

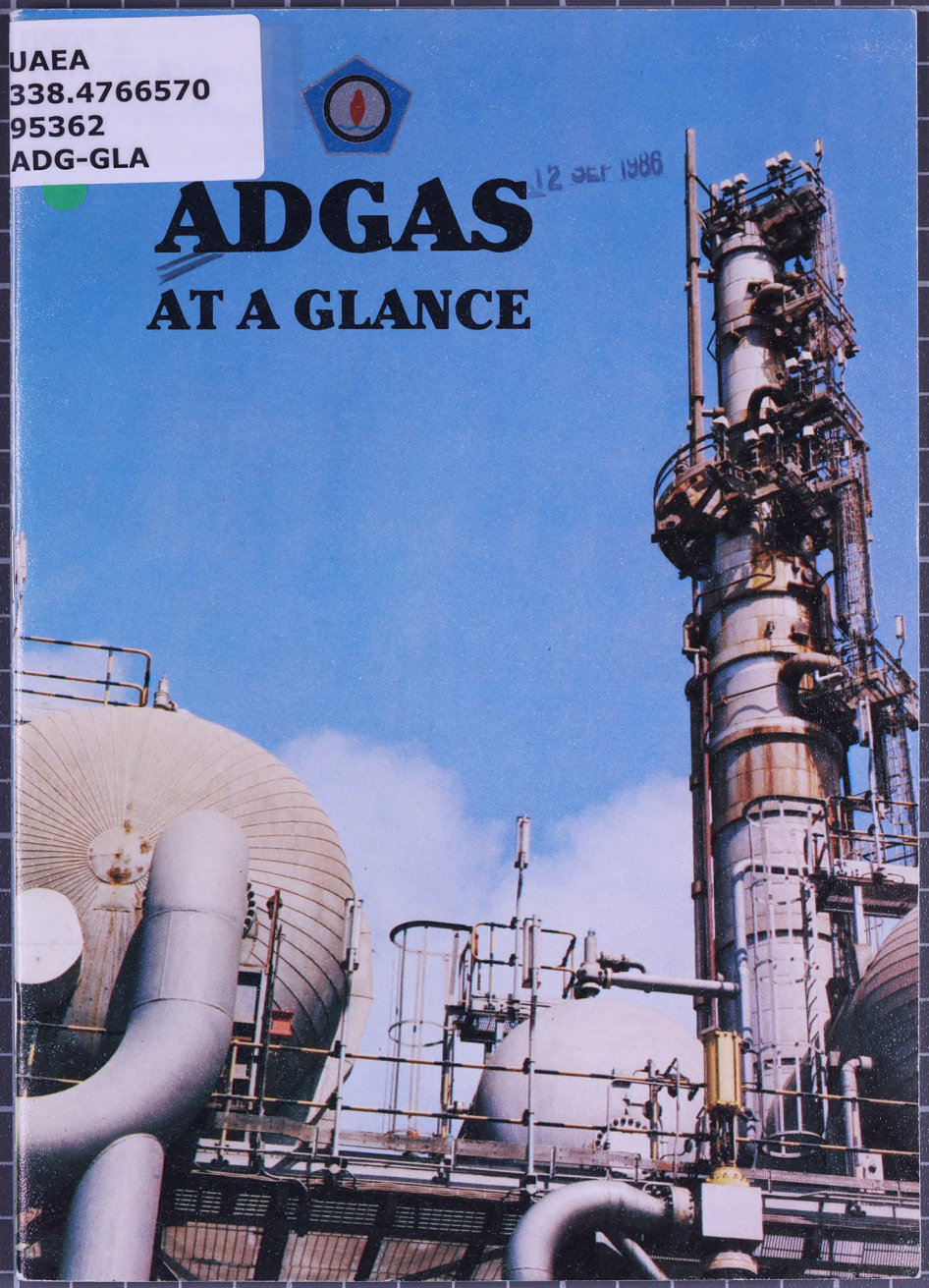
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ADGAS

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H.H. Sheikh Zayed Bin Sultan Al-Nahyan
President of the United Arab Emirates

Cover photo

the Cryogenic Column --
the heart of the LNG Plant,
where natural gas
is liquefied at minus 160
degrees centigrade

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H.H. Sheikh Khalifa Bin Zayed Al-Nahyan
Crown Prince of Abu Dhabi and Deputy Supreme Commander of the
UAE Armed Forces



H.H. Sheikh Tahnoun Bin Mohamed,

Representative of H.H. the Ruler in the Eastern Region and Chairman
of the Board of Directors Abu Dhabi National Oil Company
(ADNOC)



H.E. Dr. Mana Saeed Al-Otaiba

UAE Minister of Petroleum & Mineral Resources, Chairman of Abu
Dhabi Gas Liquefaction Company Ltd. (ADGAS)



ADGAS LNG Plant at the North-East of Das Island

The Company

The Das Island Liquefied Gas Project was conceived in the late sixties. At that time there was increasing worldwide recognition that movement of natural gas in a cold liquid state was a practical and commercially viable proposition. Demand for LNG was also growing throughout the world. This was particularly so in Japan where the continuing rise in energy demand, linked with a desire to minimise environmental pollution, provided a sound basis for a project to process liquefied gas on Das Island. The project was found to be viable despite the fact that the LNG from Das Island would be competing with sources closer to Japan.

On completion of joint studies, negotiations were successfully concluded with Tokyo Electric Power Company Inc. (TEPCO) in December 1972 that TEPCO would annually receive about 2 million metric tonnes of LNG and 800,000 metric tonnes of liquefied petroleum gas (LPG) over a 20-year period.

The Abu Dhabi Gas Liquefaction Company Limited was subsequently formed and registered in Bermuda in 1973, consisting of Abu Dhabi National Oil Company (ADNOC), British Petroleum Company Limited, Compagnie Francaise des Petroles S.A., Mitsui & Company Limited and Bridgestone Liquefied Gas Company Limited (subsequently renamed Mitsui Liquefied Gas Company).

The construction contract was awarded to a joint venture firm formed by Eastern Bechtel Corporation of San Francisco and Chiyoda Chemical Engineering and Construction Co. Ltd. of Yokohama, Japan.

His Highness President Sheikh Zayed Bin Sultan Al Nahyan laid the foundation stone for the LNG Plant in a formal ceremony on December 4, 1973. Four years later, he led the inauguration ceremony, which was attended by the members of Supreme Council, to mark the beginning of production.

Processing the Gas

The Project consists of four interdependent phases:

1. Gathering and delivering the gas to the LNG Plant on Das Island.
2. Operation of the liquefaction plant and its associated facilities.
3. Transportation of the products to Japan.
4. Reception facilities in Japan provided by TEPCO and Tokyo Gas Co. Ltd.



A General View of the LNG Plant by Night

Gas Feedstock Is Supplied to ADGAS Plant by ADMA-OPCO



Feedstock

Gas feedstock for the LNG Plant is supplied by Abu Dhabi Marine Areas Operating Company (ADMA-OPCO) from Umm Shaif and Zakum oil fields, and by Al Bundug Co. from Al Bundug oil field. ADMA-OPCO, on behalf of ADNOC, also supplies Uweinat cap gas.

The normal feedstock is gas produced naturally in association with crude oil. The volume of associated gas produced is, of course, dependent on the rate of oil production. The gas is separated from crude oil and delivered to the plant at various pressure levels.

The LNG Plant

The Plant is one of the most technologically advanced LNG plants in the world. It consists of two identical process trains to permit safe overhaul of one train while the other remains in service. The Plant is serviced by a utilities complex which can be shut down in sections for maintenance while production continues subject to some limitations.

The two liquefaction trains are designed to annually produce:-

LNG	2,300,000 tonnes
PROPANE	650,000 tonnes
BUTANE	420,000 tonnes
PENTANES	220,000 tonnes

These figures are based on 335 operating days per year and optimum gas supplies. Both LNG trains have two steam-driven centrifugal feed gas compressors to raise the pressure of the 11 gas streams flowing into the Plant to 780 pounds per square inch gauge (PSIG).

Liquefaction

Feed gas contains hydrogen sulphide and carbon dioxide, each approximately five per cent by volume. Since these two impurities freeze at low temperatures and block the cryogenic sections of the Plant, the gas is treated with a hot potassium carbonate solution and then with a diethanolamine solution to produce "sweet" gas. This treatment reduces the hydrogen sulphide content to 2.5 parts per million (ppm) and the carbon dioxide to 50 ppm. The gas is then dehydrated and cooled against evaporating



A Close-up of one of the two Trains in the Plant

propane to 35 degrees below zero centigrade. This causes condensation of the heavier hydrocarbons, which are sent to the fractionation section. The remaining gas, at minus 34 degrees centigrade, is fed to the liquefaction section.

The cryogenic section, which is the heart of the plant, uses a propane pre-cooled refrigeration cycle. Its heat exchanger cools gas from minus 34 to approximately minus 160 degrees centigrade, giving a liquid product suitable for atmospheric storage. Each cryogenic exchanger is approximately 180 feet high, 13 feet in diameter and 200 tonnes in weight. Inside each exchanger there are 515 miles of 10 millimetre aluminium tubes to provide the heat transfer surface.

Utilities

The Plant has its own utilities which consist of:

- (a) Four force-draft, gas-fired boilers each with a rated capacity of 360 tonnes of steam per hour at a pressure of 870 pounds per square inch and a temperature of 440 degrees centigrade.
- (b) Sea water cooling is provided by six pumps each with a rated capacity of 16,500 cubic metres of water per hour.
- (c) Three water pumps, each providing 400 cubic metres of water per hour into the fire fighting system.
- (d) Compressed air is supplied to three nitrogen production units. It is also dried and supplied to all pneumatically operated instruments.
- (e) All the industrial fresh water requirements of the Plant are provided by two sea water desalination units. Each unit has a proven production capacity of 35 tonnes per hour. Water required for boilers is further treated in two demineralisation units. More than 95 per cent of the steam condensate is recycled by an extensive steam condensate recovery system.
- (f) Electrical power generation capacity of 62.5 megawatts is provided by two steam turbine generators, of 17.5 megawatts each; and three gas turbine generators: one of which provides 17.5 megawatts and the other two provide 5 megawatts each.

This is sufficient to meet the normal power requirements of the Plant and of the whole of Das Island.

The LPG Tanks (right) and One of the LNG Tanks (left)



One of the Tanks under Construction

Storage

The Plant products are kept at atmospheric pressure in specially constructed storage tanks. LNG is stored in two tanks at minus 160 degrees centigrade. LPG is stored in four tanks: propane at minus 45 degrees, and butane at minus 6 degrees. The pentanes are stored at ambient temperature.

Construction of seven new storage tanks was started in 1981 to provide a storage capacity of 240,000 cubic metres for LNG and 200,000 cubic metres for LPG.

CBI Constructors Ltd. were awarded a US\$-320-million contract to build the seven tanks. Three of the tanks, each of 80,000 cubic metres capacity, will be for LNG. The other four tanks, each of 50,000 cubic metres capacity, will be for LPG.

The contract is part of a project, managed by ADNOC, to expand and develop the liquefaction plant and the shipping facilities. The original plans are estimated to cost US\$ 550 million.

Loading Facilities and Jetty



The Jetty Goes 800 Metres into the Gulf Water

The liquid products are shipped from a jetty located approximately 800 metres offshore to provide sufficient depth of water for the largest LNG ships to berth and load at all times.

The LNG loading system has 3 pumps which deliver through a 30-inch pipeline. There is a common pumping and loading system for propane and butane through a 22-inch pipeline. There is also a line for loading pentanes.

Receiving Facilities

The LNG is received by TEPCO at Sodegaura in Chiba Prefecture on the east side of Tokyo Bay at the jetty of the Tokyo Gas Co, Ltd. (TOGAS). The LNG is regasified and utilised partly at the Sodegaura Power Station and partly at Anegasaki and Goi Power Stations a few miles to the north.

The LPG is received by TEPCO at Anegasaki for use, after regasification, at the Anegasaki Power Station.

Transportation Arrangement (LGSC)

As a result of the Heads of Agreement made on 7 September 1972, it was agreed on 19 March 1973 by BP (33 1/3%), CFP (16 2/3%), Mitsui (45%) and Bridgestone (5%) to form and operate a Liquefied Gas Shipping Co. (LGSC), incorporated in Bermuda, to charter ships to transport the LNG and LPG produced on Das Island to Japan.

With the participation of ADNOC in LGSC on 24 July 1980, the shareholding was amended as follows: ADNOC 51%, BP 16 1/3%, CFP 8 1/6%, Mitsui 22 1/20% and BS 2 9/20%. On 28 June 1973, LGSC entered into two agreements with ADGAS for LNG and LPG transportation. Both agreements continue until 31 December 1995, whereby LGSC discharges the fleet operation responsibilities to ADGAS.

LNG Fleet

The original fleet of LNG gas carriers consisted of four specially designed and constructed ships to carry the liquefied cargo at a temperature of minus 160 degrees centigrade. These ships, which have been chartered for a period of 20 years, are:

- "Norman Lady", of 87,600 cubic metres capacity, owned by Methane Carriers and managed by Lelf Hoegh.
- "Gimi", "Hilli" and "Khannur", all named after villages in Abu Dhabi, and all of 125,000 cubic metres capacity. They are owned by Gotaas Larsen.
- "Golar Freeze", also with 125,000 cubic metres capacity and owned by Gotaas Larsen, was chartered for a period of 15 years in the autumn of 1980.

LPG Fleet

The LPG is transported to Tokyo under a Contract of Affreightment between Mitsui Liquefied Gas Co. (originally the Bridgestone Liquefied Gas Co. Ltd.) and BP, by three dedicated ships of 79,000 cubic metres capacity. These ships are "World Concord", "World Creation" and "World Vigour".

Other ships have made deliveries of LNG and LPG to TEPCO on behalf of ADGAS whenever the capacity of the regular fleet was found inadequate.

An LNG Tanker Loading





Training at the Workshop on Das Island

Human Resources

The Company employs 850 permanent engineering, technical and administrative personnel of 30 different nationalities. Some 220 employees work in the Company Head Office in Abu Dhabi and the Tokyo Liaison Office while 630 men operate and maintain the LNG Plant on Das Island.

ADGAS is fully committed to the training of U.A.E. nationals and other Arabs for administrative and technical careers in the Company; hence, the Company has sponsored more than 40 students and employees on scholarships to pursue engineering and business studies in the United States and the United Kingdom.

ADGAS has also sponsored many trainees at the ADNOC Career Development Centre. Many CDC graduates have already taken up on-the-job training in the LNG Plant and filled posts of increasing responsibility. Graduates from the CDC business and commercial section have also taken up administrative functions in the Company's Head Office in Abu Dhabi city.

HIGHLIGHTS IN THE HISTORY OF ADGAS

- 07/09/1971 Joint Venture Agreement to process natural gas signed by BP, CFP, Mitsui and Bridgestone, after studies started in 1967 confirmed the feasibility of the project.
- 14/12/1972 Agreement signed by BP, CFP, Mitsui and Bridgestone with Tokyo Electric Power Company (TEPCO) to purchase products of the gas liquefaction plant.
- 10/03/1973 ADGLC registered in Bermuda with ADNOC taking 20 percent of the shares.
- 23/03/1973 Construction Contract signed with Bechtel and Chiyoda.
- 28/06/1973 Gas Supply Agreement, Plant Operating Service Agreement and Contract of Affreightment signed.
- 04/12/1973 His Highness President Sheikh Zayed Bin Sultan Al Nahyan laid the foundation stone for the construction of the LNG Plant.
- 25/12/1975 ADNOC share increased to 51 percent.
- 28/03/1977 Company re-incorporated in Abu Dhabi under Law No. 2 of 1977.
- 29/04/1977 First LNG shipment loaded.
- 04/10/1977 His Highness President Sheikh Zayed Bin Sultan Al Nahyan and Members of the Supreme Council attended the Plant inauguration ceremonies on Das Island.
- 22/06/1979 Training programme started by the Company for UAE nationals and other Arabs.
- 26/07/1981 Construction contract of seven new tanks signed.
- 31/12/1982 LNG Plant production exceeds normal design capacity at 2.3 million metric tonnes per annum.
- 09/09/1983 Syndicate of Arab and international banks sign agreement in London to extend a loan of 500 million dollars to ADGAS to finance new tanks project.
- 05/10/1984 New record set for weekly production of LNG at 55,933 tonnes.

SHAREHOLDERS

Abu Dhabi National Oil Co. (ADNOC)	51%
Mitsui & Co.	22 1/20%
British Petroleum (BP)	16 1/3%
Compagnie Francaise des Petroles (CFP)	8 1/6%
Mitsui Liquefied Gas Co.	2 9/20%

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