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Economic impact potential of solar photovoltaics in Illinois

D.G. Loomis [a, *], J.H. Jo [b], M.R. Aldeman [b]

[a] Department of Economics, Illinois State University, United States
[b] Department of Technology, Illinois State University, United States

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ABSTRACT

Illinois ranks nineteenth among all states in total installed solar PV capacity as of the first quarter in 2014 [17]. The authors' prior work [14] assessed the technical potential of large-scale PV system integration in Illinois by examining hourly demand data supplied by the two transmission organizations (MISO and PJM) in the state. Depending on how technical potential is measured, three different PV system capacity options were suggested by 2025 for Illinois; 2292 MW, 2714 MW and 11,265 MW. In the present study, we seek to examine the jobs and total economic impact of the three technical potentials derived in the previous study. Based upon the Jobs and Economic Development Impact (JEDI) modeling analysis, the employment impacts during the construction period vary from 26,754 to 131,779 job years when implementing the PV system capacity options in Illinois. The employment impacts during the operating years vary from 1223 to 6010 job years. In order to achieve these jobs impacts, Illinois must encourage the development of a robust PV supply chain within the state's borders and enact policies similar to other states that have experienced greater growth.

1. Introduction

Solar energy capacity in the form of photovoltaics (PV) has grown rapidly in the United States and in other countries. Both residential PV systems and utility-scale installations have experienced considerable growth in the US. As of the first quarter of 2014, 6.68 GW of utility PV plants are operating and the contracted utility PV pipeline secured 12.5 GW [17]. Including all types of photovoltaics, cumulative operating PV capacity stood at 13.4 GW with 482,000 individual systems on-line as of the end of the first quarter of 2014 [17]. It was forecasted that new PV installations will reach 6.6 GW in 2014, up 39% over 2013 and nearly double the market size in 2012 [17]. Although this growth rate is impressive, the United States has begun to lag behind a number of other developed countries in newly installed capacity of solar PV.

California, New Jersey, and Arizona are the top three U.S. states for PV installations and Illinois ranks nineteen in PV installation capacity as of the first quarter of 2014 [17]. No large solar installations have been brought online in the last year in Illinois, so the state may fall behind in the ranking. As of November 2013, Illinois has three utility-scale solar farms in operation: Exelon City Solar is a 10 MW installation on the south side of Chicago, Grand Ridge Solar Farm is a 20 MW installation near Streator, IL, and the Rockford Solar Farm is a 3 MW installation near the Chicago Rockford International Airport.

In the previous study [14], we addressed three key research questions: First, given the current solar carve-out of 6% specified in the state's Renewable Portfolio Standard (RPS), how many megawatts of PV capacity must be installed by 2025 to meet the requirement? Second, can Illinois fully utilize all of the solar energy that will be produced as a result of the 6% carve-out without wasting a portion of the generated electrical energy? If so, then what is the maximum amount of PV capacity that could be installed in Illinois while maintaining 100% utilization of the energy that is produced by the systems? Third, how much of Illinois' electrical energy could PV supply if curtailment of the PV output is occasionally permitted? For the analysis, curtailment was allowed at a rate equal to the typical internal energy consumption at thermal generation facilities.

In this subsequent study, we seek to examine the jobs and total economic impact of the three technical potentials derived in the previous study [14].

* Corresponding author.
E-mail address: dloomis@ilstu.edu (D.G. Loomis).

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2. Background

2.1. Solar energy policies in Illinois and other states

Illinois has several policies and institutions to help promote solar energy. In 1997, Illinois established the Renewable Energy Resources Trust Fund to provide funding for support of renewable energy sources. To establish the fund, a surcharge was placed on residential and non-residential gas and electricity bills. Originally set to last ten years, in 2007 the program was extended through the year 2015. One of the main programs this fund supports is the solar and wind energy rebate program. This program provides rebates for residential, commercial, non-profit, and public sector applicants. For solar PV, residential systems are eligible for the lesser of $1.50/watt or 25% of project costs, commercial systems are eligible for the lesser of $1.25/watt or 25% of project costs, and non-profit and public sector systems are eligible for the lesser of $2.50/watt or 40% of project costs. The PV systems must be at least 1 kW and be listed by Underwriter's Laboratory or field tested for one year [20].

In 1999, the Illinois Clean Energy Community Foundation was created. The goals of the Foundation are to improve the environment, create jobs, reduce energy costs, and boost the renewable energy sector through support of renewable energy sources. To achieve these goals, the foundation supplies grants to projects for energy efficiency and renewable energy. The Foundation also administers the Illinois Solar Schools program, established in 2006, which promotes installation of 1 kW solar PV systems on school buildings to allow students to see how sunlight is converted to electricity [10].

In 2007, Illinois created the Illinois Power Agency (IPA) to develop electricity procurement plans for investor-owned utilities (IOUs). The Act that created the IPA also created a renewable portfolio standard (RPS) requiring increasing amounts of renewable energy as a percentage of the electric load for IOUs. The current RPS is set at 25% by year 2025, with a 6% solar carve-out starting in the year 2015. This means 1.5% of IOU load is to be procured from solar by the year 2025. The IPA can procure the required solar energy under long-term contracts or by purchasing Solar Renewable Energy Credits (SRECs) to meet the solar carve-out. In 2010, the Renewable Energy Credit Aggregation Program (RECAP) was implemented, allowing producers of solar energy to sell their earned SRECs to utility companies [13].

Legislation requiring investor-owned utilities to offer net metering by April 1, 2008 was enacted in 2007. Traditional net metering is allowed for systems up to 40 kW and dual metering is allowed for systems greater than 40 kW but not larger than 2 MW. This service must be provided until it reaches 5% of peak demand supplied the previous year. Those participating in the program earn credits for energy generated. At the end of the month, any excess generation rolls forward, expiring at the end of the annual period. With net metering, this amount is found by taking kWh produced and subtracting kWh consumed. With dual metering, a special meter separately measures the amount of energy consumed from the electric grid and the energy exported onto the electric grid from the PV system. The producer then typically receives a credit for costs avoided by the utility company [20].

In 2007 with the creation of net metering, the state also developed interconnection standards for systems under 10 MW. These standards were based on IEEE 1547, a nation-wide set of interconnections standards of the Institute of Electrical and Electronics Engineers. The systems are divided into four levels to determine level of review required before allowing grid connection. Levels 1, 2, and 3 are considered expedited review levels. Level 1 systems are certified systems with a capacity of 10 kW or less. The review ensures certain aspects such as the system qualifying at Level 1, the total capacity connected to a network not exceeding set limits, and that no facilities need to be constructed by the electricity distribution company to accommodate the connection. Level 2 are certified, inverter-based systems of 2 MW or less connected to a spot network serving only one customer. This review is similar to Level 1 reviews, with additional concerns for generator connections. Level 3 are either certified systems of 50 kW or less, connected to an area network with no exportation or non-exporting systems, connected to a spot network that are 10 MW or less and certified. Reviews for Level 3 follow a similar set-up as Levels 1 and 2. Level 4 systems are given a more in-depth review. These systems are any system 10 MW or less that do not fit the requirements for lower tiers. The review for Level 4 cannot be expedited and may include an interconnection feasibility study, an interconnection system impact study, or an interconnection facilities study [8]. For systems larger than 10 MW, a separate process exists. Evaluations of capacity levels, review of facilities, and multiple studies must be completed before a decision about allowing the interconnection can be made [9].

Another Illinois program designed to incentivize investment in renewable energy is the Green Energy Loan Program. The Illinois State Treasurer's Office began the Green Energy Loan program in 2008. The program allows qualified projects with loans from eligible banks to apply for a rate reduction on loans for renewable energy or energy efficiency projects [20]. Beginning in 2010, the Illinois Finance Authority was able to issue tax-exempt bonds to finance qualifying renewable energy and energy efficiency projects [12]. In 2011, the Illinois Department of Commerce and Economic Opportunity began offering grants for large distributed solar and wind projects. Businesses can receive the lesser of $1.25/watt or 25% of project cost and government and non-profit agencies can receive the lesser of $2.60/watt or 40% of project cost [11]. As a final incentive, for property tax purposes, Illinois allows solar energy equipment to be assessed at the same value as a conventional energy system [20].

Even with these advances in solar policies and programs, Illinois is not a leader in solar PV installation. Hawaii, California, Arizona, Nevada, and New Jersey all have high levels of installed solar PV capacity and high per capita installation rates. These states have higher RPS goals, better and more reliable rebates and better net metering and interconnection standards.

3. Literature review

Two previous studies have examined the economic impact of solar PV on multiple states. As far back as 1980, [7] claimed that increased solar energy production expected by the year 2020 would have a negative economic impact. This is a surprising result by today's standards of positive economic impact but Hudson assumed the costs of PV would stay relatively high and would displace cheaper energy alternatives. In the years since his study, solar PV costs have declined dramatically. In a second study, [5] quantified the economic impact of installing solar PV Systems in different states in the country. The Jobs and Economic Development Impact (JEDI) model was utilized to answer the question: which state, for a given amount of solar deployment (2.5 kW), derives the greatest statewide economic impact with the default values from NREL. Under these assumptions, Pennsylvania is ranked first with 28.98 jobs during the installation period and 0.20 jobs during the operation period. Interestingly, Illinois is ranked second with 27.65 jobs during the installation period and 0.18 jobs during the operation period.

Three other studies examined the economic impact of Solar PV on individual state economies. [1] estimated the PV market in Ohio to be $25 million, with 200 direct jobs and 460 total jobs (both