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GLOBAL PROGRESS IN HOUSEHOLD ELECTRIFICATION

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INTRODUCTION

New data show remarkable but uneven progress in household electrification across the world. On the one hand, millions of people across the world have been provided connection to the electric grid since 1980. South and East Asia count among the regions that have been making rapid progress toward universal electrification. Until now, the pace of change had been understated because of data limitations. On the other hand, Sub-Saharan Africa continues to struggle, especially in rural areas, with electrification rates stuck below 20% in many countries. These insights draw on a new database collected by ISEP that contains reliable information on household electrification (total, rural, and urban) across 124 non-OECD countries going back, in some cases, to 1949 (Aklin, Harish, and Urpelainen 2018). This database is freely available online (https://dataverse.harvard.edu/dataverse/electrification) and can be explored through interactive maps (https://aklin.shinyapps.io/ElectrificationMap/).

THE NEED FOR RELIABLE DATA

Access to good data is crucial to design and evaluate policies. Effective programs can only be identified if stakeholders can draw on reliable information. Until now, the main resource to study electrification patterns across countries remained the World Bank's Global Tracking Framework (GTF) (World Bank 2019). Drawing mostly on national surveys, GTF provides data on household electrification for over 200 countries.

There are two limitations to the GTF database. First, most of the observations it contains are not actual pieces of data but simulated values. The small print clarifies how the dataset was built. GTF started by collecting data for each country in 1990, 2000, and 2010. Then, it filled the gaps between these years through simulations – and not actual data. In forty-two countries, GTF was unable to locate any data for these years. In such cases, electrification rates were computed based on a regional average and thus contain no country-specific data.

Second, the GTF database starts in 1990. Yet many emerging countries achieved universal electrification before that. China, for instance, implemented rural electrification programs in the 1950s already (Jiahua et al. 2006). In the absence of good pre-1990 data, the lessons learned from the experiences of these countries are lost. Given that learning from success and failure is an important way to improve policies (e.g., Meseguer 2005), lack of data from earlier periods constrains policymakers.

We followed a different approach (Aklin, Harish, and Urpelainen 2018). Avoiding simulations, we collected electrification data for as many countries and years as possible. Our requirements were simple: we only included data from censuses, nationally representative surveys, or similarly recognized and reliable sources. Each observation was tracked and documented separately. The plausibility of each value was vetted individually and unreliable observations were discarded. The result is a freely-available database of total, rural, and urban electrification covering 124 non-OECD countries and going back, in some cases, to 1949. These data can be easily consulted using ISEP's online interactive maps (https://aklin.shinyapps.io/ElectrificationMap/) and are available to download as well (https://dataverse.harvard.edu/dataverse/electrification).

GLOBAL PROGRESS IN ELECTRIFICATION

Our database offers several insights on electrification patterns across the world.

First, electrification rates increased across the board over the last four decades. Most developing countries suffered from extremely low electrification rates until recently – especially in rural areas (Table 1). In 1980, household electrification rates were below 30% in four out of ten countries in our dataset. That same year, rural electrification was below the same threshold in more than two-thirds of the countries for which we have data. In sharp contrast, by 2015, several countries have achieved universal electrification (including Algeria or Paraguay), and about half of the countries in the dataset have a rural electrification rate above 60%.

Table 1: Proportion of countries that have a household electrification rate below 30%, between 30 and 60%, and above 60% in 1980, 2000, and in 2015.

Share of countries with an electrification rate:	Below 30%	Between 30 and 60%	Above 60%
All Households			
In 1980	41%	22%	37%
In 2000	31%	13%	56%
In 2015	17%	15%	68%
Rural Households			
In 1980	70%	15%	15%
In 2000	53%	12%	35%
In 2015	43%	11%	46%

Yet many countries lag behind and remain trapped in electricity poverty (Aklin et al. 2018). This is particularly true in rural areas (Steckel, Rao, and Jakob 2017). Somewhat less than half the countries in the data still fail to clear the (arbitrary) threshold of 30% rural electrification rates. This includes large countries such as the Democratic Republic of Congo or Ethiopia. The notion of a "trap" appears to be appropriate. The developing world is divided into two camps: countries that solved the problem of rural electrification and those that do not. Few countries linger in-between (Figure 1).

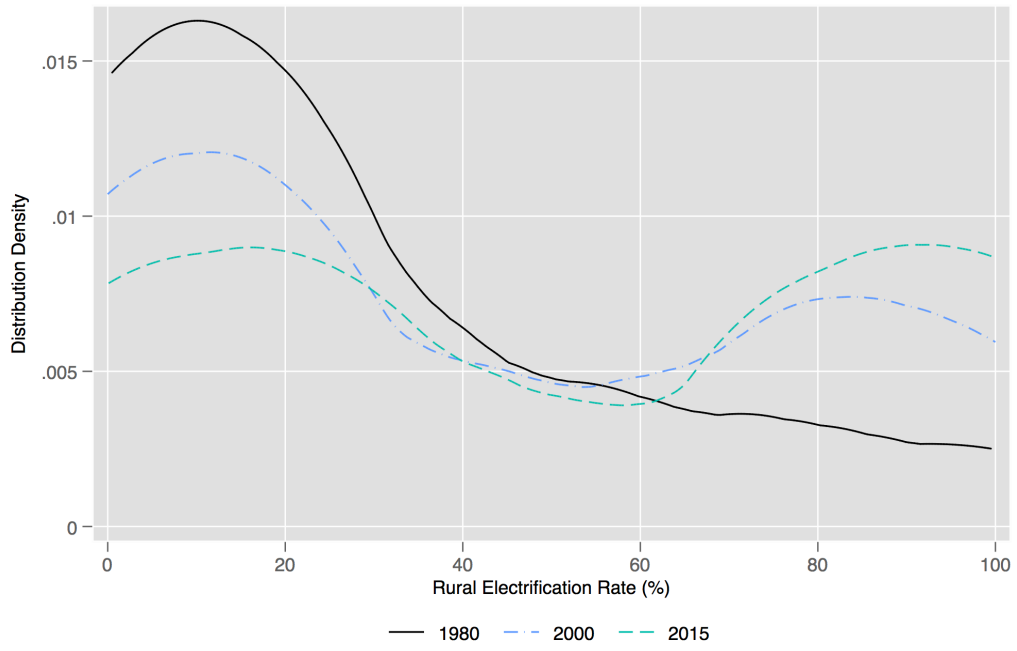

Figure 1: Distribution of countries based on their rural electrification rates in 1980, 2000, and 2015.

Figure 2 shows average electrification rates by region for urban (left panel) and rural areas (right panel). Historically, both South Asia and Sub-Saharan Africa suffered most from lack of electricity access. Their paths diverged in the 1980s. Over the last forty years, South Asia made tremendous progress in the provision of electric power. While the quality of the grid electricity service remains a problem (Aklin et al. 2016), the region will probably provide universal access in the foreseeable future.

The same cannot be said of Sub-Saharan Africa. Out of the twenty countries with the lowest household electrification rates in 2015 (which means less than 35%), eighteen are located in that region. The numbers are staggering. Back-of-the-envelope calculations suggest that about 100 million people live off the grid in Nigeria. Ethiopia and the Democratic Republic of Congo

complete the continental top-3, with about 77 and 66 million people without grid connection. The center of gravity of electricity poverty is moving quickly toward Sub-Saharan Africa.

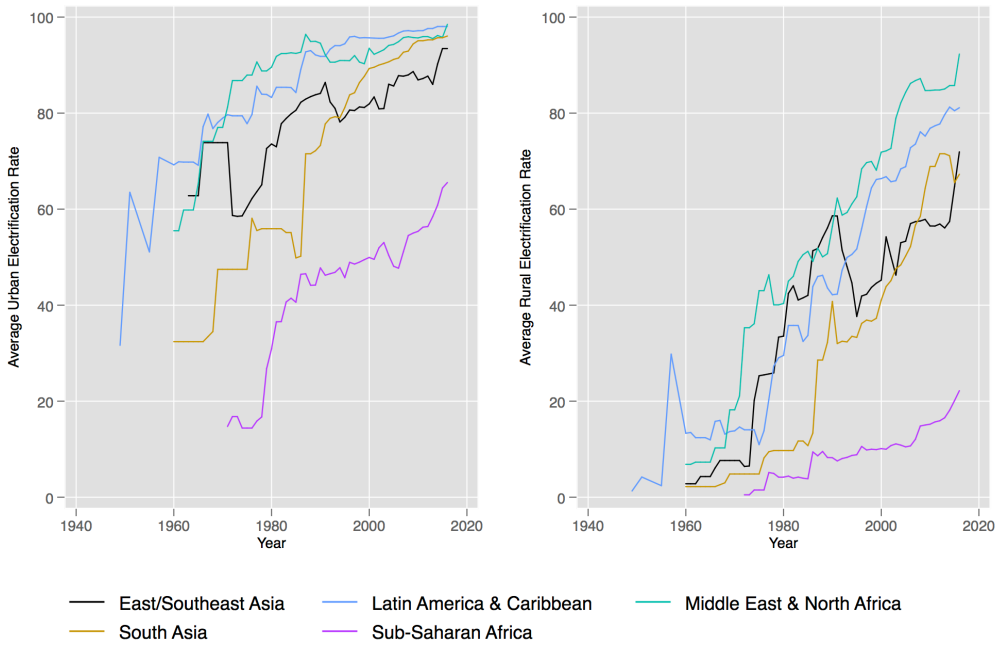

Figure 2: average electrification rates by region. The lines are based on a simple, unweighted average of electrification rates for a given region. Early years are removed when too few observations were available. North America and Europe are removed, since both regions stood at about 100% during this entire period.

NEXT STEPS

The challenges of Sub-Sahara Africa notwithstanding, electrification rates are likely to continue to improve across the world. Governments will continue to learn what works and what doesn't. And there is undoubtedly much to learn from the experiences of countries such as Vietnam or Bhutan, which have seen their electrification rates increase by more than 50 percentage points over the last twenty years. And once power infrastructures are in place, reversals are historically quite rare. Our data can help identify effective policies that have been successful at expanding the grid in the past. Future electrification policies, however, will benefit from new options as a result to declining costs of distributed renewable energy. The International Energy Agency foresees that off-grid renewable energy will provide about 30% of new connections by 2030 (IEA 2017, 12).

Increasing electrification rates also means that stakeholders will need to shift their attention to new but pressing issues. One is that connections to the grid (or equivalent off-grid devices) are a

necessary but not a sufficient condition for satisfactory electricity access. The grid is, in many countries, highly unreliable. Under these conditions, power is often too unreliable to use a household's appliances and sometimes even dangerous. Distributed power may offer a promising alternative, but off-grid technologies also struggle with their own limitations. For instance, many micro-grids offer only a very limited amount of power and thus only partially meet the needs of customers (Aklin et al. 2017).

From a practical perspective, then, there is a need for information beyond what our database can offer. Being connected to the grid means something very different for households that have only power for a few hours per day compared to those that have uninterrupted and sufficient electricity to meet their needs. Likewise, distributed power systems differ in the amount and duration of electricity they provide. The political logic will need to gradually shift from the extensive to the intensive margin: it is not about how many people need to be connected, but how much electricity they need.

POLICY RECOMMENDATIONS

- *Despite their poverty, several low-income countries have successfully increased electrification rates. Even though policies need to be tailored to specific contexts, policymakers should encourage the dissemination of information about strategies that work and learn from the failures of others. Exchanges between Sub-Saharan Africa and South Asia, whose recent experience may be particularly relevant, can help spread knowledge about effective policy design.*

- *High-quality data are essential for policymaking. In the future, stakeholders will need data that go beyond electrification rates. For instance, they will need to know how reliable and how expensive electricity is. Likewise, we will need fine-grained data to understand inequality in electricity access at the local level. Stakeholders should encourage the collection of such data.*

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About ISEP

The Initiative for Sustainable Energy Policy (ISEP) is an interdisciplinary research program that uses cutting-edge social and behavioral science to design, test, and implement better energy policies in emerging economies.

Hosted at the Johns Hopkins School of Advanced International Studies (SAIS), ISEP identifies opportunities for policy reforms that allow emerging economies to achieve human development at minimal economic and environmental costs. The initiative pursues such opportunities both pro-actively, with continuous policy innovation and bold ideas, and by responding to policymakers' demands and needs in sustained engagement and dialogue.