Balance of Plant Panel Session

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SwRI is an Applied Research & Development Company

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  - Industry and government contracts
- Over 3,200 employees
- 1,500+ acre campus
- Customer-Centric IP policy
- Deep Sea to Deep Space®…and everything in between

Alvin Pressure Hull

Pluto from New Horizons Spacecraft

SwRI's Roles in the STEP Pilot Plant Project

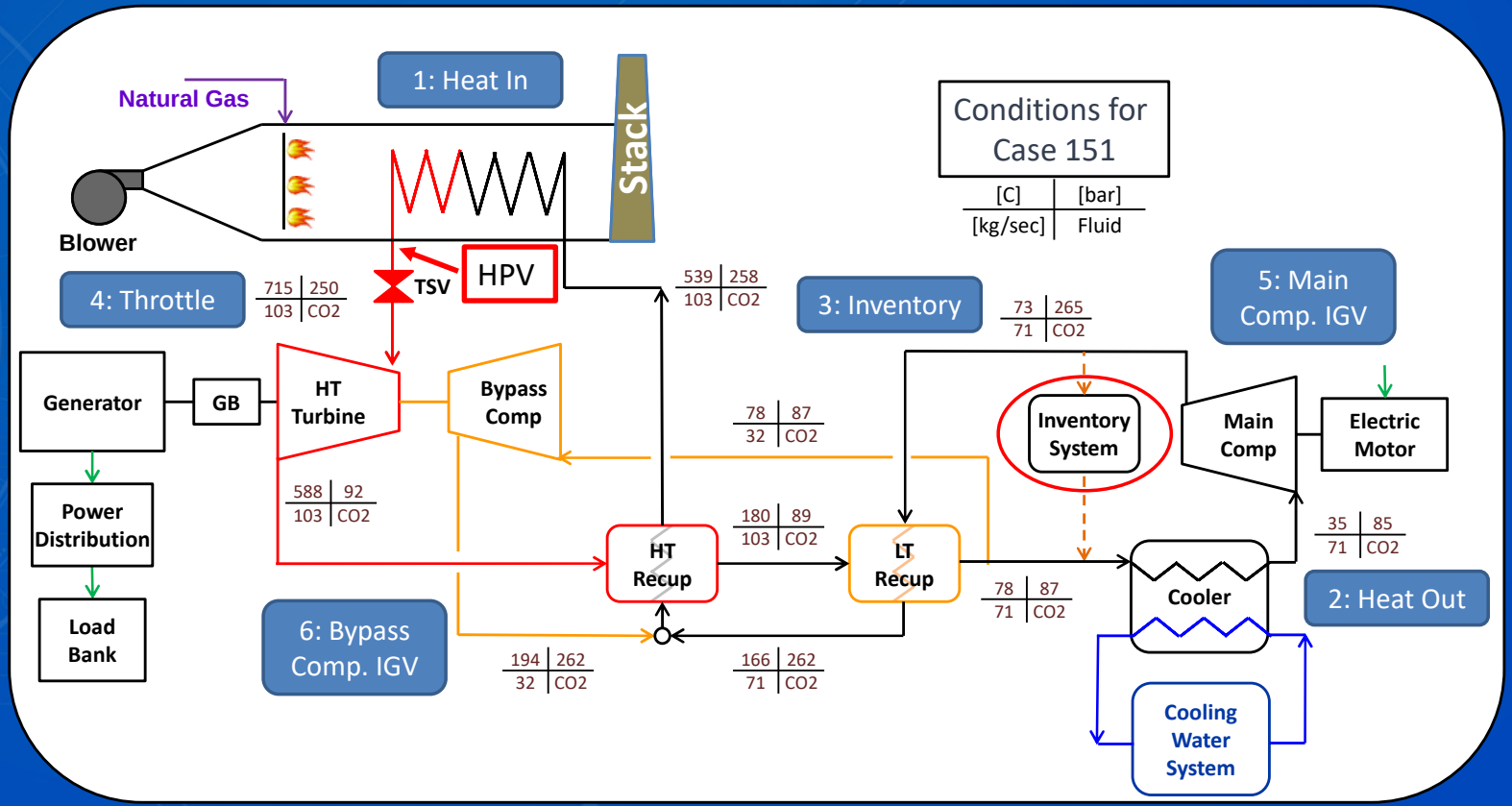
- The STEP Demo is a project funded by DOE NETL and led by GTI Energy in partnership with SwRI and GE Vernova Advanced Research
  - 10 MWe sCO2 Pilot Plant,
  - TRL3 to TRL7
- SwRI Roles:
  - Host site
  - System integration and operation
  - Data acquisition & controls
  - Piping
  - Inventory Management System (IMS)
  - Turbine design & fabrication (with GE)
  - Heater protection valve (HPV)
- Simple Cycle testing completed October 2024
- RCBC Reconfiguration in final stages of construction

STEP DEMO | NATIONAL ENERGY TECHNOLOGY LABORATORY | gti | SwRI | GE

Recompression Closed Brayton Cycle

Objectives

- **High performance** cycle configuration
- Turbine inlet up to **715°C**
- **Parallel compressors** with **different head curves**
- Multiple Heat Exchangers
- **Measure** system and component **performance**
- Evaluate operability
- Demonstrate **pathway to 50% thermal efficiency**



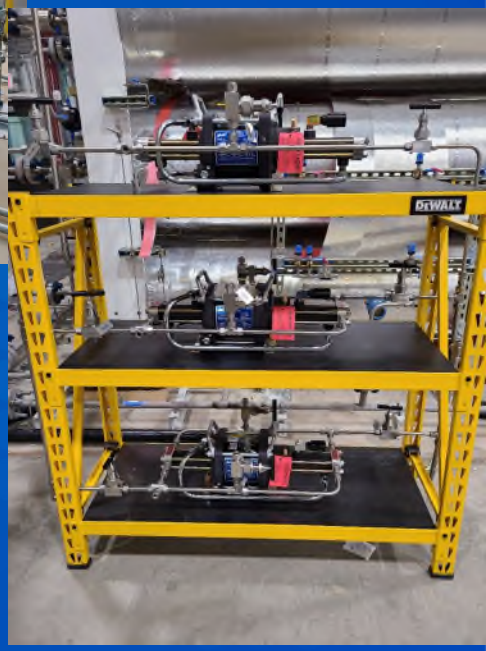
Why have an IMS?

- Controls the amount of CO2 in the system (which affects system load)
- Responsible for initial fill of system
- Supports Auxiliary systems like Dry Gas Seals (DGS)
- Can enable fast transitions between load points

Model Names	Cycle Configuration	Description	Load %	Net Power Level (MWe)	Cooler Exit Temperature	Turbine Inlet Temperature	Cycle Efficiency
133	Simple	Simple cycle minimum load case	Min	2.5	35°C	500°C	22.6%
136	Simple	Simple cycle maximum load case	Max	6.4	35°C	500°C	28.3%
151	Recompression	Baseline case	100%	10.0	35°C	715°C	43.4%
152	Recompression	"Hot" Day Case	70%	6.6	50°C	675°C	37.4%
153	Recompression	"Cold" Day Case	100%	9.9	20°C	525°C	36.8%
154	Recompression	Partial load case using inventory control	40%	4.0	35°C	715°C	37.0%
155	Recompression	RCBC at 500°C turbine inlet temperature	70%	6.9	35°C	500°C	32.5%
157	Recompression	Partial load case using TSV throttling (transient condition)	40%	4.2	35°C	715°C	30.8%
157a	Recompression	Partial load case using TSV throttling	40%	3.9	35°C	675°C	29.6%

STEP Inventory Management System

- 30 ton liquid CO_2 storage tank
- 2 VFD powered reciprocating pumps
- 2 electric vaporizers
- 6 indoor storage tanks
- DGS air driven boost pumps
- DGS buffer tank
- Heat trace
- Valves
- Lots and lots of tubing and fittings…



STEP Heater Protection Valve

- Multi-purpose valve
  - Controlled venting (% open control)
  - Pressure Relief Safety Valve
- Challenging design
  - Rated for 715°C, 250 bar venting direct to atmosphere
  - High risk of damage due to thermal cycling

Gratefully Acknowledging the Support from U.S. DOE-NETL and Project Partners

www.STEPdemo.us