



EERCSM

UND UNIVERSITY OF
NORTH DAKOTA

Critical Challenges.

Practical Solutions.



Energy & Environmental Research Center (EERC)

ENERGY & ENVIRONMENTAL RESEARCH CENTER CARBON CAPTURE

ITCN Annual General Meeting

CO2CRC Meeting Room

October 21, 2018

John P. Kay

Principal Engineer

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EERC

QUICK FACTS FY17



CONTRACT
FUNDING



\$41.5 MILLION

TOTAL ACTIVE
CONTRACTS



208

83%

OF CONTRACTS
WERE WITH

PRIVATE
INDUSTRY



EERC RESEARCH
REPRESENTS
APPROXIMATELY

50%

OF THE TOTAL
EXTERNALLY FUNDED
RESEARCH AT UND

ECONOMIC
IMPACT
IN THE GRAND
FORKS REGION



\$90.6
MILLION

MULTIDISCIPLINARY



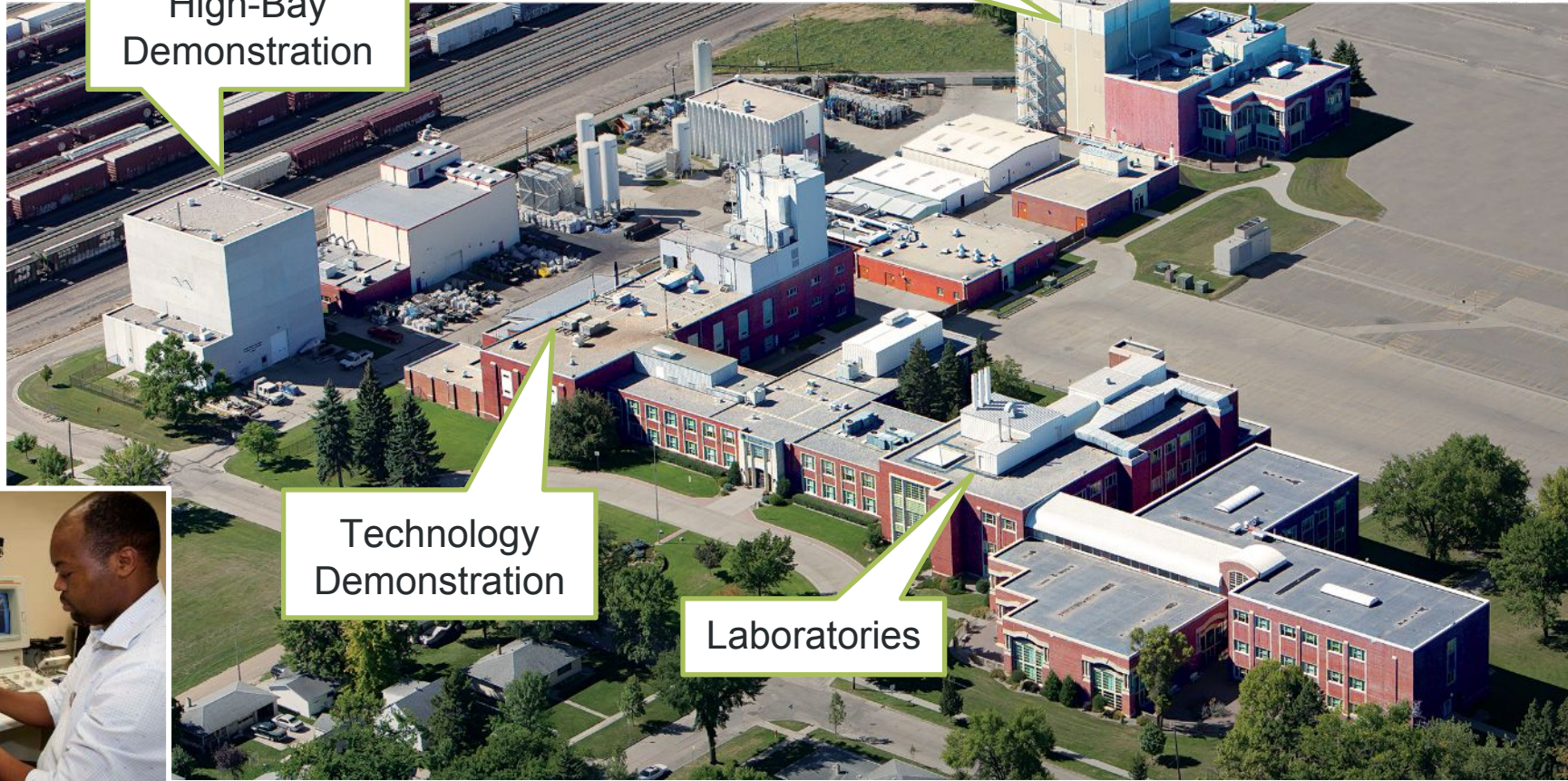
OUR FACILITIES

Fuels of the Future
& National Center for
Hydrogen Technology®

High-Bay
Demonstration

Technology
Demonstration

Laboratories



254,000 square feet of facilities.

KEY RESEARCH AREAS

- Emission control
- Next-generation power
- Carbon management
- Oil and gas



CARBON CAPTURE

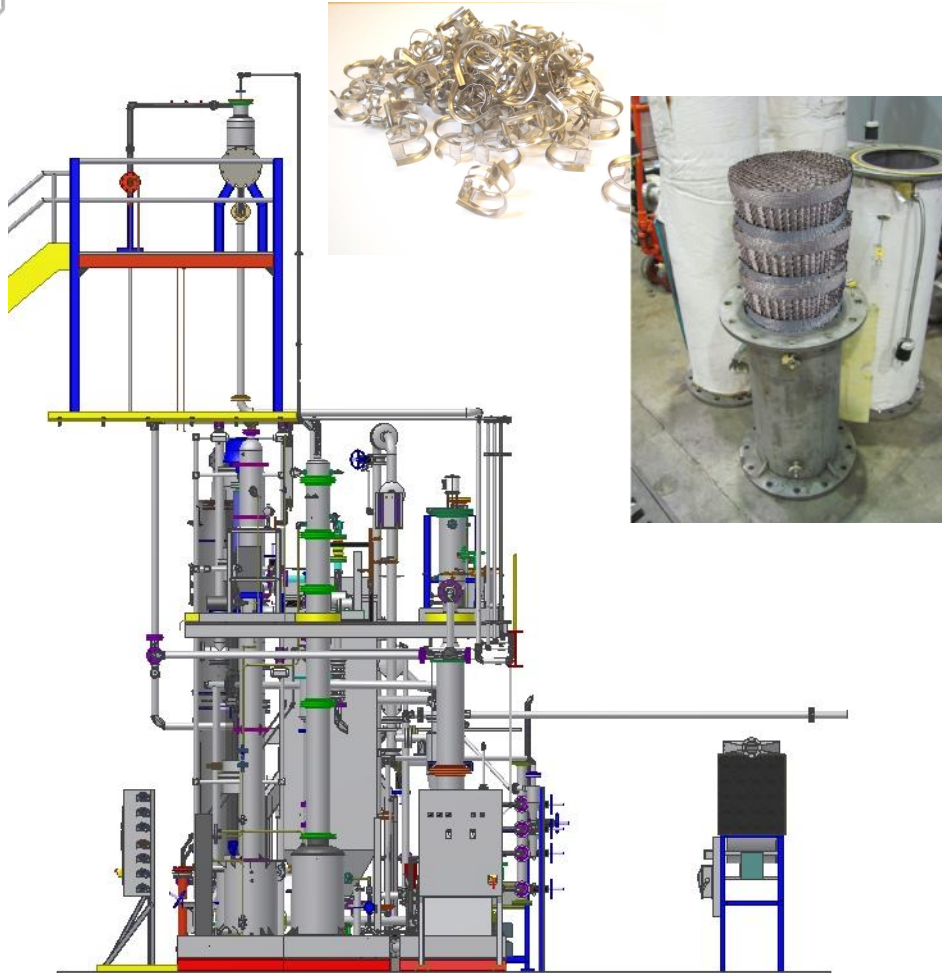
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INDUSTRY PARTNERS

FROM FORTUNE 500 COMPANIES TO SMALL START-UPS

PCOR Partnership 2003 – Present										PCO₂C Partners Phases I & II																

CO₂ CAPTURE SYSTEM



- Three 10-inch-diameter packed columns.
 - Two absorbers and one stripper that are designed for maximum flexibility.
 - Able to evaluate different solvents by adjusting the column height.
 - Absorber columns are operated in series.
 - Packing type (both random and structured) can easily be changed.
- Water wash column used to monitor solvent slip.
- Very highly instrumented to allow for tight control and accurate, precise measurement of parameters.
- Can process up to 130 scfm of flue gas.
- Capture up to 1 tonne/day of CO₂.



FLUE GAS PRODUCTION

- Size: 0.053 MW_e.
- Single-burner combustion furnace equipped with selective catalytic reduction (SCR), electrostatic precipitator (ESP), wet flue gas desulfurization (FGD), combined SCR–fabric filter (FF)–dry sorbent injection (DSI) system.
- Operates at balanced draft – slightly less than atmospheric pressure.
- Fuels: coal, coal–water, petcoke, biomass, natural gas or biogas, liquid fuel, sludge, municipal solid waste.
- Maximum furnace exit gas temperature: 1371°C (2500°F), typically maintained at 1093°–1204°C (2000°–2000°F).

TESTING CONDUCTED

Furnace System Control



Capture System Control

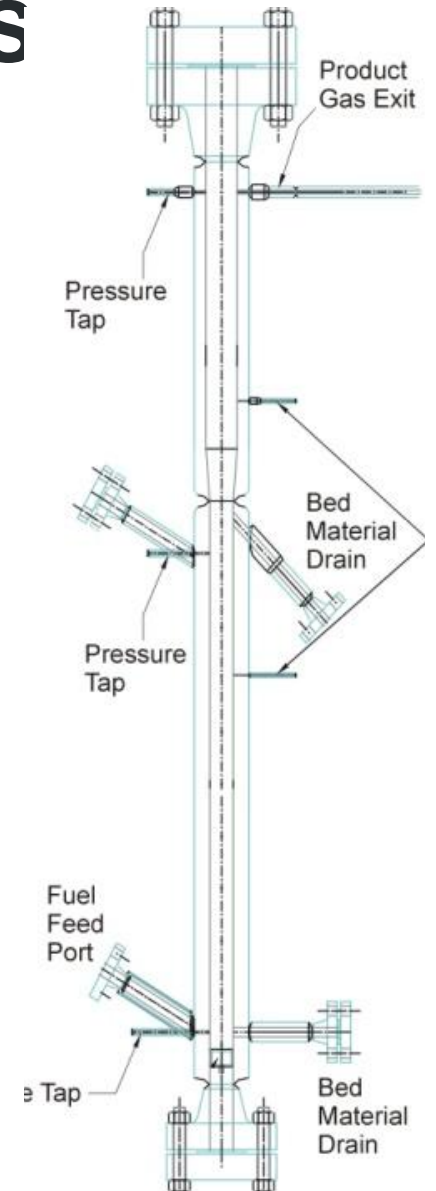


- Monoethanolamine (MEA) (30 wt%)
- Hitachi H3-1
- Mitsubishi Heavy Industries KS-1
- Methyldiethanolamine (MDEA)–piperazine
- Huntsman advanced solvent
- Huntsman solvent additive
- Baker Hughes additives
- Cansolv next-generation solvent
- Cansolv amine-based solvent for SO_x control
- ION Engineering solvent
- U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) solid sorbent
- C-Quest sorbent
- Neumann Systems Group
- CO₂ Solutions enzymatic process
- Advanced solvent from Korea
- CSIRO (Commonwealth Scientific and Industrial Research Organization) membranes

SMALL PILOT-SCALE GASIFICATION SYSTEMS



- Entrained-flow gasifier (EFG)
 - ◆ 2750°F (1510°C)
 - ◆ 300 psi (20 atm)
- High-pressure fluid-bed gasifier (FBG)
 - ◆ 1800°F (980°C)
 - ◆ 1000 psi (68 atm)
- Process optimization, fuel behavior, ash and slag behavior, warm-gas cleanup, gas separation, and chemicals and liquid fuel production.
- Biomass to petcoke.
- Gasification, catalytic gasification, hydrogasification, methanation, and pyrolysis.
- Highly reconfigurable systems.



CONTACT INFORMATION

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THANK YOU!

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