Designing National Housing Programmes: Risks and Opportunities for the Environment

June 5-8 2017 – WSBE17, Hong Kong

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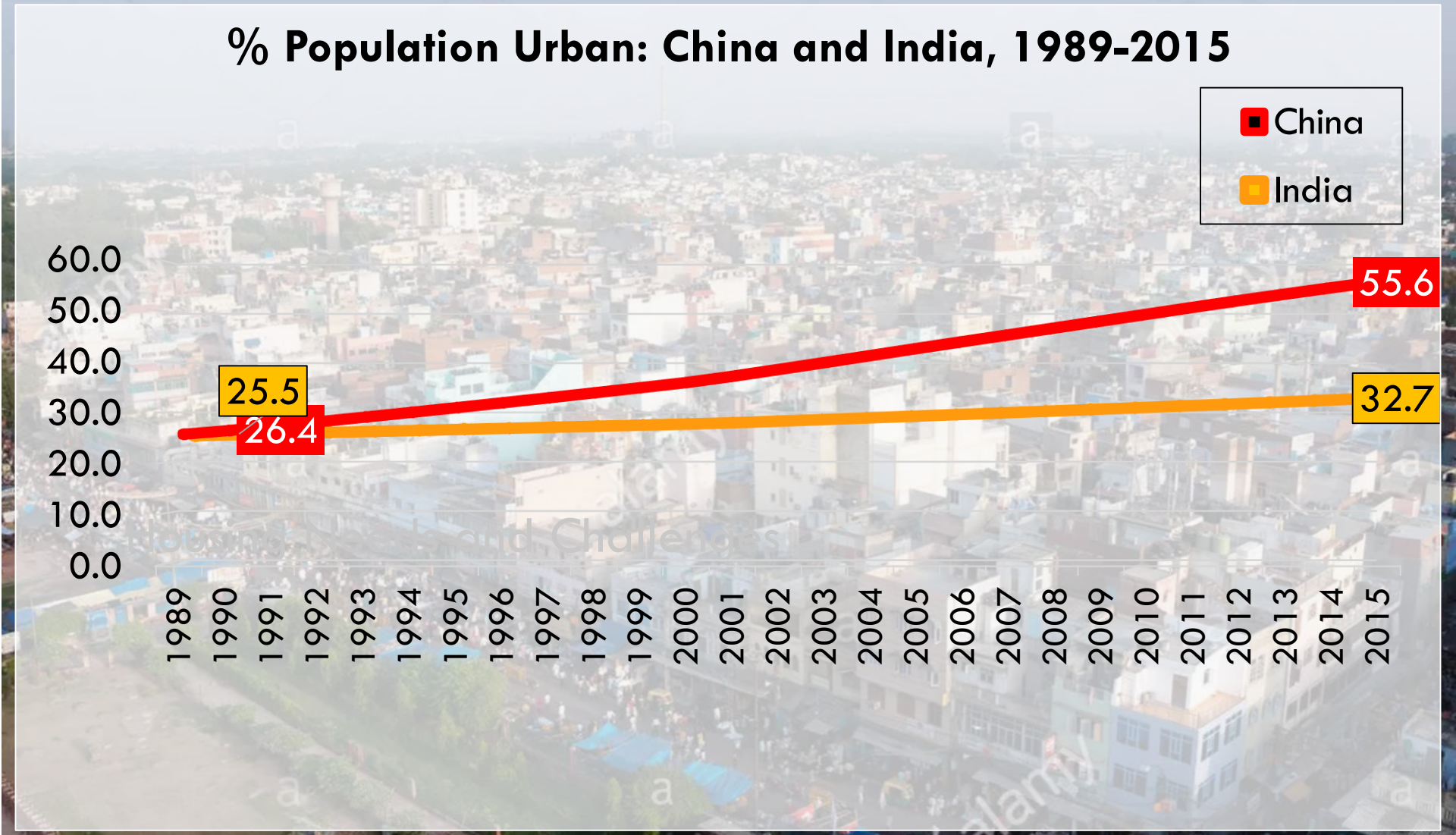
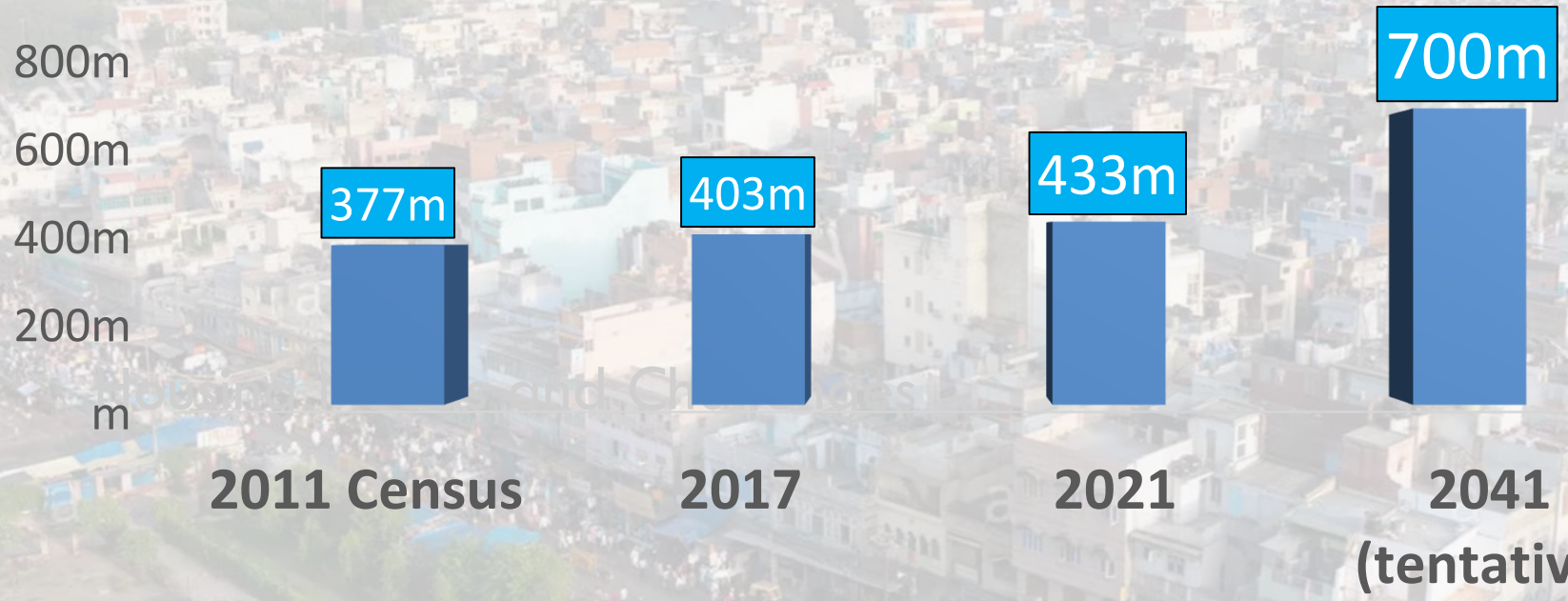
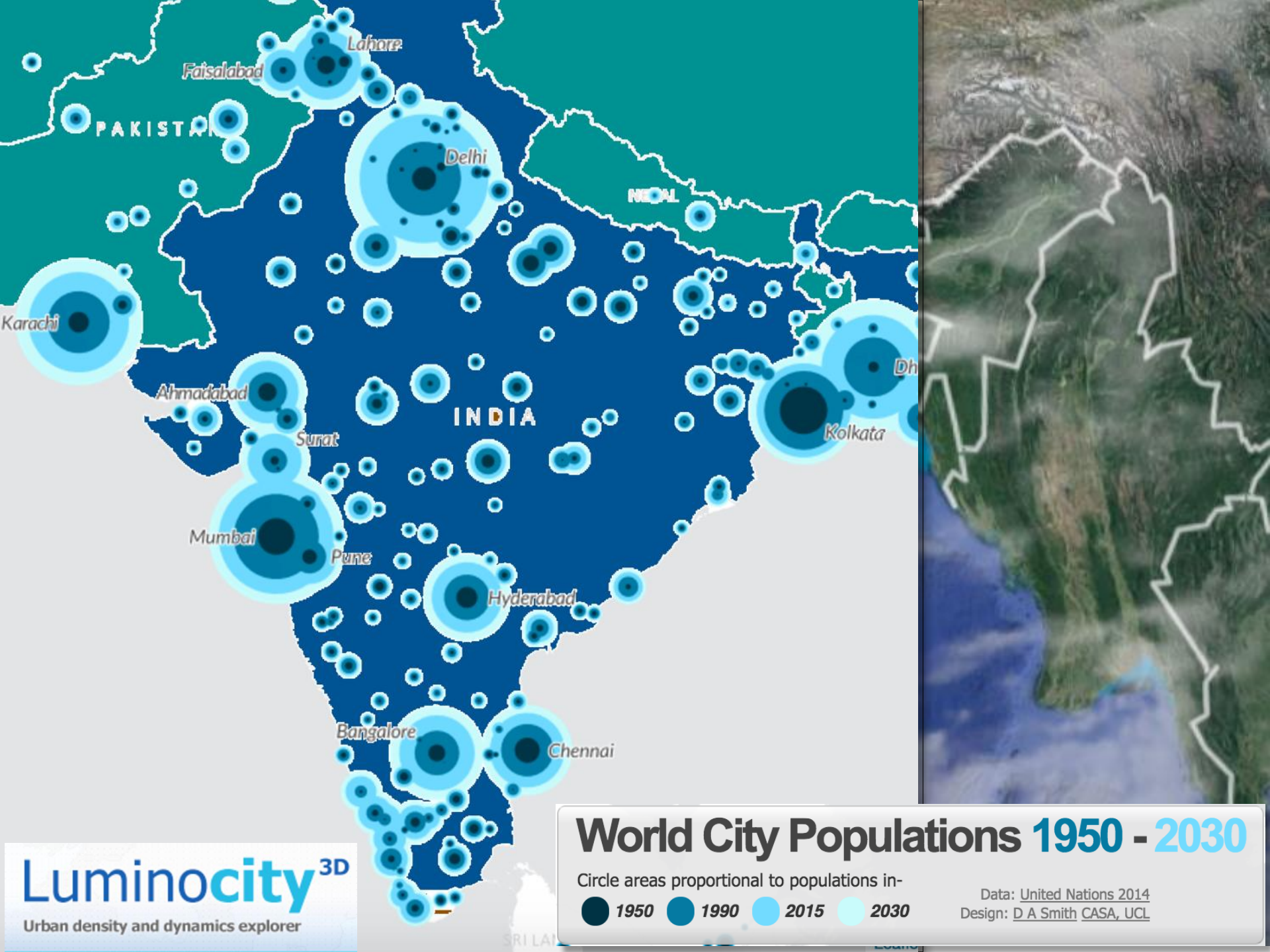
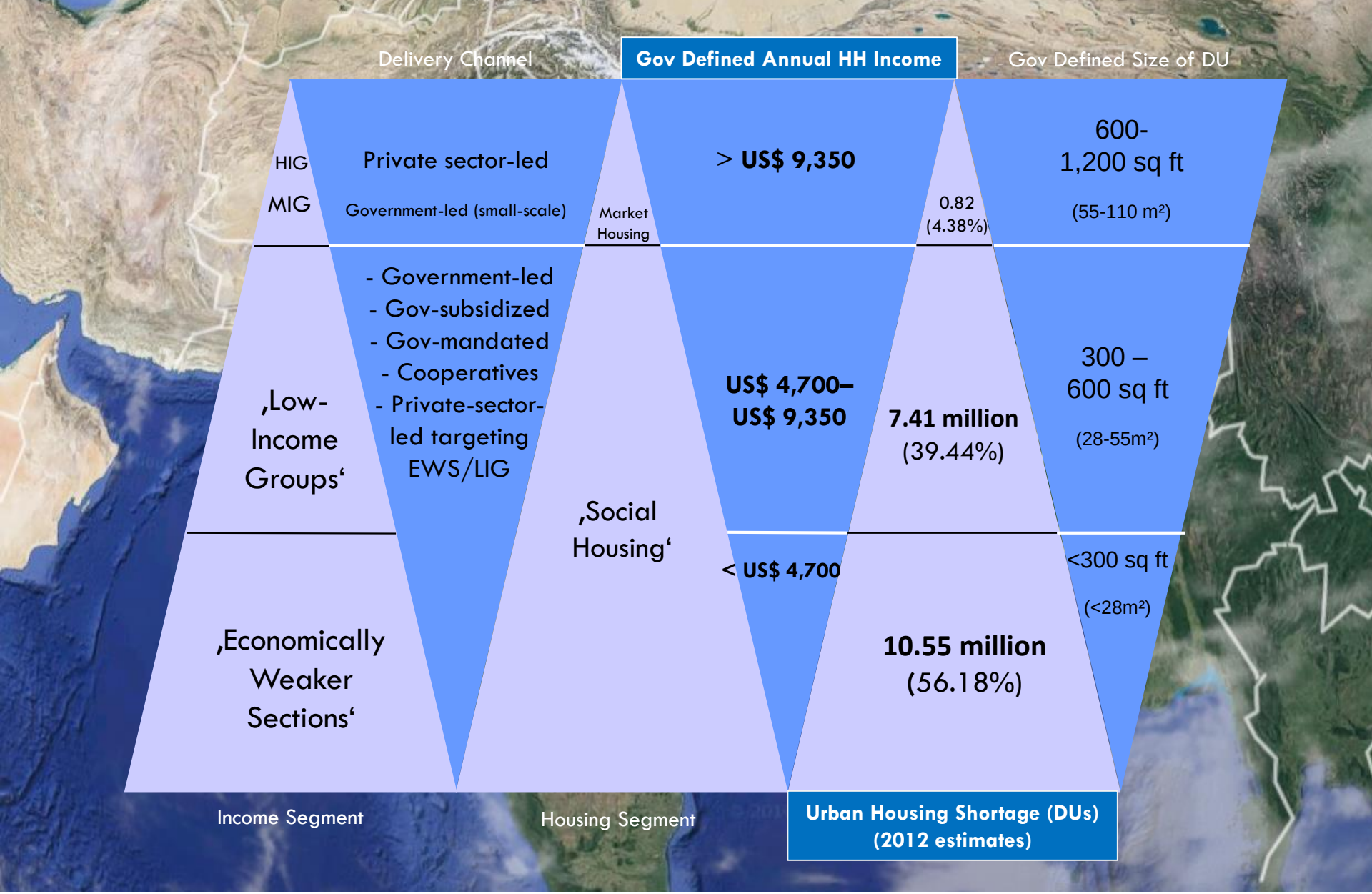
% Population Urban: China and India, 1989-2015



Urban Population (Total)




Lahore
Faisalabad
PAKISTAN
Delhi
NEPAL
Karachi
Ahmadabad
INDIA
Surat
Kolkata
Mumbai
Pune
Hyderabad
Bangalore
Chennai
Luminocity 3D
Urban density and dynamics explorer
World City Populations 1950 - 2030
Circle areas proportional to populations in-
1950
1990
2015
2030
Data: United Nations 2014
Design: D A Smith CASA, UCL



Development Alternatives

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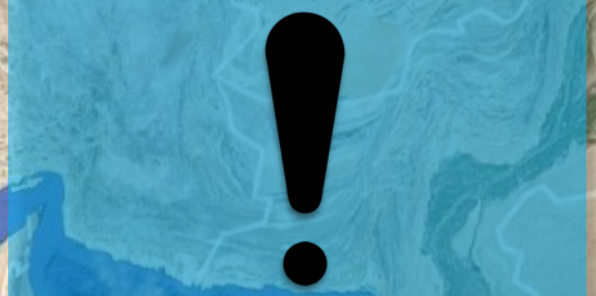
OXFORD BROOKES UNIVERSITY



Pradhan Mantri Awas Yojana

*H*ousing 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

How?

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

Prefabricated Housing

Strong Government Focus

A First Life-Cycle Energy Assessment

Melbourne School of Design

‘EnergyMetric’

Dr Andre Stephan

THE UNIVERSITY OF MELBOURNE

msd Melbourne School of Design

FACULTY OF ARCHITECTURE, BUILDING AND PLANNING

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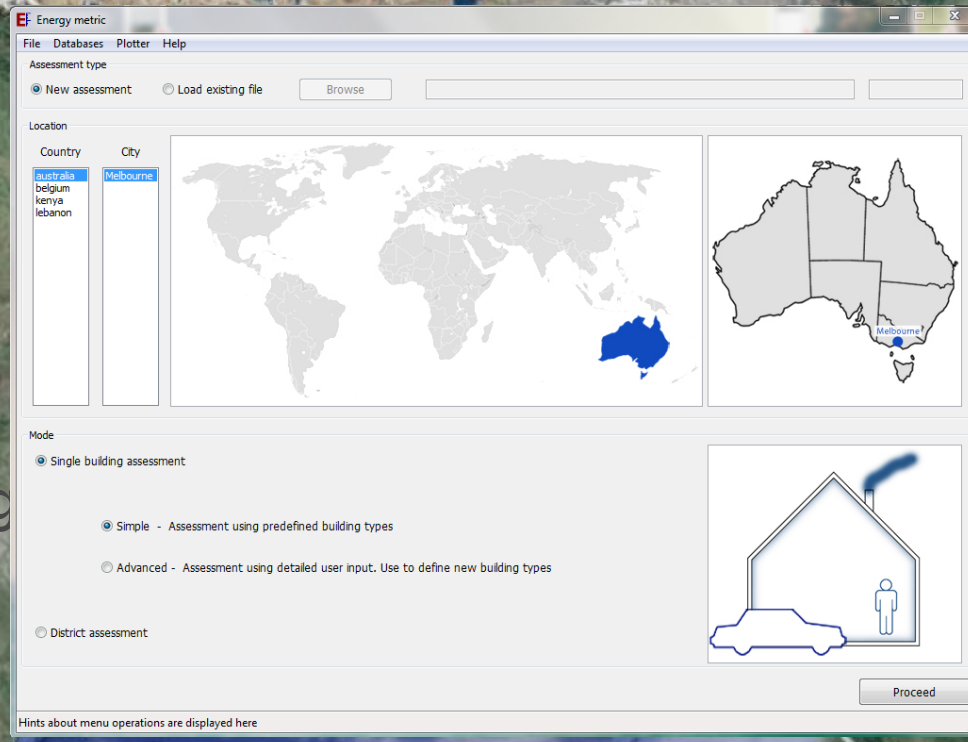

Stephan, A., Crawford, R.H. and de Myttenaere, K. (2012) Towards a comprehensive life cycle energy analysis framework for residential buildings. Energy and Buildings 55 (0):592-600.

Stephan, A. and Crawford, R.H. (2014) ‘A multi-scale life-cycle energy and greenhouse-gas emissions analysis model for residential buildings’. *Architectural Science Review* 57 (1):39-48.

A First Life-Cycle Energy Assessment

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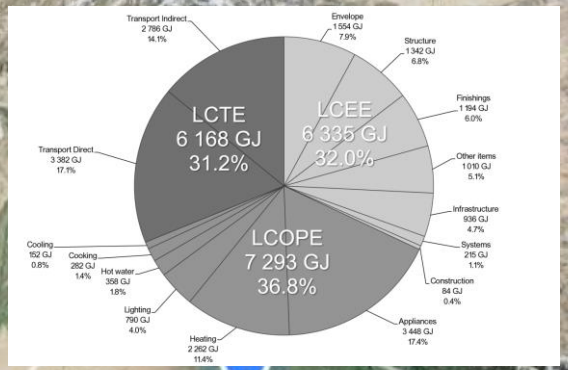

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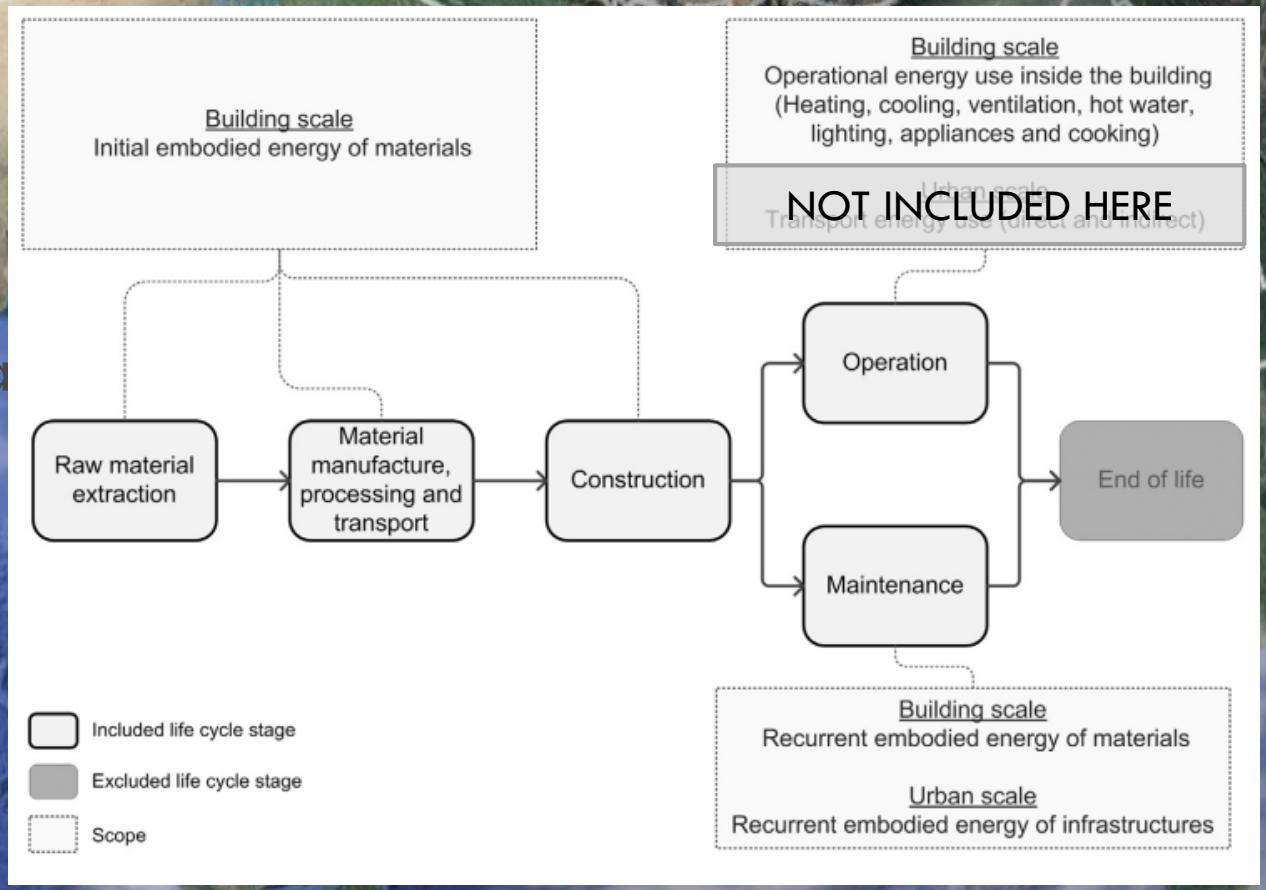
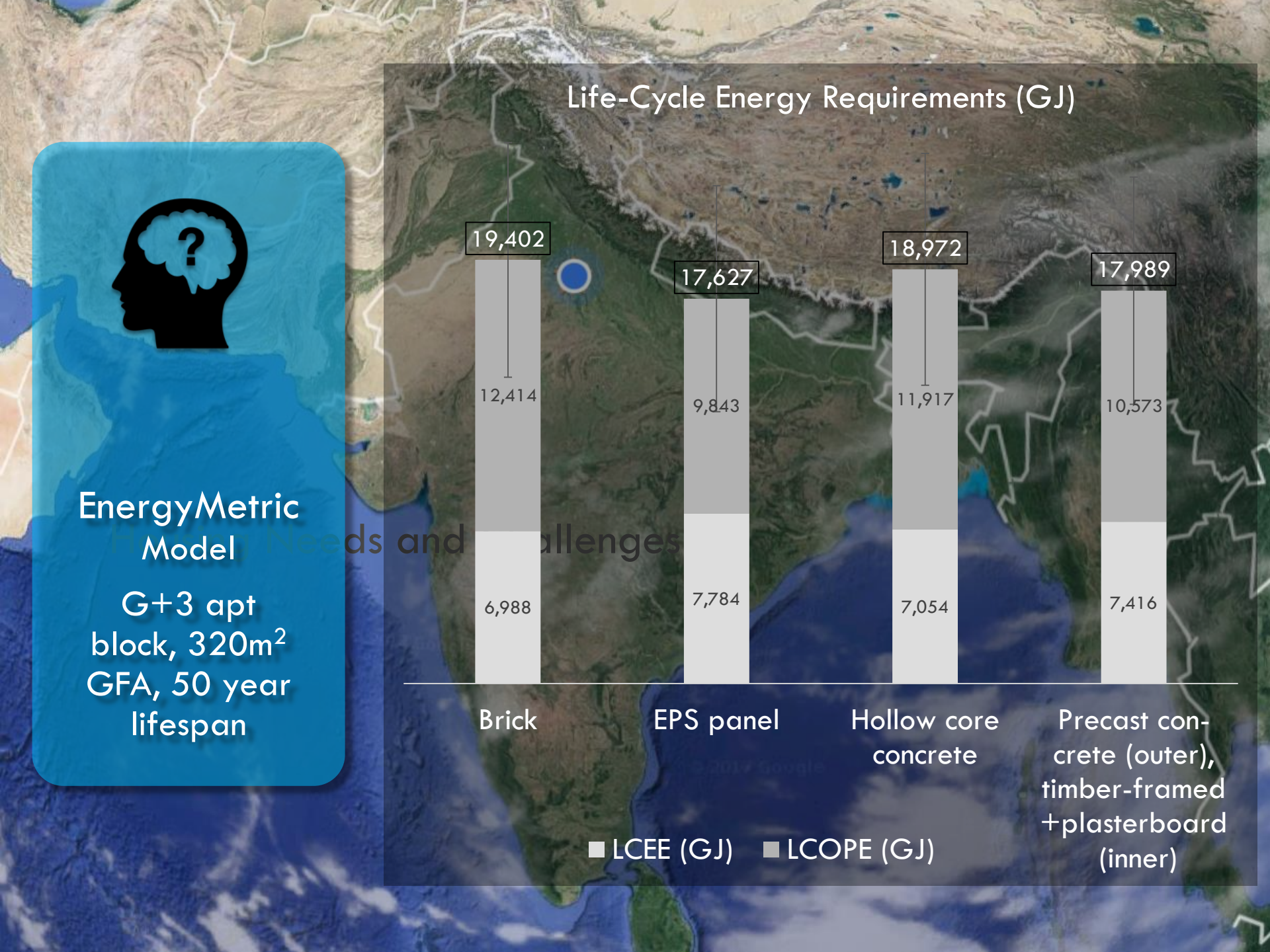




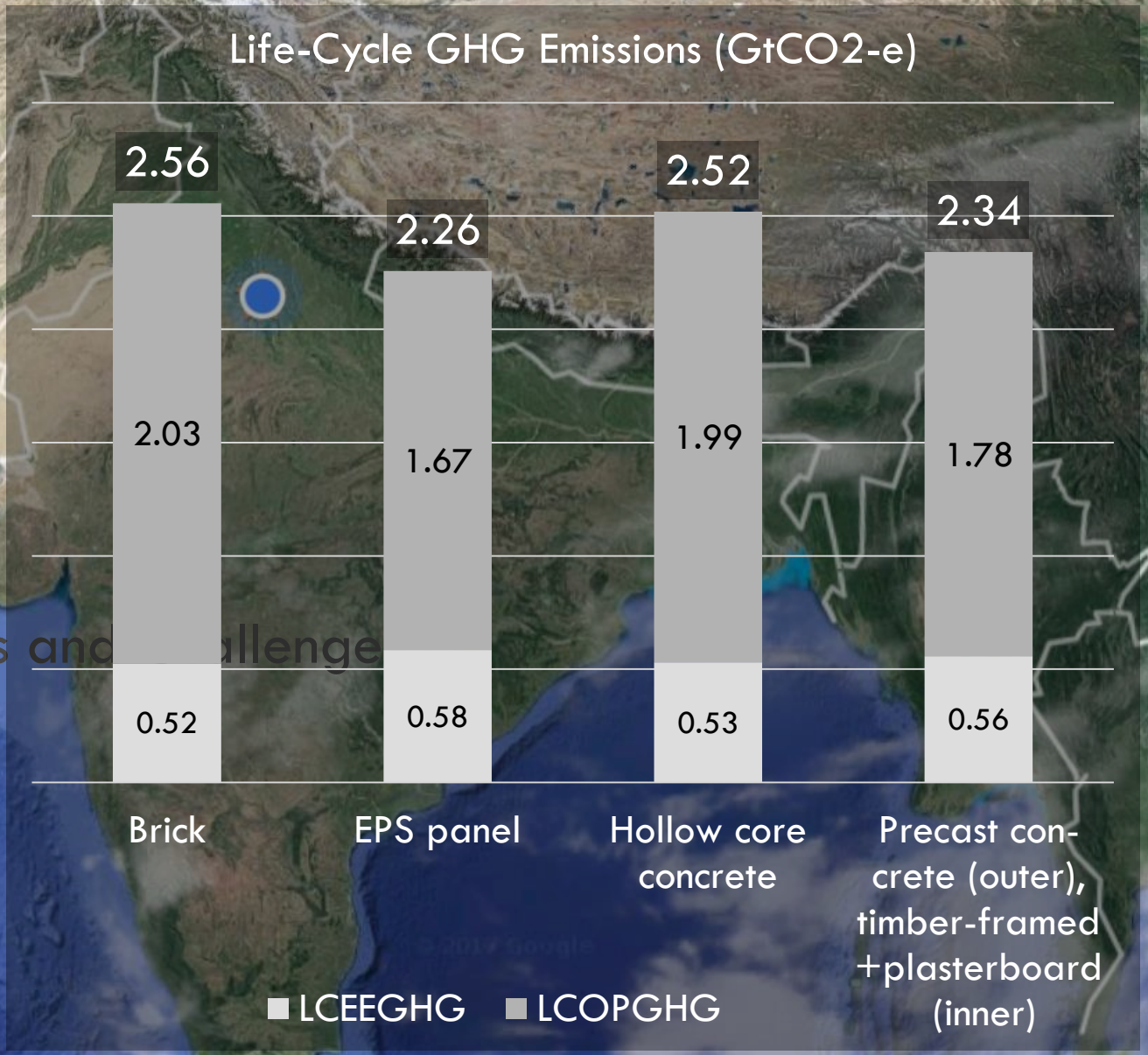
EnergyMetric Model

G+3 apt block, 320m^2 GFA, 50 year lifespan

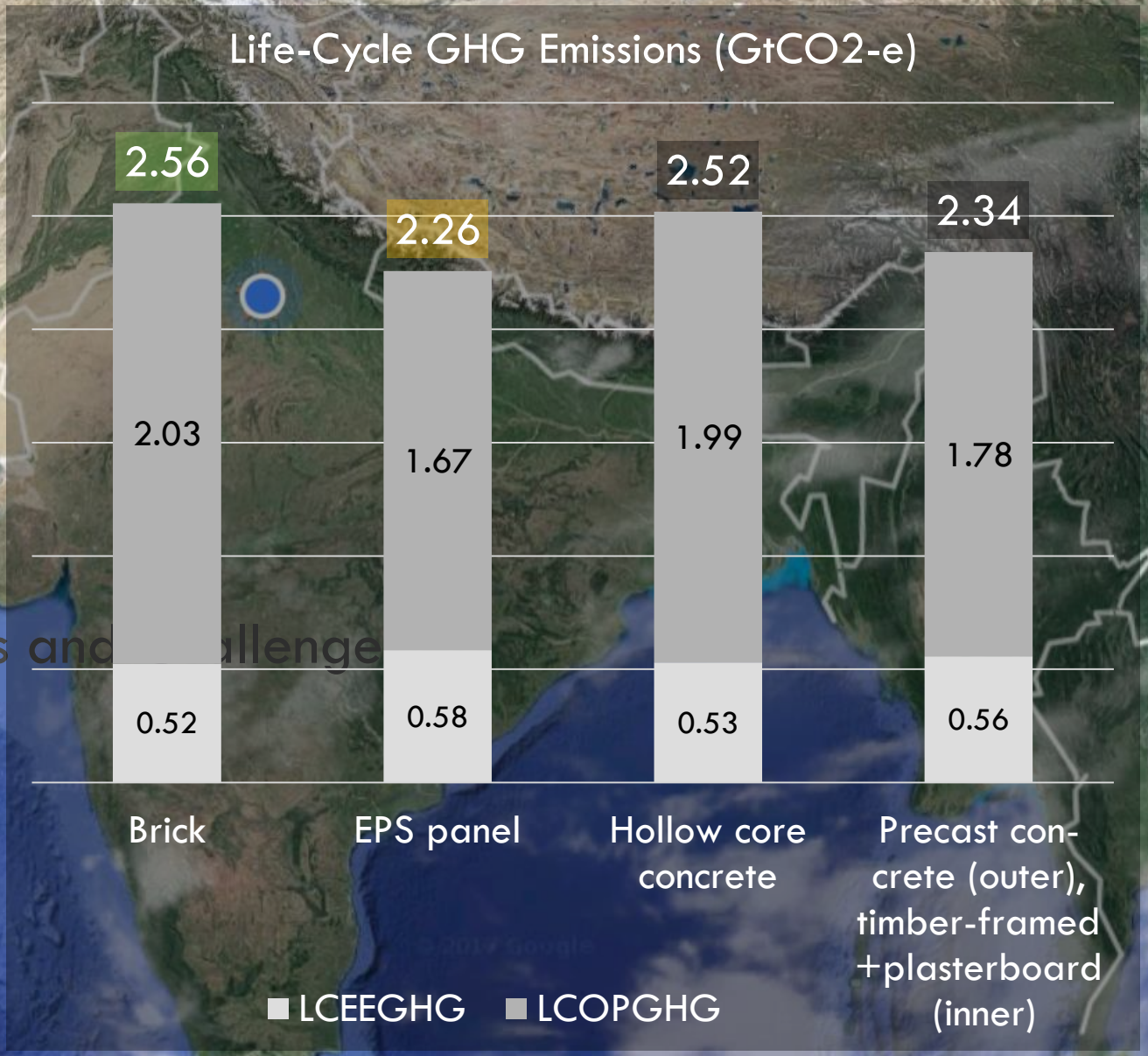
EnergyMetric Model

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)



How much is
0.3 GtCO2-e?



How much is
0.3 GtCO2-e?

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

21 years ago…

"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

Next week…

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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