European Journal of Political Research ●●: ●●–●●, 2022
doi: 10.1111/1475-6765.12539

The effect of women's parliamentary participation on renewable energy policy outcomes

HANNAH SALAMON
School of Government and Public Policy, University of Strathclyde, UK

Abstract. Decreasing CO2 emissions, a top priority of climate change mitigation, requires moving away from fossil fuels and towards renewable energy. Research shows that women tend to exhibit more knowledge about climate change, environmental concerns, and pro-environmental behaviour than men. Theories linking descriptive and substantive representation suggest that women representatives better represent women citizens' policy preferences. Therefore, do higher levels of women's parliamentary participation increase renewable energy consumption? A time-series cross-sectional analysis of 100 democracies from 1997 to 2017 provides evidence for such a relationship in both high- and middle-income democracies. Lagged modelling demonstrates that high-income states see more immediate effects while they take longer to materialize in middle-income states. These findings contribute to our growing understanding of women's role in policymaking outside of 'women's issues' and offer a means of advancing climate-friendly energy policy.

Keywords: women's representation; gender, environmental politics; climate change mitigation; comparative politics; descriptive representation; substantive representation

Introduction

Climate change is perhaps the most threatening international crisis ever faced by the global community. While all human beings will experience its consequences, we will not all experience them equally – resource restriction, negative health outcomes resulting from exposure to pollutants and environmental destruction and the ability to recover from climate change-related disasters are often contingent on identity (Islam & Winkel, 2017). Because women may lack social and economic resources to adapt to climate change, bear the brunt of household tasks and make up a large percentage of the world's poor (Carlsson-Kanyama & Lindén, 2007; Figueiredo & Perkins, 2013; Fonjong, 2008; Neumayer & Plümper, 2007) they experience the uniquely gendered costs of climate change.

Yet, the last half-century has seen a steady increase in the number of women in governance around the world, inspiring academics to question whether women make different political decisions than their male counterparts. While women make up just a quarter of parliamentary seats globally (World Bank Open Data, 2019a, 2019b, 2019c, 2019d) and are systemically excluded from law-making and many other global power networks (MacKinnon, 1989), women have made notable impacts on policy and governance. Issues like abortion, domestic violence and human trafficking have faced greater attention as women's participation in governance have grown (Wittmer & Bouché, 2013), leading eminent political scientist Jane Mansbridge to insist that 'descriptive representation by gender improves substantive representation outcomes for women in every polity for which we have a measure' (2005, p. 622). And yet, the effect of increasing women's participation in government affects not only issues deemed traditionally 'female' and

may improve outcomes not just for women. The growing body of literature investigating women's role in climate change governance suggests that women, specifically in developed countries, favour environmentalism to a greater extent than their male counterparts at the citizen level (Arnocky & Stroink, 2010; Goldsmith, et al., 2013; Hunter et al., 2004; McCright, 2010; Semenza et al., 2011; Tranter, 2011) and that increases in women's participation in governance lead to positive environmental outcomes (Ergas & York, 2012; Fredriksson & Wang, 2011; Lv & Deng, 2018; McGee et al., 2020; Norgaard & York, 2005; Nugent & Shandra, 2009; Ramstetter & Habersack, 2019; Salahodjaev & Jarilkapova, 2020).

I seek to contribute to the existing literature by investigating the roles of both time and state wealth in the emergence of climate change-related policy outcomes resulting from women's increased political participation. I account for time because policy outcomes or the results of policymaking are 'often indirect, diffuse, and take time to appear' (Hallsworth, 2011, p. 6), which has rarely been accounted for in the women's representation and environmentalism literature. Additionally, as the literature on climate change preferences suggests a gender gap between women's and men's environmental preferences specifically in developed states, I investigate the impact of state wealth on the link between women's representation and climate change outcomes.

I argue that women's presence in parliaments may impact the ultimate outcome of renewable energy consumption, a dependent variable missing from the women's representation and climate change literature, yet crucial to climate change mitigation in practice. I hypothesize that because women representatives may seek to substantively represent women's pro-environmental preferences, they may support various policies which favour renewable energy consumption, subsequently increasing renewable energy consumption itself. For these reasons, I assert that women MPs' substantive representation of their women constituents as well as their left-leaning and women-centric influence on party stances will lead to an aggregate effect of increased renewable energy consumption in developed countries. Because the evidence for a gender gap in climate change preferences is strongest in developed states (Arnocky & Stroink, 2010; Goldsmith et al., 2013; Hunter et al., 2004; McCright, 2010; Semenza et al., 2011; Tranter, 2011), effects of this representation will be most pronounced in these contexts. In addition, I put forth that these effects will take time to materialize.

To test women's influence on this climate change outcome with specific attention to both time and state development, I consider renewable energy consumption as a main dependent variable in a series of time-series cross-sectional regressions of 100 democracies (Dahlberg et al., 2018) from 1997 to 2017. I find positive relationships between women's representation and renewable energy consumption in both high-income and middle-income states, and while richer democracies exhibit more immediate relationships, those of less developed states take longer to materialize. These results provide a greater understanding of women parliamentarian's impact on policy outcomes, the contexts in which these outcomes emerge and the drivers of these outcomes, moving past correlational relationships found in the existing literature to demonstrate *when* and *where* women's political participation matters for climate change outcomes.

Gender and the environment: Theoretical and empirical connections

Predicting that women's participation in parliaments impacts environmental outcomes, like renewable energy policy, rests on some key foundations. First, public opinion research has shown that men and women in developed countries perceive climate change differently, with women

more likely to be worried about and take action against climate change as well as to support environmental energy choices (Arnocky & Stroink, 2010; Goldsmith et al., 2013; Hunter et al., 2004; McCright, 2010; Noblet et al., 2015; Semenza et al., 2011; Tranter, 2011).

This has implications for both representation and party platforms. The theoretical literature of descriptive and substantive representation discusses the mechanisms through which women, as an underrepresented group, may influence policy outcomes (Franceschet & Piscopo, 2008; Hero & Tolbert, 1996; Mansbridge, 1999; Phillips, 1995), while another stream of the literature shows how women's presence in party delegations affects party platforms (Greene & O'Brien, 2016; Keith & Verge, 2018; Kittilson, 2011). In addition, previous research shows that women's individual-level preferences are reflected among political elites (Ergas & York, 2012; Fredriksson & Wang, 2011; Norgaard & York, 2005; Nugent & Shandra, 2009; Salahodjaev & Jarilkapova, 2020; Ramstetter & Habersack, 2019). Thus, I argue that increased participation of women in parliaments may increase the likelihood that women's pro-environmental views are reflected in policy and translate into policy outcomes. I discuss the stages of this causal mechanism in more detail below.

Individual-level gender gaps

In both the developed and developing world, gendered differences persist in men's and women's experiences of climate change and thus in their climate change opinions and policy preferences. With disproportionate responsibility to perform household tasks and manage resources, women are more directly impacted when resources necessary for the health and survival of the family are unavailable (Agarwal, 2010). Women are more often harmed and killed in natural disasters due to a lack of financial resources and independence, insufficient social support and restrictive cultural expectations (Denton, 2002; Figueiredo & Perkins, 2013; Fonjong, 2008; Lookabaugh, 2017; Makina & Moyo, 2016; Neumayer & Plumper, 2007). Since women spend more time indoors conducting household labour and using energy than men, they face more dire health consequences of indoor air pollution in the home (Carlsson-Kanyama & Lindén, 2007; Soria et al., 2016); a Sweden-based study showed that women spend twice as much time as men on energy-intensive household tasks and that changing the availability or pricing of energy increases this already unequal workload (Carlsson-Kanyama & Lindén, 2007).

Gendered experiences of climate change may thus inform women's climate change opinions and policy preferences. Yet, the vast majority of the literature on the gender gap in climate change preferences comes from developed countries. Research has indicated that relative to men, American women are more knowledgeable about climate change (McCright, 2010), and Canadian women are more worried about the potential effects of climate change (Arnocky & Stroink, 2010). Hunter et al. (2004) show that women behave more environmentally than men, particularly in private, in higher income countries. Canadian women demonstrate a greater willingness to participate in ecological cooperation, a relationship which was mediated by gendered differences in empathy (Arnocky & Stroink, 2010). Australian women demonstrate more favourable attitudes towards environmental protection and concern for particularly global environmental issues than men (Tranter, 2011), and women in the United States are more willing to act against climate change because they are less likely than men to partake in system justification, or the 'psychological tendency to maintain certainty, security, and solidarity through motivated perceptions of the status quo' (Goldsmith et al., 2013, p. 159). In the United States, women are more likely to reduce their own energy consumption in response to the risk of climate change (Semenza et al., 2011). Noblet

et al. (2015) find in a Maine-based study that women were more likely to support eco-friendly energy policy. Climate change attitudes in high-income countries, Bush and Clayton (2021) show, are a function of differential perceptions of environmental policy between women and men: men tend to prioritize their perceptions of the personal and societal costs of climate change mitigation efforts, while women are more likely to perceive its benefits.

Women in the legislative process: Mechanisms of representation and party influence

While the evidence shows that women, mostly in developed countries, have demonstrably more environmentally friendly opinions at the individual level, here I outline the ways women may affect parliamentary outcomes: first, through substantively representing women's preferences, and second, through impacting the positions of political parties.

A wide body of literature demonstrates that descriptive representation of marginalized groups, in which representatives 'in their own backgrounds mirror some of the more frequent experiences and outward manifestations of belonging to the group' (Mansbridge, 1999, p. 628), leads to improved quality of life of that group (Hero & Tolbert, 1996). In other words, descriptive representation, in which representatives have similar characteristics to their constituents, leads to substantive representation, in which legislators better represent constituents similar to them. Increasing women's influence in male-dominated decision-making spaces could diversify deliberation in the democratic process as policymakers seek to understand 'which policies are good for the polity as a whole, which policies are good for a representative's constituents, and when the interests of various groups within the polity and constituency conflict' (Mansbridge, 1999, p. 634).

Substantive representation, as Anne Phillips (1995) argues, relies on a 'politics of presence', in which a 'necessary condition for the representation of women's interests is the presence of women in decision-making bodies' (Campbell et al., 2009, p. 172). When there are fewer women in male-dominated institutions, it can be difficult or impossible for women parliamentarians to 'aggregate the diverse priorities of women citizens' (Clayton et al., 2019, p. 92). In fact, a greater presence of women within governing bodies can offer women citizens an additional form of representation should the representative of their geographic constituency fail to represent them substantively (Boas & Smith, 2019).

While women are a heterogeneous group without a single set of political preferences or values, increasing the number of women within governing bodies can widen the range of issues deemed politically important while revealing the often-gendered nature of these issues (Greene & O'Brien, 2016). Childs and Krook (2006) speak to the importance of critical actors, women representatives 'who initiate policy proposals on their own, even when women form a small minority, and embolden others to take steps to promote policies for women, regardless of the proportion of female representatives (p. 528). The more women there are in parliament, the more likely the existence of many critical actors – more women to advance their women constituents' interests in government.

Within the representation literature, four main frameworks attempt to explain why legislators may represent constituents with whom they share descriptive similarities. First, shared experiences of individual and elite women may lead to preference convergence of these groups. Women at both the individual and elite levels navigate gendered social roles, and thus they may come to hold congruent beliefs based on these experiences (Phillips, 1995). Second, women in

government may have a desire to represent their women constituents specifically, regardless of whether or not they share experiences or preferences. Because women have been systematically excluded from governance, women representatives may put forth the preferences of their women constituents in order to counteract historic power imbalances (Franceschet & Piscopo, 2008). Next, the socialization framework posits that a group's rhetoric has an impact on individual-level preferences. The gendered aspects of women's lives, from being in charge of resource allocation to being socialized long-term to 'clean up messes' (Boas & Smith, 2019; Stoddart & Tindall, 2011), may have a socializing effect on both women at the individual level and women at the elite level with respect to their desire to protect and support the health of the environment. Finally, women representatives may have electoral incentives to intentionally represent women to gain re-election (Lloren et al., 2015). Voters of oppressed or under-represented groups may expect to be better represented by descriptive representatives than by traditional politicians, many of whom hail from privileged social and political groups (Mansbridge, 1999, p. 628). Bailer et al. (2018) show that representatives of under-represented backgrounds may seek to substantively represent their constituents early in their careers to '[bestow] credibility when they have hardly any legislative track record and few opportunities to demonstrate their expertise' (p. 2).

It is through these mechanisms that women may be better positioned than men to represent women constituents' preferences which, in developed countries, tend to be pro-environmental. In addition, the literature on women's effect on party politics offers another avenue through which the increased presence of women representatives in parliaments may contribute to greener outcomes like renewable energy consumption.

In most cases, representatives' actions are dictated at least in part by their political party. Parties 'bring together a multitude of interests within a single organization' (Greene & O'Brien, 2016, p. 435), and thus may limit individual party members' abilities to propose or vote for policies off the party line. Yet, increasing evidence suggests that the inclusion of women within parties' parliamentary delegations has notable effects on the policy positions of parties themselves. Greene and O'Brien (2016) show that greater representation of women in political parties not only increases the diversity of issues they address in election campaigns but also pushes parties' manifestos to the left. Kittilson (2011) finds that women's presence in parties significantly increases parties' emphasis on social justice and increases the existence of gender quotas in parties. Keith and Verge (2018) find, in addition, that the best indicator of parties' 'commitment to gender equality in decision-making positions is the percentage of women's representation in the national parliament' (p. 400). Taken together, women's increased presence in political parties pushes these parties both to the left of the political spectrum as well towards women's interests.

Thus, increasing numbers of women in parliament may increase the potential for environmentalism and thus sustainable energy policy to be prioritized, as women may substantively represent women's preferences more effectively than their male counterparts and may also push parties towards both leftward-leaning politics and women's interests. Women, as minorities in parliaments all around the world, can and do impact policy indirectly in this way – by helping to shape the policy stances of their parties, in part by advocating for women's preferences. Thus, I predict that:

H1: Democracies with a greater share of women in their parliaments will have better renewable energy outcomes.

Existing literature demonstrates that nations with higher proportions of women in parliament are more likely to ratify environmental treaties (Norgaard & York, 2005), create more protected land areas (Nugent & Shandra, 2009), have lower CO_2 emissions (Ergas & York, 2012), experience less deforestation and maintain more forest cover (Salahodjaev & Jarilkapova, 2020). Women legislators in the US.' House of Representatives favour more stringent environmental policies (Fredriksson & Wang, 2011), and countries with higher women's political empowerment see long-term reductions in CO_2 emissions (Lv & Deng, 2018). Women members of the European Parliament were significantly more likely than their male counterparts to support environmental legislation (Ramstetter & Habersack, 2019), and while increases in GDP can often increase emissions, nations with more gender equality see a much weaker association between GDP and CO_2 emissions (McGee et al., 2020). While this literature demonstrates a relationship between women's presence in parliaments and various environmental outcomes, it fails to consider two important factors that I account for in the present analysis. Below I explore, first, the impacts of time on the emergence of policy outcomes and, second, the role of state wealth on the potential relationships between women's representation and environmental outcomes.

The effect of time on the emergence of policy outcomes

Although climate change prevention and mitigation are time-sensitive, policy creation and implementation take time. Creating climate change mitigation and adaptation measures is a 'complex and ongoing process' (Scheraga et al., 2003, p. 237), affected by individual stages of policymaking which both overlap with each other and are inextricably linked (Hallsworth et al., 2011, p. 6). Once policies take effect, they often have long-term consequences, as future greenhouse gas emission mitigation and climate change adaptation rests on decisions made today (Scheraga et al., 2003, p. 237). Policy outcomes, or the results of policymaking, do not manifest immediately and are 'often indirect, diffuse, and take time to appear' (Hallsworth et al., 2011, p. 6). Some existing research suggests that environmental policymaking processes have sped up through the latter half of the twentieth century (Jordan et al., 2011), and McCormick (1998) finds that, within the European Union, environmental proposals could take up to 7 years to develop, while Hayes-Renshaw and Wallace (1997) estimate an average time of 18 months. This suggests that accounting for time is paramount in capturing women representatives' impact on environmental policy outcomes.

Importantly, further time considerations must be accounted for when testing women representatives' impact on policies and outcomes. Women representatives across the world operate in majority-male legislatures in which they may face marginalization by existing members of the legislature with an interest in preserving the status quo. This marginalization can restrict women's ability to influence the political agenda through various means, including placing women on less powerful committees, blocking them from leadership roles and failing to support their legislation (Kerevel & Atkeson, 2013); Senk (2020) shows that the systematic exclusion of women from leadership positions and influential committees in governance disadvantages their bill approval rates. Not only do many women enter legislatures in which policy priorities and values have already been defined (Clayton et al., 2019) by socio-political gendered norms, but women may be incentivized to 'adapt to [these] norms that have already coalesced around men's priorities to appear as more serious or capable politicians' (Clayton et al., 2019, p. 77), reducing their

own potential impact on policy. Although women's presence in parties influences party positions (Greene & O'Brien, 2016; Keith & Verge, 2018; Kittilson, 2011) because women have fewer avenues through which to enter politics, Clayton and Zetterberg (2021) show that women in strong party systems 'have less latitude to depart from the party line' (1) and are thus constrained, to a greater extent than their male counterparts, in their ability to influence issues outside of their party's platform. Thus, women's impact on the policy will likely not materialize immediately; rather, the process may be time-intensive as they navigate these various institutional constraints.

In addition, developed states may maintain better-functioning institutions, while developing democracies often have lower governance benchmarks and 'material, educational, structural, and organizational deficiencies that negatively affect development and governance' (Pelicice, 2019, p. 2). The lack of institutional strength can lead to bad political behaviour, including corruption, which is 'widespread among political authorities and associated staff, leading to weak policies that provide little social benefits' (Pelicice, 2019, p. 3). Robert Barro (1994) argues that economic development is necessary for the function and survival of democracy and is often a prerequisite for its formation; states with low levels of economic development are much less likely to maintain institutions and structures necessary for the healthy function of democracy. Policy creation and implementation may thus take longer to influence outcomes in structurally weaker states. While gender-based discrimination and male domination of policymaking are certainly not limited to poorer democracies, weak institutional backing may mean women's influence on policy takes longer to manifest than in states with stronger institutions.

Because the process of legislating is both time-consuming and continual, and because women representatives must navigate gendered constraints in legislatures that may slow their ability to impact policy and outcomes, determining a relationship between women's involvement in governance and renewable energy policy requires accounting for the passage of time. Although I do not attempt to disentangle the time lags attributable to the general policy-making process and the impact of women's representation in this study, I predict that

H2: Increases in the share of women in parliaments will not have immediate effects but will impact future renewable energy outcomes.

The effect of state wealth on climate change perceptions

The aforementioned impact of state wealth on the gap between women's and men's climate change preferences at the individual level may be of particular importance. The vast majority of research regarding the gender gap in environmental attitudes considers developed countries; importantly, as uncovered in the most recent analysis of women's and men's environmentalism, Bush and Clayton (2021) have found that the gender gap in climate change concern is moderated by state income, and that 'the wealthier the country, the more likely women are to express concern about climate change relative to men' (Bush & Clayton, 2021, p. 1).

If the gender gap in climate change attitudes increases with state wealth, it may be that the increased representation of women, and therefore their environmentally friendly preferences, has a greater impact on the environmental outcomes of high-income states. In states where women's and men's climate change preferences are similar, we have less reason to suspect that an increased representation of women's preferences would lead to vast changes in environmental policy and outcomes. Thus, I predict that:

H3: The relationship between increased women's participation in parliaments and renewable energy outcomes will be stronger in high-income countries.

In summary, I argue that women's presence in parliaments may impact the ultimate outcome of renewable energy consumption. Yet, these effects will be most pronounced in high-income states, as the evidence for a gender gap in climate change preferences is strongest in these contexts. Women representatives in these contexts may seek to substantively represent these preferences. For these reasons, I assert that women MPs will advocate for a range of policies in favour of sustainable energy consumption in the policymaking process and within their own parties creating an aggregate increased renewable energy consumption in higher income countries. In addition, I put forth that these effects will take time to materialize.

Research design: Methods and variables

In the following analysis, I consider only democracies as categorized by Hadenius and Teorell (2007 in Dahlberg et al., 2018, p. 87), as parliaments are the most effective in democracies. Democracies are determined by finding the mean of the Freedom House and Polity scales with a threshold between democracies and autocracies drawn at 7.5, which 'was chosen by estimating the mean cut-off point separating democracy from autocracy in five well-known categorical measures of democracy… together with Freedom House's and Polity's own categorical thresholds for democracy' (Dahlberg et al., 2018, p. 105). Data come from the 20-year period from 1997 to 2017, a selection based on data availability. Because the proportion of women in parliament theoretically does not vary between elections, I average variables for each election period. Election dates and periods were determined using the Global Elections Database (Brancati, 2020). Thus, panel data are organized by country-election term as the unit of analysis. The vast majority of election term durations range from 2 to 5 years. Not only does aggregating data into election periods accurately capture the variance in women in parliament, but it also helps to account for the different institutional timeframes in place in each country.

Dependent variable: Renewable energy consumption

Renewable energy consumption is a common measure used to gauge the amount of renewable energy consumed at the national level (Al-mulali et al., 2016; Bolük & Mert, 2015; Danish et al., 2017). Consumption quantifies not only the amount of renewable energy that was produced and subsequently consumed by each state but also states' consumption of renewable energy imported from elsewhere. Measuring consumption captures a state's willingness to use cleaner energy even if it lacks the capacity, resources, will, or governance structure to produce it domestically. Thus, I choose consumption, rather than production, as a dependent variable to avoid biasing the results in favour of those states which have unequal advantages in producing renewable energy. These data come from World Bank Data and are measured as a percentage of overall energy consumption (World Bank Open Data, 2019a).

Renewable energy consumption may be influenced by many factors. Wang et al. (2020) find that while increases in middle-income countries' consumption are mostly correlated with increased research and development initiatives, renewable energy consumption in high-income countries is bolstered most by policy and environmental pressures. Due to the importance of policy in

influencing renewable energy consumption, particularly in higher income states, below, I outline two such policies identified in the literature as impactful for renewable energy consumption: feed-in tariffs (FITs) and carbon taxes.

Smith and Urpelainen (2014) demonstrate that implementing a FIT, 'which mandates energy utilities to pay a higher price for renewable electricity to generators than for other sources of electricity' (pp. 367–368) increases renewable energy generation. Because energy utilities must pay energy generators more for renewables, generators see more profit from renewable energy generation than from other types of energy generation and are thus incentivized to generate more energy from renewable sources than from non-renewable sources (Kalkuhl et al., 2012; Mendonça, 2007; Mitchell et al., 2006; Smith & Urpelainen, 2014). FITs, 'a price-based policy tool in the sense that a government sets a price at which [renewable energy] can be sold' (Yamamoto, 2018, p. 4), allow 'households and businesses to sell their [electricity generated from renewables] to an electric utility at a set price during a number of years' (Yamamoto, 2018, p. 3). For this reason, countries like Germany and Spain's FITs were very successful, inspiring other countries, like Japan, to adopt similar FITs (Yamamoto, 2018).

Similarly, carbon taxes, which are 'levied on the emission of a quantity of carbon dioxide' (Hsu, 2012, pp. 5–6), are an oft-used policy at the state and supranational levels to make the generation of fossil fuel-based energy more expensive. Carbon taxation has often 'been part of larger energy and excise tax reform efforts, rather than [only] focused on greenhouse gas emissions' (Murray & Rivers, 2015, p. 675); yet in specific instances in which a carbon tax has been implemented independently, such as in Canada's British Columbia, it has led to reduced emissions (Murray & Rivers, 2015).

While the implementation of these policies may mediate the relationship between women's participation in governance and renewable energy consumption, others may impact renewable energy consumption as well. For instance, renewable energy consumption could be influenced by the preponderance of postmodern values within societies, a variable difficult or impossible to measure. The totality of influential policies is impossible to quantify and analyse in a systematic way; energy policy is layered, and outcomes are not likely to be attributable to one policy. Moreover, I argue not that women's presence in parliaments should correlate with the passage of any one policy but with the general movement of parliaments and parties towards environmental choices, which subsequently lead to more consumption of renewable energy. Focusing on renewable energy consumption circumvents the problem of identifying which policies are both the 'most important' in encouraging renewable energy consumption and those which are most likely to be influenced by women representatives specifically, instead of focusing on the final, aggregate effect.

Independent variable and controls

The main independent variable of interest, the percentage of women in parliament, is compiled by the Quality of Government dataset (Dahlberg et al., 2018) and comes from the World Bank Group's World Development Indicators (2019e). Control variables include GDP per capita (World Bank Open Data, 2019b), Climate Change Vulnerability Index (Chen et al., 2015), natural resource rents as a percentage of GDP (World Bank Open Data, 2019c), the level of democracy (Freedom House/Imputed Polity) (Dahlberg et al., 2018) and Human Development Index (Dahlberg et al., 2018).

I predict that GDP per capita will have a positive effect on renewable energy consumption when considered alongside the effect of the proportion of women in parliament. Additionally, there are likely to be more women in the parliaments of richer countries, and empirical literature suggests that some lower income states are not yet on a path to renewable energy (Romano et al., 2016).

Including the Notre Dame Adaptation Initiative's Vulnerability Index, which indexes the 'propensity or predisposition of human societies to be negatively impacted by climate hazards' by assessing the exposure, sensitivity, and adaptive capacity of 'six life supporting sectors: food, water, health, ecosystem services, human habitat, and infrastructure' (Chen et al., 2015, p. 3) is predicted to drive up renewable energy usage, as states that are the most likely to face harm from climate change may find it in their interests to mitigate climate change before it occurs.

Accounting for natural resource rents, which in this case include 'oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents' (World Bank Open Data, 2019c) accounts for the potentially lower renewable energy consumption by states that benefit significantly from the extraction of resources. Relatedly, some states with high resource rents (particularly oil) are also rich in unused renewable energy sources (Atalay et al., 2016), indicating that the incentives to use unrenewable resources may outweigh the burden of the clean energy transition for some states, even when renewable resources are abundant.

Both the Human Development Index and level of democracy measures are controlled for, in accordance with similar analyses, for their potential to impact both women's role in society, and thus governance, as well as electricity access in general (Ergas & York, 2012; Lv & Deng, 2018; McGee et al., 2020; Nugent & Shandra, 2009; Salahodjaev & Jarilkapova, 2020). They are obtained from the Quality of Government dataset (Dahlberg et al., 2018). The Human Development Index as measured by the United Nations Development Program provides an alternate development measure to GDP by emphasizing 'that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone' (Dalhberg et al., 2018, p. 133). The level of democracy (Freedom House/Imputed Polity) measure is a scaled variable and ranges from 0, least democratic, to 10, most democratic. Because only democracies, as characterized by Hadenius and Teorell (2007) are included in this analysis, this variable controls only for the level of democracy within states that already qualify broadly as democracies. The score is formulated by transforming both Freedom House and Polity's scores to a 0–10 scale and averaging them. Combining the two measures is demonstrated by Hadenius and Teorell (2007 in Dahlberg et al., 2018) to be more valid and reliable than each measure individually (Dahlberg et al., 2018, 77).

Importantly, country fixed effects capture renewable energy potential at the country level. This is especially vital, as some states may be better equipped to produce renewable energy and subsequently consume it. Controlling for this will ensure the validity of comparisons between states with high and low renewable capacity. Time fixed effects additionally capture the temporal trends shared by all countries, such as overall decreases in the cost of renewable technology over time, as well as trends towards postmaterialist values which may increase both women's representation and renewable energy consumption.

While the ideological position of parties, and the strength of each party, could very well impact renewable energy consumption, the proportion of women in government *also* impacts the ideological position of these parties (Greene & O'Brien, 2016; Keith & Verge, 2018; Kittilson, 2011) and thus controlling for these party dynamics could introduce posttreatment bias, which 'occurs when researchers control for covariates that are potentially affected by the treatment' (Senk, 2020, p. 5). If party positions vary according to their gender makeup, holding such

party positions constant removes this variation, and thus removes the indirect effect of women's representation on renewable energy consumption. As my theoretical argument maintains that women's effect on renewable energy consumption is indirect – in other words, not by virtue of the fact that women are women, but through mechanisms of representation and party politics – controlling for party position may bias the estimates of the relationship I seek to measure in the first place. Nevertheless, the online Appendix I includes the main models with an indexed control of the strength of all parties' left-right ideological positions.

Model specification

To test whether women's participation in parliaments influences renewable energy consumption, I estimate a two-way fixed effects panel regression. The fixed-effects model is used to avoid inconsistency of a pooling model when the individual error component is correlated with the regressors, which was the case with the data used here. Thus, the model, which takes the form $y_{it} = \beta^T x_{it} + \gamma_i + \delta_t + \varepsilon_{it}$, where a country is the individual component i, election term is the time component t, y_{it} is the dependent variable, x_{it} are time-varying independent variables, γ_i is the country-fixed effect, δ_t is the time fixed effect, ε_{it} is the error term, and β^T is a vector. With both time and country fixed effects, the model treatsγ_i 'as a further set of… parameters to be estimated' (Croissant & Millo, 2008, p. 3). This allows consistent estimates for β (Croissant & Millo, 2008, p. 3).

To account for the delayed effect that arises after women in parliament are elected and participate in the policy process and to measure H2, most of the panel data models in this analysis regress a measure of renewable energy consumption, the dependent variable, on a lagged measure of women in parliament, the main independent variable. This modelling may uncover if variation in the proportion of women in parliament in previous election cycles correlates with future renewable energy consumption in a systematic way.

Descriptive statistics

Figures 1 and 2 show the distribution of the two main variables of this analysis, renewable energy consumption and the proportion of women in parliament.

The distribution of total renewable energy consumption across countries is heavily right-skewed, with most renewable energy consumption falling below 25 per cent as a percentage of total energy consumption. Yet, breaking down this distribution by World Bank income group categorizations (World Bank Open Data, 2019d) reveals the notable differences in renewable energy consumption across income levels. A great majority of the states with the highest renewable energy consumption are low-income democracies; the average renewable energy consumption of states classified as low-income is over 75 per cent of total energy consumption, while high-income states on average consume less than 20 per cent renewable energy. This is likely due to poor energy access experienced by many low-income states; over 580 million people in Africa and 430 million people in Asia lack electricity access (Sambodo & Novandra, 2019) and thus may use small-scale and local energy sources, like solar-powered cookers and lanterns (Soria et al., 2016).

Low-income states within the sample like Zambia, Mali, and Sierra Leone, all have renewable energy consumption rates above 80 per cent of total energy consumption, while Benin demonstrates the lowest renewable energy consumption of all low-income states, at 60 per cent

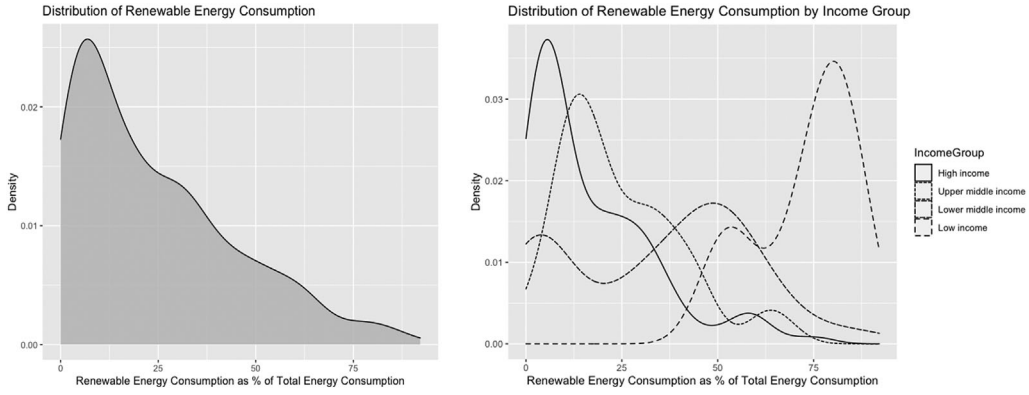

Figure 1. Distribution of renewable energy consumption and distribution of renewable energy consumption by Country Income Group.
Source: Author's own compilation.

Figure 2. Distribution of share of women in parliaments and distribution of the share of women in parliaments by Country Income Group.
Source: Author's own compilation.

renewable energy consumption. This is still over 40 percentage points more renewable energy consumption than the average of high-income states, at 17.64 per cent.

Thus, expectedly, high-income states consume far less renewable energy as a percentage of their total energy consumption. Iceland consumes the most at just over 62 per cent renewables, with Liechtenstein, Norway, Uruguay, and Sweden consuming between 40 per cent and 58 per cent renewable energy as a percentage of total energy.

The overall distribution of women in parliament is also right-skewed, with most parliaments falling at less than 20 per cent of women's participation. Low-income states have significantly fewer women in their parliaments than do high, upper middle and lower middle-income states. On average, high-income states have just over 20 per cent of women in their parliaments while low-income states demonstrate levels below 10 per cent on average. Sweden's parliament ranks number

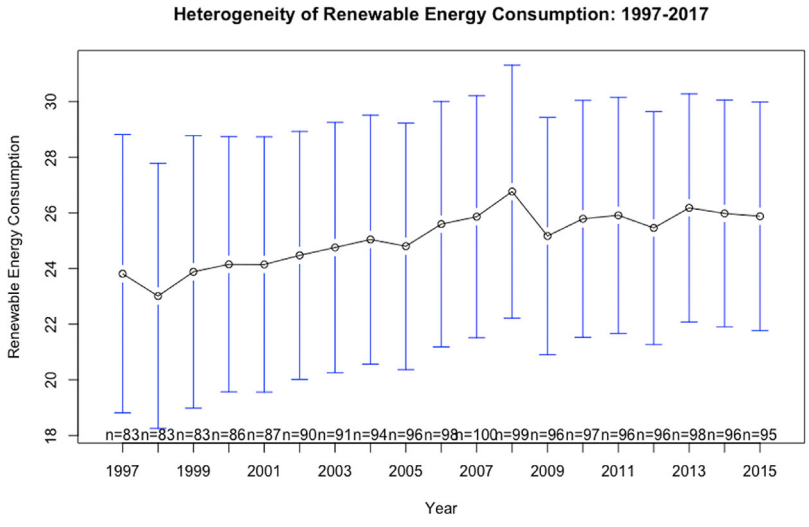

Figure 3. Heterogeneity of renewable energy consumption over time.
Source: Author's own compilation.
[Colour figure can be viewed at wileyonlinelibrary.com]

one, with an almost 44 per cent women makeup. Finland, Norway, Denmark, the Netherlands and South Africa follow with rates between 35 per cent and 38 per cent. On the other extreme, Palau and Micronesia have no women in their parliaments.

Denmark saw a 25 per cent increase in renewable energy consumption, the greatest increase during the sample period, while its level of women's representation increased by nearly 5 per cent in this timeframe. Iceland saw an increase in renewables of 22.15 per cent, accompanied by an increase in women parliamentarians by 22.2 per cent. Lithuania's 17.34 per cent increase in renewables was accompanied by a 3.8 per cent increase in women in parliament, while Uruguay's 20.35 per cent increase in renewables was met with a 9.1 per cent increase in women's representation.

Figure 3 shows the variation in renewable energy consumption in all countries across the sample period, demonstrating a slight increase in renewable energy consumption over time.

In contrast, Figure 4 shows that the percentage of women in parliament has increased steadily over time across all states in the sample.

Results

The regression results of the main variables and interactions are presented in Table 1. In Figure 5, I plot the marginal effects of the proportion of women in parliament when interacted with a logged value of GDP per capita, which ranges from Madagascar's 5.51 ($247), at the poorest, to Liechtenstein's 12.05 ($171,056), at the wealthiest. Because of the non-normal distribution of renewable energy consumption, I use a logged value of this variable in all of the following models. This requires coefficients to be interpreted substantively as exp(β), since exponentiation is the

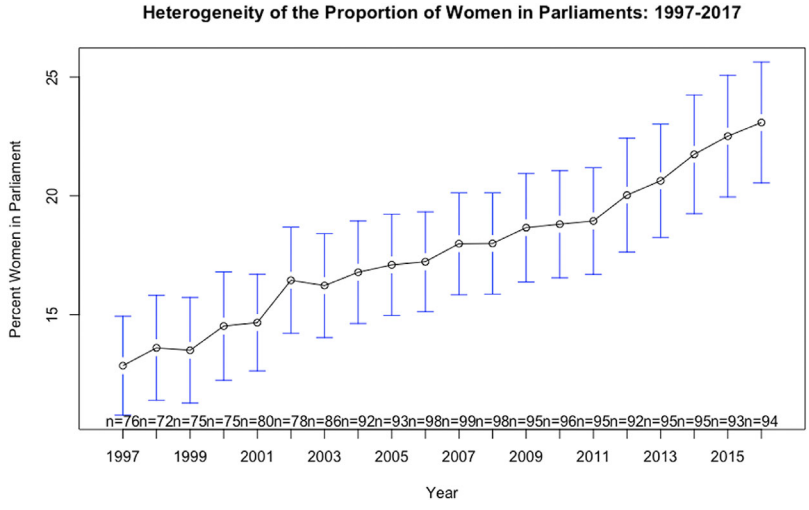

Figure 4. Heterogeneity of the proportion of women in parliament over time.
Source: Author's own compilation.
[Colour figure can be viewed at wileyonlinelibrary.com]

inverse of a logarithmic function. Significant relationships exist where estimated coefficients and their confidence intervals do not contain zero.[1]

The plotted marginal effects of the proportion of women in parliament on renewable energy consumption show the significance of the relationship as moderated by GDP per capita, the distribution of which can be found in each plot. Higher income countries demonstrate significant and positive relationships when women's participation in parliaments is lagged from zero to two election terms. In states with a logged GDP per capita of between 10 and 12 ($22,540 in Slovenia to $171,056 in Liechtenstein, with a mean of $45,395), such as Australia, Belgium and the United States, the relationship between the proportion of women in parliament and the renewable energy consumption is indeed positive and significant. With a 5 per cent increase in women in parliament, a 5.08 per cent concurrent increase and a 5.12 per cent increase in renewable energy consumption after one and two election terms[2] a significant relationship is expected in Liechtenstein, the richest of democracies. Positive significance remains after three election term lags[3] where logged GDP is equal to about 8 to 10 ($2985 in Colombia and the Marshall Islands and $21,959 in Greece), indicating significance more in middle-income countries like Ecuador, Botswana and Hungary. Conversely, the marginal effect of women's participation in parliament is significant and negative, when lagged from zero to one election terms, in lower income countries with a logged GDP per capita of about 8 or less (less than about $3000 GDP per capita), like Bulgaria, Ghana and the Philippines.

While countries with lower incomes indicate negative or non-significant relationships, results of these time-series cross-sectional regressions also indicate that, in line with prior research and with H3, women's involvement in governance does contribute to a greener policy outcome with respect to renewable energy consumption in richer states. Although H2 predicted that effects would not materialize immediately, I also find an immediate effect in higher income states. Yet, in line with H2, positive and significant effects remain after both one and two election terms in these

Table 1. Time-series cross-sectional analysis of renewable energy consumption with country and year fixed effects and interaction of women in parliament and GDP per capita

Interaction of women in parliament and GDP per capita				
	Dependent variable			
	Renewable energy consumption			
	(1)	(2)	(3)	(4)
Women in parliament	−0.069***	−0.061**	−0.049.	0.036
	(0.015)	(0.020)	(0.026)	(0.033)
Women in parliament × GDP per capita	0.007***	0.007**	0.006*	−0.003
	(0.002)	(0.002)	(0.003)	(0.003)
log GDP per capita	−0.180*	−0.205*	−0.355***	−0.318**
	(0.070)	(0.082)	(0.103)	(0.116)
Vulnerability	3.727	3.717	2.770	3.290
	(2.233)	(2.823)	(3.981)	(5.347)
Resource rents	−0.008	−0.005	0.015	0.031**
	(0.004)	(0.007)	(0.011)	(0.011)
Democracy score	0.109*	0.044	−0.143	−0.079
	(0.044)	(0.065)	(0.081)	(0.098)
HDI	0.737	0.308	1.115	2.658
	(1.143)	(1.436)	(2.069)	(2.732)
Observations	481	388	295	204
R^2	0.120	0.091	0.135	0.194
Adjusted R^2	−0.148	−0.275	−0.352	−0.475
F statistic	7.166***	3.925***	4.201***	3.805***
	(df = 7; 368)	(df = 7; 276)	(df = 7; 188)	(df = 7; 111)

Abbreviations: df, degree of freedom; HDI, human development index.
Significance levels $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.
Source: Author's own compilation.

states, while more middle-income states' relationships take longer to materialize and appear after three election terms. Thus, the results here lend support to the idea that women representatives in higher income states may substantively represent women's environmental preferences.[4]

Immediate positive effects may suggest spuriousness, yet it is important to note that time units are measured in election terms, periods that could last 5 years. Thus, immediate relationships indicate that the number of women in parliament in a potentially 5-year period influences renewables within that period. As FITs, for example, increase renewable consumption very successfully (Medonca, 2007, p. 13), subsequent effects on renewable energy consumption could very well manifest within a timeframe of 5 years or less.

While little research investigates the timeline of environmental policy creation to final outcomes, some evidence suggests that these processes have sped up through the latter half of the twentieth century (Jordan et al., 2011). McCormick (1998) asserts that, within the European Union,

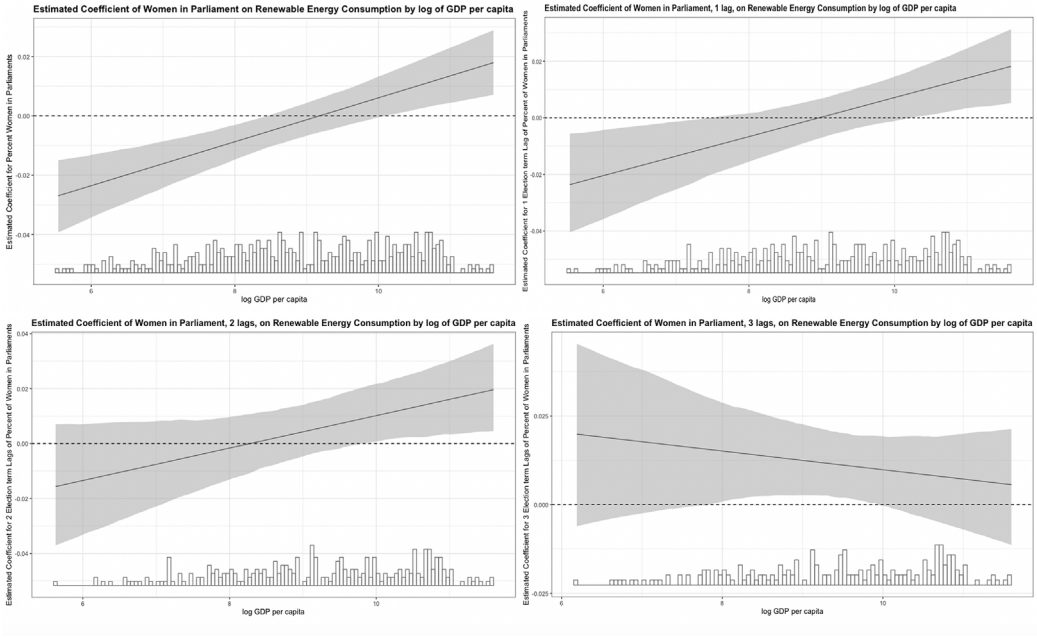

Figure 5. Plotted marginal effects of women in parliament on renewable energy consumption by GDP per capita at all lag structures.
Source: Author's own compilation.

developing environmental proposals could take up to 7 years, while Hayes-Renshaw and Wallace (1997) estimate an average time of 18 months. Because election terms last from 2 to 5 years, these estimates appear in line with the timeline of findings here; yet, in cases of longer election terms, the period from the election of women to the ultimate policy outcome could be between 10 and 15 years. So, future research should attempt to measure the difference in the timelines of policy outcomes resulting from policies spearheaded by women, compared to those spearheaded by men, to more closely measure whether institutional gender-based constraints impact policy outcomes. It should also attempt to more specifically map the timeline of the policy output-outcome process.

The role of institutional strength

Results of time-series cross-sectional regressions indicate, in line with prior research, that women's involvement in governance does contribute to a greener policy outcome with respect to renewable energy consumption: while my original prediction that the relationship would be strongest in high-income states plays out, the analysis here indicates that the increased involvement of women in democracies at mid-levels of economic development is also significant for renewable energy consumption. Yet, the relationship materializes more quickly in higher income states. Thus, the question of *whether* women make a difference in renewable energy consumption at various levels of economic development is accompanied by a question of *when* they make a difference at these various levels of economic development.

The timeline differential between high- and mid-level incomes, as well as a lack of positive significance in lowest income states, may be explained by high-income democracies' ability to

maintain functioning and effective institutions while developing democracies often have lower governance benchmarks and 'material, educational, structural and organizational deficiencies that negatively affect development and governance' (Pelicice, 2019, p. 2). As an initial test of whether the quality of democratic institutions explains the more immediate effect on women's representation in higher income countries, I interact the proportion of women in parliament with a measure of the quality of democracy (Freedom House/Imputed Polity). Online Appendix Table 3 and online Appendix Figure 1 broadly mirror the patterns in Figure 5. Yet, further research on the influence of governmental institutions on women's ability to impact policy outcomes is required to reach more concrete conclusions.

Connecting the dots: Investigating FITs and women's representation

Anecdotal evidence demonstrates women's involvement in climate change and environmental policy. U.S. Representative Debbie Dingell's introduction of the Clean Energy and Sustainability Accelerator (US Congress, 2021) is one such example of a female representative specifically initiating a policy with implications for renewable energy consumption. While a large-scale qualitative analysis of other similar policies proposed by women representatives should be undertaken in the future, to further investigate the relationship between women's representation and renewable energy consumption, I include in the online Appendix an additional set of regressions with a focus on a policy that may increase renewable energy consumption: FITs.

While I assert that women's impact on renewable energy consumption is an aggregation of their impact in parliaments and parties, the results of these models, while insignificant to the 0.005 level, demonstrate a similar direction to the above models. This offers preliminary evidence for the systematic involvement of women in the passage of environmental legislation. The full models and plotted marginal effects can be found in the online Appendix Table 8 and Figure 5.

Conclusion

While much of the academic attention paid to the effects of increased women's representation in governments has focused on 'women's issues' like abortion, paid maternal leave and human trafficking (Ennser-Jedenastik, 2017; McBride, 2001; Wittmer & Bouche, 2013), the impact of women's increased participation in governance encompasses a much broader range of issues. While existing literature has suggested a relationship between women's parliamentary participation and environmental outcomes, this study sheds new light on the important contextualities of this relationship. I find that increases in women's parliamentary participation lead to increases in renewable energy consumption, that this relationship is moderated by state wealth, and that it takes time to appear. While richer countries show positive and significant effects of women's increased presence in parliaments on renewable energy consumption, middle-income countries' significant and positive relationships take longer to materialize. Overall, these results contribute to the growing literature on the impact of women's political participation on environmentalism and give new attention to the role of both state development and time in this relationship.

The implications for these findings are manifold and widely pertinent to today's environmental politics. The first implications are political and impact all actors, from individual voters to governments themselves. They suggest that electing more women to office in higher income democracies could speed the process of decarbonization, notwithstanding the implicit and

additional benefits to gender equality. Environmentally minded voters, activists and interest groups should thus seriously consider the way their representatives' gender may impact environmentalism and take seriously the role of gender equality in their governments.

Additional implications are direct: high-income states consume far more energy and emit far more CO_2 per capita than do lower income countries (Ritchie et al., 2020). Thus, when considering global environmental outcomes, increasing high-income states' consumption of renewables is of real importance in achieving the goals set out by the Paris Climate Agreement (Ritchie et al., 2020). Because many countries aim for net zero emissions by 2050 (Bazilian & Gielen, 2020), finding fast and effective means to lower emissions is essential to meet goals as well as to substantively avoid excessive climate change. The results here suggest that increasing women's political power could accelerate higher income states' ascension to these goals.

Yet, lower income states maintain high future-emissions potential, particularly as they continue to develop. Thus, future research must uncover the unique and potentially powerful role that women representatives may play in environmental policymaking in lower income states, and the institutional, cultural, and political barriers they face in contributing to impactful environmental policy.

Further research could take this analysis in another direction by investigating women's impact on particular policies, with special attention to whether women representatives are more prone to affect certain policies over others. The role of women in various other government positions – such as cabinet members, heads of state, party leaders and the like – could also be investigated to determine which roles offer women the most power in affecting environmental outcomes. Investigating the effects of other institutional factors, like corruption, on women's ability to influence outcomes would offer additional contextual insight into the relationship between women's representation and environmental outcomes.

Revisiting these relationships once more time has passed, and thus more data are available, could help explore the relationship to an even greater extent. With these additional data, analyses could attempt to uncover differentials in the emergence of policy outcomes, investigating whether it takes women longer to change policy outcomes compared to their male counterparts. Finally, further research could investigate why, and under what circumstances, women representatives fail to make a difference in environmental policy, especially when states with lower levels of economic development, and thus potentially weaker political institutions, *do* take concrete steps to include more women in governance by instituting quotas and other equalizing initiatives. This could help uncover if the way women enter office matters for their effectiveness in influencing environmental policy.

Lastly, and beyond the scope of this research, additional work to uncover the role of government and party ideology on renewable energy policy will be of paramount importance, and such investigations should consider women's roles in shaping party platforms and agendas.

Acknowledgements

I am incredibly grateful for the feedback and guidance provided by Stefanie Reher and Patrick Bayer during the writing of this paper. I am also indebted to Becki Scola and Lisa Baglione for their constant mentorship and engaged feedback.

Online Appendix

Additional supporting information may be found in the Online Appendix section at the end of the article:

Appendix Table 1: models of all democracies with control variable results.
Appendix Table 2: Interactions of the proportion of women in parliament with democracy score, followed by the marginal effects of women in parliament on renewable energy consumption.
Appendix Figure 1: Plotted marginal effects of women in parliament on renewable energy consumption by Democracy Score at all lag structures.
Appendix Table 3: Robustness test of the interactions of the proportion of women in parliament with HDI, followed by the marginal effects of women in parliament on renewable energy consumption.
Appendix Figure 2: Plotted marginal effects of the participation of women in parliaments by HDI.
Appendix Table 4: Robustness tests including a measure of government's left-right ideological position with country and year fixed effects and control variables.
Appendix Table 5: Robustness tests including a measure of government's left-right ideological position with an interaction of the proportion of women in parliament and GDP per capita, with country and year fixed effects and control variables.
Appendix Figure 3: Plotted marginal effects of women in parliament on renewable energy consumption by GDP per capita at all lag structures.
Appendix Table 6: Robustness tests including a measure of government's left-right ideological position with an interaction of the proportion of women in parliament and democracy score, with country and year fixed effects and control variables.
Appendix Figure 4: Plotted marginal effects of women in parliament on renewable energy consumption by democracy score at all lag structures.
Appendix Table 7: Robustness tests of Appendix Table 1, in which observations before election term 3 are discounted and models are rerun.
Appendix Table 8: Robustness tests of Appendix Table 2, in which observations before election term 3 are discounted and models are rerun.
Appendix Table 9: Time-series cross-sectional analysis of FITs with country and year fixed effects and an interaction of women in parliament and GDP per capita.
Appendix Figure 5: Plotted marginal effects of women in parliament on FITs by GDP per capita at all lag structures.
Appendix Table 10: Time-series cross-sectional analysis of renewable energy consumption with country and year fixed effects and an interaction of women in cabinets and GDP per capita.
Appendix Figure 6: Plotted marginal effects of women in cabinets on renewable energy consumption by GDP per capita at all lag structures
Supplementary material

Notes

1. Results are printed for time lags with significance; while 0–3 lags result in statistically significant estimates, too many observations are lost by the fourth lag to interpret meaningful results. Thus, in the interest of space, further models with additional lags are not included.

2. One to two election terms could equal 2–10 years, depending on the state.
3. Three election terms could equal 6–15 years, depending on the state.
4. In the online Appendix Table 4 and online Appendix Figure 2, I interact women in parliament with measures from the Human Development Index as an alternative operationalization for a country's development levels, which produce similar results.

References

Agarwal, B. (2010). *Gender and Green governance: The political economy of women's presence within and beyond community forestry*. Oxford University Press.

Al-mulali, U., Ozturk, I., & Adebola, S. (2016). Investigating the environmental Kuznets curve hypothesis in seven regions: The role of renewable energy. *Ecological Indicators*, *67*, 267–282.

Arnocky, S., & Stroink, M. (2010). Gender differences in environmentalism: The mediating role of emotional empathy. *Current Research in Social Psychology*, *16*, 1–14.

Atalay, Y., Biermann, F., & Kalfagianni, A. (2016). Adoption of renewable energy technologies in oil-rich countries: Explaining policy variation in the Gulf Cooperation Council states. *Renewable Energy*, *85*, 206–214.

Bailer, S., Breunig, C., Giger, N., & Wüst, A. M. (2018). The diminishing value of representing the disadvantaged: Between group representation and individual career paths. *British Journal of Political Science*, *52*, 1–18.

Barro, R. J. (1994, December 1). Democracy: A recipe for growth?. *Wall Street Journal*.

Bazilian, M., & Gielen, D. (2020, December 10). 5 years after Paris: How countries' climate policies match up to their promises, and who's aiming for net zero emissions. The Conversation. https://theconversation.com/5-years-after-paris-how-countries-climate-policies-match-up-to-their-promises-and-whos-aiming-for-net-zero-emissions-151722.

Bolük, G., & Mert, M. (2015). The renewable energy, growth and environmental Kuznets curve in Turkey: an ARDL approach. *Renewable and Sustainable Energy Review*, *52*, 587–595.

Brancati, D. (2020). *Global Elections Database*. Constituency-Level Elections Dataset. http://www.cle.wustl.edu

Bush, S., & Clayton, A. (2021). *Facing change: Identity and cross-national responses to climate change* (Unpublished manuscript). Yale University.

Boas, T. C., & Smith, A.E. (2019). Looks like me, thinks like me: Descriptive representation and opinion congruence in Brazil. *Latin American Research Review*, *54*(2), 310–328.

Campbell, R., Childs, S., & Lovenduski, J. (2009). Do women need women representatives? *British Journal of Political Science*, *40*(1), 171–194.

Carlsson-Kanyama, A., & Lindén, A. (2007). Energy efficiency in residences—Challenges for women and men in the North. *Energy Policy*, *35*, 2163–2172.

Chen, C., Noble, I., Hellmann, J., Coffee, J., Murillo, M., & Chawla, N. (2015). *University of Notre Dame Global Adaptation Index: Country index* (Technical Report). University of Notre Dame.

Childs, S., & Krook, M. L. (2006). Should feminists give up on critical mass? A contingent yes. *Politics and Gender*, *2*, 522–530.

Clayton, A., Josefsson, C., Mattes, R., & Mozaffar, S. (2019). In whose interest? Gender and mass-elite priority congruence in sub-Saharan Africa. *Comparative Political Studies*, *52*(1), 69–101.

Clayton, A., & Zetterberg, P. (2021). Gender and party discipline: Evidence from Africa's emerging party systems. *American Political Science Review*, *115*(2), 1–16.

Croissant, Y., & Millo, G. (2008). Pane data econometrics in R: The plm package. *Journal of Statistical Software*, *27*(2), 1–-43.

Danish, Zhang, B., Wang, B., & Wang, Z. (2017). Role of renewable energy and non-renewable energy consumption on EKC: Evidence from Pakistan. *Journal of Cleaner Production*, *156*, 855–864.

Dahlberg, S., Holmberg, S., & Rothstein, B., Pachon, N. A., & Svensson, R. (2018). *The quality of Government Basic Dataset* (version Jan. 18). University of Gothenburg: The Quality of Government Institute.

Denton, F. (2002). Climate change vulnerability, impacts, and adaptation: Why does gender matter?. *Gender and Development*, *10*(2), 10–20.

Ennser-Jedenastik, L. (2017). How women's political representation affects spending on family benefits. *Journal of Social Policy*, *46*(3), 563–581.

Ergas, C., & York, R. (2012). Women's status and carbon dioxide emissions: A quantitative cross-national analysis. *Social Science Research*, *41*, 965–976.

Figueiredo, P., & Perkins, P. E. (2013). Women and water management in times of climate change: participatory and inclusive processes. *Journal of Cleaner Production*, *60*, 188–194.

Fonjong, L. N. (2008). Gender roles and practices in natural resource management in the North West Province of Cameroon. *Local Environment*, *13*(5), 461–475.

Franceschet, S., & Piscopo, J. (2008). Gender quotas and women's substantive representation: Lessons from Argentina. *Politics & Gender*, *4*, 393–425.

Fredriksson, P. G., & Wang, L. (2011). Sex and environmental policy in the U.S. House of Representatives. *Economics Letters*, *113*, 228–230.

Goldsmith, R. E., Feygina, I., & Jost, J. T. (2013). The gender gap in environmental attitudes: A system justification perspective. In M. Alston & Whittenbury K. (Eds.), *Research, action and policy: Addressing the gendered impacts of climate change* (pp. 159–171). Springer Science + Business Media Direct.

Greene, Z., & O'Brien, D. (2016). Diverse parties, diverse agendas? Female politicians and the parliamentary party's role in platform formation. *European Journal of Political Research*, *55*, 435–453.

Hallsworth, M., Parker, S., & Rutter, J. (2011). *Policy making in the real world: Evidence and analysis*. Institute for Government. London.

Hayes-Renshaw, F., & Wallace, H. (1997). *The council of ministers*. Macmillan.

Hero, R. E., & Tolbert, C. J. (1996). A racial/ethnic diversity interpretation of politics and policy in the states of the U.S. *American Journal of Political Science*, *40*(3), 851.

Hunter, L. M., Hatch, A., & Johnson, A. (2004). Cross-national gender variation in environmental behaviors. *Social Science Quarterly*, *85*(3), 677–694.

Hsu, S. (2012). *The case for a carbon tax*. Island Press.

Islam, S. N., & Winkel, J. (2017). *Climate change and social inequality*. (UN/DESA Working Papers 152). Department of Economic and Social Affairs of the United Nations.

Jordan, A., Brouwer, R., & Noble, N. (2011). Innovative and Responsive? A longitudinal analysis of the speed of EU environmental policy making, 1967–97. *Journal of European Public Policy*, *6*(3), 376–398.

Kalkuhl, M., Edenhofer, O., & Lessmann, K. (2012). Learning or lock-in: Optimal technology policies to support mitigation. *Resource and Energy Economics*, *34*(1), 1–23.

Keith, D. J., & Verge, T. (2018). Nonmainstream left parties and women's representation in Western Europe. *Party Politics*, *24*(4), 397–409.

Kerevel, Y. P., & Atkeson, L. R. (2013). Explaining the marginalization of women in legislative institutions. *The Journal of Politics*, *75*(4), 980–992.

Kittilson, M. C. (2011). Women, parties and platforms in post-industrial democracies. *Party Politics*, *17*(1), 66–92.

Lloren, A., Rosset, J., & Wüest, R. (2015). Debate: Descriptive and substantive representation of poor citizens in Switzerland. *Swiss Political Science Review*, *21*(2), 254–260.

Lookabaugh, L. (2017). Talking about the weather in Chiapas, Mexico: Rural women's approaches to climate change adaptation. *The Latin Americanist*, *61*(1), 61–80.

Lv, Z., & Deng, C. (2018). Does women's political empowerment matter for improving the environment? A heterogeneous dynamic panel analysis. *Sustainable Development*, *27*, 603–612.

MacKinnon, C. A. (1989). Chapter 8: The liberal state. *Towards a feminist theory of the state*. Harvard University Press.

Makina, A., & Moyo, T. (2016). Mind the gap: Institutional considerations for gender-inclusive climate change policy in Sub-Saharan Africa. *Local Environment*, *21*(10), 1185–1197.

Mansbridge, J. (1999). Should blacks represent blacks and women represent women? A contingent "yes". *The Journal of Politics*, *61*(3), 628–657.

Mansbridge, J. (2005). Quota problems: Combating the dangers of essentialism. *Politics & Gender*, *1*(4), 622–38.

McBride, D. E. (2001). *Abortion politics, women's movements, and the democratic state: A comparative study of state feminism*. Oxford University Press.

McCormick, J. (1998). Environmental policy?. In P.-H. Laurent & M. Maraesceau (Eds.), *The state of the European Union*. Longman.

McCright, A. M. (2010). The effects of gender on climate change knowledge and concern in the American public. *Population and Environment*, *32*, 66–87.

McGee, J. A., Greiner, P. T., Christensen, M., Ergas, C., & Clement, M. T. (2020). Gender inequality, reproductive justice, and decoupling economic growth and emissions: A panel analysis of the moderating association of gender equality on the relationship between economic growth and CO_2 emissions. *Environmental Sociology*, *6*(3), 1–14.

Mendonça, M. (2007). *Feed-in tariffs: accelerating the deployment of renewable energy*. Earthscan.

Mitchell, C., Bauknecht, D., & Connor, P. M. (2006). Effectiveness through risk reduction: a comparison of the renewable obligation in England and Wales and the feed-in system in Germany. *Energy Policy*, *34*(3), 297–305.

Murray, B., & Rivers, N. (2015). British Columbia's revenue-neutral carbon tax: A review of the latest "grand experiment" in environmental policy. *Energy Policy*, *86*, 674–683.

Neumayer, E., & Plümper, T. (2007). The gendered nature of natural disasters: The impact of catastrophic events on the gender gap in life expectancy, 1981–2002. *Annals of the Association of American Geographers*, *97*(3), 551–566.

Noblet, C., Teisl, M. F., Anderson, M. W., & McCoy, S. (2015). Public preferences for investments in renewable energy production and energy efficiency. *Energy Policy*, *87*, 177–186.

Norgaard, K., & York, R. (2005). Gender equality and state environmentalism. *Gender and Society*, *19*(4), 506–522.

Nugent, C., & Shandra, J. M. (2009). State environmental protection efforts, women's status, and world polity. *Organization & Environment*, *22*(2), 208–229.

Pelicice, F. M. (2019). Weak democracies, failed policies, and the demise of ecosystems in poor and developing nations. *Tropical Conservation Science*, *12*, 1–9.

Phillips, A. (1995). *The politics of presence*. Oxford University Press.

Ramstetter, L., & Habersack, F. (2019). Do women make a difference? Analyzing environmental attitudes and actions of members of the European Parliament. *Environmental Politics*, *29*(6), 1–22.

Ritchie, H., Roser, M., & Rosado, P. (2020). Energy: Our world in data. our world in data. https://ourworldindata.org/energy

Romano, A. A., Scandurra, G., Carfora, A., & Pansini, R. V. (2016). Assessing the determinants of SIDS' pattern toward sustainability: A statistical analysis. *Energy Policy*, *98*, 688–699.

Salahodjaev, R., & Jarilkapova, D. (2020). Women in parliament and deforestation: Cross-country evidence. *Journal for Nature Conservation*, *55*, 1–7.

Sambodo, M. T., & Novandra, R. (2019). The state of energy poverty in Indonesia and its impact on welfare. *Energy Policy*, *132*, 113–121.

Scheraga, J. D., Ebi, K. L., Furlow, J., & Moreno, A. R. (2003). From science to policy: developing responses to climate change. In A. J. McMichael (Ed.), *Climate change and human health: Risks and responses* (pp. 237–263). World Health Organization.

Senk, K. (2020). Are women less effective at passing bills? Exploring the direct and indirect effects of gender. *Legislative Studies Quarterly*, *46*, 791–816.

Semenza, J., Ploubidis G. B., & George, L. A. (2011). Climate change and climate variability: Personal motivation for adaptation and mitigation', *Environmental Health*, *10*(46), 1–12.

Smith, M. G., & Urpelainen, J. (2014). The effect of feed-in tariffs on renewable electricity generation: An instrumental variables approach. *Environmental & Resource Economics*, *57*(3), 367–392.

Soria, L., Farley, K., & Glinski, A. M. (2016). *Solar sister: Empowering women through clean energy entrepreneurship*. International Center for Research on Women. https://www.icrw.org/wp-content/uploads/2016/10/SolarSisterBrief.pdf.

Stoddart, M., & Tindall, D. B. (2011). Ecofeminism, hegemonic masculinity, and environmental movement participation in British Columbia, Canada, 1998–2007: Women always clean up the mess. *Sociological Spectrum*, *31*(3), 342–368.

Tranter, B. (2011). Political divisions over climate change and environmental issues in Australia. *Environmental Politics*, *20*(1), 78–96.

US Congress (2021). Text - H.R.806 - 117th Congress (2021-2022): Clean Energy and Sustainability Accelerator Act. (2021, March 3). https://www.congress.gov/bill/117th-congress/house-bill/806/text

Wang, Q., Li, S., & Pisarenko, Z., (2020). 'Heterogeneous effects of energy efficiency, oil price, environmental pressure, R&D investment, and policy on renewable energy — evidence from the G20 countries', *Energy*, *209*, 1–13.

Wittmer, D. E. & Bouché, V. (2013). The limits of gendered leadership: Policy implications of female leadership on "women's issues". *Politics & Gender*, *9*, 245–275.

World Bank Open Data (2019a). *World Development Indicators: Renewable energy consumption (% of total final energy consumption)*. https://data.worldbank.org/indicator/EG.FEC.RNEW.ZS?view=chart.

World Bank Open Data (2019b). *World Development Indicators: GDP per capita (current US$)*. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?view=chart.

World Bank Open Data (2019c). *World Development Indicators: Total natural resources rents (% of GDP)*. https://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS?view=chart.

World Bank Open Data (2019d). *World Development Indicators: Countries and economies*. https://data.worldbank.org/country

World Bank Open Data (2019e). *World Development Indicators: Proportion of seats held by women in national parliaments (%)*. https://data.worldbank.org/indicator/SG.GEN.PARL.ZS

Yamamoto, Y. (2018) *Feed-in tariffs and the economics of renewable energy*. Springer International Publishing.

Address for Correspondence: Hannah Salamon, School of Government and Public Policy, University of Strathclyde, Glasgow G1 1XQ, UK; Email: hannah.salamon@strath.ac.uk