Re-Allocating Risk: The Case for Closer Integration of Price- and Quantity-Based Support Policies for Clean Energy

Using RPSs and FITs as proxies, this article makes the case for closer integration of quantity- and price-based policies for better allocation of investor and regulatory risk. With aggregate risk mitigation greater than the subtotal of its parts, a joint RPS-FIT regime requires lower returns to leverage private-sector investment in renewables while ensuring sustainable growth in clean energy deployment.

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Two competing policy approaches vie for dominance in the emerging clean energy economy.[1] Quantity-based policies, such as renewable portfolio standards (RPSs), create markets for clean energy that competitive forces are expected to populate leaving the price determination to the market's invisible hand.[2] Price-based policies, such as feed-in tariffs (FITs), guarantee eligible clean energy generators the right to sell their electricity at above-market rates set by regulators at levels designed to cover costs and allow for reasonable returns on investment.[3] Qualitative analysis and empirical evidence suggest that RPSs prioritize mitigation of regulatory risk over investor risk, while FITs focus on investor risk mitigation at the expense of greater regulatory risk. Both policies have historically been

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treated as competing, mutually exclusive options.[4] Accordingly, few studies explore the potential for integrated use of price- and quantity-based policies to promote solar, wind, and other clean energy technologies.[5] In practice, both types of policies often co-exist but they rarely operate in tandem. Using RPS and FIT policies as proxies, this article makes the case for closer integration of quantity- and price-based policies for more efficient allocation of market and regulatory risk in the interest of more cost-effective deployment support for emerging clean energy technologies. With aggregate risk mitigation greater than the subtotal of its parts, a joint RPS-FIT regime requires lower returns to leverage private-sector investment in renewables while ensuring sustainable growth in clean energy deployment.

This article proceeds in three parts. Section I presents the mechanics of price- and quantity-based policies and their dissemination in the United States and across the globe. Section II analyzes the mitigation and allocation of key risks under FIT and RPS policies. Section III makes the case for risk-optimizing integration of RPS and FIT policies.

I. Price vs. Quantity: Different Means Toward the Same End

RPSs and other quantity-based policies[6] require their regulatory targets, usually load-serving utilities, to source a certain percentage of the electricity they sell from renewable sources of energy. Most RPSs gradually ramp up the required share of renewables in the electricity mix to guide growth along the path to their target percentage. Utilities prove their compliance with these requirements through renewable energy credits (RECs) that are issued, e.g., on a per MWh basis, to producers of electricity from eligible renewable sources. Non-utility, independent clean energy generators can sell the power they produce on wholesale electricity markets and, in addition, sell the corresponding RECs to utilities to earn a premium for their reliance on renewables. Alternatively, utilities subject to RPS mandates can invest in their own power generation facilities from renewables to be awarded RECs for the electricity they produce. At the end of each reporting period, utilities are required to hold RECs tantamount to the sourcing mandate imposed by their local RPS. Failure to do so triggers penalty payments designed to incentivize compliance with the RPS. RPSs have been particularly popular at the U.S. state level as illustrated by their adoption in 29 states and the District of Columbia (**Figure 1**). Around the world, nearly 30 nations have adopted RPSs to promote the large-scale deployment of renewable energy technologies.[7]

FITs are two-pronged policies for the promotion of renewables. The ''feed-in'' element guarantees renewable electricity generators the right to connect to the power grid. The ''tariff'' element requires local utilities to purchase the power that these generators feed into the grid at above-market rates under long-term contracts running up to 20 years.[8] As

Figure 1: RPS Map of United States (EIA, 2012)

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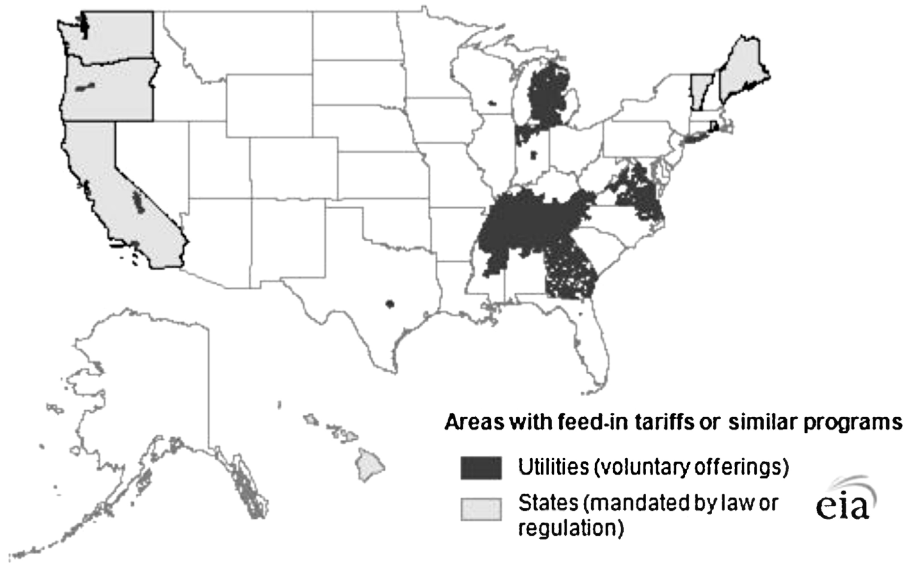

Figure 2: FIT Map of United States (EIA, 2013)

price-based policy instruments,[9] FITs require regulators to set the tariff rates at a level that is high enough to incentivize private sector investment in power generation from renewables without offering windfall profits. FIT programs have been especially popular in Europe, pioneered by countries like Denmark, Germany, Portugal, and Spain. Today, nearly 70 nations across the globe use FITs to promote renewables deployment.[10] Recently, a number of pioneering U.S. states, including California,[11] Hawaii,[12] Maine,[13] Oregon,[14] Rhode Island,[15] Vermont,[16] and Washington[17] have enacted FIT programs (Figure 2).

II. Risk Mitigation and Allocation under RPS and FIT Policies

The ultimate goal of every policy for the promotion of clean energy technologies is to leverage private-sector investment and to do so as cost-effectively as possible. As with any investment opportunity, the investor appeal of renewable energy assets hinges on the trade-offs between anticipated risks and returns.[18] In theory, policymakers could simply offer unusually high returns to incentivize private investment in renewables. To do so, however, would ignore the need for cost-effective policy design and impose a significant burden on taxpayers and/or ratepayers, many of whom are still struggling to recover from the recent economic downturn. Moreover, empirical evidence suggests that targeted risk mitigation and re-allocation measures may be a more effective and efficient policy lever to incentivize private-sector investment in clean energy deployment. According to one study based on IEA data from 35 countries across the globe, price-based FIT policies that reduce off-take and other critical market risks for investors delivered up to four times the deployment success of quantity-based RPS policies—despite offering only half the returns (Figure 3).[19] Mitigation of one type of risk, however, often requires re-allocating, and possibly exacerbating, another type of risk. To better understand these dynamics, this section explores the differences in risk mitigation and allocation under quantity-based RPS and price-based FIT policies.

A. Price-based FIT policies

FIT programs are commonly praised for the investment certainty they provide.[20] By requiring utilities and/or network operators to enter into long-term power purchase agreements (PPAs) at guaranteed, above-market rates to cover costs and offer reasonable returns on investment, FITs free eligible clean energy developers and investors from the need to sell their output on the open market. Rather than trading with unknown counterparts at rates determined by the invisible hand of fluctuating wholesale electricity markets, FIT-eligible generators are not only guaranteed a lucrative sales price for their product but also a creditworthy, well-funded off-taker, such as a rate-regulated utility company.

In addition, many FIT regimes exempt eligible clean energy

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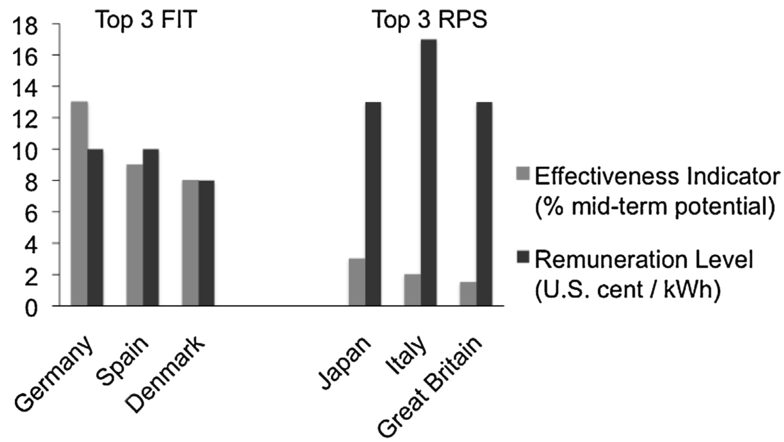

Figure 3: Onshore Wind Deployment of Top 3 FIT and RPS Countries 2004–2005 (Mormann, 2012)

facilities from the forecast and balancing responsibilities imposed on other generators in order to safeguard the electricity grid's delicate moment-to-moment equilibrium between supply and demand.[21] The intended effect of these FIT characteristics is the minimization of off-take and other market risks for clean energy projects. This risk-reducing approach is informed by the conventional wisdom that lower risks justify lower returns and, thereby, improve the cost-efficiency of clean energy policy. The highly positive attitude of investors and developers toward FIT policies, observed in several independent surveys, suggests that this mitigation of off-take and other market risks addresses real needs.[22]

The FIT approach to mitigating these risks, however, does not altogether eliminate the associated risks but, rather, re-allocates them. The certainty that market-independent prices afford to clean energy developers and investors comes at the cost of considerable regulatory risk. It is the regulator's responsibility to determine which FIT rate will allow eligible facilities to recoup their costs and earn reasonable returns on investment. A tariff set too low will fail to attract the necessary investment to deploy clean energy, as the example of Argentina illustrates. As a concession to political opposition, Argentina's 2006 FIT for wind energy was set too low to inspire serious investment, leaving deployed wind capacity stable at only 30 MW nationwide—the equivalent of 15 present-day onshore wind turbines.[23] Closer to home, the city of Palo Alto, Calif., is experiencing similar issues with its solar FIT that has failed to leverage any deployment since its adoption in 2012.[24]

Conversely, a tariff set too high will offer windfall benefits to clean energy developers and investors while imposing undue hardship on electricity ratepayers, that may ultimately undermine public support for renewables, as evidenced by Spain's original solar FIT program. The Spanish regulators chose to adopt rates similar to Germany's widely praised FIT only to find out that, in real terms, these rates were far too high in light of Spain's 60 percent greater insolation compared to Germany.[25] As a result, the Spanish FIT offered renewable energy investors windfall profits at the expense of ratepayers, eroding public support for solar energy and eventually forcing Spain's government to suspend its FIT program.[26] As these examples illustrate, both ratepayers/taxpayers and developers/investors may suffer from exposure to the regulatory risk associated with FIT policy – depending on which side the regulator errs on setting the FIT rates.

This underlying regulatory risk is compounded by the fact that most FIT policies set different rates for different technologies and project sizes, among others. Moreover, growth in deployed capacity fosters technology learning that drives down generation costs and gradually moves clean energy technologies closer to grid parity.[27] Along the way, these cost improvements require constant monitoring and modification of FIT rates to keep investor returns reasonable and avoid windfall from tariffs that, say, fail to fall along with tumbling prices for solar panels. Otherwise, a FIT program that started out with appropriate rates

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may eventually become the victim of its own success and, in the process, deliver greater and faster deployment than ratepayers are willing to fund or the electricity grid may be able to absorb.

B. Quantity-based RPS policies

RPS policies are frequently hailed as modern, market-based instruments to promote the build-out of clean energy infrastructure. This market reliance shapes the mitigation and allocation of risks under RPS regimes providing, among others, for significantly lower regulatory risk than their FIT counterparts. While FITs task regulators with setting the appropriate rates for clean electricity, RPSs rely on the market's invisible hand to determine the price of RECs intended to reward eligible generators for their commitment to clean, renewable sources of energy.[28] Once the regulator's RPS sourcing mandate for load-serving utilities has created a market for clean electricity and associated RECs, the clearing price for RECs in this market is expected to follow the basic rules of demand and supply. Presumably, buyers and sellers in this market possess greater knowledge of and more experience with clean energy than regulators, suggesting that the former are in a better position to accurately assess the market value of clean electricity embodied in RECs.

If clearing prices for REC trading turn out to be higher than expected, perhaps offering oligopoly rents as the result of supply constraints, economic theory suggests that new suppliers will enter the market eventually driving down the REC clearing price to competitive rent levels. Conversely, unexpectedly low trading prices for RECs would discourage market entry and eventually require utilities to bid higher in order to procure the RECs they need to comply with the RPS sourcing mandate. The market reliance of RPS programs, therefore, is designed to mitigate the risks associated with the regulator's failure to appropriately price the cost and value of clean electricity. The same risk mitigation dynamics are intended to provide automatic adjustments to technology learning, cost improvements, and other factors that influence the appropriate price of clean electricity. Once again, RPS regulators prefer to trust the judgment of market participants rather than their own.

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RPS policies not only mitigate the risk that regulators may set support levels for clean energy generation too high or too low, or that they may fail to adjust these levels to reflect technology innovation. They also mitigate the risks associated with the integration of wind, solar, and other intermittent clean energy sources into existing electricity grids. When regulators impose RPS sourcing requirements, they create new markets and, at the same time, limit the size of these markets. If the interconnection queues for California, Texas, and other RPS states are any indication, RPS mandates serve as both goals and limits to renewable energy deployment as deployed and planned capacity approaches the RPS target.[29] Together with the gradual ramp-up over several years mandated by most RPS programs, the simultaneous creation and limitation of clean energy markets helps regulators and, critically, network operators anticipate growth in order to ensure the grid's ability to absorb a growing share of intermittent renewable power generators.

Of course, the ability of market-based RPS policies to effectively mitigate all of the aforementioned risks depends on the regulator's success at creating and maintaining viable markets with the capacity to function as reliable conduits of information, including but not limited to market pricing. Moreover,

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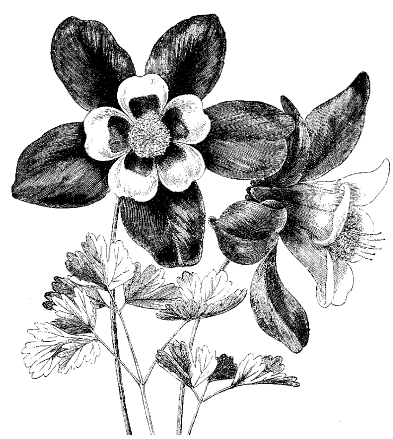
RPS-induced mitigation of the underlying regulatory risk comes at the cost of greater risk to investors compared to FITs. RPSs rely on not one but two distinct markets—the wholesale electricity market and the REC trading market—to deliver the necessary remuneration to promote renewables deployment. As a result clean energy developers and investors find themselves exposed to the price risk of two distinct markets, each following its own set of rules. Day-ahead trading in wholesale electricity markets, for instance, may require intermittent solar or wind generators to bid for capacity they may prove unable to supply when called upon.[30] Similarly, fragmented and often illiquid REC trading markets may expose clean energy generators to extreme volatility, as illustrated by geographic price fluctuations ranging from $1.75 in California to $35 in New England for a REC over 1 MWh of wind energy[31] and temporal price fluctuations from $40 down to nearly $6 for 1 MWh worth of Connecticut RECs within a one-year period.[32] Sophisticated RPS design can suggest an upper bound for REC trading prices by setting the penalty that utilities must pay for every REC they should—but fail to—procure.[33] This “buy-out” price may set a price ceiling but it does not establish a price floor. Consequently, a renewable power investor's revenue from REC sales is left to fluctuate according to the market's invisible hand, with regulatory limitations on its upside potential but not on its downside potential.[34]

The RPS-imposed need for clean energy generators to trade on two separate markets not only increases their overall market risk exposure but, importantly, also drives up their transaction costs. In contrast to a FIT, an RPS requires electricity generators that rely on



renewables to negotiate and execute one or multiple PPAs to sell their electricity output. Unless these PPAs include the transfer of associated RECs, generators also need to budget for navigating volatile REC markets. Together, these transaction costs have led to the characterization of RPSs as “big-corporation policies” with “neutral or negative effects on smaller, entrepreneurial firms.”[35] Finally, RPS policies may require clean energy developers and investors to deal with buyers—for both their power output and RECs—of lower creditworthiness than electric utilities thereby increasing the overall off-take risk.

C. Comparative summary

The preceding, non-exhaustive analysis of risk mitigation and allocation under FIT and RPS policies suggests that the choice between price- and quantity-based policies reflects differences in the prioritization of various types of risk. FIT policy design appears to be driven primarily by the objective to mitigate and, where possible, minimize investor risk so as to drive down the returns necessary to leverage private-sector investment. FITs achieve this extensive mitigation of investor risk at the cost of increased regulatory risk borne by ratepayers and/or clean energy developers and investors, depending upon which side regulators err on when setting FIT rates and other critical policy parameter.

In contrast, RPS policy design prioritizes regulatory risk over investor risk. Reliance on markets to determine the appropriate level of support for clean energy deployment relieves regulators of the obligation to set prices and other policy parameters, beyond the RPS target itself. Reliance on not just one but two distinct markets, however, significantly increases off-take and other market-related risks to clean energy developers and investors. The dominant criticism of both policies supports these observations. Critics commonly blame deficits in the observed cost efficiency of RPSs compared to FITs and other deployment

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policies on the greater investor risk under an RPS, which, in turn, requires higher returns.[36] Opponents of FIT support for clean, renewable energy, meanwhile, draw on examples of regulatory failures to set and maintain FIT rates at appropriate levels to make their case.[37]

The mitigation and allocation of risk under RPS and FIT policies appear to be two sides of the same coin. Much in the spirit of a zero-sum game, each policy appears to ultimately pay the price for its respective risk treatment choices. The following section explores the possibility of integrating FIT and RPS policies to combine the comparative strengths and mitigate the respective weaknesses of price- and quantity-based policies—for a subtotal that may be greater than the sum of its parts.

III. Re-Allocating Risk: Integrated RPS-FIT Policies

RPS policies have historically been viewed as an American, FIT policies as a European phenomenon.[38] As a result, few scholars and even fewer policymakers have considered the joint implementation of both policies. RPS and FIT policies, however, are not mutually exclusive but, rather, have the potential to work ''hand-in-glove.''[39] Empirical evidence reveals a ''general trend'' of FIT policies performing more cost-efficiently than RPS policies,[40] while qualitative analysis suggests that FITs are both more effective and more efficient than RECs at providing public policy support to renewable power projects.[41] RPS targets can create markets for renewable energy but FIT policies have proven more successful at delivering the necessary support to populate

these markets.[42] In recognition of this synergetic relationship, California, Hawaii, Maine, Oregon, Rhode Island, and Washington have already begun to use FIT programs to finance renewable project development in order to reach their respective state RPS targets.[43] The following design recommendations for integration of RPS and FIT policies draw on the factual background of current U.S. clean energy policy but, with just a few modifications, translate to the European Union, China, India, and other jurisdictions with a similarly federal(-esque) system of government.

The main challenge for successfully integrating state FIT policies with the American panoply of state RPSs (and/or a potential federal RPS) is how to treat ownership and transfer of RECs. If renewable power generators are allowed to both keep their RECs and receive FIT payments, it may create windfall benefits. Utilities would be required to purchase renewable power at the above-market tariff and pay a second premium to buy the RECs necessary to prove compliance with their RPS sourcing obligations. Integration of a state FIT with a state (or federal) RPS, therefore, should condition tariff payments on the transfer of REC ownership to the local utility company in exchange for FIT payments as authorized by the Federal Energy Regulatory Commission (FERC).[44] Simply speaking, a utility's FIT payments to clean energy generators should buy both the electricity and all associated RECs.

A. Cost-neutral default

If the utility uses the RECs to prove compliance with its state (or federal) RPS, the outcome is similar to that under an RPS without FIT support. Used RECs will be voided (to prevent double counting) and the utility can recover the cost of its RPS compliance from its ratepayers through inclusion in the retail electricity rates. Figure 4 illustrates the flow of electricity, revenue, and RECs in this scenario.

The crucial difference between the isolated RPS scenario and the

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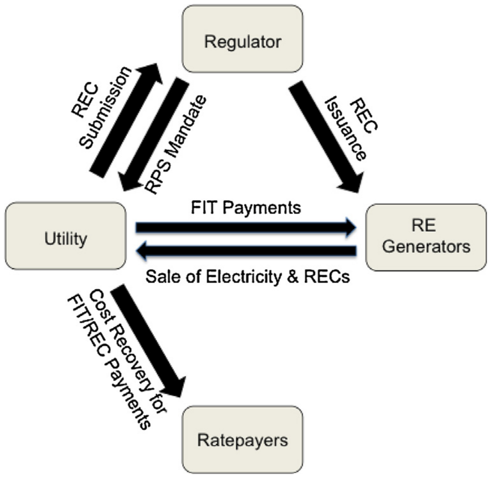

Figure 4: Flow of Electricity, Revenue, and RECs in Joint RPS-FIT Regime

combined RPS-FIT scenario lies in the investment certainty and market risk mitigation that the tariff affords renewable energy project developers and investors. And the synergy effects of a joint RPS-FIT system benefit not only developers and investors but also the utilities and their ratepayers.

Improvements in investment certainty from long-term FIT payments translate to greater planning certainty and lower financing charges, thereby driving down the RPS compliance costs of electric utilities. As FIT payments purchase both electricity and RECs, a utility's RPS compliance costs no longer depend on the substantial price fluctuations of wholesale power markets and volatile REC markets. In contrast to the RPS-only scenario's need for utilities to acquire electricity and RECs through trades on two separate markets, the integrated RPS-FIT scenario significantly reduces a utility's overall transaction costs. Given the ability of utilities to incorporate their RPS compliance costs into their electricity rates, these cost savings ultimately pass on to ratepayers in the form of lower electricity bills.

B. Profit-oriented option

In addition to the aforementioned benefits, joint RPS-FIT programs can (and should) be designed to foster inter-state competition over renewable energy deployment. To this end, electric utilities ought to be given a choice how to treat the RECs they receive in exchange for their tariff payments. As a default, utilities can continue to recoup the cost of their FIT payments by passing it on to their ratepayers and, thus, render their RPS compliance relatively cost-neutral. As an alternative to this cost-neutral approach, utilities should be allowed (and encouraged) to adopt a second, profit-oriented approach where, rather than simply use all their RECs for RPS compliance, they can choose to sell some of their RECs to other in-state utilities, out-of-state utilities, and other buyers in order to make a profit. As before, the REC-selling utility would still be obliged to pay renewable power generators the guaranteed FIT rates. Under the profit-oriented option, however, the utility trades all or part of its ability to recover the cost of these FIT payments from its ratepayers for the chance to recover the cost of its RPS compliance and make a profit in the process. This option will be particularly interesting where state FIT programs deliver so much deployment that they effectively require local utilities to purchase more renewable power and, hence, buy more RECs than they need for compliance with their local RPS mandate. Figure 5 illustrates the flow of revenue and RECs in the inter-state competition scenario.

The crucial difference between the profit-oriented approach available under a joint RPS-FIT regime and the cost-neutral default lies in the allocation of risk. Renewable energy investors and project developers are wary of REC-related risk especially where it exposes them to volatile REC markets with which they are unfamiliar.[45] Electric utility companies, in turn, have substantial experience with these markets[46] and possess the resources and expertise to navigate them successfully. As a result, utilities are the better bearers of REC-related risk than

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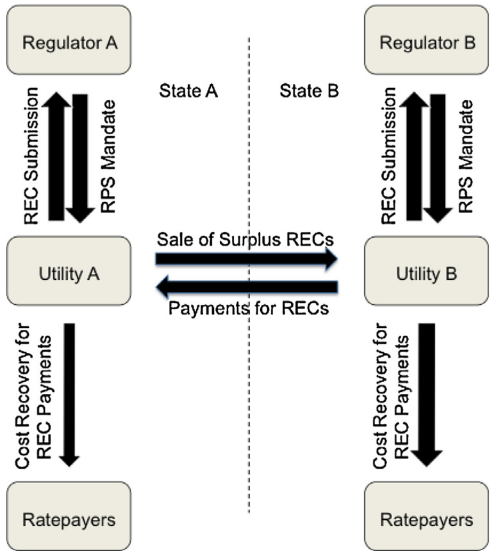

Figure 5: Flow of Revenue and RECs in Joint RPS-FIT Regime in Inter-State Competition

renewable energy developers or investors.

Innovative retail rate regulation can incentivize electric utilities to assume REC-related risk, e.g., by allowing them to keep a share of their trading gains. The remainder of these gains can be passed on to ratepayers offering an additional option to refinance state FIT programs. Such profit-sharing arrangements are not entirely novel and, in fact, continue to gain importance in the context of energy efficiency initiatives, where state regulators allow their utility companies to keep part of the profits resulting from reduced electricity consumption.[47] Properly designed, these profit-sharing arrangements offer additional incentives for the cost-effective design and administration of state FIT policy. The greater the deployment success of a state's FIT program, the more RECs its utilities will have at their disposal to trade for market profits. As new, independent renewable energy assets gradually displace utility-owned conventional energy assets, utilities and regulators grow increasingly concerned over the long-term viability of today's utility business model.[48] The profit-oriented approach allows utilities and their shareholders to earn a profit even as they produce and sell less of their own electricity, helping prepare them for the next generation of utility business models.

And the more cost-efficiently a FIT leverages deployment of renewable power assets, the greater the profit margin from REC sales will be for utilities and their shareholders. If state A manages to design and implement a particularly effective yet cost-efficient, joint RPS-FIT regime, its utilities can export their surplus RECs to other RPS states, such as state B, in order to increase their profits and, in the process, lower the overall cost to ratepayers of that state's public policy support for clean energy and climate change mitigation. Conversely, a FIT that proves ineffective (such as that of Palo Alto) or inefficient (such as Spain's original solar FIT) would diminish if not altogether eliminate the utilities' ability to sell its RECs for a profit. These dynamics provide powerful incentives for utilities to not only implement but also help improve local FIT policies since greater efficacy and efficiency translate to greater profits for the utility. In the context of inter-state competition, joint RPS-FIT regimes can provide strong financial incentives for utilities to operate in and, hence, help create a renewable energy policy environment that outperforms other states and their REC markets.

By giving utilities a meaningful, profit-bearing stake in the successful deployment of independently owned and operated renewables, joint RPS-FIT regimes can enlist the utility industry to help optimize renewable energy policy. The resulting collaboration between regulators and utilities re-allocates and thereby helps mitigate the regulatory risk that often taints standalone FIT programs requiring regulators to set and maintain appropriate rates, interconnection requirements, and other parameters for the fast-evolving, complex renewable energy industry with limited, if any, help from utility experts.

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IV. Conclusion

From a risk mitigation and allocation perspective, joint RPS-FIT regimes combine the best of both worlds. FIT policy provides critical mitigation of off-take and other market risk for renewable energy developers and investors. At the same time, FIT programs offer utilities a cost-neutral way of proving compliance with state or federal RPS mandates, while reducing the utility's transaction costs and REC market risk. The existence of viable REC markets, meanwhile, offers critical benchmarking for the proper determination of FIT rates thereby reducing the regulatory risk that commonly plagues FITs. In addition, joint RPS-FIT regimes can harness the competitive market forces inherent in RPS policies and redirect them to ensure optimal risk allocation. In interstate competition, these forces can help reduce the cost to ratepayers of FIT programs and RPS compliance while driving sustainable deployment of renewable energy technologies. This article draws on the U.S. electricity market to make the case for integration of RPS and FIT policies. The underlying risk allocation dynamics and the resulting policy recommendations, however, could, with only a few modifications, be applied to other jurisdictions with a similarly federal(-esque) system of electricity market regulation and governance, such as China, India, and the European Union, among others.■

Endnotes:

1. See, e.g., Ringel, M., 2006. Fostering the use of renewable energies in the European Union: the race between feed-in tariffs and green certificates. Renew. Energy 31, 1; Butler, L., Neuhoff, K., 2008. Comparison of feed-in tariff, quota and auction mechanisms to support wind power development. Renew. Energy 33, 1854.

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J. 20, 8; Crane, K., et al., 2011. The economic costs of reducing greenhouse gas emissions under a U.S. National Renewable Electricity Mandate. Energy Policy 39, 2730; Berry, T., Jaccard, M., 2001. The renewable portfolio standard: design considerations and an implementation survey. Energy Policy 29, 263; Cory, K.S., Swezey, B.G., 2007. Renewable portfolio standards in the states: balancing goals and rules. Electr. J. 20, 21.

3. See, e.g., Bull, P., et al., 2011. Designing feed-in tariff policies to scale clean distributed generation in the U.S. Electr. J. 24, 52; Haas, R., et al., 2011. A historical review of promotion strategies for electricity from renewable energy sources in EU countries. Renew. Sustain. Energy Rev. 15, 1003.

4. Rickerson, W.H., et al., 2007. If the shoe FITs: using feed-in tariffs to meet U.S. renewable electricity targets. Electr. J. 20, 73, p. 74.

5. But see Haddad, B.M., Jefferiss, P., 1999. Forging consensus on national renewables policy: the renewables portfolio standard and the National Public Benefits Trust Fund. Electr. J. 12, 68.

6. Other quantity-based clean energy deployment policies include quota mechanisms, green certificate trading regimes, and clean energy standards. Mindful of the prevalence of RPS programs in the United States, this article's terminology focuses primarily on RPS policies but the overall argument applies to most, if not all, of the aforementioned quantity-based deployment policies.

7. See Renewable Energy Policy Network for the 21st Century. In: Renewables 2014 Global Status Report (REN21 2014), p. 77.

8. See Finon, D., 2007. Pros and cons of alternative policies aimed at promoting renewables, EIB Papers 12, 110, p. 115.

9. Other price-based policy instruments include the production tax credit for wind and the investment tax credit for solar energy offered at the U.S. federal level. For a critique of the efficiency challenges related to federal tax credit support for renewabe energy, see Mormann, F., 2014. Beyond tax credits: smarter tax policy for a cleaner, more democratic energy future. Yale Journal on Regulation 31, 303.

10. See Renewable Energy Policy Network for the 21st Century, *supra* note 7, p. 77.

11. S.B. 32, 2009–2010 Reg. Sess. (Cal 2009) (codified at Cal. Pub. Util. Code § 399.20).

12. Order Approving FIT Tiers 1 and 2 Tariffs, Standard Agreement, and Queuing and Interconnection Procedures, Docket No. 2008-0273 (Haw. P.U.C. 2010).

13. S.P. 367, 126th Leg., (Me. 2013), An Act to Establish the Renewable Energy Feed-in Tariff.

14. H.B. 3690, 75th Leg., Spec. Sess. (Or. 2010); H.B. 3039, 75th Leg., Reg. Sess. (Or. 2009); Pilot Programs to Demonstrate the Use and Effectiveness

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of Volumetric Incentive Rates for Solar Photovoltaic Energy Systems, Order No. 11-339 (Or. P.U.C. Sept. 1, 2011); Pilot Programs to Demonstrate the Use and Effectiveness of Volumetric Incentive Rates for Solar Photovoltaic Energy Systems, Order No. 10-198 (Or. P.U.C. May 28, 2010); Rulemaking Regarding Solar Photovoltaic Energy Systems, Order No. 10-200 (Or. P.U.C. May 28, 2010).

15. H. 6104, Gen. Assemb. (R.I. 2011).

16. H. 446, Gen. Assemb. (Vt. 2009).

17. S.B. 6658, 61st Leg., Reg. Sess. (Wash. 2010); S.B. 6170, 61st Leg., Reg. Sess. (Wash. 2009); S.B. 5101, 59th Leg., Reg. Sess. (Wash. 2005).

18. For an introduction to the risk-and-return reasoning of debt and other investors regarding renewable energy projects, see Feldman, D., Settle, E., 2013. Master Limited Partnerships and Real Estate Investment Trusts. National Renewable Energy Laboratory, pp. 22–23; Varadarajan, U., et al., 2011. The Impacts of Policy on the Financing of Renewable Projects: A Case Study Analysis. Climate Policy Initiative, pp. 3–6.

19. See Mormann, F., 2012. Enhancing the investor appeal of renewable energy. Environ. Law 42, 681.

20. See, e.g., Butler and Neuhoff, *supra* note 1; Farrell, J., 2011. CLEAN v SRECs. Institute for Local Self-Reliance.

21. See Klessmann, C., et al., 2008. Pros and cons of exposing renewables to electricity market risks – a comparison of the market integration approaches in Germany, Spain, and the UK. Energy Policy 36, 3646, p. 3647.

22. See, e.g., Lüthi, S., Prässler, T., 2011. Analyzing policy support instruments and regulatory risk factors for wind energy deployment – a developers' perspective. Energy Policy 39, 4876; Bürer, M.J., Wüstenhagen, R., 2009. Which renewable energy policy is a venture capitalist's best friend? Empirical evidence from a survey of international Cleantech investors. Energy Policy 37, 4997.

23. See Mendonça, M., et al., 2009. Powering the Green Economy – The Feed-In Tariff Handbook. Earthscan, p. 57.

24. See http://www.cityofpaloalto.org/gov/depts/utl/business/sustainability/clean.asp.

25. See Mendonça, et al., *supra* note 23, p. 59.

26. See http://www.minetur.gob.es/en-US/GabinetePrensa/NotasPrensa/2012/Paginas/npregimenespecial270112.aspx.

27. See, e.g., Hearps, P., McConnell, D., 2011. Renewable Energy Technology Cost Review. Melbourne Energy Institute.

28. See, e.g., Berry and Jaccard, *supra* note 2; Cory and Swezey, *supra* note 2; International Energy Agency, Deploying Renewables – Best and Future Policy Practice, 2011. IEA.

29. See https://financere.nrel.gov/finance/content/does-rps-still-gun-engines.

30. See Klessmann, et al., *supra* note XXX.

31. See Sovacool, B.K., Cooper, C., 2008. Congress got it wrong: the case for a national renewable portfolio standard and implications for policy. Environ. Energy Law Policy J. 3, 85.

32. See Wiser, et al., *supra* note 2, p. 16.

33. See Klessmann, et al., *supra* note 21, p. 3653, discussing the example of the United Kingdom's Renewables Obligation.

34. See International Energy Agency, 2008. Deploying Renewables – Principles for Effective Policies. IEA, pp. 24–25.

35. Bürer and Wüstenhagen, *supra* note 22, p. 5005.

36. See, e.g., International Energy Agency, *supra* note 34, p. 102.

37. See, e.g., International Energy Agency, *supra* note 34, p. 81.

38. Both views are, in fact, flawed. European nations such as the United Kingdom and Sweden have a long history of implementing RPS-like certificate trading, or quota regimes. At the same time, the purchase requirements for electricity from qualifying facilities imposed by PURPA can be considered a precursor to today's European FIT programs.

39. See Davies, L.L., 2011. Incentivizing renewable energy deployment: renewable portfolio standards and feed-in tariffs. KLRI J. Law Legis., 1, 39, p. 83.

40. International Energy Agency, *supra* note 28, p. 130.

41. See Mormann, *supra* note 19, p. 723.

42. One key reason why FIT policies have proven more successful is their greater investor appeal. Even large banks, insurance companies, and other professional investors with the necessary financial acumen refuse to plan with revenue from REC sales. See, e.g., Prudential Capital Group's Richard Carrell. Presentation at 2014 Austin Electricity Conference, p. 11. Available from: http://www.mccombs.utexas.edu/~/media/Files/MSB/Centers/EMIC/Conferences/AEC%20presentations%202014/Carrell.pdf (noting the difficulty to bank REC revenue).

43. See supra notes 11–17.

44. See American Ref-Fuel Co., 105 FERC ¶ 61,004 at 61,005 (2003), rehearing denied 107 FERC ¶ 61,016 (2004).

45. See Lüthi and Prässler, *supra* note 22; Bürer and Wüstenhagen, *supra* note 22.

46. In many ways, REC markets resemble the markets for SO_2 allowances created more than twenty years ago under the Clean Air Act's acid-rain trading scheme.

47. See, e.g., Fox-Penner, P., 2010. Smart Power – Climate Change, the Smart Grid, and the Future of Electric Utilities. Island Press, p. 139.

48. *Id.* See also Cal-ISO, 2013. What the Duck Curve Tells Us About Managing a Green Grid. Available from: http://www.caiso.com/documents/flexibleresourceshelprenewables_fastfacts.pdf.

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