2026
TRENCHLESS
MOROCCO

KEYNOTE - TECHNOLOGIES SANS TRANCHÉE POUR UN AVENIR RÉSILIENT

PROFESSEUR SAMUEL ARIARATNAM, UNIVERSITÉ D'ÉTAT DE L'ARIZON

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Trenchless Technologies for a Resilient Future

Decarbonising, Digitising, and Deploying Smarter Infrastructure

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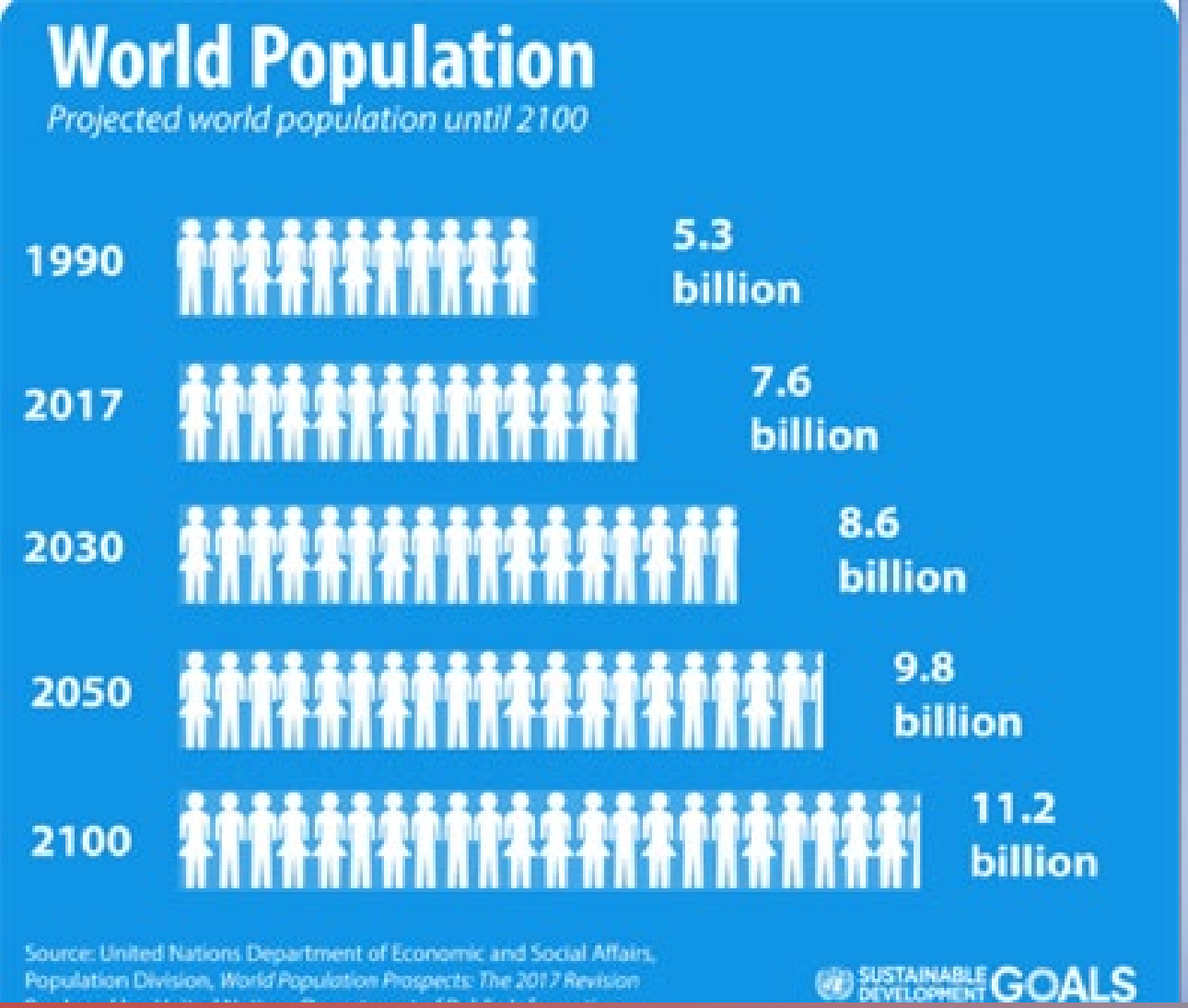
2026 TRENCHLESS MOROCCO

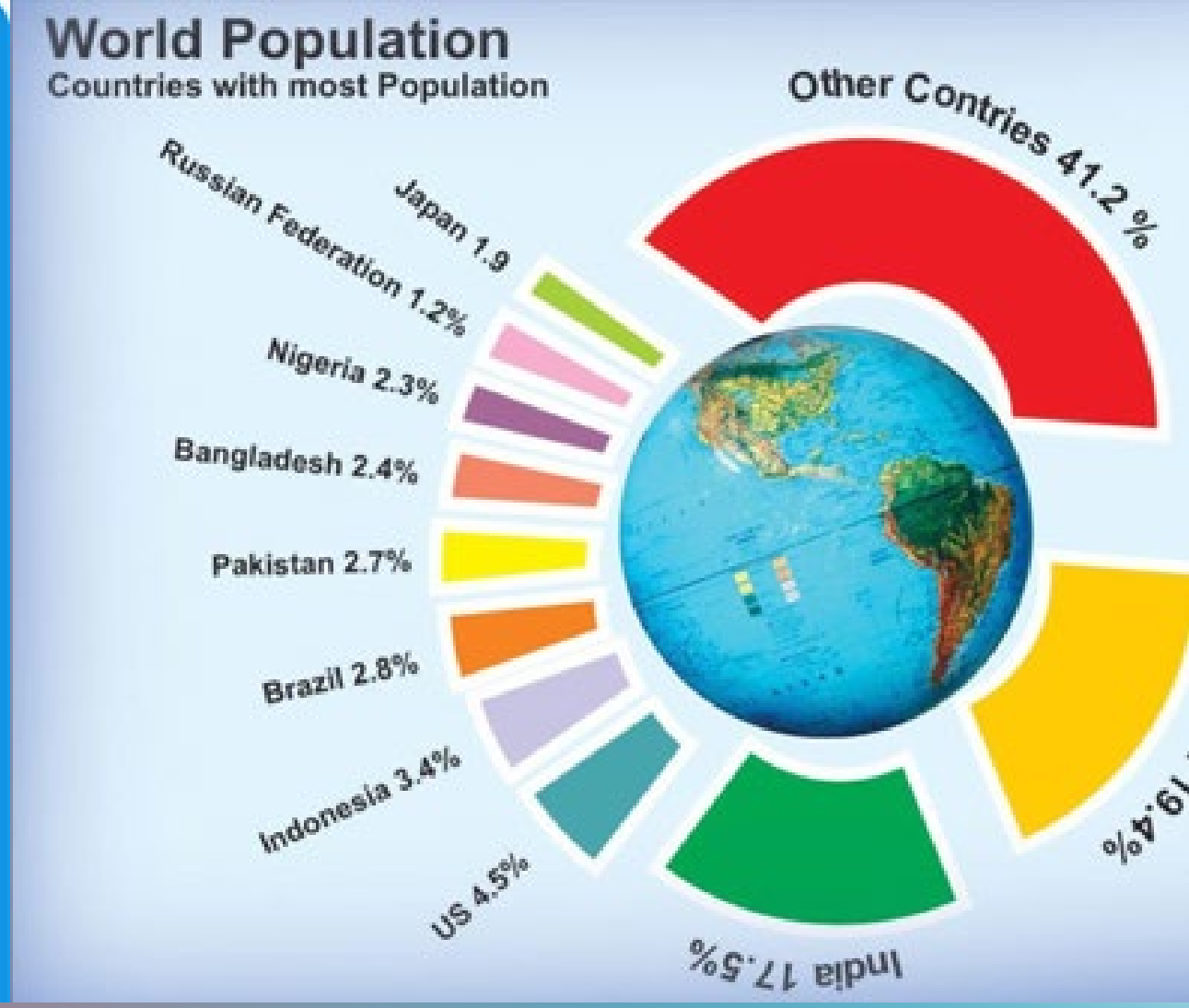
Rabat, Morocco • February 11, 2026

ASU

The Big Picture

Urbanization, climate variability, and utility demand require next-gen underground infrastructure





World Population Growth

Urban Centers

- Currently, 49% of the world's population (81% in the U.S.) live in urban centers
- This figure is expected to increase to 75% by the year 2050 as people look to urban centers for employment opportunities

Worldwide Traffic Issues

Global Water Facts

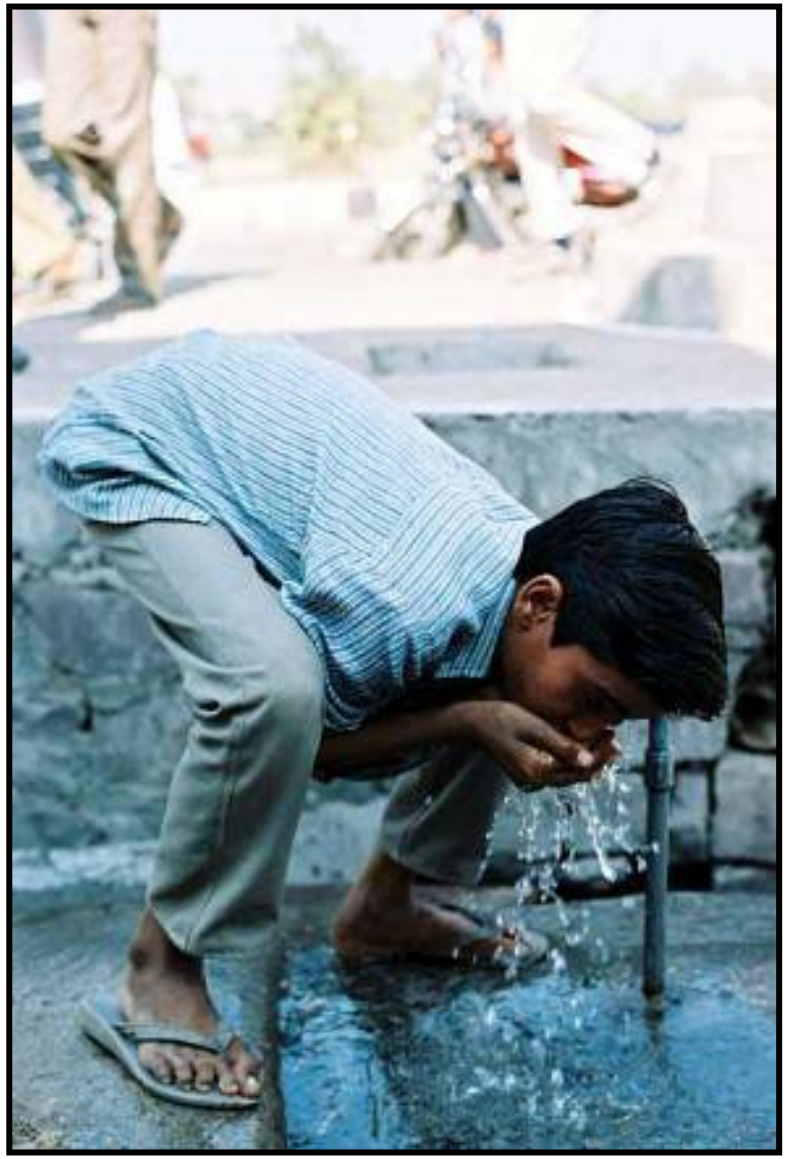
2.2 M people/yr die from illness caused by contaminated water

Five times more children die from dirty water and inadequate sanitation than from AIDS

1.1 B or one in six people lack access to safe drinking water

Daily loss of drinking water to line leakage is 4 liters per person worldwide

In the US, 30-40% of drinking water leaks from pipes before a drop even reaches a single home



Source: Underground Infrastructure Management, Sept/Oct 2007

Open Sewers in India

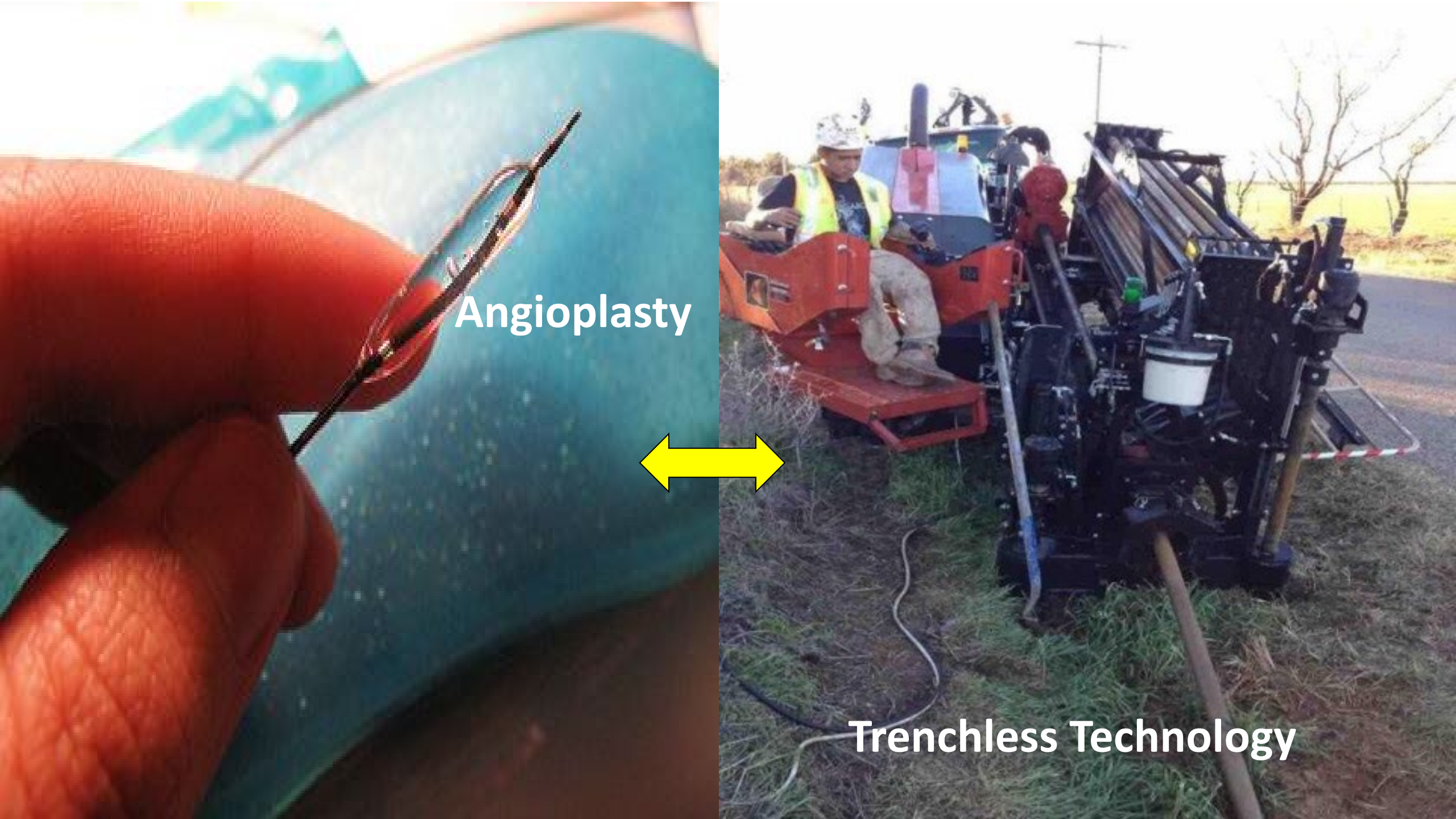
Poor Sanitation Globally

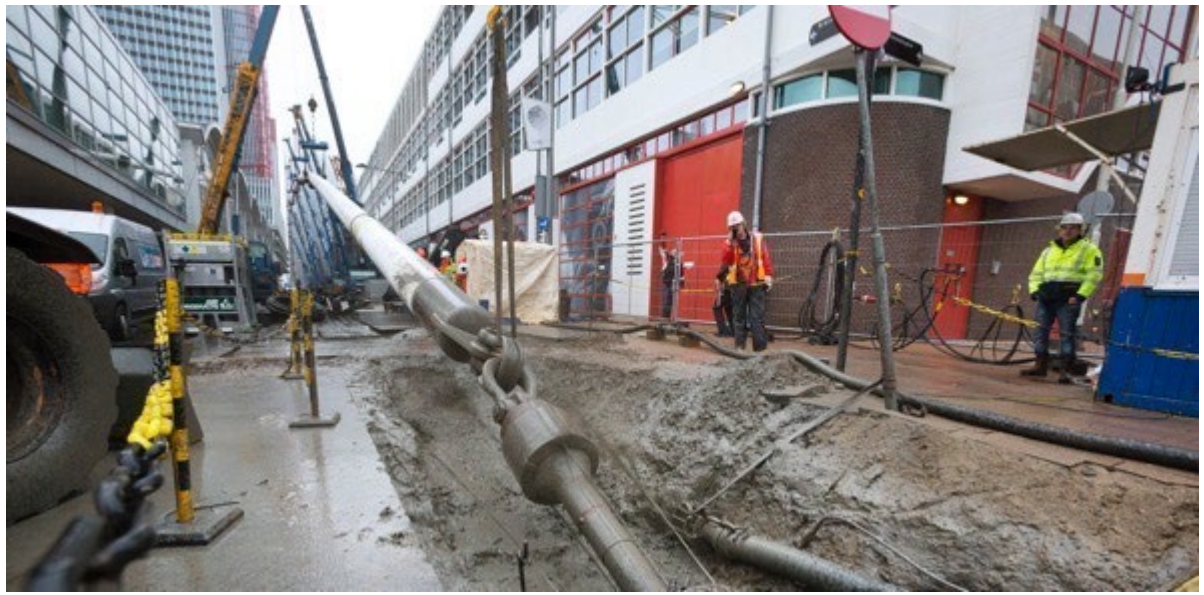
- Poor sanitation and leaking sewage occurs all over the world, not just in developing countries!

Why Trenchless, Why Now?

Trenchless minimizes disruption, lowers emissions, and supports resilient cities


Open Heart Surgery
Open Cut Construction
WELCOME TO
BUSTERS
MARKET


Angioplasty
Trenchless Technology




LANE
FIRE

Before and After Rehabilitation


TRENCHLESS
VS.
OPEN CUT


A Triple Mandate
Decarbonize – Digitize – Deploy smarter systems


SIMULATION
IoT
DATA

Digital Twins

Digital twins are revolutionizing this field by offering a **data-driven, proactive** approach

1. Subsurface Visualization

- Integrates **ground-penetrating radar (GPR)**, **LiDAR**, and **as-built records** to build a high-fidelity 3D model of existing underground assets.
- Enables planners and contractors to **see before they dig**, reducing risk and uncertainty.

2. Clash Detection & Design Optimization

- Digital twins simulate proposed utility routes in real-world conditions to avoid conflicts.
- AI-enhanced simulations can recommend **least-disruptive routing** based on cost, risk, and environmental constraints.

3. Lifecycle Asset Management

- Tracks installation, usage, maintenance, and aging of assets in real time.
- Supports **predictive maintenance** to extend asset life and prevent failures.

4. Stakeholder Collaboration

- Offers a **shared, dynamic model** that can be accessed by engineers, city planners, contractors, and utility companies for better coordination.

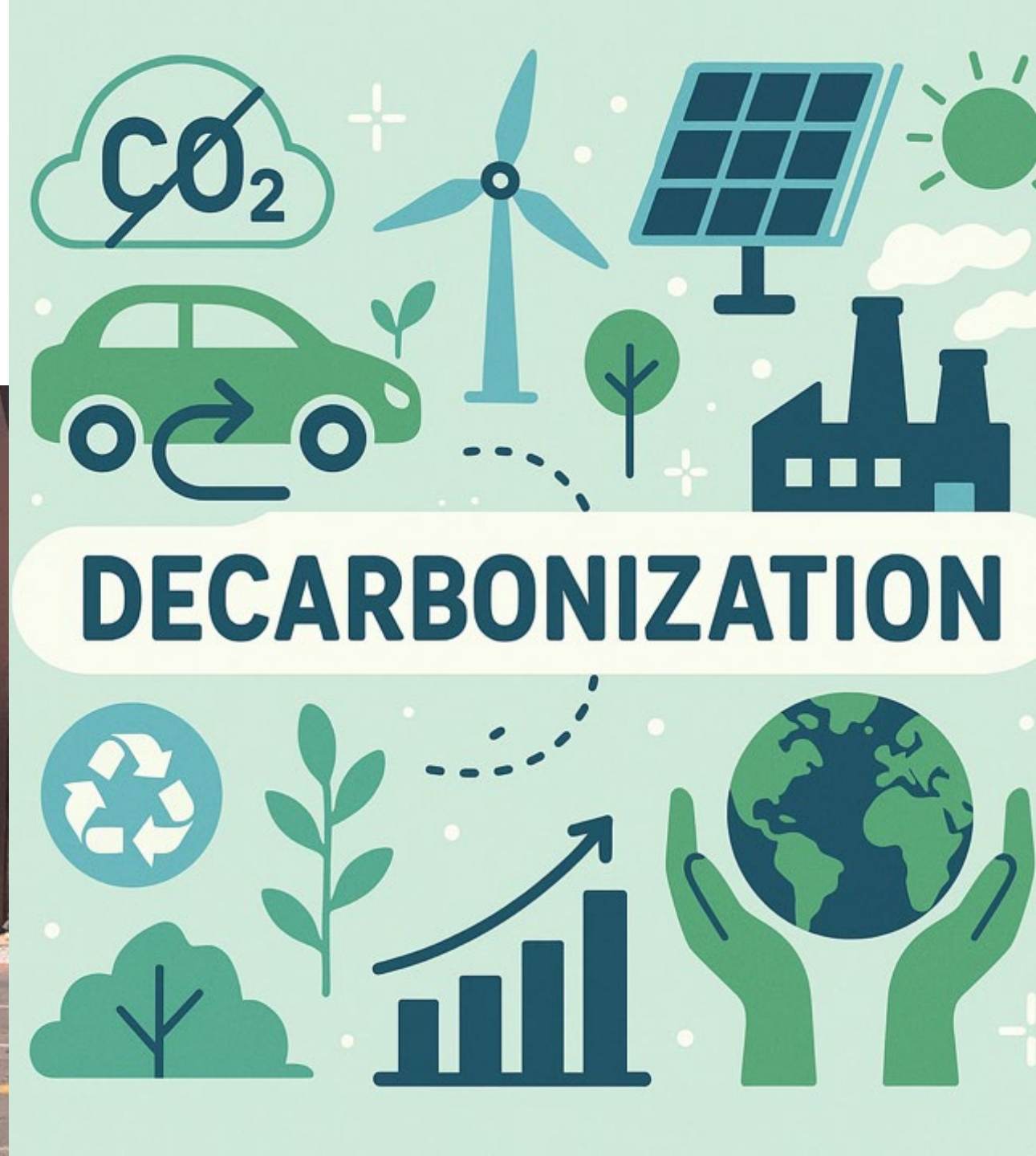
5. Smart City Integration

- Ties into broader smart city frameworks, enabling real-time coordination with surface infrastructure, transportation systems, and energy grids.

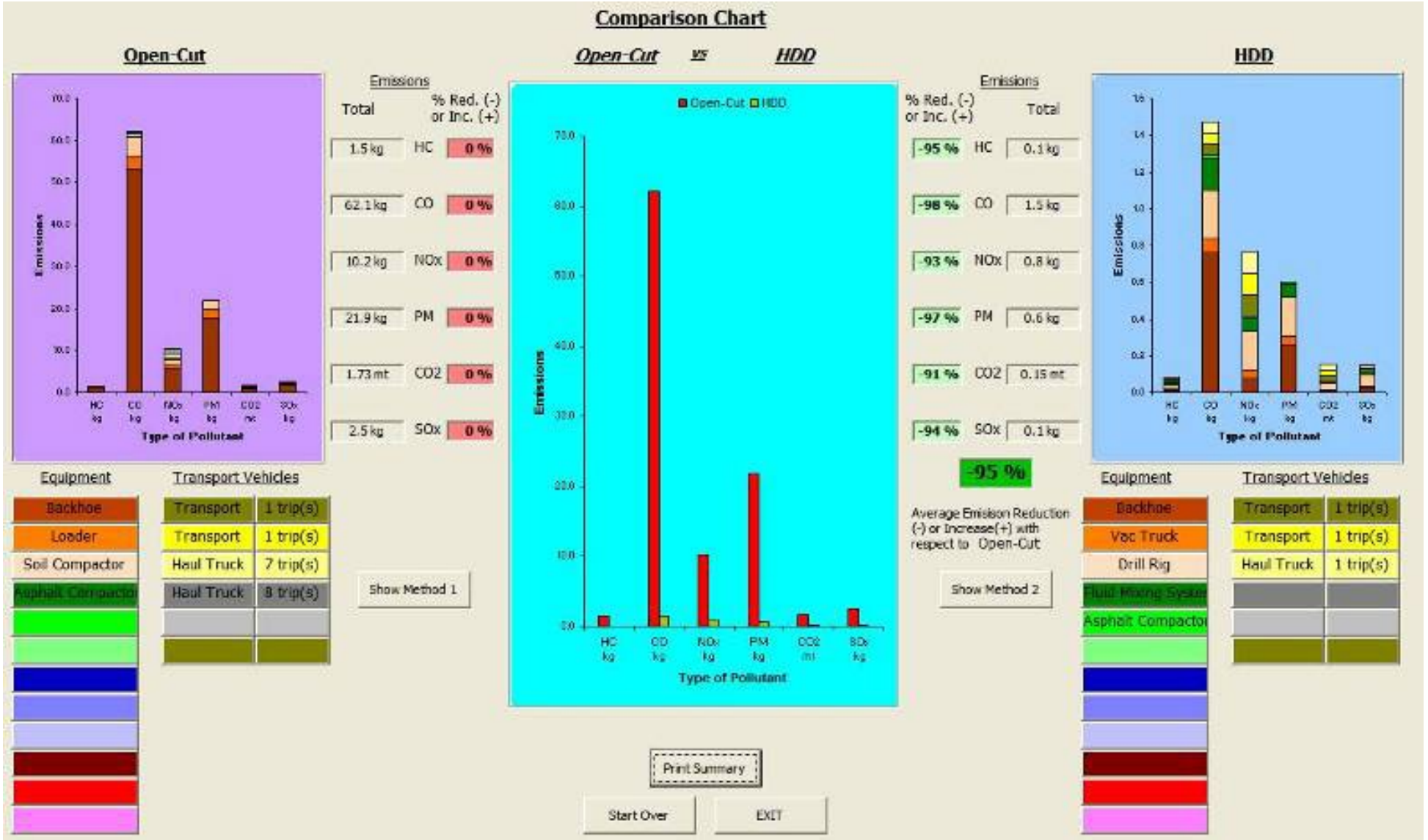
Decarbonisation Metrics

Trenchless methods reduce lifecycle emissions by up to 70% vs. open-cut methods

Trenchless Benefits



Carbon Footprint



Trenchless options produce significantly less airborne emissions !

Case Studies: Emissions Reduction

- Up to 90% Reduction in Emissions: Studies indicate that trenchless methods can reduce greenhouse gas emissions by up to 90% compared to traditional excavation. This is primarily due to decreased fuel consumption, minimized material transport, and reduced excavation needs. *(Ariaratnam)*

- **75% Lower Carbon Emissions**: PW Trenchless reports that trenchless construction can reduce carbon emissions by approximately 75% relative to open-cut methods. Their carbon calculator, approved by the Province of British Columbia CANADA, has been instrumental in quantifying these savings. *(PW Trenchless)*

- **86% Emissions Reduction in Spain**: A project near Madrid utilizing the Primus Liner® trenchless method achieved an 86% reduction in carbon emissions. This significant decrease was attributed to a 99% reduction in truck loads and an 87% savings in fuel consumption. *(Primus Liner)*

- **50–75% Emissions Savings in the UK**: Research by the UK's Pipe Jacking Association demonstrated that trenchless pipe installations could save up to 75% in carbon emissions compared to open-cut methods, particularly in deep urban installations. *(UK Pipe Jacking Association)*

Urban Undergrounding & Electrification

Trenchless tech is central to resilient underground utility corridors

Why is Electricity Critical?

Business Impacts

Impact on business and residential services.

Communications

Impact on telephone and other communication networks.

Transportation

Impact on traffic flow.

Water/ Wastewater Treatment

Impact on municipal operations.

What about charging electric cars?

Above Ground Electrical Lines

Undergrounding for Resilience

- Buried networks resist wildfires, storms, and cyber disruptions.

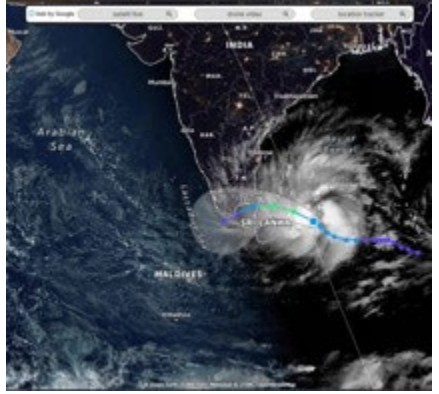

Fires from downed
electrical lines

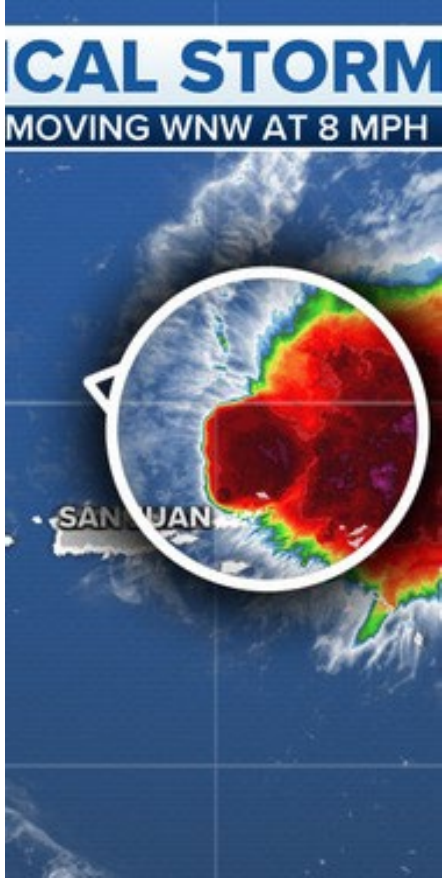
Natural Events

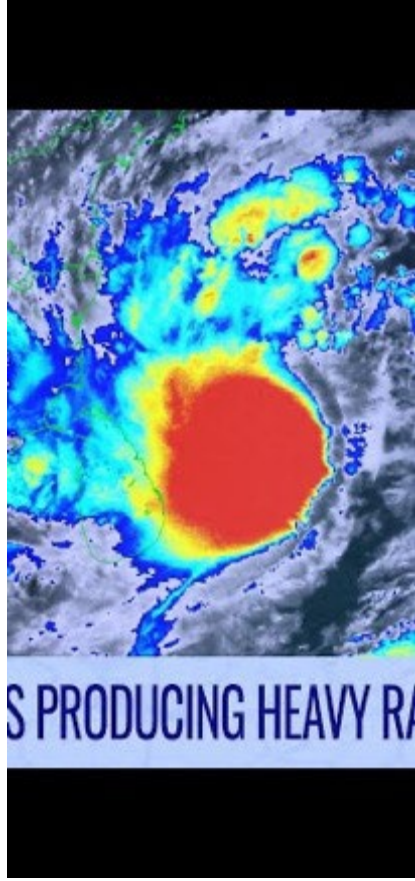
- Tsunami, typhoon, cyclone, hurricane, or tornado
- Extreme rain event
- Winter ice storm
- Earthquake
- Wildfires

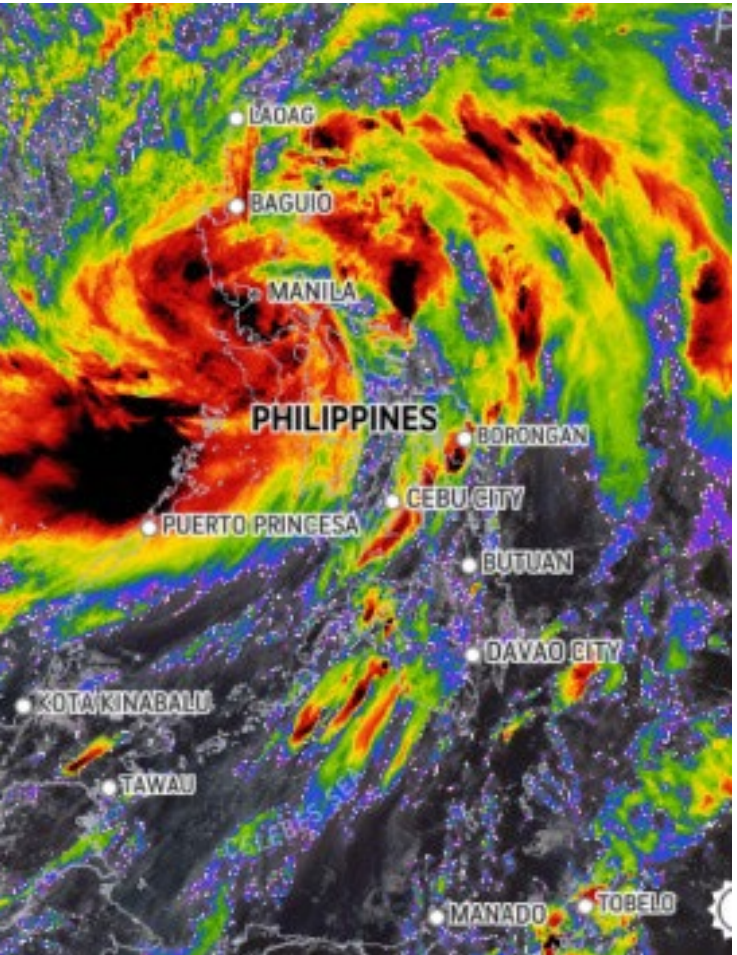

MAX DEFENDER 8
POTENTIAL TROPICAL CYCLONE TWENTY-TWO
1:00AM 300 MI WSW OF KINGSTON JAMAICA
MAX WINDS 35 mph
PRESSURE 1004 mb
MOVEMENT NNE at 7
TAMPA
MIAMI
NASSAU
SAT 7:00 PM 50 MPH
SAT 7:00 AM 45 MPH
FRI 7:00 PM 40 MPH
FRI 7:00 AM 35 MPH
SAN JUAN


TROPICAL STORM PABUK
GUSTS 95 kph
MOVEMENT NW at 17 kph
LATITUDE 7.2°N
LONGITUDE 103.0°E
Hour: 120 55 kph
Hour: 96 65 kph
Hour: 72 75 kph
Hour: 48 65 kph
Hour: 24 75 kph
Hanoi
THAILAND
Bangkok
Qui Nhon
Phnom Penh
Ho Chi Minh City
MALAYSIA
Kuala Lumpur

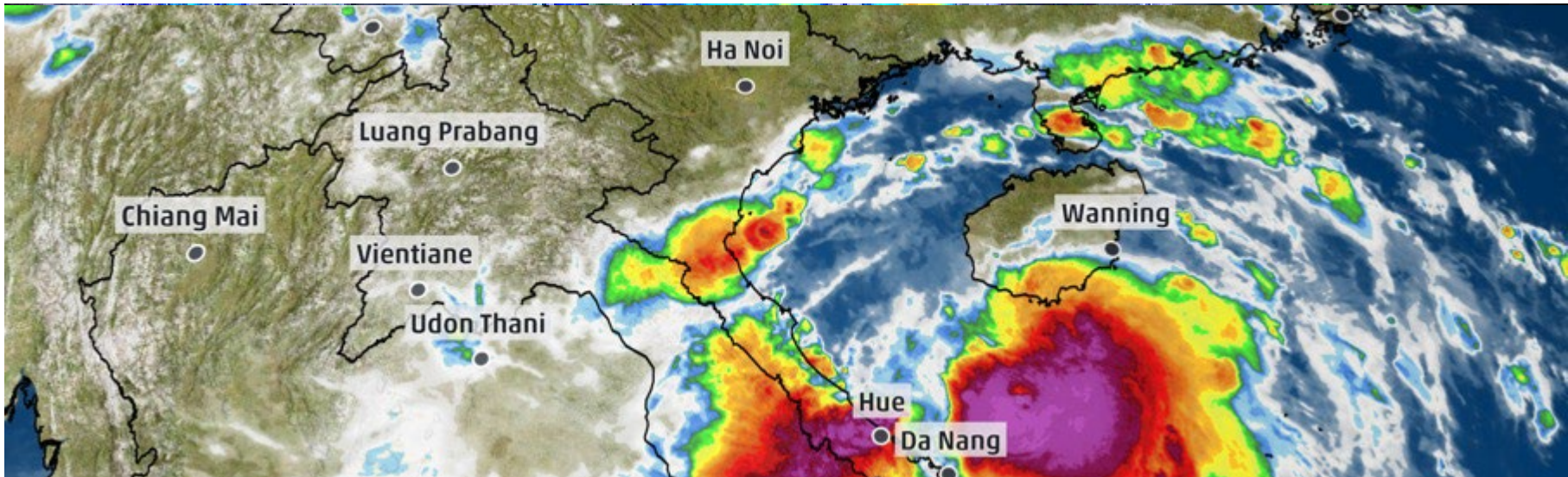

INDIA
Arabian Sea

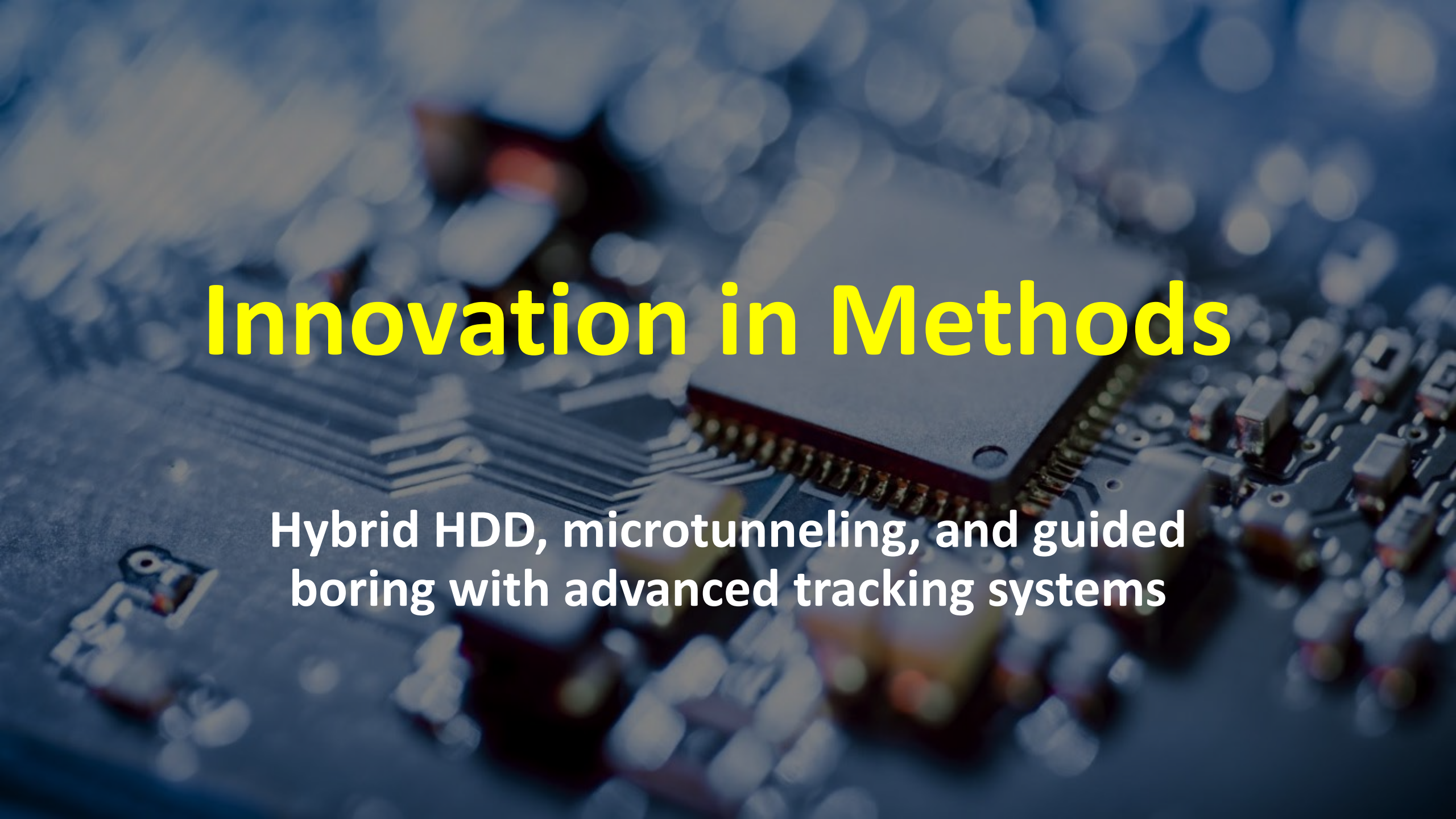

CAL STORM
MOVING WNW AT 8 MPH
SAN JUAN


S PRODUCING HEAVY RA


LAOAG
BAGUIO
MANILA
PHILIPPINES
BORONGAN
CEBU CITY
PUERTO PRINCESA
BUTUAN
DAVAO CITY
KOTA KINABALU
TAWAU
MANADO
TOBELO


Tropical Cyclone Damien Latest
Current Information
85 mph
Moving SSW at 6 mph
Port Hedland
Paraburdoo
Carnarvon
AUSTRALIA


Ha Noi
Luang Prabang
Chiang Mai
Vientiane
Udon Thani
Wanning
Hue
Da Nang


Innovation in Methods
Hybrid HDD, microtunneling, and guided boring with advanced tracking systems

Direct Steerable Pipe Thrusting

Electric HDD Rigs

“New” ARES Walkover Locating System

Small Boring Units (SBUs)

- Small Boring Units (SBU's) used for drilling in rock
- Small diameter rock cutting head 24" (600mm) to 72" (1.8m) attached to auger boring machine
- Capable of excavating hard rock on drives < ~500 ft (150m)

UV Curing

Innovations in Inspection Cameras


From: To:
%:
Remarks: VERMIN


IKI - Itty-bitty Kitty in Invert: 100%


0.0 FT.
-> 10.03.06

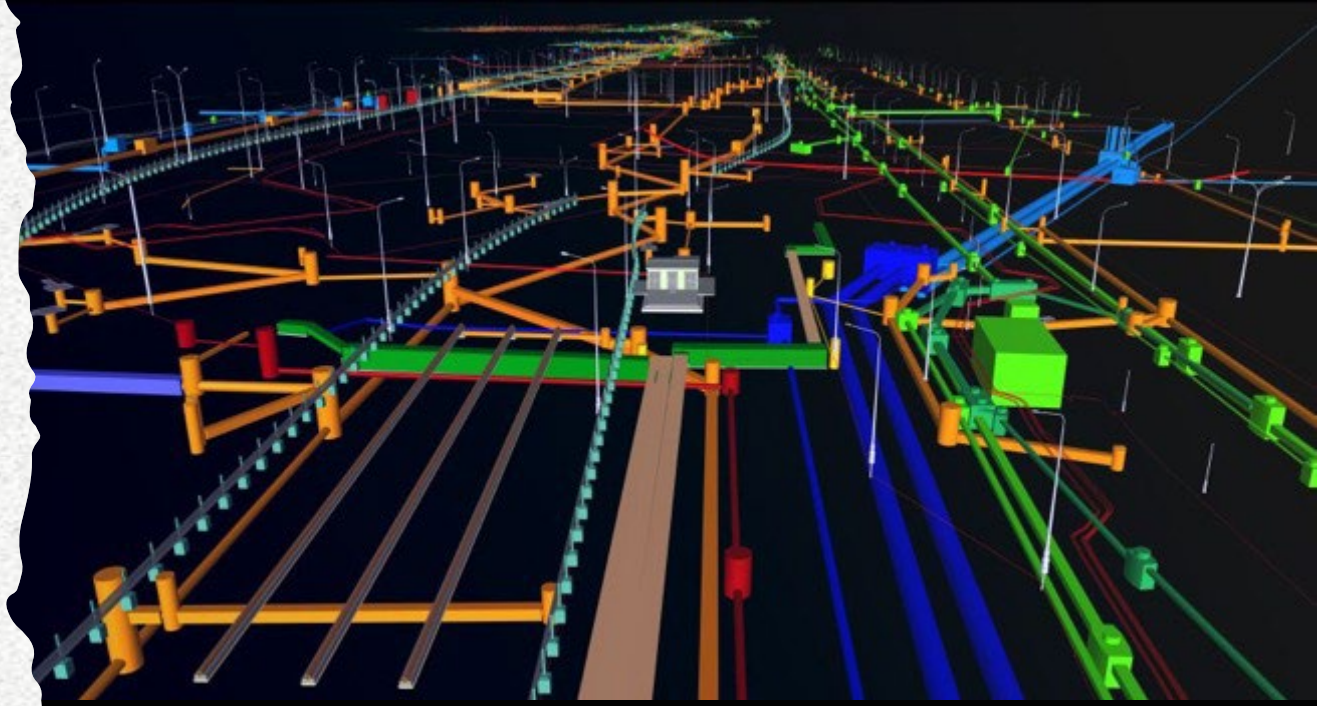

12:12:28 08.06.2018 44.32m
CONTRACT REF:

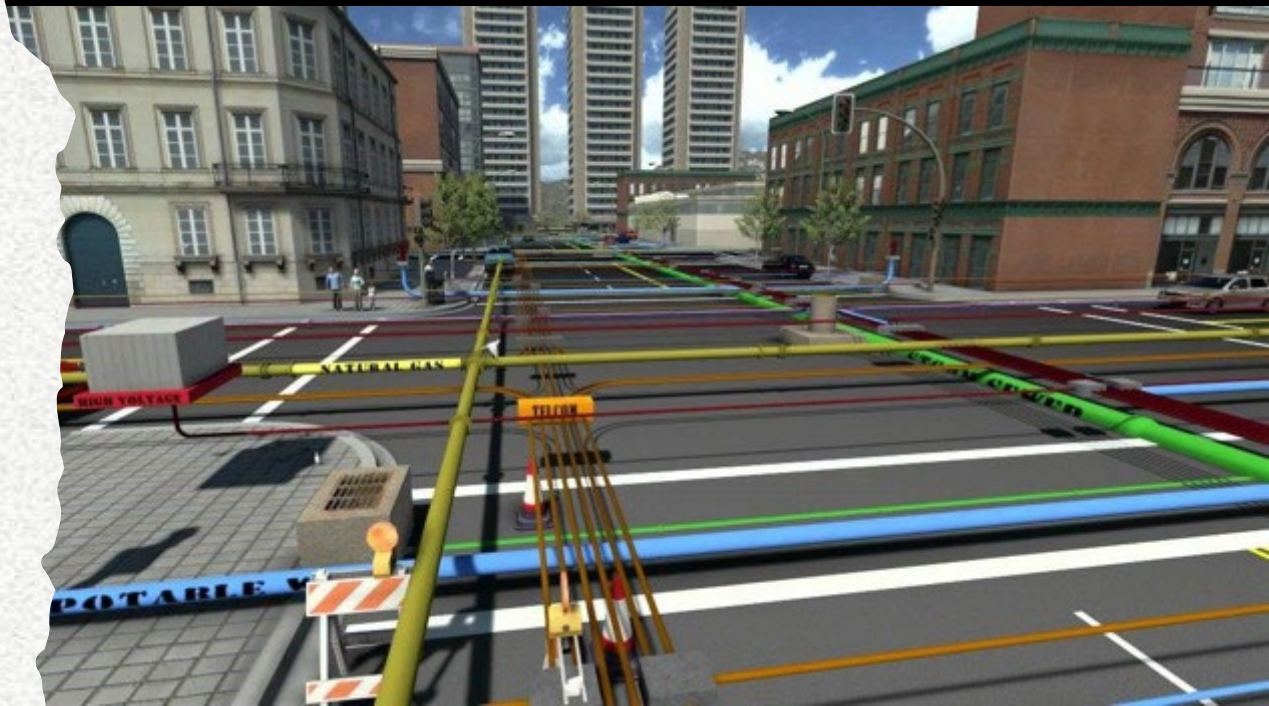

Vermin Rat

Subsurface Utility Engineering (SUE)

- Integrated 3D mapping avoids costly strikes and redesigns.

3D Computer Generated Mapping






Och amhain
Tramanna
EXCEPT
TRAMS
Och amhain
Tramanna
EXCEPT
TRAMS

Striking a Natural Gas Line


Slightly off target!


AI and Simulation Tools
AI enables route optimization and predictive failure modeling

The Digital Jobsite

- AR/VR support for planning, remote guidance, and workforce training.

Jobsite Connectivity

Workforce and Training Futures

High-tech trenchless careers attract new talent; Universities/Colleges must take the lead

Even a monkey can operate an HDD rig!

Professional Training (Field and Classroom)


Simulators and
Virtual Reality

Global Trenchless Projects

The Next Frontier?

- **Vision:** Autonomous trenchless systems and predictive subsurface infrastructure

The Construction Site of the Future?

Call to Action

Invest in education, enable testbeds, reform procurement to favour trenchless

Merci Beaucoup!