Interlinkages Between Multidimensional Poverty and Electricity

A study using the global Multidimensional Poverty Index (MPI)

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Acknowledgements

Funding Information

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Key Messages
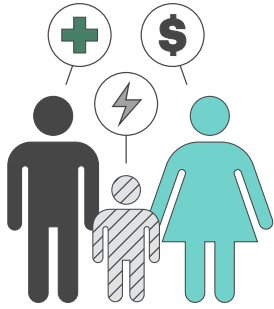
Electricity is an important proxy for multidimensional poverty, and one of its best predictors.

Of those deprived in electricity, **96% are also deprived in cooking fuel,** emphasising the acute overlapping deprivations in energy access and consumption.

16% or 922 million of the developing world population are **deprived in electricity,** hence are energy poor.

86% of those deprived in electricity also live in precarious housing, built using non-improved materials.
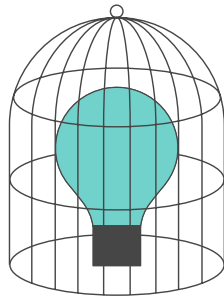
Three quarters (75%) of the global energy poor are multidimensionally poor. No other indicator of the living standards dimension in the global MPI showed higher percentages of deprivations *and* multidimensional poverty.

83% of those who do not have access to electricity also lack sanitation facility, or use unimproved toilets or are forced to share toilets with other households.
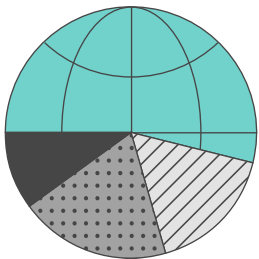
99% of the electricity deprived experience one or more additional deprivations simultaneously, emphasising the breadth of interlinkages observed among those lacking access to electricity. The persistency of this finding is striking in 13 selected countries studied with Changes Over Time data.
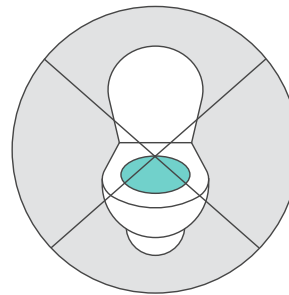
55% of the energy poor also draw their drinking water from unimproved sources or the sources are 30-minute or further from home.
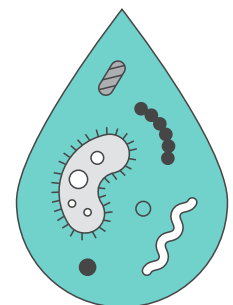
Key Messages
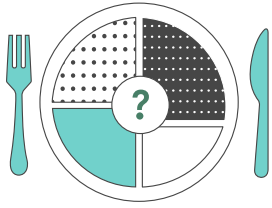
Just under half of the energy poor have **at least one person who is malnourished** in their home (45%).

12 of the 13 counties with Changes Over Time data **had statistically significant reductions in electricity deprivations over time.** No other indicator than electricy was significantly reduced for a greater number of countries.

Nearly half of those lacking electricity, **have lost a child under 18** in their household.
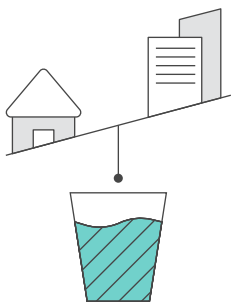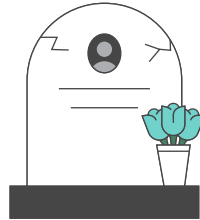
Significant improvement in electricity access were found among countries with fastest reduction in poverty over time, such as Rwanda & Sierra Leone.

While 39% of the urban energy poor lack safe drinking water, **nearly two-thirds of the rural energy poor did so (63%).** This gap is smaller with regards to sanitation, where 85% of the rural energy poor, and 75% of the urban energy poor, lacked access to improved sanitation.
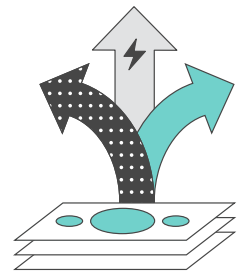
Multidimensional poverty among the energy poor remains prevalent however, even with economic development. In upper middle-income countries, **the third highest prevalence of multidimensional poverty is among the electricity deprived.**

Of the 687 million energy and multidimensionally poor, **410 million (60%), are severely poor.** Sub-Saharan Africa and South Asia is home to 88% of the electricity deprived and MPI poor.

Promisingly, **access to electricity** is found to lower severe multidimensional poverty.

This brief demonstrates **the pivotal importance of tackling energy poverty** in efforts to alleviate multidimensional poverty.
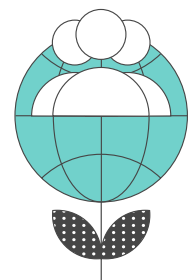
Introduction

According to the 2020 global Multidimensional Poverty Index (MPI) data, just under 1 billion people living in the developing regions of the world lack the power to light their homes. More than half of those lacking access to electricity are children under 18, disabling their chances to lead a normal play and study routine after sunset. In the present, for many of us, fast internet broadband is a necessity. Concurrently, in one-fourth of the subnational regions covered by the database – home to some 9% of the developing world population – electricity as a basic commodity is absent for two-third or more of the population living in each of these regions. While a large swath of the countryside in Sub-Saharan Africa lacks access to electricity, one will not miss observing the pockets of deprivation in electricity in urban areas of the developing region such as in Benin, Democratic Republic of Congo, Sierra Leone, to name a few using data as recent as 2017-2018. The first lens of numbers published in the global MPI database illuminate a simple fact: a substantial number of the population lack something as basic as switching on a light in their homes.

In this briefing, we extend the analysis using the global MPI microdata to explore the interlinkages between deprivation in electricity and other indicators related to health, education and living standards. The analysis on interlinkages adopted in this briefing paper is based on the approach presented in Alkire, Kanagaratnam, Nogales, and Suppa (2020). The aim of this particular analysis is to identify the most common simultaneous deprivations the electricity deprived experience in important dimensions of their everyday lives. The analysis further explores the relationship between electricity and poverty, measured using a multidimensional approach. The aim is to identify the distinctive profile of those who are poor and deprived in electricity. In addition, the analyses explores on a subset of countries to understand improvement in electricity access over time.

In addition, we also analysed the relationship between electricity and economic development. The latter was defined using the World Bank country classifications by income level. These analyses is motivated by The Rockefeller Foundation's goal on highlighting the importance of how access to reliable electricity enables upward economic mobility across low-income communities. The findings on the interlinkages between electricity and multiple indicators that relate to poverty, as well as the profiling of the poor and electricity deprived is a step towards this vision. The hope is that the analyses presented in this briefing paper can make the case for universal electrification as a path for economic development and highlight insights that can help maximize the impact of its programmatic work.

The global Multidimensional Poverty Index (MPI)

The global Multidimensional Poverty Index (MPI) is a quantitative assessment of the state of acute multidimensional poverty in the developing regions of the world. The measure systematically implements the most comprehensive counting-based measure of multidimensional poverty using internationally comparable multi-topic household surveys for over 100 countries. The global MPI was developed by Alkire and Santos (2010; 2014) in collaboration with the United Nations Development Program's Human Development Report Office. The global MPI was first published in the 20th anniversary flagship Human Development Report in 2010. Since then, the global MPI has been updated annually to include new and updated country surveys.

In 2018, the update marked a new milestone. OPHI and UNDP jointly undertook the first important revision of the global MPI (Alkire and Kanagaratnam, 2020; Alkire, Kanagaratnam and Suppa, 2018; OPHI, 2018). The aim was to closely align the measure, where possible, to the Sustainable Development Goals (SDGs) that underlie the 2030 development agenda. The MPI aims to offer a global account of acute multidimensional poverty that is transparent, disaggregated (to over 1200 subnational regions as well as age cohort, and rural-urban areas), and to the largest extent possible, comparable across countries in the developing world.

FIGURE 1
Structure of the global Multidimensional Poverty Index
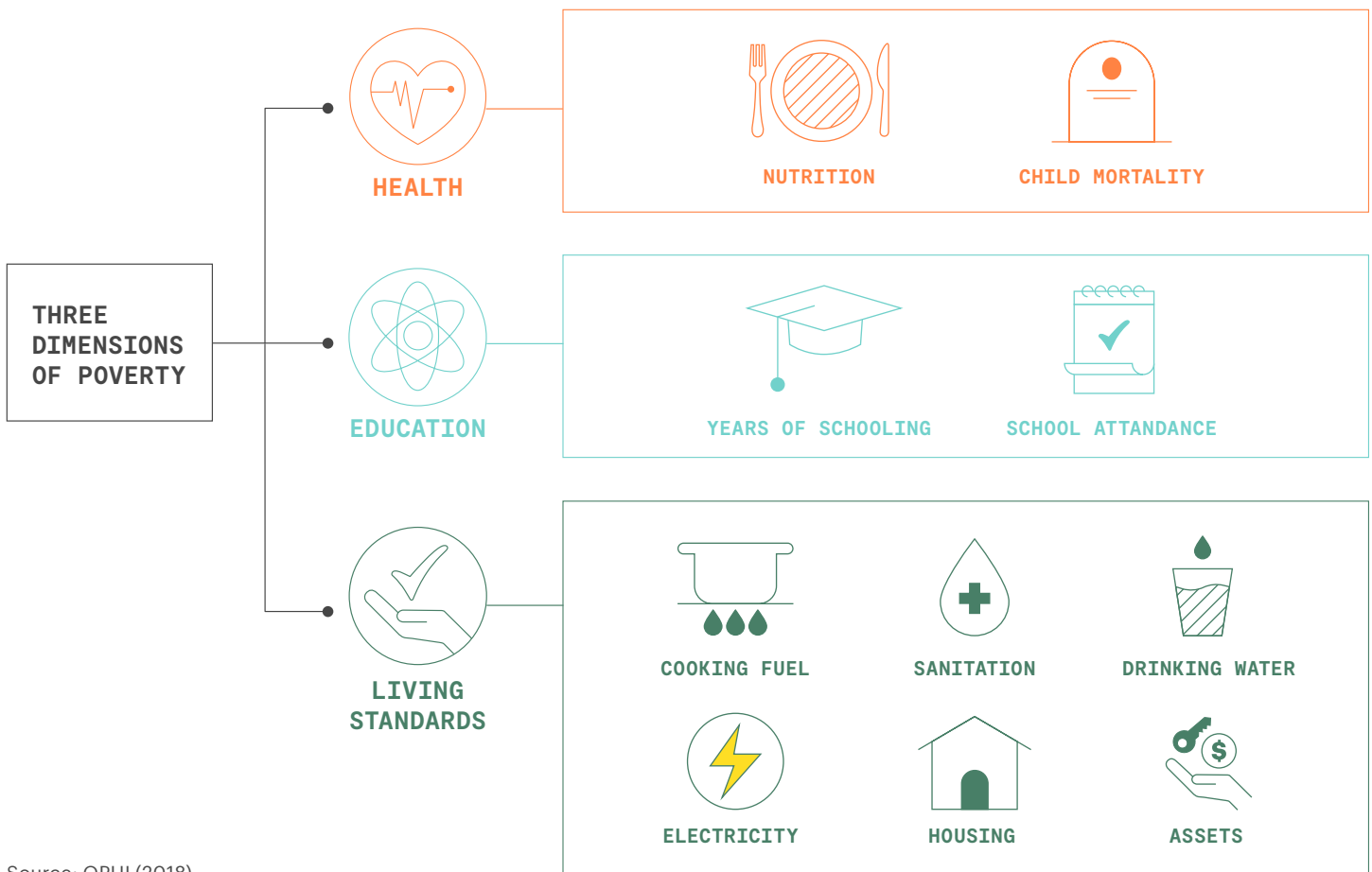
Source: OPHI (2018).

Relying methodologically on the dual-cutoff counting approach pioneered by Alkire & Foster (2011), the global MPI is recognized as a useful complement of the more traditional notion of monetary poverty by directly measuring the simultaneous shortfall in manifold dimensions of human wellbeing (see Atkinson, 2019; Report of the UN Secretary General, 2018; and Global Sustainable Development Report, 2019[1]).

The global MPI scrutinizes a person's deprivations across 10 indicators in three equally weighted dimensions of health, education and standard of living (Figure 1). This means each dimension receives one-third of the weight. The indicators within each dimension is equally weighted as well. The equal weights across dimensions reflect the normative assessment that achievements in health, education, and living standards are roughly equal in intrinsic value, in addition of easing the interpretation of the index for policy (Alkire & Santos, 2014: 256). The indicator cut-off allows us to identify whether a person is deprived or non-deprived in each of the indicator[2]. This allows us to build a deprivation profile for each person or observation in the sample surveys. In the global MPI, a person is multidimensionally poor or MPI poor if the person's deprivation score is equal to or higher than one-third of the weighted indicators. The measure offers a high-resolution lens to identify both who is poor and how they are poor. It complements the international $1.90 a day poverty rate by showing the nature and extent of overlapping deprivations for each person.

Motivation for the briefing paper

The Rockefeller Foundation's Power & Climate Initiative 10-year goal is to enable upward economic mobility by accelerating access to and consumption of reliable electricity in underserved, low-income communities. To do this it will leverage breakthroughs in data science and decentralized renewable energy, and develop large-scale, innovative partnerships that dramatically decrease the cost and accelerate the pace of electrification. The Initiative aims to achieve 3 goals:

Connect the unconnected: Provide unserved populations with quicker access to electricity as a critical tool to move out of poverty. This challenge is particularly acute in sub-Saharan Africa where 573 million people (56%) currently have no access to electricity[3].
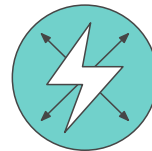
Grow energy demand and consumption (energy for development): Drive higher levels of 'productive consumption' in order to deliver on the promise of full electricity to grow incomes, improve health, and empower women[4].
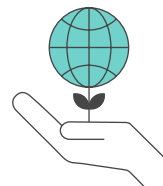
Build the grid of the future: Support more cost-effective, resilient and low-carbon energy systems that combine grid and off-grid technologies.

01 Energy Poverty and Multidimensional Poverty

A growing focus in the literature
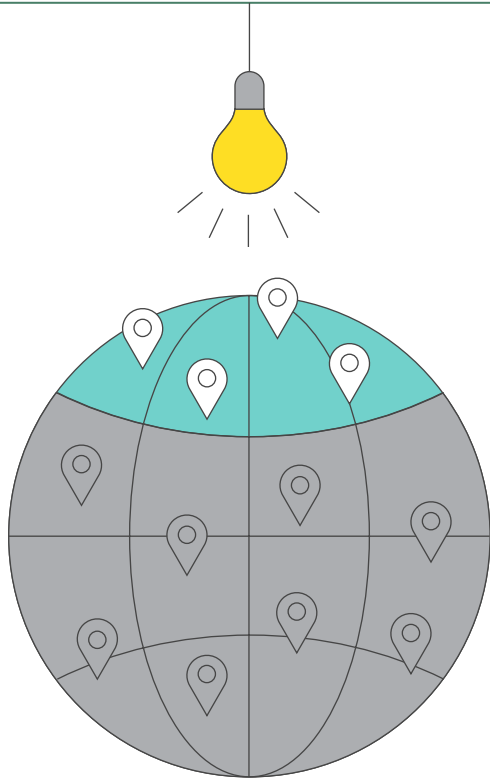
Heating, cooling, cooking and lighting are generally understood as essential energy services that support a life in dignity, allowing households to be productive, economic active, to educate their members and to recreate. Meeting energy services in developing countries is commonly done by burning solid carbon-based fuels such as charcoal, wood, peat or lignite, all of which carrying significant health and environmental risks and costs. Electricity access is commonly measured by the number of grid-connected communities and/or households. While the political focus on the technical infrastructure for electricity is increasingly criticised as too narrow – it ignores electricity pricing, climate conditions, poor grid quality and social practices of use – the Sustainable Development Goal 7 emphasizes the need to "ensure access to affordable, reliable and modern energy for all by 2030", and is

mainly seen as a need to directly improve electricity and fuel access where "energy access is commonly posited as the mirror opposite of energy poverty – a condition of unstable and/or unaffordable access to electricity and clean fuels" (Cotton et al., 2019).

The International Energy Agency estimates that 1.3–2.6 billion people on the planet experience energy poverty (Doukas and Marinakis, 2020: 45). Two recent trends in the relevant literature can be observed: firstly, recent focus has been placed on "identifying energy poor households [as] a prerequisite for mitigating energy poverty and saving energy" (ibid: 46). This recognition carries important policy implications to mitigate the socio-economic and environmental costs risks of energy poverty in a targeted manner. Secondly, several papers started to design *multidimensional energy poverty indexes* that go beyond the lack of technical infrastructure considerations. Some include both objective indicators on energy costs and subjective indicators on housing faults or whether it is perceived to be warm enough (Sokolowski et al., 2020), while other composite indices combine socio-economic population indicators with characteristics of buildings and energy performance (Gouveia et al., 2019). Further are *conceptual frameworks* designed that are specific to the needs of certain areas, such as urban cities, and study the interconnection between sociodemographic and housing vulnerabilities to energy poverty and urban social inequalities (Bouzarovski and Thomson, 2018).

A key objective of this briefing paper is to contribute to this emerging academic interest and to shed further light on the interlinkages of the energy and multidimensional poverty using the global MPI data.

Exploring electricity in the MPI

Electricity deprivation has been traditionally seen as a good proxy for energy poverty, although recent literature emerging on energy poverty would stress the importance to deepen the understanding of energy poverty beyond a lack of access to electricity to include things like power cuts, costs, and so forth. Whether electricity deprivation can be considered a good proxy for multidimensional poverty needs to further analysed and best approached through a step-by-step analysis that answers the following questions:

I.   What is the relationship between a lack of electricity and other aspects of multidimensional poverty?

II.   What are the most common simultaneous deprivations the electricity deprived face?

III.   Among the poor, how many are deprived in electricity? How are these people distinctive?

IV.   What is the association between electricity and economic development?

V.   What is the poverty intensity among those MPI poor and deprived in electricity?

VI.   What is the association between electricity and multidimensional poverty over time?
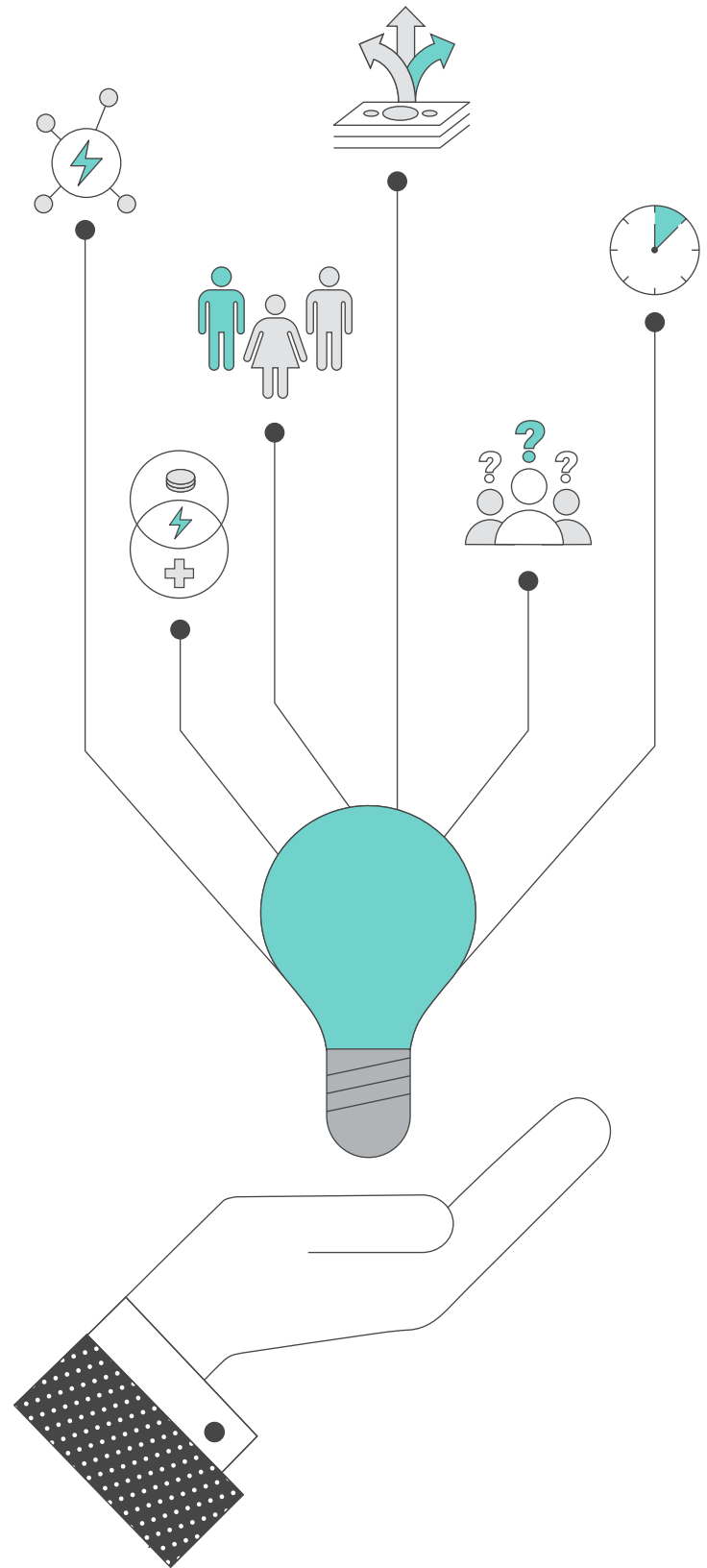
02 Data sources and geographical scope

This briefing paper primarily applies the global Multidimensional Poverty Index (MPI) 2020 pooled microdata, covering 107 countries – 28 low income, 76 middle income and 3 high income – to systematically explore the relationships between energy poverty and multidimensional poverty[5]. The overall pooled sample result is 9.28 million individual observations that represent around 5.9 billion people. This corresponds to nearly 78% of the global population and 90% of the population living in the developing world. Across the major world regions, the population coverage ranges from almost complete for Sub-Saharan Africa to half of the population living in the Europe and Central Asia region (Table 1).

Because of its robust functional form and direct measures of acute deprivation, insofar as the indicators are comparable, the global MPI can be used for comparisons across countries or regions of the world, as well as for within-country comparisons between such as rural and urban areas (Alkire, Kanagaratnam and Suppa, 2020). Out of the 107 countries included in the 2020 global MPI, disaggregation results by urban and rural areas were produced for 106 countries – all except Seychelles because information on the division between rural and urban areas were not made available by the survey providers.

The nationally representative microdata are drawn from four major sources: the Demographic and Health Surveys (DHS, 47 countries), the Multiple Indicator Cluster Surveys (MICS, 47 countries), the Pan Arab Project for Family Health (PAPFAM, 3 countries) surveys, and ten national surveys[6]. The vast majority of the countries had data that was collected in the last five years. Notably, for 83 countries – home to 92 percent of multidimensionally poor people – the data were collected in 2013/2014 or later.

TABLE 1
The global Multidimensional Poverty Index
(MPI) data coverage, by major world regions

DATA COVERAGE:

90% DEVELOPING REGIONS

78% WORLD POPULATION

EUROPE AND CENTRAL ASIA — 50%

ARAB STATES — 79%

EAST ASIA AND PACIFIC — 93%

SOUTH ASIA — 96%

LATIN AMERICA AND CARIBBEAN — 83%

SUB-SAHARAN AFRICA — 99%
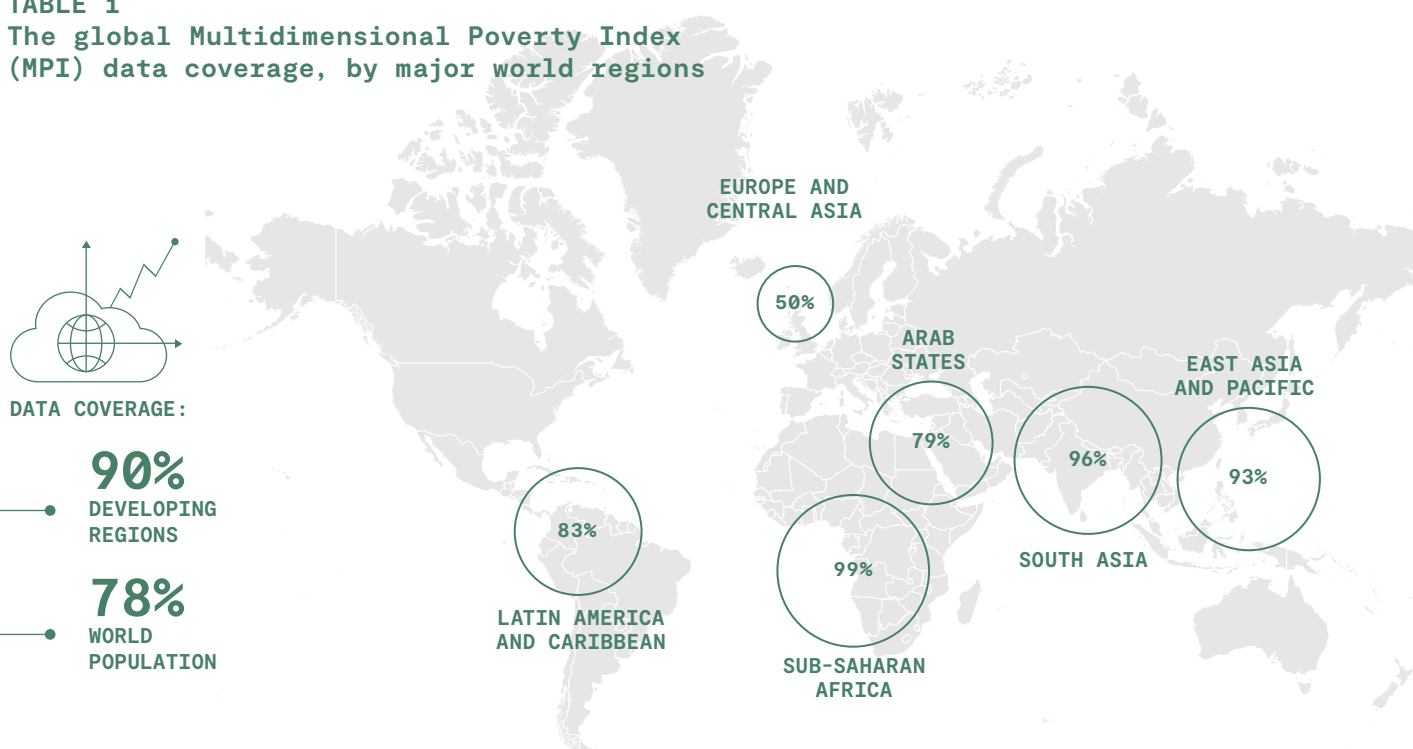
Source: Alkire, Kanagaratnam, and Suppa (2020)

In 86 countries, the results were based on all 10 indicators of the global MPI. In 20 countries, the results were based on nine indicators, while Seychelles was the only country that lacked two indicators. The countries lacking one indicator mainly lacked information on nutrition or child mortality, with Egypt and Lesotho lacking cooking fuel, Honduras, electricity and China not having information on housing. We exclude the relevant countries with missing data while estimating the population weighted share of deprivation by indicator at the aggregate level. For example, we estimate the proportion of population deprived in electricity in the developing region by excluding the population size of Honduras since the data is not available in this country.

However, in computing the number of poor, these countries are included in the estimation. In countries lacking indicators, weights on other indicators within the dimension of the missing indicator are equally increased such that they sum up to one-third (Alkire, Kanagaratnam and Suppa, 2020). This allows for maintaining equal weights across the three dimensions, while making use of all possible information to identify the multidimensionally poor.

In addition, trends in energy and multidimensional poverty are analysed in this brief for the following 13 countries: Benin, Cote d'Ivoire, Ethiopia, India, Kenya, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Togo, Uganda, and Zambia[7]. Collectively, in 2020, these countries represent some 32.5% of the developing region population, and are home to 53.0% of the MPI poor. The brief explores harmonised data between two time points studied in each country, thus allowing for an analysis of changes observed over time.

03 Results

The extent of overlapping deprivations experienced among those deprived in electricity

Firstly, across 106 countries and 5.9 billion people with data on electricity, we find that 922 million (15.7%) are deprived in electricity[8]. 88.4% of those deprived in electricity live in South Asia (208 million, 22.5%) and Sub-Saharan Africa (607 million, 65.8%). By region, we find that 59.8% of the population in Sub-Saharan Africa is electricity deprived, followed by 11.4% of the population in South Asia. Figure 2 shows a complete breakdown of electricity deprived by world region. Table A.3 in the Appendix presents the percentage and number of people deprived in electricity, by country and the world region aggregates.

Secondly, to demonstrate what is distinctive of electricity deprivations, we analysed the joint distribution of deprivations across the ten global MPI indicators. To give a visual depiction of these, we graphed the number of additional deprivations that are experienced, on average, by people who are deprived in each indicator. As can be seen in Figure 3, 99.4% of people deprived in electricity have one or more additional deprivations. In other words, global evidence shows that the proportion of persons who are only deprived in electricity (and nothing else) is less than one percent. This is the lowest of all indicators – making it the indicator that has the most interlinkages with other deprivations. This suggests that by looking at the population that is deprived in electricity, in 99% of the cases we look at people who also experience additional deprivations.

By rural and urban areas, the evidence shows that as little as 0.2% of the global rural poor are only deprived

FIGURE 2
Percentage of population and number of people deprived in electricity, by world region
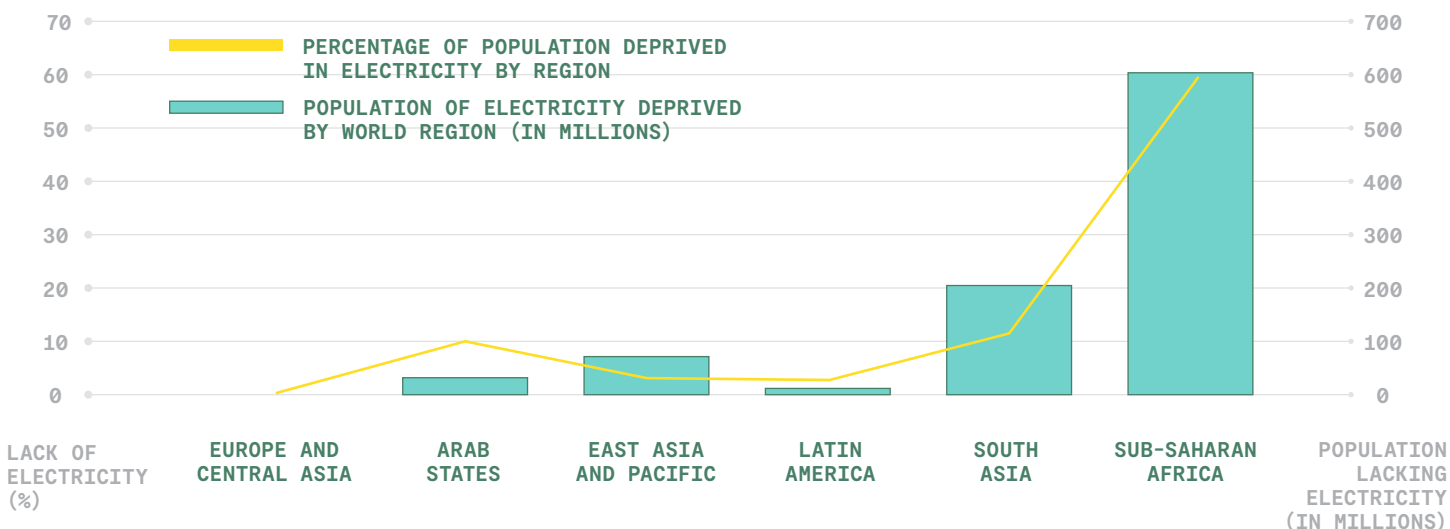
FIGURE 3

Frequency (%) of additional deprivations experienced by individuals who are deprived in each of the global MPI indicators, by developing countries, rural and urban areas

FREQUENCY (%)

WORLD　RURAL　URBAN

	NUTRITION	CHILD MORTALITY	YOS	SCHOOL ATTENDANCE	COOKING FUEL	SANITATION	DRINKING WATER	ELECTRICITY	HOUSING	ASSETS
WORLD	19.2	8.2	7.4	6.5	12.3	10.0	14.2	0.6	4.7	1.7
RURAL	9.0	4.5	3.1	2.5	10.4	3.9	9.6	0.2	2.6	0.5
URBAN	41.0	7.7	24.8	19.7	19.9	26.8	28.0	3.4	15.2	7.7

LIVING STANDARDS
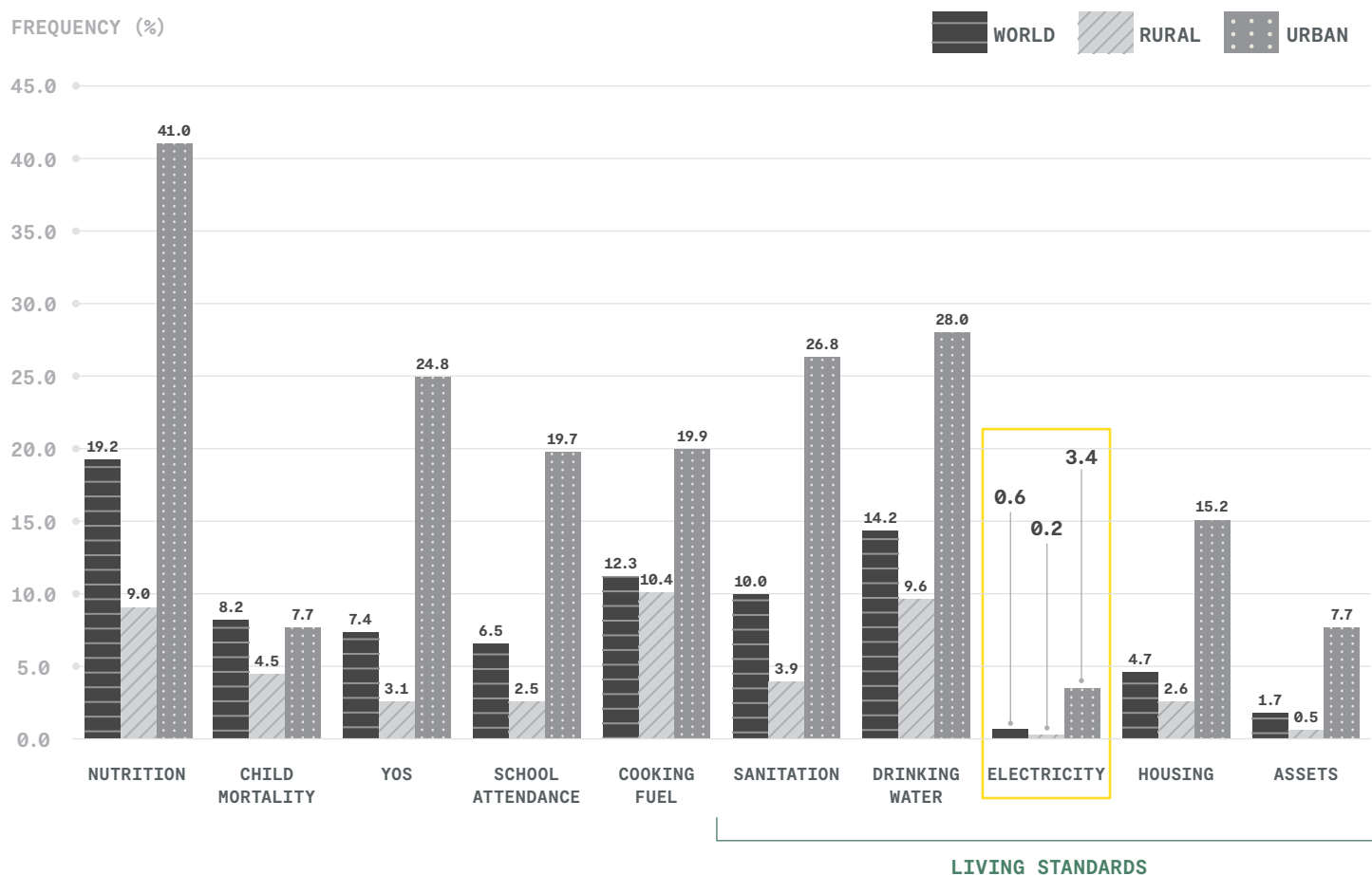
in electricity and nothing else, and 3.4% in urban areas. In both cases, electricity is the lowest of all 10 indicators in the global MPI with the proportion of people only deprived in this indicator, again, making it the most interlinked indicator in the global MPI.

Further, by looking at the electricity deprived at the world region (see Figure 4), we find that this finding is not only true at the global level. In every region, energy poverty has among the most interlinked deprivations.

In every region except Europe and Central Asia, over 96% of those deprived in electricity are multiply deprived. In South Asia and Sub-Saharan Africa, it's nearly 100%. With regards to Sub-Saharan Africa, what is distinctive here is that electricity is not the only indicator with almost 100% of deprived people carrying at least one additional deprivation. Other highly interlinked indicators include years of schooling (99.7%), school attendance (99.3%), housing (99.1%) and assets (99.9%).

FIGURE 4
Frequency (%) of additional deprivations experienced by people across the 10 indicators of the global MPI, by world region

Nutrition	Child mortality	Years of schooling	School attendance	Cooking fuel	Sanitation	Drinking water	Housing	Assets	Electricity

FREQUENCY (%) OF ADDITIONAL DEPRIVATIONS
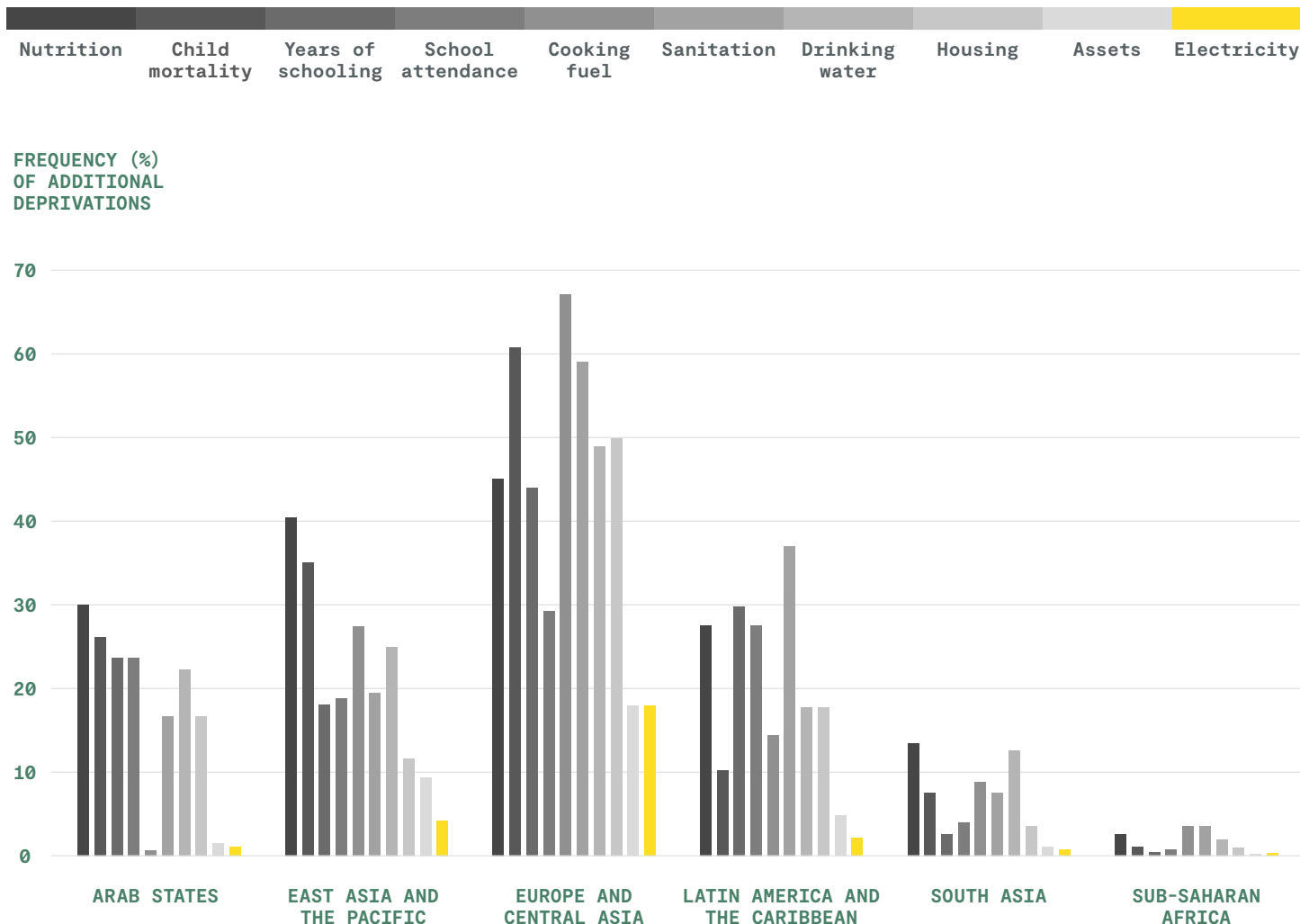
Finally, we looked at a subset of 13 countries with Changes Over Time data across two time periods and disaggregated the results by rural and urban populations. This allows to analyse trends in the data and to find persistency of the hitherto findings. In Table 2 we highlighted in yellow where electricity showed either the lowest or second lowest of all indicators with the proportion of persons who are only deprived in this indicator. We find that in 32 of 52 comparisons, electricity showed either the lowest or second lowest proportion of persons who are only deprived in this indicator. We find that in rural areas, in eight countries in Year 1 and seven countries in Year 2, electricity is ranked the lowest or second lowest of all indicators, compared to seven countries in Year 1, and nine countries in Year 2 in urban areas. With 12 of 13 countries being in Sub-Saharan Africa, what this comparison demonstrates is the *persistency* of the high interlinkages of electricity with the other indicators of the global MPI, particularly for urban and rural areas of countries in the African region.

TABLE 2
Frequency (%) of additional deprivations experienced by people across the 10 indicators of the global MPI, for 13 countries with changes over time data, by rural-urban population

Country	Year 1/2	Area	Year Difference	Nutrition	Child Mortality	YoS	School Attendance	Cooking Fuel	Sanitation	Drinking Water	Electricity	Housing	Assets
Benin	Year 1	Rural		0.02	0.17	0.05	0.11	0.84	0.06	0.23	**0.00**	0.13	0.17
	Year 2	Rural	3.5	0.05	0.04	0.00	0.05	1.42	0.09	0.09	**0.01**	0.02	0.12
	Year 1	Urban		0.73	0.79	0.13	1.91	8.85	2.18	0.23	**0.08**	0.60	0.09
	Year 2	Urban	3.5	0.82	0.17	0.56	1.72	7.35	1.90	0.12	**0.04**	0.93	0.11
Côte d'Ivoire	Year 1	Rural		0.88	0.35	0.37	0.38	1.60	0.26	0.48	**0.02**	0.28	0.01
	Year 2	Rural	4.5	0.18	0.32	0.12	0.22	2.24	0.56	0.17	**0.04**	0.04	1.56
	Year 1	Urban		7.95	8.29	1.85	7.88	10.15	7.10	8.08	**1.26**	1.18	0.57
	Year 2	Urban	4.5	16.51	13.59	7.87	11.00	13.16	18.02	5.41	**3.00**	20.02	6.30
Ethiopia	Year 1	Rural		0.00	0.00	0.01	0.04	0.04	0.00	0.04	**0.00**	0.02	0.00
	Year 2	Rural	5	0.00	0.00	0.00	0.00	0.00	0.00	0.03	**0.00**	0.00	0.00
	Year 1	Urban		1.28	3.27	0.08	2.21	2.96	1.31	0.35	**0.10**	0.82	0.12
	Year 2	Urban	5	4.08	2.41	0.48	1.67	2.52	3.71	0.67	**0.05**	3.49	0.18
India	Year 1	Rural		1.57	0.51	0.15	0.60	2.35	0.91	1.21	**0.04**	0.37	0.22
	Year 2	Rural	10	5.97	2.36	1.38	1.18	6.90	3.53	6.73	**0.30**	2.38	0.48
	Year 1	Urban		24.41	8.60	2.00	8.25	5.99	14.38	13.61	**0.59**	3.27	4.72
	Year 2	Urban	10	38.17	15.25	10.75	13.51	15.48	27.83	36.68	**5.81**	15.52	6.12
Kenya	Year 1	Rural		0.24	1.73	0.23	0.67	0.04	0.03	0.13	**0.00**	0.30	0.09
	Year 2	Rural	5.5	0.04	1.52	0.37	2.30	0.07	0.05	0.01	**0.16**	0.27	0.02
	Year 1	Urban		5.93	6.10	0.43	2.32	4.34	3.98	1.05	**0.51**	7.89	0.36
	Year 2	Urban	5.5	0.08	1.38	0.22	3.44	1.45	3.41	1.02	**0.02**	8.13	0.08
Nigeria	Year 1	Rural		0.21	0.16	0.04	0.01	1.74	2.05	0.55	**0.17**	0.03	0.01
	Year 2	Rural	5	0.85	0.33	0.03	0.01	2.90	1.98	1.06	**0.33**	0.03	0.04
	Year 1	Urban		6.96	4.05	1.43	2.26	7.83	19.34	8.46	**1.88**	1.29	1.30
	Year 2	Urban	5	4.56	2.14	1.19	3.38	9.18	13.93	17.32	**2.02**	1.45	0.31

Country	Year 1/2	Area	Year Difference	Nutrition	Child Mortality	YoS	School Attendance	Cooking Fuel	Sanitation	Drinking Water	Electricity	Housing	Assets
Rwanda	Year 1	Rural		0.77	0.88	0.10	0.15	1.01	0.07	0.13	**0.03**	0.25	0.11
	Year 2	Rural	4.5	1.53	2.90	0.59	0.12	1.91	0.05	0.03	**0.00**	0.00	0.33
	Year 1	Urban		0.54	4.06	3.34	5.60	14.17	0.60	0.05	**2.58**	0.08	0.23
	Year 2	Urban	4.5	0.33	19.01	0.05	19.18	18.61	0.98	0.05	**0.04**	8.15	0.12
Senegal	Year 1	Rural		0.42	0.39	0.46	0.83	0.83	0.09	0.02	**0.30**	0.34	0.76
	Year 2	Rural	12	0.53	1.41	0.13	0.53	2.06	0.30	0.49	**0.35**	0.24	0.59
	Year 1	Urban		15.02	13.56	5.09	14.32	10.72	29.96	4.14	**0.03**	8.31	5.18
	Year 2	Urban	12	9.19	18.91	8.04	14.30	20.83	17.92	4.55	**1.46**	2.74	1.80
Sierra Leone	Year 1	Rural		0.49	0.10	0.02	0.11	0.01	0.01	0.32	**0.27**	0.05	0.22
	Year 2	Rural	4	0.24	1.22	0.04	0.25	0.45	0.02	0.22	**0.01**	0.05	0.29
	Year 1	Urban		0.32	8.79	1.01	0.05	5.81	0.39	0.10	**2.68**	1.98	0.18
	Year 2	Urban	4	7.29	0.09	1.87	4.94	8.10	0.98	0.42	**0.13**	0.48	0.90
Togo	Year 1	Rural		0.87	0.60	0.04	0.24	0.54	0.01	0.20	**0.02**	0.05	0.48
	Year 2	Rural	3.5	0.07	0.17	0.00	0.63	0.89	0.02	0.14	**0.03**	0.06	0.08
	Year 1	Urban		1.68	0.44	0.49	2.23	12.02	1.88	0.70	**0.04**	2.61	1.25
	Year 2	Urban	3.5	3.64	1.85	0.67	2.74	12.05	4.37	4.66	**5.50**	2.15	0.08
Tanzania	Year 1	Rural		0.21	0.28	0.14	0.18	0.40	0.03	0.02	**0.01**	0.12	0.00
	Year 2	Rural	5.5	0.13	0.28	0.03	0.60	1.31	0.08	0.00	**0.02**	0.02	0.01
	Year 1	Urban		2.47	1.16	0.50	1.75	9.37	2.23	0.65	**0.11**	1.15	1.25
	Year 2	Urban	5.5	1.23	2.22	2.14	1.76	13.88	3.70	1.41	**0.38**	0.30	0.14
Uganda	Year 1	Rural		0.52	1.79	1.48	0.69	0.24	0.12	0.42	**0.39**	1.64	0.24
	Year 2	Rural	5	1.21	5.26	0.18	0.79	2.12	0.14	0.02	**0.00**	0.01	0.21
	Year 1	Urban		0.52	12.30	1.00	1.08	9.08	2.54	0.29	**2.84**	1.31	0.02
	Year 2	Urban	5	1.94	6.82	2.22	11.77	12.36	1.29	7.57	**0.19**	0.46	1.94
Zambia	Year 1	Rural		0.38	0.33	0.05	0.30	0.10	0.19	0.20	**0.45**	0.03	0.02
	Year 2	Rural	6.5	0.36	0.25	0.03	0.07	0.31	0.37	0.02	**1.13**	0.05	0.18
	Year 1	Urban		0.48	13.01	0.45	6.78	5.51	8.57	7.74	**3.79**	1.49	0.48
	Year 2	Urban	6.5	0.24	7.80	1.52	3.49	10.70	7.34	3.15	**0.13**	0.57	0.24

Profiling the energy poor by assessing the nature of their additional deprivations

We assessed the most common additional deprivations that electricity-deprived people face. We computed the ratio between the proportion of people with simultaneous deprivations in any two indicators of the global MPI, and the lowest proportion of deprivation of those indicators independently (Alkire et. al., 2015: pp. 228-232; UNDP and OPHI, 2019: 77).

$$R_{A,B} = \frac{\%\text{ of people deprived in both A and B}}{\%\text{ of population devrived in A or B, whichever is lower}}$$

This ratio answers the question: how many people who *could* be deprived in both indicators at the same time, actually are? For example, let's say that we want to look at the overlap between deprivations in electricity and nutrition. 10% of people are deprived in electricity and 20% are deprived in nutrition and 5% are deprived in both. So notice that fewer people are deprived in electricity than nutrition, so in the denominator we have 10%. And the numerator is 5%. So 50% of the people who could be deprived in both indicators, actually are.

More formally, this ratio (introduced as the redundancy coefficient in Alkire, et.al., 2015) ranges from zero to one, where zero signifies that no person who is deprived in one indicator is also deprived in the other, and one means that all people who are deprived in the indicator with the lower uncensored headcount ratio - the proportion of the population that is deprived in that indicator - are also deprived in the other indicator. In other words, we obtain the percentage of people

who are deprived in both indicators, divided by the minimum of the uncensored headcount ratio of the two indicators under study. Table 3 presents results from this redundancy test for the ten indicators of the global MPI worldwide, and disaggregated by rural and urban areas. We will place special emphasis on the electricity deprived.

First, let us see which indicators have the lower headcount ratio. Electricity has the lower headcount ratio than five indicators, but child mortality, assets and the two education indicators each have lower deprivations. This in itself is interesting. There are more energy poor people than people who live with an out-of-school child. In an information age, it provides a sense of how dramatic this deprivation is.

For five indicator pairs, the ratio is interpreted as showing the percentage of persons deprived in electricity who are also deprived in the other indicator. Of those deprived in electricity, almost all are also deprived in cooking fuel (96%), and at least five-sixths are also deprived in housing (86%), and sanitation (83%). Of the electricity deprived in rural areas, the simultaneous deprivations with these indicators are even more pronounced: 98% are also deprived in cooking fuel, 89% in housing, and 85% in sanitation. Here as well, in each of these three indicator-pairs, electricity showed the lower uncensored headcount ratio, as can be seen in Table 3.

Moving to the deprivations with lower rates overall, we find that just under half of the energy poor have malnutrition in their home (45%), and over half lack access to clean drinking water (55%). This simple analysis provides a powerful profile of the energy poor.

Moving to indicators where electricity showed the higher uncensored headcount ratio, we find additional powerful information. Nearly half of those who have lost a child under 18 years of age in the last five years (overall 3%), are energy poor (47%). Over half of those who live in households lacking any person with primary schooling (14.3%), are energy poor (55%), and similarly, for those 10% living in households where not

TABLE 3
## Ratio of simultaneous deprivations by indicator of the global Multidimensional Poverty Index (MPI)

LEVEL		Nutrition	Child Mortality	Years of Schooling	School Attendance	Cooking Fuel	Sanitation	Drinking Water	Electricity	Housing	Assets
		Indicators of the Global Multidimensional Poverty Index (MPI)									
WORLD	Nutrition	1.00									
	Child Mortality	0.53	1.00								
	Years of Schooling	0.44	0.34	1.00							
	School Attendance	0.51	0.31	0.48	1.00						
	Cooking Fuel	0.76	0.80	0.87	0.86	1.00					
	Sanitation	0.64	0.66	0.77	0.72	0.82	1.00				
	Drinking Water	0.41	0.38	0.40	0.44	0.81	0.72	1.00			
	Electricity	0.45	0.47	0.55	0.56	0.96	0.83	0.55	1.00		
	Housing	0.63	**0.66**	**0.79**	**0.76**	0.87	0.72	0.70	0.86	1.00	
	Assets	0.43	0.27	0.47	0.38	0.93	0.82	0.46	0.64	0.85	1.00
RURAL	Electricity	0.46	0.55	0.60	0.64	0.98	0.85	0.63	1.00	0.89	0.67
URBAN	Electricity	0.35	0.22	0.26	0.25	0.86	0.75	0.39	1.00	0.63	0.47

The indicators in **bold** reflect redundancy comparisons where the denominator is not electricity, because the other indicators' deprivations are lower than electricity.

Uncensored Headcount Ratio[1]

WORLD		WORLD	RURAL	URBAN
WORLD	Nutrition	30.2%	36.1%	22.5%
	Child Mortality	3.2%	4.2%	2.0%
	Years of Schooling	14.3%	20.8%	6.4%
	School Attendance	9.8%	13.7%	5.1%
	Cooking Fuel	48.3%	70.1%	21.8%
	Sanitation	34.9%	46.6%	20.7%
	Drinking Water	23.4%	32.0%	12.9%
	Electricity	15.7%	24.9%	4.6%
	Housing	40.7%	57.8%	16.5%
	Assets	13.0%	19.7%	4.7%
RURAL	Electricity	24.9%		
URBAN	Electricity	4.6%		

[1] The proportion of people who experience deprivations in each of the indicators, also known as the uncensored headcount ratio. The aggregates presented in this section is population-weighted. For countries that lack the specific indicator, we exclude the population of those countries while computing the population weighted uncensored headcount ratios for the specific indicators. Ten countries lacked nutrition indicator: Afghanistan, Brazil, Colombia, Cuba, Dominican Republic, Indonesia, Papua New Guinea, Philippines, Ukraine, and Vietnam. Five countries lacked data on child mortality: Barbados, Bosnia and Herzegovina, Jamaica, Mexico, North Macedonia and Saint Lucia. Data on school attendance was not available for Seychelles. Three countries lacked data on cooking fuel: Egypt, Lesotho and Seychelles. Honduras lacked data on electricity while housing data was not available for China.

Of those deprived in electricity, almost all are also deprived in:

83% HOUSING

96% COOKING FUEL

83% SANITATION
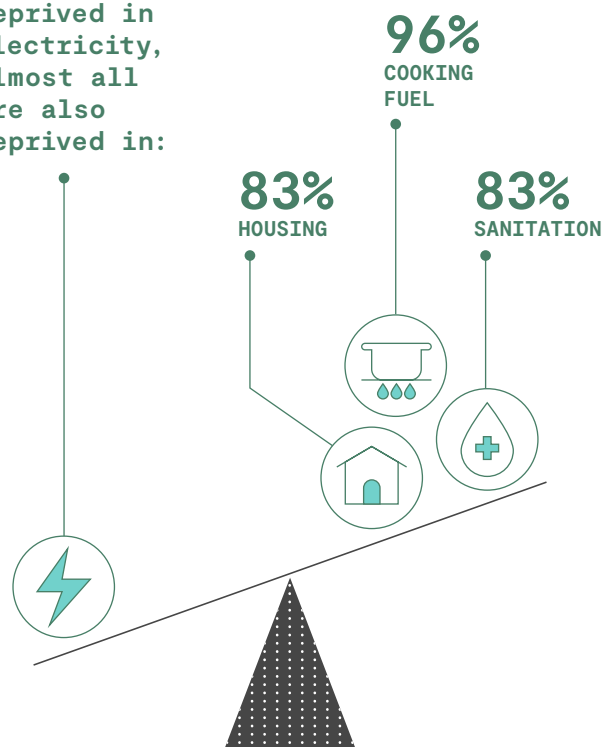
all children are attending school, more than half are energy poor (56%). Nearly two-thirds (64%) of those who do not own more than one asset (such as radio or a bicycle) also lack electricity.

Among the most interesting observation with regards to the rural and urban poor is in the living standards dimension. While 39% of the urban energy poor lack safe drinking water, nearly two-thirds of the rural energy poor did so (63%). This gap is smaller with regards to sanitation, where 85% of the rural energy poor, and 75% of the urban energy poor, lacked access to improved sanitation.

% OF ENERGY POOR LACKING ALSO ACCESS	URBAN	RURAL
TO SAFE DRINKING WATER	39%	63%
TO IMPROVED SANITATION	75%	85%
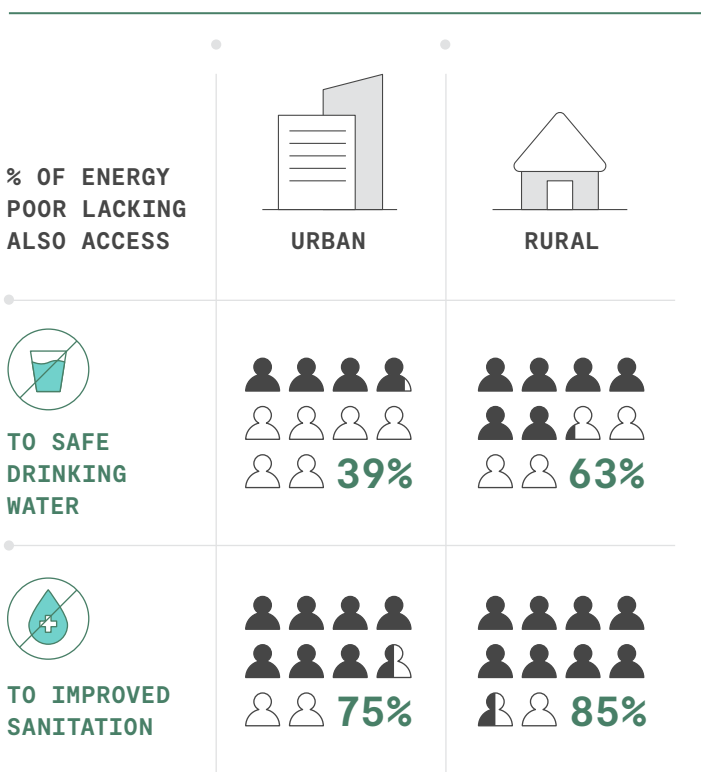
For 13 countries with harmonised data, we also assessed the most common simultaneous deprivations the electricity deprived face in year 1 and year 2 (see Table 4). Thus, we computed the redundancy ratio presented in Table 3, but only for the electricity deprived, with the other indicators, for both time periods per country. Overall, we find that the uncensored headcount ratios in electricity are throughout above 30%, except for India, and in some cases reach up to 90%, as was the case in Rwanda for Year 1. Electricity shows high simultaneous deprivations with the other indicators almost entirely throughout, and particularly in Year 1. Most noteworthy probably is the simultaneous deprivations between electricity and cooking fuel. The redundancy is above 90% throughout, and entirely, electricity showed the lower uncensored headcount ratio (the table underlines those ratios where electricity showed the lower uncensored headcount ratio of the indicator pairs). The simultaneous deprivations in year 2 generally eased in comparison to year 1 but remain pronounced, as can be seen in Uganda for example, where 84% of the electricity deprived were also deprived in sanitation in year 2.

Overall, electricity shows high simultaneous deprivations with the other indicators almost entirely throughout all countries and is persistent across time, although improvements are certainly notable. These will be explored in more depth in section 4.6.

Thus far we have considered a dashboard of 10 indicators, and studied pairwise overlaps between them finding that electricity was the most interlinked of all. But what else can we see? How many deprivations do energy poor people have – is it more than others? To address these and many more questions we use a counting-based multidimensional poverty measure, namely the global MPI introduced above.

TABLE 4
Ratio of simultaneous deprivations by indicator of the global Multidimensional Poverty Index (MPI). Underlined are those R0's where electricity showed the lower uncensored headcount ratio

Country	Year	Year Difference	Nutrition	Child Mortality	Years of schooling	School Attendance	Cooking Fuel	Sanitation	Drinking Water	Housing	Assets	Uncensored Headcount Ratio Electricity (%)
Benin	2014		0.776	0.764	0.848	0.835	0.993	0.965	0.826	0.884	0.905	66.9%
	2017/18	3.5	0.761	0.740	0.825	0.805	0.992	0.961	0.788	0.865	0.904	65.6%
Côte d'Ivoire	2011/12		0.531	0.549	0.619	0.533	0.975	0.941	0.671	0.778	0.692	43.7%
	2016	4.5	0.499	0.463	0.578	0.498	0.964	0.896	0.661	0.705	0.635	35.4%
Ethiopia	2011		0.868	0.899	0.932	0.931	0.997	0.937	0.933	0.999	0.921	81.5%
	2016	5	0.858	0.864	0.921	0.927	0.993	0.960	0.931	0.996	0.920	79.7%
India	2005/06		0.695	0.507	0.596	0.533	0.988	0.925	0.421	0.906	0.747	32.9%
	2015/16	10	0.519	0.227	0.346	0.317	0.945	0.879	0.146	0.896	0.382	12.2%
Kenya	2008/09		0.914	0.904	0.956	0.957	0.980	0.871	0.953	0.993	0.972	82.0%
	2014	5.5	0.850	0.829	0.946	0.913	0.971	0.805	0.911	0.998	0.932	71.8%
Nigeria	2013		0.569	0.626	0.785	0.716	0.956	0.753	0.667	0.798	0.783	47.0%
	2018	5	0.545	0.555	0.786	0.699	0.960	0.795	0.541	0.710	0.766	42.2%
Rwanda	2010		0.934	0.954	0.973	0.934	0.996	0.905	0.965	0.970	0.982	89.9%
	2014/15	4.5	0.818	0.824	0.905	0.861	0.997	0.784	0.883	0.923	0.917	76.9%
Senegal	2005		0.735	0.684	0.804	0.654	0.932	0.735	0.869	0.915	0.882	52.9%
	2017	12	0.531	0.504	0.616	0.733	0.972	0.708	0.653	0.778	0.831	38.3%
Sierra Leone	2013		0.922	0.896	0.985	0.956	0.997	0.930	0.922	0.972	0.981	87.1%
	2017	4	0.852	0.820	0.956	0.887	0.991	0.889	0.872	0.930	0.961	77.1%
Togo	2010		0.829	0.809	0.893	0.862	0.997	0.954	0.882	0.937	0.927	67.0%
	2013/14	3.5	0.776	0.728	0.849	0.840	0.994	0.959	0.790	0.866	0.858	59.0%
Tanzania	2010		0.930	0.931	0.989	0.941	0.991	0.916	0.953	0.977	0.982	86.9%
	2015/16	5.5	0.887	0.863	0.971	0.918	0.992	0.888	0.936	0.981	0.966	80.3%
Uganda	2011		0.935	0.947	0.967	0.970	0.990	0.905	0.959	0.973	0.987	87.8%
	2016	5	0.794	0.721	0.893	0.849	0.990	0.840	0.814	0.872	0.917	72.3%
Zambia	2007		0.870	0.817	0.983	0.921	0.999	0.907	0.955	0.990	0.974	79.1%
	2013/14	6.5	0.803	0.793	0.972	0.897	0.999	0.815	0.922	0.983	0.973	72.9%

MPI poor and deprived in electricity: What is the context and needs they face?

Recall that the global MPI draws on data for 10 indicators grouped into three dimensions, health education and living standards. The dimensions are equally weighted and the indicators within are equally weighted, such that health and education indicators weigh 1/6 and living standard indicators, including electricity and cooking fuel, weigh 1/18. The global MPI is constructed by looking at the deprivation profile of each person across the 10 included indicators. Based on this deprivation profile, their deprivation score is constructed by adding up the weights of the indicators in which they are deprived. They are identified as MPI poor if their deprivation score is 33.33% or above.

In other words, if they are energy poor, they also need to be deprived in: a) five additional living standard indicators or more; b) two health or education indicators (or more) or c) one health or education indicator and two or more additional living standard indicators. Put differently, having just one additional deprivation does not qualify to identify someone as experiencing the acute poverty condition of the MPI. At a very minimum, it is two to five indicators and in practice nearly always more.

So of the 922 million energy poor people, how many are MPI poor? It's an astonishing three-quarters – 687 million people. And of the 1.3 billion MPI poor, over half, 687 million (53%) lacked electricity, and 1.18 billion lacked access to clean cooking fuel (91%). Of the 687 million deprived in electricity, 88% (621 million) live in South Asia (151 million) and Sub-Saharan Africa (470 million) (see Figure 5). In the Arab States, Sub-Saharan Africa and South Asia, we find that over 70% of the electricity deprived are MPI poor (see Figure 6).

FIGURE 5
Number of population who are electricity deprived and MPI poor, by world region (in millions)

151
SOUTH ASIA

26
ARAB STATES

30
EAST ASIA
AND PACIFIC

11
LATIN AMERICA

470
SUB-SAHARAN AFRICA
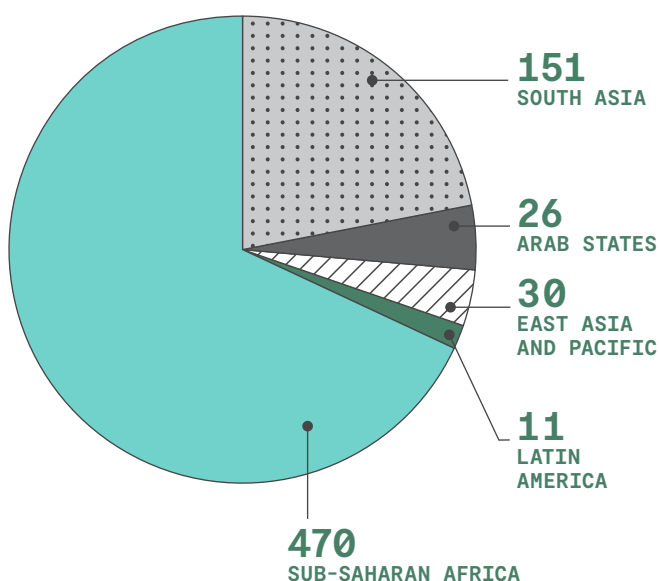
FIGURE 6
Percentage of population who are electricity deprived and MPI poor, by world region

| Region	Percentage
SUB-SAHARAN AFRICA	77.5
LATIN AMERICA AND THE CARIBBEAN	72.6
EUROPE AND CENTRAL ASIA	59.5
EAST ASIA AND THE PACIFIC	14.0
SOUTH ASIA	51.9
ARAB STATES	80.2
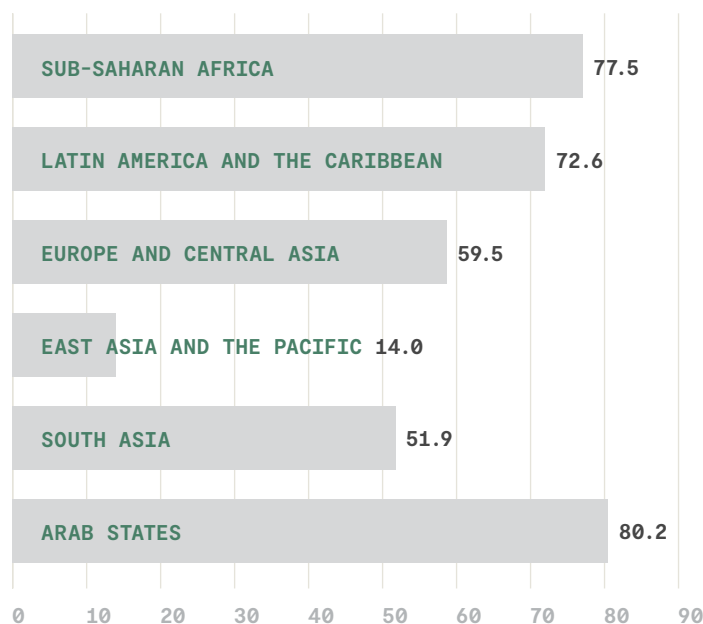
How does this compare to other indicators of the global MPI? Figure 7 has three rows: developing region labelled as 'world', rural and urban areas. The height of the bar shows the percentage of the population who are deprived in that indicator and who are also MPI poor. The Energy related indicators – electricity and cooking fuel – are coloured red at the world level. Looking at the MPI poor among those who are deprived in each indicator of the global MPI at world and area level (rural and urban), we find those deprived in electricity depict the highest share of MPI poor people at all levels in *the living standard dimension*. Overall, only child mortality (84%), school attendance (83%) and years of schooling (77%) show higher percentages of deprivations and multidimensional poverty. It is noteworthy however, that these indicators receive a greater weight in the global MPI than electricity, as they are in the health and education dimensions. Basically, those deprived in any indicator of the health and education dimension are halfway multidimensionally poor, whereas those who are deprived in any indicator of the living standards dimension require two to five additional deprivations to be classified as MPI poor. Thus, among all equally weighted indicators in the living standards dimension, electricity is the best predictor of multidimensional poverty, and the fourth best overall (see Figure 7).

An interesting finding concerns the deprived in cooking fuel and electricity, thus the energy poor in the largest sense. While of the 1.3 billion MPI poor a staggering 91% lack access to clean cooking fuel, "only" 42% of the deprived in cooking fuel were MPI poor. This finding may seem puzzling, but it reflects the fact that the number of people who cook with solid cooking fuel is far greater – standing at 2.78 billion. It also intimates that simply having electricity does not translate into clean cooking environments automatically – both need to be tracked.

FIGURE 7
The proportion of MPI poor deprived by each indicator of the global MPI, by world, rural and urban areas

LIVING STANDARDS

WORLD   RURAL   URBAN

NUTRITION   CHILD MORTALITY   YEARS OF SCHOOLING   SCHOOL ATTENDANCE   COOKING FUEL   SANITATION   DRINKING WATER   ELECTRICITY   HOUSING   ASSETS
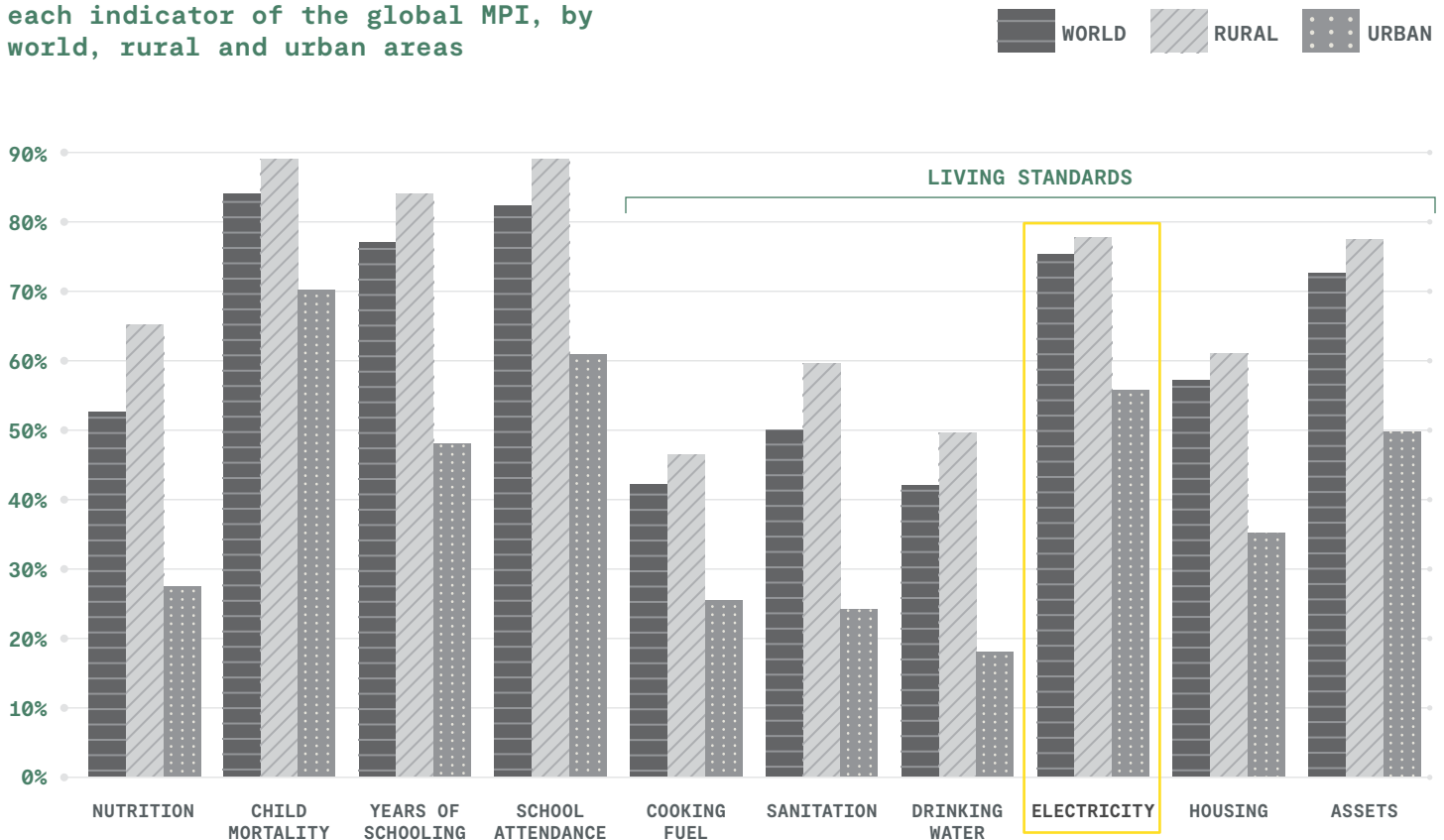
The association between energy poverty and economic development

Thus far the findings indicate that energy poverty and multidimensional poverty are least pronounced in Europe and Central Asia. Therefore, we explore the link between energy poverty, multidimensional poverty, and the world's economies income groups. We follow the classification provided by the World Bank. We ask what the percentage of multidimensional poverty is among the deprived in each indicator across low, lower middle- and middle-income countries (at population shares of 18.4%, 56.5% and 25.1%).

Figure 8 has three coloured lines, one reflecting each income category, and charts the percentage of people who are poor among the deprived in each indicator. Thus, a similar analysis to what is presented in Figure 7

GLOBALLY, 33% OF THE MPI POOR PEOPLE LIVE IN LOW INCOME COUNTRIES, 60% LIVE IN LOWER MIDDLE INCOME COUNTRIES, AND 7% IN UPPER MIDDLE OR HIGH INCOME COUNTRIES.

FIGURE 8
Percentage of individuals who are MPI poor and deprived in each of the ten indicators of the global Multidimensional Poverty Index (MPI), by income category

LOW INCOME   LOWER MIDDLE INCOME   UPPER MIDDLE INCOME
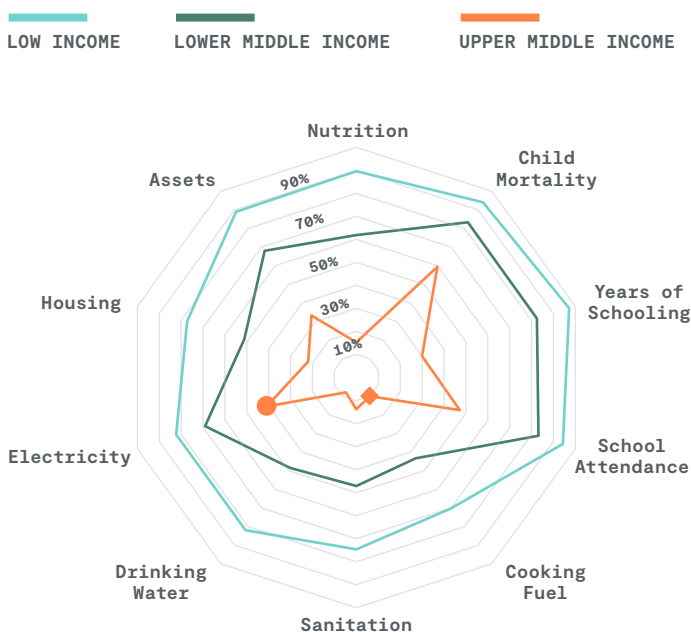
FIGURE 9
Percentage of MPI poor who are deprived in each of the ten indicators of the global Multidimensional Poverty Index (MPI), by rural and urban areas of upper middle income countries

UPPER MIDDLE INCOME (RURAL)   UPPER MIDDLE INCOME (URBAN)
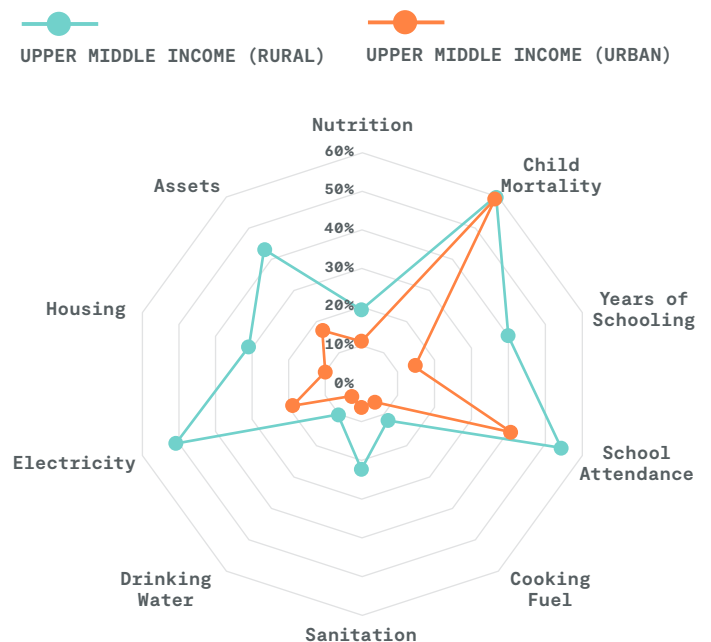
is shown, disaggregated by income category. First though, recall that globally, 33% of the MPI poor people live in low income countries (420 million), 60% live in lower middle income countries (777 million) and 7% in upper middle or high income countries (94 million).

We find relatively high levels of multidimensional poverty among the deprived in each indicator in low-income countries (70% and above). This is an expected finding. In middle income countries however, and here in particular, in upper middle-income countries, we find that the highest percentages of MPI poor are among the electricity deprived (41%), those who suffered child mortality (59%) and the deprived in school attendance (48%). The MPI poor among those who lack access to clean cooking fuel, on the other hand, showed the second lowest percentage point, with 10% (in upper middle countries). This indicates that with economic development multidimensional poverty remains more persistent with those who lack electricity in general, but particularly if compared to those who lack access to clean cooking fuel (and even housing, 22%).

This being said, increasing urbanisation in advanced economies leads to a decrease in multidimensional poverty among the deprived across all indicators (except for child mortality, Figure 9, which shows the percentage of MPI poor among the deprived in each of the ten indicators of the global MPI in upper middle income countries, disaggregated by rural and urban (population shares of 39.1% and 60.9%)). Yet, both in rural and urban areas, do the MPI poor among the electricity deprived in upper middle income countries stand out, as the third highest among all of the deprived in the ten indicators of the global MPI.

Do the energy and MPI poor have the highest intensities of poverty?

Knowing that multidimensional poverty is among the highest of those who are energy poor, it is further interesting to analyse, on average, how intense that poverty is. In Figure 10 we present, by world region, the average intensities of multidimensional poverty among those who are deprived in each of the indicators in the global MPI. In East Asia and the Pacific, as well as Europe and Central Asia, the intensities of poverty are the highest among those who are deprived in electricity (with 47% and 45% respectively), and second highest in the Arab States (56%), and Latin America and the Caribbean (48%).

In Sub-Saharan Africa and South Asia, the intensities of multidimensional poverty for the energy poor are similarly severe (if not severer), with 56% and 51% respectively. In both regions however are other indicators similarly severe, with Sub-Saharan Africa standing out as the region where six other indicators of the global MPI have even higher intensities of poverty if deprivations occurred in these. The intensities of poverty among the energy poor in both regions still classifies them as being in severe multidimensional poverty (defined as the population who are deprived in at least 50% of the weighted indicators, thus with intensities higher than 50%)[9].

What is striking is that globally, the intensity of multidimensional poverty among the electricity deprived is the highest of all indicators in the living standard dimension, with 54.5%, and the fourth highest overall

(behind child mortality (59.7%); school attendance (58.4%) and years of schooling (55.6%). Promisingly though, the intensity of multidimensional poverty is comparatively lower for those multidimensionally poor who have access to electricity, with 43%. In other words, access to electricity alleviates severe multidimensional poverty.

Note that most of the energy poor but not multidimensionally poor still faced additional deprivations of up to four indicators of the global MPI: 34.9% of the energy poor but non-multidimensionally poor faced three additional deprivations to being electricity deprivation, and 32.7% faced four. In other words, while facing additional deprivations this group did not reach the critical mass of being deprived in a weighted sum of 33.3% of the indicators in the global MPI. This group is however vulnerable to multidimensional poverty, defined as experiencing 20-33.32% intensity of deprivations. We find that the average intensity of deprivations for the non-multidimensionally poor but energy poor, is 22%. The policy focus for this group rests on avoiding impoverishment.

Intensities of multidimensional poverty among those who are deprived in electricity, by world region

EUROPE AND CENTRAL ASIA

47%

EAST ASIA AND PACIFIC

56%

45%

51%

ARAB STATES

SOUTH ASIA

48%

56%

LATIN AMERICA AND CARIBBEAN

SUB-SAHARAN AFRICA
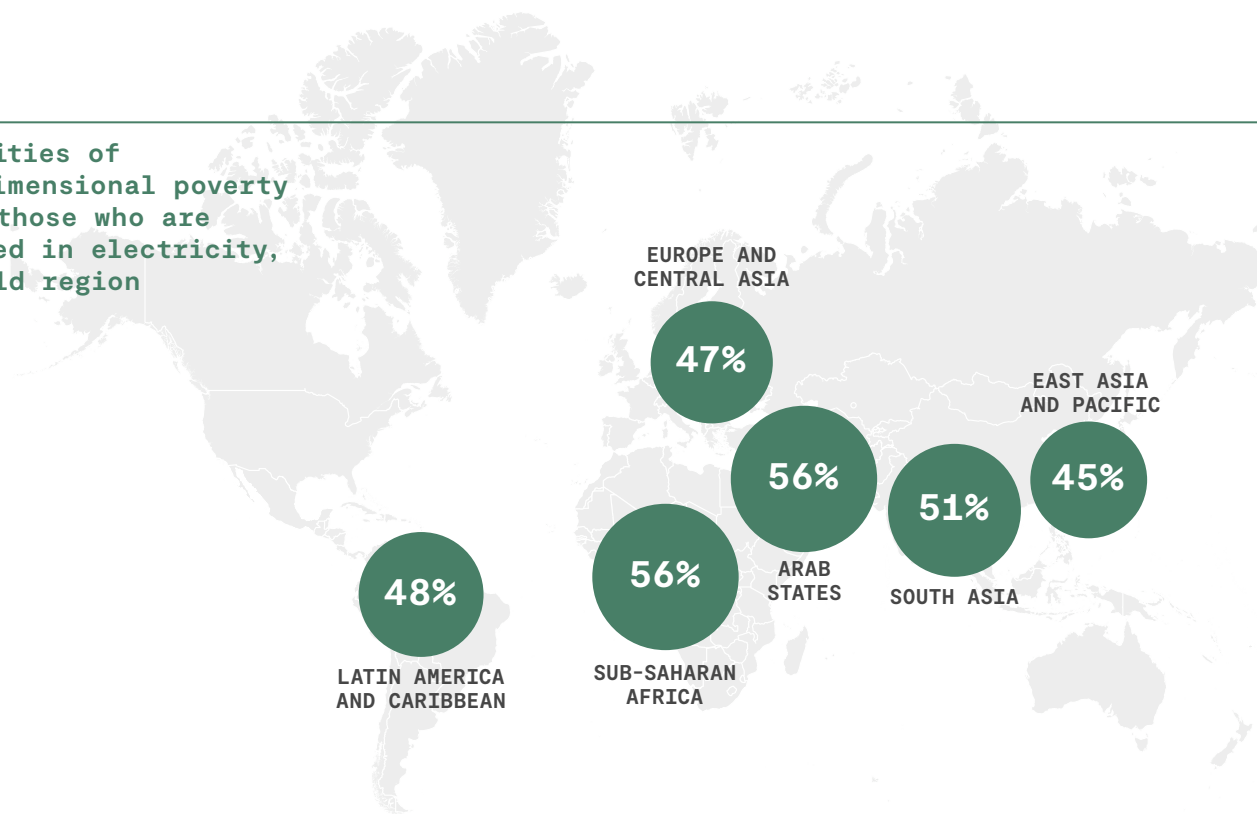
Achieving greater access to electricity: what will improve?

Looking ahead, the final question we explore is whether access to electricity is strongly associated with alleviation in multidimensional poverty overall, and specifically, the improvements in other indicators. To answer this question, we use data harmonised over two time periods for a subset of countries. Figure 11 presents the absolute annualised change in MPIt value for 13 countries[10]. We find that 11 of the 13 countries had significant reductions in multidimensional poverty in the last period, fastest in Sierra Leone, Rwanda and Côte d'Ivoire.

By looking at these three countries with the fastest reductions more closely, we find significant improvement in electricity access, reducing deprivations at up to 4 percent per year in Rwanda & Sierra Leone (see Figure 12).

Looking at all 13 countries, we find that 12 had statistically significant reductions in electricity deprivations, as shown in Figure 13. Among the other 9 indicators, only assets significantly reduced deprivations for 12 of the 13 countries at 95% confidence interval (as shown in Table 5). In other words, no other indicator than electricity was significantly reduced for a greater number of countries.

To further explore which dimensions of poverty improve when electricity access is improved, we work with the aforementioned redundancy test from section 4.2. For 13 countries with harmonised data, first, we visualise the most common simultaneous *deprivations* the electricity deprived face in year 1 and year 2, as shown in Table 4. In a second step, we also computed and visualise the ratio of the simultaneous *non-deprivations* of the electricity non-deprived with the other indicators in year 2. In other words, in year 2 we place the focus on the better off population, on those who did not suffer from deprivations in the indicators. We then compared the redundancies visually (Figure 14). If the ratio of the non-deprived in electricity with the other indicators in year 2 is equal or greater than the ratio of the deprived in electricity from year 1, we know that achieving greater access to electricity leads to positive change (although we do not claim causality).

FIGURE 11
Absolute annualized change in MPIt value for 13 countries
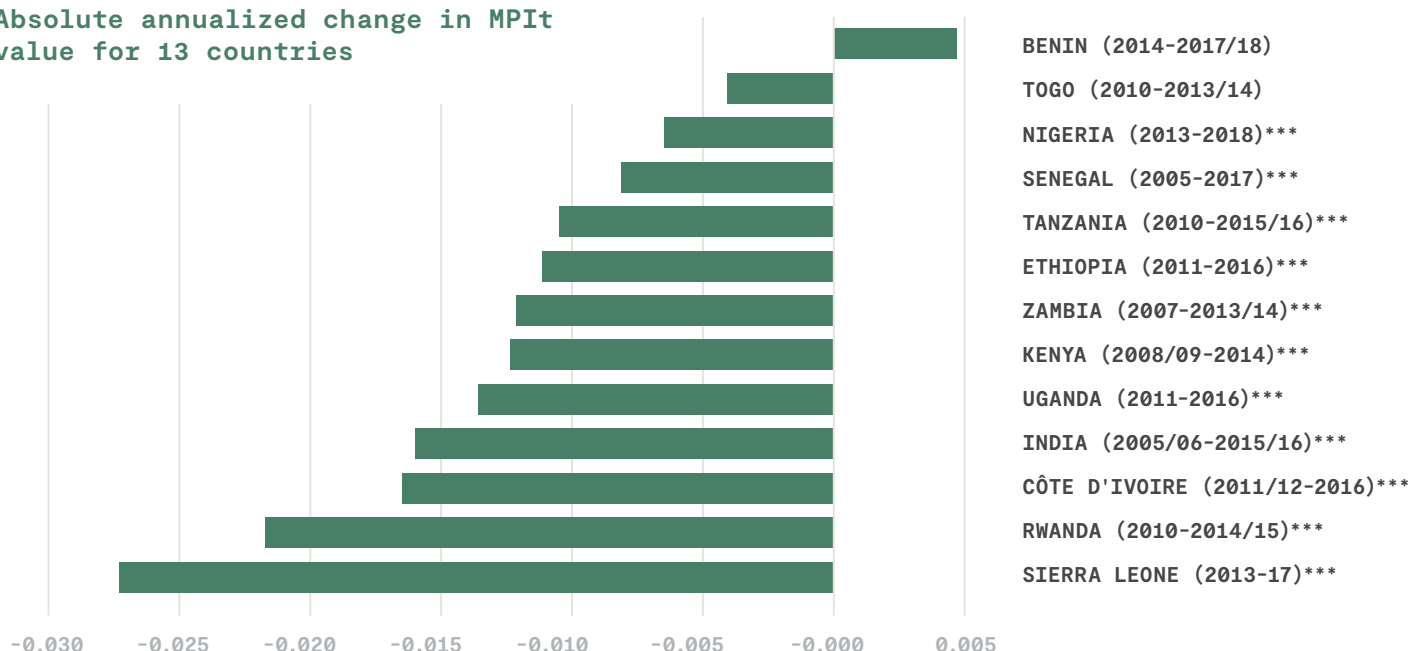
FIGURE 12
Annualized absolute change in percentage of people who are multidimensionally poor and deprived in each indicator in Côte d'Ivoire, Rwanda and Sierra Leone
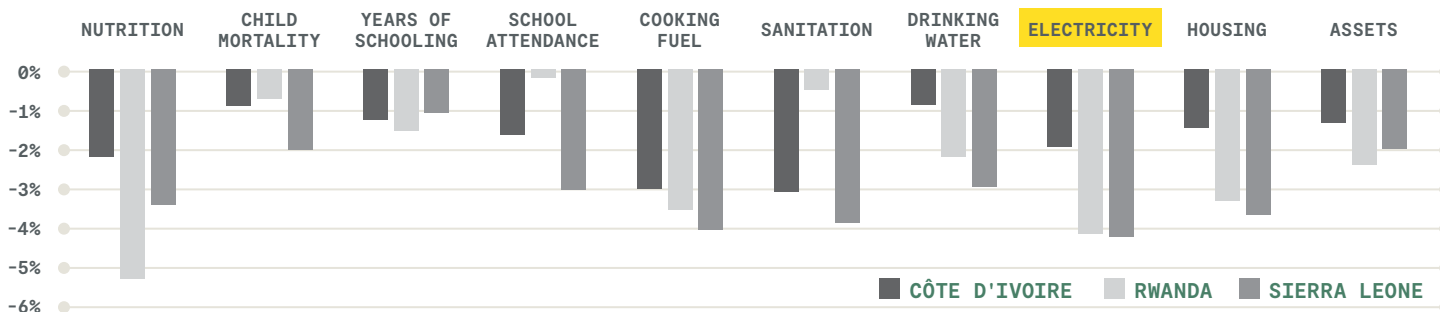
By looking at Figure 14, where we place the three redundancy measures for each county in columns. From top to bottom: Redundancies between electricity deprived & other indicators Year 1; Redundancies between electricity deprived & other indicators Year2; and Redundancies between electricity non-deprived &non-deprivations in other indicators Year 2. Each column represents one country from Benin (far left) to Zambia (for right).

FIGURE 13
Annualised absolute reduction of electricity deprivation across 13 countries
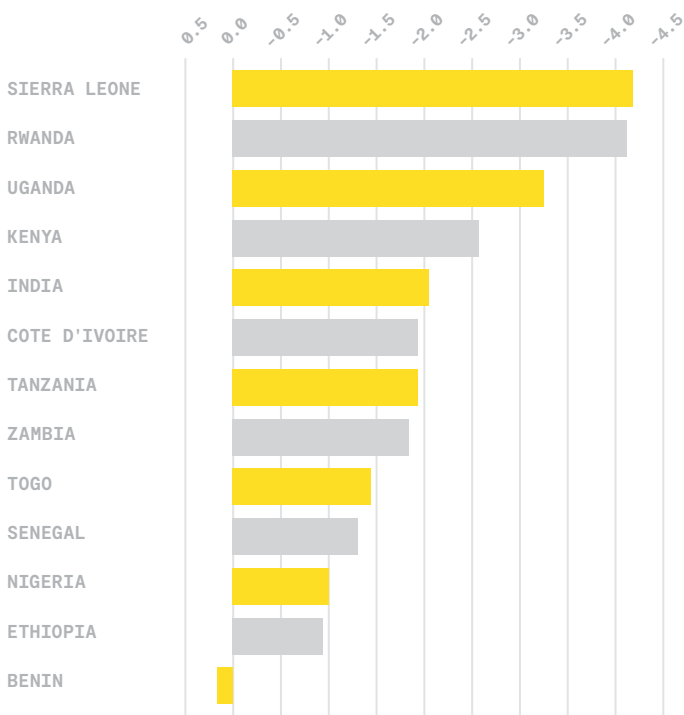
By comparing the first and third graph, thus by comparing Redundancies between electricity deprived & other indicators Year 1 with Redundancies between electricity non-deprived & other indicators Year 2, we indeed find that Year 2 show ratios that are almost equal, and sometimes greater, than the ratios computed for the deprivations in Year 1. For example, the ratio between non-deprived in electricity and non-deprived in assets in India in Year 2 is greater, with 91.3%, than the ratio between the deprived in electricity and deprived in assets in Year 1 (74.7%). This is notable, because India reduced the uncensored headcount ratio in electricity from 32.9% to 12.2% in 10 years, and also reduced the ratio of those deprived in electricity and deprived in assets to 38.2% in Year 2 (as shown in Table 4). Similarly, the ratio between non-deprived in electricity and non-deprived in child mortality in Rwanda in Year 2 is greater, with 97.2%, than the ratio between the deprived in electricity and deprived in child mortality in year 1 (95.4%)[11]. Rwanda reduced the uncensored headcount ratio in electricity from 90% to 77% in 4.5 years, and, also reduced the ratio of those deprived in electricity and deprived in child mortality to 82.4% in Year 2.

Overall, even if causality cannot be claimed, this simple visual comparison across 13 countries with two time points and 10 indicators indicates that improvements in electricity can lead to simultaneous improvements in the other indicators of the global MPI too, and warrants further research.

TABLE 5
Annualised absolute reduction of deprivations across 13 countries

Country	Nutrition	Stat. Sig.	Child Mortality	Stat. Sig.	Years of Schooling	Stat. Sig.	School Attendance	Stat. Sig.	Cooking Fuel	Stat. Sig.	Sanitation	Stat. Sig.	Drinking Water	Stat. Sig.	Electricity	Stat. Sig.	Housing	Stat. Sig.	Assets	Stat. Sig.
Benin (2014-2017/18)	0.48		-0.34	*	0.49		1.28	***	0.81	**	0.66		1.29	***	0.15		-0.51		0.37	
Côte d'Ivoire (2011/12-2016)	-2.19	***	-0.91	***	-1.26	***	-1.65	***	-2.99	***	-3.06	***	-0.88	*	-1.95	***	-1.47	***	-1.35	***
Ethiopia (2011-2016)	-1.49	***	-0.32	***	-0.97	***	-1.25	***	-1.04	***	-0.49	**	-2.36	***	-0.96	***	-0.98	***	-2.16	***
India (2005/06-2015/16)	-2.31	***	-0.23	***	-1.23	***	-1.42	***	-2.67	***	-2.58	***	-1.04	***	-2.04	***	-2.13	***	-2.80	***
Kenya (2008/09-2014)	-1.91	***	-0.29	***	-0.30		-0.59	***	-2.50	***	-2.17	***	-1.82	***	-2.55	***	-2.40	***	-1.57	***
Nigeria (2013-2018)	-0.22		0.28	**	-1.34	***	-0.62	***	-0.93	***	-0.12		-1.78	***	-1.01	***	-1.74	***	-0.46	***
Rwanda (2010-2014/15)	-5.25	***	-0.73	***	-1.55	***	-0.21		-3.50	***	-0.52	**	-2.19	***	-4.11	***	-3.30	***	-2.37	***
Senegal (2005-2017)	-0.10		-0.83	***	-1.64	***	-0.24		-0.30		-0.05		-1.23	***	-1.34	***	-1.07	***	-2.25	***
Sierra Leone (2013-2017)	-3.40	***	-2.01	***	-1.10	***	-3.02	***	-4.00	***	-3.82	***	-2.95	***	-4.18	***	-3.64	***	-1.99	***
Tanzania (2010-2015/16)	-1.53	***	-0.31	***	-0.45	***	0.08		-1.93	***	-1.87	***	-2.18	***	-1.95	***	-2.52	***	-1.83	***
Togo (2010-2013/14)	0.76	*	0.10		-1.69	***	0.22		-0.66		-0.65		-0.86		-1.46	**	0.05		-1.98	***
Uganda (2011-2016)	-1.43	***	-0.87	***	-1.35	***	-0.27		-2.09	***	-1.98	***	-1.90	***	-3.23	***	-2.43	***	-1.10	***
Zambia (2007-2013/14)	-0.72	***	-0.46	***	-0.78	***	-1.39	***	-1.61	***	-1.99	***	-2.43	***	-1.85	***	-1.71	***	-2.27	***

FIGURE 14
Comparison between redundancy ratios for deprivations in year 1 and year 2, and for non-deprivations in year 2 across 13 countries with harmonised data

Nutrition	Child Mortality	Years of Schooling	School Attendance	Cooking Fuel	Sanitation	Drinking Water	Housing	Assets	Uncensored Headcount Ratio Electricity

REDUNDANCIES BETWEEN ELECTRICITY DEPRIVED & OTHER INDICATORS

YEAR 1

BENIN 2014 · CÔTE D'IVOIRE 2011/12 · ETHIOPIA 2011 · INDIA 2005/06 · KENYA 2008/09 · NIGERIA 2013 · RWANDA 2010 · SENEGAL 2005 · SIERRA LEONE 2013 · TOGO 2010 · TANZANIA 2010 · UGANDA 2011 · ZAMBIA 2007

REDUNDANCIES BETWEEN ELECTRICITY DEPRIVED & OTHER INDICATORS

YEAR 2

BENIN 2017/18 · CÔTE D'IVOIRE 2016 · ETHIOPIA 2016 · INDIA 2015/16 · KENYA 2014 · NIGERIA 2018 · RWANDA 2014/15 · SENEGAL 2017 · SIERRA LEONE 2017 · TOGO 2013/14 · TANZANIA 2015/16 · UGANDA 2016 · ZAMBIA 2013/14

REDUNDANCIES BETWEEN NON-ELECTRICITY DEPRIVED & OTHER INDICATORS

BENIN 2017/18 · CÔTE D'IVOIRE 2016 · ETHIOPIA 2016 · INDIA 2015/16 · KENYA 2014 · NIGERIA 2018 · RWANDA 2014/15 · SENEGAL 2017 · SIERRA LEONE 2017 · TOGO 2013/14 · TANZANIA 2015/16 · UGANDA 2016 · ZAMBIA 2013/14

% of non-deprived in Electricity (Year 2)

| 34.4 | 64.6 | 20.3 | 87.8 | 28.2% | 57.8 | 23.1 | 61.7 | 22.9 | 41.0 | 19.7 | 27.7 | 27.1 |

Conclusion

This briefing paper is a pioneer study that systematically explored the role of energy poverty in context of multidimensional poverty. It demonstrates the pivotal importance of tackling energy poverty in efforts to alleviate multidimensional poverty.

In using data from the global Multidimensional Poverty Index (MPI) 2020, it can be reported that across 5.9 billion people, 922 million lacked electricity in their most recent survey, of which most (88%) live in South Asia and Sub-Saharan Africa. We found that 99.4% of the 922 million people experience 1 or more other deprivations in addition to electricity deprivations, more than any other indicator in the global MPI. In other words, electricity has the highest 'interlinkages' globally as well as both in rural and urban areas, and among the highest in each of the world regions. The persistency of this finding across 13 selected countries with Changes Over Time data was further indetified and is striking. This makes electricity the most interlinked indicator in the global MPI.

We further assessed the most common simultaneous deprivations the electricity deprived face and found that those deprived in electricity, are almost all also deprived in cooking fuel, and far more than three-quarter are also deprived in housing, and sanitation. Nearly half of the electricity poor have lost a child in their household. Among the most interesting observation with regards to the rural and urban poor is that while 39% of the urban energy poor lack safe drinking water, nearly two-thirds of the rural energy poor did so (63%). This gap is smaller with regards to sanitation, where 85% of the rural energy poor, and 75% of the urban energy poor, lacked access to improved sanitation.

By looking at the 1.3 billion MPI poor, we found that more than half lacked electricity, and 91% lack clean cooking fuel. And if instead we focus on the 922 million deprived in electricity, we see that three quarters of these are multidimensionally poor (687 million, 75%). Fully 88% of the energy and multidimensionally poor people live in South Asia and Sub-Saharan Africa. While 91% of the 1.3 billion MPI poor lack access to clean cooking fuel, 42% of the deprived in cooking fuel were MPI poor. This contrasts to electricity, where of the 1.3 billion MPI poor 53% lacked electricity, 75% of the electricity deprived were MPI poor. Because of its lower numbers overall, standing at 922 million of the world population that lacked electricity versus 2.78 billion that lacked clean cooking fuel, electricity can be regarded as the stronger proxy for energy poverty of the two, and overall, electricity is the strongest predictor of multidimensional poverty of all indicators in the living standard dimension.

While we found that those deprived in electricity depict the highest share of MPI poor people globally as well as in rural and urban areas, we also showed that 410 million energy poor are in 'severe' poverty, with deprivation intensities greater than 50%. In South Asia and Sub-Saharan Africa the energy poor are among the poorest of the poor, an immense burden on both regions that simultaneously suffered high intensities in other indicator bundles of the global MPI. Promisingly, access to electricity is found to lower severe multidimensional poverty globally.

Looking ahead, we also explored whether access to electricity is strongly associated with alleviations in multidimensional poverty overall, and specifically, the improvements in other indicators. Looking at 13 countries with harmonised data, we find that 12 had statistically significant reductions in electricity deprivations. No other indicator in the global MPI did better. We also showed significant improvement in electricity access among countries with fastest reduction in poverty over time, reducing deprivations at up to 4 percent per year in Rwanda & Sierra Leone.

While these are positive developments, we also demonstrated that multidimensional poverty among the energy poor is still prevalent, even with economic development. In upper middle-income countries, the highest prevalence of multidimensional poverty is among the electricity deprived (41%), those who suffered child mortality (59%) and the deprived in school attendance (48%). This demonstrates the importance for a long-term vision.

In conclusion, the pivotal importance of electricity deprivations in efforts to alleviate multidimensional poverty has been explored in depth. Electricity is the most interlinked indicator in the global MPI, and three quarters of the global energy poor are multidimensionally poor. This turns energy poverty in one of the strongest predictors of multidimensional poverty. Promisingly, access to electricity was found to lower severe multidimensional poverty, and positive spill-over effects onto other indicators of the global MPI were shown in various selected countries, such as in India or Rwanda. Thus solving electricity and concurrent deprivations is a crucial stepping stone in efforts to alleviate multidimensional poverty.
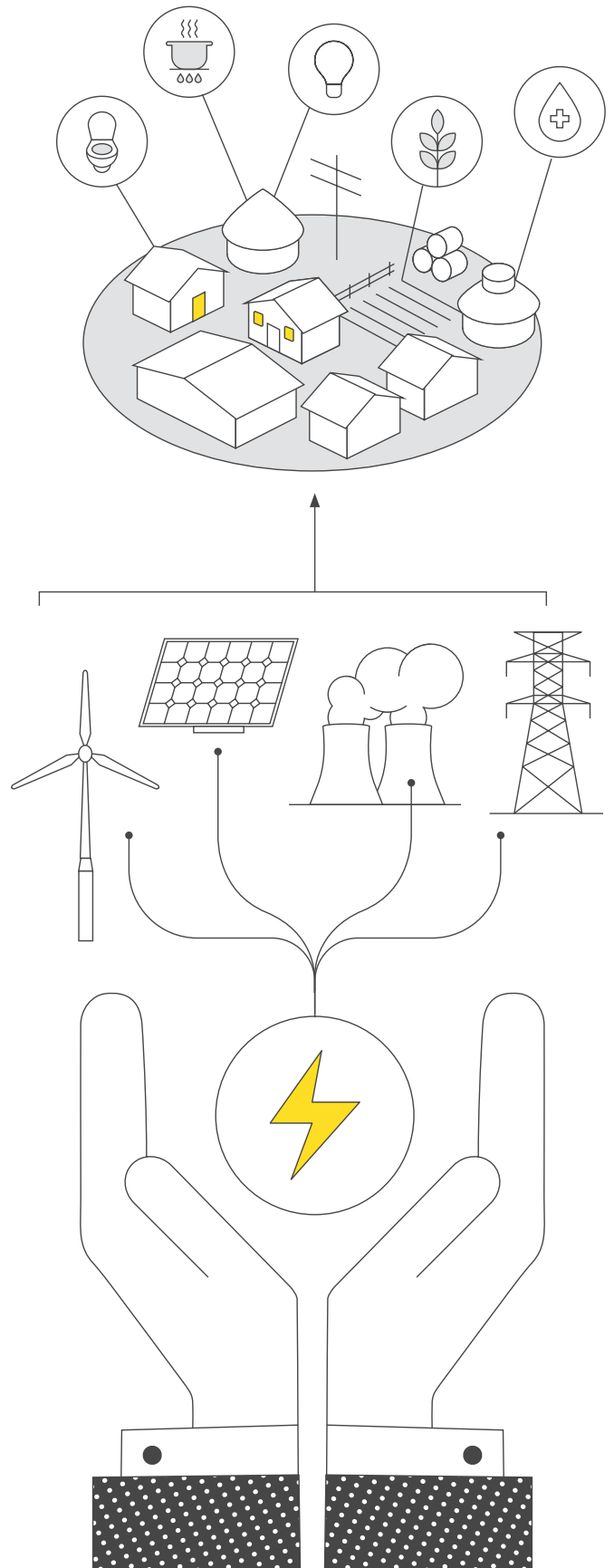
Footnotes

1. The authors of the Global Sustainable Development Report 2019 are acknowledged as the Independent Group of Scientists appointed by the Secretary-General.

2. Indicator cut-off related to the 10 global MPI indicators is presented in Table A.1, Appendix.

3. The number for Sub-Saharan Africa is based on data from 2017 reported here.

4. More information here.

5. The microdata from Alkire, Kanagaratnam and Suppa (2020) facilitated the analysis in this briefing paper.

6. See details on country, region, survey, year and population estimates in Table A.2, Appendix.

7. The microdata for these 13 countries from Alkire, Kovesdi, Mitchell, Pinilla-Roncancio, and Scharlin-Pettee (2020) facilitated the specific changes over time analysis in this briefing paper.

8. The global MPI 2020 covered 107 countries. However, Honduras lacked data on electricity. We excluded Honduras from the descriptive figures stated in this paragraph. The population in Honduras make up 0.16% of the developing region population covered in the global MPI. The relatively small sized population country means that we only observed minimal change in population coverage, that is, in decimals when we excluded the country.

9. Indeed, overall, of the 687 million energy and multidimensionally poor (88% of which located in South Asia and SSA), we find that 410 million (60%), are severely poor.

10. Absolute annualised change is the difference in the MPI value between two years, divided by the number of years between surveys.

11. Note though that child mortality depicted the lower uncensored headcount ratio of the two indicators in both years (6.8% in year 1, 3.6% in year 2).

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Appendix

Global MPI 2020 – Dimensions, Indicators, Deprivation Cutoffs, and Weight

Dimensions of poverty	Indicator	Deprived if...	SDG Area
Health	**Nutrition**	Any person under 70 years of age for whom there is nutritional information is **undernourished.**[1]	SDG 2
	Child Mortality	A child **under 18** has **died** in the household in the five-year period preceding the survey.[2]	SDG 3
Education	**Years of Schooling**	**No** eligible household member has completed **six years** of **schooling.**[3]	SDG 4
	School Attendance	Any school-aged child is **not attending** school **up to** the age at which he/she would complete **class 8.**[4]	SDG 4
Living Standards	**Cooking Fuel**	A household cooks using **solid fuel,** such as dung, agricultural crop, shrubs, wood, charcoal or coal.[5]	SDG 7
	Sanitation	The household has **unimproved** or **no** sanitation **facility** or it is improved but **shared** with other households.[6]	SDG 6
	Drinking Water	The household's source of **drinking water** is **not safe** or safe drinking water is a **30-minute** or **longer walk** from home, roundtrip.[7]	SDG 6
	Electricity	The household has **no electricity.**[8]	SDG 7
	Housing	The household has **inadequate** housing materials in **any** of the three components: **floor, roof or walls.**[9]	SDG 11
	Assets	The household does **not own more than one** of these **assets:** radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck.	SDG 1

Source: Alkire, Kanagaratnam, and Suppa (2020; p.8).

Notes:
The global MPI is related to the following SDGs: No Poverty (SDG 1), Zero Hunger (SDG 2), Health & Well-being (SDG 3), Quality Education (SDG 4), Clean Water & Sanitation (SDG 6), Affordable & Clean Energy (SDG 7), Sustainable Cities & Communities (SDG 11).

1. Children under 5 years (60 months and younger) are considered undernourished if their z-score of either height-for-age (stunting) or weight-for-age (underweight) is below minus two standard deviations from the median of the reference population. Children 5–19 years (61–228 months) are identified as deprived if their age-specific BMI cutoff is below minus two standard deviations. Adults older than 19 to 70 years (229–840 months) are considered undernourished if their Body Mass Index (BMI) is below 18.5 kg/m².
2. The child mortality indicator of the global MPI is based on birth history data provided by mothers aged 15–49. In most surveys, men have provided information on occurrence of child mortality as well but this lacks the date of birth and death of the child. Hence, the indicator is constructed solely from mothers. However, if the data from the mother are missing, and if the male in the household reported no child mortality, then we identify no child mortality in the household.
3. If all individuals in the household are in an age group where they should have formally completed 6 or more years of schooling, but none have this achievement, then the household is deprived. However, if any individuals aged 10 years and older reported 6 years or more of schooling, the household is not deprived.
4. Data source for the age children start compulsory primary school: DHS or MICS survey reports; and http://data.uis.unesco.org/
5. If survey report uses other definitions of solid fuel, we follow the survey report.
6. A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared. If survey report uses other definitions of adequate sanitation, we follow the survey report.
7. A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within a 30-minute walk, round trip. If survey report uses other definitions of clean or safe drinking water, we follow the survey report.
8. A number of countries do not collect data on electricity because of 100% coverage. In such cases, we identify all households in the country as non-deprived in electricity.
9. Deprived if floor is made of natural materials or if dwelling has no roof or walls or if either the roof or walls are constructed using natural or rudimentary materials. The definition of natural and rudimentary materials follows the classification used in country-specific DHS or MICS questionnaires.

TABLE A.2
Global MPI 2020 – Survey details and population estimates

Country	World region	Survey	Year	Total Population[a]	Number of MPI Poor People[b]
				Thousands	Thousands
Armenia	Europe and Central Asia	DHS	2015-2016	2,952	6
Ukraine	Europe and Central Asia	MICS	2012	44,246	106
Georgia	Europe and Central Asia	MICS	2018	4,003	14
Kyrgyzstan	Europe and Central Asia	MICS	2018	6,304	25
Serbia	Europe and Central Asia	MICS	2014	8,803	30
Turkmenistan	Europe and Central Asia	MICS	2015-2016	5,851	24
Jordan	Arab States	DHS	2017-2018	9,965	43
Kazakhstan	Europe and Central Asia	MICS	2015	18,320	83
Cuba	Latin America and the Caribbean	ENO	2017	11,338	50
Trinidad and Tobago	Latin America and the Caribbean	MICS	2011	1,390	9
Maldives	South Asia	DHS	2016-2017	516	4
Albania	Europe and Central Asia	DHS	2017-2018	2,883	20
Tunisia	Arab States	MICS	2018	11,565	92
Seychelles	Sub-Saharan Africa	QLFS	2019	97	1
Thailand	East Asia and the Pacific	MICS	2015-2016	69,428	545
Moldova	Europe and Central Asia	MICS	2012	4,052	38
Palestine, State of	Arab States	MICS	2014	4,863	46
Montenegro	Europe and Central Asia	MICS	2018	628	8
Saint Lucia	Latin America and the Caribbean	MICS	2012	182	3
Libya	Arab States	PAPFAM	2014	6,679	133
Algeria	Arab States	MICS	2012-2013	42,228	887
Bosnia and Herzegovina	Europe and Central Asia	MICS	2011-2012	3,324	73
Barbados	Latin America and the Caribbean	MICS	2012	287	7
North Macedonia	Europe and Central Asia	MICS	2011	2,083	53
Sri Lanka	South Asia	SLDHS	2016	21,229	620
Suriname	Latin America and the Caribbean	MICS	2018	576	16
Indonesia	East Asia and the Pacific	DHS	2017	267,671	9,687
Guyana	Latin America and the Caribbean	MICS	2014	779	26
Dominican Republic	Latin America and the Caribbean	MICS	2014	10,627	412
China	East Asia and the Pacific	CFPS	2014	1,427,648	55,464
Brazil	Latin America and the Caribbean	PNAD	2015	209,469	8,048
Belize	Latin America and the Caribbean	MICS	2015-2016	383	16
Jamaica	Latin America and the Caribbean	JSLC	2014	2,935	138
Ecuador	Latin America and the Caribbean	ECV	2013-2014	17,084	782
Paraguay	Latin America and the Caribbean	MICS	2016	6,956	313
Vietnam	East Asia and the Pacific	MICS	2013-2014	95,546	4,677
Egypt	Arab States	DHS	2014	98,424	5,083
Colombia	Latin America and the Caribbean	DHS	2015-2016	49,661	2,407

Country	World region	Survey	Year	Total Population[a]	Number of MPI Poor People[b]
				Thousands	Thousands
Philippines	East Asia and the Pacific	DHS	2017	106,651	6,181
South Africa	Sub-Saharan Africa	DHS	2016	57,793	3,616
Mexico	Latin America and the Caribbean	ENSANUT	2016	126,191	8,284
Mongolia	East Asia and the Pacific	MICS	2018	3,170	230
Syria	Arab States	PAPFAM	2009	16,945	1,253
Tajikistan	Europe and Central Asia	DHS	2017	9,101	678
Peru	Latin America and the Caribbean	ENDES	2018	31,989	2,358
El Salvador	Latin America and the Caribbean	MICS	2014	6,421	505
Iraq	Arab States	MICS	2018	38,434	3,319
Gabon	Sub-Saharan Africa	DHS	2012	2,119	315
Botswana	Sub-Saharan Africa	BMTHS	2015-2016	2,254	388
Nicaragua	Latin America and the Caribbean	DHS	2011-2012	6,466	1,051
Kiribati	East Asia and the Pacific	MICS	2018-2019	116	23
eSwatini	Sub-Saharan Africa	MICS	2014	1,136	218
Lesotho	Sub-Saharan Africa	MICS	2018	2,108	413
Morocco	Arab States	PAPFAM	2011	36,029	6,702
Honduras	Latin America and the Caribbean	DHS	2011-2012	9,588	1,851
Sao Tome and Principe	Sub-Saharan Africa	MICS	2014	211	47
Bolivia	Latin America and the Caribbean	DHS	2008	11,353	2,316
Bangladesh	South Asia	MICS	2019	161,377	39,764
Lao PDR	East Asia and the Pacific	MICS	2017	7,061	1,629
Zimbabwe	Sub-Saharan Africa	MICS	2019	14,439	3,725
Congo	Sub-Saharan Africa	MICS	2014-2015	5,244	1,273
India	South Asia	DHS	2015-2016	1,352,642	377,492
Guatemala	Latin America and the Caribbean	DHS	2014-2015	17,248	4,981
Ghana	Sub-Saharan Africa	DHS	2014	29,767	8,952
Nepal	South Asia	DHS	2016	28,096	9,550
Cambodia	East Asia and the Pacific	DHS	2014	16,250	6,043
Namibia	Sub-Saharan Africa	DHS	2013	2,448	930
Bhutan	South Asia	MICS	2010	754	282
Myanmar	East Asia and the Pacific	DHS	2015-2016	53,708	20,579
Kenya	Sub-Saharan Africa	DHS	2014	51,393	19,877
Togo	Sub-Saharan Africa	MICS	2017	7,889	2,967
Comoros	Sub-Saharan Africa	DHS	2012	832	310
Pakistan	South Asia	DHS	2017-2018	212,228	81,352
Haiti	Latin America and the Caribbean	DHS	2016-2017	11,123	4,590
Gambia	Sub-Saharan Africa	MICS	2018	2,280	948
Timor-Leste	East Asia and the Pacific	DHS	2016	1,268	581
Zambia	Sub-Saharan Africa	DHS	2018	17,352	8,313
Côte d'Ivoire	Sub-Saharan Africa	MICS	2016	25,069	11,549
Yemen	Arab States	DHS	2013	28,499	13,593

Country	World region	Survey	Year	Total Population[a]	Number of MPI Poor People[b]
				Thousands	Thousands
Cameroon	Sub-Saharan Africa	MICS	2014	25,216	11,430
Malawi	Sub-Saharan Africa	DHS	2015-2016	18,143	9,547
Nigeria	Sub-Saharan Africa	DHS	2018	195,875	90,919
Rwanda	Sub-Saharan Africa	DHS	2014-2015	12,302	6,695
Mauritania	Sub-Saharan Africa	MICS	2015	4,403	2,227
Papua New Guinea	East Asia and the Pacific	DHS	2016-2018	8,606	4,874
Uganda	Sub-Saharan Africa	DHS	2016	42,729	23,540
Afghanistan	South Asia	DHS	2015-2016	37,172	20,783
Tanzania	Sub-Saharan Africa	DHS	2015-2016	56,313	31,225
Sudan	Arab States	MICS	2014	41,802	21,874
Angola	Sub-Saharan Africa	DHS	2015-2016	30,810	15,745
Senegal	Sub-Saharan Africa	DHS	2017	15,854	8,430
Sierra Leone	Sub-Saharan Africa	MICS	2017	7,650	4,432
Liberia	Sub-Saharan Africa	DHS	2013	4,819	3,033
Congo, Democratic Republic of the	Sub-Saharan Africa	MICS	2017-2018	84,068	54,239
Benin	Sub-Saharan Africa	DHS	2017-2018	11,485	7,672
Guinea-Bissau	Sub-Saharan Africa	MICS	2014	1,874	1,261
Guinea	Sub-Saharan Africa	DHS	2018	12,414	8,220
Mali	Sub-Saharan Africa	DHS	2018	19,078	13,036
Madagascar	Sub-Saharan Africa	MICS	2018	26,262	18,142
Burundi	Sub-Saharan Africa	DHS	2016-2017	11,175	8,298
Mozambique	Sub-Saharan Africa	DHS	2011	29,496	21,371
Central African Republic	Sub-Saharan Africa	MICS	2010	4,666	3,703
Ethiopia	Sub-Saharan Africa	DHS	2016	109,224	91,207
Burkina Faso	Sub-Saharan Africa	DHS	2010	19,751	16,559
Chad	Sub-Saharan Africa	DHS	2014-2015	15,478	13,260
South Sudan	Sub-Saharan Africa	MICS	2010	10,976	10,083
Niger	Sub-Saharan Africa	DHS	2012	22,443	20,304

Source: Alkire, Kanagaratnam, and Suppa (2020).

Notes:
[a] United Nations, Department of Economic and Social Affairs, Population Division (2019).
World Population Prospects 2019, Online Edition. Rev. 1. [Accessed on 28 April 2020].
[b] Own calculations based on MPI results and population projection from 2018. This was computed by multiplying the headcount by population in 2018, and rounding to the nearest thousand.

Percentage of population and number of people deprived in electricity, by country and world region. The table sorts countries from high to low according to the percentage of people who are deprived in electricity.

World region				Percentage of people who are deprived in electricity	Number of people who are deprived in electricity[1]
Developing region				15.74	921,553,093
Arab States				9.55	32,027,567
East Asia and the Pacific				2.78	57,276,983
Europe and Central Asia				0.15	169,544
Latin America and the Caribbean				3.34	17,752,997
South Asia				11.44	207,533,299
Sub-Saharan Africa				59.79	606,792,704

	Country	Survey	Year		
Sub-Saharan Africa	**South Sudan**	MICS	2010	95.61	10,493,881
Sub-Saharan Africa	**Chad**	DHS	2014-2015	91.54	14,168,750
Sub-Saharan Africa	**Burundi**	DHS	2016-2017	91.10	10,180,401
Sub-Saharan Africa	**Liberia**	DHS	2013	90.21	4,347,056
Sub-Saharan Africa	**Central African Republic**	MICS	2010	89.49	4,175,942
Sub-Saharan Africa	**Malawi**	DHS	2015-2016	88.82	16,114,481
Sub-Saharan Africa	**Burkina Faso**	DHS	2010	88.60	17,500,590
Sub-Saharan Africa	**Niger**	DHS	2012	85.02	19,081,265
East Asia and the Pacific	**Papua New Guinea**	DHS	2016-2018	82.84	7,129,440
Sub-Saharan Africa	**Guinea-Bissau**	MICS	2014	81.62	1,529,835
Sub-Saharan Africa	**Tanzania**	DHS	2015-2016	80.16	45,141,910
Sub-Saharan Africa	**Ethiopia**	DHS	2016	79.73	87,080,356
Sub-Saharan Africa	**Mozambique**	DHS	2011	77.26	22,788,898
Sub-Saharan Africa	**Sierra Leone**	MICS	2017	77.13	5,900,478
Sub-Saharan Africa	**Rwanda**	DHS	2014-2015	76.81	9,448,791
Sub-Saharan Africa	**Uganda**	DHS	2016	72.16	30,835,085
Sub-Saharan Africa	**Kenya**	DHS	2014	71.62	36,805,744
Sub-Saharan Africa	**Congo, Democratic Republic of the**	MICS	2017-2018	70.42	59,201,945
Sub-Saharan Africa	**Zambia**	DHS	2018	67.06	11,636,445
Sub-Saharan Africa	**Benin**	DHS	2017-2018	65.64	7,538,335
Sub-Saharan Africa	**Madagascar**	MICS	2018	63.35	16,636,979

World region	Country	Survey	Year	Percentage of people who are deprived in electricity	Number of people who are deprived in electricity[1]
Sub-Saharan Africa	Mauritania	MICS	2015	60.19	2,650,473
Latin America and the Caribbean	Haiti	DHS	2016-2017	59.72	6,643,057
Sub-Saharan Africa	Lesotho	MICS	2018	56.05	1,181,764
Sub-Saharan Africa	Namibia	DHS	2013	55.98	1,370,633
Sub-Saharan Africa	Guinea	DHS	2018	55.35	6,871,413
Sub-Saharan Africa	Angola	DHS	2015-2016	54.86	16,903,194
Arab States	Sudan	MICS	2014	52.31	21,868,440
Sub-Saharan Africa	Mali	DHS	2018	49.15	9,377,295
Sub-Saharan Africa	Togo	MICS	2017	47.61	3,756,079
Sub-Saharan Africa	Cameroon	MICS	2014	46.92	11,830,651
East Asia and the Pacific	Kiribati	MICS	2018-2019	46.11	53,418
Sub-Saharan Africa	Zimbabwe	MICS	2019	45.02	6,500,180
East Asia and the Pacific	Myanmar	DHS	2015-2016	43.44	23,329,726
East Asia and the Pacific	Cambodia	DHS	2014	42.57	6,918,278
Sub-Saharan Africa	Nigeria	DHS	2018	42.19	82,642,134
Sub-Saharan Africa	Gambia	MICS	2018	39.61	903,163
Sub-Saharan Africa	eSwatini	MICS	2014	38.99	443,016
Sub-Saharan Africa	Senegal	DHS	2017	38.34	6,079,167
Sub-Saharan Africa	Congo	MICS	2014-2015	38.08	1,997,205
Sub-Saharan Africa	Côte d'Ivoire	MICS	2016	35.41	8,877,910
Sub-Saharan Africa	Botswana	BMTHS	2015-2016	34.38	775,038
Sub-Saharan Africa	Comoros	DHS	2012	30.09	250,421
South Asia	Afghanistan	DHS	2015-2016	28.78	10,696,327
Sub-Saharan Africa	Sao Tome and Principe	MICS	2014	28.07	59,234
South Asia	Bhutan	MICS	2010	27.89	210,375
Sub-Saharan Africa	Ghana	DHS	2014	25.13	7,481,316
East Asia and the Pacific	Timor-Leste	DHS	2016	23.63	299,646
Arab States	Yemen	DHS	2013	21.61	6,159,054
Latin America and the Caribbean	Nicaragua	DHS	2011-2012	20.16	1,303,178
Latin America and the Caribbean	Bolivia	DHS	2008	19.62	2,227,600
Latin America and the Caribbean	Guyana	MICS	2014	13.99	109,004
Latin America and the Caribbean	Guatemala	DHS	2014-2015	12.98	2,238,464
South Asia	India	DHS	2015-2016	12.15	164,379,346

World region	Country	Survey	Year	Percentage of people who are deprived in electricity	Number of people who are deprived in electricity[1]
Sub-Saharan Africa	South Africa	DHS	2016	10.42	6,020,926
Sub-Saharan Africa	Gabon	DHS	2012	10.11	214,157
South Asia	Nepal	DHS	2016	9.41	2,643,094
Arab States	Morocco	PAPFAM	2011	8.78	3,161,851
Latin America and the Caribbean	Belize	MICS	2015-2016	8.63	33,056
South Asia	Pakistan	DHS	2017-2018	7.82	16,591,978
South Asia	Bangladesh	MICS	2019	7.76	12,528,512
Latin America and the Caribbean	Lao PDR	MICS	2017	7.02	495,395
Latin America and the Caribbean	Philippines	DHS	2017	7.01	7,477,827
Latin America and the Caribbean	Jamaica	JSLC	2014	5.61	164,590
Latin America and the Caribbean	El Salvador	MICS	2014	4.69	301,038
Latin America and the Caribbean	Peru	ENDES	2018	4.50	1,439,744
Latin America and the Caribbean	Saint Lucia	MICS	2012	2.69	4,892
East Asia and the Pacific	Indonesia	DHS	2017	2.65	7,084,528
Latin America and the Caribbean	Suriname	MICS	2018	2.61	15,042
Latin America and the Caribbean	Colombia	DHS	2015-2016	2.53	1,258,090
Latin America and the Caribbean	Dominican Republic	MICS	2014	2.39	253,758
South Asia	Sri Lanka	SLDHS	2016	2.27	482,633
Latin America and the Caribbean	Trinidad and Tobago	MICS	2011	2.11	29,322
East Asia and the Pacific	Mongolia	MICS	2018	1.90	60,185
Latin America and the Caribbean	Paraguay	MICS	2016	1.66	115,305
Latin America and the Caribbean	Ecuador	ECV	2013-2014	1.25	213,695
Arab States	Algeria	MICS	2012-2013	1.20	506,631
Latin America and the Caribbean	Barbados	MICS	2012	0.84	2,415
East Asia and the Pacific	Vietnam	MICS	2013-2014	0.79	751,440
Europe and Central Asia	Tajikistan	DHS	2017	0.71	64,931
Latin America and the Caribbean	Mexico	ENSANUT	2016	0.65	814,904

World region	Country	Survey	Year	Percentage of people who are deprived in electricity	Number of people who are deprived in electricity[1]
Arab States	**Libya**	PAPFAM	2014	0.61	40,473
Europe and Central Asia	**Moldova**	MICS	2012	0.49	19,892
Europe and Central Asia	**North Macedonia**	MICS	2011	0.36	7,537
East Asia and the Pacific	**Thailand**	MICS	2015-2016	0.33	230,787
Arab States	**Syria**	PAPFAM	2009	0.32	53,424
Latin America and the Caribbean	**Brazil**	PNAD	2015	0.27	572,047
Europe and Central Asia	**Serbia**	MICS	2014	0.27	23,654
East Asia and the Pacific	**China**	CFPS	2014	0.24	3,446,311
Europe and Central Asia	**Bosnia and Herzegovina**	MICS	2011-2012	0.21	6,897
South Asia	**Maldives**	DHS	2016-2017	0.20	1,035
Arab States	**Egypt**	DHS	2014	0.17	169,794
Sub-Saharan Africa	**Seychelles**	QLFS	2019	0.17	167
Arab States	**Tunisia**	MICS	2018	0.17	19,308
Latin America and the Caribbean	**Cuba**	ENO	2017	0.12	13,795
Europe and Central Asia	**Montenegro**	MICS	2018	0.12	754
Arab States	**Iraq**	MICS	2018	0.11	44,091
Europe and Central Asia	**Georgia**	MICS	2018	0.11	4,405
Arab States	**Palestine, State of**	MICS	2014	0.09	4,501
Europe and Central Asia	**Ukraine**	MICS	2012	0.08	34,770
Europe and Central Asia	**Armenia**	DHS	2015-2016	0.04	1,183
Europe and Central Asia	**Turkmenistan**	MICS	2015-2016	0.03	2,024
Europe and Central Asia	**Kazakhstan**	MICS	2015	0.02	3,350
Europe and Central Asia	**Kyrgyzstan**	MICS	2018	0.00	147
Arab States	**Jordan**	DHS	2017-2018	0.00	0
Europe and Central Asia	**Albania**	DHS	2017-2018	0.00	0
Latin America and the Caribbean	**Honduras**	DHS	2011-2012	No electricity data	

Source: Alkire, S., Kanagaratnam, U. and Suppa, N. (2020).

Notes:
[1] The column on number of people deprived in electricity was computed by multiplying the headcount deprived in electricity (column D) by the 2018 population estimates by UNDESA (2019).