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## Special Report



Special Report:  
Ichthys LNG Project and Gas Supply Chain

# Delivering energy

## from the ancient seabed of Australia for the future of Japan

Off the shores of Australia, roughly 6,000 km due south of Japan, work has been progressing on the development of the large-scale Ichthys LNG Project with the goal of starting production by the end of 2016. Natural gas fields deep under the seafloor off the shores of Australia lie waiting to supply Japan with approximately 10% of its annual LNG imports. Construction on the Naoetsu LNG Terminal in Niigata Prefecture has been completed, the final piece of the supply structure for natural gas coming from Australia to Japan.

### Ancient Times

Roughly 200 km off the shores of Australia and Western Australia, at depths of 4,000 and 4,500 m, there are two geologic reservoirs of gas. These reservoirs of gas cover approximately 600 square km, roughly the same area as the 23 wards of Tokyo. One or two hundred million years ago, at the height of the Jurassic period, these geologic stratum were formed. Over a long period, these massive gas fields gradually came into being and now lie sleeping under the sea off the shores of Australia.

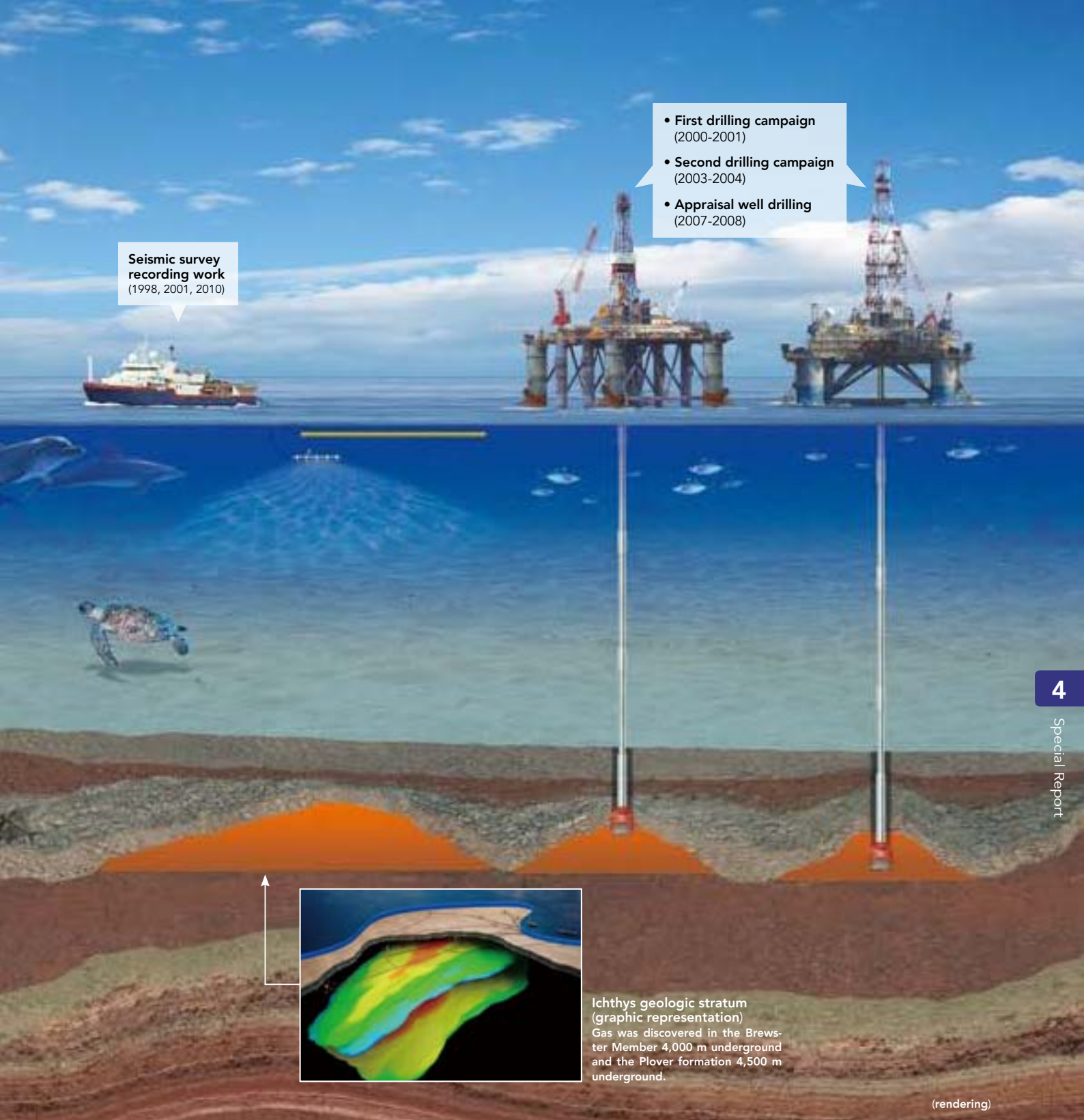
### Modern Times

In the mid-1980s, INPEX entered the field of offshore resource development in Australia, accumulating knowledge, experience and research over the next decade. In open bidding during 1997, INPEX placed the winning bid for the Ichthys block (WA-285-P Block) after confirming its considerable potential, and obtained operator rights to the area in August 1998.

Ichthys  
gas-condensate  
field

A U S T R A L I A





2000–2004

In 2000 and 2001, INPEX conducted the first drilling campaign, drilling three exploratory wells that all confirmed the presence of gas and condensate. INPEX then conducted three-dimensional seismic surveys. In the second drilling campaign in 2003 and 2004, three more exploratory wells were drilled, confirming the existence of massive gas and condensate fields under the seafloor.

2007–2008

In 2007 and 2008, INPEX drilled two wells to assess recoverable reserves of gas and condensate at Ichthys. INPEX also decided on Darwin as the location to build the LNG plant.

2009–2011

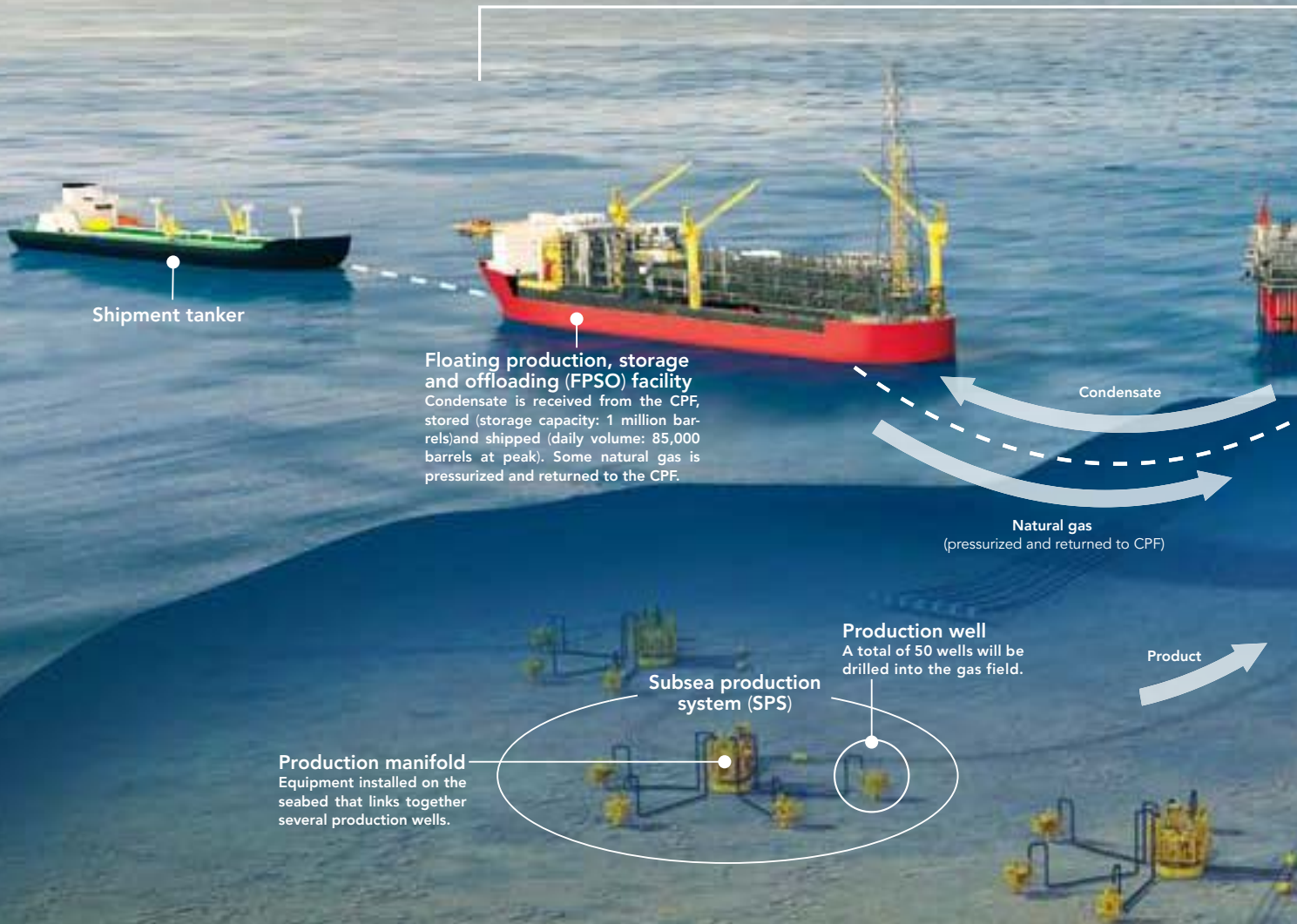
From 2009 until the final investment decision (FID) was made in January 2012, the following preparatory development work was undertaken.

- In 2009, front-end engineering and design (FEED) work began.
- From July to September 2010, conducted a public review of the Environmental Impact Statement (EIS).
- May 2011, acquired the pipeline license.
- In 2011, obtained environmental approvals from the Northern Territory Government and the Federal Government.
- Signed LNG sales contracts with eight LNG buyers, finishing contractual agreements for the purchase of the entire annual LNG production volume of 8.4 million tons.

# Development Concept of the Ichthys LNG Project

## Offshore Production Facilities

Product from development wells is collected in the subsea production system (SPS) and then sent to the offshore central processing facility (CPF) through flowlines and flexible risers. Gas and condensate are separated at the CPF, and the condensate is stored at a floating production, storage and offloading (FPSO) facility until transfer to a tanker for shipment. The gas, however, is transferred to an onshore liquefaction plant via a gas export pipeline (GEP).



## 2012

In January 2012, INPEX made a final investment decision (FID) and began development work. In March, INPEX was granted a production license, and in May, held a steel cutting ceremony for the onshore gas liquefaction plant in Darwin. In December, INPEX signed project financing arrangements totaling US\$20 billion.



Ceremony for the FID (January 2012)

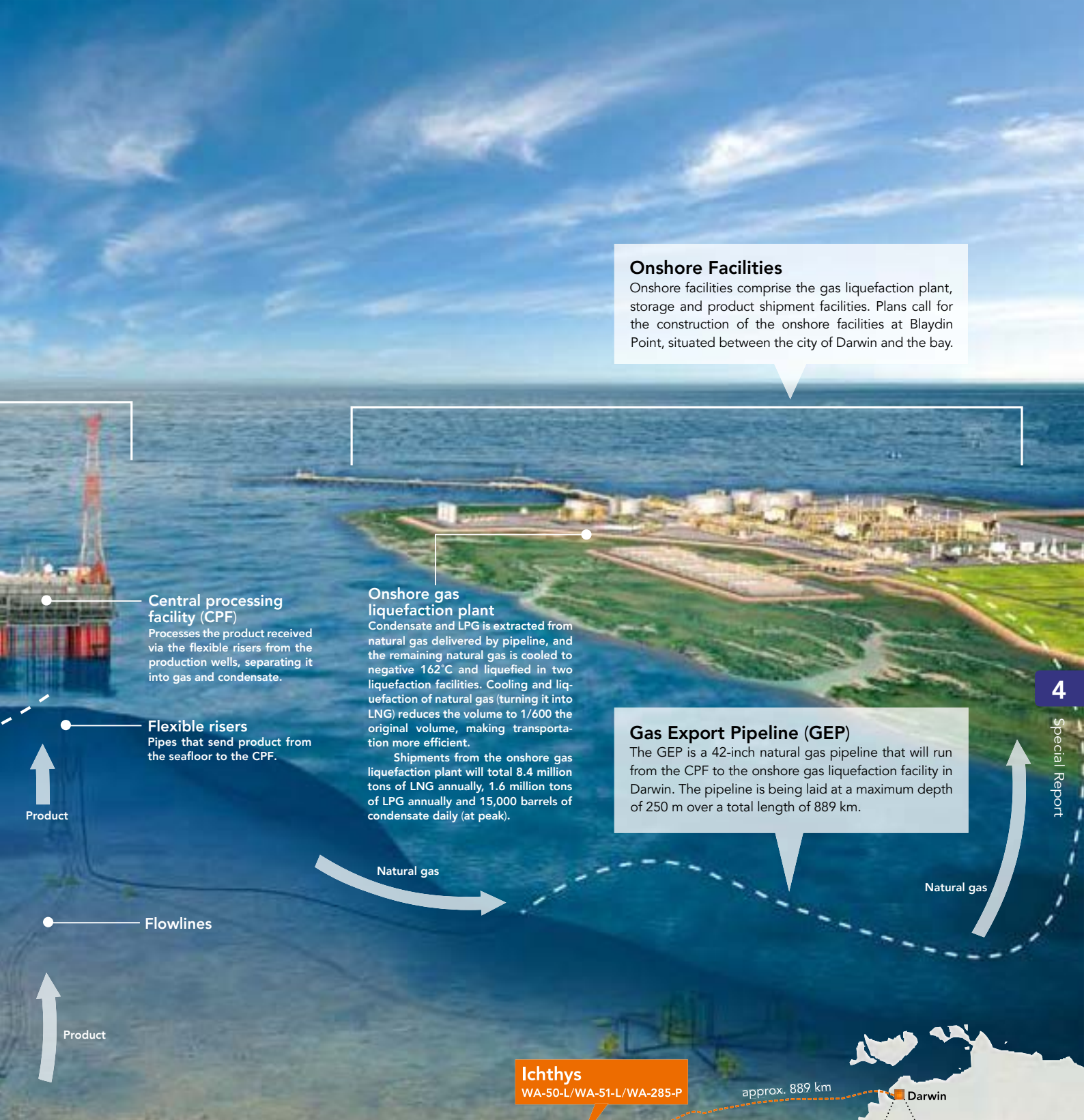
## 2013

In January, a steel cutting ceremony was held for the offshore central processing facility (CPF). In February, liability insurance was arranged for related construction facilities during the construction period. In June, INPEX signed contracts for the building and ownership of LNG carriers and contracts for time charters to transport LNG. A steel cutting ceremony was also held for the offshore floating production, storage and offloading (FPSO) facility, construction commenced on modules for the offshore facilities and onshore gas liquefaction plant, and construction started on bridges and tanks for the onshore facilities.



FPSO steel cutting ceremony (June 2013)





### Onshore Facilities

Onshore facilities comprise the gas liquefaction plant, storage and product shipment facilities. Plans call for the construction of the onshore facilities at Blaydin Point, situated between the city of Darwin and the bay.

### Central processing facility (CPF)

Processes the product received via the flexible risers from the production wells, separating it into gas and condensate.

### Flexible risers

Pipes that send product from the seafloor to the CPF.

### Onshore gas liquefaction plant

Condensate and LPG is extracted from natural gas delivered by pipeline, and the remaining natural gas is cooled to negative 162°C and liquefied in two liquefaction facilities. Cooling and liquefaction of natural gas (turning it into LNG) reduces the volume to 1/600 the original volume, making transportation more efficient.

Shipments from the onshore gas liquefaction plant will total 8.4 million tons of LNG annually, 1.6 million tons of LPG annually and 15,000 barrels of condensate daily (at peak).

### Gas Export Pipeline (GEP)

The GEP is a 42-inch natural gas pipeline that will run from the CPF to the onshore gas liquefaction facility in Darwin. The pipeline is being laid at a maximum depth of 250 m over a total length of 889 km.

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### Ichthys

WA-50-L/WA-51-L/WA-285-P

approx. 889 km

### Project Outline

<b>Production volume</b>	LNG: 8.4 million tons/year
	LPG: 1.6 million tons/year
	Condensate: about 100,000 barrels daily (at peak)
<b>CAPEX</b>	US\$34 billion
<b>Participating interests</b>	INPEX 66.070% (operator)*, TOTAL 30%, Tokyo Gas 1.575%, Osaka Gas 1.200%, Chubu Electric Power 0.735%, Toho Gas 0.420%
<b>Schedule</b>	January 2012 final investment decision (FID), plans to start production by the end of 2016

\*Of this figure, 2.625% is being transferred to CPC.

### Location of Ichthys gas-condensate field

- Browse basin on northwestern continental shelf off coast of western Australia
- About 200 km off western Australia

### Block area

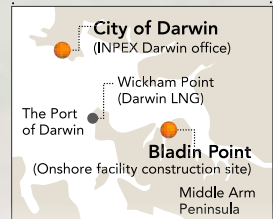
- WA-50-L/51-L block: 1,079 km<sup>2</sup>
- WA-285-P block: 995 km<sup>2</sup>

### Water depth

- Block water depth: 170–340 m
- Water depth of marine production facilities: about 250 m

100 km | 200 km

Timor Sea Northern Territory







## Work Status in 2014 (as of July 2014)

Projects to advance important work are becoming more tangible in 2014.

In February, full-scale assembly work began on the hull of the floating production, storage and offloading (FPSO) facility, and assembly of the offshore central processing facility (CPF) began in April. In June, work progress crossed the 50% mark, less than two years and six months after the final investment decision in January 2012. At the end of June, the gas export pipeline (GEP) laying started. In July, development work progressed with the launch of the FPSO hull and the start of the module arrival for the onshore gas liquefaction plant.



### Onshore facilities

- ✓ Completed Accommodation Village for construction workers
- ✓ Completed dredging of Darwin bay
- ✓ Modules started to arrive for onshore gas liquefaction plant



### Other

- ✓ Work progress at 50% (June)





**Offshore production facilities**

- ✓ Started work assembling FPSO hull
- ✓ Started work assembling CPF
- ✓ To start drilling production wells



**Gas export pipeline**

- ✓ Completed coating of steel pipes
- ✓ Started laying gas export pipeline

- 1: Aerial photo of onshore gas liquefaction plant under construction in Darwin
- 2: Cutting-edge Castrolne pipeline laying ship for deep-sea work; able to lay subsea 42-inch diameter pipelines
- 3: ENSCO 5006 drilling rig for production wells; plans call for drilling of production wells to start in 2014
- 4: LNG tank at an onshore gas liquefaction plant under construction
- 5: FPSO assembly construction
- 6: Gas export pipeline laying work in progress in the Darwin coastal waters
- 7: FPSO hull launch
- 8: Plant module assembly work in progress at an onshore gas liquefaction plant
- 9: Landing facilities under construction for onshore gas liquefaction plant
- 10: Jetty for product shipment under construction at an onshore gas liquefaction plant
- 11: Accommodation Village for up to 3,500 construction workers for onshore gas liquefaction plant
- 12: Subsea production system under construction in the United Kingdom.
- 13: CPF under construction; Ichthys CPF measures 150 m by 110 m, with a total displacement of 140,000 tons, making it one of the largest in the world
- 14: Hull of the CPF



# Procurement, construction and development work ramping up for start of production by the end of 2016



## Substantial Condensate and LPG

In addition to the 8.4 million tons of LNG per year, the production volume of the project calls for a maximum of 100,000 barrels of condensate a day and 1.6 million tons of LPG per year.

## Ratio of Lump-Sum Contracts: Approximately 75%

Approximately 75% of the amounts contracted with the EPC contractors are lump-sum contracts, which are serving to reduce the risk of cost overruns.

## Cooperation with Oil Major

Development work is being advanced with oil major TOTAL, which has a vast amount of experience in LNG projects.

## Sales of Entire LNG Production Volume Completed

The signing of sales and purchase agreements covering the entire production volume was completed before the final investment decision (FID).

## Features and strengths of the Ichthys project

### Painstaking Pre-Development Preparation

Having extended the front-end engineering and design (FEED) activities by one year, sufficient engineering work has been undertaken and raised the accuracy of the cost estimates.

### Contracts with Reliable EPC Contractors

The Company secured highly reliable EPC contractors with track records in LNG projects.

### Secure Funding

In December 2012, the Company signed project financing arrangements for US\$20 billion, thereby concluding its funding.

Onshore gas liquefaction plant under construction

Completed onshore gas liquefaction plant (rendering)

## 2015–2016 Year-End

Construction and equipment installation will continue at both offshore and onshore facilities. Modules will then be installed at onshore facilities and connected to offshore facilities, followed by trial production operations. After production commences, LNG, LPG and condensate products will be shipped and sold to customers.

### Major Work Flow Until Start of Production

#### Construction and infrastructure development

(plant module construction, infrastructure development and facility construction at plant site, etc.)

#### Plant construction with module and other installation

#### Construction and equipment installation of offshore facilities

(CPF and FPSO construction, gas export pipeline laying, etc.)

#### Connection to offshore facilities

Commissioning

Start of production

Transport and sale of product

Production well drilling



# LNG produced at Ichthys (INPEX portion) is transported from Australia to Japan via the Naoetsu LNG Terminal

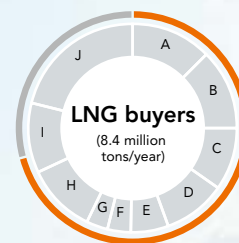


Naoetsu LNG Terminal

As an LNG carrier for the Naoetsu LNG Terminal, the Sayaendo-type LNG carrier is currently being built with a tank capacity of 155,300 m<sup>3</sup>.

**Transportation distance:** about 7,000 km

**Transportation days:** one-way is about 10 days (Reference: It takes about 30 days from the U.S. Gulf of Mexico to Japan)



**To be delivered to Japan**  
(approx. 70% of the total)

(Million tons/year)

A Tokyo Electric Power 1.05	F Kyushu Electric Power 0.30
B Tokyo Gas 1.05	G Toho Gas 0.28
C Kansai Electric Power 0.80	H INPEX 0.90
D Osaka Gas 0.80	I TOTAL (France) 0.90
E Chubu Electric Power 0.49	J CPC (Taiwan) 1.75

## Insurance Arrangements for Facilities during Construction Period Completed

In February 2013, INPEX completed insurance arrangements related to the construction periods of the project's onshore and offshore facilities.

## Addressing risks and making steady progress on projects

### Upside potential in surrounding areas

The 11 exploration blocks surrounding Ichthys could lead to greater value in the future for the Ichthys LNG Project.

Ichthys LNG Terminal

Route from Australia to Japan (Naoetsu LNG Terminal) (rendering)



**Seiya Ito**  
Director, Managing Executive Officer,  
Senior Vice President of Ichthys Project Division

**Q** How many people are engaged in the framework for advancing the development work?

**A** Excluding the EPC contractors, there are **1,800 people on the Ichthys LNG Project overall, of whom 40 are seconded from the oil major TOTAL** (as of June 30, 2014). It is expected that this will increase up to a maximum of around 2,000 for the overall project.

**Q** How do you go about managing the operations of each base, which span the world?

**A** For the Ichthys LNG Project, we have assigned a person in charge at each base. In addition to carrying out detailed operations management, we ascertain and manage the overall project operations from the Perth office on the basis of regular operational reports from each base. **In addition, a Technical Directorate and a Project Coordination control overall operations in a cross-organizational manner.**



# Naoetsu LNG Terminal and Natural Gas Pipeline Network in Japan



Full view of the Naoetsu LNG Terminal

## Naoetsu LNG Terminal

INPEX's portion of the Ichthys LNG Project will mostly be received at the Naoetsu LNG Terminal. Construction on the Naoetsu LNG Terminal began in July 2009, and it commenced operations in December 2013. Although six months or so have passed since starting operations, the terminal has operated stably without any major incidents. Up until LNG is received from the Ichthys LNG Project, INPEX will purchase a total of roughly one million tons of LNG, the equivalent of 17 LNG tanker vessels, from Chubu Electric Power Co., Ltd., and supply natural gas to Japan.

### Outline of Naoetsu LNG Terminal Facilities

#### Unloading arms (wharf)

Unloading equipment for moving LNG from LNG carriers to onshore facilities.



#### Two LNG tanks

Massive LNG storage tanks about 80 m in diameter and 50 m in height.



#### RGB (return gas blowers)

Equipment that returns boil-off gas (BOG) to LNG carriers, to modify pressure balance.



#### ORV (open rack vaporizer)

Equipment that warms LNG up to a natural gas state. Seawater is used as a heating medium.



#### BOG compressors

Equipment that compresses BOG from LNG tanks to make raw materials.





**LPG tanks**

Storage tanks for LPG used to modify the calorific value of natural gas.



Location	12 Yachiho, Jyoetsu, Niigata Prefecture
Area	Approx. 25 ha
Gas production capacity	7.5 million m <sup>3</sup> /d (LNG 240 tons/hour)
LNG tanks	180 thousand kl x 2 (upgrade possible)
LNG receiving capacity	approx. 1.5 million tons/year



**Central Control Room**

All equipment and operations within the terminal facility are monitored and controlled from a central location.

## Building a Gas Supply Chain

Since the 1960s, INPEX has maintained a pipeline network for the transport of natural gas. This pipeline network now extends a total of 1,400 km, crossing seven prefectures and one metropolis in the Kanto-Koshinetsu region.

To address domestic demand for natural gas, which is likely to grow strongly, INPEX is building out a gas supply chain that will link together the following:

① Natural gas received at the Naoetsu LNG Terminal, etc.;

- ② Natural gas mainly in Niigata Prefecture; and
- ③ Natural gas transport pipelines.

INPEX will be the first company in Japan to be involved in every facet of natural gas operations from upstream to downstream activities including development, production, liquefaction, transportation, gasification and supply, as well as the ownership and operation of its own overseas gas fields. While building a gas supply chain, INPEX will work to expand its natural gas business further over a broader region.



Successful start-up of the Ichthys LNG Project and others



Establishment of our natural gas supply chain

with the Naoetsu LNG Terminal and a domestic natural gas pipeline network

Become a top-class international oil and gas E&P company after the oil majors



## Future Growth

The Ichthys LNG Project will produce natural gas from under the sea of ancient Australia. INPEX is also building a gas supply chain for delivering natural gas throughout Japan. We are taking solid steps toward our Medium- to Long-Term Vision that targets net production volume of one million boed and domestic gas supply volume of 2.5 billion m<sup>3</sup> in the early 2020s.

The launch of this large-scale project will propel INPEX into the top ranks of the internationally competitive oil and gas E&P companies. By building a natural gas supply chain using gas infrastructure in Japan, INPEX is evolving into an integrated energy company that reliably supplies energy.

### Long-Term Outlook for Net Production Volume and Domestic Gas Supply Volume

