Minimizing your LNG project costs
20 billion USD investments at Kilpilahti Industrial Area

- Refinery
- Petrochemicals
- Storage Area
- Port
- Truck Railcar
- Refinery

NESTE JACOBS
Developed and constructed Finland's gas infrastructure
Minimizing your LNG project costs

STUDY

- Initial Concept
- Permits and Authorities
- Project Execution Planning
- Rough cost estimate

FEED
(Front-End Engineering & Design)

EXECUTION

LNG DELIVERY

STORAGE

DISCHARGE
(LNG or GAS)

Regasification
Minimizing your LNG project costs

**STUDY**
- Initial Concept
- Permits and Authorities
- Project Execution Planning

**FEED**
*(Front-End Engineering & Design)*
- Defining Solutions
- Design Package
- Final Cost Estimate
- Execution Schedule

**EXECUTION**

Final investment decision
## Comparison of EPC and EPCM

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<th>EPC</th>
<th>EPCM</th>
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<tr>
<td><strong>Time</strong></td>
<td>Fixed date for completion</td>
<td>According to estimated Schedule</td>
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<td><strong>Control</strong></td>
<td>EPC Contractor in control</td>
<td>Owner in control</td>
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<td><strong>Flexibility</strong></td>
<td>Will be executed according to tender</td>
<td>Optimizing possible</td>
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<td>Changes at extra costs</td>
<td>Possible lower OPEX</td>
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<td><strong>Procurement</strong></td>
<td>Contractor responsible for all procurement</td>
<td>Procurement as agent for the owner</td>
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<td><strong>Performance</strong></td>
<td>Contractor guarantees performance of</td>
<td>Equipment suppliers provide</td>
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<td><strong>Quality</strong></td>
<td>completed facility</td>
<td>performance guarantees</td>
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<tr>
<td><strong>Risk</strong></td>
<td>Contractor holds risk, more “bankable”</td>
<td>Multiple points of accountability</td>
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<td><strong>Competition</strong></td>
<td>Low - Few suppliers</td>
<td>High</td>
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<tr>
<td><strong>Price</strong></td>
<td>Fixed price contract</td>
<td>Reimbursable/</td>
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<td></td>
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<td>Shared pain/gain</td>
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“…there has been a significant increase in the EPCM contract procurement route ..”

*Worlds apart: EPC and EPCM Contracts, Mayer Brown, 2007*
Minimizing your LNG project costs

Typical EPCM cost break down

- Storage tank: 35%
- Civil and Building works: 12%
- Process equipment: 10%
- Piping (materials and installation): 8%
- Electrical: 5%
- Automation & Instrumentation: 5%
- EPCM: 13%

Benefits

- Reduced risk for largest component
- Performance guarantees linked to tank
- Fixed schedule on long lead item

Execute Project by EPCM

Execute Storage Tank by EPC

- inside the EPCM
- as equipment order

Price -25%
Neste Jacobs widely present in LNG and gas

Harjavalta LNG Station -2016
Norilsk Nickel LNG station
Neste Jacobs: Basic Engineering, EPCM

Göteborg LNG Terminal -2018
Swedgas & Vopak
Neste Jacobs: Feasibility study

TOLKKINEN/INKOO -2018
Gasum, LNG terminal. Capacity 300 000 m³. Neste Jacobs: PMO

PORI LNG Terminal-2016
Skangass LNG terminal. Capacity 30 000 m³. Neste Jacobs: Study, Basic Engineering, EPCM

Manga LNG Terminal-2018
LNG terminal Port of Tornio. (50 000 m³). Neste Jacobs: Study, Basic Engineering, Owners team

Finnish Compressor stations
Gasum, 1984-Today, 3 stations 9 compressors. Neste Jacobs: Study, Basic Engineering, EPCM

Finnish Gas Network 1971-2015
Gasum, 1230km. In operation. Neste Jacobs: Study, Basic Engineering, EPCM

Kilpilahti LNG plant 2006-2010
Gasum, LNG liquefaction plant. Neste Jacobs: Study, Basic Engineering, EPCM

Source: Skangass
Examples of LNG terminal projects

Pori LNG Terminal
- Skangass, Pori, Finland
- Neste Jacobs Scope: Studies, Basic engineering, **EPCM**
- Storage tank: 30,000 m³, Ship unloading/loading, Truck loading, Send-out to local consumers
- Duration: 2014-2016

“West Finland LNG Terminal”
- Gasum, Turku, Finland
- Neste Jacobs Scope: Studies, Basic engineering (**FEED**)
- Storage tank: 30,000 m³, Ship unloading/loading, Truck loading, Send-out to local consumers
- Duration: 2013-2014

ManGa LNG
- Tornio, Finland
- Neste Jacobs Scope: Pre-study, FEED, **Owners team**
- Storage tank: 50,000 m³, Ship unloading/loading, Truck loading, Send-out to local consumers
- Duration: 2012-17
Examples of LNG projects

Norilsk Nickel Harjavalta Oy LNG Station
- West Finland
- Neste Jacobs Scope: BASIC, EPCM
- 300 m³ Pressurized storage, Truck unloading, Evaporation, Send-out to local consumption
- Duration: 2014-2015

Wärtsilä LNG storage for motor testing
- Sweden & Finland
- Neste Jacobs Scope: Studies, Basic engineering, **Detailed Engineering**
- Pressurized storage, Evaporation Truck unloading, Send-out to test facilities
- Since 1993

Neste Oil LNG import terminal
- Naantali, Finland
- Neste Jacobs Scope: Studies, Basic engineering
- Storage tank: 20.000 m³. Ship unloading/loading, Truck loading, Send-out to local consumers
- Duration: 2012-
Successful EPCM projects

Pori LNG Terminal
- Skangass, Pori, Finland
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- Duration: 2014-2016

Residue Hydrocracking unit
- Neste Oil Porvoo Refinery, Finland
- TIC 750 M€
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- Start-up: 2007

Polyethylene plant revamp
- Borealis Porvoo, Finland
- TIC 65 M€
- Neste Jacobs Scope: Basic engineering, EPCM
- Start-up: 2014
Examples of LNG Studies

• AGA – Cryo AB
  • Fredrikstad, Norway
  • Neste Jacobs Scope: Extended FEED
  • Atm. Storage tank, Ship unloading/loading, Truck loading, Send-out to local consumers
  • Duration: 2008-2011

• Gothenburg LNG Terminal
  • Gothenburg, Sweden
  • Neste Jacobs Scope: Conceptual Study
  • Atm. Storage tank, Ship unloading/loading, Truck loading, Send-out to local consumers
  • Duration: 2013

• Wärtsilä Finland
  • Caribbian
  • Neste Jacobs Scope: Conceptual Study
  • Pressurized storage, Ship, Send-out to Power plant
  • Duration: 2010-2011
Examples of LNG liquefaction projects

Porvoo LNG Production facility
- Project period: 2005-2007 and 2009-2010
- Small scale LNG production in Porvoo
- Capacity 20,000 t/a
  - Semitrailers for distribution
  - Industrial clients and backup for biogas plants and gas grid

- Neste Jacobs Scope: Basic engineering, EPCM
  - Project Management & Engineering
  - Site management and supervision
  - Procurement and delivery supervision
  - Project management services
    - cost estimates and time schedules
    - cost follow-up and reporting
Examples of Cryogenic projects

Borealis Improvement of Ethylene refrigeration system
- Neste Jacobs Scope: Basic engineering, EPCM
- Renewal of ethylene refrigeration system in Porvoo
- Renewal of compressors, design of heat exchangers for future expansion
- Executed 2010-2012

Borealis Expansion of Ethylene Liquefaction system
- Neste Jacobs Scope: Studies,
- Expansion of Ethylene liquefaction system in Sines, Portugal
- Design of a new liquefaction line to increase plant capacity
- Duration 2000

Borealis Ethylene plant cold section revamp
- Neste Jacobs Scope: Basic engineering, EPCM
- Porvoo ethylene plant capacity have been increased several times
- The plant is quite complex and it has about ten different cold circulations with a lot of heat integration
- In all expansion projects cold section have been revamped and cold section capacity have been increased
Examples of Biogas projects

Espoo Suomenoja Biogas Upgrading Plant
- Client: Gasum, Finland
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- Biogas from sewage water sludge digestion plant is refined to 95% methane and compressed to the national gas transmission network
- Duration: 2011-2012

Kouvola Mäkikylä Biogas Upgrading Plant
- Client: Gasum, Finland
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- Biogas from sewage water sludge digestion plant is refined to 95% methane and compressed to the national gas transmission network
- Duration: 2010-2011

Lahti Kujala Biogas Upgrading Plant
- Client: Gasum, Finland
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- Biogas from sewage water sludge digestion plant is refined to 95% methane and compressed to the national gas transmission network
- Duration: 2013-2014
Examples of Compressor projects

Mäntsälä Compressor Station
- Client: Gasum, Finland
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- 2x10 MW
- Duration: 1995-1997

Imatra Compressor and Metering Station
- Client: Gasum, Finland
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- 1x10 MW 1995-1997
- 1x10 MW 1991-1993
- 2x5MW 1984-1986

Valkeala Compressor Station
- Client: Gasum, Finland
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- 1x10 MW 1995-1997
- 2x5 MW 1988-1990 2x5MW 1984-1986
Examples of Gas automation projects

Gasum Transmission Network SCADA Renewal
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- Replacement of the existing natural gas transmission network monitoring system (SCADA).
- Upgrade of the gas network simulation system (to on-line version).
- SCADA’s electrical supply revamping
- Executed 2012-2014

Gasum Mäntsälä Compressor Station Automation Revamping
- Neste Jacobs Scope: Studies, Basic engineering, EPCM
- Replacement of the existing automation systems.
- DCS and ESD systems upgrading according latest technology.
- Gas Turbine/Compressor Control Systems and Machine Protection Systems Renewals.
- Modernisation of the relevant field instrumentation.
- Executed 2009-2012

Gasum Imatra Receiving Station Measuring Stations Renewal
- Neste Jacobs Scope: Basic engineering, EPCM
- Two totally new measuring stations erected.
- Ultrasonic meters (7 pcs) and Gas Chromatographs installed.
- Extension of existing DCS and ESD systems.
- Flow Metering System renewal.
- Modernisation of the relevant field instrumentation.
- Duration 2006-2009
Examples of Owners Team/PMO

- Finngulf LNG Terminal
  - GASUM, Finland
  - TIC 500 M€
  - Neste Jacobs Scope: Design, Construction, Commissioning and Start-up support, Owners Team
  - Start-up: 2017

- NExBTL renewable diesel units
  - Neste Oil Singapore and Rotterdam
  - TIC 550 & 650 M€
  - Neste Jacobs Scope: technology development, study, PDP, Commissioning and Start-up support, Owners Team
  - Start-up: 2010, 2011

- Lube base oil unit
  - BAPCO, Bahrain
  - TIC 410 M€
  - Neste Jacobs Scope: FEED, Commissioning and Start-up support, Owners Team
  - Start-up: 2011
Examples of Power Plant Projects

- NEW POWER PLANT, boilers 3, 4 and 5
  - Neste Oil Porvoo Refinery, Finland
  - TIC 250 M€ & 480 MW
  - Neste Jacobs Scope: Studies, Basic engineering, EPCM
  - Start-up: 2017 - 2018

- Gas turbine power plant No. 2 and No. 3
  - Neste Oil Porvoo Refinery, Finland
  - 172 / 277 MW
  - Neste Jacobs Scope: Basic engineering, EPCM
  - Start-up: 1989 and 1997

- Refinery utility boiler No. 5
  - Neste Oil Porvoo Refinery, Finland
  - 25 MW
  - Neste Jacobs Scope: Basic engineering, EPCM
  - Start-up: 1989
Examples of Substation and power distribution projects

- Renewal of Substations M081, M002, M004
  - Neste Oil Porvoo Refinery, Finland
  - TIC 11 M€
  - Neste Jacobs Scope: Studies, Basic engineering, EPCM
  - Start-up: 2010

- Renewal of Substation M011
  - Neste Oil Porvoo Refinery, Finland
  - TIC 4,6 M€
  - Neste Jacobs Scope: Studies, Basic engineering, EPCM
  - Start-up: 2012

- Renewal of 110 kv O/H Lines and Sea Cable
  - Porvoo, Finland
  - TIC 3,8 M€
  - Neste Jacobs Scope: Studies, Basic engineering, EPCM
  - Start-up: 2008
EXCELLENCE IN ENGINEERING

NESTE JACOBS