FEATURE ARTICLE:

FLNG actively contributes to the expansion of the global LNG supply

Natural gas continues to assume an increasingly prominent position in the global energy mix, supporting socio-economic development worldwide and contributing meaningfully to the achievement of Sustainable Development Goals. Over the past decade, natural gas has been the largest contributor to the growth in global primary energy supply, accounting for nearly one-third of the total increase. This sustained expansion is driven by its abundance, versatility, flexibility, and environmental credentials. Growing gas consumption is underpinned by the steady expansion of international gas trade, with liquefied natural gas (LNG) emerging as its most dynamic component and a critical enabler of global energy security and market connectivity.

The global LNG industry, historically anchored in large-scale onshore liquefaction and regasification facilities, is undergoing a major transformation with the rapid emergence of floating solutions, such as Floating LNG (FLNG) and Floating Storage and Regasification Units (FSRUs). While onshore facilities remain the backbone of the sector, providing large-capacity gas export and import operations and strong economies of scale, floating solutions are emerging as a complementary and increasingly strategic component of the LNG sector. Originally developed to overcome the geographical, logistical and financial constraints of onshore infrastructure, floating solutions offer flexible and cost-efficient alternatives that can be deployed with greater speed and agility, adding valuable adaptability across LNG value chains.

FLNG facilities can be deployed in several configurations depending on the location and characteristics of supply source of gas. First, in a stand-alone FLNG with direct subsea connection, the unit is tied directly to subsea wells and performs all upstream operations, including gas production, treatment, and liquefaction, making it ideal for remote offshore fields without pre-existing infrastructure. Second, in an integrated FLNG with a Floating Production, Storage and Offloading (FPSO) unit, natural gas is produced and pre-processed on the FPSO, which then feeds the FLNG unit for liquefaction and storage. By separating production and liquefaction functions across two floating assets, this configuration provides enhanced operational flexibility and optimised field development. Third, in an FLNG linked to fixed offshore platforms configuration, the FLNG facility receives gas from a fixed platform that extracts and processes gas from nearby wells, suitable for established offshore fields with pre-existing infrastructure. Fourth, an FLNG supplied via an onshore pipeline network is positioned nearshore and fed by gas transported through pipelines from onshore fields, enabling flexible deployment while leveraging existing gas infrastructure.

FLNG facilities have gained momentum over the last decade, underpinned by the rising importance of offshore gas production. Today, offshore gas accounts for roughly 30% of global gas production, totalling around 1.20 tcm per annum, compared to 0.95 tcm in 2010 and 0.65 tcm in 2000. As onshore reserves mature and energy demand rises, many previously uneconomical or marginal offshore fields are becoming commercially viable. Exploration activities over the past decade further highlight the strategic importance of these offshore resources. Since 2010, offshore prospects have consistently accounted for the largest share of newly discovered recoverable resources, surpassing onshore findings. In 2024, offshore exploration yielded 340 bcm of technically recoverable resources (TRR), accounting for more than two-thirds of total discoveries. By integrating all segments of the supply chain into a single floating facility, FLNG vessels provide technical and economic advantages that unlock these offshore resources and make their development feasible.

As of November 2025, a total of eight FLNG projects were in operation worldwide, with a combined liquefaction capacity of 16.7 Mtpa, accounting for about 3% of global operational LNG capacity. An additional nine FLNG projects were under construction, totalling 20.6 Mtpa, or roughly 8% of liquefaction capacity currently being built (Table i). In total, twelve countries are engaged in the FLNG sector, with projects either in operation or under development. Mozambique leads with 7.1 Mtpa of FLNG capacity, followed by Argentina with 6 Mtpa and Malaysia with 4.7 Mtpa. In six countries, Argentina, Cameroon, Gabon, Mauritania, Senegal and the Republic of the Congo, FLNG currently makes up 100% of national LNG capacity, serving as the sole economically viable option to monetize offshore gas resources. By enabling smaller or remote fields to access global markets without large-scale onshore infrastructure, FLNG in these countries generates export revenues, attracts investment, creates employment, and supports domestic energy supply. In contrast, in Australia and Indonesia, FLNG plays a complementary role, adding flexibility and incremental capacity to their substantial onshore LNG infrastructure.

Table i: FLNG facilities operational and under construction

Status	Country	Project	Capacity	Start Year
Operational	Australia	Prelude FLNG	3.6	2019
	Cameroon	Kribi FLNG	2.4	2018
	Malaysia	PFLNG 1	1.2	2017
	Malaysia	PFLNG 2	1.5	2021
	Mauritania/Senegal	GTA FLNG	2.5	2025
	Mexico	Altamira FLNG 1	1.4	2024
	Mozambique	Coral South FLNG	3.5	2022
	Republic of the Congo	Congo FLNG	0.6	2024
Under construction	Argentina	Southern FLNG 1	2.5	2026
	Argentina	Southern FLNG 2	3.5	2027
	Canada	Cedar FLNG	3.3	2028
	Gabon	Gabon FLNG	0.7	2025
	Indonesia	Kasuri FLNG	1.2	2027
	Malaysia	ZLNG	2.0	2027
	Mexico	Altamira FLNG 2	1.4	2027
	Mozambique	Coral North FLNG	3.6	2028
	Republic of the Congo	Congo FLNG 2	2.4	2025

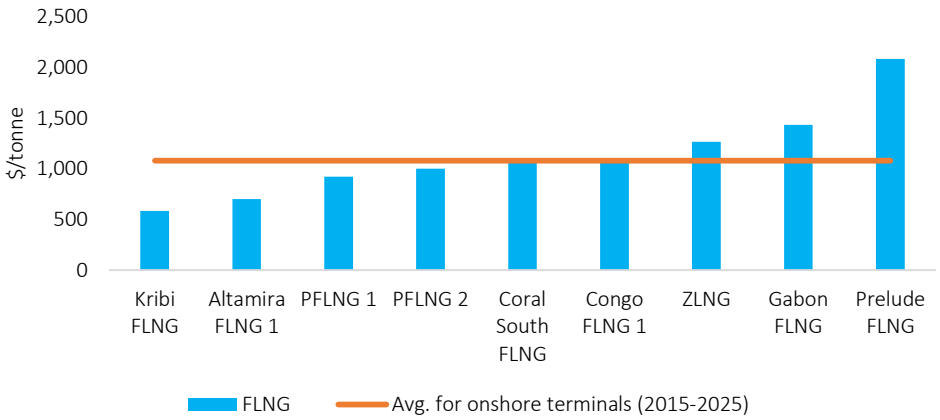
Source: GECF Secretariat based on data from ICIS LNG Edge and Project Updates

FLNG has become a versatile solution for developing offshore gas fields, offering notable advantages in resource flexibility, cost-effectiveness, time efficiency, lower environmental impact, and enhanced security when compared with onshore liquefaction facilities.

Resource flexibility allows FLNG to monetize offshore gas fields that are too remote, too small, or too technically challenging for conventional onshore LNG facilities. Its modular and floating design supports deployment in deepwater and marginal fields that would otherwise remain undeveloped, turning previously stranded or untapped resources into marketable LNG. This adaptability also enables operators to respond efficiently to market dynamics and optimize production throughout a field's lifecycle.

Cost-effectiveness arises from efficiencies in modular construction, standardized components, and offshore processing. By integrating gas extraction, liquefaction, storage, and offloading into a single vessel, FLNG eliminates the need for expensive onshore infrastructure, pipelines, jetties, and dredging, thereby reducing costs. Shorter project schedules also lower labour expenses, while fabrication in specialized shipyards ensures better quality control and safer construction. These factors translate into lower capital expenditure per tonne of FLNG compared with traditional onshore LNG facilities. Onshore LNG plants built between 2015 and 2025 have an average CAPEX of around $1,100 per tonne of annual capacity, while FLNG projects, with Prelude FLNG excluded, average approximately $1,000 per tonne, as Prelude is a notable outlier due to technical challenges, operational delays, and substantial cost overruns (Figure i).

Figure i: Capital expenditure per tonne of LNG capacity for FLNG and onshore projects



Source: GECF Secretariat based on data from Rystad Energy and Project Updates

Time efficiency in FLNG comes from modular design and standardized components, which allow faster fabrication and assembly, significantly reducing project lead times compared with onshore infrastructure, which can take years to build. This enables FLNG units to begin production shortly after discovery, allowing operators to bring new gas supplies online more quickly and respond promptly to market demand. Furthermore, FLNG vessels can be redeployed once a field is depleted or scaled up to meet rising production needs, further accelerating the development of subsequent projects.

Lower environmental impact is achieved by processing and liquefying gas directly at the field, which reduces energy losses from transportation and improves overall efficiency, resulting in a smaller greenhouse gas (GHG) footprint. FLNG also provides an opportunity to monetize associated gas that might otherwise be flared, preventing unnecessary GHG emissions. Offshore processing minimizes land use and coastal disruption compared with onshore plants, reducing effects on terrestrial and marine ecosystems. Advanced floating platform design, modular liquefaction trains, and efficient cryogenic systems further optimize energy consumption per tonne of LNG.

Enhanced security is ensured by locating processing and liquefaction offshore, keeping hazardous operations away from populated areas and reducing risks to communities. The modular, compact design includes advanced safety systems such as fire suppression, gas detection, and emergency shutdown capabilities. Offshore deployment also restricts access to authorized personnel, significantly lowering the risk of sabotage or other deliberate threats, while protecting both personnel and the facility from accidental interference or external hazards.

Technological advancements have driven the evolution of FLNG units, improving deployment, vessel design, and liquefaction processes. Deployment milestones, including operational water depths, illustrate the expanding range of offshore fields accessible to FLNG: PFLNG 1 (2017, Malaysia, 80 meters) marked the start of commercial floating LNG, followed by Prelude FLNG (2018, Australia, 250 meters), the largest and deepest operational unit with advanced mooring and turret systems. Vessel design now balances new-builds, which offer full customization to field requirements, and conversions of existing LNG carriers, which shorten timelines and reduce costs. The Hilli Episeyo, retrofitted from a Moss-type LNG carrier and deployed offshore Cameroon, is an operational converted FLNG, optimizing deck space, storage, and processing efficiency for mid-scale or marginal developments. Liquefaction processes have also advanced, with compact, modular systems tailored for offshore use. Common processes include AP-C3MR (Prelude FLNG), Dual Mixed Refrigerant (DMR) (PFLNG 1), and nitrogen expansion cycles (Hilli Episeyo), valued for efficiency and operational simplicity, while other modular systems, such as the Optimized Cascade Process and Single Mixed Refrigerant (SMR), are selected based on field size, gas composition, environmental conditions, and project economics, ensuring alignment of liquefaction processes with vessel type and development strategy.

In addition to serving as a permanent solution for stranded gas fields, FLNG can act as an interim solution for accessible conventional gas reserves while onshore LNG terminals are under construction or being planned. Its faster deployment compared with traditional onshore facilities is particularly valuable during the development of large gas fields, enabling early production and monetisation of gas resources as they are converted into proven reserves. In the case of Argentina's Vaca Muerta shale gas field, two FLNG units are being built to allow early liquefaction and export while onshore LNG infrastructure is developed. Although the resource base could support large-scale onshore liquefaction, these FLNG units will provide quicker market access and bridge the gap until permanent infrastructure is established. By bridging the gap between resource discovery and full-scale onshore facilities, FLNG helps accelerate revenue generation and supports strategic planning for long-term gas development.

In this context, FLNG technology can be transformative for developing regions, particularly Sub-Saharan Africa, which has emerged as a major holder of newly discovered gas resources. Between 2005 and 2024, approximately 6.5 tcm of natural gas were discovered in the region, nearly 90% offshore, led by Mozambique, Tanzania, Mauritania, Nigeria, Namibia and Senegal. By providing rapid access to international markets and generating revenue, FLNG can support local economic growth and complement long-term onshore infrastructure plans. The early development of these gas resources can, in turn, drive broader social and economic progress, improve energy access, and strengthen national energy security.