

Case Study: MSAR® installation at Cepsa Refinery

As part of the Joint Development Programme undertaken with Maersk Line ("Maersk") to develop and test all aspects of the use of Marine MSAR® as a bunker fuel, i.e. production, quality control, storage, loading & bunkering, a MSAR® Manufacturing Unit (MMU) was installed in 2016 at Cepsa's 240kbpd Refinery Gibraltar San Roque (RGSR). The facility was installed to enable the production and supply of MSAR® for consumption on the Seago Istanbul, a Maersk vessel undergoing routine activities (see Marine Case Study).

PROJECT SCOPE

The MSAR® facility utilised a modular 6,000bpd MSAR® system and was fully integrated into the existing refinery systems. To achieve this, Quadrise worked closely with Cepsa through all phases of the project; feasibility, engineering, procurement, construction, commissioning, and operations with specific responsibility for ISBL (see figure below) system design, installation & integration (with OSBL), commissioning, operations and Quality Control throughout the supply chain.

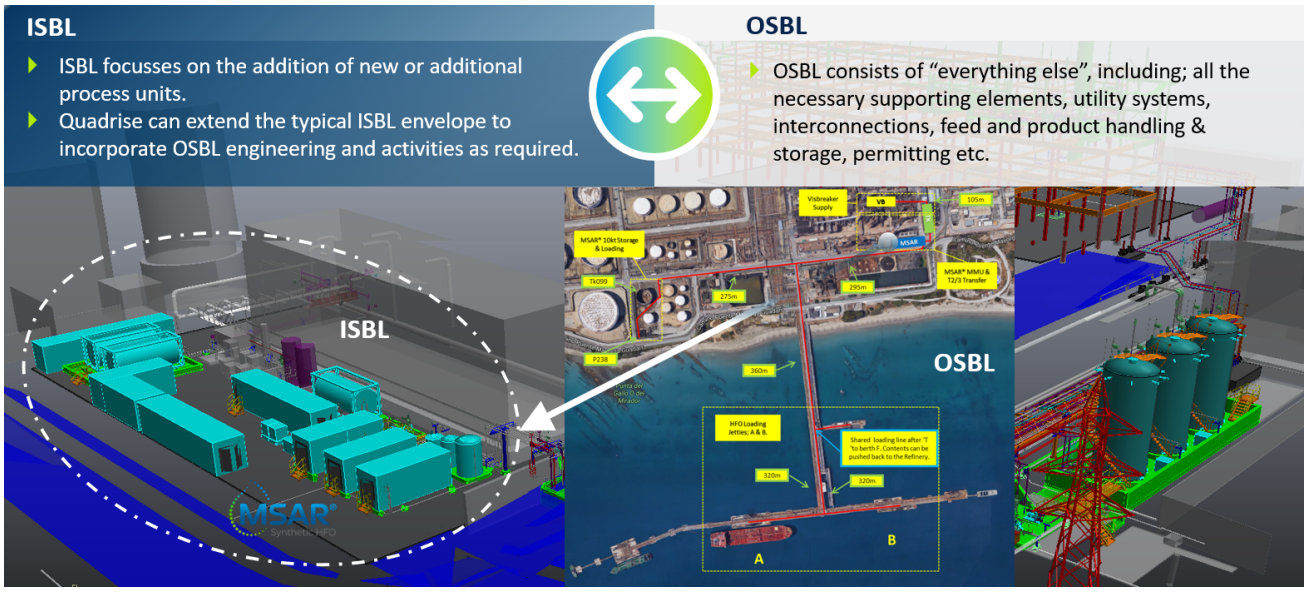


Figure 1: MSAR® Facility Scope Overview. Quadrise was responsible for all ISBL activities & Overall QC

The system was installed and commissioned within 9 months of signing commercial agreements and was designed to produce MSAR® from visbreaker residue derived from a variety of low and high sulphur crudes.

The technology installed is compatible with most typical future refinery residue upgrading plans (i.e. those producing heavy residue/pitch streams) and can produce fuel for both marine and power applications. The modular concept allows economic phased matching of demand and refinery supply.

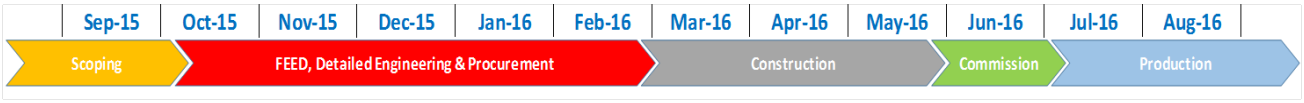


Figure 2: 'Fast track' Cepsa Project Timeline

FAST-TRACK PROJECT DELIVERY IN UNDER 12 MONTHS

Stage one – project scoping

The agreement to proceed was signed at the end of Q3 2015 at which time the Feasibility Study was completed and the basis for the project was frozen.

Stage two – pilot & operational support testing – Parallel activity at QRF

Samples of refinery residues were analysed and emulsified in an extensive laboratory and pilot plant development programme, covering feasibility and cost optimisation based on the end use application and associated specifications.

Stage three – front end engineering design

The FEED and Detailed Engineering were completed by a team comprising Quadrise, the client and an EPC Contractor in Q1 2016.

Stage four – engineering, procurement & construction

Only a limited area is required for an MMU and the ISBL plot for this installation was ~15m x 50m, including space for additive storage, lab facilities, an on-site office and other ancillary equipment.

The ISBL civils started in Q1 2016 and the main process equipment was delivered to site housed in standard ISO shipping containers. (Skid and stick built options are also possible, tailored to the refinery's requirements).

Modular design enables accelerated integration of equipment and the MMU was delivered in a 40' module, in April 2016 which was then quickly and easily integrated into the refinery, including into the Refinery control and safety systems (DCS, SCADA and SIL), with the mechanical installation completed at the end of Q2 2016.

Existing and conventional HFO infrastructure, including the loading pipelines, jetty and a bunker barge, was utilised for fuel storage and transfer to end-user, as per OSBL above.

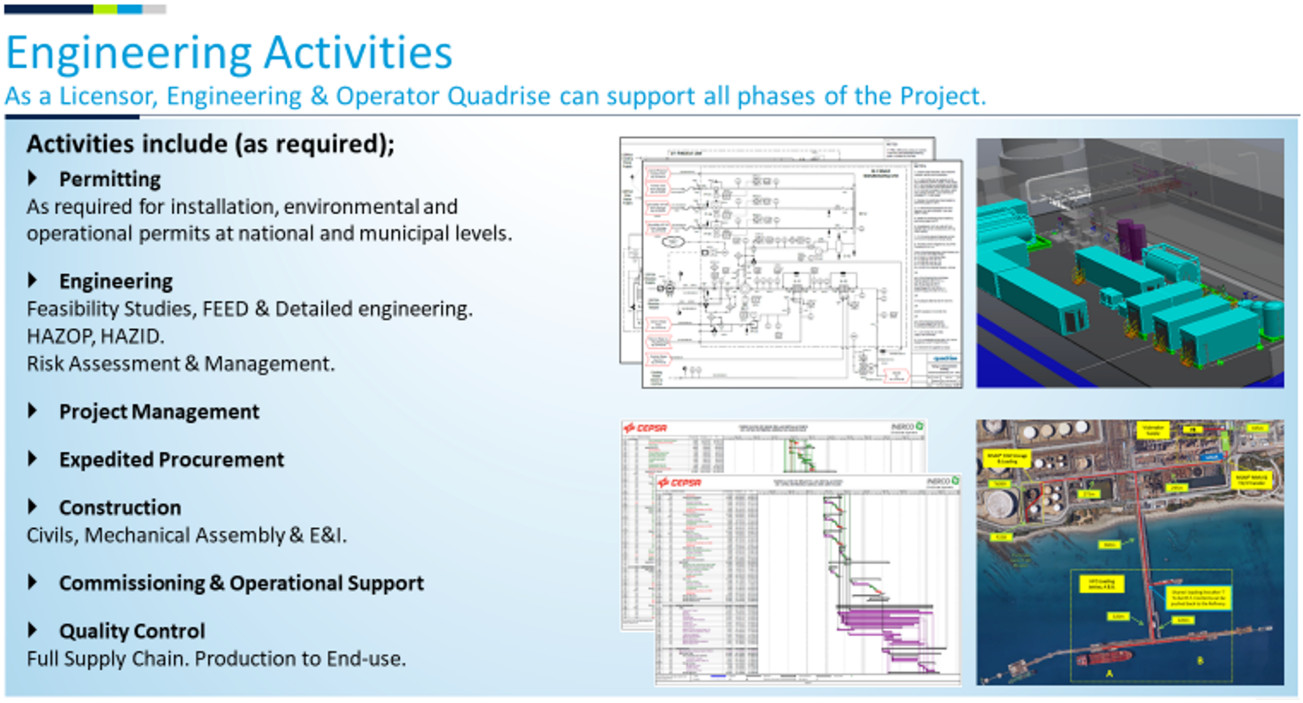


Figure 3: Engineering Activities, done in collaboration with the Refiner and their Engineers as required.

Site Development

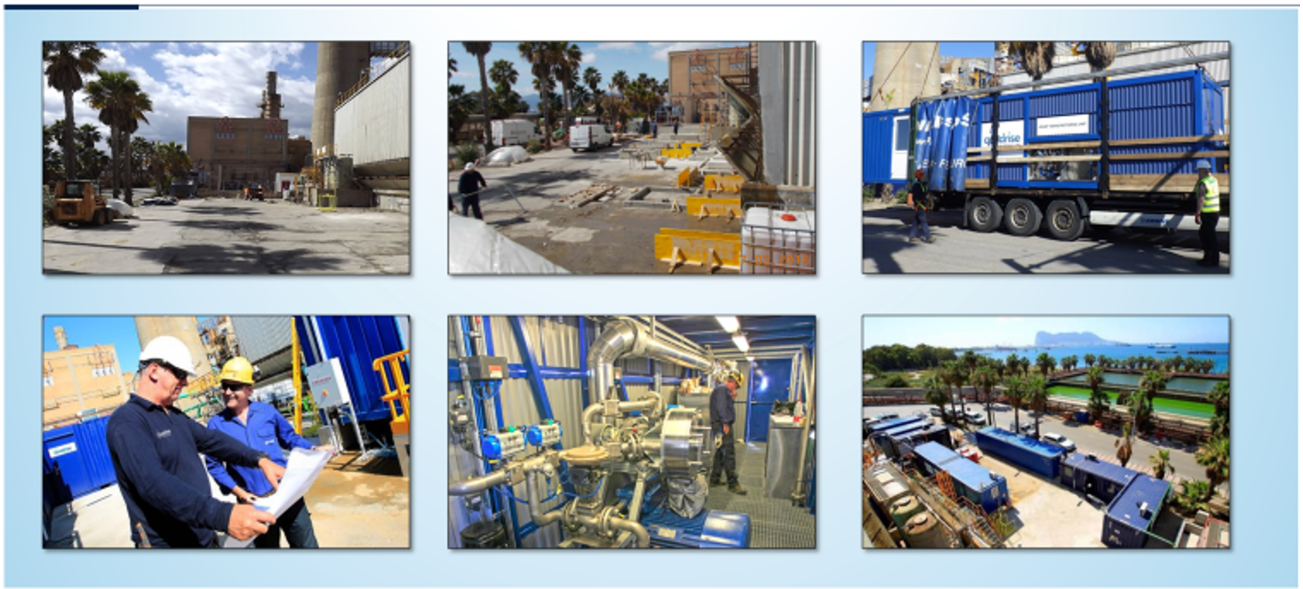


Figure 4: Site Development from a bare ISBL plot in March 2016 through to an operating facility in July 2016

Stage five – Operate

The project then moved straight to the commissioning phase. The MMU and associated infrastructure was commissioned and operational in 4 weeks.

MSAR® was then produced and supplied to Maersk in ~1000 ton batches (bunker stems) as required to meet the vessel and refinery schedules and requirements. Visbreaker residue derived from more than 20 crude slates, including high and low sulphur crudes and from a variety of geographical regions was processed, consistent with the normal day-to-day operation of the refinery.

Quadrise provided extensive Operational Support & Quality Control along the entire MSAR® Supply Chain, from feed to end use. An extensive Quality Control Plan was developed in conjunction with the Client and End User and is this was supported by Quadrise personnel and facilities, including the on-site Quadrise Laboratory and QRF back in the UK.

SUMMARY

In summary, from signing the agreements and starting the FEED to having the unit commissioned and producing MSAR® fuel at Cepsa took 9 months.

Quadrise personnel can assist in all stages of the project and provide ongoing support to the client and end-users on a day-to-day basis, including operational support and process optimisation.

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