Energy and Telecommunications Interim Committee

Absaroka Energy LLC

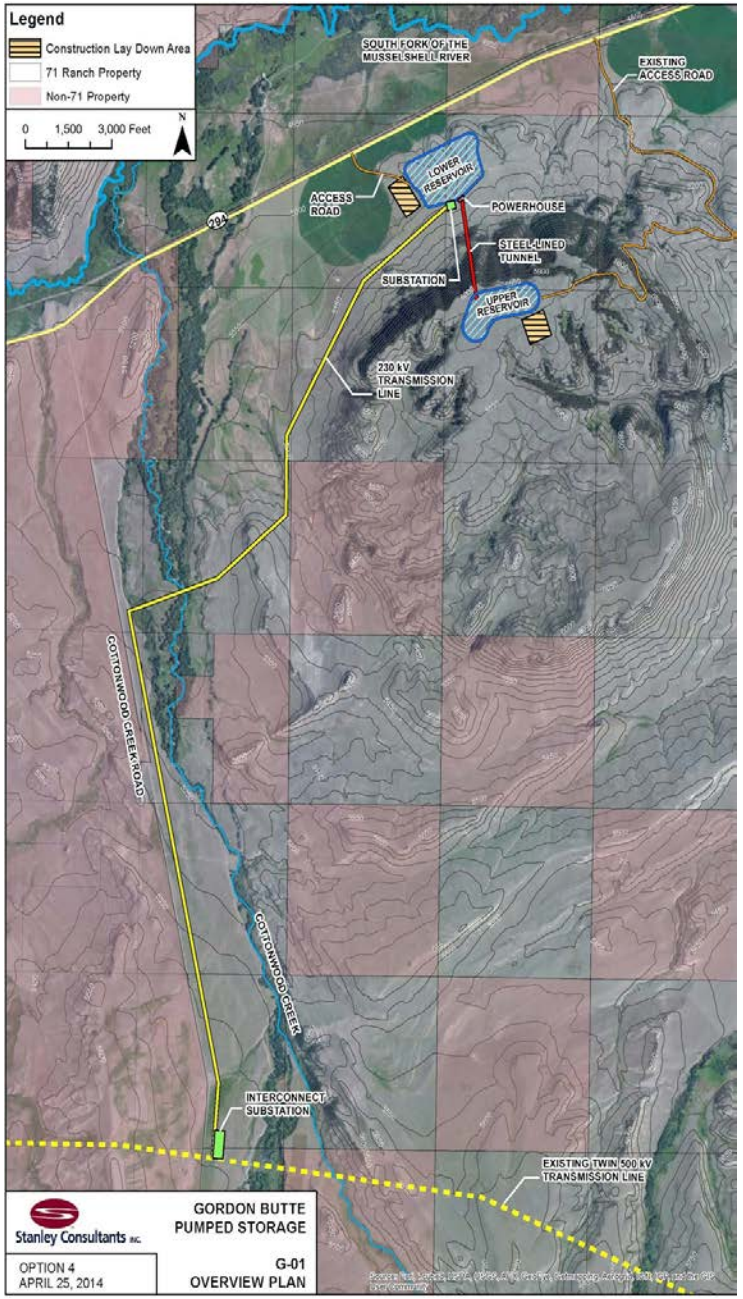
July 14, 2016


Gordon Butte
Closed Loop PSH
Colstrip 500 kV lines
Cottonwood Creek
Access Road
Highway 294
©2010 Google

Project Location (Colstrip System)

Project Highlights

- Installed Capacity: **400 MW**
- Estimated storage: **8.5 hours**
- Number of Ternary pump/turbine units: **4**
- Distance from Colstrip transmission lines: **5 miles**
- Off-stream, closed-loop project minimizes environmental and water rights issues
- All Project features located on a single landowner



Project Milestones

- Site Control ✓
- Water Right Permit ✓
- Environmental ✓
- Geotechnical ✓
- 401Water Quality Certification ✓
- Preliminary Design Completed ✓
- Interconnect Feasibility Study ✓
- Final License Application Accepted by FERC ✓

Right Project / Right Time

NorthWestern Energy (NWE) needs new flexible capacity resources

Market changes (CAISO/EIM) will cause the bilateral markets NWE currently depends on to **dry up**.

PSH is the most inexpensive storage and capacity technology available

As coal units in the region come off-line, Gordon Butte PSH will provide **energy integration**, **stability**, and **spinning-mass** for the grid.

→ The current capacity deficit is estimated at **388 MW** and will grow to **688 MW**.

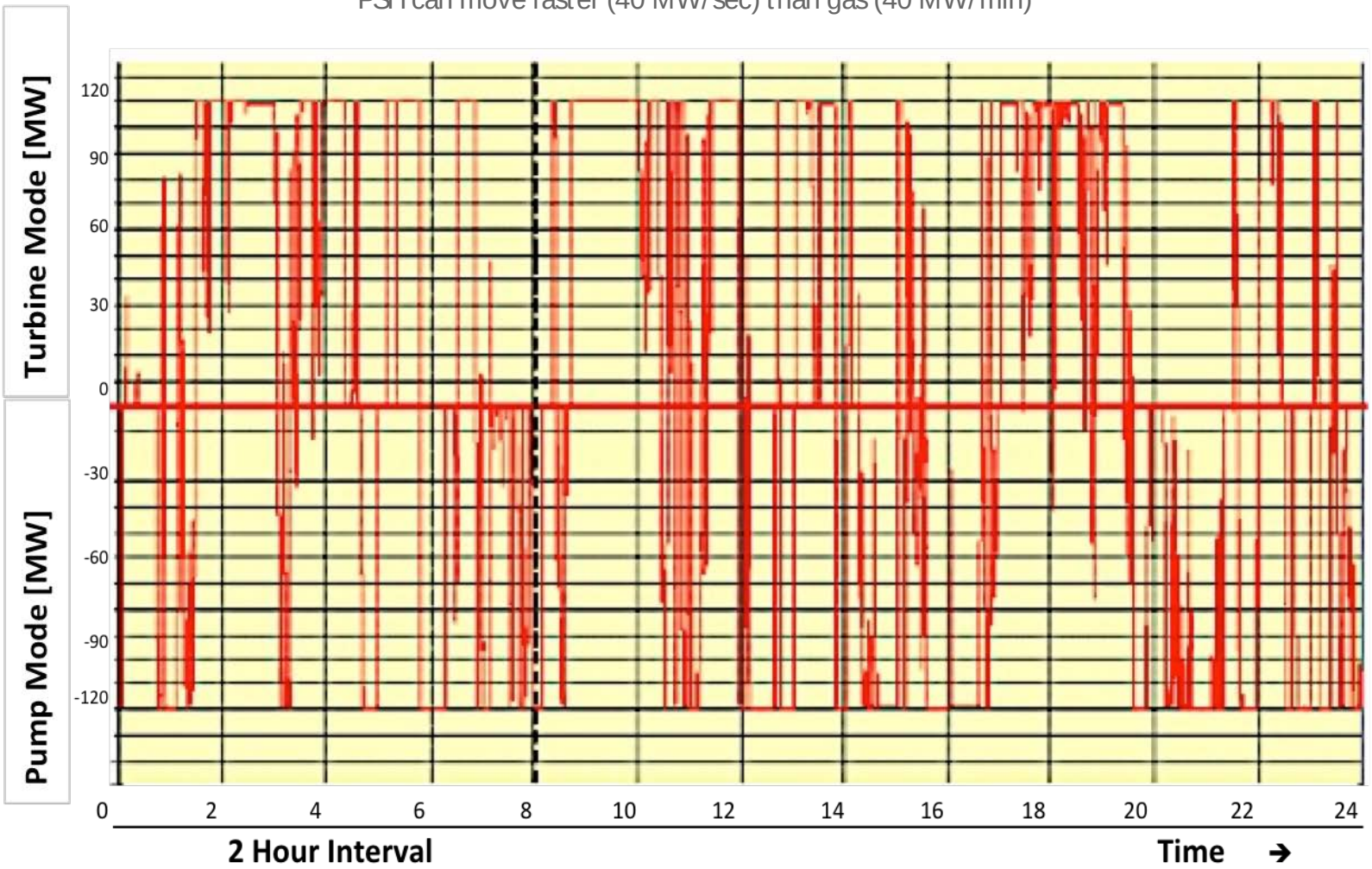
→ Market Changes are creating additional capacity pressure on regional utilities

→ PSH beats flexible gas-fired units on **cost** and **operational capabilities**.

→ Capacity with storage adds operational and cost saving benefits.

Ultimate Flexible Capacity

PSH can move faster (40 MW/sec) than gas (40 MW/min)



Gordon Butte Costs Less

PSH is the least expensive source of flexible capacity because it provides twice the regulation range, for the same nameplate capacity of flexible gas-fired units.

Resource	Gordon Butte PSH	Gordon Butte PSH	NWE DGGS	NWE 2015 IRP	PGE PW2	PGE 2013 IRP	PGE 2013 IRP	PSE 2015 IRP	PSE 2015 IRP
Technology	**Pumped Hydro**	**Pumped Hydro**	**Aero CT**	**Recip**	**Recip**	**Aero CT**	**Recip**	**Aero Ct**	**Recip**
Capacity (MW)	600	400	150	183	220	100	110	206	220
Min. Load (MW)	-600	-400	10	18	9	30	8	52	9
Reg. Capacity	1,200	800	105	165	211	70	102	154	211
Estimated Installed Cost ($Million)	$1,100[1]	$900[1]	$183[2]	$302[3]	$249	$135	$181	$259	$352
Cost/kW of Capacity	$1,833	$2,250	$1,217	$1,650	$1,451	$1,348	$1,648	$1,255	$1,600
Cost/kW of Reg. Capacity	**$917**	**$1,130**	**$1,738**	**$1,830**	**$1,513**	**$1,925**	**$1,777**	**$1,679**	**$1,668**

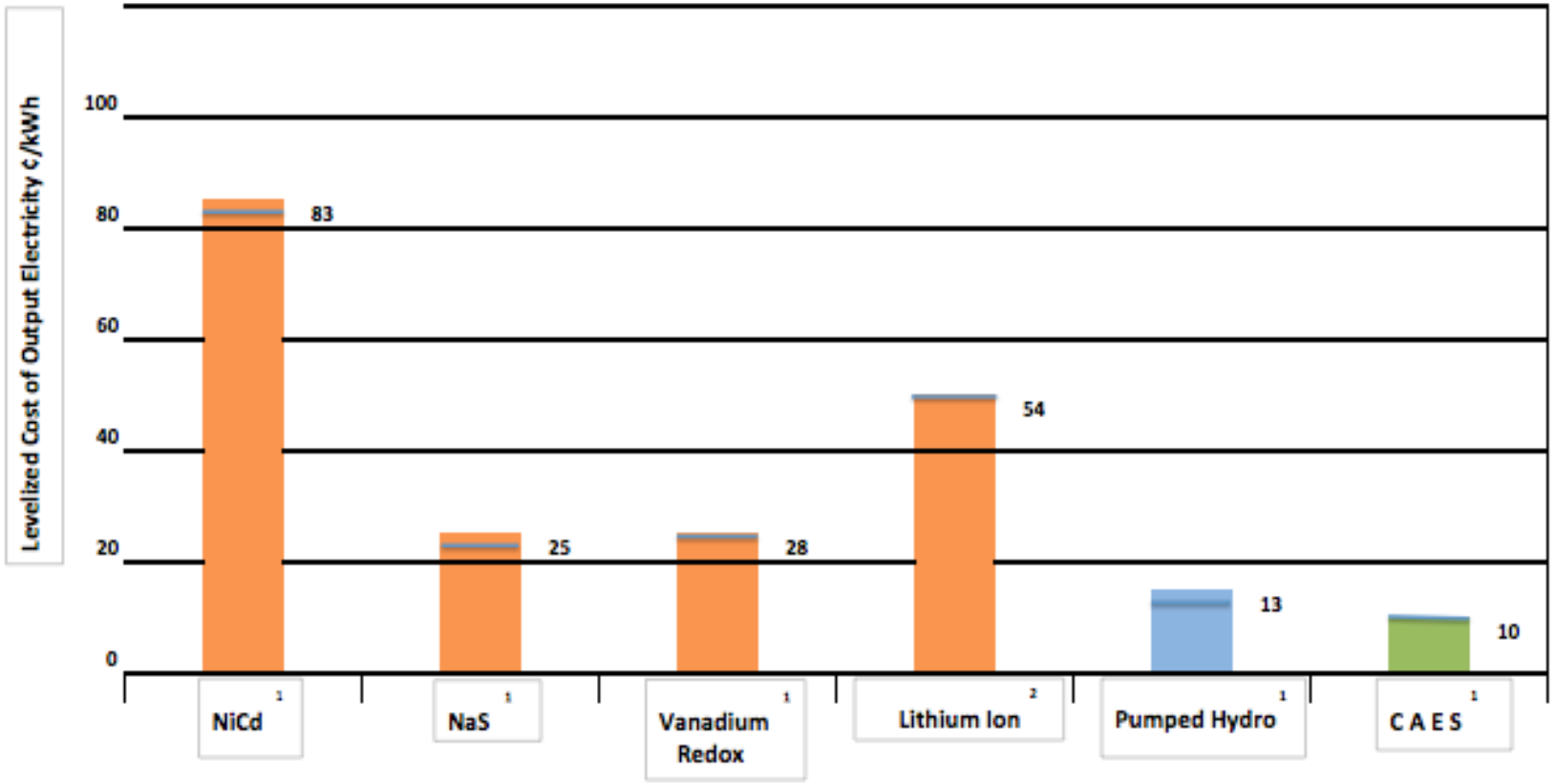
[1] Estimated Installed Cost includes Project Cost and Infrastructure Costs.
[2] Represents actual costs for Dave Gates Generation Station taken from NWE regulatory filings.
[3] Estimated Installed Cost includes estimated Project Cost and Infrastructure Costs. Cost estimates taken from NWE's 2015 Plan: Table 1-3 *Estimated EOP Costs.* Prices are in 2016 dollars.

Resource Attributes

Attribute	Pumped Hydro	Gas
Cost per kW of Regulation	$1,000-	$1,500+
Energy Cost Penalty	85% efficiency	Out-of-market costs
Other Ancillary Services	+	+
Energy Storage	+	-
Transmission Congestion Relief	+	-
Fuel Price Risk	+	-
Carbon Emissions	+	-
Capacity Varies with Temperature	+	-

Capacity/ Storage Technologies

PSH is the most mature and one of the least expensive proven capacity / storage technologies in the world.

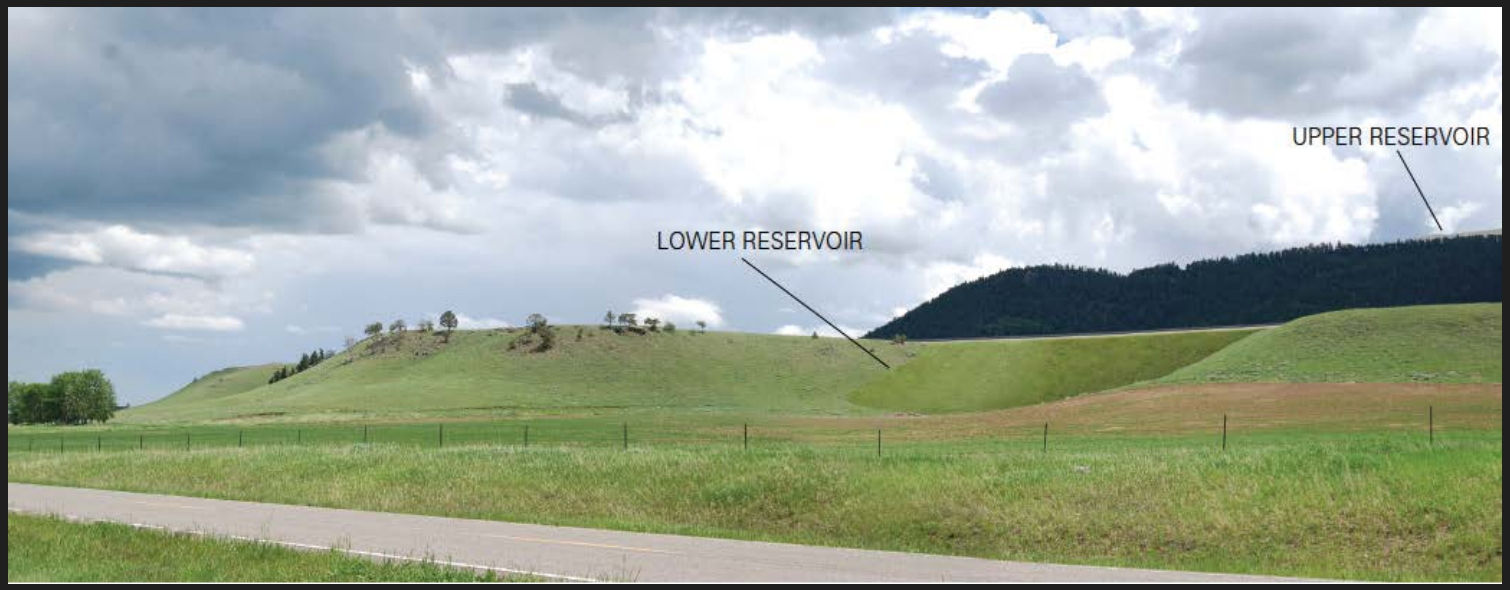


Source 1: NREL "Hydrogen For Energy Storage Analysis Overview" Darlene Steward, Todd Ramsden, Kevin Harrison
Source 2: Lazard "Levelized Cost Of Storage Analysis - Version 1.0"

Conclusion

- **RIGHT PROJECT / RIGHT TIME**
- ROBUST TOOL FOR **CAPACITY**, **FLEXIBILITY**, **REGULATION** AND **INERTIA**
- MORE **COST EFFECTIVE** THAN OTHER REGULATION TOOLS
- SUCCESSFUL FERC PERMITTING AND LICENSING PROGRESS
- **UNIVERSAL POSITIVE SUPPORT** FROM LOCAL COMMUNITY, STATE AND FEDERAL AGENCIES, ENVIRONMENTAL GROUPS, POLITICAL LEADERSHIP AND THE GENERAL PUBLIC.

Thank You



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