CCUS in Saskatchewan

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Ministry of Energy and Resources

International CCS Knowledge Centre Workshop
September 2026



Today's Conversation

1. **Our role** — How the Ministry of Energy and Resources supports CCS development
2. **How the framework works** — Policy, tenure, geology, regulation, and liability management
3. **What has evolved** — CCS-specific application requirements and technical guidance
4. **Where we are going** — Priority issues, project pathways and shared learning

Saskatchewan

The Ministry of Energy and Resources' Role in CCUS Development

POLICY

Set clear outcomes and align the regulatory framework with provincial objectives.

TENURE

Manage access to subsurface rights and to enable evaluation and development.

TECHNICAL OVERSIGHT

Assess geology, containment, capacity, operations, interference, infrastructure, monitoring and project closure.

LIFECYCLE STEWARDSHIP

Manage liability, balance risk, and long-term public interest considerations.

A coordinated system, not a single approval

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What the Ministry of Energy and Resources Manages: A Full Life Cycle View

Policy & Incentives	Enabling conditions and Support
Tenure	Access and rights (Crown)
Geology	Site suitability
Regulation	Infrastructure and operations
Monitoring	Containment & Confinement
Liability Management	Enduring stewardship



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Regulatory Framework

- Existing oil and gas framework
- Results-based regulation
- CSA Standards
  - CSA/ANSI ISO 27914:26 (CSA Z741 Geological Storage of Carbon Dioxide)
  - CSA Z662 Oil and Gas Pipeline Systems

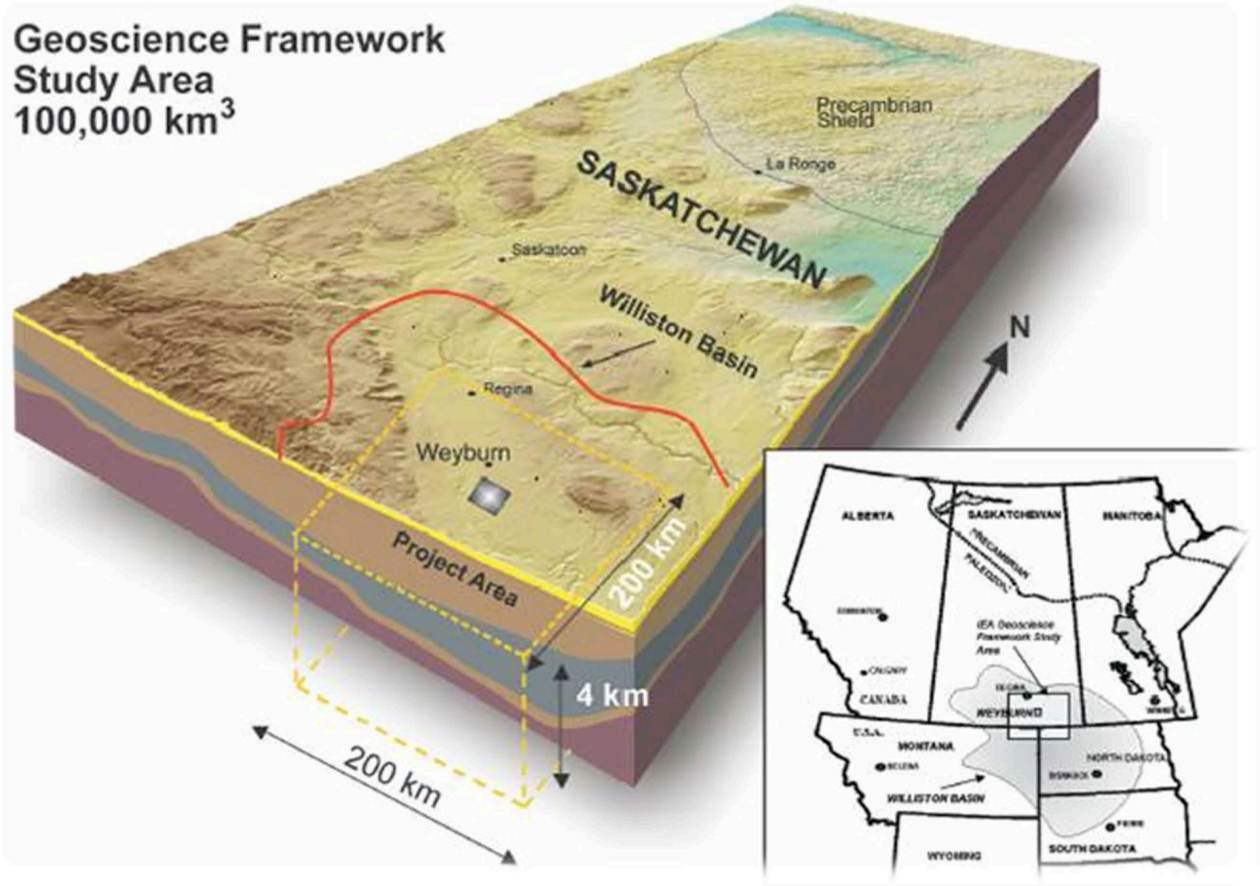
- The Oil and Gas Conservation Act
- The Oil and Gas Conservation Regulations, 2012
- Directive PNG005: Casing and Cementing Requirements
- Directive PNG006: Horizontal Oil Well Requirements
- Directive PNG008: Disposal and Injection Well Requirements
- Directive PNG009: Public Notice Requirements
- Directive PNG010: Well Logging Requirements
- Directive PNG013: Well Data Submission Requirements
- Directive PNG014: Incident Reporting Requirements
- Directive PNG015: Well Abandonment Requirements
- Directive PNG017: Measurement Requirements for Oil and Gas Operations
- Directive PNG032: Volumetric, Valuation and Infrastructure Reporting in Petrinex
- Guideline PNG021: Determining Drainage Units and Target Areas
- Guideline PNG024: Reclassification and Recompletion
- Guideline PNG029: Annulus Test Reporting Requirements
- Guideline PNG042: Measurement, Accounting and Reporting Plan (MARP) Requirements for Thermal Heavy Oil Recovery Projects

- The Pipelines Act, 1998
- The Pipelines Administration and Licensing Regulations
- Directive PNG034: Saskatchewan Pipelines Code

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CO_2 EOR and CO_2 Storage in Saskatchewan

Weyburn CO_2 EOR



The Weyburn CO_2 EOR Project has stored more than <u>44 Million tonnes</u> of CO_2

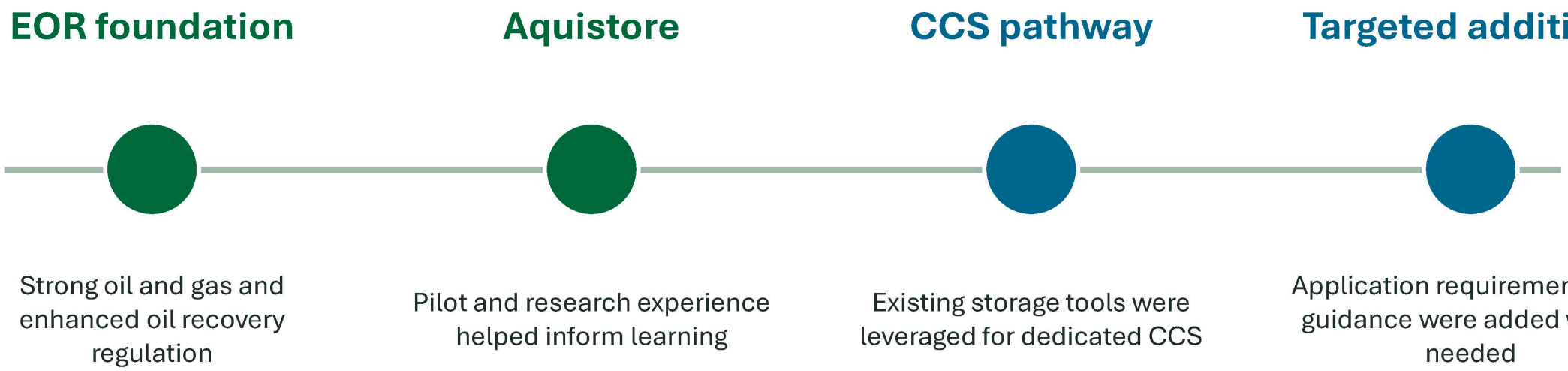
Aquistore CO_2 Storage



Aquistore has stored more than <u>650,000 tonnes</u> of CO_2

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Saskatchewan's Experience



Core message: build on proven resource regulation, then added CCS-specific requirements where risks or policy objectives differ.

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Priority policy and regulatory work

TENURE

Clarification of pore space ownership

LONG-TERM LIABILITY

Ensuring financial stewardship across the lifecycle

MMV

Fit-for-purpose measurement, monitoring and verification expectations

CONFIDENTIALITY

Appropriate treatment of information for CCS storage projects

PUBLIC ENGAGEMENT

Clearer guidance on engagement for communities, landowners and proponents

EOR & CO_2 SUPPLY

Supporting opportunities while recognizing infrastructure dependencies

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Current and Future CO_2 Capture Projects Under Consideration

Project	Company(ies)	EOR or Storage	Status
Boundary Dam 3	SaskPower	EOR/Storage	Operating
Belle Plaine Carbon Hub	Entropy	Storage	Operating
Meota East SAGD	Strathcona	Storage	Approved
Project #4		Storage	Evaluating
Project #5		Storage	Evaluating
Project #6		EOR/Storage	Evaluating

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Carbon Dioxide (CO_2) Storage Application Process

A guide to getting your CO_2 storage projects up and running

1. Pre-application Activities

- A Lease of Space (LoS) agreement
- Subsurface appraisal of the geology.

2. Project Application

- A CO_2 Storage Project Application (New)
- ER issues Minister's Order (MRO)
- Infrastructure licensing – wells, facilities, pipelines
- Proponents may be required to conduct Environmental Assessment approval from the Ministry of Environment.

3. Pre-Injection and Injection

Pre-injection Phase

- Baseline Monitoring, Measurement and Verification (MMV) work

Injection Phase

- Commence injection and monitoring.
  - Volumes measured and reported
- Progress reports and MMV update.

Post-Injection Phase

- Operator continues to monitor the project for pre-abandonment.

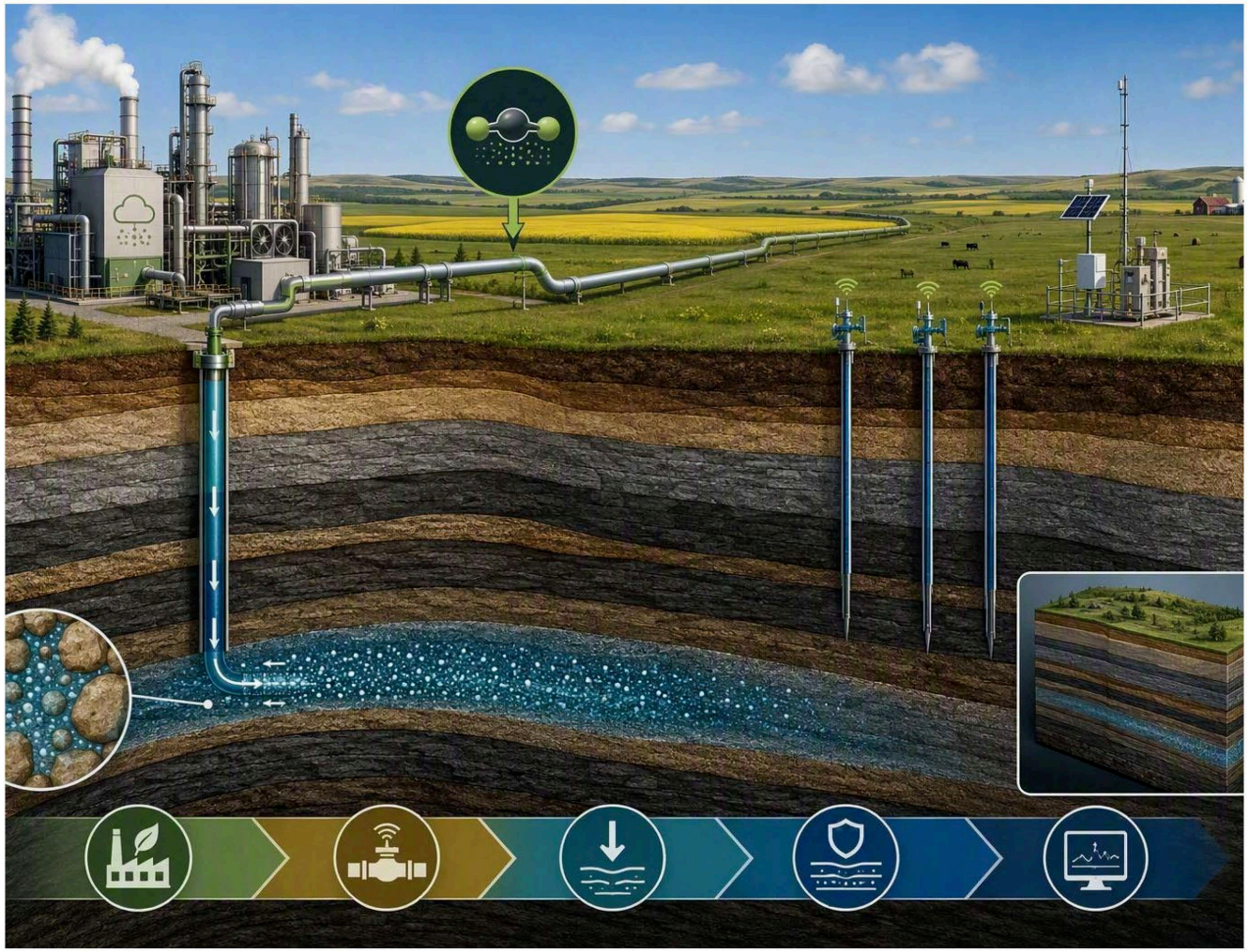
4. Closure and Abandonment

- The Ministry of Environment's Carbon Capture, Utilization and Storage Credit Standard
- Termination report
- Well and facility abandonment
- Infrastructure and LoS agreements may be decommissioned
- The operator has continuing responsibility for long-term monitoring and liability. A renewed MMV for long-term monitoring may be considered.

For more information, visit ER'S Storage Project Application site or contact
ER Service Desk
Energy and Resources
Phone 855-219-9373 or er.servicedesk@gov.sk.ca

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Co-Development of the Subsurface



THE ISSUE

CO_2 storage may overlap or interact with oil and gas, minerals, disposal and other subsurface interests.

CURRENT APPROACH

Assess interactions on a project-by-project basis using available tenure, technical and regulatory tools.

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SASKATCHEWAN PRAIRIE CARBON MANAGEMENT SERIES

September 24, 2026

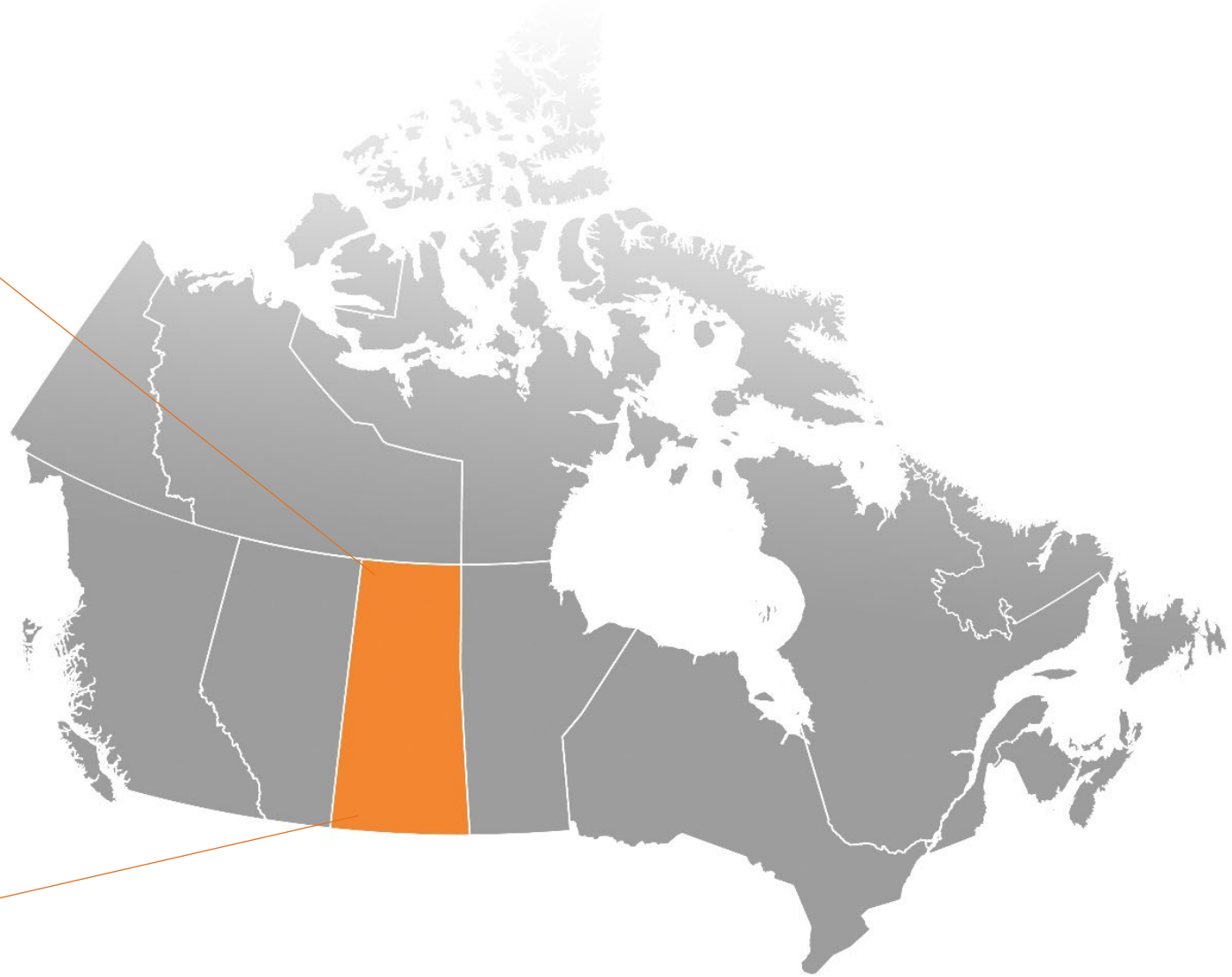
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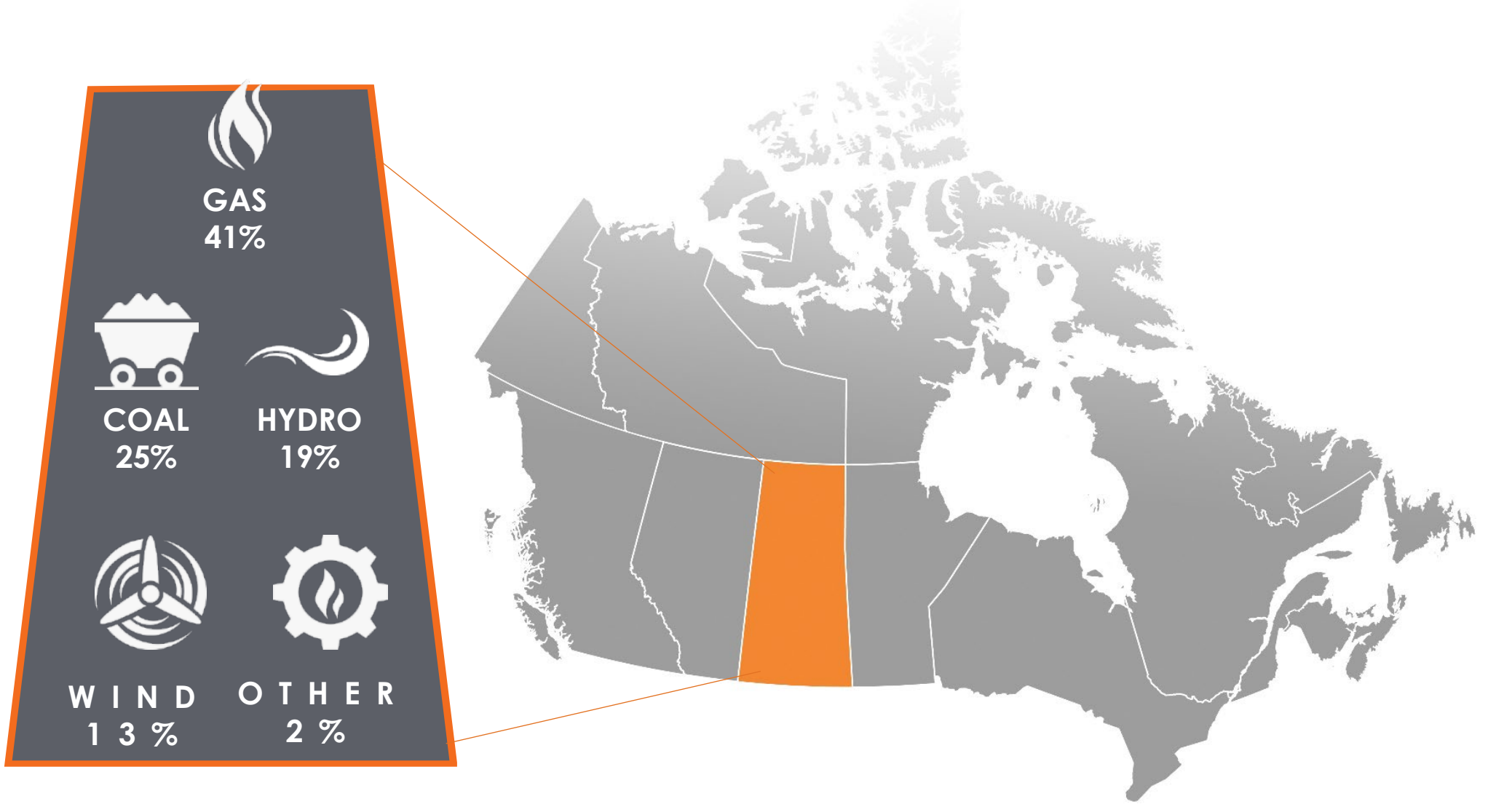
567,544
CUSTOMER ACCOUNTS

6,183 MW
CAPACITY

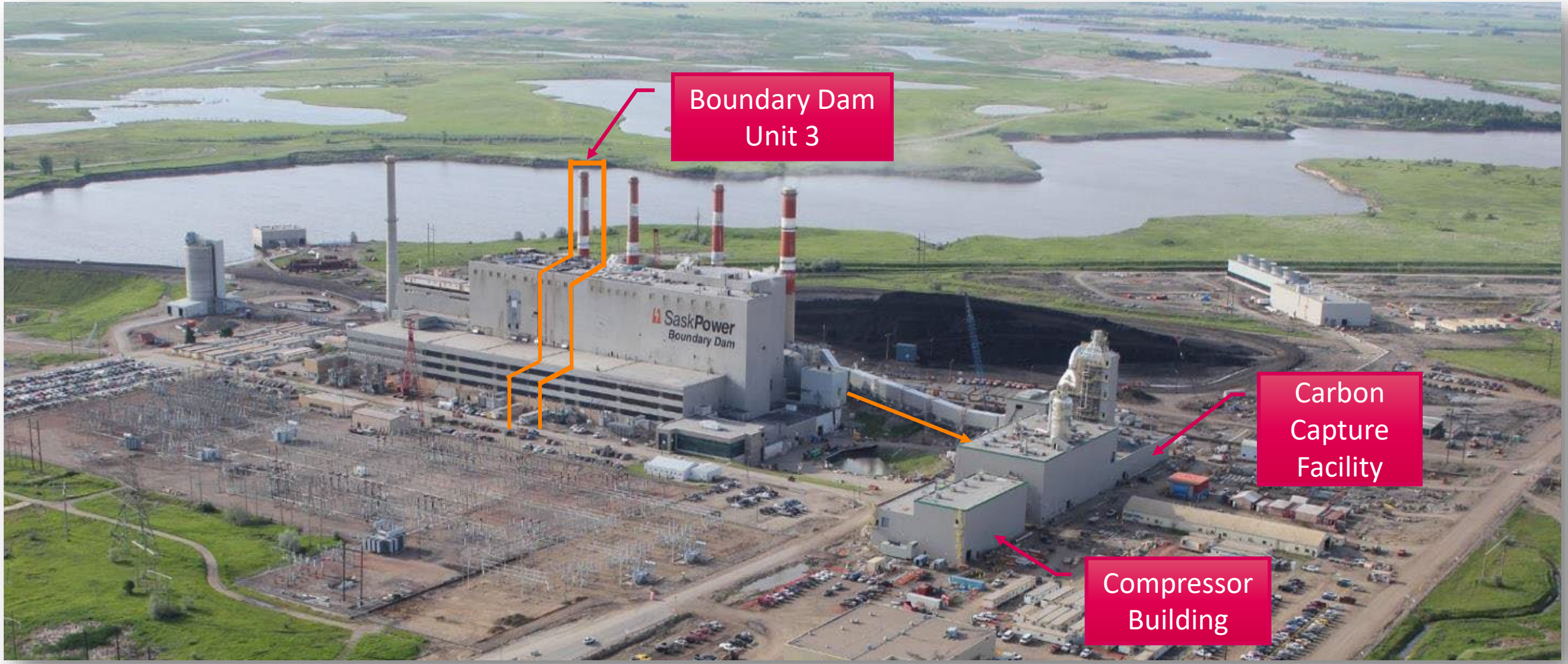
159,837 KM
OF POWER LINES



SASKPOWER'S GENERATION FLEET



BOUNDARY DAM UNIT 3 & CCS



PROJECT ROADMAP

1995 — Clean Coal Begins

2006 — Investigate Amine PCC

2007 — CANSOLV pilot campaign

2008 — FEED Study

2011 — FID

2014 — Start-up

2016 — First 1 Mt captured

2026 — 12 years of operation



CCS RELIABILITY

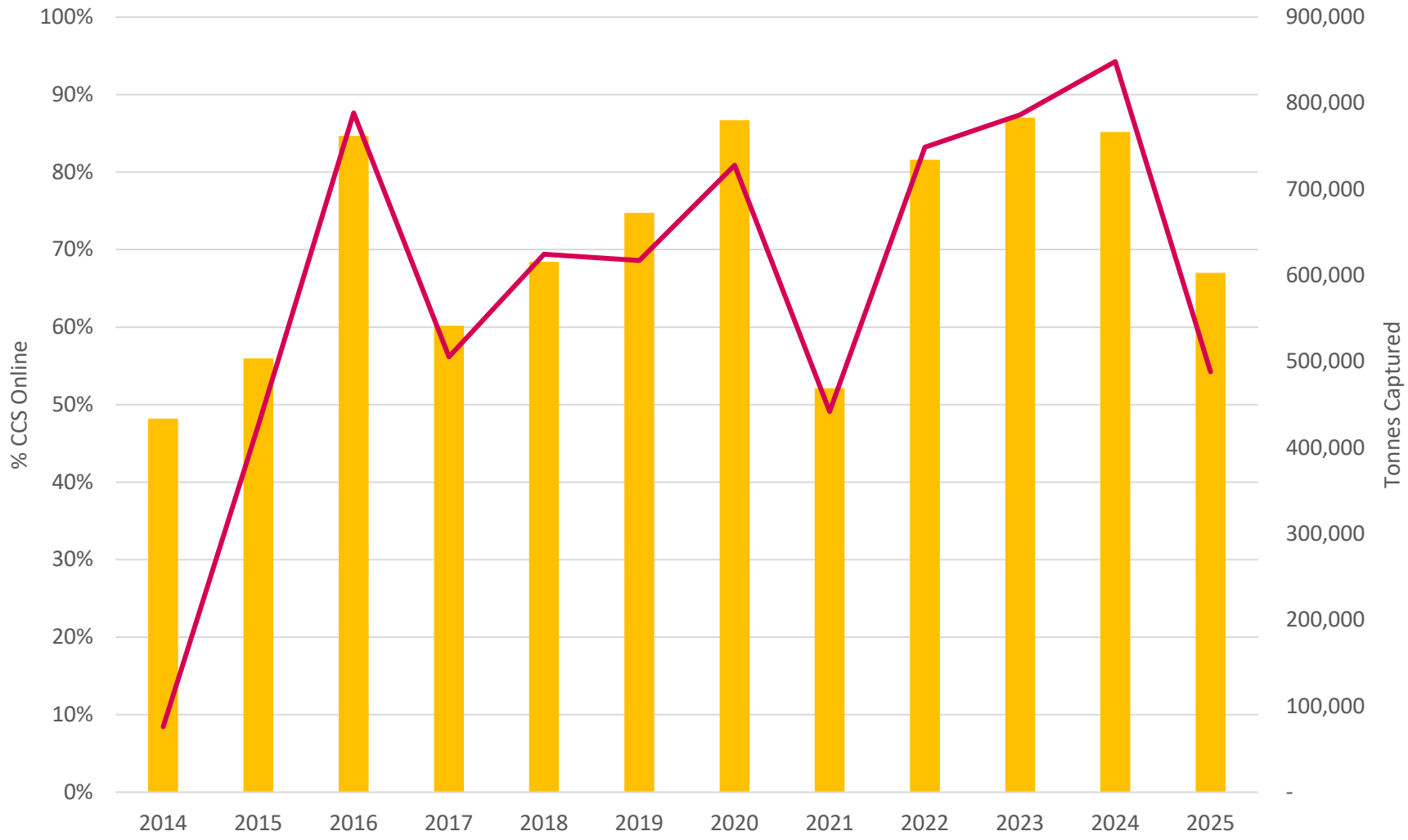
Facility optimization has improved performance significantly over the last three years.

Maximized:

- Reliability
- Availability
- Capture Efficiency

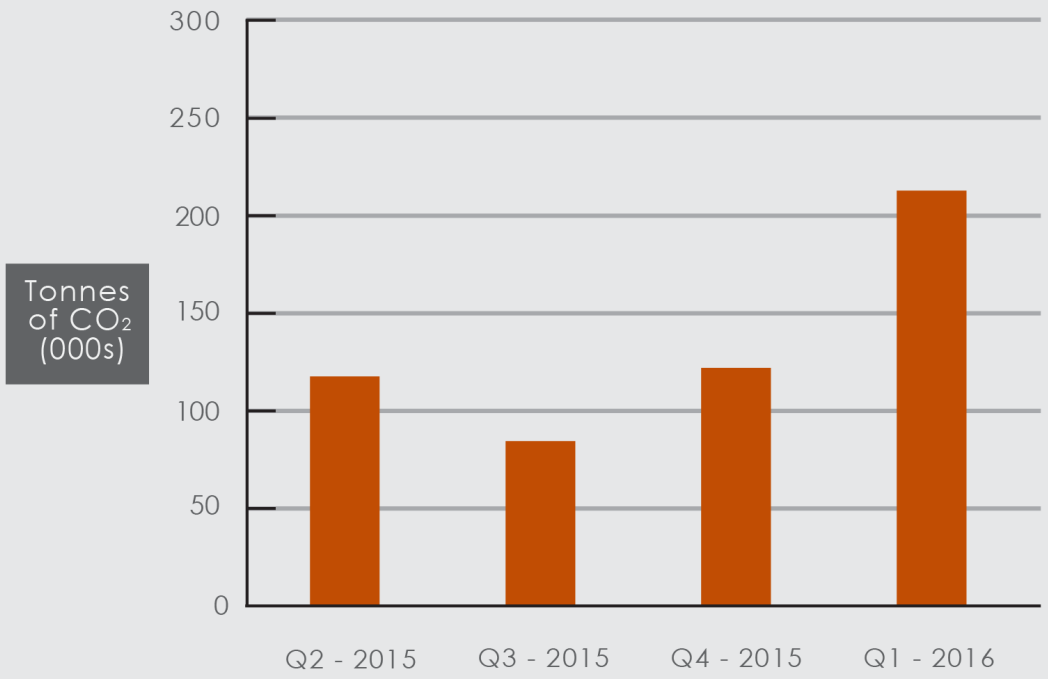
Minimized:

- Cost of Operation
- Solvent Make-Up
- Emissions Intensity

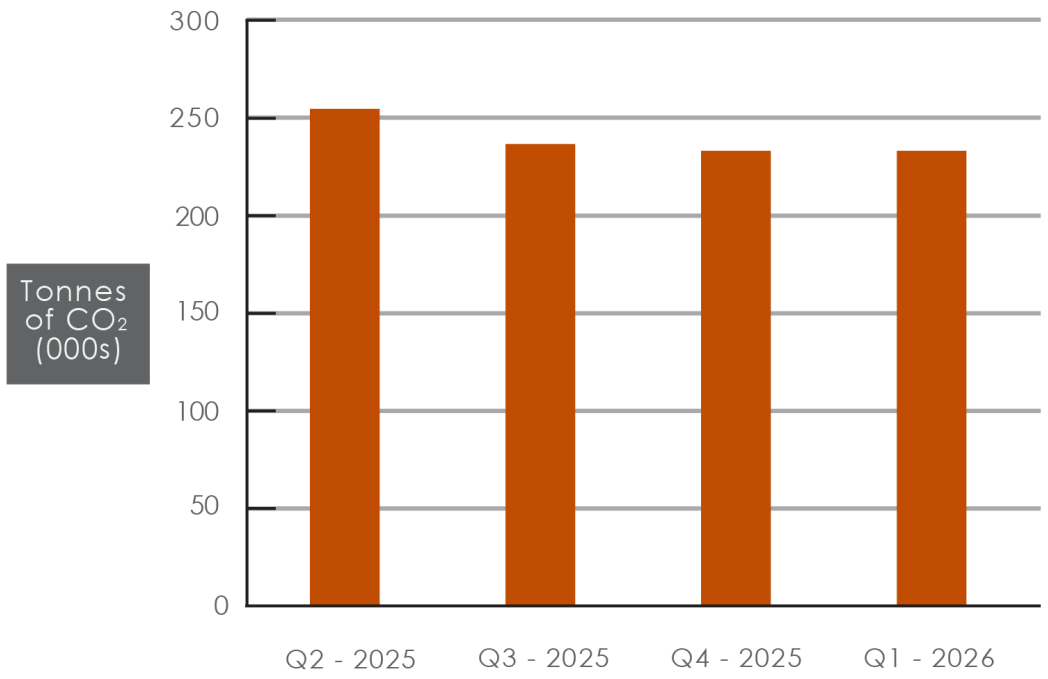


BD3 CCS PERFORMANCE COMPARISON

CO_2 VOLUME CAPTURED 2016



CO_2 VOLUME CAPTURED 2026



OPERATIONAL LEARNINGS

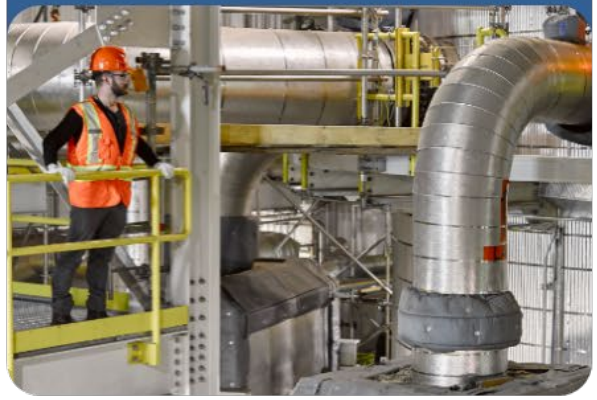
CO_2 capture technology and integration



Impact to the power plant



Maintenance and safety



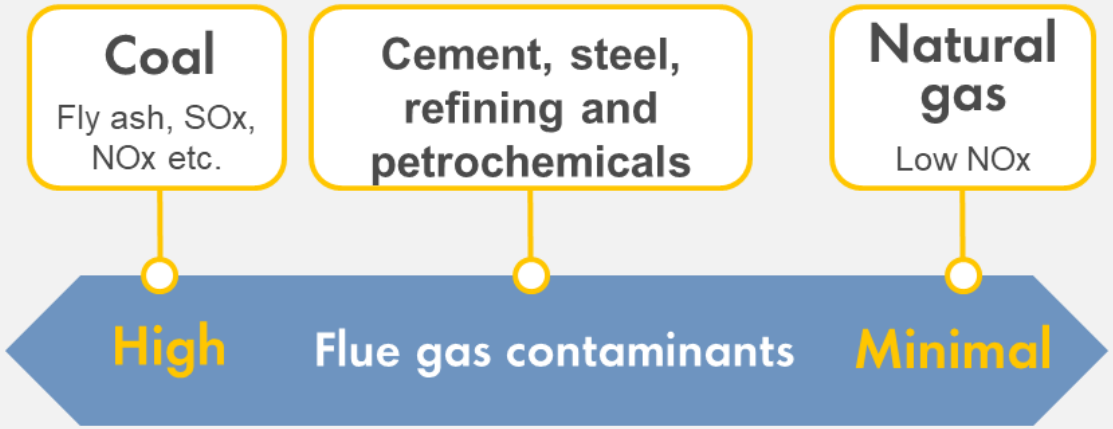
Culture of excellence



The challenge: Coal-fired power plant flue gases contain high levels of fly ash, metals and acidic contaminants.

Insights gained: impact of coal flue gas contaminants

- Pilot campaign to replicate commercial scale pre-treatment line-up
- Proper flue gas contaminants characterization
- Solvent chemistry: development of technology to mitigate impact of contaminants



Slide developed in conjunction with: Shell Catalysts & Technologies

The challenge: Ensuring reliable power plant performance when retrofitting a CCS system.

Insights gained:

- Importance of coal feedstock quality assurance
- Flue gas fly ash management requires close monitoring
- Balancing different operating modes (max capture vs lowest emission intensity) whilst meeting KPIs and off-taker agreements
- Integration with BD3 to minimize emissions intensity during S/U and S/D



Slide developed in conjunction with: Shell Catalysts & Technologies

The challenge: FOAK application of an amine system in a new industry requires creation of new procedures.

Insights gained:

- There are trade-offs to be made between cost and performance
  - Redundancy
- QA/QC of equipment and workmanship are especially critical
- Synchronizing maintenance of power island and capture island
- Implementation of safe processes and operator training



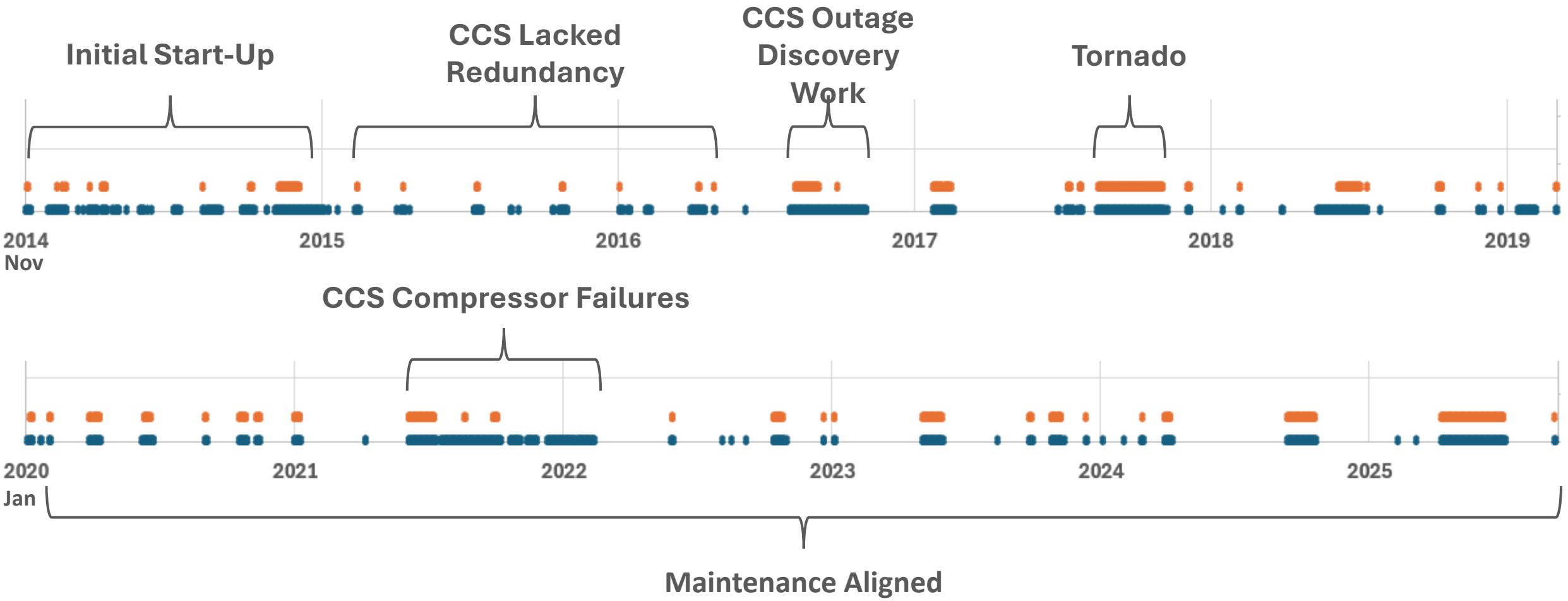
Slide developed in conjunction with: Shell Catalysts & Technologies

MAINTENANCE HISTORY

Offline

- BD3
- CCS

*Average of 4 outages/year for a coal unit is considered normal



The challenge: Optimizing a FOAK CCS plant

Insights gained:

- Licensor know-how of amine units is critical
- Close collaboration between licensor and customer supported site transition to operations
- Paradigm shift: develop capability to operate and monitor a chemical facility
- Strong commitment by operator to achieve operational excellence



Slide developed in conjunction with: Shell Catalysts & Technologies

SUMMARY

Boundary Dam 3 has reshaped global understanding of CCS.

After 10 years of operations, BD3 demonstrates that CCS does work:

- at scale (1 mtpa)
- on the most challenging application (coal).

What could this mean for you?

Invest in front end engineering with proper flue gas characterization.



Optimising power plant economics with decarbonisation drivers.



Development of application-specific carbon capture design standards based on flue gas contaminants



A strong partnership between the technology licensor and engineering contractor is key to project success.



Operational excellence is achieved through close collaboration between licensor and operator.

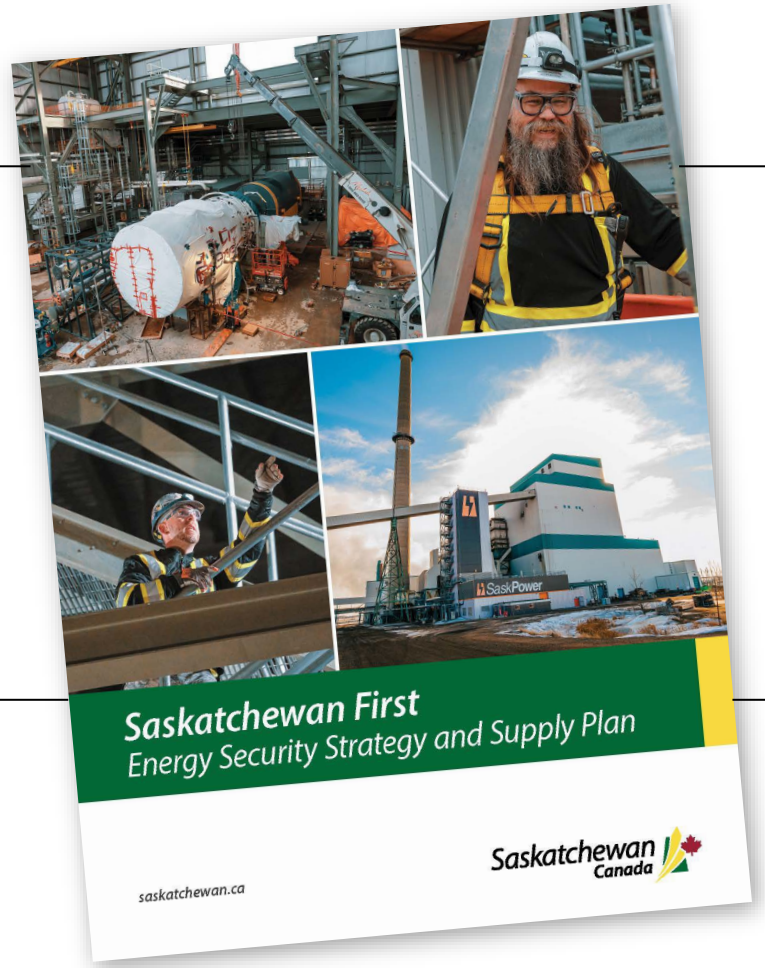


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ENERGY SECURITY STRATEGY & SUPPLY PLAN

An all-of-the-above approach and NZ 2050

Coal as a bridge to nuclear



Nuclear power as the future

Transmission infrastructure

REQUIRED REGULATORY CHANGES

- RENEWED GOVERNMENT COLLABORATION
- REPEAL / REVISE CLEAN ELECTRICITY REGULATIONS
- INVESTMENT TAX CREDIT



QUESTIONS

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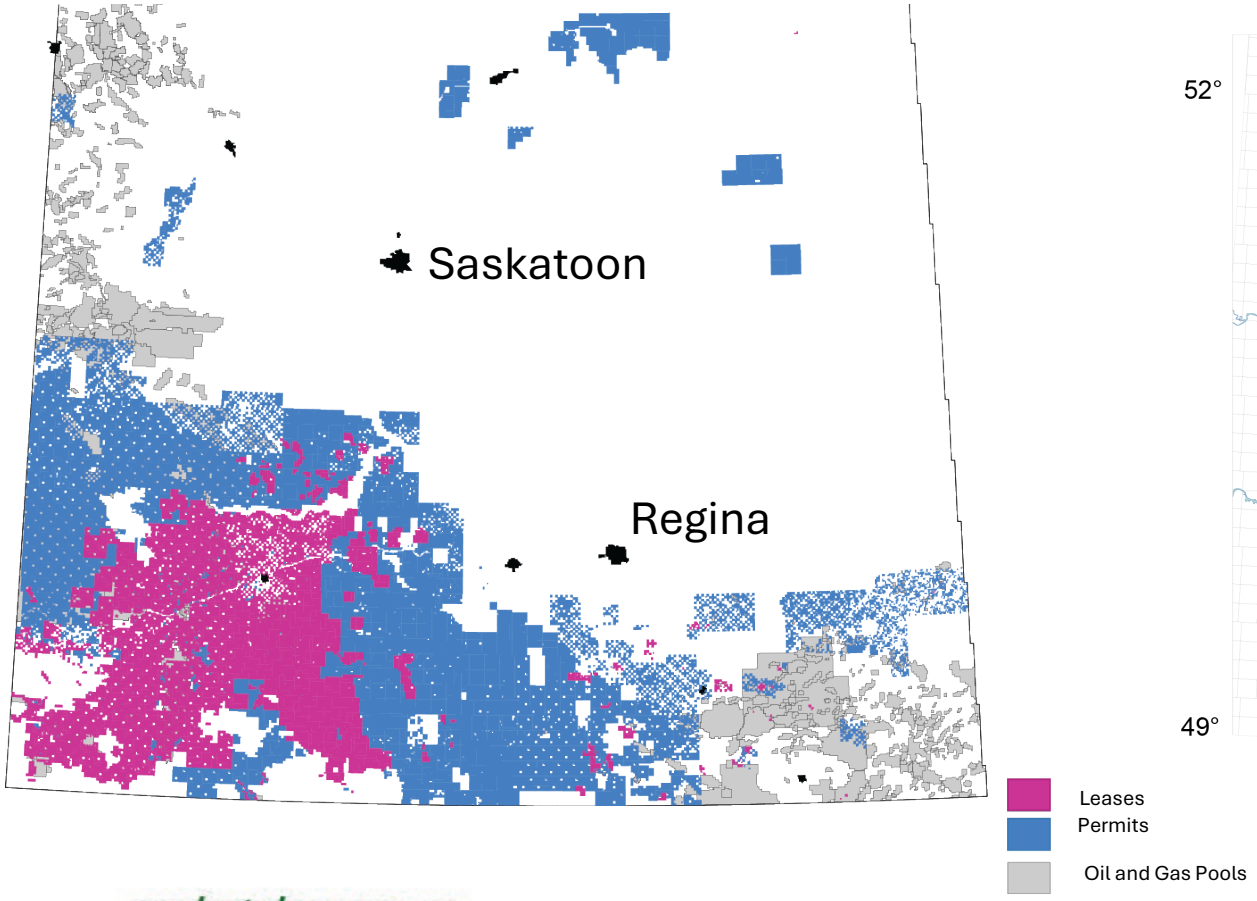
Saskatchewan's Storage Landscape

Gavin K. S. Jensen M.Sc., P. Geo., FGC
Saskatchewan Geological Survey

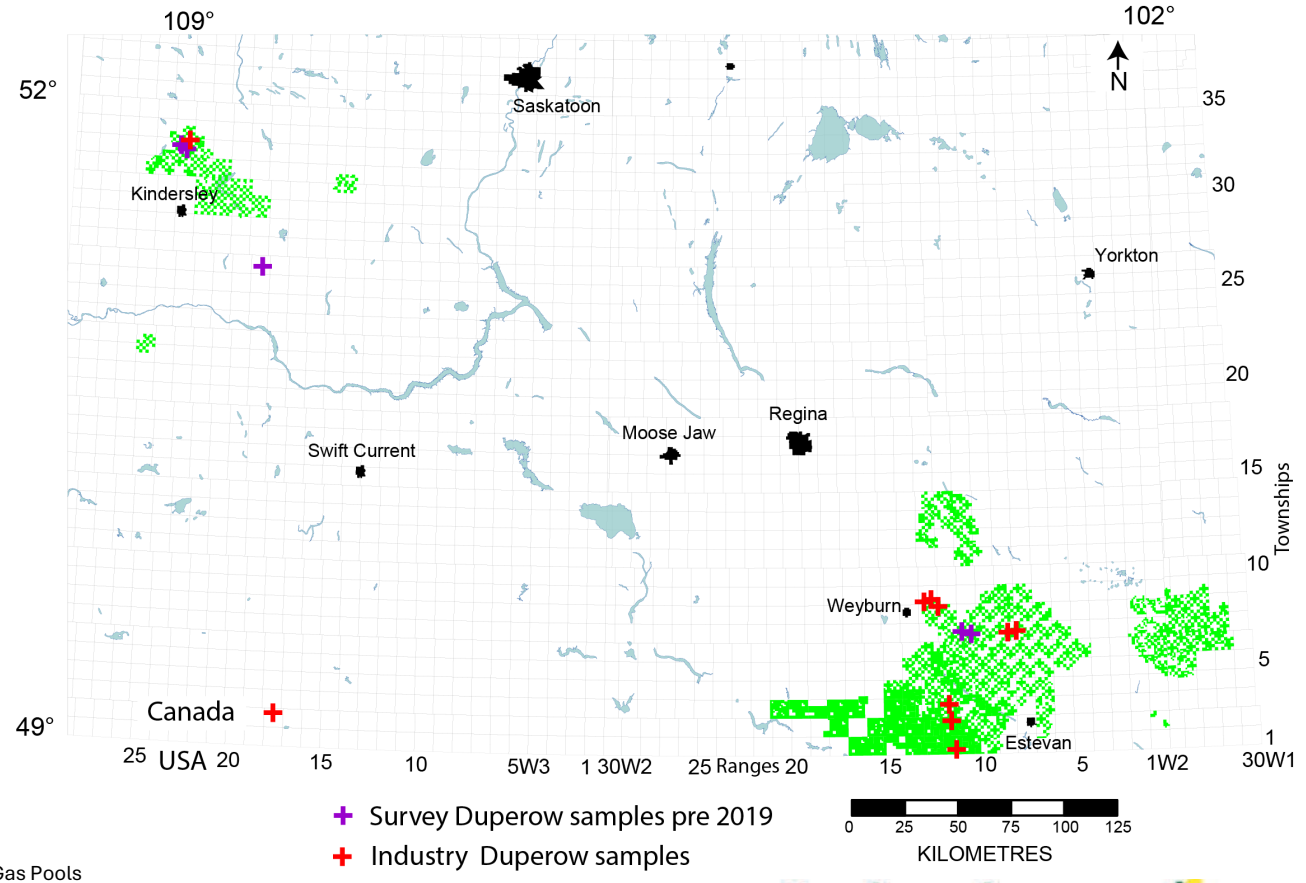
Saskatchewan: Prairie Carbon Management Series
September 23 & 24, 2026

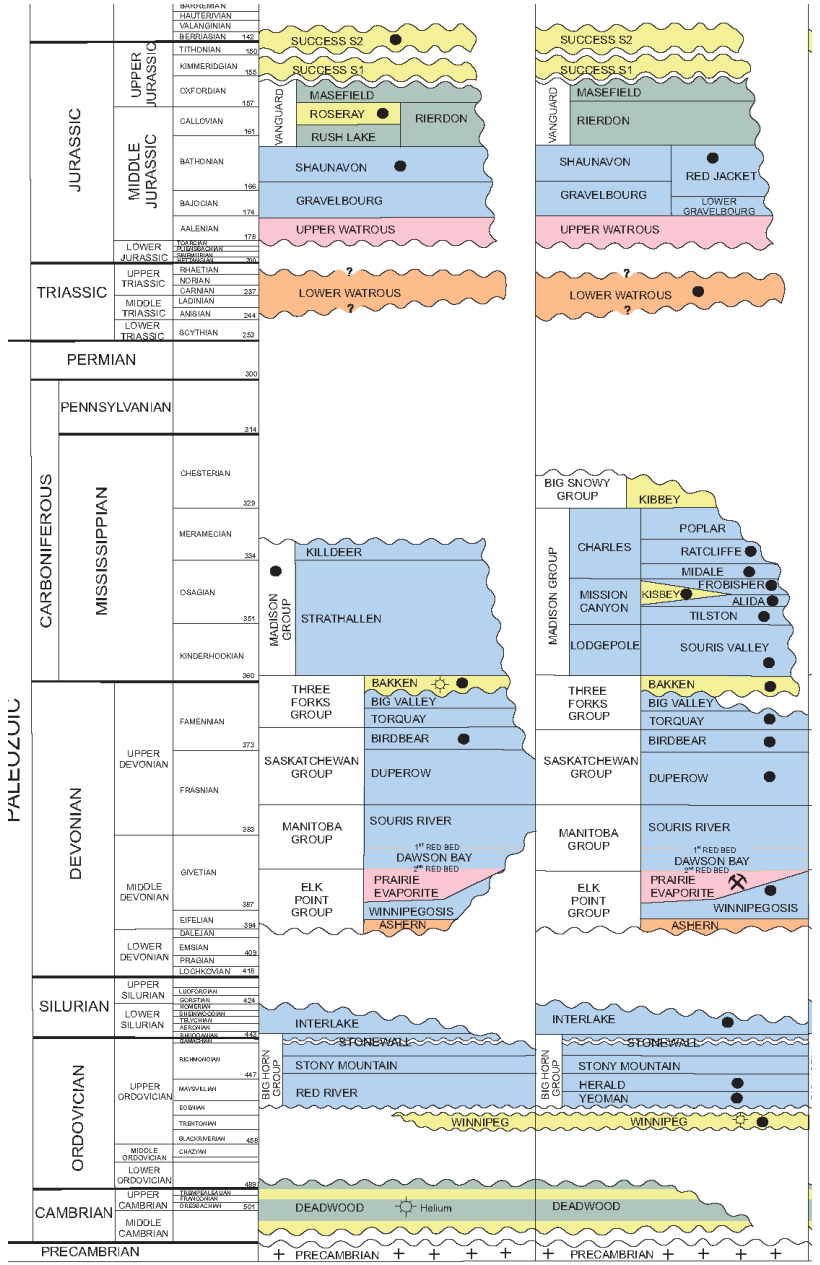
Multiple industries very active: oil, gas, helium, hydrogen & lithium
Competition for pore space

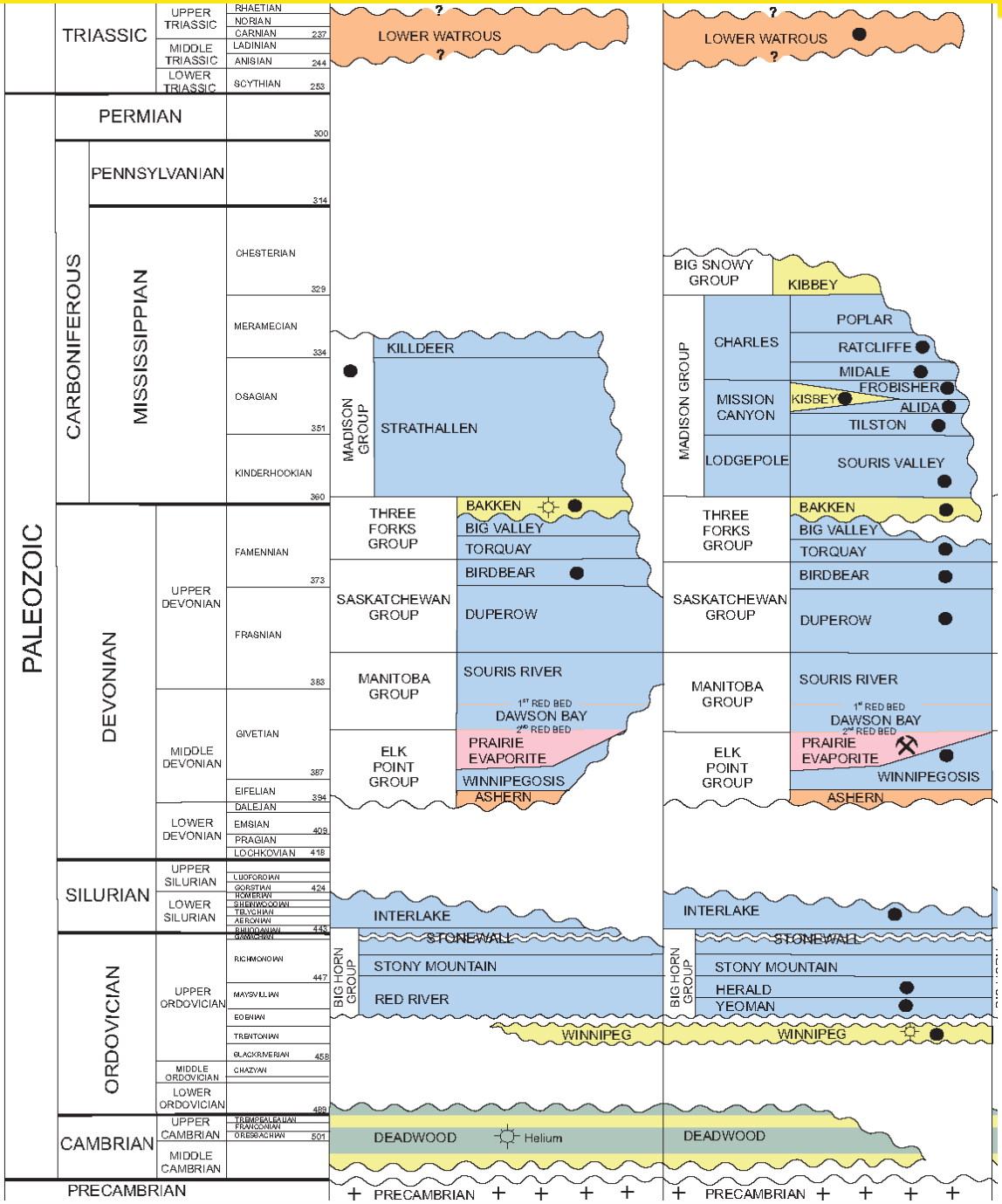
Helium and Associated Gases Leases and Permits



Lithium permits

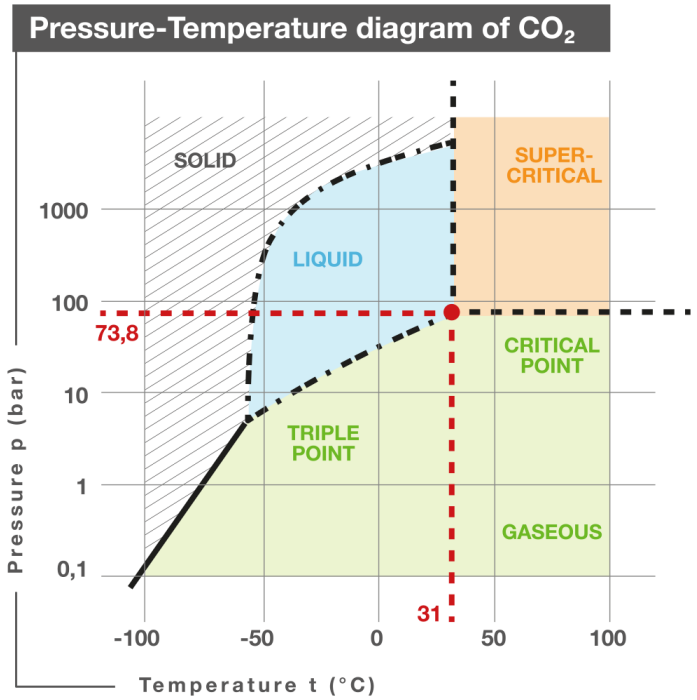


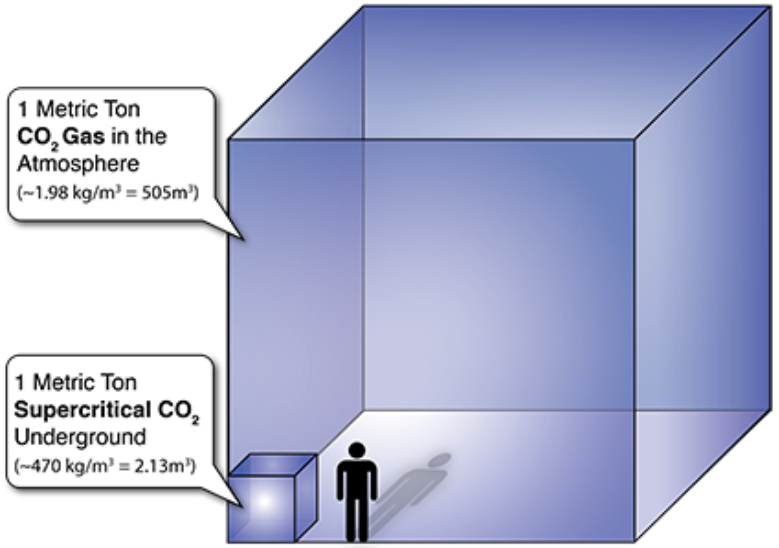

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CARBONIFEROUS
MISSISSIPPIAN
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KILLDEER
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FROBISHER
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BAKKEN
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TORQUAY
SASKATCHEWAN GROUP
BIRDBEAR
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MANITOBA GROUP
SOURIS RIVER
1ST RED BED
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ELK POINT GROUP
PRAIRIE EVAPORITE
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Helium
PRECAMBRIAN

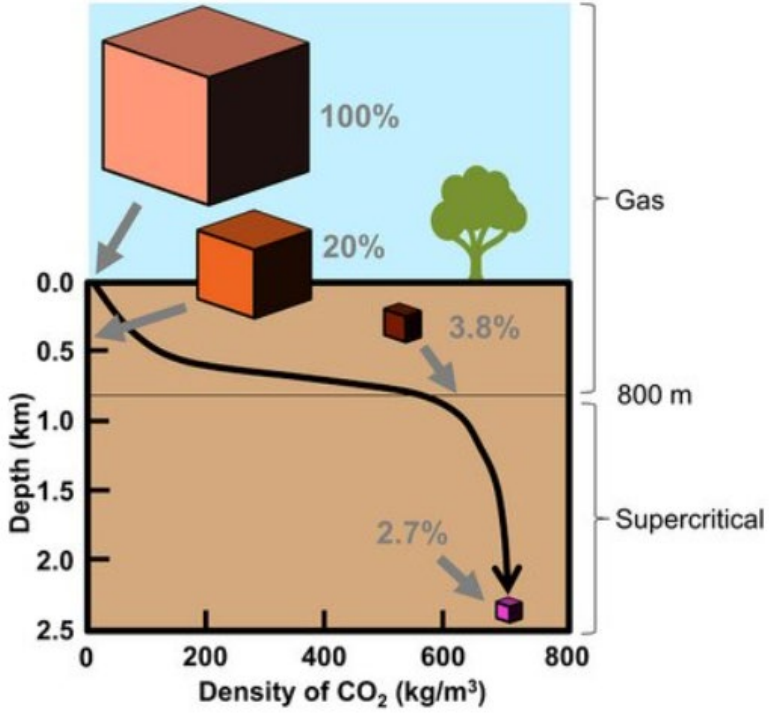

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Helium
PRECAMBRIAN

What is Super Critical CO_2?

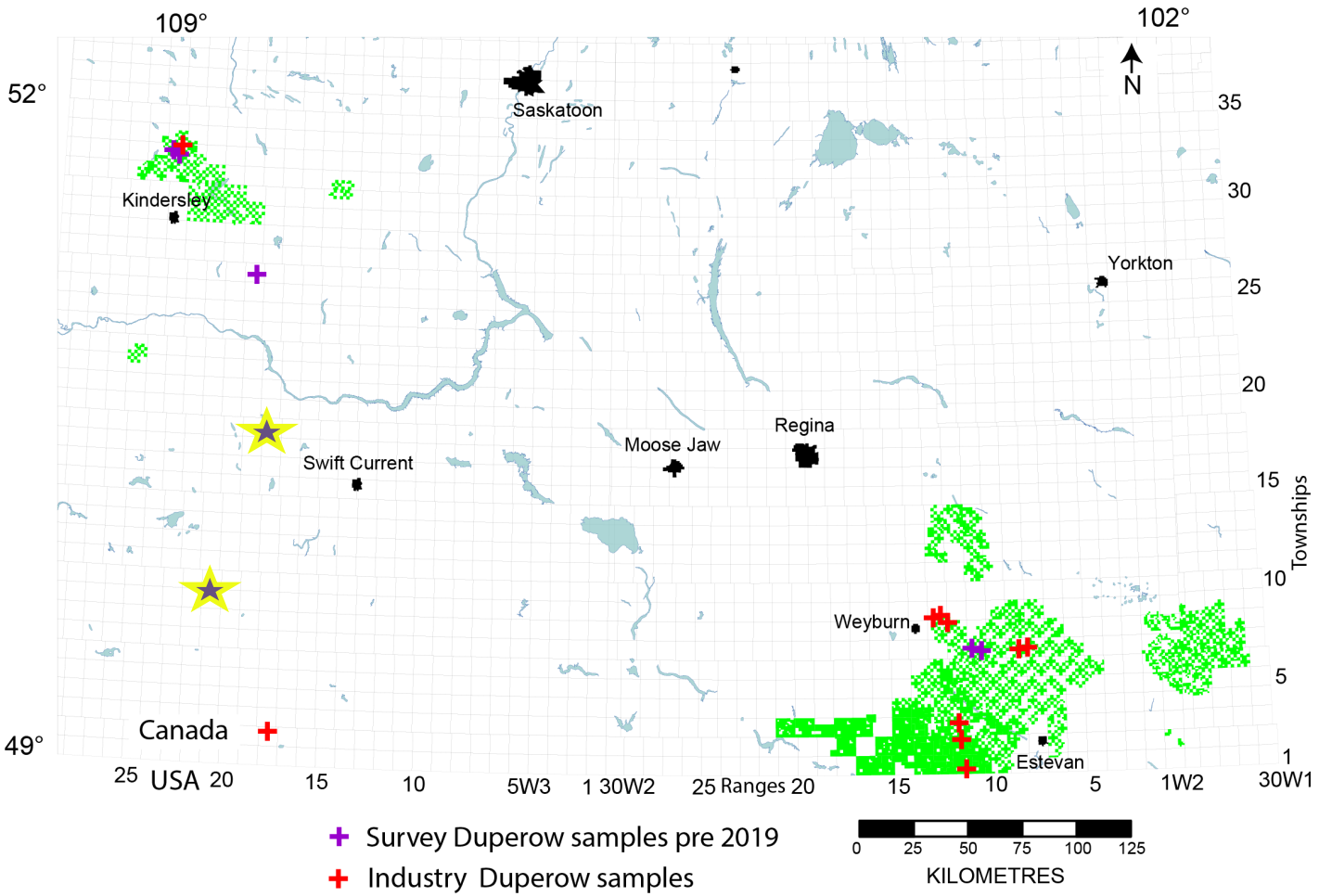
- If the temperature and pressure are both increased to be at or above the critical point for carbon dioxide, it can adopt properties midway between a gas and a liquid.
- Temperature 30.97°C & Pressure 7.3773 MPa, 1,070.0 psi, 73.773 bar
- High purity CO_2 (~95%) needed to reduce pipeline costs & reach super critical state at 31°C



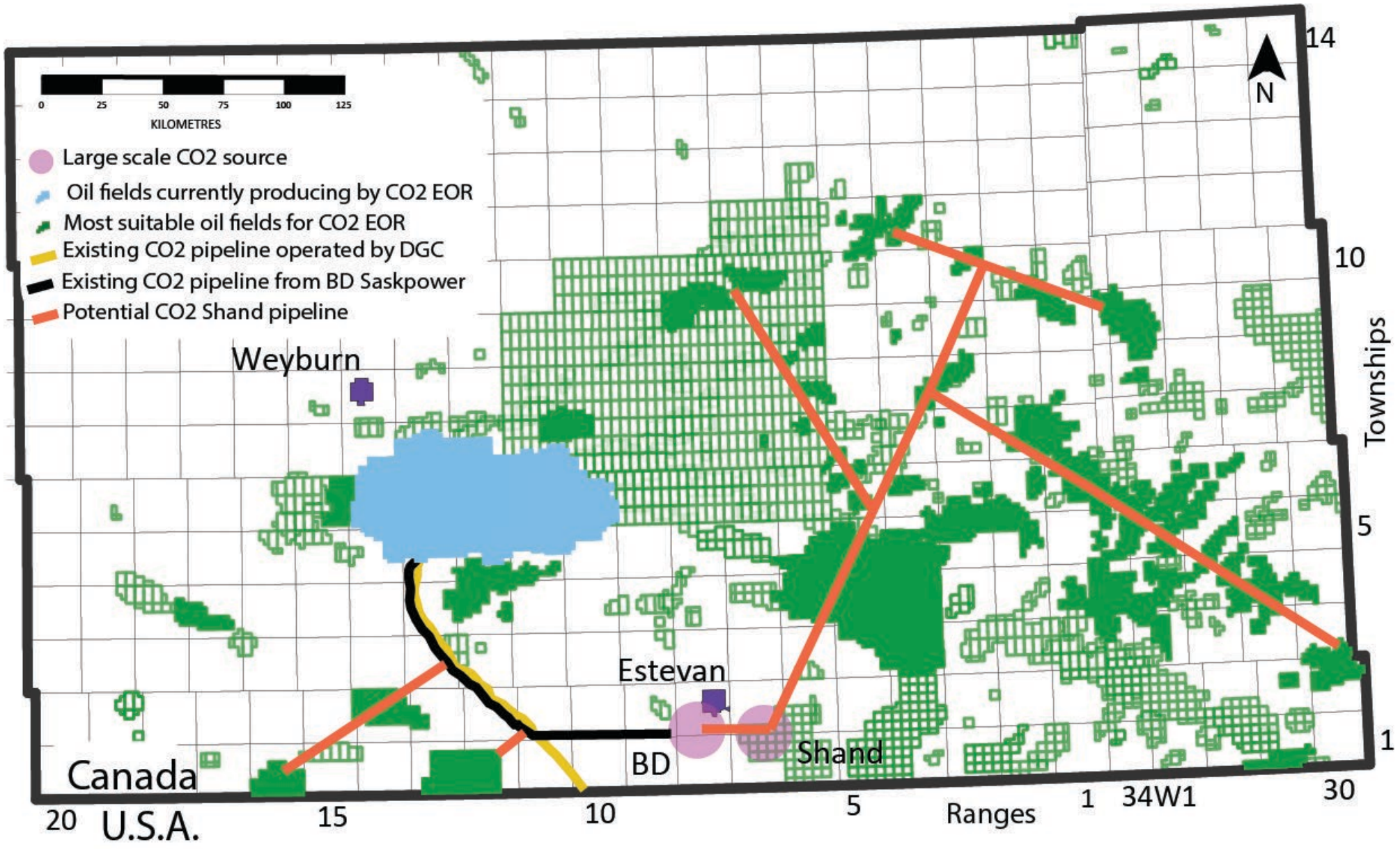




Shaunavon & Roseray pools in SW Saskatchewan meet the super critical CO2 state. Above the helium producing formations



Potential Future of CO_2 EOR SE Sask, 31 pools met criteria



Potential CO_2 EOR in Southeastern Saskatchewan

- The depleted **Mississippian** oil fields in southeastern Saskatchewan represent a large untapped resource of oil that could be recovered by miscible CO_2 flooding, **773 million barrels of oil.** Recovery factor similar to that of the Weyburn/Midale fields, which is a 15% increase in oil production (OOIP).

- This reservoirs could also act as a storage sink for the injected CO2, **250 Million tonnes of CO2**

- The unconventional fields (Bakken) in southeastern Saskatchewan present an even larger resource however more research is needed to better understand the potential recovery factor from these fields.

- This represents decades of sustained economic development for the province of Saskatchewan.

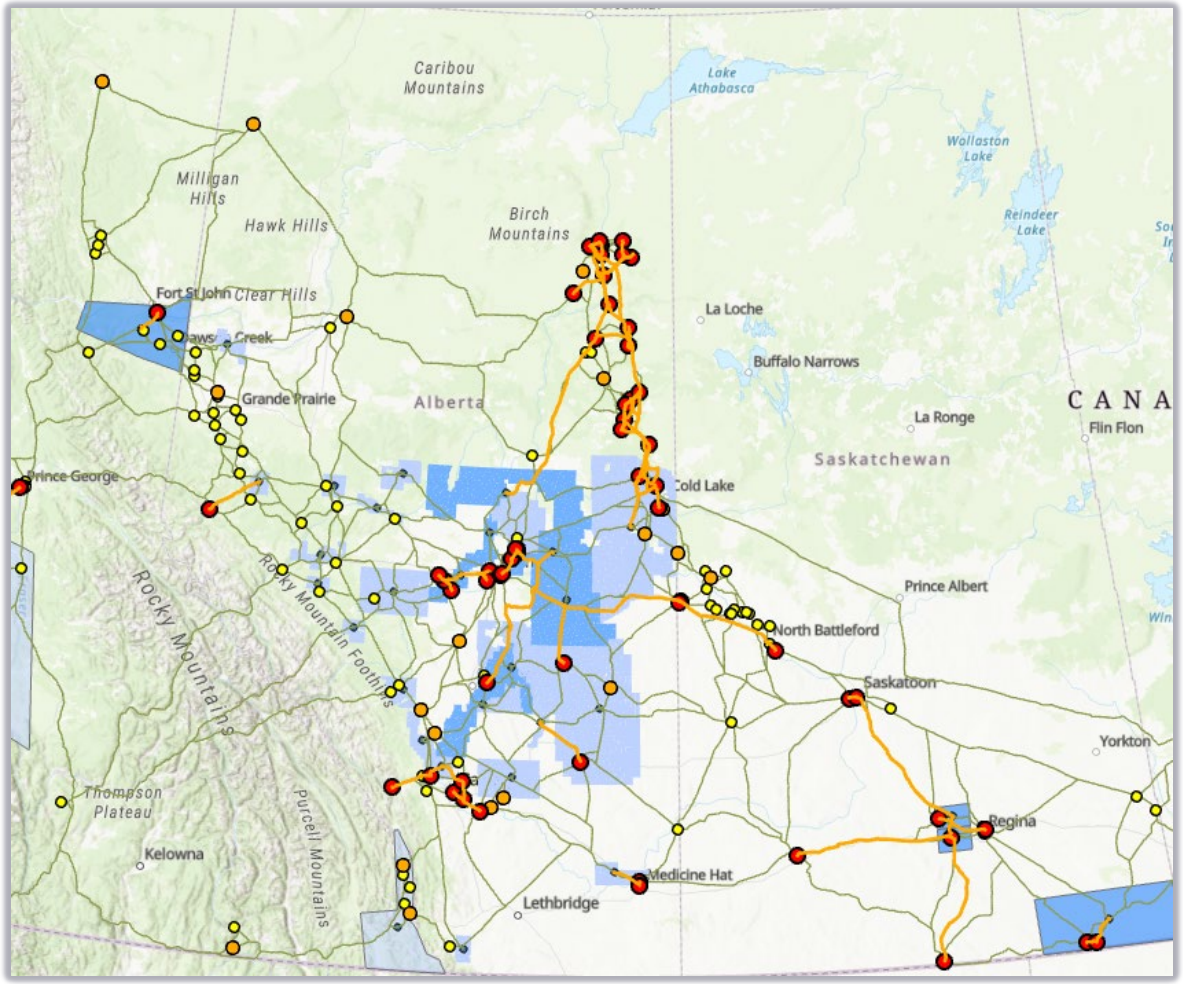
National CCUS Assessment Framework (NCAF)

Scenario analysis:
- Optimize for cost, GHG reductions, location
- Impact of policy levers (e.g. carbon price)

Infrastructure planning: Informed scale-up over time, across jurisdictions

Decarbonization economics: Trade benefits of decarbonization for specific sectors under different conditions

Behind the scenes:
- A **multiperiod, multimodal optimization model** balances cost, volume, and timing
- A **custom algorithm** solves large problems in **minutes**, enabling rapid iteration



emitters
gold lines are optimal pipeline routes
blue polygons are CO_2 storage reservoirs

Lessons Learned from the Weyburn Midal and Aquistore Projects: Beyond the technical

Erik Nickel, M.Sc., P.Geo.

President and CEO

PTRC Sustainable Energy

ptrc Sustainable Energy

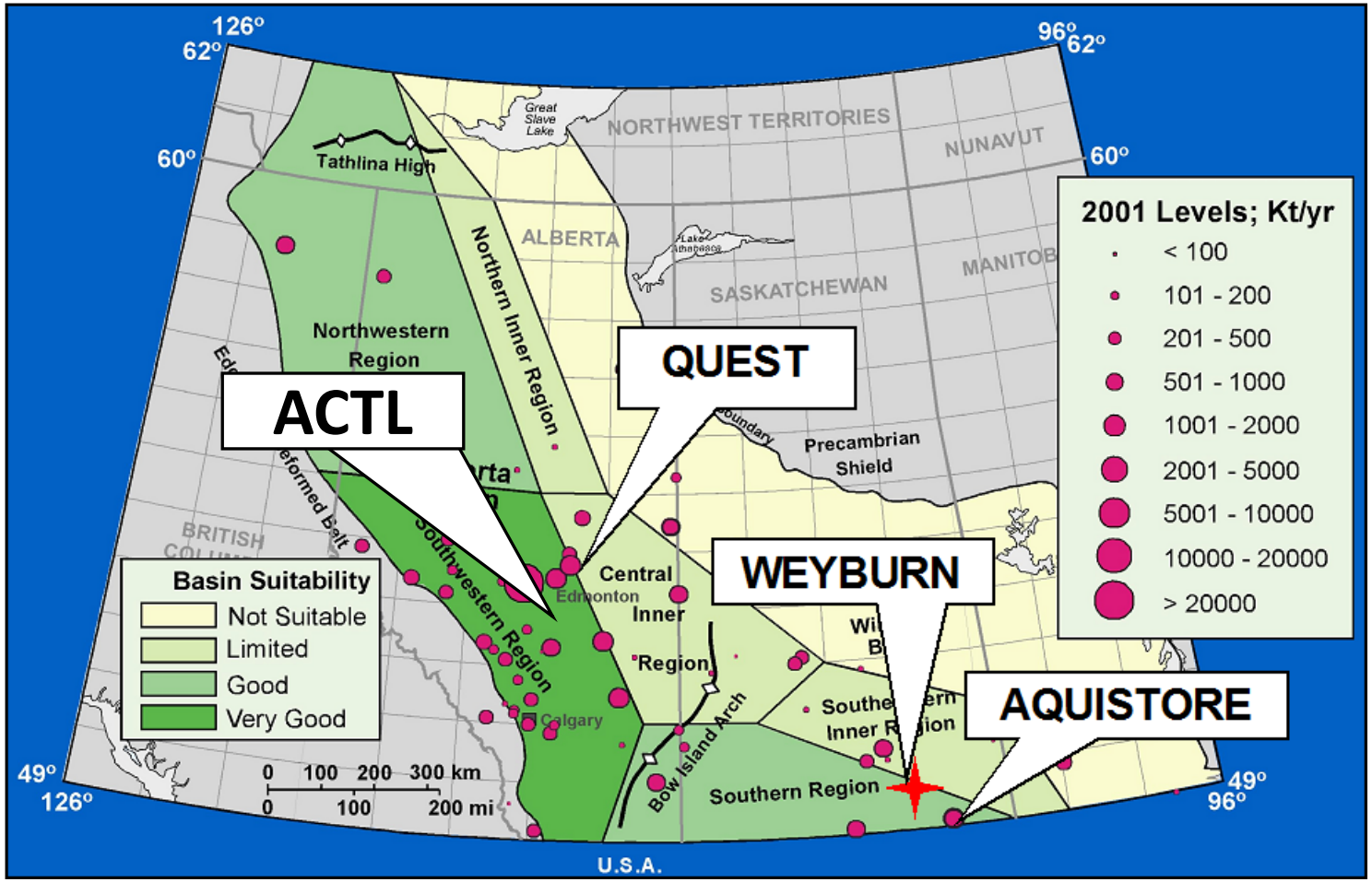
Progressive Aboriginal RELATIONS COMMITTED

Canadian Council for Aboriginal Business

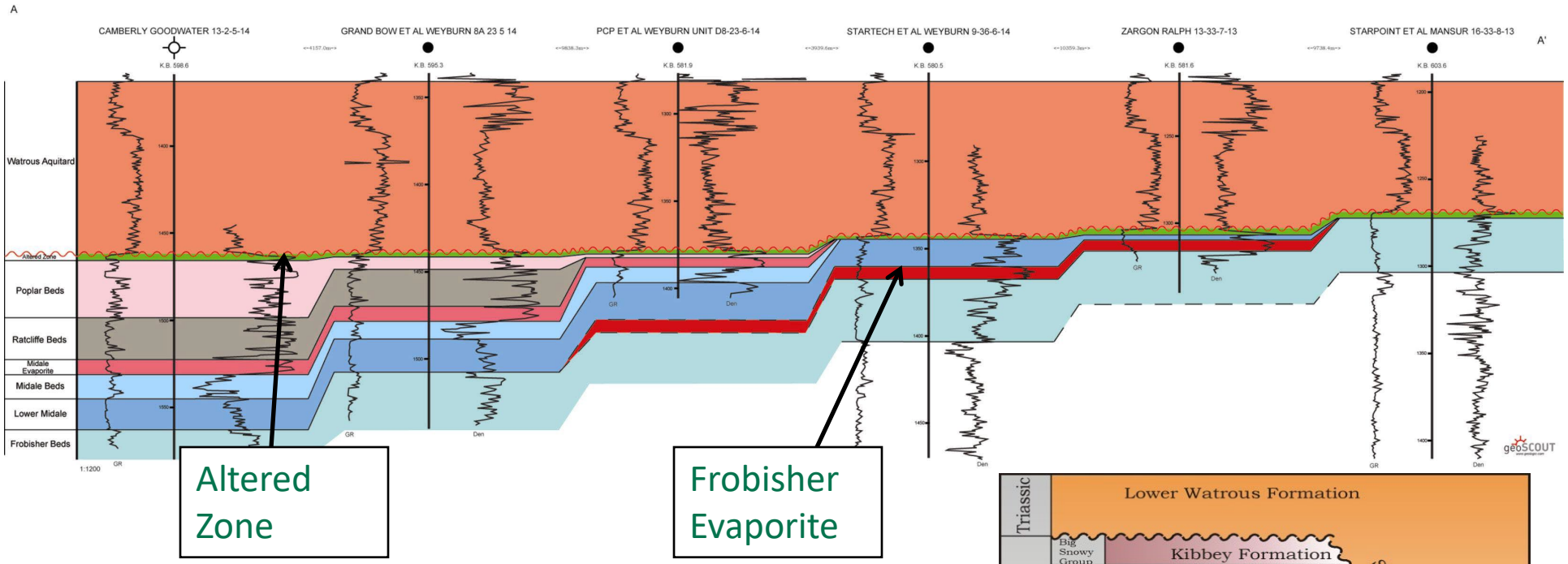
Outline

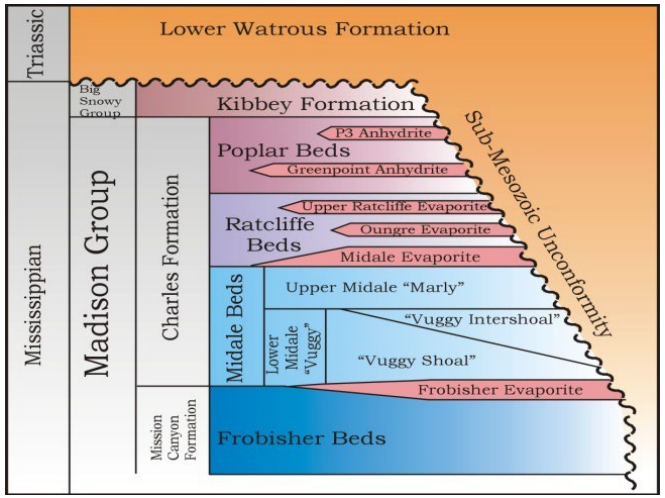
- Why Saskatchewan and the PTRC?
- The Weyburn Project
  - Background and “The Themes”
  - CO2 EOR vs CCUS in the early days
  - Research Themes and why they were chosen
- The Aquistore Project
  - Background
  - MMV testing supersite
  - Vision for CCUS in the future

***What makes a CO2 EOR Project or CO2 disposal site into a CCUS project?**



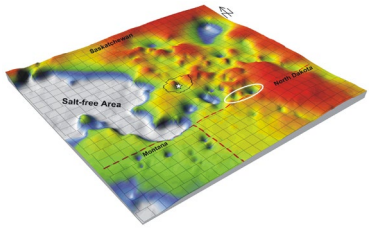
Theme 1: Geological Characterization

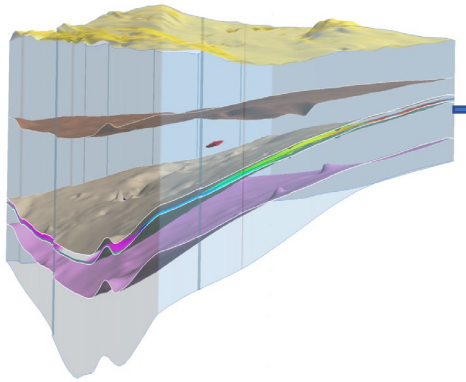


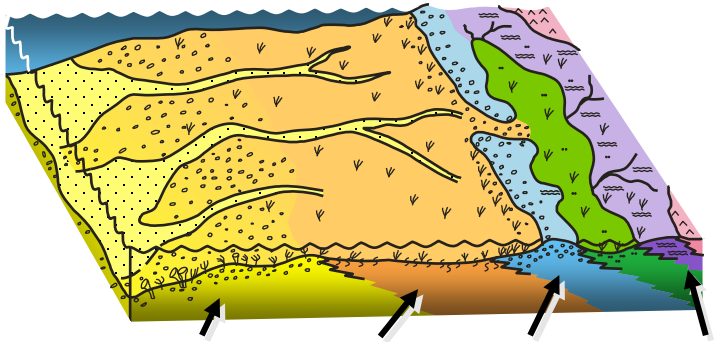


- **Completed at many scales, from maps 100km across, to microscopic datasets**
- **Designed to get the best possible understanding of the area to better understand Risks and the MMV systems to mitigate them**
- **Early days of 3D models and simulation with basic geology as above feeding into more complex modelling**

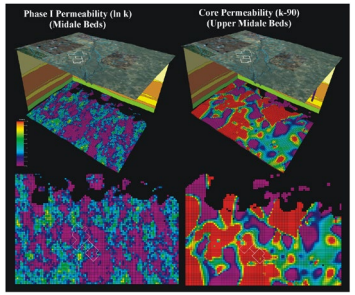
Theme 1: Geological Characterization

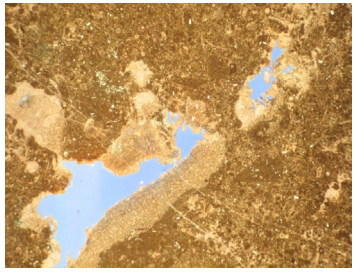


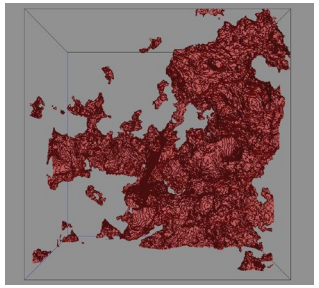




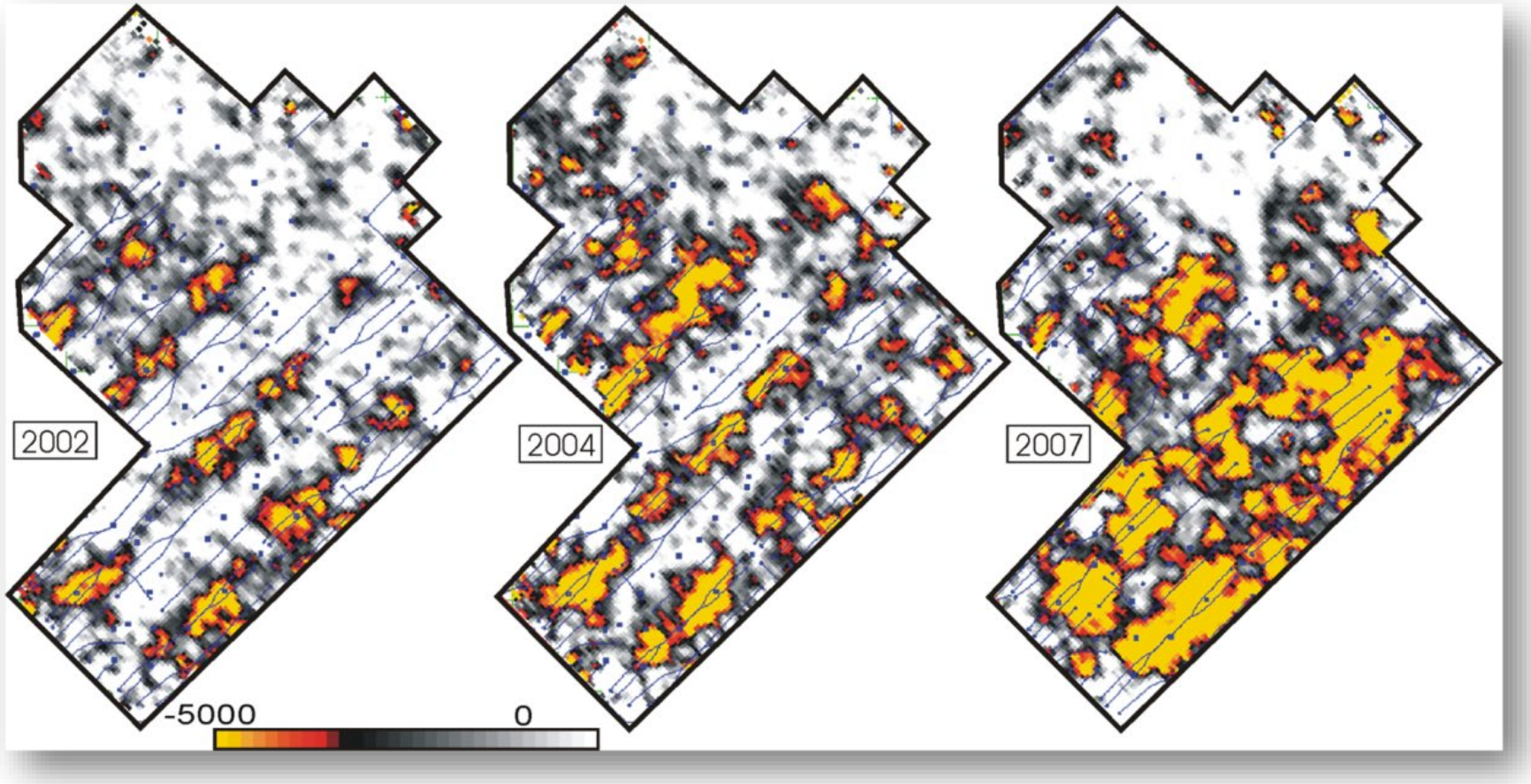
Varying **scales** and types of investigation to arrive at something close to the truth







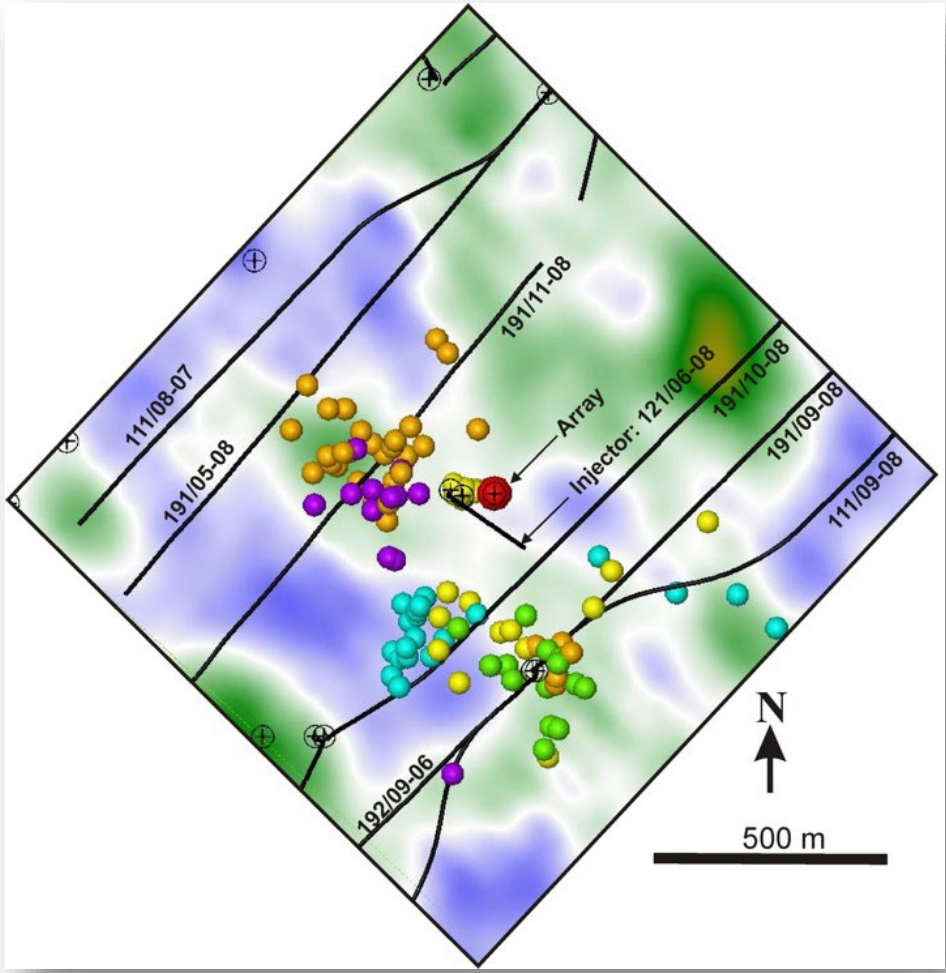
Theme 2: Prediction and Verification of CO Movement



- Some of the most important work to come out of the WMP
- Gave confidence to modellers, operators and regulators as to the conformance of CO2.
- Also included an extensive chemical monitoring program that could predict CO2 “breakthrough at production wells. Continues on to this day.

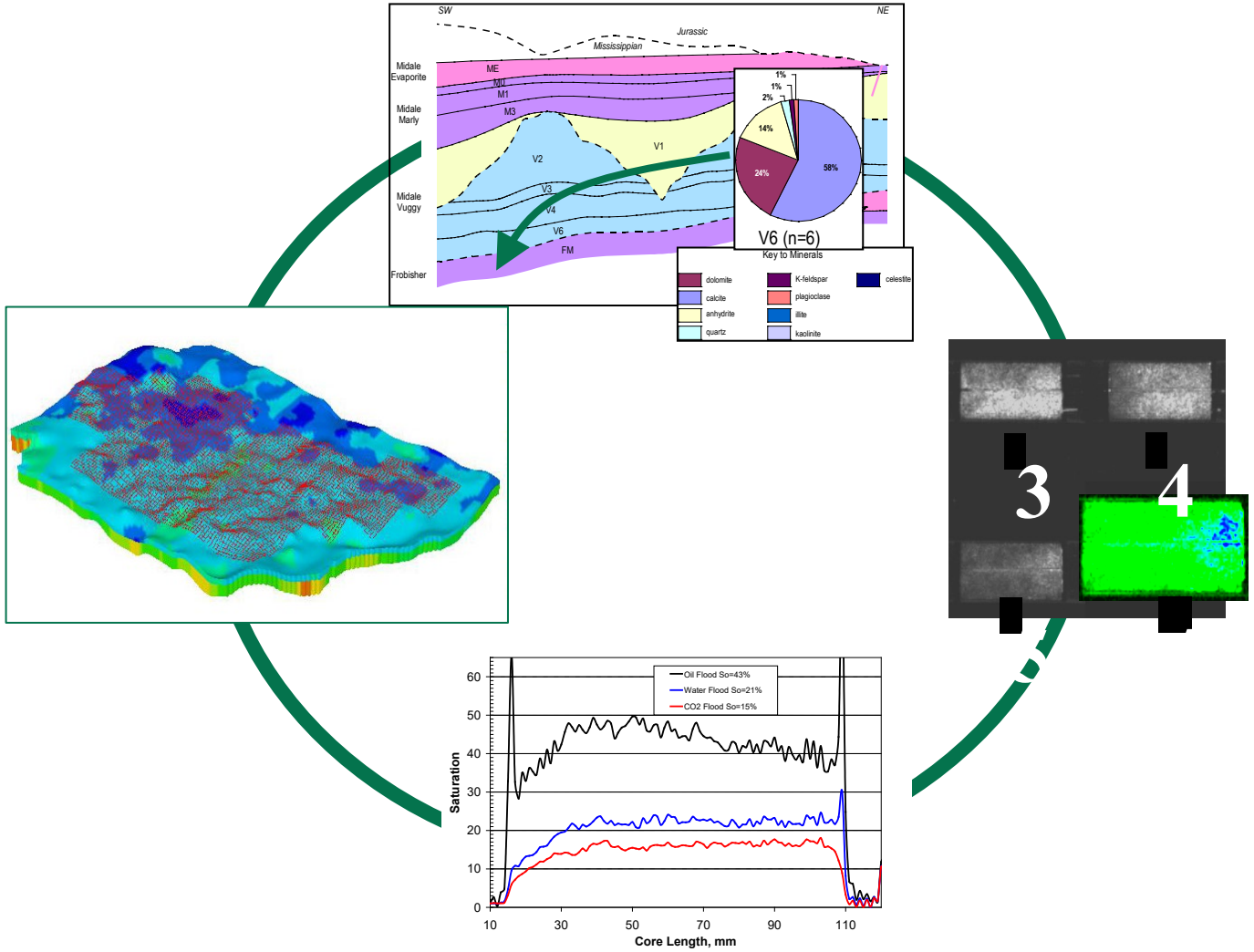
Theme 2: Prediction and Verification of CO Movement

- Early days of Passive Seismic monitoring
- In use not only for regulator, but operationally as well.
- Found that water injection moreso than CO2 injection in the WAG system caused more events.



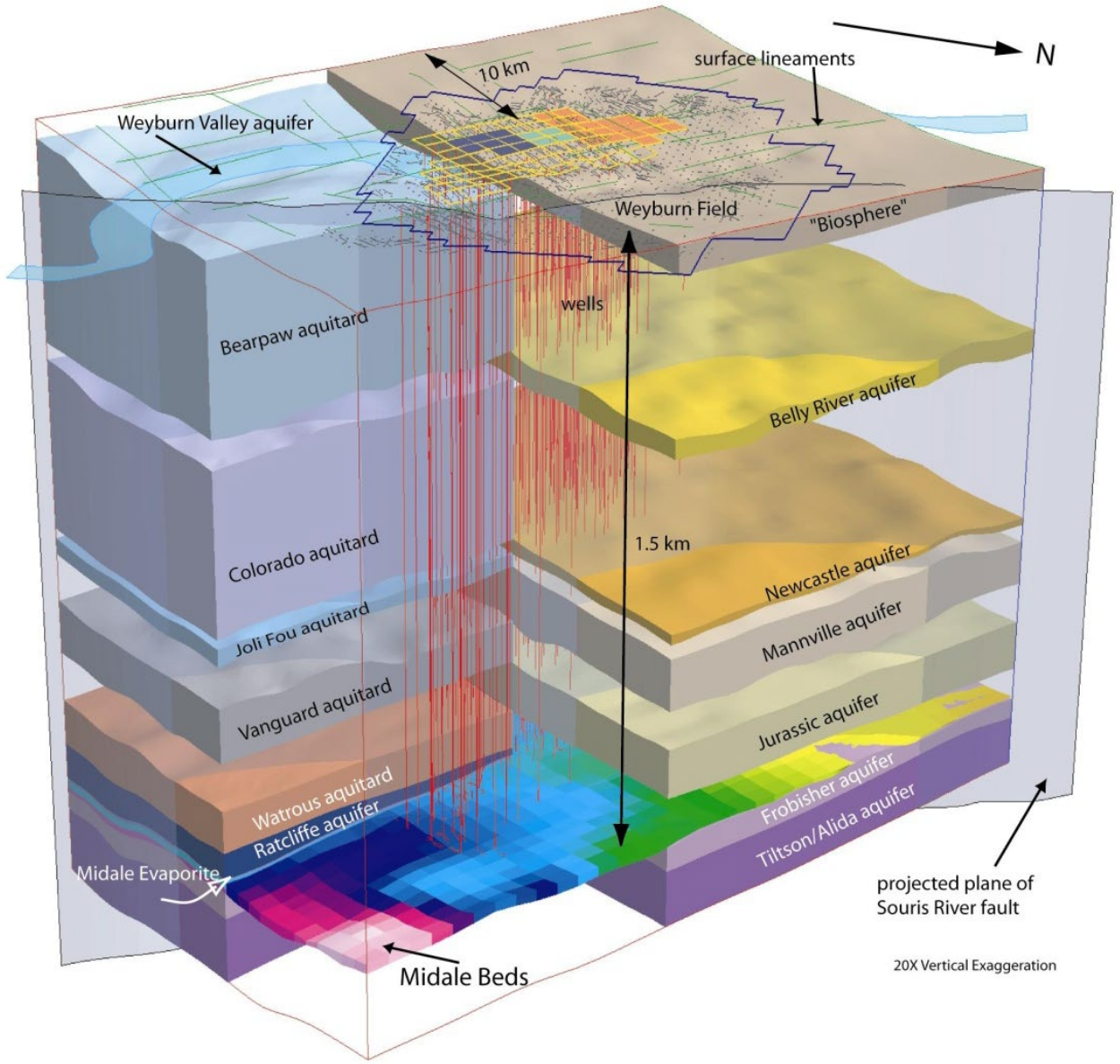
Theme 3: CO2 Storage Capacity and distribution predictions and the application of economic limits.

- Early days of 3D simulations
- Workflow Geology-Coreflood-Analyses-Simulation
- Determining not only CO2 storage capacities, but also the economics of CO2 EOR.
- Things like grid size and modelling algorithms were relatively unknown, and this set the stage for the standards of modelling and simulations to come



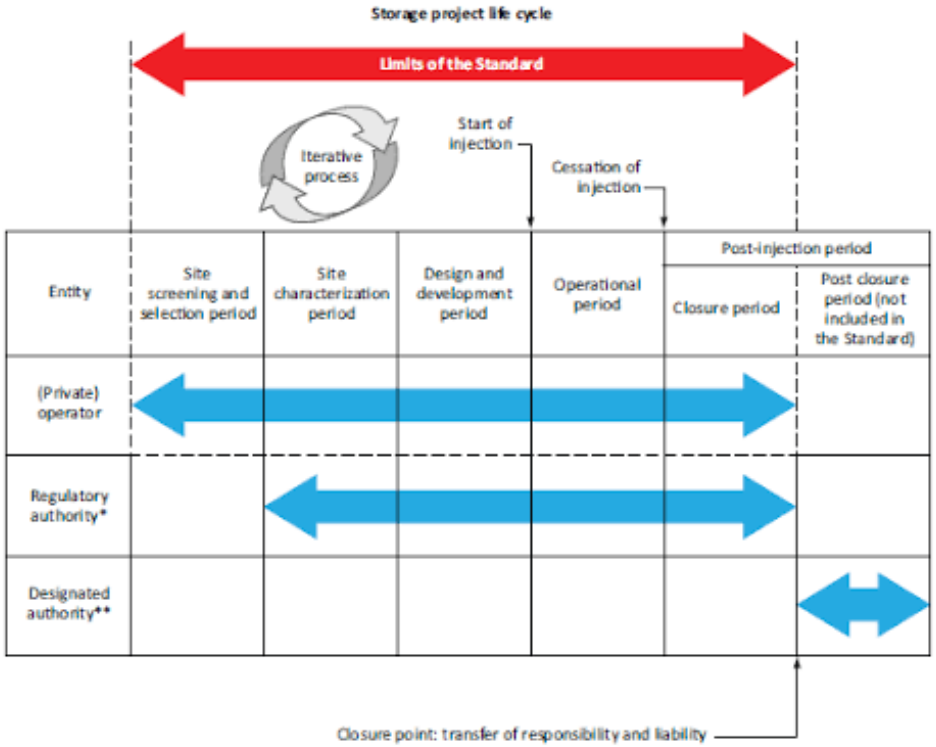
Theme 4: Long-term risk Assessment of the Storage Site

- Comprehensive and systematic evaluation of Risks in the EOR/Storage of CO2 at Weyburn
- Determination of the long-term fate of CO2 in the reservoir.
- Takes into account geology, production operations, CO2 movement, wellbore integrity and many other factors.



The Non-technical Results of the Weyburn Project

- Development of HQPs.
  - Being a new technology in the early 00's, there were few CCUS "Experts"… we created them.
- Because this was one of the few real projects in the world, many of the researchers helped to author the CSA Z741 standards for CO2 storage.
  - Became the basis for the ISO Standards
- First hand experience with "crisis communications" around CO2 storage



This Standard acknowledges that permitting/approval by regulatory authorities will be required, throughout the project life cycle, through the closure period, in order for a project to proceed through the project life cycle. The permitting process is not included in the standard.

†*In some cases, the designated authority might be the same as the regulatory authority.*

When the Project Story Stops Being about Your Project

The Case of Accusations of a Leak at Weyburn-Midale

BREAKING ENVIRONMENTAL NEWS

The Canadian Press - ONLINE EDITION

Land fizzing like soda pop: farmer says CO2 injected underground is leaking

THE TYEE

B.C.'S HOME FOR NEWS, CULTURE AND SOLUTIONS

Pfffft Goes Promise of Pumping Co2 Underground

Farmers say high profile carbon sequestration experiment is a bubbling, dangerous failure.

By Andrew Nikiforuk, 12 Jan 2011, TheTyee.ca

'Fizzing' land sparks fear of carbon storage leak

Global Regina: Tuesday, January 11, 2011

Recommend Be the first of your friends to recommend this.



Gas can be seen bubbling up from a pond on Cameron and Jane Kerr's property.

Photo Credit: Handout, Cameron and Jane Kerr

A Weyburn family is threatening legal action against a Canadian oil company following allegations of leaking carbon dioxide that's destroyed much of their land.

Dead animals, foaming water and unsual algae growths in ponds have been a common sight on Cameron and Jane Kerr's property since 2004. They allege the carbon dioxide is escaping from the world's largest carbon capture storage project, run by enery giant Cenovus.

THE VANCOUVER SUN

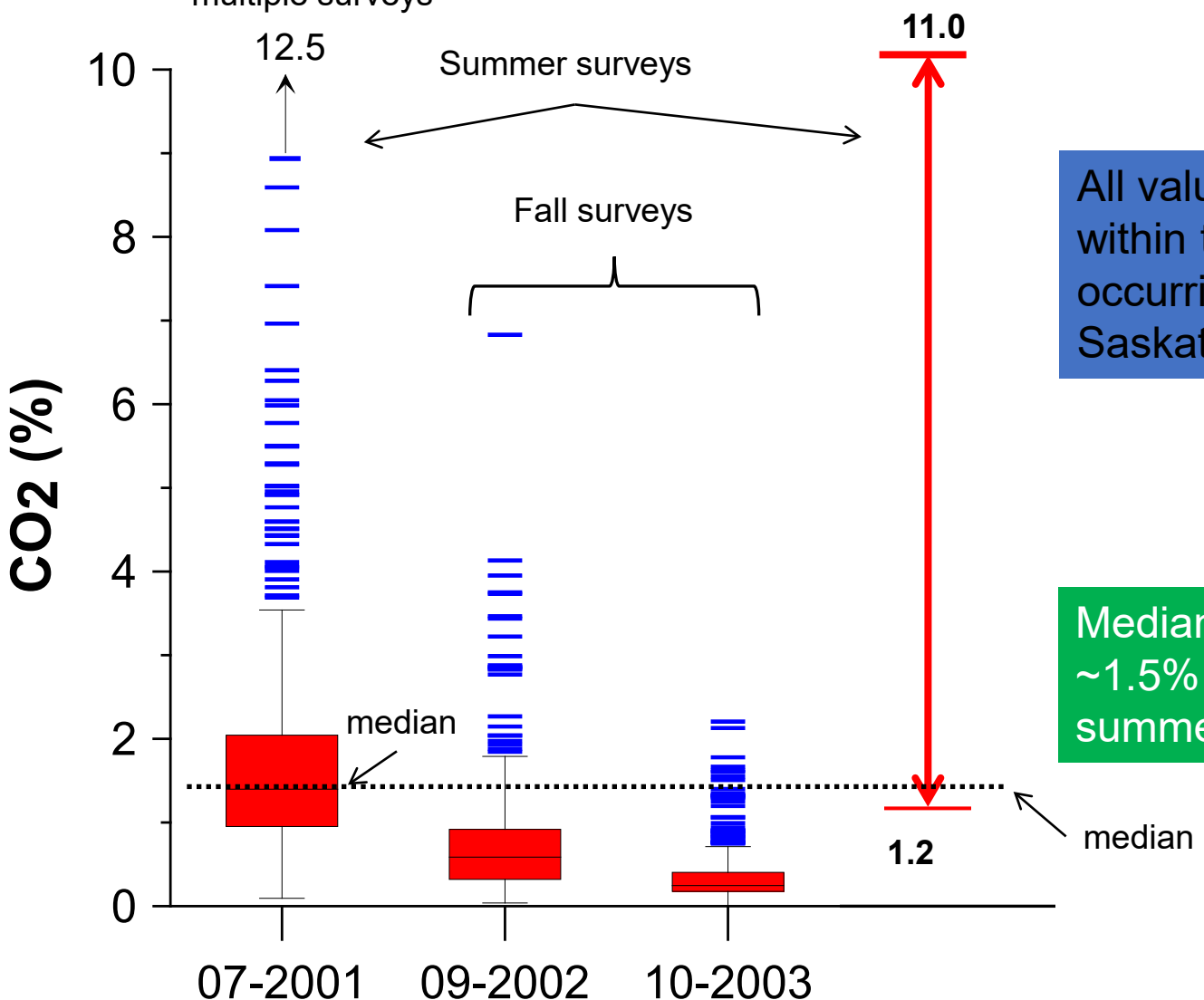
Sask. family claims carbon-capture-and-storage site captured, spewed dead animals

BY BRUCE JOHNSTONE, POSTMEDIA NEWS JANUARY 11, 2011

Soil Gas CO_2

Above Weyburn EOR Area
360 sample locations repeated in multiple surveys

At Kerr Site
26 samples – Summer survey

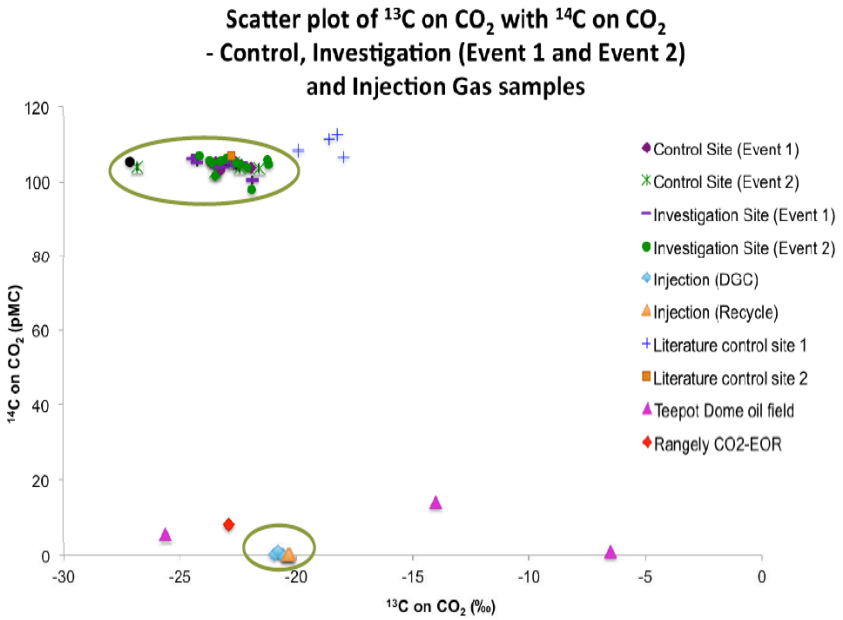


All values at Kerr site are within the range of naturally occurring CO_2 in soils in Saskatchewan

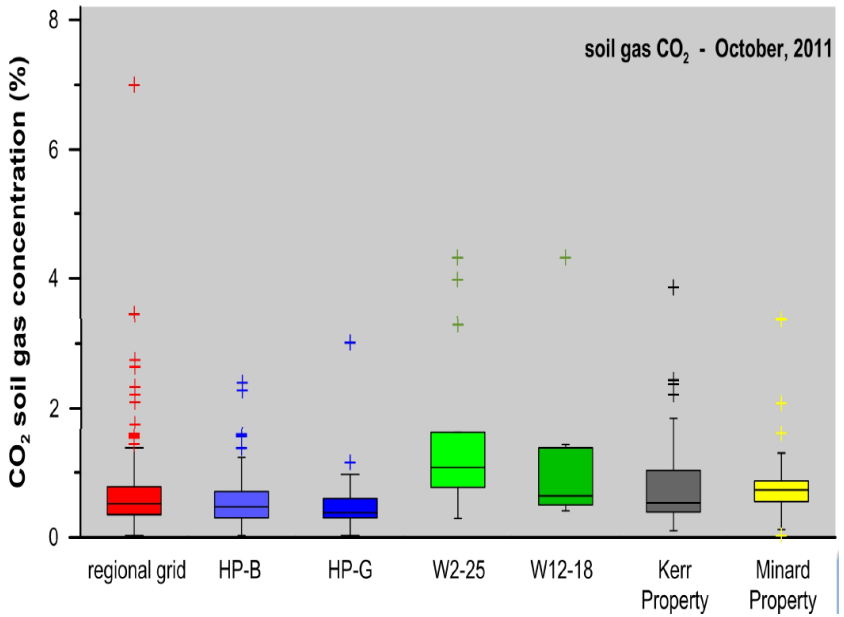
Median value at Kerr site is ~1.5% CO_2 – similar to summer 2001 survey

THE SCIENCE: ADDITIONAL SOIL GAS AND WATER SAMPLING

- Carbon-14 Isotope



- Soil Gas Concentrations



Media after Release of Report

The New York Times

Green

A Blog About Energy and the Environment

January 22, 2011, 8:08 AM

A Carbon Storage Leak? Not So Fast, Experts Caution

By JOHN COLLINS RUDOLF

THE GLOBE AND MAIL

Alleged leaks from carbon storage project questioned

NATHAN VANDERKLIPPE

CALGARY— From Friday's Globe and Mail

Published Thursday, Jan. 13, 2011 7:19PM EST

Last updated Wednesday, Jan. 19, 2011 2:26PM EST

SCIENTIFIC AMERICAN

Experts Criticize Evidence Used to Diagnose a Suspected Leak at One of the World's Largest CO2 Storage Sites

Citing a lack of information, scientists argue a consultant's conclusion that Saskatchewan's Weyburn oil field is leaking greenhouse gas is unfounded

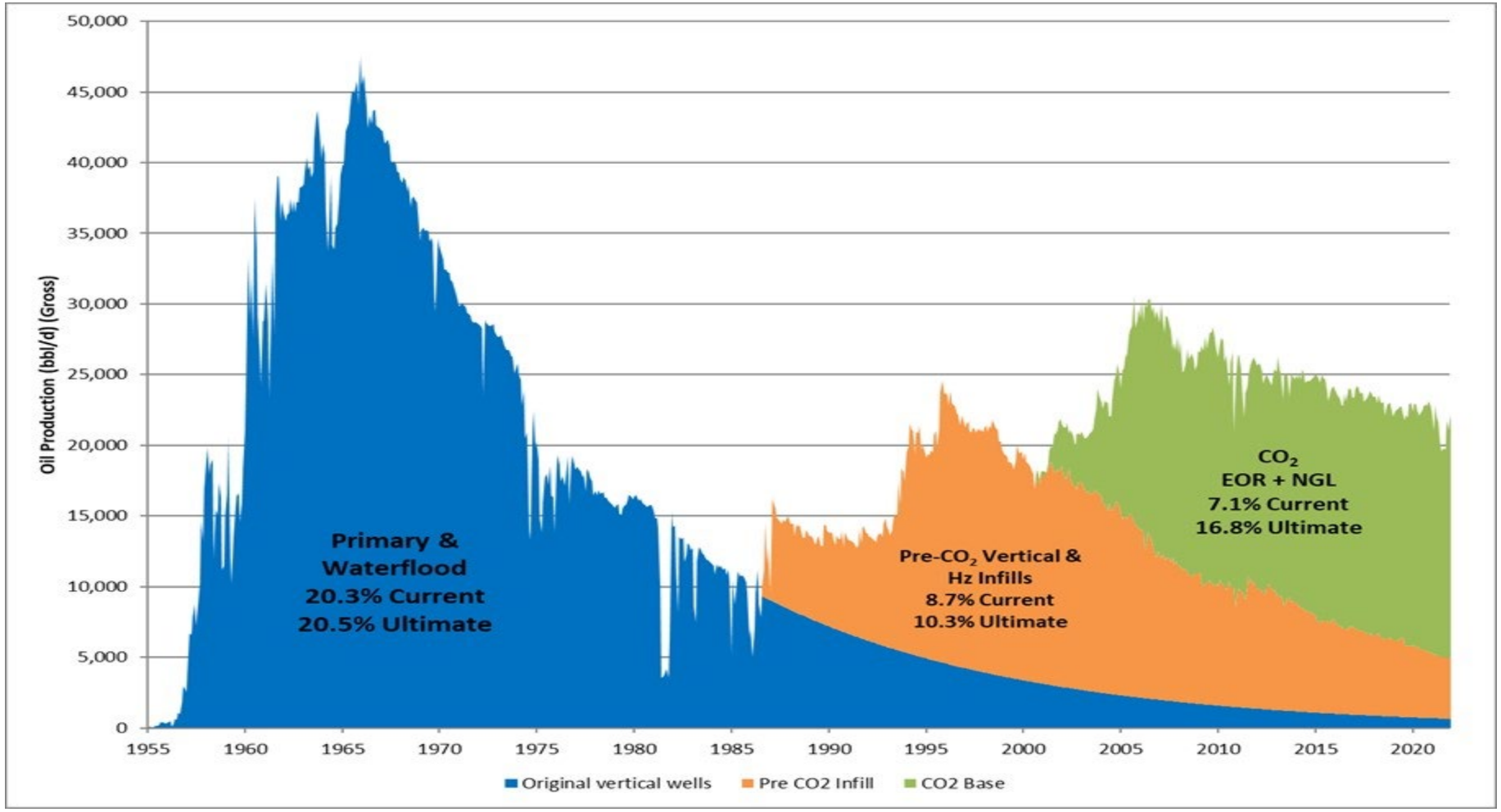
By Mike Orcutt | January 20, 2011 | 17

Saskatchewan researchers deny claim of carbon dioxide leak

THE VANCOUVER SUN

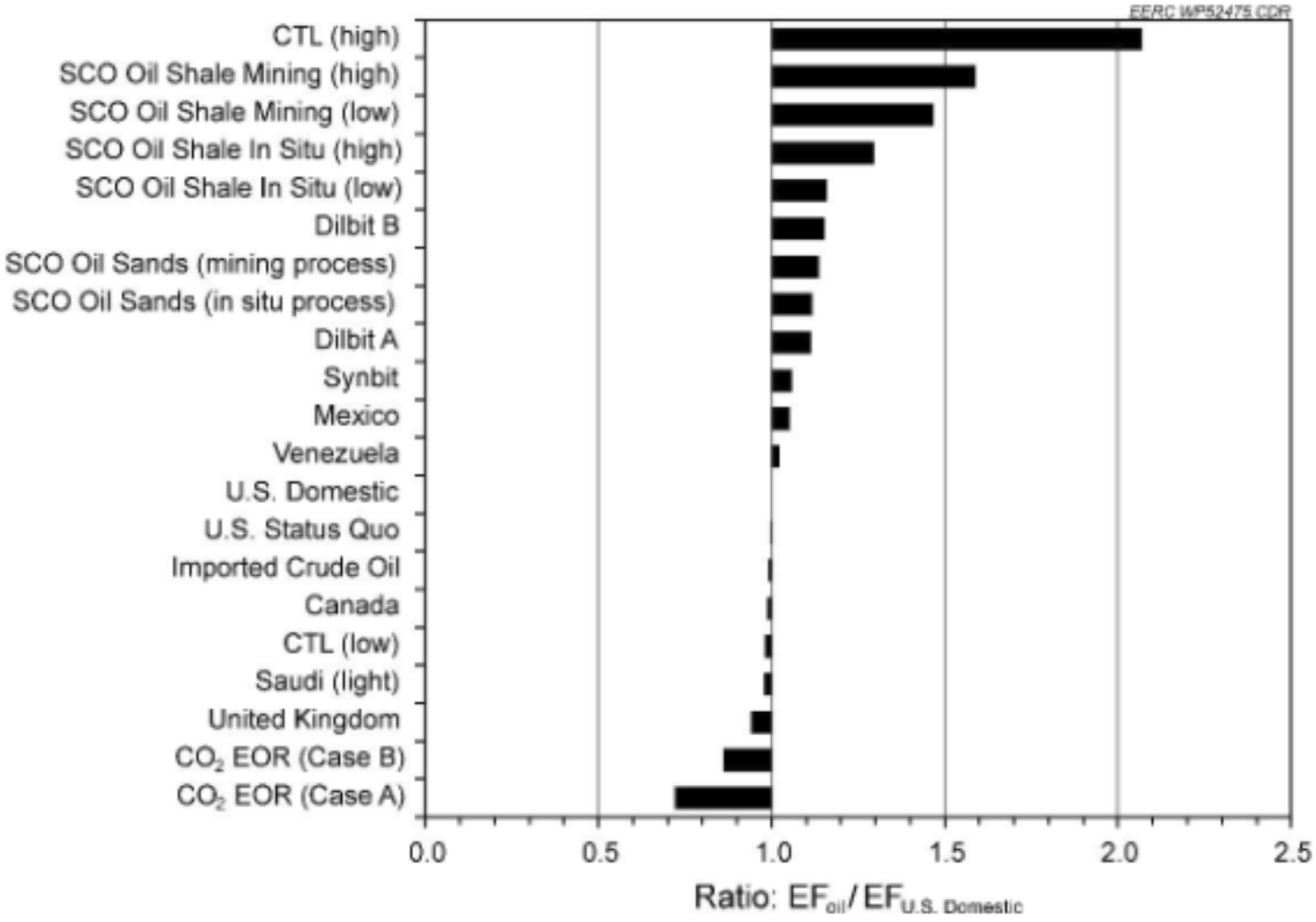
Weyburn Production 1955-2021

Weyburn Incremental Production because of CO_2-EOR



Is this Oil "Green"?

- Lifecycle analysis work done by the EERC in North Dakota
- Essentially because it takes 1 Tonne of CO2 to produce 3 incremental bbls of oil, each bbl has 1/3 less CO2 impact
- Overall emissions intensity decrease



Azzolina et al, 2016

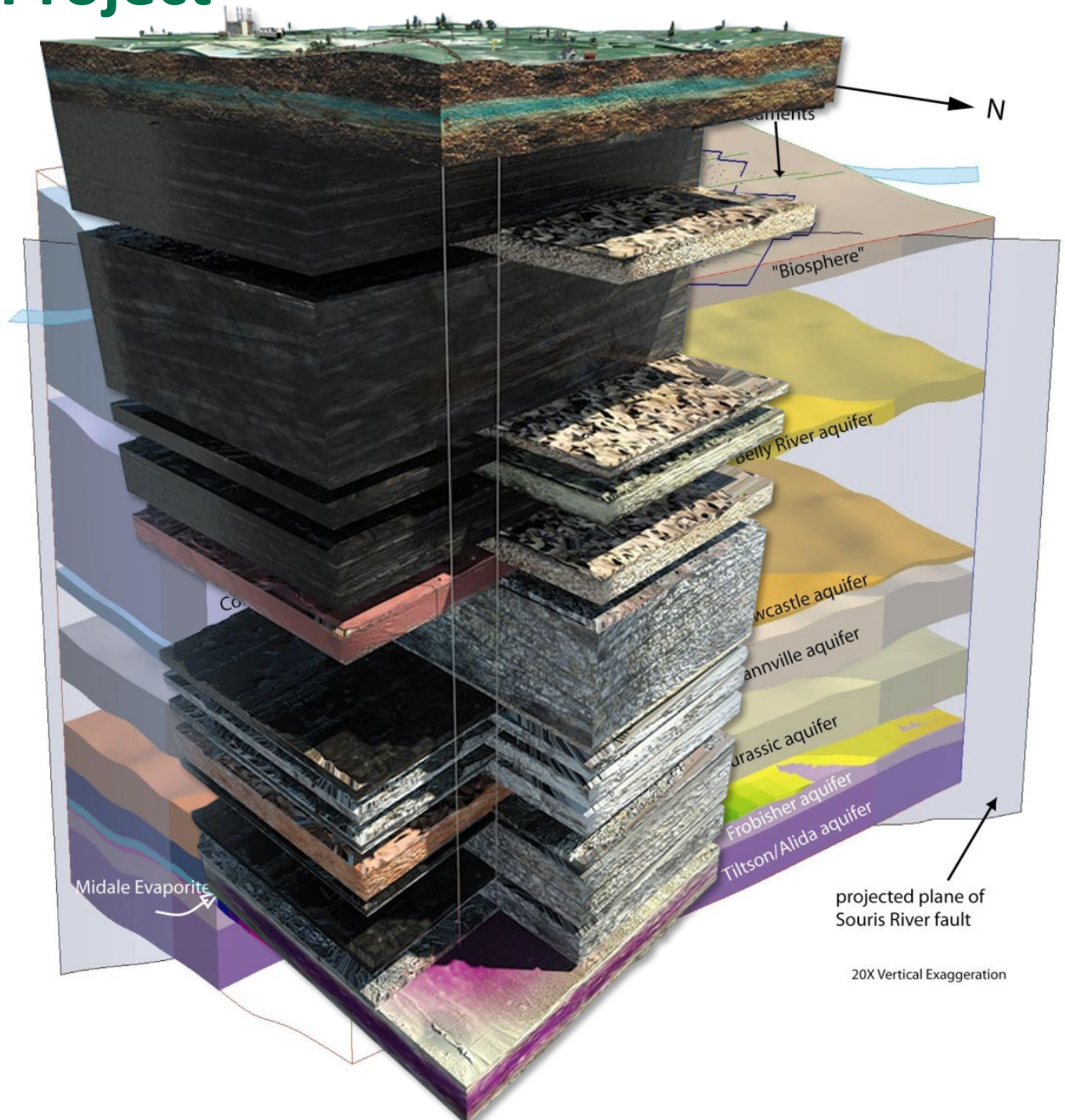
For the full technical overview and other information:



The Aquistore Project

- Taking the learnings, the knowledge, and even the people, and applying it all to the problem of long term deep saline Aquifer Storage.
- Enter New Partners and new goals!

SaskPower



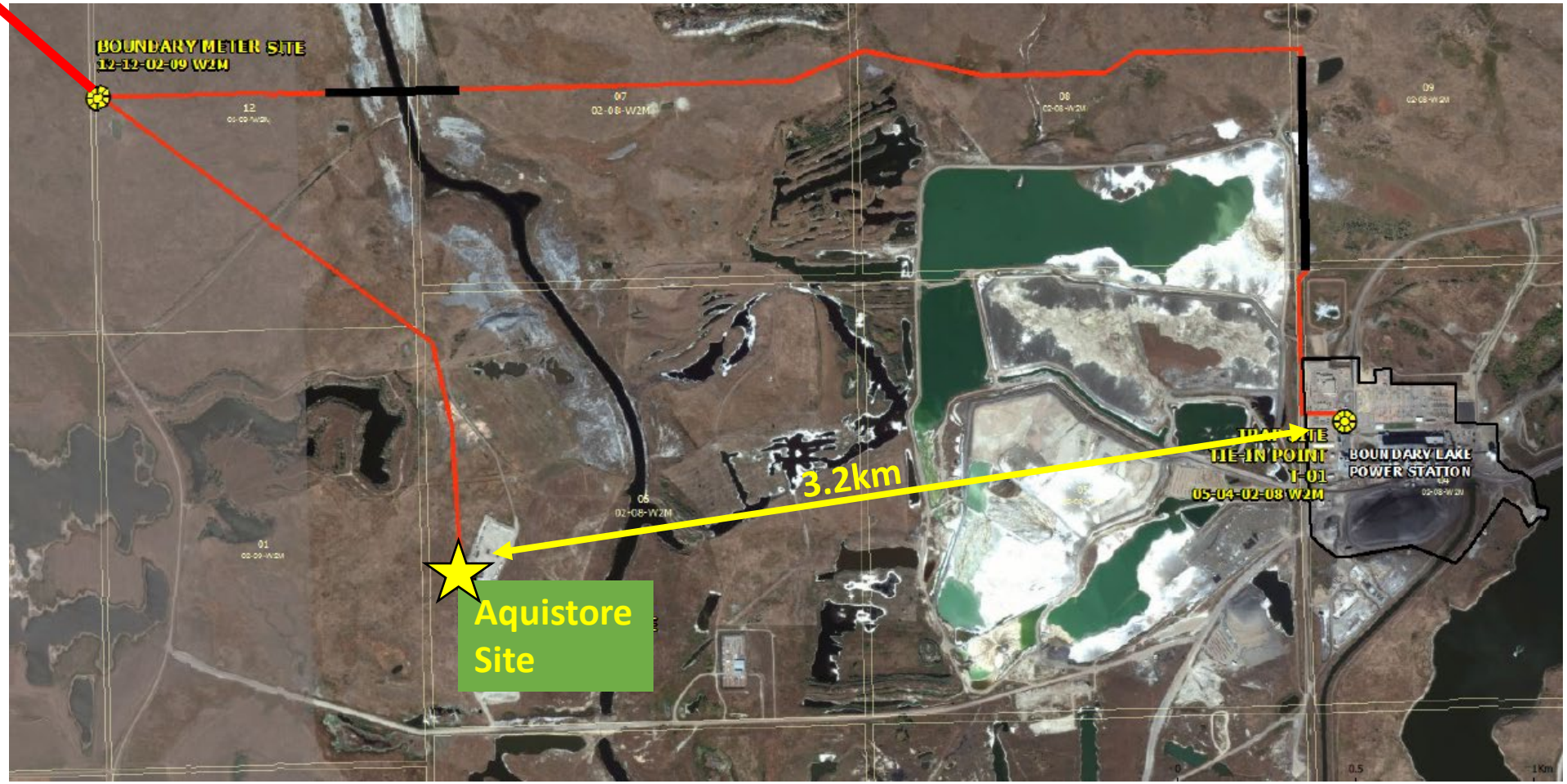
Aquistore/Boundary Dam Background

- CCS plant in left
- Each stack represents a “unit” at the plant
- Line from Unit 3 seen running to CCS plant
- Decision to build was in 2008
- Wells drilled in 2012
- Producing CO2 in 2015



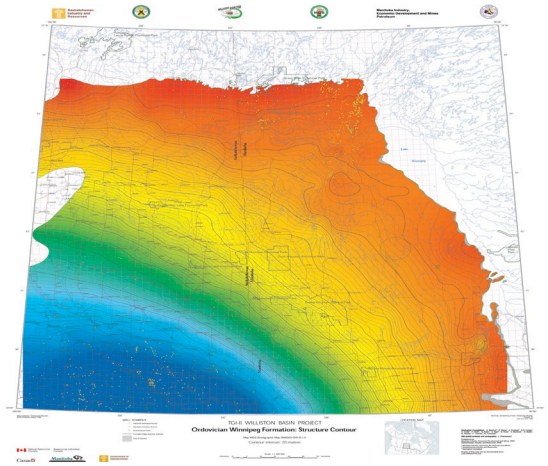
Pipeline Route

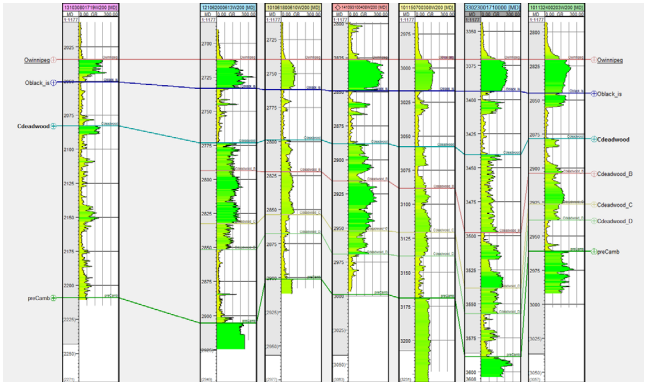
Sales to Whitecap (Weyburn)



Pre-Drill Characterization

- Extensive literature on the geology of the Williston/WCSB
  - regional structure, isopach maps
  - pressures, fluid flow directions
  - temperatures
  - formation water chemistry, etc





- Access to public well information
  - well files, drilling reports (11 wells to PC)
  - core samples
  - potash mine information

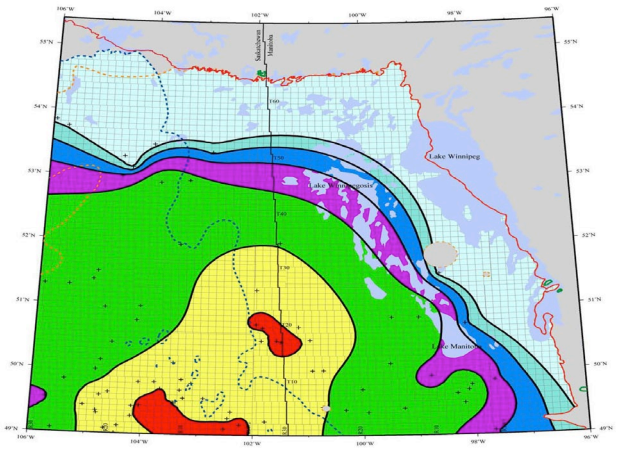
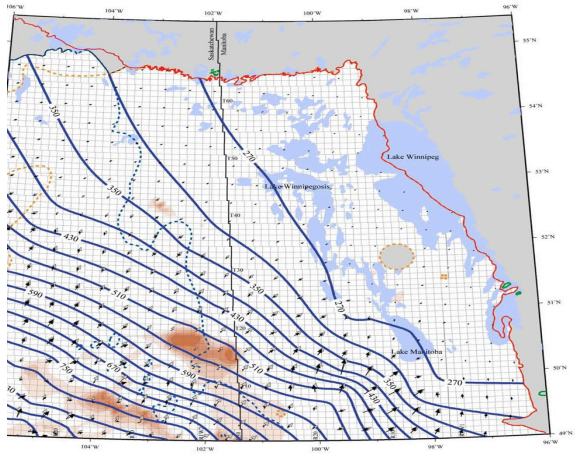


Figure 3.2. Total Dissolved Solids (TDS) in the Cambro-Ordovician Aquifer.



4.1. Water Driving Force (WDF) in the Cambro-Ordovician Aquifer.

- Seismic data available for purchase

Deadwood Formation





Fine- to very coarse-grained quartz sandstone

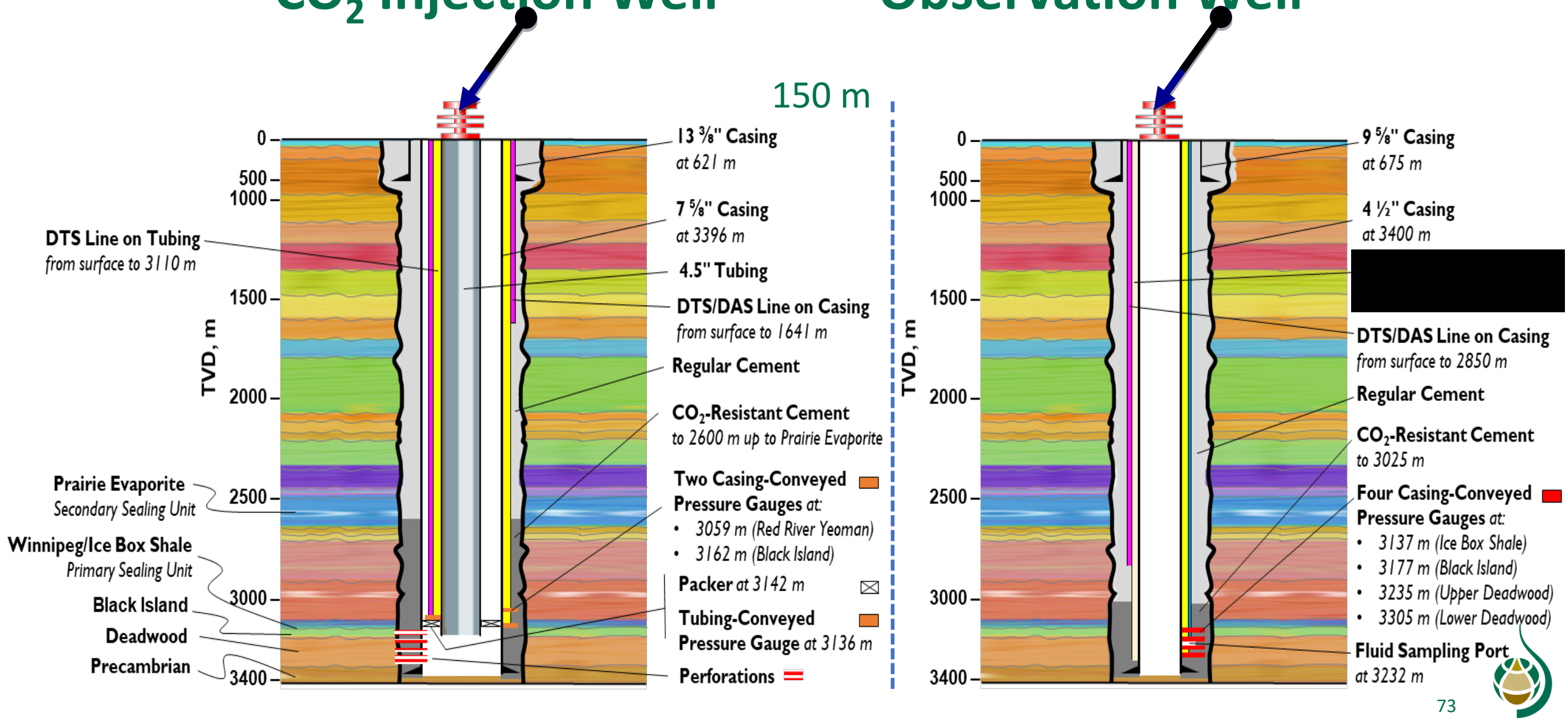
Drilling:

- Drilled: 3396 m deep injection well (July-Sept 2012)
- Drilled: 3400 m deep monitoring well (Oct-Nov 2012)
- 150 m apart
- (2012: 2 deepest wells in SK)
- Extensive Coring Program



CO_2 Injection Well

Observation Well



What it looks like at surface







Injection parameters

- Bottom Hole Pressure Measured at 3136m
  - 90% Fracture at this depth = 6,020 psig (41,000kPa)
- Annulus surface pressure
  - ESDV Trip Point = 1,000 psig
- Alarms built into DCS for Surface Casing and Ambient CO2 Levels.
- Data is reviewed on a monthly basis, although monitored in real time





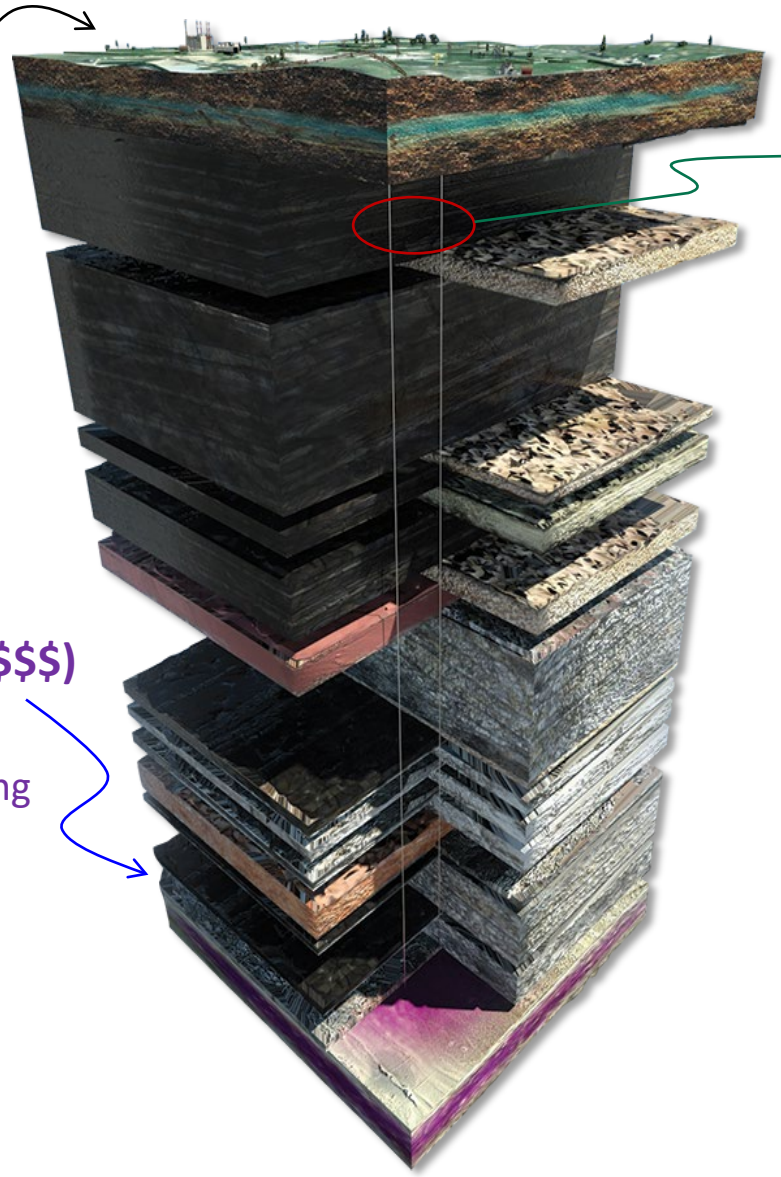
Aquistore Monitoring Program

Surface/Near Surface Monitoring ($)

- Injection Rates
- Wellhead Pressure
- Surface Pressure
- CO_2 Temperature at Surface
- CO_2 Sensor at Surface
- Gas Chromatograph
- Shallow Groundwater
- Soil Gas
- Passive Seismic

Reservoir/Plume Monitoring ($$$)

- Bottom Hole Pressure &Temp
- Reservoir Saturation Tool Logging
- Reservoir Model/Simulations
- Pressure Falloff Test

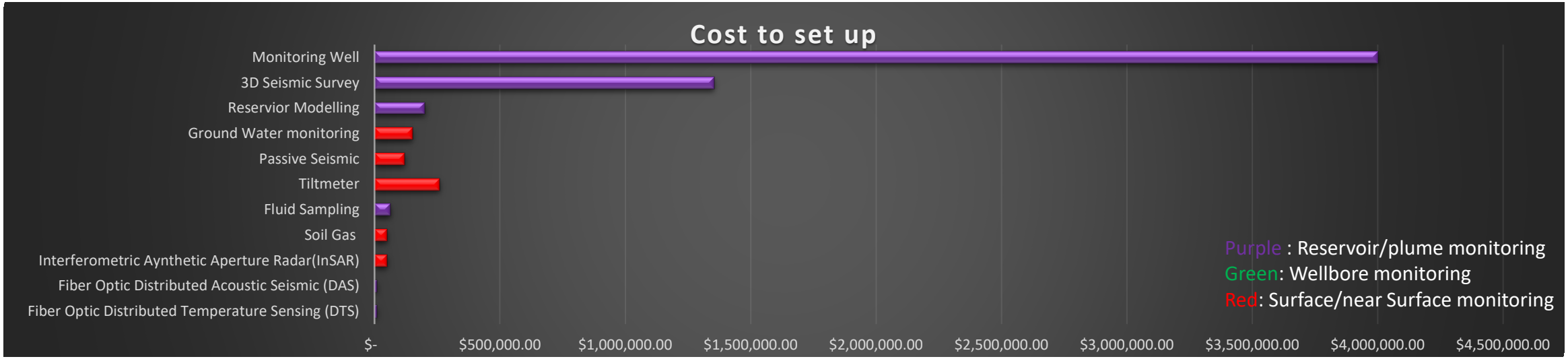


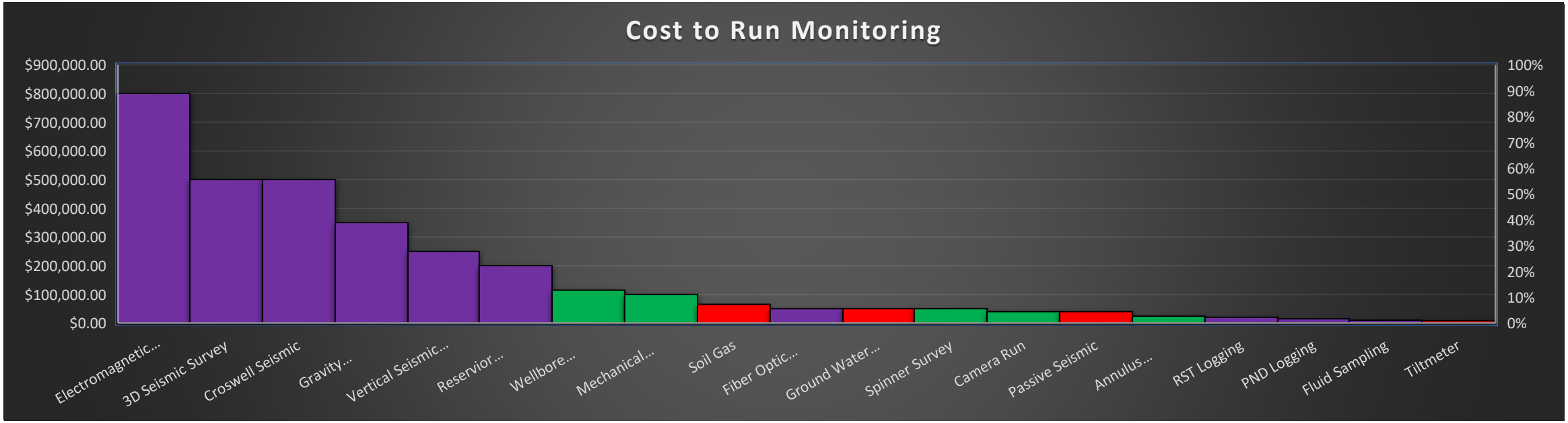
Wellbore Monitoring ($)

- Pressure Testing of Casing/Annulus
- Cement Bond Log
- Injection Summary
- Corrosion Integrity
- Mechanical Integrity Testing

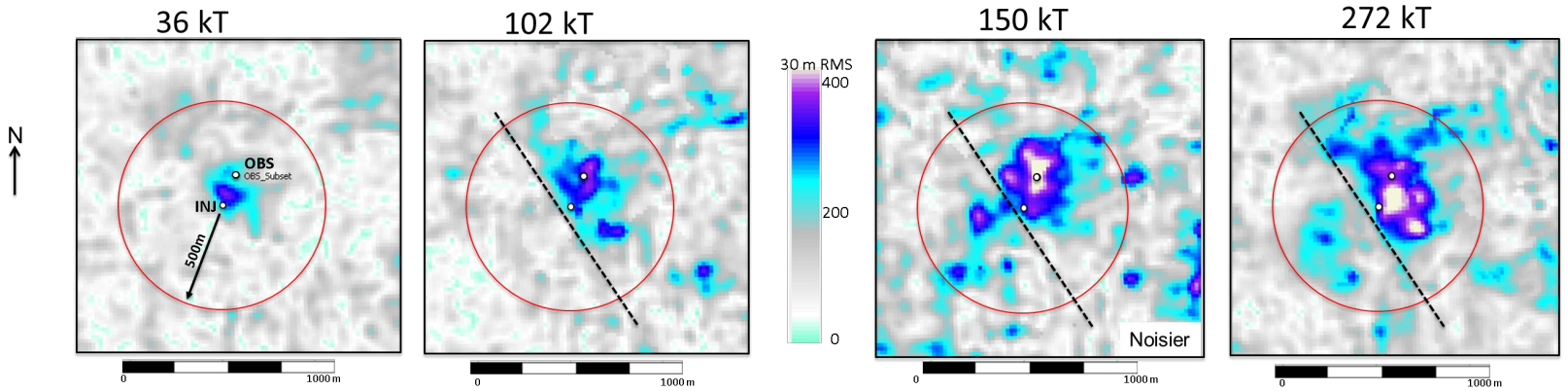
Selecting the right MMV technology for your CCS project matters!

Cost to Run an MMV Program



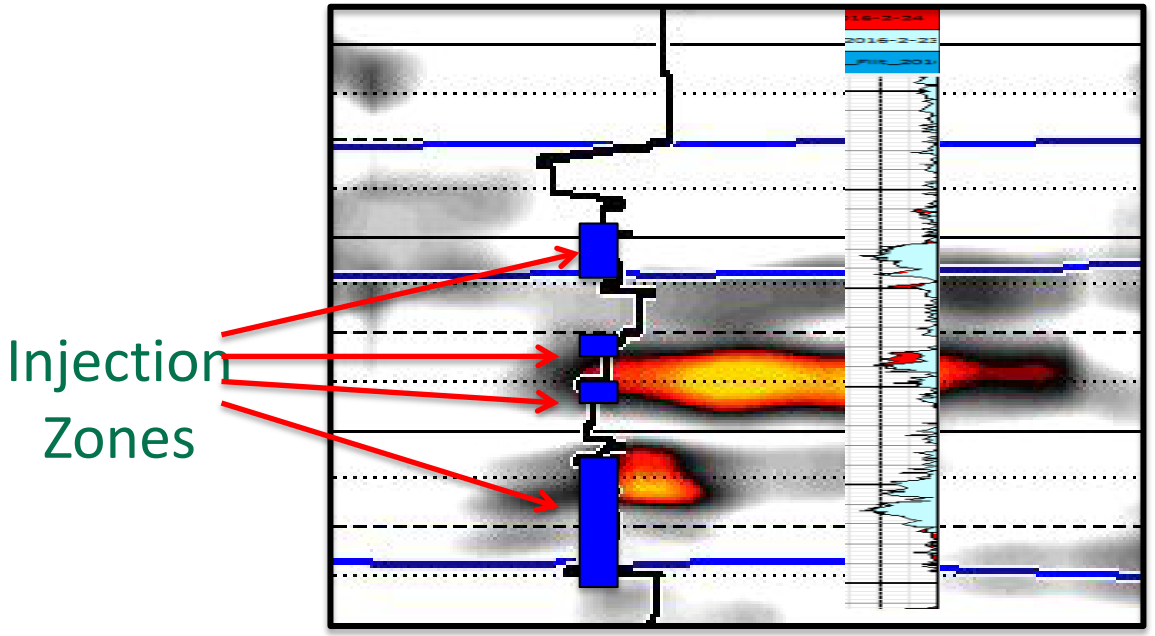


Aquistore: 4D Seismic Imaging

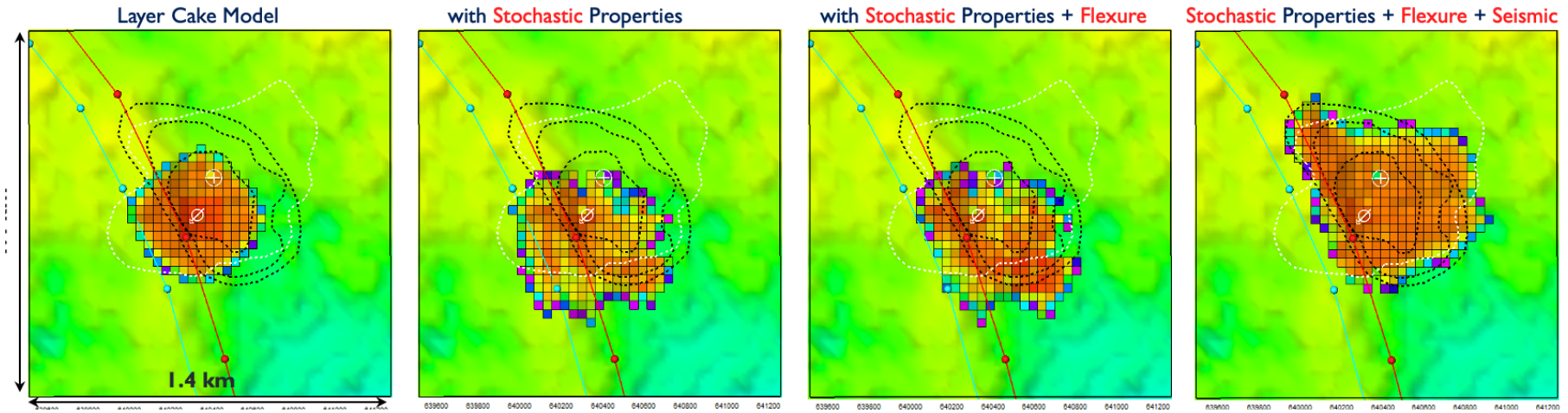


Deep Saline Storage Demonstration

- 3200m Deep in a Deadwood Formation (Cambrian Saline Aquifer)
- Repeated seismic acquisitions show differences related to CO2 presence
- Confirmed by using logs in the observation well



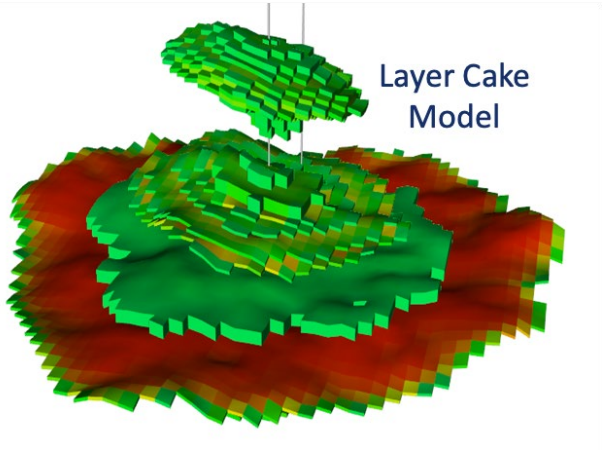
3D Plume Geometries

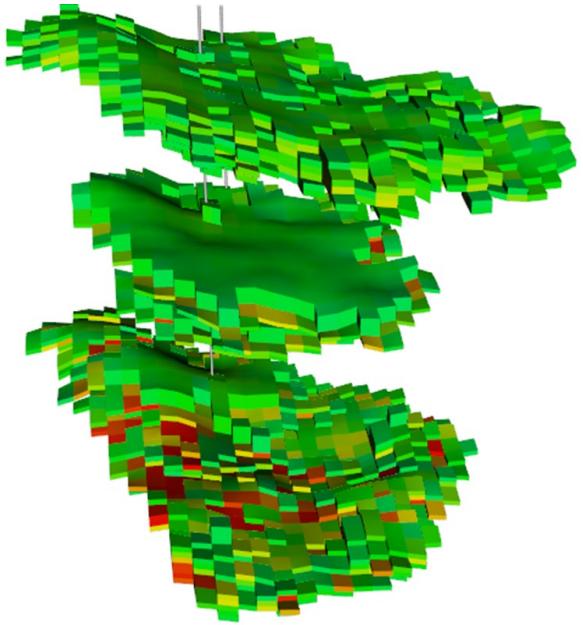


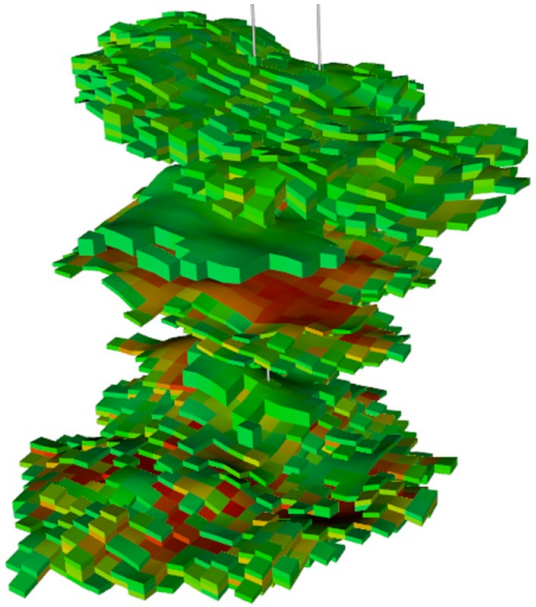
Layer Cake + Stochastic Properties + Flexure
- Properties constrained to AVO seismic inversion volumes

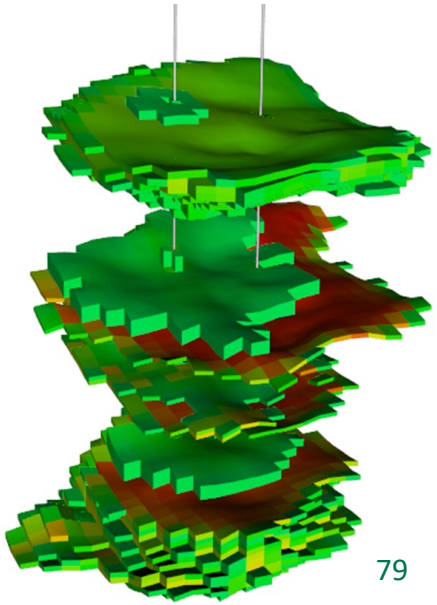
Layer Cake + Stochastic Properties

Layer Cake + Stochastic Properties + Flexure









New Observation Well

To solve outstanding issues, a project has been funded by NRCAN and Aqusitore partners.

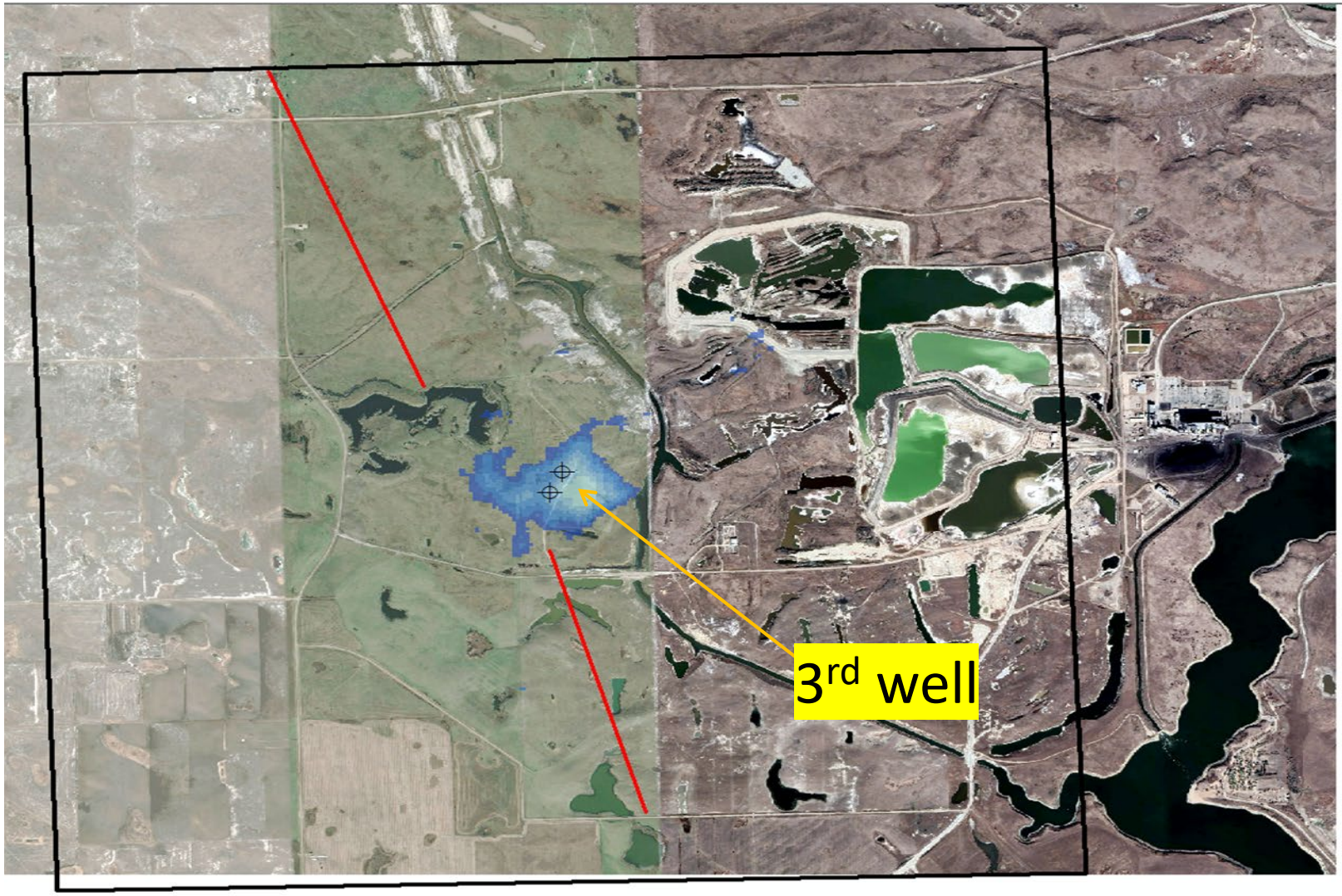
A 3rd well will be drilled to solve the mysteries around injection, salt precipitation, CO2 concentration, and sampling the main injection horizon.

- Acquire core samples from the reservoir region
- Study mineralization , salt precipitation and phase behavior with rock-brine-CO_2 system
- Petrophysical analysis
- Geochemical and reservoir fluid testing
- Geophysical surveys
- Design for a well into a CO_2 pressurized reservoir



New Observation Well

- Well location has been chosen
- Well Design is near complete
- Post Drilling Research program is being set, but open to new partnerships and opportunities
- The future of Aquistore and CCUS in the province!



SaskPower

Canadian Natural

Pathways Project

Mosaic®

Main Takeaways

- Early CCUS at Weyburn gave us the confidence, and the expertise to pursue deep saline storage
- Weyburn is an example of CCS in a dolostone reservoir where 4D seismic, among other technologies were in the very early stages of development.
- Aquistore is a successful research site/field lab attached to an industrial CO2 source
- Monitoring at Aquistore has shown some surprises, and mitigation methods are not always well known.
- Finding “real” data is difficult at 3km depth, but modelling is the best assessment we can get… even though its wrong.
- Monitoring is done for regulatory, operational, and public assurance reasons.



***What makes a CO2 EOR Project or CO2 disposal site into a CCUS project?**

Measurement

Monitoring

Verification

Focus of research now is mostly on better understanding of the reservoir so it can be modelled and monitored at minimum cost

Progressive Aboriginal RELATIONS COMMITTED
Canadian Council for Aboriginal Business



What Makes a Carbon Management Project Economic?

September 2026

INTERNATIONAL CCS KNOWLEDGE CENTRE

What Makes a Carbon Management Project Economic?

A carbon management project becomes economic when the realized revenue and avoided compliance costs exceed the full lifecycle levelized cost of capture, transport, and storage.

Viability can be determined primarily through the following inputs:

- CO_2 concentration in flue gas
- Thermal / Power Energy requirements
- Subsurface quality and pore space access
- Transport and shared infrastructure proximity
- Offtake and revenue certainty
- Direct policy support and compliance pricing

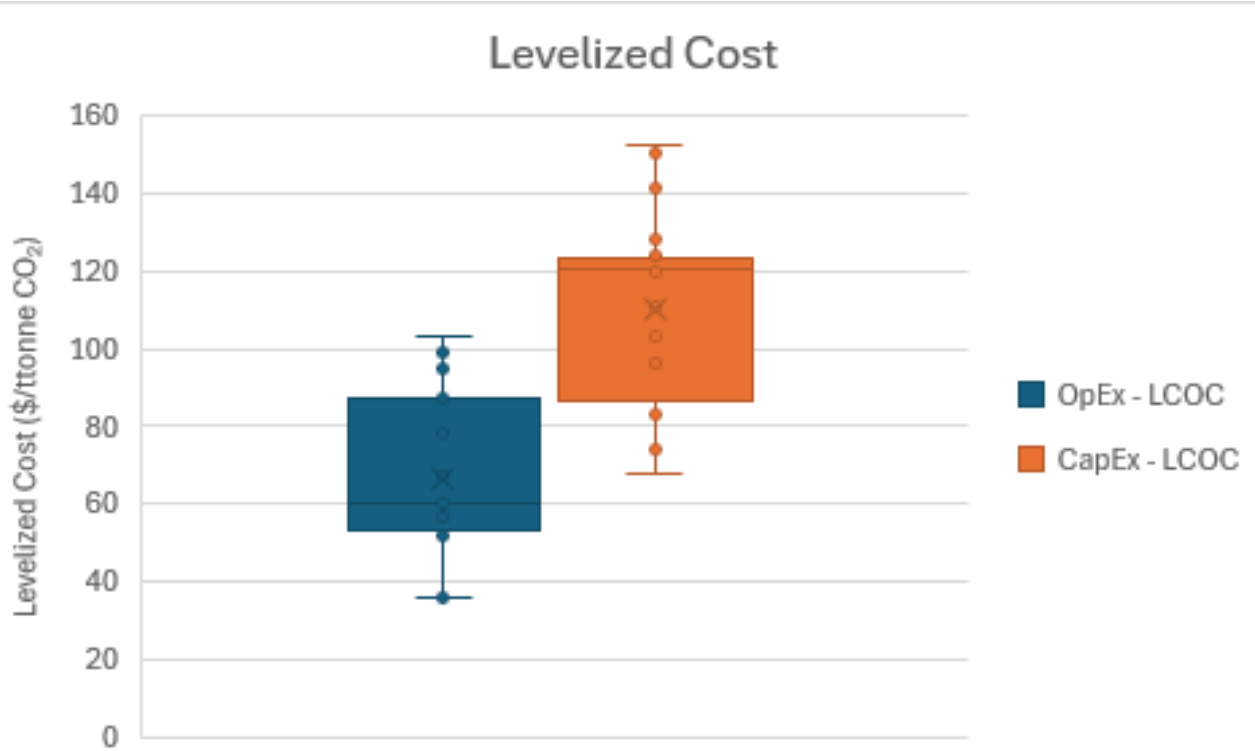
Economic Sensitivities of Carbon Capture Projects

Levelized cost of capture (LCOC)

LCOC is the average cost per tonne of CO_2 captured over a project's lifetime which includes:

- Capital costs
- Operating costs
- Maintenance costs

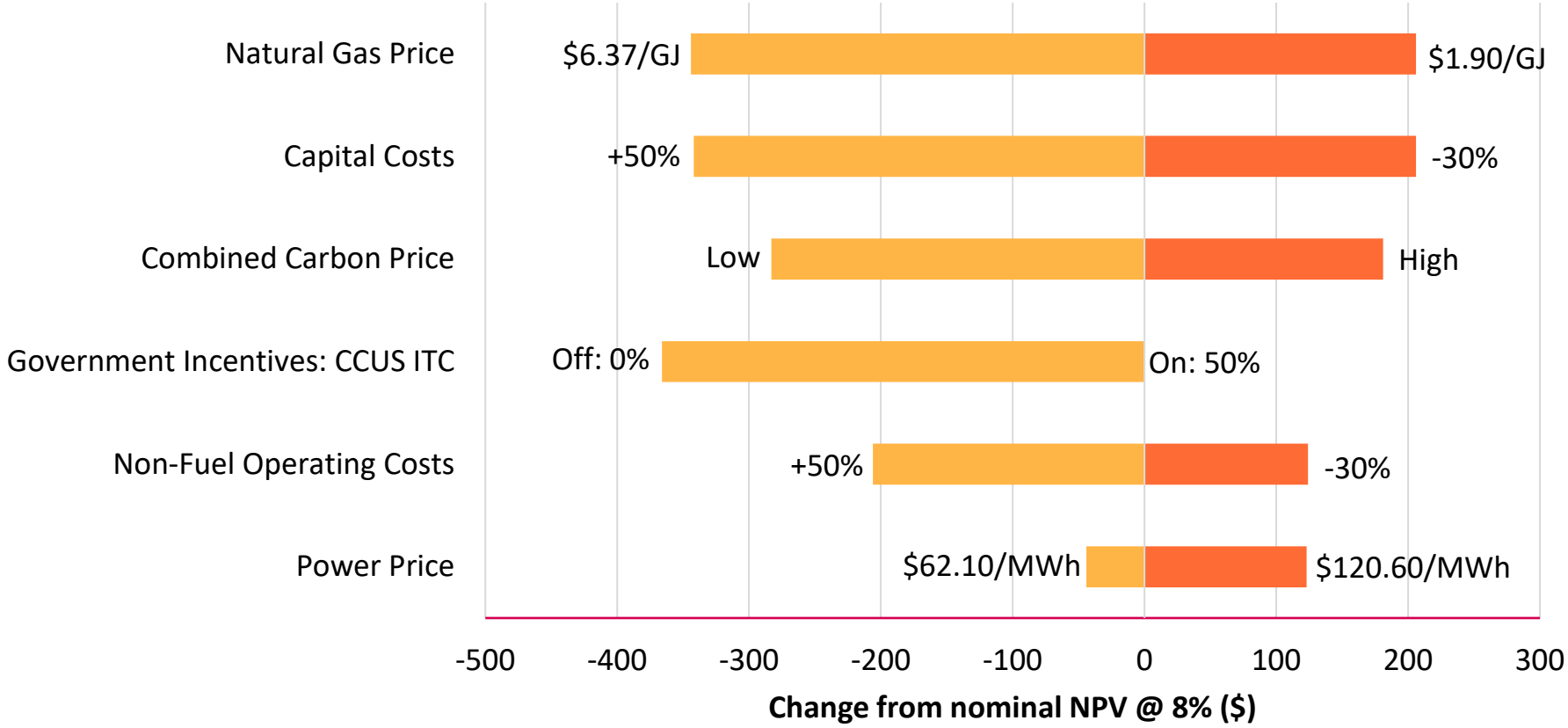
These costs are divided across the total captured CO_2 to allow fair comparison between technologies and projects.



Note: Capture only, excluded transportation and storage

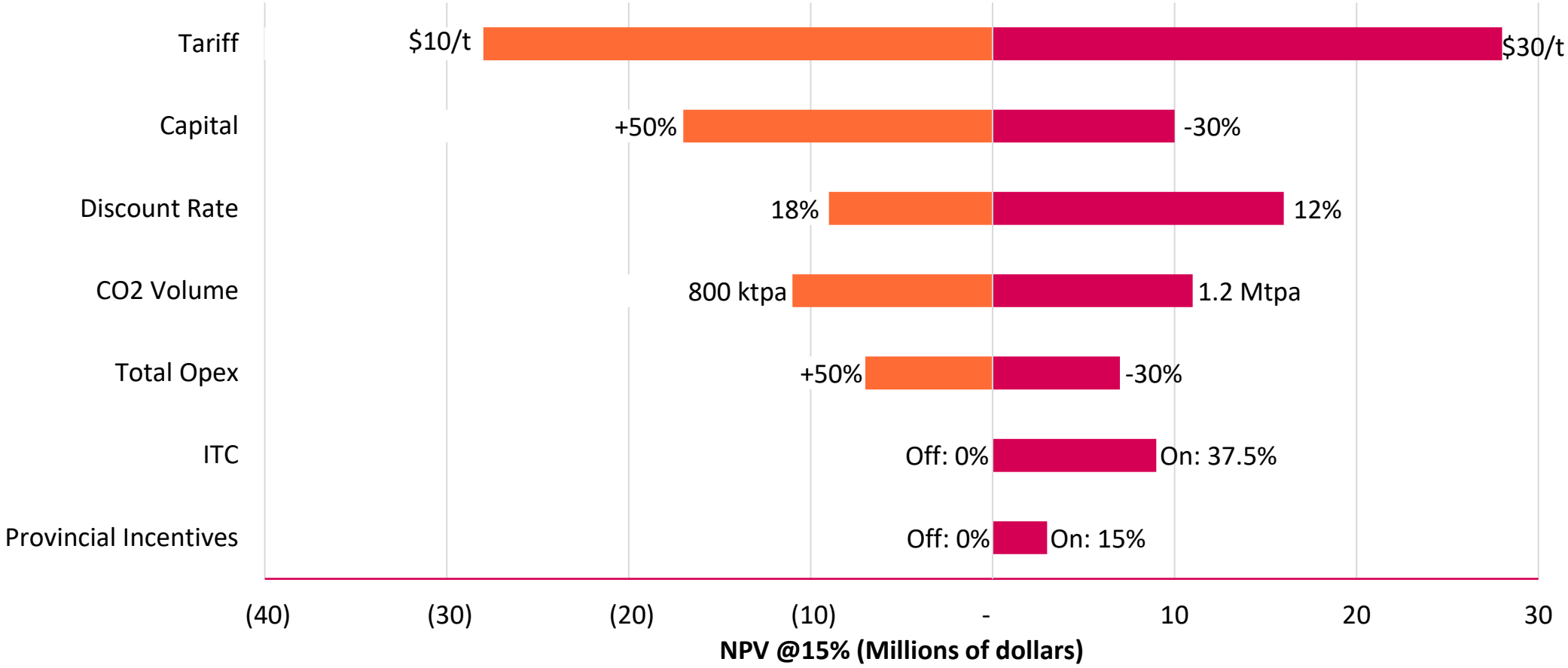
Economic Sensitivities of Carbon Capture Projects

Post-combustion carbon capture project (with a combined heat and power unit)



Economic Sensitivities of Carbon Capture Projects

Single source transportation and storage project



Summary

The economics for carbon capture projects are most sensitive to:

- Natural Gas Prices
- Capital Costs
- Carbon Pricing
- Operating Costs

The primary economic drivers for carbon capture infrastructure are:

- Tariff Costs Received
- Capital Costs
- CO_2 Volume Transported

A project is not economic simply because credits or incentives exist..