POLICY BRIEF

The Economic Impact of Washington State's Renewable Portfolio Standard

A joint study by The Beacon Hill Institute and Washington Policy Center

April 2013

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Key Findings

1. *Washington's current renewable portfolio standard will increase energy rates by about 13% by 2020.*
2. *The RPS will reduce employment in Washington state by up to 11,885 jobs by 2020, or twice the number of jobs currently in utilities and mining industries combined.*
3. *The standards will cost the average household an additional $170 per year, with low-income families paying a heavier relative cost.*
4. *The Energy Independence Act might generate small economic benefits, but Washington electricity customers will pay higher rates, face fewer employment opportunities, and watch investment flee to other states.*

Executive Summary

In 2006, Washington became the second state to implement a Renewable Portfolio Standard (RPS) via Initiative 937, the Energy Independence Act.[1] The RPS had two primary requirements. The first was to require qualified utilities to "pursue all available conservation that is cost-effective, reliable, and feasible," as well as the more common RPS requirement of producing a set percentage of energy from eligible renewable sources.[2] "Qualifying utilities" — in the case of the Washington state RPS — refers to electric utilities that serve more than 25,000 Washington customers, which would be required to produce 15% of their electricity from renewable sources by 2020.

The Beacon Hill Institute has applied its STAMP® (State Tax Analysis Modeling Program) model to estimate the economic effects of these RPS mandates. The U.S. Energy Information Administration (EIA), a division of the Department of Energy, provides optimistic estimates of renewable electricity costs and capacity factors. This study bases our estimates on EIA projections, but we also provide three estimates of the cost of Washington's RPS mandates — low, medium and high — using different cost and capacity factor estimates for electricity-generating technologies from other academic literature. Our major findings show:

- The current RPS law will raise the cost of electricity by $1.22 billion for the state's electricity consumers in 2020, within a range of $675 million and $1.675 billion
- Washington's electricity prices will rise by 13.6% by 2020, due to the current RPS law

These increased energy prices will hurt Washington's households and businesses and, in turn, inflict significant harm on the state economy. In 2020, the RPS would:

- Lower employment by an expected 8,650 jobs, within a range of 4,780 jobs and 11,885 jobs
- Reduce real disposable income by $1.005 billion, within a range of $555 million and $1.38 billion
- Decrease investment by $147 million, within a range of $81 million and $203 million; and
- Increase the average electricity bill for households by $170 per year, for commercial businesses by an expected $1,135 per year, and for industrial businesses by an expected $13,225 per year

1 Washington State Legislature, Ballot Initiative 937, at www.secstate.wa.gov/elections/initiatives/text/I937.pdf.

2 Washington State Legislature, Chapter 19.285 RCW, Energy Independence Act, at apps.leg.wa.gov/RCW/default.aspx?cite=19.285.

Introduction

In 2006, Washington state voters passed Initiative 937, and thus became the second state in the nation to use the ballot process to institute a Renewable Portfolio Standard. Upon full implementation the law requires all utilities in the state with more than 25,000 customers to produce a share of their electricity from renewable sources, as well as undertake all cost-effective energy conservation initiatives.

Specifically the act requires that Washington's power supplies increase the percentage of electricity sold from new renewable energy sources. The RPS mandates that by 2012, providers must produce, or purchase Renewable Energy Credits (RECs), to cover 3% of their electricity load. This amount increases to 9% in 2016 and to 15% in 2020. Additionally the law requires that all qualifying utilities "shall pursue all available conservation that is cost-effective, reliable, and feasible."[3] As part of this regulation, each qualified utility must submit annual reports with their "achievable cost-effective conservation potential."[4]

While the law states that it aims to use "the strong foundation of low-cost renewable hydroelectric generation," lawmakers went to great lengths to blacklist low-cost hydroelectric generation. Energy produced by new hydroelectric plants does not count toward the standard requirements, while only incremental efficiency improvements are allowed.[5] A law designed to promote renewable energy, while keeping the interests of ratepayers in mind, should not exclude the most cost-efficient and proven form in the state.

The act also contains measures to limit the impact to retail customers by implementing a cost cap. The law allows for qualified utilities to be in compliance with the RPS even if they do not reach the required percentages. To do this, a qualified utility must have "invested 4% of its total annual retail revenue requirement on the incremental costs of eligible renewable resources, the cost of renewable energy credits, or a combination of both." Incremental cost is the difference in the cost between an eligible renewable energy and the cost of the conventional energy it is replacing.

According to the most recent information available, the RPS law covers 17 utilities, which serve 2.9 million customers and produce 81.4% of total electricity sales in the state.[6] If these 17 utilities committed 4% of their 2010 revenues to the RPS, they would spend a combined $209 million. Compared to the cost cap, the actual spending on renewable sources would be much higher, due to the incremental cost wording of the law. Since the utilities are "entitled to recover all prudently incurred costs associated with compliance," this is the minimum annual cap that can be passed along to ratepayers in the form of higher utility bills.[7] It is the minimum cap since annual retail revenue is forecasted to increase — in part due to the RPS law — annually.

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3 Ibid.

4 Ibid.

5 Ibid.

6 Energy Information Administration, Table 10; Class of Ownership, Number of Consumers, Sales, Revenue, and Average Retail Price by State and Utility, All Sectors; 2010, at 205.254.135.7/electricity/sales_revenue_price/pdf/table10.pdf.

7 Washington State Legislature, Chapter 19.285 RCW, Energy Independence Act, at apps.leg.wa.gov/RCW/default.aspx?cite=19.285.

Our projections show that this amount will be reached during the later years when the 9 and 15% load credit requirements come into effect. For the purpose of discussion we exclude the cost cap from our projections in order to assess the true cost of the RPS requirements on their own.

The law assigns bonus credits for specific types of electricity generation. Specifically if a renewable source comes online in 2006 or later, each generated megawatt hour (MWh) counts as 1.2 MWhs to the RPS. Similarly if the production of the facility used apprenticeship programs, the resulting production also receives a 1.2 multiplier. Facilities with less than five megawatts of generation capacity which utilize distributed generation may count each MWh produces as two MWhs. Detailed amounts have not been released about the use of these credits, but according to the Washington Department of Commerce: "Most utilities did not claim anything.... Few claimed a little."[8]

Another component of the act — the banking and usage of RECs —could help defray costs. By producing more green energy than required by the act, energy suppliers could bank credits to reduce future requirements. However, the EIA projections made prior to the law show a baseline scenario in which renewable electricity generations will fall below RPS minimums. Therefore, we think it is unlikely that producers will supply excess renewable energy to trigger banking. All green energy produced will go toward the requirement for that year, not banked for future consumption. For this reason, we assume that they will have no effect on overall price of production.

BHI quantified both the positive and negative dynamic effects of the RPS in this study. Since renewable energy generally costs more than conventional energy, many have voiced concerns about higher electric rates. A wide variety of cost estimates have been made for renewable electricity sources. The EIA provides estimates for the cost of conventional and renewable electricity generating technologies. However, the EIA's assumptions about the cost, capacity and reliability of renewable sources are optimistic.

A review of the literature shows the EIA's projected costs in most cases to be at the low end of the range of estimates, while the EIA's capacity factor for wind to be at the high end of the range. The EIA does not take into account the actual experience of existing renewable electricity power plants. Therefore, we provide three estimates of the cost of Washington's RPS mandate — low, medium and high — using different cost and capacity factor estimates for electricity-generating technologies from the academic literature.

One could justify the higher electricity costs if the environmental benefits — in terms of reduced greenhouse gasses (GHG) and other emissions — outweighed the costs. However, it is unclear that the use of renewable energy resources, especially wind and solar, significantly reduces GHG emissions. Due to their intermittency, wind and solar require significant backup power sources that are cycled up and down to accommodate the variability in the production of wind and solar power. A 2010 study found that wind power actually increases pollution and greenhouse

8 Email correspondence with Howard Schwartz, Washington State Department of Commerce, June 2012.

gas emissions.[9] Thus there appear to be few, if any, benefits to implementing RPS policies based on heavy uses of wind.

Governments enact RPS policies because most sources of renewable electricity generation are less efficient and thus more costly than conventional sources of generation. The RPS policy forces utilities to buy electricity from renewable sources and thus guarantees a market for them. However, there is no free lunch. The higher costs are passed on to electricity consumers, including residential, commercial and industrial customers.

Increases in electricity costs are known to have a profound negative effect on the economy — not unlike taxes — as prosperity and economic growth are dependent upon access to reliable and affordable energy. Since electricity is an essential commodity, consumers will have limited opportunity to avoid the costs added by the renewable standards. For the poorest members of society, these energy taxes will compete directly with essential purchases in the household budget, such as food, transportation and shelter.

In this paper the Beacon Hill Institute at Suffolk University (BHI) estimates the costs of this act and its impact on the state's economy. To that end, BHI applied its STAMP® (State Tax Analysis Modeling Program) to estimate the economic effects of the state RPS mandate.[10]

Estimates and Results

In light of the wide divergence in the costs and capacity factor estimates available for the different electricity generation technologies, we provide three estimates of the effects of Washington's RPS mandate using low, medium and high cost estimates of both renewable and conventional generation technologies. Each estimate represents the change that will take place in the indicated variable against the counterfactual assumption that the RPS mandate would not be implemented. Table 1 displays the cost estimates and economic impact of the current 15% RPS mandate in 2020, compared to a baseline of no RPS policy.

9 "How Less Became More: Wind, Power and Unintended Consequences in the Colorado Energy Market," Bentek Energy, LLC, May 2010, at www.bentekenergy.com/documents/bentek_how_less_became_more_100420-319.pdf.

10 Detailed information about the STAMP® model at www.beaconhill.org/STAMP_Web_Brochure/STAMP_HowSTAMPworks.html.

Table 1: The Cost of the 15% RPS Mandate on Washington (2012 dollars)

Cost Estimates	Low	Medium	High
Total Net Cost in 2020 ($m)	675	1,220	1,675
Electricity Price Increase in 2020 (cents per kWh)	0.70	1.26	1.73
Percentage Increase	7.5	13.6	18.8
Economic Indicators			
Total Employment (jobs)	(4,780)	(8,650)	(11,885)
Investment ($m)	(81)	(147)	(203)
Real Disposable Income ($m)	(555)	(1,005)	(1,380)

The current RPS will impose costs of $1.22 billion by 2020, within a range of $675 million and $1.675 billion. As a result, the RPS mandate would increase electricity prices by 1.26 cents per kilowatt-hour (kWh) or by 13.6%, within a range of 0.7 cents per kWh, or by 7.5%, and 1.73 cents per kWh, or by 18.8%.

The STAMP model simulation indicates that, upon full implementation, the RPS law will harm Washington's economy. The state's ratepayers will face higher electricity prices that will increase their cost of living, which will in turn put downward pressure on households' disposable income. By 2020, the Washington economy will shed 8,650 jobs, within a range of 4,780 and 11,885 jobs.

The job losses and price increases will reduce real incomes as firms, households and governments spend more of their budgets on electricity and less on other items, such as home goods and services. In 2020 real disposable income will fall by an expected $1.005 billion, between $555 million and $1.38 billion under the low and high cost scenarios respectively. Furthermore, net investment will fall by $147 million, within a range of $81 million and $203 million.

Table 2 shows how the RPS mandates affects the annual electricity bills of households and businesses in Washington. In 2020, the 15% RPS will cost families an average of $170 per year, commercial businesses $1,135 per year, and industrial businesses $13,225 per year.

Table 2: Annual Effects of RPS on Electricity Ratepayers (2012 dollars)

Cost in 2020	Low	Medium	High
Residential Ratepayer ($)	95	170	235
Commercial Ratepayer ($)	625	1,135	1,560
Industrial Ratepayer ($)	7,310	13,225	18,175
Cost over period (2012–2020)			
Commercial Ratepayer ($)	370	640	935
Industrial Ratepayer ($)	2,460	4,230	6,185
Industrial Ratepayer ($)	28,700	49,350	72,185

Emissions: Life Cycle Analysis

One could justify the higher electricity costs if the environmental benefits — in terms of reduced GHG and other emissions — outweighed the costs. Up to this point we calculated the costs and economic effects of requiring more renewable energy in the state of Washington. The following section conducts a Life Cycle Analysis (LCA) of renewable energy and the total effect that the state RPS law is likely to have on Washington's emissions.

The burning of fossil fuels to generate electricity produces emissions as waste, such as carbon dioxide (CO2), sulfur oxides (SOx) and nitrogen oxides (NOx). These emissions are found to negatively affect human respiratory health and the environment (SOx and NOx), or are said to contribute to global warming.

Many proponents of renewable energy (such as wind power, solar power and municipal solid waste) justify the higher electricity prices, and the negative economic effects that follow, based on the claim that these sources produce no emissions (see examples below). But this is misleading. The fuels that power these services, such as the sun and wind, create no emissions. However, the process of construction, operation and decommissioning of renewable power plants does create emissions. This begs the question:

Is renewable energy production as environmentally friendly as some proponents claim?

"Harnessing the wind is one of the cleanest, most sustainable ways to generate electricity. Wind power produces no toxic emissions and none of the heat trapping emissions that contribute to global warming."[11]

Wind turbines harness air currents and convert them to emissions-free power.
- Union of Concerned Scientists[12]

As far as pollution ... Zip, Zilch, Nada ... etc. Carbon dioxide pollution isn't in the vocabulary of solar energy. No emissions, greenhouse gases, etc.
- "Let's Be Grid Free," Solar Energy Facts[13]

The affirmative argument is usually based on the environmental effects of the operational phase of the renewable source (that will produce electricity with no consumption of fossil fuel and no emissions) excluding the whole manufacturing phase (from the extraction to the erection of the turbine or solar panel, including the production processes and all the transportation needs) and the decommission phase. LCA provides a framework to provide a more complete answer to the question.

LCA is a "cradle-to-grave" approach for assessing industrial systems. LCA begins with the gathering of raw materials from the earth to create the product and ends at the point when all materials are returned to the earth. By including the

11 "How Wind Energy Works," Union of Concerned Scientists, at www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/how-wind-energy-works.html.

12 "Our Energy Choices: Renewable Energy," Union of Concerned Scientists, at www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/.

13 "Let's Be Grid Free," Solar Energy Facts, at www.letsbegridfree.com/solar-energy-facts/.

impacts throughout the product life cycle, LCA provides a comprehensive view of the environmental aspects of the product or process and a more accurate picture of the true environmental trade-offs in product and process selection. Table 3 displays LCA results for conventional and sources.

Table 3: Emissions by Source of Electricity Generation (grams/kWh)

Phase	Emission	Coal	Gas	Wind	Nuclear	Solar	Biomass
Construction and Decommission	CO_2	2.59	2.20	6.84	2.65	31.14	0.61
	NO_x	0.01	0.01	0.06	0.00	0.12	0.00
	SO_x	0.06	0.05	0.02	0.00	0.14	0.00
Production and Operation	CO_2	1,022.00	437.80	0.39	1.84	0.27	58.60
	NO_x	3.35	0.56	0.00	0.00	0.02	5.34
	SO_x	6.70	0.27	0.00	0.01	0.00	2.40
Total	CO_2	1,024.59	440.00	7.23	4.49	31.42	59.21
	SO_x	3.36	0.57	0.06	0.01	0.14	5.34
	NO_x	6.76	0.32	0.02	0.01	0.14	2.40

Coal and gas produce significantly more emissions of all three gases than all the other technologies. Nuclear and wind produce the fewest emissions of the nonconventional types, with solar and biomass significantly higher due to construction and decommission for solar and production and operations for biomass. However, the construction and decommission phases of wind and solar produce non-trivial levels of emissions, with solar several factors higher than the others. Nevertheless, LCA analysis shows that wind, nuclear, solar and biomass produce significantly fewer emissions than do coal and gas.

However, this LCA analysis is incomplete. The analysis shows that wind and solar technologies derive benefits from their ability to produce electricity with no consumption of fossil fuels and subsequent pollution without adequately addressing the intermittency of these technologies. These intermittent technologies cannot be dispatched at will and, as a result, require reliable back-up generation running —idling, per se —in order to keep the voltage of the electricity grid in equilibrium. For example, if the wind dies down, or blows too hard (which trips a shutdown mechanism in commercial windmills), another power source must be ramped up (or cycled) instantaneously. Therefore, new wind and solar generation plants do not replace any dispatchable generation sources.

This cycling of coal and (to a much lesser extent) gas plants causes them to run inefficiently and produce more emissions than if the intermittent technologies were not present. As a result, according to a recent study, wind power could actually increase pollution and greenhouse gas emissions in areas that generate a significant portion of their electricity from coal.[14] The current LCA literature ignores this important portion of the analysis, which provides a distorted assessment of wind and solar power.

14 "How Less Became More: Wind, Power and Unintended Consequences in the Colorado Energy Market," Bentek Energy, LLC, May 2010, at http://www.bentekenergy.com/documents/bentek_how_less_became_more_100420-319.pdf.

The incorporation of renewable sources does, by itself, produce much lower emissions than conventional sources; it still displaces only a small amount of emissions from conventional sources.

To better judge the actual total benefit derived from switching from the current energy source portfolio to one that involves more renewable energy, as the RPS dictates in Washington state, BHI compared the total emissions impact according to our projections using a life cycle analysis for the various energy sources. Table 4 displays the results.

Table 4: Change in Emissions Due to the Washington RPS Mandates (in thousands of metric tons)

Emission Gas	2020	Total 2012–2020
No Capacity Factor Differences		
Carbon Dioxide	(4,215)	(13,550)
Sulfur Oxide	13	4
Nitrogen Oxide	(11)	(49)
Capacity Factor Differences		
Carbon Dioxide	(1,185)	(4,060)
Sulfur Oxide	21	28
Nitrogen Oxide	4	(5)

The results are somewhat counterintuitive. The RPS mandates reduce emissions of CO2 by 1.2 million metric tons in 2020, with a total reduction compared to a reduction of 4.1 million tons between 2012 and 2020. If no back-up capacity was required due to the intermittency issues of renewables, then the reduction would be more than three times as much. Surprisingly, SOx emissions show a slight increase compared to a baseline in all years. The reason for this is that biomass and wood waste, two large sources of renewable energy in Washington, emit large amounts of these two types of particulate matter.

Conclusion

The "declaration of policy" for I-937 states:

> *Increasing energy conservation and the use of appropriately sited renewable energy facilities builds on the strong foundation of low-cost renewable hydroelectric generation in Washington state and will promote energy independence in the state and the Pacific Northwest region. Making the most of our plentiful local resources will stabilize electricity prices for Washington residents, provide economic benefits for Washington counties and farmers, create high-quality jobs in Washington, provide opportunities for training apprentice workers in the renewable energy field, protect clean air and water, and position Washington state as a national leader in clean energy technologies.*[15]

15 "Energy Independence Act," Washington State Legislature, Chapter 19.285 RCW, at apps.leg.wa.gov/RCW/default.aspx?cite=19.285.

But the policy removes new hydroelectricity, a cheap and abundant form of renewable energy, from the RPS policy. Hydroelectricity is expected to account for 70% of total electric industry generation in 2050, while coal, natural gas, nuclear and renewables will account for another 29%. Petroleum accounts for 0.06% of generation.[16]

Furthermore, supporters of the act commit the "broken windows fallacy" by claiming that the law will produce high-quality jobs; proponents claim there is an underlying benefit to smashing windows in a neighborhood because that would mean profits for local glassmakers and window installers. Is this really beneficial? By requiring utilities to forgo lower cost sources of energy in favor of higher-cost "green energy," supporters of the act might be able to point to individual investment projects and jobs. However, the important consideration should be the net economic effects of the mandate. The jobs that will be lost due to higher energy costs are not as easy to identify, but they are just as important.

While Initiative 937 might generate small economic benefits, Washington electricity customers will pay higher rates, face fewer employment opportunities, and watch investment flee to other states with more favorable business climates.

Firms with high electricity usage will likely move their production, and emissions, out of Washington to locations with lower electricity prices. Therefore, the policy may not reduce global emissions, but rather send jobs and capital investment outside the state.

Washington Policy Center is a non-partisan, independent research organization in Washington state.

The Beacon Hill Institute at Suffolk University develops and performs economic and statistical analyses of current and emerging public policy issues.

Nothing here should be construed as an attempt to aid or hinder the passage of any legislation before any legislative body.

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16 "Table 5. Electric Power Industry Generation by Primary Energy Source, 1990 through 2010," at www.eia.gov/electricity/state/washington/xls/sept05wa.xls.