A Global Map of Electricity and Gas Distribution Network Companies

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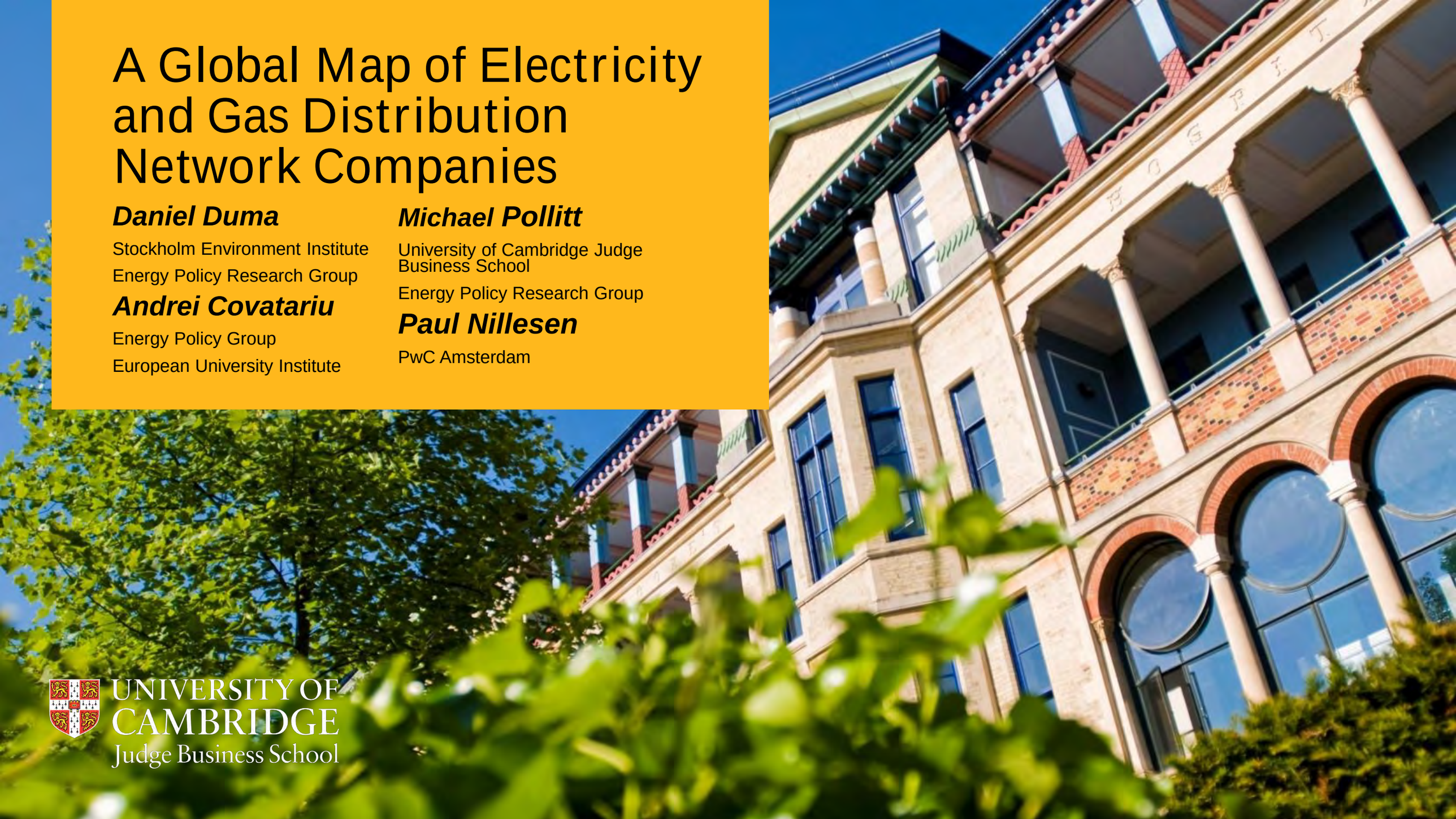

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Introduction

This paper is inspired by the crucial role that energy distribution network utilities are playing and are expected to play in the energy transition.

The relevance:

- The **optimal organisation** of the sector for the challenges of deep decarbonisation is uncertain. Some of the questions that remain:
  - Separation of gas and electricity
  - Optimal size or ownership
  - Degree of vertical and horizontal unbundling
- DSOs are facing **significant challenges**:
  - Higher investment needs
  - Integrating renewables and distributed energy resources
  - Increased penetration of electric mobility and heating

In this context, this paper seeks to present a map of global DSOs to illustrate the variation in power and gas distribution across the world as we contemplate the role of DSOs in advancing the energy transition.

Future work will look at DSO innovation around the world and the active DSO in a subset of advanced jurisdictions

Definition and clusters of indicators

Our definition of DSO

- **Definition**
  - The entity that performs the network operation, even if the same entity performs other functions (including system operation or retail).
- **Sample**
  - One DSO per country, the one that covers the capital
    - 194 electricity
    - 67 gas

Clusters of indicators

- **Ownership**
  - Public, mixed, or private
- **Size**
  - Number of customers
  - Energy distributed
  - Length of network
  - Number of employees
- **Integration**
  - Vertical (bundled or unbundled)
  - Horizontal (with gas or water)
- **Performance** (for electricity)
  - Network losses
  - SAIDI & SAIFI

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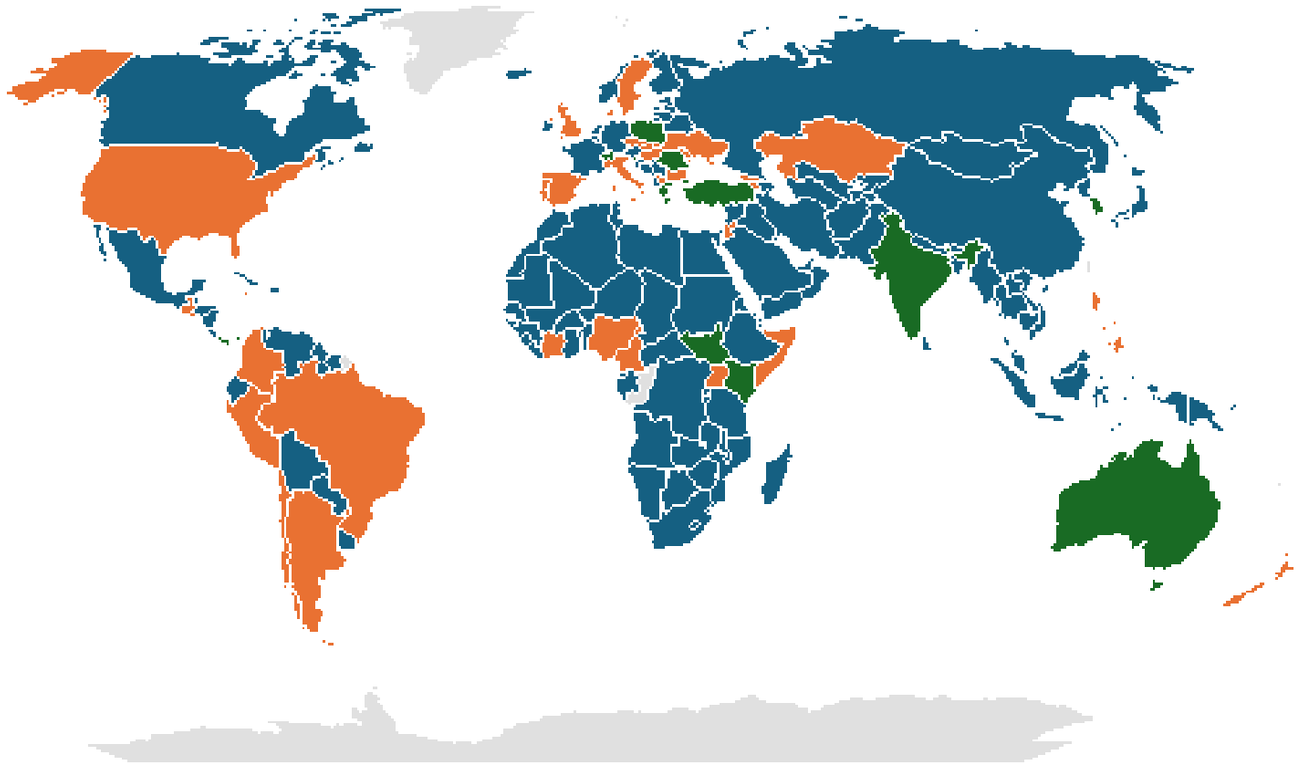
FINDINGS ELECTRICITY

Three quarters of DSOs are public



Public = ownership by state higher than 50%

Mixed = ownership by state between 5% and 50%

Private= ownership by state lower than 5%

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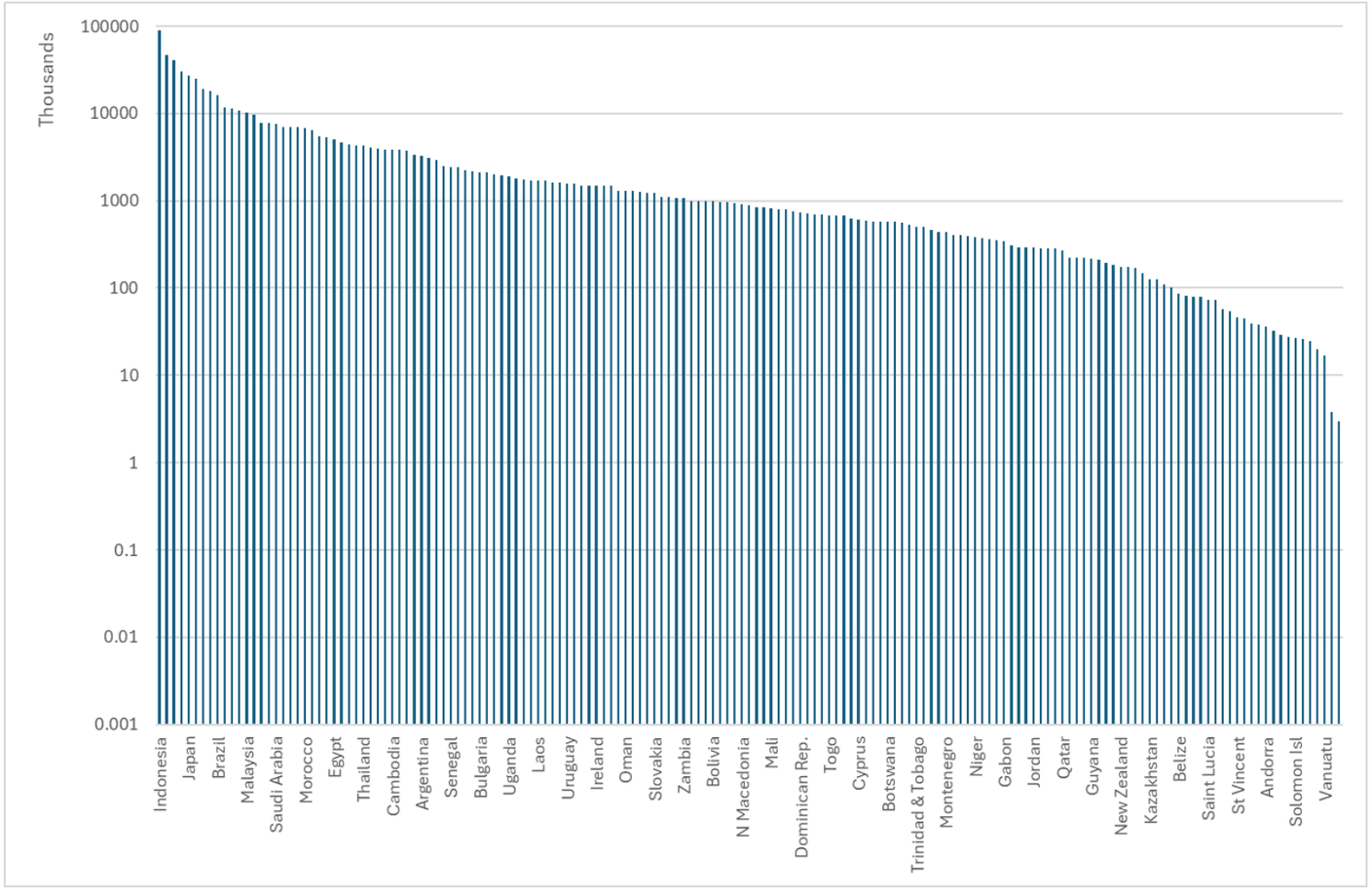
Huge range in terms of customers

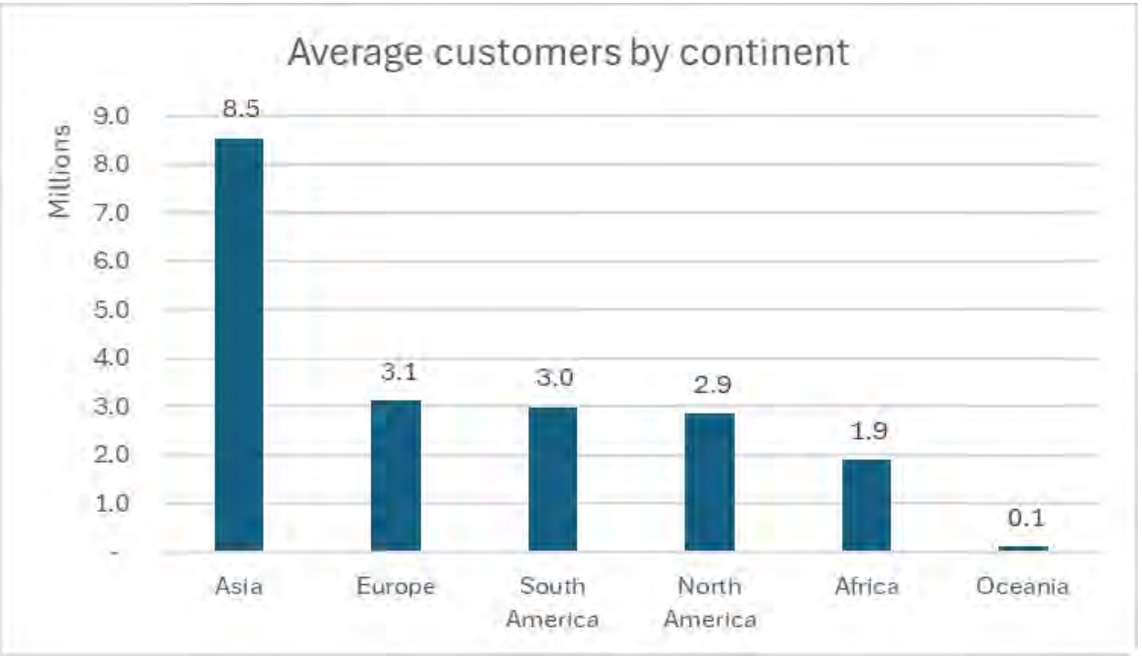


In logarithmic scale

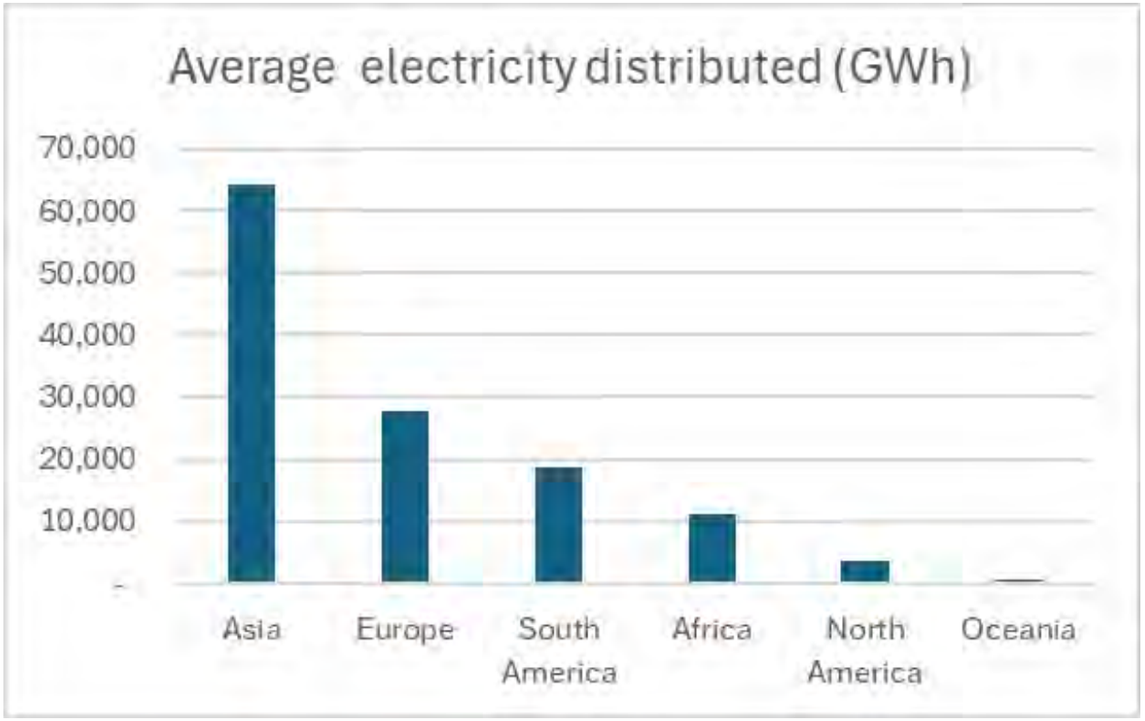
Max: Indonesia – 89m
Min: Nauru – 3800
Mean: 3.7 m
Median: 906,000

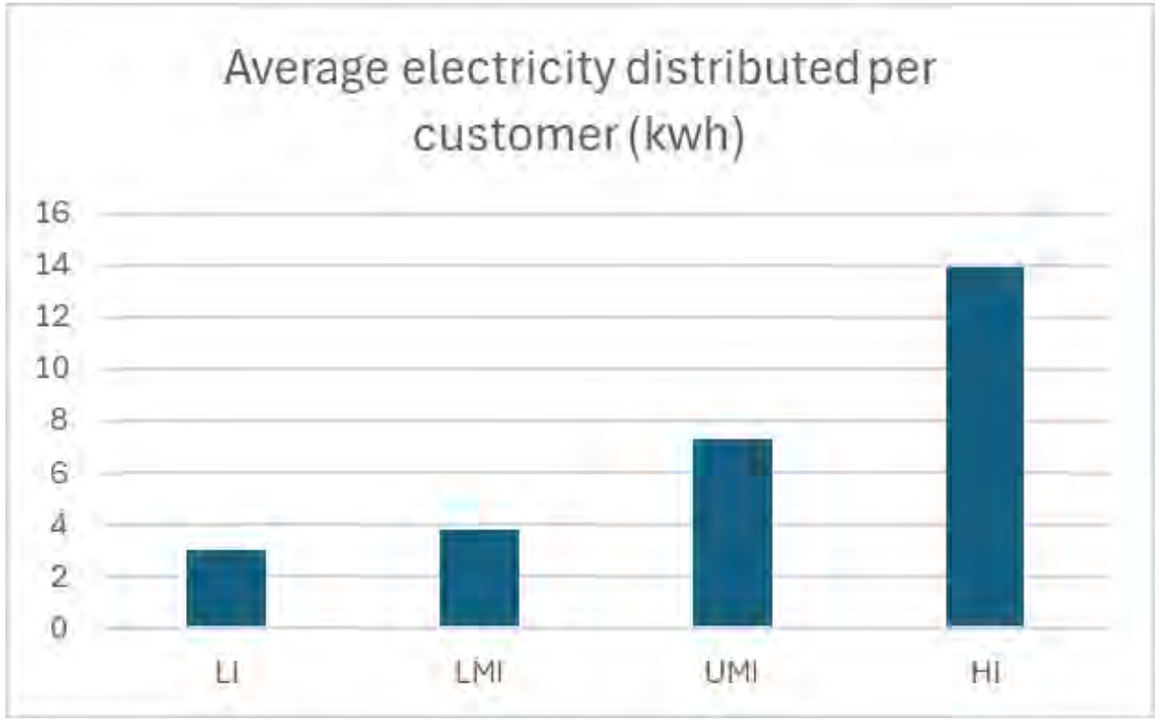
Excluding China
Includes DSOs that are part of integrated utilities

DSOs in Asia are much larger on average



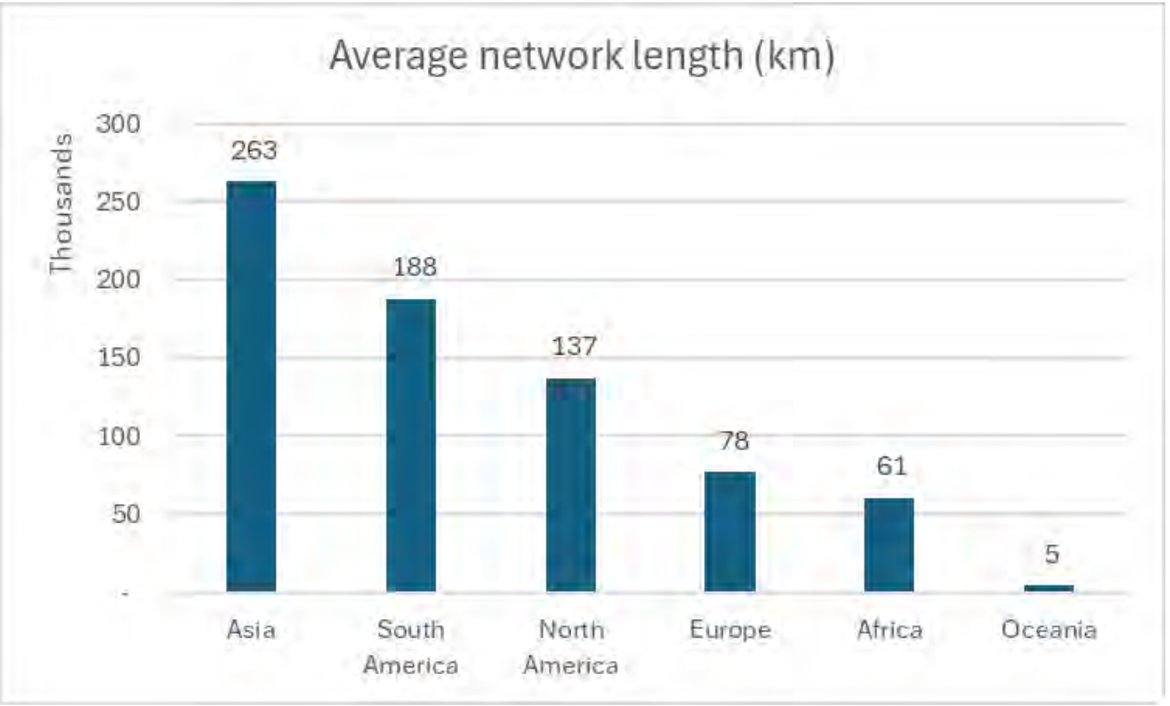
DSOs in higher income economies are much larger

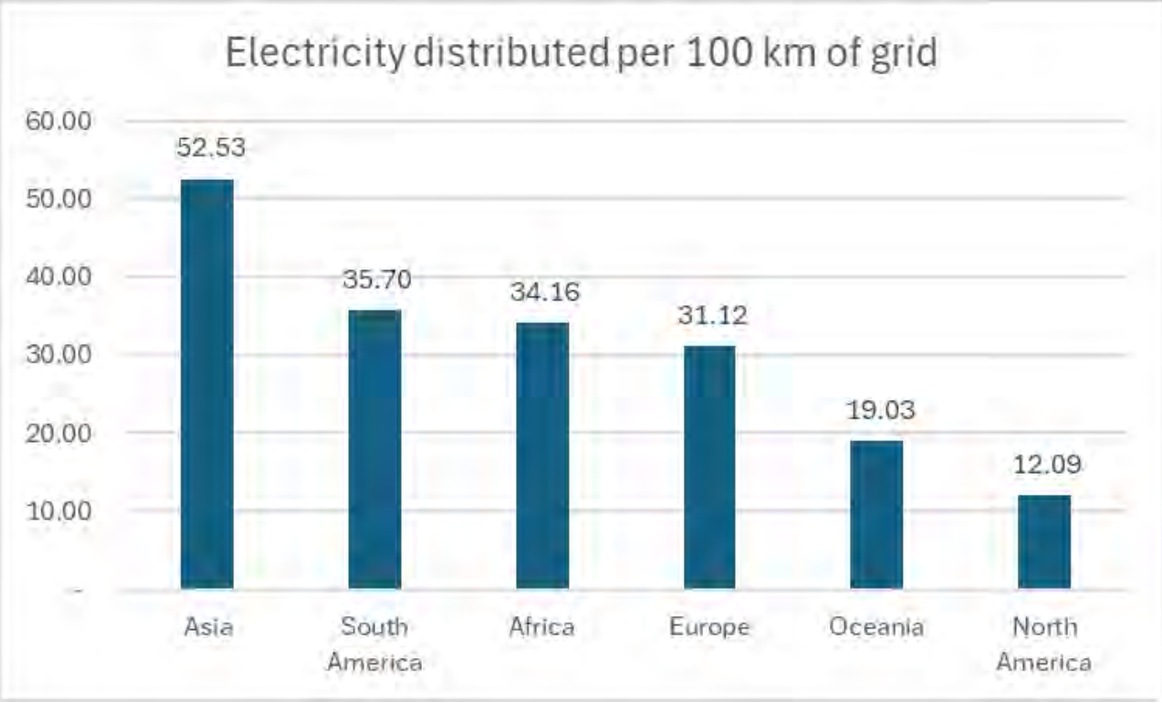




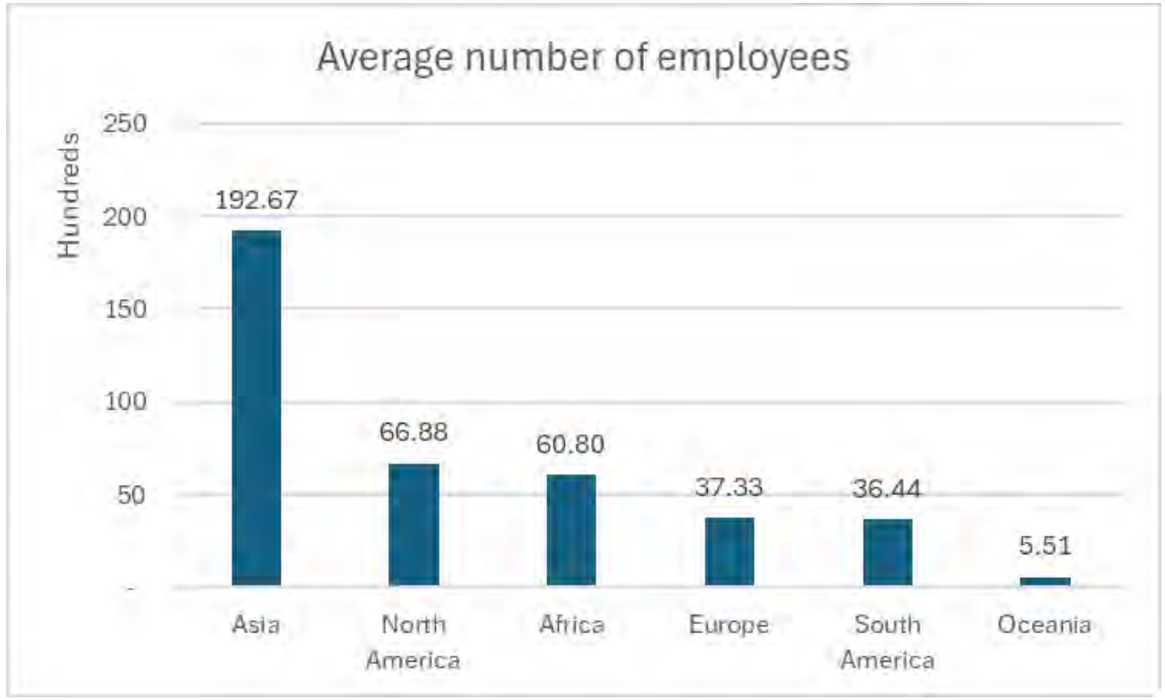
LI = Low income
LMI = Lower-middle income
UMI = Upper-middle Income
HI = High income

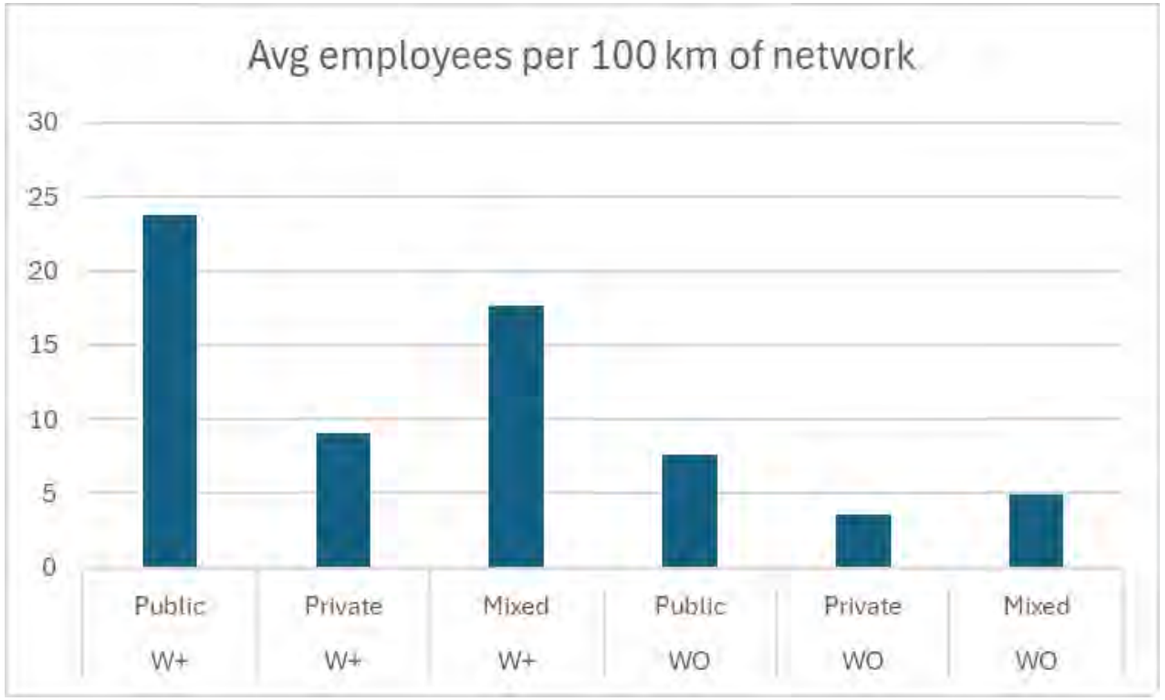
DSOs in Asia have bigger networks





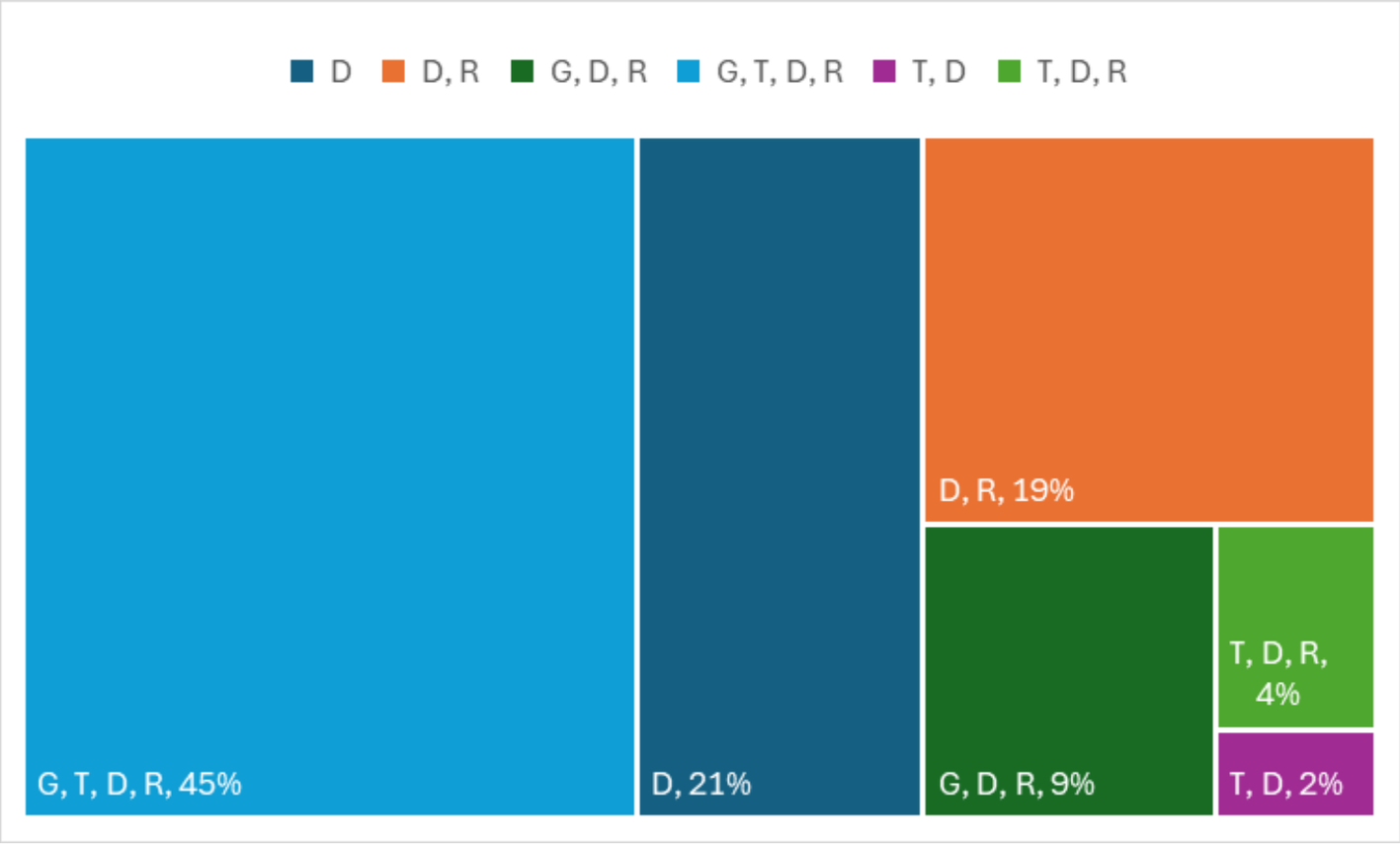
Public DSOs have more employees





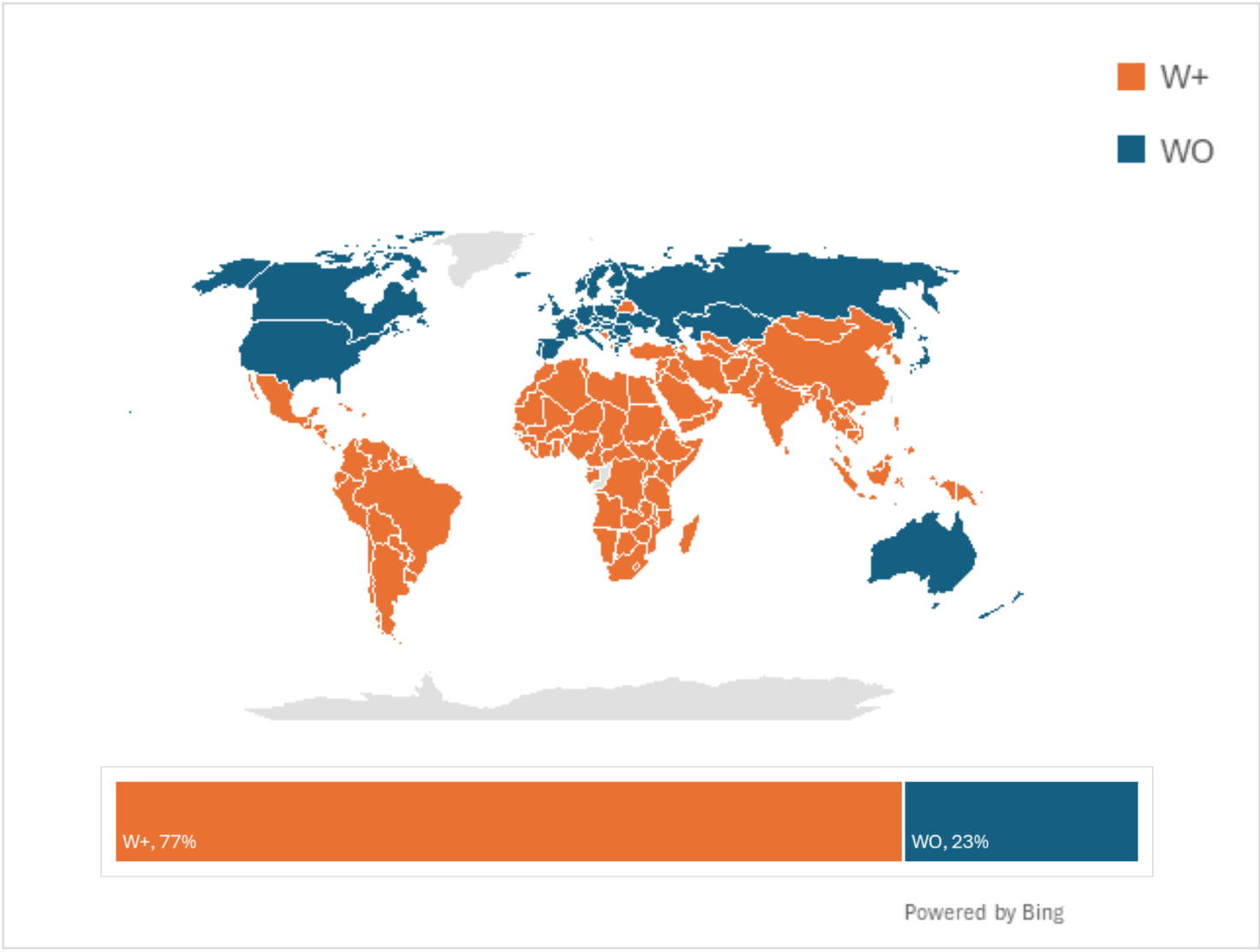
*Includes DSOs that are part of integrated utilities

Half of DSOs are integrated with generation



Ownership unbundling – if legal entity that performs Distribution (D) function performs other services like Transmission (T), Generation (G) or Retail (R) it will be considered bundled

Wires-only DSOs are predominant in Europe



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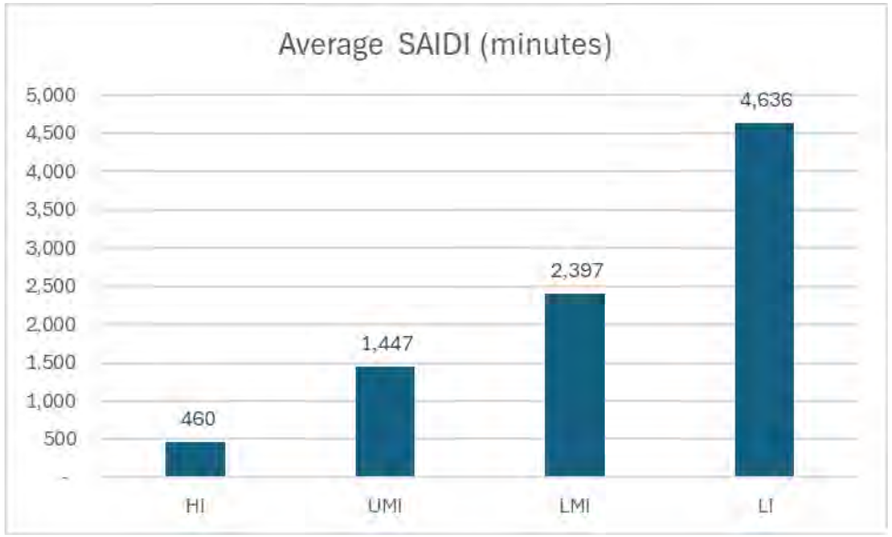
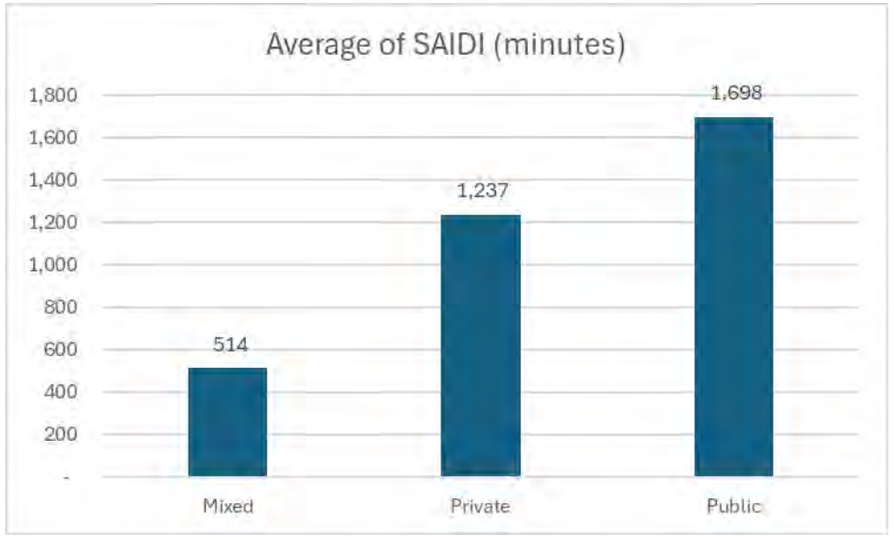
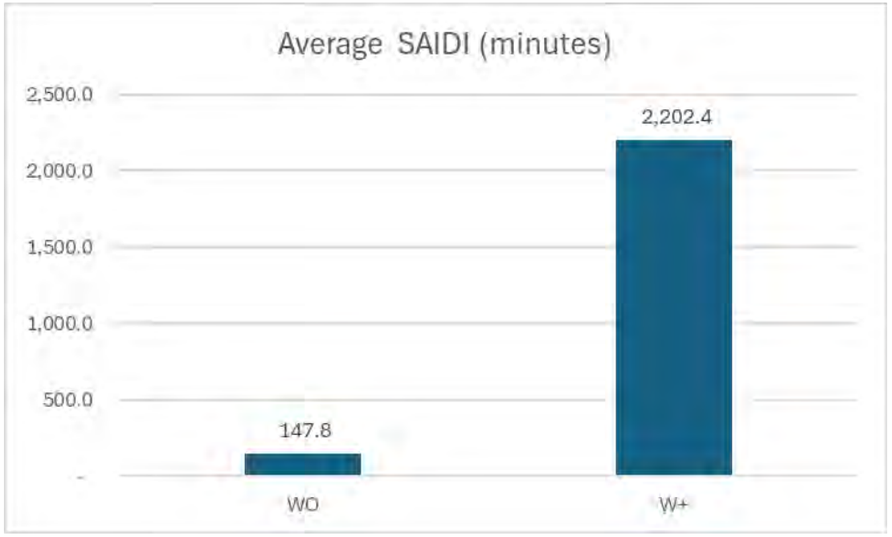
Interruptions are much longer in lower income countries and public DSOs







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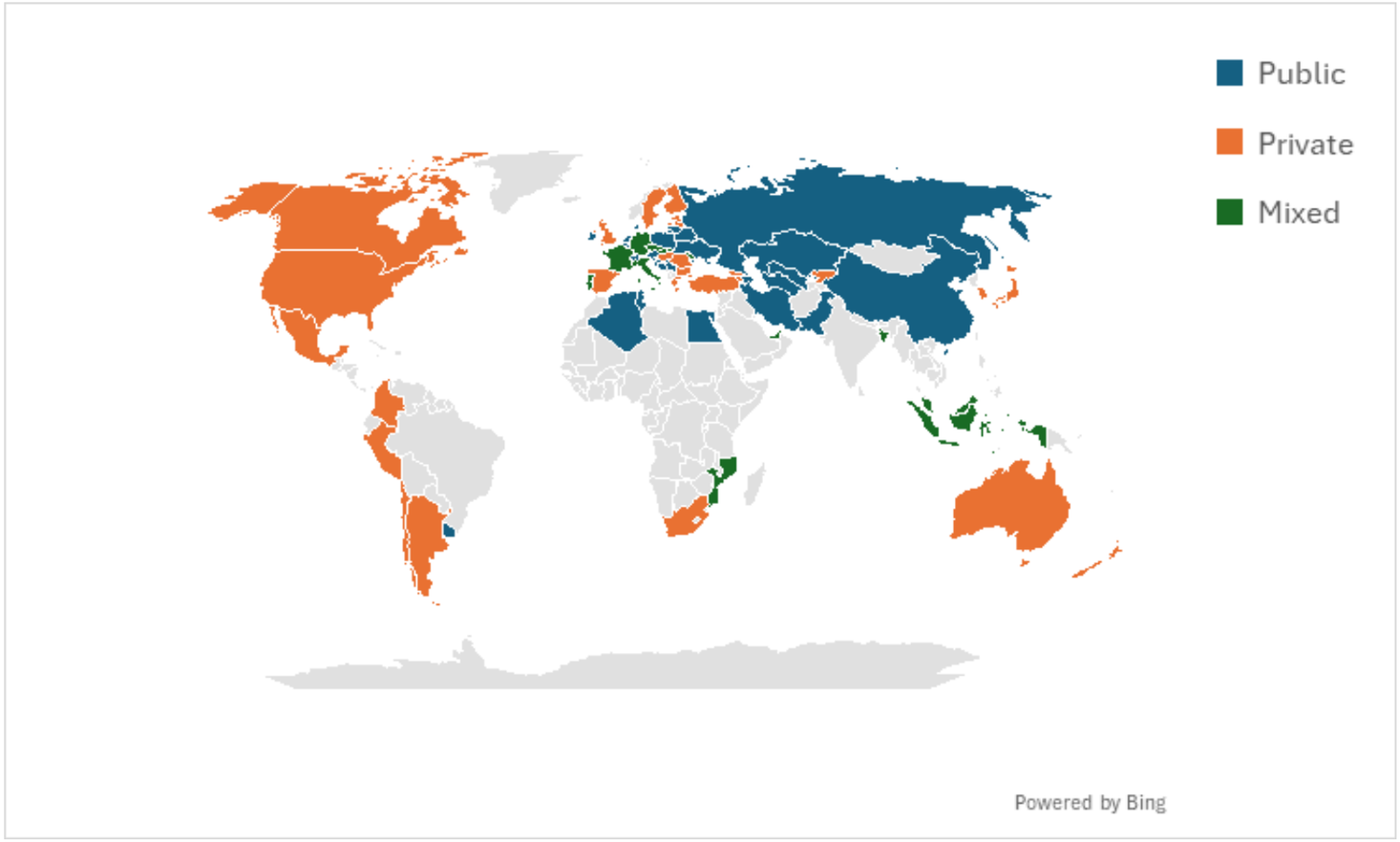
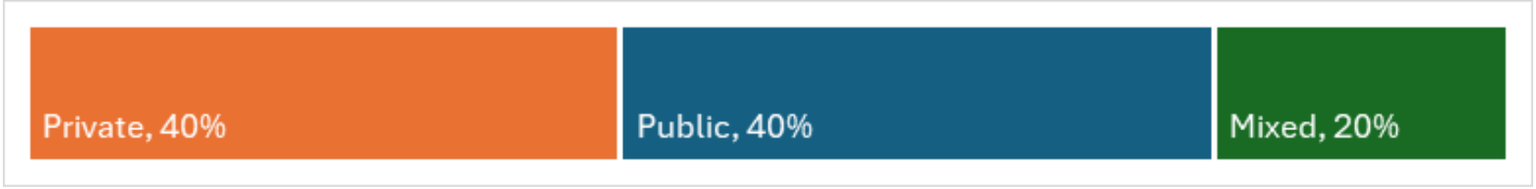
FINDINGS GAS

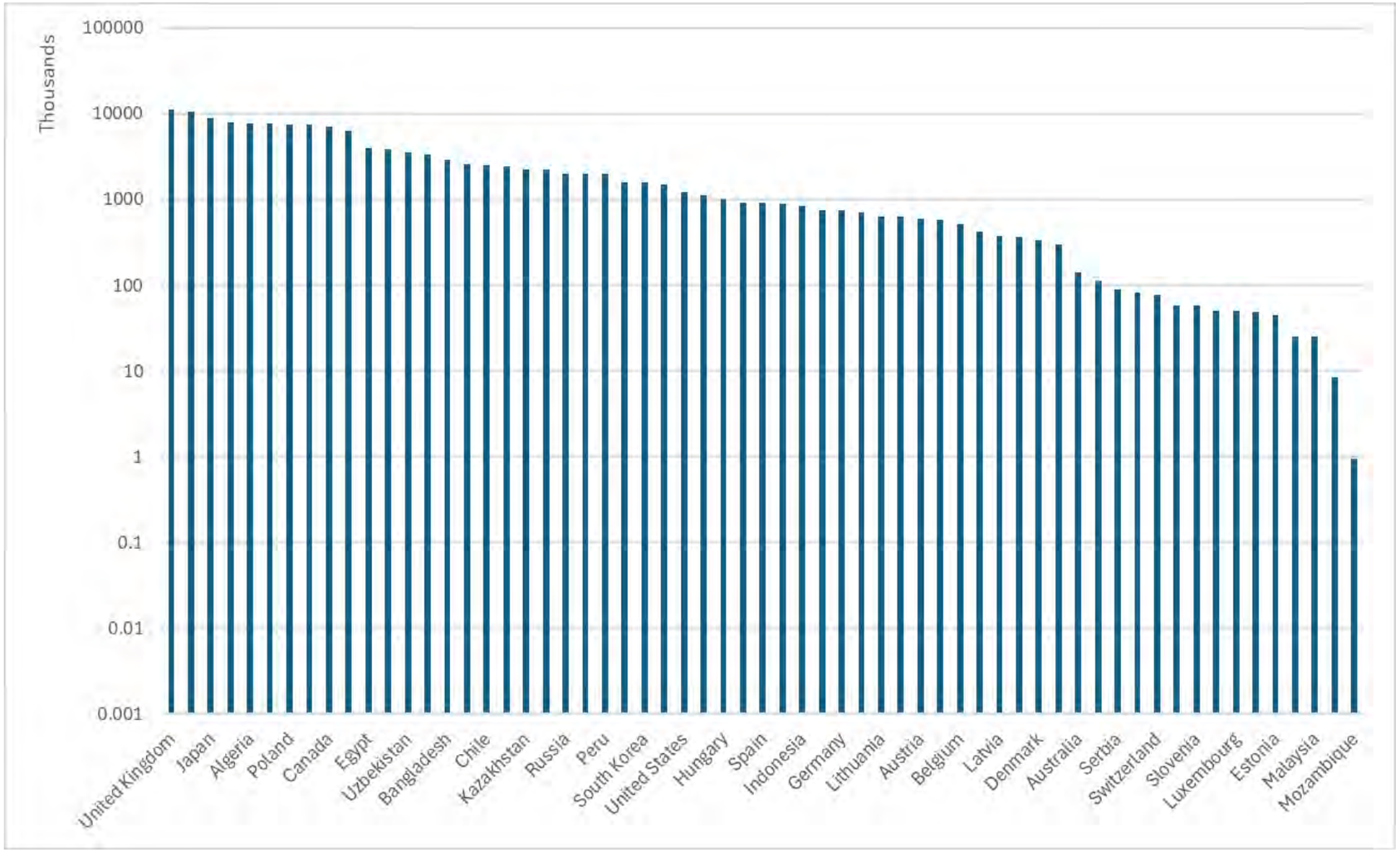
Almost even split between public and private





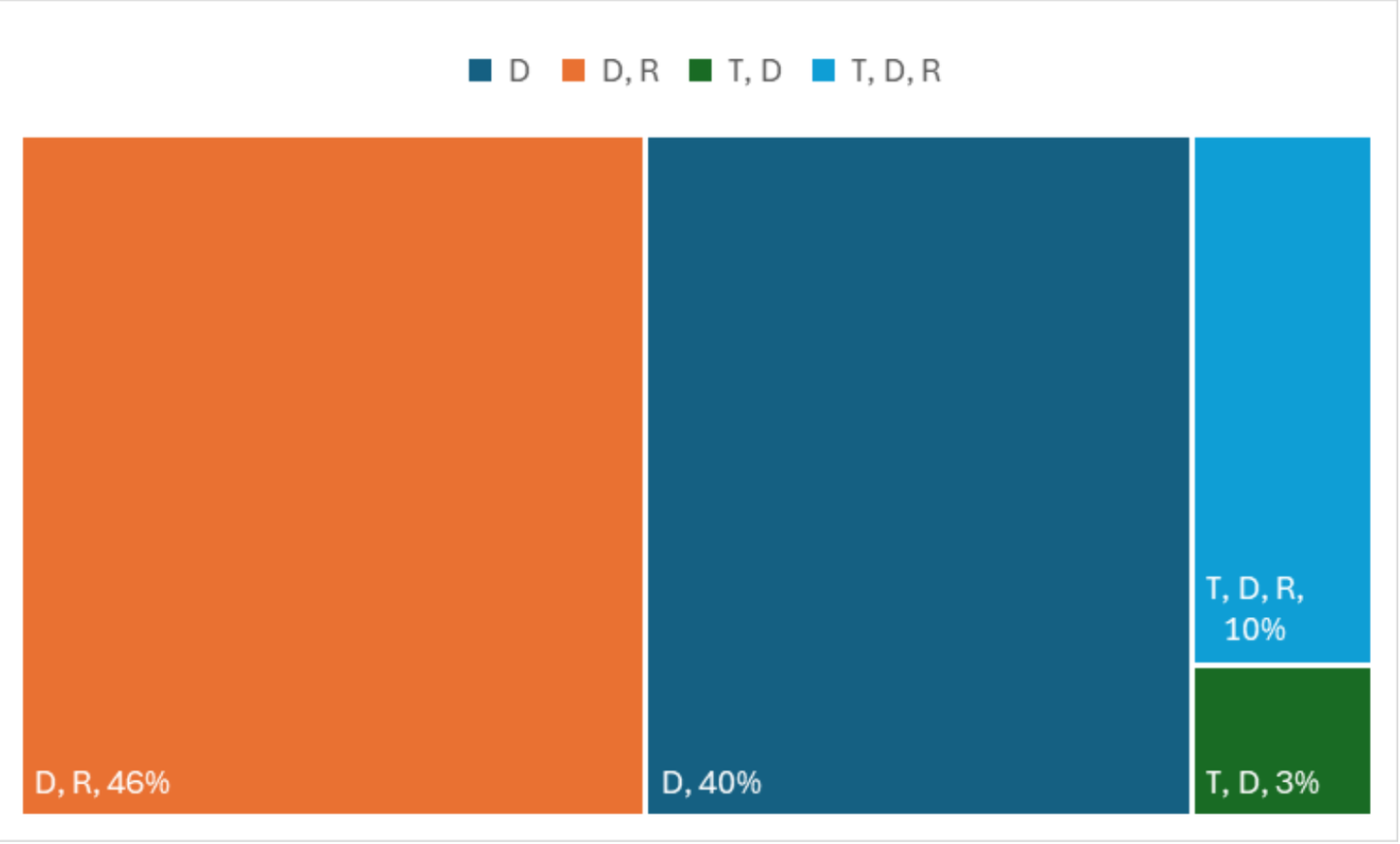
*gray means there is no gas DSO serving the capital

Gas DSOs are much smaller than electricity

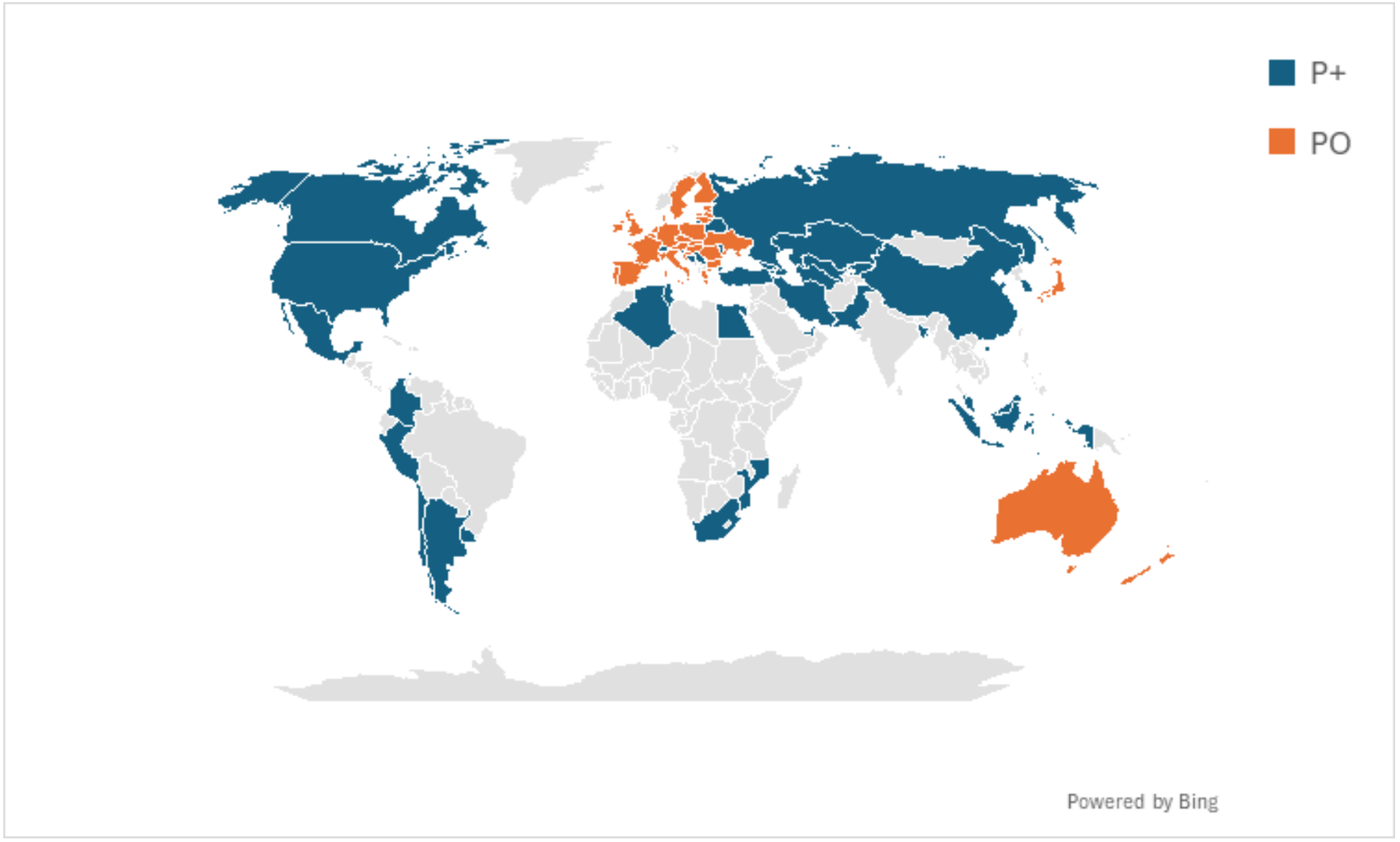


In logarithmic scale

Almost half are pipelines-only



Europe has almost all unbundled DSOs



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Gas and electricity DSOs are quite different

- The findings for electricity are richer than for gas, partly because the gas sample is smaller, but also because performance indicators are less widely reported publicly.
- Compared to electricity, gas DSOs are:
  - smaller on average,
  - more likely to be private or mixed, and
  - more likely to be ‘pipelines only’ (43%) compared to 23% of electricity DSOs who are ‘wires only’.
- This also reflects the fact that gas networks tend to be found in higher income countries where privatizations, market design reforms and unbundling have been more prevalent.
- All gas DSOs are unbundled from upstream operations, but many are bundled with retail.
- In our sample, only 16 DSOs are integrated with electricity DSOs.

Concluding thoughts (I)

Wide disparity of DSOs in terms of:

- Ownership, most still in public ownership, with private DSOs most prevalent in Central and Eastern Europe and South America for electricity and Europe for gas
- Size, ranging from municipality-owned or island states with a few thousand customers to single country-wide utility to large multinationals with tens of millions of customers
- Integration, most still vertically integrated with unbundling predominant in Europe, North America and Australia / New Zealand
- Performance ranging from a few minutes per year of interruptions to several hours

Concluding thoughts (II)

Different agendas and realities:

- DSOs in lower income countries struggle with profitability, revenue collection, customer management, and network extensions and upgrades to reduce interruptions and losses
- DSOs in upper middle- and high-income countries work on flexibility, decarbonization and advanced digitalization

Approach to sustainability:

- On electricity only about a quarter of world DSOs (50 out of 194) published a sustainability report in recent times. Some report sustainability information in their integrated report, while others have dedicated sections on the website for corporate social responsibility.
- On gas, about half of surveyed DSOs (34 of 67) have published a sustainability report.

Approach to innovation

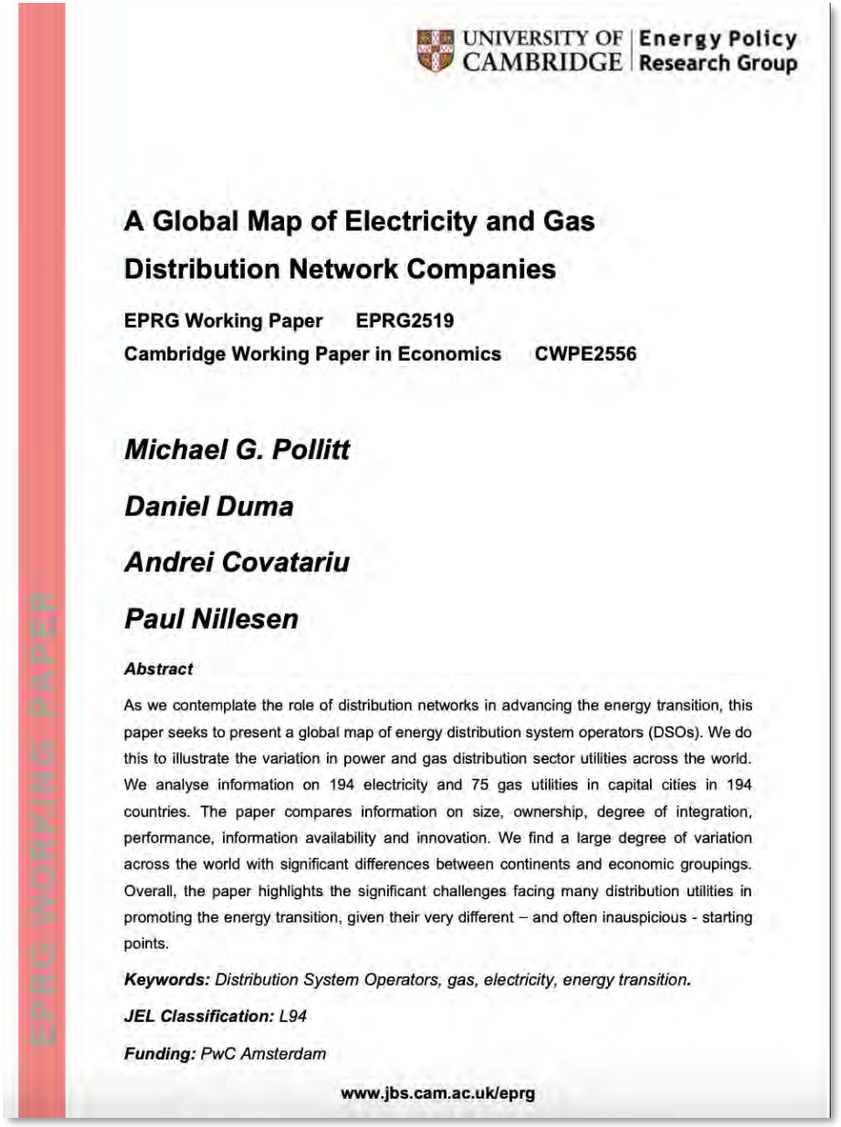
- Reported innovation tends to cluster around themes, with the most common one being decarbonization and enabling renewable energy. However, there are also DSOs where customer management (including metering) or digitalization of the network represent the primary focus of their innovation.
- In gas, the innovation themes are related to biomethane and hydrogen, but also customer management, metering and improved safety, reflecting the specifics of the gas business.

Next steps

Two additional approaches:

- Innovation in DSOs around the world using automated and LLM assisted text analysis of corporate reports
- Revisiting the definition and measuring the active DSO for:
  i. the global sample of electricity and gas DSOs
  ii. a subset of advanced electricity DSOs

More details



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Abstract

As we contemplate the role of distribution networks in advancing the energy transition, this paper seeks to present a global map of energy distribution system operators (DSOs). We do this to illustrate the variation in power and gas distribution sector utilities across the world. We analyse information on 194 electricity and 75 gas utilities in capital cities in 194 countries. The paper compares information on size, ownership, degree of integration, performance, information availability and innovation. We find a large degree of variation across the world with significant differences between continents and economic groupings. Overall, the paper highlights the significant challenges facing many distribution utilities in promoting the energy transition, given their very different – and often inauspicious - starting points.

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