The political geography of the international energy transition in the Global South

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Abstract

What are the political benefits of the internationally sponsored energy transition for developing countries? Foreign aid, particularly infrastructure projects, is politically targeted to allies and supporters of recipient country leaders. As donors increase funding for renewable energy, are these politically located by, and therefore politically beneficial to, country leaders? And how does this targeting compare to that of fossil fuels? I examine the political determinants of energy generation projects before and during the international community's green energy investment push. Using geolocated World Bank-sponsored energy projects over time and measures of political targeting, including leader birth regions, I map the political geography of the energy transition across the developing world. Initial results suggest that fossil fuels are consistently regularly targeted to political allies, but renewables have been politically targeted in the last decade. The findings suggest that international efforts to support the green energy transition are unlikely to face opposition from local elites.

1 Introduction

The global green energy transition requires countries to disinvest in fossil fuel and move towards renewable energy sources. In the Global South, capital constraints mean that much of the energy transition must be supported by international actors. Aid donors, particularly large international development organizations, play a crucial role in funding the energy

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transition in developing countries. However, these donors previously invested heavily in fossil fuel production to alleviate energy poverty in the same developing countries.

The question of whether, and how, energy aid projects are targeted to political constituents combines literature on aid targeting and energy politics in developing states. A large literature examines the political economy of the green energy transition in industrialized countries (Colantone *et al.*, 2022; Mildenberger, 2020; Stokes, 2020; Voeten, 2022)–the distributional effects of phasing out fossil fuels pose large political barriers to adopting green policies.

In the developing world, the dynamics differ. With few exceptions (notably South Africa), fossil fuel labor and industry are less intwined than in the Global North, making the domestic fossil fuel constituency less politically powerful. For poor countries, however, the costs of abandoning fossil fuel plants are higher simply for the capital constraints these countries face (Bos & Gupta, 2019; Colgan & Hinthorn, 2023). Efforts to invest in new energy sources, while economically efficient in the long term, shift funding from other potential development projects. In places with energy security through fossil fuels, the premature contract termination of coal and oil plants effectively shifts years of revenue away from other development–and disruption of energy production during the transition can cause additional strife. Stranded assets in the global south are economically and politically costly.

While in industrialized countries the fossil fuel constituents hold direct sway over their political representatives, the late industrialization process in developing countries could reverse the direction of this power. In other words, political leaders can target fossil fuel development at their supporters rather than courting the support of fossil fuel constituents. Large infrastructure projects in development, particularly those funded by international donors, are often politically driven. A large literature highlights the political targeting of aid within recipient countries: ethnicity (Briggs, 2014; Isaksson & Kotsadam, 2018; Jablonski, 2014; O'Brien-Udry, 2022, 2021), political affiliation (Briggs, 2012, 2021), and leader birth region

(Dreher *et al.*, 2021) are all factors that cause greater levels of aid support for a given population. Political leaders direct aid to key voters in order to shore up support for their reigns (Briggs, 2015; Jablonski, 2014)–though several new papers question the efficacy of this targeting (Briggs, 2019; O'Brien-Udry, 2021).

Recent work on Chinese aid suggests that increases in Chinese steel exports lead to greater infrastructure investment in Africa and Belt-and-Road Initiative countries (Dreher *et al.*, 2022). The Chinese emphasis on infrastructure projects increases pressure on the World Bank itself to invest more heavily in large-scale infrastructure (Zeitz, 2021). Chinese development projects come with fewer conditions and greater flexibility for political leaders –leading to greater political favoritism in the targeting of Chinese aid projects in comparison to US or World Bank projects–and Chinese preference for infrastructure means that these large projects are especially likely to be politically targeted (Dreher *et al.*, 2021; Isaksson & Kotsadam, 2018).

In the case of energy aid, natural resources are often geographically bound. One cannot mine coal in an area without coal ore nor construct a hydropower station where there is no river. These physical constraints have inspired literature on natural resource windfalls– the discovery of economically productive natural resources either through new exploration or technological change that enhances the existing natural resources' value. If energy production potential is fully exogenous, political targeting of energy aid would not occur.[1]

However, energy production may be geographically fungible on the margins. While raw mineral extraction is certainly geographically constrained, refineries, processing plants, and other downstream industry activities have more flexibility. For renewable energy, these constraints are even less onerous. Solar and wind potential may be greater in some locations

[1]A clear exception to this could be that energy potential in a geographic location leads that particular population to develop more economic and political power, causing its members to be more likely to come into office. Any additional investment in energy generation in this region could appear to be politically targeted but could, instead, be the result of energy potential creating political power rather than the opposite.

than others, but neither are fully dependent on geographical location. Even hydropower, constrained as it is to river sites, is politicized by the location along the river that is dammed (Bakker, 1999; Hancock & Sovacool, 2018). For all of these energy plants, an optimal economic location likely exists, and political geographic targeting may reduce energy output–however, this is the cost paid by all political targeting of public goods.

2 Theory

Is internationally funded energy production politically targeted? The answer may depend on the type of good and the timing of the energy project. Compared to other types of projects, fossil fuel projects may be more likely to be politically targeted based on the economic benefits that accrue to local populations. The low-skilled labor market generated by fossil fuel production offers employment opportunities to local constituents. These labor conditions then create demand for additional goods and services that stimulate the local economy. Renewable energy, which requires higher-skilled labor and less daily maintenance, is less likely to cause the samegvbghyt local economic boom. With these assumptions, we should expect fossil fuels to be more politically targeted than renewables.

H1a: Fossil fuel production is more likely to be politically targeted than general aid projects.

H1b: Renewable energy is less likely to be politically targeted than general aid projects.

H1c: Fossil fuel production is more likely to be politically targeted than renewable energy projects.

Renewable technology has advanced rapidly in the last few decades, challenging the axiomatic economic superiority of fossil fuels. At the same time, the costs of climate change and imperative for action to reduce emissions has led aid donors to prioritize decarbonization and the green energy transition. In 2013, the World Bank officially declared it would no longer fund new coal projects (Bank, 2013). With one notable exception, the New Kosovo coal project in the Balkans (O'Brien-Udry, 2023), the Bank pledged to shift its funding from coal production to renewable energy.

Does political targeting for fossil fuel and renewable energy change when the international community reverses its priorities? Post-2013, two competing pressures emerge. First, the international community's increased focus on renewable energy should drive greater supply of renewable projects, making it easier for political leaders to capture these projects. If leaders are indeed more likely to come from areas with existing fossil fuel projects, new renewable funding could be a means of compensating the local population for lost development. Second, while the international community increased its funding for renewables, the structural factors that make fossil fuels attractive for political targeting–local labor market forces–still hold in the post-2013 era. These two opposing theories lead to two hypotheses.

H2a: Post-2013, fossil fuels are less politically targeted than renewable energy.

H2b: Post-2013, fossil fuels are more politically targeted than renewable energy.

If donor-funded fossil fuel energy projects are not politically targeted, the international community's efforts for a just energy transition are more likely to be successful. Concentrating fossil fuel projects in areas with political power likely slows the pace of progress on decarbonization in the same way as developed nations. On the other hand, the political targeting of renewables could generate coalitions of support for decarbonization. In the following sections, I map the locations of energy projects across the world and test whether these projects are colocated in leader birth regions.

3 Data

I identify the universe of World Bank projects from 1955 to 2022 aimed at energy generation through sector categorization and project descriptions. These include any project that invests in: fossil fuel production, renewable production, fossil fuel mining, and fuel transportation. These *do not* include efforts to strengthen the electric grid, energy efficiency, building insulation, battery storage, or other activities that, while improving energy capacity, do not actively invest in a given form of energy. Theoretically, projects aimed at generally improving the power sector in a given country do not generate political cleavages between fossil fuel and renewable energy producers.[2] Figure 1 shows the location of all energy projects funded by the World Bank globally. Each point represents an individual site; projects may have multiple sites under the same umbrella funding. Fossil fuel projects (orange circles) outnumber renewable energy projects (green triangles).

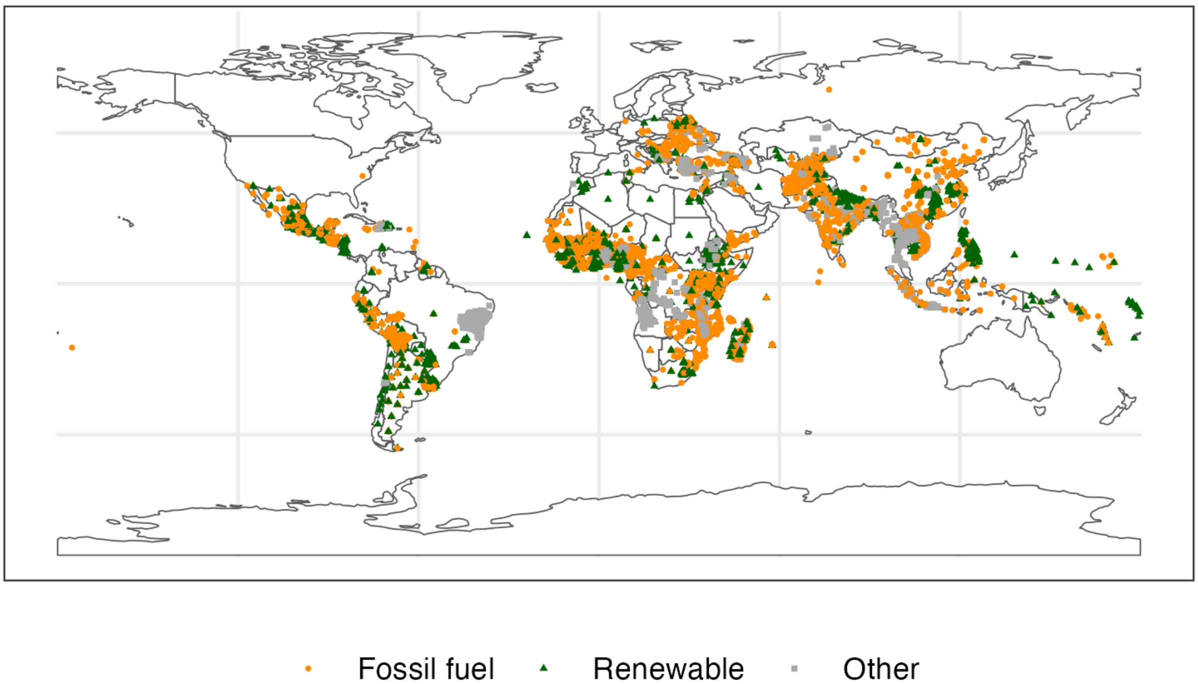

Figure 1: *Geography of energy projects:* Geolocated World Bank energy projects, 1955-2022. Orange circles indicate fossil fuel projects, green triangle renewables, and grey squares other projects.

I then identify whether individual projects are located in the birth region of political

[2]This is a simplification of energy dynamics for the purpose of initial analysis. See Appendix **??** for more on the role of grid stability, battery capacity, and overall energy efficiency in supporting the green energy transition. Robustness tests that include these projects do not substantively affect results.

leaders and developed during a leader's reign. Data on leaders come from the Political Leaders Affiliation Dataset (PLAD) (Bomprezzi, 2020). Projects are considered colocated in a leader birth region if project site coordinates are contained in the district (ADM1) of the leader's birth and are approved or implemented during a leader's reign. Figure 2 shows the subset of project sites that are located in the region and started during the reign of a given leader.

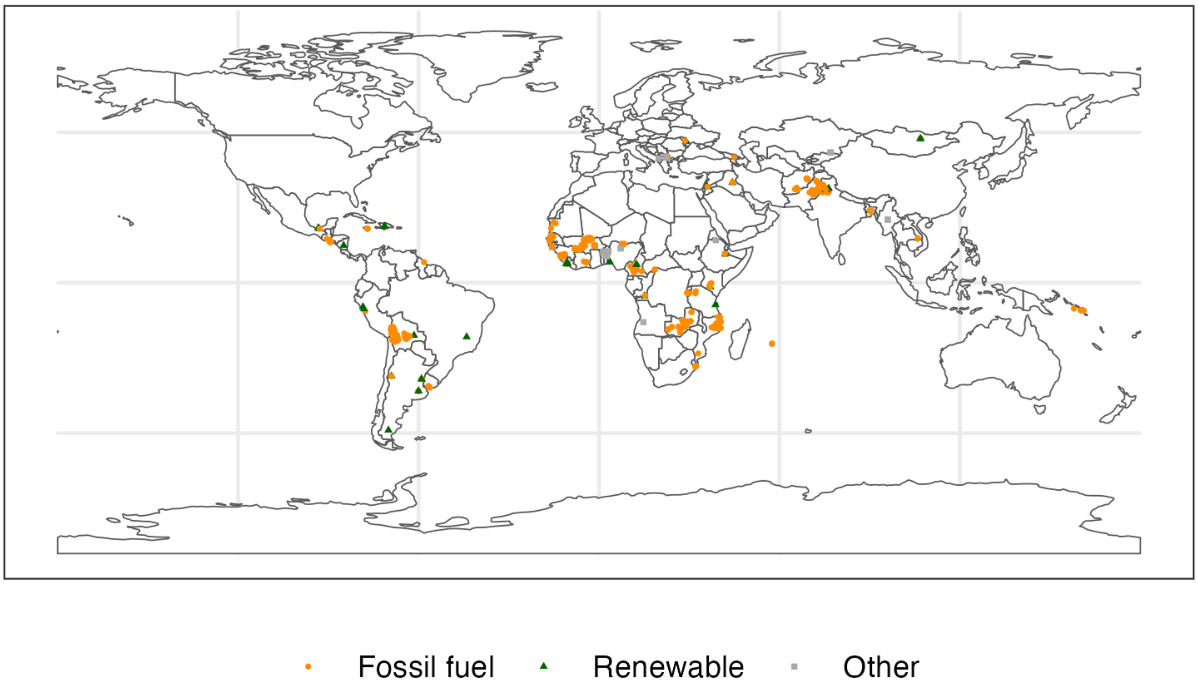

Figure 2: *Political geography of energy projects:* Geolocated World Bank energy projects, 1955-2022, subsetting to projects located in the birth region of political leaders and implemented during their reign. Orange circles indicate fossil fuel projects, green triangle renewables, and grey squares other projects.

The number of renewable projects in leader birth regions is substantially lower than the number of fossil fuel projects. As Table 1 depicts, almost twice as many individual fossil fuel projects are located in leader birth regions compared to renewable energy projects–and four times as many individual fossil fuel sites. Substantively, the proportion of fossil fuel projects in leader birth regions (20%) is greater than both renewable energy projects (16%), other energy projects (18%), and non-energy projects (18%). Notable, renewable energy projects are less likely than other project subsets to be colocated in leader birth regions.

	# projects		Birth region		Fiscal year			Proj. cost	GDPpc
	Indv.	Sites	Indv.	Sites	Min.	Max	Mean	(mill. USD)	(country)
Fossil fuel	350	14485	87	443	2002	2021	2013	178.15	7542
Renewable	226	4711	45	102	1999	2021	2011	205.43	6011.2
Other energy	215	5888	50	255	1996	2020	2012	264.1	4081.8
General	2833	96023	615	2508	1997	2024	2013	134.8	6777.7
Total	3392	114256	738	3041	1996	2024	2013	143.1	6790.9

Table 1: *Summary statistics*

I conduct a grid cell level analysis using the PRIO-GRID (Tollefsen *et al.*, 2012) which divides the globe into a 0.5x0.5 decimal degree grid. I limit the spatial analysis to countries that have received World Bank projects in the last twenty years. This temporal limit is necessary due to missingness in the geolocated coordinates of projects.

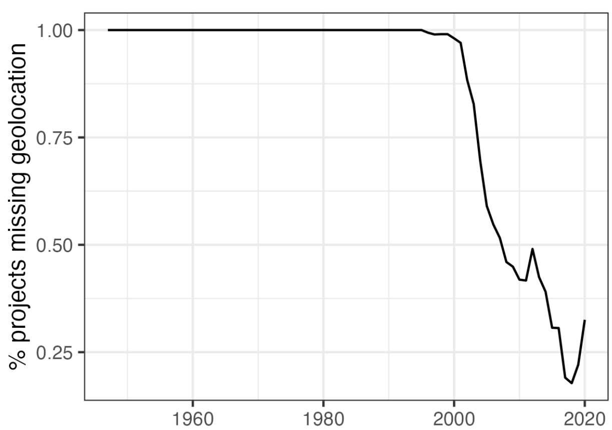

Figure 3: *Missingness:* Proportion of all World Bank projects missing location data over time.

Missing data becomes a larger concern when considering the projects of interest: fossil fuel and renewable energy projects. Figure 4 shows the proportion of missing projects across time (panel A) and country (panel B) by sector. The proportion of all projects missing geolocations goes down over time, but %50 of renewable and fossil fuel project geolocations are regularly missing until 2015. Panel B shows the average variation in missingness within countries; that is, how consistently is a country missing data on project geolocations. Within an average country, data missingness is more consistent for non-energy projects than fossil fuel projects.

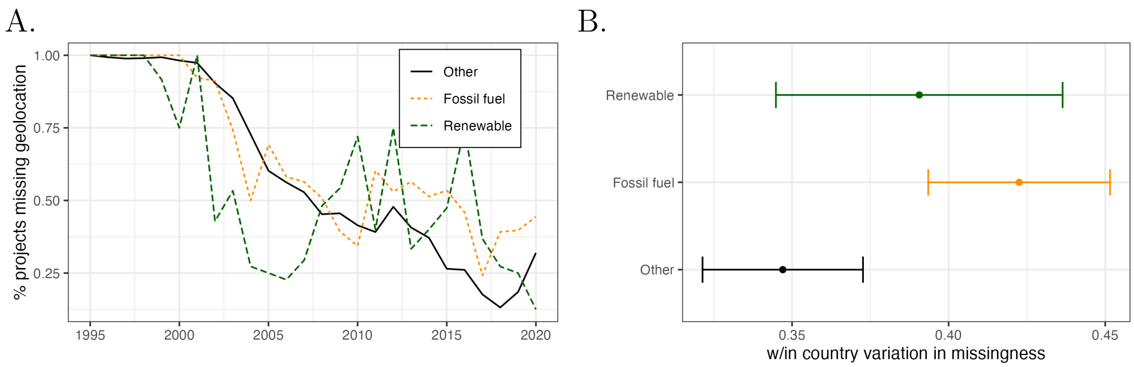

Figure 4: *Missingness by sector and country:* Proportion of all World Bank projects missing location data over time by type of project. Green line indicates renewable sector, orange fossil fuel, and black line all other projects.

If projects within a country were regularly missing or not missing according to sector, country fixed effects would account for variation across countries. However, as project coordinates are not consistently reported or not reported, the results must be taken as preliminary given the potential for nonrandom missingness.

I control for time trends and a number of additional country- and project-level covariates. Richer countries are more likely to receive aid and may have higher capacities to absorb energy aid costs, thus I control for `GDP`. More populous countries may also have higher labor capacity to staff energy projects and are also more likely to receive aid (`Population`). Larger countries may have a greater abundance of natural resources that contribute to energy projects (`Land area`). Democracies are more likely to receive aid than autocracies (`VDem`). Finally, energy projects are likely to be more expensive than general projects due to the infrastructure needed to operationalize these projects (`Project cost`). `GDP`, `Population`, and `Land area` come from the World Development Indicators. `VDem` is the polyarchy variable from Lindberg *et al.* (2014). The `Project cost` come from the Bank's project-level data. I include country fixed-effects, thus results should be interpreted as within-country changes. I also cluster the robust standard errors by project–as Table 1 shows, projects often have multiple sites. I consider spatial autocorrelation between projects and report Conley standard errors in addition to the robust standard errors.

4 Results

Table 2 displays the main results for OLS regressions. The unit analysis is the grid cell-year. In a given year, for a given grid cell, how many World Bank projects are started? The coefficient of interest is `Leader birth region`, which takes on a value of one if the grid cell is in the current political leader's birth region (at the ADM1 level). Positive coefficients indicate that more renewable (Model 1) or fossil fuel (Model 2) projects are implemented in grid cells in leader birth regions than other types of projects. Model 3 subsets the sample to only fossil fuel and renewable projects and looks at the interaction term between renewable projects and leader birth region. Each model includes country fixed effects; thus coefficients should be interpreted as within-country changes in leader birth regions and project locations.

Grid cells in a leader birth region receive more renewable and fossil fuel projects than other types of World Bank projects. Compared to fossil fuel projects, leader birth region grid cells receive 1.5 fewer renewable projects in a given year. Substantively, these results suggest that both fossil fuel and renewable energy projects are politically valuable for recipient country leaders–though fossil fuel projects are significantly more valuable than renewable projects. Appendix Table 4 replicates models 1 and 2 excluding fossil fuel and renewable projects, respectively, and the coefficient for leader birth region becomes insignificant for renewable energy.

	Renewable (1)	Fossil fuel (2)	Fossil fuel (vs Renewable) (3)
Leader birth region	0.022	0.377	1.796
	(0.014)	(0.042)	(0.222)
Year	0.012	−0.010	0.058
	(0.002)	(0.002)	(0.012)
GDP (log)	−0.611	−0.706	−4.008
	(0.034)	(0.043)	(0.162)
Population (log)	0.025	1.667	1.398
	(0.140)	(0.134)	(0.715)
VDem	−1.112	2.208	−12.058
	(0.091)	(0.128)	(1.115)
Land area (log)	−154.804	−58.285	−680.204
	(18.927)	(10.391)	(104.076)
Renewable			−0.071
			(0.062)
Renewable x			−1.526
Leader birth region			(0.243)
Country FE	✓	✓	✓
Num.Obs.	197 203	197 203	45 612
R2	0.073	0.062	0.234
R2 Adj.	0.073	0.061	0.232

Table 2: *Temporal results:* Number of of new renewable (Model 1) or fossil fuel (Model 2) projects located in a leader's birth region during the leader's reign. Model 3 shows the interaction effect of a leader's birth region with renewable energy projects, compared to fossil fuel projects. All models include country fixed effects; robust standard errors in parentheses.

However, the World Bank does not officially remove its support from any fossil fuels until 2013 when it bans coal. The results in Table 2 may mask important differences in Bank lending before and after its policy change. Splitting the sample before and after the coal ban, Table 3 shows clear changes in political associations of fossil fuels and renewables pre- and post-2013.

Across both time periods, gridcells in leader birth regions contain more fossil fuel projects than other types of projects. Renewable projects, however, are less likely to be located in leader birth regions than other projects prior to 2013 and more likely to be located in leader birth regions after 2013. A gridcell located in a leader birth region during their reign is expected to have four fewer renewable projects than fossil fuel projects before 2013. This trend reverses after 2013, when a leader birth region grid cell has, on average, 1.7 more renewable projects than fossil fuel projects.

Figure 5 shows yearly estimates of the difference in political colocation of fossil fuel (Panel A) and renewable (Panel B) projects and general projects. The results broadly align with the more coarse analysis of Table 3–fossil fuel projects are more likely to be politically colocated in the pre-2013 era while renewable projects are less likely to be politically colocated during this time period.

The results support the theory of political targeting of fossil fuels at the expense of renewable energy. However, the international community's push towards renewable investment in the post-2013 world shows a change in political targeting of energy projects. Neither fossil fuels nor renewable energy projects are politically targeted at higher rates than other projects. The loss of political targeting for energy, particularly renewable energy, could be a sign of increased focus on effective energy development. It could also pose challenges for international efforts to decarbonize if renewable energy is not used to curry favor with political supporters. The lack of political targeting of fossil fuels post-2013, however, is evidence that political leaders may no longer see the economic or political benefits of fossil fuels for

	Pre-2013			Post-2013		
	Renew.	FF	FF (vs Renew.)	Renew.	FF	FF (vs Renew.)
	(4)	(5)	(6)	(7)	(8)	(9)
Leader birthregion	−0.067	0.624	3.023	0.130	0.077	−0.935
	(0.017)	(0.075)	(0.323)	(0.025)	(0.032)	(0.206)
Year	−0.035	−0.032	−0.205	0.004	−0.026	0.240
	(0.004)	(0.004)	(0.028)	(0.006)	(0.007)	(0.037)
GDP (log)	−0.096	1.216	1.604	−0.031	2.232	−4.600
	(0.053)	(0.064)	(0.295)	(0.096)	(0.089)	(0.687)
Population (log)	0.539	−2.739	−5.660	1.810	0.354	10.211
	(0.144)	(0.150)	(1.767)	(0.156)	(0.297)	(1.545)
VDem	1.429	1.991	−0.537	0.279	−0.928	−26.801
	(0.131)	(0.127)	(1.738)	(0.128)	(0.185)	(2.604)
Land area (log)	−3005.625	−1220.140	−12 584.229	1.778	62.102	−175.466
	(329.429)	(162.581)	(1063.846)	(0.699)	(12.273)	(899.741)
Renewable			−1.376			0.056
			(0.092)			(0.108)
Renewable x			−3.970			1.746
Leader birthregion			(0.342)			(0.224)
Country FE	✓	✓	✓	✓	✓	✓
Num.Obs.	108 385	108 385	26 318	88 818	88 818	19 294
R2	0.199	0.117	0.328	0.076	0.085	0.367
R2 Adj.	0.198	0.116	0.326	0.075	0.084	0.365

Table 3: *Temporal results:* Number of of new renewable (Models 4 and 7) or fossil fuel (Model 5 and 8) projects located in a leader's birth region during the leader's reign. Models 6 and 9 show the interaction effect of a leader's birth region with renewable energy projects, compared to fossil fuel projects. Models 4-6 estimate results prior to 2013; Models 7-9 after 2013. All models include country fixed effects; robust standard errors in parentheses.

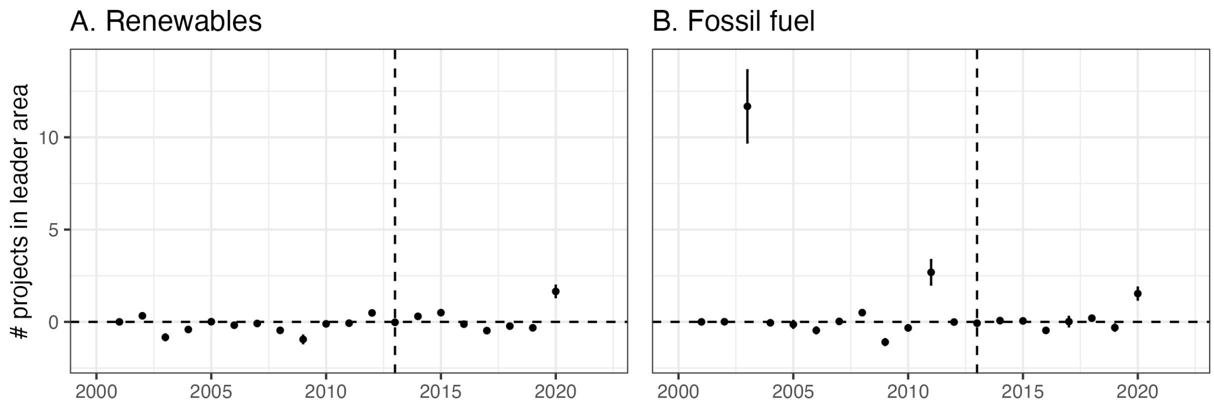

Figure 5: *Event study:* Number of energy projects in leader birth region grid cells in a given year compared to general projects. OLS with covariates and 95% confidence intervals displayed. Dotted line at 2013 to mark World Bank coal cut-off. Left panel (A) shows estimates for renewables projects, right panel (B) for fossil fuels.

their constituents.

5 Conclusion

Under construction.

6 To do:

- Integrate Chinese aid projects – expect more politically targeted
  - Initial results suggest not! Why?
- Map natural resource endowments to address reverse causality
- Geolocate fossil fuel locations slated for decommissioning; particularly those sponsored by the international community
- Placebo test of political targeting

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	Renew. (1)	FF (2)
Leader birth region	0.008	0.378
	(0.009)	(0.043)
Year	0.004	−0.021
	(0.002)	(0.002)
GDP (log)	−0.529	−0.705
	(0.036)	(0.047)
Population (log)	−0.083	1.860
	(0.094)	(0.124)
VDem	−1.345	2.048
	(0.089)	(0.130)
Land area (log)	−80.639	23.836
	(10.144)	(3.559)
Country FE	✓	✓
Num.Obs.	182 254	188 675
R2	0.060	0.062
R2 Adj.	0.059	0.061

Table 4: Main results (excluding other energy): Number of new renewable or fossil fuel projects located in a leader's birth region during the leader's reign. Model 1a excludes fossil fuel projects, Model 2a excludes renewables. All models include country fixed effects; robust standard errors in parentheses.

A Robustness