Introducing new bunker fuels in ports: The port perspective

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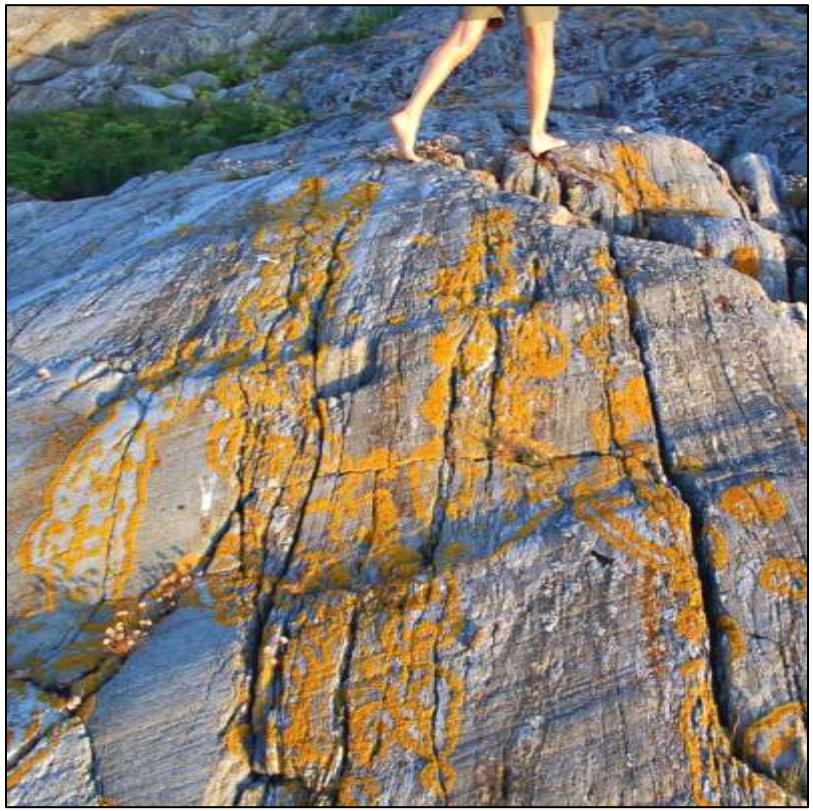
SSPA Your Maritime Solution Partner

Agenda.

- Presentation by SSPA, Captain Johan Gahnström
  - Compliance strategies for meeting MARPOL 2015
  - Pilot projects and case studies
  - Port Policies for LNG bunkering
- Questions

SSPA Sweden AB

- Providing maritime consultancy services on a worldwide basis
- Independent Consulting Company, fully owned by the Foundation Chalmers University of Technology
- Main clients; Maritime operators and ship yard industry, energy companies, industry, ports, authorities, EU, OECD, IMO, EMSA



Compliance Strategies for meeting MARPOL 2015

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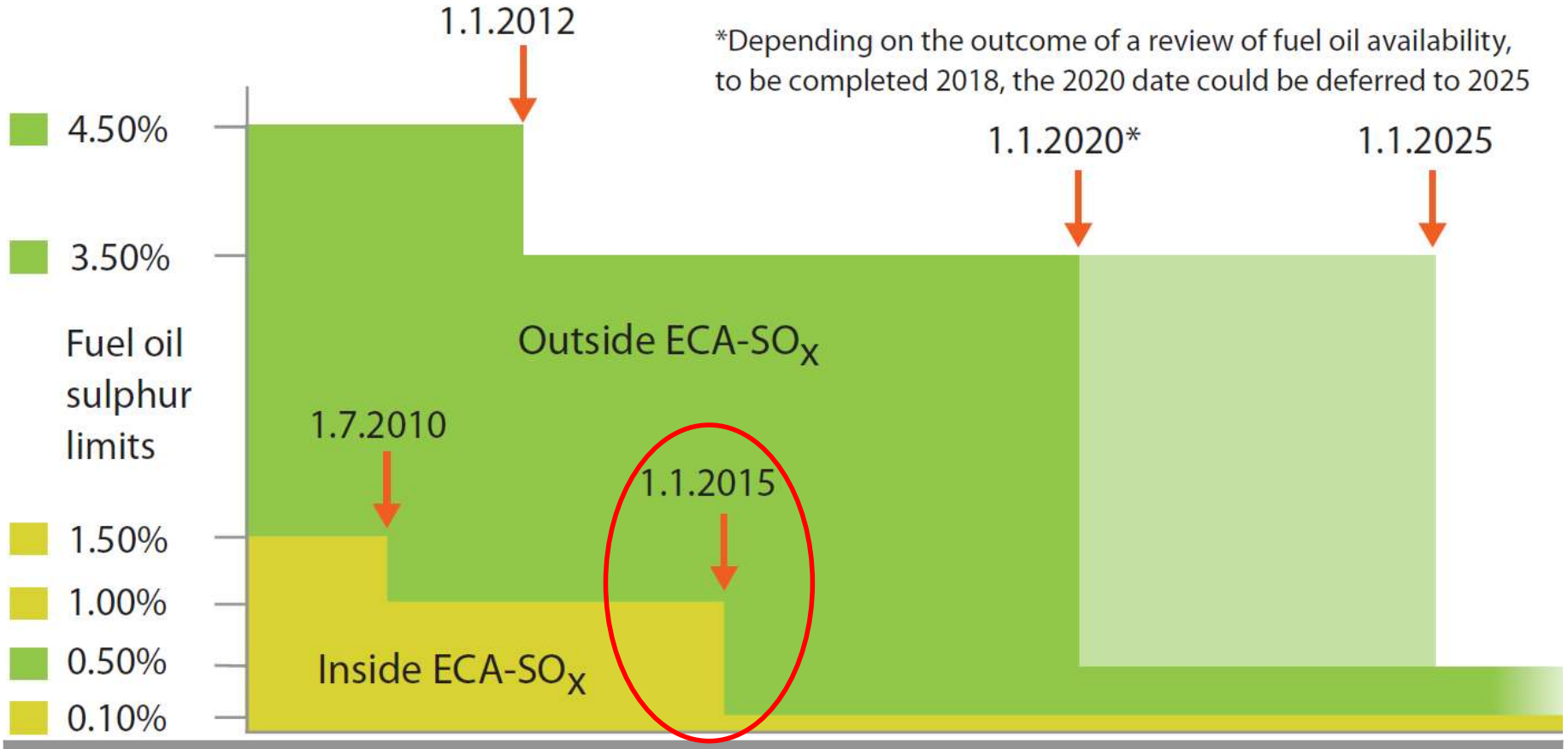
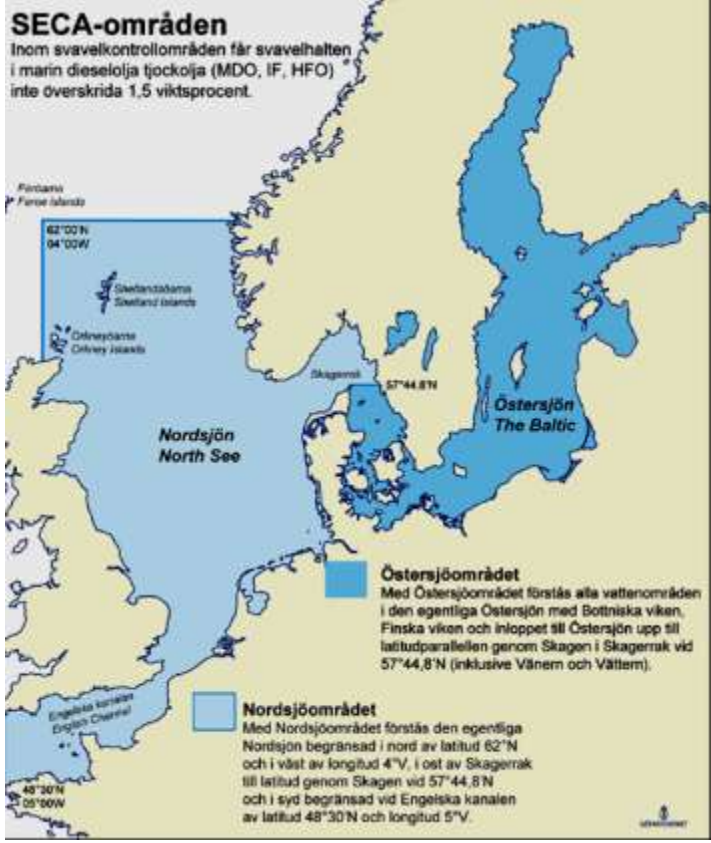
Introduction – IMO MARPOL Annex VI



Current and confirmed Emission Control Areas (ECAs)	Entry into force	Effective from
Baltic Sea SECA (SO_x)	19 May 2005	19 May 2006
North Sea SECA (SO_x)	22 November 2006	22 November 2007
North America ECA, up to 200 nautical miles (SO_x, NO_x and PM)	1 August 2011	1 August 2012
US Caribbean Sea ECA, Puerto Rica/US Virgin islands (SO_x, NO_x and PM)	1 January 2013	1 January 2014

ECA - Emission Control Areas

- Baltic Sea, North Sea & English Chanel
- North America
- Others to come…



Ship owner´s choice in SECA..

Seagas at Stadsgårdskajen, Photo Johannes Hüffmeier

Low sulphur fuel

- Easy and low CAPEX
  very high OPEX

Scrubber installations

- Medium CAPEX but uncertain, complicated and medium OPEX

LNG propulsion

- High CAPEX
  but (potentially) lowest OPEX

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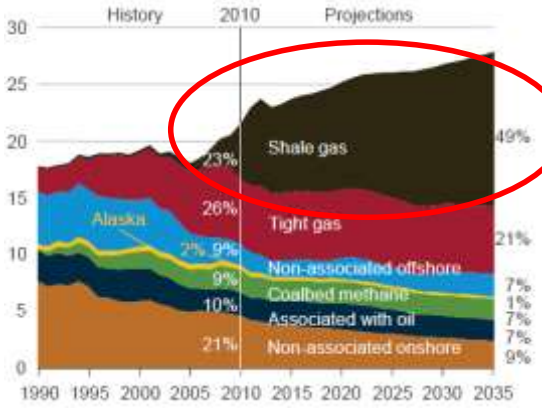
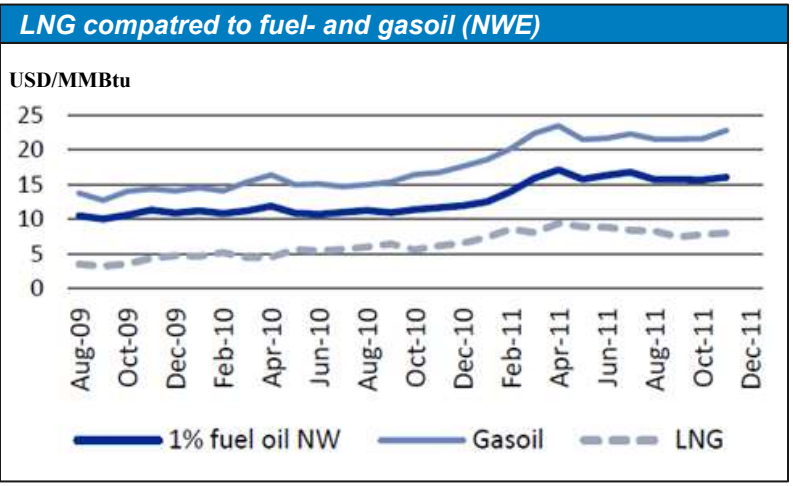
- And Methanol…

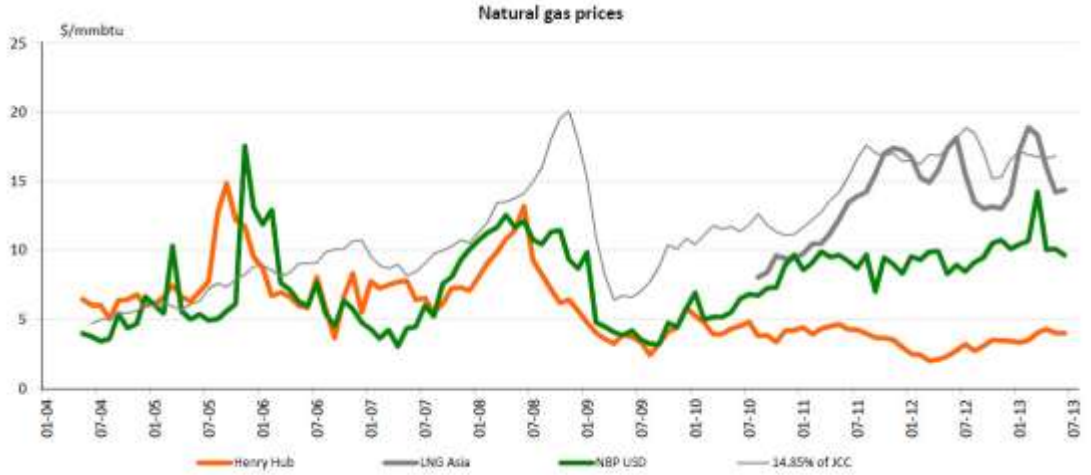
The LNG price and introduction of small scale LNG

Market Price → Sourcing cost → Supply cost



LNG Source → LNG Feeder vessel → Intermediate LNG terminal → Truck / Bunker vessel / Pipeline → Receiving vessels



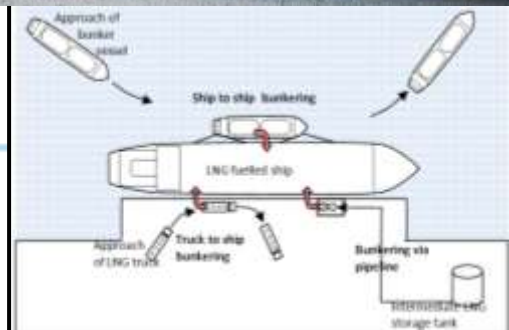


Pilot projects and case studies

Examining experiences of risk analysis for LNG bunkering

Example case: Viking Grace

- The ”Viking Grace” bunker LNG in down town Stockholm, in operation 2013.
- SSPA supported AGA with all risk analysis for safe and efficient bunkering operations
- SSPA was a discussion partner with the client during the whole process
- Done in two phases



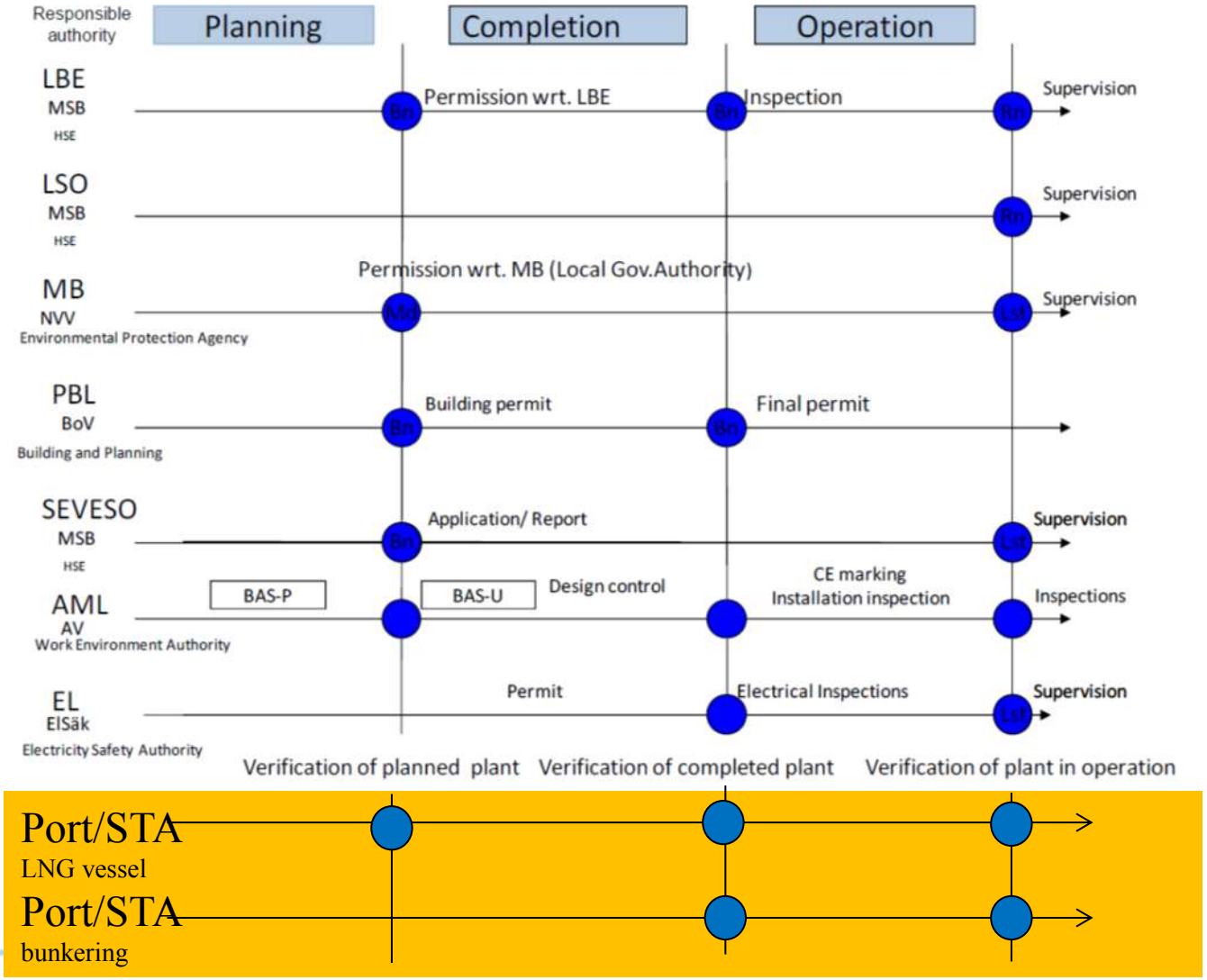
- DF-electric powerplant 4x W8L50DF
- Flag: Finland

- 200 crew
- 1275 lane meters for trailers, partly with hoistable car platforms
- 500 lane meters for cars

Permission process

Terminal/
Shore-side

Maritime



Bunkering permit

- ”Uncharted waters” - no existing or stipulated process for permit approval
- AGA had to solve issues and answer questions along the process.
- Learning process
- Educating authorities
  - What is LNG?
  - Risks?
  - Fire dept was used to judging quantative data – not enough knowledge base of LNG incidents

- SSPA acted as partner to assist AGA in the risk assessment and answering the stakeholders/authorities questions during the whole process.

Photosource: AGA

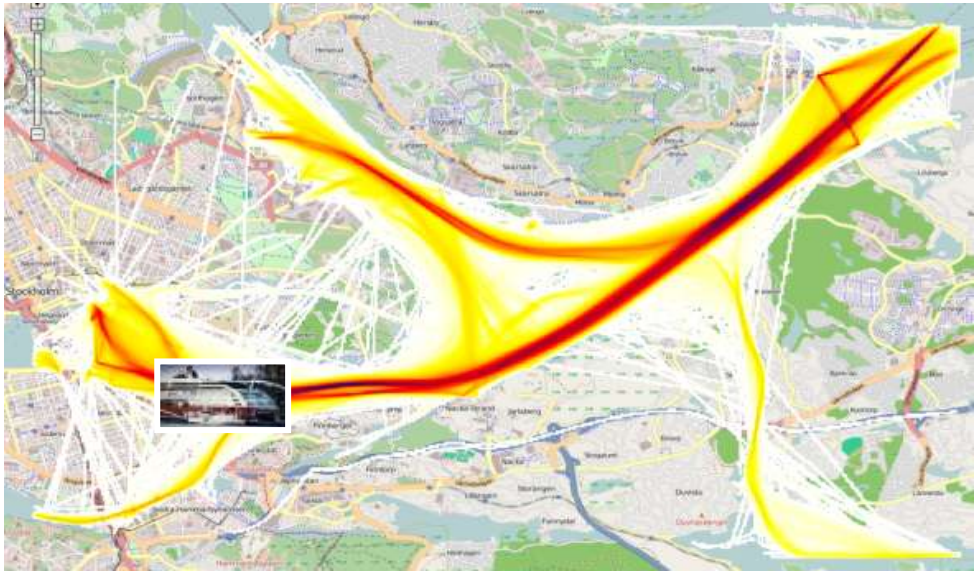
Distribution of LNG toViking Grace

- First idea was to place road trailers on existing road ferry
- Refined proposal to place fixed tanks on rebuilt road ferry
  - SEAGAS
  - Road truck supplied LNG at separate terminal
  - 70 ton LNG/call
  - 1 hours alongside

First task

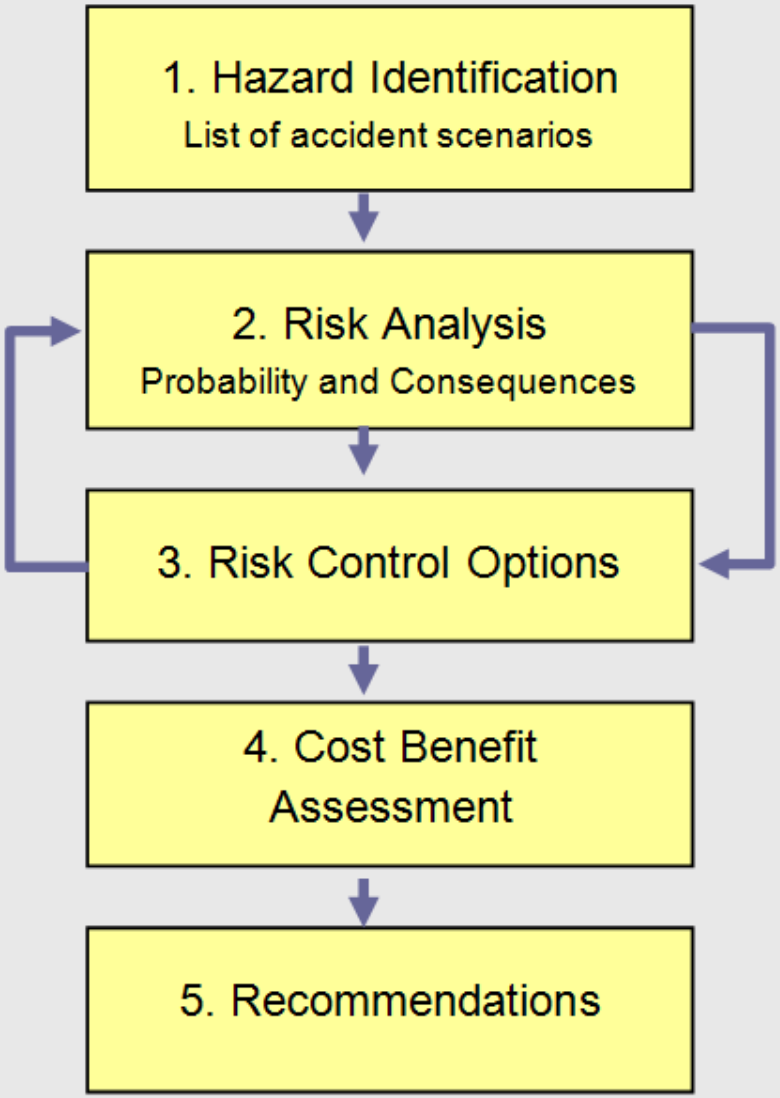
SIGTTO's large scale LNG recommendations that was discussed in risk assessment as advised by STA:

- VTS
- Patrol boats
- Escort tugs
- Tugs
- **Speed reduction**
- **Turning circle for LNG**
- Pilotage
- **"Passage planning"**
- **Establish safe mooring sites**
- **Weather restrictions**
- **Human factors**



Second task

- SSPA did a Full Formal Safety Assessment
- Assisted AGA in answering questions in the permit process.



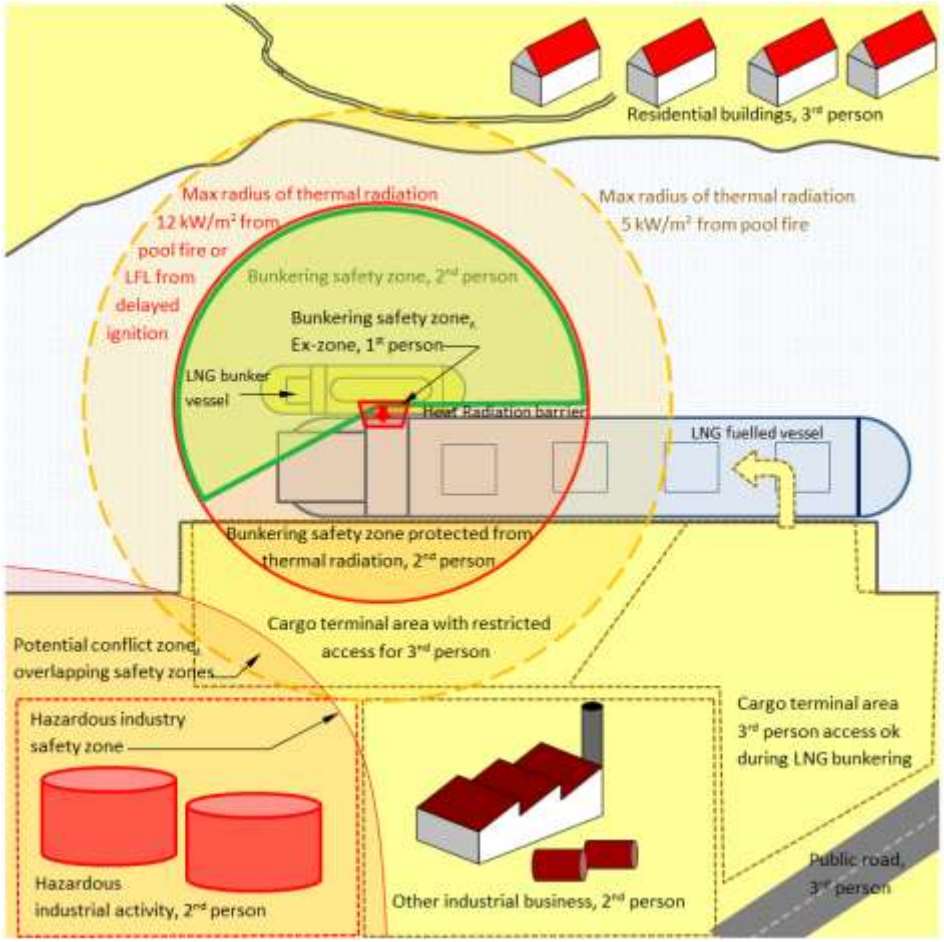
Accidents while bunkering

- Statistics from the Mediterranean 1977 to 2010 includes 12 accidents in connection with bunkering.
- Most common cause was overfilling of tanks.
- Hose rupture occur in two cases.
- SSPA analyzed data from the English accident database (MAIB, 2011):
  - Safety - 63.6%
  - Human Factor - 45.5%
  - Technical factor - 30.9%
  - Procedures - 45.5%
  - Practice - 40.0%
  - Environment - 18.2%
  - Equipment - 7.3%.

Most accidents occurs on deck,

Safety zone outline

- Safety zone size
- EX zone size
- Zone geometry
- Ignition sources
- Public information
- Safety zone enforcement
- Dispersion contours
- Fire radiation contours



Final questions from STA

Following AGA's first application for a bunker permit the Swedish Transport Agency (STA) requested a more through risk analysis especially regarding STS bunkering. Following that some further questions were raised:

- The effects of **swell** from passing traffic at the bunker terminal (Loudden) and at the bunker quay (Stadsgårdskajen)?
- What happens if adviced actions to reduce risk were not implemented?
- **Collision** between bunker barge and the *Cinderella* (high speed pax) or *Bildösund* (old steamship)

- The final report from SSPA could demystify these last questions

Current status

- AGA received permit for STS bunkering operations during normal cargo operations in downtown Stockholm
- Window for bunkering 50 min during morning rush hour.
- The bunker barge was delayed, rebuilt to fit amended class rules (Full IGC tanker!)

- **So far > 300 bunker operations has been carried out without release of LNG**

Photo: Viking Line

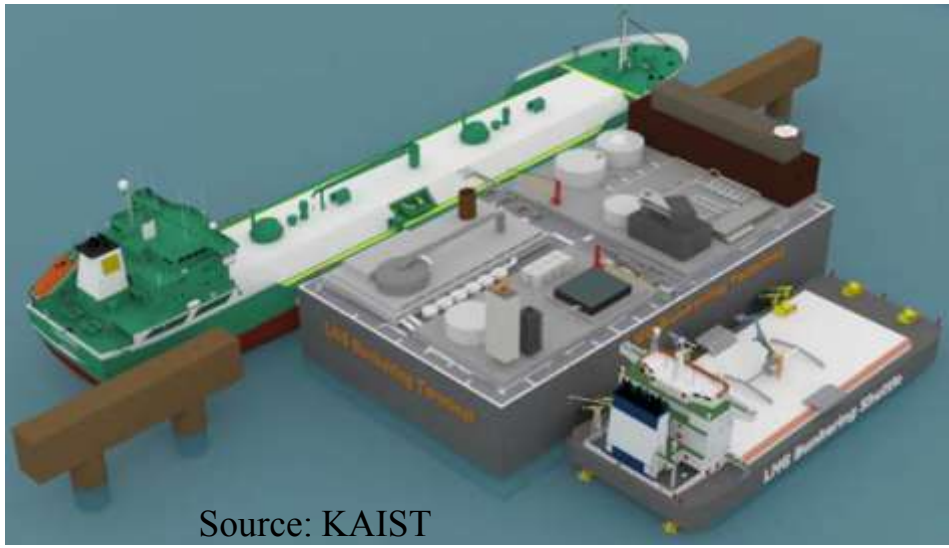
Photo: AGA

Viking Grace:

Film by AGA/LINDE

Outside ECAs? Example Busan Port

- If 15% of all vessels calling Busan port would chose LNG as a marine fuel, then:
- The required amount of LNG would be 53 700 M^3/day
- That is approximately one Q-flex every fourth day…..



Source: KAIST

Is your port ready for new fuels?

- Calculations by KAIST (Korea Advanced Institute of Science and Technology) and JIP with SSPA 2011

Port Policies for LNG bunkering

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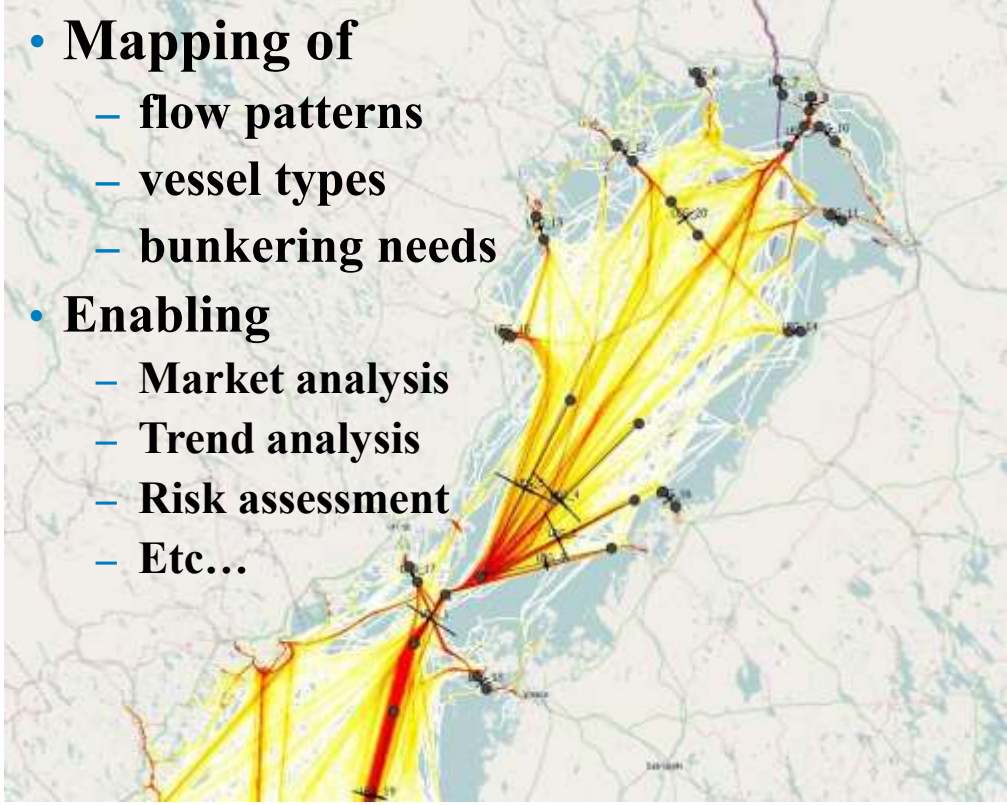
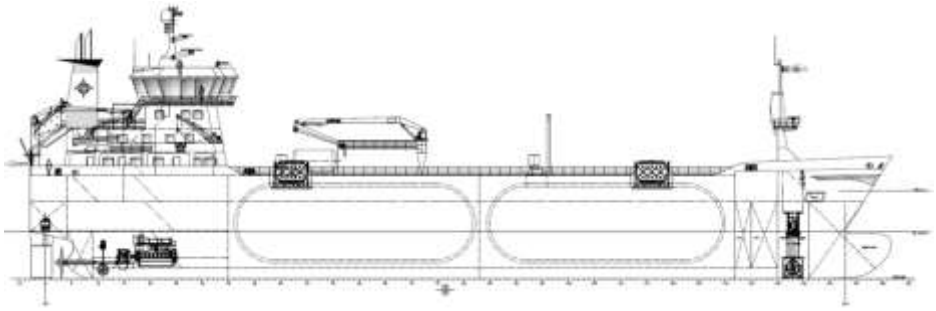
New fuels in the port - the way forward

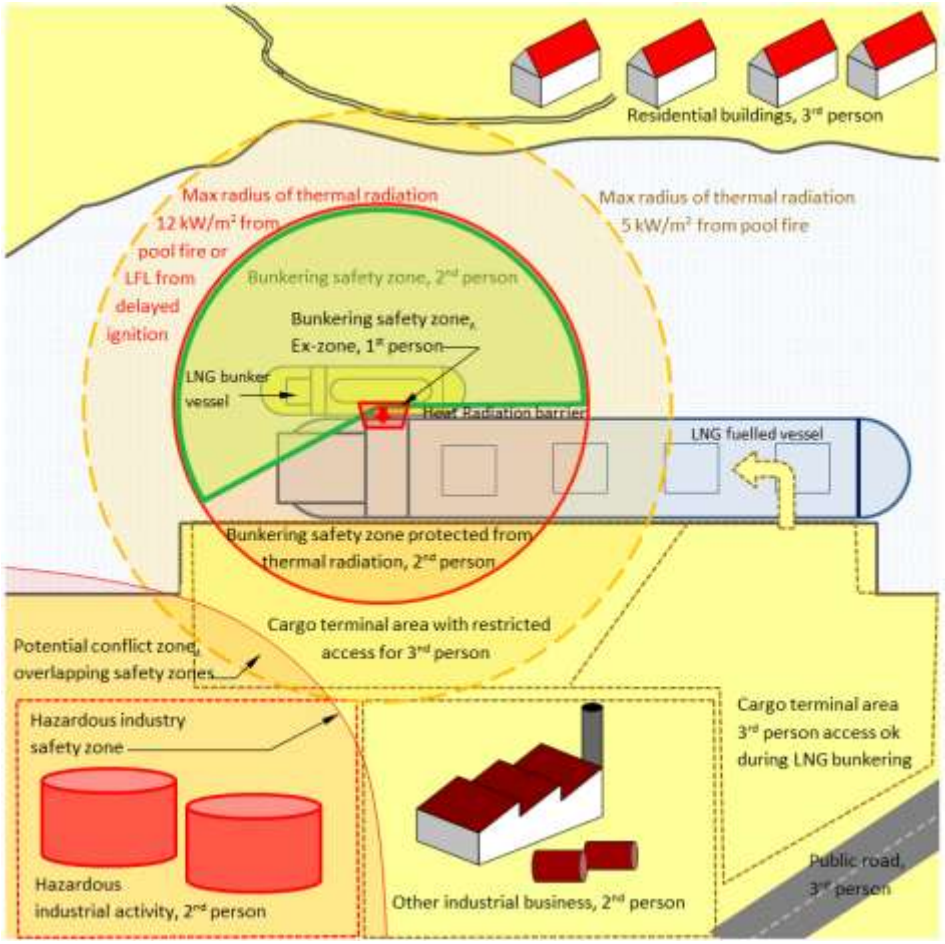
- Make a feasibility study combined with a market study.
  - This will look at all aspects on a high level, Make sure the study have a dialog with large customers in the port, what are their plans?
  - Competitive advantage towards other ports?
- Who will enter the market as seller and/or distributor of the new fuel?
  - Will the port actively look for someone to enter the market or will you chose a wait and see who enters the market.
  - A new bunker barge is expensive, who will pay?





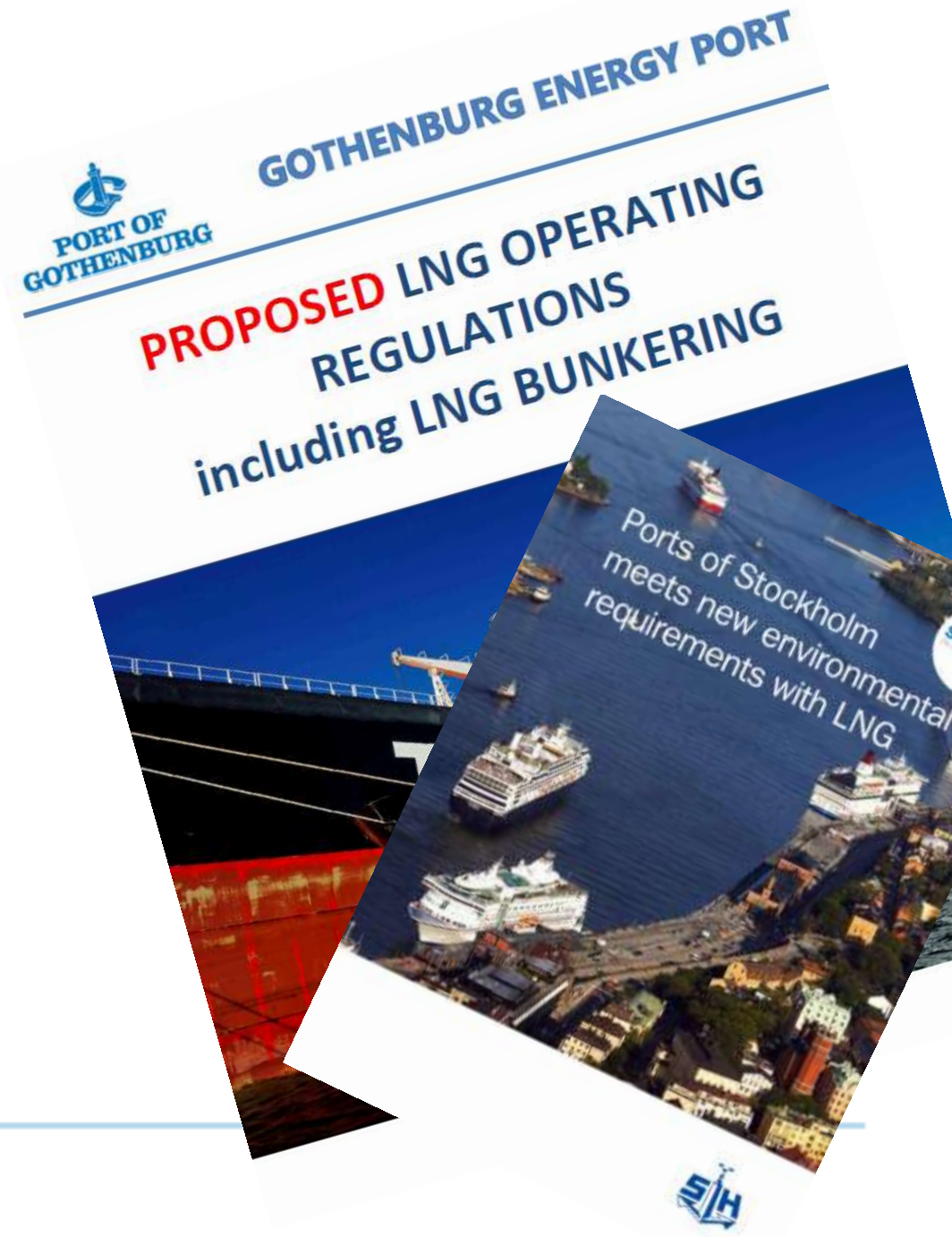
Permit process LNG Bunkering

- Specific safety assessment for each bunker vessel, LNG flow rate and bunkering location in order to:
  - Identify credible accident scenarios; leakage, hose crack...
  - Estimation of possible consequences; heat radiation fire scenarios
  - Risk Control Options…



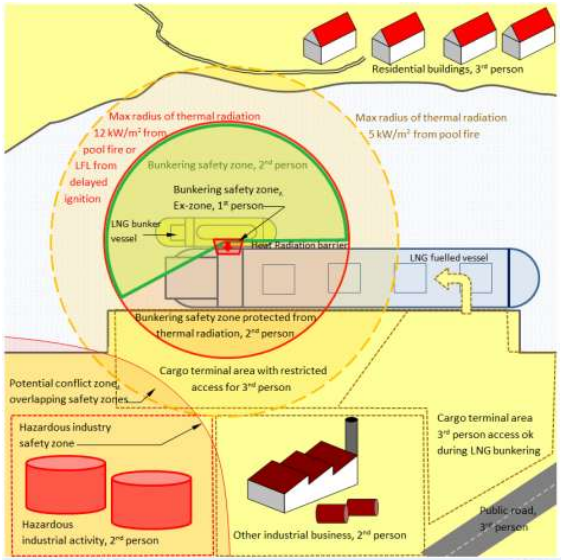
Port policy

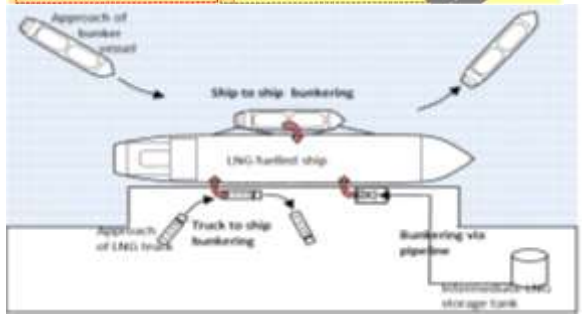
- There is a need to update port bye laws and develop port procedures for new fuels
- SSPA assisted Ports of Stockholm with their safety manual and procedurers for LNG in the port.



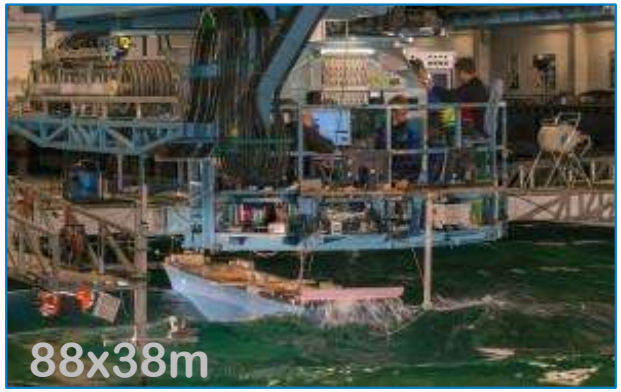
Conclusion
Enablers for LNG as ship fuel

- Make sure you have collected all facts before you start your journey.
- Minimise operability impact
  - Ensure that bunkering and embarking/ disembarking of passengers can be conducted simultaneously.
  - Optimise bunkering time
- Identify risk based safety zones
  - depending on quantities handeled, bunker flow and pressure
- Public consultation and awareness
  - Provide adequate information and demystify LNG by showing good pilot examples



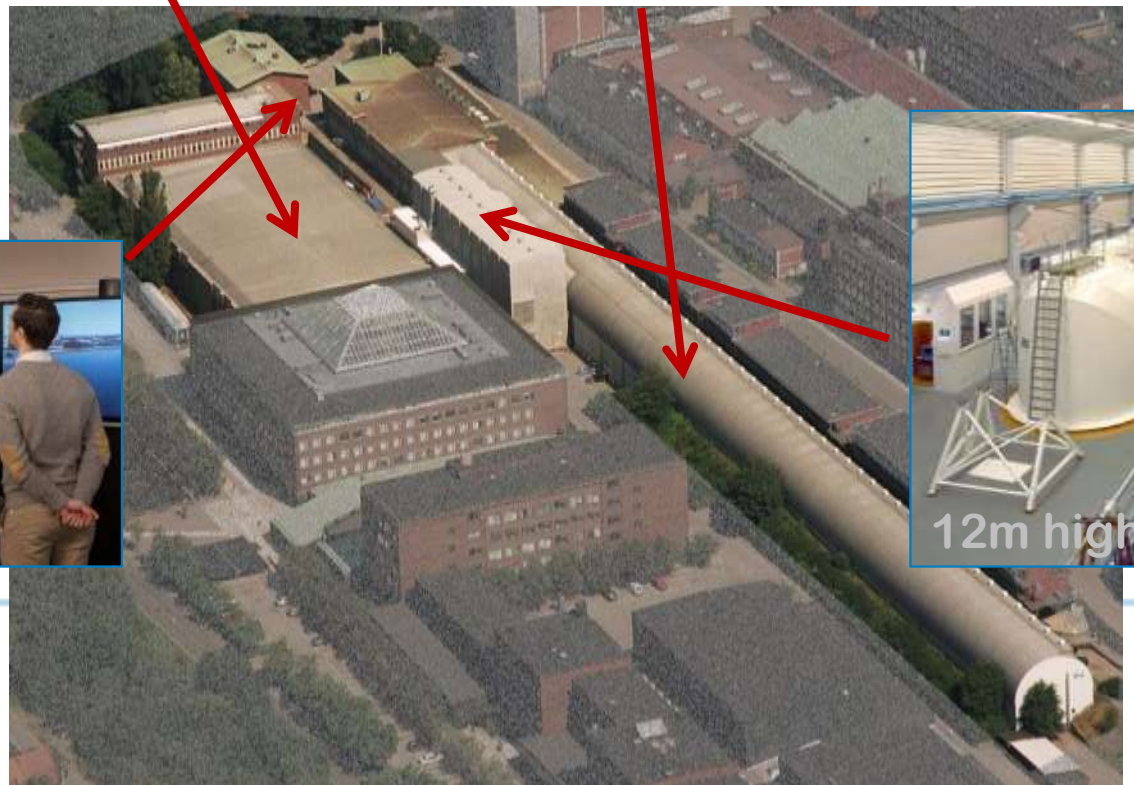


The SSPA office...



MARITIME DYNAMICS LABORATORY

TOWING TANK



SEAMAN SIMULATION

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CAVITATION TUNNEL

Our capabilities

Marine operations and simulations

Environment

Ship design

Port and coastal planning

Risk and safety

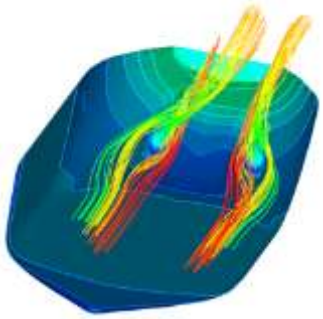
Intermodal transport systems

Maritime Operations

- Port and Fairways
- Transport system and logistics
- Maritime infrastructure
- Ice management
- Risk assessment
  - Operation
  - Environment
  - Risk and safety
  - VTS, Harbour Management systems
  - ISPS

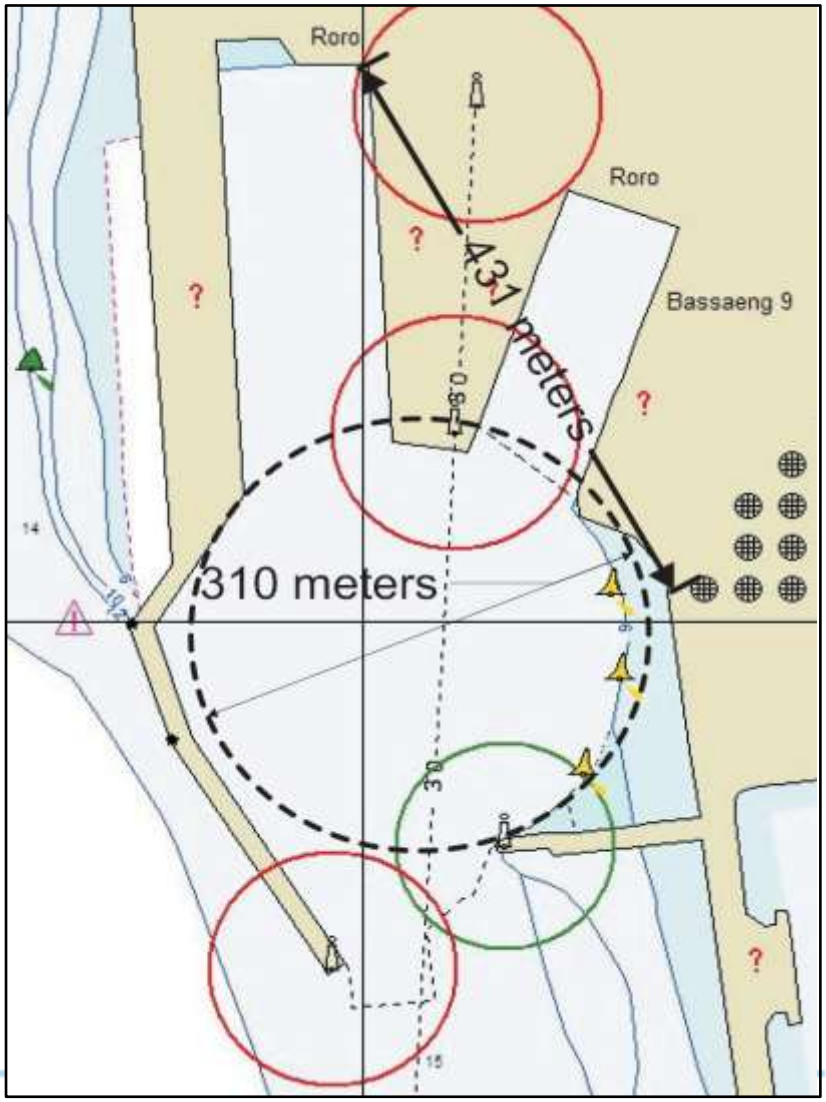
Ship Design

More than 7000 hull forms have been tested/designed at SSPA



Port development?

- Localization
- Fairway/Fairway Layout
- Turning basins
- Port layout
- Erosion, impact, fenders
- Risk and Safety
- Logistics and multimodal solutions
- VTS &VTMIS
- EIA

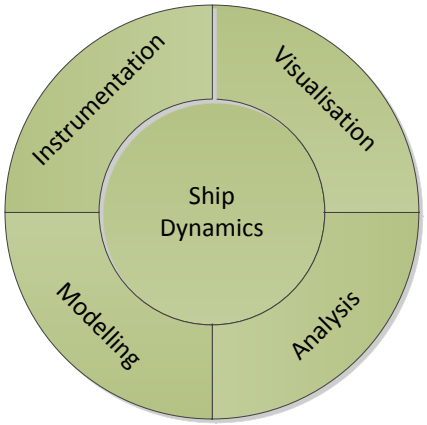


Simulation activities at SSPA

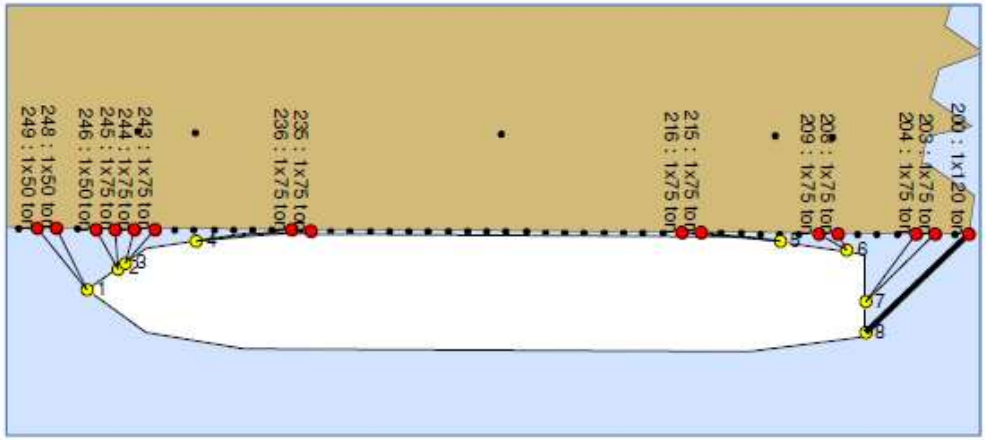
- Vessel performance
  - Maneuvering
  - New vessel concepts
  - New port layout
  - Sea keeping (with stabilizing devices)
  - Track-keeping and dynamic positioning (DP)
  - Lightering operations
  - Mooring analysis
  - Fender forces
- Investigations of environmental conditions
  - Weather windows – a specific ship in a specific environment
  - Tug types and number
  - Harbor layouts
  - Efficiency and safety
- Accidental investigations

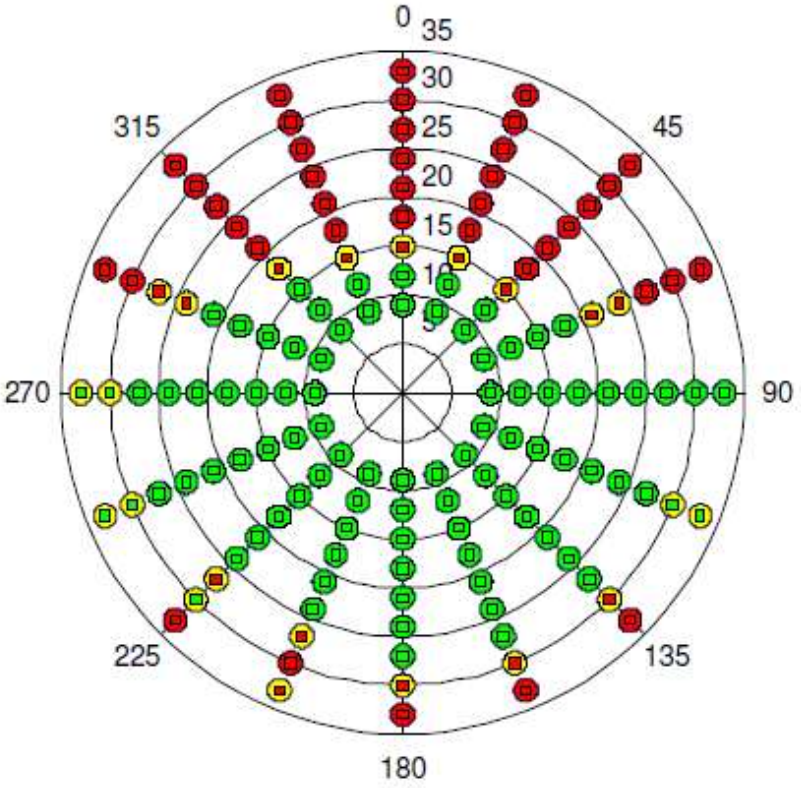
SSPA Simulator
Ship dynamics

- The foundation for any serious nautical simulation is calculations on how the ship will react under influence of the control forces and the ships environment.
- SSPA uses its decades of experience in this area to make sure that the accuracy of the simulation is up to our client's standards.
- Ongoing participation in several research programs makes sure that our knowledge on ship dynamics stays at the forefront of the industry.



Advanced mooring simulations
(where standard systems lack capability!)





Line	Number of lines	Connected to bollard nr	Breaking strength of one line [kN]	Bollard strength [ton]
1	2	248	740	2x50
2	2	245	740	2x75
3	2	244	740	2x75
4	2	236	740	2x75
5	2	216	740	2x75
6	2	209	740	2x75
7	2	204	740	2x75
8	3	200	740	1x120

- Limit for northerly winds 12 m/s (mean)
- Bollards more sensitive than the lines
- Fenders limiting southerly winds

SSPA - LNG

- Ship design
- Market analysis
- Bunker infrastructure
- Terminal layout and operation
- Risk assessment
- Marine simulations
- Training

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Thank you.

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Ras Laffan, Qatar: :Photo: Johan Gahnström

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