



Dunkerque LNG terminal

**Innovation and adaptability as main levers
for a "on safety, on time, on budget"
project**

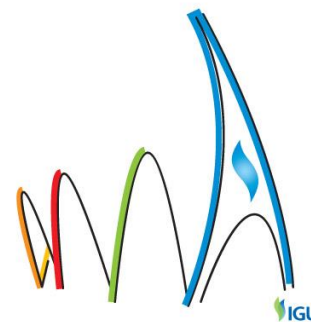


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Background

In June 2011, the shareholders of DUNKERQUE LNG (EDF 65%, Fluxys 25% and Total 10%) decided to finance and construct the Dunkirk Liquefied Natural Gas (LNG) terminal, located North of France, thus realising an ambition dating back to 2006.

DUNKERQUE LNG entrusted the construction works as “turn-key” contracts to three separate contractors:

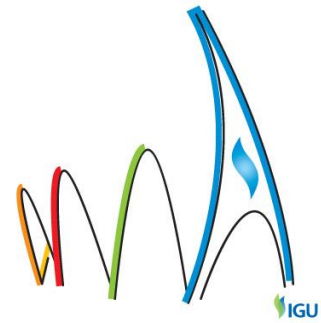
- one to build the 5 kilometres tunnel to recover the warm water from the Gravelines nuclear power station (saving 436,000 tonnes of CO₂ per annum),
- another for the erection of three gasholders, 190,000 m³ each,
- with the last and main contractor in charge of constructing the process facilities and the jetty.

This 1,2 billion euros facility, will have a capacity of 10 mt LNG (13 billion m³ of gas) per year. By the end of 2015, it shall start its commercial operations and will be able to accommodate tankers with LNG capacities ranging from 65,000 to 267,000 m³.

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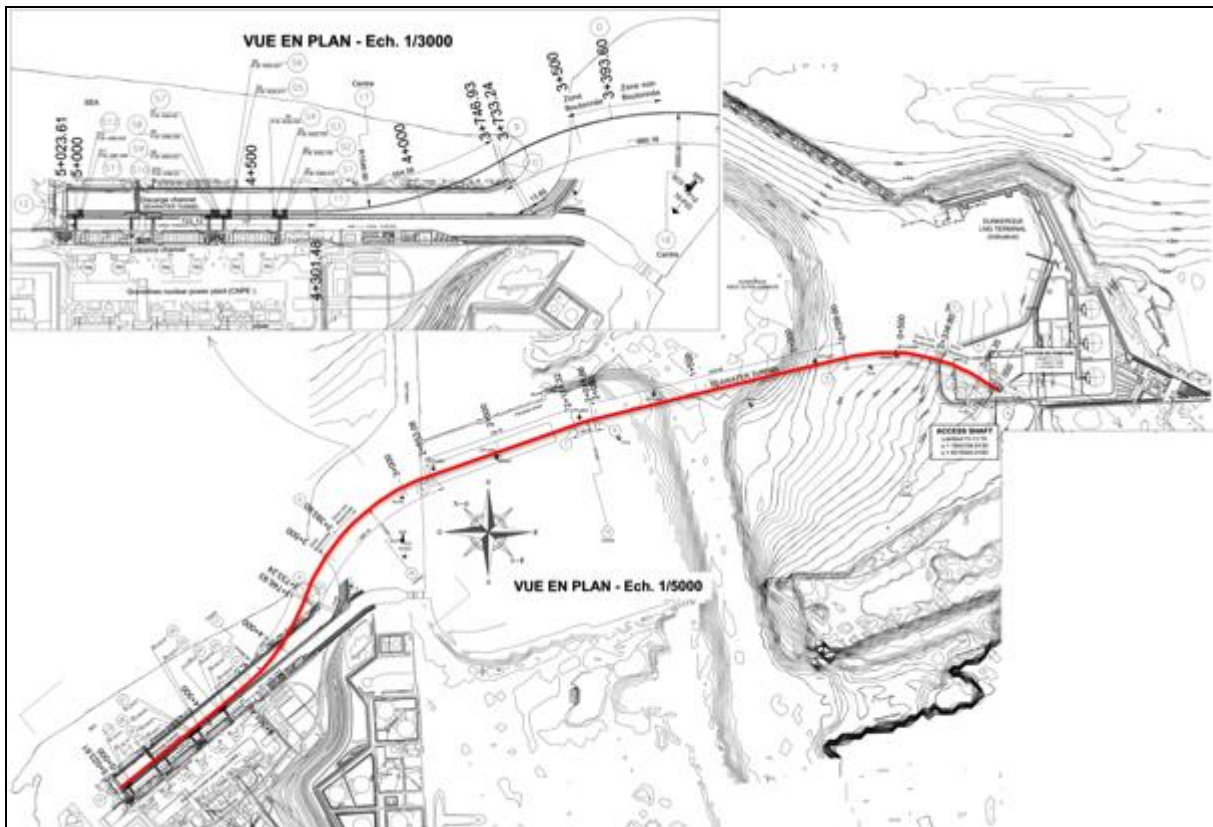
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The plot of the plant is 53 hectares (20 hectares gained on the sea) with two unique specificities:

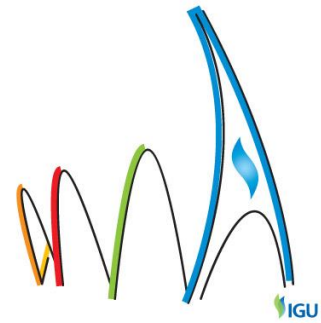
- A twin connection to both French and Belgium gas networks
- And a 5 km subsea tunnel linking the terminal to the nuclear plant of Gravelines (the red line on the picture below)



During the feasibility studies, the project already had to be adapted in order to take into account a certain number of constraints such as those induced by the safety aspects or necessary to avoid, reduce or compensate environmental impact.

During the building phase, new regulatory, technical and other requirements surfaced, requiring greater responsiveness from the organisations involved in the project.

To date, the project is "on time" and "on budget".



Aim

The presentation will endeavour to list examples of responses brought by the project to hazards of diverse natures that arose, so far, during the different phases of the project:

- *Tackling with new environmental measures following the public debate;*
- *Implementing new HSE criteria that apply to such projects in France following the industrial accident of AZF (Toulouse) in 2001;*
- *Leveraging on the organisation to maintain high HSE standards;*
- *"On time, on budget": what management practice beyond the words?*
- *What if the tunnel-boring machine went broken?...*
- *Responding to social requests;*
- *And beyond project management...*

Tackling with new environmental measures following the public debate

To satisfy the conclusions of the public debate that took place in 2007 and respond to the obligations linked to the operating permit granted in April 2010 the project fully incorporated the preservation of habitats of protected animals and plant species.

It turned out that after having selected the site, the ground of the terminal's facilities was hardly usual with regard to industry practices. It was also in this context that a certain number of environmental support measures (70 hectares converted) were decided leading the project towards subjects far from the initial requirements.

The most important environment measure was the modification of the ground plane of the project to protect birds called « *Sterne naine* » and the beach where they make their nest. **An extended platform of 20 hectares was then necessary to be gained on the sea on the opposite of that beach.**

Initial ground plane (photo)



Modified ground plane (photo)



Implementing new HSE criteria that apply to such projects in France following the industrial accident of AZF (Toulouse) in 2001

The Dunkirk LNG terminal was the first plant to need an authorisation under the *then* new 2005 law for highest standards of SEVESO criteria plant in order to respond to the renewed requirements of the hazard assessment studies.

Those requirements resulted from an analysis of the major industrial accident that occurred in 2001 in Toulouse in a company called AZF. Several innovations had to be planned.

Among those implemented and put into practice, the most representatives concerned:

- The network for the collection of the LNG that would come from **any accidental loss of confinement** (including a massive leak),
- The roof of the tanks, **which are frangible to high pressures**,
- And the collect of **all the valves directly to the flare**.

In the same time some classical disposals are installed like a reliable detection system distributed over the site, associated with a drastic reduction in the risks of uncontrolled release of gas, as well as an automatic principle of securing the facilities resting on independent systems, progressive actions following a division by geographical and functional zones.

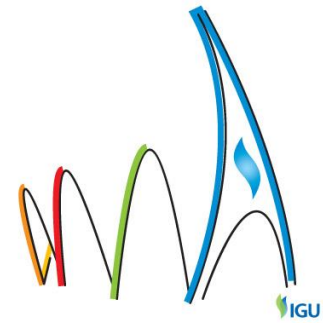
Leveraging on the organisation to maintain high HSE standards

The HSE policy of Dunkerque LNG, which soon emerged from the engineering phase, has been the subject of rigorous specifications. The contractual obligations made to the participants have focused on a number of aspects of the site's organisation, the second largest industrial site in France behind that of EPR (nuke) in Flamanville.

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The HSE contractual obligations are:

- Commitment on resources: 1 HSE supervisor for 50 workers
- Certification obligation: MASE or OHSAS or equivalent
- A bonus / malus incentive scheme for safety results

In addition:

- Managerial commitment with a safety charter shared by the owner and all the contractors and the use of a safety standard including penalties against offenders
- A specific organization is deployed with HSE committee and HSE Lead (team)
- Extended communication with campaigns taking into accounts the need of the workers using different supports (flyers, safety days...) and main languages spoken on site.

However, despite the requirements shared from the consultation phase with all partners and players, the project has faced two types of adverse events. Firstly, diffuse but repeated events altering indicators, **but also more serious or potentially fatal accidents.**

Faced with this, new organisational responses were provided, intended to correct the shortcomings in the best way and thus preserve the integrity of the participants. **Specific HSE committee in front of Dunkerque LNG with the contractors were organized when any "high potential gravity" situation occurred**, to explain what happened and decide the followings so as to avoid repetition. This organisation was supplemented by an adapted and innovative communication in the field, particularly through an **analysis by a sociologist to define the needs expressed by the workers and taking into account their diversity**, in the view of a second communication campaign.

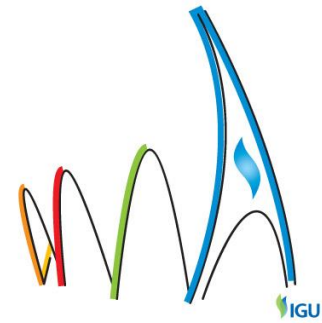
1st communication campaign...scary message



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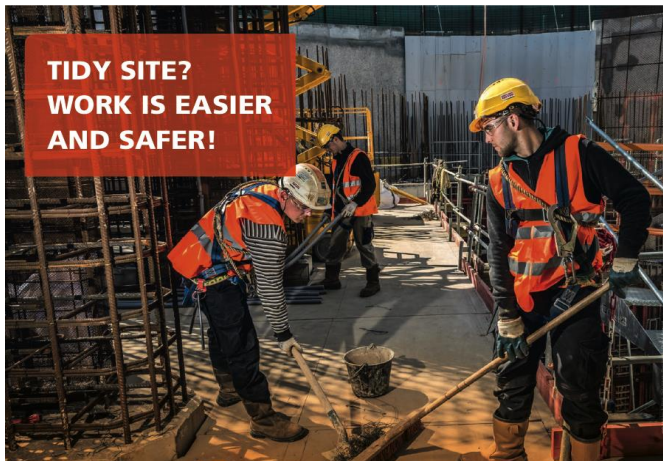
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2nd communication campaign, following the survey lead by a sociologist: "count on me..."



Dunkerque LNG
GROUPE EDF

SAFETY FIRST



COUNT ON ME,
I'M RELYING ON YOU

cofiva ingénierie GAZ-OPALE ENS LNG
ENTREPRISE BOSSAC HAZEL-HEC SOLUTIONS BACHY

"On time, on budget": what management practice beyond the words?

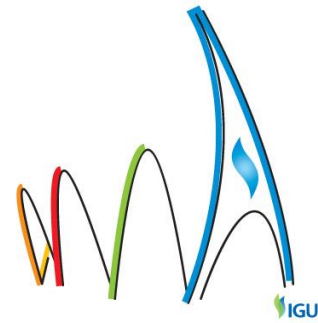
Since the beginning of the project the motto was and still is: *be safe, on time, on budget*.

To achieve this goal, a lot of requirements were applied for safety. But in the same time, to be *on time* and *on budget* requires a strong *timeboxing* practice, a dedicated margin budgeting and a creative contract management.

The parties (owner & contractors) have to maintain a joint interest in carrying on the construction instead of calling for arbitration when first difficulties appear. In addition to the initial contracts with their incentive milestones included, one of the most important levers appears to be the creative use of part of the budgeted contingencies. The principle is to allocate them to solve past issues and create new milestones in the project. Doing so, the project is able to confirm a start date by the end of this year.

Though interfaces between the 3 EPC were quite well defined in the contracts, their day-to-day management appears to be critical and one of the main risk for the owner. The owner organization has to permanently adapt to the organisation of the 3 EPC contractors and coordinate depending on the different phases of project: design studies, civil works, mechanical, commissioning, ...

To reach these goals, a strong reporting on the planning and the financial margins is established and up-dated by the project team. Then optimizations can be proposed so as to make sure that at the end of the day the parties are aligned on dates.



What if the tunnel-boring machine went broken?

The project has so far encountered several unforeseeable events in its attainment. The most significant relates to the breakdown of the tunnel-boring machine (TBM) below the sea...

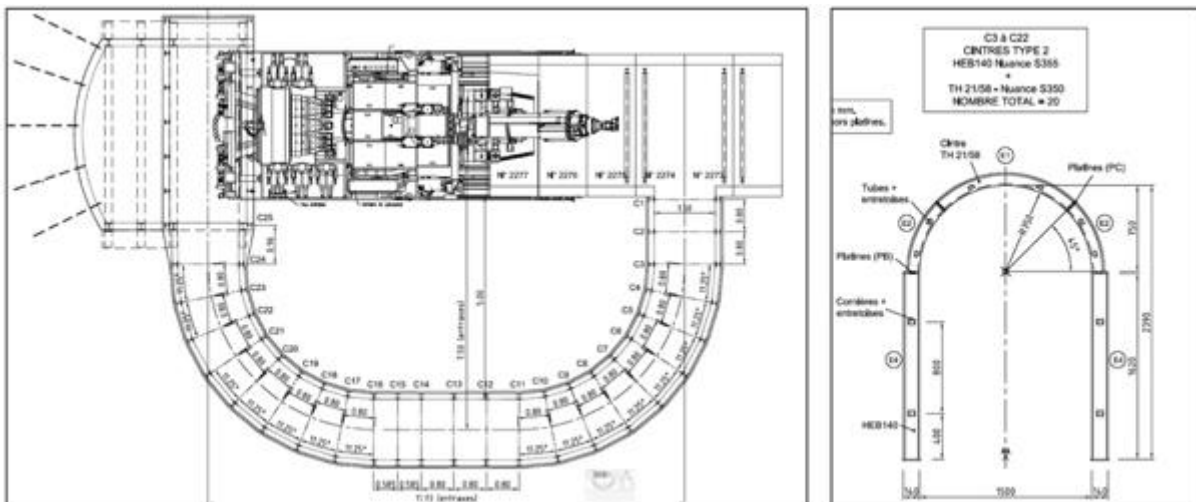
In fact, the project includes a tunnel 5 km in length and 3 metres in diameter in the layer of clay situated at a depth of around fifty metres below sea level. This tunnel is intended to flow warm water from the nuclear plant of Gravelines to the LNG terminal.

After nearly three kilometres of digging without a mishap the machine suffered a major damage requiring repairs that were both specific and exceptional, considering the situation of the TBM...below the sea...

However, whereas the probability of occurrence of this risk had always been considered as very low, this equipment failure was made used of to study alternative solutions for the supply of warm water needed by the terminal and compliant with the commissioning schedule.

At the end of the day, the breakdown occurred on the 29th of April 2014 and no later than the 4th of November 2014 the tunnel-boring machine was back into action. Adapting interfaces between contractors mitigated the impact on global planning.

Scheme of the lateral tunnel built to reach and repair the head of the TBM



Moreover, an alternative solution defined as "A plan" as an alternative to the basic solution is always maintained alive and ready to be launched.

The key factor in managing this adverse event was twofold:

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- **Maintaining the interest of the contractor into repairing** the machine and leading the works to a positive end, this meaning releasing some planning contractual penalties and contributing through a financial support;
- **Working on a credible and robust alternate** to the basic solution, to avoid being trapped...

Workers in front of the TBM preparing their intervention



Responding to social requests:

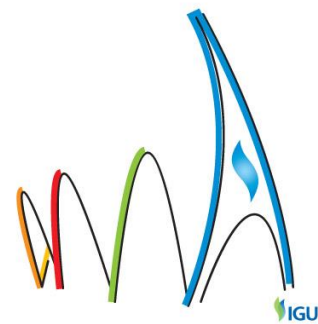
Among the setbacks to a rigorous schedule, we should also relate the subject of employment. At first, Dunkerque LNG decided to:

- Introduce social clauses favouring the employment of local unemployed workers from the very start of the project: more than 1,200 work contracts have been signed with local unemployed people;
- And recruit women for technical jobs: e.g. 50% of the patrollers recruited by the future operator, with a specific program looking on the capabilities more than on the diploma.

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Rapidly, the project owner and all the stakeholders around him, particularly local ones, strongly expressed their concern that the construction phase of the terminal could support local employment in a more prominent way.

Despite a voluntary initiative bringing together on the site employment offices and contractors but also local manufacturers and contractors, which generated activity, this objective was partially achieved, considering the adverse economic context witnessed in France and within Europe since 2011. In fact, at the height of the construction activity, up to two thirds of the workers on site come from European countries other than France, namely Italy, Portugal and Romania.

While such a high proportion of European workers is satisfying in itself as a contribution to European integration, and quite legitimate considering Dunkerque LNG as a European market player, **this situation has given rise to various demonstrations (by unions or through the media) leading to new social measures by the owner** (e.g.: job contracts for 50 young people aged under 26 undergoing training with all of the partners).

Worker on site



Above all, the project owner and its contractors and sub-contractors show a **constant commitment to fully comply with European and French laws and ensure equal work conditions for all workers**, helped by the strong scrutiny of local and national authorities.

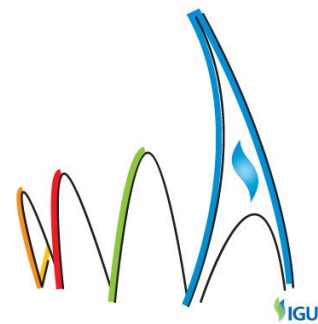
Beyond project management...

It is necessary to consider the real feed back of the project on the territory to ensure a positive impact, whether social, economic or industrial. An agreement, named "*local anchorage*", was entered in with local authorities in 2014 to support the chamber of

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commerce and industry into helping small local companies to win contracts in the oil and gas sector in France and in Europe: adapt to European "call for tenders" rules, practice of English, specificities of oil and gas industrial markets: HSE requirements, industrial organisation...

As part of the project's support measures, it had been initially planned to use the presence of the terminal to develop a cooling circuit thus offering a possible synergy between industrial neighbouring sites, as can be seen in Japan.

Although this did not result in a technical design, the willingness to develop activities relating to cooling and cryogenics has given rise to the **Innocold® association** which, under the aegis of the local community, brings together manufacturers and scientists to undertake research projects related to cooling and by doing so, shedding light at the regional level on the contribution of terminal to the local economy.

Today there are 8 research projects amounting to 4 million euros including subsidies with 11 researchers mobilised to work on them and new professional studies including an option in « industrial cold » taught at the *Université du Littoral*.

Conclusions

This memo aims to illustrate, through the experience of a large-scale industrial operation, the necessity for flexibility in its organisation that allows for innovation.

However, responsiveness and imagination cannot alone constitute effective adaptation without a constant understanding of project management requirements, keeping such requirements continuously renewed to guarantee the completion schedule and ensure effective cost control.

This is how a balance must be maintained between on the one hand the formalism essential to the rigour of a project of such a size and on the other hand the flexibility required by the internal players for effective adaptation to the day-to-day life of the project.

References

Speaker: Marc GIRARD

Job title: President

Company: Dunkerque LNG

Country: France