



# SWITCH POWER

2019 ARCTIC DEVELOPMENT EXPO

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# ELECTRICITY

## SUSTAINABLE POWER GENERATION IN THE ARCTIC

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# AGENDA

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- 1. Introduction**
- 2. Arctic Energy Paradigm Shift**
- 3. Solution, value proposition & process**
- 4. Case study: Sanikiluaq, NU**
- 5. Mining**
- 6. Q & A**





# SWITCH

## THE WAY WE THINK ABOUT POWER

Sustainable power is our mandate and creates the foundation of the three pillars we strive to achieve in every project: how do they impact our environment, are they economical and based on market fundamentals, and do they benefit our counterparties?.

We develop, build, own, and operate sustainable energy power generation projects, consisting of distributed energy resources; wind, solar, battery storage, and thermal generation, bundled with an innovative energy management system.

# THE ARCTIC ENERGY PARADIGM SHIFT

## Energy Poverty

68% of energy is imported to the north (YE 2016). Flight of wealth from Arctic.

## Individual approaches to Energy Supply

No scale approach to an effective energy solution

## Rising Concern around Climate Change

How do we get to 100% sustainable energy supply?

## Economic Development is tied to Energy supply

Increase in employment, lower cost of living and business operation

## A collaborative approach to scale

A migration to local operation, maintenance and ownership, with scale through modularity

**175% higher**

Average electricity prices in northern remote communities and mines are 30 cents per kWh compared to a national average of 12.9 cents

**34 times**

The GHG emission intensity for diesel versus wind in electricity generation is 34 times greater

**360**

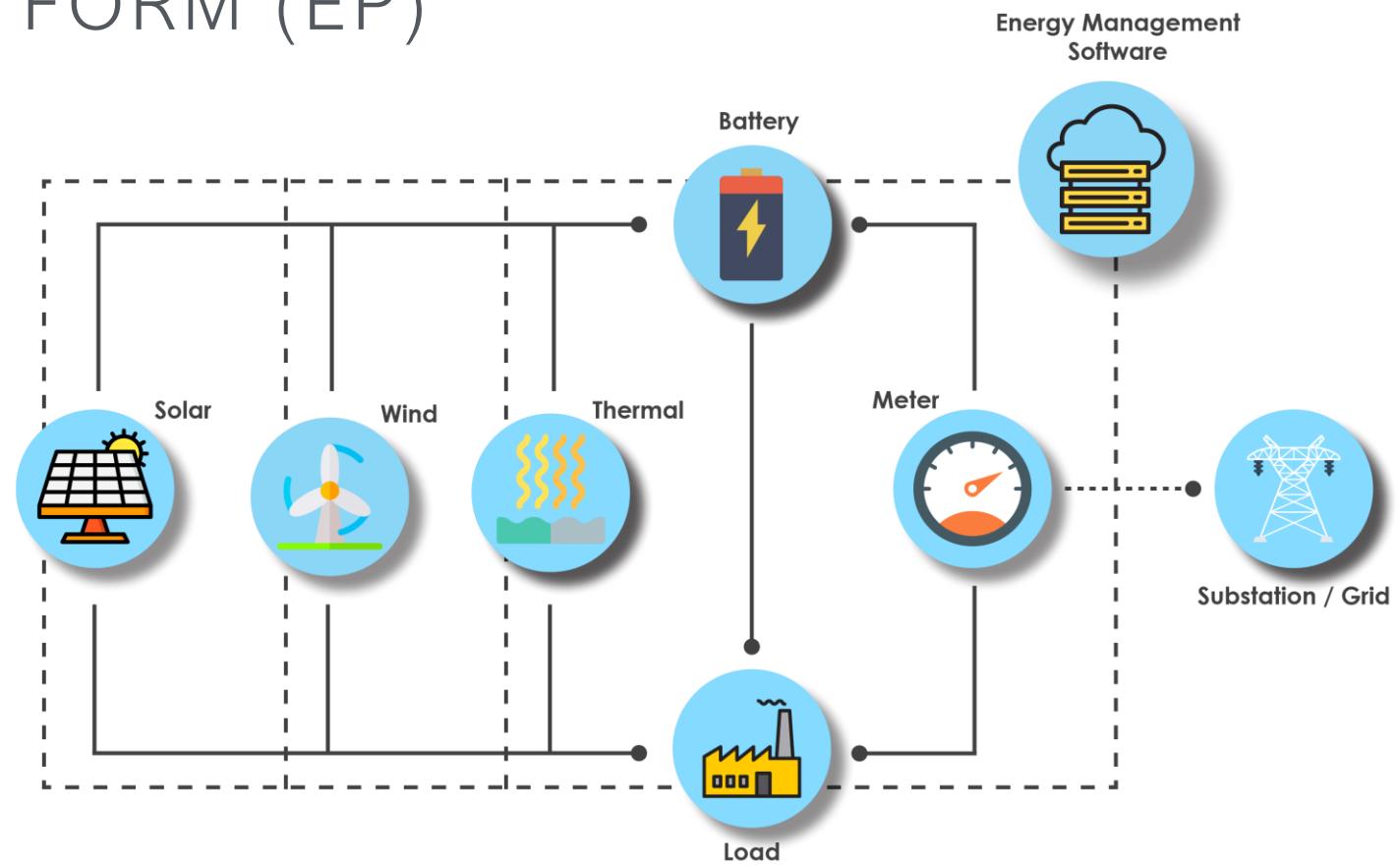
There are 360 remote communities across Canada that rely on diesel generation as their source of electricity

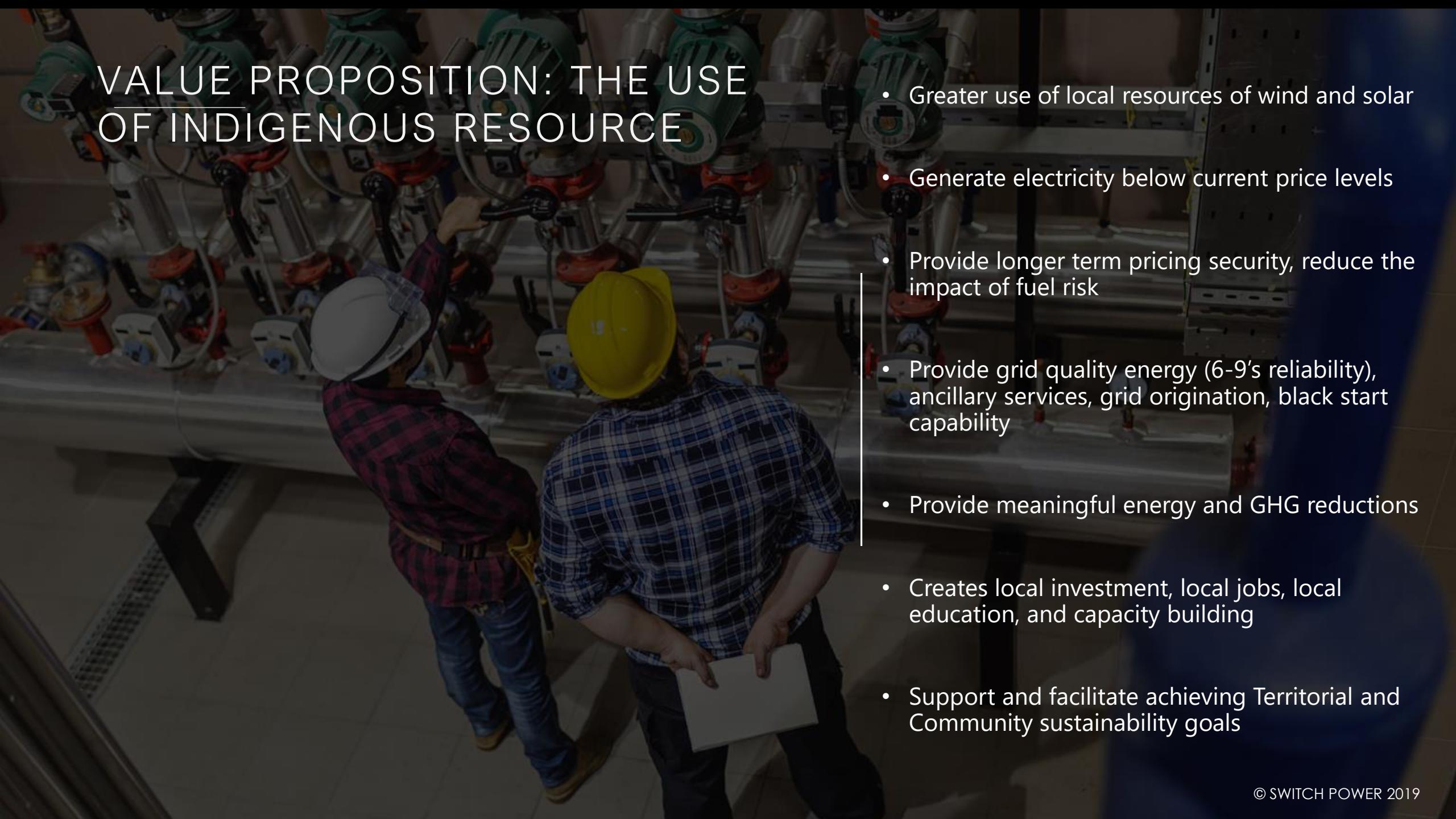
Renewable energy can grow the energy economy of Canada's Northern Territories coupled with focused local investment in projects, education and capacity building.

# MULTIGEN™ ENERGY PLATFORM (EP)

**MultiGen EP** incorporates renewable energy technologies (wind, solar, battery) with thermal baseload (gas, diesel) where required, utilizing an energy management software to innovatively meet customer electricity needs.

Switch Power has spent over 12 months validating various technologies, fostering relationships, and has secured best in class competitive supply and distribution agreements with technology providers well suited for our target markets and value proposition.

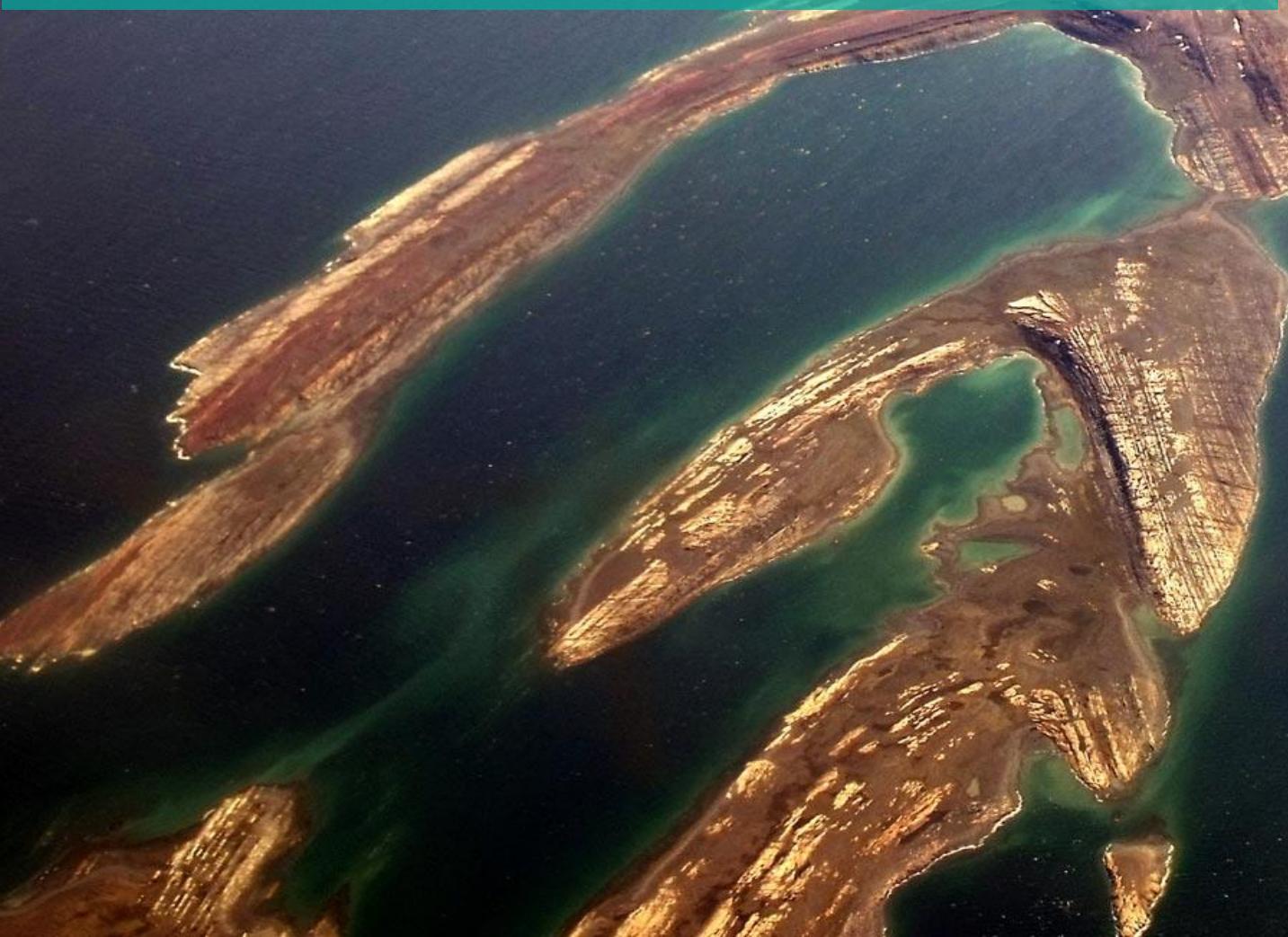




# VALUE PROPOSITION: THE USE OF INDIGENOUS RESOURCE

- Greater use of local resources of wind and solar
- Generate electricity below current price levels
- Provide longer term pricing security, reduce the impact of fuel risk
- Provide grid quality energy (6-9's reliability), ancillary services, grid origination, black start capability
- Provide meaningful energy and GHG reductions
- Creates local investment, local jobs, local education, and capacity building
- Support and facilitate achieving Territorial and Community sustainability goals

# CASE STUDY – SANIKILUAQ, NU



## Overview

Population 856

9921.47 kWh daily

Peak load of 1072 kW  
and hourly average of  
447 kW

Modelled using an  
adaptive version of the  
HOMER Grid Software

QEC Cost of Energy is  
escalating at 5% per  
year

## Solution

17 kw PV, 35 25kw  
turbines, 8  
100kw/400kwh flow  
batteries

83% RE penetration

Extend life of existing  
diesel generation by 10  
years

## Outcome

Anticipated savings  
of 27%, or \$10M in  
electricity costs over  
20 years

Reduction in  
 $\text{CO}_2\text{e}/\text{tonnes}$  per  
year from 2.42 to 0.63

1 FTE operation job,  
10+ construction jobs.



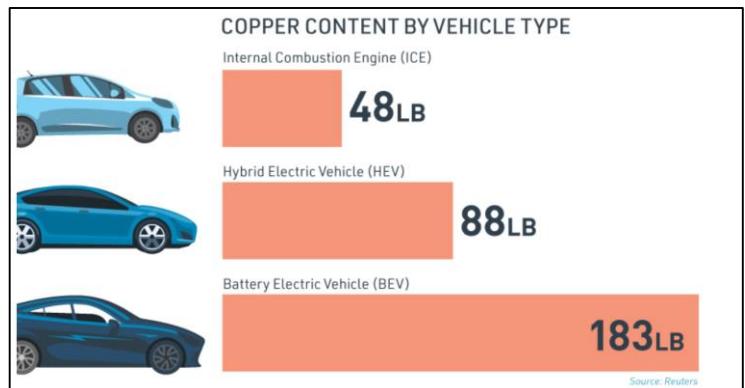
# MINING ECONOMIC DEVELOPMENT AND ELECTRICITY



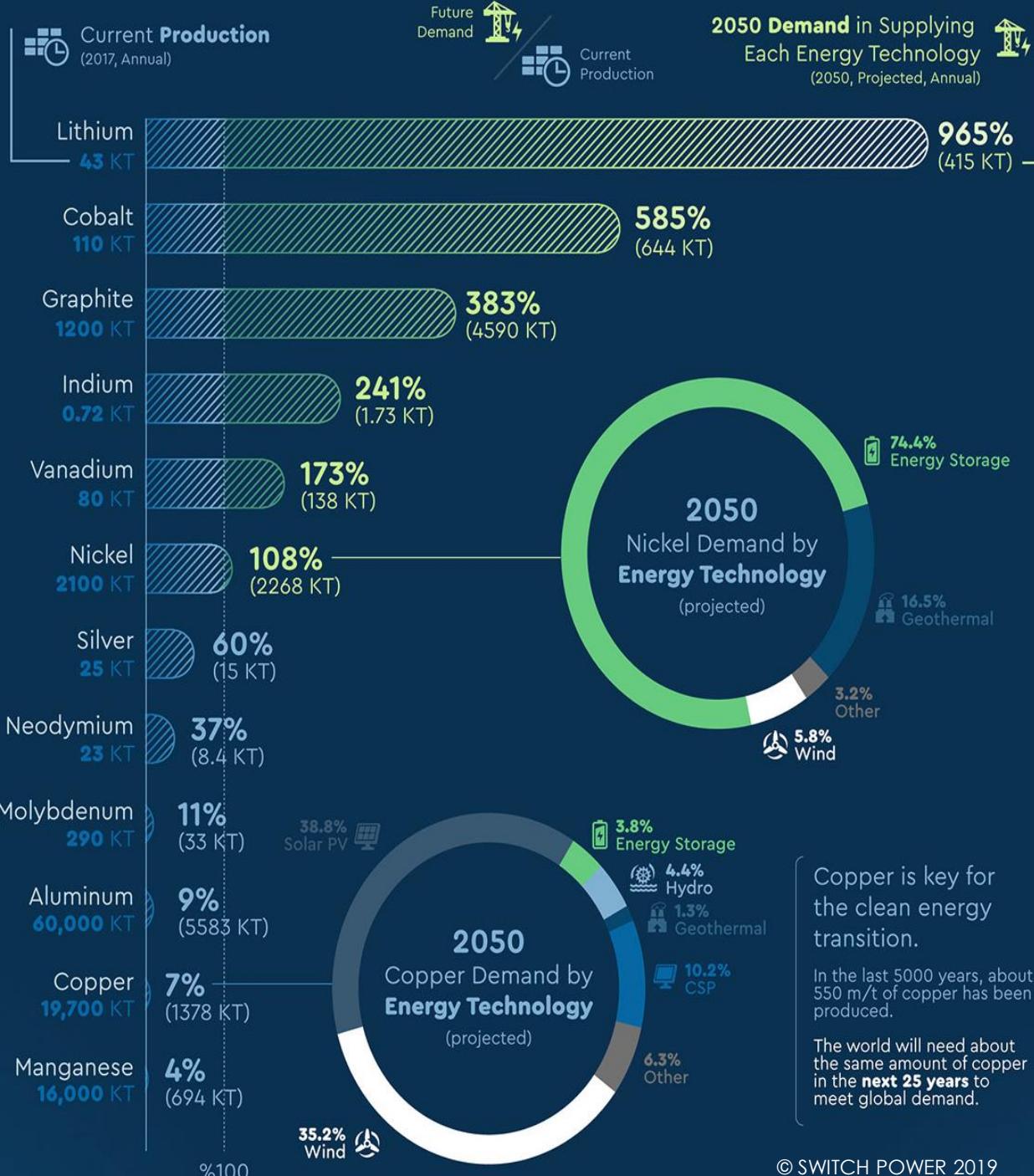
# MINING AS A DRIVER TO SUSTAINABLE DEVELOPMENT

## Mining is Critical for Our Current Lifestyle and Is Necessary for The Transition to Cleaner Energy

- Anything that cannot be grown has to be mined
- Cars, cell phones, electricity, plumbing, jewelry, tvs, zippers, snowmobiles, vitamins, health and beauty products, fertilizers for mass food production, surgery equipment, guns for hunting, pots and pans, buildings (concrete, steel, copper wire).....
- Commodities required for electrification and tackling climate change require more metal - Electric cars, solar panels, energy storage and wind turbines require more metal



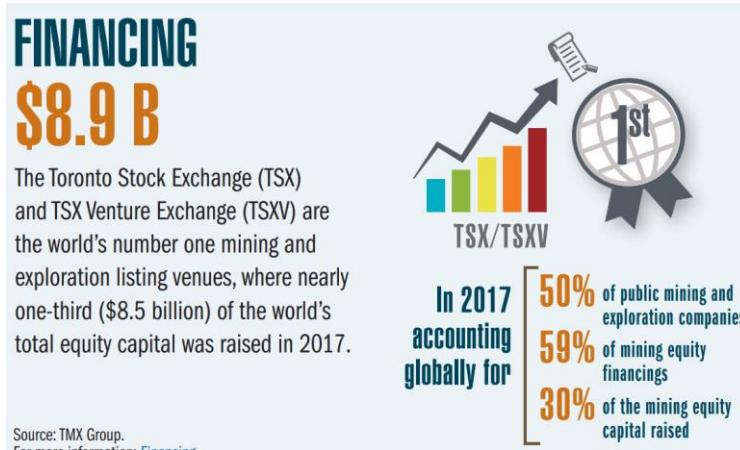
From Climate Smart Mining: Minerals for Climate Action. World Bank. March 2019



# MINING – CANADA'S POTENTIAL GLOBAL INFLUENCER

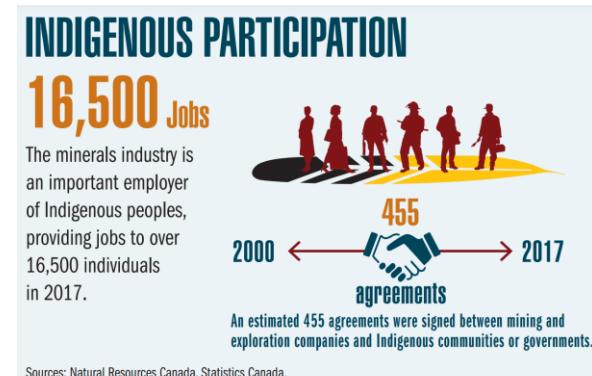
## Canada is a Leader in Global Mine Investment and Development

- As of April 2019, there are 1,169 publicly traded mining companies in Canada on the TSX and TSX-V, mainly headquartered in Toronto and Vancouver – 50% globally, operating and exploring globally



## Mining Can Drive Sustainable Development that Benefits Communities

- Mines require community support for exploration, development and uninterrupted operations
- Mines provide direct jobs and procurement contracts for goods and services (local and global suppliers)
- Mining companies support community programs and infrastructure development



# POWER AT MINES

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## Mining Is Not Easy

- 10 to 15 years from discovery to operation – no revenue!
- Requires significant infrastructure – power, water, rail/shipping/trucking, processing plant, tailings storage
- Financing is always a concern
- Extracting economic ore is challenging – does the ore match the guesstimate of the ore body (location, grade, dilution)? Is the recovery from the mining method and processing plant as expected? Are commodity prices still favourable? Has the political situation changed?
- The near surface, easy to find, high grade deposits with nearby infrastructure in favourable jurisdictions are already found

## Power Intensity

- Mines use about 10% of the world's power
- Power can be 10 to 30% of operating costs
- Mines are striving to be more energy efficient BUT lower grade ore requires more power to recover, electrification requires more power, more remote mines require more power for logistics
- Remote mines have traditionally used 100% diesel for power – shipped or trucked to site, sometimes over borders, sometimes only seasonally, sometimes facing theft or bribes to access; with volatile prices
- Example – Diavik diamond mine in NWT: in 2012 used 50 million litres of fuel transported over a 353 km ice road each winter, costing \$70 million

## Current Themes and Drivers at Mining Companies

- Sustainability
- Social License to Operate
- Diversification and Inclusion
- Innovation and Disruption – including operating and energy efficiencies
- Access to Capital – now investors have carbon footprint targets

# HYBRID RENEWABLE POWER – THE STRATEGIC ROLE

## Renewable Power = An Enabler of Mine Development and Sustainability

- Canadian mining companies can play a strategic role in promoting global positive sustainable development that benefits the communities by adding renewable power, as part of a holistic Sustainability program.
- Applicable to: existing mine operations, mine expansions, new mine development, and during remediation at mine closure (community legacy)

## Economics

- Adding some % of renewable power (solar, wind, energy storage, controls) improves economics (NPV, LCOE) and reduces carbon footprint
- Economics are usually calculated by measuring an offset in diesel and lower operations & maintenance vs the increased capex
- BUT – harder to put numbers on the social and environmental benefits; evolving carbon taxes; the security of power supply; the reduced wear & tear on fuel generators, reduced access to winter roads for trucking fuel..... And often mine lives are longer than anticipated (5 + 5 + 5 yrs...)

## Challenges of Adding Renewable Power => Myths!

- Mines require 24/7 uninterrupted power – ok – hybrid power
- Renewable power is not economic – wrong; even over short mine lives of 5 years, it is economic
- Financing is hard enough, we can't add to capex – wrong; actually can reduce the capex of the entire power project with a PPA
- The technology is not advanced enough, especially in arctic conditions – wrong; technologies have been proven commercially and are evolving
- Renewable Power doesn't work in the Arctic – wrong

## Actual Challenges of Adding Renewable Power

- Lack of knowledge and expertise for power at mining companies
- Lack of resources by mine operators (time, knowledge, capital) to assess hybrid renewable power
- Lack of financing
- Solution... Collaboration, knowledge sharing, IPP/Power Developers

Diavik wind farm: 9.2 MW (10% of power) at a cost of \$31 M in 2012 (8 year payback)

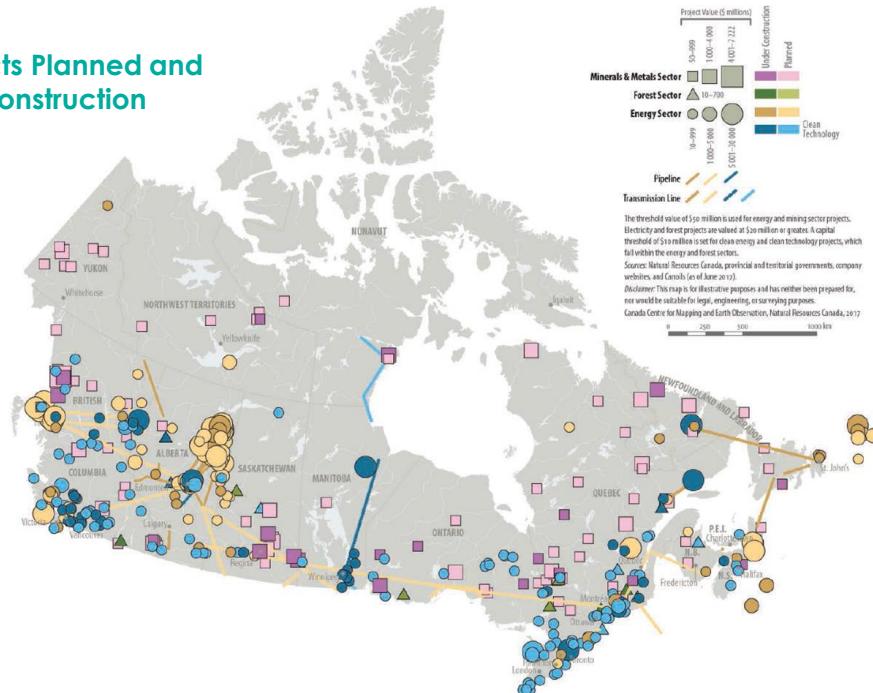
- 50 million litres of fuel transported over 353 km ice road each winter, costing \$70 million annually
- Wind saves \$5 M per year, 3.8 M liters of fuel or 65 truck loads

# DIESEL POWER & MINING DISTRICTS IN CANADA

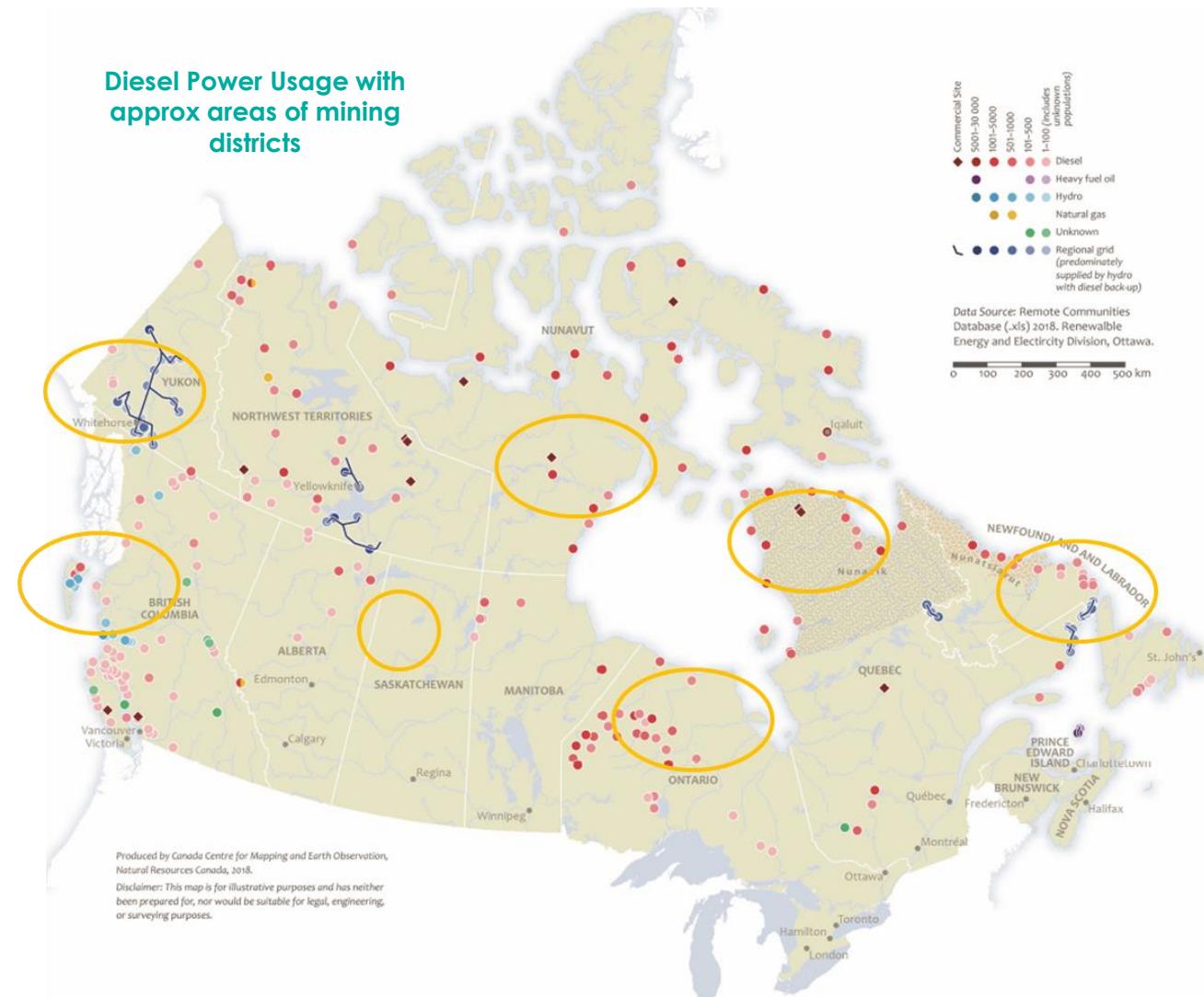
## Opportunity to Reduce Diesel Dependence

- There are many known and emerging mining districts in Canada and Alaska – many remote, many using 100% diesel
- Operating mines are expanding and require more power
- Developing mines and their EPC/M partners have been negligent in including hybrid power options in Feasibility Studies or Procurement during construction
- Adding renewable power can make financing, permitting, community support easier and mines more profitable

## Major Projects Planned and Under Construction



Diesel Power Usage with approx areas of mining districts



From Natural Resources Canada publications



creating change  
through collaboration

## QUESTIONS AND ANSWER SESSION

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