Cyrq Energy

GEMS Workshop
November 2023

EthosEnergy

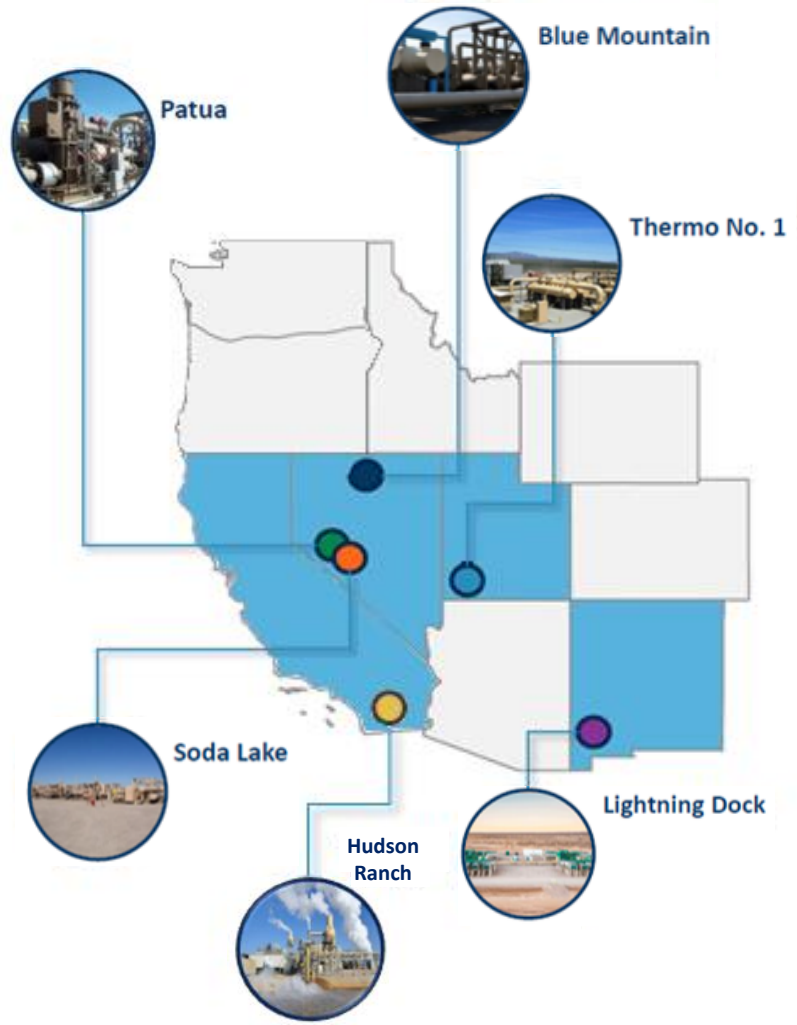
Cyrq – Company Intro

Cyrq is the second largest privately held geothermal power producer in the U.S.

We operate a fleet of 6 power plants with a combined 186MW of capacity in Utah, New Mexico, Nevada, and California

Cyrq has a development pipeline consisting of 200MW of new generation as well as several direct use district heating projects

Cyrq is a portfolio company of Macquarie Asset Management (MAM), a global infrastructure fund with over $340B in assets under management



Portfolio

Gas turbines

Steam turbines

Generators

Compressors

Transformers

Controls and Actuators

Field service

Operations and Maintenance

Steam Turbine Capabilities

Optimization

- **Engineered Solutions for Any Steam Turbine**
- **Expert Engineering**
  - 600+ man years of steam turbine design experience
  - Leader in reverse engineering technology
- **Advanced Steam Paths**
- **Increase Output / Efficiency**

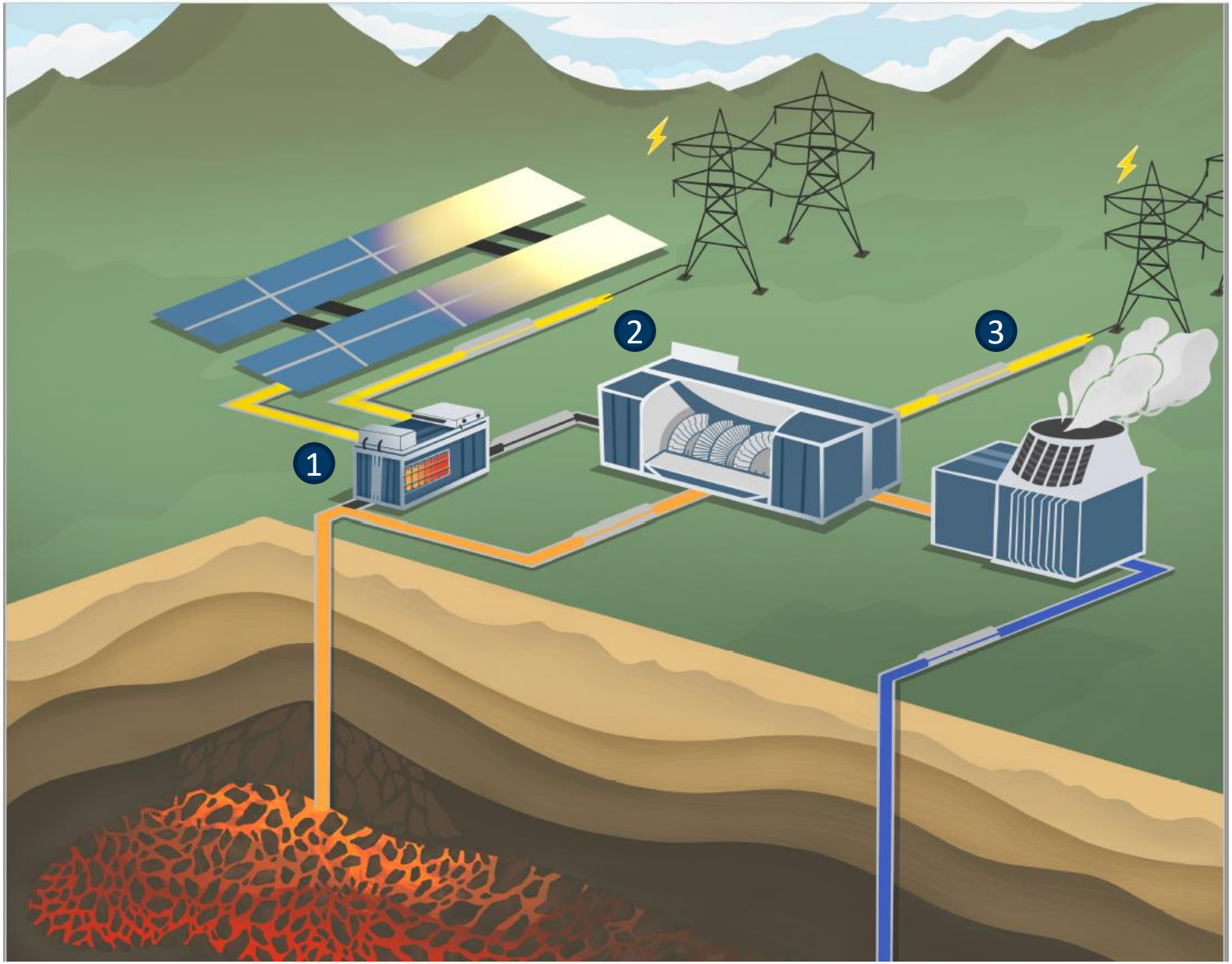
Reliability Upgrades

- **Blade Failure Redesign**
- **Long-shanking**
- **Life extension**
- **Feed Pump Turbine Upgrades**
- **Geothermal Turbine Rerates**

Steam Turbine Engineering Services

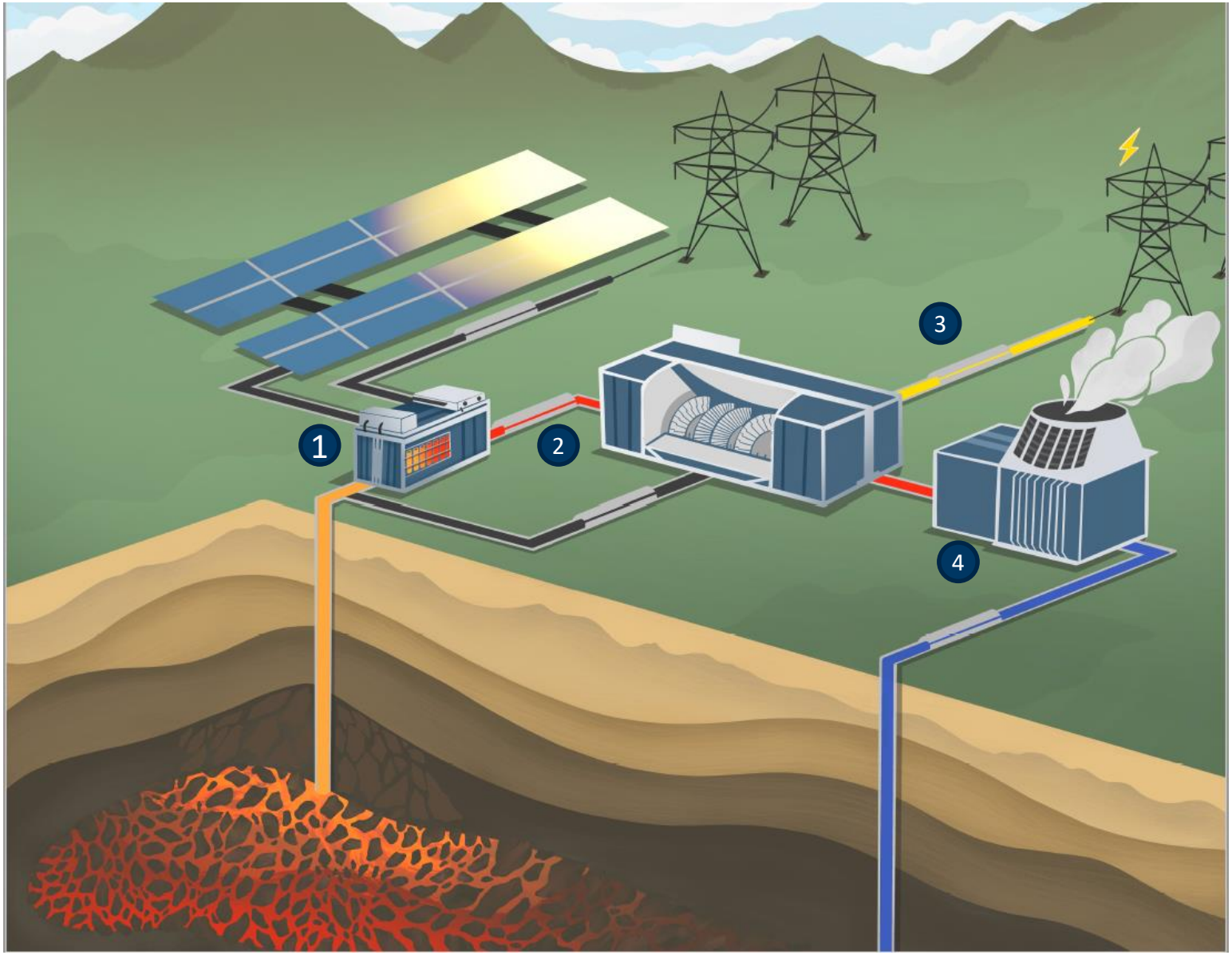
- **Custom Engineered Solutions**
- **Full Steam Path Redesigns**
- **Root Cause Analysis of Failed Components**
- **Rotor Dynamic Analysis**
- **Engineering Studies**
- **Advanced Weld Repair Technology**
- **Plant and Process Change Turbine Optimizations**
- **Change of Use Evaluations**
- **Component Material Upgrades**
- **Customer Seminars**

Charging Cycle



1. TES Unit: The thermal storage is charged electrically either from the grid or behind the fence with a renewable source like PV.
2. Steam from the wellfield bypasses the TES and the plant operates as normal.
3. The amount of power sent to the grid could be modulated by both the charging and discharging systems.

Discharging Cycle



1. TES Unit: The thermal storage acts as a superheater during discharge. Steam enters from the wellfield and is superheated either directly or through a heat transfer fluid.
2. Superheated steam enters the steam turbine.
3. Net generation increases and can potentially be variable with different levels of superheat.
4. Condenser and reinjection are not impacted.

Geysers Case Study

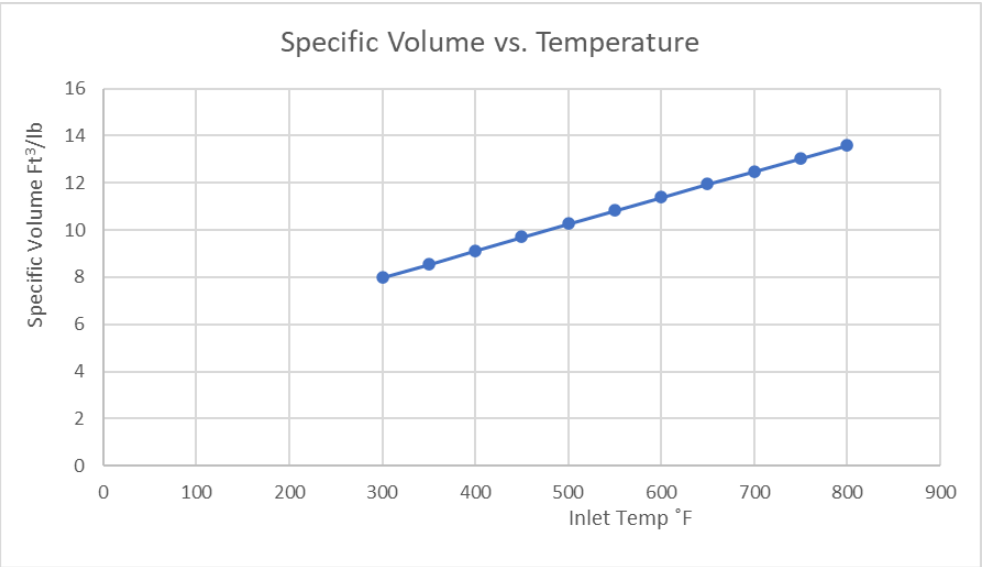
- Cyrq modeled its superheat system on two plants in the Geysers with the help of the plant's owner, Ethos, and turbine manufacturers.
- Our base case is a 20MW plant running on near saturated steam.
- The table below is an extrapolation of those results as actual plant data is confidential.

Temperature	Gross Generation	Turbine Efficiency	Generation Increase from Baseline	Thermal Energy Required for Superheat	Thermal Efficiency
325°F	20MW	71%	0	0	
600°F	26.2MW	79%	6.3MW	15.3MW	41%
750°F	30.4MW	81%	10.4MW	23.5MW	44%

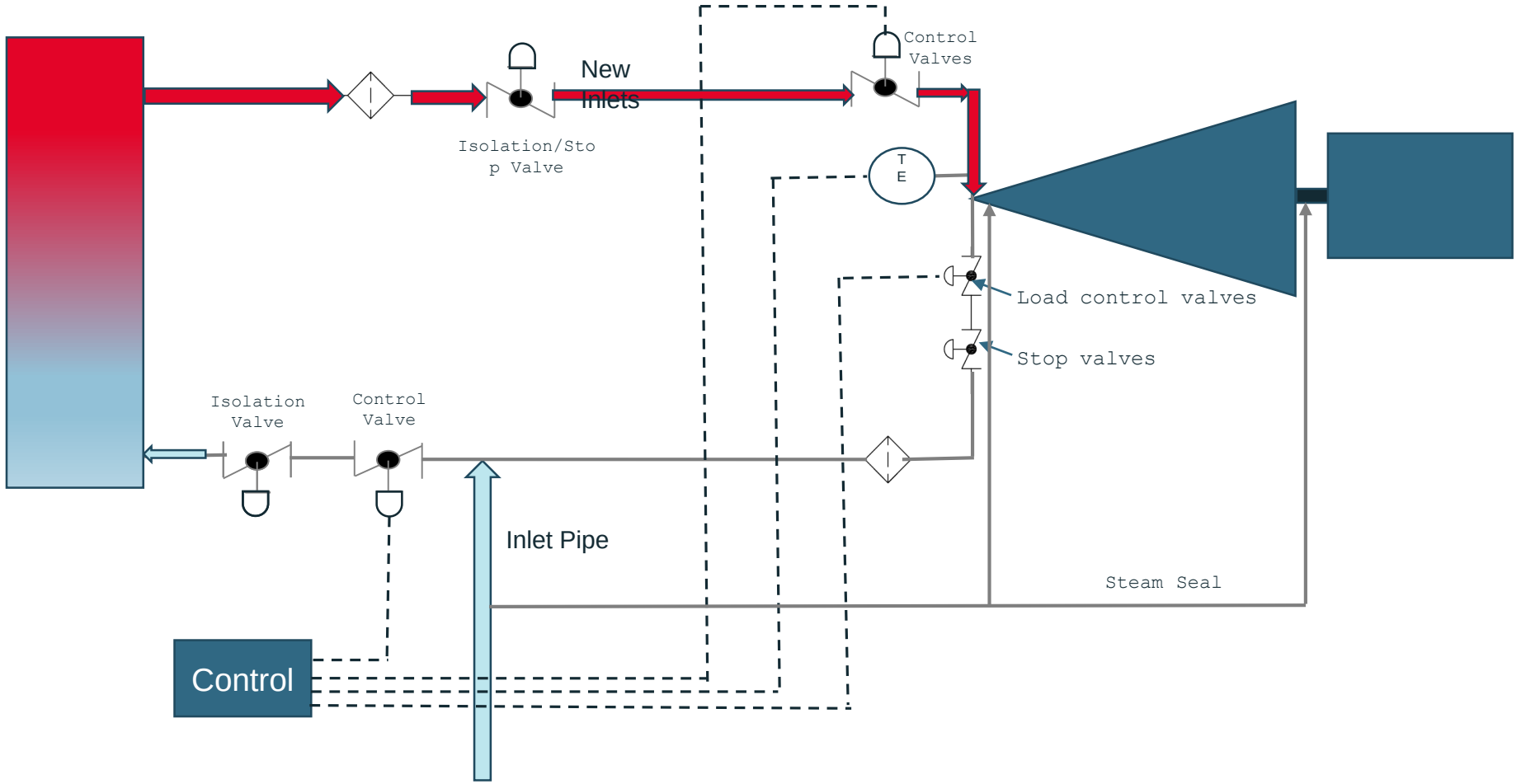
Superheating to 750°F boosts output by over 50% and stays within temperature constraints of carbon steel casing.

Specific Volume Change With Increased Temperature at 55 psia

Inlet Temp Deg F	Spec Vol Ft^3/lb
300	7.994
350	8.546
400	9.13
450	9.702
500	10.267
550	10.826
600	11.381
650	11.954
700	12.485
750	13.034
800	13.583



Steam Inlet Valves for Online Transition



NCPA: New Conditions – Added 2 Inlets to Address the 100% Increase in Volume Flow

Inlet pressure reduced from 113 psia (7.8 bara) to 63 psia (4.8 bara); flow increased from 487,500 lb/hr to 908,500 lb/hr; Output increased from 29,000 kW to 53,000 kW
Project included controls retrofit and two additional inlet connections to handle double the volume flow
Unit output achieved: 54,500 kW

Pilot Project Plan and Team

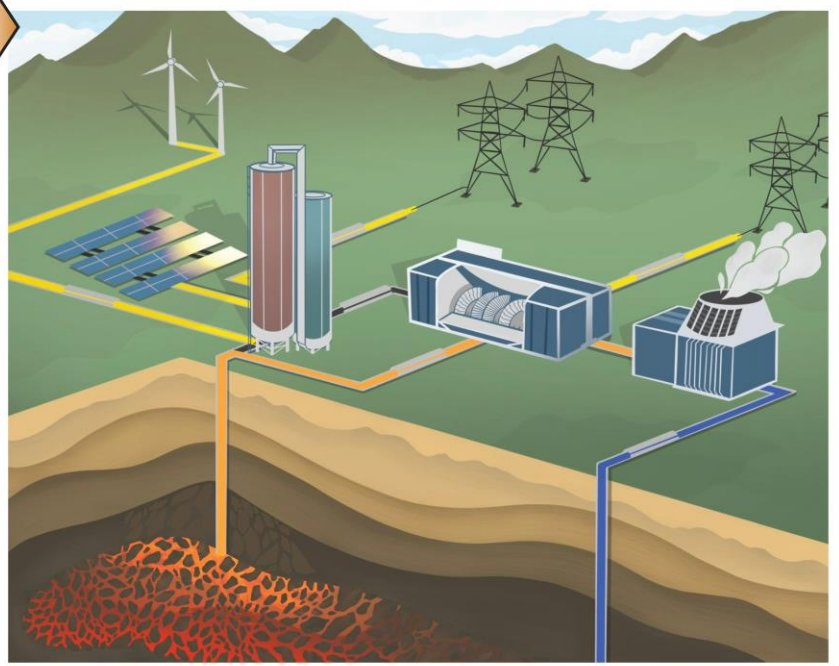
Program Team

Cyrq energy
B&W Babcock & Wilcox
Macquarie
Sonoma Clean Power
EthosEnergy
NREL

Relevant Prior Work

- Cyrq has built a portfolio of over 150MW of renewable generation
- B&W has built similar heat exchangers and material handling for coal-fired power plants
- Macquarie has financed over 12,000 GW of development and acquisitions

Project Objective: Build a commercial-scale long-duration storage system using ENDURING and Vapor-Rise Technologies



Technical Approach

- Use high-TRL version of NREL's ENDURING stand storage technology in a low-risk/ high-reward application

Technical Challenges

- Footprint and terrain

Program Deliverables

- 6MW/120MWh system design and spec
- Commercial agreements and long-term project off-take agreement
- Operational System
- Pipeline of near-term, first-generation deploy-ments beyond this system

Anticipated Benefits of the Proposed Technology

- Low LCOS
- De-coupled design allows for component-level improvements
- Scalable
- Commercially viable
- Integrates with existing infrastructure


Questions?