Financial viability of energetic retrofitting: Modelling your payoff gets easy with the RentalCal Tool

(Summary of WP6)

KEY AREAS OF INTEREST

A complex decision situation with energy efficient modernisation

Many players in the real estate business do not know how to quantitatively and qualitatively evaluate possible energy efficient modernisation investment so that they are able to make the right decision. While homeowners are “convinced” to push the energy efficient modernisation, whether it is because of cheap loans or other subsidies and the contribution they make to climate protection, the decision-making process in rented premises is much more complex and many-faceted. Energy efficient modernisation must literally "pay off”. This requires the clarification of a multitude of questions that cannot all be specified individually. Therefore, the following selection of questions shall illustrate the complexity of the decision or the tool mechanics:

- When is the right time to instigate the energetic refurbishment?

This question arises in almost every decision situation. Is it better to act immediately or wait for further developments? For example, the development of energy prices or inflation plays a decisive role in the implementation of the procedure. This is because it influences, among other things, the cost-effectiveness, which is the number one decision-making criterion for most energy efficient renovations. It then has to be decided whether the energy efficient renovation can or should be integrated in the normal maintenance cycle of the building. In many cases, it can make sense to bundle measures and carry them out in parallel. The fundamental period of consideration for the evaluation of the procedure should also be critically questioned, since energy efficient renovations are probably in most cases long-term investments (i.e. long amortization periods).

- To what extent should the energetic refurbishment take place?

Since not every energy efficient renovation is the same, it is important to compare costs and returns. It is therefore necessary to clarify which part of an investment is actually attributable to the increase in energy efficiency and which measures should have been taken anyway. The tool answers this question not only from a purely monetary point of view, but also includes social and environmental decision-relevant factors. Measures should comply with current and, if applicable, possible future regulatory requirements in order to be considered as "future proof". Ultimately, the scope of the measures depends on the affordability and feasibility of the activity. Which sections or bundles of measures make an energy efficient refurbishment reasonable (roof, exterior façade, building technology, etc.) must always be decided individually for each property.

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The tool provides the user with assistance and helps to determine energy efficient redevelopment according to its extent and its effect. With a modernisation, one must take into account possible negative effects. Hence, vacancies or rental reductions can occur. In addition, changes in the operating costs are conceivable, since technical progress is usually associated with higher maintenance. Overall, many factors play a role in order to be able to conclusively assess the scope and its advantageousness.

- How can the energetic refurbishment generate a return?

In addition to the cost-effectiveness of the activity, many other factors play a role. The tool aims to filter out the corresponding factors and present them to users as additional benefits. Nevertheless, profitability is still the decisive criterion for implementation. Energy efficient refurbishments must generate a positive cash flow within the amortisation period, which however is often set too short. This will mostly come from the increased rental payment. If an increase in the net rent is possible, the user has different possibilities of increasing the rent (e.g. rent neutrality, break-even rent increase, etc.). The tool considers both interested parties, i.e. landlords and tenants, and thus contributes to the perception and clarification of the investor-user dilemma, which occurs when calculating the profitability. However, the advantages of a modernisation are significantly linked to the financing. Subsidies and preferential loans or financing are included in the calculation. If desired, the tool also gives the user the possibility to account for an increased sales price (so called Green Premium). Indeed, empirical studies show that modernised real estate is experiencing a repositioning of the property or apartment on the market. The appreciation against non-renovated real estate is reflected in the higher market value. In this case, one speaks of the "Grey Discount" for non-modernized buildings.

In a structured manner, these exemplary questions and other aspects of the decision-making situation must be incorporated in the financial assessment of an energy-saving refurbishment. Therefore, the RentalCal consortium analysed technical, legal, institutional and financial framework conditions and published the results in extensive reports. In addition to these qualitative results of the project, however, a calculation methodology was developed, which allows collecting the essential input variables of the energy efficient refurbishment measure in a structured process. Afterwards, these parameters are compressed within the framework of a financial mathematical calculation in such a way that the owner retrieves a clear characteristic for the financial advantage of the refurbishment. Until now, there was no generally accepted software for assessing the economic advantages of such modernisation procedure.

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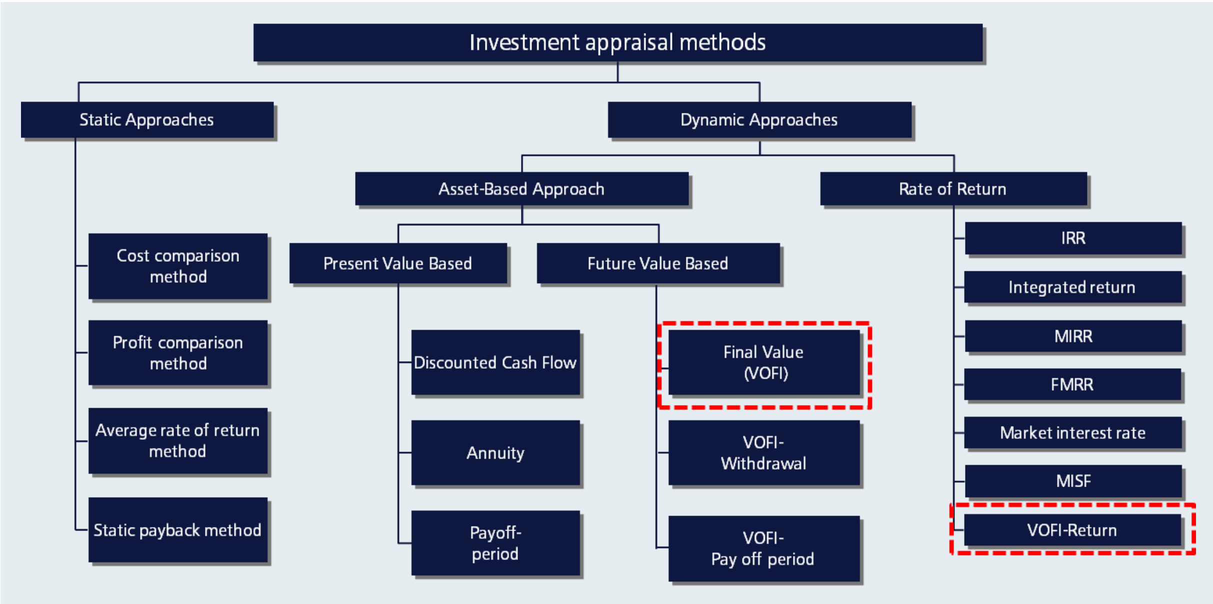
Dynamic calculation offers assistance

In order to analyse the economic effects of modernisation, it is necessary to calculate parameters that support decision-making, taking into account business and economic perspectives. In the following, in particular, the underlying calculation method is discussed.

Not only the general technical literature, but also the RentalCal consortium agrees that a dynamic calculation model (thus dynamic investment calculation as part of financial mathematics as a basis) in the form of a complete financial plan (hereafter: VOFI) which is used to test the profitability of energy efficient modernisation procedures in rental housing construction must be applied in practice.



1 Overview of the different investment appraisal techniques. Source: own figure based on Rompeter (1998).

Figure [1] is intended to facilitate the classification of the VOFI method into the general investment calculation procedures. However, as energy efficient modernisation procedures have a complex flow of incoming and outgoing payments, static methods for assessing the benefits are rather inappropriate. The dynamic investment calculation, on the other hand, resolutely addresses the timing of payments. This consideration is vital, since considerable costs are incurred, especially at the beginning of an energy efficient refurbishment, whereas savings or additional revenues only accrue in later periods. Furthermore, in the case of modernisation procedures, a long economic life or a long period of observation is assumed, and thus a refurbishment that takes into account interest and compound interest effects is essential for realistic mapping.

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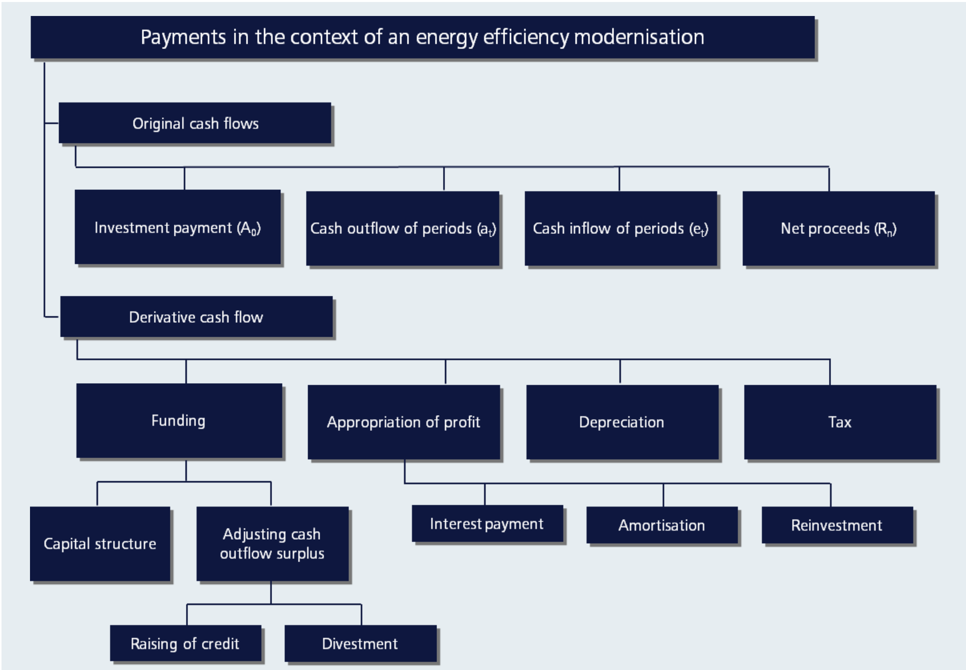
Visualisation of Financial Implications (VOFI) as tool calculation basis

However, the decisive factor in using the VOFI method for assessing the profitability of energy efficient modernisation procedures is, that this dynamic process involves not only the payment series of an investment property (the so-called "original payments"), but also the payments due to financial dispositions relating to the property (the so-called "derivative payments", e.g. financing and taxes). This distinction or consideration is central to energy efficiency projects, as cash flows such as financing, depreciation and the (income) tax situation directly affect profitability. Figure [2] illustrates the different payment methods.



2 Original and derivative payments. Source: own figure based on Rompeter (1998).

The term "original payments" includes all direct payments resulting from the energy efficient refurbishment. In addition to the initial investment payment, it includes all incoming and outgoing cash surpluses of all periods and any sales proceeds at the end of the economic life. With regard to the data to be collected, it should be noted that only payments, which according to the principle of causation can be directly allocated to the investment, must be taken into account.

Thus, as already indicated in the introductory questions, a division of the investment costs into energy-related costs and so-called "anyway costs" is therefore necessary. The latter are costs, which would have incurred anyway with a normal renovation (e.g. setting up scaffoldings) and are therefore not relevant for making the decision. The tool supports the user in this division. Once the costs directly related to the energy efficient modernisation have been determined, based on this, the derivative cash flow can be set up.

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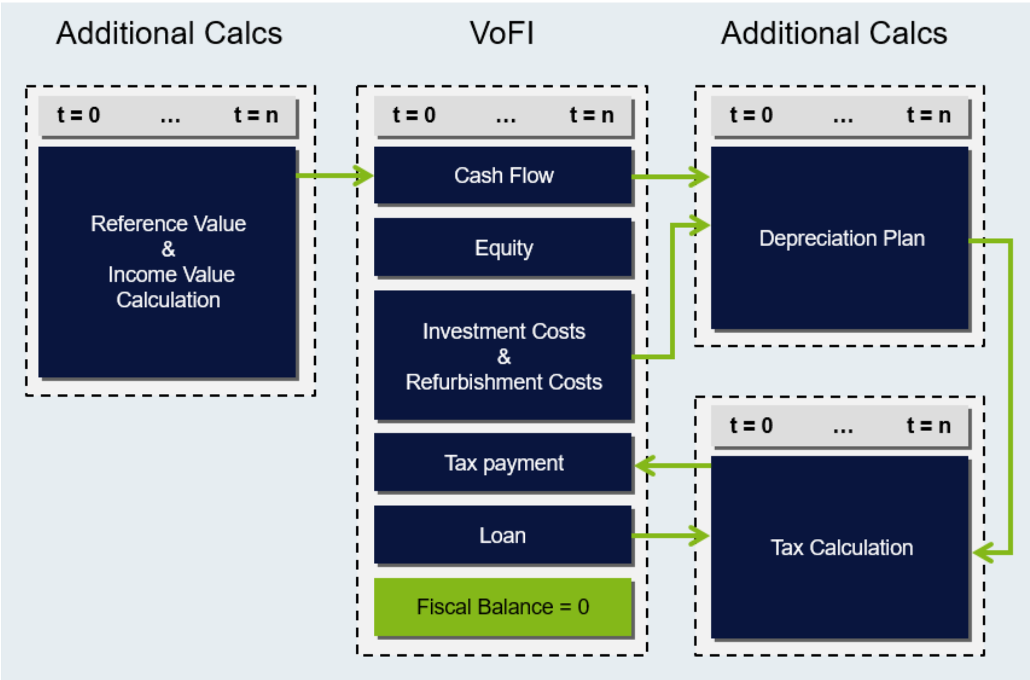
In contrast to the original payments, the derivative payments cannot be derived directly from the investment, but only from the underlying investment theory model and thus describe the financial consequences of the exogenous data. Figure [3] schematically illustrates the calculation procedure of the VOFI method and helps to understand the actual calculation process of the VOFI. It is to be understood as a simplified representation that does not cover all calculation areas of the tool.



3 VOFI method. Source: own figure based on Grob (2006).

Due to the iterative table-based structure of the VOFI (see Figure 4), for each individual period of the observation period (usually 20 years), the incoming and outgoing payments caused by the investment can be depicted as realistically as possible.

The example is for illustrative purposes only and does not include all aspects considered in the online tool. Nevertheless, it fulfills the purpose of presenting the method of calculation in this context.

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Sections	Line	Time	t_0	t_1	t_2	t_3	t_4
		Original cash flow					
Section 1	1	A_0 (Investment)	-1.000.000				
	2	$ü_t$ (Annual revenues)		497.984	497.984	-200.000	0
	3	R_n (additional sales proceeds)					300.000
		Derivitave cash flow					
Section 2	4	Equity	400.000				
	5	Debt	600.000				
	6	Interest payments (on debt)		-18.000	-13.698	-9.266	-4701
	7	Tax		-150.494	-152.033	90.678	194.128
	8	Amortization (of debt)		-143.416	-147.719	-152.150	-156.715
	9	Payback from t-1			186.073	370.701	100.149
	10	Interest payments (+/-)			93	185	50
	11	Reinvestment		-186.073	-370.701	-100.149	0
	12	Balance of payments		0	0	0	0
	13	Outstanding debt	600.000	456.584	308.865	156.715	0
	14	Current investment value	0	186.073	370.701	100.149	432.911
	15	Current equity share	-600.000	-270.510	61.836	-56.566	432.911
	16	Final debt					**432.911**
		Auxiliary calculation - Financing					
Section 3	17	Debt	600.000				
	18	Interest (3%)	0	18.000	13.698	9.266	4.701
	19	Amortization	0	143.416	147.719	152.150	156.715
	20	Outstanding debt	600.000	456.684	308.865	156.715	**0**
		Auxiliary calculation - (tax) depreciation					
Section 4	21	Depreciation rate		5%	5%	5%	5%
	22	Depreciation basis	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000
	23	Depreciation		50.000	50.000	50.000	50.000
	24	Residual value (book value)	1.000.000	950.000	900.000	850.000	800.000
		Auxiliary calculation - taxes					
Section 5	25	Income		497.984	497.984	-200.000	0
	26	Depreciation		-50.000	-50.000	-50.000	-50.000
	27	Credit interest (+)		0	93	185	50
	28	Debit interest (-)		-18.000	-13.698	-9.266	-4.701
	29	(Additional) sales proceeds		0	0	0	300.000
	30	Residual value (book value)		950.000	900.000	850.000	800.000
	31	Taxable sales proceeds		0	0	0	-500.000
	32	Tax rate		35%	35%	35%	35%
	33	Tax base		429.984	434.380	-259.081	-554.651
	34	Tax payment		**150.494**	**152.033**	**-90.678**	**-194.128**

4 VOFI illustration. Source: own figure based on RentalCal (2017).

In the upper part (section 1), the VOFI shows the initial investment and subsequent deposits and withdrawals. The rental payments and any proceeds from the sale at the end of the period are recorded here as deposits. In a first step, the payment sequence of the investment is determined. The essential basis for the payment series are the necessary investment requirements for the energy efficient modernisation and the development of the rental income (i.e. the amount of the rent increase caused by modernisation).

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Section 2 forms the actual core of the VOFI, the derivative part. As described above, this can only be filled by secondary calculations. All value-relevant parameters are combined here to calculate the final VOFI value. These include, in particular, expenses for interest and amortization, non-recoverable costs (here not included for reasons of simplification) and tax.

Based on the financing structure (section 2, lines 4-5, t = 0), the calculation of the derivative interest payments in section 3 can then be started. These include all financing instruments. The tool allows the user to depict low-cost loans with grace periods and subsidies or government-aided loans. It is also possible to choose between different types of repayment (instalments, lump sum payment, etc.). For the sake of simplicity, this case is a simple annuity loan. An annuity is a constant amount made up of interest and principal. The repayment reduces the interest component. The repayment share increases by this amount to keep the rate constant. The individual periods are filled in with the corresponding values. Interest and amortization payments are subsequently included in section 2 (lines 6 and 8, t = 1). The outstanding debt (line 20, t = 0) is transferred to line 13 (t = 0) and updated as current equity share (lines 13 and 15, t = 0) with the opposite sign (-).

In a further step, the depreciation (section 4) must be determined. In the present example, a constant depreciation rate is applied (5%), while the tool also allows other depreciation methods (degressive, progressive, etc.). The investment from section 1 (line 1, t = 0) serves as depreciation basis. The depreciation is particularly relevant for the calculation of the tax burden and is to be paid at this point.

Since all incoming and outgoing payments or value-relevant input variables are available now, the tax burden on the owner or investor can be determined in a further step. Thus, in section 5 (lines 25-31, t = 1), all the cash-effective parameters are listed in their chronological order so that the tax can be calculated therefrom. From this point on, the VOFI in sections 2 and 5 must be filled in phases, as results from the previous period have an influence on the subsequent period.

[Start iterative process] Now that all variables in columns 2-8 are available for t = 1, the reinvestment volume or refinancing volume can be calculated. The expenses (columns 6-8, t = 1) are subtracted from the revenues (column 2, t = 1). In our case, there is a revenue surplus, which is noted as current investment value (column 14).

The amount of debt outstanding (column 13, t = 1) is calculated as the difference between the debt amount of the previous period (line 13, t = 0) and the reinvestment amount (line 11, t = 1), which is the inverse of the current investment value. If you cumulate the amounts from the reinvestment (line 11, t = 1) and the outstanding amount of debt (line 13, t = 1), you receive the current equity value (line 15, t = 1).

The user recognizes at the latest at this point that the calculation is by no means trivial and the realistic implementation involves various challenges, since both framework conditions and input variables vary greatly in every single country and thus make the

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implementation significantly more difficult. The reinvestment / refinancing amount (line 11, t = 1) is transferred to the subsequent period (line 9, t = 2) and invested / refinanced at a fixed interest rate (line 10, t = 2). This credit interest or additional debit interest now influences the tax payment from section 5 (lines 27-28). After calculating the tax burden, all input quantities (lines 2-8, t = 2) are also calculated for period 2, after which the iterative process, as already mentioned, must be repeated for the remaining periods. [End iterative process] The final equity value (section 2 line 16) is subsequently used to assess the energy refurbishment.

OUTPUT

It seems obvious that the calculation of cost-effectiveness, taking account of the above-mentioned questions and the input parameters derived therefrom, is not exactly straightforward. The calculation tool processes the inputs of the user as well as the selection of given values. The programme automatically processes the so-called „Throughput“. The compression of the input parameters ultimately results in a selection of decision criteria, which should make it easier for the investor to make an investment decision. Exemplary calculation results from the tool are shown in Figure [4].

Perspective	Indicator
Landlord	Additional rental income and upside potential
Landlord	Additional sales value and upside potential
Landlord	Return on equity *
Landlord	Debt service cover ratio *
Landlord	Amortisation period *
Landlord	Change in non-reimbursable maintenance costs
Tenant	Change in net rent
Tenant	Change in ancillary costs and gross rent
Environment	Savings in end-energy per energy carrier
Environment	Savings in non-renewable primary energy
Environment	Reduction of emissions

* Calculation w ith/w ithout Green Premium

5 Decision parameters. Source: own figure.

Thus, both the amortisation period and the return on equity can be used as benchmarks for the profitability of the investment, with the VOFI return on equity representing the average interest yield, which, taking into account compound interest, increases the initial capital employed to the ending market value. The evaluation software is not limited to the output of the results solely based on the view of the owner or investor, but also shows the view of the tenant or even the social impact of an energy efficient refurbishment.

FURTHER READING & SOURCES

- RentalCal Deliverable 6.1 (2015): Scenario set up and tool architecture.
- RentalCal Deliverable 6.2 (2016): Different sheets and databases structuring the input data.
- RentalCal Deliverable 6.3 (2016): Methods for profitability calculation in EXCEL (VOFI).
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