



## Lignite Research Council: History of Innovation

The Lignite Energy Council has a longstanding **R&D program** in partnership with the North Dakota Industrial Commission (NDIC). The NDIC reinvests a tax levied on coal production in the state to R&D projects that are vetted by the Lignite Research Council (LRC). The LRC consists of 30 members appointed by the Governor of North Dakota. Appointees represent lignite mining, lignite processing, lignite research, state agencies, federal agencies, the labor community, North Dakota legislature, owners of lignite reserves, counties, and the public and includes goals such as:

- Support continued options to **enhance performance** of the existing fleet
- Invest in **transformational research** (Next generation of Lignite conversion systems that integrate CO2 capture)
- Focus on **Carbon Capture Utilization & Storage (CCUS)**

The Lignite Research program is focused on solving both **regulatory and economic challenges** faced by the coal industry. These challenges result from **regulations** to reduce **regional haze** or **CO2**, but also from **market dynamics** exacerbated by an **uneven field in power markets**. For every state dollar invested in R&D, more than nine dollars are invested by other sources. To date, total investment for its **200 projects is more than \$700 million**.

The biggest priorities surrounding CO2 are to find technology to allow **new coal plants** to be built at **near-zero emissions**, find **retrofit technology** to allow current plants to operate more effectively in today's markets by **monetizing CO2**, and to find **long term solutions for the captured CO2**. The Lignite Research Program has active projects in each of these areas.

- One of the most promising technologies for new plant construction with near zero emissions (full carbon capture) are "**supercritical CO2**" systems, such as the **Allam Cycle**.
- A natural gas prototype Allam-cycle plant is nearing completion in Texas.
- North Dakota utilities are involved in an effort to build an **Allam Cycle plant running on gasified lignite**
  - Started in 2013 as **BNI/Minnesota Power** technology development, in partnership with **Basin Electric**.
  - \$475,000 spent through 2016
  - Project paused in April 2017 **awaiting completion of Texas pilot plant** and value proposition to ALLETE from technology owner



- We also need to look at economically-viable options **to retrofit existing plants.**
- North Dakota utilities have initiated “**Project Tundra,**” a retrofit option for the Milton R. Young station based off of NRG’s successful **Petra Nova carbon capture project.**
  - Started in 2015 as **ACE- ALLETE** Energy Corridor project in partnership with **NRG.**
  - \$500,000 spent in early development up to 2016.
  - Project restarted in mid-2016 – **ACE in partnership with BNI & Minnkota.**
  - 2017 ~\$8M committed & \$6M pending to technology assessment & preliminary design
  - 2018- **North Dakota Industrial Commission** approved \$15M to help pay for engineering and design work on the project.
- **CarbonSAFE** is a project to find long term solutions for **captured CO2 storage** and sequestration
  - \$8M DOE study of CO2 placement at DGC/AVS and Young Station. Partnership with Basin, Minnkota, ACE/BNI. MPC/ALE

### Track Record of Success

The R&D program has enjoyed a great deal of success in **reducing emissions** and increasing the efficiency of coal-fired power plants, as well as development of **value-added products** and additional market opportunities for the industry. One of our most high profile success stories was a partnership with the Department of Energy, Great River Energy and the Lignite Research Council to develop Great River Energy’s patented **DryFining**. DryFining is an advanced coal drying process that reduces the moisture content of lignite from 38 to 29 percent moisture, and increases the heating value by nearly 1,000 Btu/ton. The process has reduced carbon dioxide emissions by four percent, and has achieved reductions of 40 percent for mercury and sulfur dioxide, as well as 20 percent reduction in nitrogen oxide. The development of DryFining technology also allowed Great River Energy to construct the nation’s newest coal-fired power plant - Spiritwood Station, a 99-megawatt **combined heat and power plant**, 100 miles east of Coal Creek Station.

Other examples of projects funded under the lignite research program include:

- **Rare Earth Element** Extraction from North Dakota Coal-Related Feedstocks (Joint DOE Project)
- **Advanced Reclamation Strategies** for North Dakota Coal Mine Lands
- Evaluation of the “**linear no-threat**” model of risk analysis
- Combined **heat and power** systems



## **Breakthrough Solutions Require Federal Support**

As the LEC and its research partners continue to explore options for carbon capture and other technologies to allow coal to remain a strategic energy resource for the United States, the industry needs the Department of Energy and Congress to **expand its efforts** to support the use of coal and **provide parity with support for other energy resources**. The LEC appreciates Congress' funding of DOE's **clean coal technology** programs, and urges its continued support of this valuable use of taxpayer dollars. We ask that federal support continue and:

- Recognize that **New Source Review** sometimes conflicts with R&D advances and acts as a disincentive to improve plant efficiency through new and innovative research
- Maintain **positive tax environment**
- Develop a **workable tax credit** to provide meaningful incentive for carbon capture business models
- Expand R&D funding to develop **advanced energy solutions** that work for North Dakota's energy industries, but have world-wide applicability
  - Encourage the Department of Energy funding solicitation to advance **post-combustion carbon capture at commercial scale** (i.e. greater than 350 Megawatt-Equivalent.)
  - Encourage the Department of Energy funding to develop **largescale advanced supercritical carbon dioxide cycles** – 200 Megawatt-Equivalent or greater.