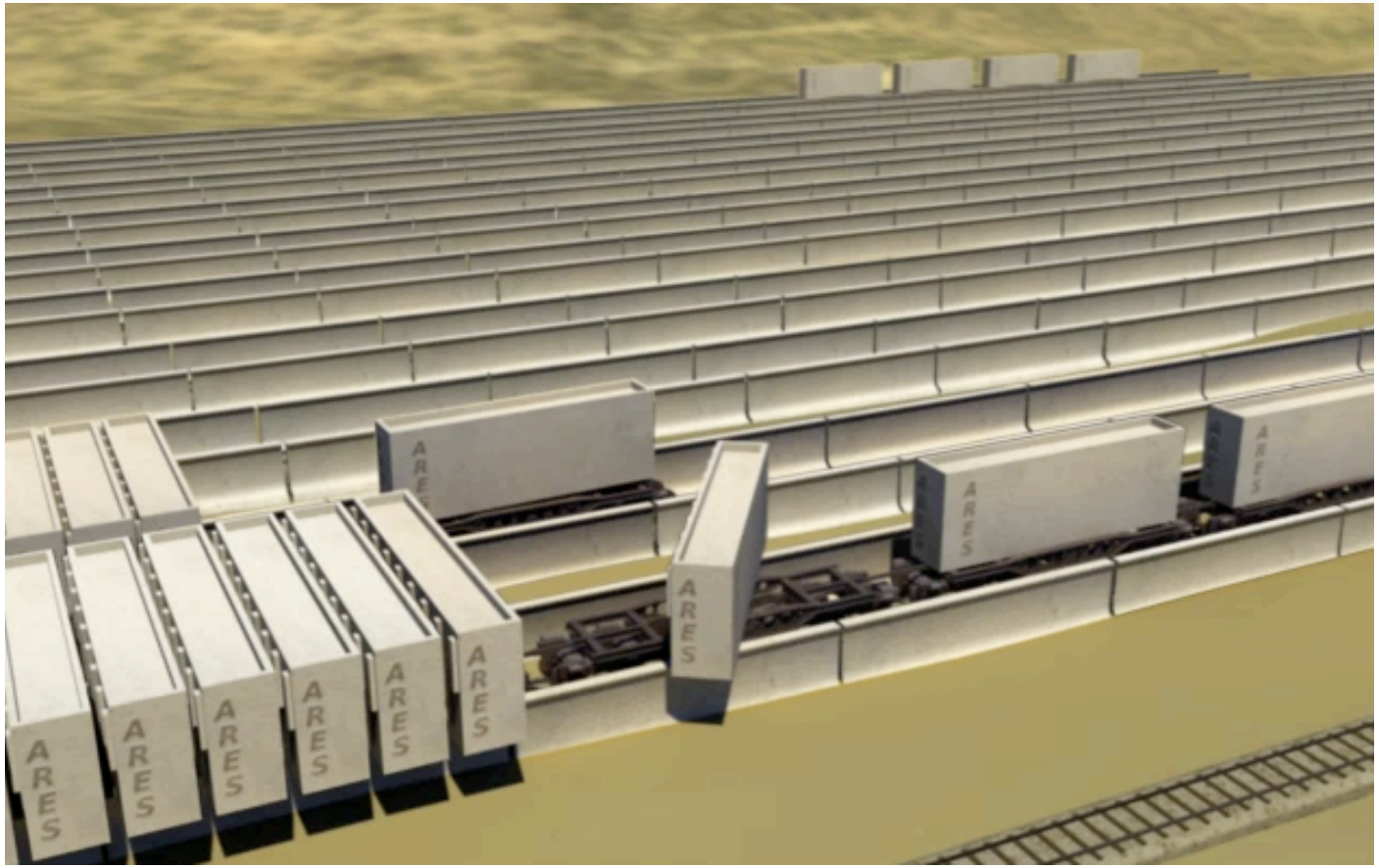
ARES NW Power and Conservation Council Presentation

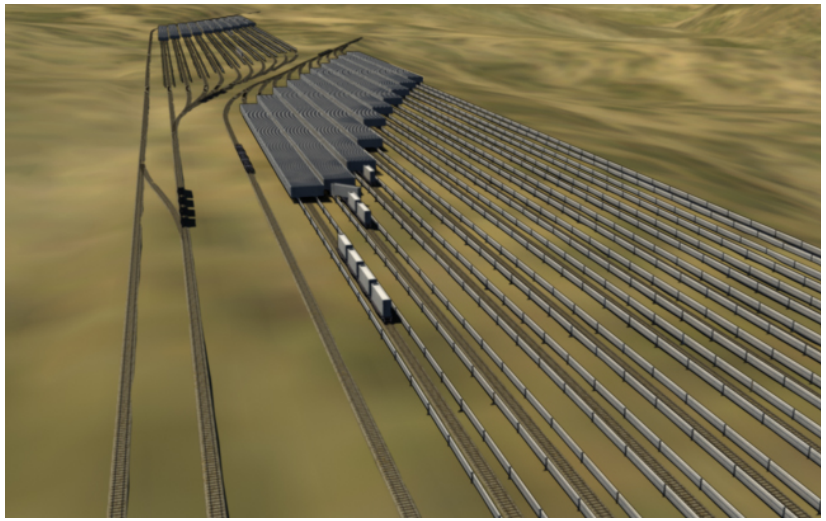
February 13, 2013

ARES Overview

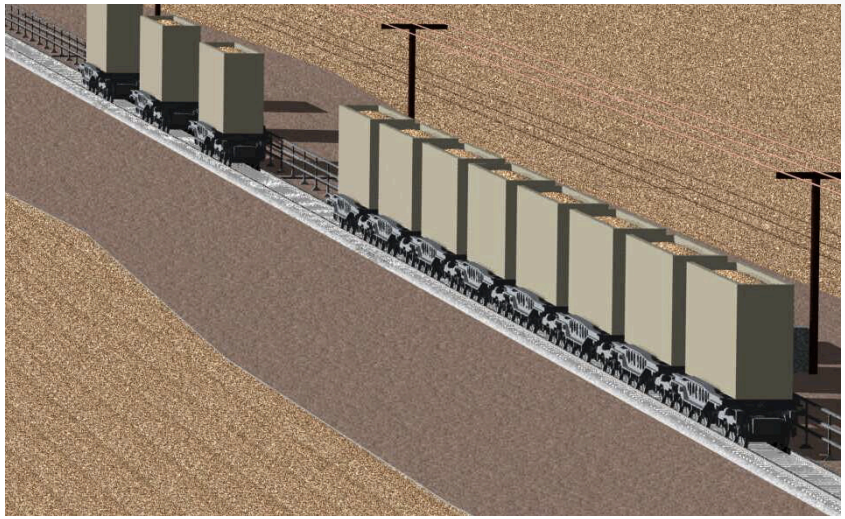


- Breakthrough utility-scale energy storage
- Uses electric trains and masses to store/release potential energy
- ARES stores off-peak energy and releases it when needed
- ARES provides stability to an increasingly unstable electrical grid

ARES Energy Storage Technologies



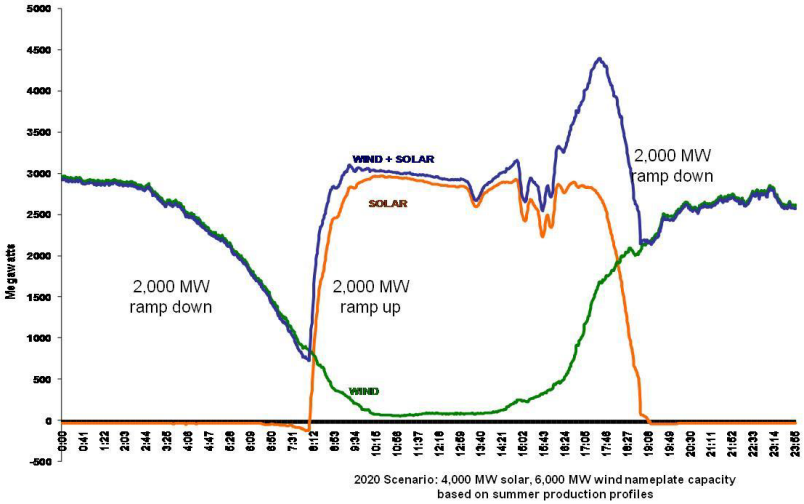
ARES 668MW Energy Storage Facility in SCE Territory

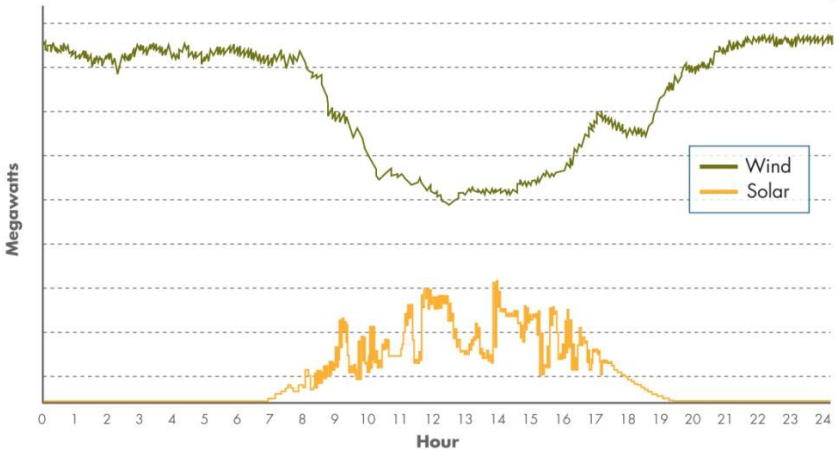


ARES Single Track 50MW Ancillary Services System

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 =

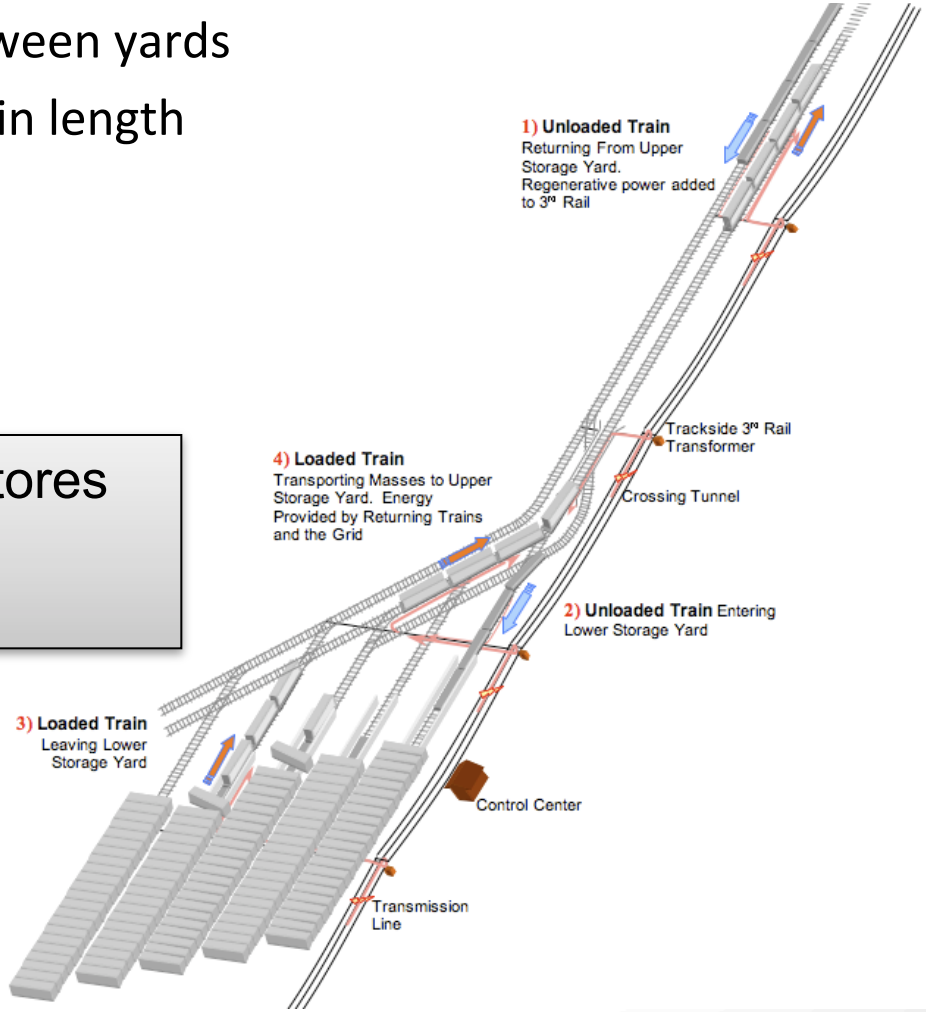
Increasing Need for Energy Storage and Ancillary Services

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

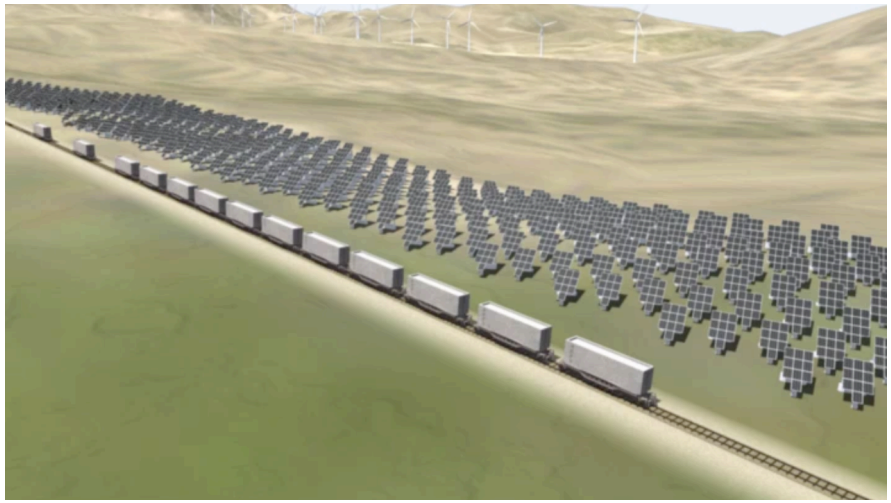
Design will be unique to each site and project/utility requirements



ARES Energy Storage Performance

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

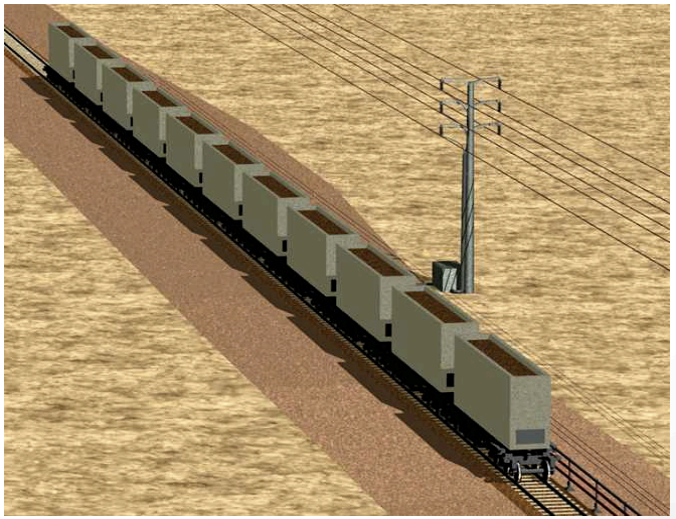
ARES Fast Response Ancillary Services



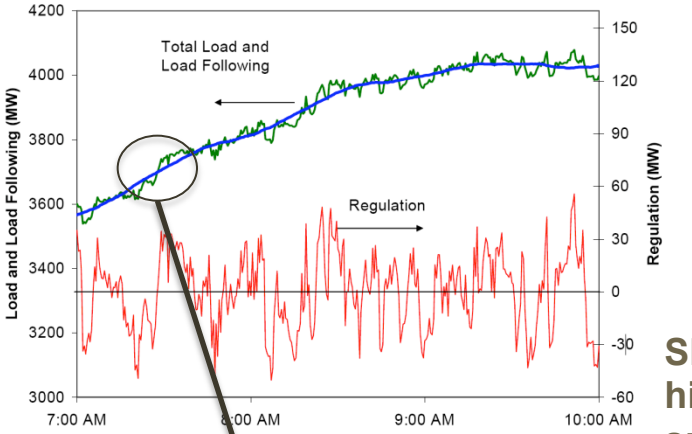
- Ancillary Services are critical grid-support functions provided by energy storage systems
- They provide short-duration stability to the grid allowing larger and slower responding generation units time to respond to power fluctuations

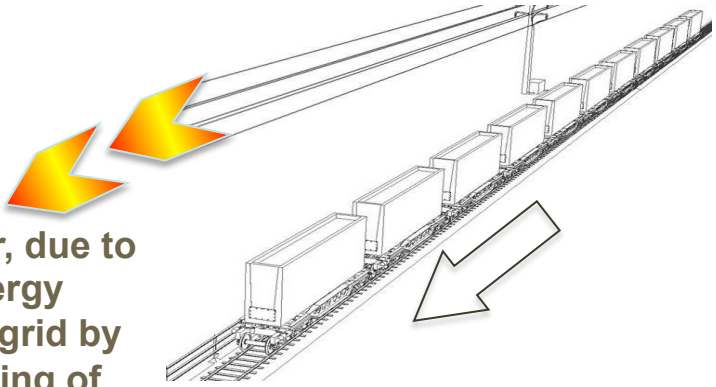
ARES can provide stand-alone Ancillary Services to stabilize the electric grid:

- Voltage, frequency, inertia, etc.

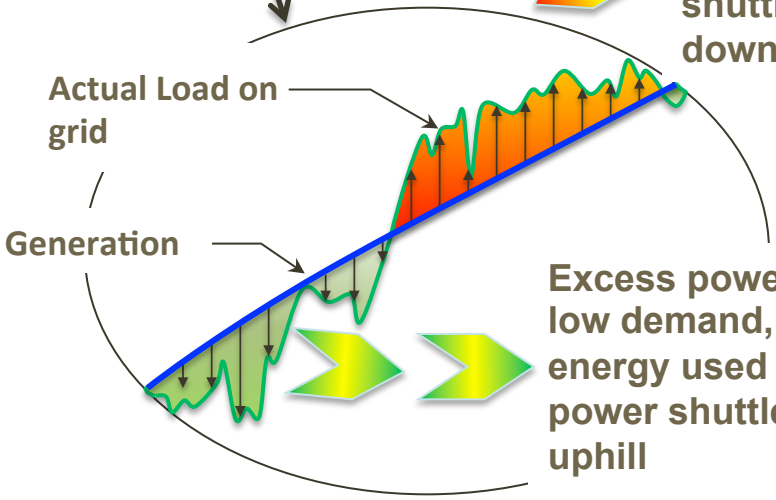


How ARES Performs Frequency Regulation

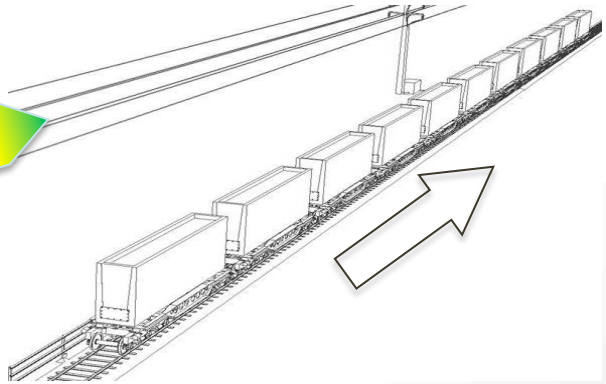




Shortfall of power, due to high demand, energy supplied into the grid by regenerative braking of shuttle units moving downhill

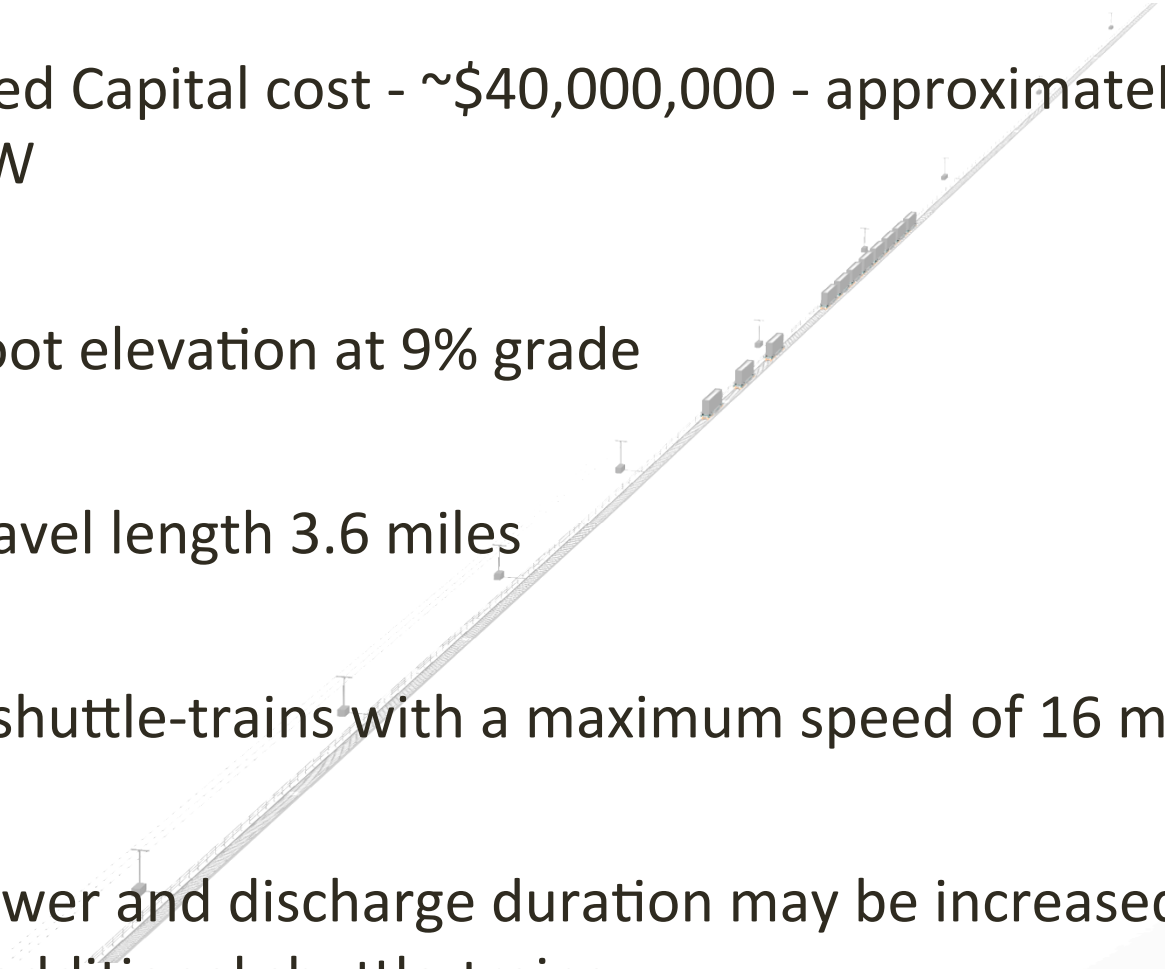


Excess power due to low demand, grid energy used to power shuttle units uphill



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

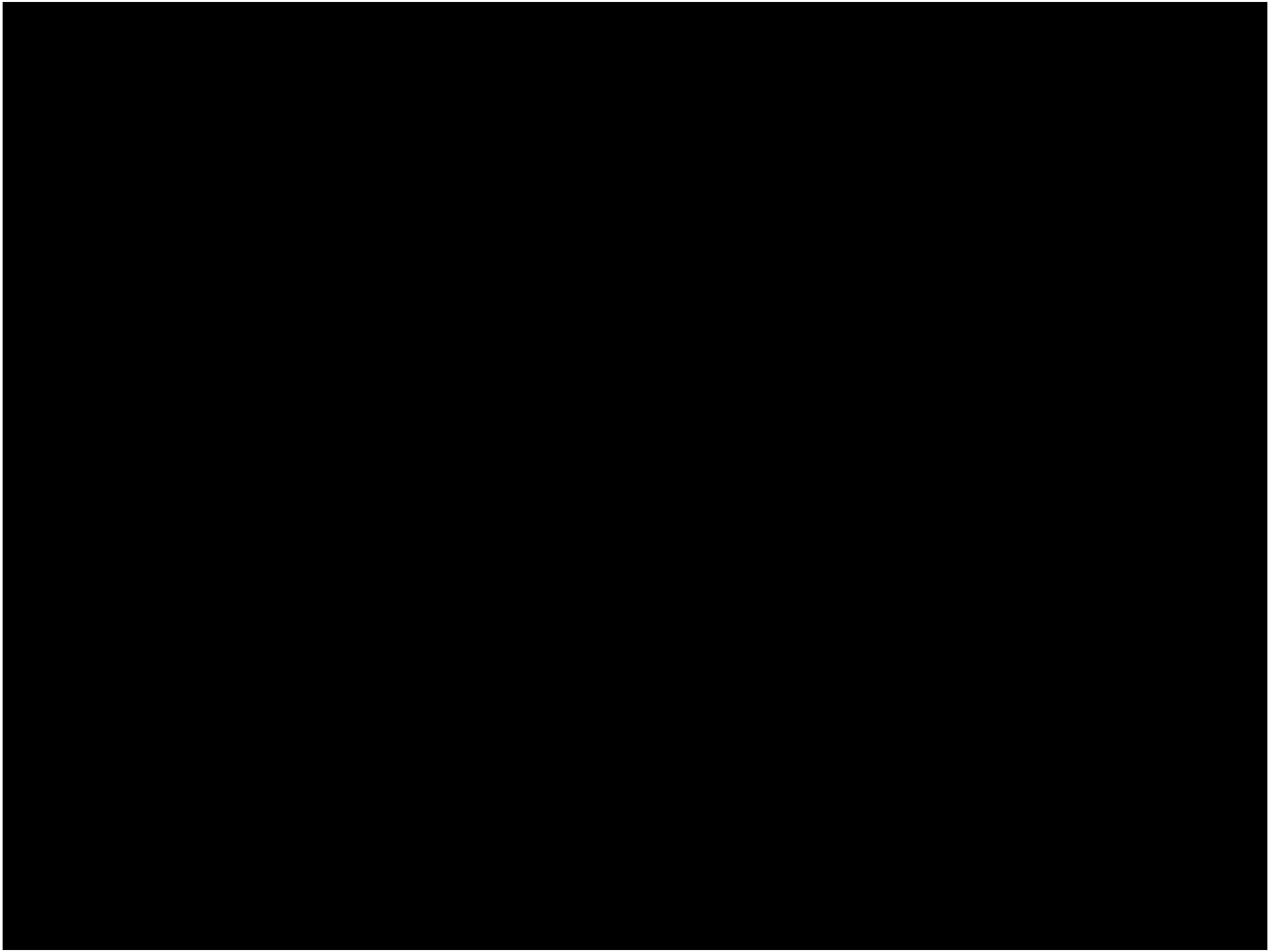
Scalability	**10 – 200 MW**
Storage Duration	**15 – 60 minutes**
Response Time 0 to 100% Reg-Up Power	**< 10 seconds**
Response Time 0 to 100% Reg-Dn Power	**< 4 seconds**
One-way Efficiency	**> 93%**
Time from Full Charge to Full Discharge	**<13 seconds**
System Life	**40 years +**
Standby Storage Losses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

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 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



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