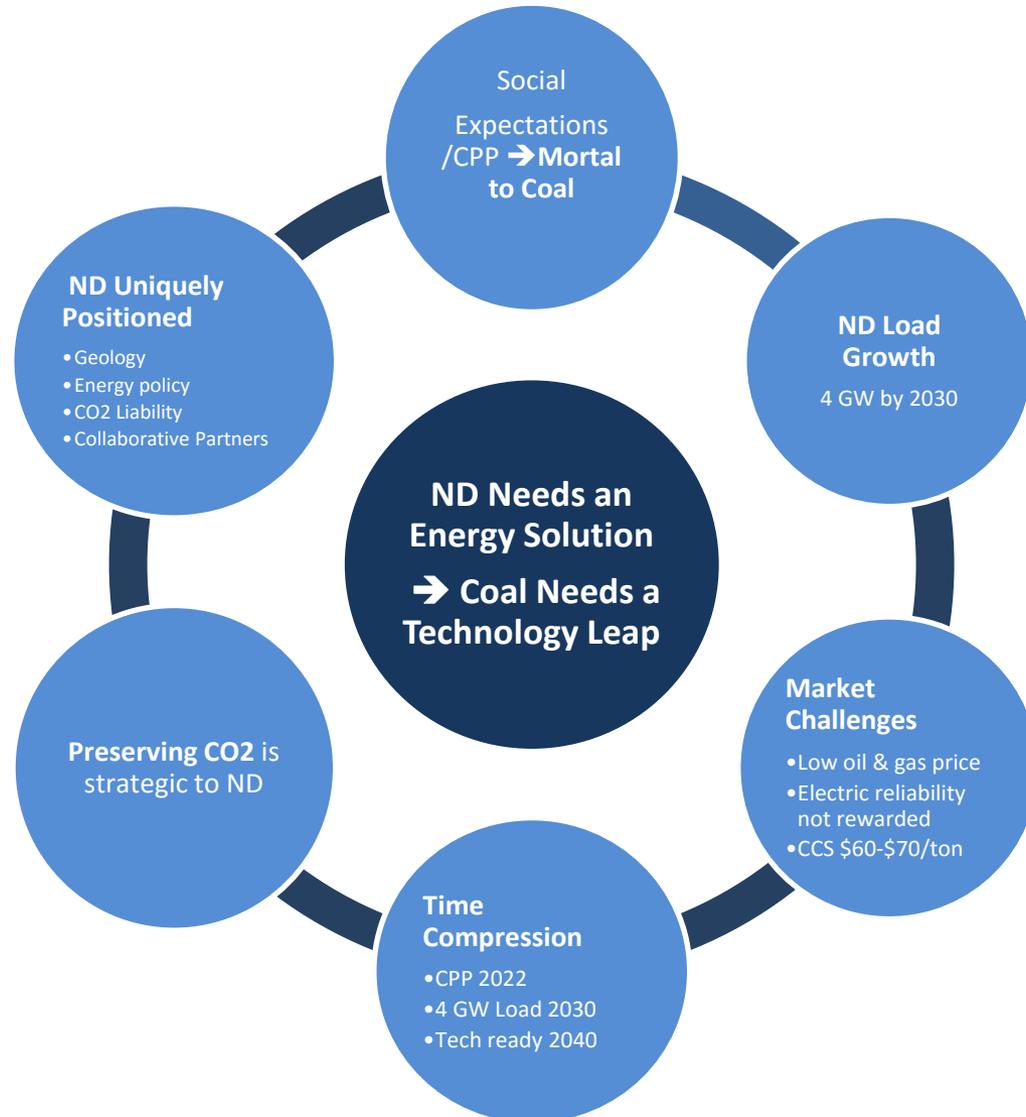


North Dakota Allam Development Initiative

*A next generation energy solution for
North Dakota*

Presented by Wade Boeshans
President & GM BNI Energy Inc.
May 11, 2016

ND Landscape Assessment



Our Solution → A Broad Vision

Sustainable Solution for lignite married with a sustainable solution for tertiary oil recovery in the Bakken:

- *Demonstrate the Allam technology, then develop and build a commercial electric generation plant in North Dakota using local lignite*
- *Transport CO₂ from Allam plants to depleted conventional ND oil fields for Enhanced Oil Recovery and sequestration*
- *Develop a solution for tertiary oil recovery in the Bakken using CO₂*

Allam Cycle Preserves the “Coal Option”

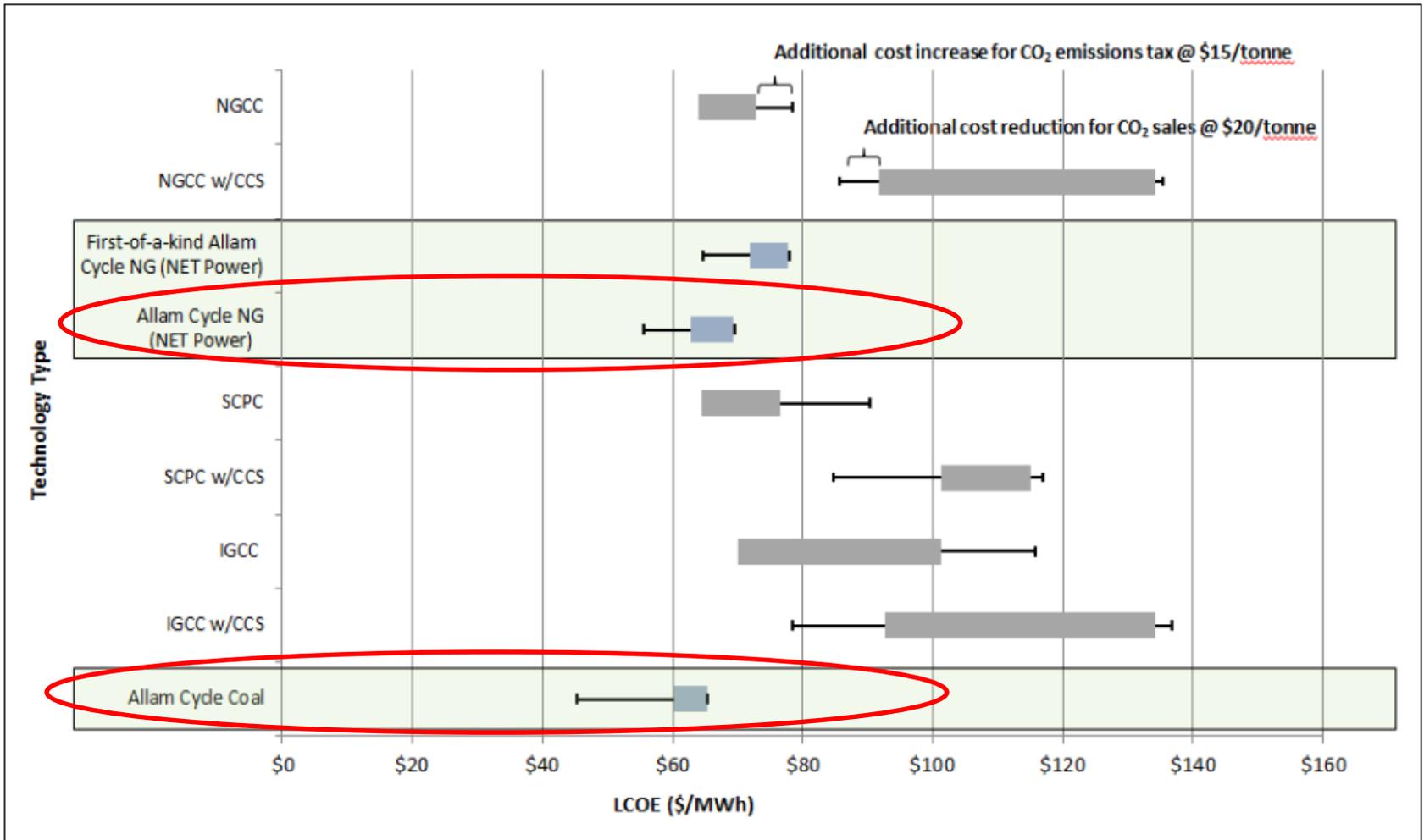
The Allam Cycle is **next generation technology**.

- The turbine is driven by **supercritical CO₂**
- **Near-zero emissions** - 100% of the CO₂ available for utilization.
- **Efficiency estimates nearing 50%** - 1.4x higher than the U.S. coal fleet average.
- **Economic Power Generation**
 - \$0.04-\$0.05 /kWh with sale of CO₂
 - \$0.06-\$0.07 /kWh without the sale of CO₂
- **Smaller Footprint** - 20% of a traditional coal-based plant.
- **Exceeds 111(b) NSPS rule from EPA.**

Allam Cycle Preserves the “Coal Option” cont.

- Research, engineering, and lab-modeling has been **successfully conducted**
- A 25 MWe natural gas-fired demonstration plant is currently **being constructed** in Texas.
- Further development creates a **path forward** for continued utilization of coal.
- Substantial **investment already committed** from federal, state, international and industrial partners.

Clean, low-cost electricity competitive with all state-of-the-art systems



Note:

- LCOE calculated using EPRI methodology
- Assumes \$6.50/MMBtu natural gas and \$2.00/MMBtu coal
- Cost ranges represent data from several sources: EIA (2013); Parsons Brinkerhoff (2013); NETL (2012); Black & Veatch (2012)

Courtesy from Net Power & 8Rivers

Why North Dakota?

Technical Expertise

- Commercial gasification experience
- Gasifier technology development
- Internationally recognized leadership at EERC

Enhanced Oil Recovery Potential

- New coal plants will require CO₂ capture
- Billions of barrels of additional oil may be recovered thru EOR in North Dakota

ND must Host to control our own destiny

- North Dakota leads the way in environmentally sustainable fossil fuel production

Working Together to Accelerate a Pathway to Low-Carbon Lignite Utilization



**DAKOTA
GASIFICATION
COMPANY**



8 RIVERS

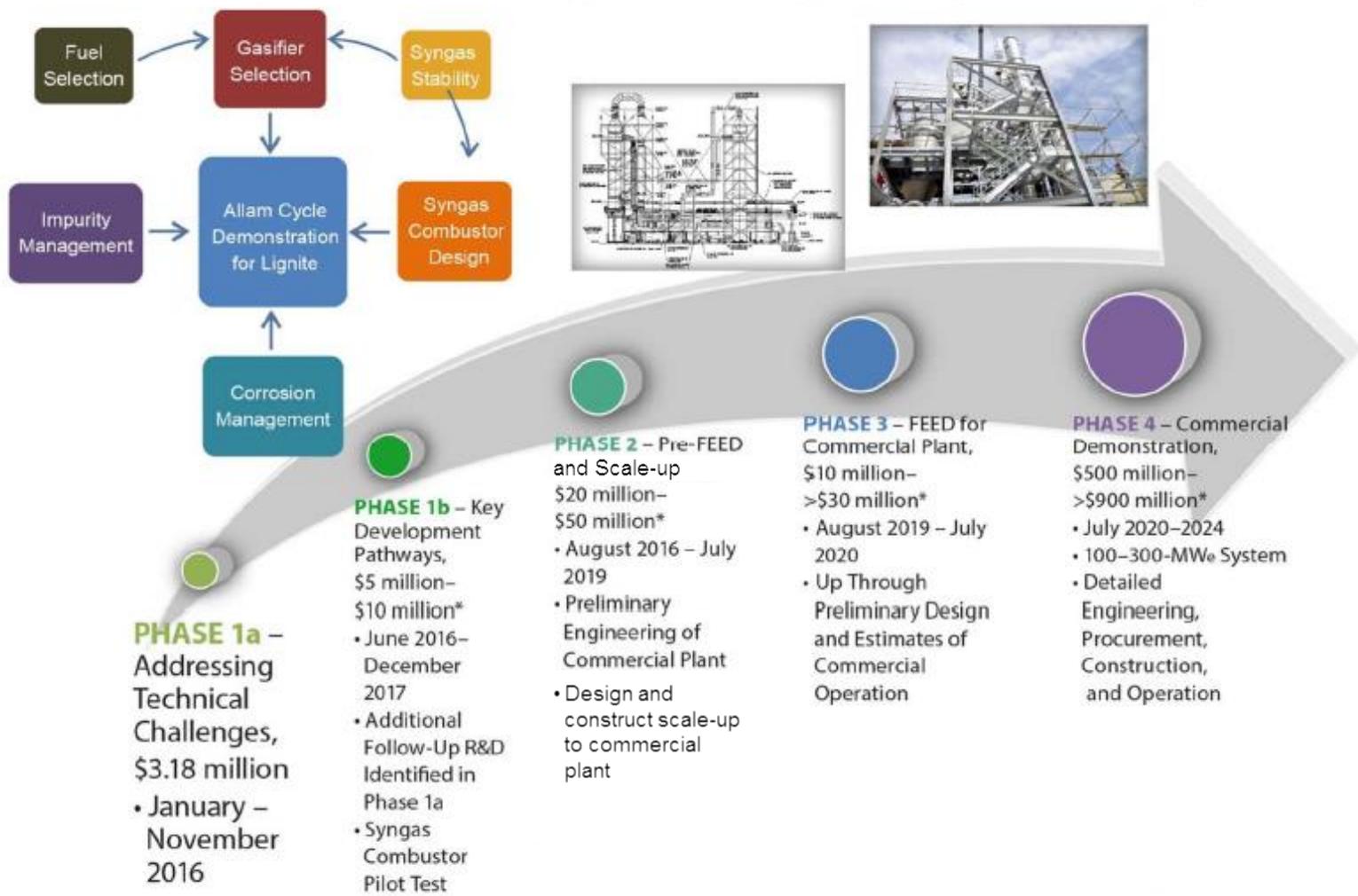


**U.S. DEPARTMENT OF
ENERGY**



Our Path Forward

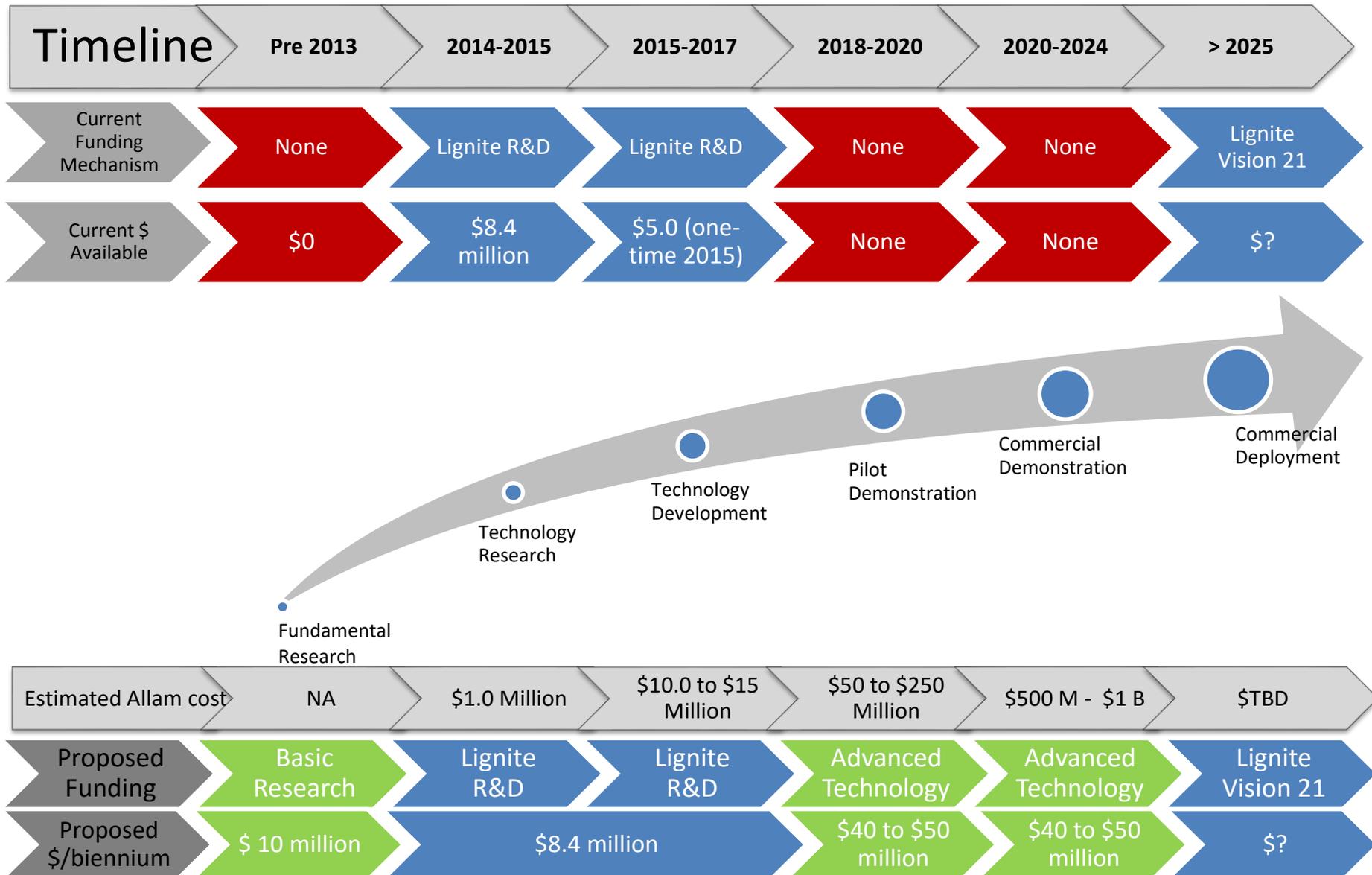
Lignite-Based Allam Cycle Technology Development Road Map



EERC JS51631.AI

*Costs are estimated and include matching support from federal and industrial sponsors.

Allam Cycle Development Pathway & Funding



Keys to Success

1) State, Federal & Energy Industry Collaboration

→ Lignite & Petroleum Industry Alignment

2) Maintaining state primacy

→ Ensure ND agencies have the resources they need

3) Communications → Vision vs. Policy

→ Frame positive messages

→ The science is not proven/commercial

→ Time is of the essence

→ Message Clarity

- Tundra / Allam
- Conventional / Unconventional EOR