



The Economic Impact of Renewable Energy in Arizona

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By:
Richard Merritt, President
Elliott D. Pollack & Company



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Why a Renewable Energy Study?

- **Renewable Energy is viewed as a Growth Industry**
- **Government Mandates– Renewable Portfolio Standards (RPS)**
- **Government Incentives**
- **Utility Incentives**





Arizona REST Mandates

(Renewable Energy Standards & Tariffs)

Requirements for ACC Regulated Electrical Utility Companies		
Year	Total Renewable Energy Requirement	Distributed Energy Requirement*
2010	2.5%	20.0%
2015	5.0%	30.0%
2020	10.0%	30.0%
2025	15.0%	30.0%

* Percentage of total renewable energy requirement

Source: Arizona Corporation Commission

**SRP Sustainable Resources Goal:
20% by 2020**



Renewable Portfolio Mandates for Selected States

State	Renewable Portfolio Standard (RPS)	Year to Meet RPS	Population
California	33.0%	2020	37,253,956
Colorado	30.0%	2020	5,029,196
Arizona	15.0%	2025	6,392,017
Pennsylvania	18.0%	2021	12,702,379
New York	29.0%	2015	19,378,102
Florida	None	--	18,801,310
Texas	5,880 MW	2015	25,145,561
Oregon	25.0%	2025	3,831,074
New Jersey	20.4%	2021	8,791,894
Massachusetts	22.1%	2020	6,547,629

Source: The Solar Foundation



Arizona's Renewable Energy Capacities (MW) 2010

Renewable Energy Technology	Regulated Utilities		Non-Regulated
	Arizona Public Service	TEP/UNSE	Salt River Project
Solar	65	41	22
Wind	190	-	128
BioMass	20	-	10
BioGas (Landfill)	3	5	22
Hydro	-	-	383
Low Impact Hydro	-	-	5
GeoThermal	10	-	-
Unspecified Purchases	-	-	25
Total	288	46	595





APS Renewable Energy Portfolio (MW) 2011

Type	Online	In Development
Purchase Power Agreements	222	377
APS Owned & Operated	39	50
Customer Owned & Operated	101	141
Total	362	568

Sources: Arizona Public Service





Components of Renewable Energy Industry

- **Operating Companies – Primarily involved in:**
 - **Residential/Commercial Sales & Installations**
 - **Manufacturing**
- **Companies working on Utility-Scale Renewable Energy Projects**





Study Methodology

- **Emerging Industry – Limited data on renewable energy employment**
- **Companies are going in and out of business**
- **Federal government just starting to track industry employment**





Study Methodology

- **Used best available data for this study**
 - **The Solar Foundation**
 - **Solar Energy Industry Association (SEIA)**
- **Consulted with ASU Solar Tracker Project**





Operating Companies





Operating Company Industries

- **Installations**
- **Sales**
- **Manufacturing**
- **Research & Development**
- **Professional Services**
- **Other (Finance, Product Development)**





Examples of Arizona Operating Companies

Sources: Energy Acuity, Phoenix Business Journal Book of Lists 2010, SEIA, ASU

Company	Industry
Anderson Solar Controls	Solar Panel Installation
Suntech Power	Solar Panel Manufacturer
Bowman Consulting	Engineering Services
Southwest Windpower	Small Wind Generator Manufacturer
Kyocera Solar Inc.	Solar Panel Manufacturer
GreenFuel Technologies	Biofuel Manufacturer
SunSystems Inc.	Solar Pool Heating
SolarCity	Solar Panel Installation
First Solar	Solar Panel Manufacturer



Solar Employment 2011

Top Ten States

Source: The Solar Foundation

Rank	State	Estimated Solar Jobs	% of Total Solar Jobs	Estimated Solar Establishments	% of Total Companies
1	California	25,575	25.5%	3,550	20.7%
2	Colorado	6,186	6.2%	1,020	5.9%
3	Arizona	4,786	4.8%	980	5.7%
4	Pennsylvania	4,703	4.7%	750	4.4%
5	New York	4,279	4.3%	840	4.9%
6	Florida	4,224	4.2%	825	4.8%
7	Texas	3,346	3.3%	665	3.9%
8	Oregon	3,346	3.3%	545	3.2%
9	New Jersey	2,871	2.9%	480	2.8%
10	Massachusetts	2,395	2.4%	410	2.4%
Top Ten States		61,711	61.6%	10,065	58.6%
U. S. Solar Employment		100,237		17,189	





Arizona Solar Employment (Updated)*

Source: The Solar Foundation, Arizona State University

Employment by Industry	Employees	Percent
Manufacturing	814	15%
Installation	1,723	33%
Research & Development	574	11%
Sales	1,292	25%
Professional Services (Legal/Engineering)	479	7%
Other (Finance, Product Development)	383	9%
Total	5,265	100%

***Based on data from ASU Solar Tracker Project**





Economic Impact Analysis

- **This is a Gross Economic Analysis**
- **Does not account for offsetting effects/displacement of employment in energy industry**
- **Does not account for incentives provided to the industry**





Economic Impacts of Operating Renewable Energy Companies Arizona - 2011

Operating Companies			
Impact Type	Jobs	Wages (millions)	Economic Output (millions)
Direct	5,265	\$237.47	\$585.53
Indirect	1,699	\$77.01	\$214.69
Induced	2,489	\$102.72	\$304.64
Total	9,453	\$417.20	\$1,104.86





Utility-Scale Energy Projects





Utility-Scale Energy Projects

- **Concentrating Solar Power (CSP)**
- **Solar Photovoltaic (PV)**
- **Wind**
- **BioMass**
- **BioGas (landfill gas)**



Arizona Solar Projects - 2011

Project Name	Type of Project	Capacity	Utility	County
Solana	CSP	250 MW	APS	Maricopa
Cotton Center	PV	17 MW	APS	Maricopa
Hyder	PV	17 MW	APS	Yuma
Paloma	PV	17 MW	APS	Maricopa
Sun Edison Prescott	PV	10 MW	APS	Yavapai
RE Ajo	PV	5 MW	APS	Pima
Agua Caliente	PV	290 MW	PG&E	Yuma
Copper Crossing	PV	20 MW	SRP	Pinal
NRG Solar	PV	25 MW	TEP	Pima





Arizona Wind Projects - 2011

Project Name	Capacity	Utility	County
Perrin Ranch	99 MW	APS	Coconino
Kingman Wind	10 MW	TEP	Mohave





Economic Impacts of Utility-Scale Projects

Important Considerations

- A large amount of components and equipment are built out-of-state or out-of-country
- Impact in Arizona today is primarily in construction





Economic Impacts of Utility-Scale Projects

Methodology

- **Economic impacts based on average capital cost for renewable energy facilities in 2011**
 - **CSP: \$5.80M per MW**
 - **PV: \$3.75M per MW**
- **Assume that 25% of project cost is supplied by Arizona companies**





Economic Impacts of Utility-Scale Projects in Arizona

Direct Construction Job Creation - 2011

Renewable Energy Technology	Direct Jobs	Direct Wages (millions)
CSP	1,792	\$91.86
Solar PV	1,631	\$83.61
Wind	189	\$9.67
Total	3,612	\$185.14





Economic Impacts of Utility-Scale Projects in Arizona

Economic Impact of Construction - 2011

Type of Impact	Jobs	Wages (millions)	Economic Impact (millions)
Direct	3,612	\$185.14	\$412.06
Indirect	965	\$52.71	\$140.41
Induced	1,883	\$77.72	\$230.48
Total	6,460	\$315.57	\$782.95





Economic Impacts of Utility-Scale Projects in Arizona

Economic Impact of O & M - 2011

Type of Impact	Jobs	Wages (millions)	Economic Impact (millions)
Direct	251	\$34.54	\$168.23
Indirect	258	\$12.38	\$35.24
Induced	368	\$15.22	\$45.13
Total	877	\$62.14	\$248.60





Total Economic Impact of Renewable Energy - 2011

Job Creation - 2011

Type of Impact	Operating Cos.	Utility Scale Projects	O&M	Total
Direct	5,265	3,612	251	9,128
Indirect	1,699	965	258	2,922
Induced	2,489	1,883	368	4,740
Total	9,453	6,460	877	16,790





Total Economic Impact of Renewable Energy - 2011

Wages and Output - 2011

Type of Impact	Wages (Millions)	Economic Output (Millions)
Direct	\$475.15	\$1,165.82
Indirect	\$142.11	\$390.33
Induced	\$195.66	\$580.25
Total	\$794.92	\$2,136.40



Observations & Conclusions

Prospects for the Future

- **Tremendous Future Demand**

Projects Under Development (Greater Than 20 MW)				
State	No. of Projects	Total MW	Avg. MW Per Project	No. of Projects Over 200 MW
AZ	12	2,117	176	4
CA	68	14,176	208	21
NV	16	3,187	199	9
Totals	96	19,480	203	34

Source: SEIA, January 2012





Observations & Conclusions

Prospects for the Future

- **Manufacturing Job Creation in AZ**
 - **First Solar Mesa Plant – 600 jobs**
 - **Suntech Goodyear Plant – 100 jobs**
 - **Saint-Gobain Goodyear Plant – 50 jobs**
 - **Rioglass Surprise Plant – 100 jobs**





Observations & Conclusions

Prospects for the Future

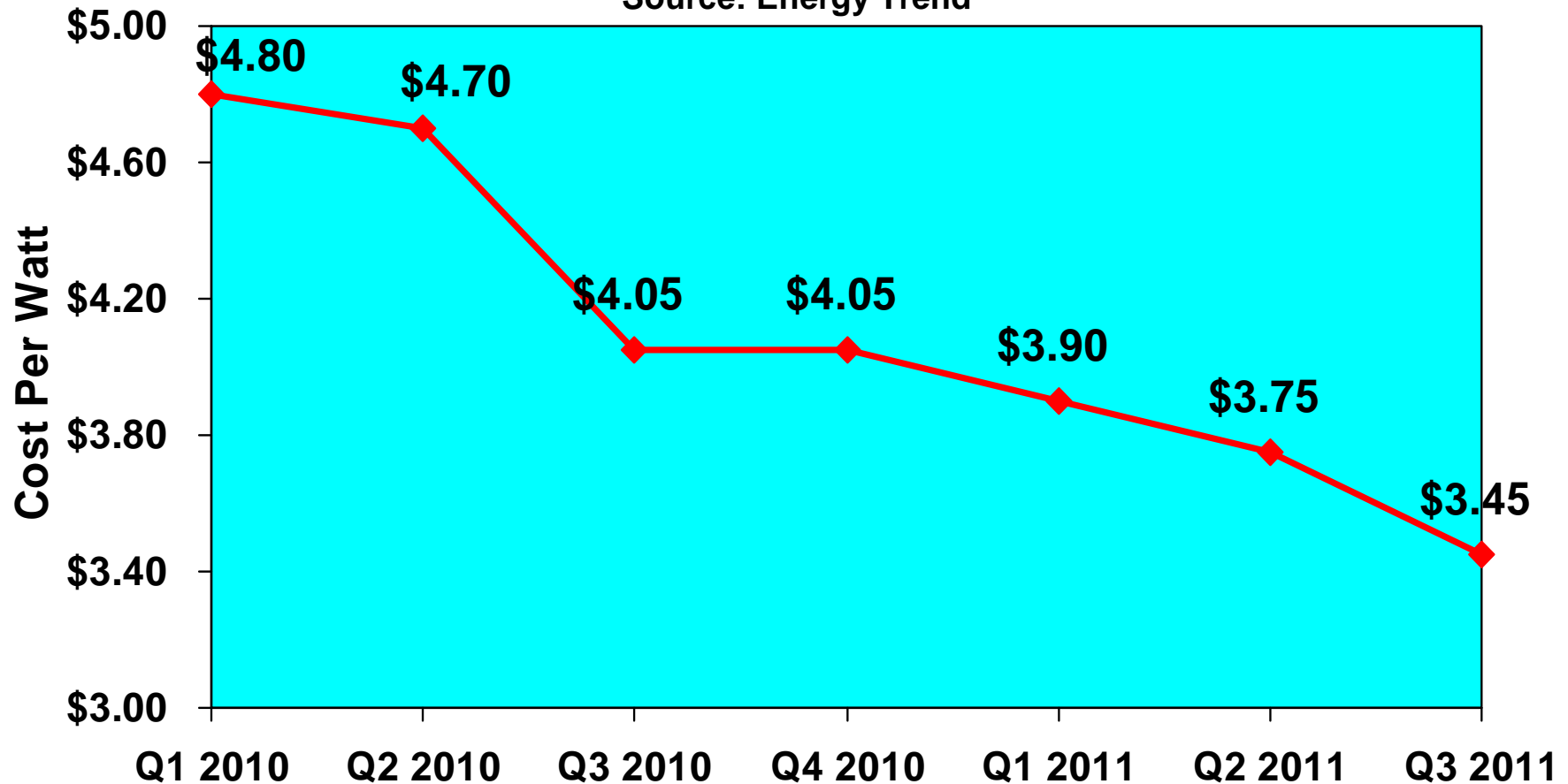
- **Capital costs declining; efficiencies improving**
- **Developers of CSP projects switching to PV due to declining costs**



Observations & Conclusions

Installed Cost For Utility Scale PV Plants

Source: Energy Trend





Observations & Conclusions

Prospects for the Future

- **Small scale residential and commercial systems are part of solution to offset need for large capital-intensive generating facilities**





Observations & Conclusions

Prospects for the Future

- **On-going job creation comes from manufacturers of components and installers of distributed energy systems**
- **Job creation related to utility scale project construction is variable and changes each year**
- **Once utility scale projects are completed, little impact from O&M**





Observations & Conclusions

Challenges Going Forward

- **Financial: High comparative costs; subsidies still required, but market changing**
- **Predictions that in two years, PV generation could be competitive with conventional electrical generating sources in 20 high-cost states**





Observations & Conclusions

Challenges Going Forward

- The industry is still very risky
- It is an “EMERGING” industry
- Developers still learning the technology
- Federal government has made missteps





Observations & Conclusions

Challenges Going Forward

- **Global competition: China**
- **Bankruptcies:**
 - **Solyndra - California**
 - **Stirling Energy – Scottsdale**





Observations & Conclusions

Challenges Going Forward

- **Will Federal & State incentives continue – is industry facing political headwinds?**





Observations & Conclusions

Arizona needs to expand its manufacturing capabilities to:

- **Manufacture and export Renewable Energy products globally and nationally**
- **California and Colorado are significant growth markets that can be served by Arizona companies with lower manufacturing costs**

**We are talking about creating a new
“Base Industry”**



“Base” (or Export) Sector Companies Drive The Economy





Why do ghost towns exist?





Flow of a Region's Economy

Base Industries

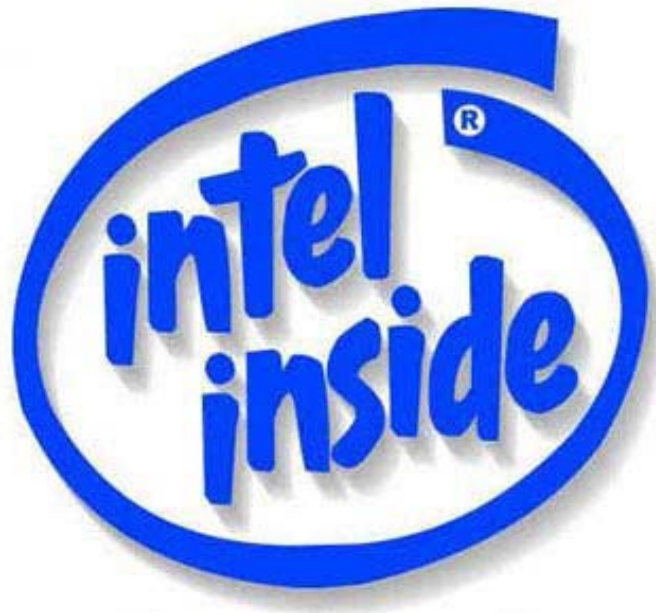
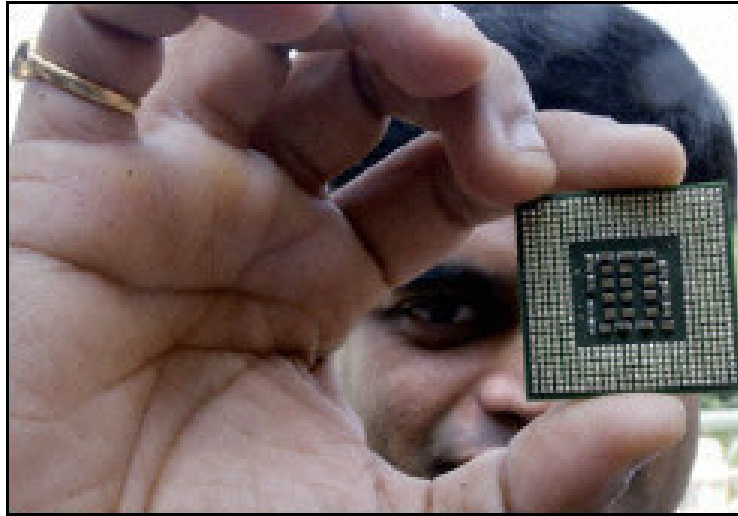
Manufacturing, Tourism, Export-Related Business Services,
Retirement, Etc.

Spending
by
Base
Industries

Local Market Industries

Retail, Construction, Local Business Services, Banks,
Local Government





**The health
of an
economy is
a function
of its
export, or
“base”
industries.**





Arizona Economic Drivers

- **Manufacturing (Aerospace & Semiconductors)**
- **Tourism**
- **Advanced business services**
- **Federal government**
- **Retirement & second homes**



Average Annual Wages & Multiplier Effects

Industry	Average Annual Wages	Job Multiplier
Base Industries		
Computer & other electronic equipment	\$111,524	3.2
Chemical manufacturing	\$105,340	4.7
Federal government	\$78,820	1.6
Machinery manufacturing	\$69,197	2.7
Advanced business services	\$69,539	2.1
Local Industries		
Educational services	\$33,643	1.4
Health care	\$33,491	1.4
Retail sales stores	\$29,381	1.4
Real estate	\$26,451	1.8





Renewable Energy Forecast



Forecast 2010 - 2025

Planned Utility Scale Capacity	APS	TEP	SRP*	Total
Planned New Renewable Energy Capacity 2010 – 2025 (MW)	2,430	600	705	3,735
Less Distributed Energy at 30% (MW)	729	180	212	1,121
Planned Utility Scale Capacity (MW)	1,701	420	484	2,615
Avg. Annual Utility Scale Capacity Added (MW)	113	28	33	174

***Assumes SRP will continue to develop Renewable Resources between 2020 & 2025 at currently planned pace.**





Forecast 2010 - 2025

**If Arizona can expand its
Renewable Energy manufacturing
base – more components of
projects can be built here,
increasing the potential economic
impact**



Forecast 2010 - 2025

Utility Scale Employment	AZ Jobs at 30% of Total Capital Cost	AZ Jobs at 60% of Total Capital Cost
Avg. Annual Utility Scale Direct Employment	1,800	3,600
Avg. Annual Utility Scale Indirect Employment	481	961
Avg. Annual Utility Scale Induced Employment	939	1,877
Total Annual Jobs	3,219	6,438





Summary

Major Benefits of Renewable Energy Industry

- **Reduction in carbon footprint, improved air quality**
- **Reduction in importation of natural gas and other fuels**





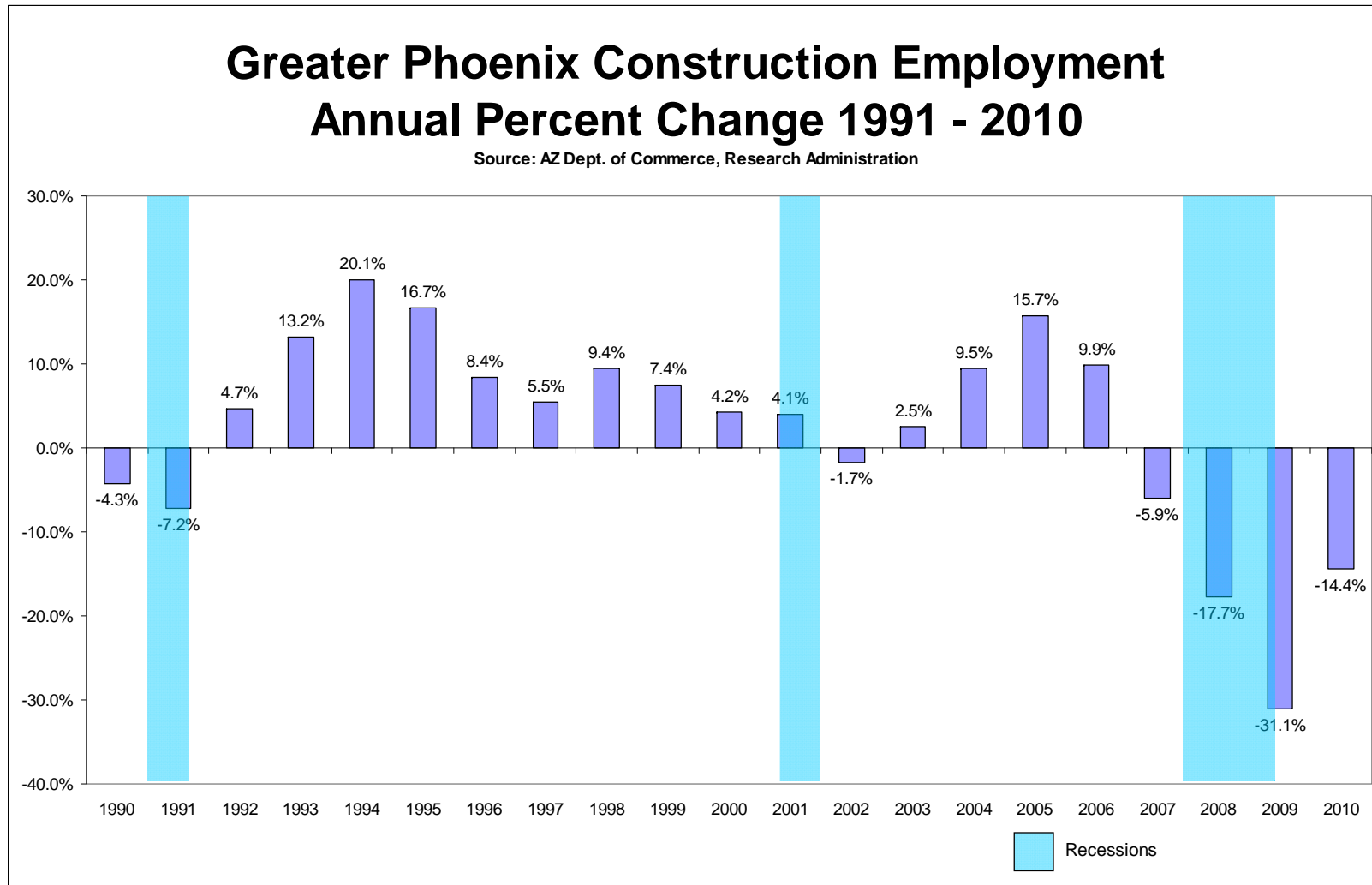
Summary

Major Benefits of Renewable Energy Industry

- In last few years, Renewable Energy Industry allowed construction firms and workers to transition to new occupations or different types of construction projects
- Renewable Energy Industry back-filled construction jobs lost to residential and commercial real estate market



Summary





A Word About Pinal County

- **There is one Renewable Energy project in Pinal County today: Copper Crossing, a 20 MW PV facility that sells power to SRP**
- **Virtually all solar projects in AZ are located in Maricopa County or to the west in Yuma and La Paz Counties**





A Word About Pinal County

- **Western and Central Arizona have flat available land suitable for solar projects**
- **Water is available in many locations**
- **Solar radiation in Western AZ is second only to low deserts of Southern California & Nevada**





A Word About Pinal County

- **Western AZ has extensive Federal BLM land available for lease**
- **Western AZ land is likely less expensive than in Pinal County**
- **Western AZ sites are well suited to serve California utilities**





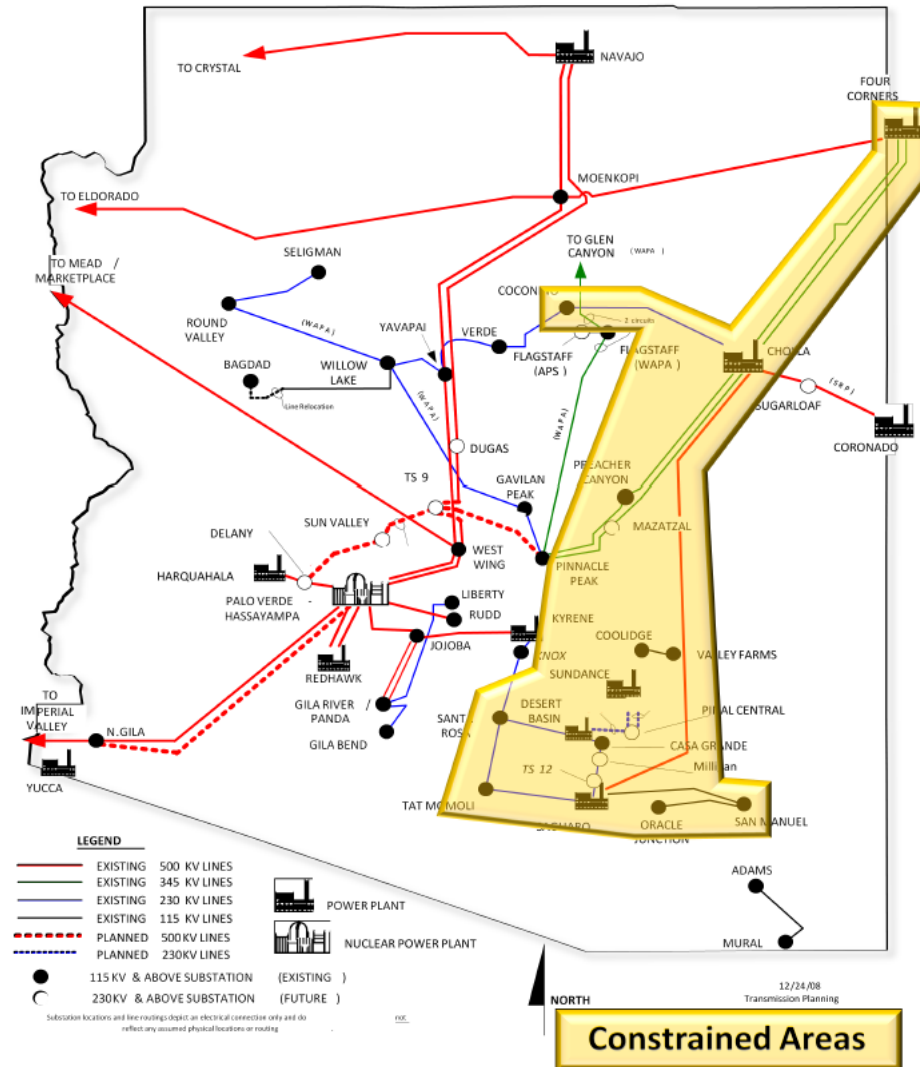
A Word About Pinal County

- **For the primary driver of Renewable Energy in Arizona – APS – Pinal County is within a “Constrained Transmission Area” - limited APS transmission assets in Pinal County**



A Word About Pinal County

APS Constrained Transmission Areas





A Word About Pinal County

- **Limited transmission assets for APS could limit construction of Utility Scale projects in Pinal County**
- **Still opportunities for solar manufacturing based on workforce capabilities and low land prices compared to Maricopa County**





Remember These Numbers

Economic Impact of Renewable Energy - 2011

Type of Impact	Jobs	Wages (Millions)	Economic Output (Millions)
Direct	9,128	\$475.15	\$1,165.82
Indirect	2,922	\$142.11	\$390.33
Induced	4,740	\$195.66	\$580.25
Totals	16,790	\$794.92	\$2,136.40





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7505 East Sixth Avenue, Suite 100 Scottsdale, Arizona 85251

480-423-9200 P / 480-423-5942 F / www.arizonaeconomy.com / info@edpco.com

