13. Site and Site Conditions

13.1 New South Wales Plant

Location

The notional site selected for the coal conversion plant in New South Wales is in the upper Hunter Valley about 8 km south-west of the town of Scone. The site is about 5 km west of the New England Highway and lies within the Scone Shire.

Topography

The Hunter River drains an area of about 22 000 km^2 and discharges at Newcastle, which is the one of Australia's major industrial centres and the principal port for the area.

The area selected for the plant site is characterised by gently undulating lowlands falling to the flood plain of the Dart Brook and the Hunter River in the east. To the west of the site the land rises stepply from an elevation of about EL 200 to an escarpment at a level of about EL 500.

Environmental Considerations

The area surrounding the proposed plant site has been developed over many years for agricultural and pastoral purposes and the construction of the plant would not be a major hazard for ecological conversion. No unique or endangered species of flora or fauna have been identified in the area.

The proven coal fields extend close to the boundaries of the existing townships and future development of these areas is likely to have a significant impact on the environment of the towns and adjacent areas.

Relationship to Coal Deposits

Large areas of the upper Hunter Valley underlain by the Singleton Coal Measures have been allocated to operating companies and authorities under various types of titles. Titles have been issued as :

Authorisations which permit the holder to carry out investigations for the extension of existing coal areas or the establishment of new mines in particular areas.

Exploration Permits, usually issued by tender to enable the holder to carry out geological investigation and exploration in a large area

Coal Leases, usually granted by means of tender to enable mining to commence investigation under an Authorisation or an Exploration Permit.

Heavy Load Transport

The Port of Newcastle is one of the major ports in Australia, handling large quantities of general cargo, in addition to the main export item of coal and the main import of materials associated with the steel industry. Loads up to 300 t have been unloaded for the EC of NSW by means of Ship's gear onto a barge for transport to a power station site.

Studies carried out by the EC of NSW in connection with future heavy loads have indicated a preference for unloading in Sydney Harbour and transport by rail to the site. The crane limitations at present are the 250 t crane at Garden Island and a 150 t Titan floating crane. Suitable wharves are available for unloading by ship's gear onto either rail or road transport

For future heavy loads, the EC of NSW proposed to use a special heavy rail wagon, at present under construction, with a payload of 340 t and a gross weight of 600 t. However, dimensions of heavy loads could preclude the use of this wagon for large items of equipment.

Water Supply

Water required for the coal conversion plant could be made available from the existing storage of Glenbawn Dam located about 20 km east of the plant site. A lot of installations would be required to supply water to the plant.

Waste Water Disposal

It has been estimated that the total quantity of waste water, with varying mineral contents, to be discharged from the plant will be about 1840 m^3/h or about 14,7 Gl/year.

About 50% of this water can be used for coal washing purposes and recirculated as required. A further quantity will be required for firefighting storage, washing down of coal areas and for ash disposal for transport as slurry to the ash disposal pond.

The design of the plant and ash disposal facilities will provide for all water pollutants to be contained within the site during all but exceptional floods.

Ash Disposal

The estimated quantities of ash to be disposed of, are :

Hydrogenation residue gasification	86 t/h
Coal gasification (Synthesis gas)	57 t/h
Coal gasification (Fuel gas)	36 t/h
Power station	61,1 t/h
	240,1 t/h

It has been assumed that ash from the power station, including fly-ash will be mixed with waste water to from a slurry for pumping to the ash disposal pond about 2 km south of the site. Water used for pumping the slurry will drain from the ash deposits and will be pumped back to the return storage tanks where it will be neutralised for reuse.

Ash from the hydrogenation and gasification will be received in wet condition and will be transported by conveyer to selected ash disposal areas for land-fill. After the first suitable areas of the coal fields become available for restoration, they will be used as ash disposal areas and fully restored for agricultural purposes.

13.2 Queensland Plant

Location

The notional site für the Queensland plant is located in the Surat Basin in south-western Queensland about 12 km north-west of the town of Wandoan. The area is within the Taroom Shire which is bounded in the south by the Great Dividing Range and extends to the north beyond the Dawson River to the Bigge Range.

Topography

The topography within the Shire varies considerably from flat lands generally in the river valleys to steep hillsides.
The area tentatively selected for the site for the plant and the nearby storage and assembly area is undulating and gently sloping with slopes of the order of 1%. The elevation of the site is approximately EL 250 (above sea level) with slopes towards the adjacent Woleebee and Juandah Creeks which are at approximately EL 230.

A suitable site has been selected for a water supply service reservoir on Log Hut Creek which is a tributary of Mud Creek.

Environmental Considerations

The area has been long developed for agricultural purposes and no unique flora or fauna would be lost as a result of the implementation of the project. As there are no major rock outcrops in the area there is no evidence of aboriginal relics which might be affected. The proposed site for the plant is far enough from Wandoan to minimise ash fallout problems. The prevailing winds are also favourably oriented with respect to Wandoan.
The plant would be located some 3.5 km from the Leichhardt Highway and would be only partly visible from the highway.

Relationship to Coal Deposits

The site tentatively selected for the plant was chosen in the first instance to be clear of known coal deposits to ensure that future development would not be hindered. The location proposed is approximately in the centre of the known coal deposits within about 20 km of Wandoan. The plant location is within 5 km of the Austinvale, Woleebee and Anchor Bar areas, which are conveniently located for transport of coal to the plant during the first years of operation.
Portions of these areas, after the extraction of coal would be suitable ash disposal areas for the remainder of the life of the plant.

Heavy Load Transport

The most suitable port for the import of equipment and materials for the project is Brisbane, where new facilities have recently been completed by the Port of Brisbane Authority at Fisherman Island. The equipment required for the plant will include some very heavy and large items which are beyond the scope of normal transport equipment. For loads in excess of 200 t, major problems would have to be overcome if the normal transport methods and routes were to be used. These would include provision of special crane capacity and strengthening of wharves and bridges. Very heavy loads could be transported from the ship's side by a barge with roll-on/roll-off facilities, which could travel up the Brisbane River to a suitable unloading point near the Warrego Highway. Heavy-lift ship's gear would be required to load directly on to the transporter on the barge, and a roll-off ramp would be needed to give access to the highway.

Water Supply

The only reliable source of water in sufficient quantities for the plant is the Dawson River. A lot of installations on the Baroondah Dam and Dawson River would be required to supply water to the plant.

Waste Water Disposal

It has been estimated that the total quantity of waste water, with varying mineral content, to be discharged from the plant will be 1 748 m^3/h or about 14 Gl/year.

About 50 % of this water can be used directly for coal washing purposes and recirculated as required. A further quantity will be required for ash disposal for transport as slurry to the ash disposal pond. Water used for pumping the slurry will drain from the ash deposits and will be pumped back to the return storage tanks where it will be neutralised for reuse.
By making appropriate provisions in the design of the plant and ash disposal facilities, all water pollutants would be contained within the site during all but exceptional floods.

Ash Disposal

The estimated quantities of ash to be disposed of, are :

- gasifiers	134 t/h
- power station	125,5 t/h

It has been assumed that the fly-ash and furnace ash from the power station will be mixed with waste water to form a slurry for pumping to the ash disposal pond about 3 km to the north of the plant.

Ashfrom the gasifiers will be conveyed in a damp form and deposited as land fill in selected areas for the first 5 to 8 years of operation, or until the first suitable areas for reclaim are available from the coal deposits. After that time, ash will be deposited in one of the disused areas.

The capacity of the proposed ash disposal pond will be sufficient to contain the total quantity of ash for about 8 years.

13.3 Victorian Plant

Location

The notional site used for the studying of a coal conversion plant in Victoria is 12 km to the south of Rosedale and just outside the boundary of the Latrobe River catchment, in the Central Gippsland Region. The area lies within the Shire of Rosedale.

Topography

The Latrobe Valley is a broad structurally controlled depression which forms the western limits of the Gippsland Plains. The depression was formed in early Tertiary geological time as an east-west down-faulted area between the Eastern Highlands and Great Dividing Range to the north and the Strzelecki Ranges to the south.
The elevation of the valley varies from about 20 m above sea level along the Latrobe River to about 700 m above sea level in the Strzelecki Ranges.

Environmental Consideratons

The area surrounding the proposed site for the plant has been developed over long periods for agricultural, pastoral and timber purposes. Further changes in the use of the land around the site will result from future development of the vast coal resources.
The effects of the coal conversion plant will be similar to those of the large thermal power stations already operating in the area.

The plant would be located about 10 km from Princess Highway and the adjacent railway.

Waste disposal pipelines, with ocean outfalls are already in operation to dispose of waste water from established power stations and other projects in the Latrobe Valley. A similar system could be established to dispose of saline water from the coal conversion plant.

Relationship to Coal Deposits

The notional site selected for the plant has been located clear of the known boundaries of the major coal deposits, to ensure that coal fields are not alienated.

The site lies immediately to the north of the Stradbroke field and to the east of the Gormandale field.

The major portions of the Stradbroke, Gormandale, Rosedale and Holey Plains fields are all within about 10 km of the proposed site. Portions of these areas would be suitably located as ash disposal areas after all coal has been extracted.

Heavy Load Transport

Harbour facilities able to handle very heavy loads are available at the Port of Melbourne and at Western Port Bay. Wharf facilities are available in the Melbourne area to unload heavy equipment up to about 300 t. Heavier loads could be handled by the use of ship's gear or by jacking into roll-in roll-off transporters. A 250 t floating crane is available at the Port of Melbourne.

Heavy loads in excess of 250 t have been transported to power stations in Victoria by road. The bridges on the Princess Highway leading to the Latrobe Valley have been specifically designed for a gross load of about 560 t, which would enable a pay load of 350 t to be carried, using the only heavy transporter available at present.

Water Supply

Water required for the coal conversion plant should be made available from the Blue Rock Reservoir which is now under construction on the Tanjil River, about 60 km north-west of the plant site. A lot of installations would be required to provide water to the plant.

Waste Water Disposal

It has been estimated that the total quantity of waste water, with varying mineral contents, to be discharged from the plant will be about 860 m^3/h or about 6.9 Gl/year.
A large proportion of this water, particularly that derived from the cooling water cycles, can be used in the open-cut fire fighting systems or for washing down of power station and coal handling areas.
A further quantity will be required for ash disposal for transport as slurry to the ash disposal pond.

All surplus saline water can be discharged via an ocean outfall pipe to Bass Strait. The recently completed saline water outfall pipeline from Loy Yang Power Station to Bass Strait passes adjacent to the proposed plant side. The pipeline distance from the site to the outfall is 42 km.

Ash Disposal

The estimated quantities of ash to be disposed of, are :

coal drying plant	8.8 t/h
gasifiers	68.0 t/h
power station	18.0 t/h
Total Dry	94.8 t/h

This amount to 125.5 t/h or 1 004 000 t/year of wet ash.

It has been assumed that ash from the power station, including fly-ash will be transported as slurry to an ash disposal pond. A suitable site for an ash disposal pond, with a capacity sufficient to receive ash for at least 20 years, has been located about 5 km from the plant site. By this time it is expected that the first areas of the coal fields may be available for disposal after removal of the coal. If not, it would be possible to construct another ash disposal pond about 6 km further to the east.

Ash from the gasifiers and coal drying plant could be transported by conveyors in a damp form and deposited as land fill in selected areas clear of the coal fields, until such time as suitable areas of the coal fields are available for reclaim.

14. Investment Costs

The investment costs for each individual process unit and auxiliary unit have been estimated for a site in West Germany (price basis: mid-1980) and differentiated in compliance with the wishes of the Australian side.
In accordance with the arrangements made the cost estimates have different accuracies :
one plant ± 25%, 8 plants ± 20% and 16 plants ± 15%.

For example, the accuracy of the cost estimates
for the hydrogenation and upgrading plant is ± 20%,

for the gasification plants, interconnecting piping and ammonia plant ± 20%,

for the entire Fischer-Tropsch synthésis, distillation plants, power plants and oxygen plant ± 15%.

The investment costs estimated in the current basis (1980) of West German DM values have been converted to Australian values. The breakdown of the process units and auxiliary units is shown in the attached Table 9 which gives all costs in Australian Dollar.

In the total amount the licence and knowhow fees for the standard technologies such as water treatment, gas purification, oxygen plants, etc. are contained.

The licence and knowhow fees for the coal preparation, coal hydrogenation, coal oil refinery, gasification of coal and vacuum residue as well as catalyst preparation for the Fischer-Tropsch synthesis plant are to be fixed at a later time in the course of further negotiations of the contract. The costs for the personnel of the contractor and the training of the operating personnel have not been considered.

Table 9

Investment in million A $ (1980)

	New South Wales		Queensland		Victoria	
Coal preparation and hydrogenation	892	25 %	885	26 %	819.1	32 %
Fuel gas production and desulphurisation	144	4 %	140	4 %	114.2	4 %
H_2 production	244	7 %	213	6 %	297.7	11 %
Synthesis gas production	457	13 %	435	12 %	-	-
Fischer-Tropsch synthesis	236	7 %	237	7 %	-	-
Refinery	325	9 %	318	9 %	278.3	11 %
Power Station	639	18 %	638	19 %	747.9	28 %
Auxiliary installations	556	15 %	545	15 %	313.1	12 %
General service facilites	75	2 %	75	2 %	65.7	2 %
Total	3 567	100 %	3 487	100 %	2 636.0	100 %
Additional costs	560		536		427	
Total costs	4 127		4 023		3 108	

The additional costs cover the following positions :
Sea and inland (Australia) transport costs, land and site preparation, capital and operational costs for the construction camp, land for ash disposal and costs for ash transport utilities, duty for imported equipment and project management for erection.

15. Financial and Economic Project Evaluation

Apart from the technological descriptions, as detailed in Chapters 1 to 13 of this summary, the feasibility study calls also for the elaboration and presentation of financial and economic evaluations as to prove the commercial viability of the respective plants in New South Wales, Queensland and Victoria.

15.1 Financial and Economic Analysis Method

To measure the economic worth of an investment, the anticipated earnings must be related to the amount of capital committed. The method adopted for this study has been to calculate the Discounted Cash Flow Rate of Return (DCFROR) or Internal Rate of Return (IRR). Although relatively complex, this method has advantages in that increased precision and objectivity can be achieved, and profitability is expressed conveniently, in the form of a simple percentage return on investment.

In this method, capital and operating cost data are used to construct annual cash flows for both the construction and the operation phases of the project. The interest rate which results in the discounted cash inflows being equal to the discounted cash outflows is the DCFROR or IRR for the project. This is the highest interest rate which the required capital could be borrowed and repaid from the cash earnings generated. If money is available at a lower interest rate, the debt could be retired with something left over; if the cost of capital is higher than the DCFROR then the cash generated by the project will not be enough to repay the money borrowed.

Conventional project evaluation may include in the DCF analysis allowances for such items as company tax and depreciation. The effects of other factors such as inflation and project financing are generally neglected. This approach reduces the number of assumptions required to obtain a result. However, the discount rate obtained would need to be inflation-adjusted before comparison with commercial interest rates, and a more common practice is to compare the DCFROR of IRR obtained against a "benchmark" value which has been developed from previous experience for projects at that stage of development.

Because of the interest expressed by the Australian partners in the financial aspects of the analysis, a fairly complete model has been prepared and results, using various levels of detail, are presented in later sections.

15.2 Basic Assumptions Applied to Analysis

Company Structure

The plant is owned and operated by a single company through which all equity and loan capital is raised and for which the return on equity funds is to be calculated. Operation of the coal-to-oil plant was assumed to be the sole company activity.

Project Life

A construction period of up to 6 years and an operating life of 20 years were adopted. Construction starts on January 1st, 1984.

Fixed Capital

The fixed capital investment was distributed over the construction period. No allowance was made for plant additions of modifications during its operating life. The equipment was assumed to have zero salvage value at the end of 20 years.

Working Capital

The working capital required in each year of operation was estimated as the sum of :

- The cost of 30 days supply of coal
- The cost of 30 days production on product storage plus 3 days production for in-plant inventory
- The cost of 2 months maintenance supplies
- The cost of 30 days credit to customers less 30 days credit on coal and operating supplies
- The cost of a 30 days allowance for "inescapable" cost viz wages, overheads and insurance.

Working capital was assumed to be supplied from equity funds and to be recovered completely following the last year of plant operation.

Operating Rate
Production will be less during start-up (years 1 and 2).

Project Income
Sale of products was assumed to be the only source of income.

Taxation

The project was assumed to be liable for local (rates), State (turn-over, payroll) and Commonwealth (company) taxes. For calculation of company tax liability, all operating costs, other taxes, interest on loans, and any accumulated losses were assumed to be deductible. The allowance for depreciation was calculated using the "straight-line" method. Company tax payments were assumed to lag by one year.

Inflation

It was assumed that movements in a particular price over the project life could be adequately represented as an average annual inflation rate.

Financing

Loan funds were assumed to be used only for fixed capital investment and to be raised only over years -5 to 0. Loan repayment was assumed to commence in the year the loan was raised.

15.3 Model Parameters (see Table 10 and 11)

In order to carry out the sensitivity studies requested by the Australian partners, a large number of items were included in the model as parameters. The effect of some parameters on the project economics has been studied; others are to be studied in Australia at a later date. The results are outlined in the subject reports.

Table 10

Model Parameters

Parameters	Values studied	Value supplied directly	Value supplied indirectly
Fixed Capital Investment -			
Total Investment	V		X
Construction Time	5-6 y		X
Cost of -			
site preparation	NS	X	
construction camp	NS	X	
imported equipment	NS	X	
construction labour	V	X	
Australian equipment	NS	X	
sea transport	NS	X	
land transport	NS	X	
design	NS	X	
project management	NS	X	
infrastructure	NS	X	
Duty on imported equipment	2%,20%	X	
Inflation rates -			
German CPI	6%/y	X	
Australian CPI	8-12%/y	X	
Australian equipment	8-12%/y	X	
Australian labour	10-14%/y	X	

Table 10 contd.

	Values studied	Value supplied directly	Value supplied indirectly
Change in Australian exchange rate	1-3%/y	X	
Financing -			
Debt/Equity Ratio	0/100/100/0	X	
Loans - amount	NS	X	
- term	10-15y	X	
- interest rate	12-18%/y	X	

Table 11

Model Parameters

Parameters	Values studied	Value supplied directly	Value supplied indirectly
Sales -			
Product prices	V	X	
Product price inflation	11-15%/y	X	
Raw Materials -			
Price of coal for hydrogenation	V	X	
Price of coal for gasification	V	X	
Price of power station coal	V	X	
Price of water	V	X	
Price of ash disposal	V	X	
Coal price inflation	5-10%/y	X	
Operating Costs -			
Chemicals, catalysts	V	X	
Wages	V	X	
Wage-related overheads	20-50%	X	
Maintenance supplies	V	X	
Plant overhead	V	X	
Rates and insurance	V	X	

Table 11 contd.

	Values studied	Value supplied directly	Value supplied indirectly
Taxation -			
Depreciation			
(straight-line)	10÷20y	X	
Turn-over tax	V	X	
Payroll tax	0%,5%	X	
Company tax	0%,46%	X	

NS - This item was not studied during the project. It is intended that this will be studied at a later date.

V - The range studied varied from site to site

Product Prices

Wholesale prices (excluding excise) for petroleum were obtained from the Australian Prices Justification Tribunal as at 1/6/80 :

	($ 1980)	Average		(¢/l where appl.)
LPG	205 $/t	205	p	205
RON 98	358 - 367	362.5	0.740	26.825
RON 92	352 - 374	363	0.725	26.318
ADO	316 - 338	327	0.840	27.468

There is no information publicity available on typical marketing and distribution costs in Australia.
The cost of m + d has been assumed to be of the order of 2 ¢/l. This cost is assumed not to apply to LPG prices.

	Ex refinery prices	$/t
LPG	205	205
RON 98	24.825	336
RON 92	24.318	335
ADO	25.468	303