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Nevada Green Bank Study Deliverable 3 – Nevada Clean Energy Market Size

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April 2016

Project Deliverables

Review

(1) Market &
Policy Review

(2) Green Bank
Review

(3) Market Sizing

Synthesis

(4) Financing
Gaps & Needs
Assessment

Recommendations

(5) Green Bank &
Financing
Solutions

(6) Green Bank
Form &
Next Steps

Current market size presented in terms of energy and dollars invested

		Objectives	Limitations
Current size of individual clean energy markets	Total Investment	<ul style="list-style-type: none"> Determine total amount of public and private investment for each market segment Present single dollar figure representing current market size Use most current values available 	<ul style="list-style-type: none"> Limited access to private sector financial information Availability of data varied across years, necessary to extrapolate when current data was unavailable Most data exists at state level
	Total Installed Capacity ¹	<ul style="list-style-type: none"> Determine total amount of installed capacity or net energy savings for each market segment Present single measurement of total installed capacity or net energy savings Use most current values available 	<ul style="list-style-type: none"> Units of measurement vary across technologies Availability of data varied across years, necessary to extrapolate when current data was unavailable Most data exists at state level

Serviceable Addressable Market (SAM) describes the market segment that should be targeted

SAM = Economically viable market

- SAM – Serviceable Addressable Market
 - Total possible investment that is technically, economically, and politically viable for a given technology
 - Total possible installed capacity based on available resources (e.g., units, households, people in the market, natural resources) and constraints
- SAM calculated based on variety of reports, studies and assumptions to account for county-level market

Market sizing focuses on four current clean energy markets

Clean Energy Technologies Considered in Market Sizing

Technology	Definition
1 Solar	<ul style="list-style-type: none">• Solar photovoltaic (PV) installed in the residential, commercial and industrial, and utility markets. Residential and commercial and industrial markets are referred to as distributed generation markets• NREL assessment only considers PV, not solar thermal or CSP
2 Geothermal	<ul style="list-style-type: none">• Electricity generated from geothermal heat• Includes hydrothermal resources only
3 Wind	<ul style="list-style-type: none">• Wind power technology including turbines, blades, and towers, and services installed in residential, commercial, and utility-scale markets
4 Energy Efficiency	<ul style="list-style-type: none">• Technologies, methods, or strategies that result in using less energy to produce the same service or level of comfort• Technologies may include a conservation or efficiency strategy that helps users save energy in the built environment or a technology that is more efficient than traditional types• Only address electricity, includes CHP

Data from NREL economic potential analysis, plus other relevant market and policy inputs

Methodology

- NREL assessment produced economic potential estimates for multiple renewable technologies all 50 states
- 6 different scenarios depending on policy and market conditions
- This study considers low and high estimates across scenarios for each technology
- Also includes other key data points from trusted sources
- Efficiency market size from SWEEP market assessment

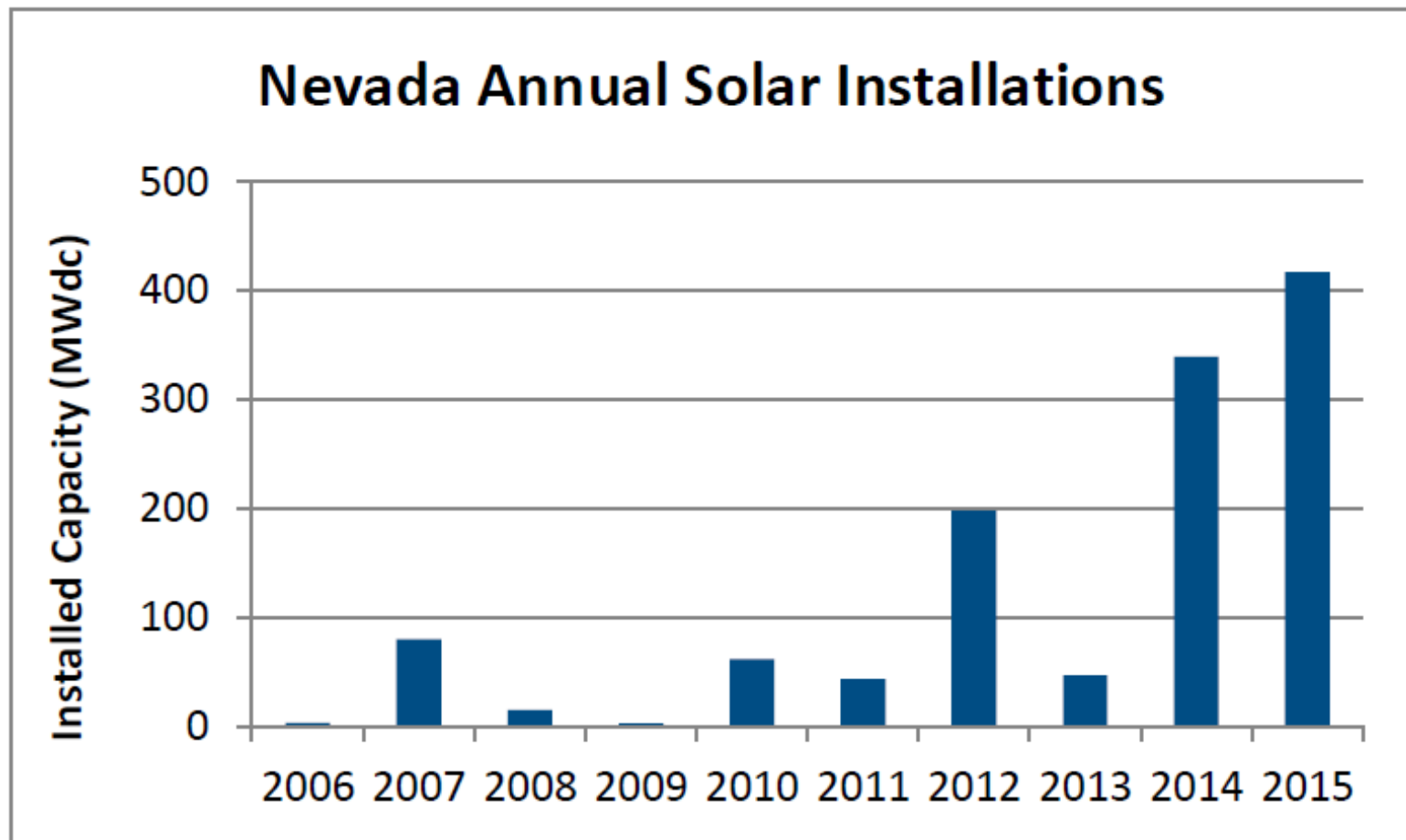


Estimated Nevada market potential for economically viable clean energy is at least \$26 billion

High & Low Scenario Addressable Market by Technology

Selected Technologies		Potential Energy Capacity		Investment Need (millions)	
		High Scenario	Low Scenario	High Scenario	Low Scenario
1 Solar	Utility	352.8 GW	5.7 GW	\$511,600	\$8,200
	Distributed	0.3 GW	0.3 GW	\$1,000	\$1,000
2	Geothermal	4.242 GW	1.391 GW	\$10,605	\$3,478
3	Wind	6.329 GW	1.526 GW	\$2,609	\$10,822
4	Electric Efficiency	7,040 GWh		\$2,590	
TOTAL		N/A	N/A	\$528,404	\$26,090

Nevada has 5th most installed solar capacity in the nation, installed 3rd most in 2015

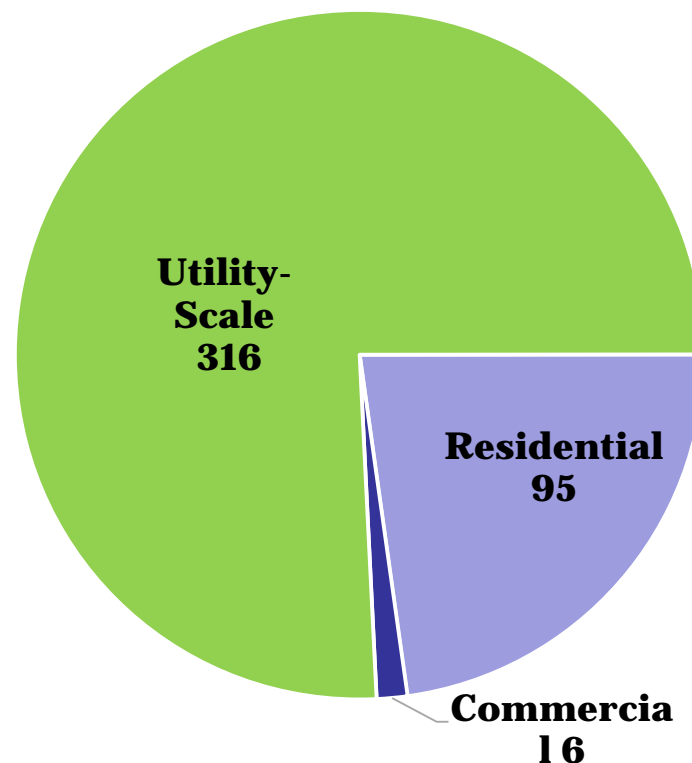


Nevada has fifth largest solar market in the country

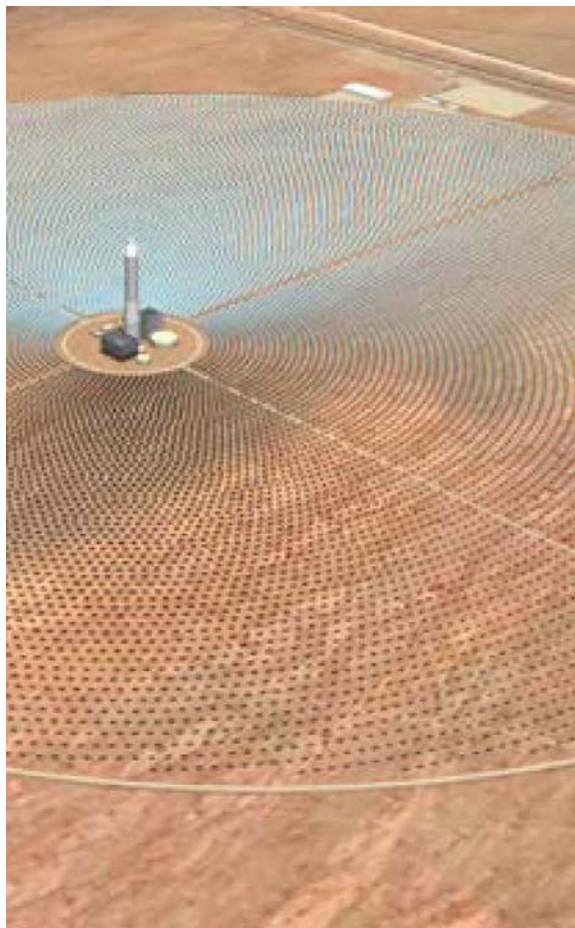
Solar Market Facts

- 1,240 MW installed through '15
- 417 MW installed in 2015, 198 in 4th quarter alone
- \$833 million invested in solar '15
- 6% YoY cost decline, 48% cost decline since 2010
- NV Energy reached net-metering cap of 235 MW in August '15
- As part of new net-metering tariff, there is now no capacity cap

2015 Nevada Solar Capacity Installed By Market Segment (MW)



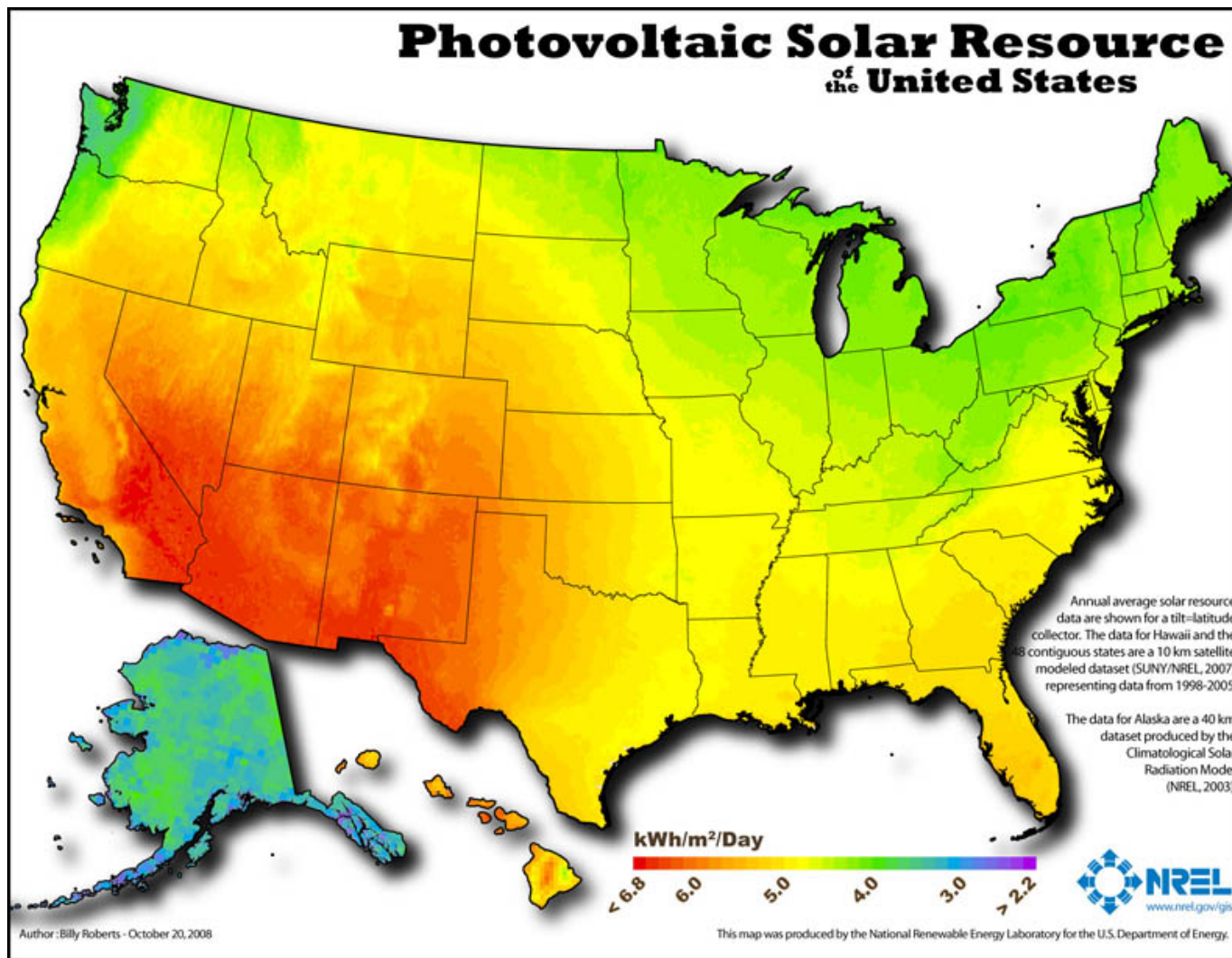
Installed solar capacity dominated by utility-scale



Crescent Dunes Project

NV Energy Solar Projects		
Project	Capacity (MW)	Tech
Apex Nevada	20	PV
Crescent Dunes	110	CSP
LV Valley Water	3	PV
Mountain View	10	PV
Nellis Solar Star	13.2	PV
Nellis Array II	15	PV
Nevada Solar One	69	CSP
Searchlight Solar	17.5	PV
Silver State Solar North	52	PV
Spectrum Nevada Solar	30	PV

Nevada has some of best solar resources in the nation



1

12th most technical potential, but share of potential that is economical is FAR higher than any other state

State	Technical Potential (TWh/yr)	Economic Potential (TWh/yr)	% of Technical Potential
Texas	41,309	17,066	41%
New Mexico	17,561	3,368	19%
Kansas	13,637	0	0%
Arizona	13,580	2,720	20%
Nebraska	10,614	0	0%
Oklahoma	10,280	208	2%
Montana	10,174	0	0%
South Dakota	10,001	0	0%
Colorado	9,998	28	0%
Minnesota	9,565	0	0%
Nevada	9,494	7,705	81%
California	9,192	92	1%

Nevada has enough solar potential to more than power than entire state

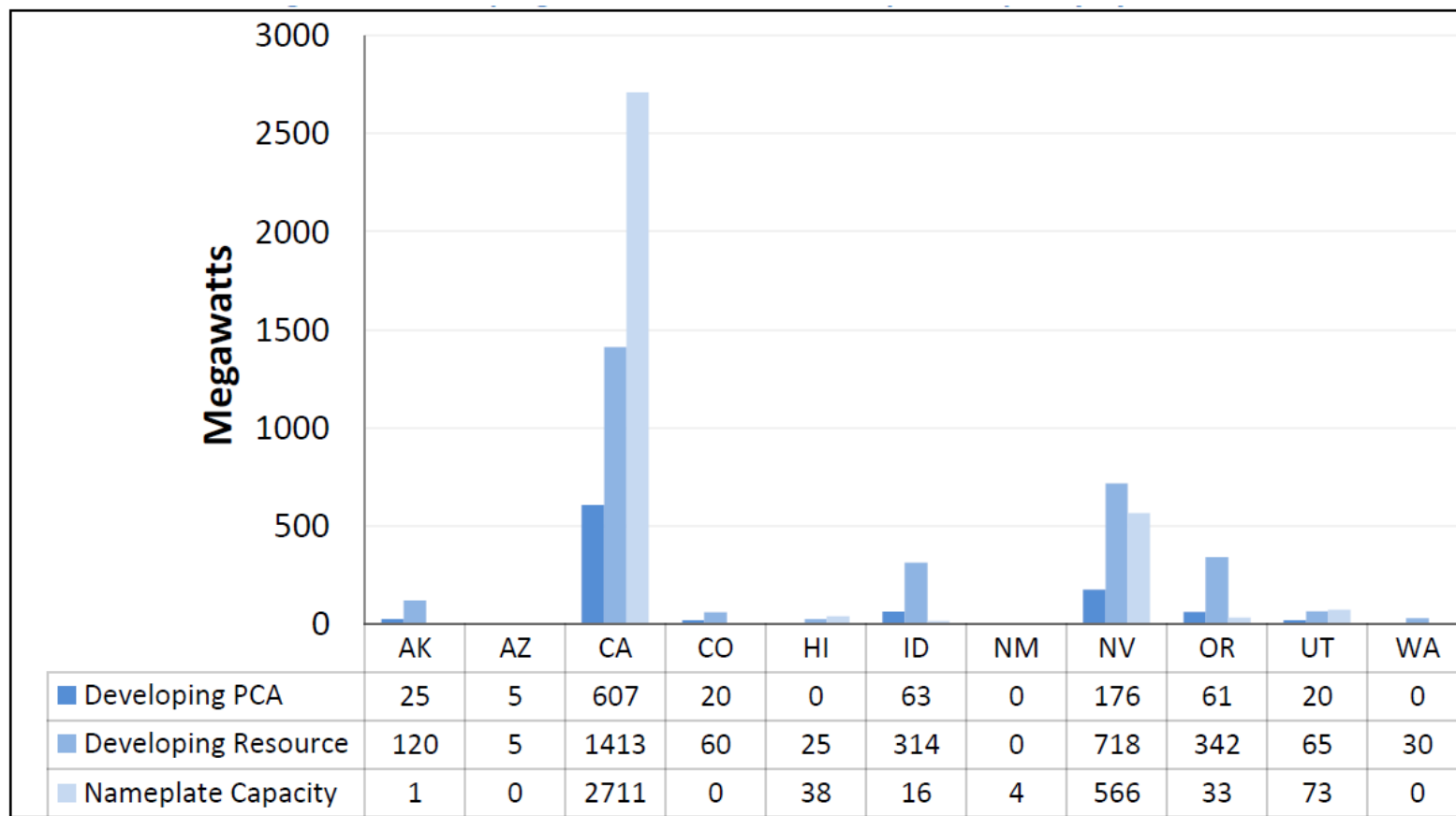
- NREL finds Nevada has 5,727 GW of utility scale technical potential, capable of producing 10,614 TWh/yr
 - In 2014 Nevada used 35 TWh of electricity
 - 4.4 GW of residential & 4.7 GW of commercial technical potential
- NREL economic potential ranges from 3,532 GW to 60 GW, depending on market and policy assumptions
- **To be conservative, this report estimates that only 10% of economic potential is realized and can be deployed into the market**

Realizing Nevada economic solar market potential requires minimum \$9 billion of investment

	Utility Solar	Distributed Solar	Total
Technical Potential (GW)	4.348	9.1	4,357
Economic Potential-High (GW)	3,528	3.4	3,532
Economic Potential-Low (GW)	56.6	3.4	60
Market Potential-High (GW)	352.8	0.3	353.2
Market Potential-Low (GW)	5.7	0.3	6
Investment Need-High (billions)	\$511.6	\$1.0	\$512.6
Investment Need-Low (billions)	\$8.2	\$1.0	\$9.2

Nevada has second most installed geothermal in the nation

Geothermal Capacity by State as of April 2014

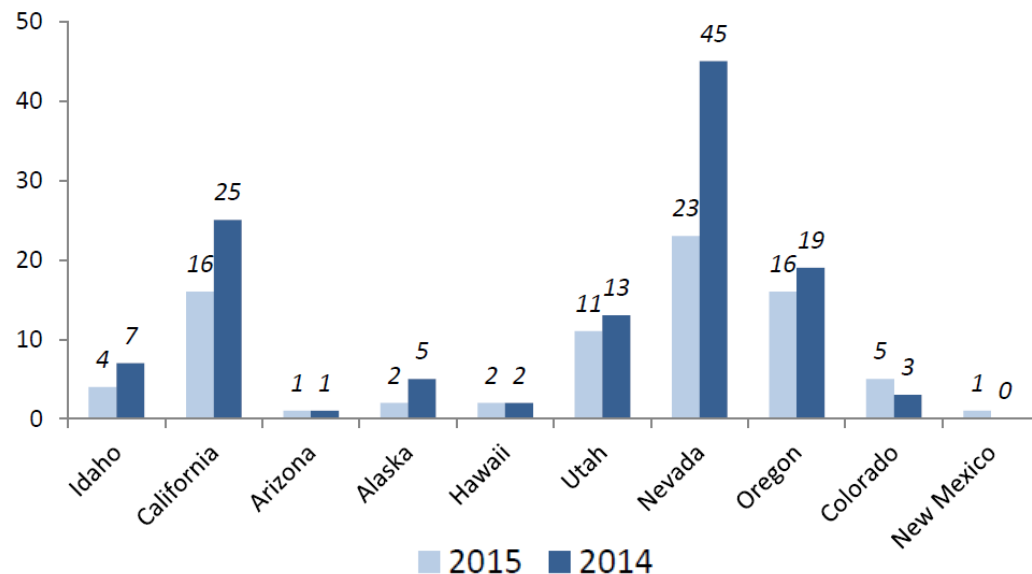


Nevada geothermal market growing, supported by world leader in geothermal equipment

Geothermal Market Facts

- 600+ MW installed capacity through 2014
- As of 2014, 16 fields, produced 2.742 million MWh generated
- Equal to ~7.5% of retail electricity sales in Nevada
- First projects built 30 years ago
- More projects in development in Nevada than any other state
- Ormat, based in Nevada, supplies equipment to more projects than any other developer in the world

Number of Developing Geothermal Projects by State



Nevada has second highest identified geothermal resource potential in the nation

Electric Power Generation Potential By State

State	N	Identified Resources (MWe)				Undiscovered Resources (MWe)				Enhanced Geothermal Systems (MWe)			
		F95	F50	Mean	F5	F95	F50	Mean	F5	F95	F50	Mean	F5
Alaska	53	236	606	677	1,359	537	1,428	1,788	4,256	NA	NA	NA	NA
Arizona	2	4	20	26	70	238	775	1,043	2,751	33,000	52,900	54,700	82,200
California	45	2,422	5,140	5,404	9,282	3,256	9,532	11,340	25,439	32,300	47,100	48,100	67,600
Colorado	4	8	11	30	67	252	821	1,105	2,913	34,100	51,300	52,600	75,300
Hawaii	1	84	169	181	320	822	2,027	2,435	5,438	NA	NA	NA	NA
Idaho	36	81	283	333	760	427	1,391	1,872	4,937	47,500	66,700	67,900	92,300
Montana	7	15	51	59	130	176	573	771	2,033	9,000	16,100	16,900	27,500
Nevada	56	515	1,216	1,391	2,551	996	3,243	4,364	11,507	71,800	101,300	102,800	139,500
New Mexico	7	53	153	170	343	339	1,103	1,484	3,913	35,600	54,400	55,700	80,100
Oregon	29	163	485	540	1,107	432	1,406	1,893	4,991	43,600	61,500	62,400	84,500
Utah	6	82	171	184	321	334	1,088	1,464	3,860	32,600	46,500	47,200	64,300
Washington	1	7	20	23	47	68	223	300	790	3,900	6,300	6,500	9,800
Wyoming	1	5	31	39	100	40	129	174	458	1,700	2,900	3,000	4,800
Total	248	3,675	8,356	9,057	16,457	7,917	23,739	30,033	73,286	345,100	507,000	517,800	727,900

Sources: US Geological Survey, "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States," Fact Sheet 2008-3082, U.S. Department of the Interior, 2008.

Nevada needs several billion dollars to tap economically viable geothermal investment

Nevada Geothermal Market Potential & Investment Need

	Source	Potential Type	Capacity (MW)	Estimated Investment Need (millions)
Low →	USGS	Conventional, identified	1,391	\$3,478
	NREL	Economic Potential – Low	3,841	\$9,601
High →	NREL	Economic Potential – High	4,242	\$10,605
	USGS	Conventional, undiscovered	4,364	\$10,910
	USGS	Unconventional	102,800	\$257,000

Conservative estimates show Nevada Geothermal SAM is between \$3.5 and \$10.6 billion.

Notes & Sources: Assumes \$2,500/kw install cost. *SEE*

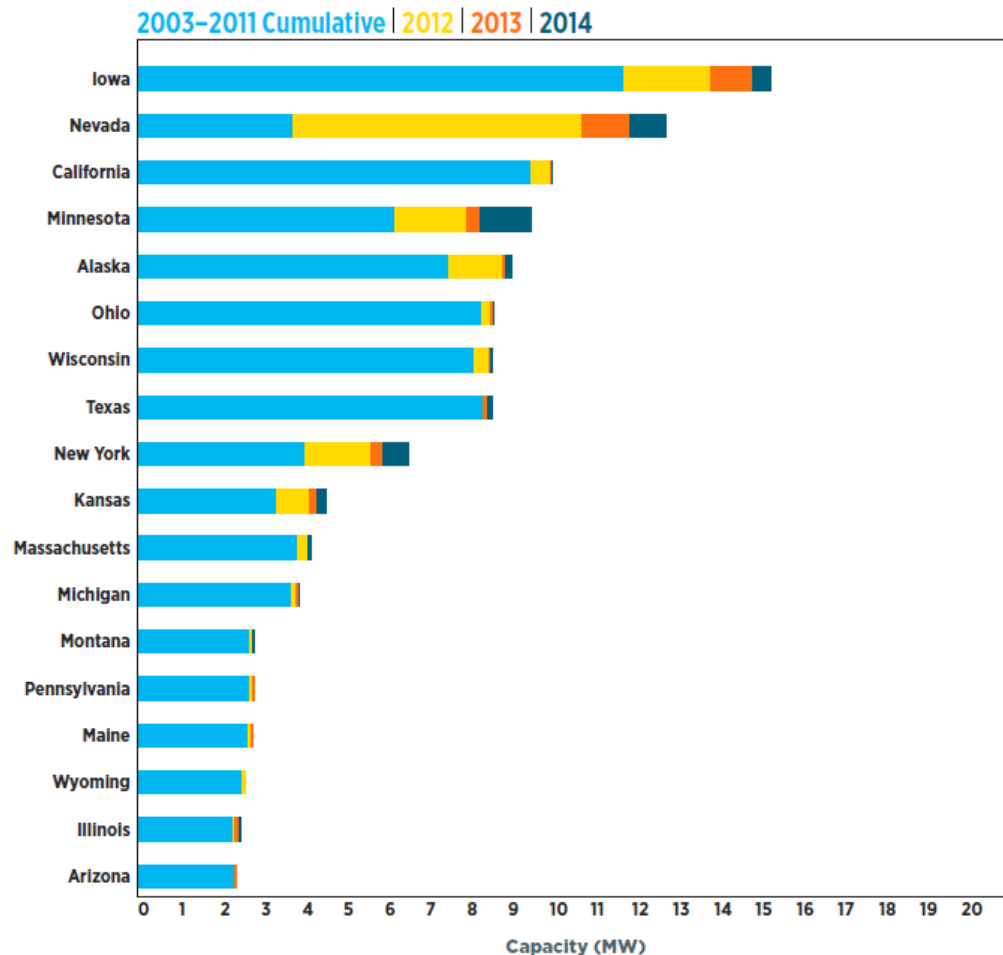
<http://energy.gov/eere/geothermal/geothermal-faqs>. NREL, “Estimating Renewable Energy Economic Potential in the United States: Methodology & Initial Results,” July 2015; US Geological Survey, “Assessment of Moderate- and High-Temperature Geothermal Resources of the United States,” Fact Sheet 2008-3082, U.S. Department of the Interior, 2008.

To date only 1 utility-scale wind installation in Nevada, but a leader in distributed wind

Wind Market Facts

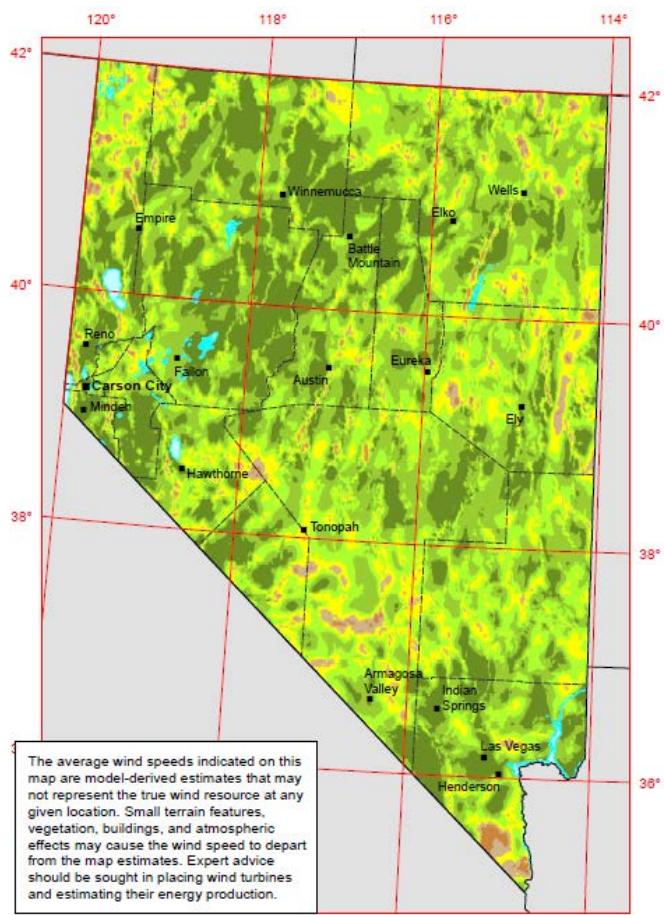
- Only 1 utility-scale project built in the state
- 151.8 MW Spring Valley Wind Project, built in 2012
- \$280 million of capital investment
- Began operation Aug 2012
- NV Energy also supports smaller, distributed installations
- 2nd largest distributed energy market (13 MW) in the U.S.

Top States for Small Wind Capacity

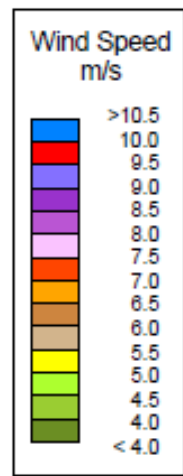
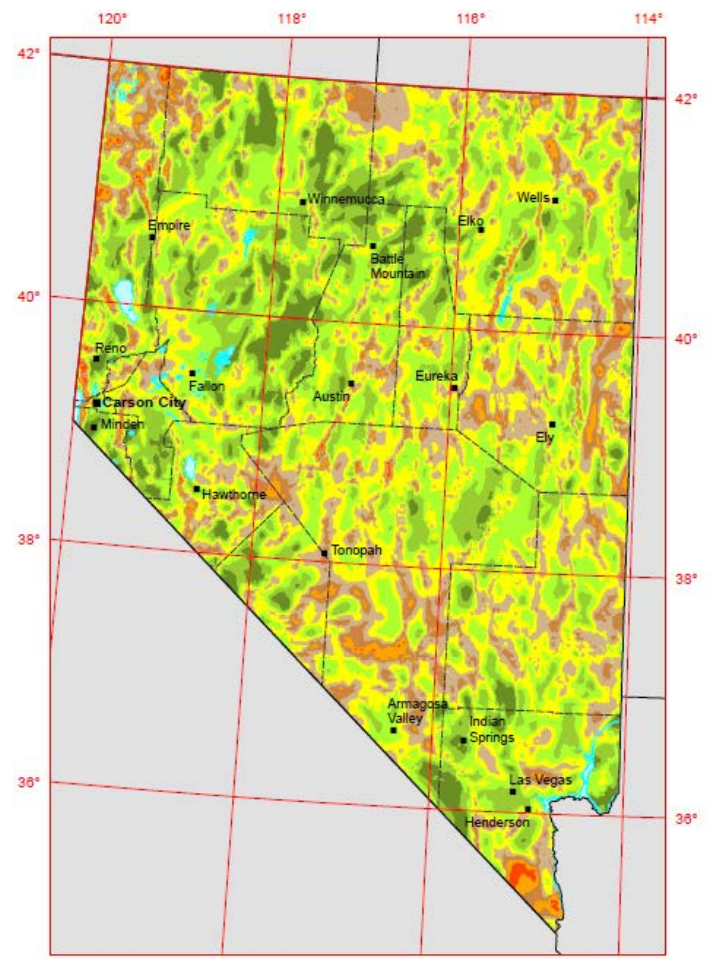


Limited natural wind resource due to minimal elevation changes

Avg Wind Speed @ 30m



Avg Wind Speed @ 80m



Even limited natural resource, though, still over a billion dollars of potential investment

Nevada Wind Market Potential & Investment Need

	Source	Potential Capacity (GW)	Estimated Investment Need (millions)
Low →	DOE Wind Vision (@80M)	1.526	\$2,609
High →	NREL – Low	6.329	\$10,822
	NREL - High	20.349	\$34,796

- NREL estimates technical wind potential in Nevada is 24.5 GW, which would produce 72 TWh/yr
- Economic potential ranges between 1,526 and 20.35 GW
- Even in low scenario, wind can produce over 50% of state electricity needs

Notes & Sources: Assumes install cost of \$1,710/kw, based on LBNL study. See <http://newscenter.lbl.gov/2015/08/10/study-finds-that-the-price-of-wind-energy-in-the-united-states-is-at-an-all-time-low-averaging-under-2-5%C2%A2kwh/>.

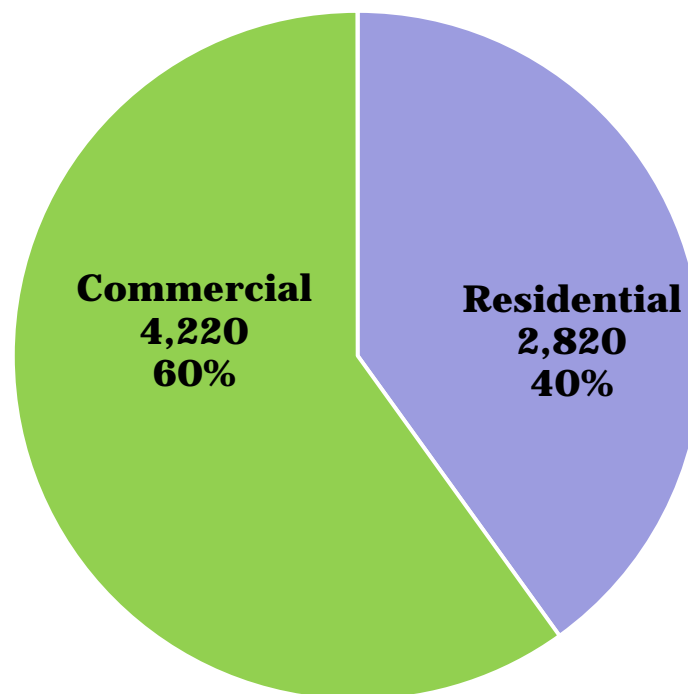
AWEA, NREL, “Estimating Renewable Energy Economic Potential in the United States: Methodology & Initial Results,” July 2015.

Market potential studies show Nevada can reduce electricity usage by over 20% with efficiency

Efficiency Market Facts

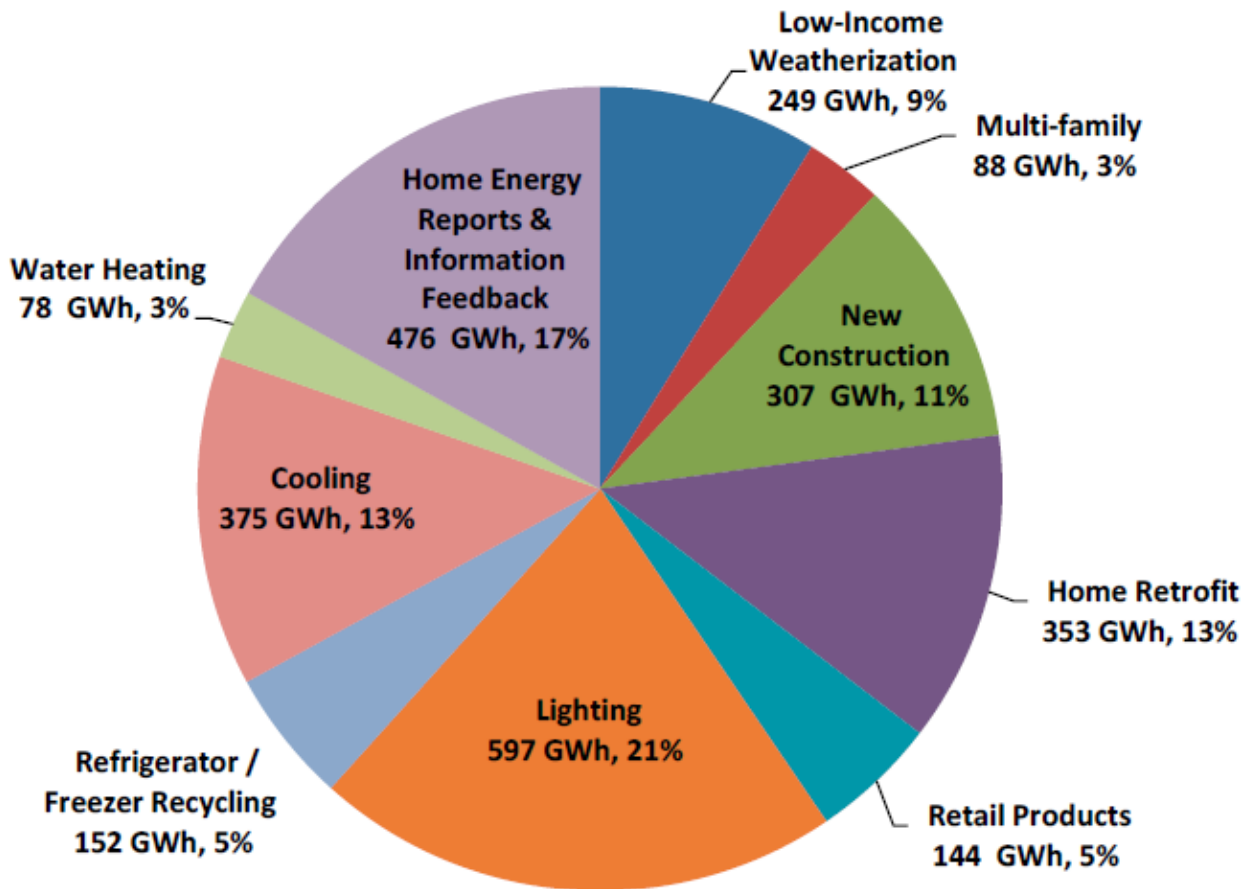
- Nevada can reduce electricity usage by 7,040 GWh with efficiency investment
- 2,820 GWh in residential building sector
- 4,220 GWh in commercial building sector
- Represents 22.2% savings versus baseline electricity usage
- Reduce peak demand by 1.7 GW

Nevada Building Efficiency Market Potential (Annual Savings)



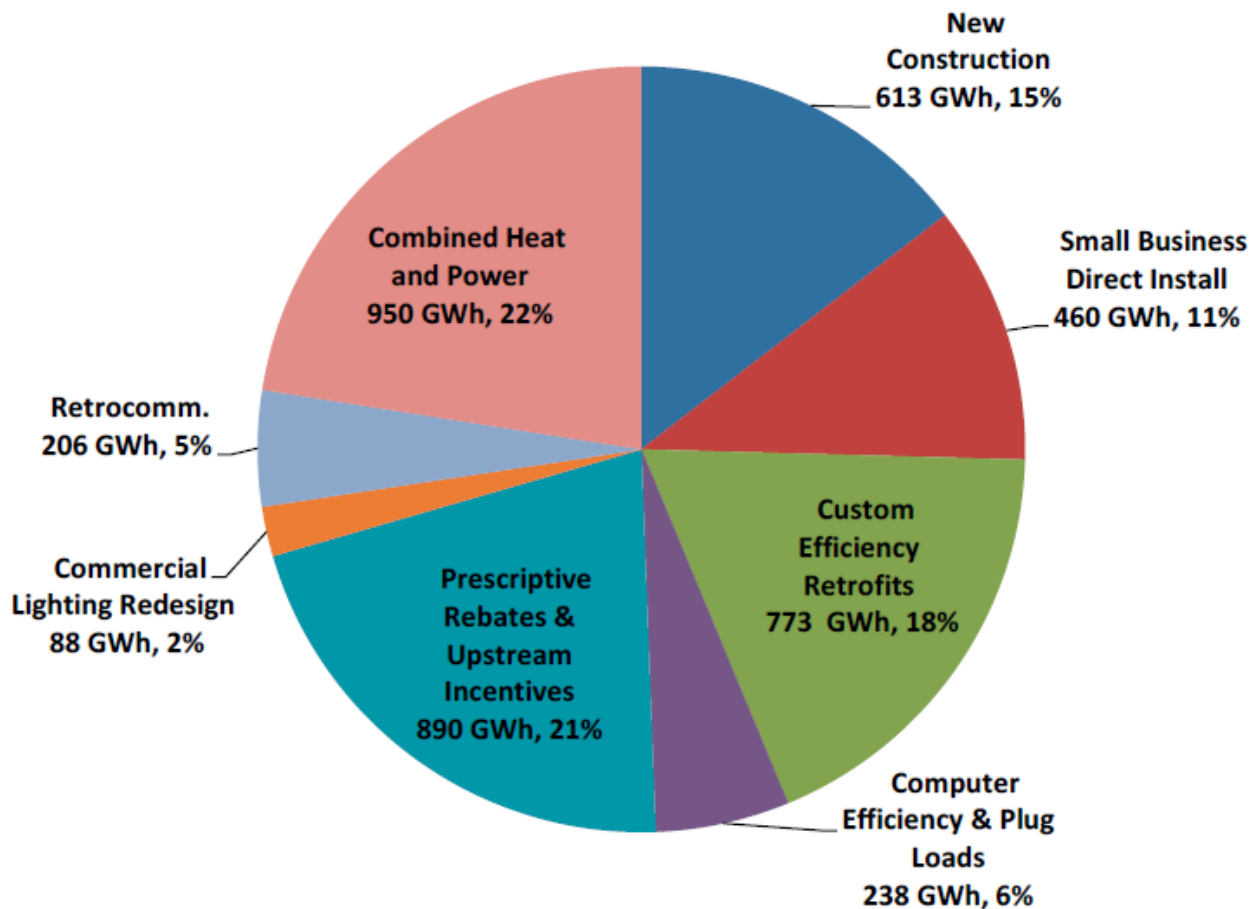
Residential electricity savings potential driven by lighting, cooling, whole home retrofits & information

Nevada Electric Efficiency Potential in Residential Buildings



Commercial building efficiency drive by CHP, retrofits, and efficient new construction

Nevada Electric Efficiency Potential in Commercial Buildings



Achieving savings requires \$2.59 billion in total investment

Nevada Electric Efficiency Investment Needs

	Annual Investment (millions)					NPV of Total Investment
	Year 1	Year 5	Year 10	Year 15	Year 20	
Residential	\$17	\$96	\$169	\$128	\$45	
Commercial	\$64	\$178	\$295	\$223	\$78	
Total	\$81	\$274	\$464	\$351	\$123	\$2,590

\$2.59 Billion of efficiency investment will produce \$5.97 billion in cost savings.

Other data points confirm EE potential market size

- RCG Economics performed top-down market size estimate and came to similar figures
 - Assumed that each of Nevada's roughly 1 million housing units received upgrade \$5,000 per unit → \$5 billion potential
 - Unreasonable to assume all housing units are part of SAM
 - Rather, assume one quarter of units are upgraded → **\$1.25 billion**
 - Study also assumes 100k commercial buildings upgraded at \$10,000 per building → **\$1 billion**

RCG top-down study suggests attainable efficiency SAM of \$2.25 billion – Similar to SWEEP \$2.59 billion estimate.

Distributed energy market potential is over \$3 billion in Nevada

High & Low Scenario Addressable Market by Technology

Selected Technologies		Potential Energy Capacity		Investment Need (millions)	
		High Scenario	Low Scenario	High Scenario	Low Scenario
1 Solar	Utility	352.8 GW	5.7 GW	\$511,600	\$8,200
	Distributed	0.3 GW	0.3 GW	\$1,000	\$1,000
2	Geothermal	4.242 GW	1.391 GW	\$10,605	\$3,478
3	Wind	6.329 GW	1.526 GW	\$2,609	\$10,822
4	Electric Efficiency	7,040 GWh		\$2,590	
TOTAL		N/A	N/A	\$528,404	\$26,090

Key Takeaways

- Entire clean energy market SAM could be as high as half a trillion dollars, driven by enormous utility scale solar potential
- Also enormous untapped wind potential – over \$10 billion of investment opportunity
- Distributed solutions are smaller share of overall SAM, but still far greater than current investment capacity
- Distributed solar market size, residential and commercial, estimated to be \$1 billion
- Building efficiency opportunity is over \$2 billion of cost-effective investment
- If a Nevada Green Bank were to primarily focus on distributed energy solutions, the SAM for the Green Bank would be approximately \$3.5 billion of capital investment



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Thank You

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