Implementation of Large-Scale Carbon Capture Units – a Canadian Perspective

John Grace

Clean Energy Research Centre

University of British Columbia

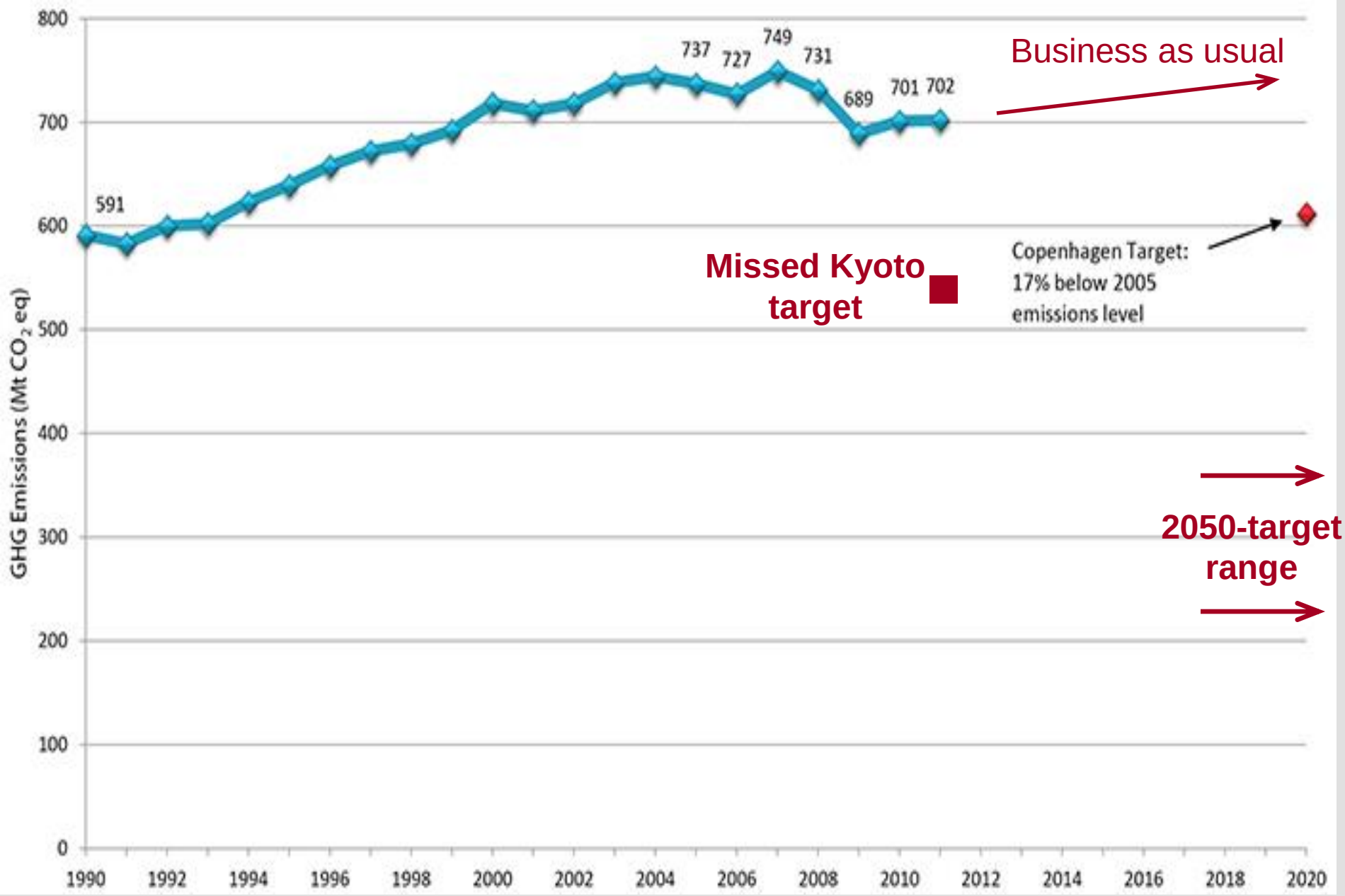
Vancouver

RCN CCUS Annual Meeting & Workshop, Columbia University

April 2014

Canadian Context

- Very large energy user and per capita GHGs.
- Signed on to Kyoto, did virtually nothing.
- Conservative government pulled out in Dec., 2011: Wished to “harmonize” with the U.S.
- Jurisdictional (provincial-federal) problems.
- Aspirations to be an “Energy superpower”.
- Pipeline proposals from Alberta.
- CCS seen as the major strategy by the Alberta and Canadian governments.
- Will miss all targets by a wide margin, despite effects of climate change: polar ice melt, fires, ice storm, floods, pine beetle.



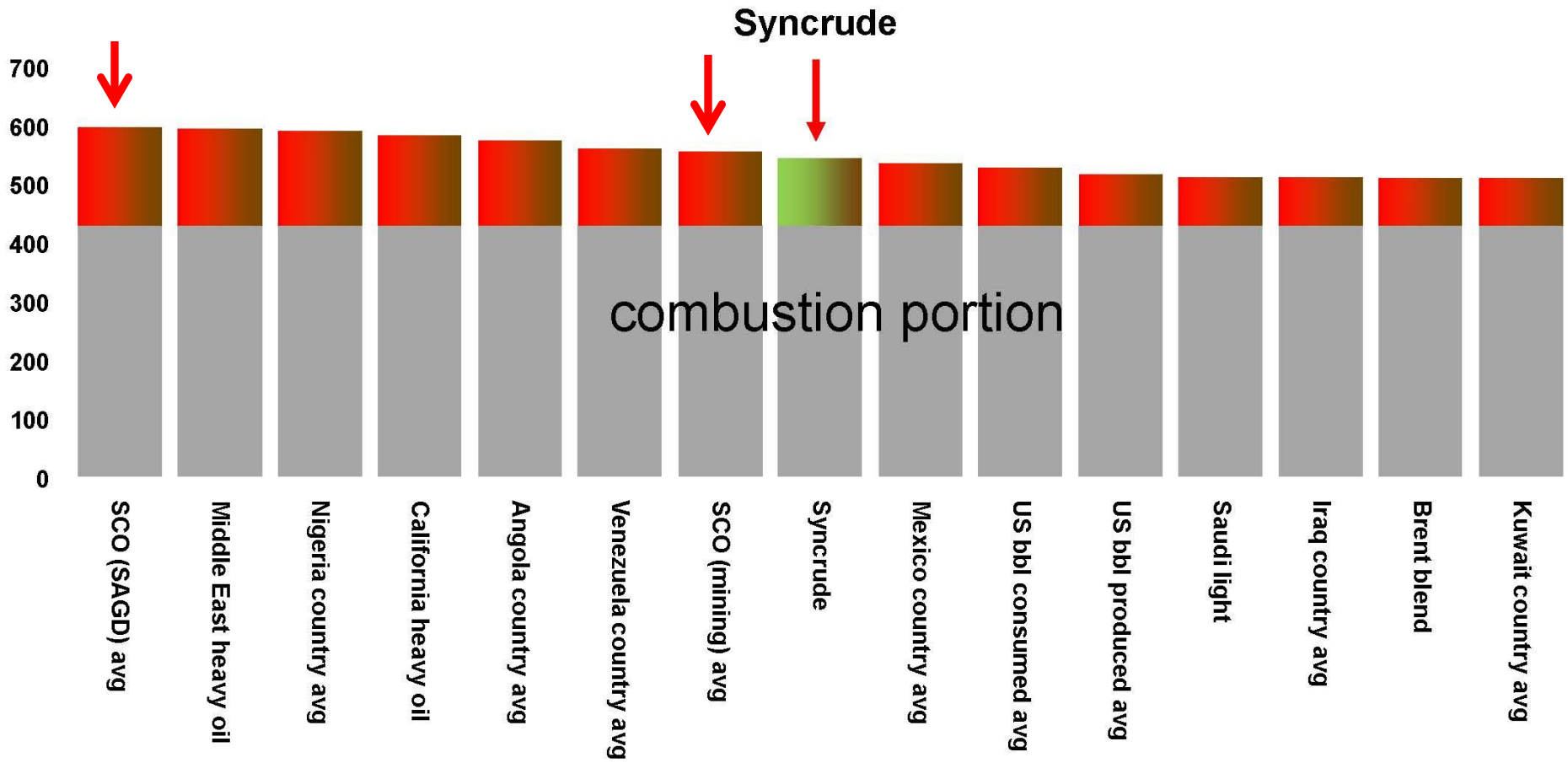
Canada's Greenhouse Gas Emissions

Oil Sands Mining Truck

"Wells-to-wheels" CO_2 emissions

Kg CO_2e emitted for every bbl of crude oil produced (extraction, processing, distribution and combustion).

Full-life cycle, well-to-wheels, including combustion.



Source: Cambridge Energy Research Associates, 2009

Blue shows saline aquifers in Canada and the US.

Pipeline Proposals

- Keystone XL ↓ 830,000 bbls/day
- Northern Gateway ← 550,000 bbls/day
- Kinder Morgan (Trans Mountain) ← ---------- additional 590,000 bbls/day
- Eastern Energy → 1,100,000 bbls/day
  (Mackenzie) ↑

3,070,000 bbls/day

IEAGHG Weyburn Project

History: Launched in 2000 and ran to late 2011; stored ~8000 t/day of CO_2 transported 330 km from Beulah, North Dakota

Company: Cenovus (formerly Pan Canadian, EnCana)

Usage: CO_2 used for enhanced oil recovery (EOR) in Weyburn and Midale reservoirs

In 2008 it was the world's largest CCS project.

Generated considerable data on site characterization, wellbore integrity, monitoring and verification

2011 leakage claims proven false.

Overall capacity: 20 Mt CO_2

Quest Project

Companies: Shell, Chevron, Marathon Oil

Location: Fort Saskatchewan, Alberta

CO_2 Source: Oil Sands Bitumen Upgrader

Capacity: 1.2 Mt CO_2/year

Capture process: Amine solvents

Storage: Deep saline aquifer

Public funding: $745M Alberta, $120M Cdn gov't

Total cost: $1.33B (includes 10 yrs of operation)

Expected start date: 2015

Alberta Carbon Trunk Line

Company: Enhance Energy

Location: Northern Alberta

Description: 240 km pipeline to gather, compress and transport CO_2 from industrial area in North Alberta to Lacombe area where it will be injected for EOR (enhanced oil recovery)

Capacity: 14.6 Mt CO_2/year (called the world's largest CCS project)

Public funding: $495M Alberta, $63M Cdn Gov't

Boundary Dam, Saskatchewan

Company: SaskPower (utility)

Location: Coal (lignite)-fired power plant near Estevan, Saskatchewan

Funding: $1.3B with $240M from Cdn Gov't

Capacity: 1 Mt CO_2/year to be used for EOR

Also building $60M facility for testing capture technologies

Cancelled Projects

Project Pioneer: Despite $436M from Alberta & $342M from Ottawa, cancelled in April 2012. Due to economics: willing to pay $15/t penalty. TransAlta coal-fired power station. Issued a statement saying “We still believe there is a future for CCS.”

Swan Hills: Cancelled in February 2013 despite $285M from Alberta. Was to have captured and used CO_2 for EOR from Coal-to-Syngas plant north of Edmonton. Blamed low price of natural gas.