Scenario Solar PV Jobs and Economic Development Impact (JEDI) Model

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Why Do Impact Modeling?

- **Evaluate potential scenarios – current or future**
- **Inform residents, stakeholders, decision makers**
- **Assist businesses**
  - Identify potential customers
  - Evaluate economic development efforts
- **Assist government**
  - Representing public interest
  - Planning and evaluating
  - Community development

Photo Credit: NREL PIX #14936

Jobs and Economic Development Impacts (JEDI)

- Freely available input-output tool to estimate employment and economic impacts that result from an investment in new power generation or fuel production.
- JEDI default inputs are from developers and industry experts, based on existing projects.
- User input can be minimal using defaults or be very detailed for more precise results.

Photo Credit: Warren Gretz / NREL PIX #10603

http://www.nrel.gov/analysis/jedi

JEDI Background

- All models contain two basic elements: the project description in terms of expenditures and the input-output model
- Expenditures can either be customized or model users can opt to use defaults
- Defaults based on real-world projects or input from engineers, experts
- IMPLAN input-output model currently used

Input-Output Models

- **Snapshot of the relationships between sectors of an economy at a single point in time**
  - Industries, labor, households, capital, investments, government, imports/exports

- **Expenditures in an economy**
  - Inputs: goods/services from other industries, payments for labor, capital, taxes, imports
  - Outputs: goods/services to other industries, households, and governments, exports

- Captures ripple effects within a region
  - i.e. , an increase in demand for electricity might increase demand for turbines, which will further increase demand for electricity

Interpreting Results and Model Limitations

- JEDI results are gross, not net
- JEDI does not factor in far-reaching impacts from development such as changes in utility rates, greenhouse gas emissions, property values or public health
- Input-output models cannot estimate impacts from supply-side changes such as technological improvements, price changes, or changes in taxes/subsidies
- JEDI doesn't evaluate a project's feasibility or profitability
- NREL is not responsible for how the model is used, applied or results interpreted

Interpreting Results and Model Limitations

- JEDI models use an input-output model from a single year (currently 2010; updated as new data become available).

- Scenario JEDI assumes that the economy has the same structure over time - relative prices don't change, technology doesn't change, and production/consumption patterns don't change.

Photo credit: Aspen Skiing Company / NREL PIX # 14729

JEDI Results

- **Jobs (FTEs)**
  - Number of people working the equivalent of 40 hr. weeks, 52 weeks/yr.
- **Earnings**
  - Income from work
  - Includes wages, salaries, employer provided supplements (retirement, health)
- **Gross output**
  - Measure of total economic activity
  - Value of production plus inputs
  - Not the same as GDP, which is the value of production

Project Development & Onsite Labor Impacts

- **Sample job types**
  - Installer
  - Electrician
  - Truck driving
  - Crane operation
  - Management, support
  - Siting

Photo credit: Jim Tracy / NREL PIX #09275

Photo Credit: Craig Miller Productions / NREL PIX # 03500

Photo credit: Susan Bilo / NREL PIX #21393

Photo credit: Dennis Schroeder / NREL PIX #22182

Local Revenues, Turbine, Module, & Supply Chain Impacts

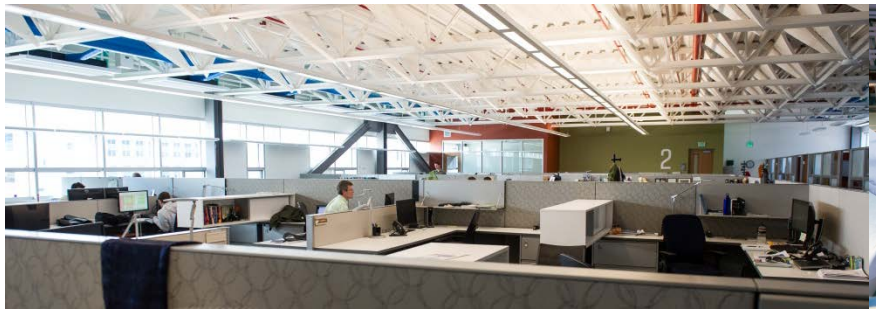

Photo Credit: Dennis Schroeder / NREL PIX #22569

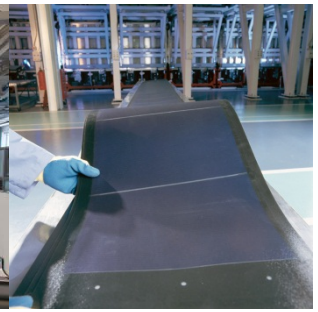

Photo Credit: United Solar Ovonic / NREL PIX # 15779

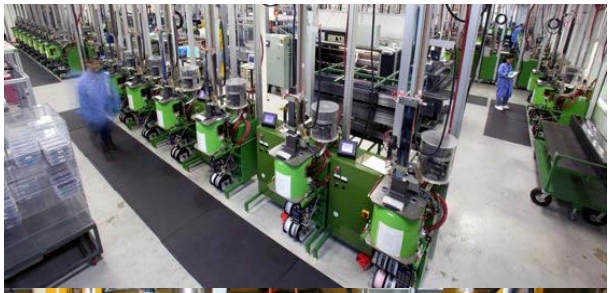

Photo Credit: Evergreen Solar / NREL PIX #14722

Photo Credit: Shell Solar Industries/ NREL PIX #13856

- Polysilicon manufacturers
- Module and component manufacturers
- Equipment sales and financing
- Property taxes, banking, accounting

Photo Credit: SunPower / NREL PIX #13451

Photo Credit: John De La Rosa / NREL PIX #26513

Photo Credit: Frank Jeffrey / NREL PIX #07781

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Induced Impacts

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Money spent in the local area on goods and services from increased revenue:
sandwich shops, child care, grocery stores, clothing, other retail, public transit, new cars, restaurants, medical services

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Scenario JEDI

- **Looks at deployment scenario over time**
  - *Example: What is the impact of 10 MW of solar installed over a 5 year period that is split between utility, residential and commercial installations?*

- **Other JEDI models look at single projects or single grouping of projects**
  - *Example: What is the impact of 150 kW in small commercial rooftop installations?*

Other Innovations New for Scenario JEDI

- Users have flexibility in selecting scenario targets. Available formats include:
  - Capacity (MW)
  - Electricity generated (GWh)
  - Investment ($m)
  - Percent of retail consumption
  - Number of systems
- Users have flexibility in inputting costs for improving output accuracy:
  - e.g., user can input assumed cost for any component for any year within the study period.
- Users can access expanded and in-depth guidance, including:
  - Methodology explanations and sources for data, which are located in cell help bubbles right at the point of entry. This obviates the inconvenience of having to flip to search for information in FAQs.
  - Marked increase in use of "breadcrumbs," hot link buttons that make it easier for user to navigate to other locations within the model they will most likely want to visit next.

Other Innovations New for Scenario JEDI

- **More granularity, with new breakouts for:**
  - Market sectors that distinguish:
    - Large commercial and small commercial
    - Residential new construction and residential retrofit
  - PV technologies that distinguish:
    - Fixed mount and single-axis tracking
    - C-Si and thin film
- **New data resources within the model to save users' time in conducting additional research, including:**
  - Projected market size (SEIA/GTM) by state
  - Projected solar carve-out capacity by state
  - State average capacity factors used in the model
  - Property tax information by state
  - List of solar firms by state

Scenario JEDI Timeline

- **Impacts reported in year that projects are specified to come online, not necessarily when construction is started or expenditures made.**
  - Example: 10 MW online in 2013 that uses components purchased in 2012 reports all impacts in 2013

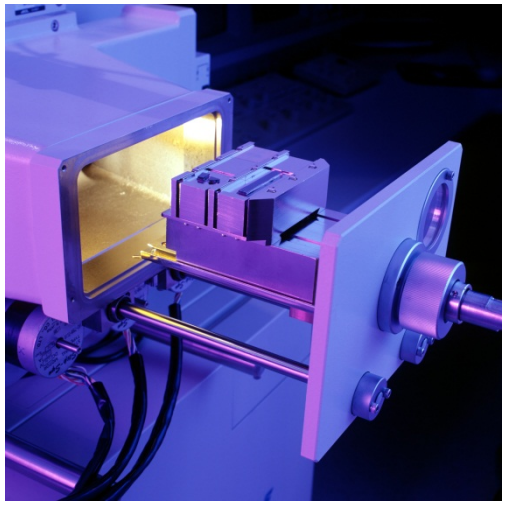
- **Construction and Installation Phase**
  - Equivalent of one year, regardless of how long the project actually takes to build

- **Operating Phase**
  - Annual, ongoing results

Basic Scenario

- **Time frame**
- **Deployment scenario type**
  - Nameplate capacity, generation, cost, number of systems or percentage of total electricity generated
- **Distribution between residential, commercial, utility**
- **Contains default cost values, but users can enter their own information**

Photo credit: Jim Yost /NREL PIX #02024



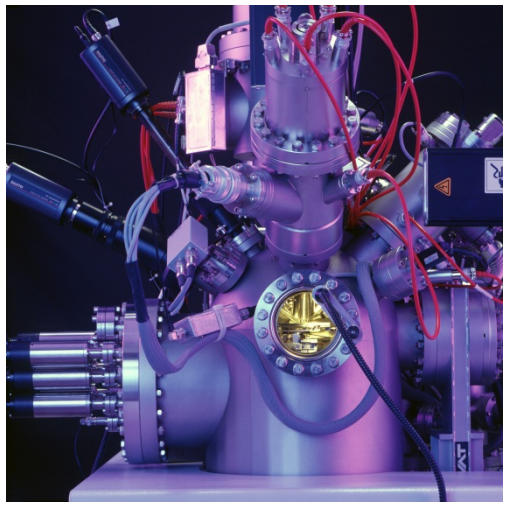


Photo credit: Jim Yost /NREL PIX #02014

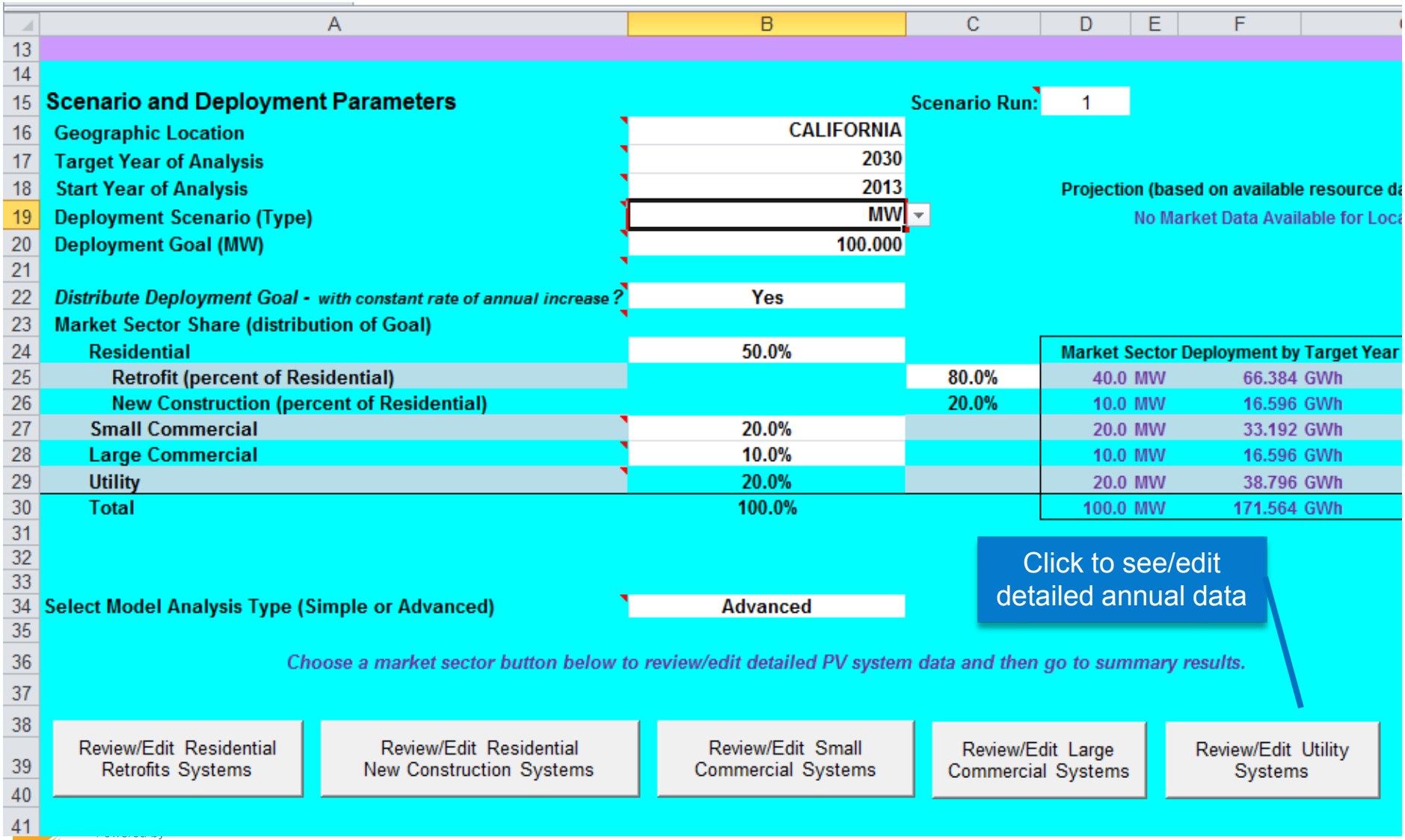
Basic Scenario

11	NOTE: Additional information is available by pointing to the red triangles located in cell corners, referring t		
12	the FAQ worksheet. Only those cells with a white background can accept new values.		
13			
14			
15	**Scenario and Deployment Parameters**		Scenario Run:
16	Geographic Location	CALIFORNIA	
17	Target Year of Analysis	2030	
18	Start Year of Analysis	2013	
19	Deployment Scenario (Type)	MW	
20	Deployment Goal (MW)	100.000	
21			
22	*Distribute Deployment Goal - with constant rate of annual increase?*	Yes	
23	Market Sector Share (distribution of Goal)		
24	Residential	50.0%	
25	Retrofit (percent of Residential)		80.0%
26	New Construction (percent of Residential)		20.0%
27	Small Commercial	20.0%	
28	Large Commercial	10.0%	
29	Utility	20.0%	
30	Total	100.0%	
31			

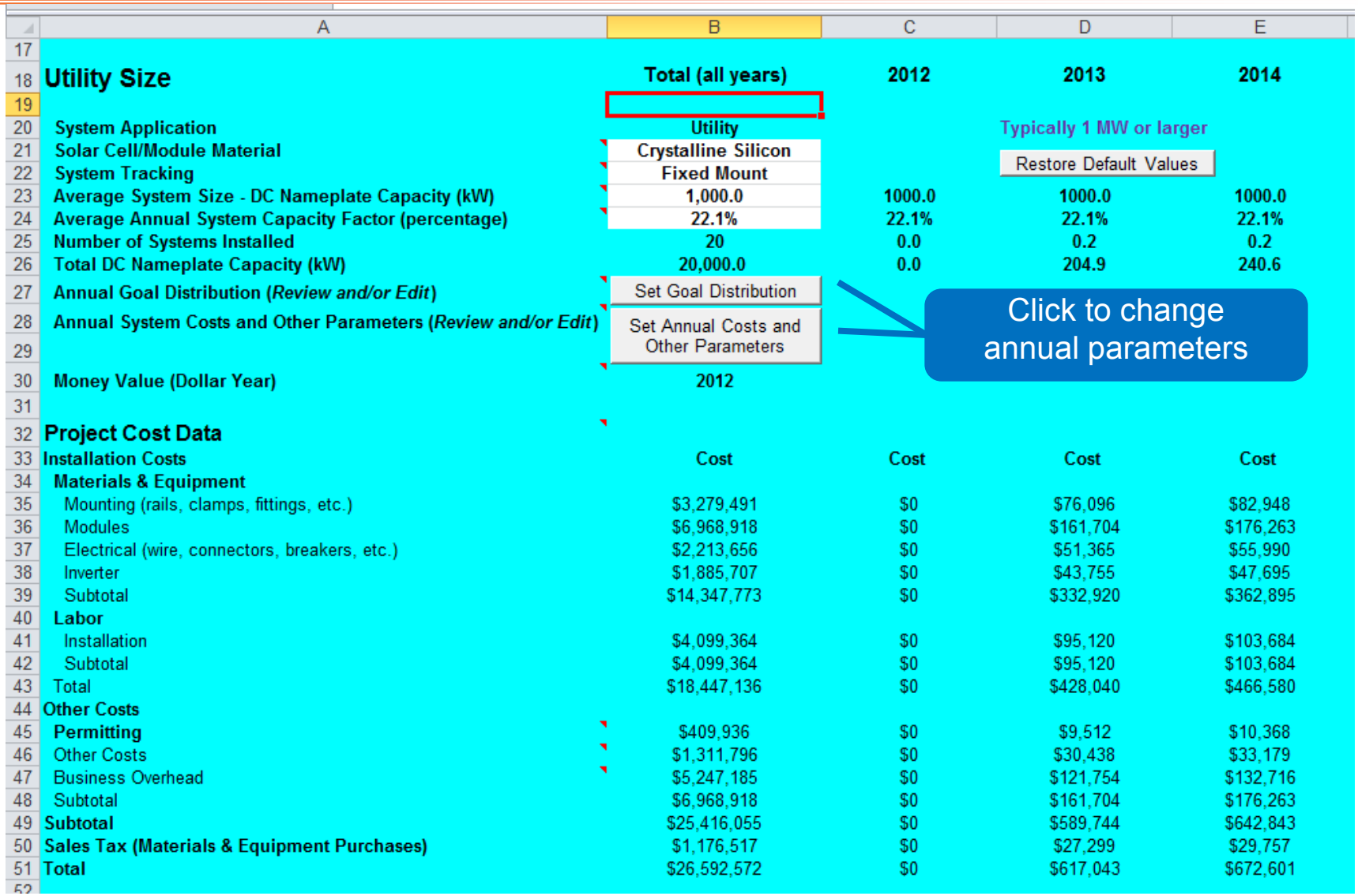
Advanced Inputs

- Deployment over time can be specified (default is constant percentage change).
- Expenditures for each type of solar (new/retrofit residential, small/large commercial, utility) can be specified.
- If you do specify expenditures, be careful! The I-O model represents the entire economy at a single point in time with constant prices - if you change specific prices, they should be adjusted for inflation.

Advanced Inputs



Advanced Inputs



	A	B	C	D	E
17					
18	**Utility Size**	**Total (all years)**	**2012**	**2013**	**2014**
19					
20	System Application	Utility		Typically 1 MW or larger	
21	Solar Cell/Module Material	Crystalline Silicon			
22	System Tracking	Fixed Mount		Restore Default Values	
23	Average System Size - DC Nameplate Capacity (kW)	1,000.0	1000.0	1000.0	1000.0
24	Average Annual System Capacity Factor (percentage)	22.1%	22.1%	22.1%	22.1%
25	Number of Systems Installed	20	0.0	0.2	0.2
26	Total DC Nameplate Capacity (kW)	20,000.0	0.0	204.9	240.6
27	Annual Goal Distribution (*Review and/or Edit*)	Set Goal Distribution			
28	Annual System Costs and Other Parameters (*Review and/or Edit*)	Set Annual Costs and Other Parameters			
29					
30	Money Value (Dollar Year)	2012			
31					
32	**Project Cost Data**				
33	**Installation Costs**	Cost	Cost	Cost	Cost
34	**Materials & Equipment**				
35	Mounting (rails, clamps, fittings, etc.)	$3,279,491	$0	$76,096	$82,948
36	Modules	$6,968,918	$0	$161,704	$176,263
37	Electrical (wire, connectors, breakers, etc.)	$2,213,656	$0	$51,365	$55,990
38	Inverter	$1,885,707	$0	$43,755	$47,695
39	Subtotal	$14,347,773	$0	$332,920	$362,895
40	**Labor**				
41	Installation	$4,099,364	$0	$95,120	$103,684
42	Subtotal	$4,099,364	$0	$95,120	$103,684
43	Total	$18,447,136	$0	$428,040	$466,580
44	**Other Costs**				
45	**Permitting**	$409,936	$0	$9,512	$10,368
46	Other Costs	$1,311,796	$0	$30,438	$33,179
47	Business Overhead	$5,247,185	$0	$121,754	$132,716
48	Subtotal	$6,968,918	$0	$161,704	$176,263
49	**Subtotal**	$25,416,055	$0	$589,744	$642,843
50	**Sales Tax (Materials & Equipment Purchases)**	$1,176,517	$0	$27,299	$29,757
51	**Total**	$26,592,572	$0	$617,043	$672,601

Advanced Inputs - Costs

9					
10	**Market Sector**	2013			
11	**Utility**				
12	**Base Installed System Cost ($/kW$_{DC}$)**	$2,878			
13	**Annual Direct Operations and Maintenance Cost ($/kW)**	$17.02			
14	**Average System Size - DC Nameplate Capacity (kW)**	1,000.0			
15	**Number of Systems Installed**	0			
16	**Total DC Nameplate Capacity (kW)**	204.9			
17	Return to Utility / Restore UT Default Data				
18					
19	**Project Cost Data**				
20	**Installation Costs**	**Percent of**	**Cost**	**Purchased**	**Manufactured**
21	**Materials & Equipment**	**Total Cost**	**per kW**	**Locally (%)**	**Locally (%)**
22	Mounting (rails, clamps, fittings, etc.)	12.9%	$371	0%	0%
23	Modules	27.4%	$789	0%	0%
24	Electrical (wire, connectors, breakers, etc.)	8.7%	$251	0%	0%
25	Inverter	7.4%	$214	0%	0%
26	Subtotal	56.5%	$1,625		
27	**Labor**				
28	Installation	16.1%	$464	100%	
29	Subtotal	16.1%	$464		
30	Total	72.6%	$2,089		
31	**Other Costs**				
32	Permitting	1.6%	$46	100%	
33	Other Costs	5.2%	$149	100%	
34	Business Overhead	20.6%	$594	100%	
35	Subtotal	27.4%	$789		
36	**Subtotal**	100.0%	$2,878		
37	**Sales Tax (Materials & Equipment Purchases)**				
38	**Total**				

Advanced Inputs - Deployment

	A	B	C	D	E	F	G	H	I	J
1	**Deployment Goal Distribution**									
2	Analysis Type: Advanced			Review and/or Edit cells (with white background) to incorporate new annual values i						
3				After editing, default values may be restored by pressing the Restore Default Data bu						
4										
5	Return to Scenario Data									
6	**Market Sector**	**MW**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
7	**Residential Retrofit**	**Goal**								
8	**Goal**	**40.000**		0.410	0.481	0.565	0.663	0.779	0.915	1.074
9	**User revised total**	**40.000**								
10										
11	Return to Residential Retrofit	Restore RR Default Data								
12	**Residential New Construction**	**Goal**								
13	**Goal**	**10.000**		0.102	0.120	0.141	0.166	0.195	0.229	0.269
14	**User revised total**	**10.000**								
15										
16	Return to Residential New Construction	Restore RNC Default Data								
17	**Small Commercial**	**Goal**								
18	**Goal**	**20.000**		0.205	0.241	0.283	0.332	0.390	0.457	0.537
19	**User revised total**	**20.000**								
20										
21	Return to Small Commercial	Restore SC Default Data								
22	**Large Commercial**	**Goal**								
23	**Goal**	**10.000**		0.102	0.120	0.141	0.166	0.195	0.229	0.269
24	**User revised total**	**10.000**								

Default is constant percentage change

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Results

Go To All Sectors Detailed Results

Go To Residential Retrofit Detailed Results

Local Economic Impacts - Summary Results	Total Cumulative Job Years	100.000 MW Earnings $Million (2012)	Output $Million (2012)	Residential Retrofit Cumulative Job Years	40.000 MW Earnings $Million (2012)	Output $Million (2012)
During construction and installation period						
Project Development and Onsite Labor Impacts						
Construction and Installation Labor	201	$14.9	$17.1	113	$7.3	$7.3
Construction and Installation Related Services	331	$18.1	$39.1	150	$10.7	$17.7
Subtotal	**532**	**$33.0**	**$56.1**	**262**	**$18.1**	**$25.0**
Module and Supply Chain Impacts						
Manufacturing Impacts	0	$0.0	$0.0	0	$0.0	$0.0
Trade (Wholesale and Retail)	219	$12.7	$39.2	120	$9.2	$21.6
Finance, Insurance and Real Estate	0	$0.0	$0.0	0	$0.0	$0.0
Professional Services	56	$2.7	$9.4	26	$1.6	$4.3
Other Services	150	$10.3	$36.9	66	$6.0	$16.2
Other Sectors	219	$8.7	$26.3	105	$5.5	$13.6
Subtotal	**644**	**$34.4**	**$111.8**	**317**	**$22.4**	**$55.8**
Induced Impacts	**562**	**$24.7**	**$90.0**	**271**	**$15.3**	**$43.2**
Total Impacts	**1,739**	**$92.1**	**$257.9**	**850**	**$55.8**	**$124.0**
Average Annual Impacts	**97**	**$5.1**	**$14.3**	**47**	**$3.1**	**$6.9**

Sum over all years

During operating years - Cumulative	Total Cumulative Job Years	Total Earnings $Million (2012)	Total Output $Million (2012)	Residential Retrofit Cumulative Job Years	Earnings $Million (2012)	Output $Million (2012)
Onsite Labor Impacts						
PV Project Labor Only	46.2	$3.8	$3.8	26	$1.6	$1.6
Local Revenue and Supply Chain Impacts	24.0	$1.9	$3.6	5	$0.4	$1.0
Induced Impacts	20.9	$1.2	$3.5	6	$0.3	$1.0
Total Impacts	**91.1**	**$7.0**	**$10.9**	**38**	**$2.3**	**$3.5**
Average Annual Impacts	**5.1**	**$0.4**	**$0.6**	**2**	**$0.1**	**$0.2**

Final year

During operating years (Target)	Year 2030 Jobs	Annual Earnings $Million (2012)	Annual Output $Million (2012)	Year 2030 Jobs	Annual Earnings $Million (2012)	Annual Output $Million (2012)
Onsite Labor Impacts						
PV Project Labor Only	6.9	$0.6	$0.6	4	$0.2	$0.2
Local Revenue and Supply Chain Impacts	3.5	$0.3	$0.5	1	$0.1	$0.1
Induced Impacts	3.1	$0.2	$0.5	1	$0.1	$0.1
Total Impacts	**13.6**	**$1.0**	**$1.6**	**6**	**$0.3**	**$0.5**

Results - Detailed

System Application	Utility			Utility		
Number of Systems Installed	20			0		
Total DC Nameplate Capacity (kW)	20,000.000			240.622		
Money Value (Dollar Year)	2012			2012		
Local Economic Impacts - Summary Results		All Years			2014	
	Total Job Years	Earnings $Million	Output $Million	Total Job Years	Earnings $Million	Output $Million
During construction and installation period						
Project Development and Onsite Labor Impacts						
Construction and Installation Labor	28	$4.1	$4.1	1	$0.1	$0.1
Construction and Installation Related Services	31	$2.2	$3.6	1	$0.1	$0.1
Subtotal	**58**	**$6.3**	**$7.7**	**1**	**$0.2**	**$0.2**
Module and Supply Chain Impacts						
Manufacturing	0	$0.0	$0.0	0	$0.0	$0.0
Trade (Wholesale and Retail)	6	$0.4	$1.0	0	$0.0	$0.0
Finance, Insurance and Real Estate	0	$0.0	$0.0	0	$0.0	$0.0
Professional Services	5	$0.3	$0.9	0	$0.0	$0.0
Other Services	14	$1.3	$3.4	0	$0.0	$0.1
Other Sectors	22	$1.1	$2.4	1	$0.0	$0.1
Subtotal	**47**	**$3.1**	**$7.6**	**1**	**$0.1**	**$0.2**
Induced Impacts	**52**	**$2.9**	**$8.3**	**1**	**$0.1**	**$0.2**
Total Impacts	**157**	**$12.3**	**$23.6**	**4**	**$0.3**	**$0.6**
Average Annual Impacts	**9**	**$0.7**	**$1.3**			
	Total Cumulative Job Years	Total Earnings $Million	Total Output $Million			
During operating years (cumulative)						
Onsite Labor Impacts						
PV Project Labor Only	5	$0.7	$0.7			
Local Revenue and Supply Chain Impacts	1	$0.1	$0.3			
Induced Impacts	2	$0.1	$0.4			
Total Impacts	**9**	**$0.9**	**$1.3**			
Average Annual Impacts	**0**	**$0.1**	**$0.1**			
	2030 Jobs	Earnings $Million	Output $Million	2014 Jobs	Earnings $Million	Output $Million
During operating years (Target and annual)						
Onsite Labor Impacts						
PV Project Labor Only	1	$0.1	$0.1	0	$0.0	$0.0
Local Revenue and Supply Chain Impacts	0	$0.0	$0.0	0	$0.0	$0.0
Induced Impacts	0	$0.0	$0.1	0	$0.0	$0.0
Total Impacts	**1**	**$0.1**	**$0.2**	**0**	$0.0	$0.0

Thank you

Barry Friedman

David Keyser

August 12, 2013