

HERRENKNECHT



Tunnelling Systems

HERRENKNECHT

PIONEERING UNDERGROUND TOGETHER

Tokyo, 24.01.2024, Jean-Daniel Brabant, Herrenknecht portfolio and innovations

ヘレンクネヒトの紹介

ブラバン ジャン・ダニエル



HERRENKNECHT IN GERMANY

ヘレンクネヒトについて

Strongly rooted in the location of
Schwanau and the surrounding region

Around 2,400 employees work in
Schwanau and Kehl

Our long-term and sustainable thinking is
reflected in our support of education,
environment and society

Key figures

HERRENKNECHT GROUP

ヘレンクネヒトグループ

1,232

Total output

生産高

2022 in million euros

1,205

Revenue

売上高

2022 in million euros

1,331

Incoming orders

受注高

2022 in million euros

EMPLOYEES WORLDWIDE

従業員数

5,033

Employees

従業員

at the end of 2022

189

Trainees

訓練生

at the end of 2022



Key figures

HERRENKNECHT GROUP YESTERDAY AND TODAY

沿革

1977

1977 to
19871988 to
19971998 to
20072008 to
2017

2023

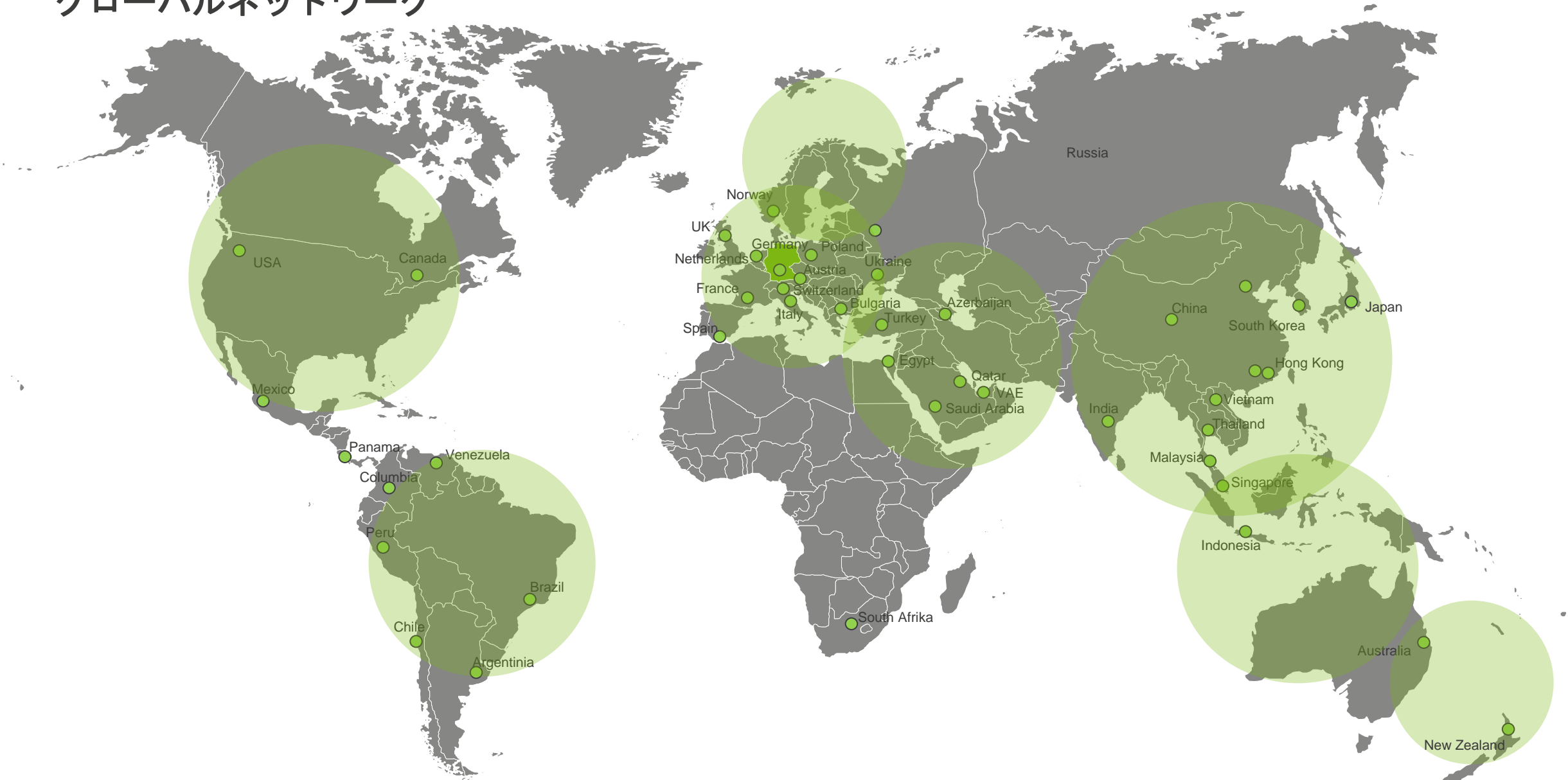


An Idea.

Develop technologies &
expand market shares.Grow and develop. In all
areas.Lead the market & open
up to Asia.Things are moving
forward everywhere!
E.g. at the Gotthard Base
Tunnel.Being part of the next
underground milestones.

HERRENKNECHT WORLDWIDE

グローバルネットワーク



Sustainable Underground Structures

MARKET SEGMENTS OF THE HERRENKNECHT GROUP

事業セグメント

TRANSPORT AND MOBILITY

輸送・モビリティ

- › Road
- › Railway
- › Metro
- › Passenger transport
- › Cargo

SUPER-SAFE UNDERGROUND STRUCTURES

大深度地下利用

- › Safe storage facilities, e.g. castor storage
- › Safe underground facilities, e.g. for research purposes

MINING AND RAW MATERIAL

鉱山・資源開発

- › Vertical access or production shafts
- › Ventilation shafts
- › Access ramps and transport infrastructure
- › Tunnel infrastructure

WATER

水資源

- › Sewage infrastructure
- › Water supply
- › Desalination
- › Flooding infrastructure
- › Storage and reservoirs

ENERGY

エネルギー

- › Transportation of oil, gas and hydrogen
- › Development drilling
- › Hydroelectric power
- › Geothermal energy
- › District heating/geothermal energy
- › Energy storage
- › Power lines



HERRENKNECHT FOR OTHERS

サステナビリティ

Taking the social mission seriously. In all areas of life:



Education and science
教育



Environment and Resources
環境



Sports
スポーツ



Social
社会

WE TAKE RESPONSIBILITY

企業の社会的責任

- > **Acatech (産学連携):**
 Transfer between science and industry and promotion of young technical scientists
- > **Engineer Day Lahr (体験型ものづくりイベント):**
 Getting children and young people interested in STEM and supporting start-ups.
- > **Herrenknecht scholarships and support at universities**
 (ヘレンクネヒト奨学金及び大学支援):
 Karlsruhe Institute of Technology, TU Munich, Offenburg University of Applied Sciences, RWTH Aachen, Carolo Wilhelmina Braunschweig, etc.
- > **Lothar Späth Award (ローター・シュペート賞):**
 Award for the development of particularly groundbreaking product, process and service innovations from business and science
- > **TBM remanufacture (TBM再整備)**
 in Kehl harbor for sustainability in tunnel construction.
- > **Carbon Neutral (脱炭素に向けて)**
 Member of the “Energy Efficiency - Made in Germany” initiative



HERRENKNECHT FULL RANGE SOLUTIONS

ソリューション

H+E
LOGISTIK GMBH



BOHRTEC



EUROFORM



HERRENKNECHT
FORMWORK



HERRENKNECHT
SEPARATIONS



TECHNI-MÉTAL
SYSTÈMES



GLOBAL
TUNNELLING
EXPERTS



CONTROL CENTER & DATA MANAGEMENT

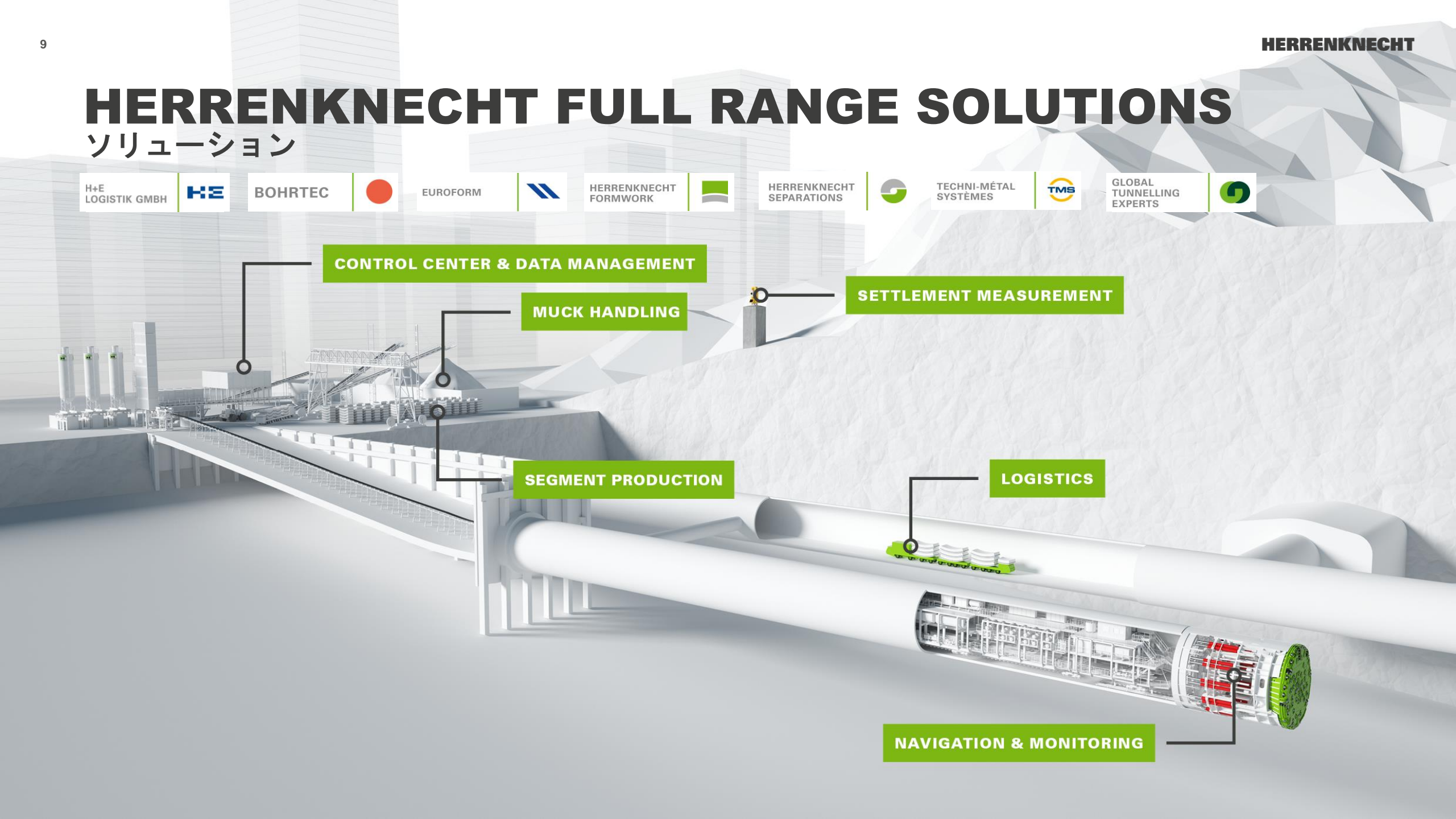
MUCK HANDLING

SETTLEMENT MEASUREMENT

SEGMENT PRODUCTION

LOGISTICS

NAVIGATION & MONITORING



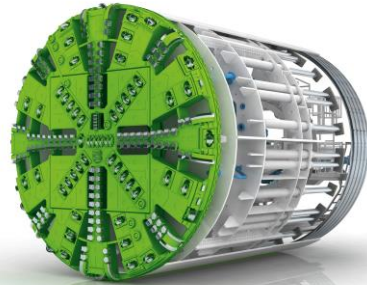
Product Portfolio

OUR TUNNELLING TECHNOLOGY

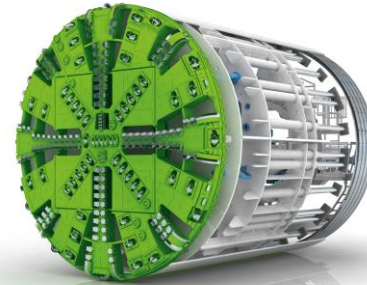
主要製品

**AVN Machine**

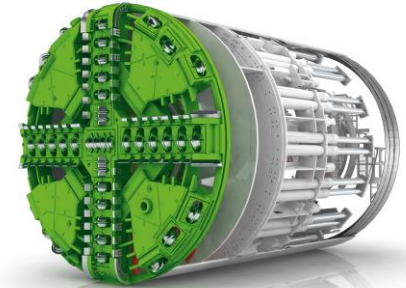
AVNマシン

**Mixshield**

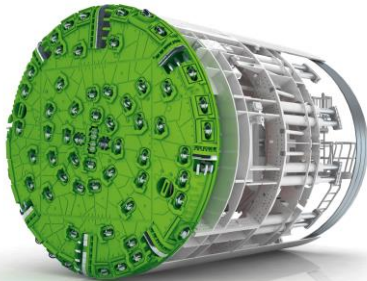
泥水式シールド

**Multi-mode TBM**

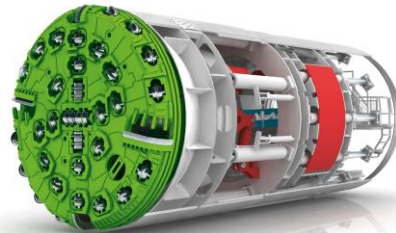
マルチモードTBM

**EPB Shield**

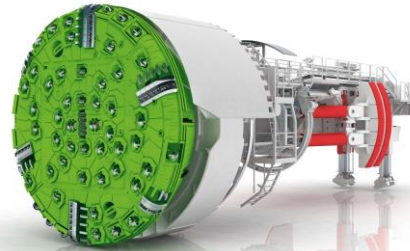
泥土圧シールド

**Single Shield TBM**

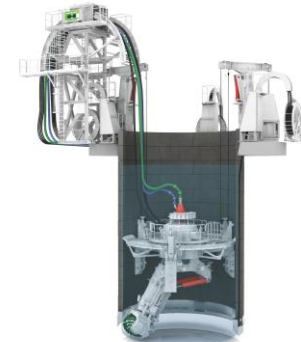
シングルシールドTBM

**Double Shield TBM**

ダブルシールドTBM

**Gripper TBM**

グリッパーTBM

**Vertical Shaft Sinking
Machine VSM**

Machine VSM

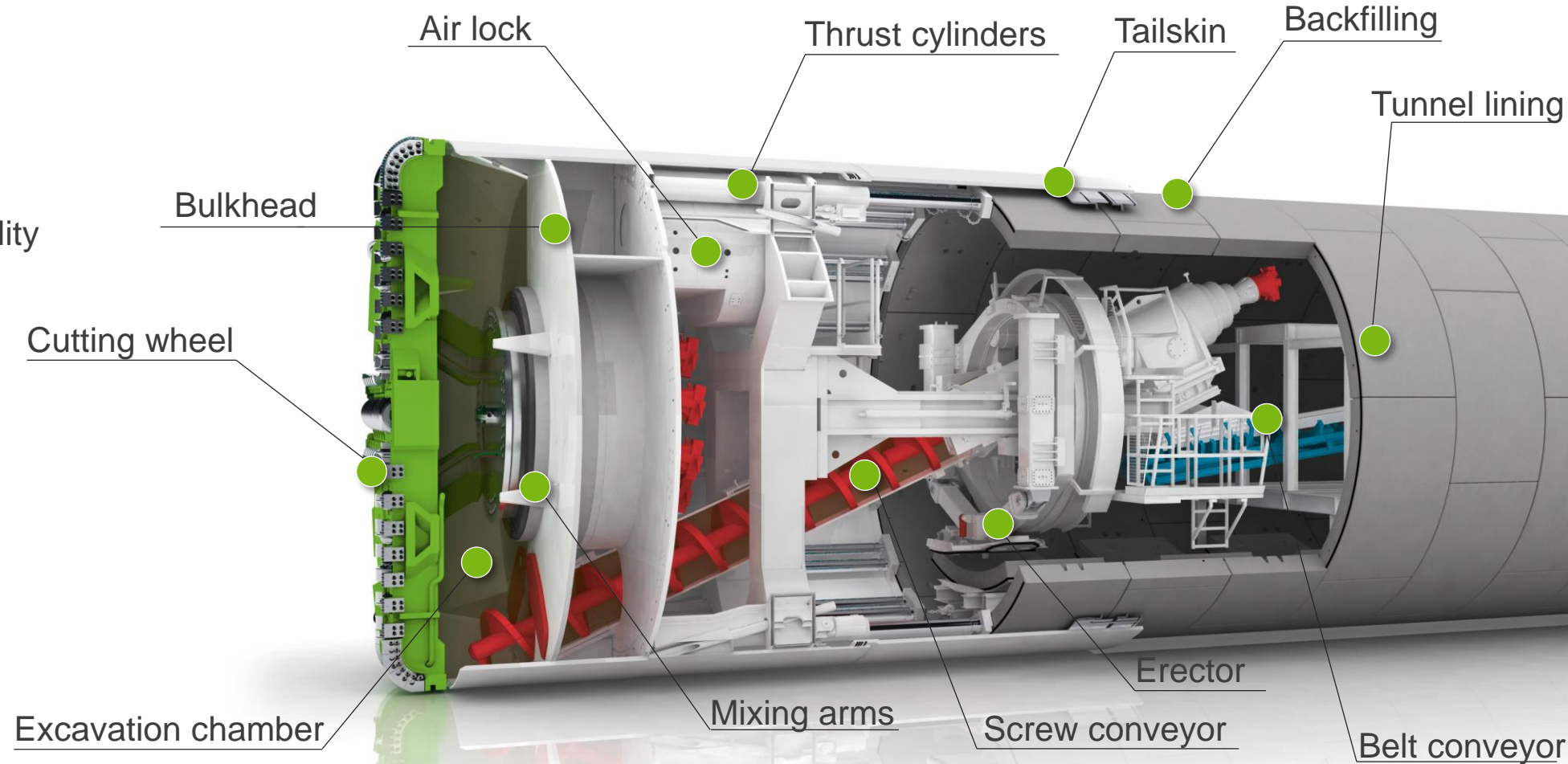
Functional Principle

EPB SHIELD

泥土圧シールド

○ Soft ground with low water permeability (clay, silt, loam)

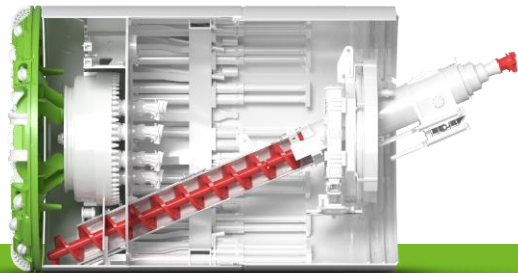
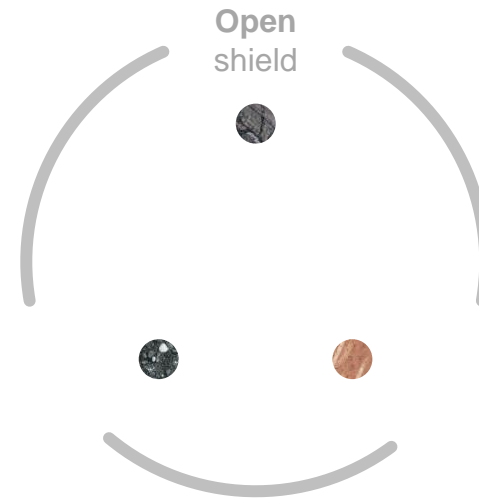
↔ 1.7–16 m



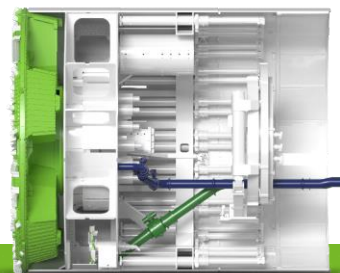
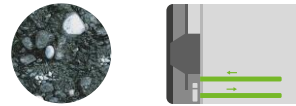
Spectrum of Herrenknecht TBM

BASIC TBM TYPES

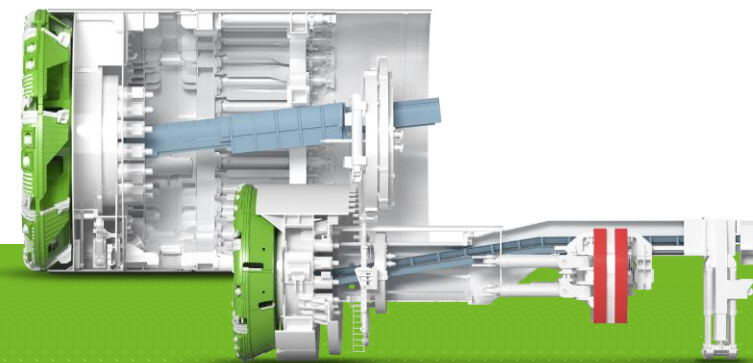
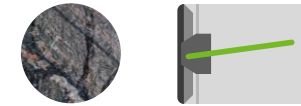
マシンタイプ



01
 Earth Pressure
 Balance Shield
 泥土圧シールド



02
 Mixshield
 泥水式シールド

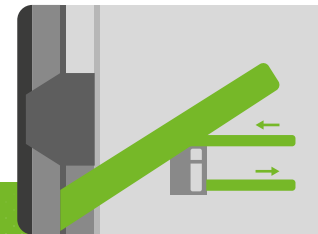
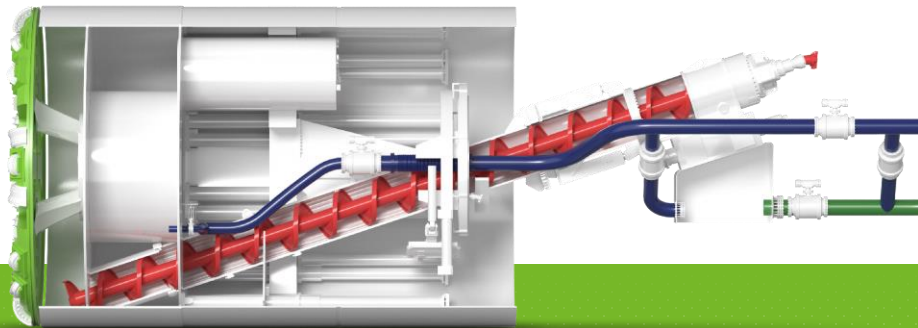
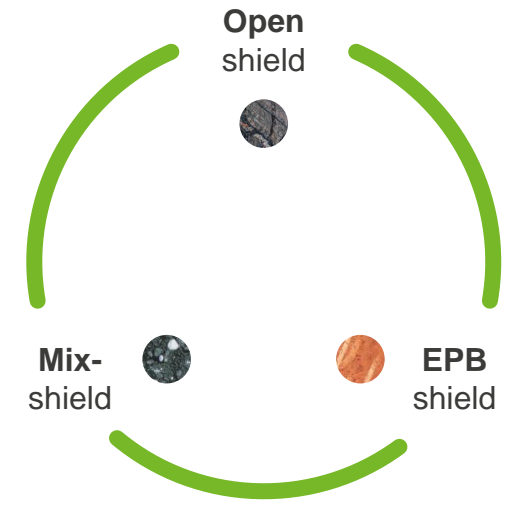


03
 Open shield TBM
 開放型TBM
 (Gripper TBM, Single
 Shield TBM or Double
 Shield TBM)

Spectrum of Herrenknecht TBM

VARIABLE DENSITY TBM

VD(可變密度) TBM

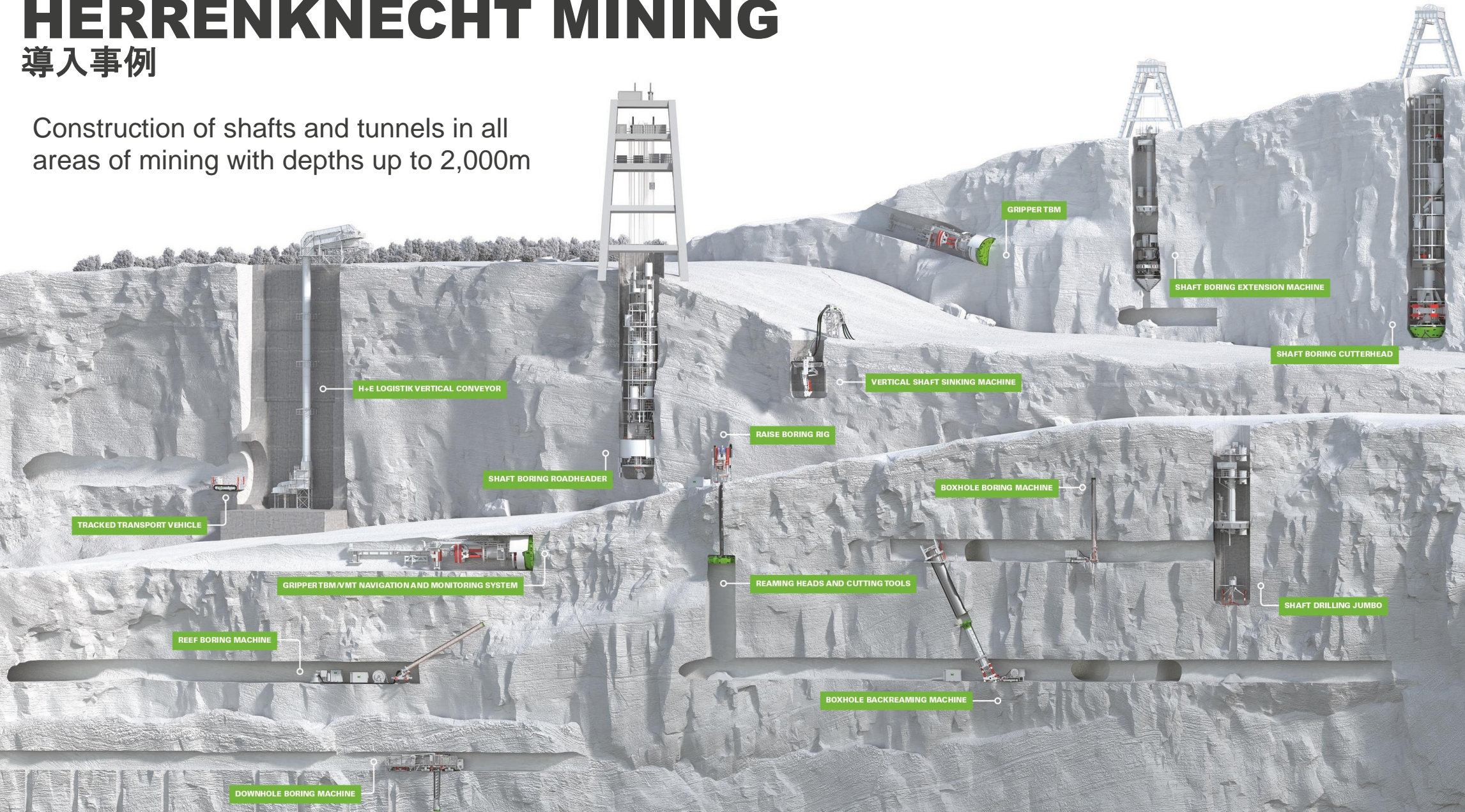


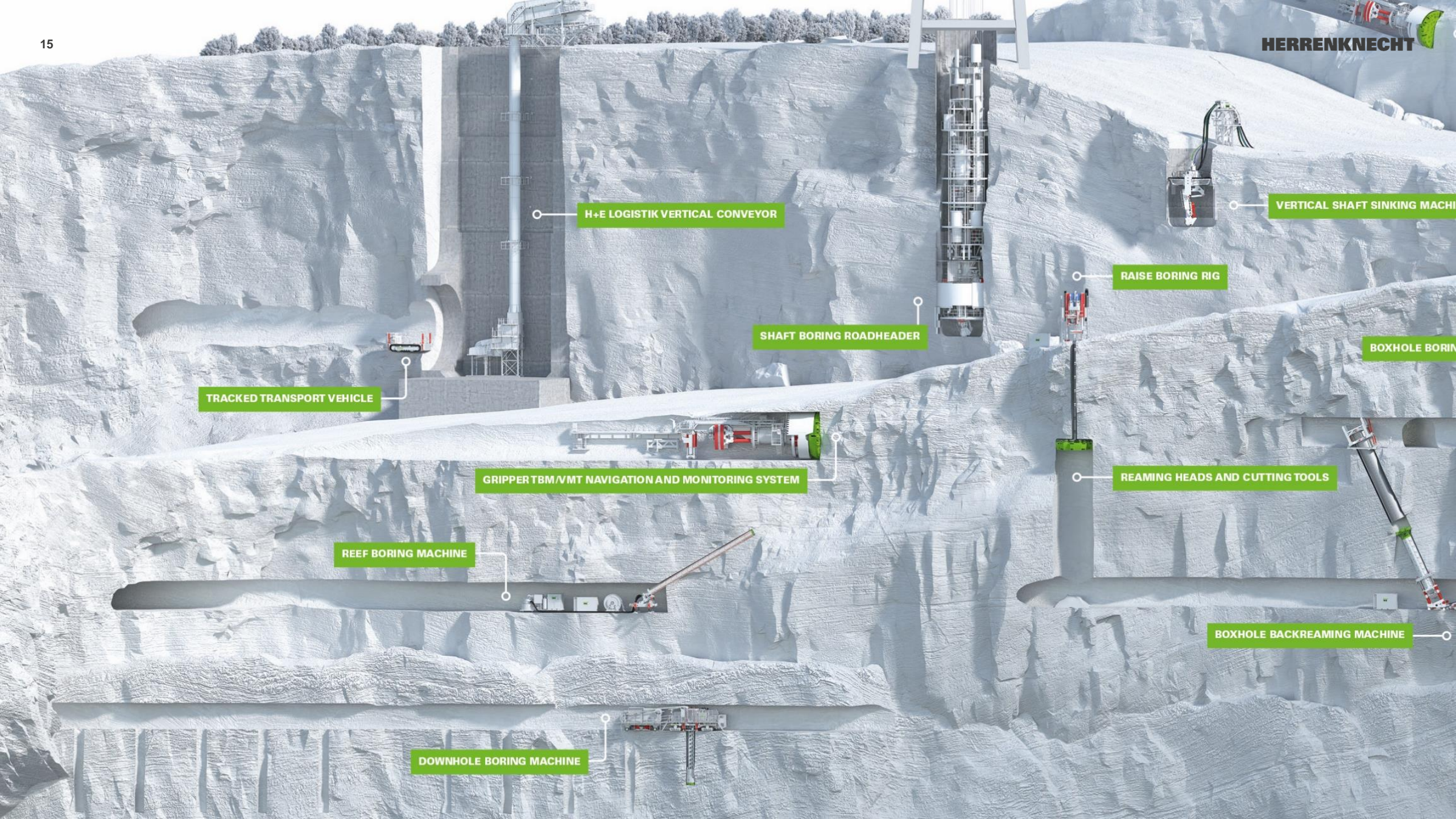
Variable Density TBM
VD(可變密度)TBM

HERRENKNECHT MINING

導入事例

Construction of shafts and tunnels in all areas of mining with depths up to 2,000m





H+E LOGISTIK VERTICAL CONVEYOR

VERTICAL SHAFT SINKING MACHINE

RAISE BORING RIG

SHAFT BORING ROADHEADER

BOXHOLE BORING MACHINE

TRACKED TRANSPORT VEHICLE

GRIPPER TBM/VMT NAVIGATION AND MONITORING SYSTEM

REAMING HEADS AND CUTTING TOOLS

REEF BORING MACHINE

BOXHOLE BACKREAMING MACHINE

DOWNHOLE BORING MACHINE



GRIPPER TBM

SHAFT BORING EXTENSION MACHINE

SHAFT BORING CUTTERHEAD

VERTICAL SHAFT SINKING MACHINE

RAISE BORING RIG

BORING ROADHEADER

BOXHOLE BORING MACHINE

REAMING HEADS AND CUTTING TOOLS

SHAFT DRILLING JUMBO

BOXHOLE BACKREAMING MACHINE



EXPLORATION

エネルギー開発

HERRENKNECHT VERTICAL

Group Brand of Herrenknecht AG

Foundation: March 2005 in Schwanau

Deep drilling rigs for deep geothermal energy
and oil & gas deposits

Onshore & Offshore Drilling

Technological edge through hydraulic drive
technology

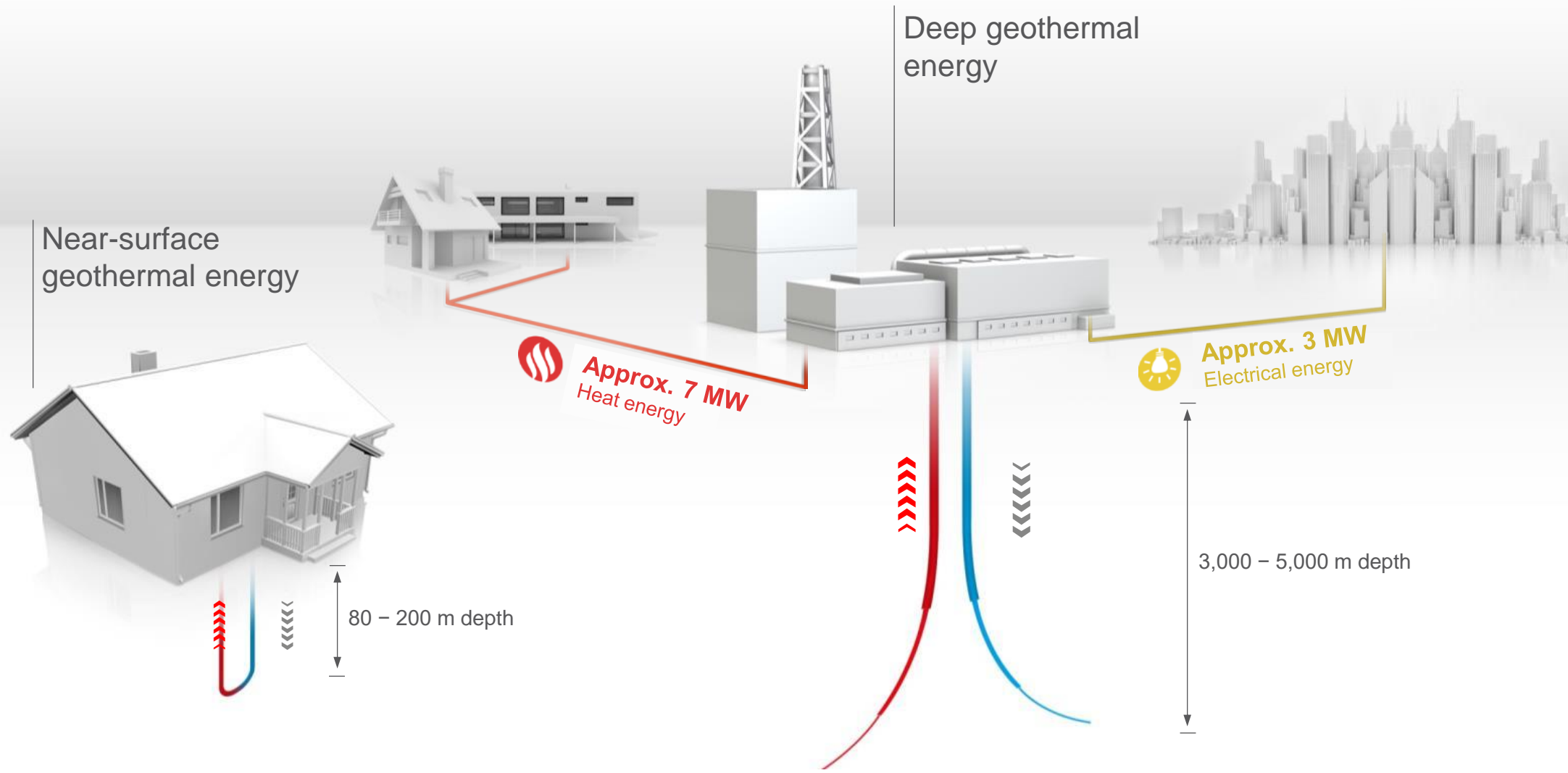
High degree of automation

Reduced manpower

Great potential for clean and stable energy supply

GEOTHERMAL ENERGY

地熱発電



REMANUFACTURING

リマニュファクチャリング

There are many reasons for the basic reconditioning of tunnel boring machines. Herrenknecht is the pioneer here.

In accordance with ITA guidelines on rebuilding and ISO 9001/14001 standards

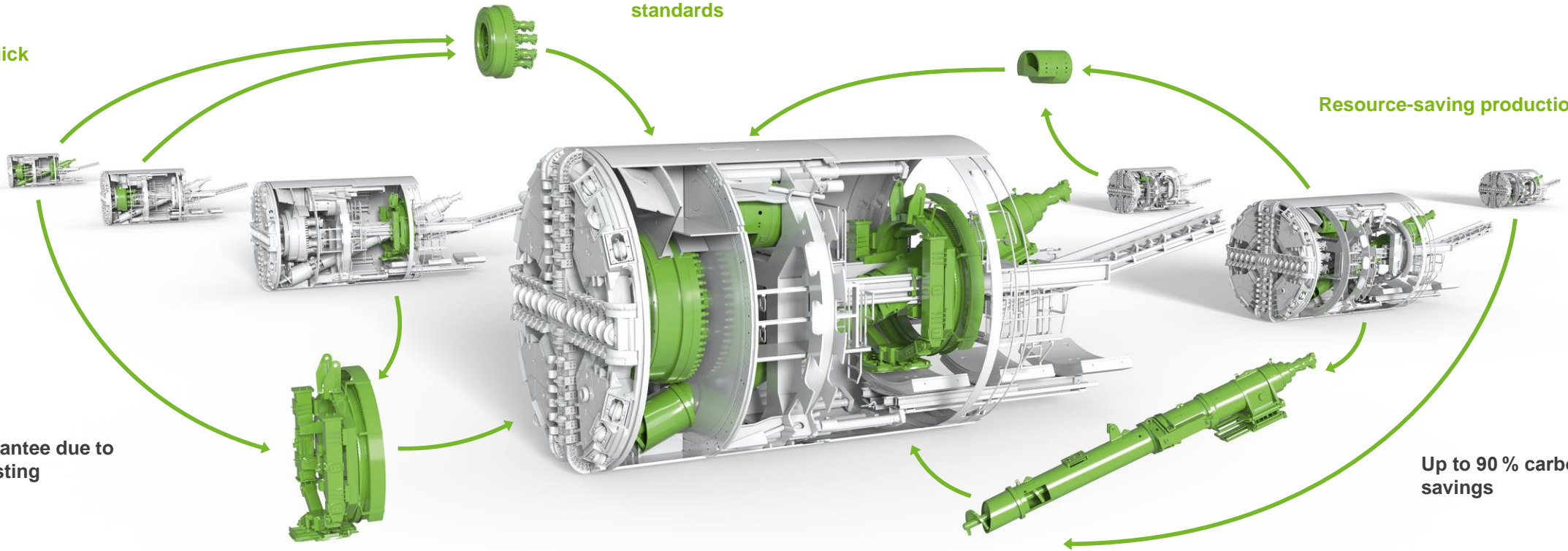
High and quick availability

Highest quality and safety standards

Resource-saving production

Full guarantee due to 100 % testing

Up to 90 % carbon dioxide savings



TRENDS AND CHALLENGES IN TUNNELLING

トレンドと課題

Separation & Logistics

泥水処理 & ロジスティックス

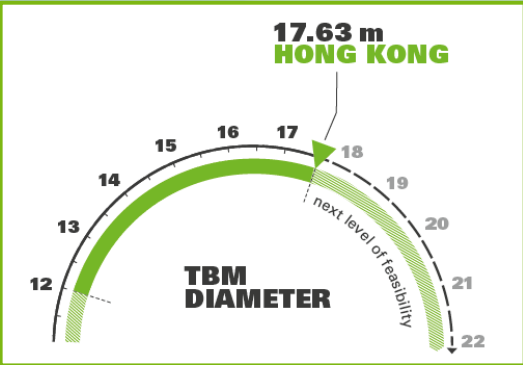
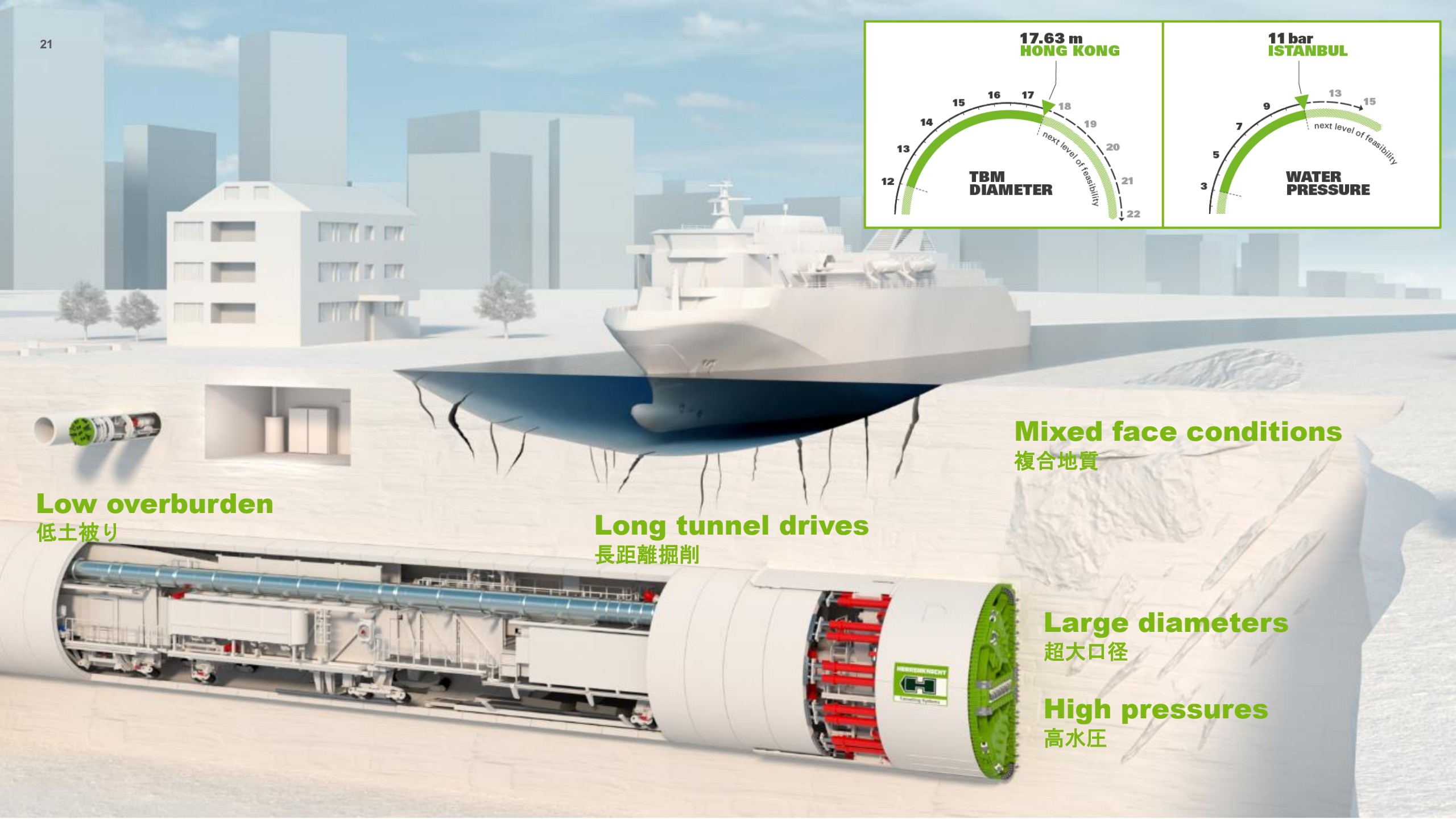
Material re-use

材料再利用

Digitalization

デジタルトランスフォーメーション





Low overburden
低土被り

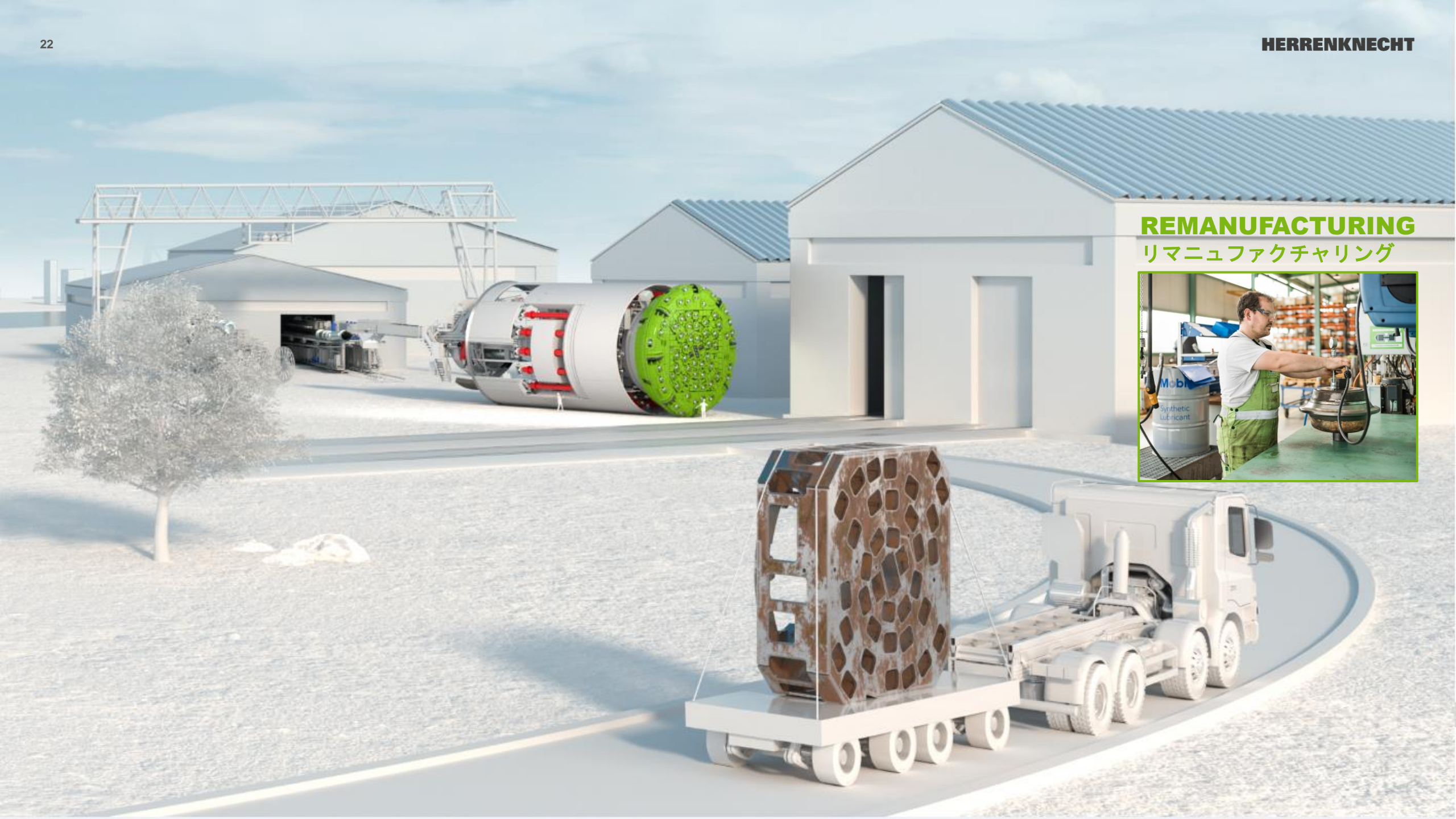
Long tunnel drives
長距離掘削

Mixed face conditions
複合地質

Large diameters
超大口径

High pressures
高水圧

REMANUFACTURING
リマニュファクチャリング



Increasing the diameter

GOING BIGGER STEP BY STEP

超大口径への挑戦

› The world's largest Variable Density TBM

- › Hampton Roads Bridge Tunnel, Virginia, USA
- › Ø 13,990 mm



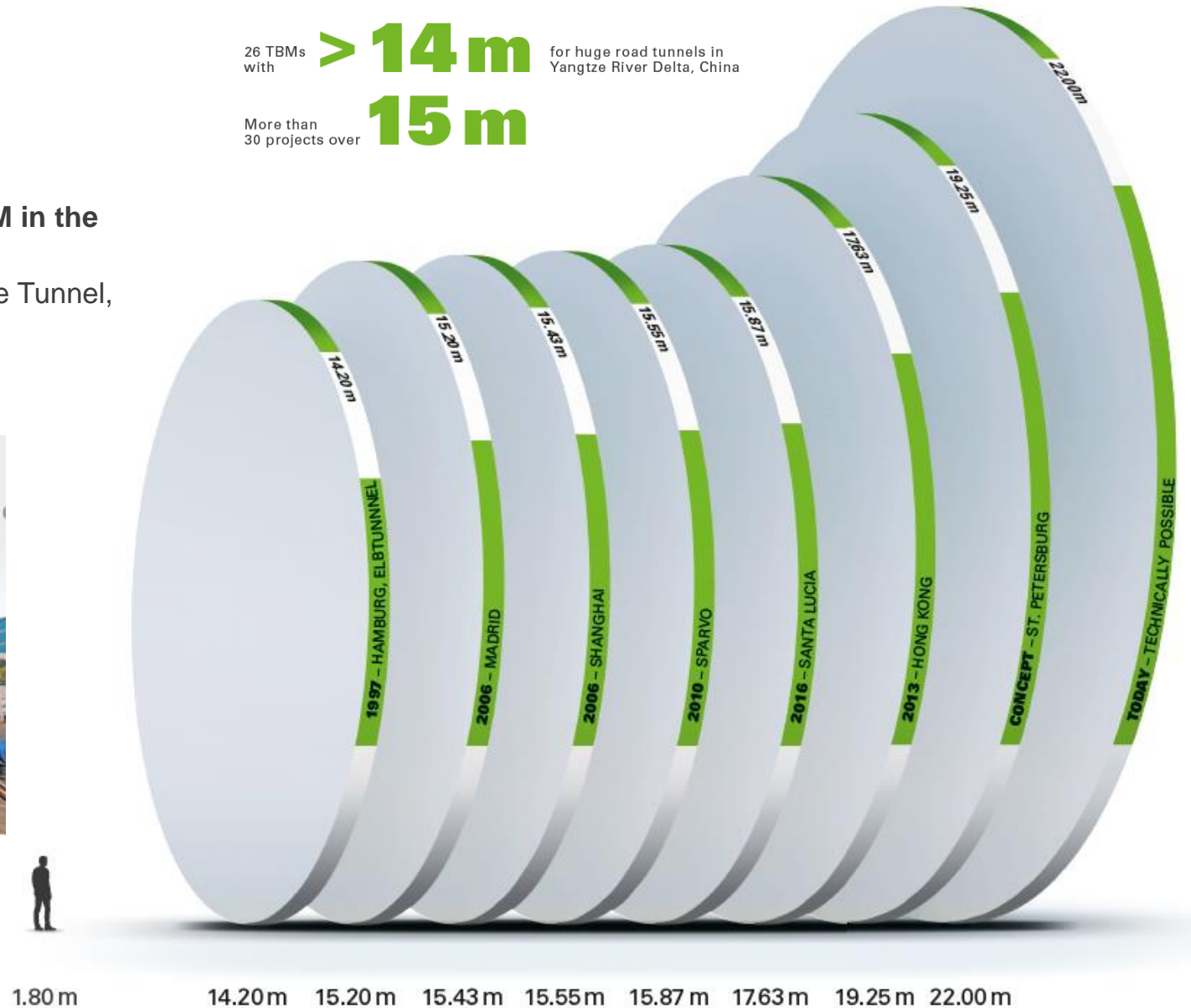
› Currently the largest TBM in the southern Hemisphere

- › Melbourne West Gate Tunnel, Australia
- › 2x EPB Shield
- › Ø 15,550 mm



26 TBMs with **> 14 m** for huge road tunnels in Yangtze River Delta, China

More than 30 projects over **15 m**



1.80 m

14.20 m 15.20 m 15.43 m 15.55 m 15.87 m 17.63 m 19.25 m 22.00 m

AUTOMATION

自動化

DIGITALIZATION

デジタルトランスフォーメーション

ARTIFICIAL INTELLIGENCE

人工知能

ROBOTICS

ロボット技術

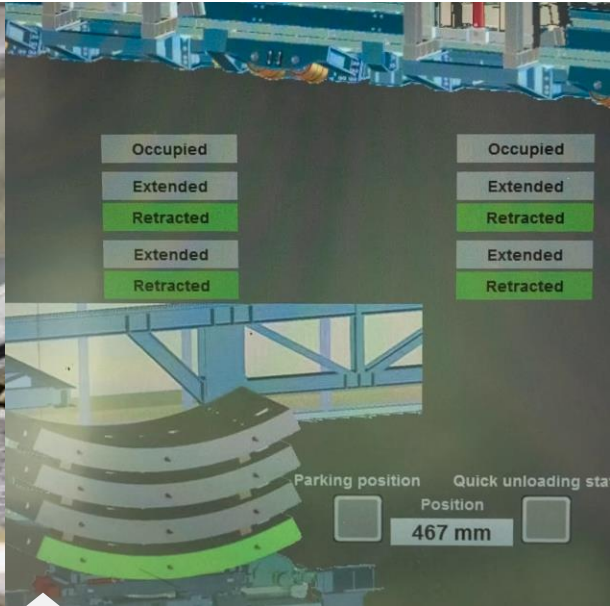


AUTOMATION & DIGITALIZATION

自動化&デジタルトランスフォーメーション



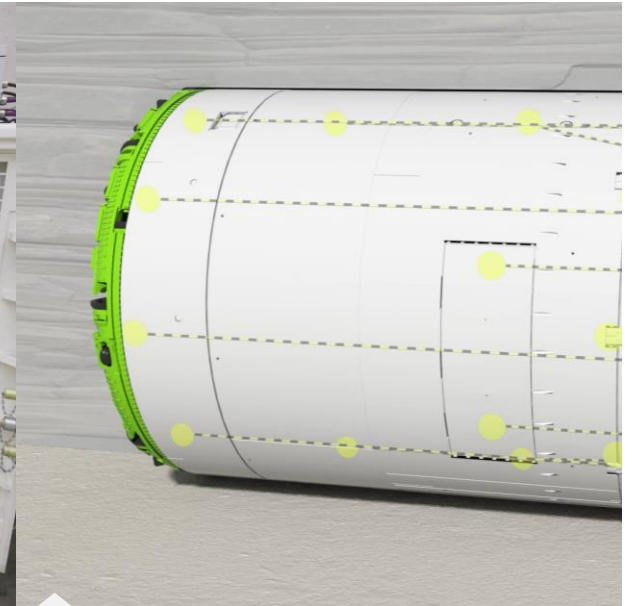
Automated ring building
セグメント自動組立



Automated segment handling
セグメント自動搬送



Driving assistance for MSVs
MSV運転支援



Sensor Data Management
センサーデータ管理

Innovation

HERRENKNECHT **CON**NECTED

コネクティッド



Latest Reports

DCLM Report DCLM_0494.pdf	28.10.2020 02:52:39
TBM Advance Report en_AdvanceReport_r0456.pdf	27.10.2020, 02:53:31
Alarm Report en_AlarmReport_r0456.pdf	

Traffic Tunnelling

WORLDWIDE LIGHTHOUSE PROJECTS

納入実績



Grand Paris Express



High Speed 2



Brenner Base Tunnel



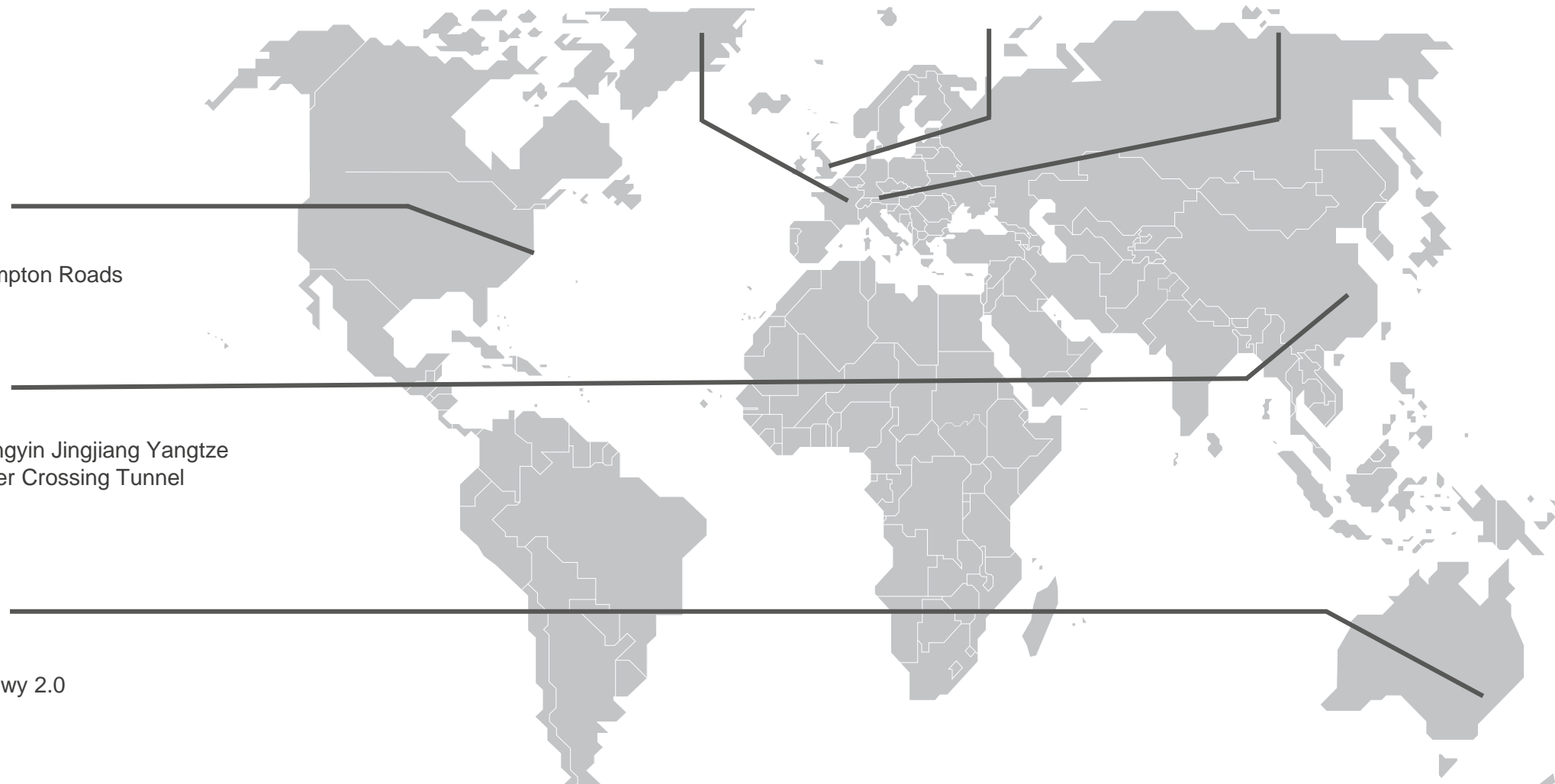
Hampton Roads



Jiangyin Jingjiang Yangtze River Crossing Tunnel



Snowy 2.0



Utility Tunnelling / Mining

WORLDWIDE LIGHTHOUSE PROJECTS

納入実績



Saint-Nazaire OFD



Woodsmith Mine



E-Power Pipe Eindhoven



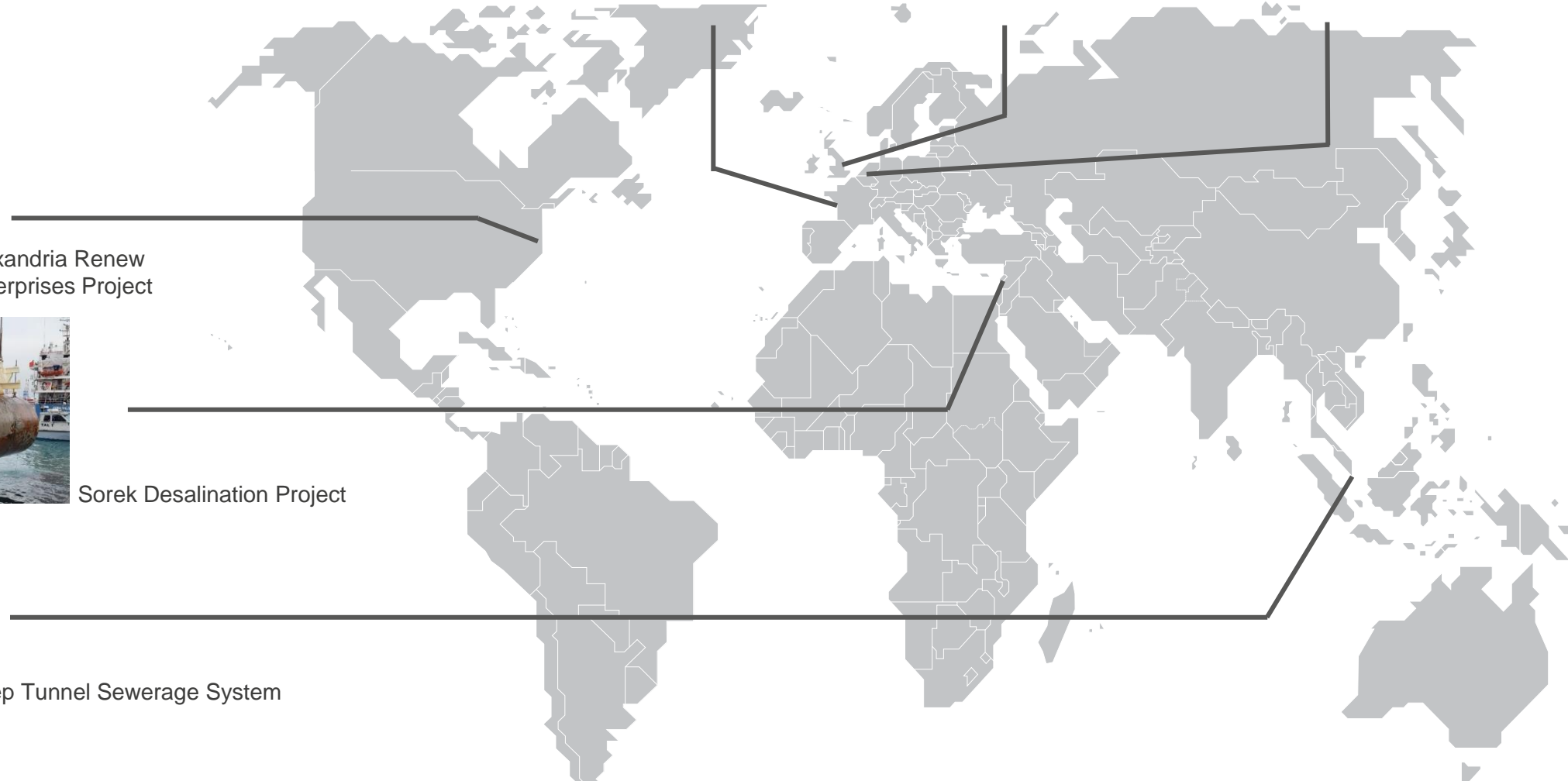
Alexandria Renew Enterprises Project



Sorek Desalination Project



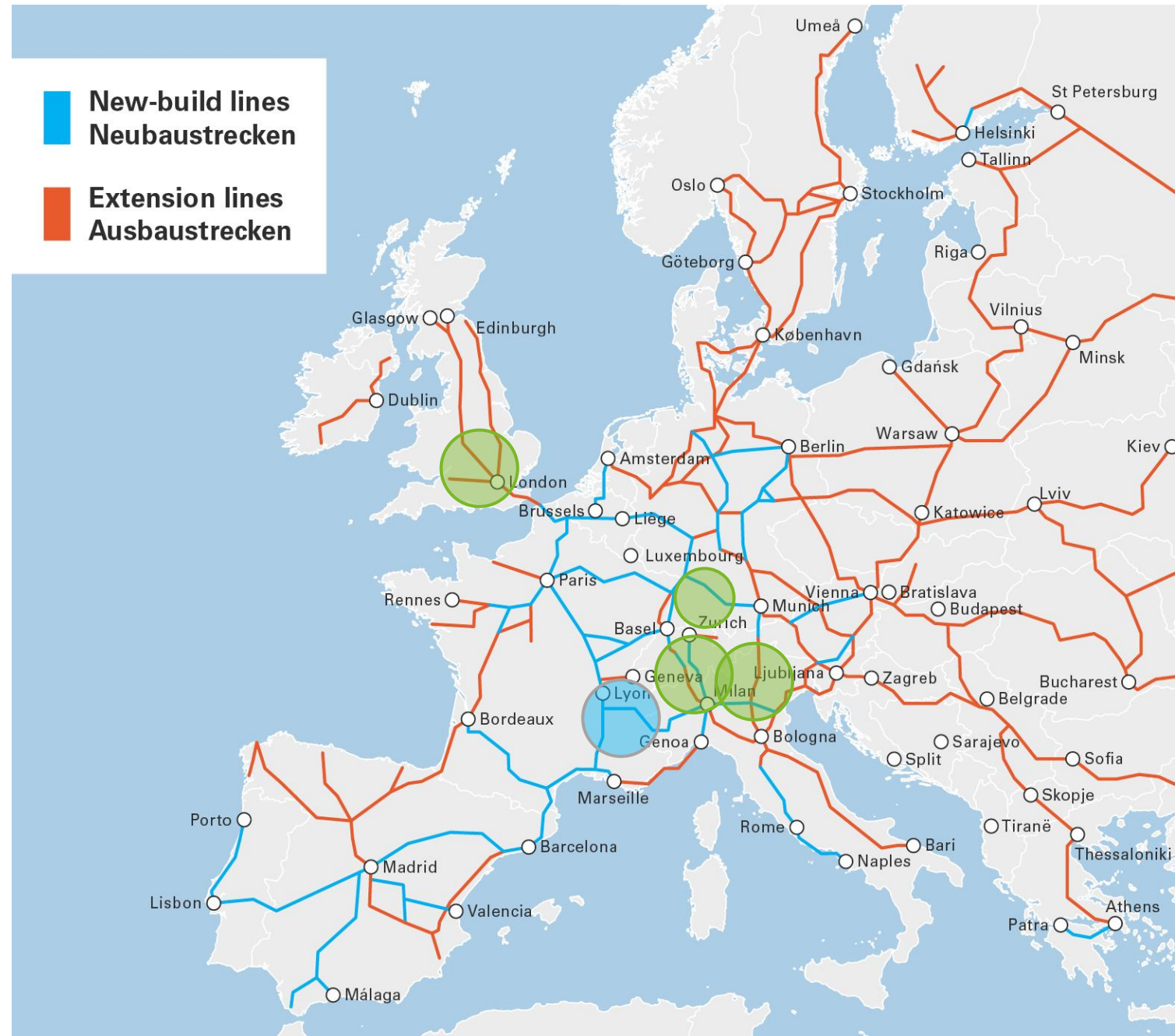
Deep Tunnel Sewerage System



EUROPEAN HIGH SPEED NETWORK

欧州高速鉄道ネットワーク

- › 110 Herrenknecht TBMs built around 700km of European railroad tunnels to date. (ヘレンクネヒト製TBM : 110基)
- › **Highlight projects:**
 - › Gotthard Base tunnel
 - › Stuttgart-Ulm (Stuttgart 21)
 - › Brenner Base Tunnel
 - › High Speed 2 – Phase 1
 - › TELT Lyon-Turin



Glasgow ○ Edinburgh

BRENNER BASE TUNNEL

ブレンナーベーストンネル



Overview

BRENNER BASE TUNNEL

ブレンナーベーストンネル

- **1x Gripper TBM, Tulfes-Pfons:**
 - S-932, 16.6km

- **3x Double Shield TBM, Mauls 2/3:**
 - S-1054 Ø 6.85 m: 14km
 - S-1071/72 Ø 10.71 m: 2x 14km

- **2x Single Shield TBM, Siltschlucht-Pfons:**
 - Start in summer 2023
 - S-1343/44 Ø 10.34 m, 2x 8km

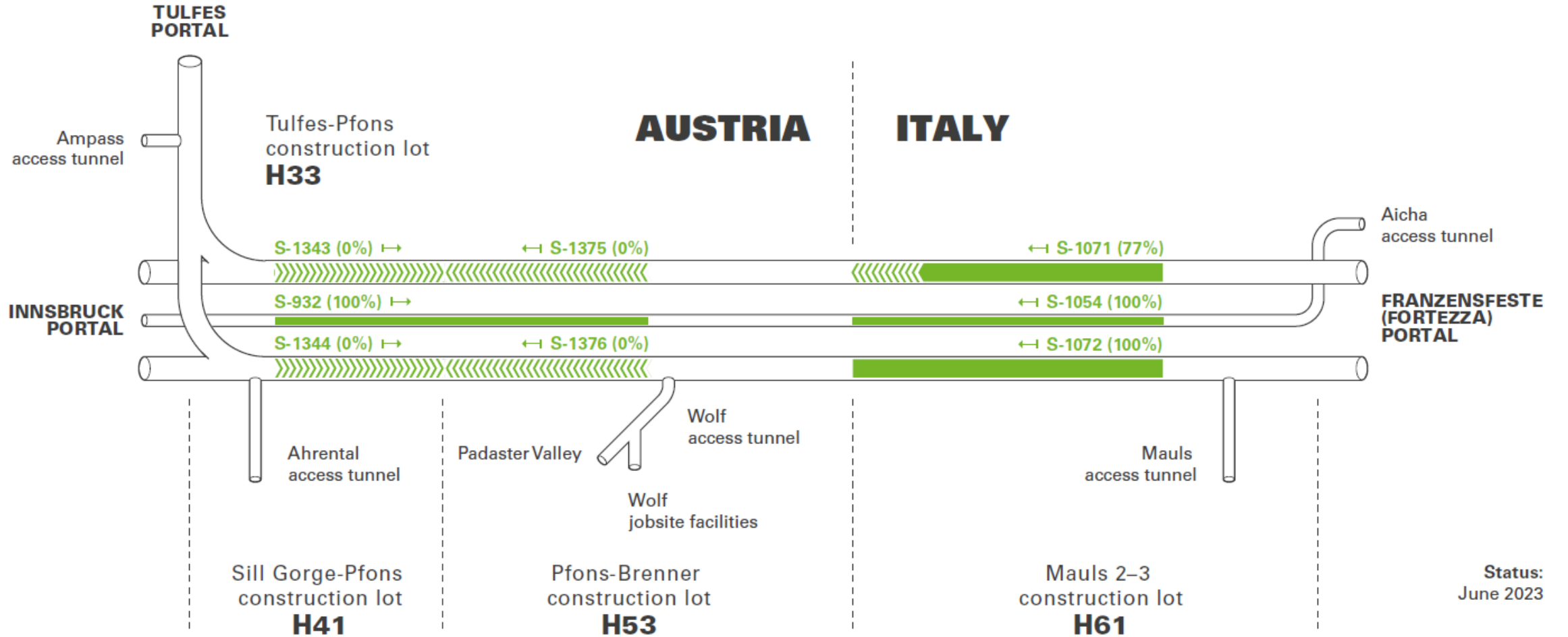
- **2x Double Shield TBM, Pfons-Brenner:**
 - S-1375/76 Ø 10.33 m: 2x 7.5km



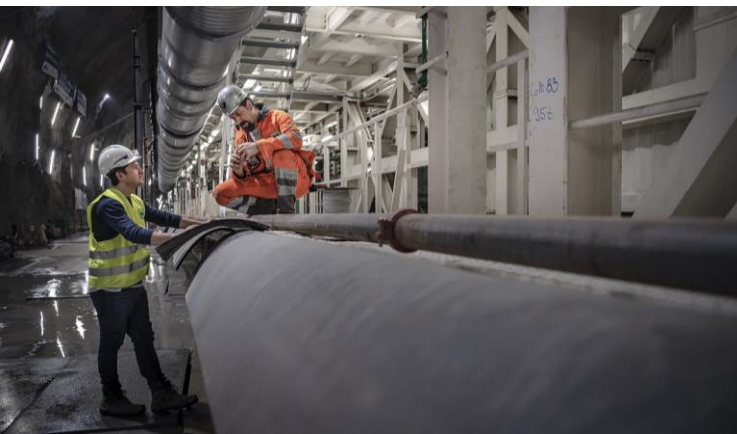
Current Status

BRENNER BASE TUNNEL

ブレンナーベーストンネル



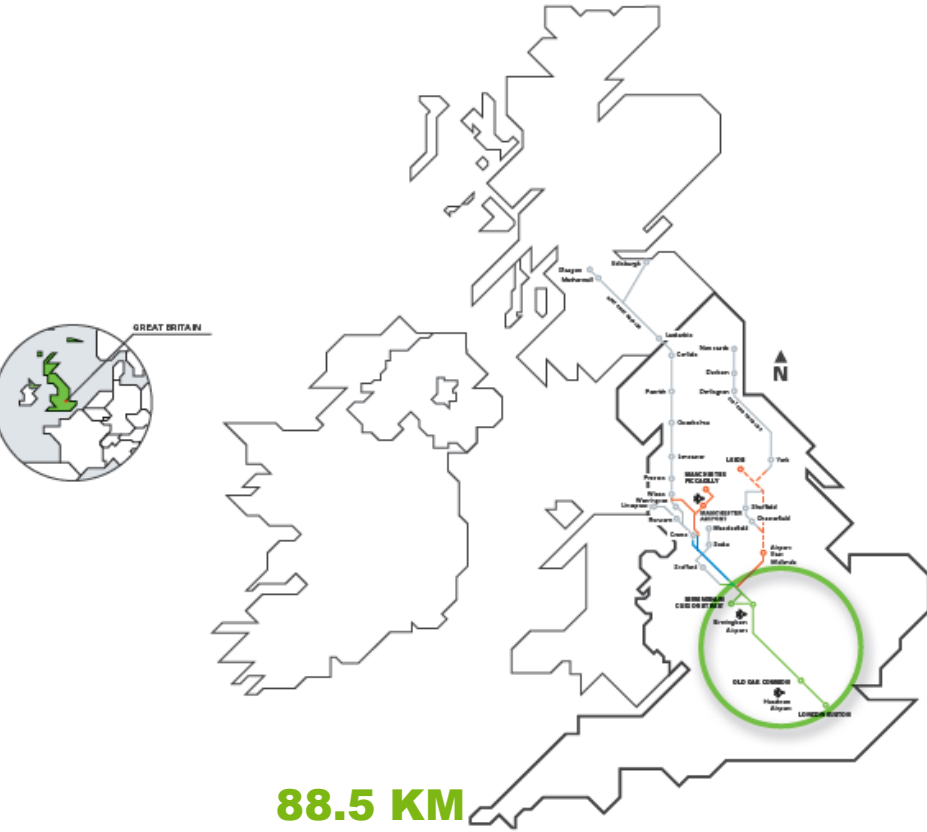
Status:
June 2023



From London to Birmingham

HIGH SPEED 2

HS2高速鉄道



88.5 KM RAILWAY TUNNEL

HS2 CONSTRUCTION FACTS

- ● ● Destinations served by HS2
- HS2 Phase 1
- HS2 Phase 2a
- HS2 Phase 2b
- - - Eastern leg scrapped
- HS2 services on existing network

Status as per September 2022. Subject to changes.

BIRMINGHAM

Birmingham Curzon Street
Birmingham Airport



BROMFORD TUNNEL

2 x 5.7 km
1 x Variable Density TBM:
S-1299
Ø 8,560 mm
Ready to bore:
Spring 2023

LONG ITCINGTON WOOD TUNNEL

2 x 1.5 km
1 x Variable Density TBM:
S-1249 "Dorothy"
Ø 9,950 mm
Ready to bore:
October 26, 2021
First breakthrough:
July 22, 2022



ATLAS ROAD LOGISTICS TUNNEL

850 m
1 x EPB Shield:
S-1311
Ø 7,080 mm
Ready to bore:
Early 2023

NORTHOLT TUNNEL WEST

2 x 7.9 km
2 x EPB Shield:
S-1274, S-1275
Ø 9,820 mm
Ready to bore S-1274:
September 8, 2022
Ready to bore S-1275:
Autumn 2022



CHILTERN TUNNEL

2 x 16 km
2 x Variable Density TBM:
S-1205 "Florence", S-1206 "Cecilia"
Ø 10,240 mm
Ready to bore S-1205:
May 7, 2021
Ready to bore S-1206:
July 2, 2021



NORTHOLT TUNNEL EAST

2 x 5.5 km
2 x EPB Shield:
S-1332, S-1333
Ø 9,080 mm
Ready to bore S-1332:
Summer 2023
Ready to bore S-1333:
Autumn 2023

Heathrow Airport

LONDON

EUSTON TUNNEL

2 x EPB Shield:
S-1366, S-1367
Ø 8,500 mm
Ready to bore:
Spring 2024

Innovative concepts in initial use

HIGH SPEED 2

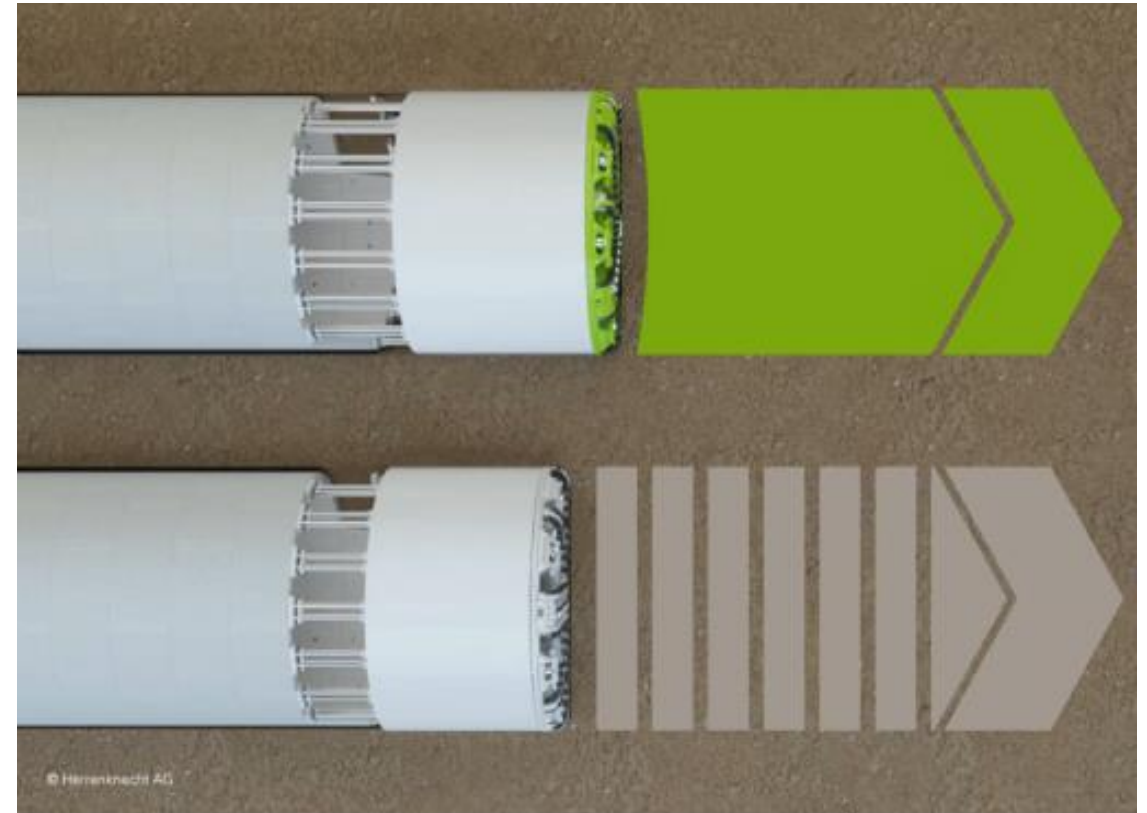
HS2高速鉄道



➤ Robotics



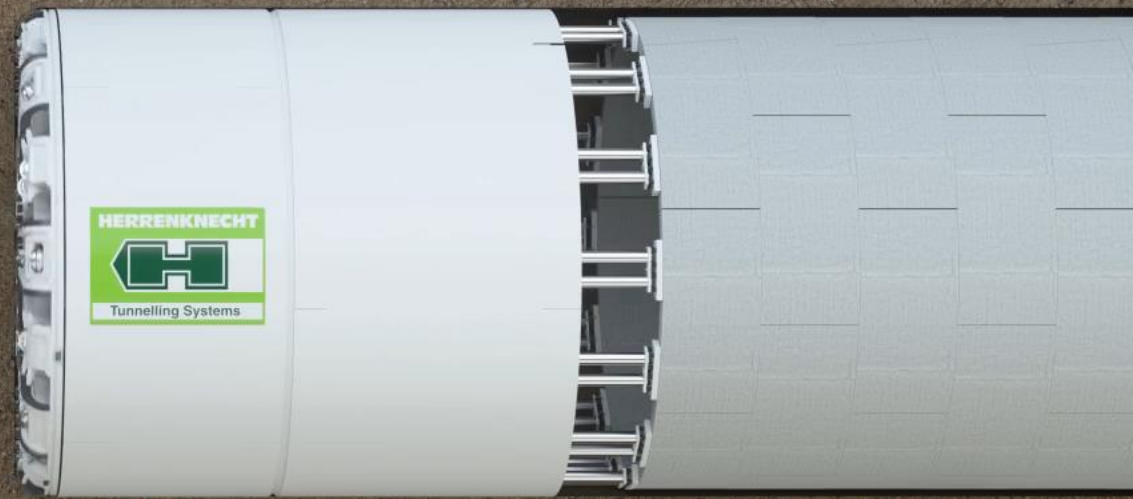
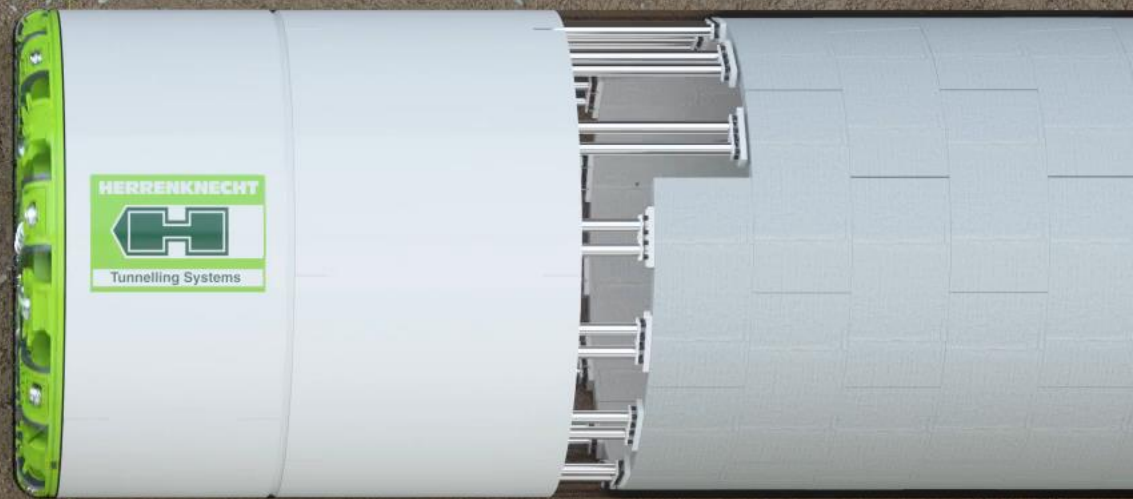
➤ (Semi) Continuous advance



Innovation

CONTINUOUS ADVANCE

同時掘進システム



Singapore

DEEP TUNNEL SEWERAGE SYSTEM (DTSS)

大深度下水システム

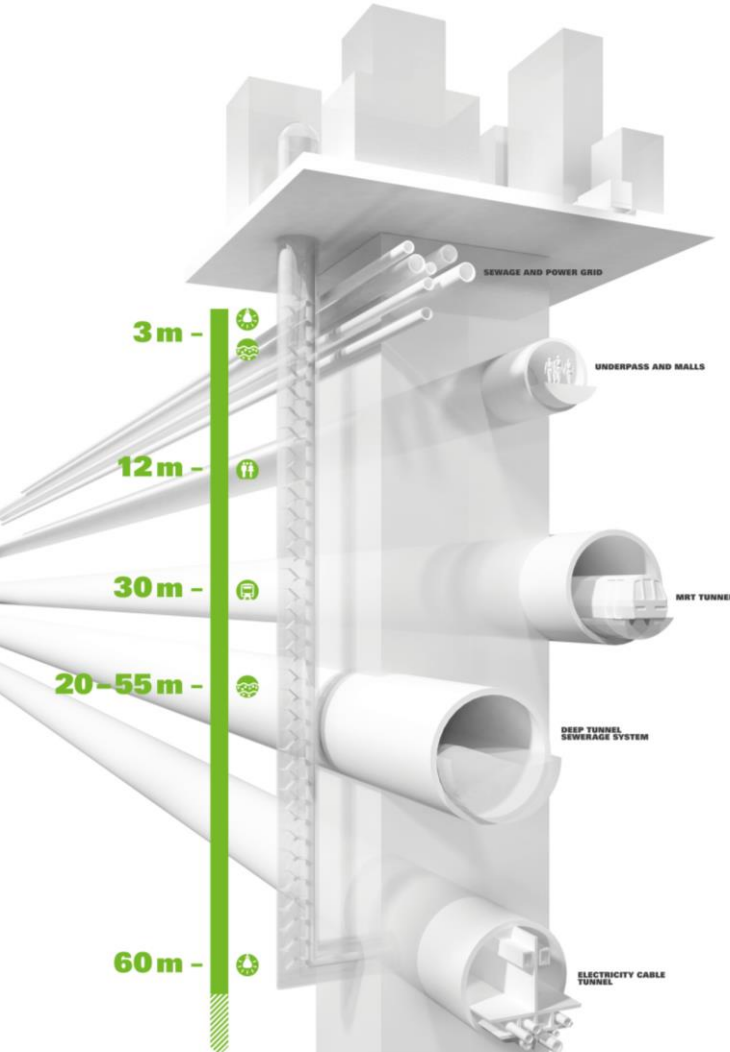


- Total of 200 km sewage tunnels in phase 1 and phase 2
- Sewage treatment for reuse

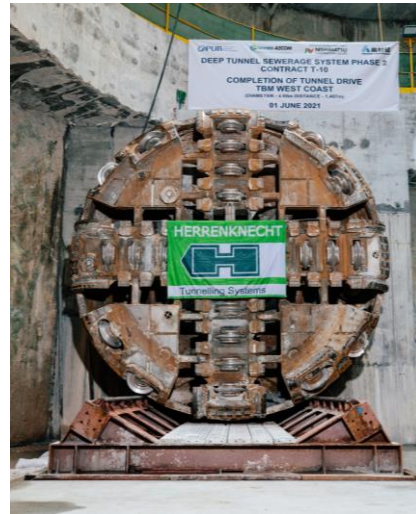
Singapore

DEEP TUNNEL SEWERAGE SYSTEM (DTSS)

大深度下水システム



- › Economical and sustainable tunnel solution for the next 100 years
- › Extremely deep lines (up to 55m deep)
- › 5x EPB Shield for phase 1 (Ø 4,450 - 7,200mm)
- › 19x TBM for phase 2 (Ø 3,000 - 7,415mm)
- › 1x VSM
- › 11x Separation Plants



OFD® - OFFSHORE FOUNDATION DRILLING SAINT-NAZAIRE OFFSHORE WIND FARM

オフショア ファンデーション ドリリング
サンナゼール洋上風力発電プロジェクト（フランス）



OFD[®] - OFFSHORE FOUNDATION DRILLING SAINT-NAZAIRE OFFSHORE WIND FARM

- Full-face drilling concept, low noise emissions
- 73 monopile foundations excavated, Ø 7,700mm
- Overall average drilling performance: **2.5 m/h**



Utility Tunnelling

OFD®

Project Saint-Nazaire

The wind farm
consists of

80



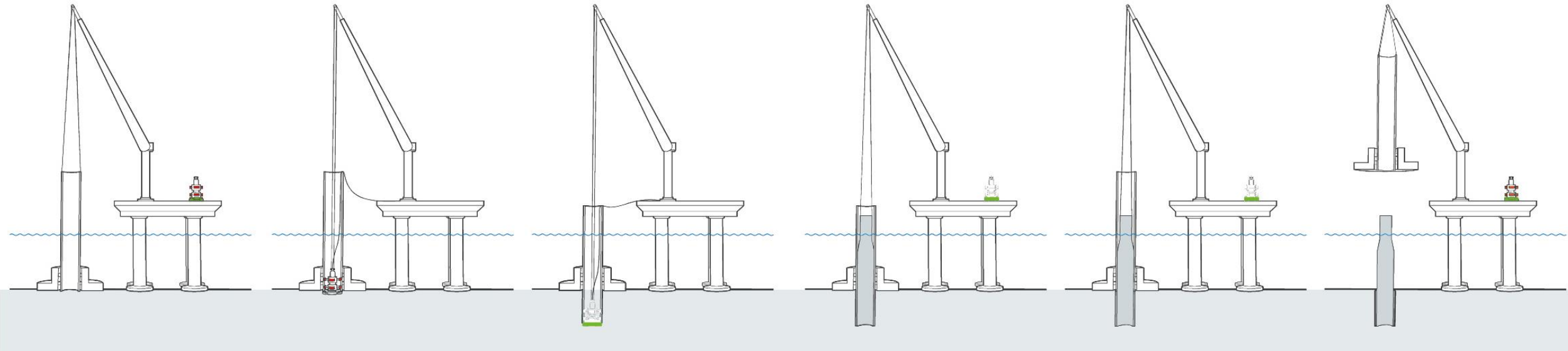
turbines on an area of about 78 km². 73 of them require drilling technology for the construction of the monopile foundations.

PROJECT DATA

- › **Client:**
Parc du Banc de Guérande
- › **Contractor:**
DEME
- › **Application:**
Wind power
- › **Geology:**
Sand, solid rock

MACHINE DATA

- › **OFD® FF 7700 C-7050 F**
Diameter: 7,700 mm
Cutterhead power: 1,600 kW
Nom. torque: 3,763 kNm
Revolutions: 0–5.9 min⁻¹



1. Installation of the MODIGA on the seabed

2. Installation of the OFD machine in the liner

3. Start of the drilling process and lowering of the liner to the target depth

4. Recovery of the OFD machine and installation of the monopile in the liner

5. Lifting of the liner to seabed level and grouting of the annular gap

6. Recovery of the MODIGA

Mining

WOODSMITH MINE

ウッズミス鉱山



SHAFT BORING ROADHEADER

Service Shaft

SHAFT BORING ROADHEADER

Production Shaft

Shaft Boring Roadheader

- Ø 7,500 mm – 12,000mm
- Shaft depth: 1,600m

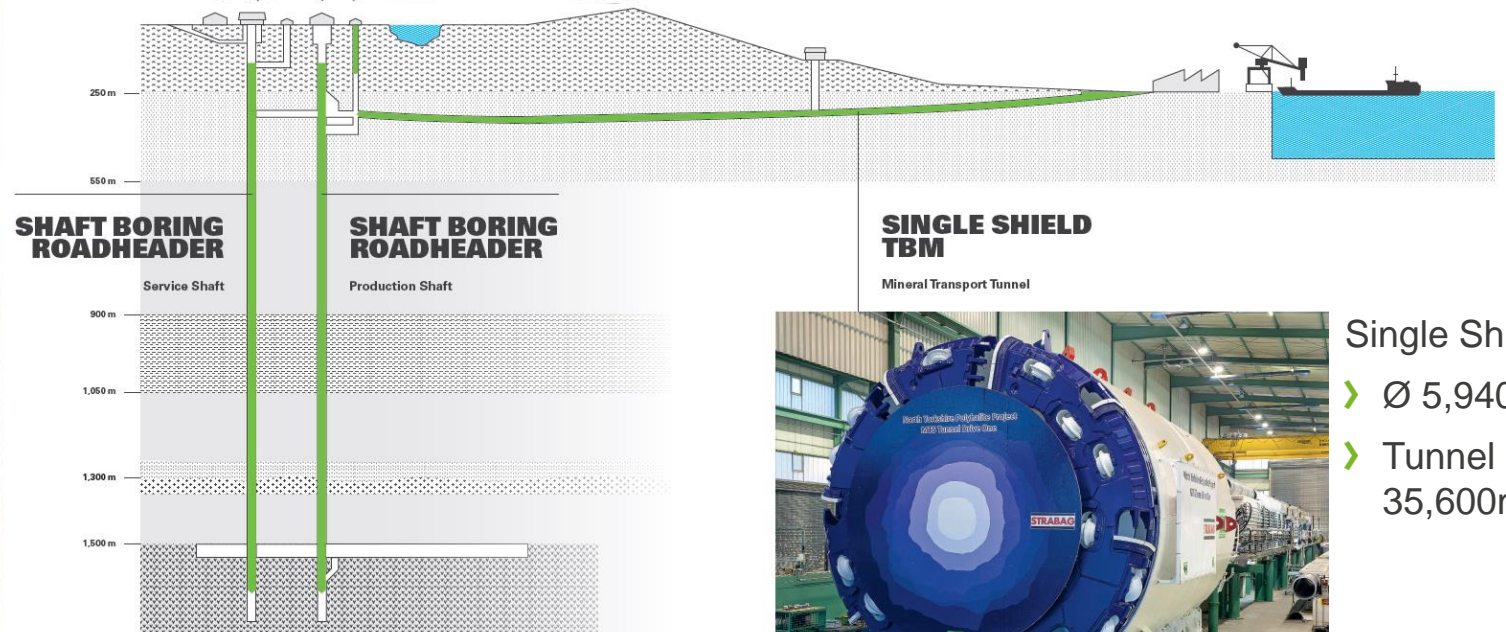


VERTICAL SHAFT SINKING MACHINE

Pilot Shaft for Mineral Transport System

Vertical Shaft Sinking Machine (VSM)

- Ø 9,000mm
- Shaft depth : 115m



SINGLE SHIELD TBM

Mineral Transport Tunnel



Single Shield TBM

- Ø 5,940mm
- Tunnel length: 35,600m

GOT QUESTIONS?

THANK YOU FOR YOUR ATTENTION!

ご清聴ありがとうございます！



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Tunnelling Systems