Innovation Challenges at Cost & Scale
GE Oil & Gas Technology Center
March 3, 2016

Imagination at work.
Innovation Challenges at Cost and Scale
Water for 2060 Initiative

Comparison of water needs & produced water generation

By Sector
- Oil & gas
- Thermo-electric
- Agriculture
- Manufacturing
- Municipalities

By Region
- Infrastructure
- Logistics
- Energy mix
- Waste mgt.
- Regulatory/legal

MISSISSIPPIAN
GRANITE WASH
CANA WOODFORD
FAYETTEVILLE
ARKOMA WOODFORD
ARDMORE WOODFORD
Fit-for-Purpose Strategy

Water management technologies and strategies\(^1\)

**Tier 1:** Minimize the volume of produced water volumes brought to surface

**Tier 2:** Reuse and repurpose produced water

**Tier 3:** Reduce disposal to Class II SWD wells

Outcomes must be actionable

- Cost
- Energy
- Water
- Risk
- Food

Meet short-term needs and ensure long-term reliable water-energy supply.

1: U.S. Produced water volume and management practices in 2012 (Veil, 2015)
GE Response to Market Challenges

Innovation pillars

- Technology and design
- Digital Industrial
- New business models
- Next Gen
- Regulation & Policy

Roadmap & path forward

Technology & Design
- Modularization and structuring footprint and cost reduction
- Process optimization
- Advanced materials, robotics, additive manufacturing

Extending Digital Industrial
- Automation and robotics
- Remote/unmanned operations
- Process/production flexibility
- Prediction/optimization

Business model (e.g.)
- BOO, leased equipment, service
- Pay for performance
Technology Management

Determining what we will and won’t do and why

- **Feasibility**
  - Technical Reality

- **Viability**
  - Commercial Value
  - Willing Stakeholders
  - Commercial Plan

- **Desirability**
  - Enabling the Digital Age
  - Optimizing Industry Operations
  - Transforming the Industry
  - Maintaining Industry’s Social License to Operate
  - Enhancing the Value of Oil & Gas in the Energy System
  - Creating New Markets for Production
Fall in love with the *Problem*, not the solution....

There's a way to do it better—

**FIND IT**

—Thomas Edison

**MISSION**

Use no more fresh water in 2060 than was used in 2012, while supporting Oklahoma’s continued growth and prosperity.