

Vishwanathan S.S., Fragkos, P., Fragkiadakis, K., Paroussos, L. and Garg, A. (2018). Energy system transitions and macro-economic assessment of Indian building sector. *Building Research & Information*.

SUPPLEMENTAL INFORMATION

APPENDIX A

Table S1. Policy measures, model assumptions and model output for AIM/Enduse Building (Residential and Commercial)

Scenarios	BAU	Advanced NDC
Policy Measures	National Action Plan on Climate Change (NAPCC) document: NSM, NMEEE, National Sustainable Habitat Mission (NSHM), National Programme on Improved Chulhas (NPIC), National Biomass Cookstoves Initiative (NBCI)	Intended Nationally Determined Contributions (INDC) document: Adv. NSM, Adv. NMEEE, Adv. NSHM; Energy-efficient residential and commercial through Energy Conservation Building Code (ECBC); Standards and Labelling (S&L) Programme; Unnat Jyoti by Affordable LEDs for All (UJALA); Deen Dayal Upadhyaya Gram Jyot Yojana (DDUGJY); Pradhan Mantri Ujjwala Yojana (PMUY); National Smart Grids Mission (NSGM); Smart Cities Mission; the Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
Model input constraint	Lighting: Shift to CFL Cooking: Improved fuel and technically efficient stoves	Lighting: LED to save 100 TWh annually Space Cooling: Energy efficient ACs (with energy starts), inverters, ACs with cooled roofs Cooking: Improved fuel and technically efficient stoves Water heating: Gas and solar heaters Micro- smart grid: 0% in 2015, 15% in 2030
Model Output	Sectoral Final Energy Consumption – Fuel wise, Technology wise Carbon dioxide emissions	Sectoral Final Energy Consumption – Fuel wise, Technology wise Carbon dioxide emissions

Source: Adapted from Vishwanathan et al. (2018)

Appendix B: Model information

I. AIM/Enduse

Rapid urbanization and increased levels of income have created demands for an improved quality of life. The increased penetration of electrical appliances and changes to cooking fuels account for the increasing demand for commercial energy in the residential sector. With urbanization expected to affect 40% of the population in 2050, household energy demand will also increase in the future. The demand for domestic appliances has been estimated based on the number of households and data collected from the National Sample Survey Office (NSSO) survey. The energy intensity of appliances by fuel type is then used to calculate energy demand in the residential sector. For per capita floor area and household size we use extrapolation to estimate 2030 values. Table S2 presents the input parameters for service demand.

Table S2. Input parameters

Service	Technology	Parameters
Lighting	LEDs CFL Incandescent	Usage per day, days in year Number of households Average household size Penetration rate of each appliance Floor area for commercial buildings
Space Cooling	Fans ACs(Star-rated)	Usage per day, days in year Number of households Average household size Penetration rate of each appliance Usage Frequency Floor area for commercial buildings
Cooking	Biomass LPG Electric Solar	Usage per day, days in year Number of households Average household size Penetration rate of each appliance
Water Heating	Gas Solar rooftops	Usage per day, days in year Number of households Average household size Penetration rate of each appliance Usage frequency
Other	Micro- smart grids ICTs	Area Coverage in cities Usage per day, days in year Number of households Penetration rate of each appliance Usage frequency

For further information on Indian AIM/Enduse, please refer:

<https://smartnet.niua.org/content/39c27f4c-4d9e-4aaf-be6c-3c590e7da119>

or

<https://knowledge.unccd.int/publications/brics-countries-cooperate-energy-efficiency-two-reports-have-highlighted-potential>

For AIM/Enduse, latest manual including model equations will be found at:

http://www-iam.nies.go.jp/aim/data_tools/enduse_model/aim_enduse_manual.pdf

II. GEM-E3

For GEM-E3, detailed model manual, including model equations and assumptions can be found at

http://www.e3mlab.eu/e3mlab/GEM%20-%20E3%20Manual/GEM-E3_manual_2017.pdf.