



## Development and Engineering Highlights in 1996/1997

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### Abstract

The last two years has seen substantial new investment in the infrastructure which supports the upstream industry. Almost without exception, this relates to enhancements, or exploitation, of production from existing fields, including the development of known reserves, previously discovered but delayed due to market conditions. In some cases new technologies have created opportunities for enhancing the value of petroleum products to better meet market requirements. In the Taranaki Basin, there is now a well developed infrastructure and this creates an excellent opportunity for the commercial development of new oil and gas discoveries that previously may have been sub-commercial. The projects described in this paper include, the Maui FPSO Oil Development, Tariki/Ahuroa Gas Plant, Kapuni Gas Treatment Plant Upgrade and the reinforcement of the NGC Gas Transmission to Auckland. Also described are a variety of other minor projects, including some down stream investment. These investments total some \$300 million. In combination with well drilling, the industry has reinvested almost \$400 million in the last two years.

### Introduction

Over the past two years, the industry has seen substantial new investment in the infrastructure which supports the upstream industry. Almost without exception, this relates to enhancements of production from existing fields, and the development of known reserves, previously discovered, but delayed due to market conditions. In some cases new technologies have created opportunities for enhancing the value of petroleum products, to better meet market requirements.

In the Taranaki Basin, there is now a well developed infrastructure which provides an excellent opportunity for the commercial development of new oil and gas discoveries that previously may have been sub-commercial. The projects described in this paper include, the Maui FPSO Oil Development, Tariki/Ahuroa Gas Plant, Kapuni Gas Treatment Plant Upgrade and the reinforcement of the NGC Gas Transmission system to Auckland. Also described are a variety of other minor projects, including some downstream investments. The upstream investments alone total

some \$300 million. In combination with well drilling, the industry has reinvested almost \$400 million in the last two years.

## Maui FPSO Oil Development

At a cost of \$150 million, the Maui FPSO Oil Development is by far the most significant project to be completed since the last conference. Work on this project followed the identification of Maui oil in 1993 during the drilling of gas wells for the Maui B development. A project team was put together by Shell Todd Oil Services Limited for the Maui partners in 1994, and the project was completed and first oil produced in October 1996. The development comprised a stand alone Floating, Production, Storage and Offloading Vessel (FPSO), named the Whakaaropai ("Good Thoughts"), located some 1.3 km from the Maui B platform, approximately 40 km offshore Taranaki. An existing super tanker was purchased by the joint venture, and converted to a FPSO, for permanent use over the estimated seven year production life span. Initial reserves were estimated to be 22 million barrels of oil. Processing design capacity is 5000 m<sup>3</sup>/d of oil, 700,000 m<sup>3</sup>/d of gas, with initial water rates of 3,000 m<sup>3</sup>/d. The vessel itself was fitted out in the Singapore yard of MODEC, and motored down here under its own power for positioning in the third quarter 1996. Twenty-four hour manning of the vessel employs twelve personnel per shift, with maintenance staff bought on the vessel as required.

The nearby Maui B platform was modified to provide manifolds, separators, and control equipment for a "not normally manned" operating status.

The FPSO solution has proved to be very cost effective for the development of what was otherwise a marginal oil resource. Other alternatives would have required pipelines to the shore, and expensive upgrades to the Oaonui gas production station. The project was completed essentially on time and \$20 million under budget. New benchmarks were established in terms of the time to complete and bring on stream, the overall cost of development, and the manning philosophy.

The challenge now for the Maui Joint Venture and other explorers offshore Taranaki, will be to prove up whatever incremental oil reserves exist in the area to ensure maximum utilisation of the FPSO while it remains in Taranaki waters for the next approximately five years.

## Tariki/Ahuroa Gas Plant

The onshore gas fields of Tariki and Ahuroa, with reserves of approximately 100 petajoules, were discovered in 1986. Following a tender process, the gas was contracted to Electricorp, with the contract subsequently assigned to Contact Energy. The contract provided for the gas to be used at either the New Plymouth or Stratford power stations, with provision for delaying first gas until the middle of 1996. Meantime the Waihapa oil field was developed, with the production facility constructed in 1992 to process oil, associated gas and water. Provision was made on the site for the later addition of a gas plant to process the gas from Tariki and Ahuroa. In 1994, preparations were made for the design and construction of an appropriate gas plant and a contract was subsequently awarded to Propak Industries of Airdrie, Alberta, for the design and construction of a 35 mmscfd gas plant, with LPG recovery, and fractionation of the propane and butane components for separate storage and sale. Condensate recovery at maximum gas rates is 320 m<sup>3</sup>/d with LPG production of up to 130 t/ day.

Construction began on site in November 1995, and the plant was shipped in modular form from Canada, arriving in February 1996, with start-up in July 1996. The peak workforce employed on site was 150, and the total project cost, including pipelines from the gas wells some 15 km away, was \$32 million. The plant uses standard industry proven technology with glycol dehydration, and triethelene glycol refrigeration to cool the gas stream down to -32°C for maximum condensate and LPG recovery. The gas is then recompressed and shipped some 40 km to the Contact Energy power station at New Plymouth, with the potential to supply Stratford power station in the future. LPG is shipped out via road tankers and the condensate is blended with Waihapa crude oil for shipping by pipeline to the Omata Tank Farm at New Plymouth.

## Kapuni Gas Treatment Plant Refurbishment

This three year project was completed in December 1997 at a total cost of \$25 million. The original Gas Treatment Plant, owned and operated by NGC, was built in the late 1960s and commenced operations in 1970. Various modifications have been made over the years to optimise the processing and treatment of gas from the adjacent Kapuni gas condensate field. In 1991, the need for a substantial upgrade was identified to maximise the life of the facility. This would incorporate the latest technology and extend the economic life through to the next century. Changes made include state of the art control systems, enhanced efficiency and control of product quality, and improved environmental performance. Additionally, the LPG process was completely changed, to provide more efficient recovery of LPG. The original ammonia absorption and glycol dehydration systems were replaced by IFPEXOL methanol drying and propane refrigeration down to -25°C. The LPG plant was commissioned in 1997, and final refurbishment work was completed at the end of December 1997 with the plant due to be officially opened following this conference, by the Minister of Energy, The Hon Max Bradford, on 2 April.

The current capacity of the plant is 6 million m<sup>3</sup>/day raw gas, with LPG production of 280 t/d. The gas is compressed for sale through the NGC pipeline transmission and distribution network. LPG is picked up by road tanker and residual natural gas liquids (NGLs) are returned to the

adjacent Shell Todd facility.

## **NGC Transmission System Reinforcement**

NGC identified a customer requirement for improved gas capacity into Auckland to meet increased demand, in particular from the proposed Contact Energy Otahuhu Power Station. The overall cost of this project which began in 1996 is estimated to be \$19 million.

The work comprises:

1. Substantial expansion of the Rotowaro compressor station with the addition of two gas turbine driven compressors.
2. The looping of approximately 3 km of existing 350 mm diameter pipeline in South Auckland.
3. The construction of a 2.5 km, 300 mm diameter pipeline lateral to supply gas to the Otahuhu Power Station.

Following approximately 18 months work, the construction is now complete and commissioning is scheduled to start in early April 1998. After completion of this project, the capacity of the transmission system to south Auckland will be 4.2 million m<sup>3</sup>/d, which is a 65% increase over the previous capacity.

## **Engineering Alliances**

Significant developments have occurred in the Taranaki engineering and construction industry. Most noteworthy is the joint venture announced in February between Worley and Fitzroy Engineering. These companies have set up a new Joint Venture to provide comprehensive engineering and construction service to the petroleum and petrochemical industries in New Zealand, based in New Plymouth. This mirrors developments of a similar kind overseas and provides a well resourced company with the capability to carry out a wide range of EPC contracts. As with similar developments in contracting and risk sharing overseas, the alliance will provide benefits for both the customer and the service provider, with opportunity for both to share in the more cost effective solutions that are expected from such an alliance arrangement.

On a smaller scale, construction company Inglewood Engineering, has formed a joint venture with engineering designers Plant and Platform, to provide a similar EPC capability.

## **Butane Storage at Oaonui**

Another project of significance was the addition of dedicated butane storage at the Maui Onshore Production Station at Oaonui. At a total cost of \$10 million, this project provided the Maui Joint Venture with the capability to separately store sufficient butane to supply markets in the Pacific Islands. With the addition of 1,000 t of extra storage, cargo sizes can be optimised.

## **Maui Well Control Systems**

The Maui A platform control systems were significantly upgraded in 1997 at a cost of \$7 million.

These upgrades included a DCS and high capacity microwave communications link between the onshore production station at Oaonui, and the offshore facilities. A consequence of more automated controls is a reduction in the need for offshore staff, with the attendant drop in risk to personnel, and less likelihood of undesirable operator intervention.

## **Kaimiro Gas Conservation**

In 1995 Fletcher Challenge Energy Limited (FCE) continued developing the Kaimiro oil field with significant associated gas. Up to that time, the relatively nominal quantities of gas had been flared. However, with increases in oil production up to 1200 bpd, a project was implemented to conserve and sell the gas. This involved modifying the original gas plant, which was installed in the early 80s for Kapuni Formation gas from Kaimiro-1, and providing a 4 mmscfd gas compressor. Total cost of this project was \$4.85 million. This project was completed in late 1996, has successfully eliminated flaring, and is currently working at full capacity.

Following that project, FCE has contracted with the Ngatoro Joint Venture to similarly conserve gas currently being flared at the Ngatoro Field. Currently, pipelines, process equipment and a compressor are being installed to expand the gas handling facilities at Kaimiro with completion scheduled for July this year. At that point, the total gas handling capacity will be approximately 8 mmscfd, with all the gas from Kaimiro and Ngatoro conserved for sale to the market throughout the existing transmission system.

## Downstream Projects

Somewhat less directly related to the upstream exploration industry, but nevertheless important from a marketing point of view, are the following.

Commissioning of this plant is currently being completed. The project is one of the largest single-shaft combined cycle power plants in the world, with the combination of a front end gas turbine driver, and waste heat steam turbine, giving an overall efficiency of approximately 55%. This plant is located adjacent to the original Contact Energy single-cycle 200 megawatt gas turbine plant near the town of Stratford. The total projected cost is \$340 million.

This plant has been developed by NGC and Bay of Plenty Electricity. Construction began in June 1997 and the plant was commissioned in late December 1997, at a total cost of \$37 million. The waste heat from the single-cycle gas turbine is utilised to produce steam for the NGC Gas Treatment Plant and the Lactose New Zealand Ltd Dairy Factory some 3 km away. After providing for the electricity requirements of the Gas Treatment Plant and the dairy factory, the excess power is supplied to the electricity transmission grid. Two Solar Mars gas turbines are used for electricity generation and the plant is located adjacent to the existing NGC Gas Treatment Plant.

This project and the Kapuni Gas Treatment Plant upgrade were carried out concurrently, involving up to 100 contractor personnel on site.

The other downstream project of significance is the expansion of the Omata Tank Farm by FCE, for its entry into the downstream retail market. This project has involved the installation of three additional storage tanks with a total capacity of 16,000 t of refined product. The facility will be used as a terminal to receive motor spirits shipped in through Port Taranaki, and to distribute those via road tankers to the retail market being established by FCE.

The Omata Tank Farm has seen significant development over the years, since the first tanks were built in 1984, as part of the infrastructure associated with the development of the Motunui Gas to Gasoline Plant, and the McKee oil field. At that time there were a total of four tanks at Omata, two for the storage of synthetic gasoline, and two for the storage of crude oil. Since then, various additions have been made and the current complement of tanks comprises four for the storage of synthetic petrol or methanol, one 25,000 t tank for the storage of Maui condensate, three tanks for storage of crude oil, and three tanks for motor spirit.

With multiple pipeline connections to the petrochemical wharf at Port Taranaki, the Omata and Paritutu Tank Farms are important infrastructure which will continue to underpin the future viability of the petroleum industry in Taranaki.

## Author

Geoff Logan manages the operated upstream interests of Fletcher Challenge Energy Limited (FCE) in Taranaki. His career with FCE spans 15 years and includes management of the McKee Development infrastructure, and the Waihapa Field. Following three and a half years in Calgary with FCE Canada, Geoff assumed his current role in 1995. He has a Civil Engineering degree from Canterbury University.