CH0401 Process Engineering Economics

Lecture 1f

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Process Engineering Economics

1. **Introduction – Time Value of Money**
2. Equivalence
3. Equations for economic studies
4. Amortization
5. Depreciation and Depletion

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Depletion

When exhaustible resources are sold, part of the sales realization is a return of capital, and the income tax should adjust for that. Also, it is desirable to have an incentive to encourage exploration for new resources as existing resources are used up. Depletion is the term used to describe the write-off certain exhaustible natural resources such as minerals, oils and gas, timber. Depletion implies to production units withdrawn from the property, whereas depreciation limited to original cost less the estimated salvage value.

In other words, Capacity loss due to materials actually consumed is measured as *depletion*. Depletion cost equals the initial cost times the ratio of amount of material used to original amount of material purchased. This type of depreciation is particularly applicable to natural resources, such as stands of timber or mineral and oil deposits.

Depletion

There are two methods for computing depletion:

1. Cost depletion
2. Percentage depletion

Cost depletion

The value of depletion, unit, say, a ton of ore is arrived at by calculating the total value depleted (or reduced) divided by the tons of ore to be depleted.

$$\text{Value of depletion unit(a ton of ore)} = \frac{\text{total value depleted}}{\text{tons of ore to be depleted}}$$

Deduction for a tax year = depletion unit the number of units sold within the year

Depletion

Percentage depletion

In the percentage method, the depletion allowance for the year is a specified percentage of the "gross income from the property" but must not exceed 50% of the taxable income figured without depletion allowance. The cost depletion method can always be used but the percentage depletion method has certain shortcomings.

The deduction should be computed in both the ways, if applicable, and the large deduction taken.

Percentage depletion varies from 5% to a maximum of 22% Oil and gas wells have recently lost the percentage depletion allowance, except for certain small producers subjected to limitations.

It should be noted that under cost depletion, when total cost and accumulated depletion are equal, no further cost depletion is allowed. However, percentage depletion is not limited to original cost less salvage, as is ordinarily true with depreciation of assets.

Depletion

A mining property with an estimated 1 megaton (Mt=1×10^6 t) of ore originally cost \$50,00,000 (50 lakhs). In one year 100 kilotons (kt) of ore is sold for \$16/t with expenses of \$10,00,000 (10 lakhs). The percentage depletion allowance is 50%, and the tax rate is 46%. Calculate the annual cash flow. Which is more advantageous, cost depletion or percentage depletion?

Solution:

Given :

Available or estimated resources	= 1×10^6 t	
Original cost of the resource	= \$50,00,000	
Quantity of ore sold in a year	= 100 kt	= 100×10^3 t
Price of ore sold in a particular year	= \$16/t	
Percentage depletion allowance	= 50%	
The tax rate for the year	= 46%	

Required:

1. Annual cash flow for the year
2. Suggestion for the advantageous method (Cost depletion or Percentage depletion) or Money saved or Income retained after depletion (Cost and Percentage) allowance

Depletion

$$\text{Cost depletion} = \text{Value of depletion unit(a ton of ore)} = \frac{\text{total value depleted}}{\text{tons of ore to be depleted}}$$

$$= \frac{50,00,000}{10,00,000} = \frac{\$5}{t}$$

$$\text{Price of ore sold in a year} = \frac{\$16}{t}$$

$$1 \text{ ton} = \$16$$

$$100 \times 10^3 \text{ ton} = \frac{100 \times 10^3 t \times \$16}{1t}$$

$$= 100 \times 10^3 \times 16$$

$$= \$16,00,000$$

$$\left.\begin{matrix}\text{Gross income on the sale} \\ \text{of 100 kt of ore}\end{matrix}\right\} = \$16,00,000$$

Process Engineering Economics – **Depletion**

Particulars	Cost depletion	Percentage depletion
1. Gross income	$16,00,000.00	$16,00,000.00
2. Expenses for the year, excluding depletion	$10,00,000.00	$10,00,000.00
3. Gross income after expenses, taxable income [1 – 2]	$6,00,000.00	$6,00,000.00
4. (a) Cost of depletion at $5/t for 100 kt i.e 1t = $5 for 100 kt it is = $5,00,000.00	$5,00,000.00	_____
4. (b) Percentage depletion, at 50% i.e. 50% of [3]	_____	$3,00,000.00
5. Actual income after the above deductions [cost and percentage depletion] or actual taxable income [3 – 4a]	$1,00,000.00	$3,00,000.00 [3 – 4b]
6. Tax at 46% on actual income	$46,000.00	$1,38,000.00
7. Net cash flow or Available cash after all tax deduction [3 – 6]	$5,54,000.00	$4,62,000.00

Therefore, the cost depletion is advantageous that the percentage depletion.

Since the larger deduction is usually taken into account as mentioned above.

Result :

1. The annual cash flow by

Cost depletion	=	$5,54,000.00
Percentage depletion	=	$4,62,000.00

2. The cost depletion is advantageous than the percentage depletion.

Process Engineering Economics – ***References***

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