Assistant **B**uilding's addition to **R**etrofit, **A**dopt, **C**ure **A**nd **D**evelop the **A**ctual **B**uildings up to ze**R**o energy, **A**ctivating a market for deep renovation

DELIVERABLE 2.4

REPORT

FINANCIAL TOOLKIT – preliminary report – M19

(Task Coordinator) Knowledge Innovation Market **(KIM)**
University of Bologna **(UNIBO)**
RINA CONSULTING (**RINAC)**National and Kapodistrian University of Athens (**UOA**)
Cecodhas Housing Europe (**CECODHAS**)
Architects' Council of Europe (**ACE**)
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TU Delft Onderzoek voor de gebouwde omgeving (**OTB**)
Norwegian Institute of Wood Technology (**TRETEKNISK**)
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Sociedad Aragonesa de Gestión Medioambiental (**SARGA**)
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Author(s)	Isaac Matamoros (KIM), Steven Fawkes and Matt Pumfrey (ENERGYPRO)	
Co-Author(s)	Annarita Ferrante (UNIBO)	
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CONTACT: Project Coordinator Email: annarita.ferrante@unibo.it

Website: www.ABRACADABRA-project.eu

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INTRODUCTION

Retrofitting has been proposed as a method to significantly reduce energy consumption and emission derived from the housing sector. Having said this it remains clear that severe restraints remain; and the concept of a "one solution fits all" is at the very least unrealistic.

As it has been repeatedly supported via the Abracadabra project any potential solution must deal with significantly complex issues at technical, legislative and regulatory levels, and of course at financial and economic levels.

Considering that such renovations must be primarily supported by the owners themselves (either as individuals, communities of owners, or as businesses) it is evident that any process must ensure also the financial viability of the initiative.

Furthermore, the least dependent the proposed solution becomes on direct or indirect public support measures the more widely it can be implemented. The analysis of existing literature as well as the application of basic financial review has led to a preliminary (and in some cases self-evident) set of issues to be considered:

a) Significant renovations are costly and affect a variety of elements in any given housing unit (Façade, Roofs, Gaps, Floor, Renewable Energy Systems, HVAC and Electrical Systems).
b) If the reduction on the cost of energy consumed is insufficient to palliate the investment carried out it may be possible to see potential payback periods that greatly exceed the useful life of the investments. The report developed by the European Court of auditors on the "*Cost-effectiveness of Cohesion Policy Investments in Energy Efficiency*" is particularly devastating to this effect.

The Abracadabra consortium is well aware of these issues as well as their implications; and thus the work carried out on financial terms has focused not only in providing a financial tool to represent the needs analysis but rather to develop an framework that will have cost efficiency as a key consideration.

With this purpose in mind, the work carried out has considered the following preliminary findings before proceeding to the development of the toolkit:

a) The financial viability of a project within a reasonable time period is heavily affected by the existing level of energy consumption; this means that projects with a real and pre-existing low level of consumption may find it very difficult or even impossible to carry out a project in economically viable terms. The opposite of course also applies to initiatives with a very significant level of energy related costs. Simply put the higher the pre-existing cost the higher the potential savings.
b) Simplistic financial models have failed to deliver convincing results. It is therefore the intention of the present work to develop a comprehensive model that includes relevant items such as; detailed projections on; itemized energy prices (country by country basis and on type of energy source); national expected inflation levels; estimations on replacement costs based on the average useful life of the different renovated elements; maintenance costs; and specific loan conditions.

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This document is an interim outline of the development of the financial toolkit, which provides guidelines and tools, and outline process for relevant stakeholders to understand, assess and implement the financial assessment and viable processes required for the deployment of successful building renovation projects.

This toolkit includes an integrated and simplified cost assessment analysis that allows potential investors to carry out an estimation of the Return on Investment (ROI) and payback period for the different energy efficiency measures, a calculation of the Net Present Value as well as the new value of the building after the deep renovation with AdoRe.

The impacts of different regulatory incentives and/or barriers also are introduced in the calculation.

Contextually to the development of this tool the ABRA consortium has been working with project partners on:

1) An assessment of the current financial mechanisms and models that could be followed by stakeholders and investors interested in proposing a deep renovation through AdoRes
2) The development of a clear methodology for the development of AdoRes renovation projects that from a procedural perspective will have the financial model at the core.
3) To establish the viability of using an extension of the allowed constructed surface as a support in the establishment of retrofitting.

The financial toolkit was prepared under task 2.4, the main responsibility of which lies with KIM in the framework of work package 2, led by. The nZEB Toolkits and Policy recommendations tasks of the project (WP2) will run from month 2 to month 36.

An additional and very relevant functionality of the tool will also be one of carrying out a preliminary analysis of the different case studies involved and considered during the project.
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COST ASSESSMENT TOOL

During the Task 2.2 Feasibility studies and cost-analysis assessment implementation, a detailed economic and financial assessment on the case studies has been carried out based on a detailed financial analysis developed by using Net Present Value (NPV), economic indicators like ROI, income statements, debt service ratio, and so on.

A cost assessment tool has been developed by KIM in order to analyze different scenarios involving different hypothetical investors and financial schemes to assess benefits/barriers/constraints in each one of the case studies with the aim of providing a large spectrum of possible scenarios, while providing a scheme for the standardisation of the financial process.

COST ASSESSMENT APPROACH

The cost assessment tool allows potential investors to carry out an estimation of the return on investment and payback period required for the different energy efficiency measures that they consider, as well as the new value of the building after the construction of AdoRes.

During the reporting period, a beta version has been developed in order to allow stakeholders to compare different options; **3 "scenarios/renovation type"** have been made available. The user must select the option (scenario) of interest with an "X". The tool will provide an updated calculated payback period for the chosen scenario, as well as for the improved real state value of the building.

Variable	Pessimistic	Neutral (base)	Optimistic
Energy Prices	80%	100%	120%
Inflation rate	120%	100%	80%
Interest rate of loan	120%	100%	80%
Construction costs	120%	100%	80%
Average value of the new construction	80%	100%	120%

The following variables considered are **adjusted in the toolkit according to the respective inflation rate** of the selected country/region:

- The original real estate value of the building;
- The energy prices (the energy savings considered for the payback calculation are adjusted according to the inflation rate and maintenance costs);
- The cost of the works chosen for the retrofitting of the existing building;
- The interest rate of the loan.

To estimate the overall investment of the project, users must fill in **the relevant sections of the toolkit with the following inputs**:

- A cost estimation of the selected deep renovation intervention categories (euro/m^2);
- Expected increase in constructed m2 (as an implementation of the ADORE). This data may be provided on the additional m2 or as a percentage of the original size of the building.
- The average real estate value of the new AdoRes (euro/m^2)
- The **inflation rate** of the country or EU area taken into account (the actual version of the tool takes into account an average inflation rate).
- The replacement period in years for each of the selected intervention category.

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The cost per m^2/unit may be calculated by using different databases such as the ones listed in ANNEX 1

This is however not a recommended approach by the developers of the toolkit and it should only be used to provide very rough estimates. The use of **real construction quotes** or at the very least an estimation by a local architect should be applied.

Investment calculation

Existing Building

Category	Solution	Measure	m2 / Units	Installation cost per m2 or per unit	Total installation cost
THERMAL ENVELOPE	Structure	Roof structural repairs	1600	155,00 €	248.000,00 €
		Wall structural repairs	1200	23,00 €	27.600,00 €
		Foundation structural repairs	23,76	150,00 €	3.564,00 €
	Façade	External thermal insulation	671,84	42,00 €	28.217,28 €
		Internal thermal insulation	0	- €	- €
		Plinth thermal insulation	0	- €	- €
		Insulation of pillars and other thermal bridges	0		
	Roofs	Thermal insulation of Attics	500	30,00 €	15.000,00 €
		Thermal insulation of roofs	100	41,00 €	4.100,00 €
		Internal celing insulation	0		
		Awning and entrance roof repair	0		
	Floor	Floor insulation	0		
		Basement ceiling insulation	0		
	Openings	Replacement of entrance doors	0		
		Replacement of windows	671,84	23,00 €	15.452,32 €
INSTALLATIONS	Renewable Energy Systems	Installing RES	1	14.000,00 €	14.000,00 €
	HVAC	Heating system (local heating)	1	- €	- €
		Heating substation (district heating)	0	- €	- €
		Heat distribution system	0	- €	- €
		Domestic Hot Water system	0	- €	- €
		Ventilation system	1	23.500,00 €	23.500,00 €
	Electrical System	Lighting system renovation	40	50,00 €	2.000,00 €
				Total investment for existing building's renovation	381.433,60 €

ADORE

Category	Solution	Measure	m2 / Units	Installation cost per m2 or per unit	Total installation cost
THERMAL ENVELOPE	Adore Structure	Roof structural	200	155,00 €	31.000,00 €
		Wall structural	600	90,00 €	54.000,00 €
		Foundation structural	200	150,00 €	30.000,00 €
	Adore Façade	External thermal insulation	500	42,00 €	21.000,00 €
		Internal thermal insulation	100	35,00 €	3.500,00 €
		Plinth thermal insulation	100	41,00 €	4.100,00 €
		Insulation of pillars and other thermal bridges	100	37,00 €	3.700,00 €
	Adore Roofs	Thermal insulation of Attics	500	30,00 €	15.000,00 €
		Thermal insulation of roofs	100	41,00 €	4.100,00 €
		Internal celing insulation	0		
		Awning and entrance roof repair	0		
	Adore Floor	Floor insulation	200	41,00 €	8.200,00 €
		Basement ceiling insulation	0		- €
	Adore Openings	Replacement of entrance doors	2	500,00 €	1.000,00 €
		Replacement of windows	120	43,00 €	5.160,00 €
INSTALATIONS	Adore Renewable Energy Systems	Installing RES	1	14.000,00 €	14.000,00 €
	Adore HVAC	Heating system (local heating)	1	- €	- €
		Heating substation (district heating)	0	- €	- €
		Heat distribution system	0	- €	- €
		Domestic Hot Water system	2	1.500,00 €	3.000,00 €
		Ventilation system	1	23.500,00 €	23.500,00 €
	Adore Electrical System	Lighting system	10	50,00 €	500,00 €
OTHER	Yard General Costs	Estimated at 10% of costs			22.176,00 €
				Total investment for ADORE	243.936,00 €

The yearly cost of replacement refers to the costs associated to the accumulation of funds required to replace those elements of the retrofit once they reach the end of their useful lifespan. As some of the lifespans are quite lengthy, the values are adjusted to the applicable inflation rate (based on the available averages per country). As different materials based on their characteristics and quality will have different expected durations the tool allows the user to insert their own data on the basis of the specifications of the products or the expected durability of the action. It must also be stated that these costs are separate from maintenance costs, and must not be confused; actually if investment in maintenance is reduced two negative effects may take place:

- The reduction in the expected efficiency of the retrofit and adore elements.
- The reduction in the useful lifespan of the retrofit and adore elements.

NOTE: In the case that an overall quote is provided and not a detailed one, the calculation of replacement cost will have to be carried out on the basis of averages of their useful life-span.

The table below shows the basis of the calculation on the relevant replacement costs.

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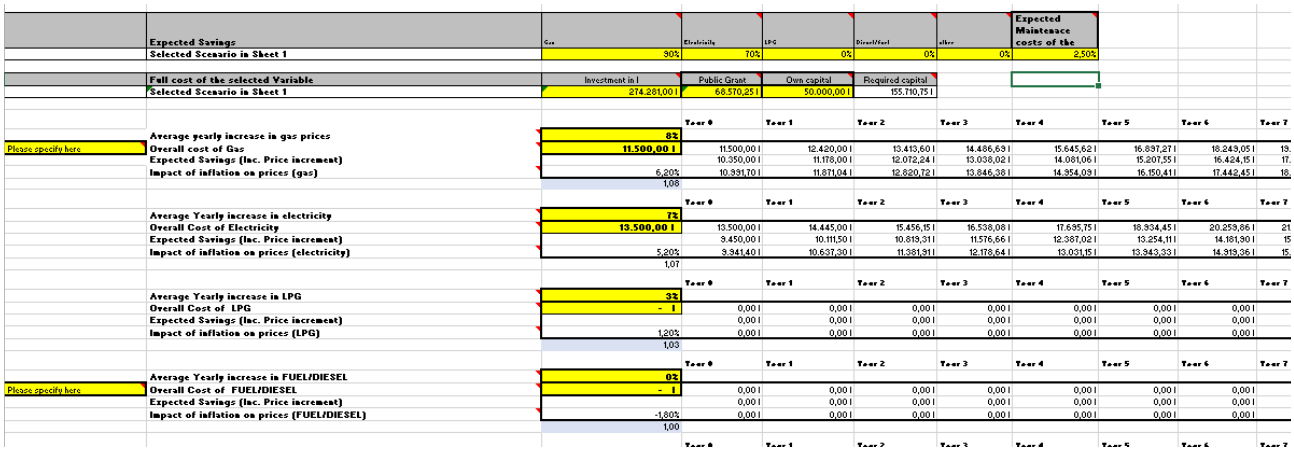
Category	Solution	Measure	Implemented	Lifespan in yrs	Yearly reserve	Inflation-adjusted cost
THERMAL ENVELOPE	Structure	Roof structural repairs	YES	20	- €	- €
		Wall structural repairs	YES	30	- €	- €
		Foundation structural repairs	YES	20	- €	- €
	Façade	External thermal insulation	YES	30	- €	- €
		Internal thermal insulation	YES	25	- €	- €
		Plinth thermal insulation	NO	25	- €	- €
		Insulation of pillars and other thermal bridges	NO	30	- €	- €
	Roofs	Thermal insulation of Attics	NO	15	- €	- €
		Thermal insulation of roofs	NO	15	- €	- €
		Internal celing insulation	YES	30	- €	- €
		Awning and entrance roof repair	NO	35	- €	- €
	Floor	Floor insulation	NO	25	- €	- €
		Basement ceiling insulation	YES	15	- €	- €
	Openings	Replacement of entrance doors	YES	15	- €	- €
		Replacement of windows	YES	15	- €	- €
INSTALLATIONS	Renewable Energy Systems	Installing RES	NO	30	- €	- €
	HVAC	Heating system (local heating)	NO	20	- €	- €
		Heating substation (district heating)	NO	30	- €	- €
		Heat distribution system	YES	15	- €	- €
		Domestic Hot Water system	YES	15	- €	- €
		Ventilation system	NO	15	- €	- €
	Electrical System	Lighting system renovation	NO	15	- €	- €

To determinate the **payback time** and the **new value of the building**, users shall insert the following data:

- The **total estimation of the energy costs per year** (excluding taxes and other expenses). These costs must be specified depending on the energy source (gas, electricity, etc) and could be estimated directly with the ABRACADABRA technical toolkit
- **Total cost of the renovation** (obtained from the technical toolkit)
- The financial **information related to the loan** (if required): interest rate, duration and starting year.
- The **expected energy savings** (in %) for each of the variables considered. They will need to know the expected impact of your renovations in your energy consumption as a percentage and per type of source used.
- The **original value of the building and the average real estate value per m^2 of the new construction**.



	Expected Savings	Gas	Electricity	LPG	Diesel/fuel	other	Expected Maintenace costs of the
	Selected Scenario in Sheet 1	90%	70%	0%	0%	0%	2,50%
	Full cost of the selected Variable	Investment in I	Public Grant	Own capital	Required capital		
	Selected Scenario in Sheet 1	274.281,00 I	68.570,25 I	50.000,00 I	155.710,75 I		

			Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
	Average yearly increase in gas prices	8%								
Please specify here	Overall cost of Gas	11.500,00 I	11.500,00 I	12.420,00 I	13.413,60 I	14.486,69 I	15.645,62 I	16.897,27 I	18.249,05 I	19.
	Expected Savings (Inc. Price increment)		10.350,00 I	11.178,00 I	12.072,24 I	13.038,02 I	14.081,06 I	15.207,55 I	16.424,15 I	17.
	Impact of inflation on prices (gas)	6,20%	10.931,70 I	11.871,04 I	12.820,72 I	13.846,38 I	14.954,09 I	16.150,41 I	17.442,45 I	18.
		1,08								
			Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
	Average Yearly increase in electricity	7%								
	Overall Cost of Electricity	13.500,00 I	13.500,00 I	14.445,00 I	15.456,15 I	16.538,08 I	17.695,75 I	18.934,45 I	20.259,86 I	21
	Expected Savings (Inc. Price increment)		3.450,00 I	10.111,50 I	10.819,31 I	11.576,66 I	12.387,02 I	13.254,11 I	14.181,90 I	15
	Impact of inflation on prices (electricity)	5,20%	3.341,40 I	10.637,30 I	11.381,91 I	12.178,64 I	13.031,15 I	13.943,33 I	14.919,36 I	15.
		1,07								
			Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
	Average Yearly increase in LPG	3%								
	Overall Cost of LPG	- I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	
	Expected Savings (Inc. Price increment)		0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	
	Impact of inflation on prices (LPG)	1,20%	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	
		1,03								
			Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
	Average Yearly increase in FUEL/DIESEL	0%								
Please specify here	Overall Cost of FUEL/DIESEL	- I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	
	Expected Savings (Inc. Price increment)		0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	
	Impact of inflation on prices (FUEL/DIESEL)	-1,80%	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	0,00 I	
		1,00								

After the inputting of the above-mentioned data, the toolkit provides the following **results**:

1. **New value of the building** by calculating the present value of the building, the NPV of the savings and the added value with the new construction of AdoRes.
2. **The Payback time based only in potential energy savings**, by taking into account only the cash flow income generated with the savings in energy bills.
3. **The Payback time based in potential energy savings and earnings**, by taking into account the cash flow income generated with the savings in energy bills and the value of the new construction.

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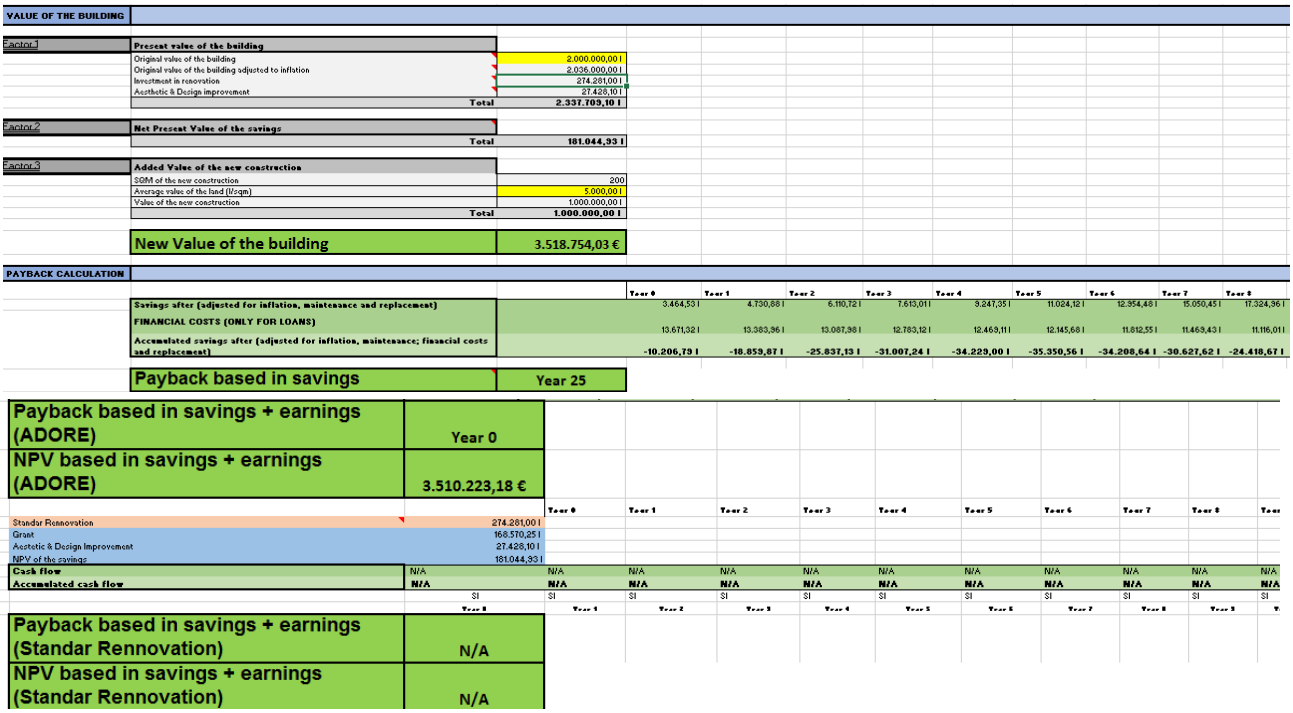
The tool allows users to evaluate and compare the different scenarios considering the results of the economical assessment and indicators described.



VALUE OF THE BUILDING		
Factor 1	Present value of the building	
	Original value of the building	2.000.000,00 €
	Original value of the building adjusted to inflation	2.035.000,00 €
	Investment in renovation	274.281,00 €
	Aesthetic & Design improvement	27.428,10 €
	Total	2.337.709,10 €
Factor 2	Net Present Value of the savings	
	Total	181.044,93 €
Factor 3	Added Value of the new construction	
	SQM of the new construction	200
	Average value of the land (€/sqm)	5.000,00 €
	Value of the new construction	1.000.000,00 €
	Total	1.000.000,00 €
	New Value of the building	3.518.754,03 €

PAYBACK CALCULATION		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
	Savings after (adjusted for inflation, maintenance and replacement)	3.464,53 €	4.730,88 €	6.110,72 €	7.613,01 €	3.247,35 €	11.024,12 €	12.354,48 €	15.050,45 €	17.324,36 €
	FINANCIAL COSTS (ONLY FOR LOANS)	13.671,32 €	13.383,96 €	13.087,98 €	12.783,12 €	12.469,11 €	12.145,68 €	11.812,55 €	11.469,43 €	11.116,01 €
	Accumulated savings after (adjusted for inflation, maintenance; financial costs and replacement)	-10.206,79 €	-18.859,87 €	-25.837,13 €	-31.007,24 €	-34.229,00 €	-35.350,56 €	-34.208,64 €	-30.627,62 €	-24.418,67 €
	Payback based in savings	Year 25								

Payback based in savings + earnings (ADORE)	Year 0
NPV based in savings + earnings (ADORE)	3.510.223,18 €

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year
Standar Rennovation	274.281,00 €										
Grant	168.570,25 €										
Aesthetic & Design Improvement	27.428,10 €										
NPV of the savings	181.044,93 €										
Cash flow	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Accumulated cash flow	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year

Payback based in savings + earnings (Standar Rennovation)	N/A
NPV based in savings + earnings (Standar Rennovation)	N/A

Financial costs

As is to be expected under any large scale project the retrofitting of a building is normally financed by the use of a mix of:

- Own resources
- Loans
- Subsidies

The task managers have therefore also included within the kit an integrated calculation of fixed interest rates loans.

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THE ONLINE ASSESSMENT TOOL (BETA VERSION)

Introduction

The objective of the online assessment tool is to provide potential users and stakeholders with a simplified version of the calculator.

It is the hope of the developers that this will provide a greater dissemination of the project results by making its results widely available and approachable.

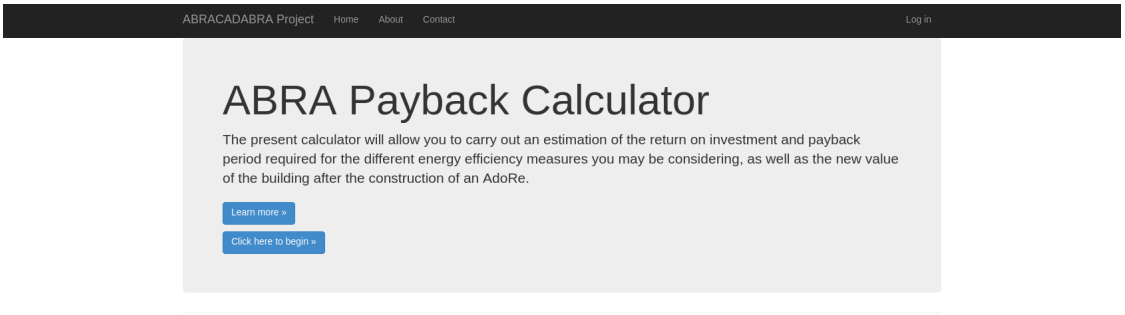
As with any BETA version significant testing must be carried out to ensure not only the functionality of the tool but also its user friendliness.

Presently the tool is being tested in several case studies, both real and fictitious, along the EU territory, and disseminated between different typologies of stakeholders, during the 4th National Meetings and also in the scope of Capacity Building activity carried out within the framework of the Barcelona's International Workshop (5th October), the cost assessment tool will be improved.

As a result of the feedback received, the aim of the online calculator will need be to more user friendlier and with better user experience.

Functionality

The operation of the BETA calculator follows a step-by-step approach. In the same way a user would normally respond to a questionnaire the tool requests from the user to introduce with basic data. At this stage it should also be pointed out that as it is the case with any forecasting tool a significant degree of leeway must be provided as many unforeseen factors may affect the final result. Nonetheless it must be underlined that the more accurate the data provided the more reliable the results will be.



Fase 1: Determining the nature of the project

The preliminary step determines one of two options.

a) The project in question is a standard retrofit (ie. Potential earnings will only come from the increase in the value of the building after its renovation and the derived energy savings),
b) The project in question follows the ADORE proposal thus deriving additional earnings (through AddOns) to the previously mentioned ones.

Evidently this initial choice will have a very clear impact on the final results.

Having said this it is also important to point out that, at the moment the regulatory framework does not mark clearly what would be the maximum allow size of these add-ons, the developers are

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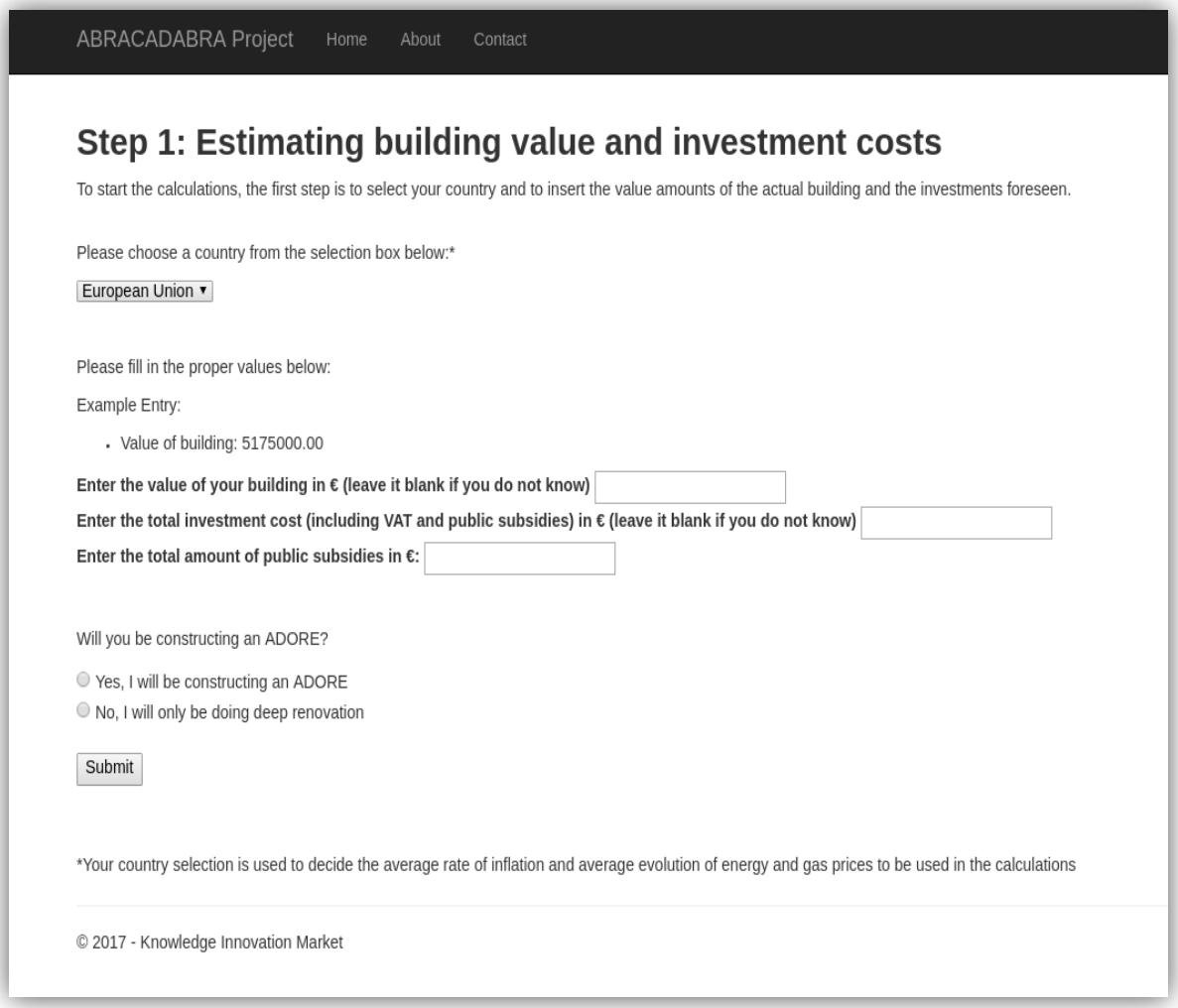
presently operating on an assumption of a 20% increase from the original size of the property. This is an element that will be reviewed and adapted as the projects results become available.

As it can be seen on the screenshot below the user is requested the following data:



A) **The location where the project will take place**: This item determines a number of very significant factors that are automatically calculated thanks to the extensive database regarding EU data in which the tool is supported. These factors are the projections on inflation and energy prices based on historical data on a country by country basis or in a EU average if so desired.
B) **The value of the building/flat/project on current prices**: Even though it would be possible to do a calculation based on average price per m^2 this was decided to be potentially too misleading due to the price variation even in a very small radius of a city could be very significant.
C) **The expected costs of the retrofit**: Even though the online tool can provide support in reaching an estimate of the cost (using as the basis for the calculation the existing and freely available databases on construction costs averages per type of retrofitting intervention) it is strongly recommended that the user should previously gather at least one quote either from and architect or a construction company. The use of "rough" estimates at this stage would have a very strong negative impact on the credibility of the final results.

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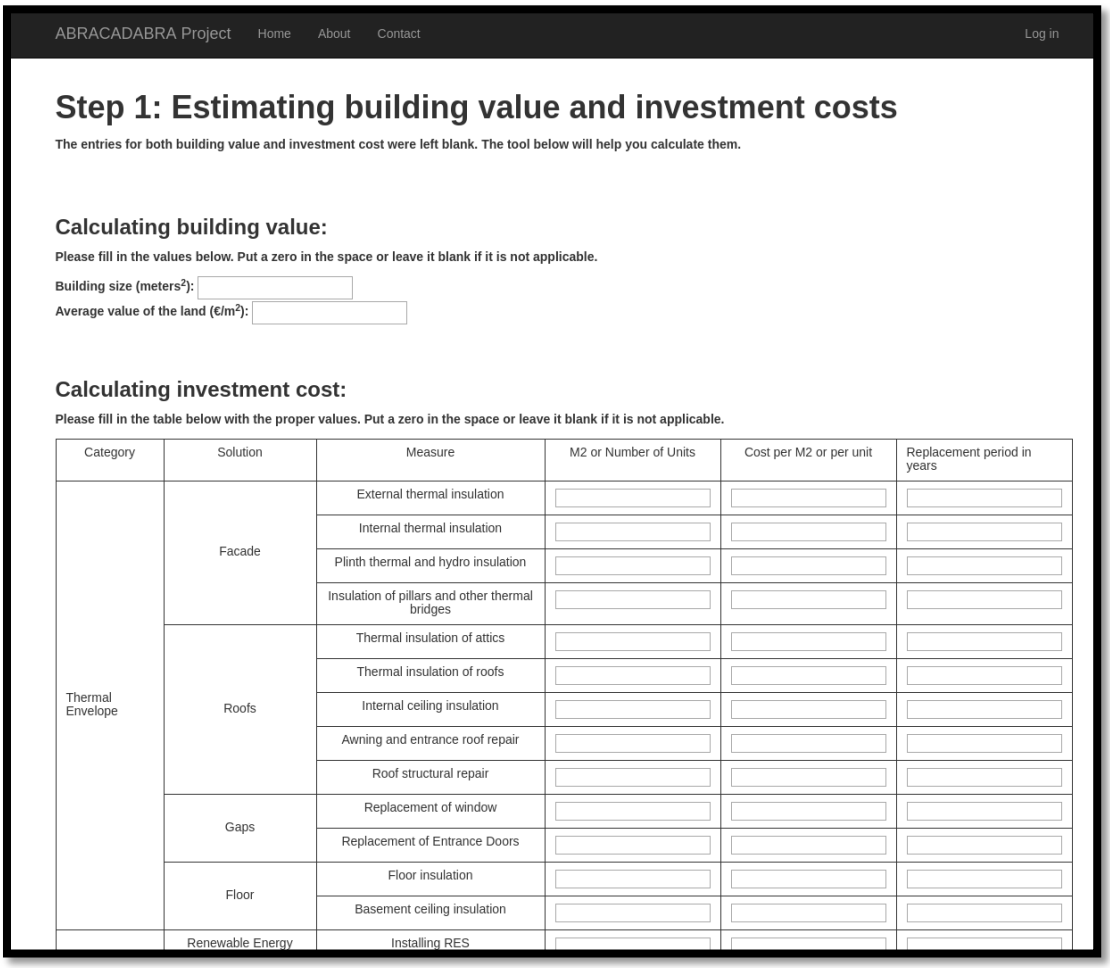
D) **Monetary value of any direct or indirect subsidies received**: As the typology; size and characteristics of any subsidies vary significantly across Europe. The user is requested on this online tool to simply provide a monetary value. Although this should be an easy task for some subsides provided directly as a percentage of the renovation costs, it could be considered as considerably more complex to calculate in the case the subsidy is given as an indirect support measure such as soft loans; tax breaks; etc. (in the case of indirect support the user must either put a value of zero, or provide and estimation in cash equivalent value).

As mentioned previously in the case that the user is unable to provide its own (and therefore more accurate) figures and applicable VAT the online tool will provide the support to carry out rough estimations on both the present value of the property as well an on the expected renovation costs; however this is not the preferred option.

The subsequent screenshot provides a visual representation of the aforementioned factors.



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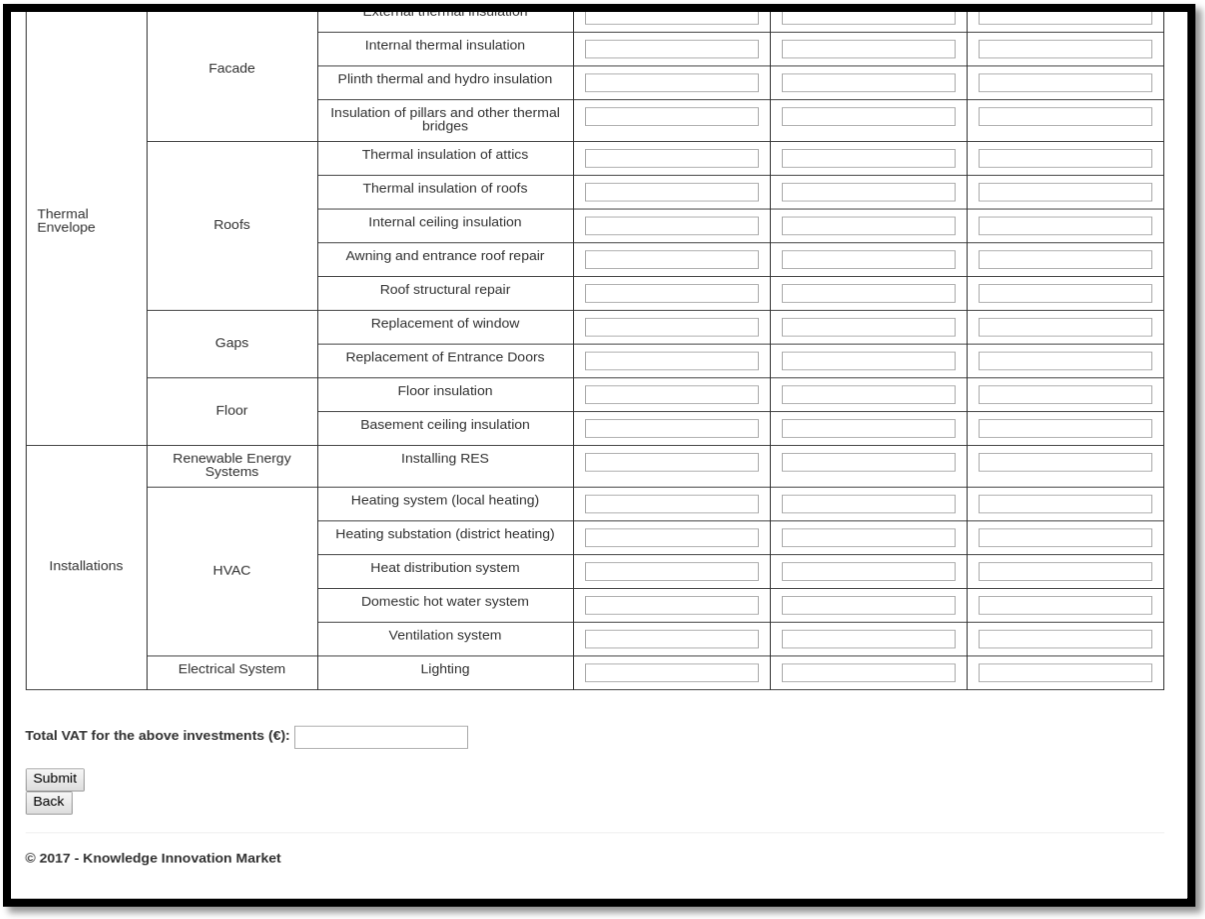

Thermal Envelope	Facade	External thermal insulation			
		Internal thermal insulation			
		Plinth thermal and hydro insulation			
		Insulation of pillars and other thermal bridges			
	Roofs	Thermal insulation of attics			
		Thermal insulation of roofs			
		Internal ceiling insulation			
		Awning and entrance roof repair			
		Roof structural repair			
	Gaps	Replacement of window			
		Replacement of Entrance Doors			
	Floor	Floor insulation			
		Basement ceiling insulation			
Installations	Renewable Energy Systems	Installing RES			
	HVAC	Heating system (local heating)			
		Heating substation (district heating)			
		Heat distribution system			
		Domestic hot water system			
		Ventilation system			
	Electrical System	Lighting			

Total VAT for the above investments (€):

Submit
Back

Fase 2: Financial Costs

The determination of the associated financial costs will have a very significant on the economic viability of any initiative. The online tool automatically calculates the cost of the loan (if applicable) on the basis of the applicable interest rate (assuming a fixed rate), the duration of the loan itself, the overall value and any applicable grace period.

However, there are exclusions carried out in this section such as any penalties for potential prompt or late payment of the loan.

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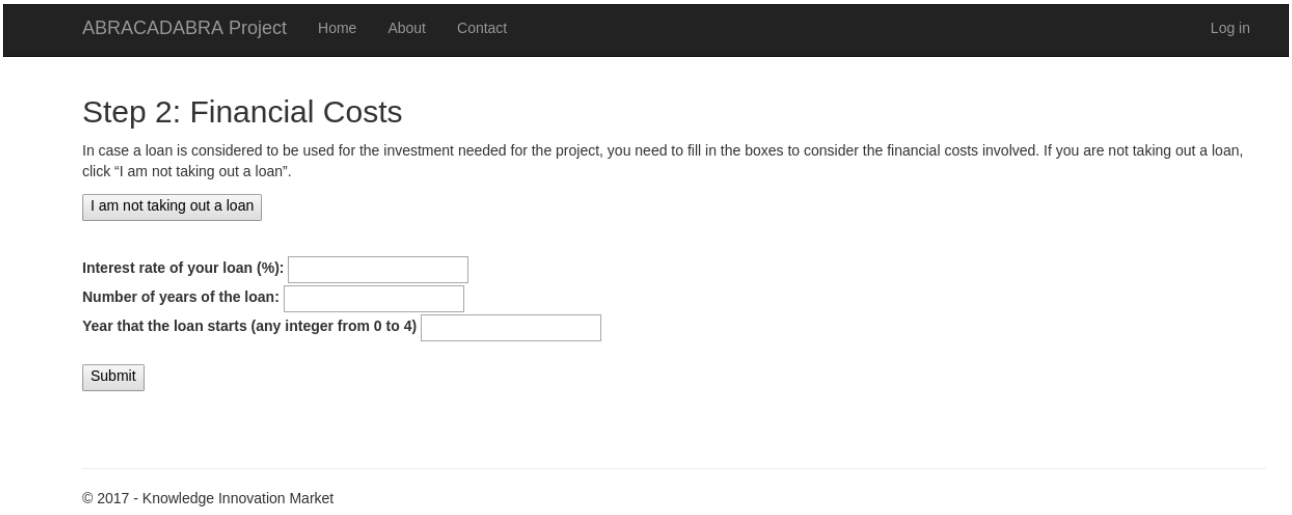

Fase 3: Energy costs and derived savings

The results and values that must be inserted in this section strongly depend on the technical analysis. As it was mentioned in the introduction of the present report the level of current state energy consumption of any project is very significant in determining the economic impact that a retrofit will have. According to Eurostat the average price paid by private households per kw/h in 2015 was EUR 0.211 per kWh. Thus assuming a reduction in consumption (HVAC) of approximately 85% it is possible to have a rapid understanding of how important providing very accurate figures on this section is; especially considering that whilst costs are real and present, savings after the renovation are in nature theoretical.

As an illustration of this let us assume 2 households each of 150 m^2 (As an indication EEA estimates place EU average at around 200 kwh m^2) one with high consumption and one with low consumption (this is a common case in EUROPE due to significant climatic differences)

With this data we can carry out a very rough illustration of the maximum annual potential savings:

1) **Low consumption level residential home:**
   a. Present energy costs = 100kwh/ m^2 x150m^2 x 0,21€ = 3150€ thus the maximum theoretical savings per year would be 3150€ x 85%=**2677,5€**
2) **High consumption level residential home**:
   a. Present energy costs= 300kwh m2 x 150m2 x 0,21€=9450€ thus the maximum theoretical savings per year would be 9450€ x 85%=**8032,5€**

The above illustration reveals quite clearly how the economic viability of a project would be strongly determined by the original level of consumption.

Thus in this 3rd step it is fundamental that as accurate values as possible are put forward by the user in the following fields

a) Expected maintenance cost of the renovation
b) Overall yearly cost of gas
c) Overall yearly cost of electricity
d) Overall expected gas savings as a percentage, and
e) Overall expected electricity savings as a percentage

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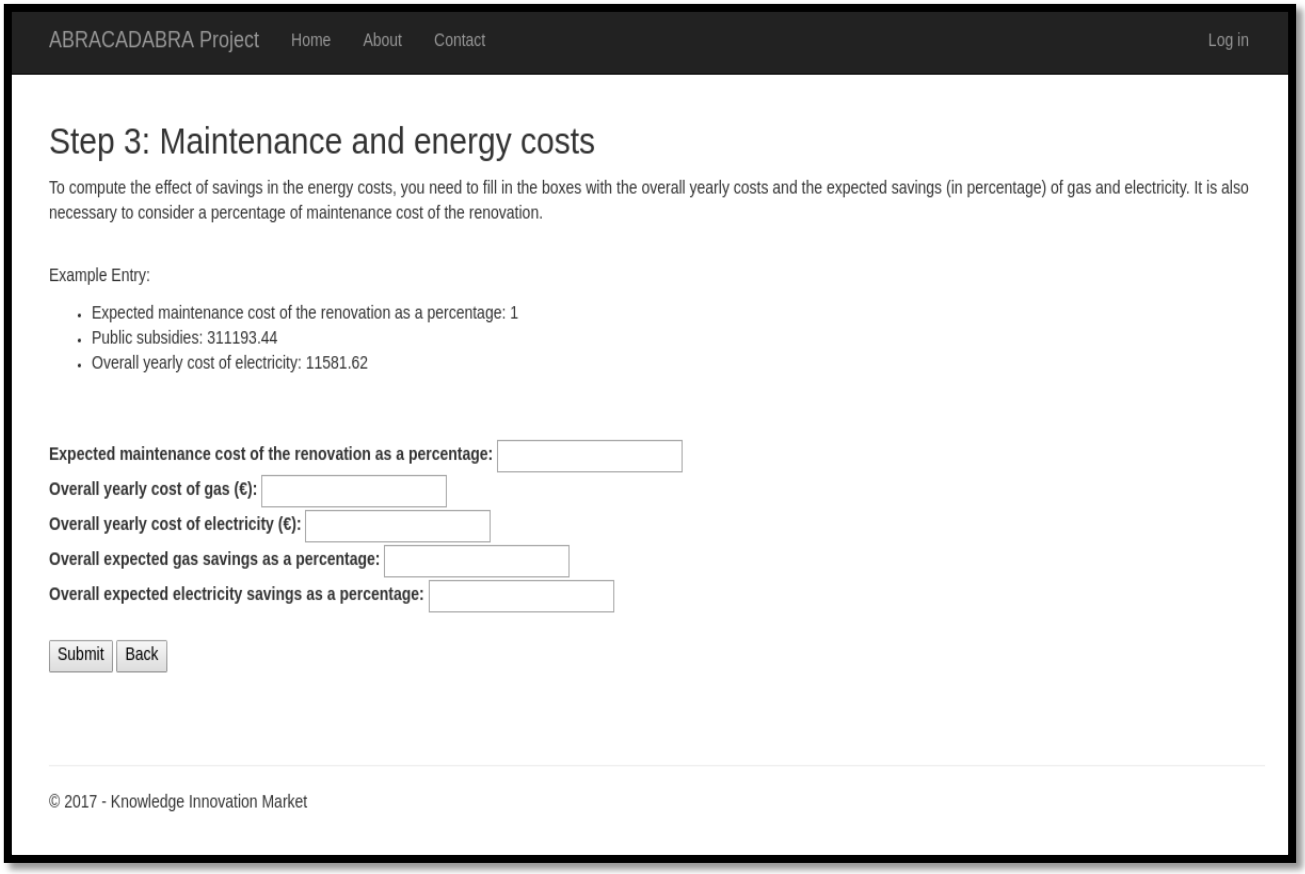
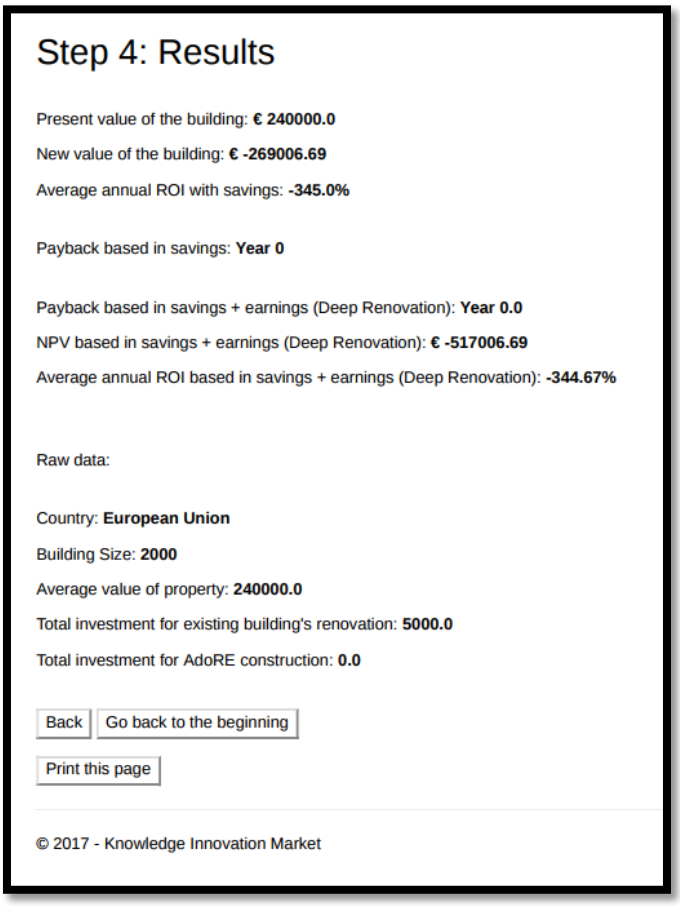


Fase 4: Results

The final step will provide the user with a set of results. It must be noted that although the extended (excel) tool different scenarios and projections may be easily generated, the same is not true for the online simplified version.

None the less; the result page will produce a mini printable report with the provided inputs as well as the key financial indicators such as the expected payback period; ROI; NPV etc.



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CASE STUDIES RESULTS

CASE STUDIES OF THE ABRACADABRA

Case studies have been and will be used to demonstrate the feasibility of the different scenarios in different European contexts. Consequently all selected case studies will be analyzed in their economic and financial aspect to obtain a model that will be combined with a risk analysis evaluation tool, to show to financial institutes and potential investors (e.g. developers, owners, etc.) the probability/entity of the risks, and calculate the economic value of the total assessed risk.

On the other hand, case studies will benefit of the results of the set of ABRACADABRA toolkits (Technical, Financial and Regulatory). Case studies have been and will be tested to analyse the possible volumetric Add-ons and Renewables (AdoRe) and the toolkits will provide specific answers regarding the potential of each type of AdoRes including technological solutions, potential energy reduction, potential economical booster to the investment and normative guidelines.

The case studies have been selected 7 selection criterion:

Geographical Component	Climate	Country
Regulatory Component	**Technological component**	**Environmental component**
Applicabiliy at discrict or higher scale	Innovative aspects	RES (types and numbers)
Standardisation/replicability	Durability of technologies/infrastructures	EE (types and numbers)
Residual urban capacity use	Maintenance	Adaptation and/or resilience
Legislative context influence	Duration of works	Armony with the context
Procurement	Design concept	Other Environmental Aspects
Social Component	**Financial Component**	**Property/Ownership Component**
User-friendliness and comfort (internal and external)	Innovative schemes and leverage factors	National ownership
Participation	Use of Funds	Regional ownership
Accessibility	PPP	Local Government ownership
Social analysis	Break even, ROI...	Social Housing ownership
Public image	Other financial elements	Private Property

In addition to the 10 initial case studies, we are looking for 40 more case study buildings, which are planning an energy renovation.

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In this sense, future webminars and International Capacity building sessions will give us the chance to collect new case studies directly from participants.

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MAIN RESULTS

The Abracadabra project is based on a set of basic technical; regulatory and financial assumptions. In summary the project has as its starting point that:

a) Some of the projects and case studies will show the technical possibility to increase their constructed area.
b) That the relevant regulation could be modified not only allow for this increase in built area but also that "adore" (intensive energy efficiency actions) may be a reward for those developers that invest in the renovation of pre-existing housing with a clear and effective energy efficiency aim.
c) That housing renovation towards energy efficiency can be viable in economic terms thus encouraging investment and the development of "bankable projects"

It is however important to point out that he consultations with stakeholders as well as the execution of the tasks foreseen in the project have led to a number of significant preliminary results and potential conclusions. These may be summarized as follows.

1. Residential private use can in some cases represent only a fractional part of the total consumption and emissions (e.g. in the region of Andalucía this has been estimated around 9-10% of the total).
2. The average (Eurostat) energy consumption and kw prices an average European 4 person household would spend around 1300€ per year in energy (6200 kwh excluding fixed costs, taxation and fees at an average 2015 price of 0,21€ kwh)
3. A deep renovation of a building towards NZEB (considering; envelope, HVAC, lighting and energy) may easily exceed 450€ per m2. Thus the cost for a private dwelling of 100m2 would be 45000€ plus VAT (54450€ tax included). Even if we assume that the result of the renovation would be a reduction of 90% of the energy consumed it would still take (assuming present prices) around 45 years to recuperate the investment. In other words above the useful life of most of the components in the renovation.
4. Abracadabra shows a potential alternative to this situation by generating (when regulatory, technical and financial conditions allow it) a potential additional source of income to offset the carried out investment. More specifically the conditions to be met are:
   - **Regulatory:** That an increase in the overall built surface is allowed by the relevant authorities.
   - **Technical:** That it is technically viable to build an extension or add-on.
   - **Financial:** That economic conditions such a significant spread between renovation costs and per m2 prices, and/or the existence of significant subsidies our other financial measures to incentivize such actions.

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PRE-EXISTING FINANCIAL MODELS

A key part of the ABRA project is the identification and review of potential financial models that could be used for the deployment of projects using the AddOns and/or the AdoRes proposed structures, collectively known as ABRA projects.

From the first stages of the project it has been clear that to have a chance of developing a new and innovative readily replicable financial model specifically for the deployment of ABRA projects would be close to impossible. The financial stakeholders within the ABRA project have thus been focused on looking at the possibility of utilising current financial instruments being used within the investment community where ABRA projects could be funded utilising these models and mechanisms.

In the current climate the financial community is certainly more interested in the opportunities that the climate change agenda is bringing, however it is important to recognise that despite the public commitment of a number of financial institutions the development and deployment of any project needing investment will be judged on the risk and return profile of that particular project. Furthermore, each financial institution will have different risk and return criteria as well as market segment and geographical criteria. Without a clear understanding of these it will be very difficult to get the financial institution engagement required to deliver projects using the ABRA technique.

NZEBS TOOLKITS AND POLICY RECOMMENDATIONS

Within Work Package 2 there is a clear process of works that have been running concurrently over the last 18 months, but ultimately the final detail for the final tool kit and report will be dependent on the cascade of information that is required from other parts of the project that will influence and feed into the final report and financial tool kit.

Through the first 18 months of the project the main focus of the partners involved in the financial work package has been the design, development and release of a draft financial model that could be sense checked and ultimately used by those actually developing ABRA projects on the ground. The working model aims to be a tool that can be used by project developers where all relevant financial information related to the physical deployment of the project is assessed and modeled into working templates. The aim is for this information to provide the detailed financial analysis of the project to firstly determine if the project is viable and secondly to provide 'bankable' information for the financial stakeholders being approached to fund the project.

Aligned to the development of this model Energy-Pro has been working with project partners on two further key areas. Firstly, an assessment of the current financial mechanisms that could be used by developers using the ABRA model and secondly the development of a clear methodology for the development of ABRA projects that from a project perspective will have the financial model at the core.

FINANCIAL MECHANISMS

From the outset it should be made clear that the development and deployment of projects impacting the energy and energy efficiency of buildings have been taking place for many years, although not necessarily just purely focused on the energy component of a building. But as a result, there are currently deployed models and financial institutions that have an understanding and potential appetite for investment into energy and energy efficiency projects within the built environment. Indeed in 2016 the investment in energy efficiency projects increased by some 9%

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globally to approximately $231Bn, however this is just the tip of the iceberg of the many trillions of dollars/Euros that will have to be invested in global housing stock in the coming years if we are to get close to and deliver the climate targets agreed in Paris.

One of the areas that needs to be understood and addressed within the development and delivery of building energy efficiency projects, and that the financial tool kit aims to help address, is the differences in 'language' between the energy and financial sectors. The two sectors are obviously quite different in their operation and as a result could be seen as insular in their methods, drivers and goals in respect to evaluating projects. An important part of the financial tool kit is to provide an understanding of this difference and also to provide a methodology that all parties can follow that helps to overcome this language gap and ensure that all parties understand each others perspective as the project moves forward. By doing this it should be possible to create a tool kit that enables project stakeholders to work through a clear methodology using the same process to ensure they all understand, agree and work towards a clearly defined set of outcomes that meets the requirements of all parties and ensures a project has the greatest chance of being a success.

The Financial Tool kit that is being developed will clearly lay out the process flow that should be followed that will help address respective stakeholder areas within the design, development and completion of any project. The main steps are outlined below.

Ultimately monies being invested in energy efficiency or through AdoRes type projects come in two distinct types;

- debt financing
- equity financing

At the core of the requirements for both of these financial structures are the 'return on investment' and the risks associated with gaining these returns and how these risks can be mitigated. Within the financial tool kit these risks will be detailed and how they could be mitigated and / or controlled through the project life will be a key for financial investors.

Obviously the specific issues faced by those developing ABRA projects in their specific country or region and the type of project being developed may vary and it would not be possible within the scope of the ABRA project to list all specific risks. But by providing an appropriate project methodology it should be possible for all those at the coal face to work through a process to identify and mitigate risks accordingly.

Alongside this process EnergyPro are developing and will be providing clear assessments of the types of investment vehicle and how applicable these could be for organisations looking to develop ABRA type projects. These financial mechanisms will include those funding levers used at the start of a project, through to longer term investments mechanisms traditionally put in place through the operational phase of a project(s).

The financial mechanisms that are currently being assessed for the ABRA project and those that will be detailed within the final financial too kit are as follows;

- Financial instruments – such as EIB PF4EE
- Property loans – both commercial and residential
- Consumer loans – both secured and unsecured
- Specialised energy efficiency funds – such as LEEF, EEF, BEERS, Susi EE Fund, Eiffel Energy Transition Fund
- Property funds – specialising in energy efficient buildings such as Credit Suisse EU Climate Value Property Fund

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- Green Bonds
- Forfeiting Funds – e.g. Latvian Baltic Energy Efficiency Fund

These are more traditional funding types being assessed for their ability to be used within AdoRes projects and this detail will be provided in the final financial tool kit.

Alongside the traditional financial instruments that have been used in the energy efficiency and property sectors there are some interesting and innovative financial mechanisms being created globally. It is important to note that these models have taken a significant amount of time, resources and often political will to gain any form of traction, but these models may be relevant for ABRA and will be outlined within the final financial tool kit as potential mechanisms for ABRA projects. The most promising ones related to ABRA are;

- PACE – the property assessed clean energy programmes that have been deployed in America where the local authority has the ability to recoup monies from the property owner to cover the costs of capital deployed within energy efficiency retrofit activity. A programme to bring this to the EU is currently being developed.
- On Bill Recovery – a model that was pioneered in the US, but has been used in the UK within the Green Deal. Whilst the Green deal was not a direct success the mechanism of using the energy bill to collect monies in relation to invested energy efficiency activity is still valid.
- Warehouse for Energy Efficiency Loans (WHEEL) – created in the US by the Pennsylvanian Treasury to aggregate unsecured residential energy efficiency loans that has issued a $12.8m Green Bond backed by $16m of loans. A very small instrument, but a potentially important piece of the financial jigsaw within the energy efficiency sector.
- Green Mortgages – these are the most recognisable and relevant new financial instrument for organisations pursuing ABRA type projects. They are started to be offered and are based on the assumption that more efficient properties have higher asset values and lower bills that imply a lower risk of default.

Even with these offerings it still does not remove the need to follow a specific methodology for the deployment of funds into ABRA type projects. Further information will be provided within the final financial tool kit.

FINANCIAL TOOL KIT METHODOLOGY

The development of any project within the property sector, regardless of whether it is straight development or an energy focused development as ABRA is, a clear methodology must be followed to provide the greatest chance of a successful outcome. By using a clear road map that all stakeholders buy into it is possible to maintain control on costs and ensure that transactions can be completed speedily and within budget.

The Financial Tool kit will have relevance to a broad range of stakeholders, including but not limited to:

- Project originators / developers
- Landlords / building owners
- Regeneration teams
- Design professionals
- Construction
- Financial / investor community
- Planning personnel
- Vendors

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A key component of the financial tool kit will be to provide a very clear process that project stakeholders will utilise to ensure that all parties are clear and understand their requirements, in terms of data and documentation that is required through the process. Through this methodology it will ensure that financial institutions access the right information in a timely manner and all parties are clear about the commitments they are making within the proposed project.

Within the first phase of any project it is vital that all relevant baseline information is captured and verified prior to being fed into any financial model. The use of Best Practice documentation will be detailed within the financial tool kit to ensure that relevant data is sources from stakeholders that is validated and clearly categorized and presented to the model to ensure that the highest level of transparency and accuracy is used throughout the financial assessment.

In this way it is then possible for the investor and developer to interact in a positive way and ensure that both parties understand each other requirements in relation to financial matters, governance, process, risk appetite, risk mitigation and returns threshold. With this 'language translation' the financial tool kit will ensure that all parties understand the requirements of each other. Something that is often missing in current energy project development.

EXAMPLE BASELINE INFORMATION REQUIREMENT

To understand the financial viability of a proposed ABRA project the following examples of information would be needed within the first phase of a project to ensure that the viability of a project is closely assessed through this first phase:

- understanding and quantifying the potential revenue uplift from ABRA deployment on a property
- quantifying the asset value uplift from increased revenue
- quantifying the value uplift from improved operational and energy efficiency of property
- quantifying (if possible) the increased aesthetic of the property
- quantifying as accurately as possible the capital costs of project design, infrastructural costs, site downtime cost etc
- quantifying the costs associated with contract development and execution, finance, insurance etc
- quantifying ongoing costs of monitoring and tracking financial improvements within the project site
- quantifying O&M plan and the potential value these savings can bring
- any other quantifiable benefits the development may bring to key stakeholders

By working methodically through this process, it should be possible to ensure that all relevant financial information is sourced early in the project so that financial institutions have the information they require to start their Underwriting process.

THE UNDERWRITING PROCESS

Underwriting is the formal process is where investors analyse the risks, uncertainties, technical feasibility and the financial inputs to make an investment decision. By utilising the methodology outlined above it should be possible to provide the relevant validated information in an agreed standardised format that will enable investment questions to be raised and decisions to be made more easily. The information will feed into a suite of documents that any typical project would require. These could include:

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- preliminary risk assessment, including;
  - capital cost risks
  - delivery risks associated with contractor, delays etc
  - performance risks from technical / design failure
- feasibility study
- project financial forecast and/or cash-flow model
- financial documentation, such as loan/equity agreements
- structural documentation, such as shareholders agreements for potential SPV
- performance guarantees / warrantees
- credit worthiness
- government permits / licences
- insurances

All the above areas will have uncertainties and the aim of the standardised process that will be detailed within the financial tool kit will be to ensure that these risks are identified and quantified as early as possible and where possible mitigation strategies put into place that ensure projects that go ahead have the greatest chance of a successful outcome.

SUMMARY

In summary the proposed financial tool kit that is being developed through the ABRA project will:

- provide a critical path that all parties should understand, buy into and utilise through the projects development, deployment and operation phases
- will ensure that all parties are 'speaking the same language'
- enable project viability to be quickly assessed
- ensure transaction costs and time is minimised
- ensure all relevant information is drawn together and validated to provide investor confidence not only in the project, but also in the stakeholder's ability to deliver.

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NEW AND INNOVATIVE FINANCIAL MODELS

It is important to understand when looking at and / or appraising new and innovative financial models that the same basic rules of finance apply in the background, regardless of the financial mechanism being used. Whilst there are some examples of new financial mechanisms coming to market, such as on-bill recovery, the basic financial rules still requires a clear assessment of the risks and returns profile, whether or not an uplift in asset value is part of the financial equation or not.

The levers behind any financial model and instrument can only be pulled by either the financial institution itself, or by central / local government in relation to tax or grant incentives being put in place to drive any particular agenda.

As outlined above there are some interesting and innovative financial mechanisms coming to market that may have resonance with organisations looking to utilise the ABRA model. How applicable they truly are in Europe may be dependent on the country they are looking to be deployed in and the specifics of that particular market in respect of the areas the ABRA project is focusing on. Some examples of funding structures and mechanisms have been outlined below, and where they have been implemented regardless of whether they were a success or failure learnings can be taken from them by ABRA partners.

PUBLIC FUNDING INITIATIVES

Within the public sector there are two main areas of investment, the social / public housing area and wider public sector buildings, such as leisure facilities, libraries and offices. Within this second group the increase in potential asset value is not as important as in the private sector as the buildings tend not to be being prepared for sale. Central government funding or funds developed within the private and/or public sector tend to be purely focused on energy efficiency outcomes rather than broader asset uplift. As a result ABRA projects will have to focus on broader operational benefits, such as building quality and increased rentable space, rather than asset uplift.

The local authority run housing sector is an area where the ABRA concept should be more relevant. Public sector housing in much of Europe tends to be run directly by the public sector itself, however in some countries, such as the UK and the Netherlands, social housing groups have been created to oversee the operations and management of these public sector assets.

One of the key issues within the public sector is the tendency to follow the lead of other bodies, even when schemes have not been that successful and as a result lessons are often missed.

The Green Deal programme in the UK conceptually had many of the components to be a potentially successful programme, however some key lessons had not been learnt from similar overseas funding experiences that ultimately lead to its failure. The actual concept and mechanism to deliver were generally sound, but real world financial issues caused the programme to fail and some are outlined below:

- the interest rate offered within the loans was too high. The 6.96% interest rate for the 25 year duration of the loan was high in comparison to the headline figures within the wider loans market
- the low credit rating of those in fuel poverty meant they couldn't access the scheme due to the financial risk of default. The programme therefore could not support those most in need of its support
- the implications on house sale by having 'another bill to pay' attached to the property. Whilst in practice having the energy savings measures attached to the meter is a good idea the messaging and understanding provided to the customer market was poor

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- the mechanism used for calculating the interest : capital ratio over the 25 year term of the loan meant that the actual available amount of cash on day one available for retrofits was often not enough to cover the cost of the proposed measures
- the cost of setting up the green deal financial plan was high due in a big part to the complexity of setting up each financial contract. By not having a truly standardised and simple process in place the costs became a significant disincentive to households.

Whilst it is unlikely that ABRA type propositions could use this exact mechanism, the lessons are clear from the Green Deal's failure and should be learnt from for stakeholders engaging with the development of loan structures for ABRA type projects.

PRIVATE FUNDING INITIAVES

The most likely financial route for the deployment of the ABRA concept at scale in the housing market will come from the private funding market. The most common form associated with the property sector is the mortgage to fund works carried out to upgrade a property. Standard mortgages do not tend to take into consideration the direct energy efficiency of a home when it is being arranged. However, in recent time's great progress has been made with the concept of Green Mortgages and how this modification of a tried and tested financial model could open up a substantial funding route to those considering an ABRA type approach.

The scale of investment required in Europe's building stock is estimated to be in the order of €100 billion per year, each year through until 2050. To have any chance of meeting these levels of investment private finance must play the major role. The mortgage model is a tried and tested one that is common across Europe and by modifying the criteria on which mortgages are determined, a tweak to the mechanism if you like, the benefits of a greener property should be able to be accounted for that may really drive forward those looking to carry out ABRA projects.

The interest from the financial community is substantial in this development and in September 2016 the European Mortgage Federation and the European Covered Bond Council launched a ground-breaking mortgage financing initiative that is geared towards supporting energy efficiency improvements in buildings, potentially including those proposed in ABRA type projects. This initiative brings together a group of major banks and mortgage lenders alongside other relevant stakeholders to address the concept of energy efficiency mortgages that has great resonance for ABRA projects. The programme aims to create a suitable framework for a standardised energy efficiency mortgage product that can be offered across Europe to borrowers seeking to purchase and retrofit properties.

Again, the key for this initiative is associated with traditional financial requirements, the benefits of which have been outlined in the EeMAP initiative diagram below:

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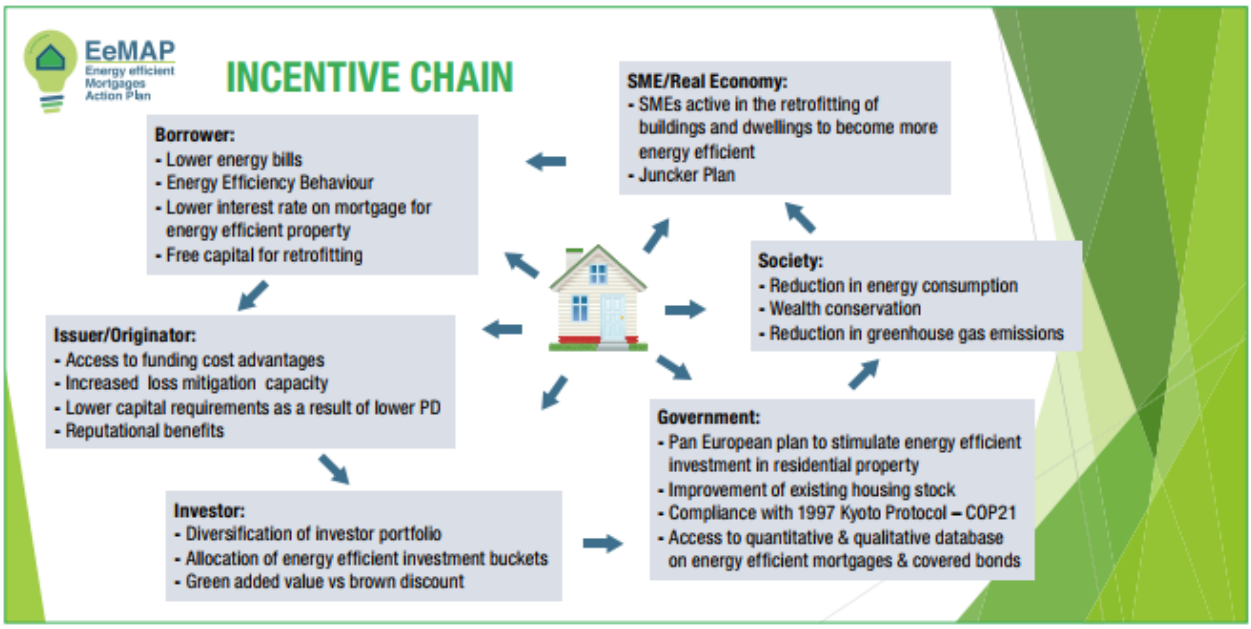

Initial analysis from a survey of 365,000 Danish homes estimates an increase in property value equivalent to adding between 10 and 15m^2 of space to the size of the property. If this analysis is correct and the further additional benefits of using an ABRA type project to further increase property space and improve property efficiency the combined benefits would be amplified.

The Green Mortgage has substantial implications for the development of ABRA projects and will be closely engaged with this through the remaining length of the ABRA project.

PUBLIC PRIVATE PARTNERSHIPS

Public Private Partnerships have become a common mechanism for public bodies to 'pump prime' funds to draw out private finance for investment in infrastructural programmes, including energy and energy efficiency.

An example of this specifically in the building retrofit sector is the Low Carbon Workplace Fund (LCWF). LCWF is a partnership between the Carbon Trust, fund manager Columbia Threadneedle Investments and property developer Stanhope. Through the LCWF, the partnership acquires commercial office buildings and refurbishes them into modern, energy efficient workplaces. Occupiers benefit from ongoing support from the Carbon Trust, helping them to minimise their energy costs and carbon emissions. Energy and carbon performance is monitored and assessed against the Carbon Trust's Low Carbon Workplace Standard, and occupiers that successfully meet the criteria are awarded with certification to the Standard.

The Low Carbon Workplace concept was developed by the Carbon Trust in 2010 to break the 'circle of inertia' that had prevented many cost effective carbon reduction opportunities in non-domestic buildings from being realised. The Carbon Trust was publicly funded and helped develop the concept and bring in private investors. LCWF delivers refurbished low carbon buildings to occupiers who are both motivated and empowered to ensure potential energy and carbon savings are achieved. Occupiers reap the benefits of an efficient, comfortable and environmentally sensitive workplace, and investors and landlords profit from having attractive, 'future-proofed' buildings in their portfolios.

This type of model may have potential to be modified to enable the ABRA approach that not only addresses the energy efficiency aspect of the building, but also enables increased asset value uplift through the increase in rentable space within the commercial real estate market.

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ANEX I

Each country counts with different specific databases (free to use and fee based) which will provide more specific data.

As an example please refer to the following (ES) Databases:

CYPE, SA (www.generadordeprecios.info);

Colegio de Aparejadores de Guadalajara (http://www.preciocentro.com/content/6-visualizador-precio-centro)

Base de Costes de la Construcción de Andalucía www.juntadeandalucia.es (Download)

Comunidad de Madrid www.madrid.org (Internet)

Fundación de Estudios para la Calidad en la Edificación de Asturias www.fecea.org (Internet)

Gobierno Vasco www.presupuesta.com (Internet)

Instituto de Tecnología de la Construcción de Cataluña www.itec.es (Internet)

Instituto de la Construcción de Castilla y León www.iccl.es (Download)

Instituto Tecnológico de Galicia www.presupuesta.com (Internet)

Instituto Valenciano de la Edificación www.five.es (Internet)

NOTE: Due to the early success of Presto, thirty years ago, many different private and public entities (most from Autonomic regions) published this type of databases. Non Spanish Presto users may easily use these databases as long as the use the integrated translation tools and allow for price adaptation to the local market. Sometimes the labor may be cheaper and the industrial products more expensive, or the other way around.

Other databases

RSMeans www.rsmeans.com (USA: CD & Internet)

SPON www.sponpress.com (UK, Asia-Pacific, Ireland, Africa, Europe, Latin America Books)

Batiprix www.batiprix.com (France Internet)

Free Construction Cost Data - www.allcostdata.info (Internet)

Compass International www.compassinternational.net (International Books)

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