EXHIBIT 2 | Greystock's DCF Analysis of the Merseyside Project (financial values in millions of British pounds)

Assumptions				
Annual Output (metric tons)		250,000	Discount rate	10.0%
Output Gain/Original Output		7.0%	Tax Rate	30%
Price/ton (pounds sterling)		675	Investment/Outlay (mill.)	12.0
Inflation Rate (prices and costs)		0.0%	Depreciable Life (years)	15
Gross Margin (ex. Deprec.)		12.50%	Salvage Value	0
Old Gross Margin		11.5%	WIP Inventory/Cost of Goods	3.0%
Energy savings/Sales	Yr. 1-5	1.25%	Months Downtime, Construction	1.5
	Yr. 6-10	0.8%	Preliminary Engineering Costs	0.5
	Yr. 11-15	0.0%	Overhead/Investment	3.5%

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year	Now	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1. Estimate of Incremental Gross Profit																
New Output (tons)		267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500
Lost Output—Construction		(33,438)														
New Sales (Millions)		157.99	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56
New Gross Margin		13.8%	13.8%	13.8%	13.8%	13.8%	13.3%	13.3%	13.3%	13.3%	13.3%	12.5%	12.5%	12.5%	12.5%	12.5%
New Gross Profit		21.72	24.83	24.83	24.83	24.83	23.92	23.92	23.92	23.92	23.92	22.57	22.57	22.57	22.57	22.57
Old Output		250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Old Sales		168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75
Old Gross Profit		19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41
Incremental gross profit		2.32	5.42	5.42	5.42	5.42	4.52	4.52	4.52	4.52	4.52	3.16	3.16	3.16	3.16	3.16
2. Estimate of Incremental WIP inventory																
New WIP inventory		4.67	4.67	4.67	4.67	4.67	4.70	4.70	4.70	4.70	4.70	4.74	4.74	4.74	4.74	4.74
Old WIP inventory		4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48
Incremental WIP inventory		0.19	0.19	0.19	0.19	0.19	0.22	0.22	0.22	0.22	0.22	0.26	0.26	0.26	0.26	0.26
3. Estimate of Incremental Depreciation																
New Depreciation		1.60	1.39	1.20	1.04	0.90	0.78	0.68	0.59	0.51	0.44	0.57	0.57	0.57	0.57	0.57
4. Overhead		0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
5. Prelim. Engineering Costs		0.50														
Pretax Incremental Profit		−0.20	3.61	3.80	3.96	4.10	3.32	3.42	3.51	3.59	3.66	2.17	2.17	2.17	2.17	2.17
6. Cash Flow Adjustments																
Less Capital Expenditures	−12.00															
Add back Depreciation		1.60	1.39	1.20	1.04	0.90	0.78	0.68	0.59	0.51	0.44	0.57	0.57	0.57	0.57	0.57
Less Added WIP inventory		−0.19	0.00	0.00	0.00	0.00	−0.03	0.00	0.00	0.00	0.00	−0.04	0.00	0.00	0.00	0.00
7. Free Cash Flow	−12.00	1.27	3.92	3.86	3.81	3.77	3.08	3.07	3.05	3.02	3.00	2.05	2.09	2.09	2.09	2.09
NPV =	10.45															
IRR =	24.0%															

CASE 23

Victoria Chemicals plc (B): Merseyside and Rotterdam Projects

James Fawn, executive vice president of the Intermediate Chemicals Group (ICG) of Victoria Chemicals, met with his financial analyst, John Camperdown, to review two mutually exclusive capital-expenditure proposals. The firm's capital budget would be submitted for approval to the board of directors in early February 2008, and any projects proposed by Fawn for the ICG had to be forwarded to the chief executive officer of Victoria Chemicals soon for his review. Plant managers in Liverpool and Rotterdam had independently submitted expenditure proposals, each of which would expand the polypropylene output of their respective plants by 7%.[1] Victoria Chemicals' strategic-analysis staff argued strenuously that a companywide increase in polypropylene output of 14% made no sense, but half that amount did. Thus, Fawn could not accept *both* projects; he could sponsor only one for approval by the board.

Corporate policy was to evaluate projects based on four criteria: (1) net present value (NPV) computed at the appropriate cost of capital, (2) internal rate of return (IRR), (3) payback, and (4) growth in earnings per share. In addition, the board of directors was receptive to "strategic factors"—considerations that might be difficult to quantify. The manager of the Rotterdam plant, Elizabeth Eustace, argued vociferously that her project easily hurdled all the relevant quantitative standards and that it had important strategic benefits. Indeed, Eustace had interjected those points in two recent meetings with senior management and at a cocktail reception for the board of directors.

[1]Background information on Victoria Chemicals and the polypropylene business is given in "Victoria Chemicals PLC (A): The Merseyside Project," (UVA-F-1543).

This case was prepared by Robert F. Bruner as a basis for class discussion rather than to illustrate effective or ineffective handling of an administrative situation. Victoria Chemicals is a fictional company, reflecting the issues facing actual firms. The author wishes to acknowledge the helpful comments of Dr. Frank H. McTigue, the literary color of Anthony Trollope, and the financial support of the Citicorp Global Scholars Program.

Fawn expected to review the proposal from Lucy Morris, manager of the Liverpool plant, at the meeting with Camperdown, but Fawn suspected that neither proposal dominated the other on all four criteria. Fawn's choice would apparently not be straightforward.

The Proposal from Merseyside, Liverpool

The project for the Merseyside plant entailed the enhancement of existing facilities and the production process. Based on the type of project and the engineering studies, the potential benefits of the project were fairly certain. To date, Morris, manager of Merseyside Works, had limited her discussions about the project to conversations with Fawn and Camperdown. Camperdown had raised various exploratory questions about the project and had presented preliminary analyses of it to managers in marketing and transportation for their comments. The revised analysis emerging from those discussions would be the focus of the discussion with Camperdown in the forthcoming meeting.

Camperdown had indicated that Morris's final memo on the project was short, only three pages. Fawn wondered whether this memo would satisfy his remaining questions.

The Rotterdam Project

Elizabeth Eustace's proposal consisted of a 90-page document replete with detailed schematics, engineering comments, strategic analyses, and financial projections. The basic discounted cash flow (DCF) analysis is presented in **Exhibit 1** and shows that the project had an NPV of (British pounds) GBP11 million and an IRR of 15.4%. Accounting for a worst-case scenario, which assumed erosion of Merseyside's volume equal to the gain in Rotterdam's volume, the NPV was GBP8 million.

In essence, Eustace's proposal called for the expenditure of GBP10.5 million, spread over three years, to convert the plant's polymerization line from batch to continuous-flow technology and to install sophisticated state-of-the-art process controls throughout the polymerization and compounding operations. The heart of the new system would be an analog computer driven by advanced software written by a team of engineering professors at an institute in Japan. The three-year-old process-control technology had been installed in several polypropylene production facilities in Japan and although the improvements in cost and output had been positive on average, the efficiency gains had varied considerably across each of the production facilities. Other major producers were known to be evaluating this system for use in their plants.

Eustace explained that installing the sophisticated new system would not be feasible without also obtaining a continuous supply of propylene gas. She proposed to obtain this gas by pipeline from a refinery five kilometers away (rather than by railroad tank cars sourced from three refineries). Victoria Chemicals had an option to purchase a pipeline and its right-of-way for GBP3.5 million, which Eustace had included in her GBP10.5-million estimate for the project; then, for relatively little cost, the pipeline could be extended to the Rotterdam plant and refinery at the other end. The

option had been purchased several years earlier. A consultant had informed Eustace that to purchase a right-of-way at today's prices and to lay a comparable pipeline would cost approximately GBP6 million, a value at which the consultant believed the right-of-way could be sold today at auction. The consultant also forecasted that the value of the right-of-way would be GBP40 million in 15 years.[2] This option was set to expire in six months.

Some senior Victoria Chemicals executives firmly believed that if the Rotterdam project were not undertaken, the option on the right-of-way should be allowed to expire unexercised. The reasoning was summarized by Jeffrey Palliser, chairman of the executive committee:

> Our business is chemicals, not land speculation. Simply buying the right-of-way with the intention of reselling it for a profit takes us beyond our expertise. Who knows when we could sell it, and for how much? How distracting would this little side venture be for Elizabeth Eustace?

Younger members of senior management were more willing to consider a potential investment arbitrage on the right-of-way.

Eustace expected to realize the benefit of this investment (i.e., a 7% increase in output) gradually over time, as the new technology was installed and shaken down and as the learning-curve effects were realized. She advocated a phased-investment program (as opposed to all at once) in order to minimize disruption to plant operations and to allow the new technology to be calibrated and fine-tuned. Admittedly, there was a chance that the technology would not work as well as hoped, but due to the complexity of the technology and the extent to which it would permeate the plant, there would be no going back once the decision had been made to install the new controls. On the other hand, it was possible that the technology could deliver more efficiencies than estimated in the cash flows, if the controls reached the potential boasted by the Japanese engineering team.

Fawn recalled that the strategic factors to which Eustace referred had to do with the obvious cost and output improvements expected from the new system, as well as from an advantage from being the first major European producer to implement the new technology. Being the first to implement the technology probably meant a head start in moving down the learning curve toward reducing costs as the organization became familiar with the technology. Eustace argued:

> The Japanese, and now the Americans, exploit the learning-curve phenomenon aggressively. Fortunately, they aren't major players in European polypropylene, at least for now.

[2]The right-of-way had several commercial uses. Most prominently, the Dutch government had expressed an interest in using the right-of-way for a new high-speed railroad line. The planning for this line had barely begun, however, which suggested that land-acquisition efforts were years away. Moreover, government budget deficits threatened the timely implementation of the rail project. Another potential user was Medusa Communications, an international telecommunications company that was looking for pathways along which to bury its new optical-fiber cables. Power companies and other chemical companies or refineries might also be interested in acquiring the right-of-way.

> This is a once-in-a-generation opportunity for Victoria Chemicals to leapfrog its competition through the exploitation of new technology.

In an oblique reference to the Merseyside proposal, Eustace went on to say:

> There are two alternatives to implementation of the analog process-control technology. One is a series of myopic enhancements to existing facilities, but this is nothing more than sticking one's head in the sand, for it leaves us at the mercy of our competitors who *are* making choices for the long term. The other alternative is to exit the polypropylene business, but this amounts to walking away from the considerable know-how we've accumulated in this business and from what is basically a valuable activity. Our commitment to analog controls makes the right choice at the right time.

Fawn wondered how to take the technology into account in making his decision. Even if he recommended the Merseyside project over the Rotterdam project, it would still be possible to add the new controls to Merseyside at some point in the future. Practically speaking, Fawn believed the controls could be added in 2010, which allowed sufficient time to complete all the proposed capital improvements before embarking on the new undertaking. Similar to the Rotterdam project, it was expected that the controls would raise Merseyside's margin by 0.6% per year to a maximum of 15%. However, the controls would not result in an incremental volume gain as Merseyside would already be operating at its capacity of 267,500 tons. To obtain a supply of propylene gas at Merseyside, it would be necessary to enter into a 15-year contract with a local supplier. Although the contract would cost GBP0.4 million pounds per year, it would remove the need to build a pipeline as proposed for Rotterdam, which resulted in an investment at Merseyside of GBP7.0 million pounds spread over three years.[3]

Lucy Morris, the plant manager at Merseyside, told James Fawn that she preferred to "wait and see" before entertaining a technology upgrade at her plant as there was considerable uncertainty in her mind as to how valuable, if at all, the analog technology would prove to be. Fawn agreed that the Japanese technology had not been tested with much of the machinery that was currently being used at Rotterdam and Merseyside. Moreover, he knew that reported efficiency gains had varied substantially across the early adopters.[4]

Conclusion

James Fawn wanted to give this choice careful thought because the plant managers at Merseyside and Rotterdam seemed to have so much invested in their own proposals. He wished that the capital-budgeting criteria would give a straightforward indication

[3]If the Merseyside project were to being two years later, the cost of the contract and the investment costs were expected to rise by the rate of inflation. Gas contracts were quoted in terms of the first-year cost, but carried an inflation clause that raised the cost for each subsequent year by the inflation rate.

[4]Using Monte Carlo simulation, Morris had estimated that the cash returns from the Japanese technology had a standard deviation of 35%. The nominal risk-free rate of return was about 5.5%.

of the relative attractiveness of the two mutually exclusive projects. He wondered by what rational analytical process he could extricate himself from the ambiguities of the present measures of investment attractiveness. Moreover, he wished he had a way to evaluate the primary technological difference between the two proposals: (1) the Rotterdam project, which firmly committed Victoria Chemicals to the new-process technology, or (2) the Merseyside project, which retained the flexibility to add the technology in the future.

EXHIBIT 1 | Analysis of Rotterdam Project (financial values in millions of British pounds)

Assumptions					
Annual Output (metric tons)		250,000			
Output Gain Per Year/Prior Year		2.0%	Discount rate		10.0%
Maximum Possible Output		267,500	Depreciable Life (years)		15
Price/ton (pounds sterling)		675	Overhead/Investment		3.5%
Inflation (prices and costs)		0.0%	Salvage Value		0
Gross Margin Growth Rate/Year		0.6%	WIP Inventory/Cost of Goods Sold		3.0%
Maximum Possible Gross Margin		15.0%	Terminal Value of Right-of-way		40
Gross Margin		11.5%	Months Downtime, Construction	2001	5
Tax Rate		30.0%		2002	4
Investment outlay (million)	Now	3.5		2003	3
	2001	5		2004	0
	2002	1			
	2003	1			

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year	Now	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1. Estimate of Incremental Gross Profit																
New Output		255,000	260,100	265,302	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500	267,500
Lost Output—Construction		(106,250)	(86,700)	(66,326)												
New Sales (Millions)		100.41	117.05	134.31	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56	180.56
New Gross Margin		11.6%	11.7%	11.9%	12.2%	12.6%	13.0%	13.6%	14.3%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
New Gross Profit		11.62	13.70	16.01	22.04	22.71	23.54	24.55	25.75	27.08	27.08	27.08	27.08	27.08	27.08	27.08
Old Output		250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Old Sales		168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75	168.75
Old Gross Profit		19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41
Incremental Gross Profit		(7.79)	(5.70)	(3.40)	2.64	3.31	4.14	5.14	6.35	7.68	7.68	7.68	7.68	7.68	7.68	7.68
2. Estimate of Incremental Depreciation																
Yr. 1 Outlays		0.67	0.58	0.50	0.43	0.38	0.33	0.28	0.24	0.21	0.18	0.24	0.24	0.24	0.24	0.24
Yr. 2 Outlays			0.14	0.12	0.10	0.09	0.08	0.07	0.06	0.05	0.04	0.05	0.05	0.05	0.05	0.05
Yr. 3 Outlays				0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Total, New Depreciation		0.67	0.72	0.78	0.67	0.58	0.50	0.43	0.37	0.32	0.27	0.34	0.34	0.34	0.34	0.34
3. Overhead		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Pretax Incremental Profit		(8.46)	(6.42)	(4.17)	1.97	2.73	3.64	4.72	5.98	7.36	7.40	7.34	7.34	7.34	7.34	7.34
5. Tax expense		(2.54)	(1.93)	(1.25)	0.59	0.82	1.09	1.42	1.79	2.21	2.22	2.20	2.20	2.20	2.20	2.20
6. After-tax Profit		(5.92)	(4.50)	(2.92)	1.38	1.91	2.55	3.30	4.19	5.15	5.18	5.14	5.14	5.14	5.14	5.14
7. Cash Flow Adjustments																
Add back Depreciation		0.67	0.72	0.78	0.67	0.58	0.50	0.43	0.37	0.32	0.27	0.34	0.34	0.34	0.34	0.34
Less added WIP inventory		1.82	(0.44)	(0.45)	(1.21)	0.02	0.02	0.03	0.04	0.04	—	—	—	—	—	—
Capital Spending	3.50	5.00	1.00	1.00												
Terminal Value, land																40.00
8. Free cash flow	(3.50)	(12.07)	(4.34)	(2.70)	3.25	2.47	3.02	3.70	4.52	5.43	5.46	5.48	5.48	5.48	5.48	45.48

DCF, Rotterdam = -GBP11.37
IRR, Rotterdam = 15.4%

continued

EXHIBIT 1 | Analysis of Rotterdam Project (financial values in millions of British pounds) (*continued*)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year	Now	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
9. Adjustment for erosion in Merseyside volume:																
Lost Merseyside Output		—	—	—	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500
Lost Merseyside Revenue		—	—	—	11.81	11.81	11.81	11.81	11.81	11.81	11.81	11.81	11.81	11.81	11.81	11.81
Lost Merseyside Gross Profits		—	—	—	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
Lost Gross Profits after Taxes		—	—	—	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Change in Merseyside Inventory		—	—	—	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Total Effect on Free Cash Flow		—	—	—	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)
DCF, Erosion Merseyside GBP**3.05**																
Cash flows after erosion	(3.50)	(12.07)	(4.34)	(2.70)	2.66	1.87	2.42	3.10	3.92	4.83	4.86	4.88	4.88	4.88	4.88	44.88

DCF, Rotterdam Adjusted for Full Erosion at Merseyside = GBP8.32

IRR 14.0%