Is it Time to Move On? An Analysis of Renewable Portfolio Standards and its Policy Alternatives

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Introduction

On December 12th, 2015, 196 countries signed the Paris Agreement at the UN Climate Change Conference in Paris, France, where they pledged to implement measures that would limit the warming of global temperatures to 1.5 °C above pre-industrial levels (United Nations Framework Convention on Climate Change [UNFCC], 2024). The threshold was set meticulously at 1.5 °C because research from the UN's Intergovernmental Panel suggests that passing this threshold would exacerbate the severity of climate change consequences like storms, heatwaves, and drought etc. For example, reaching a temperature increase of 2 °C in 2050 would mean as many as 270 million more people will experience issues with water scarcity vs. 1.5 °C (Buis, 2019). To prevent such catastrophic consequences, greenhouse gas (GHG) emissions would have to reach their peak by 2025 and subsequently decline by 43% by 2030. As part of this framework, the U.S. openly committed to decrease overall emissions by 50-52% below 2005 levels by 2030 (Ellerbeck, 2023). Yet, emissions have only declined by 13.8% as of March 2023, and to meet the agenda, an extra 4.5% drop would have been needed in 2022 on top of the mere 1.5% drop that year.

A contributing issue to this lag is that, in the power sector, the primary policy mechanisms combating climate change are state initiatives that have witnessed controversy since their inception. These state initiatives, known as renewable portfolio standards (RPS), are state-enforced energy standards that require in-state utilities and electricity providers to procure a certain percentage of their energy mix from hydro, wind, and other renewable sources (National Conference of State Legislatures [NCSL], 2021). First established in 1983 in the state of Iowa with other states following suit in the 2000s, some form of an active RPS is now implemented in

29 states, Washington D.C., and 2 U.S. territories (Lawson, 2021); it is the most extensively adopted state clean-energy policy in the United States (Foley, 2023).

Despite being such a prevalent and instrumental piece of the energy production landscape, RPSs face relentless scrutiny by critics for raising electricity prices across the board and hurting American consumers, for being cost-inefficient, and for a flawed system that permits private sector misuse of renewable energy certificates (RECs) under the RPS. Advocates of change call for shifts to alternative energy policy designs like feed-in tariff (FIT) and cap-and-trade (CAT) programs that may not only hold remedies to these issues but have also shown success both abroad and domestically. Against the backdrop of stalling U.S. progress in meeting Paris Agreement targets and the intense debate surrounding the RPS, a question must be considered: is it time to move on from the RPS?

What is the RPS?

The intention of the RPS is to reduce GHG emissions over the long term by requiring and encouraging the diversification of the electricity generation mix with more renewable energy sources (Foley, 2023). RPS across the states are nonuniform and can differ based on what type of energy sources are included to be in compliance with standards and the percentage of the energy mix required from these sources. For example, some states have even opted to rename their RPS policy to "Clean Energy Standards" (CES) as those states mandated more stringent standards that eliminated sources of energy that are renewable but are not necessarily carbon-free like biofuels (NCSL, 2021). Additionally, some states have separate solar "carve-out" policies that specify some percentage of energy to be generated from solar photovoltaic (PV) cells to encourage the development of solar energy. The eligible energy mix under these standards is mostly determined based on a state's existing energy generation composition and sources of potential development within the state. Colorado, for instance, qualifies for solar, wind, biomass, geothermal, hydroelectric resources, and emissions-neutral coal-mine methane versus Hawaii, which qualifies for all but the latter two in addition to energy generation from ocean water, falling water, waves, and currents.

States generally set targets that differ in ambition where there are aggressive targets like California's that aim to reach 100% clean energy generation from its in-state utilities by 2045 (NCSL, 2021). There are also less ambitious targets set by states like Illinois that require 50% by 2040. Standards can be multi-step and specify both short-term targets and long-term targets as well as multifaceted where different percentages are required depending on the type of utility: investor-owned and municipalities & electric cooperatives. They can differ significantly due to many factors including the natural resources available, the economics of renewable/clean energy, and the social and political context of renewable energy within the state.

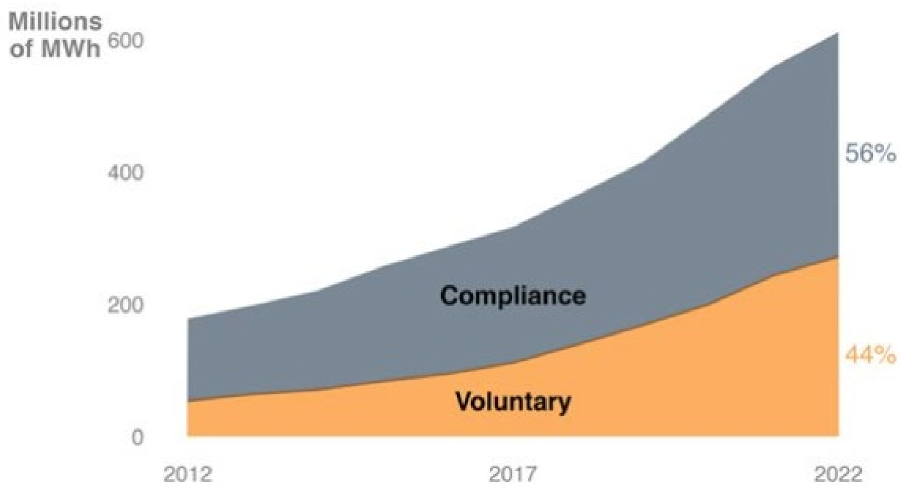
A critical portion of measuring compliance within this policy piece is the REC system. RECs represent the only way to substantiate renewable energy use claims in the U.S., backed on a legal basis by at least 35 states and territories, the U.S. Environmental Protection Agency, the Federal Trade Commission, and many other federal agencies (Center for Resource Solutions [CRS], 2023). RECs are certificates that detail characteristics of the renewable energy generated, including location and type, and essentially serve as proof for 1 MWh of renewable energy generated by the power supplier. For perspective, the average U.S. home used 899 kWh or .899 MWh per month in 2022 (U.S. Energy Information Administration [EIA], 2024).

As a result of commodification, RECs can be purchased or sold in the market and the holder of these unique RECs retains the right to substantiate renewable energy production claims to meet statewide RPS standards. Power suppliers can either meet RPS requirements by generating defined renewable energy in-house, purchase equivalent amounts in RECs, or use a combination of both. To prevent double counting, each REC has its unique tracking ID, and the selling party of an REC relinquishes their rights to claim 1 MWh of renewable energy generation (U.S. Environmental Protection Agency [EPA], 2024). The new owner has the option to either resell the certificate or “retire” the certificate, equivalent to claiming ownership of the REC and the usage of “that” MWh (CRS, 2023). Once retired, the REC can no longer be purchased or sold.

RECs not only serve these power suppliers who are mandated by law to utilize these certificates in the mandatory or compliance market, but they also serve retail customers like corporate, institutional, and residential buyers in the voluntary market. This voluntary market, comprising 44% (Figure 1) of renewable energy sales as of 2022 (EPA, 2024), is driven by consumer demand of RECs for proof of renewable energy generation towards meeting private environmental agendas like corporate net-zero targets.

Figure 1

2022 Renewable Electricity Power Market Sales

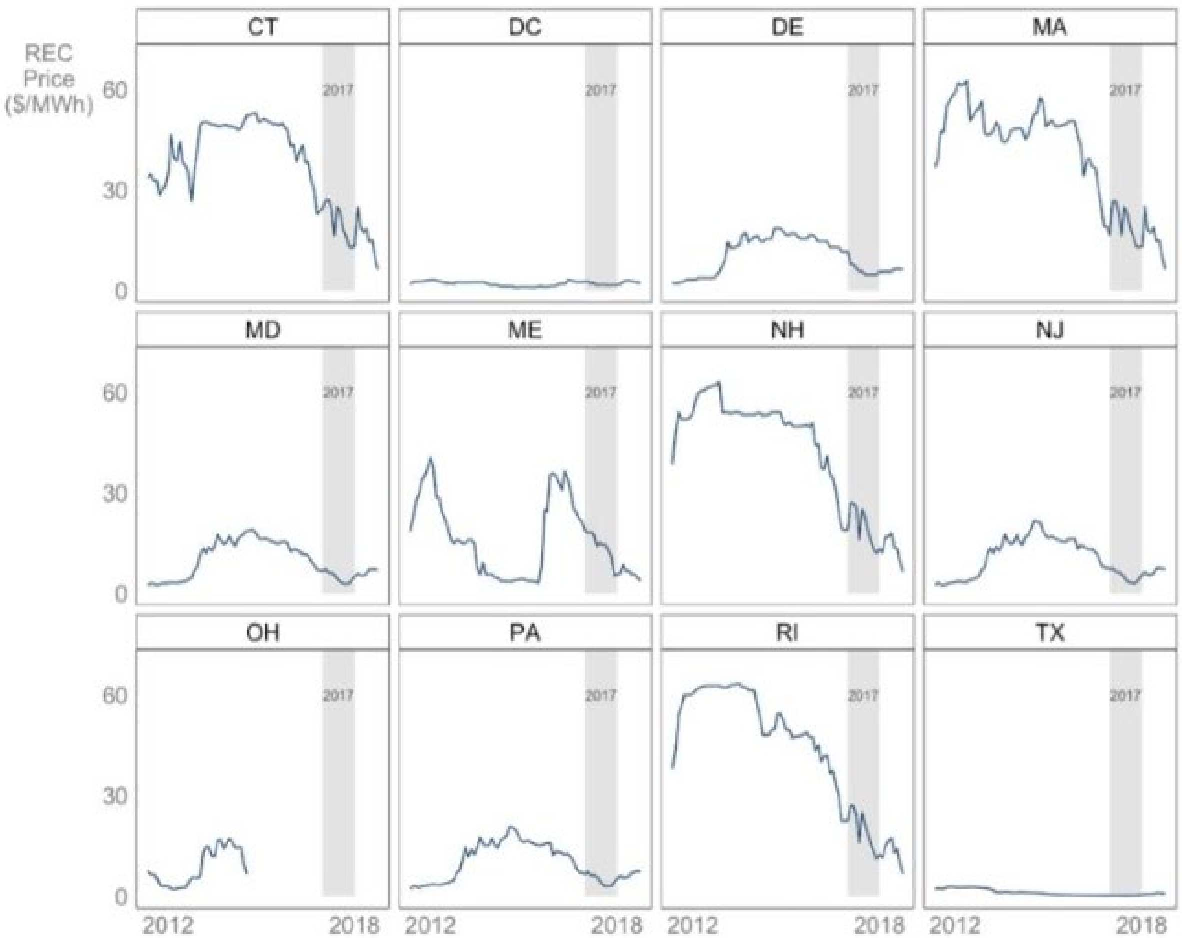


Note. Reprinted from U.S. Environmental Protection Agency, In *U.S. Renewable Electricity Market*, n.d., Retrieved May 5, 2024, from https://www.epa.gov/green-power-markets/us-renewable-electricity-market

REC prices vary depending on typical market supply and demand conditions, consumer preferences in generation type, location, and even the type of market the REC is in. Generally, compliance market RECs are more expensive and have reached $60 per MWh in past years (EPA, 2024) while the less expensive voluntary market RECs tend to stay within the margins of $0.31 to $1.2 per MWh. Such a big discrepancy between the voluntary and compliance markets is mostly due to the fact that state RPS often specify the attributes of RECs that may be used for compliance like geographic boundaries, procurement levels, and timetables etc. which limits the type of certificates that may be used in the market and increases demand for the ones that are eligible. Furthermore, compliance market REC prices vary significantly across states, as shown in Figure 2 below, since states have different RPS policies and resources that contribute to the fluctuation of prices. In sum, think of the compliance market as a market with lower liquidity of RECs segmented into smaller state markets and the voluntary market as one with higher liquidity that enjoys more of the attributes of a single free-flowing marketplace.

Figure 2

Example State Compliance REC Prices



Note. The figure shows the price of RECs in the compliance market from January 2012–August 2018 across various states. Reprinted from U.S. Environmental Protection Agency, In *Green Power Pricing*, n.d., Retrieved May 5, 2024, from https://www.epa.gov/green-power-markets/green-power-pricing

Issues with RPS

Renewable portfolio standards, despite playing a prominent role in the U. S's process towards decarbonization for more than three decades, are constantly called into question regarding their actual impact on reaching climate goals. Despite an abundance of scholarly research, research cannot determine definitively the efficacy of the RPS for two main reasons. It is difficult to conclude causal impact when the implementation of RPS across the states are not random but rather have been shown to correlate closely with factors like political ideology, resource availability, labor market conditions, and interest group activity (Deschenes et al., 2023). Additionally, it is impossible to ignore the fact that RPS will have heterogeneous effects across states and territories due to inherent policy differences and aforementioned factors. Although further research is needed, the following section aims to provide insight into several focal points of the debate where critics are dissatisfied with the impact of RPS on general electricity prices, the cost-effectiveness of RPS, and the rampant corporate misuse of RECs.

"PS" for Portfolio Standards or Price Surge?

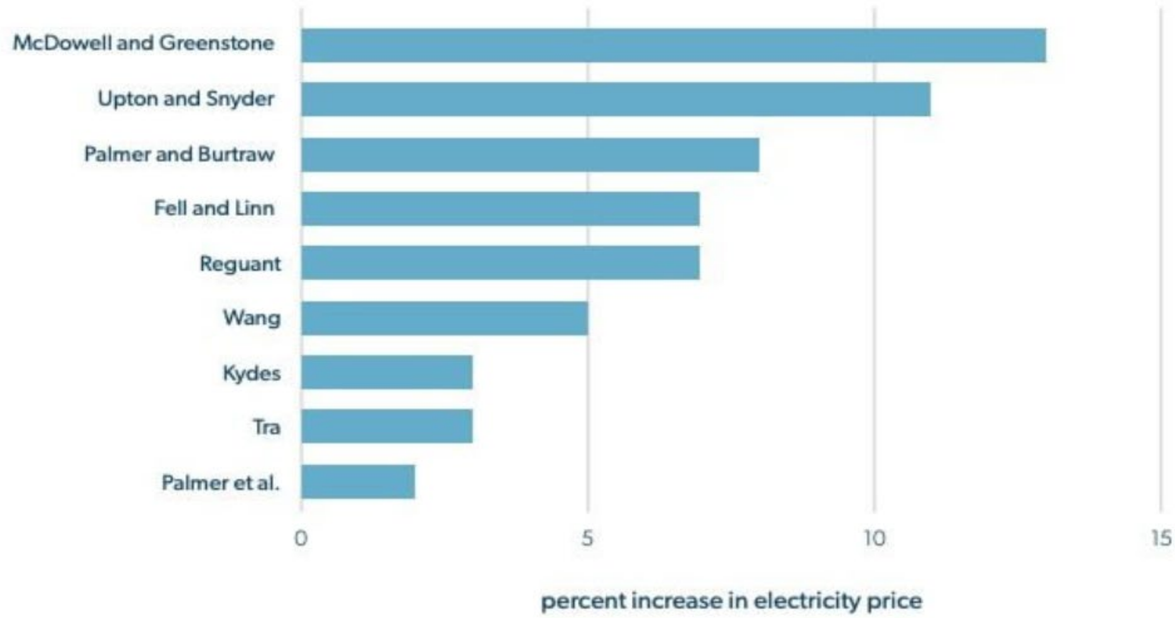
According to various sources of research, renewable portfolio standards may increase electricity prices across the board through two main mechanisms that are not necessarily separate but are important to differentiate.

Imposing RPS is the equivalent of forcing utilities to supply power generated from renewable energy sources which are typically more costly depending on the resources available in the states and the technology type (Smith & Cornwall, 2019). As a result of greater expenses on the upper lines of the utilities' income statements, market forces will, by and large, raise the prices of other types of electricity as well to maintain healthy bottom lines. While the quantifiable effect RPS has on prices varies across states, again, depending on their resources, location, and market etc., some scholars have an interesting proposition tying the relationship between the price elasticity of renewable energy vs. traditional energy sources. Fischer (2010), for instance, argues that RPS may both increase or decrease electricity prices depending on the price elasticity of the two types of sources and the rigorousness in standards. She notes that with loose standards where the percentage requirement is lower, a subsidy effect for renewable energy dominates and increased investment from utilities into these sources lower their prices. Yet, with more stringent regulations, a "tax effect" on traditional sources dominates which leads to increased electricity prices. Furthermore, Fischer suggests based on her analysis that the breakeven point may be in the 10-15% range where requiring higher percentages of the generation mix to be from renewable sources causes prices to accelerate. Although she suggests a duality to the effect of RPS on prices, it is important to note that most state RPSs require significantly more than 10-15% (NCSL, 2021).

Research leans towards the dominance of the inherent tax effect of RPS on traditional sources like what Fischer concluded. Upton and Snyder (2015), using a differences-in-differences analysis, compared the electricity prices of states with active RPS against those without to estimate that, on average, RPS states increased by approximately 11.8% relative to non-RPS states. Their estimation is in the upper quartile of estimations performed by various past studies using different methods which range from 2% to 13% as shown in Figure 3 below (Smith & Cornwall, 2019).

Figure 3

Estimations of Electricity Price Percent Increases from RPS



Note. The figure aggregates and visualizes various scholarly estimations of percent increase in electricity price as a result from RPS. Reprinted from The Center for Growth and Opportunity at Utah State University, In *What Is the Relationship between Renewable Portfolio Standards and Electricity Prices?*, by J. T. Smith & V. Cornwall, 2019, Retrieved May 5, 2024, from https://www.thecgo.org/research/what-is-the-relationship-between-renewable-portfolio-standards-and-electricity-prices/

The other avenue through which RPS raises electricity prices works similarly economically where the direct compliance costs of RPS indirectly raises electricity prices. Compliance costs are defined and broken down into two parts where the first are the costs associated with the mandated purchase of RECs to meet requirements, and the second are alternative compliance payments which are essentially state fines for when power suppliers do not meet RPS requirements (Barbose, 2023). Barbose in his 2023 Annual Status Report on RPS finds that compliance costs increase, on average, ~3.5% of customer electricity bills based on data from 2020 and 2021. He further emphasizes that the variance across states is quite notable where some states can see figures reaching as high as 12% while some are close to zero. These higher figures are propelled by solar carve-out policies in states with solar RECs that are noticeably more expensive to purchase. Other variances are driven by differences in RPS design, renewable energy market economics, and other factors etc.

All in all, opponents of RPS standards are unsettled by the fact that RPS is a win for renewable energy but a loss for everyone else including power suppliers, traditional energy producers, and utility customers because of elevated energy prices.

A Little Expensive…

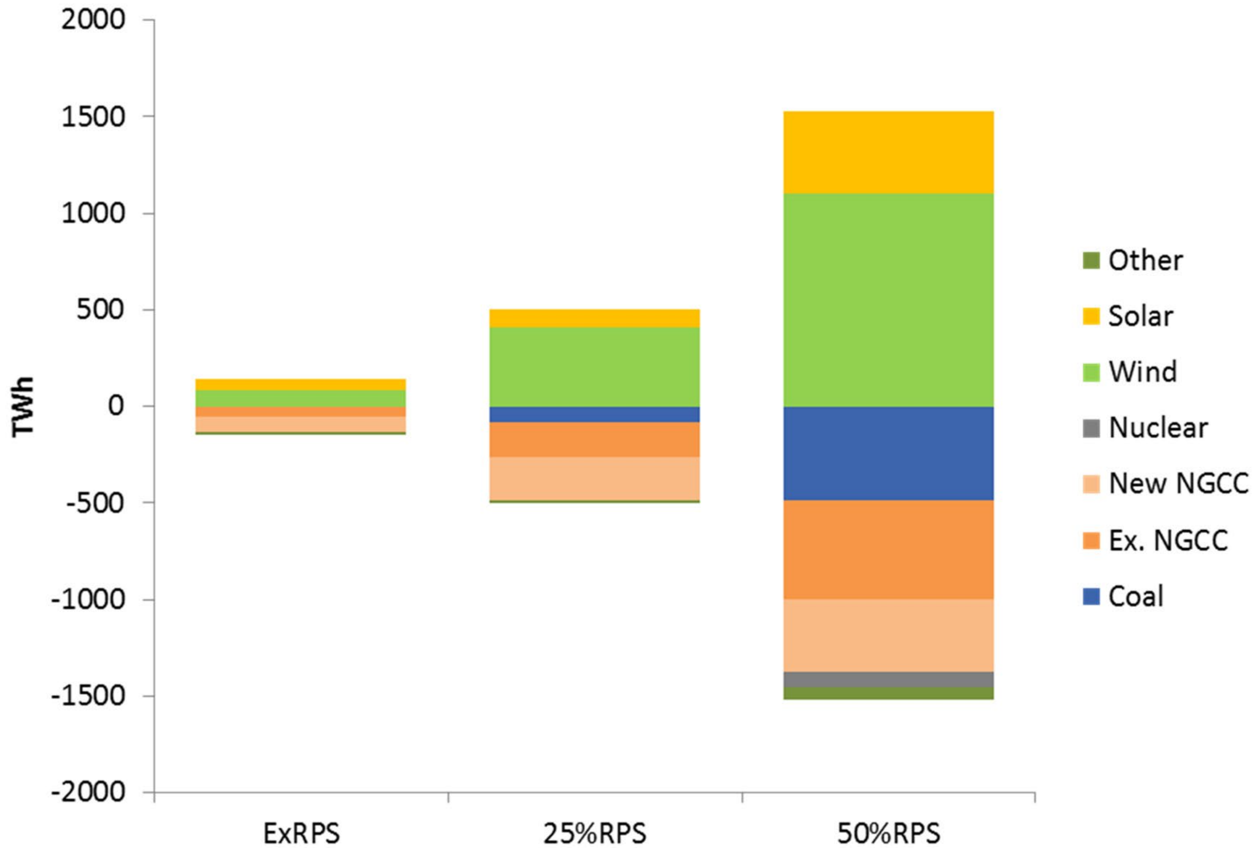
There are three main issues that opposing literature studying cost-effectiveness of RPS have with the state policies. The first is that findings suggest RPS encourages renewable energy generation at the expense of natural gas disproportionately more than coal although the former is notably more carbon-intensive (Smith & Cornwall, 2019). Secondly, RPS policy design favors the use of available renewable sources deemed eligible under its standards which are not necessarily the cheapest options possible, instead of incentivizing the development of cheaper broad-based renewable technologies. Lastly, some scholars have produced research to suggest that alternative policy designs and energy regulations are simply more cost-effective. The first two controversies will be discussed in this section while the last dispute regarding policy alternatives will be expanded upon further in the next section.

The development of renewable energy is more likely to result in the displacement of natural gas use vs. coal use partly since many selected renewable sources like solar and wind inconsistently generate energy and are reliant on weather conditions (Smith & Cornwall, 2019).

Consequently, renewables tend to replace the use of natural gas, a more flexible source, rather than coal which provides baseload capacity. Young and Bistline (2018) construct a model using data that projects and compares the carbon emissions reduced and the generation mix displaced using three scenarios: no RPS, 25% RPS, and 50% RPS by 2030 (Figure 4). They find that natural gas combustion cycle (NGCC) units are the first to be displaced when raised to 25% RPS coupled with little coal displacement, and only at 50% does coal generation become notably replaced. They attribute this phenomenon to the fact that NGCC is a relatively new power generation technology that produces natural gas at higher efficiencies but is also more expensive compared to goal generation. For this additional reason, power suppliers are incentivized to cut natural gas generation first, although NGCC units emit less than half the amount of carbon dioxide as compared to coal. The results from Young and Bistline's model show that at 25% RPS, carbon dioxide emissions are only reduced by 5% and only at 50% RPS does the figure rise to 39% (Figure 4), suggesting a cost-inefficiency in the RPS's efforts in reducing carbon emissions.

Figure 4

3 Scenarios of 2030 Generation Mix



Note. Figure 4 compares the displacement of various renewable sources between 3 scenarios: no RPS, 25% RPS, and 50% RPS by 2030. As noted, blue, representing coal displacement, is only meaningful at 50% RPS. Reprinted from "The costs and value of renewable portfolio standards in meeting decarbonization goals," by D. Young & J. Bistline, 2018, *Energy Economics*, *73*.

They note that the key to the reduction of carbon emissions is the displacement of coal in the electricity generation mix and as aforementioned, while the RPS mandates a specific portion of the mix to be renewable energy, much of the displacement starts with NGCC rather than coal, reducing the cost-efficiency of RPS. In the "least-cost portfolio" they implemented in their model where it was asked to simulate the cheapest pathway that would reach the same goals as set by the RPS standards, the pair found that, on average, the incumbent state policy is around twice as costly (Young & Bistline, 2018). Smith and Cornwall (2019) recommend that by relaxing the constraints of energy sources eligible and incentivizing the improvement of other carbon neutral technologies like nuclear power plants and carbon sequestration would grant power suppliers greater flexibility in meeting requirements through cheaper pathways. In short, critics argue that there are both cheaper-cost alternatives and more cost-efficient policy designs to lower carbon emissions than what the RPS has entailed.

Corporates Love the RPS—For the Wrong Reasons

Prior to the discussion of corporate misuse of RECs under the renewable portfolio standards to achieve supposed "net-zero" targets, a deeper understanding of the mechanics of unbundled RECs is necessary. As aforementioned, RECs are certificates detailing the attributes of the 1 MWh of renewable energy it was generated along with that is primarily used for the substantiation of renewable energy production claims. RECs become "unbundled" when the REC is separated from the 1 MWh of renewable energy it was born with, say, when a wind farm sells the wind power to a utility but keeps the RECs associated with the sold wind power (Crandall, 2010). Furthermore, due to the significance of RECs as renewable energy generation validation, the renewable electricity unbundled from its REC is no longer considered "green". On the other hand, electricity from a non-renewable source with an REC bundled to it will be considered "green".

In the voluntary market, unbundled RECs accounted for approximately 43.7% of sales in terms of energy volume as of 2021, and some of its biggest customers are corporations (Sumner et al., 2023). This is due to the fact that, taking into account the climate change tailwind and pressure on the private sector, more and more companies began to integrate their own net-zero carbon emissions goals or began to follow the standards & guidance created by the Science Based Targets initiative (SBTi) that aims to provide a clearly defined pathway for companies to reduce emissions and work towards the 1.5 °C goal set by the Paris Climate Agreement (Bjorn et al., 2022). Unbundled RECs are the stars of the private sector's efforts in reaching net-zero emissions due to its cheap price compared to more expensive options of, for example, renewable energy procurement contracts or physically building solar panels on top of offices to power energy expenditures (Naik, 2022). The additional cost of purchasing unbundled RECs to claim "green" can be as low as 1% to 2% per MWh of original energy expense.

The two main issues opponents have with this approach are that it is not only misleading to the general public, but it also jeopardizes efforts in meeting global climate goals. Corporations can source 100% of their energy from fossil-fuel sources while claiming to be "clean" as long as they purchase an equivalent amount of use in unbundled RECs (Naik, 2022). Note that, in the process, no carbon emissions are reduced, but the company nevertheless can slap "carbon-free" on its main corporate page shamelessly. Corroborating this notion, a recent study investigated the clean energy progress of 115 companies adhering to SBTi standards that, in total, reported a 30.7% decrease in market-based scope 2 emissions, indirect GHG emissions from corporate purchase and use of electricity, from 2015 to 2019 (Bjorn et al., 2022). Bjorn and his colleagues found that without the purchase of unbundled RECs, only ~32% (9.9%/30.7%) of the claimed reduction resulted in legitimate carbon offsets. These instruments created under the RPS and recognized by SBTi are thus taken advantage of as a loophole in the system without actually contributing to climate agreements or stated goals of reducing emissions.

If Not RPS, Then What?

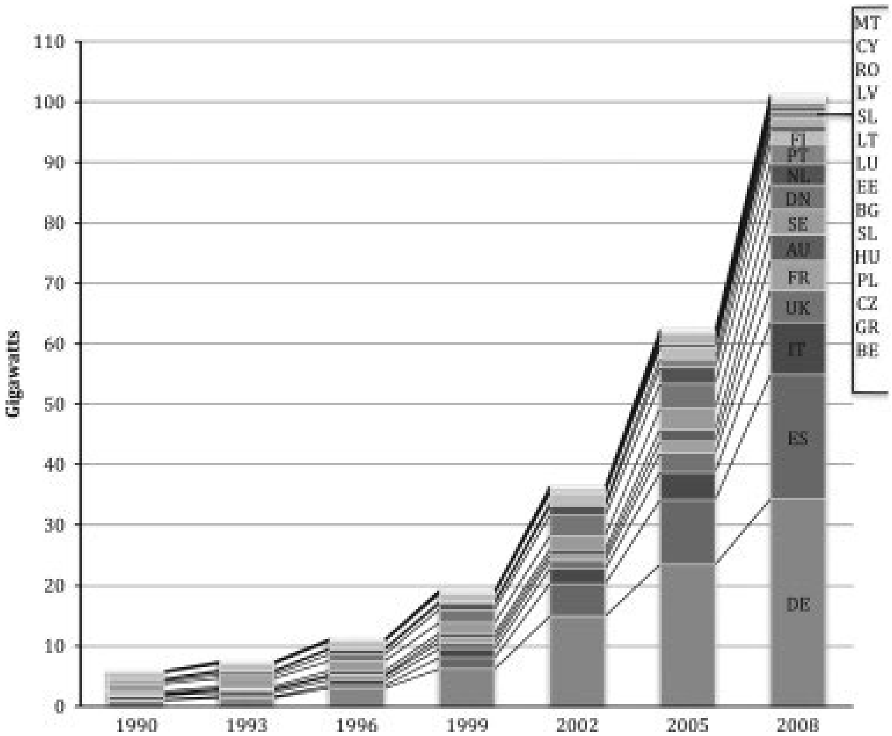
Owing to the problems inherent in the RPS system, many skeptics call for alternative energy policy designs that have shown success abroad or in similar settings, departing further than just improving and adapting the RPS. Two of the most widely recognized and implemented alternatives are feed-in tariffs (FITs) and cap-and-trade (CAT) policies where both are prevalent abroad and even utilized domestically to some degree, but on a smaller scale than the RPS championed by the U.S.

FIT is a policy design intended to encourage renewable energy development by granting long-term electricity purchase agreements to developers, contracting the sale of the renewable project's current or future energy generation (Couture et al., 2010). The contracts specify a price at which every kWh of electricity produced will be sold over a period of time typically ranging from 10-25 years. Many different pricing strategies exist across FIT schemes where some purchase agreements may implement eventually declining payment levels to developers so as to incentivize technological innovation and to follow ultimately declining costs associated with innovation. The prices themselves are generally tailored based upon the technology type, project location, and prevailing market prices etc., and can be offered at a premium. Lastly, FIT provisions also include guaranteed access to the grid, meaning that the electricity produced by these renewable sources are guaranteed to be sold instead of displaced by, say, an abundance of coal power in the electricity grid.

The most notable strength of the FIT is that the purchase agreement secures a stable and low-risk market for renewable investors and developers (Couture et al., 2010). By essentially guaranteeing revenue/profits over a defined period of time, investors and developers are not only more willing to develop projects but are also more susceptible to investing in relatively riskier innovations in contrast to under the RPS, where developers and suppliers are only incentivized to use existing and policy-designated renewable technologies (Smith & Cornwall, 2019). Advocates of the FIT further note that the existing track record of FIT lends it great credibility considering that globally, the policies may be attributed to ~75% of PV and ~45% of wind power deployment as of 2010 (Couture et al., 2010). Popular in Europe, 23 European Union (EU) members enacted FITs between 1990 and 2008 and during this span of 18 years, non-hydroelectric renewable electricity generation capacity increased approximately twenty-fold from ~5 GW to >100 GW shown in Figure 5 below (Jenner et al., 2013). In Germany, the FIT was instituted with the passage of its Electricity Feed-in Law in 1991 and since then, the installed wind power capacity grew more than 400 times from 0.1 GW to 46 GW in 2016 (Hitaj & Löschel, 2019). All in all, some critics support a greater adoption of the FIT for its immense success in countries abroad and its procurement of a stable renewable market among other strengths.

Figure 5

EU Non-Hydroelectric Renewable Electricity Generation Capacity

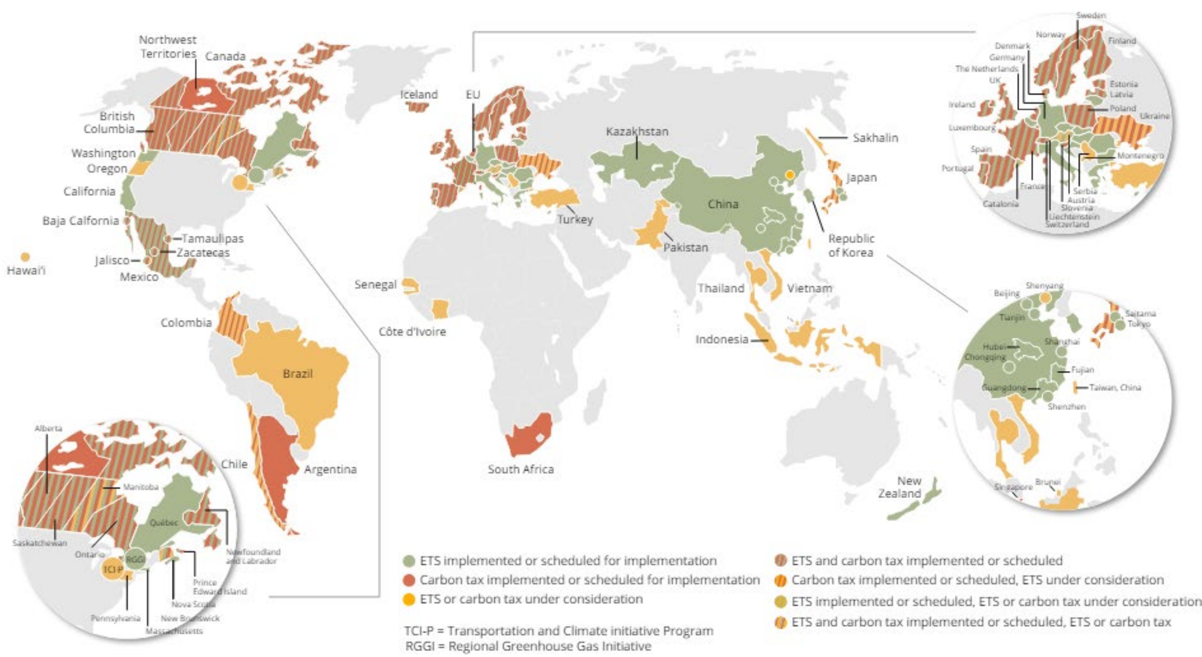


Note. Shows the change in non-hydroelectric renewable generation capacity in EU27 countries from 1990 to 2008. Reprinted from "Assessing the strength and effectiveness of renewable electricity feed-in tariffs in European Union countries," by S. Jenner et al., 2013, *Energy Policy*, *52*.

Cap-and-trade or what Europe calls their emissions trading system, is a policy design where the government imposes a limit on GHG emissions by setting a cap on total emissions in a particular period within its corresponding jurisdiction and issuing an amount of emission "allowances" to companies that permit the emittance of one ton of GHG (Center for Climate and Energy Solutions [C2ES], 2024). Similar to the voluntary market for RECs, these allowances are tradable, and companies emitting GHG, the market participants, decide for themselves the price of these allowances (World Bank, 2023). Compared to a similar policy mechanism known as the carbon tax where emitters are taxed for every GHG emission, CAT provides certainty on future emissions as opposed to the inverse where the carbon tax provides certainty on emissions price (C2ES, 2024).

Figure 6

2021 Carbon Pricing Map

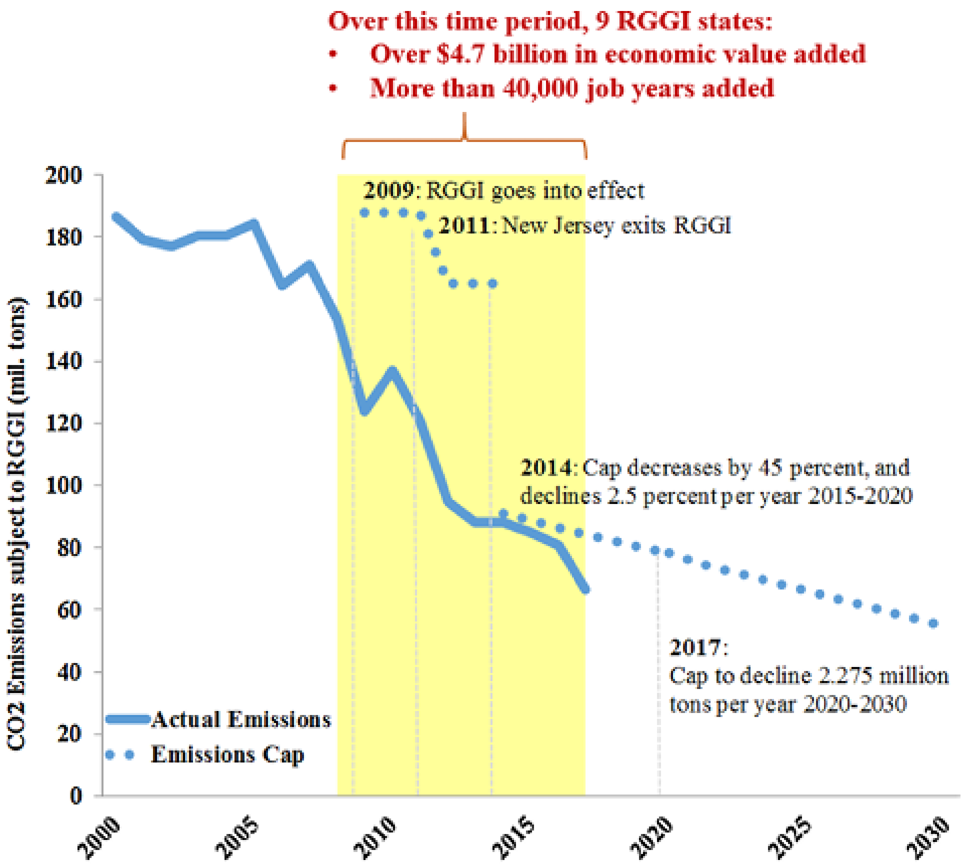


Note. World map displaying which countries have what form of carbon pricing program active in 2021. Reprinted from Center for Climate and Energy Solutions, In *Cap and Trade Basics*, n.d., Retrieved May 5, 2024, from https://www.c2es.org/content/cap-and-trade-basics/#:~:text=In%20a%20cap%2Dand%2Dtrade,market%20establishes%20an%20emissions%20price

Implemented across the world (Figure 6) in some EU countries, parts of China, and in 12 U.S. states etc. (C2ES, 2024), CAT boasts the aforesaid capability of certainty in emissions in addition to being particularly economically beneficial and cost-effective. Unlike the RPS, CAT allows governments to realize monetary gains that can be then recycled for further climate and economic benefits (Hibbard et al., 2018). This is due to the fact that allowances can either be allocated for free or auctioned out periodically by the governments (World Bank, 2023). For example, Hibbard and his co-authors followed the revenue collected from quarterly allowance auctions in 10 U.S. states participating in the Regional Greenhouse Gas Initiative, a CAT program, and found that the states were able to collect around $2.7 billion allowance auction proceeds from 2009-2017. They also estimated that these $2.7 billion, later funneled back into the economy through various means including further development of renewable energy, netted an economic benefit of $4.7 billion in those states (Hibbard et al., 2018). In terms of effectiveness, as of 2017, CO2 emissions have been reduced to around one-half of 2009 levels when the program was implemented. Furthermore, in terms of cost-effectiveness, researchers using an economic model of electricity markets found that reducing carbon emissions by 5.8% is 7.5 times more costly with regards to social welfare under the RPS than a CAT policy (Palmer & Burtraw, 2005). Supporters of the alternative CAT policy contend its effectiveness, economic benefits, and cost-effectiveness over an RPS.

Figure 7

CO2 Emissions and Caps in RGGI States



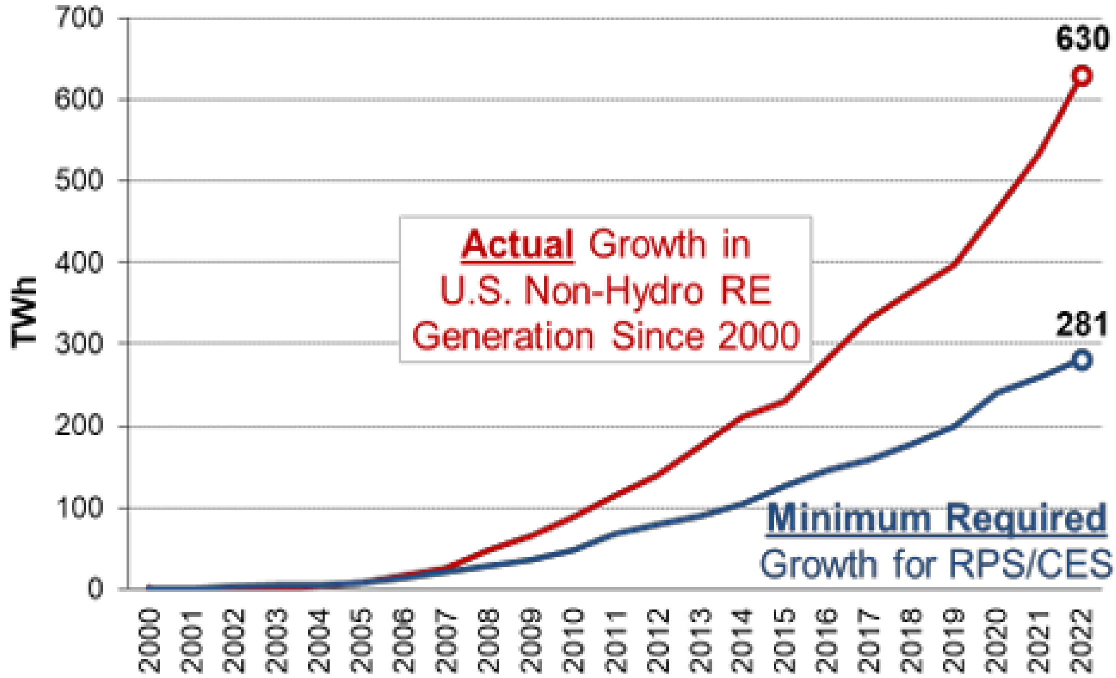
Note. Figure 7 tracks CO2 emissions across RGGI states along with their respective caps. The highlighted area is based on actual data up until 2018 and everything past are projections. Reprinted from "An expanding carbon cap-and-trade regime? A decade of experience with RGGI charts a path forward," by P. J. Hibbard et al., 2018, *The Electricity Journal*, *31*.

Make the Switch?

Despite the fervent discourse that has been stirred by skeptics of the RPS, it would be equally ignorant to conclude that the RPSs are without merits than it would be to believe that the RPSs are infallible. For one, from 2000 to 2022, the period in which most RPS policies were implemented in the states, non-hydroelectric renewable generation grew by an estimated 630 TWh or 630 million MWh (Barbose, 2023). Of the 630 TWh, 281 TWh were required by the RPS and its variant policies (Figure 8). It should be noted that while some of the progresses were likely canon regardless of state policies, the same could be argued conversely with regards to spillover effects of RPS contributing to excess growth. Likewise, opponents may point out that correlation in renewable growth over this period does not imply causation, but then the same could be applied to both FITs and CATs. It was mentioned that due to heterogeneous effects and non-random adaptation of RPS, it is difficult to isolate and conclude definitively the impact of RPS and alternative policies. Additionally, scholars studying the issue estimate that the current RPS framework brings about $97 billion in air-pollution health benefits and $161 billion in climate damage reductions, overwhelming the $31 billion in electric system cost increases in terms of net present value from 2015-2050 (Wiser et al., 2017). They conclude that while RPSs are not the most cost-effective path towards global climate goals, they nevertheless are still cost-efficient and an effective energy policy tool.

Figure 8

Growth in Non-Hydro Renewable Generation from 2000-2022



Note. A figure tracking growth in U.S. non-hydro renewable energy generation from 2000-2022. Reprinted from "U.S. State Renewables Portfolio & Clean Electricity Standards: 2023 Status Update," by Galen Barbose, 2023. Copyright 2023 by Galen Barbose.

While further research would certainly contribute to the debate of "best" policy mechanism to limit the globe's temperature to 1.5 °C Celsius above pre-industrial levels, it could be the case that all the examined policy designs can get the job done, and the contributors are merely quarreling over preferences arising from strengths and weaknesses of each design. Couture et al. (2010), along with discussing advantages of the FIT, also mentioned that FITs nonetheless raise electricity prices across the board in addition to discouraging direct price competition between developers. Likewise, CAT programs can disproportionately influence the well-being of lower income households vs. higher income households although consumers across the board are negatively impacted (Shammin & Bullard, 2009). The common factor is that energy policy promoting renewable energy is inevitably a tradeoff between short-term costs of consumer well-being and long-term benefits of renewable energy development and climate goals. Although even more can be discussed in this dialogue, it is imperative to circle back and highlight that the impacts to global wellbeing associated with not meeting Paris Agreement goals will undoubtedly overshadow any costs to consumers. Scholars estimate 1.5 °C of global warming decreases global GDP by ~3.2% (trillions USD) compared to the counterfactual world without global warming (Waidelich et al., 2024). While the discourse remains unresolved, what is certain is that, given sluggish U.S. progress towards Paris agreements, more aggressive action is required—whatever the design.

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