



# RENEWABLE & SMART ENERGY PROJECTS IN THE PORT OF HAMBURG

**Día Mundial del Medio Ambiente en el Clúster de Valenciaport**

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HPA Hamburg Port Authority

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# Introduction

## The Hamburg Port Authority (HPA)

# 01



# The Hamburg Port Authority (HPA)

Institution under public law with 1,800 employees

## Key duties

- Maintaining the waterside and landside infrastructure
- Ensuring safe and efficient navigation
- Maintaining & upgrading the port railway facilities
- Managing the port property
- Providing port industry services

## Challenges

- Creating growth despite limited land resources
- The port – an industrial area in the heart of the city of Hamburg





# Motivation

## Drivers toward decarbonization of ports

# 02

# For the port industry worldwide, both energy efficiency and the use of renewables have become important topics



Reducing the negative environmental impacts of port operation is especially important in light of **increased port competition** and **increasingly strict environmental regulations**



# Background

## The role of ports in the energy transition

03

# Ports will play a pivotal role in the world's decarbonization challenge

Ports are often not only logistics hubs but also important industry clusters

## Decarbonize logistics activities within the port

- Port and logistics activities (e. g. electrification)
- Maritime transport (e.g., onshore power)



## Coordinate and facilitate industry decarbonization activities

Lead & coordinate new initiatives to foster carbon-neutral activities, e. g.,

- Energy system integration
- Waste to energy and chemicals
- Circular and bio-based energy
- ...



## Transform ports as energy hubs

Position port as importing & distribution hub for sustainable energy for industry and households

- Hydrogen
- Ammonia
- Methanol
- LNG
- ...





# Renewable and smart energy projects in the Port of Hamburg

# 04



# The Port Hamburg

**Germany's largest seaport**

**Germany's second largest inland port**

**Europe's largest port rail hub**

**Distance to the North Sea** approx. 135 km

**Short distances into the hinterland**  
(Tri-modal: railway, inland shipping, truck)

## Port area

- Total port area: about 7,000 ha  
**of which**
  - Land area: about 4,200 ha
  - Water area: about 2,800 ha

Last updated in 2020



**More than 800 calls**  
by vessels from a length of  
330m and/or a beam of 45m



**Europe's third  
largest seaport**  
Total cargo throughput from  
over 126 million tonnes

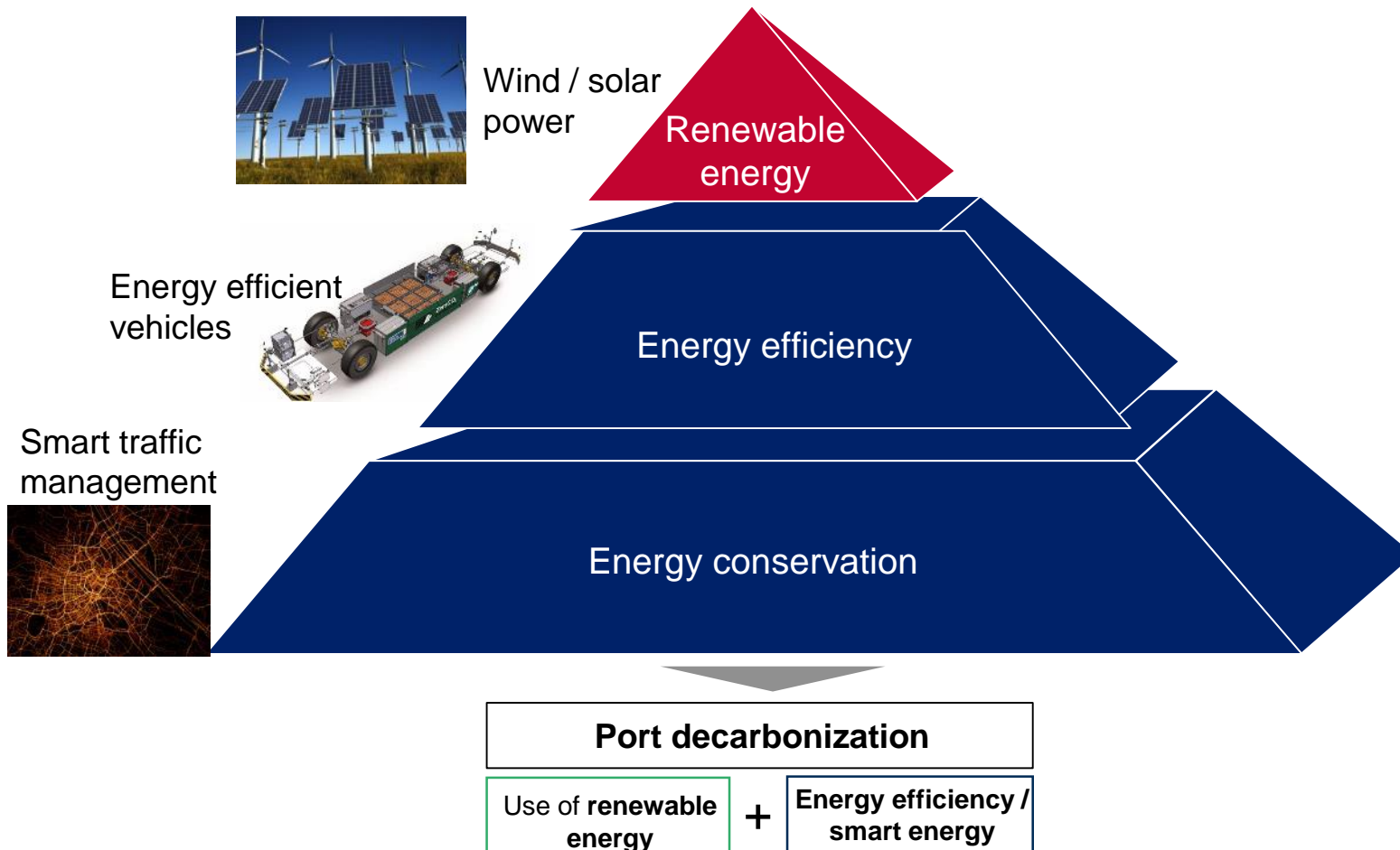


**Europe's  
largest port rail hub**  
about 300km of rail tracks

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# Our strategy: port decarbonization requires not only expanding renewable energy but also improving energy efficiency



## Our goals

- ✓ Achieve **carbon neutrality** in the port area by 2040
- ✓ **Reduce energy consumption & emissions**
- ✓ Become a “**flagship port**” for renewable & smart energy projects
- ✓ Establish a **green hydrogen economy** and become Europe’s logistics hub for green hydrogen

# Factors influencing renewable and smart energy projects in the port

1. The “whole” port – including its large energy-intensive companies – is a **huge energy consumer**
2. **Our land scarcity** restricts the expansion of on-site renewable energy, especially wind and biomass
3. Hamburg's relatively **narrow tidal range** limit opportunities for commercial tidal power generation
4. The **environmental awareness** of Hamburg's population is comparatively high and even expected to rise





# Different renewable energy sources in the port: overview and examples

**PV energy:** total capacity  $\approx 3.5$  MW

HHLA GATEWAY TO THE FUTURE



**Biomass:** recovery of biomass waste for green energy and biochar production



**Wind power:**  $\approx 15$  turbines



Hamburger  
**Energiewerke**

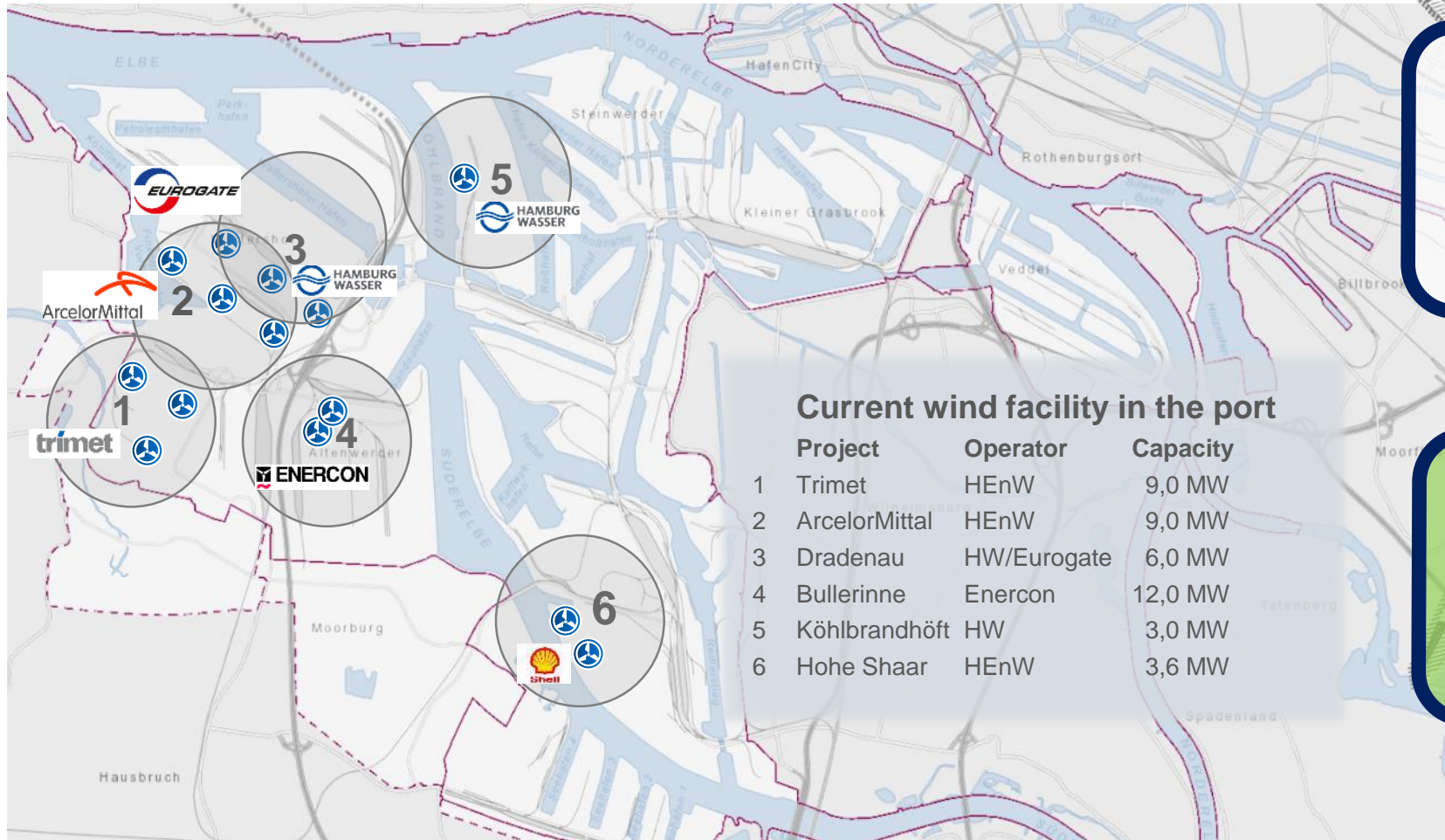
**Geothermal energy:** carbon-neutral heat for 5,000 households



Hamburger  
**Energiewerke**



# Wind power: the City plans a large expansion of wind power in the port



## Current wind power inventory in the port

**14 wind turbines**  
with 42 MW power  
**100 Mio. kWh/a**  
**50 Tto CO<sub>2</sub> savings**

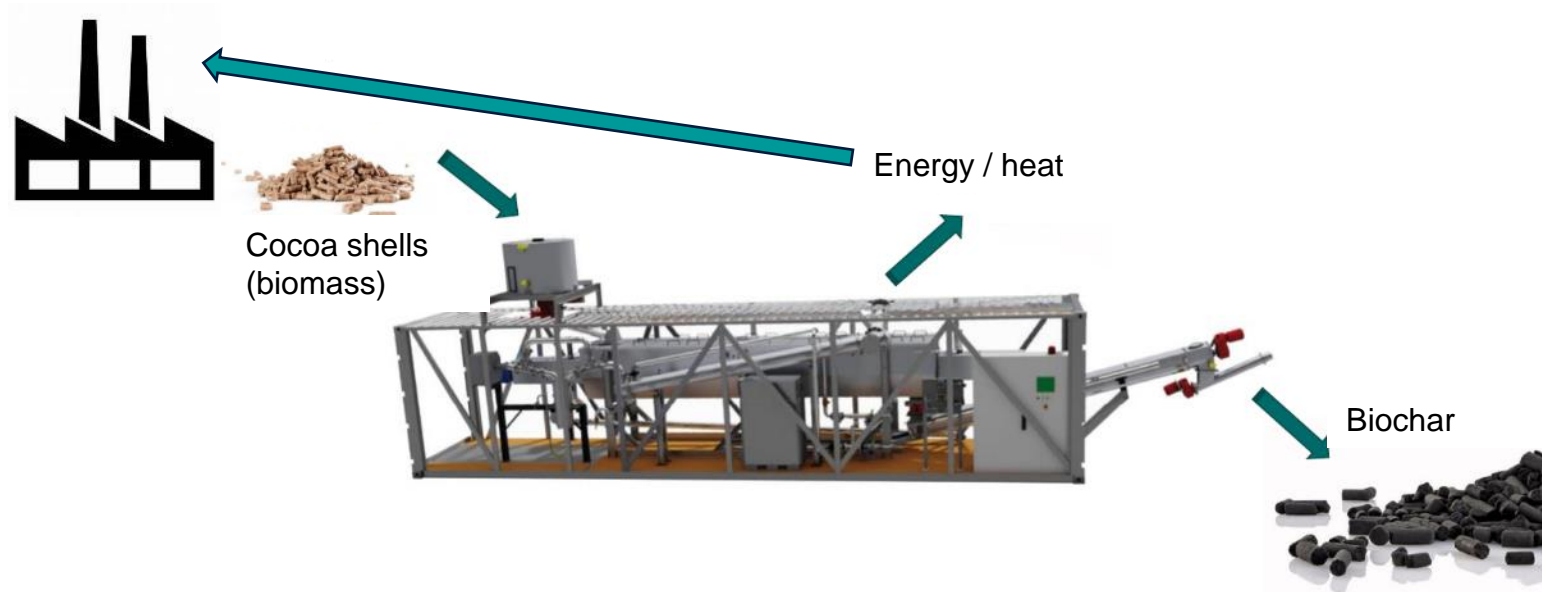
## Future wind power inventory in the port

**Approx. 30 wind turbines**  
with 200 MW power  
**340 Mio. kWh/a**  
**170 Tto CO<sub>2</sub> savings**



# Bioenergy: ports are perfect hubs for circular economy

- The company „Circular Carbon“ operates a biomass plant to produce biochar and renewable heat from cocoa shells of the nearby cacao factory



Soil conditioner



Animal farming

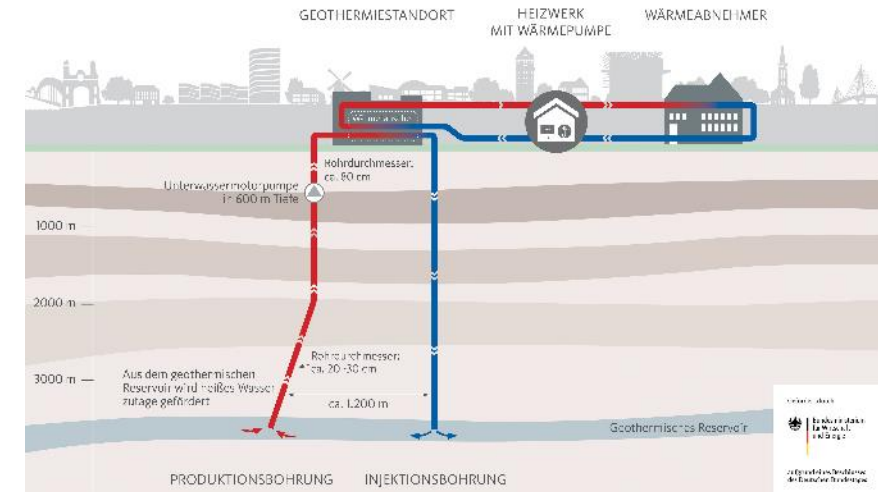


Decontamination



# Geothermal energy: first project has started in the port

- The idea of geothermal technology is to use terrestrial heat for climate-friendly heating or to generate electric power
- In the Port of Hamburg, a geothermal energy plant is currently constructed to provide heating energy for approx. 5,000 households
  - ✓ Fossil-free energy and heat generation
  - ✓ Permanent access to the energy source
  - ✓ Low space requirement





# Different smart energy projects in the port: overview and examples



**Shore power facilities:** for cruise and container vessels



**Smart grid & electrification:** batteries of AGVs as grid stabilizer



**Energy storage:** 130 MWh of thermal energy using volcanic rocks



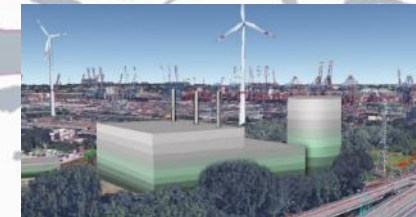
**Hydrogen ecosystem:** H<sub>2</sub> production in the port



**Climate-friendly domestic harbor craft**

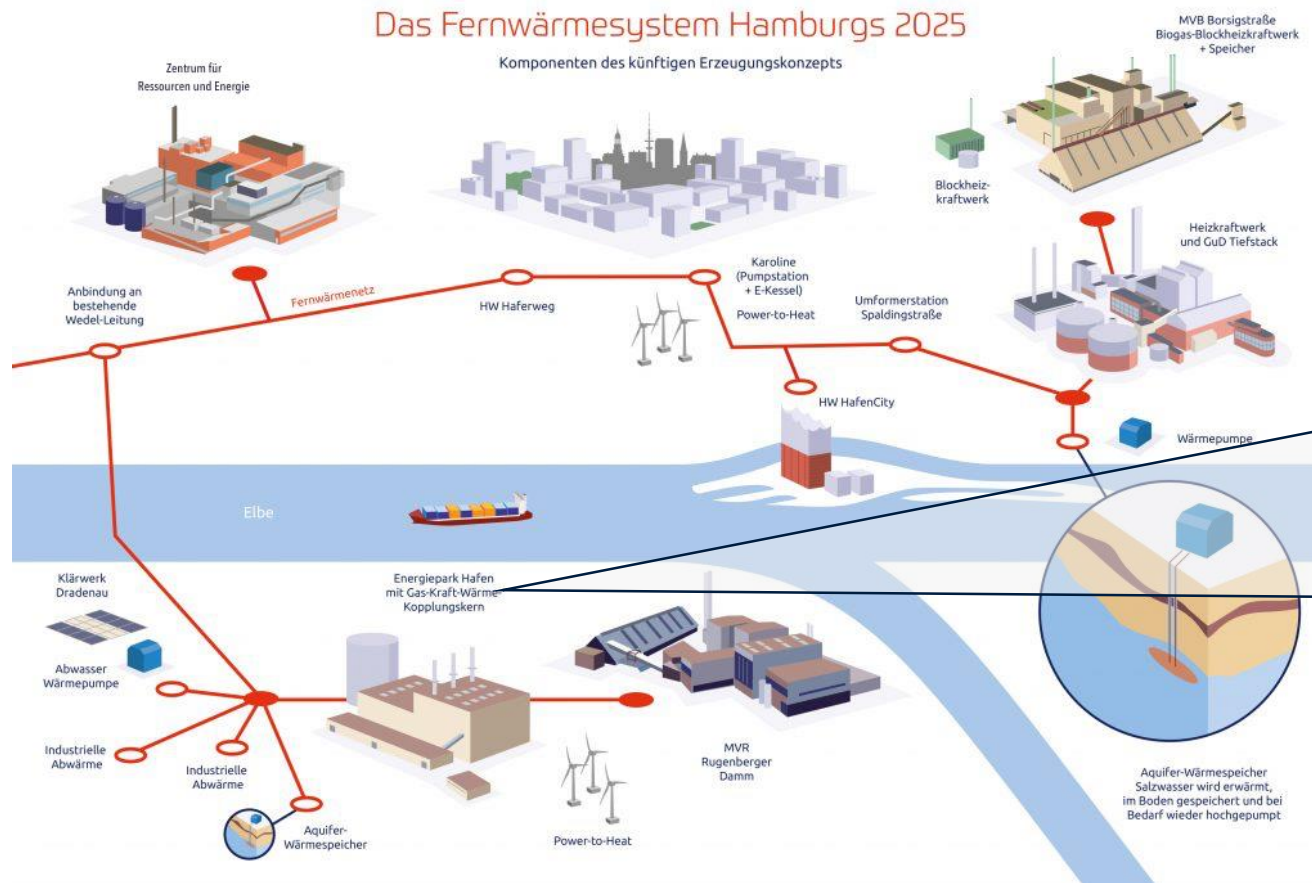


**Climate neutral heating:** collection & usage of waste industry heat



Hamburger  
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# Port district heating: smart connection of climate neutral heating sources in the port



## Port Energy Park“

Collection of climate neutral heating sources



Conversion, heating and storage of energy



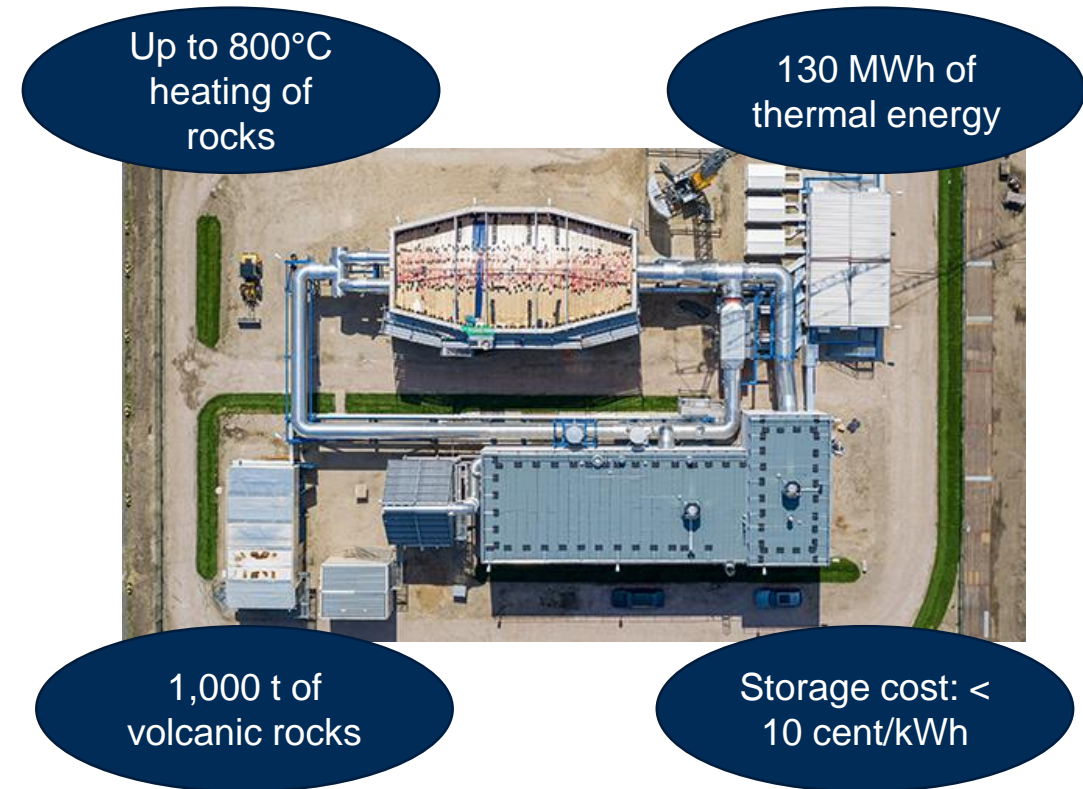
Distribution via district heat





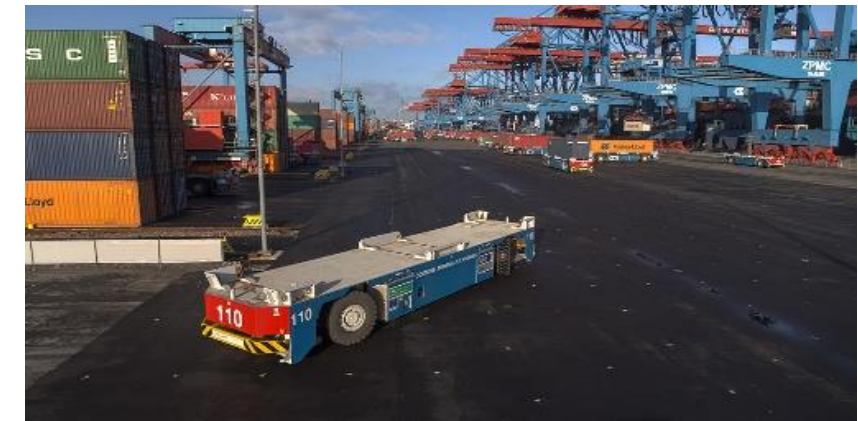
# Electric thermal energy storage systems (ETES) in the port

- Siemens Gamesa operates an ETES with volcanic rocks as energy storage medium
- The technology makes it possible to store large quantities of renewable energy cost-effectively and thus decouple electricity generation and use
- Siemens plans to use the technology in commercial projects and scale up the storage capacity and power



# Smart grid: container transporters as mobile power stores

- On of the greatest challenges of the energy transition is to ensure grid stability with a high share of fluctuating renewable energy
- In the HHLA FRESH project, the battery capacities of the 100 automated guided vehicles are integrated into the energy grid as flexible storage units and contribute to grid stability
- In total, the lithium-ionen batteries can provide 4 MW via the 18 charging stations





# Conclusion and Summary

# 05

# Main findings and conclusion

## Top 3 findings

1. Energy sustainability and security will become an important **value adding factor for ports**
2. Renewable energy **conditions differ from port to port** → high potential for climate neutral heat and wind energy in Hamburg
3. **Limited influence of port authorities** on renewable and smart energy projects

## Top 3 conclusions

1. Ports need to deploy **more smart and renewable energy projects**
2. Ports need to **adapt to overall changes in the energy landscape** (e. g. infrastructure & land use)
3. **Collaboration and building networks** is paramount to achieve a green port transformation



HAMBURG PORT AUTHORITY

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Neuer Wandr

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