

# Demand Side Response in Iceland

Utilizing the Wide-Area-Monitoring  
& Control

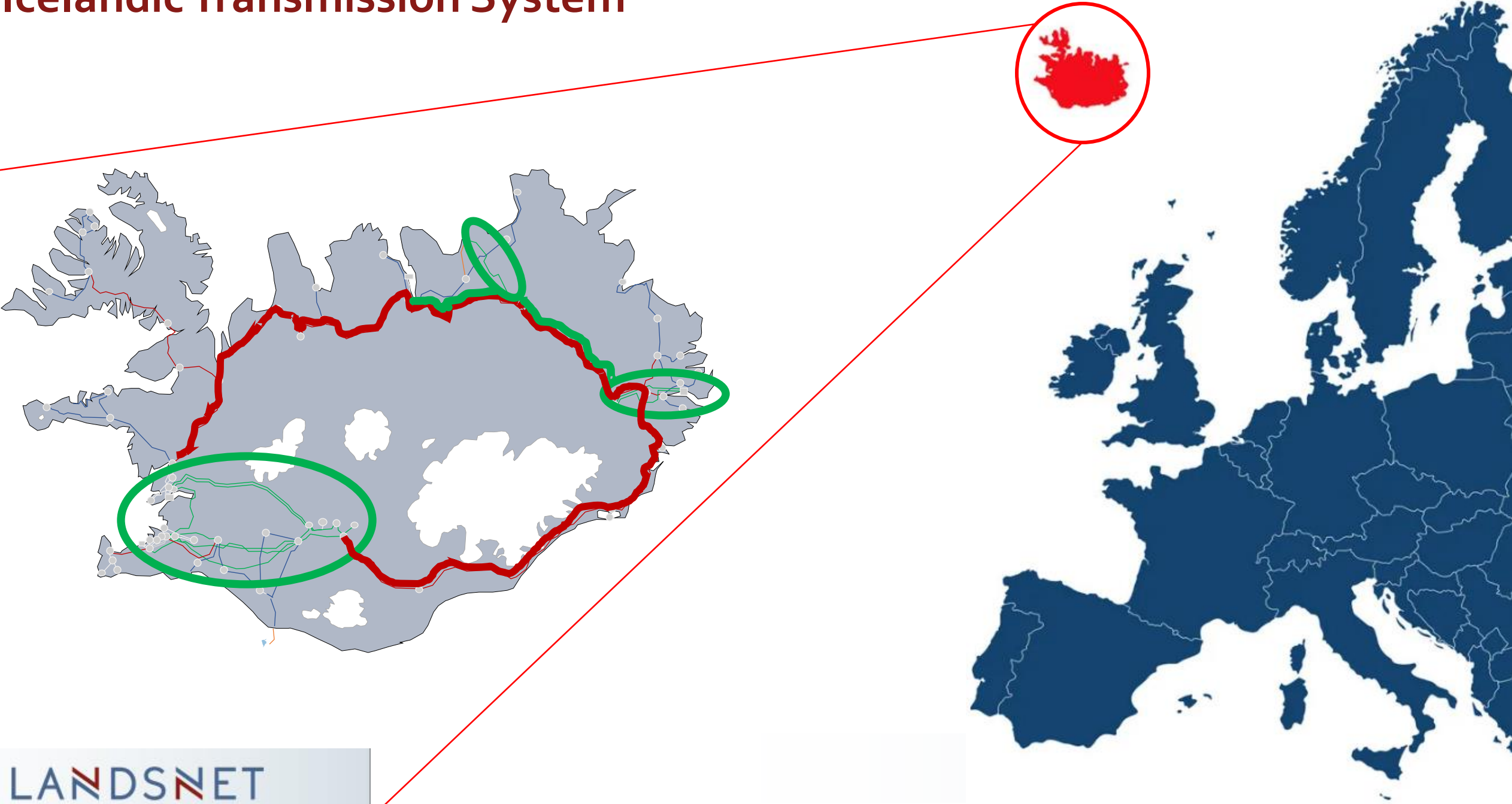
Dec 2023

*Birkir Heimisson*

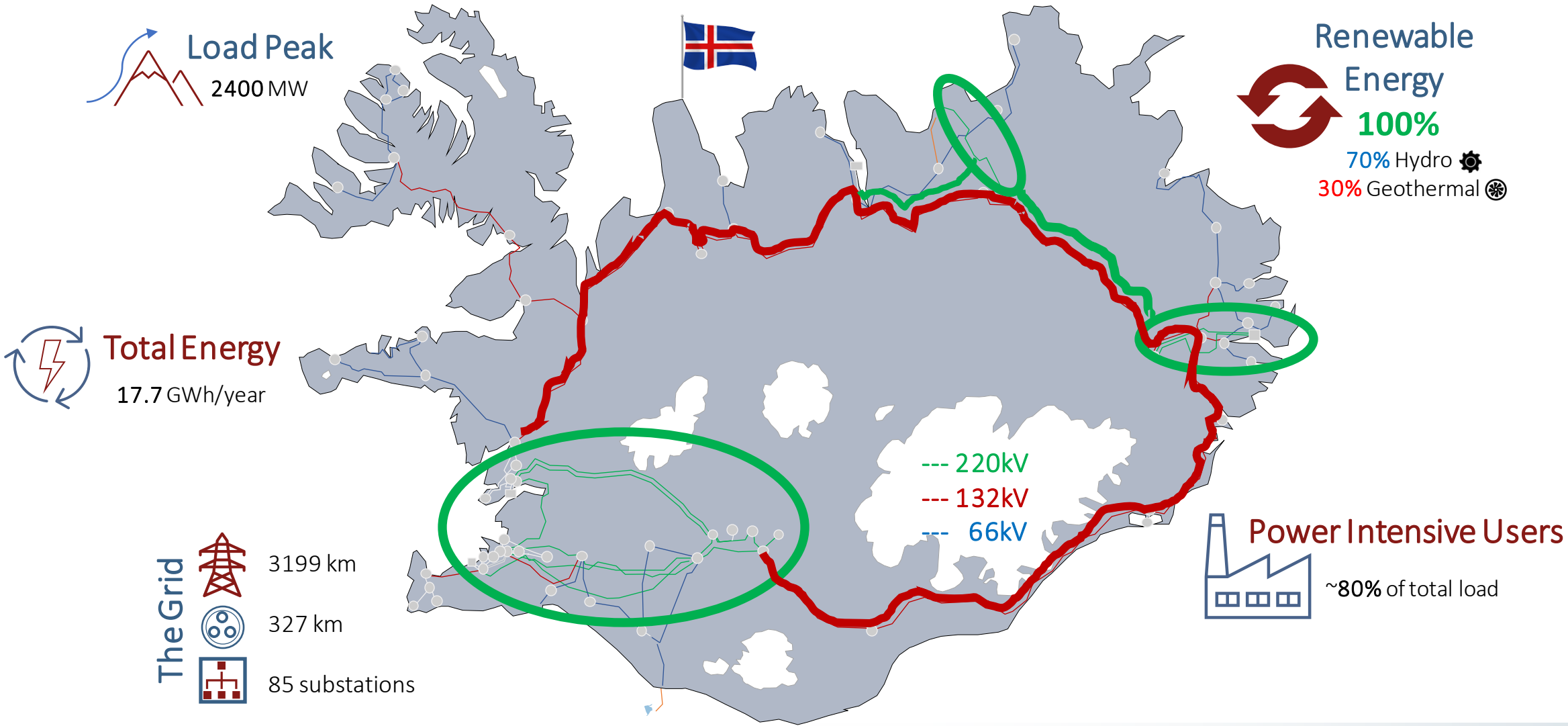
LANDSNET



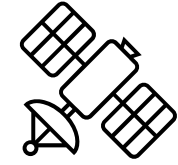
# Icelandic Transmission System



# Icelandic Transmission System



# Wide-Area-Monitoring-&-Control-System

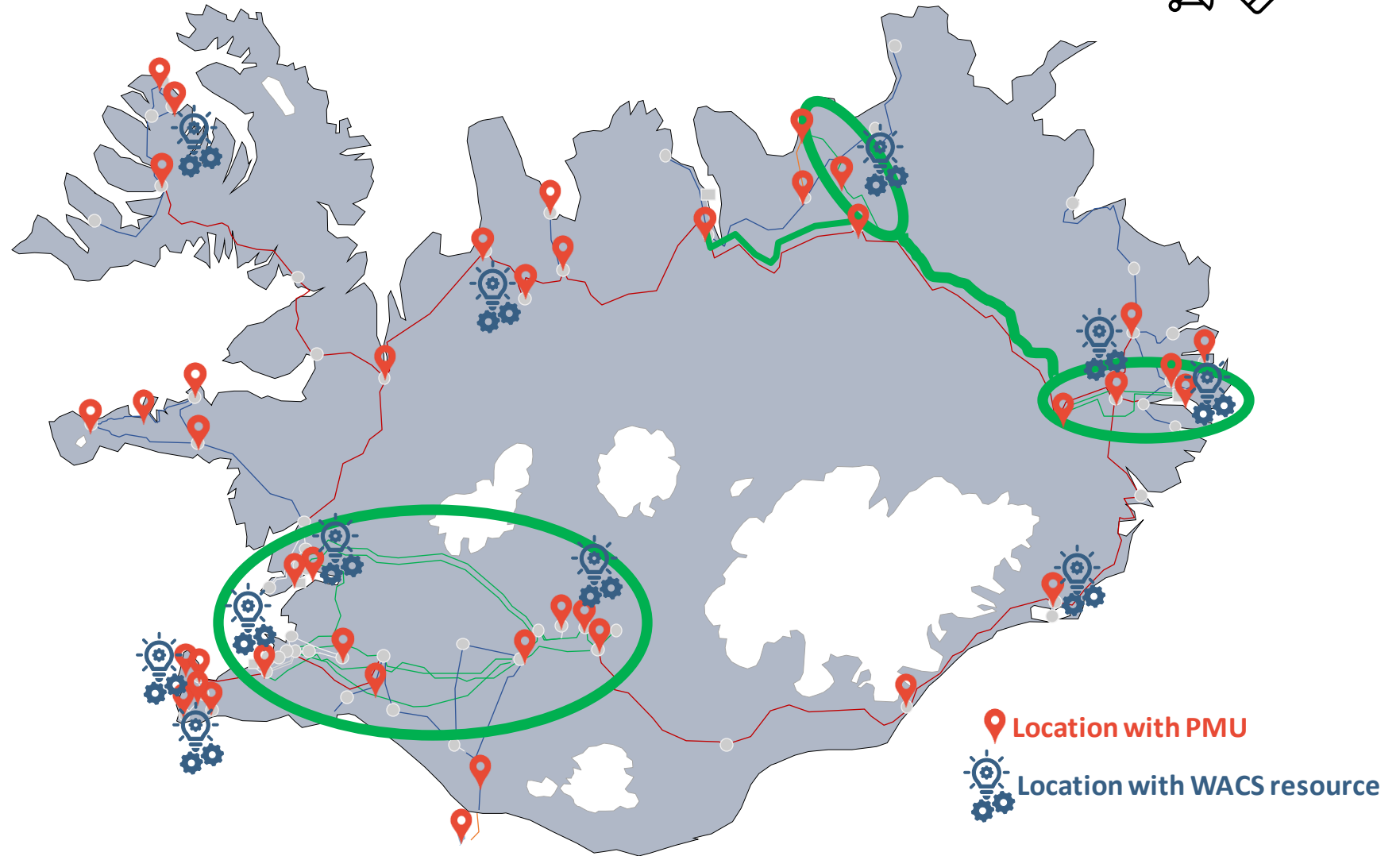


Extensive WAMPAC monitoring  
(~110 PMUs)

Good quality communications  
network

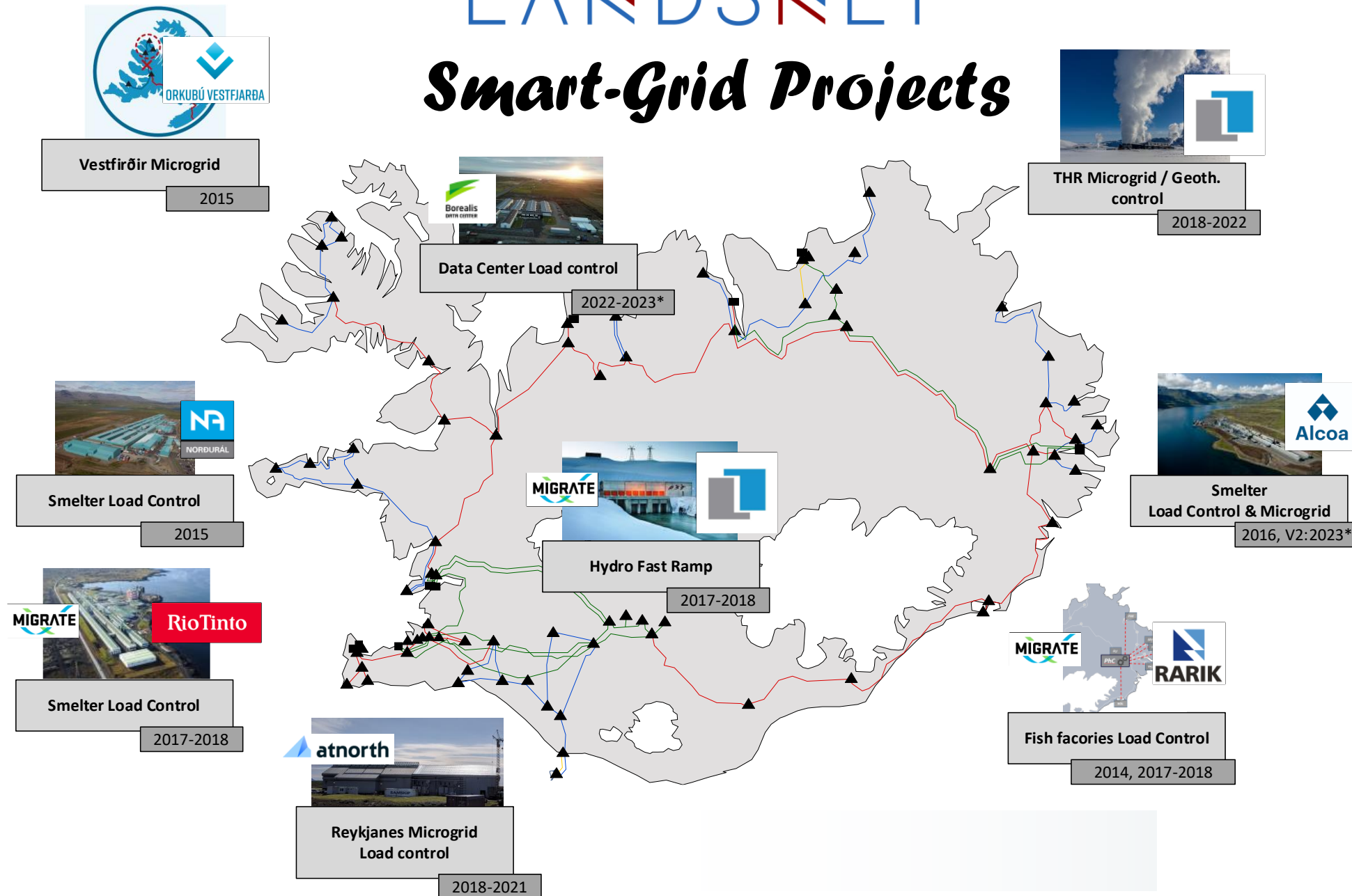
Multiple Wide-Area-Control  
schemes in operation for  
improved reliability and stability

New control is measurable on  
small system

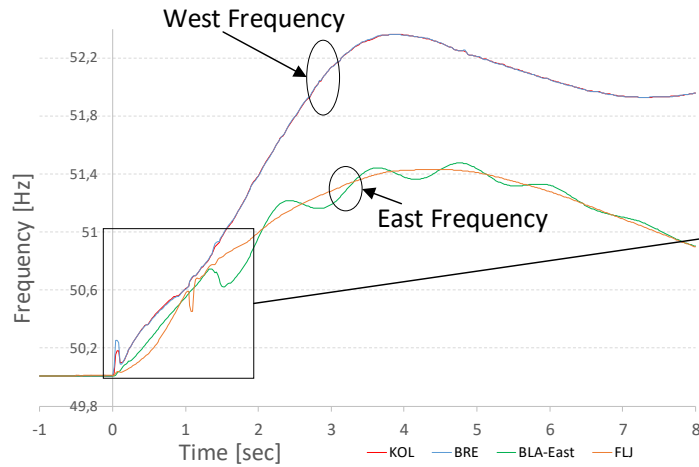


# LANDSNET

## Smart-Grid Projects



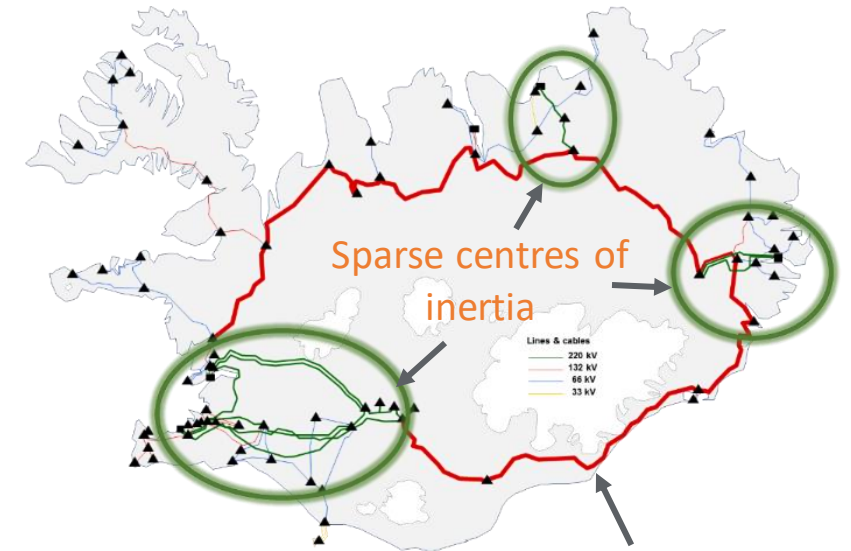
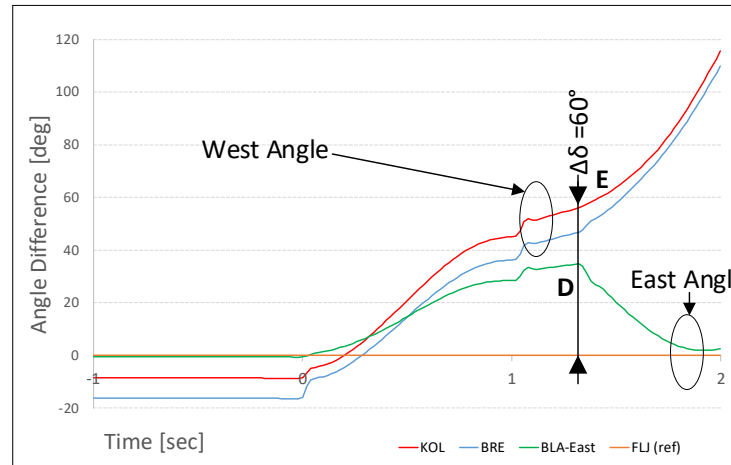
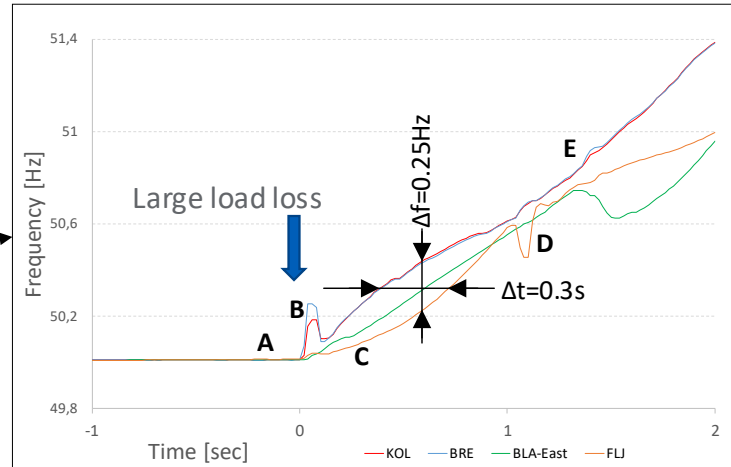
# Effect of sparse inertia



➔ 1.2s to Islanding

➔ 4s to Frequency Peak

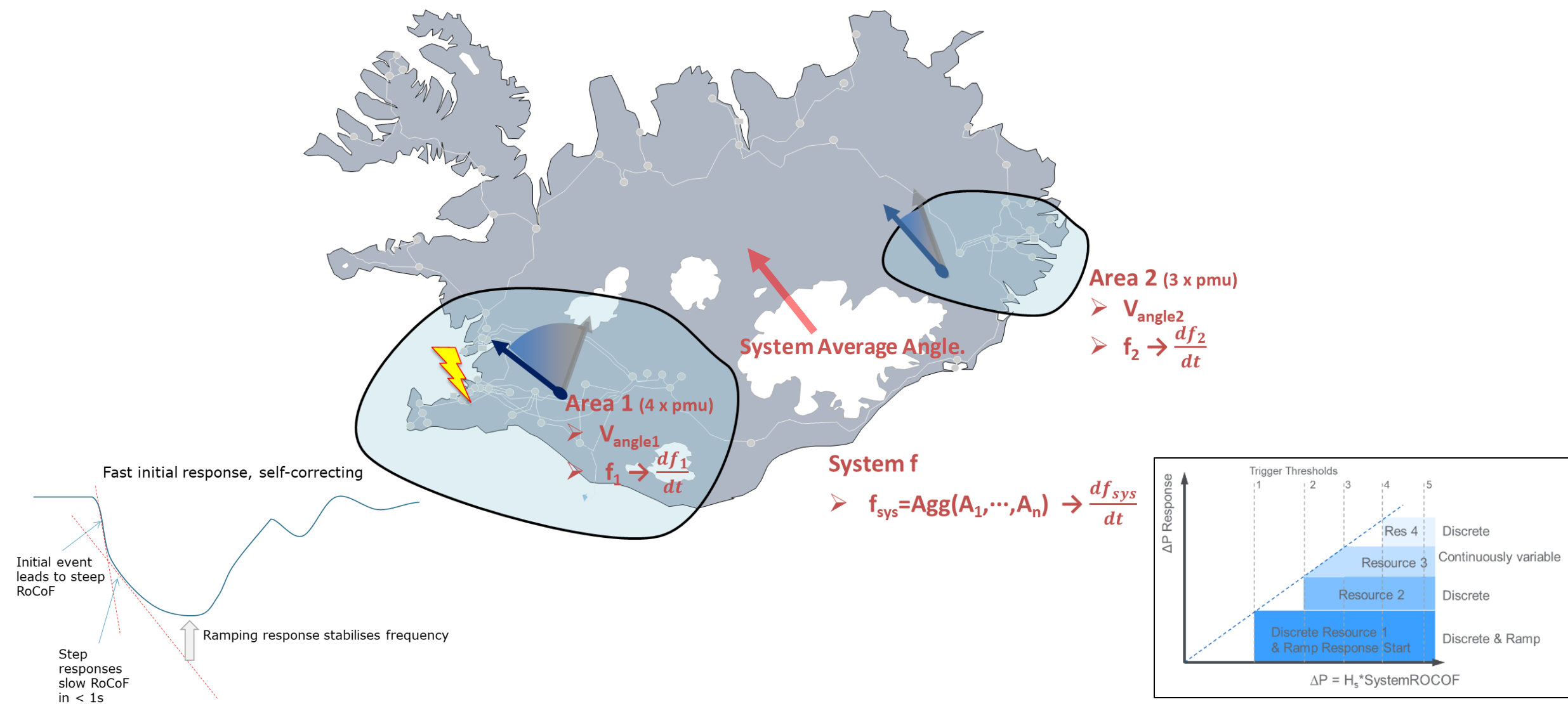
- A** T=0s Industrial load #1 reduction (first stage)
- B** T=0.2s Industrial load #1 reduction (second stage)
- C** T=0.36s Industrial load #1 trip
- D** T=1.1s Area angles separated by 60°, result in high E-W power. One route opens by special protection
- E** T=1.2s Areas accelerate away from each other; synchronism is lost and system islands



separated by long transmission distance

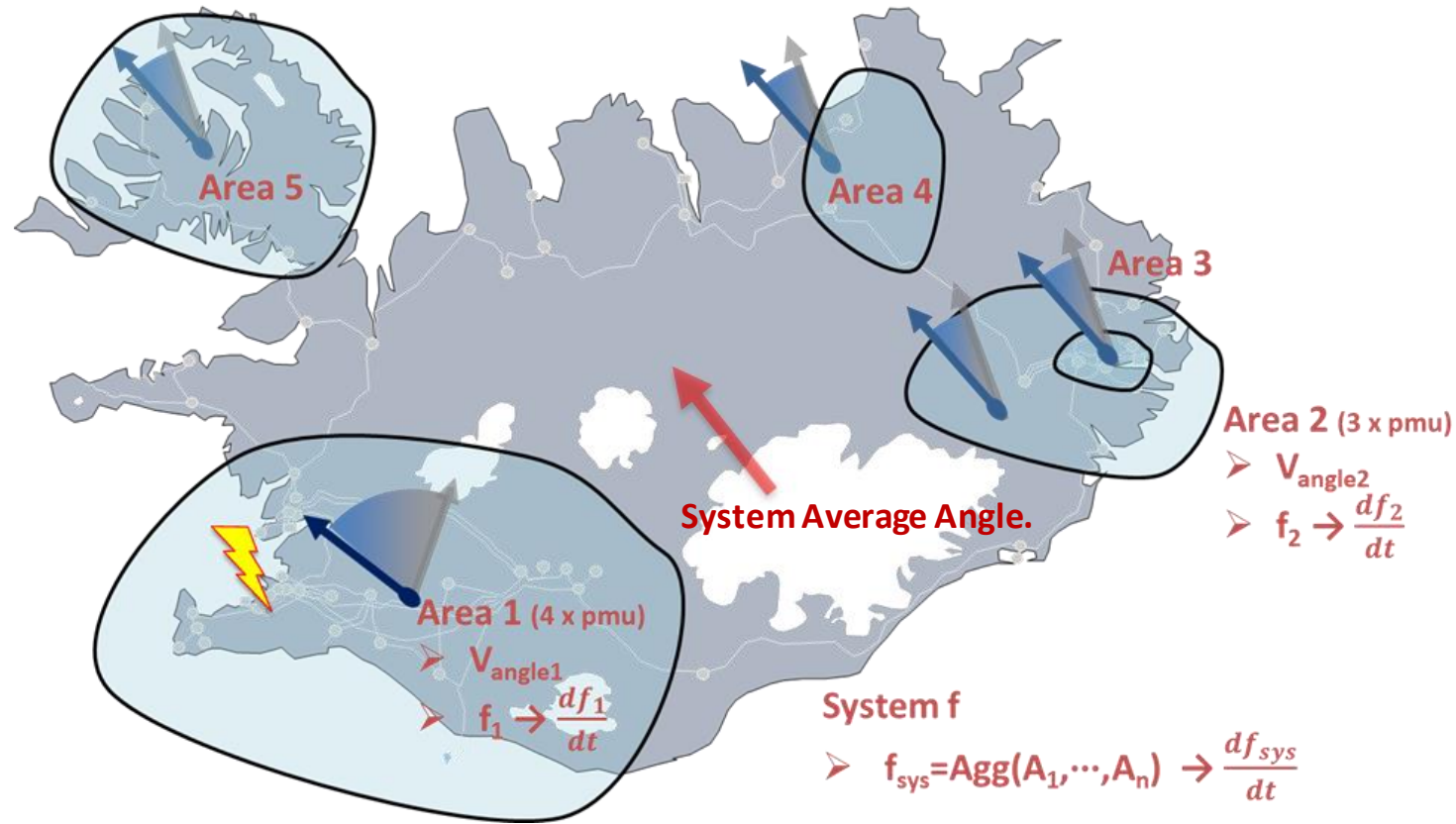
Loss of large load causes rapid, unequal rise in frequency  
 ➔ phase angles diverge  
 ➔ Islanding

# General Method for Locational Fast Response





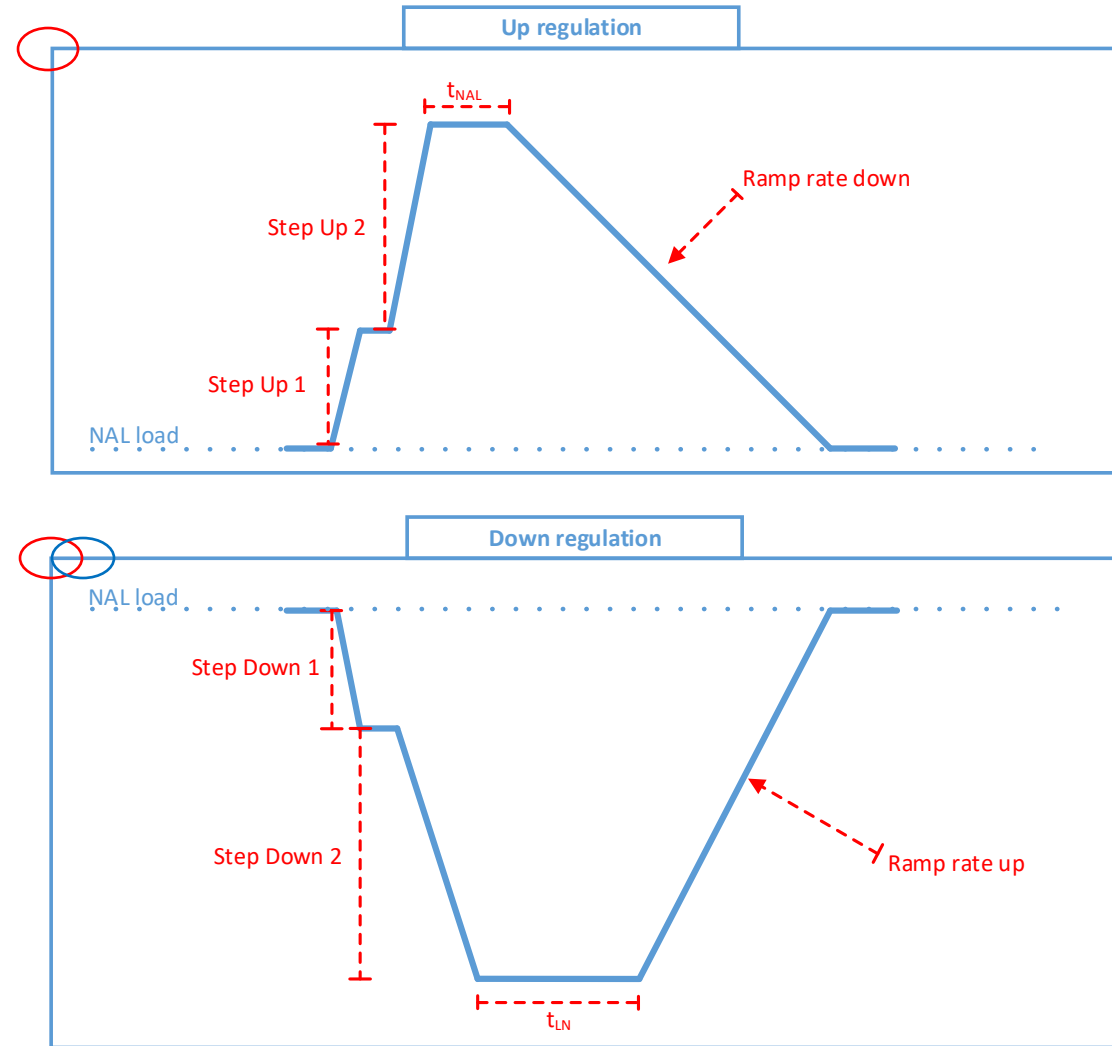
# General Method for Locational Fast Response



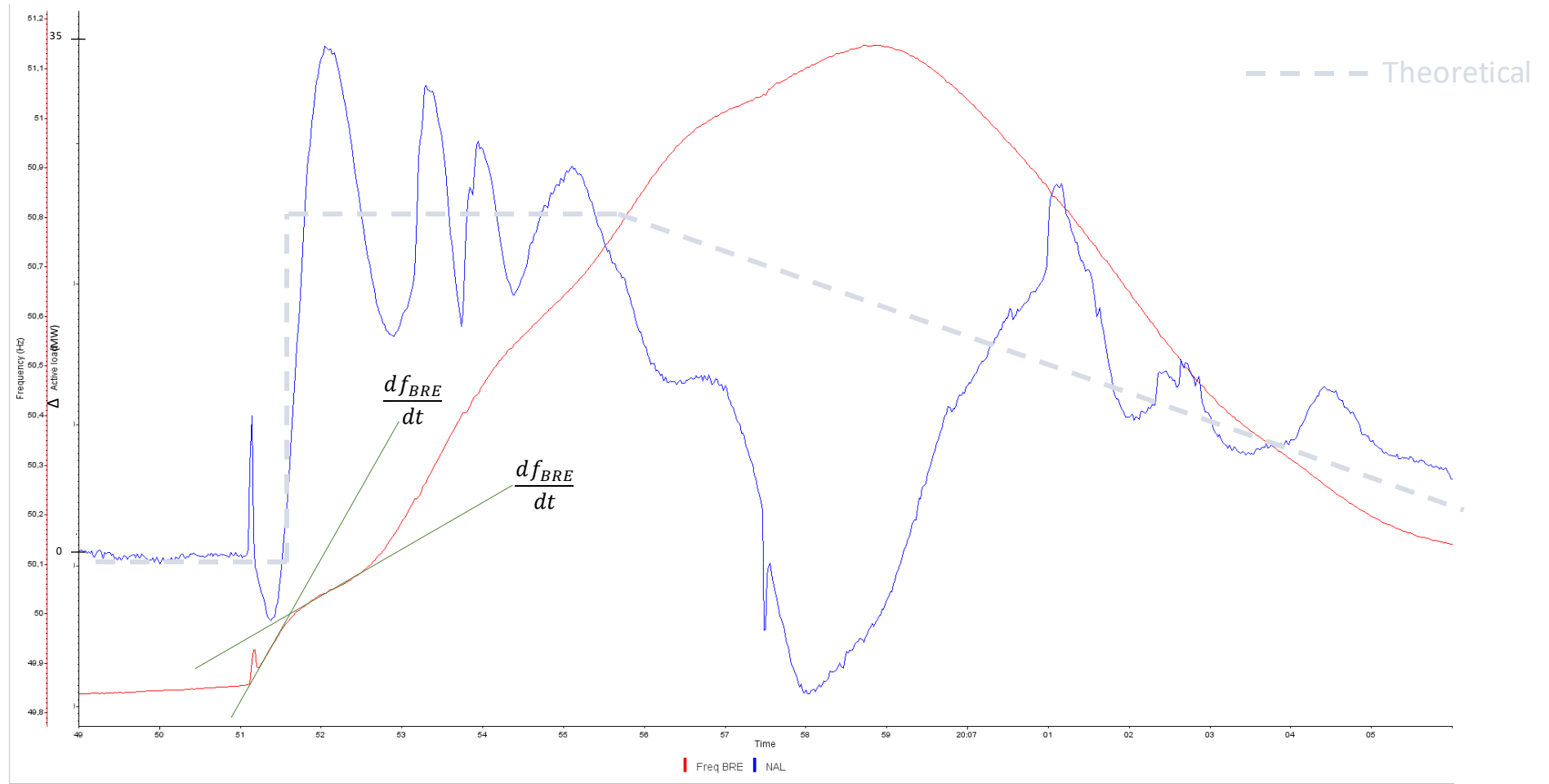
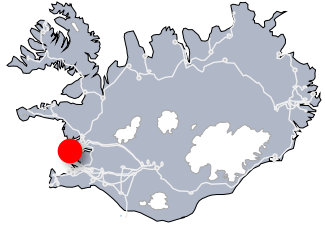
- Response Driven
- Event Driven



# Dynamic Load Control of Smelters



## During 130 MW Load Trip

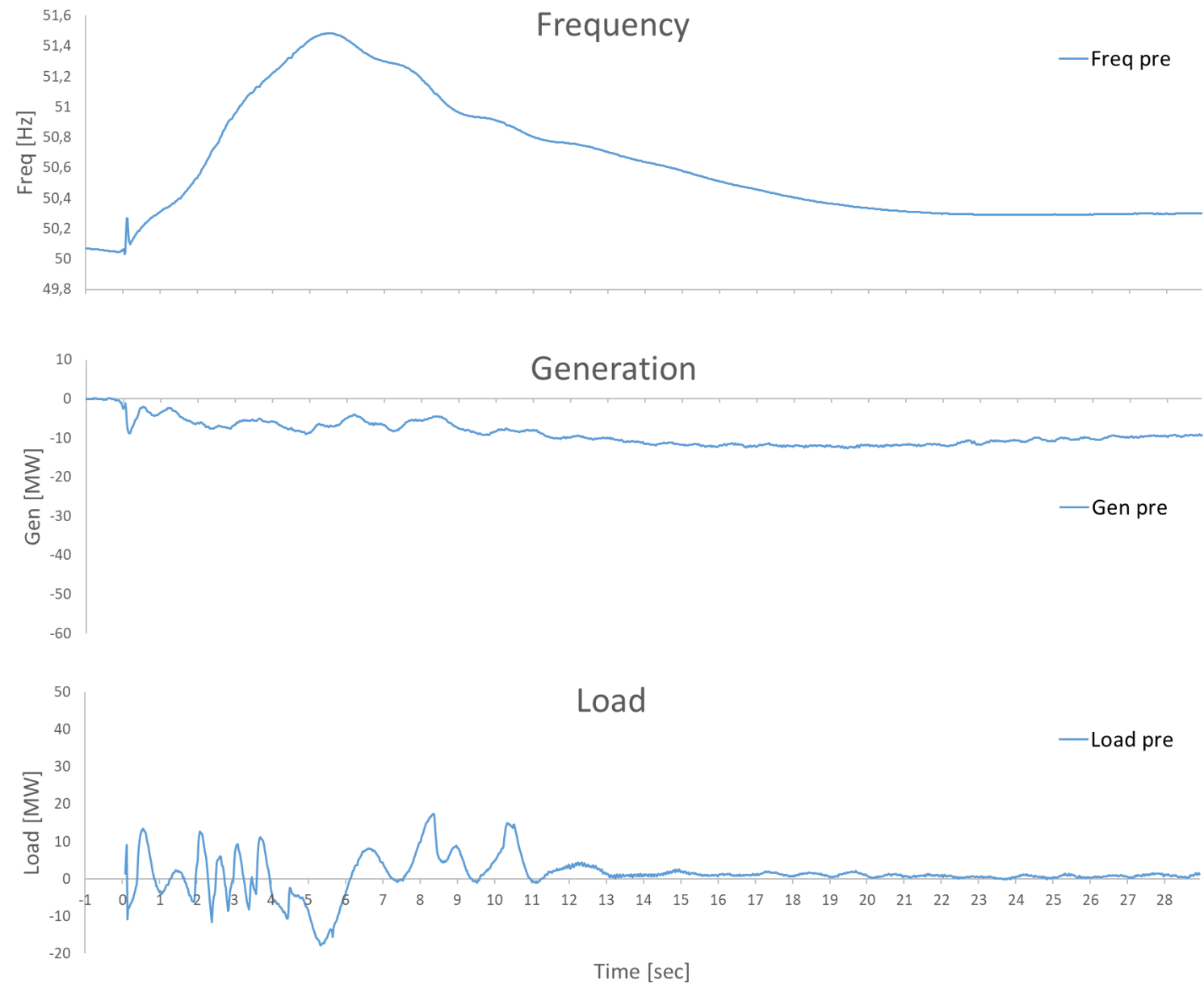
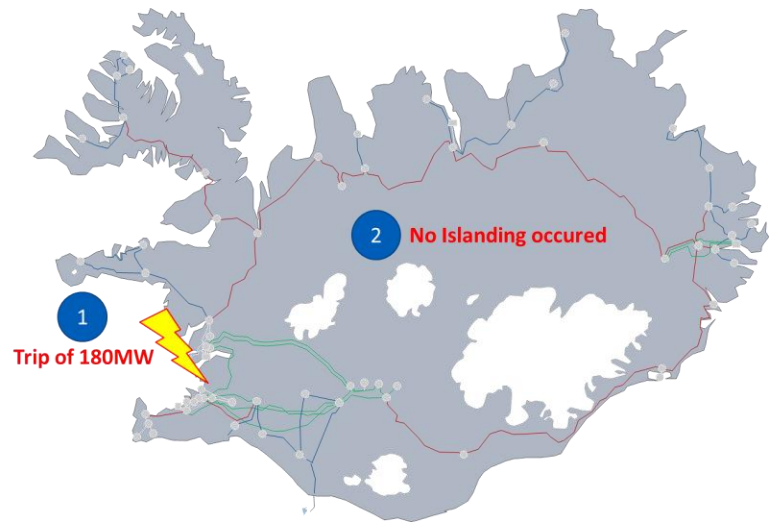


## During 70 MW Generation Trip



# REAL SYSTEM RESPONSES

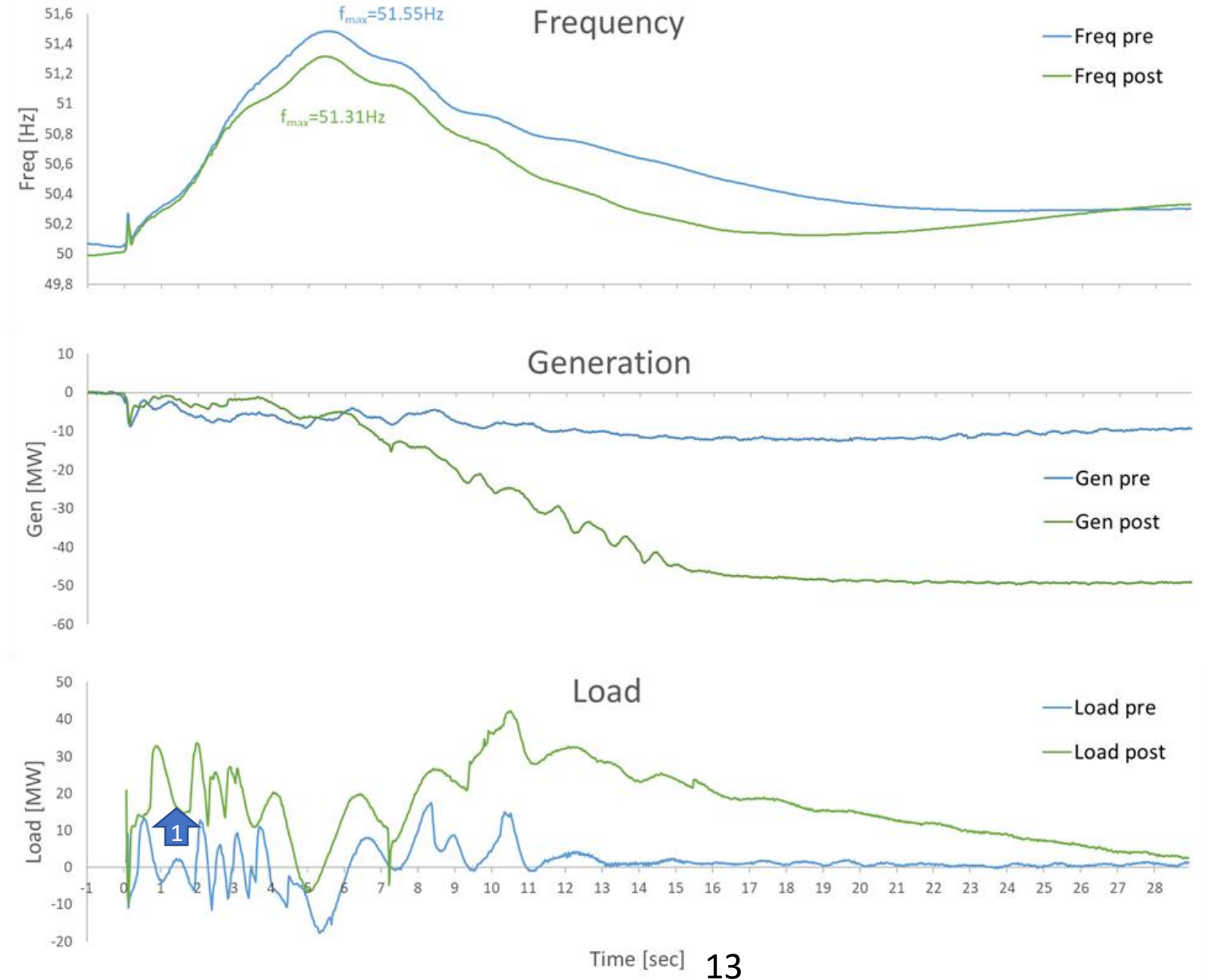
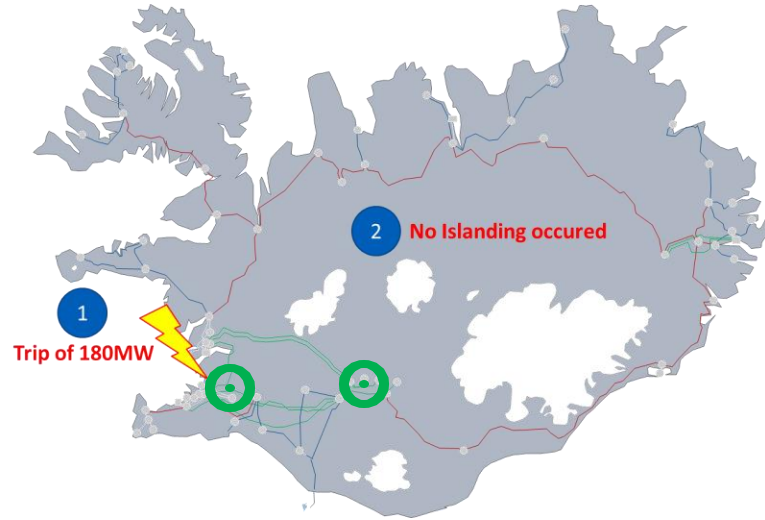
LOAD LOSS EVENT **BEFORE** WACS IMPLEMENTATION





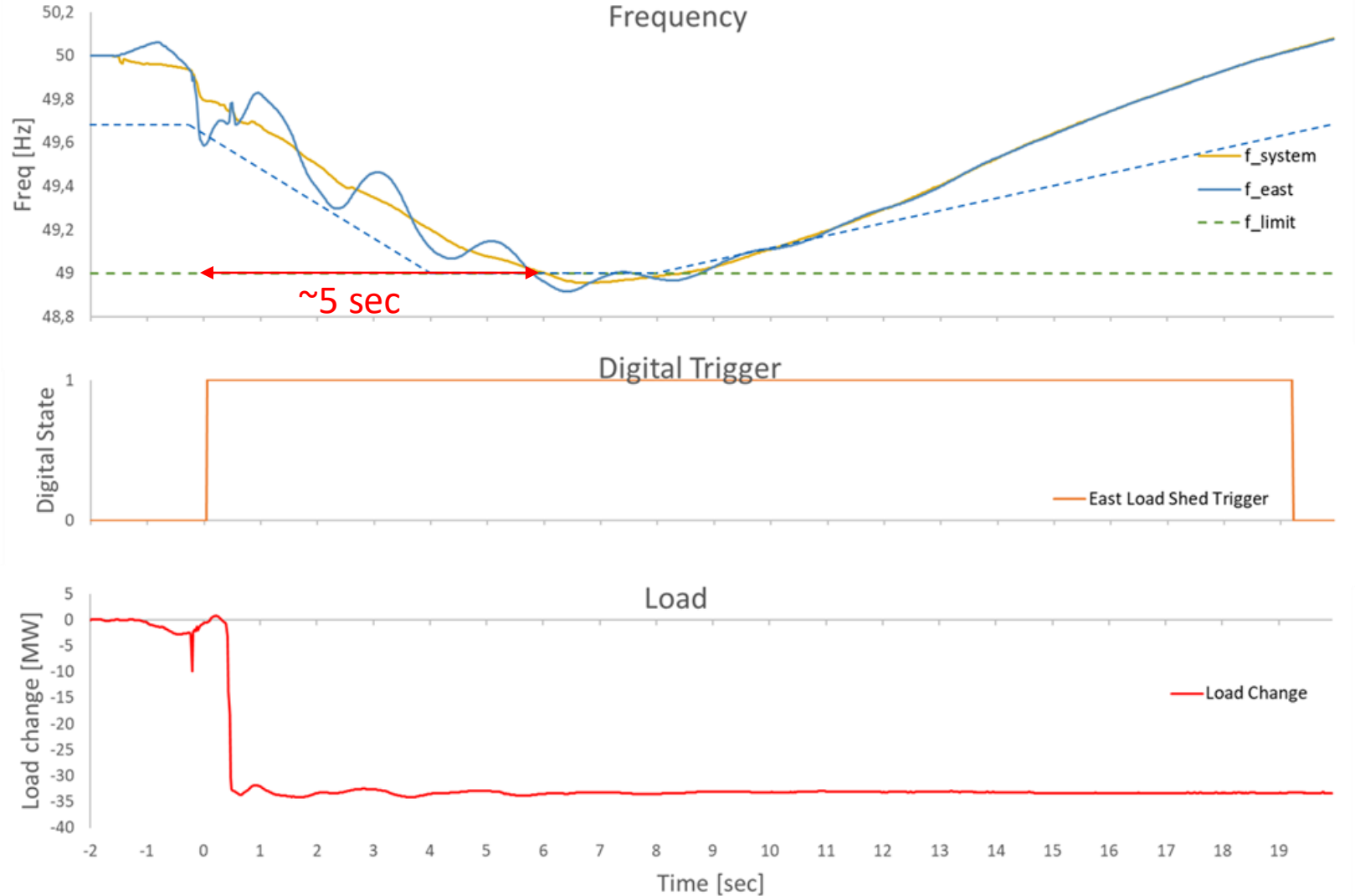
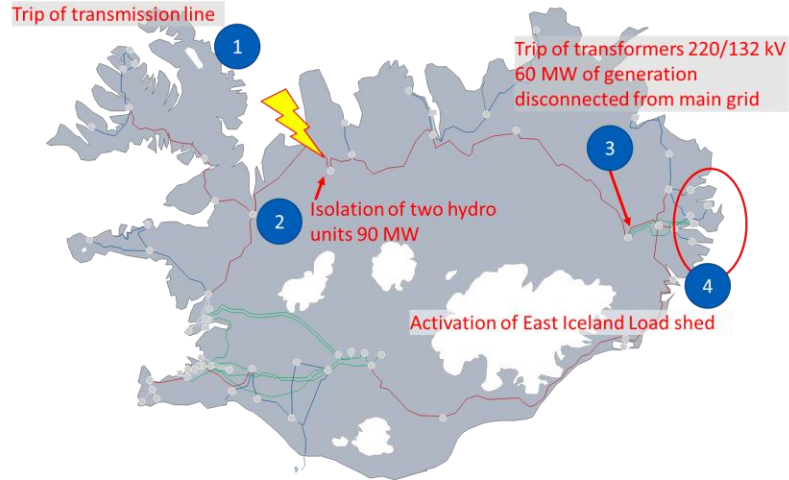
# REAL SYSTEM RESPONSES

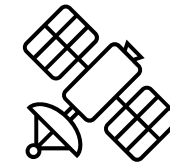
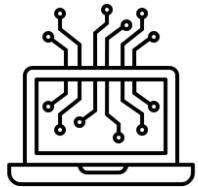
LOAD LOSS EVENT **AFTER** WACS IMPLEMENTATION



# REAL SYSTEM RESPONSES

## UNDER FREQUENCY EVENT - EAST ICELAND LOAD SHED SCHEME





**“The future is DIGITAL, the opportunities are endless”**



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**vimeo**

The Digital future of Transmission Systems  
<https://vimeo.com/641137942>

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