Who we are

- A global specialty chemical company headquartered in Kingsport, Tennessee
- Approximately 14,000 employees and 50 manufacturing sites around the globe
- Serving customers in more than 100 countries
- A company dedicated to environmental stewardship, social responsibility and economic growth
- A Responsible Care® company for more than 25 years
- 2017 ENERGY STAR® Partner of the Year Sustained Excellence
- 2016 revenue of $9 billion
Self sufficiency mindset

- CHP since the 1920's
- Incineration complex
- Hazardous and non-hazardous landfills
- Wastewater treatment
Eastman’s first encounter with CHP
Kingsport, Tennessee plant

- Eastman Chemical Company’s Tennessee Operations (TNO) is one of the largest chemical manufacturing sites in North America, covering approximately 900 acres.
- This facility produces a variety of chemicals, fibers, and plastics and also serves as the worldwide headquarters for Eastman Chemical Company.
- The facility began operating its first CHP system in 1920’s and has continued adding to the system until its most recent expansion in 1993.
- TNO’s experience with CHP predates the construction of a reliable electric grid in the Kingsport area.
- When it first came online, the CHP system was the only reliable source of electricity for the facility.
Benefits of Combined Heat and Power (CHP)

- Dramatically improves Eastman’s footprint: ~70% energy captured versus ~40%
- ~90% of the electricity at Eastman comes from CHP technology
- CHP has broad support from environmental groups and the Department of Energy
Steam and electricity generation at TNO

- One of the most energy efficient plants in the country
- TNO received ENERGY STAR® Combined Heat and Power (CHP) Award
  (requirement: use at least 10 percent less fuel than state-of-the-art separate heat and power generation)
- Steam generation
  - 17 boilers
  - Typical steam load: 3.6 million lb/hour
  - Similar to 700 MW power station
- Electricity generation and distribution
  - Generate 90% of plant’s electricity needs
  - Electrical nameplate capacity = 190 MW (enough for a city of ~170,000 homes)
  - 19 turbine-generators
  - ~200 substations
CHP at Eastman today

- **Benefits of CHP at the TNO site:**
  - CHP total efficiency: >70%
  - Avoided CO₂ emissions: 358,000 tons/yr
  - Yearly savings: $~45M
  - Reduced demands on existing transmission and distribution infrastructure

- **Two other Eastman sites currently make use of CHP**
  - Longview, Texas
    - Two GE 7241(FA) combustion turbines
    - Two heat recovery steam generators (HRSG)
    - One GE condensing/extraction steam turbine-generator
  - Indian Orchard, MA
    - Generates ~4 MW as steam pressure is reduced from 650 to 125 psig for process use

- 87% of Eastman’s worldwide production occurs at sites with co-generation
- Enables a source energy reduction of several trillion Btu’s each year
Improving CHP efficiency at the Kingsport site
TNO cogeneration system evaluation

- Energy is a significant cost to Eastman
- In today’s environment, we need to make operations as efficient as possible, including energy efficiency improvements
- A detailed internal study of the system took place in 2016
- Involved Technology, Utilities, and Worldwide Energy Program personnel
- Led to significant learnings

Goal

Determine the proper strategy to maximize profits by improving system efficiency
TNO cogeneration imbalances

- Over time, various changes have led to periods of time when the steam electric system at TNO is unbalanced.
- Although the overall efficiency is very high, this imbalance does reduce the ability to operate the power plant as efficiently as possible with current equipment.
- Primary factors include:
  - Shift towards specialty chemical company has changed energy demand profile
  - Move to public company and automation increased HVAC load
  - Improved efficiency has reduced thermal steam demand in processes (which reduces electricity cogeneration)
  - Sub-optimization of the use of mechanical drives throughout the plant
  - Ambient temperature reduces thermal steam demand in warmer months
Path forward after evaluation

- Ensure users are valuing utility cost savings appropriately
- Identify and implement attractive capital projects to bring the system into balance
- Educate manufacturing, technology, and engineering on findings and promote involvement
- Form the Utilities System Balance Team to review projects and oversee the health of the system
- Determine if it is viable to add external customers of 15 & 100 psig steam
Path forward after evaluation

Ensure users are valuing utility cost savings appropriately

Identify and implement attractive capital projects to bring the system into balance

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Form the Utilities System Balance Team to review projects and oversee the health of the system

Determine if it is viable to add external customers of 15 & 100 psig steam

Focus of DOE Steam System In-Plant Training
DOE Steam System In-Plant Training

- Held in June, 2016
- Led by Dr. Greg Harrell
- Focused on identifying options to improve the steam/electric balance at the Kingsport site
- Several potential projects were identified and are now in various stages of implementation:
  - Absorption chiller operation strategy
  - Backpressure turbine loading strategy
  - Fan drive turbine → motor replacement
Future improvement strategy

- Some modes of operation are less efficient.
- In most cases, these inefficiencies occur due to constraints in our very complex system.
- Power Department operations continuously monitors plant needs for steam and electricity and attempts to optimize the system within constraints.
- The newly formed **Steam Electric Balance Team** will monitor the system and recommend equipment / operational changes to improve system efficiency.
- Over time, these actions are expected to remove current operating constraints for Power Department and effectively eliminate time spent in inefficient operating modes.

Steam Demand Electric Demand
Summary

- CHP systems may not be the lowest upfront capital cost approach to supply energy, but they are clear winners when evaluated on a life cycle cost basis.
- Over time, the users and configuration of a CHP system may change in a way that impacts overall efficiency.
- Operating a CHP system at optimal efficiency requires continual focus to ensure users are not sub-optimizing.
- The Department of Energy provides valuable resources to Partners including software, training, and technical support.
A truly sustainable company is one that creates significantly more value in the world than the resources it uses.

David Golden, senior vice president, chief legal & sustainability officer, and corporate secretary