker Sections - Government-led (small-scale) Gov-mandated - Cooperatives - Private-sector-led targeting EWS/LIG

'Low-Income Groups'

Private sector-led

Government-led (small-scale)

Gov Defined Annual HH Income

> US$ 9,350

US$ 4,700–US$ 9,350

< US$ 4,700

Gov Defined Size of DU

600–1,200 sq ft

300 – 600 sq ft

<300 sq ft

Income Segment

Housing Segment

Urban Housing Shortage (DUs) (2012 estimates)

6.15 million (39.44%)

10.55 million (56.18%)

1.85 million (11.41%)

Market Housing

Social Housing

Urban Housing Shortage (DUs) (2012 estimates)

6.15 million (39.44%)

10.55 million (56.18%)

1.85 million (11.41%)
Housing Needs and Challenges

Pradhan Mantri Awas Yojana
Housing for All by 2022

• Launched in 2015 with goal of building 20 million units by 2022:

✓ Be code compliant
✓ Affordable
✓ Suitable to different geo-climatic and hazard conditions
✓ Typologies from single storey to multi-storey, both developer led, government led or ‘assisted self-help’ delivery
✓ Give “due consideration” to the environmental and energy concerns of the building industry
1) What are the existing construction technologies available for low-cost housing at such large scale?

2) Are these technologies the most suitable for the task?

3) If not, what could be possible alternatives?

4) What might be their environmental impact?
Points to Consider

1) Depletion of raw materials

2) Conventional construction often associated with air pollution and adverse health effects

3) Massive construction in a short time requiring *speed* and *quality*

4) Life-cycle impacts must be assessed before policy decisions are made
Housing Needs and Challenges

Strong Government Focus

Prefabricated Housing
A First Life-Cycle Energy Assessment

Melbourne School of Design

‘EnergyMetric’

Dr Andre Stephan


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Housing Needs and Challenges

EnergyMetric Model

G+3 apt block, 320m²
GFA, 50 year lifespan

Life-Cycle Energy Requirements (GJ)

- Brick: LCEE (GJ) = 6,988, LCOPE (GJ) = 12,414
- EPS panel: LCEE (GJ) = 7,784, LCOPE (GJ) = 9,843
- Hollow core concrete: LCEE (GJ) = 7,054, LCOPE (GJ) = 11,917
- Precast concrete (outer), timber-framed + plasterboard (inner): LCEE (GJ) = 7,416, LCOPE (GJ) = 17,989

- Precast concrete (outer), timber-framed + plasterboard (inner): LCEE (GJ) = 7,416, LCOPE (GJ) = 17,989
EnergyMetric Model

CO2-eq for 10 mio 40sqm units (uncertainty not given)

- Embodied to CO2eq: 60 kgCO2eq/GJ
- Operational to CO2eq: dep. on energy vector used (e.g. gas for heating, electr. for appliances)

Life-Cycle GHG Emissions (GtCO2-e)

Brick | EPS panel | Hollow core concrete | Precast concrete (outer), timber-framed + plasterboard (inner)
---|---|---|---
2.56 | 2.26 | 2.52 | 2.34
2.03 | 1.67 | 1.99 | 1.78
0.52 | 0.58 | 0.53 | 0.56
Housing Needs and Challenges

How much is 0.3 GtCO2-e?

Life-Cycle GHG Emissions (GtCO2-e)

- Brick: 2.03
- EPS panel: 1.67
- Hollow core concrete: 1.99
- Precast concrete (outer), timber-framed + plasterboard (inner): 1.78

LCEEGHG | LCOPGHG
India’s Total Emissions in 2010:

2.136 GtCO2-e

(Source: 2016 Biennual Update Report to UNFCCC)

0.3 GtCO2-e is thus equivalent to shutting down the Indian economy for 51 days.
BUT ...

- Embodied energy data for India non-existent for many technologies and not ISO-compliant, where it is available.
- Localized carbon conversion factors for products similarly unknown.
- Other non-environmental trade-offs such as design flexibility, impact on low-skilled labour requirements or cultural acceptance need to also be assessed and made accessible.
- Significant policy decisions are made in an extremely information poor environment.
LOOKING BACK...
18 years ago...

“The first step would be to establish the current state of affairs in developing countries (on a country-by-country basis) in respect of the impact of the built environment, the broad construction process, the capacity of the construction industry (including the built environment professionals), and the life-cycle properties of existing technologies used in these countries.”

1999 Agenda 21 on Sustainable Construction
“Promote the free exchange of information on the entire range of the environmental health aspects of construction, including the development and dissemination of databases on the adverse environmental effects of building materials, through the collaborative efforts of the private and public sectors.”

- 1996 Habitat Agenda, Section 4.2.1
Virtual EGM to develop metadata for SDG Indicator 11.c.1

“Proportion of financial support to the least developed countries that is allocated to the construction and retrofitting of sustainable, resilient and resource efficient buildings utilizing local materials.”

**WHEN** June 16th, 10am-12.30pm GMT

**WHERE** Connection details via Eventbrite event

“Virtual Expert Group Meeting on SDG Indicator 11.c.1”
Thank You

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