How many green jobs are there in electricity generation?
A replicable quantification method for developing countries under data constraints

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Just Transitions and measuring the Green Economy

- Assessing the scale of green jobs and the socioeconomic effects of the energy transition is relevant and timely;

- While lacking clear, comparable methodologies.

- The discussion around just transitions, and the extent to which renewable energy creates more positive socioeconomic impacts than fossil fuels, increasingly attracts attention.

- However, data constraints expose a relevant gap in providing quantitative evidence for such discussions, especially relevant in developing economies.
Example of data challenge – Brazil

IRENA, 2016

Brazil’s official data (CEMPRE 2015) total employment in electricity generation (all sources), transmission and distribution is of 122,843 full-time equivalent jobs.

IRENA: Wind 41,000; Solar 4,000 and Large Hydro 195,000 in 2015 in Brazil

For modelling and policy purposes, there must be an account for each sector with no double counting.
Benchmarks for Green Economy data
Data approach for direct employment and income

Aim: create a dataset of jobs and wages disaggregated by electricity source for Brazil in 2015 to calibrate a Computable General Equilibrium model.
Data approach for direct employment and income

Datasets used for Brazil:

1. **National accounts (Input Output tables):** jobs and income data for the single aggregated sector: electricity generation all sources, Transmission & Distribution (T&D) and natural gas and other utilities;

2. **Official employment data** (*CEMPRE - Central Register of Enterprises*) disaggregated into (i) electricity generation (ii) Transmission and Distribution (iii) natural gas and (iv) other utilities;

3. **National Energy Balance:** Share of each source in electricity installed capacity;

4. **US Bureau of Labour Statistics:** Detailed data for number of workers employed in each electricity source - for calibration [jobs/MWh per source]. Could be other employment factors per source, as long as they are comparable.
Data approach for direct employment and income

1. National official employment data
   Share of Generation x Share of T&D %

2. US Bureau of Labour Statistics
   Jobs/MWh per source

3. National Energy Balance - MWh
   Total estimated jobs per source
   % of each source in total

4. National Accounts (Input-Output data)
   1. Disaggregate electricity generation from T&D and gas
   2. Disaggregate each source
Results: Brazil 2015

Jobs Total FTE
T&D and Generation

- Solar: 799
- Other: 4492
- Nuclear: 2559
- Coal: 2046
- Wind: 1484
- Petroleum products: 2771
- Biomass: 4992
- Natural Gas: 8555
- Hydropower: 27608
- T&D: 94605
- Gas: 3856

Wages (2015 R$)

- Hydropower: 53%
- Natural Gas: 16%
- Biomass: 10%
- Petroleum products: 5%
- Solar: 4%
- Other: 3%
- Wind: 2%
- Coal: 1%
- Nuclear: 1%
- Other: 1%

Jobs (FTE)

- Hydropower: 49%
- Natural Gas: 16%
- Biomass: 9%
- Petroleum products: 5%
- Solar: 4%
- Other: 4%
- Wind: 3%
- Coal: 3%
- Nuclear: 2%
- Other: 1%

Generation (MWh)

- Hydropower: 61%
- Natural Gas: 14%
- Biomass: 8%
- Petroleum products: 4%
- Solar: 3%
- Other: 4%
- Wind: 2%
- Coal: 1%
- Nuclear: 2%
- Other: 1%
Final remarks

- This **disaggregation** was conducted to calibrate a **Computable General Equilibrium (CGE)** with a **detailed electricity sector** disaggregated by **source** to analyse the **economic effects of renewable energy policy**;

- This simple **disaggregation methodology** could be **replicated** for **other developing countries** both to provide:
  - ✓ **The current scale of renewable and non-renewable electricity jobs** and income or
  - ✓ **As the database for further modelling** analyses.

- This is an estimate of the **existing jobs employed in generation**, more but using **intermediary consumption** data we can relatedly estimate indirect jobs along **supply chains**.

- Developing economies with larger data constraints may need to use an international default for percentage of T&D in total.
Thank you.

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Data approach for direct employment and income

Data triangulation steps:

1. Calculate the shares of generation and T&D in electricity sector total employment using the national official employment data;
2. Calculate employment factors for each source using US observed data (jobs/MW per source);
3. Apply step 2 to the total MW of installed capacity per source from the National Energy Balance;
4. Calculate shares of total generation employment per source from step 3;
5. Apply shares from step 3 to total generation employment from step 4: obtain number of jobs per source of electricity generation;
6. Apply shares to labour income from national accounts (calibrating to maintain shares of value added).
The challenge ahead...