WE ARE

GE VERNOVA

GE Vernova Portfolio of Businesses:

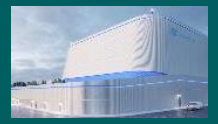
ONE-OF-A-KIND

POWER

Gas Power
- Heavy Duty Gas Turbines
- Aeroderivative Gas Turbines
- Steam Turbines/Generators

Steam Power
- US Nuclear, Global Coal
- Steam, Generators, Boilers

Hydro
- Hydro Turbines/Generators
- Pumped Storage



Nuclear
- Boiling Water Reactors
- Fuel
- Small Modular Reactors

WIND

Onshore Wind
- 2 - 3.5 MW platform
- 5 – 6 MW platform
- Services & repowering

Offshore Wind
- Haliade-150 (6 MW)
- Haliade-X (14 MW)

Wind Power
- ONW blades
- Haliade X blades

ELECTRIFICATION

Grid Solutions
- Transmission
- Transformers
- Grid Automation

Power Conversion
- O&G Electrification
- Naval Electrification
- Microgrids

Solar & Storage Solutions
- Inverters
- Energy storage

DIGITAL

- Grid Software
  - Opus One Plat.
- Manufacturing
- Power and O&G

FINANCIAL SERVICES

Financial Services
- 3rd Party Financing Support
- Direct Financing though Equity

ACCELERATORS

Advanced Research
- Differentiated Technologies
- External Partnerships

Consulting Services
- Power Market Assessments
- Investment Decision Analysis

Helping our customers generate

~30% of the World's Electricity

Advanced Research at a GLANCE

GE VERNOVA

TALENT

275+

Global Researchers

70%

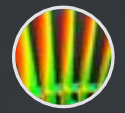
PhDs

LOCATIONS

Niskayuna, NY

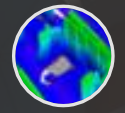
Bangalore, India

TECH CAPABILITIES



Aero & Thermosciences

AI, Robotics & Software



Controls & Optimization

Electrical & Power Systems

Embedded Systems & Cybersecurity

Material Chemistry & Physics

Materials, Coatings & Modeling

Mechanical Systems & Design

sCO2 … Research to Reality

8th International sCO2 Symposium

Jason Mortzheim
sCO2 Platform Leader
Senior Manager – External Technology Partnerships

sCO2 Power Cycle Active Opportunities

	Technology	Current Programs *persent-3 yrs*	TRL	Where are the GAP *3-5+ yrs*	GE pursuit / Interest Level
Fossil Gen	**Oxy-Fuel** 	❑ TBD	Expander Heat source Compressor Heat Exchangers	▪ Scale-up ▪ Expander inlet temperature ▪ Limited retrofit capability	▪ Evaluating indirect fired application for CHP ▪ Not to be confused with Allam cycle
Fossil Gen	**Waste Heat Recovery** 	✓ **DoE FE** Bearings ($4.8M) ✓ **DoE FE** STEP ($12M … $140M)	Expander Heat source Compressor Heat Exchangers	▪ Efficiency Challenge vs Recip Engines ▪ Variety of Markets limits standardization	▪ Aeroderivative WHR active pursuit ▪ Evaluating high response CC applications ▪ System Optimization
REN Gen	**Concentrated Solar Power** 	✓ **DOE SETO** ✓ Bearings ($4.0M) ✓ Cycles ($1.0M) ✓ Near Net Shape HIP ($2M)	Expander Heat source Compressor Heat Exchangers	▪ GE content low fraction of CAPEX ▪ Overall CSP system needs to meet LCoE targets ▪ Requires TES	▪ Evaluating system optimization with energy storage and solar ▪ Advancing technology to improve economics
Nuclear	**Nuclear** 	✓ **DoE Nuclear (ARC)** ✓ **Internal investment**	Expander Heat source Compressor Heat Exchangers	▪ Paced by advanced reactor timeline ▪ sCO2 power block scale-up	▪ Several pursuits with Gen IV reactors: ▪ Sodium fast reactor ▪ High temperature gas reactors
TES	**Thermal Energy Storage** 		Expander Compressor	▪ Commercial Readiness	▪ Active pursuit in mid temperature application

Commercial Interest is Growing at an Expanding Rate

Gaps to Close

Economics:

- Low temperature applications (<500C):
  - Efficiency vs steam is challenging
  - Cost comparable, need n^{th} of a kind
  - Focus on unique applications
- High temperature applications (>600C):
  - Cost of materials/manufacturing prohibitive
  - Efficiency increase does not offset cost

LM6000 Gas Turbine

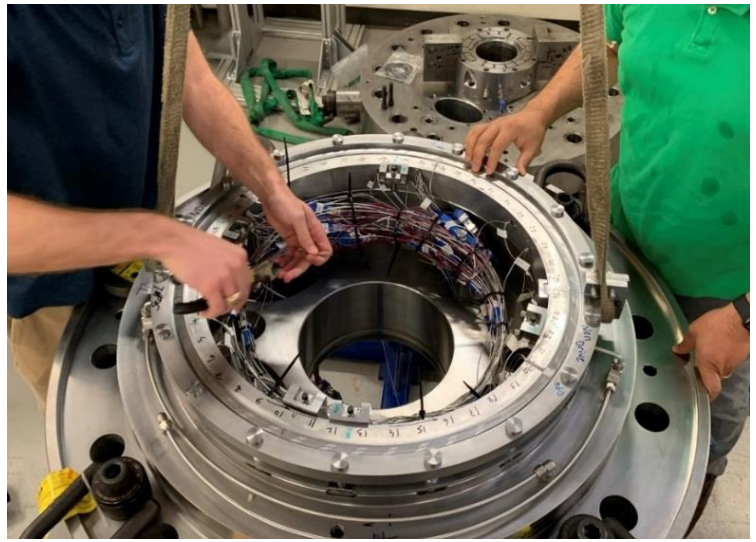
10MWe STEP facility

Availability/Reliability:

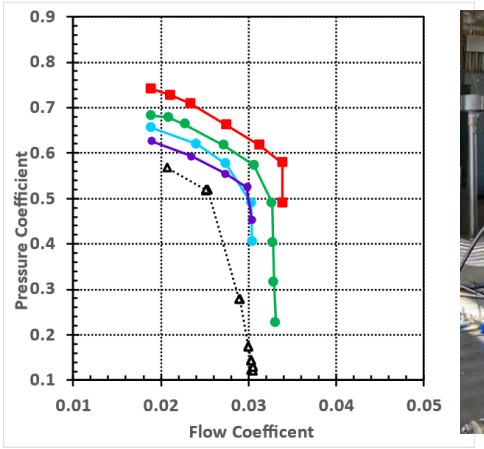
- Steam:
  - 125 yr old technology
  - Limited technology enhancements
- sCO2:
  - Current operation: 40-50hrs
  - Need >1000hrs to demonstrate reliability
  - Large potential for technology advancement

Most customers still compare sCO2 to steam

Notable Achievements



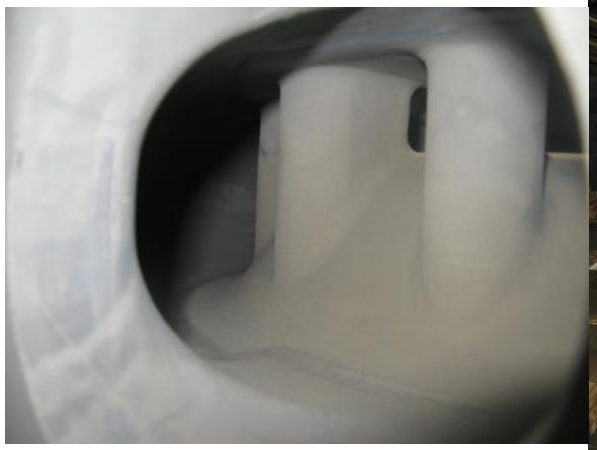
24” advanced seal test
Allows scalability to >500MWe

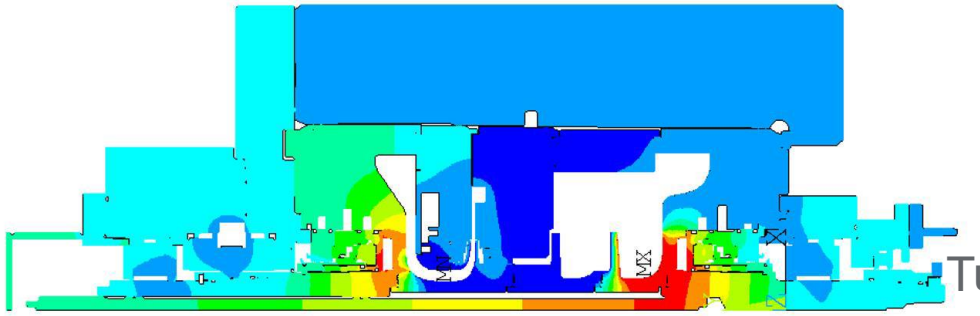


Enhanced compressor operating data

Increased predictability

Advanced manufacturing modality for turbine case – 50% cost reduction





System Thermal Model
Turbomachinery inputs critical for seal design

GE Vernova continuing to advance sCO2 technology

GE VERNOVA

sCO2 Features and Use Cases - WHR

Features of sCO2 Turbine

- Fast Start <30 minutes cold start
- Turbine designed for > 10,000 start cycles
- Minimal maintenance
- Designed for temperatures up to 700˚C
- Small footprint, skid factory assembled

Features of sCO2 Cycle

1. Unattended boiler
2. No water required
3. Add renewable or stored thermal energy
4. Recuperators added to optimal efficiency vs cost

Potential Use Cases

- Combined cycle efficiency → unattended boiler
- Combined cycle efficiency → without water
- High efficiency peaking power with fast start
- Integrated with renewable heat source or stored thermal energy
- Provides stable synchronous generation

GE VERNOVA

GE VERNOVA ADVANCED RESEARCH

Jason Mortzheim

2/27/2024