The Shifting Finance of Electricity Generation*

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Abstract

We collect ownership data of U.S. power plants accounting for 99% of U.S. electricity generation over the 2008-2020 period. Domestic listed corporations have reduced their ownership from 69% to 54% of total generation, while private equity, institutional investors, and foreign corporations have increased their ownership from 8% to 24%. These new entrants have increased their share largely through the creation of new natural gas, solar, and wind power plants rather than acquisitions of existing plants. We find only limited support for the leakage hypothesis that incumbent domestic corporations, which are subject to more disclosure requirements and scrutiny, sell older fossil-fuel power plants to the new ownership types in order to keep them alive. Market competition is the main economic condition that attracts new capital and facilitates the adoption of innovative technologies, while climate concerns and renewable policy measures have a limited effect. The changing ownership structure has implications for electricity markets as private equity operates power plants at lower capacity factors and sells electricity for $1.87 higher average price per MWh. Private equity owners sell electricity under contracts with shorter duration, shorter increment pricing, and more peak-term periods, especially when selling electricity generated from fossil fuels.

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Keywords: utilities, private equity, institutional investors, innovation, power plants, electricity, energy.

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I. Introduction

The impacts of both competition and financing on promoting innovation have been a significant topic of research for most of the past century. Schumpeter (1942) argued that the canonical firm existing in an environment of perfect competition has fewer incentives and a weaker capacity to adopt new technologies compared to larger firms in oligopolistic markets. Implementing innovation requires investors willing to put capital at risk, so if smaller firms are to disrupt larger ones with new technologies, the smaller firms require significant financing. Arrow (1962) in contrast argued that market power stifles innovation, as firms wish to protect their rents and avoid cannibalization of existing assets, and that product market competition spurs competition. The destruction process is also costly as incumbents face legal or regulatory risks associated with legacy technologies and will question whether they should retain "stranded" assets or transfer them to specialized firms.[1] Whether the implementation of innovation comes more from dominant incumbents or smaller new entrants depends on the competitive and regulatory environment, as well as the availability of capital whose owners are willing to bear risk (Shapiro, 2012).

We document that competitive markets attract new owners and facilitate creation and destruction in the energy sector. The electricity generation industry is well suited to examine the role of competition and innovation for three reasons. First, power plants are basic infrastructure assets that can stimulate long-term economic growth through spillovers to other sectors and provision of vital services to the population (Glaeser and Poterba, 2020). Blackouts and pricing volatility in electricity markets can have a profound influence on industrial production, quality of life, and poverty. The Russia-Ukraine war conflict and other global events have also heightened concerns about the need for security and energy independence across countries, a goal that requires substantial new domestic investments. Second, the energy sector is a capital-intensive sector that has experienced a great deal of innovation, including new renewable technologies using solar and wind energy as well as the shale gas boom (e.g., Gilje, Loutskina, and Strahan, 2016).

[1] The term "stranded assets" refers legacy assets whose values unexpectedly and prematurely decline and expose incumbents to economic losses and risks. In the energy industry, the term refers to older assets using fossil fuels whose value may decline due to technology shifts or regulation promoting green energy.

Implementing these innovations requires large amounts of capital. Third, power plants are at the center of government environmental policy and demands for reduced pollution.[2] Although U.S. CO_2 emissions have fallen since their peak in 2007, due both to a shift away from coal towards natural gas and the introduction of renewables, electricity generation is still a large source of emissions that would require substantial investments if its carbon footprint is to be further reduced.

We collect data on the ownership of U.S. power plants and document a persistent trend of changes in the ownership of electricity generating assets. Over the 2008-2020 period, the ownership share of domestic listed corporations has declined from 69% to 54%, while total U.S. electricity generation has remained roughly constant at around 4.1 trillion kWh per year. Private equity, institutional investors, and foreign corporations have gradually replaced domestic corporations in the ownership of both renewable and fossil fuel power plants. As of 2020, private equity, institutional investors, and foreign corporations together owned 59% of wind, 44% of solar, 28% of natural gas, and 11% of coal electricity generating capacity.

We analyze the relative importance of three mechanisms that could drive these ownership changes — creation of new power plants, sales of existing power plants, and decommissioning (shutdown) of power plants — as well as the economic conditions that facilitate ownership transitions. First, we compare the role of incumbent owners, such as domestic corporations, and new owners, such as private equity, institutional investors and foreign corporations, in implementing the three mechanisms. Second, when analyzing the economic conditions that enable changes, we examine the impact of market competition, climate concerns among the state population, and policy incentives for renewable energy. Our measure of deregulated markets captures whether the wholesale electricity market is administered by an independent balancing authority rather than a traditional vertically integrated utility.[3] The staggered introduction of "market

[2] The International Energy Association calculated in 2021 that annual energy investment must rise to $5 trillion per year by 2030 to achieve net zero emissions by 2050 (International Energy Association, 2021). At the 26th Glasgow Conference of the Parties later that same year, over 450 financial institutions that together manage $130 trillion of assets pledged to use their funds towards that goal (Council on Foreign Relations, 2021).

[3] The introduction of ISO balancing authorities occurred during the wave of state-level restructurings in the 1990s and early 2000s, before the expansion of renewable technologies and shale gas. The restructuring reform allowed independent power producers to sell electricity to utilities, and new retail service providers to displace utilities' role

dispatch" and independent system operators (ISOs) as balancing authorities represents an important source of regional-level variation in market competition (Borenstein and Bushnell, 2015; Cicala, 2022). The ISO operated wholesale markets were established before our sample period, and before new technologies became competitive, which reduces concerns regarding reverse causality.

The first mechanism focuses on differences in the creation of new power plants. Domestic corporations are the incumbent owners and may have various competitive advantages for creating new assets, including size, established access electrical grid, synergies with existing operations, and the ability to impact government policy (e.g., Chandler, 1994; Autor et al., 2020; Kwon, Ma, and Zimmermann, 2022). However, domestic corporations also may prefer to delay the implementation of new technology when they are protected by limited competition and a lack of market discipline (e.g., Arrow, 1962; Bertrand and Mullainathan, 2003; Gutierrez and Philippon, 2017; Cunningham, Ederer, and Ma, 2021). The incentives to promote innovation can depend also on the firm's ownership structure (Aghion, Van Reenen, and Zingales, 2013; Antón, Ederer, Giné, and Schmalz, 2022).

Consistent with a strong role for new entrants in creating greenfield assets, which we define as the first 12 months of plant operation, we find that private equity financed 26% of all new power plants, with foreign corporations financing 14%, and an increasing trend in both categories. Conditional on power plant fuel type (i.e., solar, wind, natural gas, coal, and other production technologies) and plant state, private equity is 1.55 percentage points more likely to own a given power plant in the greenfield stage than domestic corporations, which represents an increase of 89% relative to the baseline greenfield share of 1.75%. Foreign corporations are 1.27 percentage points more likely to own a greenfield plant than domestic corporations, an increase of 73% relative to the baseline. Institutional investors are considerably less likely to own a greenfield plant, as they seek more mature operating assets with stable cash flows.

Deregulated electricity markets with an ISO balancing authority have an overall higher proportion of greenfield assets. We find that these markets experience more innovation because they attract

in procuring energy and billing customers. The wholesale market restructurings are generally associated with production cost reductions (Fabrizio, Rose, and Wolfram, 2007; Davis and Wolfram, 2012; Cicala 2015).

investments from new owners. The difference in new power plant creation between domestic corporations versus private equity and foreign corporations is significant only in deregulated markets. In these competitive markets, domestic corporations are 1.41 percentage points less likely to own a greenfield power plant, and this difference is particularly driven by the creation of new natural gas plants. In addition to deregulated markets, the differences in the probability of creating new renewable power plants are also concentrated in states where the population displays higher climate concerns as private equity and foreign corporations are more likely to create new solar and wind plants in these states.[4]

The second mechanism focuses on sales of existing power plants by incumbent domestic corporations to private equity, institutional investors, and foreign corporations. Private equity has experienced substantial inflows in the past decade as institutional investors have increased allocations to alternative asset classes (Ivashina and Lerner, 2018; Andonov and Rauh, 2022). One potential concern of policymakers is that this transaction mechanism could lead to leakage (reallocation) of older power plants using fossil fuels from domestic corporations to new owners (Copeland, Shapiro, and Taylor, 2021). Stricter disclosure requirements apply to domestic corporations, and they are also more likely to be affected by public pressure (Benthem et al., 2022; Bolton and Kacperczyk, 2022).[5] Domestic corporations might therefore sell their older power plants to owners who are subject to more lenient regulatory and disclosure requirements such as private equity (see Bernstein (2022) for a review) and foreign corporations.[6]

We find that while the sales mechanism is important for the reallocation of ownership of electricity generating assets from domestic corporations to new ownership types, there is very little evidence that this leads to an extension in the lifespan of fossil fuel plant operation. Using multinomial logit specifications,

[4] We measure climate concerns among the population according to the Yale Climate Survey. Higher climate concern among the population could attract relatively more new investors to commit capital to greenfield projects as the investors might expect higher demand for cleaner technologies, as well as pressure on local governments to impose stricter regulations on older power plants in these states.

[5] One example of the increased public scrutiny is the 2021 action by activist investor Engine No. 1 in collaboration with several large asset managers to win board seats at Exxon Mobil Corporation. The activist investors then voted to cut oil production at Exxon, and Exxon reportedly sold some oil fields to PetroChina (Rubenfeld and Barr, 2022).

[6] The leakage hypothesis relates to the concerns about outsourcing pollution in international trade (e.g., Antweiler, Copeland, and Taylor, 2001; Cherniwchan, Copeland, and Taylor, 2017; Shapiro and Walker, 2018; Shapiro, 2021).

we document three results that do not support the leakage hypothesis. First, domestic corporations are more likely to retire older power plants that they owned at the start of our sample period in 2008. For instance, a one unit increase in the logarithm of plant age is associated with 17.0 percentage points higher probability to be retired by a domestic corporation by the end of our sample in 2020 versus 8.5 percentage points lower probability to be sold by a domestic corporation, where the baseline probability in each case is around 15%. Second, domestic corporations are more likely to retire power plants located in states where the population has high climate concerns, instead of selling these assets. Third, coal, petroleum, and natural gas plants are 31-41% more likely to have been retired by the original domestic corporate owner than other fuel types, but no more likely to be sold to other owners and still operating.

The third mechanism is differences in decommissioning of power plants. If the new owners are more likely to continue operating plants for a longer period of time than domestic corporations, their ownership stake will increase. The same differences in disclosure requirements and public pressure that affect asset sales could also affect ownership through differences in decommissioning rates (Bertrand and Mullainathan, 2003). We do find that domestic corporations have the highest decommissioning rates across all ownership structures, and private equity is somewhat less likely to be the owners of a coal power plant that is decommissioned within 12 months. However, private equity has a similar probability of shutting down power plants as governments, co-operatives, and other traditional owners of power plants, and is more likely to shut down than institutional investors or foreign corporations.[7]

The sales and decommissioning mechanisms are also stronger in competitive electricity markets. This difference in sales and decommissioning rates of power plants between deregulated and traditional markets is driven by domestic corporations, which sell and shut down more power plants in competitive markets. For instance, domestic corporations have 1.12 percentage points higher probability to own a retired power plant in deregulated markets as compared to traditional markets.

[7] When investing directly in power plants, institutional investors seem to reduce their exposure to risks associated with creation of new assets as well as shutting down of older assets, as these activities could expose them to higher liability and litigation risks (e.g., Bellon, 2022; Lam, 2022). Consequently, we find that institutional investors have very limited exposure to legacy power plants using coal and petroleum fuels.

Overall, we document that the majority of changes in ownership of power plants occur through creation of new greenfield assets and decommissioning of older assets. The sales mechanism has a limited role in explaining the ownership changes. Electricity market deregulation is the main driver of ownership changes. Deregulated markets are more innovative and attract new capital from private equity and foreign corporations. Deregulated markets also push domestic corporations to shut down a higher proportion of the assets. The differences in power plant creation are economically larger than the differences in power plant shutdowns. In terms of economic policy, differences in climate concern as a proxy for demand play a minor role in attracting more investments in renewable plants from private equity and foreign corporations. Differences in tax and production-based incentives across states also do not seem to explain the heterogeneity in ownership of power plants as the ownership types do not differ in their sensitivity to renewable policy incentives.

We examine implications of the ownership changes for the operational performance, contracting, and pricing in electricity markets. An alternative version of the leakage hypothesis is that the new owners might operate the older fossil fuel assets more intensively. In fact, we find no evidence for this version of the leakage hypothesis. If anything, private equity firms operate plants at slightly lower capacity factors, particularly natural gas power plants. We therefore again find very limited evidence consistent with the hypothesis that new ownership is supporting fossil fuel powered electricity generation assets at the expense of other ownership types.

We use Federal Energy Regulatory Commission (FERC) Electric Quarterly Reports (EQR) to data on electricity transactions FERC data to analyze differences in contracting and pricing across ownership types. We observe that private equity implements substantially different pricing contracts, though primarily in the non-renewables space. Across all types of electricity generation, private-equity-owned power plants sell electricity for $1.87 higher average price per MWh relative to other producers of the same fuel type in the same state and month. Private equity owners enter into contracts with more short-term duration, lower length increments, and more peak-period sales, all conditional on fuel type this result is driven by non-renewables. Direct ownership by institutional investors is associated with longer term contracts and

contracts with longer increment lengths, in line with their objective to obtain stable long-term cash flows from infrastructure investments in private markets (Andonov, Kräussl and Rauh, 2021).

The results overall indicate that the level of pricing by private equity is higher than pricing by domestic corporations. Combined with the finding that the ownership in the electricity generation market has shifted considerably towards private equity owners, this implies the possibility of higher prices and higher volatility on wholesale electricity markets.

The fact that private equity backed firms and foreign corporations are now conducting a large share of the financing of the energy transition as domestic corporations may well reflect reluctance to introduce new (e.g., renewables) products that compete with their existing products, although there are several alternative explanations. If these incumbent companies engage in a mix of fossil fuel and renewable electricity generation, raising capital from the increasing large number of investors with ESG objectives may be more costly or even impossible. Furthermore, domestic corporations are often regulated utilities or subsidiaries of them and may face regulatory limits on their ability to raise prices. Lastly, the compliance costs and need for disclosure in public markets may have driven much innovation in electricity generation to private firms, where private equity is the most important source of finance. Our results on the energy sector, fit into the broader trend of declining number of U.S. listed companies (Doidge, Karolyi, and Stulz, 2017; Ewens and Farre-Mensa, 2020).

This paper contributes to several streams of research literature. Relative to the literature on whether incumbents or new entrants are the natural sources of new technology (e.g., Shapiro, 2012), we find that in electricity generation, smaller privately financed firms are playing a role both in the financing of new technology and also continuing to finance older fossil-fuel technologies. Our findings also relate to research on the role of regulation and market power in innovation as we observe that owners with monopoly on customers, such as industry, cooperatives, and government, are the last to adopt new technology (Aghion, Bergeaud, and Van Reenen, 2021) and specifically in the environmental space (Porter, 1991; Jaffee and Palmer, 1997). Relative to the literature on climate finance (e.g., Hong, Karolyi, and Sheinkman, 2020;

Giglio, Kelly, and Stroebel, 2021), we focus specifically on the ownership structures and financing behind the new and legacy electricity generation technologies.

Second, our paper relates to the energy economics literature that studies wholesale electricity markets. A large literature has focused on the deregulation of electricity markets, or more specifically the ceasing of regulating vertically-integrated utilities based on cost-of-service, and in particular their impact on market concentration (e.g., Borenstein, Bushnell, and Wolak, 2002; Borenstein, 2002), costs (e.g., Fabrizio, Rose, and Wolfram, 2007; Cicala, 2015), and consumer markets (Borenstein and Bushnell, 2015). Cicala (2022) studies the cost impacts of the shift from a command-and-control approach by balancing authorities to the use of auctions for electricity in centralized wholesale electricity markets ("market dispatch"). Our contribution is to show that as the regulatory status changes, ownership structure also changes, and new participants potentially drive the changes in these deregulated markets.

Third, our paper relates to the literature on the impact of private equity on efficiency, employment, and productivity.[8] Our contribution is to study the creation of new assets and retirement of existing assets, rather than to focus only on changes in ownership through acquisitions. Private equity has a major role in adopting new technologies and shutting down stranded assets, but the impact of private equity does not seem to be driven by the business model with high-powered incentives as we document that foreign corporation also adopt innovative technologies. The creation and destruction seem to be primarily affected by market competition and incumbency status rather than differences between public and private markets.

II. Power Plants and Electricity Generation

Our sample covers all U.S. power plants reporting to the Energy Information Administration (EIA) over the 2008-2020 period. We use EIA Form 923 to collect data on monthly electricity net generation at

[8] Prior research has examined the impact of private equity ownership on operational performance, productivity, employment, and profitability (e.g., Davis et al., 2014; Bernstein and Sheen, 2016; Antoni, Maug and Obernberger, 2019; Davis et al., 2021); workplace safety, employees health, and employee satisfaction (e.g., Cohn, Nestoriak and Wardlaw, 2019; Lambert, Moreno, Phalippou, and Scivoletto, 2021); environment and pollution (e.g., Shive and Forster, 2020; Bellon, 2022); customers in regulated industries (e.g., Eaton, Howell and Yannelis, 2020).

the power-plant-prime-mover level — that is, if a power plant in a given time period uses multiple prime-mover technologies for generating electricity (e.g., a natural gas plant using steam turbine, combustion turbine, and combined-cycle combustion turbine), it will have multiple observations in that time period.

EIA Form 860 provides information on all U.S. electric power plants with at least 1MW of nameplate capacity. We aggregate the information from EIA Form 860 for power-plant generators that use the same prime-mover technology and merge both datasets on a power-plant-prime-mover level. Table 1 shows that our sample contains 11,421 unique power plants, 13,036 unique power-plant-prime-mover units, and 1,288,195 monthly observations. Fossil fuel power plants use often multiple prime-mover technologies, while nuclear, hydro, wind, and solar power plants rely only on one prime-mover technology. When we use the term power plant in the paper, we refer to power-plant-prime-mover observations.

Table 1 reports summary statistics on the average power plant nameplate capacity and age. In our analysis all values are weighted by power plant nameplate capacity, which is the total megawatt-hours that the plant would produce if it could continuously run at all hours of the day. We present weighted statistics and regression estimates, as the sample of power plants contains many small power plants that contribute very little to overall net generation. For instance, there are 3,940 unique solar power plants in the sample, but they account for less than 3% of electricity generation in 2020. The average power plant has a nameplate capacity of 0.97 GW and is 31.32 years old. Capacity factor is one measure of power plant's operating performance and is defined as the ratio of monthly net generation to capacity. Power plants differ in the average capacity based on the fuel used to generate power. Nuclear power plants have the highest operating performance with an average capacity factor of 0.86, while solar power plants have the lowest operating performance with an average capacity factor of 0.24.[9]

[9] One limitation of the nameplate-capacity-weighting is that power plants that rely on fuels with lower capacity factors, such as wind and solar farms, will receive disproportionally higher weights than power plants that use fuels with higher capacity factors, such as nuclear energy. An alternative weighting variable is the monthly net generation. However, a limitation of the net-generation-weights is that the decision to generate electricity is a choice and varies over time, especially for fossil fuel power plants. In our analysis we rely primarily on capacity-weights, but we estimate robustness tests without weighting. In these robustness estimations, we limit attention to the subsample of larger power plants with capacity of at least 20 MW. Online Appendix Table A.1 reports summary statistics without weighting the power plants and focuses only on the subsample of power plants with capacity of at least 20 MW.

Table 1 also presents statistics on greenfield and decommissioned power plants. We classify power plants as a new greenfield asset in the first 12 months of plant operation. Our sample contains 5,871 unique greenfield plants and their first 12 months of operation account for 1.75% of our sample on a capacity-weighted basis. Greenfield plants are concentrated in new renewable technologies, such as solar and wind, as well as natural gas plants which were supported by the shale gas boom (see Gilje, Loutskina, and Strahan (2016) for discussion on the rapid growth of shale gas production). Decommissioned power plants capture the last 12 month of plant operation before the shutdown. During our sample period, 1,553 unique power plants are shut down and their last 12 months of operation account for 1.12% of our sample on a capacity-weighted basis. Decommissioned plants are concentrated in fossil fuels, such as coal and natural gas.

We manually collect ownership data of all U.S. power plants based on regulatory announcements, Preqin infrastructure dataset, and newswire articles. Table 1 Panel B classifies the owners into eight categories: domestic corporations, private equity, institutional investors, foreign corporations, industry firms, government, cooperatives, and other. The largest category based on ownership stakes is *domestic listed corporations*, which includes traditional utilities and listed independent power producers (e.g., Duke Energy, Exelon Corporation, PG&E Corporation, Southern Company, etc.).

The other traditional owners of power plants are industry firms, government, and cooperatives. I*ndustry firm* category includes power plants owned directly by large industrial companies engaged in energy-intensive manufacturing, such as production of paper, steel, aluminum, and chemical products (e.g., International Paper Co, Dow Chemical Co, Alcoa Corporation, etc.). These industrial firms consume most of the produced energy for own production purposes. The *government* category includes power plants owned by federal, state, and local governmental entities (e.g., Tennessee Valley Authority, U.S. Bureau of Reclamation, Los Angeles Department of Water and Power, etc.). The electric *cooperatives* category covers power plants that are built and owned by the communities they serve (e.g., Basin Electric Power Coop, Associated Electric Coop, East Kentucky Power Coop, etc.).

The new rising owners of power plants are private equity, institutional investors, and foreign corporations. The *private equity* category includes investments made by private equity and infrastructure

funds as well as other investment vehicles (e.g., ArcLight, KKR, LS Power, Macquarie, etc.). In this category, we also incorporate a small number of power plants owned by private companies and family businesses (e.g, Caithness Energy Invenergy, Koch Industries, Tenaska, etc.). The *institutional investors* category covers direct investments of pension funds, insurance companies, and sovereign wealth funds in energy assets. Almost all direct investments come from foreign institutional investors, such as Canadian and Dutch pension funds (e.g., Canada Pension Plan Investment Board, Ontario Municipal Employees Retirement System, Algemene Pensioen Groep, etc.). The *foreign listed corporations* category covers power plants owned by European, Canadian, and Asian energy companies (e.g., EDP Group, Engie, Iberdrola, Itochu Corporation, Kansai Electric Power Co., Osaka Gas, etc.). The final category includes other (small) power plants, which we have not classified yet in one of the other categories.

Figure 1 shows that we categorize 99% of the electricity generation in any month over the 2008-2020 period into one of the seven ownership categories, and the remaining other category covers around 1% of the generation in any month. If a power plant is owned by multiple ownership types, we divide the ownership and generation equally across the ownership types (i.e., if a private equity and institutional investor jointly own a power plant, we assume that each ownership types owns 50% of the plant). This adjustment does not matter for most ownership types, as they typically act as sole investors and acquire 100% stake in the power plants, except for institutional investors. Institutional investors typically co-invest with other investors, and they share ownership in more than 93% of their observations.[10] Thus, institutional investors do not lead energy investments, but rather provide deep pockets for larger transactions or partial exit to other investors (Fang, Ivashina, and Lerner, 2015; Andonov, Kraussl and Rauh, 2021).

Figure 1 shows that the percentage of electricity generated by power plants owned by domestic corporations declines from 69% in 2008 to 54% in 2020. Private equity, institutional investors, and foreign corporations replace domestic corporations as their share jointly increases from 8% in 2008 to 24% in 2020.

[10] For instance, Canada Pension Plan Investment Board co-invested with Energy Capital Partners fund in the buyout of Calpine Corporation in March 2018. Alberta Investment Management Corporation established a joint venture with AES Corporation to acquire Sustainable Power Group LLC (sPower).

The generation share of governments, cooperatives, and industry firms remains constant. The ownership changes while the total output remains constant. Online Appendix Figure A.1 shows that U.S. produced 4.1 trillion kWh of electricity in 2008 and the total output has remained constant over our sample period. The total imports and exports of electricity also remain stable over our analysis and economically marginal as they account for less than 2% of the U.S. electricity market.

The ownership structure of power plant differs across fuel types. Figure 2 depicts the ownership of net generation for the six main fuel types: natural gas, coal, nuclear, hydro, wind, and solar.[11] Renewable fuels have a smaller contribution to the overall electricity generation, so we scale the y-axis for their plots to 35TWh, while nuclear and fossil fuels account for the majority of generation and we scale y-axis for their plots to 200TWh. Over the 2008-2020 period, natural gas became the main fuel for electricity generation and replaced the declining coal generation. Wind and solar energy is increasing over our sample period and captures the majority of newly created greenfield plants. The generation from hydro and nuclear power plants stays relatively stable, despite the decommissioning of some assets, and the ownership structure of these asset also does not exhibit significant shifts. The new types of owners, private equity, institutional investors, and foreign corporations, control 58% of the wind, 46% of the solar, and 34% of the natural gas electricity generation in 2020. Domestic corporations own large part of the generation in all fuel types, but they are especially negatively affected by the declining coal generation.

Table 1 Panel C presents statistics on the electricity markets. *ISO Balancing* is our main measure of market competition, and it is an indicator for power plants that operate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. The ISOs that provide nondiscriminatory grid access were formed after the adoption of the Energy Policy Act of 1992 and Federal Energy Regulatory Commission (FERC) orders 888 and 889.[12] In the areas that are not services by an ISO,

[11] Hydro category includes only power plants using hydraulic turbine as a prime mover and excludes plants with pumped storage as a prime mover. Solar category includes only power plants with photovoltaic prime mover and excludes plants with steam turbines that can use solar stream.

[12] Our definition classifies the following balancing authorities as ISO: California Independent System Operator, Electric Reliability Council of Texas, Midcontinent Independent System Operator, ISO New England, New York Independent System Operator, PJM Interconnection, and Southwest Power Pool.

vertically integrated local electric utilities own power plants generating electricity as well as the transmission system and delivery network. These utilities do not adopt a market dispatch mechanism and could potentially exclude independent producers from the market by denying transmission access (Borenstein and Bushnell, 2015; Cicala, 2022). The utilities that serve also as a balancing authority within their exclusively operated territories are typically owned by government or domestic corporations. Importantly for our analysis, the ISO operated wholesale markets were established before our sample period, mostly around 2000, and before wind and solar technologies became competitive as well as before the shale gas revolution, which reduces concerns regarding reverse causality.

Our alternative measure of market power captures states which have restructured their retail electricity markets. This measure is based on EIA classification of states that liberalized retailing, i.e., marketing and resale of wholesale power to end-use customers (Borenstein and Bushnell, 2015). The ISO balancing measure is broader as it covers also states that did not restructure their generation or retail sectors, but agreed to operate in a competitive wholesale market. The *EIA Restructured* indicator variable is based on EIA classification of state electric industry restructuring as of 2003.[13] These state restructuring initiatives stopped after the California electricity crisis in 2000-2001, and there were no changes after 2003.

Based on the Yale Climate Opinion Maps, we collect information on the climate concerns on a state level over time (Howe, Mildenberger, Marlon, and Leiserowitz, 2015). The Yale Climate Survey was created in 2014 and then updated it in 2016, 2018, and 2021.[14] The comparison of responses within a state over time is limited by changes in the survey design, but we focus on cross-sectional differences across states measured in the same survey year. Our *Climate Concern* variable is based on the percentage of state population who think that global warming is happening, and it is defined as the percentile ranking between zero and one of the state where the plant is located. The percentile rankings of states based on climate

[13] Based on EIA, the following states have a restructured retail electricity markets: Arizona, Connecticut, DC, Delaware, Illinois, Massachusetts, Maryland, Maine, Michigan, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, and Virginia (EIA summary and map: link).

[14] The Yale Climate Opinion Maps data has been used by Bernstein, Gustafson, and Lewis (2019) and Baldauf, Garlappi, and Yannelis (2020) to examine the relation between climate change beliefs and real estate prices.

concern over time are very stable and, therefore, we merge the survey ranking in 2014 with our data on power plants over the 2008-2014 period. We make similar adjustments with the later survey waves. Our alternative *CO2 Limits* measure is the percentile ranking of the state where the plant is located based on the percentage of state population who support setting strict limits on existing coal power plants.

We use the Database of State Incentives for Renewables & Efficiency from the N.C. Clean Energy Technology Center to collect information on the policy incentives introduced by different states to stimulate the transition to renewable energy sources. We split the policy initiatives into tax incentives and production-based incentives. There are three different types of tax incentives: Renewables Corporate Tax, Renewables Property Tax, and Renewables Sales Tax. There are two different types of production incentives: Renewables Production and Renewables Tariffs.[15] In our analysis, we include a *Renewables Incentives* index, which aggregates the three tax indicators and the two production indicators.

Figure 3 shows that the trend in ownership changes is similar across all U.S. states, but domestic corporations decrease their ownership share relatively more in states with deregulated energy markets. In the states with liberalized competitive energy markets, such as Ohio and Pennsylvania, especially private equity increases the ownership share. Institutional investors and foreign corporations almost did not exist as energy owners in most U.S. states in 2008, but they increase their share across all U.S. states. Thus, the ownership changes are broad and affect the entire U.S. electricity market.

We merge the EIA power plant data with information on pricing and contracting of electricity sales. We use the Federal Energy Regulatory Commission (FERC) Electric Quarterly Reports (EQR) to collect data on electricity transactions. The FERC EQR data is available from July 2013 to December 2020, and

[15] Renewables Corporate Tax Incentives capture programs that provide corporate tax credit, corporate tax deduction, corporate depreciation. Renewables Property Taxes capture programs offering property tax exemption or reduction. Renewables Sales Taxes incentives offer an exemption or reduction from sales and use tax for equipment, generation, etc. Renewables Production incentives offer monetary compensation per KWh that can differ by fuel types and plant capacity. Renewables Tariffs incentives capture primarily feed-in tariffs, which offer long-term contracts with an above market price to renewable energy producers.

we convert the quarterly reports into monthly data.[16] The FERC regulatory requirements affect (larger) power plants located in states that are interconnected with power plants in other states. This requirement implies that power plants located in Alaska and Hawaii do not complete the FERC EQRs. Moreover, power plants operating in the Electric Reliability Council of Texas (ERCOT) are also not interconnected with power plants in other states and are not required to report to FERC.[17]

Overall, we merge 303,625 plant-prime-mover monthly observations owned by domestic corporations, private equity, institutional investors, and foreign corporations with FERC data on contractual terms and pricing. We do not analyze electricity transaction of power plants owned by government, cooperatives, and industry firms as they typically do not transact on the wholesale market, but rather use their electricity generation for own consumption within an area that they exclusively serve.[18] Panel A of Table 2 shows that the average electricity price in our sample is $33.81 per MWh, while the median price is $31.22 per MWh. Power plants experience significant volatility in the prices of their electricity sales as the standard deviation of quantity-weighted monthly price is $22.07 per MWh.

We classify transactions based on contractual terms in three ways. First, we distinguish between short and long-term contract duration. Electricity sales transactions with contract durations of one year or greater are classified as long-term, while transactions with shorter contract durations are classified as short-term. Second, we split the transactions into short, medium, and long based on the increment pricing terms. Short transactions use 5-minute, 15-minute or hourly increments (up to 6 hours). Medium transactions have daily or weekly increments (from 6 hours to 168 hours). Long transaction use monthly or yearly increments (longer than 168 hours). Third, we classify transaction into full-period, peak and off-peak based on the peaking terms. Full-period transactions cover both peak and off-peak period.

[16] If an electricity transaction in the FERC dataset continues over multiple months, we split the quantity and transaction charges across the months based on the number of days in each month. The price for these transactions will remain the same across the months.

[17] The FERC EQR data has been used by Lin, Schmid and Weisbach (2021) to study pricing and liquidity management.

[18] Section 205(c) of the Federal Power Act defines who must submit EQRs to FERC. FPA section 201(f) clarifies that the reporting provisions do not apply to the United States, a State, or any political subdivision of a State, as well as electric cooperatives. The reporting requirements also do not apply to utilities that make less than 4,000,000 MWh of annual wholesale sales.

Panel B of Table 2 reports the average percentage of quantity sold, while Panel C of Table 2 presents the average percentage of transaction charges by different contractual terms. Around 56% of the electricity quantity in our sample is sold under contracts with short durations and 50% of the transactions use short increments to determine the price. Transactions covering the full period account for 39% of the quantity sold and 38% of the charges. Peak period sales are more expensive as they account for 31% of the quantity and 36% of the charges, while off-peak sales are smaller and cheaper. Power plants using fossil fuels, such as coal and natural gas, are more flexible to adjust operation hours so they rely relatively more on short-term contracts, short increment pricing, and peak-term production. Solar and wind power plants depend on weather conditions and have limited flexibility in operating hours, so they use relatively more long-term contracts, long increment pricing, and full-term period contractual terms.

III. The Determinants of Ownership Changes

Figure 1 shows that the ownership share of domestic corporations has declined from 69% in 2008 to 54% in 2020. Private equity, institutional investors, and foreign corporations have gradually replaced domestic listed corporations in the ownership of both renewable and fossil fuel power plants. The changes in ownership over time can occur through three mechanisms: creation of new power plants, sales of existing power plants, and decommissioning (shutdown) of power plants. In this section, we examine the relative importance of three mechanisms as well as the economic conditions that stimulate ownership changes.

III.A Creation of New Power Plants

The first mechanism examines differences in the probability to create and own new power plants. Energy markets experienced substantial innovation over our sample period, and we analyze which owners are more likely to implement innovative technologies as well as the economic conditions that facilitate the adoption of new technologies. Creating new power plants is risky as it exposes the owners to risks related to getting regulatory approvals, finalizing plant construction, connecting the power plant to electric grid, and establishing sales contracts with customers.

One potential hypothesis is that domestic corporations, which are the traditional incumbent asset owners in our setting, may have various competitive advantages for creating new assets. Their advantages are size, established access to the transmission network, synergies with existing operations, and ability to impact government policy. However, an alternative hypothesis is domestic corporations also may prefer to delay the implementation of new technology (Arrow, 1962), especially under the protection of market power (Bertrand and Mullainathan, 2003; Cunningham, Ederer, and Ma, 2021).

In terms of economic conditions, our focus is on the role of energy market liberalization. Figure 4 Panel A shows that liberalized markets with an independent ISO balancing authority manage to attract significantly more innovation and investments in creating new greenfield power plants. On average, greenfield power plants represent 1.96% of the total nameplate capacity in markets with ISO balancing authority as compared to 1.37% of the total nameplate capacity in markets with a traditional vertically integrated utility as a balancing authority.

Panel B of Figure 5 shows that private equity, institutional investors, and foreign corporations are more likely to own a greenfield power plant as compared to their overall ownership share. For instance, private equity owns on average 26.3% of the greenfield power plants as compared to 11.7% of all power plants. Appendix Figure A.2 shows that most of the newly created power plants use wind and solar technology, but there is also a significant share of new natural gas power plants. This figure suggests that ownership structures could differ in their relative importance in the creation of both renewable and natural gas power plants.

However, based on the figures, we cannot distinguish how much the new ownership structures create new assets from their general preference to invest in certain fuel types (e.g., preference for renewable energy). In Table 3, we examine the probability to create greenfield power plants across fuel types and compare the sensitivity of different ownership types to electricity market conditions and regulatory incentives. We estimate pooled OLS regressions where the unit of observation is at the plant-prime-mover-month level, which for the 89% of power plants that use a single fuel technology implies one monthly observation per plant. The dependent variable is binary and captures whether a plant is a greenfield plant

or not; it is set at one for the first 12 months of plant operation. In the pooled OLS regressions, we weight the power plants by nameplate capacity which assigns higher weight to larger power plants. The OLS regressions are more suitable for our setting than nonlinear logit regressions as our focus is on the marginal effects rather than the latent index variable (Angrist and Pischke, 2009; Bertrand, Djankov, Hanna, and Mullainathan, 2007). Online Appendix Table A.2 shows that our results are robust to using logit specifications instead of pooled OLS, and without weighting the observations by nameplate capacity. However, we rely more on the OLS specification as the weighted coefficients are economically more relevant, and they include a more saturated set of fixed effects.

To distinguish the willingness to create new assets from the preferences to invest in certain technologies, we include in the specifications fuel type fixed effects. The fuel type fixed effects capture the baseline level that a solar or natural gas power plant is greenfield, while state fixed effects capture differences in weather conditions or available natural resources affecting plant location. In our analysis, we further saturate the specifications by including fully interacted fuel-type, state, and year-month fixed effects. When including these saturated set of interacted fixed effects, the estimates only rely on variation in ownership and probability to create greenfield assets across power plants using the same fuel and located in the same state and moment of time.

The unconditional probability equals 1.75% which captures the proportion of power plants that are in their first greenfield level in any given month. We find that domestic corporations are significantly less likely to own a given greenfield power plant. Based on Column (3), domestic corporations have a 1.24 percentage points lower probability of owning a greenfield plant as compared to the omitted ownership types, which are private equity, institutional investors, and foreign corporations. This coefficient corresponds to approximately 71% decrease relative to the baseline unconditional probability. Column (4) shows that private equity and foreign corporations have a 1.55 and 1.27 percentage points higher probability to own a greenfield power plant (or 86% and 73% increase relative to the unconditional probability). For institutional investors, we find that they have a significantly lower probability to own greenfield power plants after controlling for fuel-type fixed effects, even though Figure 2 shows that they own substantial

share of the newly created wind and solar power plants. Thus, institutional investors seem to have a preference to hold renewable energy assets, but they are not willing to create these new power plants. Institutional investors prefer to co-invest in established operational assets. In the analysis, we control but do not report the coefficients on government, cooperatives, and industrial firms. These ownership structures are less likely to create new power plants.

Our analysis on the economic conditions that could affect the decision to finance a greenfield power plant focuses on three factors. First, market competitiveness and regulation affect the ability of power plant to operate and sell electricity. Deregulated electricity markets may attract relatively more capital from new investors as the transmission is not operated by a monopolist utility that is also involved in electricity generation. Second, states where the population displays higher climate concerns may attract more investors through increased demand for new renewable or efficient power plants. The higher climate concern among the population could also incentivize relatively more new investors to commit capital to greenfield projects as they could expect politicians in these states to adopt stricter regulation and licensing of old power plants. Third, states implement various tax and production-based incentives to stimulate the transition to renewable energy and different owner types may respond to different incentives. In our analysis, we compare the relative importance of these three factors in explaining the heterogeneity in ownership structure across greenfield power plants.

The probability that private equity and foreign corporations create new power plants is not equally distributed across all U.S. states. We use the indicator for power plants participating in a wholesale market administered by an ISO balancing authority as our main indicator for deregulated electricity market. The interaction term of domestic corporations and ISO balancing authority in Column (5) of Table 3 shows that domestic corporations are especially less likely to create new power plants in states with liberalized competitive wholesale electricity markets. For instance, the baseline coefficient on domestic corporations in Column (5) is insignificant which implies that they are almost equally likely to create a given greenfield power plant in states with traditional markets as private equity and foreign corporations. The interaction term of domestic corporations and ISO balancing authority implies that domestic corporations are around

1.41 percentage points less likely to own a given greenfield plant in states with liberalized markets than in states with traditional markets. Figure 5 Panel A shows that private equity and foreign corporations are the two ownership types that are more likely to create greenfield power plants in states with deregulated electricity markets.

In Column 6, we examine the role of climate concerns among the population as a proxy for increased demand for new renewable or efficient power plants. The interaction term of domestic corporations and above-median climate concern indicator variable is insignificant suggesting that the differences in probability to finance new power plants are not driven by stronger sensitivity of private equity and foreign corporations to climate concern and public demand. In Column 7, we also show that the differences in ownership of greenfield plants are not captured by differences in the sensitivity of domestic corporations, private equity and foreign corporations to renewable energy tax incentives or production-based incentives.

Column (7) of Table 3 shows that liberalized electricity markets are the main economic condition that attract investments by private equity and foreign corporations in new power plants as only the interaction term with ISO balancing authority is economically and statistically significant. We find that the ability to sell electricity in a deregulated market is the key factor in explaining the heterogeneity in ownership structure and dominates the role of climate concern among the population, tax-based incentives for renewable energy, and production-based incentives for renewable energy.

In Online Appendix Table A.3, we use the *EIA Restructured* indicator as an alternative proxy of deregulated electricity market instead of ISO balancing authority. The results in Columns (5) and (6) confirm that the main factor that explains where private equity and foreign corporations finance the creation of new power plants is market competitiveness.

In Online Appendix Table A.4, we estimate a robustness test by limiting attention to the subsample of power plants with a nameplate capacity above 20MW as we cannot weight the observations by power plant capacity instead of weighting power plants by nameplate capacity. In this test, we want to avoid that the results are driven by few large newly created power plants (we also do not include all power plants to

avoid that the results are driven by micro solar plants). The unconditional baseline probability in this unweighted subsample equals to 3.01% as compared to 1.75% in the weighted broad sample, which shows that the newly create power plants tend to be on average smaller than the existing power plants. The results confirm that domestic listed corporations are less likely create new power plants than private equity and foreign corporations. The difference in the probability to create new electricity generating assets is concentrated in states with liberalized markets.

In Table 4, we consider heterogeneity by fuel type in the greenfield ownership results. The specifications focus on greenfield plants using solar, wind and natural gas fuels as they account for the vast majority of newly created power plants. We define the binary dependent variable as greenfield wind and solar plants in Panel A, and as natural gas plants in Panel B, leaving out of consideration the small number of new plants that use other technologies. The baseline probability for greenfield solar and wind plants is 0.88%, while the baseline probability for natural gas plants is 0.80% (which together add up to 1.68% out of the 1.75% shown in Table 3). This decomposition of the greenfield dependent variable by fuel type enables us to also decompose the coefficients on the ownership variables and interaction terms.

Based on Column (3), domestic corporations have a 0.66 percentage points lower probability to own greenfield solar and wind power plants, and 0.48 percentage points lower probability to own greenfield natural gas power plants. Thus, their aggregate coefficient 1.24 percentage points lower probability of owning a greenfield plant (Table 3 Column (3)) is relatively more due to their lower probability to create renewable power plants. Column 4 of Table 4 shows that both private equity and foreign corporations are more likely to own greenfield solar and wind power plants, but only private equity is more likely to own new natural gas power plants. The coefficient on foreign corporations in the specifications focusing on natural gas power plants are statistically and economically not different from domestic corporations.

The differences in probability of creating new wind and solar farms does not seem to be concentrated only in states with competitive electricity markets, but other states seem also able to attract capital from private equity and foreign corporations to finance the creation of new renewable power plants. The differences in ownership probability of greenfield solar and wind plants are driven partially by the

climate concern dimension. For instance, Column (6) of Table 4 Panel A shows that domestic corporations are 0.43 percentage points less likely to own a greenfield renewable power plant in states with low climate concern, but the significant interaction term shows that this difference grows by additional 0.35 percentage points in states with high climate concerns.

Panel B of Table 4 documents that domestic corporations are also less likely to create new natural gas power plants, and this difference is entirely concentrated in states with deregulated electricity markets. The interaction term between domestic corporations and ISO balancing authority captures the entire lower probability of domestic corporations to own new natural gas power plants. Based on Column (5) of Table 4 Panel B, domestic corporation are 1.19 percentage points less likely to create a new natural gas plant in states with restructured markets as compared to states with traditional electricity markets. Thus, the interaction effects between domestic corporations and market competition shown in Table 3 are largely driven by the location and ownership of new natural gas power plants.

Overall, private equity and foreign corporations own almost 50% of the newly created power plants and their willingness to adopt new innovative technologies contributes significantly to the changing ownership structure. The market organization driven by liberalization restructurings affects the extent to which private equity and foreign corporations actively finance new fossil fuel and renewable power plants as compared to domestic corporations, which have traditionally dominated electricity markets. Climate concern among the local population also incentivize relatively more private equity and foreign corporations to create new renewable plants as compared to domestic corporations. We can conclude that the higher degree of innovation in liberalized electricity markets presented in Figure 4 Panel A is driven by the ability of these markets to attract additional capital flows from private equity and foreign corporations into new greenfield projects.

III.B Sales of Power Plants

The second mechanism of ownership transition focuses on sales of existing power plants by incumbent domestic corporations to new ownership structures, such as private equity, institutional

investors, and foreign corporations. This mechanism has received significant attention in prior research on cross-border mergers and acquisitions (see Erel, Jang and Weisbach (2022) for a review), and private equity leveraged buyouts (see Bernstein (2022) for a review).

To assess the relative importance of the sales and acquisition mechanism we start by focusing on all power plants were owned by domestic corporations at the beginning of our sample in January 2008, when domestic corporations accounted for 69% of the electricity generation and before their share declined to 54%. We classify all power plants were owned by domestic corporations into four potential outcomes based on the latest observation in our dataset. The latest observation is either the shutdown date or December 2020 for plants that are not decommissioned. These are the four potential outcomes: *Still Own & Operating* covers plants that did not change ownership and are still operated by domestic corporations; *Owned & Retired* captures plants that did not change ownership, but were retired by domestic corporations during the sample period; *Sold & Operating* captures plants that were sold to other ownership type and are still operated by these new owners; and *Sold & Retired* covers power plants that were sold to other ownership types and were retired by these new owners during the sample period.

Table 5 presents the baseline probabilities for all these four outcomes weighted by nameplate capacity. We observe that domestic corporations retain ownership and continue operating 1,288 out of 2,261 power plants or around 69% of their initial nameplate capacity. The sales mechanism is economically equal to the decommissioning mechanism. Domestic corporations retired 15.2% and sold 16.2% (= 15.3% + 0.9%) of their initial nameplate capacity. These statistics highlight that sales of power plants are not the dominant form of ownership transitions in the energy industry.

The main concern regarding the sales mechanism is that domestic listed corporations transfer older polluting power plants to other owners. Based on this leakage hypothesis, domestic corporations face higher degree of regulatory pressure and public scrutiny. Private equity and foreign corporations are subject to more lenient regulation and lower reporting requirements so they may be willing to own and operate longer older power plants. Thus, the leakage hypothesis would predict that private equity and foreign corporations are more likely to continue operating older polluting plants and postpone their decommissioning.

In Table 5, we compare the characteristics of power plants that are sold and retired by domestic corporations. We report the marginal effects of multinomial logit regressions on the four potential outcomes: still own & operating, owned & retired, sold & operating, and sold & retired. The main control variable is power plant size, measure as nameplate capacity, as domestic corporation seem to own and operate longer period of time to ensure security and stability of the energy system. The specifications also include controls for fuel type and state fixed effects.[19]

We find three results that provide evidence against the leakage hypothesis. First, we observe that domestic corporations are more likely to retire older power plants. Domestic corporations are less likely to continue operating older power plants and less likely to sell older power plants to other owners, such as private equity, institutional investors, or foreign corporations. For instance, based on Column (5), a one unit increase in the natural logarithm of plant age is associated with 8.9 percentage points lower probability that a power plant is sold and still operated by a new owner, which is a substantial economic magnitude relative to the unconditional probability of 15.3%.

Second, we document that domestic corporations are not more likely to sell fossil fuel power plants to other owners. Based on Column (3), domestic corporations are more likely to retire own coal, petroleum, and natural gas power plants. The results in Column (7) show that even if coal and petroleum power plants end up being sold to new owners, these new owners are more likely to retire these plants soon rather than to continue operating them until the end of our sample period.

Third, domestic corporations are not more likely to sell power plants located in states where the population has high climate concern and might put relatively more pressure on the domestic corporations. Our analysis focuses almost exclusively on sales of fossil fuel power plants as solar and wind power plants almost did not exist at the beginning of our sample period, in January 2008. In states with high climate concern, domestic corporations are less likely to continue operating power plants and more likely to shut

[19] Coal & Petroleum is a joint indicator variable for power plants that use coal, waste coal, petroleum coke, or residual petroleum fuel.

down these plants, but we do not observe statistically and economically significant increase in the probability to sell an asset to new ownership types.

In addition, in line with our results on the role of market regulation for creating new power plants and adopting innovative technologies, we also observe that domestic corporations are more likely to sell power plants to new owners, such as private equity, institutional investors, and foreign corporations, in deregulated markets with an independent balancing authority. Based on Column (5), if a power plant is in a wholesale market that is administered by an ISO as a balancing authority, domestic corporation have a 7.7 percentage points higher probability to sell this power plant to new owners.

Overall, the sales mechanism explains only one-third of the ownership transitions. While in other infrastructure sectors transactions account for the vast majority of ownership changes (e.g., airports), creation of new power plants and adoption of innovative technologies seem to be highly relevant in the energy sector. In addition, we observe no evidence on leakage of older fossil fuel power plants from domestic corporations to private equity, institutional investors, and foreign corporations, as domestic corporations are more likely to shut down their older fossil fuel power plants.

III.C Decommissioning of Power Plants

Our analysis on sales and acquisitions suggests that there is a limited leakage of older fossil fuel power plants from domestic corporations, but it has two potential limitations. First, we focus only on power plants owned by domestic corporations at the beginning of our sample period since they accounted for 69% of electricity generations and reduced their ownership share in the next period. However, private equity, institutional investors, and foreign corporations jointly owned already 8% of the generation assets in 2008 and it may well be that they continue operating these assets for a longer period. Second, the multinomial logit analysis examines only the final outcomes and does not evaluate potential differences in the timing of power plant decommissioning across ownership categories. Due to these limitations, our previous analysis does not address an alternative version of the leakage hypothesis, which argues that domestic corporations

decommission fossil fuel power plants sooner than private equity, institutional investors, and foreign corporations because they are subject to stricter disclosure requirements and public scrutiny.

Power plant decommissioning is that the third mechanism that could contribute to ownership changes. In this section, we analyze which owners are more likely to shut down energy assets as well as the economic conditions that facilitate the retirement of old technologies. Decommissioning power plants is risky as it exposes the owners to risks related to pollution liability lawsuits, plant demolition, and reduced contracts with customers in anticipation of the shutdown date.

In terms of economic conditions, our focus is again on the role of energy market liberalization. Figure 4 shows that the decisions to commission new greenfield plants and decommission old plants closely follow each other, as the figures display correlated trends over time. In line with the trend on plant creation, Panel C shows that owners shut down more power plants in deregulated markets with an independent balancing authority. On average, decommissioned power plants represent 1.26% of the total nameplate capacity in markets with an ISO balancing authority as compared to 0.85% of the total nameplate capacity in markets with a traditional vertically integrated utility as a balancing authority.

Panel D of Figure 4 presents that domestic corporations dominate the retirement decisions, while private equity, institutional investors, and foreign corporations own a small fraction of the decommissioned power plant as compared to their overall ownership share. For instance, domestic corporations own 68.4% of the decommissioned plants which is higher than their ownership share of 59.0% of all power plants, whereas foreign corporations own only 1.4% of the retired power plants as compared to 4.1% of all power plants. This figure suggest that ownership types differ in the probability to retire a power plant, but based on the figures, we cannot distinguish whether the new owners operate power plants longer or invest less in power plants affected by the shutdown trend (e.g., preference not to invest in coal plants).[20]

[20] This figure also shows that electricity production is becoming more decentralized as often many small solar and wind power plants with diluted ownership replace one larger fossil fuel power plant. The greenfield power plants have a lower average nameplate capacity of 0.35GW, while the decommissioned plants have an average capacity of 0.76GW. Furthermore, the new generation technologies have a lower capacity factor than the replaced technologies. Thus, even though Figure 4 shows that the new greenfield capacity seems higher than the decommissioned capacity, the total capacity of U.S. power plants remains at best stable as the new technologies have lower operating efficiency.

In Table 6, we estimate the differences in decommissioning power plant across ownership types and market regulation settings. We estimate pooled OLS regressions where the unit of observation is at the plant-prime-mover-month level. The dependent variable captures completely decommissioned power plants (not a partial retirement of one generator) and equals to one for the last 12 months of plant operation. In the pooled OLS regressions, we weight the power plants by nameplate capacity which assigns higher weight to larger power plants. We also control for plant capacity as larger power plants have greater strategic importance for network stability and security of electricity supply. The specifications include fully interacted fuel-type, state, and year-month fixed effects. We also control for plant age which in combination for fuel-type fixed effects capture the profitability and efficiency of power plant. In these specifications with saturated set of interacted fixed effects and plant age, the ownership coefficients can be interpreted as differences in probability to decommission a power plant controlling for differences in profitability of different fuel sources and technologies.

The unconditional probability equals 1.12% which represents the proportion of power plants that are in their decommissioning period in any given month. We find that domestic corporations are slightly more likely to own a power plant that is going to be shut down. Based on Column (1), domestic corporations have a 0.39 percentage points higher probability of owning a decommissioned plant as compared to the omitted ownership types, which are private equity, institutional investors, and foreign corporations, but this difference is not significant after controlling for more saturated fixed effects on a fuel-state-time level. Column (4) shows that private equity has a similar probability to own retired power plants, while institutional investors and foreign corporations have a 1.05 and 0.51 percentage points lower probability to own a decommissioned power plant (or 94% and 46% decrease relative to the unconditional probability). For institutional investors, we can conclude that they invest in established operational assets and do not hold power plants in their decommissioning as well as greenfield stage. In terms of economic significance, Figure 2 shows that institutional investors and foreign corporations have very limited exposure to legacy power plants using coal, which is the main fuel type subject to shutdowns, and this explains why the coefficient on domestic corporations is statistically insignificantly different.

The probability that domestic corporations shut down power plants is not equally distributed across all U.S. states. Based on the interaction term with ISO balancing authority in Column (5) of Table 6, domestic corporations are more likely to shut down power plants in states with deregulated wholesale electricity markets. For instance, the baseline coefficient on domestic corporations in Column (5) is significantly negative which implies that they are 0.63 percentage points less likely to decommission a given power plant in states with traditional markets than the new ownership types. The interaction term of domestic corporations and ISO balancing authority implies that domestic corporations are around 1.12 percentage points more likely to retire a given power plant in states with liberalized markets than in states with traditional markets.

We also observe that smaller power plants, as proxied by nameplate capacity, and older power plants have significantly higher decommissioning rates. These controls confirm that decommissioning decisions are affected by strategic importance and profitability of technology over time.

In Online Appendix Table A.5, we estimate a robustness test on the differences in decommissioning power plant across ownership types using a Cox proportional hazard model. We estimate the hazard rate of decommissioning a power plant, defined as the probability that a decommissioning will be completed in month *t* conditional on it not becoming complete prior to month *t*. These robustness specifications focus on the subsample of power plants with nameplate capacity of at least 20MW and do not weight the observations by nameplate capacity. One limitation of the hazard models is that we cannot include interacted fixed effects, but we still control for fuel and state fixed effects. The Cox proportional hazard model is robust to time-specific common factors, which is analogous to controlling for time fixed effects (Dinc and Gupta, 2011). The results confirm that domestic listed corporations are more likely to shut down power plants than other ownership types. The difference in the probability to retire electricity generating assets is again concentrated in states with liberalized markets.

In Table 7, we examine differences by fuel type in the decommissioning decisions. The specifications focus on retired fossil fuel power plants as they account for almost all decommissioned power plants, leaving out of the analysis a small number of retired plants that use other technologies. In Panel A,

the sample covers power plants that use coal, waste coal, petroleum coke and residual petroleum as a fuel. In Panel B, the sample includes natural gas power plants.[21] The baseline probability for decommissioned coal and petroleum plants is 0.71%, while the baseline probability for natural gas plants is 0.29% (which together add up to 1.00% out of the 1.12% shown in Table 6). The coefficient on the independent variables and interaction terms can be interpreted also as a decomposition of the results presented in Table 6.

Based on Column (3) of Table 7, domestic corporations have a 0.28 percentage points higher probability to retire coal and petroleum power plants, and 0.19 percentage points lower probability to retire natural gas power plants. Thus, their aggregate positive coefficient of decommissioning a power plant (Table 6 Column (3)) is entirely due to their higher probability to shut down coal power plants. Column 4 of Table 4 shows that both private equity and foreign corporations are less likely to retire coal and petroleum power plants after controlling for plant capacity, plant age, and fuel-state-time fixed effects. These results provide some evidence supporting the leakage hypothesis, but the differences in decommissioning rates are economically and statistically smaller than the differences in creation of new power plants.

The differences in probability of decommissioning power plants are concentrated in states with deregulated electricity markets, while climate concern and renewable policy incentives do not explain the heterogeneity in shut down rates. For instance, Column (5) of Table 7 Panel A shows that domestic corporations are 0.72 percentage points more likely to retire a coal or petroleum power plant located in a deregulated wholesale market than a power plant located in a traditional market. In Panel B of Table 4, we do not observe significant differences in the baseline probability of domestic corporations to shut down natural gas power plants, but the interaction terms with ISO balancing authority again suggest that domestic corporations retire more natural gas power plants in states with deregulated markets.

Overall, we observe that the higher level of power plant shutdowns in deregulated wholesale electricity markets, presented in Figure 4 Panel C, is due to higher decommissioning rates of fossil fuel

[21] If a power plant is designed to use both coal and natural gas as a fuel, we classify this plant in the sample of coal and petroleum power plants. Some natural gas power plants use also biogenic municipal solid waste, landfill gas, wood waste, or other gases, so we can still include fuel-state-time fixed effects in the specifications.

power plants by domestic corporations. These differences in retirement of coal, petroleum and natural gas power plants can be interpreted as supporting evidence of the leakage hypothesis. However, an alternative interpretation is that competitive electricity markets with an independent balancing authority stimulate faster transition away from fossil fuels since domestic corporations are forced to retire more fossil fuel plants in deregulated markets and new ownership types are not acquiring these plants.

IV. Power Plant Operating Performance

Based on the previous analysis, domestic corporations have lost ownership share primarily by creating less new greenfield power plants and retiring more power plants. We find only limited support for the leakage of older fossil fuel plants from domestic corporations to private equity, institutional investors, and foreign corporations. However, the previous analysis examines only ownership of power plants and does not study the intensity of power plant operation. An alternative hypothesis is that the new ownership types operate their power plants with a higher capacity factor and this increased operating intensity could represent an alternative form of leakage.

In this section, we analyze power plant operating performance and focus on the power plant capacity factor, which equal to the ratio of net electricity generation in MWh to nameplate capacity. We winsorize the capacity factor at 0.5% and 99.5%. In the analysis in Table 8, the specifications include interacted fuel-state-year-month fixed effects and effectively limit the analysis to comparing the operating performance of power plants using the same fuel or technology, located in the same state, and in the same moment of time. This saturated set of fixed effects address to a large extent differences in pricing of resources (e.g., coal and natural gas prices) as well as weather differences (e.g., sunny hours in different months).

In the estimating equations, we also control for the greenfield and decommissioning period. *Greenfield 1m* is an indicator for the first month when a plant starts operating, and *Greenfield 12m* is an indicator for the first 12 months when a plant starts operating. *Decommissioned 1m* is an indicator for the

last month when a plant is still operating, and *Decommissioned 12m* is an indicator for the last 12 months when a plant is still operating. We find that creating new power plants and retiring old power plants is costly for the owners as power plants in these periods operate under significantly lower capacity factors. Based on Column (3) of Table 8, power plants have a 0.159 lower capacity factor in the first 12 months after starting operation and a 0.124 lower capacity factor in the last 12 months of their operations. These coefficients are economically and statistically significant as the average capacity factor of all power plants is 0.40.[22]

Regarding the lifecycle of power plant operating performance, the coefficients on *Greenfield 12m* and *Decommissioned 12m* should be also interpreted jointly with the coefficient on plant age. The negative and significant coefficient on plant age suggest that newer assets are more efficient than older assets and operate with higher capacity factors. Implementing new technologies leads to higher marginal efficiency of electricity generation. However, the indicators for greenfield and decommissioning stage show that the creation and destruction processes in the energy sector are costly for the owners as power plants in these stages stand idle for a longer period and generate less electricity. For greenfield plants, we interpret these results as evidence that it takes time to gain market share and establish contracts with customers as well as to gain experience how to operate the power plant efficiently with a higher capacity factor,

Table 8 shows that power plant owner types differ in operating performance across owner types. Based on Column (4), domestic corporations achieve a 0.032 higher capacity factor on their power plants than private equity. However, power plants owned by institutional investors seem to have the highest operating performance and their capacity factor is 0.097 higher than the capacity factor of plants owned by domestic corporations.

[22] The operating performance seems to be even lower in the first and last month as the coefficients on *Greenfield 1m* and *Decommissioned 1m* indicator variables are negative and significant, and these coefficients can be added to the effect estimated for the 12-month indicator variables. However, part of the negative coefficient for the first and last month could be mechanical as power plants do not always operate for the entire month and could be started or decommissioned in the middle of the month.

The difference in operating performance between domestic corporations and private equity is concentrated in states with traditional wholesale electricity markets. In these markets, private equity owned power plants depend on the local electric utility serving also as a balancing authority when deciding how much electricity to produce. Based on Column (5), a power plant owned by domestic corporations in areas that are not covered by an ISO balancing authority has 0.056 higher capacity factor than plants owned by private equity, institutional investors, and foreign corporations. The interaction term of domestic corporation and ISO balancing authority is significantly negative and outweighs the baseline coefficient on domestic corporations, which suggests that the differences in operating performance among ownership categories are not significant in areas covered by an ISO balancing authority.

Table 9 examines separately the capacity factor of wind and solar plants, natural gas plants, and coal and petroleum plants. The difference in utilization rate between domestic corporations and new ownership structures are driven primarily by fossil fuels plants. Column (3) shows that domestic corporation operate their natural gas power plants with 0.034 higher capacity factor, which is economically substantial as the average capacity factor of natural gas power plants is 0.313. Based on Column (4), the differences in capacity factor of natural plants between domestic corporations and new ownership types are significant only in traditional wholesale markets. The interaction term of domestic corporation and ISO balancing authority is negative and outweighs the baseline coefficient on domestic corporations. The results for coal and petroleum present a similar trend in terms of differences between deregulated and traditional markets. For renewable power plants, the differences in operating performance are economically smaller.

Overall, we do not find evidence that new ownership types, which are subject to less strict disclosure requirements and public scrutiny operate fossil fuel power plants with higher capacity factor. If anything, our results suggest that domestic corporations operating more intensely fossil fuel power plants in traditional wholesale markets.

V. Electricity Pricing and Contractual Terms

In this section, we examine the implications of the emergence of private equity, institutional investors, and foreign corporations as major electricity producers. First, we study differences in contractual terms across ownership types. Second, we examine whether different ownership structures are associated with differences in electricity pricing. The new types of power plants owner, such as private equity, institutional investors, and foreign corporations, enter electricity markets typically as independent power producers and have significant flexibility to adjust contractual sales terms in line with their objectives and incentives.

The contracting and pricing analysis is limited to the subsample of larger power plants matched with the FERC EQR data over the 2013-2020 period. We focus on power plants owned by domestic corporations, private equity, institutional investors, and foreign corporations, as the other ownership categories (e.g. industry) use a large part of their generated electricity for own consumption are not required to report all transactions to FERC.

In Table 10, we examine the contractual terms of electricity transactions. The dependent variables are the percentage of electricity quantity sold under different contractual terms. Columns (1) and (2) analyze contract duration and distinguish between short contracts with duration of less than one year and long-term contract duration. Columns (3) to (5) split the transactions into short, medium, and long based on increment terms. Short transactions use 5-minute, 15-minute or hourly increments (up to 6 hours). Medium transactions have daily or weekly increments (from 6 hours to 168 hours). Long transactions use monthly or yearly increments (longer than 168 hours). Columns (6) to (8) classify transactions into full-period, peak and off-peak based on the peaking terms. The specifications include interacted fuel-state-year-month fixed effects which absorb variation in contracting terms across power plant technologies, location, and time. Online Appendix A.6 shows that our results are robust to defining all contractual-term dependent variables based on the percentage of transaction charges instead of the percentage of quantity sold.

Private equity seems to prefer selling electricity under contracts with shorter duration and during peak term periods. Column (1) shows that power plants owned by private equity sell 9.2 percentage points

more electricity quantity under short-term instead of long-term contracts. Private equity general partners also use more shorter increment pricing periods as they sell 12.2 percentage points more electricity quantity based on increment terms of less than one hour instead of long-term monthly or yearly increment terms.

Institutional investors differ significantly from private equity and domestic corporations as they rely less on short increments to determine the price and establishing contracts that cover the full period instead of targeting peak-period sales. Based on Column (6) of Table 10, institutional investors sell 18.6 percentage points more electricity under contracts that cover the full period instead of separate peak-period and off-peak-period contracts. This result is in line with the objective of institutional investors to obtain stable long-term cash flows from their direct investments in private markets (Andonov, Kräussl and Rauh, 2021). The differences in contracting terms between institutional investors and private equity are highly relevant as institutional investors supply the vast majority of commitments to private equity funds. These differences point out to potential agency conflicts and misalignment of objectives between institutional investors and private equity funds acting as intermediaries (Binsbergen , Brandt and Koijen, 2008).

For foreign corporations, we observe that they display some preferences against sales under longer increments and during off-peak hours. Their contractual terms have similarities with the contracts of private equity as well as with the contracts of domestic corporations.

Online Appendix Table A.7 shows that the differences in contractual terms between new entrants and incumbent domestic corporations are entirely driven by fossil fuel power plants. Panel A shows that wind and solar power plants owned by private equity seem to be selling more quantity actually under long term contracts and increments. However, when selling electricity from natural gas and coal power plants private equity firms use contracts with shorter duration and shorter pricing increments, and target peak-period sales. The contractual terms of fossil fuel power plants dominate the aggregate results because we weight the observations by nameplate capacity and fossil fuel power plants are economically substantially more significant than renewable power plants.

Overall, we document substantial heterogeneity in the contractual preferences of different ownership types. Private equity owners establish more short-term contracts that can respond more to short

term signals in the electricity market and have more flexibility to adjust their electricity production. Institutional investors seem to prefer long-term contracts that can deliver less volatile output and more predictable cash flows. Domestic and foreign corporations seem to establish contract in between these two extremes.

In Table 11, we examine the pricing of electricity sales and later we focus on the contractual terms underlying the pricing outcomes. The dependent variables are the mean and median of monthly electricity price per MWh, and we winsorize these pricing variables at 0.5% and 99.5%. The specifications include either fuel-type and state-year-month fixed effects or fully interacted fuel-state-yer-month fixed effects. We find that private equity sells electricity for higher prices than domestic corporations. Based on Columns (1) and (3), private equity obtains $4.49 higher average price per MWh and $4.48 higher median price per MWh of electricity sales. The interacted state-year-month fixed effects in this specification absorb variation in electricity prices across states and over time, but they do not absorb variation from power plants using different fuels and selling electricity in the same state and at the same moment of time.

In Columns (2) and (4), we introduce a more saturated set of fixed effects on a fuel-state-year-month level. In these specifications, the difference between private equity and domestic corporations shrinks to $1.87 average price per MWh and $2.05 median price per MWh. This reduction in the differences suggests the higher prices obtained by private equity may partly reflect the greater flexibility of PE-owned plants to scale up or down their production in certain state-months.

We interpret the pricing differences between private equity and domestic corporations jointly with our results on contractual differences. We observe that power plants owned by private equity have more flexible contractual terms, so they can adjust both output and pricing according to demand. Private equity owners seem to obtain higher electricity prices on the wholesale market through flexible output that responds to signals in the spot electricity market. For instance, private equity could reduce the electricity production in periods of low prices, which could result in higher average prices. Private equity could establish different sales contracts which result in higher average prices, such as short-term contracts that target peak-period sales.

For institutional investors and foreign corporations, we do not observe significant differences in mean or median electricity prices. Even though these ownership types display some differences in the contractual terms, we do not see that these differences translate into different prices.

Reflecting the challenges with adopting new technologies in the electricity sector, we find that greenfield power plants obtain significantly lower mean and median prices. This result can be interpreted in two ways. First, newer power plants are competitive and can potentially reduce the average prices on wholesale markets, by undercutting incumbents and increasing market competition. Second, new power plants seem to have lower operating performance (see Table 8) as well as lower average prices, which suggests that new owners adopting innovation need time to gain market share and establish contracts with customers as well as to gain experience with how to operate the power plant efficiently.

Overall, we document that PE and the other new ownership types offer different contractual terms and electricity pricing compared to domestic listed corporations. Private equity firms sell electricity for a higher price per MWh, and they sell electricity under contracts with shorter duration, shorter increment pricing, and peak term periods. Institutional investors establish fewer volatile contracts for the power plants that they own directly, thus reducing the volatility of the electricity sales by their power plants.

VI. Conclusion

Regardless of the exact policy direction, the stated national commitments to reduce greenhouse gas emissions and achieve greater energy independence will require substantial capital investments to change the mix of capital assets that produce electricity. Using data on U.S. power plants accounting for 99% of the electricity generation over the 2008-2020 period, we find that domestic listed corporations have reduced their ownership from 69% to 54%, while private equity, institutional investors, and foreign corporations have increased their ownership stakes from 8% to 24%. Private equity and foreign corporations increase their ownership largely through the creation of new power plants. These new entrants have increased their ownership share largely through the creation of new solar, wind and natural gas power plants in states with

deregulated competitive electricity markets and states where the population is highly concerned about climate change. We find limited support for the leakage hypothesis that incumbent domestic listed corporations, which are subject to higher disclosure requirements and public scrutiny, sell older fossil fuel power plants to the new ownership types. Domestic corporations have the highest probability of decommissioning a power plant conditional on plant age and capacity, but private equity is the second most likely ownership structure to shut down power plants. Institutional investors and foreign corporations maintain very low exposure to plants subject to decommissioning.

Private equity owners show lower asset intensity, as well as differences in contractual terms and electricity pricing compared to the incumbent domestic listed owners. For instance, private equity sells electricity for $1.87 higher average price per MWh. Private equity firms sell electricity under contracts with shorter duration, shorter increment pricing, and more peak-term periods, especially when selling electricity generated from fossil fuels. Overall, private equity owners appear to obtain higher electricity prices on the wholesale market through flexibility in output that responds to signals in the spot electricity market.

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Figure 1: Ownership and Electricity Net Generation

This figure presents the average ownership by the nine categories as a percentage of monthly net generation over the 2008-2020 period. If a power plant is owned by multiple ownership types, we divide the ownership and generation equally across the ownership types (i.e., if a private equity and domestic corporation jointly own a power plant, we assume that each ownership types owns 50% of the power plant).

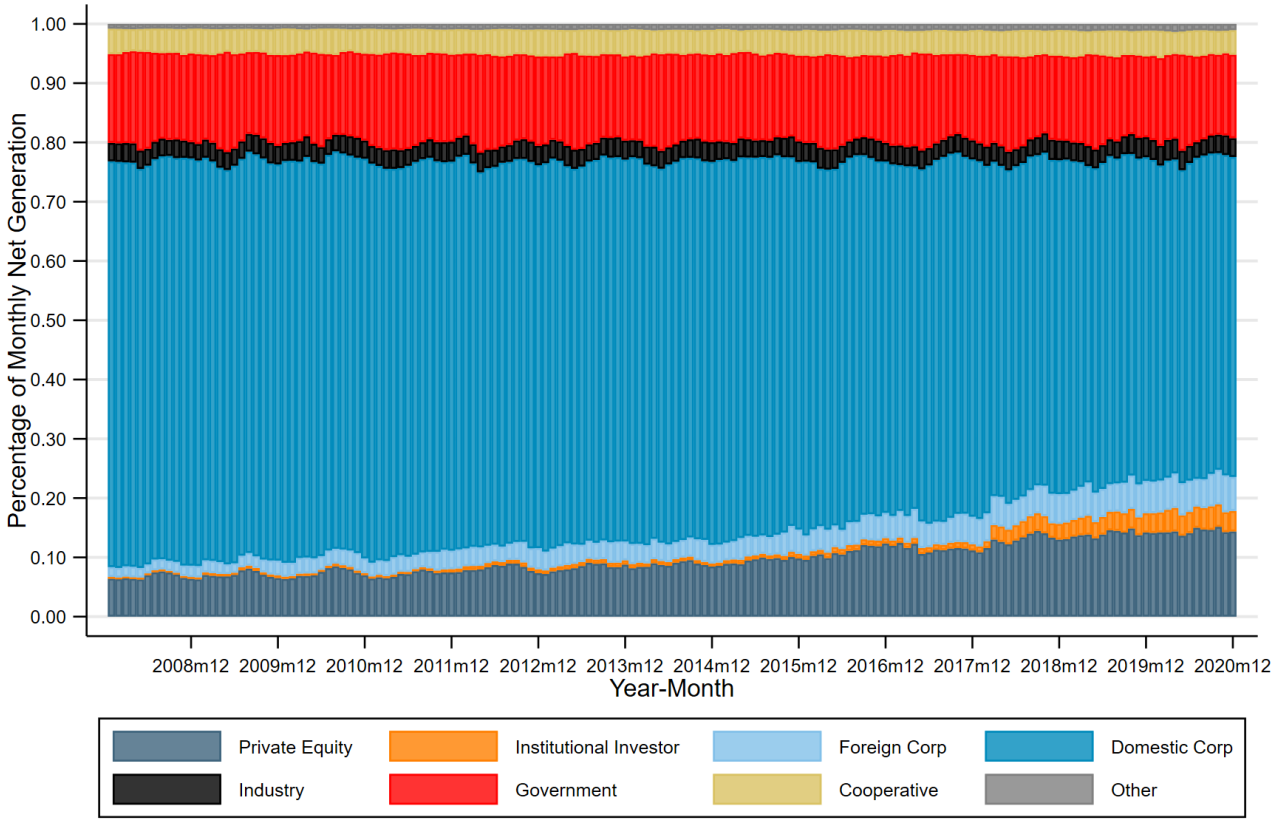


Figure 2: Ownership and Electricity Net Generation by Fuel Type

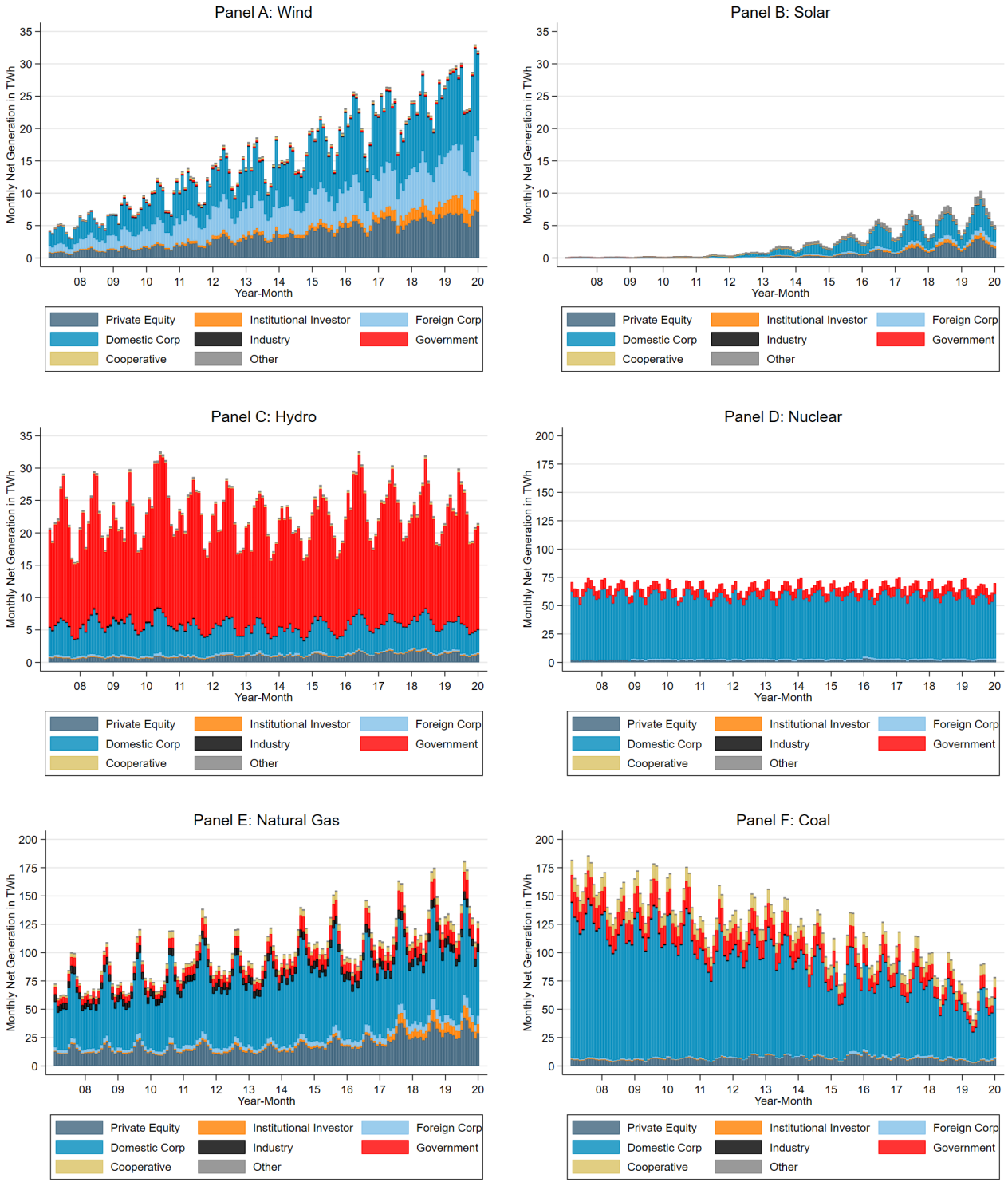


Figure 3: Ownership and Electricity Net Generation by State

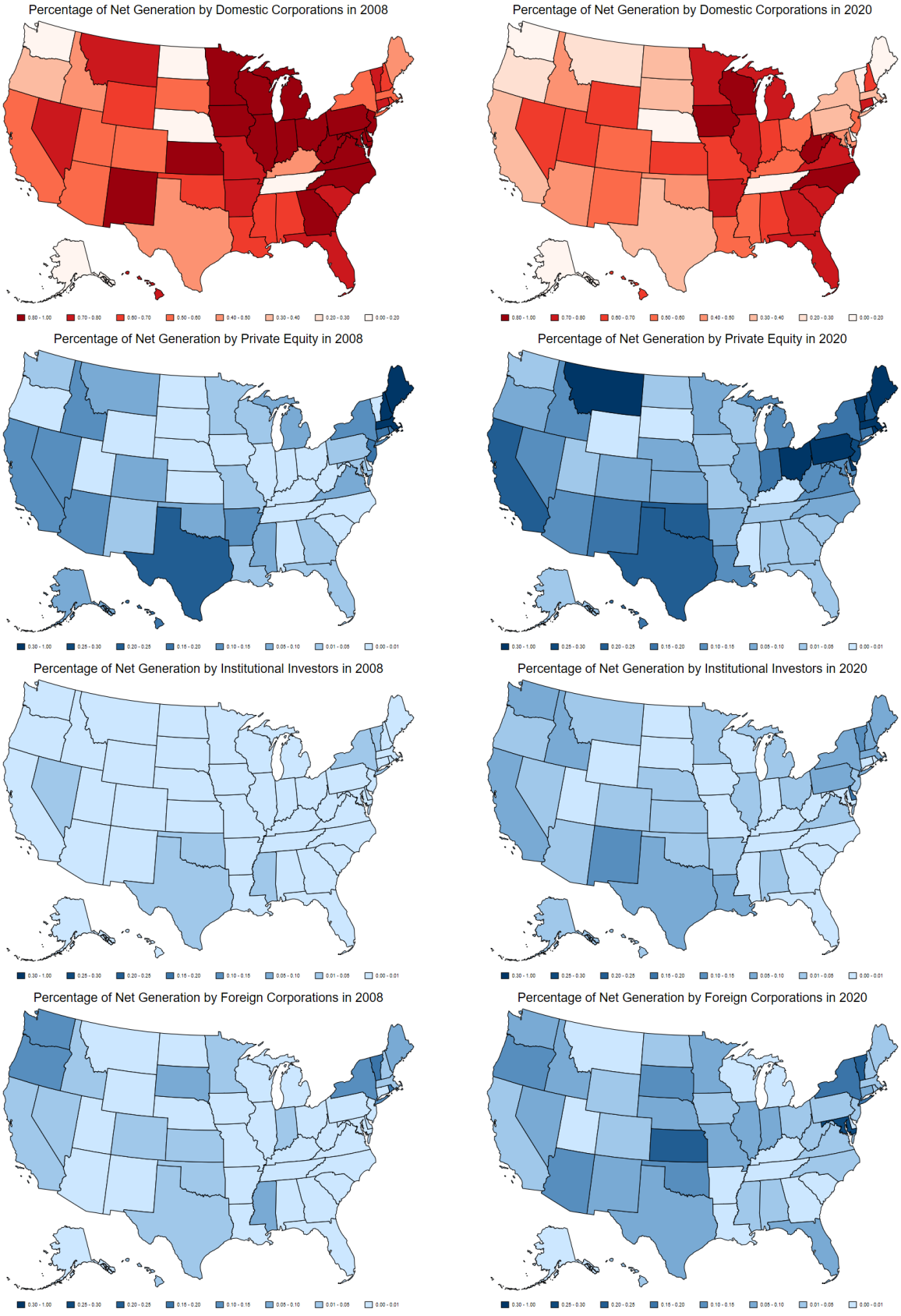


Figure 4: Greenfield and Decommissioned Power Plants

We classify power plants as a greenfield asset in the first 12 months of plant operation. Panel A presents the percentage of greenfield power plants weighted by nameplate capacity and Panel B shows the ownership of greenfield plants. We classify power plants as a decommissioned asset in the last 12 months of plant operation. Panel C shows the percentage of decommissioned power plants weighted by nameplate capacity, and Panel D presents the ownership of decommissioned power plants. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority and electric power transmission system operator.

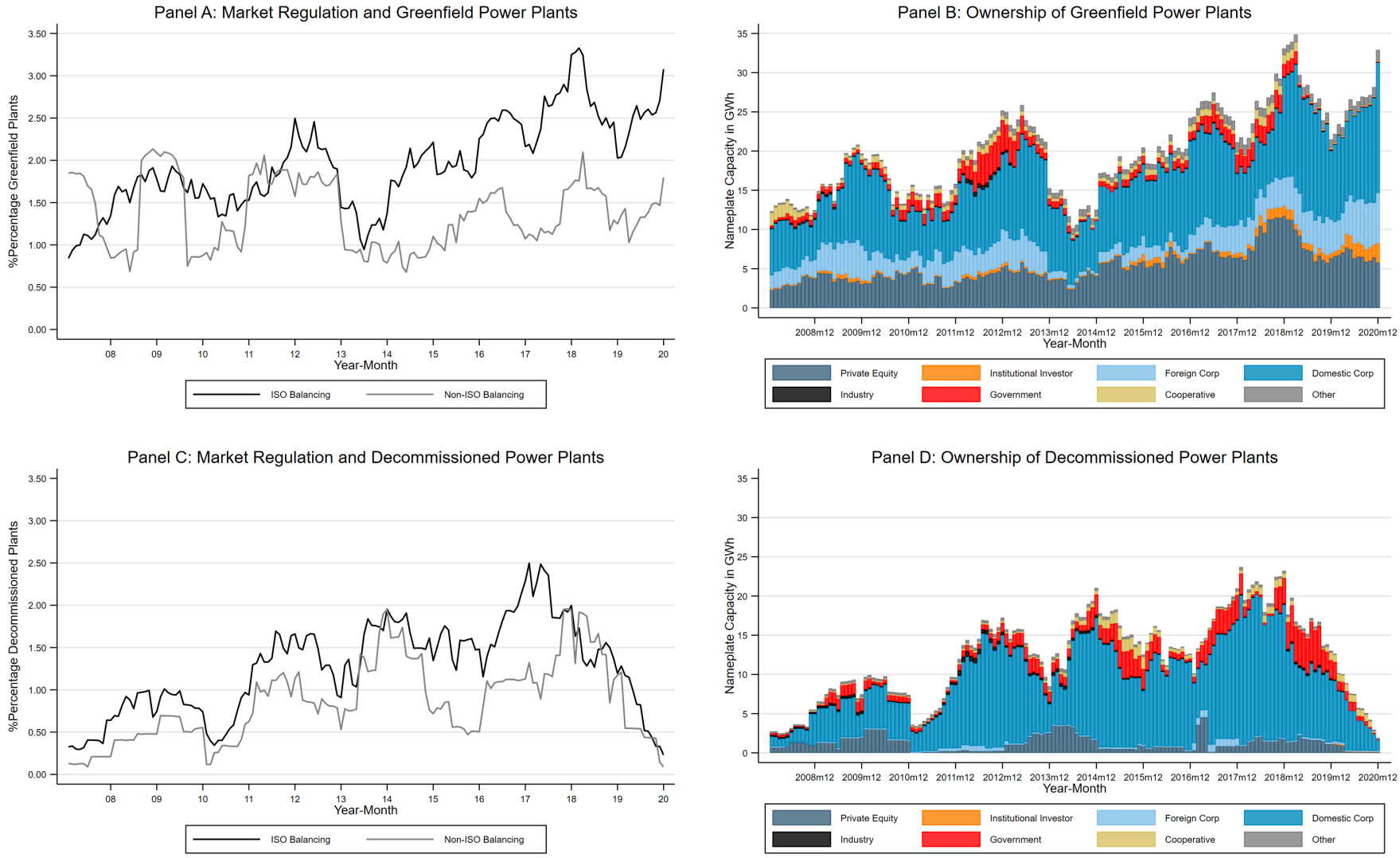


Figure 5: Ownership of Greenfield Power Plants

This figure presents coefficient estimates and confidence intervals of multiple specifications. In all models, observations are at the plant-prime-mover-month level and weighted by power plant nameplate capacity. The dependent variable captures greenfield power plants and equals to one for the first 12 months of plant operation. We report the coefficients for private equity and foreign corporations (the omitted category in all specifications is domestic corporations). The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover. The baseline coefficients corresponds to the estimations in Table 3 Column (4). We estimate separately the role of ownership categories for power plants located in areas administered by an ISO balancing authority or traditional balancing authority. Next, we estimate separately the role of ownership categories for power plants located in states where the population has high climate concerns or states where the population has low climate concerns.

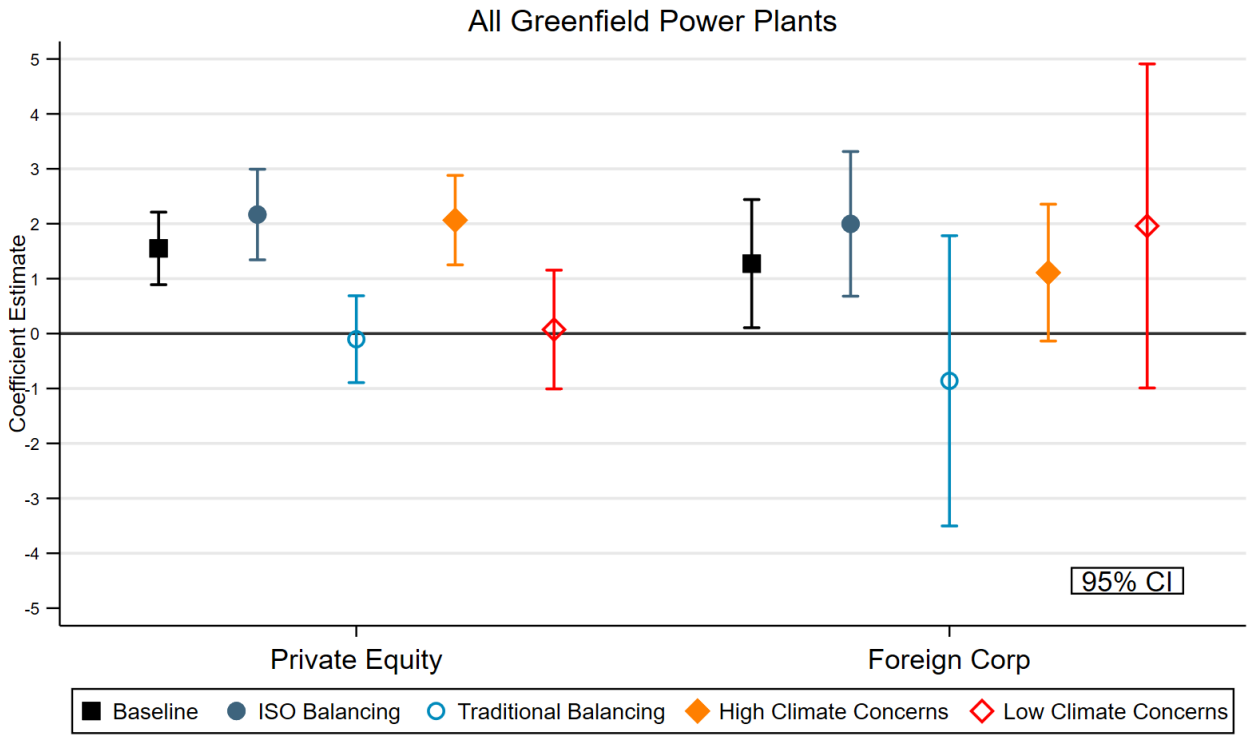


Table 1: EIA Power Plants

The table presents summary statistics on a plant-prime-mover-month level for all power plants together as well as separately for the main fuel types: natural gas, coal, nuclear, hydro, wind, and solar plants. All statistics are the weighted averages by power plant nameplate capacity. Panel A reports statistics for the main power plant characteristics. *Capacity* shows the average nameplate capacity in GWh. *Capacity Factor* is the mean ratio of monthly net generation to capacity. *Age* presents the average plant age in years. *Greenfield 12m* is an indicator for the first 12 months when a plant starts operating. *Decommissioned 12m* is an indicator for the last 12 months when a plant is still operating. Panel B reports the average ownership by the eight categories in percent. If a power plant is owned by multiple ownership types, we divide the ownership and generation equally across the ownership types (i.e., if a private equity and domestic corporation jointly own a power plant, we assume that each ownership types owns 50% of the power plant). Panel C presents statistics on state electricity markets. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority and electric power transmission system operator. *EIA Restructured* is an indicator for states with a restructured energy market. *Climate Concern* is the percentile ranking of the state where the plant is located based on the percentage of state population who think that global warming is happening surveyed by the Yale Climate Opinion Maps. *CO2 Limits* is the percentile ranking of the state where the plant is located based on the percentage of state population who support setting strict limits on existing coal-fire power plants surveyed by the Yale Climate Opinion Maps. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy.

	All	NatGas	Coal	Nuclear	Hydro	Wind	Solar
Panel A: Power Plant Characteristics							
# Unique Plants	11,421	2,916	737	66	1,481	1,289	3,940
# Unique Plants-Prime-Mover	13,036	3,997	845	66	1,481	1,289	3,940
Observations	1,288,195	472,581	92,281	9,839	220,419	126,822	187,873
Capacity (GWh)	0.974	0.707	1.441	2.041	1.094	0.177	0.100
Capacity Factor	0.398	0.313	0.503	0.856	0.401	0.330	0.241
Age (Years)	31.324	26.492	42.758	34.545	60.371	6.141	2.908
# Unique Greenfield	5,871	633	36	0	51	980	3,633
Greenfield 12m	0.017	0.014	0.003	0.000	0.001	0.114	0.244
# Unique Decommissioned	1,553	770	280	9	64	76	31
Decommissioned 12m	0.011	0.011	0.020	0.006	0.000	0.002	0.001
Panel B: Power Plant Ownership							
Domestic Corporation	0.590	0.583	0.711	0.836	0.207	0.415	0.470
Private Equity	0.117	0.151	0.060	0.023	0.038	0.224	0.236
Institutional Investor	0.013	0.016	0.002	0.000	0.003	0.050	0.046
Foreign Corporation	0.041	0.035	0.012	0.017	0.012	0.273	0.060
Industry	0.023	0.038	0.017	0.000	0.005	0.000	0.006
Government	0.158	0.116	0.132	0.124	0.718	0.013	0.007
Cooperative	0.048	0.054	0.064	0.000	0.008	0.010	0.006
Other	0.010	0.008	0.003	0.000	0.010	0.014	0.168
Panel C: State Electricity Markets							
ISO Balancing Authority	0.633	0.663	0.637	0.646	0.302	0.802	0.611
EIA Restructured	0.415	0.435	0.363	0.531	0.263	0.419	0.243
Climate Concern	0.530	0.546	0.410	0.560	0.650	0.524	0.737
CO2 Limits	0.509	0.514	0.407	0.572	0.635	0.491	0.693
Renewables Incentives	2.355	2.397	2.266	2.263	2.366	2.737	2.598

Table 2: FERC Electricity Pricing and Contracting

We report summary statistics on a plant-prime-mover-month level and they are weighted by power plant nameplate capacity. The sample includes power plants owned by domestic corporations, private equity, institutional investors, and foreign corporations. Panel A presents summary statistics on electricity prices and reports average of the mean, median, and standard deviation of price per MWh. Panel B reports the average percentage of quantity sold by different contractual terms. Panel C reports the average percentage of transaction charges by different contractual terms. We split electricity sales based on three contractual terms. First, we analyze contract duration and distinguish between short contracts with duration of less than one year and long-term contract duration. Second, we split the transactions into short, medium, and long based on the increment terms. Short transactions use 5-minute, 15-minute or hourly increments (up to 6 hours). Medium transactions have daily or weekly increments (from 6 hours to 168 hours). Long transaction use monthly or yearly increments (longer than 168 hours). Third, we classify transactions into full-period, peak and off-peak based on the peaking terms.

	All	NatGas	Coal	Nuclear	Hydro	Wind	Solar
Panel A: Electricity Prices							
#Unique Plants	5,479	1,467	381	56	672	860	1,671
Observations	303,625	98,569	24,041	4,526	52,071	52,268	52,711
Mean Price MWh	33.814	33.578	29.895	29.686	29.765	40.276	72.285
Median Price MWh	31.224	30.417	28.087	27.998	27.998	39.351	67.889
StDev of Price MWh	22.073	24.916	21.555	26.366	26.366	11.496	20.341
Panel B: Contractual Terms Based on Quantity Sold							
Contract Duration - Short	0.562	0.608	0.586	0.491	0.671	0.379	0.240
Contract Duration - Long	0.435	0.388	0.412	0.509	0.328	0.614	0.760
Increment Terms - Short	0.499	0.543	0.556	0.407	0.384	0.346	0.190
Increment Terms - Medium	0.041	0.051	0.033	0.045	0.085	0.012	0.028
Increment Terms - Long	0.434	0.392	0.396	0.504	0.397	0.595	0.737
Peaking Terms - Full Period	0.393	0.352	0.353	0.468	0.350	0.551	0.597
Peaking Terms - Peak	0.312	0.350	0.329	0.256	0.269	0.180	0.184
Peaking Terms - Off-Peak	0.222	0.230	0.252	0.215	0.212	0.174	0.090
Panel C: Contractual Terms Based on Transaction Charges							
Contract Duration - Short	0.587	0.647	0.602	0.492	0.683	0.382	0.282
Contract Duration - Long	0.410	0.349	0.396	0.508	0.316	0.612	0.718
Increment Terms - Short	0.512	0.564	0.571	0.397	0.392	0.346	0.217
Increment Terms - Medium	0.043	0.055	0.031	0.042	0.084	0.013	0.030
Increment Terms - Long	0.419	0.367	0.383	0.519	0.390	0.595	0.710
Peaking Terms - Full Period	0.378	0.329	0.343	0.468	0.352	0.550	0.570
Peaking Terms - Peak	0.361	0.404	0.382	0.300	0.300	0.217	0.224
Peaking Terms - Off-Peak	0.191	0.202	0.214	0.179	0.182	0.142	0.083

Table 3: Ownership of Greenfield Power Plants

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. The dependent variable captures greenfield power plants and equals to one for the first 12 months of plant operation. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. *Climate Concern* is an indicator for state with above median ranking based on the percentage of population who think that global warming is happening. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

	All Greenfield Power Plants (Unconditional Prob. = 1.75%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Domestic Corp	-1.146***		-1.239***		-0.215	-1.004***	0.020
	[0.242]		[0.293]		[0.344]	[0.339]	[0.515]
Domestic Corp × ISO Balancing					-1.405***		-1.401***
					[0.325]		[0.326]
Domestic Corp × Climate Concern						-0.346	-0.313
						[0.358]	[0.431]
Domestic Corp × Renewables Incentives							-0.011
							[0.202]
Private Equity		1.445***		1.551***			
		[0.290]		[0.337]			
Institutional Investor		-2.612***		-2.008**			
		[0.947]		[0.989]			
Foreign Corp		1.327***		1.273**			
		[0.423]		[0.595]			
ln Plant Capacity	0.080	0.074	0.146**	0.149**	0.171**	0.150**	0.174**
	[0.056]	[0.056]	[0.069]	[0.069]	[0.069]	[0.069]	[0.069]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195
Adjusted R-squared	0.087	0.087	0.179	0.179	0.179	0.179	0.179

Table 4: Ownership of Greenfield Power Plants by Fuel Type

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. In Panel A, the dependent variable equals to one for the first 12 months of operation for solar and wind greenfield power plants. In Panel B, the dependent variable captures natural gas greenfield power plants. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Solar & Wind Greenfield Power Plants (Unconditional Prob. = 0.88%)							
Domestic Corp	-0.480***		-0.663***		-0.514***	-0.428**	-0.446*
	[0.108]		[0.153]		[0.161]	[0.193]	[0.239]
Domestic Corp × ISO Balancing					-0.205		-0.201
					[0.148]		[0.149]
Domestic Corp × Climate Concern						-0.347*	-0.440**
						[0.186]	[0.201]
Domestic Corp × Renewables Incentives							0.091
							[0.095]
Private Equity		0.515***		0.810***			
		[0.109]		[0.153]			
Institutional Investor		-1.979***		-1.920**			
		[0.702]		[0.760]			
Foreign Corp		1.132***		1.038**			
		[0.312]		[0.461]			
ln Plant Capacity	0.136***	0.134***	0.199***	0.201***	0.203***	0.202***	0.206***
	[0.029]	[0.029]	[0.044]	[0.044]	[0.044]	[0.044]	[0.044]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195
Adjusted R-squared	0.152	0.152	0.194	0.194	0.194	0.194	0.194
Panel B: Natural Gas Greenfield Power Plants (Unconditional Prob. = 0.80%)							
Domestic Corp	-0.527***		-0.483**		0.384	-0.432*	0.742*
	[0.201]		[0.244]		[0.296]	[0.255]	[0.419]
Domestic Corp × ISO Balancing					-1.190***		-1.187***
					[0.284]		[0.283]
Domestic Corp × Climate Concern						-0.076	0.133
						[0.293]	[0.373]
Domestic Corp × Renewables Incentives							-0.181
							[0.170]
Private Equity		0.755***		0.628**			
		[0.248]		[0.291]			
Institutional Investor		-0.627		-0.125			
		[0.679]		[0.668]			
Foreign Corp		0.127		0.194			
		[0.265]		[0.377]			
ln Plant Capacity	-0.001	-0.005	-0.024	-0.023	-0.003	-0.023	-0.002
	[0.045]	[0.045]	[0.052]	[0.052]	[0.052]	[0.052]	[0.052]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195
Adjusted R-squared	0.038	0.038	0.150	0.150	0.151	0.150	0.151

Table 5: Transitions of Power Plants Owned by Domestic Corporations

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. We present the results of a multinomial logit regression and report the marginal effects at the means of the independent variables. The sample covers power plants that were owned by domestic corporations at the beginning of our sample, in January 2008. We analyze four potential outcomes based on the latest observation in our dataset (December 2020 for plants that are not retired). These are the four potential outcomes: *Still Own & Operating* covers plants that are still owned and operated by domestic corporations; *Owned & Retired* covers plants that remained in domestic corporations' ownership, but were retired during the sample period; *Sold & Operating* captures plants that were sold to other ownership types and are still operating; *Sold & Retired* captures plants that were sold to other ownership types and were retired by these other owners during the sample period. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. *Climate Concern* is an indicator for state with above median ranking based on the percentage of population who think that global warming is happening. The specifications include fuel-type and state fixed effects. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. *ln Plant Age* is the natural logarithm of plant age in years. *Coal & Petroleum* is a joint indicator for power plants that use coal, waste coal, petroleum coke, or residual petroleum fuel. We cluster standard errors by power plant, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

	Still Own & Operating		**Owned & Retired**		**Sold & Operating**		**Sold & Retired**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
# Unique Plants	1,288	1,288	427	427	487	487	59	59
Unconditional Prob.	0.686	0.686	0.152	0.152	0.153	0.153	0.009	0.009
ln Plant Capacity	0.105***	0.131***	-0.072***	-0.095***	-0.025**	-0.029**	-0.008***	-0.008***
	[0.015]	[0.015]	[0.010]	[0.009]	[0.011]	[0.013]	[0.002]	[0.002]
ln Plant Age	-0.092***	-0.081***	0.186***	0.170***	-0.089***	-0.085***	-0.004*	-0.004*
	[0.027]	[0.024]	[0.025]	[0.023]	[0.015]	[0.013]	[0.002]	[0.002]
ISO Balancing	-0.126***		0.048**		0.077***		0.001	
	[0.034]		[0.024]		[0.026]		[0.004]	
Climate Concern	-0.069**		0.046*		0.013		0.009**	
	[0.034]		[0.024]		[0.026]		[0.005]	
Coal & Petroleum	-0.336***	-0.416***	0.310***	0.407***	-0.024	-0.023	0.050**	0.032**
	[0.048]	[0.036]	[0.039]	[0.032]	[0.042]	[0.040]	[0.021]	[0.014]
Natural Gas	-0.350***	-0.427***	0.337***	0.407***	0.006	0.013	0.007	0.006
	[0.056]	[0.045]	[0.053]	[0.037]	[0.034]	[0.033]	[0.007]	[0.007]
Fuel FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	2,261	2,261	2,261	2,261	2,261	2,261	2,261	2,261

Table 6: Ownership of Decommissioned Power Plant

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. The dependent variable captures decommissioned power plants and equals to one for the last 12 months of plant operation. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. *Climate Concern* is an indicator for state with above median ranking based on the percentage of population who think that global warming is happening. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. *ln Plant Age* is the natural logarithm of plant age in years. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$.

	All Decommissioned Power Plants (Unconditional Prob. = 1.12%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Domestic Corp	0.393*		0.178		-0.633**	0.060	-0.354
	[0.203]		[0.223]		[0.285]	[0.313]	[0.422]
Domestic Corp × ISO Balancing					1.121***		1.123***
					[0.310]		[0.308]
Domestic Corp × Climate Concern						0.173	0.388
						[0.332]	[0.438]
Domestic Corp × Renewables Incentives							-0.218
							[0.189]
Private Equity		-0.154		0.007			
		[0.246]		[0.275]			
Institutional Investor		-1.752***		-1.047***			
		[0.300]		[0.304]			
Foreign Corp		-0.751***		-0.506**			
		[0.250]		[0.245]			
ln Plant Capacity	-0.685***	-0.688***	-0.703***	-0.702***	-0.724***	-0.705***	-0.725***
	[0.071]	[0.071]	[0.091]	[0.091]	[0.091]	[0.090]	[0.091]
ln Plant Age	1.106***	1.117***	1.134***	1.142***	1.111***	1.132***	1.109***
	[0.112]	[0.113]	[0.142]	[0.143]	[0.142]	[0.142]	[0.142]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195
Adjusted R-squared	0.044	0.044	0.255	0.255	0.256	0.255	0.256

Table 7: Ownership of Decommissioned Power Plants by Fuel Type

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. In Panel A, the dependent variable captures decommissioned power plants that use coal, waste coal, petroleum coke, and residual petroleum as a fuel, and equals to one for the last 12 months of plant operation. In Panel B, the dependent variable captures natural gas decommissioned power plants. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Coal and Petroleum Decommissioned Power Plants (Unconditional Prob. = 0.71%)							
Domestic Corp	0.355**		0.281*		-0.243	0.206	-0.168
	[0.145]		[0.143]		[0.228]	[0.275]	[0.336]
Domestic Corp × ISO Balancing					0.724***		0.725***
					[0.266]		[0.264]
Domestic Corp × Climate Concern						0.111	0.186
						[0.274]	[0.382]
Domestic Corp × Renewables Incentives							-0.081
							[0.152]
Private Equity		-0.281*		-0.293*			
		[0.167]		[0.170]			
Institutional Investor		-0.745***		-0.085			
		[0.252]		[0.157]			
Foreign Corp		-0.472**		-0.306*			
		[0.217]		[0.174]			
ln Plant Capacity	-0.495***	-0.496***	-0.498***	-0.498***	-0.511***	-0.499***	-0.512***
	[0.056]	[0.055]	[0.065]	[0.065]	[0.066]	[0.065]	[0.066]
ln Plant Age	0.396***	0.400***	0.256***	0.256***	0.242***	0.255***	0.241***
	[0.065]	[0.065]	[0.066]	[0.066]	[0.066]	[0.066]	[0.066]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195
Adjusted R-squared	0.049	0.049	0.358	0.358	0.359	0.358	0.359
Panel B: Natural Gas Decommissioned Power Plants (Unconditional Prob. = 0.29%)							
Domestic Corp	-0.109		-0.189		-0.450***	-0.189	-0.220
	[0.127]		[0.164]		[0.169]	[0.142]	[0.247]
Domestic Corp × ISO Balancing					0.360**		0.363**
					[0.157]		[0.157]
Domestic Corp × Climate Concern						-0.001	0.129
						[0.182]	[0.212]
Domestic Corp × Renewables Incentives							-0.128
							[0.109]
Private Equity		0.253		0.362*			
		[0.165]		[0.211]			
Institutional Investor		-0.732***		-0.873***			
		[0.166]		[0.253]			
Foreign Corp		-0.097		-0.032			
		[0.102]		[0.147]			
ln Plant Capacity	-0.097**	-0.099**	-0.146**	-0.144**	-0.152**	-0.145**	-0.152**
	[0.039]	[0.039]	[0.062]	[0.062]	[0.062]	[0.062]	[0.061]
ln Plant Age	0.635***	0.642***	0.826***	0.834***	0.819***	0.826***	0.819***
	[0.088]	[0.089]	[0.126]	[0.127]	[0.126]	[0.126]	[0.125]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195
Adjusted R-squared	0.016	0.016	-0.026	-0.026	-0.026	-0.026	-0.026

Table 8: Operating Performance (Capacity Factor)

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. The dependent variable is the monthly capacity factor, which is the ratio of net electricity generation in MWh to nameplate capacity. We winsorize the capacity factor at 0.5% and 99.5%. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. *Climate Concern* is an indicator for state with above median ranking based on the percentage of population who think that global warming is happening. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. *ln Plant Age* is the natural logarithm of plant age in years. *Greenfield 1m* is an indicator for the first month when a plant starts operating. *Greenfield 12m* is an indicator for the first 12 months when a plant starts operating. *Decommissioned 1m* is an indicator for the last month when a plant is still operating. *Decommissioned 12m* is an indicator for the last 12 months when a plant is still operating. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

	Capacity Factor of All Power Plants						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Domestic Corp	0.014		0.019*		0.056***	0.007	0.046**
	[0.010]		[0.011]		[0.017]	[0.015]	[0.023]
Domestic Corp × ISO Balancing					-0.052***		-0.052***
					[0.016]		[0.016]
Domestic Corp × Climate Concern						0.018	0.020
						[0.016]	[0.019]
Domestic Corp × Renewables Incentives							-0.001
							[0.007]
Private Equity		-0.026**		-0.032***			
		[0.011]		[0.012]			
Institutional Investor		0.115***		0.097***			
		[0.030]		[0.032]			
Foreign Corp		-0.017		-0.014			
		[0.017]		[0.015]			
ln Plant Capacity	0.032***	0.032***	0.019***	0.019***	0.020***	0.019***	0.020***
	[0.004]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
ln Plant Age	-0.108***	-0.109***	-0.117***	-0.118***	-0.116***	-0.117***	-0.116***
	[0.006]	[0.006]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
Greenfield 1m	-0.181***	-0.181***	-0.180***	-0.180***	-0.180***	-0.180***	-0.180***
	[0.010]	[0.010]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
Greenfield 12m	-0.133***	-0.132***	-0.159***	-0.158***	-0.159***	-0.159***	-0.159***
	[0.011]	[0.011]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
Decommissioned 1m	-0.103***	-0.103***	-0.086***	-0.086***	-0.086***	-0.086***	-0.086***
	[0.014]	[0.014]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
Decommissioned 12m	-0.153***	-0.152***	-0.124***	-0.123***	-0.121***	-0.124***	-0.122***
	[0.016]	[0.016]	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195
Adjusted R-squared	0.473	0.474	0.650	0.651	0.651	0.650	0.651

Table 9: Operating Performance (Capacity Factor) by Fuel Type

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. The dependent variable is the monthly capacity factor, which is the ratio of net electricity generation in MWh to nameplate capacity. We winsorize the capacity factor at 0.5% and 99.5%. Columns (1) and (2 examine the subsample of solar and wind power plants, Columns (3) and (4) examine the subsample of natural gas plants, and Columns (5) and (6) examine the subsample of coal, waste coal, petroleum coke and residual petroleum plants. We focus on the ownership by domestic corporations also control for the ownership by industry firms, government, cooperatives, and other (the omitted ownership categories are private equity, institutional investors, and foreign corporations). *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. *ln Plant Age* is the natural logarithm of plant age in years. *Greenfield 1m* is an indicator for the first month when a plant starts operating. *Greenfield 12m* is an indicator for the first 12 months when a plant starts operating. *Decommissioned 1m* is an indicator for the last month when a plant is still operating. *Decommissioned 12m* is an indicator for the last 12 months when a plant is still operating. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$.

	Solar & Wind		**Natural Gas**		**Coal & Petroleum**	
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic Corp	0.006*	-0.000	0.034**	0.080***	-0.007	0.045
	[0.004]	[0.006]	[0.015]	[0.024]	[0.038]	[0.046]
Domestic Corp × ISO Balancing		0.009		-0.066***		-0.058*
		[0.006]		[0.026]		[0.033]
ln Plant Capacity	-0.000	-0.000	0.010*	0.011*	0.073***	0.074***
	[0.002]	[0.002]	[0.006]	[0.006]	[0.011]	[0.011]
ln Plant Age	-0.055***	-0.055***	-0.130***	-0.128***	-0.166***	-0.167***
	[0.003]	[0.003]	[0.008]	[0.008]	[0.023]	[0.023]
Greenfield 1m	-0.138***	-0.138***	-0.202***	-0.202***	-0.349***	-0.350***
	[0.005]	[0.005]	[0.018]	[0.018]	[0.124]	[0.124]
Greenfield 12m	-0.048***	-0.048***	-0.203***	-0.203***	-0.418***	-0.421***
	[0.003]	[0.003]	[0.021]	[0.021]	[0.087]	[0.087]
Decommissioned 1m	0.026	0.026	-0.008	-0.008	-0.133***	-0.133***
	[0.017]	[0.017]	[0.010]	[0.010]	[0.032]	[0.032]
Decommissioned 12m	-0.118***	-0.118***	-0.125***	-0.123***	-0.074***	-0.071***
	[0.015]	[0.015]	[0.015]	[0.015]	[0.024]	[0.023]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes
Fuel-State-Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	314,695	314,695	398,889	398,889	122,158	122,158
Adjusted R-squared	0.677	0.677	0.358	0.360	0.498	0.500

Table 10: Contractual Terms of Electricity Sales

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. The dependent variables are the percentages of electricity quantity sold under three different contractual terms. First, we distinguish between short contracts with duration of less than one year and long-term contracts. Second, we split transactions into short, medium, and long based on the increment pricing terms. Short transactions use 5-minute, 15-minute or hourly increments (up to 6 hours). Medium transactions have daily or weekly increments (from 6 hours to 168 hours). Long transaction use monthly or yearly increments (longer than 168 hours). Third, we classify transactions into full-period, peak, and off-peak based on the peaking terms. The sample includes power plants owned by domestic corporations, private equity, institutional investors, and foreign corporations. We focus on the ownership by private equity, institutional investors, and foreign corporations (the omitted ownership category is domestic corporations). *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. *ln Plant Age* is the natural logarithm of plant age in years. *Greenfield 12m* is an indicator for the first 12 months when a plant starts operating. *Decommissioned 12m* is an indicator for the last 12 months when a plant is still operating. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$.

	Contract Duration		**Increment Terms**			**Peaking Period Terms**		
	Short	Long	Short	Medium	Long	Full	Peak	Off-Peak
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Private Equity	0.092***	-0.096***	0.122***	-0.019**	-0.113***	-0.007	0.065***	-0.036***
	[0.027]	[0.028]	[0.024]	[0.009]	[0.025]	[0.025]	[0.018]	[0.011]
Institutional Investor	-0.167**	0.181**	-0.267***	0.050	0.227***	0.186**	-0.120***	-0.030
	[0.071]	[0.072]	[0.069]	[0.030]	[0.084]	[0.079]	[0.040]	[0.028]
Foreign Corp	0.038	-0.032	0.070*	-0.005	-0.112***	0.024	-0.024	-0.043**
	[0.039]	[0.039]	[0.037]	[0.009]	[0.039]	[0.037]	[0.021]	[0.018]
ln Plant Capacity	0.013	-0.015	0.001	-0.001	0.007	-0.005	0.005	0.001
	[0.010]	[0.010]	[0.009]	[0.002]	[0.009]	[0.010]	[0.007]	[0.004]
ln Plant Age	-0.003	-0.001	0.005	-0.003	0.001	-0.023*	0.028***	0.000
	[0.014]	[0.014]	[0.013]	[0.004]	[0.012]	[0.012]	[0.009]	[0.005]
Greenfield 12m	0.015	-0.031	0.056**	0.001	-0.060***	-0.066***	0.060***	0.036***
	[0.024]	[0.024]	[0.022]	[0.006]	[0.022]	[0.023]	[0.015]	[0.009]
Decommissioned 12m	0.038	-0.037	0.017	0.001	0.005	-0.006	0.010	0.003
	[0.035]	[0.035]	[0.034]	[0.004]	[0.031]	[0.034]	[0.023]	[0.017]
Fuel-State-Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	303,603	303,603	303,603	303,603	303,603	303,603	303,603	303,603
Adjusted R-squared	0.611	0.610	0.652	0.642	0.637	0.623	0.627	0.615

Table 11: Pricing of Electricity Sales

In this table, observations are at the plant-prime-mover-month level and are weighted by the quantity of sold electricity. The dependent variables are the mean and median of monthly electricity price per MWh. We winsorize the dependent variables at 0.5% and 99.5%. The sample includes power plants owned by domestic corporations, private equity, institutional investors, and foreign corporations. We focus on the ownership by private equity, institutional investors, and foreign corporations (the omitted ownership category is domestic corporations). *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. *ln Plant Age* is the natural logarithm of plant age in years. *Greenfield 12m* is an indicator for the first 12 months when a plant starts operating. *Decommissioned 12m* is an indicator for the last 12 months when a plant is still operating. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

	Mean Price		**Median Price**	
	(1)	(2)	(3)	(4)
Private Equity	4.494***	1.867*	4.480***	2.052*
	[0.987]	[1.091]	[0.950]	[1.052]
Institutional Investor	0.815	1.696	-0.612	-0.083
	[3.252]	[2.915]	[2.690]	[2.441]
Foreign Corp	0.993	-1.788	1.121	-1.221
	[1.572]	[1.657]	[1.447]	[1.672]
ln Plant Capacity	-0.436	-0.165	-0.396	0.010
	[0.500]	[0.579]	[0.473]	[0.575]
ln Plant Age	1.187**	0.917	1.148**	0.739
	[0.487]	[0.567]	[0.484]	[0.555]
Greenfield 12m	-5.211***	-5.808***	-5.087***	-5.865***
	[1.155]	[1.220]	[1.093]	[1.147]
Decommissioned 12m	-1.408	-1.920	-2.349	-3.423
	[1.457]	[1.715]	[1.864]	[2.450]
State-Year-Month FE	Yes	No	Yes	No
Fuel FE	Yes	No	Yes	No
Fuel-State-Year-Month FE	No	Yes	No	Yes
Observations	236,033	236,033	236,033	236,033
Adjusted R-squared	0.583	0.716	0.520	0.679

Online Appendix

The Shifting Finance of Electricity Generation

November 2022

Figure A.1: Total U.S. Electricity Generation

This figure presents the total U.S. electricity generation over 20008–2021 period. The data is based on the Energy Information Administration (EIA) Monthly Energy Review Table 7.2a, and includes generation from power plants with at least 1 megawatt electric generation capacity.

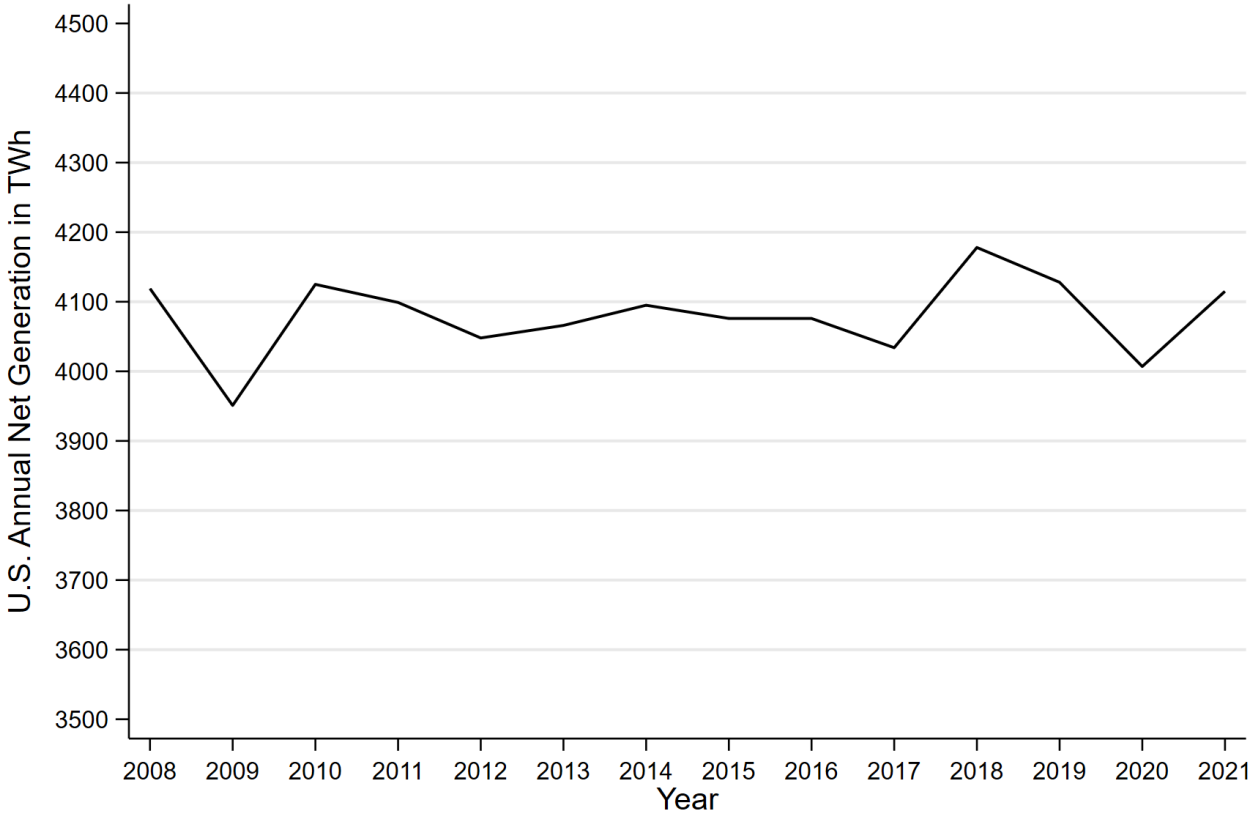
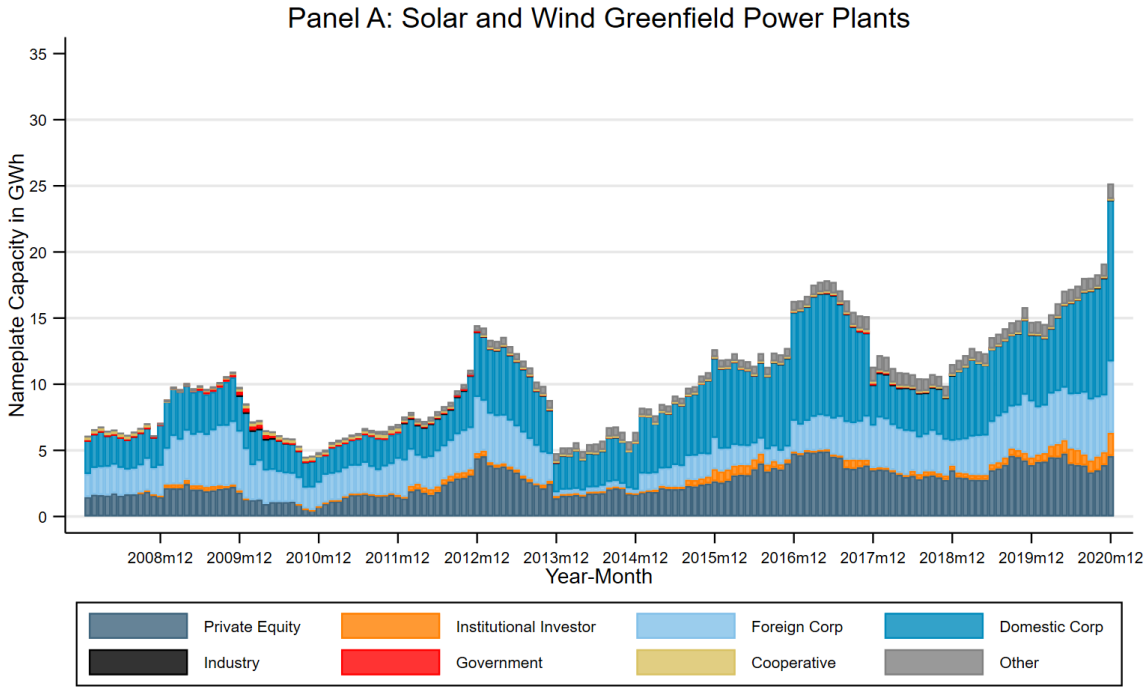


Figure A.2: Ownership of Greenfield Power Plants by Fuel Type

Panel A presents the ownership of new solar and wind greenfield generation capacity by month. Panel A presents the ownership of new natural gas greenfield generation capacity by month. We classify power plants as a greenfield asset in the first 12 months of plant operation.



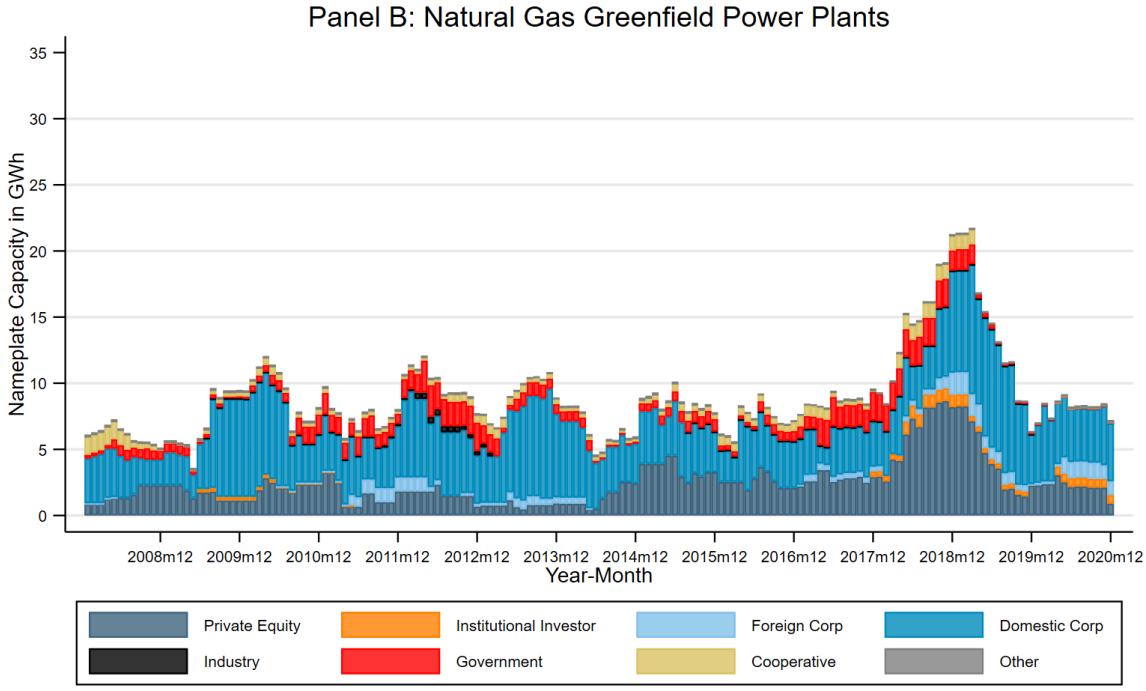


Table A.1: EIA Power Plants

Robustness statistics of Table 1: We do not weight observations by power plant nameplate capacity, but we limit attention to the subsample of power plants with a nameplate capacity of at least 20MW.

The table presents summary statistics on a plant-prime-mover-month level for all power plants together as well as separately for the main fuel types: natural gas, coal, nuclear, hydro, wind, and solar plants. The sample includes only power plants with a nameplate capacity of at least 20MW. Panel A reports statistics for the main power plant characteristics. *Capacity* shows the average nameplate capacity in GWh. *Capacity Factor* is the mean ratio of monthly net generation to capacity. *Age* presents the average plant age in years. *Greenfield 12m* is an indicator for the first 12 months when a plant starts operating. *Decommissioned 12m* is an indicator for the last 12 months when a plant is still operating. Panel B reports the average ownership by the eight categories in percent. If a power plant is owned by multiple ownership types, we divide the ownership and generation equally across the ownership types (i.e., if a private equity and domestic corporation jointly own a power plant, we assume that each ownership types owns 50% of the power plant). Panel C presents statistics on state electricity markets. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority and electric power transmission system operator. *EIA Restructured* is an indicator for states with a restructured energy market. *Climate Concern* is the percentile ranking of the state where the plant is located based on the percentage of state population who think that global warming is happening surveyed by the Yale Climate Opinion Maps. *CO2 Limits* is the percentile ranking of the state where the plant is located based on the percentage of state population who support setting strict limits on existing coal-fire power plants surveyed by the Yale Climate Opinion Maps. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy.

	All	**NatGas**	**Coal**	**Nuclear**	**Hydro**	**Wind**	**Solar**
Panel A: Power Plant Characteristics							
# Unique Plants	4,388	1,911	643	66	454	878	502
# Unique Plants-Prime-Mover	5,298	2,721	716	66	454	878	502
Observations	627,468	345,197	81,695	9,839	69,802	83,314	21,062
Capacity (GWh)	0.282	0.284	0.642	1.698	0.164	0.117	0.063
Capacity Factor	0.316	0.289	0.448	0.856	0.373	0.323	0.257
Age (Years)	28.478	26.228	43.566	35.121	62.642	6.954	2.701
# Unique Greenfield	1,732	397	34	0	5	745	501
Greenfield 12m	0.030	0.013	0.004	0.000	0.001	0.098	0.252
# Unique Decommissioned	662	341	226	9	4	22	1
Decommissioned 12m	0.013	0.015	0.033	0.011	0.001	0.003	0.001
Panel B: Power Plant Ownership							
Domestic Corporation	0.415	0.394	0.512	0.857	0.349	0.408	0.527
Private Equity	0.153	0.156	0.081	0.016	0.079	0.240	0.241
Institutional Investor	0.018	0.018	0.002	0.000	0.005	0.041	0.057
Foreign Corporation	0.072	0.042	0.015	0.020	0.024	0.263	0.094
Industry	0.058	0.089	0.109	0.000	0.011	0.000	0.011
Government	0.193	0.191	0.168	0.106	0.514	0.014	0.003
Cooperative	0.052	0.066	0.072	0.000	0.019	0.009	0.004
Other	0.039	0.045	0.042	0.000	0.000	0.025	0.063
Panel C: State Electricity Markets							
ISO Balancing Authority	0.668	0.698	0.680	0.723	0.435	0.788	0.552
EIA Restructured	0.376	0.410	0.354	0.516	0.214	0.382	0.174
Climate Concern	0.573	0.577	0.441	0.561	0.573	0.527	0.738
CO2 Limits	0.553	0.552	0.453	0.585	0.559	0.511	0.685
Renewables Incentives	2.368	2.374	2.256	2.287	2.185	2.615	2.515

Table A.2: Ownership of Greenfield Power Plants

Robustness check of Table 3: We use logit specifications and do not weight observations by power plant nameplate capacity, but we limit attention to the subsample of power plants with a nameplate capacity of at least 20MW.

In this table, observations are at the plant-prime-mover-month level and the sample includes only power plants with a nameplate capacity of at least 20MW. The dependent variable captures greenfield power plants and equals to one for the first 12 months of plant operation. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. *Climate Concern* is an indicator for state with above median ranking based on the percentage of population who think that global warming is happening. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. The specifications include fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$.

Greenfield Power Plants with Capacity $\geq$ 20MW (Unconditional Prob. = 3.01%)					
	(1)	(2)	(3)	(4)	(5)
Domestic Corp	-0.889***		-0.070	-0.732***	0.254
	[0.156]		[0.254]	[0.243]	[0.423]
Domestic Corp × ISO Balancing			-1.134***		-1.164***
			[0.287]		[0.288]
Domestic Corp × Climate Concern				-0.242	-0.322
				[0.289]	[0.298]
Domestic Corp × Renewables Incentives					-0.038
					[0.134]
Private Equity		1.185***			
		[0.185]			
Institutional Investor		-1.602**			
		[0.628]			
Foreign Corp		0.778***			
		[0.202]			
ln Plant Capacity	0.765***	0.771***	0.772***	0.767***	0.775***
	[0.090]	[0.089]	[0.090]	[0.089]	[0.089]
Other Owners	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Fuel FE	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes
Observations	617,523	617,523	617,523	617,523	617,523

Table A.3: Ownership of Greenfield Power Plants

Robustness check of Table 3: We control for EIA restructured indicator instead of ISO balancing authority as a proxy of deregulated markets.

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. The dependent variable captures greenfield power plants and equals to one for the first 12 months of plant operation. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. *EIA Restructured* is an indicator for states with a restructured energy market. *Climate Concern* is an indicator for state with above median ranking based on the percentage of population who think that global warming is happening. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

	All Greenfield Power Plants (Unconditional Prob. = 1.75%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Domestic Corp	-1.146***		-1.239***		-0.414	-1.004***	-0.853*
	[0.242]		[0.293]		[0.342]	[0.339]	[0.498]
Domestic Corp × EIA Restructured					-1.577***		-1.769***
					[0.395]		[0.443]
Domestic Corp × Climate Concern						-0.346	0.102
						[0.358]	[0.449]
Domestic Corp × Renewables Incentives							0.189
							[0.205]
Private Equity		1.445***		1.551***			
		[0.290]		[0.337]			
Institutional Investor		-2.612***		-2.008**			
		[0.947]		[0.989]			
Foreign Corp		1.327***		1.273**			
		[0.423]		[0.595]			
ln Plant Capacity	0.080	0.074	0.146**	0.149**	0.134*	0.150**	0.129*
	[0.056]	[0.056]	[0.069]	[0.069]	[0.069]	[0.069]	[0.069]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195	1,288,195
Adjusted R-squared	0.087	0.087	0.179	0.179	0.179	0.179	0.179

Table A.4: Ownership of Greenfield Power Plants

Robustness check of Table 3: We do not weight observations by power plant nameplate capacity, but we limit attention to the subsample of power plants with a nameplate capacity of at least 20MW.

In this table, observations are at the plant-prime-mover-month level and the sample includes only power plants with a nameplate capacity of at least 20MW. The dependent variable captures greenfield power plants and equals to one for the first 12 months of plant operation. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. *Climate Concern* is an indicator for state with above median ranking based on the percentage of population who think that global warming is happening. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$.

	Greenfield Power Plants with Capacity ≥ 20MW (Unconditional Prob. = 3.01%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Domestic Corp	-1.286***		-1.593***		-0.635	-1.371***	-0.719
	[0.214]		[0.303]		[0.395]	[0.423]	[0.641]
Domestic Corp × ISO Balancing					-1.348***		-1.368***
					[0.385]		[0.387]
Domestic Corp × Climate Concern						-0.327	-0.595
						[0.416]	[0.469]
Domestic Corp × Renewables Incentives							0.203
							[0.217]
Private Equity		1.578***		2.012***			
		[0.251]		[0.343]			
Institutional Investor		-2.955***		-1.825			
		[0.869]		[1.138]			
Foreign Corp		1.633***		1.501***			
		[0.387]		[0.565]			
ln Plant Capacity	0.503***	0.505***	0.673***	0.678***	0.698***	0.673***	0.696***
	[0.060]	[0.059]	[0.085]	[0.085]	[0.086]	[0.085]	[0.086]
Other Owners	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year-Month FE	Yes	Yes	No	No	No	No	No
Fuel FE	Yes	Yes	No	No	No	No	No
Fuel-State-Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	627,468	627,468	627,468	627,468	627,468	627,468	627,468
Adjusted R-squared	0.107	0.108	0.114	0.114	0.114	0.114	0.114

Table A.5: Ownership of Decommissioned Power Plant

Robustness check of Table 8: We estimate Cox proportional hazard model instead of pooled OLS.

In this table, observations are at the plant-prime-mover-month level. We present results of a survival analysis using the Cox proportional hazard model. The event of interest is a complete decommissioning of a power plant (not partial retirement of one generator). We limit attention to the subsample of power plants with nameplate capacity of at least 20MW. *#Plants* reports the number of unique plant-prime-mover units included in the survival analysis, while *#Decommissioned* reports the number of unique plant-prime-mover units that are retired by the end of the survival analysis. We measure the ownership by domestic corporations, private equity, institutional investors, and foreign corporations. We also control for the ownership by industry firms, government, cooperatives, and other. *ISO Balancing* is an indicator for power plants that participate in a wholesale market that is administered by an Independent System Operator (ISO) as a balancing authority. *Climate Concern* is an indicator for state with above median ranking based on the percentage of population who think that global warming is happening. *Renewables Incentives* is an aggregate index of three indicators if a state has corporate tax, property tax and sales tax incentives for renewable energy as well as two indicators if a state has production or feed-in tariffs incentives for renewable energy. *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. *ln Plant Age* is the natural logarithm of plant age in years. The specifications include fuel-type and state fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

Power Plants with Capacity $\geq$ 20MW (5,298 Plants; 662 Decommissioned)					
	(1)	(2)	(3)	(4)	(5)
Domestic Corp	0.404***		0.216	0.546***	0.328
	[0.131]		[0.186]	[0.178]	[0.292]
Domestic Corp × ISO Balancing			0.245		0.219
			[0.172]		[0.176]
Domestic Corp × Climate Concern				-0.194	-0.169
				[0.163]	[0.170]
Domestic Corp × Renewables Incentives					0.013
					[0.076]
Private Equity		-0.204			
		[0.142]			
Institutional Investor		-5.951***			
		[2.099]			
Foreign Corp		-0.522**			
		[0.247]			
ln Plant Capacity	-0.484***	-0.482***	-0.486***	-0.486***	-0.487***
	[0.041]	[0.040]	[0.040]	[0.041]	[0.040]
ln Plant Age	1.236***	1.231***	1.242***	1.238***	1.243***
	[0.103]	[0.101]	[0.104]	[0.103]	[0.104]
Other Owners	Yes	Yes	Yes	Yes	Yes
Fuel-Type FE	Yes	Yes	Yes	Yes	Yes
Plant State FE	Yes	Yes	Yes	Yes	Yes
Observations	626,533	626,533	626,533	626,533	626,533

Table A.6: Contractual Terms of Electricity Sales

Robustness check of Table 10: The dependent variables capture the percentage of transaction charges instead of the percentage of quantity sold under various contractual terms.

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. The dependent variables are the percentages of electricity transaction charges under three different contractual terms. First, we distinguish between short contracts with duration of less than one year and long-term contracts. Second, we split transactions into short, medium, and long based on the increment pricing terms. Short transactions use 5-minute, 15-minute or hourly increments (up to 6 hours). Medium transactions have daily or weekly increments (from 6 hours to 168 hours). Long transaction use monthly or yearly increments (longer than 168 hours). Third, we classify transactions into full-period, peak, and off-peak based on the peaking terms. The sample includes power plants owned by domestic corporations, private equity, institutional investors, and foreign corporations. We focus on the ownership by private equity, institutional investors, and foreign corporations (the omitted ownership category is domestic corporations). *ln Plant Capacity* is the natural logarithm of plant's monthly capacity. *ln Plant Age* is the natural logarithm of plant age in years. *Greenfield 12m* is an indicator for the first 12 months when a plant starts operating. *Decommissioned 12m* is an indicator for the last 12 months when a plant is still operating. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

	Contract Duration		**Increment Terms**			**Peaking Period Terms**		
	Short	Long	Short	Medium	Long	Full	Peak	Off-Peak
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Private Equity	0.082***	-0.086***	0.120***	-0.020***	-0.111***	-0.002	0.054***	-0.031***
	[0.029]	[0.030]	[0.025]	[0.007]	[0.026]	[0.026]	[0.019]	[0.010]
Institutional Investor	-0.153**	0.167**	-0.256***	0.071**	0.192**	0.182**	-0.107**	-0.009
	[0.074]	[0.075]	[0.072]	[0.032]	[0.087]	[0.079]	[0.046]	[0.026]
Foreign Corp	0.028	-0.023	0.062*	-0.000	-0.111***	0.036	-0.034	-0.040***
	[0.040]	[0.040]	[0.038]	[0.008]	[0.040]	[0.037]	[0.022]	[0.015]
ln Plant Capacity	0.017*	-0.020**	0.003	-0.001	0.005	-0.008	0.007	0.002
	[0.010]	[0.010]	[0.009]	[0.003]	[0.009]	[0.010]	[0.007]	[0.004]
ln Plant Age	-0.011	0.006	0.005	-0.005	0.002	-0.019	0.027***	-0.002
	[0.015]	[0.015]	[0.013]	[0.005]	[0.013]	[0.012]	[0.010]	[0.004]
Greenfield 12m	0.012	-0.028	0.060***	0.000	-0.064***	-0.067***	0.068***	0.027***
	[0.026]	[0.026]	[0.023]	[0.007]	[0.023]	[0.023]	[0.017]	[0.008]
Decommissioned 12m	0.056	-0.055	0.033	0.003	-0.012	-0.025	0.022	0.009
	[0.037]	[0.037]	[0.035]	[0.005]	[0.032]	[0.035]	[0.027]	[0.015]
Fuel-State-Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	303,503	303,503	303,503	303,503	303,503	303,503	303,503	303,503
Adjusted R-squared	0.585	0.584	0.640	0.622	0.620	0.610	0.621	0.598

Table A.7: Contractual Terms of Electricity Sales by Fuel Type

Robustness check of Table 10: The dependent variables capture contractual terms of electricity sales by fuel type.

In this table, observations are at the plant-prime-mover-month level and are weighted by power plant nameplate capacity. The dependent variables are the percentages of electricity quantity sold under different contractual terms. The contractual terms focus on the contract duration, increment pricing, and peaking period. Panel A examines the subsample of solar and wind power plants, Panel B examines the subsample of natural gas plants, and Panel C examines the subsample of coal, waste coal, petroleum coke and residual petroleum plants. The sample includes power plants owned by domestic corporations, private equity, institutional investors, and foreign corporations. We focus on the ownership by private equity, institutional investors, and foreign corporations (the omitted ownership category is domestic corporations). We include the same control variables for plant size, age, greenfield stage, and decommissioning stage. The specifications include interacted fuel-type, state, and year-month fixed effects. We cluster standard errors by plant-prime-mover, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

	Contract Duration		**Increment Terms**			**Peaking Period Terms**		
	Short	Long	Short	Medium	Long	Full	Peak	Off-Peak
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Solar and Wind Power Plants								
Private Equity	-0.113**	0.091**	-0.079**	-0.008	0.027	-0.021	-0.008	0.015
	[0.045]	[0.046]	[0.038]	[0.006]	[0.043]	[0.050]	[0.022]	[0.020]
Institutional Investor	-0.050	0.048	-0.145**	0.092**	0.007	-0.057	0.005	0.053
	[0.077]	[0.077]	[0.059]	[0.037]	[0.076]	[0.091]	[0.037]	[0.037]
Foreign Corp	-0.080*	0.082*	-0.089**	-0.012**	-0.019	0.080	-0.081***	-0.070***
	[0.047]	[0.047]	[0.039]	[0.005]	[0.045]	[0.050]	[0.020]	[0.019]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fuel-State-Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	104,979	104,979	104,979	104,979	104,979	104,979	104,979	104,979
Adjusted R-squared	0.251	0.240	0.301	0.181	0.239	0.194	0.273	0.316
Panel B: Natural Gas Power Plants								
Private Equity	0.109***	-0.110***	0.145***	-0.026*	-0.126***	-0.014	0.103***	-0.061***
	[0.037]	[0.038]	[0.032]	[0.014]	[0.033]	[0.036]	[0.025]	[0.016]
Institutional Investor	-0.325***	0.348***	-0.428***	0.002	0.456***	0.375***	-0.218***	-0.087**
	[0.104]	[0.105]	[0.104]	[0.045]	[0.122]	[0.111]	[0.064]	[0.037]
Foreign Corp	0.040	-0.034	0.071	-0.003	-0.073	0.029	-0.009	-0.057**
	[0.059]	[0.059]	[0.053]	[0.017]	[0.057]	[0.052]	[0.036]	[0.027]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fuel-State-Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	82,310	82,310	82,310	82,310	82,310	82,310	82,310	82,310
Adjusted R-squared	0.468	0.467	0.560	0.420	0.531	0.546	0.514	0.508
Panel C: Coal and Petroleum Power Plants								
Private Equity	0.316***	-0.317***	0.298***	0.006	-0.281***	0.027	-0.006	0.009
	[0.097]	[0.097]	[0.097]	[0.008]	[0.107]	[0.051]	[0.044]	[0.026]
Institutional Investor	0.288***	-0.287***	0.279***	0.007	-0.279***	0.008	-0.075*	0.074***
	[0.100]	[0.100]	[0.095]	[0.009]	[0.104]	[0.062]	[0.043]	[0.028]
Foreign Corp	0.487***	-0.487***	0.415**	0.054	-0.461***	-0.033	-0.058	0.066*
	[0.163]	[0.163]	[0.172]	[0.046]	[0.167]	[0.044]	[0.038]	[0.034]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fuel-State-Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,266	29,266	29,266	29,266	29,266	29,266	29,266	29,266
Adjusted R-squared	0.625	0.627	0.681	0.917	0.701	0.662	0.652	0.615