APS' Renewable Energy Plans

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Preview

- Current projects
- Renewable Energy Targets
- Solar Technologies
- Conclusion

APS Renewable Generation Current Portfolio

High Lonesome Wind Ranch

Location – Torrance County, New Mexico;
55 miles southwest of Albuquerque

Total Generation – 100 megawatts

Construction – The $190 million project became operational on July 16, 2009

Owned and Operated – High Lonesome Mesa, LLC, a subsidiary of Edison Mission Energy. It was developed by Foresight Wind Energy

Power – APS has a long-term power purchase agreement for the electricity. APS receives the energy though the Four Corners switch yard

Size – 40, 2.5 MW wind turbines spread across a nine-mile mesa

Aragonne Mesa Wind Farm

Location – 40 miles southwest of Santa Rosa, New Mexico

Total Generation – 90 megawatts

Construction – Took 18 months. It first produced electricity on December 21, 2006

Owned and Operated – Aragonne Wind, LLC, a wholly-owned subsidiary of Babcock & Brown Operating Partners LLC

Power – APS has a 20 year agreement to purchase all the power from the farm

Size – 90, 1-MW turbines spread over 15 square miles

Snowflake White Mountain (Biomass)

Location – 10 miles east of Snowflake, AZ. The plant is adjacent to the Catalyst Paper Corporation's paper recycling plant.

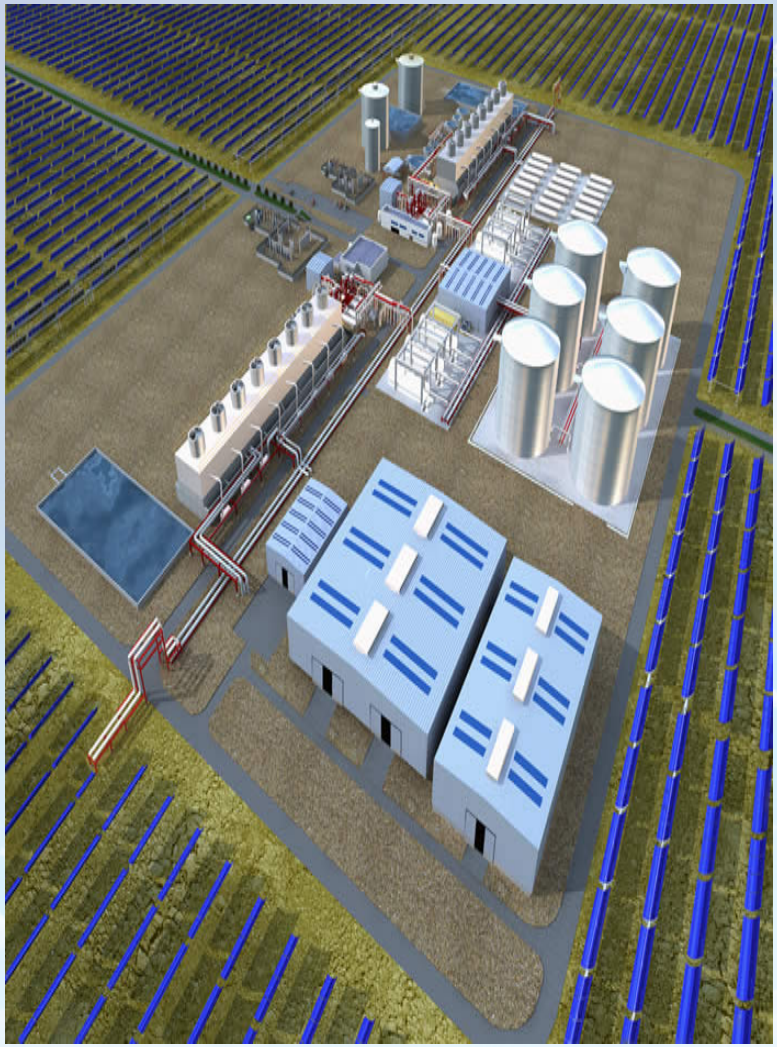
Total Generation – 24 megawatts. APS receives up to 14 MW.

Construction – The plant was completed in June 2008

Owned and Operated –Renergy Holdings Inc.

Power – APS has a 15 year agreement to purchase power

Solana



Location – 70 miles southwest of Phoenix, near Gila Bend, Arizona

Total Generation – 280 megawatts ~ 40 percent annual capacity factor

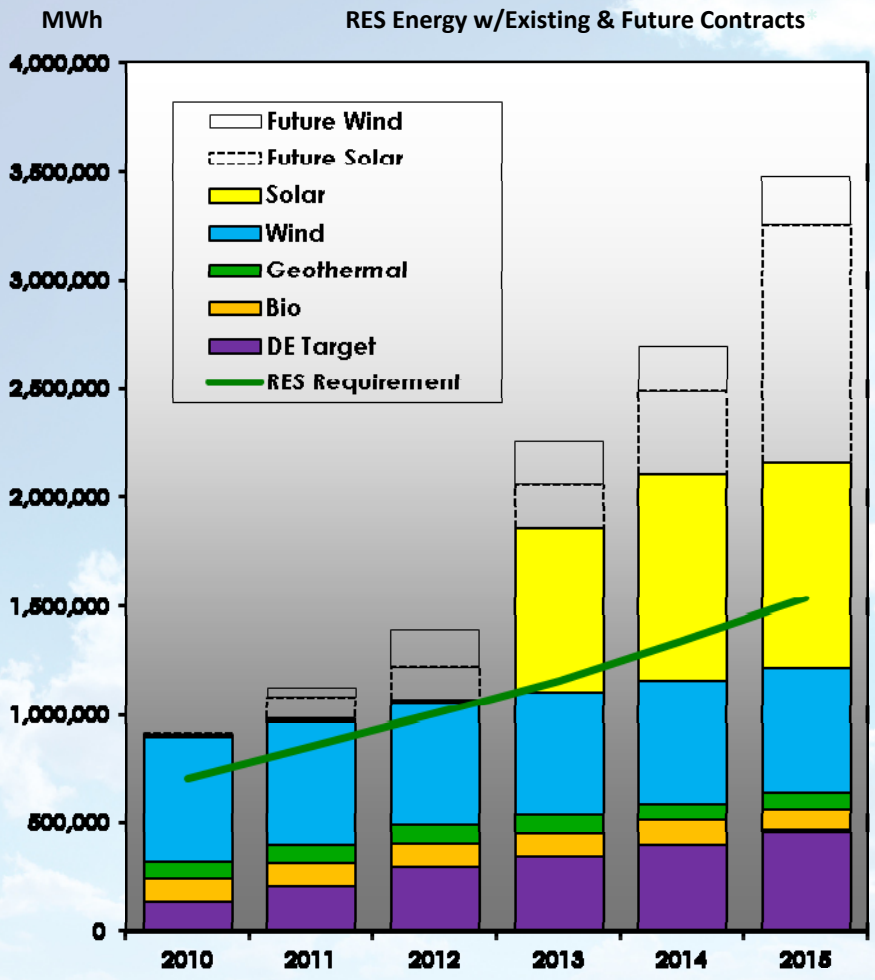
Construction – Tentative completion date of 2013

Owned and Operated – Abengoa Solar Inc.

Power – Two 150 MW steam units

Size – 3 square miles

Renewable Energy Targets



- **15% by 2025.**
- **30% must be DE.**
- **5% of total retail sales by 2015 required.**
  - APS committed to 10% by 2015
  - Broad list of eligible technologies
  - Cost recovery through RES surcharge adjusted annually

Commitments to Renewable Energy

- **Approximately 10% of retail sales will come from renewables by year end 2015**
- **Requires new renewable projects for:**
  - **In-state wind generation**
  - **Utility-scale photovoltaic generation**
- **Renewable transmission projects**
  - **Intended to help further BTA renewable work and advance renewable development in Arizona**

Arizona's Renewable Energy Options

- **Wind – Moderate Potential**
  - Best sites located across Northern Arizona
  - Some good sites but not as strong as some states
  - Transmission availability limits accessibility to some sites
- **Geothermal – Low Potential**
  - No commercially viable sites identified in the state (at this time)
  - Good potential in neighboring states
- **Biomass – Limited Potential**
  - Arid state means only limited opportunities for biomass
- **Solar - Huge Potential**
  - Arizona has, on average, 300 days of sunshine a year

Deploying Solar Technologies

Photovoltaic
Distributed

Emerging → Mature

CPV

PV

Thermal
Large Scale

Emerging → Mature

Dish

Tower

Trough

Overview of Solar Thermal Players

	Pros	Cons
Trough ***Solana / Nevada Solar One*** 	• Simple technology • Cost effective on large-scale grid connected projects • Low maintenance costs relative to other thermal technologies • Uses traditional steam turbine to generate electricity	• Loss of energy through heat exchangers / storage • Water usage
Tower ***BrightSource /eSolar*** 	• Energy losses are low relative to trough systems • Other pros similar to Trough ▪ Cost effective based on large-scale ▪ Uses steam turbine	• Technology still under development • Other cons similar to Trough ▪ Loss of energy through heat exchangers / storage ▪ Water Usage
Dish ***Stirling Energy Systems*** 	• High efficiencies • Electricity is generated through a heat engine so no need for the traditional steam process of electricity generation • Can operate as standalone units or linked together for larger grid-tied project • Water usage	• Maintenance of a field of engines increases ongoing O&M relative to other technologies • Still new technology • Expensive tracking systems required

Overview of Solar Photovoltaic Players

	Pros	Cons
Crystalline Silicon ***Mono: SunPower*** ***Poly: Solon*** 	• Base material, silicon, is a highly abundant element on earth (impure form), second only to oxygen • Single axis tracking helps better match load	• Competes with semiconductor markets • Costly to ship and handle
Thin Film ***a-Si: Sanyo*** ***CdTe: First Solar*** ***CIGS: Miasole, Solyndra*** 	• Flexible and thin (think spray painting of substrate on aluminum foil)	• Degradation is an issue
Concentrating Photovoltaics (CPV) ***SolFocus, Concentrix*** 	• Higher efficiencies than any other PV technology (~23%) • Lower cost due to a reduced need for PV materials (around 85% less) • Two-axis tracking matches load better than fixed or single-axis tracking	• Originally cost prohibitive due to the high cost of high efficiency cells • Few large scale installations compared to flat plate technologies • Advanced two-axis tracking systems key to optimizing use of expensive cells

Segmented Solar Strategy

Distributed Energy

3kW – 10MW

Customer Sited

Small Utility-Scale

1 – 20MW

Distribution Level

Large Utility-Scale

>50 MW

Central Station

Closing Remarks