Decent Living Energy: How much energy do we 'need' to provide minimum living standards to all?

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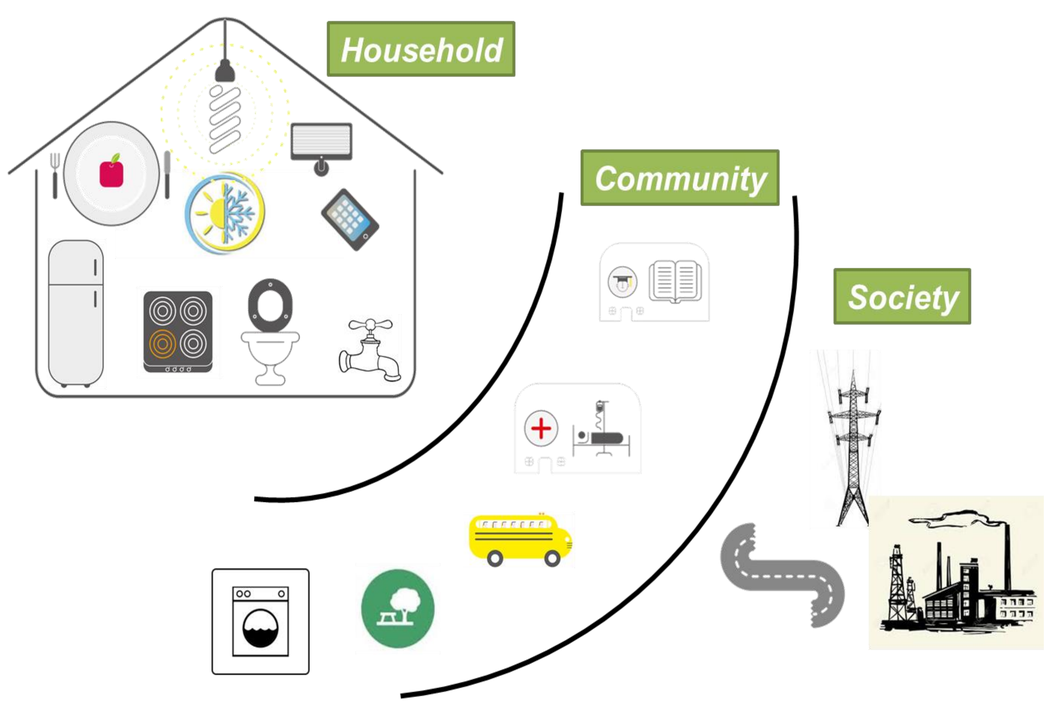
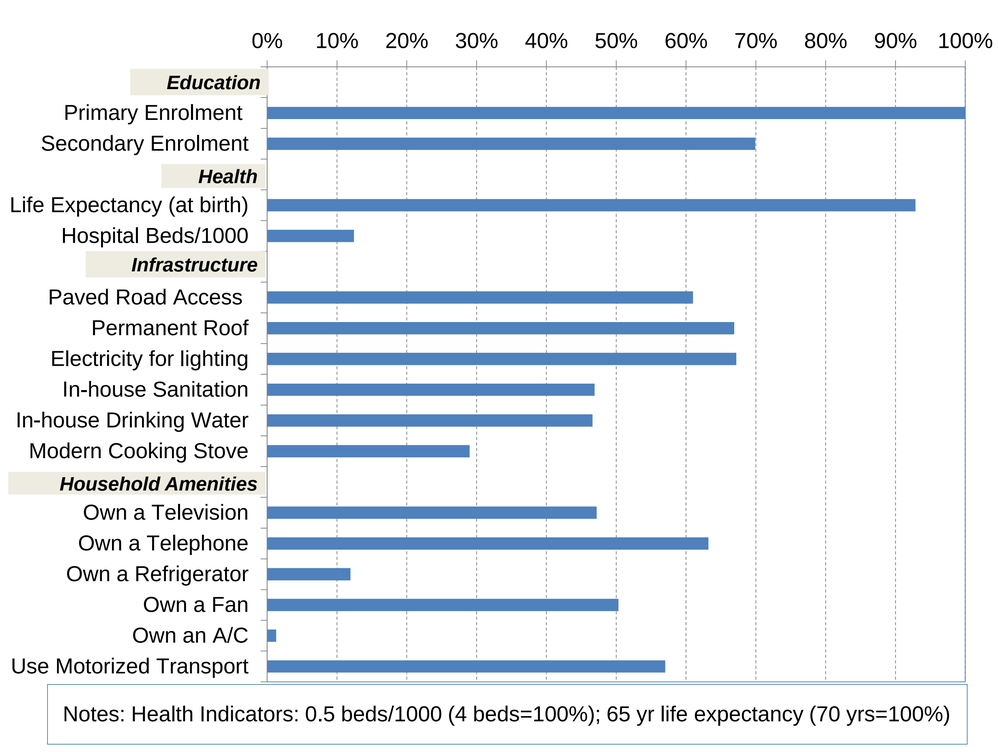
Decent Living: Material preconditions



India's Progress Towards Decent Living



Notes: Health Indicators: 0.5 beds/1000 (4 beds=100%); 65 yr life expectancy (70 yrs=100%)

Research Motivation

How much energy will ending poverty entail? Is climate stabilization at safe levels compatible with this level of energy growth?

The Sustainable Development Goals aim to achieve both goals. Yet, we understand little of what poverty eradication means, in material terms, let alone know the resource requirements for achieving such a goal. We understand energy demand as a function of macroeconomic growth, not of human development. Growing evidence of the tenuous relationship between GDP and human development suggests the need to link energy directly to human well being.

Key Principles

More expansive minimum than previous poverty indicators: current measures of human development, such the Human Development Index (income, life expectancy, literacy), or the Multidimensional Poverty Index (MPI) inadequately measure the extent of human deprivation. Based on *objective criteria* supported by literature on basic justice and *subjective criteria* that reflect global preferences, we propose a 'decent living standard', which entails material requirements at the household, community and national scale (See Figure *Decent Living: Material Preconditions).*

Universal standards, country-specific energy requirements: while the services proposed are universal, the material requirements may differ by country, due to culture (e.g., diet), climate (e.g., space conditioning), natural resource endowments (e.g., energy sources, agriculture) and other circumstances.

Energy requirements include: '*development' energy***,** the energy needed to build out the infrastructure to provide basic services**,** and *'maintenance' energy***,** the annual energy required to deliver these services and maintain infrastructure.

Future emissions pathways: the energy requirements for decent living and their associated greenhouse gas emissions under different scenarios of decarbonization inform the possibilities for equitable climate mitigation in developing economies.

Methods

We used statistical methods and energy modeling to relate basic goods to material requirements. For instance, we relate life expectancy to a number of health indicators, such as physicians and hospitals per 1000 people; we relate road access to the density of paved road in countries. Electricity network requirements were estimated using a global energy model, with spatial representation of populations without electricity access.

Using life-cycle analysis and input-output analysis, and simulation techniques we estimate embodied energy intensities of delivering goods and services in the decent living standard.

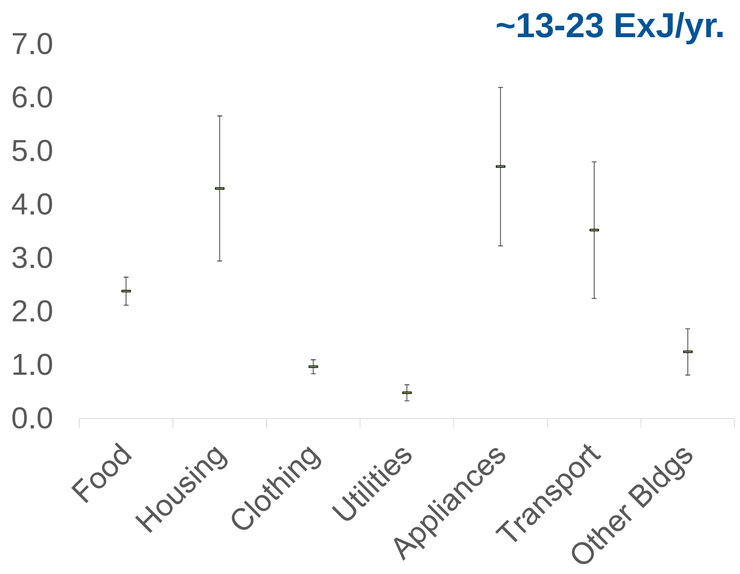
We use parametric analysis to assess the magnitude of key sources of uncertainty.

Geographic Scope

The project will cover India, Brazil, S. Africa, Indonesia and China. Results for India are shown.

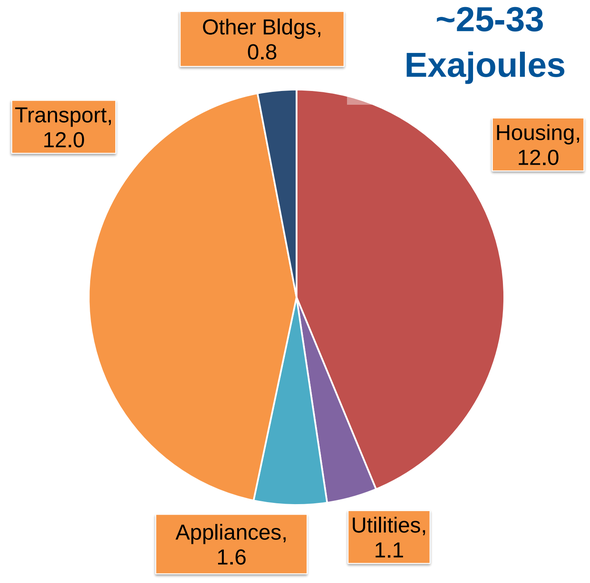
Energy Requirements for Decent Living in India

Operating Energy



Includes Operation, Maintenance, & Capital Turnover

Development (Construction) Energy



Development energy: the embodied energy to build out the infrastructure and appliances lacking to support decent living.

Policy Insights

India's primary energy use was about 33 Exajoules in 2011, or ~29 GJ/cap. Half this energy on an annual basis, and another full year's energy, hypothetically, would be sufficient to provide decent living to all. Yet, an even smaller share of annual energy use serves basic living standards. This raises questions about the equitable distribution of energy supply and development policy priorities.

The energy need to provide basic health, hygiene and education is relatively small, implying energy shortages doesn't constrain basic human development.

References

Rao, ND, P. Baer, 'Decent Living Emissions: A Conceptual Framework', *Sustainability*, 4, 656-681

Rao, ND, J. Min, 'Decent Living Standards: Material requirements for human wellbeing, *In Rev.*

Legend

· Housing: concrete homes and space conditioning (ACs, fans) · Transport: roads and vehicles (public transport, 2-wheelers, cars)

· Appliances: clean cook stoves, refrigerator, TV, cell phones · Other bldgs: hospitals, schools, other commercial · Utilities: electricity, water, sanitation, cell networks