Ajax Petroleum
Teaching Commentary

OVERVIEW

This short but very rich case is based on an actual capital expenditure decision in one of the major oil companies in 1980. There are three major themes in the case:

1. Sorting out the managerial insights in a "joint costing" product context.
2. Review of the financial analysis framework for capital investment decisions.
3. Blending financial and strategic factors in capital spending.

ANSWERS TO ASSIGNMENT QUESTIONS

Question 1

The economic return calculations for the project under the various combinations of prices for resid and fuel gas are shown in Exhibit A. Obviously, the accounting choices make a big difference.

Question 2

This question should be easy for students if they focus on the incremental flows for the refinery as a whole. Only the "opportunity cost" is relevant for the capital investment analysis. For both resid and fuel gas, this is the current market price of resid, which is $25. This is the foregone revenue if resid is used as feedstock instead of being sold and is the cost to replace with resid any fuel gas diverted from use as a fuel somewhere else in the refinery to use as fuel at the SDU.

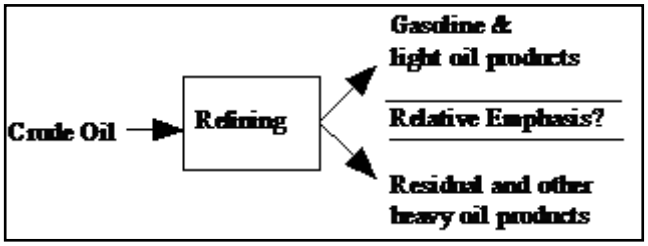
The accounting arguments about joint-cost and by-product cost are irrelevant for the capital expenditure analysis. Typically, most, but not all, students will see this. Question 2 is worth some discussion time to emphasize the points noted here, but not much time. This is a "right/wrong" question, which isn't really discussible.

An interesting side issue here is whether to use the current market price of $25/bbl or the refinery controller's estimate of $20 over the life of the project. The point here is very simple—for a commodity product, the best estimate of the future price is the current price.

If Fred Morton is really wise enough to know how residual prices are going to change over the next several years, he is wasting his time at the refinery! He should be trading oil futures and getting rich based on his knowledge of future prices. There is a certain common sense appeal to the $20 estimated average price because it appears to be a better proxy for future prices than the $25 figure. But this is an illusion that students should be encouraged to see through. Our experience is that many students will use $20 rather than $25. It is a fun few minutes to ask them where they acquired this prescient knowledge of oil prices. Reinforcing the notion that commodity markets are presumed to be "weak form efficient" is worth a few minute side trip here.

Question 3

Based on the information in the case, the project *looks* like a winner for the Middletown refinery on an incremental cash flows basis. Using the $25/bbl value for resid and fuel gas, the project IRR is 60% and the payback is less than two years. Of course, the return is highly dependent on unknowable trends in gasoline prices and resid prices.



Based on this uncertainty, some students will conclude that the project really hinges on the spread between gasoline and resid prices rather than the absolute level for either one. It is then possible to calculate the break-even spread to yield the desired 20% economic return. This is shown in the far-left column of Exhibit A. When the current spread is $14 ($39 - $25), and the controller's estimate of the spread over the foreseeable future is $19 ($39 - $20), a break-even spread of ~$8 for a 20% return seems to be further support for the project.

Another level of analysis here is to evaluate the SDU including 1/3 of the cat cracker investment and fixed operating costs. As Andersen (the project analyst) says in the case, you can only get the 60% incremental IRR if you have $65M in idle investment lying around!

Incremental versus full utilization basis for capital expenditure evaluation is a rich topic often ignored in the textbooks. A good reference on the topic is: Shank, J. 1996. "Analyzing Technology Investments–From NPV to SCM," *Management Accounting Research, 7*, 185-197. I wrote it!

Question 4

In fact, Mr. MacGregor did recommend the project and it was approved. It was built in 1981, within the budgeted cost of $30 million. And it never made even one dollar of profit for Ajax! What happened?

At about the time of the case, gasoline demand peaked in the United States as a result of a lagged price elasticity response to the steady run-up in prices between 1972 and 1981 (from about $.15/gallon to about $1.50/gallon). The drop in demand as a result of higher prices was delayed for several years as institutionalized patterns of driving behavior took a long time to change. But once aggregate demand began to decline, it continued downward for fourteen years, in spite of declines in price back toward $1.00/gallon. Gasoline demand in the United States finally bottomed out in 1994 at a level 40% below the peak in 1981.

When there is not enough demand for gasoline to utilize capacity fully from the first pass through a refinery, there is no need for the second pass capacity (an SDU). Basically, the SDUs installed in North America from 1980 to 1982 were never needed and were used only occasionally to keep them from rusting.

Was this result foreseeable? Did it catch all the major oil companies by surprise? In fact, Ajax was not the only major oil company caught with an amazing total flop of an investment project. But many of the major oil companies did not invest. The following table illustrates the split:

Yes		**No**
Ajax (Gulf)	$ 30 M	Exxon
Arco	$100 M	Mobil
Chevron	$ .3 B	Sohio/BP
(Pascagoula, MS)		(although they all had excess cracker capacity in 1980 that they were not using)

Since the incremental cash flows for the project should look the same to any oil company with a mix of heavy oil (resid) and light oil (gasoline) sales, why did Exxon and Mobil walk away from such an apparently lucrative investment idea? One possibility is just more caution. There are dramatically few "60% return" projects in real life, so an SDU should have attracted a lot of skepticism. There is relevance here in the old adage, "Remember that things that look too good to be true probably are!"

We think there is more to this split than just different degrees of caution, however. The issue is strategic focus and how it affects capital investment spending. Consider the following strategic profile of Exxon versus Gulf (Ajax) at the time of the case.

Exxon

- Refineries geared to process heavy Venezuelan crude. A mix of outputs heavy in resid is expected and planned for.
- A marketing organization geared to sell the resulting mix of gasoline and resid all along the East Coast.
- The Company uses *sales value joint costing* so that resid shows the same gross margin % as gasoline. Both are equally "profitable."
- Resid is a good thing.

CONCLUSION: NOT REALLY INTERESTED IN GETTING RID OF RESID AT A HEAVY INCREMENTAL CAPITAL COST.

Gulf

- Refineries geared to process light Kuwait crude. But this supply was lost when their Kuwaiti reserves were nationalized.
- Must now process heavy Nigerian crude (and Angolan) crude in refineries not geared up for heavy oil. Thus, resid is a real nuisance at the refinery.
- A marketing organization geared primarily to gasoline (from the Kuwait days). Resid is seen as a fringe product.
- The company uses a *volumetric joint cost* approach in which resid typically carries a cost higher than its selling price. Resid is seen as a "loser," in the market, at the refinery, and in the accounting reports.

CONCLUSION: A PROJECT TO CONVERT RESID INTO GASOLINE LOOKS GREAT.

We don't believe it is luck or contrarian judgment that explains why Gulf, Arco, and Chevron went for an SDU while Exxon, Mobil, and Sohio/BP did not. Some finance/economics theoreticians who see capital expenditures purely in net present value (NPV) terms will reject the idea that strategic direction might outweigh isolated calculations of project return. But we believe NPV is just one analytical tool and is not a decision criterion. Is it conceivable that Exxon looked at the same "rosy" cash flow projections for an SDU as Gulf but decided not to invest for reasons of strategic positioning? We think the answer is yes. Whether the instructor or the students agree or not isn't the point. Regardless of one's point of view, the case makes a great vehicle for discussing capital expenditure analysis from a perspective that considers strategic issues as well as project-level economics.

A CEO I once visited had a sign in his office that read: "I Fund Strategies, Not Projects!"

TEACHING STRATEGY

I use this case in a second-year MBA elective in Strategic Cost Management to review capital expenditure analysis techniques while emphasizing a blending of calculations with strategic assessment. The case can also be used at or near the end of a segment on capital expenditure analysis in an MBA core course.

In class, I start with a primer on joint cost accounting, using an example that parallels the case facts. I try to start the consideration of the SDU proposal by emphasizing that it is purely a matter of accounting mechanics whether or not gasoline is a "more profitable" product than resid. The example we use is reproduced here as Exhibit B. It takes about fifteen minutes to cover the example if the instructor chooses to start this way.

After this start, we follow the case questions in order. We find that it is usually possible to cover Questions 1 and 2 in about thirty minutes if students already have a good grounding in basic economics and basic discounted cash flow techniques. We try to save at least thirty minutes at the end to discuss the actual results and try to make some sense out of them. The case is an excellent one to help students build judgment about the capital expenditure evaluation process as a major management decision area.

We end the class by showing Exhibit C on an overhead. It seems to us as good a "final message" as any for this case.

Exhibit A

AJAX PETROLEUM
Cash Flows Analysis for the SDU Project

B/E Spread For The Incremental Cash Flows*						
X - 1.1y = $3.70	Value of Cracking Stock Produced	$37.50	$37.50	$37.50	$37.50	$37.50
	Fuel Cost	(2.90)	(3.23)	(2.00)	(2.50)	(2.50)
	Raw Material Costs	(32.30)	(32.30)	(20.00)	(25.00)	(25.00)
	P/C per bbl.	$2.30	$1.97	$15.50	$10.00	$10.00
12.3M	Total P/C (3,285,000 bbls./year)	7,555,000	6,471,450	50,917,500	32,850,000	32,850,000
3.3M	Operating Costs/Yr.	3,300,000	3,300,000	3,300,000	3,300,000	4,800,000
9.0M	Operating Cash Flow/Yr.	4,255,000	3,171,450	47,617,500	29,550,000	28,050,000
4.9M	After Taxes (46%)	2,297,700	1,712,583	25,713,450	15,957,000	15,147,000
.7M	Depn. Tax Shelter/yr.**	690,000	690,000	690,000	690,000	2,185,000
5.6M	Total Annual Cash Flow	2,987,000	2,402,583	26,403,450	16,647,000	17,332,000
27M	Total PV (20 yrs. at 20%)	14,449,000	11,701,000	128,581,000	81,671,000	85,032,000
0	NPV (20 years at 20%)	(12,551,000)	(15,299,000)	101,581,000	54,671,000	(468,000)
	Payback	9.10 Years	11.24 Years	1.02 Years	1.62 Years	4.93 Years
20%	Internal Rate of Return	~9%	~6+%	~100%	~60%	~20%
1.0	Profitability Index	.54	.43	4.76	3.00	1.00-
	Return on Capital Employed	19.8%***	16%	176%	111%	36.5%

*With X = Value of Cracking Stock & y = Value of Resid. For example, if X = $37.50, then the break even value for resid to yield a 20% return is:

$37.50 - 1.1y = 3.70
1.1y = 33.80
y = 30.73
and the "spread" is $39.00 - $30.73 = $8.27

** For columns 1-4, $30,000,000 ÷ 20 years = $1,500,000/yr. × 46% = $690,000. For Column 5, the investment changes to $95,000,000 and the tax shield to $2,185,000.

***Annual after-tax cash flow divided by average investment. This is a "strange" measure, which is hard to defend conceptually. It happens to be a measure Ajax actually used as a proxy for the ROA impact of the project on internal financial statements.

Exhibit B

AJAX PETROLEUM
A Joint Costing Example

- Assume 100,000 bbl. of crude are processed daily in the refinery at an average purchase price of $29 per barrel (total cost - 2,900,000).
- Assume "crude still" operating costs are $313,000 per day.
- Assume 5,000 bbl. of fuel gas are produced daily and charged a cost of $145,000 (5,000 × $29 = $145,000).
- The remaining product mix must absorb total costs of $3,068,000 ($2,900,00 - $145,000 + $313,000)
- Assume production at the crude still of 45,000 bbl. of gasoline feedstock, 40,000 bbl. of middle distillate, and 10,000 bbl. of residual oil. Total production = 95,000 bbl per day.

The question is how to apportion the $3,068,000 to the 95,000 bbl.

I. Volumetric Basis (Gulf)—Simply charge each bbl. for a proportionate share of cost ($3,068,000 ÷ 95,000 = $32.30*, for gasoline, M/D and resid.)

*This is the cost number presented in the case.

II. Market Value Basis (Exxon)—Assume gasoline feedstock costs $2.50/bbl. to convert to gasoline, which sells for $39/bbl. Assume M/D costs $.60/bbl. to convert to fuel oils (jet fuel, diesel fuel, heating oil), which sell for an average of $36/bbl. Assume resid requires no further processing and sells for $25/bbl. The total net realizable value of the day's production is:

$1,643,000	for gasoline [45,000 × $36.50 (39.00 - 2.50)]
$1,416,000	for M/D [40,000 × $35.40 (36.00 - .60)]
$250,000	for resid [10,000 × $25.00]
$3,309,000	Total

The overall cost ratio is 93% ($3,068,000/$3,309,000). Charging cost so that each product earns the same overall gross margin (7%) yields the following figures:

					Per Bbl.
Gasoline	$36.50	×	.93	=	$33.95
M/D	$35.40	×	.93	=	$32.92
Resid	$25.00	×	.93	=	$23.25

It should be noted that this system would show a *profit* for resid, even at a price of $25.00. Under this approach, not every product must show a cost greater than crude itself, contrary to the statements in the case. That is, the case is intentionally misstated in order to illustrate this common misperception for the students.

III. Heat Value Basis (DOE)—It is a fact that the heavier the concentration of carbon in the oil, the greater its heat value (BTUs generated per bbl.). Assume relative heat values as follows per bbl: 90% for gasoline, 100% for MD, and 110% for resid. Allocating cost based on heat value yields the following breakdown:

	Volume	Relative Heat Value	Total Relative Heat Value	
Gasoline	45,000	90%	40,500	(44%)
MD	40,000	100%	40,000	(44%)
Resid	10,000	110%	11,000	(12%)
	95,000		91,500	(100%)

	Share of Operating Costs		Per bbl.
Gasoline	$1,350,000	(44%)	$30.00
MD	$1,350,000	(44%)	$33.75
Resid	$368,000	(12%)	$36.80
	$3,068,000	(100%)	

These three approaches serve to illustrate the three general possibilities over the three product categories, equal cost, increasing cost, or decreasing cost.

	Gulf Volumetrics	Exxon Market Values	DOE Heat Value (BTUs)
Gasoline	32.30	33.95	30.00
MD	32.30	32.92	33.75
Resid	32.30	23.25	36.80

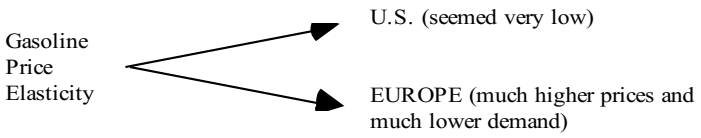
Any of these three approaches is equally defensible or indefensible as an "accurate" cost allocation scheme. What is the relative profitability of gasoline versus resid? It depends!

Exhibit C

AJAX PETROLEUM
Final Observations

1. "Herd mentality" is hard to fight, but you have to try.

2. What the "economic analysis" missed was future trend in gasoline consumption. How could we know?



Is the European experience relevant in the US in 1980?

3. A big part of the problem was the notion in Ajax that gasoline is "more profitable" than resid—an accounting illusion.

4. Strategy does matter—maybe financial analysis does too, *if* you get the "right" numbers.