



# Combined Reverse-Brayton Joule-Thompson Hydrogen Liquefaction Cycle

Gas Equipment Engineering Corporation  
Milford, CT  
March 25, 2005

This presentation does not contain any proprietary or confidential information

Project ID # PDP46



## Program Information

- ❖ US DOE Research and Development Grant - Hydrogen Production and Delivery
- ❖ Program Topic - Hydrogen Delivery
  - Subtopic – Hydrogen Liquefaction
- ❖ \$2.6 M for Pilot Plant Design, Fabrication, and Testing
- ❖ 23% Cost Share
- ❖ Projected Start Date June 1, 2005



# Project Partners

## Team Member

Gas Equipment Engineering  
Corp.

R&D Dynamics  
Bloomfield, CT

AMCS  
Princeton, NJ

## Responsibility

Project Management  
Detailed Design  
Liquefier Fabrication  
System Testing

Turbo-Expander Design and  
Fabrication

Cycle Modeling  
Liquefier Control Program

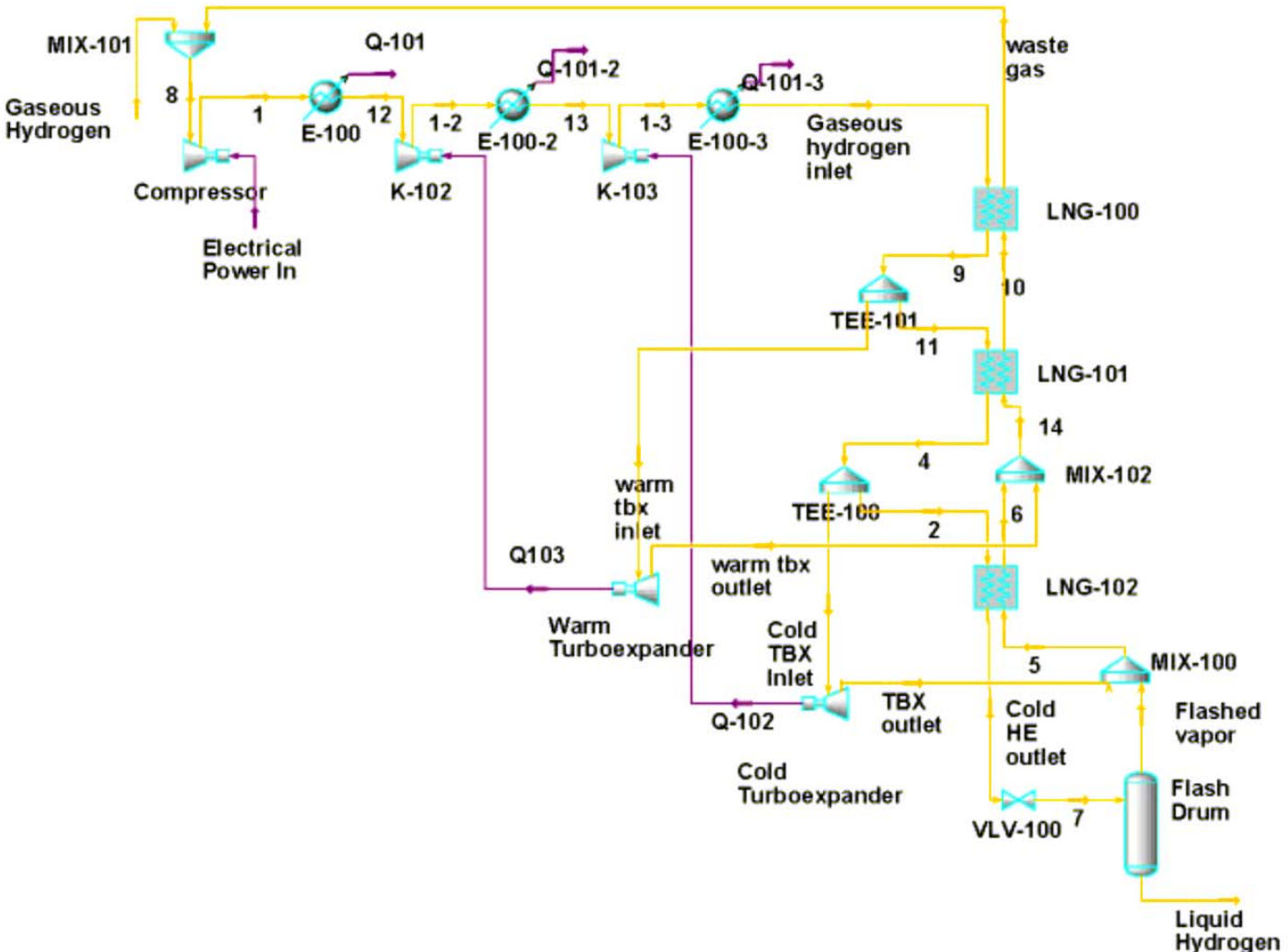


# Approach

- ❖ Use Twin Turboexpander-Compressors
- ❖ Build Small Scale Pilot Plant of 200 to 500 kg/day
  - Consistent with Small Service Station Size Application
- ❖ Scalable to >50,000 kg/day Systems
- ❖ Emphasis on Capital and Operating Cost Minimization
- ❖ Power Requirement Target of 3.6 – 5.0 kWh/kg



# Cycle Schematic





# Turbo-Expander Description

- ❖ single stage turbine and compressor mounted on the same shaft
- ❖ two foil gas journal bearings
- ❖ pair of foil gas thrust bearings
- ❖ labyrinth turbine inlet seal
- ❖ insulator plate between cryogenic turbine and ambient temperature compressor

