15.4 Calculation Procedure

(1) Costs for each fixed capital element were reallocated in current dollars. Import duty and the totals by element and year were calculated.

(2) The totals were used to adjust the "capital cost by process unit" data to current dollars.

(3) Revenues and operating costs for each year were calculated, converted to current dollars and adjusted for the annual operating rate.

(4) Working capital requirements were calculated for each year. Any increase required over the preceeding year was treated as new equity investment. All working capital was recovered in year 21.

(5) Loans raised were specified in the input file either by amount or by an overall debt/equity ratio. For each loan, the annual interest charge and repayment amount was calculated and annual totals were generated.

(6) Taxable income was then calculated after allowing for the assumed deductible items. If taxable income was negative, this was carried forward as an accumulated loss.

(7) The net cash flow was then calculated as the after-tax income less loan repayments, less equity funds invested. The cash flows were summed to provide a cumulative cash flow profile.

(8) The break-even time was determined as the point in time where the cumulative cash flow became positive. This method is correct for the 100% equity case only.

15.5 Investment Cost

The investment cost for the construction of the necessary facilities and all appurtenant constructions have been calculated on the assumption that the construction work will be executed by a general contractor who will be assisted by subcontractors or suppliers. In such a way it is expected that the main part of the managerial staff and of the required highly skilled technicians will be of Australian origin.

All prices are based on prices prevailing in the second half of 1980.

All foreign exchange costs have been converted into Australian Dollar by applying an exchange rate of A $ 1.00 = DM 2.05.

A full compilation and critical judgement of all cost data and their sources has been prepared.

15.6 Re-Investment and Re-Current Cost

Re-investment expenditures will not become necessary as a proper maintenance and repair schedule will be executed

Re-current cost, e.g. maintenance and repair expenditures, have been calculated at a rate of 2 % of the primary investment expenditures, except the acquisition of land.

15.7 Total Assets Required

Considering all forementioned cost components and the model parameters assumed the total assets required for each plant are as follows (in M A $) :

	1980 prices	1989 escalated prices
New South Wales	4,127.81	6,994.34
Queensland	4,022.74	6,895.47
Victoria	3,107.75	5,362.43

Analysis of capital investment by process area is detailed in Tables 12, 13 and 14.

Table 12 — Analysis of Capital Investmen: by Process Area New South Wales

Process Area	M $ in year -5	-4	-3	-2	-1	0	1	Total	%
Coal Pretreatment	0.0	19.37	42.40	78.78	91.83	48.97	0.0	281.35	4.0
Hydrogenation	0.0	80.92	177.17	329.23	383.72	204.63	0.0	1175.67	16.8
Hydrogenation Refinery	0.0	23.89	52.31	97.19	113.29	60.42	0.0	347.10	5.0
H_2 from Process Gases	0.0	29.35	64.25	119.39	139.16	74.20	0.0	426.36	6.0
H_2 & Fuel Gas ex Gasification	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gasification for F-T & Fuel Gas	0.0	90.78	198.74	369.33	430.46	229.55	0.0	1318.85	18.9
Fischer-Tropsch Synthesis	0.0	39.25	85.95	159.71	186.15	99.27	0.0	570.34	8.2
Power Station	0.0	70.69	154.77	287.63	335.22	178.76	0.0	1027.07	14.7
Service Facilities, Tank Farm	0.0	14.53	31.81	59.13	68.91	36.76	0.0	211.13	3.0
Piping, Electrical	0.0	33.57	73.50	136.58	159.19	84.89	0.0	487.73	7.0
Water Treatment	0.0	6.61	14.47	26.89	31.33	16.72	0.0	96.01	1.4
Sub Total	0.0	408.96	895.36	1663.85	1939.27	1034.16	0.0	5941.61	85.0
Site Preparation	57.90	26.54	17.52	0.0	12.09	53.19	0.0	167.25	2.4
Construction Camp	8.78	9.66	21.26	46.77	0.0	0.0	0.0	86.48	1.2
Duty	0.0	1.62	6.88	18.22	22.54	13.65	0.0	62.91	0.9
Sea Transport	0.0	9.29	39.36	104.31	128.99	78.10	0.0	360.05	5.1
Inland Transport	0.0	21.50	11.39	25.06	30.31	15.14	0.0	103.40	1.5
Infrastructure	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Project Management	4.11	4.53	14.95	27.40	36.18	60.43	125.04	272.65	3.9
Total	70.80	482.10	1006.72	1185.60	2169.38	1254.69	125.04	6994.35	100.0

Table 13 Capital Investment by Process Area Queensland

Process Area	M $ in year -5	-4	-3	-2	-1	0	1	Total	%
Coal Pretreatment	0.0	12.45	45.20	88.15	101.42	39.48	1.92	285.62	4.1
Hydrogenation	0.0	51.41	174.17	363.77	418.61	162.94	7.88	1178.79	17.1
Hydrogenation Refinery	0.0	17.35	58.86	122.84	141.35	55.01	2.67	398.08	5.8
H_2 from Process Gases	0.0	16.83	57.01	119.06	137.01	53.32	2.58	385.81	5.6
H_2 & Fuel Gas ex Gasification	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gasification for F-T & Fuel Gas	0.0	57.68	194.93	407.11	468.47	182.33	8.83	1319.35	19.1
Fischer-Tropsch Synthesis	0.0	25.93	87.83	183.46	211.11	82.16	3.98	594.47	8.6
Power Station	0.0	43.36	146.90	306.78	353.01	137.38	6.64	994.07	14.4
Service Facilities, Tank Farm	0.0	8.74	29.59	61.79	71.09	27.69	1.34	200.24	2.9
Piping, Electrical	0.0	22.31	73.50	156.13	172.98	64.43	3.99	493.35	7.2
Water Treatment	0.0	4.44	15.04	31.41	36.14	14.08	0.68	101.78	1.5
Subtotal	0.0	260.49	880.03	1840.52	2111.19	818.81	40.51	5951.56	86.3
Site Preparation	62.43	0.0	0.0	0.0	0.0	79.89	0.0	142.32	2.2
Construction Camp	0.0	19.33	21.26	23.38	25.72	0.0	0.0	89.69	1.3
Duty	0.0	0.0	5.68	20.98	23.50	7.96	0.0	58.12	0.8
Sea Transport	0.0	0.0	35.09	129.69	145.20	49.21	0.0	359.19	5.2
Inland Transport	0.0	19.05	17.20	39.38	38.37	12.50	0.0	126.50	1.8
Infrastructure	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Project Management	0.0	2.63	10.40	20.87	50.67	83.54	0.0	168.11	2.4
Total	62.43	301.50	969.67	2074.83	2394.64	1051.91	40.51	6895.49	100.0

Table 14

Capital Investment by Process Area Victoria

Process Area	M $ in year							Total	%
	-5	-4	-3	-2	-1	0	1		
Coal Pretreatment	0.0	34.45	98.51	265.44	373.73	165.70	8.13	945.95	17.6
Hydrogenation	0.0	17.75	50.77	136.79	192.58	85.39	4.19	487.47	9.1
Hydrogenation Refinery	0.0	15.69	44.84	120.83	170.12	75.42	3.69	430.59	8.0
H_2 from Process Gases	0.0	12.19	34.85	93.92	132.22	58.62	2.88	334.68	6.2
H_2 & Fuel Gas ex Gasification	0.0	20.31	58.06	156.27	220.27	97.66	4.80	557.55	10.4
Gasification for F-T & Fuel Gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fischer-Tropsch Synthesis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Station	0.0	43.02	122.98	331.42	466.60	206.88	10.14	1181.05	22.0
Service Facilities, Tank Farm	0.0	7.09	20.24	54.56	76.83	34.06	1.67	194.44	3.6
Piping Electrical	0.0	15.22	43.50	117.22	165.05	73.18	3.58	417.76	7.8
Water Treatment	0.0	3.29	9.41	25.36	35.70	15.84	0.77	90.37	1.8
Subtotal	0.0	169.01	483.15	1301.99	1833.09	812.75	39.85	4639.86	86.5
Site Preparation	90.41	0.0	0.0	0.0	0.0	38.91	0.0	129.31	2.4
Construction Camp	0.0	9.66	21.26	23.38	0.0	0.0	0.0	54.31	1.0
Duty	0.0	0.0	2.51	13.47	22.92	7.37	0.0	46.26	0.9
Sea Transport	0.0	0.0	15.50	83.29	141.71	45.56	0.0	286.06	5.3
Inland Transport	0.0	10.32	7.65	20.68	28.19	18.67	0.0	85.51	1.6
Infrastructure	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Project Management	0.0	1.61	6.32	17.09	36.31	59.80	0.0	121.13	2.3
Total	90.41	190.61	536.40	1459.89	2062.22	983.06	39.85	5362.44	100.0

15.8 Financial Cash Flows

The financial cash flows consider both the construction period and the operation period as well.
During the construction period all primary investment expenditures at financial values are distributed according to the implementation schedule. The incurred cost during this period are then compared with the net results of the operational cash flows during the operational period.

15.9 Economic Evaluation of the Project

A financial evaluation examines the net financial return from the point of view of the providers of the project's capital. Accordingly the evaluation does not consider such matters as social costs and benefits of the project or whether the market prices relevant to the project truly reflect economic resource costs. The fact that these and other matters are not taken into account illustrates the point that any financial or economic evaluation is undertaken with reference to a particular entity. Economic analysis of the project needs to calculate the return on the project from the point of view of the nation as a whole.

Distinction between Economic and Financial Evaluation

The economic evaluation has been undertaken in constant 1980 prices. As a general rule the following changes are made to the financial model to accommodate the broader perspective of the economic analysis.

Exclusion of all Transfer Payments

While such outlays as taxation and import duty are of direct relevance for financial analysis, they are nevertheless transfer payments which in no way diminish the national economic benefit of a project. To exclude all transfer payments the company tax rate, payroll tax, import duties and the insurance and local taxes parameters were all set equal to zero. The product prices used are net of excise tax for this is a pure transfer payment.

Shadow Price Adjustments

Under ideal circumstances the market price of a resource should equate to the opportunity cost, that is to output foregone in its most productive alternative use. In certain cases market prices are not a true measure of economic resource cost owing to market imperfections. This situation is of particular importance where markets are thin or nonexistent and where resources are underutilised. In such circumstances it is necessary to adopt shadow prices to cost resources used in projects. For the project there are two areas in which consideration could legitimately be given to shadow pricing-coal and labour. For those two sectors price adjustment factors have been applied and to overheads which partly consist of transfer payments ,too.

Relative Price Trends

Adjustment for movements in relative prices, which was undertaken as a sensitivity exercise for the base financial evaluation. The relative price of each item is expressed as its own inflator less the Australian CPI.

Financing

The economic evaluation abstracts from the financing arrangements for the project by assuming 100 % equity, which is in fact the assumption adopted in the base financial evaluation. This is a quite acceptable procedure, particularly when one bears in mind that one of the principle attractions of debt funding, the tax deductability of the interest payments, is in effect a transfer payment.

15.10 Economic Cash Flow

The adjustments detailed in the previous section, were applied to the base financial case to convert it to an economic evaluation. For this purpose the same calculation model was used.

15.11 Resulting Rate of Return from Financial and Economic Evaluations

From the financial and economic cash flows the followings DCFROR or IRR are shown in Table 15 -

- case 1 base case, 100 % equity
  price bases 1980
  without all inflators

- case 2 base case, 100 % equity
  price basis 1980
  with all inflators applied

- case 3 base case, 100 % equity
  price basis 1980
  with all inflators applied
  relative price movement for products 3 % above general Australian inflation rate (CPI)

- case 4 base case, debt/equity ratio 75:25
  price basis 1980
  with all inflators applied
  relative price movement for products 3 %
  above general Australian inflation rate
  (CPI)

- case 5 base case, 100 % equity
  price basis 1980
  conversion factors for adjustment to
  economic values (EIRR)

Table 15

	DCFROR	Australian Coal Liquefaction Plants		
		New South Wales	Queensland	Victoria
Case 1	(FIRR)	4.4	4.6	7.3
Case 2	(FIRR)	11.8	14.6	15.5
Case 3	(FIRR)	21.6	22.0	25.4
Case 4	(FIRR)	23.8	24.4	29.0
Case 5	(EIRR)	16.6	17.6	21.4

15.12 Sensitivity Tests

The financial and economic analysis model allows for many economic factors to be tested separately to determine the sensitivity of the rate of return (% DCFROR or IRR) to variations.
From various variants tested it may be stated in general that the following variables are to be seen to have a sensitive influence on the DCFROR :

Critical parameters

- product price and relative price movements
- operating rate of plant
- construction cost
- exchange rate
- coal cost and their relative price movements, but to a lesser degree

Less sensitive parameters

- labour costs
- relative price movements of equipments
- depreciation rate
- taxes and import duties
- miscellaneous operating factors
  e.g. maintenance supplies,
  insurance,
  local taxes,
  wage overheads and
  general overheads
- financing arrangements

15.13 Conclusions with Respect to Financial Viability

15.13.1 New South Wales

The method adopted for the financial and economic evaluation was to model the cash flow streams of the plant, taking account of timing by discounted cash flow analysis, and calculate the internal rate of return or discounted cash flow rate of return (DCFROR).

The base financial evaluation, in constant 1980 prices with no adjustment for relative prices and assuming 100% equity funding, produced a real, after tax,rate of return of 4.4 % p.a. This is not sufficient to encourage commercial development, given the massive capital investment involved and the large number of economic, technological and policy related uncertainties involved.

The Australian partners provided forecasts of each of the inflators relevant to the project. When applied to the cash flow the nominal, after tax rate of return was 21.8 %, with the general inflation rate of 10%. Hence the relative price movements implied in the forecasts have increased the real rate of return from 4.4 % to 11.8 %. This rate of return would make the project marginally viable commercially, but there are certain aspects of the relative price forecasts used which are open to debate.

The economic rate of return for the plant, incorporating the relative price forecasts of the Australian partners, is 15.4 %. However, under alternative relative price forecasts in line with those adopted in the above alternative scenario, financial evaluation the rate of return would be between 11 % and 14 %. At such a rate of return the project is worthy of further examination from the point of view of national and state public policy.

15.13.2 Queensland

It was considered that for this project in Australia, investing companies would look for a return (DCFROR) of at least 12 percent for analysis in constant prices and 22 percent when inflation (10 % per annum) is included. The 12 percent acceptable level is arbitary and it could be thought of as being 6 percent risk and 6 percent real return on funds.

The base case assuming 100 % equity, after-tax, no inflation, had a result of 4.6 percent which is well below the project acceptance level of 12 percent.

In summary it was shown that the DCFROR was considerably lower than the acceptance level in most of the cases examined. However a number of variables were selected for sentivitiy analysis, and within the ranges selected, the DCFROR was decreased as well as increased. The size, direction and probability of each effect must be evaluated before making a final conclusion.

Nevertheless is should be stated that the only variables that raised the DCFROR to acceptable levels were those that included the assumption that product prices would increase in real terms by more than 3 percent per annum.

Under normal commercial conditions this project would not be contemplated until product prices -

- either increased very substantially e.g. doubled,

or - the real annual increase in product prices was guaranteed to exceed 3 percent for three decades,

or - an equivalent combination of the two existed.

15.13.3 Victoria

In the analysis of the proposed coal liquefaction plant using current prices, the general inflation rate was assumed to be 10 percent. Assuming no relative price changes and all variables escalating at this rate, the project DCFROR was estimated to be 17.3 percent, exactly 10 percent above the base case DCFROR estimated at constant (1980) price . Thus the effect of general inflation on the model is cancelled out by compensating effects on revenues and costs.

Assuming 100 percent equity investment in the project, the expected project DCFROR under a set of "more likely" assumptions about the main parameters was estimated at 25.4 percent.

This rate is sufficiently high to suggest that investment in the proposed coal liquefaction plant for Victoria would be economic under set assumptions as to future trends in costs and prices. This represents a real return after tax of 15.4 percent net of inflation. If this return is further discounted by 5 percent representing a risk premium (to cover possible cost estimation and other forecast inaccuracies), the resultant real rate of return of 10.4 percent is not unreasonable. Naturally this result is a reflection of the assumptions made about future costs and revenues: it is reasonable to point out that if relative prices change from the present they are likely to move in directions favourable to the economics of this coal liquefaction plant.

This "more likely" estimate of the expected project DCFROR assuming 100 percent equity invested, was also analysed with the inclusion of a possible set of financing conditions to cover the case where the project is predominantly debt-funded. A debt/equity ratio of 75/25 was assumed with a 15 percent interest rate on 10 year loan borrowings raised each year as required. Under these financing conditions, the use of 75 percent debt-funding increases the estimated project DCFROR to

29.0 percent, compared to 25.4 percent assuming 100 percent equity-funding.

Thus the proposed Victorian coal liquefaction plant, under a set of "more likely" assumptions as to future trends in costs and revenues is estimated to have a DCFROR of 25.4 percent with 100 percent equity investment, and 29.0 percent with 75 percent debt-funding. At these estimated rates of return the project appears to be economic, although this conclusion is critically dependent upon the validity of the assumptions adopted and the estimated construction costs of the plant.

15.14 Project Economies

From a pure economic point of view the DCFROR's for the plants to be established in all States are quite encouraging for further considerations with respect to the implementation of the plants.

It may be mentioned that highly capital intensive projects, like these coal liquefaction plants, show relative low operating costs. Product price increases, once the capital investment has been made, will therefore tend to gear into profits rapidly even if cost inflation should be in the same order as product prive inflation.

The conclusion is abvious. In this game, those who have the courage and conviction to take the first plunge will reap the highest reward. This is a much more viable approach than ineffective attempts to try and hit a moving target which hopefully will come closer but in reality tends to recede all the time.

To wait with the implementation of synfuel projects until international oil prices are at a level which will give a very high return on investment already in the early years of full production may lead to the reserve development, e.g. into a loosing situation. Consequently, a synfuel plant at any oil price, with the required capital investment committed, with increasing oil prices, will become progressively more economic, and its product cost over time will attain parity or even overpass the oil prices.

Thus, the sooner a plant is built, the better the prospects for such a plant, assuming continuing oil price escalation.

Realistic evaluation of synfuel projects must always look ahead, as today's decision needs to be made in terms of its effects several years hence.

15.15 Macro-Economic Parameters

In addition to a judgement which is merely based on the project's own financial and economic merits, also socio- as well as macro-economic conditions are possibly boosted by the project's implementation. The following impacts to a.m. parameters may be expected :

- generation of considerable employment opportunities. Each one of the plants could generate about 6,000 full time employment positions considering the required operating personnel itself, as well as the cumulating multiplier effects to the adjacent supply and services sectors.

- the intended liquefaction plants will also provide training to unskilled labour which will be promoted to semi-skilled and skilled workers, an effect of immeasurable benefit to the country.

- the construction of the plants require a certain expansion of the local manufacturing capacities and even the establishment of new industries. - Also the creation of these additional capacities may be regarded as valuable asset to the manufacturing industry.

- thus stabilizing effects for future economic development in all fields and sectors and

- strengthening of the national and/or regional economic structure

- higher level of Australian self-sufficiency with respect to cover overall energy requirements within all sectors of the economy, providing safer supplies, which on the otherhand declines the dependency on foreign crude oil sources.

- relief of the foreign exchange balance by substituting the necessary crude oil imports, at expected rising world market prices, by processing indigenous coal resources, which are available abundantly.

- a trend to convert the former structure of solely exporting valuable indigenious raw material resources into a homebased processing industry and thus generating generally added values for the national economy

- invention of highly sophisticated industrial conversion technologies which might enable technology developments of its own in Australia and thus generate future export potentials

- an overall investment-boost, which not onl[illegible]plements the new industries themselves, but stab[illegible] or justifies present or previous investment [illegible]isions.

The above mentioned project induced impacts might be regarded as intangible effects, as their proper valuation is not possible in some cases. Nevertheless, they are supporting the apart from these remarks justified financial and economic merits of the projects. - Nonetheless is seems worthwile to accentuate on these factors.