PORT OF GOTHENBURG

ONSHORE POWER SUPPLY

Experiences operating OPS in the Port of Gothenburg

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Agenda

- The Port of Gothenburg
- Sweden’s energy system in brief
- Dialog with the local grid owner
- Timeline OPS installations
- Strategy going forward
- Conclusions

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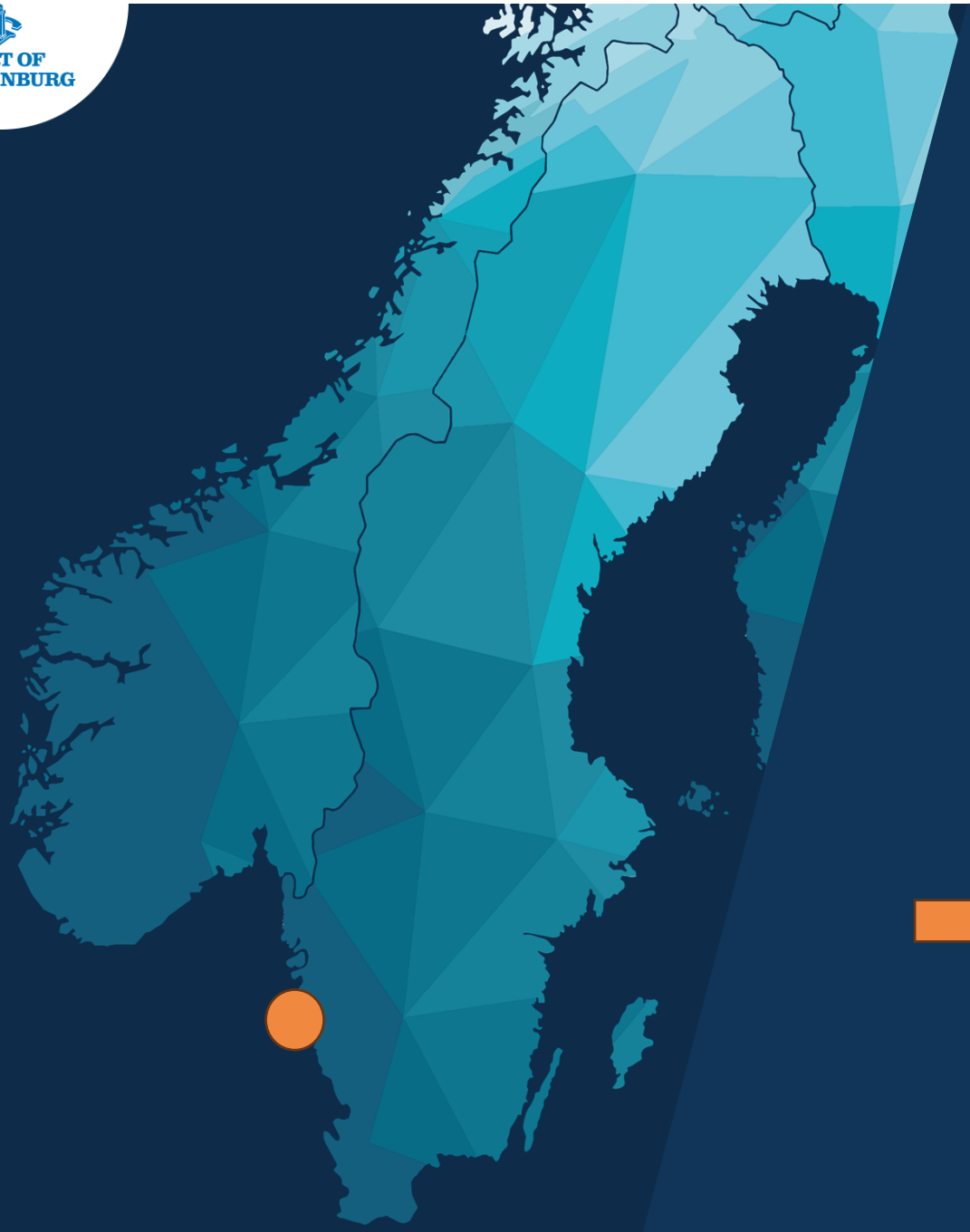

Why is OPS important for us

- To reach our own climate goals. OPS will help us reduce 40 000 tons of CO2 annually which is equivalent to 24% in total
- To meet upcoming legal requirements by 2030
- We are aware of shipping companies upcoming increased costs due to tougher regulations

→ Hence, we have a strategy to implement OPS in the whole port with a focus on climate benefits and legalizations 2024 – 2035

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Port of Gothenburg 2023

914 000
containers TEU

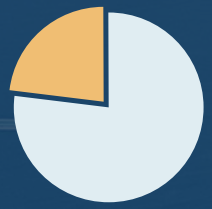
267 000
shipped cars

18.4 m
tonnes energy goods

57%
containers in Sweden

5 800
ship calls

1.4 m
passengers



23%
of all foreign trade

70
train movements/day

36.3 m
tonnes of goods

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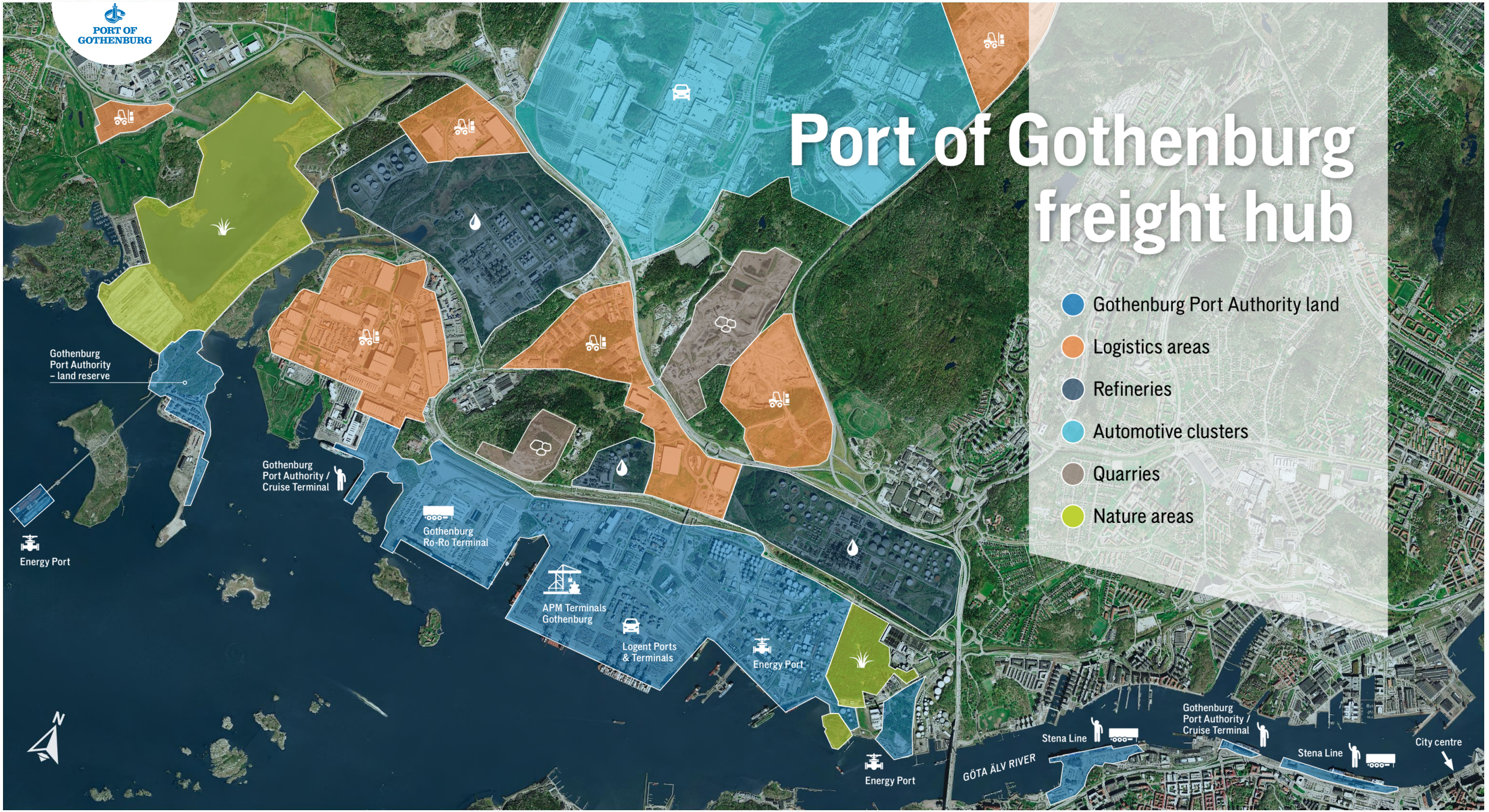
PORT OF GOTHENBURG VALUE PROPOSITION

Climate-smart port

- Forceful and far-reaching climate goals
- 70 % reduction to 2030 (base year 2010 and includes rail, road and sea in Gothenburg region)
- Major investments in climate-smart transport
- As much freight as possible by rail
- Skandia Gateway – deepening of the fairways. allowing the world's largest ocean-going vessles to call at the Port of Gothenburg fully loaded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Port of Gothenburg freight hub
Gothenburg Port Authority land
Logistics areas
Refineries
Automotive clusters
Quarries
Nature areas
Gothenburg Port Authority – land reserve
Gothenburg Port Authority / Cruise Terminal
Gothenburg Ro-Ro Terminal
Energy Port
APM Terminals Gothenburg
Logent Ports & Terminals
Energy Port
Energy Port
GÖTA ÄLV RIVER
Stena Line
Gothenburg Port Authority / Cruise Terminal
Stena Line
City centre
N

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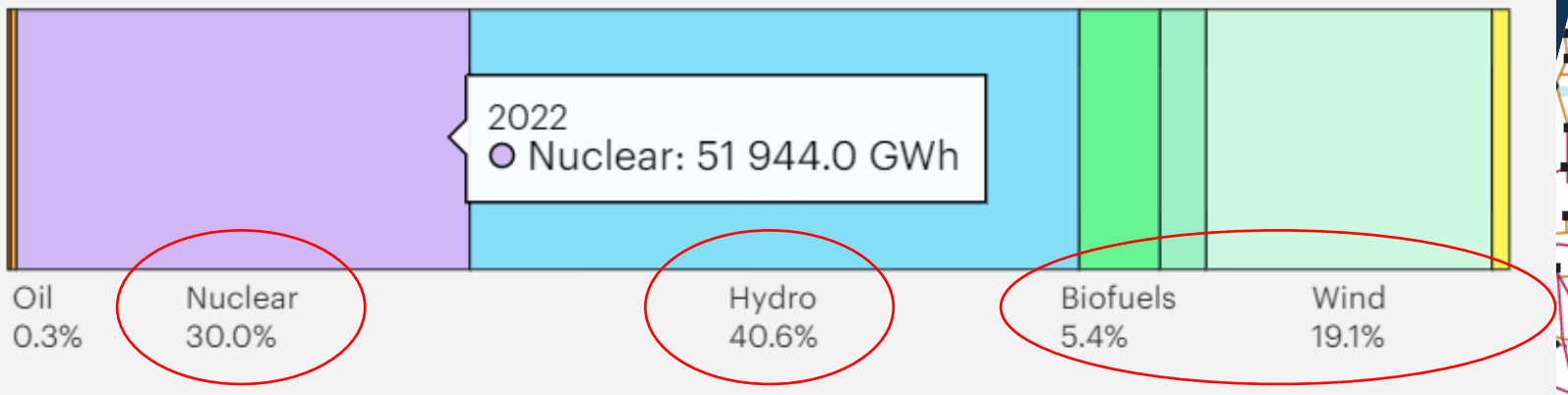
Energy mix

Electricity generation mix, Sweden, 2022

Total energy supply | Production | Electricity | Consumption



» https://www.iea.org/countries/sweden

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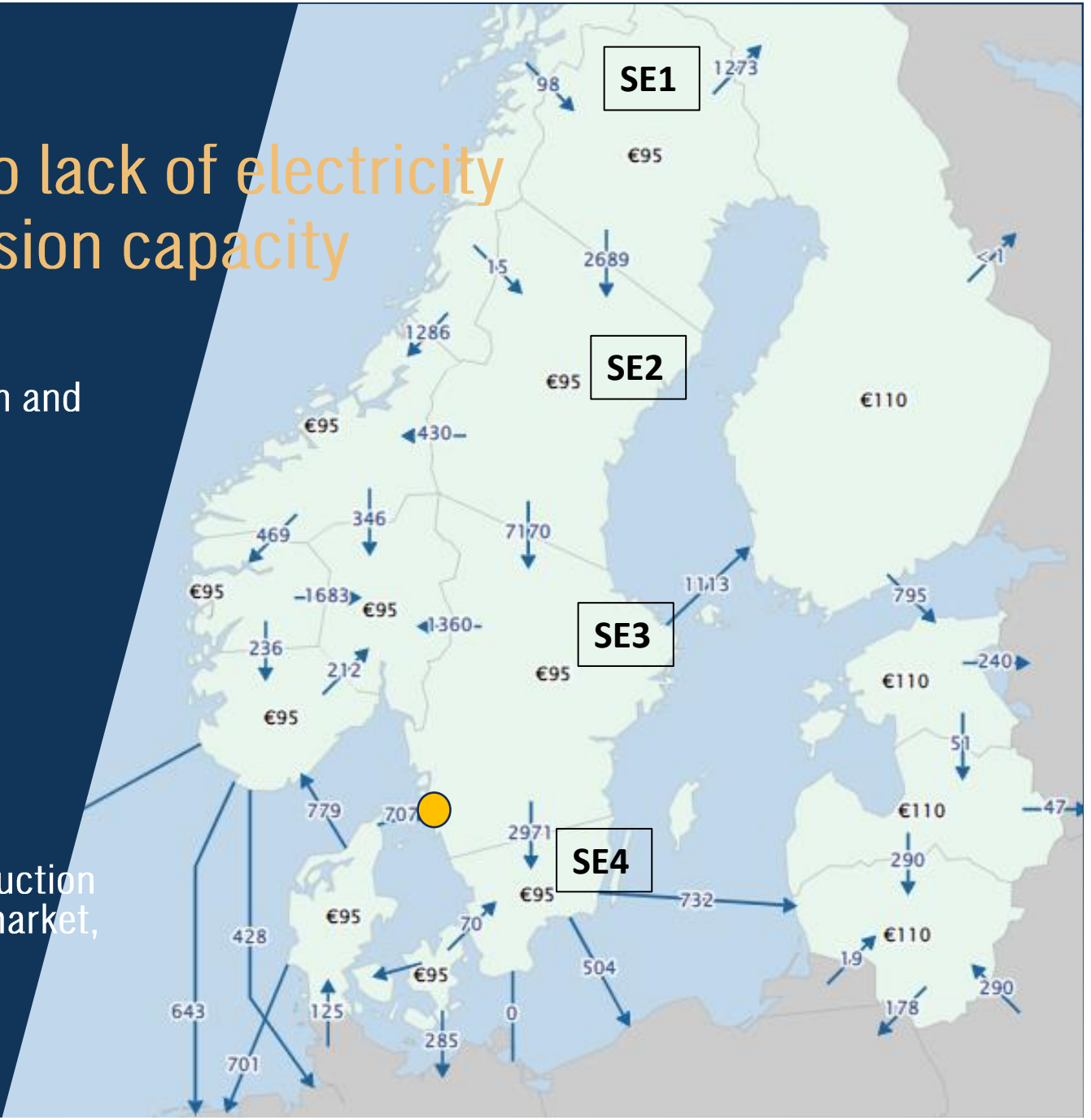
Sweden's Energy system has no lack of electricity – the challenge is the transmission capacity

- Sweden has 4 energy areas, SE1-SE4, 50 Hz
- The challenge is a lack of transmission capacity in and between some areas (Sweden produces 165 TWh, consumes 135 TWh)
- Actors in the electricity system
  - Net owners with monopoly (Main network, Regional network, Local grids)
  - Electricity producers
  - Electricity suppliers
  - Electricity bill 2 parts: 1) to net owner for transportation, 2) to supplier for used energy
- Solutions: network capacity expansion, new production units, peak shaving (price mechanism, flexibility market, energy storages…)

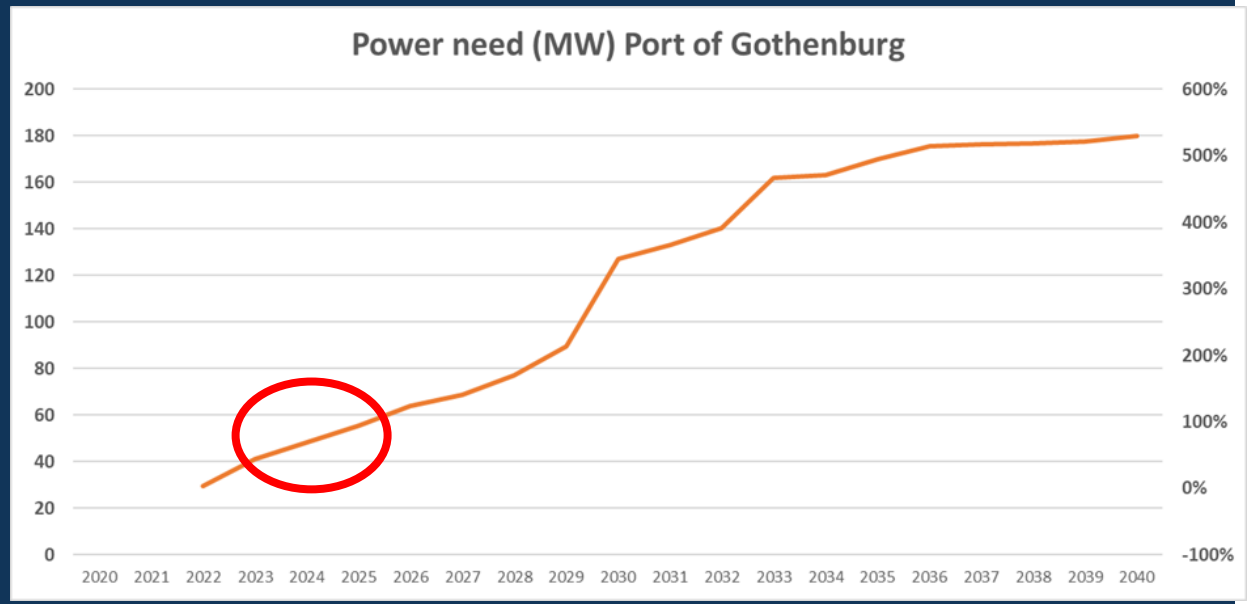
** Energy supplied over the years*
** The price development of the years*



Success factor: Understand your own power need, establish a good relationship with the local grid owner and create a win-win situation

Plan for your demand for electricity infrastructure for the coming ~30 years

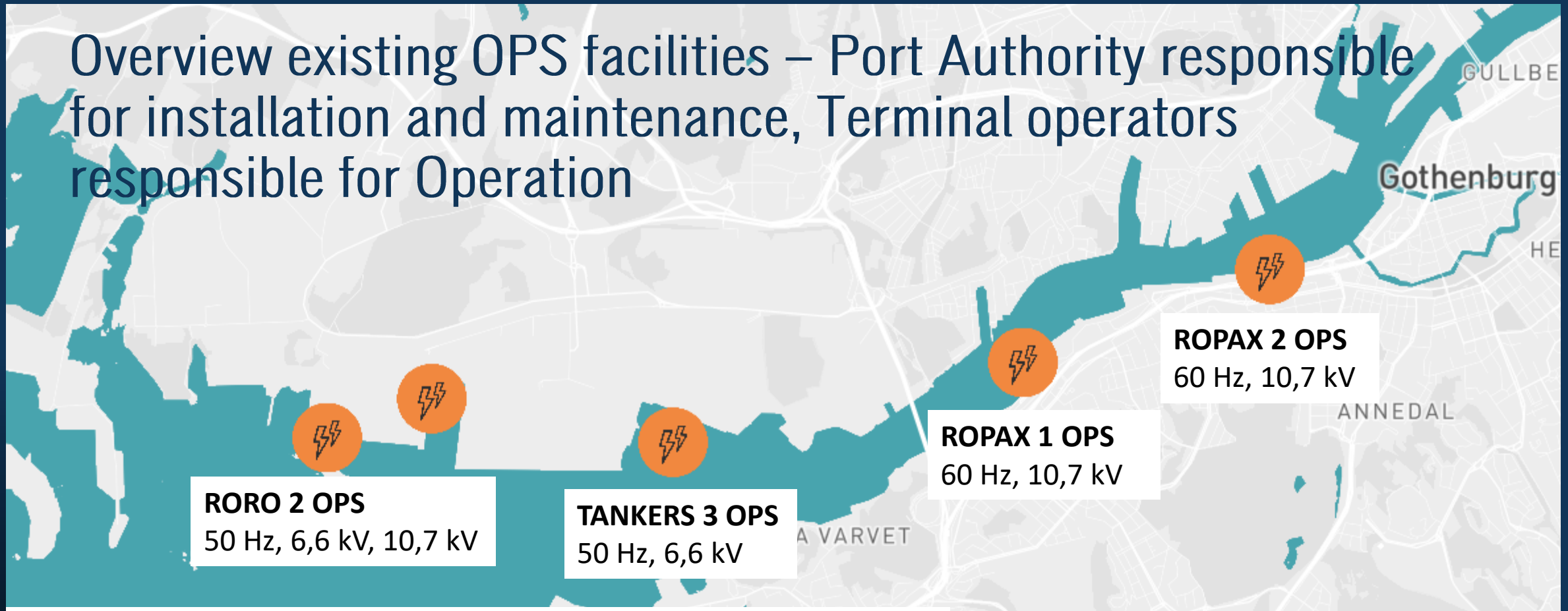
1. Learn what the available effect is in your net
2. Become friends with the local grid company and build trust
3. Simulate the port areas demand for effect
4. Elaborate different solutions to handle the effect that are intermittent (co-storage factors, energy storages, etc.



TIMELINE FOR OPS IN THE PORT OF GOTHENBURG

1989	1 OPS ROPAX low voltage (Stena Line, do not exist today)
2000	1 OPS RORO the worlds first HVSC, 50 Hz, 6,6 kV (GRT 700, updated 2016)
2004	Energy Globe Award
2008	Clean Seas Award, World Ports Climate Initiative is formed and PoG takes the lead
2011	2 OPS ROPAX, HVSC, 60 Hz, 10,7 kV, fixed crane at quay (Stena Line)
2012	Conditions in our environmental permits concerning OPS
2014	1 OPS ROPAX, HVSC, 60 Hz, 10,7 kV, fixed crane at quay (Stena Line)
2019	1 OPS RORO, HVSC, 50 Hz, 10,7 kV, fixed crane at quay (GRT 712)
2021	Start collaboration in project with OPS for tankers
2023	Légalisation in EU, AFIR and Fuel EU Maritime
2024	3 OPS TANKERS completion of project Green Cable, 50 Hz, 6,6 kV

Overview existing OPS facilities – Port Authority responsible for installation and maintenance, Terminal operators responsible for Operation



** Invoicing to the customer has been carried out by the terminal operator. They have an own subscription to the local network owners*

** CAPEX & Maintenance costs managed in lease agreements. We own the switchgear stations*

Lessons learned: important to have a clear plan after the warranty period is finished (clear roles & responsibilities, maintenance process…)

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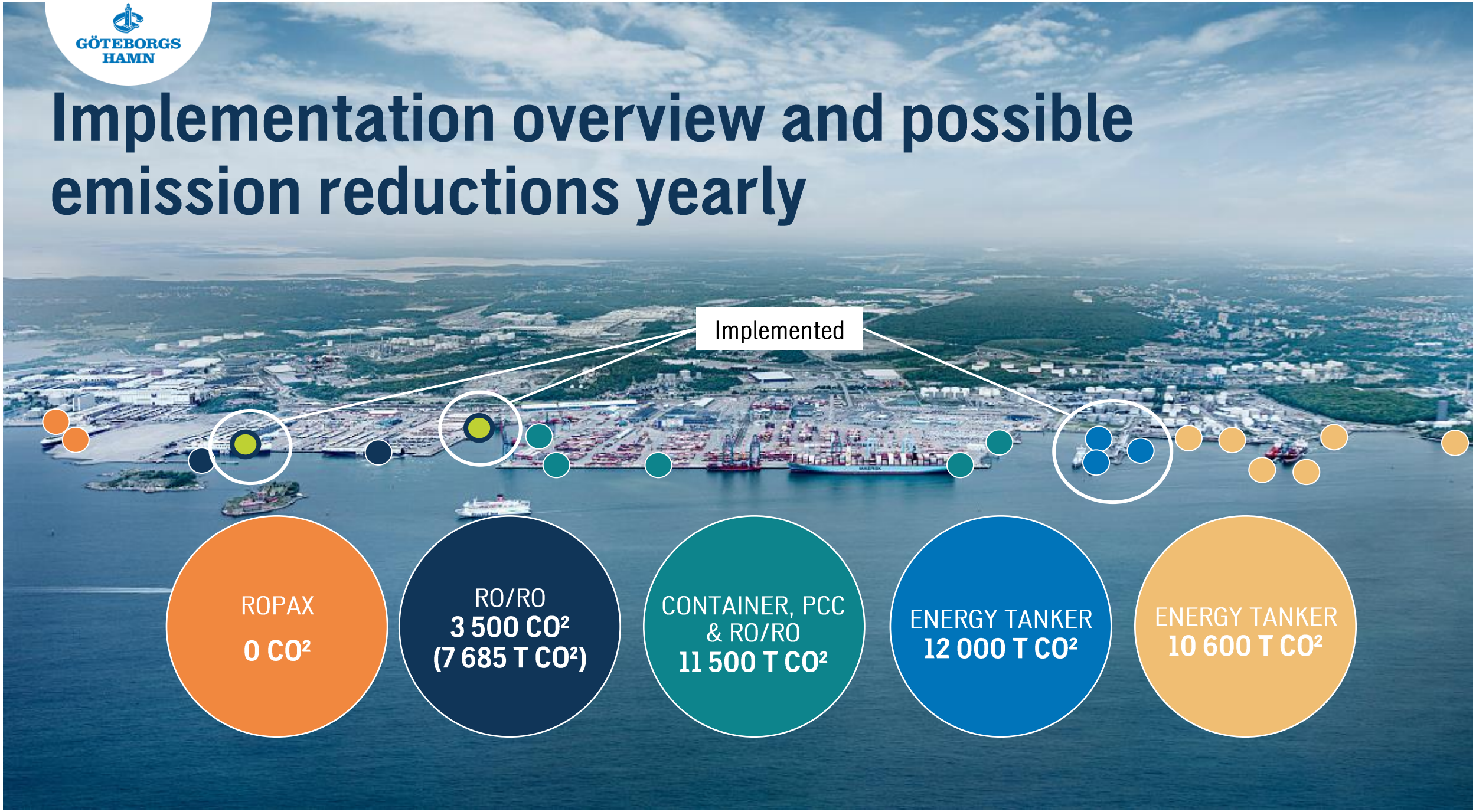
Strategy and moving forward

- 40,000 tCO2 can be reduced per year in time
- Focus on climate benefit & upcoming regulations 2024-2035
- Parallel activities across various segments
- Different business models and roles & responsibilities for different terminal areas
- Proactive plan for grant applications to reduce CAPEX and enhance competitiveness
- Planning to build according to the IEC 80005-1 standard
- Long-term competence- and staffing plan
- The unique tanker project Green Cable will be in operation 2024 and aims to be a good international reference for upcoming project. OCIMF to develop recommendation for HVSC, to be public in the last quarter of 2024

Implementation overview and possible emission reductions yearly



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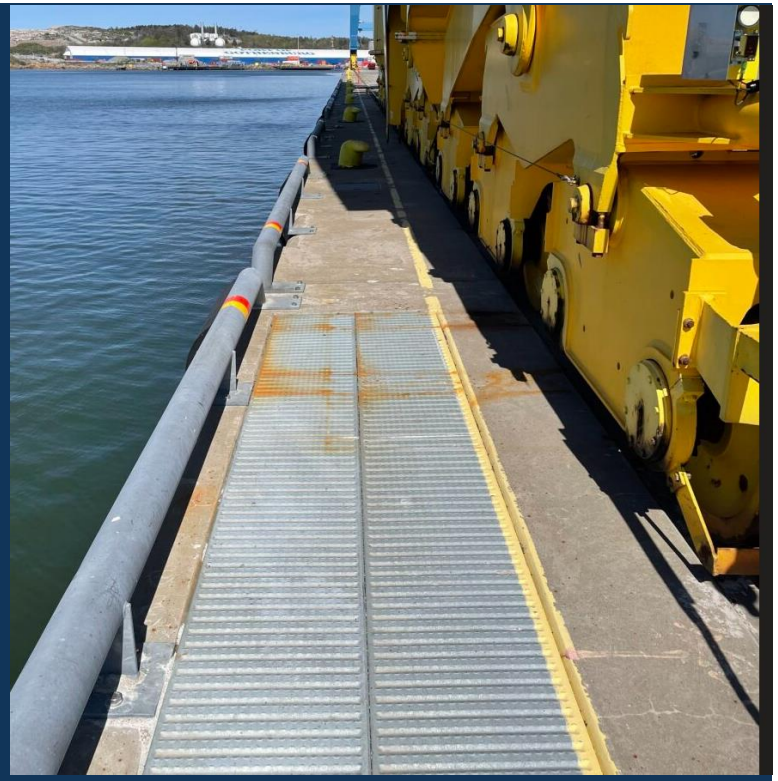
CONTAINER

- South and West quays is approx. 1,8 km and narrow (0,9 m)
- Planning for several HVSC OPS, IEC 80005-1, Annex D
- Complexity in finding optimal system design
- Expensive -> main substation, switchgears, channelization's
- Challenge in finding and estimating future actual power consumption from container ships



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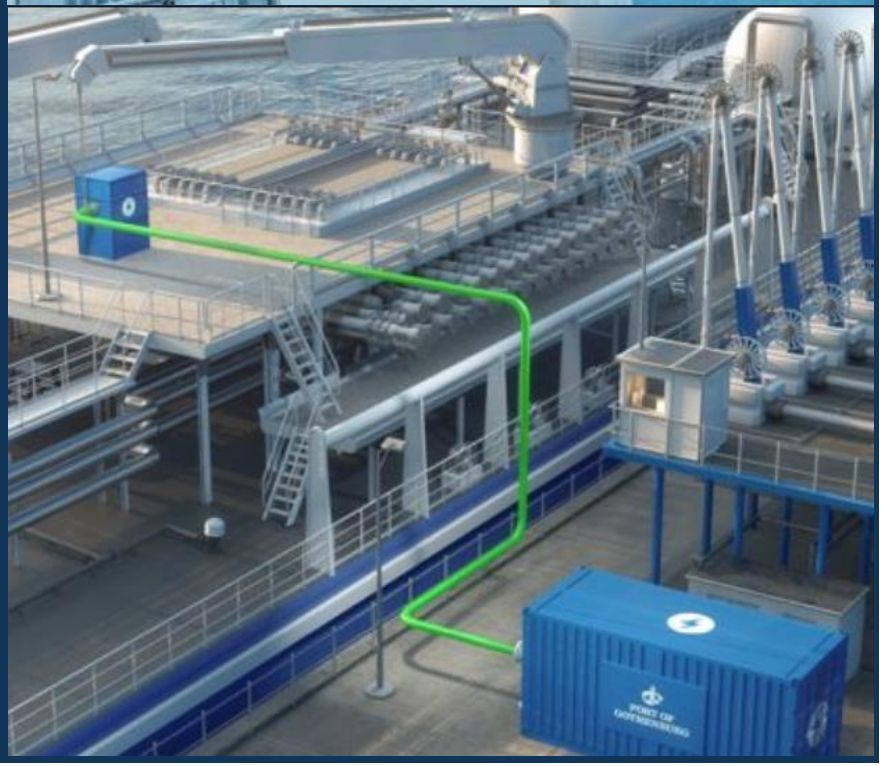
HVSC FOR TANKERS

- A new standard for shoreside power for tankers berthed in a hazardous environment
- In association with shipping companies on the island of Donsö, as well as national and European ports, classification societies, local oil companies, and the Swedish Transport AgencyPower supply up to 2 MW per jetty
- Supply voltage 6,6 kV, grid frequency 50 Hz
- Shore based cable, handling with onboard crane, plug and socket system PC6 (RORO Annex B)
- Midship position at ship in manifolder area, flexible for starboard and portside handling, central position at shore in loading arm area
- Design to be in operation within permanent ATEX zone 1
- ATEX (P) design pressurized system at shore with oxygen, at in the ship compartment, with inert gas or oxygen



To conclude / Lessons learned

- OPS is an important part in order for us to reach our climate goals
- Valuable to have a clear picture of your emissions
- Building an OPS system is not a product delivery – it is a *system design delivery* => thus important to prepare good procurement documents with a focus on clear functional requirements
- Collaborations and relationships with ship owners is important
- Plan for a clear plan after warranty period is over
- Require data sharing in your agreements

GÖTEBORGS HAMN

Thank you!

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