

# Research, Development and Innovation (RD&I) in Landsnet

Statnett's RD&I Conference, Oct 2022

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# Nordic R&D co-operation

## SPARC

- SynchroPhasor-based Automatic Real-time Control (2018-2022)

SPARC is a 4 year competence-building project (KPN) co-financed by the Research Council of Norway (RCN) together with the Nordic TSOs and GE.

The project will contribute to the development of new knowledge, methods and tools for automatic control and wide area protection in transmission systems. This is vital to ensure efficient and stable operation of the future sustainable power system.



<https://www.sintef.no/sparc>



SINTEF

NTNU

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SVENSKA  
KRAFTNÄT

ENERGINET

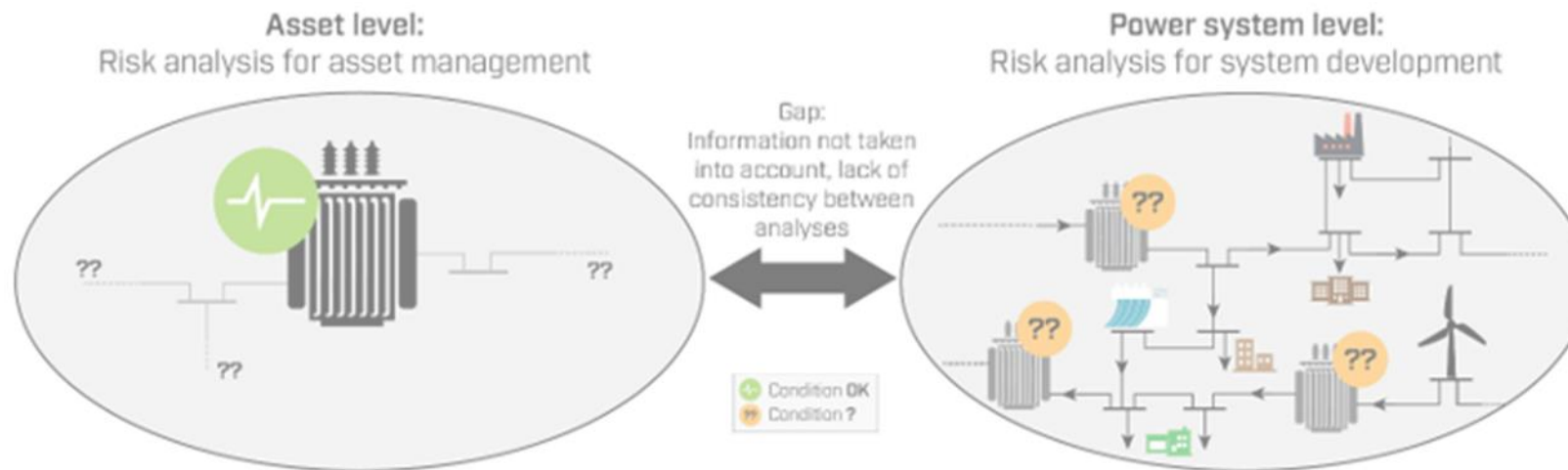
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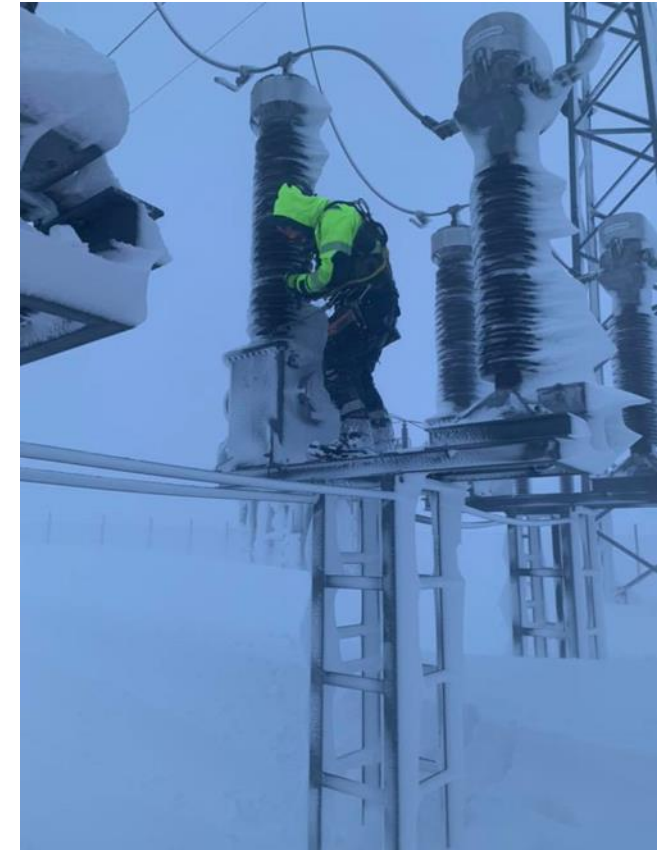
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# Nordic R&D co-operation



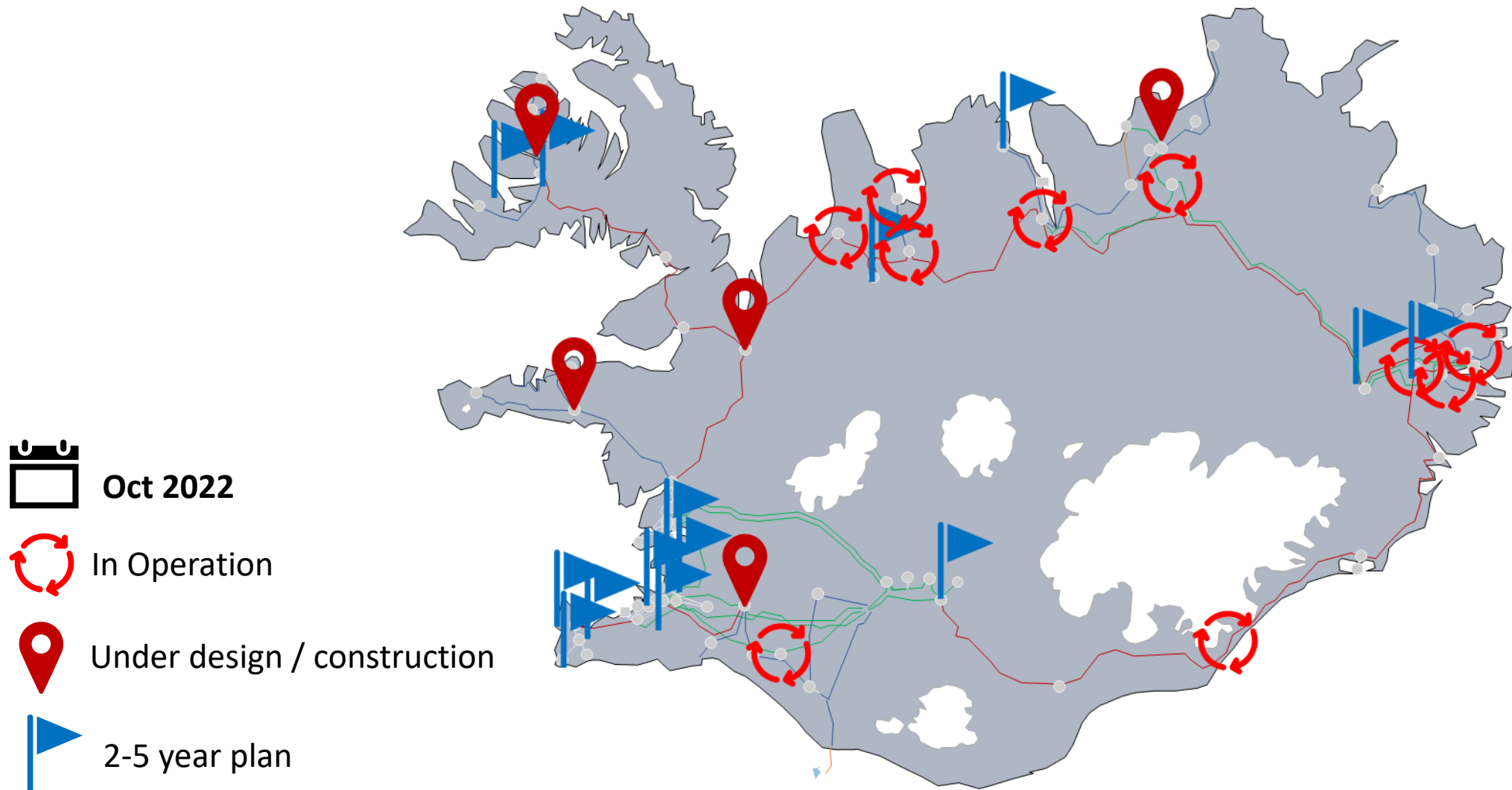
# Digital substations

- All new & retrofit projects will be fully digital substation based on IEC 61850 ed.2 or later
- Voltage levels 220/132/66 kV
- AIS replaced by GIS substations
- SF6 started to being phased out by GreenGas
- Multi-vendor approach for PACS
- Low Power Instrument Transformers (LPIT)
  - > Capacitive based CVTs, Rogowski coil [no fiber options for GIS yet]
- Conventional cable CTs for application such as TWS
- Main 1 and Main 2 requirement for high category substation (~ 220kV)
- Call for vendors design of LCC cubicle, inline with digital substation
- Strict requirements and implementation guidelines for Landsnet design of the digital substation projects



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# Digital substations – overview



*“20–24 Digital substation in operation before 2024,  
83 total substations today”*

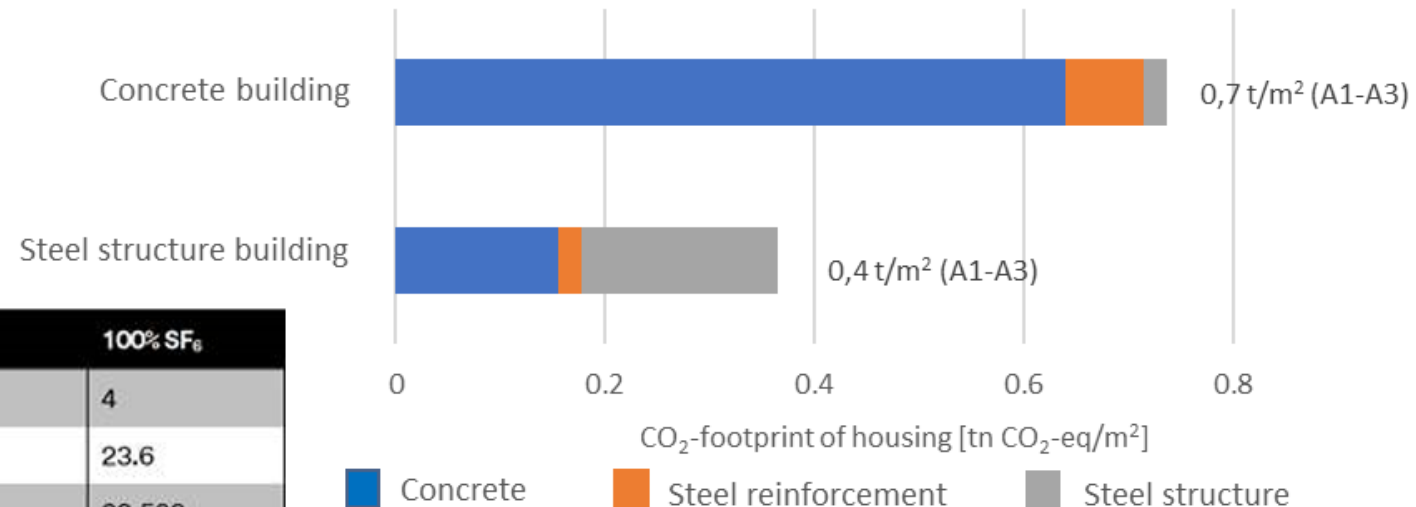
# LCA-analysis of substation equipment

## Substation equipment

- AIS
- GIS
  - SF6
  - „Green gas“, Novec 4710
- Vacuum

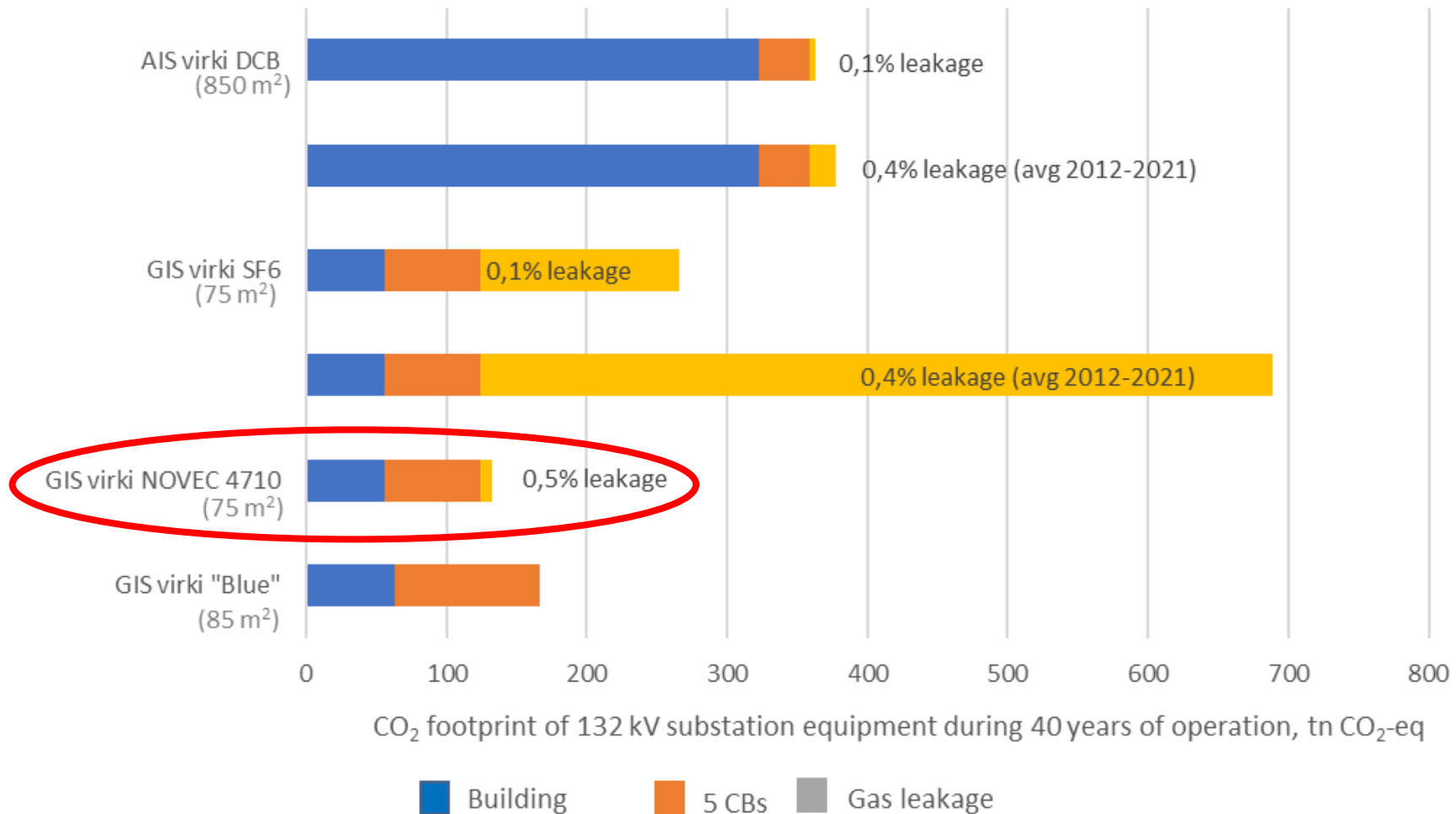
## Substation housing

- Steel structure
- Concrete



Gas formulation	Novec 4710 Gas (3.5 mole %) in CO <sub>2</sub>	100% SF <sub>6</sub>
Gas pressure (bar)	6	4
Gas density at 25°C (kg/m <sup>3</sup> )	11.9	23.6
Composite GWP of gas mixture	292**	23,500
GWP reduction compared to SF <sub>6</sub>	98.8%	-
GHG emissions (MT CO <sub>2</sub> e/m <sup>3</sup> )	3.5	554
GHG emissions reduction (i.e. CO <sub>2</sub> e reduction)	99.4%***	-

# LCA-analysis of substation equipment







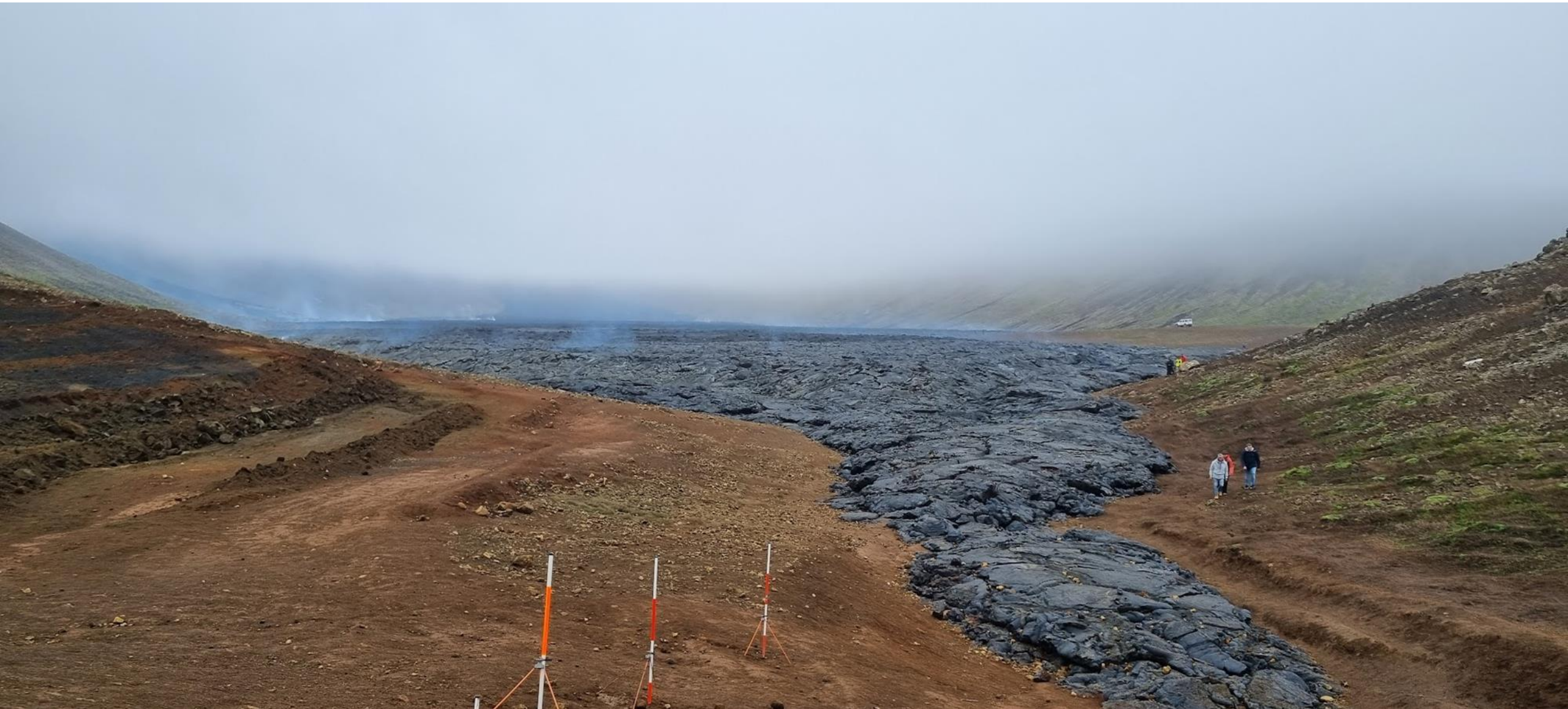




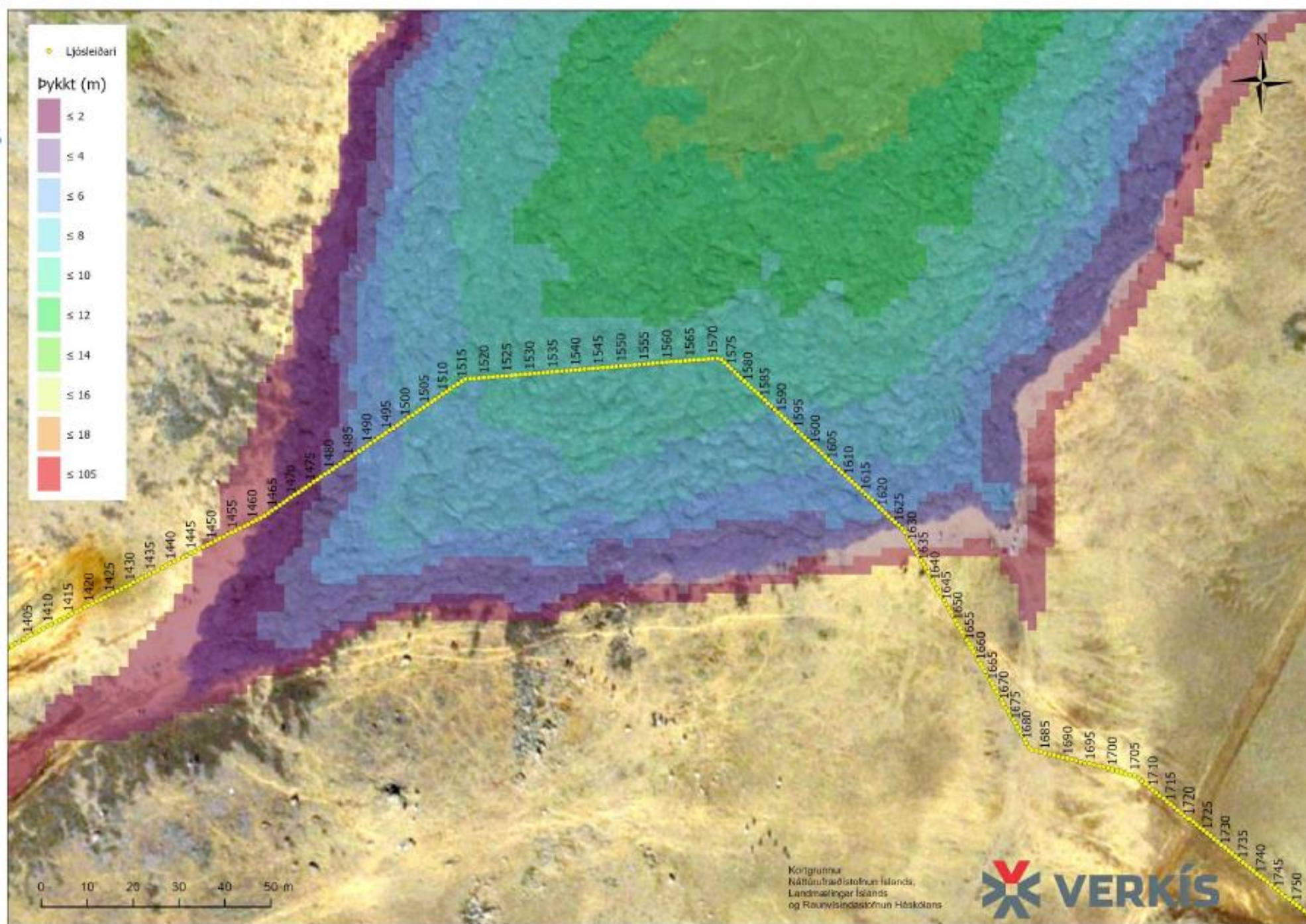




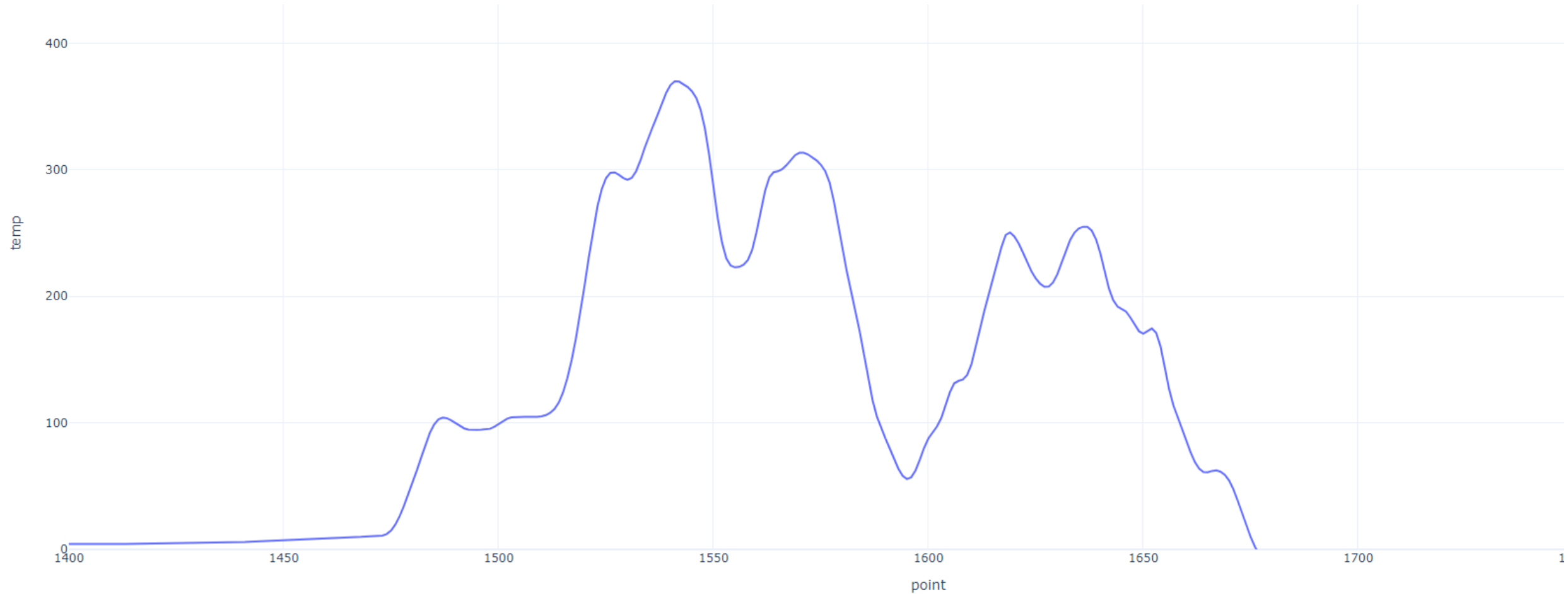








# Measured



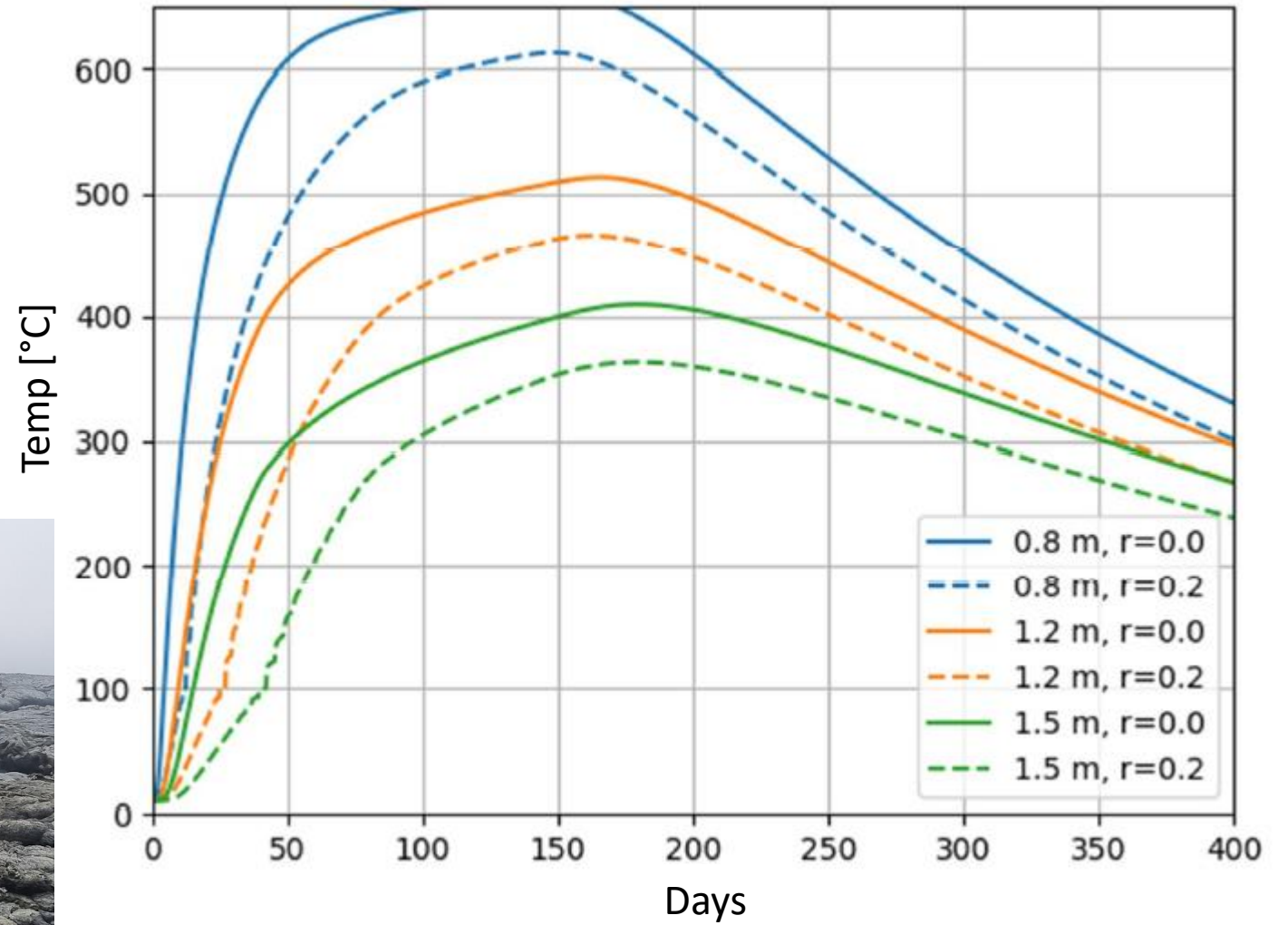
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# Simulated





# Success story – Laki Power

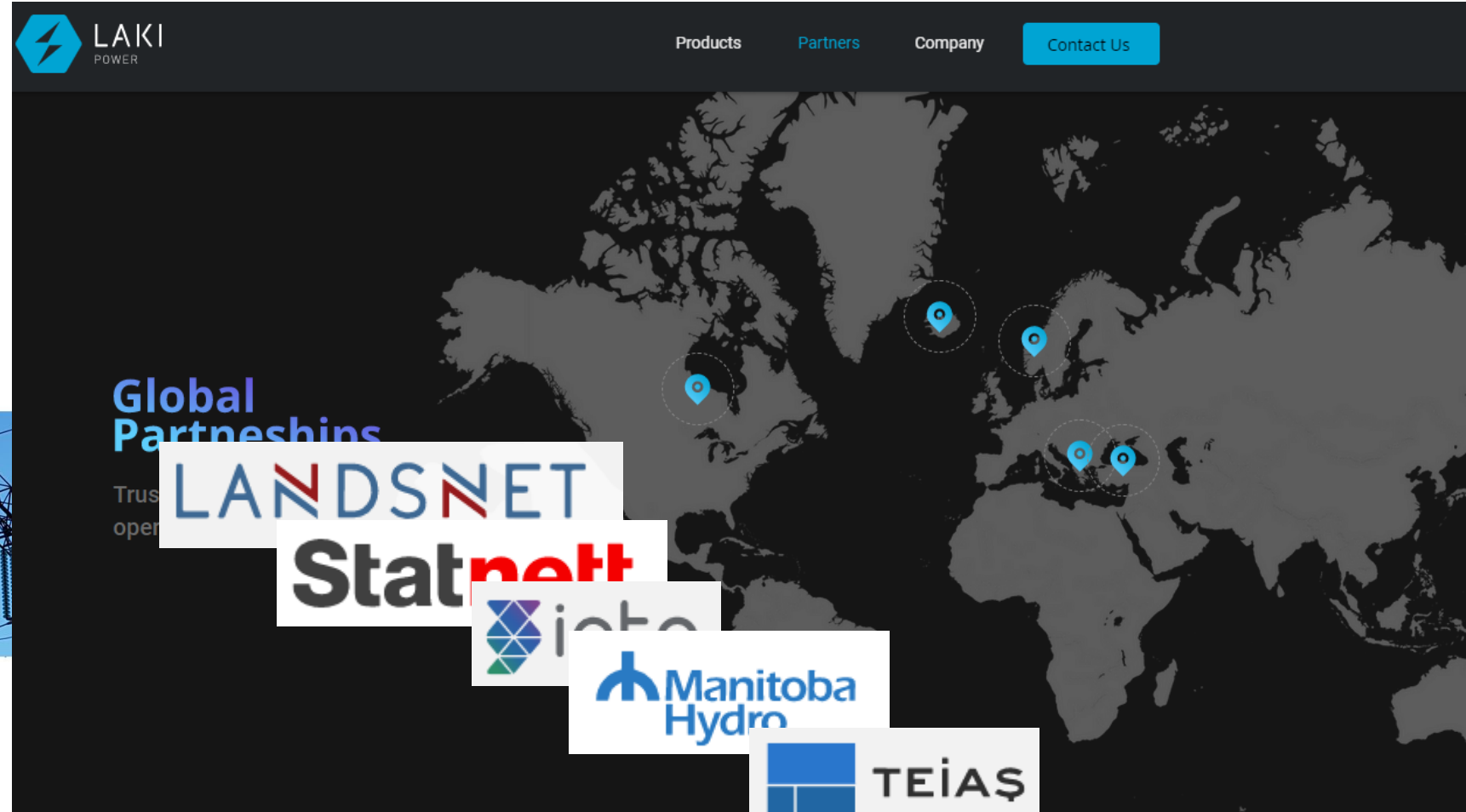
PowerOnLineGenerator

**PARTNERS**

LANDSNET FINGRID SIEMENS Technology Development Fund European Union European Union Funding for Research & Innovation



2019



2022

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# Next success story? - Alor



## ALUMINUM BATTERIES

Alor was established for the purpose of developing and later producing sustainable aluminum batteries. The aluminum batteries will accelerate energy transitions in fisheries, agriculture, transport, and industry. For example, the aluminum batteries can be used as:

- Backup power.
- Batteries in vehicles instead of lead acid batteries.
- Batteries in boats.
- Batteries in a wide range of operations, such as fisheries, agriculture, and industrial production.

Alor is also working on the development and production of large aluminum energy storage units that can store excess electricity and promote improved utilization. In addition, large energy storage units will enhance safety when it comes to transmission of electricity, e.g., due to storms, volcanic eruptions, or other natural disasters.

## COLLABORATION

Alor collaborates with the University of Iceland and the Spanish company Albufera Energy Storage, which is a leader in development of aluminum batteries in Europe. The Spanish company has worked on development of the technology for the last 9 years. Alor has also signed contracts with Landsnet, Orku náttúrunnar and Tengill.



## GRANTS



## AWARDS



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