# TRAK INTERNATIONAL

Green Energy Resources


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**Ontario Offices:**
- **Milton**
- **Toronto**
- **Kitchener**

# About Us

- We are **driven to do good for people** because we are good people.

- Value Proposition: We provide engineered HVAC/R system solutions to energy-intensive owner/operators of residential, commercial and industrial buildings and processes that want to significantly increase safety, reduce overall energy use and reduce their carbon footprint.

# About Us

2022 Clean 50 exceptional contributors to the clean economy / contributeurs exceptionnels à l'économie propre TOP PROJECT

- **National energy and environmental award-winning engineering, design/build and construction firm** that has developed some of the most effectively installed, energy-efficient, and environmentally beneficial HVAC/R systems in North America.

- **Inventor and patent holder of proven advantageous energy-efficient equipment and methods** for widespread, commonly needed heating and cooling environments.

# About Us

- A strong, long-established **network of trusted supporting suppliers and installer partners**.

- Have **provided over 500 production and energy studies and over 100 distinguished projects** completed since 1991 across Canada and the United States.

# About Us

**Real-world, measured and repeatable solutions:**

- Facility energy use reductions typically 50% to 70%,
- Energy and maintenance operating cost savings typically 40% to 50%,
- Water abuse and cost reduction, and
- Onsite GHG reductions in major facilities of up to 100%. (elimination of natural gas use)

# TRAK Team

Mitchell Wilkie, MIM, SBCC, CMMIII
Chief Strategy Officer

Jeff Maxwell, P.Eng., LEED AP
CEO, President

Scott Zimmer, P.Eng.
Lead Engineer
Manager, Eastern Canada

Darrell Bertram
Director, Drilling Operations

Sabine Maxwell, M.SC., B.ED., LEED AP
BD+C
Green Projects Coordinator
Controller & Administrative Supervisor

Andre Bourget, P.Eng.
Senior Mechanical Engineer

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TRAK CANADA


Winners


TRAK INTERNATIONAL®
Green Energy Resources

5-1050 LEATHEAD ROAD
KELOWNA, BC V1X 2K2

KITCHENER, ON
TORONTO, ON
MILTON, ON

- **1991-TRAK Companies founded** – Specialized in Design of GeoExchange-Based, Energy-Efficient Building Systems and provision of Energy Management Controls in Northern Ontario - Schools & LT Care Facilities. Pulp & Paper, Mining.

- **2002-Relocated to Kelowna** – Added Heat Pump and Controls Manufacturing, General Mechanical Design/Build Contracting - Multi-Residential Condo and Resort Developments.

- **2008-Merged with Harris Companies** – American Schools, Ice Arenas, Condo. $300M/yr.

- **2013-TRAK International separated to be Canadian owned company.** Expanded and formed delivery partnerships to focus on solutions in the Ontario energy condition.

# Vision

To be a leading sustainable HVAC/R company that best understands and satisfies mechanical, electrical, and controls needs for the commercial and industrial world.

# Mission

To provide customized, engineered solutions to energy-intensive users through dependable, efficient, environmental control systems in the commercial, industrial, institutional and recreation sectors by our team of highly skilled accredited professionals.

# Value Proposition

TRAK International's sustainable, innovative HVAC/R Smart Energy Systems and Engineering Services helps industrial, commercial, institutional and recreational property owners who want to improve their facility and environmental controls by operating HVAC/R systems more efficiently and significantly reduce their overall energy use and carbon footprint unlike the conventional systems provided by typical HVAC/R companies.

# Professional Engineering

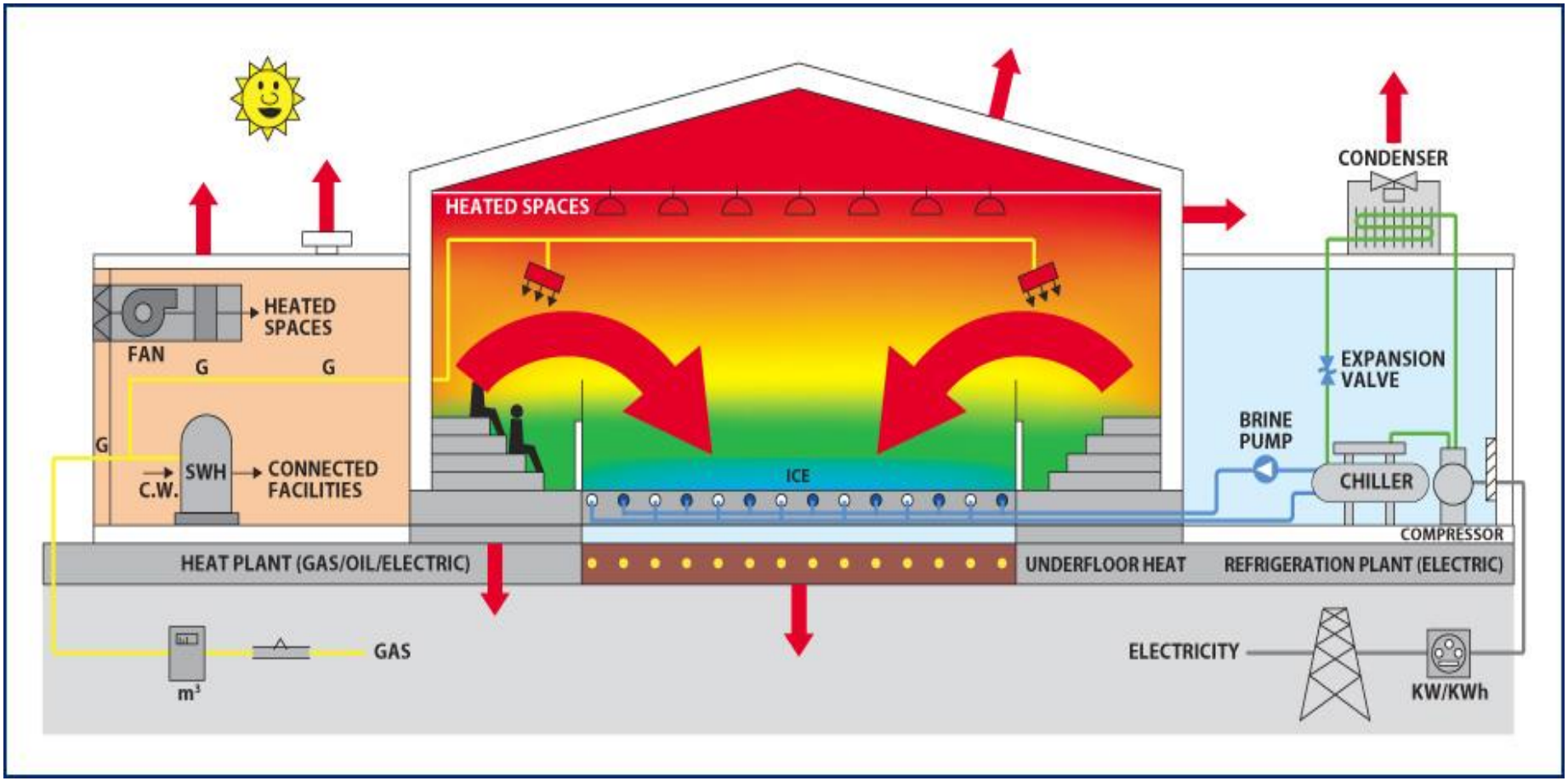
- Engineering Feasibility Studies
- Mechanical & Controls Design as Prime Contractor
- Cost Estimating
- Project Management
- Commissioning
- Ongoing Monitoring and Service Management

Professional Engineers Ontario

ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA

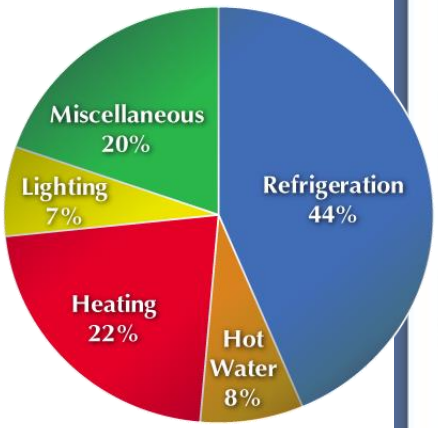
# Typical Arena Energy Flow

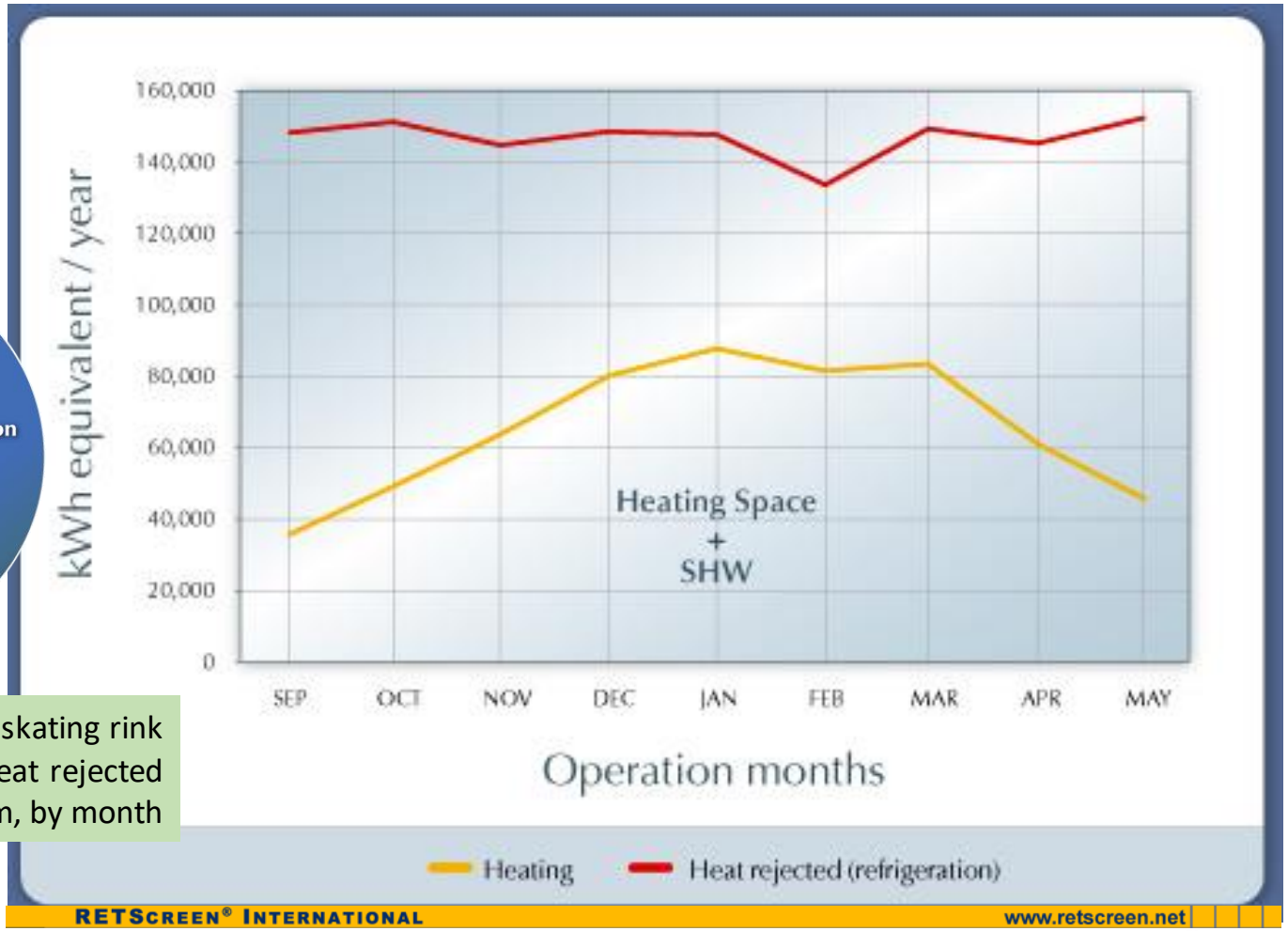
Heat transfer from hot to cold, flood water, operating equipment, lighting, building ceiling and floor, space heating…



- In a typical arena, most of the heat is dumped outside by an air condenser.
- Heating system must make up for some of the rejected heat.
- Commonly, the heat rejected by refrigeration system generally exceeds the heating load.

Electricity for refrigeration, lighting and other




Typical Canadian skating rink heating load and heat rejected by refrigeration system, by month

# Supply and Installation of an Ice Plant in the Lake of Bays Community Centre

1. Replace ~300lbs freon R22 refrigerant with an environmentally acceptable 407C refrigeration (~50lbs total in two independent circuits).
2. Install two TRAK hydronic Heat Pump modules (120 HP total – 120 refrigeration ton) exceeding existing 70-RT capacity in any load condition.
3. Provide mechanical and electrical engineering for demolition and rebuild.
4. Create mechanical/electrical drawings and specifications for demolishing existing ice plant toward retrofit intent.
5. Remove Brine Fluid from rink floor and equipment and replace with ethylene glycol solution.
6. Site modifications to fit new cooling plant system in existing mechanical room and power requirements.
7. Optimize heat recovery and rejection.
8. Replace controls with new system and remote access.
9. Provide full system training to staff operators and managers.

# The Solution – Technology & Services

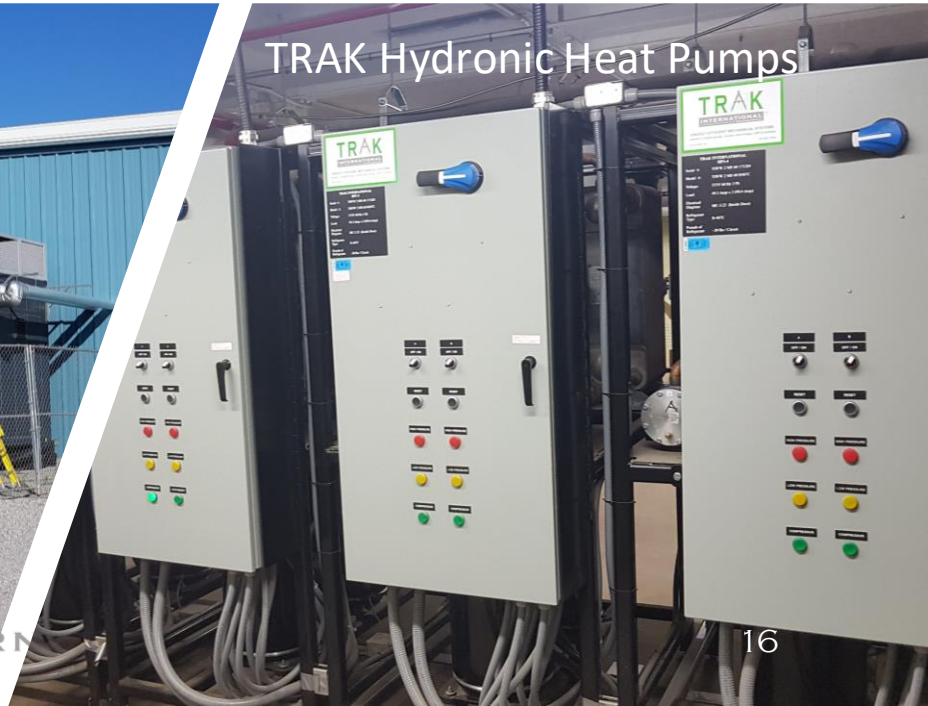
## HVAC/R Smart Energy Systems (SES)

- GeoExchange Field.
- Heat Pumps.
  - TRAK manufactured, modular, hydronic
  - 30 RT; 60 RT; 120 RT capacity.
- TRAK Energy Device (TED) & Intelligent Metering TRAK Energy Device (imTED) Boxes.
- Combined Heat & Power (CHP) Co-generation.
- Energy Management System (EMS) Controls with Building Automation System (BAS).


Controls

Geoexchange


CHP Cogeneration

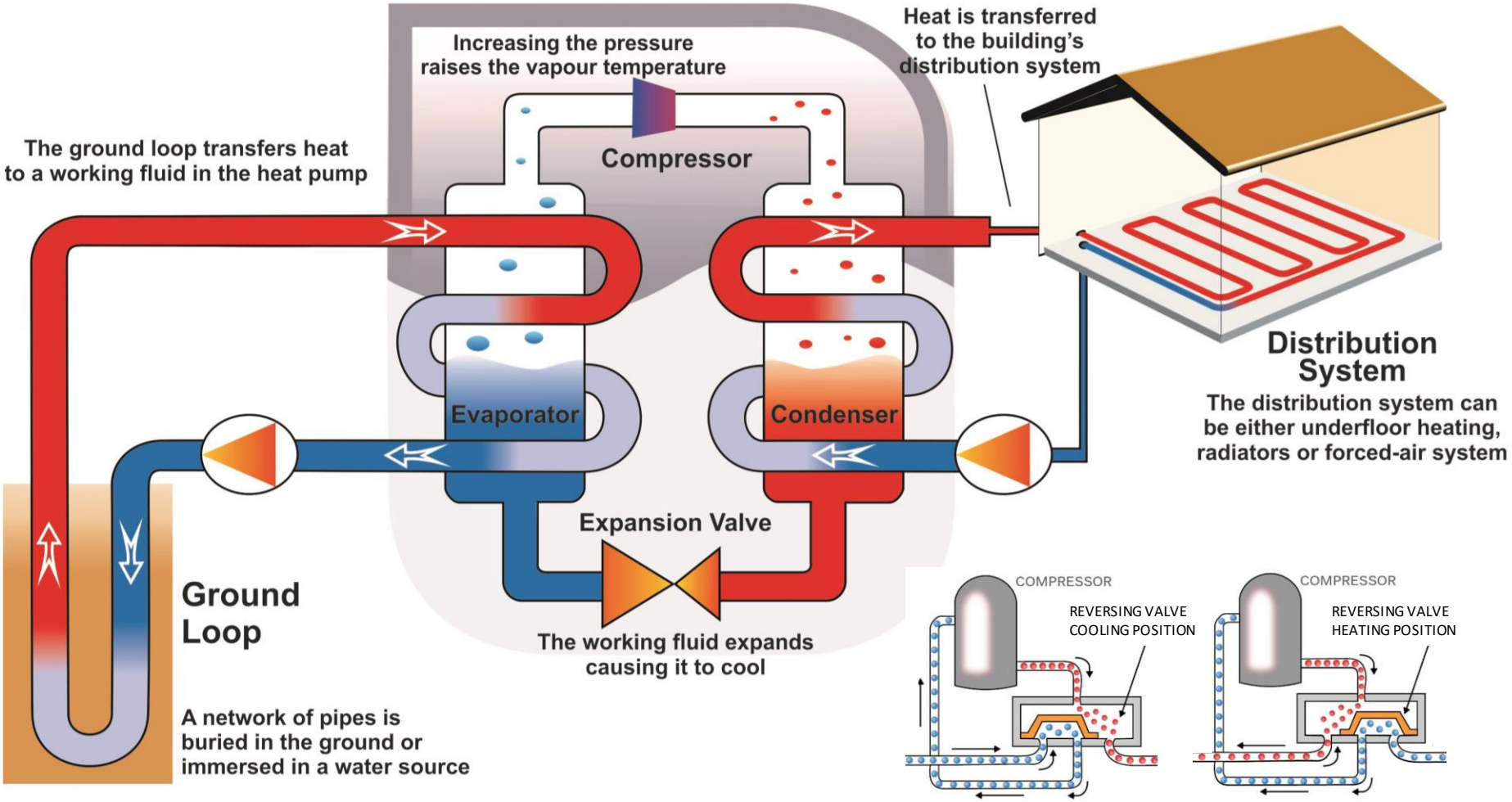



TRAK Hydronic Heat Pumps

# How it Works

**Smart Energy Systems (SES)** for Recreation Facilities optimally integrate all or parts of safe and efficient refrigeration, comprehensive heat recovery, on-site cogeneration, geoexchange and energy storage to produce an efficient and reliable green energy system for ice making, facility HVAC/R, and electricity demand, use, and GHG reduction.

# Heat Pumps


Increasing the pressure raises the vapour temperature
Heat is transferred to the building's distribution system
The ground loop transfers heat to a working fluid in the heat pump
Compressor
Evaporator
Condenser
Distribution System
The distribution system can be either underfloor heating, radiators or forced-air system
Expansion Valve
Ground Loop
The working fluid expands causing it to cool
A network of pipes is buried in the ground or immersed in a water source
COMPRESSOR
REVERSING VALVE
COOLING POSITION
COMPRESSOR
REVERSING VALVE
HEATING POSITION

# Modular Heat Pumps

**Provides efficient low-temperature chilled fluid (-15°C/+5°F) for ice making and air conditioning while simultaneously, by the same work, creating heated fluid (+71°C/+160°F) for heating applications. 30 RT | 60 RT | 120 RT capacity.**

**Safe, Non-Ammonia System**. Uses comparatively small volume of environmentally safe refrigerant.

**Easily serviceable** by commercial refrigeration trades. Basic operator requirements.

Sizing and valving with onboard protection and controls for **continuous monitoring, trending, and long-term overall system efficiency and minimal operating costs.**

**TRAK Project – St. Cloud Municipal Athletic Complex**

## TRAK HEAT PUMPS in Arenas

- St. Cloud Municipal Athletic Complex, St. Cloud MN
- Egan Arena Civic Arena, Eagan, MN
- Bielenberg Sports Centre, Woodbury, MN
- Richfield Ice Arena, Richfield, MN
- Kapuskasing Sports Palace, ON

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# Ammonia Incidents

**'It is blinding toxic': Expert sounds alarm on ammonia at public rinks**

- A former chief inspector with the government says ammonia ice-making equipment is a serious public danger - October 19, 2017

# Ammonia Incidents - 2020

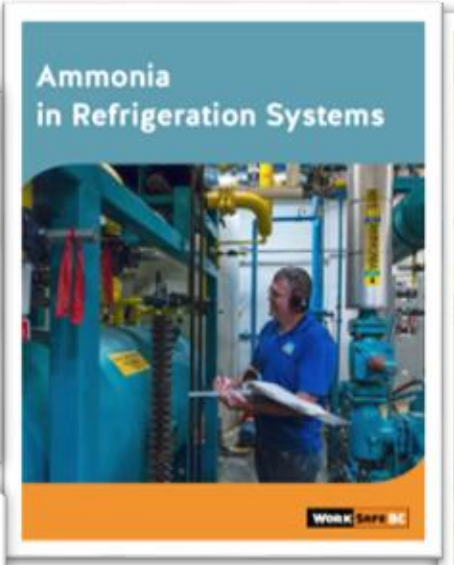
- St. John's, NF **Fire department responds to report of ammonia leak at National Research Council building** – March 11, 2020.
- Vancouver, BC **UBC quietly appeals conviction for dumping fish-killing ammonia in Fraser River tributary** – March 5, 2020.
- Kelowna, BC **Toxic levels of carbon monoxide at Kelowna rink led to 12 men falling ill after rec hockey game** – March 5, 2020**.**
- Kelowna, BC **Hockey players accidentally gassed at game?** – February 22, 2020.
- Chilliwack, BC **Chilliwack Chiefs fined $3,500 by WorkSafeBC for ammonia plant safety deficiencies** – February 12, 2020.
- Calgary, AB **Ammonia leak prompts evacuation of Rocky Ridge YMCA** – February 12, 2020.
- Fernie, BC **City of Fernie suing refrigeration company Toromont Industries Ltd. over 2017 ammonia leak that killed three workers** – January 17, 2020.

# Ammonia Incidents - 2019

- **Cole Harbour, NS Ammonia leak causes evacuation at election** – October 13, 2019.
- **Calgary Unreported ammonia release gets Agrium $28,750 fine** – October 10, 2019.
- **Kimberly, BC Civic Centre Ammonia leak causes evacuation –** October 7, 2019.
- **Upper Skeena, BC Arena ammonia leak evacuation**– September 16, 2019.
- **London, ON Farquharson Arena ammonia leak evacuation**– September 15, 2019.
- **Courtenay, BC Ammonia leak triggers evacuation of Comox Valley Sports Centre** – September 13, 2019
- **Claresholm (Calgary) State of local emergency lifted in after ammonia leak contained** – August 22, 2019
- **Edmonton Ammonia leak shuts down intersection of 66 Street and Fort Road** – August 21, 2019
- **Hamilton Pier 8 rink area evacuated for ammonia leak** – August 8, 2019
- **Ammonia leak at Goose Bay Curling Club** - June 25, 2019
- **UBC fined $1.2M and CIMCO fined $800K for 2014 release of ammonia** - June 23, 2019
- **High ammonia levels at City of Windsor ice rink machinery rooms** - April 30, 2019
- **Ammonia leak forces closure of Cobourg Community Centre** -April 8, 2019
- **Ammonia leak closes Gatineau Robert-Guertin arena -** April 02, 2019
- **Southwest Edmonton arena reopened after ammonia gas leak** - March 14, 2019
- **Nelson, BC Curling Club evacuation from ammonia leak** - February 14, 2019
- **Corner Brook Civic Centre reopens after ammonia leak** - February 14, 2019
- **Calgary's Seton YMCA re-opens after ammonia leak** - February 6, 2019

# Ammonia Incidents - 2018

- **Cranbrook, B.C., arena avoids ammonia disaster after ice-machine breaks down** - August 31, 2018
- **'Very sad day for us': Ammonia leak forces closure of Prescott's only arena** - August 23, 2018
- **Deadly Fernie ammonia leak caused by decision to operate leaky chiller: report** - July 25, 2018
- **Brampton ammonia leak sends 8 to hospital** -June 24, 2018
- **Ammonia leak forces evacuation of Vancouver's West End Community Centre** - May 18, 2018
- **Ammonia leak investigated by Calgary fire crews** - March 23, 2018
- **All rinks, arenas in New Brunswick to be inspected by end of March on ammonia safety** - February 23, 2018
- **North Okanagan arena ammonia tests yield mixed results** - February 21, 2018
- **Possible ammonia leak forces partial evacuation of Airdrie's Genesis Place** - February 3, 2018





NOT TRAK INTERNATIONAL®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# Small – Curling Rink

**TRAK Project – Kapuskasing Sports Palace (adjacent curling rink)**

# Medium – Twin Sheet

**TRAK Project – Kapuskasing Sports Palace**

# Large – Twin Pad Centre

**TRAK Project – Bielenberg Sports Centre**

# Large – Twin Pad Sports Centre

**TRAK Project – Eagan Arena**

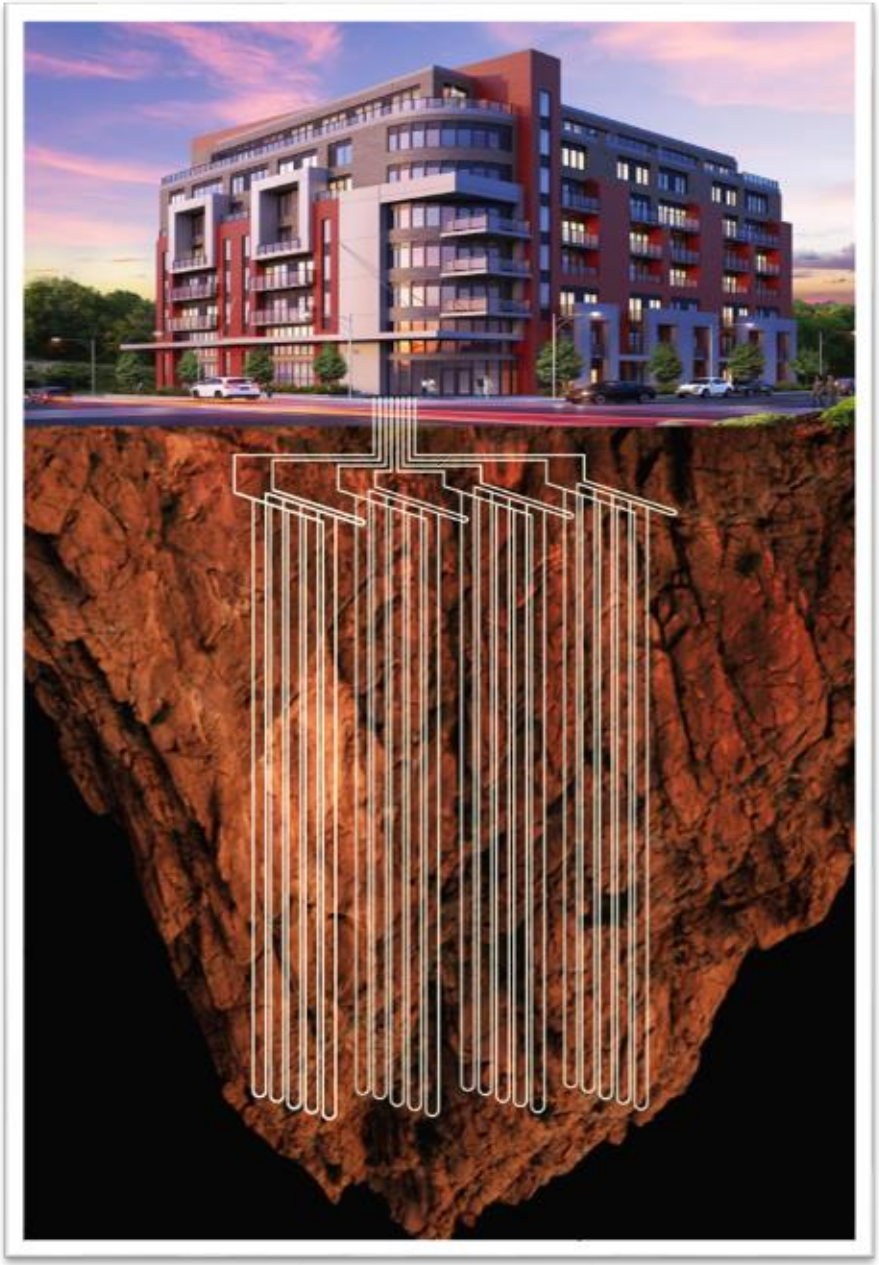
# Geo-Exchange

Uses the earth as a heat source (in winter) or a heat sink (in summer).

Water and glycol pumped through these loops about 140 metres (450 feet) deep either absorbs or releases heat, depending on the season.

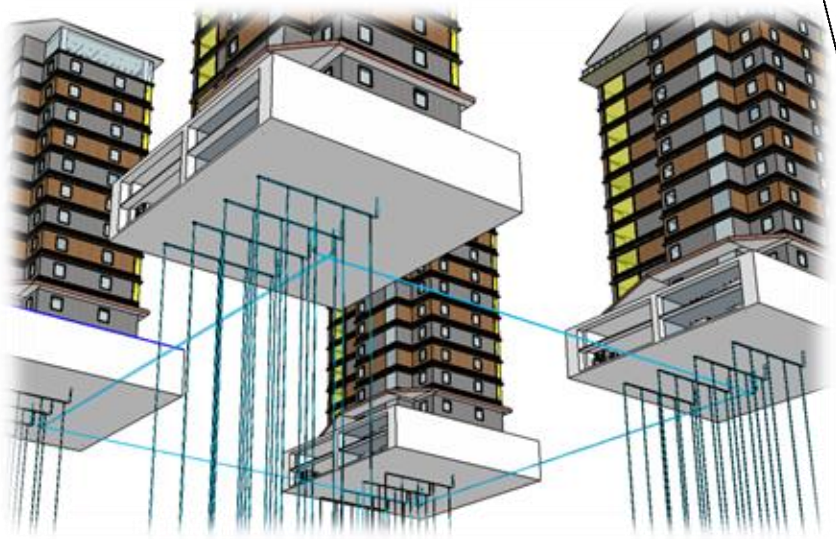
Takes advantage of consistent year-round underground temperatures (+6°C to +16°C) to boost efficiency and reduce operating costs of heating and cooling systems.

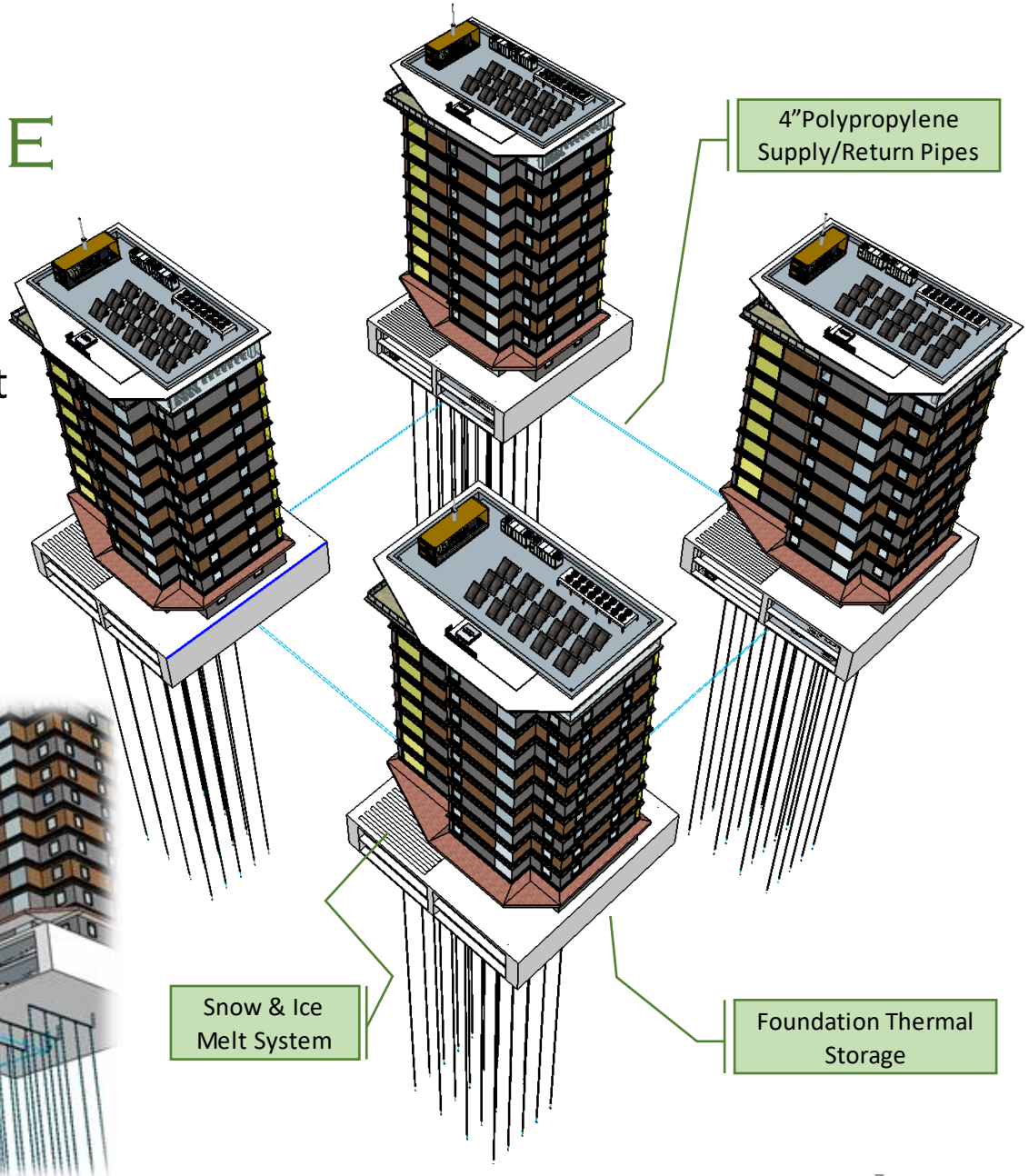
This median temperature can be used to directly heat or cool portions of the ventilation load at very minimal costs



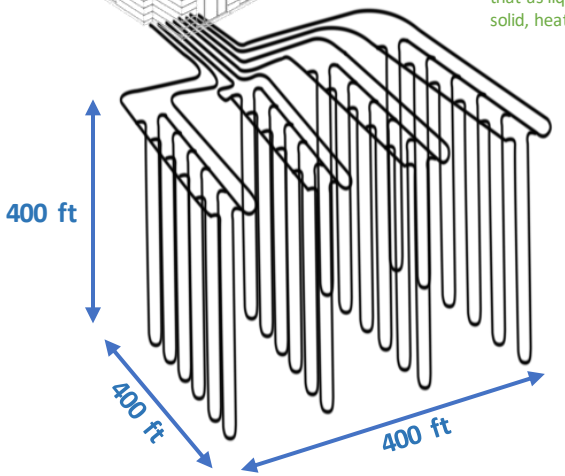
# District Geo-Exchange

Multiple buildings connected with a twin-pipe supply/return hydronic system below the frost line and integrated with each heat pump plant and geoexchange field.





# Geo-Exchange Thermal Mass

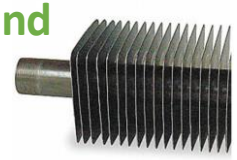



**Geoexchange** field thermal mass (heat sink) will become a thermal battery that can store heat by absorbing it from a source and then releasing it slowly over time.

Uses the earth as a heat source (in winter) or a heat sink (in summer). Like an energy bank to borrow from and deposit into.

Cubic volume mass holds temperature the best. TRAK shapes its geoexchange field cubicle and not a long, thin radiant mass.

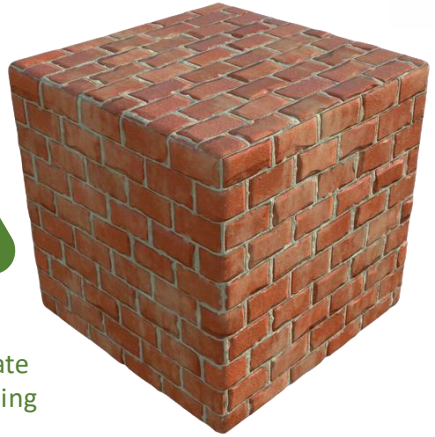
**Take a degree of thermal energy out of the ground and nature puts a degree back.**



Freezing is almost always an exothermic process, meaning that as liquid changes into solid, heat is released.

Cool Ground Absorbs Rejected Heat in Summer

Phase Change of State Melting-Freezing



Ground Releases Heat in Winter

The energy released upon freezing, known as the enthalpy of fusion, is a latent heat, and is exactly the same as the energy required to melt the same amount of the solid.

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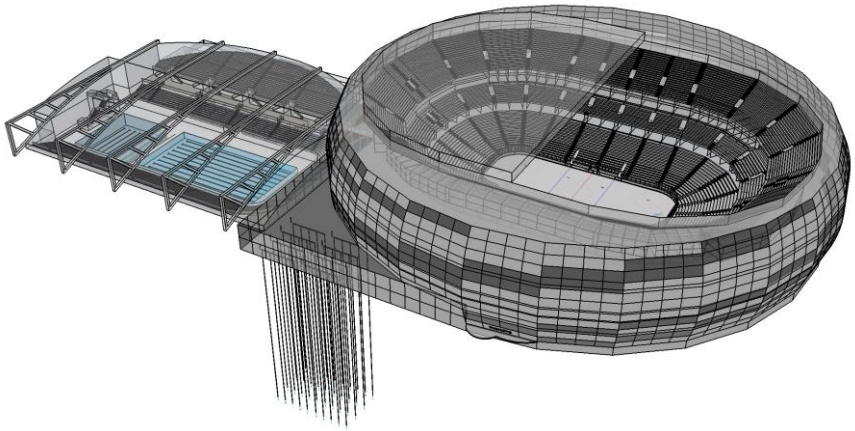
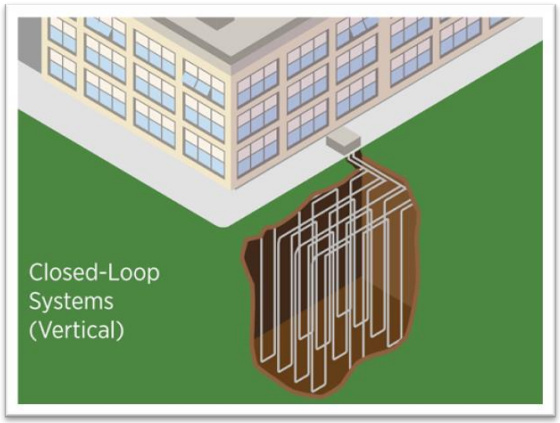
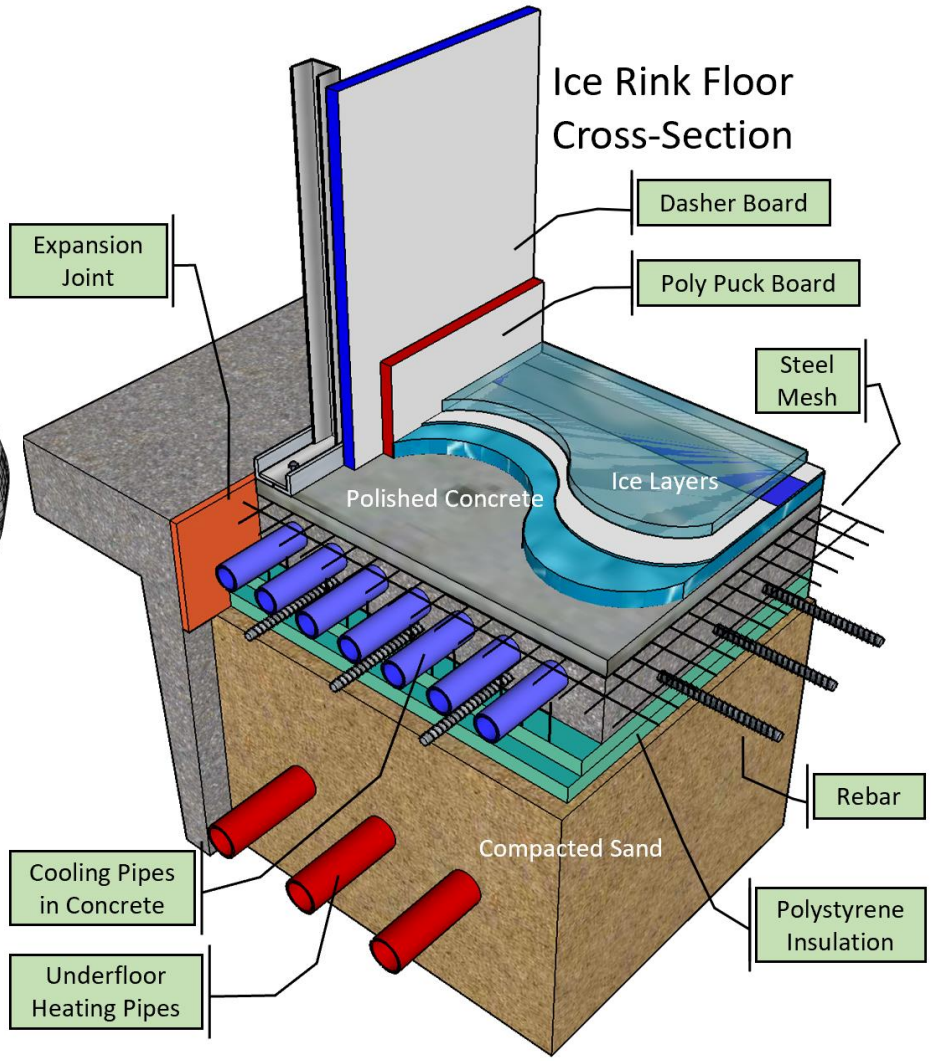
# Geo-Exchange Thermal Mass

Our Smart Energy Systems utilize concrete and foundation slabs as in ice rink floors, underground parking garages, water storage, and the ground as “thermal batteries”.



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# Geo-Exchange Thermal Mass

Water and glycol fluid solution pumped through geoexchange loops about 120m (400ft) deep either absorbs or releases heat, depending on the season. Takes advantage of consistent year-round global underground temperatures (+6°C to +16°C) to boost efficiency and reduce operating costs of heating and cooling systems.

**We charge the Thermal Battery (Geoexchange Field)**
**with a high-temperature supply of fluid.**

1. Underground Parking Ramp Exhaust Air (18-22°C).
2. Wastewater Heat Recovery (26°C).
3. Air Conditioning Cooling By-product Heat (30-40°C).
4. Combined Heat and Power (CHP) Cogenerator Leftover Heat Recovery (90°C).

**TRAK uses the building's rejected, reclaimed, and recycled**
**heat first before relying on the geoexchange field!**

**Benefits Acquired:**

- Free Heating and Warmed Ventilation Air without Heat Pump Compressor work.
- Geoexchange Field is Efficiently Sized for Best Effectiveness – Typically Smaller.
- Heatpump Coefficient of Power (COP) doubled from 3.5 to 7.0. Like running on steroids with pre-warmed fluid. Easier for compressors to draw out thermal energy.
- No Need to Always Use Electricity.
- Nature Keeps the Ground Temperature Consistent.

Most geothermal only address loads in a MURB suite and nothing else – Not TRAK.

# TRAK Smart Energy Systems

**TRAK Smart Energy Systems** (SES) optimally integrate energy efficient processes and building systems with basic and innovative methods of: **Internal Energy Recycling**, **Energy Efficiency** and **Thermal Storage**.[1]

These methods can cost-effectively **combine with onsite power generation** to deliver consistent, sustainable and more resilient operating conditions. The SES is **a holistic approach** to meeting the energy needs of process and building performance in the most efficient way possible.

1. Canadian and International Patents - Heating and Cooling Methods
   - Jeffrey H. Maxwell. P.Eng., TRAK International

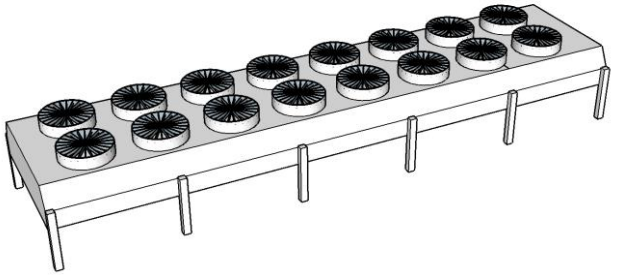
# Small Geoexchange Drilling Site

# Large Geoexchange Drilling Site

**TRAK Project - The Cove Beach Resort, West Kelowna, BC, (2005)**

# Free Heat Rejection, Cooling & Refrigeration Offset

At times, we value the outside ambient air conditions and can use this without traditional water use to more efficiently reject heat or do free ice-making that offsets compressor use. Outdoor conditions can also be used to "re-centre" thermal storage.



Depending upon outside air temperatures, liquid pumped through this dry cooler can gain (*defrost*) or lose heat (*condenser rejection or ice-making*) to either hot or cold loops.

# Roof-top Drycooler

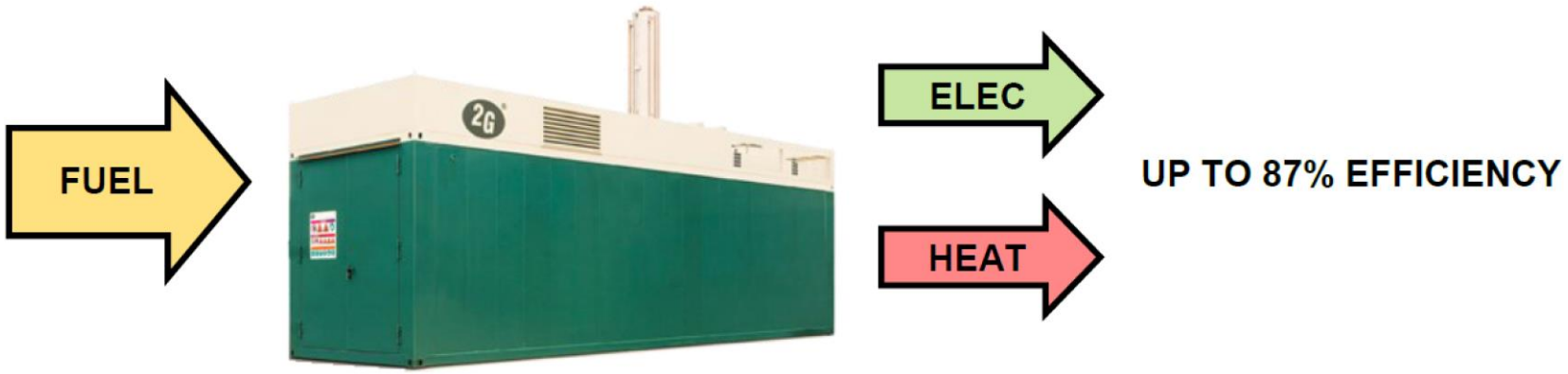

**TRAK Project – St. Cloud Municipal Athletic Complex**

# Natural Gas Cogeneration


**Combined Heat and Power (CHP)** provides cost-efficient electricity generation to drive compressors and all other electrical loads. Fluid cooling the generator is typically heated to a blended 90°C and used for heating applications.

The high-temperature heat can also be used for driving desiccant dehumidification and low-grade absorption chilling.

Long-term natural gas supply agreements can help hedge electricity cost increases.




The **CHP** component is typically operating behind the meter in "**Parallel Mode**" utilizing a small percentage of electricity from the grid.

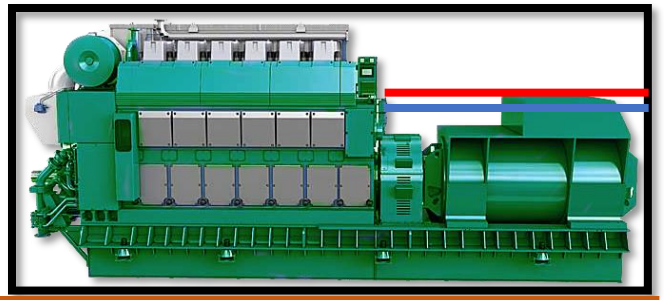
With properly configured switch gear, controls integrated with the building load and load leveling strategies can be operated in "**Island Mode**" during grid power failures or poor power supply conditions.

# Process & Generator Balance

*Its not just about electrical load following, but also managing a load that can be regulated to best suit the generator operating conditions*

- Major Electricity Loads
- Central Heat Pump Compressors
- VSD Main Fans
- VSD Main Circulating Pumps
- Lighting

- Generator Output
- Parallel Grid Electricity Input
- Thermal Loads



BALANCE BEAM

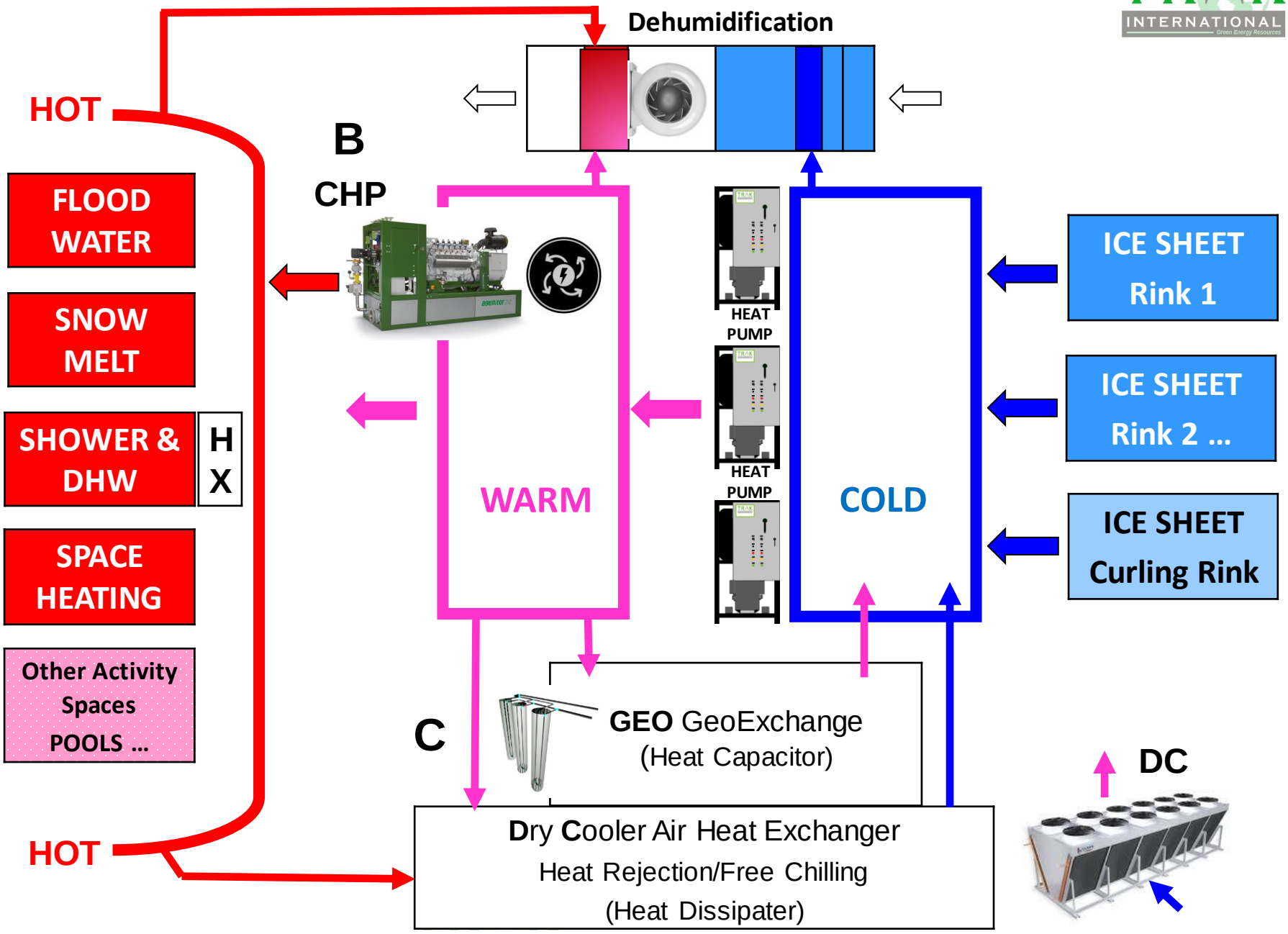
TRAK Project
The Kapuskasing Sports Palace
Kapuskasing, ON (2016-2017)
CHP Delivery

# "Free" Cooling & CHP

# Operator Training

TRAK Project
The Kapuskasing Sports Palace
Kapuskasing, ON (2016-2017)

# Sample TRAK SES - Ice Facility Energy Flow Diagram

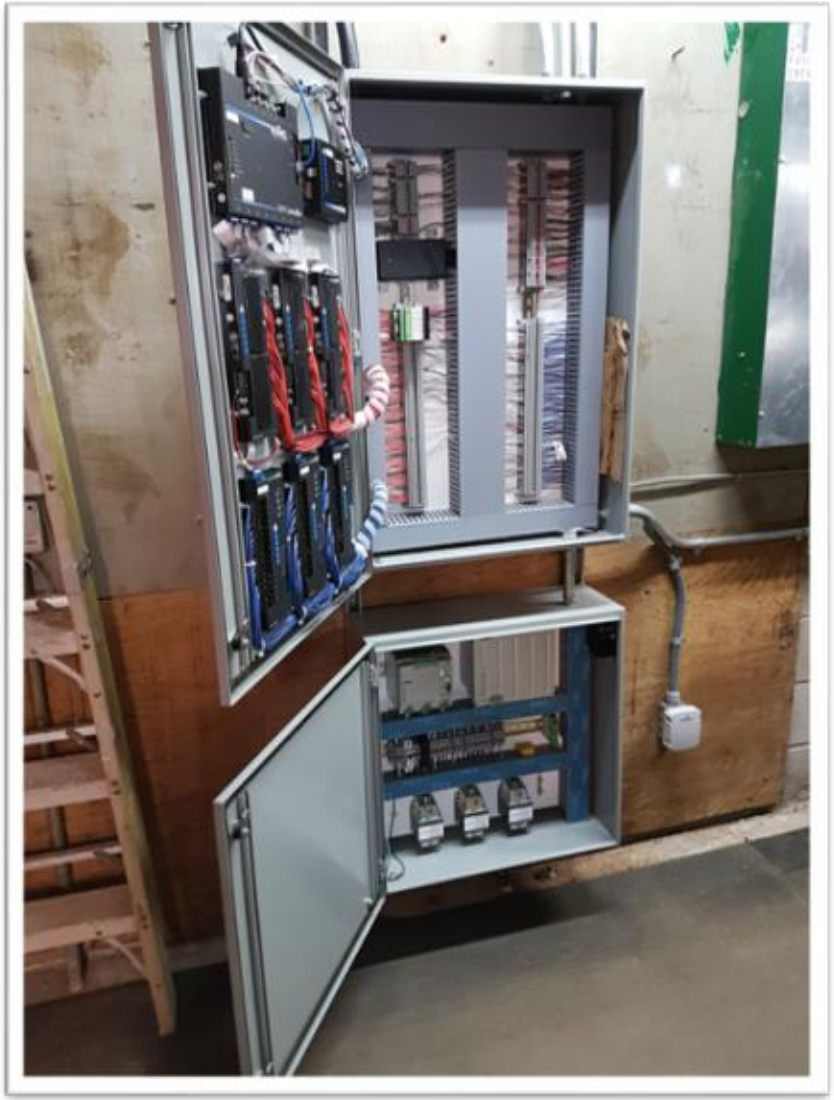


# Smart Energy Management (SES) System Controls

*Energy Management Controls tie it all together in a smart way*

*Various Platforms*
*International Base*
*Open Protocol – BACNet/Modbus*
*=>CFR 21 Part 11, etc.*

- TRAK Software platform that controls the Smart Energy System and other items as required.
- Monitors power and energy use. Manages for optimal system performance in the most even and energy-efficient way possible.
- Data trending and analytics capable for precision environments (*temperature, humidity, air circulation and changes, VOCs, radon, water, hydroponic nutrients, plant transpiration rates, substrate volumetric water content and electrical conductivity, lighting spectrum and intensity, etc.*).
- Remotely accessed for off-site management with 24/7 notification.

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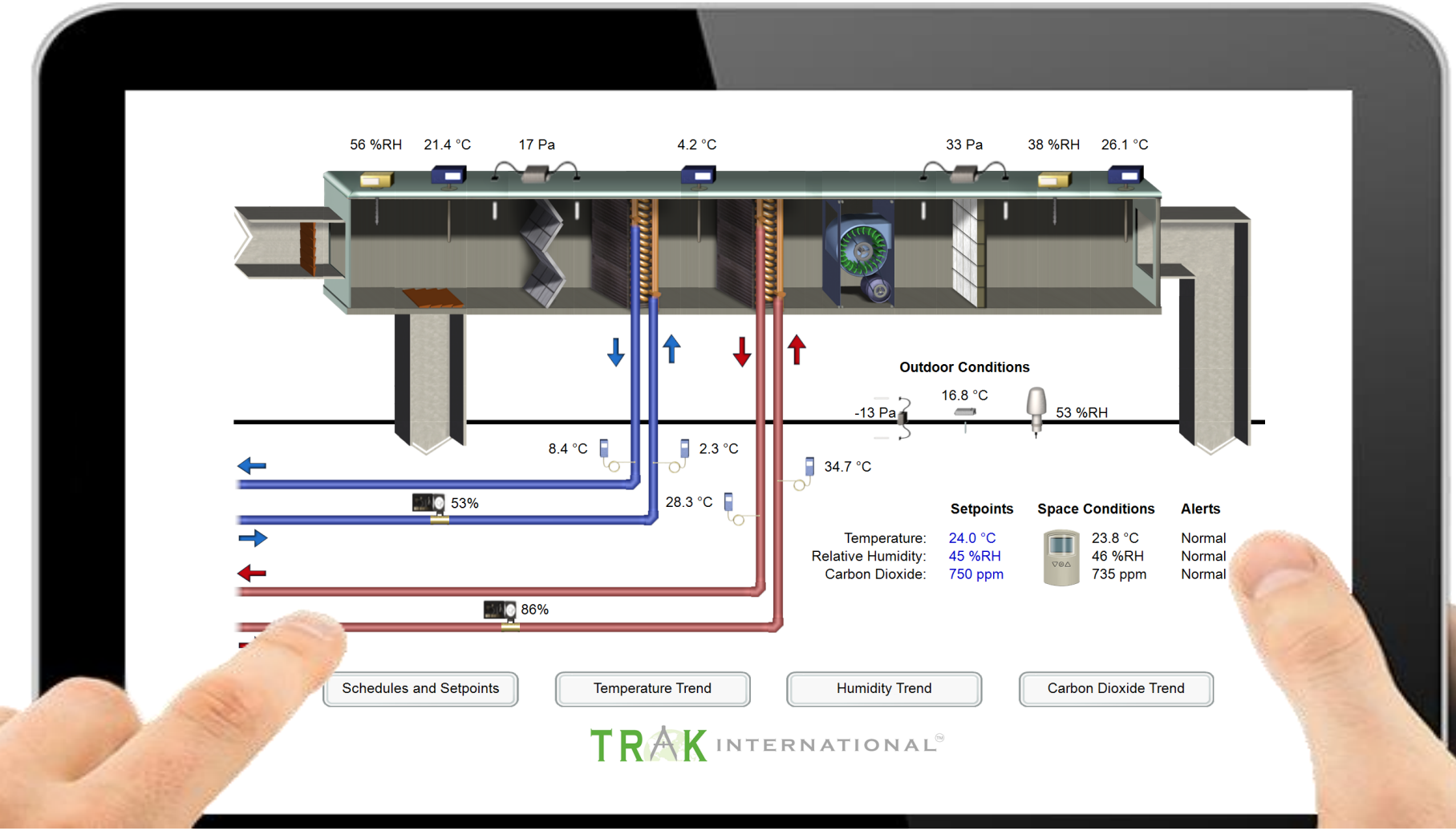
TRAK

# Smart Energy Platform

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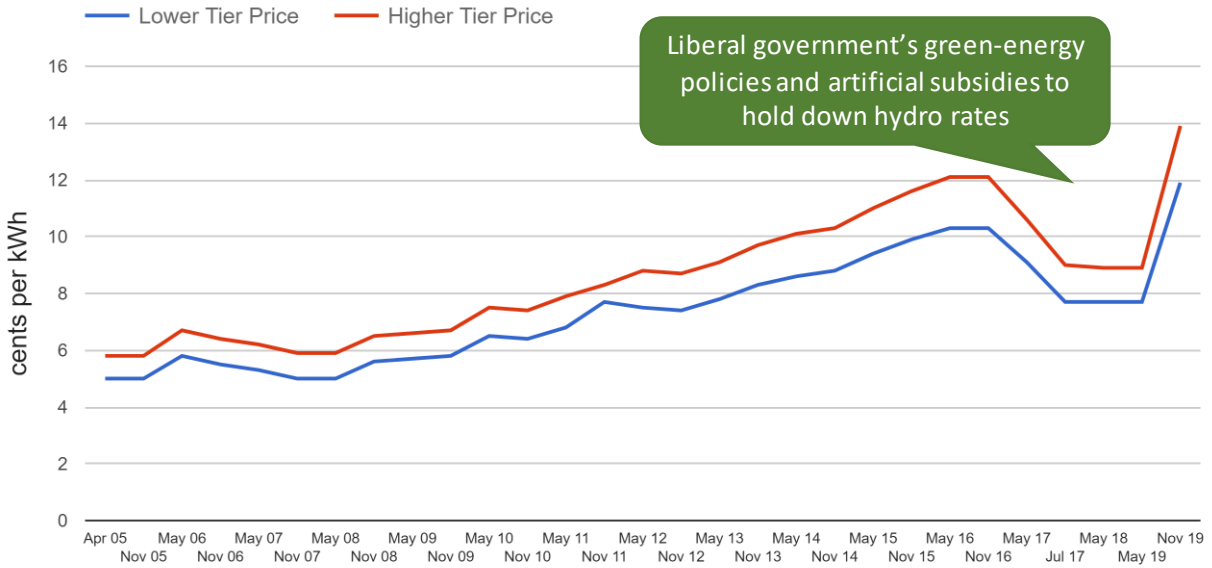
# Ontario Historical Electricity Rates

Ontario has some of the highest and fastest growing industrial and residential electricity costs in North America (Boston & New York).




The Historical Blended Hydro Rate per the Ontario Energy Board Regulated Price Plan (RPP) increases as shown in *Figure 7-4* have far outpaced our annual inflation rate[1]. "*During the past 8 years the cost of hydro in Ontario has increased by 140%, hurting consumers and crippling businesses*"[1]

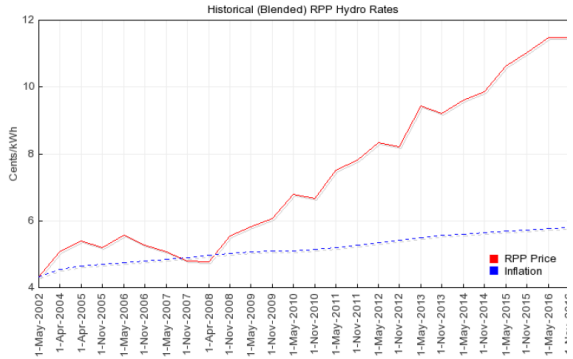
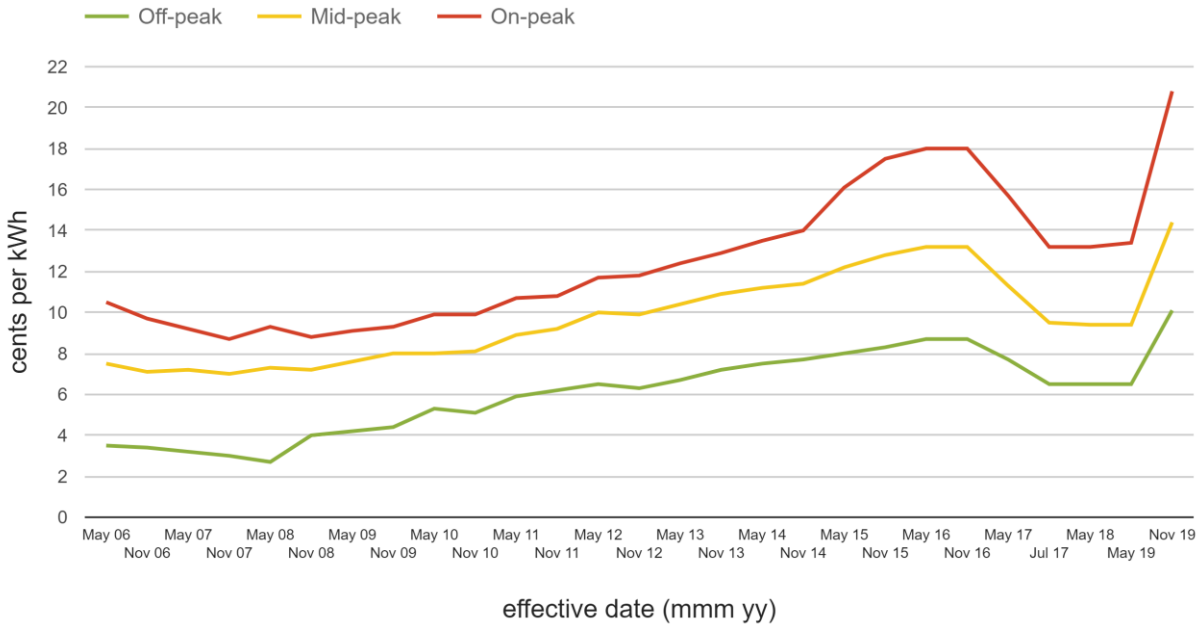



**Figure 7-4 Historical (Blended, Ontario) Regulated Price Plan**
([1]Ref Ontario Hydro: http://www.ontario-hydro.com/historical-rpp-rate).




TRAK INTERNATIONAL™




Kapuskasing Sports Palace

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