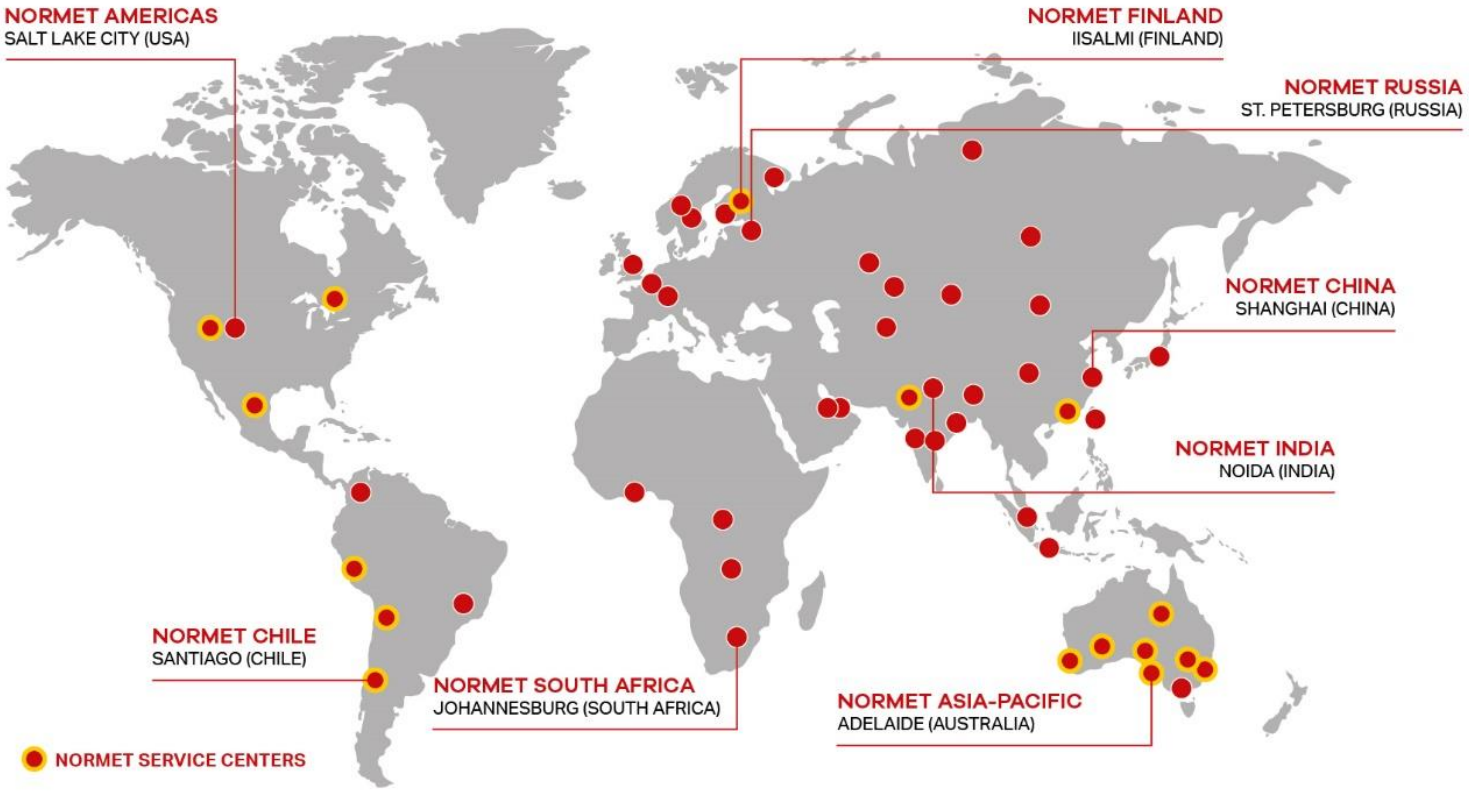
Sustainable Solution for Sprayed Concrete in Underground project

Sourish Nanda

DEFINING THE FUTURE UNDERGROUND

normet

AS GLOBAL AS POSSIBLE
AS LOCAL AS NECESSARY

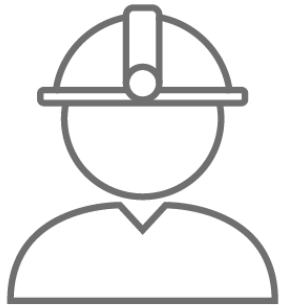


Normet has manufacturing facilities in:

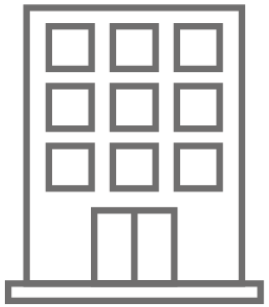
Finland
Norway
Sweden
United Kingdom
Switzerland
Indonesia
Taiwan
India
Australia
USA
Mexico
Chile

NORMET
IN NUMBERS

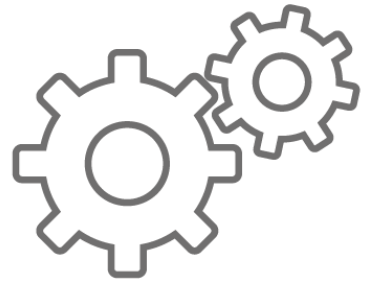
60 YEARS OF EXPERIENCE



~ 1 600 EXPERTS



~ 50 OFFICES



~ 14 000 MANUFACTURED MACHINES

NORMET HISTORY

1960 | 1970 | 1980 | 1990 | 2000 | 2010 | 2020

1962
Normet was founded (Peltosalmen Konepaja)

1972
Normet starts making mining machines and becomes Normet Oy

~1975
First explosives (anfo) charging machine PK1300

~1979
First dumper, PK 3000

1983
Normet's 1st spraying machine Normet RBY 800

1985
First emulsion charger

1989
First scaling machine

1990
Development of tunnelling equipment offering

1991
Multimec slide on and off cassette system

1995
Himec the lifting offering for tunnelling

2005
Normet Service

2008
NorSmart CAN control system

2010
Acquisition of TAM International
Basis for the construction chemical business

2013
Acquisition of Dynamic Rock Support AS
Basis for the rock reinforcement business

2019
SmartDrive & other new technologies launch at Bauma

2022
Acquisitions:
Aliva
Garock
Rambooms

Normet Supports numerous major tunnel projects worldwide

We believe project success is through early involvement and partnerships

The right underground equipment for the project

Through shared development, selection of the right construction chemical solutions

Local and reliable quality production and logistics – Chemicals and Equipment Spares

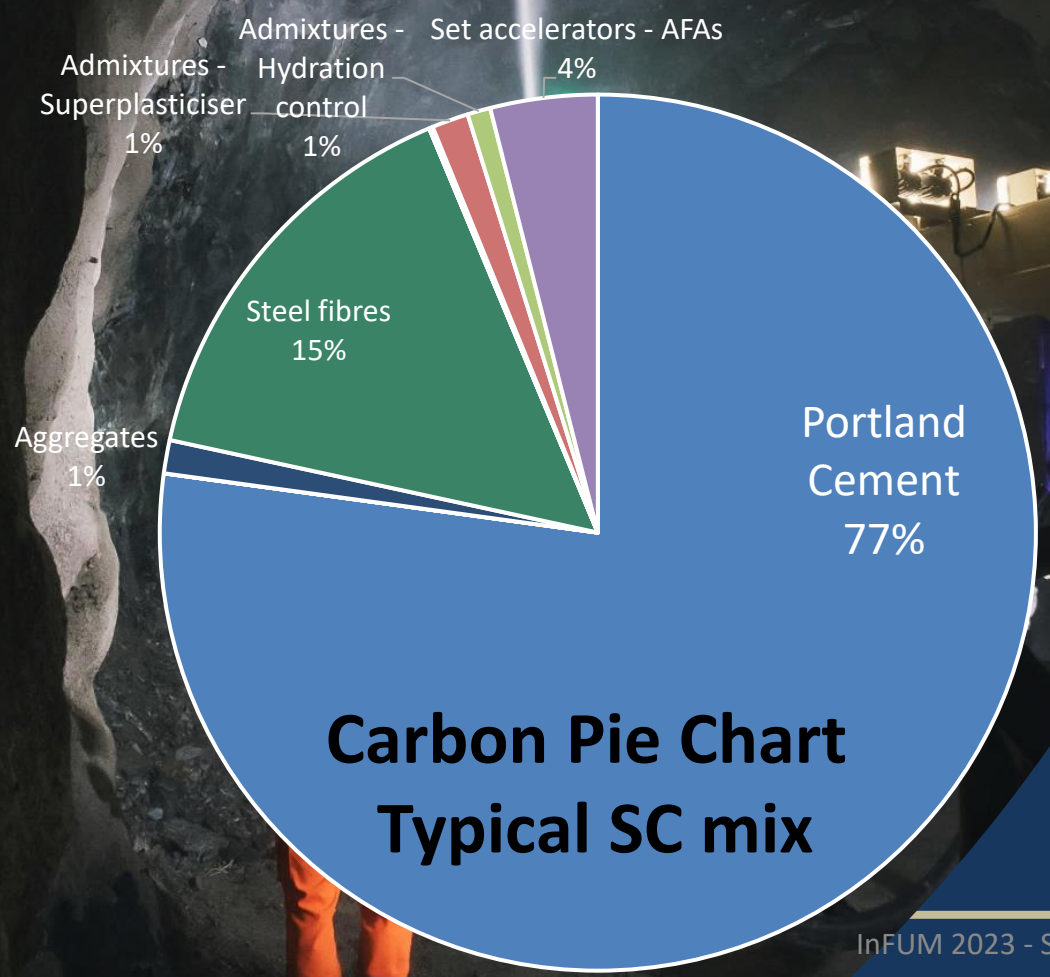
(An often integrated) Competent site support team

So, how can our industry help?

1 tonne of cement =
>1 tonne of CO_2

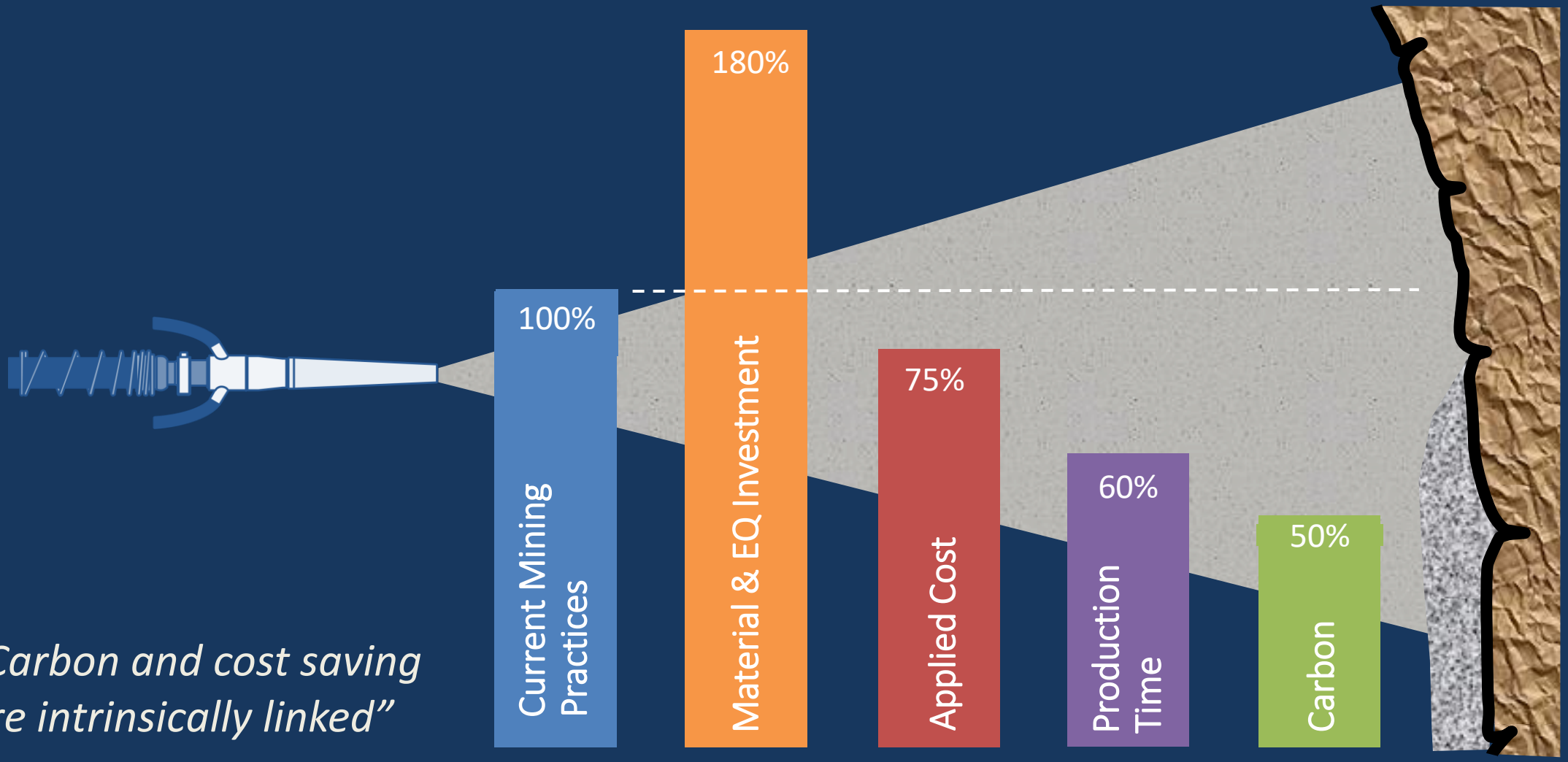
SUSTAINABLE SPRAYED CONCRETE PROCESSES

Sprayed concrete is quite carbon rich!



- High amounts of Portland Cement
- Steel girders and mesh
- Always applying more thickness than the design requirement
- Rebound from spraying
- Un-used batched concrete
- Diesel powered tunneling equipment

Invest in low carbon technology to make significant savings



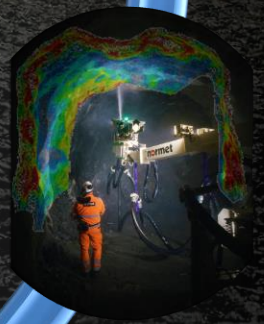
"Carbon and cost saving are intrinsically linked"

A Holistic Approach

Sustainable Sprayed Concrete

Lower carbon, higher performing sprayed concrete

Lower carbon tunnelling equipment



Efficiency using digital technology

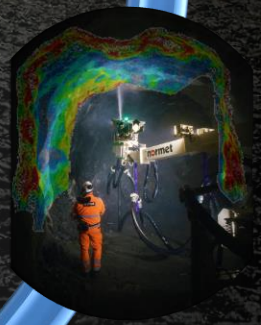
Improving sustainable practices

Low Carbon Sprayed Concrete

Sustainable Sprayed Concrete

Lower carbon, higher performing sprayed concrete

Lower carbon tunnelling equipment

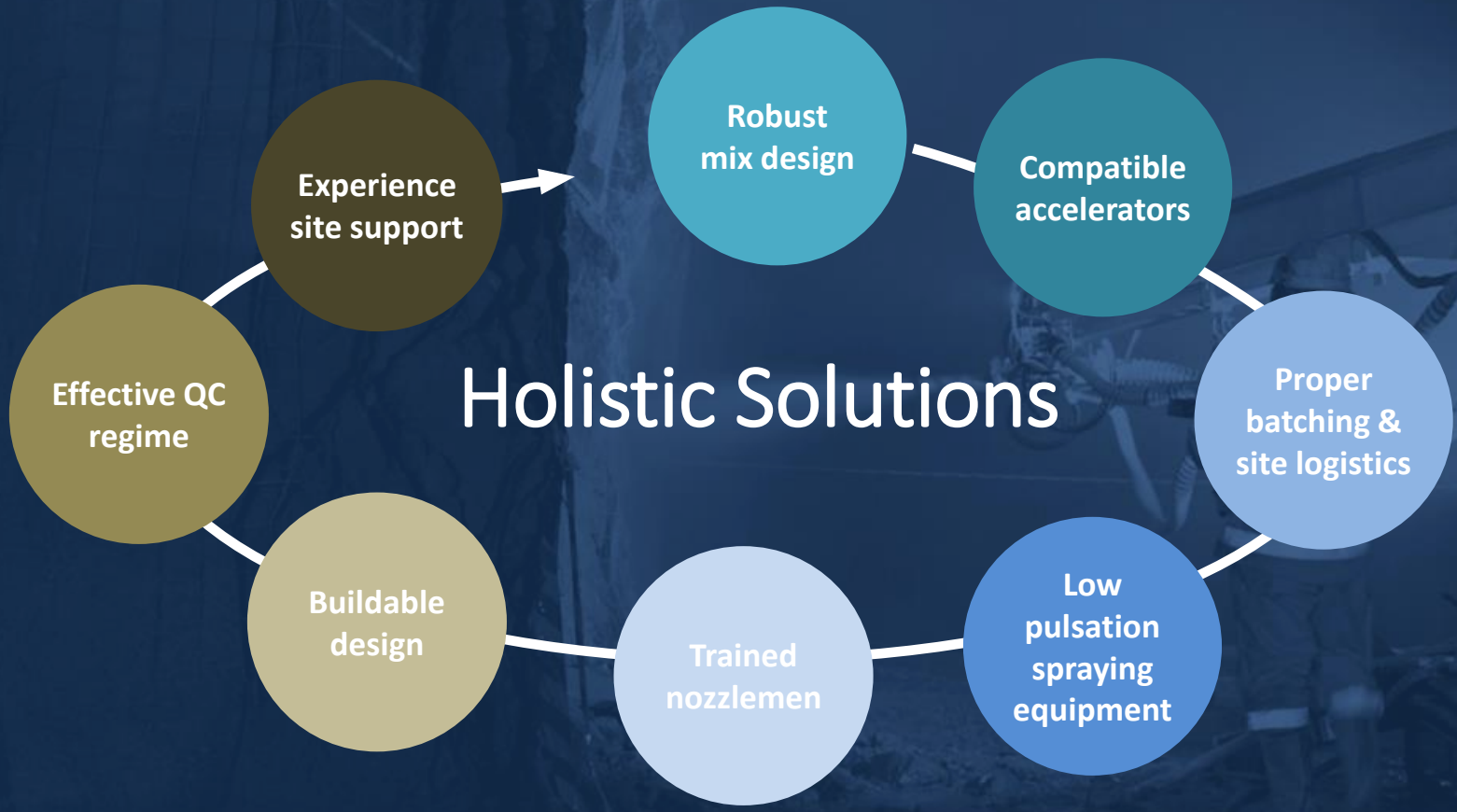


Efficiency using digital technology

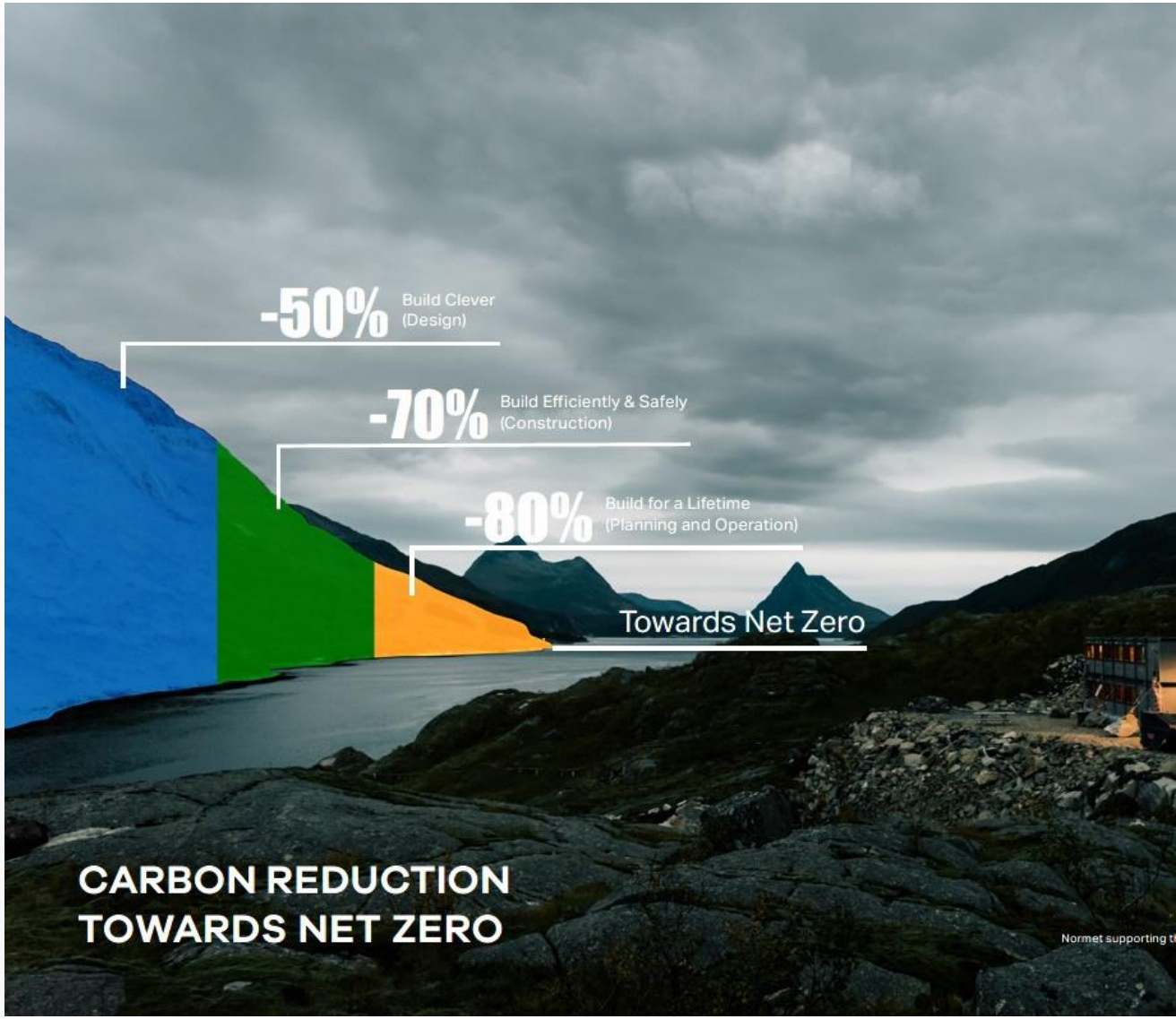
Improving sustainable practices

Sprayed concrete is concrete

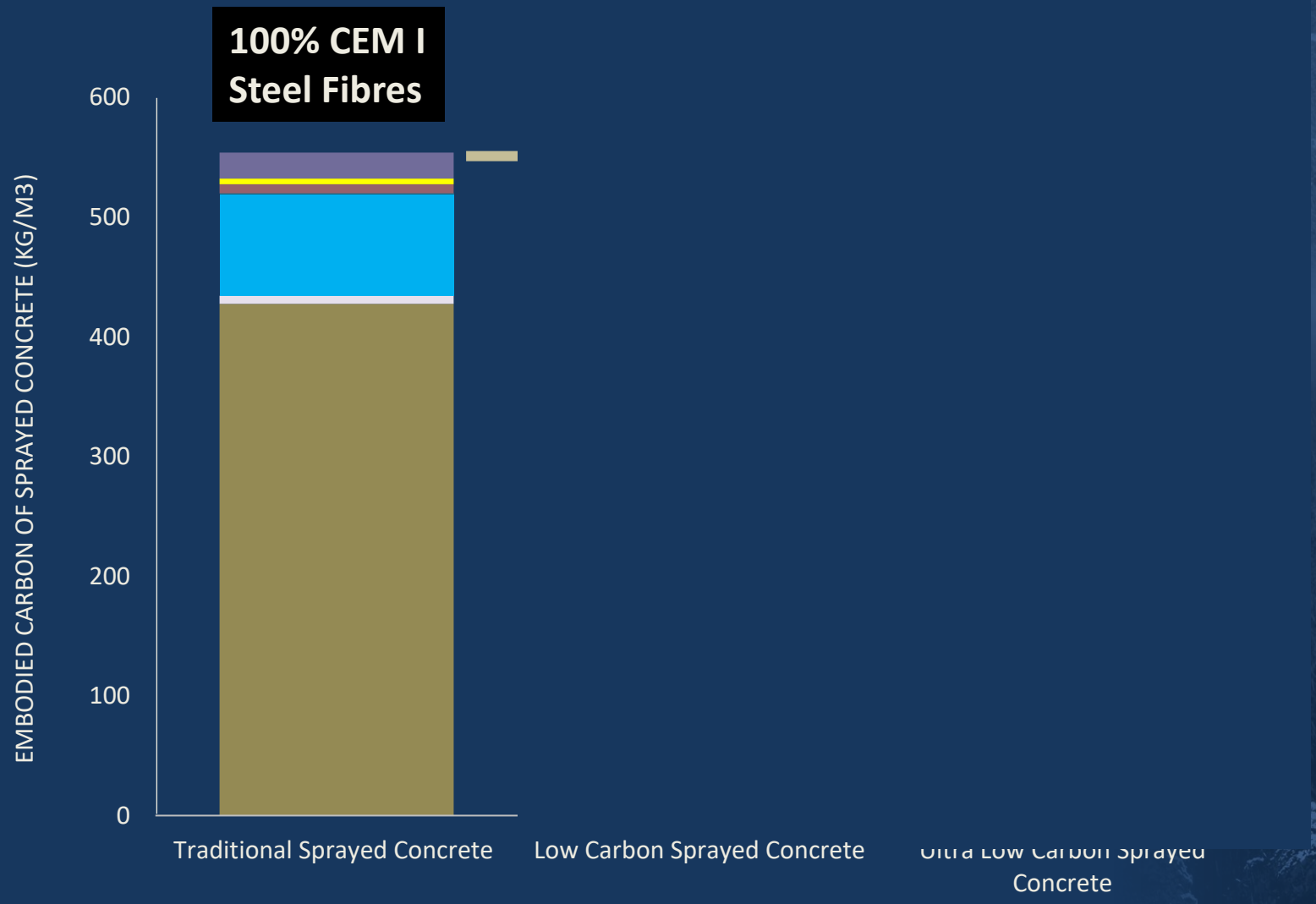
You need to take a holistic approach



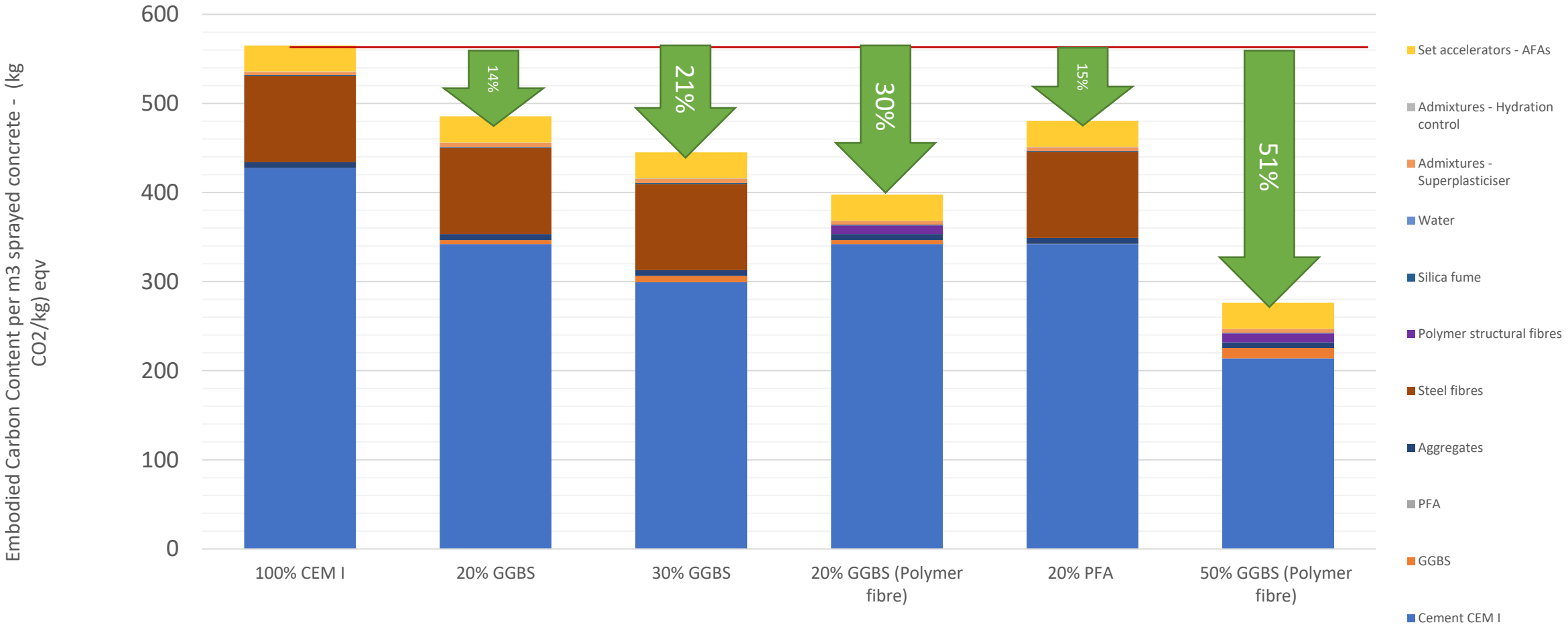
SUSTAINABLE TUNNEL OFFERING - MATERIALS



Low and Ultra Low Carbon SCL Mixes



Recent low carbon sprayed concrete trials
Embodied carbon reduction



Cemex-Normet Dry Silo Mortar (DSM) Partnership – Lower Carbon Mixes

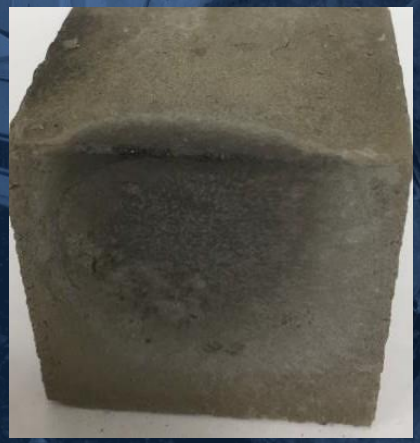
This year we have developed lower carbon mixes:

- CEM I with 40% GGBS replacement
- CEM II A-L mixes
- Now working on CEM II A-L plus 20% GGBS
- We can replace steel fibres with much lower cost and carbon structural polymer fibres

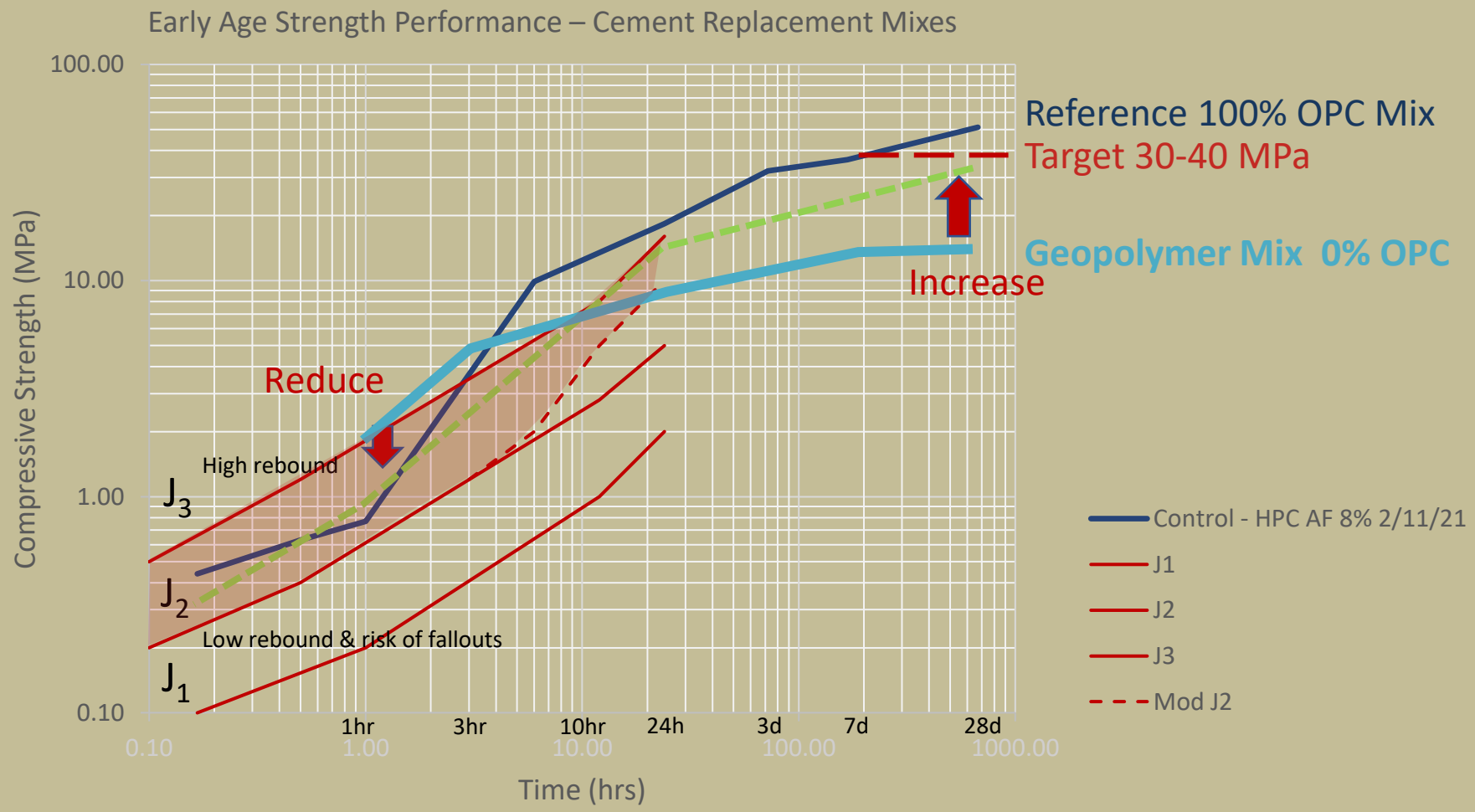
Sprayed concrete without cement is another development - Geopolymers

- Portland cement has many challenges
- Geopolymers offer some notable advantages
- Formed by chemical activation of sodium silicate + low calcium flyash + Blast Furnace slag
- Several advantages
  - Eco-friendly - 80% reduction in CO_2 footprint compared to Portland Cement
  - Very durable – low shrinkage, low porosity, fire resistant, chemically stable

Cooling



Performance needed with Geopolymer SC



- We have very good early strengths 2MPa @ 1hr
- But we can reduce early age strength
- As we need to gain improvements in long term strength

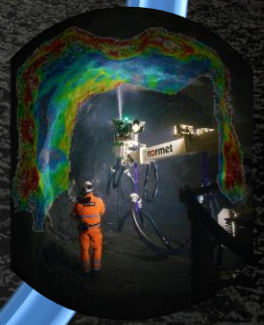
NORMET INNOVATION - MINI LAB SPRAYER

Low Carbon Mining Equipment

Sustainable Sprayed Concrete

Lower carbon, higher performing sprayed concrete

Lower carbon tunnelling equipment

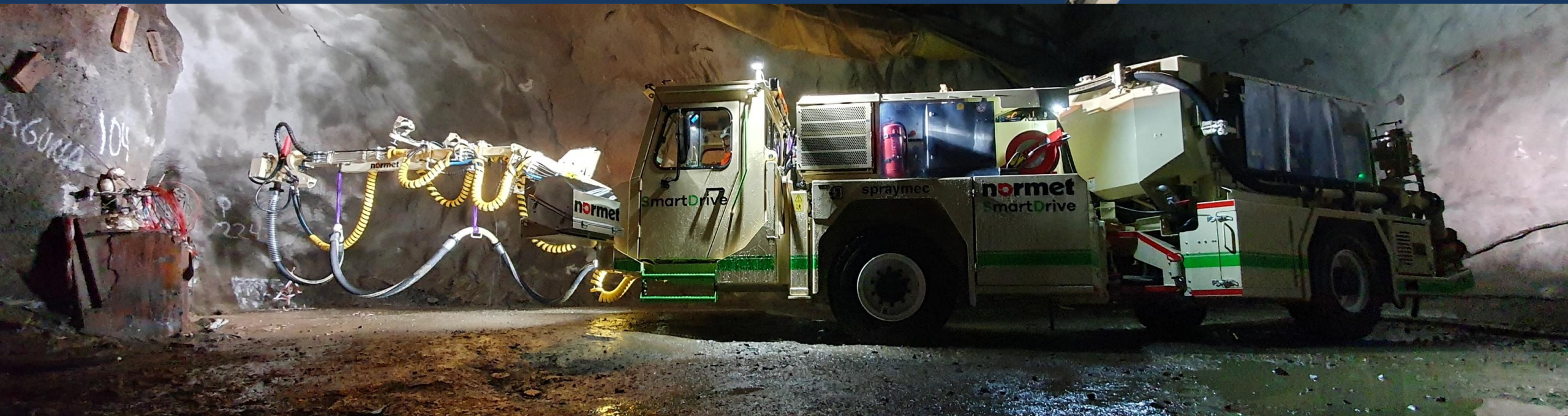


Efficiency using digital technology

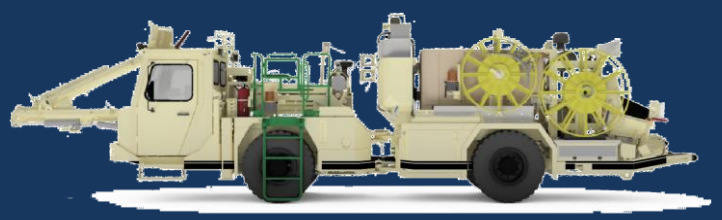
Improving sustainable practices

Automated Battery Electric Drive Sprayer

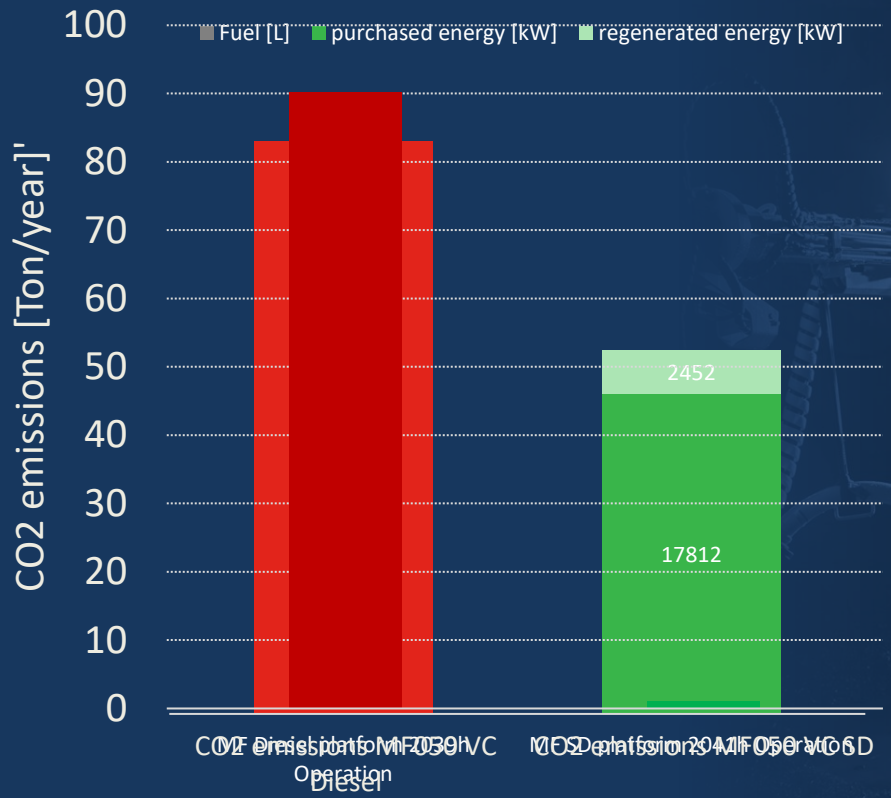
- Electric vehicles are coming onto the market, but slowly!
- Replacing diesel power trains – clean energy
- Reduced CO_2 emissions through power from renewable energy sources
- Smart spraying technologies



Sustainability with BEV Spraying Robots – CO_2 EMISSIONS



Diesel Sprayer



- 40-60% less energy
- >95% less CO_2

BEV Sprayer

ABSORBS 1 TONNE OF CO_2 IN 100 YEARS

To neutralize 5 years machine lifetime 450 trees and 105 years would be required

normet SmartDrive®

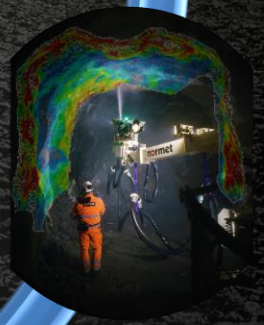
*The calculation considers 2 hours driving per shift, 2 shifts per day.

New Technologies to Support Sprayed Concrete

Sustainable Sprayed Concrete

Lower carbon, higher performing sprayed concrete

Lower carbon tunnelling equipment



Efficiency using digital technology

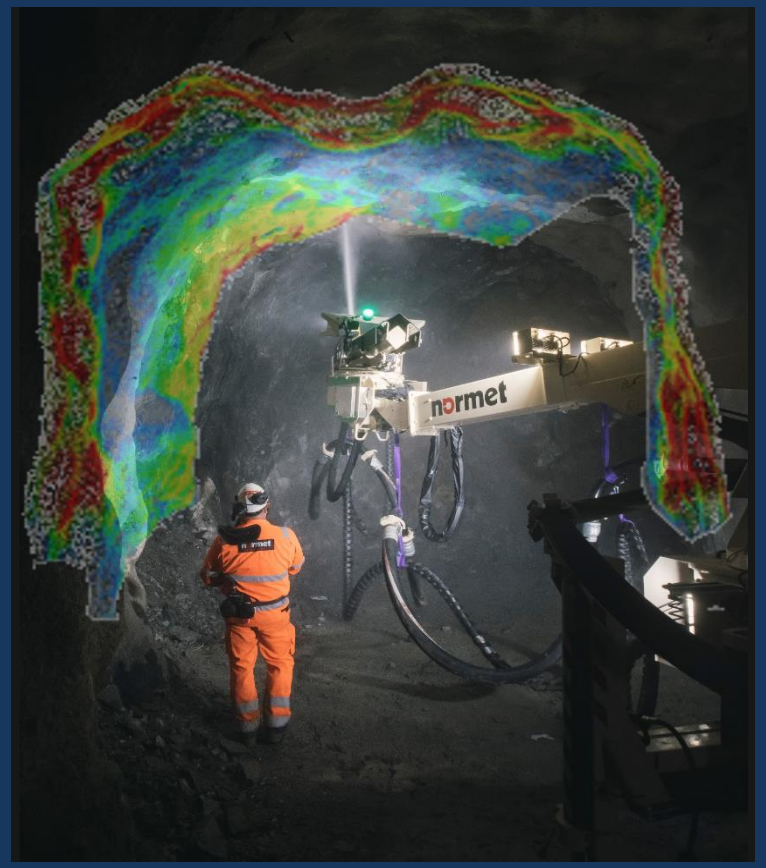
Improving sustainable practices

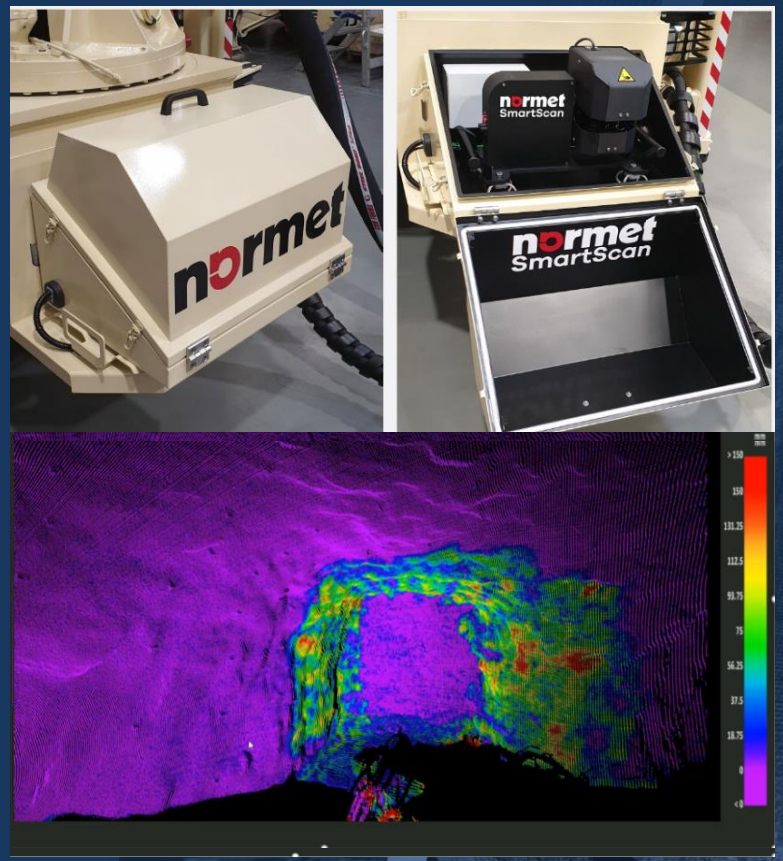
Spraying Simulator training is a useful tool

- Fully EFNARC approved simulator training tool
- For training and now integral to certification process
- Helps get nozzle operator up and running
- Not breaking anything too expensive too soon!
- Up to a 25% improvement in performance . . . Even with experienced nozzle operators
- Stress free learning environment
- Good fit to the new, young generation!

Real time control - SmartScan

Most sprayed concrete linings are between 1.5x and 2.5x theoretical amount!





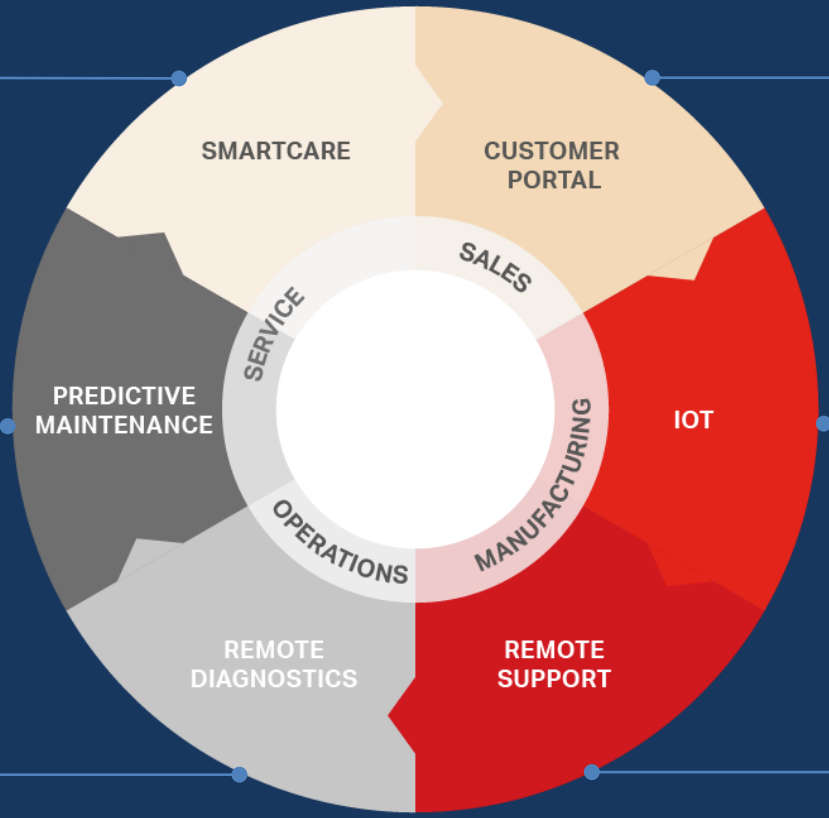
- Nozzle operator more in control
- Getting it right at the point of application – not later, too late!
- Spraying to profile is coming soon
- Safety - knowing minimum thickness is applied
- Controlling quality and economy
- Remove steel girders/arches as we can spray to profile without them now
- **We can start measuring carbon and start improving!**

Spraying Process Equipment - Digitalisation

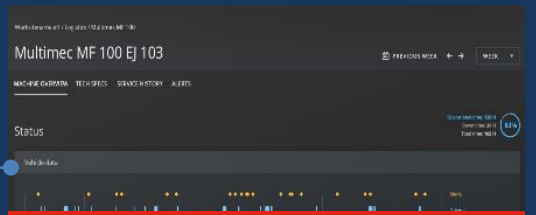
Service history and OEE in one place

Active predictive maintenance based on machine learning and AI

Remote trouble-shooting and technical service

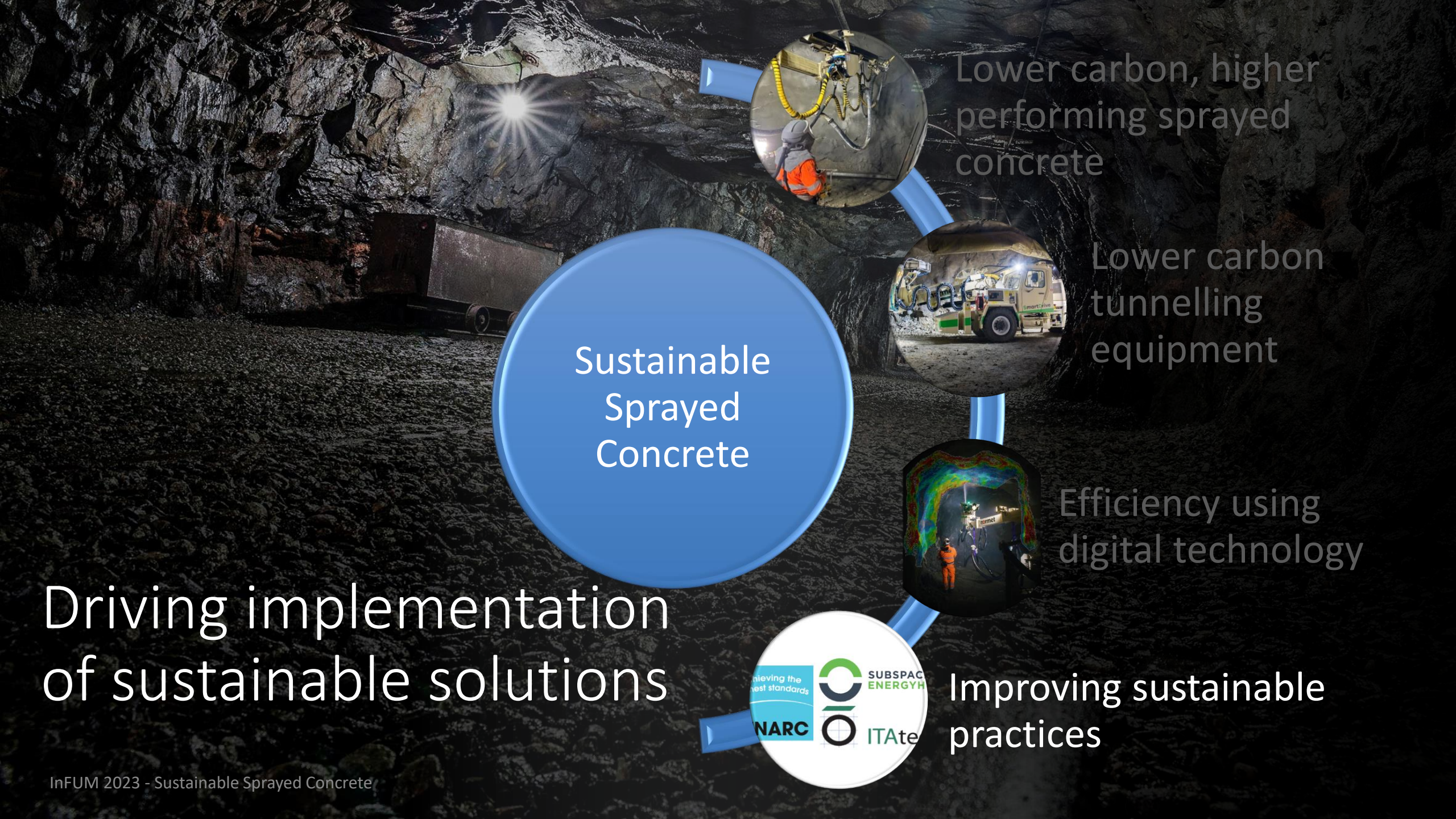


Customer specific configurations and service packages



Machine data available from factory

Remote operations support based on real-time information



Driving implementation of sustainable solutions

We have good standards in our industry

Common standards let everyone work to the same levels of safety and quality

achieving the highest standards
EFNARC

ITA AITES

EUROPEAN SPECIFICATION for SPRAYED CONCRETE

GUIDELINES
FOR SPECIFIERS AND CONTRACTORS

CHECKLIST
FOR
SPECIFIERS AND CONTRACTORS

EUROPEAN SPECIFICATION FOR SPRAYED CONCRETE
EXECUTION OF SPRAYING
(revised version of Section 8)

Remember Sprayed concrete is Concrete