



Future Supply Side Resource Costs for 2021 IRP

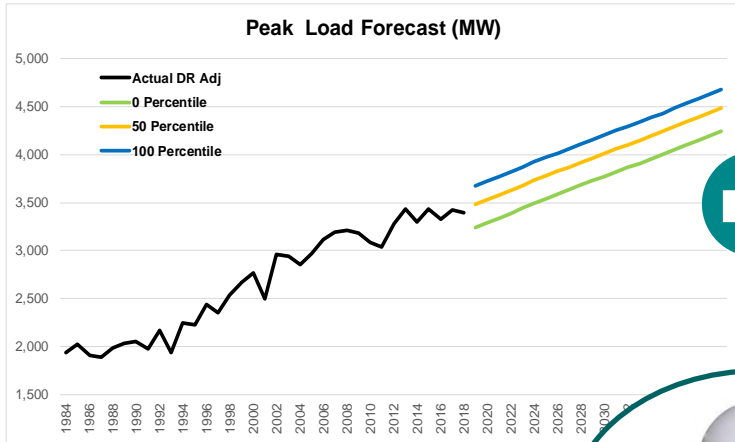
Ian McGetrick, Resource Planning
May 13, 2021



Integrated Resource Plan Construction



Future Supply Side Resources



Optimized Resource Expansion



Preferred Portfolio





Supply Side Resources Selected

- Natural Gas (CCCT, SCCT, Aeroderivative, Recip, Retrofit)
- Small Modular Nuclear Reactor (SMR)
- Geothermal
- Biomass
- Solar
- Solar + Battery (.25:1 - 1:1)
- Wind
- Battery (Lithium Ion 4-Hr/8-Hr, Sodium Sulfur, Zinc)
- Pumped Hydro
- Compressed Air Energy Storage 8-Hr (CAES)
- Hydrogen

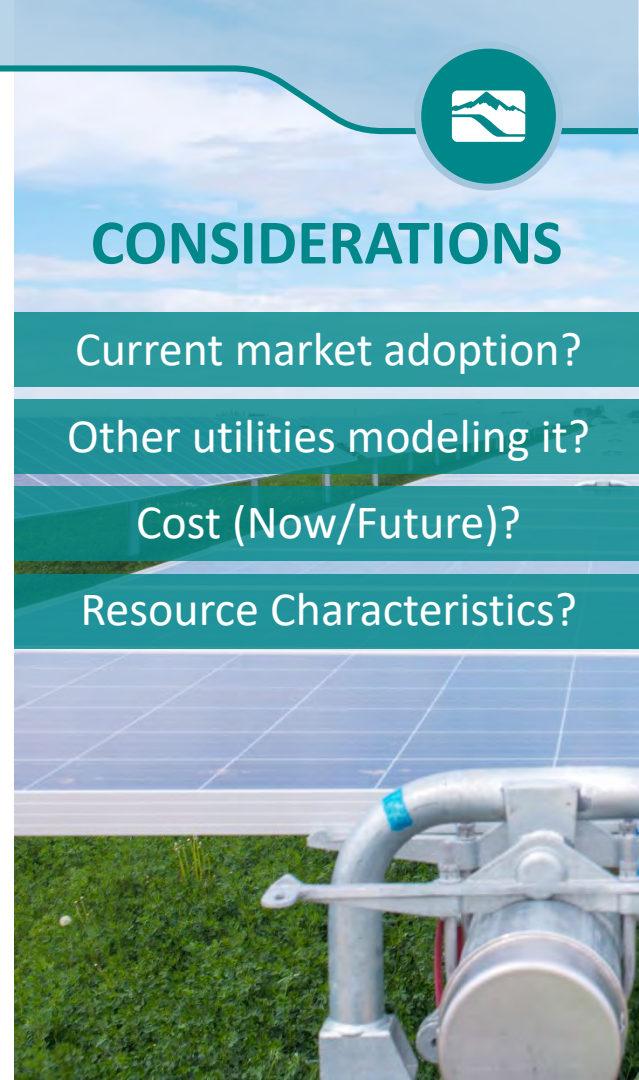
CONSIDERATIONS

Current market adoption?

Other utilities modeling it?

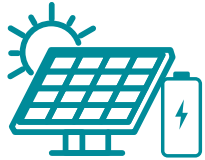
Cost (Now/Future)?

Resource Characteristics?





Supply Side Resources Not Selected



Solar+Storage (.25:1)

- Lower ELCC

Sodium Sulfur/Zinc Batteries

- Less cost effective
- Lower market adoption

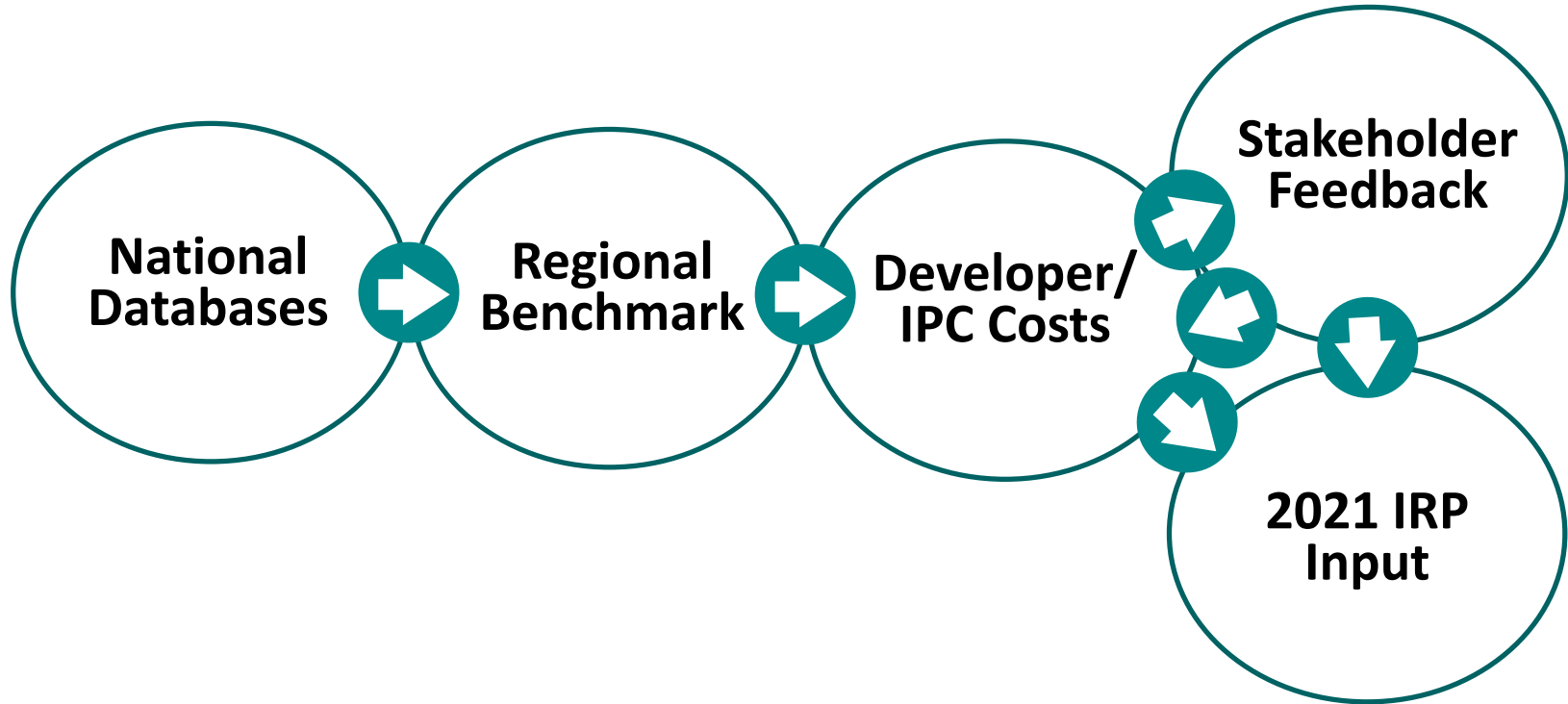


Hydrogen

- Almost no US market adoption
- Limited utility sector modeling
- Modeling complexities
- Limited available information



Resource Cost Methodology





Once we have determined all the inputs, we will release an Excel file with supply side resource cost information like prior year IRP's

Included in Supply Side Resource Costs:

- Overnight Capital Cost
- Fixed/Variable O&M
- Transmission/Interconnection Costs
- Construction/Finance Costs



Supply Side Resource Costs (2021 dollars)



Resource	Overnight Capital Cost* (\$/kilowatt [kW])	Source
Natural Gas – CCCT (300 megawatt [MW])	1,380	Historic IPC Costs, Regional Benchmark
Natural Gas – SCCT (170 MW)	750	EIA, NREL
Natural Gas – Recip (55 MW)	1,300	Developer, EIA
Natural Gas – Aeroderivative (45 MW)	1,250	EIA
Natural Gas – Danskin 1 CCCT Retrofit (90 MW)	2,350	Developer, IPC, Lazard
Small Modular Nuclear Reactor (77 MW)	4,250	Developer, NREL
Geothermal (30 MW)	4,500	Developer, NREL, Lazard
Biomass (35 MW)	4,176	NREL

*Overnight Capital Cost = Cost to construct a resource; no financing costs included.



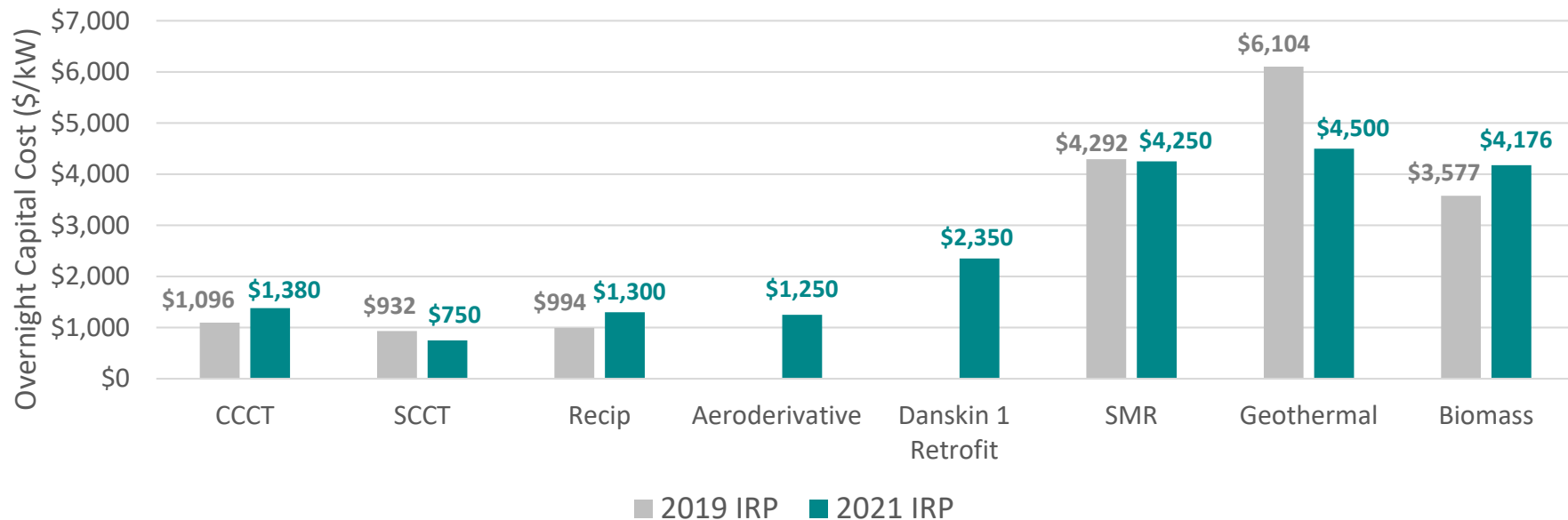
Supply Side Resource Costs (2021 dollars)

Resource	Overnight Capital Cost (\$/kW)	Source
Solar (100 MW)	1,000	Developer, Lazard
Solar + Battery (100 MW + 100 MW)	2,150	Developer, Lazard, NREL
Wind (100 MW)	1,300	Regional Benchmark, Lazard
Pumped Hydro (250 MW)	2,100	Developer, DOE
Lithium Ion 4-Hr (50 MW)	1,150	Developer, NREL
Lithium Ion 8-Hr (50 MW)	2,100	Regional Benchmark, NREL
Compressed Air Energy Storage (150 MW)	2,200	DOE, Regional Benchmark



Resource Cost Comparisons to 2019 IRP

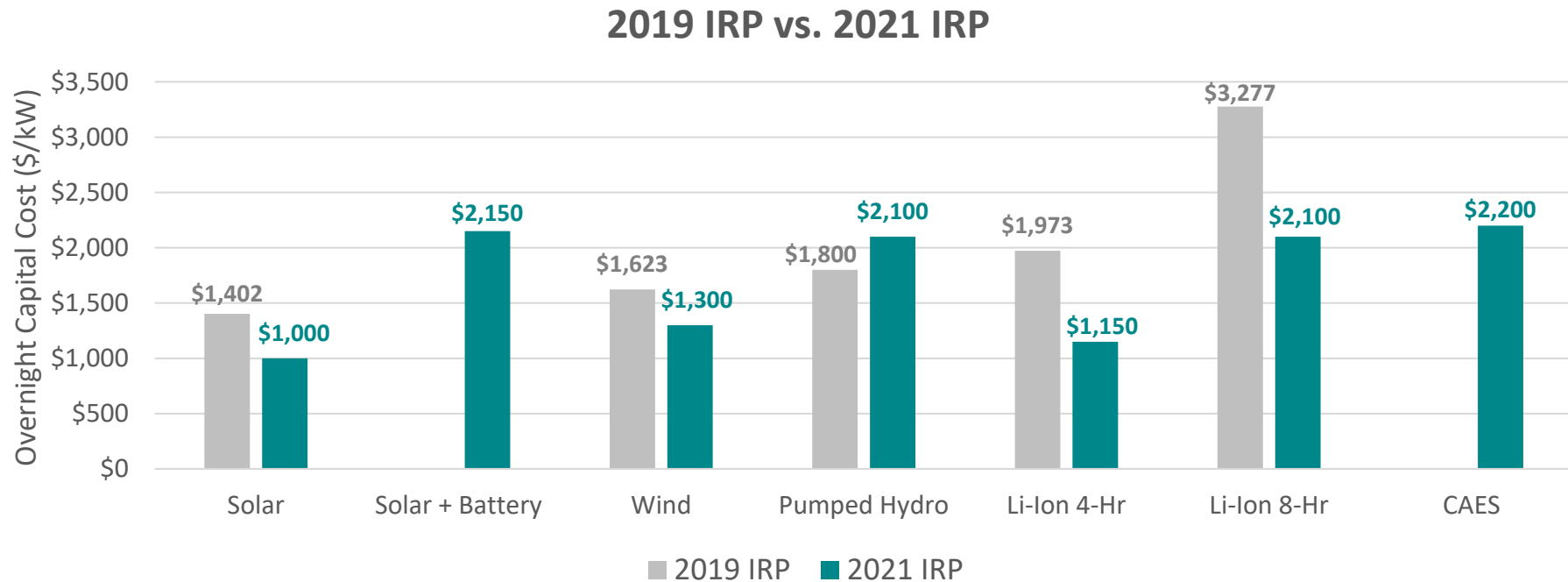
2019 IRP vs. 2021 IRP



*in 2030



Resource Cost Comparisons to 2019 IRP





Questions/Comments

Thank you!