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Business ratios and their basic data on investments

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Business ratios and their basic data on investments

Peter Klatecki

To assess whether an investment is appropriate and therefore profitable for a company, different business ratios are used in business management. For technically (not commercially) trained personnel are, however, some uncertainties concerning the calculation and the predications of these indicators. So sometimes content is derived from the concepts that is not applicable. Additionally, it is sometimes difficult to select the data underlying these ratios appropriately.
Below, hints are given on the selection of data and some important business ratios are explained. Described solely are so called "analytical procedures", considering a single investment. The "synthetic method", which pursues a holistic approach on the company, including company financing and even divestiture, is not subject of this article and a task of corporate controlling. The following specific indicators are explained:

- *Return on Investment (ROI)*
- *Static Amortization*
- *Capital Value / Dynamic Amortization*

The selection of the basic data is crucial for the results of the calculations. While the ratios are usually expressed via simple mathematical relationships, the selection (consideration) of the basic data triggers repetitive discussions. However, these data are largely determinative for the significance of the investigation. It is essential that only costs and surplusses are considered, which are directly related to the investment. At the same time, the data to choose are always "anticipated" data. Because of this the calculations are representing a forecast. If there is a choice between expected and guaranteed data, the guaranteed data has to be used. For example the values naming fuel consumption; here the guaranteed values are usually higher than the values during operation.

The investment

Hereby not only the purchase price of the investment is meant. To be factored too are additional costs in direct context to the investment:

- preparation work for the installation (building measures such as foundations, a new building or adaptation of logistic requirements, etc.)
- costs incurred by a variance in staff
- costs for licensing, regulatory framework
- loss of production during the construction period, if the installation can not be performed during the annual revision, which is preferential
- …

Reducing the amount of investment, under certain circumstances, the price necessary for a current replacement investment may be considered. This if a repair is necessary in order to maintain the current production and the alternative solution is a complete new installation or revamping [1].

The calculatory interest rate

In principle, with any investment there is the possibility to choose a long-term investment at the capital market alternatively (and to refrain from the investment). This is the basis of contemplation (calculation) with some business ratios, regardless of whether the amount of investment is available as cash or financing is necessary. This is considering a "evaded interest income" at the capital market. To be taken as a basis here, is reasonably the related interest rate to be achieved for a termed deposit for the duration of the depreciation time of the asset to purchase. For example government bonds with 10-year loans. The bonds in Germany offer (actually) a return of just over 3% (per year). Corresponding bonds in other European countries provide sometimes significantly more, however, correlative with increased risk.

In general, a higher interest rate is demanded by the company. This is a management decision. A required interest rate of 8 - 10% per year is usual. This value will be set as "alternatively be achieved". Any additional interest claimed must be judged as not in touch with the investment.

The calculatory interest rate delineates to:

- the desired (requested) return on capital
- is depending on the business
- is, in general, exceeding the capital market rate for an investment of money
- is considering additional influences as:
  - additional risks (out of the company operation)
  - …

The liquidation receipts

This is the "virtual" sales price of the plant at the end of the depreciation period (resale value, scrap price). It can be found in the literature and also in the calculation for the capital value (see below).

While e.g. with a purchase of a motor vehicle the resale value at the end of the operating time has to be taken into account; when contemplating furnaces, only the scrap price (metal value) of the plant has to be considered normally. In the latter case, the impact on the consideration is marginal and can be omitted therefore.

The periods under consideration

This space of time, in general, is the depreciation time for the asset and separated in a given number of periods. Typically years (fiscal years). Depending on the capital goods a deviation is possible (e.g. monthly), but only in rare cases. It must be ensured, however, that ALL the basic data applies to the same period length. The selected observation period affects the calculation of the capital value, as it is part of the formula.

The ongoing costs

Here, all costs are covered, resulting from the operation of the capital goods and hereby are directly linked to it.

- maintenance
- staff costs
- fuel / consumables; potentially CO_2 tax
- financing costs (see below)
- …

In addition the corporate taxes have to be considered also. If the operation of the investment generates higher yields and higher profits (by production or savings), so of course, the burden of tax is increased. The investment expenditure itself results in a decrease of tax in the year of purchase.

Especially for the fuels used, an expected increase of price has to be taken into account. Here, significant price increases are to be expected in the future with a corresponding impact on the investigation.

Are depreciation costs?

The depreciation, as used in the company accounting, is the valuation of assets. With this, the decrease of the value of operational means of production is recorded in the accounting to show the "actual real" value approximately. In general, this decrease of value is NOT to be stated as costs while calculating the business ratios. This is an accounting task, reducing the value of fixed assets or, in other words, the distribution of the purchase price on the operating life.

Calculating the ratios, the price of the system is considered directly (as basic data). Additional consideration of the depreciation would lead to a falsified result, because the system would quasi be paid double in the calculation. The impact on the calculation of the amortization time is obvious.

It is of course in principle possible, to take the depreciation values into account as costs in the respective periods (and set the investment I equals 0). This leads to the same mathematical problems as with complete financing (see below: "variants with financing, amortization, net present value") and the methods used are partly mathematical undefined or senseless.

The periodical surplusses

To be incorporated here are the returns (surplusses) out of the operation of the investment. These are the amounts refinancing the investment.

In particular:

- output (production) for new plants
- increase of output (increase of production) for modernizations
- savings of fuel (and CO_2 reduction additionally) for modernizations
- potential reduce of losses (melting operation) for modernizations
- reducing of payroll costs
- …

The cumulated surplusses

This is the balance of the periodical surplusses and the ongoing costs, calculated for the selected periods under consideration.

An overview about the progression of the investment can be done using a spreadsheet program, calculating this value for each period. Displayed as a graph, the progression is easily ascertainable.

The business ratios

In the exemplifications it is assumed mostly, that an investment achieves amortization inside the time frame of investigation.

ROI – Return On Investment

The ROI is one of the most frequently cited ratios when talking about the economic viability of investments. However, this is also, in my experience, the most often misinterpreted figure. Often miscalled is a ROI of "5 years", of "157,000 EURO" or similar.

In fact: The ROI is always expressed as a percentage and is without dimension therefore! In addition, it is always determined for a given time (period) within the consideration period.

In the literature various calculations of the ROI could be found, all for different considerations in parts of the company. Even a calculation to asses the entire company too. Best suited for industrial investments, with notable amount and long observation period, appears the following calculation:

$$ROI = \frac{\text{cumulated-surplusses}}{\text{Investment}} (\cdot 100)$$

An elegant option is the direct consideration of the investment as a negative "start value" in the numerator, ie:

$$ROI = \frac{-\text{Investment} + \text{cumulated-surplusses}}{\text{Investment}} (\cdot 100)$$

In this case, the ROI is analogous to the static amortization (see below). The absolute reported value is of course lower by exactly 100% than in the conventional calculation, but now the ROI will become positive first in the period in which the static amortization is achieved.

The procedure is as follows:

A period (year) is selected. The ongoing costs and periodical surplusses up to this time are balanced and related to the investment (division). The result is the ROI up to the selected year.

In some companies, this value is used as a decision criterion. In this case at least one fixed-to-reach ROI in a certain period is stipulated by the management to implement an investment. Example: ROI is more than 100% after the third year. If this is not achieved the investment is omitted.

As a general statement:

- If ROI > 0 up from one period inside the time frame the investment remunerates in principle (during the observation period).
- While talking about the ROI, it should be ensured that the same calculation formula (based on) is used.

The static amortization

This is a rough look. Determined is the time t, when the cumulated surplusses are covering the investment.

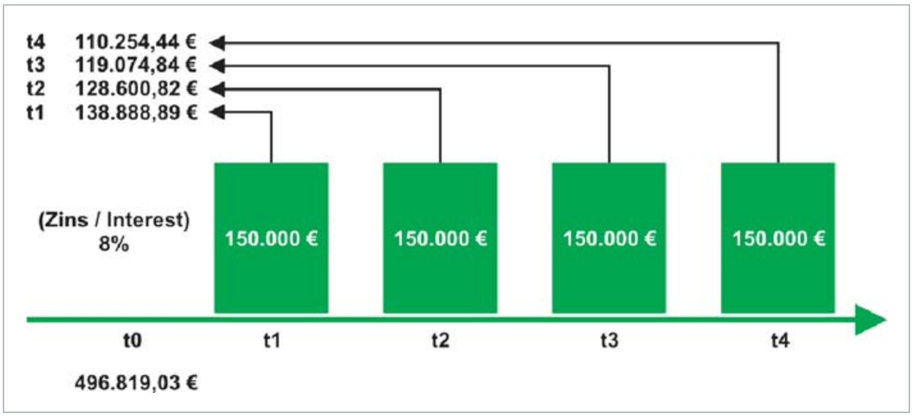

Fig. 1: Discounting and calculation of the present value (Source: Jasper GmbH)

t ⇔ Investment = cumulated_surplusses

t represents the approximate information when the investment is "paid" through the cumulated surplusses (amortized). The determined date is always before the real amortization time because some influences, such as interest (calculatory interest), are not considered.

The capital value

Using this method, the value of the investment at the time of the investment (!) is determined. The purchase price (investment) is compared to an alternative investment of money, considering the calculatory interest.

All anticipated future revenues and expenses in connection with the investment are correlated to the start time. The calculated capital value (C_0) is therewith depending on:

- I the investment
- T the periods under consideration
- E the surplusses (earnings)
- A the necessary costs
- i the calculatory interest
- L the liquidation receipts

$$C_0 = -I + \sum_{t=1}^{T}\left((E_t - A_t)\cdot(1-i)^{-t}\right) + L\cdot(1-i)^{-T}$$

Explanation (example):

In case of investment, an annual cumulative surplus of € 150,000 (in t1 to t4) is expected. The time of consideration is thus 4 periods (years). The calculatory interest is determined to 8%. The liquidation receipts are not considered.

$$\left(L\cdot(1-i)^{-T} = 0\right)$$

The value of the periodical surplusses at present time (assumed date of investment) will be determined, considering the interest (**Fig. 1**).

The added results delineate the so called Present Value (Pv) of the investment.

$$Pv = \sum_{t=1}^{T}\left((E_t - A_t)\cdot(1-i)^{-t}\right)$$

In this case, the total surplusses of € 600,000 at 8% interest rate represents, at the day of investment, a value of € 496,819.03. Or, in other words: With a current investment of € 496,819.03 at an interest rate of 8% a payout of € 150,000 each in 4 consecutive seasons (years) is achieved, in sum € 600,000. A purchase for a price equal to the Present Value provides exactly the intended interest.

Is it possible to buy at a lower amount than the present value, e.g. to € 450,000 (investment I), the difference to Pv is the **capital value** (C_0), here € 46,819.03. In this case, a higher interest rate is achieved, 12.59% instead of 8%.

As a general statement:

If Capital Value > 0 the investment remunerates in principle (during the observation time), which means it is

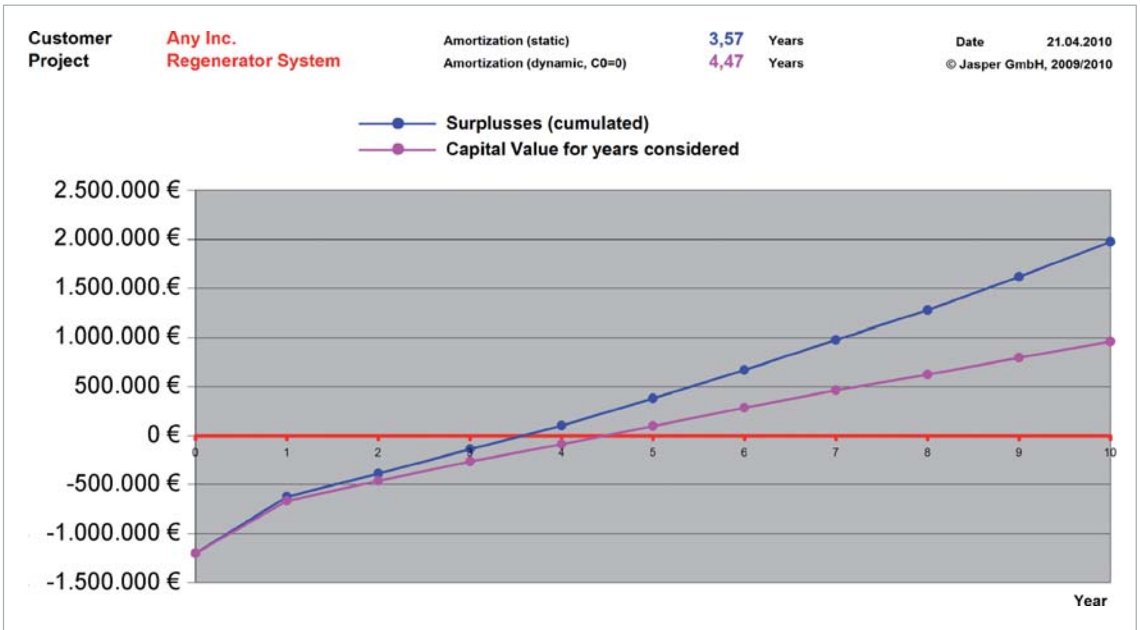

Fig. 2: Times of amortization (Source: Jasper GmbH)

more profitable than the alternative investment at the capital market, ascertained using the calculatory interest.

The dynamic amortization

Calculating the dynamic amortization, the time (t) is figured out when the capital value equals 0 (with the given basic data). Thus, all other factors are also taken into account, in particular the calculatory interest rate.

$t \Leftrightarrow C_0 = 0$

This calculation is based on the capital value calculation. The mathematics behind are much more complex than the previous calculations. The formula for the capital value should be set equal to 0 and then solved to t. This is not trivial and nowadays generally done by iterative procedures in data processing.

There is, however, a method which provides a sufficiently accurate result and avoids complex mathematics or programming.

Although there is always exactly one capital value for a space of time it is possible to determine this value for each period. If these values are displayed graphically the time of dynamic amortization is the intersection of this graph with the X-axis.

If the values of the periods around this intersection are selected and then, using these two points, the linear equation is determined, the value for the intersection with the X-axis can be calculated (**Fig. 2**).

In Fig. 2 the cumulated surplusses and capital values for an (arbitrary) sample system are shown. The intersection of the blue graph (cumulated surplusses) with the X-axis represents the static amortization time, the intersection of the purple graph (capital values) the dynamic amortization time. The later within the period the amortization takes place, the further apart these two points are. It is even possible that a static amortization is achieved but a dynamic one is not possible. In this case the calculatory interest could not be achieved. If both graphs for the period considered are completely below the x-axis, the system has no amortization time. It should be noted that today an amortization time below 3 years or less is stipulated generally.

Variants with financing, the impact on amortization and capital value

As said before, for this contemplation it does not matter that the financial means for the investment are available in cash or a financing is required. At first it will be calculated as if the funds were available in order to establish comparability.

If financed, at least, the interest on the loan (or lease) has to be considered as ongoing costs. In fact, however, a completely new situation from the perspective of the company is established.

If interest and repayment for the loan are stated as ongoing costs and the amount of investment is reduced according the loan, extremely short amortization times will be the result.

However, to perform the calculations above a certain fundamental amount of investment is required. Otherwise, the calculations provide meaningless results or are not feasible. With full financing (interest rates and repayment are included in the costs => investment = 0) the formula of the ROI is affected by a division by 0, which is not allowed. Concurrently, -I = 0 in the capital value formula will lead to meaningless results (amortization directly when purchased).

On the other hand, this approach illustrates that companies can almost benefit from the additional profit/savings of a useful investment immediately (amortization of the reduced, scheduled investment less than one year). Using financing, the total yield is of course lower, as debt service has to be done, however, the yields are available more rapidly to the company's results and liquidity is not retrenched.

The example

A furnace plant should be revamped. The price for the modernization amounts to € 400,000. The assumed

Costs and Profit					Date	21.04.2010
Revamping / Comparision						
Customer	Any Inc.					
Project	Regenerator System					
No. of considered years	10	Selection			Financing	Nein / No Selection
Price of System	400.000 €	+ ←	0 €	Additional nec. Investment		
Annual Costs (Maintenance, etc.)	2,00%	- ←	0 €	Actual necess. Replacement Investment		
Annual tons	35.000	to				
Value of Interest	8,00%		8000	Annual hours 333 days		
Liquidation Receipts	15.000 €	(Salvage Value)				
Price of Fuel (per kWh)	0,02440 €	<----------	5,00%	Expected Increase of Price/Year		
Price of Fuel (prior, per kWh)	0,02440 €		62,89%	In year 11, (10 times annual increase, Turn of Year)		
Guarantee Value per to (Fuel)	700	kWh				
Expected Savings (Fuel, in %)	36,36%					
Consumption (prev.)	1100	kWh <----------	1.100	kWh <----------		
Decrease of Metal-Losses (in % absolut)	0,00%					
Price per kg	1,00 €	<----------	1,00%	Expected Increase of Price/Year	Year 2009	
Company-Taxes (in %)	29,44%	Germany	Company Tax: 29,44%	VAT:	19,00%	

	Start 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Amount to be invested (purchase)	-400.000 €											-400.000 €
Annual Costs (Maintenance, etc.)		-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-80.000 €
Costs of Loan		-	-	-	-	-	-	-	-	-	-	
Leasing Costs		-	-	-	-	-	-	-	-	-	-	
Acquisition (End of Leasing)		-	-	-	-	-	-	-	-	-	-	
Other Costs (-) / Profits (+) in period		-	-	-	-30.000 €	-	-	-	-30.000 €	-	-15.000 €	-75.000 €
Surplusses (Fuel)		341.600 €	358.680 €	376.614 €	395.445 €	415.217 €	435.978 €	457.777 €	480.666 €	504.699 €	529.934 €	4.296.610 €
Increase of fuelprice, applied to year 1		0,00%	5,00%	10,25%	15,76%	21,55%	27,63%	34,01%	40,71%	47,75%	55,13%	
Surplusses (Losses)		-	-	-	-	-	-	-	-	-	-	
Liquidation Receipts											15.000 €	15.000 €
Taxes (variance)		19.548 €	-103.240 €	-108.520 €	-105.232 €	-119.885 €	-125.997 €	-132.414 €	-130.321 €	-146.228 €	-153.657 €	-1.105.946 €
Surplusses per Period	-400.000 €	353.148 €	247.440 €	260.094 €	252.213 €	287.332 €	301.981 €	317.363 €	312.345 €	350.471 €	368.277 €	2.650.664 €
Surplusses (cumulated)	-400.000 €	-46.852 €	200.588 €	460.682 €	712.895 €	1.000.228 €	1.302.209 €	1.619.571 €	1.931.916 €	2.282.387 €	2.650.664 €	
ROI (per indicated year)	-100%	-12%	50%	115%	178%	250%	326%	405%	483%	571%	663%	
Amortization (static)		-	1,19	-	-	-	-	-	-	-	-	
Capital Value for years considered	1.616.671 €											
Amortization (dynamic, C0=0)		-	1,34	-	-	-	-	-	-	-	-	
Annuity	240.932 €											
Final Value (inv. of Money)	400.000 €	-	-	-	-	-	-	-	-	-	863.570 €	

Fig. 3: Example (Source: Jasper GmbH)

Costs and Profit				Date	21.04.2010
Revamping / Comparision					
Customer	Any Inc.				
Project	Regenerator System				

No. of considered years	10	Selection		
Price of System	400.000 €	+	0 €	Additional nec. Investment
Annual Costs (Maintenance, etc.)	2,00%	-	0 €	Actual necess. Replacement Investment
Annual tons	35.000	to		
Value of Interest	8,00%		8000	Annual hours 333 days
Liquidation Receipts	15.000 €	(Salvage Value)		
Price of Fuel (per kWh)	0,02440 €	<----------	5,00%	Expected Increase of Price/Year
Price of Fuel (prior, per kWh)	0,02440 €		62,89%	In year 11, (10 times annual increase, Turn of Year)
Guarantee Value per to (Fuel)	700	kWh		
Expected Savings (Fuel, in %)	36,36%			
Consumption (prev.)	1100	kWh <----------	1.100	kWh <----------
Decrease of Metal-Losses (in % absolut)	0,00%			
Price per kg	1,00 €	<----------	1,00%	Expected Increase of Price/Year; Year 2009
Company-Taxes (in %)	29,44%		Germany	Company Tax: 29,44% VAT: 19,00%

Financing	Kredit / Loan	Selection
Loan		
Maturity	60	Months
Interest of Loan	7,50%	
Price of System	400.000	EUR
Additional nec. Investment	0	EUR
Payout (%)	100,00%	
Own Capital	100.000	EUR
Loan Amount (necessary)	300.000	EUR
Repayments	360.683	EUR

	Start 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Amount to be invested (purchase)												
Annual Costs (Maintenance, etc.)		-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-8.000 €	-80.000 €
Costs of Loan	-100.000 €	-72.137 €	-72.137 €	-72.137 €	-72.137 €	-72.137 €	-	-	-	-	-	-460.683 €
Leasing Costs		-	-	-	-	-	-	-	-	-	-	
Acquisition (End of Leasing)		-	-	-	-	-	-	-	-	-	-	
Other Costs (-) / Profits (+) in period		-	-	-	-30.000 €	-	-	-	-30.000 €	-	-15.000 €	-75.000 €
Surplusses (Fuel)		341.600 €	358.680 €	376.614 €	395.445 €	415.217 €	435.978 €	457.777 €	480.666 €	504.699 €	529.934 €	4.296.610 €
Increase of fuelprice, applied to year 1		0,00%	5,00%	10,25%	15,76%	21,55%	27,63%	34,01%	40,71%	47,75%	55,13%	
Surplusses (Losses)		-	-	-	-	-	-	-	-	-	-	
Liquidation Receipts											15.000 €	15.000 €
Taxes (variance)		-47.535 €	-82.003 €	-87.283 €	-83.995 €	-98.648 €	-125.997 €	-132.414 €	-130.321 €	-146.228 €	-153.657 €	-1.088.081 €
Surplusses per Period	-100.000 €	213.929 €	196.540 €	209.195 €	201.313 €	236.433 €	301.981 €	317.363 €	312.345 €	350.471 €	368.277 €	2.607.846 €
Surplusses (cumulated)	-100.000 €	113.929 €	310.469 €	519.663 €	720.977 €	957.410 €	1.259.391 €	1.576.753 €	1.889.098 €	2.239.569 €	2.607.846 €	
ROI (per indicated year)	-100%	114%	310%	520%	721%	957%	1259%	1577%	1889%	2240%	2608%	
Amortization (static)		0,47	-	-	-	-	-	-	-	-	-	
Capital Value for years considered	1.631.666 €											
Amortization (dynamic, C0=0)		0,50	-	-	-	-	-	-	-	-	-	
Annuity	243.166 €											
Final Value (inv. of Money)	100.000 €	-	-	-	-	-	-	-	-	-	215.892 €	

Fig. 4: Example, respecting loan (Source: Jasper GmbH)

liquidation receipts after the useful life (scrap price) should be € 15.000. The plant has a production of 35,000 tons of aluminium per year. Through the use of regenerators, the specific consumption of fuel per tonne will be reduced from 1,100 kWh to 700 kWh (guaranteed value of the supplier, the real value during operation may be lower). The estimated costs for maintenance per year should be 2% of the investment. The fuel price (actually) amounts to € 0.0244 per kWh. It is expected that the fuel price increases with 5% per year (seems to be realistic currently). The system is located in Germany; therefore the company tax rate (generally) is 29.44%. Every 4 years an exchange of the regenerator filling is necessary, each for € 30,000. A potential reduction of loss through the use of regenerators is not addressed. This is to be expected but not guaranteed by the supplier (**Fig. 3**).

Out of Fig. 3, the above business ratios could be taken. The course of costs and revenues over the period under consideration can be read. Of interest is the development of fuel costs in % and the savings of these costs as a result of the investment.

The ROI for the third year is 115%, so the investment has generated its price more than two times (-I has been set as start value). The static amortization time is 1.19 years, the dynamic 1.34 years. The capital value amounts to € 1,616,671.

While an investment of 400,000 € in bonds (with an interest of 8%!) provides € 863,570 after ten years time, the cumulative value of € 2,650,664 out of the investment is clearly more profitable for the investor.

The period of consideration corresponds to the duration of the depreciation time. Then the plant is "virtually" scrapped (liquidation receipts). However, the operating time of such a facility in reality is articulately longer. For this reason, even half the amount of the regenerator filling to replace is taken into account in the last year, since this cost must be considered for the last two periods.

The example, financed

The investment on the same system is analyzed again with consideration of loan. As outlined above, repayment and interest are taken into account as costs. € 100,000 (new investment I for the calculation) is used as equity ratio, so it remains an amount of € 300,000 to be financed (**Fig. 4**).

The new values are delineated in Fig. 4, the basic data of the loan too. The dynamic amortization now only lasts half a year. While more than € 60,000 has to be spent on interest payments, the cumulated surplusses (over the observation period) are only declined by around € 43,000. The ROI in year 3 is now at 520%. The capital value is almost unchanged.

This is not a general statement obviously. It must be examined on a case by case basis.

Conclusion

The above-mentioned business ratios allow, with a realistic selection of basic data, an assessment of planned investments; with reasonable effort. The described methods only assess an individual investment and therefore considering no junctions with any other projects inside the entire company. This is a task of the controlling division and/or the management.

Literatur

[1] HP 03/2008; FB Peter Klatecki; Evaluation of investments in modernizing thermal processing plants

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