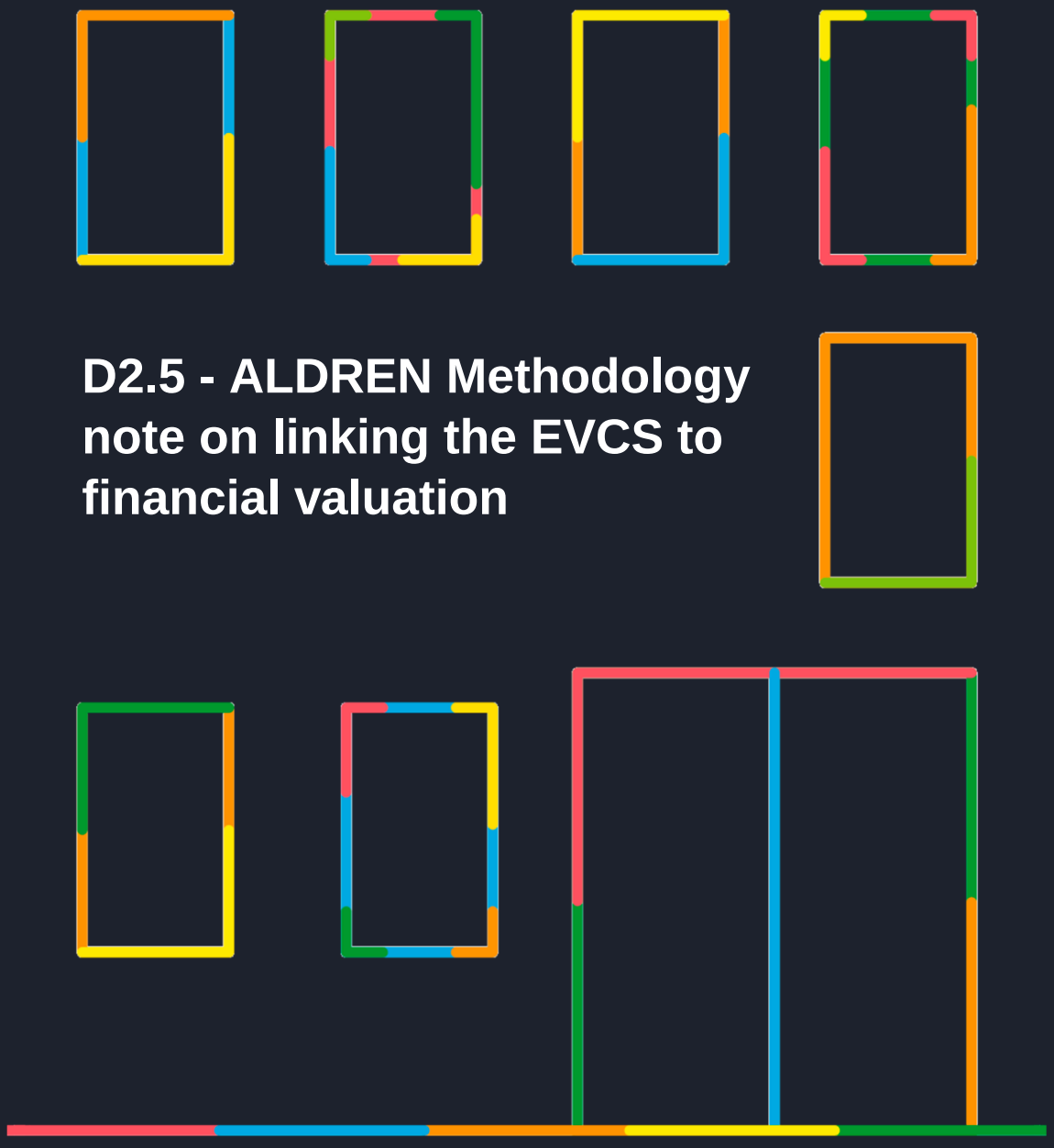
D2.5 - ALDREN Methodology note on linking the EVCS to financial valuation



ALDREN ALliance for Deep RENovation in buildings

Implementing the European Common Voluntary Certification Scheme, as back-bone along the whole deep renovation process

Disclaimer:

Attention: The present versions are still working documents

*The aim of these **draft** ALDREN Methodology notes is to provide information on how to apply the different ALDREN protocols during the pilot phase, to test, consolidate and validate the work done on the different tasks, to collect feedback from stakeholders on their utility and applicability.*

Therefore, they are made public.

These drafts will be finalized and updated for roll-out before the end of the ALDREN project.

Project resume:

Start: 1 November 2017
End: 30 Avril 2020

The ALDREN objectives are to achieve higher renovation rates and better renovation quality by overcoming market barriers and preparing the ground for investment.

The excellence of the ALDREN solutions offered are:

1. a harmonized Energy performance rating based on the European Voluntary Certification Scheme (EVCS) verified by measurements to increase comparability, confidence and market uptake by standardized solutions (CEN / ISO);
2. associating low energy renovation with high quality indoor environments to trigger renovation and to promote health and comfort;
3. aligning market recognition of high quality with enhanced building value by financial tools and capacity building. Establishing business case for deep renovation to motivate private investment.

These solutions will be integrated in a consistent, common way in a building passport to ensure the results and effective financing also in case of step by step renovation.

The ALDREN coordinate and support actions bring together in ALDREN Alliance the main stakeholders involved in building renovation to specify the needs of the non-residential building sector and to organize the pilot use of the ALDREN procedure.

The ALDREN actions are sound and credible. They answer a market request for common reliable tools by using the EVCS policy instrument (EPBD Art. 11(9)) and by completing it to reach the needed holistic approach for deep renovation.

The implementation and dissemination of the ALDREN procedure will use existing channels of environmental scheme operators for the pilot phase, but also for further dissemination.

The ALDREN overarching outcome will be the infrastructure to enable market transformation by deep renovation driven by the business case and able to directly support the EU policies (EED, EPBD).

Coordinator:

- **CENTRE SCIENTIFIQUE ET TECHNIQUE DU BATIMENT** — **France**

Participants:

- ENBEE SRO — Slovakia
- INSTITUTO VALENCIANO DE LA EDIFICACION — Spain
- CERTIVEA — France
- REHVA — Netherlands
- VERCO ADVISORY SERVICES LIMITED — United Kingdom
- DANMARKS TEKNISKE UNIVERSITET — Denmark
- POLITECNICO DI MILANO — Italy

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Revision History

Date	Version	Author/Revision by	Comments
19 April 2019	Version 1.0	CERTIVEA / Yona Kamelgarn	First consolidated version based on own work and input from Jana Bendzalova
26 April 2019	Version 2.0	CERTIVEA / Yona Kamelgarn CSTB / Noelvia Sedoarisoa	Revision and addition of a section on cost standards

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Content

1. Executive summary

1.1 Context

Current levels of investment are insufficient to deliver on the Union's energy objectives for 2030. Estimates suggest that around €100 billion need to be invested annually in the EU to achieve Europe's 2020 energy efficiency targets – mostly in buildings (source: Energy Efficiency Financial Institutions Group Report: "Energy Efficiency – the first fuel for the EU Economy. How to drive new finance for energy efficiency investments", February 2015). At present, annual investments are below half of these requirements. Highlighting financial benefits of deep renovation could help mobilize further investment and improve market financing conditions.

1.2 Objectives

One of the main barriers hindering deep energy renovation stems from a gap existing between an engineer's approach of sustainability topics in buildings and a financial analyst's understanding of real estate assets. On the one hand, there is a growing awareness that energy, health and comfort performance is relevant for the protection of assets value (IIGCC). On the other hand, sustainability information remains underexploited in multi-year plan provision, financial valuation and asset risks appraisal. To bridge this gap, the aim of ALDREN T2.5 is to propose a methodology to link EVC indicators resulting from T2.1, T2.2, T2.3 and T2.4 to economic and financial indicators so as to better highlight financial benefits of energy, health and comfort upgrades in terms of asset value and risk protection.

1.3 Outcomes

The methodology proposed consists in additional financial indicators to be added in the building passport and EVC as well as guidance ("protocol") on how to calculate these indicators based on the outcomes of T2.1, T2.2, T2.3 and T2.4, and how to use all this information to better integrate energy, health and comfort topics into financial valuation, risk appraisal and renovation decisions. The scope is set beyond energy and costs savings which only reflect a narrow view of the financial benefits with sometimes low expected return of investment (ROIs) and long payback periods. It also encompasses to long term risks mitigation and the impact on financial value.

This choice is aligned with recommendations from EU high level expert group on sustainable finance stating: "Energy efficiency investments affect the value of a building, industrial facility or other infrastructure by more than just the present value of the expected energy savings. A process to provide guidance to financial institutions on the identification and measurement of these multiple value streams would help de-risk energy efficiency." (Final report 2018, p59)

The methodology proposed does not targets the calculations of absolute market value and mortgage lending value, which should be calculated by qualified valuers, but proposes guidance on how to better integrate technical information on building in particular energy, health and comfort performance into valuation and estimation of potential changes before/after renovation.

1.4 Mid-term achievements

Mid-term of the project, a list of key indicators has been proposed and a first protocol for their computation and optimal utilisation has been drafted. These first propositions need to be refined based on the outcomes from other tasks and tests on pilots. In particular, indicators concerning risks which represented a new indicator developed specifically for the ALDREN project rather than coordination of existing research requires further testing.

2. Overview of work undertaken

As proposed in the initial roadmap and Grant Agreement, three stages were carried out to organise work: a state of the art to identify standards and existing initiatives to be used in the ALDREN protocol, the definition of the working framework to shape outcomes and interconnections with other tasks and the construction of the indicators and protocol themselves.

2.1 State of the art

With mobilizing private finance and building owners for deep renovation as a starting point, it was chosen early in the project to focus on the financial benefits for the owners. A review of the financial benefits associated with sustainability related features in buildings and the state of the art in their integration into financial decisions and valuations is attached in Appendix 1. This first step was paramount to share a common understanding of the different types of economic and financial values and the different types of valuation and appraisal situations.

In a nutshell, the financial benefits (benefits for owners) are both (see Figure 1):

- **direct benefits, directly cashed by the owner** : costs savings that can be easily expressed (e.g. energy costs, maintenance costs, replacement costs) and have a direct impact on cash flows,
- **indirect benefits resulting from benefits to other stakeholders**: increased asset attractiveness, reduced obsolescence, higher rents, …. resulting from tenants' preferences, and investor's preferences… resulting in risk mitigation, impacts on building cash flow and improved financial value.

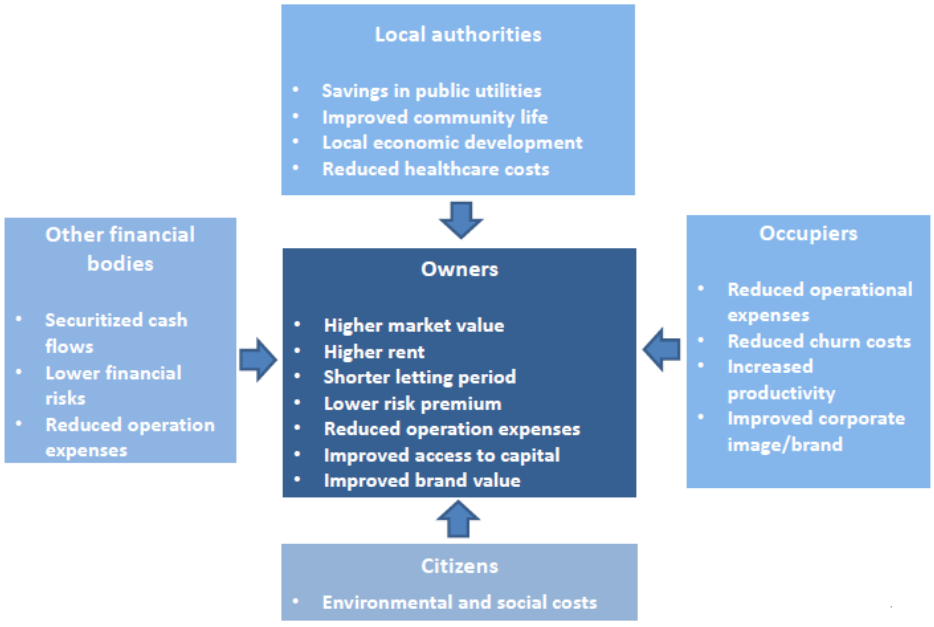

Figure 1: Financial benefits associated with sustainability-related performance of buildings (source: SBA, 2015)

As regards direct benefits, cost indicators were investigated through an inventory of costs standards. In particular, the Amended Energy Performance of Buildings Directive (EPBD 2018) requires every member state to define a national long-term renovation strategy to achieve a nearly zero energy buildings stock by 2050, in a cost-effective manner. In order to define cost-effectiveness, collecting sustainability-related information as well as technical and economic

information on the building life cycle is paramount to identify trigger moments in the building life.[1] Reg 244 2012 has defined how to define cost effectiveness. It was thus agreed to work within this standard to propose costs indicators to be added in the passport as both additional information and financial value input parameter.

As regards, indirect benefits, three types of financial values were investigated:

- **Market value (M**V): according to EU Regulation No. 575/2013 Article 4 (76), it represents "the estimated amount for which the property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had each acted knowledge." Market value is used for transactions, for accountability purposes as well as for obtaining financing.
- **Mortgage Lending Value (MLV):** according to EU Regulation No. 575/2013 Article 4 (74), it represents "the value of immovable property as determined by a prudent assessment of the future marketability of the property taking into account long-term sustainable aspects of the property, the normal and local market conditions, the current use and alternative appropriate uses of the property." Mortgage lending value is understood by banking supervisors as a more prudent value for estimating exposures in lending activities.
- **(Investment) worth (W):** According to International Valuation standard, investment value or worth is defined as "The value of an asset to a particular owner or prospective owner for individual investment or operational objectives." The investment worth measures the benefits associated with the ownership of the building. It may thus take into account benefits which may not be fully reflected in the market analysis but are relevant to the owner.

A listing of initiatives aiming to better incorporate sustainability-related information into economic appraisals and financial valuations was thus undertaken. It both fuelled discussions to define framework within which the task needed to unfold and helped identify relevant projects and findings to which ALDREN protocol could refer. In particular the RenoValue[2] was identified as particularly relevant for recommendations in the protocol. Based on this literature, the **Discounted Cash Flow** (DCF) approach appears as the most appropriate to better incorporate energy, health and well-being into financial valuation of office buildings and hotels. It can show explicitly the benefits for building owner following from deep renovation integrating several aspects during building commercialisation such as building quality/obsolescence, energy performance and Health & Well-being (attractiveness for occupants).

2.2 Framework outline

Numerous discussions occur to share a common understanding of the task between the different members of the ALDREN consortium and identify key added value for the task. Emphasis was put on how outputs from other tasks could be plugged in the financial indicators, thus requiring for those other tasks to be sufficiently advanced.

Three main barriers needed to be overcome to define the general shape of the task outputs:

1. Address financial market players with their own language and be easily integrated into current practices
2. Help better integrate sustainability criteria into investment decisions for deeper renovations
3. Be easily integrated into current practices.

Based on the literature review, key indicators to address financial market players appear to be the financial value. However, both Market value and Mortgage Lending Value need to be

[1] https://www.renovate-europe.eu/2019-new-ep-and-new-commission/
[2] RenoValue project : http://renovalue.eu/)

estimated by qualified valuers based on international valuation standards. Furthermore, their display may raise confidentiality issues. First interviews with owners indeed reflected a general reluctance to display highly sensitive financial value in an EVC. Consequently, it was chosen not to make market value and mortgage lending as output indicator of the ALDREN project but to focus on Investment Worth and to suggest how they could better incorporate information on energy, health and well-being.

Overall, the target was set in informing valuers in how their input parameters (costs, rental value, discount factor…) could be better estimated using data integrated in the ECV and building passport (T2.1, T2.2, T2.3, T2.4). In addition, it was possible to suggest calculation of worth directly within the ALDREN protocol to compare before/after renovation (T2.6).

2.3 Indicators and protocol

The third step was to investigate further the chosen pathway and propose detailed indicators based on the framework chosen. Three main types of indicators have been distinguished:

- **Costs:** relatively objective, this type of data can be further detailed by technical information collecting in energy, health and well-being audit as proposed in the ALDREN project. It was thus obvious to make them an additional information resulting from the more-in depth understanding gained by ALDREN procedure.
- **Financial value:** market value, mortgage lending are calculated by qualified valuers. In addition, they heavily depend on a local market context, and as regards the former on economic fluctuations. It was thus deemed not appropriate to make them direct outputs from the ALDREN procedures. However, it was particularly important to ensure that the protocol conceived specify how to integrate more transparently sustainability-related information relating to tasks 2.1, 2.2, 2.3, 2.4 in the valuation exercises, and most specifically investment worth. In particular, the Discounted Cash flow (DCF) approach was selected
- **Risks:** although financial value cannot be an additional indicator displayed in the passport or the ECV, it was important to maintain a financial information. To do so, a risk approach was selected with the proposition of a risk rating indicator that could be used to appraise how the building perform as regards future financial risks that could result from poor energy, health and well-being performance. This risk rating was designed as the financial translation of energy, health and well-being performance in the local market context (supply and demand fur sustainable building, regulation, data transparency…).

The estimation and use of these types of indicators have been detailed in a side protocol, distinguishing three situations:

- **initial appraisal**: use of ALDREN protocol to appraise an existing building
- **renovation decision making process**: the use of ALDREN indicators to build, compare and schedule renovation package
- **ex post appraisal**: to assess whether the effective benefits that could be achieved through deep renovation and engage with stakeholders to ensure lasting favourable financing conditions.

A survey has also been designed to question external financial players about what they require to better understand interviews and workshops with representatives of market players will be undertaken. This survey was postponed due to issues external to the ALDREN project. It will be updated with project advances, in particular as regard risk rating, in order to collect feedbacks on the appreciation of the main risk factors associated with energy, health and well-being performance. The ALDREN Alliance members acting as finance providers will be closely involved in the developments. The Alliance and the pilot sites will also allow describing the current market status and consolidating the methodological approach and its integration in the overall ALDREN procedure.

3. Main outcomes

The aim of ALDREN project is to present additional economic indicators and guidance on how financial input parameters can be better assessed through the use of sustainability-related information (technical description, energy, health and well-being). There is no intention of ALDREN project to estimate building mortgage lending value or market value in the heterogenic real estate EU markets. In order to do so, outputs from T2.5 consists in (Figure 2):

- **an additional list of economic indicators**: three types of interconnected indicators have been detailed, that should be used for different purposes: costs, value and risks. Costs and financial value indicators are more relevant for the Building Passport and RenoMap as decision making indicators rather than assessment tools. Only a specific risk indicator will be disclosed in the EVC as a rating. All indicators will be listed as additional economic indicators in the building passport.
- **a stand-alone guidance protocol** for data collection, indicators calculation and incorporation of information into financial decisions.

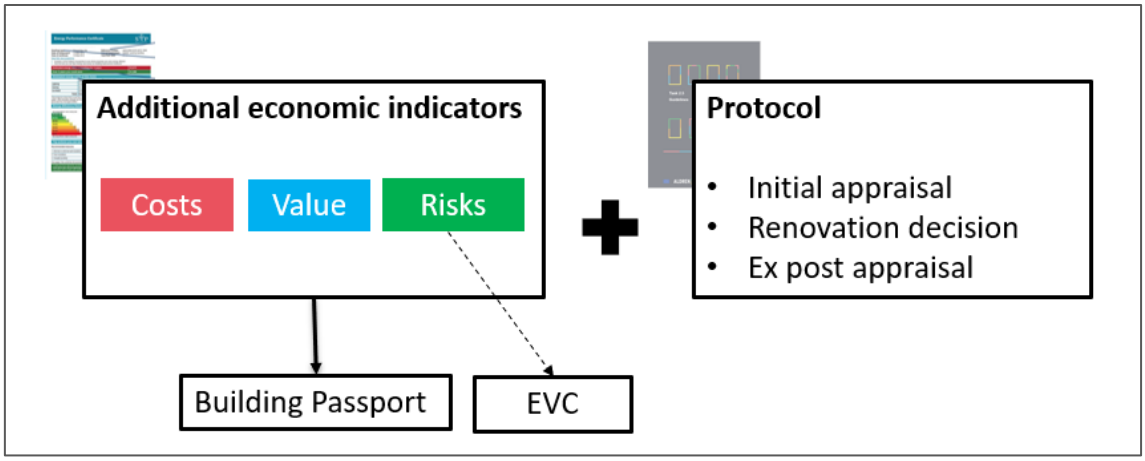

Figure 2: Overview of task 2.5 outputs

3.1 Providing more detailed information on costs

First outcome is to provide more detailed information on costs through additional dedicated indicators. Costs indicators are particularly important to better assess a building state as well as to estimate potential benefits from renovation decision. It is particularly important to not only consider energy-related costs but to also consider other costs along the remaining of the building lifespan so as to develop a broader vision of the economic benefits associated with energy, health and well-being.

Aligned with Reg 244/2012 on cost optimum calculations as well as EN 15459-1:2017 Energy performance of buildings-Economic evaluation, five sub costs indicators have been distinguished apart from an aggregated global cost indicator:

- **energy costs and revenues: "**annual costs and fixed and peak charges for energy including national taxes" as well as annual revenues resulting from contingent selling the energy produced on site to third parties, including national taxes and tariffs**.**
- **operational costs:** annual cost for utilities other than energy, including water consumption and waste management and building insurance **other running costs**
- **maintenance costs:** "annual costs for measures for preserving and restoring the desired quality of the building or building element. This includes annual costs for inspection, cleaning, adjustments, repair and consumable items."
- **Replacement costs: "**substitute investment for a building element, according to the estimated economic lifecycle during the calculation period."
- **Cost of greenhouse gas emissions**: 'the monetary value of environmental damage caused by CO2 emissions related to the energy consumption in buildings"

- **Global costs (life cycle costs)** : “sum of the present value of the initial investment costs, sum of running costs, and replacement costs (referred to the starting year), as well as disposal costs if applicable”.

Estimations of these indicators are detailed in the protocol. For initial building appraisal, collecting actual data from invoices is recommended. When no actual data is available for assessing impacts renovation packages, technical audits and calculations performed for T2.1 to T2.4 should be used.

These costs indicators are additional indicators suggested for the building passport. In the protocol, there as both used to better characterize the building and appraise its financial performance, as well as for comparing renovation packages. No rating is performed based on the estimates, since costs level depends not only on building quality but also on the quality of service in the manner the building is operated and used by its occupants.

3.2 Providing a risk assessment linked with sustainability

Second outcome is to provide a risk rating assessment to appraise and compare buildings. This risk rating aims to provide a simplified rating to assess within a single figure the potential impacts of energy, health, well being and more globally of a good understanding of building characteristics and pathway towards a NZEB in terms of financial risks and futureproofness of the asset. Work is still in progress and will be refined during the pilot phase of the ALDREN project.

A this stage, the ALDREN risk rating comprises four main factors, reflecting the four types of risk categories relating to ALDREN :

- **Energy performance:** Energy rating provides a clear view of where building stands in terms of future regulation compliance to meet NZEB 2050 target. On the shorter term, energy monitoring and performance verification provide a direct path to investigate the quality of building operation and limit dysfunctions, which can represent added operational costs. High energy performance represents a higher risk for commercialisation, as well as for future capex to renovate building. Risk is higher when more stringent energy regulation is already announced and when supply for energy efficient building is higher than demand.
  ALDREN input data: T2.2 and T2.3
- **Health and well-being performance:** Health and well-being play a key role to attract and retain tenants. Numerous studies [3]show indeed impacts on indoor environment. Failing to propose a good indoor environment represents an added risk in terms of commercialization, occupation rate… Risk is higher when more when supply for good indoor quality building is higher than demand.
  ALDREN input data: T2.4
- **Cost management**: Managing costs enables building owners to detect discrepancies and disfunctions, and thus to better pilot buildings. Failure to properly capture and manage costs represent a higher operational risk.
  ALDREN input data: T2.5
- **Information management**: Data capture and management represents a good practice in real estate management with increasingly being attached to the data itself”[4] .Failure to present organised exploitable data on building characteristics and performance represents an added risk in the sense that prospective owner could assume worst case scenarios to fill the gap of missing information and would be required to pay for their collection.
  ALDREN input data: T2.1

[3] See among other publications from the World Green Building Council for an overview of the state of the art on the link between indoor environment parameters, health and productivity.
[4] RICS (2017) Global Trends in Data Capture and Management in Real Estate and Construction.

At this stage, it is important to note that the ALDREN risk indicator reflects only the risks associated with the features encompassed in the ALDREN project. It does not cover all risks associated with sustainability related information. In particular, environmental hazards, adaptation to climate change, functional obsolescence associated with the new ways of working… are not considered.

3.3 Informing valuations and renovation decisions

Third outcome is to inform valuations and renovation decisions by providing a protocol and better highlighting the links between building characteristics and performance and financial value input parameters and financial value.

A summary of connections highlighted in the protocol to reflect multiple effects but avoid double counting is synthesised in Figure 3. This Figure was elaborated based on the review of existing initiatives on the links between sustainability -related features and value.

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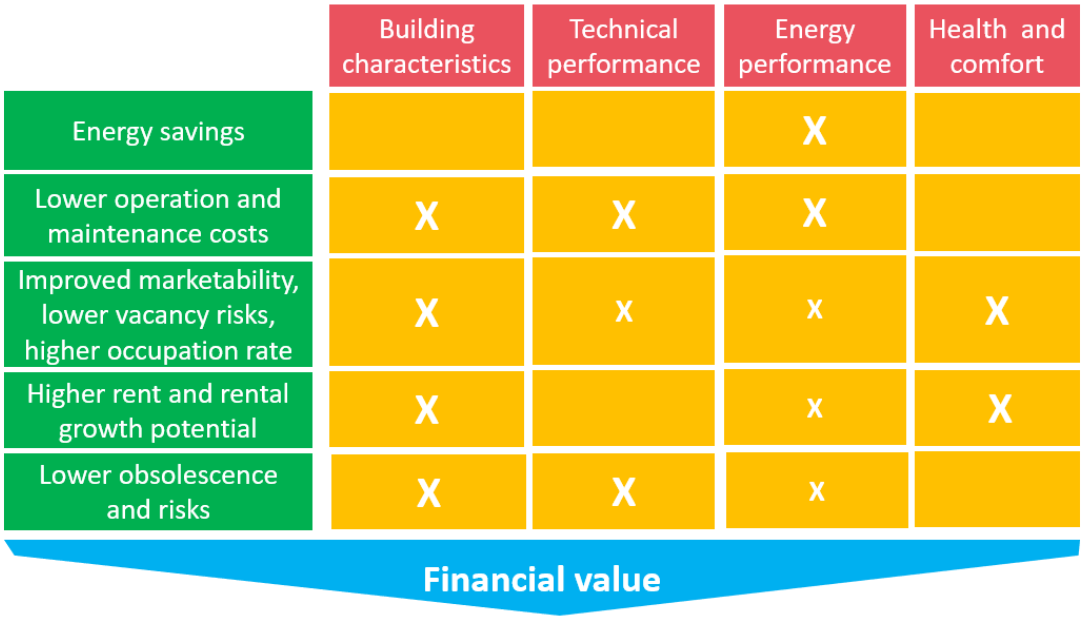

Figure 3 : Impact of technical performance, energy, health and comfort on financial value input parameters

This protocol can be used to calculate both a market value or an mortgage lending value. In the ALDREN protocol, it is required only to calculate the (Investment) worth of the different renovation packages. To do so, the protocol specifies the method to be used (the Discounted Cash Flow methodology) and the main parameters and assumptions that should be adjusted according to the building characteristics, energy, health and comfort performance as well as detailed costs calculations.

This choice of the DCF method is consistent with international practices used in real estate valuation. DCF is based on the net present value calculation of all future cash flows (earnings and costs) from building operation during calculation period. Its use is recommended in best practices, (in particular in RenoValue EU funded project) since it allows for a more transparent integration of benefits associated with energy, health and comfort performance. Inputs are:

- all future cash flows (incomes, costs) during calculation period including the incorporation of detailed costs indicators, and influence of energy, health and well-being performance,
- discount rate: with more detailed assessment of risks based on the ALDREN risk rating,
- end value for subsequent sale (value at the end of calculation period.

4. Main steps of the protocol

Task 2.5 is a financial translation of outputs from other tasks (T2.1 to T2.4) in order to better inform financial valuation and renovation decisions. Different protocols according to the stage considered are suggested. Protocols consist in mandatory and optional actions to compute indicators and use them to appraise buildings, identify renovation opportunities and select between renovation packages.

4.1 Protocol for initial appraisal

For initial building appraisal (Figure 4), five steps are suggested to calculate the risk rating and the investment worth.

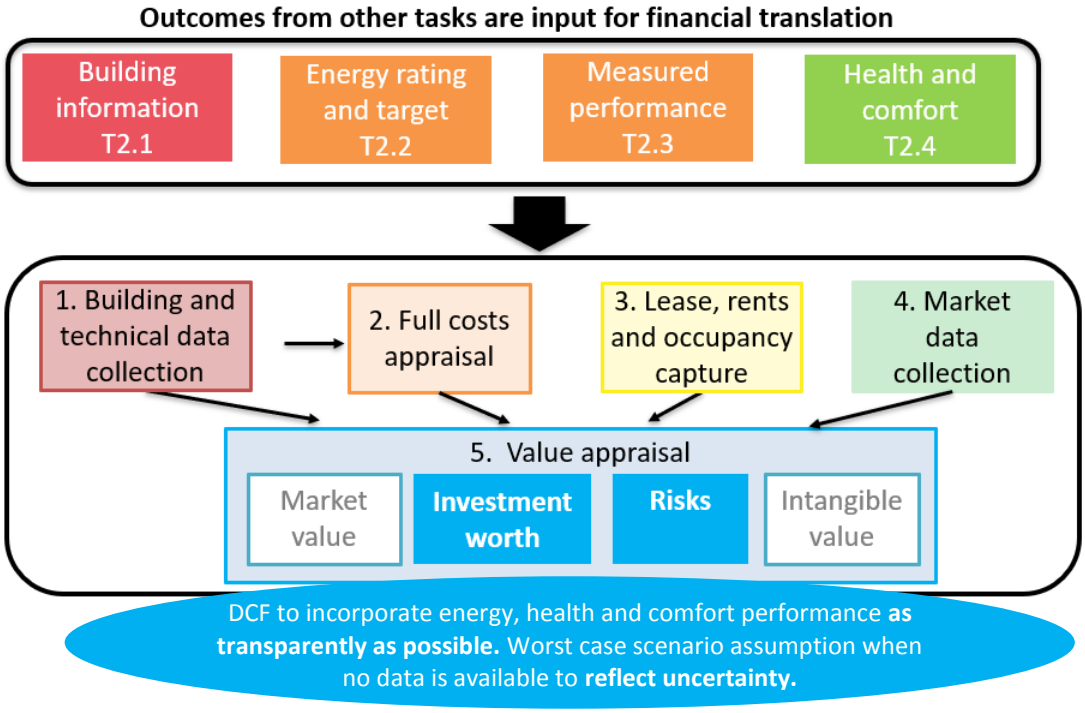

Figure 4: Overview of protocol for initial appraisal

First step consists in capturing relevant building information, including technical characteristics, energy, health and well-being performance as well as the list of main amenities and a description of the state and age of main components and building installations. Second step deals with costs appraisal to calculate the costs indicators mentioned previously. Third step includes capturing information on lease, rents and occupancy whereas fourth step extends beyond the building being considered to examine its market and identify comparables. All the information gathered in the four first steps is then used to calculate an investment worth indicator as well as the ALDREN risk rating. Worth is calculated using the DCF method, with sensitivity analysis and/or Monte Carlo simulations being recommended to display the uncertainty associated with the calculation.

4.2 Protocol for renovation decision making process

For renovation decisions (Figure 5), 5 steps are suggested to compare renovation package and help owners make their selection. First step consists in assessing optimum date for component replacement based on the technico-economic audit performed to assess costs in the initial appraisal. Second step aims to identify renegotiation opportunities based either on the end of existing leases and renewals, and rental renegotiation opportunity stated in the contracts. Step three uses result from those two previous steps in order to cluster renovation actions into

consistent renovation packages. Step four appraises the impact of each of these renovation packages on asset value. In particular, it is recommended to distinguish three scenarios based on level of ambition, possibility to undertake whilst occupied and potential impact on value. Whenever possible, the package should discriminate between a scenario with energy upgrades not ambitious enough to justify a significant rental increase and a scenario ambitious enough to allow for higher rents. Step five provides key decision ratios to compare the renovation packages.

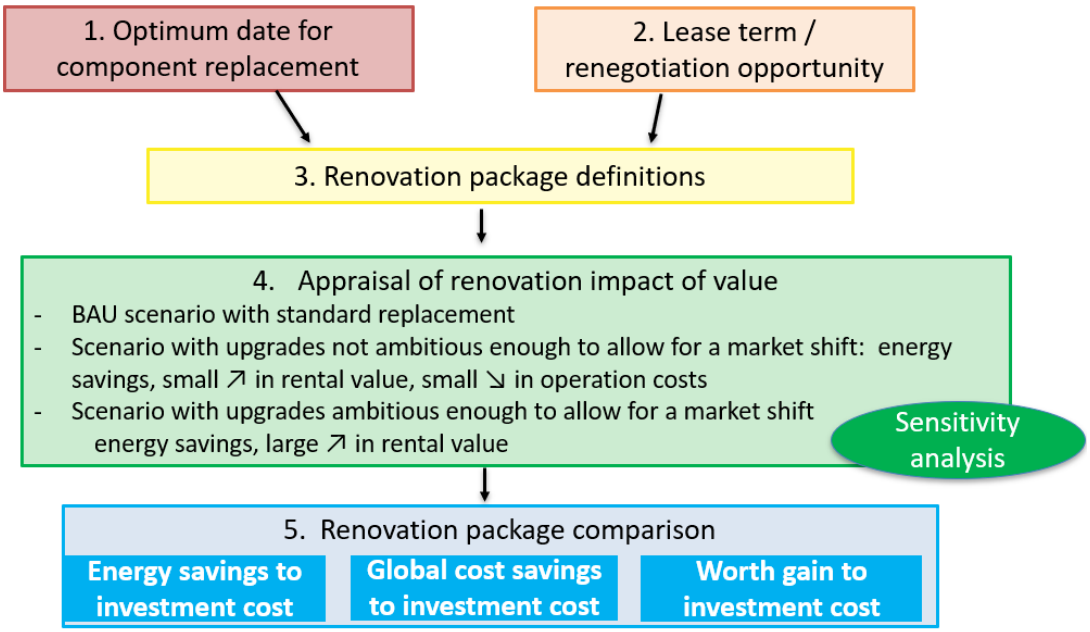

Figure 5: Overview of protocol for renovation decisions

4.3 Protocol for ex post appraisal

This protocol is still in progress. The underlying principle is to provide recommendations on how and how to verify and monitor effective after renovation and how to engage with stakeholders to ensure maximum financial benefits from the renovation works undertaken.

5. Step-by-step detailed protocol

5.1 Protocol for initial appraisal

Actions	Detailed actions	Mandatory / Desirable?	Description	Links with other ALDREN tasks	Participants	Guidance Guidelines
Technical data 1. collection	**1.1. Collect key information on building location and characteristics**	Mandatory	Key information on building characteristics should be collected as part of the initial appraisal of the building. This information will also be used in the initial discussions between technical assessors, valuers and clients. It will also help categorize the building and compare it against appropriate benchmark. Overall, this first step is paramount to properly assess the economic performance of the building, in particular its market value and investment worth. Checklists of key data that should be collected are provided in annexes of valuation standards. Key sections include : - Location and site considerations (transportation, green areas, infrastructure, natural and technological hazards) - Building age (date of initial construction, date of last refurbishment) - Floor area - Installations, amenities and services - Fixtures and fittings - Building main components and technical equipment - Data storage and ease of collection Sources : Data collection should result from gathering documentation from owner, market data and market report as well as site inspection.	Task 2.1 Task 2.6.2	- Client - Technical expert	- ALDREN protocol T2.1 - EN 15459-1:2017, Reg. 244/2012 - RICS Red Book 2017 Annex.

	1.2. Retrieve results from energy, health and comfort performance in a readily usable format with benchmark against similar buildings	Mandatory	Energy, health and comfort performance should be collected and conveyed in a format readily usable by financial stakeholders who are not specialists of sustainability-related issues. In particular, whenever possible scoring/rating should be made available for benchmark against similar buildings (area, building type, types of tenants, types of owners) to help compare against peers and against European targets. Sources : Performance should result from outputs from tasks 2.2, 2.3 and 2.4.	Task 2.2 Task 2.3 Task 2.4	- Design team - Technical expert	- ALDREN protocol T2.2, T2.3 and T2.4 - UNEP FI (2014) Sustainability metrics - ALDREN protocol T2.1
2. Full costs appraisal	**2.1. Gather data on the running costs associated with building operation and maintenance**	Mandatory	Yearly costs associated with the building operation and maintenance should be assessed to have a clear picture of the building economic performance. Data should be collected for the three following running costs categories : - Energy costs and revenues including subscription price and taxes. - Other utilities costs (water, waste) including subscription price and taxes. - Maintenance and minor repair costs including planned preventive maintenance, emergency minor repairs and replacement items as well as building regular inspections. Costs include both components prices for minor replacement and workforce. - Other running costs (insurance, taxes...) Both costs directly supported by owners and costs supported by tenants should be collected. As operation and maintenance costs depend on the level of service provided, information regarding the level and quality of service (ie service level agreement) should also be documented. Sources : Whenever possible, actual data should be collected using invoices and contracts with building operators and contractors. When no actual data are available or when only partial data are available, estimations should be based on lump sums (other running costs) or on estimations based on a percentage of initial investment costs for main components as recommended in EN 15459-1:2017. Energy costs and revenues should be consistent with energy calculations performed in tasks 2,2 and 2,3 with energy consumption per carrier and energy carrier price as well as a fixed subscription fee.	Task2.2 Task 2.3	- Asset Manager - Building operator	- ICMS 2 - EN 15459-1:2017, Reg. 244/2012

	2.2. List major technical installations and components and characterize state of deterioration	Mandatory	In order to estimate costs for major repairs and replacement, the first step consists in referencing major technical equipment and building components. For each item: - identify date of installation and/or last upgrade, - assess deterioration state, - check schedule work plans. The objective is to determine the optimum date for replacement. Minimum equipment that should be considered are major components and technical equipment (HVAC mostly). When no data can be collected, it is advised to use statistical figures based on worst case assumptions, so as to reflect additional risks associated with the lack of information.		- Asset Manager - Technical team	- RICS new rules of measurement, NRM 3: Order of cost estimating and cost planning for building maintenance works - ICMS 2 - EN 15459-1:2017, Reg. 244/2012
	2.3. Estimate optimum date for replacement and associated replacement cost	Mandatory	For each of the previously referenced item, the underlying principle is then to predict a schedule of future replacement and refurbishment along the remaining lifespan of the building based on : - state of deterioration - optimum lifetime recommendation from manufacturer - provision of unscheduled works Replacement costs should include upgrading to modern day equivalents. Minimum equipment that should be considered are major components and technical equipment (HVAC mostly). Sources : Use optimum lifetime recommendation from manufacturer as well as deterioration investigation to deduce probable date when replacement will be needed and associated replacement cost (component prices + workforce for installation). When no data can be collected, use statistical figures/lump sum based on worst case assumptions. Sources of data and assumptions used for costs should be recorded.		- Asset Manager - Technical team	- RICS new rules of measurement, NRM 3: Order of cost estimating and costplanning for building maintenance works - ICMS 2 - EN 15459-1:2017, Reg. 244/2012

	2.4 Assess future upgrade and refurbishment costs (replacement cost) over the remaining life cycle of the building	Desirable	To characterize physical deterioration state and impact of economic performance, it is possible at this stage to calculate using life cycle methodology an annualized replacement costs. Stipulate : - discount rate for net present value calculation - inflation rate - net present value		- Asset Manager - Technical team	EN 15459-1:2017, Reg. 244/2012
	2.5 Assess carbon prices associated with energy consumption	Desirable	To characterize externalities associated with GhG emissions, assess carbon costs associated with energy consumption considering: - energy consumption and production for the different energy carriers, - recognized standard (EN 15459-1:2017, Reg. 244/2012) for carbon content of each energy carrier - carbon price as specified in the standard.		- Technical team	- EN 15459-1:2017, Reg. 244/2012
	2.5 Assess global costs	Desirable	Sum the present value of the annual running costs, replacement costs as well as carbon costs over the remaining estimated lifespan of the building. Add disposal costs if applicable at the end of the period. Calculation should be performed using the methodology described in the ISO 15686-5:2017, EN 15459-1:2017 standards. It should include over the remaining lifetime of the building (assumption of 50 years): - energy costs - other running costs - periodic replacement costs - disposal costs NB: Construction costs are considered as sunk costs and should be omitted. Future costs should be calculated using appropriate inflation rates at the time they are incurred. They then should be discounted using a discount factor to calculate their net present value.		- Technical team	- EN 15459-1:2017, Reg. 244/2012

3. Lease, rents and occupancy capture	**3.1 Examine lease structure and rents as well as room price and occupancy rate for hotels**	Desirable	For office buildings, collect information on the lease structure, in particular the number of leases and for each lease, specify : - the lease term - the rent - the contractual terms on recoverable expenses For hotels, collect information on the number and type of rooms (room size and class of amenities). For each room type, determine : - room price - average occupancy rate around the year When no data can be collected, use market figures based on worst case assumptions (precautionary approach).		- Asset Manager - Valuer	
4. Market data collection	**4.1. Capture rental value and reletting period for comparable buildings (room price and occupancy rate for hotels).**	Mandatory	Collect market information on rental value and reletting period (office buildings) or room market price and occupancy average rate (hotels). Whenever possible, this market data should be collected from up-to-date valuation report. When no valuation report is available, consider building characteristics and amenities to identify comparable buildings where rental transactions details are known to base assumptions. Minimum characteristics that should be considered include : - Location and site considerations - Building age and last renovation - Floor area - Installations, amenities and services - Fixtures and fittings - Main components and technical installations - Energy, health and comfort assessment		- Asset manager - Valuer	- International Valuation Standards 2017 - RICS Red Book 2017 Annex.

	4.2 Capture rental value and reletting period for buildings with target performance after renovation	Mandatory	Identify maximum potential for rental value based on building in same location in pristine state with performance and characteristics that could be achieved after a deep renovation. Minimum characteristics that should be considered include : - Location and site considerations - Building age and last renovation - Floor area - Installations, amenities and services - Fixtures and fittings - Main components and technical installations - Energy, health and comfort assessment		- Asset manager - Valuer	- International Valuation Standards 2017 - RICS Red Book 2017 Annex.
	4.3. Gather information on supply and demand for similar premises and premises with performance and characteristics that could be achieved after deep renovation	Desirable	Identify supply and demand for or similar premises and premises with performance and characteristics that could be achieved after deep renovation. Sources of information that could be used include valuation report, transactions observatory/inventory… Rate of vacancy, take-up against supply... are information that should be investigated.		- Asset manager - Valuer	
5. Risk and value appraisals	**5.1 Calculate ALDREN risk indicator**	Mandatory	Calculate ALDREN risk indicators using the dedicated risk rating questionnaire, outputs from other tasks and informed qualitative assessment for each parameter. - Energy performance - Health and well being performance - Cost management - Information management (see Appendix for the detailed questionnaire)	Tasks 2.1, 2.2, 2.3 and 2.4	- Asset manager - ALDREN assessor	ADREN methodology

<table>
<tr>
<td></td>
<td>5.2 Carry out an investment worth calculation of the asset using DCF methodologies</td>
<td>Mandatory</td>
<td>The investment worth refers more specifically to the owner's context and cash flows he may capture from owning the property. As opposed to market value (and mortgage lending value) which may only be determined by a qualified valuer, investment worth calculations may be calculated by a financial analyst.
The investment worth should be calculated using the DCF (Discounted Cash Flow).
Investment worth report should clearly based the assumptions used for the main parameters on the data collected and computed in the ALDREN Protocol (see Indicators)
- the number of years over which the DCF is calculated (min. 15 years).
- the discount rate
- the inflation rate(s)
- the rent and market rental value :
- other revenues and expenses
- letting fees and reletting duration
- the yields
- the terminal value
Energy, health and comfort performance should be considered in a transparent manner:
<table>
<tr><th>Value drivers</th><th>Key recommendations for incorporation energy, health and comfort performance</th></tr>
<tr><td>Running costs</td><td>Impact of energy, health and comfort should be integrated by a more detailed calculations of costs with the use of costs indicators proposed in the list of ALDREN indicators for task 2,5. Caution, only costs non attributable to the tenants should be accounted for.</td></tr>
<tr><td>Replacement costs</td><td>Impact of energy, health and comfort should be integrated by a more detailed calculations of costs with the use of costs indicators proposed in the list of ALDREN indicators for task 2,5.</td></tr>
<tr><td>Other expenses (letting fees, vacancy ...)</td><td>According to the demand and supply of building with similar performance, impact on letting fees, duration to let, occupancy rate...</td></tr>
<tr><td>Rental value and rental growth</td><td>- Energy, health and comfort performance should be considered when investigating comparable buildings as best as information on transactions allows
- To compare before/after renovation, rental value and rental growth may be modified for new lease or if lease renegotiation. Health and comfort, as well as amenities, should be considered to identify the type of market that can be targeted for letting.
- A fraction of energy and other operational savings attributable to tenants may be passed on to rental value as compared to similar buildings with poorer performance.</td></tr>
<tr><td>Discount rate</td><td>- Small positive impact of component replacement on risks for building with average performance.
- Small to large positive impact of health and comfort performance to account for functional obsolescence mitigation
- Larger positive impact for building aligned with NZEb to account for anticipation of regulation and mitigation of obsolescence associated</td></tr>
</table>
</td>
<td>All other tasks</td>
<td>Assessor</td>
<td></td>
</tr>
</table>

	5.3 Ask or carry out an assessment of the uncertainty associated with the value and worth calculations	Desirable	Assess uncertainty associated with value calculations by: - making a qualitative assessment of the exposures to change in legislation (sustainability policy and regulation) and market expectations in terms of sustainability-related characteristics (obsolescence) - conducting a sensitivity analysis of key input assumptions based on worst case and best case scenario. Parameters that should be considered are : - yields -rental value - vacancy/occupation rate. It is recommended to assess uncertainty with Monte Carlo simulations, by simulating triangular distribution (best case, worst case, best guess) for rental value, yields and discount rate input values. in order to identify regulatory and functional obsolescence. Ask for relevant sources of information to support risk assessment. In particular, assess likelihood to command top market rent with sustainability upgrades and to improve vacant rate.		Client Valuer assessor	Sustainable real estate investment framework
	5.4 Ask the valuer to carry out a market valuation with a transparency on the impact of sustainability-related criteria	Desirable	Question whether sustainability-related criteria are being taken into account for the building valuation and collaborate with valuers to incorporate sustainability-related issues in the most transparent way as possible using the Discounted Cash Flow method. In particular, valuer should comply with best practices specified in Renovalue project.		- Asset manager - Valuer	Renovalue.

5.2 Protocol for renovation decisions

Actions	Detailed actions	Mandatory / Desirable?	Description	Links with other ALDREN tasks	Participants	Guidance Guidelines
1. Optimum date for component replacement	**1.1 Analyse state of the equipment**	Mandatory	Analyse main technical installations for the HVAC systems. Assess : - state of deterioration - remaining lifespan to determine optimum date for replacement.	2.6.3	- ALDREN assessor - Asset manager	
	1.2 Analyse costs performance associated to building	Mandatory	Assess costs performance associated with building operation - energy costs - maintenance costs - replacement costs Identify malfunction and loss of efficiency to prioritise renovation actions.		- ALDREN assessor - Asset manager	
2. Lease term / renegotiation opportunity	**2.1 Analyse opportunity for rental renegotiation**	Mandatory	Analyse lease structure, contractual conditions and duration within the building to identify opportunity for rental renegotiation. Lease renewal and new leases represent key moments in the asset life when major renovations may be valued in the rents through the lease renegotiation (vacancy, lease renewal…)		Asset manager	

3. Renovation package definitions	**3.1 Characterize Energy Renovations Actions (ERA)**	Mandatory	Define Energy Renovations Actions (ERA) based on energy, health and comfort audit. For each ERA proposed, assess: - investment costs - energy savings - global costs savings - potential impact of health and comfort - possibility to implement ERA in occupied site At this first step, costs assessment needs not be very accurate. It will be refined afterwards.	2.6.3	- ALDREN assessor	
	3.2 Define Renovation Packages based on the clustering of ERAs	Mandatory	Define Renovation Package by clustering several ERAs according to : - energy savings to investment costs ratio (for example low, medium, high ratio) - possibility to implement whilst building is occupied by tenants - optimum date for component replacement	2.6.3	- ALDREN assessor	
	3.3 Provide recommendations on key moments for implementing renovation packages	Optional	Identify lifecycle trigger points when sustainability upgrades will be more cost effective and could trigger value creation the most by considering : - component lifecycle, - technical optimum order : (eg : change energy production after reducing need through window improvement ...) - regulatory change and evolution - lease opportunity. Link refurbishment strategy and upgrade to key moments of asset life to maximise potential value with asset	2.6.3	- ALDREN assessor	

4. Appraisal of impact on value for each renovation package	**4.1 Assess costs, value and risks mitigation associated with renovation packages**	Mandatory	Assess costs and benefits associated with renovation. In terms of costs : assess investment renovation costs to implement renovation package including compensation paid to tenants for disruption and relocation during works and vacancy costs (if required) In terms of benefits, assess - energy savings - global costs savings - impact on health and comfort - risk mitigation - impact on investment worth		- ALDREN assessor	
	4.2. Assess uncertainty	Optional	Conduct a sensitivity analysis for impact on investment worth and display results using Monte Carlo simulations. Simulations should cover at least uncertainty on the following key parameter - rental value - exit yield - discount rate		- ALDREN assessor	
5. Renovation package comparison	**5.1 Compare renovation package based on key decision ratio**	Mandatory	Use the three key following ratio to compare renovation packages : - Energy savings to investment cost - Global cost savings to investment cost - Worth gain to investment cost with the initial building appraisal used as initial reference. Methodology:		- Asset manager	

			Energy savings, global cost savings and worth gains should be calculated by subtracting the performance of the initial building to the performance of the refurbished building. Investment cost required for energy renovation. Whenever possible, it is advised to only account for additional costs associated with the energy upgrades (compared to renovation with standard performance). It should account both for component purchase and workforce for their installation. Whenever renovation works undertaken results in vacancy costs, relocation costs and/or compensation costs to the tenants for the nuisance caused by the refurbishment works, those additional costs should be accounted for.			

6. Conclusion and further improvement steps

At date, a first full draft of the task 2.5 outputs has been produced with both the list of indicators (including definitions, methodology and sources of data), and a protocol for their calculation and uses within financial valuation and renovation decision-making processes.

The main difficulty dwelled in the definition of the output framework and selection of indicators to address market financial players in their own language without overriding qualified valuers' tasks. It was thus chosen to include only investment worth and a dedicated risk rating within the boundary of the ALDREN indicators, while still detailing impacts on market and mortgage lending value in the protocol. In addition, some of the indicators suggested could only assembled once other outputs in the other tasks were stabilised.

Further works improvements are thus still required on:

- the ALDREN risk rating: the risk rating tool based on a questionnaire still need further work, in particular as regards scoring and display of results, with possibility of weightings that could be introduced. A survey of financial market players on their uptake of the risks associated with energy upgrades and renovation could help further refined this risk rating, as could testing on the pilot projects.
- the ex post protocol, which was only added as an afterthought is still in progress and will need to be completed.
- all the indicators and methodology will need to be tested on pilot to verify feasibility and workability.

7. Annex 1: State of the art

Current levels of investment are insufficient to deliver on the Union's climate change and energy objectives for 2030. Estimates suggest that around €100 billion need to be invested annually in the EU to achieve Europe's 2020 energy efficiency targets – mostly in buildings (source: Energy Efficiency Financial Institutions Group Report: "Energy Efficiency – the first fuel for the EU Economy. How to drive new finance for energy efficiency investments", February 2015). At present, annual investments are below half of these requirements. The lack of tailor-made financing products for energy efficient building renovation is a main barrier for deep renovation.

There is a need to link the level of **energy and sustainability performance** to be achieved during building renovation works and **the economic and financial benefits.** Financing the required up front investments remains a challenge. Even if potential energy savings may be significant, the financing approaches considering exclusively these savings result in not very favourable traditional expected return of investment (ROIs) and exclude all the potential on asset value and risk protection in the mid to long term. The financial benefits from deep renovation also encompass:

- global costs extending beyond energy savings to encompass also maintenance costs and replacement costs in life cycle approach,
- asset attractiveness, property value,
- reduced risk for the loan provider and investor.

This review aims to provide a succinct state of play in the benefits associated with energy, health and wellbeing performance and the manner they could be better incorporated in economic and financial indicators and decision-making process.

7.1 Sustainability and cost assessments standards

The Amended Energy Performance of Buildings Directive (EPBD 2018) requires every member state to define a national long-term renovation strategy to achieve a nearly zero energy buildings stock by 2050, in a cost-effective manner. In order to define cost-effectiveness, collecting sustainability-related information as well as technical and economic information on the building life cycle is paramount to identify trigger moments in the building life.[5]Several standards have stated definitions and methodology to appraise costs and defined cost effectiveness.

Cost appraisal in European regulation for energy efficiency/renovation in buildings:

- **Reg 244/2012**

Reg 244/2012 completes the Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings. It aims to establish a comparative methodology framework to be used by Member States to compute the cost-optimal levels of minimum energy performance requirements for new and existing buildings and building elements. The methodology can be used for comparing energy efficiency measures, measures incorporating renewable energy sources and packages and variants of such measures, based on the primary energy performance and the cost attributed to their implementation. It also indicates how to apply these rules to selected reference buildings in order to identify the cost-optimal levels of minimum energy performance requirements.
Reg 244/2012 contains the fundamental principles and terminology necessary for the analysis, including: global cost, initial investment costs, energy costs, operational costs, maintenance costs, disposal costs, annual cost, replacement cost, cost of greenhouse gas, energy from renewable sources, etc. It also describes the cost-optimal methodology framework and indicates the required data for evaluation. In addition, it contains appendices, including: information on

[5] https://www.renovate-europe.eu/2019-new-ep-and-new-commission/

estimated long-term energy price developments, information on estimated long-term carbon price developments, reporting template that Member States may use for reporting to the Commission.

Cost appraisal in buildings standards

- **EN 15459-1:2017**

EN 15459-1:2017 is a European Standard that aims to harmonize the assessment methods of the energy performance in the building sector by providing economic computations methods for the building envelope or others related systems. It applies to all types of new and existing buildings.

EN 15459-1 : 2017 has served to the use of standardized economic equations, notably those regarding: the global cost, the initial investment cost, the running cost, the maintenance cost, the operational cost, the energy cost, the periodic cost, the replacement cost for component or system, the annual cost, the disposal cost, the price development rate, the discount rate, the discount factor, the life span, the economic lifecycle, the payback period, the starting year, the calculation period, the residual value, the present value, the global unitary cost.

The main content of the standard includes: the definitions and the structure of the types of costs which should be considered for the calculation, data needed for definition of costs related to systems under consideration, the calculation method(s), the expression of the result of the economic study. This standard also contains informative annexes giving the default values to be used - such as information on the calculation period, repair costs and maintenance costs - in order to introduce these default values into the calculations.

The systems concerned by this standard are: the heat pump for space heating, the combi boiler for space heating and domestic hot water, the solar system for domestic hot water, the direct electrical heating system, the electrical storage water heater for domestic hot water, the mechanical ventilation (with and without heat recovery units), the VMC auto-regulated, the VMC hydro-regulated, the natural ventilation, the electrical heat pump for heating and domestic hot water and the building construction.

- **ISO 15686-5:2017**

As opposed to EN 15459-1:2017**,** ISO 15686-5:2017 covers the whole building. It aims to standardize the methodology of the assessment of life-cycle costing (LCC) in the construction's industry whether it's an ex post or ex ante stage, while considering the uncertainties and risks that may occur. Moreover, it clarifies the difference with the whole-life costing (WLC) while providing a menu of costs for both type of life costing. This menu may be directly used or adjusted with the cost codes and data-structure conventions at the national and international scales. It focuses on new and old: buildings, constructed assets and their parts.
The following specification was used for the project regarding the life-cycle costing: the acquisition cost, the operation, maintenance and replacement costs, the costs at disposal, the end-of-life residual valuations, the discount rate, the inflation, the taxes and subsidies, the changes in costs over times, the energy and utilities cost.

Regarding the whole-life cycling various variables were used general ones and other related to: the externalities, the environmental impact costs, social benefits and costs, the contribution of the construction works to sustainability and sustainable development, to intangibles (for instance the functional efficiency), the future income streams and financing cost. Finally, other decisions variables were provided such as: the real costs, the nominal costs, the discounted costs and the present value.

Cost appraisal in practitioner's professional standards

- **- ICMS**

The International Construction Measurement Standards Coalition (ICMSC) gathers 40 professional organisations, among which the IMF, RICS,… It launched in 2015 an International construction Measurement standard to compare construction projects (building or civil

engineering) around the world. to do so, the standard defines 3 main Project Capital Cost categories, further broken down in 3 sub categories levels

- Capital construction costs
- Associated construction costs
- Site acquisition and client's other costs

In 2019, the ICMS 2 project extends on this first version to account for full life cycle costs, thus further defining CROME:

- Construction: the first version of the ICMS
- Renewal: based on the same categories as construction
- Operational costs: cleaning, utilities, securities, …
- Maintenance costs: …
- End-of-life: decommission, decontamination, demolition…

This standard provides categorisation, definitions, as well as a separate contextualisation section to describe the building (age, construction, …) and help contextualise the data for comparison and benchmarking… However, it does not provide methodology on how the data should be computed or collected. On this regard, two RICS guidance have been considered: RICS standard on the cost estimating of building maintenance works [6]and on life cycle costing.[7]

Conclusions for application in the ALDREN project

For ALDREN, it was selected to conserve the definitions and classification framework from the Reg 244/2012. in order to propose a building passport aligned with other European regulations standard. Nevertheless, crosswalks were examined with the ICMS standard to ensure relevance for practitioners, and ISO 15686-5:2017 definitions were considered to extent running costs beyond energy systems.

7.2 Sustainability and financial valuation standards

Three types of financial values were investigated:

- **Market value (M**V): according to EU Regulation No. 575/2013 Article 4 (76), it represents "the estimated amount for which the property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had each acted knowledge." Market value is used for transactions, for accountability purposes as well as for obtaining financing.
- **Mortgage Lending Value (MLV):** according to EU Regulation No. 575/2013 Article 4 (74), it represents "the value of immovable property as determined by a prudent assessment of the future marketability of the property taking into account long-term sustainable aspects of the property, the normal and local market conditions, the current use and alternative appropriate uses of the property." Mortgage lending value is understood by banking supervisors as a more prudent value for estimating exposures in lending activities.
- **(Investment) worth (W) :** According to International Valuation standard, investment value or worth is defined as "The value of an asset to a particular owner or prospective owner for individual investment or operational objectives." The investment worth measures the benefits associated with the ownership of the building. It may thus take into

[6] RICS new rules of measurement. Order of cost estimating and cost planning for building maintenance works. https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/construction/nrm_3_building_maintenance_works_1st_edition_pgguidance_2013.pdf

[7] RICS Life cycle costing 1st edition. https://www.rics.org/uk/upholding-professional-standards/sector-standards/construction/black-book/lifecycle-costing/

account benefits which may not be fully reflected in the market analysis but are relevant to the owner.

Valuation standard

Different valuation methods for asset value estimation are codified in several European legislations and international valuation standard. Valuation methods include [8]:

- **Sales comparable approach** - mostly used to assess the value of buildings that do not produce income (e.g. residential buildings), it is based on the capture of information on comparable transactions.
- **Cost approach** -the value is determined by the cost to obtain an asset of equal utility. This method is mainly reserved for special use when no cash flow is produced, often combined with national coefficients to come from investment costs to market value,
- **Income capitalisation approach** – the value is determined by reference to the value of net income generated by the cashflow using a single income value that is capitalised with no explicit projection period.
- **Discounted Cash Flow** (DCF) approach: the forecasted cash flow is discounted back to the valuation date though a net present value calculation. This approach allows for the more precisions and transparency in the integration of building related information though the assumpations of the key input parameters used in the calculation.

Discounted cash flow methodology

$$\text{Worth M V} = \sum_{J=1}^{n} \frac{R_J - C_j - C_{xj} - OE_j}{(1+r)^j} - \frac{T_n}{(1+r)^n}$$

n = number of years for the DCF calculations. 15 years recommended
Rj = total rental value at year j.
Rj = rental value per m² at y=1 X rental space X (1+ rental growth)^j
Cj = running costs at year j
Cj = running costs per m² at y=1 X total space X (1+ inflation rate)^j
Cxj = replacement costs at year j
Cxj = replacements costs (1+ inflation rate)^j
OEj = other expenses (letting fees, commercialization, vacancy) at year j
r = discount rate
r = risk free rate + (risk premium associated with real estate (yield for prime building)+ risk premium specific to asset)
Tn = terminal value at the end of the calculation y=n
Tn = $\frac{CF_n(1+g)}{r-g+d}$ with r- g +d= exit yield = discount rate – CF growth + depreciation

Incorporation of sustainability information in valuation standards

Sustainability-related information is increasingly acknowledged as relevant for valuations, with recommendations for the collection of sustainability-related information by valuers and the integration of relevant information within the asset appraisal to the extent an impact on value drivers can be documented. If sustainability is not reflected in the market, valuers are still advised to account for it in the risk assessment provided in their valuation report. More specifically:

- In the international valuation standard, “Sustainability and any client requirements in relation to green buildings” is listed as “Matters that typically need to be considered for specific investigation when undertaking a valuation » (IVCS, International Valuation Standards 2017, p97).
- In the RICS RED BOOK 2017, “Although not mandatory, valuers are also strongly advised to collect and record appropriate and sufficient sustainability data, as and when it becomes available, for future comparability, even if it does not currently impact on value » (RICS Red Book 2017 p 53) Although sustainability should only be factored into

[8] International valuation standards council (2016) IVS 105: Valuation approaches and methods

value where market evidence support its impact on market value, the red book recommends valuers to provide additional comment and strategic advice in their report : “Where appropriate, in order to comply with best practice in reporting, valuers are recommended to:

- assess the extent to which the subject property currently meets sustainability criteria typically expected within the context of its market standing and arrive at an informed view on the likelihood of these impacting on value, i.e. how a well-informed purchaser would take account of them in making a decision as to offer price
- provide a description of the sustainability-related property characteristics and attributes that have been collected, which may, where appropriate, include items not directly reflected in the final advice as to value
- provide a statement of their opinion on the relationship between sustainability factors and the resultant valuation , including a comment on the current benefits/risks that are associated with these sustainability characteristics, or the lack of risks and
- provide an opinion on the potential impact of these benefits and/or risks to relative property values over time.” (RICS Red Book, 2017, p. 138)

An increasing number of projects and initiatives tried to propose a framework to integrate sustainability-related information in valuation in a standardised manner. The table below (source : amended and completed from SBA 2015, Y. Kamelgarn Phd) provides an overview of the main references:

Reference	Date	Type	Country	Indicator	Key content
Environmental value added Masato Ito Sumito Motrust	2005	Project	Japan	Worth Market Value	Analysis of the added value from sustainability which is defined as the net income increase and the cost reduction between sustainable and non-sustainable properties. The use of environmental ratings is advocated as a support for the calculation of the added value. In particular, the project discusses possibility to connect real estate value appraisals to CASBEE rating system.
Value Beyond Cost saving Green Building Finance Consortium Muldavin, S. (lead author)	2006	Report	US	Worth	Suggestions on how to adapt existing appraisal methodologies such as the discounted cash flows to integrate sustainability issues transparently in the model inputs. It reaches beyond costs considerations (energy savings) to integrate broader impacts on value. On the whole, it reckons that no new methodologies are required but advocates a deeper understanding on how sustainability performances can affect tenants and how investors perceive the value of these features according to the market context.
The Sustainable Property Appraisal project. Ellison, L. and Sayce, S.	2004 -2007	Project	UK	Worth Risk	Appraisal system for investors. It consists in three separate tools: 1.a future proofing property questionnaire which sets a framework for investors to assess the risks

					associated with poor sustainability performance 2. the sustainability Appraisal Tool using the questionnaire results as inputs in a DCF 3. a pilot Sustainable Property Investment Index.
ESI-Property valuation Meins, E., Wallbaum, H., Hardziewski, R., Feige, A	2007-2010	Academic article	Switzerland	Worth Market Value	Proposition of methodology to integrate risks linked to poor sustainability performance due to future market shifts and regulation developments using a global adjustment factor called ESI. The ESI (Economic Sustainability Indicator) is constructed as follows. Property is rated against five key sustainability criteria. Experts' diagnosis on the potential impacts on value for different probabilised scenarios is used to weight each criterion. The resulting ESI Indicator is thus integrated in the DCF method in the discount rate as an addition to the property risk.
RICS Valuation Information Paper N°13.	2009	Valuation guidelines	Europe	Market value	Guidance note for valuers. It recommends valuers to integrate sustainability issues in their value calculations only if there is evidence reflected in the market.
Immovalue project	2008 - 2010	Project	Europe	Market value	The project inventories approaches and methodologies on how new developments such as EPC/EPBD as well as life-cycle costing (LCC) and analysis (LCA) could be integrated in property valuation.
Integrating Sustainability and Green Building into the Appraisal Process. Runde, T. Thoyre, S.	2010	Academic article	US	Market value	Proposition of a three-step valuation model for real estate valuers. First step consists in assessing the market uptake of sustainability (importance of sustainability topics for the different stakeholders in the market). Second step consists in analysing the subject property using a sustainability risk matrix provided in the article. The subject property is thus positioned according to its sustainability performance in relation to the market standard and uptake. Last step consists in monitoring the evolution of demand and supply of sustainable properties (resulting in sustainable property liquidity) over time.

Sustainability and Income- Producing Property Valuation. Austin, G.W.	2012	Academic article	North America	Market value	This paper provides a systematic practical procedure for evaluating sustainable property. The underlying principle is that appraisers should systematically collect information on sustainability-related features as well as market context so as to adjust traditional input parameters. The uncertainty associated with the procedure is then assessed through a sensitivity analysis using Monte-Carlo simulations.
RICS Sustainability and commercial property valuation. 2nde edition. Sayce, S., Quinn, F.	2013	Valuation guidelines	Europe	Market value	Guidance note for valuers, updating the note n°13 published in 2009. The guidance note encourages valuers to gather information on a sustainability checklist, assess their impact on value and integrate them in value calculation if reflected by the market and provide advices to their clients on sustainability issues beyond current market integration.
How to calculate and present deep retrofit value Rocky Mountain Institute. Bendewald, M., Hutchinson, H., Muldavin, S. Torbert, R	2014	Project	US	Worth	Guide providing practical guidance for owner occupiers as to how value deep retrofits beyond the mere costs savings. They define "Deep retrofit value is the net present value of all of the benefits of a deep energy or sustainability investment." Methodologies incorporate risks analysis and considerations to properly avoid double counting. Nine discrete value elements are considered: 1. Retrofit Development Costs 2. Non-Energy Property Operating Costs 3. Retrofit Risk Mitigation 4. Health Costs 5. Employee Costs 6. Promotions and Marketing Costs 7. Customer Access and Sales 8. Property-Derived Revenues 9. Enterprise Risk Management/Mitigation
Monte Carlo Cash Flows and Sustainability:Stein, M., Braun, W., Villa, M. S., Binding, V.	2014	Academic article	US	Worth	Cash flow model using Monte Carlo simulations to account for the decision-making process in front of different future scenarios. Various assumptions are tested for both costs and benefits of sustainability-related features through an integration into the different value input parameters.

Valuing green building certificates as real options. Vimpari, J. and Junnila, S.	2014	Academic article	Finland	Worth	The article proposes a methodology to assess green building certificates using real option and discounted cash flow (DCF) methodology. The added value of sustainability is evaluated using fuzzy analysis through experts' assessment of best guess, best case and worst case scenarios.
Sustainability Metrics: Translation and Impact on Property Investment and Management UNEP FI /PRI/IGCC	2014	Report	Europe	Worth	The report synthetises main practices as regards collection and integration of sustainability related information into investment and management practices, and makes recommendations on how to better use the data collected and better integrate it into investment decision-making process.
Sustainability issues in the valuation process of project developments. Fröch, G.	2015	Academic article	Europe	Market value	System to incorporate the economic benefits of sustainability into the valuation of real estate project developments. Using a catalogue of parameters, key parameters for the specific project development to be valued are identified. These parameters are then quantified by means of distribution functions and checked for interdependencies. This analysis is incorporated into the calculation of the market value and the internal rate of return. Results are communicated through distribution functions.
Sustainability thresholds generating value Sustainable Building Alliance.	2012-2015	Project	Europe	Worth Market Value	The project investigated what are the different types of value associated with sustainability performance and how they can be integrated into investment decision-making process and value appraisals.
Renovalue	2014-2016	Project	Europe	Worth Market Value	Training material for valuation professionals on sustainability features and their impacts on value drivers (rent, discount rate, capital expenditures, maintenance costs, etc.). The project stems in the belief that there is no automated formula to integrate sustainability into valuation process. Training valuers to account for sustainability as part of their daily assessment of buildings feature thus appears paramount.
Reflecting sustainability in property valuation – a progress report Milh, P. Lorenz D., Lützkendorf, T., Sayce, S.	2016	Academic article	Europe	Worth Market Value	The article analyses results from a survey conducted by the RICS on the extent to which valuers account for sustainability in their valuation practices. One of the main barriers highlighted in the availability of data.

Sustainable Real estate Invesment UNEP FI/ IIGCC/INCR/PRI/RICS…	2016	Report	Europe	Worth Market Value	This guide proposes a framework for different type of financial market players (direct investors, owners, indirect investors, advisors…) to better integrate ESG and climate risks into their decision making process.
EEFIG	2016	Project	Europe	Worth Market Value	The project gathers resources (toolkit) to better integrate energy efficiency into the value and risk appraisal as well as in the underwriting process for energy efficincy projects
The Future of valuations. RICS	2017	Valuation guidelines	Europe	Market value	The report synthetises key trends on the evolution of valuation practices. Among the main issues highlighted is the data collection including information on physical characteristics and sustainability performance of buildings.
Global Trends in Data Capture and Management in Real Estate and Construction. RICS	2017	Report	Europe	Worth Market Value	Using a survey, the report presents the key types of data that are currently being collected by financial market players. Data considered in the report are threefolds: physical building characteristics, environmental building performance, real estate transaction and investment
EeMAP Energy efficient mortgages Action Plan	2016-2019	Project	Europe	Mortgage lending value	This project aims to define and promote energy efficient mortgages. Three dimensions are investigated: how to define energy efficient mortgages (which physical indicators and data could be used) , how to appraise financial performance of energy efficient mortgages and how to foster deployment of energy efficient mortgages.
Green Tagging: Mobilising Bank Finance for Energy Efficiency in Real Estate Climate Strategy & Partners, UN Environment Inquiry	2017	Report	Europe	Loan value, credit risk	Using a survey of 10 European banks, the report presents how banks identify, analyse and promote green real estate. It shows that "green" is most commonly defined through energy efficiency and GhG emissions. It highlights the need for more analytical investigations on the links between financial performance of mortgages and energy performance, for a common building data database as well as for prudential regulation which account for green assets.

In most of these initiatives, DCF approach is presented as the valuation method the most adapted to account for sustainability related information as transparently as possible with the accounting of multiple effects on the different value drivers, as illustrated in RenoValue toolkit (Figure 6)

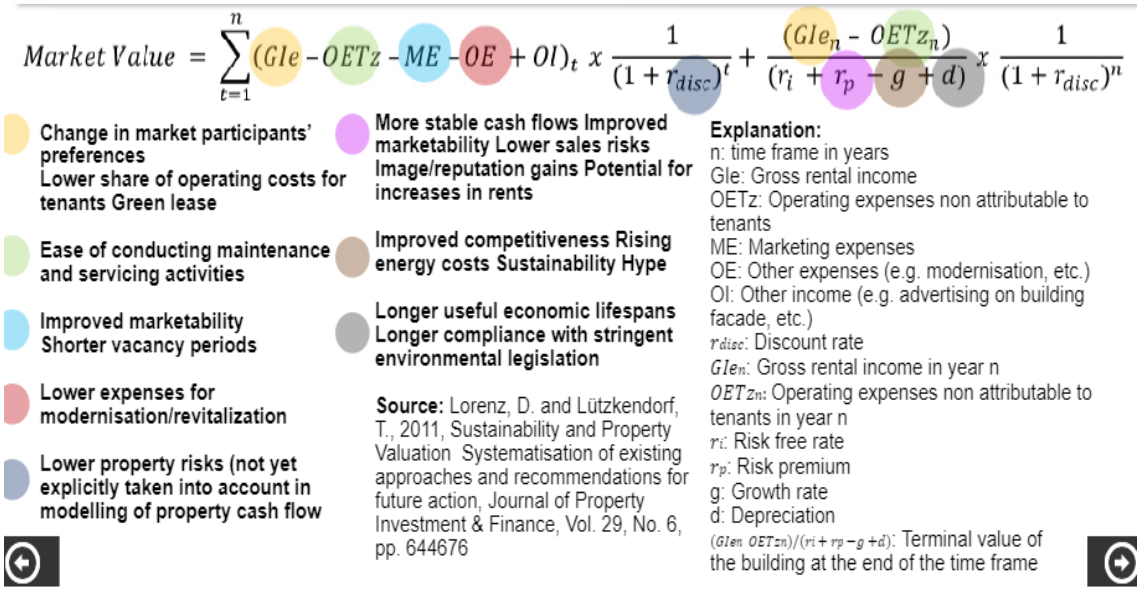

Figure 6 : integration of sustainability-related information in valuation using the DCF approach in the RenoValue training toolkit

Conclusions for application in the ALDREN project

Integrating energy, health and wellbeing information into valuation exercise appears as key for a better of sustainability-related features in decision making process. However, valuation exercises in particular as regards market value and mortgage lending value are standardised, and can only account for sustainability to the extent of its reflection by the market. Better highlighting those impacts and explaining how they influence market value driver is thus key. In addition, DCF approach appears the most straightforward methodology to do so since it enables for more transparency in the accounting of the multiple effects of sustainability-related information and performance into the various value drivers. To do so, the RenoValue project appears particularly relevant, and was thus selected as the recommended guidance to follow for the ALDREN project.

7.3 Sustainability and financing context

Climate and responsible finance is booming. Total issuances of green bonds in 2017 hit US$ 155 billion.[9] Simultaneously with the development of green financial products, banks and insurance companies start questioning the financial risks associated with the extra financial performance of their assets. The launch of Responsible Principles for the banking sector in November 2018 will further intensify this trend.

Banks can play a leading role in deepening the renovation of the building sector by promoting and providing financing for energy improvements. Banks and other financial market players may finance sustainability upgrades in the building stock through different means:

- mortgage transactions and other secured lending for the property
- specific loans for sustainability upgrades: this would occur for example when a owner asks for a loan to renovate its building.
- corporate lending and debt financing: owners may issue bonds to finance among other things their real estate portfolio. Sustainability-related features may be included in this bond issuance. This is typically the aim of Green Bonds.

Building energy and sustainable performance is of interest for banks and other financial institutions, to implement their responsible banking policy in the property sector and to better

[9] Climate bond Initiative 2018

assess financial risks associated with their loans. Lenders have a clear interest in better assessing the risks of their investment, including risks associated with energy, health and well-being performance.

Financing context and regulation

In the lending process, banks set the loan conditions according to the quality of the asset being offered as security for the loan and/or the capacity of the borrower to repay the loan and its associated interests. Following the financial crises, strict rules are set by Regulation (EU) No 575/2013 for banks to grant and secure loans and mortgages. In this regard, two main aspects are considered, as also illustrated in Figure 7:

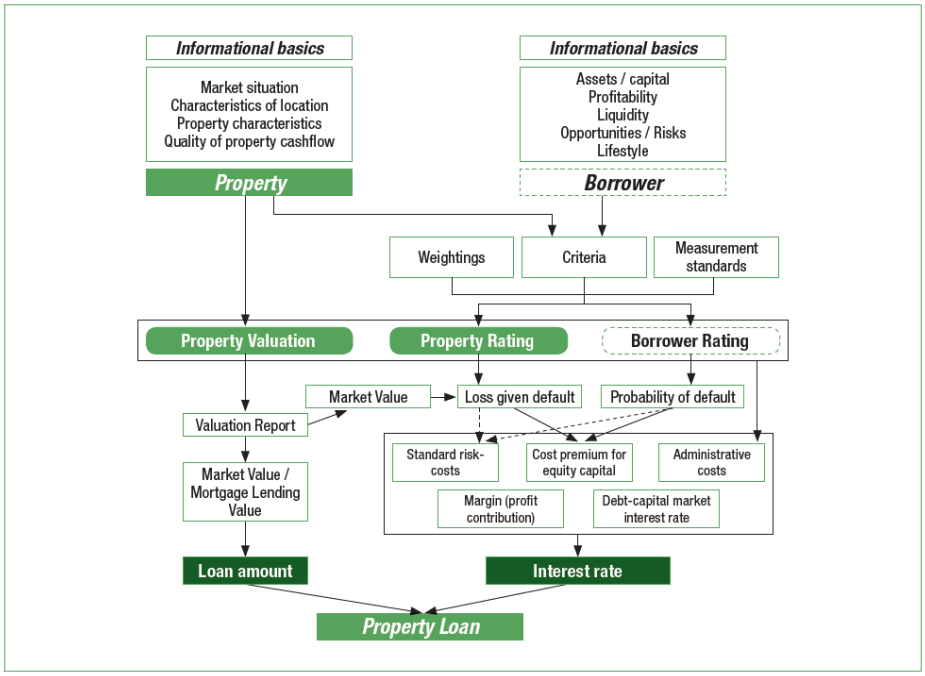

Figure 7 Financing conditions under the IRB approach of the Basel Accord (source: EeMAP)

- **Borrower valuation** for loan repayment and risk limitation (Article 208) : has an impact on probability of default, loss given default and consequently interest rate.
- **Property valuation** for loan securisation (Articles 126, 229) : has an impact on loan amount and loss given default (when property is used as collateral).

Two values are considered as relevant in Regulation (EU) No 575/2013 : market value and mortgage lending value. (see Table for definitions) Whereas Market Value is a 'mark to market' approach, Mortgage Lending Value is sometimes described as a 'mark to model' approach, as it is essentially a risk-adjusted figure taking into account perceptions of the long-term risk of the loan from the lender's perspective.

Table : Definitions of Market Value (MV) and Mortgage Lending Value (MLV) in different documents

Document	Market Value (MV)	Mortgage Lending Value (MLV)
EU Reg. No. 575/2013	Article 4 (76) of EU Reg. 575/2013 **'market value'** means, for the purposes of immovable property, the estimated amount for which the property should exchange **on the date of valuation** between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently and without being under compulsion;	Article 4 (74) of EU Reg. 575/2013: **'mortgage lending value'** means the value of immovable property as determined by a prudent assessment of the future marketability of the property taking into account **long-term sustainable aspects** of the property, the normal and local market conditions, the current use and alternative appropriate uses of the property.

The mortgage lending value and the market value are calculated independently of one another using different methods. One fundamental difference is that the market value refers to a specific date. By contrast, the mortgage lending value must apply “throughout the life of the lending” – normally for a period of many years. As a rule, the mortgage lending value is well below the market value. Even in phases of a prolonged property market downturn – which is not to be reflected in the mortgage lending value as it constitutes an economic fluctuation – it must not exceed the respective market value. To clarify the difference, the TEGoVA (The European Group of Valuers’ Association) states in its Blue Book that Mortgage Lending Value is understood by banking supervisors as a risk management tool where only long-term sustainable aspects of the property and no speculative elements shall be taken into account. This difference is illustrated in Figure 8.

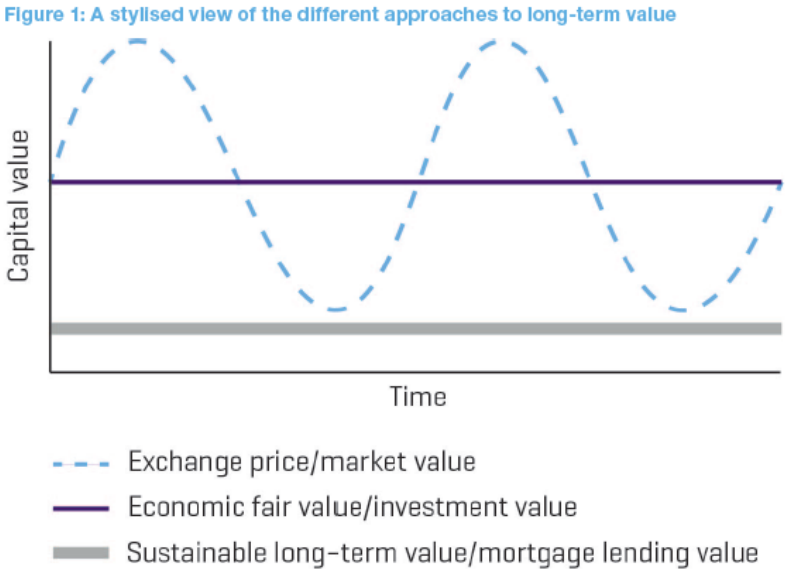

Figure 8: Illustration of the differences between market value, investment value (worth), and mortgage lending value

Focus on the EeMAP Project

The EeMAP project is a European initiative led by the European Mortgage Federation aiming to create a standardised “energy efficient mortgage” private system with preferential interest tates for energy efficient buildings. As opposed to ALDREN, it focuses mainly on the residential sector. However, it also more globally questions the impact of sustainability features, in particular energy efficiency, on credit risk. The review of the state of play highlights that currently banks and other mortgage lenders seldom differentiate their loans according to the energy performance of the underlying buildings. Investigating building performance from a risk management perspective is advocated with proposition to factor energy efficiency into credit risk assessment.

The main financing indicators considered in the EeMAP project are :[10]

- property valuation
- Market value
- Mortgage Lending value
- probability-of-default
- the loss-given-default
- the debt to income
- the loan to value

The assessment of the energy performance of the building in the EeMAP project is mainly based on the national EPCs, although various reports of the project cautions against a lack of harmonised standard across countries and discrepancies with measured performance. “ In its report review on the links between lending and green value, it is clearly stated : “There is no guarantee that an investment into energy efficiency upgrades will automatically lead to higher property values or higher rents. Yet the review on the state of play of valuing energy efficiency and wider sustainability aspects shows that, while no straightforward or automated formula to account for energy efficiency and wider sustainability issues in valuation exists, there are various ways of reflecting energy efficiency within the valuation process and in mortgage valuation reports.”

Synthesis of possible impacts of deep renovation on financing conditions

Deep renovation has impacts on the two aspects mentioned above: client valuation and property valuation.

As regards client valuation, the payment default risk, that is “the potential of a borrower or another counterparty to fail to meet it payment obligations in time, i.e. in accordance with contractually agreed terms “ (Basel Committee, 2000) is positively affected by the sustainability performance of building. A theoretical argument why owners and tenants of more sustainable (more energy efficient/green/better performing) buildings are less prone to default in their payments has been established by Pelizzon and Riedel (2017) within the EeMAP project16 building on recent literature. Hereby, a summary and extension of their argumentation to commercial building is given. On one hand, the financial status of the borrower will be affected:

- As has been shown in this report, the operational costs (energy bill) of an energy efficient building are lower, therefore the cashflow and the disposable income of the borrower are higher (EEFIG, 2017), which remains available for errands and unexpected events, etc.
- The financial stability is also underpinned by the fact that the costs are more predictable according to Burt et al. (2010).
- Furthermore, energy price fluctuations do not affect the operational costs of the building as much as those of the standard buildings.

As regards property valuation, energy efficiency improvement investments have a positive impact on the value of the property which is used as a collateral (see section 7.2 Sustainability and financial valuation standards)/

[10] EeMAP Annex 1 : valuation and energy efficiency checklist

7.4 Sustainability and risks appraisals

Different types of risks exist according to the types of events or circumstance: legal risks, political risks, environmental risks, market risks… Risk can be defined as ”an uncertain event or circumstance that, if it occurs, will affect the outcome of a programme/project” (RICS Guidance note on Risk management 2015). Risks assessments thus include investigating potential events that could negatively impact the project / operation. Main assessments methods include:

- first risks identification with the listing of risk sources and qualitative assessment of likelihood and potential impact
- second, risk rating with a classification of the level of risk against peers,
- third, risk quantification: once a source of risk has been identified, it is possible to quantify its impact using methods such as sensitivity analysis, simple three point distribution (worst, best and more likely scenarios) or Monte Carlo simulations (distribution assumptions on the input parameters) which assess the impact of an event on the cash flows and convey information on the uncertainty associated to the estimation.

Risks assessment in the financial context

Risk assessments are commonly used in the financial context, including net present value calculations and valuations, as well as prudential and accountability exercises.

Risk assessments are in particular required in the calculation of the discount rate used to calculate financial value in the DCF method. According to financial theory, the discount rate may indeed be calculated using the CAPM model (Capital asset pricing model) stating that :

$$ER_i = R_f + \beta_i (Er_m + R_f)$$

- ER_i is the expected rate of return of investment
- R_f is the risk free rate
- $(Er_m + R_f)$ is the risk premium associated with the market (the additional rate of return expected by investors when investing in the asset market rather than in the risk free rate
- β_I is the beta coefficient, corresponding to the volatility of the rate of return of the asset considered in the market considered.

In its simplified used, the discount rate used in the DCF calculations can thus be estimated as the addition of the risk free rate and a risk premium reflecting systemic risks associated with the type of market and specific risks associated with specific building characteristics and performance.

Risk ratings are also required in prudential regulations. The Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 had been put in place according to the scope Art. 1 lays down uniform rules concerning general prudential requirements that lending institutions (banks) shall comply with in relation to the own funds requirements relating to entirely quantifiable, uniform and standardised elements of credit risk, market risk, operational risk and settlement risk; requirements limiting large exposures; liquidity requirements relating to entirely quantifiable, uniform and standardised elements of liquidity risk; reporting requirements and to leverage, public disclosure requirements.

RICS guidance note on Environmental risks and global real estate

All these previous references mainly consider financial risks. Sustainability is considered in risks assessment specifically in Environmental Screening Reports as recommended in the RICS (2017) guidance note on Environmental risks and global real estate. This guidance note suggests a risk classification divided in High, Medium and Low. Based on checklist, the risks associated t to negative impacts on the environment is monitored. High risks Is achieved in case of poor management and/or non compliance with environmental obligation and/or risk of exposing hazardous chemicals to the environment

Sustainability risk rating in valuation context

Two main projects have proposed sustainability related risk rating in a valuation context (see table of initiatives above)

- the ESI (Environmental sustainability index) : a property rating against five key sustainability criteria based on experts' diagnosis on predefined items and weightings based on probabillised impacts on value. This ESI risk rating indicator is then used to adjust a standard value calculations.

- the sustainability appraisal tool : a a future proofing property questionnaire which sets a framework for investors to assess the risks associated with poor sustainability performance, which is then used as inputs to better inform valuation through DCF calculation.

None of these methodologies are widely acknowledged, and to the best of our knowledge they have not even be disseminated. However, they provide very interesting paths to explore to bypass the conundrum of having to better assess future impacts associated with sustainability while only reflecting market uptakes within valuations.

Conclusions for application in the ALDREN project

To bypass the limitations imposed by market reflection in the integration of energy, health and well being information into valuation exercises, a risk approach appeared particularly relevant. however, there is no standardised methodology to account for financial risk associated with sustainability and even few initiatives; developing a risk approach with a dedicated approach appears like an additional but promising endeavour for the ALDREN project, with the objective of a first simple indicator to be refined over time.

8. Annex 2: List of indicators for task 2.5

Category	Indicator		Unit	References
Costs	**Annual costs and revenues associated with energy**			
	Energy costs (whole building)	Annual cost and fixed and peak charges for energy including national taxes. **NB :** Energy costs for the whole building should be accounted for. This includes both energy costs paid with owners and tenants. If possible, specific energy uses such as data centre should be excluded from the perimeter. If relevant in the pricing, distinction between peak and off-peak prices should also be accounted for. <u>- Option 1 (</u>invoices can be collected): Yearly energy costs based on the average of the last 3 years historical data (to limit variability associated with weather conditions). Energy costs should include subscription, consumption and energy prices including all taxes. <u>- Option 2 (</u>calculations based on energy consumption) Calculation is based on the following formula : Subscription fees + energy consumption per energy carrier X energy carrier prices (including taxes) + additional taxes. If relevant, distinction between peak and off-peak prices should also be accounted for. Whenever energy simulations show impact on power required and energy consumption distribution, findings should be integrated into select the appropriate subscription fees and pricing.	€/m²/year	EN 15459-1:2017, Reg. 244/2012

	Energy revenues (whole building)	Annual energy revenues resulting from selling energy produced on site to third parties, including national taxes and tariffs. It includes selling energy back to the electric grid as well as heating and cooling networks. **NB :** Energy revenues for the whole building should be accounted for. - Option 1 (invoices can be collected): Yearly energy revenues based on the average of the last 3 years historical data (to limit variability associated with weather conditions). - Option 2 (calculations based on energy production) Calculation based on the following formula : Buy-back price for energy per energy carrier x energy carrier price (including taxes) + additional taxes or subsidies. When national legislation or operator has multi-annual plan for energy buy-back, forecasted feed-in tariff for the date of the assessment should be used.	€/m²/year	EN 15459-1:2017, Reg. 244/2012
	Annual other running costs			
	Operational cost	all costs linked to the operation of the building including annual costs for insurance, utility charges (water consumption, waste management...) and other standing charges and taxes. As regards utility charges, it includes subscription to utility services, taxes and other fixed costs in addition to metered charges according to water consumption/waste production. Building insurance includes policy premium for building damage risk (protection from natural disasters, theft, fire, vandalism. It excludes insurance of furniture and goods in the building - Option 1 (invoices can be collected): Yearly costs associated with water consumption and waste management. Annual cost for building insurance. Bu - Option 2 (lump sum ratios) Lump-sum based on comparable buildings	€/m²/year	

	Maintenance costs for HVAC systems	Annual necessarily labour, material and other related costs incurred to retain main building systems and components in a state in which it can perform its required functions .Maintenance includes conducting corrective, responsive and preventative maintenance on constructed assets, or their parts, and includes all associated management, cleaning, servicing, repainting, repairing and replacing of parts, where needed, to allow the constructed asset to be used for its intended purposes. The perimeter covered should be consistent with the perimeter recommended in the EN 15459-1:2017 standard : Building envelope and others building related systems covered by the EPB standards (Heating, Ventilation, Cooling, Domestic Hot water, Lighting, Building envelope, Electricity production). NB: Both component costs and labour costs should be accounted for. <u>- Option 1</u> (invoices or contracts with fees can be collected): Yearly maintenance and minor repair costs related to main systems based on the average of the last 3 years historical data (to limit variability associated with weather conditions). <u>- Option 2 (</u> detailed estimation) Estimation based on % of initial investment cost (component cost + installation cost) for each technical component categories. The use of the default values from NF EN 15459-1:2017 standard (as % of initial investment) is recommended for systems covered by the standard. <u>- Option 3 (</u>lump sum estimation) Estimation based on lump sums for comparable buildings	€/m²/year	EN 15459-1:2017, Reg. 244/2012

	Whole maintenance costs	Annual necessarily labour, material and other related costs incurred to retain the building and its component in a state in which it can perform its required functions. Maintenance includes conducting corrective, responsive and preventative maintenance on constructed assets, or their parts, and includes all associated management, cleaning, servicing, repainting, repairing and replacing of parts, where needed, to allow the constructed asset to be used for its intended purposes. NB: Both component costs and labour costs should be accounted for. NB : Maintenance costs for the whole building should be accounted for, either paid by the owner or the tenants. <u>- Option 1</u> (invoices can be collected): Yearly maintenance and minor repair costs based on the average of the last 3 years historical data (to limit variability associated with weather conditions). <u>- Option 2 (</u> detailed estimation) Estimation based on % of initial investment cost (component cost + installation cost) for each technical component categories. The use of the default values from NF EN 15459-1:2017 standard (as % of initial investment) is recommended for systems covered by the standard. For other maintenance costs (auxiliary, mechanical systems (elevators...), fittings, general cleaning, safety, external spaces maintenance) calculation should be based on the following calculation : OR labour hours X hourly wage within a year <u>- Option 3 (</u>lump sum estimation) Estimation based on lump sums for comparable buildings	€/m²/year	ISO 15686-5:2017, EN 15459-1:2017
	Renewal costs			

	Replacement costs (major components and equipment)	Substitute investment for a building element, according to the estimated economic lifecycle during the calculation period. Replacement costs for component or system include the periodic costs of component j at time LS n, 2LS n,… that correspond to the economic lifecycle of the component (including disposal of component j). The perimeter covered should be consistent with the perimeter recommended in the EN 15459-1:2017 standard : Building envelope and others building related systems covered by the EPB standards (Heating, Ventilation, Cooling, Domestic Hot water, Lighting, Building envelope, Electricity production). **NB:** Only major equipment and technical components replacements which can be recorded as capital investment costs should be considered. Other minor replacement costs should be registered in maintenance costs. **NB:** Both component costs and labour costs should be accounted for. Calculation should be based on the following stages : - investigate of state of deterioration of major building components and technical equipment in the following list : Building envelope, Windows and glazing, Internal walls and surface materials, Energy generation system, Heating and cooling systems, Ventilation systems, Other major technical equipment. - investigate age and remaining life duration - investigate future replacement costs and lifespan : periodic future costs should be calculated using inflation rates assumptions. - calculate associated net present value : future costs should be discounted to calculate their net present value. - annualize calculation period by dividing by the remaining lifetime of the building with the assumption of a building life of 50 years.	€/m²/year	Adaptation methodology partially based on ISO 15686-5:2017, EN 15459-1:2017
	Global costs			

	Global costs (Life cycle costs)	Sum of the present value of the initial investment costs, annual running costs and replacement costs (referred to the starting year) as well as disposal costs if applicable. Calculation should be performed using the methodology described in the ISO 15686-5:2017, EN 15459-1:2017 standards. It should include over the remaining lifetime of the building (assumption of 50 years): - energy costs - other running costs - periodic replacement costs - disposal costs NB: Construction costs are considered as sunk costs and should be omitted. Future costs should be calculated using appropriate inflation rates at the time they are incurred. They then should be discounted using a discount factor to calculate their net present value.	€/m²/year	ISO 15686-5:2017, EN 15459-1:2017	
Financial value	**Financial value drivers**				

	Market rental value	"Estimated amount for which an interest in real property should be leased on the valuation date between a willing lessor and a willing lessee on appropriate lease terms in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion." (RICS Red book 2017) Assessment completed by the valuer on the basis of the building appraisal and the market analysis. As recommended in the RICS Red Book 2017, "The valuer must also consider whether any sustainability factors that affect the valuation are likely to have altered." **NB:** Energy, health and comfort performance should be considered when investigating comparable buildings. In particular, after renovation, the following assumptions should be investigated further according to the local market conditions : - a proportion of the savings in operational expenses benefiting directly the tenants may be converted into an increase in the rent rental value increase (after reletting or lease renegotiation). The exact proportion of this increase will depend on the local market conditions. - a shift in the market target for the assets (for example from standard building to high end premises) resulting in a more important change in market rental value.	€/m²	Valuation standards, RICS Red Book
	Rental growth	Annual rental evolution either based on contractual agreement between the lessor and the lessee or assumptions based on market analysis forecasts.	%	Valuation standards, RICS Red Book

	Discount rate	The rate at which the forecast cash flow is discounted. It should account for the time value of money as well as the risks associated with the type of assets. It is advised to use the capital asset pricing model (CAPM) to calculate the discount rate, using both expected rates of return based on market yields analysis and the integration of a specific risk factor. NB : Energy, health and comfort performance should be considered when investigating the risks associated with the building.	%	Valuation standards, RICS Red Book
	Vacancy and commercialization costs	All the costs associated with the vacancy periods (duration to let, expenses when premises remain vacant..) and the commercialization phase (marketing expenses, letting fees…). NB : Energy, health and comfort performance should be considered. They can have an impact on the duration to let in particular.		€/m²
	Room price (hotel only)	Room price paid per guest in the hotel assessed in the protocol.	€/room/night	
	Standard and High end room price for similar hotels (hotel only)	Room price paid per guest in similar hotels	€/room/night	
	Financial value drivers			
	Market value	"The estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion." (RICS red book) Market value should be calculated using the DCF (Discounted Cash Flow) approach since this approach allows for the more transparency on how energy, health and comfort performance and more generally building characteristics impacts on the different value	€	Valuation standards, RICS Red Book Renovalue

		parameters. The valuation should be made in accordance with valuation standards. Valuation report should clearly state the assumptions used for the main parameters : - the number of years over which the DCF is calculated (min. 15 years). - the discount rate - the inflation rate(s) - the rent and market rental value - other revenues and expenses - letting fees and reletting duration - yields - the terminal /exit value NB: Energy, health and comfort performance should be considered when assessing the different parameters. In particular: - impact on the discount rate through their impact on risks and depreciation - impact on the rental value through the type of market segment, the passing on of a fraction of the savings benefitting the tenants on the rental value - impact on the other revenues and expenses through impact on both operational costs and renewal costs supported by the owner - impact on letting fees and reletting duration through attractivity of the asset for potential lessee - impact on yield through market attractivity, depreciation and obsolescence mitigation - impact on the terminal /exit value through the impact on renewal cost, depreciation and obsolescence mitigation.		training toolkit
	Investment worth	"The value of an asset to a particular owner or prospective owner for individual investment or operational objectives." The investment worth measures the benefits associated with the ownership of the building. It may thus take into account benefits which may not be fully reflected in the market analysis but are relevant to the owner.	€	Valuation standards, RICS Red Book Renovalue

		The investment worth should be calculated using the DCF (Discounted Cash Flow) approach since this approach allows for the more transparency on how energy, health and comfort performance and more generally building characteristics impacts on the different value parameters. Valuation report should clearly state the assumptions used for the main parameters : - the number of years over which the DCF is calculated (min. 15 years). - the discount rate - the inflation rate(s) - the rent and market rental value - other revenues and expenses - letting fees and reletting duration - the yields - the terminal value NB: Energy, health and comfort performance should be considered when assessing the different parameters. In particular: - impact on the discount rate through their impact on risks and depreciation - impact on the rental value through the type of market segment, the passing on of a fraction of the savings benefitting the tenants on the rental value - impact on the other revenues and expenses through impact on both operational costs and renewal costs supported by the owner - impact on letting fees and reletting duration through attractivity of the asset for potential lessee - impact on yield through market attractivity, depreciation and obsolescence mitigation - impact on the terminal /exit value through the impact on renewal cost, depreciation and obsolescence mitigation.		training toolkit
	Investment worth per floor area	Ratio per floor area of the previous indicator.	€/m²	
Externalities mitigation	**GhG emissions costs**			

and other benefits	**GhG costs**	Annual monetary value of environmental damage caused by CO2 emissions related to the energy consumption in buildings. CO2 emissions encounter effects of all greenhouse gases weighted with their global warming potential expressed as an equivalent to CO2 during a 100 year period (EN 15978). NB: Carbon price through the Emissions Trading System (ETS). Cost should be calculated as follows: Consumption of the various energy vectors X their carbon content (Value from the World Energy Outlook)	€/m²/year	ISO 15686-5:2017, EN 15459-1:2017
Renovation decision-making indicators	**Renovation decision-making indicators**			
	Renovation Investment cost	Investment cost required for energy renovation. Whenever possible, it is advised to only account for additional costs associated with the energy upgrades (compared to renovation with standard performance). It should account both for component purchase and workforce for their installation. Whenever renovation works undertaken results in vacancy costs, relocation costs and/or compensation costs to the tenants for the nuisance caused by the refurbishment works, those additional costs should be accounted for. NB : This indicator can be applied either for an energy renovation action or globally for the whole renovation package.	€/m²	
	Energy savings	Energy savings resulting from energy renovation. It should encompass all energy energy savings whether they benefit the owner or the tenants. NB : This indicator can be applied either for an energy renovation action or globally for the whole renovation package.	€/m²	

	Energy savings to investment cost ratio	Ratio of energy savings to renovation investment costs. NB : This indicator can be applied either for an energy renovation action or globally for the whole renovation package.	%	
	Global costs savings to investment cost ratio	Ratio of global costs savings to renovation investment costs. NB : This indicator can be applied either for an energy renovation action or globally for the whole renovation package.	%	
	Investment cost to investment worth ratio	Ratio of investment costs to investment worth after renovation. NB : This indicator should only be applied on whole renovation package to be relevant.	%	
	Investment cost to market value ratio	Ratio of investment costs to market value after renovation. NB : This indicator should only be applied on whole renovation package to be relevant.	%	

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ALDREN ALliance for Deep RENovation in buildings

Implementing the European Common Voluntary Certification Scheme, as back-bone along the whole deep renovation process