Sustainable logistics operations for LNG distribution networks and offshore wind farms: an overview of two R&D projects

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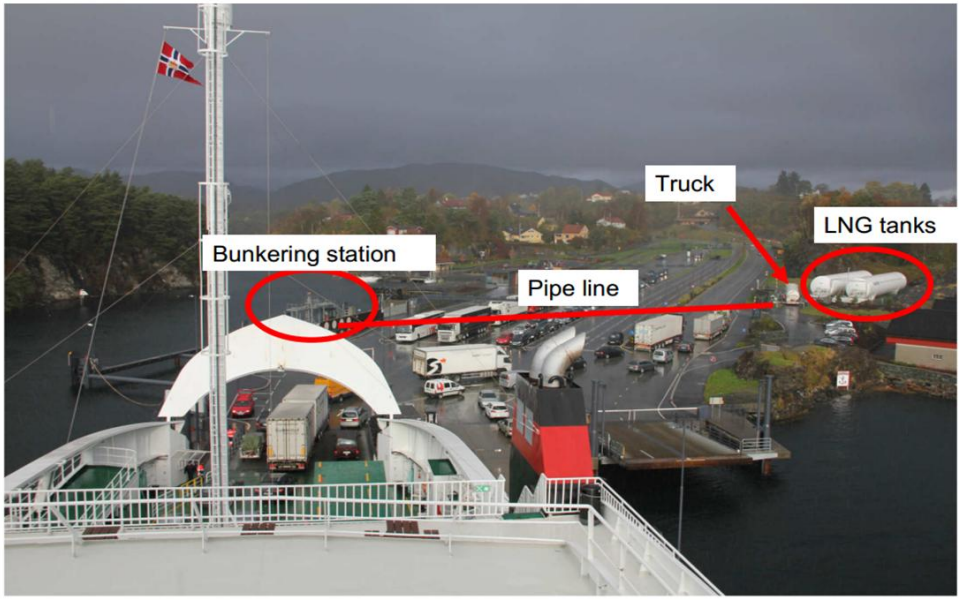
2 of the R&D projects at Operations

Sustainable Service Logistics for Offshore Wind Farms

Applicants: Veldman, Teunter, Roodbergen and Vis
Project budget: 1.0 million euro
Period: 2015 – 2019

Design of LNG Networks

Applicants: Vis, Roodbergen (RUG),
Van Woensel en Dam (TUE)
Project budget: 1.2 million euro
Period: 2013-2016



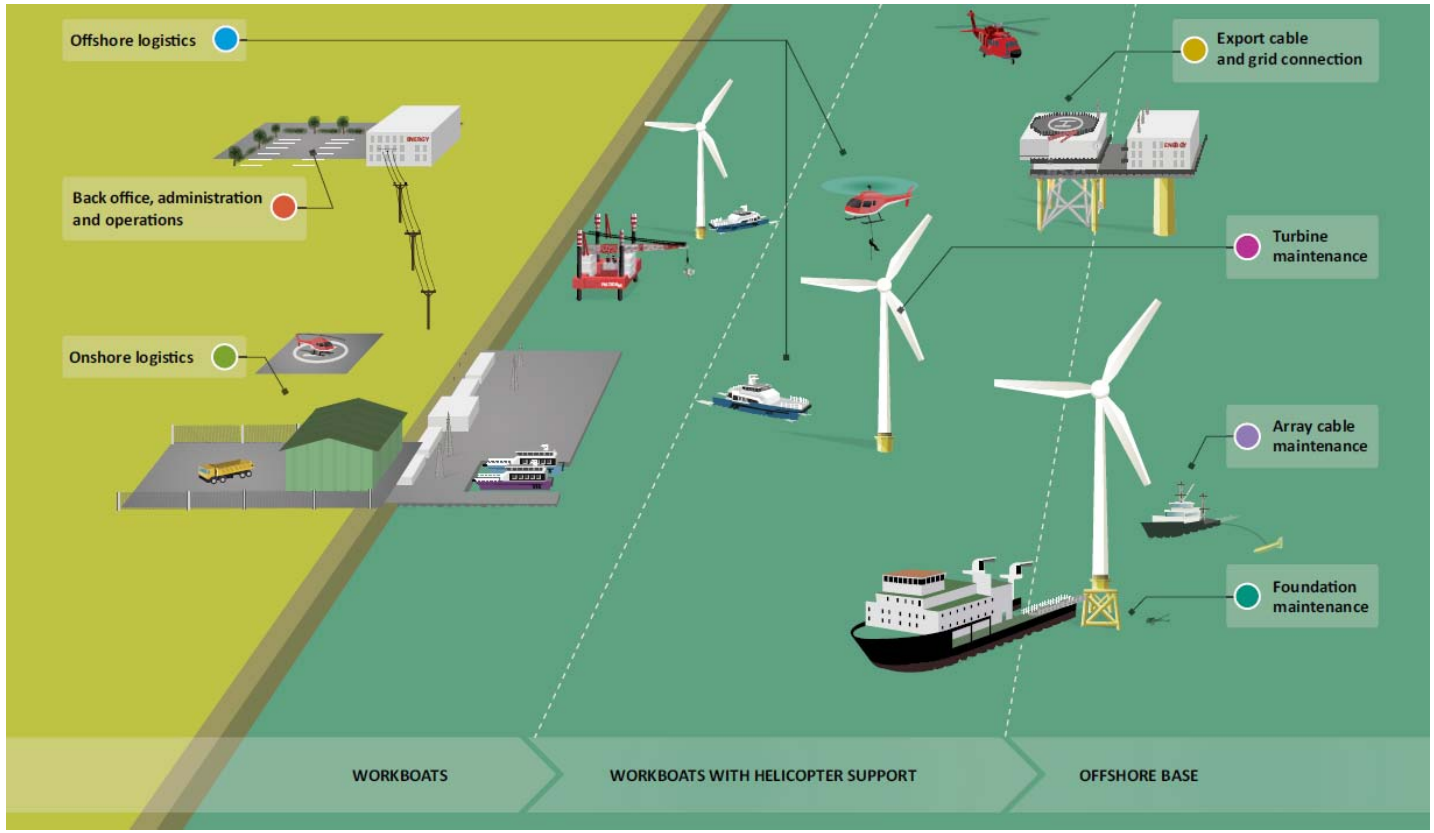
(Bron: Fjord1)

Offshore wind farms: relevance

- **Goals and benefits**
  - 13,9% of total EU electricity demand by 2030[1]
  - Cumulative investments 211,1 billion euros until 2030[2]
  - Annual reduction 315 Mt of CO_2 emissions[2]
  - 50.000 fte employment in The Netherlands by 2020[3]
- **Service logistics**
  - Operations & maintenance (O&M) 25% of total cost[1]
  - Service logistics typically 50% of O&M cost[4]
  - 40% (O&M) cost decrease needed for profitable wind energy[1]
  - Even for 2015 capacity (37.000MW[5]) and corresponding O&M cost, a 5% cost reduction amounts to 1 billion euros
- *Smarter service logistics can help make this energy source truly sustainable*

Sources: [1]Topteam Energie (2012), [2]EWEA (2011), [3]http://www.nwea.nl/Werkgelegenheid, [4]GL Garrad Hassan (2013), [5]Bilgili et al. (2011)

Service logistics for offshore wind farms



Research Team

- Dr. Jasper Veldman
- Prof. dr. Ruud Teunter
- Prof. dr. Kees Jan Roodbergen
- Prof. dr. Iris F.A. Vis
- 3 PhD candidates
- 2 post-docs
- M.Sc. Students
- Companies:
  - Focus on maintenance/spare parts
  - Focus on logistics and transport
  - Focus on port operations

Challenges and goals

Challenges:

- Lumpy service demand
- Multi-material network (spares, tools, consumables)
- Coordination flows materials and technicians (different transportation requirements)
- Coordination onshore and offshore flows
- Uncertainties (e.g. weather)
- Coordination of return flows
- Cooperation within and across wind farms

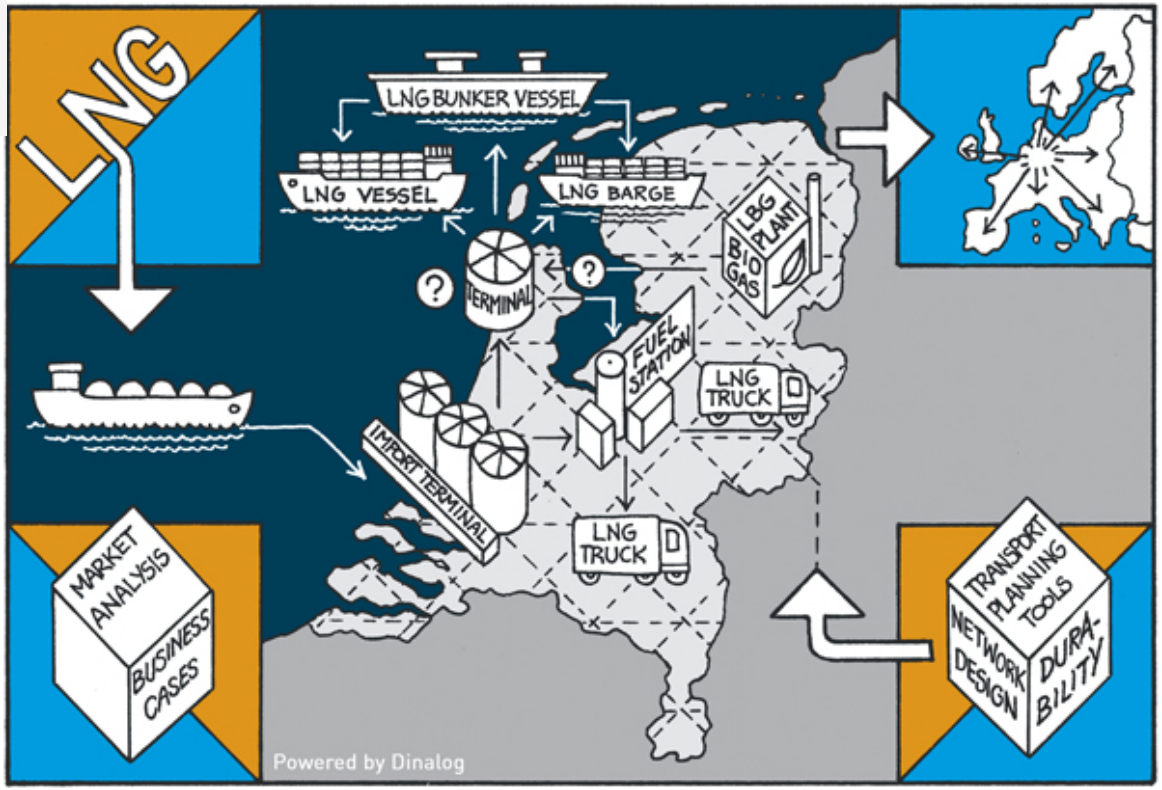
Goals:

- Improving availability
- Reducing maintenance
- Reducing waiting time
- Reducing time spent offshore (and onshore)
- Reducing transportation

Work packages

WP 1: Onshore and offshore network design	• *Buffer and repair facilities design; location decisions; kitting locations; transshipment locations*
WP 2: Planning of offshore service policies	• *Failure prediction; opportunistic CBM; multiple resource planning; joint service and resource planning*
WP 3: Coordination of sustainable service logistics	• *Vehicle assignment, routing, timing; storage; kit completion*
WP 4: Collaboration and governance aspects	• *Performance-based contracting, cooperation in diads and triads, multiple wind farms, trust*
WP 5: Integrated logistics operations	• *Robustness, simulation; cross-chain control, implementation*

Design of LNG Networks



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LNG in the logistics sector

- Emissions:
  - 2015: New SECAs in North and Baltic Sea area.
  - Possible new legislation on CO_2 emissions
- Costs and sound reductions:
  - Lower fuel costs in relation to potentially higher investments
  - More flexibility in deliveries.
- Distribution Network:
  - Chicken and the egg problem: Transition towards LNG will only be made if a supply network is in place.
  - Transport of LNG by logistics sector to third parties by means of different modes
  - Usage of LNG by different modes for transport operations by the transport and maritime sector

Work Packages

- WP 1: design **building blocks** to be used in the support of business cases and relevant investment decisions.
- WP 2: To propose tools for mode selection and efficient distribution and replenishment of the network (to users).
- WP 3: Bunkering alternatives: comparative analysis and design of planning and routing tools

Blueprint LNG distribution network

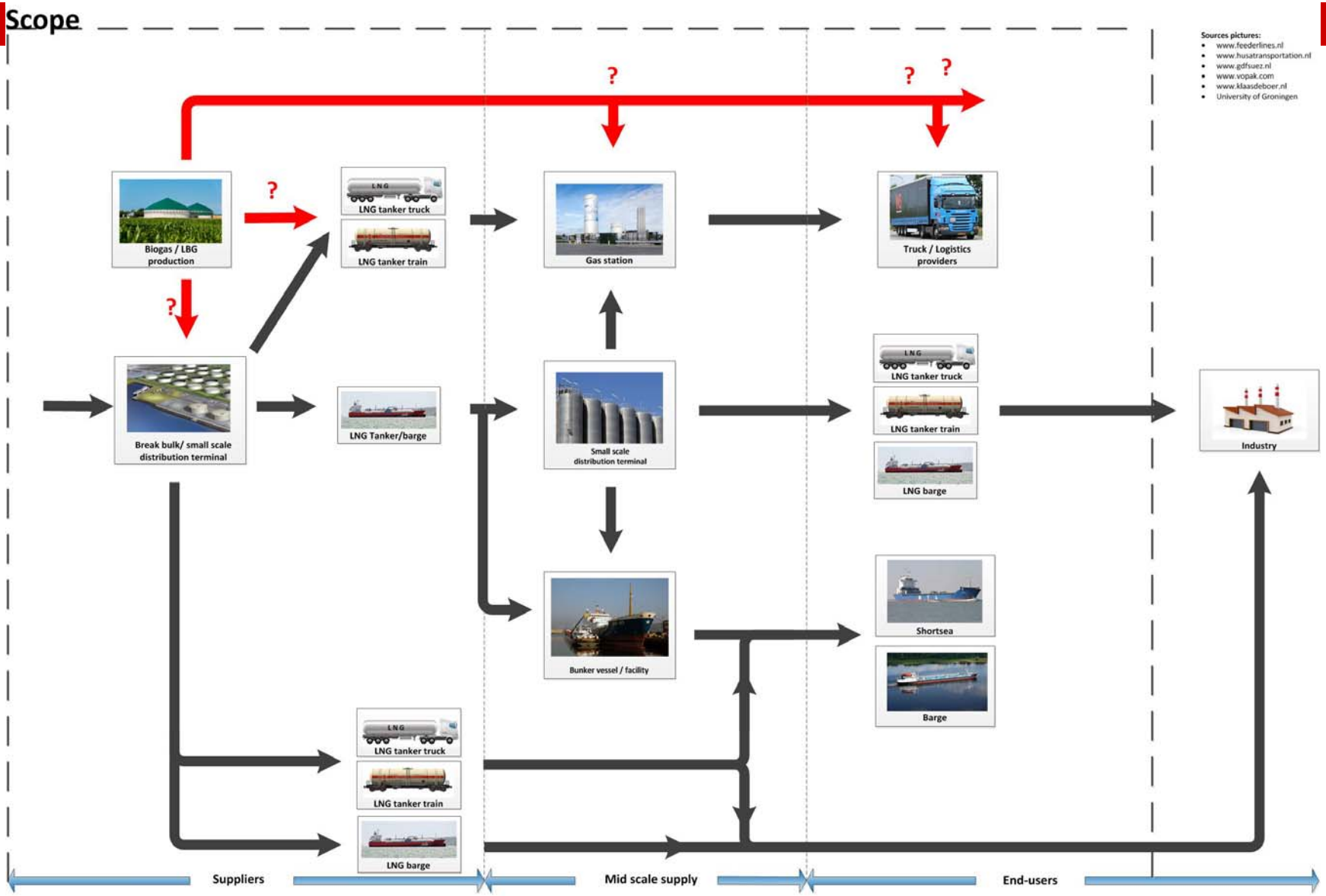
- Based on input from all the project partners to get a market perspective.
- Validation sessions with different types of stakeholders.
- Defining LNG supply chains for all stakeholders involved, from LNG traders to infrastructure owners, to end users:
  - What are the constraints in LNG supply chains?
  - What are the needs in LNG supply chains?
  - What is the minimal infrastructure needed for LNG demand?
- Which parts of LNG supply chains need further research?

Example: end user trucks

What factors are of importance regarding LNG?

- Does an LNG truck have sufficient power?
- What is the range of an LNG truck?
- Where is LNG available?
- Is it possible to refuel at any station?
  - Standardization procedures and materials
- Does LNG have the same quality at every station?
- Price of LNG in the future?
- Mono fuel versus dual fuel?
- Emission constraints (stronger than for industry)
- Bio LNG interesting option?

Blueprint


Scope
Sources pictures:
www.feederlines.nl
www.husatransportation.nl
www.gdfsuez.nl
www.vopak.com
www.klaasdeboer.nl
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Biogas / LBG production
LNG tanker truck
LNG tanker train
Gas station
Truck / Logistics providers
Break bulk/ small scale distribution terminal
LNG Tanker/barge
Small scale distribution terminal
LNG tanker truck
LNG tanker train
LNG barge
Industry
Bunker vessel / facility
Shortsea
Barge
LNG tanker truck
LNG tanker train
LNG barge
Suppliers
Mid scale supply
End-users

More information

- *Project leader offshore wind project:* Ir. Filips Jager
- *Project leader LNG project*: Drs. Tom Steffens
- *COPE/Operations*: Prof. dr. Kees Jan Roodbergen and Dr. ir. Paul Buijs

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