Potential assessment of Building Integrated Photovoltaics in India

Integrated Photovoltaic Conference

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Background

- Significant building stock yet to be built in India
- Total residential space projected to rise from 20 billion m^2 to 50 billion m^2 in next 2 decades

- 500 GW RE by 2030 & 1500 GW RE by 2047
- Land availability constraints – looking beyond rooftop for urban DRE
- Focus on sustainability in the built environment

The problem

- Estimate BIPV potential for all urban areas in India without detailed 3D data for these areas.

- CSTEP using hi-res drone/satellite imagery for rooftop solar in 120 cities

Available information

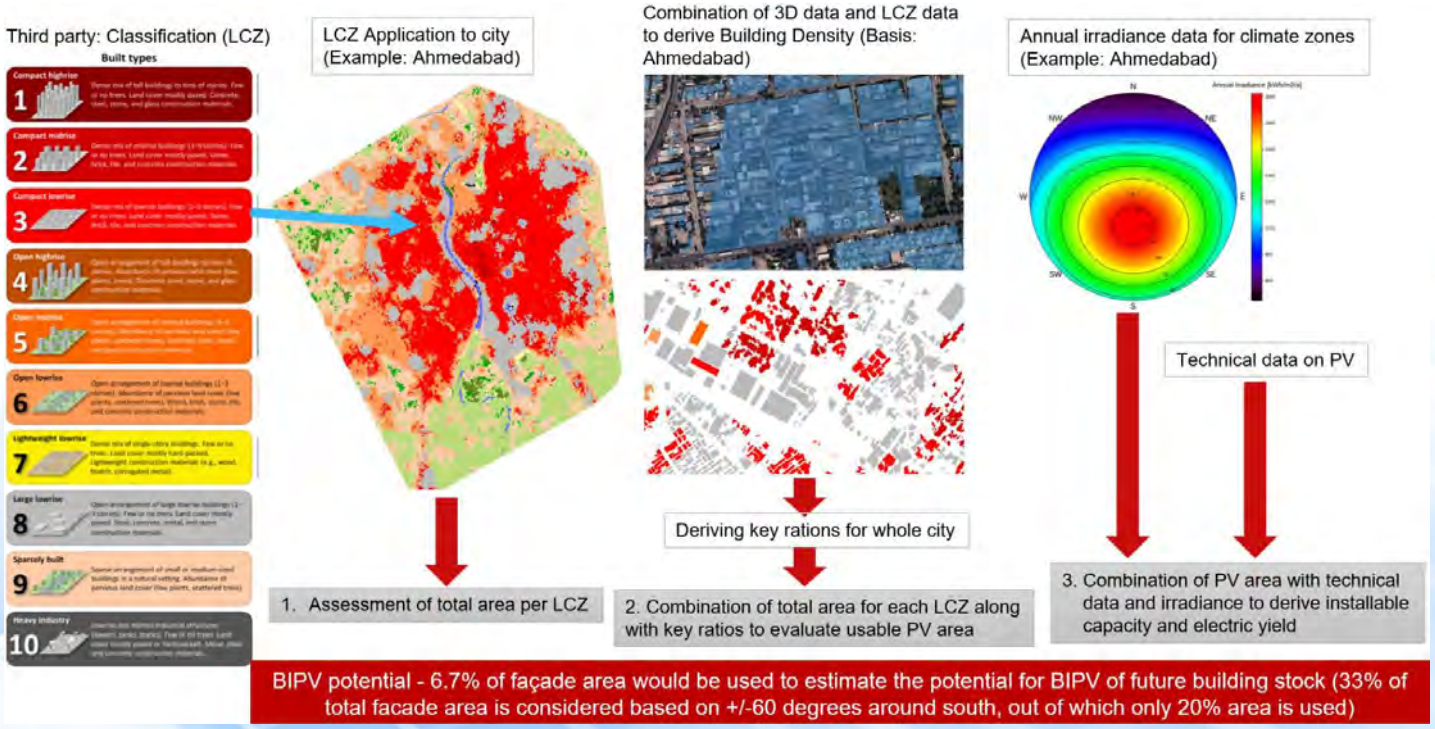
- 3D data is available for the city of Ahmedabad (LOD1*).
- Phenotypes of city districts, called Local Climate Zones (LCZ**), have been mapped for Indian cities.

***LOD1 data**, used in urban planning and 3D city modelling, represents buildings with simplified geometric shapes, typically using block-like representations.

****Local Climate Zones (LCZ)**, a concept from urban meteorology, categorizes urban areas into zones based on their climatic and environmental characteristics, such as building density, land use, and vegetation cover.

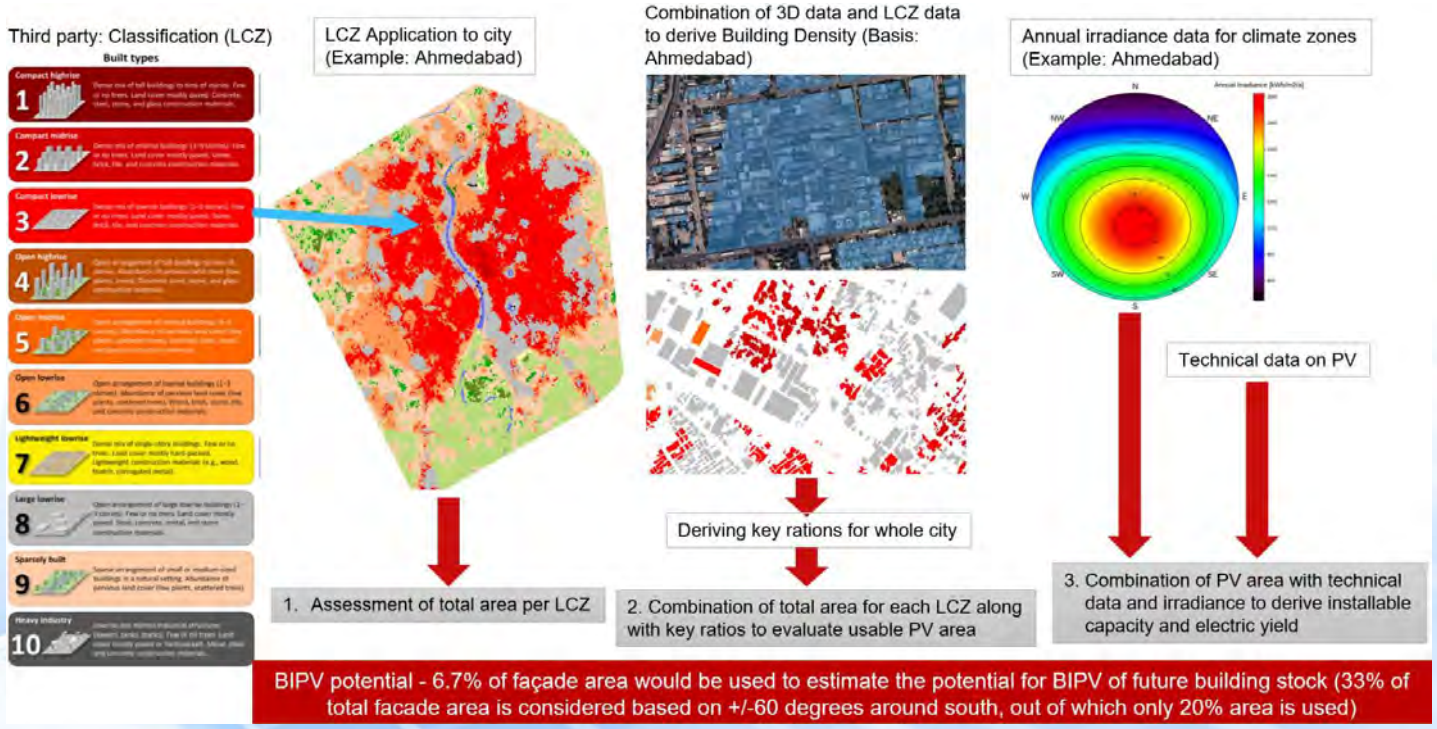
The method

- The method assumes a subdivision of the main cities of India in a few LCZ.
- LCZ are characterized by morphological parameters that can be obtained once from 3D data from Ahmedabad.
- A PV potential assessment can be carried out for each archetype.
- The results can then be extrapolated at country level.



Potential calculation

- For Ahmedabad, calculate the annual irradiance for different façade orientations.
- For a typical PV system, calculate the annual energy yield (assuming 20% module efficiency and 85% performance ratio).



Results

- The potential BIPV capacity for Ahmedabad is estimated at 16 GWp.
- Considering shading effects, the annual electricity yield is is estimated 11 TWh/a.
- Based on the LCZ approach, the calculation is extrapolated to other cities across India, leading to an estimated BIPV potential of 309 GW in India.

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Thank you!

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