

Economic Impacts of the Tax Credit Expiration

Final Report

Prepared for the

American Wind Energy Association
(AWEA) and the Solar Energy Research
and Education Foundation (SEREF)

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Content of Report

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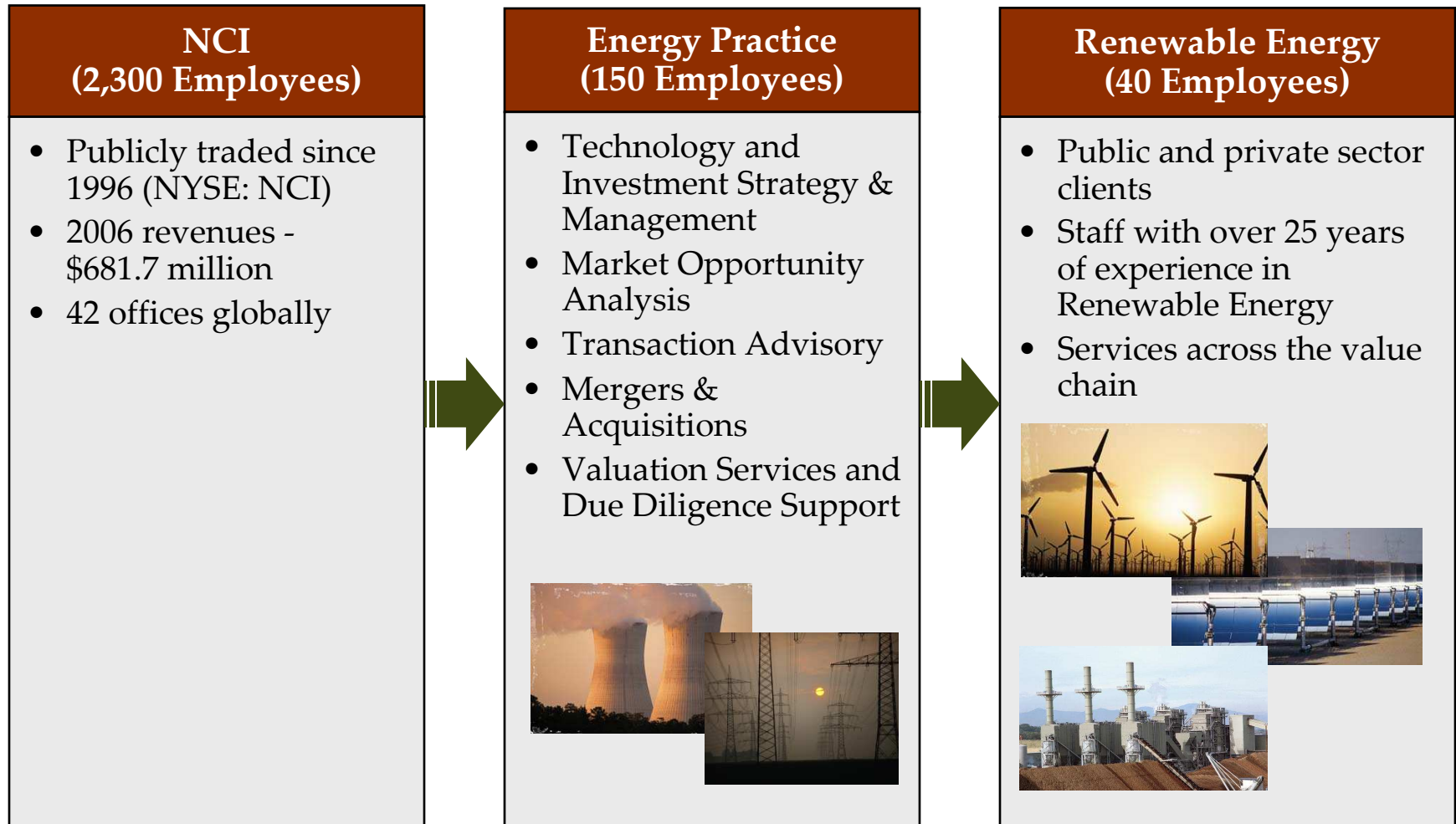
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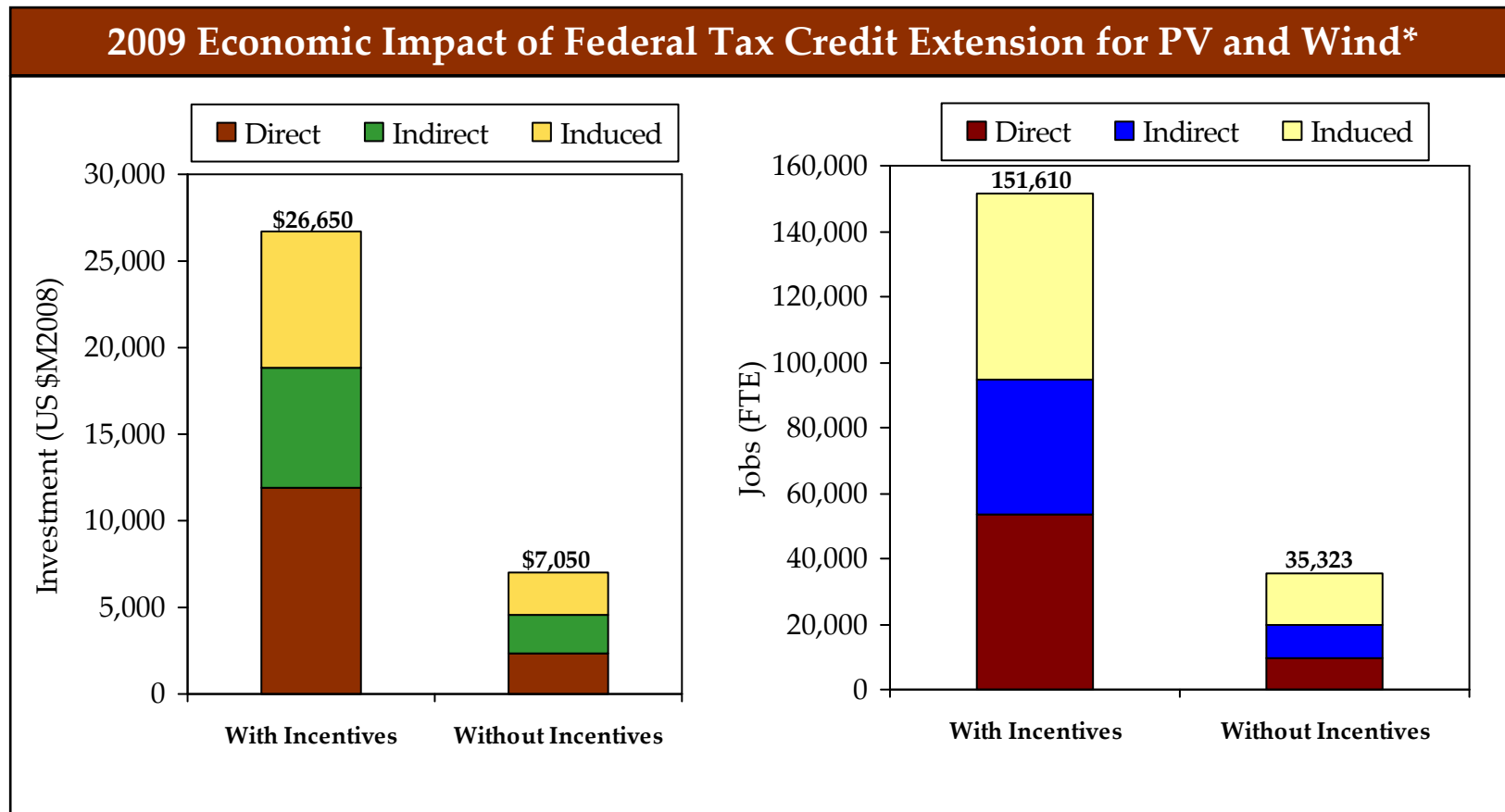
About NCI

Navigant Consulting, Inc. (NCI) is a specialized consulting firm known globally for its renewable energy technology and strategy expertise.



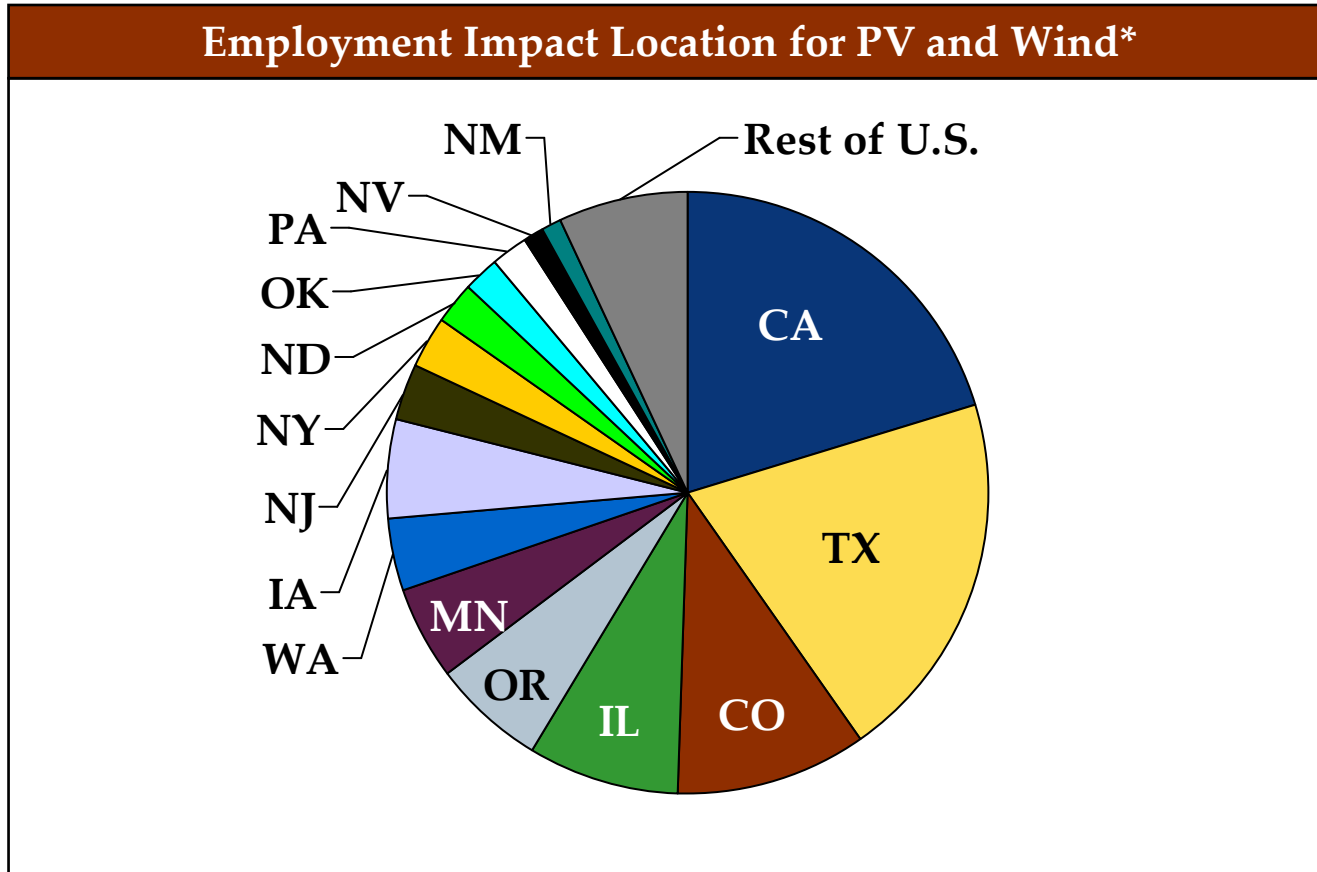
Executive Summary

PV and Wind federal tax credit expiration could result in ~\$19 billion of lost investment and ~116,000 of lost employment opportunity.



* Analysis uses 6,500 MW of wind and 790 MW of PV installations in 2009 if tax are credits extended, and 500 MW of wind and 325 MW of PV without tax credits in 2009.

California and Texas would feel the biggest employment impact.



* Employment impact location was calculated by projecting the location of 2006 (PV) and 2007 (Wind) installations to 2009 and attributing job loss to the state of installation. This is accurate for construction and installation jobs, but only provides a *very* rough indicator for manufacturing jobs.

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Objectives and Approach

Navigant Consulting, Inc. assessed lost investment and employment opportunities in wind and PV* due to the tax credit expiration.

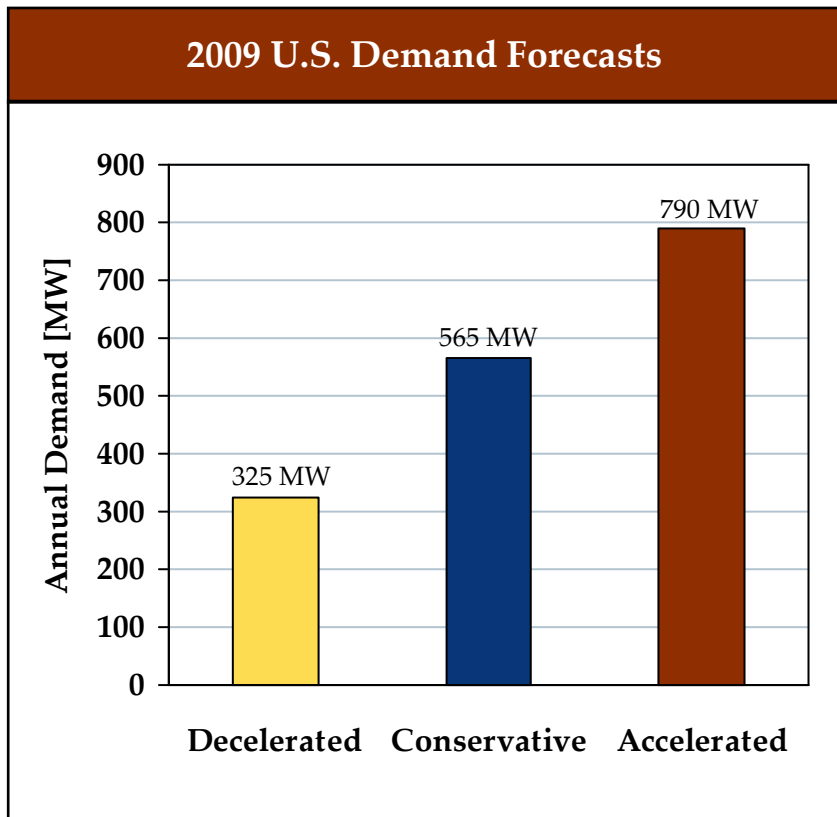
Navigant Consulting, Inc. (NCI) Calculation Methodology					
1. Estimate 2009 Market Size	2. Project System Costs	3. Calculate Labor Intensity	4. Find Economic Multipliers	5. Calculate Lost Employment	6. Calculate Lost Investment
<ul style="list-style-type: none"> • Purpose - Estimate 2009 market size with and without federal tax incentives. • Method - Use NCI market knowledge, NCI Wind Market Model, NCI PV Services market data, and industry interviews. 	<ul style="list-style-type: none"> • Purpose - Project direct investment due to wind and PV installations. • Method - Use NCI's PV Services projections and NCI studies on wind system costs. 	<ul style="list-style-type: none"> • Purpose - Calculate direct labor intensity (in FTE/MW) for each step of the wind and PV value chains. • Method - Conduct analysis based upon DOE's JEDI Wind model and NCI's PV labor intensity analyses. 	<ul style="list-style-type: none"> • Purpose - Estimate indirect and induced employment and investment impacts. • Method - Use economic multipliers from JEDI Wind model and NREL study on the Solar America Initiative. 	<ul style="list-style-type: none"> • Purpose - Calculate lost employment opportunity due to expiration of federal tax credits. • Method - Apply economic multipliers to direct jobs calculated in step 3 using the market sizes from step 1. 	<ul style="list-style-type: none"> • Purpose - Calculate lost investment opportunity due to expiration of federal tax credits. • Method - Apply economic multipliers to direct investment calculated in step 2 using the market sizes from step 1.

*This study did not analyze concentrating solar power, solar hot water or solar heating, cooling, & lighting technologies.

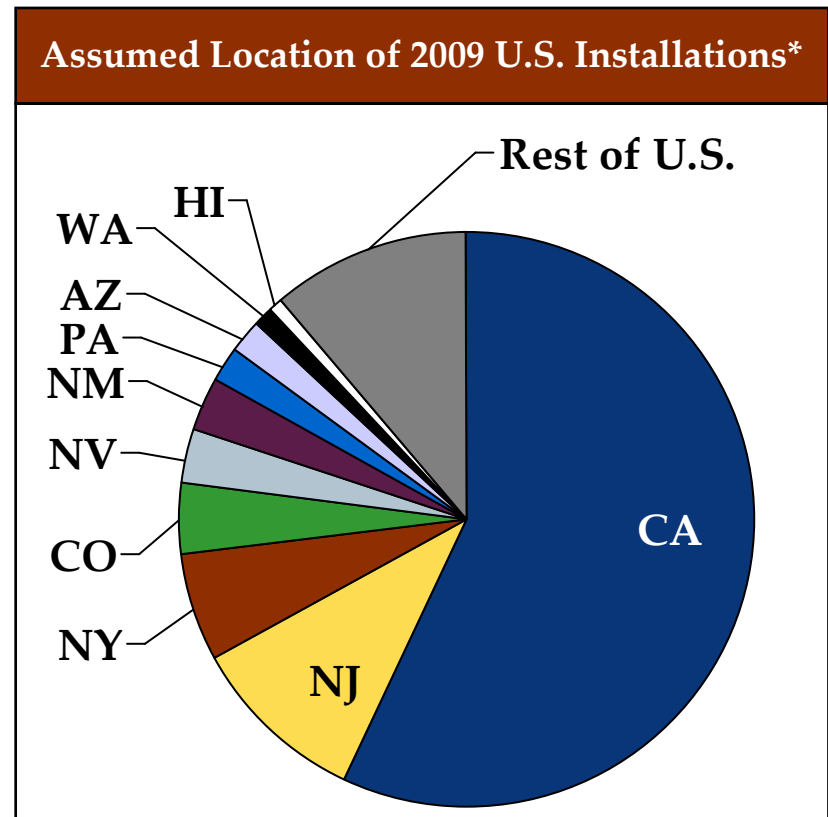
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NCI's *PV Service's* 2009 accelerated forecast (790 MW) was used for the ITC market scenario, and the decelerated forecast (325 MW) for the scenario without the ITC.



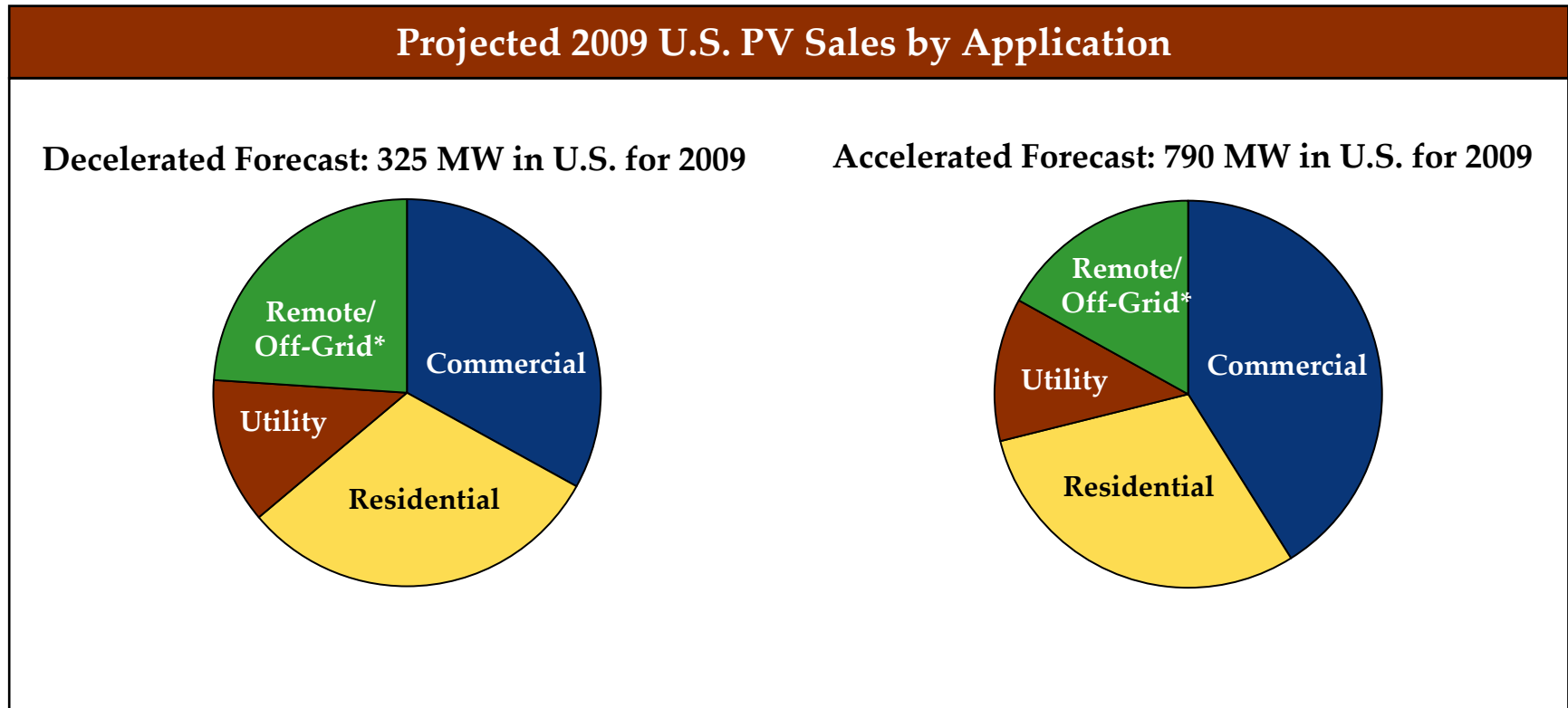
Source: NCI PV Services Program, January, 2008.



Source: NCI PV Services Program, May, 2007.

*NCI used data on location of 2006 installations and assumes the same proportions for 2009.

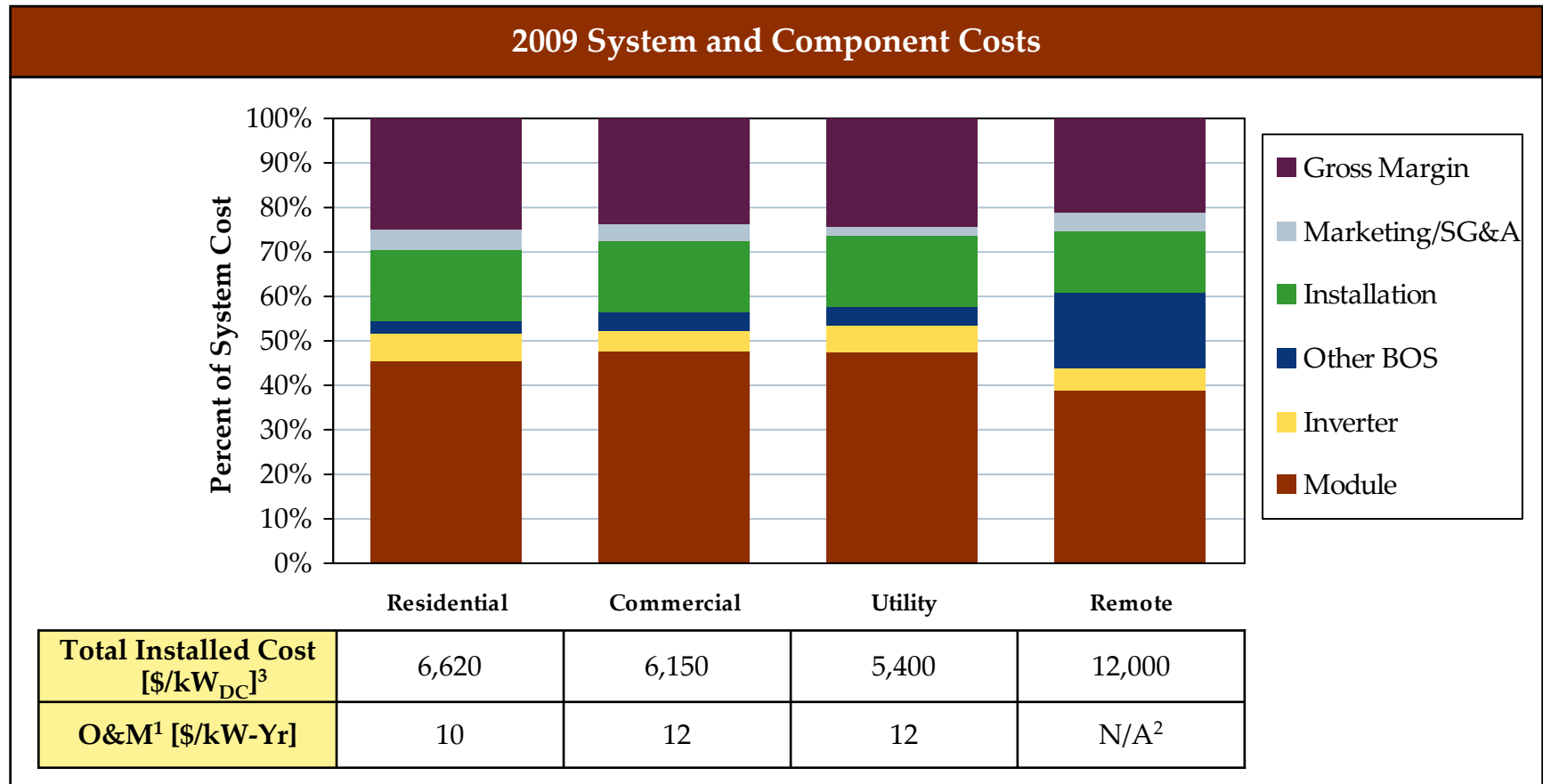
Commercial and residential applications will dominate the U.S. market in the decelerated and accelerated scenarios.



Source: NCI PV Services Program, January, 2008.

*Remote/Off-Grid applications include remote habitation, remote industrial and consumer products.

2009 installed system costs range between \$5,400/kW_{DC} and \$12,000/kW_{DC}.



Sources: NCI PV Services January, 2008; "Renewable Systems Interconnection: Rooftop PV Market Penetration Scenarios", J. Paidipati, L. Frantzis, H. Sawyer, A. Kurrasch December, 2007; "Comparative Costs of California Central Station Electricity Generation Technologies", California Energy Commission June, 2007, CEC 200-2007-011-SD; NCI Analysis January, 2007.

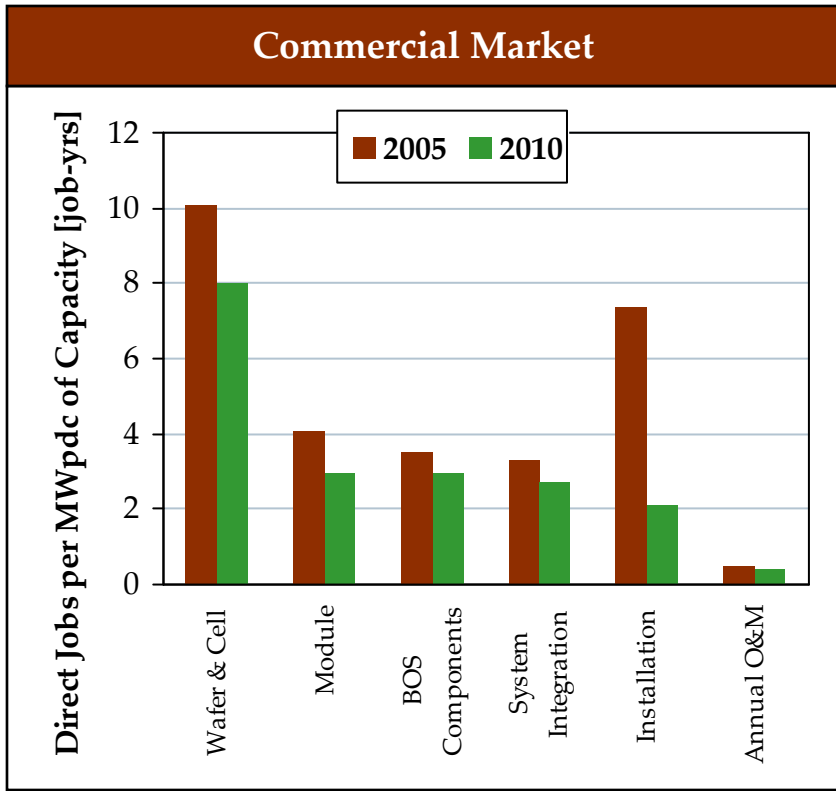
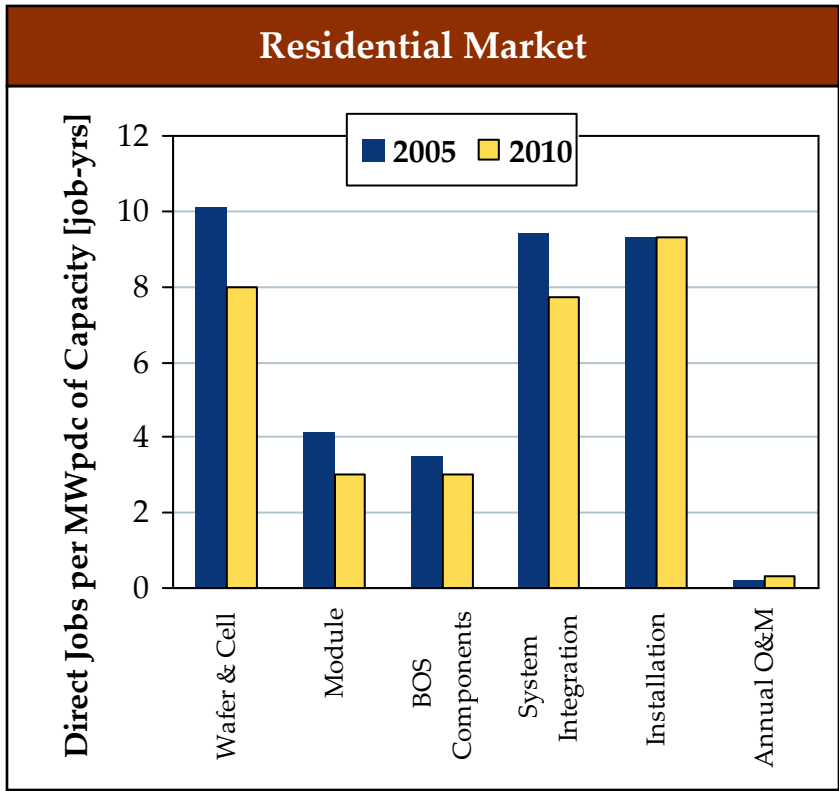
1. This does not include inverter replacement costs because this analysis is only looking at the first year of operation.
2. Most remote systems are only serviced once per year. This analysis is only looking at the first year of operation, so O&M will not likely occur.
3. Using an 80% DC to AC derating, these values are \$8,280, \$7,690, and \$6,750/kWac for residential, commercial and utility systems, respectively.

NCI calculated potential PV-related employment rates as a function of time.

<p>Primary Data Sources and Data Elements¹</p>	<ul style="list-style-type: none"> • NCI's PV module manufacturing cost model and Levelized Cost of Energy (LCOE) model. <ul style="list-style-type: none"> – These models provide detailed labor and non-labor cost estimates for all aspects of PV system manufacturing and installation • Interviews with PV industry sources – manufacturers, equipment suppliers, and installers • <i>The Work That Goes Into Renewable Energy</i>, Renewable Energy Policy Project (REPP), November 2001, Research Report No. 13.
<p>Method</p>	<ul style="list-style-type: none"> • Use NCI models and interview results to confirm and update REPP labor estimates. <ul style="list-style-type: none"> – NCI accounted for changes in technology, automation and material prices, and applied the updates to the range of available PV technologies • Weight the hour estimates by technology market shares to derive a weighted average hour for each labor task category. • Convert weighted estimates to job-years (1 job-year = 1,960 hours). • Using labor-hours and material estimates per installation task from NCI's LCOE model, and labor rate data from interviews with industry professionals and R. S. Means, calculate labor costs for residential: 3.5-kW, commercial: 1,500-kW and utility central station: 2-MW system installations. • Convert all results to per-MW costs.

1. In the manufacturing model, a process flow details each step and its costs, with technology improvements tracked as they occur. For each step, a detailed activity-based accounting is made of material, labor, capital and overhead costs, based on material quotes, machine capability spec sheets, machine cost quotations, U.S. labor rates, and industry financial parameters. The LCOE model accounts for module prices, inverter costs, installation labor, system integration, installer margins, etc. to build total system price, based on interviews with a wide array of industry sources.

NCI expects employment rates to decline over time as PV manufacturing becomes more automated and installation practices mature¹.



Notes:

1. For this analysis, NCI assumed similar labor intensity between the commercial and utility markets and between the residential and remote.
 Notes: One job-year is equal to 1,960 hours (40 hours per week, 49 weeks per year). System Integration includes system integration, design and distribution.

Source: Navigant Consulting, Inc. estimates, June 2006.

A recent NREL study looked at the economic impacts of DOE’s Solar America Initiative and reported economic multipliers.

Employment Economic Multipliers			
Construction and Manufacturing		Operation & Maintenance	
Ratio of Indirect to Direct*	Ratio of Induced to Direct*	Ratio of Indirect to Direct	Ratio of Induced to Direct
1.4	2.1	0.5	0.8

Investment Economic Multipliers			
Construction and Manufacturing		Operation and Maintenance	
Ratio of Indirect to Direct	Ratio of Induced to Direct	Ratio of Indirect to Direct	Ratio of Induced to Direct
1.1	1.3	0.7	0.9

Source: S. Grover, “Energy, Economic, and Environmental Benefits of the Solar America Initiative”, August 2007, NREL/SR-640-41998.

Economic multipliers calculated using IMPLAN regional economic modeling software.

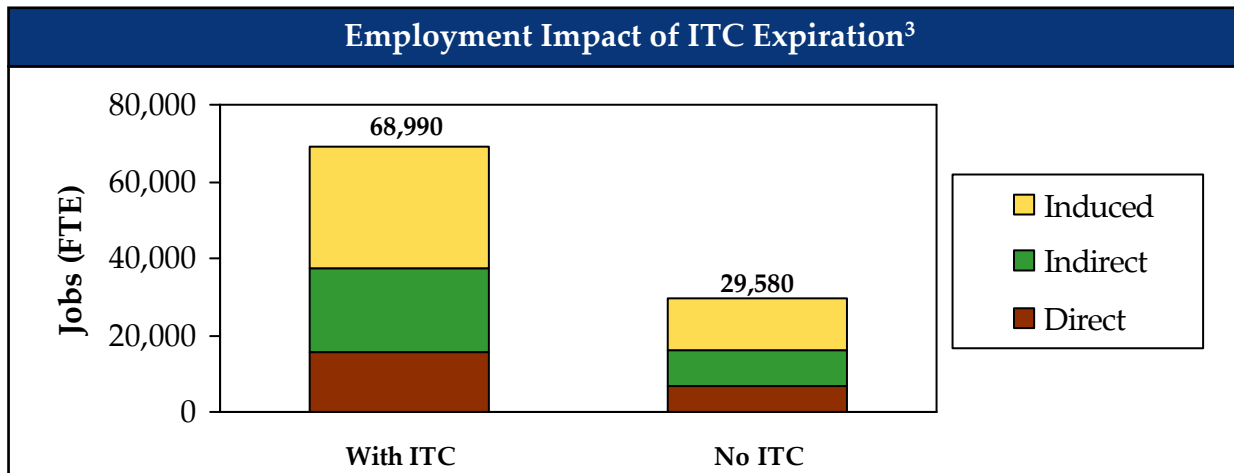
*Refer to the appendix for definition of direct, indirect, and induced impacts.

ITC expiration could accelerate lost employment opportunity to 39,400 jobs through 2009...

2009 Market Projections [MW]		
Market	With ITC	Without ITC
Residential	237	101
Commercial	325	107
Remote	134	78
Utility	95	39

\times Labor Intensity^{1,2} \times

Employment Economic Multipliers			
Construction and Manufacturing		Operation and Maintenance	
Indirect: Direct	Induced: Direct	Indirect: Direct	Induced: Direct
1.4	2.1	0.5	0.8



1. Refer to slide 11 for details on labor intensity.
2. Analysis assumes, per EIA form E-63B for 2006, 55% of manufacturing is done in the U.S.
3. Refer to appendix for assumed state-by-state impacts.

... and accelerate lost investment opportunity to ~\$8.1B through 2009.

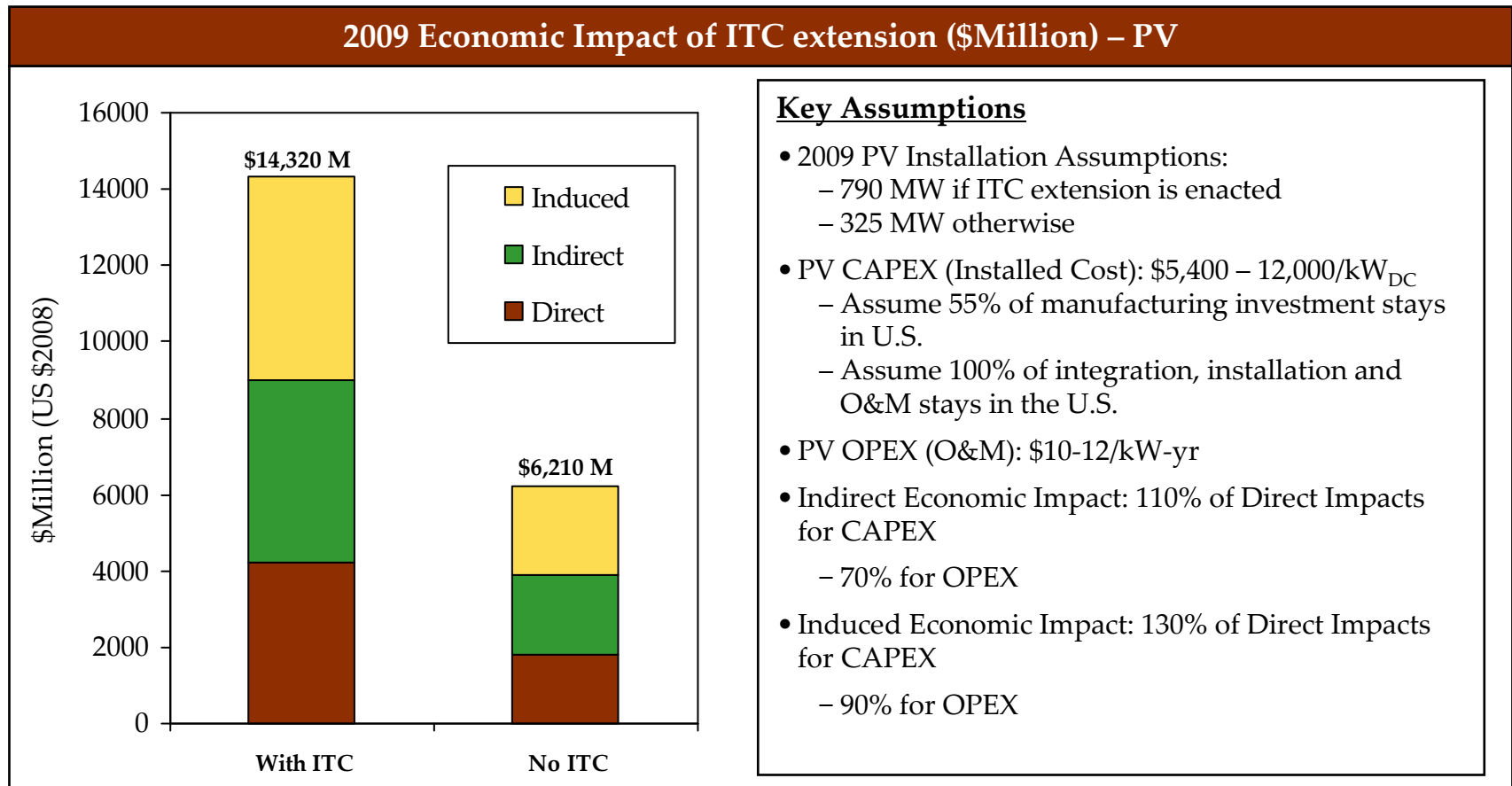
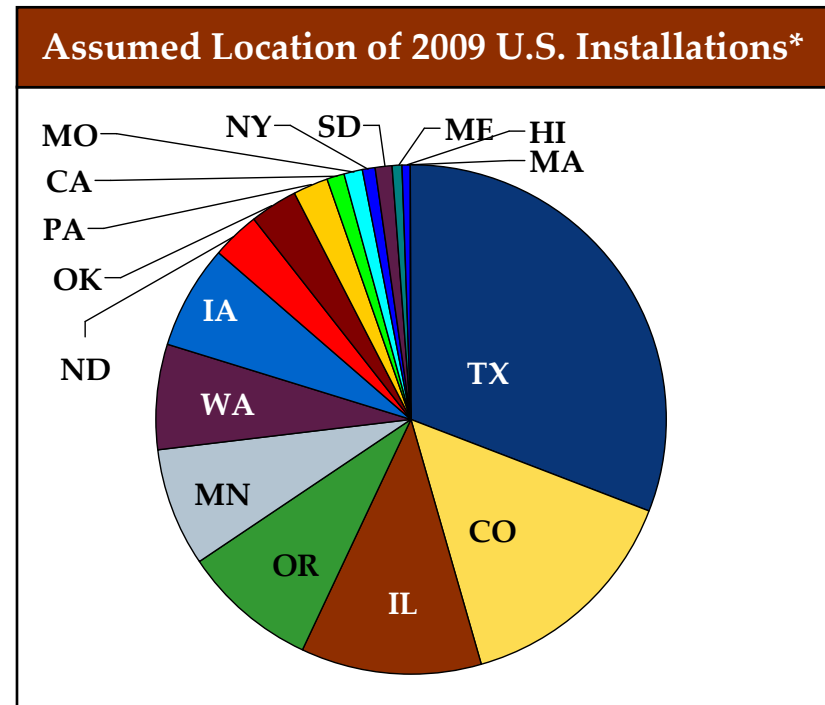
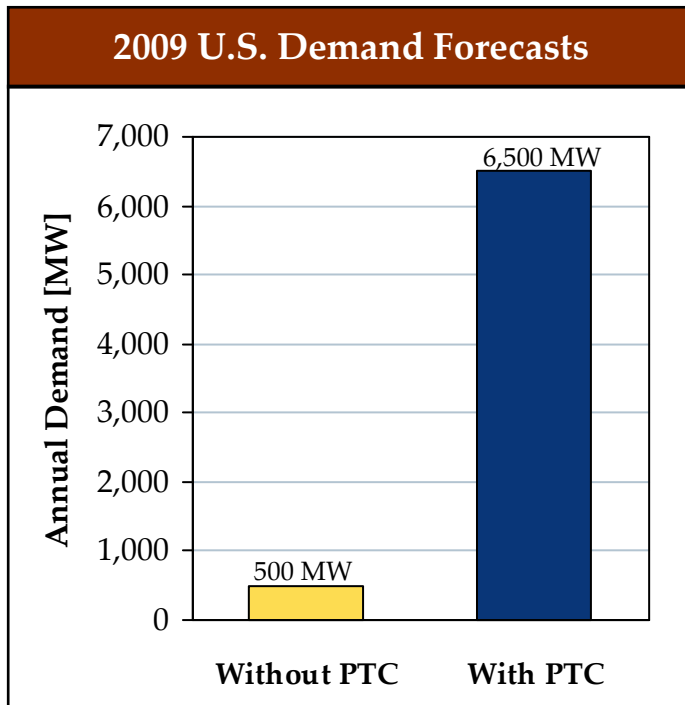


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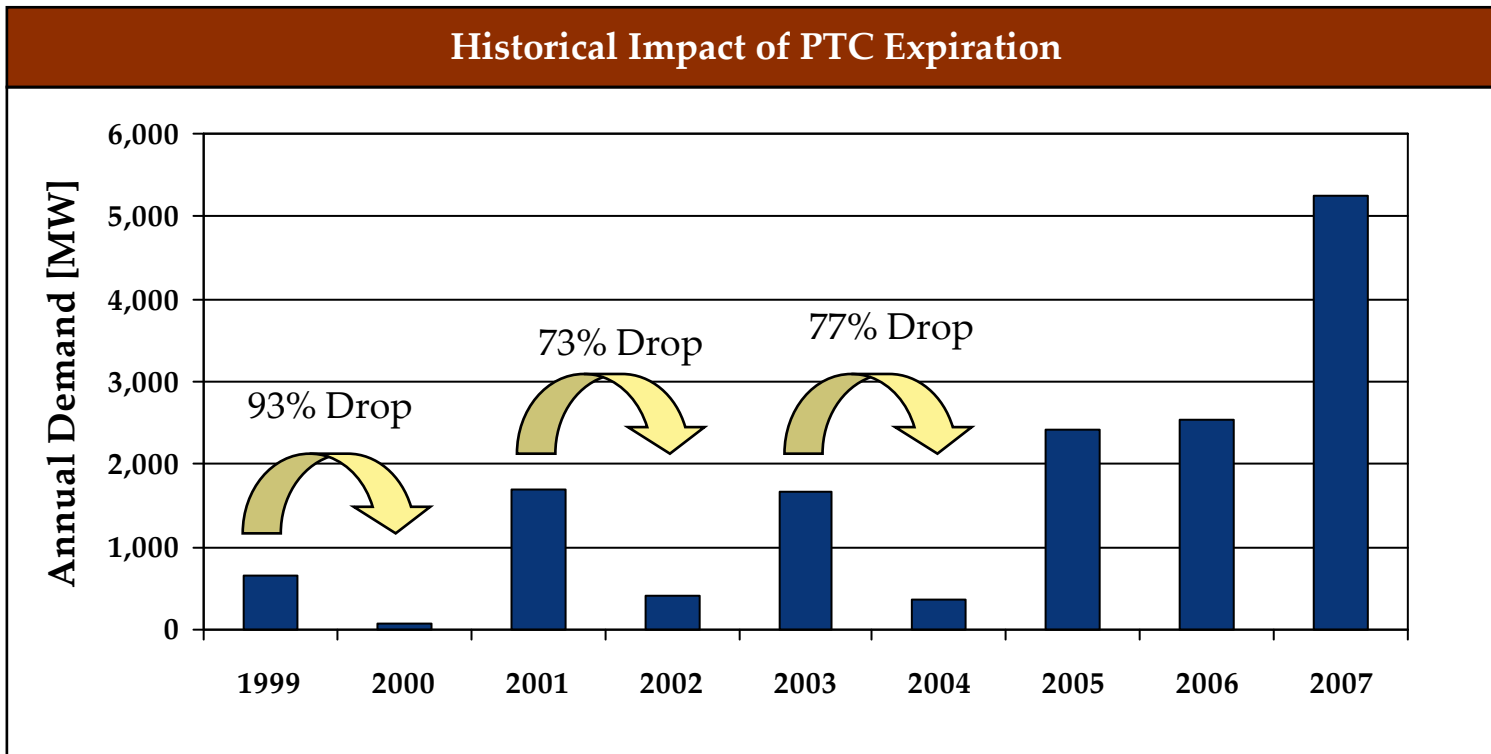
NCI projects 2009 installations to be between 500 MW and 6,500 MW, depending on the PTC availability.



An installed system price of \$1,900/kW was assumed for wind power.

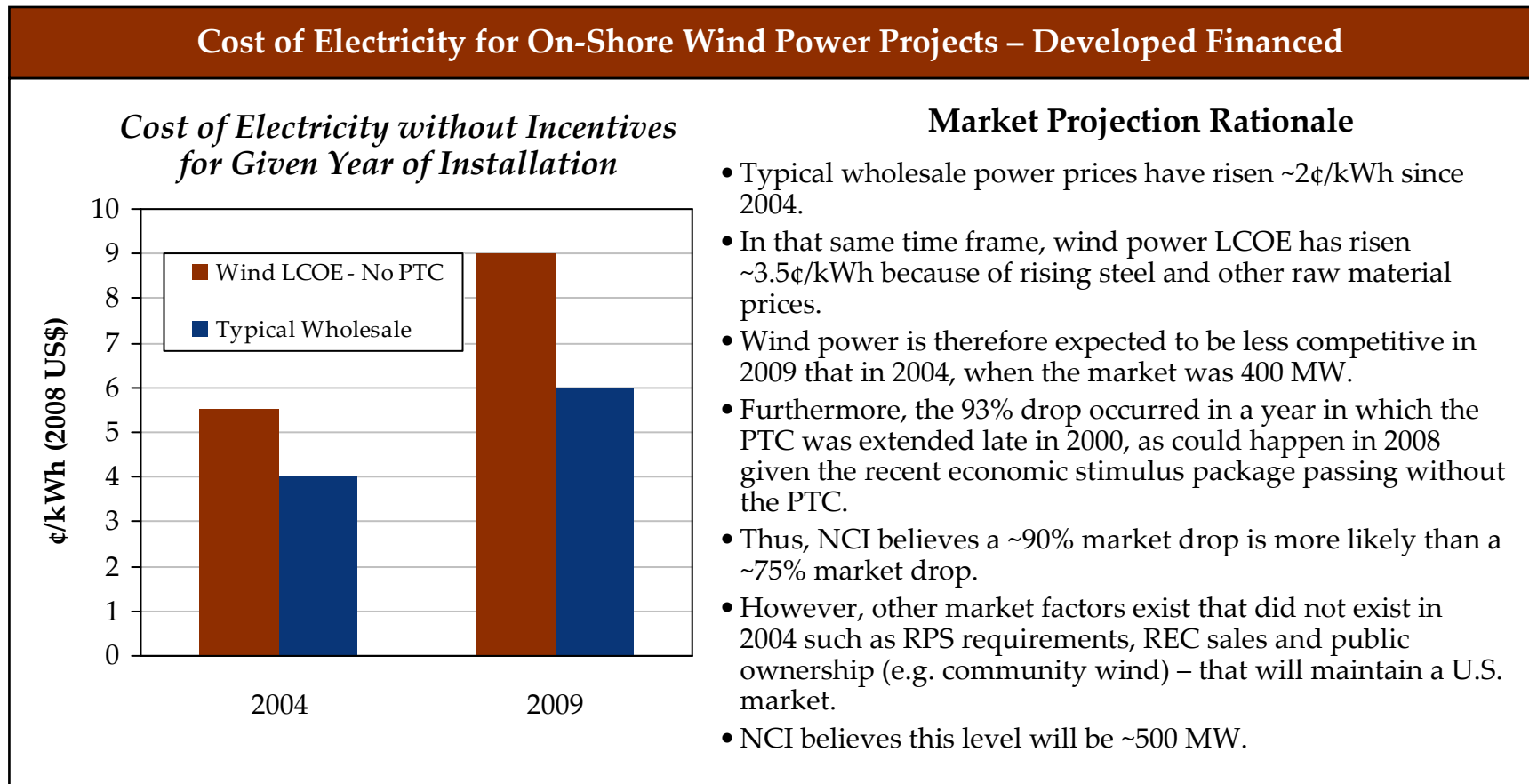
Source: NCI Analysis January, 2008; "U.S. Wind Energy Projects" AWEA January, 2008; "Comparative Costs of California Central Station Electricity Generation Technologies", California Energy Commission June, 2007, CEC 200-2007-011-SD; NCI Analysis January, 2008
 *NCI used AWEA data on location of 2007 installations and assumes the same proportions for 2009.

Historically, the PTC expiration has caused a 73% to 93% market drop to around 400 MW of annual installations.



Source: AWEA, January 2008

Without the PTC the LCOE for wind power in 2009 is expected to be even less competitive with wholesale power than in 2004 when about 400 MW were installed.



Source: NCI analysis, January 2008.

*This is NCI's best estimate based upon NCI market knowledge and high level analysis done within the scope and budget of this work.

NCI used DOE’s Wind Jobs and Economic Development Impact (JEDI) model to assess labor impacts.

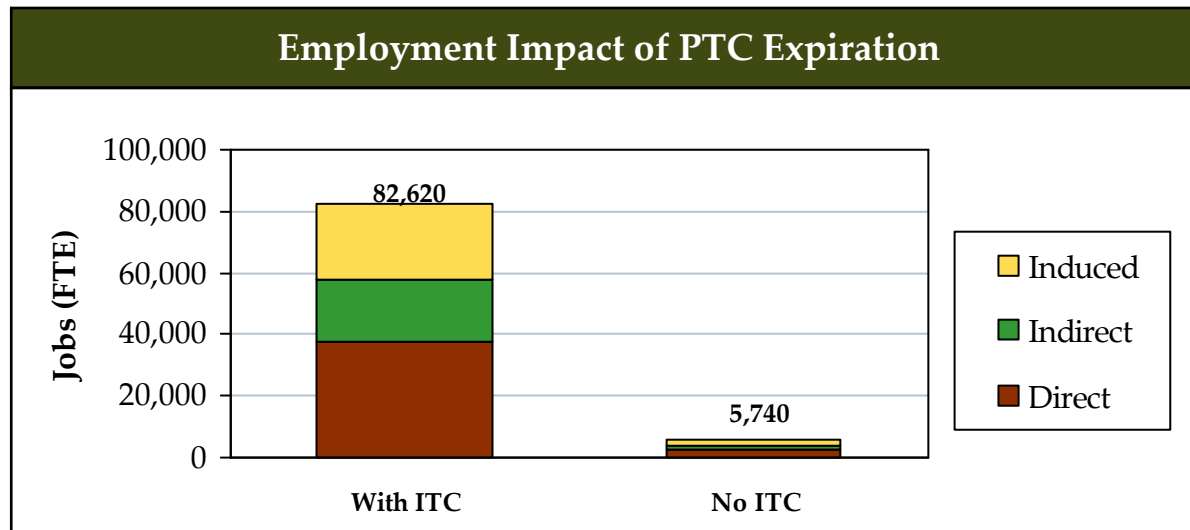
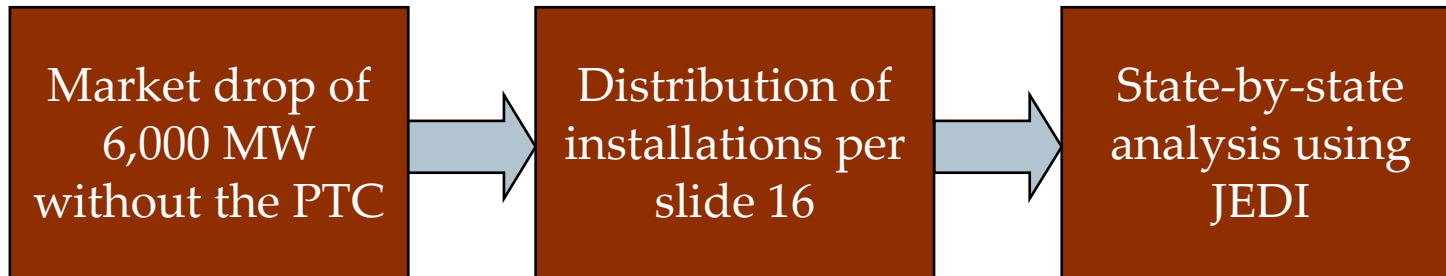
Sample JEDI Outputs*		
Output	Jobs [FTE]	Investment [\$M]
During Construction		
Direct	500	106.0
Indirect	248	31.2
Induced	326	36.3
During Operation		
Direct	27	12.4
Indirect	7	4.1
Induced	15	4.6

JEDI Model
<ul style="list-style-type: none"> • The JEDI model was developed for the U.S. Department of Energy to analyze the economic benefits of constructing and operating wind power plants. • JEDI contains labor intensity data and then uses the IMPLAN model to project indirect and induced economic impacts. • NCI ran a separate JEDI run for each state of interest. <ul style="list-style-type: none"> – Indirect and induced impacts vary regionally.

Sources: Department of Energy’s Wind and Hydropower Technologies Program at http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemid=707

* Analysis done for a 100 MW wind farm in Texas assuming \$1,900 kW installed, \$27/kW-Yr O&M, and 40% local turbine and blade manufacturing.

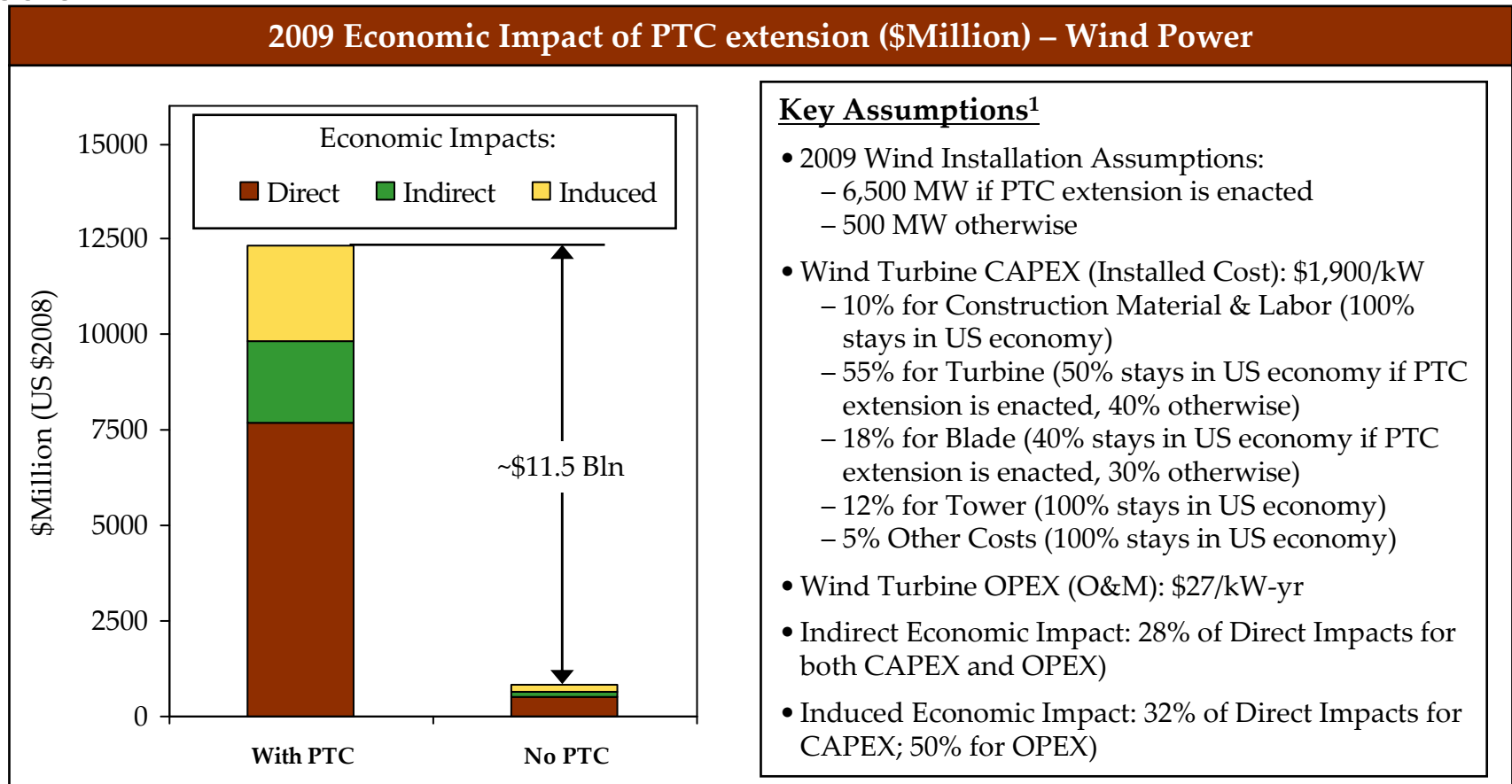
PTC expiration could accelerate lost employment opportunity to 76,800 jobs through 2009...



Source: NCI analysis, January, 2008. Refer to appendix for assumed state-by-state impacts.

* Analysis assumes 40% local turbine and 30% local blade manufacturing if the PTC does not pass and 50% local turbine and 40% local blade if it does pass.

...And lack of PTC extension beyond 2008 would “cost” the US economy ~\$11.5 billion through 2009 from decreased economic activity in the wind sector.



1. Assumptions are derived from the Jobs and Economic Development Impact (JEDI) Model and NCI estimates, January 2008.

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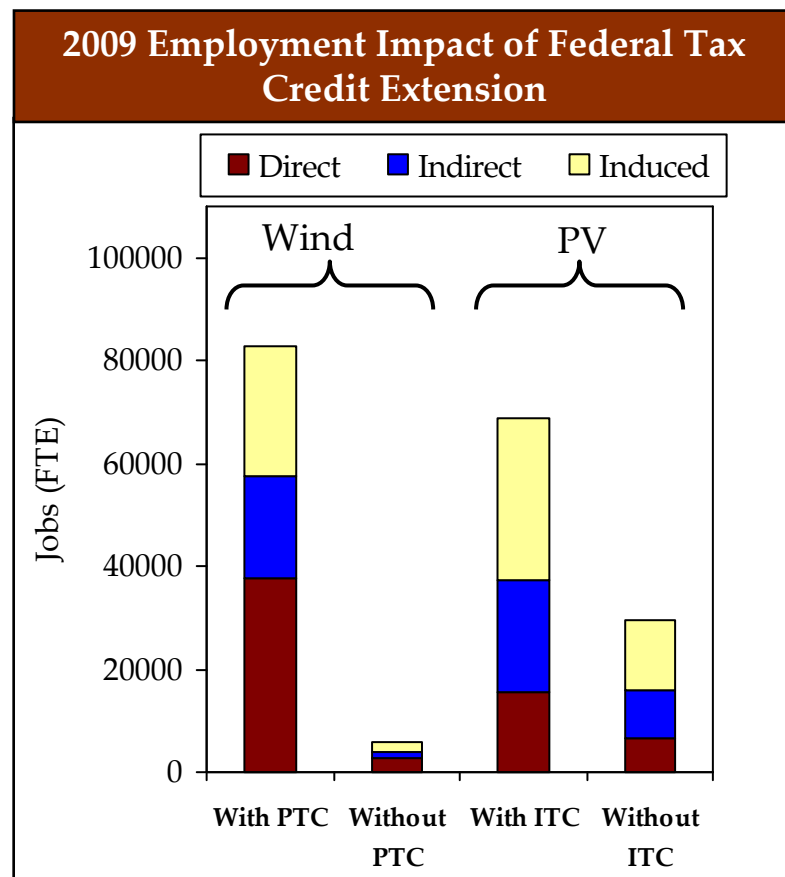
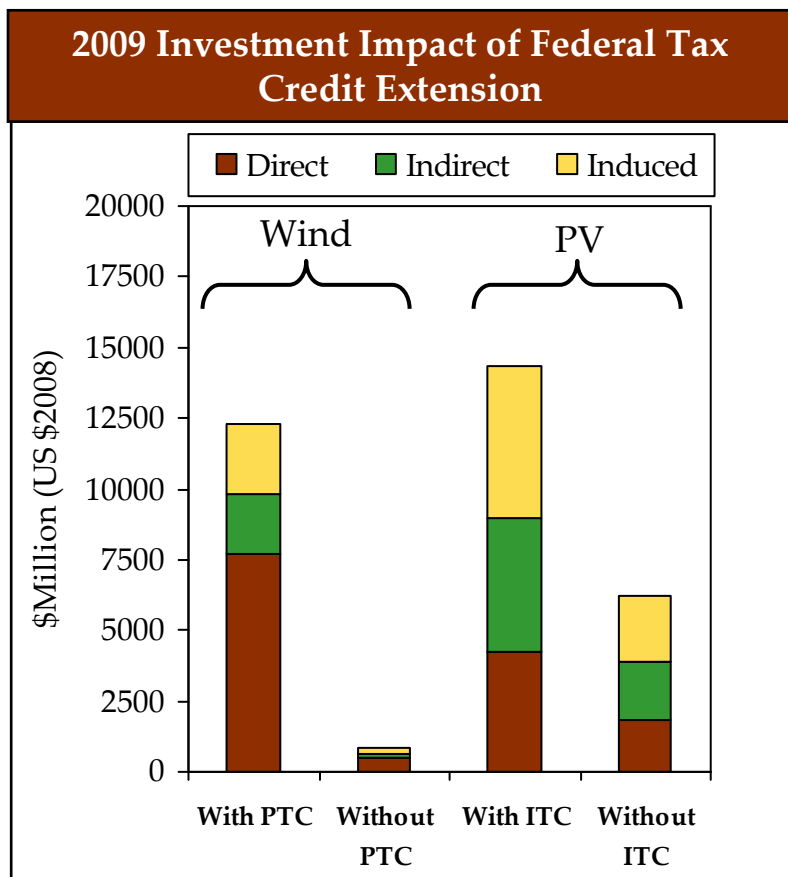


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Appendix

NCI used the following definitions of economic impacts.

2009 Investment Impact of Federal Tax Credit Extension

- **Direct Impacts** - represent the initial change in final demand for the industry sector in question. Direct impacts describe the changes in economic activity for sectors that first experience a change in demand because of a project, policy decision, or some other stimuli.
- **Indirect Impacts** - represent the response as supplying industries increase output in order to accommodate the initial change in final demand. These indirect beneficiaries will then spend money for supplies and services, which results in another round of indirect spending.
- **Induced Impacts** - are generated by the spending of households who benefit from the additional wages and business income they earn through all of the direct and indirect activity. The increase in income, in effect, increases the purchasing power of households.

Source: S. Grover, "Energy, Economic, and Environmental Benefits of the Solar America Initiative", August 2007, NREL/SR-640-41998.

NCI apportioned lost employment by state of installation.

PV Employment Impacts	
State	Lost Employment Opportunity Without ITC
California	22,583
New Jersey	3,894
New York	2,352
Colorado	1,557
Nevada	1,168
New Mexico	1,168
Pennsylvania	7,79
Arizona	7,79
Washington	389
Hawaii	389
Rest of US	4,283

Wind Employment Impacts	
State	Lost Employment Opportunity Without PTC
Texas	23,139
Colorado	10,625
Illinois	8,938
Oregon	7,297
Minnesota	6,304
Washington	4,744
Iowa	5,254
North Dakota	2,343
Oklahoma	2,468
Pennsylvania	1,617
California	809
Missouri	976
New York	696
South Dakota	978
Maine	472
Hawaii	196
Massachusetts	24

Employment impact location was calculated by projecting the location of 2006 (PV) and 2007 (Wind) installations to 2009 and attributing job loss to the state of installation. This is accurate for construction and installation jobs, but only provides a *very* rough indicator for manufacturing jobs.

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