Supplementary information

A BREAK-EVEN ANALYSIS AND IMPACT ANALYSIS OF RESIDENTIAL SOLAR PHOTOVOLTAIC SYSTEMS CONSIDERING STATE SOLAR INCENTIVES

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Table S1A. Solar incentives by target cities in each state

State	City	Tax incentives				Cash incentives						No. of incentives
		State income tax credit (%)		PTE[a] (%)	STE[b] (%)	Capacity-based incentives ($/kW)			Performance-based incentives ($/kWh)			
		Amount	Cap			Amount	Cap	Type	Amount	Cap	Type	
AK	Anchorage	–	–	–	–	–	–	–	–	–	–	0
AL	Birmingham	–	–	–	–	–	–	–	–	–	–	0
AR	Little Rock	–	–	–	–	–	–	–	–	–	–	0
AZ	Phoenix	25%	$1,000	100%	100%	$100/kW	$50,000 or 50% of costs	URP[c]	–	–	–	4
CA	Los Angeles	–	–	100%	–	$200/kW	–	SRP[d]	–	–	–	2
CO	Denver	–	–	100%	100%	$1,000/kW	$10,000	URP	$0.07	10 yrs	UP[e]	4
CT	Bridgeport	–	–	100%	100%	$1,750/kW	$11,500	SRP	–	–	–	3
DC	District of Columbia	–	–	100%	–	$500/kW	$10,000	SRP	$397/SREC	15 yrs	SREC[f]	3
DE	Wilmington	–	–	–	100%	$1,250/kW	$15,000	SRP	$235/SREC $50/yr flat	1–10 yrs 11–20 yrs	SREC	3
FL	Miami	–	–	100%	100%	$2,000/kW	$20,000	URP	–	–	–	3
GA	Atlanta	35%	$10,500	–	–	–	–	–	$0.17	5 yrs	UP	2
HI	Honolulu	35%	$5,000	100%	–	–	–	–	–	–	–	2
IA	Des Moines	15%	$3,000	100%	100%	$6,031[h]	$4,500	URP	–	–	–	4
ID	Boise	$390/yr[i]	4 yrs $5,000/yr	–	–	–	–	–	–	–	–	1
IL	Chicago	–	–	100%	–	$1,500/kW	$10,000	SRP	$105/SREC	15 yrs	SREC	3
IN	Indianapolis	–	–	100%	100%	$2,000/kW	$4,000	URP	–	–	–	3
KS	Wichita	–	–	100%	–	–	–	–	–	–	–	1
KY	Louisville	$3,000/kWh[j]	$500	–	–	–	–	–	–	–	–	1
LA	New Orleans	50%	$12,500	100%	–	–	–	–	–	–	–	2
MA	Boston	15%	$1,000	100%	100%	$400/kW	$4,250	SRP	$256.5/SREC	15 yrs	SREC	5
MD	Baltimore	–	–	100%	100%	$1,000 flat	–	SRP	$175/SREC	15 yrs	SREC	4
ME	Portland	–	–	–	–	–	–	–	–	–	–	0
MI	Detroit	–	–	–	–	$200/kW	–	URP	$0.03	17 yrs	UP	2
MN	Minneapolis	–	–	100%	100%	$1,500/kW	$90,000 or 60% of costs	URP	–	–	–	3
MO	Kansas city	–	–	–	–	$2,000/kW	$50,000	URP	–	–	–	1
MS	Jackson	–	–	–	–	–	–	–	–	–	–	0
MT	Billings	$500 /taxpayer	$1,000	100%	–	$3,000/kW	$6,000	URP	–	–	–	3
NC	Charlotte	35%	$10,500	80%	–	–	–	–	$100/SREC	15 yrs	SREC	3
ND	Fargo	–	–	100%	–	–	–	–	–	–	–	1

Table S1B. Solar incentives by target cities in each state (Cont'd)

State	City	Tax incentives				Cash incentives						No. of incentives
		State income tax credit (%)		PTE[a] (%)	STE[b] (%)	Capacity-based incentives ($/kW)			Performance-based incentives ($/kWh)			
		Amount	Cap			Amount	Cap	Type	Amount	Cap	Type	
NE	Omaha	0.005/kWh[d]	10 yrs	–	–	–	–	–	–	–	–	1
NH	Manchester	–	–	100%	–	$750/kW	$3,750 or 50% of costs	SRP	–	–	–	3
NJ	Newark	–	–	100%	100%	–	–	–	$192/SREC	15 yrs	SREC	3
NM	Albuquerque	10%	$9,000	100%	100%	–	–	–	$0.04	8 yrs	UP	4
NV	Las Vegas	–	–	100%	–	$1,250/kW	$12,500	SRP	–	–	–	2
NY	New York City	25%	$5,000	100%	100%	$1,400/kW	$9,800 or 40% of costs	SRP	–	–	–	4
OH	Columbus	–	–	100%	100%	$1,500/kW	$12,000 or 50% of costs	URP	$156/SREC	15 yrs	SREC	4
OK	Oklahoma City	–	–	–	–	–	–	–	–	–	–	0
OR	Portland	$2,100	$6,000 or 50% of costs	100%	100%	$750/kW	$5,000	SRP	–	–	–	4
PA	Philadelphia	–	–	–	–	$750/kW	$7,500 or 35% of costs	SRP	$97/SREC	15 yrs	SREC	2
RI	Providence	25%	$10,000	100%	100%	–	–	–	–	–	–	3
SC	Columbia	25%	$3,500	–	–	–	–	–	$0.10	–	SP[g]	2
SD	Sioux Falls	–	–	100%	–	–	–	–	–	–	–	1
TN	Memphis	–	–	–	–	$1,000 flat	–	URP	$0.19	20 yrs	UP	2
TX	San Antonio	–	–	100%	–	$1,600/kW	$25,000 or 50% of costs	URP	–	–	–	2
UT	Salt Lake City	25%	$2,000	–	–	–	–	–	–	–	–	1
VA	Virginia Beach	–	–	–	–	–	–	–	–	–	–	0
VT	Burlington	–	–	100%	100%	$450/kW	$4,500	SRP	–	–	–	3
WA	Seattle	–	–	–	100%	–	–	–	$0.15	8 yrs $5,000/yr	SP[e]	2
WI	Milwaukee	–	–	100%	100%	$600/kW	$2,400	SRP	–	–	–	3
WV	Charleston	–	–	–	–	–	–	–	–	–	–	0
WY	Cheyenne	–	–	–	–	–	–	–	–	–	–	0

Note: [a] PTE refers to property tax exemption; [b]STE refers to sales tax exemption; [c]URP refers to utility rebate program; [d]SRP refers to state rebate program; [e]UP refers to utility program; [f]SREC refers to solar renewable energy certificates; [g]SP refers to state program; [h]The state offers capacity-based incentives based on the estimated electricity generation in the first year ($0.75/kWh(incentive rate)×7,540kWh(estimated electricity generation in the first year) = $6,031); [i]The state offers income tax deduction (40% in the first year, 20% per year for next three years (cap: $5,000/yr) instead of state income tax credit ($5,000/yr(cap)×7.8%(sales tax rate) = $390/yr); and [j]The state offers state income tax credit based on the electricity generation of the solar PV system.

Table S2. Profile of the panel and inverter in the PV system (Yingli Solar, SMA)

Classification		Photovoltaic panel	Photovoltaic inverter
Model name		YL250P-29b	Sunny Boy 6000TL-US
Power capacity (w)		250	6,000
Module efficiency (%)		15.3	97.0
Size	Width (B)	1,650mm	–
	Length(A)	990mm	–
	Thickness	40mm	–

Table S3. Nominal interest rate and inflation rate from 2002 to 2012

Category	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Nominal interest rate	5.43%	4.96%	5.04%	4.64%	5.00%	4.91%	4.36%	4.11%	4.03%	3.62%	2.54%	4.42%
Inflation rate	1.60%	2.30%	2.70%	3.40%	3.20%	2.80%	3.80%	–0.40%	1.60%	3.20%	2.10%	2.39%

Table S4A. Electricity price growth rate and real discount rate for electricity by state

State	City	Electricity price growth rate												Real discount rate for electricity
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average	
AK	Anchorage	−0.58%	−0.70%	4.01%	6.78%	11.86%	2.02%	9.45%	3.06%	−5.15%	8.70%	1.15%	3.69%	0.70%
AL	Birmingham	1.03%	3.91%	3.15%	4.59%	8.69%	7.16%	11.51%	2.59%	0.67%	3.62%	1.74%	4.42%	0.00%
AR	Little Rock	−6.19%	−0.06%	1.74%	8.26%	10.58%	−0.84%	6.58%	−1.62%	−2.72%	1.42%	2.79%	1.81%	2.56%
AZ	Phoenix	−0.23%	0.76%	1.77%	4.51%	5.66%	2.98%	6.54%	4.43%	1.84%	1.41%	1.68%	2.85%	1.52%
CA	Los Angeles	4.62%	−3.06%	−0.55%	2.39%	14.12%	0.89%	−4.10%	6.61%	0.37%	0.07%	5.04%	2.40%	1.97%
CO	Denver	−1.31%	10.39%	3.42%	7.55%	−0.47%	2.88%	9.12%	−1.48%	10.44%	1.90%	0.96%	3.95%	0.46%
CT	Bridgeport	0.45%	3.56%	2.44%	17.43%	23.87%	13.13%	2.51%	3.81%	−5.27%	−6.07%	−4.14%	4.70%	−0.27%
DC	District of Columbia	0.66%	−0.40%	2.23%	14.35%	8.65%	12.63%	14.32%	8.55%	1.78%	−3.80%	−8.45%	4.59%	−0.17%
DE	Wilmington	0.49%	−0.54%	2.00%	2.43%	32.15%	10.93%	6.06%	1.06%	−1.71%	−0.96%	−1.00%	4.63%	−0.20%
FL	Miami	−4.94%	4.64%	5.30%	6.77%	17.61%	−0.90%	3.65%	6.63%	−7.55%	0.34%	0.22%	2.89%	1.49%
GA	Atlanta	−1.28%	1.36%	1.92%	9.50%	2.70%	2.36%	9.11%	2.38%	−0.57%	9.53%	−0.71%	3.30%	1.08%
HI	Honolulu	−4.43%	7.23%	7.82%	14.48%	12.92%	3.23%	34.87%	−25.65%	16.32%	23.52%	7.47%	8.89%	−4.10%
IA	Des Moines	−1.17%	3.01%	4.63%	3.23%	4.02%	−1.96%	0.90%	5.22%	4.53%	0.27%	3.24%	2.36%	2.02%
ID	Boise	8.93%	−5.57%	−1.60%	2.93%	−1.48%	2.59%	10.13%	10.99%	2.43%	−1.48%	7.48%	3.21%	1.17%
IL	Chicago	−3.89%	0.47%	−0.08%	−0.79%	1.00%	20.74%	9.60%	1.87%	1.89%	2.75%	−3.19%	2.76%	1.62%
IN	Indianapolis	−0.55%	2.32%	3.47%	2.79%	9.46%	0.45%	7.85%	6.77%	0.97%	4.88%	3.16%	3.78%	0.62%
KS	Wichita	−0.16%	0.89%	0.76%	1.73%	4.36%	−0.37%	8.34%	8.19%	4.87%	5.84%	4.77%	3.57%	0.82%
KY	Louisville	0.92%	3.39%	5.03%	7.22%	6.81%	4.71%	8.28%	5.02%	2.99%	7.17%	1.13%	4.79%	−0.35%
LA	New Orleans	−11.39%	10.57%	2.71%	10.38%	3.30%	2.88%	8.71%	−20.13%	10.37%	−0.62%	−6.12%	0.97%	3.42%
MA	Boston	−12.38%	6.15%	1.22%	14.34%	23.40%	−2.13%	9.12%	−4.64%	−13.57%	0.49%	1.93%	2.17%	2.20%
MD	Baltimore	0.26%	0.60%	0.86%	7.94%	15.06%	22.57%	16.51%	8.10%	−4.61%	−6.73%	−3.59%	5.18%	−0.72%
ME	Portland	−2.40%	−3.33%	−1.96%	9.59%	3.36%	19.94%	−2.07%	−3.62%	0.58%	−2.16%	−4.35%	1.23%	3.15%
MI	Detroit	0.23%	1.08%	−0.13%	0.44%	16.43%	4.59%	5.16%	8.43%	7.04%	6.60%	6.39%	5.11%	−0.66%
MN	Minneapolis	−1.53%	2.37%	3.73%	4.29%	4.86%	5.84%	6.28%	3.13%	5.55%	3.62%	3.49%	3.78%	0.61%
MO	Kansas city	0.44%	−0.62%	0.18%	1.03%	4.78%	3.36%	5.50%	6.66%	5.82%	6.98%	2.63%	3.34%	1.04%
MS	Jackson	−1.17%	4.45%	7.89%	6.45%	11.16%	−3.10%	10.47%	−0.97%	−3.31%	3.30%	0.03%	3.20%	1.18%

Table S4B. Electricity price growth rate and real discount rate for electricity by state (Cont'd)

State	City	Electricity price growth rate												Real discount rate for electricity
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average	
MT	Billings	5.08%	4.56%	4.26%	2.99%	2.02%	6.12%	4.29%	−2.36%	2.69%	6.48%	3.16%	3.57%	0.82%
NC	Charlotte	0.77%	1.98%	1.45%	2.33%	5.07%	3.12%	1.37%	5.14%	1.33%	1.51%	5.04%	2.65%	1.73%
ND	Fargo	−1.82%	2.46%	5.07%	2.65%	1.49%	2.78%	3.57%	1.28%	6.81%	5.99%	4.26%	3.14%	1.24%
NE	Omaha	2.95%	2.54%	2.18%	1.67%	4.28%	2.79%	4.62%	8.36%	4.25%	4.21%	6.57%	4.04%	0.37%
NH	Manchester	−4.43%	0.86%	4.40%	8.15%	8.59%	1.13%	5.55%	3.57%	0.41%	1.20%	−2.53%	2.45%	1.93%
NJ	Newark	1.66%	2.77%	5.03%	3.70%	9.15%	10.63%	10.75%	5.19%	1.42%	−1.36%	−2.83%	4.19%	0.22%
NM	Albuquerque	−2.82%	2.10%	−0.13%	5.24%	−0.76%	0.82%	9.44%	0.15%	4.78%	4.56%	3.26%	2.42%	1.95%
NV	Las Vegas	5.10%	−3.51%	6.06%	6.20%	7.99%	6.20%	2.12%	6.68%	−3.39%	−6.32%	2.41%	2.69%	1.69%
NY	New York City	−3.64%	6.13%	1.47%	8.08%	7.20%	1.50%	6.58%	−4.08%	6.98%	−2.56%	−3.29%	2.21%	2.16%
OH	Columbus	−1.73%	0.87%	2.18%	0.28%	9.89%	2.33%	5.66%	6.15%	5.63%	0.88%	1.88%	3.09%	1.29%
OK	Oklahoma City	−7.37%	11.41%	3.37%	2.98%	8.09%	0.92%	5.17%	−5.06%	6.98%	3.63%	−0.36%	2.71%	1.67%
OR	Portland	12.68%	−0.71%	1.63%	0.95%	3.45%	9.83%	3.35%	2.41%	2.16%	7.39%	3.12%	4.20%	0.21%
PA	Philadelphia	0.27%	−1.17%	−0.11%	2.70%	4.95%	5.95%	3.78%	2.74%	8.87%	4.37%	−3.58%	2.61%	1.76%
RI	Providence	−15.84%	13.29%	5.17%	6.88%	16.17%	−6.92%	24.12%	−10.19%	1.59%	−10.13%	0.51%	2.24%	2.13%
SC	Columbia	0.37%	4.17%	1.26%	6.44%	3.84%	1.85%	7.59%	6.01%	0.62%	5.46%	4.40%	3.82%	0.58%
SD	Sioux Falls	−0.61%	1.38%	2.66%	1.36%	0.79%	3.30%	2.97%	2.63%	5.78%	4.02%	6.07%	2.76%	1.62%
TN	Memphis	1.22%	2.53%	5.04%	1.27%	10.90%	1.39%	14.04%	3.78%	−0.10%	7.52%	0.72%	4.39%	0.03%
TX	San Antonio	−8.64%	12.92%	6.27%	12.45%	18.02%	−3.35%	4.94%	−4.13%	−6.52%	−4.47%	−0.26%	2.48%	1.90%
UT	Salt Lake City	0.74%	1.74%	4.44%	3.95%	0.96%	7.13%	1.59%	2.71%	2.51%	3.26%	10.43%	3.59%	0.80%
VA	Virginia Beach	−0.37%	0.26%	2.65%	1.93%	3.90%	3.01%	9.95%	10.69%	−1.60%	1.86%	4.29%	3.32%	1.06%
VT	Burlington	0.82%	0.49%	1.04%	0.00%	3.37%	5.65%	2.39%	2.89%	4.56%	4.40%	6.17%	2.89%	1.49%
WA	Seattle	9.77%	0.37%	0.87%	2.84%	4.84%	6.21%	3.71%	1.80%	4.86%	2.87%	3.01%	3.74%	0.65%
WI	Milwaukee	3.46%	6.19%	4.59%	6.35%	8.85%	3.39%	6.15%	3.43%	6.14%	2.97%	1.88%	4.85%	−0.41%
WV	Charleston	−0.65%	0.53%	−0.34%	−0.35%	2.44%	5.87%	5.06%	11.58%	11.59%	6.77%	4.41%	4.26%	0.15%
WY	Cheyenne	2.63%	0.91%	2.72%	3.37%	3.68%	−0.09%	6.62%	4.16%	2.23%	3.63%	7.87%	3.43%	0.96%

Table S5. SREC price growth rate and real discount rate for SREC by state

State	City	SREC price growth rate												Real discount rate for SREC
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average	
DC	District of Columbia	0.00%	0.00%	0.00%	−30.00%	−14.29%	−33.33%	0.00%	−25.00%	0.00%	−66.67%	0.00%	−15.39%	23.41%
DE	Wilmington	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.42%
MA	Boston	−4.91%	−5.16%	−13.91%	4.92%	−4.91%	−5.16%	−4.95%	−4.95%	−4.93%	–	–	−4.89%	9.78%
MD	Baltimore	0.00%	−12.50%	0.00%	−42.86%	0.00%	−25.00%	0.00%	−33.33%	0.00%	−50.00%	0.00%	−14.88%	22.68%
NJ	Newark	−47.11%	−2.36%	−2.42%	−2.48%	−2.22%	−2.60%	−2.33%	−2.39%	−2.45%	−2.51%	−2.21%	−6.46%	11.63%
OH	Columbus	−14.29%	0.00%	−16.67%	0.00%	−20.00%	0.00%	−25.00%	0.00%	−33.33%	0.00%	−50.00%	−14.48%	22.10%

Table S6A. LCC and $LCCO_2$ analysis results of residential solar PV system by target cities in each state

State	City	Solar incentives' net present value (NPV) ($)				LCC & $LCCO_2$ Analysis result		
		Up-front incentive	Annual incentive	Tax exemption	Total incentive	Net present value (NPV) ($)	Profitability index (PI)	Payback period (PP) (yrs)
AK	Anchorage	7,800	–	−4,233	3,567	−9,209	0.752	–
AL	Birmingham	8,502	–	−3,622	4,880	−8,407	0.774	–
AR	Little Rock	8,502	–	−3,737	4,765	−16,445	0.559	–
AZ	Phoenix	8,850	–	–	8,850	−2,741	0.917	–
CA	Los Angeles	9,202	–	−2,340	6,862	−968	0.973	–
CO	Denver	11,300	4,736	–	16,036	4,738	1.144	18
CT	Bridgeport	13,925	–	–	13,925	9,957	1.302	15
DC	District of Columbia	9,999	13,240	−1,495	21,744	8,917	1.256	10
DE	Wilmington	12,175	22,103	−1,772	32,506	23,375	1.674	7
FL	Miami	14,800	–	–	14,800	−93	0.997	–
GA	Atlanta	15,304	5,719	−4,855	16,168	−85	0.998	–
HI	Honolulu	11,651	–	−1,170	10,481	99,408	3.889	5
IA	Des Moines	13,050	–	–	13,050	−4,010	0.878	–
ID	Boise	9,360	–	−3,416	5,944	−12,851	0.65	–
IL	Chicago	13,772	7,836	−2,405	19,203	1,722	1.048	20
IN	Indianapolis	10,600	–	–	10,600	−5,466	0.834	–
KS	Wichita	8,358	–	−1,859	6,499	−7,487	0.788	–
KY	Louisville	8,618	–	−3,474	5,144	−11,521	0.687	–
LA	New Orleans	17,252	–	−2,340	14,912	−7,905	0.78	–
MA	Boston	9,900	15,824	–	25,724	12,747	1.387	8
MD	Baltimore	8,500	6,219	–	14,719	5,434	1.165	18
ME	Portland	8,190	–	−5,939	2,251	−12,577	0.679	–
MI	Detroit	8,968	2,360	−7,936	3,392	−5,682	0.862	–
MN	Minneapolis	13,050	–	–	13,050	−1,135	0.966	–
MO	Kansas city	15,462	–	−4,864	10,598	−6,464	0.832	–
MS	Jackson	8,346	–	−3,923	4,423	−12,469	0.666	–

Table S6B. LCC and $LCCO_2$ analysis results of residential solar PV system by target cities in each state (Cont'd)

State	City	Solar Incentives' Net Present Value (NPV) ($)				LCC & $LCCO_2$ Analysis Result		
		Up-front incentive	Annual incentive	Tax exemption	Total incentive	Net present value (NPV) ($)	Profitability index (PI)	Payback period (PP) (yrs)
MT	Billings	12,700	–	–	12,700	−2,662	0.919	–
NC	Charlotte	15,197	8,153	−2,378	20,972	4,003	1.112	12
ND	Fargo	8,385	–	−1,950	6,435	−12,314	0.652	–
NE	Omaha	8,346	341	−6,983	1,704	−13,964	0.654	–
NH	Manchester	10,425	–	–	10,425	−2,282	0.931	–
NJ	Newark	7,800	9,442	–	17,242	8,478	1.257	14
NM	Albuquerque	9,620	2,633	–	12,253	755	1.023	24
NV	Las Vegas	12,807	–	−2,106	10,701	66	1.002	25
NY	New York City	16,200	–	–	16,200	6,513	1.198	14
OH	Columbus	13,050	5,332	–	18,382	1,992	1.06	20
OK	Oklahoma City	8,453	–	−4,470	3,983	−13,813	0.636	–
OR	Portland	14,625	–	–	14,625	−3,816	0.884	–
PA	Philadelphia	11,049	3,047	−6,730	7,366	−8,343	0.793	–
RI	Providence	12,350	–	–	12,350	−1,482	0.955	–
SC	Columbia	10,796	11,119	−3,620	15,435	1,899	1.051	21
SD	Sioux Falls	8,268	–	−1,560	6,708	−11,144	0.681	–
TN	Memphis	9,222	33,953	−4,387	38,788	23,605	1.622	11
TX	San Antonio	14,044	–	−2,145	11,899	−4,193	0.882	–
UT	Salt Lake City	9,734	–	−3,715	6,019	−9,608	0.741	–
VA	Virginia Beach	8,268	–	−3,851	4,417	−11,720	0.685	–
VT	Burlington	9,375	–	–	9,375	184	1.006	25
WA	Seattle	7,800	6,030	−1,840	11,990	−9,452	0.728	–
WI	Milwaukee	9,480	–	–	9,480	53	1.002	25
WV	Charleston	8,307	–	−3,140	5,167	−12,181	0.666	–
WY	Cheyenne	8,268	–	−3,439	4,829	−10,701	0.709	–

Table S7. Sensitivity analysis results for the NPV and PI by target cities in each state

State	City	NPV_d[a]	NPV_s[b]	Accuracy	PI_d[c]	PI_s[d]	Accuracy
AK	Anchorage	–9,209	–9,135	99.20%	0.752	0.752	99.98%
AL	Birmingham	–8,407	–8,486	99.06%	0.774	0.772	99.77%
AR	Little Rock	–16,445	–16,595	99.09%	0.559	0.556	99.39%
AZ	Phoenix	–2,741	–2,824	96.99%	0.917	0.914	99.69%
CA	Los Angeles	–968	–909	93.88%	0.973	0.974	99.90%
CO	Denver	4,738	4,746	99.83%	1.144	1.143	99.95%
CT	Bridgeport	9,957	9,583	96.24%	1.302	1.292	99.23%
DC	District of Columbia	8,917	8,568	96.09%	1.256	1.246	99.20%
DE	Wilmington	23,375	23,818	98.11%	1.674	1.684	99.38%
FL	Miami	–93	–105	87.19%	0.997	0.997	100.00%
GA	Atlanta	–85	–90	93.85%	0.998	0.998	100.00%
HI	Honolulu	99,408	99,868	99.54%	3.889	3.881	99.79%
IA	Des Moines	–4,010	–3,900	97.26%	0.878	0.881	99.61%
ID	Boise	–12,851	–12,939	99.31%	0.65	0.646	99.35%
IL	Chicago	1,722	1,798	95.56%	1.048	1.051	99.71%
IN	Indianapolis	–5,466	–5,416	99.09%	0.834	0.836	99.80%
KS	Wichita	–7,487	–7,703	97.12%	0.788	0.781	99.14%
KY	Louisville	–11,521	–11,540	99.83%	0.687	0.687	99.93%
LA	New Orleans	–7,905	–7,848	99.27%	0.78	0.781	99.90%
MA	Boston	12,747	11,967	93.88%	1.387	1.362	98.20%
MD	Baltimore	5,434	5,472	99.29%	1.165	1.166	99.91%
ME	Portland	–12,577	–12,840	97.91%	0.679	0.673	99.07%
MI	Detroit	–5,682	–5,486	96.55%	0.862	0.867	99.48%
MN	Minneapolis	–1,135	–1,089	95.93%	0.966	0.967	99.90%
MO	Kansas city	–6,464	–6,600	97.90%	0.832	0.828	99.55%
MS	Jackson	–12,469	–12,709	98.07%	0.666	0.661	99.29%
MT	Billings	–2,662	–2,679	99.35%	0.919	0.919	99.98%
NC	Charlotte	4,003	4,026	99.44%	1.112	1.112	99.96%
ND	Fargo	–12,314	–12,335	99.83%	0.652	0.651	99.91%
NE	Omaha	–13,964	–13,966	99.99%	0.654	0.653	99.88%
NH	Manchester	–2,282	–2,317	98.48%	0.931	0.931	99.95%
NJ	Newark	8,478	8,487	99.89%	1.257	1.259	99.82%
NM	Albuquerque	755	748	99.10%	1.023	1.023	99.99%
NV	Las Vegas	66	61	92.98%	1.002	1.002	100.00%
NY	New York City	6,513	6,644	97.99%	1.198	1.203	99.61%
OH	Columbus	1,992	1,848	92.79%	1.06	1.056	99.62%
OK	Oklahoma City	–13,813	–13,897	99.39%	0.636	0.632	99.37%
OR	Portland	–3,816	–3,848	99.15%	0.884	0.883	99.89%

End of Table S7

State	City	NPV_d[a]	NPV_s[b]	Accuracy	PI_d[c]	PI_s[d]	Accuracy
PA	Philadelphia	–8,343	–8,491	98.23%	0.793	0.789	99.50%
RI	Providence	–1,482	–1,371	92.52%	0.955	0.958	99.69%
SC	Columbia	1,899	1,912	99.34%	1.051	1.052	99.90%
SD	Sioux Falls	–11,144	–11,269	98.88%	0.681	0.678	99.56%
TN	Memphis	23,605	23,565	99.83%	1.622	1.619	99.82%
TX	San Antonio	–4,193	–4,154	99.06%	0.882	0.884	99.77%
UT	Salt Lake City	–9,608	–9,699	99.05%	0.741	0.738	99.60%
VA	Virginia Beach	–11,720	–11,766	99.61%	0.685	0.682	99.56%
VT	Burlington	184	193	95.04%	1.006	1.006	100.00%
WA	Seattle	–9,452	–9,478	99.72%	0.728	0.726	99.73%
WI	Milwaukee	53	56	93.77%	1.002	1.002	100.00%
WV	Charleston	–12,181	–12,117	99.47%	0.666	0.666	100.00%
WY	Cheyenne	–10,701	–10,730	99.73%	0.709	0.709	100.00%

Note: [a] NPV_d refers to the NPV calculated based on the deterministic approach; [b] NPV_s refers to the NPV calculated based on the stochastic approach; [c] PI_d refers to PI calculated based on the deterministic approach; and [d] PI_s refers to the PI calculated based on the stochastic approach.

Table S8. Classification of group (A) to (F) by PI increase ratio

Classification	Range
Group (A)	$2.0 \leq PI_r$
Group (B)	$1.8 \leq PI_r < 2.0$
Group (C)	$1.6 \leq PI_r < 1.8$
Group (D)	$1.4 \leq PI_r < 1.6$
Group (E)	$1.2 \leq PI_r < 1.4$
Group (F)	$1.0 < PI_r < 1.2$

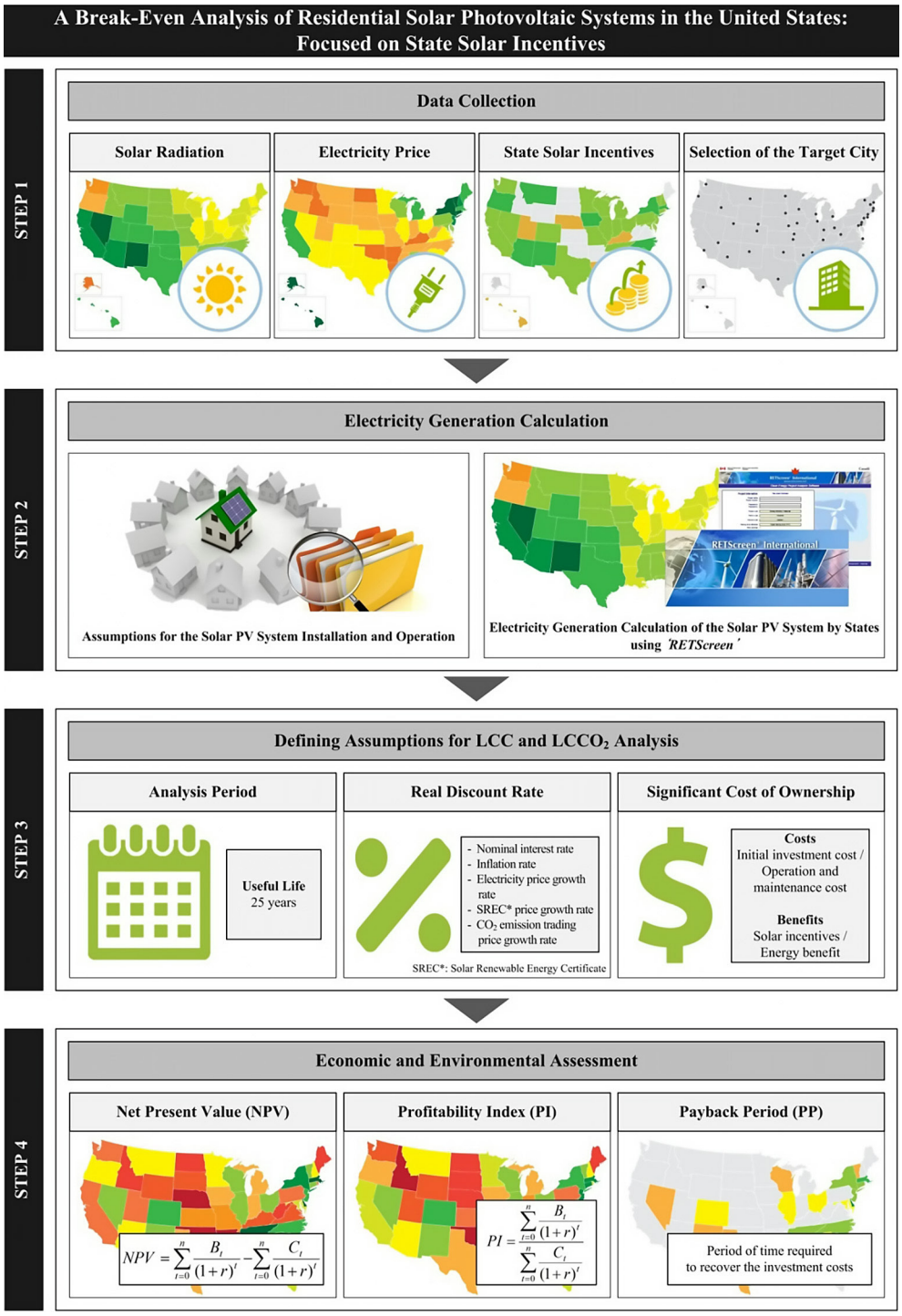

Fig. S1. Research framework

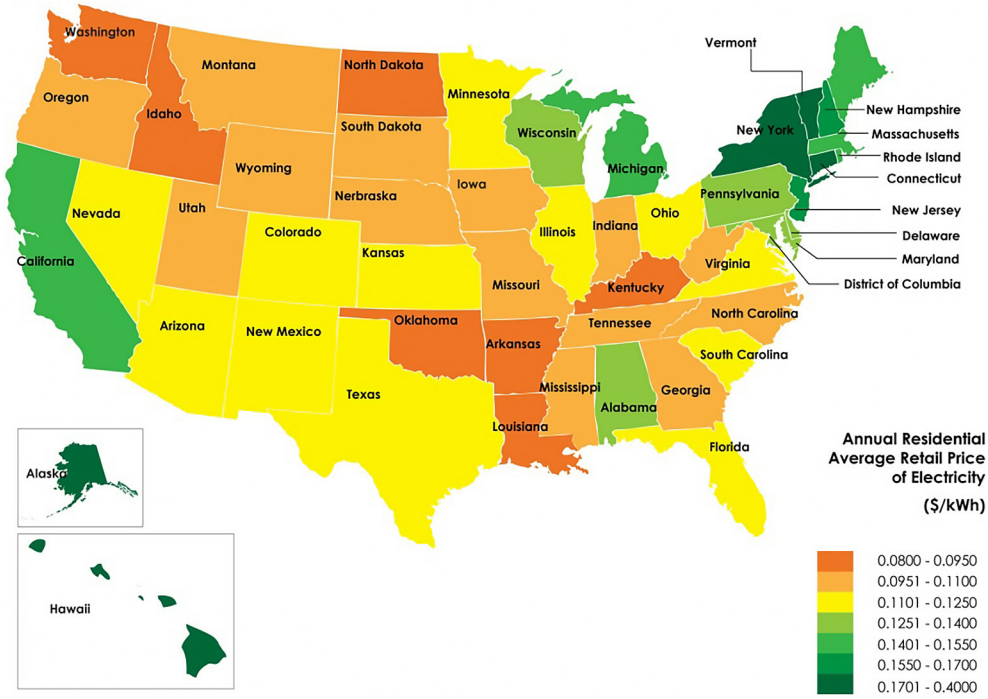

Fig. S2. Residential average retail price of electricity by state

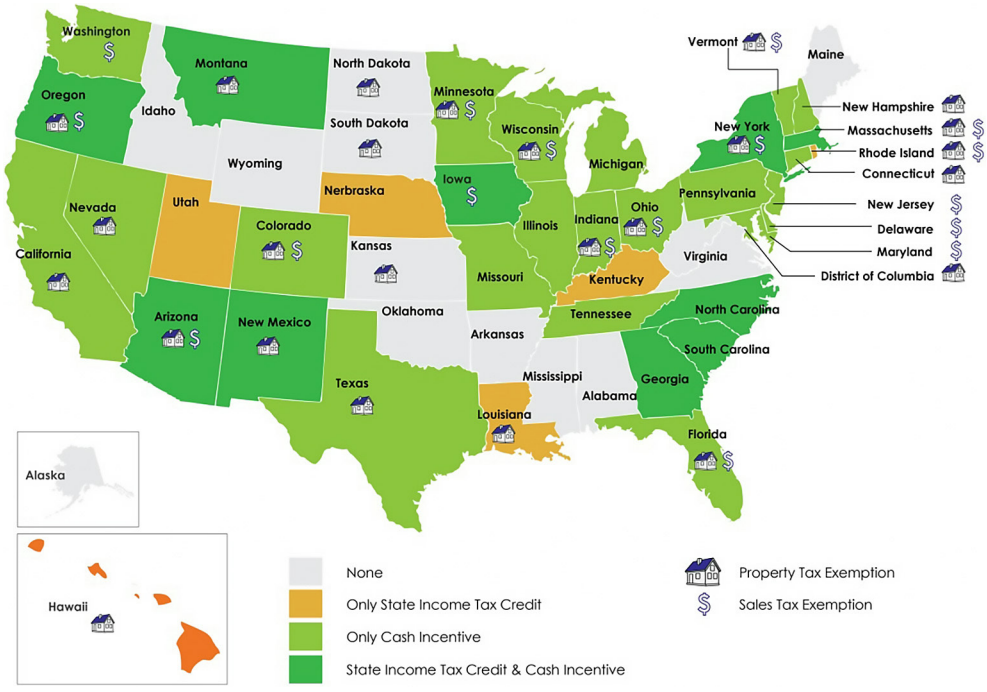

Fig. S3. Residential solar incentives by state (based on tax and cash incentives)

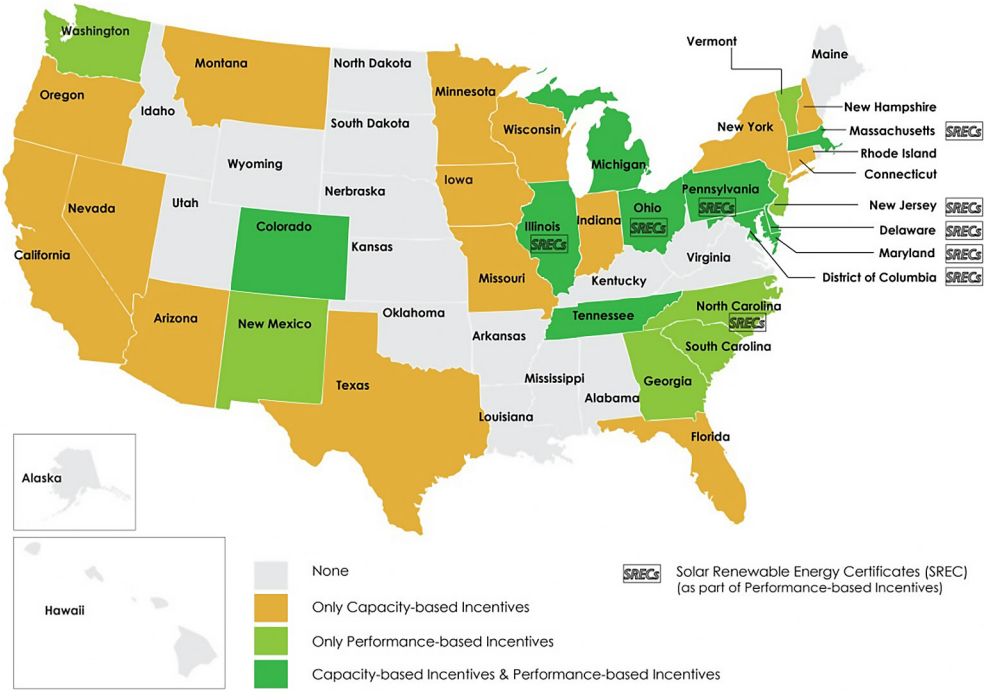

Fig. S4. Residential solar incentives by state (based on only cash incentives)

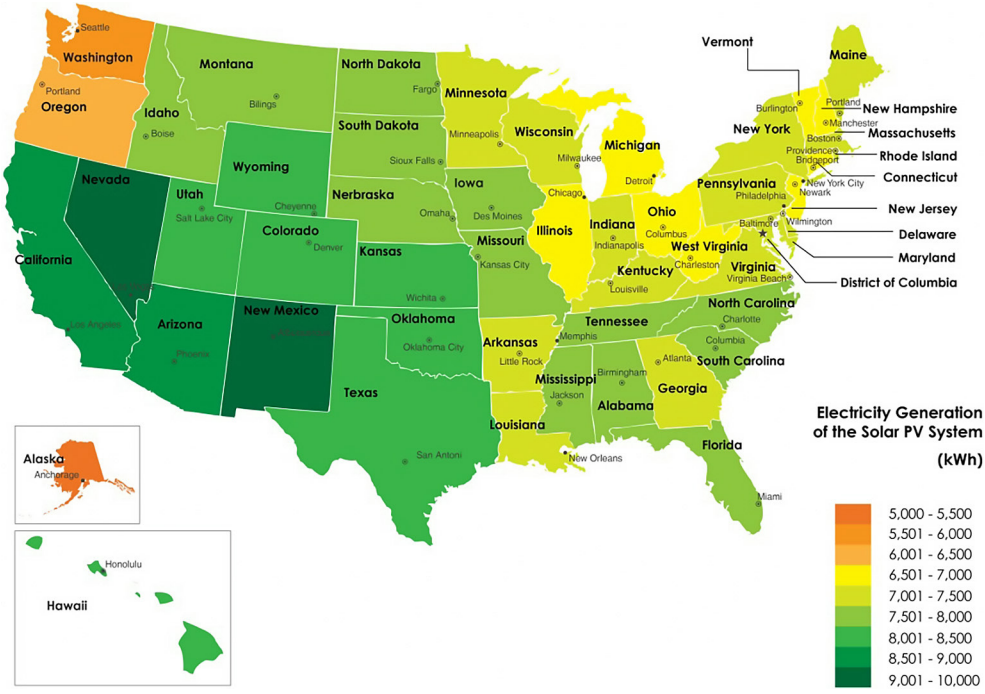

Fig. S5. Electricity generation of the solar PV system by target cities in each state

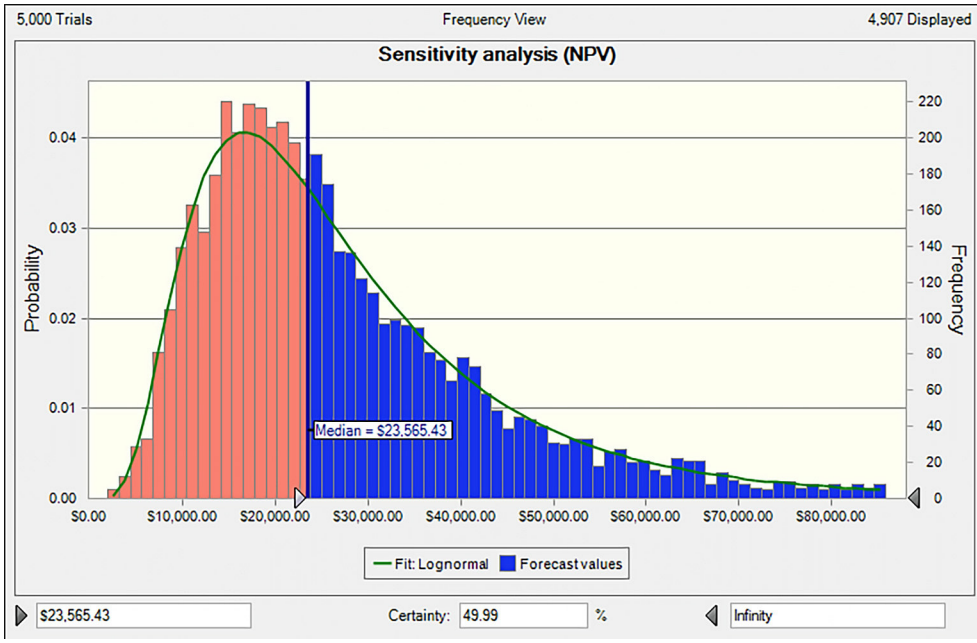

Fig. S6. Probability distribution for NPV in Memphis, Tennessee

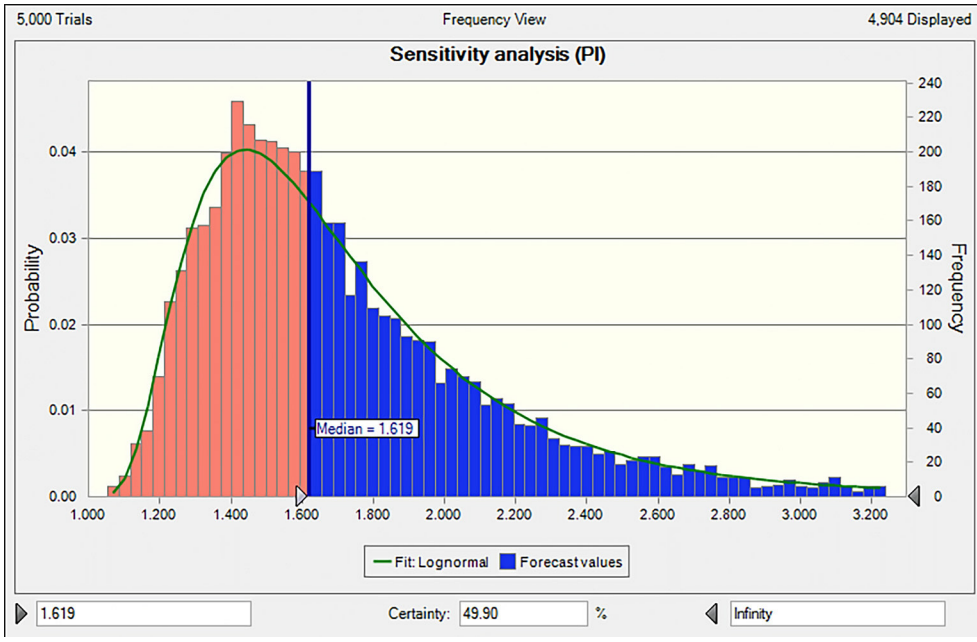

Fig. S7. Probability distribution for PI in Memphis, Tennessee