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
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
LNG in the logistics sector

› Emissions:
  • 2015: New SECAs in North and Baltic Sea area.
  • Possible new legislation on CO₂ 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?
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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