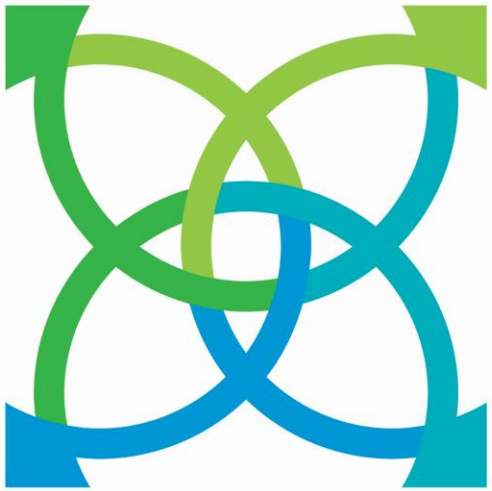
Spring 4-12-2016

Introduction to the Wyoming Integrated Test Center

Jason Begger
Wyoming Infrastructure Authority



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Powering the Nation, Fueling Innovation

Wyoming Infrastructure Authority

The WIA is an instrumentality of the State of Wyoming and was created in 2004 by the Wyoming State Legislature.

Our Mission: The WIA will diversify and expand the state's economy by adding value to Wyoming's energy resources and infrastructure for the benefit of Wyoming and the region.

Our Vision: The WIA will advance Wyoming's Energy Strategy by promoting the value of Wyoming's energy resources; supporting the necessary infrastructure; enhancing resource development and operation; and ensuring a credible and objective voice for Wyoming.

Within the statutory purview of the WIA is "advanced coal technology and advanced energy technology facilities. The facilities and related supporting infrastructure may include all facilities, structures and properties incidental and necessary or useful in the production or transmission of energy". In addition, effective July 1, 2014, the responsibilities of the WIA include coal exports pursuant to HB 147 which was enacted in the 2014 Legislative Session.

In addition, the WIA has $1 billion in bonding authority to finance transmission and generation and coal export infrastructure.

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Why? We don’t need coal anymore!

Think of the grid as a swimming pool

- The water is the electricity
- Faucets filling the pool are the generation sources
  - Renewable energy sources are faucets turning on and off intermittently
  - Baseload sources such as coal run almost constantly
- At the same time, water is being removed
  - Factories, businesses, individuals – all taking out different amounts

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Coal is important to the grid

The water needs to stay above a certain line to make sure the power stays on

- That line moves up and down throughout the day based on use

Grid operators are good at knowing when they'll need power

- Adding and removing generation based on need
- The hard part is adding more water to the pool when you don't know when a part of the supply will be available
- We know the coal electricity is always available!

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Why is coal important to Wyoming?

- Jobs
- Tax base
- School construction funding
- About $1 billion annually in direct tax payments to Wyoming

Meadowlark Elementary – Laramie #1 Jan. 2016

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Why does Wyoming need take the lead?

- The Federal Government is not prioritizing coal research
- The Administration recommends restructuring the National Energy Technology Laboratory (NETL). There will no longer be an NETL In-House R&D program included in the Coal CCS & Power Systems budget.
- Puts Wyoming is in a much stronger position to request resources

DOE Program (dollars in millions)	FY 2015 Omnibus	FY 2016 Omnibus	FY17 Request	Increase or Decrease Over Enacted	
				$	%
Fossil Energy*	560,587	632,000	600,000	-32,000	-5.1
Energy Efficiency and Renewable Energy	1,914,195	2,069,194	4,233,400	+2,164,206	+104.6
Electricity Delivery & Reliability	146,975	206,000	262,300	+56,300	+27.3
Nuclear	833,379	986,161	993,896	+7,735	+0.8
Science	5,067,738	5,347,000	5,672,069	+325,069	+6.1
ARPA-e	279,982	291,000	500,000	+209,000	+71.8

* When the $240 million in CCPI funding is applied to the program, it leaves a balance of $360 million for the program, which represents a 43% cut in funding from FY16 enacted levels, which does not appear to be consistent with increasing funding by 20% as agreed to under the Mission Innovation initiative.

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The Goals

How to keep coal viable and an important part of Wyoming's economy while addressing societal concerns over carbon emissions?

Can we turn a liability into an asset?

Let's position Wyoming as a leader on solutions!

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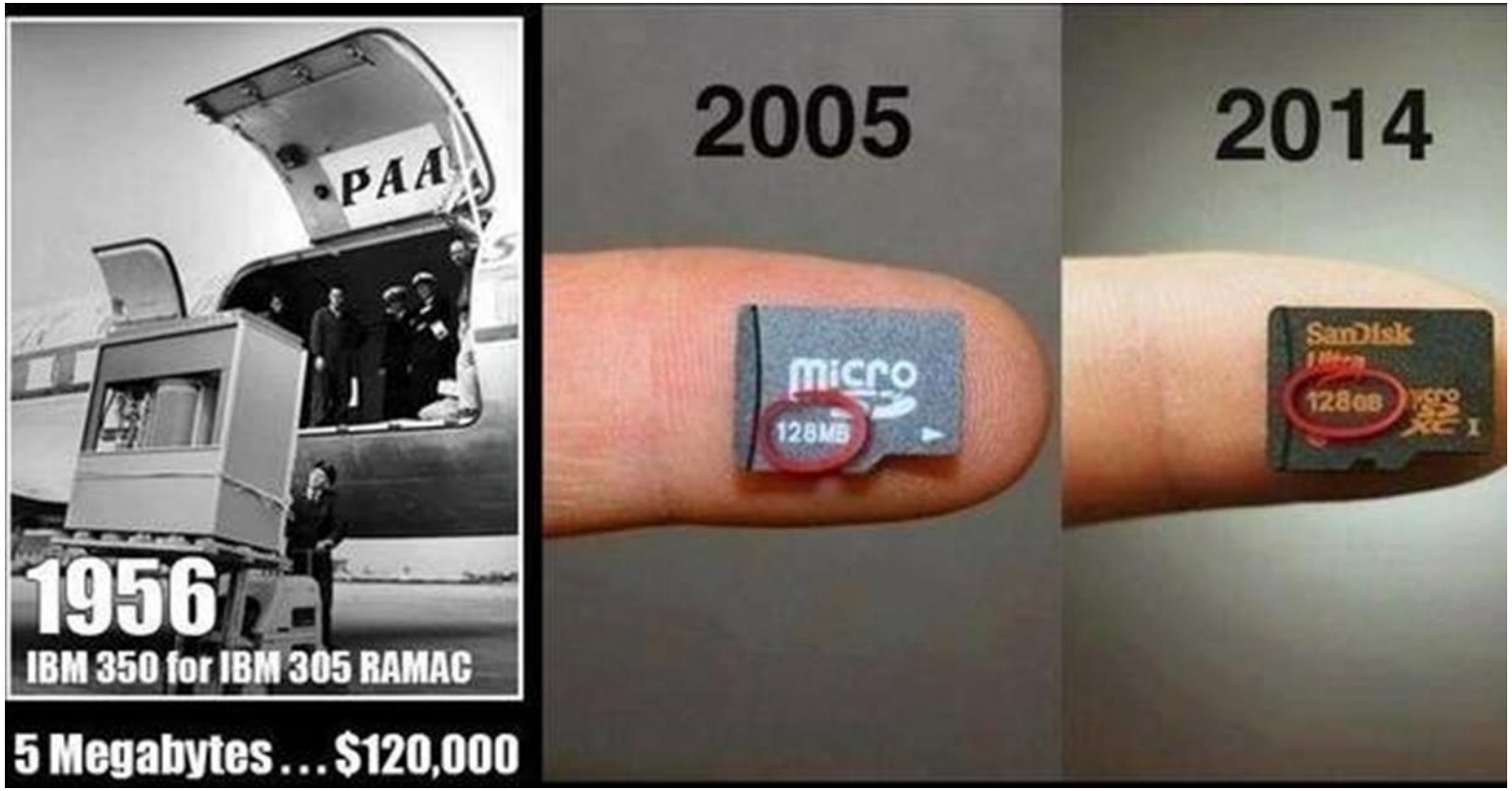
Technology development works



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Technology development works

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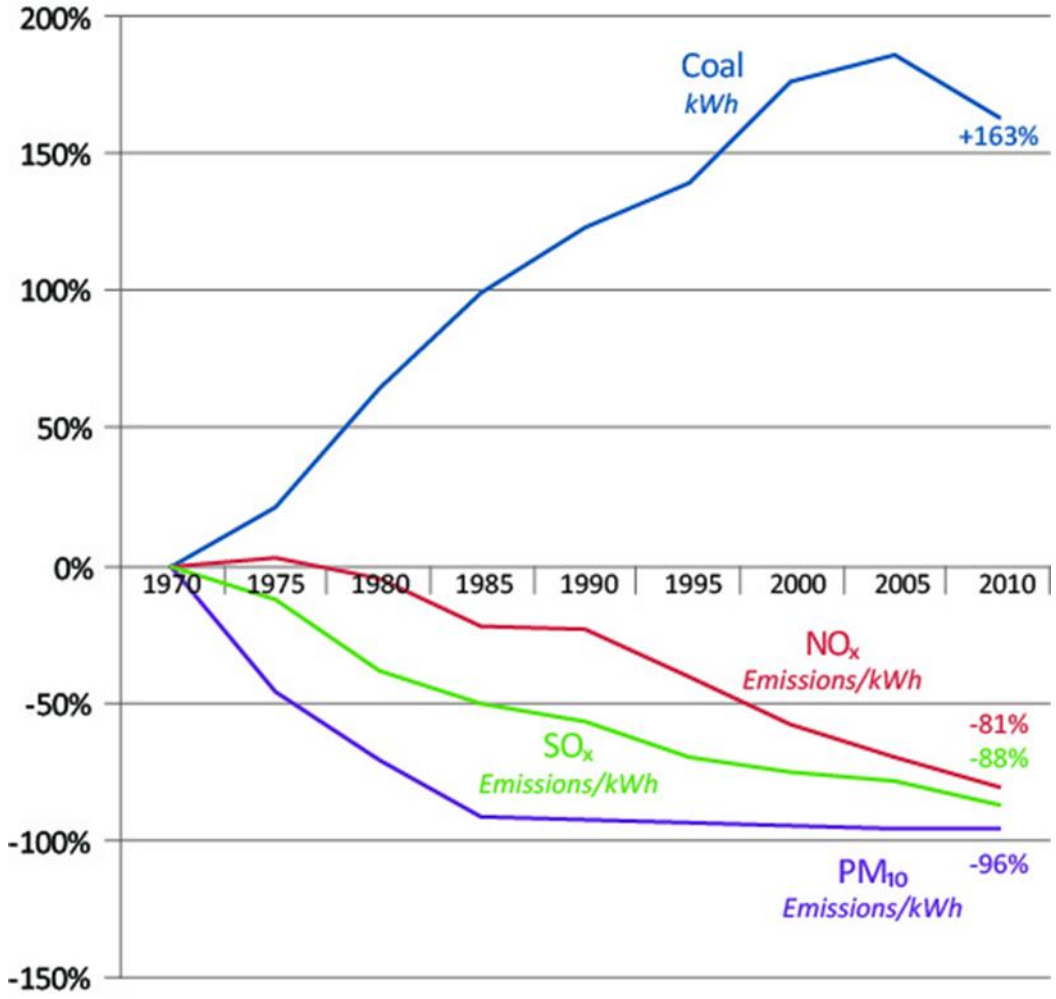
Emissions Technology Works



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The Integrated Test Center

- The Wyoming Legislature appropriated $15 million in 2014
- ITC Working group – Governor, UW, industry, R&D
- Tri-State Generation and Transmission matched $5 million
- The National Rural Electric Cooperatives are providing $1 million
- Basin Electric Cooperative is providing the host site
- Rocky Mountain Power and Black Hills Corp. provided technical expertise
- XPRIZE Foundation is the first tenant
- $12 million capital construction, remainder for operations

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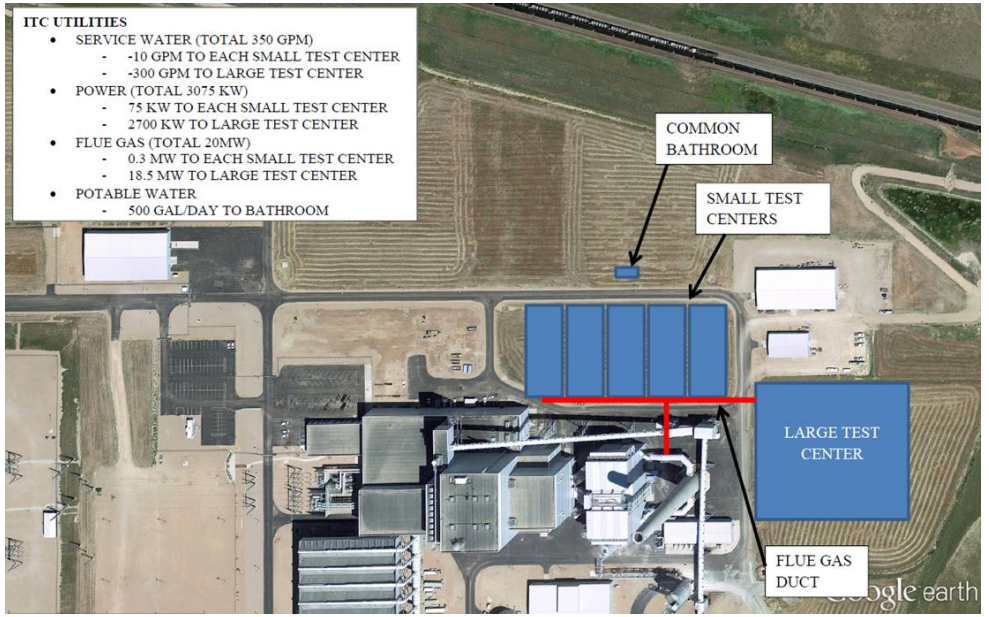
What exactly is the ITC?

- At completion, it will be one of only six similar facilities in the world
- Supplied with 20 MW of flue gas from the Dry Fork Power Station
- Simple design keeps costs low, provides flexibility for researchers and quick turnaround time
- Designed for maximum flexibility and scalability for testing – not a laboratory



Credit: Basin Electric Cooperative

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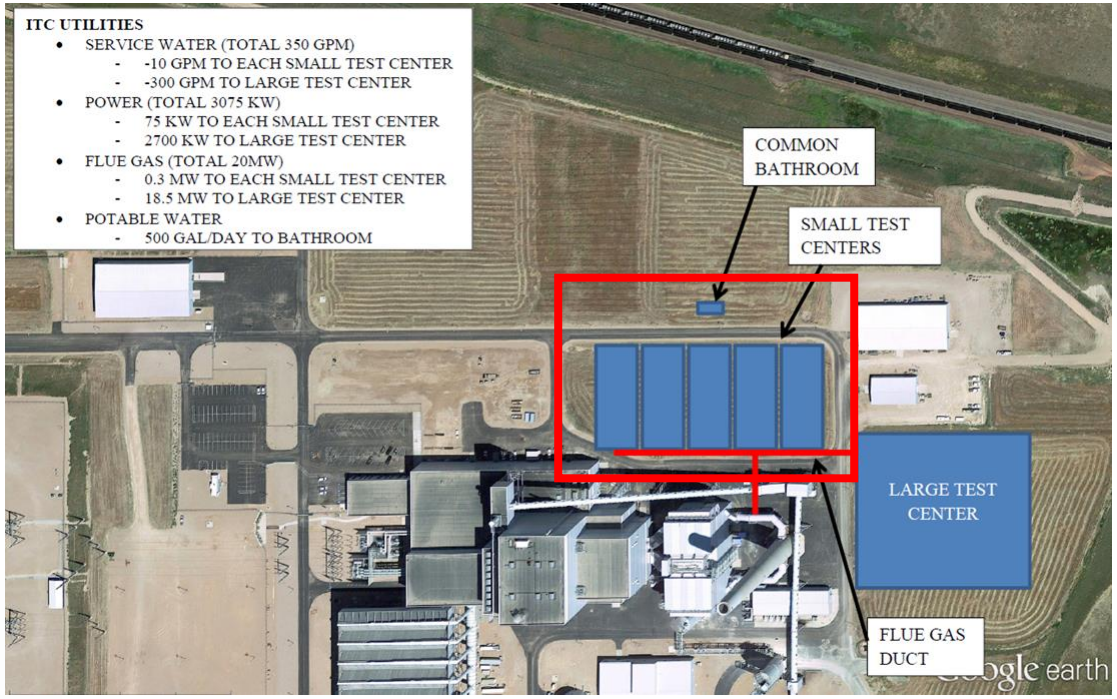
Small Test Bays

Site of XPRIZE competition



Credit: Basin Electric Cooperative

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XPRIZE Foundation

"The $20M NRG COSIA Carbon XPRIZE will challenge the world to reimagine what we can do with CO_2emissions by incentivizing and accelerating the development of technologies that convert CO_2 into valuable products."

- In September 2015 announced Carbon XPRIZE competition with NRG and COSIA
- Two tracts
  - Natural gas
  - Coal
- Three rounds of competition per tract
  - 1 – Technical Papers – up to 15 teams will move on
  - 2 – Small scale, laboratory testing – up to 5 teams will share $2.5 million prize
  - 3 – Real world, larger scale – grand prize of $7.5 million

XPRIZE is a tenant and at the completion of the competition, the space will be available to new testers.

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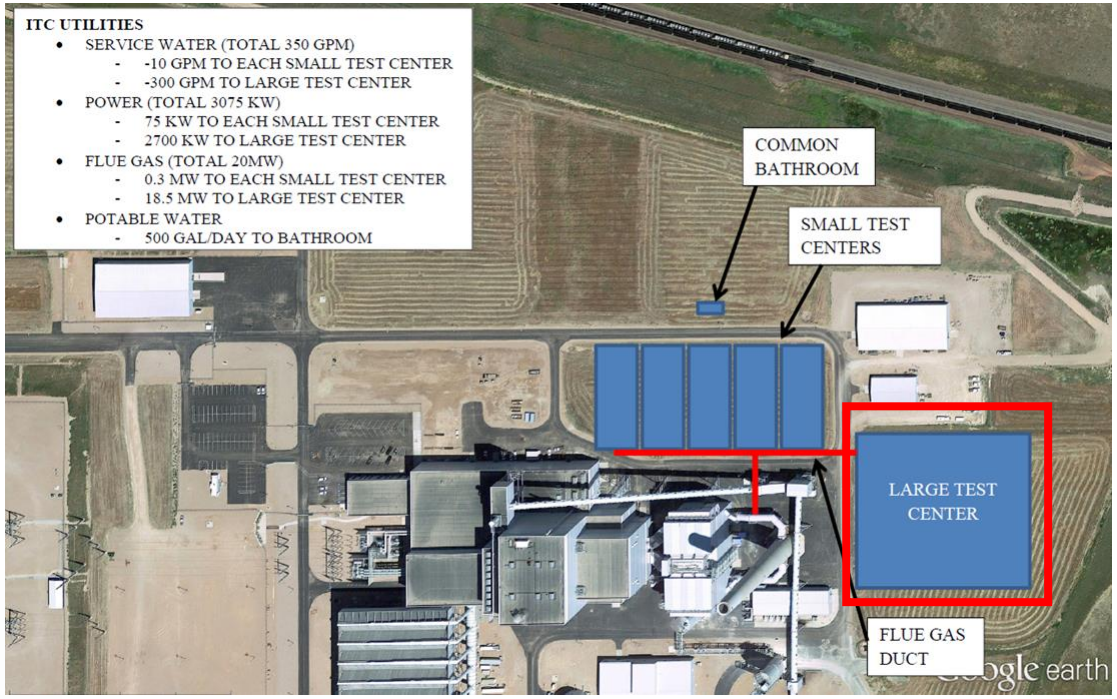
Large Test Bay



Credit: Basin Electric Cooperative

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Major Milestones

- March 2014 – Legislative Authorization
- Spring 2014 – Creation of ITC Working Group
- Summer 2015 – Feasibility Study Completed
- Summer 2015 – Governor Mead authorizes ITC construction based upon legislative milestone completion
- August 2015 – WIA appointed to lead ITC construction
- September 2015 – MOU between UW-SER and WIA executed
- October 2015 – MOU between XPRIZE and WIA executed
- October 2015 – Basin Electric orders damper and steel for first phase of construction
- November 2015 – MOU between Tri-State G&T and WIA executed
- December 2015 – Communications and PR development begins
- February 2016 – Launch website – www.wyomingitc.org
- *Winter 2016 – Completion of MOU's with Basic Electric and NRECA*
- *Fall 2015-Summer 2016 – Final engineering completed*
- *March 14 – April 12, 2016 – Installation of the damper*
- *Summer 2016 – Finalization of Operating Entity*
- *Spring-Fall 2016 – Construction of test bays, utilities and flue gas distribution network*
- *Winter 2017 – Testing and Commissioning*
- *May 2017 – Completion and ready for testing!*
- *Fall 2017 – XPRIZE begins on-site testing*

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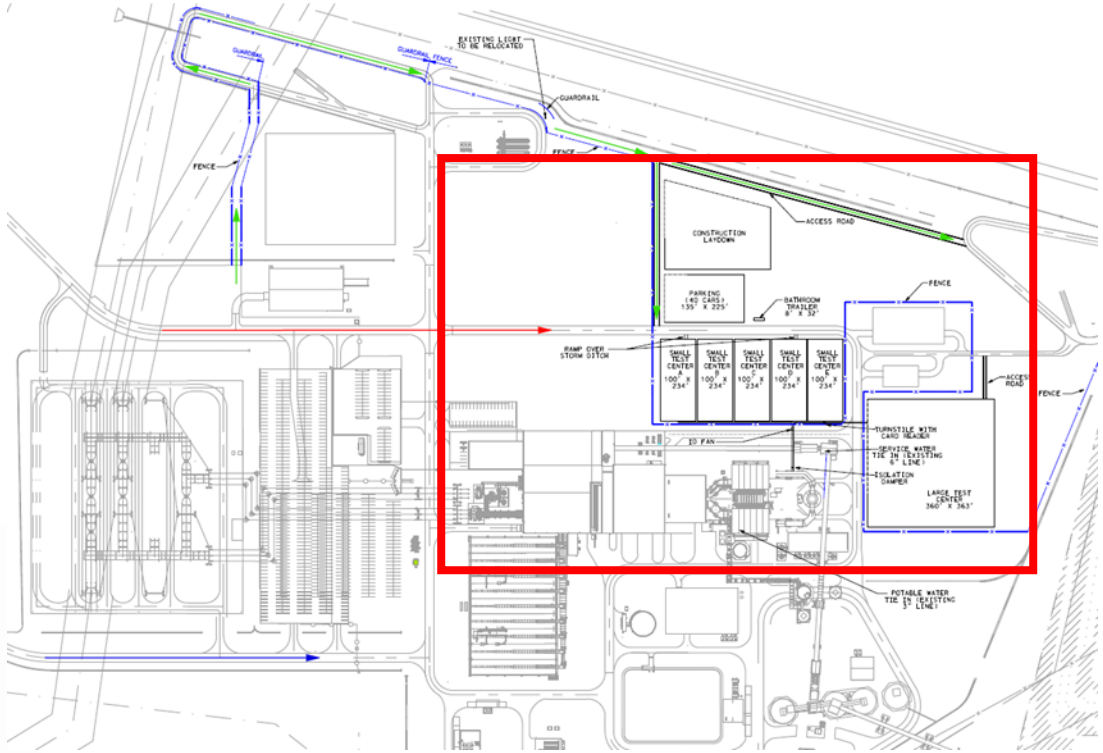
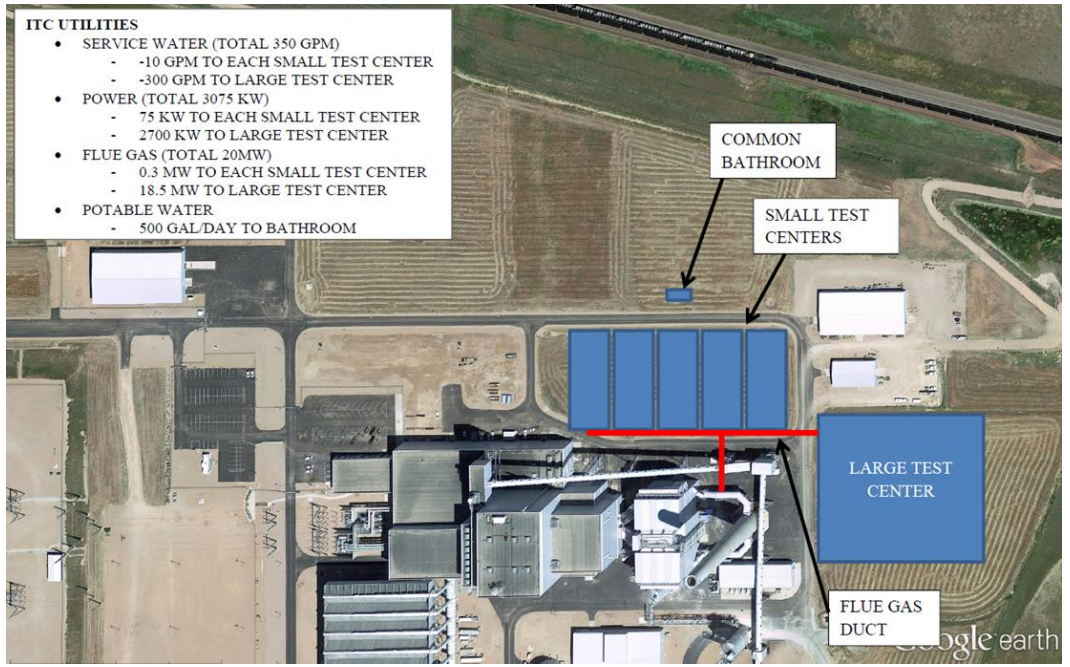
Damper Installation Mar-April 2016





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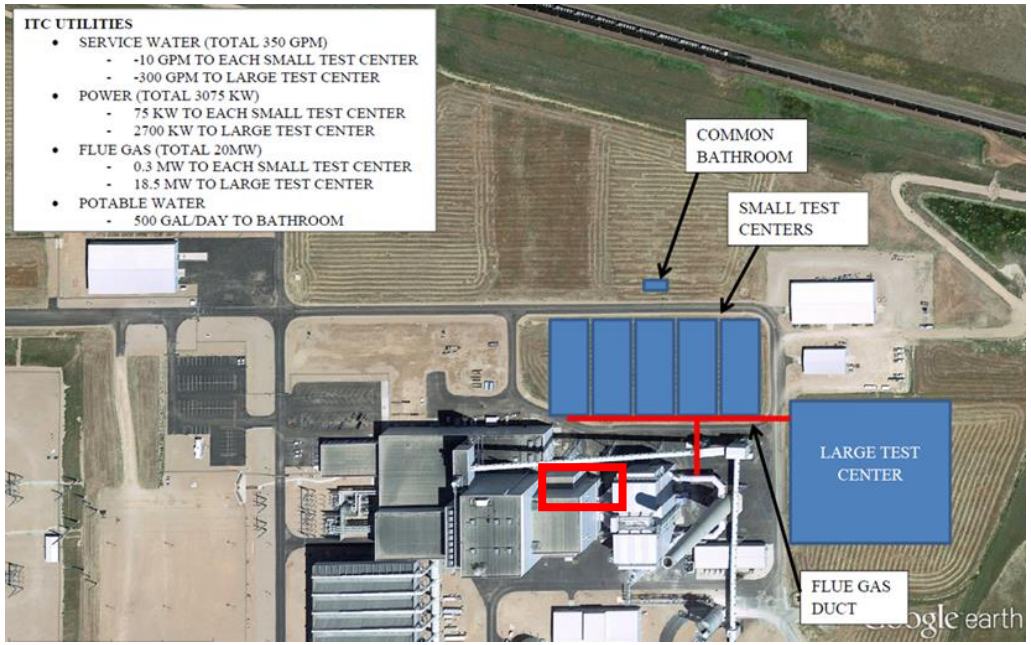
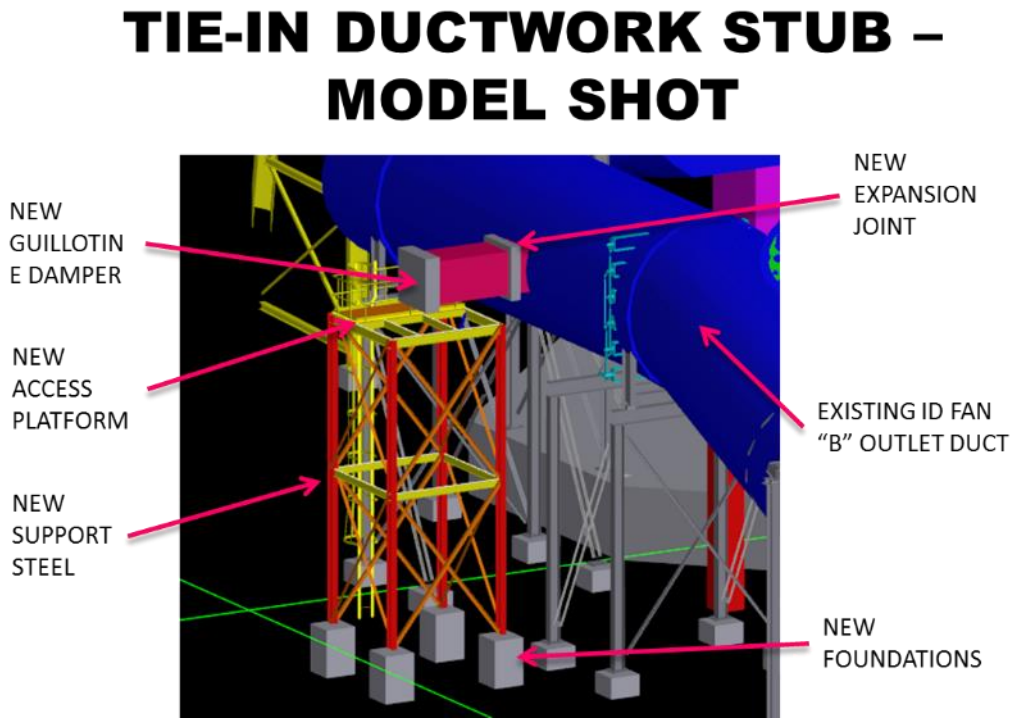


Credit: Basin Electric Cooperative



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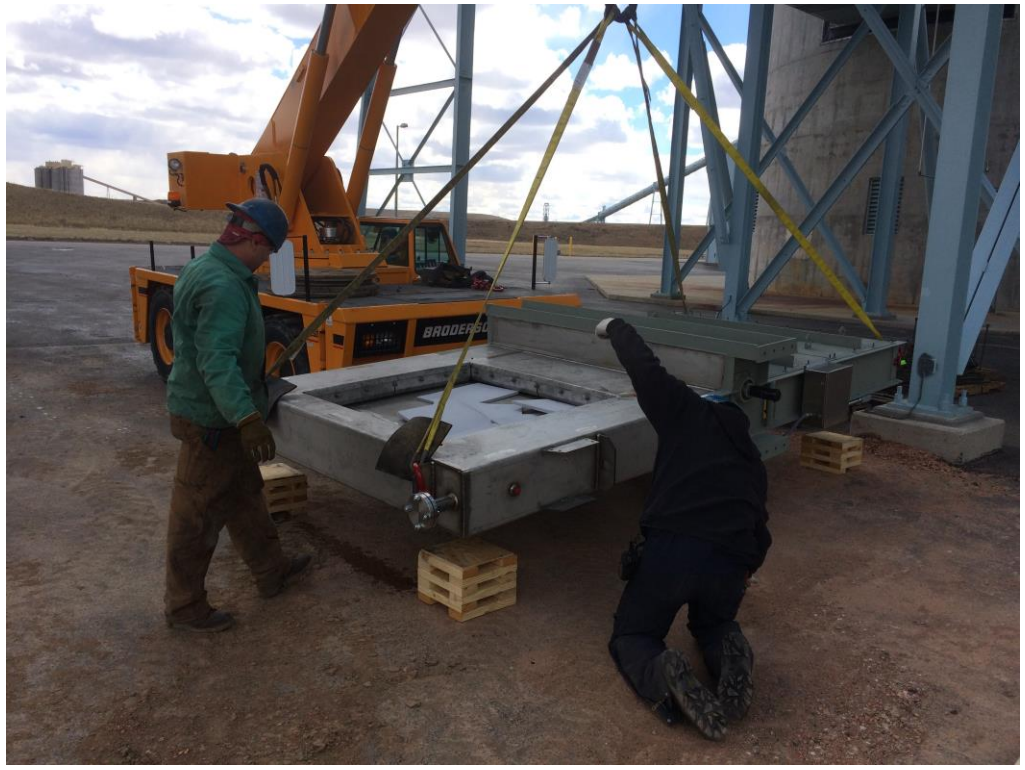

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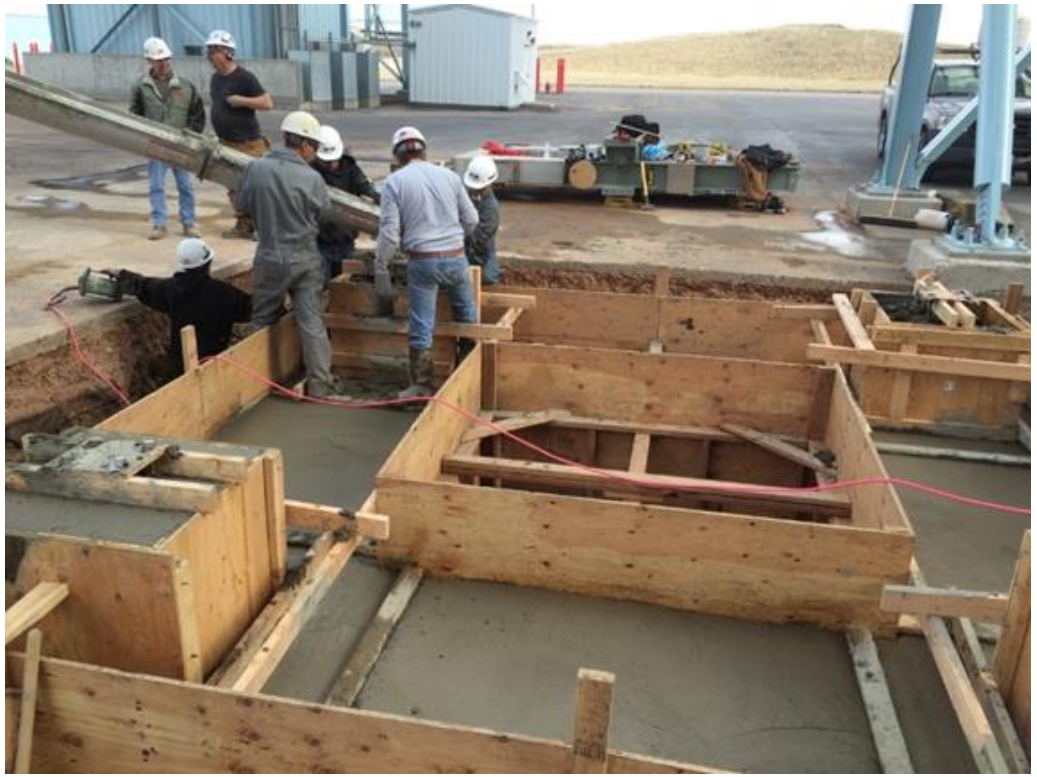

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Next Steps

- Explore opportunities to leverage Federal funds
  - Have reached out to Department of Energy
- Open dialog with international organizations to promote and advertise ITC
  - The International Carbon Capture Centre Network
    - CO2 Technology Centre Mongstad – test facility at Mongstad, Norway
    - E.ON – test facility at Wilhelmshaven, Germany
    - SaskPower – test facility at Shand, Saskatchewan, Canada
    - Southern Company/National Carbon Capture Center – test facility at Wilsonville, Alabama, USA
    - UK CCS Research Centre's PACT Facilities – test facility at University of Sheffield, UK
  - World Coal Association
    - R&D MOU

Construction is ahead of schedule, on budget!

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WORLD COAL ASSOCIATION

U.S. DEPARTMENT OF ENERGY

CCS
TEST CENTRE
NETWORK

SHARE KNOWLEDGE ON TESTING CO_2 CAPTURE
CCS

Questions?

Jason Begger
Executive Director
Wyoming Infrastructure Authority
jason.begger@wyo.gov
(307) 256-0098

www.wyomingitc.org

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