CONSORZIO LaMMA

Laboratorio di monitoraggio e modellistica ambientale per lo sviluppo sostenibile
(L.R. n. 39 del 17 luglio 2009)

DECRETO

n. 22 del 18/04/2023

Attività di committenza esterna: sviluppo e la manutenzione di un servizio di previsione meteo-marina dedicato nell'area del terminale FSRU (Floating Storage and Rigasification Unit) di Piombino.

Committente: Golar Trading Corporation.

Responsabile dello svolgimento della prestazione: dott. Claudio Tei.

Corrispettivo: € 14.400 oltre IVA.

Avvio delle prestazioni: 04.04.2023.

Termine: 03/12/2023. E' prevista la possibilità di rinnovo.

All. A : Offerta Tecnico-economica

L'AMMINISTRATORE UNICO

- Vista la L.R. n. 35 del 23.02.2005 che ha disposto la costituzione del Consorzio LAMMA "Laboratorio di Monitoraggio e Modellistica ambientale per lo sviluppo sostenibile", avente come soci fondatori la Regione Toscana, il Consiglio Nazionale delle Ricerche (C.N.R.) e la Fondazione per la Meteorologia Applicata (FMA);

- Vista la L.R. n°. 39 del 17 luglio 2009 recante la nuova disciplina del Consorzio LAMMA;

- Vista la Convenzione del Consorzio LAMMA approvata dall'assemblea straordinaria dei soci del 26 maggio 2010 con verbale redatto dal notaio dott. Mario Piccinini il 26 maggio 2010, rep. n. 62.549 fasc. 27.188 e successiva modifica;

- Visto lo Statuto del Consorzio LAMMA, approvato dall'assemblea straordinaria dei soci straordinaria del 26 maggio 2010 con verbale redatto dal notaio dott. Mario Piccinini il 26 maggio 2010, rep. n. 62.549 fasc. 27.188 e successiva modifica;

- Visti il verbale dell'assemblea dei Soci del 4 marzo 2021 e il decreto del Presidente della Giunta Regionale della Toscana n. 42 del 19.02.2021 relativi alla nomina del dott. Bernardo Gozzini quale Amministratore Unico del Consorzio LAMMA;

Considerata la possibilità per il LaMMA di svolgere attività in favore di soggetti terzi non consorziati;

- Vista l'Offerta tecnico- economica predisposta dal dott. Claudio Tei;

Dato atto che:

- esistono presso l'Ente adeguate competenze specifiche per lo svolgimento delle prestazioni richieste dal Committente;
- l'attività oggetto del presente contratto non comporterà alcun pregiudizio allo svolgimento delle normali attività dell'Ente;
- detta attività risulta compatibile, nei modi e nella misura, con i fini istituzionali del LaMMA;

Tutto quanto sopra premesso

D E C R E T A

1. che la premessa costituisce parte integrante, motivante e sostanziale del presente dispositivo;
2. di approvare l'offerta tecnico-economica predisposta dal dott. Claudio Tei, quale parte integrante e sostanziale del presente decreto (All. A) nella quale è descritta la prestazione in capo al LaMMA;
3. che in virtù delle prestazioni relative allo sviluppo e la manutenzione di un servizio di previsione meteo-marina dedicato nell'area del terminale FSRU (Floating Storage and Rigasification Unit) di Piombino, il Committente corrisponderà al LaMMA l'importo di € 14.400 oltre IVA;
4. di dare atto che le prestazioni hanno preso avvio in data 04.04.2023 e termineranno il 03.12.2023;
5. di provvedere a tutti gli atti necessari e conseguenti al presente decreto.

Bernardo Gozzini
Amministratore Unico
documento firmato elettronicamente

TECHNICAL-ECONOMIC OFFER

FOR THE SUPPLY OF METEO-MARINE FORECAST DATA TO SUPPORT THE MANAGEMENT OF THE FSRU IN PIOMBINO

CONSORZIO LaMMA

1. Generalities

This proposal describes the development and maintenance of a dedicated meteo-marine forecast service for GOLAR LNG, in the area of the FSRU (Floating Storage and Regasification Unit) terminal in Piombino.

This proposal stems from the experience gained at the LAMMA Consortium in the development of meteo-marine products to support activities of civil and industrial interest. In particular, through its CNR partner, LAMMA has contributed, since 2012, to the dedicated meteo-marine forecast service for LNG Offshore Toscana (OLT), in the area of the Leghorn regasification terminal. This latter meteomarine service was developed in several phases, relating to the construction of the modelling and data supply system infrastructure, the calibration and validation of the models, and finally the start-up of the operational phase, including continuous data quality control.

LAMMA also operates other marine weather forecasting services to support offshore or near-port activities.

In carrying out these activities, users expressed the need for:

- A data supply system that is as robust as possible and continuous over time (limiting as much as possible the situations of no forecast data)

- To have a fairly long forecast window (even > 5 days) with acceptable forecast release times

- Have more consistent outputs between large-scale and local-scale models

- Reduce forecast uncertainty further and improve data quality as far as possible

In discussions with SNAM, interest also emerged in the application of specific port-scale models for the study of in-port agitation conditions forced by the larger-scale forecast models.

2. Weather and sea forecast data provision service

The service will be realised through the provision of weather and sea forecasts up to 5 days with updates 2 times/day. The forecasts will mainly concern wind and waves, for the entire period of interest, and it will be limited to the nearshore field outside the port of Piombino. It will be possible to highlight the exceeding of the threshold levels defined by the Customer, which may also be subject to modification according to the Customer's requirements. Optionally, a detailed forecast of the circulation (currents) in the area of interest may also be provided (not quotated in this offer).

The forecast will cover various scales, so as to include not only the coastal scale of interest (outside the Piombino port), but also neighbouring areas, as well as weather and sea conditions for navigation in the wider area (Tyrrhenian and Ligurian Sea).

The areas in which the meteo-marine parameters of interest will be mapped will be agreed with the customer, similarly to what happened with the forecast service for OLT, where the areas were defined on the basis of specific agreed requirements.

The features of the service are described below.

2.1 Operational chains used for meteo-marine data generation

The LaMMA Consortium has been operating marine weather models since 1997 with proprietary calculation clusters.
The models used in the operational forecast runs, which are active at the LaMMA Consortium, are currently: the WRF model and the MOLOCH model (for atmosphere, hence wind) and the WaveWatch III model (WW3, for waves). The initialisation and boundary conditions for the atmospheric model come from the American global model GFS and the IFS model of the European centre (ECMWF).
The marine weather forecasting system consists of two independent modelling chains, based on ECMWF and GFS data respectively, in order to have redundancy and avoid missing forecasts in case one of the two datasets is not available.

The model chains are as follows (see also attached images).

Atmospheric models:
1) ECMWF global forecast (~25 km), integrated with the high resolution ECMWF forecast (~9 km) over the whole Mediterranean Sea, and again integrated with a high resolution (~3 km) reduced domain WRF model nested onto the ECMWF forecast (~9km). If available, the 9-km ECMWF forecast can be used over the whole area.

2) BOLAM model over a domain that includes the entire Mediterranean Sea (~7 km resolution), combined with a high resolution (~2.5 km) reduced-domain MOLOCH model, both nested onto the GFS forecast (~25 km

Wave motion model (for both chains):

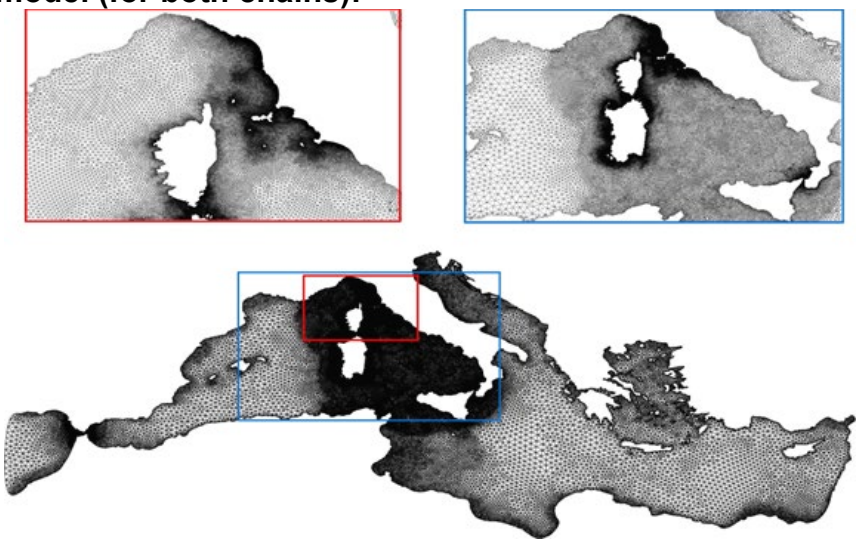

Figure 1 Structure of the unstructured mesh calculation grids used wave prediction model.

The computational domain extension of the WW3 wave model includes the entire Mediterranean basin and an area 150 km west of the Strait of Gibraltar. This domain has been discretized with an unstructured mesh and a variable resolution up to 500 m along the coasts of the north-western Mediterranean Sea. The highest coastal resolution is dedicated to the coasts of Tuscany and the Tuscan Archipelago, of the dangerous areas (straits and channels, including that of Piombino). This model resolution allows detailed forecasting over the entire marine area of interest for the port of Piombino.

The data produced can also be used as a forcing for specific port-scale models, if of interest to the client.

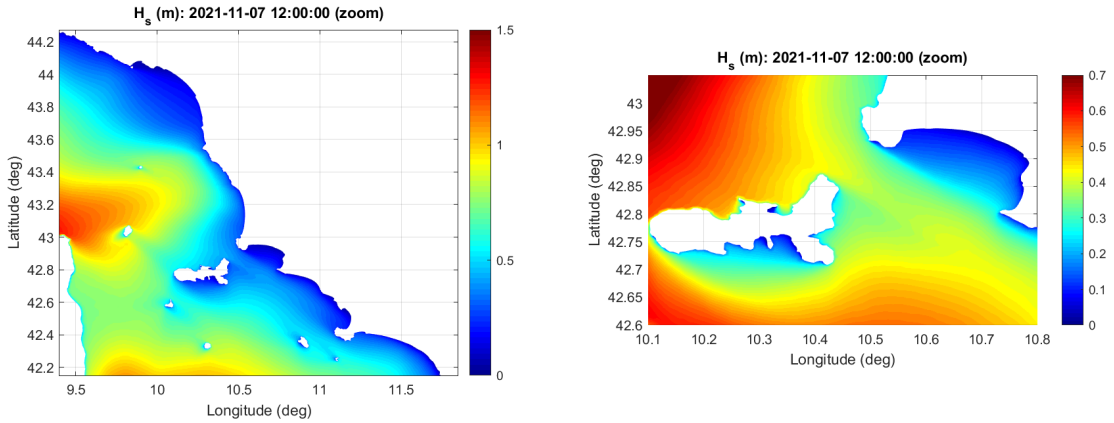

Figure 2 Detailed modelling for the area of the Tuscan archipelago and the Gulf of Follonica using an unstructured mesh wave prediction model.

2.2 Description of products provided

The following products are part of this offer

- Bulletin in pdf format with 5-day spot forecasts + synoptic maps and area maps (see Annex 1). In the remainder of this offer, this item will be referred to as "Bulletin";
- Telephone counselling with a forecaster during the following phone availability hours: Monday to Friday from 8 a.m. to 5 p.m., Saturday, Sunday and public holidays from 7 a.m. to 1 p.m. In the continuation of this offer, this point will be called "Forecaster counselling".

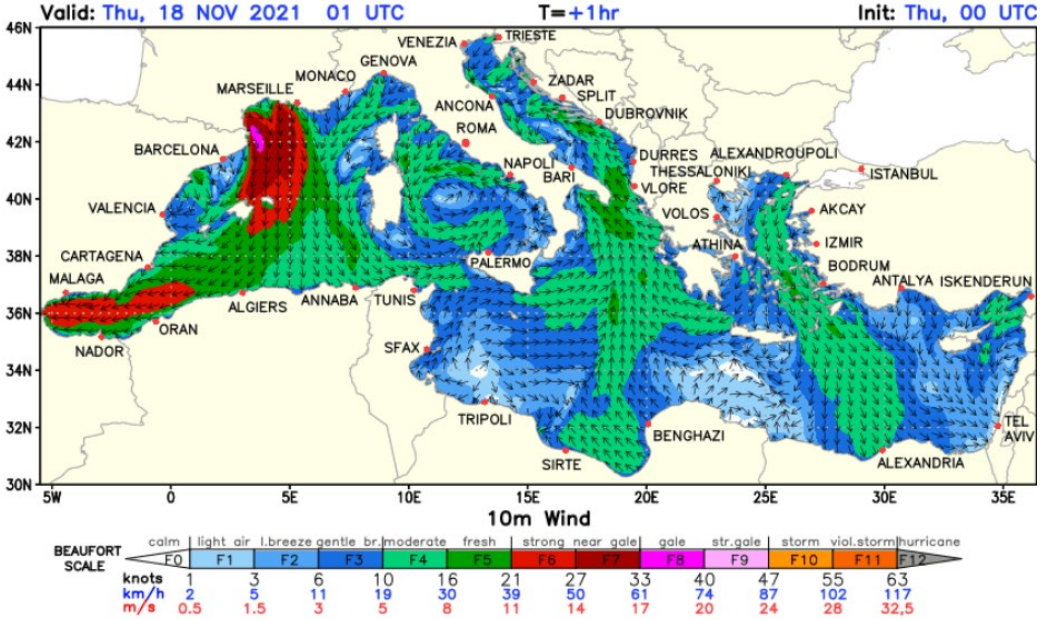

Figure 3 Example map of the wind field at an altitude of 10 m, calculated from an operational run of an active meteorological model at the LaMMA Consortium, for 01:00 UTC on 18/11/2021.

2.4 Provision delivery of products

The "Bulletin" in pdf format is sent to a mailing list provided by the customer.

Changes to the list (addition or deletion of addresses) will be communicated by the client, the list will be updated promptly (within 24 hours).

The "Telephone Consulting" is to be understood as a service during particular operations relating to the interpretation of the information in the "Bulletin" and in the "Web Maps".

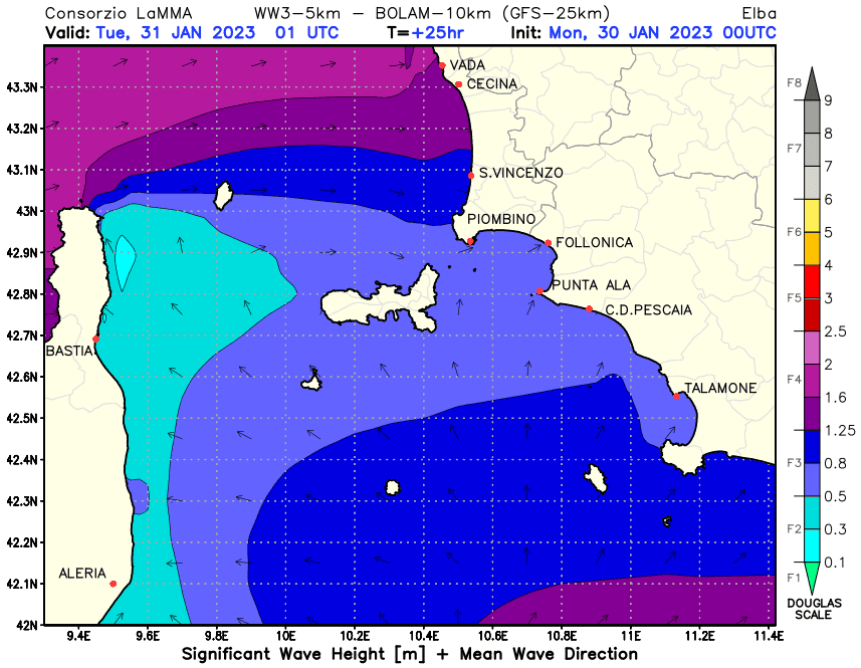

Figure 4 Example of a forecast map for the Tuscan Archipelago and Gulf of Follonica area.

5. Economic quotation of supplies

Based on the technical details described above, the relevant services and supplies are quoted below:

- **Service for the provision of forecast weather information: "Bulletin", "Web Maps" and "Forecast Consultancy":**
  - **1.800,00 €/month + VAT;**
  - Duration: to be agreed with the customer.

Technical Contact Person
Dr Claudio Tei