Example 5:

Calculation of economic efficiency

Provide an update on the summarization of economic fundamentals (profits, costs, revenues).

Conversion expense and revenue streams using the so-called suppliers

During the lifetime is changed monitored economic variables. If the change will last from T_1 to year T_2, i.e. total $T_r = T_2 - T_1 + 1$ year, then e.g. for the sum of periodically varying costs for the period T_r applies:

$$N_{Tr} = \sum_{T=T_1}^{T_2} N_T \cdot r^{-T} = N_{T1} \cdot \sum_{T=T_1}^{T_2} \cdot k_T = N_{T1} \cdot k$$

where: N_{T_r} - updated total costs for *Tr* years
N_{T_1} - costs in year $T1$
k_T - member of the series, whose size depends on the type of change
k - supplier (composed supplier) x (r^{1-T1})
r - interest ($r = 1+p$, p – interest rate)

We consider 4 options during the monitored variables:

a) quantity is constant during *Tr*

$$k = \frac{1 - r^{T_r}}{r^{T_r}(1-r)} \cdot r^{1-T_1} = s^{(0)}_{T_r} \cdot r^{1-T_1}$$

where: $s^{(0)}_{T_r}$ – 0st degree supplier

b) quantity annually changing B-times (i.e. by β% per year), can be e.g. costs associated with the increase of electric power consumption in a particular area, i.e.:

$$B = 1 + \frac{\beta}{100}$$

Then:

$$k = \frac{B^{T_r} - r^{T_r}}{r^{T_r}(B-r)} \cdot r^{1-T_1} = s^{(1)}_{T_r} \cdot r^{1-T_1}$$

where: $s^{(1)}_{T_r}$ – 1st degree supplier

c) **Variable annually changing B^2-times** (i.e. by β^2% per annum), e.g. change in costs to a loss of electrical power load change management, then

$$k = \frac{B^{2T_r} - r^{T_r}}{r^{T_r}(B^2 - r)} \cdot r^{1-T_1} = s^{(2)}_{T_r} \cdot r^{1-T_1}$$

where: $s^{(2)}_{T_r}$ – 2nd degree supplier

d) Variable is changed annually by *D* Kč, then:

$$k = r^{1-T_1}\left[\frac{r^{T_r} - 1}{p \cdot r^{T_r}} + \frac{D}{N_{T_1}}\left(\frac{1 - r^{1-T_1}}{p^2} - \frac{T_r - 1}{p \cdot r^{T_r}}\right)\right]$$

Said relationship is valid provided that the change in the first year of the relevant period is not yet !!!

Economic criteria

The economic criteria are used to calculate the present (today) values investment and subsequent decisions, whether in the investment or not to proceed. The most commonly used criteria (especially in the economic evaluation effectiveness of investment projects) include:

Criterion updated profit (Net Present Value - NPV)

$$Z_{T_{\check{z}}} = \sum_{T=1}^{T_{\check{z}}} \left(V_T - N_{pT}\right) \cdot r^{-T} - N_{ip} \overset{!}{=} max \quad \textbf{[Kč]}$$

where: $Z_{T_{\check{z}}}$ - updated profit for lifetime $T\check{z}$
V_T - revenues of the assessed investment in the T year of its operation
N_{pT} - operating costs of the assessed investment in the T year of its operation
N_{ip} - comparative investment cost

Task:

Use the updated criteria for assessing the profit possibilities of realization plant construction with knowledge of the following parameters:

- construction time: T_v = ***8 years***
- the construction period exceeding over start of operation: ΔT = ***2 years***
- interest rate: ***p = 10 %***
- lifetime: $T_ž$ = ***25 years***
- allocation of investment costs:

T [years]	1	2	3	4	5	6	7	8
N_{iT}[mil. CZK]	5	10	10	20	15	10	5	5

- operating costs in the individual years of operation:

year	1.- 3.	4.- 7.	8.- 20.	21.- 25.
N_{pT}[mil. CZK]	10	3%	const.	-4%

- revenues for the supply of electricity:

year	1.- 5.	6.- 10.	11.- 22.	23.-25.
V_T [mil. CZK]	20	5%	const.	-2%