Problem 8-13

Goal: Decide whether to replace existing Batch reactor with new Continuous reactor

Given:

Minimum Acceptable Return	15.0%	MARR
Design:	**old Batch**	**new Continuous**
Fixed Capital Investment	$40,000	$70,000
extra Operating Costs	-	$15,000
new years ago	5	-
Salvage Value	$1,000	$0
Depreciation recovery perio	10	10
current Salvage Value	$5,000	-

Approach: Incremental Investment paired comparison

calculate delta Investment, include old salvage as income to reduce new investment

calculate straight line annual depreciation, (Investment - salvage)/life

Existing unit depreciation based on current salvage value & remaining life

ASSUME 35% income tax rate 35.0% assume original $1,000 salvage value still good at end of 10 yr life

calculate delta savings for each item, then sum to total savings, then delta ROI

compare to MARR, accept one and discard other

Alternate approach: Minimum Acceptable Return as an expense

add 15% of each investment to costs and choose design with largest profit

Calculations:

either unit let "R" be revenue = total income

let "E" be cash expenses common to both units

old unit for tax caclualtions, no salvage value allowed according to MACRS U.S. Tax Law

depreciation for tax calculations, d = straightline $40,000/10 $4,000

depreciation for current old capital recovery, d = straightline ($5,000-$1,000)/5 $800

Net Profit = Revenue - All Expenses - Taxes Paid = R - (E + d_{o5}) - (R - E - d_{o10})t

Net Profit = R - E - d_{o5} - (R - E - d_{o10})t

Net Profit = R - E - 800 - (R - E - 4000)0.35 alt. MARR cost

Net Profit = 0.65 R - 0.65 E - 800 + 1,400 = 0.65 (R-E) + 600 $750

old Net Profit = 0.65 (R-E) + $600 ($150.00)

new unit for tax caclualtions, no salvage value allowed according to MACRS U.S. Tax Law

depreciation for tax calculations, d = straightline $70,000/10 $7,000

same depreciation for capital recovery, d = straightline $70,000/10

cash expenses = E - $15,000

All expenses = cash expenses + deprerciation = E - $15,000 + $7,000

Net Profit = Revenue - All Expenses - Taxes Paid = R - (E - $15,000 + d) - (R - E - $15,000 - d)t

Net Profit = R - (E - $15,000 + $7000) - (R - {E - $15,000} - $7,000)0.35 alt. MARR cost

Net Profit = 0.65 R - 0.65 E + 8000 - 2,800 = 0.65 (R-E) + 5,200 $9,750

new Net Profit = 0.65 (R-E) + $5,200 ($4,550.00)

Compare New Profit - Old Profit = 0.65(R-E) + $5,200 - {0.65(R-E) - $600}

delta profit = $5,200 + $600 $5,800

new investment = $70,000 - salvage of old unit $65,000 Continuous net profit (loss)

Replacement Incremental ROI **8.92%** **($4,400.00)**

Answer **Recommend** **keep existing Batch Reactor, DO NOT make replacement**

new Continuous replacement does not exceed 15% MARR

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10/25/2007