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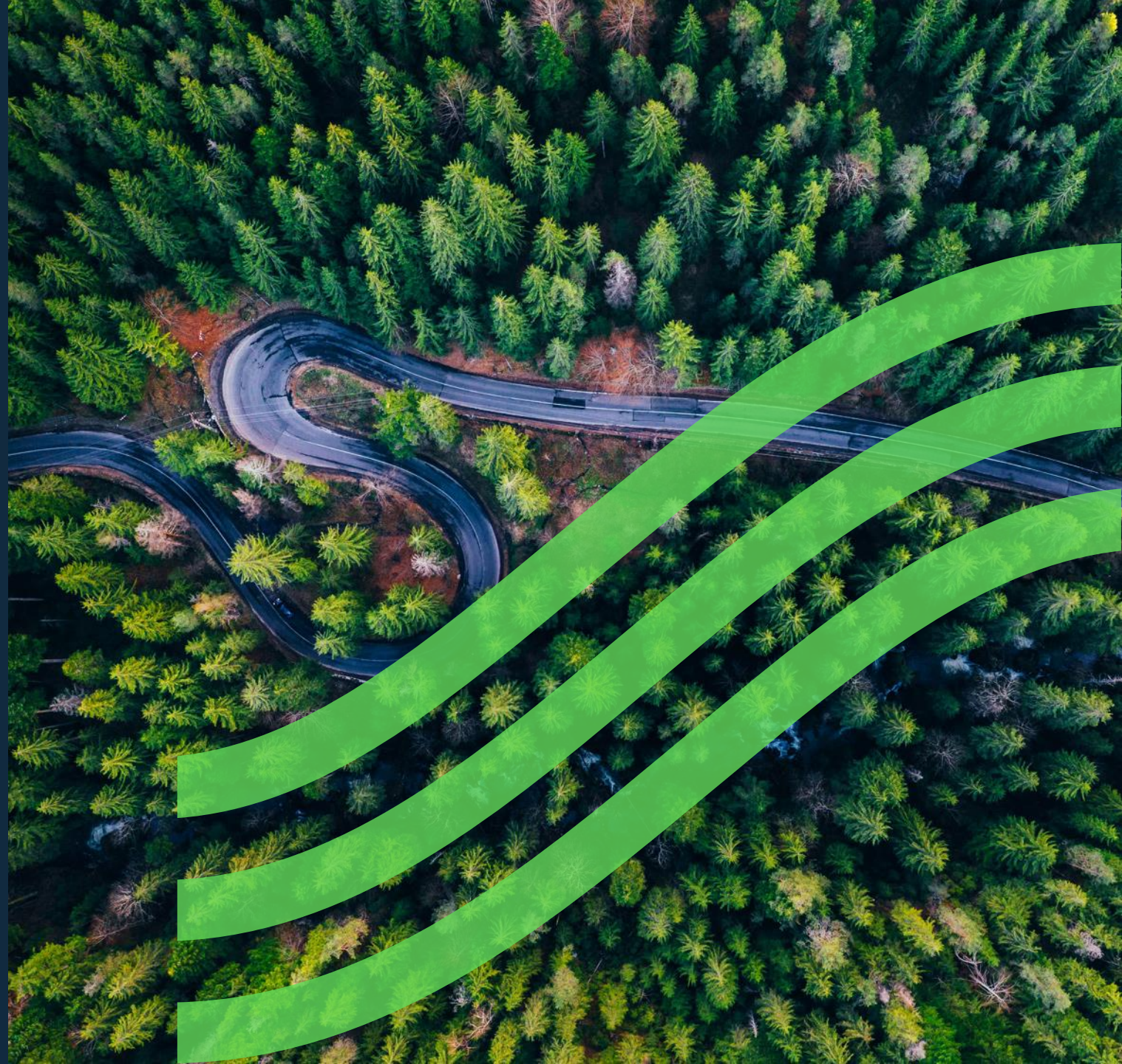
Environmental Conditions to be considered in Design and Choice of Geosynthetics

IGS Nordic Annual Meeting

Thursday 6th, March – Catrin Tarnowski



Content

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Environmental Conditions

Applications with geomembranes

Any external factor – whether natural or human induced – that effects a specific system

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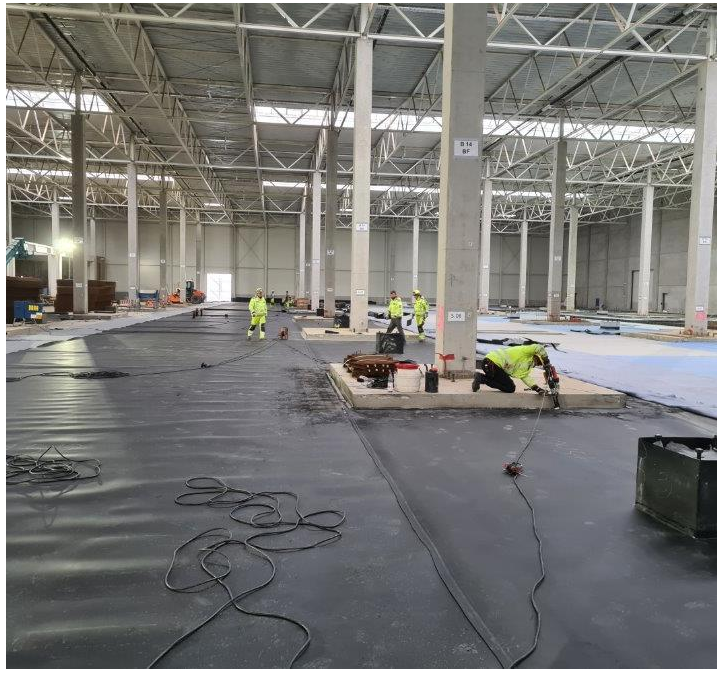
Environmental Conditions

Exposure Conditions affecting Geomembranes



Secondary Containment

Traffic, Construction induced Stress, Chemicals

Mining

UV radiation, temperature , overburden, chemicals

Evaporation Ponds

UV radiation; Chemicals

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Environmental Conditions

Exposure Conditions affecting Geomembranes

Industry

Wind load, temperature changes, chemicals

Oil & Gas

Design details- requirements

Biogas Containment

Gas Pressure, UV, temperature

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Environmental Conditions

Exposure Conditions affecting Geomembranes

Canals

Induced strain from water and/or wind, temperature

Source: Huesker

Landfill

Waste water, chemicals, (UV), temperatue

Heat Storage- PTES

Hot Water, Cold Water, UV

Source: WIMeG

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Environmental Conditions: from Design to Operation

What is to be considered – Installation & Operation

- UV Exposure or not
- Installation – weather conditions, exposure, construction impact
- Underlaying and overlaying materials with regard to impact on function
- Operational conditions :

  Filling: Exposure to UV; Wind; Chemicals; Fluid or Solids, Hot or cold temperature

  Operation: Exposure to UV; Wind, Chemical, Fluids or Solids, Hot or cold temperature

ENVIRONMENTAL CONDITIONS IN PIT THERMAL ENERGY STORAGE

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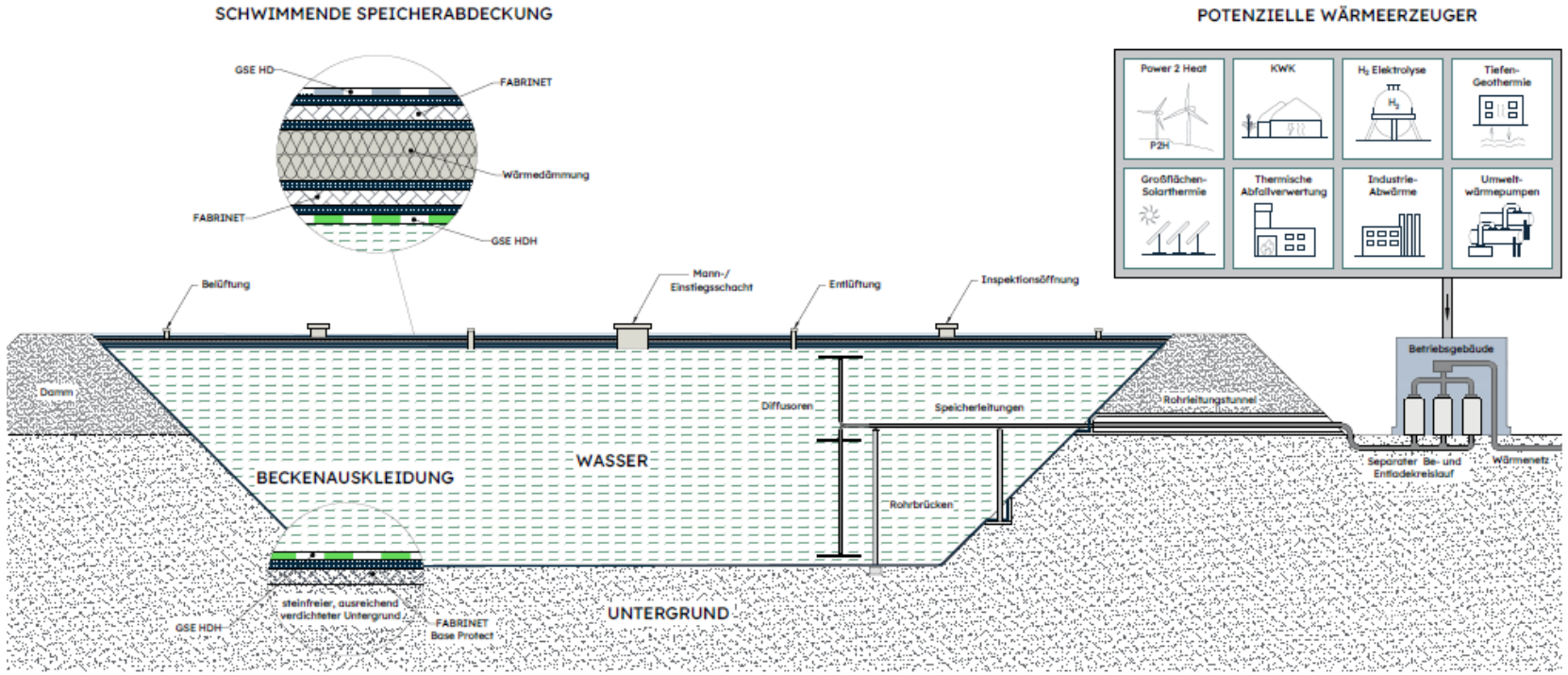
PTES

Design Scheme

Pit Thermal Energy Storages (PTES) are seasonal/ multifunctional heat storages in which typically water serves as a storage medium

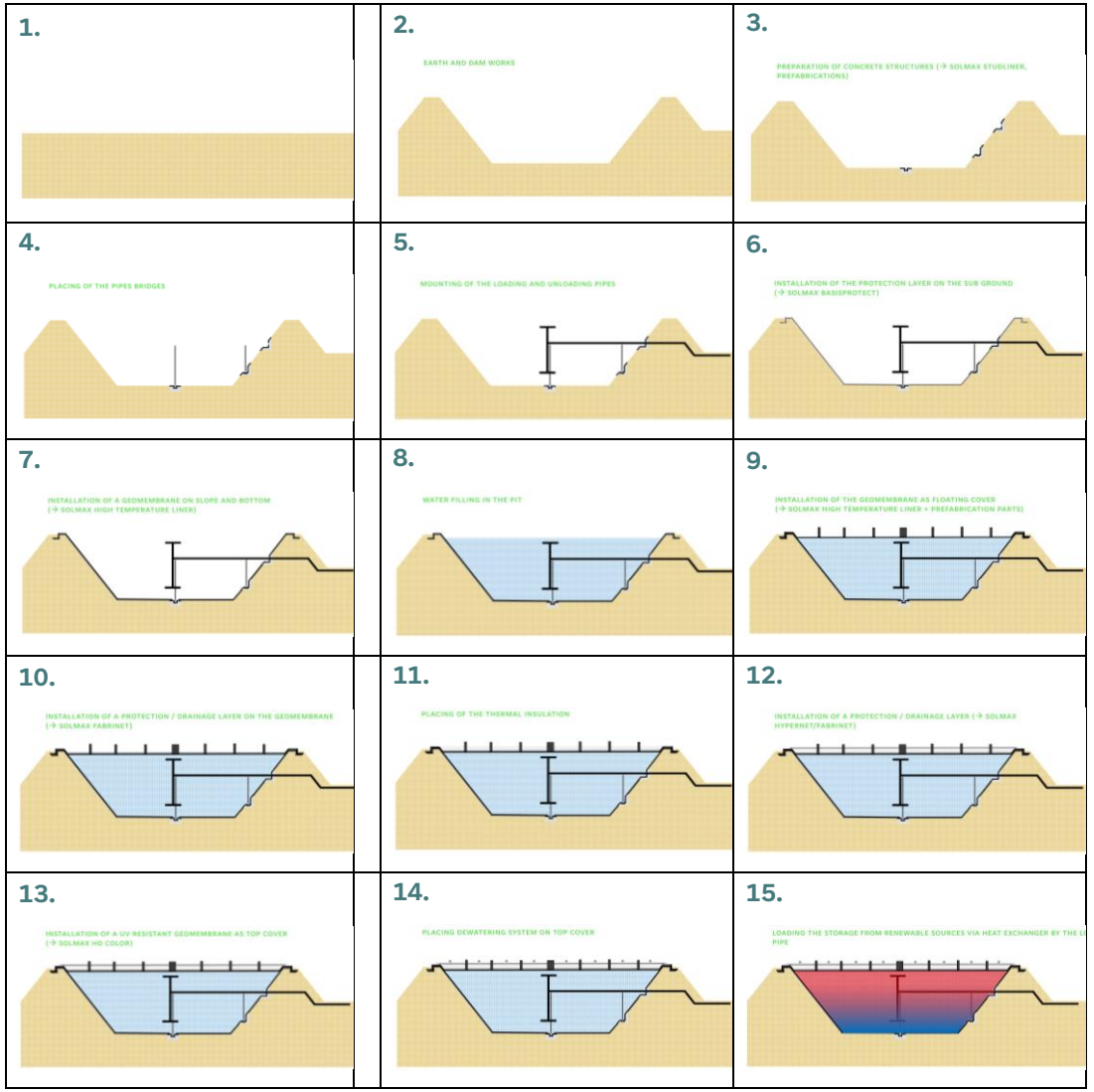
Construction with geosynthetics



PTES

FROM DESIGN TO OPERATION

1. Site selection
2. Excavation and dam construction
3. Concrete structures
4. Pipe bridges
5. Loading- and unloading pipes
6. Protection Layer
7. Temperature resistant geomembrane
8. Water filling, - treatment
9. Temperature reistant geomembrane floating cover
10. Protection and drainage layer
11. Insulation
12. Protection and drainage layer
13. Cover layer – e.g. geomembrane
14. Surface water drainage
15. Energy loading / offloading- operation



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PTES

Installation

Pond structure: Protection layer + heat resistant geomembrane, possible leak detection

UV exposure + warm and cold temperatures during construction, thus elongation and shrinkage

Concrete constructions

Connections, possible strain, mechanical attachment

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FILLING OF PIT STRUCTURE

STARTS TYPICALLY IN AUTUUM

ENDS TYPICALY IN COLD SEASON

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PTES

FlOATING COVER

Lower geomembrane

Exposure to water, cold during filling, hot during operation

Connection to structures /Load

Possible strain during service life

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PTES

Floating Cover

Upper Geomembrane: exposed , non exposed , ballasted , multifunctional ?

Picture: Arcon-Sunmark Large-scale Solar Systems Integration Co., Ltd

Quelle: Marcus Brandt / dpa aus DER SPIEGEL 17/2024

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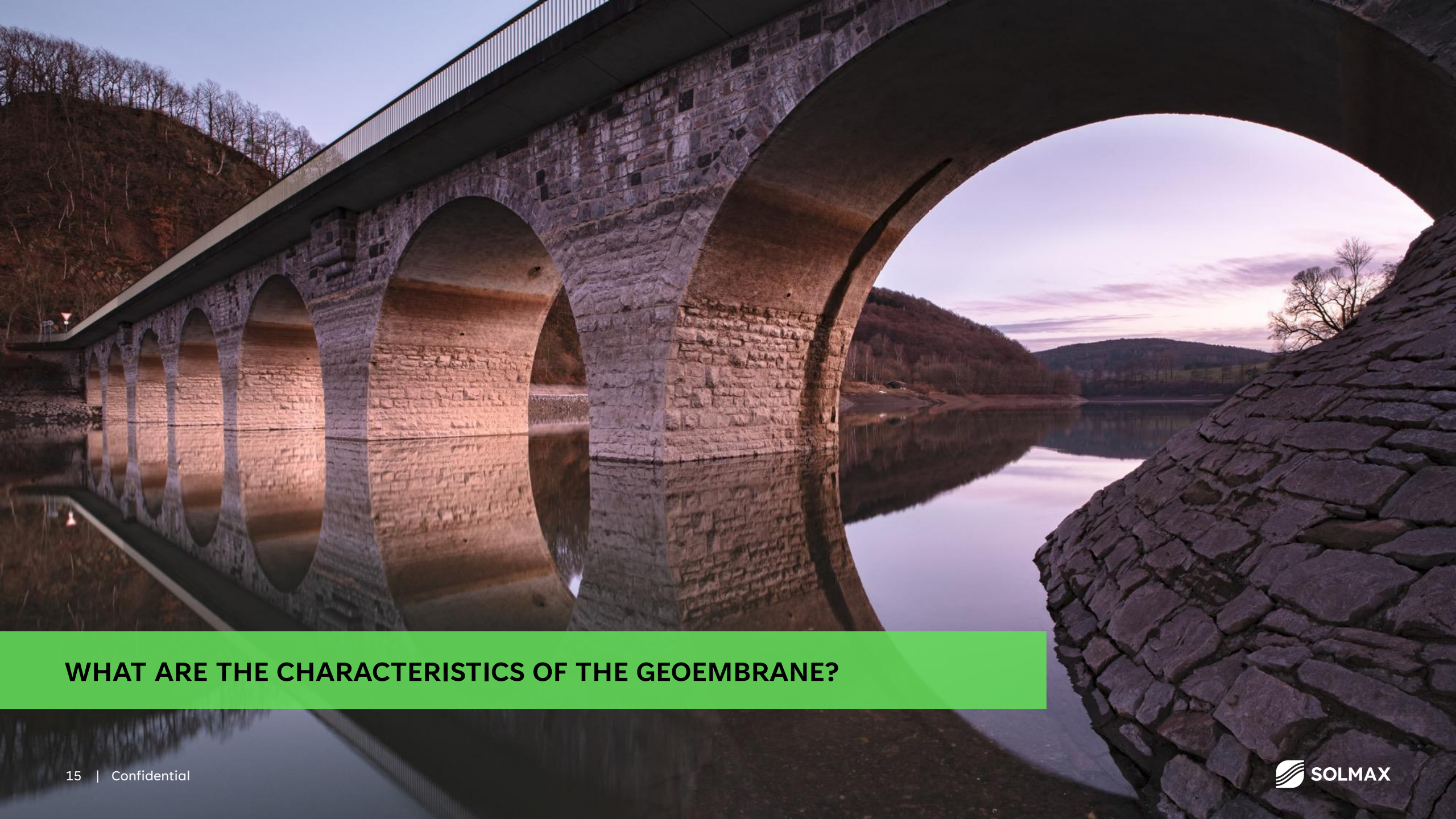

WHAT ARE THE CHARACTERISTICS OF THE GEOEMBRANE?

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A unique answer

WHAT ARE THE GEOMEMBRANE CHARACTERISTICS?

Longest service life at project conditions : long-term barrier function and long-term protection of the environment

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A unique answer

WHAT ARE THE GEOMEMBRANE CHARACTERISTICS?

ROBUSTNESS & LONG TERM SERVICE LIFE

- Oxidative Resistance (Thermal /UV)
- Leaching Resistance
- Stress Crack Resistance
- Chemical Stability
- Flexibility to overcome stress/strain
- Resistance to hot and cold temperatures

Not a unique answer

WHAT ARE THE GEOMEMBRANE CHARACTERISTICS?

- Is high/higher values in a data sheet giving information?
- Are all characteristics in a data sheet?
- Index properties or performance properties
- Accelerated lab testing
- Practical experience
- Index test results
- Performance test results
- Research results

Standard products/solutions (e.g. GM 13 / 17) vs challenging conditions :service/consulting & adopted products

If you define the problem correctly, you almost have the solution.

Steve Jobs

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Conclusion

1	Evaluate Environmental Conditions for Installation and Operation – define the problem
2	Multiple applications can be served with standard products/solutions (e.g. GM 13 / 17)
3	Do not use standard for challenging conditions, use expertise which is not only laboratory research, but also practical/field experience

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Thank you

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