



Renewable Portfolio Standards and State-Level Employment: An Ex Post Analysis

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- Work supported by Florida Energy Systems Consortium Project # 0077818.
- Results are preliminary and incomplete. Do not cite.
- The views expressed herein are solely those of the author. They do not reflect the opinions of the University of Florida, the Public Utility Research Center, or the Florida Energy Systems Consortium.



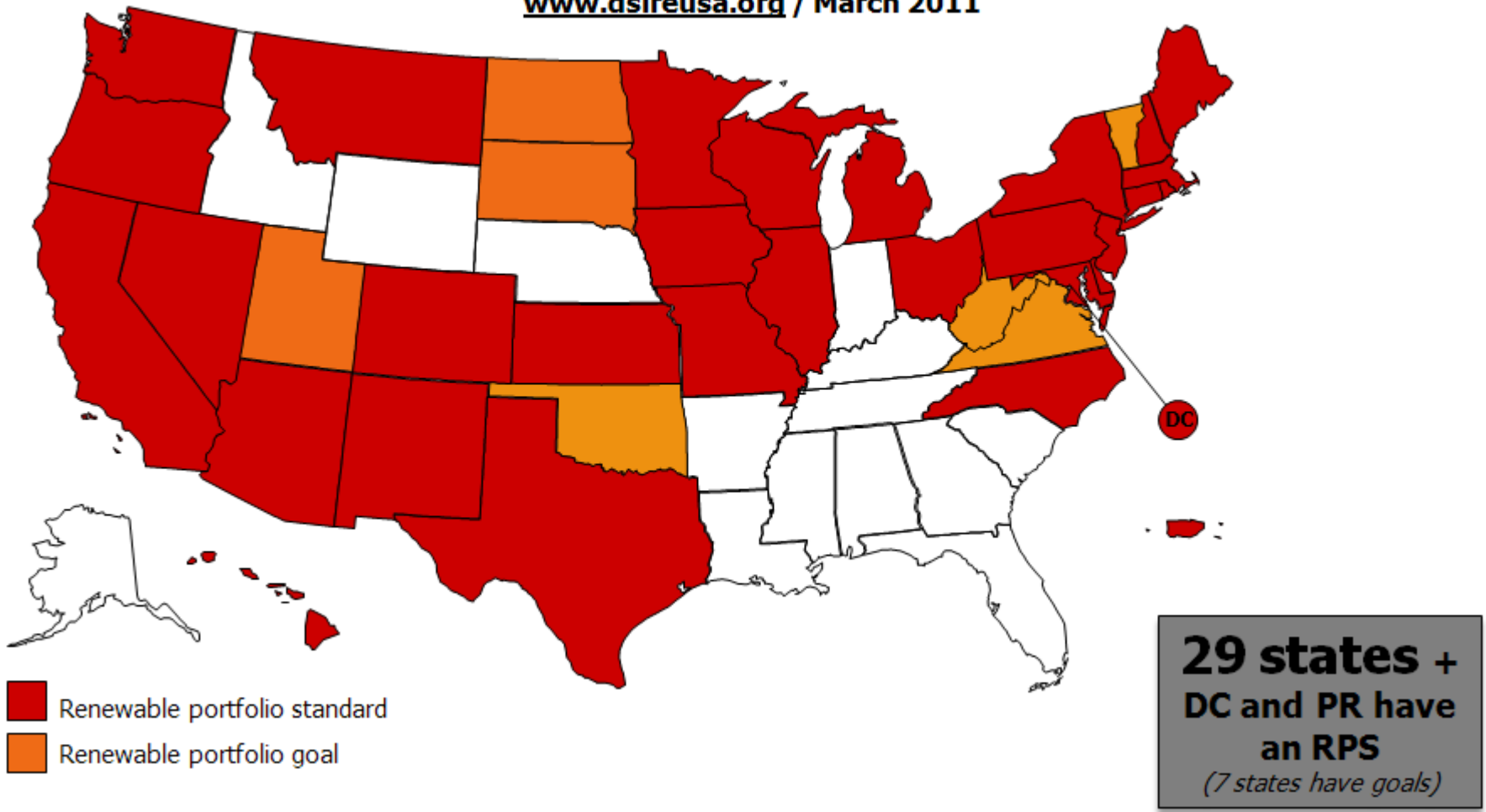
Background

- In 1983, Iowa adopts first RPS
- By 2010, 36 states plus DC have adopted some form of RPS rules (Standards or Goals)
- By 2010, 25 states plus DC have **binding** standards in place



RPS Policies

www.dsireusa.org / March 2011





The Existing Literature

-Forecasts/Simulations (*Ex Ante*)

- More numerous
- Results vary based on assumptions
- Transparency can be an issue

- Empirical (*Ex Post*)

- Few in number
- Even smaller number measure effectiveness
- No study measures employment



The Forecasting/Simulation Literature

- Palmer and Burtow (2005)
 - Studied the effects of various RPS scenarios
 - RPS will raise energy prices and displace natural gas
 - “Higher natural gas prices lower the cost of renewables programs”
 - Uses Haiku (peer-reviewed model)
- English et al. (2006)
 - Studied a national 25% by 2025 RPS
 - Policy would create 5.1 million jobs
 - Used POLYSYS and IMPLAN (COTS)



The Forecasting/Simulation Literature

- Noguee et al. (2007)
 - Evaluated studies of 20% by 2020 RPS
 - Would create 355,000 jobs
 - Would lower energy prices in 19 of 20 study years
 - Used NEMS (EIA)
- Black and Veatch (2010)
 - Evaluated a 15% AEPS for Pennsylvania
 - Used RIMS (BEA)
 - 129,000 more job-years over Fossil Fuels only scenario



The Empirical Literature

- Huang et al. (2007)
 - Cross-sectional analysis of RPS adoption
 - Found political party dominance, population growth, gross state product and education predict adoption
 - Did not address employment
- Kneifel (2008)
 - Panel study looking at renewable capacity
 - Capacity requirements are more effective than sales requirements
 - PBFs and MGPOs also increase renewable capacity

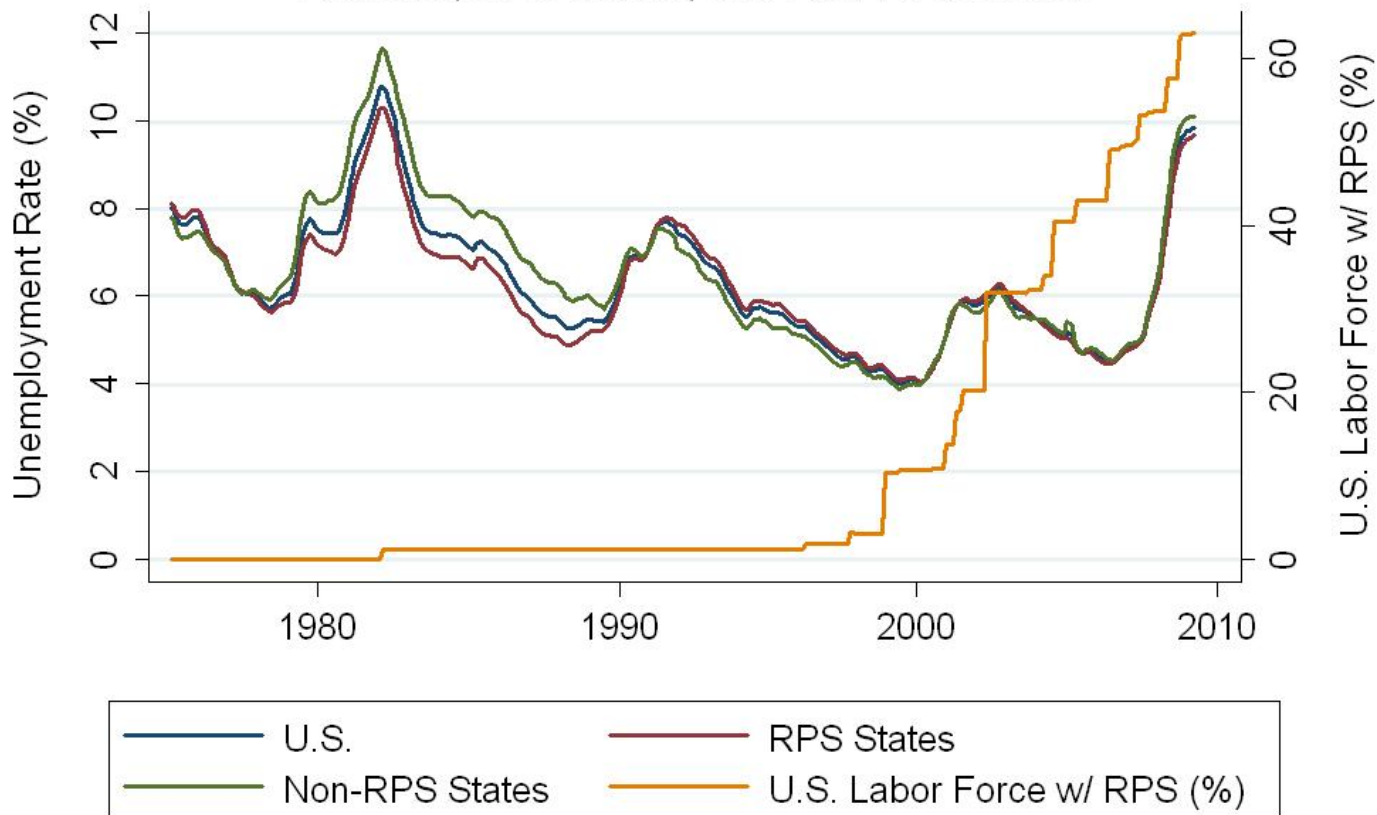


The Empirical Literature

- Alvarez et al. (2009)
 - Evaluate green jobs in Spain (BOTE)
 - Key stat: Subsidy per green job created/average capital per worker in private industry
 - Find each green job costs 2.2 private jobs
- Lyon and Yin (2010)
 - Panel study looking at RPS adoption
 - Duration models show local pollution conditions and employment do not explain adoption



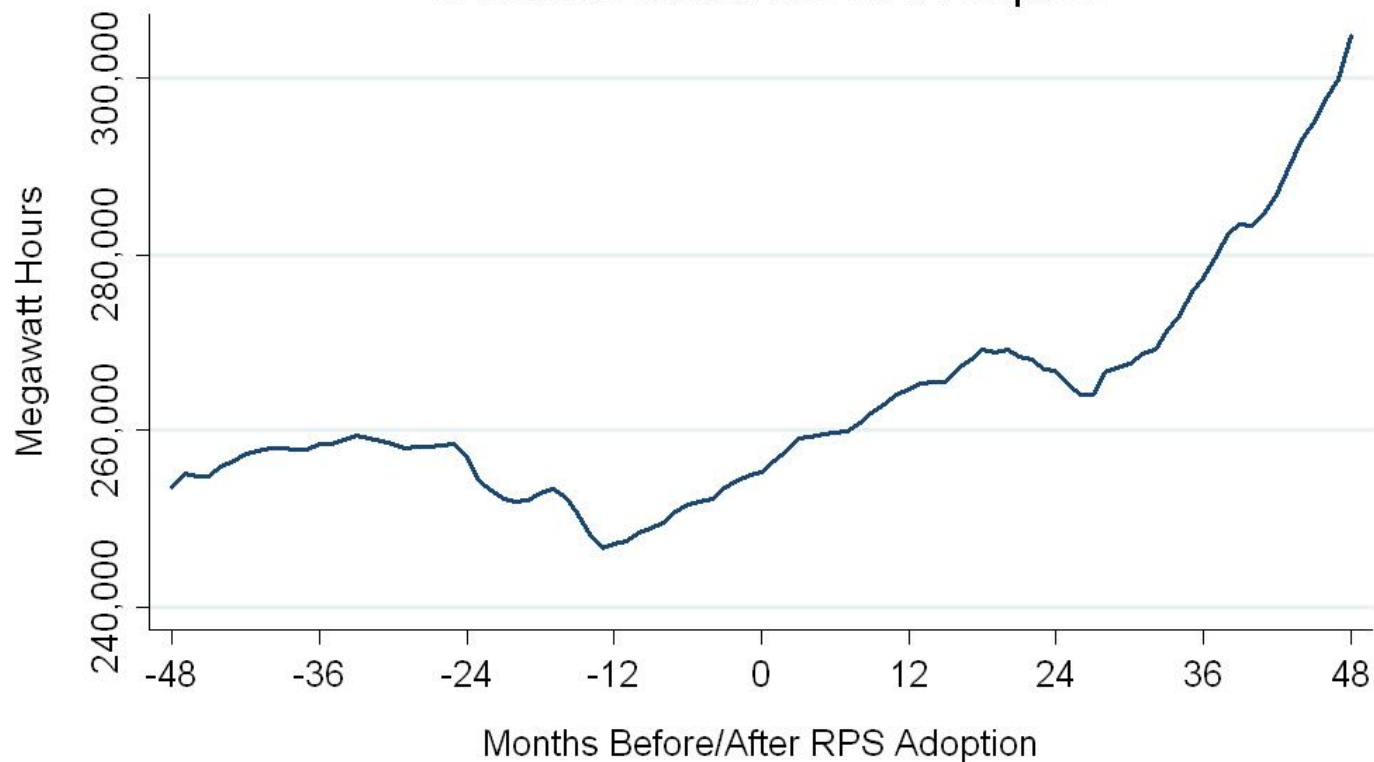
Unemployment Rates: 1976-2010 National, RPS States, and Non-RPS States



Source: DSIRE and BLS



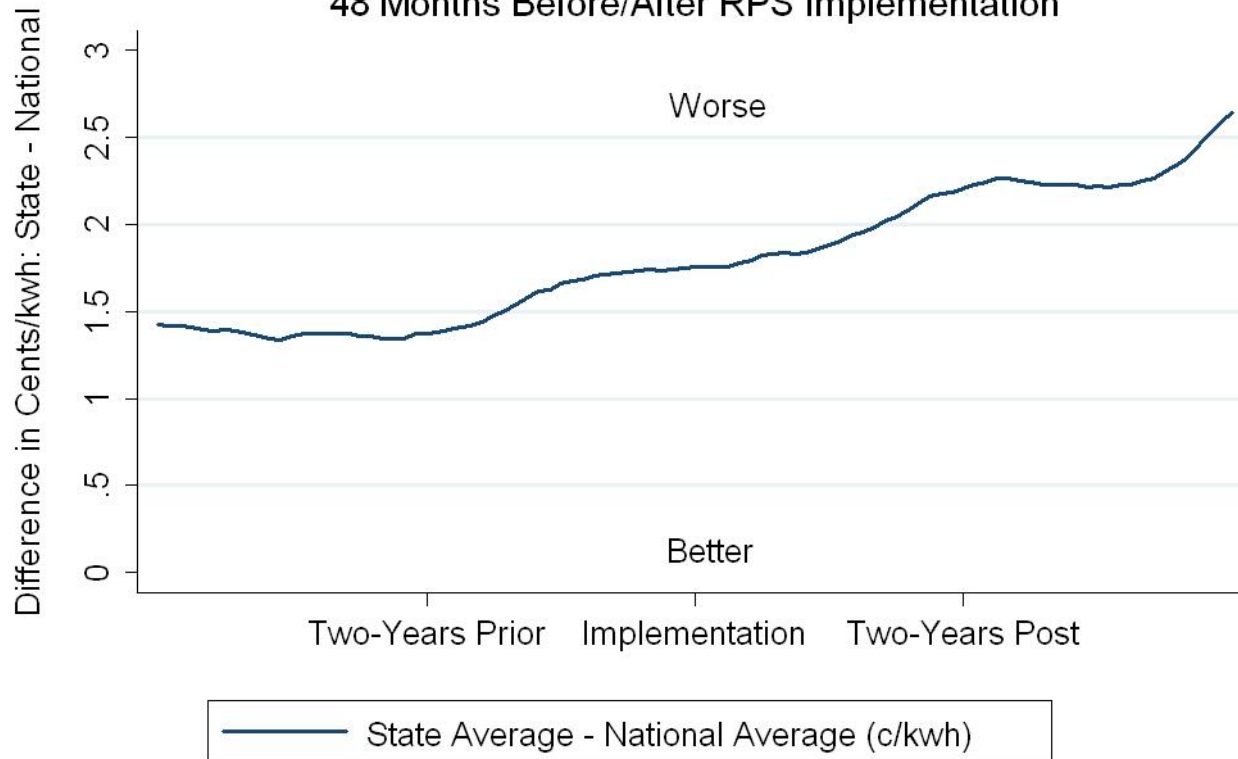
Net Generation by Renewables 48 Months Before/After RPS Adoption



Sources: DSIRE and EIA
(Includes data from 16 RPS adoptions. Calculations are unweighted and have been smoothed using a 12-month moving average.)



Difference in Nominal Energy Prices for RPS States 48 Months Before/After RPS Implementation



Sources: DSIRE and EIA



Model

- $Y_{it} = \text{Policy}_{it} + \text{Energy}_{it} + \text{Demo}_{it} + \text{State} * \text{Year}_{it} + e_{it}$
- Y_{it} : # Employed, Avg Retail Price, MWh Generated
- Policy_{it} : Dummy variables for RPS, GPPP, MGPO, NETMTR
- Energy_{it} : % of net generation by coal, natural gas and/or renewables and average price/KWh
- Demo_{it} : Size of Labor Force, Income Per Capita, % of Neighbors with an RPS
- Data are monthly by state (except per capita income and generation data for 1990 - 2000)

RPS Effect on Employment

	(1)		(2)		(3)	
	State and Year	State by Year	State and Year	State by Year	State and Year	State by Year
	(a)	(b)	(a)	(b)	(a)	(b)
Fixed Effect Structure						
RPS in Effect	1,042,202 (760,275.45)	-3,550 (4,951.92)	-10,122 (10,697.76)	-15,294*** (3,640.01)	-14,364 (11,289.25)	-12,692** (6,029.56)
Size of Labor Force			0.98*** (0.01)	0.99*** (0.03)	0.98*** (0.01)	0.99*** (0.05)
State Unemployment Rate - National Unemployment Rate			-33,417*** (6,871.91)	-22,501*** (945.75)	-31,268*** (6,900.48)	-20,727*** (1,724.74)
Real Price of Electricity			328 (1255.98)	-645 (396.76)	-141 (1383.86)	182 (799.43)
Percent of Generation (Renewables)			178 (793.25)	176 (290.21)	150 (786.92)	844 (763.11)
Percent of Generation (Coal)			28 (293.22)	295*** (69.01)	-136 (306.46)	103 (161.67)
Percent of Generation (Hydroelectric)			340 (546.47)	245*** (91.00)	292 (651.48)	239 (176.11)
Percent of Generation (Petroleum)			28 (289.85)	128*** (41.89)	145 (266.88)	192** (82.52)
Percent of Generation (Nuclear)			197 (272.21)	80 (80.50)	107 (271.15)	-173 (209.35)

RPS Effect on Employment (cont.)

Public Benefit Fund in Effect			12,041	2,023	10,072	2,894
			(9723.89)	(1798.35)	(9434.96)	(4491.04)
Mandatory Green Purchase Option in Effect			2,993	-4,079***	6,135	-7,070***
			(8889.63)	(1263.21)	(8943.04)	(2315.81)
Green Power Purchasing Program in Effect			12,250***	-21,871***	13,625**	-27,592
			(4267.67)	(7904.70)	(5668.76)	(20978.48)
Netmetering Program in Effect			-6,633	-11,324***	-7,598	-11,436**
			(9290.29)	(2324.08)	(9866.96)	(4897.01)
Percent of Neighbors with an RPS			21,126	-24,437***	24,976	-18,819**
			(14670.60)	(4180.04)	(15050.84)	(7384.50)
Real Income Per Capita (\$000s)					2.80**	4.30***
					(1.12)	(0.75)



RPS Effect on Renewable Generation

RPS in Effect	-3,489	738	14,489
	(5,492.29)	(5,122.17)	(11,871.98)
Size of Labor Force		-0.069	-0.1
		(0.05)	(0.08)
Unemployment Rate		682	2,440
		(1,323.23)	(2,229.36)
Percent of Generation (Renewables)		17,708***	26,964***
		(1,632.59)	(4,175.82)
Percent of Generation (Coal)		-62	1,211***
		(169.77)	(455.93)
Percent of Generation (Hydroelectric)		721***	2,135***
		(222.02)	(459.20)
Percent of Generation (Petroleum)		142***	110
		(49.10)	(108.15)
Percent of Generation (Nuclear)		181	511
		(229.16)	(404.42)



RPS Effect on Renewable Generation

Public Benefit Fund in Effect	-5,274** (2,671.41)	584 (4,473.81)
Mandatory Green Purchase Option in Effect	21,543*** (5,788.13)	28,764 (18,740.31)
Green Power Purchasing Program in Effect	7,511*** (2,166.63)	9,810** (4,826.51)
Netmetering Program in Effect	6,897** (3,299.71)	8,986 (7,402.19)
Percent of Neighbors with an RPS	-12,187 (11,453.02)	-11,841 (29,655.39)
Real Income Per Capita (\$000s)		4.3*** (1.38)



Results Not Shown

- Effect of RPS on Price: Ambiguous
 - Sensitive to the deflation of nominal energy prices
 - Effect of variation in natural gas prices



The Way Ahead

- Not all RPSs are the same...need to measure stringency

- Binding vs. Goals.
- How goals are measured (% sales vs. amount)
- In-state sourcing requirements
- REC Trading (in-state vs. regional)
- Technology carve outs
- Cost recovery mechanisms
- Cost effectiveness clauses
- Treatment of IOUs, MOUs and Co-ops

- The effect of income on the basket of renewable policies and first-mover advantage



Questions and Comments