



# LNG AS A FUEL

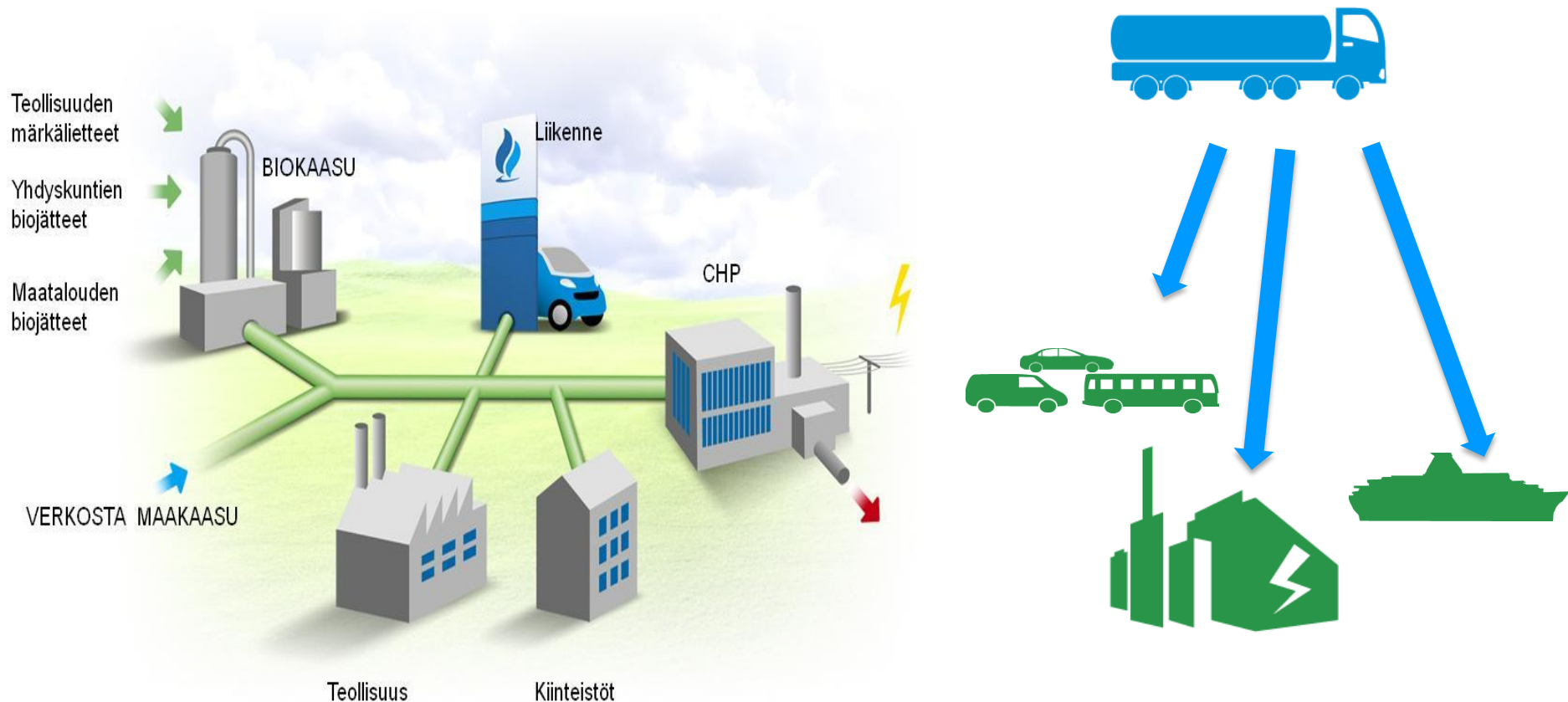
**TOMMY MATTILA**

**Gasum**

# Why LNG ?

LNG is a logistical solution !

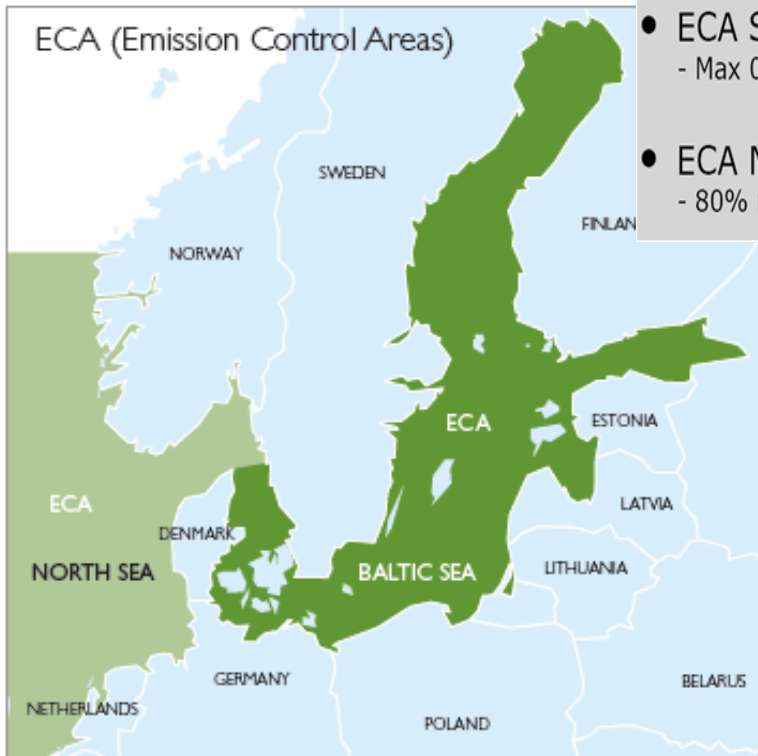
Natural gas and biogas through the grid or as LNG/LBG with trucks or barges



# What is LNG ?

- Natural gas in liquid form. Natural gas imported to Finland is almost pure methane (CH<sub>4</sub>).
  - Cryogenic liquid – 162° C
  - Density about 0,42 kg/ltr
  - Heat value 13,7 kWh/kg
  - 1m liquid = 600m<sup>3</sup> gas
- In liquid form will not ignite, only in gas phase
- Natural gas is odorless, tasteless and non-toxic
- Ignition temperature abt. 650°C (diesel 240°C )
- Ignites in a 5-15% air concentration
- Natural gas in gas phase is about half the density of air 0,56
  - Possible leakages vaporizes fast up in the air

# New limitations for emissions



- ECA Sulphur limitations
  - Max 0,1%, effective from January 1, 2015
- ECA NO<sub>x</sub> limitations
  - 80% reduction from Tier II for new ships after 1. January 2016

### Reduce emissions - What are the options?

Back in the day's  
HFO or MDO

Today and in the future  
What to select?

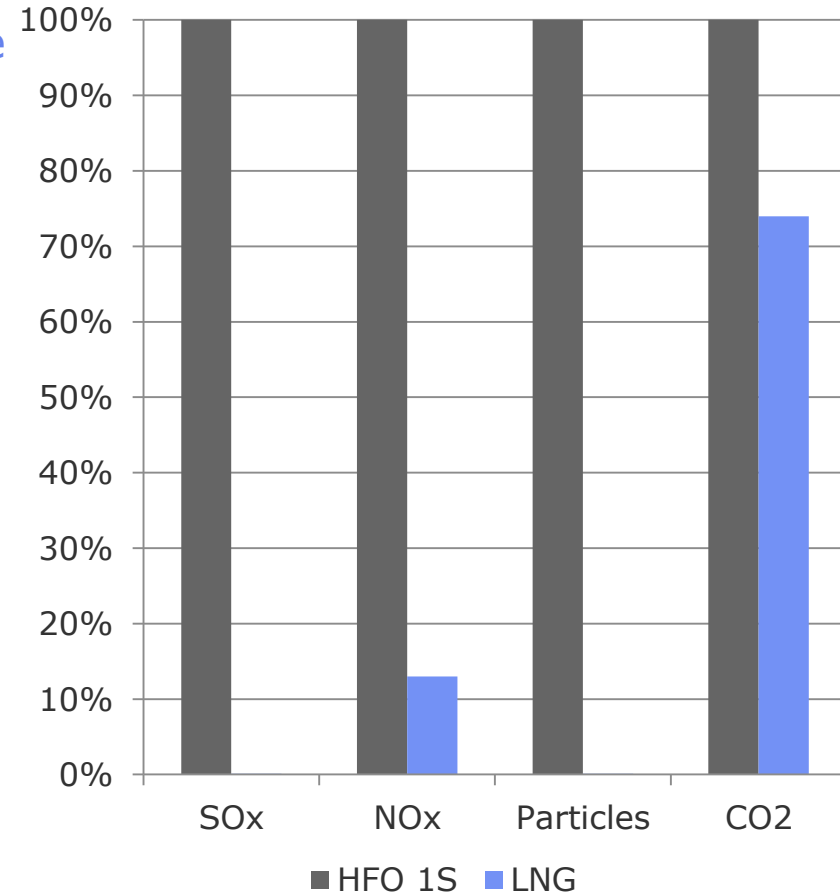
<b>HFO</b> Aftertreatment Scrubbers SCR	<b>MDO?</b> NO <sub>x</sub> Tier 3 compliant engine + Low sulphur fuel	<b>GAS</b> Gas as fuel
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And in the end it all boils down to \$\$\$

# Why ? LNG is the cleanest alternative

- LNG full fills all coming emission regulations as such with out any extra systems.
  - LNG is sulpha free. IMO and EU directive limits the sulpha to 0,1% from 1.1.2015
  - NOx reduction 85-90%. From 2016 reduction limit for new buildings 80% from 2016 (TIER III)
  - CO2: EEDI index from 1.1.2013. EU and IMO is planning for more measures to reduce CO2.
  - Particles: reduction of PM emissions.
- No oil spill risk
- Bio-LNG → LBG possibilities
  - Biogas and natural gas both consists of methane.

**Emissions LNG vs Heavy Fuel Oil**



# Why ? LNG is competitive

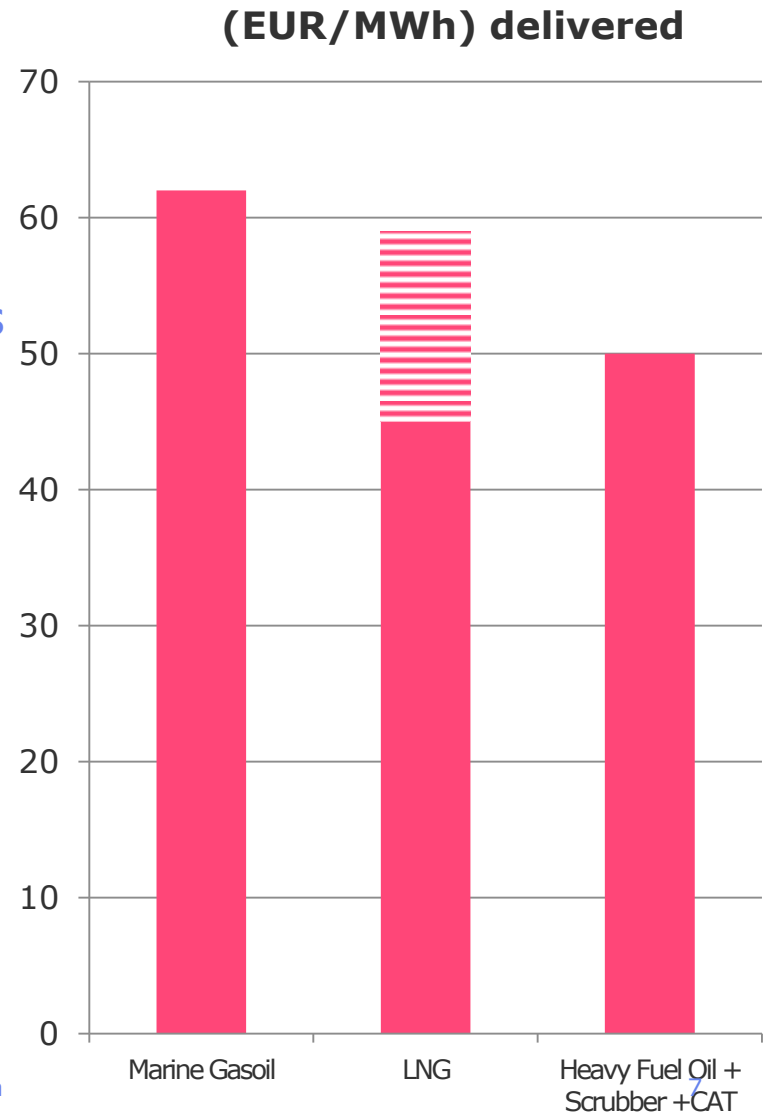
The price development of LNG is foreseen to be more stable than that of oil. Long term competitiveness.

- Growing "large scale LNG" in Europe
- More gas reserves than oil, shale gas

The LNG supply chain is more expensive than that of oil. Especially in the start up phase when the volumes are small.

Building the infrastructure is key

- is LNG available ?
- what is the price of LNG ?





# SEA routes in the Baltics

## RoRo & ROPAX



## Containers





# MARINE LNG – MAJOR CONSUMPTION POINTS

- The majority of Finland's exports are transported by sea.
- Passenger ferries and RoPax and RoRo carriers operating in Baltic routes are potential LNG users.
- The biggest marine LNG potential can be seen in the ports of Helsinki, Turku/Naantali and Kotka/Hamina.
- The LNG potential in other countries around the Baltic Sea should also be assessed when exploring possibilities for marine LNG distribution in Finland.



# Present LNG activity in Finland

- Gasum's small scale LNG production in Porvoo since 1996, 20.000 t /a
- Semitrailers for distribution
- Industrial clients and backup for biogasplants and gas grid maintenance



# Gasum is planning to start LNG-import in mid- and large-scale

- Large-scale LNG import terminal could be connected to the natural gas transmission network
  - Mid-scale terminal is planned to deliver LNG for new markets outside the gas network
- Gasum is carrying out LNG import terminal projects in several locations:

**A Pansio (Turku)**  
• Mid-scale LNG import terminal

**B Inkoo**  
• Large-scale import terminal, connection to gas network  
• OR mid-scale LNG import terminal

**C Porvoo**  
• Large-scale import terminal, connection to gas network  
• OR mid-scale LNG import terminal

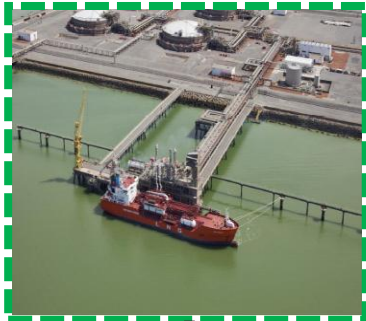


# LNG:n supply chain small scale

LNG production



LNG large scale terminal



LNG bunkering barge



LNG Marine



LNG feeder



LNG fixed bunkering



LNG Industrial



LNG terminal



LNG truck



LNG/CNG Filling station



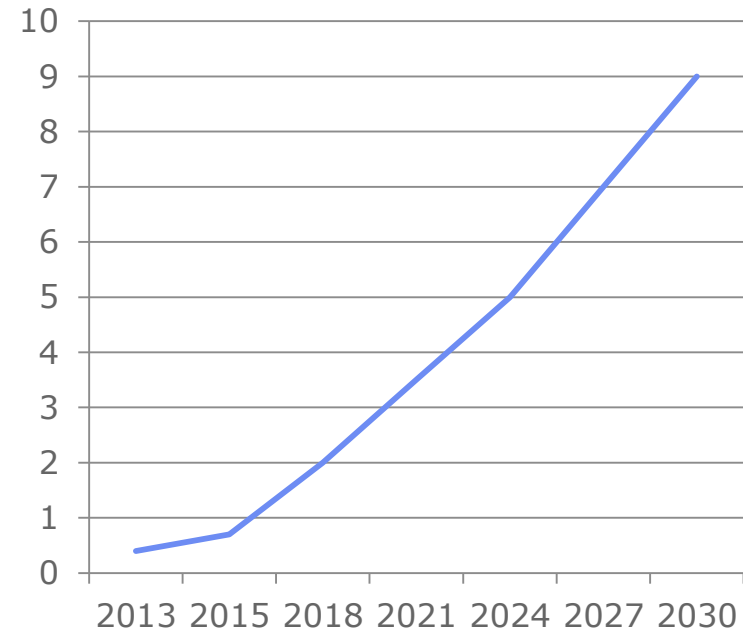


# LNG market potential

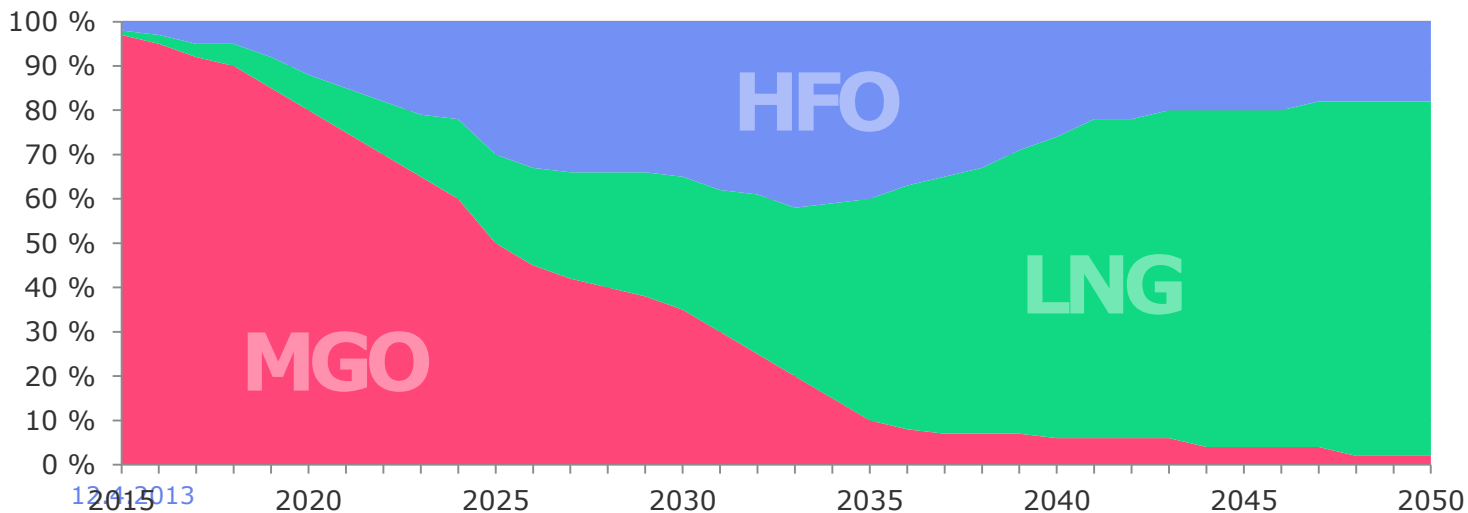
## Market Development

1. Industrial oil user outside NG grid
2. Marine new builds on fixed routes
3. Industrial LPG user outside NG grid
4. Marine new builds cargo
5. Traffic use, LNG and CNG filling stations
6. Marine retrofits

LNG market (TWh)



MGO osuus    LNG osuus    HFO+SCRU+SCR osuus



It's time for gas !

