Yamal LNG

Yamal LNG
Project overview

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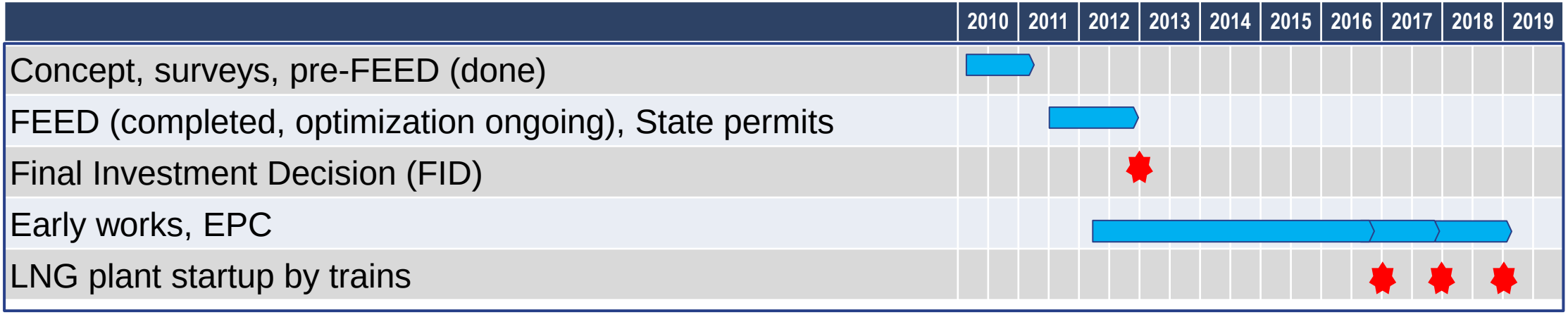
Project overview

Yamal LNG

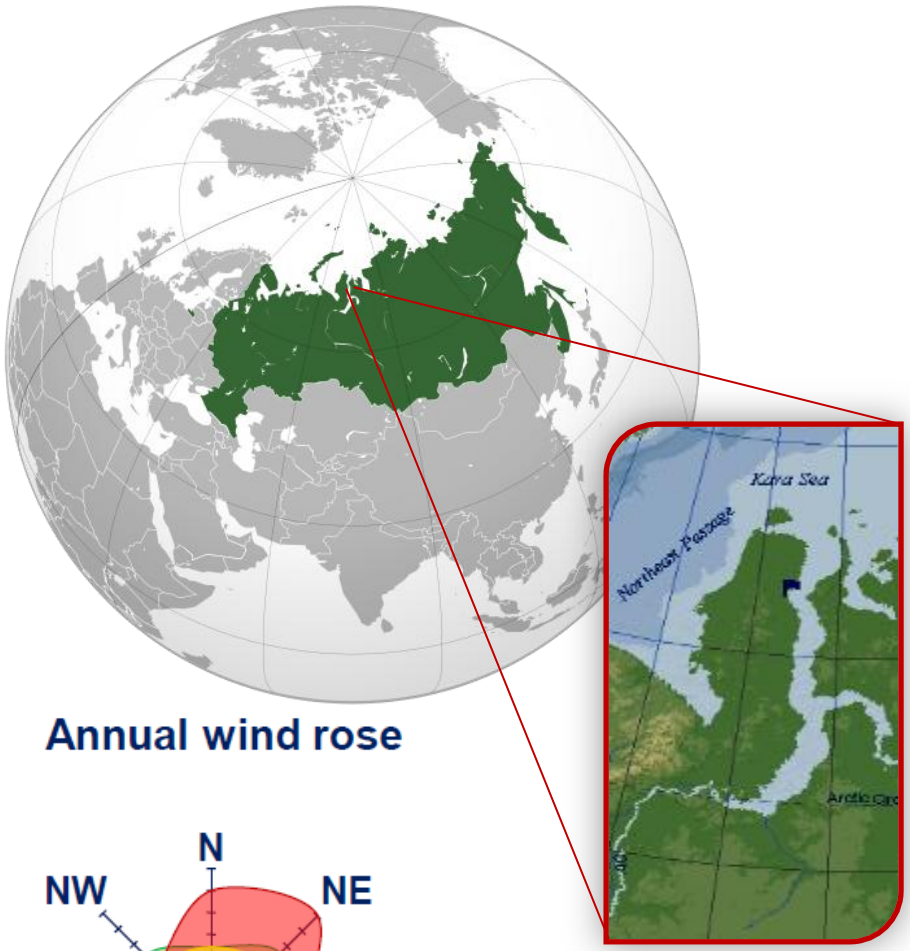
Pilot LNG project on the Yamal Peninsula, Russia

- Onshore field / 2P gas reserves 879 BCM
- 16.5 mtpa of LNG (3 trains)
- 1 mmt of gas condensate
- LNG plant and port at Sabetta
- Sponsors – NOVATEK (80%) and TOTAL (20%)
- Supported by Russian government



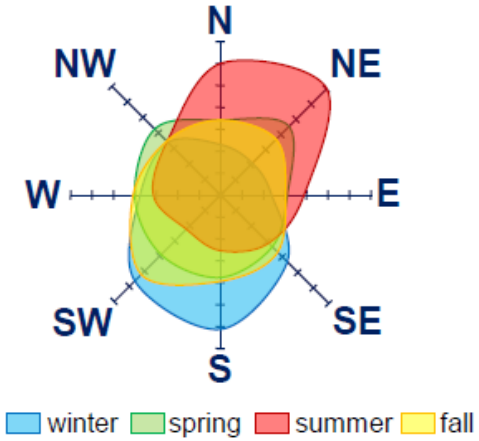
Yamal Peninsula

Yamal LNG

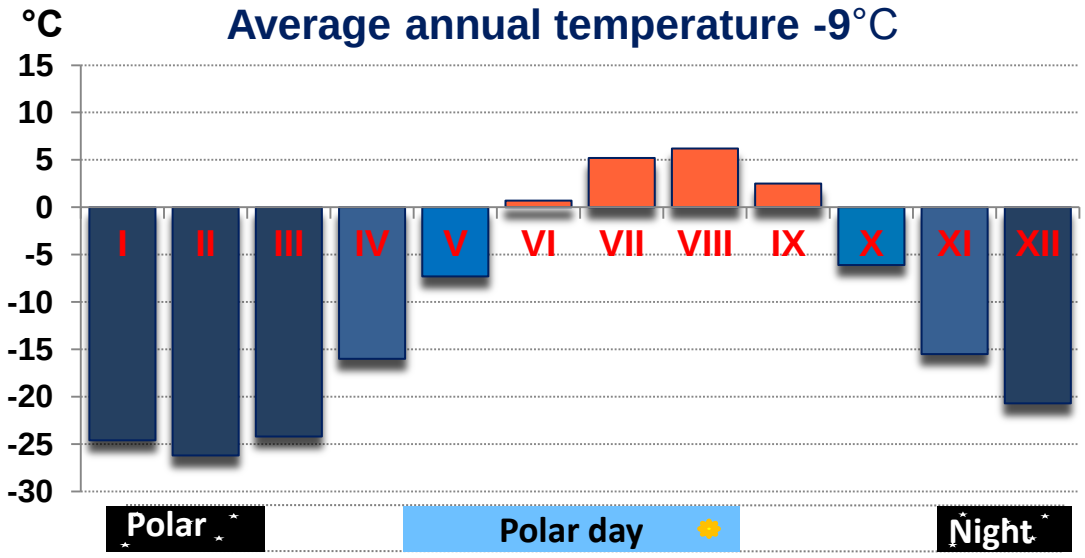


- The Yamal Peninsula is located in the north of Western Siberia and is bordered by the Kara Sea to the west and by the Gulf of Ob to the east
- Its administrative center is Yar-Sale and the Peninsula has a total population of 16,100 inhabitants
- The Yamal territory is located in the tundra zone. The peninsula consists of mostly permafrost soil - permafrost depths to 300-500 meters
- The Peninsula's relief is characterized as smooth with altitude variations of less than 90 m. Average altitude is approximately 50 meters above sea level
- Long-lasting ice cover (about 300 days a year). Swamps and lakes cover over 60% of the territory

Annual wind rose



Average annual temperature -9°C



Project Site Overview

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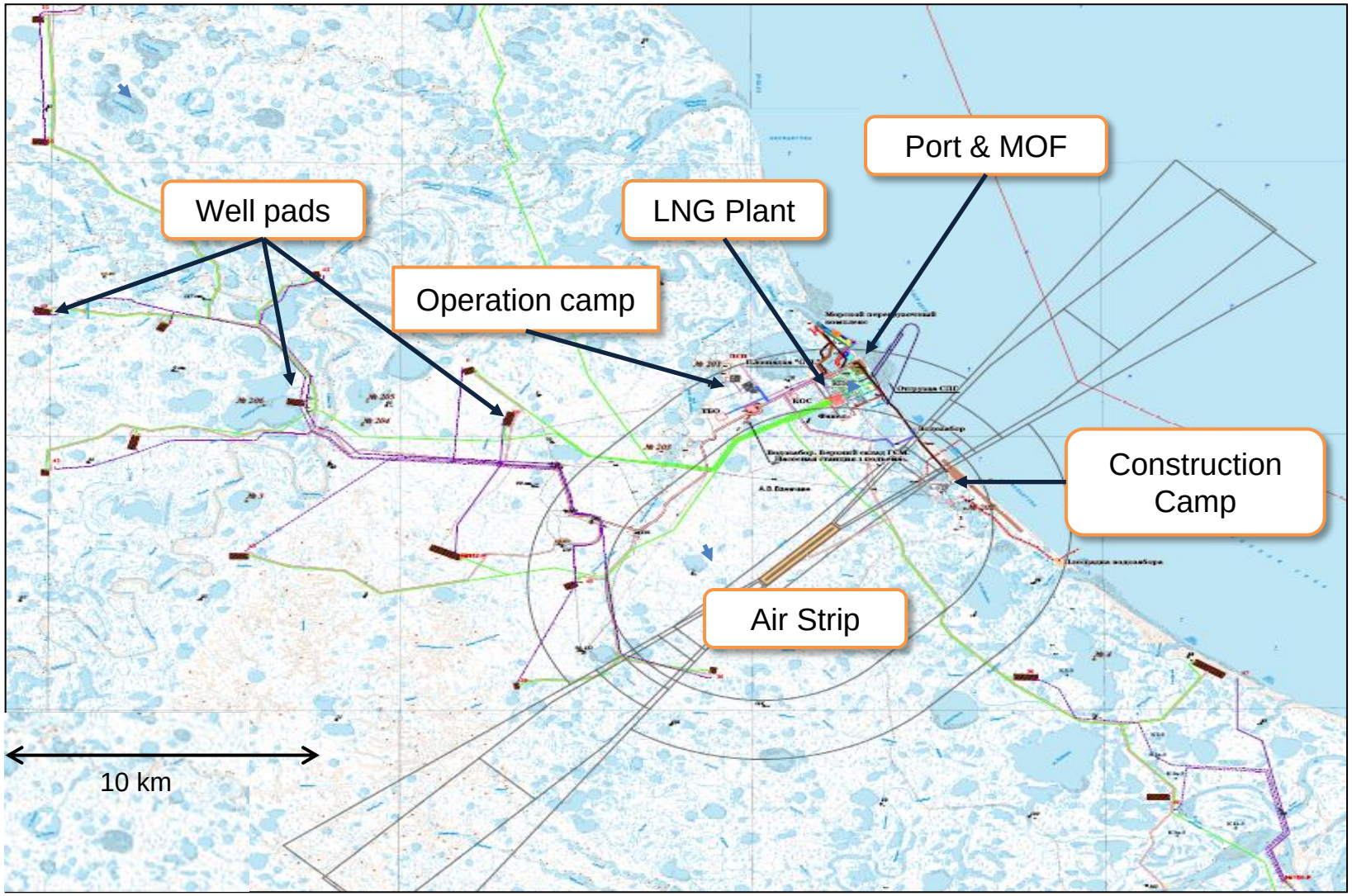
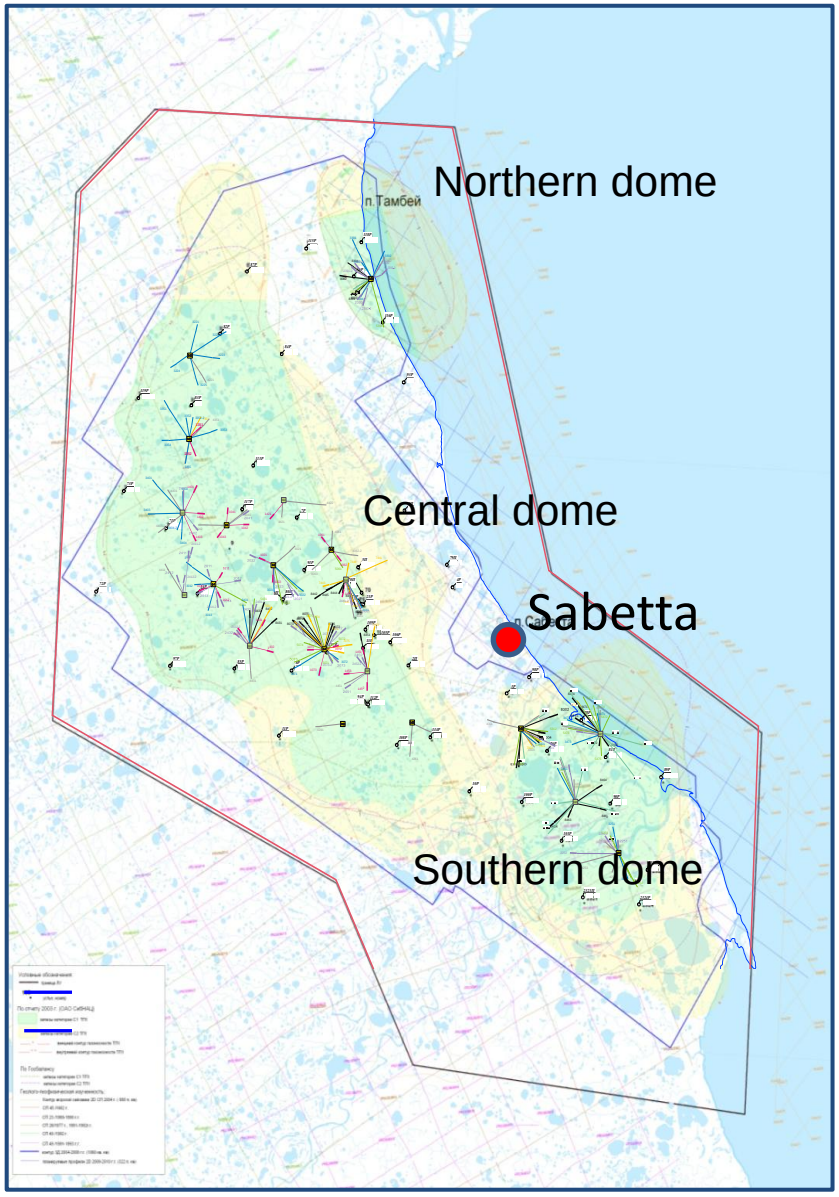


- One field based integrated project
- Close proximity of gas production facilities to LNG plant
- Integrated gas treatment and liquefaction facility
- Well prepared field infrastructure

Geology and field development

Yamal LNG



Geology

- Onshore location, with possible offshore extension in North-East
- Cretaceous sandstone reservoirs between 900 and 2800m
- Appraised by 58 wells (3 drilled and tested in 2011-2012)
- Field covered by 3D-seismic

Field Development

- Production plateau 27 bcm/year
- Peak condensate production at 1.1 mmt/year in 2020-2021
- 208 production wells, deviated and horizontalized over 500m
- 2 rigs are mobilized in 2012 to start drilling April 2013
- Wells will be drilled on 19 clusters on 3 domes

LNG Plant main facilities

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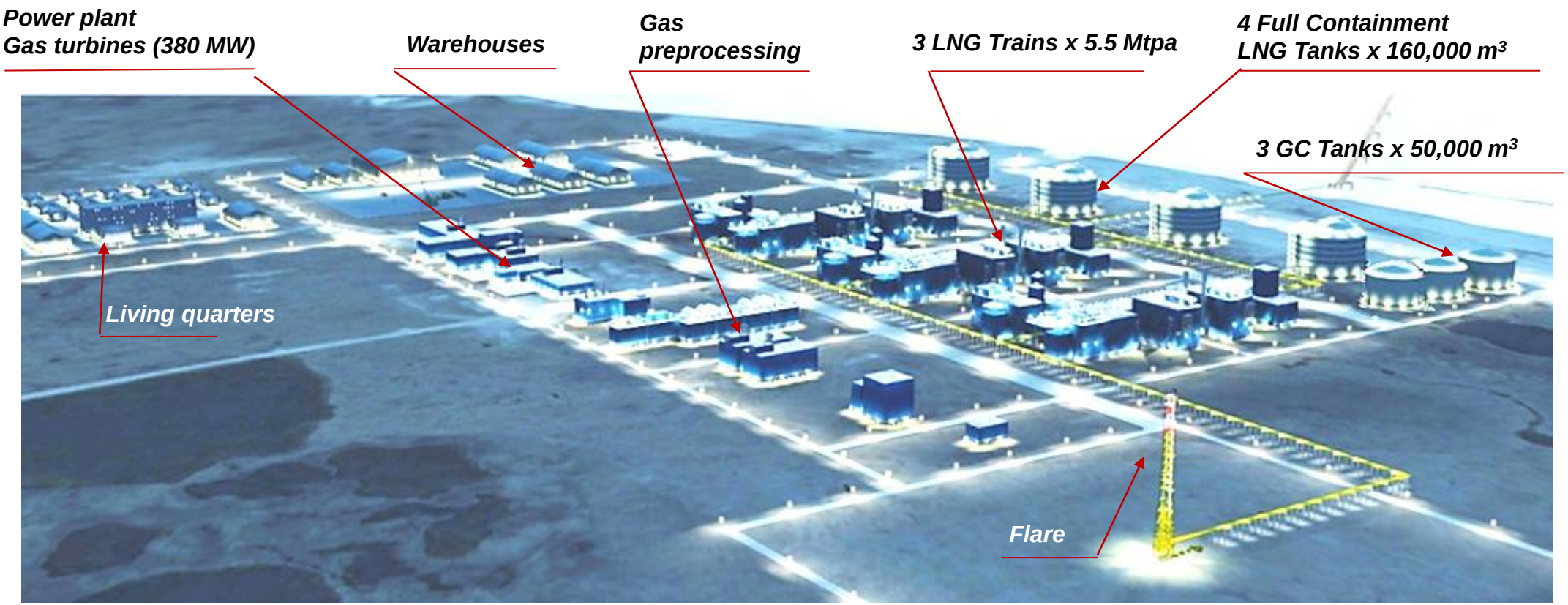
- Balanced combination of stick-build and modular construction
- Careful attention to foundation design in permafrost environment
- Standard and internationally proved technologies with:
  - minimum number of novelties
  - aim at minimizing impact on environment

- Proven APCI C3MR process
- BASF Acid Gas removal process
- Mercury removal
- Air Cooled liquefaction process – less environmental impact
- Full containment Tanks



LNG Plant Modularization Concept

- Modularization (~ 240 modules)
- To be transported by specialized ships
- Modules shall be transported and installed using self-propelled module trailers (SPMT)
- Heavy cranes application on site will be minimized
- Winterization (adapted for wind, snow and low temperature)

Port facilities, berth/jetty and harbor

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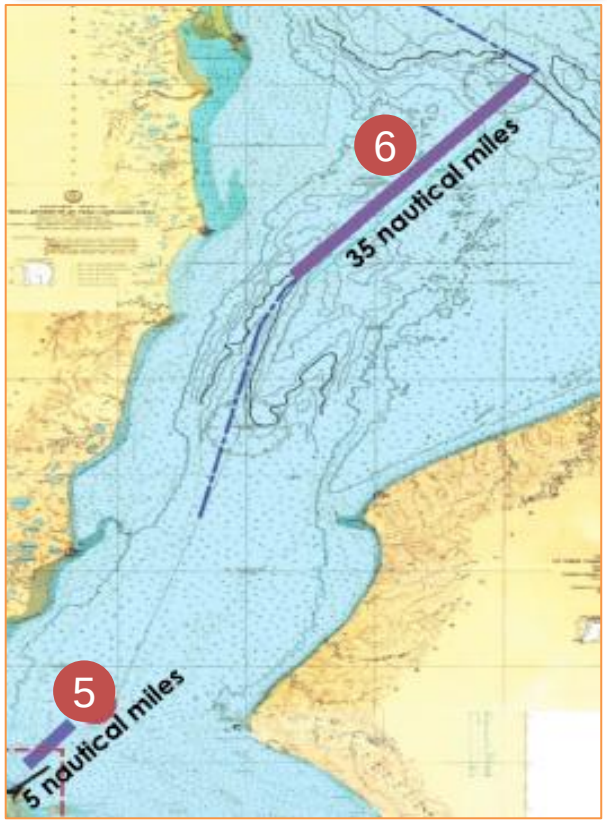
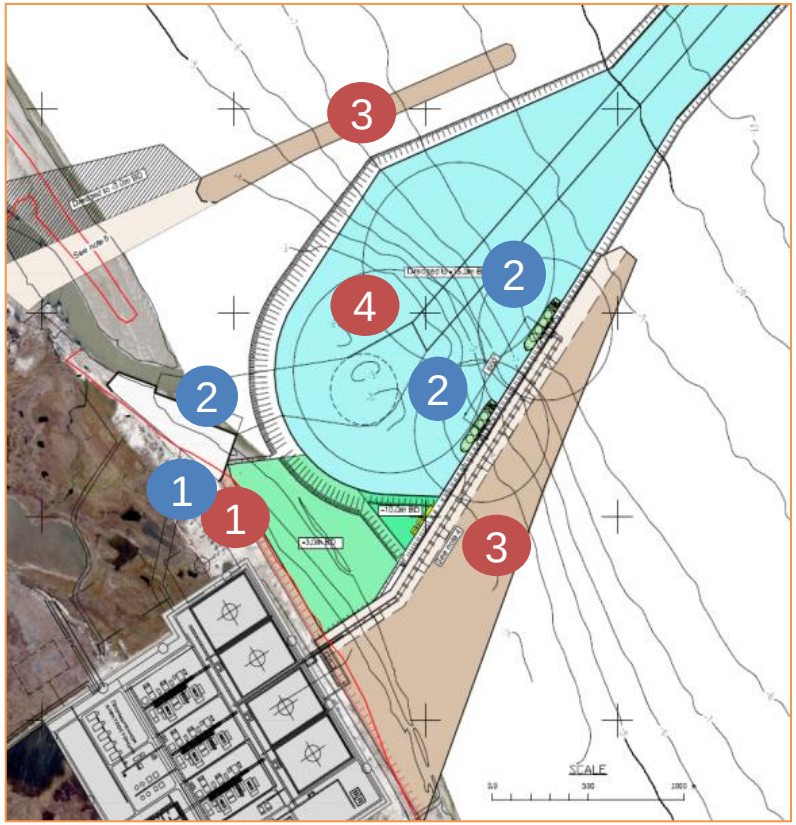
Seaway and approach channels



Port facilities, berth and harbor



Government facilities

1. Administrative facilities (customs office, captain's office, federal offices)
3. Ice protection facilities
4. Port harbor
5. Approach channel
6. Seaway channel

Yamal LNG facilities

1. Administrative facilities
2. Berths, jetty, and utility system

- Agreements with Rosmorport concluded*
- Allocation of operational responsibilities is agreed between federal and Yamal LNG infrastructure
- Required funds are included in federal budget (officially approved for 2012-2014)

* FSUE "Rosmorport" is responsible for development of the Russian sea transport infrastructure, maintain federal property in the seaports.

Early Stage Facilities of port Sabetta

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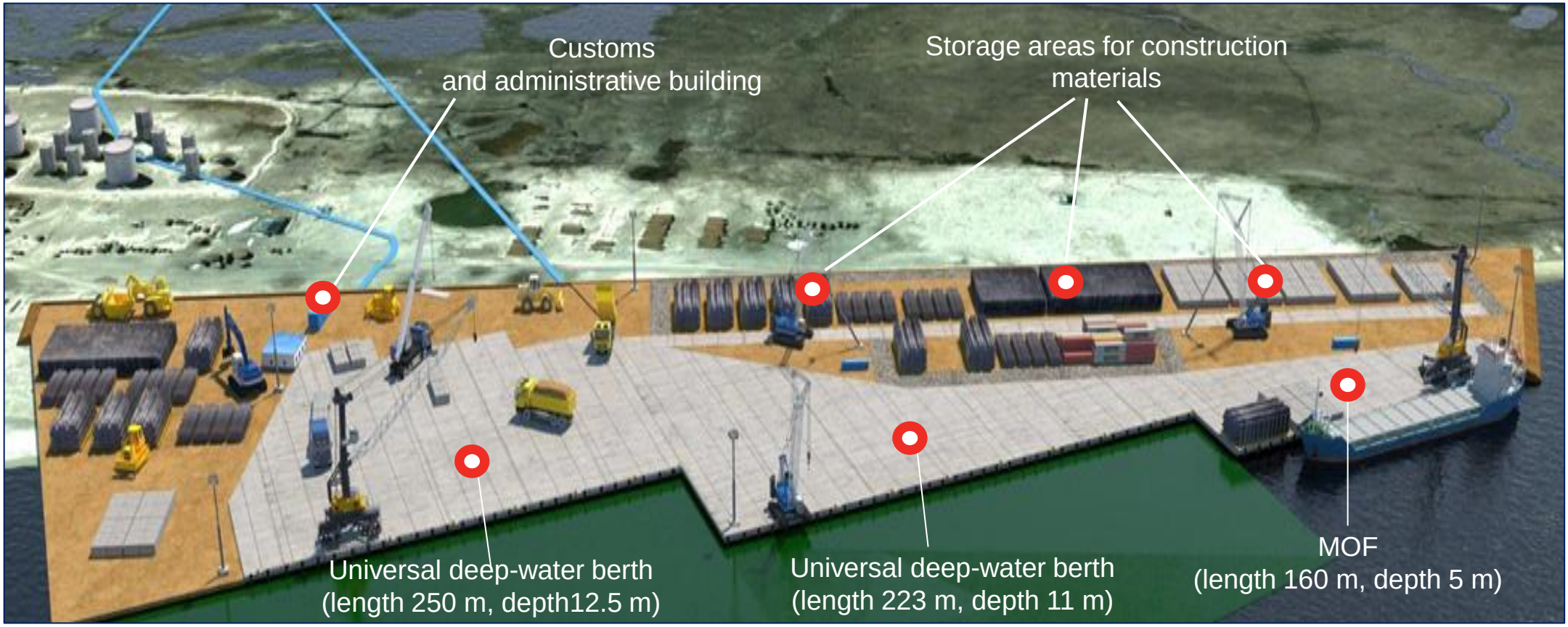
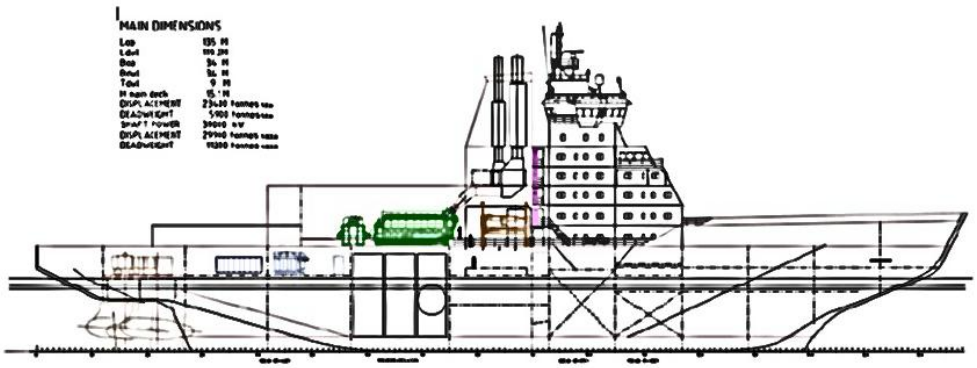
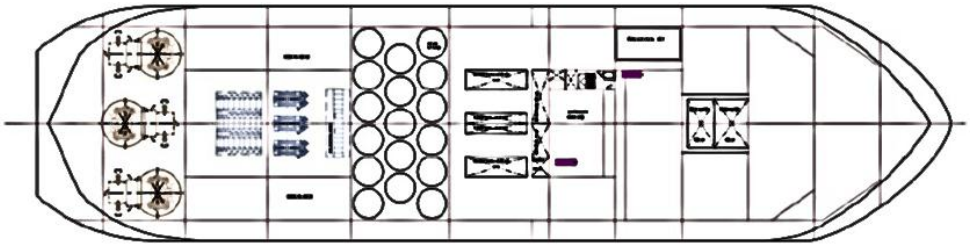


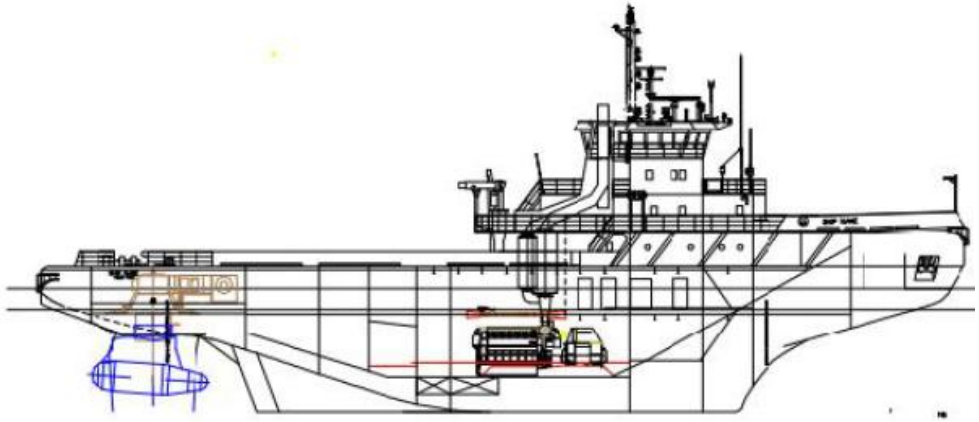
- Port construction in Sabetta is commenced in July 2012
- 1st stage: construction of the berths for offloading big-size LNG plant process modules. Ready by 2014 navigation
- 2nd stage: LNG and gas condensate loading jetty. Ready for first LNG in 2016, in 2018 the port will be operated over its full design capacity of ~18 mln tons

Port fleet

- **Port fleet: preliminary investigation by AARC**
  - 1 line ice breaker: 39MW
  - 1 port ice breaker: 13MW
  - 4 port tugs
- **Evaluating LNG fuelled propulsion:**
  - Gas mode operation in ice
  - Bunker tank technology and capacity
  - Bunkering station
- **Conceptual design exists. Project-specific design and specification will be available in 2012**







Shipping Arrangements

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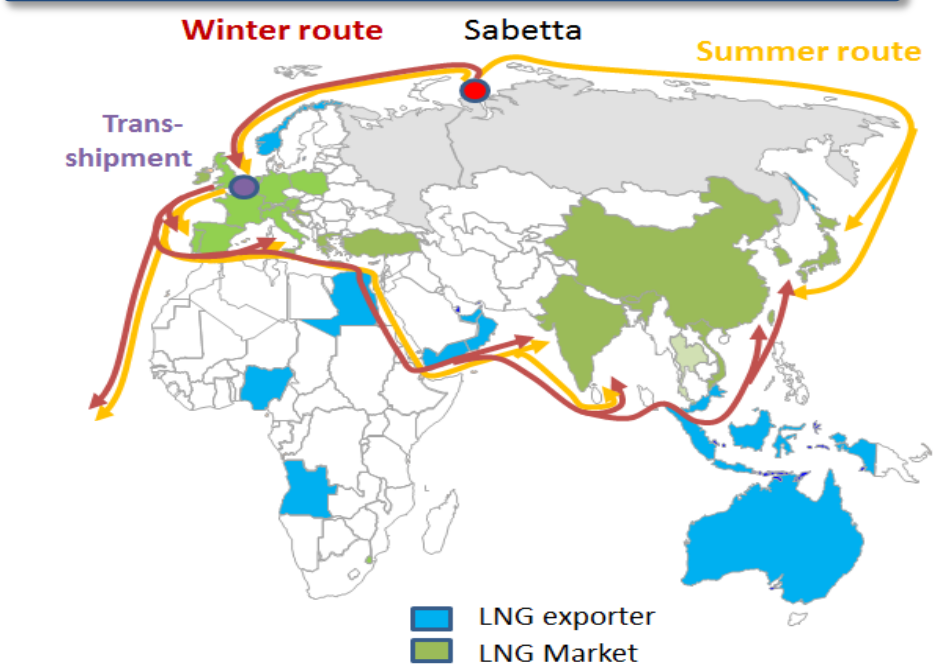
- **Shipping Solution**
  - Vessels sailing from Sabetta to markets on long term Time Charter contracts
  - Combination of dedicated ice class and conventional LNG vessels
  - Demonstrated navigability:
    - Western route: available all year-round
    - Northern Sea Route to Asia: available in summer (July to November)
- **ARC7 Ice Class ship (Russian classification) design**
  - Strong cooperation with the Russian research institute CNIIMF
  - Ship specification developed by Aker Arctic
  - Confirmation test of the ship model in HSVA (Hamburg)
  - 170,000 m^3 ship design feasibility validated in Ice Model tests
- **Contracting**
  - Pre-qualification of Shipowners and Shipyards for the ARC7 vessels achieved
  - Ice Class shipping:
    - Tender with Shipyards: September 2012
    - Tender with Shipowners: September 2012
    - Selection: by December 2012
    - Ice breaking contingent support solutions under studies with Atomflot

Indicative shipping routes



Shipping in Arctic waters
large scale NOVATEKs gas condensate cargoes

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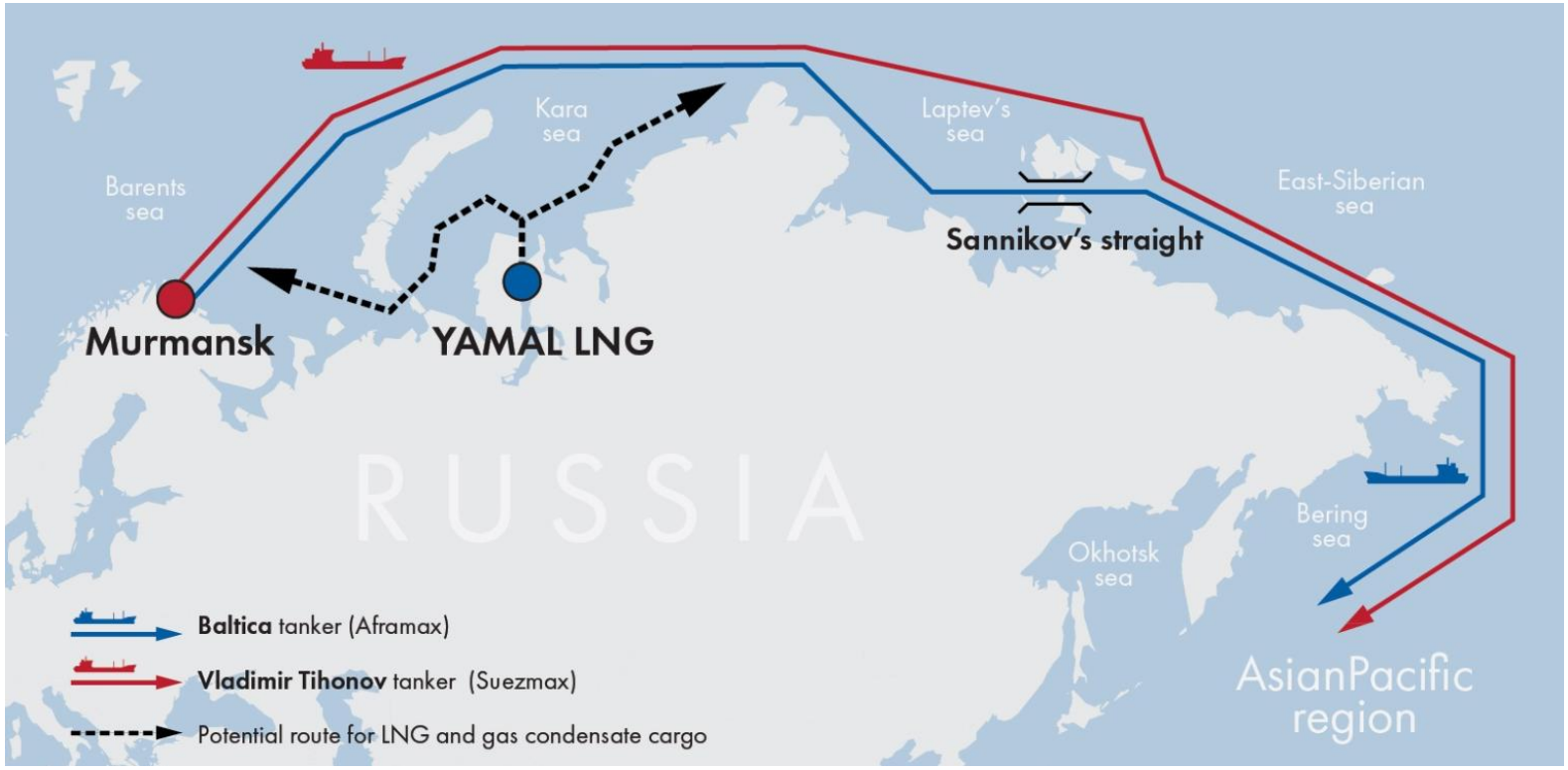
71 thousand tons – first large scale condensate shipment in August 2010 through Northern Sea Route on «Baltica» tanker

120 thousand tons of condensate in September 2011. «Vladimir Tikhonov» tanker sailed in 7 days, 14 knots through the North Sea Route:

- LOA 280.5 m, 50 m width, 16.5 m draft,
- Similar parameters as the designed arctic LNG carriers



Atomic icebreaker «50 let Pobedy» is providing assistance on ice passage to «Vladimir Tikhonov» tanker at NSR

The successful large scale cargo shipments of gas condensate through NSR in 2010-2012 have provided exclusive valuable information on the ice conditions and proven feasibility of utilizing this sea route to ship LNG and gas condensate to Asia

Project on the Move

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- **FEED completed.** It's being using as a basis for Russian proyekt documentation development. Design documentation package is submitted for State approvals. FEED optimization ongoing
- **Camp and infrastructure construction.** Power plant and power grid, utility networks, Living quarters, fuel storage, warehouses, airstrip
- **Early works**
  - Well pads, roads, LNG plant site backfilling,
  - MOF & RoRo construction
  - Procurement – piles and LLIs
- **3 exploration wells has been drilled. Field Development optimized** (19 well pads instead of 35)
- EPC tender ongoing. December 2012 – EPC contractor selection, detailed design and OBT start


Acting heliport


Living quarters construction on piles


Airstrip preliminary works


Running well


Construction camp


Berth reconstruction

Challenges and Solutions

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Main Challenges	Solutions
Site remoteness with limited access	• Minimizing work at site • Modularization • Delivery of modules mainly during summer season
Arctic conditions (permafrost)	• Construction on piles to isolate ground from equipments • Winterization considered design and execution plan
Drilling in Arctic conditions	• Winterized rigs and suitable mud/casing /drilling programs • Novatek experience in field exploration and development in Arctic conditions wells drilled in 2011
Complexity and interface management	• Best world practice (EPC contract) • Professional management team • Sponsors support and expertise
Shipping in Arctic conditions	• Ice-class ships developed by the leading industry players for Arctic conditions • Availability of Ice breaker support • Novatek experience: Northern Route recently tested

All technical aspects are known, with reliance on extensive studies, tested technologies and expertise in similar projects

Thank you for attention!