

Getting Electricity

A pilot indicator set from the Doing Business project

International Conference on Infrastructure Economics and Development (Toulouse, January 14-15, 2010).

“Connecting Businesses to the Electrical Grid in 140 Economies”

by

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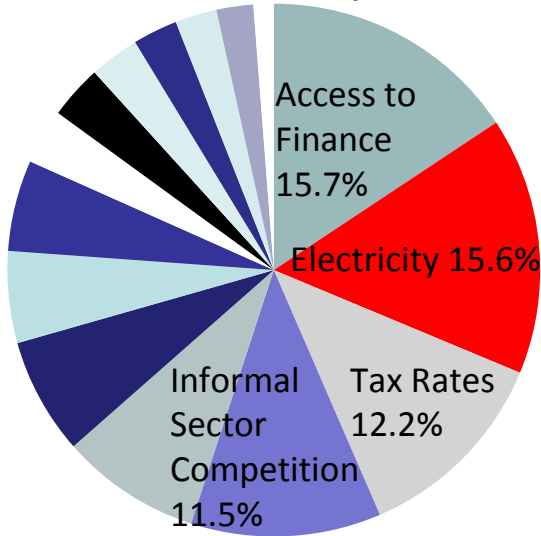
The *Doing Business* Approach to Benchmarking

- Launched 7 years ago
- From 5 indicators in 133 economies to 10 indicators in 183 economies.
- Focus on regulations relevant to the life cycle of a small- to medium-sized domestic business based on a standardized case.
- Underlying Philosophy: Institutions matter for Growth, therefore data on institutions is important.
- The objective: identify efficient regulations, accessible to all, and simple in their implementation
- Goal: Provide consistent and objective data that can inform regulators and governments seeking to strengthen the effectiveness of their regulations.

How Electricity Services Matter for Businesses

Firms consider electricity one of the biggest constraints to their business activity

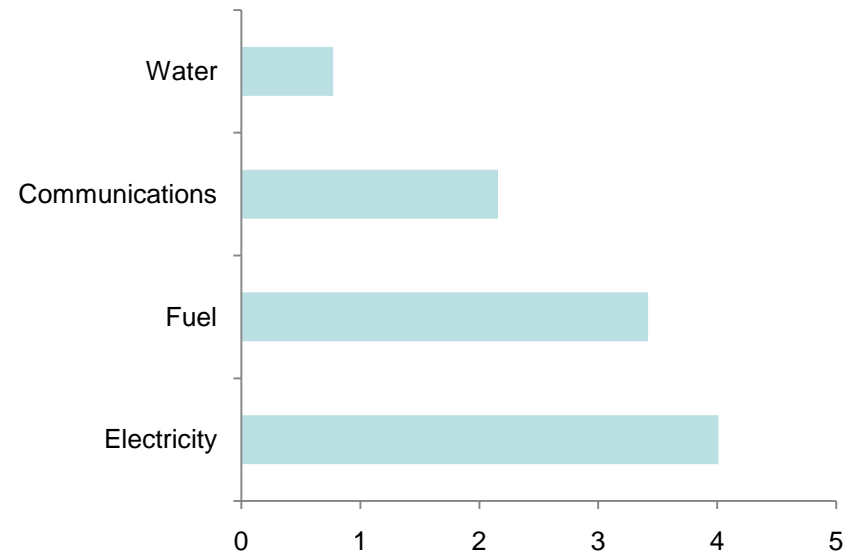
Percentage of managers identifying electricity as one of the most serious obstacles to their business operation



- Access to Finance
- Tax Rates
- Political instability
- Crime, Theft & Disorder
- Access to Land
- Licenses & Permits
- Customs & Trade Reg
- Courts
- Electricity
- Informal Sector
- Corruption
- Inadequately educated workforce
- Tax Administration
- Transportation
- Labor regulations

Firms spend more on electricity than on any other infrastructure service

Firms' Spending on Infrastructure (% of sales)



Source: World Bank Enterprise Surveys. Includes 89 countries in Africa, Latin America and Caribbean and Eastern Europe and Central Asia for the first graph and 64 countries for the second graph.

Building a new indicator set

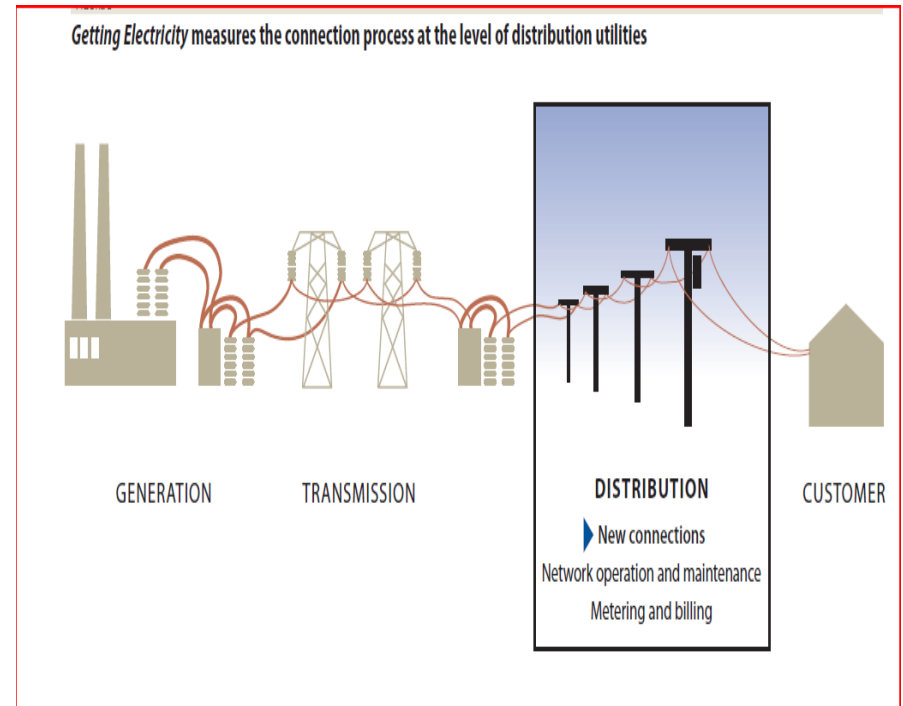
Recording the Process of Obtaining an Electricity Connection between June 2008 and June 2009:

- **Procedures** - any interaction of the company employees or the company's main electrician with external parties
- **Time** - captures the median duration that the electricity utility and experts indicate is necessary in practice
- **Cost** - recorded as a percentage of the economy's income per capita. Exclusive of value added tax and bribes.

Based on a standardized Case Study:

- Newly built warehouse for cold meat storage
- The internal wiring up to the metering point has already been completed
- The warehouse will need a 140 kVA (kiloVoltAmpere) final connection

Building a new indicator set



Data Collection Process:

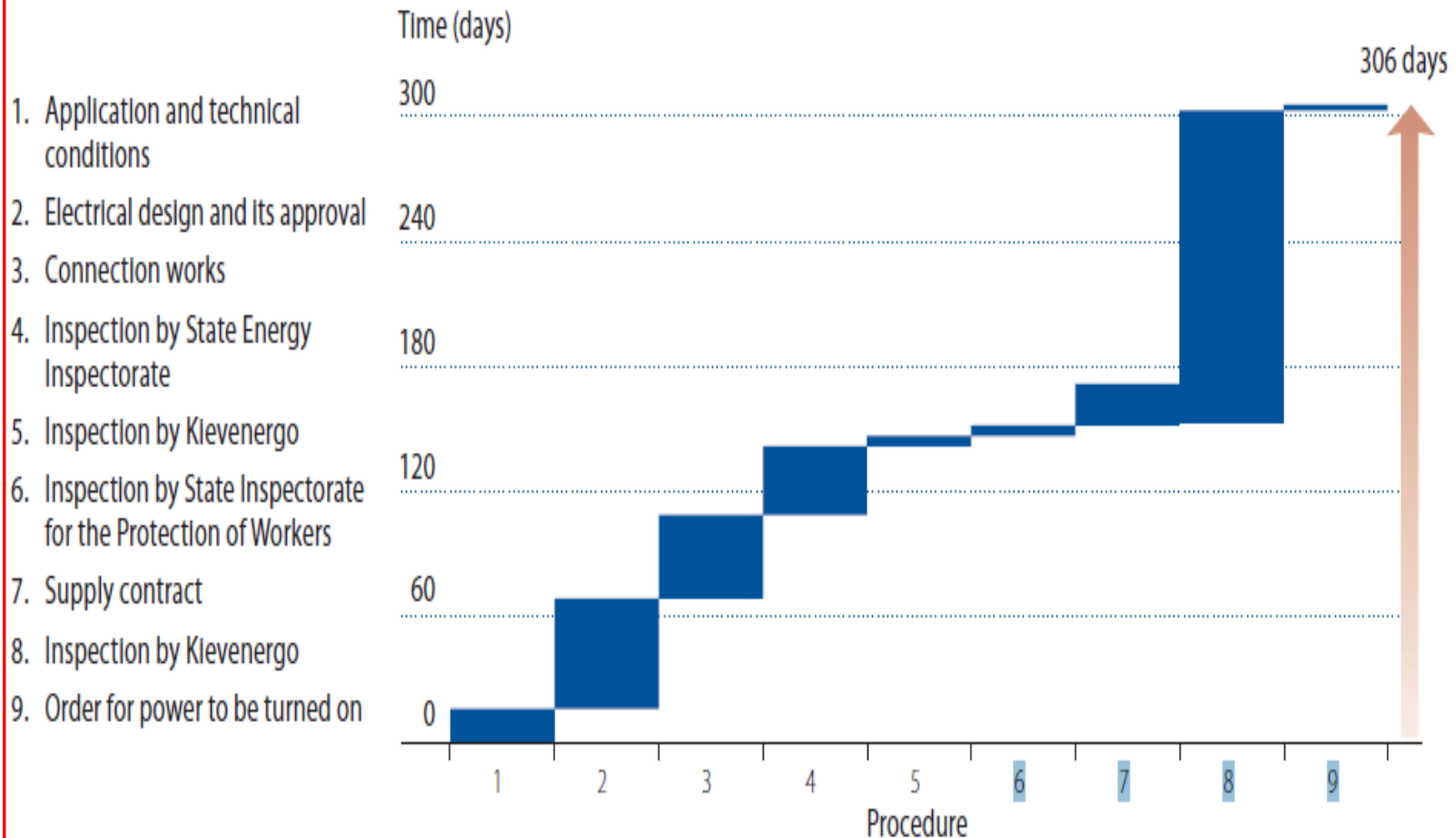
- One distribution utility
- Main business city of each economy
- Verified with independent professionals
- 567 respondents for 140 countries

The sample includes:

- 95 majority publicly owned and 45 majority privately owned utilities
- in 39 high income, 37 upper-middle income, 36 lower-middle income, and 28 low income economies.
- in 30 economies located in Sub-Saharan Africa, 16 in the Middle East and Africa region, 10 in East Asia and the Pacific, 8 in South Asia, 27 in Latin America and the Caribbean, 26 in Europe and Central Asia and 23 in OECD economies.

A concrete example of a connection process for illustration

Procedures for getting an electricity connection in Ukraine add up to a 10-month process



Source: Getting Electricity database.

Relevant Literature

- The new indicators follow a methodology similar to the one developed in the seminal paper on the “Regulation of Entry” by Djankov et al (2002).
- **Poor electricity supply has been shown to have adverse affects on firms’ productivity and the investments they make in their productive capacity** (Calderon and Serven (2003), Dollar et al. (2005), Reinikka and Svensson (1999), Eiffert (2007)).
- **Better sector performance for infrastructure services has been linked to the quality of regulatory institutions** (Kirkpatrick et al. (2002), Cubbin and Stern (2006), Andres et al. (2008)).
- We add to the literature by proposing an indicator set that measures a set of outcomes of electricity regulation for small and medium enterprises.

Summary Statistics by income group

| Entire Sample | | | Upper Middle Income | | |
|----------------------------|------|-----------------------------|---------------------|------|-----------------------------|
| Procedures | Time | Cost as % of GNI per capita | Procedures | Time | Cost as % of GNI per capita |
| Obs | 140 | 140 | Obs | 37 | 37 |
| Mean | 5.18 | 116 | Mean | 5.27 | 98 |
| Std. Dev. | 1.38 | 89 | Std. Dev. | 1.37 | 62 |
| Min | 3 | 17 | Min | 3 | 18 |
| Max | 10 | 441 | Max | 10 | 272 |
| Low Income | | | High Income | | |
| Obs | 28 | 28 | Obs | 39 | 39 |
| Mean | 5.21 | 192 | Mean | 4.62 | 87 |
| Std. Dev. | 1.37 | 122 | Std. Dev. | 1.14 | 65 |
| Min | 4 | 35 | Min | 3 | 17 |
| Max | 8 | 441 | Max | 8 | 306 |
| Lower Middle Income | | | | | |
| Obs | 36 | 36 | | | |
| Mean | 5.67 | 108 | | | |
| Std. Dev. | 1.49 | 75 | | | |
| Min | 4 | 33 | | | |
| Max | 9 | 306 | | | |

Does ownership matter?

Table 6a: Getting Electricity Indicators by Utility Ownership

| Variable | Public Utility | | | | | Private Utility | | | | | T-test |
|---|----------------|--------|-----------|-------|---------|-----------------|--------|-----------|------|--------|--------------------|
| | Obs | Mean | Std. Dev. | Min | Max | Obs | Mean | Std. Dev. | Min | Max | Public vs. Private |
| Procedures Getting Electricity | 95 | 5.23 | 1.51 | 3.00 | 10.00 | 45 | 5.07 | 1.07 | 3.00 | 8.00 | 0.657 |
| Time Getting Electricity | 95 | 128 | 99 | 18 | 441 | 45 | 91 | 58 | 17 | 252 | 2.354 |
| Cost in USD Getting Electricity | 95 | 30,704 | 46,765 | 1,086 | 435,090 | 45 | 22,422 | 17,471 | 0 | 75,935 | 1.148 |
| Cost as % of GNI pc Getting Electricity | 95 | 2,591 | 5,951 | 4 | 43,020 | 45 | 641 | 922 | 0 | 5,210 | 2.182 |

Table 6c: Time and Cost of Getting Electricity controlling for GNI

| | Time Getting Electricity | | Cost as % of GNI pc Getting Electricity | |
|-------------------|--------------------------|-----------------------|---|---------------------------|
| Private utility | -37.385*** (13.309) | -25.565** (12.190) | -1,019.309*** (375.270) | -718.828*** (246.766) |
| Ln GNI per capita | | -20.383*** (5.028) | -1605.11*** (427.372) | -1,020.84*** (164.944) |
| Constant | 128.27*** (10.140) | 296.30*** (46.800) | 15,825*** (4,003.520) | 10,369*** (1,619.234) |
| Observations | 140 | 140 | 140 | 138 |
| R-squared | 0.039 | 0.167 | 0.286 | 0.355 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

3 research questions

- 1. Can the new data provide for a proxy of the efficiency of the electricity sector overall?**
- 2. Are high levels of bureaucracy in a country associated with more cumbersome electricity connection processes?**
- 3. Are simpler electricity connection processes associated with better firm performance?
(preliminary)**

Does a more efficient connection process mirror better electricity sector outcomes?

- Time and cost to obtain an electricity connection are negatively correlated with the **electrification rate** (including when we control for income).
- The cost to obtain and electricity connection is negatively correlated with the **% of transmission and distribution losses** (including when we control for income).

Magnitude of the results

- One additional day of delay to connect to electricity is associated with a decrease of 0.09 percentage points in the electrification rate of a country and an increase in the connection cost equal to the income per capita is associated with a 0.2 percentage point decrease in the electrification rate.
- An increase in the connection cost equal to the income per capita is associated with a 0.07 percentage point decrease in the transmission and distribution losses ratio.
- One extra procedure in the process of getting electricity is associated with an increase of 0.7 percentage points in the transmission and distribution losses as percentage of output.

Non-results

- We find no statistically significant co-movement with the Value lost due to electricity outages variable.
- A dummy for the ownership structure of the utility does not enter significantly in any of the specifications.

Electrification Rate + Getting Electricity

| | | Electrification Rate | |
|--------------------------------|--------------------------------|----------------------|----------------------|
| Time Getting Electricity | -0.191*** (0.044) | -0.179*** (0.045) | -0.095*** (0.024) |
| Private utility | | 12.370 (8.140) | |
| Ln GNI per capita | | | 15.430*** (2.162) |
| Constant | 82.86*** (6.013) | 77.84*** (6.807) | -48.20** (18.400) |
| Observations | 64 | 64 | 64 |
| R-squared | 0.231 | 0.259 | 0.600 |
| Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | | |

| | | Electrification Rate | |
|--|--------------------------------|----------------------|----------------------|
| Cost as % of GNI pc Getting Electricity | -0.004*** (0.001) | -0.004*** (0.001) | -0.002** (0.001) |
| Private utility | | 10.610 (7.702) | |
| Ln GNI per capita | | | 14.66*** (2.653) |
| Constant | 72.31*** (3.926) | 68.65*** (4.719) | -48.60** (22.160) |
| Observations | 64 | 64 | 64 |
| R-squared | 0.320 | 0.340 | 0.581 |
| Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | | |

% of Losses + Getting Electricity

| | Electric power transmission and distribution losses (% of output) | | |
|--------------------------------|---|---------------------|----------------------|
| Procedures Getting Electricity | 1.502*** (0.551) | 1.517*** (0.554) | 0.739* (0.385) |
| Private utility | | 0.733 (1.654) | |
| Ln GNI per capita | | | -2.370*** (0.477) |
| Constant | 4.991 (3.012) | 4.650 (3.120) | 29.710*** (5.532) |
| Observations | 106 | 106 | 106 |
| R-squared | 0.067 | 0.068 | 0.237 |
| Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | | |

| | Electric power transmission and distribution losses (% of output) | | |
|--|---|---------------------|-----------------------|
| Cost as % of GNI pc Getting Electricity | 0.0001 (0.000) | 0.0001 (0.000) | -0.0007*** (0.000) |
| Private utility | | 0.559 (1.730) | |
| Ln GNI per capita | | | -3.286*** (0.433) |
| Constant | 12.81*** (0.872) | 12.59*** (1.102) | 42.43*** (4.405) |
| Observations | 106 | 106 | 106 |
| R-squared | 0.001 | 0.002 | 0.274 |
| Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | | |

| | Electric power transmission and distribution losses (% of output) | | |
|--|---|---------------------|----------------------|
| Country rank on the ease of getting electricity | 0.048*** (0.018) | 0.048*** (0.018) | 0.024* (0.014) |
| Private utility | | 0.562 (1.656) | |
| Ln GNI per capita | | | -2.385*** (0.469) |
| Constant | 10.16*** (1.310) | 9.951*** (1.454) | 32.36*** (4.755) |
| Observations | 106 | 106 | 106 |
| R-squared | 0.062 | 0.064 | 0.237 |
| Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | | |

Do utilities in less bureaucratic economies connect customers more efficiently?

- **Procedures and time of Starting a Business, Registering Property and Dealing with Construction Permits** used as independent variables.
- **The number of procedures** associated with all 3 other public services are positively correlated with the number of procedures to obtain an electricity connection (even after controlling for income).
- **Split sample by ownership of utilities:** the coefficients lose their statistical significance for the private utility sub-sample but retain them in the public utility sample, suggesting that public utilities are more likely to have cumbersome procedures if other government services are also cumbersome in the country.
- The split-sample specification using the procedures of the **Dealing with Construction Permits indicator yields a different result.** Here, both the private and the public sub-sample show a positive correlation between the process for obtaining an electricity connection and the process of obtaining a construction permit.

Do utilities in less bureaucratic economies connect customers more efficiently?

| Procedures Getting Electricity | | | | |
|--------------------------------|--------------------------------|---------------------|-----------------------|------------------------|
| | Full Sample | | Public Utilities only | Private Utilities only |
| Procedures starting a business | 0.085** (0.035) | 0.061* (0.036) | 0.106* (0.056) | -0.013 (0.047) |
| Ln GNI per capita | | -0.146** (0.071) | -0.102 (0.083) | -0.296** (0.146) |
| Constant | 4.535*** (0.286) | 5.951*** (0.732) | 5.282*** (0.871) | 7.781*** (1.566) |
| Observations | 140 | 140 | 95 | 45 |
| R-squared | 0.042 | 0.067 | 0.077 | 0.103 |
| Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | | | |

| Procedures Getting Electricity | | | | |
|---------------------------------|--------------------------------|---------------------|-----------------------|------------------------|
| | Full Sample | | Public Utilities only | Private Utilities only |
| Procedures registering property | 0.156*** (0.047) | 0.129*** (0.048) | 0.188*** (0.063) | 0.004 (0.076) |
| Ln GNI per capita | | -0.129* (0.074) | -0.084 (0.092) | -0.274* (0.148) |
| Constant | 4.256*** (0.301) | 5.501*** (0.782) | 4.818*** (0.959) | 7.454*** (1.684) |
| Observations | 139 | 139 | 94 | 45 |
| R-squared | 0.073 | 0.093 | 0.115 | 0.102 |
| Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | | | |

| Procedures Getting Electricity | | | | |
|---------------------------------|--------------------------------|----------------------|-----------------------|------------------------|
| | Full Sample | | Public Utilities only | Private Utilities only |
| Procedures Construction Permits | 0.0744*** (0.018) | 0.0698*** (0.018) | 0.0744*** (0.023) | 0.0536* (0.027) |
| Ln GNI per capita | | -0.162** (0.067) | -0.153* (0.080) | -0.214* (0.120) |
| Constant | 4.326*** (0.238) | 5.744*** (0.636) | 5.616*** (0.726) | 6.378*** (1.199) |
| Observations | 140 | 140 | 95 | 45 |
| R-squared | 0.106 | 0.140 | 0.132 | 0.170 |
| Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | | | |

Is a more efficient connection process associated with better firm performance?

- We analyze if different industries are more affected by electricity provision than others:

$$Y_{it} = \beta_0 + \beta_1 E_{it} + \beta_2 X_{it} + \beta_3 I_j + \beta_4 C_{it} + \beta_5 I_j \cdot E_{it} + \varepsilon_{it}$$

Results

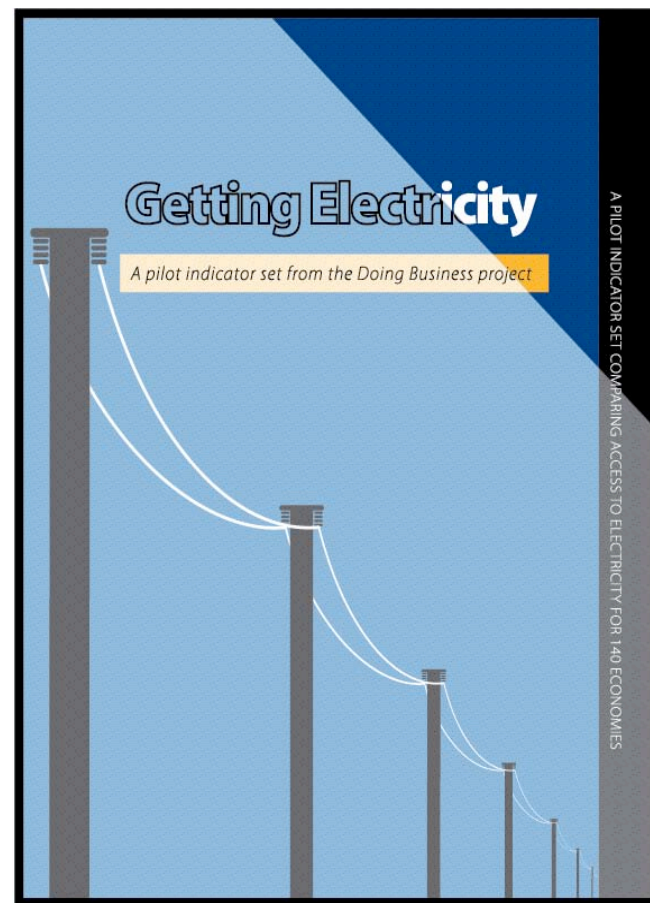
- Moving from the country with the most complex electricity connection process to the country with the least complex is associated with an increase of 0.02 in the log of sales.
- Once the interaction terms are included, sales of manufacturing industries are more likely to be affected by electricity provision

Caveats

- These results are preliminary and refer to cross section only (therefore not causal inferences can be drawn)
- We are working on improving this analysis (for instance, through including country dummies)

Some of the main results from the pilot study

- Connection delays increase where opportunities are missed to streamline approvals with other public agencies.
- Connection delays increase where customers face multiple procedures related to the quality and safety of the internal wiring.
- Connection delays increase where utilities do not have the materials needed to connect customers readily available.
- Connection costs are not simply a function of the level of development of the country.
- The standard connection fee component of the total connection cost is smaller in economies with less developed distribution systems.



Thank you for your attention

Questions?

**The full report and detailed data for
140 countries can be found at:**

www.doingbusiness.org