Energy Policy 44 (2012) 217–225

Contents lists available at SciVerse ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Comparative economic analysis of supporting policies for residential solar PV in the United States: Solar Renewable Energy Credit (SREC) potential

John Edward Burns, Jin-Su Kang *

Institute of Business and Management, National Chiao Tung University, Taiwan, ROC

ARTICLE INFO

Article history:
Received 19 August 2011
Accepted 23 January 2012
Available online 10 February 2012

Keywords:
US
Solar Renewable Energy Credit
Residential solar PV

ABSTRACT

Numerous studies and market reports suggest that the solar photovoltaic markets rely heavily, if not entirely, upon governmental support policies at present. Unlike in other countries where these policies are enacted at a national level, the 50 states in the US pursue different policies in an attempt to foster the growth of renewable energy, and specifically solar photovoltaics. This paper provides an economic and financial analysis of the US federal and state level policies in states with solar-targeted policies that have Solar Renewable Energy Credits (SREC) markets. After putting a value on SRECs, this study further compares solar carve-outs with other incentives including the federal tax credit, net metering, and state personal tax credits. Our findings show that SREC markets can certainly be strong, with New Jersey, Delaware, and Massachusetts having the most potential. Despite their strong potential as effective renewable policies, the lack of a guaranteed minimum and the uncertainty attached are major drawbacks of SREC markets. However, the leveraging of this high value offers hope that the policies will indeed stimulate residential solar photovoltaic markets.

1. Introduction

Among many factors driving global *Solar Photovoltaic* (SPV) demand, this study focuses on government policy, specifically focusing on financial incentive policies implemented in support of SPV. SPV is a high cost renewable resource, and therefore has lagged behind other sources of renewable energy, so subsidies and incentives are considered among the key drivers of global SPV demand (Wiser et al., 2010).

The US energy market is different from other nations in that energy is primarily regulated at a state level or lower rather than on a fully national scale. Likewise, electrical energy companies in the US operate at a state or regional level, not typically on a fully national scale. Consequently, each state functions effectively as a separate energy market, and thus each state is thereby a separate SPV market. Given the web of different incentives each state provides, it is difficult to quantify how much each different policy affects the SPV industry.

Many states have been passing renewable energy support policies over the past decade, with the most common method being a *Renewable Portfolio Standards* (RPS) (Wiser et al., 2010). Additionally, states specifically target SPV by creating solar *set-asides* or *carve-outs* within the RPS specifically requiring a percentage of energy to be derived from SPV. One of the most common ways to enforce set-asides is through Solar Renewable Energy Certificates or *Solar Renewable Energy Credits* (SREC) markets, nine of which are in place as of July 2011 (DSIRE).

SREC markets are fresh in the US, and subsequently very few studies have evaluated them in depth. Previous studies explore the value of financial incentives in the US SPV market, but intentionally leave out valuing SRECs due to their speculative nature (Barbose et al., 2011; Wiser et al., 2010). This study attempts to place a quantifiable value on SRECs, and thus paint a better picture of the US SPV financial incentive landscape.

There have been many attempts to measure the success of government policies on renewable energy sources (Buckman, 2011; Menz and Vachon, 2006; Yin and Powers, 2010). One examination performs a comparative financial and economic analysis of each individual European nations' package of financial incentives for residential photovoltaics, estimating *Net Present Value* (NPV), *Discounted Cash Flows* (DCF), and *Internal Rate of Return* (IRR) of policies (Dusonchet and Telaretti, 2010a, b).

A comprehensive study of incentives in the US uses the *Present Value per Watt-Capacity* (Present Value/W_p), providing a metric to measure and compare the different incentives (Barbose et al., 2011). The analysis mentions the value of SREC policies, but does not go in great detail about SRECs, as they are considered too difficult to measure.

Thus, this study intends to provide insight into the newer SREC markets that populate US RPS policies. Through financial analysis using NPV, DCF, IRR, and Present Value/W_p, we intend to answer the following questions:

1. Which of the US states with solar carve-outs that include SREC policies have the most robust overall state-level package of incentives for residential SPV?

* Corresponding author.
E-mail addresses: jskang@mail.nctu.edu.tw, jinsu.kang@gmail.com (J.-S. Kang).

0301-4215/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
doi:10.1016/j.enpol.2012.01.045

2. What is the value of SREC markets to residential SPV, and which SREC markets are strong enough to be as effective as other financial incentives: *Net Metering*, or personal tax credits?

The remainder of the paper is organized as follows. In Section 2, we present a succinct overview of the many different financial incentive policies in the US at the state and federal level. Then, a comprehensive overview of SREC markets follows, providing a state-by-state breakdown of US SREC markets in place as of October 2011. We apply conventional financial metrics, including Present Value, NPV, DCF, and IRR, to compare states' financial incentives. Then, Present Value per W_p compares SREC value versus the other policies. Section 5 presents the findings, and Section 6 is a conclusion.

2. Supporting policies in the United States

At the federal level, a personal income tax credit is provided, while state and municipal authorities employ various SPV-targeted tax incentives in the form of tax exemptions, tax deductions, and tax credits.

While Feed-in-Tariffs (FIT) have been prevalent and successful at stimulating SPV in Europe (Dusonchet and Telaretti, 2010a; Lipp, 2007), the 1978 Public Utilities Regulatory Policies Act (PURPA) has made it difficult to establish European-style FITs in the US (Hempling et al., 2010). As such, FITs are not prevalent in the US, and states tend to pass other forms of incentive policies to stimulate residential SPV.

Most of the different policies are separate laws, and as such represent different incentives that can be cumulated on top of each other (DSIRE), and the resulting package of incentives can be used to offset the higher price of energy from SPV. However, each state is different in their method of supporting SPV, and not all policies can be cumulated. Those which cannot be cumulated are explained and accounted for when performing the financial evaluation. The following sections introduce the financial incentive policies in place in the US related to SPV market examined through financial analysis within this study.

2.1. Tax credits

The federal "Residential Renewable Energy Tax Credit" is a non-refundable personal tax credit and applies only to residential renewable energy systems. As this is a federal incentive, there are no differences among the states. Many states have also passed personal income tax credits, although in this study the only two that have them are Massachusetts and North Carolina.

The federal government allows SPV installations a one-time credit equivalent to 30% of the cost of installation. The price of the installation includes equipment, on-site preparation, assembly or original installation, labor costs, wiring, and piping for connection with the grid (US Department of Energy). The tax credit was established on January 1, 2006, and is scheduled to expire on December 31, 2016 after recently being extended past 2011. It is not guaranteed, and must be approved when filing income taxes.

2.2. Cash rebates

Many states pass financial incentives in the form of *cash rebates*, which are a dollar amount paid per watt-capacity of SPV energy installed. These incentives have been shown effective at reducing installed SPV costs (Wiser et al., 2010; Barbose et al., 2011). However, cash rebates often suffer from a lack of funding, and are paid out on a first-come first-serve basis until the budget dries up, and as such are not guaranteed, as happened in Pennsylvania as of August 2011 (DSIRE). So, while studies of funding for installed projects that received rebates is possible, for the purposes of this study, rebates are not considered.

2.3. Net Metering

The simplest incentive for renewables is Net Metering. This allows customers to offset their electricity use by the amount of energy their integrated renewable systems generate. Each state's law has different wording and different specifics on how they go about employing Net Metering laws.

Integrated SPV systems are required to have a specified meter that records the flow of electricity in both directions. Each month the meter records the inflow of electricity from utility providers, and also records the outflow of electricity generated by the residence and pumped back into the electricity grid. All the energy produced and consumed locally by an SPV system is effectively a savings equal to the retail electricity price at the time they produced and consumed their electricity.

Should the system generate electricity in excess of consumption each month, this *Net Excess Generation* (NEG) can be carried forward as credit against future energy consumption in the coming months, or paid out to the residence – normally at year's end (DSIRE). The price paid for this excess generation is different in each state. Most states allow SPV generators to receive the retail price for the excess generation; others allocate NEG differently (DSIRE). Should a customer's year-end energy bill have excess generation over the customer's annual residential consumption, the customer is then entitled a cash rebate equivalent to NEG from the utilities company (DSIRE).

In essence, Net Metering is designed to allow customers to profit off the total amount of energy they generate – not just the amount of energy they consume locally from their SPV system. Unfortunately, the cost of energy from SPV is above the market price, thus net metering alone is not necessarily enough to put SPV in competition with traditional means of electric energy production.

Table 1 shows the summary of Net Metering for nine states related to this study: How the state handles NEG and the maximum capacity for a Net Metering system. Additionally, the 2010 Average Retail Energy price per kW h, and the 20-year nominal annual change in energy price is provided to give a comprehensive view of Net Metering policies within each state.

2.4. Renewable portfolio standard (RPS)

Each state has strong, but not complete authority to regulate the utilities companies serving their residents. As such, many states have been setting goals and requirements for electrical energy production from renewable resources similar to those seen in Europe. As of March 2011, 33 states and the District of Columbia have RPS programs in place (US Environmental Protection Agency).

These different RPS strategies cover the whole spectrum of renewable energy, and implementation varies by state. States require utilities companies to acquire a *Renewable Energy Certificate* (REC) which is equivalent to 1 MW h of energy created by a renewable resource, similar to Tradable Green Certificates (TGC) found in some European nations.

Should an insufficient amount of RECs be produced or purchased by energy producers, energy producers pay an *Alternative Compliance Payment* (ACP). The ACP for each RPS is different and subject to adjustment. Ohio's is $45 per MW h, New Jersey's is $50 per MW h; Ohio's ACP decreases $5 per MW h bi-annually, whereas New Jersey's has remained unchanged since 2004.