Chief Power Engineer Education Conference

Date: October 25, 2023

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

SAFETY MOMENT

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Pyrophorics

- Pyrophoric materials are substances that ignite instantly upon exposure to oxygen.

- *Sarnia – April 2019*
- *Modifications made to the tower in 2011 allowed an unexpected accumulation of the byproduct – known as pyrophorics – to heat up and melt portions of the 15-story structure, said refinery manager Rohan Davis.*
- *"It's a design change that was on this unit, and the risks around pyrophorics were not adequately considered when the design change was made," Davis said last week following a lengthy internal investigation.*

- *Sept 2023 - BASF Total Energies Petrochemicals – Port Arthur*
- *Vessel was empty for a TA*
- *Incident is still under investigation*

Please share with all TA teams to ensure they review and understanding learnings from these events

OPENING REMARKS – George Mitsopoulos

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WELCOME

EMERGENCY EXITS

COMMITTEE

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Keith Greenaway
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Mustang Energy Service and Consulting

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Vice President

Pembina Pipeline

Les Anderson
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Alberta Institute Of Power Engineers, Edmonton Branch

Kelly Perrott -
Director

Inter-pipeline

Bryan Bonnett
Director

Ian Lovell - Director

Orica

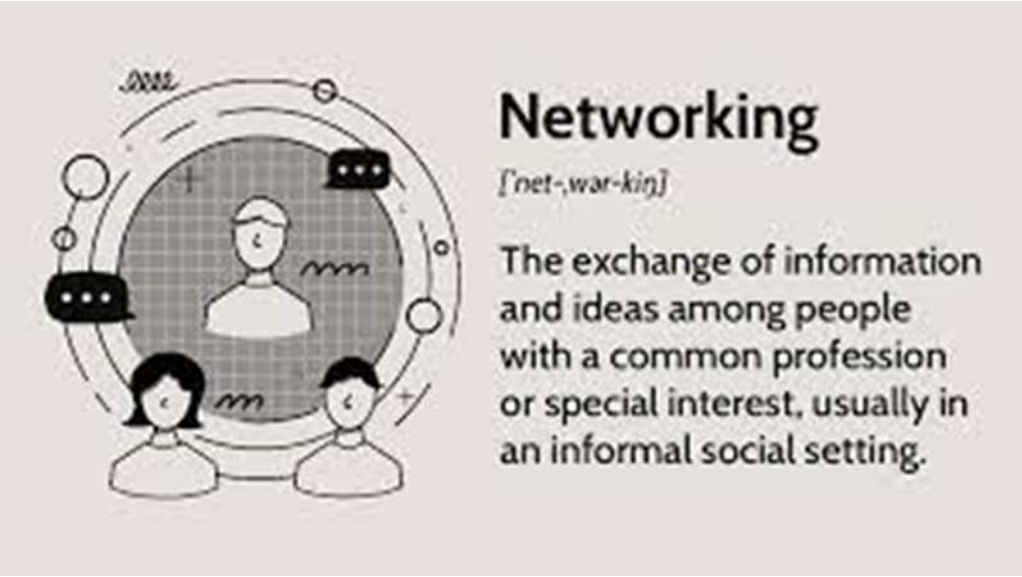
Tom Leming -
Advisor

ABSA, the pressure equipment safety authority

COMMITTEE GOAL

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

- **<u>Provide an environment for Alberta Chief Power Engineers to learn, grow and network.</u>**
- The conference was developed in response to requests from Chief Power Engineers across all industries in Alberta.
- This is the 9th year of the conference
- Started in 2015 (7 in person, 1 virtual, 1 cancelled)



GROUND RULES

1) Be Respectful
2) Cell Phones – Silent
3) Participate (Ask Questions)

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AGENDA

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

Time	Topic	Presenter
8:00-8:05	Safety Moment - Pyrophorics	George Mitsopoulos
8:05-8:15	Welcome & Opening Remarks	George Mitsopoulos
8:15-9:15	KEY NOTE SPEAKER - Human Organizational Performance	Murray Elliott
9:15-10:15	ABSA Update	Tom Leming
10:15-10:30	**BREAK**	
10:30-11:00	Combustion Topic - Flaring & Emissions	Jamal Ghazala
11:00-12:00	KEY NOTE SPEAKER - Alberta 2025	Angus Watt
12:00-13:00	**LUNCH**	
13:00-14:00	Training Topic - Control Room Simulators	Ron Besuijen
14:00-14:45	That's My Certificate on the Wall	John Giles
14:45-15:00	**BREAK**	
15:00-15:30	Women in Power Engineering	Dawn Ziesman / Caitlin Hartigan
15:30-16:00	Technology Topic - Digital Journey to Energy Management	Ian Ignatiuk
16:00-16:30	ABSA Special Topics & Discussion	Tom Leming
16:30-16:45	Final comments and close	George Mitsopoulos

Human Organizational Performance

Murray Elliott – CEO, Energy Safety Canada

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

Human & Organizational Performance

October 25, 2023

ENERGY SAFETY CANADA

ENERGY SAFETY CANADA

The National Safety Association for Canada's Energy Industry

Recognized Training & Certificates

Safety training delivered to 100,000+ workers annually

Expansive network across Canada

Accepted at most Canadian worksites

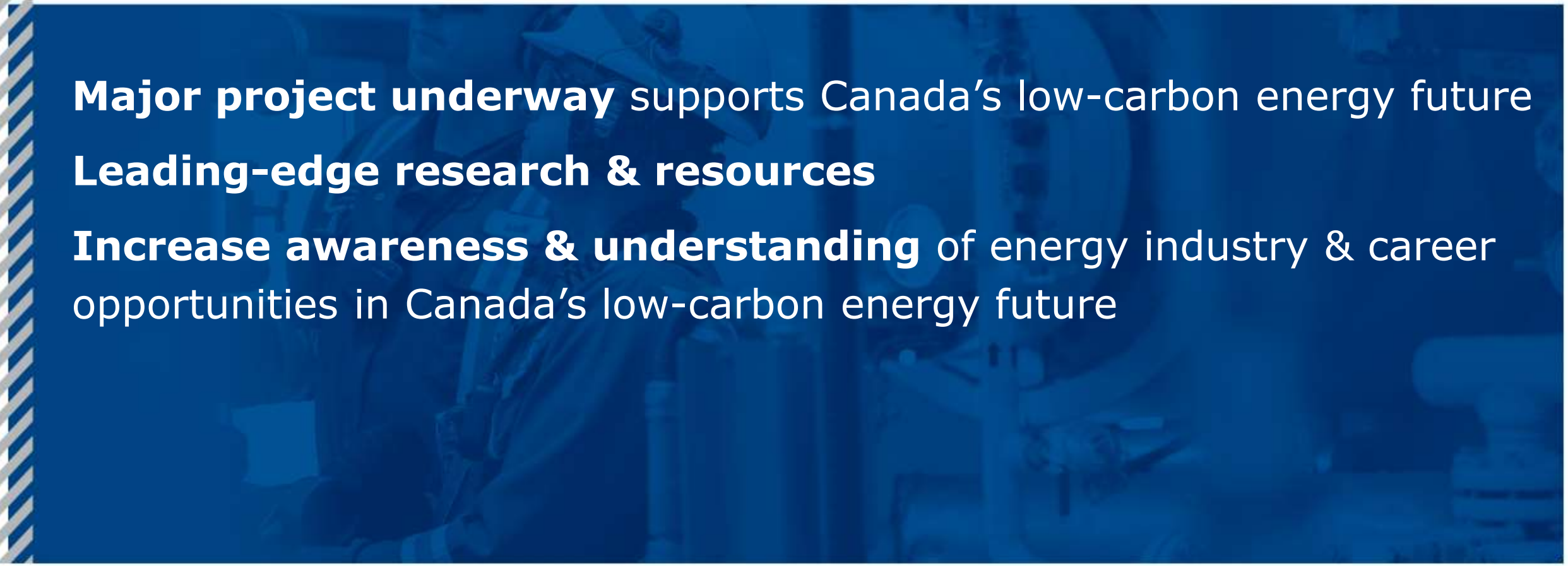
Safety Centre of Excellence

Gather, generate & share data about safety practices

Build partnerships & create networks to accelerate & scale safety improvement

Develop & implement safety interventions to strengthen performance across the industry

Building a Workforce for Canada's Energy Future



Major project underway supports Canada's low-carbon energy future

Leading-edge research & resources

Increase awareness & understanding of energy industry & career opportunities in Canada's low-carbon energy future

Industry Safety Performance

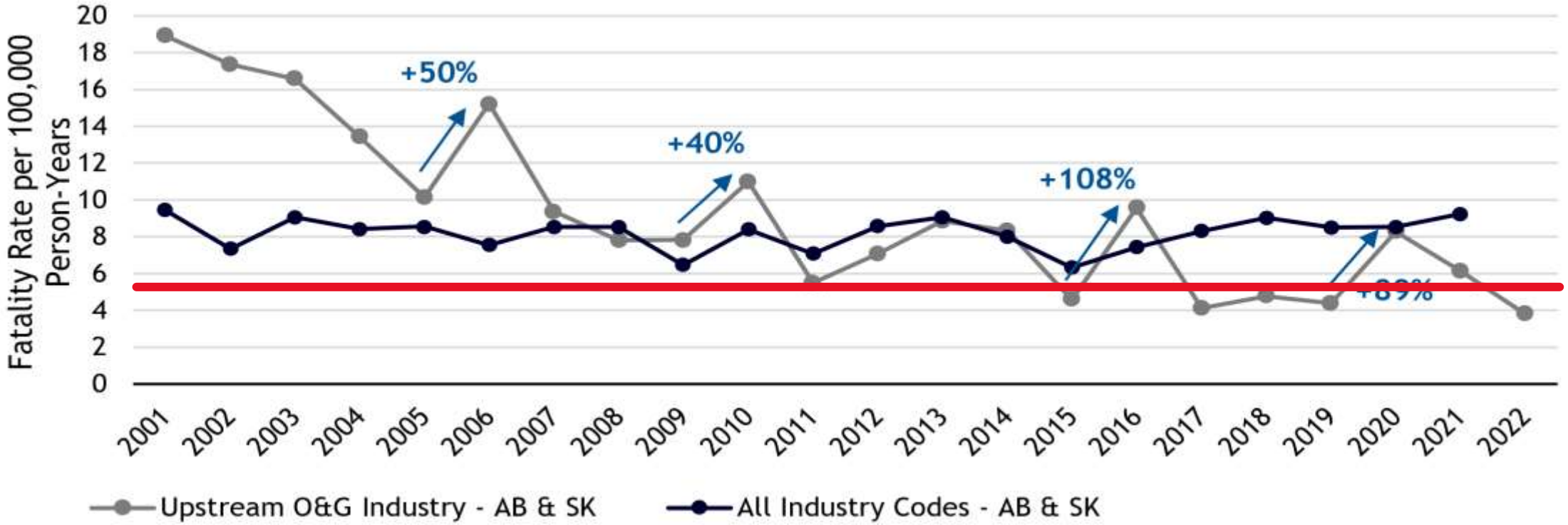
An exemplary safety record

Energy industry is one of the safest industries in Canada

Barriers & controls in place to ensure industry is safe

Between 2001-2022 injuries fell by 35%

Oil & Gas Fatality Rates | Over 20 Years



Data Source: WCB Alberta, Saskatchewan WCB, AWCBC, data as of Q4 2022. *"All Industry Codes" data retrieved from AWCBC. 2022 data unavailable.*

Moving Away from Zero

Zero-harm mindset sees all incidents as avoidable

It's an oversimplified view of a complex work environment

Safety is not about the number of incidents

It's about outcomes & what we can learn from them

Build capacity & resilience in people, processes & systems so when things fail, they fail safely

Human & Organizational Performance

- **New approach**
  Change the way H&S systems are designed, delivered & managed
- **Instead of blaming workers**
  Understand context & learn from success *and* failure
- **Recognize complex interactions**
  Between people, technology, environment & systems
- **Encourage & foster**
  Frontline problem solving & innovation

Redefining safety
Not the absence of incidents, but the capacity to fail safely

Five Principles of HOP

1. **Error is normal**
   Errors are not choices.
2. **Blame fixes nothing**
   Blame makes errors look like choices.
3. **Learning is vital**
   Without it we are limited to past results & responses.
4. **Context drives behavior**
   Context influences behaviour – Systems drive outcomes.
5. **Response matters**
   Organizational learning is shaped by reaction to failure.

Benefits of HOP

- Identifies & amplifies existing expertise
- Brings transparency to normal work & capacity thresholds
- Brings clarity to operational challenges & successes
- Uncovers hidden barriers & pain points

- Creates a platform to learn & listen from employees
- Capitalizes on worker expertise to sustainably solve problems
- Utilizes an inclusive approach to break down silos
- Engages & empowers the workforce

SOURCE: www.southpacinternational.co

Critical Factors for HOP Success

Building trust & psychological safety

- Focused & consistent leadership engagement with frontline
- People feel they can speak up without fear of embarrassment or retribution
- People know they can ask questions when they are unsure
- People trust & respect their colleagues

SOURCE: The Fearless Organization – Amy Edmondson

Activities to Progress HOP Principles

Operational Learning

- Understanding work from the worker's perspective
- Goal to have a deeper understanding of normal work
- The black line, blue line concept (WAI vs WAD)
- End goal for planner & worker to work together

1. Get a more holistic view of how processes are working
2. Remove unacceptable goal conflicts
3. Reduce error traps
4. Expand on what creates success
5. Build stronger & more sustainable defenses to improve reliability & resilience

Energy Safety Canada HOP Resources

HOP Community of Practice | Access to global network of experts

HOP/New View | Delivery of company-requested presentations

Safety Evolution Seminar | 1-day event

Safety Evolution Workshop | Virtual program with Dr. Tristan Casey

EnergySafetyCanada.com| Free resources

Energy Safety Conference | April 29 to May 2, 2024 in Banff, AB

ENERGY SAFETY CANADA

ABSA Update – Tom Leming

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

CHIEF

POWER ENGINEER'S

CONFERENCE

2023

ABSA

the pressure equipment safety authority

October 25, 2023

What's new at ABSA?

- ABSA update
- Statistics
- SOPEEC update

What's new at ABSA?

- ABSA fee increase
  - 4.77% effective November 1, 2023 for all services
  - 4.77% for Annual Vessel Invoices effective April 1, 2024

- Large increase in the reporting of Unsafe conditions, Accidents & Fire reporting. It is strongly recommended to go to our website at www.absa.ca and checkout the summary.
  - This increase appears to be driven by an increase in reporting not by an increase in incidents.

- New Power Engineering Portal
  - We anticipate a launch of our CPECS portal by the end of this year. This portal will give power engineers easier access to scheduling of examinations and streamline the process for experience submittal and certificate issuance.
  - Long term this portal will assist in the mobility between jurisdictions

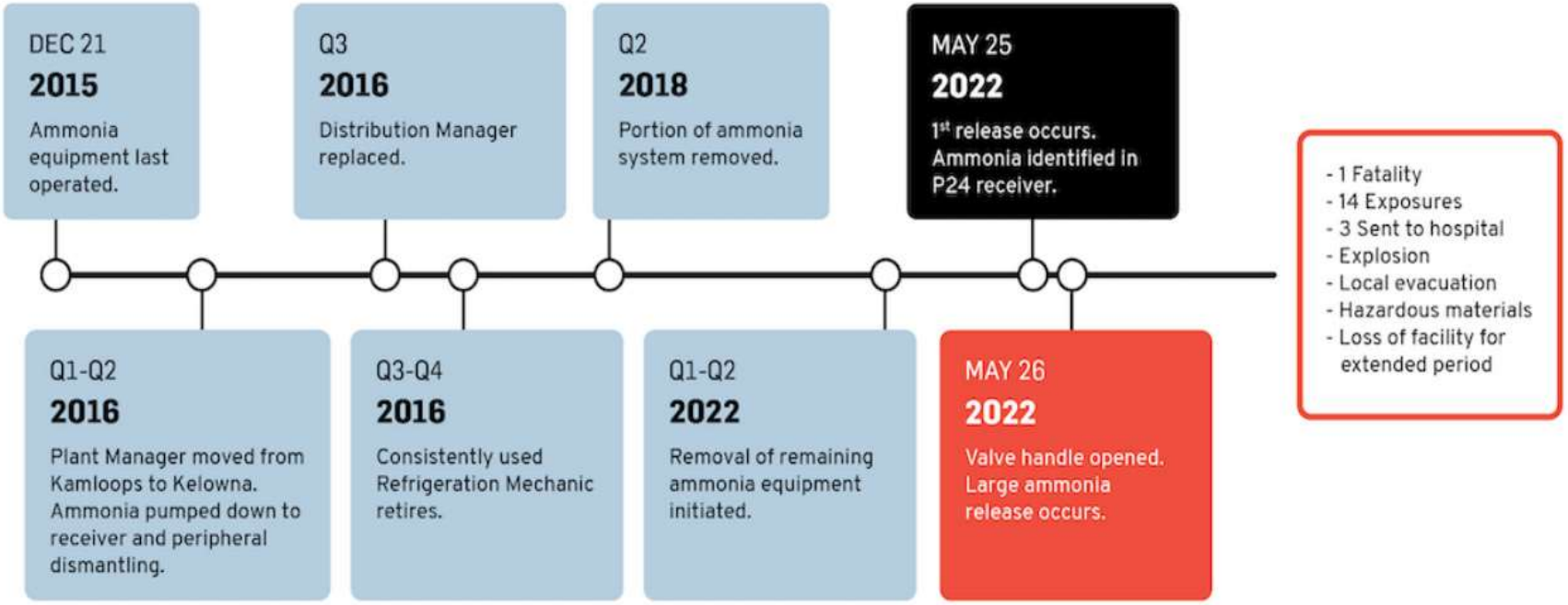
What's new at ABSA?

- Information Bulletins
  - You will notice a lot of traffic in our Information Bulletin page on our website. Almost all of it is our process for reconfirmation of bulletins that we do on an ongoing basis to ensure that nothing has changed in the intent of the IB.
  - Please feel free to brows through them on our website and if have any questions give us a call.
  -

What's new at ABSA?

- IB23-026
  - promotes awareness of the investigation findings and recommendations by Technical Safety BC regarding the accident that occurred in the Arctic Glacier Facility located near Kamloops, British Columbia

IB23-026

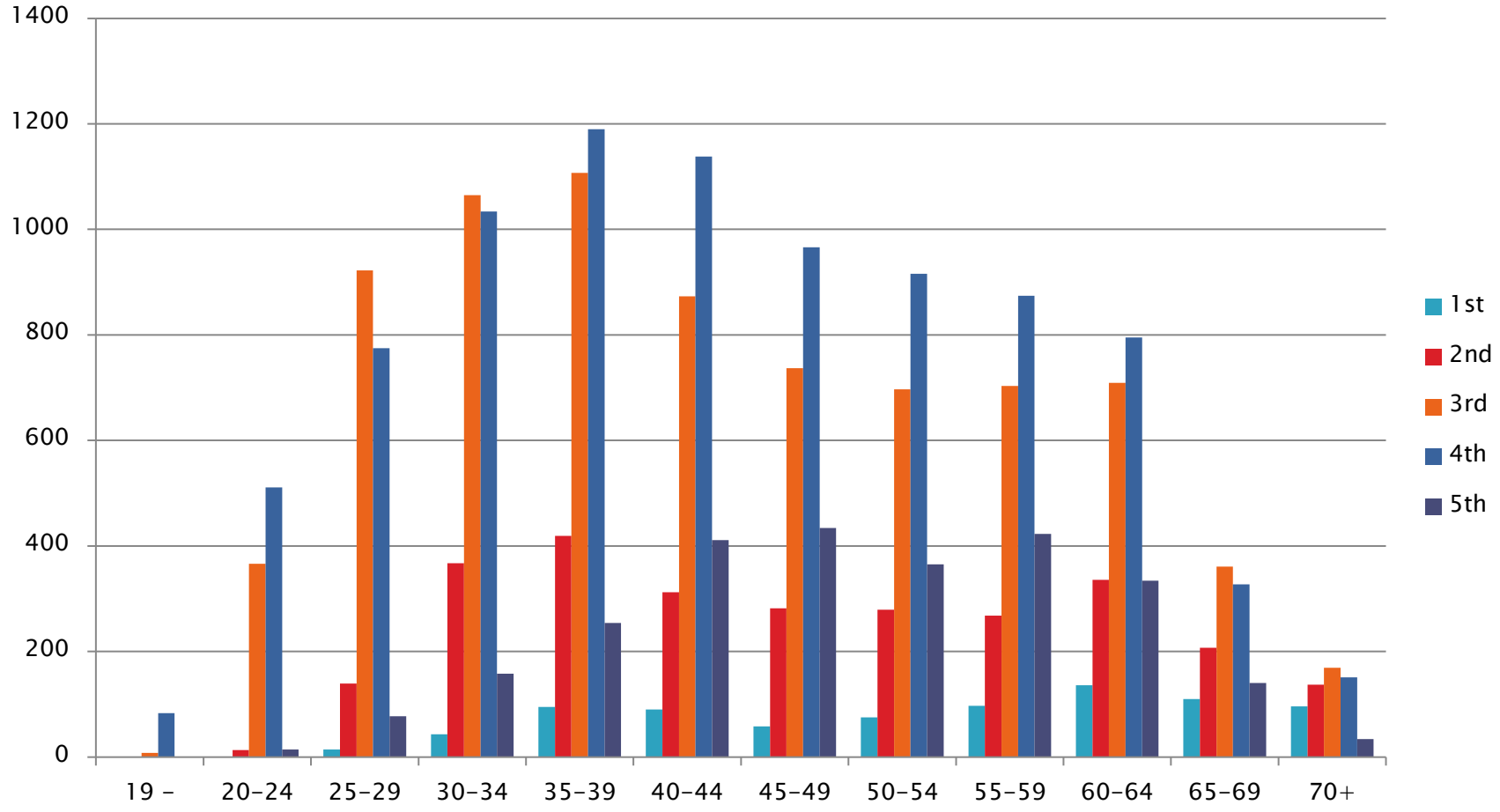

DEC 21
2015
Ammonia equipment last operated.
Q1-Q2
2016
Plant Manager moved from Kamloops to Kelowna. Ammonia pumped down to receiver and peripheral dismantling.
Q3
2016
Distribution Manager replaced.
Q3-Q4
2016
Consistently used Refrigeration Mechanic retires.
Q2
2018
Portion of ammonia system removed.
Q1-Q2
2022
Removal of remaining ammonia equipment initiated.
MAY 25
2022
1st release occurs. Ammonia identified in P24 receiver.
MAY 26
2022
Valve handle opened. Large ammonia release occurs.
- 1 Fatality
- 14 Exposures
- 3 Sent to hospital
- Explosion
- Local evacuation
- Hazardous materials
- Loss of facility for extended period

IB23-026

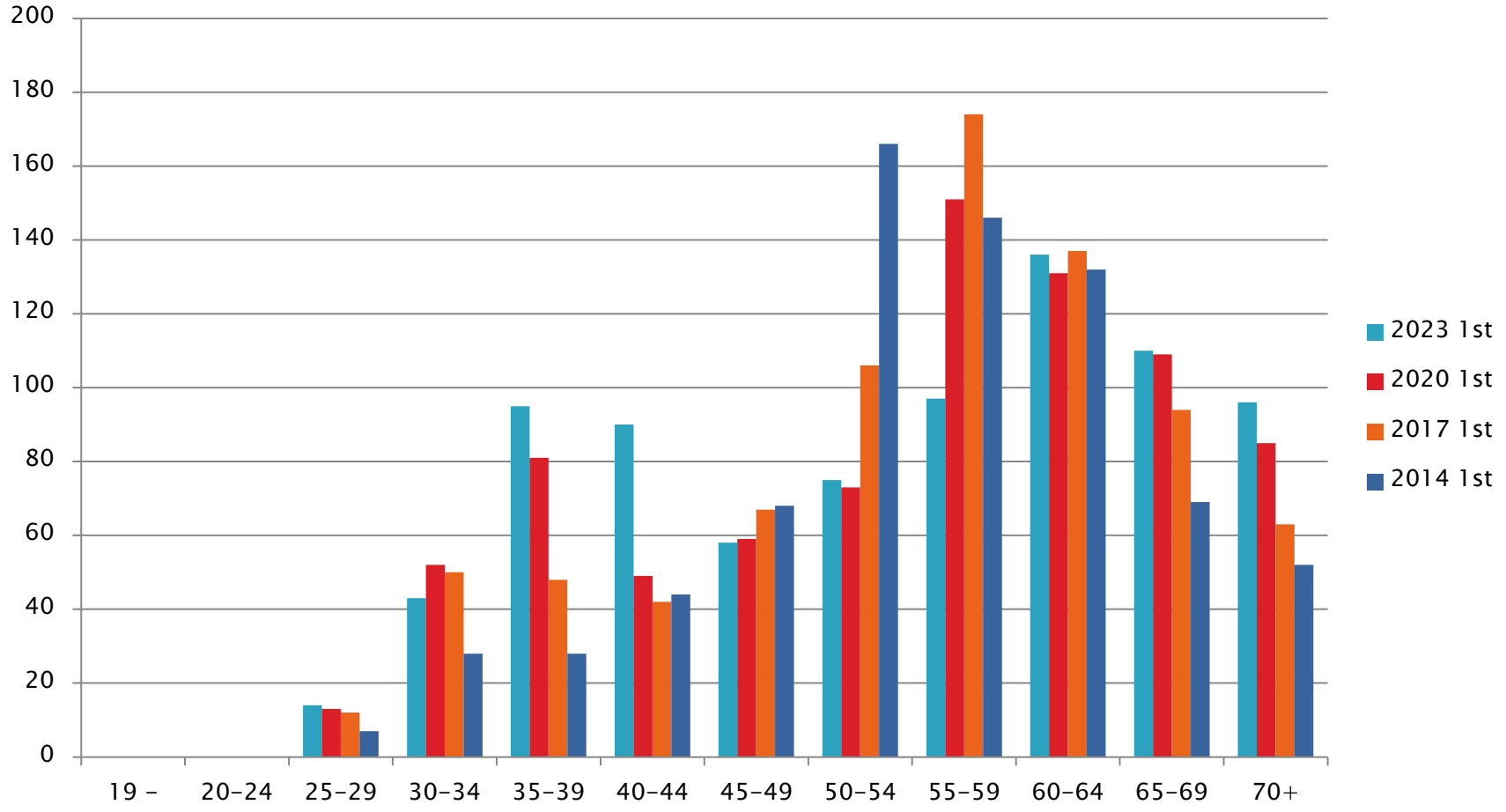
- To develop a decommissioning plan, the owner should review CSA B52 *Mechanical Refrigeration Code* and ANSI standard IIAR-8 *Decommissioning of Closed-Circuit Ammonia Refrigeration Systems*. ANSI/IIAR 8-2020 specifies the minimum criteria for removing the ammonia charge in conjunction with the decommissioning of closed-circuit ammonia refrigeration systems.
- Based on recommendations in the Kamloops Ammonia Release Investigation Report, the CSA B52 Technical Committee is developing requirements for decommissioning of refrigeration systems. The requirements are planned to be published in the 2024 Edition of CSA B52.
- In addition to this article, owner and operators of ammonia refrigeration systems are encouraged to review the Technical Safety BC report as a case study from which learnings may be taken to help improve safety.

STATISTICS

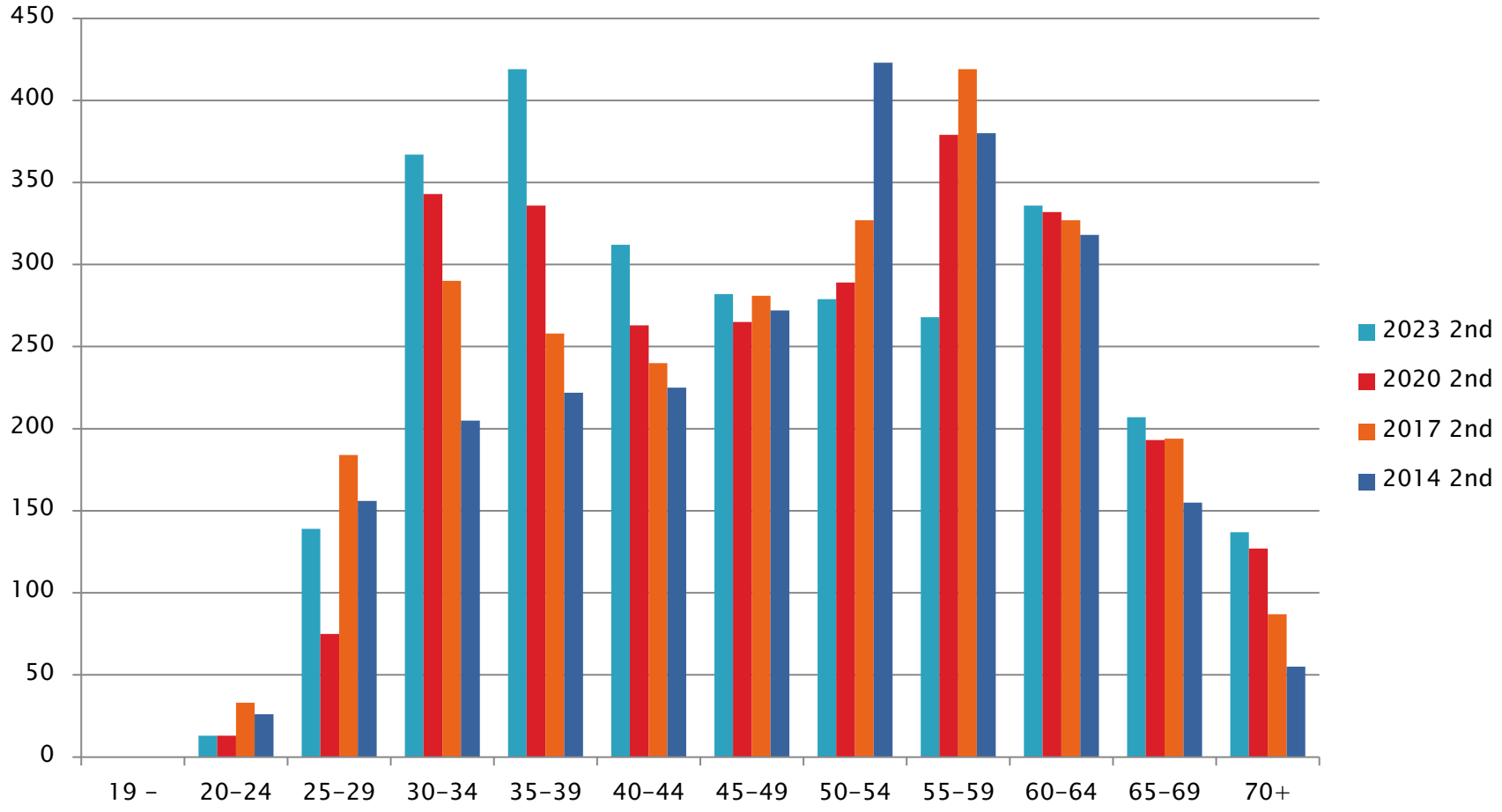
Average Age October 2023



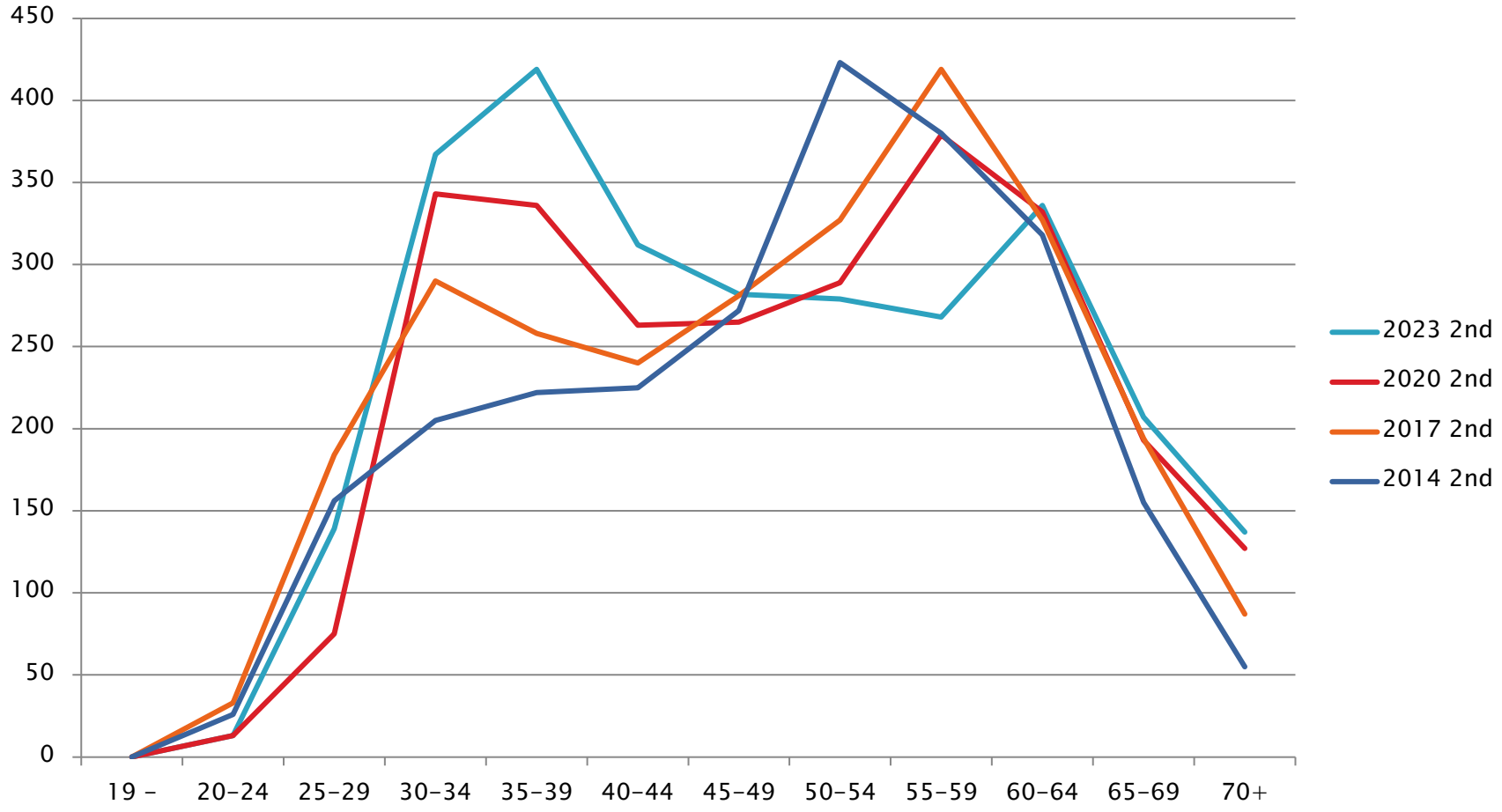
Average Age 1st class



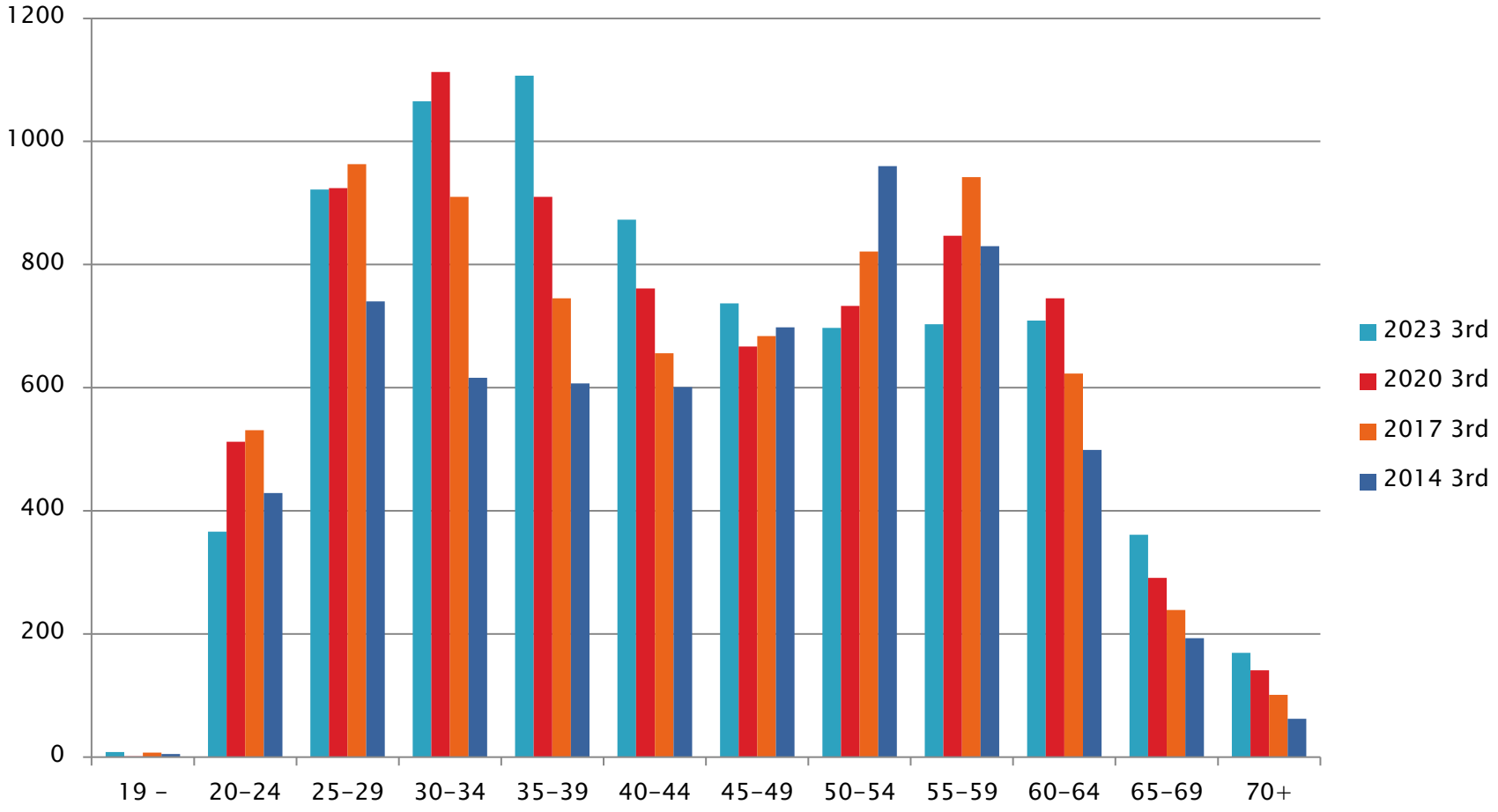
Average Age 2nd class



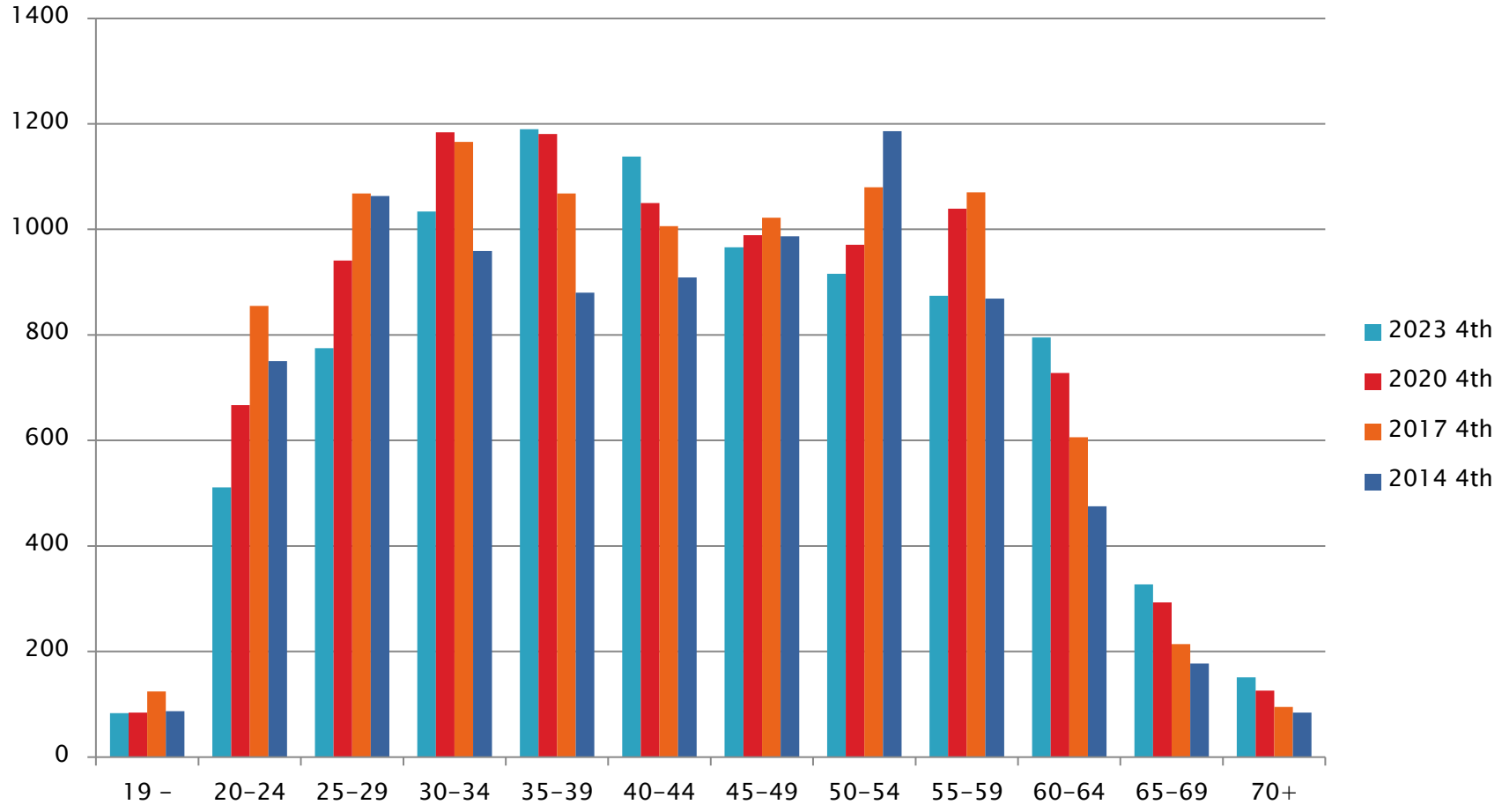
Average Age 2nd class



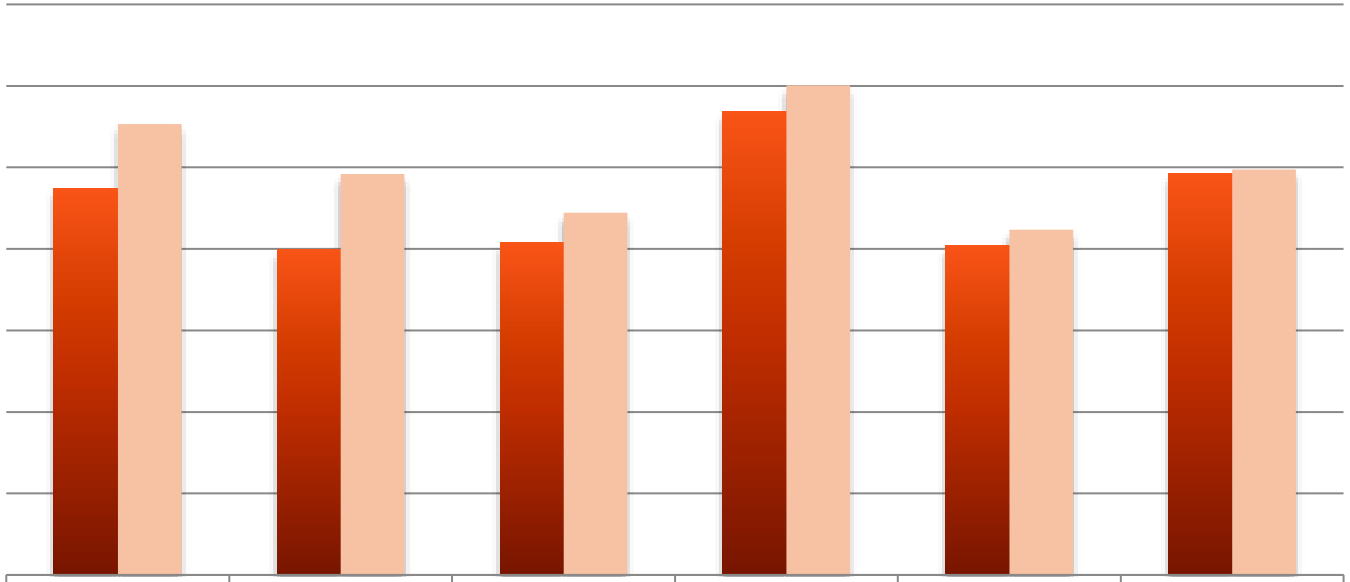
Average Age 3rd class



Average Age 4th class

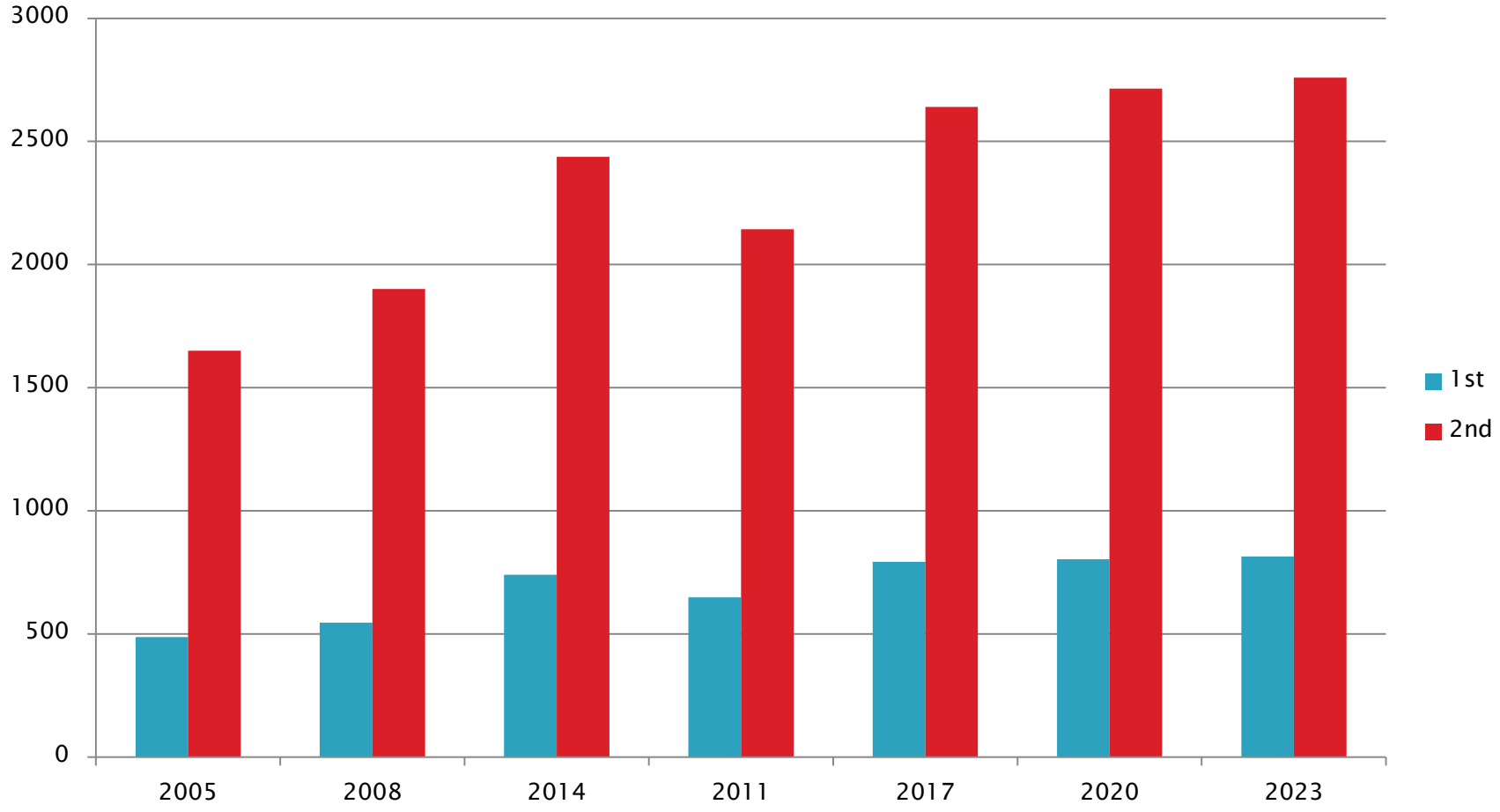


Average Age of Certificate Holders (Power Engineers) by Class

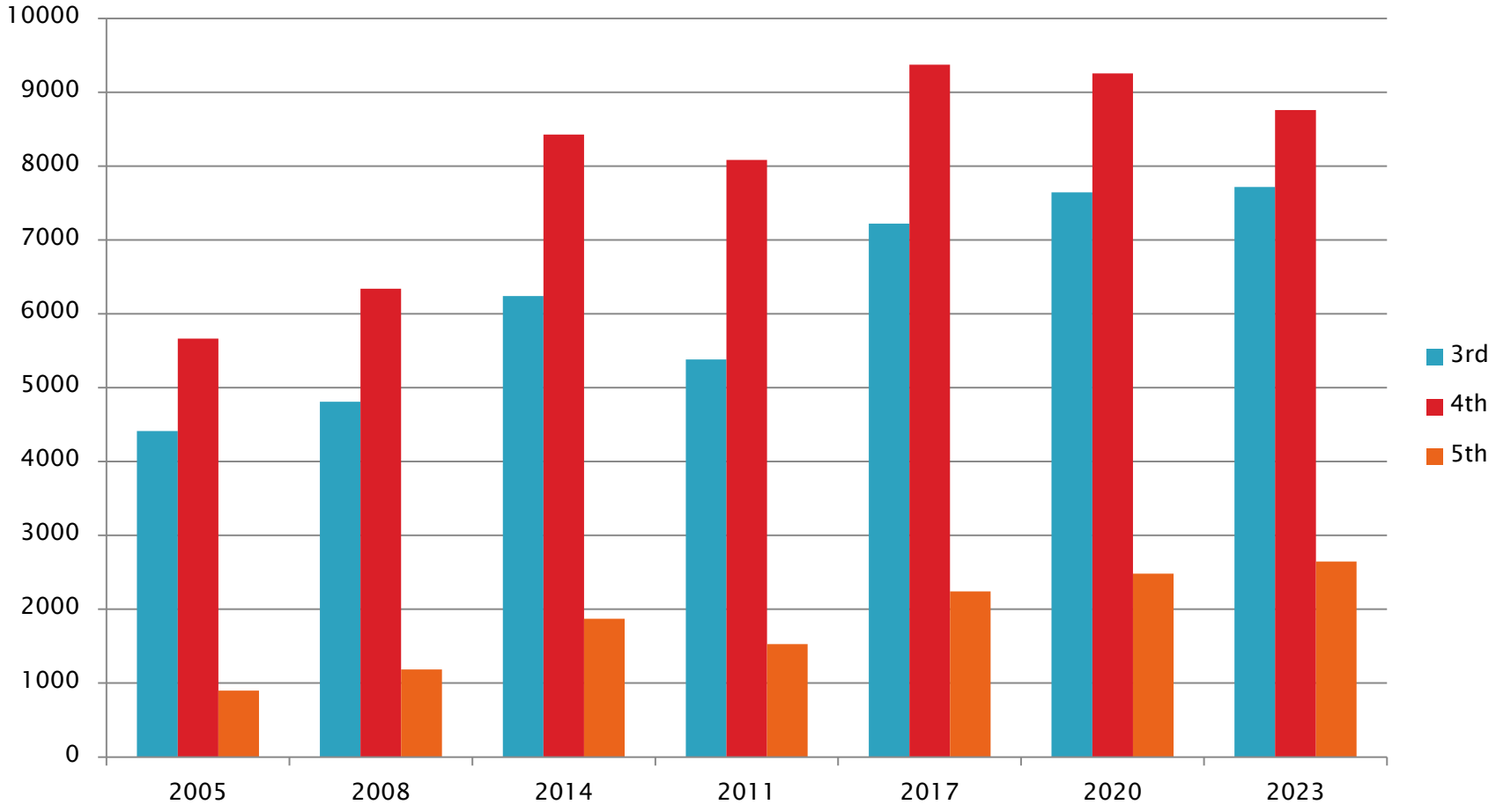


	1st Class	2nd Class	3rd Class	4th Class (Old)	4th Class	5th Class
Average Age of Certificate Holders (Women)	47.5	40.0	40.8	56.8	40.4	49.2
Average Age of Certificate Holders (Men)	55.3	49.2	44.4	60.1	42.4	49.7

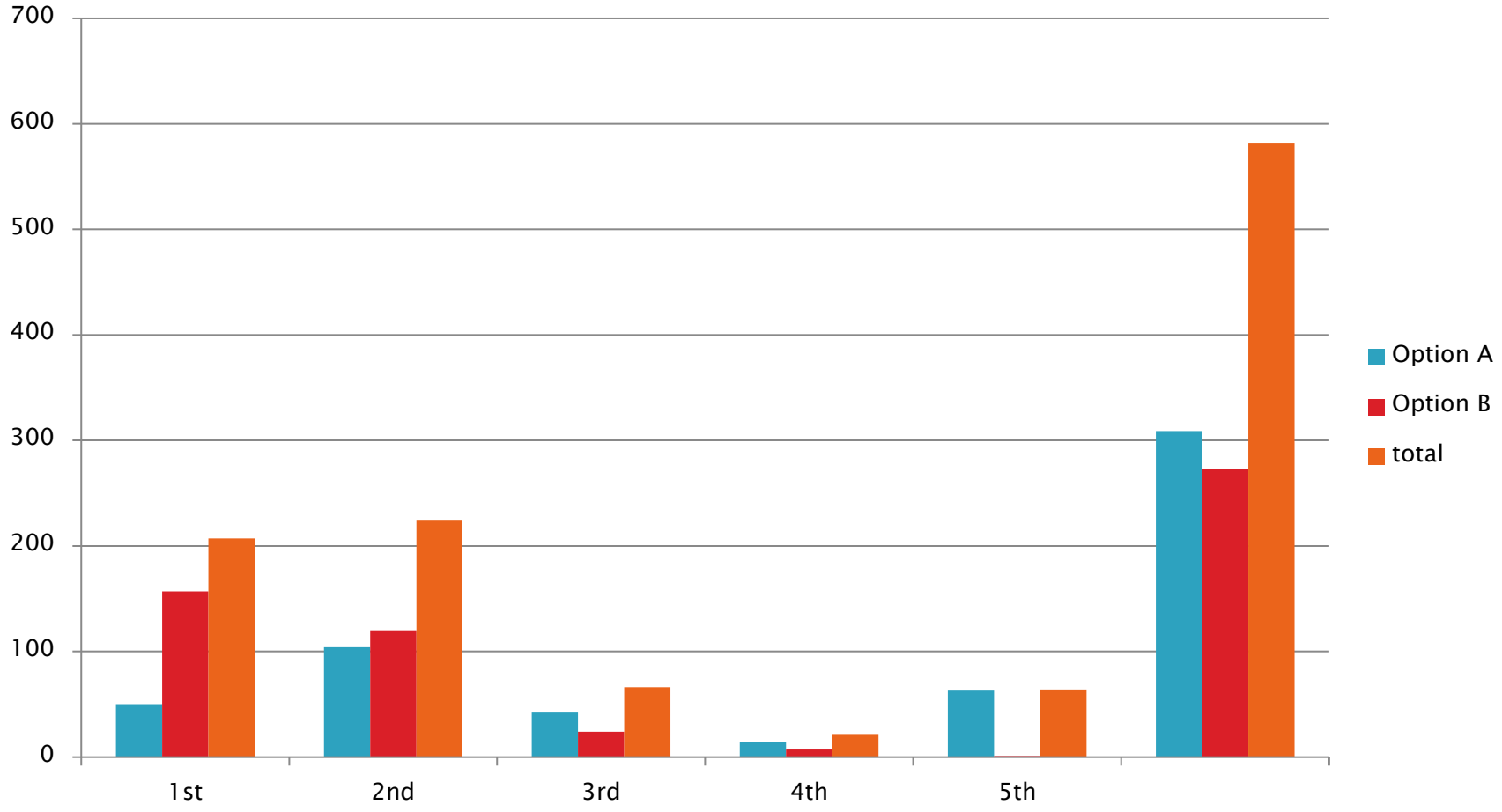
Valid Alberta Certificates (2023)



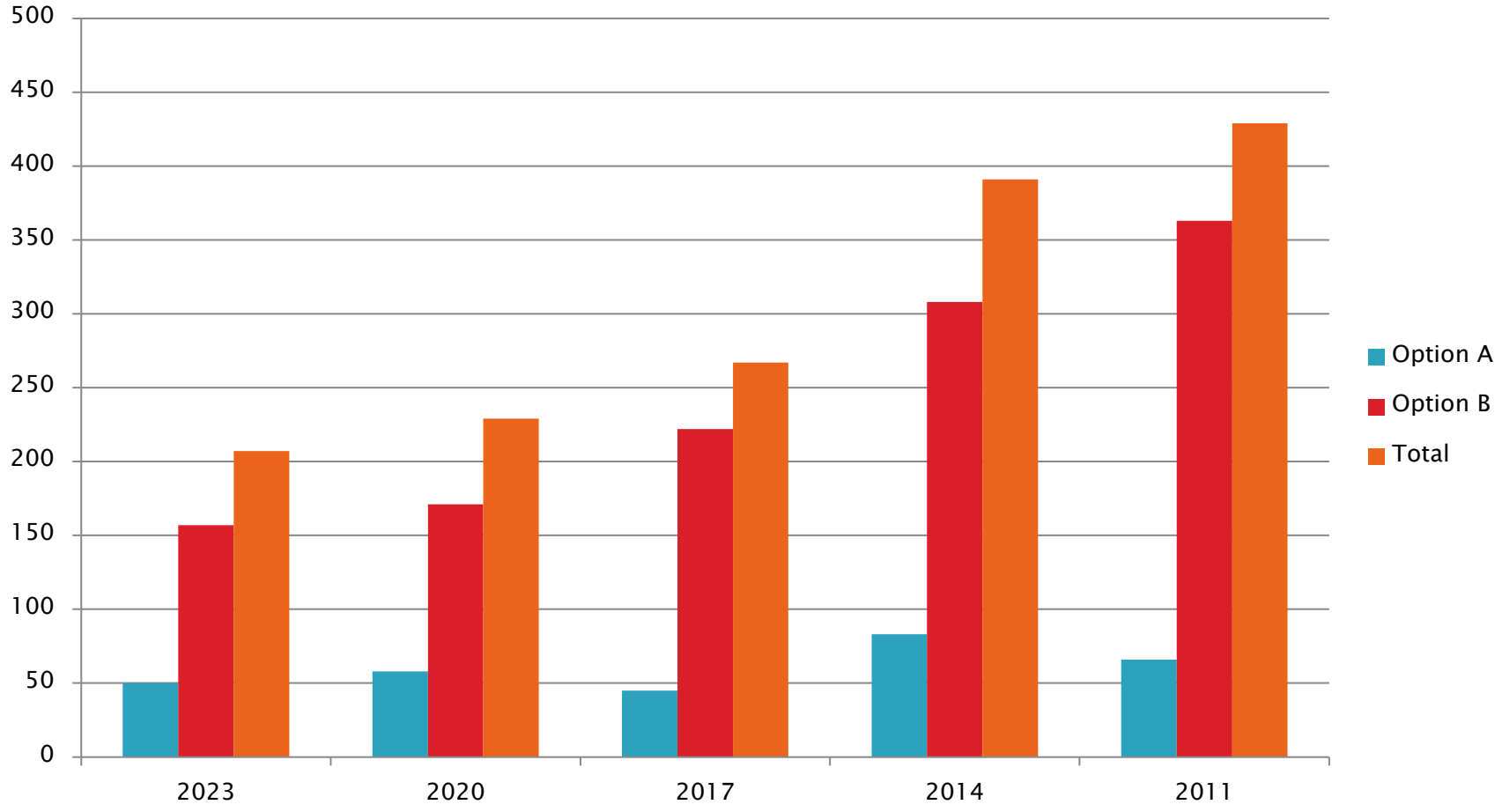
Valid Alberta Certificates (2023)



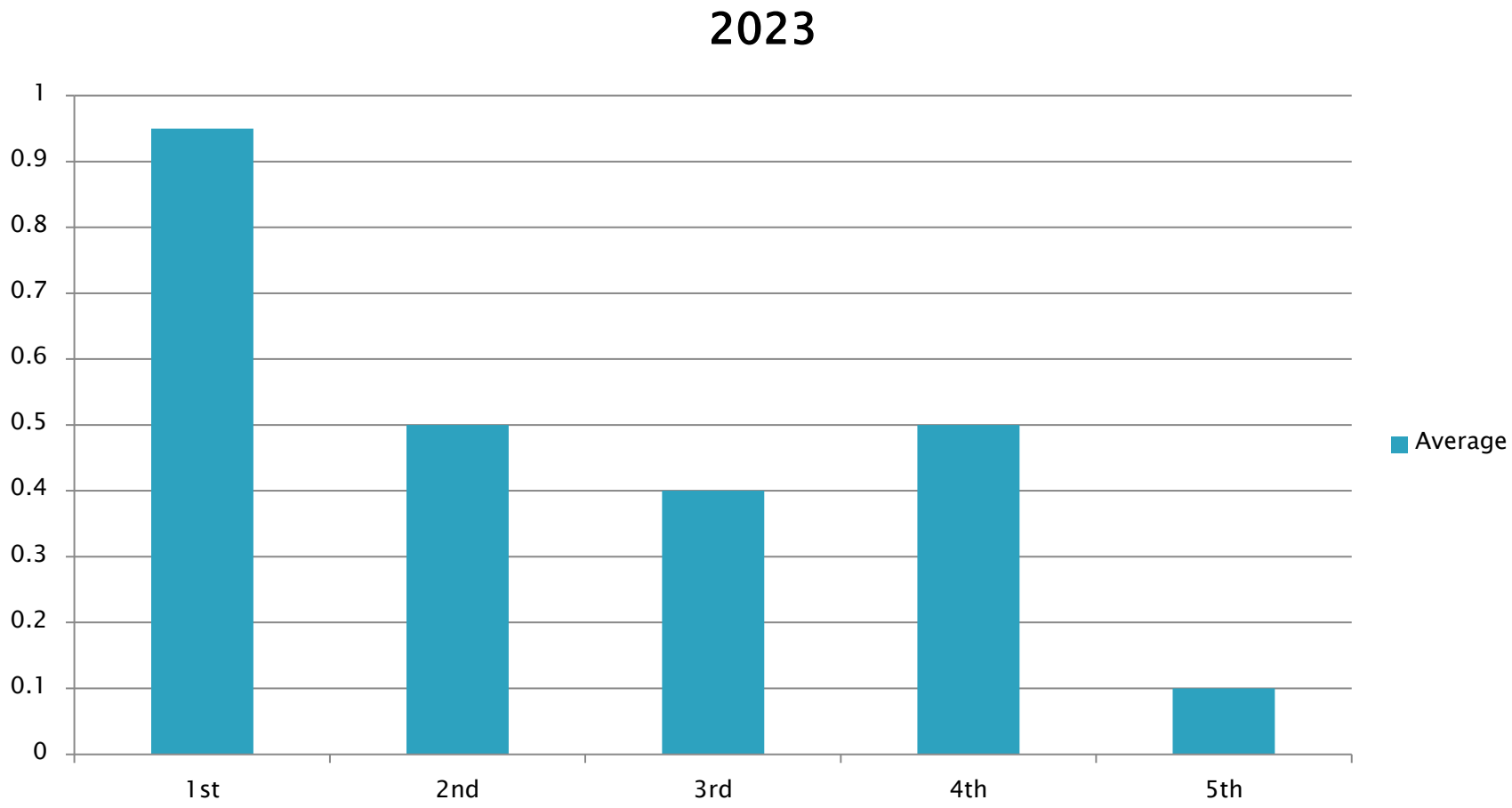
Temporary Certificates 2023



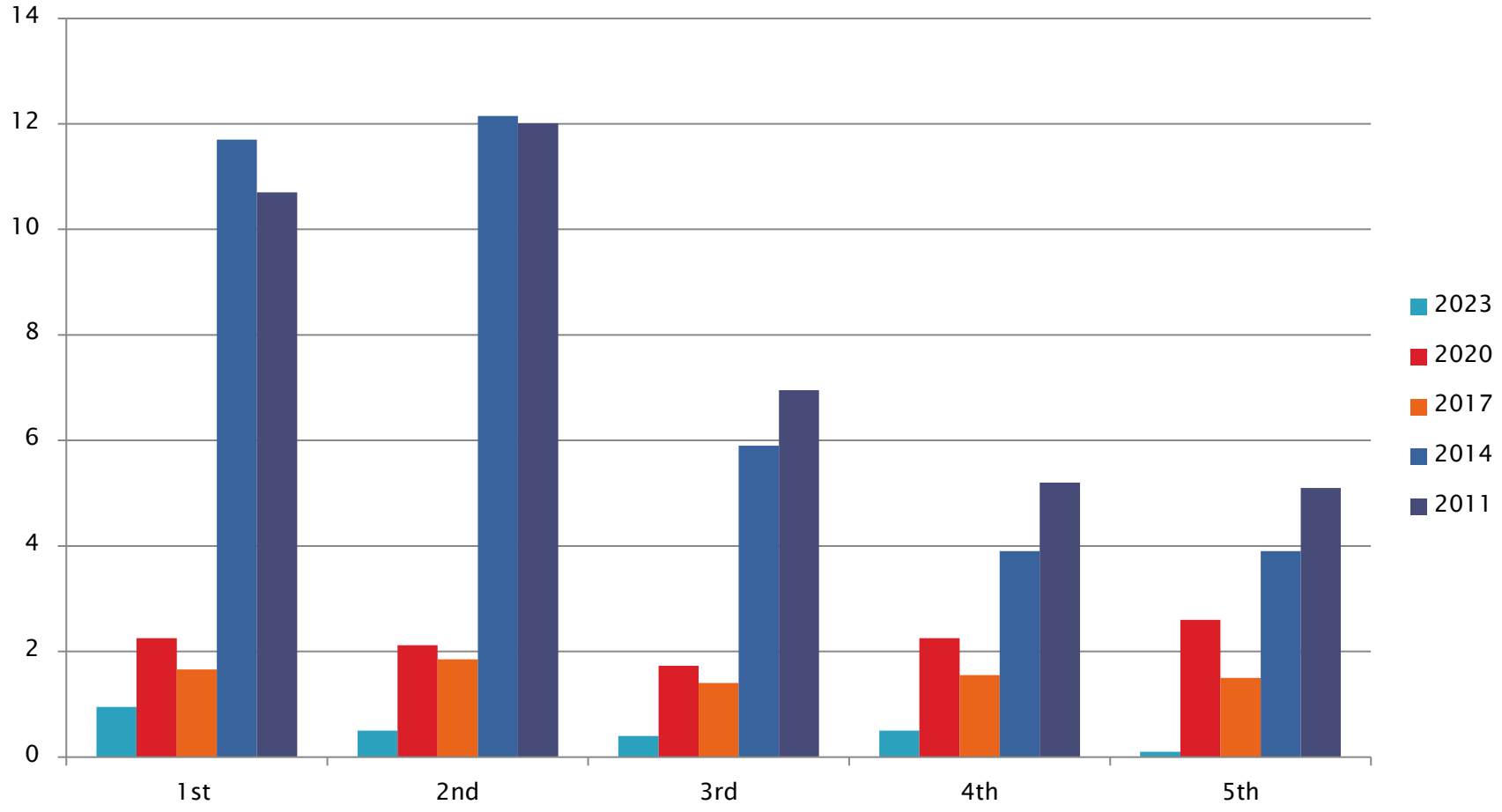
Temporary Certificate Issuance



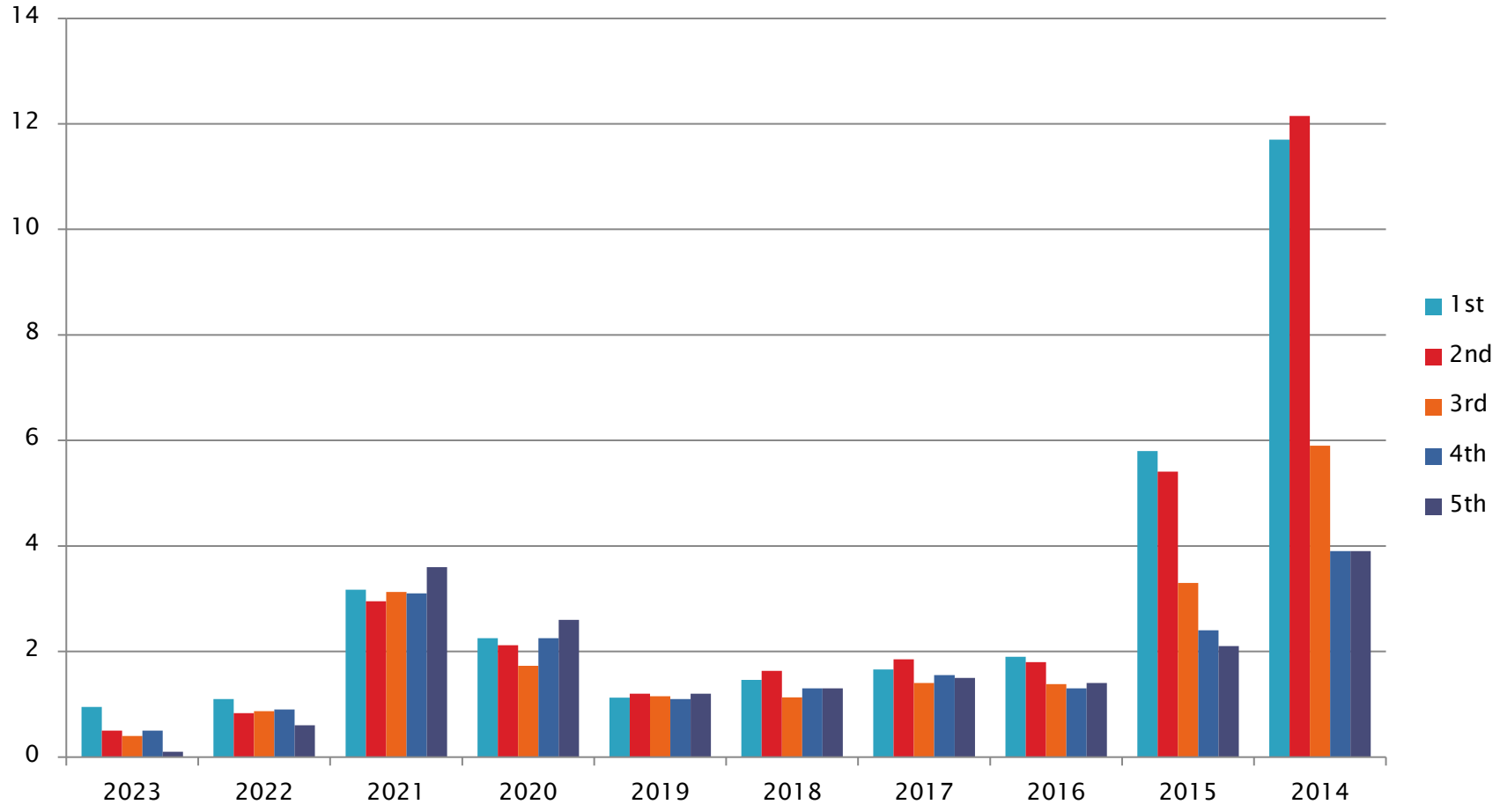
Examination Marking Time



Marking Times Historic

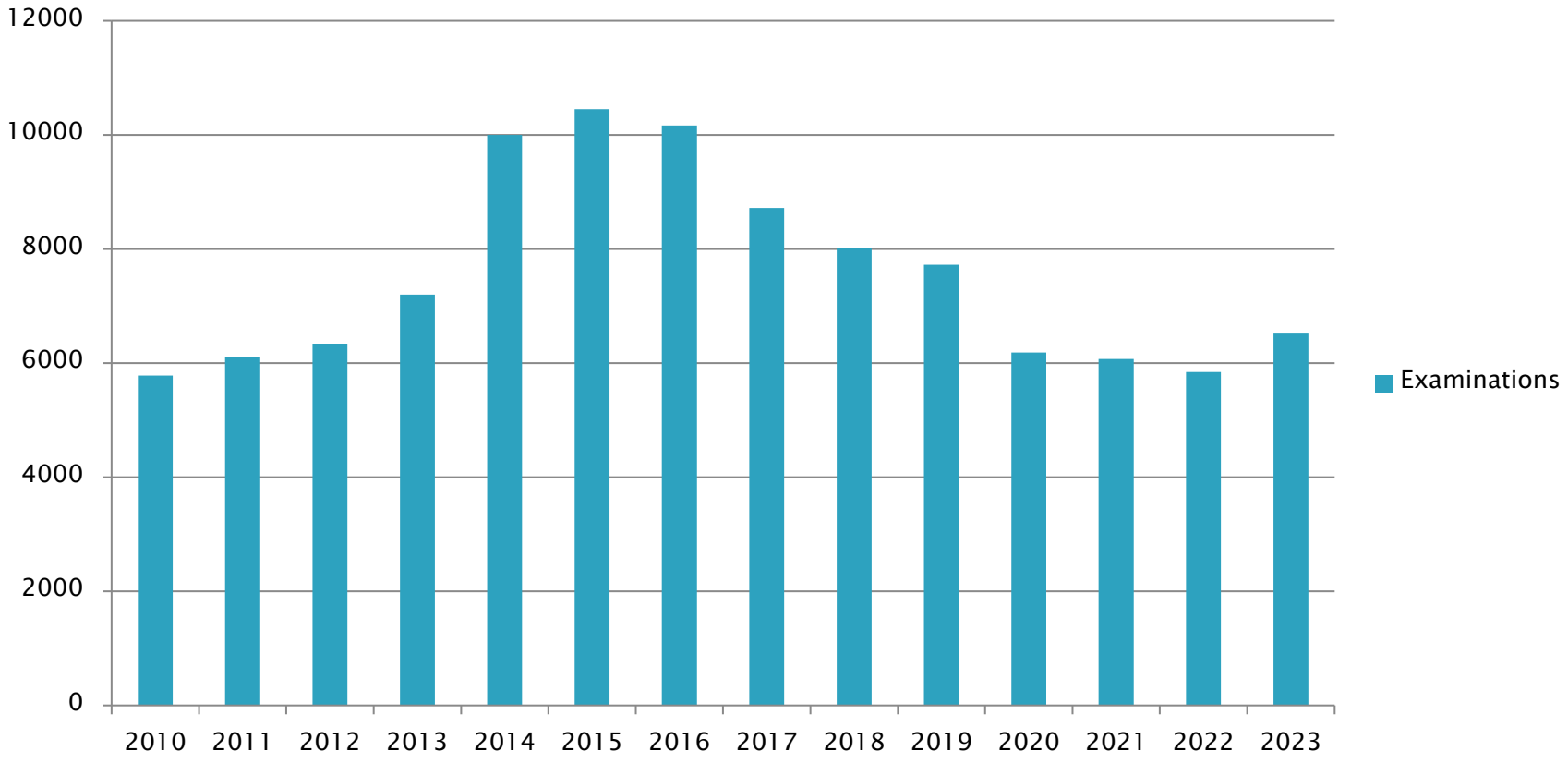


Marking Times Historic



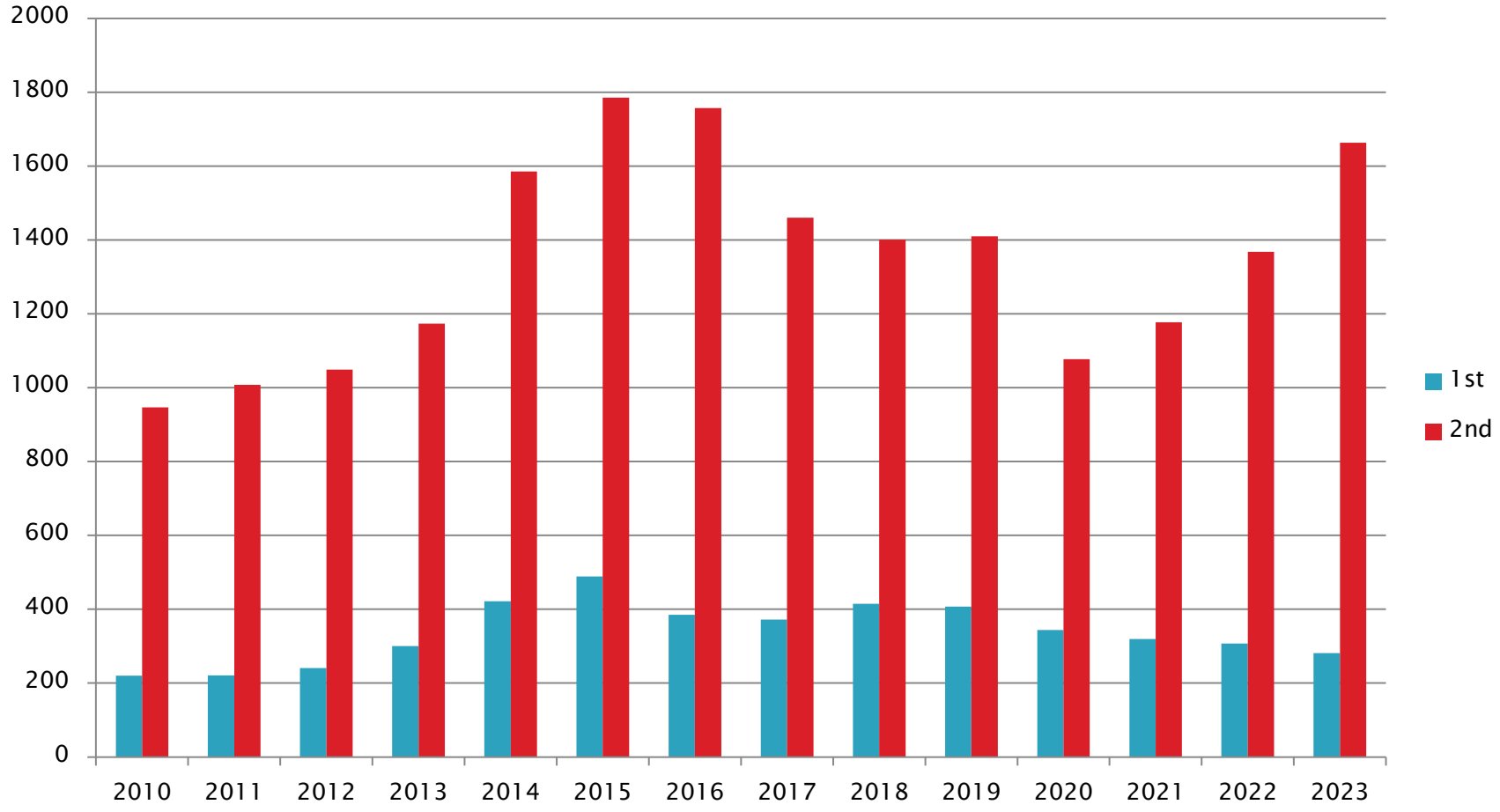
SOPEEC Examination written

(all classes)



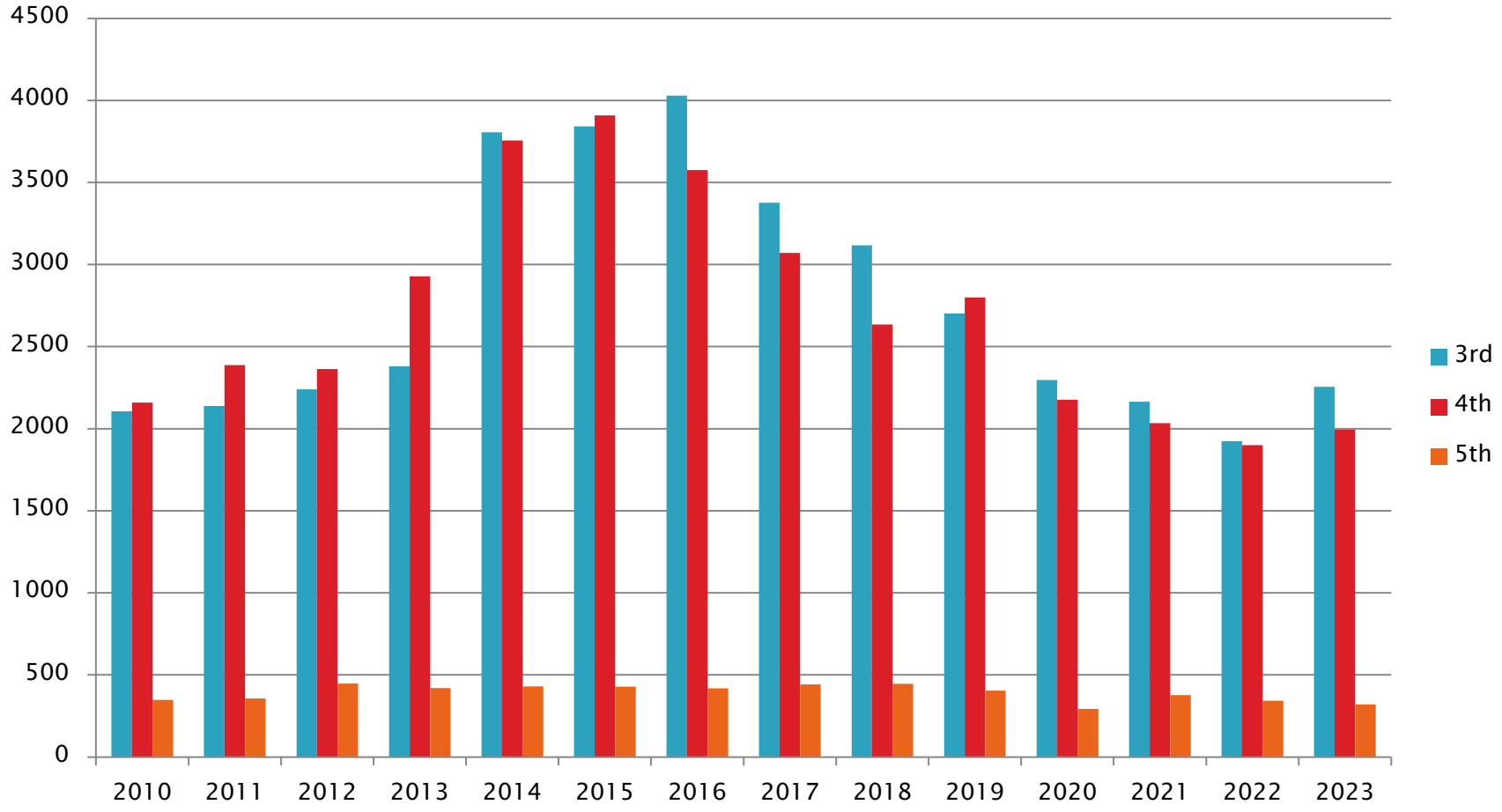
SOPEEC Examination written

(1st & 2nd)



SOPEEC Examination written

(3rd, 4th, & 5th)



SOPEEC

Update

What is SOPEEC?

- Standardization of Power Engineering Examination Committee
- Consists of all Canadian Jurisdictions
- Reports to the Association of Chief Inspectors
- Works with industry representatives and training providers both jurisdictionally and nationally (IPECC*)
- Creates all examination delivered for power engineering across Canada.

*Interprovincial Power Engineering Curriculum Committee

What's new with SOPEEC?

- 2A2 examinations go multiple choice.
  - Effective January 1, 2024 the 2A2 examination will be delivered in a multiple choice format.
- The 2A3, 2B1, 2B2, & 2B3 examinations are currently multiple choice.
  -

What's new with SOPEEC?

- Effective January 1, 2023 the 3rd, 4th, and 5th class examination became 100 multiple choice questions.
- Effective January 1, 2024 all SOPEEC multiple choice examinations will have a 3 hour time limit.

What's new with SOPEEC?

- The Standards Council of Canada has awarded the Canadian Standards Association (CSA) with the development contract to create a National Standard for Power Engineering (plant rating and staffing. SOPEEC will be working closely with CSA on this project.

- There is a call for Technical Committee members and I will be passing this on to the committee chair for distribution.

What's new with SOPEEC?

- We are anticipating that we will have an avenue in place for online delivery of multiple choice examinations by the end of march 2023.

- This is currently in the developmental/testing stages.

THANK YOU

QUESTIONS?

BREAK

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BREAK – SPONSOR RECOGNITION

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Flaring & Emissions

Jamal Ghazala – Senior Combustion Engineer
TIWW

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Tornado Combustion Technologies, Inc.

DESIGN & MANUFACTURING SINCE 1984

The Ancient Art of Combustion Manipulated by Innovative Minds

TIW WESTERN Inc.

TORNADO

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

Flares, Combustion & Environmental Emission

TIW WESTERN Inc.

TORNADO

Presentation Agenda

FLARES COMBUSTION

- Incomplete Combustion (non-smokeless)
- Complete Combustion (smokeless)
- Flare Combustion
- 3 T's of Combustion

Smokeless Flares

- LP Smokeless (Air Assisted / Steam Assisted / Gas Assisted / Ground Flares)
- HP Smokeless

HP-Smokeless Sonic Flares

- Single Jet / Multi Jet /Coanda

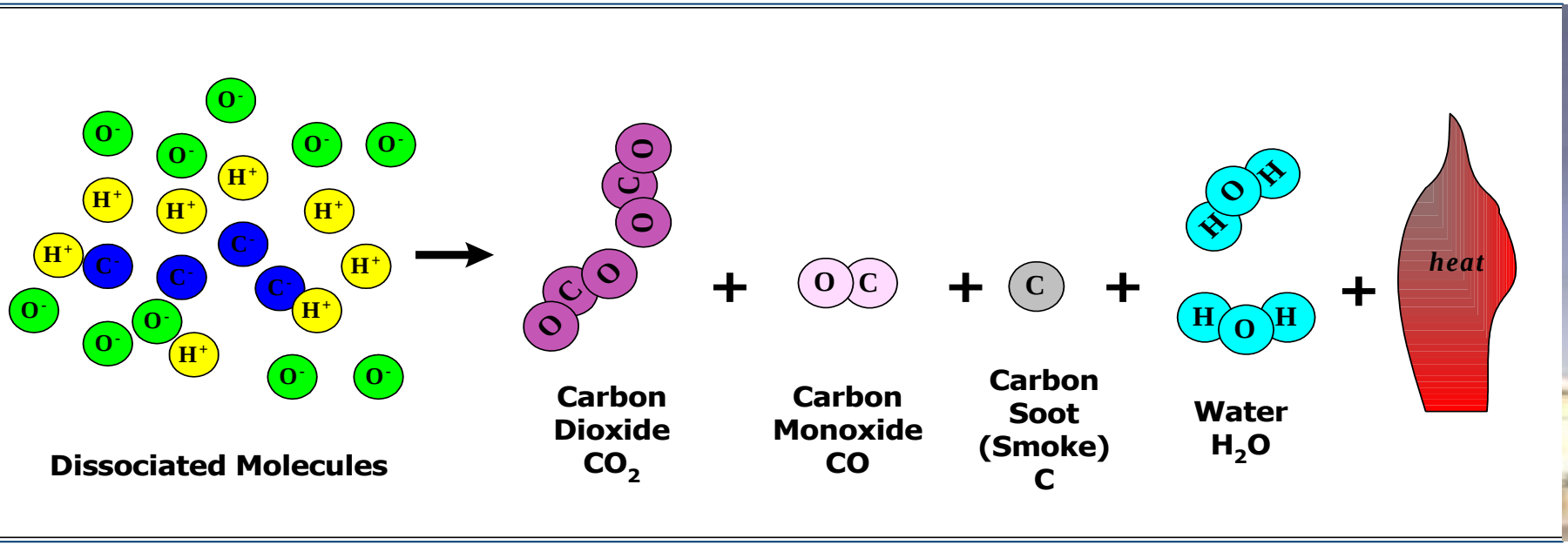
Combustion & Emission /Regulatory Issues & Compliance

- EPA & FLARING REGULATIONS

Open Discussion

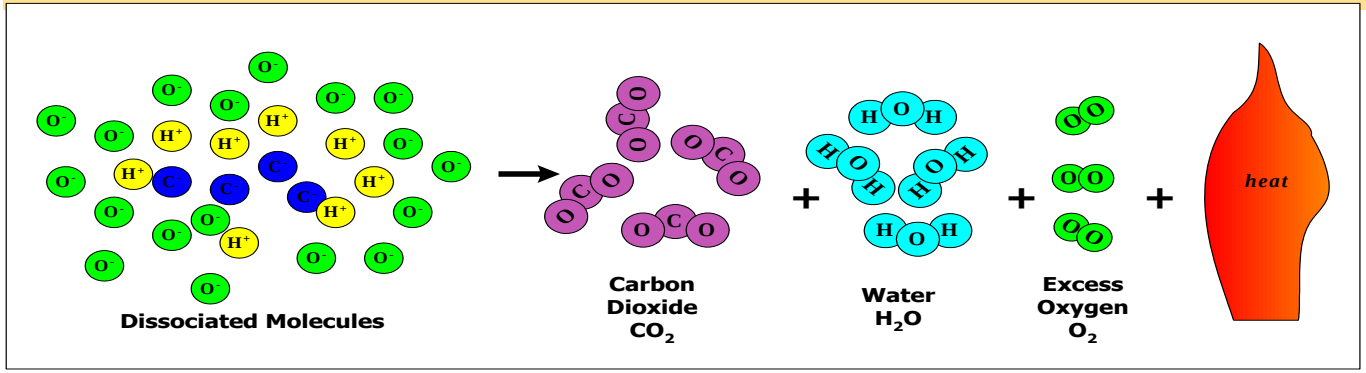
FLARES COMBUSTION / INCOMPLETE COMBUSTION (NON-SMOKELESS)

- If there is not sufficient excess oxygen, the hydrocarbon will not be able to react completely to carbon dioxide and water.
- The products of incomplete combustion will include carbon monoxide and raw carbon soot (smoke).
- **Carbon monoxide (CO)** is a colorless and odorless poisonous gas. Besides smoke from tobacco, known sources of exposure to CO include exhaust fumes from cars, gas stoves, wood stoves and heaters. CO is also formed by natural processes and is released into the environment or into the (human) body.
- **Carbon soot** is a type of air pollutant that is often seen as black smoke emitted from vehicles, industrial facilities, and the burning of biomass such as wood and agricultural waste. It is composed of carbon particles that are produced from incomplete combustion of fossil fuels, wood, or other organic matter.



FLARES COMBUSTION / COMPLETE COMBUSTION (SMOKELESS)

- If there is sufficient excess oxygen, all of the carbon and hydrogen in the hydrocarbon will react completely with oxygen to form carbon dioxide and water.
- The complete combustion will liberate heat in the form of a flame



RINGELMANN CHART		
% Light Transmission	Plume % Opacity	RINGELMANN Number
0	100	5
20	80	4
40	60	3.0
60	40	2
80	20	1
100	0	0

The flare will be NON smokeless as specified. Smoke will be in the scale of 1<R<2.

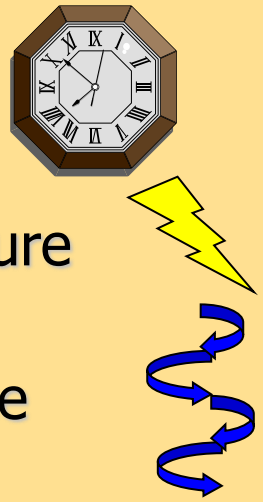
FLARE COMBUSTION

- Flares are, by nature, open to atmosphere combustion processes. There is therefore an unlimited supply of excess oxygen (or excess air) available for combustion.
- The key feature of efficient flare combustion is, therefore, designing the flare to ensure that the atmospheric air and hydrocarbons are forced to mix in the high temperature environment of the flame

The Three T's of Flare Combustion

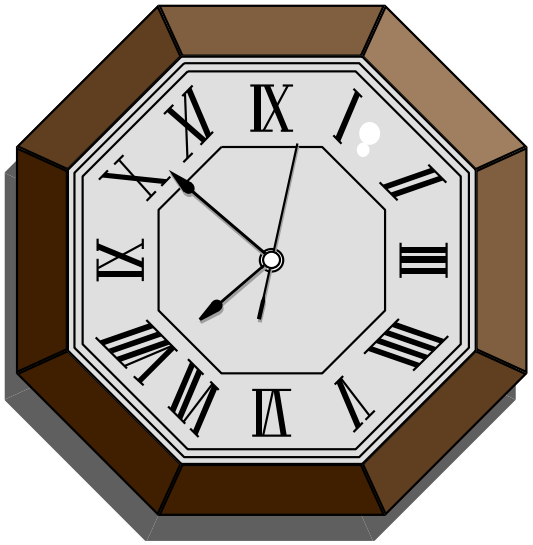
In any combustion process, the efficiency of the combustion is a function of proper control of the three T's of combustion

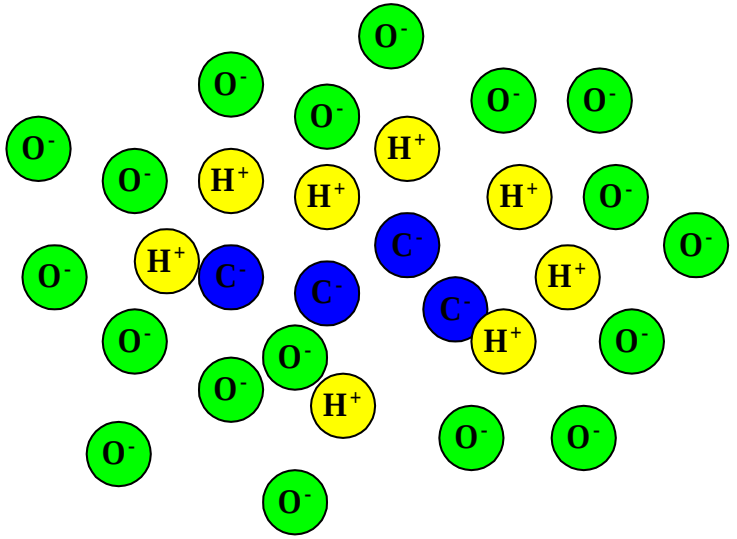
- Time
- Temperature
- Turbulence



TIME

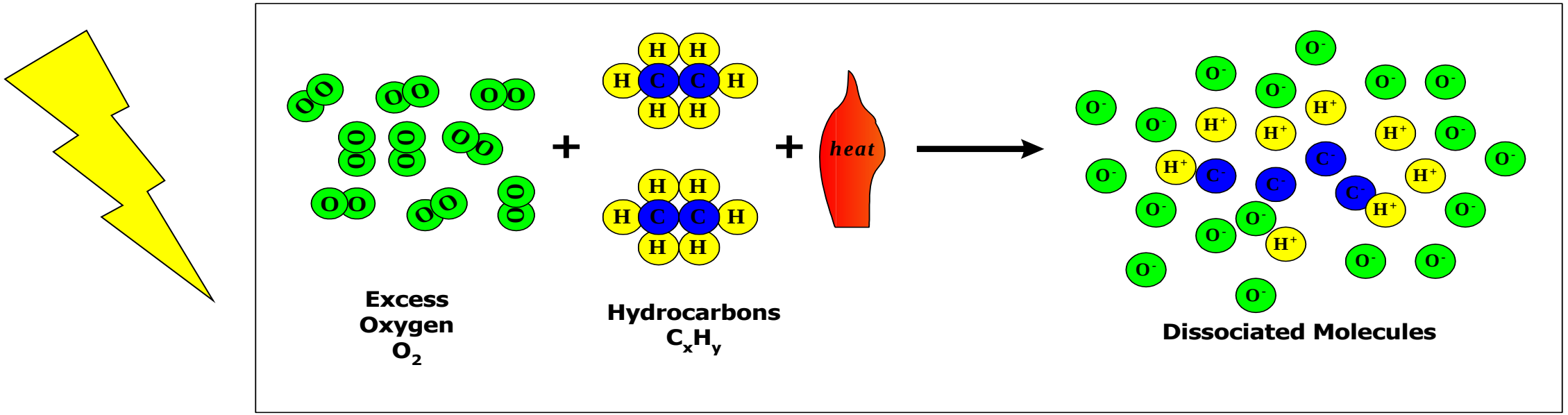
- In order for the combustion reaction to proceed the hydrocarbon molecules must be in intimate contact with the oxygen in order to complete the reaction.
- The design exit velocity of a flare tip determines how much time the flare gas spends within the high temperature zone of the flame.
- With a LP flares, where the turbulence is fairly low, if the exit velocity gets too high, flame liftoff will occur and extinguish the flare flame





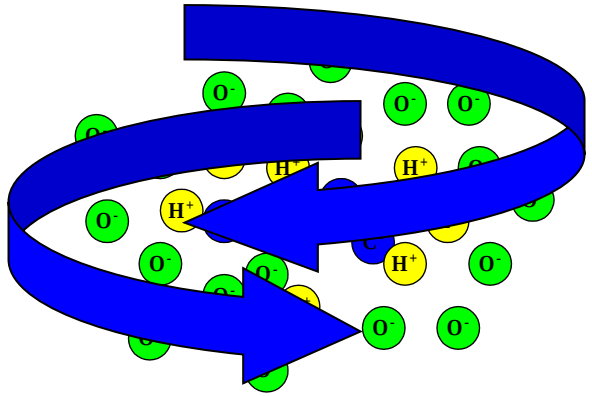
TEMPERATURE

- In order for the combustion reaction to proceed the temperature must be high enough for the hydrocarbons and oxygen to dissociate and mix.
- If the temperature of the flame is not kept high enough the flame will extinguish.
- Low BTU flares must maintain a minimum heating value of > 200 BTU/SCF or the flame temperature will become too low.



TURBULENCE

- In order for the combustion reaction to proceed there must be sufficient turbulence for the dissociated hydrocarbons and oxygen to mix thoroughly.
- The Sonic (Coanda) flare tip creates very efficient mixing of air due to the Coanda Effect, in contrast with a simple utility flare that relies on natural convective mixing in atmosphere.
- The Coanda (or Sonic) flare therefore creates much more efficient combustion and much improved destruction efficiency

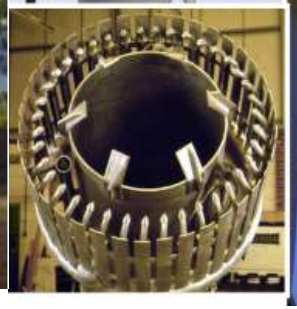


SMOKELESS FLARES / LP-SMOKELESS FLARES

- AIR-ASSISTED
- STEAM-ASSISTED
- ENCLOSED GROUND FLARES
- PARTIALLY OPEN GROUND FLARES (BARRIERS)



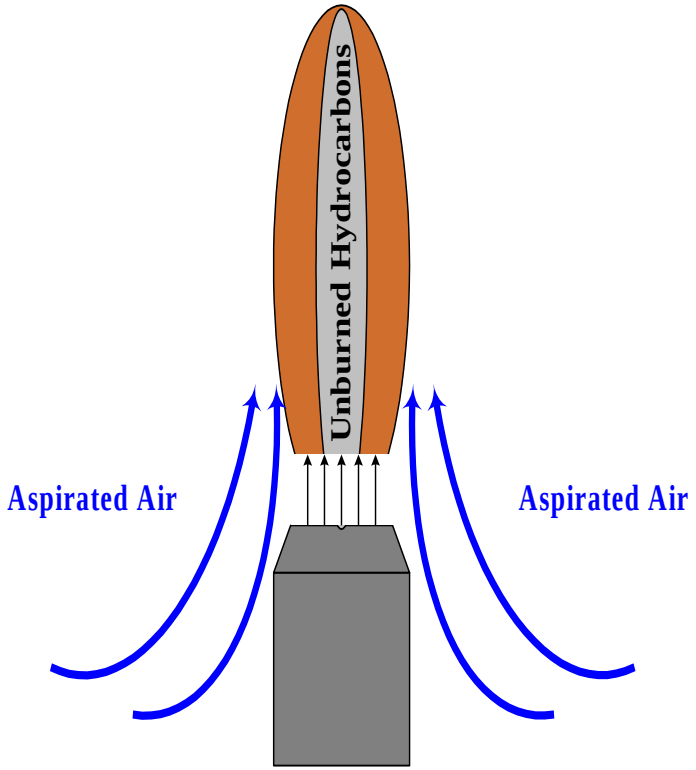


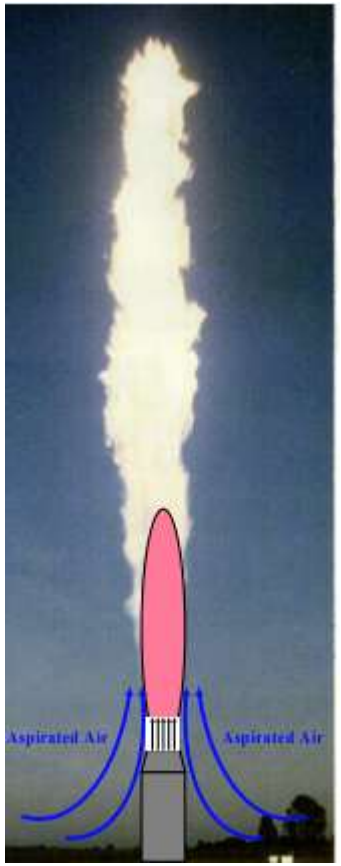


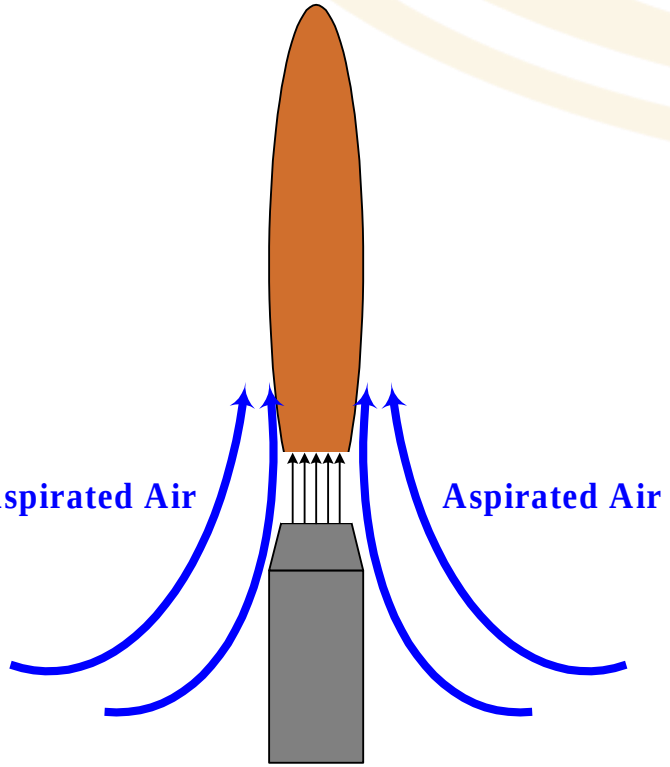

TIW WESTERN Inc.

SMOKELESS FLARES / HP-SMOKELESS FLARES

- **SINGLE-JET SONIC PIPE**

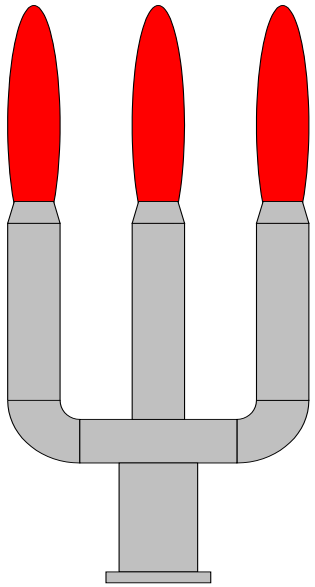






SMOKELESS FLARES / HP-SMOKELESS FLARES

- **MULTI-JET SONIC PIPE**



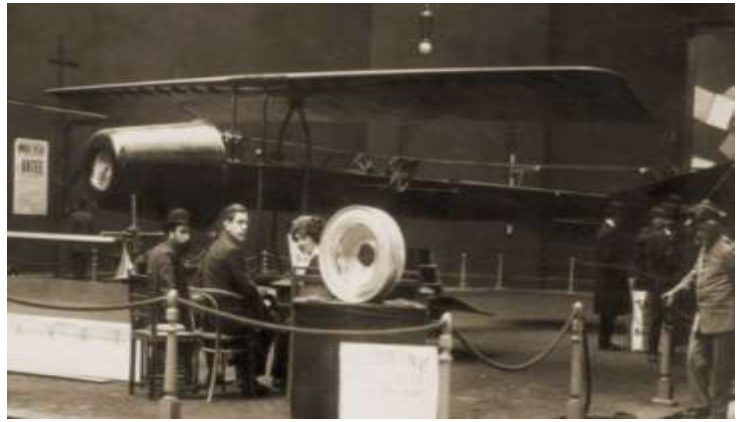
In order to maintain small diameter nozzles and high flow capacities, multi-point sonic flares are used.

SONIC FLARES-COANDA

HISTORY OF COANDA

Henri Marie Coandă was a Romanian inventor, aerodynamics pioneer, and builder of an experimental aircraft, the Coandă-1910.

Born: June 7, 1886.
Died: Nov 22, 1972.

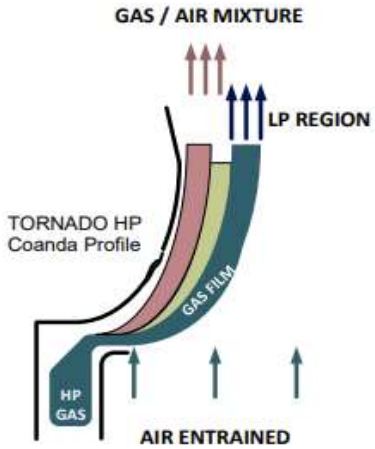


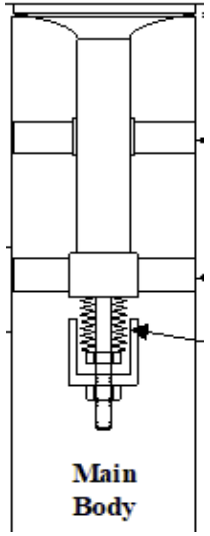
He was employed by the Nazi's during the second world war to develop their jets.

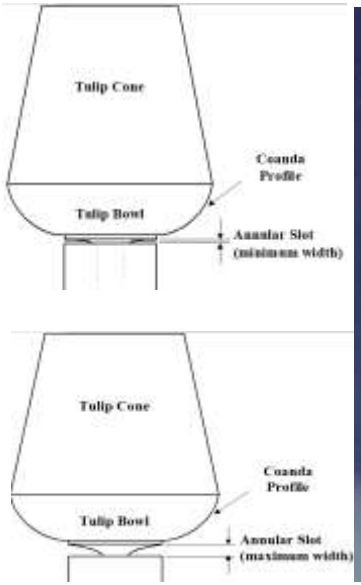
SMOKELESS FLARES / HP-SMOKELESS FLARES

- **SINGLE-JET COANDA (Fixed & Variable)**

How Does it Work?

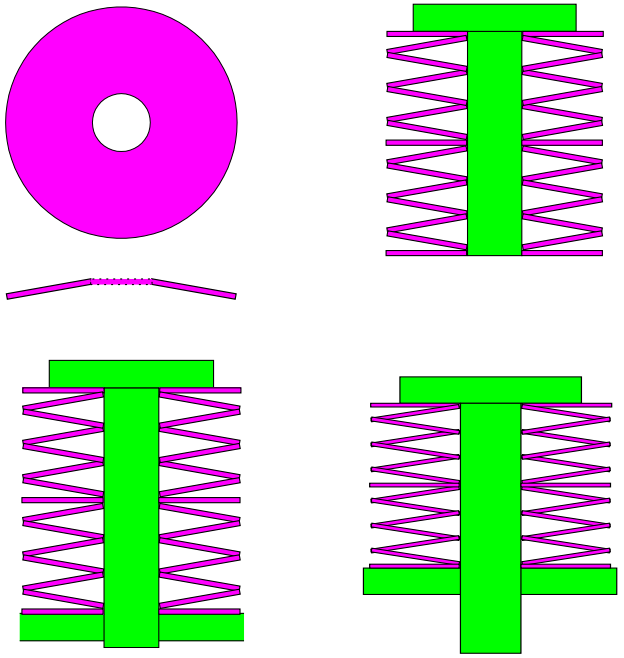






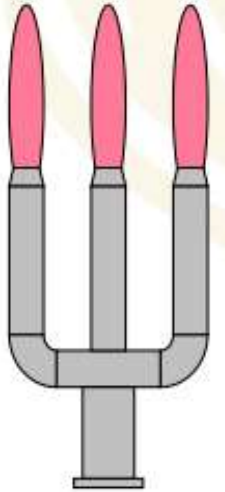
SMOKELESS FLARES / HP-SMOKELESS FLARES

- **MULTI-JET COANDA (Variable)**



SONIC FLARES-GENERAL-FACTS

1. SONIC FLARES CAN BE USED IF WE CAN ATTAIN MACH 1 +/- BASED ON GAS AND PRESSURE.
2. High Efficiency Sonic Flares" utilize the energy associated with high pressure gases to entrain air into a flame, thereby creating an aerated, high efficiency flame.
3. Conventional sonic flares rely on high pressure nozzles to entrain air into the flame. There is no pre-mixing or turbulence of the mixture
4. Single point sonic pipe flares utilize a single pipe with a single nozzle, designed for sonic exit gas velocity (i.e., Mach No = 1) in an attempt to achieve a high efficiency flame. With small diameters (up to 8") these designs will create aerated flames, but at larger diameters, air can not penetrate to the center of the flame.
5. In order to maintain small diameter nozzles WITH high flow capacities, multi-point sonic flares are used
6. Coanda Effect assisted flares are significantly more efficient than conventional sonic flare tips that use high pressure nozzles to entrain air into the flame.
7. Emissivity Factors for Coanda flares range between 0.08 and 0.1.
8. Emissivity Factors for Conventional single and MJ sonic flare range from 0.12 – 0.15.
9. COANDA flames are stiff, high directional pencil-shaped flames that are not easily distorted by winds.
10. The COANDA flare tip can handle up to 20% liquid carryover with the flare gas.
11. Due to the high air entrainment rate and the turbulent pre-mixing of the air and gas, the COANDA flare tip will provide smokeless flaring of any hydrocarbon gas stream (including unsaturated-type hydrocarbons such as olefins and aromatics).



ENVIRONMENTAL & REGULATIONS

Flare emissions

Includes, at a minimum, nitrogen oxides (NOX), carbon monoxide (CO), and un-combusted flared gas compounds. In addition, if the flared gas contains sulfur-bearing compounds, emissions will also include hydrogen sulfide (H2S) and sulfur dioxide (SO2).

Products of Combustion

Products of combustion include NOX, CO, and SO2. The heat output of both the flared gas and the pilot gas impact emission rates of NOX and CO. Flared gas and pilot gas sulfur content determine SO2 emissions.

Compounds from Un-combusted Flared Gas:

The flare's destruction efficiency determines what fraction of the flared gas remains un-combusted. The un-combusted flared gas compounds are generally volatile organic compounds (VOCs), but may also include H2S, CO, ammonia, and other organic and inorganic compounds present in the flared gas

NOX and CO Emissions / Soot

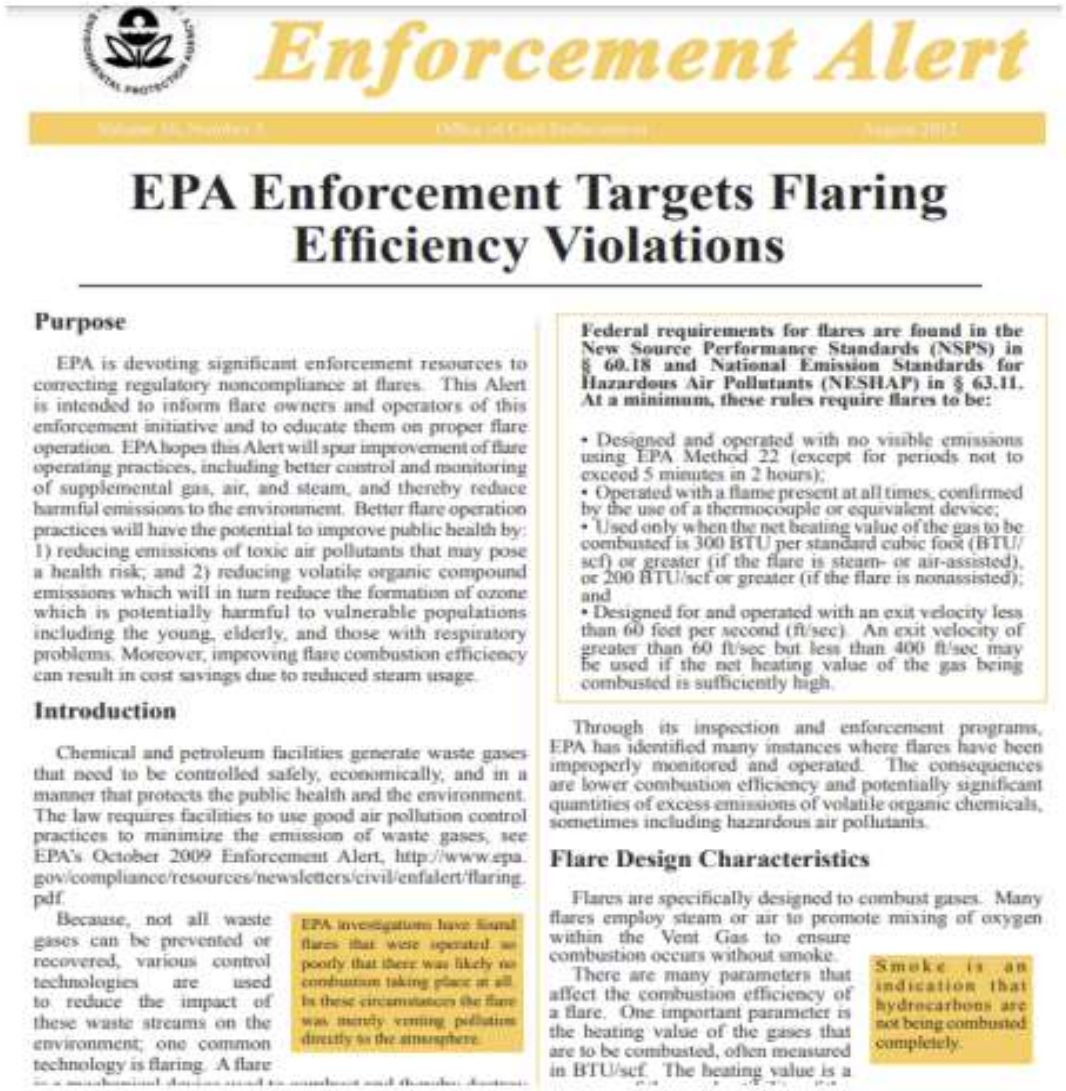
Un-combusted Flared Gas Emissions (VOCs & H2S)

What happens if we do not comply with 40 CFR 60.18

What happen if we do not comply with EPA OOOO.

What happen if we do not comply with the EPA Refinery Rule.

ENVIRONMENTAL & REGULATIONS



Enforcement Alert

Volume 10, Number 1 Office of Civil Enforcement August 2011

EPA Enforcement Targets Flaring Efficiency Violations

Purpose

EPA is devoting significant enforcement resources to correcting regulatory noncompliance at flares. This Alert is intended to inform flare owners and operators of this enforcement initiative and to educate them on proper flare operation. EPA hopes this Alert will spur improvement of flare operating practices, including better control and monitoring of supplemental gas, air, and steam, and thereby reduce harmful emissions to the environment. Better flare operation practices will have the potential to improve public health by: 1) reducing emissions of toxic air pollutants that may pose a health risk; and 2) reducing volatile organic compound emissions which will in turn reduce the formation of ozone which is potentially harmful to vulnerable populations including the young, elderly, and those with respiratory problems. Moreover, improving flare combustion efficiency can result in cost savings due to reduced steam usage.

Introduction

Chemical and petroleum facilities generate waste gases that need to be controlled safely, economically, and in a manner that protects the public health and the environment. The law requires facilities to use good air pollution control practices to minimize the emission of waste gases, see EPA's October 2009 Enforcement Alert, http://www.epa.gov/compliance/resources/newsletters/civil/enfalert/flaring.pdf.

Because, not all waste gases can be prevented or recovered, various control technologies are used to reduce the impact of these waste streams on the environment; one common technology is flaring. A flare

EPA investigations have found flares that were operated so poorly that there was likely no combustion taking place at all. In these circumstances the flare was merely venting pollution directly to the atmosphere.

Federal requirements for flares are found in the New Source Performance Standards (NSPS) in § 60.18 and National Emission Standards for Hazardous Air Pollutants (NESHAP) in § 63.11. At a minimum, these rules require flares to be:

- Designed and operated with no visible emissions using EPA Method 22 (except for periods not to exceed 5 minutes in 2 hours);
- Operated with a flame present at all times, confirmed by the use of a thermocouple or equivalent device;
- Used only when the net heating value of the gas to be combusted is 300 BTU per standard cubic foot (BTU/scf) or greater (if the flare is steam- or air-assisted), or 200 BTU/scf or greater (if the flare is nonassisted); and
- Designed for and operated with an exit velocity less than 60 feet per second (ft/sec). An exit velocity of greater than 60 ft/sec but less than 400 ft/sec may be used if the net heating value of the gas being combusted is sufficiently high.

Through its inspection and enforcement programs, EPA has identified many instances where flares have been improperly monitored and operated. The consequences are lower combustion efficiency and potentially significant quantities of excess emissions of volatile organic chemicals, sometimes including hazardous air pollutants.

Flare Design Characteristics

Flares are specifically designed to combust gases. Many flares employ steam or air to promote mixing of oxygen within the Vent Gas to ensure combustion occurs without smoke.

Smoke is an indication that hydrocarbons are not being combusted completely.

There are many parameters that affect the combustion efficiency of a flare. One important parameter is the heating value of the gases that are to be combusted, often measured in BTU/scf. The heating value is a

Penalties for Violations

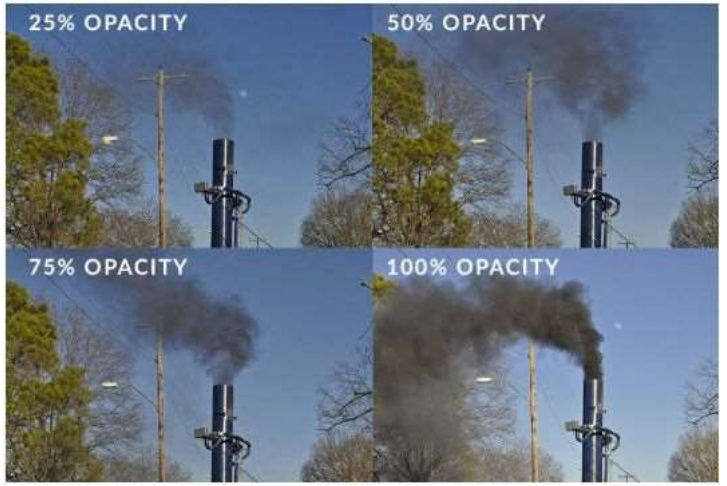
Violating federal requirements for flares can result in a penalty, under the Clean Air Act, of up to $37,500 per violation, per day. To knowingly violate a flare requirement, including knowingly making a false or fraudulent statement or omiting material information required concerning a flare and its operation, can subject a person to criminal prosecution. Convictions can result in fines, imprisonment, or both.

ENVIRONMENTAL & REGULATIONS

Flaring	USA	Canada
Regulation	EPA	CEPA
Flaring Hydraulics	40 CFR 40.18	
Radiation	API-521 (W/ a few deviations)	

Emission	USA	Canada
NOx-THL-8 Hrs.	9-25 PPM	
COx-THL-8 Hrs.	50 PPM	125 PPM
H2S-THL-8 Hrs.	10 PPM	10 PPM (Alberta)
	USA	**Canada**
SO2-THL-8 Hrs.	5 PPM (Indoor)	5 PPM
VOC-THL-8 Hrs.	0.5 PPM	0.5 PPM

Does the EPA cover Canada?
EPA implements environmental agreements and cooperative frameworks both bilaterally and trilaterally with Canada and Mexico



OPEN DISCUSSION

Alberta 2025
Angus Watt – National Bank Financial

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

Alberta…Connecting the Dots

Alberta Chief Power Engineer Conference

https://www.ctvnews.ca/polopoly_fs/1.3796908.1562605447!/httpImage/image.jpg_gen/derivatives/landscape_1020/image.jpg

Presented by: Angus Watt Advisory Group
October 25, 2023

NATIONAL BANK FINANCIAL
WEALTH MANAGEMENT

ANGUS WATT ADVISORY GROUP+

Research provided by:
Stéfane Marion, Chief Economist & Strategist,
National Bank

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**** While opinions expressed are based on analysis and interpretation of historical data believed to be accurate the underlying data is not necessarily guaranteed as to accuracy.
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2021
Awards of Excellence

Team of the Year
National Winner

2022
Awards of Excellence

Team of the Year
Alberta & Okanagan

REPORT ON BUSINESS 2022 SHOOK
CANADA'S TOP WEALTH ADVISORS

2020 Awards of Excellence

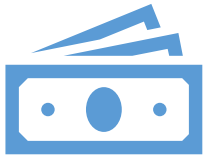
Social Commitment
Alberta & Okanagan

NATIONAL BANK FINANCIAL
WEALTH MANAGEMENT

ANGUS WATT
ADVISORY GROUP+

Why is Inflation Bad?

How?



Tax on individuals

Reduced purchasing power

Spending more to receive less

Tax on industry

Increased cost of goods and services

Profits shrink unless they can increase productivity

Cost of inflation is passed on to the consumer

Tax on governments

All levels of government have some sort of debt

Cost of debt servicing increases, leads to:

- Decreased spending
- Cut programs
- Increased taxes

Inflation in Canada?

- Canada is in a very special place
  - Strong immigration program
    - Impacts infrastructure, health care, education, and transportation
  - Growth versus stagflation

Goldilocks and the 3 Bears

Oil Prices

Interest Rates

Earnings

Oil prices (too hot)

- We identify oil prices with inflation
- Increase in oil prices means higher cost to farming, truck drivers, fertilizer … products becomes more expensive

Interest rates (cooling down the economy)

- Impact on housing, disposable income, consumer spending, governments & taxes

Earnings (just right)

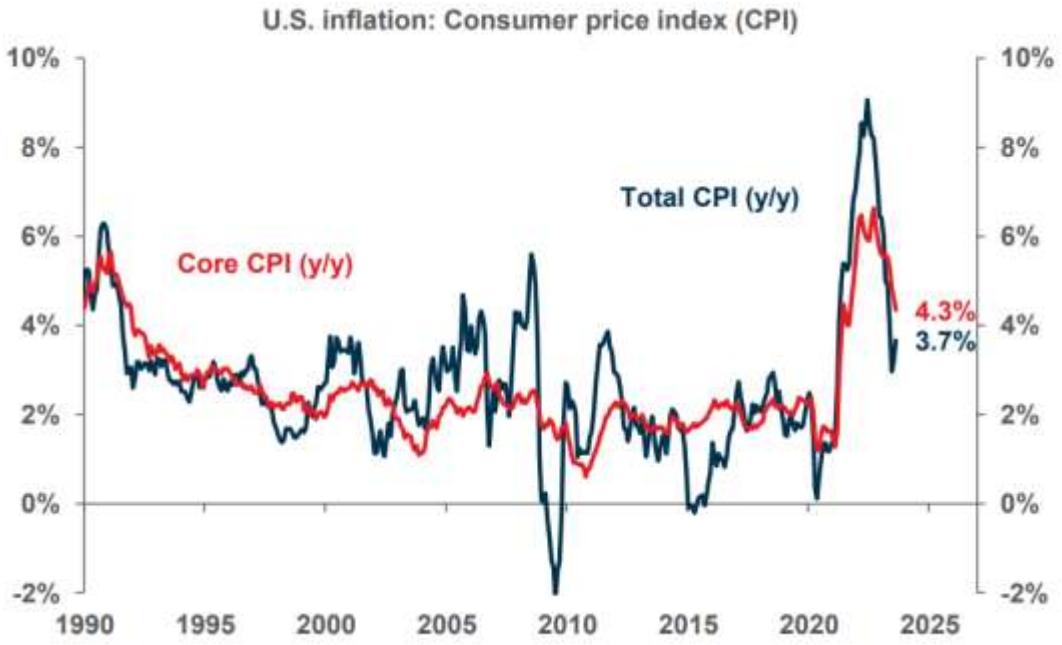
- Robust economy & low unemployment

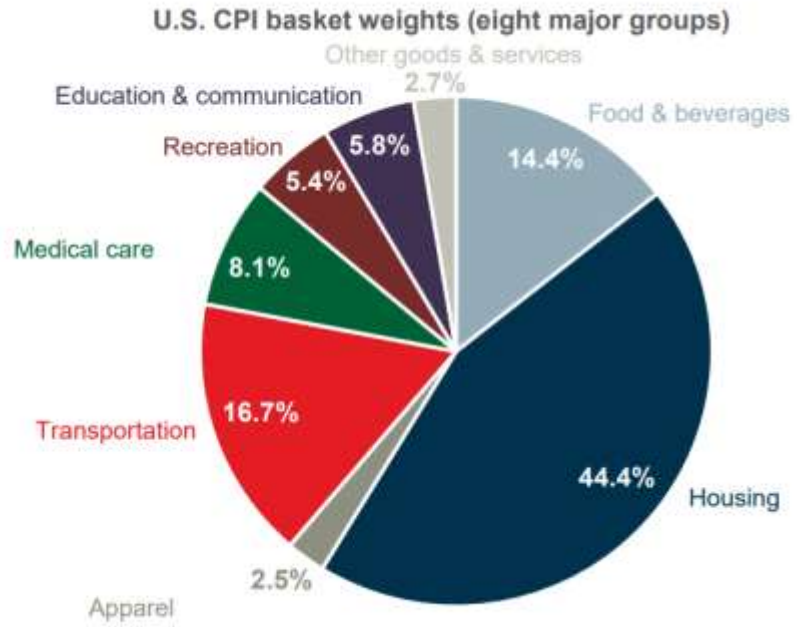
Goldilocks and the 3 Bears

Goldilocks

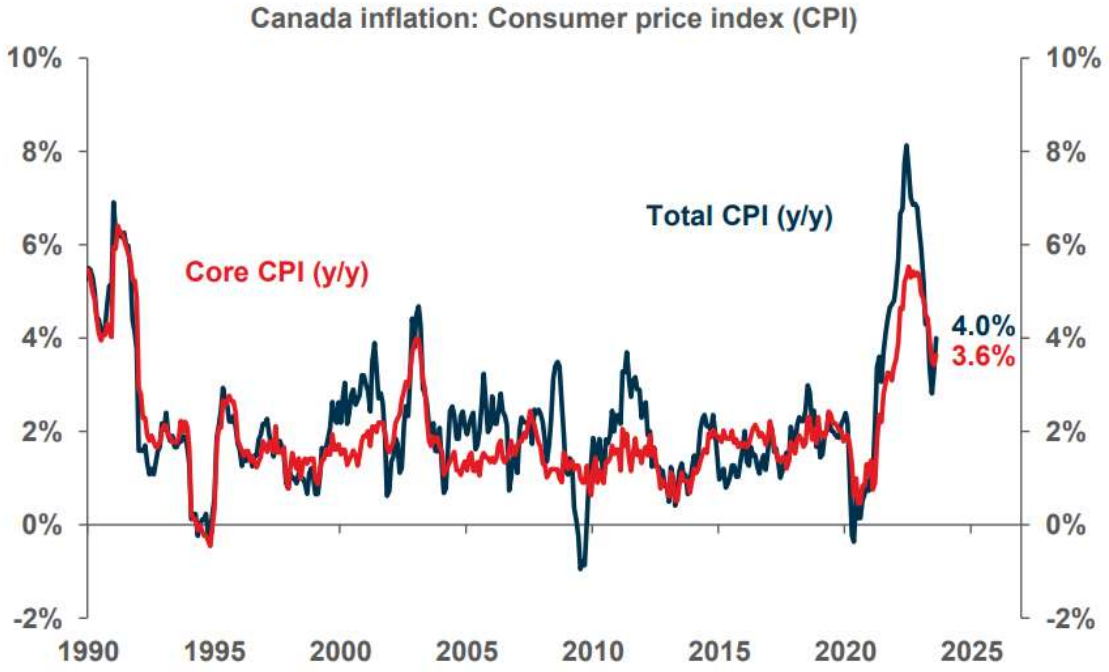
- Productivity
- Artificial Intelligence

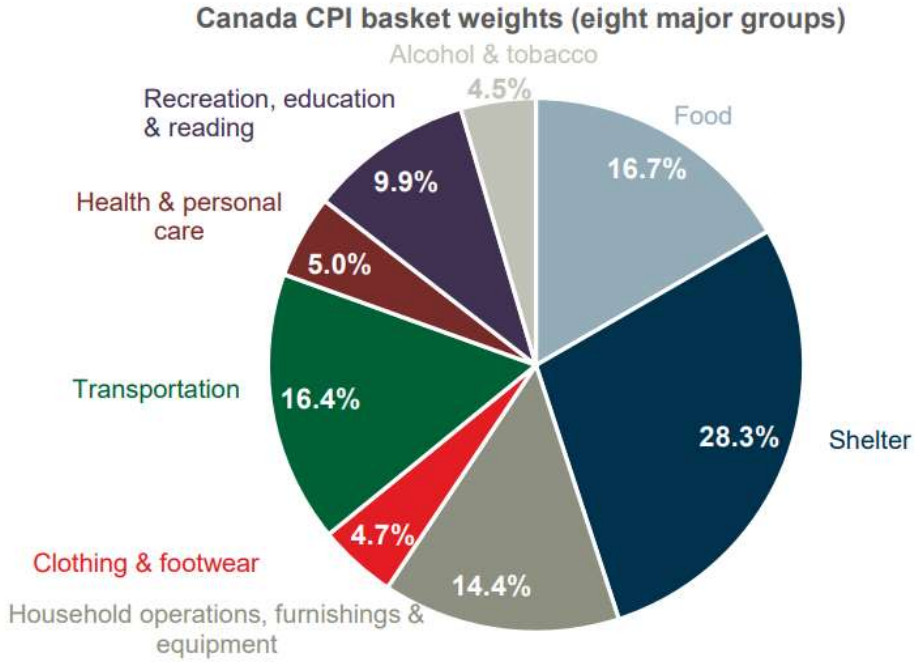
US Inflation and CPI Composition





Canada Inflation and CPI Composition





Source: National Bank CIO Office (Dada via Refinitiv)

Mortgages by Interest Rate - US

- According to US Census data nearly 38% of households are mortgage free
- As of October 18, 2023, US 30-year mortgages are at 8.0%
- The average mortgage rate in the US is 3.4%

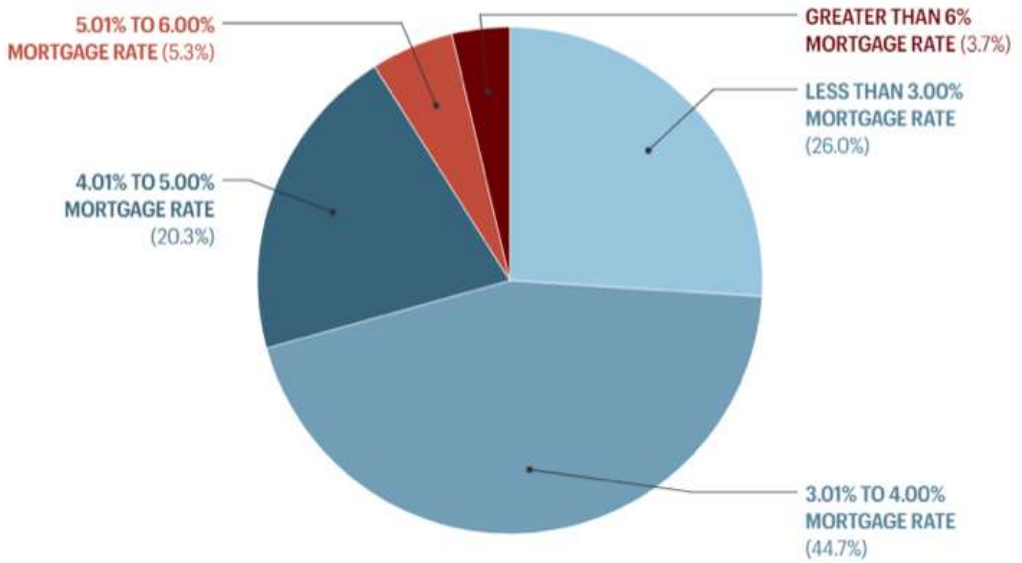


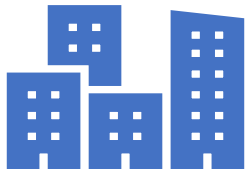
Chart: Lance Lambert. Source: Federal Housing Finance Agency, Morningstar

Mortgages - Canada

- 66% of Canadians are homeowners
- 50% have a mortgage
  - 70% have a fixed-rate mortgage that is not immediately affected by higher interest rates

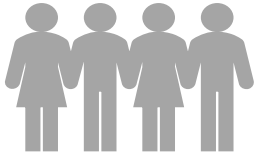
Bank of Canada: Financial System Review 2022

Shift from Rural to Urban



1920

30% of the world's population was urban.



2007

World's urban population surpassed its rural population.

2020

Urban housing now much more expensive and people began shifting to suburbs.

Why is the Population Declining?

Birth control pill was introduced in 1957 and approved by FDA in 1960 for contraceptive use.

Abortion became legal in US in 1973

The awareness of AIDs

Lessening influences

- Kin
- Rural/Urban
- Religion

Increasing influences

- Increase in women's rights
- Women in the workforce
- Social changes

…and COVID

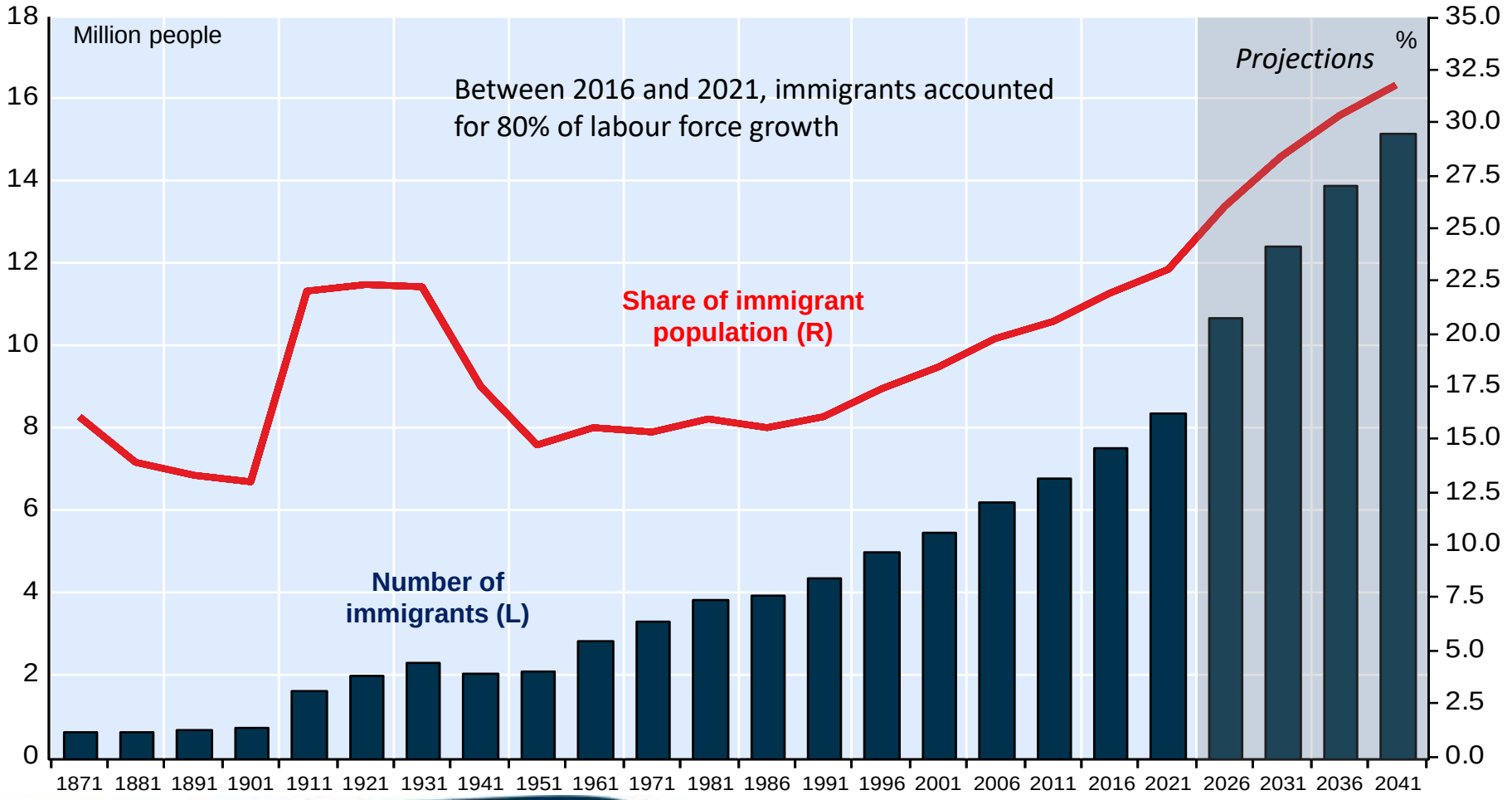
COVID Hangover

Mental health	Environment	Relationships	Immigration	Housing
• Workplace / work from home (stress) • Relationships (uncertainty/lack of tolerance) • Social (fear) • Physical health	• New social environment • New work environment	Delay of: • Marriages • Relationships • Starting families	• Typically, well-educated young people that have started or getting ready to start a family	• Higher costs of a family home

…Families will be smaller

Canada: A growing share of the population is immigrants

By census year



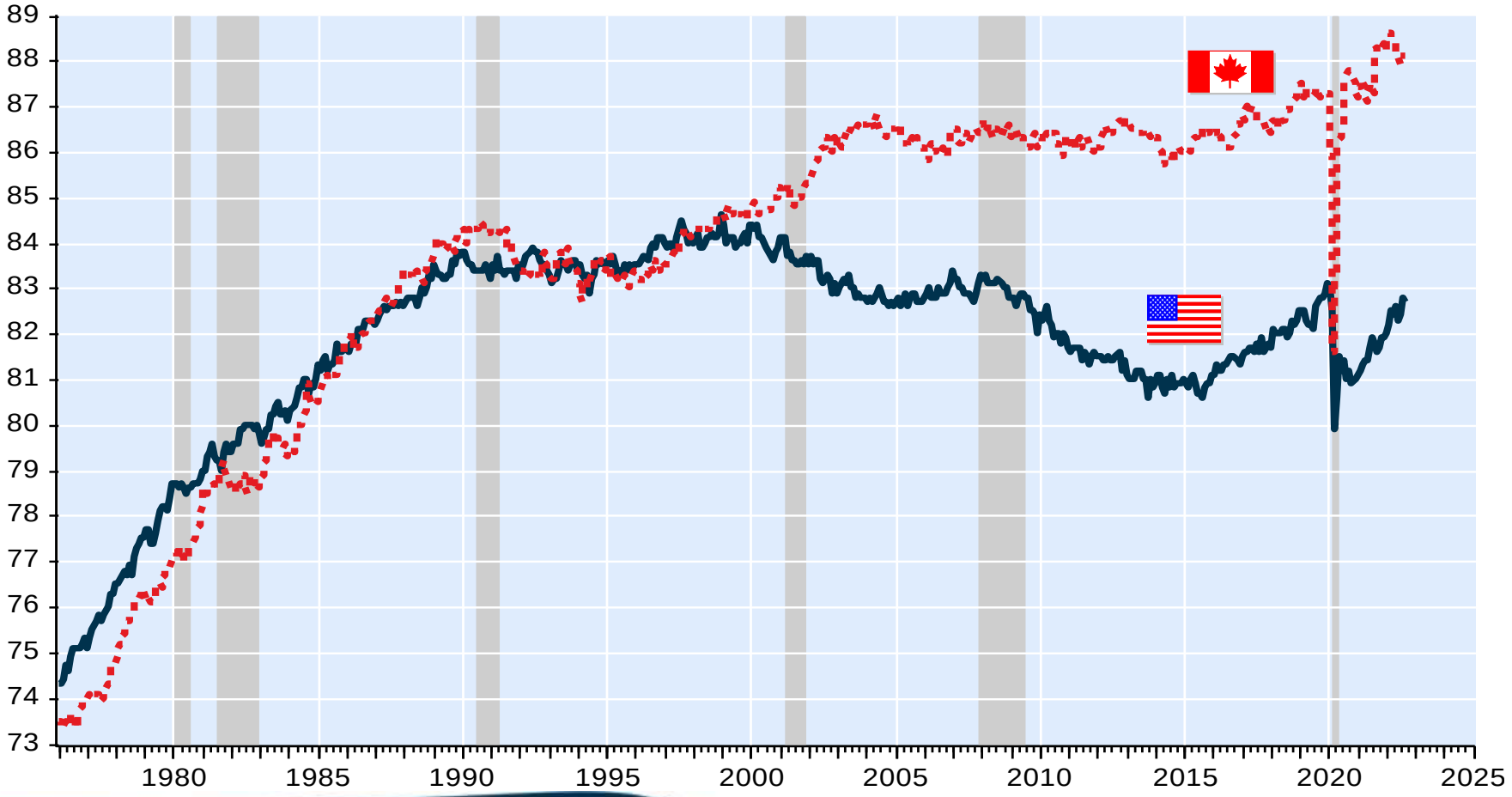
NBF Economics and Strategy (data via Statistics Canada
https://www150.statcan.gc.ca/n1/daily-quotidien/221026/g-a001-eng.htm

NATIONAL BANK FINANCIAL WEALTH MANAGEMENT

ANGUS WATT ADVISORY GROUP+

Canada: Labour force participation near a record high

Labour force participation rate for population aged 25-54



NBF Economics and Strategy (data from Statistics Canada, U.S. Bureau of Labor Statistics)

Canada's Immigration Targets

2022: 431,645

2023: 465,000

2024: 485,000

2025: 500,000

Challenges are many:

- schools
- healthcare
- housing

We will need an additional 3.5 million homes above the current home-building projections by 2030 – CHMC.

Do we have the labour capacity to build, fill and run these new schools, hospitals and homes?

Statistics Canada

Canada's Population Problem (2016-2021)

Canadian population grew 5.2%.

Canadians over 65 increased by 18.3% to 7 million; over 85 rose by 12%; and over 100 rose by 15%.

Number of Canadians younger than 15 grew *6x slower* than the number of people 65+.

Number of children under 5 declined 3.6%.

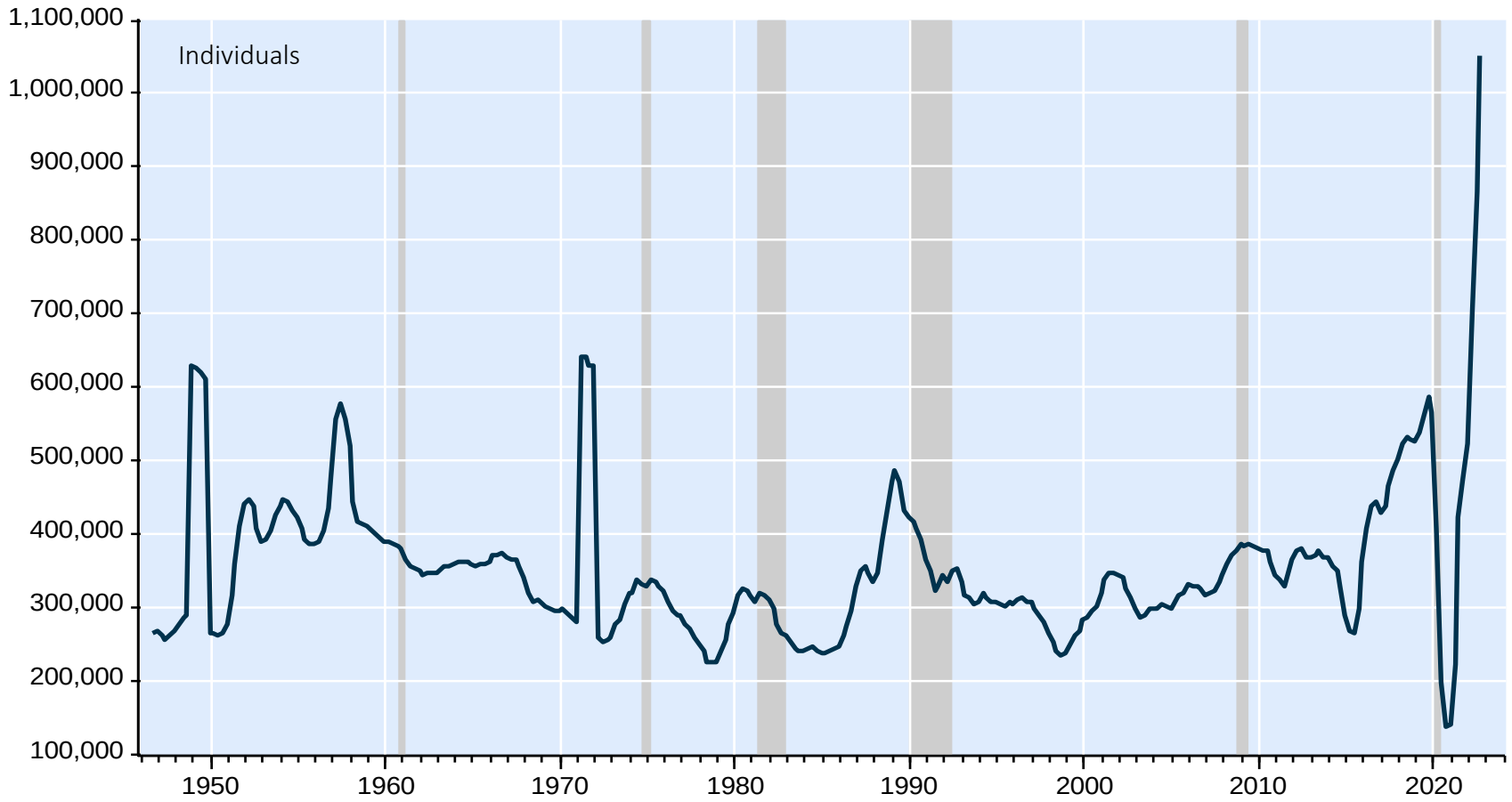
2020 saw the lowest birthrate since WW1.

By 2051, nearly 25% of the population will be 65+, almost 12 million people, and only 7.5 million children under 15.

Statistics Canada 2021 Census

Canada: Population growth is surging

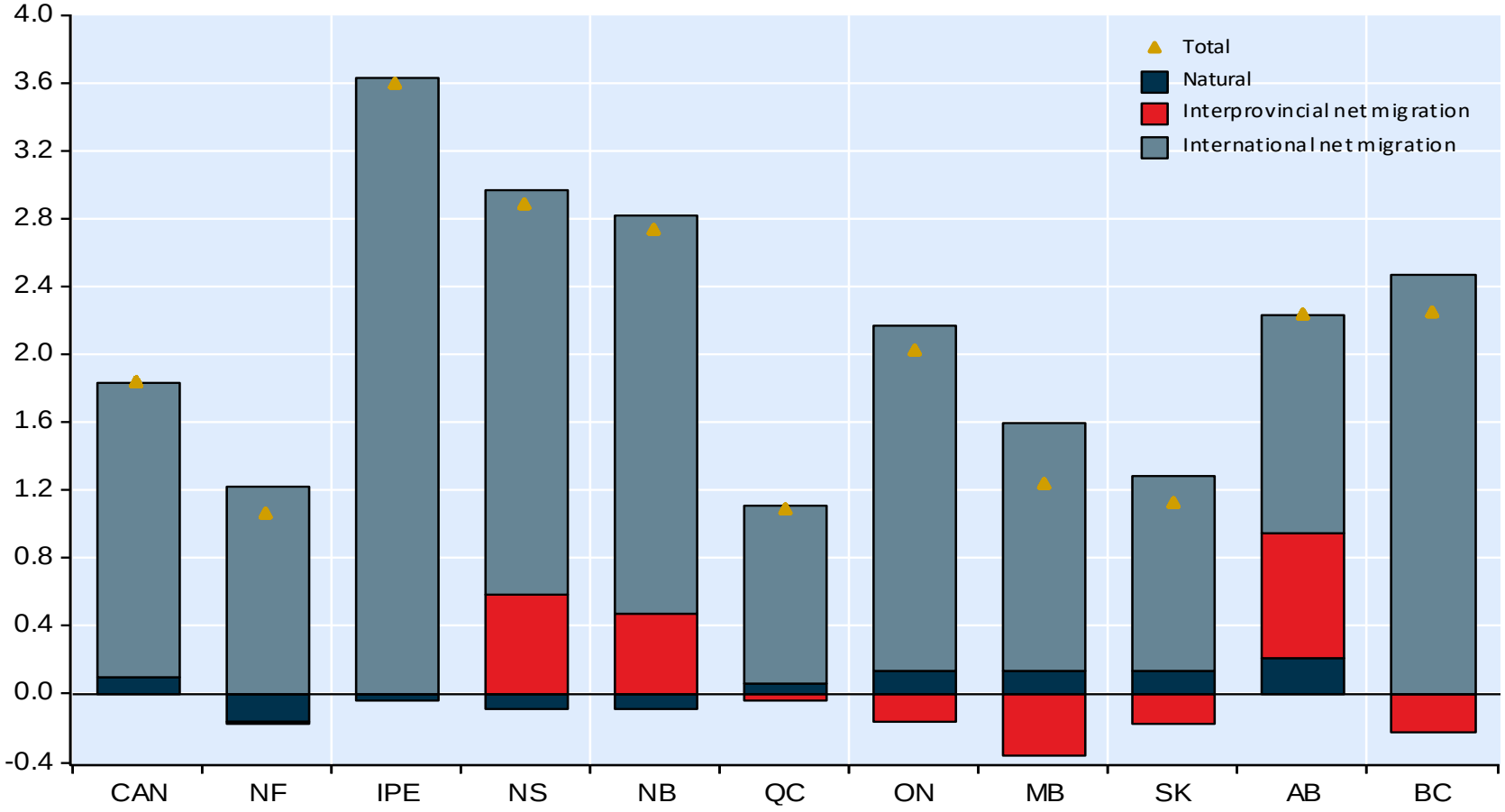
Annual growth in total population



NBF Economics and Strategy (data via Statistics Canada)

Canada: Population growth decomposition

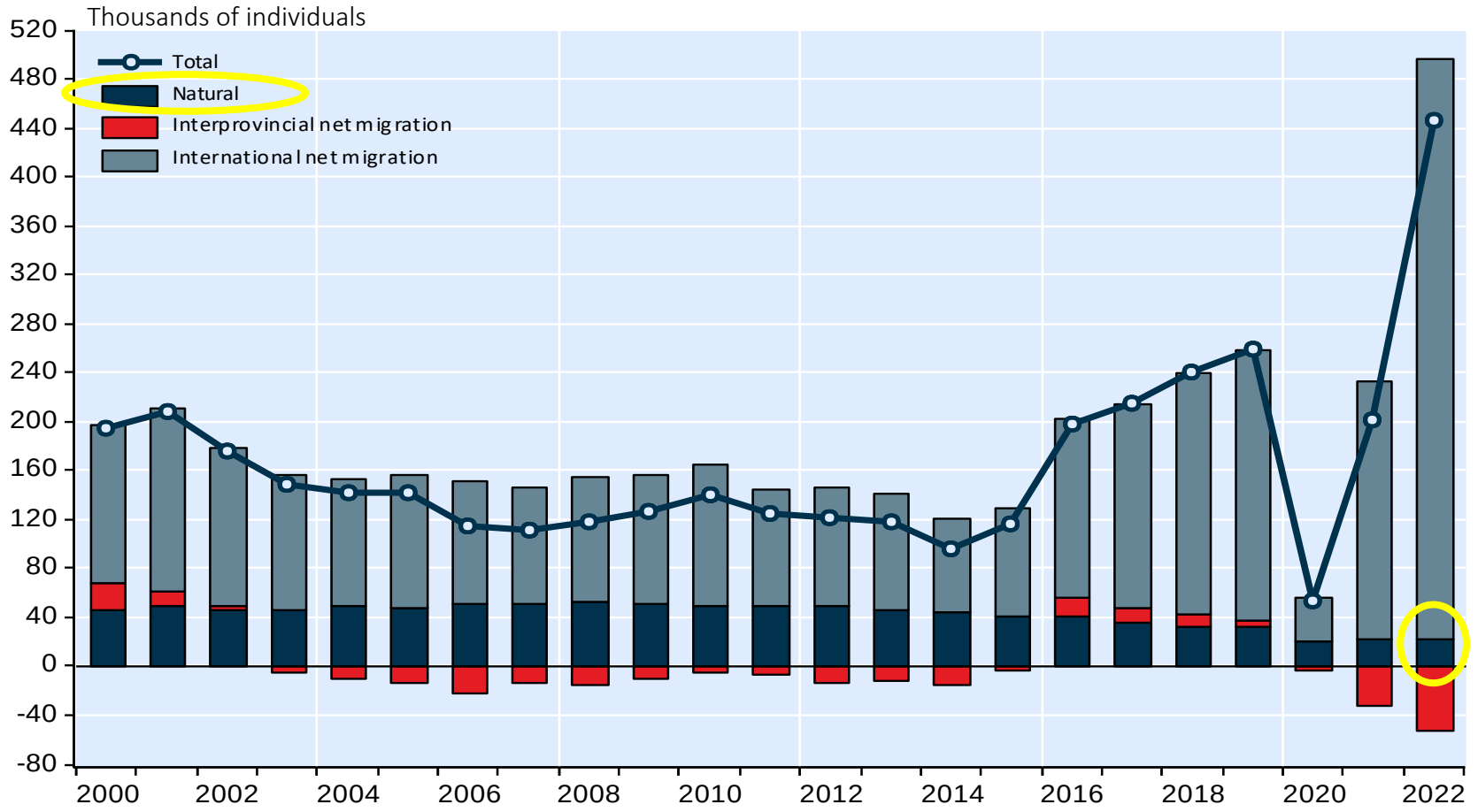
Population growth, 2022 Q4



NBF Economics and Strategy (data via Statistics Canada)

Ontario: Population growth decomposition

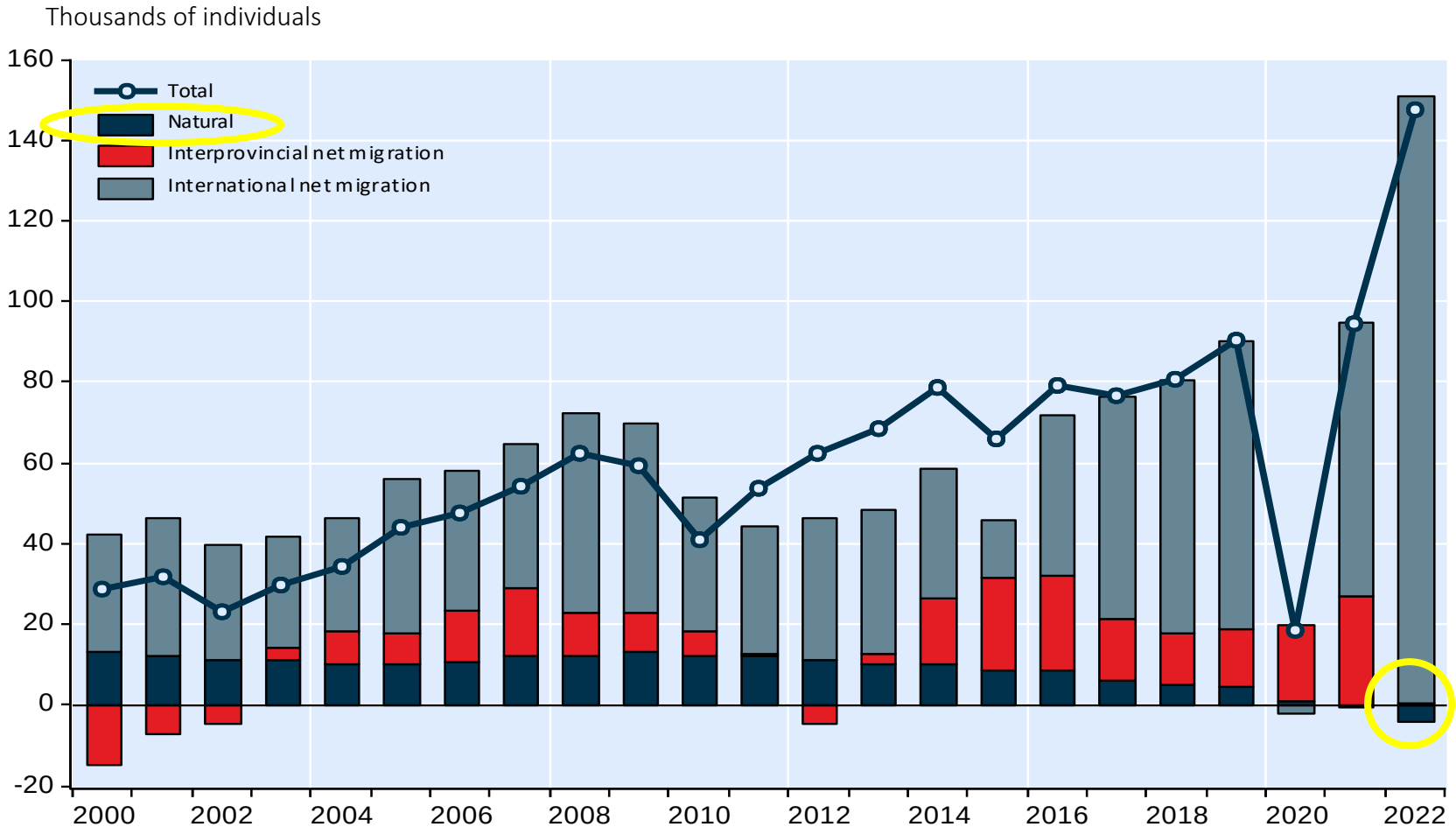
Population growth, calendar year



NBF Economics and Strategy (data via Statistics Canada)

British Columbia: Population growth decomposition

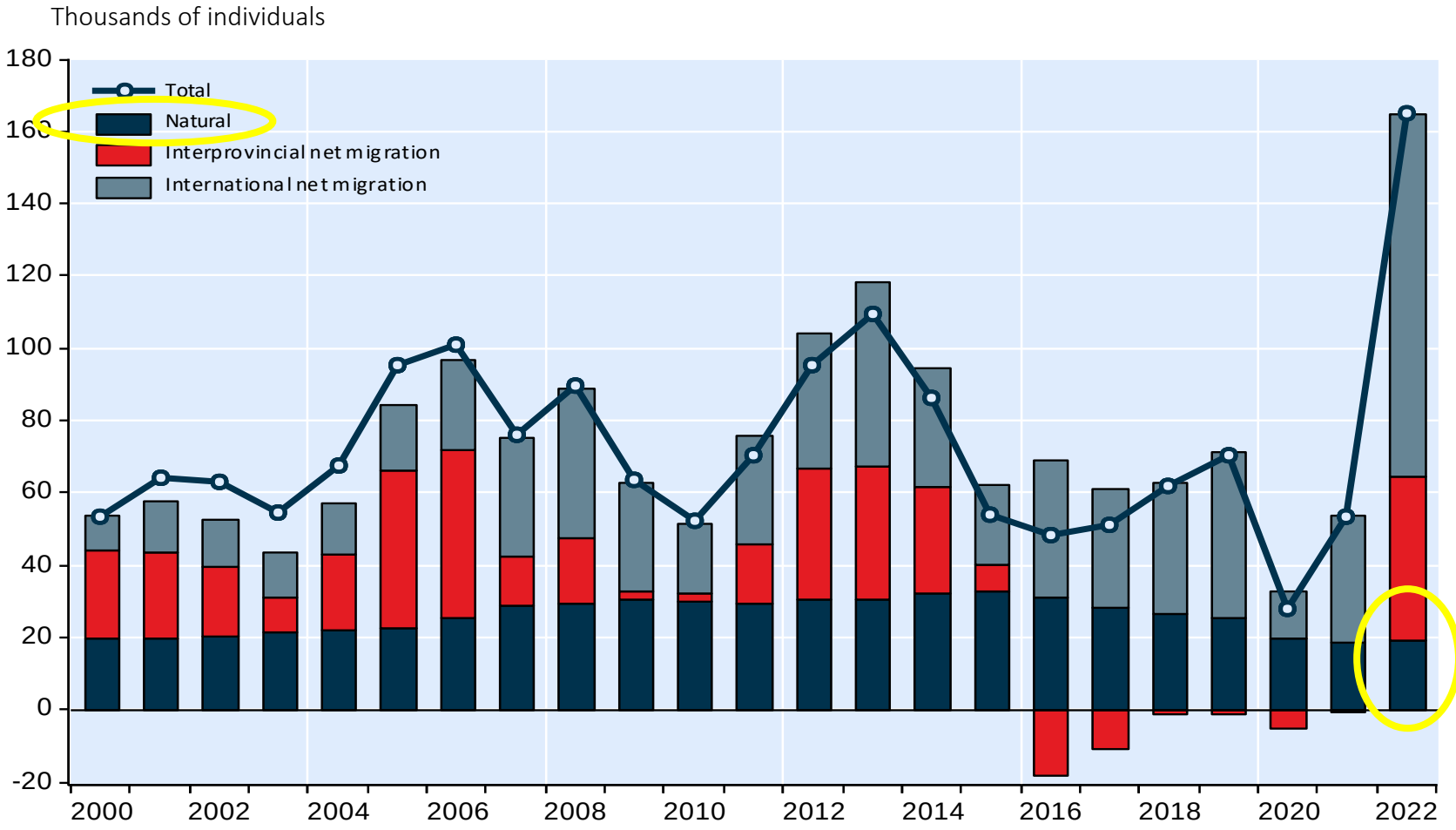
Population growth, calendar year



NBF Economics and Strategy (data via Statistics Canada)

Alberta: Population growth decomposition

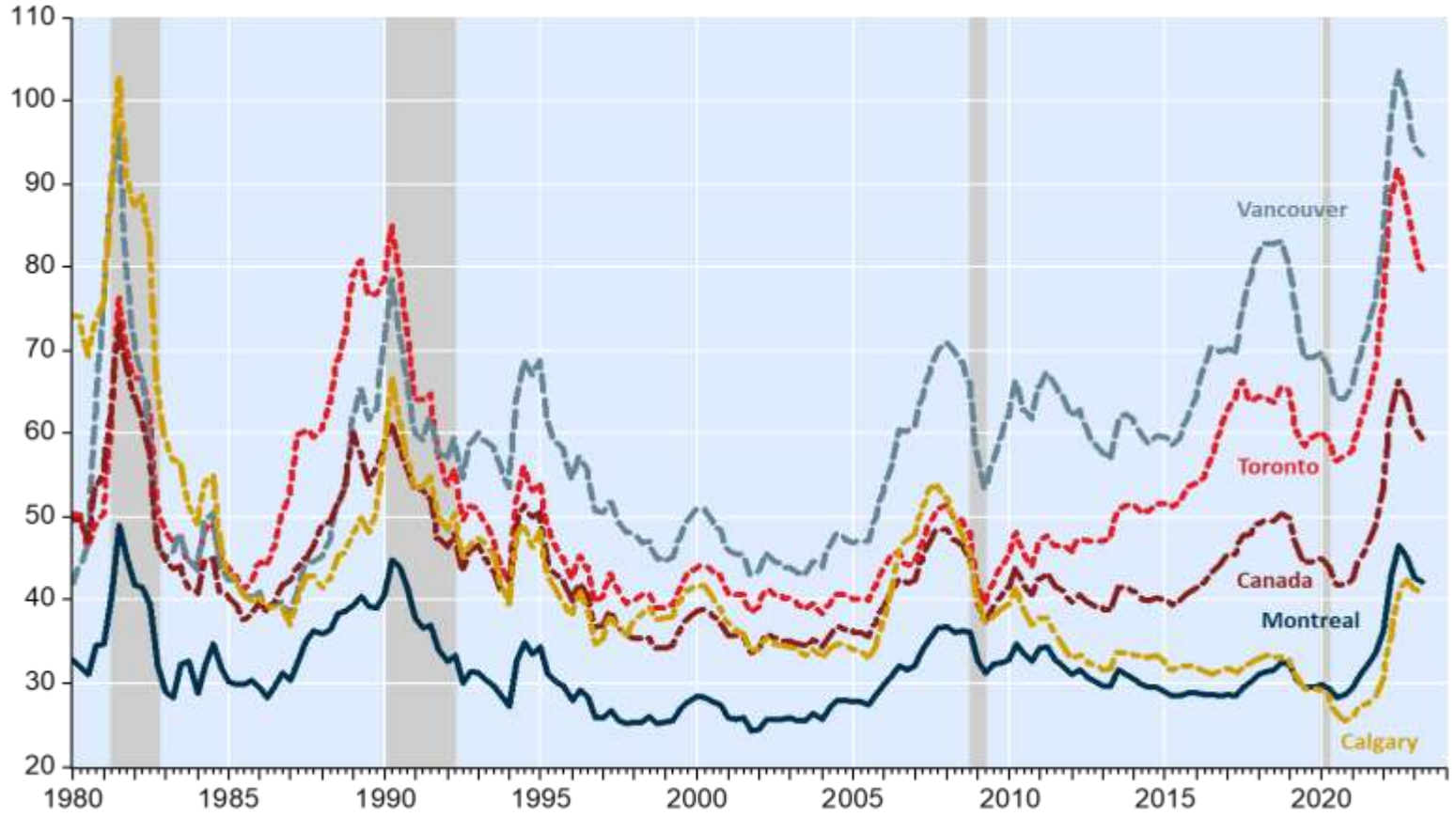
Population growth, calendar year



NBF Economics and Strategy (data via Statistics Canada)

Canada: Perspective on Housing Affordability

Monthly mortgage payment on median home price, all types of dwellings (25-year amortization, 5-year term)



NBF Economics and Strategy (data via Statistics Canada, Teranet-National Bank, CREA)

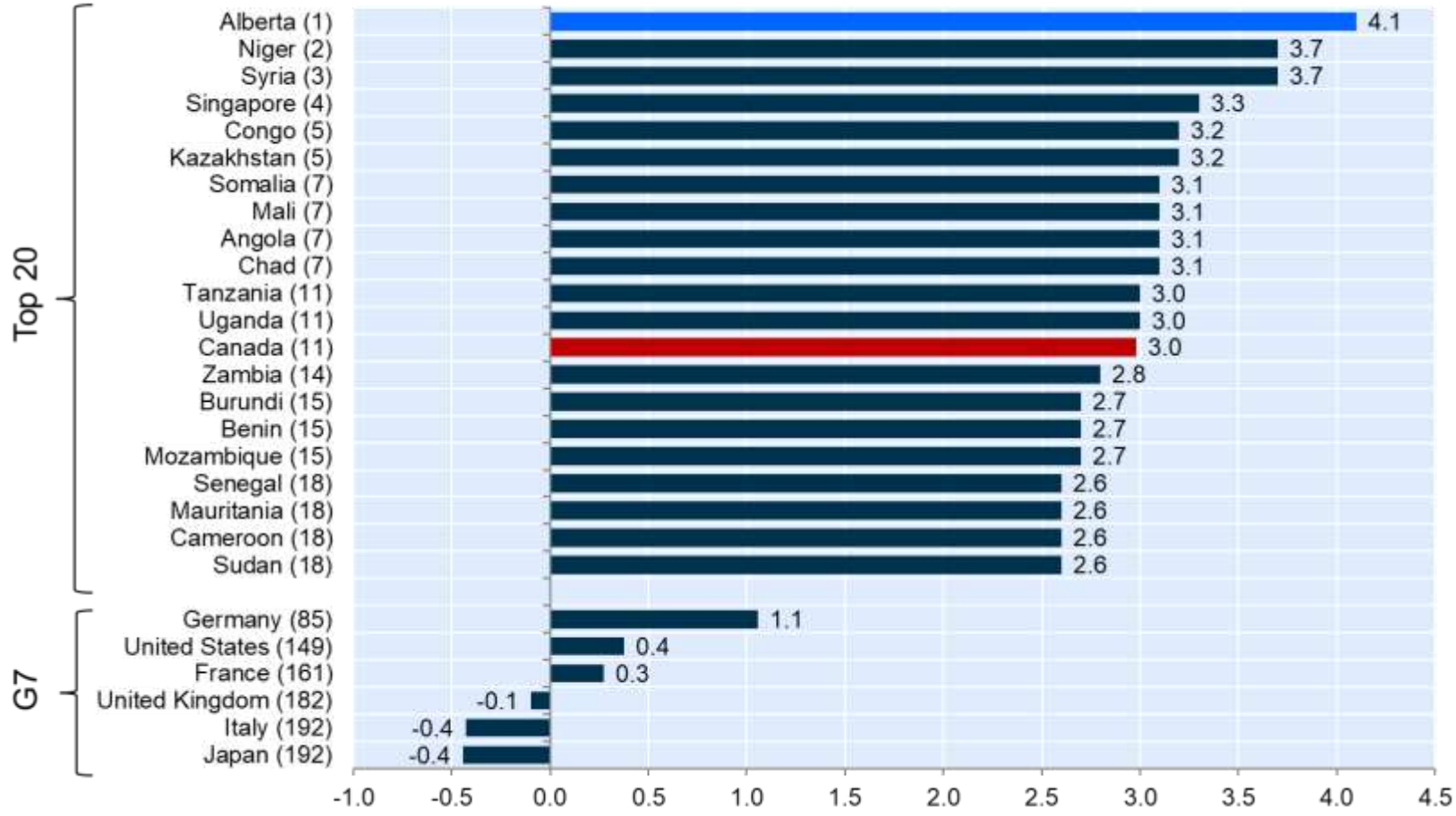
Canada: Housing Affordability (non-condo)

City	Average price of home in metropolitan market	Household annual income needed	Months of saving for downpayment (10% savings rate)	Mortgage payment as % of income (MPPI)
Toronto	$1,163,670	$236,221	304	84.7%
Vancouver	$1,587,439	$322,245	455	126.7%
Calgary	$612,630	$146,251	48	45.5%
Edmonton	**$461,563**	**$111,264**	**31**	**34.3%**

NBF Economics and Strategy (data via Statistics Canada, Teranet-National Bank)

Alberta: Population Growth is the Fastest in the World

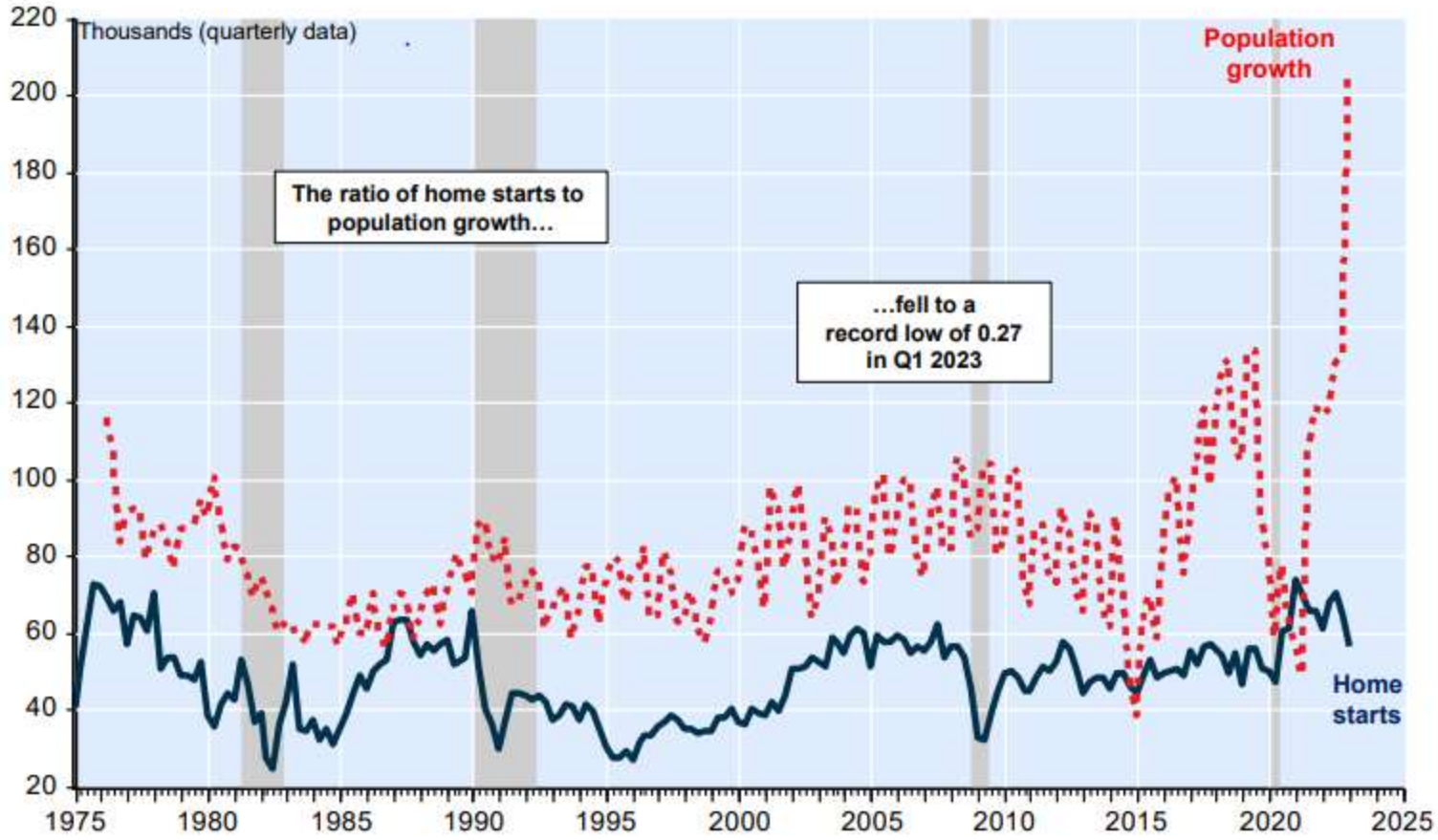
Population growth in 2022, top 20 countries + Alberta and G7 economies (2023 data for CA and AB)



NBF Economics and Strategy (data via World Bank, Statistics Canada)

Canada: Homebuilders aren't keeping up with Population Growth

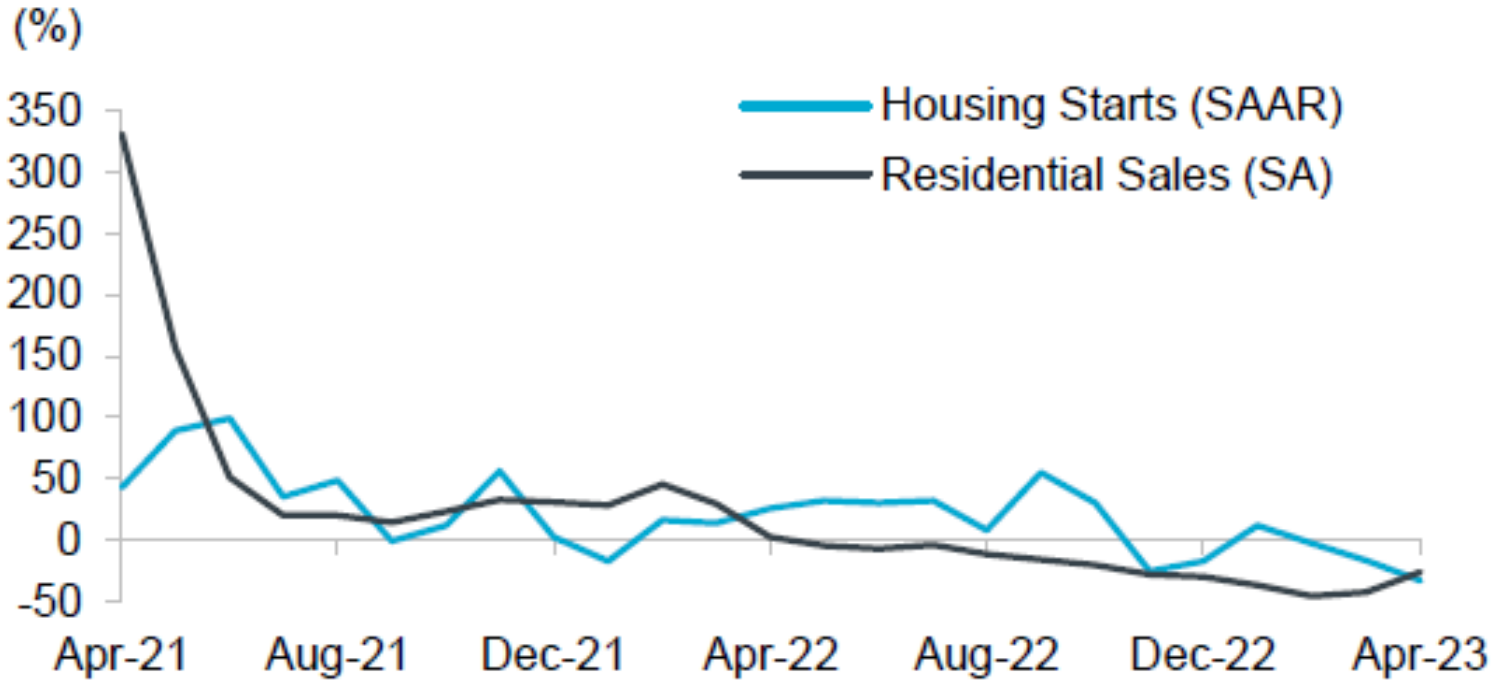
Quarterly change in population aged 15+ vs. quarterly residential home sales



NBF Econmics and Strategy (data via Statcan and FRED)

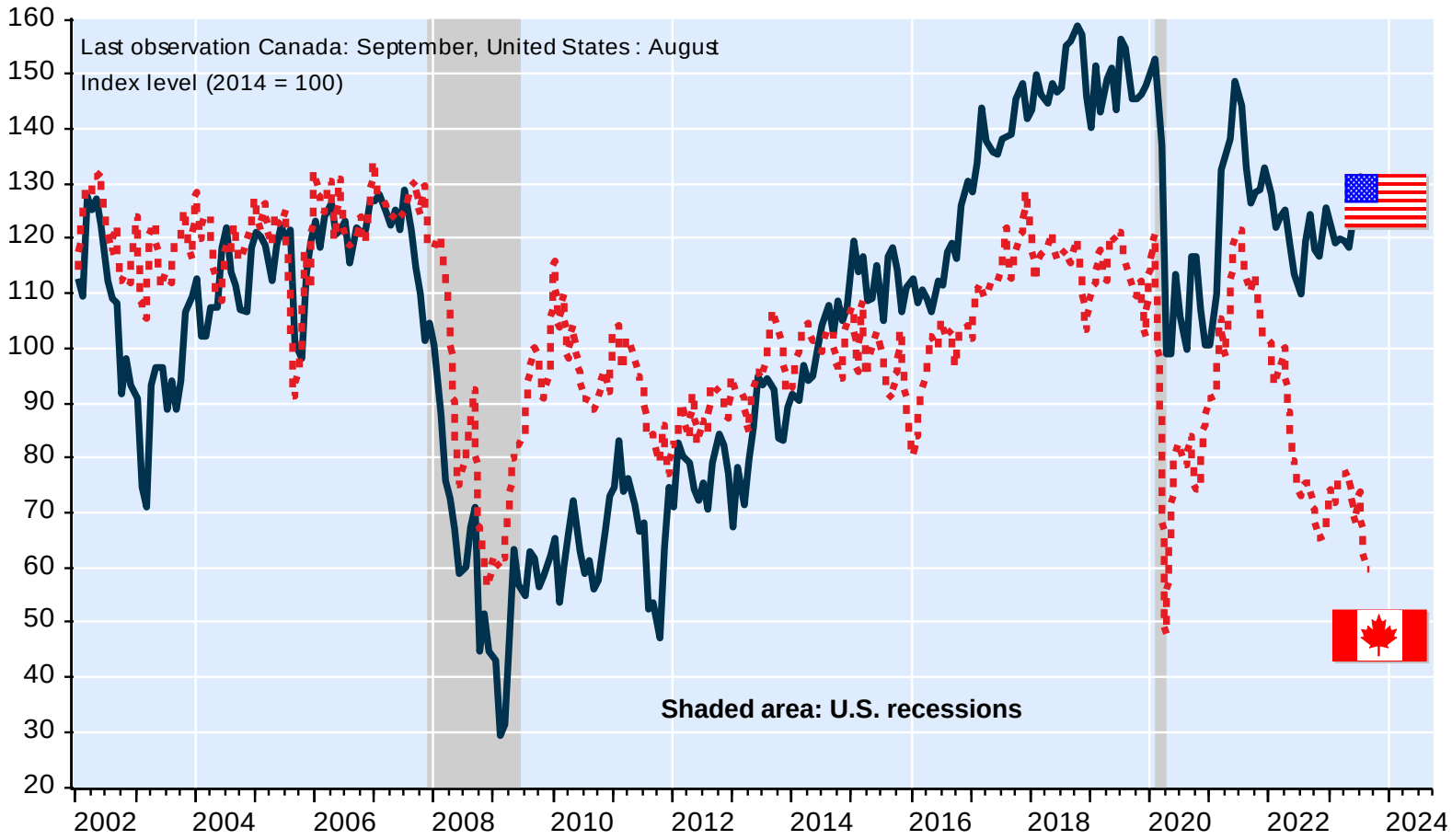
Alberta: Housing Starts and Home Resales

Year-over-year change (%)



Statistics Canada, Canadian Real Estate Association, Haver Analytics; SAAR - Seasonally Adjusted Annual Rate

Consumer Confidence is Falling



NBF Economics and Strategy (data from Conference Board of Canada)

“Build the highway…and they will come.”

Fasten your seatbelts, Highway 2 is about to explode
as our Province takes off.

Net Population Movement for Alberta (Q2-2023)

Highest second quarter growth rate on record

Added 50,061/1.1%

International migration: (31,371/0.67%)

Interprovincial migration: (13,926/0.30%)

Natural growth: (4,764/0.10%)

Alberta still has highest natural growth rate, youngest average age, lowest proportion of 65+

Alberta population: 4,695,290, Y/Y growth rate of 4.09% (Canada 2.98%)

April 1, 2023 – June 30, 2023

Statistics Canada and Alberta Treasury Board and Finance

Alberta – Connecting the dots: the Next 2 Years

Strong interprovincial and international migration.

→

Increased demand in housing, schools, healthcare and infrastructure.

→

Shortage of skilled workforce.

↓

New residents to Alberta are looking for:

- A home, a backyard, and a school nearby
- A place to develop a career
- A place to raise a family

→

Need a tax regime that supports corporations and the people of Alberta.

→

Need provincial research incentives.

"We are a province of problem solvers" *Joe Lukacs*

Alberta – Connecting the dots

The future
is ours!

Questions

780.412.6644

angus.watt@nbc.ca

anguswatt.com

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Control Room Simulators

Ron Besuijen – Nova Chemicals

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

Operator Training Simulators

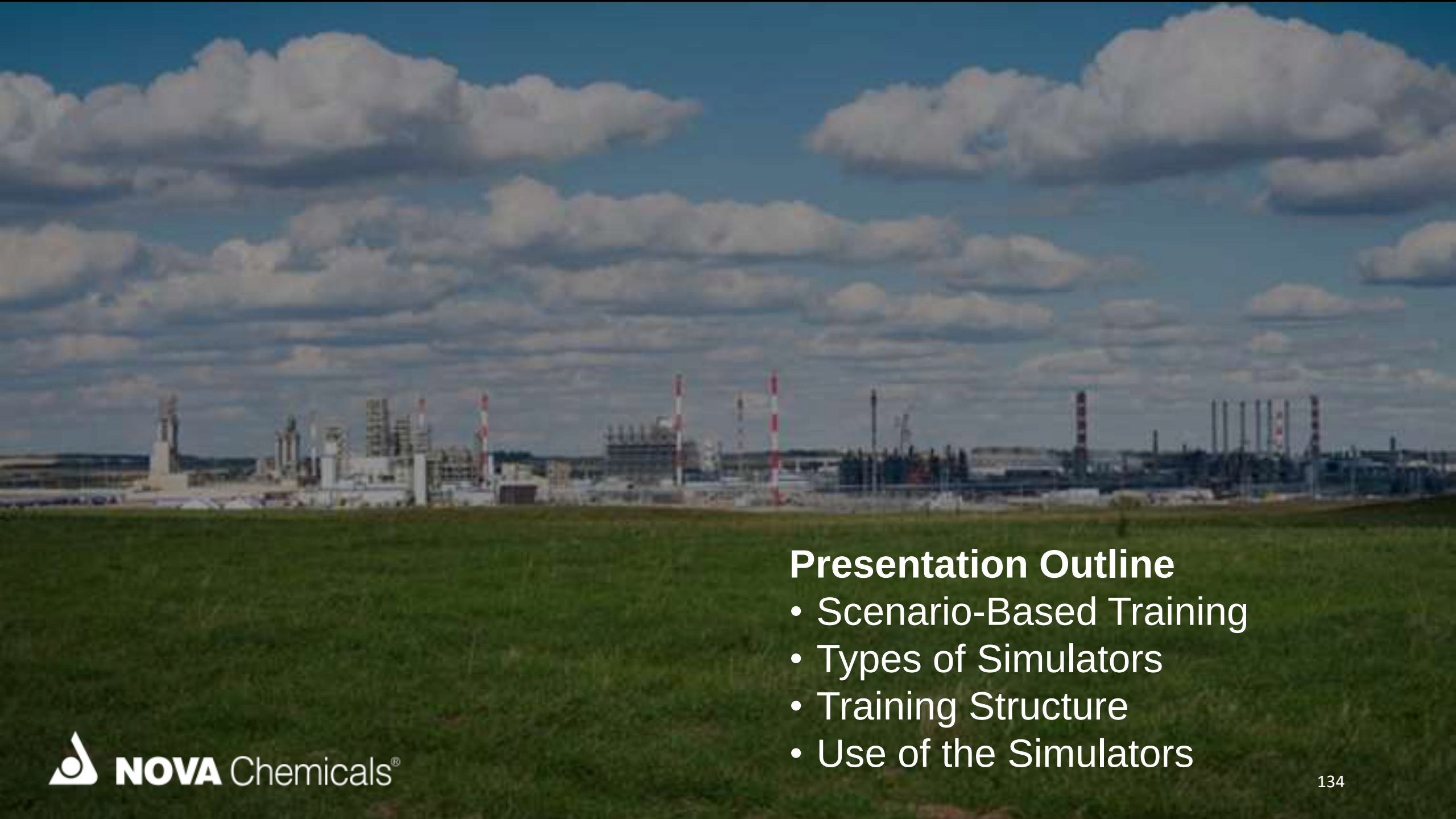
NOVA Chemicals' Experience for Training, Certification & Other Applications

Presented by: Ron Besuijen – NOVA Chemicals

Chief Power Engineering Training Conference 2023

NOVA Chemicals®

Oct 25, 2023



Presentation Outline

- Scenario-Based Training
- Types of Simulators
- Training Structure
- Use of the Simulators

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Challenge

- We require our operators to make $million+ decisions in a short period of time
- Procedures fall short of addressing every possibility

Practical Training

Better prepared for actual response

Classroom Training

Unsure if ready for actual response

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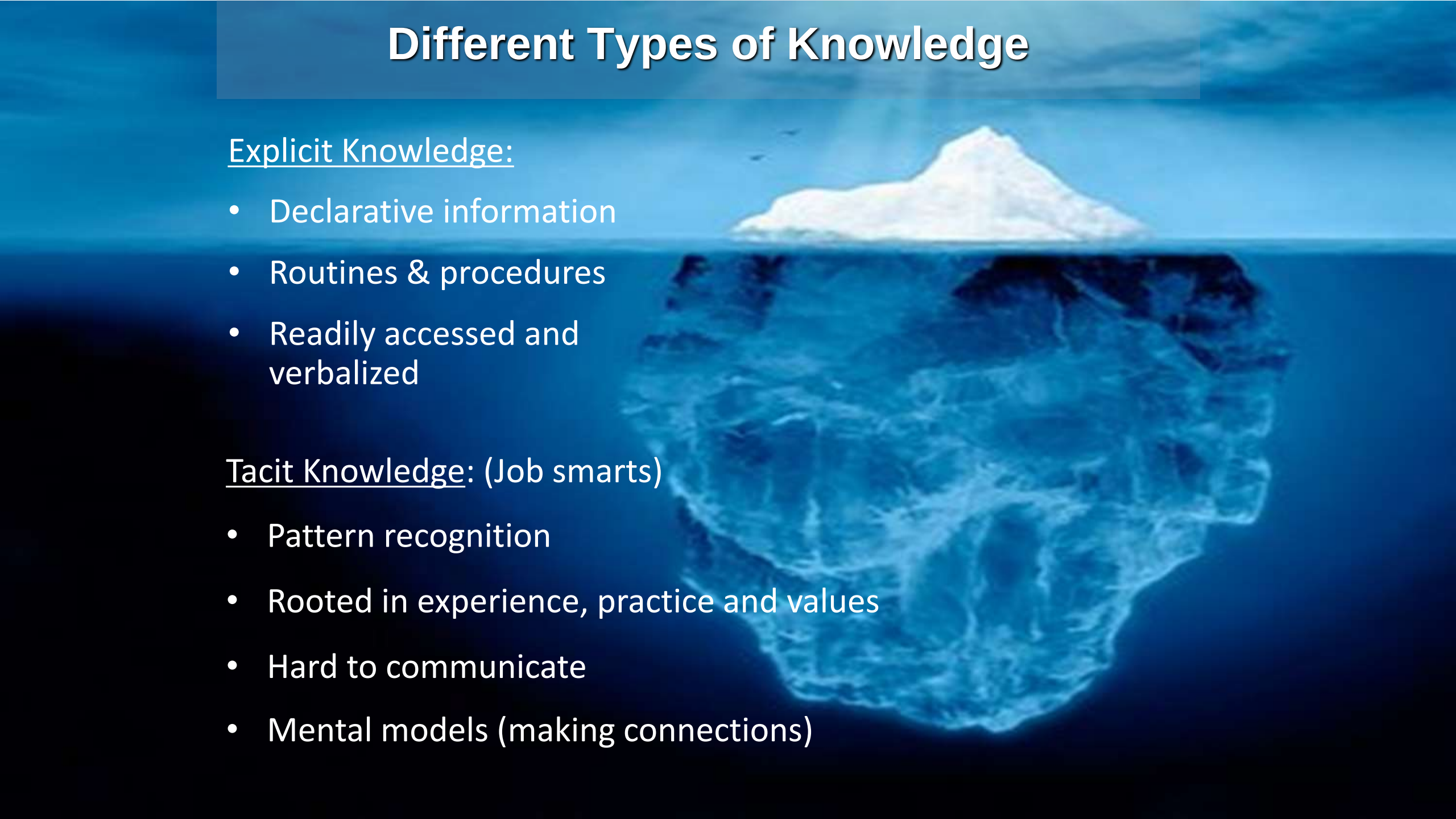
Scenario Based Training Benefits

- Traditionally, training has focused on retaining information and performing tasks or following procedures
- This is a good starting point but is not always adequate for our complex processes

Different Types of Knowledge



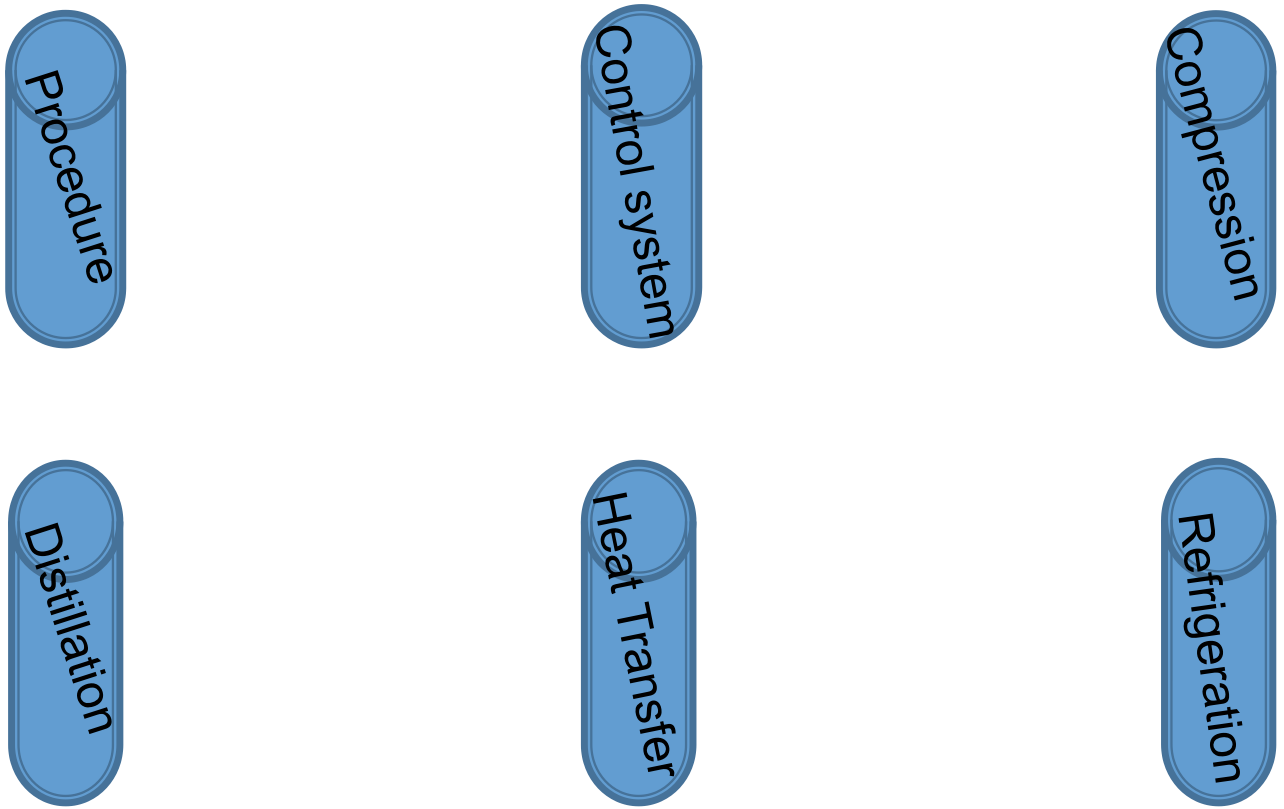
Explicit Knowledge:

- Declarative information
- Routines & procedures
- Readily accessed and verbalized

Tacit Knowledge: (Job smarts)

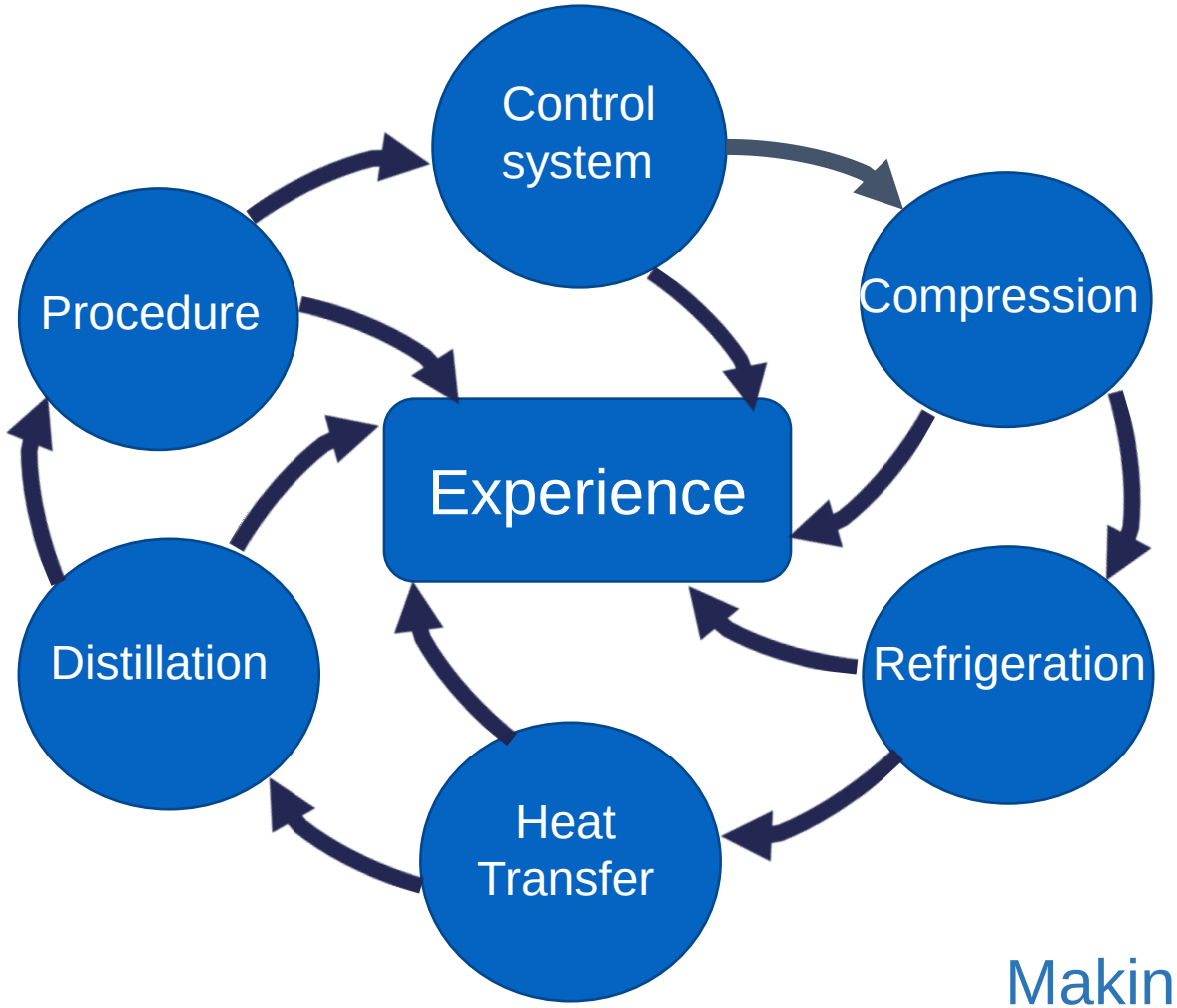
- Pattern recognition
- Rooted in experience, practice and values
- Hard to communicate
- Mental models (making connections)

Inert Knowledge



Knowledge Silos

Tacit Knowledge



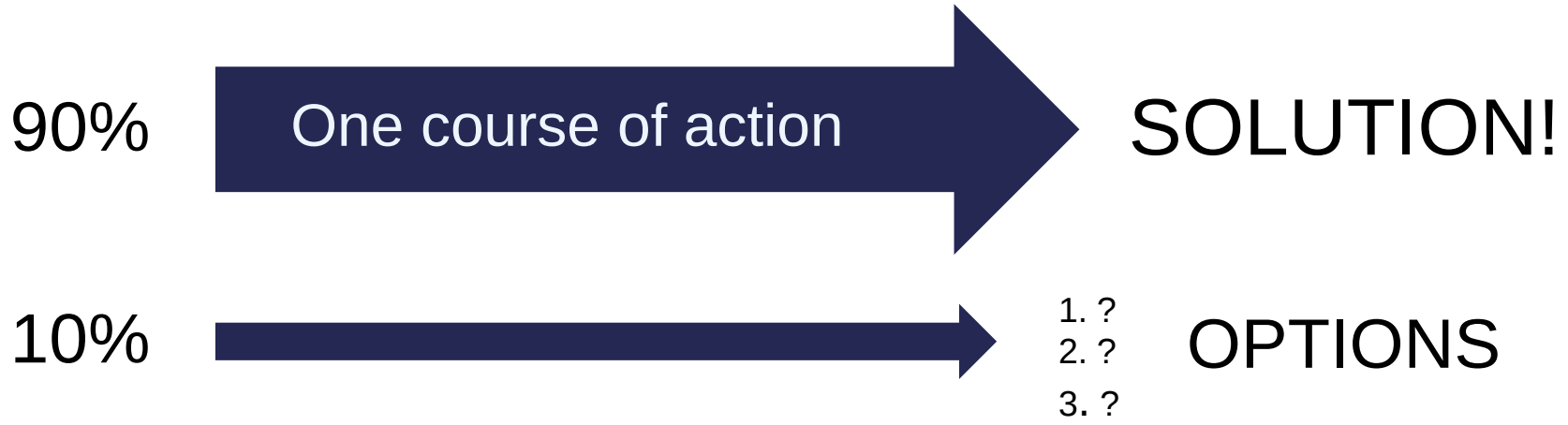
Pattern recognition

Hard to communicate

Making connections – Mental Models

Decision Making

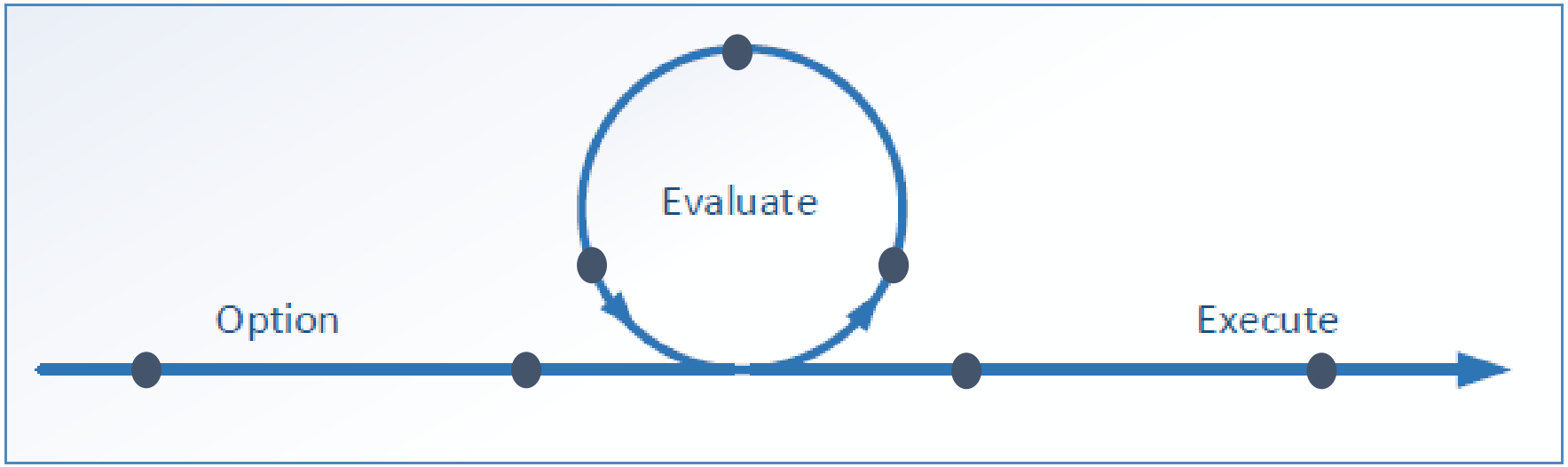
- Studies of decision making in **critical situations** with **time constraints** have shown that approximately 90% of the time one course of action is determined.
- There is not a comparison of options.



- 90% + of training focuses on this 10%
- Memorizing facts, following procedures

Decision Making

- Perform a mental simulation (run it through in your mind) before you implement an action. This would be taking the solution and asking what would happen if I _____ (executed this action)? This would help you determine if you had to adjust your response or provide a totally new solution.



Reality Check

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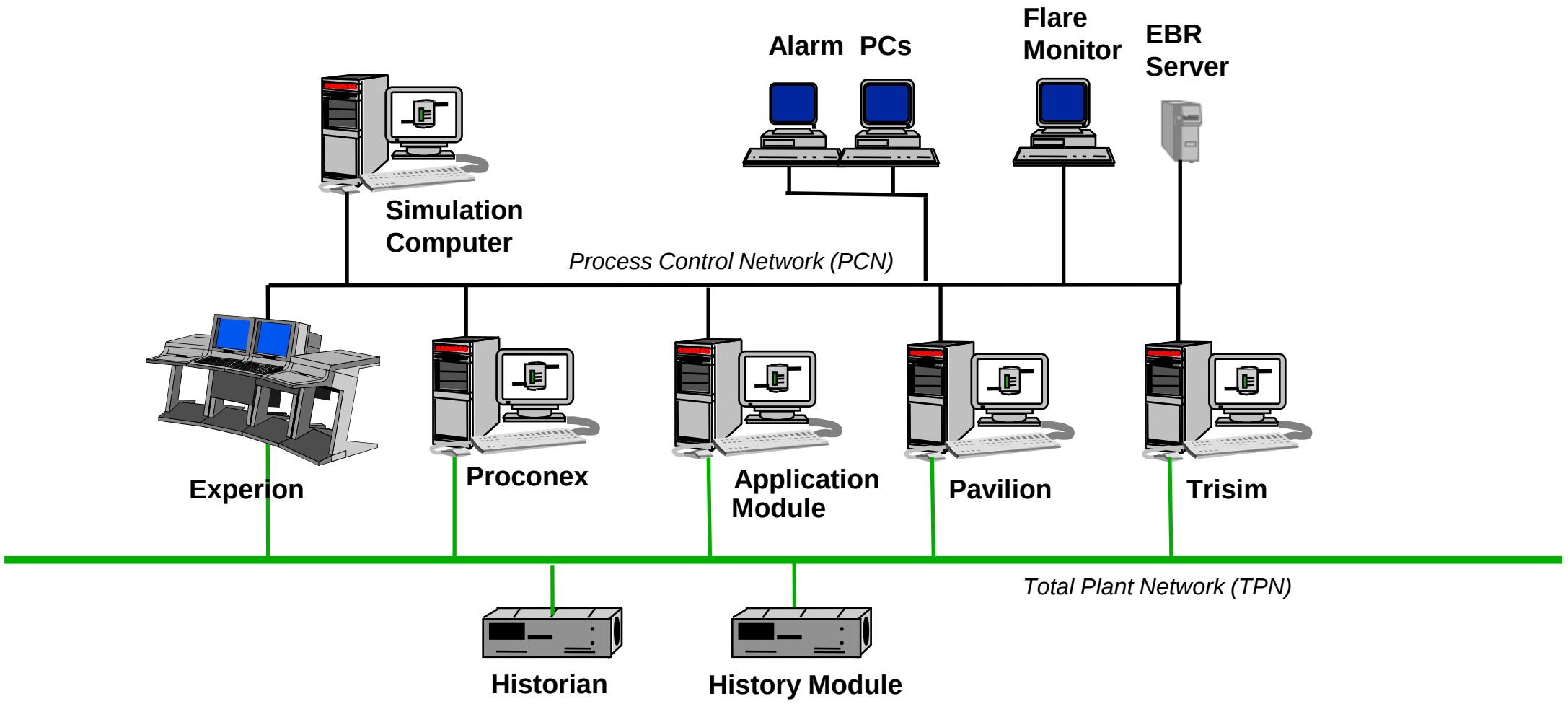
NOVA Simulation

- 3 Ethylene facilities with Cracking & Finishing
- 1 Ethylene facility with Finishing
- 2 Polyethylene with Process and Extrusion
- 1 Polyethylene with Process
- Ethylene Pipeline

Simulation

- Simulators are an excellent way to develop tacit knowledge and mental models

E2 Simulator



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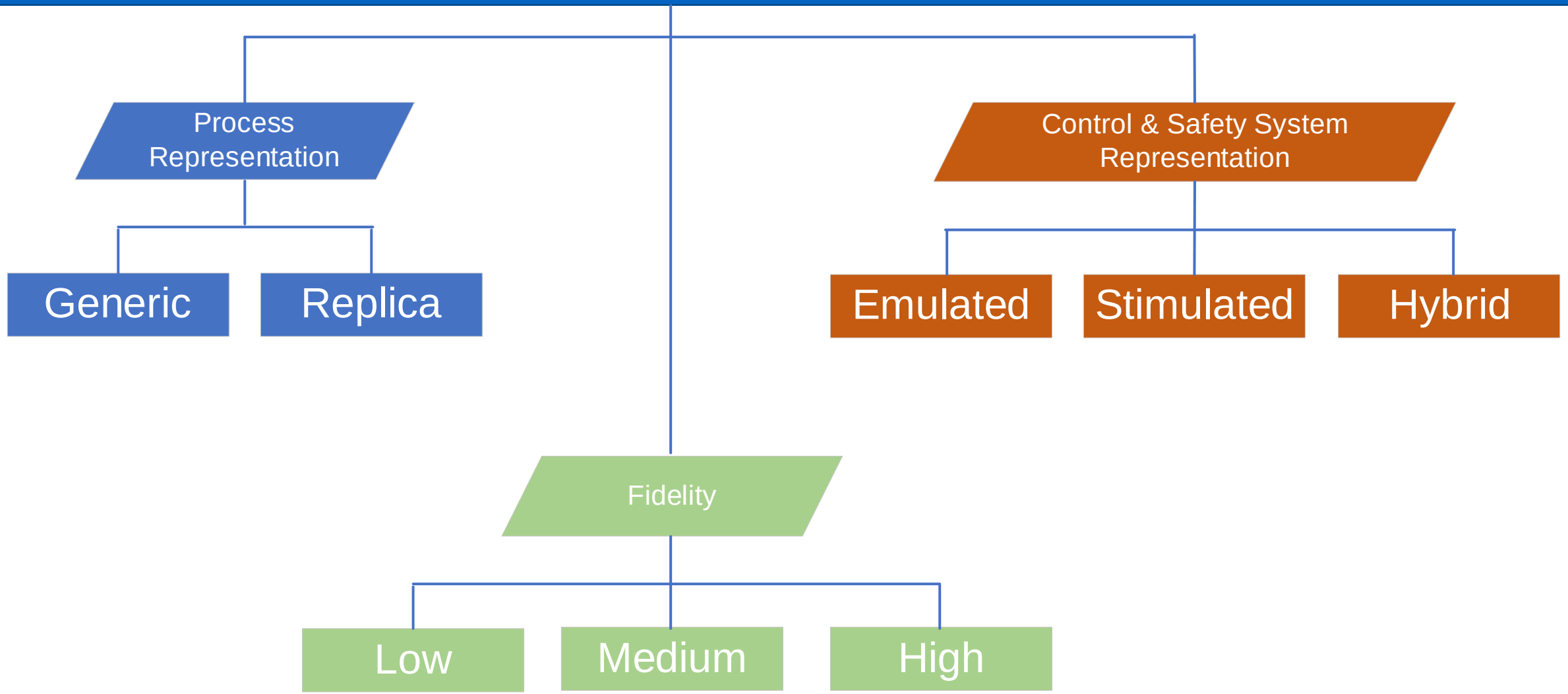
Design Considerations

- Use of actual DCS hardware/software
- Communication from simulator model to DCS
- Simulation of safety logic
  - Modeled in simulator
  - Vendor hardware/software
- Flare monitor
- Trip buttons (real vs. touch screen)
- Hardwired alarms (Light Boxes)

Operator Training Simulator Types



Process Representation

- Generic
  - Off the shelf
  - Different equipment and instrumentation numbers
  - Different graphics
  - Understanding of the principles of process operation
- Replica
  - Designed from plant’s data sheets
  - Controllers and safety systems are the same
  - DCS Stations and graphics are duplicated

Fidelity Considerations

- Low
  - Basic logic testing
  - Not dynamic
  - Minimal training benefits
- Medium
  - Data is estimated
  - Steady state, dynamic responses limited
- High
  - First principal engineering and thermodynamics
  - Accurately predicts model responses for scenarios like startup, shutdown, and abnormal responses
  - Some of the model can be simplified

Fidelity Considerations

- High, Medium, Low

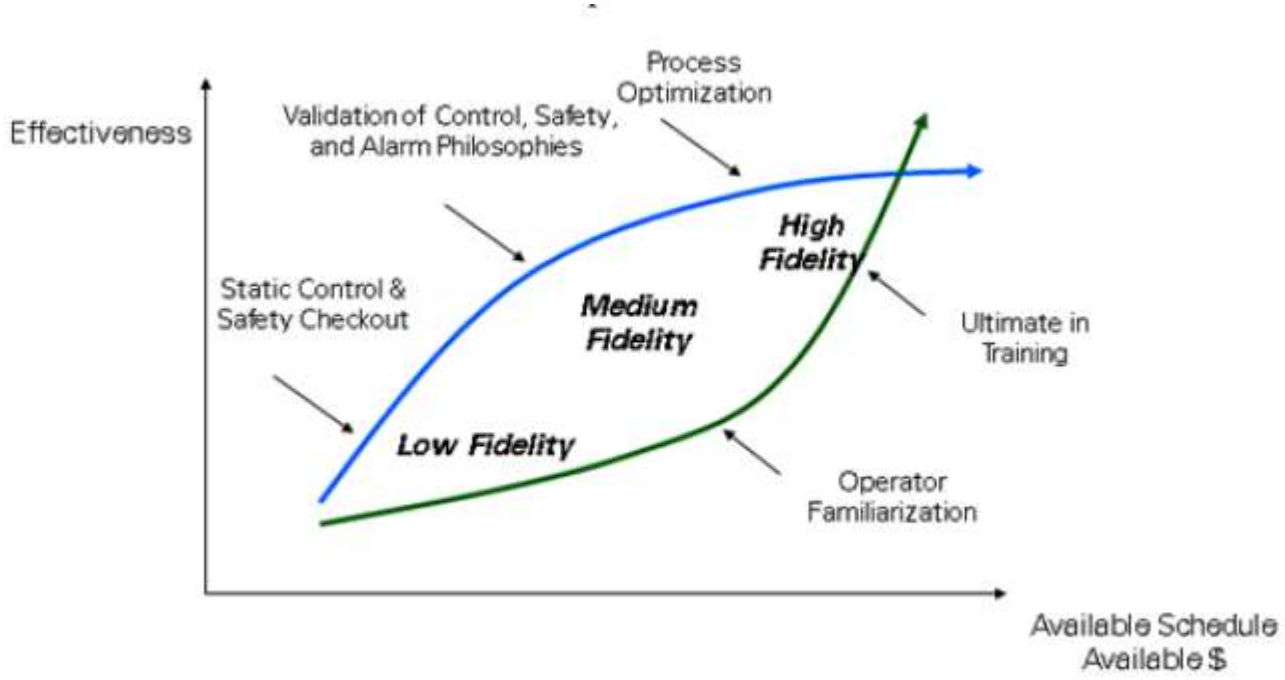


Figure 1.11 – OTS effectiveness versus cost

Control & Safety System Representation

- Emulated
  - Logic behaves the same (translation)
  - Graphics are recreated
- Stimulated
  - Same hardware and software as plant
- Hybrid
  - Logic code is recreated the same as the plant
  - HMI is the same

Third-Party Representation

- i.e., compressor speed controllers
  - Can be modeled in the simulator
  - Supplier hardware and software

Questions to ask

- What will the simulator be used for?
  - A new or existing process
  - Will there be a major change to the process
  - Experience level of operators
  - Testing new control systems
  - Testing DCS software updates
- Complexity of the process
  - Response time required by operations to mitigate upsets
  - How long it takes to restart the process and what will the cost of lost production be?

Maintaining

- Dedicated trainer
- Include updating the simulator in project budgets
- Engineering license and training
- Set up remote access for the model engineer
- Budget for yearly maintenance
- Develop an excel sheet to document problems

Item No.	Problem Description	Date Reported	Reported By	Priority (High/Med/Low)	Date Fixed	Fix Confirm Date	Item Closed (Y/N)	Vendor Comments	Client Comments	Type	All IC's	Additional Queries	Status
1	P634 will not start from instructor interface	26-Jul-2023	Ron	Med	07/29/2023								Retest

Training Structure

- Startup
- Emergency Procedures & Trip Applications
- Advanced malfunctions
- Refresher Training

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Benefits of using OTS

- Training
  - Initial
  - Refresher
  - Reduction of freeze responses during process upsets
  - Team Coordination
  - DCS technicians
  - Emergency response
- Verify and Improve Procedures
- Controller Validation and Tuning

Benefits of using OTS

- Safety logic validation
- Network security testing
- Abnormal Situation Management
- Development of online process upset procedures
- DCS Upgrade to Experion
  - Test graphics
  - Train operators
- Incident prevention
- Graphic development
- Test software updates
- Controller tuning
- Alarm analysis
- Engineering studies

Trip Applications (E2)

- Propylene Refrigeration Compressor trip
- Cracked Gas Compressor trip
- Cracked Gas Compressor trip with an immediate restart
- Reactor Off spec
- Ethylene Refrigeration Compressor trip
- Finishing Feed Pull
- Furnace Feed Reduction

Flare Reductions

- Startups and Shutdowns
  - Saved Millions
  - Reductions down by half
- Propylene Refrigeration startup
  - Reduced surges and high temperatures
- Acetylene Reactor Off spec
  - Ethylene Bullets Practice

Polyethylene 2

- 12 days to qualify
- Procedure development
- Graphics reworked
- Startup requires 100 steps in 1 hour
- Shutdown requires 30 steps in 10 minutes
- SPI Trip Recovery Application (affects reaction and distillation)
- Hot transition application transitions catalyst platforms while maintaining production

ASM Research

- Operator interface case study
  - 40% improved operator response
- Alarm management research
  - Studied human capability and how we process alarm information
- Ecological interface design project
  - Analyze effect on the work domain or environment

Center for Operator Performance Research

- ShadowBox Training
- Mental Models
- Alarm Automation Impact
- CAARGO (Cognitive After-Action Review Guide for Observers)

Budget

- Initial cost of hardware and software
- 100 K low fidelity
- 500 K + for high fidelity
  - Will the same DCS software be used? License fees
  - Will the same console be used?
  - Are renovations required for the training room?
- Yearly costs
  - Training instructor
  - Updates to match any changes in the actual process
  - License fees
  - Maintenance agreements

Training Tips

- Be clear when you are in training mode and when you are testing
- Pointing out errors is necessary, then focus on how they arrived at their answers
- Train with compassion

Keys to Success

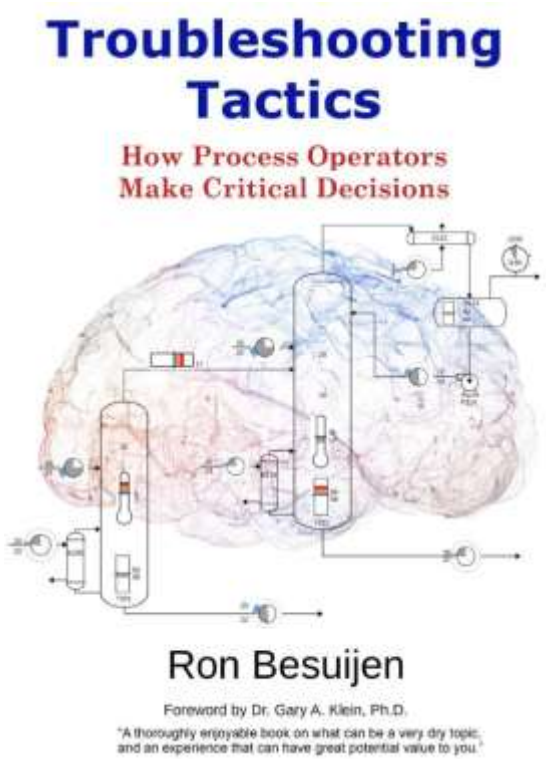
- Full time simulator trainer
- Leadership support for budget and training time
- Support by control system group
- Project management includes simulator updates
- Maintenance support from vendor

Conclusion

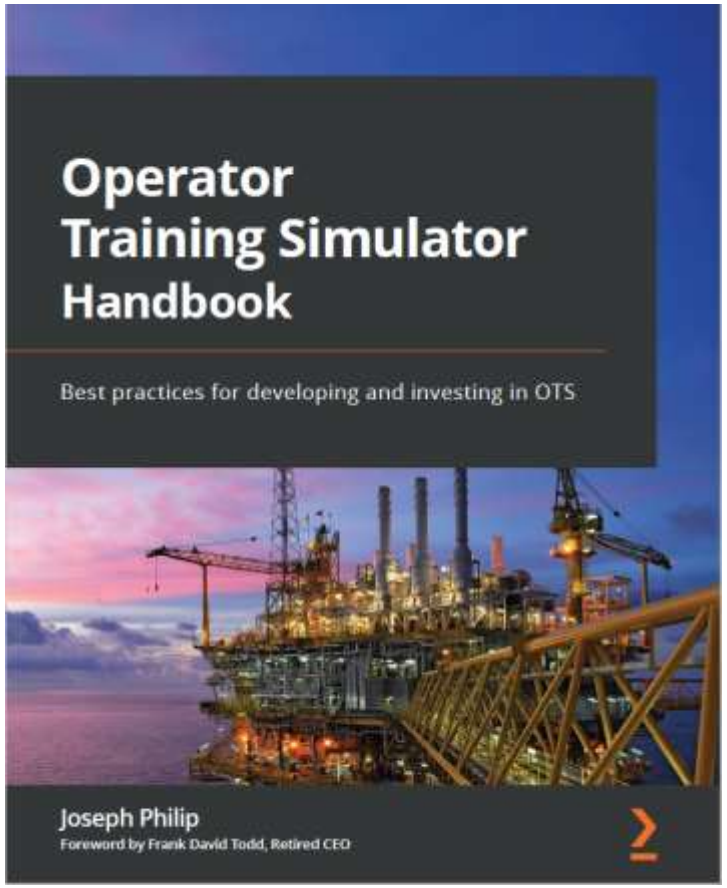
Simulators have many uses & exceeded expectations:

- Development of tacit knowledge and decision making
- Dynamic high-fidelity models provide realistic training
- Simulators provide software and hardware testing
- Simulators are used by several groups

Resources



rbesuijen@yahoo.com

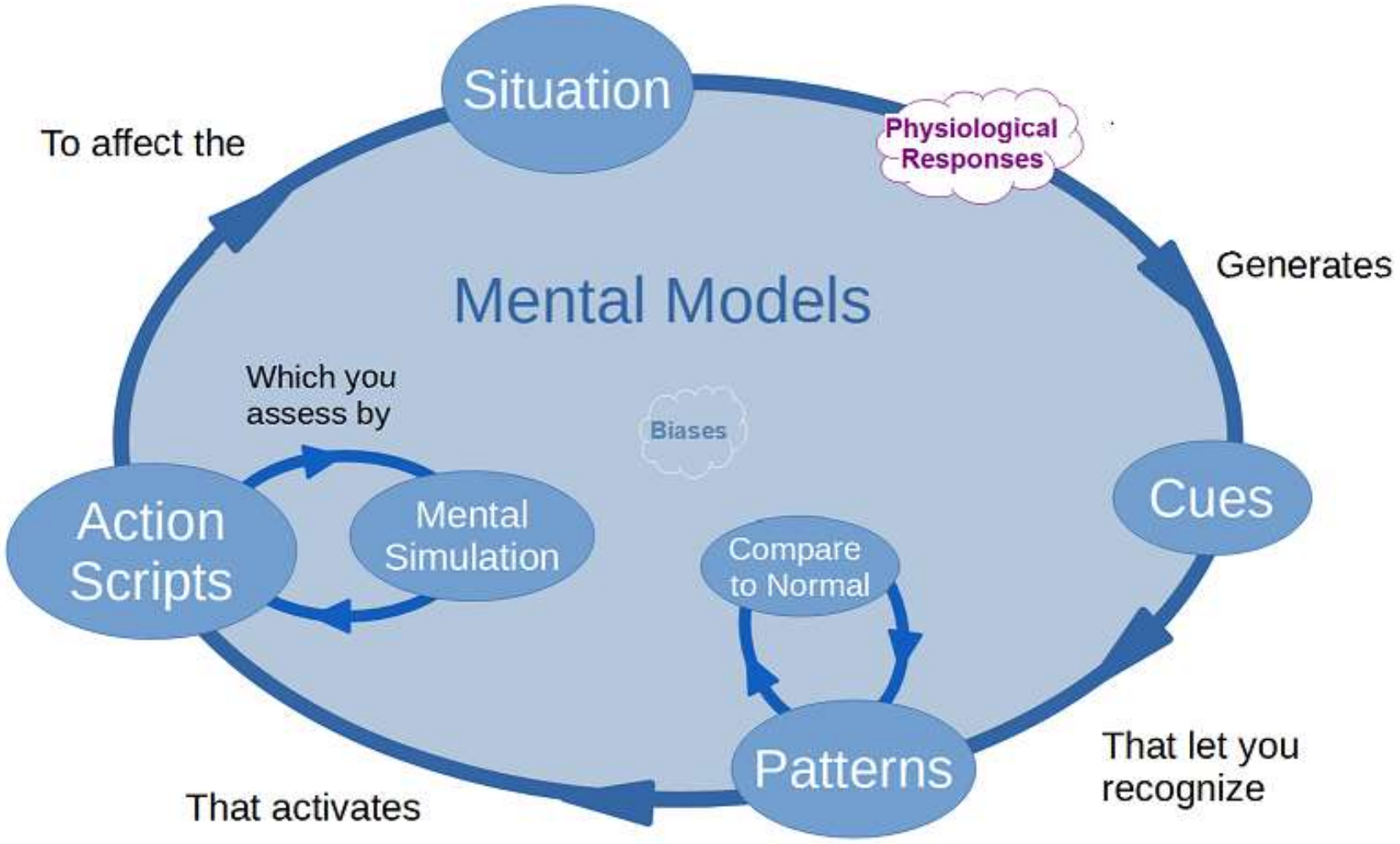


CORYS
dynamic simulation

Graham Provost

graham.provost@corys.com

Recognition Primed Decision Model



Adapted from "The Power of Intuition" pg. 26, by Dr. Gary A Klein

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Representation continued

Generic		Replica	
Pros	**Cons**	**Pros**	**Cons**
Usually, this is cheaper than a replica OTS.			This is more expensive.
It can be used to train operators on a generic process subject, for example, distillation.	It cannot be used to train operators on a specific plant process.	It can be used to train operators on a specific plant process	
	It cannot be used to train operators on a specific plant ICSS.	It can be used to train operators on a specific plant ICSS.	
	It cannot be used for plant optimization (process or ICSS).	It can be used for plant optimization (both process and ICSS).	
	It cannot be used to test operating procedures.	It can be used to test all operating procedures.	
		It can be used to tune all plant controllers and perform all control systems.	
It can be easily transported to different locations.			Other than a cloud solution, these are usually difficult to relocate.

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That’s My Certificate on the Wall

John Giles – TES Group

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

John M Giles

V.P. Business Development

TES

Process Combustion Systems Inc.

dcm

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That's My Certificate On The Wall!

Outline

- Pay homage to the profession, the people and their work
- My 35 years working around Power Engineers in Alberta
- The Steam Chief of the Past, the Present and the Future
- Highlight future challenges, changes that can be expected & opportunities to be all-stars

What Is A Power Engineer?

How You See Yourself

How Others See You

Language Matters

- **Species** – Power Engineer – aka Stationary, Steam, Facilities Engineers, Plant or Process Operators
- **Occupation** – A profession, as it requires a high degree of knowledge or expertise in their field of practice
- **Vocation** – An activity to which one regularly devotes oneself , fills you with a higher purpose by helping others and contributing to greater social good
- **Location** – Found in boilerhouses, steam/heating/power plants, and other utility & industrial sites

Your duties & responsibilities may include….

Power Engineer

- **Wiki's Definition** – Power Engineer is a technically trained professional who operates, troubleshoots and oversees industrial machinery, boilers & equipment that provide & utilize energy in various forms
- **My Definition** – An invisible profession, a front-line infrastructure worker often taken for granted, but expected to dependably/reliably provide utility services necessary for the health, welfare and safety of the public, commercial and industrial facilities

Qualities

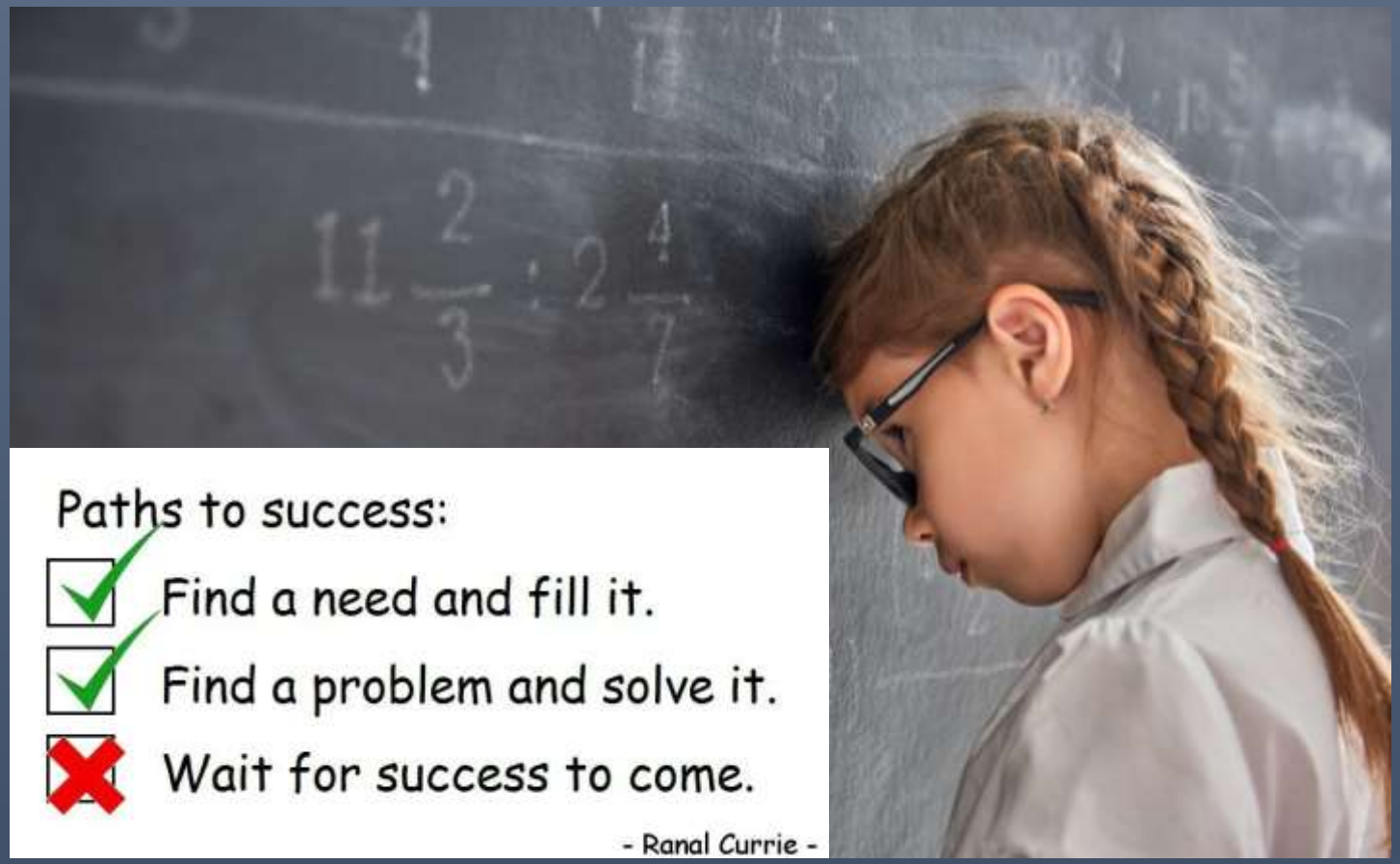
- **Professional** – Students of the subject who have a blend of technical, commercial, troubleshooting and leadership skills
- **Hardworking** – Career choice requires discipline and dedication, working shifts while maintaining a life balance
- **Integrity** – Like the equipment they operate, Power Engineers take their role serious and rely on precision & punctuality
- **Attention To Detail** – Very aware of the regulatory environment, the equipment safety codes and plant performance demands

In The Beginning

The earth was formless, empty and dark until…

My Start

- Arrived in Alberta in 1989, construction of a state-of-the-art new Pulp Mill to be an SNR Area Engineer
- First exposure to boilers, turbines, generators, fuel system, precipitators, evap.s', water & effluent treatment, etc..
- Had to ask, what am I doing here? There is no future in steam
- Introduced to the steam plant operators and this guy with the title of "Steam Chief"– that encounter taught me many lessons
- So began a 35-year career working in this rewarding space

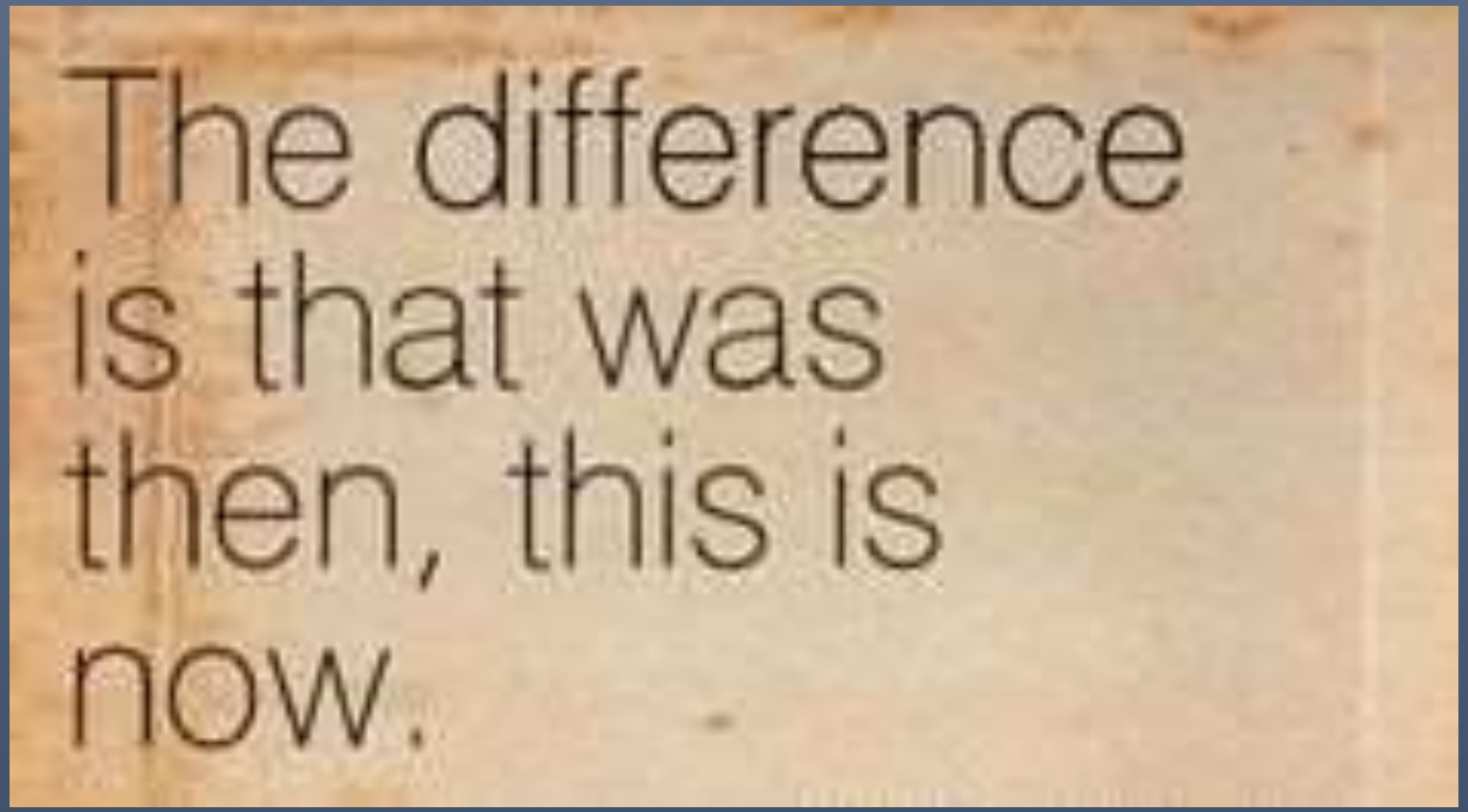


Today’s solution is tomorrow’s problem…

My Learnings

- **A** – Add value or get out of the way, always bring a solutions mindset to problems
- **B** - Be a general specialist and not a specialized generalist, be known for your skills and always pick up more
- **C** - Concentrate on applications that generate high value to your organization, avoid marginal work
- **D** - Differentiate yourself by working in a field where it feels rewarding and more like a hobby than a job
- **E** - Execute well and let the quality of your work be your signature and legacy

Let’s Compare



Who said, the more things change the more they stay the same?

Cost Delta

1989	What	2023
$58,024	Average Family Income	$125,522
$4.50/hr	Alberta Minimum Wage	$15.00/hr
$101,000	Edmonton House Price	$525,641
12.0%	5-year Mortgage Rate	5.7%
$17,000 USD	F-150 Gas Pickup	$58,000 USD
$0.29/l	Price of Regular Gas	$1.38/l
$1.50/GJ	Price of Natgas	$2.00/GJ
5.1%	Inflation Rate	4.2%
$1.84 CDN	Exchange Rate $USD	$1.35 CDN
$100	Value	$213

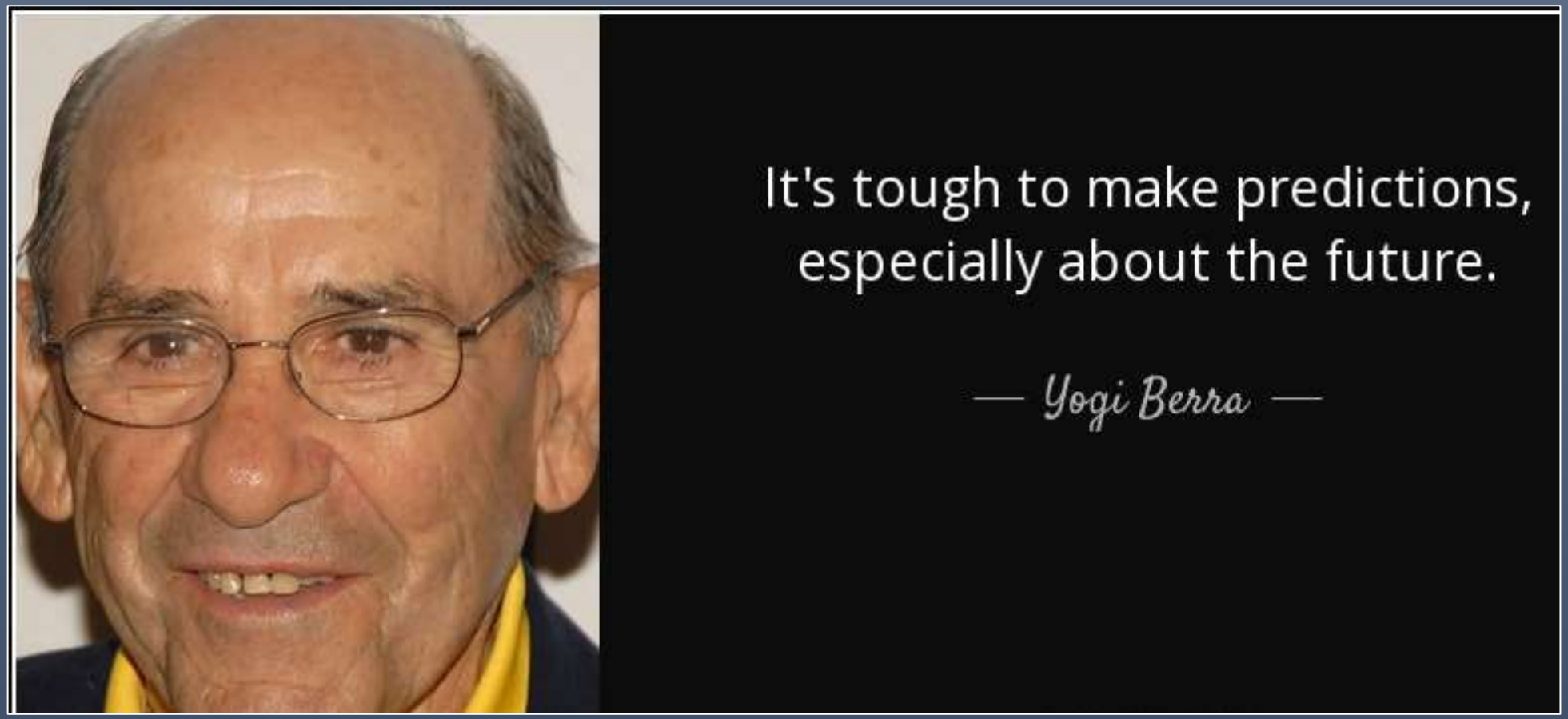
Life Delta

1989	What	2023
5.19 billion	World Population	8.2 billion
27.3 million	Canada's Population	40.0 million
Tiananmen Sq.	China	Economic Power
Berlin Wall	Russia	Ukraine
Exxon Valdez	USA	LNG
GPS & MS Office	Technology	MS & Apple
Sony CD Player	Devices	iPhone
Lexus Launched	Vehicles	Tesla EV's
Canadian	Boilers	Asian
G2-Coal	Fuel	G2&3 – CCGT & CC

My Observations

- Health & Safety – use to fall on the Steam Chief
- Quality & Integrity – use to fall the Steam Chief
- Energy Purchases – use to fall the Steam Chief
- Environmental Compliance - use to fall the Steam Chief
- Human Relations - use to fall the Steam Chief
- Operations & Production – use to fall the Steam Chief
- Outage & Maintenance – use to fall the Steam Chief

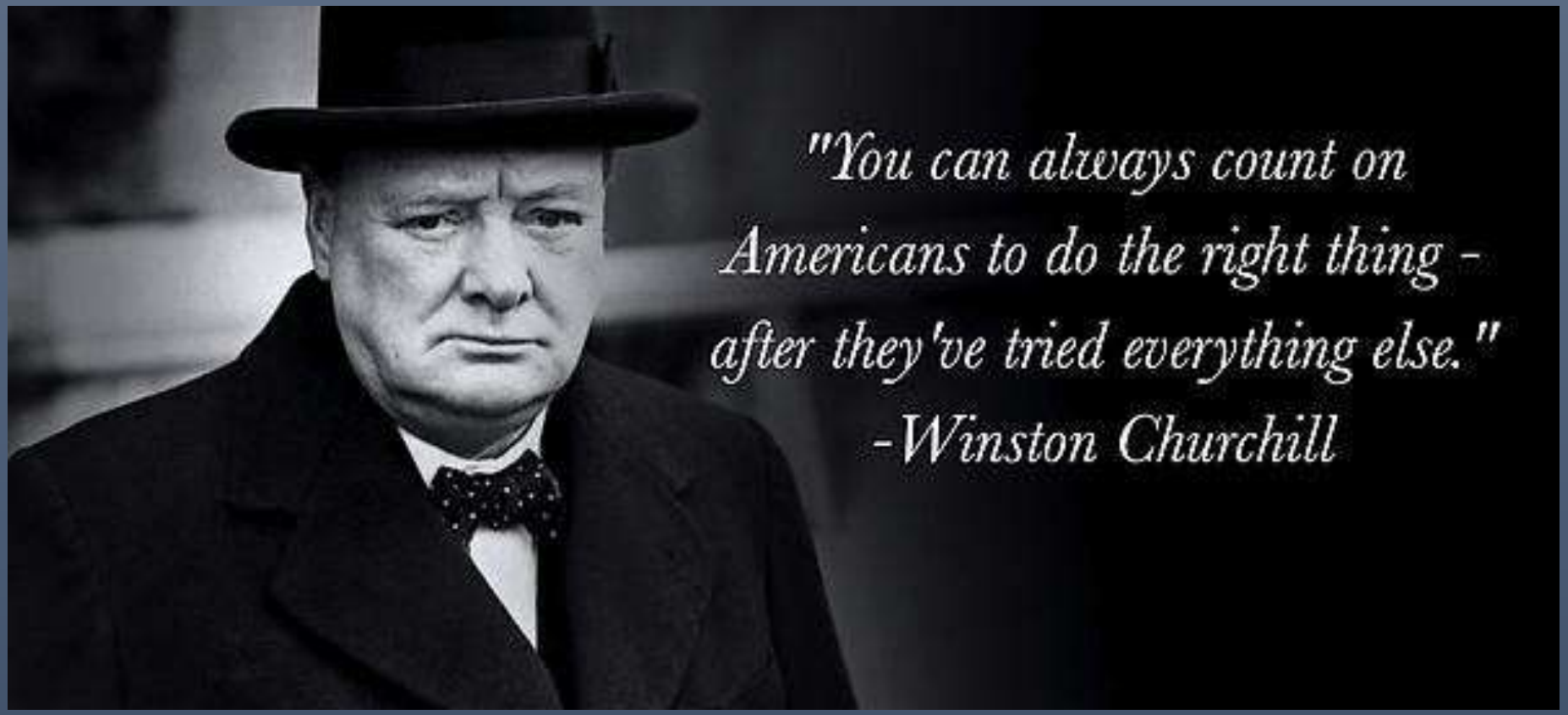
The Future



The best way to predict the future is to create it...

World Empires

- If you lived in the 19th century – you would want to live in London - England
- If you lived in the 20th century – you would want to live in New York - USA
- If you lived in the 21st century – you would want to live in Shanghai - China
- Those who have cheap energy, abundant resources, and productively use labour & capital - generate wealth



Love thy neighbour, but don’t pull down your hedge...

The US Empire

- Despite its social decline, the US still sees itself as the world’s power state, the odd war helps their position
- The leader of free market capitalism, world's largest economy & holder of the reserve currency $USD
- Reshoring critical manufacturing after Covid exposed their dependency on other countries such as China
- Huge spending bills in trillions of dollars (IRA, Infrastructure, ESG, Defense) and subsidies in the name of national security

Oh Canada – what have we done...

The Canadian Empire

- What We Were Gifted
  - 3rd largest proven oil reserves in the world
  - 3rd largest exporter of electricity
  - 4th largest producer of natural gas in the world
  - 30% of world's potash supply
  - 20% of world's fresh water
  - 15% of world's uranium production
  - 15% of world's wheat exports
  - 10% of world's forests

The Canadian Empire

- The world needs what Canada has - food, fertilizers, forest products, minerals & especially energy
- We produce the most ethical, environmental, socially responsible goods of any country
- We are an exporting nation with US market next door
- We should be capitalizing on global resource/energy demand situation with LNG exports
- Without our resource revenues, Canada would be a 3rd world nation

The Challenges

Flight, flight or freeze – your choice….

Challenges

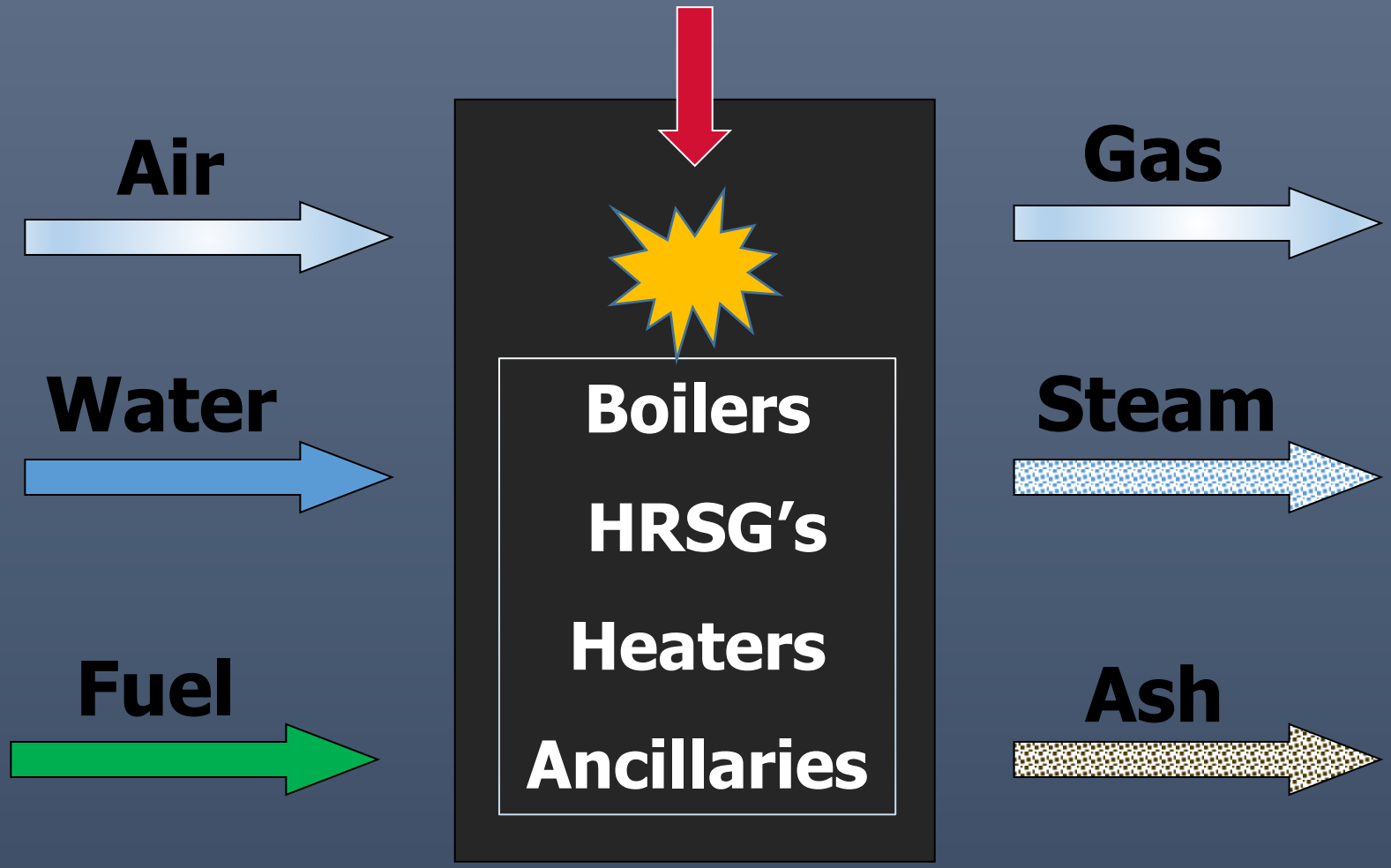
- Don’t become a Steam Chief on paper, stay engaged in your vocation and continue to expand your abilities
- Don’t get pulled into the feelings versus facts debate, stick to the fundamentals and the laws of science
- Don’t loose the spirit to innovate in your work, avoid the ISO homogenization blender and take a risk once in awhile
- Understand the data, information, knowledge, and wisdom hierarchy, fight the red tape and bureaucracy

The Opportunities

Take us to warp factor 5 Mr. Scott….

Opportunities

- Make the profession sexy, be proud & share your work, increase energy, historical and financial literacy
- Embrace the energy transition, we have always saved ourselves through technology so think fuel density
- Expand your career - start up, step out, try something new
- Prepare for rapid change in technology and automation
- To those starting, think about your next 35-years



Thank & open to any questions

BREAK

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BREAK – SPONSOR RECOGNITION

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We are appreciative of the great support we have received from our sponsors

Women in Power Engineering
Dawn Ziesman – Air Products
Caitlin Hartigan – Women Building Futures

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

Women in Power Engineering

Dawn Ziesman

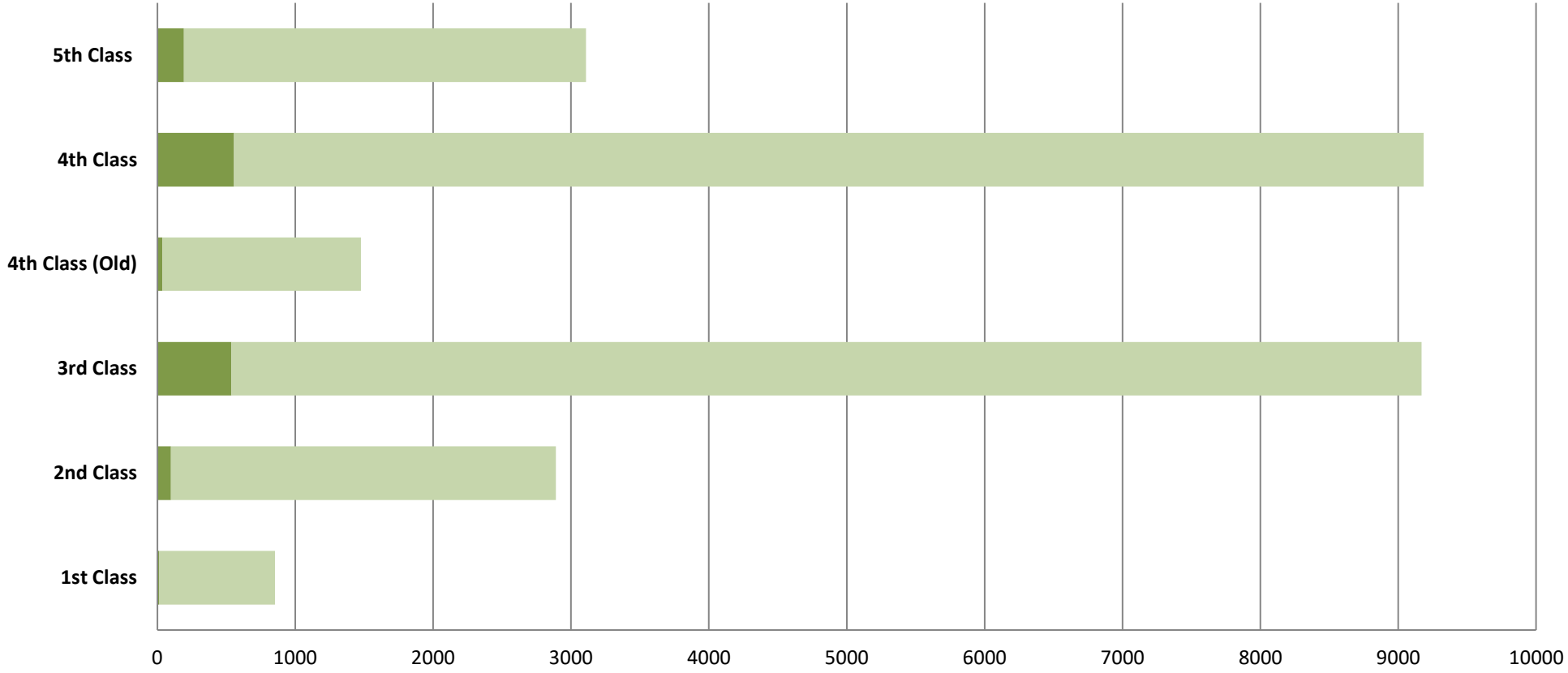
Objectives

- Introduction
- ABSA Stats
- Challenges and advice to overcome
- Advise to Employers
- Advise to Hiring Managers
- Closing remarks
- Introduction to Women Building Futures

Introduction

- Prior to Power Engineering worked in male dominated environments.
- Joined operations in 2008
- 2015 Chief Engineer

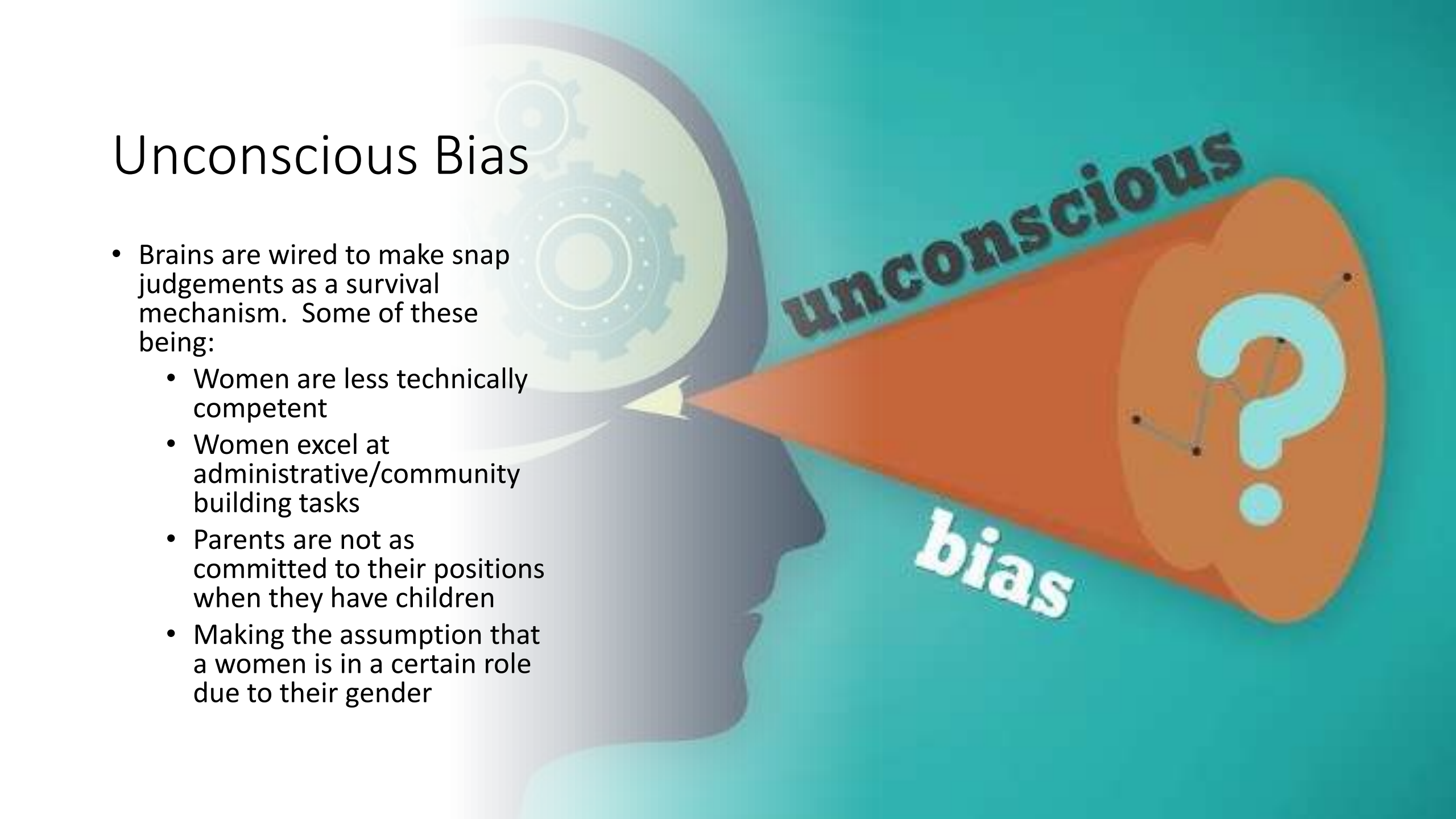
Valid Power Engineer (PE) Certificates Held in Alberta



	1st Class	2nd Class	3rd Class	4th Class (Old)	4th Class	5th Class
PE Certificates Held by Women in Alberta	13	98	537	37	556	193
Total PE Certificates Held in Alberta	841	2793	8632	1440	8627	2916
Percentage Women	1.5%	3.5%	6.2%	2.6%	6.4%	6.6%

Unconscious Bias

- Brains are wired to make snap judgements as a survival mechanism. Some of these being:
  - Women are less technically competent
  - Women excel at administrative/community building tasks
  - Parents are not as committed to their positions when they have children
  - Making the assumption that a women is in a certain role due to their gender



How to overcome Unconscious Bias

- Unconscious Bias training for all
  - Ex. Linked in/Youtube videos
- Actively listen and ask questions
- Ensure equal opportunities are given to employees
- Assign tasks equally based on merit and competency

Workforce Set up/Flexibility

Challenges:

- Workforces not set up with accommodations
    - Washrooms, change rooms, properly sized PPE
- Support - pregnancy, coming back from leave, family flexibility

How to Overcome:

- Ensure proper accommodations/PPE/work attire (prior to employment
- Check in with employees when pregnant to see what work they are comfortable doing
- Check in and help support employees when back from a leave
- Try to offer flexibility in workplace (if possible)

Challenges

- Feeling like ideas not heard until brought up my someone else, particularly a male
- Lack of confidence and not speaking up
- Feeling you have to work harder and do more to prove oneself

Advice

- In meetings try to get feedback from all. Make a conscious effort to not talk over anyone.
- Find a mentor for women in the workforce
- Include into women diversity groups if you have
- Set up expectations and check in

Advice for Employers

- Treat women the same as men. ‘Coddling’ women can lead to resentment in the workforce.
- Give them the tools to succeed.
  - Expectations, tools for the workplace, individuals to reach out to

Advise for Hiring Managers

- Ensure there is a diverse panel for both interviewees and interviewers
- Look at hobbies and past experiences
- If possible, bring women to recruitment events/industry presentations and talk about gender goals if company has them

Concluding Thoughts

- Women (like men) want to succeed in the field. You can help by giving them the tools and resources to do so.
- Industry has come a long way but there is still room to improve.
- Provide training to all team members
  - Unconscious Bias
  - Micro-aggressions
  - Harassment in the workplace
- Listen and ask questions
- Set up mentorship or allies

WOMEN BUILDING FUTURES®

An Overview of Women Building Futures

Prepared for the Alberta Steam Chiefs Conference

October 25th, 2023

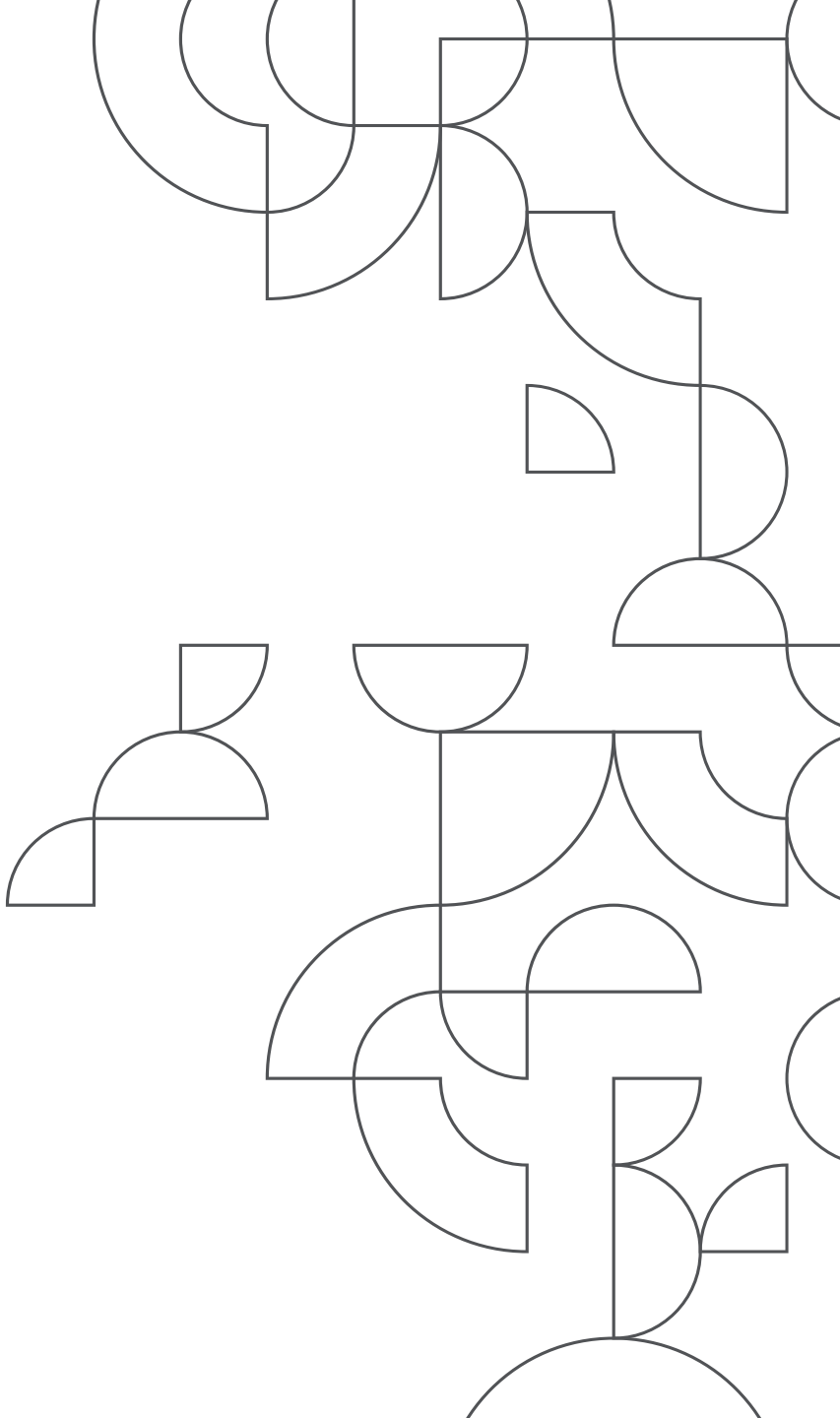
Caitlin Hartigan

ABOUT US

We are a non-profit organization based in Edmonton, Alberta, serving women across Alberta and recently into British Columbia and Saskatchewan.

We offer programs and support services to help under/unemployed women explore and connect to careers that pay above a living wage.

Our mission is to foster economic security for women facing barriers to entry in a workforce where they are traditionally underrepresented.



HOW WE SUPPORT

- Workforce inclusion efforts
- Raising awareness of opportunities
- Readiness supports
- Employment training programs
- Financial aid
- Connection to employment with Employers of Choice
- Continued Alumni supports after program completion

OUR PROGRAMS

Journey to Trades
Construction Bootcamp
Automotive Trades Readiness
Professional Class 1 Driver
Driver & Operator (Class 3)
Women Ready to Work (BFI, Worley)

Suncor Heavy Equipment Operator
Vesta’s Wind Turbine Tech
Pre-Apprenticeship Heavy Equipment Technician
Power Engineer Career Accelerator
BHP Construction Readiness

Our Mission

To foster ***economic security*** for women facing barriers to entry in a workforce where they are traditionally underrepresented.

WHO WE PARTNER WITH

Industry
Program sponsors, employers, providing program feedback, support of curriculum development, in-kind donation of additional facilities.

All levels of Government
Funding of core mission & programs.

Other non-profit and community agencies
As ambassadors of WBF programming & mission.

For a full list of our partners, please visit womenbuildingfutures.com

Power Engineering

Strategic Provincial Recruitment (PSI), Partnership Alignment of support, Shift to virtual WBF training

- Recruitment from current 4th & 3rd class Power Engineering Students (who fit our client persona)
- Pivoting partner's offerings of support
- Expanding out our partner's employment opportunity locations
- 3-week virtual model for WBF training (provincially inclusive)
- PECA 03 – 10 students / 10 seats

What we learned:

- Women are experiencing barriers through all levels of power engineering, not just at entry. We can help!

Re-envisioned PECA Model – In Development (PECA 04):

- Maintain virtual WBF model
- Expand EOC Partners and asset locations for work placements across the province
- Expand and engage in formal partnerships with Power Engineering PSIs (recruitment referrals and laddering)

OPPORTUNITIES WE SEE

ATTRACTING YOUNG AND DIVERSE TRADESPEOPLE

We need people to choose the trades to satisfy critical and on-coming resource gaps, but this is a challenge when people don't see themselves in this role.

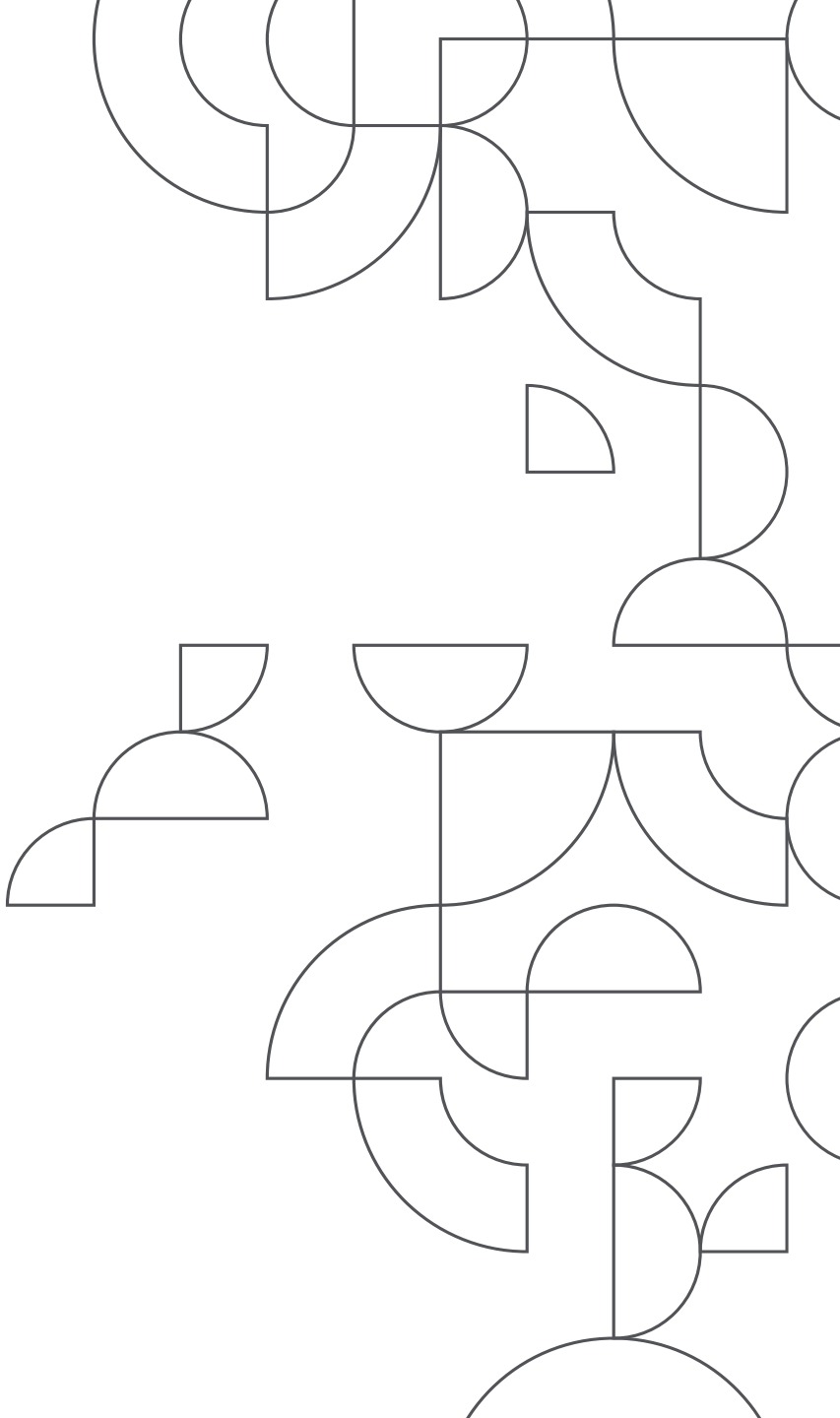
CULTIVATING A NEW TRADES CULTURE

The trades industry culture needs to be changed to ensure that inclusive, welcoming environments are the standard.

WRAP AROUND SUPPORTS FOR ALL TRADEWSWOMEN Keeping women in the trades means supporting them throughout their careers, WBF wants to help.

24/7 AFFORDABLE CHILDCARE

Allowing women to take on positions that require shift work required accessible and affordable childcare




Questions

Digital Journey to Energy Management

Ian Ignatiuk – Spartan Controls

ALBERTA CHIEF POWER ENGINEERS EDUCATION CONFERENCE

SPARTAN CONTROLS

Emerson Impact Partner

EMERSON

Experience Industrial Innovation

Digital Journey to Energy Management

Ian Ignatiuk, P.Eng.

CANADA'S BEST MANAGED COMPANIES Platinum member

Corporate Summary

- Spartan has been in business for 60 years
  - Private, Employee owned – strong entrepreneurial culture
  - ~1300 employees (perm, temp, contract)
  - 14 office locations
- Emerson Impact Partner (Automation Solutions) – Western Canadian focus
- Sell, apply and servicing automation … valve, measurement, control products, software and solutions for the process industries
- Systems, Software and Solutions focused on providing integrated business value

Systems, Software & Solutions (S3) – Business Group

- Machinery Performance (E&C, Reliability)
- Combustion Management
- Industry Applications
- Digital Transformation
- Process & Safety Systems
- Power & Drives

Today’s Agenda

1

INTRODUCTION

What is EMIS and why it is so important

2

INFRASTRUCTURE

Digital infrastructure journey for a successful EMIS implementation

3

EMIS APPLICATION

EMIS Application function and features

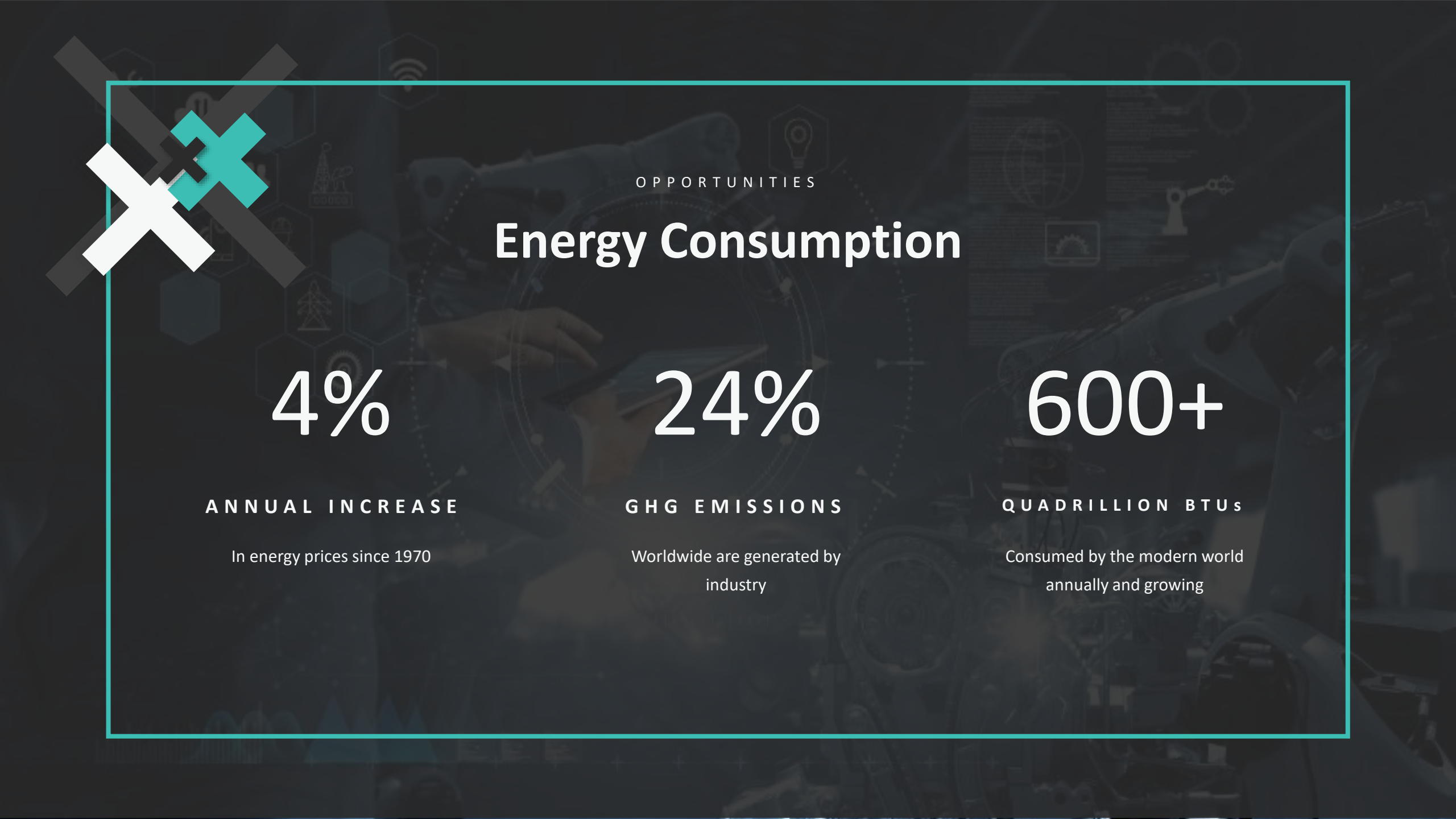
4

PRODUCT DEMO

BlueMarvel.ai EMIS application demo

BLUEMARVEL

EMIS Introduction



OPPORTUNITIES

Energy Consumption

4%

ANNUAL INCREASE

In energy prices since 1970

24%

GHG EMISSIONS

Worldwide are generated by industry

600+

QUADRILLION BTUs

Consumed by the modern world annually and growing

Outcomes of Energy Management

TURN A LARGE VARIABLE COST INTO A **CONTROLLABLE EXPENSE**

Energy Management

is the process of tracking, benchmarking, and optimizing energy consumption and/or generation to reduce costs and GHG emissions.

Outcomes:

- Resource optimization
- Minimize energy consumption
- Cost savings
- Ensuring energy longevity

EVOLVING LANDSCAPE

Drivers for EMIS

An effective EMIS directly reduces the amount of energy consumed. This translates to savings in energy usage, and carbon tax, and helps you abide
to new GHG regulations.

Effective Energy Management

See

Visibility into your Energy Consumption

Begin by monitoring your energy consumption to gain real time insight

Decide

Use Data to Drive Actions

Make informed decisions to increase operating efficiency using EMIS telemetry

Act

Achieve Site-wide Energy Targets

Achieve your energy goals, save on energy costs, and reduce your carbon footprint

Effective Energy Management

Trying to save energy without **information** is like trying to get somewhere in a strange city without any road signs or Google Maps…

- X **It will take you much longer to get there**
- X **You'll miss all the shortcuts**
- X **You'll never know how far you've gone**
- X **You'll never know how far you've got left to go**
- X **You may just end up lost**

Digital Infrastructure

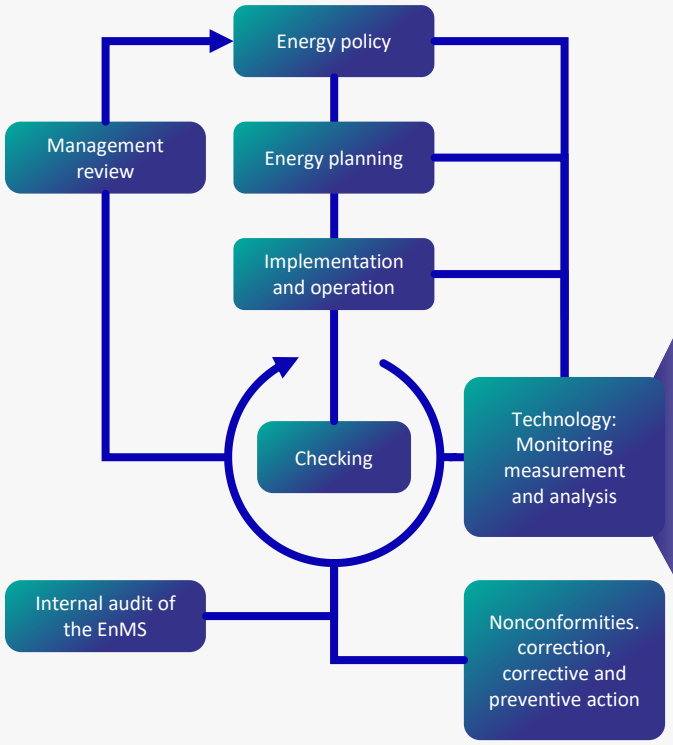
Energy Management is not Energy Accounting

Period: 01/01/21-01/31/21

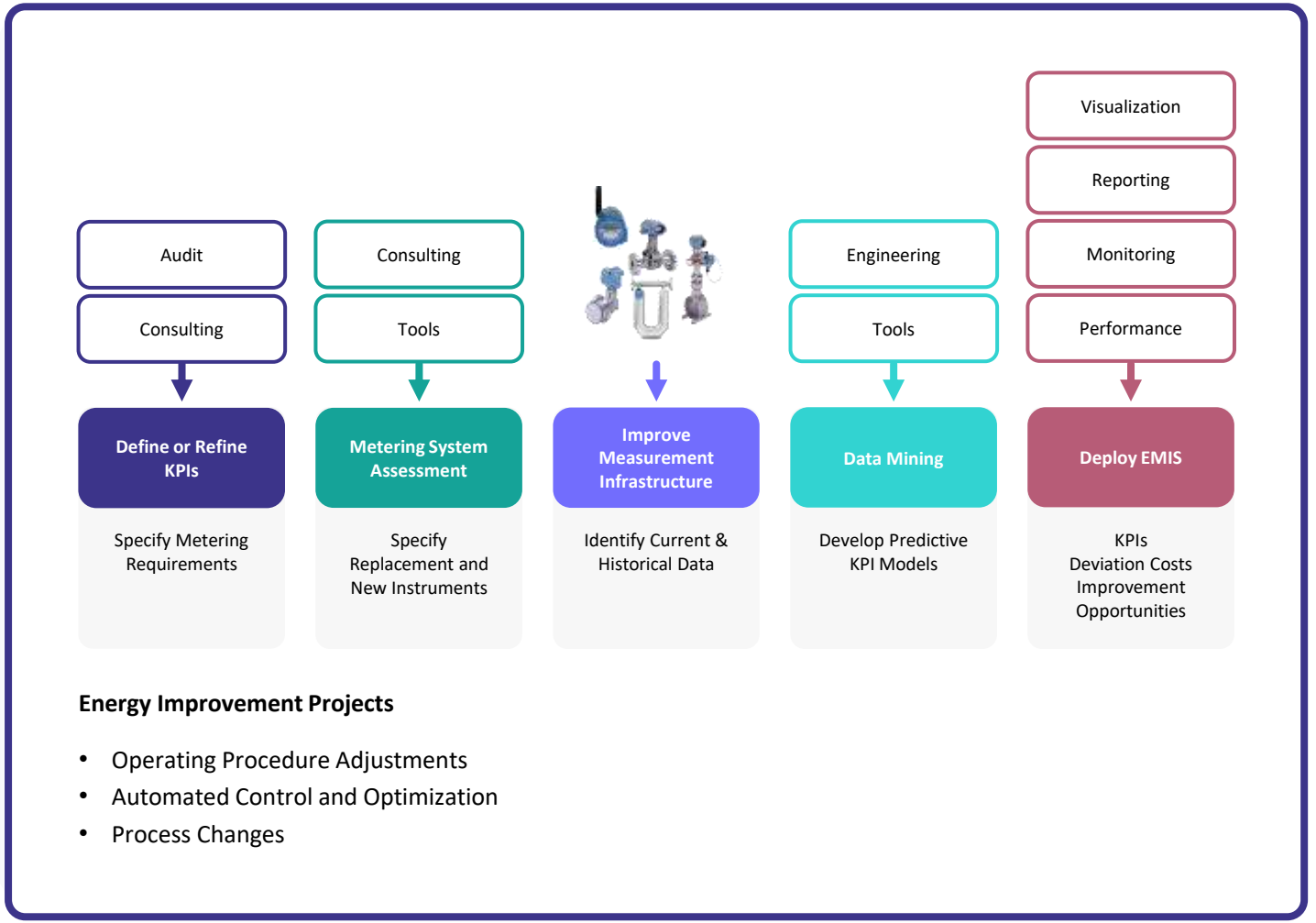
Operational Cost Summary

		300	6000	2120		Pricing Spreadsheet Link		Import Data	
		1015	12400	17700	850	59	54000	520	
	Production	Electricity	Gas	Water	Biofuel	Oil	Chemical	Elec. Export	Total	Overrun
	T	MWh	GJ	m3	T	bbl	$	MWh		
% of Target	104%	101%	107%	96%	88%	122%	112%	106%		
Target	37500	36000	450000	600000	30000	1500	1500000	19500		
Cost Target		$ 1,440,000	$ 2,025,000	$ 30,000	$ 360,000	$ 72,000	$ 1,674,000	$ 877,500	$ 6,478,500	
Cost		$ 1,457,510	$ 2,167,628	$ 28,869	$ 342,550	$ 93,279	$ 1,500,000	$ 988,641	$ 6,578,478	$ 99,978
Unit Price - Est		$ 40	$ 5	$ 0.05	$ 12	$ 48		$ 45		
Unit Price - Act		$ 40	$ 5	$ 0.05	$ 11	$ 51		$ 48		
Monthly Average	1254	1175	15539	18625	850	59	54000	664		
Monthly Total	38875	36438	481695	577388	26350	1829	1674000	20597		
1/1/2021	1142.0	1094.7	15933.4	18873.7	850.0	59.0	54000.0	602.0		
1/2/2021	1474.3	1307.9	16027.5	18022.1	850.0	59.0	54000.0	573.3		
1/3/2021	1272.5	1066.7	12917.7	17726.3	850.0	59.0	54000.0	685.3		
1/4/2021	1047.9	1125.1	18260.8	19315.2	850.0	59.0	54000.0	598.2		
1/5/2021	1179.0	1137.5	17415.0	19109.9	850.0	59.0	54000.0	764.4		
1/6/2021	1153.1	1165.0	13338.9	19021.6	850.0	59.0	54000.0	769.9		
1/7/2021	1020.4	1307.9	14662.2	19172.9	850.0	59.0	54000.0	697.9		
1/8/2021	1203.1	1303.2	15810.0	17729.9	850.0	59.0	54000.0	604.5		
1/9/2021	1095.2	1198.2	13642.0	17845.1	850.0	59.0	54000.0	667.1		
1/10/2021	1491.9	1190.2	15827.4	17888.5	850.0	59.0	54000.0	798.7		
1/11/2021	1162.3	1279.7	17944.0	17950.6	850.0	59.0	54000.0	793.0		
1/12/2021	1380.9	1289.9	13970.1	19071.0	850.0	59.0	54000.0	617.8		
1/13/2021	1299.5	1021.7	14865.2	17922.3	850.0	59.0	54000.0	765.9		
1/14/2021	1384.0	1088.2	17909.9	18077.2	850.0	59.0	54000.0	797.7		
1/15/2021	1351.2	1089.2	16077.1	19400.2	850.0	59.0	54000.0	794.5		
1/16/2021	1127.5	1255.6	17312.1	18264.8	850.0	59.0	54000.0	602.1		
1/17/2021	1148.1	1064.1	13435.7	18695.6	850.0	59.0	54000.0	644.2		
1/18/2021	1261.8	1202.4	12897.4	19165.5	850.0	59.0	54000.0	754.6		
1/19/2021	1362.9	1167.0	16716.2	18955.5	850.0	59.0	54000.0	529.0		
1/20/2021	1280.8	1112.5	14979.5	18703.0	850.0	59.0	54000.0	651.1		
1/21/2021	1454.4	1106.8	18290.2	18635.4	850.0	59.0	54000.0	722.3		

EnMS Powered by Technology (EMIS)



ISO-50001 – Energy Management Systems Model



Referenced from the ISO 50001 Energy Management Standard

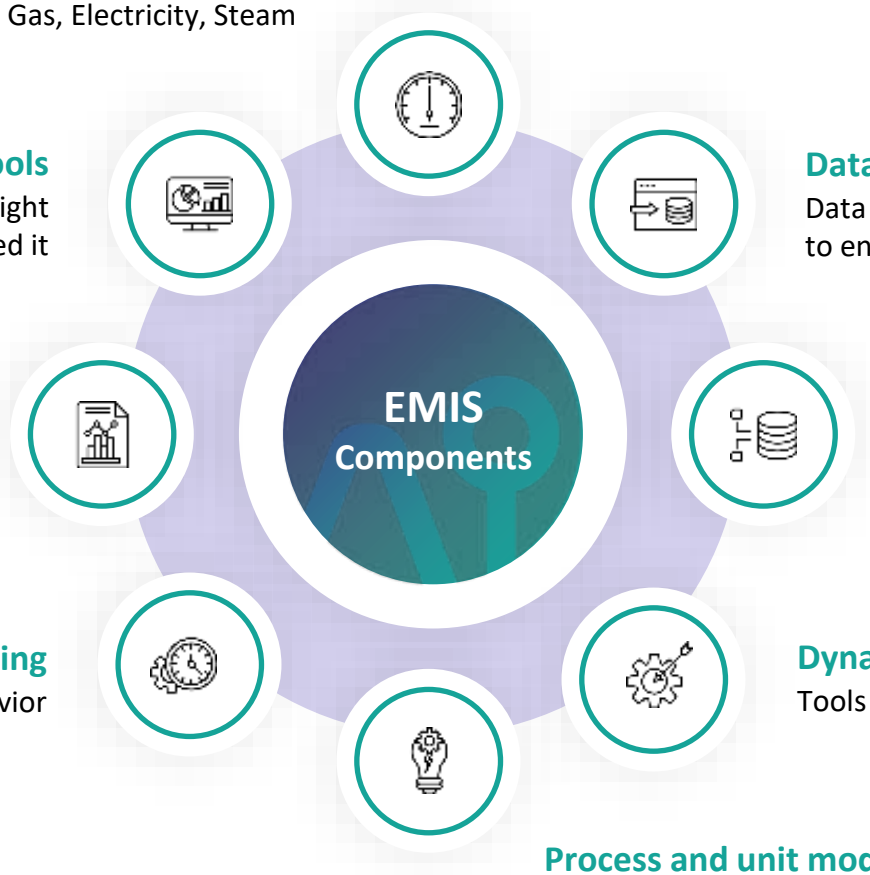
Digital Infrastructure for EMIS

Energy sensors and measurements
Metering infrastructure, wired or wireless Water, Air, Gas, Electricity, Steam

Visualization tools
Simple and intuitive dashboard – the right information as you need it

Data historian
Data Infrastructure can expand from site to enterprise

Data analysis and reporting
Reports that work out of the box – regardless of energy hierarchy!



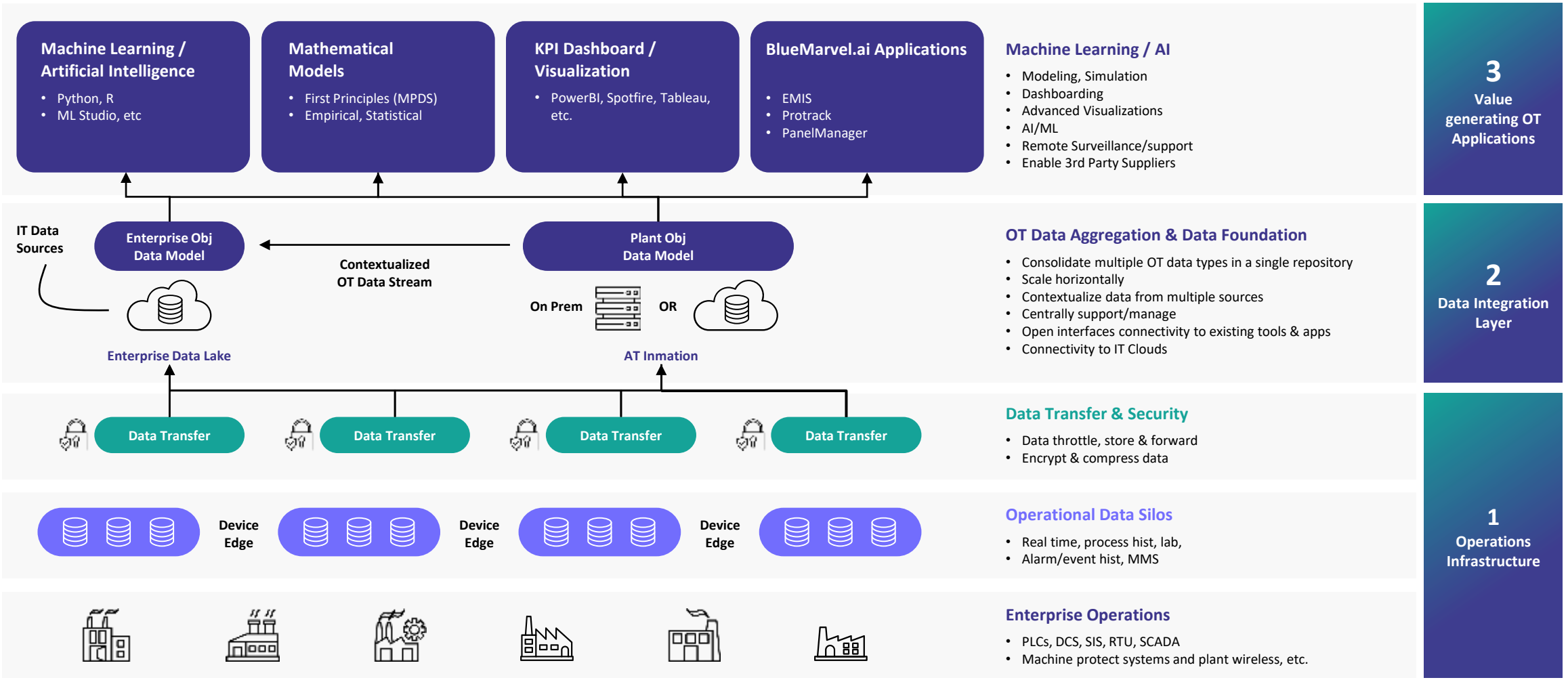
Measurement integrity checking
Tools to clean up the data, if needed

Overconsumption alarming and logging
Real time energy alerts drive real time behavior

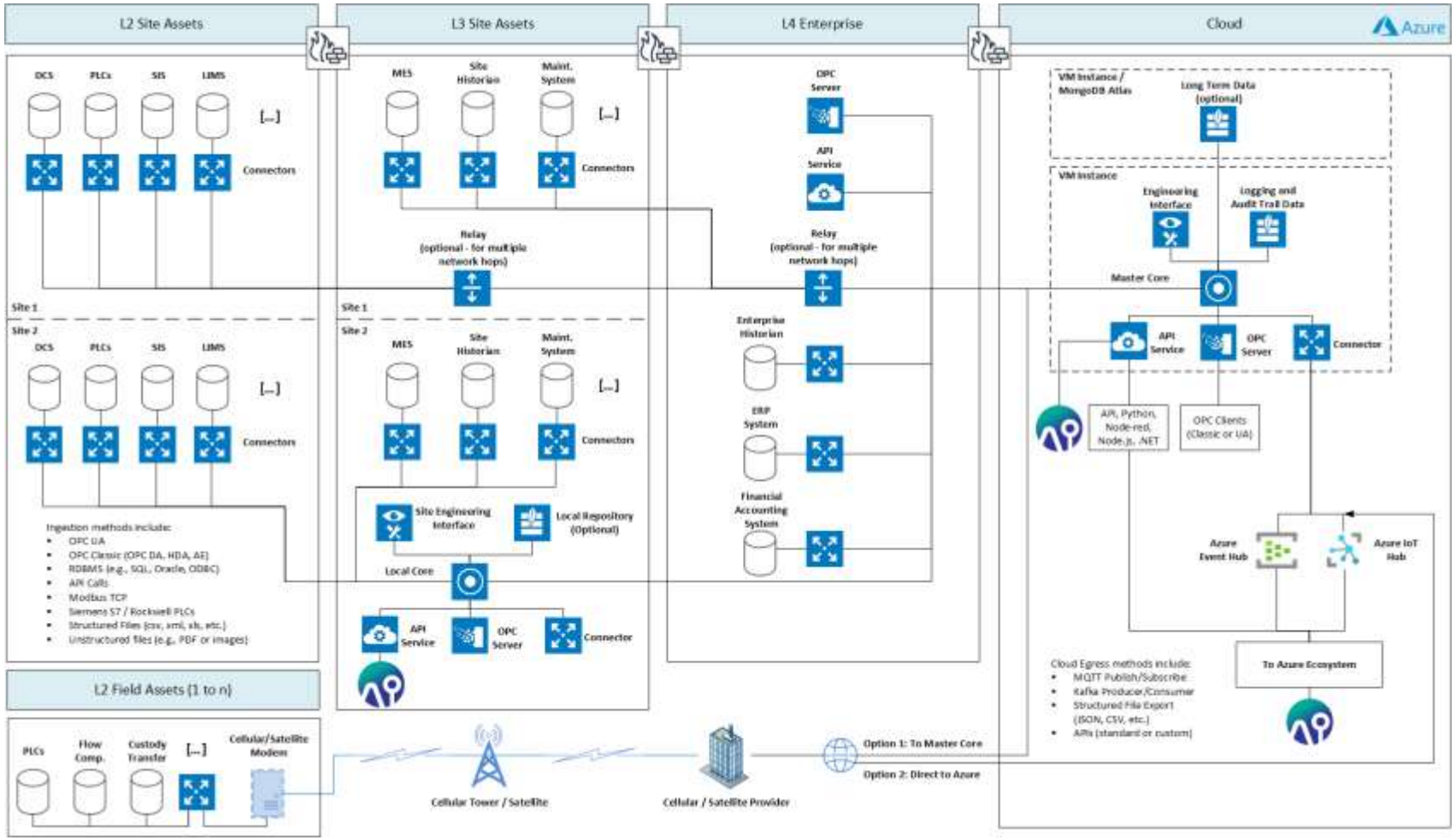
Dynamic energy target setting
Tools that make target development easy

Process and unit models
Process models that know what energy performance should be – and why it is not

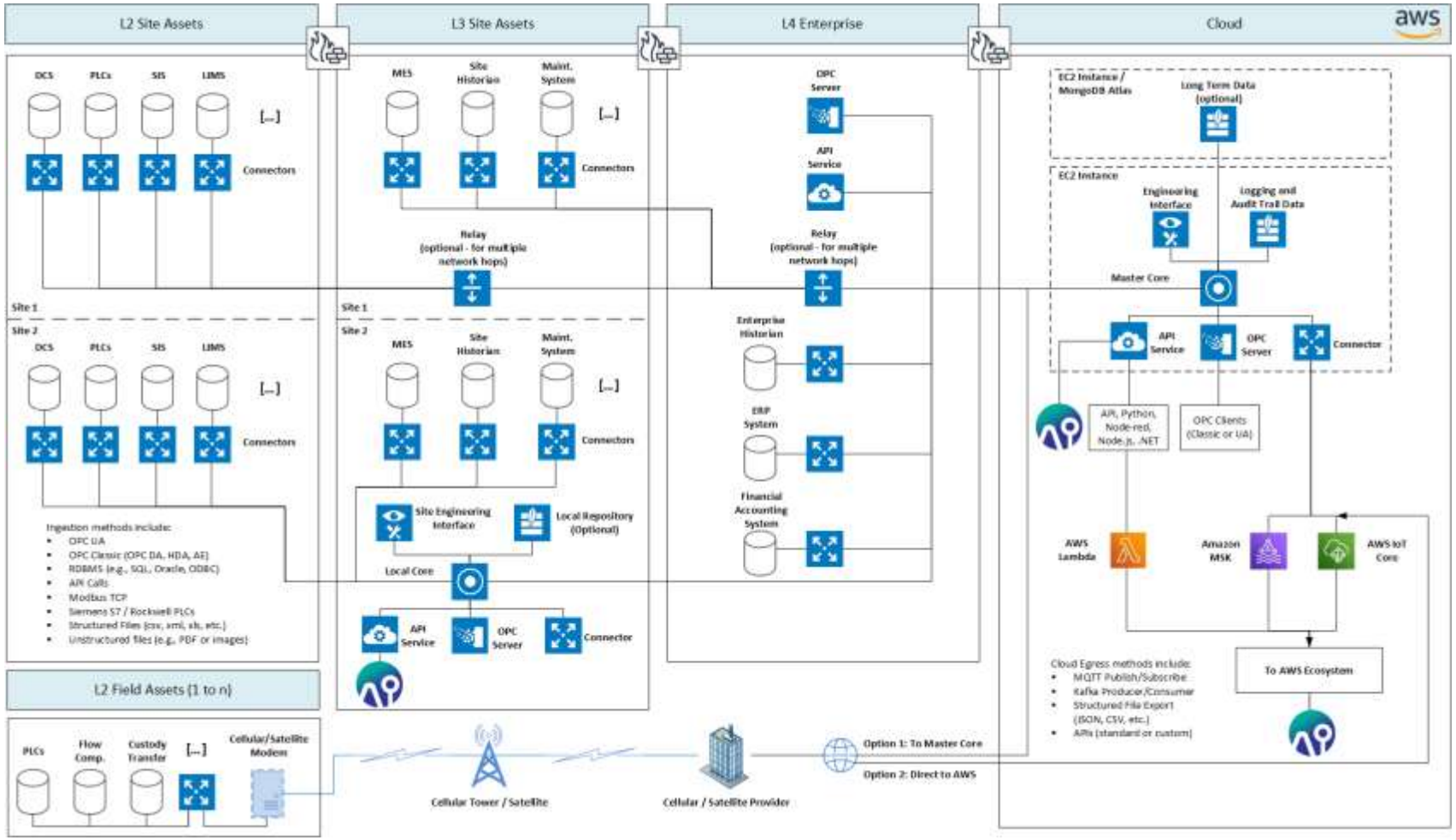
Digital Infrastructure for Enterprise-wide EMIS



IT/OT Integration – Azure Cloud

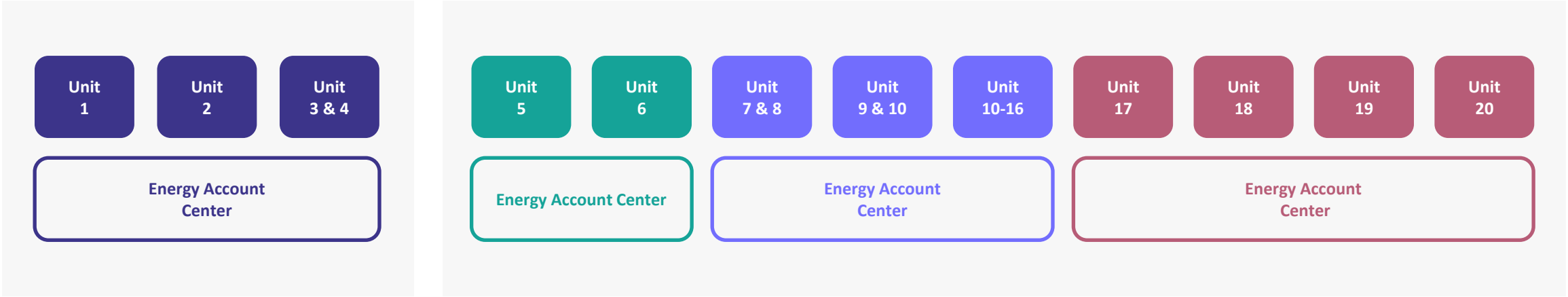


IT/OT Integration – AWS Cloud



Digital Journey

Think Big Start Small



Start with

- Process area with best data infrastructure
- Document success

Expand gradually to other areas

- As the data infrastructure gets better
- Repeat success

BlueMarvel.ai
EMIS

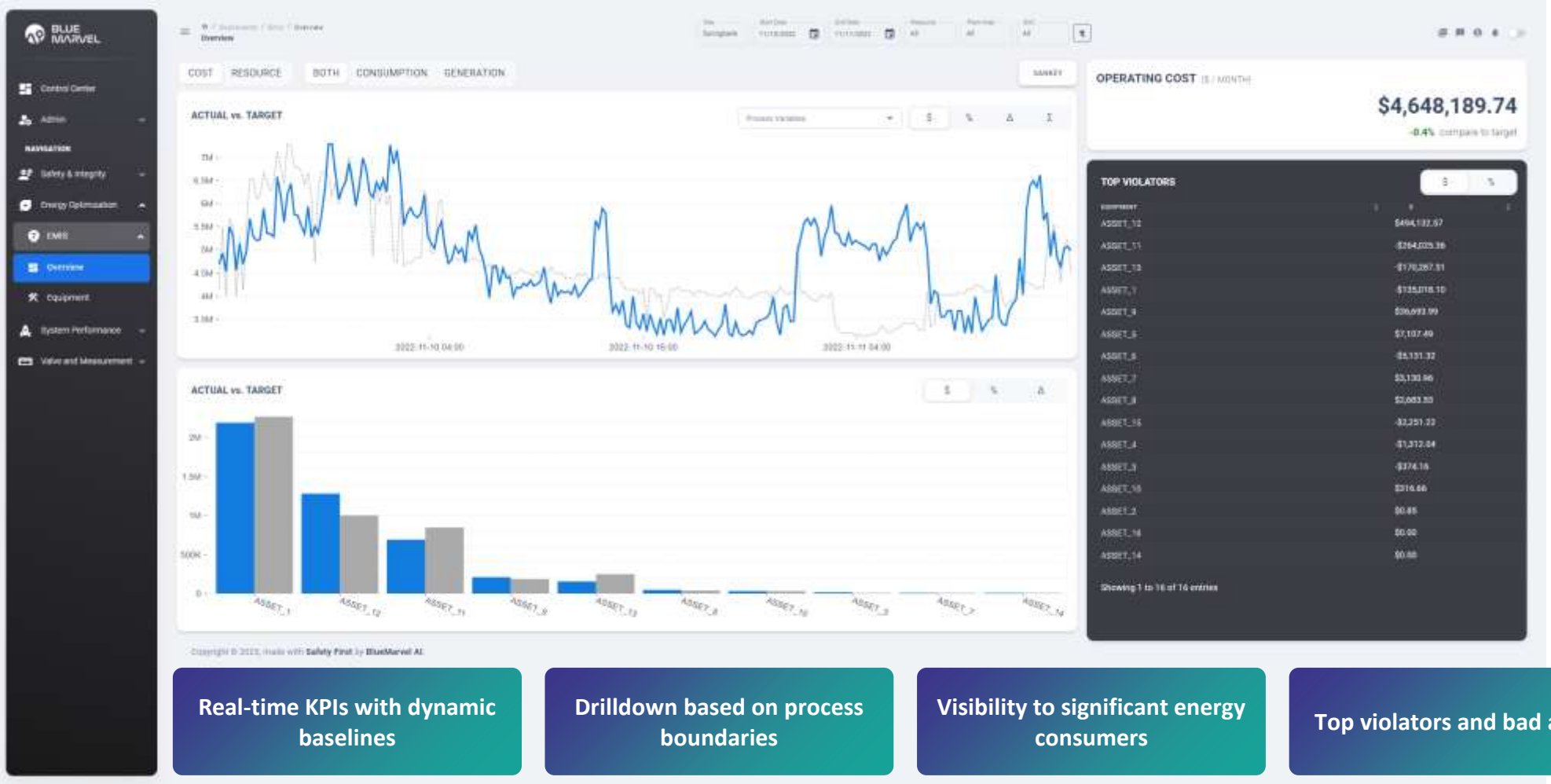
DIGITAL CONNECTEDNESS

Enterprise-wide Energy Data

View your energy data on one company-wide web-based platform accessible anytime, anywhere, and on any device.

For further enhancements, optimal energy consumption data can be overlaid to help you track down energy culprits.

EMIS Features and Functions



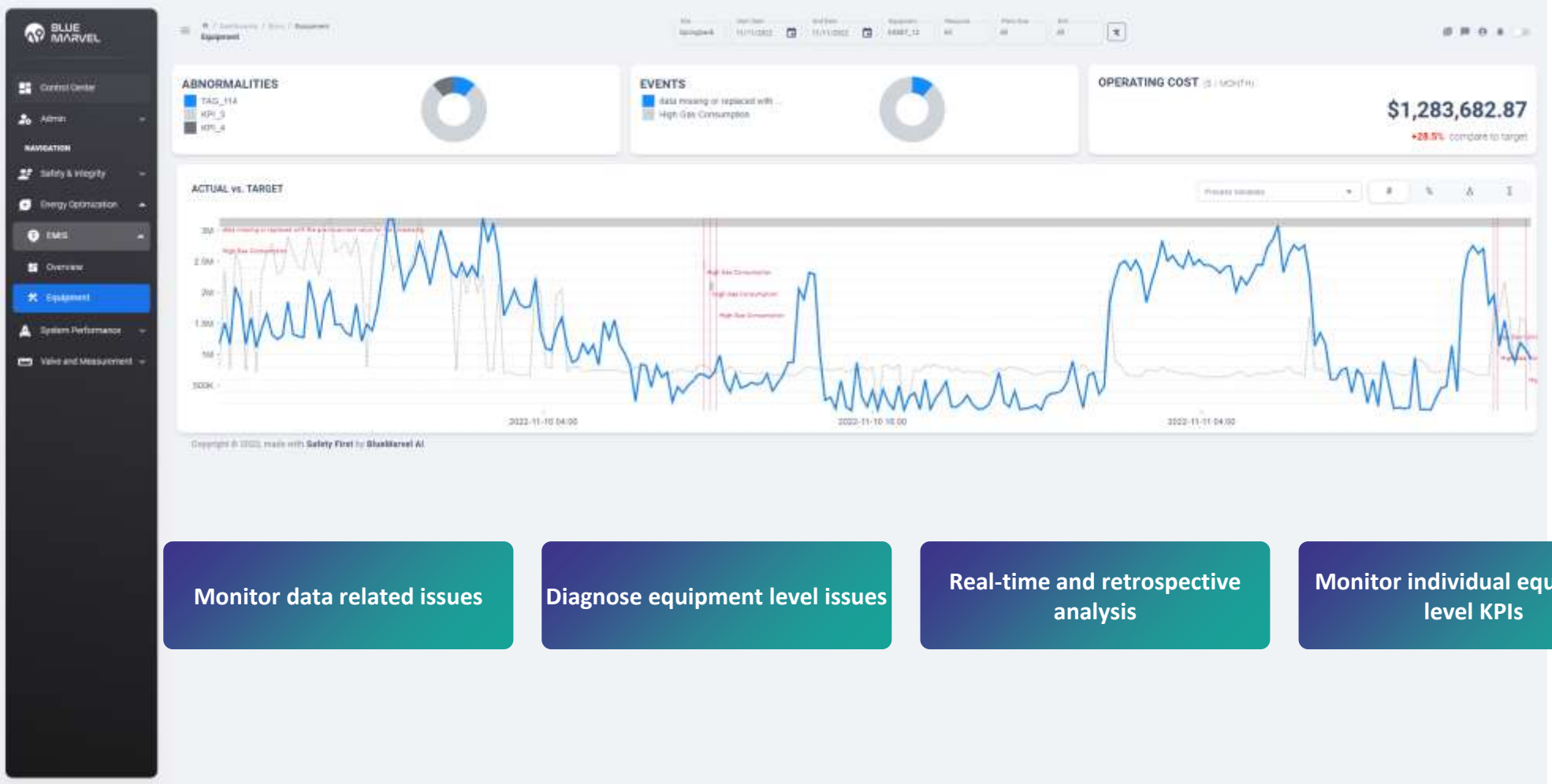
Real-time KPIs with dynamic baselines

Drilldown based on process boundaries

Visibility to significant energy consumers

Top violators and bad actors

EMIS Features and Functions



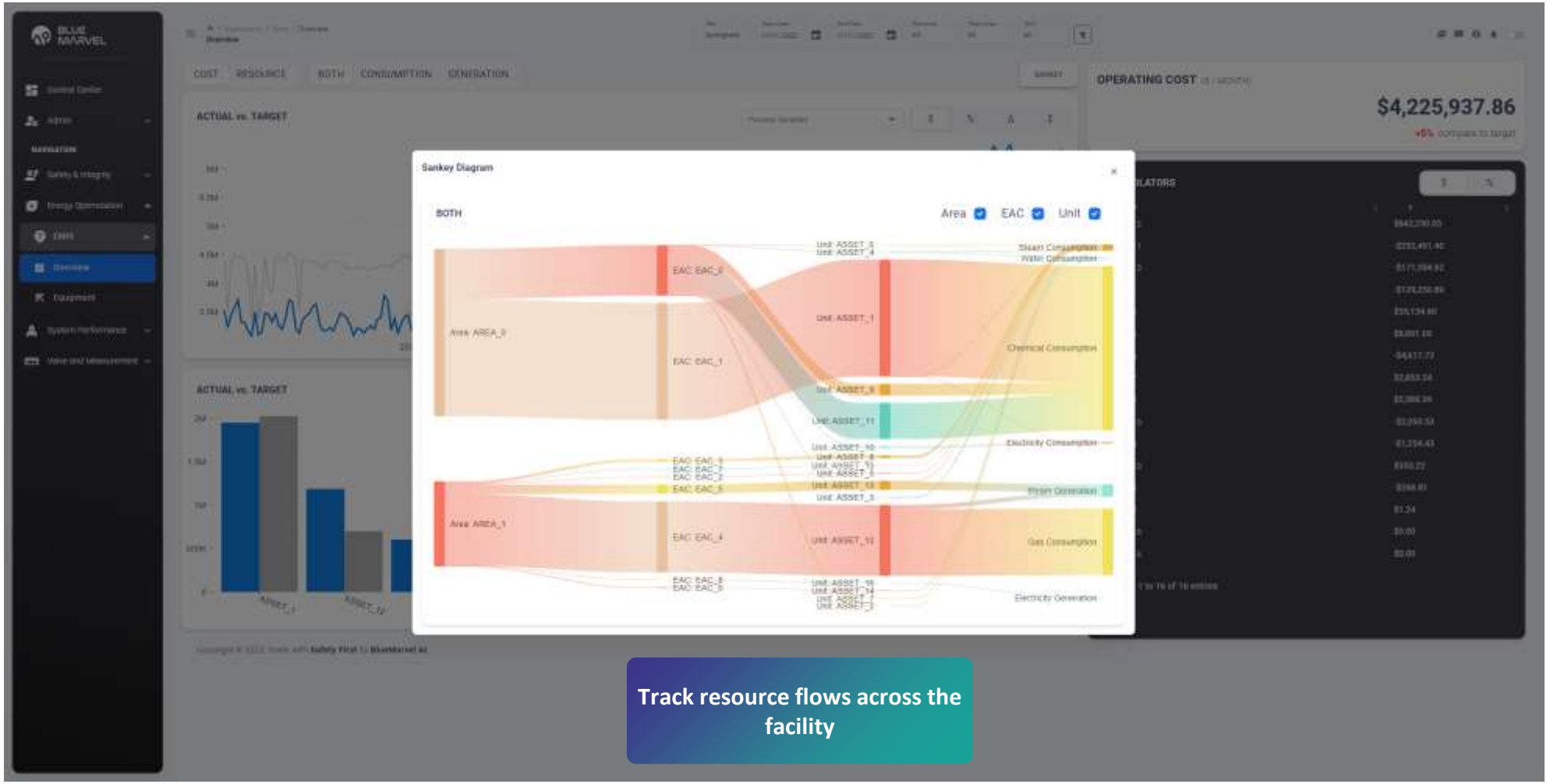
Monitor data related issues

Diagnose equipment level issues

Real-time and retrospective analysis

Monitor individual equipment level KPIs

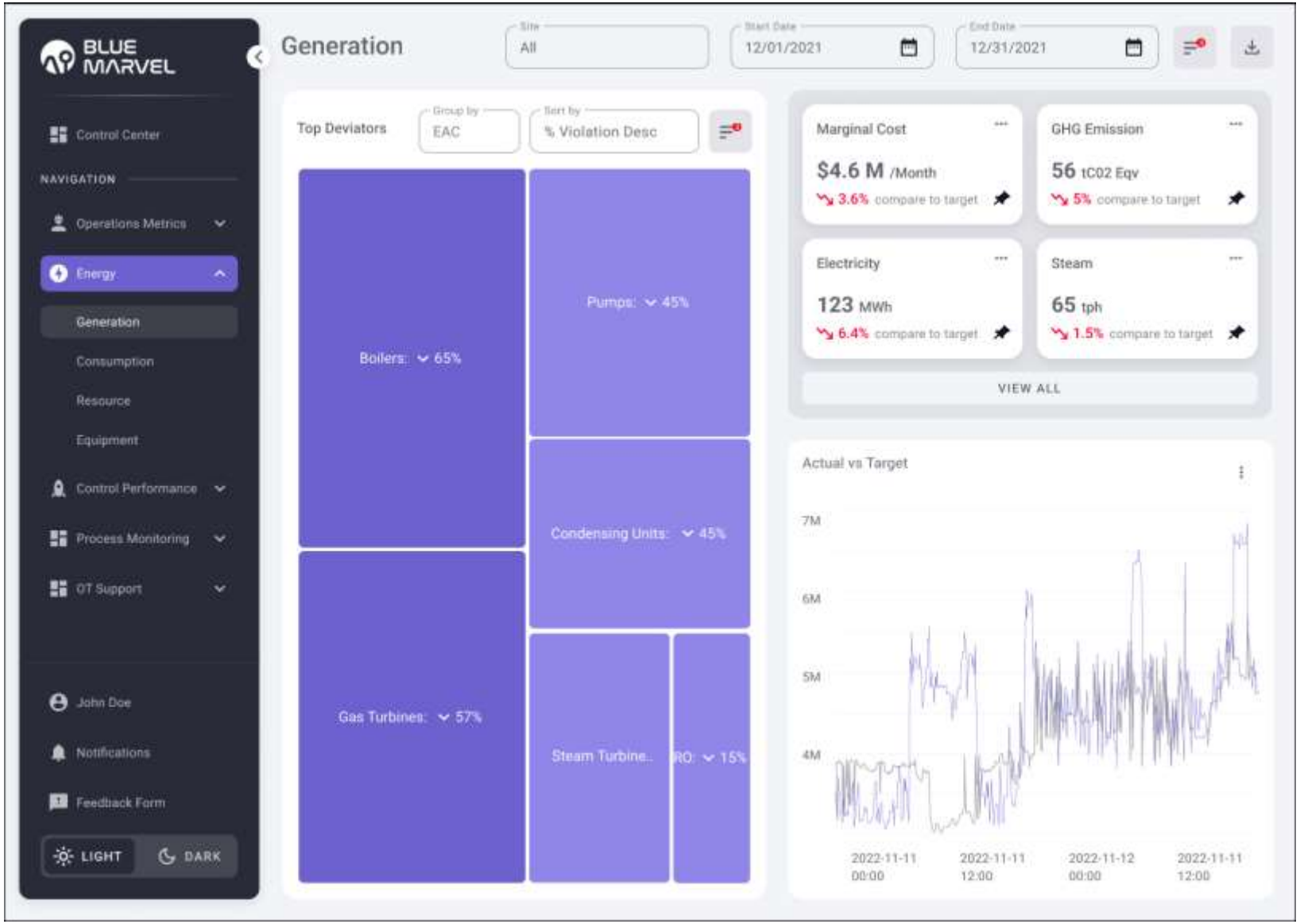
EMIS Features and Functions



Energy Account Center Performance Monitoring

Steam Generation Area

- Boilers
- Gas Turbines
- Steam Turbine
- Pumps



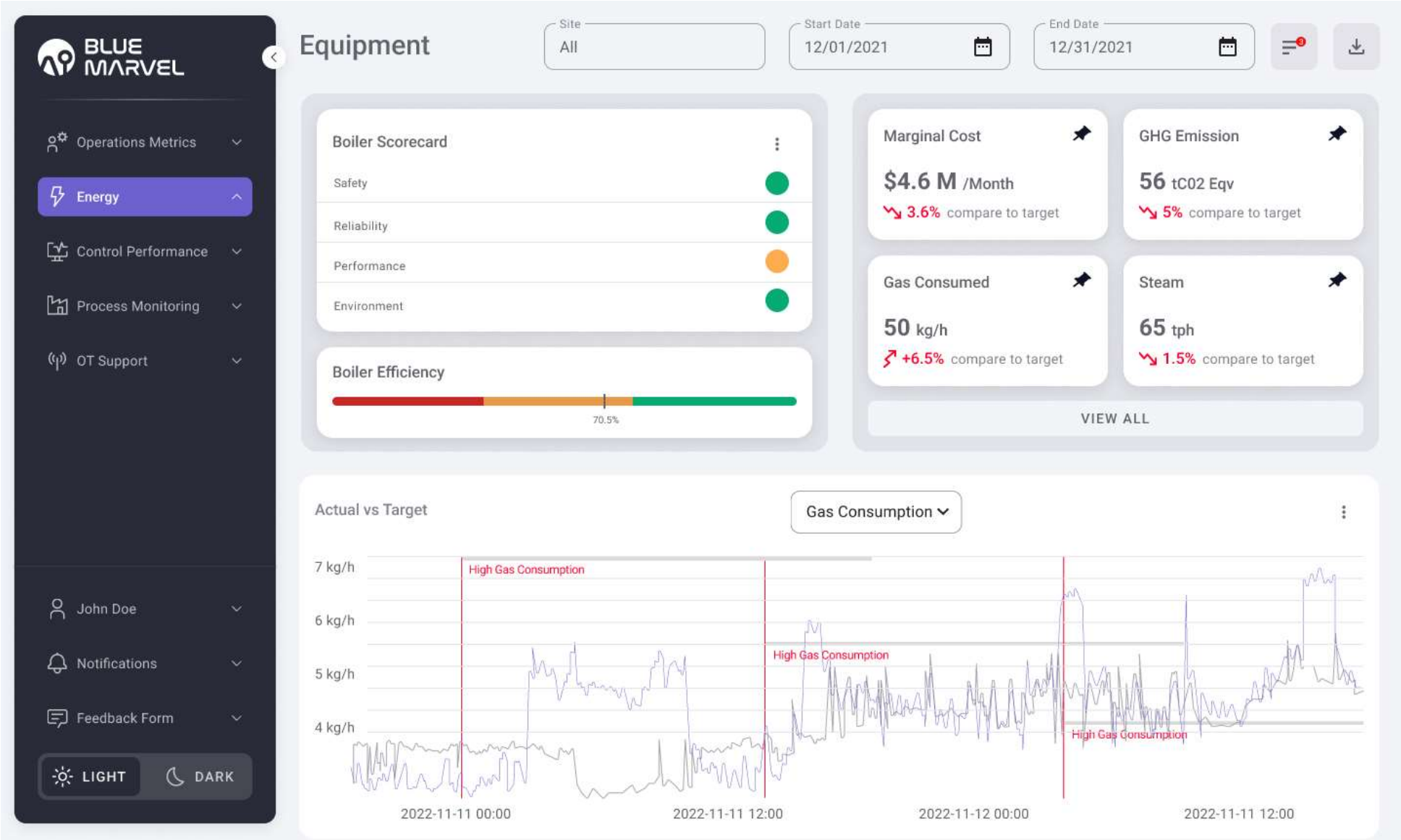
BLUEMARVEL

Equipment Area Specific Monitoring

Boiler Area Specific

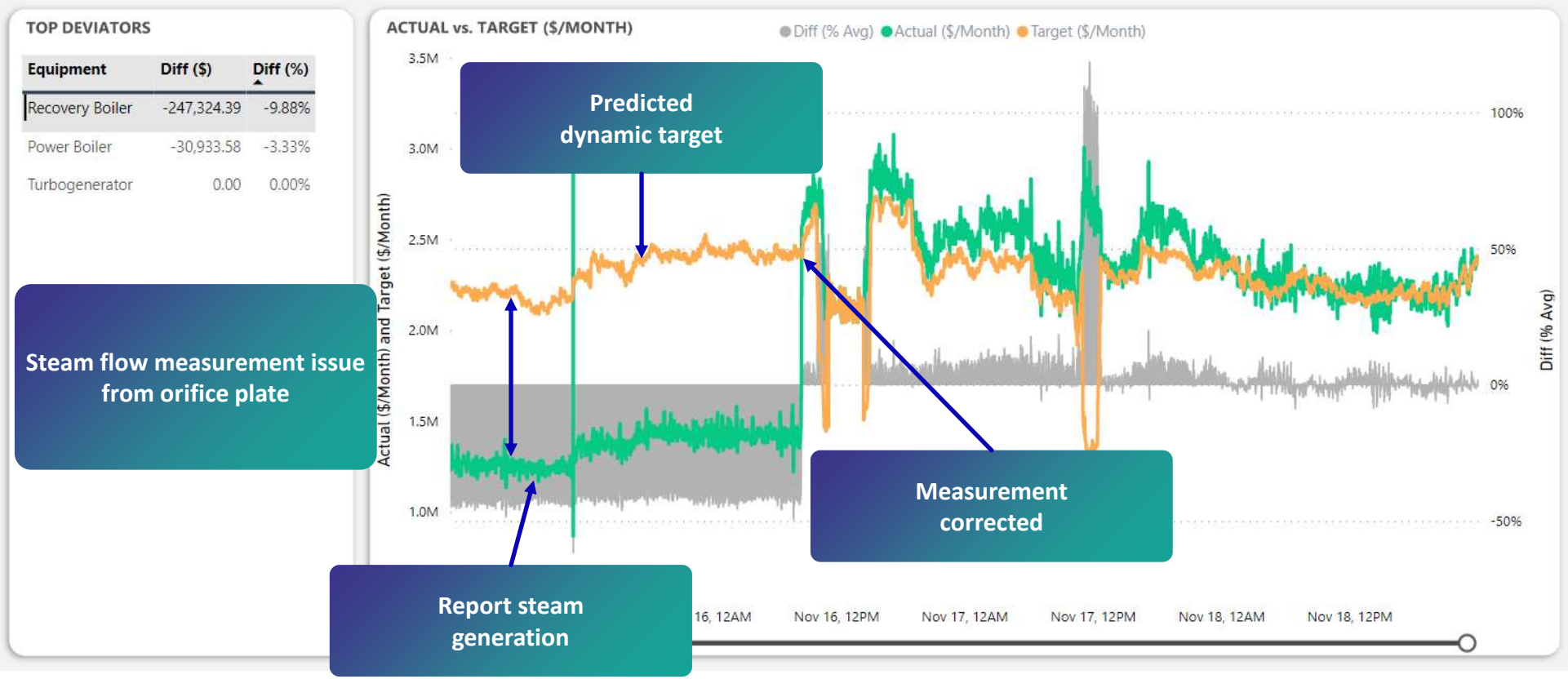
Performance Monitoring

- Combustion Efficiency
- Performance Compared to Target
- Reliability Monitoring
- Control Loop Monitoring

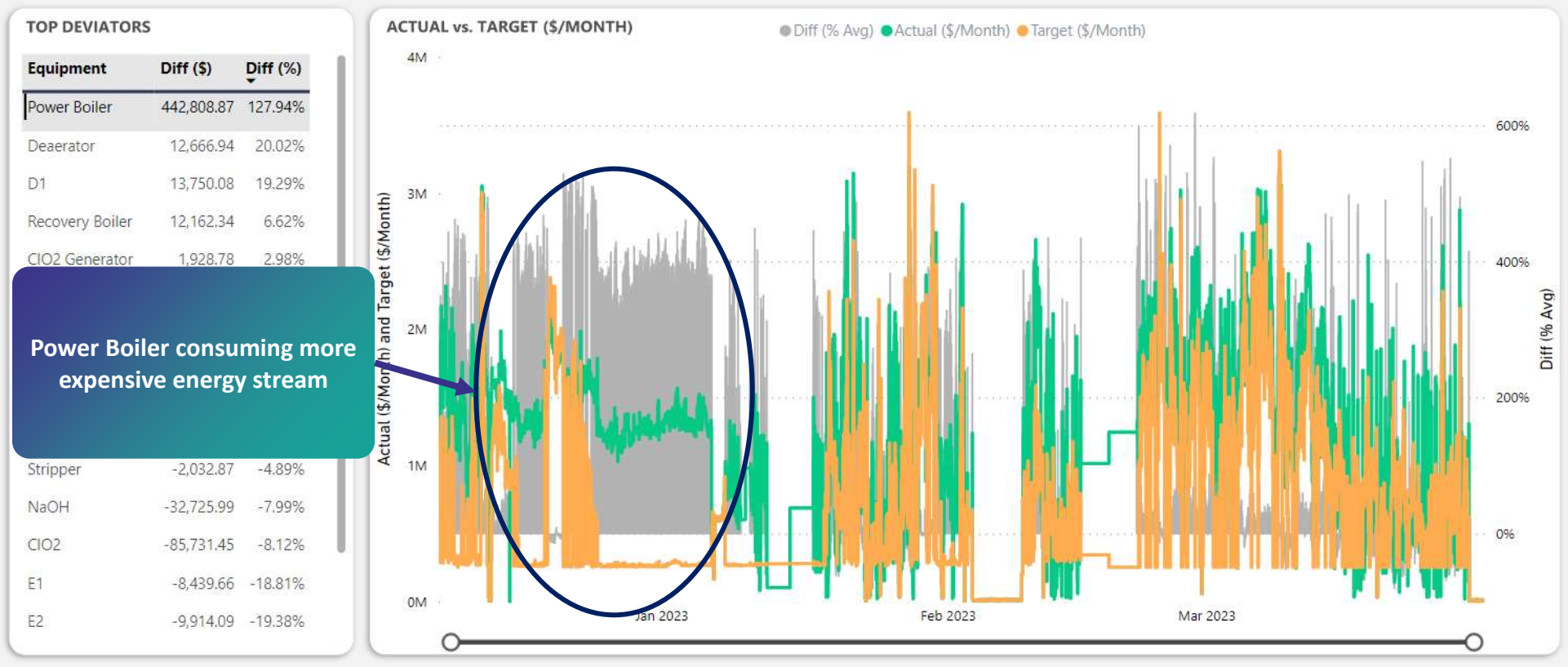


BLUEMARVEL

Catching Real-time Operational Issues



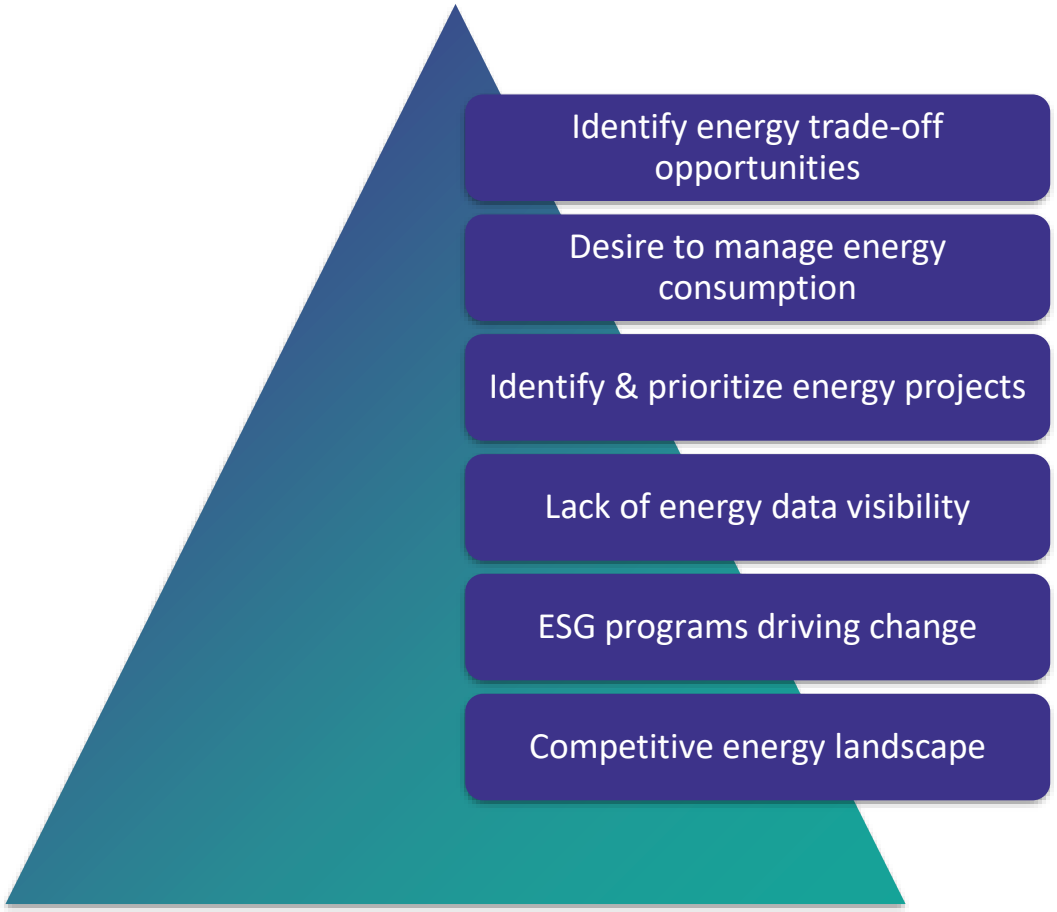
Retrospective Analysis



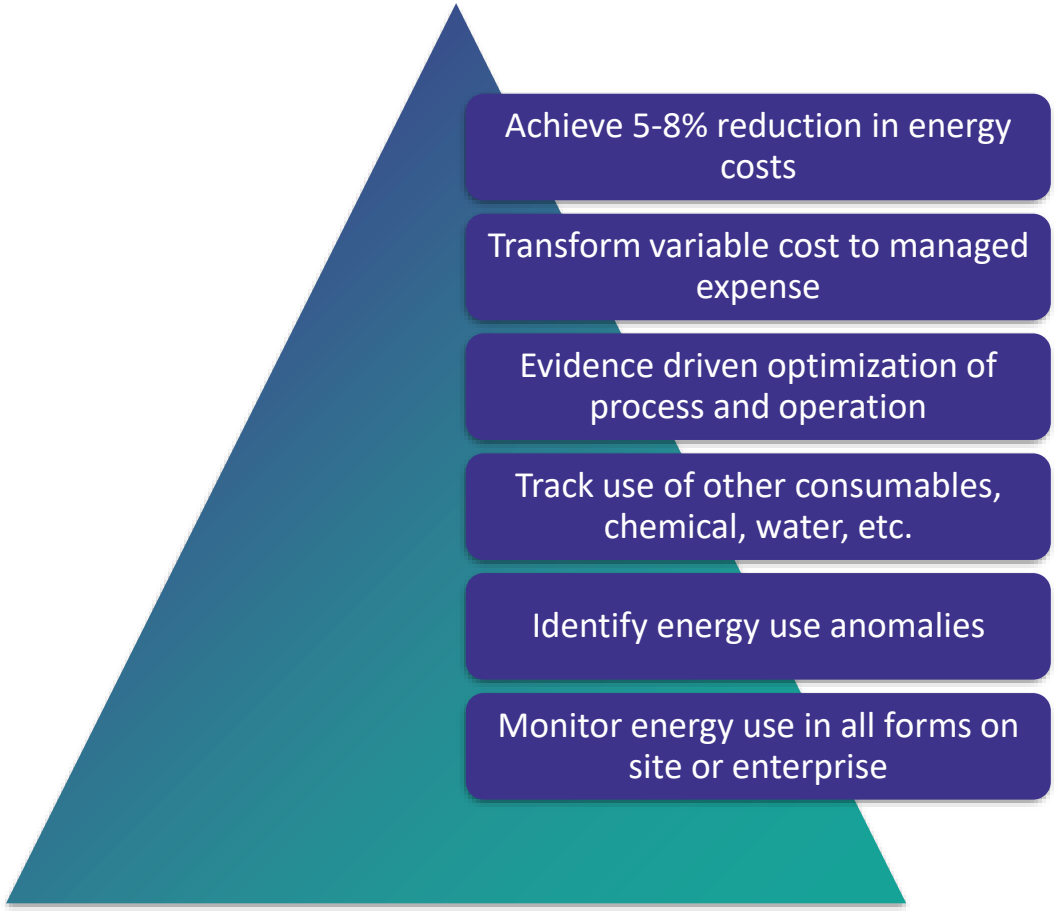
Typical Issues Caught by EMIS

EMIS Summary

Challenges



Solution



EMIS Demo

Technical Advantage

	BlueMarvel	Traditional
Data Integration	**Natively via Aspentech inmation & other enterprise DBs**	**Multiple point connectivity solutions**
Accessibility	**Anywhere, anytime, on any device**	**At site or remote access**
Cybersecurity	**Single Sign-on**	**N/A**
Deployment	**Containerized**	**Installation/configuration of various software**
Upgrades	**Over-the-air, anytime**	**Scheduled**

Evolving Approach

ENERGY DRIVERS

Production

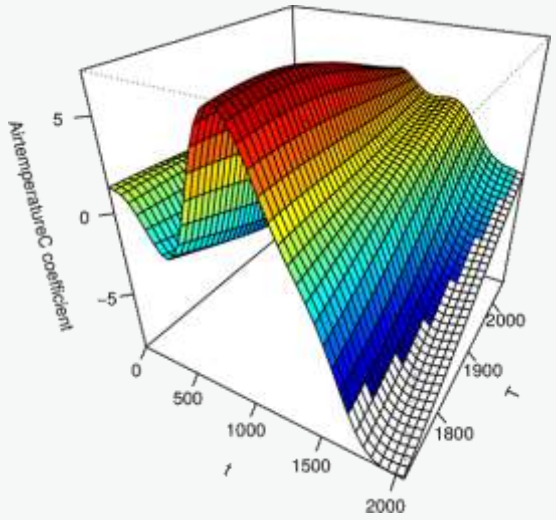
Ambient Temperature

Quality Setpoint

Feed Composition

...

PROCESS



DYNAMIC ENERGY TARGETS

Steam

Water

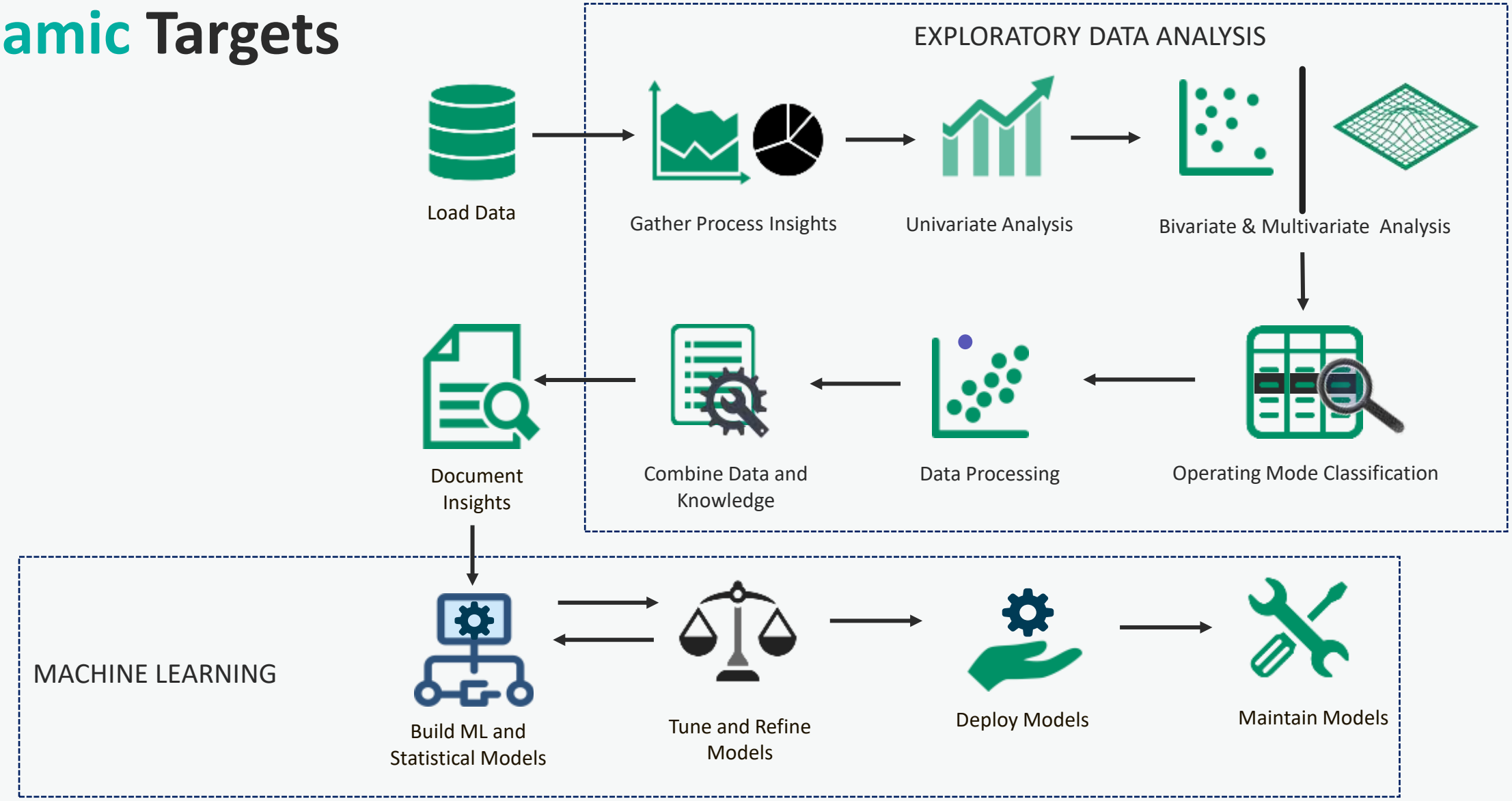
Fuel

Electricity

Reagents

Static Targets → **Historical Benchmarks** → **Dynamic Targets**

Dynamic Targets



ABSA Special Topics – Tom Leming

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CLOSING COMMENTS – George Mitsopoulos

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FEEDBACK FORM

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- 2 draws for 2 hockey tickets each
- December 10 at 6:00 PM (Oilers vs Devils) at Rogers Place

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CLOSING COMMENTS – Thank You!

- Attendees
- Presenters
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See you in October 2024 in Edmonton, AB

THANK YOU

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