NET Power

Truly Clean, Cheaper Energy

Carbon Sequestration Leadership Forum

October 2016

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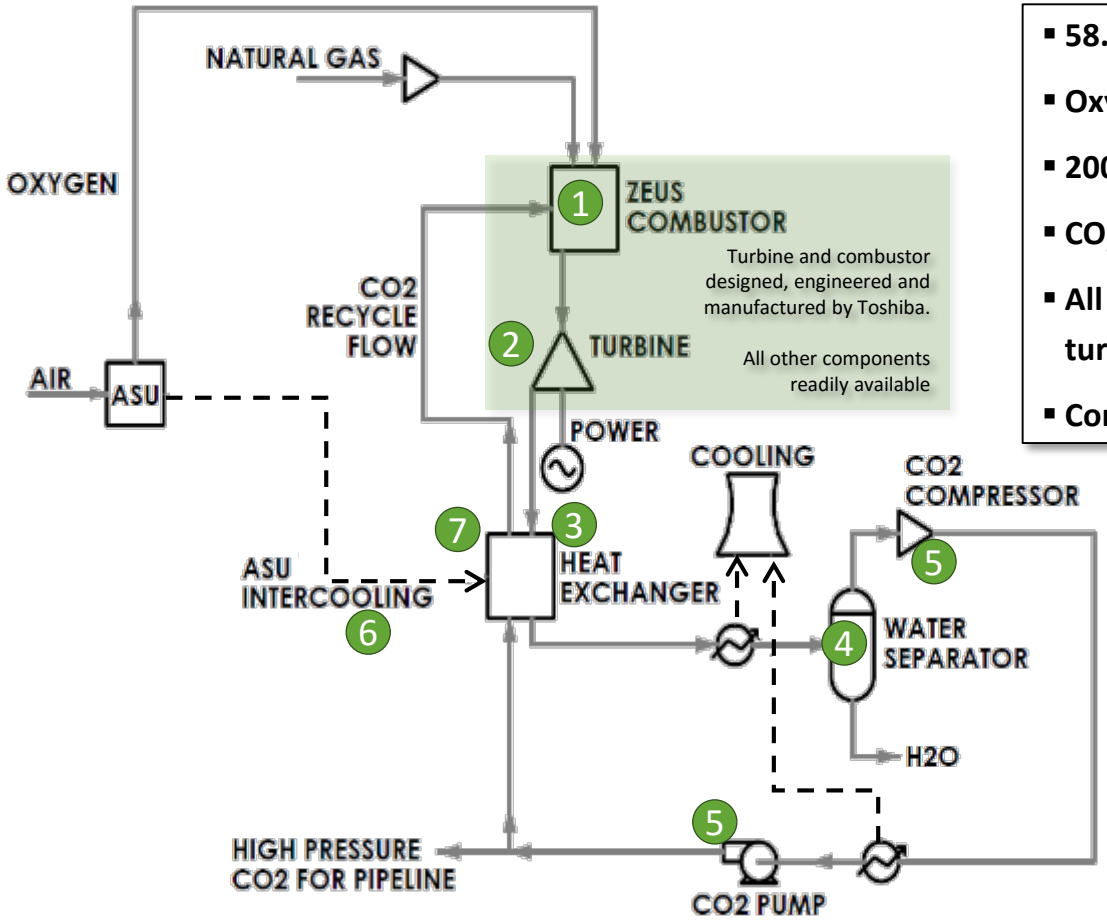
Cycle Introduction

sCO_2 Allam Cycle Introduction

- **Novel, highly-efficient supercritical CO_2 power cycle**
  - Uses high-pressure carbon dioxide as the cycle working fluid
  - Uses oxy-fuel combustion of fossil fuels

- **Generates low-cost, emissions-free power**
  - No atmospheric emissions: near-100% CO_2 capture at pipeline pressure
  - Does not lead to an increase in the cost of electricity compared to the best current systems without CO_2 capture, due to:
    - High efficiency: competitive with current combined cycle systems that do not capture CO_2
    - Low capital costs: simple cycle design; elimination of steam cycle components; single turbine

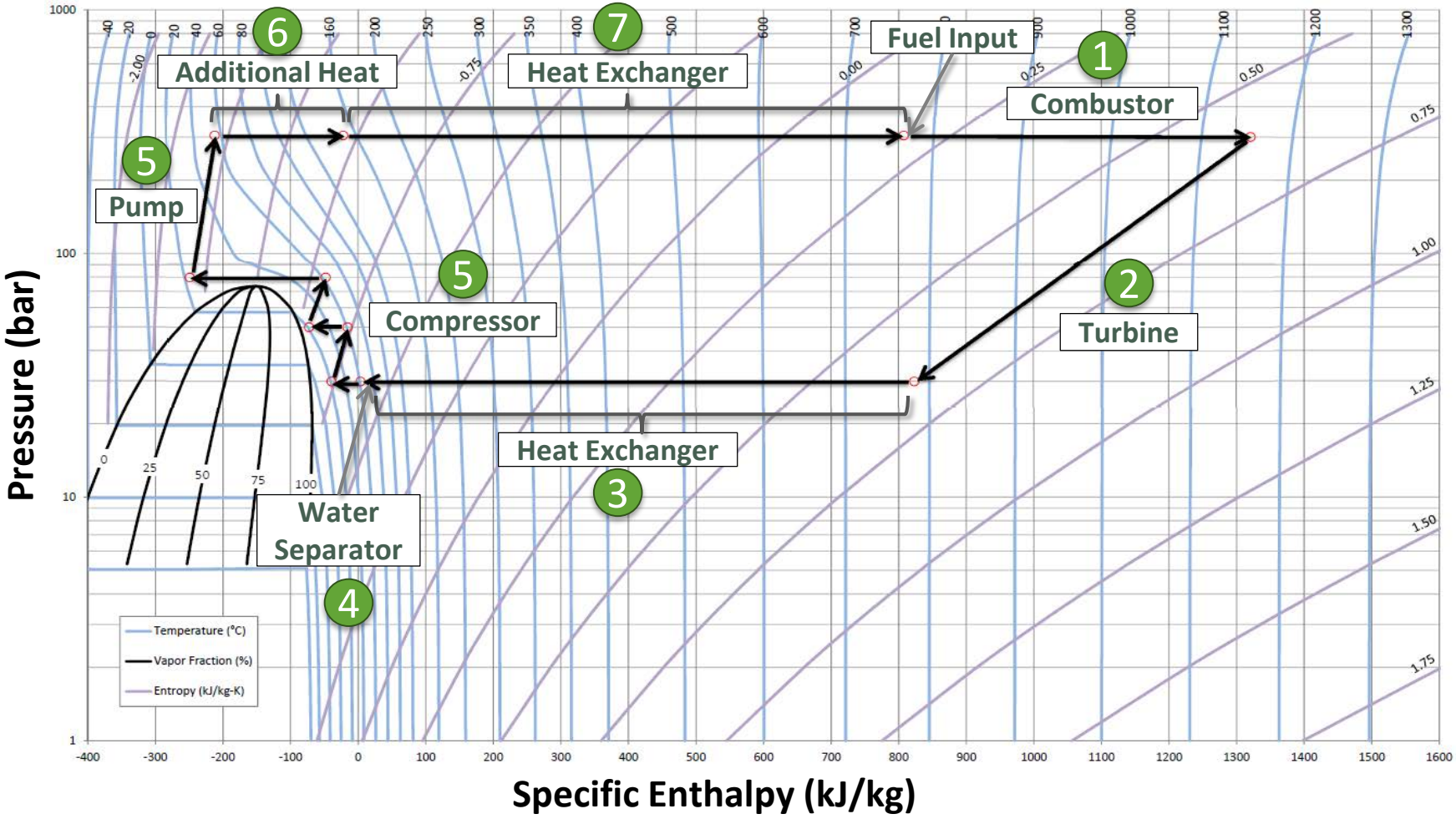
The Allam Cycle Natural Gas Platform



- 58.9% (LHV) net efficiency, with full carbon capture
- Oxy-fuel, closed-loop, CO_2 working fluid
- 200-400 bar; 6-12 pressure ratio
- CO_2 and water are the only byproducts
- All components, other than combustor and turbine, currently available
- Combustor and turbine developed by Toshiba

1. Fuel Combustion
2. CO_2 Turbine
3. Heat Rejection
4. Water Separation
5. Compression and Pumping
6. Additional Heat Input
7. Heat Recuperation

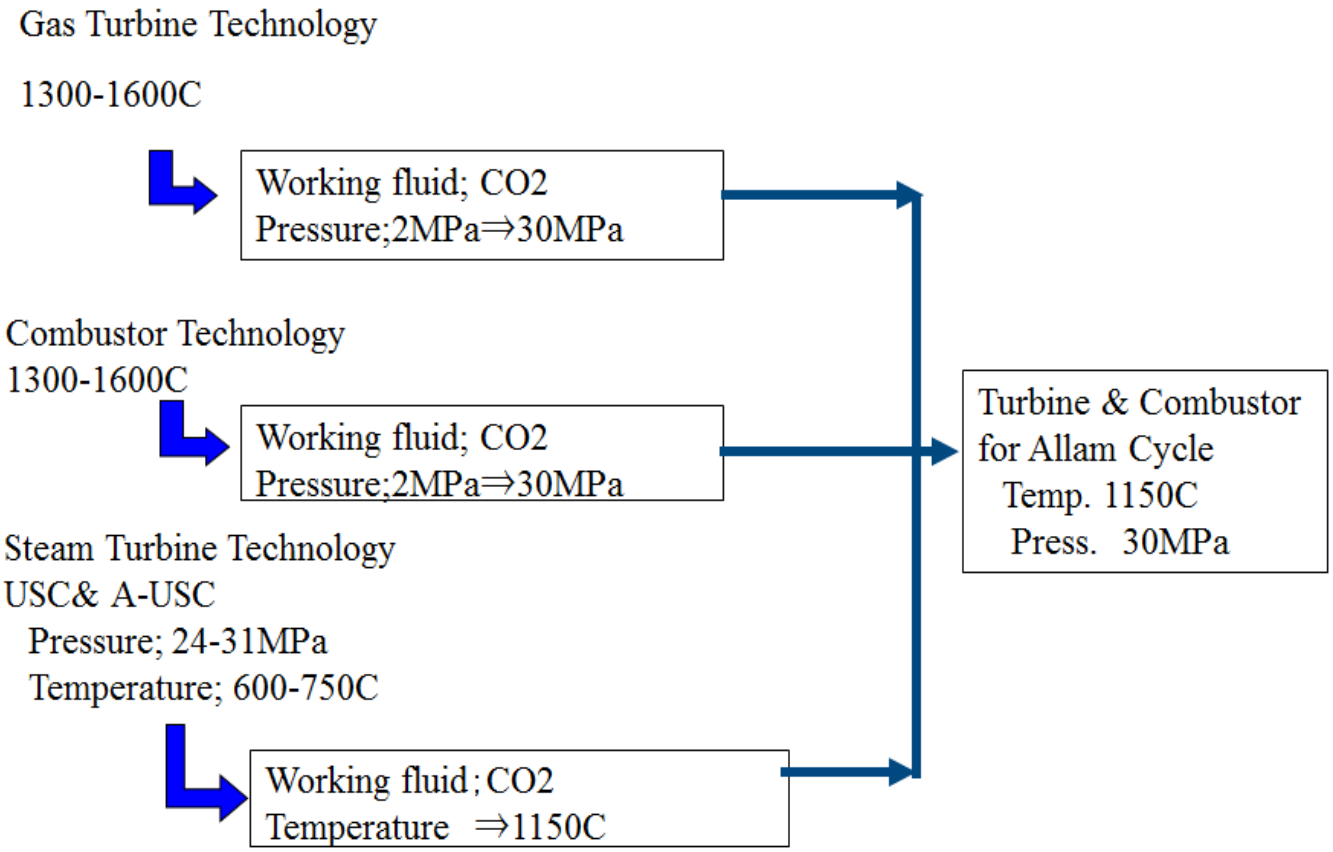
Allam Cycle Pressure-Enthalpy Diagram



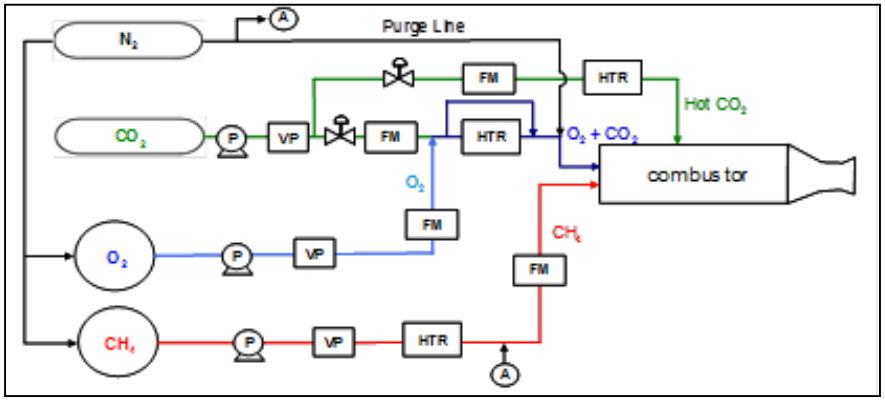
Other Allam Cycle Variations

Technology	LHV Efficiency	Other Benefits
Coal	51.4%	Greatly simplifies coal gasification.
LNG Regasification	66%	Recovers energy put into liquefaction
Solar-Natural Gas Hybrid	74%†	True integration, not dual plants; enables reliable availability.

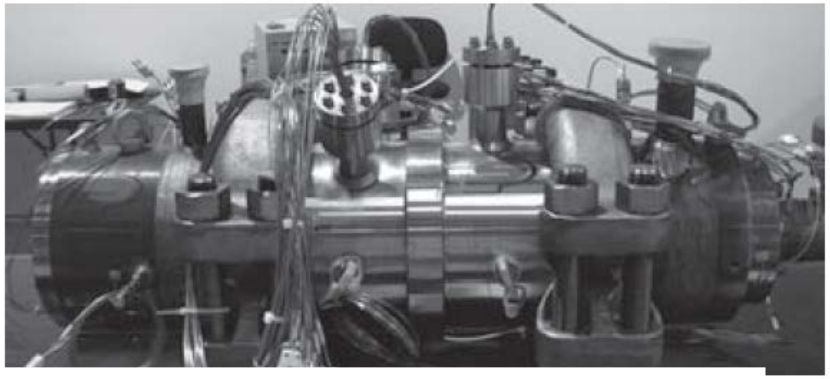
Turbine and Combustor Development



Combustor Development



Testing has been completed using facility in California



Test Combustor

Stack

Exhaust Duct

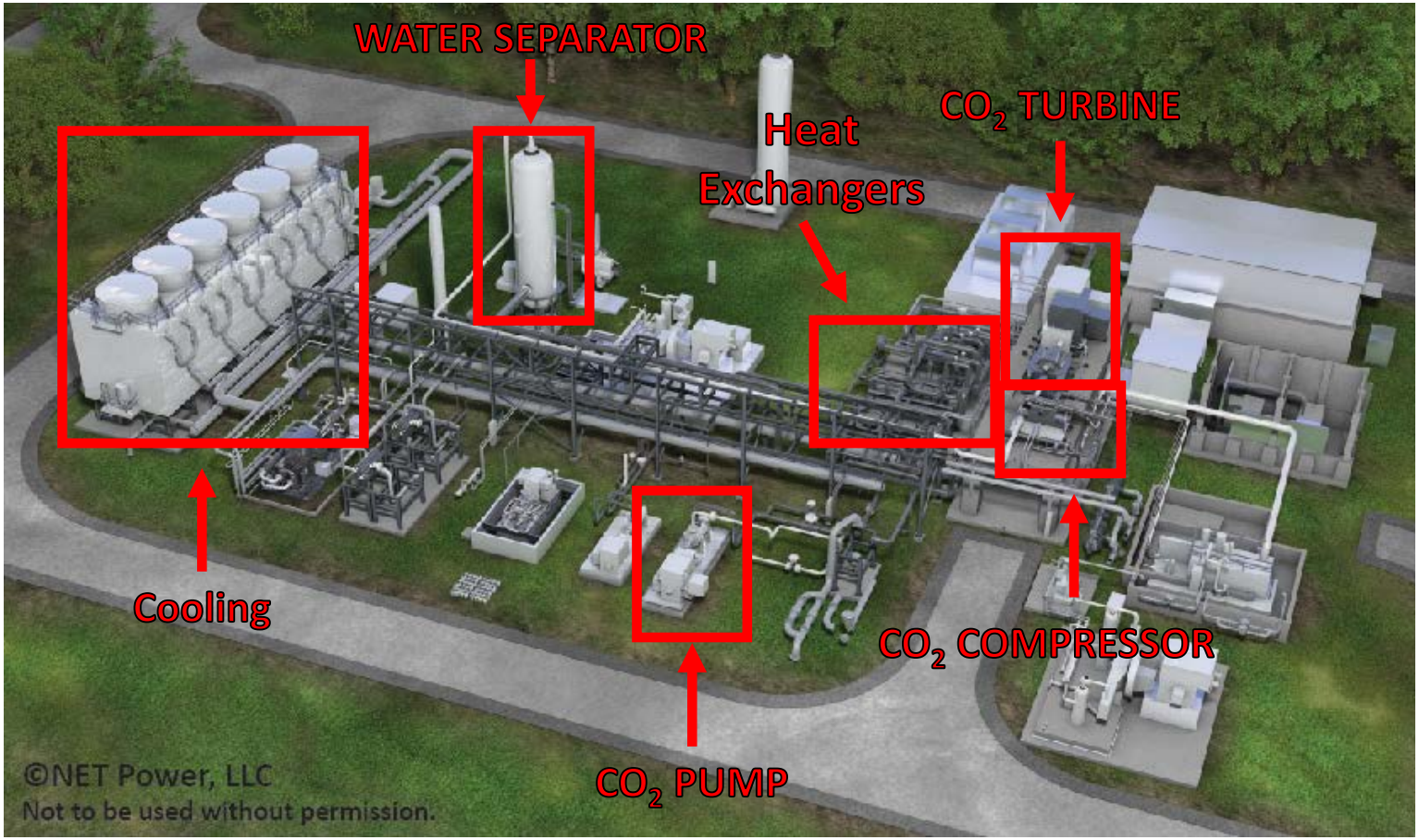
Test Stand

50MWth Plant Development

50 MWth Demonstration Plant Description

- **50MWth natural gas plant**
  - Scaled down from 500 MWth pre-FEED design to ensure scalability
  - Site is in La Porte, TX
  - First fire: Q2 2017
- **Includes all core Allam Cycle components**
  - Combustor/turbine, heat exchangers, pumps/compressors, controls, etc.
  - Full operation tests (startup, shutdown, ramping, hot/warm/cold starts)
  - Oxygen will be pulled from a pipeline as opposed to a dedicated ASU
  - CO_2 quality (pressure; purity) will be confirmed for off-take viability
- **$140 million (USD) program funded**
  - Includes first of a kind engineering, all construction, and testing period
  - Partners include Exelon Generation, CB&I, 8 Rivers and Toshiba

50MW the Plant Layout: 3D Drawing



50MWth Demonstration Plant Development Status

Groundbreaking March 3, 2016 – On Schedule

Most Major Equipment/Components On-Site – Turbine Ships in October

Commercial Plants Are Under Development

- **Initial 295MWe pre-FEED completed**
  - Currently undergoing a “refresh” following learnings from demo plant detailed design
  - Pursing several advanced design concepts
  - Seeking to issue a notice to proceed following successful demonstration plant operation in 2017
  - Several projects under development and in consideration to host first plant

NET Power Commercial Natural Gas Plant	
Electric Output	295MW
CO_2 Output	804,000 ton/year at 120 bar pressure
N_2 Output	4.2 MM ton/year
ASU Output Demand	3,500 ton/day
Site Area	13 acres

Acknowledgements

- **The following entities have supported development of NET Power and/or the coal-based Allam Cycle:**
  - UK Department of Energy and Climate Change funding of £6.3m:
    - "Path to Coal" study on coal variation of the Allam Cycle coal
    - Development of manufacturing processes for advanced turbine and heat exchanger materials used by the Allam Cycle
    - Pre-FEED study for a UK-based demonstration plant
    - Series of process design improvement studies
  - The US Department of Energy National Energy Technology Laboratory:
    - Design of a coal-syngas combustor for use with supercritical CO_2 power cycles
  - The State of North Dakota and the US Department of Energy:
    - Allam Cycle Lignite Study
    - R&D to address key coal cycle technical challenges

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