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Household final energy footprints in Nepal, Vietnam and Zambia: composition, inequality and links to well-being

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This research is motivated by:

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- Lack of understanding of the context of household energy use in developing countries.
- The narrative that perpetuates a false understanding that improving well-being can be realized only with a significant increase in energy use (or economic growth)

Research questions:

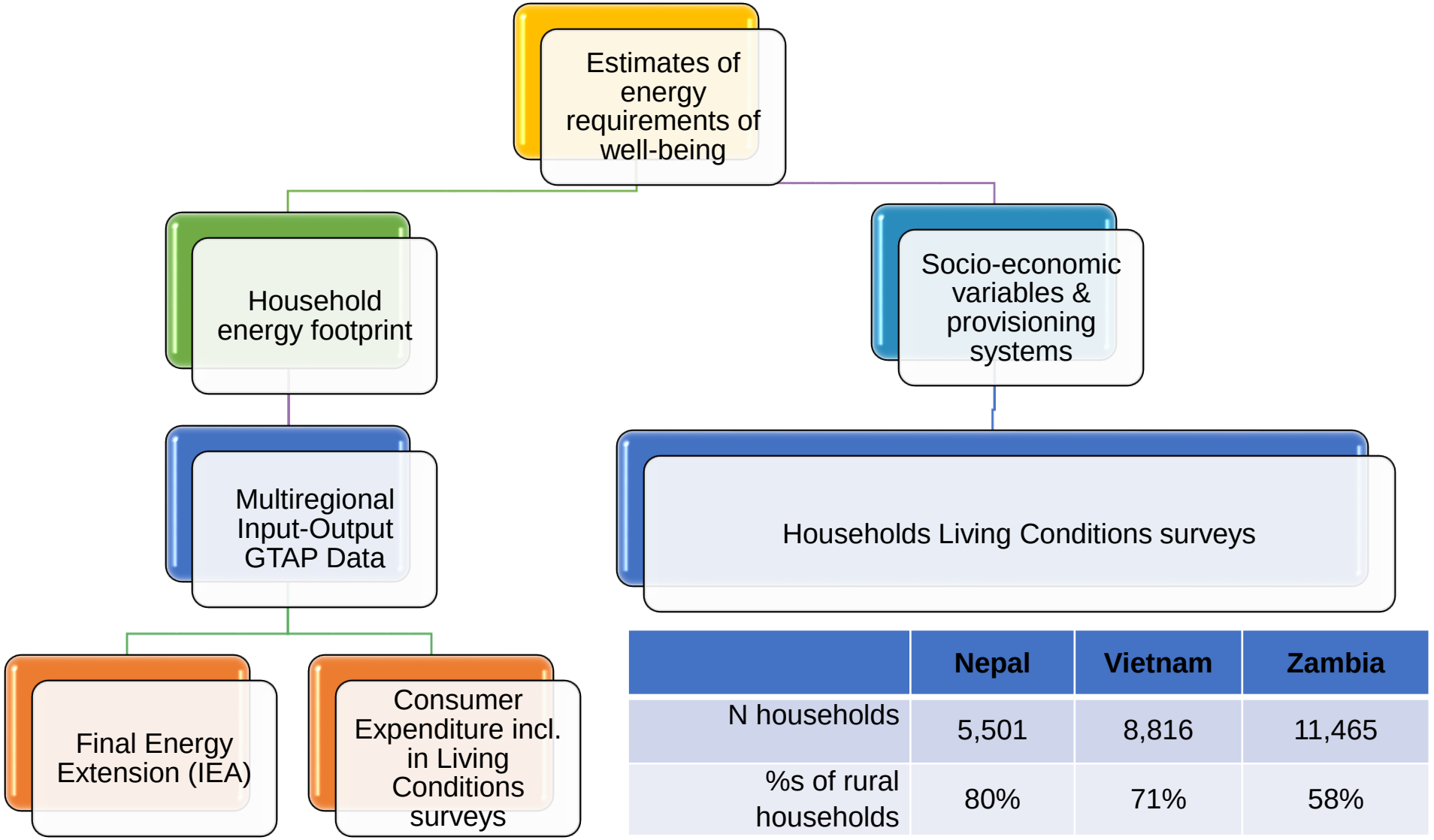
- If energy is used for fostering well-being, what do we mean by living well?
- How much energy is required to end multiple deprivations?

We test the null hypothesis that:

- With the increase in income Energy Footprint increases too
- Households with basic well-being outcomes use more energy than households without these outcomes.

Data & Methods

Data & Methods



	Nepal	Vietnam	Zambia
N households	5,501	8,816	11,465
%s of rural households	80%	71%	58%

Methods

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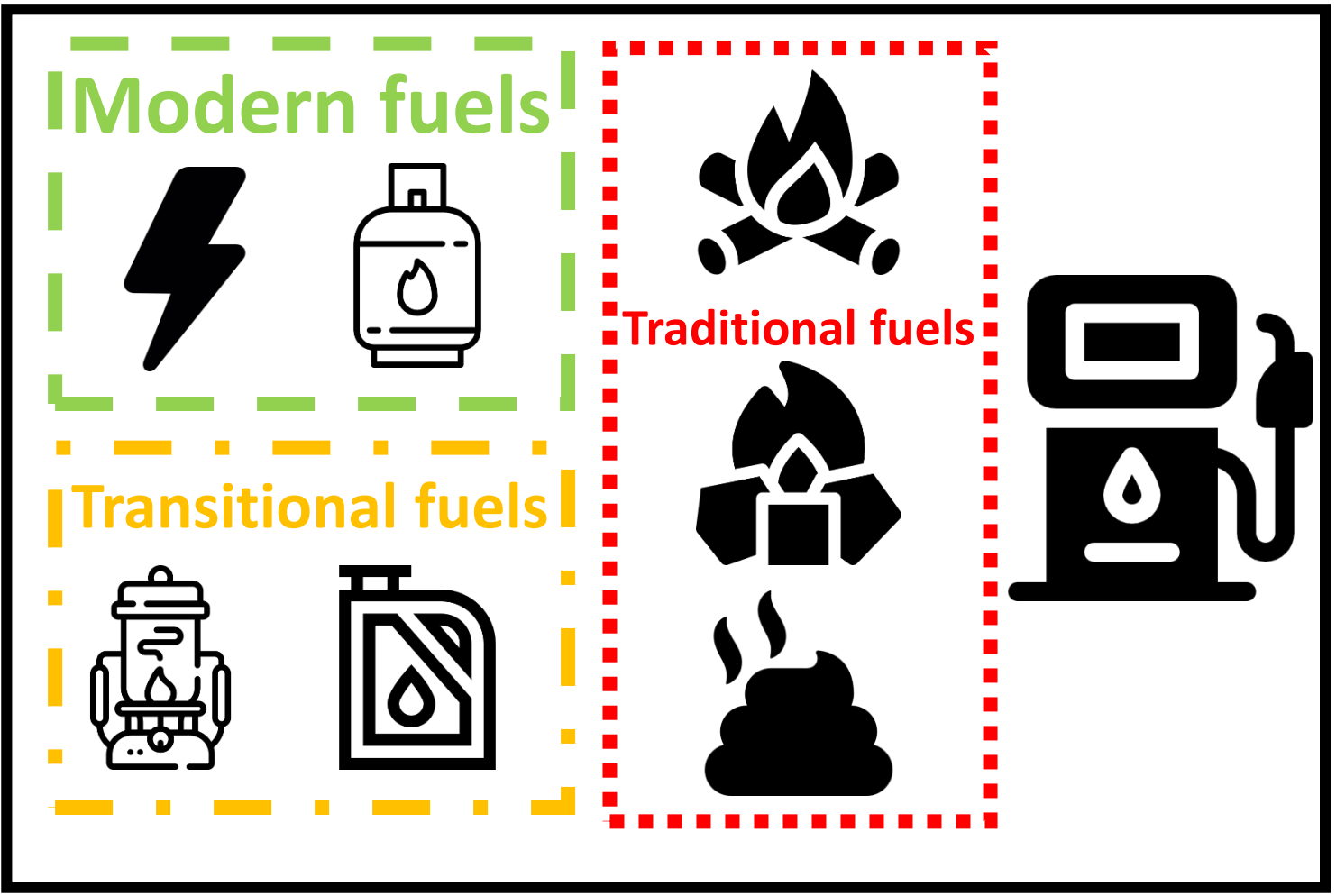
- Consumption based input-output model using household final demand, household expenditures (surveys) and IEA energy data.
- Gini-coefficients to account for inequalities
- Logistic Regression to examine socio-economic characteristics and their effects on chances for households to achieve well-being outcomes

Definitions & Conceptualization

Energy Footprint dictionary

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Direct



Indirect



Well-being connection: conceptualization

based on “A Theory of Human Need” (Doyal and Gough, 1991)

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Baseline

Universal Characteristics of Needs Satisfiers








How?

Intermediate Need Satisfiers

- Culturally specific
- Dependent on time, place and provisioning systems available to us

Physical: infrastructure, technology, land use, supply chains
Social: state, markets, norms, culture, institutions.

What for?

Basic Needs



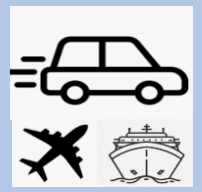


Operationalizing Well-being

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Intermediate Needs satisfiers

- Kcal of red meat vs kcal of veggies
- Number of flights
- Mileage (car) vs public transp.
- kwh of firewood vs electricity usage
- Number of rooms
- Working hours



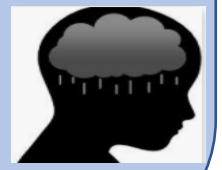



Outcomes (basic needs)

- Healthy Life expectancy
- Malnutrition status
- Literacy
- Mental and physical status in society (e.g. prevalence of depression)

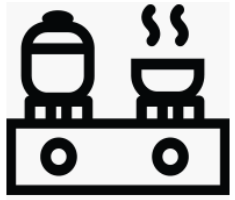




Variables chosen for basic well-being outcomes

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- Modern cooking fuels (≥50%)



- Household head and spouse have at least 9 years of education



- sufficient food



- Access to water at home (<1km)

Variables chosen for basic well-being outcomes

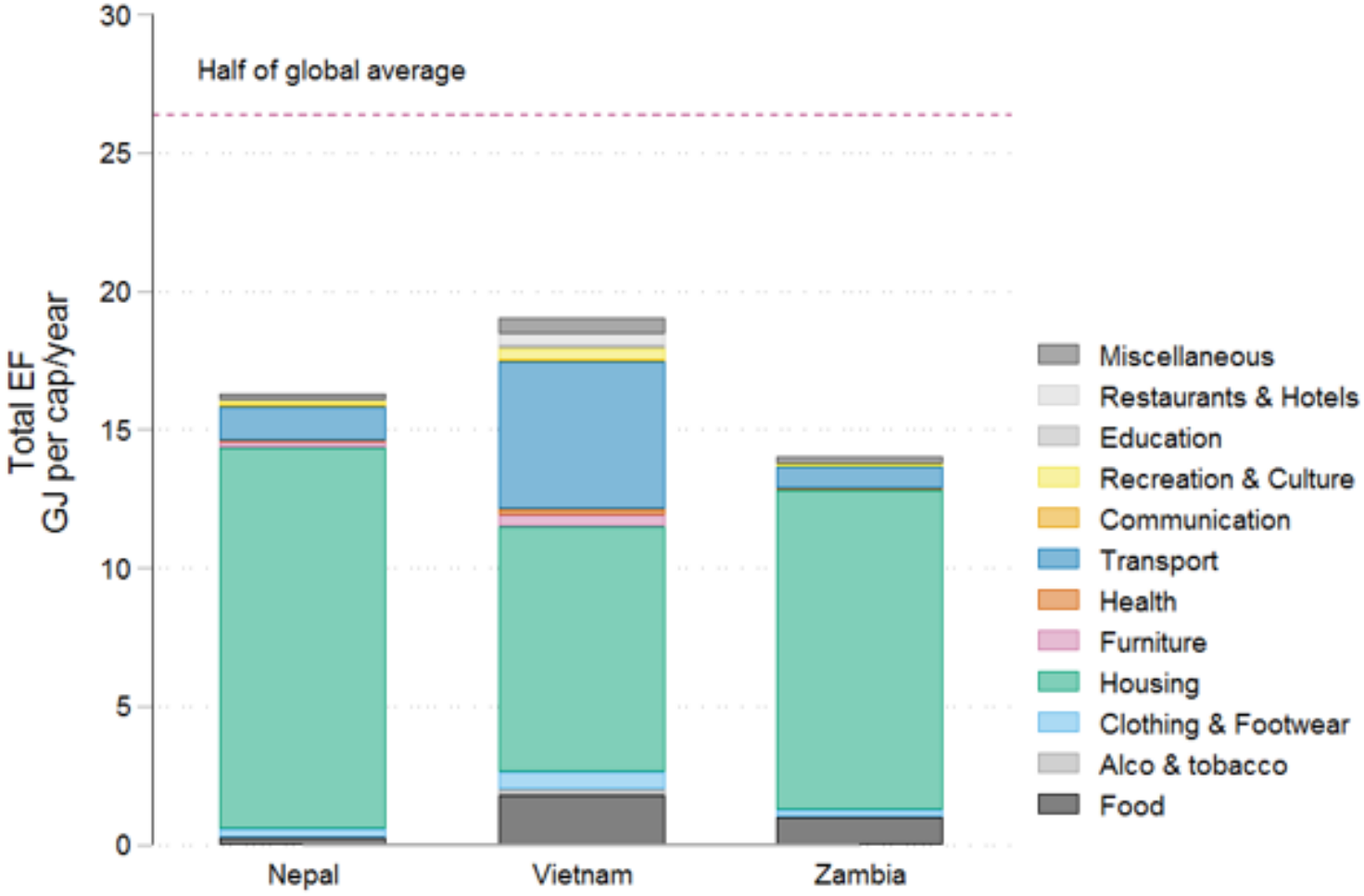
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Share of households having:	Nepal	Vietnam	Zambia
	20%	42%	9%
	10%	65%	29%
	84%	92%	55%
	83%	90%	64%
all four outcomes	**5%**	**30%**	**6%**

Energy Footprints

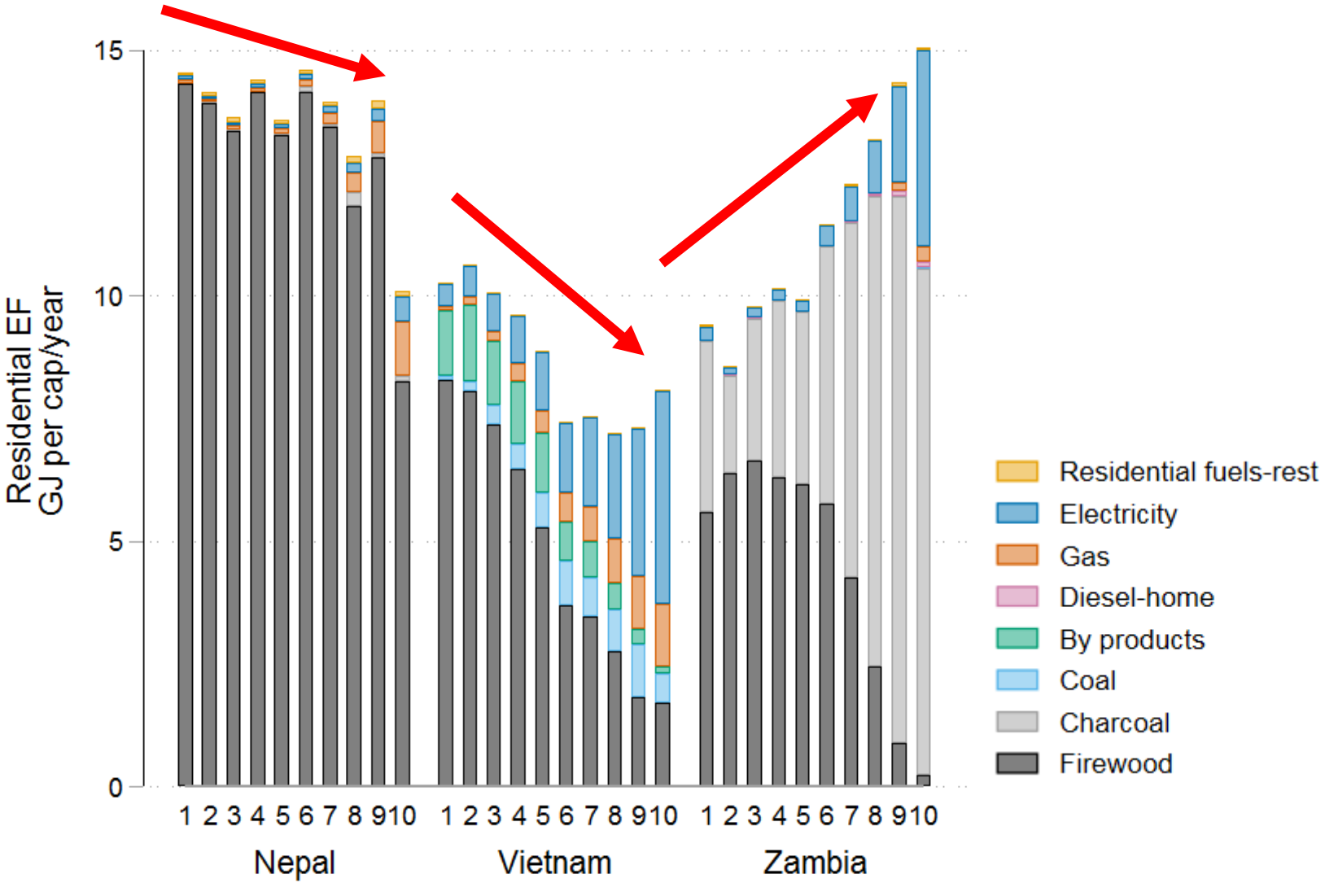
Total Final Energy Footprints per capita…

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- Vietnam has the highest per capita footprints
- EF dominated by Housing
- Indirect energy constitutes small portion of the total footprints
- Transportation important especially in Vietnam
- Much lower than global average ~52 GJ

Residential fuels - composition

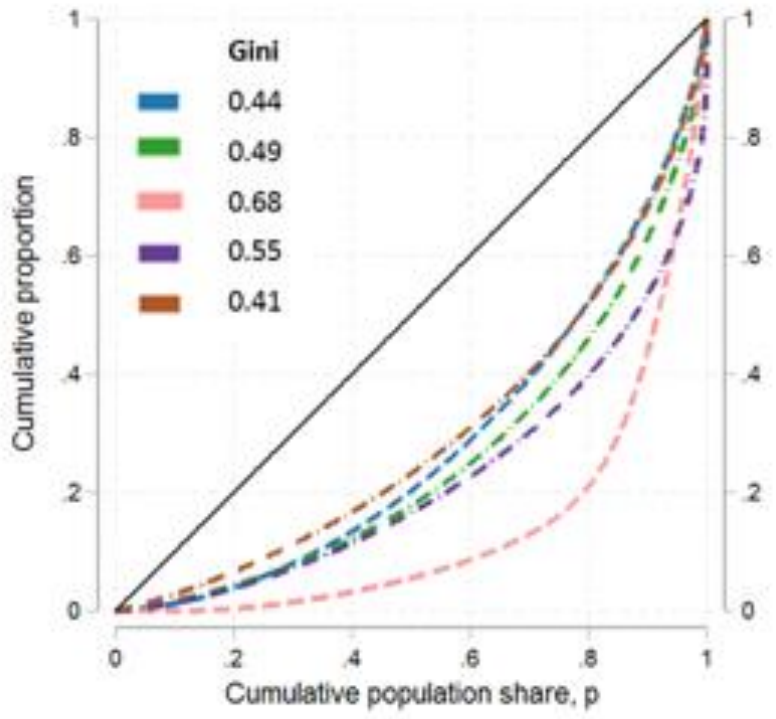


Inequalities

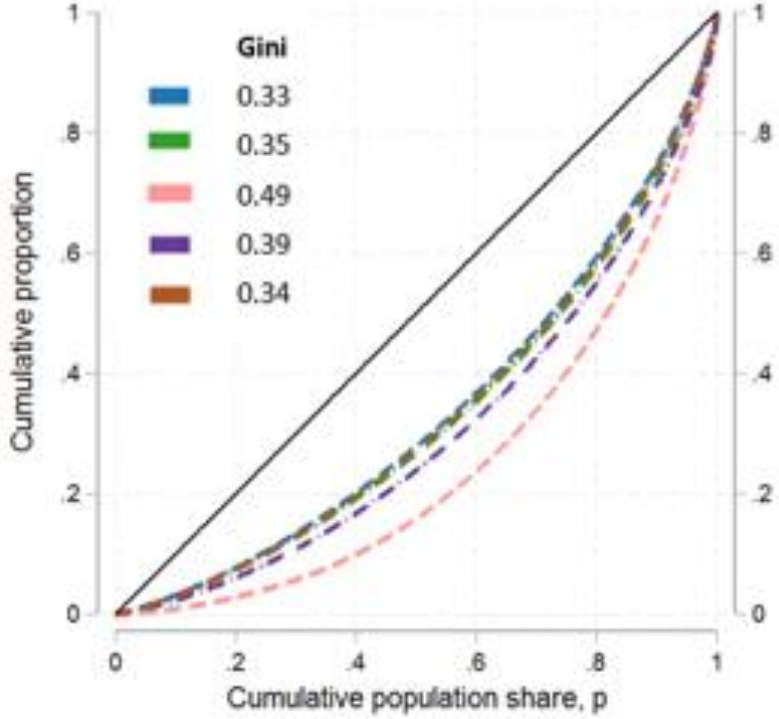
Inequalities

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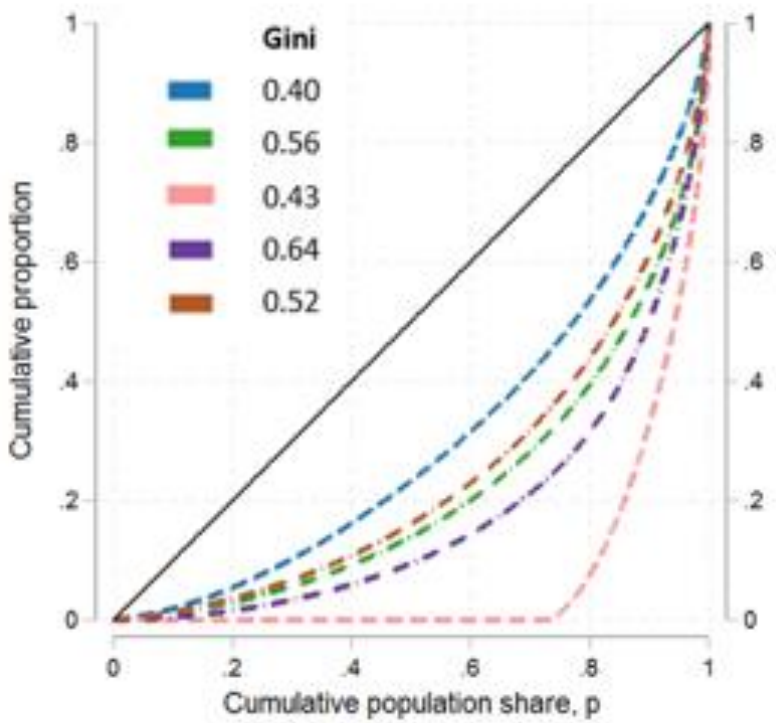
Nepal



Vietnam



Zambia

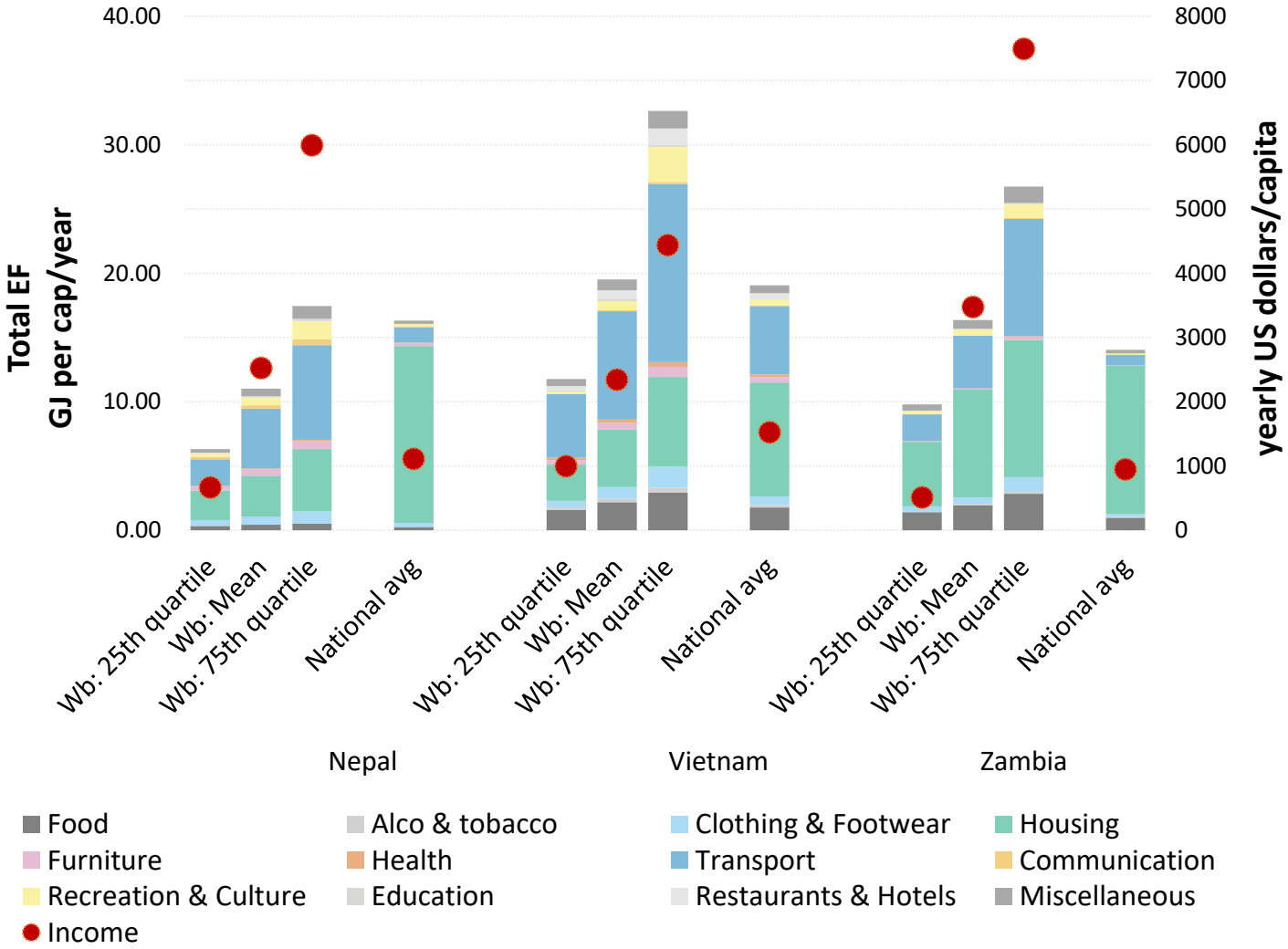


Total EF Indirect EF Food EF Modern fuels Income Expenditures Equality

Energy Footprints vs well-being outcomes



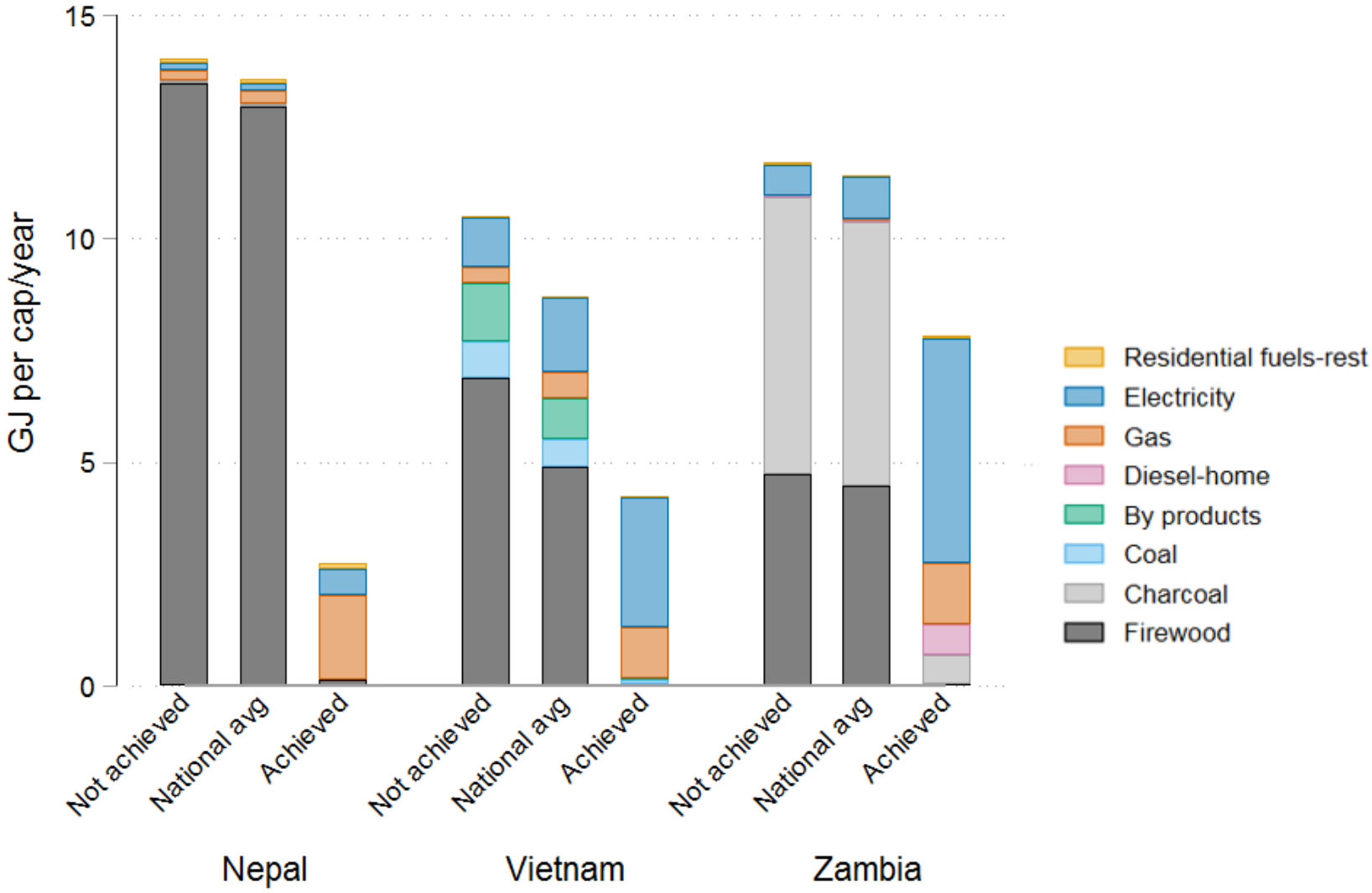
Households with well-being outcomes vs without



Households with basic well-being outcomes (sufficient food, safe water, basic education, and >50% modern fuels) split by income quartiles vs national average

Dirty/Clean fuels: **Extreme poverty drives energy demand up**

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Importance of provisioning systems

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	Nepal		Vietnam		Zambia	
F: protection	4.217***	(6.95)	4.638***	(21.85)	3.413***	(8.36)
F: collective provisioning Nepal	3.867**	(2.81)	—	—	—	—
F: collective provisioning Zambia	—	—	—	—	1.448*	(2.40)
Rural	0.711*	(−2.36)	—	—	—	—
Household size	0.840***	(−4.66)	0.855***	(−6.74)	—	—
Not poor	1.735***	(4.19)	—	—	3.988***	(10.11)
Minimum floor area	—	—	—	—	1.800***	(4.91)
Electricity access	—	—	—	—	1.729***	(3.49)
Residential fuels (GJ cap^{-1})	0.947***	(−5.31)	0.960***	(−6.07)		
Total EF (GJ cap^{-1})	1.042***	(4.95)	1.036***	(6.79)	1.011**	(3.12)
Share of modern fuels	1.010***	(4.59)	1.002*	(2.04)	1.015***	(8.07)
Access to market w/n 5 km	—	—	1.910***	(6.41)	—	—
Phone	—	—	2.140***	(10.06)	1.680***	(3.72)
Television	—	—	—	—	2.010***	(5.06)
Motor cycle	—	—	1.654***	(6.51)	—	—
_cons	0.0207***	(−6.78)	0.112***	(−14.39)	0.00517***	(−28.55)
N	5501	—	8816	—	11 465	—
Pseudo R^2	0.227	—	0.190	—	0.393	—
Chi2	786.8	—	1380.6	—	1283.8	—

Exponentiated coefficients; z statistics in parentheses.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Note: The dependent variable is a product of three binary variables: sufficient food, safe water, and basic education (see table S9). The dependent variable is coded 1 if all three binary variables equal to 1. Resulting factor analysis (see table S8), following factors are included (starting from the top of the table): factor: 'protection' which includes having solid shelter, sewage, and safe toilet; factor: 'collective provisioning Nepal', which refers to access to health canter, public transport and market within 5 km from home; factor: 'collective provisioning Zambia', which refers to garbage disposal and access to health centre, public transport and market within 5 km from home. Reading odds ratio: one indicates no effect, positive effects are greater than one, and negative effects are between zero and one.

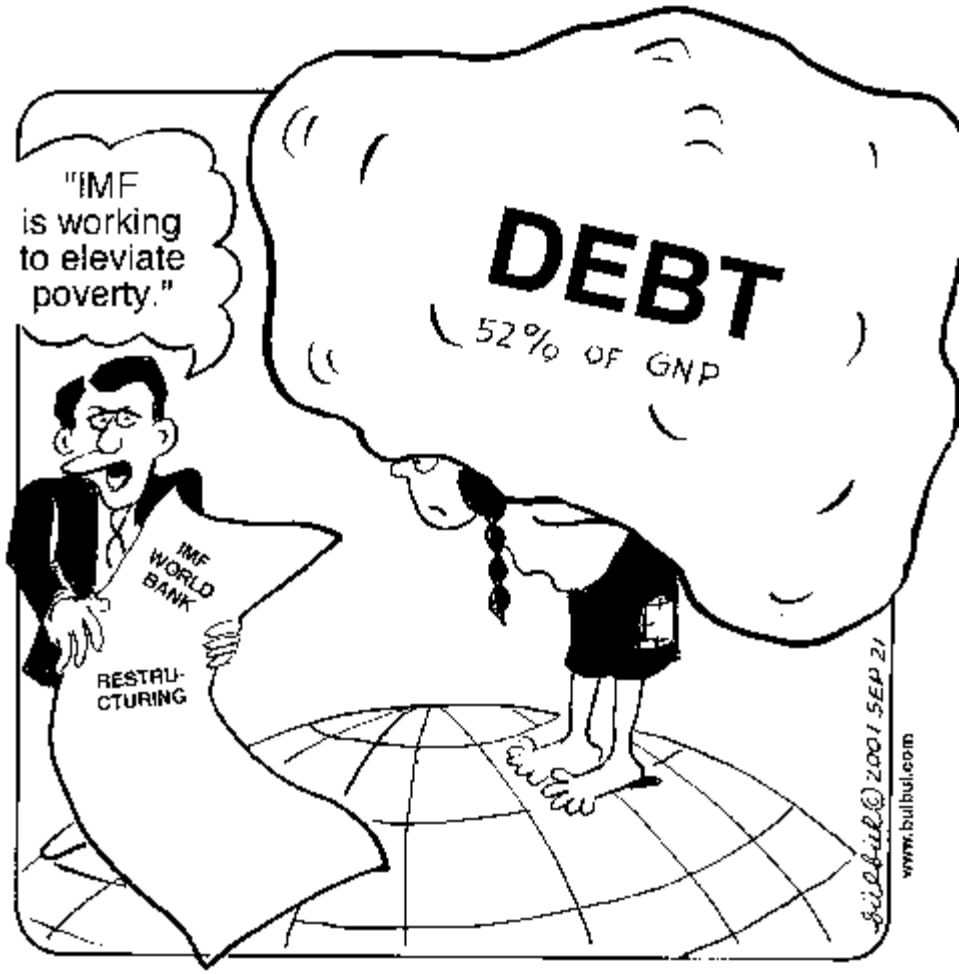
Instead of focusing on how much energy is used, we are pointing to the importance of collective services (like electricity, indoor sanitation, health centres and public transport) for alleviating the multiple deprivations of poverty.

Extreme poverty does not just happen, it is created

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One of the many economic tools actively stopping countries from investing in their physical and social infrastructure is neo-colonial structural adjustment.

Cancelling debts of Global South would allow them invest in public services, and thus improve basic need satisfaction whilst reducing resource use.



← Check out the article

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Thank you!

Questions?

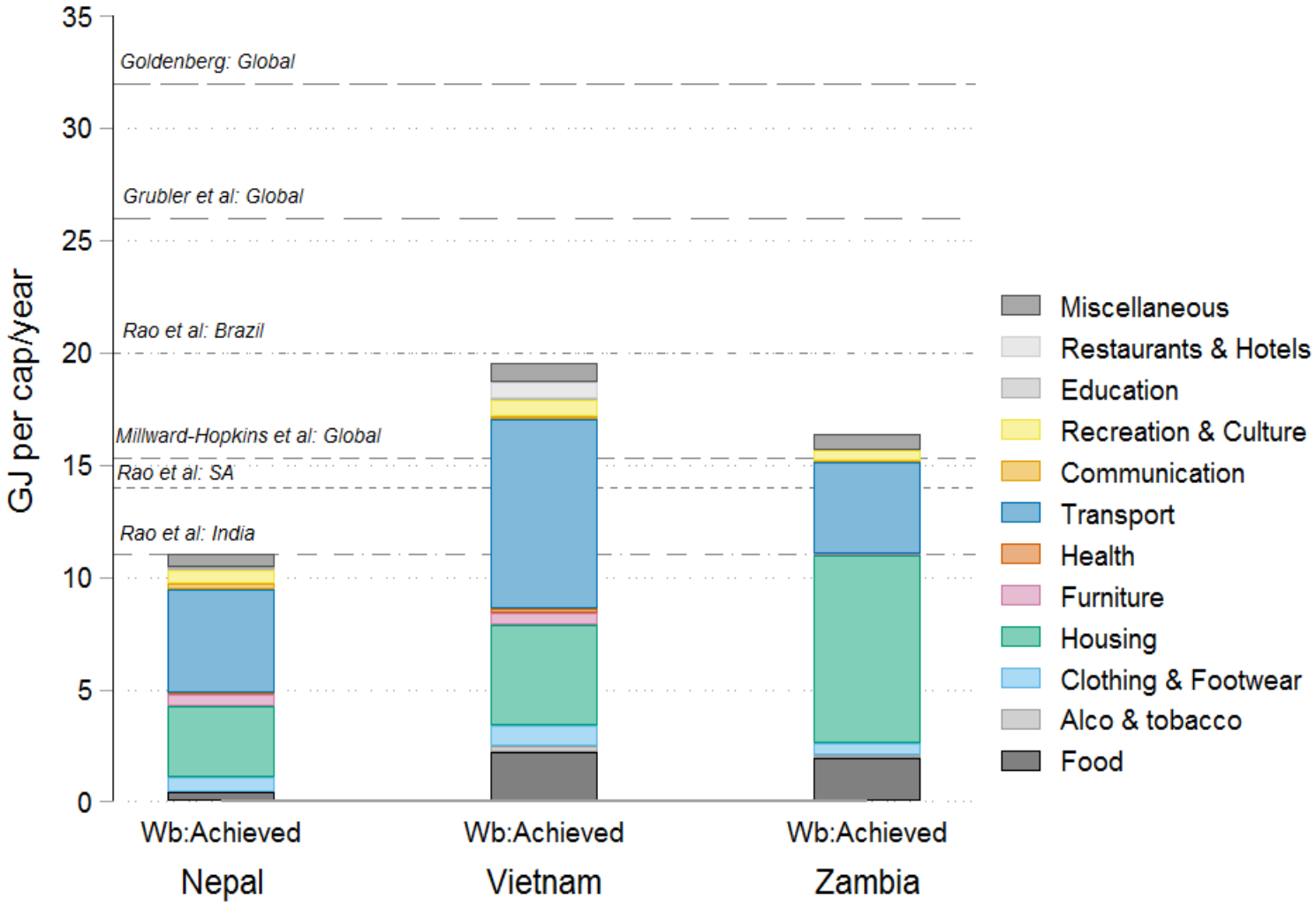


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Households with basic well-being outcomes vs other studies

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Dirty/Clean fuels: **Extreme poverty drives energy demand up**

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