PORT OF ROENNE

Together we create

Bornholm Bunker Hub

13.10.2022

Maja Felicia Bendtsen, Port of Roenne

OWE in the Baltic Sea

2020: 2.2GW installed

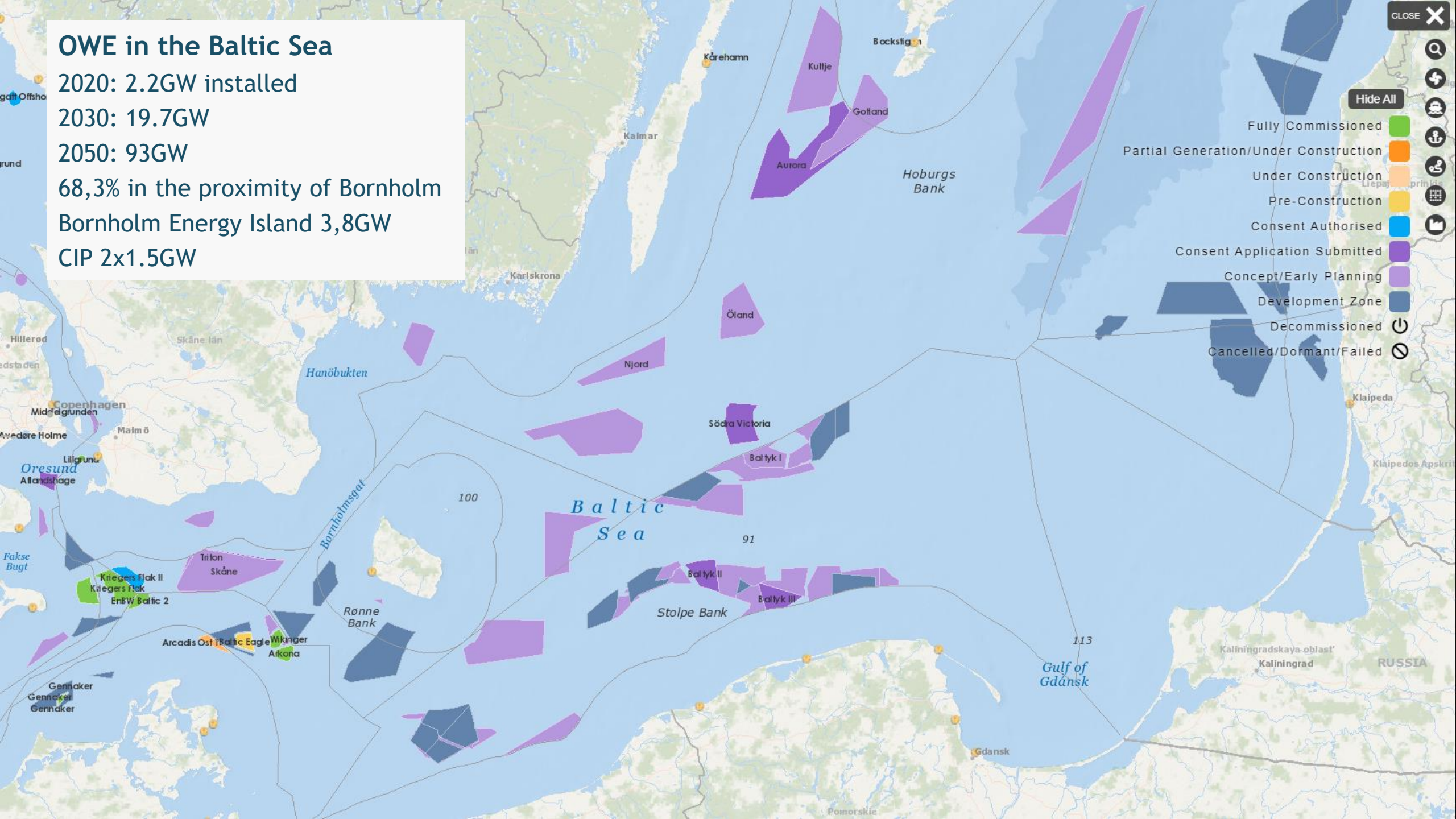
2030: 19.7GW

2050: 93GW

68,3% in the proximity of Bornholm

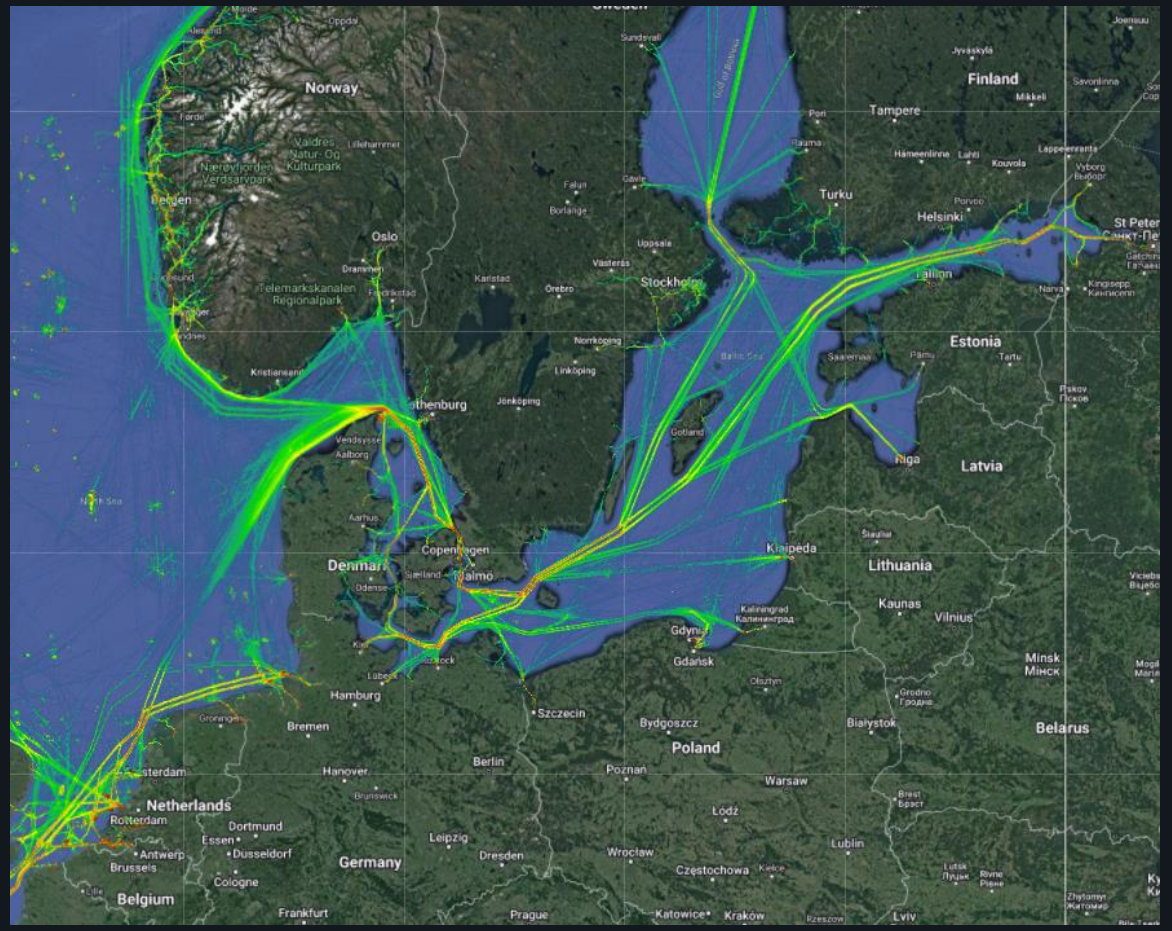
Bornholm Energy Island 3,8GW

CIP 2x1.5GW



Bornholm Bunker Hub

- +60.000 vessels pass by every year
- Community based ferry service
- Ready with green fuels from 2025



RAMBØLL Bright ideas. Sustainable change.

Ørsted

Bunker Holding Group

WÄRTSILÄ

TOPSOE

MOLSLINJEN

BUREAU VERITAS

PORT OF ROENNE
Together we create

Power-to-X Feasibility study

- Bornholm Energy Island with 3,8 GW open potential for Power-to-X production
- Business case
  - Availability of green power
  - Size and configuration
  - Market
  - Integration with energy systems
  - Location of plant and storage
- Simulation tools for future developers

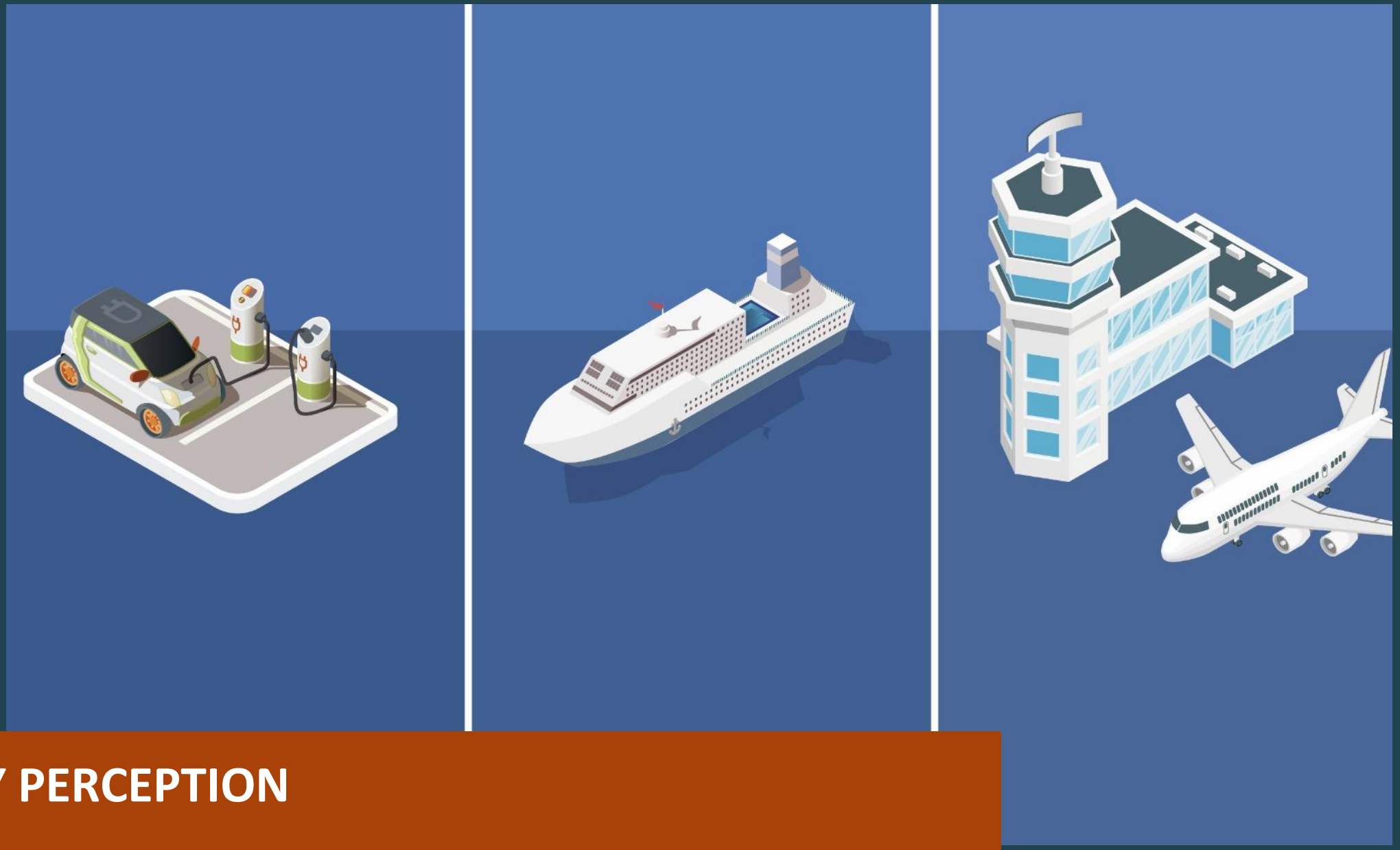
THE EUROPEAN UNION
The European Regional Development Fund
Funded as part of the Union's response to the COVID-19 pandemic
Investing in your future
Danish Board of Business Development

Safety and Public Perception

October 13th 2022

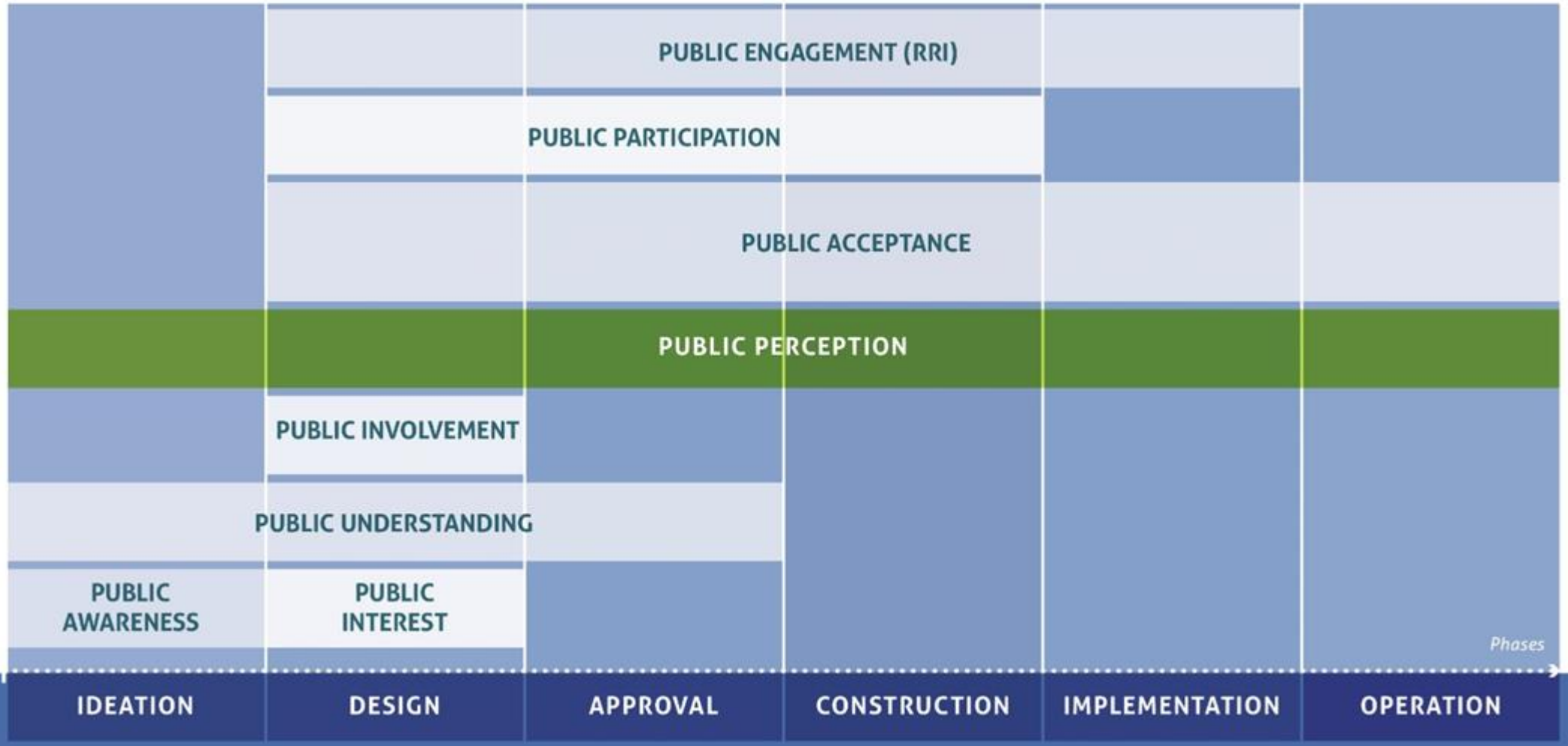
Nicklas Koch

DBI
BRAND OG SIKRING



SAFETY PERCEPTION

ROADMAP FOR PROJECT OWNERS OF A PTX FACILITY



TAKE HOME MESSAGES

- **Listen to the local communities**
- **Communicate**
- **Early involvement is key**

Maritime Ammonia Insights

Ammonia Bunkering Port & Safety

Introduction

- Jan Gramkov
  - 15 years as process safety manager
  - Rambøll, department of risk and safety

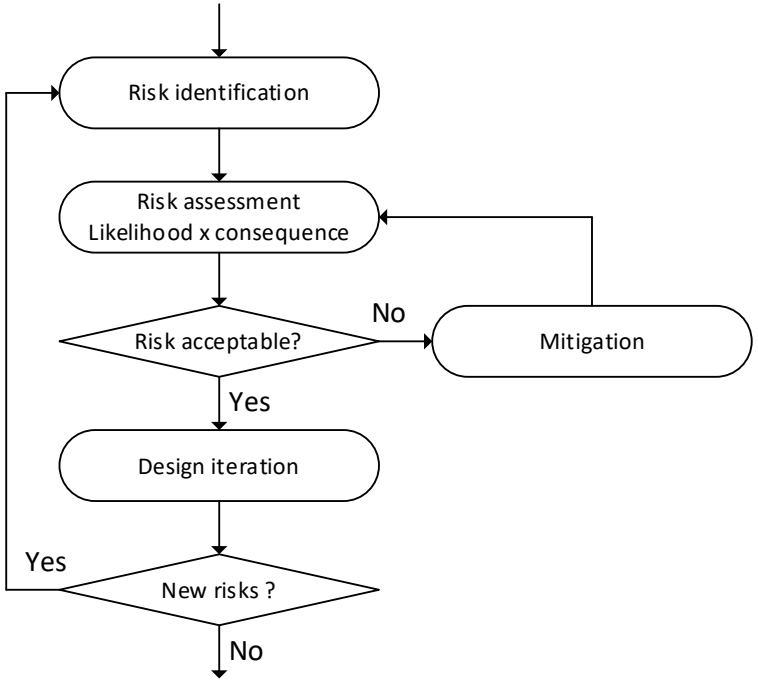
  - Assessing risk across a wide range of industries and materials, including
    - Ammonia storage for flue gas cleaning
    - Ammonia cooling
    - Oil and gas storage
    - CO_2 storage and transport
    - Loading and unloading operations

Risk assessment

- Risk is the combination of:
  - Likelihood × Consequence

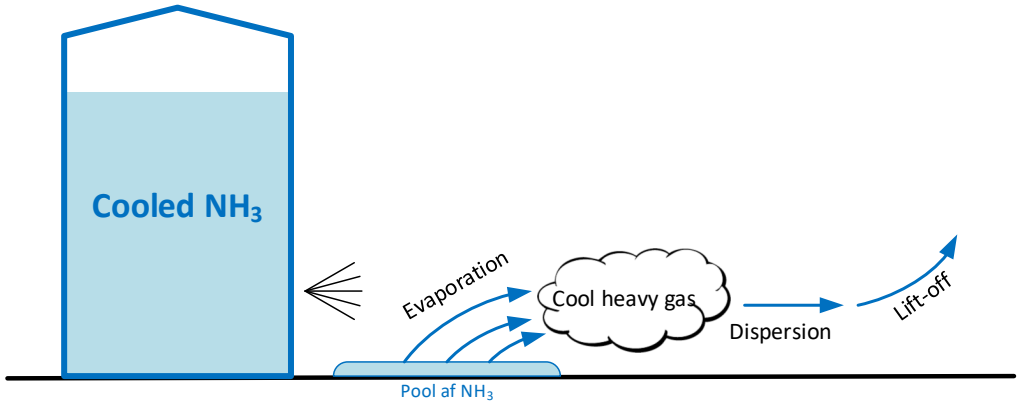
- Risk accept criteria are important
  - Partly national regulations
  - Partly standards
  - Partly current accident levels

- Standards represent:
  - Industry standards
  - BAT (Best Available Technology)
  - Mitigations from past accidents
  - BUT always remember to verify the applicability
  - BUT always risk assess



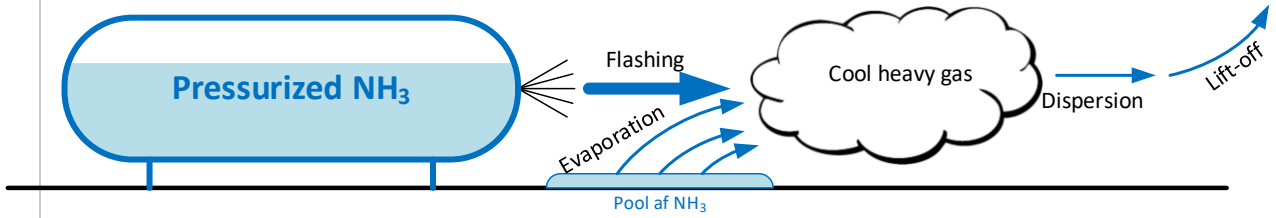
Properties of ammonia
Loss of containment

- Refrigerated (atmospheric)
  - Pool (÷34°C)
  - Heavy gas spread
  - Lift-off, when heated to ambient temperature



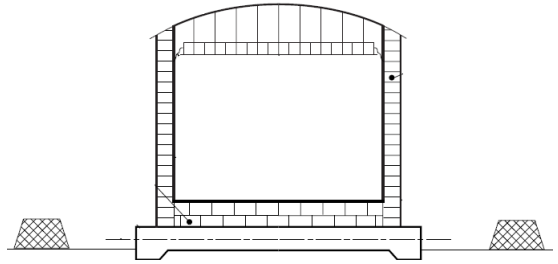
- Semi-refrigerated or Pressurized
  - Flashing (÷34°C → ÷60°C)
  - Pool
  - Heavy gas spread
  - Lift-off, when heated to ambient temperature

- Higher temperature/pressure, more flashing, longer dispersion, later lift-off.

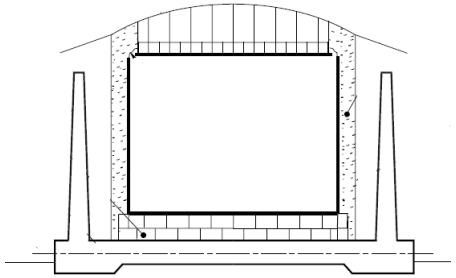


Risks associated with loss of containment

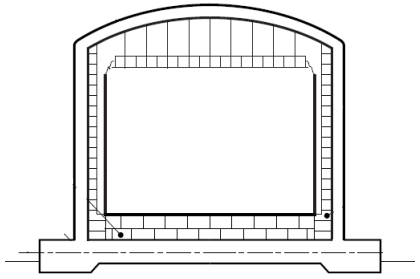
- Single containment atmospheric tank (refrigerated NH_3)
  - Bund (for containment of liquid) → Dispersion of cold HN_3 gas
- Single containment pressure tank (semi-refrigerated NH_3 or Pressurized)
  - Bund (for containment of liquid) → Flashing and dispersion of cold HN_3 gas



- Double containment atmospheric tank (refrigerated NH_3)
  - Gas overflow (less than bund) → Dispersion of cold HN_3 gas



- Double containment pressure tank (semi-refrigerated NH_3 or Pressurized)
  - Expensive and difficult to maintain
- Full containment atmospheric tank (refrigerated NH_3)
  - Overpressure risk (dispersion of cold HN_3 gas)



Storage mitigation

- Choosing a tank design that is suitable for ammonia
  - EN 14620 standard series (where HN_3 is mentioned), guide to selection of tank design
    - Centred around liquid containment being enough and gas release being an acceptable risk

  - Storage near risk sensitive areas → gas containment may be needed (risk mitigation)
  - Some gas containment/retention may be achieved terrain or layout
  - Bunds may be designed for gas retention (until ambient temperature)

- Tank inspection of atmospheric tanks is not mandatory everywhere, but some national regulation require inspection

Loading/unloading mitigation

- Loading and unloading has the highest initial likelihood of loss of containment
  - Containment and retention is harder to achieve:
    - Structures to divert HN_3 (could be into the water)
  - Mitigation focus on limiting amount of HN_3 released:
    - ESD (mandatory)
    - Dry-break / break-away couplings
    - Excess flow valves