

# Regulations, Codes & Standards for hydrogen handling and use

International workshop on Renewable Energy and  
Hydrogen Export

24 March, 2015 at Trondheim

## Agendas

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- Who we are, what we did
- Regulatory scheme around hydrogen handling and use
- What we do
- Summary

## **We are a global classification, certification, technical assurance and advisory company**

OUR PURPOSE

**TO SAFEGUARD  
LIFE, PROPERTY  
AND THE ENVIRONMENT**

## Organized to maximise customer value

**MARITIME**



**OIL & GAS**



**ENERGY**



**BUSINESS  
ASSURANCE**



**SOFTWARE**



**MARINE CYBERNETICS**

**RESEARCH & INNOVATION**



## Hydrogen and DNV GL

- Why?
  - In line with DNV GL's purpose, vision and values
  - Hydrogen has a great zero emission and sustainability potential
  - Hydrogen can be safe
- Hydrogen in DNV GL
  - From 2001: Research Topic
  - From 2009: Integrated into Services



Risk  
Management

Technology  
Qualification

Approval Support,  
Standardization  
& Certification

## Selected Experiences

- European Projects:
  - H2SusBuild
  - HySafe
  - HyApproval
  - European Integrated Hydrogen Project (EIHP2)
  - HyWays
  - Zemships
- IEA Annex 19 Hydrogen Safety
- Safe and Reliable user interface in hydrogen refueling stations
- National Norwegian Project on Safety, Regulations, Standardization and coordination of activities
- Hytrec (Hydrogen Technology Research Centre)
- FellowSHIP – Viking Lady



## Hydrogen as an Energy Carrier

- Moving from pre-commercial markets to commercialization
- Ambition toward broader application
  - New technological solutions
  - Limited availability of hydrogen specific experience, data and information
  - Further pre-normative work required especially for newer applications



## Regulations, Standards and Codes

### Regulations

- Legally binding
- International & local (national)

#### UN ECE

- Global Technical Regulation (Vehicles)
- ADR (Road transport)
- ADN (Inland waterways transport)

#### IMO

- IMDG code (Maritime transport)
- *IGC code* (Maritime transport in bulk)
- *IGF code* (Ships)

#### EU Directives, local regulations

- Pressure vessel (PED etc.)
- Explosive atmosphere (ATEX etc.)
- Fuelling stations (AFI etc.)

etc.

### Standards & Codes

- NOT legal documents
- Serve as guidelines to meet requirements

#### Standards

- Developed by standardization organizations
- May be harmonized with regulations

**ISO** TC197 (Hydrogen technologies)

**IEC** TC105 (Fuel cell technologies)

etc.

#### Codes

- Developed by interested industrial parties

#### EIGA

- IGC Docs (Hydrogen station, Pipelines etc.)

#### SAE International

- J2601 etc. (Fuelling protocols etc.)

etc.

*Italic: Under Development*



## Regulatory regime around hydrogen supply chain (handling & Use)

### Transport/Distribution

#### Land Transport

- **UN ECE ADR**
- EIGA IGC Doc 06/02
- **Local regulations**

#### Pipeline

- EIGA (IGC Doc 121/04)
- **Local regulations**  
(US: ASME B31.12)

#### Maritime Transport

- **IMO IMDG Code**
- *IMO IGC Code*
- **UN ECE ADN**
- **Local regulations**

### Refueling/Transfer

#### Hydrogen Refueling Station

- ISO TC197
- EIGA IGC Doc 15/06, 6/02
- SAE J2600, J2601, J2799
- HyApproval handbook (EU)
- **Local regulations** (EU: AFI)

#### Hydrogen loading/offloading

- ??

#### Hydrogen Bunkering

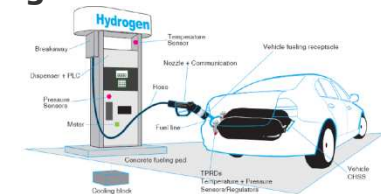
- ??



### Use (Transport)

#### Fuel Cell Vehicles

- **UN ECE GTR**
- ISO TC197
- SAE J2578, J2579, J2594 etc.
- **Local regulations**



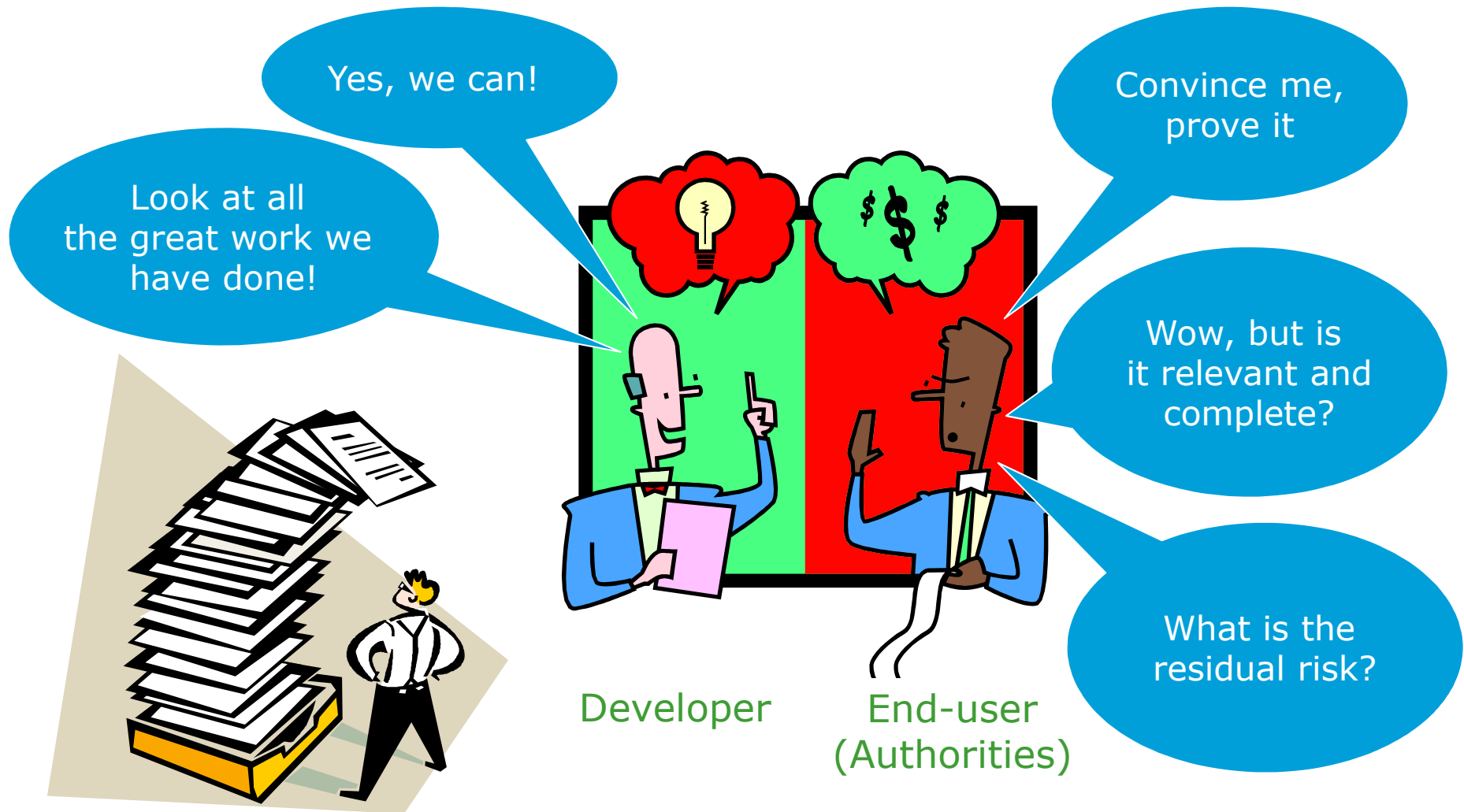
#### Fuel Cell on Ships

- **IMO (IGF Code)**
- Class Rules
- **Local regulations??**



**Bold: Regulations, *Italic: Under Development***

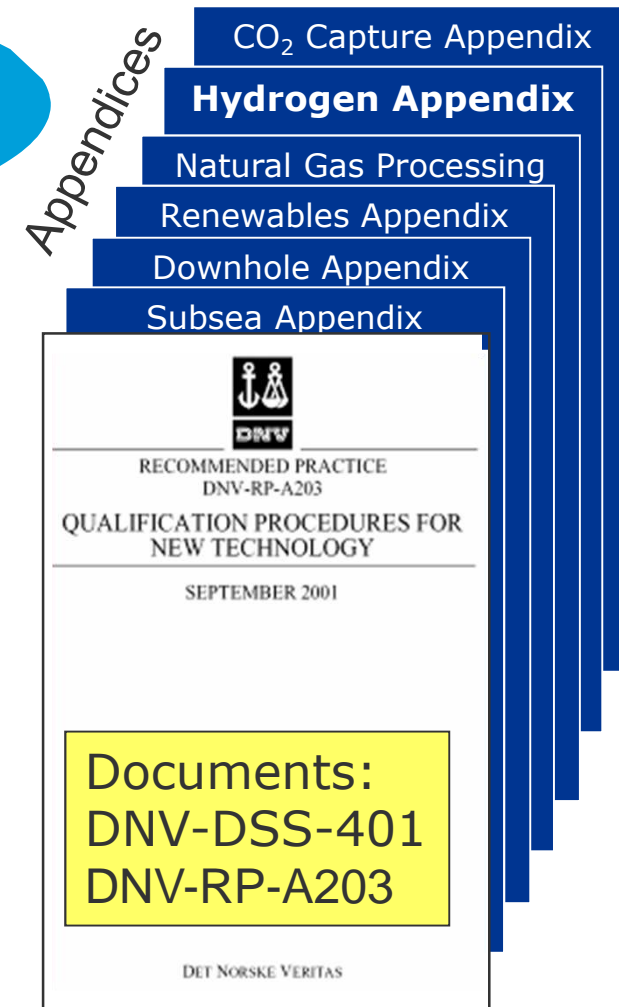
# How to close the regulatory gaps



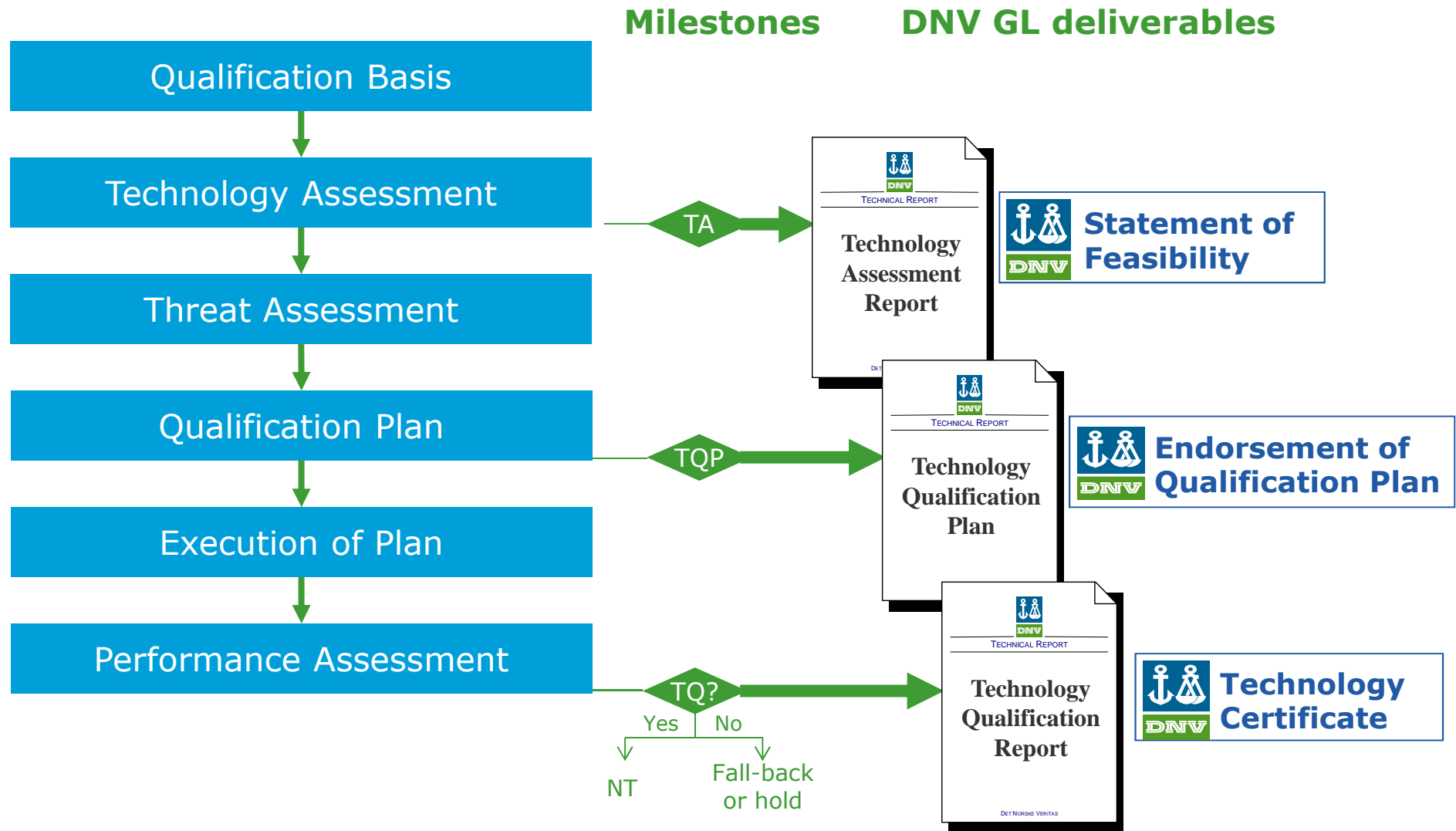
## Technology Qualification

"The process of providing evidence that the technology will function within specified limits with an acceptable level of confidence"

- What is the purpose of technology qualification?
  - The purpose is to enable industry to cost efficiently put technology into use.
- Can you qualify anything?
  - Yes, almost. The methods and tools may applicable for:
    - large projects
    - specific components
    - Limited deviation from an applicable standard
    - General technology of wide application



# Technology Qualification Methodology/Procedures



## Ongoing Initiatives

- HAZOP studies of several electrolysis based ballast water treatment systems
- HyREADY (JIP: Joint Industry Project)
- Summer Project 2015 (Renewable sources to produce hydrogen)



## Get prepared for hydrogen addition to natural gas, get HYREADY!

### Challenge

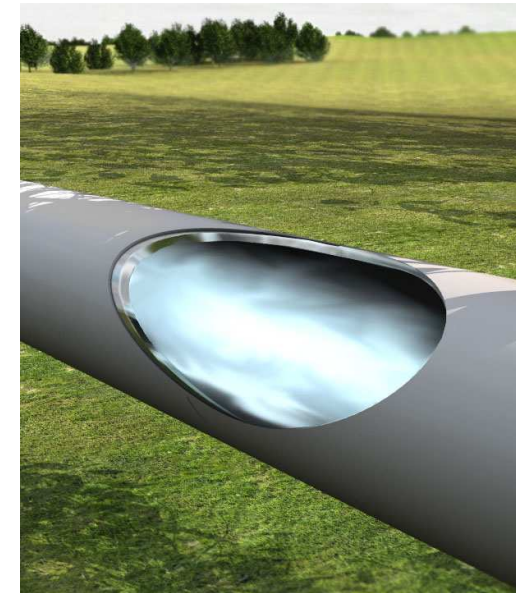
- To support the decarbonisation of the energy system, stakeholders consider the accommodation of hydrogen (e.g. from Power-to-Gas) in the natural gas grid. There are no guidelines for TSO's and DSO's how to prepare their natural gas networks and operations for the injection of hydrogen with acceptable consequences.

### Benefits

- The HYREADY guidelines present uniform, impartially prepared and unequivocal guidelines to the market.
- The guidelines will support TSO's and DSO's to obtain a sound balance between feasible measures and remaining consequences of hydrogen addition to natural gas.

### Delivery

- Practical guidelines to support gas TSO's and DSO's in preparing their networks and end users for hydrogen addition to natural gas with acceptable consequences. More in particular "how to" questions will be addressed. The guidelines will be based on existing knowledge



Contact:

[onno.florisson@dnv-gl.com](mailto:onno.florisson@dnv-gl.com)

+31 50 7009723

Region:

Europe & Southern Africa

## Summary

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- Hydrogen is in line with DNV GL's purpose, vision and value
  - Started as a research topic in 2001.
  - integrated into our services such as "Risk Management", "Technology Qualification" and "Approval Support, Standardization & Certification".
  - HyREADY JIP, Summer Project and HAZOP studies etc. are ongoing.
- Regulations, Codes and Standards are established/becoming established regarding hydrogen as industrial gas and fuel for road vehicles.
- There still exists gaps regarding:
  - Bulk maritime transportation and transfer
  - Fuel for ships (including bunkering) etc.
- In order to close gaps, structured methodology such as Technology Qualification instead of trial and error approach will be efficient.

**Thank you for your attention!!**

**Ikuo Hamanaka**

ikuo.hamanaka@dnvgl.com

+47 902 48 542

**www.dnvgl.com**

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