Global Thermal Energy Network Momentum

Moderator: Ania Camargo / *HEET Board of Directors*

Panel: Eric Bosworth / *Thermal Energy Insights*

Zeyneb Magavi / *HEET*

Miles Ingraham / *Jacobs*

Mikko Ojanne / *Rototec Europe*

Geothermal in Central Asia and the Middle East

Eric Bosworth- Principal, Thermal Energy Insights
Eric@TEInsights.com

Central Asia

- IFC (World Bank) led initiatives in 4 Central Asian Countries
- Old USSR style districts are past end of life and need to be replaced
- Many countries see extreme cold temperatures in the winter, so reliable heating is critical
- Legislative and permitting environment is much more flexible than US or Europe
- Very large (3,000 – 30,000) home equivalent projects are planned
- Initial feasibility is ongoing, but results are showing strong IRR when compared to other options (modern central district, ASHP, etc.)
- Moving away from reliance on coal is a huge focus in the region

Jordan

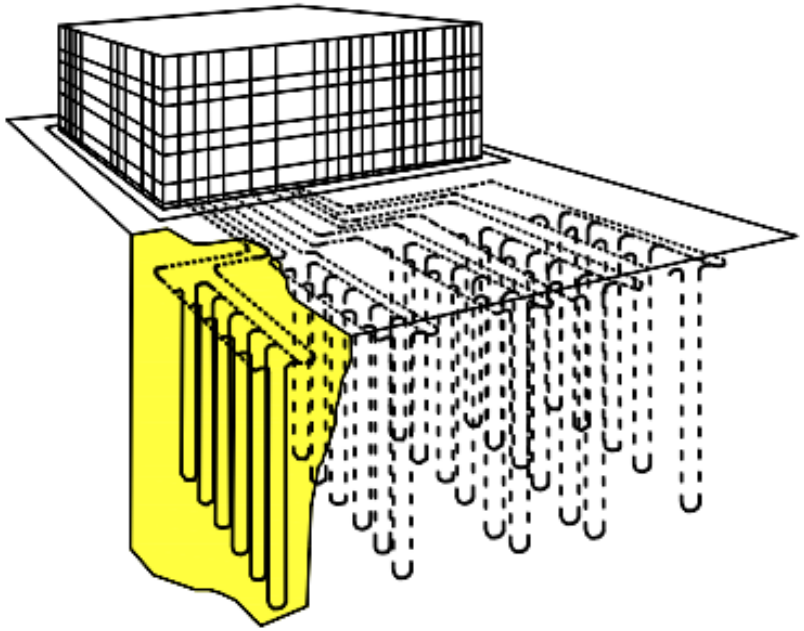
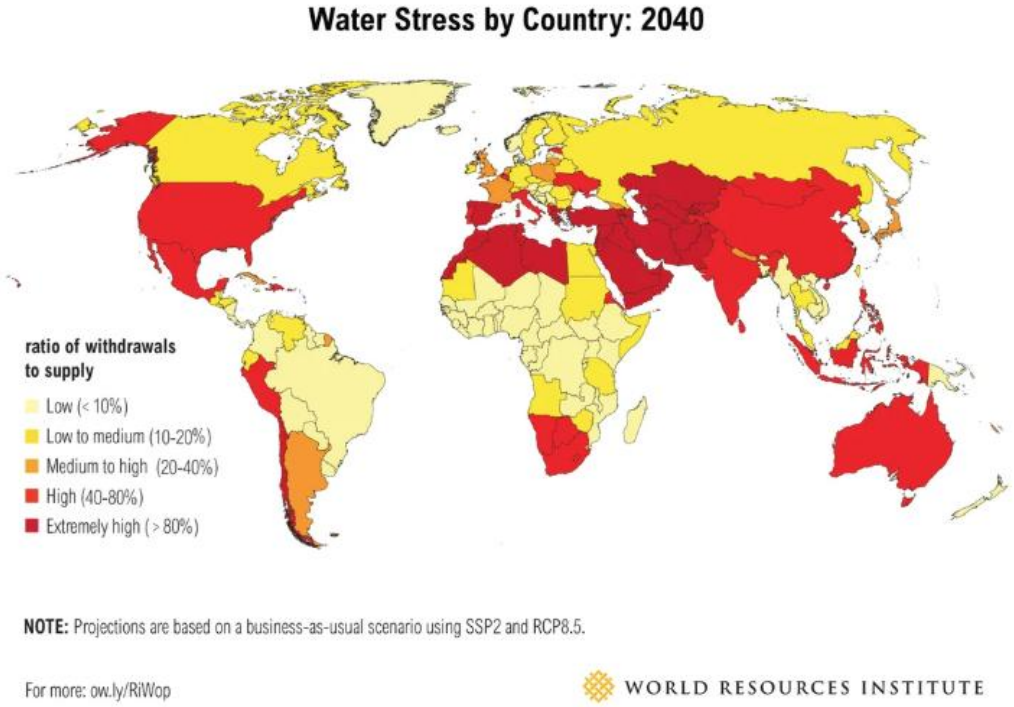
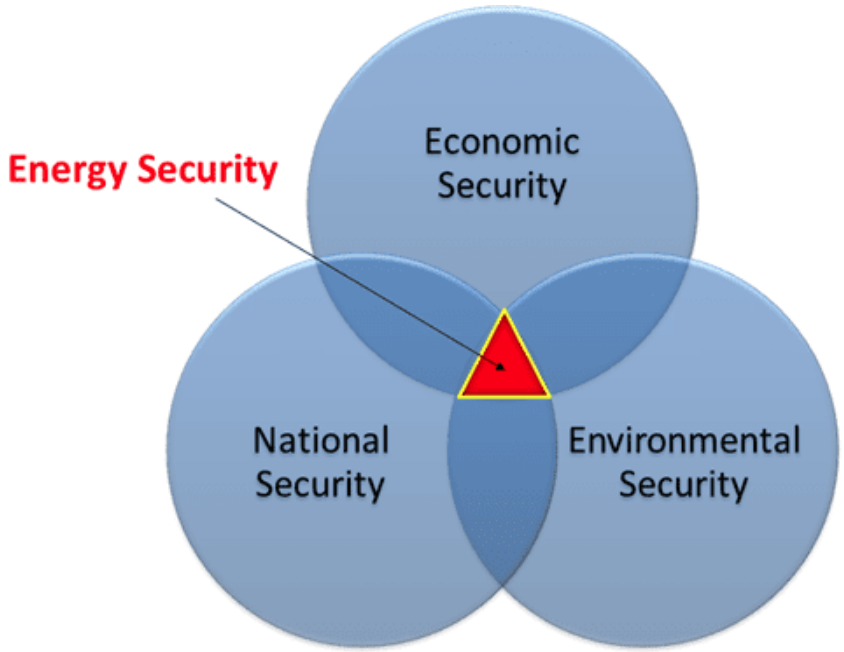


Figure 2: Close loop system of AUM

- Country-wide feasibility report to evaluate 5th generation single pipe loop
- While the climate is very cooling dominated, system can be balanced with hot water and other heating loads
- Some demonstrations of individual GSHP installs to serve as technology example (Jordan University of Science and Technology)
- Heating COP of 6 and cooling COP of 4.5 observed on this single system install
- Main challenge with existing GSHP systems have been support and maintenance from Europe
- Comparison to other heating and cooling very strong due to geothermal efficiency. No gas competition, so primarily electric resistance and delivered fuels

Value Drivers Around The World





Credit: Arava Institute

- Local energy security is a huge priority (insulation from geopolitics and lack of domestic energy)
- Grid stability is the second largest priority with many aging and unstable grids
- Reduction in subsidies for energy supply (many countries directly subsidize both fuel and electricity)
- In-country manufacturing and production
- Decarbonization and air quality initiatives
- Water conservation (Middle East especially)

Discussion & Questions

GLOBAL MOMENTUM

ZEYNEB MAGAVI

MARCH 2026

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Will briefly touch on four global case studies illustrating how context creates the opportunity, including law, regulation, economics, geopolitics, and more.

- **UKRAINE**
- **NETHERLANDS**
- **TURKIYE**
- **PAKISTAN**

UKRAINE

Energy Security is National Security.

Delegation visits Framingham and begins moving municipal projects forward.

As they prepare to rebuild after the war, Ukrainian delegation visits Mass. to study geothermal energy

A dozen ministers, mayors, and utility regulators traveled to the Bay State to learn how to incorporate renewable heating into their vision for a postwar Ukraine

By Ivy Scott Globe Staff, Updated September 21, 2024, 8:31 a.m.

Learning together with the Ukrainians.

THE NETHERLANDS

Decided in 2019 to move off gas by 2050, halted gas production in 2023, and now in 2026 gas boiler replacements must be heat pumps.
'ZLT' is a new pathway for the Dutch, with growing interest.

Positionpaper TKI Urban Energy

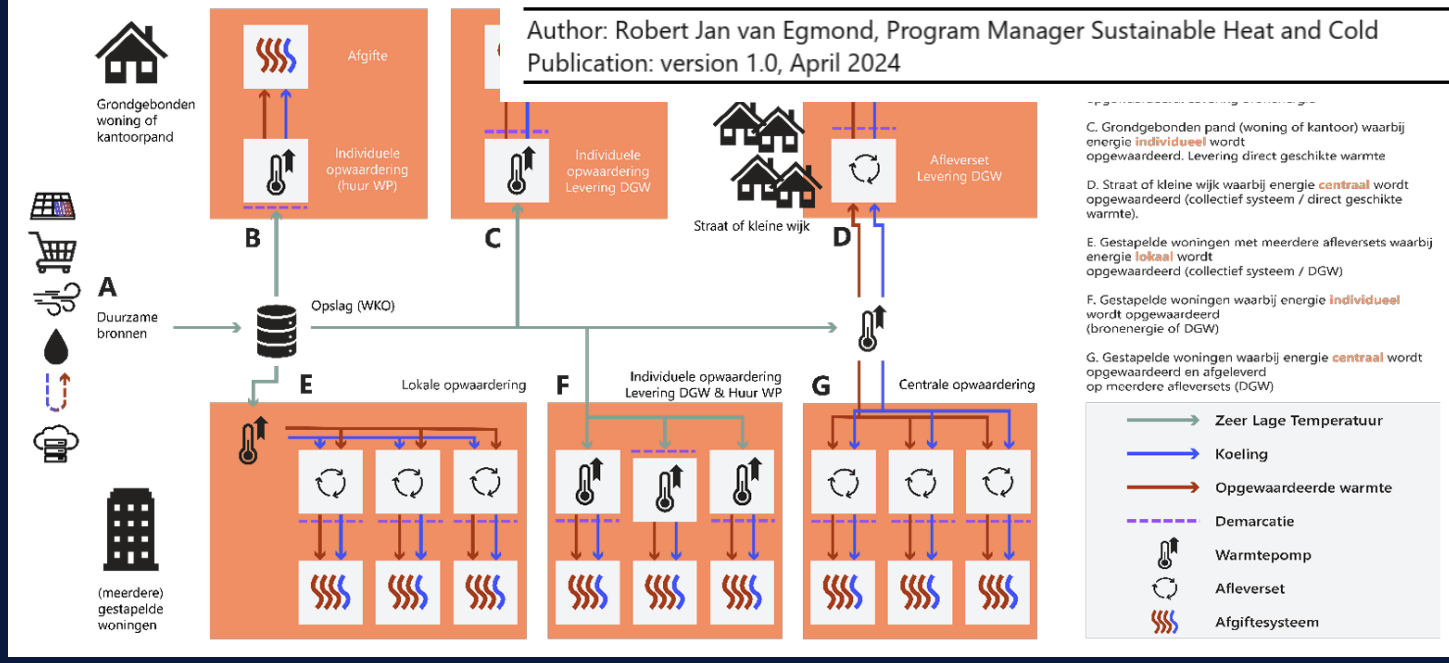
tki urban energy
topsector energie

An extra route for the Dutch heat transition

Social investment in Ultra Low Temperature (ULT) exchange networks as future-proof infrastructure for heating and cooling, with the advantages of both heat pumps and heat networks.

Author: Robert Jan van Egmond, Program Manager Sustainable Heat and Cold
Publication: version 1.0, April 2024

Schematic representatio



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THE GAS TO GEO PATHWAY

The opportunity to shift specifically gas utility companies, gas workers, and gas customers to geothermal networks multi-solves barriers to change: providing workforce transition, stabilizing loads & energy burdens, and **utility financing**.

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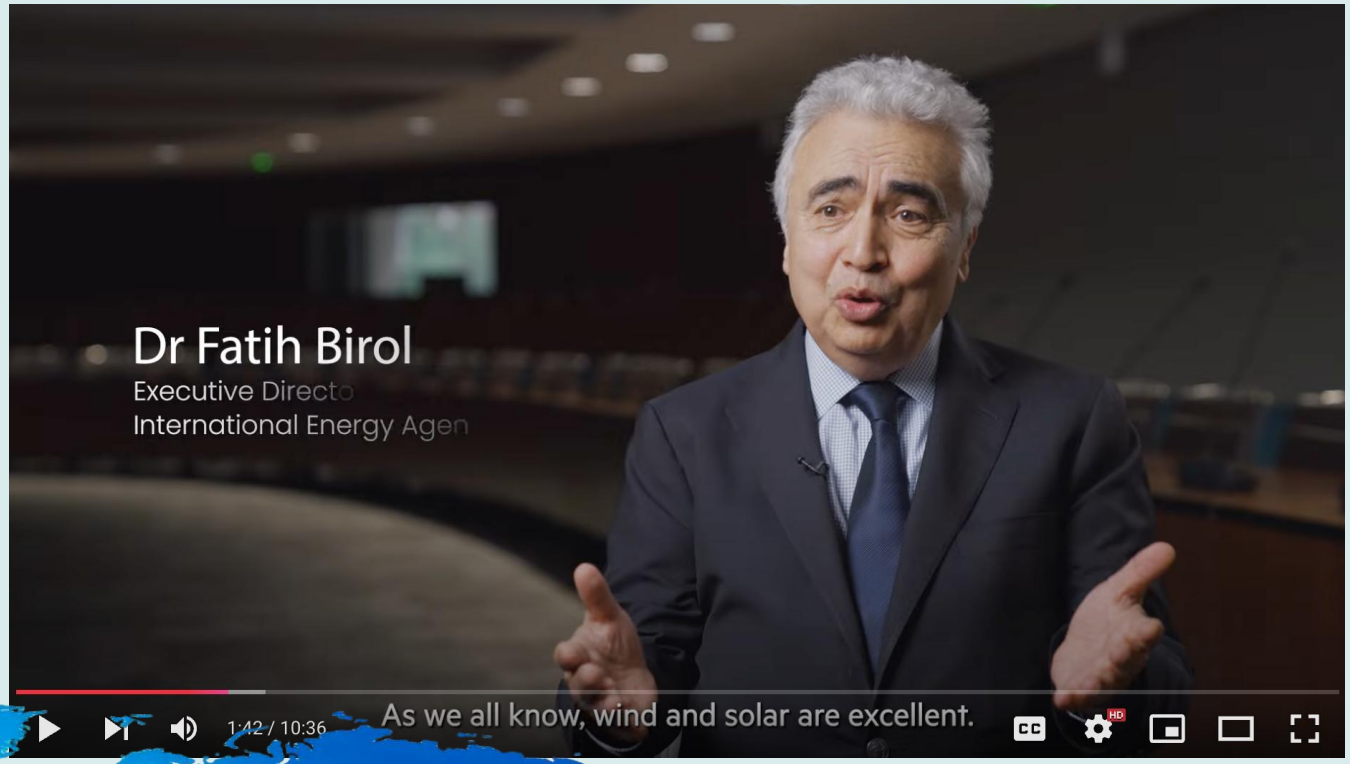
GLOBAL ORGS

A Financial Times video launched at COP29 with the head of the IEA together with the World Bank Groups' IFC. The IFC launched feasibility studies in Turkiye, Jordan, and Pakistan, while exploring potential in Uzbekistan, Kazakhstan, and Tajikistan . . .



FT LIVE in partnership with IFC International Finance Corporation WORLD BANK GROUP

https://www.youtube.com/watch?v=mvOoBL-et7U

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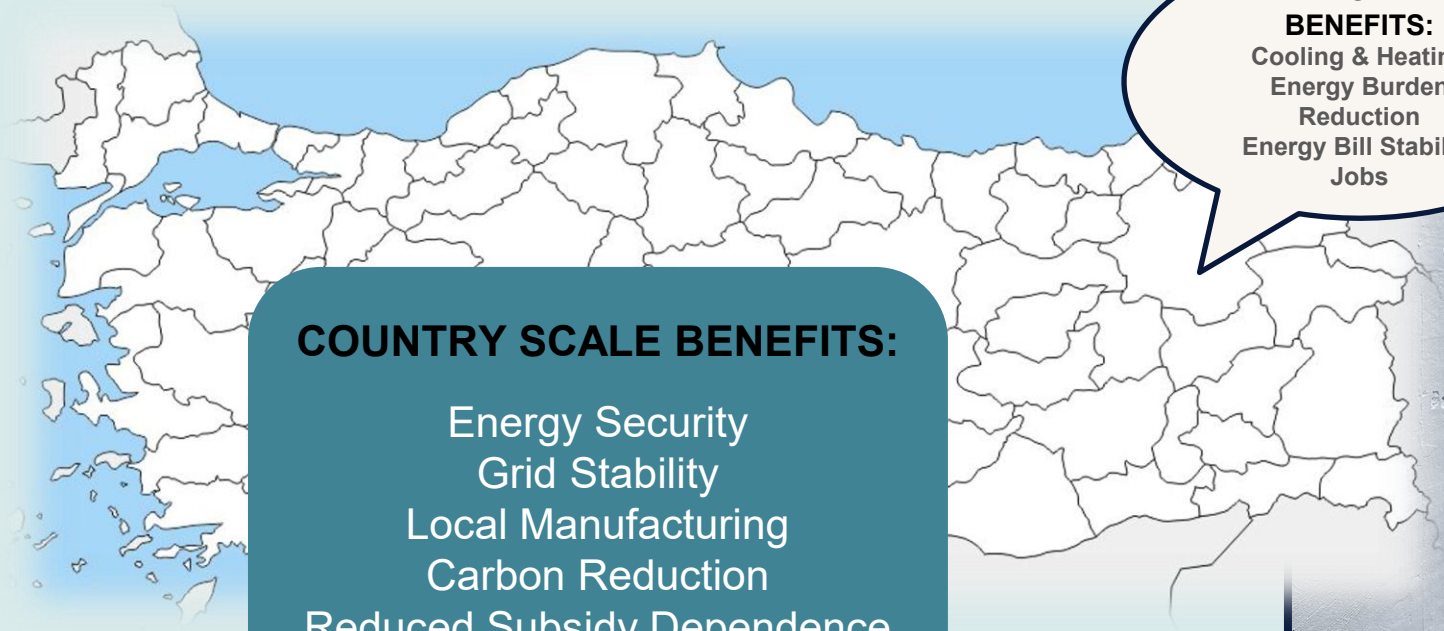
TURKIYE

Campaign promise around gas buildout has created opportunity . . .

Initial feasibility analysis indicates IRR ranges of 8-15% with payback ranges of 4-16 yrs.

Geothermal network deployment can address a fossil fuel subsidy burden projected to exceed 200 Billion TRY in 2025 with costs in some regions projected to outperform subsidized gas.



CITY SCALE BENEFITS:

Cooling & Heating Energy Burden Reduction
Energy Bill Stability
Jobs

COUNTRY SCALE BENEFITS:

Energy Security
Grid Stability
Local Manufacturing
Carbon Reduction
Reduced Subsidy Dependence

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PAKISTAN

Integrated energy system planning matters.

Large gatherings in Islamabad, Lahore, and Karachi demonstrated aligned interests for Gas to Geo.

Solar deployment 5X from 2021 to 2025, now estimated to be 1/5th of grid supplied electricity. 90% of LNG passes through Straits of Hormuz, in 2024, Pakistan spent 10% of its GDP on fossil imports.

FIRST GEOTHERMAL INSTALL in ISLAMABAD

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DRIVERS OF GLOBAL MOMENTUM

Energy systems are the basis of the Economy & Well-Being.

Energy Security in National Security.

System efficiency drives Affordability & Grid Impacts.

Geothermal is rock solid, local, and price stable energy.

Addressing our changing climate is existential.

Welcome to the Geothermal Century

ZEYNEB MAGAVI

MARCH 2026

Jacobs Challenging today. Reinventing tomorrow.

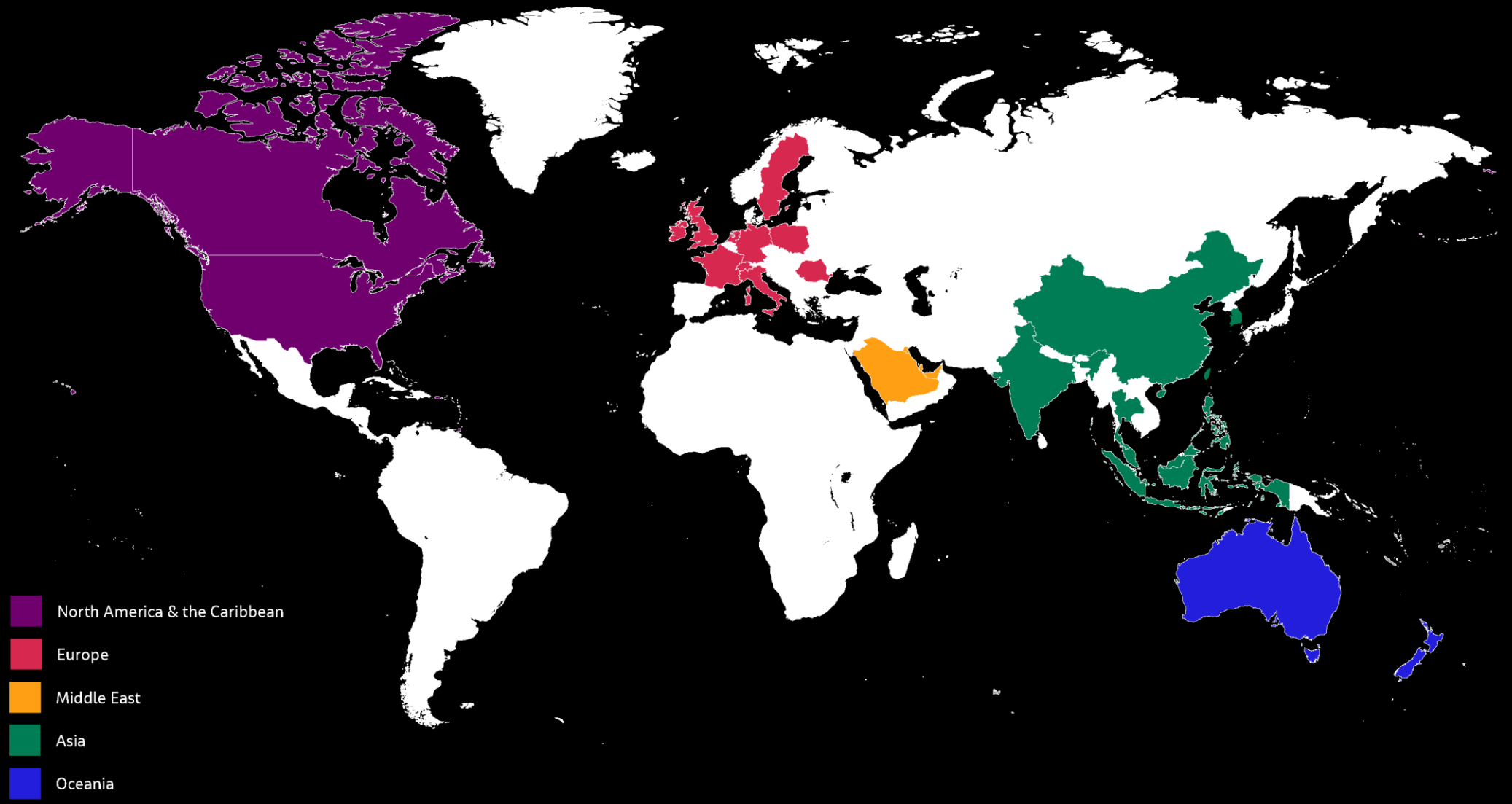
Thermal Energy Networks
Global Trends in Defense Industry

Miles Ingraham, PE, PG, GCSD

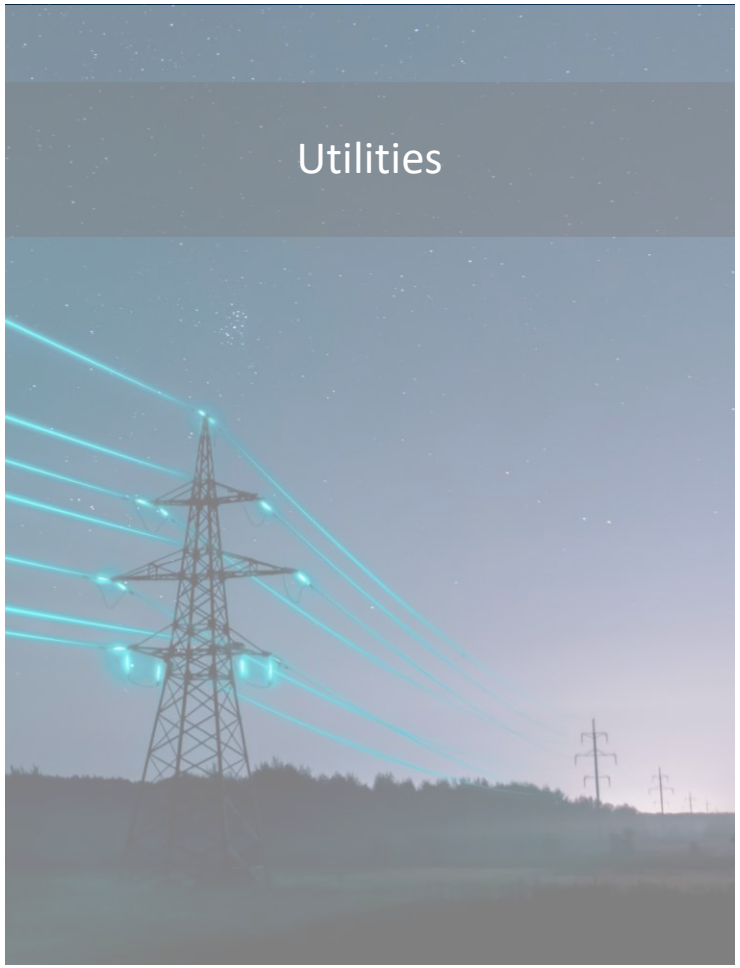
NY-GEO

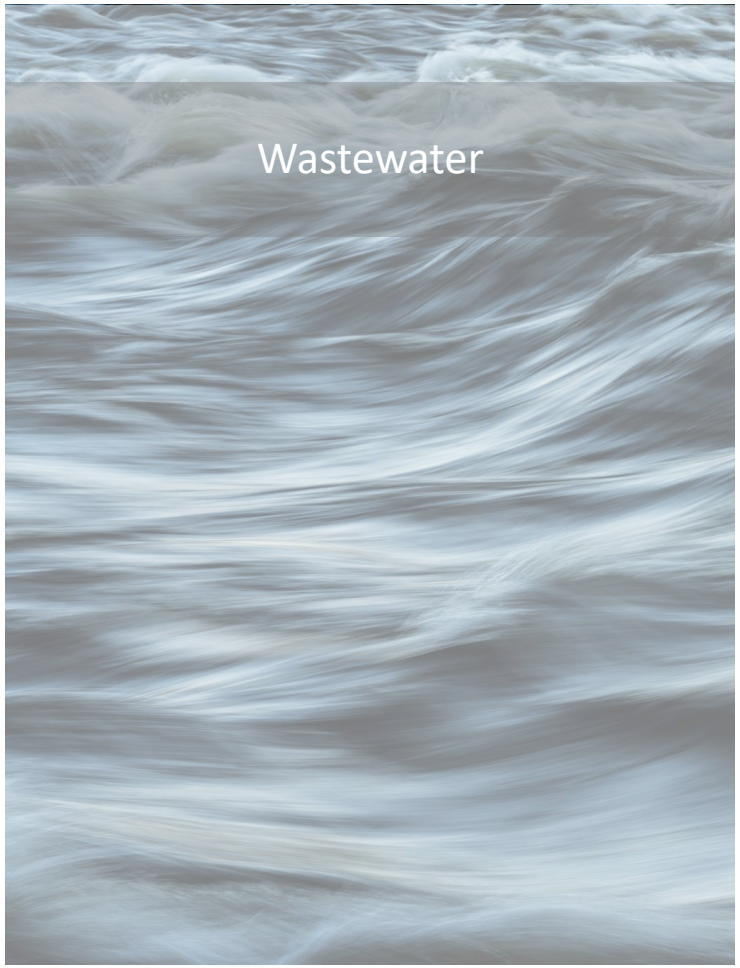
March 24, 2026

Jacobs Presence By Country



Global TEN Markets Sectors





Converting Defense Facility Infrastructure into TENs – United Kingdom

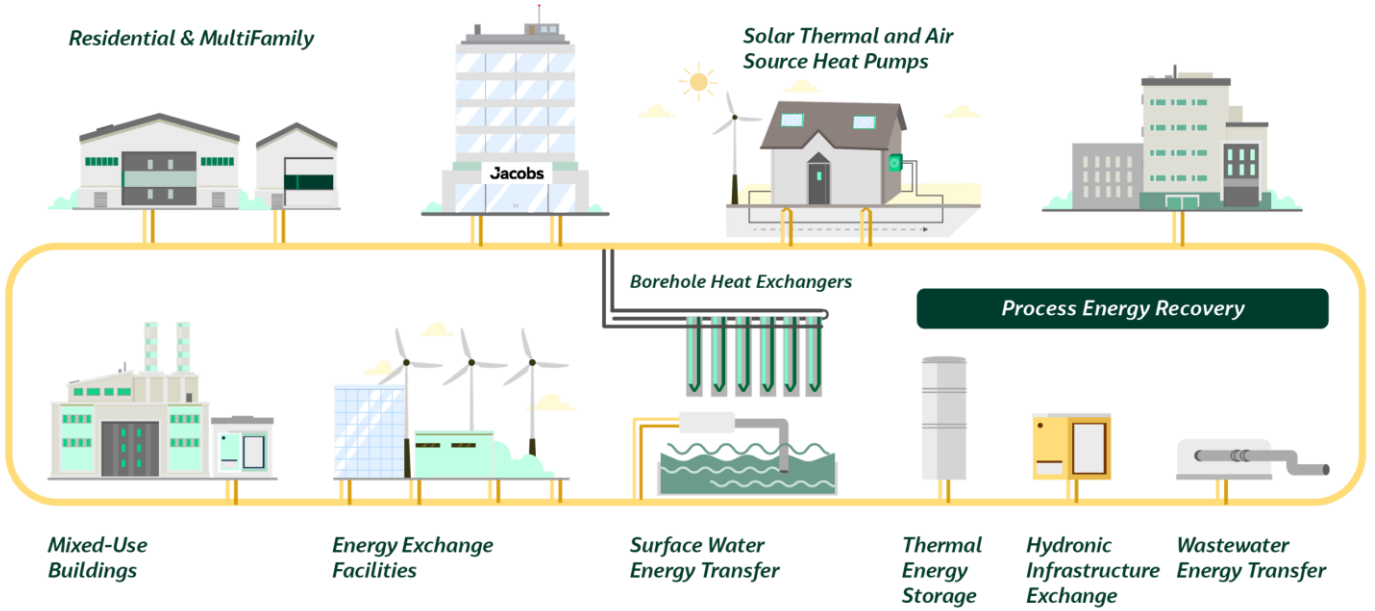
TEN Feasibility

Key Drivers

- Base considering options to upgrade building heating and cooling systems
- Evaluated GSHPs and TENs
- Strategic fuels reliability motivation

Key Outcomes

- Comparative cost analysis and energy performance clearly showed TENs were more cost effective
- Increased energy resilience over alternatives



Converting Defense Facility Infrastructure into TENs – Japan

TEN Feasibility & Design

Key Drivers

- Fuel supply security (40 – 50% energy savings with TENs)
- Facilities management is not a core mission

Key Outcomes

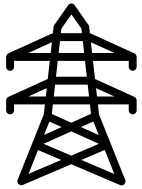
- Basing operations have ample drilling areas proximate to service loads
- Good load diversity – warehousing, residences, office buildings
- Challenging permitting, onerous administrative processes, contaminated soil management is common

In Defense of Geothermal

Drivers for TEN Infrastructure at Military Installations Globally

Reduced water consumption for cooling

Harness onsite thermal loads and waste heat



Lower electrical peaks; demand-side management

Supply chain simplification; no delivered fuels

Move critical infrastructure underground or inside

Be in touch.

Miles.Ingraham@jacobs.com

Geothermal Design Manager

Jacobs

Challenging today.
Reinventing tomorrow.

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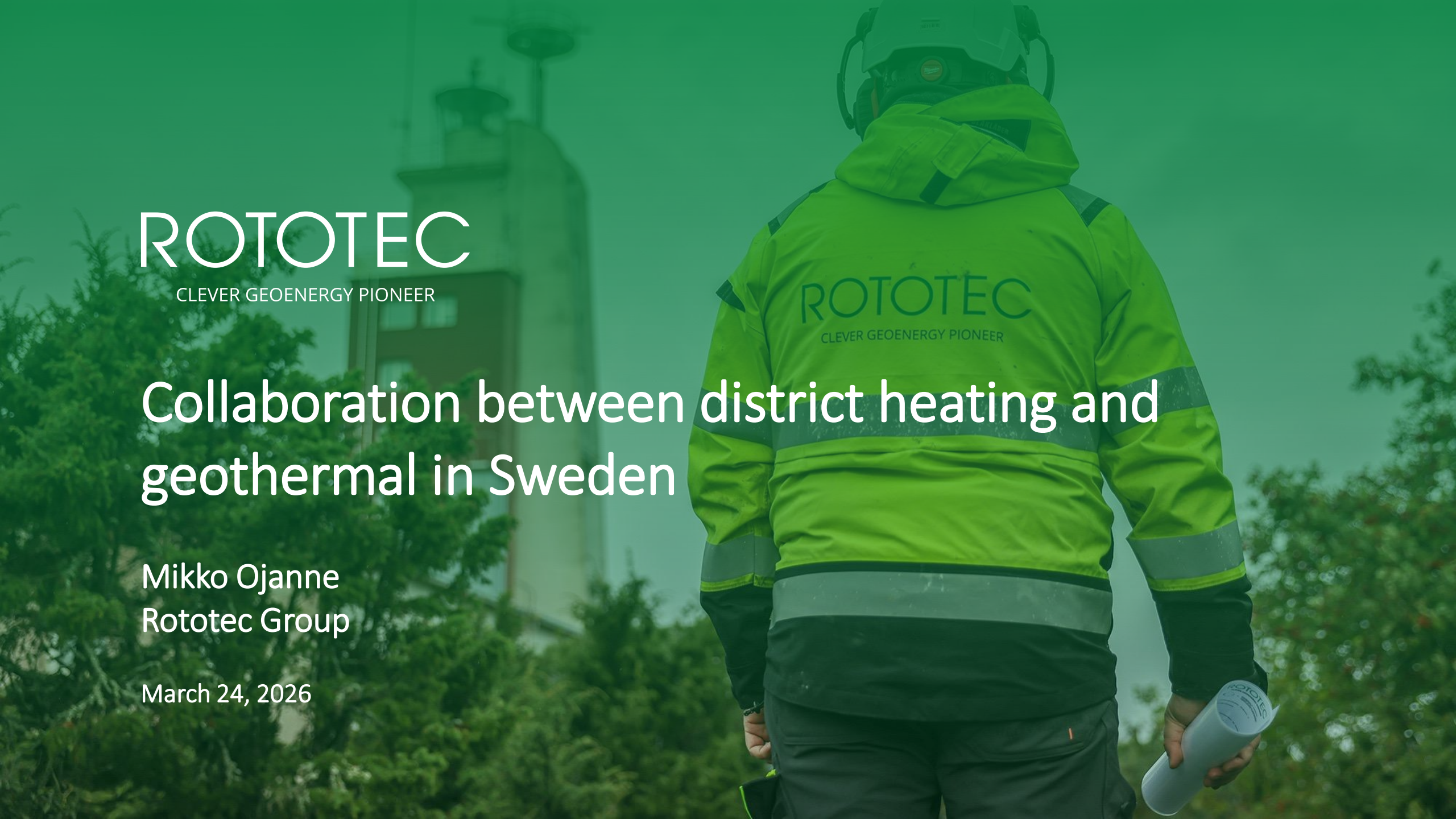
Important



ROTOTEC

CLEVER GEOENERGY PIONEER

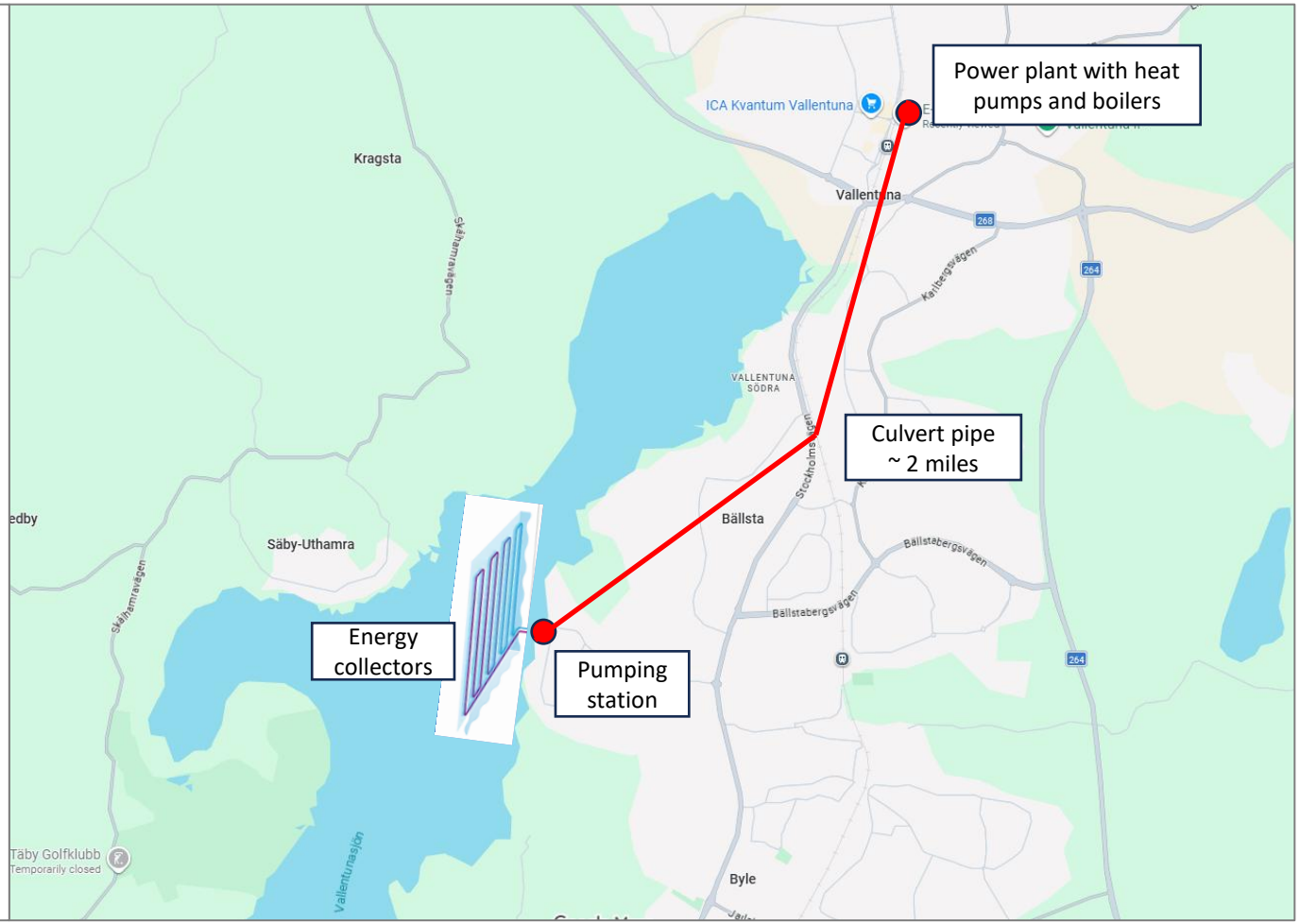
Collaboration between district heating and geothermal in Sweden

Mikko Ojanne
Rototec Group

March 24, 2026

Vallentuna lake source district heating plant

The municipality of Vallentuna, ca 15 miles north of Stockholm, produces district heating with heat pumps using a nearby lake (Lake Vallentuna) as a heat source.



Current state: Aging lake source district heating system

Brief description of the current system

- Heat pumps fed with lake water
- The plant also has two biofuel boilers
- Operation started in 1985
- The lake source system, including heat pumps, is nearing the end of its useful life
- Achievable flow rate in the system has dropped by 40% due to clogging of the system, which leads to severe performance issues
- The municipality would like to at least partially keep using lake-source heat pumps as a way to aerate the lake

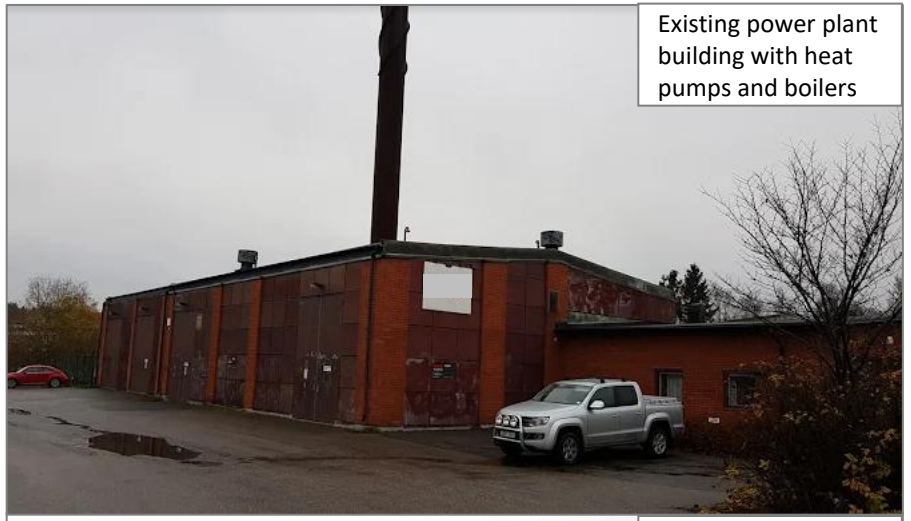
Technical data

- Required district heating supply temperature: 176 - 212°F
- Maximum power output of heat pumps: 6 MW
- Refrigerant: R134a (GWP 1430) of which there is an enormous amount: 15 400 lbs
- Maximum design flow rate for lake water intake: 10.6 cfs
- Maximum design supply temperature from heat pumps: 169°F. Currently, only ~ 127°F (COP ~ 2.2) is reached in typical winter conditions
- Priming with biomass boilers raises the temperature to the required district heating supply temperature

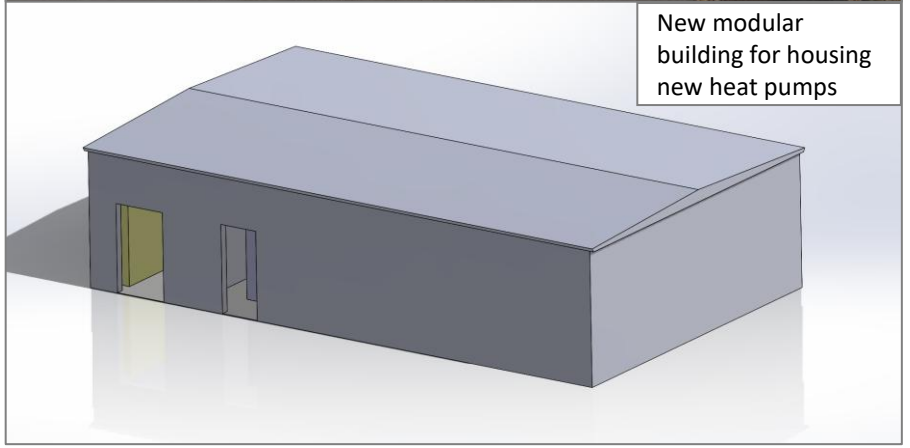
Rototec's solution: Hybrid with boreholes, lake source heat and biomass boilers

Rototec's approach: Hybrid solution with heat from lake, boreholes and biomass boilers

- New heat pumps able to raise the supply temperature to 203°F in one stage using a natural refrigerant (GWP 0)
- Maximum power output: 6 MW at COP = 2.5 in typical winter conditions. 10 MW at COP = 3.4 in typical summer conditions
- Heat pumps to be housed in a separate modular building
- Boreholes ca 300 x 1 000 ft connected to the heat pumps
- Roughly half the energy to be taken from the lake to keep it aerated
- Biomass boilers can be used if more power is demanded
- The solution helps the municipality of Vallentuna to keep combustion at a minimum



Existing power plant building with heat pumps and boilers



New modular building for housing new heat pumps

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