

# The impact of the energy transition on process safety of ports

EPSC conference 2022

**Open** Simone van Dijk, Ido Pat-El September 2022

## **Speaker's introduction**

### Ido Pat-El MSc. Senior Technical Safety Specialist



- Green Hydrogen Inherent Safety Practice Joint Industry Project Risk Assessment Lead
- Hydrogen Safety Innovation Platform working group
- On/offshore oil & gas, chemical and nuclear safety projects

### Simone C.A. van Dijk MSc. Leading professional External Safety



- Impact on energy transition on safety & environment in ports of Amsterdam and Rotterdam
- Integral accessibility study Port of Amsterdam
- Area process safety passport project Port of Amsterdam



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# **Examples of port projects**

## Port of Amsterdam



- Strategic area vision
- Integral port accessibility study (hazardous materials)
- Risk space study
- Electrolyzer QRA's

- Electrolyzer park
- Hydrogen pipeline studies
- QRA's new energy carriers
- Knowledge table on safety of new energy carriers



- Energy diversity studies
- Assist in development of infrastructure plan
- Investigate energy provisions solutions for decarbonization of the PLA fleet by 2040

The energy transition will have a fundamental impact on activities of ports and the associated HSE risks will have an impact on space allocation

Changes	
κ <u>β</u>	Hazards
€ C C C C C C C C C C C C C C C C C C C	Interaction and complexity processes
	Operations and emergency response



## **Topics**

## What is changing?

- What new hazards are introduced?
- How does this affect space allocation?
- Conclusions

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## Decarbonization drives the green transition of ports.



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> The new energy landscape Impact on and implications for European ports



## Impact of energy transition on energy infrastructure



Limited number of market parties

Hierarchy and one-directional supply Demand is leading and supply is predictable Consistency has value Everyone is a market party (prosumers) Distributed and bi-directional Weather and seasonal variations determine supply Consistency & flexibility has value

### The most relevant changes applicable to ports

- Fuel switch of maritime transport: maritime diesel replaced by e,g ammonia, methanol, biofuels, synthetic fuels.
- Electrification of port equipment
- Hydrogen as feedstock and energy vector
- Renewable power generation in the port areas
- Large scale import of hydrogen carriers as renewable energy resources
- Energy system integration
- Offshore wind integration
- Carbon capture and storage, e.g.
- Changes in hazards that will require to be managed



# **Topics**

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### Change in property of substances results in changes in hazards while at same time new innovative techniques requires emerging risk to be managed

- Import of non-fossil energy fuels and new energy carriers, such as hydrogen, ammonia, methanol
- Large scale conversion technologies expected to get an increasing presence in ports
- New initiatives and changes in production processes such as production of synthetic fuels in some ports





Figure: Artist impression of a GigaWatt scale electrolyser (RHDHV, 2022, source)

# Import of hydrogen and ammonia's will require a re-evaluation of the hazards at port sites due to a change in substance properties

- Hydrogen explosion severity in confined and congested geometries point of concern
- Ammonia toxicity introduces a new hazard compared to existing fuels



# The toxicity of ammonia will result in an increase in safety distances compared to other fuels and require fit-for-purpose solutions



From Ref.2 DNV GL, RH2INE Sub-study Guidance for Safety Distances, 2022

# New conversion technologies and the scale at which these are being introduced pose new safety challenges

## Important examples:

Technology	Challenge	
(Green) hydrogen electrolyzers		<ul> <li>Little operation experience with large scale production</li> <li>Quantification of fire and explosion risks</li> </ul>
Ammonia cracking to produce hydrogen, storage, transport	Ż	<ul> <li>Lack of industry experience in large scale cracking</li> <li>How to deal with toxic risks near urban areas and occupied buildings</li> </ul>
Electrification		<ul> <li>Increase in large scale battery storage with new fire hazards</li> </ul>
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The ports will change from transport and storage of fossil fuels to becoming a production and conversion facility of renewable energy. The interaction and complexity with neighboring Industries will increase

- Interaction with neighboring industry will become more the norm to increase energy efficiency.
- This will lead to increased complexity of processes, technically as well as from communication perspective
- Ports as hubs for CCS, e.g. Porthos
- The development of additional hydrogen pipelines to connects ports via the European hydrogen backbone
- Transition period in which both "old" en "new" technologies will operate concurrently





## What is changing?

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# Personal risk and attention areas for fire, explosion and toxic clouds





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## How does this effect space allocation?

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# **Recommendation: More 'risk space' needed**

- More 'risk space' needed, should be part of the strategic vision of the ports
- Proper consideration of group risk and attention zones
- Short term vision
  - Review how new technologies and activities might impact occupied areas
  - Consider this in space allocation and assess what additional mitigating measures are needed
  - Take into account that due to uncertainties surrounding new large-scale technologies that adequate safety margins will need to be taken into account.
  - Assess impact on emergency response
- Long term strategic vision:
  - Consider zoning of the ports in which similar activities are clustered
  - Each zone will have a characteristic set of activities which are allowed within that zone
  - High risk activities separated from high occupancy activities



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# **Conclusions**

- The energy transition will have a fundamental impact on activities of ports and the associated HSE risks will have an impact on space allocation.
- Now is the time to develop a strategic vision on the ports of the future which plays a crucial role in the global renewable energy system.





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## References

[1] RHDHV, The New Energy Landscape, European Sea Ports Organisation
(ESPO) and European Federation of Inland Ports (EFIP), May 2022
[2] DNV GL, RH2INE Sub-study 1b SuAc A3&B3 Guidance for Safety Distances Final Report, Rev1, 2022