

## HOW TO SECURE THE PROJECT TIME SCHEDULE TAKEN INTO ACCOUNT THE EXTREME COLD WINTER CONDITIONS?

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### ABSTRACT

The Snøhvit LNG Project will be realised on the island of Melkoya, in the proximity of Hammerfest in Northern Norway. This area has specific ambient winter conditions, where the freezing temperature together with the high Northern wind, gives a wind chill factor up to - 45°C.

As such, outside works are become unfeasible from end of October until end of March.

The project for the storage ( 4 full containment storage tanks ) and send – out (3 different sets of loading arms ), of the liquefied natural gas products ( LNG , LPG and condensate ), was awarded to Tractebel Gas Engineering – Belgium SA on the 16<sup>th</sup> July , 2002, while the commissioning is scheduled for August to October 2005.

With respect for the extreme winter conditions, the project management decided:

- To optimise the outside works during the summer period.
- To create the possibility to work inside the tanks during the winter periods.
- To minimise the site erection works by prefabricating in Belgium the piping racks in modules.
- To integrate the equipment in skid modules
- To slip form erect the concrete walls at the storage tanks.

Weekly workshop meetings and monthly combined project review meetings are guiding the project to a common objective: completion of the project within time and budget.

## **Snøhvit Project Introduction**

The Snøhvit project embraces the first export facility for liquefied natural gas (LNG) in Norway and Europe. Huge volumes of gas deeps beneath the Barents Sea will be piped ashore, cooled down and shipped by special carrier to Spain and the USA. Shipment starts in 2006.

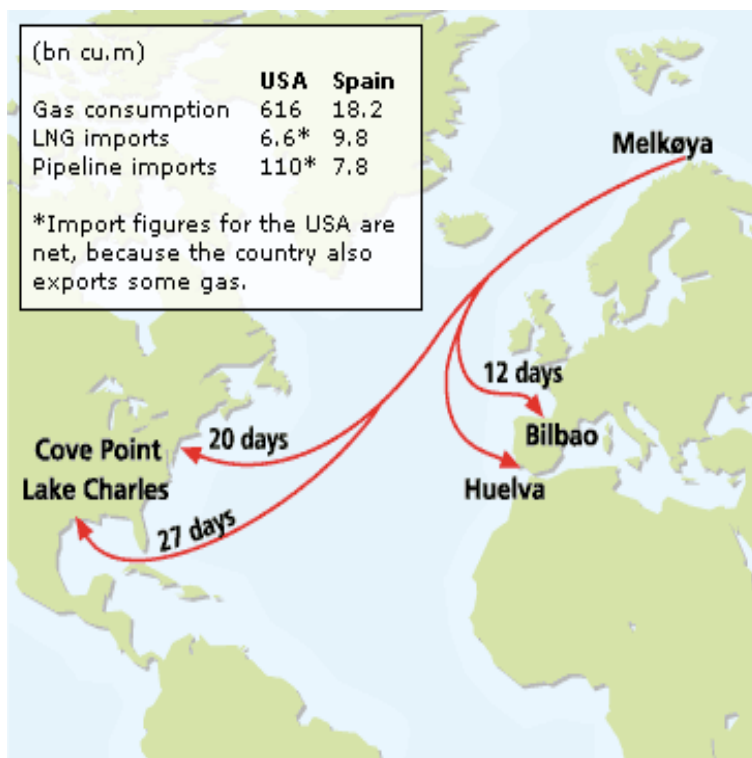
Snøhvit is the largest ever industrial project in northern Norway's Finnmark county, costing about NOK 45 billion overall. Costs associated with LNG ship construction come in addition.



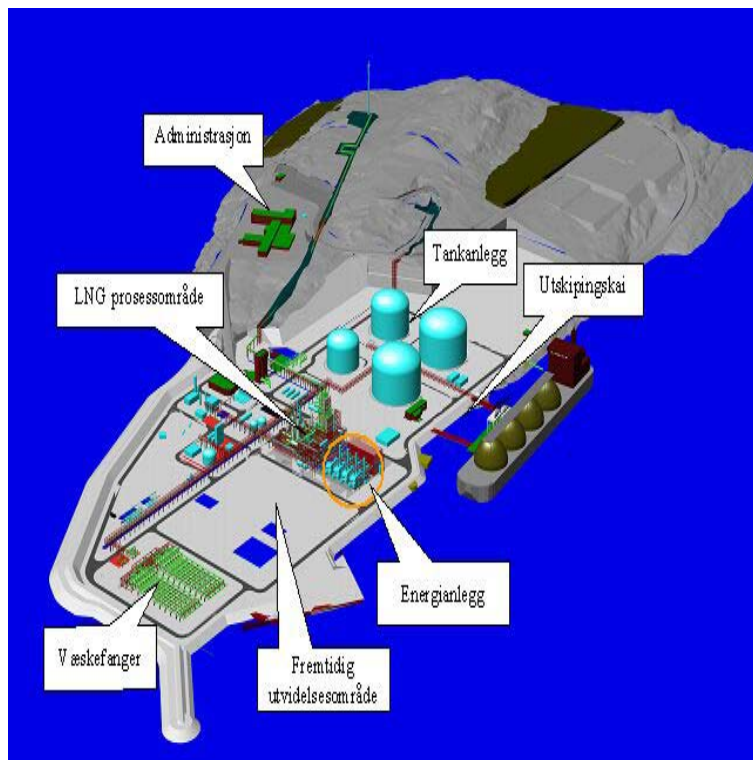
**Slide 1. Location north Norway**



Slide 2. Gas production system to export terminal



Slide 3. LNG export



**Slide 4. Overall arrangement**

### **Storage and Loading Project Presentation**

The project for the storage (4 full containment storage tanks) and send-out (3 different sets of loading arms), of the liquefied natural gas products (LNG, LPG and condensate), was awarded to Tractebel Gas Engineering – Belgium SA (TGE) on the 16<sup>th</sup> July, 2002 for the Consortium TGE, Fabricom and Entrepose.

The major items of the project are:

- 2 x 125.000 m<sup>3</sup> full containment LNG Tank.
- 75 000 m<sup>3</sup> condensate Tank.
- 45 000 m<sup>3</sup> LPG Tank.
- Jetty with 3 Loading Systems (1/product).
- Metering Systems.
- LNG HP – Send Out to Liquefaction Plant.
- LNG BOG Blower.
- External Flare and Incinerator.
- All interconnecting piping, electrical and instrumentation works.

LNG Export Terminal for Snøhvit License Group :

- **Operator :**

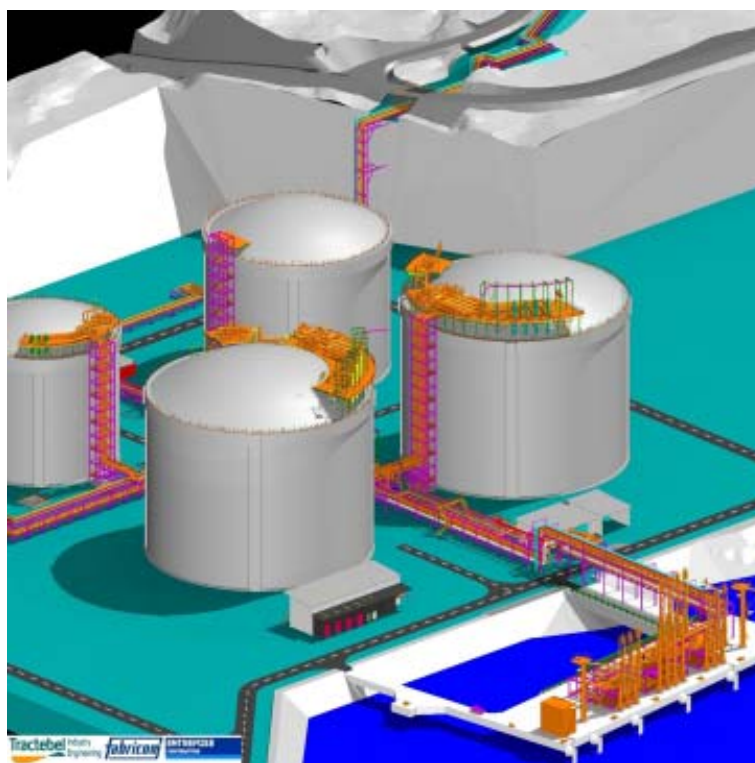
STATOIL for Snøhvit License Group

- **Contractor :**

Tractebel Gas Engineering Belgium SA for Consortium

Tractebel, Fabricom, Entrepouse (TFE)

**Slide 5. Project presentation**



**Slide 6: Project 3D model**



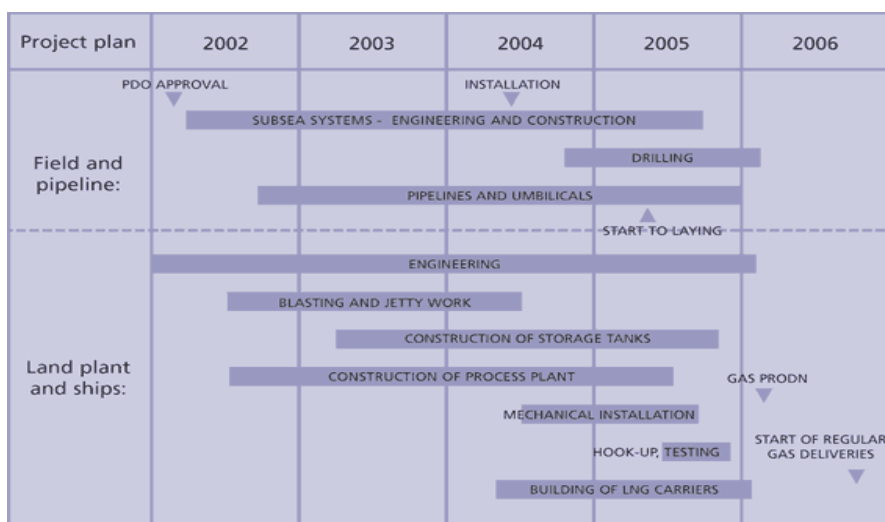
- 2 x 125. 000 m<sup>3</sup> LNG Tanks
- 75.000 m<sup>3</sup> Condensate Tank
- 45.000 m<sup>3</sup> LPG Tank
- Jetty with 3 Loading Systems
- Metering Systems
- LNG HP-Send Out to Plant
- LNG BOG Blower
- External Flare and Incinerator

**Slide 7. Main systems**

## Overall Snøhvit Project Schedule

The Engineering work for the Snøhvit project by Linde started early 2002. The Site preparation and blasting works on the Melkoya Island started mid 2002.

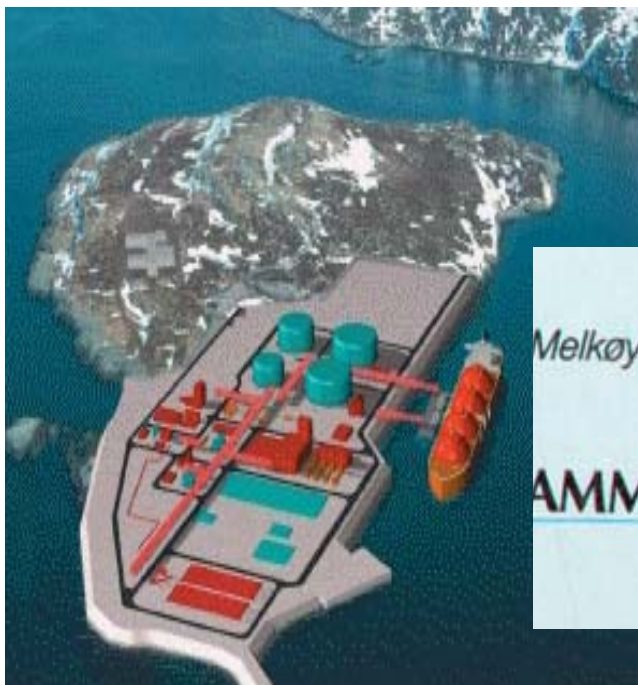
The Mechanical completion of the plant is scheduled for August 2005, followed by the commissioning activities, while the first gas production is planned early 2006.



Slide 8. Overall Schedule



Slide 9. Melkøya island location



Export Terminal



Slide 10. Export terminal

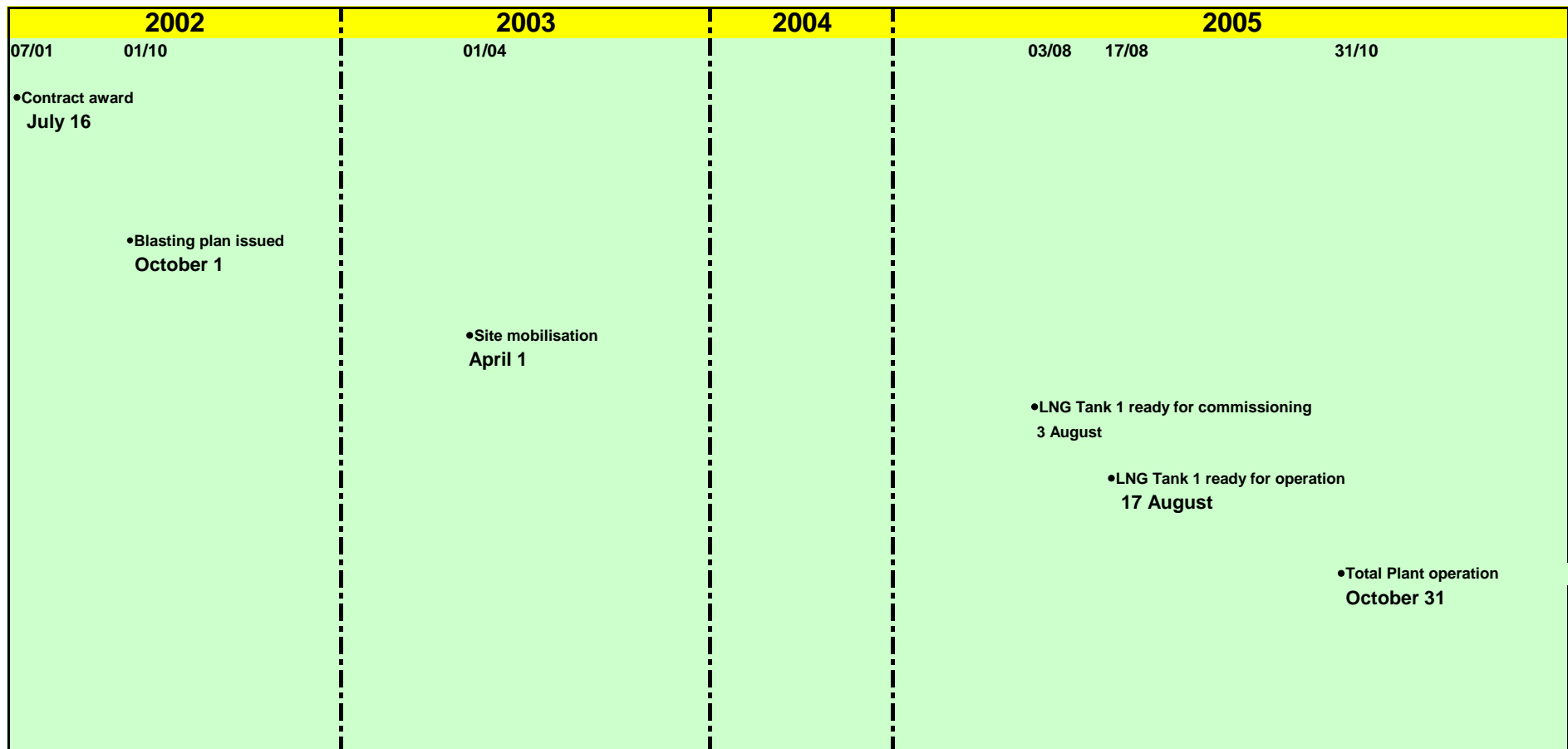


**Slide 11. Melkoya – April 2003**

### **Storage and Loading Project Schedule**

The Contract was awarded to TGE on July 16<sup>th</sup>, 2002.  
Specific key contractual dates of the contract are:

- Contract award: 16 July 2002.
- Blasting plans issued: 01 October 2002.
- Site mobilization: 01 April 2003.
- LNG tank 1 ready for commissioning: 03 August 2005.
- LNG tank 1 ready for operation: 17 August 2005.
- Plant fully ready for operation: 31 October 2005.



Slide 12: Project schedule key dates

## **HOW TO SECURE THE PROJECT SCHEDULE TAKEN INTO ACCOUNT THE EXTREME COLD WINTER CONDITIONS.**

The Snøhvit LNG Project will be realised on the island of Melkoya, in the proximity of Hammerfest in Northern Norway.

This area has specific ambient winter conditions, where the freezing temperatures of -5°C to -15°C and the high winds blowing from the North, with velocity up to 25m/s, gives a wind chill factor up to -45°C.

Snow drift around the installed construction areas creates an additional obstacle. As such, outside works are become unfeasible from end of October until end of March.

### **Constraints of Normal Construction Schedule.**

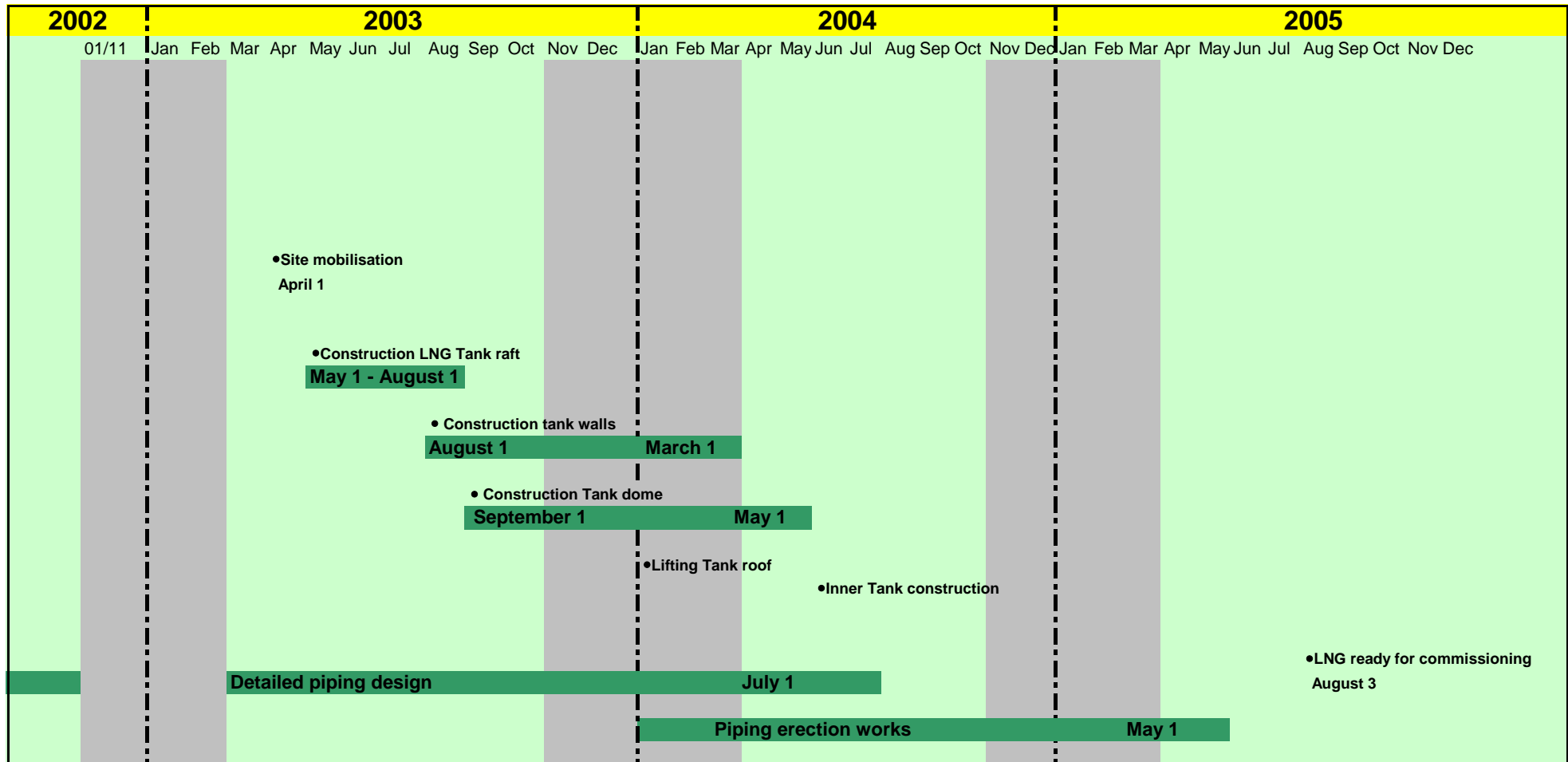
Within a normal construction schedule, it takes about 28 months between starting on site with the LNG Tank raft and the moment LNG Tank is ready for commissioning.

In other words, starting on April 1<sup>st</sup> 2003, leads to completion on August 1<sup>st</sup>, but:

- With working all over the year, even in winter time.
- Preparing the roofs during winter and lifting the roof in May 2004, within the high-winds season. (see slide 13).

Within a normal construction schedule, site piping erection works starts  $\pm$  18 months after contract award, with detail engineering isometrics completed 24 months after contract award.

This involves starting erection works in January 2004, in full winter period, and complete the piping works during the winter period of 2005.



Slide 13: Normal LNG - project schedule key dates

The same applies for the erection of electrical and instrumentation works, where the activities could start on February 2004 but for quality reasons would be interrupted during the winter period in 2004 and 2005.

### **Specific Snøhvit Project Construction Schedule.**

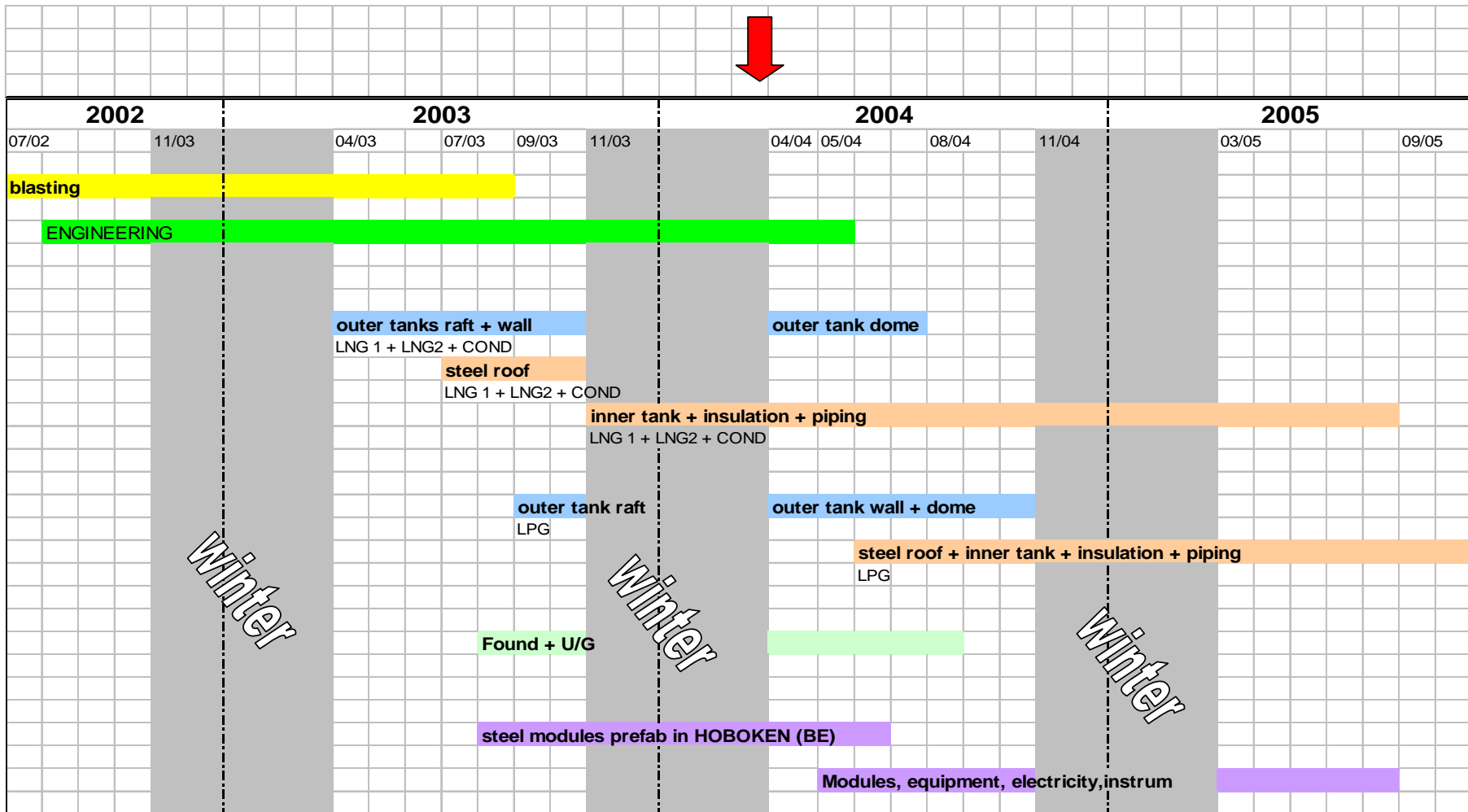
With respect for the extreme winter conditions, the project management decided:

- To minimise the construction works at site.
- To optimise the outside works during the summer period (April - October).
- To slip form and erect the concrete walls of the storage tanks,
- To prefabricate, transport and install the tank roofs in summer period, in order to create workable conditions for inside works in the tanks during winter period.
- To minimise the site erection works by prefabricating in Belgium the piping racks in Belgium.
- To integrate the equipment in skid modules.

In order to meet the project time schedule including the intermediate contractual milestones following specific measure were taken:

- Blasting of the island and site clearance (under Client control) from July, 2002, until end of March 2003).
- Site mobilisation on April 1<sup>st</sup>, 2003.
- Fast track detailed design performed in 12 months in order to start site activities for the tanks and prefabrication works. (modélisation of pipe racks and equipment ships).
- Accelerate the procurement activities for the bulk material (piping, insulation, electrical heat tracing, instrumentation) in order to meet the production schedule of the modules.
- Realization of concrete works. (foundation and wall) for 3 tanks plus steel roofs before the winter period of 2003 -2004.
- Begin inside tank works for the metallic part during the winter period 2003-2004.
- Start prefabrication of piping skids in 2003, in order to have a first shipping campaign to site in spring 2004.
- Install all piping and equipment skids before the winter of 2004.
- Precommissioning and mechanical complete the plant in spring 2005.
- The LNG tanks hydro tested in June 2005.
- Plant fully commissioned in October 2005.

Those specific Snøhvit aspects were leading to an overall project as presented in slide 14.



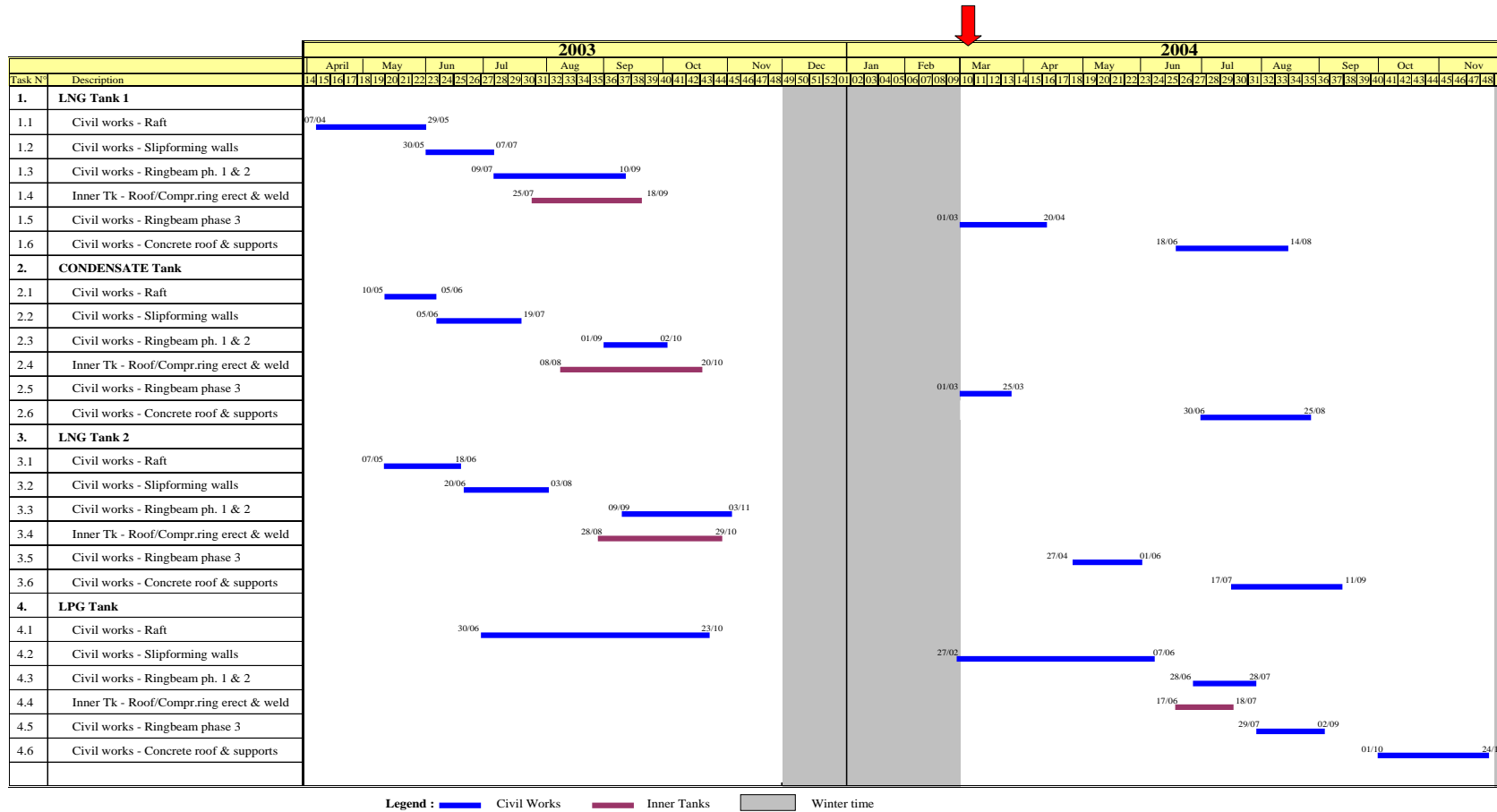
Slide 14. Snøhvit specific aspects

### **Actual Project Status**

Before the winter of 2003 TGE realised the following activities on site:

- Closure of 3 tanks, (2 LNG/ 1 condensate) by end of October 2003.
- Raft erection of 4<sup>th</sup> tank (LPG)
- Concrete foundations for 25 % of piping modules.

Slide 15 is presenting the actual project schedule for the tanks, realized and scheduled for 2004.



Slide 15. Snøhvit project construction schedule for the tanks



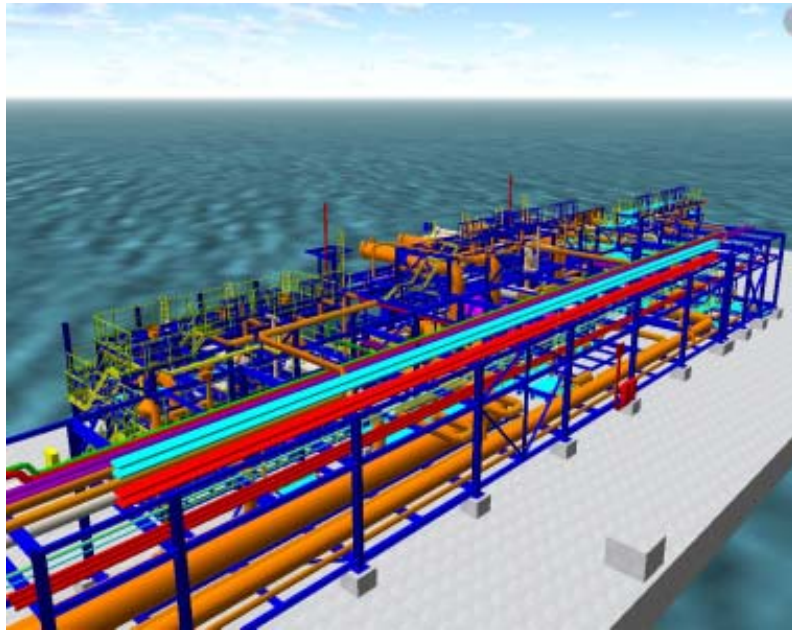
**Slide 16. Tanks completed**

Today, TGE has achieved already a 30 % progress on the inside works of the LNG tanks and 45 % on the condensate tanks.

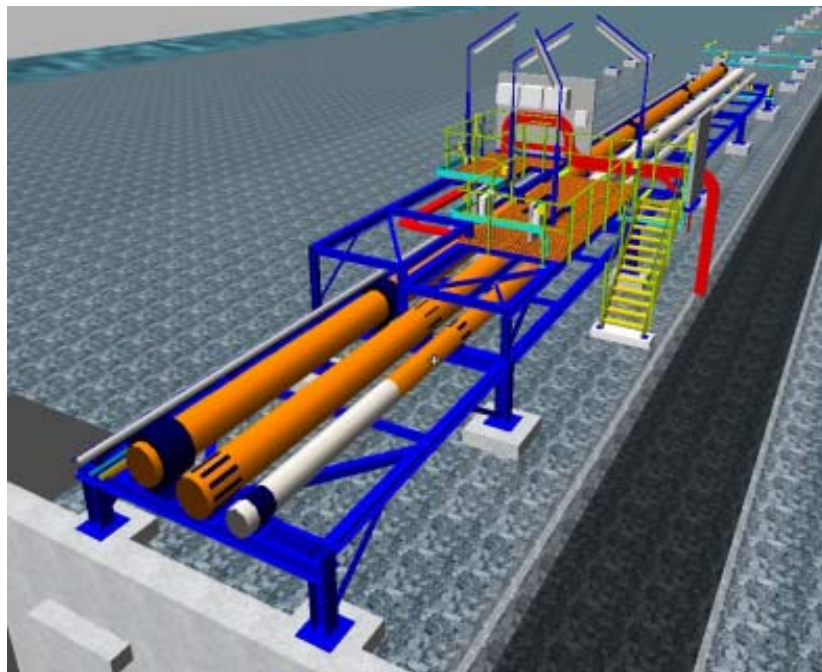
Foundations works for the remaining piping modules will start on April 1<sup>st</sup>. Outer tanks concreting works for the LPG will start April 15<sup>th</sup> in order to have the dome installed by July 2004.

First campaign with 20 modules is ready for shipment and site erection works will start by end of June.

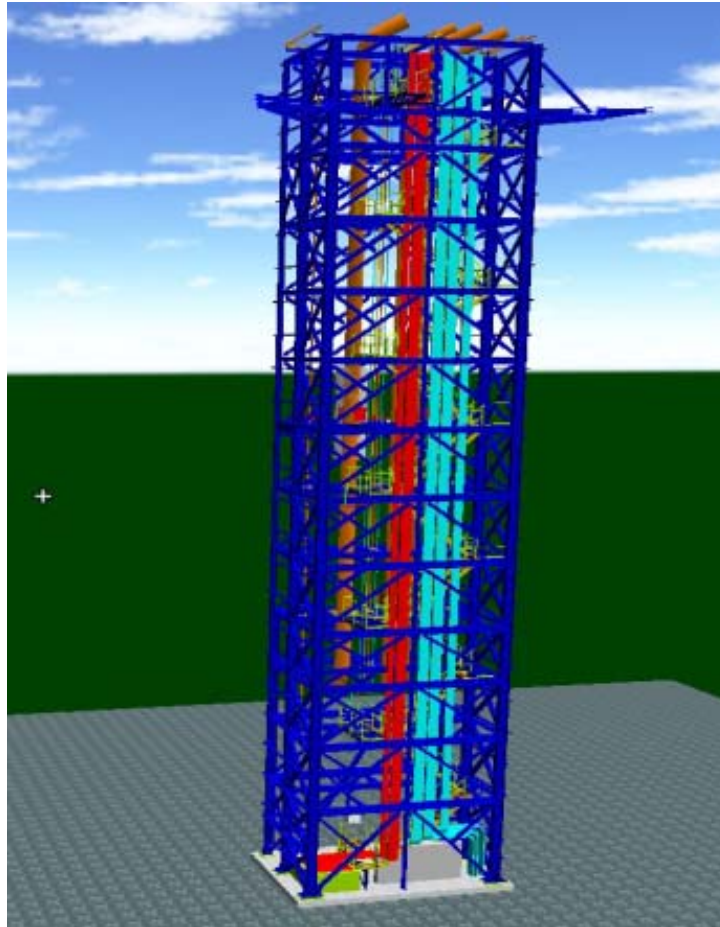
TGE refers to attached pictures of the piping modules which are finalised and ready for shipment.



**Slide 17. Jetty Module**



**Slide 18. Pipe Rack Module**



**Slide 19. Stair Tower**

## **CONCLUSION**

Taking into account this specific ambient weather conditions and having in mind that the Snøhvit project is a fast track project the only way to achieve the project schedule was to address a specific execution plan regarding tank construction and site erection works.

The decision taken by Contractor during the bidding stage to proceed in this way was facilitating the Contractor to mobilize the project team and structure immediately after contract award.

## **Acknowledgments**

The Client, fully supporting the effort to meet the target deadline, integrating his project team into Contractor's office task force during the engineering phase, and is today integrated within Contractors fabrication workshops offices of the modules in order to anticipate on all potential quality, interfaces and timing aspects.

Weekly workshops meeting and monthly combined project review meets where and when guiding the project to a common objective: completion of the project within time and budget.