



SKILLS TRAINING FOR THE FUTURE

# bridging the gap

Preparing the Next Generation of Workers  
for a Safe Adoption of BEVs in the Mining  
Industry

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Canadian labour market studies project that **25%** of the current mining workforce will retire and roughly **80,000 workers** will need to be hired **before 2030**

## Other factors:

- Constantly evolving technologies
- Mining sector will have to compete with other sectors
- Current workforce must upskill to meet the industry's needs



**Over 50%** of organizations indicated that the **talent gap** is hampering their digital transformation (Capgemini Digital Transformation Institute / LinkedIn research study, 2017)

The market for BEVs within the mining sector has increased rapidly, and with BEVs now considered **proven technology**, it has led mining operations to accelerate its adoption

## Key Priorities



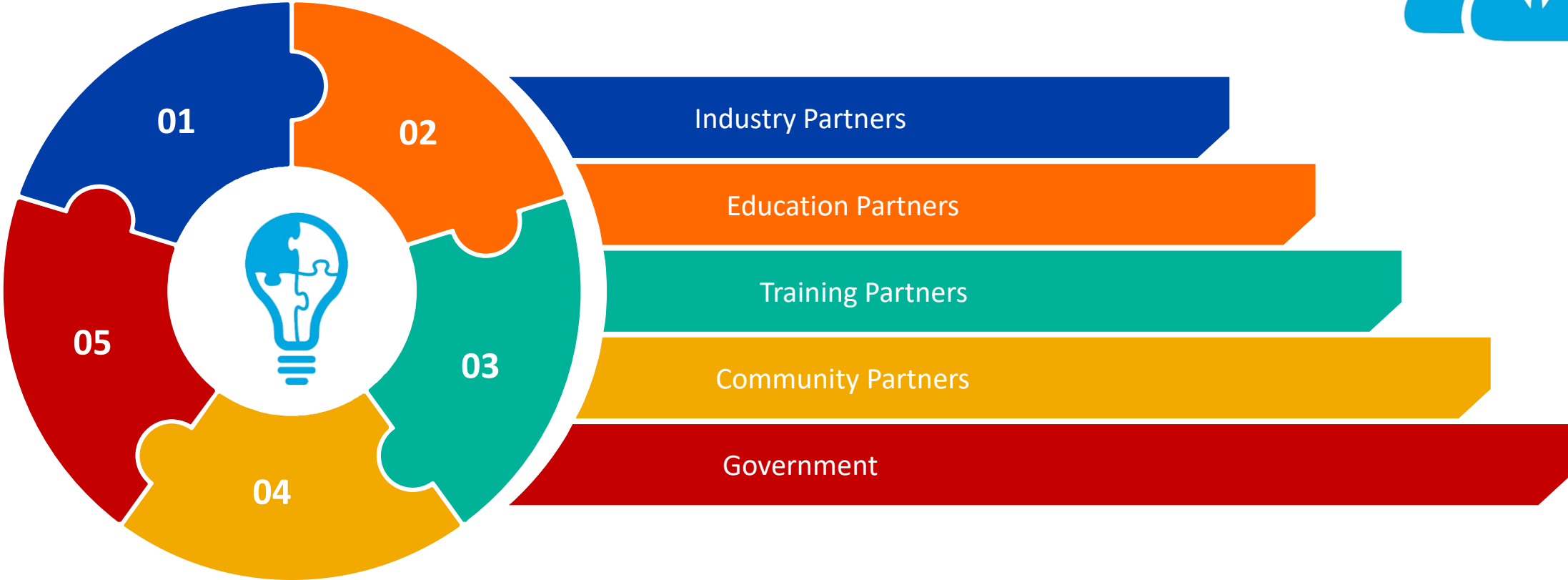
Stakeholder  
Collaboration



Change Management



Education



In July 2022 – the Federal Economic Development Agency for Northern Ontario (**FedNor**) announced an investment of **more than \$2 million dollars** to position Greater Sudbury as a **hub** for Battery Electric Vehicle **expertise**



- Cambrian College received funding to establish a BEV lab within its Centre for Smart Mining
- NORCAT to procure and deploy a battery-electric load-haul-dump (LHD) machine and implement corresponding infrastructure

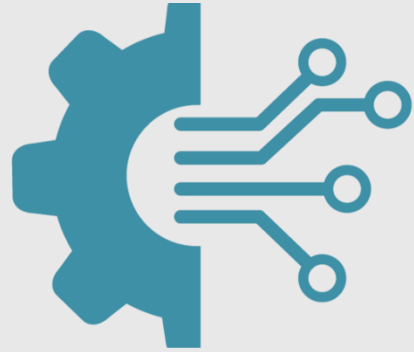
- Core5 aims to develop an ecosystem that will enable the rapid development, testing, validation and ultimately, commercialization of industrial BEV and EV technologies across the value chains.
- Core5 is focused on critical mineral extraction by leveraging unique assets, resources, and service offerings from partners across Northern Ontario.
- Specifically, our strategy for the Northern Ontario RTDS aligns closely with Ontario's BEV / automotive strategy and with the direction of Ontario's critical mineral strategy.

## CORE

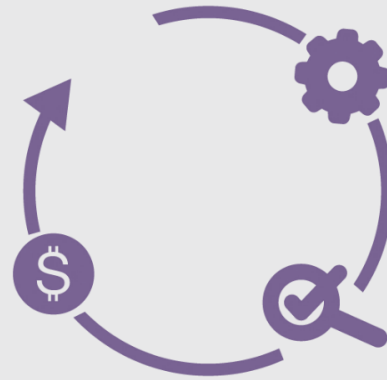


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Open Innovation  
Ecosystem



Development, testing  
and demonstration/  
commercialization of  
technology



Regional Innovation  
Centre Services &  
Resources



## Open Innovation Ecosystem

An online technology platform / global marketplace that connects the builders and buyers of innovation alongside other key stakeholders to help identify and accelerate the;

- Development
- Testing
- Deployment of solutions to address the challenges and opportunities facing Ontario's BEV supply chain.





## Open Innovation Ecosystem

The five key regions will be responsible for building a BEV/EV ecosystem for their respective region.

The ecosystem will host an inventory of:

- Available supports
- Key contacts
- Main challenges, gaps & needs/wants
- Technologies & potential solutions





## Development, Testing and Demonstration/Commercialization of Technology

We will provide access to;

- Resources
- Specialized Equipment
- Infrastructure
  - Cambrian College
  - Canadore College ICAMP
  - Northern College IHUB
  - NORCAT Underground Centre





## Regional Innovation Centre Services

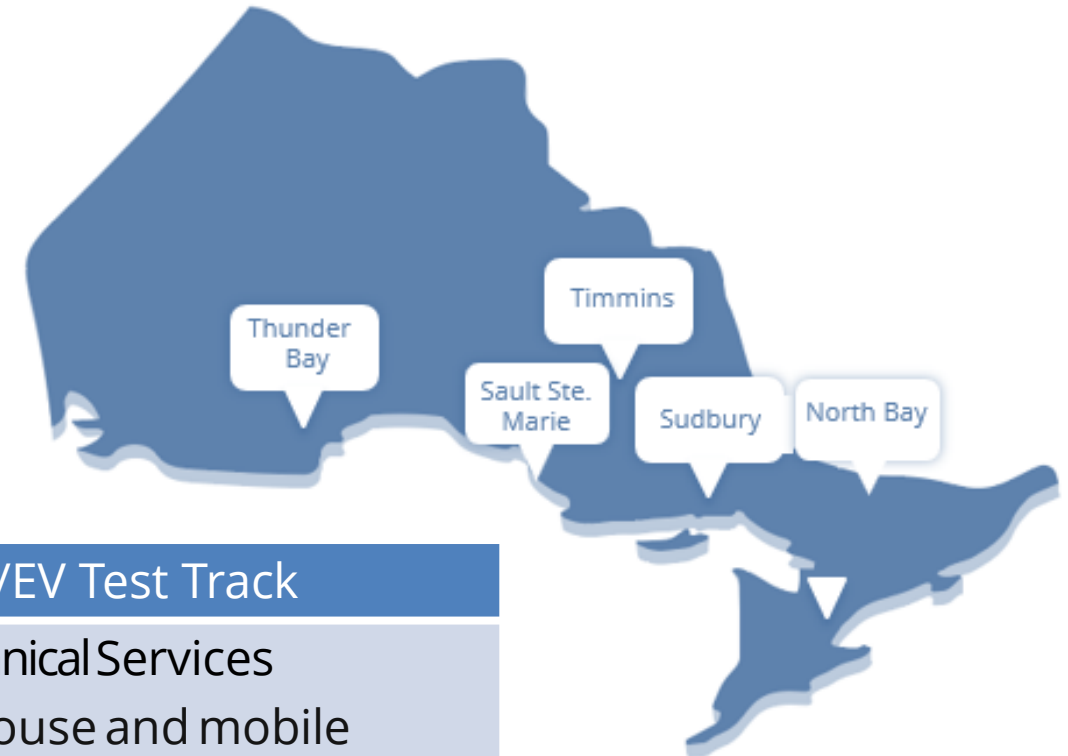
We will provide startups and SMEs with access to the key resources and connections they need to grow & Scale

1. Advisory & Mentorship Services
2. Co-working Space
3. Education and Workshops
4. Capital Services / Access to Investors
5. Networking Events & Buy / Sell Days



## Partners:

- NORCAT
- Cambrian College
- Canadore College
- IION (Innovation Initiative Ontario North)
- Timmins Economic Development Corporation
- Economic Development Sault Ste. Marie



## Some Available Resources:

5G Connectivity	Operating Mine	BEV/EV Test Track
Battery Electric Vehicle Lab AC and DC charger testing	Advanced Manufacturing Prototyping Lab	Technical Services In-house and mobile technical services
Chemical Analysis	Over 70,000 sq.ft of Lab Space	Jet Fusion Colour 3D printer

As mining continues to **evolve** and continues to involve more automation, electrification and digitalization – some organizations are experiencing **change fatigue** – shifting ways of working requires careful and calculated **introduction of technology** into daily operations and into the workforce’s daily tasks



**Adoption is only possible through effective change management**

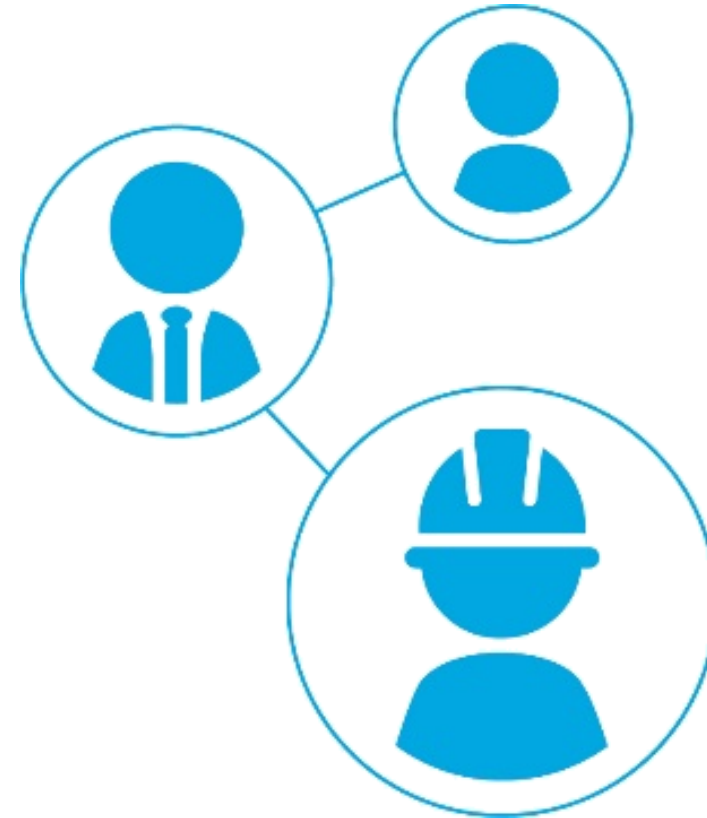
## Change Fatigue

- Change fatigue is a function of two variables – change capacity and change disruption
- Change capacity - affected by culture, history, structure, perceived need for change and change management competency
- Change disruption - affected by the number of changes going on and the disruption that each one causes
- Many organizations are feeling saturated right now with change – pandemic-related changes, industry changes, uncertain economy, growing pressure for organizations to change in order to survive



## Challenges of implementing technology

- Lack of senior management support
- Lack of a communication plan
- Not communicating to all stakeholders
- Lack of attention to training
- Not training all stakeholders
- Leaving training at all levels to vendor



## Effective Change Management

- Leadership support
- Worker involvement
- Organizational support
- Training
- Procedures
- Risk Assessments





## Effective Change Management

- Leadership support
  - Understand the mine's current initiatives and programs, and the rationale for them
  - Must embrace change
  - Communicate positively
  - Empathy - understanding how the change affects all levels of the organization and to what extent
  - Identify your stakeholders and involve them in the process



## Effective Change Management

- Worker involvement
  - Have workers involved in the solution
  - Identify your change agents and squeaky wheels
  - Impacted operators and maintenance personnel must be in the know



## Effective Change Management

- Organizational support
  - Organizations should adopt an integrated change perspective – communications, education, training, and stakeholder impacts
- Communication plan
  - Provide the reasons for change
  - Include “WIIFM” answers
  - Use face to face communication
  - Repeat key messages
  - Create opportunities for participation



## Effective Change Management

- Training
  - Establish training requirements
    - What type of equipment?
    - Who needs training (operators, mechanics, etc.)
    - What kind of training
    - Emergency response
  - Worker education around BEVs, how it can improve worker safety, lower costs and reduce emissions, is just one of the many strategies when shifting to an electric mine and workers embracing the benefits of BEVs
  - Change can be hazardous when not communicated properly



## Effective Change Management

- Procedures
  - Effective communication and evaluation of these policies/procedures across the organization:
    - Inspection
    - Startup/shutdown
    - Operation
    - Charging procedure, charging stations
    - Storage for batteries
    - Emergency procedures
    - Maintenance activities



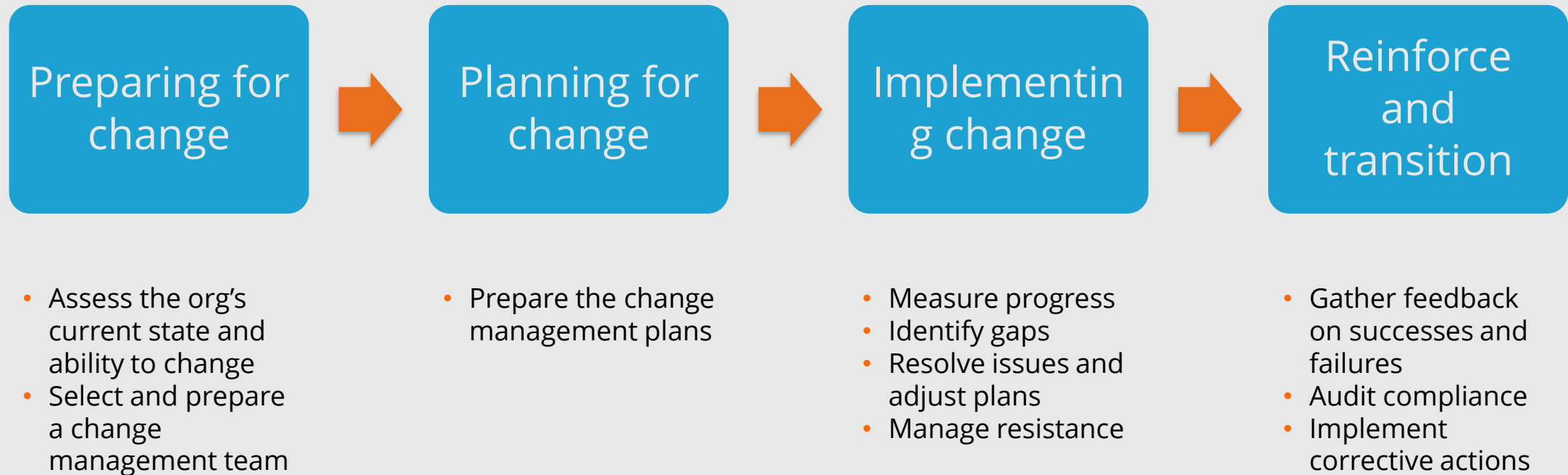
## Effective Change Management

- Risk Assessments
  - Financial risks
  - Production risks
  - Health and safety risks
  - Environmental risks





# Framework for Mining Technology Change



McCarthy, B. (2016). International Mine Management Conference

## Challenges of Training on BEVs

- Lack of existing knowledge on BEVs in the workforce
- Lack of experience on BEVs
- Lack of training standards
- Development of new work practices, procedures
- Revise existing training packages
- Cost







## Training the Existing Workforce

- Training the existing workforce involves relearning principles
- Training must include:
  - Operating differences between diesel powertrain and BEV equipment
  - Safety concerns specific to BEV
  - Charging safety and procedures
  - Maintenance activities
- Cambrian College – Industrial Battery Electric Vehicle Maintenance Certificate Program





## Training the Existing Workforce

- Operational practices that will differ from a diesel equivalent include:
  - Inspection criteria
  - Start up procedures
  - Operator interface and alarms
  - Emergency procedures
  - Performance differences
    - Lower noise levels
    - Higher torque output
    - Higher maximum speed
    - Regenerative braking



\* Operational differences also exist among OEMs and models



## Training the Existing Workforce

- Training requirements should be tailored to each role
- Conduct a Training Needs Analysis

Role	Training
<b>Operators</b>	Training for battery user interface and charging
<b>Mechanics</b>	Non-electric components (e.g. hydraulic packs)
<b>Electricians</b>	Aptitude for instrumentation, additional personnel specifically trained for battery electric equipment (similar to instrumentation technologists)
<b>Remote service / Support</b>	Additional skillsets may be required when troubleshooting – perhaps direct toward OEMs and / or engineers
<b>Fuel / Charging</b>	All workers need to be trained to conduct the chosen charging method

Global Mining Guidelines Group, 2022

## Training the Existing Workforce

- Safety concerns specific to BEV
  - Fire
  - Electric shock
  - Arc flash
  - Battery user interface
  - Power and drive systems
  - Battery chemistry and safety
  - Charging systems
  - Machine-specific safety considerations



## Training the Existing Workforce

- Charging/Maintenance Safety
  - Static discharge
  - Faulty chargers
  - Over-discharge
  - Contamination from metal particulates
  - Heat-related battery failures
  - Cold temperature charging
  - Inappropriate charging



## Training the Existing Workforce

- Job planning
  - Trimming range or working time
    - Shorter than refuelling with diesel
    - Longer charge or battery swap time than refuelling with diesel



## Training the Existing Workforce

- Awareness
  - Changes to emergency protocols
  - Communication protocols due to the quiet operation of BEV
  - Handling and storage of batteries



## Training the New Workforce

- Requires a Different Approach
  - No established procedures to relearn
  - BEV integration into common core







## Training the New Workforce

### NORCAT Underground Centre

- #770010 Underground Hard Rock Miner Common Core
  - Module U0010 – Muck with LHD
  - Operator training
    - Pre-op checks
    - Safety
    - Machine components
    - Operational checks
    - Operation
    - Emergency procedures
    - Shutdown
    - Charging
- Introduction to BEVs





## Training the New Workforce

- Curriculum Development
  - Traditional in-class and in-the-field delivery methods
  - Take into consideration:
    - Applicable legislation
    - OEM specifications / operating instructions
    - SMEs
    - Site-specific procedures

## Training the New Workforce

- Train the Trainer
  - Prior to training the new BEV module(s) trainers will receive their own training to ensure:
    - They are comfortable with the subject matter
    - They understand the new training requirements



## Training the New Workforce

- Impact of Introducing BEVs During Common Core Training
  - Makes trainees more appealing to employers
  - Reduce onboarding training – speed up worker readiness
  - Workers enter the workforce aware of the benefits of BEVs and the importance of change



## NORCAT Underground Centre

- Future Developments
  - BEV simulator
  - VR circle check for a BEV
  - Use the FiAR for fire suppression



Our teams deliver innovative and **customized solutions** and **expertise** to create a positive and lasting impact.



 **NORCAT** SKILLS TRAINING FOR THE FUTURE

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