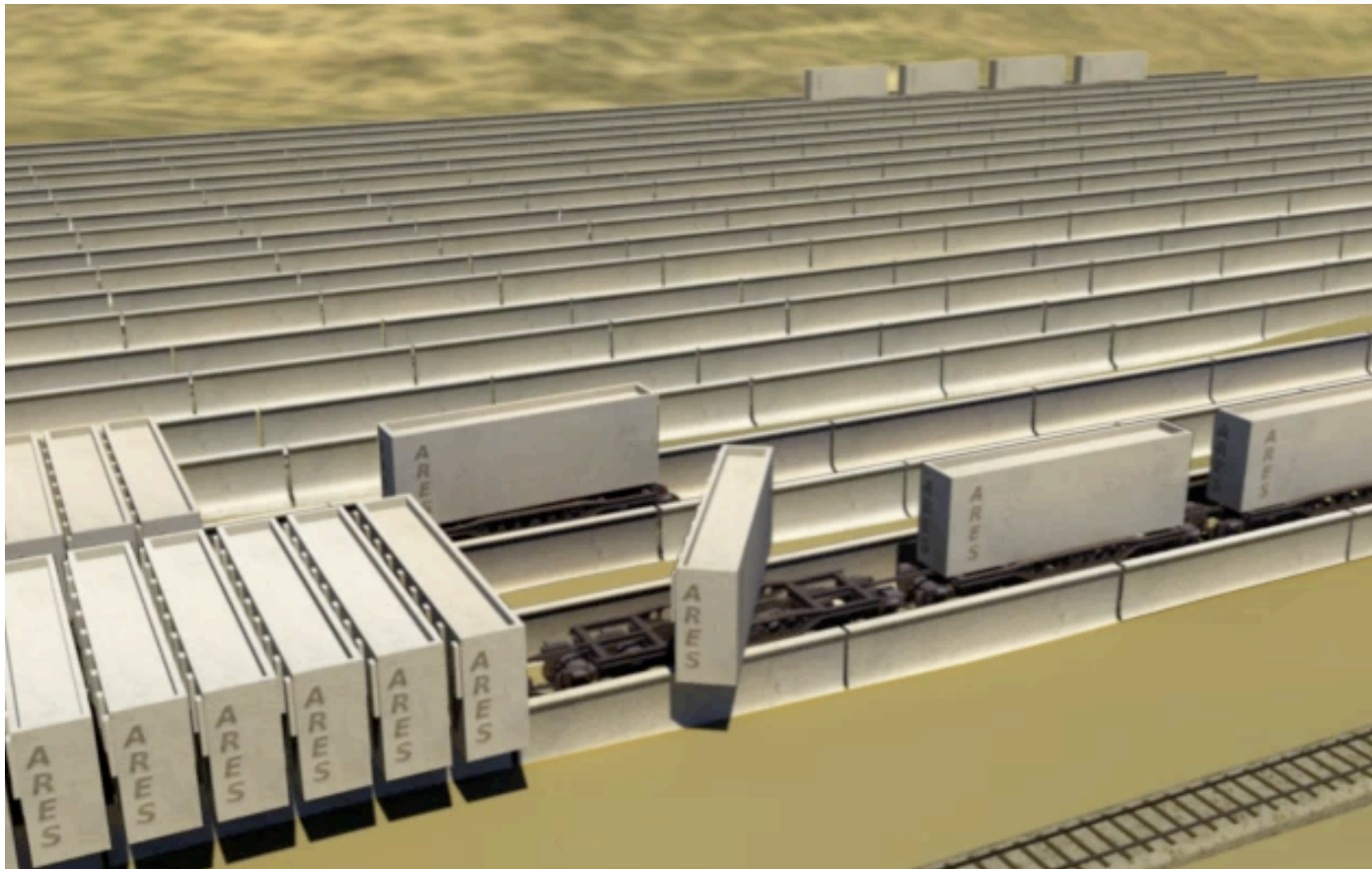




# ARES NW Power and Conservation Council Presentation

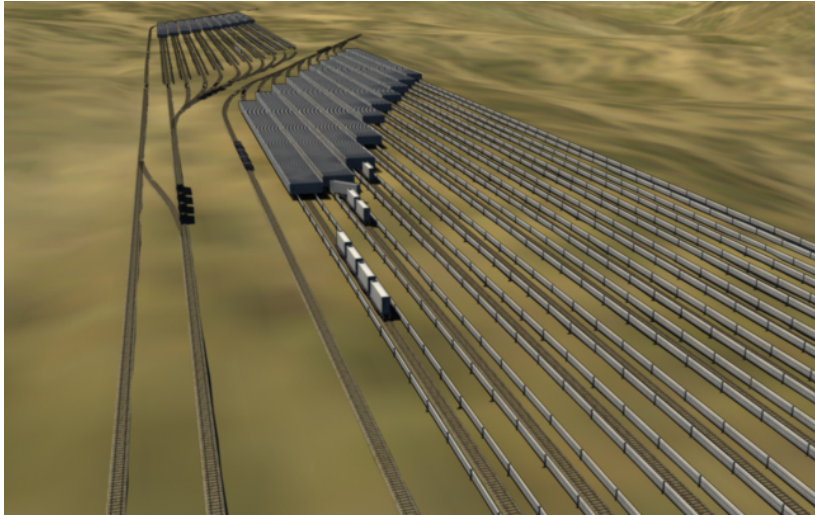
February 13, 2013

# ARES Overview

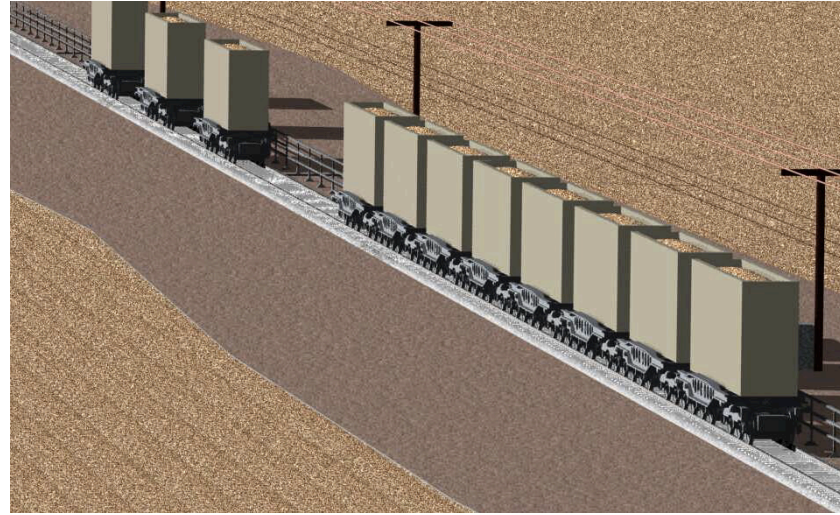


- Breakthrough utility-scale energy storage
- Uses electric trains and masses to store/release potential energy
- ARES stores off-peak energy and releases it when needed
- ARES provides stability to an increasingly unstable electrical grid

# ARES Energy Storage Technologies



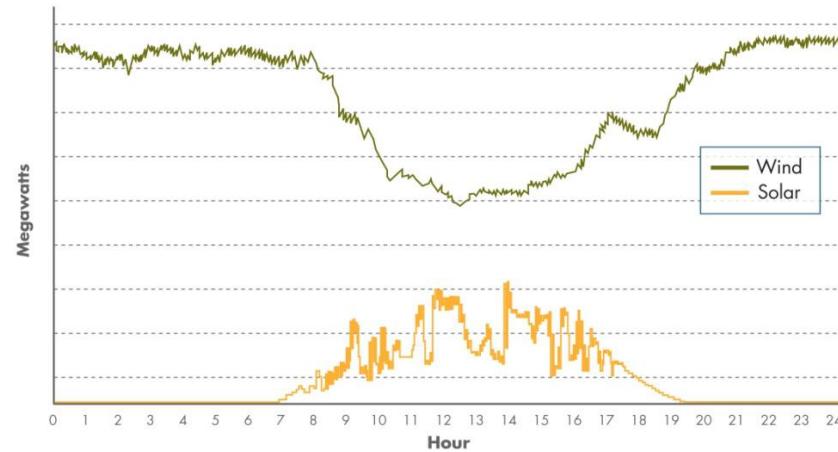
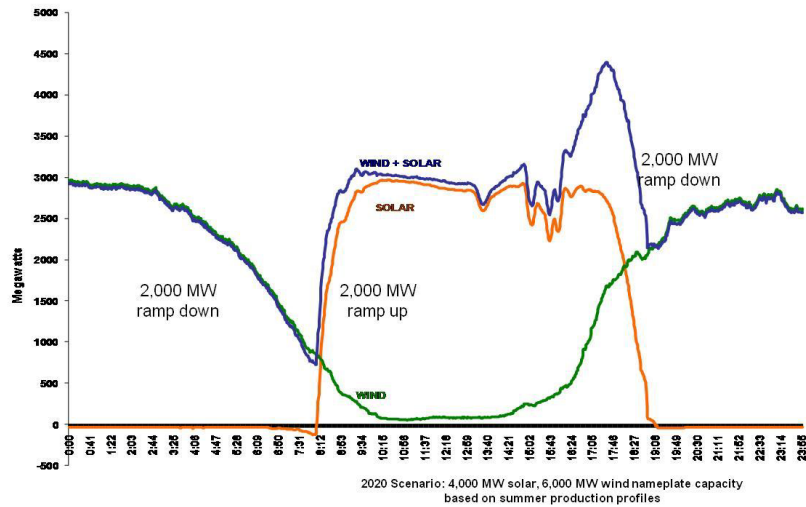
ARES 668MW Energy Storage Facility in SCE Territory



ARES Single Track 50MW Ancillary Services System

ARES is a scalable rail-based energy storage technology which integrates proven state-of-the-art equipment to economically provide grid scale energy storage and ancillary services.

# ARES Can Solve Difficult Problems



Existing Storage Requirements + Expanding Renewables  
Integration =  
Increasing Need for Energy Storage and Ancillary  
Services

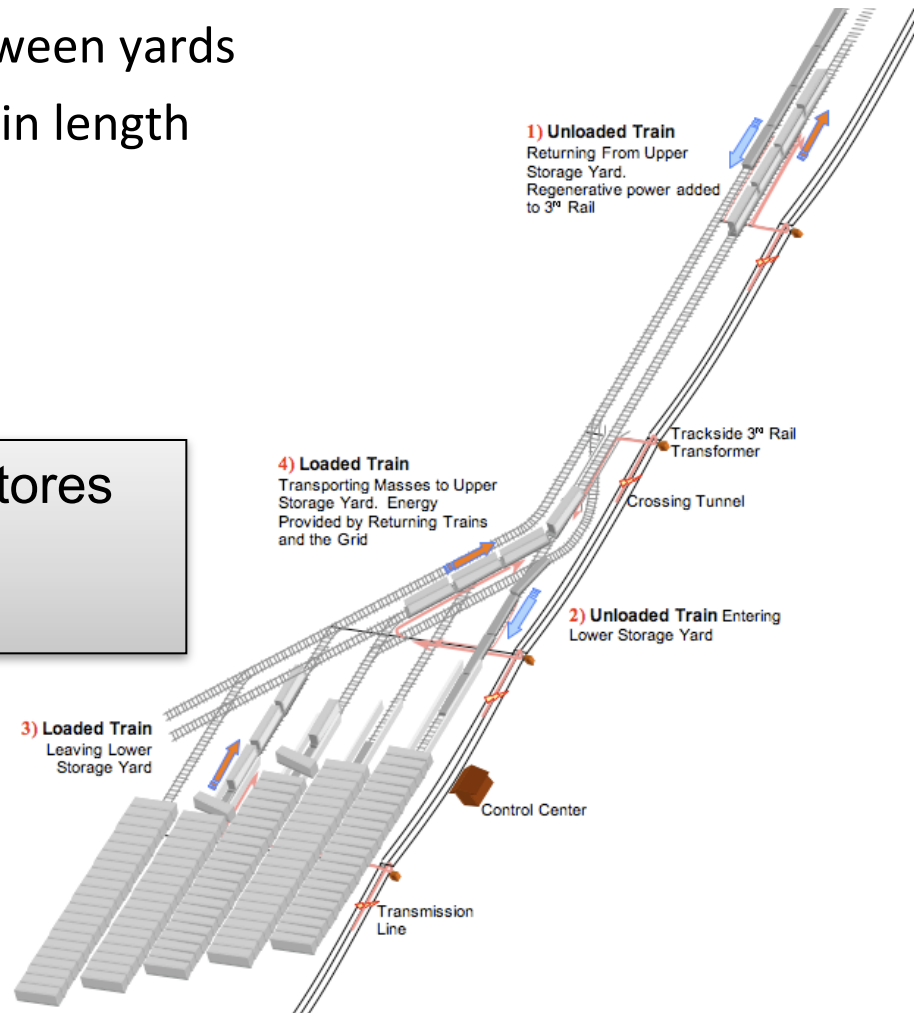
# How ARES Performs Storage

(333MW with 8 hours storage)

- 2 rail storage yards
- 3 interconnecting tracks between yards
- Track grade of 7.5%; 8 miles in length
- 70 Energy Shuttle Trains

Each Energy Shuttle Trip stores approximately 2 MWh of potential energy

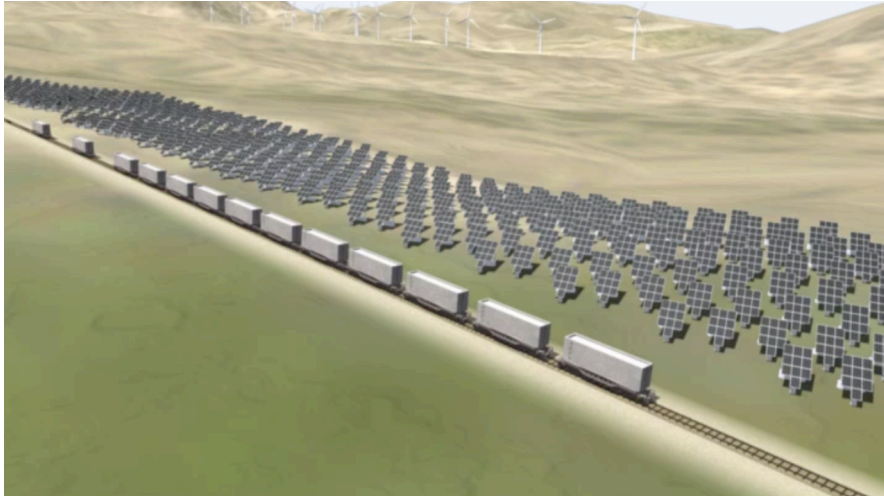
Design will be unique to each site and project/utility requirements



# ARES Energy Storage Performance

<b>Scalability</b>	<b>100 – 3,000 MW</b>
<b>Storage Duration</b>	<b>2 – 24 hours</b>
<b>Response Time (0 to 100% rated power)</b>	<b>5 Seconds to Full Charging 25 Seconds to Full Discharging</b>
<b>Round-Trip Energy Efficiency</b>	<b>~78%</b>
<b>Time from Full Charge to Full Discharge</b>	<b>~30 seconds</b>
<b>Standby Storage Losses</b>	<b>None</b>
<b>System Life</b>	<b>40 years +</b>

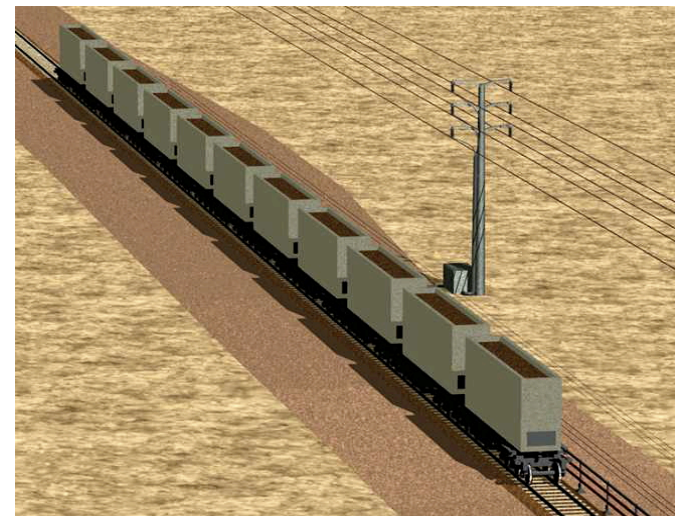
# ARES Fast Response Ancillary Services



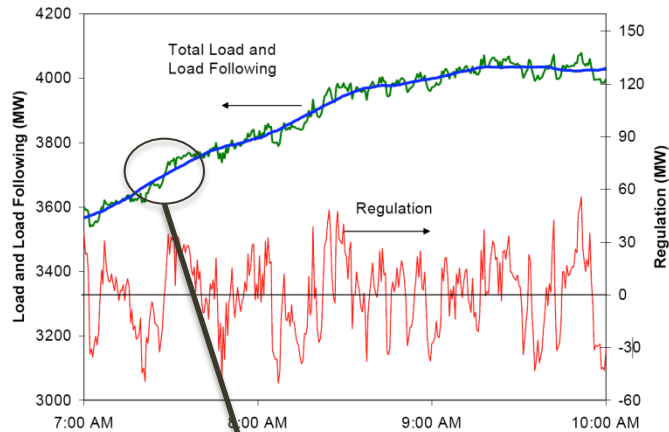
- Ancillary Services are critical grid-support functions provided by energy storage systems
- They provide short-duration stability to the grid allowing larger and slower responding generation units time to respond to power fluctuations

ARES can provide stand-alone Ancillary Services to stabilize the electric grid:

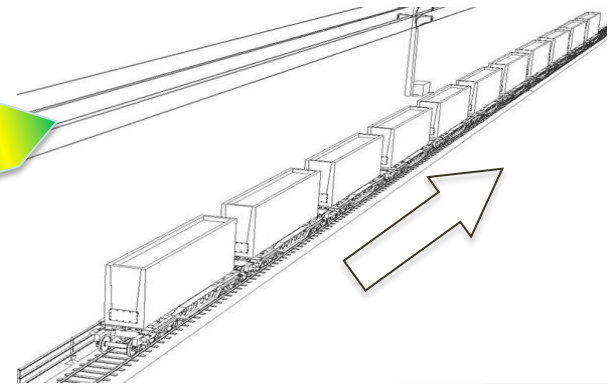
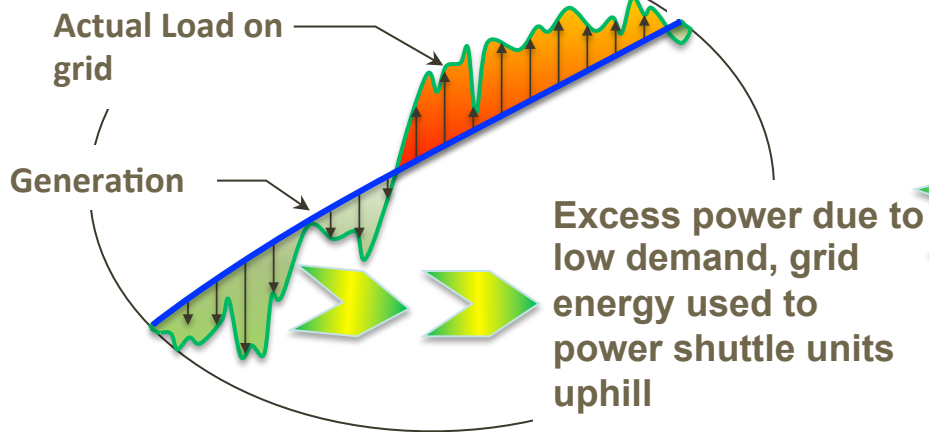
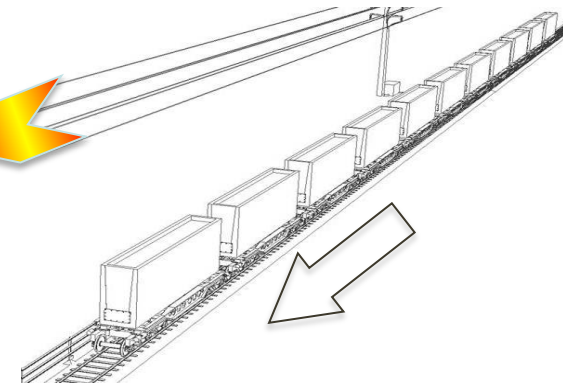
- Voltage, frequency, inertia, etc.



# How ARES Performs Frequency Regulation

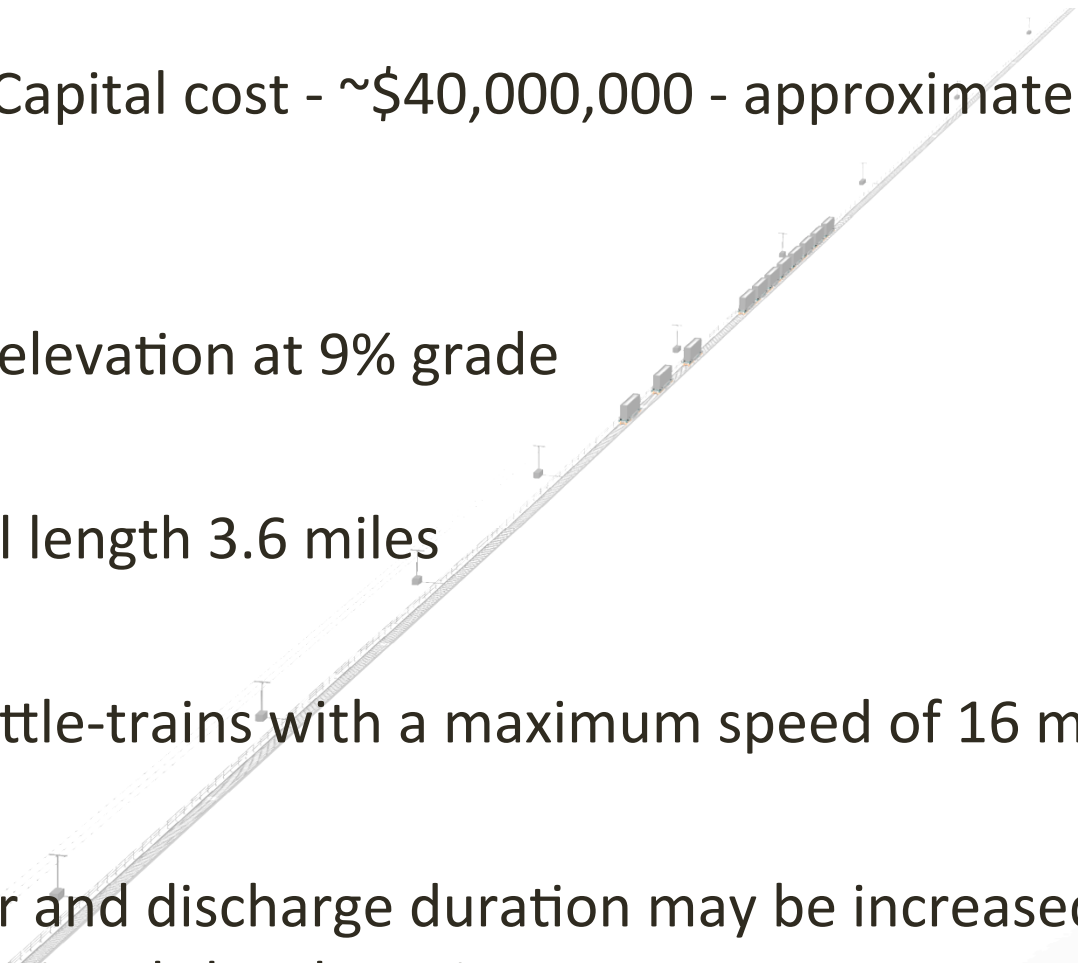


Shortfall of power, due to high demand, energy supplied into the grid by regenerative braking of shuttle units moving downhill





# ARES 50MW Fast Response Ancillary Services Facility

- Estimated Capital cost - ~\$40,000,000 - approximately \$780/kW
  - 2,000 foot elevation at 9% grade
  - Mass travel length 3.6 miles
  - 8 4-car shuttle-trains with a maximum speed of 16 mph
  - Both power and discharge duration may be increased by adding additional shuttle-trains
- 

# ARES Ancillary Services Performance

<b>Scalability</b>	<b>10 – 200 MW</b>
<b>Storage Duration</b>	<b>15 – 60 minutes</b>
<b>Response Time 0 to 100% Reg-Up Power</b>	<b>&lt; 10 seconds</b>
<b>Response Time 0 to 100% Reg-Dn Power</b>	<b>&lt; 4 seconds</b>
<b>One-way Efficiency</b>	<b>&gt; 93%</b>
<b>Time from Full Charge to Full Discharge</b>	<b>&lt;13 seconds</b>
<b>System Life</b>	<b>40 years +</b>
<b>Standby Storage Losses</b>	<b>None</b>

# ARES Significant Advantages

- **Scalability** -- ARES Energy Storage facilities are scalable from 100MW storage capacity up to large 2-3GW regional energy storage systems.
- **Extensive site options** -- ARES sites are abundant in the arid regions coincident with wind and solar resources -- maximizing transmission resources by providing storage at the point of intermittent generation.
- **Variable Output at a Constant Efficiency** -- An ARES system operates at a constant high-efficiency over its full range of power output regardless of discharge state
- **Higher Efficiency** -- ARES round-trip energy storage efficiency is ~78%
- **Lower Capital Cost** -- ARES cost is approximately 60% of an equivalent power pumped-hydro facility
- **Lower Operating Cost** -- ARES has the lowest operating cost per kWh of comparable technologies
- **No Use of Water**

# ARES 668MW System Animation/Movie



**ARES-Technology**  
<http://vimeo.com/48344799>



# ARES Contacts

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