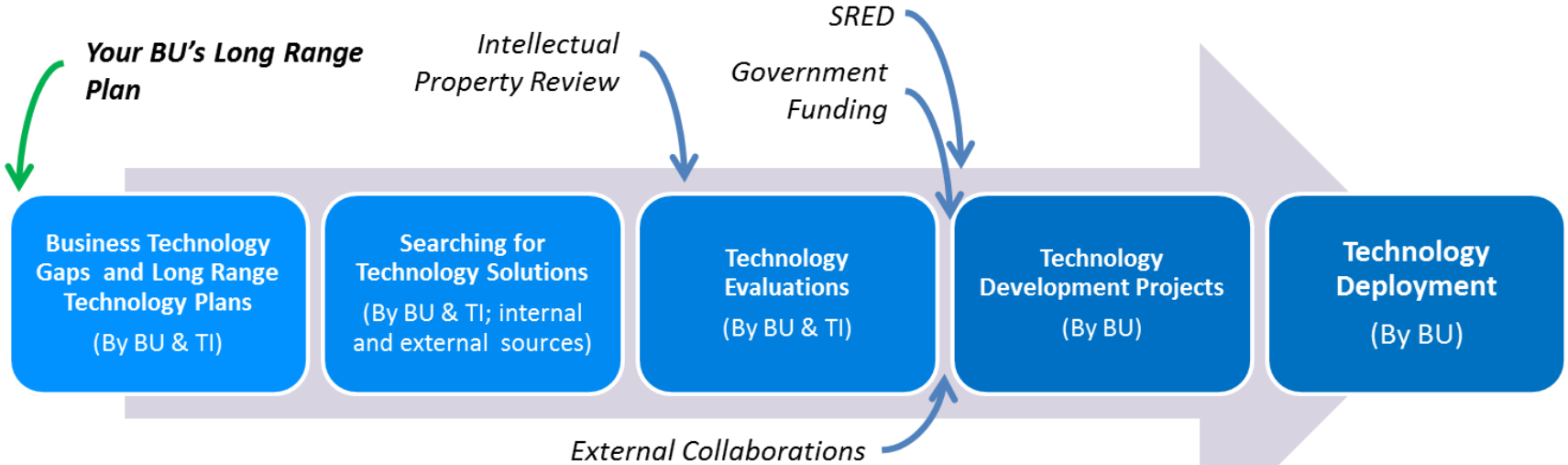
Canadian Natural

TECHNOLOGY ADOPTION AND INNOVATION TO ACHIEVE EFFICIENCY

February 27, 2019

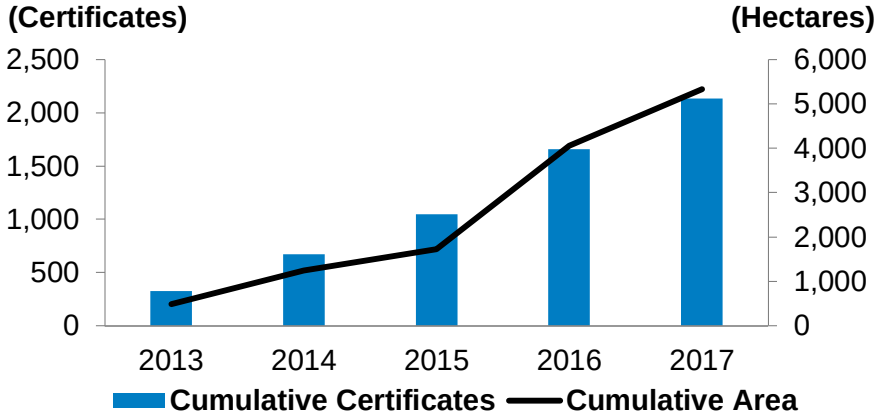
PREMIUM VALUE. DEFINED GROWTH. INDEPENDENT.

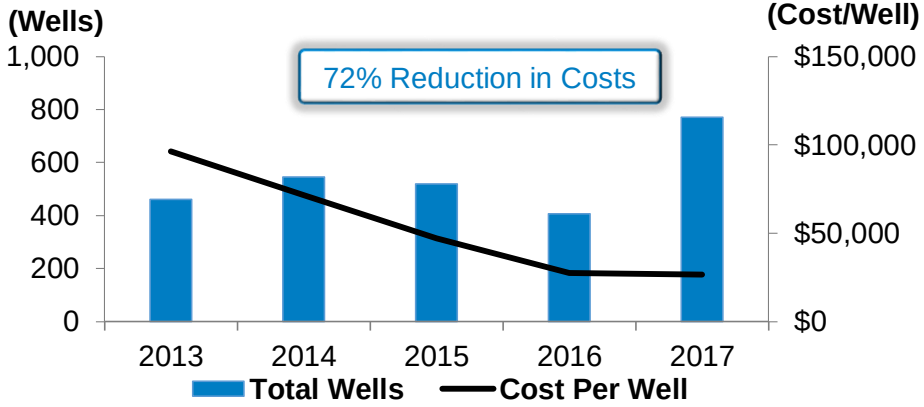
How Canadian Natural Accelerates Innovation



Environmental Excellence

Environmental Continuous Improvement
Reclamation Initiatives





- Restoring land to natural conditions
- Integrated liability management
- Coordinated, area-based approach
- Over 5,300 hectares of land has been reclaimed in our North American E&P Operations
- Over 2,700 wells have been abandoned in the last 5 years
  - Well abandonment costs down ~72%
- 735 hectares progressively reclaimed at Oil Sands Mining and Upgrading

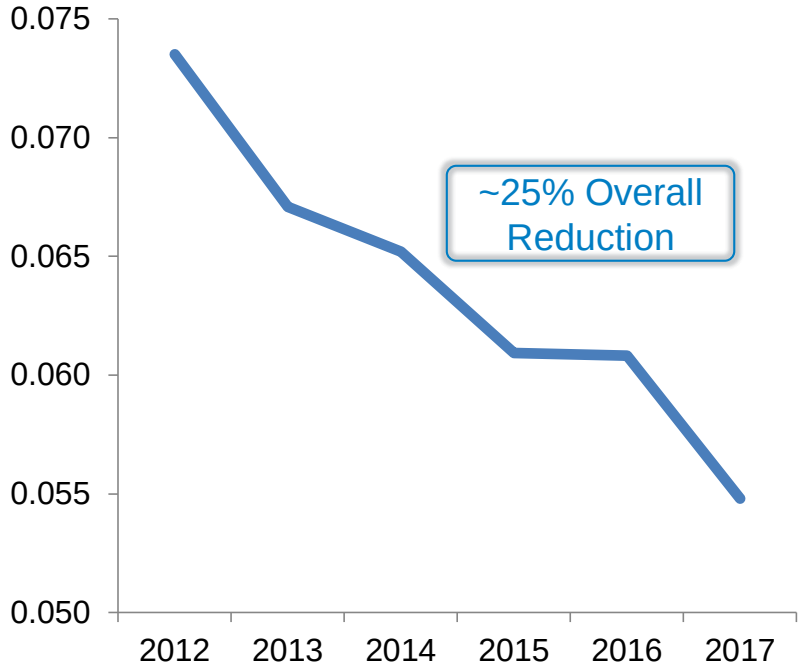
GHG Emissions Management

Strategy

- Integrating emission reduction in project planning and operations
- Leveraging technology
- Investing in R&D and supporting collaboration
- Continuous improvement to drive long-term emissions reductions
- Leading in Carbon Capture and Sequestration/Storage
- Engaging proactively in policy and regulation
- Considering and developing new business opportunities

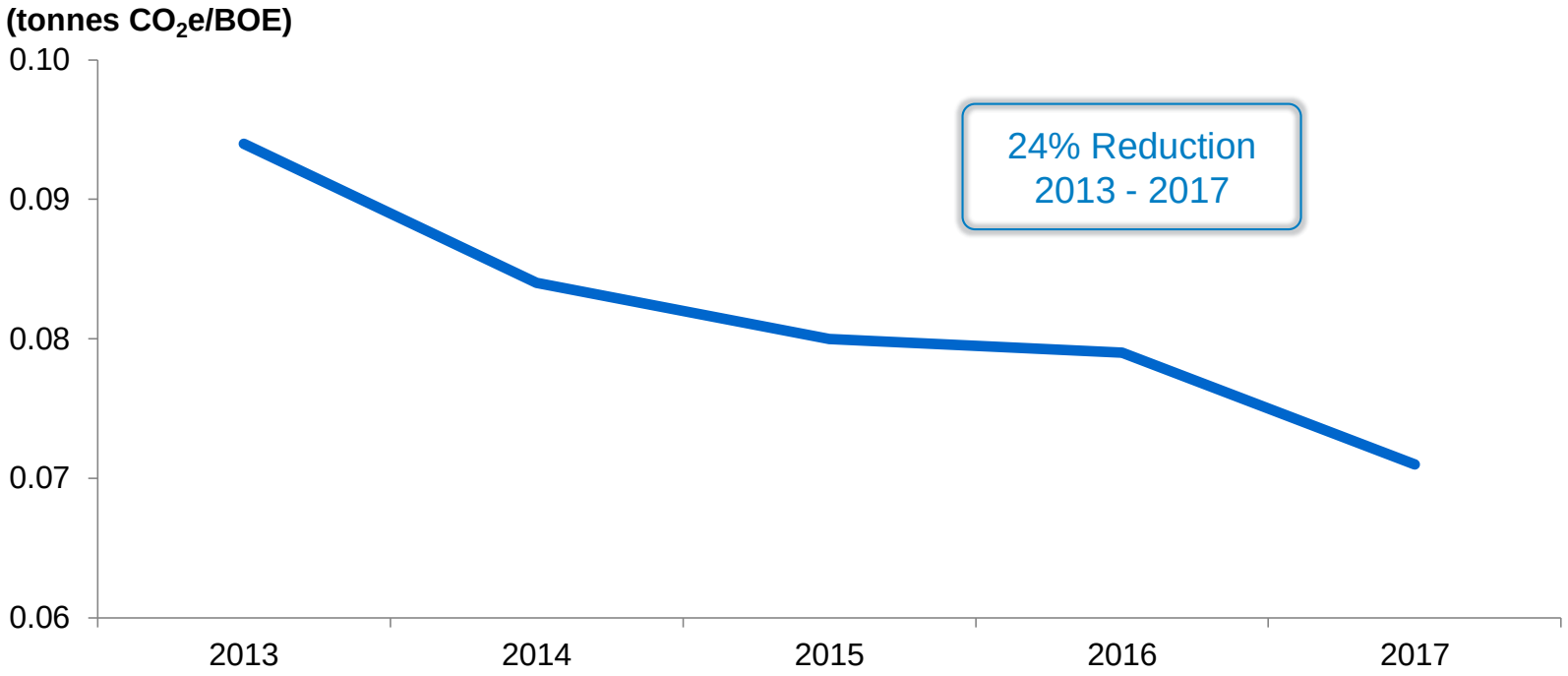
Environmental Excellence

Corporate GHG Emissions Intensity (tonnes CO_2e/BOE)

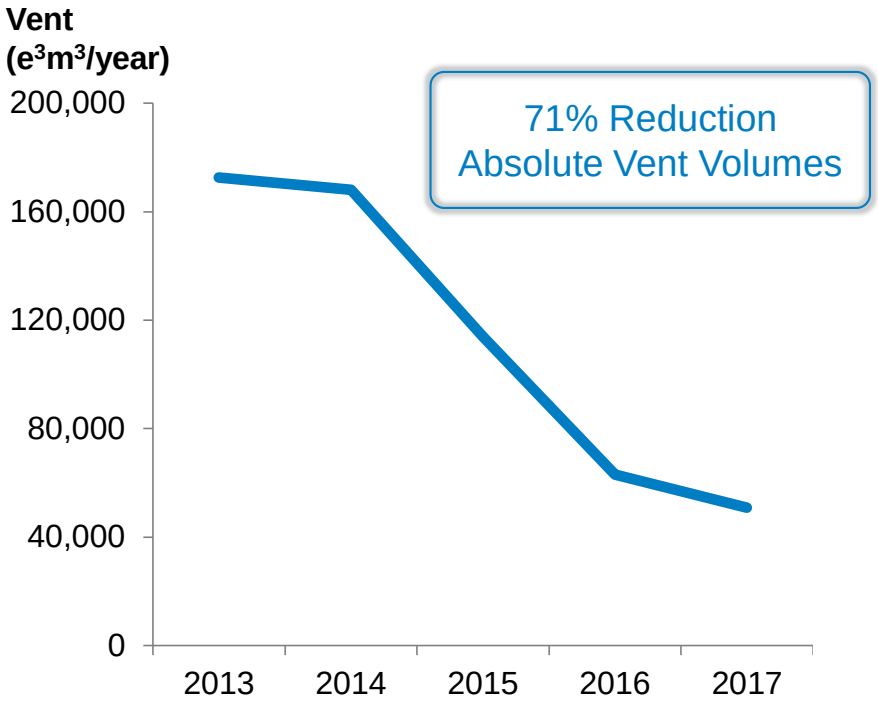


- Proactive environmentally responsible operations
- Reducing corporate greenhouse gas emissions intensity
  - ~25% reduction over last 6 years
- Meet or exceed all regulatory requirements
- Continuous improvement initiatives have reduced emissions

Continuous Improvement in GHG Emissions
Horizon Oil Sands

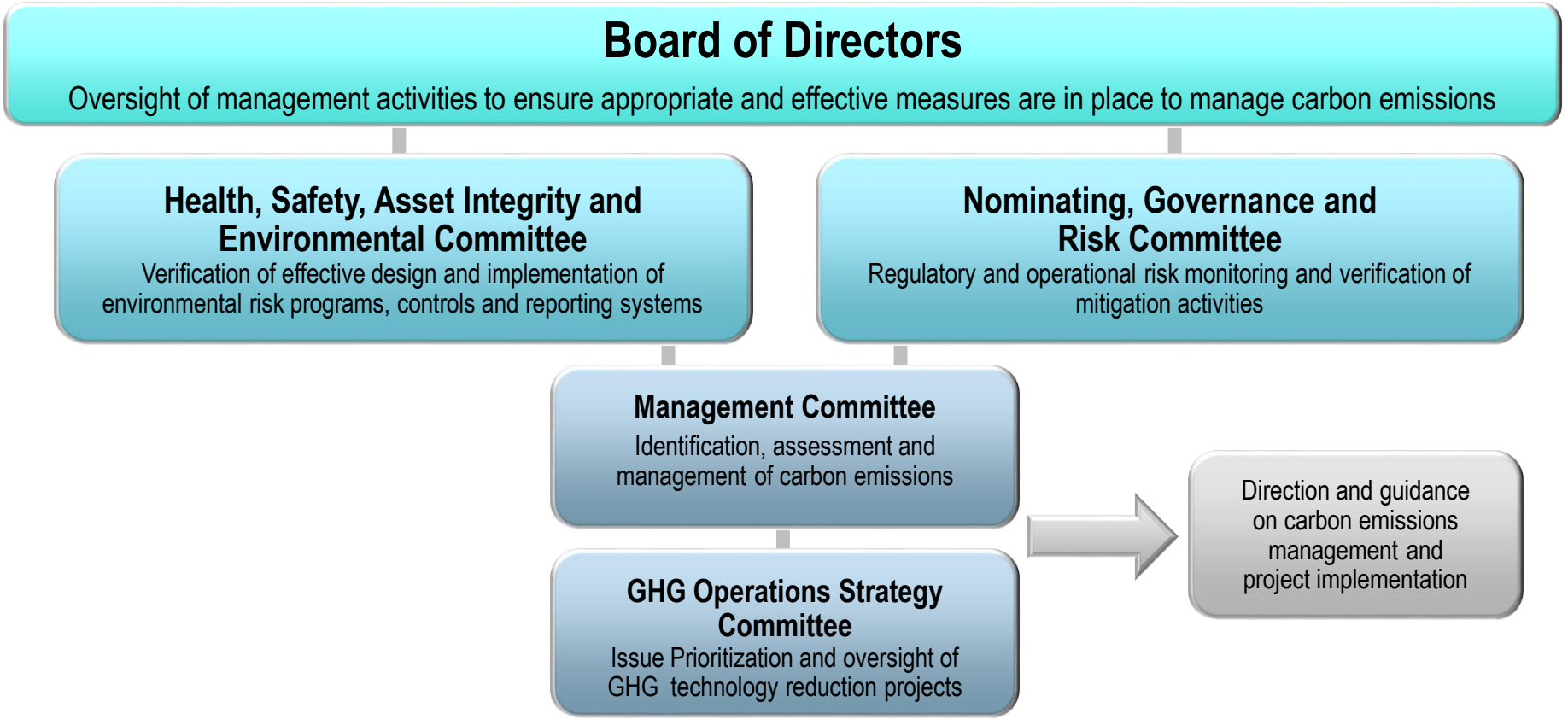


Continuous Improvement in GHG Emissions
Primary Heavy Crude Oil



- Continuous improvement initiatives have reduced environmental emissions
- Heavy Oil Casing Gas vent reduction
  - Solution Gas Conservation has reduced GHG emissions
- Total reduction of over 17.9 million CO_2e tonnes over the last 5 years, equivalent to ~3.8 million cars off the road

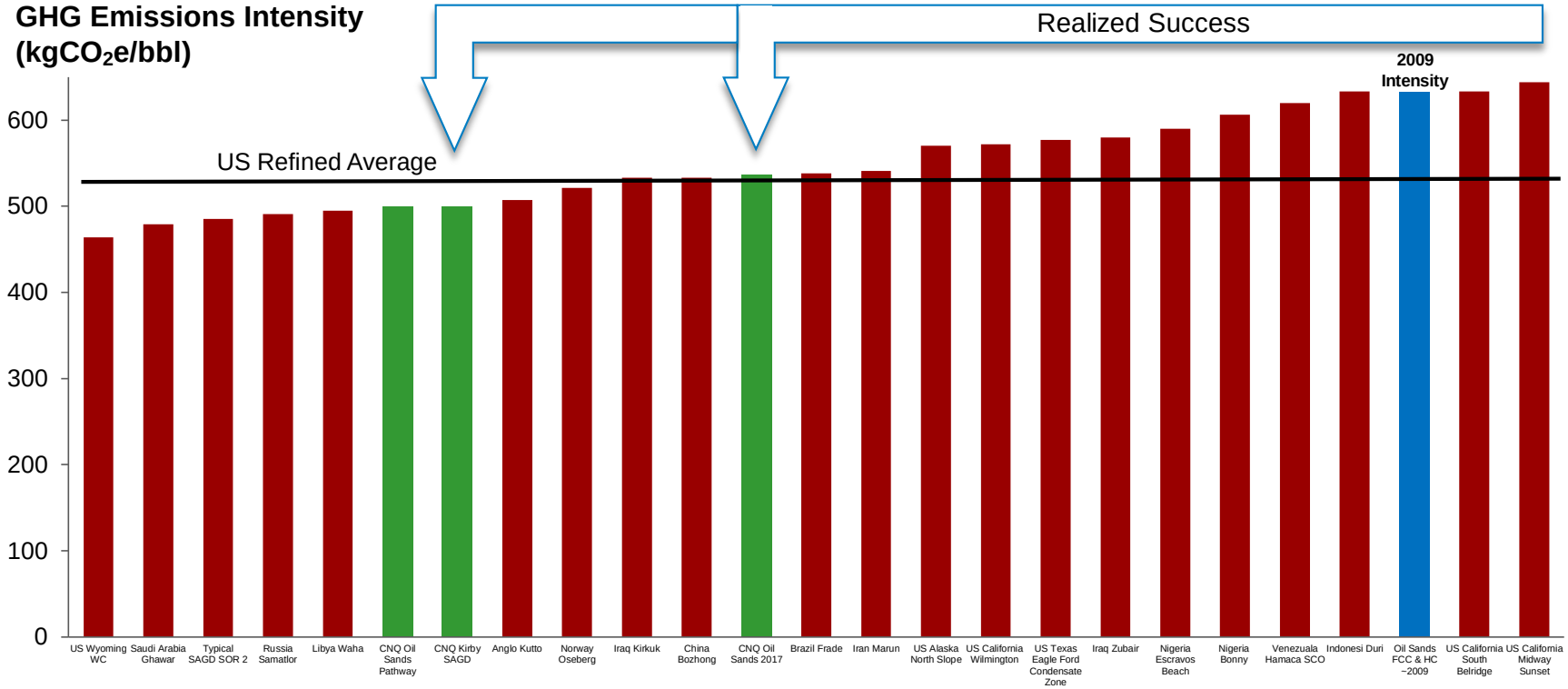
Governance


Board of Directors
Oversight of management activities to ensure appropriate and effective measures are in place to manage carbon emissions
Health, Safety, Asset Integrity and Environmental Committee
Verification of effective design and implementation of environmental risk programs, controls and reporting systems
Nominating, Governance and Risk Committee
Regulatory and operational risk monitoring and verification of mitigation activities
Management Committee
Identification, assessment and management of carbon emissions
GHG Operations Strategy Committee
Issue Prioritization and oversight of GHG technology reduction projects
Direction and guidance on carbon emissions management and project implementation

Processes for Continuous Improvement

- GHG Coordination Working Group
  - Supports each business unit/working group to deliver on their GHG reduction projects
  - GHG working groups for thermal, oil sands mining, and methane
- For example, Methane Working Group
  - Manages and coordinates GHG reduction and technology projects, including projects to reduce venting in Heavy Oil Operations
  - Ensures project deliverables are achieved
  - Reinforces to the operator level the importance of GHG emissions reduction

Oil Sands Well-to-Combustion



Note: Total emissions intensity includes: production and upgrading, transportation, refining, transportation of refined product and combustion. CNQ Oil Sands includes: Oil Sands Mining and Upgrading and Thermal Crude Oil.
Source: Internal company reports and ARC Energy Research Institute 2017 Report.

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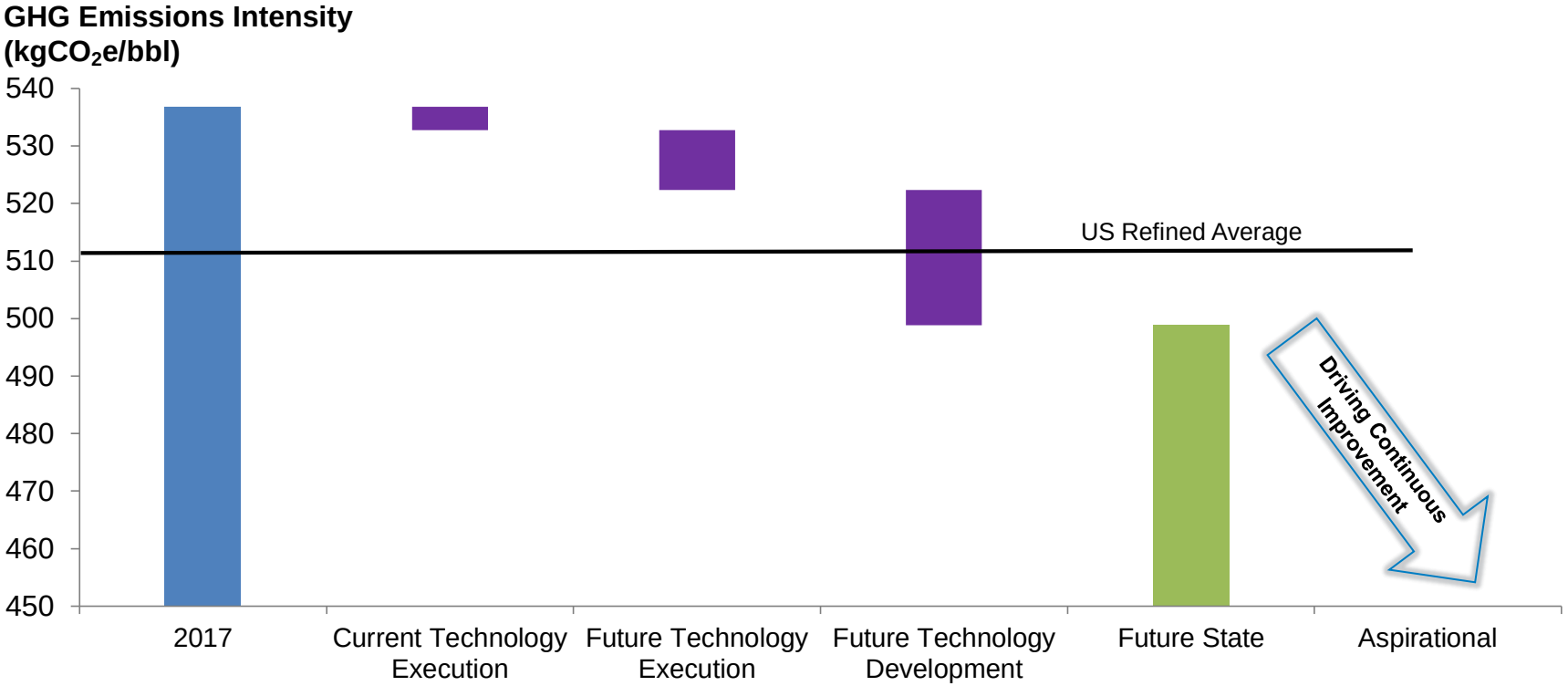
CLEAR DEFINED GOAL TO REDUCE GHG EMISSIONS

Capturing Technological Improvements in Oil Sands
Oil Sands Operations Pathway to the Future



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Source: Internal company reports and ARC Energy Research Institute 2017 Report.

PATHWAY TO CONTINUE TO REDUCE GHG EMISSIONS

Technology, Innovation & Continuous Improvement

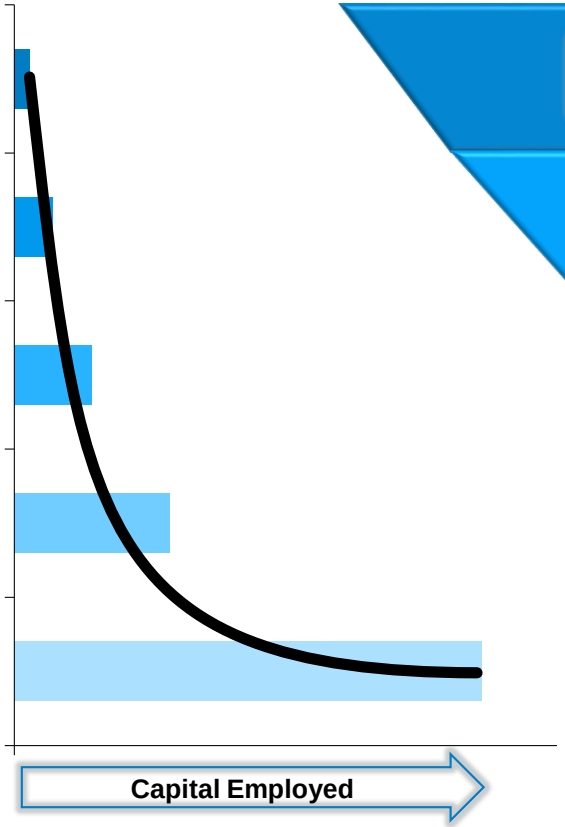
Strategy

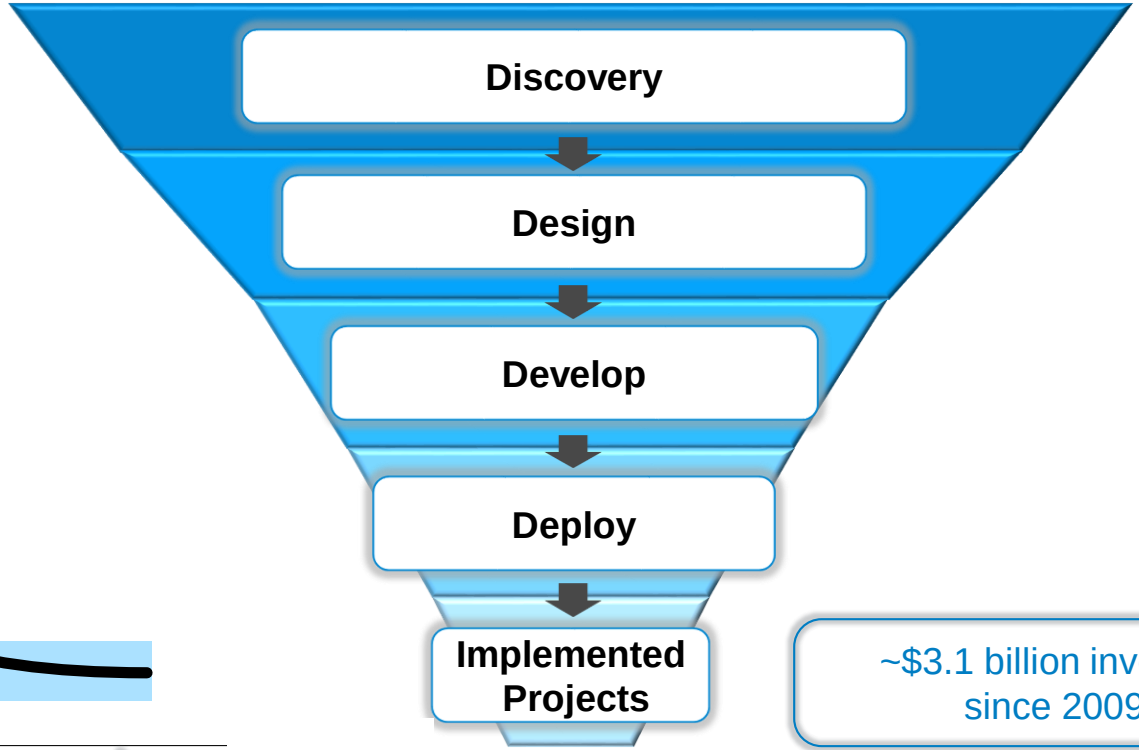
- Invest in research and development
- Leverage technology and innovation
- Canadian Natural's continuous improvement culture drives long-term value
- Socially responsible and proactive community involvement
- Deliver responsible and sustainable operations

Technology, Innovation & Continuous Improvement

- Leading R&D investor
  - ~$3.1 billion invested since 2009
- Benefits
  - Unlocking reserves
  - Becoming more effective and efficient
  - Increasing production
  - Reducing environmental footprint
- Canadian Natural's culture of leveraging technology, innovation and continuous improvement is everyone's accountability and is key to driving sustainable operations and long-term value

Structured Research & Development Funnel





~$3.1 billion invested since 2009

Technology & Innovation Projects

Carbon Capture & Sequestration / Storage Technology

- 3rd largest CO_2 capturer and sequesterer for oil and gas sector in the world(1)
- Reduced CO_2 footprint
- Reduced CO_2 charges

	Tonnes per Year
Horizon	0.4 million
Quest(2)	1.1 million
NWR(3)	1.2 million
	2.7 million

Equivalent to ~576,000 cars off the road per year

(1) Per the Global CCS Institute.
(2) Canadian Natural is a 70% working interest owner in Quest.
(3) On stream in 2019.

Oil Sands Mining & Upgrading – Environmental Technology
CO_2 Sequestration and Innovative Tailings Management

- CO_2 sequestration technology and innovation at Horizon have helped reduce water usage
  - ~80% of water from tailings ponds can be recycled more rapidly, as sequestration causes fine tailings to settle much quicker
  - Annual fresh water withdrawals have been 1/3 of our regulated allocation since start-up in 2009
  - Horizon's tailings pond is approximately half the size than originally targeted

Oil Sands Mining & Upgrading – Environmental Technology
In Pit Extraction Process (IPEP)

- Potential for cost savings of $2.00/bbl - $3.00/bbl for operating and sustaining costs
- ~40% less GHG emissions during bitumen production
- Eliminates tailings ponds
- Overburden mining – shovel to conveyor – reducing haul truck fleet
- Extraction technology that separates bitumen in the mine pit
  - Pilot test started in April 2018
- Relocatable, modular extraction plant
  - Moves as mine face advances
  - Produces stackable dry tailings
  - Accelerates reclamation

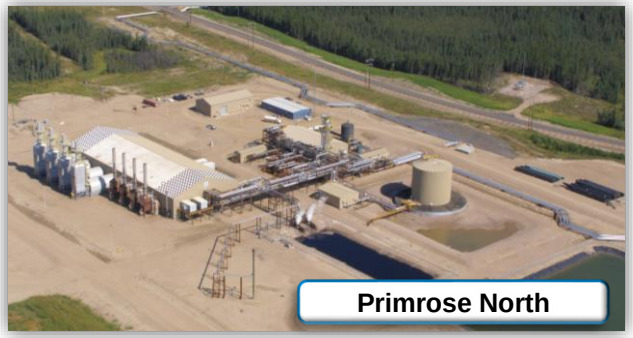

IPEP Field Pilot at Horizon

Oil Sands Mining & Upgrading – Environmental Technology
Autonomous Trucks

- Manufacturer estimates GHG emissions reduction of up to 5% from fuel savings
- Longer term opportunity compared to peers due to current top tier haul truck utilization
  - Current haul truck utilization ~90%
- Jackpine Mine 18 truck operation pilot
  - Capital cost of ~$75 million
- Implementation Plan at Jackpine Mine
  - 3 truck trial at targeted for late 2020
  - 5 truck overburden operation targeted for early 2021
  - 18 autonomous trucks targeted for 2022
- Long-term potential of running all 140+ trucks at all 3 mines
  - Incremental capital cost is targeted to be $275 million to $325 million
  - Reduced operating costs of ~$0.30/bbl - $0.50/bbl
  - Staged implementation to all mines targeted for 2022 to 2025

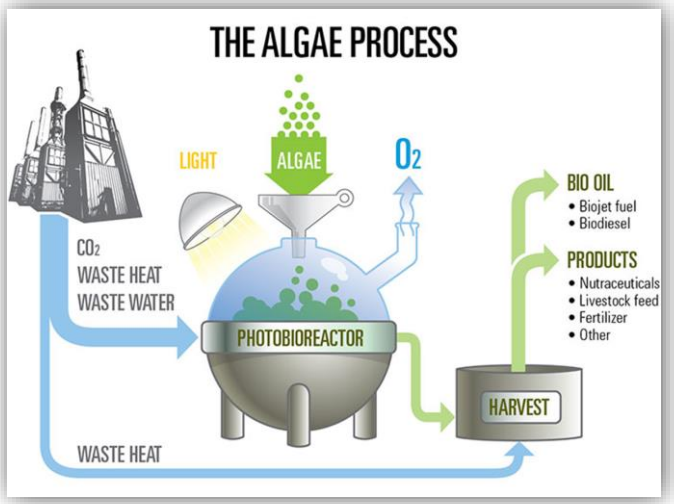
Thermal In Situ Oil Sands – Environmental Technology
Unlock Reserves & Reduce Emissions

- Vacuum Insulated Tubing (VIT) and Annulus Gas Blankets – SAGD and PAW Steam flood
  - Reduced heat loss = more energy available to heat bitumen and less GHG emissions per barrel of bitumen
  - Less steam required to reduce bitumen viscosity → reduces water use
- Non-Condensable Gas (NCG) Injection Pilot – Kirby
  - Co-injecting trace amounts of NCG, like methane, with steam into an oil sands reservoir
  - Frees up steam capacity for use into lower SOR wells
- Solvent Enhanced SAGD Pilot – Kirby and Primrose
  - Demonstrate existing SAGD process can be improved by co-injecting solvent with steam
  - Simulation studies and competitor pilot analysis show ~50% lower SOR → less GHG emissions



Environmental Technology
Carbon Capture and Conversion / Utilization

- $20 million NRG COSIA Carbon XPRIZE
  - 4½ year global competition (ending March 2020) to turn waste CO_2 emissions into valuable products
  - 10 finalist teams from India, China, Canada, Scotland and U.S. in final round of competition
  - Technologies being tested at the Alberta Carbon Conversion Technology Test Centre
- Molten Carbonate Fuel cells (MCFC)
  - Capture CO_2 from natural-gas fired processing units with fuel cells
  - Convert chemical energy from fuel into low-GHG generating electricity
  - Pilot site identified at Scotford Upgrader
- Algae Project
  - Capturing CO_2, placing in large tanks with algae and promoting photosynthesis with LED lights
  - Creates bio oil and biomass materials



Oil Sands
Canadian Success Story

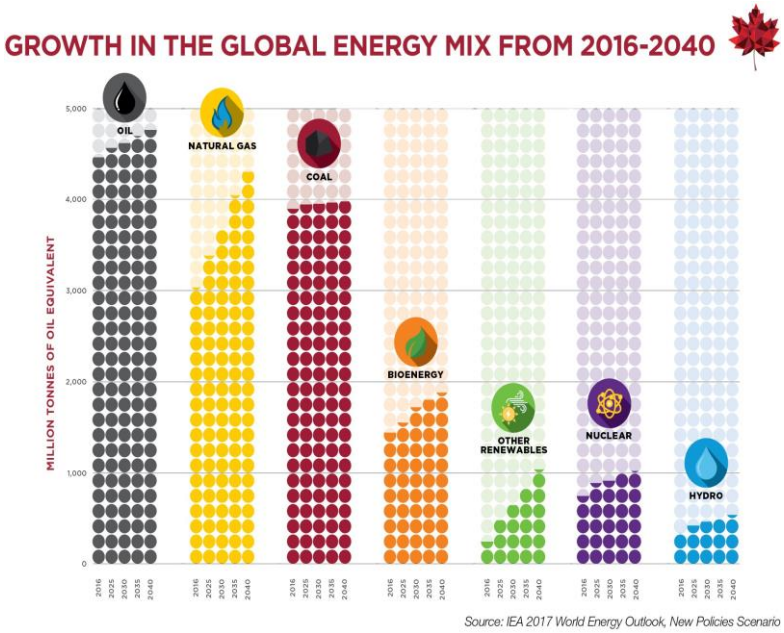
- World needs energy
- Canada and Alberta have progressive and leading climate policy
- Canada has highest regulatory and environmental standards
- Collaboration and leveraging technology in the oil sands
  - Canadian success story
- Identified pathway for Canadian oil sands operations to continue to reduce GHG intensity
- Canada's oil sands, light crude oil and natural gas can significantly reduce global GHG emission intensity

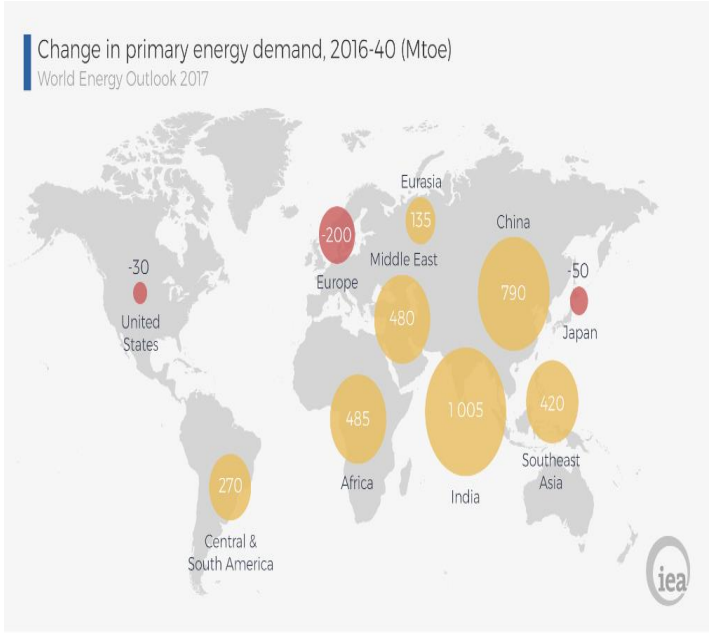
Canada is the Global leader in Producing Clean Hydrocarbon Energy from Source to End Use

- Many players contribute to the oil and natural gas innovation system
- Solutions to today's energy challenges require an understanding of entire innovation system and how pieces fit together
- CRIN aims to enhance innovation effectiveness by:
  - Better priority setting and alignment on key game changing technologies to pursue
  - Broader source of ideas and more entrepreneurs engaged from across Canada and the world
  - Focus on deployment phase (field pilots to commercial roll out) where current system falters
  - Better connectivity between all participants (academics, entrepreneurs, funders, customers, governments)
  - Expand "path to deployment" and customer centered objectives for the technology work across sectors

Innovation will position Canada to contribute responsibly to increased global growing energy demands

- World Business Council on Sustainable Development frames the 2050 challenge as “nine billion people not just living on the planet, but living well and within the limits of the planet”.
- Canada has a role to play in helping those countries meet the growing energy needs, while reducing emissions and growing the economy.

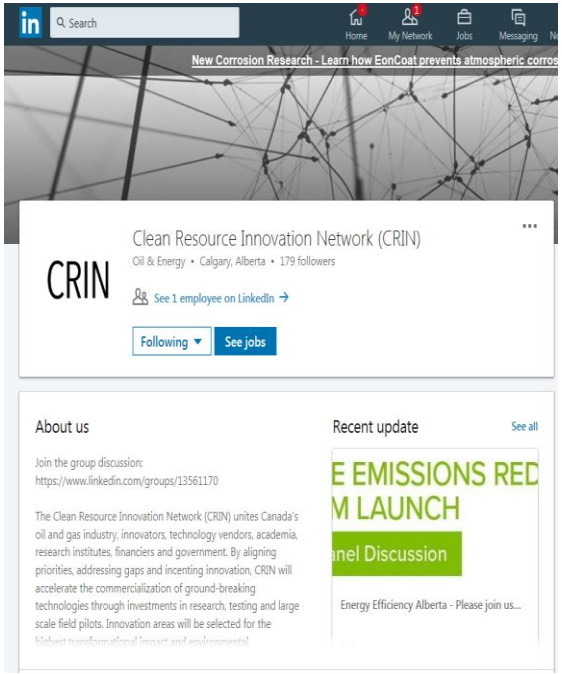




Follow CRIN and Join Online Discussions

- **Follow CRIN on the Public LinkedIn Page** to get the latest updates on current CRIN events, news and activities and updates for network members
- **Join our Member-only group pages** for technology-focus areas with exclusive content and discussions, accessible only to CRIN members:

- Canadian Fuels Standard – Reducing the Carbon Intensity of the Barrel
- Clean Resource Innovation Network (CRIN) Members
- Digital Oil and Gas Technology
- Low to Zero Carbon Hydrocarbon Production to End Use
- Methane Monitoring, Quantification and Abatement
- Novel Hydrocarbon Extraction
- Novel Land and Wellsite Remediation
- Water Technology Development



Note: *You must be logged into your LinkedIn account to view groups and must request to join these groups.*

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