

Access to modern energy services for all: Climate compatible development opportunity

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10 February 2022

IEA-ETSAP Webinar on Energy poverty and energy access

Importance of Energy Services

Energy is the engine of the modern world

Energy **fundamental** to all aspects of human life

Inequities in energy access and use globally, even today

- ~1 billion without electricity
- ~3 billion without clean cooking
- Average use in the developed world a factor 10-20 more than in the least developed nations

Externalities from current fossil-based energy systems are damaging

- Harmful emissions/ effluents exceed assimilative capacity of local, regional, and global environments
- Health of the planet, people, crops, and biodiversity impacted

Historically, energy transitions have occurred at a **very slow pace**

- Past rates of change: up to 100 years, unprecedented transformation required by 2030/50

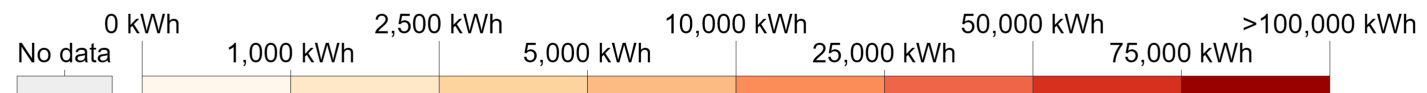
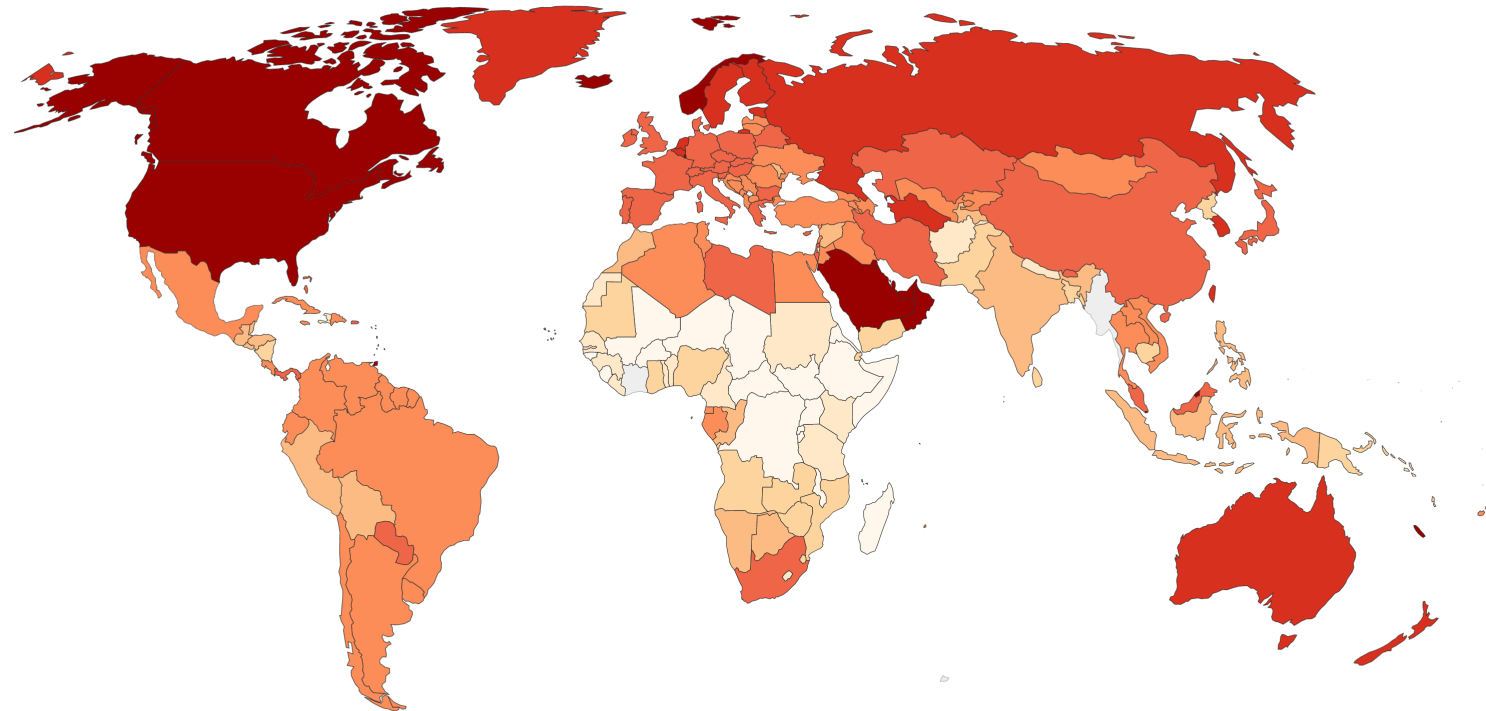
Investments required are **expensive and long-lived**

- Power plants typically have a lifetime of >30 years (stranded assets)

Unequal per capita energy use globally

Energy use per person

Our World
in Data



Source: Our World in Data based on BP & Shift Data Portal

Note: Energy refers to primary energy – the energy input before the transformation to forms of energy for end-use (such as electricity or petrol for transport).

OurWorldInData.org/energy • CC BY

What do we mean by modern energy access and how many are without it?

SDG 7 – Goals for 2030 and Targets Status



7.1 Universal access to modern energy services

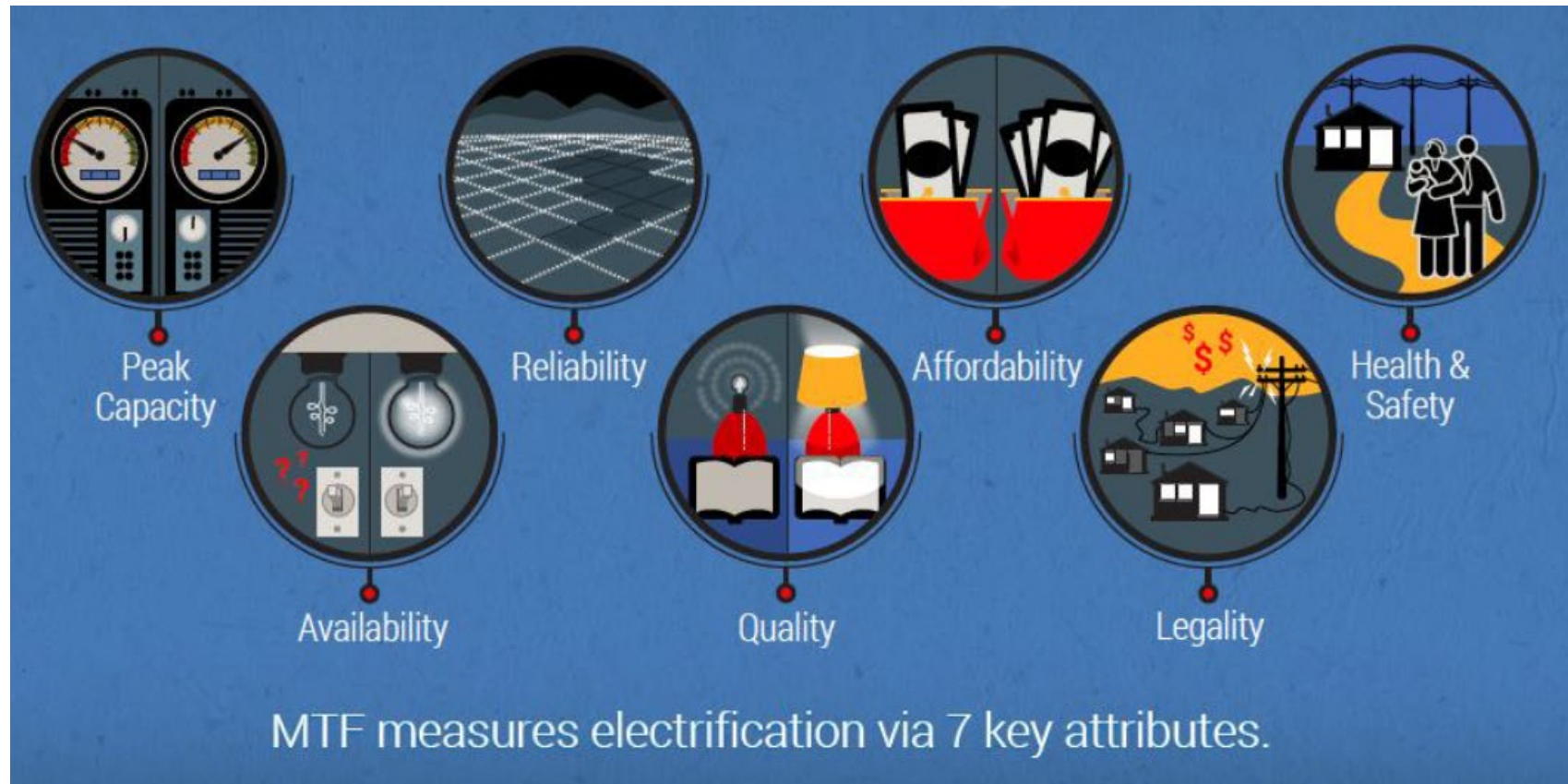
7.2 Increase the share of renewable energy

7.3 Double the rate of energy efficiency improvement

STATUS OF SDG#7.1

- 2.6 billion without clean cooking in 2019 (Official Indicators)
- 759 million in 2019 without electricity (Official Indicators)
- Over 4 billion continue to stack solid fuels even if they report primary reliance on clean cooking (ESMAP 2020)
- 3.5 billion without access to reliable electricity (Ayaburi et al. 2020)

World Bank's Multi-Tier Framework



	TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Tier criteria		Task lighting AND Phone charging	General lighting AND Phone Charging AND Television AND Fan (if needed)	Tier 2 AND Any medium-power appliances	Tier 3 AND Any high-power appliances	Tier 2 AND Any very high-power appliances

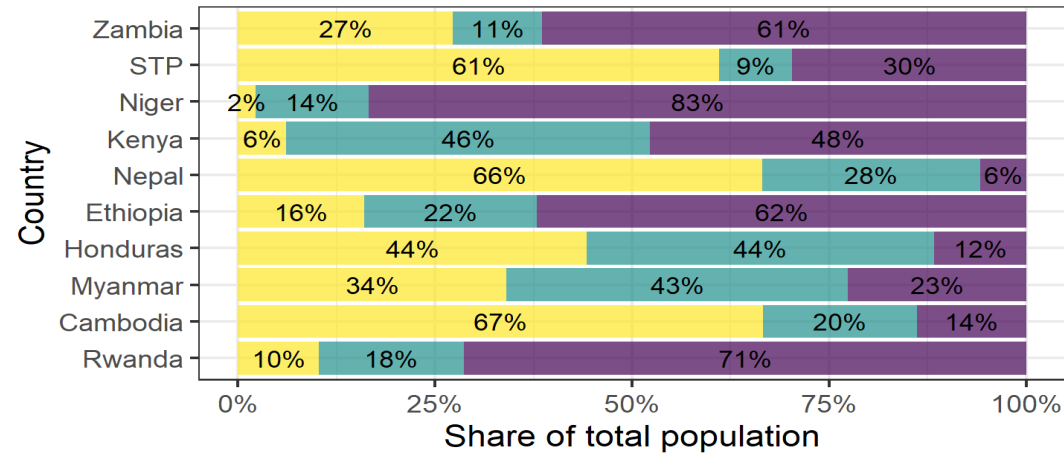
Issues with Existing Measures and Metrics

Definitional and Measurement Issues

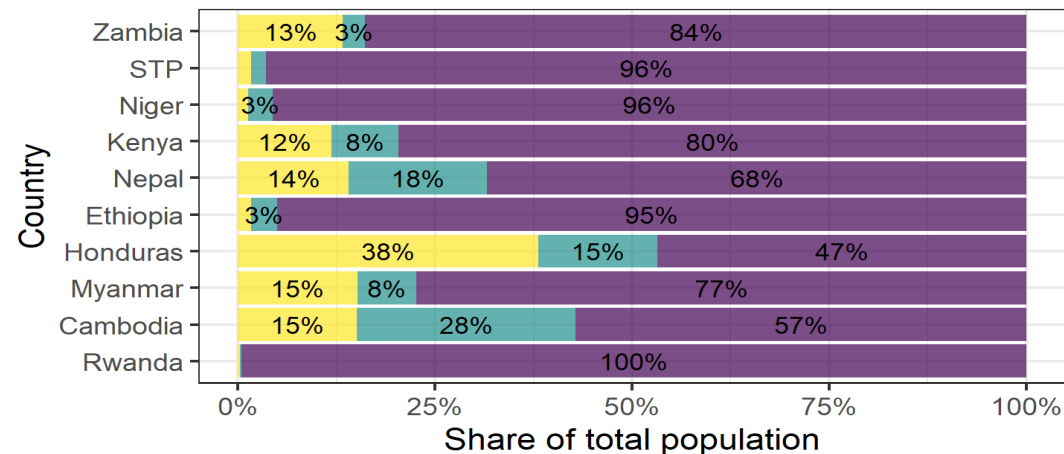
- Focus on supply inadequately captures access to services
- Focus on consumption and capacity as measure of services may undermine efficiency goals
- Some dimensions, like affordability, poorly captured
- Normative thresholds for reliability, legality and quality may not apply or be universally accepted in different political and cultural contexts
- Aggregates are very sensitive to algorithm changes

More without access than official measures

National SDG7.1.1 Status



National SDG7.1.2 Status



Group ■ Served (CF and AF) ■ Served (CF only) ■ Unserved

Current framework (CF) typically counts more households as served than our proposed Alternative framework (AF)

AF Indicators

- Electricity available for ≥ 16 hours per day, AND Access to at least decent energy services, AND Expenditures $\leq 5\%$ of expenditures
- $>50\%$ of daily cooking time using BLEN stoves, AND BLEN fuels available for 10 months of the year, AND Expenditures $\leq 5\%$ of expenditures

Source: Pachauri & Rao 2020

<https://doi.org/10.1088/2516-1083/aba890>

Pelz et al 2021 *Env. Res. Ltr.*

<https://doi.org/10.1088/1748-9326/ac16a1>

Scenarios of household access to energy services





nature
energy

ARTICLES

<https://doi.org/10.1038/s41560-021-00871-0>

 Check for updates

Global scenarios of household access to modern energy services under climate mitigation policy

Miguel Poblete-Cazenave [✉], Shonali Pachauri , Edward Byers , Alessio Mastrucci and Bas van Ruijven 

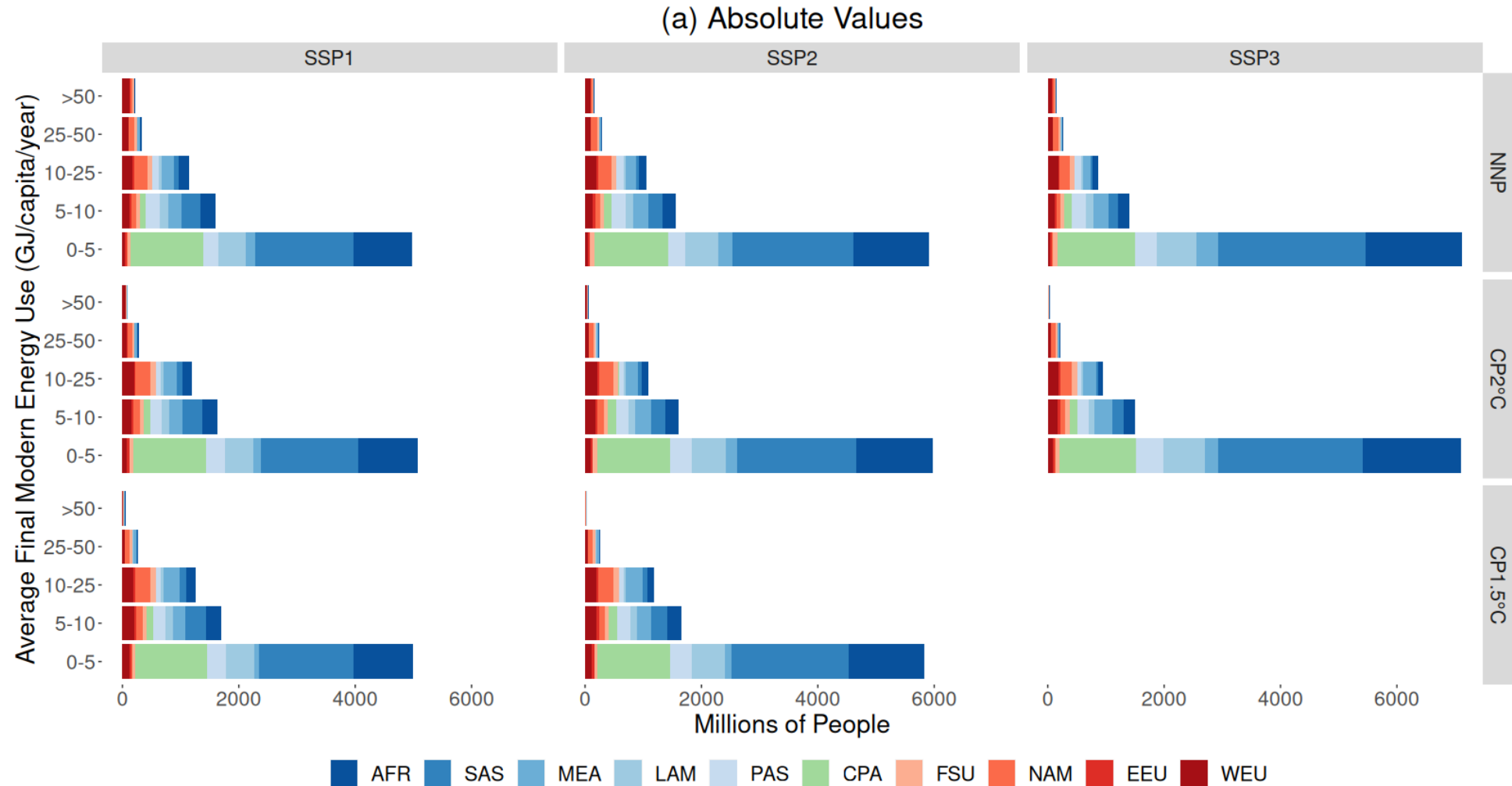
Emission reduction scenarios to meet climate change mitigation policy goals rarely explore the differential impact of alternative pathways on access to energy for different economic strata of society across countries. Here we show that even under optimistic socioeconomic growth scenarios, inequalities in use of modern energy in homes could persist. We find that, although access improves in high growth scenarios, over 10% of populations in sub-Saharan Africa and South Asia could lack access to energy services for thermal comfort, food preparation and conservation, and cleaning in 2050. Ambitious climate mitigation scenarios do not substantially alter household access to energy services in the Global South, and only affect gas consumption in high-income regions. Our work suggests that efforts to meet climate mitigation policy goals are not at odds with progress towards universal access to modern energy services in the Global South, however, directed policy will be needed to meet access goals.

Objectives and approach

Understand drivers of preferences for energy services and demand that can inform analysis of how these will change in the future across diverse populations as electricity becomes more easily accessible and affordable

Develop a highly granular bottom-up residential appliance and energy demand model estimated using microdata from national household surveys to assess changes under different socioeconomic (SSP1, SSP2 & SSP3) and climate policy scenarios (CP2C & CP1.5C)

Key result – Demand grows but inequalities persist

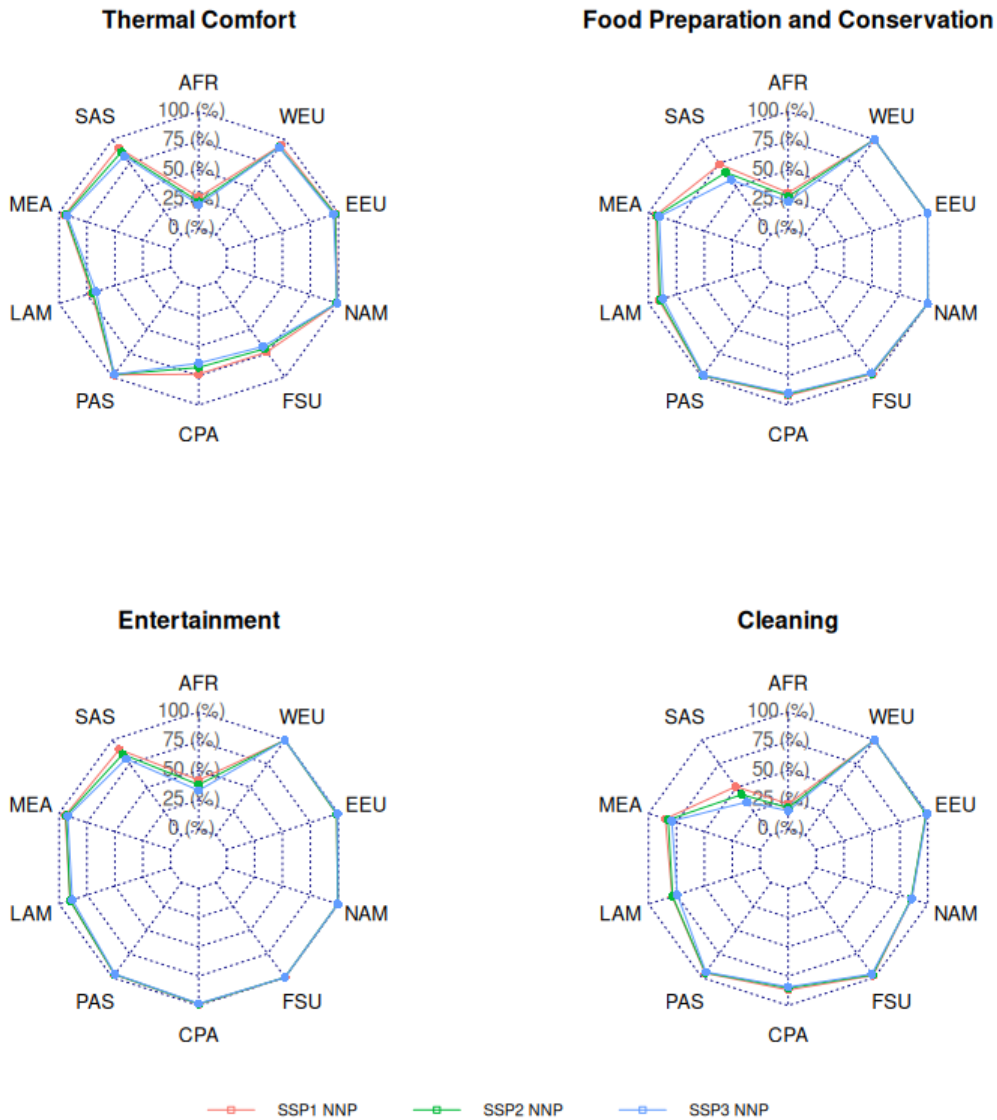


Source: Poblete-Cazenave et al. Nature Energy 2021

[10.1038/s41560-021-00871-0](https://doi.org/10.1038/s41560-021-00871-0)

Residential electric services in 2030

(a) 2030



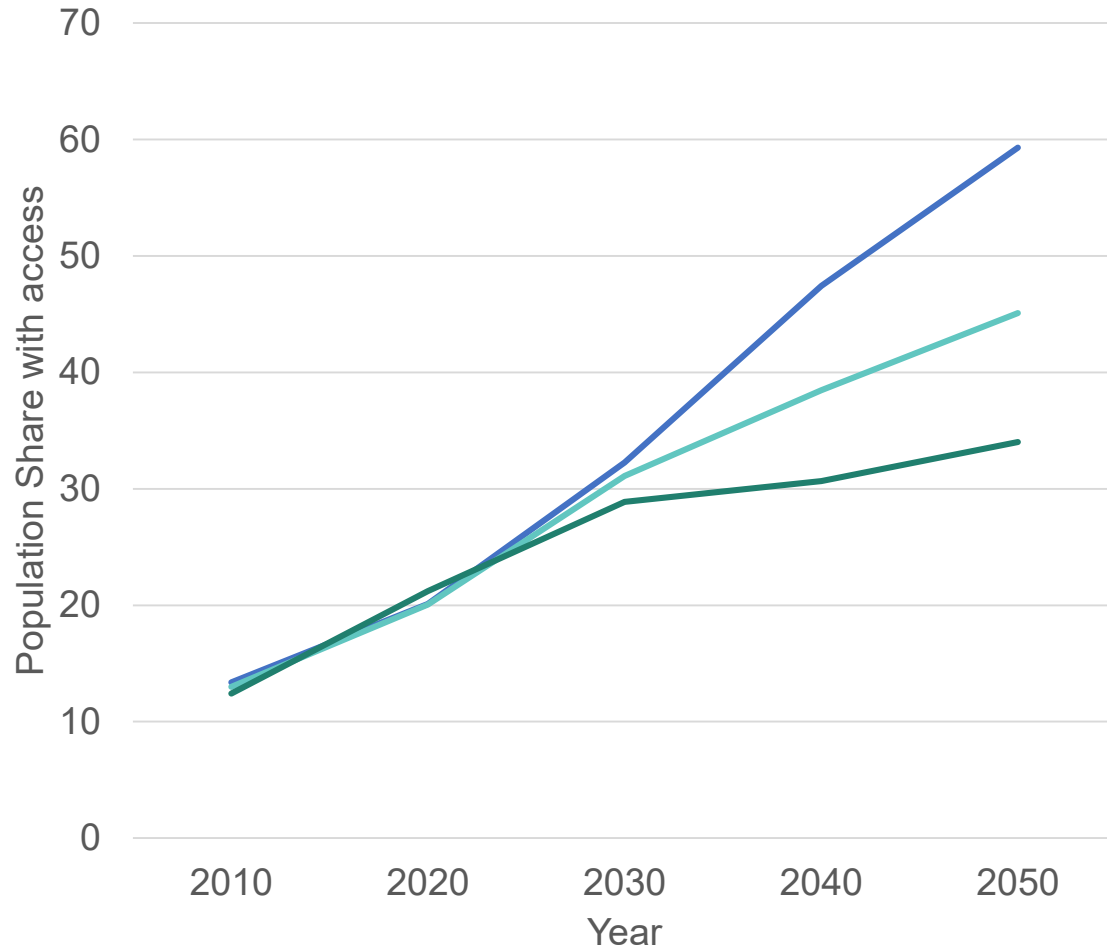
Despite rapid growth in residential electricity use in regions of the global South, inequities in access to basic electric end-use services persist even in optimistic baseline scenarios of high economic growth and more equitable income distribution

Source: Poblete-Cazenave et al. *Nature Energy* 2021
[10.1038/s41560-021-00871-0](https://doi.org/10.1038/s41560-021-00871-0)

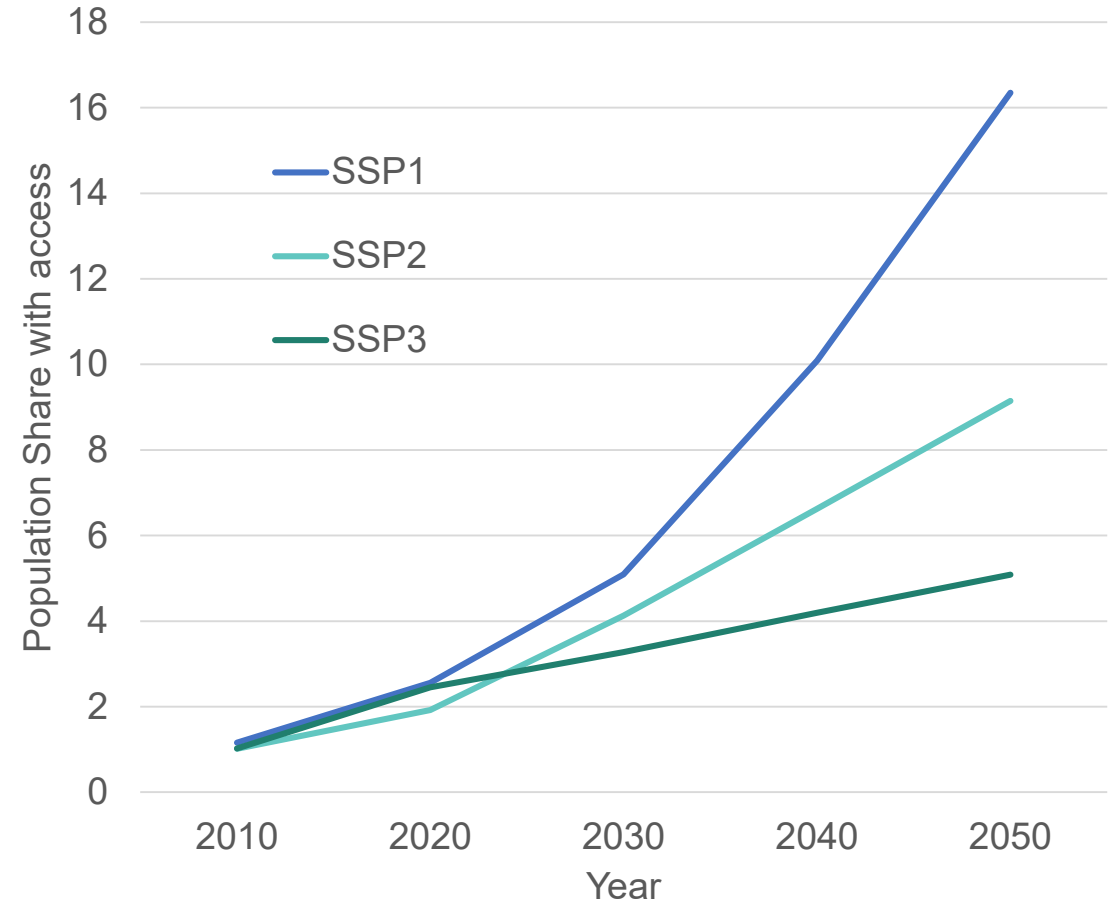
Air Conditioner Ownership in South Asia

Currently, >85% without adequate cooling; inequities and inadequate access even in 2050

URBAN



RURAL



Source: Poblete-Cazenave et al. Nature Energy 2021
[10.1038/s41560-021-00871-0](https://doi.org/10.1038/s41560-021-00871-0)

Clean cooking access scenarios post-pandemic and under climate mitigation futures



Access to clean cooking services in energy and emission scenarios after COVID-19

Shonali Pachauri¹, Miguel Poblete-Cazenave¹, Arda Aktas² and Matthew J. Gidden^{1,3}

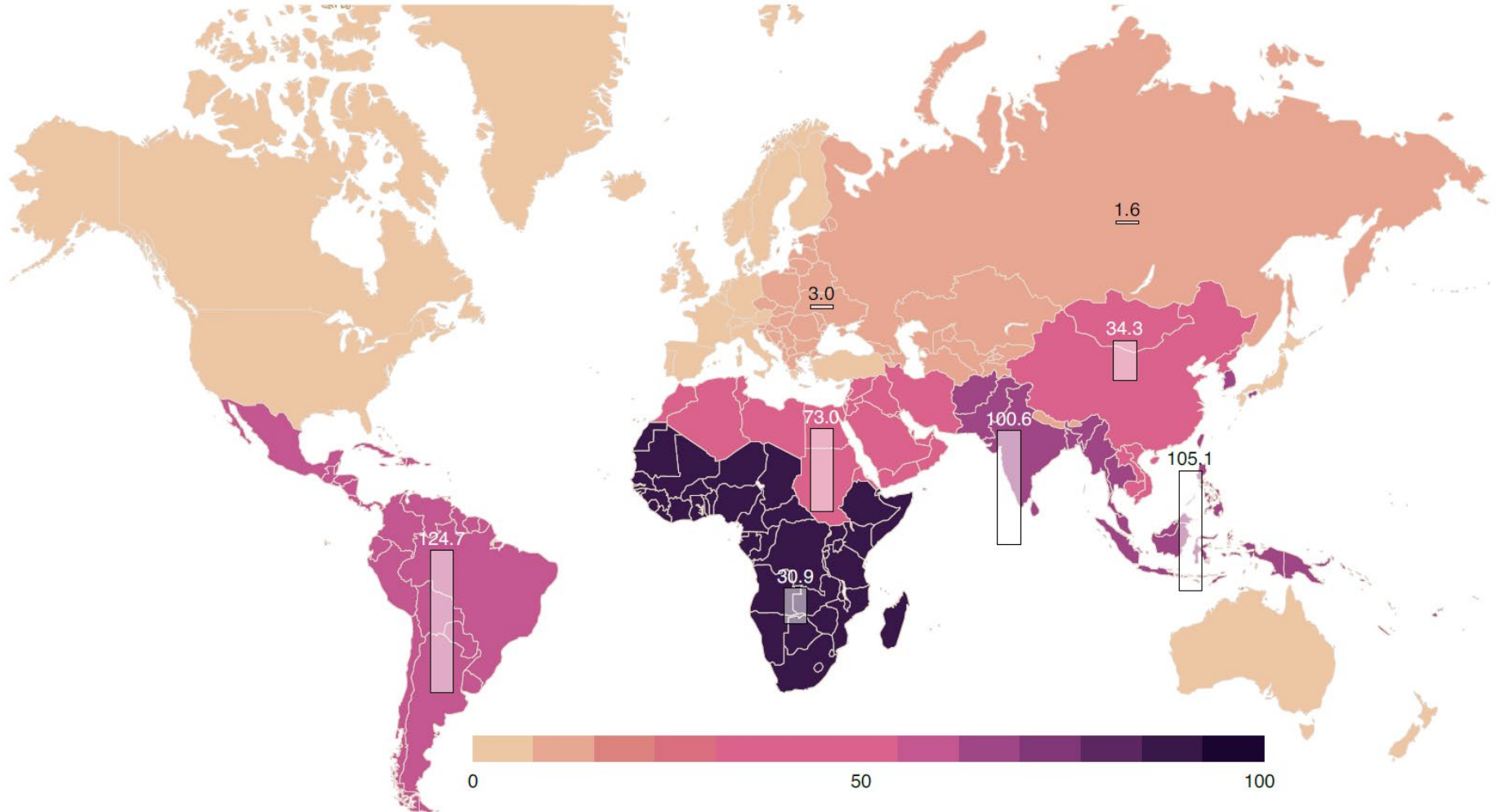
Slow progress in expanding clean cooking access is hindering progress on health, gender, equity, climate and air quality goals globally. Despite a rising population share with clean cooking access, the number of cooking poor remains stagnant. In this study we explored clean cooking access until 2050 under three reference scenarios, a COVID-19 recovery scenario and ambitious climate mitigation policy scenarios. Our analysis shows that universal access may not be achieved even in 2050. A protracted recession after the pandemic could leave an additional 470 million people unable to afford clean cooking services in 2030 relative to a reference scenario, with populations in sub-Saharan Africa and Asia the worst affected. Ambitious climate mitigation needs to be twinned with robust energy access policies to prevent an additional 200 million people being unable to transition to clean cooking in 2030. Our findings underline the need for immediate acceleration in efforts to make clean cooking accessible and affordable to all.

Cooking Energy Access Post Pandemic

Understand drivers of preferences for cooking stoves and fuels, accounting for the fact that many use multiple stoves and there is huge heterogeneity across populations and regions

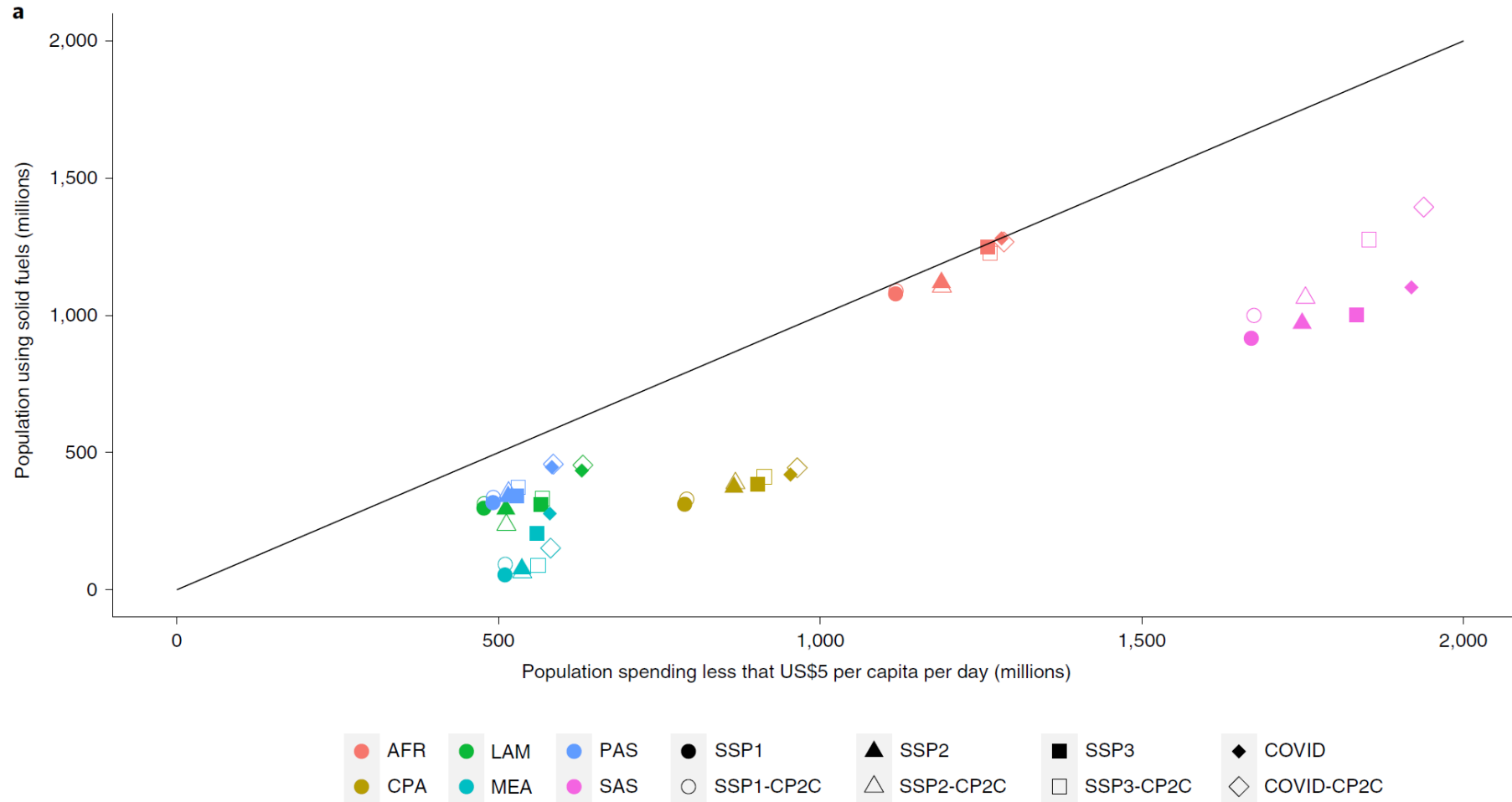
Explore baseline scenarios, a slow economic recovery from the COVID-19 pandemic scenario assuming a 20-year recovery period, and ambitious climate mitigation policy scenarios set to limit global warming to below 2 °C by end century

Key result – Potential setback to clean cooking access



Source: Pachauri et al. Nature Energy 2021
[10.1038/s41560-021-00911-9](https://doi.org/10.1038/s41560-021-00911-9)

Income poverty and cooking poverty correlated



Source: Pachauri et al. *Nature Energy* 2021
[10.1038/s41560-021-00911-9](https://doi.org/10.1038/s41560-021-00911-9)

Energy – A necessity: How much energy do we need for a decent life for all?

IOP Publishing

Environ. Res. Lett. **16** (2021) 095006

<https://doi.org/10.1088/1748-9326/ac1c27>






ENVIRONMENTAL RESEARCH LETTERS



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LETTER

Decent living gaps and energy needs around the world

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Keywords: decent living, energy, poverty, human needs, climate, equity

Macro Estimates of Energy Needed for Decent Living

Basic Minimum For Direct Needs

- AGECC and UN SG SE4ALL initiative define 3 tiers of basic energy needs & estimate 100kWh+100kgoe for basic lighting and cooking
~ **5GJ/capita**

Basic Needs and More

- Goldemberg et al., 1985 estimated 1kW per capita for basic needs and more
~ **32GJ/capita**

Energy Needs for a high HDI

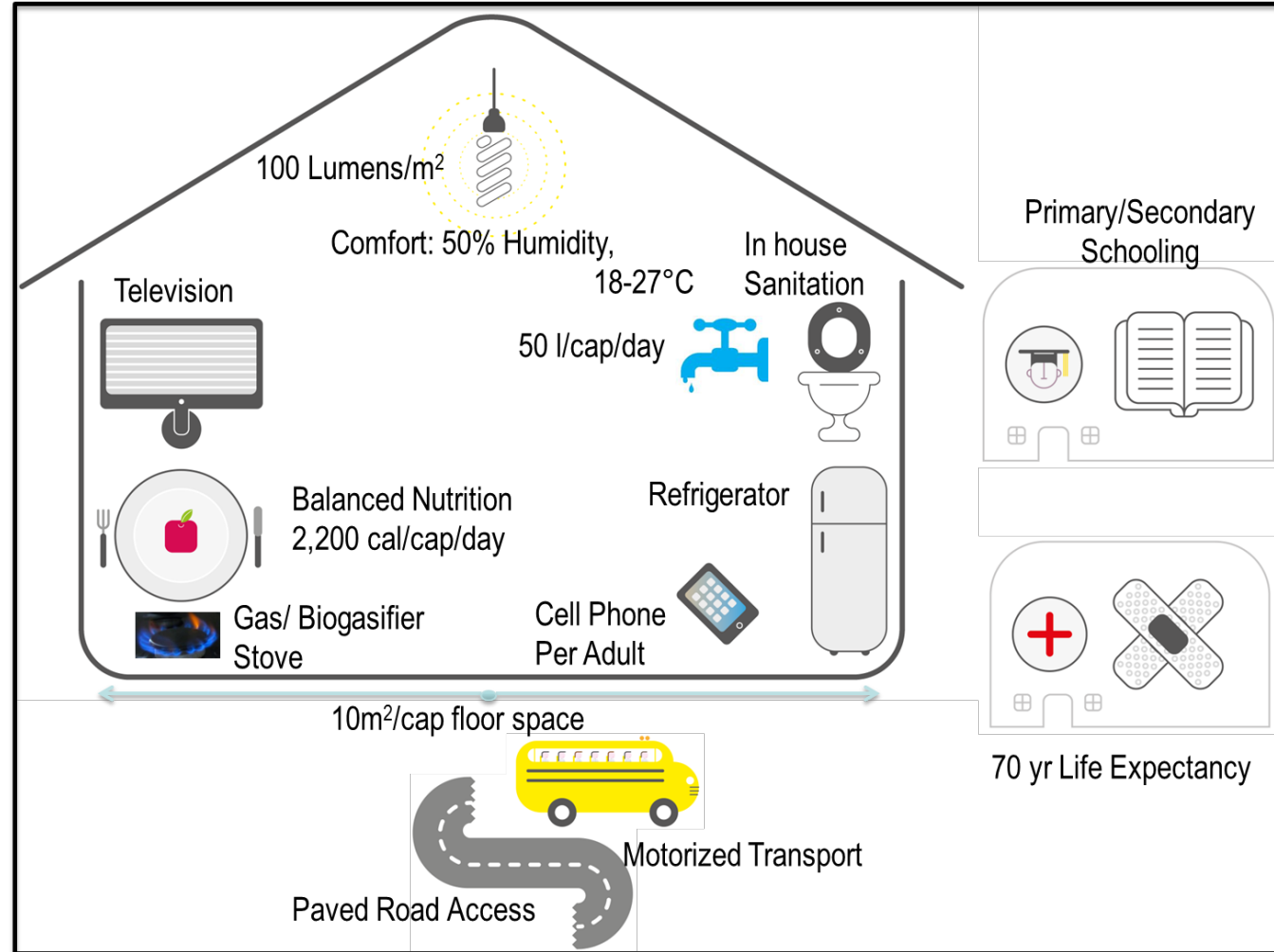
- Macro estimates from Lamb et al 2015; Steinberger & Roberts, 2010; Steckel et al. 2011 that correlate HDI with energy use, estimate ~**30-100 GJ/capita** with some decoupling observed over time

Decent Living Standards (DLS) for all

Define a standard universal set of living standards, important for living a decent life. Estimate gaps globally and estimate the energy requirements for filling these gaps

Explore a normative scenario of meeting DLS for all by 2040 and compare this to baseline and mitigation scenarios

A Bottom-Up View of Energy Needs



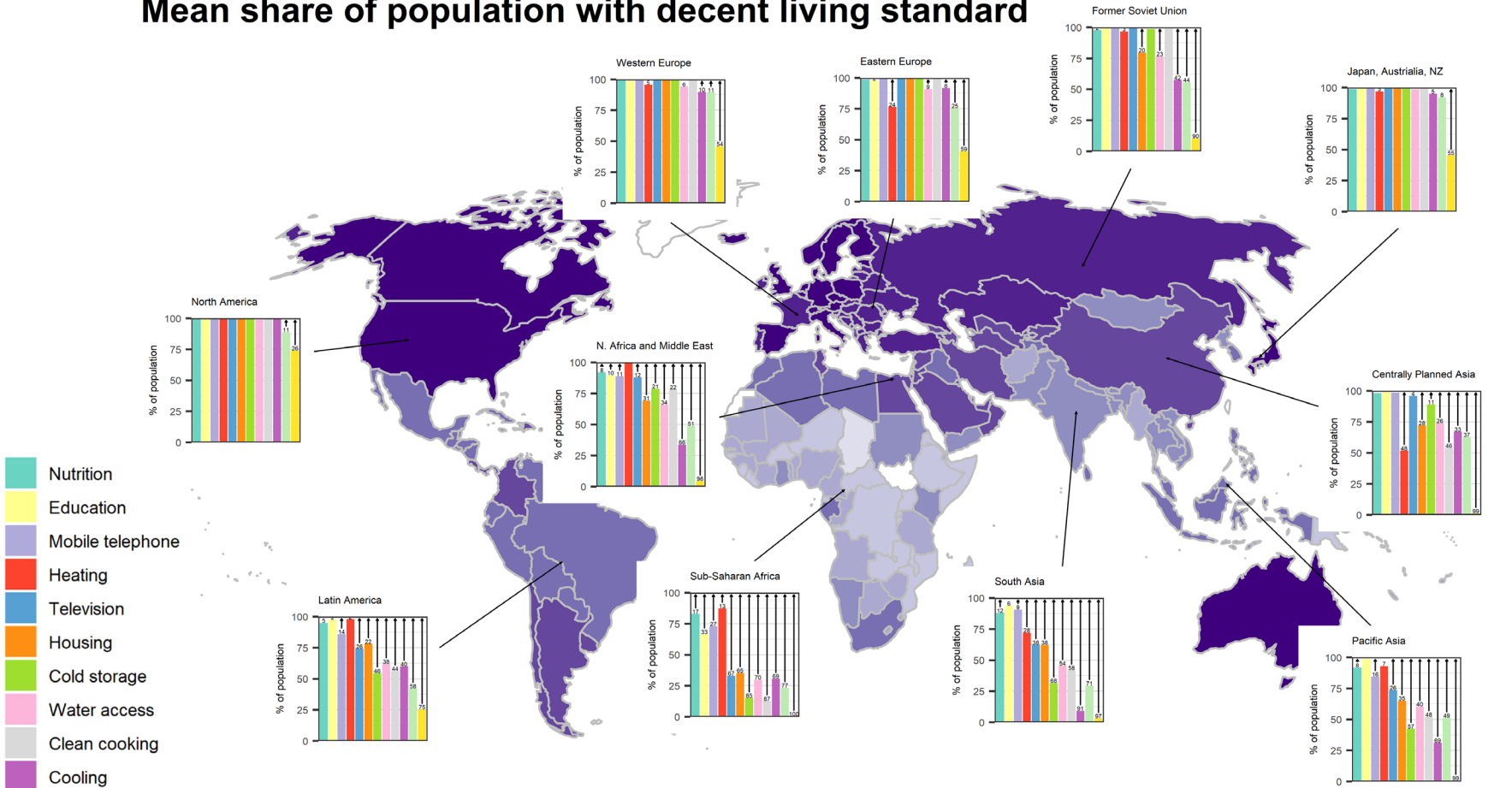
From Basic Needs to Minimum Set of Required Satisfiers

	Needs groups	Sub-Dimensions	Material Satisfiers
Physical	Shelter	Housing	Minimum space (10 m ² /cap), durable quality
		Indoor comfort	Heating/Cooling/Lighting/Clothing
	Nutrition	Food	Sufficient calories, cold storage (Fridge), clean cooking
	Health & Hygiene	Water	65 litres/day, improved access
Sanitation		Access to improved sanitation	
Provision of health care*		National health care expenditure	
Social	Socialization	Education	Lower secondary education
		Social connectedness	TV, cell phone (Internet)
	Mobility	Physical connectedness	8,527 p-km, motorized transport

Source: Rao, ND & J. Min, Social Indicators Research, 2018

Focusing on Decent Living Services (DLS) for all

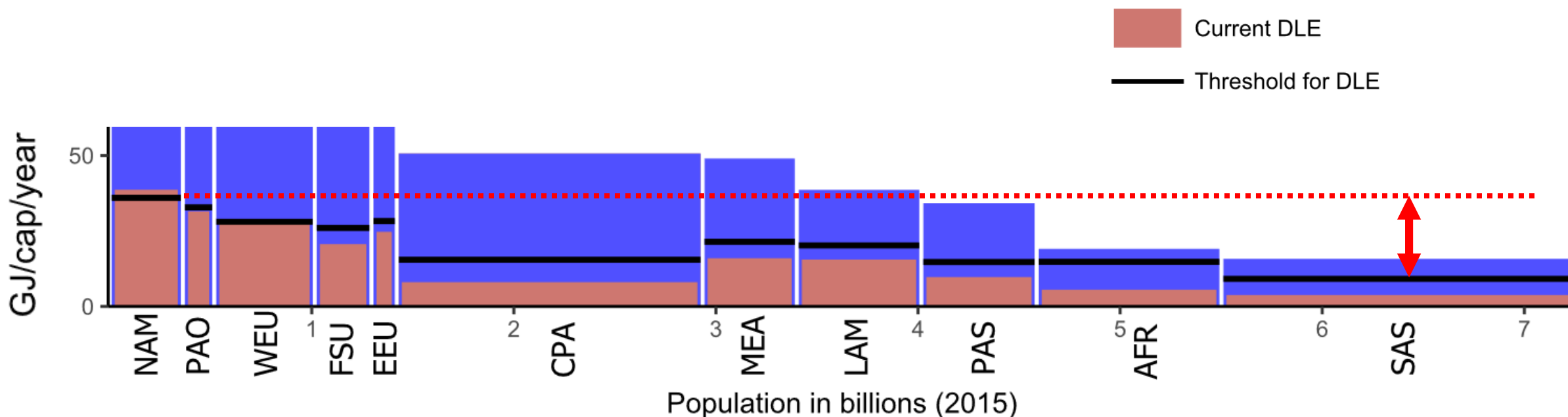
Mean share of population with decent living standard



Source: Kikstra al 2021; <https://doi.org/10.1088/1748-9326/ac1c27>

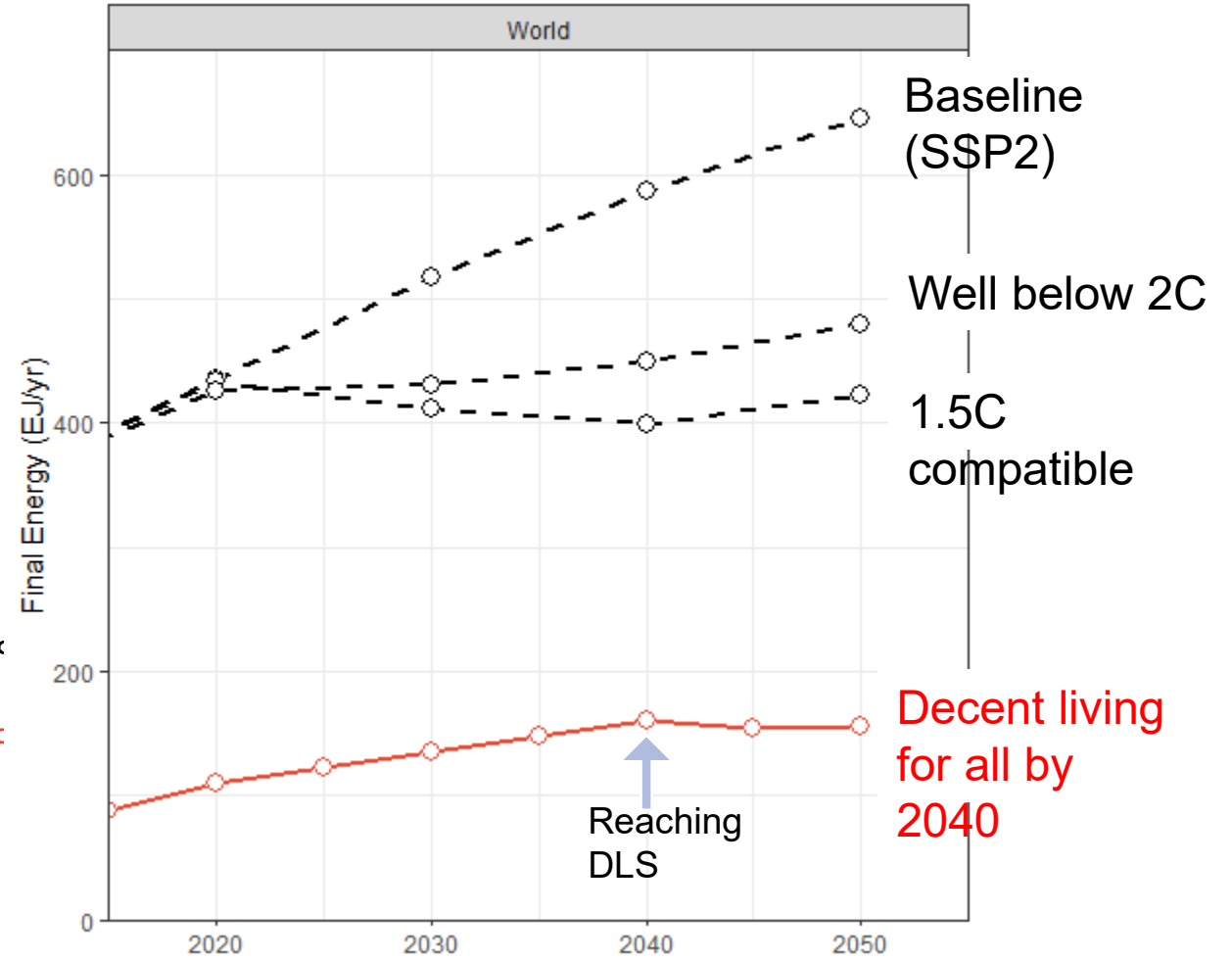
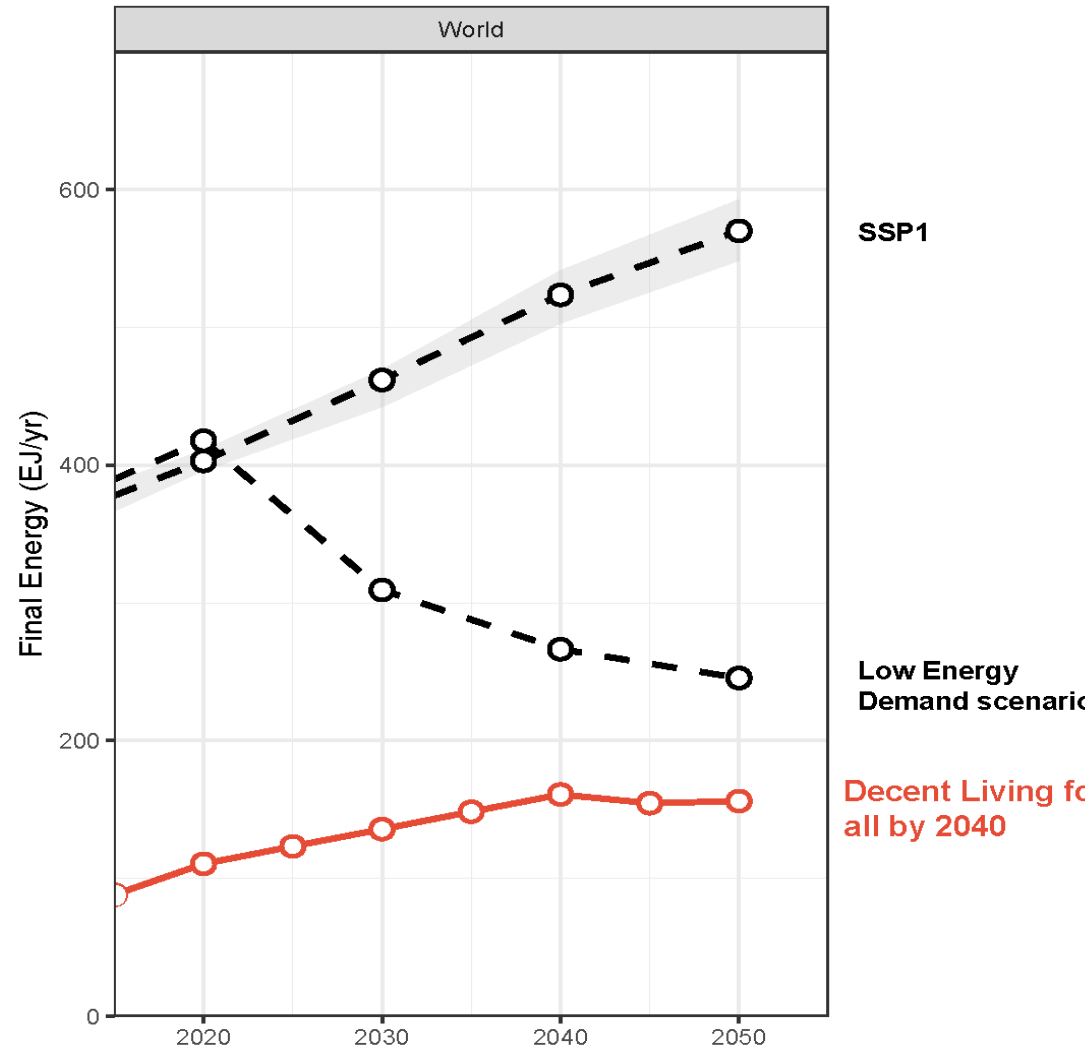
Human needs are the same, Decent Living Energy (DLE) needs are not.

- Regional energy needs vary from about **9 to 36 GJ/cap/yr**



Source: Kikstra al 2021; <https://doi.org/10.1088/1748-9326/ac1c27>

Globally enough to meet DLS for all



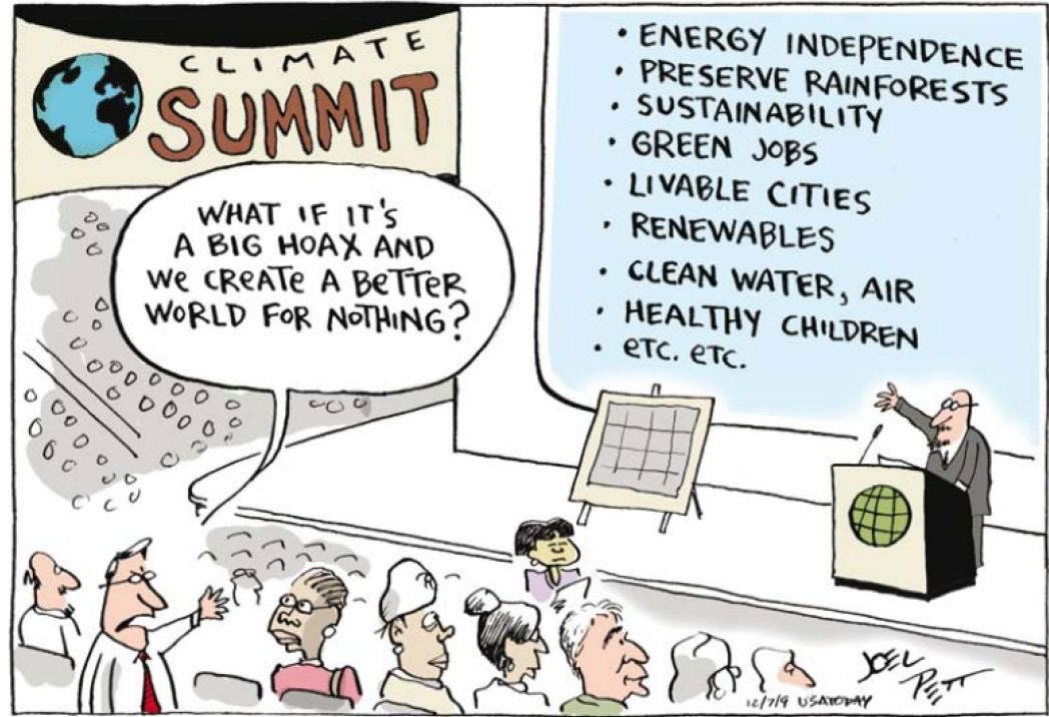
Source: Kikstra et al. (2021), *Environ. Res. Lett.* [10.1088/1748-9326/ac1c27](https://doi.org/10.1088/1748-9326/ac1c27).

Main Takeaways

- Trickle down economics will not work – explicit policies and efforts required to ensure universal access to basic energy services and decent living standards
- Despite significant growth in energy demand in regions of global South, inequalities persist and access for all is not likely without policy
- Enough energy globally, to meet universal decent living standards but redistribution may be necessary
- Climate mitigation and universal access goals can be achieved simultaneously if the poor and vulnerable are shielded

Thank you very much for your attention!

Questions?
Comments?



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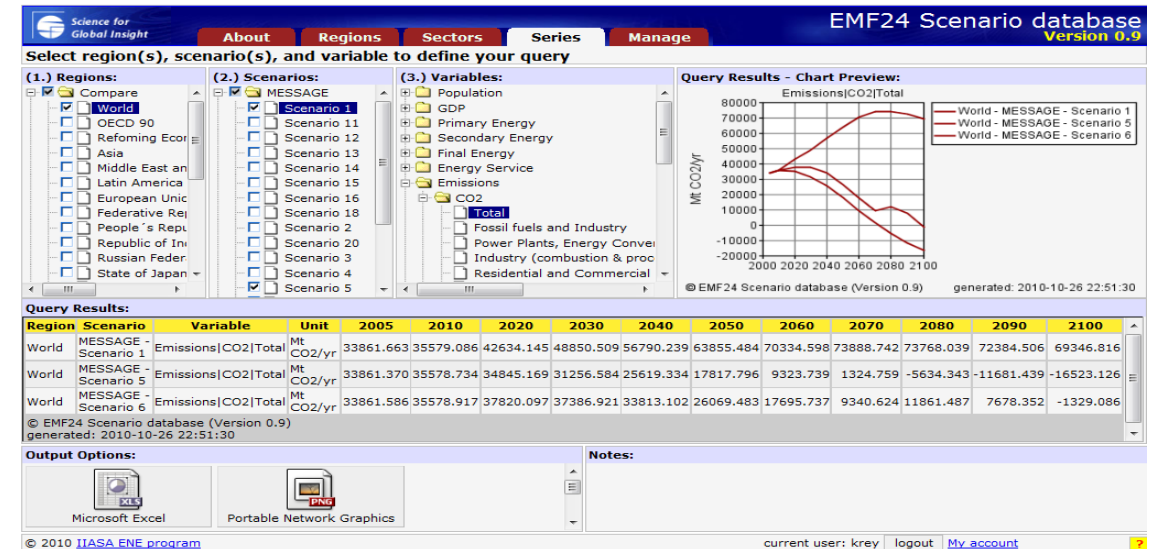
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