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**KEEPING THE PROMISE:
MAKING RENEWABLE PORTFOLIO STANDARDS WORK**

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ABSTRACT

The Renewables Portfolio Standard (RPS) is a key policy option for promoting new renewables like wind power in competitive markets. Indeed, the potential from RPSs is enormous: in theory, bills currently before the U.S. Congress could lead to some 30,000 to 100,000 MW of wind capacity in the U.S. by 2020. However, key design characteristics of the RPS, in conjunction with new market rules including transmission pricing and scheduling approaches, could seriously harm wind's chances of profiting from the RPS opportunity. Ultimately, RPS targets themselves may not be met. A series of RPS and market design choices will be key to ensuring that its main objective – significant market penetration by new, green power technologies – is achieved.³

1. INTRODUCTION

The advent of competitive markets for electricity in the United States and elsewhere has in many ways brought radical change to the issues, options and imperatives related to the advancement of "green power" technologies. Indeed, competition and consumer choice create new market challenges, solidify price constraints and render inoperable many existing regulatory approaches toward promoting green power products. While green power marketing may open new opportunities, it is highly unlikely that its scale will be sufficient to ensure significant market penetration by new renewable technologies.

For these reasons, a number of regulatory mechanisms have been proposed for application in competitive markets. Perhaps foremost among these is the Renewables Portfolio Standard.

2. RPS IN A NUTSHELL

The Renewables Portfolio Standard aims to ensure that a certain percentage of power sold or generated in a given jurisdiction is derived from a set of specific energy resources, within a framework of competitive neutrality (see Rader and Norgaard, 1996). Under an RPS, generators of eligible resources are given credits on the basis of their annual electrical output derived from these resources. Each retailer (or generator, see discussion in section 3) is in turn obliged to obtain, before or around year's end, an amount of credits equal to the mandated standard for that year (set as a percent of total sales). Credits are bought and sold on the open market until all retailers (or generators) have enough credits to satisfy the RPS mandate (alternatively, penalties are applied for non-compliance).

In many ways, an RPS is simply a renewables set-aside reconfigured for applicability in the competitive marketplace⁴. Yet in combining a fixed mandate with credit trading

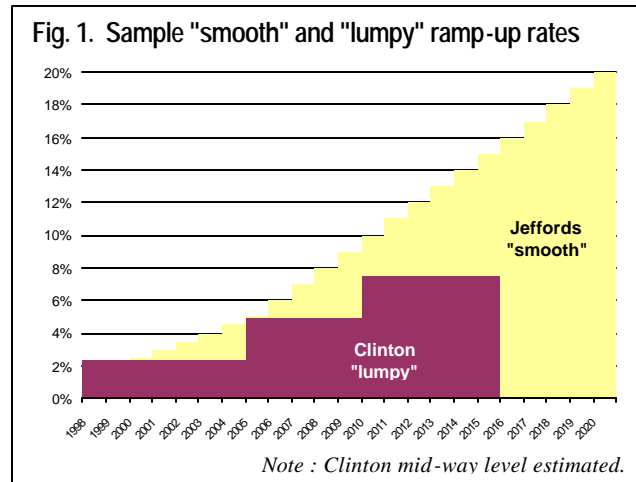
³ By "green power" I refer to clearly advantageous power sources from an environmental perspective. These include solar, wind, geothermal and most forms of biomass.

⁴ Since under competitive markets the distribution utility is no longer the sole supplier of power, the traditional set-aside approach would place that utility at an unfair, competitive disadvantage.

opportunities, the RPS seeks to introduce a degree of flexibility inexistant in the set-aside approach. As such, its key objective is both to ensure a guaranteed market for environmentally-superior energy products *and* to minimize the costs of so doing.

3. KEY OPEN ISSUES

While the RPS is simple in its basic design, application details can vary widely. The following are some typical RPS implementation issues:



- **Generators or retailers.** The RPS can be applied to either generators or retailers. Indeed, bills currently before the U.S. Congress show a split in this regard, with two applying the mandate to retailers and two to generators.⁵ While seemingly innocuous, this choice may have profound implications if ever Canadian or Mexican renewables were deemed eligible for purposes of the U.S. RPS. While this is not currently on the table, it is worth considering: indeed, NAFTA equal treatment provisions may eventually lead to legislative modifications along those lines.
- **Sunsets.** An RPS can include sunset provisions (the Clinton bill sunsets in 2015), or be self-sunsetting (e.g. Sen. Jeffords). A sunset provision provides a date certain for termination of the RPS scheme, while an RPS that “self-sunsets” allows for termination only when the eligible technologies no longer require credits to achieve the significant market shares an RPS aims to achieve. This would occur when credit prices over a certain period of time are marginally above or equal to zero.
- **Ramp-up rates.** The objective of an RPS is to increase the relative size of green power generation in a given jurisdiction’s energy supply portfolio. This can be done “lumpily” or smoothly, according to the ramp-up rate provided for in the RPS mandate. For example, the latest Clinton Administration restructuring bill includes a “lumpy” RPS, in which the percent mandates increase in large blocs in only two of the mandate’s fifteen years (2005 and 2010). Another bill, proposed by Republican senator James Jeffords, includes a smooth, annual ramp-up rate (see fig.1). As we will see in 5.3, the ramp-up rate will be a critical determinant of the supply / demand balance of credits in the marketplace which, in turn, may have serious implications for the market value of the credits and potential risk premiums associated with credit price swings and uncertainty.

⁵ Retail mandates : Clinton administration (S.1048, HR 1828), Murkowski (S.1047). Generation mandates : Jeffords (S.1369), Pallone (HR 2569).

- **Proxy price caps.** A critical issue in designing an RPS is whether or not to include a proxy price cap. This is done, as in the Clinton bill, by offering, parallel to the marketplace, an unlimited number of credits at a fixed price.⁶ In so doing, this public offering has the effect of capping the market price of credits, since buyers will be unwilling to pay to green power credit owners a price that exceeds what they could pay otherwise to a government agency. Alternatively, in the absence of a proxy price cap mechanism, credit prices could go as high as the penalty cost of non compliance.⁷ As we will see later, the proxy price cap may constitute the single greatest threat to the ultimate success of an RPS.

- **Eligible resources and technology bands.** For obvious reasons, another critical issue is the choice of eligible resources. While there is unlikely ever to be controversy surrounding the inclusion of solar, wind, sustainable biomass and geothermal technologies, there is considerable controversy surrounding two other potential entrants: municipal solid waste (MSW) and hydropower.⁸ These resource options generate three potential problems for an RPS: (1) they may be significantly less environmentally advantageous than their eligible resource counterparts, (2) they may already be cost-effective and therefore not require an RPS for market penetration, and (3) in the case of hydropower, the technology may already be mature and therefore unable to profit from the RPS in terms of gaining economies of scale, climbing knowledge curves or otherwise achieving a self-sustaining market presence. Table 1 highlights these issues:

Table 1. Some key issues in designating RPS “eligible resources”⁹

	Significant environmental benefits?	Higher cost than alternatives?	Room for significant technology, cost gains?
Solar	YES	YES	YES
Wind	YES	YES	YES
Geothermal	YES	YES	YES
Biomass	PERHAPS	YES	YES
MSW	NO	PERHAPS	YES
Discussion :	Significant environmental issues compared with wind, solar, geothermal.		
Hydro	NO	NO	NO
Discussion :	Large, cost-effective potential (in and outside U.S.) could be harnessed and sold outside RPS. Inclusion would bring no net environmental benefits (relative to other eligible resources), no significant relative increase in market shares, no significant technology/cost improvements.		

⁶ The Clinton bill for example mandates the Department of Energy to sell unlimited credits at 1.5 cents/kWh.

⁷ Non compliance penalty provisions tend to be set at two to three times the value of credits on the market.

⁸ There may also be controversy regarding certain forms of non-MSW biomass energy. Concern involves use of "stranded" biomass from timber harvesting (removal of forest floor "waste", critical to forest regeneration) or alternative uses for industrial floor wastes. These issues are highly site-specific, however, given the large number of alternative use or disposal scenarios, many of which depend on local ecology, proximity to industry and rural or urban setting.

⁹ For a comprehensive comparison of these and other issues, see CEC 1997.

While MSW and hydro resources may be inappropriate for inclusion in the RPS, they may nonetheless represent environmental benefits over the base case fossil fuel plants. A number of non RPS related approaches can provide advantages to these technologies over fossil plants, without harming the key intent of an RPS, i.e. increased market penetration by new, environmentally benign and otherwise not-yet-cost-effective technologies.¹⁰ Nonetheless, it is also possible to afford these resources a place in the RPS by creating separate technology bands (i.e. a certain percentage requirement reserved for “superior” eligible resources, and a supplementary requirement for less beneficial ones).¹¹ Finally, if the goal is simply to ensure that existing hydropower resources are fully utilized, “existing” and “new” tiers can be used.

Finally, it is worth noting that some States are considering including advanced fossil plants in an RPS, including both cost-effective (gas turbines, cogen) and non-cost-effective (fuel cell) options. In the least, these technologies should be separated out of a *renewables* portfolio standard. Also, bands should ensure reasonable price competitiveness between eligible resources, which argues against combining fuel cells in an RPS band with gas turbines or cogeneration plants.

- **Interaction with other policy tools.** Finally, a key provision of any RPS is the interplay between it and other policy tools. For example, if a system benefits charge (SBC) is levied on consumers in order to provide funds for renewables development, an eligible generator may seek to obtain dual benefits, receiving funds to develop an eligible project, then receiving a premium again by selling RPS credits (the same is possible for net metering). As a general rule, it is far preferable to aim at making multiple policy tools complimentary. For example, an RPS can help commercial technologies in gaining greater market share immediately, while an SBC may be needed to fund research, development and demonstration projects for technologies not yet commercially ready or available. Nonetheless, the RPS should, as a caution, preclude double-dipping explicitly (as does the Clinton bill).

4. HIGH EXPECTATIONS: 100,000 MW OF WIND?

Since it was first conceived of in 1994 by Nancy Rader and others at AWEA, the RPS has taken on considerable importance in the regulatory and legislative policy arenas. Today, half a dozen U.S. States have adopted RPSs, while a dozen others are either contemplating

¹⁰ Foremost among these is a cap-and-trade emissions credits scheme, applied to pollutants such as NOx or SOx, greenhouse gases, or both.

¹¹ The Arizona RPS under final consideration would be reserved strictly for solar power. The Nevada, New Jersey and Connecticut RPSs provide for a two-tiered approach in which two "classes" of eligible resources distinguish between simply advantageous and clearly superior energy technologies, the latter being reserved a portion of the overall mandate. In Europe, the European Wind Energy Association is also calling for a multi-tiered approach in which wind developers would compete amongst themselves in a closed, "wind-only" band (Bourillon, 1999).

or implementing variances (set-asides, etc.) (table 2)¹². Furthermore, the 106th Congress has so far seen four bills tabled mandating significant U.S.-wide renewables portfolio standards.

Commensurate with this increase in RPS legislative and regulatory activity, are high expectations for market results. In fact, analysis of the key federal RPS bills put forth since last year confirms these expectations.

Combining projected demand, annual requirements of each of four RPSs currently before Congress and some assumptions about interim levels to be set at a later date (in the case of the Clinton Administration bill), I identify the total energy output targets of these bills. For simplicity, where sunsets apply prior to 2020, I assume market shares in the year prior to sunset remain constant in future years up to that date.

As can be seen in figure 2, total generation targets for new renewables under these four bills range from roughly 130 TWh in 2020 to nearly 900 TWh in that same year.

These numbers are indeed impressive for the wind community. If, as a plausible hypothesis, wind retains 30% of these quota^{13,14}, the industry could expect to have between 30,000 and 95,000 MW of installed capacity online by 2020 (the Clinton Administration bill would lead to some 30,850 MW by that year) (see figure 3).

Table 2. State and Federal RPSs

	RPS passed	RPS considered	RPS-like passed
Arizona		◆	
Connecticut	◆		
Delaware		◆	
Kansas		◆	
Iowa		◆	◆
Maine	◆		
Massachusetts	◆		
Minnesota			◆
Nebraska		◆	
Nevada	◆		
New Jersey	◆		
New Mexico		◆	
Ohio		◆	
Pennsylvania			◆
Texas	◆		
Vermont		◆	
Wisconsin		◆	◆
U.S. Congress		◆	

¹² One adopted RPS, in Maine, seems to be far more a measure of economic protectionism than renewables advancement. Indeed, the Maine legislation creates a stagnant, 30% RPS requirement in a State where roughly 50% of current resources would already be considered eligible.

¹³ I assume this to be reasonable where wind is competing in the RPS against solar, geothermal sustainable biomass and potentially landfill gas. This hypothesis is unlikely to hold if hydro and MSW are included in the list of eligible resources. However, no bills currently before Congress include hydropower or MSW as explicitly eligible, though it is unclear whether it could be so under the Clinton bill.

¹⁴ Recent modelling by Clemmer et al. (1999) points to wind capturing anywhere between 25% and 55% of the renewables market under the various federal RPSs.

Fig. 2. RPS Targets in Federal Restructuring Bills (106th Congress)

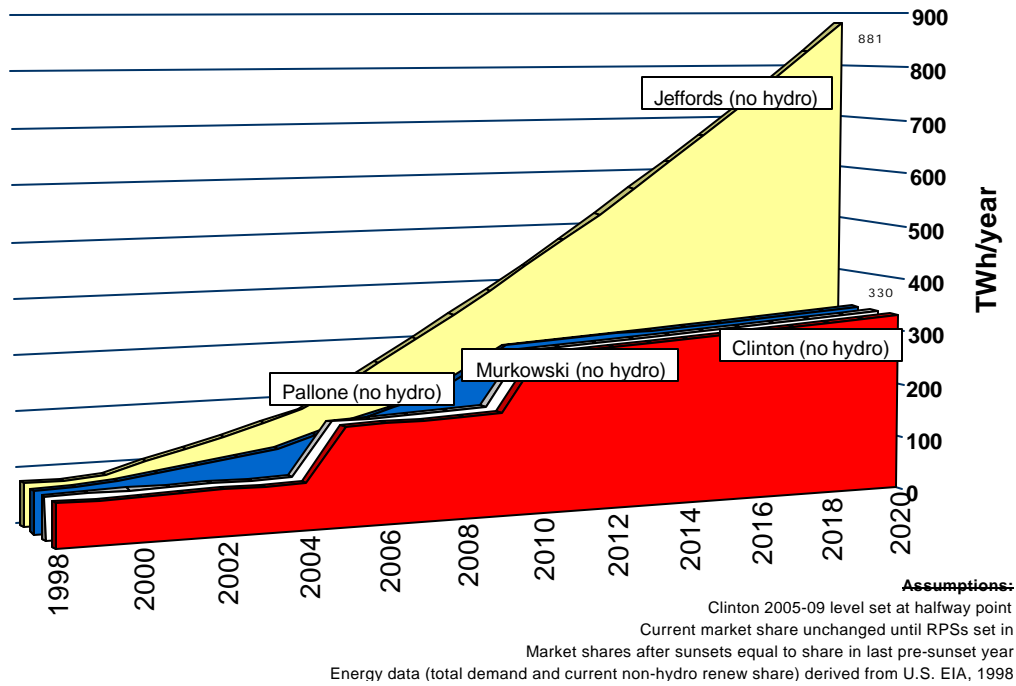
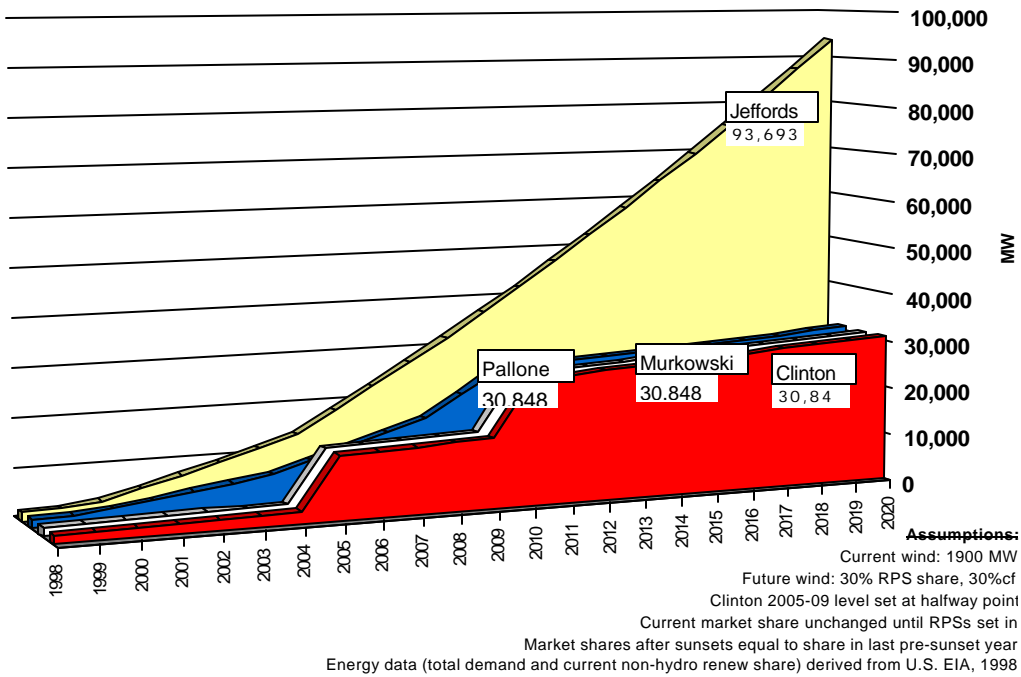


Fig. 3. Total Windpower Installed Capacity Under Four Key Federal RPS Bills (with 30% market share)



As we can see, the importance given to an RPS is indeed well founded. However, several elements of the new competitive marketplace, coupled with key design characteristics of the RPS itself, may undermine achievement of these targets.

5. LIMITATIONS: THREE REASONS WHY THE RPS TARGETS MAY NOT BE ACHIEVED

As I mentioned earlier, key design characteristics of the RPS may limit its ultimate objective to one of targets, not absolute requirements. The “loopholes” responsible for this disjunct are threefold: (1) inclusion of mature, cost-effective resources in the basket of eligible resources, (2) proxy price caps and (3) lumpy ramp-up rates.

5.1 Eligible resources

To the extent an RPS includes such resources as hydropower and MSW in the basket of eligible resources, significant market penetration by emerging technologies such as wind may be compromised. This is especially important in the case of hydropower, which constitutes a low-cost, technologically mature resource.

While overall hydro generation in the U.S. is declining¹⁵, there remains a very large potential for growth, especially if regulatory hurdles are removed or lessened, a plausible scenario¹⁶. Furthermore, to the extent that RPS legislation also allows for imports of eligible resources, significant hydro generation could be exported from many regions throughout Canada, at extremely low cost.¹⁷ If either of these scenarios occurred, the bulk of resource additions due to an RPS may come from new or existing hydropower, at the expense of wind and other lower impact technologies. It is important to remember that due to their relatively low cost, most of these hydropower resources would come on line regardless of RPS eligibility.

5.2 Proxy price caps

Proxy price caps would exist if an RPS, such as the one proposed by the Clinton Administration, mandated the government to sell an unlimited number of credits into the market at a fixed price. This would indeed have the effect of capping credit prices eligible generators could receive.

¹⁵ Net negative growth is attributable to three key environmental factors: (1) complex regulatory environmental approval procedures, including FERC oversight, (2) marginal constraints such as regulatory requirements to increase reserved flows and, to a lesser extent, (3) unsuccessful relicensing leading to removal of existing hydropower facilities.

¹⁶ For example, H.R. 2335, the "Hydroelectric Licensing Process Improvement Act of 1999", introduced in late June 1999 by Rep. Edolphus Towns (D-NY), is intended to streamline the relicensing process for hydropower projects.

¹⁷ In Québec for example, the provincial utility claims to be able to develop more than 5,000 MW of *new* hydropower at *below* 3¢CAN – or 2¢USD – per kWh.

At face value, the level of price caps proposed by the Clinton Administration would not seem to harm the opportunities for wind. Indeed, wind generation costs may be oscillating around 5¢/kWh, while new gas turbines can be installed at roughly 4¢/kWh. The apparent spread – 1¢ per kWh – is significantly less than allowed for by a cap of 1.5¢. However, this back-of-the-envelope analysis may be misleading.

With the advent of competitive markets, the rules of the game have changed, in some ways dramatically. In particular, relative economics of power generation options is no longer confined to mere comparisons of busbar costs. In today's electricity markets, transmission pricing, scheduling and reservation policies, combined with timing of sales into the market, are key determinants of the cost-effectiveness of certain resources compared with base case alternatives.

A body of work has begun to emerge regarding the disadvantage at which intermittent resources are placed in the new marketplace¹⁸. Key problem areas are:

- **Transmission pricing.** Wind resources are often located far from load centers, contrary to new, low-NOx gas turbines. While some regions are choosing postage-stamp pricing – by which all users pay the same charge independent of distance –, others are opting for various forms of distance- or location-based pricing. The purpose of these pricing approaches is laudable – to incent generation to locate where transmission costs and congestion are minimized –, but could seriously burden wind power generators, for whom resource location is a relatively inelastic imperative. Distance-based or locational pricing could therefore increase the costs of wind generators in delivering their power to load, relative to base case gas turbines. This in turn increases the required price – or credit – premium.
- **Transmission zone pancaking.** In some regions, where previous monopoly service territories were geographically relatively small, wind generators have to cross more than one zone to deliver power to customers. This leads to "pancaking", whereby transmission costs are paid to more than one grid owner. While postage stamp pricing within one region could, as mentioned previously, be beneficial to wind, the opposite may hold true when wind generation has to cross more than one zone to reach load. In that case, the effect of zonal pancaking would be to force wind generators to pay average system costs of multiple grid owners, even when only a small portion of the zones is travelled. While gas turbines can often avoid pancaking by siting projects optimally and near load centres, wind generators are not afforded the same flexibility. In essence then, where wind generation has to travel across multiple grids, distance-based pricing may be better suited to minimize costs, whereas the postage stamp approach would better serve wind's needs when load is located within the transmission zone in question.¹⁹ In both cases though, the costs of

¹⁸ For an excellent review of transmission pricing and scheduling hurdles, see Stoft et al. 1997.

¹⁹ In the case of wind, this problem may not be confined to areas with multiple, geographically small service territories. Indeed, a glance at U.S. wind maps indicates resources concentrated heavily in a vertical slice of the country heading from the middle northern States down through Texas. Since load centers are essentially on the eastern and western edges of the country, wind may have to travel significant distances over which

delivering wind power to load will likely be significantly higher than for base case alternatives like gas.

- **Capacity-based pricing, firm reservations and curtailment.** Current transmission pricing schemes are generally based on capacity – not energy – charges. Furthermore, in order to ensure transmission availability, reservations must be made far in advance of actual use, for example up to one month for monthly service, or one week for weekly service. This presents critical problems for an intermittent resource such as wind power.

Indeed, if the wind generator were to opt for least-cost transmission services by reserving, say, seven days or one month in advance, he would be unable to realistically reserve for anything less than total capacity throughout every hour of every day in that time period (output would vary unpredictably between zero and maximum capacity). Since statistically his total output over that time may be no more than 30% of capacity, his transmission costs per unit delivered would *more than triple*.

If, on the other hand, the wind generator chose to schedule no more than 24 hours in advance (allowing for somewhat accurate wind predictions), transmission capacity may no longer be available, and curtailment would lead to blocking the generator from bringing his power to market. If it *were* available, he would still have to pay for those times when wind output is lower than expected (though 24-hour predictability can be significantly increased by aggregating multiple wind clusters or farms (Durstewitz et al. 1999)). All of this would result in a risk premium as well as unit cost increases relative to the base case gas turbine.

Finally, the wind generator could opt instead for acquiring non-firm hourly transmission service (essentially equivalent to an energy-based charge), not requiring advance reservations. In most cases, this still requires 12- or 24-hour-ahead scheduling, and increases again the risks of curtailment and, therefore, of not being able to deliver to market.²⁰ Also, non-firm prices may vary, increasing the uncertainty of the cost of delivering power to load.

It should be noted that intermittents such as wind generators can firm up their generation with non-intermittent, high capacity factor fossil, biomass, geothermal or hydro (controlled flow) resources, though this too would increase the cost of doing business. Also, in theory at least, transmission rights acquired by a wind generator but not useful due to low wind speeds, could be sold into a secondary transmission rights market (the wind generator could equally purchase transmission rights in this way). However, beyond simply increasing transaction costs, secondary markets are

multiple large-size utility territories once existed. In this sense, pancaking may be more acute for wind than for other eligible resources.

²⁰ The risk factor is significantly higher for northern, winter-peaking systems (i.e. U.S. Midwest states). There, wind and electricity demand have a positive statistical correlation, meaning that the likelihood of curtailment is increased during those very months when wind turbines would be producing the most power.

extremely weak, and will likely remain so for very short-term, last-minute trading, precisely the pattern required by wind.²¹

None of these issues arise for gas turbines, meaning that relative cost increases and/or severe risk premiums could be applied to wind power projects. It is noteworthy too that these risks are further heightened by the high capital intensity of wind turbines (no fuel costs means no fuel savings when curtailed).

- **Timing of sales.** It is generally recognized that in the new competitive marketplace, generation profit margins in the spot market will be taken from peak hours and rare price spikes. In order to fully profit from these high-price opportunities, it will be necessary to be present in the market during those hours. Wind and other intermittent resources, however, are unable to influence the timing of their output and, as such, may miss these profit opportunities. This may decrease revenues and/or increase risk premiums relative to gas turbines.²²

Quantification of the combination of revenue losses, cost increases and/or risk premiums is well beyond the scope of this paper. However, it is clear that given these factors, a 1.5¢/kWh price cap relative to a 1¢/kWh busbar spread may not suffice. Indeed, a rather generous analysis by the Union of Concerned Scientists pointed to a renewables shortfall in five of the fifteen years of the Clinton Administration's proposal (Clemmer et al. 1999).

5.3 Lumpy ramp-up rates

While new market rules may render the 1.5¢/kWh credit price cap insufficient, lumpy ramp-up rates included in the Clinton and Murkowski bills could have the effect of reducing credit prices to significantly below the 1.5¢/kWh cap, further accentuating wind's problems.

Lumpy ramp-up rates mean that in a majority of RPS years, supply may outstrip RPS-mandated demand. Take for example the Clinton bill: while eligible resource generation would have to increase steadily from inception through 2004 (increase attributable only to normal total sales growth), it would literally have to leap – from roughly 80 TWh to ~175 TWh in the one year following.²³ Growth would then resume its steady pace until 2010 when, from the previous year's ~185 TWh, the RPS would mandate nearly 290 TWh of eligible resource output.

²¹ Furthermore, the Federal Energy Regulatory Commission (FERC) has adopted a price cap on transmission capacity reassignments (set as the highest of the price initially paid for the capacity, the highest available transmission rate or the seller's opportunity cost (Stoft, 1997)). This cap on capacity reassignments, aimed at shielding transmission customers from excess prices, is asymmetric, limiting the capacity holder's profits while doing nothing to protect him against losses.

²² Although it should be noted that the winter peak – demand correlation noted previously in footnote 20, may have somewhat the opposite effect.

²³ Assuming that 2005-2009 requirements are set mid-way between 2004 and 2010 requirements.

In practice, it is unlikely in the extreme that 100 TWh of new eligible resources would be put on line in any given year. Rather, one scenario would see additions accumulate in advance – for example, 250 TWh may be on line by 2008, 270 TWh by 2009 and so on.²⁴ This situation leads to a supply-demand imbalance, in which a significantly greater number of RPS credits than is required would enter the market in most years. The effect of this imbalance may be significant: the combination of generators with near-zero avoidable operating costs, competing for a smaller number of buyers, could lead credit prices to plummet. Temporarily at least, prices could fall up to the theoretical point of $1/\infty$.

In reality, the existence of a mandate coupled with penalties of two to three times the price cap for non compliance, would ensure market readjustment: as generators fall from the market and new generation stalls, credit prices would eventually rise again – *subject to the legislatively imposed cap* – to the level required to meet the mandate. However, the effect may be destabilizing on the wind industry, leading once again to risk premiums, this time applied to uncertainties surrounding future credit prices.

The impact of proxy credit price caps, especially though not necessarily combined with lumpy ramp-up rates, may therefore render wind and other intermittent generators unable to take advantage of the RPS (as could inclusion of MSW or hydropower as eligible resources). Indeed, if revenue losses, cost increases and/or risk premiums force the spread between net costs of wind power and gas turbines to exceed the price of unlimited credit sales by government, retailers will opt for the latter (or for non-intermittents like biomass). *Ultimately, the RPS targets, while seemingly required, may not be met.*

6. SAVING THE BABY: SOME REQUIREMENTS FOR A SUCCESSFUL RPS

The purpose of this paper is to highlight potentially significant limitations of the RPS, depending on specific design characteristics. While I have not endeavoured to assess the full breadth of measures to avoid these pitfalls, I will nonetheless outline a few key options below.²⁵ I divide these into two categories: critical RPS design issues and complementary policy options.

6.1 RPS design issues

As we have seen, design details of the renewables portfolio standard will be critical to achieving stated targets. Key choices include:

²⁴ The other scenario of course is that capacity comes on line *after* requirement dates. The likelihood of either scenario will depend on a combination of situational issues and the level of an eventual proxy price cap.

²⁵ Also, it is worth noting that this is only a list of issues and options for ensuring a successful RPS. Other, non-RPS related renewables policy options include: (1) a system benefits charge (SBC) for funding renewables research, development, demonstration and early commercialization projects, (2) mandatory disclosure and labelling requirements (in addition to credible certification processes) to ensure adequate information in the retail market for green power, (3) mandatory net metering policies, (4) consumer education and green power purchase incentives, (5) stringent market power and divestiture rules, (6) grid interconnection rules, etc. See Noguee et al., 1999.

- **Elimination of proxy credit price caps.** Proxy price caps should be eliminated, for the same reasons that power exchange price caps are viewed unfavourably: they can skew markets and unnecessarily limit new supply. If proxy caps are retained, they should be significantly higher than current busbar cost spreads (between eligible generators and base case gas turbines, for example), accounting for new and significant costs and risks imposed by current transmission pricing and scheduling régimes.
- **Smooth ramp-up rates.** Use of small annual increases in percent mandates – as opposed to occasional, large increases –, is critical to ensuring a supply-demand balance of credits. This balance is necessary to ensure predictability in credit prices and prices based on price spreads as opposed to near-zero avoidable marginal costs.
- **Containment of eligible resources.** Eligible resources should be limited to those that share the following characteristics: (1) current above-market costs, (2) technological immaturity with significant potential for improvement and cost reductions and (3) relative and comparable environmental benefits. If policy makers seek to advance resources not meeting these three characteristics, they should be placed in separate technology bands. Each band should be dedicated to resources similar in cost, technological maturity and environmental characteristics.
- **Preclude double-dipping.** An RPS provision should preclude eligible resource projects from benefiting from system benefit charges or net metering.

6.2 Complementary market rules affecting the RPS

If the Standard does contain a proxy price cap, in combination or not with lumpy ramp-up rates, then electricity market design choices will become essential to allowing wind to benefit from the RPS.²⁶ In particular, appropriate transmission rules for locationally-inflexible, intermittent, low capacity factor renewables will be key to minimizing the risk premiums, revenue losses and cost increases noted earlier. Key market design choices include:

- **Postage stamp vs. distance-based transmission rates.** Where wind is likely to sell the bulk of its power within an existing transmission zone, postage-stamp rates – i.e. transmission rates that are independent of distance or location within a transmission service territory – would be most beneficial.²⁷ Alternatively, where wind is likely to have to cross multiple zones to reach load, distance-based pricing may help to minimize the effects of zonal pancaking. Impacts of distance-based pricing on intermittents will be region specific and should be given due consideration.

²⁶ Note that in the absence of proxy price caps or lumpy ramp-up rates, these are still critical market rules to ensuring the long term viability of the wind industry. Furthermore, they are crucial, during the period of a non-price-capped RPS, to minimizing the costs of intermittent renewables that will eventually be recovered by consumers.

²⁷ In practice though, proponents should carefully consider the specifics of each region prior to arriving at this conclusion.

- **Supra-territorial transmission operators.** Whether regional ISOs, regional transmission operators (RTOs) or any other similar configuration, wind would generally benefit from larger transmission territories and less zonal pancaking.
- **Energy-based transmission charges.** Critical to overcoming transmission hurdles for wind and other intermittents are energy-, as opposed to capacity-based charges for transmission rights. This would allow wind generators to pay only for the transmission actually used. One proposal, by Stoft et al. (1999), suggests a two-tiered pricing scheme whereby roughly 80-90% of total revenue requirements are generated from energy charges and the remaining 10-20% from capacity charges. Recognizing that capacity charges are only necessary for containing congestion, this cost unbundling approach could significantly alleviate the large and undue burden faced by intermittent generators. This transmission pricing model is not only good for wind but, generally, provides more economically efficient price signals.
- **Reduce hour-ahead reservation requirements.** Alternatively, reducing the lag between reservation and use of hourly transmission rights could help to increase the reliability of required wind predictions. For example, reducing from 24-hour to 4-hour ahead reservation requirements would allow wind generators to more accurately predict wind output and minimize the unused portion of acquired transmission rights.
- **Credit price insurance options.** If regulators or legislators do elect to build lumpy ramp-up rates into their RPSs, a choice I counsel against, the resulting volatile credit prices could be partially offset by development of insurance options. Such options could significantly reduce the risks lenders apply in assessing project financing requirements. These insurance options could be developed along very similar lines to the approach recently proposed for green power market premiums by a collaborative of the renewables industry, the insurance industry and the U.S. Department of Energy (see Renewable, 1999 and Means, 1999).

This list is not exhaustive.²⁸ However, it represents some of the key market rules that could reduce risk and costs for intermittent renewables, thereby increasing their chance of profiting from an RPS with a proxy credit price cap.

7. CONCLUSION

The Renewables Portfolio Standard holds great promise for the wind industry. Indeed, federal RPSs currently tabled before Congress could lead to wind power capacity additions of several tens of thousands of megawatts in the coming two decades.

²⁸ For example, encouraging ISOs or other entities to operate power exchanges may enhance the market for secondary transmission rights.

Ultimately however, the RPS concept in and of itself will not guarantee real-life markets for intermittent resources such as wind. Rather, the success of the RPS in meeting its fundamental targets will depend heavily upon key design details, as well as on non-RPS market rules, in particular regarding transmission pricing and capacity reservation.

Policy makers, legislators and renewables proponents should pay careful attention to these design characteristics and market rules. They will, in the end, make the difference between significant market penetration by wind power technologies, and stagnation as a marginal electric power resource.

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