

Where energies make tomorrow ●

Loading Systems

Offering advanced technology, expertise and innovation

T.EN

**TECHNIP
ENERGIES**



Loading Systems

Leading provider of fluid transfer systems for the energy industry



Technip Energies Loading Systems is a trusted solutions provider. As an offshore and LNG leader, we differentiate ourselves through quality products, innovation, unmatched engineering support structures and unrivaled aftersales services.

Technip Energies Loading Systems serves clients across the petrochemicals, gas and new energies industries from offshore facilities to refineries and chemical users. Safety and quality drive everything we do and we maintain a strong focus on developing new technology.

Since the 1950s, we have been providing marine loading arms for onshore and offshore use with different applications for the energy market. Our superior loading arms engineering has helped to distinguish us in the LNG market. We have been blazing trails in offshore and ship-to-ship transfers while providing a

full-fledged FLNG offer. We have field-proven technologies to meet any energy transition challenge.

Worldwide footprint

Global commitment, proven expertise and quality

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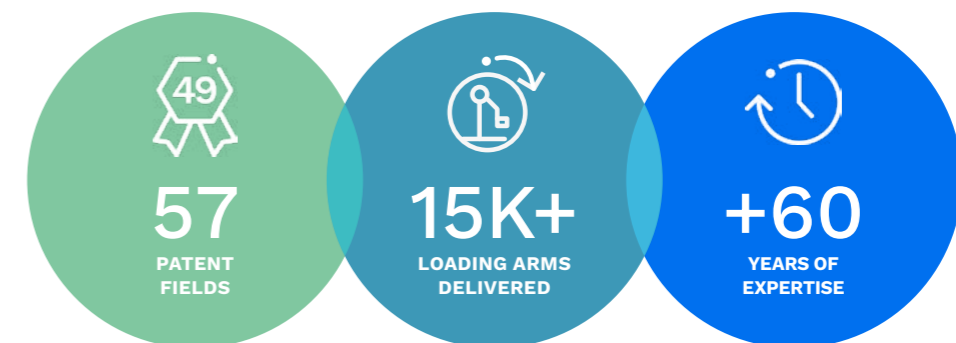
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In a nutshell

- Three certifications
 - ISO 9001: 2015 – Quality management systems.
 - ISO 14001: 2015 – Environmental management.
 - ISO 45001: 2018 – Occupational health and safety.
 - ISO/IEC 27001: 2013 - Information security management system.
- 24/7 responsive service.
- 83,000 m² main plant in Sens, France.
- Scope: Design and manufacture of loading systems for crude and refined products, chemicals, liquefied and cryogenic gases and other fluids.
- 33 highly-skilled field engineers with global coverage dedicated to rapid intervention and onsite supervision.
- Two manufacturing plants.



A full range of products

Making the link

CONVENTIONAL LNG
MARINE LOADING ARMS

SMALL-SCALE MARINE
LOADING ARMS

SHORE-TO-SHIP
TRANSFER SYSTEM
FOR LNG BUNKERING

SHIP-TO-SHIP
TRANSFER SYSTEM
FOR LNG BUNKERING

CONVENTIONAL
PETROCHEMICAL
MARINE LOADING ARMS

ARCOS®
or
OFFSHORE MARINE LOADING ARMS

HPNG MARINE
LOADING ARMS

OLAF®
or
OFFSHORE MARINE
LOADING ARMS

OFFSHORE MARINE LOADING ARMS

TRUCK & RAIL CAR

LIQUIFIED CO₂
MARINE LOADING ARMS

ATOL®

Leading solutions for onshore and nearshore

Our advanced technology in transfer operations offers innovating designs, systems, packages and services to the energy industry.

Onshore



REFINING AND PETROCHEMICAL LOADING SOLUTIONS

- Configurable loading arm design adapted for the transfer of petroleum, LPG, refined products or chemicals (including sulfuric, nitric acids, chlorine, sulfur, bitumen, ammonia, etc).
- Applicable for liquid CO₂
- Diameter from 6" to 24" and design pressure up to 50 bars (ANSI 300)
- Self-supported product line
- Integrated control system
- Reliable and field-proven pantograph system, swivel joints, Quick Connect / Disconnect Couplers (QC/DC), Emergency Release Systems (ERS)
- Multiple configuration options available such as piggy back line, heat tracing system, insulation, Constant Position and Management System (CPMS), EasyDrive, AutoDrive, electrical drives, etc...

LNG LOADING SOLUTIONS

- Leader in LNG transfer systems including swivel joints, ERS and QC/DC in-house components
- LNG loading arms designed for small- to large-scale LNG transfer (from 6" to 20")
- Unique offering of complete 20" full bore
- Exposed jetties solutions with our patented technology



HIGH-PRESSURE NATURAL GAS (HPNG)

- Diameter: 12"
- In-house ERS and QCDC design
- Two design pressure classes: ANSI 600 and ANSI 900
- High-duty swivel joint design with three redundant sealing levels
- Tri-redundant dynamic sealing for swivel joints to reduce maintenance and optimize availability
- Simple, reliable and safe emergency shutdown (ESD) philosophy

TRUCK AND RAILCAR LOADING MODULES

Loading arms

- Top/bottom loading and unloading arms
- Top-closed systems loading arms for pressurized service
- Loading systems for special applications (e.g. heated, corrosive and toxic products)
- Cryogenic loading arms

Skids

- Design and supply of integrated packages and turnkey installations including loading and unloading systems
- LNG products



Nearshore

ARCOS (ARTICULATED RIGID CATENARY OFFLOADING SYSTEM): MAKING THE SHIP-TO-SHIP LNG TRANSFER SAFE AND EFFICIENT

We offer unique combinations of rigid technologies and flexible behavior designed for floating storage regasification unit (FSRU) operators looking for a cost-effective solution for safe and efficient ship-to-ship LNG transfer operations.

- Self-supported
- Fully rigid transfer system composed of three articulated piping assemblies made of 16" stainless steel pipes
- Field-proven cryogenic swivel joints equipped with full bore ERS
- Enhanced flow performance and at least 30% faster on operations compared to flexible solutions
- Minimized lifting and bolting
- SIL 2 ESD capabilities



Tailored technology for offshore transfer systems

Designed and tested to the highest standards of safety and reliability, we use proven technology tailored to our clients' needs and supported by more than 60 years of excellence in LNG operations. We provide essential expertise from the early project stage to define and integrate the offloading function in the most cost-effective manner.

Side-by-side loading arms

For dynamic environmental conditions with Hs up to 2.5m, side-by-side offloading configuration requires specifically developed loading arms to transfer LNG from the FLNG to the carrier.

Our **targeting system** enables a safe, repetitive and reliable connection and disconnection of the loading arms. Based on a fiber rope and stretched at a constant tension, it guides the loading arm during its approach towards the LNGC manifold flange.



DCMA-S Double Counterweight Marine Arm Structure

OLAF Offshore Loading Arm Footless
Reaches the smallest carriers without increasing loads onto the carrier manifold (e.g. Shell Prelude FLNG)



Offering a combination of expertise and experience in LNG offshore transfer systems, we deliver a full range of solutions for floating liquefied natural gas (FLNG) and floating storage regasification unit (FSRU) applications operating offshore in side-by-side or tandem configurations.

ATOL (Articulated Tandem Offshore Loader)

- Full rigid transfer system allowing LNG transfer up to Hs of 5.5m
- High-flow performance up to 16,000 m³/h of LNG flow rate thanks to 20" full bore product lines
- Same key components design philosophy (swivel joint, ERS, QC/DC) and loading arms operating philosophy used for offshore side-by-side loading arms



PLS (Parallel Loading System)

- PLS combines the advantages of side-by-side and tandem by accepting standard LNGC fleets while allowing LNG transfers up to Hs of 4m.
- A bridge simulated LNG carrier position prevents collision risks even in degraded mode.



Breakthrough innovation

EasyDrive system

The EasyDrive system allows an intuitive MLA linear control resulting in simpler and safer maneuvering, connection and disconnection operations.

- Intuitive rectilinear control of the presentation flange motions
- Variable speed (real-time proportional control)
- Smooth displacement with virtually no oscillation of the presentation flange
- Reduction of connection time in dynamic conditions
- Minimal risk of manifold flange and packing damage and fewer operator training requirements



eMAX

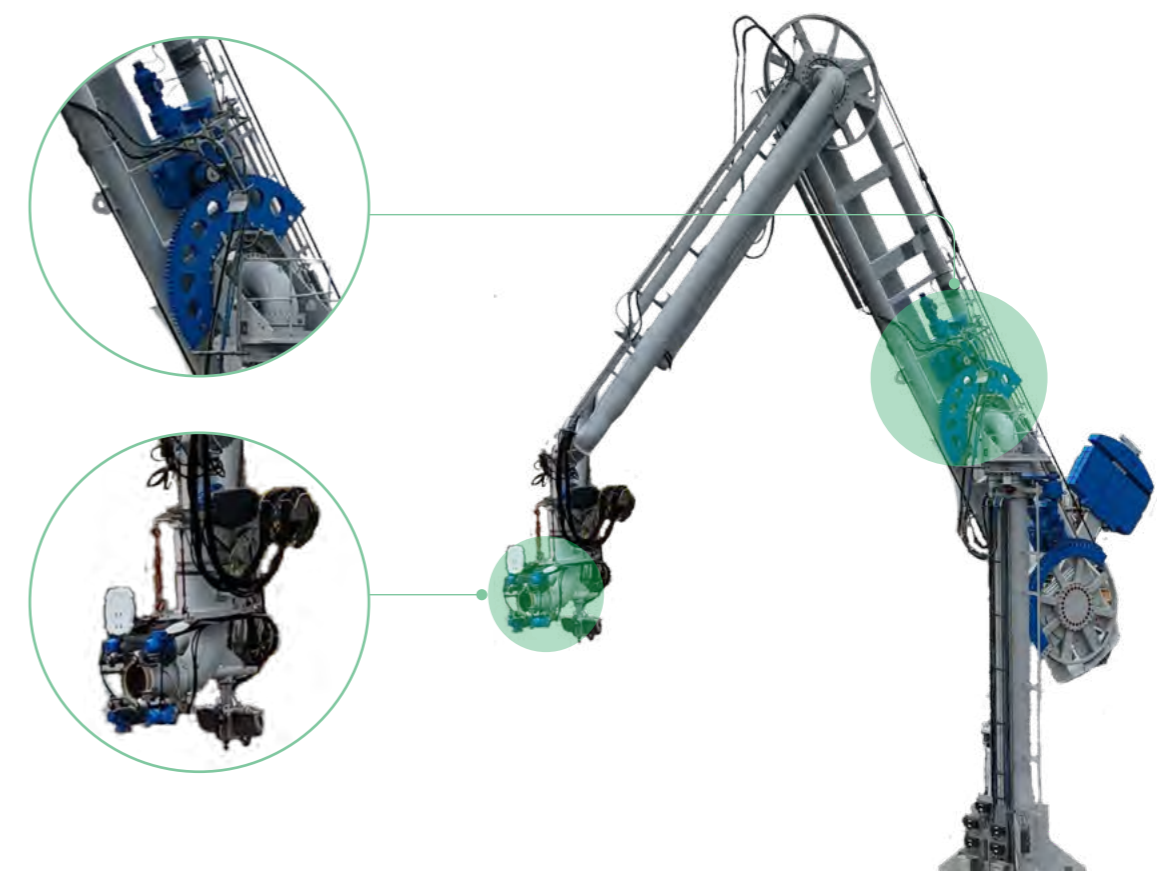
electric Monitoring AutoDrive Xross Applications

Easier operation

- Lower operations duration
- Lower manning requirements
- Lower operator training requirements
- Lower human exposure and operation danger
- Lower material damage and environmental risks from misoperation

Simpler maintenance

- Detect and alert operations team on any abnormal arm behavior
- Move from corrective or preventive maintenance
- Log operations data, learn and improve
- Customize maintenance schedule
- Simplify integration on the jetty



First-rate services

Recognized project management

We provide tailored loading and offloading solutions, working as a partner to keep clients' projects and operations on schedule and on budget with state-of-the-art services.

Commitment to quality

Our dedicated teams work in close collaboration with our clients' project teams to ensure the highest levels of anticipation, testing and quality control. We thoroughly review all project specifications to determine the right path forward.

FIT-FOR-PURPOSE MAINTENANCE CONTRACTS TO MEET EVERY CLIENT'S NEEDS

Our worldwide services network consists of top professionals based in various locations worldwide, ensuring a close, personal approach to each client and their needs.

We offer skilled advice and assistance throughout the life of the equipment from installation and commissioning to upgrades and major overhauls of loading arms.

Core services:

- Highly trained field service technicians for installation and maintenance
- Preventive Maintenance Inspections (PMI)
- Modular or tailor-made training programs
- Large range of supplies for new and long-lived systems spare parts (40 y+)
- Full revamping and upgrading of loading arms and associated equipment
- Digital services:
 - **OspreyEyes:** Remotely Piloted Aircraft (RPA) for PMI
 - **EagleEyes:** Innovative and alternative solution for remote inspection with RPA
 - **TigerEyes:** Expert remote assistance anytime and anywhere
 - **SquirrelEyes:** Online training with interactive section possibly including virtual reality tools
 - **Beyond LS:** Digital web platform with access to key apps

Key references

Sinopec Tianjin LNG (Phase 1 & 2) **CHINA**

Award: 2015 & 2020 **Startup:** 2018 & 2021
 Nine marine loading arms delivered in two phases for one of the biggest LNG terminal in China.

STAR Refinery 4 **TURKEY**

Client: STAR RAFINERI A.S.
Award: 2014 **Startup:** 2016
 Thirty-four marine loading arms delivered and associated field services for the \$5.6 billion Star Refinery project (SOCAR Turkey Aegan Refinery), one of the biggest project in the Middle East and North Africa.

Petronas FLNG (Satu & Dua) **MALAYSIA**

Award: 2013 / 2014 **Startup:** 2017 / 2021
 LNG offshore loading arms for Satu (first worldwide operational FLNG facility) and Dua FLNGs.

Al Zour LNG Import Terminal **KUWAIT**

Client ENGINEERING: Hyundai Engineering Company
END Client: Kuwait Integrated Petrochemical Industries Company (KIPIC)
Award: Jan 2017 **Startup:** 2021
 Delivery of two sets of four 20" full bore LNG loading arms for the LNG import terminal in Al-Zour.

Shell Prelude **AUSTRALIA**

Client: Shell
Award: 2012 **Startup:** 2019
 The world's largest offshore floating facility, including seven 16" marine loading arms (four LNG and three LPG loading arms).

Basra Oil Export Terminal **IRAQ**

Client: Gulf Commercial Group for Basra Oil Company (BOC)
Award: 2017 **Startup:** 2019
 24" marine loading arms delivered and the associated field services as part of the refurbishment of the crude oil export jetties of the Basra Oil Export Terminal in Iraq.

Northern Lights **NORWAY**

Client: Aker Solution for Equinor
Award: 2021 **Startup:** 2023
 Three world first marine loading arms 8» to transfer liquid CO₂.

Porto de Açu **BRAZIL**

Client: Acciona Industrial
Award: 2019 **Startup:** 2020
 Two 12" high-pressure natural gas marine loading arms for the 3GW LNG to power project of Gas Natural Açu (GNA).

Acronyms glossary

ALLS: Amplitude LNG Loading System
ARCOS: Articulated Rigid Catenary Offloading System
ATOL: Articulated Tandem Offshore Loader
CPMS: Constant Position and Management System
DCMA-S: Double Counterweight Marine Arm Structure
eMAX: electric Monitoring AutoDrive X Apps
ERS: Emergency Release System
ESD: Emergency Shut Down
FLNG: Floating Liquefied Natural Gas

FSRU: Floating Storage Regasification Unit
LNGC: LNG Carrier
MLA: Marine Loading Arms
OLAF: Offshore Loading Arm Footless
PLS: Parallel Loading System
PMI: Preventive Maintenance Inspection
QC/DC: Quick Connect / Disconnect Couplers
RPA: Remote Piloted Aircraft
T&RC: Truck and Railcar





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