ACI Research Paper #03-2024

Impact of Climate Legislation on Cross-border Public Investments in Renewable Energy in ASEAN

Shubhangi GUPTA

Thi Hang BANH

April 2024

Please cite this article as:

Gupta, Shubhangi and Thi Hang Banh, "Impact of Climate Legislation on Cross-border Public Investments in Renewable Energy in ASEAN", Research Paper #03-2024, *Asia Competitiveness Institute Research Paper Series* (April 2024)

Impact of Climate Legislation on Cross-border Public and Quasi-Public Investments in Renewable Energy in ASEAN

Shubhangi Gupta[1] and Thi Hang Banh[2]

April 2024

Abstract:

As climate change improves its grip on the world, support for climate action has increasingly garnered attention. Many countries set net-zero targets, introduced sustainability-action plans, and enacted legislation to keep a check on greenhouse gas emissions. In this paper, we analyze the impact of national climate legislation on public and quasi-public investments in renewable energy in ASEAN countries. Applying fixed effects regression methodology on a panel of 160 unique ASEAN country-donor combinations from 2000 to 2020, this study finds strong evidence of a positive relationship between climate policies and public and quasi-public investments in renewable energy. With the introduction of a new climate policy, on average, ASEAN economies experience a 2.2% increase in the ratio of bilateral investments in renewable energy. We conclude that national climate legislation has an important and positive role in attracting much-needed investments in renewable energy to finance the green transition.

[1] Asia Competitiveness Institute, Lee Kuan Yew School of Public Policy, National University of Singapore. s.gupta@nus.edu.sg

[2] Asia Competitiveness Institute, Lee Kuan Yew School of Public Policy, National University of Singapore. hangbanh@nus.edu.sg

1. Introduction:

The human footprint on climate change and resultant extreme weather events has been scientifically proven and is being widely addressed. In 2021, the global mean temperature was 1.1 degrees Celsius higher than its pre-industrial era counterpart (from 1850 to 1900) (United Nations, n.d.). The seven years from 2015 to 2021 were the warmest years to be recorded. The consequences of climate change are felt and acknowledged across the world. Climate change is responsible for reduced food and water security, extreme heat events, human mortality, and more. Importantly, these adverse impacts and losses are unevenly distributed across systems, regions, and sectors. Calling climate change a systemic risk, UNCTAD estimates total economic losses from disasters increased from USD 150 billion in 2019 to USD 202 billion in 2020, with about USD 190 billion loss attributable to natural catastrophes (United Nations Conference on Trade and Development, 2021). The 2023 Intergovernmental Panel on Climate Change report has reaffirmed human influence's role in accelerating climate change (Calvin et al., 2023). The global community has, on more than one occasion, come together to address the issue through important international agreements, including the Kyoto Protocol and the Paris Agreement.

With 192 parties, the Kyoto Protocol was adopted in 1997 and came into force in 2005. It was the first legally binding climate treaty that placed a "heavier burden" of emission reduction targets on certain industrialized economies (United Nations Framework Convention on Climate Change, n.d.(a)). The treaty targeted an average five percent reduction in the first commitment period from 2008 to 2012 compared to 1990 levels. It did not compel developing countries like India and China to reduce emissions. Another gas-guzzling economy, the United States never ratified the treaty. As a result, global emissions rose relative to 1990, driven by the economies excluded from the pact. Despite battling a troubled legacy, there is consensus among scholars that the treaty "paved the way for future climate negotiations and revealed the loopholes that can emerge in these processes" (Bassetti, 2022).

Kyoto Protocol set in motion further negotiations to include and induce more economies to reduce their emissions (Savaresi, 2016). After multiple rounds of negotiations and setbacks later, the Paris Agreement was adopted in 2015 and entered into force the following year. Working on five-year cycles, member countries submit their national climate action plan called Nationally Determined Contributions (NDCs) (United Nations Framework Convention on Climate Change, n.d.(b)). The NDCs reflect each party state's ambition in constraining their greenhouse gas emissions. The Paris Agreement framework enables a review of each Party's progress toward achieving the global goal and their contribution (Savaresi, 2016). This is where the Kyoto Protocol differed from the more comprehensive Paris Agreement.

As climate change diplomacy intensified, there was an increased level of activity in climate action at the national level as well. Many of the party countries strengthened their climate commitments through pledges to reduce emissions and support other countries in adapting to the extreme effects of climate change (Maizland, 2023; and Climate Action Tracker, 2024). This paper examines the impact of climate legislation relevant to energy on attracting investment into the renewable energy sector. Renewable energy includes solar, wind, hydropower, biofuels, and others, which are central to the transition to a less carbon-intensive future (International Energy Agency, 2023). Since our focus is on the renewable energy sector, climate legislation, policies, and investments also pertain to the same.

Governments worldwide are modeling pathways toward a sustainable future through country-specific climate legislation (Organisation for Economic Co-operation and Development, 2017). Figure 1 exhibits the increasing adoption of new climate laws and policies focusing on the renewable energy sector in 194 countries and jurisdictions over time. We observe that over time, there were sudden jumps following the passage of the Kyoto Protocol (in 2005-06) and in preparation for the Paris Agreement (2015-16). As a growing number of countries continue to have laws in place, the need to legislate further reduces, which

plateaus and even dips the adoption of new legislation (Nachmany et al., 2015). Nevertheless, an overall increasing trend points to the popularity and utility of climate legislation globally (Tollefson, 2014).

A number of these policies (that include executive orders and legislative acts) in ASEAN countries regulate renewable energy consumption and supply. For example, Thailand's Alternative Energy Development Plan 2018-2037 aims to increase the share of renewable energy to 30% of final energy consumption by 2037. One of Vietnam's executive orders sets out the strategy for achieving net-zero emissions by 2050, which includes promoting the use of green energy, decreasing Greenhouse gases (GHG) emissions by 32.6% in energy and 43% in agriculture, and increasing the ratio of sources of renewable energy in electricity production. A legislative act in the Philippines sets out plans to increase energy efficiency and contains provisions regarding financial and other incentives to encourage energy efficiency measures.

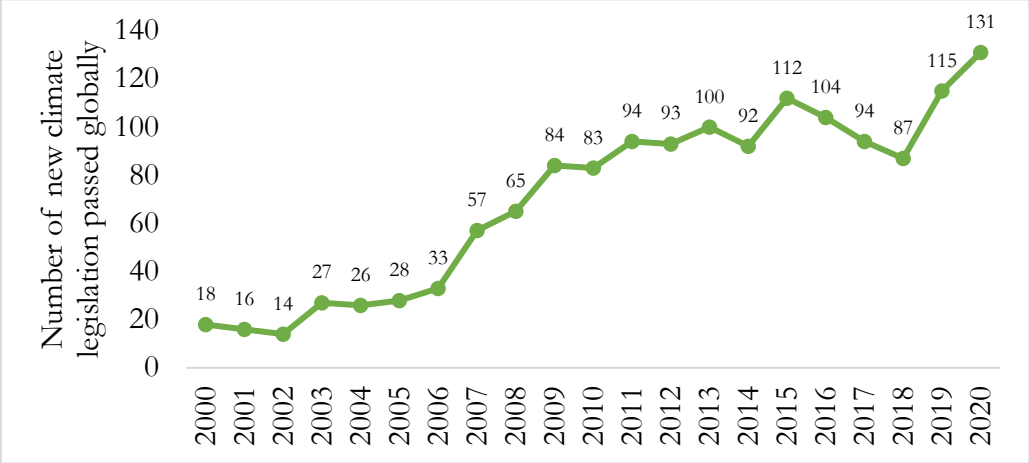

Figure 1: New climate legislation passed globally between 2000 and 2020

Source: Authors' compilation based on Climate Change Laws of the World

Investment required to "zero out the world's carbon emissions by 2050" is estimated at a whopping USD 196 trillion by Bloomberg (Gongloff, 2023). These investments will have to triple to USD 6.9 trillion by 2030 to meet the 2050 target to net the world's carbon emissions. Arriving at a similar estimate, IRENA reckons that yearly investments will need to quadruple to over USD 5 trillion to stay on the 1.5-degree Celsius pathway (International Renewable Energy Agency, 2023). Adaptation to the physical consequences of climate change might cost emerging and developing countries a further USD 140 billion to USD 300 billion a year (Ehlers et al., 2022). Substantial investments are, therefore, required to mitigate and adapt to the effects of climate change.

Over the last decade, ASEAN has witnessed steady economic and social development, marked by improved developmental indicators such as poverty reduction, food and nutritional security, education, women empowerment and employment, and peace and stability. ASEAN, simultaneously, is also highly vulnerable to climate change and its impacts. Storms, floods, typhoons, heat waves, and other extreme weather events continue to batter the region (Frye, 2020).[3] The Global Climate Risk Index, which ranks countries based

[3] See: *South China Morning Post*. 2023. "As Climate Change Wreaks Havoc, Asean Is Rising to the Challenge," August 20, 2023, sec. Comment. https://www.scmp.com/comment/letters/article/3231561/climate-change-wreaks-havoc-asean-rising-challenge.

on the extreme weather events they face, included Myanmar, the Philippines, and Thailand in the top 10 economies most affected by climate change in the last decade (Eckstein, Kunzel, and Schafer, 2021).

Acutely aware of the magnitude of the challenge, national governments have enacted legislation. Figures 2 and 3 depict the passage of climate legislation in each country and over time in the region. Vietnam and Indonesia lead the pack. Indonesia is one of the most vulnerable to climate change in the world. It is the sixth most susceptible country to high-impact natural hazards (International Monetary Fund Asia and Pacific Department, 2021). Indonesia is also a large producer of coal, which means the economic dependence on fossil fuels is still very high. This continues to derail Indonesia's climate efforts and therefore, a stronger commitment is required to put the country on a low-carbon trajectory (Climate Action Tracker, 2023).

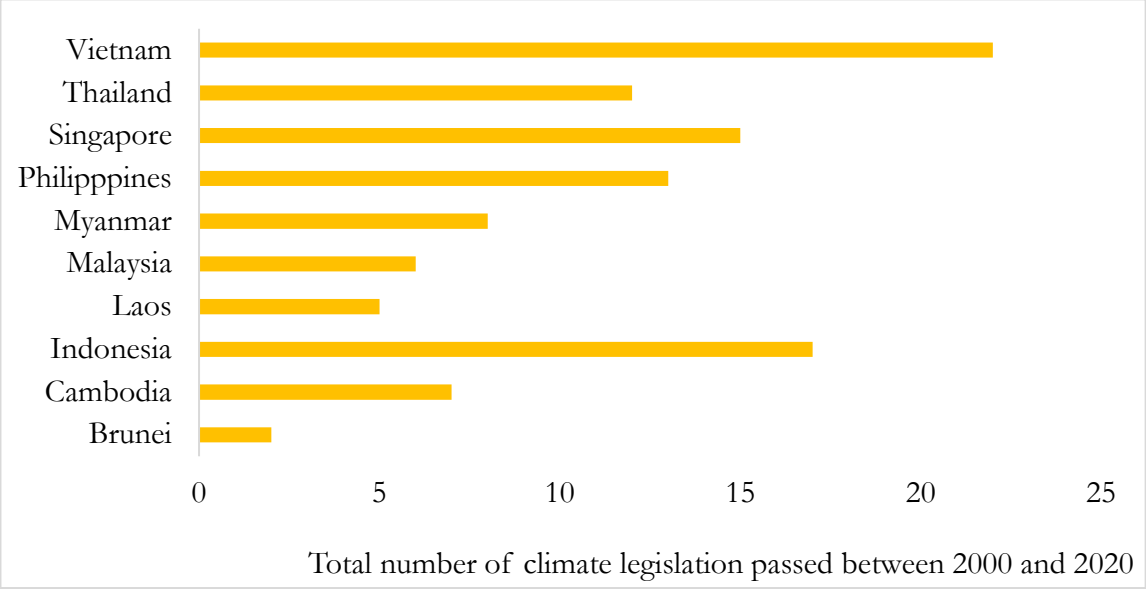

Figure 2: Total number of climate legislation passed between 2000 and 2020 in ASEAN countries

Source: Authors' compilation based on Climate Change Laws of the World

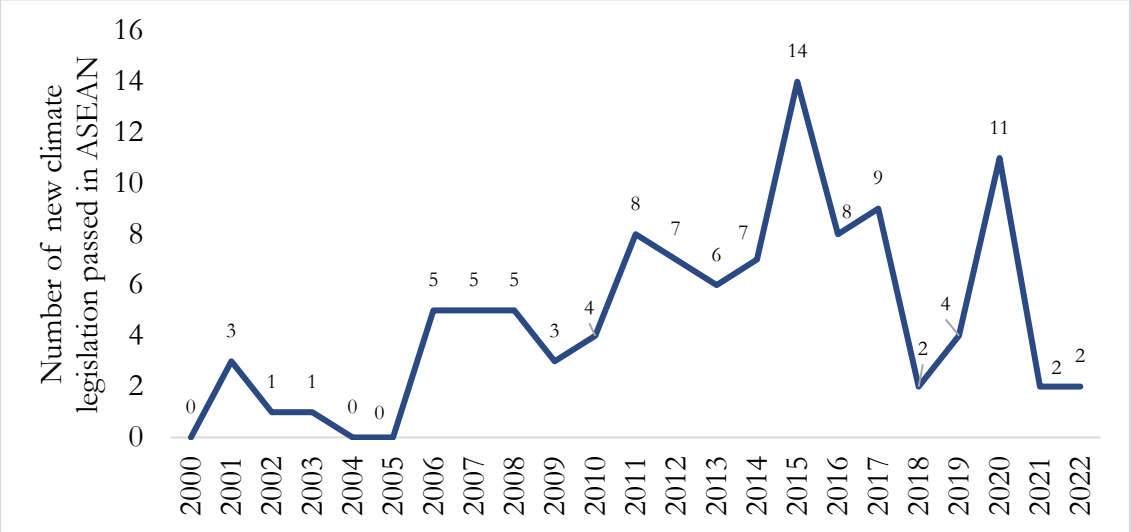

Figure 3: New climate legislation passed in ASEAN countries

Source: Authors' compilation based on Climate Change Laws of the World

Although the number of climate-related legislation across ASEAN countries shows minimal disparity, there is a substantial divergence in the overall public and quasi-public investment allocated to renewable energy within the region between 2000 and 2020 (Figure 4). Laos received the most investment, followed by Indonesia and Vietnam. Laos' exceptional increase in renewable investment comes from one megaproject in 2017-18 – Pak Lay hydropower project, built by state-owned Power China Resources and financed by China's Export-Import Bank. The project was estimated to be a 2.1 USD billion project (Macan-Markar, 2018). It is one of the 11 hydropower projects planned for the lower Mekong river and has an installed capacity of 770 MW of electricity.[4]

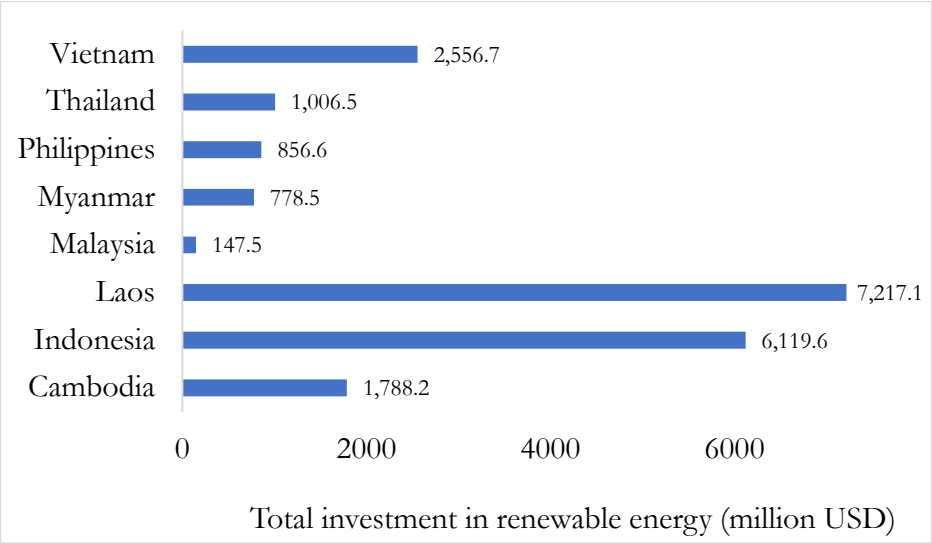

Figure 4: Total investments in renewable energy in ASEAN countries between 2000 and 2020 (Unit: 2020 USD million)

Source: Authors' compilation based on International Renewable Energy Agency

Townshend et al. (2013) ideate that national legislation is important because "it makes an international agreement both more likely (if domestic experience increases the confidence to commit internationally) and more meaningful (because international pledges are meaningless without national legislation to implement them)". As new policies come about, an important question arises on the impact of these policies on investment in renewable energy.

In this paper, we aim to estimate the impact of climate legislation on the public and quasi-public investment in renewable energy in the Association of Southeast Asian Nations (ASEAN). We look at the cross-border investments made by public sector institutions in the donor country and international organization such as the Asian Development Bank (ADB), the World Bank (WB), etc. to ASEAN countries between 2000 and 2020. We find that there is a positive correlation between climate policies and bilateral public and quasi-public investments in renewable energy in ASEAN countries. Our analysis contributes to the growing discourse on the effectiveness and impact of climate legislation on various aspects of an economy.

The rest of the paper is structured as follows. Section 2 provides a brief review of the relevant literature. Section 3 describes the data and the econometrics model used in the study. We discuss our results in section 4. And section 5 concludes.

2. Literature Review

[4] See Mekong River Commission (MRC) (n.d.).

Achieving and supporting these net-zero ambitions require major governmental funding – which needs to go beyond research and development. A slew of studies find that public investments help mobilize private investments to foster climate action (Meckling et al., 2022; Azhgaliyeva, Beirne, and Mishra, 2023; and Georgieva and Adrian, 2022).

However, much of the existing literature in this area focuses on the need for and impact of private investments to achieve climate goals (Ragosa and Warren, 2019). Regardless of the source of investments, it is almost unanimously acknowledged that appropriate climate policy has a positive effect on overall investments addressing climate change.[5] Further, Schütze et al. (2017), C. Jaeger et al. (2011), and Jaeger et al. (2015) recommend that climate policies must not be enacted in isolation and must be part of a wider program targeting technical innovation. Guo et al. (2017) finding supports this recommendation, i.e., environmental regulations affect regional green growth performance through technological innovation in China. On the other hand, Kawabata (2019) finds that "strictness of climate policy is not associated with the level of engagement in climate finance [of financial institutions] …but [their] membership in climate finance initiatives is [highly significant]". Similarly, a report by UN Environment and World Bank Group (2017) emphasizes that national initiatives such as those that promote the issuance of green bonds and securities, mainstream environmental factors into financial decision-making, and so on drive the transition to a sustainable financial system.

Our study is also relevant to the strand of literature that focuses exclusively on the impact of climate legislation on various outcomes, such as GHG emissions.[6] Investigated on the state level in the US, Bergquist and Warshaw (2023) find that state climate policy is associated with a reduction in CO2 emissions. Other studies include the effect of climate legislation on bank lending in MENA (Middle East and North Africa) countries (Ghosh, 2023), environmental expenditure and air-pollution abatement investment in Sweden (Jaraite, Kazukauskas, and Lundgren, 2014) or oil and gas private investments (Bogmans, Pescatori, and Prifti, 2023). Menz and Vachon (2006) and Carley (2009) identify political motivations, policies, and legislation enacted to be important in the adoption and promotion of renewable energy. There, however, is no research on the impact of national climate legislation on public investments in the context of ASEAN countries that this paper addresses.

3. Data and Variables

3.1. Data

The data on national climate legislation has been taken from *Climate Change Laws of the World* (CCLW), which is jointly maintained by the Grantham Research Institute (at the London School of Economics) and Sabin Center (at Columbia Law School) and powered by Climate Policy Radar.[7] The database covers climate-related laws and other laws and policies that promote low-carbon transitions in areas such as energy, transport, land use, and climate resilience. As mentioned before, we focus on legislation that addresses energy (either individually or in combination with other sectors). Townshend et al. (2013) find that energy efficiency is very often legislated by the national governments, which also helps them become more energy secure and energy independent. The database distinguishes between policies (executive decisions) and laws (legislative decisions), which is outside the scope of this paper. We include both in our study and, for the sake of brevity, collectively refer to them as 'legislation'. These legislations have full legal force at the national level. While legislative action may not be a perfect indicator of a country's response to climate

[5] See Darvas and Wolff (2021), Songwe, Stern, and Bhattacharya (2022), Prasad et al. (2022), D'Orazio and Löwenstein (2022), Sullivan (2014), Yang et al. (2019), Aziz and Jahan (2023) and Eyraud, Clements, and Wane (2013).

[6] See Eskander and Fankhauser (2020) and Balogh and Mizik (2023).

[7] See Climate Change Laws of the World (n.d.).

change, "it is [nonetheless] a helpful indicator of how serious a country is about climate change" (Townshend et al., 2013).

Data on public investment in renewables is obtained from the International Renewable Energy Agency (IRENA), which is an inter-governmental organization facilitating countries in their transition to sustainable energy.[8] The database specifies renewable energy finance flows by technology, recipient, donor, financial instrument, and financial institution. We use this database to create ASEAN recipient-public/quasi-public sector donor combinations and their corresponding annual investments in renewables and non-renewables. Renewables include bioenergy, geothermal energy, wind energy, marine energy, hydropower, and solar energy. Non-renewables include coal and peat, fossil fuels, natural gas, nuclear, oil, and other non-renewables. This dataset does not contain information on Singapore and Brunei. As a result, the two countries are dropped from the panel data used in our analysis.

In this paper, public and quasi-public investments refer to financing efforts undertaken by government entities and agencies or international institutions such as the ADB, the WB, the European Bank for Reconstruction and Development (EBRD), among others (see Figure 5 for top 10 investors in renewable energy in ASEAN countries between 2000 and 2020). Public and quasi-public investments play a unique and complementary role alongside private investments in the renewable energy sector. Renewable energy projects often require significant upfront investment with long payback periods. Through the provision of financial incentives, subsidies, or guarantees, public and quasi-public investments can help mitigate these high initial costs and uncertainties, making projects more viable and attractive to private investors. Additionally, the environmental benefits of renewable energy, such as reduced pollution and carbon emissions, are public goods that benefit society as a whole. However, these benefits might not be fully accounted for by the market, leading to underinvestment by the private sector. Public investment can help address this market failure and lead to positive externalities and spillovers that benefit the entire industry. Public and quasi-public investments can also leverage additional private sector investments through partnerships and co-financing arrangements.

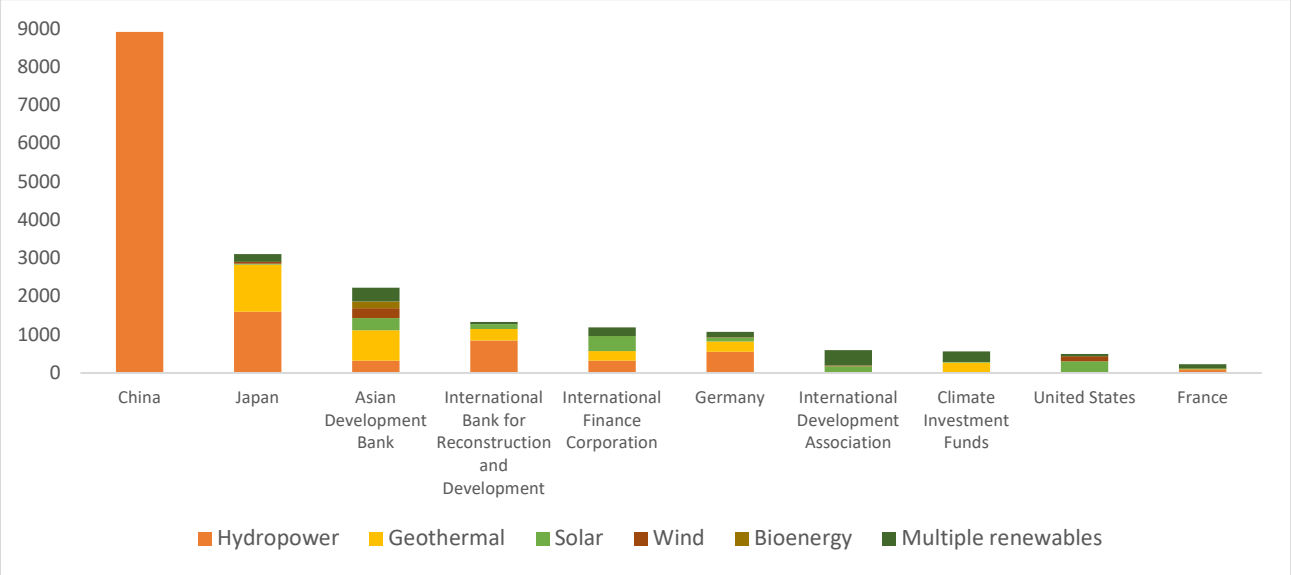

Figure 5: Top 10 investors in renewable energy in ASEAN countries between 2000 and 2020 (Unit: 2020 USD million)

Source: Authors' compilation based on International Renewable Energy Agency

[8] See International Renewable Energy Agency (n.d.(a)) and International Renewable Energy Agency (n.d.(b)).

3.2. Econometric Specification and Variables

We use the following econometrics specification to examine the effect of policy on investment in renewable energy:

$$\boldsymbol{inv\_renewables_{ijt}} = \boldsymbol{\beta_1} + \boldsymbol{\beta_2}.\boldsymbol{policy_{jt}} + \boldsymbol{\beta_3}.\boldsymbol{X_{jt}} + \boldsymbol{\beta_4}.\boldsymbol{X_{it}} + \boldsymbol{\beta_5}.\boldsymbol{X_{ijt}}$$

$$+ \boldsymbol{\beta_{10}}\boldsymbol{year_t} + \boldsymbol{\gamma_j} + \boldsymbol{\gamma_i} + \boldsymbol{\varepsilon_{ijt}} \qquad (1)$$

Where: $\boldsymbol{inv\_renewables_{ijt}}$ refers to the share of investment in renewable energy from partner i to ASEAN country j in total investment in energy from i to j; $\boldsymbol{policy_{jt}}$ is our main variable of interest, which refers to the number of active climate policies in ASEAN country j at time t. We also check for the robustness of our results using lagged of policy variable *(*$\boldsymbol{policy_{jt-1}}$*)* to mitigate the reverse causality concern. We also include $\boldsymbol{year}$ in our regression to account for the time trend in the analysis. It is intuitive that the number of climate policies will increase over time. Therefore, this temporal trend is taken care of by including $\boldsymbol{year}$ as a control variable. $\boldsymbol{\gamma_j}$ **and** $\boldsymbol{\gamma_i}$ are the origin fixed effects and destination fixed effects to capture all unobservable characteristics specific to either origin or destination country. $\boldsymbol{\gamma_{jt}}$ represents ASEAN country and time fixed effects, capturing unobservable characteristics relating to both. $\boldsymbol{X_{jt}}$, $\boldsymbol{X_{it}}$, and $\boldsymbol{X_{ijt}}$ are controls varying at either the origin-year, destination-year, or origin-destination-year level, which we divided into 3 groups:

1. Economic variables:
    a. log of GDP (USD current)
    b. log of population
    c. regulatory quality (score)
    d. FDI restrictiveness which measures statutory restrictions on FDI
2. Environment-relate variables:
    a. Emissions (per capita)
    b. Log of Energy Imports (ktoe – kilo tonnes of oil equivalent)
    c. (Ratification of) Kyoto Protocol
    d. (Ratification of) Paris Agreement: =1 if ratified at time *t*
    e. KP and PA combined: =1 when both countries are parties to either Kyoto protocol or Paris Agreement at time *t*, and 0 otherwise
3. Gravity variables:
    a. Log of Distance (between capital cities, in km)
    b. Common legal framework: =1 if both countries have common legal framework post transition
    c. Entry cost (of business start-up procedures)
    d. Entry time (required to start a business)

The sources of these variables are presented in Table 1. Literature on determinants of renewable energy development is abundant. Przychodzen and Przychodzen (2020) found that higher economic growth, rising levels of unemployment, size of general government debt, and implementation of the Kyoto Protocol were all significant positive predictors of renewable energy generation. We, thus, control for the level of economic development[9] and the ratification of the Kyoto Protocol and Paris Agreement in our analysis. Additionally, Marques and Fuinhas (2012) found that interest in renewable energy is also motivated by the goal of becoming energy self-reliant and reducing carbon emissions. We follow them to include energy imports and per capita emissions in ASEAN countries in our specifications.

[9] See Marques, Fuinhas, and Pires Manso (2010), Chang, Huang, and Lee (2009) and Azarova and Jun (2021).

An important aspect of attracting cross-border investment is the domestic investment climate.[10] Regulatory quality, defined as the perceptions of the ability of the government to formulate and implement sound policies and regulations[11], is found to support investments in renewable energy.[12] Further, restrictions on FDI have also been found to impact investments.[13] Therefore, we also control for other FDI-affecting variables include the time and cost of setting up a business in the destination country, which likely impacts its attractiveness to investors. Since we are focussing on bilateral investments, we also include a couple of gravity model related variables – distance between capital cities and common legal framework after transition.

Table 1: Control variables and their sources

Variable	**Source**
Nominal GDP	World Development Indicators
Population	World Development Indicators
Emissions, per capita	Global Carbon Budget
Energy imports (ktoe)	OECDStats
Kyoto Protocol	UN Treaty Collection
Paris Agreement	UN Treaty Collection
Regulatory Quality	World Governance Indicators
FDI Restrictiveness Index	OECD
Distance between capital cities (KM)	CEPII
Common legal origins after transition	
Cost of business start-up procedures	
Time required to start business (days)	

Source: Authors' compilation

4. Results

Results of the specification (1) are reported in Table 2. Column (1) reports the estimate of the impact of policy on bilateral investments taking into account destination country-specific variables. The second set of results in column (2) controls for additional destination country-specific variables. Column (3) adds two gravity model-related variables, and column (4) includes FDI-affecting variables. Results in Table 1 show a positive correlation between climate legislation and bilateral investments in renewable energy in ASEAN countries. The results remain significant even as we control for more variables impacting FDI and renewable energy. On average, each additional climate policy enacted is associated with a 2.3% increase in the share of investment in renewable energy. As we account for more variables, the share remains significant at 2.2%.

[10] See Ang, Röttgers, and Burli (2017).
[11] See World Bank (2023).
[12] See Liu et al. (2021), Kim (2020) and Azarova and Jun (2021).
[13] See Mistura and Roulet (2019).

Table 2: Impact of climate legislation

VARIABLES	(1)	(2)	(3)	(4)
$policy_{jt}$	0.023***	0.022***	0.022***	0.022***
	(0.005)	(0.006)	(0.006)	(0.008)
$log(GDP)_{jt}$	0.067	0.071	0.071	0.123
	(0.065)	(0.068)	(0.069)	(0.089)
$regulatory\_quality_{jt}$	-0.006	0.002	-0.004	0.048
	(0.075)	(0.086)	(0.087)	(0.097)
$emissions\_pc_{jt}$	0.019	0.027	0.030	0.045
	(0.023)	(0.021)	(0.021)	(0.035)
$log(energy\_imports)_{jt}$	0.013	-0.001	-0.004	-0.011
	(0.043)	(0.047)	(0.047)	(0.061)
$log(population)_{jt}$	1.163***	1.136**	1.143**	0.697
	(0.422)	(0.480)	(0.470)	(0.694)
KP_PA_{ijt}		0.116*	0.113*	0.630***
		(0.069)	(0.069)	(0.097)
$policy_{it}$		-0.001	-0.001	0.001
		(0.001)	(0.001)	(0.002)
$log(GPD)_{it}$		-0.113*	-0.113*	-0.119
		(0.069)	(0.069)	(0.084)
$log(distance)_{ijt}$			-0.082	-0.046
			(0.091)	(0.096)
$common\_legal\_framework_{ijt}$			0.104***	0.118***
			(0.034)	(0.038)
$entry\_cost_{jt}$				-0.001*
				(0.000)
$entry\_time_{jt}$				-0.000
				(0.001)
$FDI\_restrictiveness_{jt}$				0.009
				(0.009)
$year$	-0.035***	-0.033***	-0.033***	-0.038**
	(0.010)	(0.012)	(0.012)	(0.015)
KP_{jt}	0.037			
	(0.064)			
PA_{jt}	-0.013			
	(0.037)			
Constant	48.955***	48.618***	48.499***	65.180***
	(16.164)	(17.793)	(17.775)	(22.024)
Observations	610	507	507	454
R-squared	0.192	0.204	0.213	0.254

Notes: The dependent variable is the share of investment in renewable energy from partner i to ASEAN country j in total investment in energy from i to j. Robust standard errors are reported in the parentheses.

Table 3 checks for the robustness of our results by using one-period lag of the number of climate legislation, all other control variables remained unchanged. The positive relationship between bilateral renewable investments and climate legislation remains robust in these specifications.

Table 3: Impact of climate legislation, robustness check

VARIABLES	(1)	(2)	(3)	(4)
$policy_{jt-1}$	0.021***	0.018**	0.017**	0.016*
	(0.007)	(0.007)	(0.007)	(0.009)
$log(GDP)_{jt}$	0.081	0.098	0.102	0.130
	(0.073)	(0.081)	(0.081)	(0.096)
$regulatory\_quality_{jt}$	0.069	0.068	0.057	0.089
	(0.082)	(0.098)	(0.099)	(0.112)
$emissions\_pc_{jt}$	0.015	0.010	0.010	0.038
	(0.022)	(0.022)	(0.023)	(0.038)
$log(energy\_imports)_{jt}$	0.001	-0.001	-0.006	-0.008
	(0.052)	(0.060)	(0.060)	(0.067)
$log(population)_{jt}$	0.598	0.582	0.547	0.189
	(0.481)	(0.541)	(0.527)	(0.777)
KP_PA_{ijt}		0.068	0.065	0.605***
		(0.087)	(0.087)	(0.100)
$policy_{it}$		-0.001	-0.001	0.001
		(0.001)	(0.001)	(0.002)
$log(GPD)_{it}$		-0.117	-0.123*	-0.135
		(0.074)	(0.074)	(0.083)
$log(distance)_{ijt}$			-0.086	-0.066
			(0.098)	(0.099)
$common\_legal\_framework_{ijt}$			0.109***	0.117***
			(0.039)	(0.042)
$entry\_cost_{jt}$				-0.001
				(0.000)
$entry\_time_{jt}$				-0.000
				(0.001)
$FDI\_restrictiveness_{jt}$				0.012
				(0.010)
$year$	-0.029***	-0.026**	-0.024**	-0.026*
	(0.011)	(0.013)	(0.012)	(0.015)
KP_{jt}	0.046			
	(0.077)			
PA_{jt}	-0.010			
	(0.040)			
Constant	45.719***	43.123**	41.867**	50.908**
	(17.618)	(19.641)	(19.449)	(22.794)
Observations	578	476	476	440
R-squared	0.189	0.199	0.207	0.253

Notes: The dependent variable is the share of investment in renewable energy from partner i to ASEAN country j in total investment in energy from i to j. Robust standard errors are reported in the parentheses.

5. Conclusion

Climate change is a malady that has universally gripped the global citizenry, businesses, and governments. Governments worldwide have time and again organised themselves into groups and blocs to address the issue of climate change collectively. The mass appeal and near-universal ratification of the Kyoto Protocol and the Paris Agreement are two cases in point. This was followed by passage of multiple climate policies and legislation with varying degrees of objectives and strategies.

In our study, we estimate the impact of such climate policies, particularly in the energy sector, on the investments in renewable energy in ASEAN countries. We find that there is a positive correlation between climate policies in ASEAN countries and the renewable investment inflows. Our results underline the important role of climate policies in attracting investments in renewable energy. Even though we don't

establish causation, our results indicate that national climate policies signal to foreign investors the commitment to developing renewable energy, which attracts investment.

There are a few limitations of our study. First, the analysis did not include Brunei and Singapore since the data on renewables investments was missing. Second, we only dealt with public and quasi-public investments in renewable energy due to data limitation. Inclusion of private investments can perhaps paint a better picture of the overall investment environment in ASEAN. Third, there may be sub-national policies that were not included in our analysis due to lack of data availability. Our study, nonetheless, offers avenues for further research including analysing private investment flows into the ASEAN region and how they impacted by not just country-specific policies but also bloc-wide policies.

References:

Ang, Geraldine, Dirk Röttgers, and Pralhad Burli. 2017. "The Empirics of Enabling Investment and Innovation in Renewable Energy." Paris: OECD. https://doi.org/10.1787/67d221b8-en.

Azarova, Ekaterina, and Hannah Jun. 2021. "Investigating Determinants of International Clean Energy Investments in Emerging Markets." *Sustainability* 13 (21): 11843. https://doi.org/10.3390/su132111843.

Azhgaliyeva, Dina, John Beirne, and Ranjeeta Mishra. 2023. "What Matters for Private Investment in Renewable Energy?" *Climate Policy* 23 (1): 71–87. https://doi.org/10.1080/14693062.2022.2069664.

Aziz, Shakila, and Sheikh Morshed Jahan. 2023. "Determinants of International Development Investments in Renewable Energy in Developing Countries." *Energy for Sustainable Development* 74 (June): 215–30. https://doi.org/10.1016/j.esd.2023.04.008.

Balogh, Jeremiás Máté, and Tamás Mizik. 2023. "Global Impacts of Climate Policy and Trade Agreements on Greenhouse Gas Emissions." *Agriculture* 13 (2): 424. https://doi.org/10.3390/agriculture13020424.

Bassetti, Francesco. 2022. "Success or Failure? The Kyoto Protocol's Troubled Legacy." *Foresight* (blog). December 8, 2022. https://www.climateforesight.eu/articles/success-or-failure-the-kyoto-protocols-troubled-legacy/.

Bergquist, Parrish, and Christopher Warshaw. 2023. "How Climate Policy Commitments Influence Energy Systems and the Economies of US States." *Nature Communications* 14 (1): 4850. https://doi.org/10.1038/s41467-023-40560-y.

Bogmans, Christian, Andrea Pescatori, and Ervin Prifti. 2023. "The Impact of Climate Policy on Oil and Gas Investment: Evidence from Firm-Level Data." *IMF Working Papers* 2023 (140). https://doi.org/10.5089/9798400248443.001.A001.

C. Jaeger, Carlo, Leonidas Paroussos, Diana Mangalagiu, Roland Kupers, Antoine Mandel, and Joan David Tabara. 2011. "A New Growth Path for Europe." Synthesis Report. German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. https://globalclimateforum.org/fileadmin/ecf-documents/Press/A_New_Growth_Path_for_Europe__Synthesis_Report.pdf.

Calvin, Katherine, Dipak Dasgupta, Gerhard Krinner, Aditi Mukherji, Peter W. Thorne, Christopher Trisos, José Romero, et al. 2023. "IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (Eds.)]. IPCC, Geneva, Switzerland." First. Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647.

Carley, Sanya. 2009. "State Renewable Energy Electricity Policies: An Empirical Evaluation of Effectiveness." *Energy Policy* 37 (8): 3071–81.

Chang, Ting-Huan, Chien-Ming Huang, and Ming-Chih Lee. 2009. "Threshold Effect of the Economic Growth Rate on the Renewable Energy Development from a Change in Energy Price: Evidence from OECD Countries." *Energy Policy* 37 (12): 5796–5802. https://doi.org/10.1016/j.enpol.2009.08.049.

Climate Action Tracker. 2023. "Indonesia." Indonesia. December 2023. https://climateactiontracker.org/countries/indonesia/.

———. 2024. "CAT Climate Target Update Tracker." January 1, 2024. https://climateactiontracker.org/climate-target-update-tracker-2022/.

Climate Change Laws of the World. n.d. "Law and Policy Search - Climate Change Laws of the World." Accessed January 30, 2024. https://climate-laws.org/.

Darvas, Zsolt M., and Guntram B. Wolff. 2021. "A Green Fiscal Pact: Climate Investment in Times of Budget Consolidation." Research Report. Bruegel Policy Contribution. https://www.econstor.eu/handle/10419/251071.

D'Orazio, Paola, and Philipp Löwenstein. 2022. "Mobilising Investments in Renewable Energy in Germany: Which Role for Public Investment Banks?" *Journal of Sustainable Finance & Investment* 12 (2): 451–74. https://doi.org/10.1080/20430795.2020.1777062.

Eckstein, David, Vera Kunzel, and Laura Schafer. 2021. "Global Climate Risk Index 2021." Briefing Paper. German Watch. https://www.germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021_2.pdf .

Ehlers, Torsten, Charlotte Gardes-Landolfini, Fabio Natalucci, and Ananthakrishnan. 2022. "How to Scale Up Private Climate Finance in Emerging Economies." IMF. October 7, 2022. https://www.imf.org/en/Blogs/Articles/2022/10/07/how-to-scale-up-private-climate-finance-in-emerging-economies.

Eskander, Shaikh M. S. U., and Sam Fankhauser. 2020. "Reduction in Greenhouse Gas Emissions from National Climate Legislation." *Nature Climate Change* 10 (8): 750–56. https://doi.org/10.1038/s41558-020-0831-z.

Eyraud, Luc, Benedict Clements, and Abdoul Wane. 2013. "Green Investment: Trends and Determinants." *Energy Policy* 60 (C): 852–65.

Frye, Zachary. 2020. "Extreme Weather Highlights Southeast Asia's Vulnerability to Climate Change | ASEAN Today." November 2, 2020. https://www.aseantoday.com/2020/11/extreme-weather-highlights-southeast-asias-vulnerability-to-climate-change/.

Georgieva, Kristalina, and Tobias Adrian. 2022. "Public Sector Must Play Major Role in Catalyzing Private Climate Finance." IMF. August 18, 2022. https://www.imf.org/en/Blogs/Articles/2022/08/18/public-sector-must-play-major-role-in-catalyzing-private-climate-finance.

Ghosh, Saibal. 2023. "Does Climate Legislation Matter for Bank Lending? Evidence from MENA Countries." *Ecological Economics* 212 (October): 107923. https://doi.org/10.1016/j.ecolecon.2023.107923.

Gongloff, Mark. 2023. "$200 Trillion Is Needed to Stop Global Warming. That's a Bargain." *Bloomberg.Com*, July 5, 2023. https://www.bloomberg.com/opinion/articles/2023-07-05/-200-trillion-is-needed-to-stop-global-warming-that-s-a-bargain.

Guo, Ling ling, Ying Qu, and Ming-Lang Tseng. 2017. "The Interaction Effects of Environmental Regulation and Technological Innovation on Regional Green Growth Performance." *Journal of Cleaner Production* 162 (September): 894–902. https://doi.org/10.1016/j.jclepro.2017.05.210.

International Energy Agency. 2023. "Renewables - Energy System." IEA. 2023. https://www.iea.org/energy-system/renewables.

International Monetary Fund Asia and Pacific Dept. 2021. "Indonesia and Climate Change: Recent Developments and Challenges." *IMF Staff Country Reports* 2021 (047). https://doi.org/10.5089/9781513570860.002.A007.

International Renewable Energy Agency. 2023. "Investment Needs of USD 35 Trillion by 2030 for Successful Energy Transition." March 28, 2023. https://www.irena.org/News/pressreleases/2023/Mar/Investment-Needs-of-USD-35-trillion-by-2030-for-Successful-Energy-Transition.

———(a). n.d. "IRENA – International Renewable Energy Agency." Accessed January 30, 2024. https://www.irena.org/.

———(b). n.d. "Renewable Energy Finance Flows." Accessed January 30, 2024. https://www.irena.org/Data/View-data-by-topic/Finance-and-Investment/Renewable-Energy-Finance-Flows.

Jaeger, Carlo C, Franziska Schütze, Jahel Mielke, Gesine Steudle, Sarah Wolf, Steffen Fürst, Diana Mangalagiu, Frank Meißner, and Leonidas Paroussos. 2015. "Investment-Oriented Climate Policy: An Opportunity for Europe." German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. https://www.bmuv.de/fileadmin/Daten_BMU/Pools/Forschungsdatenbank/fkz_um13_41_179_eu_climate_bf.pdf.

Jaraite, Jurate, Andrius Kazukauskas, and Tommy Lundgren. 2014. "The Effects of Climate Policy on Environmental Expenditure and Investment: Evidence from Sweden." *Journal of Environmental Economics and Policy* 3 (2): 148–66. https://doi.org/10.1080/21606544.2013.875948.

Kawabata, Toyo. 2019. "What Are the Determinants for Financial Institutions to Mobilise Climate Finance?" *Journal of Sustainable Finance & Investment* 9 (4): 263–81. https://doi.org/10.1080/20430795.2019.1611148.

Kim, Jung Eun. 2020. "Regulation Trumps Economics? Examining Renewable Energy Policy, Diffusion and Investment in 80 Developing Countries." *Energy Research & Social Science* 70 (December): 101613. https://doi.org/10.1016/j.erss.2020.101613.

Limited, Bangkok Post Public Company. 2023. "Asean Heat Wave Blamed on Climate Inaction." *Bangkok Post*, May 17, 2023. https://www.bangkokpost.com/thailand/general/2572680/asean-heat-wave-blamed-on-climate-inaction.

Liu, Jia, Dayong Zhang, Jing Cai, and John Davenport. 2021. "Legal Systems, National Governance and Renewable Energy Investment: Evidence from Around the World." *British Journal of Management* 32 (3): 579–610. https://doi.org/10.1111/1467-8551.12377.

Macan-Markar, Marwaan. 2018. "Chinese Dams Ramp up Lao External Debt." Nikkei Asia. November 2, 2018. https://asia.nikkei.com/Economy/Chinese-dams-ramp-up-Lao-external-debt.

Maizland, Lindsay. 2023. "Global Climate Agreements: Successes and Failures." Council on Foreign Relations. December 5, 2023. https://www.cfr.org/backgrounder/paris-global-climate-change-agreements.

Marques, António C., José A. Fuinhas, and J. R. Pires Manso. 2010. "Motivations Driving Renewable Energy in European Countries: A Panel Data Approach." *Energy Policy*, Energy Efficiency Policies and Strategies with regular papers., 38 (11): 6877–85. https://doi.org/10.1016/j.enpol.2010.07.003.

Marques, António Cardoso, and José Alberto Fuinhas. 2012. "Are Public Policies towards Renewables Successful? Evidence from European Countries." *Renewable Energy* 44 (August): 109–18. https://doi.org/10.1016/j.renene.2012.01.007.

Meckling, Jonas, Joseph E. Aldy, Matthew J. Kotchen, Sanya Carley, Daniel C. Esty, Peter A. Raymond, Bella Tonkonogy, Charles Harper, Gillian Sawyer, and Julia Sweatman. 2022. "Busting the Myths around Public Investment in Clean Energy." *Nature Energy* 7 (7): 563–65. https://doi.org/10.1038/s41560-022-01081-y.

Mekong River Commission (MRC). n.d. "Fast Facts about the Pak Lay Hydropower Project." Accessed January 29, 2024. https://www.mrcmekong.org/assets/Uploads/Fast-facts-about-Pak-Lay-hydropower-project.pdf.

Menz, Fredric C., and Stephan Vachon. 2006. "The Effectiveness of Different Policy Regimes for Promoting Wind Power: Experiences from the States." *Energy Policy* 34 (14): 1786–96. https://doi.org/10.1016/j.enpol.2004.12.018.

Mistura, Fernando, and Caroline Roulet. 2019. "The Determinants of Foreign Direct Investment: Do Statutory Restrictions Matter?" Paris: OECD. https://doi.org/10.1787/641507ce-en.

Nachmany, Michal, Sam Fankhauser, Jana Davidová, Nick Kingsmill, Hitomi Roppongi, Philip Schleifer, Joana Setzer, et al. 2015. "The 2015 Global Climate Legislation Study." https://eprints.lse.ac.uk/65347/1/__lse.ac.uk_storage_LIBRARY_Secondary_libfile_shared_repository_Content_Grantham%20Institute_Globe%20climate%205ed_Global_climate_legislation_study%205t%20ed_2015.pdf.

Organisation for Economic Co-operation and Development. 2017. "Investing in Climate, Investing in Growth." https://web-archive.oecd.org/2017-05-22/438923-Key-findings.pdf.

Prasad, Ananthakrishnan, Elena Loukoianova, Alan Xiaochen Feng, and William Oman. 2022. "Mobilizing Private Climate Financing in Emerging Market and Developing Economies." *Staff Climate Notes* 2022 (007). https://doi.org/10.5089/9798400216428.066.A001.

Przychodzen, Wojciech, and Justyna Przychodzen. 2020. "Determinants of Renewable Energy Production in Transition Economies: A Panel Data Approach." *Energy* 191 (January): 116583. https://doi.org/10.1016/j.energy.2019.116583.

Ragosa, Giulia, and Peter Warren. 2019. "Unpacking the Determinants of Cross-Border Private Investment in Renewable Energy in Developing Countries." *Journal of Cleaner Production* 235 (October): 854–65. https://doi.org/10.1016/j.jclepro.2019.06.166.

Savaresi, Annalisa. 2016. "The Paris Agreement: A New Beginning?" *Journal of Energy & Natural Resources Law* 34 (1): 16–26. https://doi.org/10.1080/02646811.2016.1133983.

Schütze, Franziska, Steffen Fürst, Jahel Mielke, Gesine A. Steudle, Sarah Wolf, and Carlo C. Jaeger. 2017. "The Role of Sustainable Investment in Climate Policy." *Sustainability* 9 (12): 2221. https://doi.org/10.3390/su9122221.

Songwe, Vera, Nicholas Stern, and Amar Bhattacharya. 2022. "Finance for Climate Action: Scaling up Investment for Climate and Development." London School of Economics and Political Science.

Sullivan, Rory. 2014. "Climate Change: Implications for Investors and Financial Institutions." http://www.ssrn.com/abstract=2469894.

Tollefson, Jeff. 2014. "National Policies Advance as Climate Summit Approaches." *Nature*, February. https://doi.org/10.1038/nature.2014.14786.

Townshend, Terry, Samuel Fankhauser, Rafael Aybar, Murray Collins, Tucker Landesman, Michal Nachmany, and Carolina Pavese. 2013. "How National Legislation Can Help to Solve Climate Change." *Nature Climate Change* 3 (May): 430–32. https://doi.org/10.1038/nclimate1894.

United Nations. n.d. "Climate Change." *United Nations Sustainable Development* (blog). Accessed January 29, 2024. https://www.un.org/sustainabledevelopment/climate-change/.

United Nations Conference on Trade and Development. 2021. *World Investment Report 2021: Investing in Sustainable Recovery*. United Nations Conference on Trade and Development (UNCTAD) World Investment Report (WIR). United Nations. https://doi.org/10.18356/9789210054638.

United Nations Framework Convention on Climate Change(b). n.d. "The Paris Agreement." Accessed January 29, 2024. https://unfccc.int/process-and-meetings/the-paris-agreement.

———(a). n.d. "What Is the Kyoto Protocol?" Accessed January 29, 2024. https://unfccc.int/kyoto_protocol.

World Bank. 2017. "Roadmap for a Sustainable Financial System." https://unepinquiry.org/wp-content/uploads/2017/11/Roadmap_for_a_Sustainable_Financial_System.pdf.

———. 2023. "Worldwide Governance Indicators." Text/HTML. World Bank. 2023. https://www.worldbank.org/en/publication/worldwide-governance-indicators.

Yang, Xiaolei, Lingyun He, Yufei Xia, and Yufeng Chen. 2019. "Effect of Government Subsidies on Renewable Energy Investments: The Threshold Effect." *Energy Policy* 132 (September): 156–66. https://doi.org/10.1016/j.enpol.2019.05.039.