

Does renewable generation promote local electricity access? Evidence from Indonesia

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with

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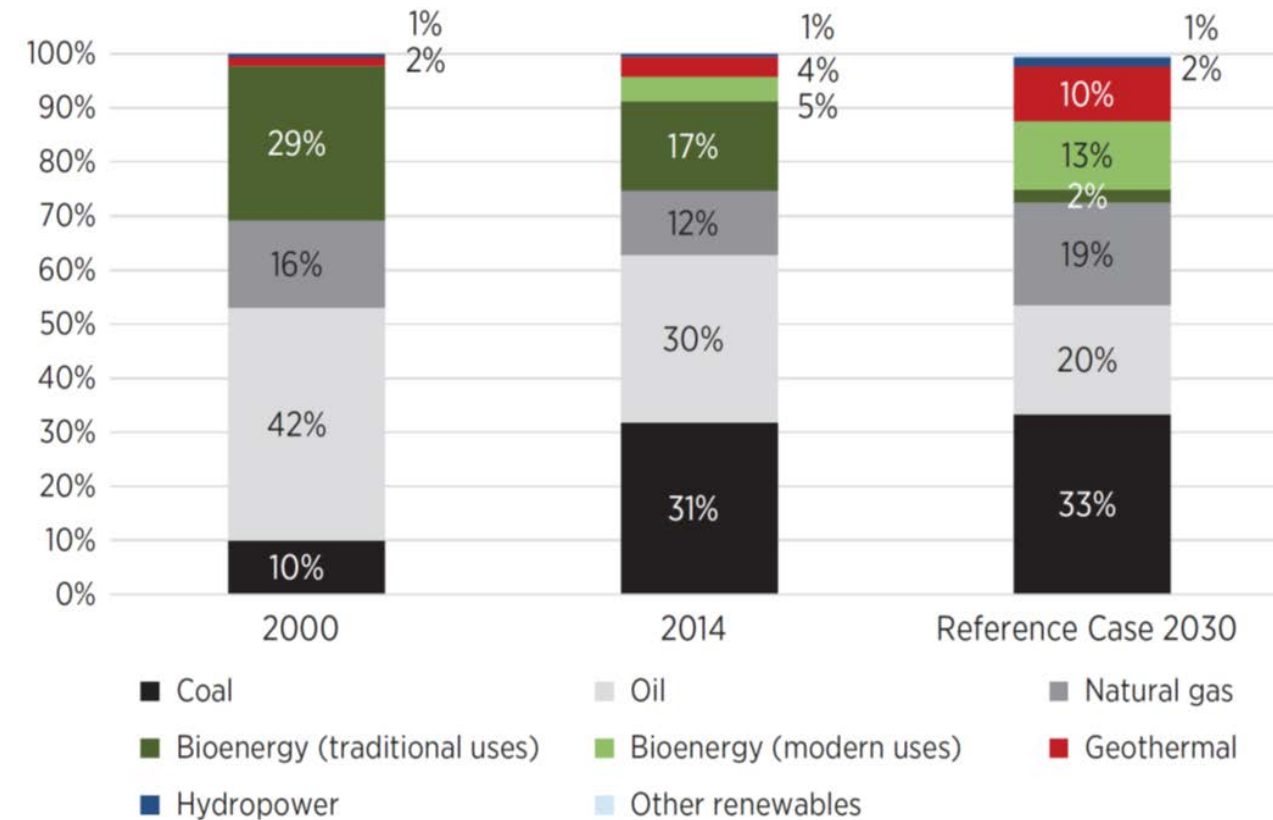
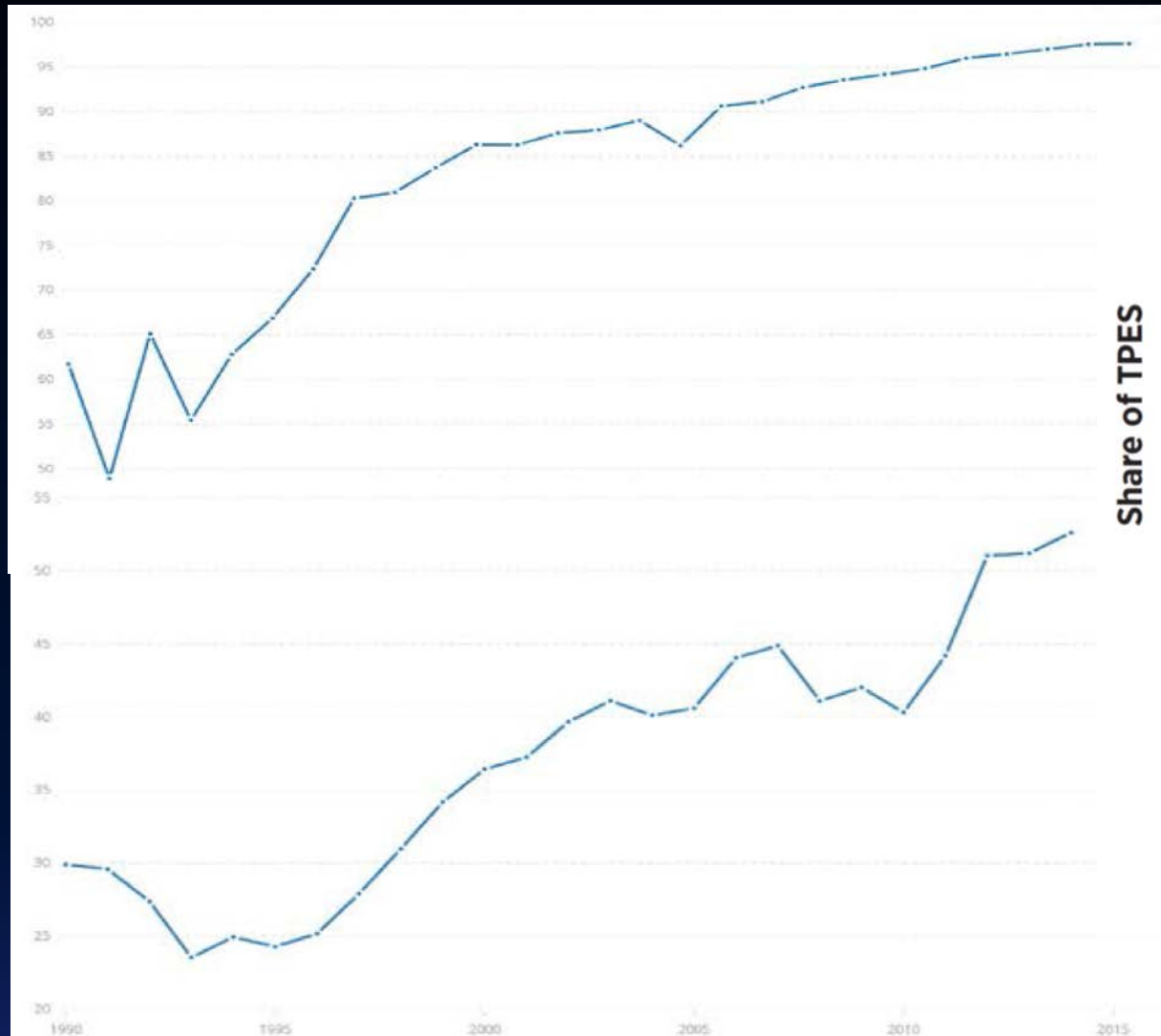
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Energy Future in Indonesia

- Huge Increase in Demand
 - Electricity demand in Indonesia expected to triple between 2015 and 2030
 - Large problems with brownouts

Dramatic Increase in electrification rate, Indonesia 1990-2016

... much of which has come from coal, which is expected to continue

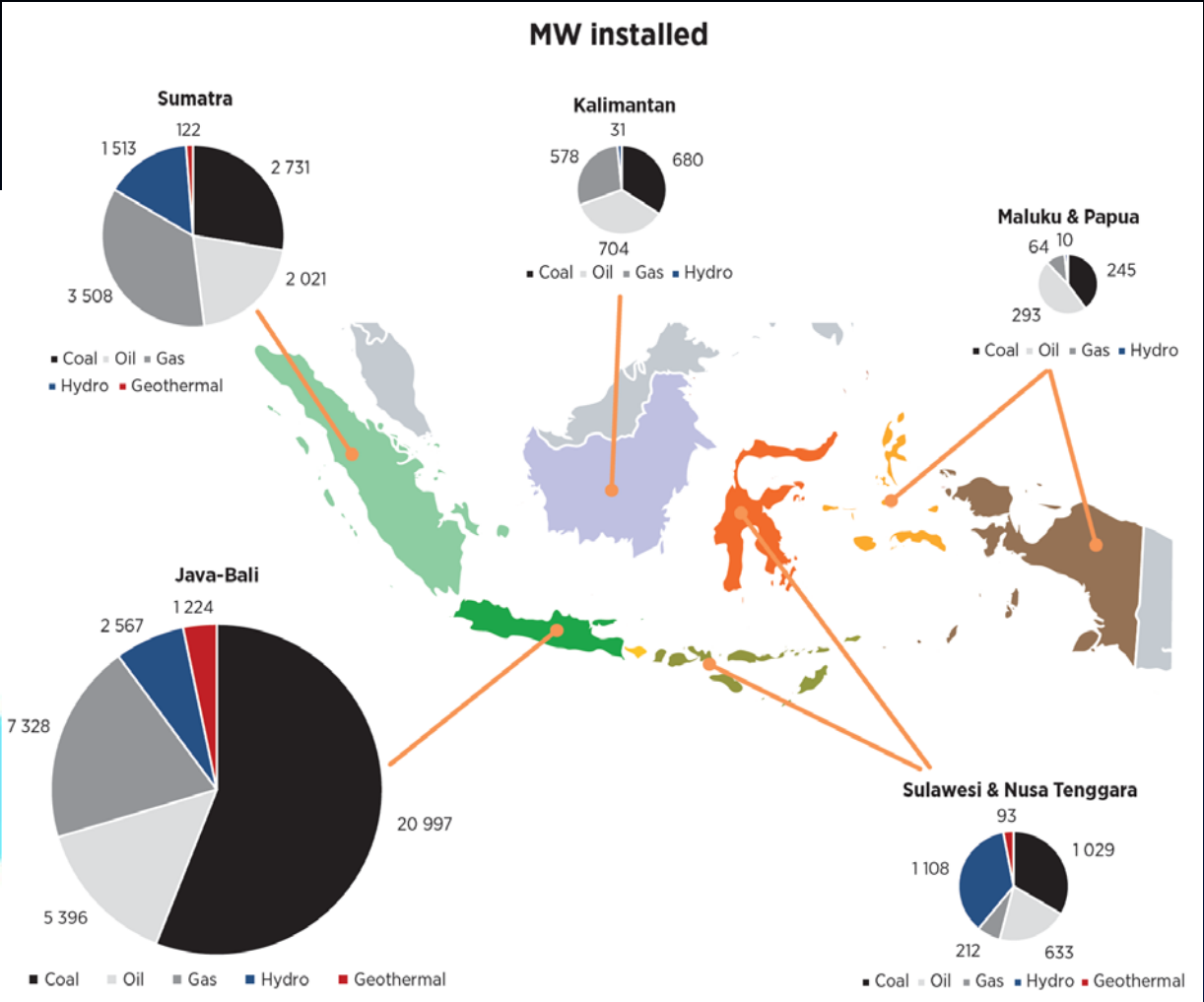
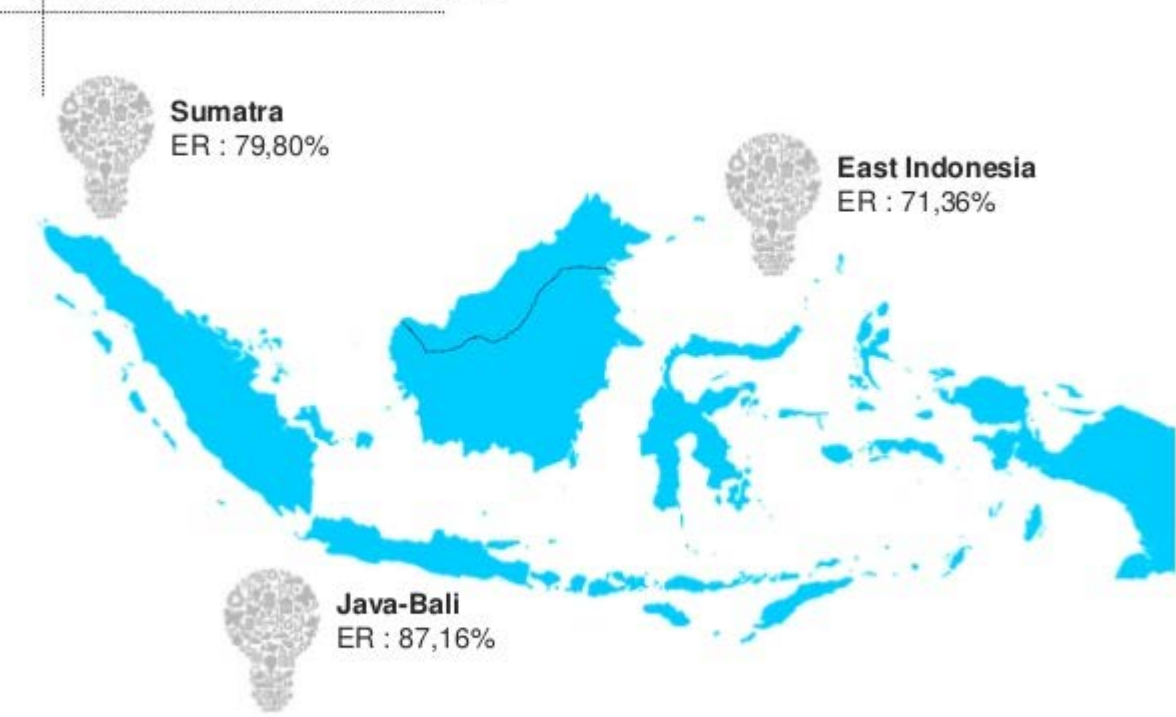


Energy Future in Indonesia

- Huge Increase in Demand
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- Grid is variable
 - 70% on-grid power generation capacity on Java-Bali
 - Small-scale diesel generators still widespread in Maluku and Papua

Electricity source and grid access highly varied by region

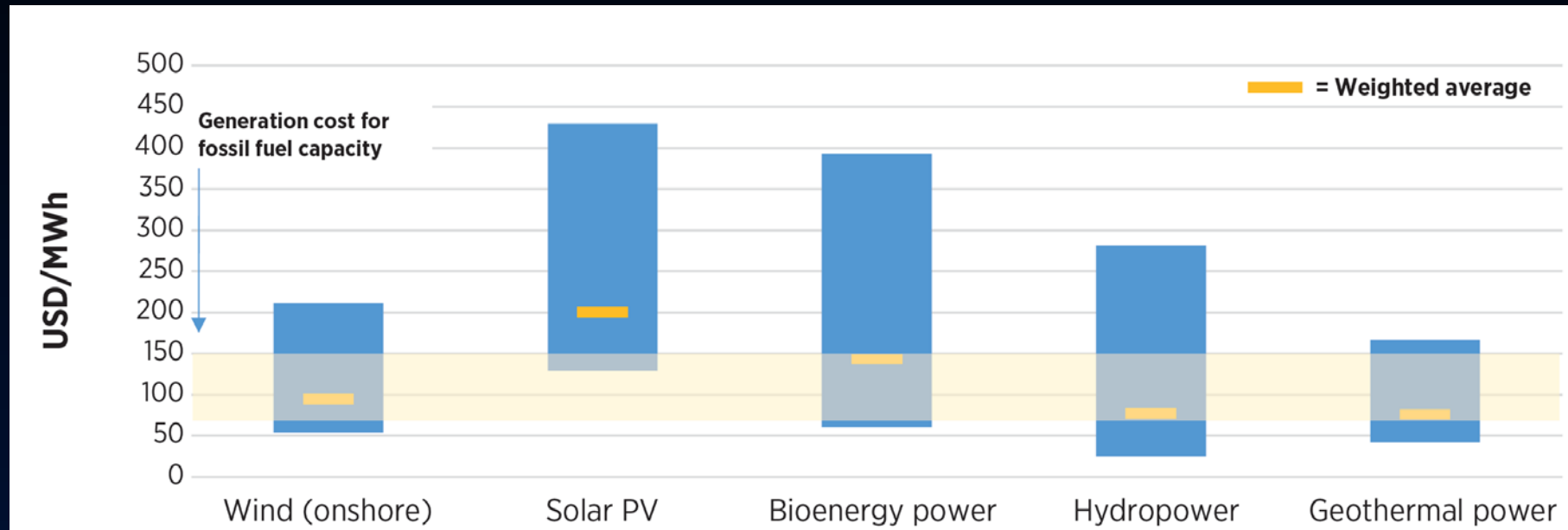
Electrification Ratio 2014



Energy Future in Indonesia

- Huge Increase in Demand
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- Grid is variable
 - 70% on-grid power generation capacity on Java-Bali
 - Small-scale diesel generators still widespread in Maluku and Papua
- Substantial Investment in Renewables
 - Indonesia has set out to achieve 23% renewable energy use by 2025, and 31% by 2050
 - Renewables account for 11% on-grid electricity generation (2014); largely Hydro and geothermal (15TWh and 10TWh)

Hydro and Geothermal Competitive



Research Question

- Where is this new electricity going?
- Do the local communities benefit?

Why do we care?

- Electricity is important for development
- Promise of 'green development' associated with renewables
- Local externalities

Why might we think it might be local?

- Renewables often located in more remote areas
- Associated with grid expansion
- Consistency may generate local economic benefits
- ...but also constrained by source

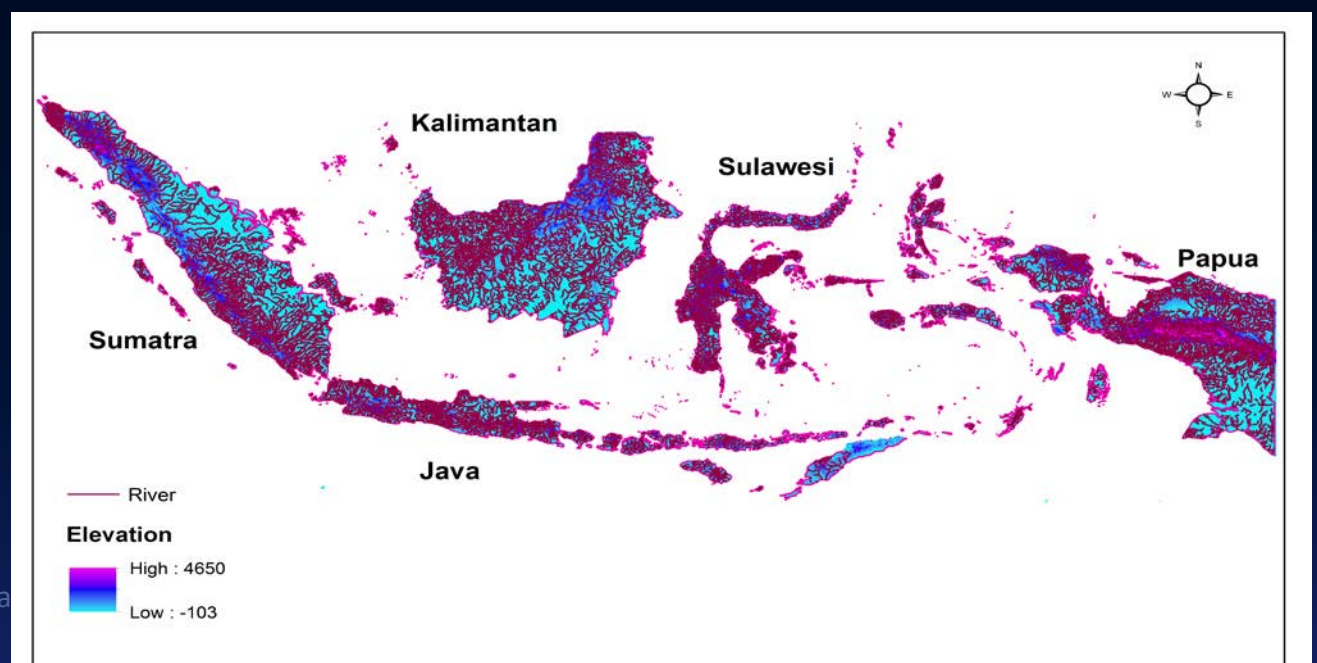
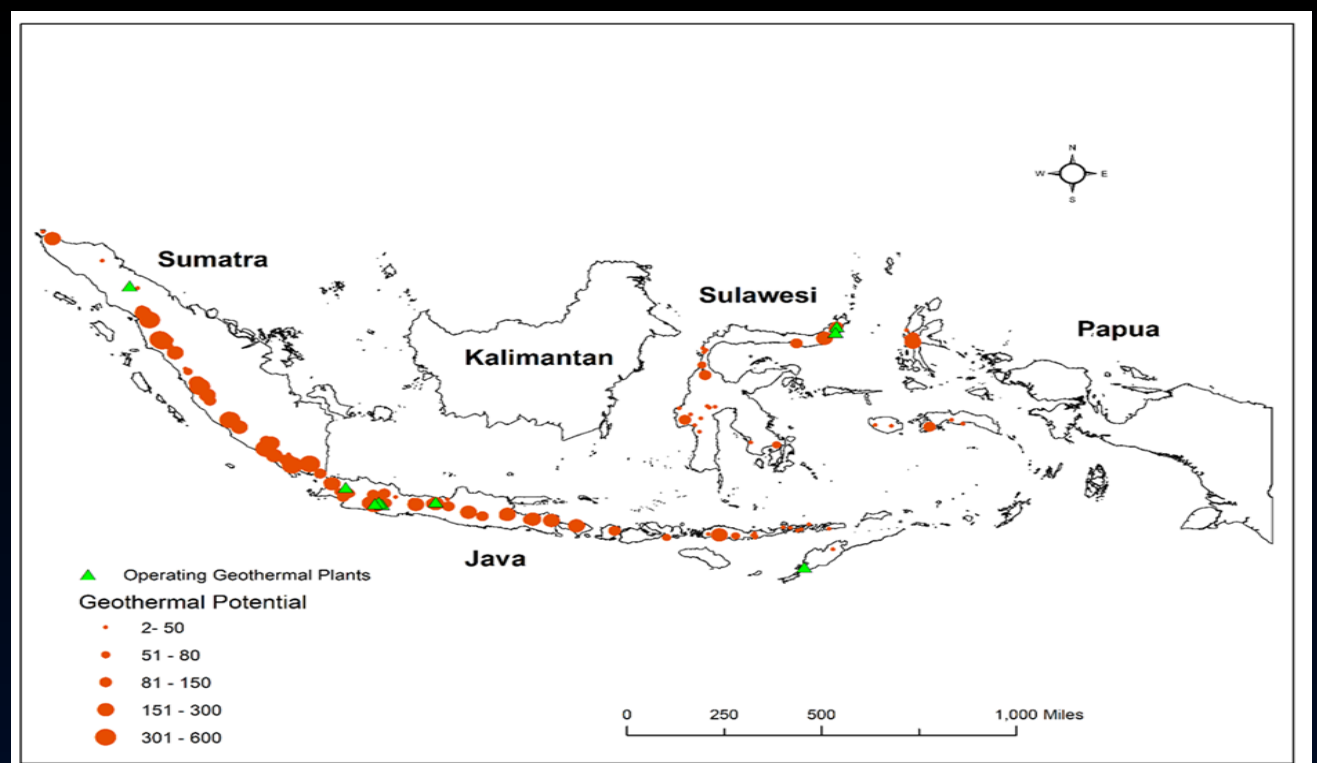


What do we do?

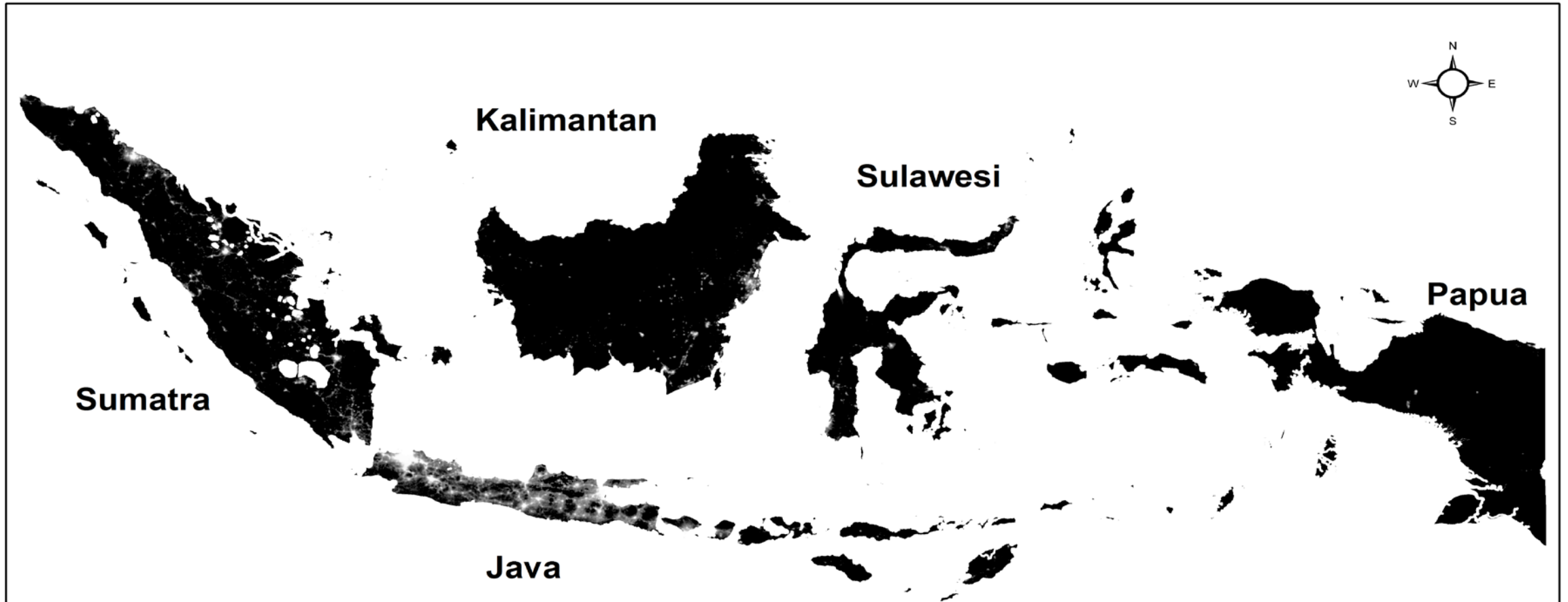
- Collect geocoded data on new renewable and non-renewable generation facilities in Indonesia (1992-2012)
- Match over geographic characteristics and baseline economic activity
- Estimate changes in electricity use nearby the plants for renewable and non-renewable generation

Identification challenges

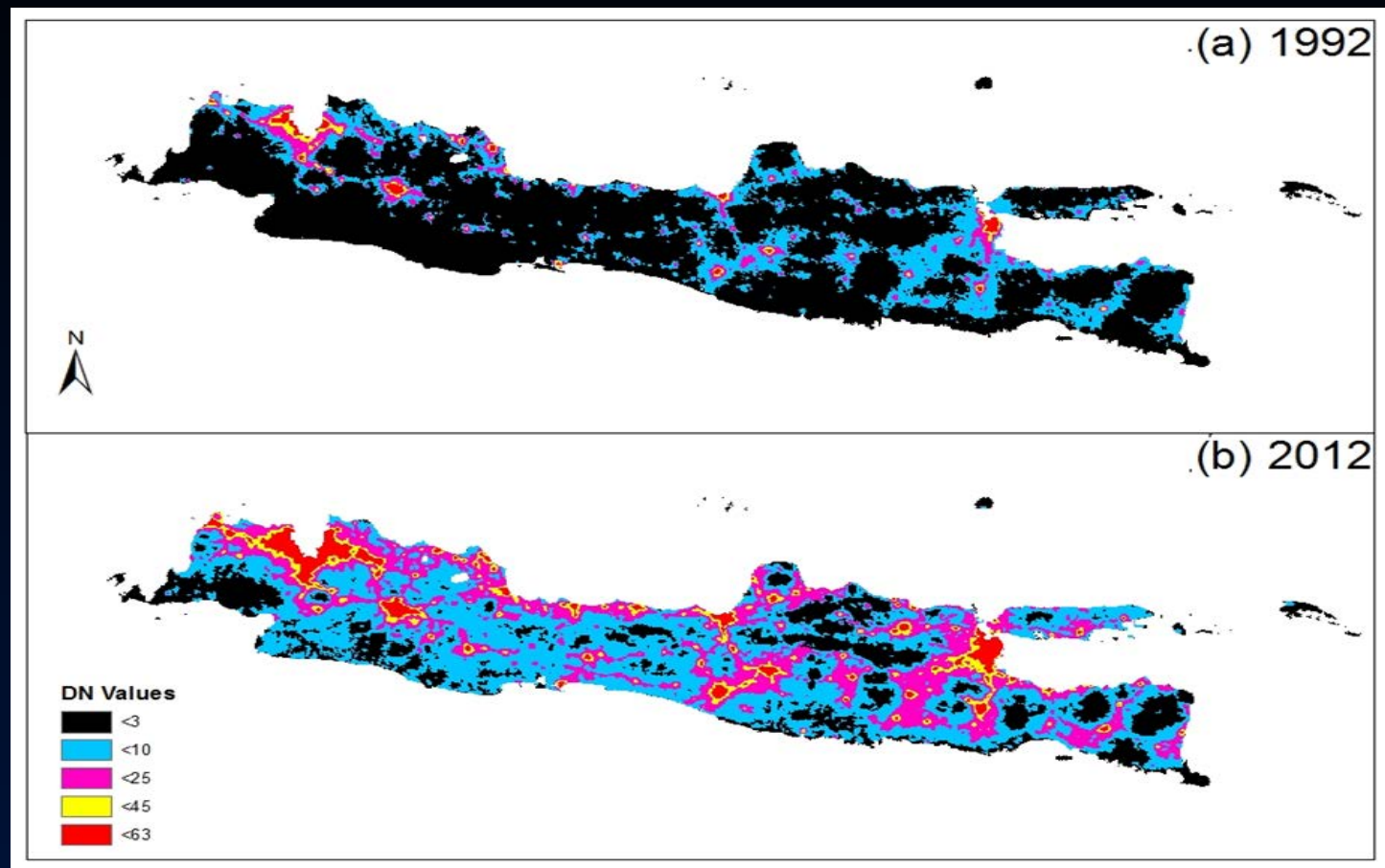
- Site location is not random
- We make use of 'potential' to identify locations of renewable plants
- Control for demand factors like population density, income



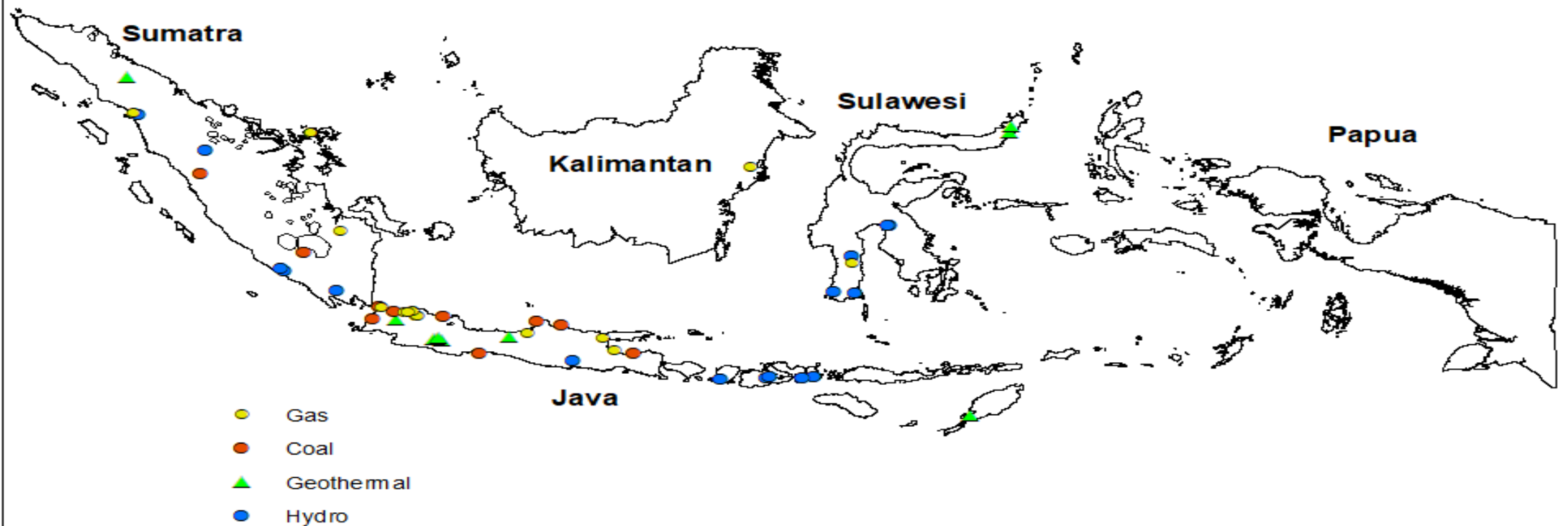
Data: Night Lights



Java lights over time



Plants opened 1992-2012



Plants commissioned between 1992-2012

Sector	Number of plants	Average MW Capacity
Geothermal	10	80.63 (109.03)
Hydro	16	28.64 (44.27)
Coal	10	540 (381.34)
Gas/oil	14	385.21 (392.27)
Total	50	12083.7

Results

	Renewable	Non-Renewable	Re & Non-Re
MW RE Plant	0.179** (0.0880)		0.671** (0.330)
MW Non-RE Plant		0.140 (0.0910)	-0.528 (0.341)
Constant	-3.707*** (0.0435)	-3.707*** (0.0435)	-3.707*** (0.0435)
Controls:			
Year Fixed Effects	Y	Y	Y
Grid Fixed Effects	Y	Y	Y
Observations	7,832	7,832	7,832

...larger effect comes from Hydro

	Renewable Plants Types
Hydro Plant Commissioning	0.461** (0.187)
Geothermal Plant Commissioning	0.112*** (0.0325)
Constant	-3.707*** (0.0434)
Controls:	
Year Fixed Effects	Y
Grid Fixed Effects	Y
Observations	7,832

...and seems to dissipate over time

	RE	Non-RE
Plant Commissioning _(0-3 years)	0.147** (0.0631)	0.130** (0.0634)
Plant Commissioning _(3-6 years)	0.0490 (0.0758)	0.0459 (0.0759)
Plant Commissioning _(6-9 years)	0.00102 (0.0868)	-0.00221 (0.0868)
Constant	-3.707*** (0.0435)	-3.707*** (0.0435)
Year Fixed Effects	Y	Y
Grid Fixed Effects	Y	Y
Observations	7,832	7,832

Placebo Test

	Renewable	Non-Renewable
RE Plant Commissioning _(t+2)	0.0161 (0.0166)	
Non-RE Plant Commissioning _(t+2)		0.0150 (0.0166)
Constant	-3.707*** (0.0435)	-3.707*** (0.0435)
Controls:		
Year Fixed Effects	Y	Y
Grid Fixed Effects	Y	Y
Observations	7,832	7,832

Conclusions

- Evidence that a renewable plant is associated with increased electricity consumption (10% increase in capacity => 2% increase in local electricity consumption)
- More so than for fossil fuels
- Particularly for hydro



Next steps

- Mechanisms
 - Grid expansion?
 - Economic activity?