

Shining Bright: Growing Solar Jobs in Iowa

March 2011

A report from the
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In collaboration with



THE
Vote Solar
INITIATIVE



ENVIRONMENTAL LAW & POLICY CENTER



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Introduction/Summary

Can solar energy help build the Iowa economy? This analysis answers that question with a resounding “Yes.” Iowa has almost all the right ingredients on hand: demonstrated ability to be a renewable energy leader with wind power, a solar energy industry that already employs people across the state, and more sunshine than New Jersey or Germany, both leading global solar markets. Solar is taking off in the Midwest. The industry is creating jobs and economic growth in Illinois, Michigan and Ohio, which have passed legislation to drive demand for solar power.¹ Iowa can cash in on the opportunity to create jobs and generate economic activity, if supported by appropriate state policy.

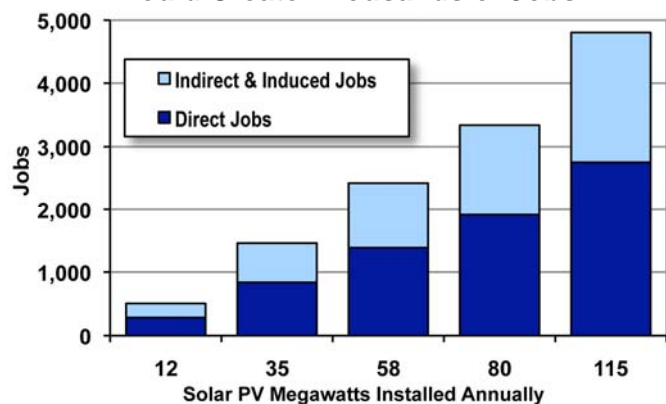
This report examines the potential job creation and economic activity that would result from installing 300 megawatts (MW) of solar photovoltaic (PV) systems on homes, farms, business and public buildings across Iowa over the next five years. Three hundred megawatts of solar power was set as a reasonable, yet robust target that would have a minimal impact on customer rates.² Table 1 lists the megawatts that would be installed each year to reach this goal. Economic output modeling for the development of 300 MW of solar energy finds that in year five of the program, the equivalent of almost 5,000 jobs would be created and over \$332 million in value would be added to Iowa’s economy. (See Fig. 1, right, and Table 2, p. 2.)

This report explains the potential job creation and economic impacts of a robust solar industry in Iowa based on input-output modeling undertaken by Iowa State University economist David Swenson. The report also profiles Iowa’s nascent solar industry. The report concludes with a discussion of what policies have successfully spurred solar industries in neighboring states and what policies are necessary to help Iowa reap the full economic benefit from solar power.

Table 1. Solar capacity installation as projected in five-year, 300 MW model

Program Year	MW annually	MW cumulative
1 (2012)	12	12
2 (2013)	35	47
3 (2014)	58	105
4 (2015)	80	185
5 (2016)	115	300

Figure 1. Installing 300 MW of Solar PV Would Create Thousands of Jobs



“Shining Bright: Growing Solar Jobs in Iowa,” was produced as a collaboration of four organizations: The Iowa Policy Project, the Iowa Environmental Council, the Environmental Law & Policy Center, and the Vote Solar Initiative.

Table 2. Iowa Would See Big Boost in Economic Activity from 300 MW of Solar Installation

Solar Economy Activity Values (Installation)						
Year	MW Installed		Industrial Output	Value Added	Labor Income	Jobs
1	12		\$ 60,031,935	\$ 34,677,480	\$ 19,561,363	501
2	35		\$ 175,093,145	\$ 101,142,651	\$ 57,053,975	1,463
3	58		\$ 290,154,354	\$ 167,607,822	\$ 94,546,588	2,424
4	80		\$ 400,212,902	\$ 231,183,202	\$ 130,409,086	3,343
5	115		\$ 575,306,046	\$ 332,325,854	\$ 187,463,062	4,805

Solar Economy Activity Values (Operation & Maintenance)						
Year	Cumulative MW Serviced Annually		Industrial Output	Value Added	Labor Income	Jobs
1	12		\$ 144,089	\$ 88,835	\$ 73,938	2
2	47		\$ 596,790	\$ 367,940	\$ 306,237	6
3	105		\$ 1,346,982	\$ 830,456	\$ 691,191	14
4	185		\$ 2,381,729	\$ 1,468,410	\$ 1,222,162	24
5	300		\$ 3,869,178	\$ 2,385,468	\$ 1,985,432	39

The Impact of Growing the Solar Industry on Iowa’s Economy

Methodology

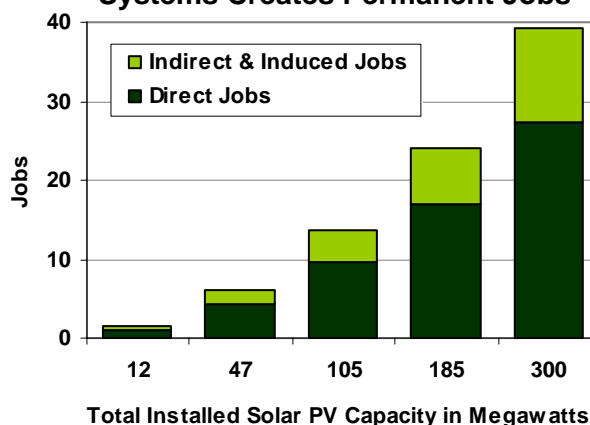
The economic model used in this report is based on the Implan input-output model built using local, Iowa-specific coefficients. Assumptions on solar costs are derived from National Renewable Energy Lab data, as well as widely respected industry forecasts on installed solar costs. Model assumptions and detailed output figures are included in Appendix A. The economic model has several conservative assumptions including no in-state manufacturing of solar systems. The actual impacts could be far greater, especially if solar manufacturing comes to Iowa.

Increasing Solar Energy Creates Jobs

Our modeling indicates that in the fifth year, with the installation of the final 115 MW, the equivalent of almost 5,000 jobs (4,805) would be created (See Fig. 1, p. 1). About 2,700 of the projected jobs would be directly associated with bringing on solar capacity. In addition, more than 2,000 other jobs would be created by indirect and induced employment resulting from the installation. The direct solar jobs are mainly associated with contracting for and installing solar panels on homes, public buildings and businesses. If for some reason

solar development stopped in the sixth year, only the operation and maintenance jobs would continue. (See Fig. 2 above.) Ongoing operation and maintenance work would sustain 27 jobs directly and the equivalent of 12 more indirect or induced jobs. The average number of jobs produced during this five-year period can also be calculated by summing the each year’s total and dividing by five. Table 3 shows a five-year program to install 300 MW of solar would create an annual average of 2,507 jobs.

Figure 2. Operating and Maintaining Solar Energy Systems Creates Permanent Jobs



The direct jobs and the indirect and induced jobs that follow are local jobs that, by their nature, are not easily outsourced.³ Growth in the solar industry means direct jobs for more than just rooftop installers, but also for electricians, builders, contractors, engineers, technicians, financiers, lawyers, marketers and salespeople.⁴ Solar manufacturing jobs have *not* been included in this analysis, but could represent significant additional benefits to Iowa's economy.⁵ In fact, solar creates more jobs per megawatt-hour than any other energy technology.⁶

Table 3. Solar Development Would Add Millions to Iowa Economy

<i>Average Yearly Economic and Jobs Benefits from Installing 300 MW of Solar in Iowa Over Five Years</i>	
Value Added	\$174 Million
Industrial Output	\$302 Million
Labor & Wages	\$99 Million
Jobs	2,507

Developing Solar Would Power the Iowa Economy

The solar industry can make a significant contribution to Iowa's economy. Our economic modeling finds during a five-year program an annual average of over \$174 million in value added to the state's economy.⁷ The industrial output during the five-year construction period averages \$302 million annually.⁸ The average annual impact of labor income or wages (a subset of value added) is nearly \$100 million.⁹

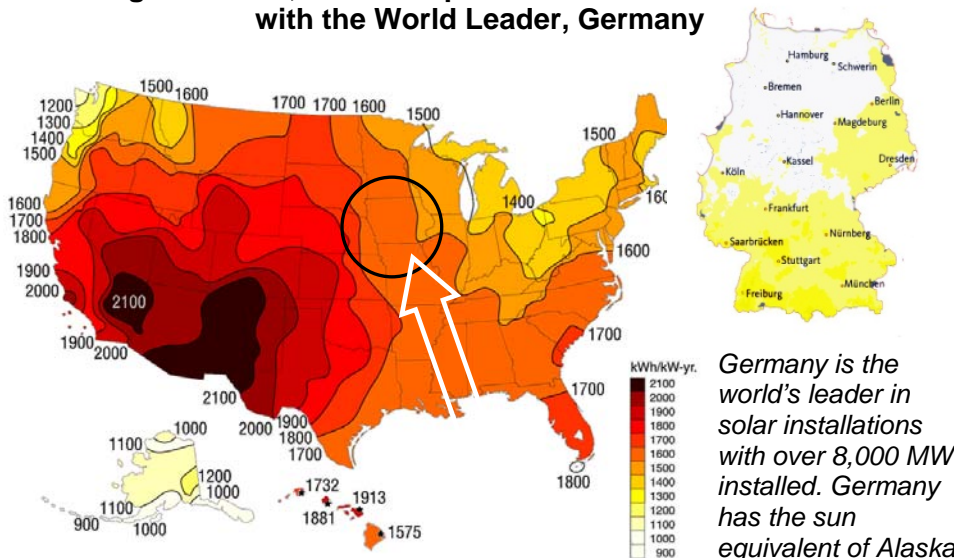
Iowa is Ready to Reap Solar's Rewards

Iowa has almost all the right ingredients to grow the solar industry and reach a target of 300 MW in five years.

Iowa has experience. Iowa has already demonstrated its ability to be a renewable energy industry leader with wind power. Iowa currently generates nearly 20 percent of its electricity from thousands of wind turbines. According to a recent ELPC study, Iowa's wind power supply chain comprises 80 Iowa companies with a total of over 2,300 employees in manufacturing alone.¹⁰ This positive experience has Iowa well-positioned to take the next step with solar.

Iowa has leaders. A solar industry is beginning to take root in Iowa. Completed solar energy projects are online and generating clean, quiet, renewable energy for schools, homes and businesses. Many more projects are on the drawing board. There are a growing number of Iowans who are trained in installing and maintaining solar systems, and a fledgling solar trade association has formed.

Figure 3. U.S., Iowa Compare Well on Solar Resources with the World Leader, Germany



Iowa has plenty of sun. While some may still believe that solar energy can only be used in states with deserts and palm trees, the abundant and ubiquitous use of solar power in places such as New Jersey demonstrates that solar energy works, and works well, in locations not known for their sun.¹¹ In fact, Iowa has a better solar resource than Germany, the country with the most installed solar

Germany is the world's leader in solar installations with over 8,000 MW installed. Germany has the sun equivalent of Alaska.

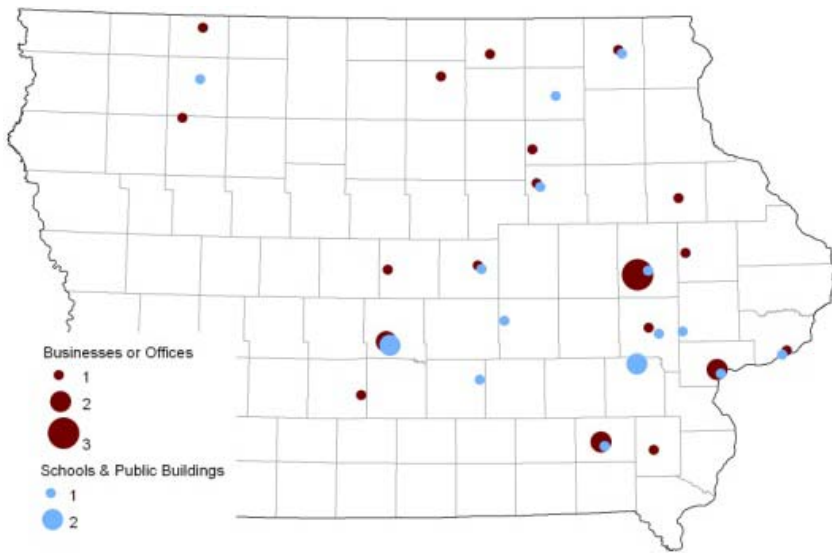
power. Iowa already depends upon the sun to fuel its primary industry — agriculture — so it is fitting for Iowans to look to the sun to fuel economic expansion.

The missing ingredient is policy. In 1983, Iowa became the first state in the country to adopt a renewable energy standard (RES). The 105 MW goal seems modest by today’s standards, but it worked to galvanize the development of Iowa’s leading wind industry. Good policy can do the same thing for solar today.

Solar is Already Providing Power Across Iowa

Solar panels are already going up across Iowa as business owners, officials and homeowners begin to understand the benefits. At least 25 Iowa businesses and nonprofits and 16 Iowa universities, colleges, community colleges, schools and libraries, and many more homes are using solar energy.

Figure 4. Many Iowa Businesses and Communities are Installing Solar
*Iowa Solar Installations in the Commercial and Public Sectors*¹²



Allsteel – Muscatine

Allsteel, a national company headquartered in Muscatine, designs, builds and delivers workplace furniture solutions. The company has a stated goal of reducing its energy consumption each year. Part of their energy saving plan was solar power. Allsteel’s own employees installed 42 solar panels totaling 9.3 kilowatts on the roof of their seating manufacturing facility. The solar array produces enough electricity to power the Muscatine plant’s seating production lines. Allsteel predicts a three-year payback on its investment.¹³



Marshalltown Public Library – Marshalltown



When Marshalltown was making plans for a new library its leaders focused on designing a “library for a new century” and becoming Leadership in Energy and Environmental Design certified. Included in this effort was the installation of Iowa’s largest solar array as of 2008 (15.75 kilowatts). The library’s roof has 90 175-watt panels. Real-time information on how much energy

is being produced is collected and available at a kiosk in the library and online. During 2010, its first full year of production, the system produced 18,385 kilowatt hours, close to 5 percent of the library's energy needs.¹⁴

Home of Holly and John Fogarty – Spencer

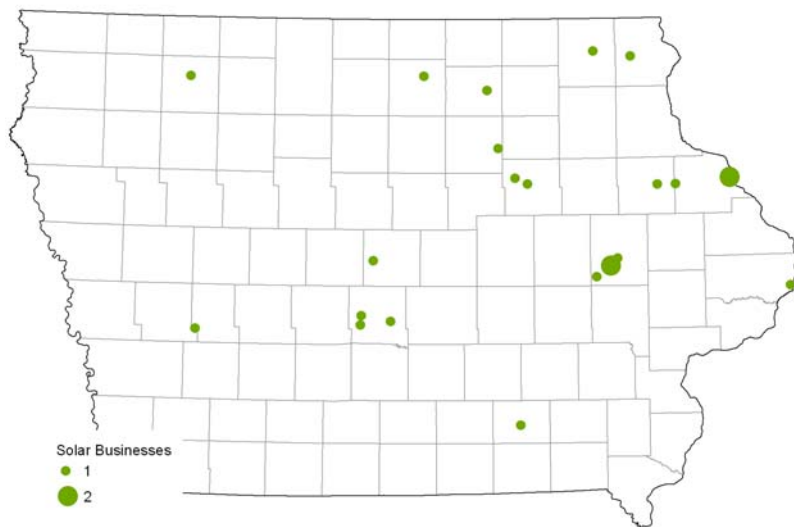
Holly and John Fogarty began harnessing the sun's energy almost 30 years ago when they installed a solar thermal system in their home. They had a great experience with their solar thermal system and wanted to try solar PV in their new home. The Fogartys also wanted to reduce their electric bill and their environmental impact, so in January 2010 they took advantage of the 30 percent federal tax credit to help pay for their system. The Fogartys' 1.84-kilowatt array provided 43 percent of their home's power in 2010. The Fogartys believe more homeowners would install solar panels if panels continue to decrease in price and if there were additional federal or state incentives.¹⁵



Iowa's Solar Businesses are Ready to Grow

Many Iowa companies are responding to the new solar market. At least 22 companies and individuals now manufacture, install or maintain solar systems. These companies range from start-ups to small businesses with more than a decade of experience installing solar systems.

Figure 5. Businesses that Provide Solar Services are Spread Across the State¹⁶



Eagle Point Solar is a solar PV and solar thermal installer located in Dubuque. The company started operations in 2010 and plans to focus on commercial and municipal installations. The company has a staff of eight but has plans for considerable growth. President and founder Barry Shear believes Iowa has tremendous potential and he intends to support domestic suppliers as much as possible, despite their higher costs.

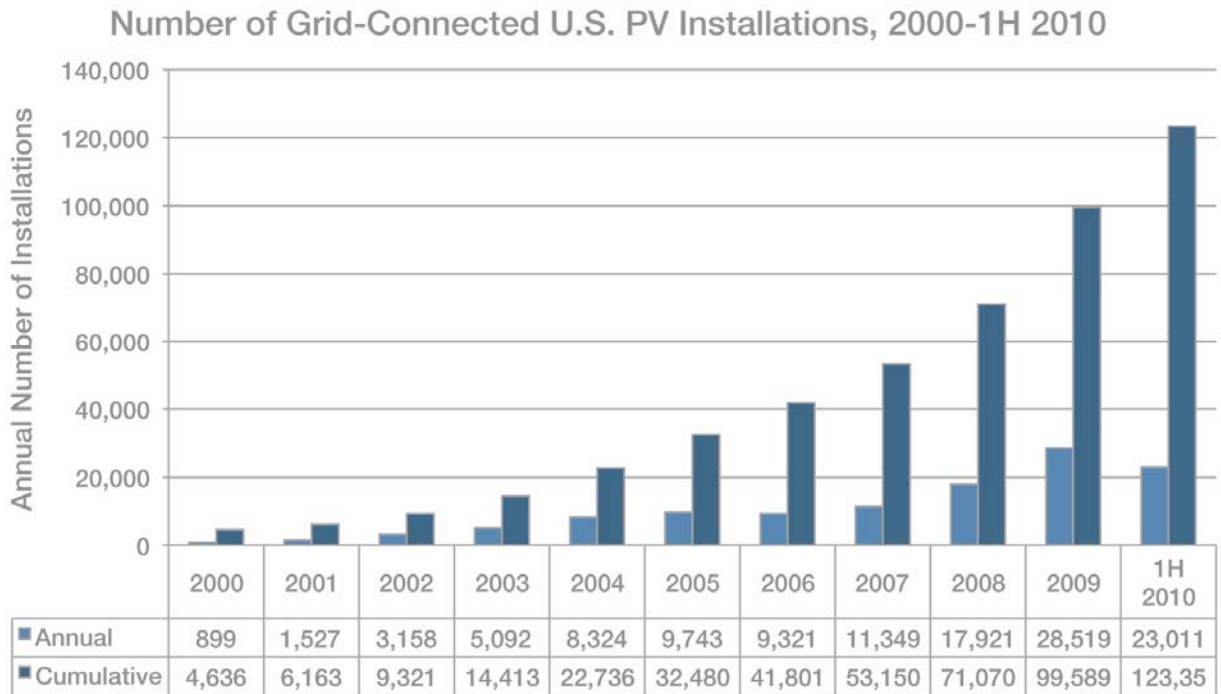
Pfoff Electric is based in Cedar Rapids and completed 10 solar installations in 2010 on residential and commercial applications and one school. Owner Stan Pfoff believes interest in solar power is picking up in Iowa but new policies to drive the industry would allow him to hire more employees to focus on solar.

Go Solar, of Decorah, has worked on over 130 solar projects in Iowa in the 15 years that owner Dennis Pottratz has been working in the business. Pottratz is currently operating the business by himself but would add staff if demand increased.

Good Policy Leads to Solar

In many places, the solar industry is booming. According to the Solar Energy Industries Association (SEIA), the U.S. PV market has grown at an average annual rate of 69 percent over the past 10 years, rising from just 3.9 MW in 2000 to 435 MW in 2009. Over 120,000 PV systems are connected to the grid in the United States. More than 20,000 of these installations were completed in the first half of 2010 alone.¹⁷ This market growth is putting thousands of people to work in highly skilled and well-paid solar industry jobs each year.¹⁸

Figure 6. Increasingly, U.S. Solar Installations are Being Connected to the Grid



Source: SEIA

Other States' Policies Promote Solar

Where solar markets are flourishing, it is because good policy has made solar energy accessible and offered reasonable incentives to drive private investment in solar technology. For example, system installation growth more than doubled in New Jersey, Florida, Arizona, Massachusetts and Texas in 2009. As reported by the Interstate Renewable Energy Council (IREC), each of these states has one or more significant financial incentives and/or a renewable energy standard (RES) program with a specific solar or customer-sited mandate.¹⁹

Eighteen states now have separate solar or distributed generation “carve-outs” within their RES programs and five states provide extra credit toward RES compliance for solar energy or distributed generation.²⁰ There are several Midwest examples, including Illinois (1.5 percent PV by 2025), Michigan (triple credit for solar electric), Missouri (0.3 percent solar electric by 2021), and Ohio (0.5 percent solar electric by 2025).²¹ Illinois’ solar carve-out alone will require more than 600 MW of new solar development by 2015.

Iowa Should Enact Solar Policies, Too

Other incentives and grant programs can be deployed in conjunction with an overarching state solar goal. For example, a bill introduced in the 2011 Iowa state legislative session would provide \$10 million in solar incentives to encourage investment by Iowa homeowners and businesses.²² There are many other options including production based incentives, tax credits and waivers, an expansion of our first-in-the-nation RES to require additional solar, and low-interest financing programs.²³ Iowa already has the essential net metering and interconnection policies in place to help facilitate customers' access to the grid and ensure they receive fair credit for the power they produce.²⁴ As the state gains more experience with solar energy, we encourage Iowa policymakers to adopt a 300 MW solar goal as a powerful tool to put Iowans to work in this vibrant new economy.²⁵

Conclusion

The economic benefits of solar energy are indisputable. Even during the recent global economic crisis, solar has proven to be a bright spot of job creation and business opportunity in states that have aggressive solar goals in place. Studies show those same state-level policies help drive down the installed cost of solar, in turn driving further demand in a virtuous cycle of market expansion.²⁶ Iowa has a choice to make: sit on the sidelines and watch as surrounding states attract the investment and jobs solar will inevitably bring, or aggressively pursue solar energy as it did decades ago with wind and become a national leader.

Notes:

¹ Environmental Law & Policy Center, *The Wind and Solar Energy Supply Chain in Ohio*, Jan. 2011 and *The Wind and Solar Energy Supply Chain in Michigan*, forthcoming. (available at <http://elpc.org/2010/11/30/the-wind-energy-supply-chain-new-jobs-and-clean-energy-for-the-midwest>).

² Vote Solar modeling predicts a rate impact of no more than 2 percent, which is equal to approximately \$1.70 per month for the average residential customer

³ Construction period jobs are inherently short-term. One construction period job is defined as one 2,080-hour working period or one full-time job for 1 year. The annual construction period employment impact varies depending on the length of the construction/installation process and the number of individuals employed. Two construction period jobs can be satisfied by one worker working two years or two workers 1 year. Construction period jobs include direct, indirect and induced employment opportunities.

⁴ California Centers of Excellence 2007 Solar Jobs Study, John Carrese.

⁵ While the solar industry has a global manufacturing base, proximity to market is one significant factor in locating new manufacturing plants. It is possible that investments in solar markets could bring solar supply chain manufacturing to Iowa.

⁶ Testimony before the US Senate Hearing on Environment and Public Works, Prof. Dan Kammen, University of California - Berkeley (Sept. 25 2007).

⁷ Value added is composed of wages and salaries to workers, returns to management to sole proprietors, incomes from properties and other investments and indirect tax payments that are part of the industrial production processes. Value added is the same thing as Gross Regional Product, and it is the standard manner in which we gauge the size of an economic activity, especially on a comparative basis.

⁸ Total industrial output is the value of what is produced in the industries that are evaluated.

⁹ Labor income is a subset of value added. It is composed of the payments to workers and the proprietors' incomes. Labor incomes are useful for regional analysis because very large fractions of them accumulate to resident workers, whereas incomes from investments, for example, mostly accumulate out of the region of scrutiny.

¹⁰ Environmental Law & Policy Center, *The Wind Energy Supply Chain in Iowa*, Nov. 2010 (available at <http://elpc.org/wp-content/uploads/2010/11/IowaWindSupplyChainReportDownload.pdf>).

¹¹ New Jersey, through the use of aggressive incentive programs, went from having a few kilowatts (kW) of installed capacity in 2001 to 200 megawatts (MW) at the end of 2010. 2011 could bring a tripling of total capacity. Source: http://www.pv-magazine.com/news/details/beitrag/sreccs--competitive-strategies-and-the-new-jersey-solar-market_100002090/.

¹² Based on information collected by the Iowa Environmental Council and Iowa Policy Project.

¹³ Personal communication with Allsteel staff, Mary Palmer and Kirsten Minino and http://www.allsteeloffice.com/NR/rdonlyres/0CC02957-5868-45A2-AE2F-5AC7DA00E2C9/0/Solar_Panels_FINAL.pdf.

¹⁴ Personal communication with Library's director, Glenda Davis-Driggs and <http://wwaw.marshalltownlibrary.org/green.html>.

¹⁵ Personal communication with Holly Fogarty and Paul Rekow.

¹⁶ Based on information collected by the Iowa Environmental Council and Iowa Policy Project.

¹⁷ SEIA, U.S. Solar Market Insight 2d Quarter 2010 (available at http://seia.org/galleries/pdf/SEIA_Q2_2010_EXEC_SUMMARY.pdf).

¹⁸ SEIA estimates that the solar industry added over 10,000 people between 2008 and 2009, when many industries were struggling in the face of a prolonged recession. SEIA, U.S. Solar Industry Year in Review 2009.

¹⁹ IREC, U.S. Solar Market Trends 2009 (available at http://irecusa.org/wp-content/uploads/2010/07/IREC-Solar-Market-Trends-Report-2010_7-27-10_web1.pdf).

²⁰ SEIA, U.S. Solar Industry Year in Review 2009. (available at <http://www.seia.org/galleries/default-file/2009%20Solar%20Industry%20Year%20in%20Review.pdf>).

²¹ DSIRE Solar, RPS Policy Map (available at <http://www.dsireusa.org/solar/summarymaps/>)

²² Senate File 99, 84th General Assembly (available at <http://coolice.legis.state.ia.us/Cool-ICE/default.asp?Category=billinfo&Service=Billbook&menu=false&hbill=SF99>).

²³ For a comprehensive overview of state, local, utility, and federal incentives and policies that promote solar energy, see the Database of State Incentives for Renewables and Efficiency (DSIRE) Solar Portal - <http://www.dsireusa.org/solar/>.

²⁴ See 199 Iowa Admin. Code 45 (2011).

²⁵ For example, see House File 477, 84th General Assembly (available at <http://coolice.legis.state.ia.us/Cool-ICE/default.asp?Category=billinfo&Service=Billbook&menu=false&hbill=hf477>).

²⁶ Tracking the Sun III: The Installed Cost of Photovoltaics in the U.S. from 1998-2008. Wisner, R., G. Barbose, C. Peterman, and N. Darghouth. LBNL-2674E. December 2009.

APPENDIX A

The solar industry has the potential to produce thousands of jobs

Those knowledgeable about the solar industry in Iowa were queried about a reasonable ramp up for the industry over the next five years. The cumulative megawatts (MW) installed in year three was designed to be reasonable and to mimic the policy that established a wind industry in Iowa. Thirty years ago, in 1983, the original renewable electricity requirement was passed by the legislature and signed by Governor Branstad. Tying solar policy to the previous wind power policy is meant to remind policy makers that small beginnings can lead to a powerful new industry.

The proposed levels of new Iowa solar photovoltaic (PV) installation over the next five years are (Table 1):

Table 1

Program Year	MW installed	MW cumulative
1 (2012)	12	12
2 (2013)	35	47
3 (2014)	58	105
4 (2015)	80	185
5 (2016)	115	300

The total MW installed in each year would be split 57 percent in school systems or other suitable public institutions, with the remaining 43 percent to be installed as residential retrofits.

There are two types of economic values that will be measured. The first is the annual value and labor associated with installing the program year MW goals. The second is the annual value and labor required to maintain the installed PV systems and keep them in good working order.

The initial technical coefficients for this evaluation were derived from the National Research Energy Laboratory JEDI impact model for PV systems. In conducting the Iowa analysis, only the original technical, labor, and cost coefficients from the JEDI framework were used as the study had access to more precise Iowa-specific numbers. Two separate industries in a state of Iowa input output model (2009 IMPLAN for Iowa) were modified to be the proxy industries for the two types of installation firms. Those industrial sectors in the IMPLAN model were adjusted to reflect the respective labor income costs, labor requirements, estimated value added production, as well as all other typical overhead costs.

Conservative Assumptions

In building the IMPLAN sectors it was determined that the installed PV systems originated as whole units external to the Iowa economy, so there is no PV module or complementary parts purchases in-state. This is a very conservative assumption and the job estimates in this analysis should be considered to be the minimum associated with MWs of solar technology we used in the analysis. All other costs of operation, however, were assigned the regional purchasing coefficients that were embedded within the respective sectors and modified for this analysis. The engineering and other research required to develop the initial PV technical and cost assumptions are assumed to be reliable and research based. The total installed costs for the public institutions

and for the residential applications were derived by averaging estimates from several sources (Table 2).

Table 2

Installed Cost Assumptions - 2009 Base Year

Estimate Source -->		JEDI	Bal Energy	Grn World	Prod LED	Average
Res - Retro	\$	7.09	\$ 7.07	\$ 7.66	\$ 7.08	\$ 7.23
Small institution	\$	7.56	\$ 6.47	\$ 6.76	\$ 6.25	\$ 6.76

Installed costs for residential retrofits were set at \$7,230 per kilowatt (kW), and small institution costs were put at \$6,760. The initial table of JEDI coefficients was adjusted so that the respective table of inputs summed to the appropriate cost per kW assumption.

As stated above all PV systems were assumed be manufactured out of state. All other costs of operation, however, were assigned the regional purchasing coefficients that were embedded within the respective sectors and modified for this analysis. Values for year one are contained in Table 3. While small institution total costs would be \$46.24 million, only \$19.325 million accrues to the state of Iowa.¹

Table 3

Year 1 Values for Modeling: 12 MW Installed

	Small Institutions	Residential Retrofits
Total Cost	\$ 46,238,400	\$ 37,306,800
Iowa Output	19,325,179	18,990,431
Iowa Supplied Inputs	7,456,745	9,012,438
Value Added	11,868,434	9,977,993
Earnings	7,162,902	6,248,857
Profit	1,570,885	1,126,113
Other	703,441	805,281
Production taxes/fees	2,431,206	1,797,742
Jobs	135	152

Basic assumptions were also built into the modeling process regarding the necessity to annually maintain the installed systems. Those amounts are found in Table 4. As is readily evident, the annual O & M labor requirements for these systems are comparatively meager.

¹ Distributor / installer firms receive a 5 percent mark-up on the PV systems as a nominal return within the value added component of the modeling assumptions.

Table 4

Year 1 Values for Modeling: 12 MW Maintained

	Small Institutions	Residential Retrofits
Iowa Output	\$ 66,830	\$ 42,013
Iowa Supplied Inputs	28,487	17,909
Value Added	38,342	24,104
Labor Income	33,489	20,960
Jobs	0.6	0.4

The IMPLAN model, suitably modified, produced sets of multipliers for the two installation systems as well as one set for the maintenance of the PV systems (Table 5). These are the coefficients that were applied to the initial direct values for each estimation year to arrive at the annual total economic impact of either the installation activity or the annual maintenance.

Table 5

	Type Total Multipliers			
	Output	Value Added	Labor Income	Jobs
Institutions	1.5448	1.5279	1.4206	1.7949
Residential retro	1.5891	1.6580	1.5020	1.6999
Annual maintenance	1.3238	1.4226	1.3616	1.4295

Impacts

The following figures show the annual job value of PV systems installations (Figure 1) and, separately, the jobs required to annually maintain the installed systems (Figure 2). Direct jobs are those required for the actual installation of the units. Indirect jobs occur as the installing firm demands inputs into its business from in-state firms. Induced jobs accumulate when workers convert their incomes into household spending. The sum of direct, indirect, and induced jobs represents the annual number of jobs that would be supported from the PV purchases annually.

Figure 1

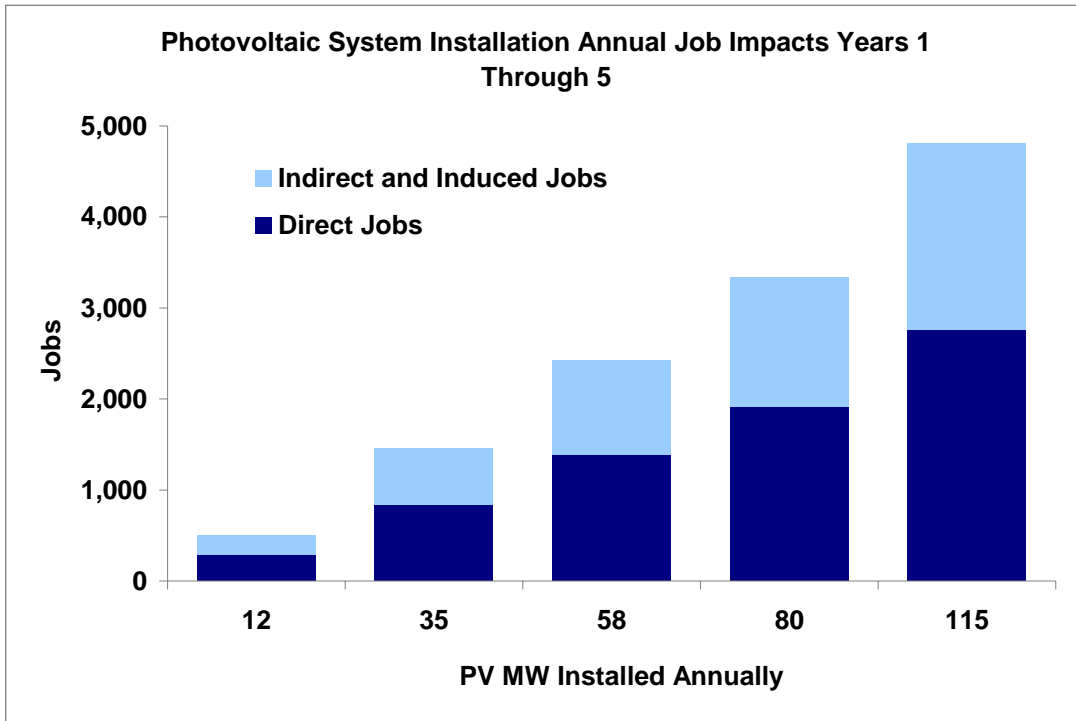
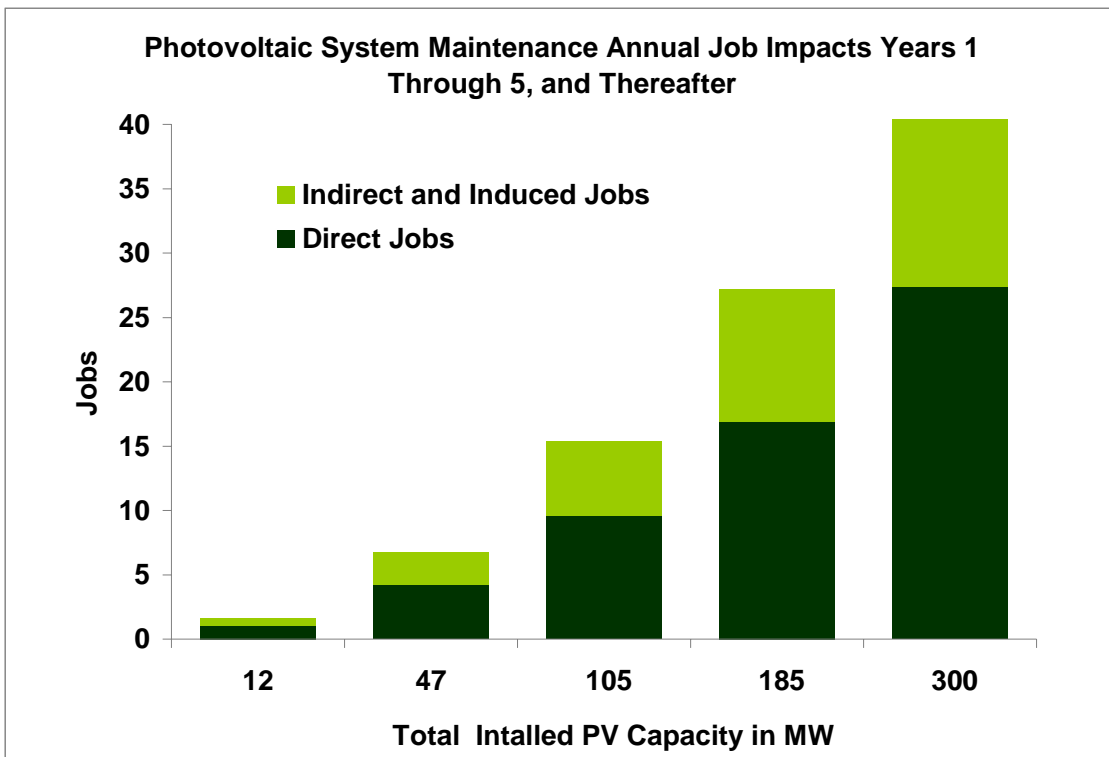
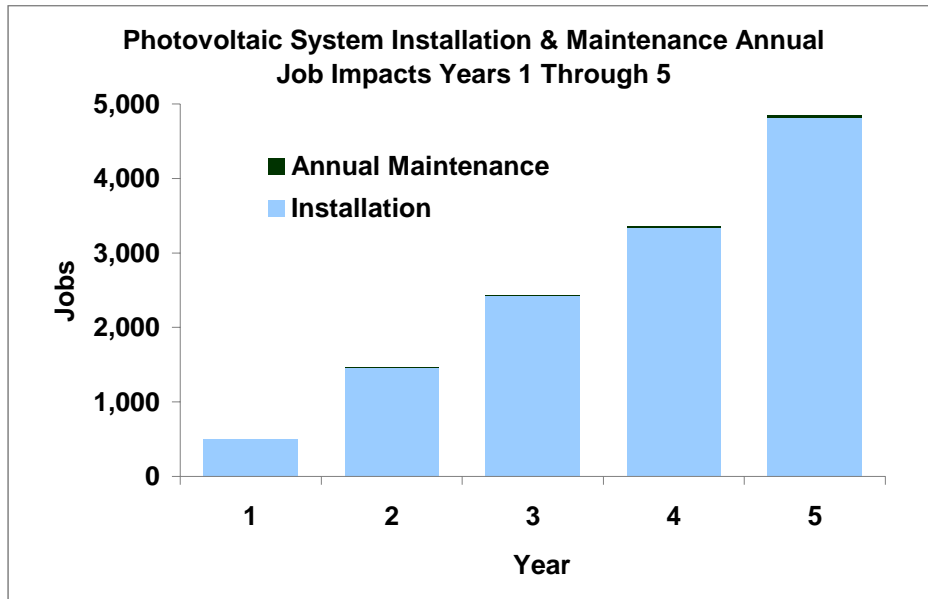


Figure 2



Readers of course notice the comparatively much smaller number of jobs generated by annual maintenance operations as compared to installation labor requirements demonstrated in Figure 3.

Figure 3



Summary

Direct, indirect, induced and total impacts are contained in Table 6 through Table 8 shown below. In year five, assuming 115 MW of solar PV systems are installed, the Iowa economy would see 4,805 jobs earning \$187.46 million in labor incomes. Value added (or state gross domestic product), of which labor income is a subset, would be \$332.3 million. Total statewide industrial output would be \$575.3 million (Table 8). Maintaining the installed systems would add 39.2 jobs to the state's economy earning \$1.985 in labor incomes. Value added would be boosted by \$2.86 million, and total state output would be \$3.87 million (Table 8).

Table 6 Direct Values

Base Data			Installation Direct Values				Annual O & M Direct Values			
Year	MW	Total Small Insitution Cost	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs
1	6.8	\$ 46,238,400	\$ 19,325,179	\$ 11,868,434	\$ 7,162,902	135.3	\$ 66,830	\$ 38,342	\$ 33,341	0.6
2	20.0	\$ 134,862,000	\$ 56,365,107	\$ 34,616,266	\$ 20,891,798	394.7	\$ 261,749	\$ 150,173	\$ 130,585	2.5
3	33.1	\$ 223,485,600	\$ 93,405,034	\$ 57,364,099	\$ 34,620,693	654.1	\$ 584,759	\$ 335,494	\$ 291,733	5.5
4	45.6	\$ 308,256,000	\$ 128,834,530	\$ 79,122,895	\$ 47,752,680	902.3	\$ 1,030,290	\$ 591,108	\$ 514,007	9.7
5	65.6	\$ 443,118,000	\$ 185,199,637	\$ 113,739,161	\$ 68,644,478	1,297.0	\$ 1,670,740	\$ 958,553	\$ 833,524	15.7
Year	MW	Total Residential Cost	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs
1	5.2	\$ 37,306,800	\$ 18,990,431	\$ 9,977,993	\$ 6,248,857	152.1	\$ 42,013	\$ 24,104	\$ 20,960	0.4
2	15.1	\$ 108,811,500	\$ 55,388,756	\$ 29,102,480	\$ 18,225,834	443.5	\$ 189,057	\$ 108,468	\$ 94,320	1.8
3	24.9	\$ 180,316,200	\$ 91,787,082	\$ 48,226,967	\$ 30,202,810	735.0	\$ 432,731	\$ 248,271	\$ 215,888	4.1
4	34.4	\$ 248,712,000	\$ 126,602,872	\$ 66,519,955	\$ 41,659,048	1,013.8	\$ 768,834	\$ 441,103	\$ 383,567	7.2
5	49.5	\$ 357,523,500	\$ 181,991,628	\$ 95,622,435	\$ 59,884,882	1,457.3	\$ 1,251,980	\$ 718,298	\$ 624,607	11.7
Year	MW	Total Cost	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs
1	12	\$ 83,545,200	\$ 38,315,610	\$ 21,846,427	\$ 13,411,759	287.4	\$ 108,842	\$ 62,446	\$ 54,301	1.0
2	35	\$ 243,673,500	\$ 111,753,863	\$ 63,718,747	\$ 39,117,631	838.3	\$ 450,807	\$ 258,641	\$ 224,905	4.2
3	58	\$ 403,801,800	\$ 185,192,116	\$ 105,591,066	\$ 64,823,503	1,389.2	\$ 1,017,491	\$ 583,764	\$ 507,621	9.5
4	80	\$ 556,968,000	\$ 255,437,402	\$ 145,642,850	\$ 89,411,729	1,916.1	\$ 1,799,123	\$ 1,032,210	\$ 897,574	16.9
5	115	\$ 800,641,500	\$ 367,191,265	\$ 209,361,596	\$ 128,529,360	2,754.4	\$ 2,922,721	\$ 1,676,851	\$ 1,458,131	27.4

Table 7 Indirect and Induced Values

Installation Indirect and Induced Values						Annual O & M Indirect and Induced Values			
Year	MW	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs
1	6.8	\$ 10,529,124	\$ 6,265,897	\$ 3,012,747	107.6	\$ 21,641	\$ 16,203	\$ 12,057	0.3
2	20.0	\$ 30,709,945	\$ 18,275,533	\$ 8,787,179	313.8	\$ 84,762	\$ 63,461	\$ 47,223	1.1
3	33.1	\$ 50,890,766	\$ 30,285,169	\$ 14,561,610	520.0	\$ 189,361	\$ 141,775	\$ 105,499	2.4
4	45.6	\$ 70,194,160	\$ 41,772,647	\$ 20,084,980	717.2	\$ 333,636	\$ 249,795	\$ 185,879	4.2
5	65.6	\$ 100,904,105	\$ 60,048,180	\$ 28,872,158	1,031.0	\$ 541,031	\$ 405,073	\$ 301,426	6.7
Annual O & M Indirect and Induced Values									
Year	MW	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs
1	5.2	\$ 11,187,201	\$ 6,565,156	\$ 3,136,857	106.4	\$ 13,605	\$ 10,186	\$ 7,580	0.2
2	15.1	\$ 32,629,336	\$ 19,148,371	\$ 9,149,165	310.4	\$ 61,222	\$ 45,837	\$ 34,109	0.8
3	24.9	\$ 54,071,472	\$ 31,731,587	\$ 15,161,474	514.4	\$ 140,130	\$ 104,916	\$ 78,071	1.7
4	34.4	\$ 74,581,340	\$ 43,767,706	\$ 20,912,378	709.6	\$ 248,969	\$ 186,405	\$ 138,709	3.1
5	49.5	\$ 107,210,677	\$ 62,916,077	\$ 30,061,543	1,020.0	\$ 405,425	\$ 303,544	\$ 225,875	5.0
Annual O & M Indirect and Induced Values									
Year	MW	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs
1	12	\$ 21,716,325	\$ 12,831,053	\$ 6,149,604	214.0	\$ 35,246	\$ 26,389	\$ 19,637	0.4
2	35	\$ 63,339,281	\$ 37,423,904	\$ 17,936,344	624.2	\$ 145,984	\$ 109,299	\$ 81,332	1.8
3	58	\$ 104,962,238	\$ 62,016,756	\$ 29,723,084	1,034.4	\$ 329,491	\$ 246,692	\$ 183,570	4.1
4	80	\$ 144,775,500	\$ 85,540,353	\$ 40,997,358	1,426.8	\$ 582,605	\$ 436,199	\$ 324,588	7.3
5	115	\$ 208,114,782	\$ 122,964,257	\$ 58,933,702	2,051.0	\$ 946,457	\$ 708,617	\$ 527,301	11.8

Table 8 Total Values

		Installation Total Values				Annual O & M Total Values				
Year	MW	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs	Cumulative MW
1	6.8	\$ 29,854,303	\$ 18,134,331	\$ 10,175,649	242.9	\$ 88,471	\$ 54,545	\$ 45,398	0.9	6.8
2	20.0	\$ 87,075,052	\$ 52,891,800	\$ 29,678,976	708.5	\$ 346,511	\$ 213,635	\$ 177,809	3.5	26.8
3	33.1	\$ 144,295,800	\$ 87,649,268	\$ 49,182,304	1,174.1	\$ 774,120	\$ 477,269	\$ 397,232	7.8	59.9
4	45.6	\$ 199,028,690	\$ 120,895,542	\$ 67,837,660	1,619.5	\$ 1,363,926	\$ 840,902	\$ 699,886	13.8	105.5
5	65.6	\$ 286,103,742	\$ 173,787,341	\$ 97,516,636	2,328.0	\$ 2,211,772	\$ 1,363,626	\$ 1,134,950	22.4	171.0
Year	MW	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs	Cumulative MW
1	5.2	\$ 30,177,632	\$ 16,543,149	\$ 9,385,714	258.5	\$ 55,618	\$ 34,290	\$ 28,540	0.6	5.2
2	15.1	\$ 88,018,093	\$ 48,250,852	\$ 27,374,999	754.0	\$ 250,279	\$ 154,305	\$ 128,429	2.5	20.2
3	24.9	\$ 145,858,554	\$ 79,958,554	\$ 45,364,284	1,249.4	\$ 572,862	\$ 353,187	\$ 293,959	5.8	45.2
4	34.4	\$ 201,184,212	\$ 110,287,661	\$ 62,571,426	1,723.4	\$ 1,017,803	\$ 627,507	\$ 522,276	10.3	79.6
5	49.5	\$ 289,202,305	\$ 158,538,512	\$ 89,946,425	2,477.3	\$ 1,657,406	\$ 1,021,842	\$ 850,482	16.8	129.0
Year	MW	Output	Value Added	Labor Income	Jobs	Output	Value Added	Labor Income	Jobs	Cumulative MW
1	12	\$ 60,031,935	\$ 34,677,480	\$ 19,561,363	501.4	\$ 144,089	\$ 88,835	\$ 73,938	1.5	12.0
2	35	\$ 175,093,145	\$ 101,142,651	\$ 57,053,975	1,462.5	\$ 596,790	\$ 367,940	\$ 306,237	6.0	47.0
3	58	\$ 290,154,354	\$ 167,607,822	\$ 94,546,588	2,423.6	\$ 1,346,982	\$ 830,456	\$ 691,191	13.6	105.0
4	80	\$ 400,212,902	\$ 231,183,202	\$ 130,409,086	3,342.9	\$ 2,381,729	\$ 1,468,410	\$ 1,222,162	24.1	185.0
5	115	\$ 575,306,046	\$ 332,325,854	\$ 187,463,062	4,805.3	\$ 3,869,178	\$ 2,385,468	\$ 1,985,432	39.2	300.0