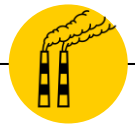
Safely Reducing Greenhouse Gas Emissions from Sulphur Recovery Unit Incinerators in Alberta



Global Analyzer Systems


WORLD'S NEWS
TOKYO
SIDNEY
LONDON
PARIS
WE NEED
TO SAY STOP
The average temperature of Earth's
tmosphere and oceans started to rise
o fast. The scientists say that defor-
GLOBAL WARMING ALARM!
DISASTER!
The effects of global warming can be


BUSINESS
ECONOMY · INVESTMENTS · CORPORATIO
Economic Growth

Canada is the worlds 5th largest producer of natural gas

Alberta Sour Gas Statistics

≈250

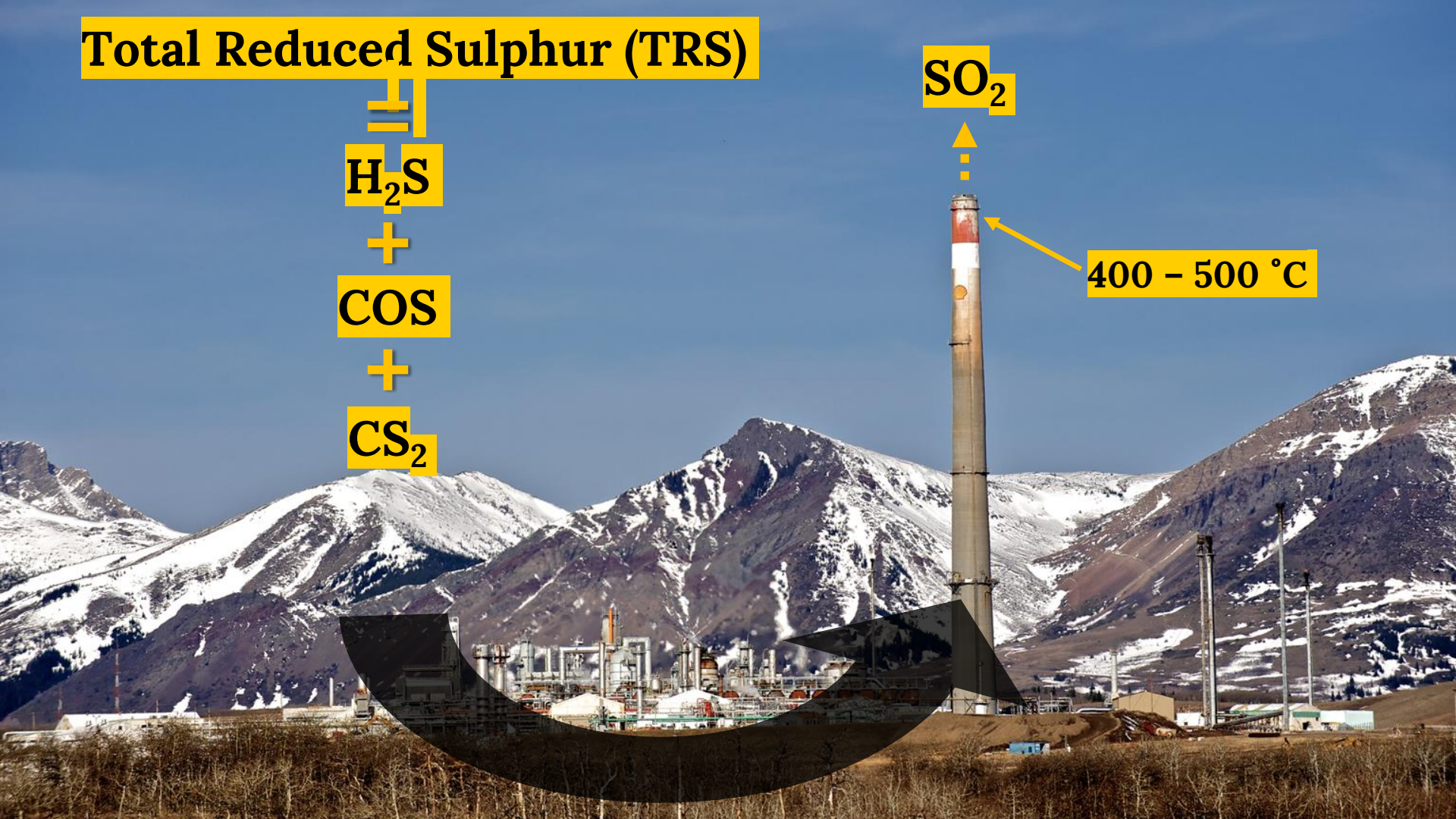
Number of sour gas processing plants

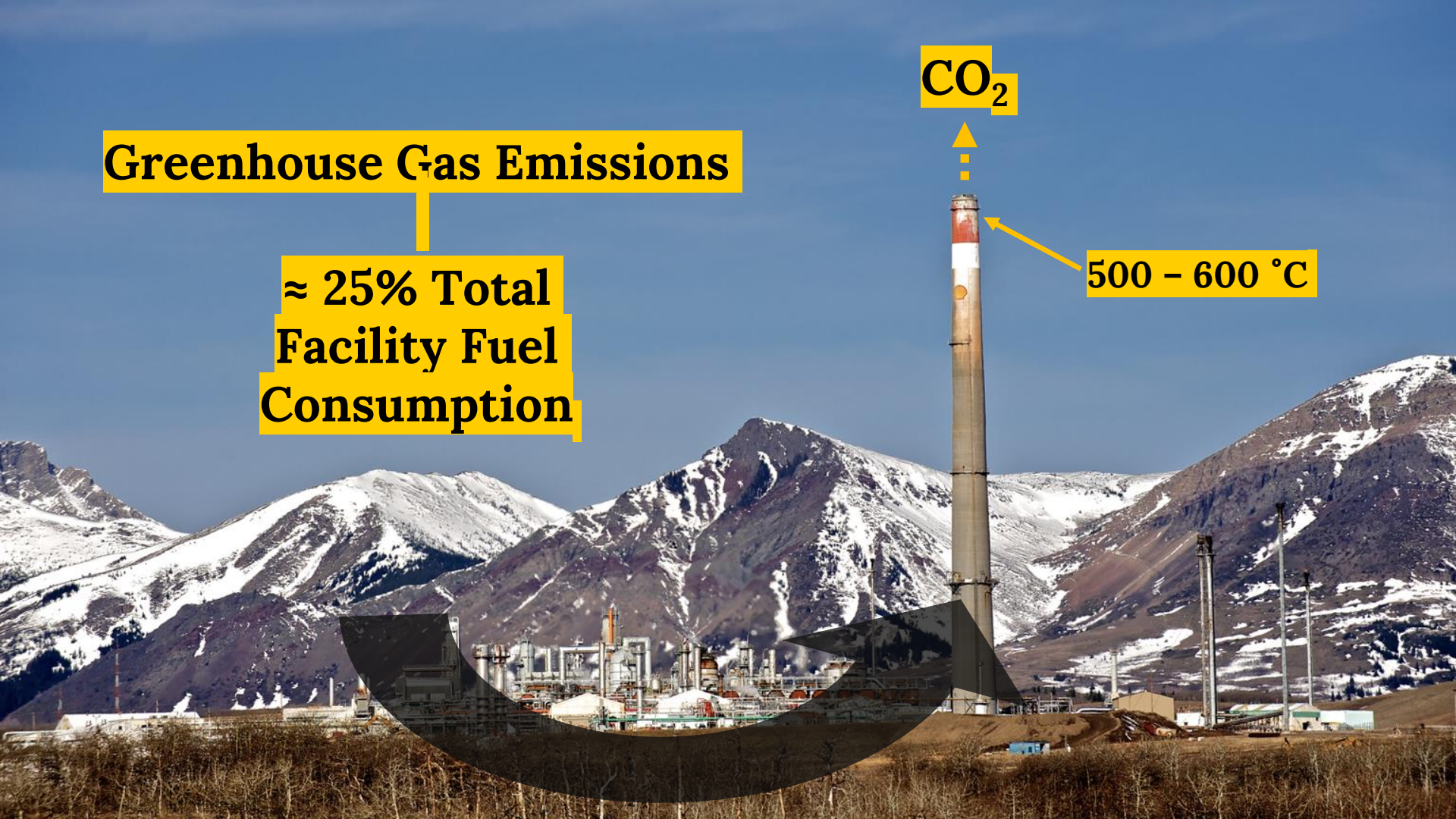
>50

Larger facilities that produce elemental sulphur

20%

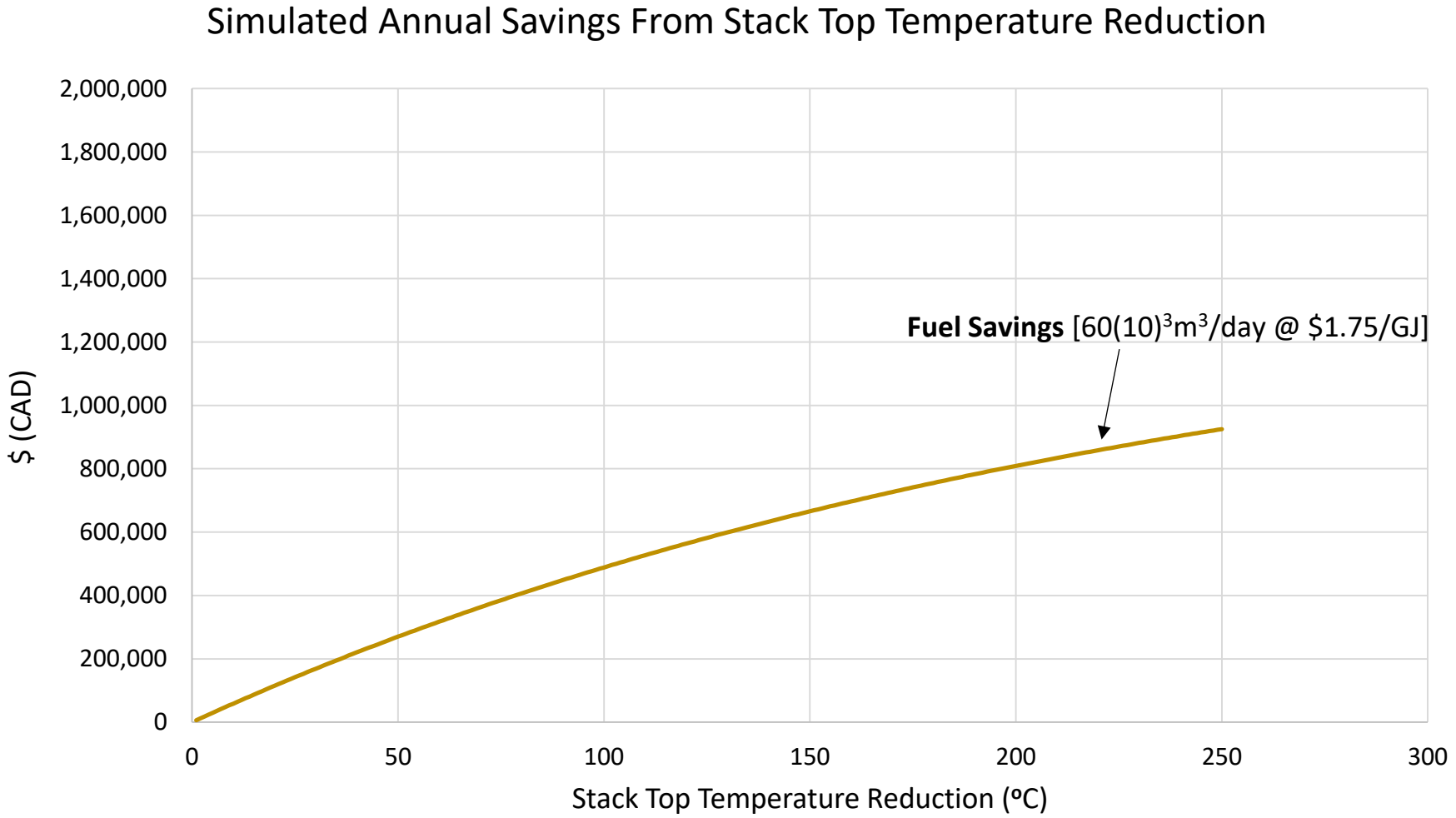
Total Fuel Consumption from Upstream Oil & Gas

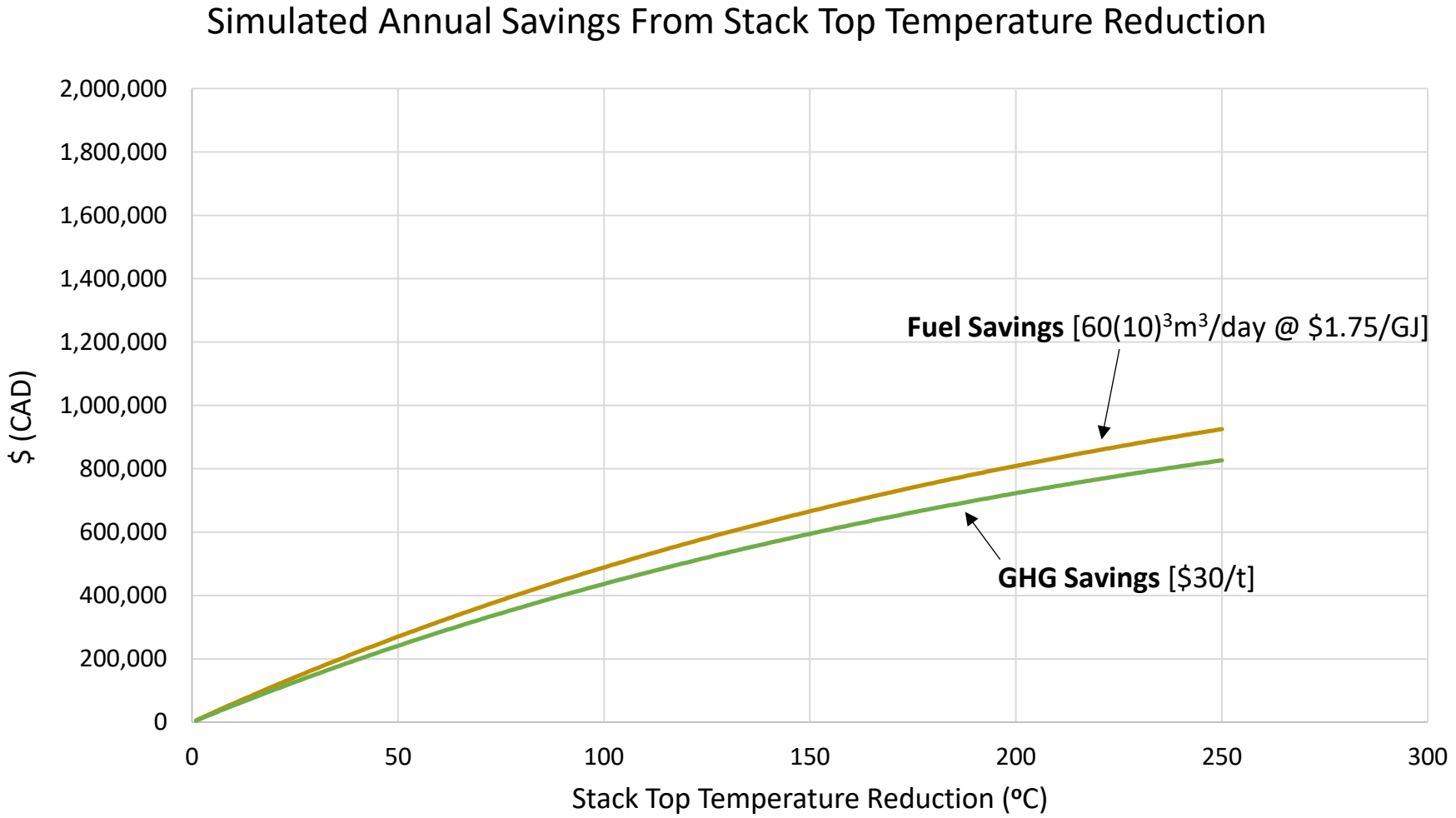

Total Reduced Sulphur (TRS)
H_2S
+
COS
+
CS_2
SO_2
400 – 500 ˚C


Greenhouse Gas Emissions
≈ 25% Total Facility Fuel Consumption
CO_2
500 – 600 ˚C

Why Does This Matter?

We Can Reduce GHG Emissions and Operating Costs


Simulated Annual Savings From Stack Top Temperature Reduction
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
$ (CAD)
Fuel Savings [60(10)3m3/day @ $1.75/GJ]
0
50
100
150
200
250
300
Stack Top Temperature Reduction (ºC)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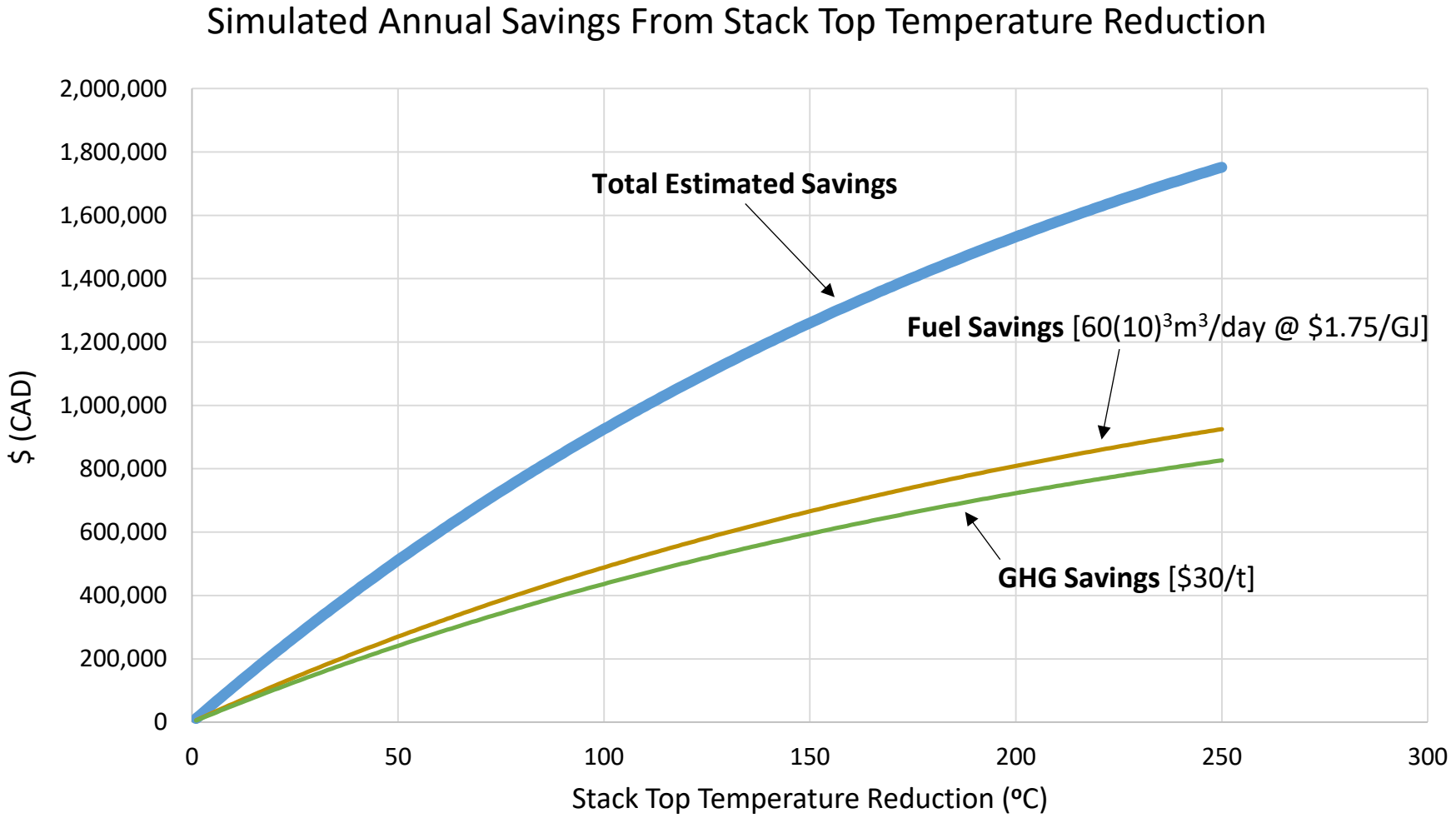
600,000
400,000
200,000
0
$ (CAD)
0
50
100
150
200
250
300
Stack Top Temperature Reduction (ºC)
Fuel Savings [60(10)3m3/day @ $1.75/GJ]
GHG Savings [$30/t]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600,000
400,000
200,000
0
$ (CAD)
Total Estimated Savings
Fuel Savings [60(10)3m3/day @ $1.75/GJ]
GHG Savings [$30/t]
0
50
100
150
200
250
300
Stack Top Temperature Reduction (ºC)

What is the trade-off to reducing stack temperature?

- loss of thermal energy needed to ensure that the stack plume rises in the atmosphere.
- loss of thermal conversion efficiency in the stack.

How do we lower stack temperature safely?

- We need an accurate measurement method to ensure TRS emissions do not exceed the compliance limits which were set to safeguard human health and the environment.

Project Objectives

DEVELOP

Measure accurately and continuously the total reduced sulphur compounds being emitted from a high temperature SRU incinerator stack.

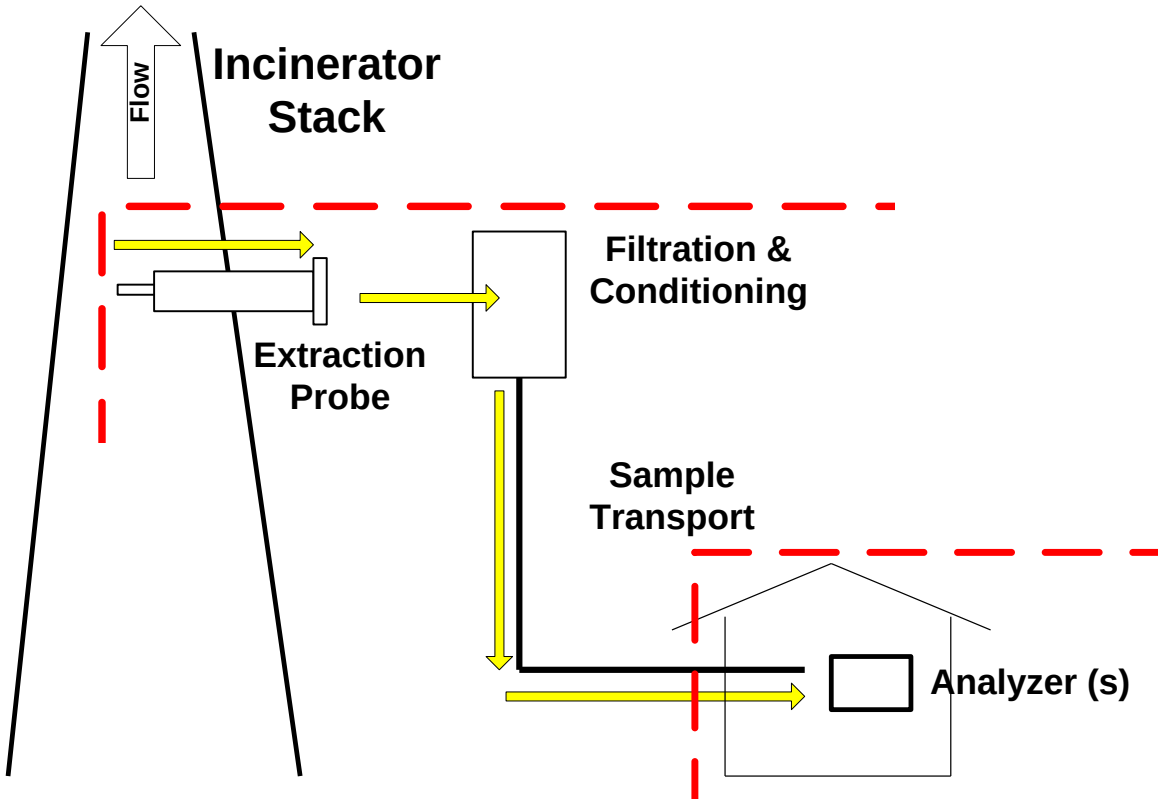
FACILTATE

Aid in the AER license amendment process to permit a stack top temperature limit reduction within the SRU incinerator stack.

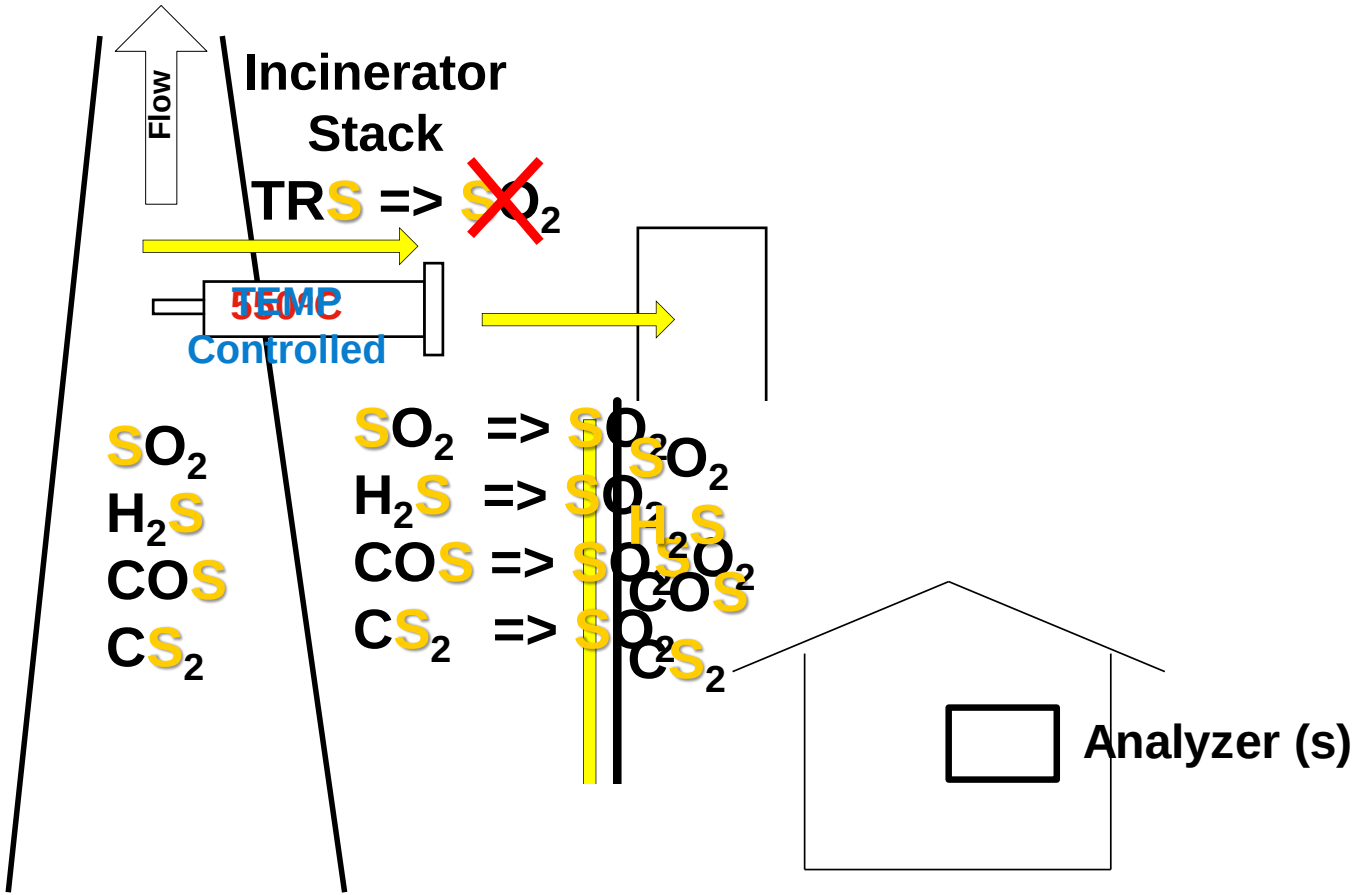
ACHIEVE

Obtain a minimum greenhouse gas reduction of approximately 4,850 tonnes of CO_2e per year by lowering the incineration temperature.

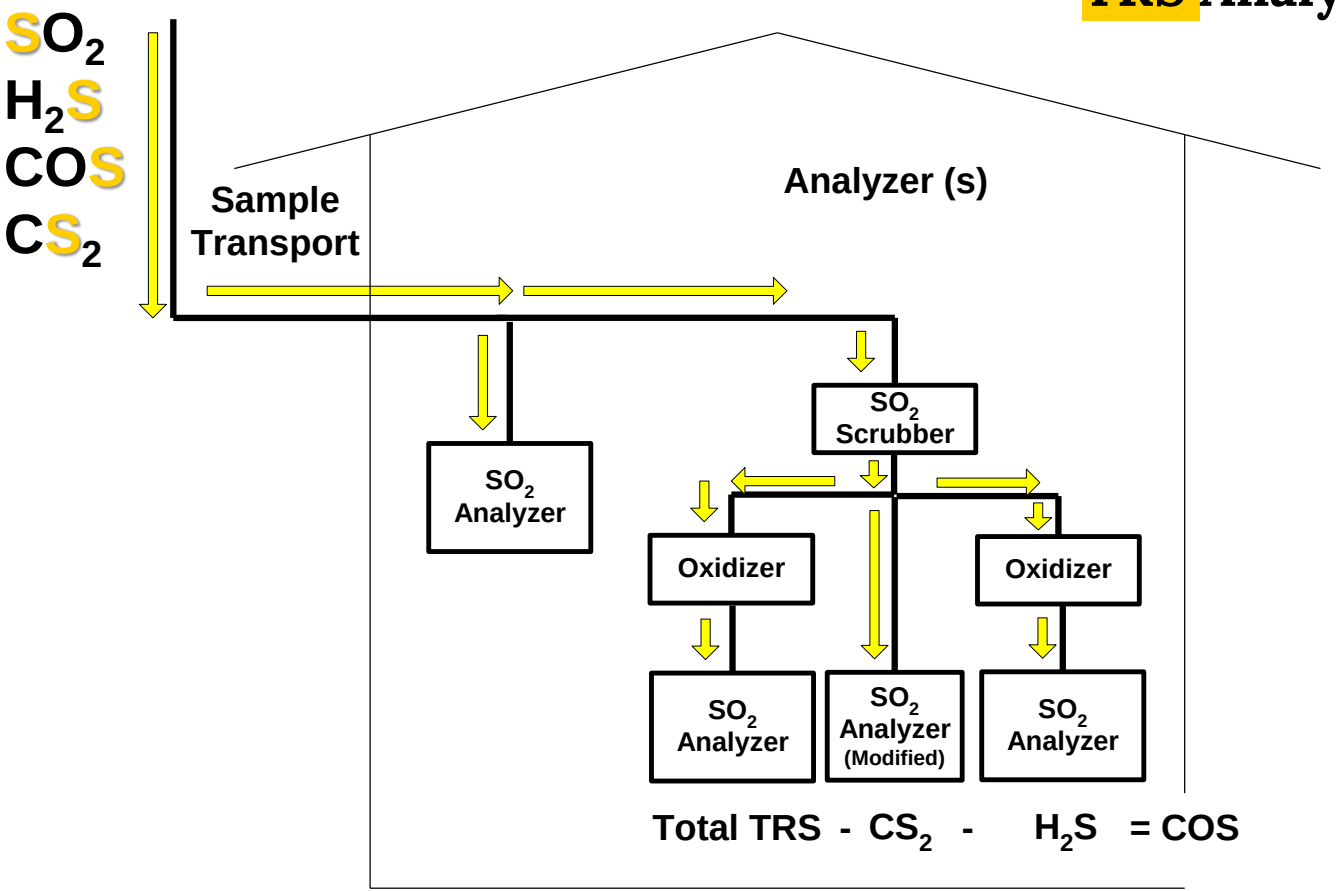
TRS Continuous Measurement Challenges



TRS Sampling System Challenges



TRS Analysis Challenges

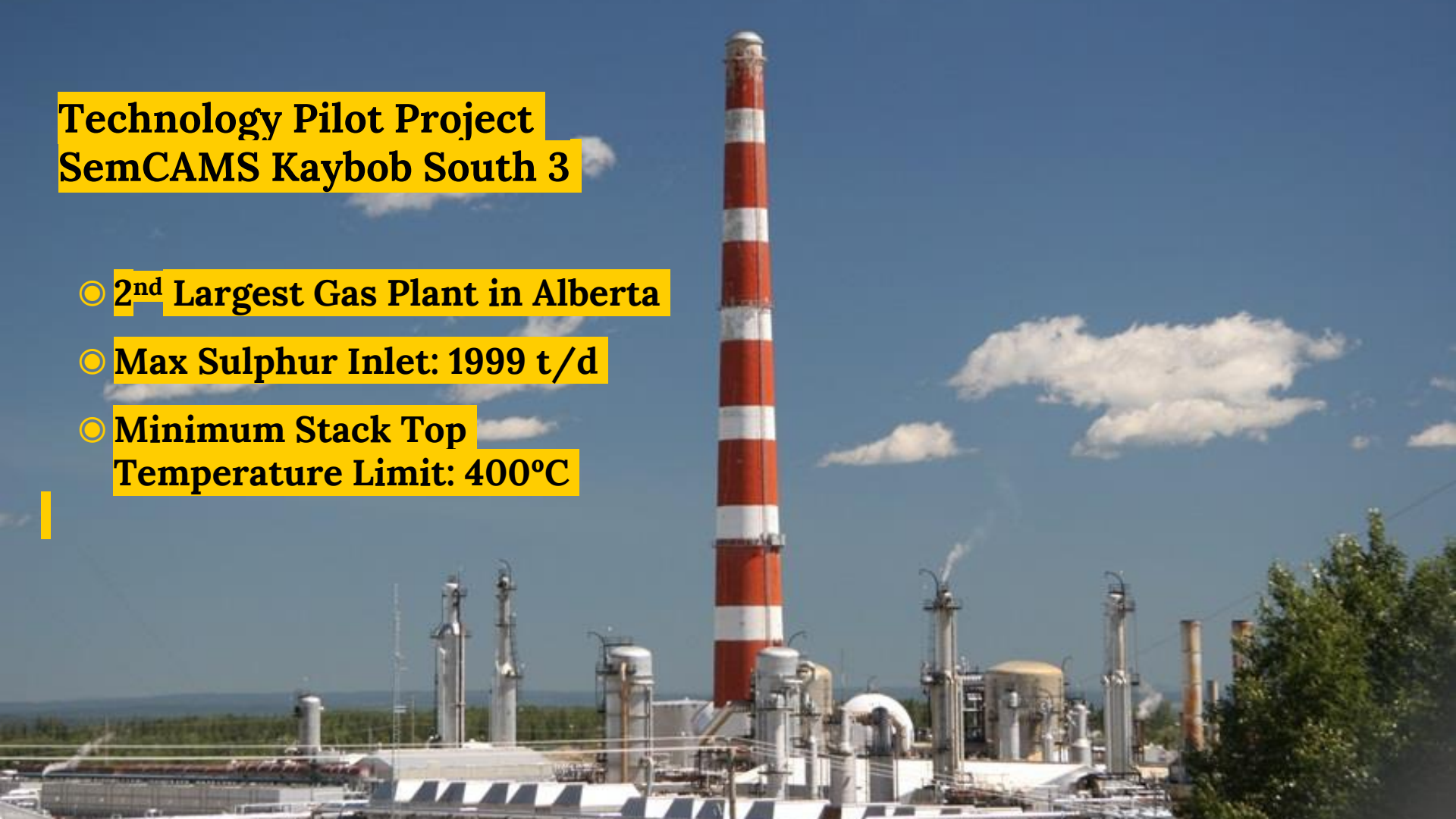


Real World Application: The 3 Phase Approach

Modelling

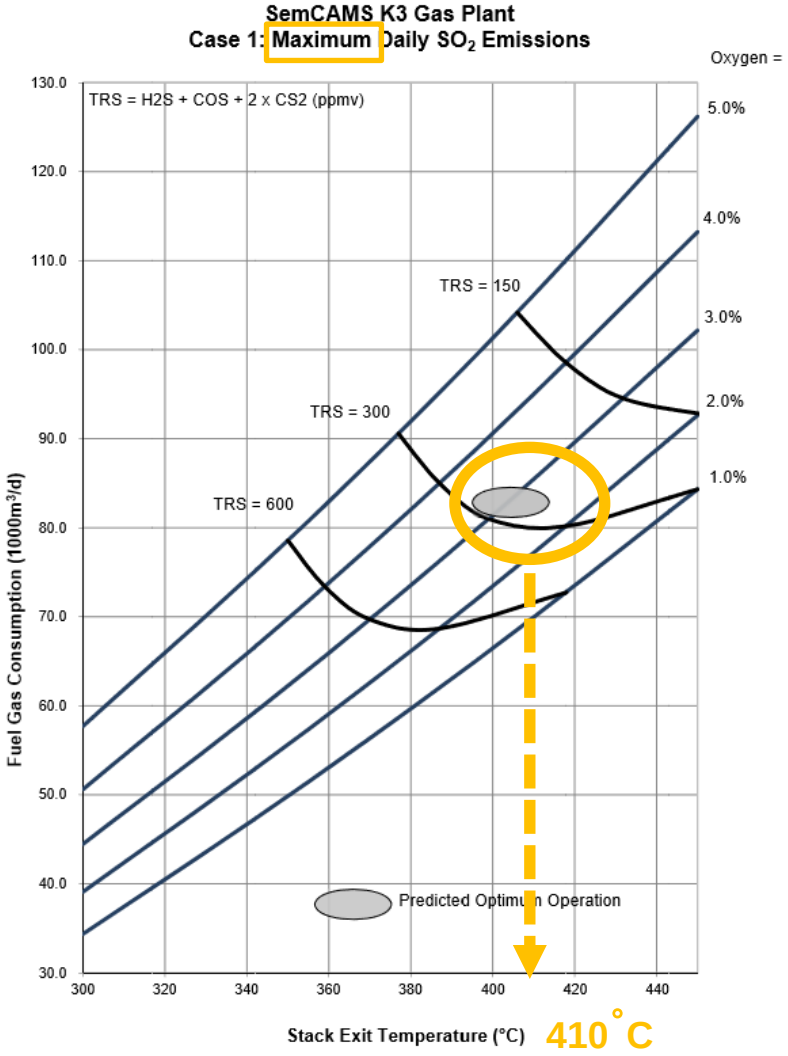
Field Study

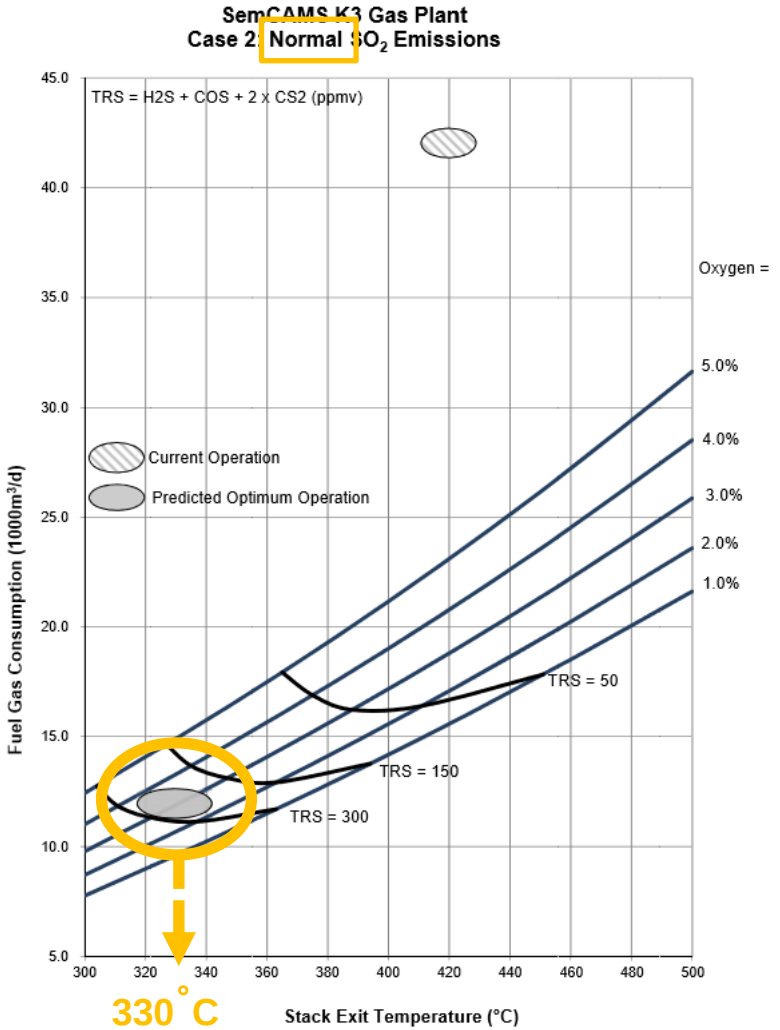
Certification of TRS CEMS Technology



Technology Pilot Project
SemCAMS Kaybob South 3

- 2nd Largest Gas Plant in Alberta
- Max Sulphur Inlet: 1999 t/d
- Minimum Stack Top Temperature Limit: 400°C


SemCAMS K3 Gas Plant
Case 1: Maximum Daily SO_2 Emissions
Oxygen =
TRS = H2S + COS + 2 x CS2 (ppmv)
5.0%
4.0%
3.0%
2.0%
1.0%
TRS = 150
TRS = 300
TRS = 600
Predicted Optimum Operation
Fuel Gas Consumption (1000m³/d)
Stack Exit Temperature (°C)
410 °C


SemCAMS K3 Gas Plant
Case 2: Normal SO_2 Emissions
TRS = H2S + COS + 2 x CS2 (ppmv)
Oxygen =
5.0%
4.0%
3.0%
2.0%
1.0%
Current Operation
Predicted Optimum Operation
TRS = 50
TRS = 150
TRS = 300
Fuel Gas Consumption (1000m³/d)
330 °C
Stack Exit Temperature (°C)

SemCAMS K3 Field Study Results

	Average Normal Operating Conditions (prior to testing)	Optimization Results	Δ
Stack Exit Temperature (ºC)	420	335	(85)
%Oxygen	8.0	4.7	(3.3)
Fuel Gas Consumption ($1000m^3/d$)	60	20	(40)
TRS (ppmV)	35 (±20)	45	10

$1,522,000

estimated annual savings from fuel & GHG reduction

12,250,000

m^3/year reduction in sales gas fuel used

24,256

tonnes of CO_2e reduction per year

5273

Passenger vehicles off the road

Certification of TRS CEMS

There are many factors that affect the ability to draw a Relative Accuracy comparison [manual method vs CEMS]

- Differences in the sample extraction techniques
- Time-to-analysis
- Time of travel in the stack
- Stratification of gas within the stack
- Sample integration times

Certification of TRS CEMS

- Most challenging part of project
- Took several attempts and investigations to successfully pass current provincial standards
- Sample degradation in reference method problematic

Conclusion

- Reducing stack temperatures in order to conserve fuel and lower greenhouse gas emissions is a viable way to reduce emissions within Alberta.
- An accurate method to measure TRS has been developed and proven within the regulatory framework in Alberta
- Accurate methods, such as the TRS CEMS, are needed to ensure the TRS compounds do not exceed the compliance limits which were set to safeguard human health and the environment.

Next Steps

- Further testing using a mobile platform that will be used as a tool to quantify emissions, validate incinerator performance, and optimize Sulphur Recovery Unit performance.

Thanks!

Any questions ?

You can find us at

- www.gasl.ca
- c.grimm@gasl.ca