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Update on the NET Power 50 MWth zero emission power station

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NET Power

Truly Clean, Cheaper Energy

April 2016

The NET Power Advantage

- NET Power makes **electricity from natural gas**
- NET Power costs the **same as, or less than, electricity from existing natural gas power plants**
- NET Power will capture **substantially all of the carbon and non-carbon atmospheric emissions without any additional cost**
- NET Power also **does not need to use water (at a small reduction in efficiency)**

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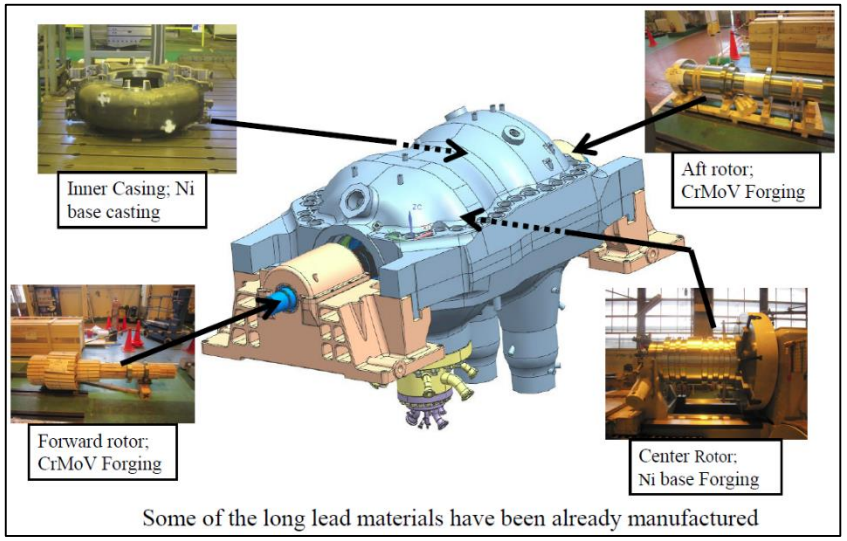
Readiness

Every single item of equipment is commercially available, except the turbine

The turbine is in an advanced state of readiness

- **It is being engineered, designed and manufactured by Toshiba.**
- **The blades, stages and pressure shells are not new.**
- **Only the combustor is new.**
- **A 5MWt test combustor has been operating since January 2013.**



Some of the long lead materials have been already manufactured

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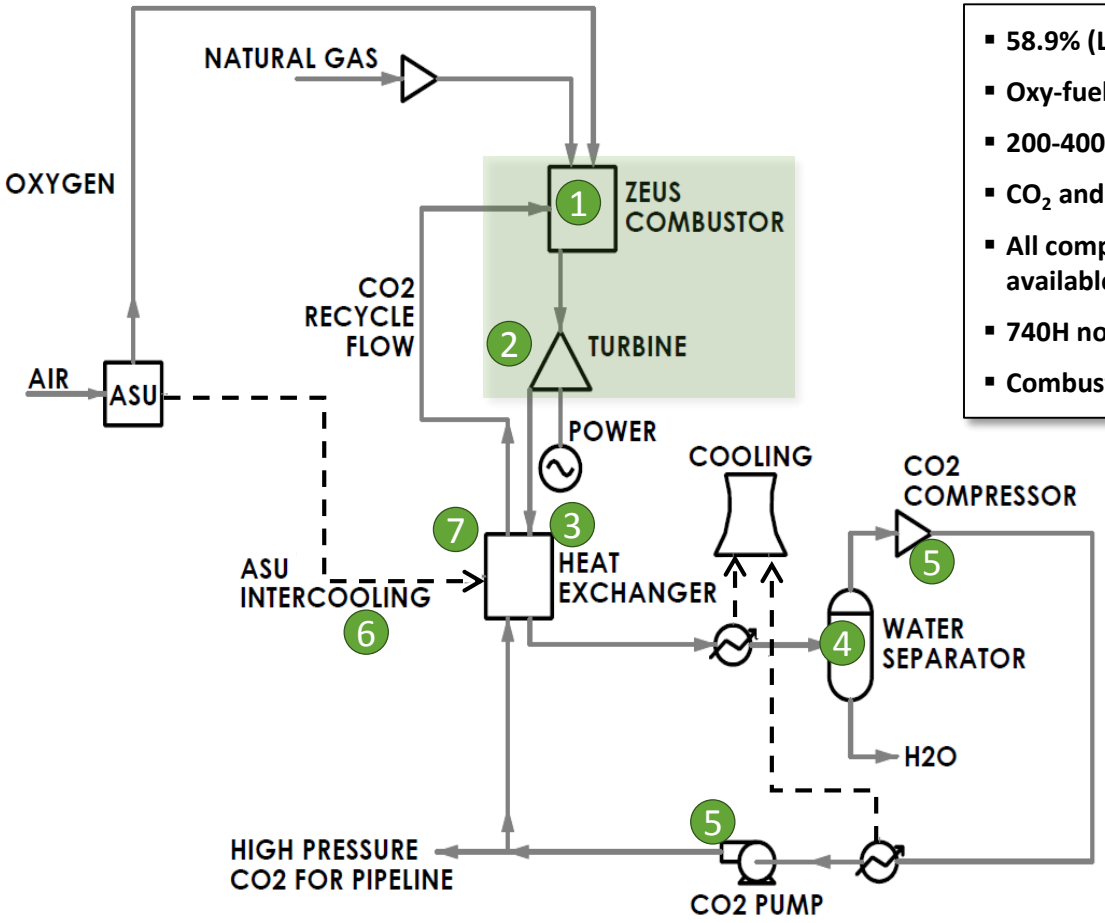
Technology Overview and Status

The Supercritical CO_2 Allam Cycle

NET Power is based on the Allam Cycle platform



- 58.9% (LHV) net efficiency, with capture of >97% of carbon
- 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
- 740H now in commercial use at two facilities
- Combustor and turbine under development 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

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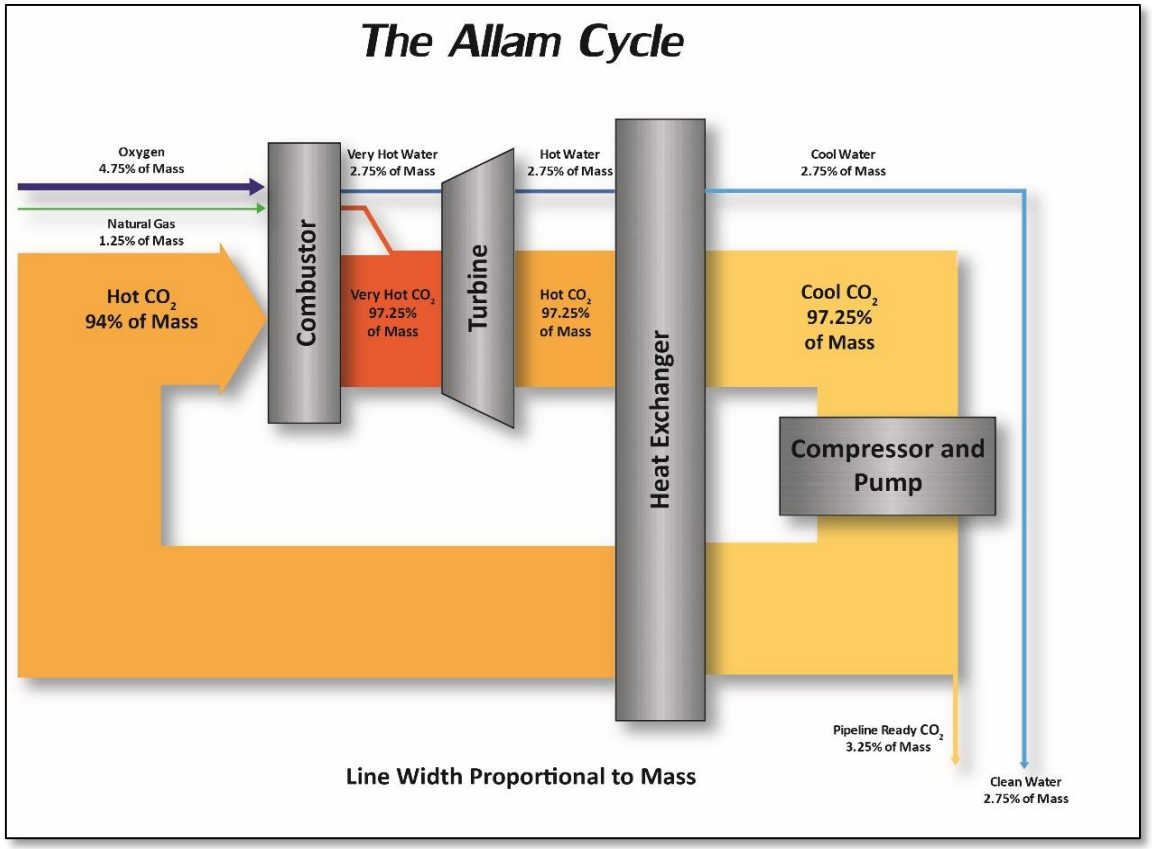
The supercritical CO_2 Allam Cycle is simple

- **Oxy-combustion is a well-known method for simplifying carbon capture**
- **The main problem is that oxygen is too expensive to produce to make the process economic**
- **The Allam Cycle makes oxy-combustion economic by:**
  - Relying on a more efficient core power cycle
  - Reducing ASU and O_2 costs by requiring less O_2 through recycling heat within the system



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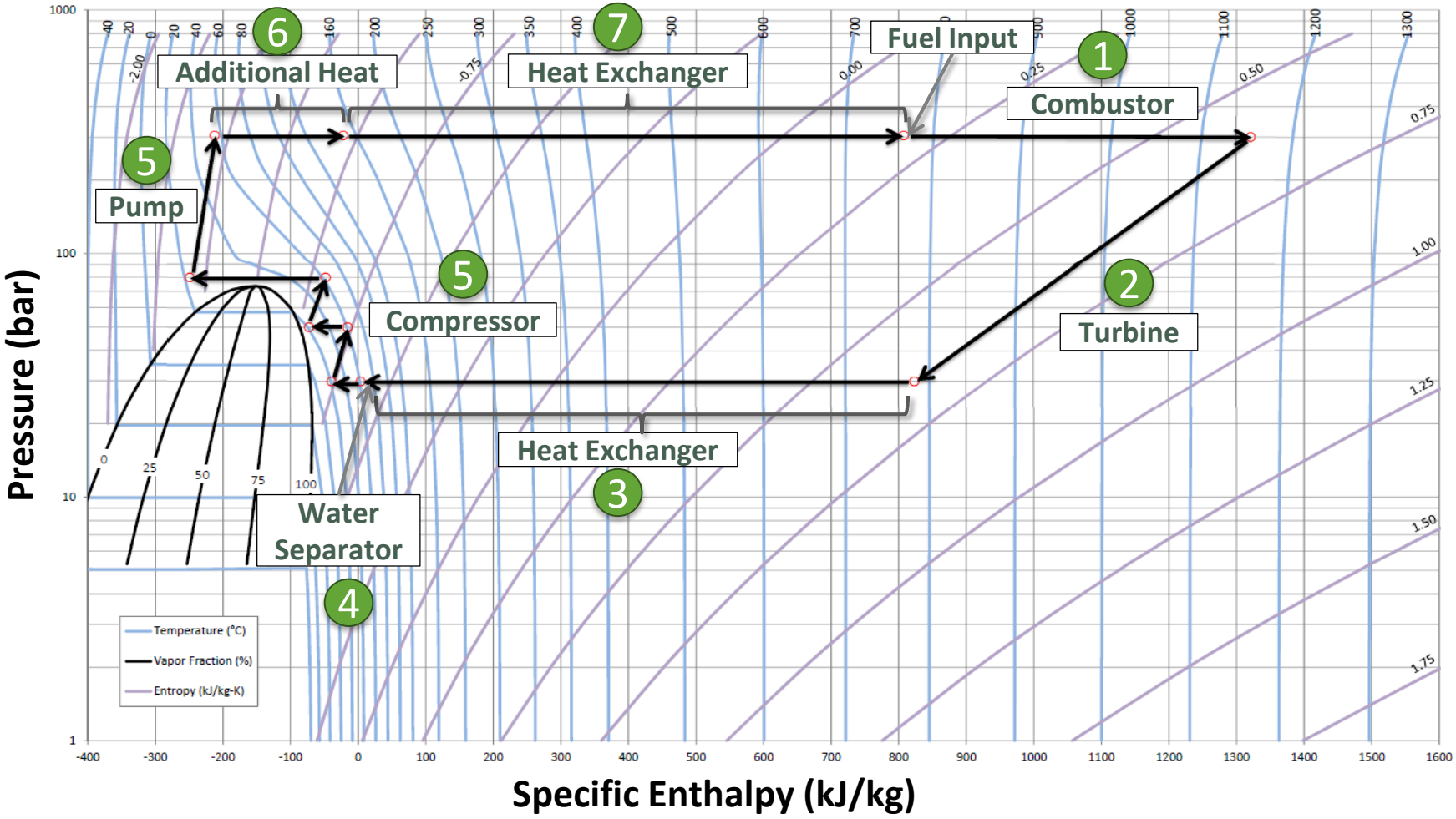
The Allam Cycle natural gas power system



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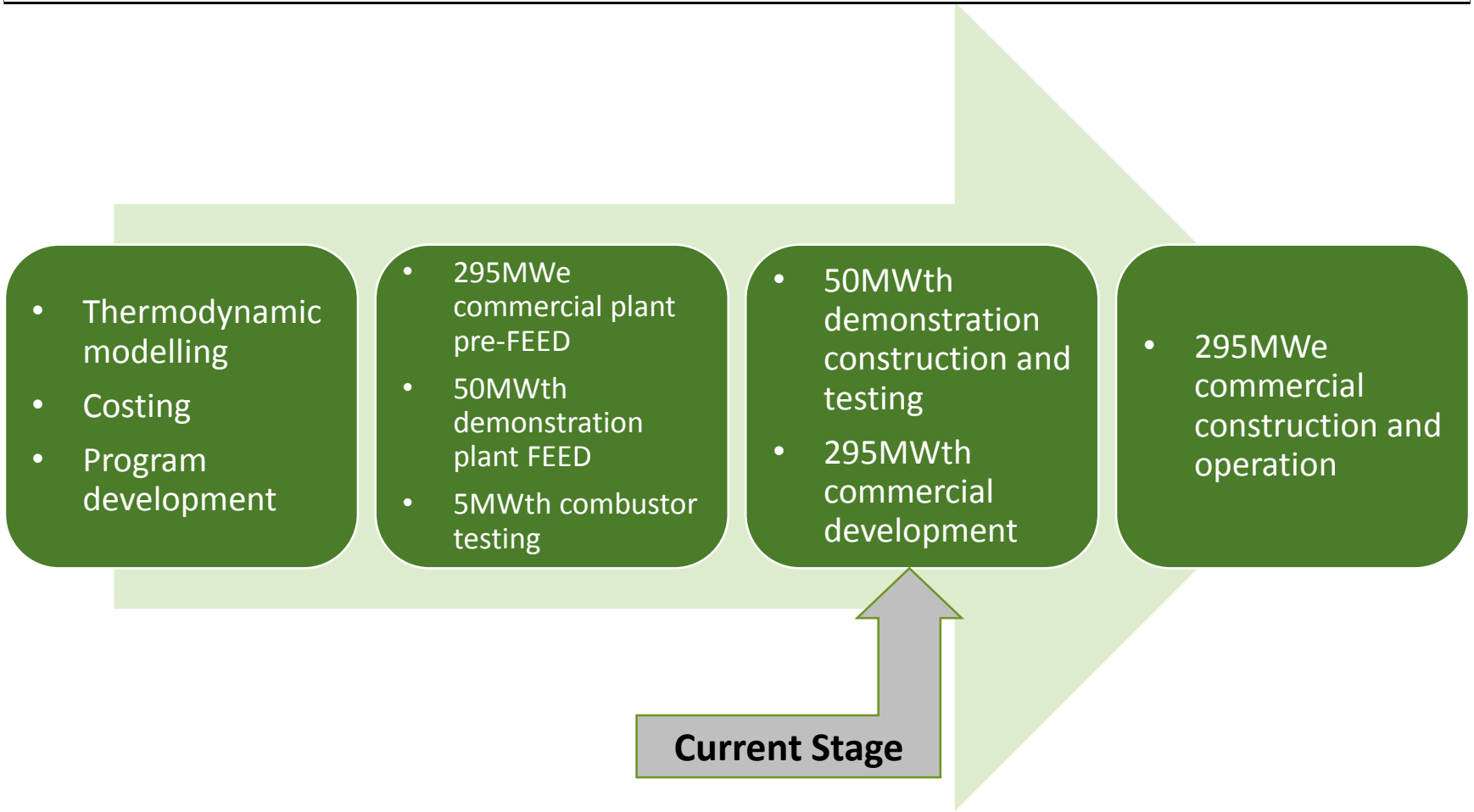
NET Power's Development Program

Performance and Economics Overview

Development pathway



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Construction is underway on NET Power's 50MW demonstration plant

- **50MWth natural gas demonstration plant**
  - Plant design scaled down from 500MWth pre-FEED design to ensure scalability to commercial size
  - Site is in La Porte, TX
- **Plant includes all core components of the Allam Cycle**
  - Combustor/turbine, heat exchangers, pumps and compressors, control system, and ancillary equipment
  - Plant will undergo full performance evaluation (startup, shutdown, ramping, hot/warm/cold starts, emergency operations)
  - Oxygen will be pulled from a pipeline as opposed to a dedicated ASU
  - CO_2 will be generated at high pressure and quality, but will be emitted
    - CO_2 off-take found to be impractical for variable testing operation period
    - CO_2 quality will be confirmed and monitored to ensure viability for commercial facility
- **Program is fully funded**
  - $140 million program includes first of a kind engineering, all construction, and testing period

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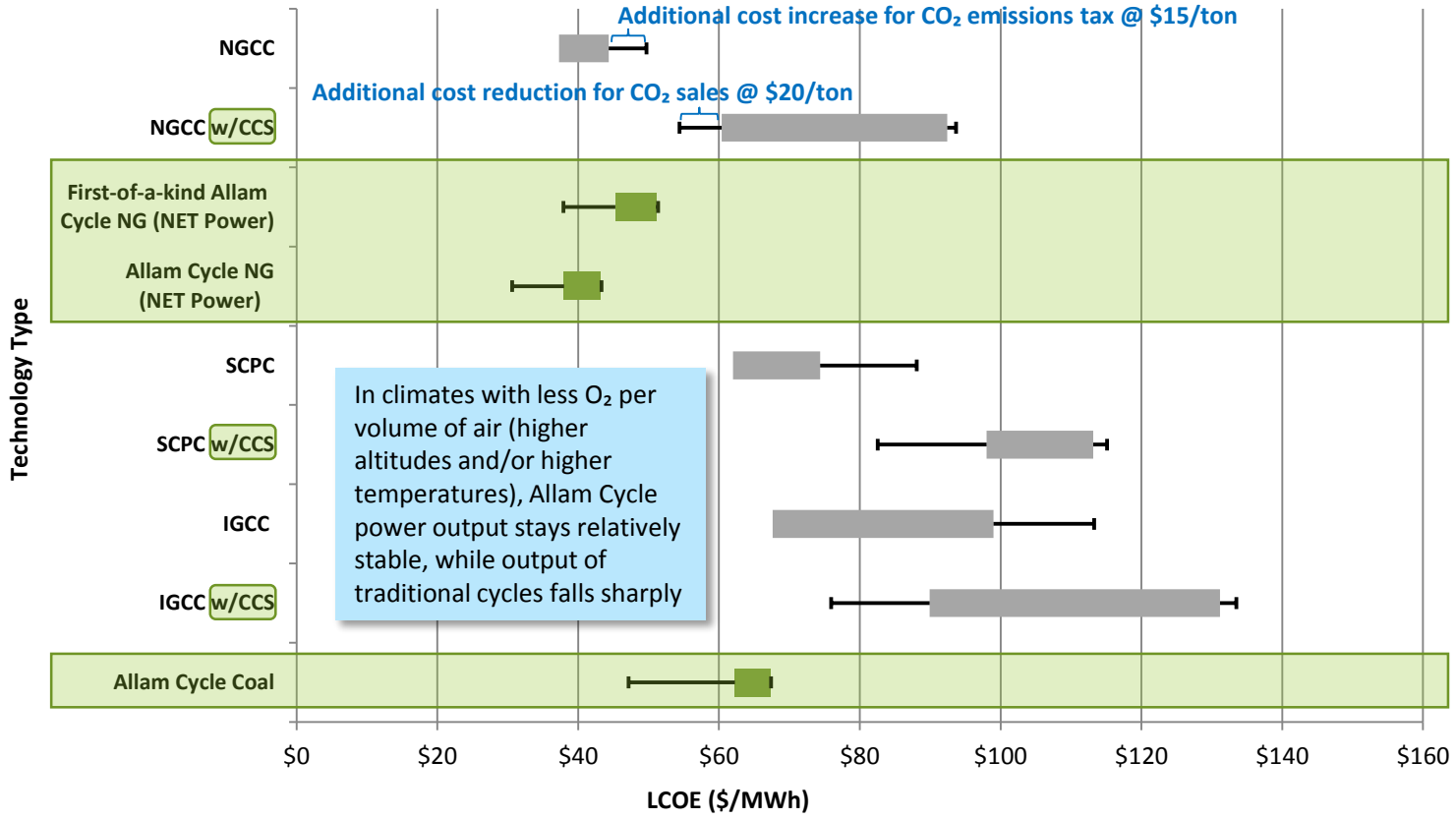
NET Power's Benefits

Performance and Economics Overview

NET Power is competitive without CO_2 sales



- LCOE calculated using EPRI methodology
- Assumes natural gas at $2.85/MMBTU and coal at $1.73/MMBTU
- Every move of $1 in natural gas moves LCOE $6
- Cost ranges represent range of data combined from: EIA (2013), Parsons Brinkerhoff (2013); Black & Veatch (2012); DOE NETL (2012)

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NET Power plants are highly efficient

NET Power and Combined Cycle: Efficiency Comparison				
	HHV		LHV	
Energy Components	F-Class US NGCC Plant (0% CC)*	NET Power NG Plant (100% CC)	F-Class US NGCC Plant (0% CC)*	NET Power NG Plant (100% CC)
Gross Turbine Output	51.06% (Compressors mechanically coupled)	74.65%	58.7% (Compressors mechanically coupled)	82.7%
CO_2 Compressor Power		-10.47%		-11.6%
Plant Parasitic Auxiliary Power	-0.86%	-11.01%	-1.2%	-12.2%
Net Efficiency	**50.20%**	**53.17%**	**57.5%**	**58.9%**

Parasitic Load Provides Opportunity for Efficiency Improvement	
ASU	91.8%
NG Compressor	8.2%

*Performance data from NETL Cost and Performance Baseline Report, 2013.

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NET Power's low cost-of-capture solves the CO2 utilization and storage problem

- **CO_2 capture**
  - at no extra cost
  - already at pressure (available from 30 bar/450 psi to 300 bar/4500 psi)
  - already high quality
- **Cheaper than geologic CO_2 used for Enhanced Oil Recovery (no associated lifting costs or mineral lease costs)**
- **Significantly lower-cost CO2 enables much more economic utilization in a variety of ways**
  - Sequestration
  - Enhanced oil recovery
  - Enhanced coal bed methane recovery
  - Building materials
  - Biomass production
  - Chemical processes

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The NET Power advantage summarized

Low-Cost

- Utilizes abundant, low-cost natural gas
- Produces electricity that is equal to, or less than, NGCC's cost of electricity
- No additional cost for CO_2 capture

Cleaner

- Near-100% capture of all carbon emissions (>97%)
- No other air emissions, including NOx
- Water usage can be eliminated

Flexible

- Less sensitive to changes in siting conditions (high altitude and temp)
- Siting not water or air permit constrained
- Capable of full electrical turndown without emissions issues, enabling fast response

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