LPG/ LNG Challenges in Norway
- development
- inspection findings

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Development LPG – LNG last 20 years

- Industry, transport and maritime sector converting from heavy fuel oil to LPG and LNG for heating and fuel
  - Environmental incentives – from 2015 new SO2-emission limits for maritime sector
- Increasing number of LNG –sites under Seveso, as of today:

Number of sites	Lower tier	Upper tier	Non-Seveso
LPG	21	9	>7000
LNG	23	17	120

- The Majority of sites have been operating 5 -20 years, LPG sites older than LNG-sites.
- Few production sites – many sites where we have storage and consuption

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Gasnor LNG-plant Snurrevarden

Annual capasity 20 000 tons

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Gasnor LNG-plant Kollsnes

Annual Capasity 2x40 000 tons

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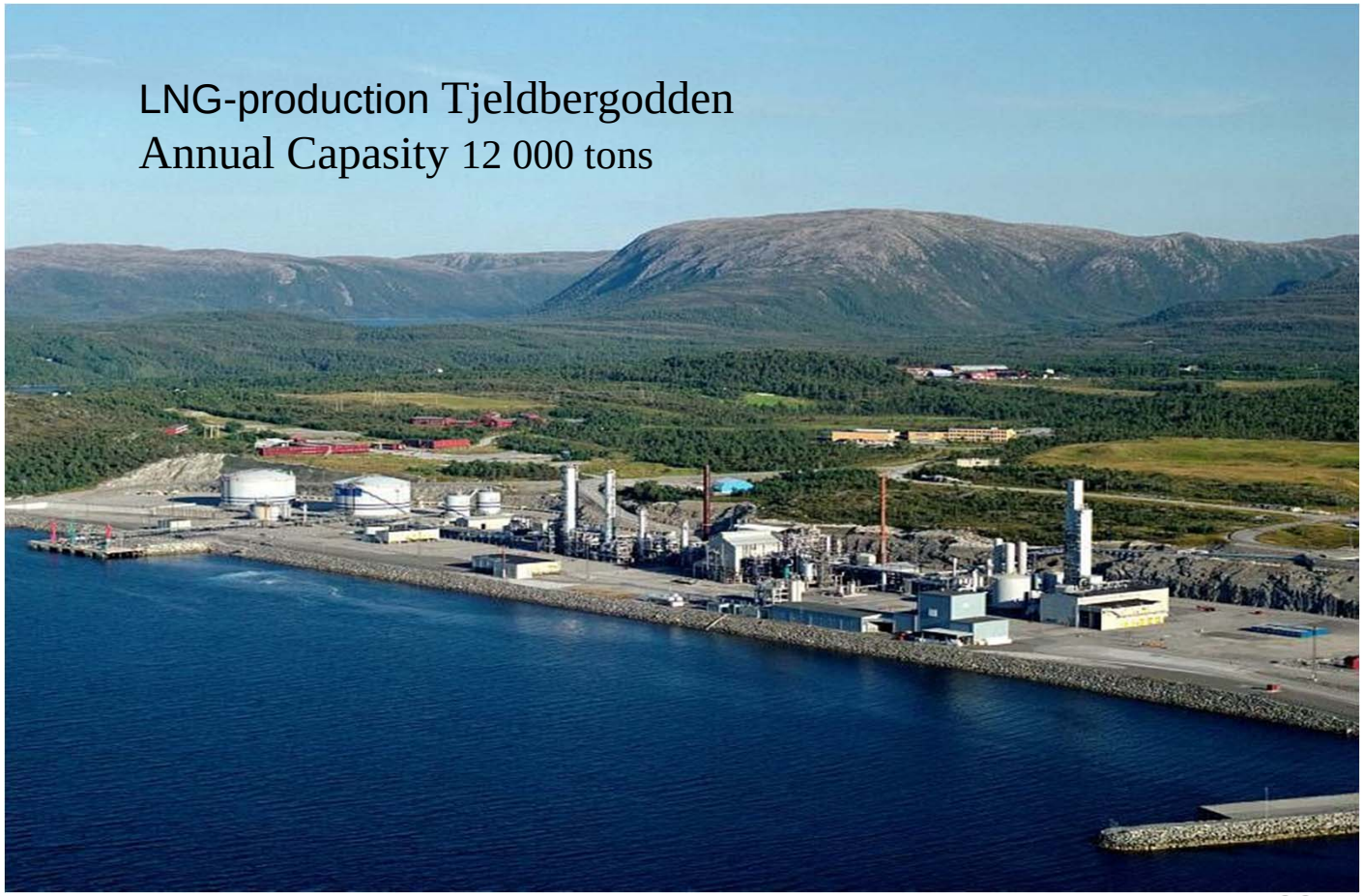
Skangass LNG plant in Risavika – Annual capasity 300 000 tons

LNG-production Tjeldbergodden
Annual Capasity 12 000 tons



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The most relevant standards for LNG installations

- EN 1473 – Installation and equipment for liquid natural gas – design of onshore intallations
- EN 13645- Installation and equipment for liquid natural gas – Design of onshore intallations with a storage capacity between 5 t and 200 t
- NFPA 59A- Standard for the production, storage, and handling of liquiefied natural gas (LNG)
- NS-EN ISO 28460 Petroleum and natural gas industries. Installation and equipment for LNG ship-to-shore interface and port operations

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Some of our Challenges LPG – LNG

- Storage LPG-LNG on railway-sites
- Ownership – tank – product – site
- Unmanned sites - Remotely controlled
- Bunkring of LNG in ports and ferry terminals

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Storage on railway-sites

- Some gas companies are allowed by the Railway company to store large amounts of gas transport tanks close to main railway stations, before being transported to the gas company site for unloading.
- These gas companies have been using this storage as a way to keep under Seveso, and is for them cost saving.
- We have concluded that the railway-sites under these circumstances are under Seveso, as they represent the same risk or higher to 3.party than ordinary sites.
- It is unfair that this storage can take place without consequence- and risk analysis, ordinary Land Use Planning practices, ordinary licencing regiemes, etc.
- Their business-assosiation has started a dialogue with our ministry - complaining about our standpoint.

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Ownership: tank – product – site

In Norway, we find many varieties of ownership of LPG-LNG tanks. This sometimes makes it difficult for us in inspections. These variations can be:

- Gas supplier owns tank and product in tank – and operates the tank remotely, but the tank is located on the site of the consuming industry. We experience unclarities regarding responsibilites for maintenance, emergency preparedness, training.
- Gas supplier sometimes owns a certain percentage of the tank and the tank is operated by the gas consuming industry.
- Sometimes difficult for us to conclude which of them to hold responsible for the follow-up of the Seveso-regulation.

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Unmanned sites

- Remotely controlled, might be no one on site in an emergency situation. Gas supplying company operate a «hot-line» for emergencies.
- Fire brigades must handle an eventual situation.
- Tank truck drivers have access to the site for filling of tanks.
- Training of the drivers to handle emergencies not always sufficient.

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LNG terminal, Fredrikstad

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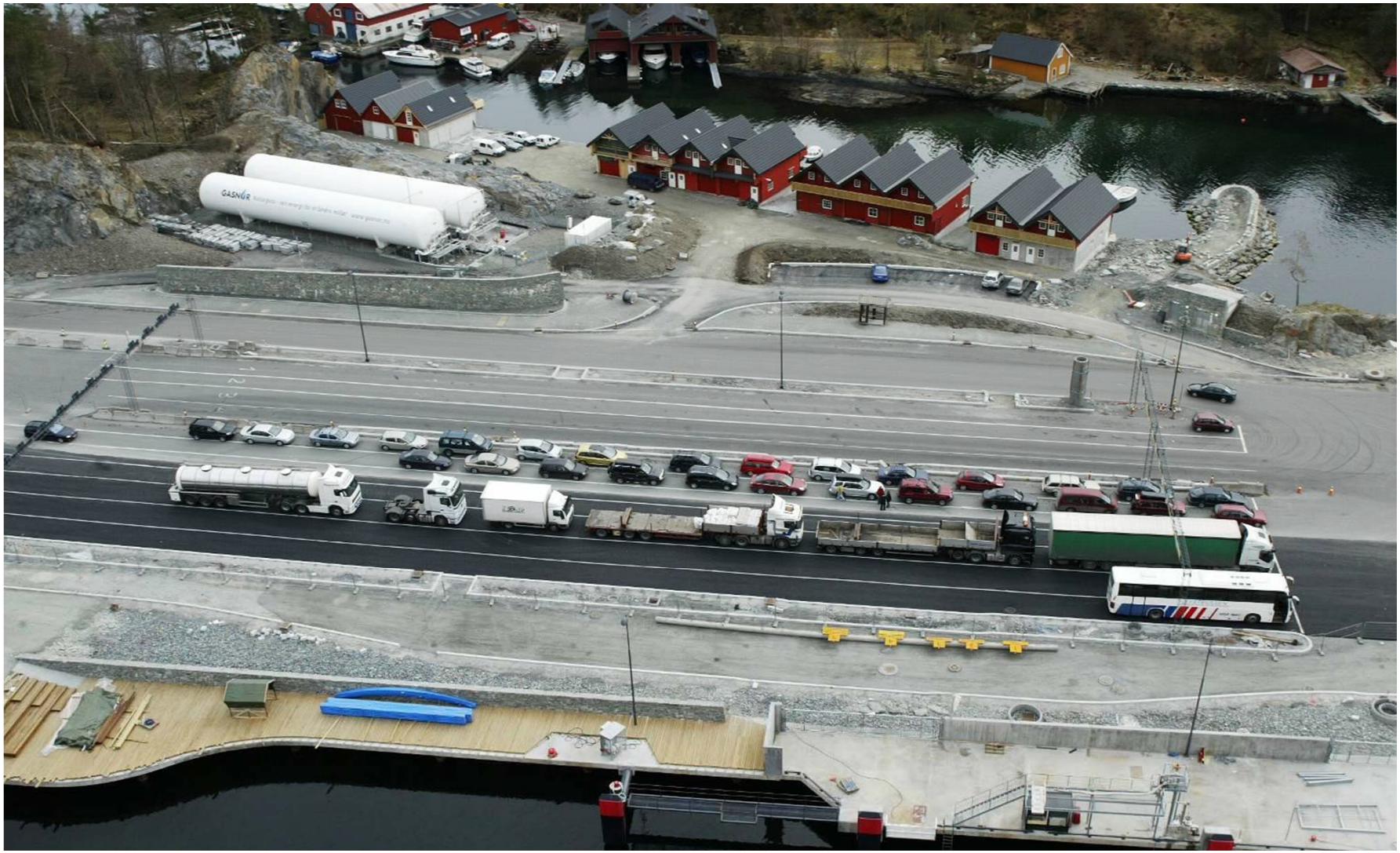
LNG terminal, Fredrikstad

- 9 tanks, 500-1000 m^3 , 32-48 meters
- total volume 6.500 m^3 (~ 3.400 tons)
- Vacuum isolated pressuretanks
- 24 combustion towers
- Supplies local industry by pipeline, as well as being a loading terminal for tank trucks.
- 1 man on shift daytime, nighttime 1 man when loading/ unloading


GASNÄR

Last years a development towards a more environmentally friendly maritime sector

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Bunkering of LNG in ports and ferry terminals

- Conversion from heavy fuel oils and marine gas oils to gas fired engines has increased the need for gas bunkering facilities.
- Operators want to bunker as passengers are leaving and/or entering the ships/ ferries
- DSB were very reluctant to allow this due to safety reasons
  - Initiated risk evaluations in order to conclude whether this is acaceptable.
  - Now accepted under certain conditions

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36 + ships and ferries operating on LNG

- > 21 ferries
- 8 Supply ships
- 3 Coastal Guard ships
- 2 LNG tankers
- 2 Sea-Cargos RoRo-ships

- More coming...

Bunkering of ships from tanktrucks, permanent onshore installations or lecters/ ships

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Onshore tank arrangement

LNG piping arranged underground

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Some findings in inspections

- Unclear responsibilities operation, maintenance, training
- Unclear emergency planning and training
- Insufficient maintenance and control
- Insufficient protection of piping and labelling of piping
- Insufficient function testing of safety critical equipment
- Bridging of safety critical instrumentation
- Where storage and filling – unorganized storage of cylinders
- ATEX-documentation and work in ATEX-areas
- Insufficient routines for bunkering of LNG close to passenger areas.

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