

QER's New Fuels Development Centre



The next generation in creating new fuels for Australia
July 2011

Australia is fast running out of our own oil and as a country we need to be creating new fuels...

The importance of Queensland's oil shale resources

Queensland's vast oil shale deposits contain an oil production potential around three times that of the Bass Strait oil field, to date the largest single oil field discovered in Australia.

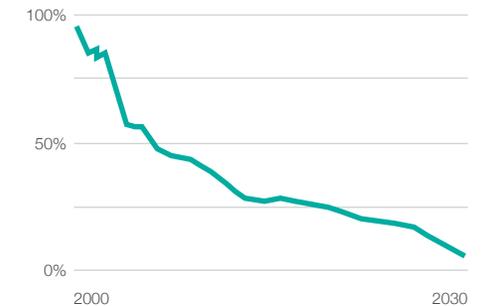
Why are these deposits so important? Because as Figure 1 shows, Australia is fast running out of our own oil and as a country we need to be creating new fuels. Queensland's oil shale deposits offer a promising and realistic solution to help address our nation's current and worsening oil shortage, especially in the provision of transport fuel (see Figure 2).

Responsibly developing these rich oil shale deposits will help Australians fuel our cars, trucks, trains, ships, motorbikes, tractors, bulldozers, planes, boats and anything else that requires liquid fuel to operate.

The fuels created will transport food from the farm to the table, keep ambulances on the road and medicines and blood supplies moving to hospitals, keep tourists travelling and help tens of thousands of young Australians stay employed, and fuel the ships which transport our nation's wealth-generating agricultural and resource exports.

That is why we looked to Queensland's oil shale when we set about creating new fuels for Australia.

Figure 1: Australia's forecast decline in oil self-sufficiency



Part of an oil shale deposit north of Gladstone, Queensland



Our Queensland operations

We have an oil shale mine and small-scale oil shale processing plant north of Gladstone, Queensland, within the New Fuels Development Centre. Because of the nature of our Queensland oil shale and the relative shallowness of the deposits, it makes sense to mine the oil shale and safely process it above ground.

The Paraho II™ technology demonstration plant at the New Fuels Development Centre is a key part of our plans to strategically develop our share of Queensland's rich oil shale resource assets.

We estimate the Stuart oil shale deposit, on which the New Fuels Development Centre is located, could produce up to one billion barrels of synthetic crude oil and high quality transport fuels over the next few decades. We are also continuing evaluation of our other Queensland oil shale resources.

Our technology demonstration plant

We have set a number of objectives for the technology demonstration plant, including:

- Demonstrate safe operation
- Establish environmental credibility, thereby further building community and Government support
- Maximise technical development and enhance operational expertise
- Test process improvements and evaluate varying oil shale feed properties
- Further understand the properties of our fuel products to ensure we meet all relevant fuel standards

The technology demonstration plant will enable the Queensland Government and our neighbouring communities to assess the Paraho II™ process, and see firsthand just why we have selected this technology.

Our plant will in due course become a research and development centre in surface oil shale processing with the Paraho II™ technology as its centrepiece.

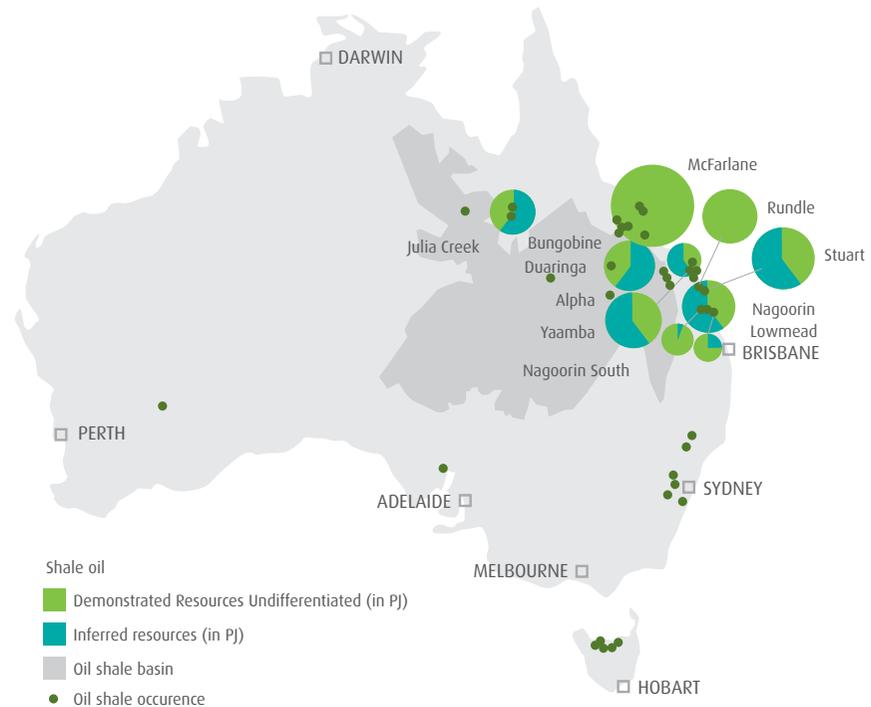


Figure 2: Australia's oil shale resources = 22.9bn barrels of oil.
Source Geoscience Australia 2010.



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What makes up the technology demonstration plant

While small in terms of the volume of oil shale processed, the technology demonstration plant is nevertheless complex in nature. We refer to it as an 'end-to-end' plant in that it contains all the key elements that would be found in a commercial-scale oil shale processing plant.

A pictorial representation of the plant can be seen in Figure 3.

The crushing plant takes the oil shale from the open-cut mine at the site and crushes it to between 10mm and 40mm in size. In doing this, some fine particles are also produced. These are collected and turned into small briquettes (akin to BBQ briquettes) in the briquetting press, which is part of the crushing and screening plant that sorts different sized oil shale particles.

Queensland oil shales contain relatively high levels of moisture. Depending on the particular shale in question, the moisture content can be anywhere from 8% to 30%. It is therefore necessary to dry the shale before it can be fed into the Paraho II™ processing retort, and this is done in the dryer where hot air is used to dry the shale. After drying, the shale is transported by covered conveyor and fed into the retort.

In the retort, the crushed shale passes gradually through a series of temperature zones. The retort itself contains no internal moving parts in the temperature zones and the shale moves under gravity. It takes approximately six hours for the shale to travel from the top of the retort to the bottom.

The key zone in the retort is where the shale is heated to about 500°C to extract the kerogen contained in the shale as a vapour of oil droplets. (Kerogen is a mixture of organic compounds found in sedimentary rocks, which when heated releases hydrocarbons.) The retort is a completely sealed vessel and the temperature of the shale when it exits the bottom of the retort is about 190°C. (This is about the temperature you bake a cake at in your oven at home). The processed shale is moistened to further cool it to about 70°C before it is conveyed back to the mine pit area.

The oil vapour rises in the retort with the recycled hot gas and is then captured in the oil recovery unit of the plant. The oil recovery unit condenses the water vapour contained in the gases and both this condensed water and the oil droplets are sent



to the measure tanks in which the oil is separated from the rest of the liquid. The remaining water is then pumped from the measure tanks to holding tanks for treatment.

The oil is sent from the measure tanks to the oil upgrading facility at the plant. The oil upgrading facility produces high quality fuel products in small quantities. These fuels include ultra low sulphur diesel, high quality aviation fuel and low sulphur fuel oil. Other products may also be produced.

We are able to store up to 1,300 barrels (206,000 litres) of products in different holding tanks at the New Fuels Development Centre. Fuels will be transported in small containers from the product load out facility to Brisbane by road (see Figure 4) and from Brisbane will then be transported onwards to final destinations.

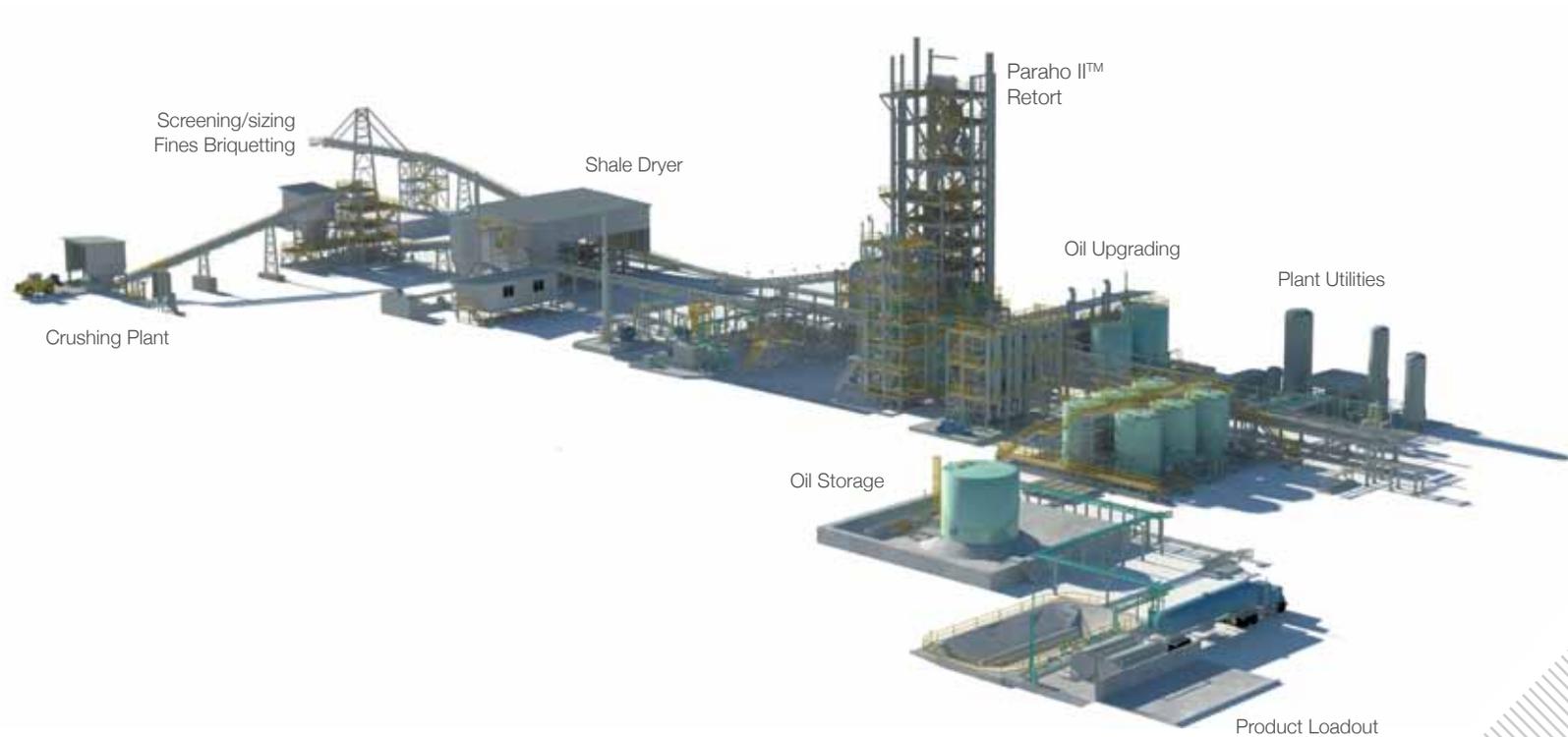


Figure 3: QER's technology demonstration plant



Figure 4: An example of the tanks in which fuel will be transported from the New Fuels Development Centre

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The technology demonstration plant in operation

We will operate the plant in a steady state for some months and we will be providing technical data on the plant's performance to the Queensland Government on a regular basis for verification and assessment. We will also test the plant in various operating conditions (for example, operating the retort with more or less oxygen and other gases).

The results gained from running the plant in different modes will provide us with better information about how any possible future commercial scale operations would perform.

At all times we will operate our plant in a manner that ensures we remain within our environmental licence conditions.

Controlling and minimising dust

We have a number of dust suppression measures in place that will ensure our neighbours and the environment are unaffected by our mine and plant operations. Properly sealed, curbed and guttered roads in the plant area ensure that there will be minimal dust from vehicular movements in this area. The use of covered conveyor belts to convey the crushed oil shale to and from the processing retort is another important component in minimising dust.

In the mine area, for the next few years we will be mining infrequently and removing only small volumes during mining campaigns. We will nevertheless use water to suppress dust. And we will also use water to moisten the processed shale when it exits the retort, both

to reduce temperature and reduce the chance of any fugitive dust, even though the nature of the retort is such that particles exit the retort predominantly as lumps. Particles are not subject to any mechanical action in the dryer or retort that causes severe abrasion and hence they are not broken down into large quantities of fine particles.

During the crushing and screening of the shale we also utilise baghouse technology that will capture any dust from this process that might otherwise escape.

How we minimise odour and emissions

If you are working at, or taking a guided tour through, our plant you may notice a slight odour that is associated with any hydrocarbon facility, such as an oil refinery. Anyone who has visited



any of the refineries in Brisbane, Melbourne and Sydney would have experienced this. But if you are not in the immediate vicinity of the plant site, you will not smell our plant operating.

The most important feature of the Paraho II™ vertical retort is that it is a sealed unit, preventing any fugitive emissions. The processing of oil shale, like many industrial processes, produces what are known as volatile organic compounds that can be odorous even at small concentrations. Our demonstration plant captures these compounds and combusts them with oxygen in a Thermal Oxidiser (essentially a high temperature incinerator) in order to break them down and eliminate odour. These gases are then emitted into the atmosphere in very low concentrations, within the licence limits set by the Queensland Government.

Products from our plant 2011 – 2014

The primary purpose of the oil upgrading facility within the plant is to produce ultra low sulphur diesel and jet fuel for ongoing testing and certification purposes. We are also producing a low sulphur fuel oil at the plant.

The relative proportions of diesel and aviation fuel produced will vary from time to time according to testing requirements for volumes. To ensure that the ultra low sulphur diesel and jet fuels meet Australian fuel quality and performance standards, we have engaged two of the world's foremost fuel research and testing institutes.

Southwest Research Institute (SwRI) in San Antonio in the USA has conducted engine testing on the ultra low sulphur diesel. The jet fuel testing is being conducted by University of Sheffield staff at the Low Carbon Combustion Centre in the UK. This comprehensive evaluation program will take more than two years to complete.

Production quantities for the next few years will be small. We will only produce about 37 – 40 barrels per day of synthetic crude oil and high quality fuels for transport. (A barrel contains 159 litres, so this equates to between 5,800 litres and 6,300 litres per day).

Government approvals and licences

In order to construct and operate the technology demonstration plant we have required several different Queensland Government approvals. The Queensland Government has granted a Mining Lease (ML80003), a Mining Environmental Authority, a Petroleum Environmental Authority and a Petroleum Facility Licence. The Federal Government has determined that the operation of the mine and plant is not a controlled action for the purposes of the *Environmental Protection & Biodiversity Conservation Act 1999*.

We will only progress beyond the technology demonstration plant if the Queensland and Australian Governments approve any commercial development. We will not proceed until we are satisfied we can safely and efficiently operate such a facility. In addition, a public Environmental Impact Assessment process will ensure all Australians, and most importantly the people of Gladstone and our neighbouring communities of Yarwun, Targinnie and Mt. Larcom, have the opportunity to review our plans thoroughly and provide comment.



About QER

Australia is fast running out of its own oil. Yet development of Queensland's rich oil shale resources could produce enough fuel to fill every family car in Australia once a week, every week for the next 70 years. Several of Queensland's largest oil shale resources, containing about 16 billion barrels of oil, are held by QER, an Australian company. In 2010, the Queensland Government gave approval for QER to produce high quality aviation and transport fuels from oil shale at a demonstration plant near Gladstone.

QER's Vision

QER's vision is to help secure Australia's energy future.

QER's Mission

QER's mission is to build and operate a safe, economically viable and sustainable shale to liquids industry in Queensland.

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