SLOVENSKI STANDARD
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Metodologija za vrednotenje investicij v zvezi z energijo (ValERI)

Methodology for the Valuation of Energy Related Investments (ValERI)

Methodik zur Bewertung von energiebezogenen Investitionen (ValERI)

Méthodologie pour l'évaluation des investissements liés à l'énergie (ValERI)

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ICS:

27.015	Energijska učinkovitost. Ohranjanje energije na splošno	Energy efficiency. Energy conservation in general

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Methodology for the Valuation of Energy Related Investments (ValERI)

Méthodologie pour l'évaluation des investissements liés à l'énergie (ValERI)

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European foreword

This document (prEN 17463:2020) has been prepared by Technical Committee CEN/CLC/JTC 14 “Energy efficiency and energy management in the framework of energy transition”, the secretariat of which is held by UNI.

This document is currently submitted to the CEN Enquiry.

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Introduction

In order to reach the energy related targets of the EU and its member states, energy related investments (ERIs) have to increase. The current lack of investments may not only result from a lack of the available capital but also from a lack of reliable financial evaluations of the benefits of ERIs.

Different investment ideas often compete for the available money within organisations. Therefore, enhancement of the financeability of ERIs can be achieved by showing the full economical value that they are able to generate. When this is done properly, priorities for budgets of ERIs should rise automatically and thus more investments will be undertaken.

The state of the art of today's energy related project valuation in practise reveals that in order to help the user to undertake a firm and correct valuation it is necessary to avoid:

— incorrect results which result from the neglection of relevant parameters and cash flows;

— intransparent calculation models which are difficult to understand;

— models containing errors or that are incomplete;

— use of of calculated costs instead of cash flows;

— time value of money not beeing considered,

— discount rate beeing used in an unreflected manner;

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— risks beeing not or not properly considered;

— missing sensitivity and scenario analyses;

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— missing traceability;

— missing interpretation of results;

— price variation rates (very important for energy project valuation) beeing not appropriately considered.

The objectives of this European Standard are

— to help proposers of energy related investments (ERIs) to valuate their ideas economically and qualitatively in a uniform, transparent and understandable way by generating all material information that is relevant for a decision;

— to generate comparable results (for this it is important to ensure that the estimation of the cash flows is done in a comparable way by using correct price variations, the usage of marginal prices for all cash flows etc.)

— to help the elaborator of the valuation to generate valuation results than can be easily understood by those who decide upon them;

— to help the decision maker and possible financial institutions who decide on the basis of the valuation results and expect the results to be correct and complete but also easy to understand, retraceable and explicit (material);

— to complement other standards or protocols that focus on the technical determination of energy savings and

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In order to accomplish these objectives this European Standard offers a valuation procedure, a calculation methodology (just one), and a documentation structure that covers the following features:

— application of one calculation method only;

— correct and complete results (Net Present Value considering among other things also all relevant cash flows and their price variation rates over the whole project lifetime);

— unequivocal (one indicator at the end which can be directly used for decision-making);

— uniform (a standard);

— easy to use (table based, one uniform calculation table);

— retraceable and easy to reproduce (calculations are transparent and the assumptions made are explained);

— as simple as possible;

— flexible (the user can adjust parameters and can customise the calculation table);

— undertaking of sensitivity and scenario analyses;

— the standard contains templates for reporting the calculation results and all additional qualitative effects.

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Transparent calculations including retraceable assumptions that show the full value of ERIs will help organisations as well as households to identify the added value resulting from such ERIs. The proposed methodology could also be used in energy reviews/audits (according to EN 16247-1), when prioritising energy improvement potentials.

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An easy to use and standardized procedure would be helpful as energy management teams might not always include personell that is equipped to translate technical ideas into conclusive economical results in order to ensure a solid basis for decision-making.

This European standard relates to standards regarding energy in general. The most relevant standards on the international and European level might be EN ISO 50001 and EN 16247-1, EN 15900. Those standards state, that ERIs should be evaluated and prioritised but give no guidance on the methodology and procedure.

This standard proposes the use of “Net Present Value” (NPV) calculations and its result as a basis for decision-making.

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1 Scope

This document specifies requirements for a valuation of energy related investments (VALERI). It provides a description on how to gather, calculate, evaluate and document information in order to create solid business cases based on Net Present Value calculations for ERIs. The standard is applicable for the valuation of any kind of energy related investment.

The document focusses mainly on the valuation and documentation of the economical impacts of ERIs. However, non-economical effects (e.g. noise reduction) that may occur through undertaking an investment are considered as well. Thus, qualitative effects (e.g. impact on the environment)– even if they are non-monetisable – are taken into consideration.

2 Normative references

There are no normative references cited for this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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3.1
adjustment parameter
quantifiable parameter affecting the results of the valuation process

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Example: energy savings (kWh), discount rate, project lifetime, energy price variation rates etc

3.2
degradation
decrease in the performance characteristics or service life of a product

Note 1 to entry: The degradation rate is measured as performance decline per year (e.g. 1 %/a).

Note 2 to entry: For the purpose of this document deterioration (decline in the performance of an efficiency measure) is included in the concept of degradation.

[SOURCE: EN 60194:2007-03 – NOTE added]

3.3
benefits
positive effects resulting from an investment

Note 1 to entry: Benefits can have a qualitative, quantitative, or a financial/fiscal nature.

Note 2 to entry: Benefits can be direct or indirect effects

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3.4
cash flow
movement of money

Example: Initial payment of an investment

Note 1 to entry: Depreciation is not a cash flow

Note 2 to entry: In this document cash flow is also refered to as payment (P).

Note 3 to entry: Energy savings are considered as cash flows into a business or project as they reduce the payments for energy consumption.

3.5
discount factor "q"
multiplier (1+*r*) of a cash flow to calculate the present value (PV) depending on the discount rate (*r*) and the period (*t*)

Note to entry 1: For each period (t) the cumulated discount factor is calculated with $(1+r)^t$ *or* q^t.

3.6
discount rate "*r*"
interest rate that reflects the time value of money

Note 1 to entry: Abbreviated by "*r*" ("*r*" for required rate of return).

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Note 2 to entry: The risk may also be taken into account when setting the value of the discount rate.

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3.7
efforts
negative effects resulting from an investment

Note 1 to entry: Efforts can have a qualitative, quantitative, or a financial/fiscal nature.

Note 2 to entry: The negative effects may occur in a direct or indirect way.

3.8
energy related investment (ERI)
any kind of investment in which energy consumption or energy generation plays a role irrespective whether it is an energy efficiency measure or an energy supply system project

3.9
internal rate of return (IRR)
discount rate at which the net present value (NPV) of all cash flows of a project equals zero for the lifetime of the project

3.10
investment risk
the volatility of the return of an investment, particularly the likelihood of occurrence of losses relative to the expected return on any particular investment

Note 1 to entry: Investment risks may derive from credit risk, construction risks, operational and maintenance risks, performance risks etc.

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3.11
lifetime of an investment
period during which the investment causes cash flows

3.12
monetisation
transformation of benefits and efforts into cash flows

Note 1 to entry: This is usually done by multiplying the quantitified benefits and efforts with the specific price per unit.

3.13
net present value
(NPV)
sum of discounted cash flows over the whole lifetime of an investment

3.14
non-energy effects
effects that result from an ERI but are not directly related to the energy consumption or generation

Example: motivation of employees, increased production capcity, less noise, better working conditions etc

3.15
payback period
time required to recover the outpayments of an investment

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3.16
risk premium
compensation for investors accounting for the given risk compared to that of a risk-free asset

Note to entry 1: Risk premium can be included in the interest rate or defined as an additional cash flow.

3.17
scenario analysis
procedure to calculate extreme but still realistic results

3.18
sensitivity analysis
procedure to assess the impact of changes of adjustment parameter settings on the NPV

3.19
valuation of energy related investments
(VALERI)
procedure of assessing and reporting financial and non-financial effects of an ERI in order to lay a foundation for decision-making

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4 Symbols, abbreviations and subscripts

For the purposes of this document, the specific symbols, abbreviations and subscripts listed in Table 1 apply.

Table 1 – Symbols, abbreviations and subscripts

Symbol / Abbriviation	Name of quantity	Unit
AW	Annual Worth (or Annuity)	€
degrad	Annual degradation	
CHP	Combined Heat and Power system	
$ded_{risk, t}$	Deduction to account for risk in period t ($=\sum P_t \times f_{ded\_risk}$)	€
DPB or DPP	Discounted Payback Period	years
epr	Annual price variation energy	
$E_{savings, A}$	Annual energy savings for energy carrier “A” without considering degradation	kWh/year
f_{ded_risk}	Risk deduction factor ($= p_{loss} \times R_{loss}$)	
IRR	Internal Rate of Return	
it	Income tax rate	
LCC	Life Cycle Cost	€
NPV	Net Present Value	€
NS	Net Savings	€
P	Payment (in payment or outpayment)	€
PI	Profitability Index	
p_{loss}	Probability of the occurrence of the net return loss	
pr	Annual price variation not energy	
PW	Present Worth or Present Value	€
q	Discounting factor (= 1+r)	
r_{debt}	Interest rate for debt capital	
$rdebt^{bt}$	Interest rate for debt capital (before taxes)	
$rdebt^{at}$	Interest rate for debt capital after taxes ($= r_{debt}^{bt} \times [1–it]$)	
r_{eq}	Interest rate for equity capital	
r_{eq}^{at}	Expected return on equity after taxes ($= r_{eq}^{bt} \times [1–it]$)	
r_{eq}^{bt}	Expected return on equity (before taxes) ($= r_f + \beta \times [r_m – r_f]$)	
r_f	Interest rate for a risk-free investment	

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Symbol / Abbriviation	Name of quantity	Unit
R_{loss}	Risk expressed in a quantified return loss	
$r_{nominal}$	Nominal discount rate	
r_{real}	Real discount rate	
r_t	discount rate in period t	
$Share_{debt}$	Share of debt capital (= Debt capital/Total investment capital)	
$Share_{eq}$	Share of equity capital (= equity capital/total investment capital)	
$SpecPrice_{energy\_A, t}$	Specific energy price (energy carrier A) in period t	€/kWh
SPP or SPB	Simple Payback Period	years
SIR	Saving Investment Ratio	
SSIR	Simple Savings to Investment Ratio	
t	period	year
T	Lifetime of the investment	years
T_{tax}	Depreciation period (only relevant if taxes are considered)	years
VAT	Value Added Tax	
$WACC_{at}$	Weighted Average Cost of Capital after taxes in first year (= $Share_{eq} \times r_{eq}{}^{at} + Share_{debt} \times r_{debt}{}^{at}$)	
$WACC_{bt}$	Weighted Average Cost of Capital before taxes in first year (= $Share_{eq} \times r_{eq}{}^{bt} + Share_{debt} \times r_{debt}{}^{bt}$)	

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5 Valuation procedure

For the valuation of an ERI the organization shall (as shown in Figure 1):

A. Setting up the model

1. determine all **benefits** and **efforts** that result from the given ERI (including all relevant energy flows);

2. quantify the benefits and efforts of the potential investment, and describe in a qualitative manner all those effects that can't be quantified;

3. monetise the benefits and efforts to outpayments and inpayments (the relevant cash flows) taking into account the expected price variations for each cash flow, and estimating price variation effects and degradation; specify non-monetisable effects;

4. determine the number of periods that should be considered (regularly the lifetime/lifespan of an investment) and specify the points in time when the cash flows occur;

5. estimate all relevant risk factors, as appropriate;

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6. determine the appropriate discount rate for discounting the cash flows;

B. Calculation

7. calculate the Net Present Value of the ERI using the most likely parameter-settings, which will result in the most likely case scenario;

8. perform a sensitivity analysis under variation of all adjustment parameters that are fraught to uncertainty, as apropriate;

9. perform a scenario analysis including at a minimum a worst-case, and best-case scenario;

C. Assessment

10. interpret the quantitative and the qualitative results;

D. Reporting

11. present the calculation and its results in a transparent and retraceable manner.

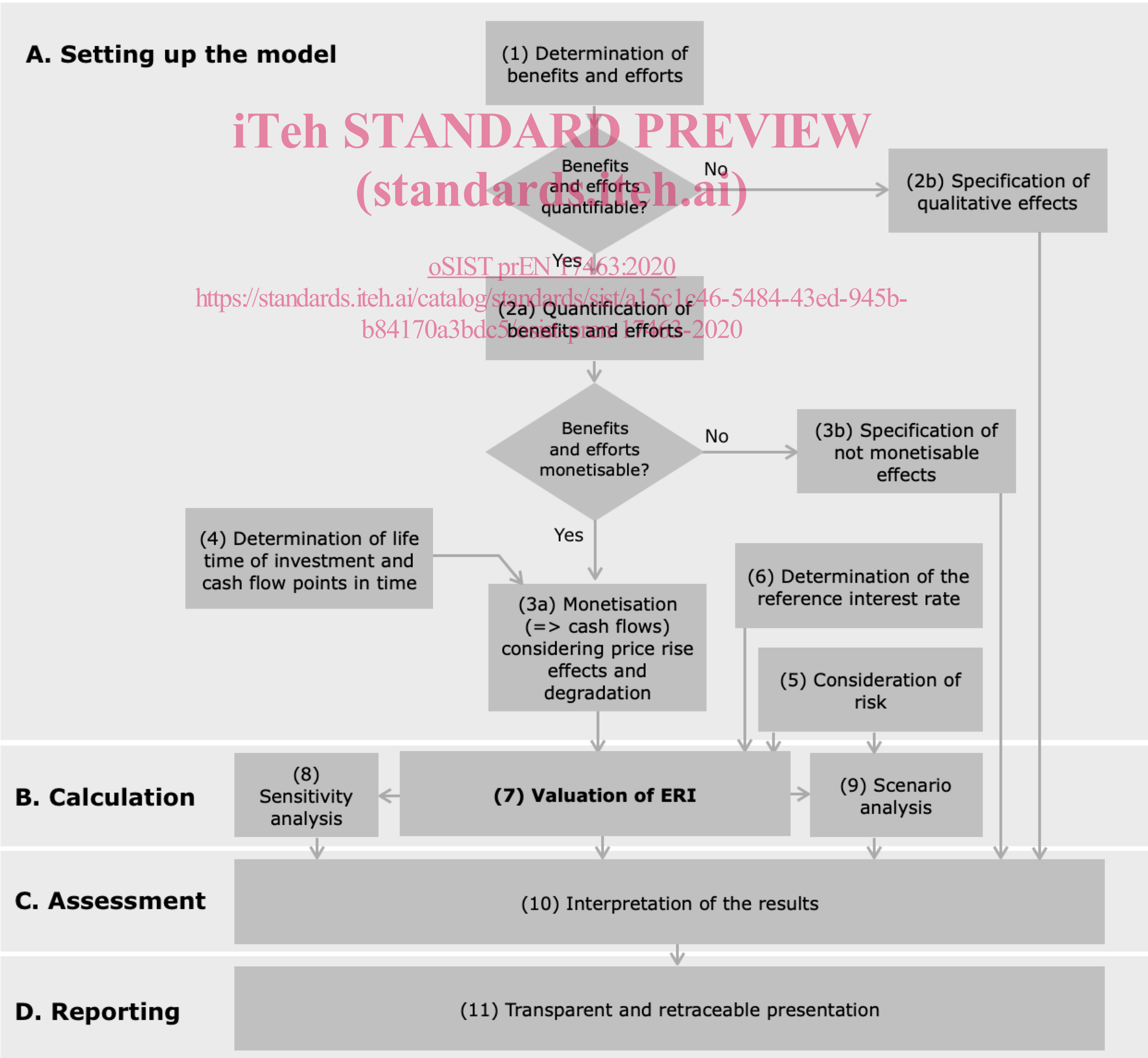

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Figure 1 – Valuation procedure

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For explanation purposes the valuation procedure is outlined by using an example for an ERI (here: exchange pumps for a cooling system).

6 A Setting up the model

6.1 Determination and qualitative description of benefits and efforts

In the beginning, all benefits and efforts that result from an ERI shall be described as qualitative data. This process requires thinking beyond the obvious financial effects in order to account for all relevant benefits and efforts which might be relevant for the investment decision.

The organization shall divide "benefits and efforts" into the sub-categories

— "energy flow effects" (expressed as energy and financial effects),

— "additional financial effects" (that go beyond the energy flow effects), and

— "miscellaneous effects",

as shown in Table 2.

Visualization of energy flow effects might improve the overall understanding. This could be done by setting up an energy flow chart (see example in Annex D).

"Additional financial effects" and "miscellaneous effects" are considered as "non-energy effects" which may have a strong influence on the profitability of an investment (e.g. subsidies, increase in productivity, marketing effects etc.) and should therefore be included in the valuation.

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Qualitative effects such as noise reduction, cleaner air, less pollution, less GHG emission etc. shall be checked. All effects shall be listed and later be included in the valuation report to show all finacial and other impacts of the investment.

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When determining the benefits and efforts of the ERI indirect effects may occur that result from the investment, including:

— cost reduction resulting from lower CO_2 taxes and GHG emission allowances,

— other tax related invcentives connected with energy related investments.

Example: A measure leads to a reduction in electricity use of 150 000 kWh per year. Assuming an individual CO_2 factor for electricity of 486 g/kWh the measure leads to a CO_2 reduction of 72,9 tons per year. Shoul the CO_2-tax amount to 80 € per ton this would lead to an aditional financial benefit of 5 832 € per year.

At this stage benefits and efforts are listed, but they are not quantified or monetised. At the end of this step the results could look like Table 2.

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Table 2 – Benefits and efforts of the given example

Effects of the ERI		here: replacement of pumps in a cooling system in order to increase the energy efficiency
Efforts	additional financial effects	Initial investment for new pumps
		Designing a new pump system
	miscellaneous effects	Production losses during set up
Benefits	energy flow effects	Annual energy savings (electricity)
	additional financial effects	Less maintenance and repair costs
		Scrap value of old pumps
		Potential incentives (e.g. tax reductions)
	miscellaneous effects	Noise reduction
		Enhancement of production reliability
		New pumping system takes up less space

The investment measure to be valued usually has a defined effect on a process section (n) in a longer process chain. When determining the benefits and efforts of the planned measure, the effects on the directly preceding (n-1) and downstream (n+1) processes or any other preceding or downstream processes shall be taken into account. The efforts and benefits may have impact on different processes.

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Sometimes energy efficiency measures require additional energy flows in order to generate a net energy efficiency advantage (e.g. CHP systems, see example in Annex D). These additional energy flows shall also be considered at this stage (in section "efforts").

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6.2 Quantification of the benefits and efforts

In the second step all effects that were gathered in step 1 shall be quantified, if possible.

The estimation of the

— expected energy **savings** through the measure or

— energy **generated** through the usage of new or improved energy supply systems

shall be based on solid technical calculations. These calculations can be conducted by the organization or an external service provider.

Calculations should also take into account information on possible degradation over time (see 6.3).

NOTE Guidance for calculations of energy savings can be found in e.g. EN 15459-1 or ISO 50046. The methodology for such calculations however is not part of this standard.

Table 3 shows this data for the given example in which the quantified values reveal **the most likely case**.