TABLE P7.57

	Net Cash Flow	
n	Project A1	Project A2
0	−$10,000	−$15,000
1	5,000	20,000
2	5,000	—
3	5,000	—

Short Case Studies

ST7.1 *Will That be Cash, Credit—or Fingertip?*[11] Have you ever found yourself short of cash or without a wallet when you want to buy something? Consider the following two types of technologies available in retail stores to speed up checkouts.

- **Pay By Touch** ™ takes fingerprints when customers enroll in the program. The image is then converted to about 40 unique points of the finger. Those points are stored in a computer system with "military-level encryption." They want this to be your cash replacement because of the time savings, and a lot of customers who are paying cash will find it more convenient now to use these cards.
- **A contactless card** allows the shopper to pay in seconds by waving his or her contactless card in front of a reader, which lights up and beeps to tell the shopper the transaction is done. A contactless payment is twice as fast as a no-signature credit card purchase and three times as fast as using cash. That's why it's catching on at fast-food restaurants and convenience stores.

Profits depend, in part, on how quickly customers—typically with small purchases—get through the line. These new technologies being rolled out at convenience stores, supermarkets, and gas stations could someday make it passé to carry bulky wallets. Without the need to dig for cash and checks at the register, the quick stop-and-go payments promise speedier transactions for consumers—and perhaps fatter profits for retailers.

The appeal is that there is no need to run anything through a machine. A contactless-card transaction is usually more expensive for a retailer to process than a cash payment. But retailers that adopt contactless payments hope they'll bring in more customers, offsetting higher costs. If that turns out to be false, then some could turn their backs on the new technology.

One retailer who just installed a Pay By Touch™ system hopes to increase its customer traffic so that a 10% return on investment can be attained. The Pay By Touch™ scanners cost about $50 each, the monthly service fee ranges between $38 and $45, and each transaction fee costs 10 cents. In a society driven by convenience, anything that speeds up the payment process attracts consumers. But technology providers will need to convince consumers of the safety of their information before the technologies can become a staple in the checkout line.

Suppose that you are a national franchise operator with 28,000 stores. As a part of growth strategy, you are thinking about installing the Pay-By-Touch™ systems (say, two systems for each store location). What kinds of additional revenue per store would justify the investment, if you are looking for at least 20% return on your investment?

ST7.2 Critics have charged that, in carrying out an economic analysis, the commercial nuclear power

[11] "Will That be Cash, Credit—or Fingertip?" Kathy Chu, *USA Today*, Section B1, Friday, December 2, 2005.

industry does not consider the cost of decommissioning, or "mothballing," a nuclear power plant and that the analysis is therefore unduly optimistic. As an example, consider the Tennessee Valley Authority's Bellefont twin nuclear generating facility under construction at Scottsboro, in northern Alabama. The initial cost is $1.5 billion and the estimated life is 40 years. The annual operating and maintenance costs are assumed to be 4.6% of the initial cost during the first year and are expected to increase at an annual rate of 0.05% thereafter. Annual revenues are estimated to be three times the annual operating and maintenance costs throughout the life of the plant.

(a) The criticism that the economic analysis is overoptimistic because it omits "mothballing" costs is not justified, since the addition of a cost of 50% of the initial cost to "mothball" the plant decreases the 8.95% rate of return only to approximately 8.77%.

(b) If the estimated life of the plants is more realistically taken to be 25 years instead of 40 years, then the criticism is justified. By reducing the life to 25 years, the rate of return of approximately 9% without a "mothballing" cost drops to approximately 7.7% when a cost to "mothball" the plant equal to 50% of the initial cost is added to the analysis.

Comment on these statements.

ST7.3 The B&E Cooling Technology Company, a maker of automobile air-conditioners, faces a three-year deadline to phase out the traditional chilling technique, which uses chlorofluorocarbons (CFCs)—a family of refrigerant chemicals believed to attack the earth's protective ozone layer. B&E has been pursuing other means of cooling and refrigeration. As a near-term solution, the engineers recommend a cold technology known as an absorption chiller, which uses plain water as a refrigerant and semiconductors that cool down when charged with electricity. B&E is considering two options.

- **Option 1.** Retrofit the plant now to adapt the absorption chiller and continue to be a market leader in cooling technology. Because of untested technology on a large scale, it may cost more to operate the new facility while personnel are learning the new system.
- **Option 2.** Defer the retrofitting until the federal deadline, which is three years away. With expected improvement in cooling technology and technical know-how, the retrofitting cost will be cheaper. However, there will be tough market competition, and the revenue would be less than that of option 1.

The financial data for the two options are as given in Table ST7.3.

TABLE ST7.3

	Option 1	Option 2
Investment timing	Now	3 years from now
Initial investment	$6 million	$5 million
System life	8 years	8 years
Salvage value	$1 million	$2 million
Annual revenue	$15 million	$11 million
Annual O&M costs	$6 million	$7 million

(a) What assumptions must be made to compare these two options?

(b) If B&E's MARR is 15%, which option is the better choice based on the IRR criterion?

ST7.4 An oil company is considering changing the size of a small pump that is currently operational in wells in an oil field. If this pump is kept, it will extract 50% of the known crude-oil reserve in the first year of its operation and the remaining 50% in the second year. A pump larger than the current pump will cost $1.6 million, but it will extract 100% of the known reserve in the first year. The total oil revenues over the two years are the same for both pumps, namely, $20 million. The advantage of the large pump is that it allows 50% of the revenues to be realized a year earlier than with the small pump.

TABLE ST7.4

	Current Pump	Larger Pump
Investment, year 0	0	$1.6 million
Revenue, year 1	$10 million	$20 million
Revenue, year 2	$10 million	0

If the firm's MARR is known to be 20%, what do you recommend based on the IRR criterion?

ST7.5 You have been asked by the president of the company you work for to evaluate the proposed acquisition of a new injection-molding machine for the firm's manufacturing plant. Two types of injection-molding machines have been identified, with the estimated cash flows given in Table ST7.5.

TABLE ST7.5

	Net Cash Flow	
n	**Project 1**	**Project 2**
0	−$30,000	−$40,000
1	20,000	43,000
2	18,200	5,000
IRR	18.1%	18.1%

You return to your office, quickly retrieve your old engineering economics text, and then begin to smile: Aha—this is a classic rate-of-return problem! Now, using a calculator, you find out that both projects have about the same rate of return: 18.1%. This figure seems to be high enough to justify accepting the project, but you recall that the ultimate justification should be done with reference to the firm's MARR. You call the accounting department to find out the current MARR the firm should use in justifying a project. "Oh boy, I wish I could tell you, but my boss will be back next week, and he can tell you what to use," says the accounting clerk.

A fellow engineer approaches you and says, "I couldn't help overhearing you talking to the clerk. I think I can help you. You see, both projects have the same IRR, and on top of that, project 1 requires less investment, but returns more cash flows

$$(-\$30{,}000 + \$20{,}000 + \$18{,}200 = \$8{,}200$$

and

$$-\$40{,}000 + \$43{,}000 + \$5{,}000 = \$8{,}000)$$

Thus, project 1 dominates project 2. For this type of decision problem, you don't need to know a MARR!"

(a) Comment on your fellow engineer's statement.

(b) At what range of MARRs would you recommend the selection of project 2?