

Virtual demo and practical application workflow

Martino Gubert, Eurac Research

Online, 11/06/2024



INFINITE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No **958397**

Contents - Scope and Methodology

- Scope -> why we are doing it?
- Methodology -> How we do it!
- Practical application

Scope:

Test the implementation of the INFINITE BIM-Platform and its related Plug-ins to boost the market activation for deep industrialized retrofit.

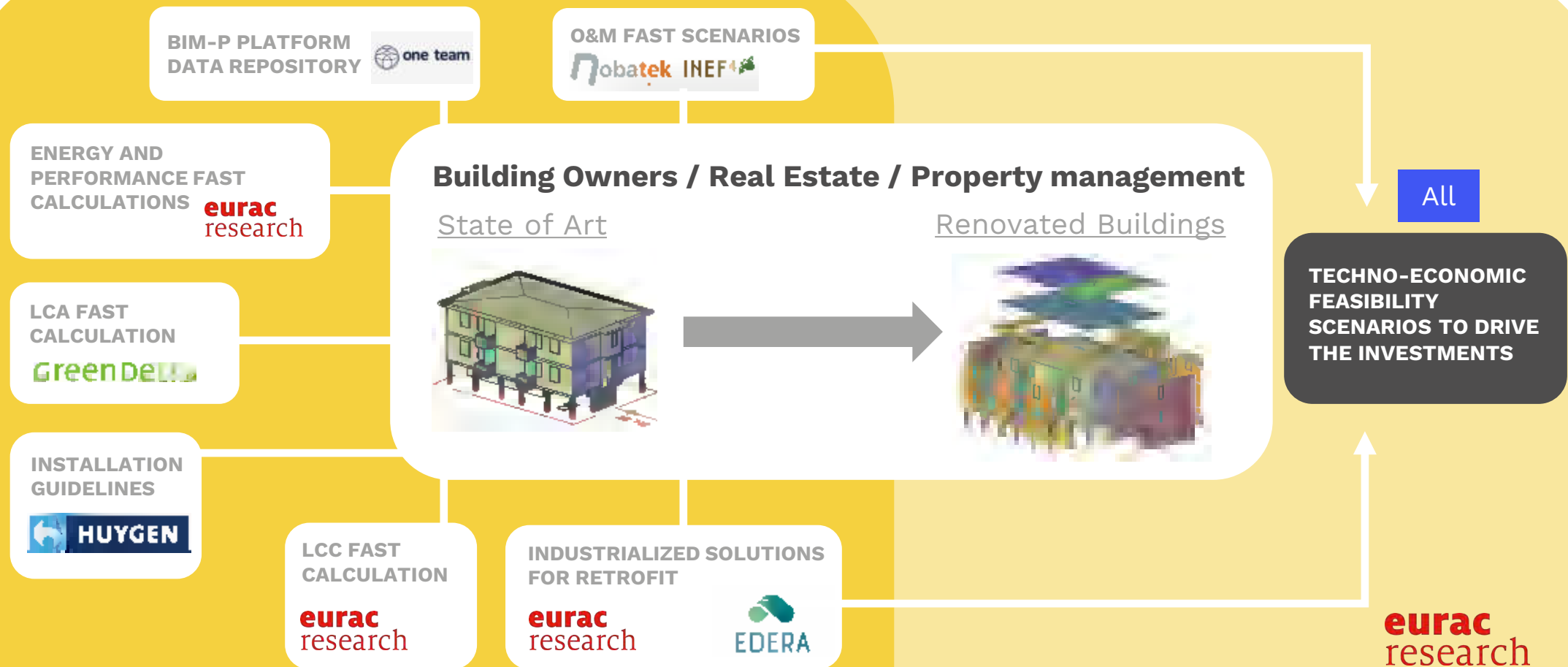
Develop a SERVICE to perform a fast Techno-economic analysis for building deep industrialized renovation

Method - INFINITE service:

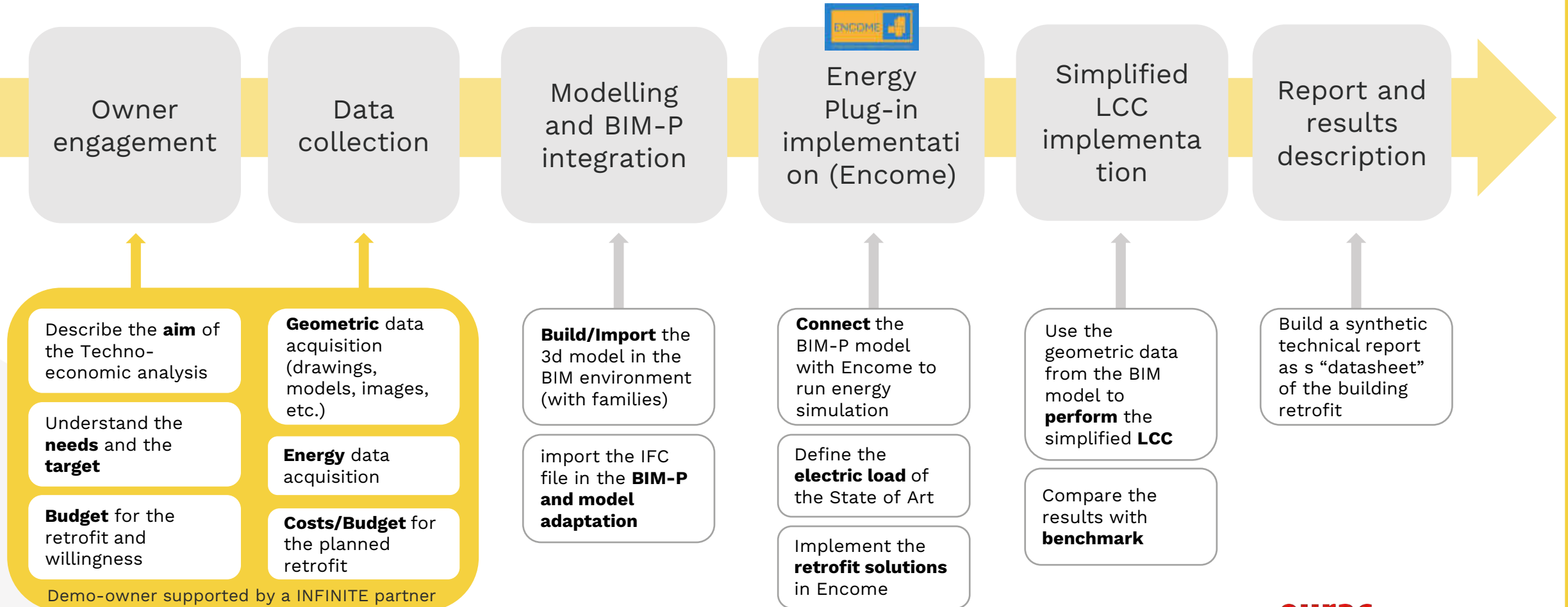
Techno-economic analysis for a deep industrialized retrofit

INFINITE service

INFINITE boudary



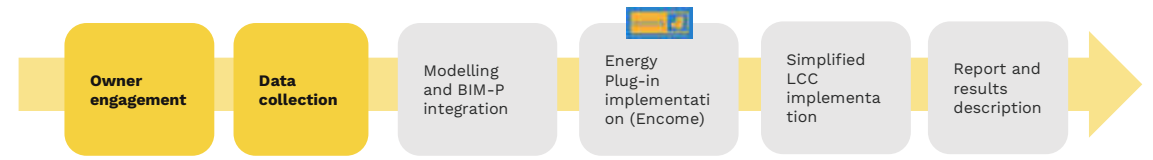
Method-> Industrialized Techno-economic analysis



Practical application on a Virtual Demo Case in Spain

Techno-economic analysis for a deep industrialized renovation with
INFINITE technologies

1st Virtual DEMO -> SPAIN



VIRTUAL DEMO | ALICANTE City Council - Barrio Juan XIII 2º Sector – Alicante - SPAIN

The municipal housing board of Alicante (social housing provider) will retrofit 740 homes distributed in 53 buildings in the Juan XXIII neighbourhood of Alicante using own funds and state aid. The forecast is that the works begin in 2022. In addition, other buildings in the same neighbourhood and the same typology were retrofitted about 7 years ago and the results of the traditional rehabilitation performed with insulation from the outside could be compared with the INFINITE concept and preliminary study. Energy Efficiency studies were performed and could be used.

BUILDING TYPE

Number of dwellings per floor: 4
 Number of floors: 4 floors
 Constructed area (1 dwelling): 72m2 built
 Useful area: 61.2m2
 Useful area of common elements: 110.5 m2 built.

WINDOWS -> Casement windows, double leaf, steel frame, single glazing.

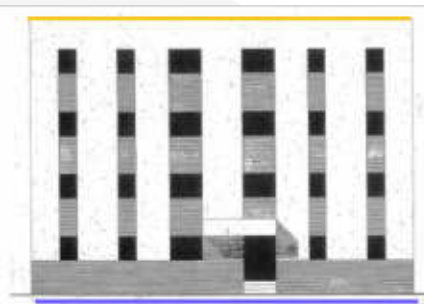
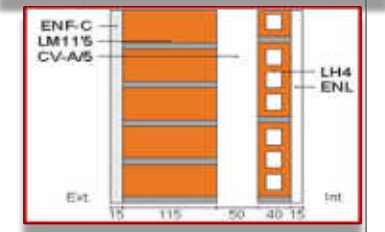
Dimensions: ->Width: 0.80 m / 1.70
 Height: 1.30 m
 Set back: 0.15 m

Frame: -> Steel windows without thermal break
 Frame ratio: 10%; Casement window
 Thermal transmittance U (W/m2K): 5.70

Glass: -> Thickness: 3 mm; Solar factor: 0.85
 Thermal transmittance U (W/m2K): 5.70



Main façade	Composition
F1	ENF-C+LM11+CVSV/5+LH4+ENL
F2	ENL plaster
Thermal transmittance U (W/m2K): 1,64	



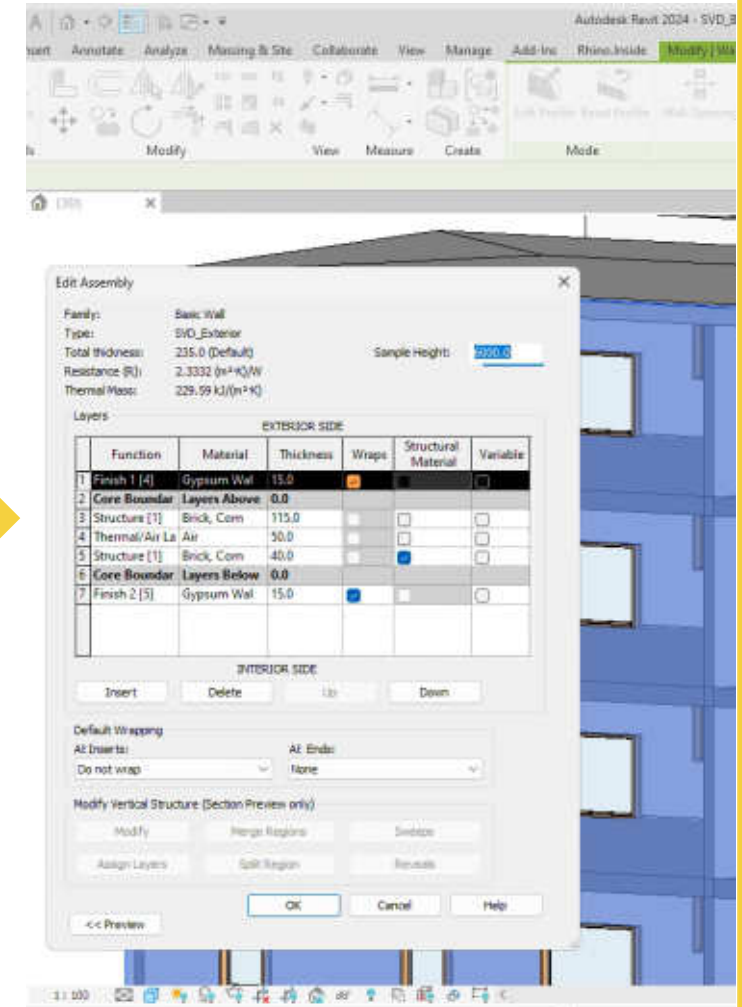
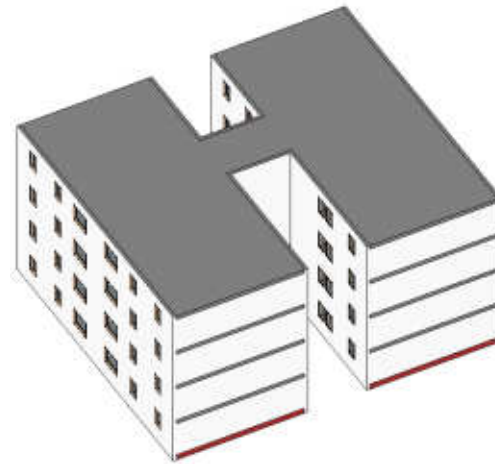
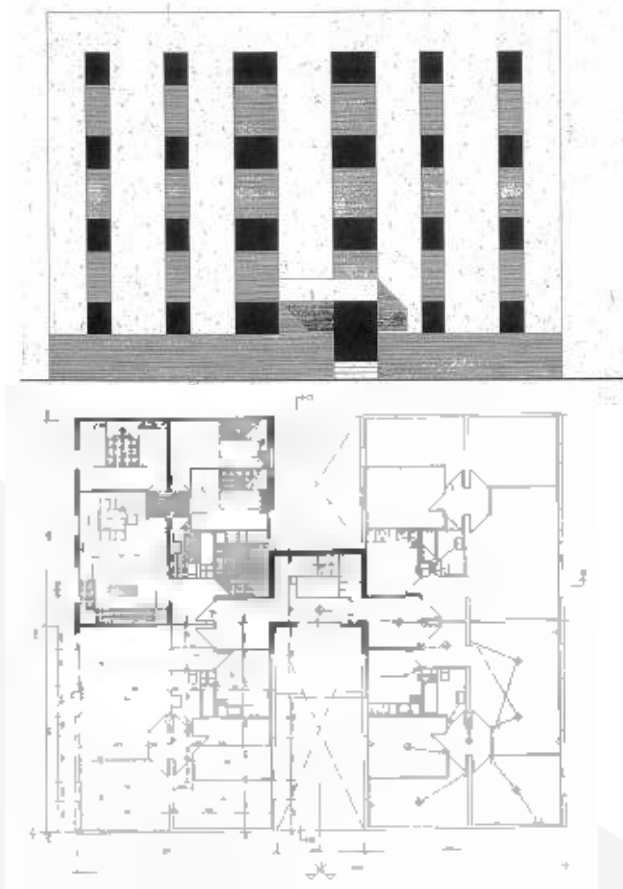
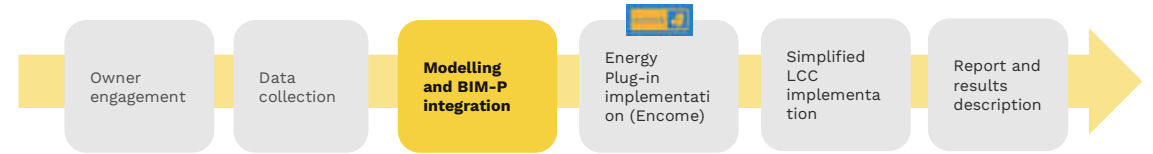
- Roof 1: flat roof
- Roof 2: flat roof
- Floor 1: with crawl space



- Façade 1: East
- Façade 2: West
- Façade 3: North
- Adiabatic party wall 1

Modelling and BIM-P interaction

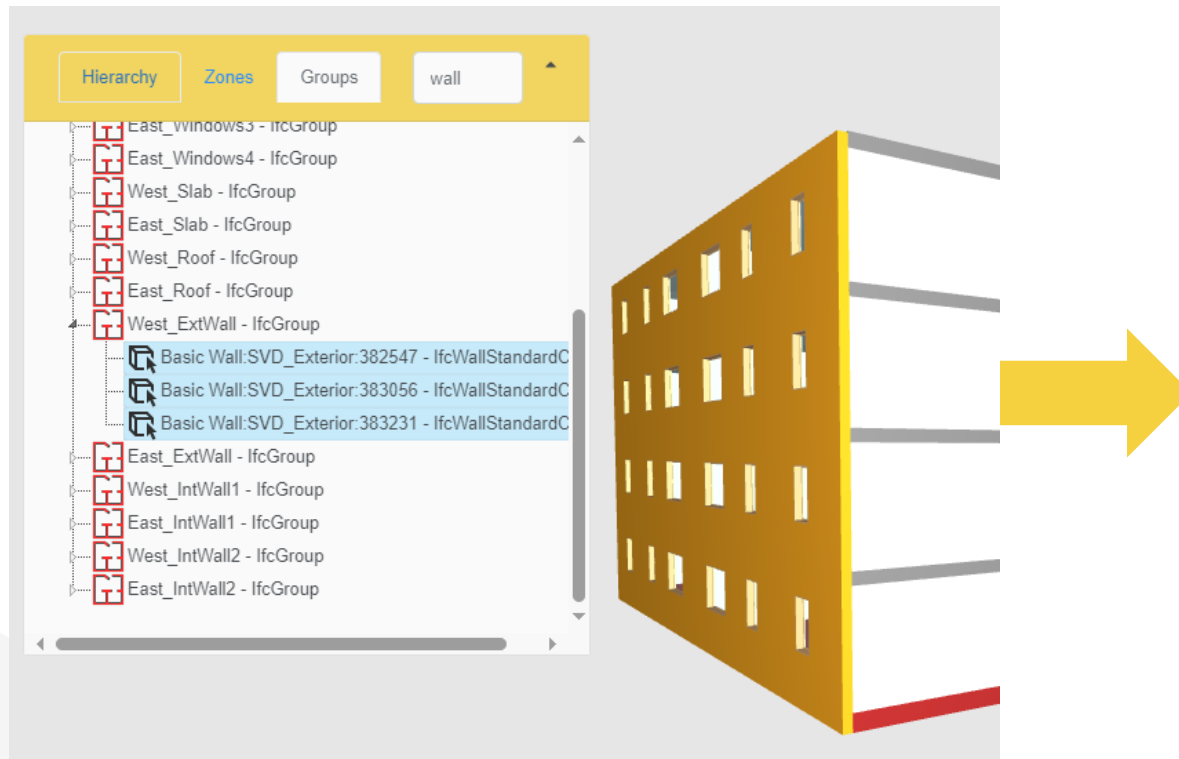
From drawings to 3D model to stratigraphy characteristics



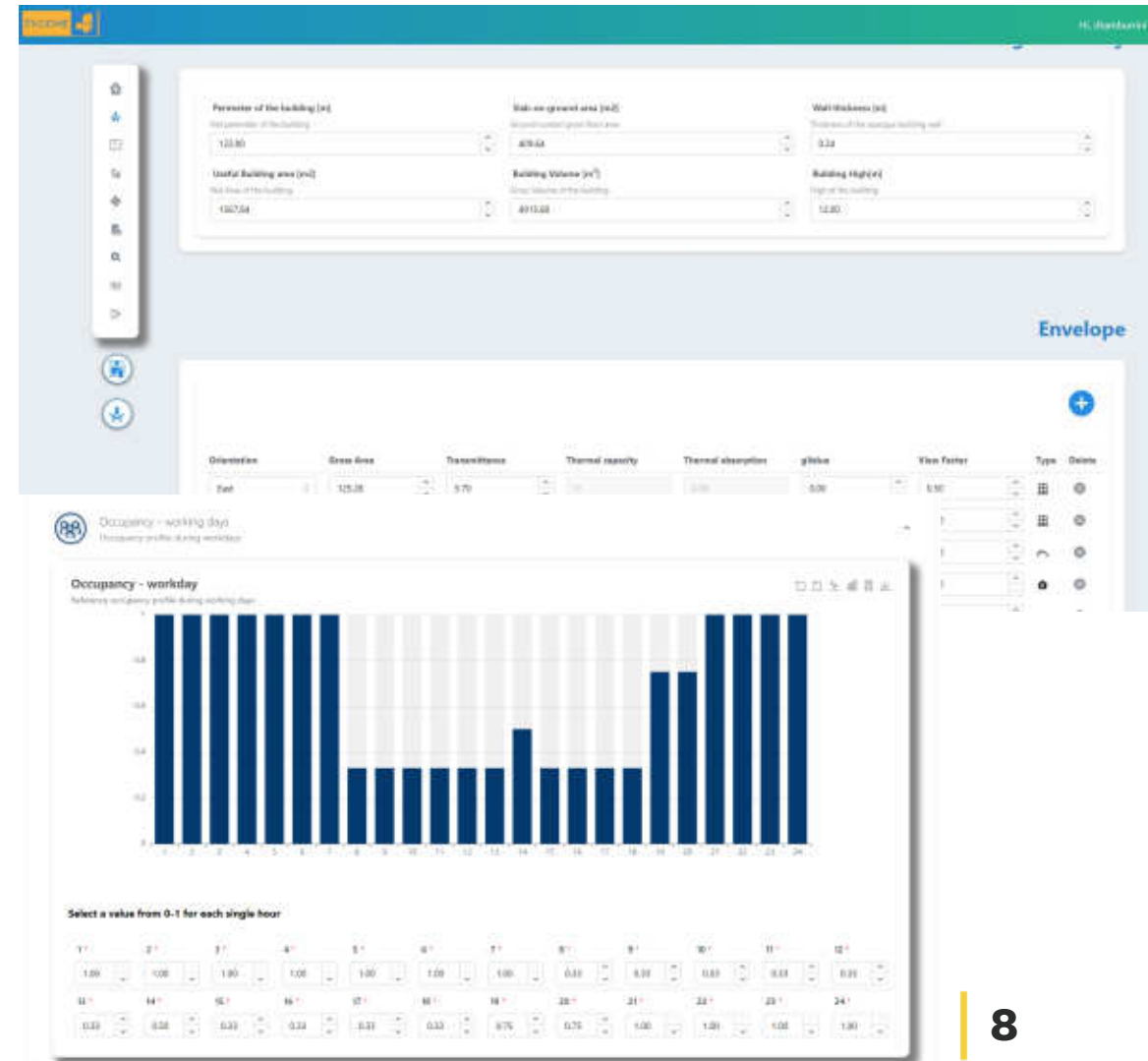
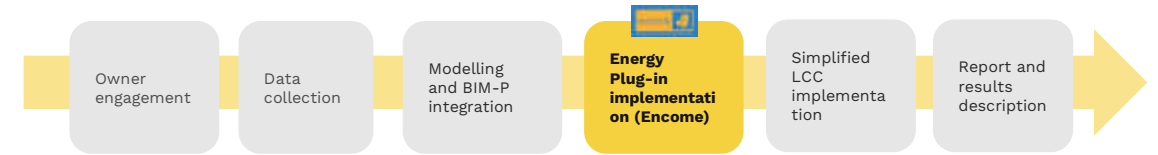
Taking the plans and elevations as reference, the building is modelled in Revit. Only the heated volumes are considered, leaving out the staircase

Energy analysis

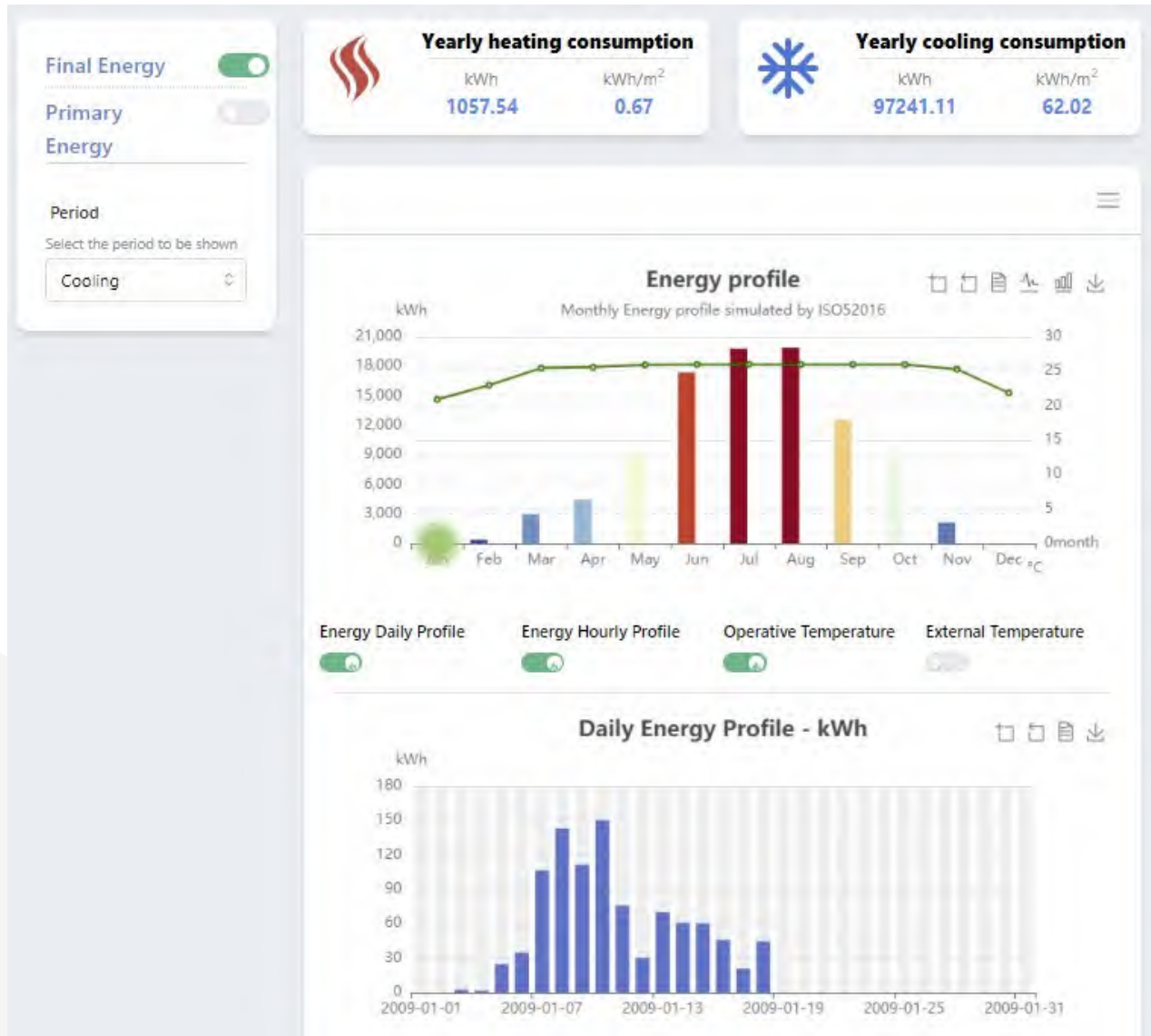
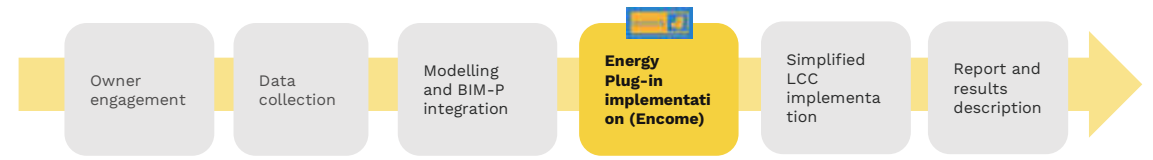
From the BIM-P to the Energy plug-in



Creation of element groups in BIM-p and importing the model into Encome. A check was made of the geometric data and parameters imported into Encome, heating systems were entered and building occupancy data estimated.



Energy Results Retrofit concept



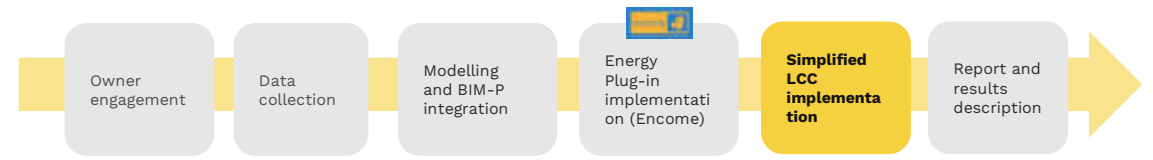
Measures:

- 900 sqm** of Prefabricated facade + roof insulation (6cm insulation)
- 120 sqm** of Window replacement with Uvalue 1
- Adding **Cooling system** (split centralized system)

Results:

- 98%** of Yearly heating Consumption
- + 62 kWh/sqm** for the cooling
- summer **comfort**

Costs analysis tool



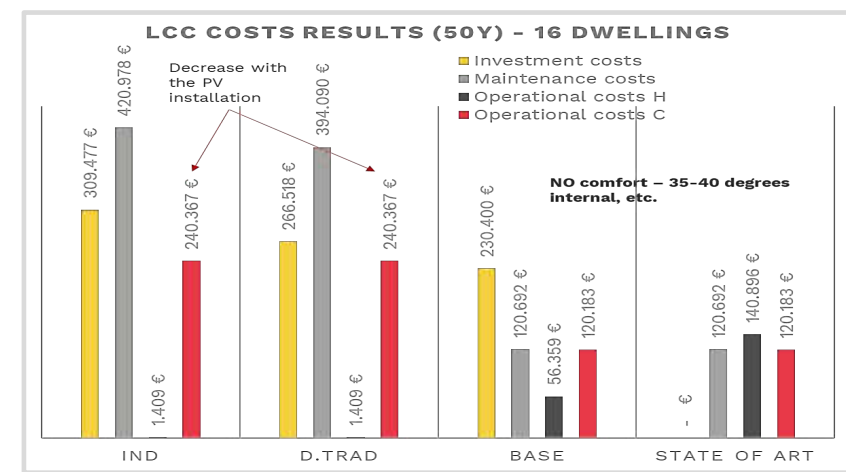
Building features and geometrical characteristics							
n. piani	4	facciata ovest	250,8	Area copertura	425	numero app	10
h interpiano	3	facciata est	250,8	Area singolo app	92	numero moduli facc	41
finestra 1 [mq]	1,04	Facciate verso int	306	n. stanze app	4		
finestra 2 [mq]	2,21	Perimetro ester	41,8	n. stanze palazzina	64		
finestre in pianta	52,8	Perimetro Inter	34	area strisce PV facciata	319,2		

Building 3d model			
	Superfici finestrat	Superfici riscaldate	Vano scala
Nord	esterno	-	51,84
	m. divisori	224,4	-
Est	esterno	8,58	216,72
	cortile	6,24	176,88
Sud	esterno	-	51,84
	m. divisori	224,4	-
Ovest	esterno	8,58	216,72
	cortile	6,24	176,88
Copertura proiezione tot palazzina		398,51	30,66
		118,56	

INDUSTRIALIZED SCENARIO					
Maintenance Costs					
% Maintenance costs Construction	1,50%				
Interest rate	1,51%				
	choice	Constructi on costs [€]	Maintenan ce %	Maintenan ce costs [€]	Lifespan [year]
Prefabricated - industrialized					
Main components					
Prefabricated facade passive module w/o ext	1	79240	1,5%	1188,6	50
Prefabricated roof passive module w/o exte	0	44625	1,5%	669,4	50
Windows installed offsite (overall costs)	0	53352	1,5%	800,3	50
New prefabricated balconies	0	0	1,5%	0,0	50
Energy system					
Technical room with HP for H/C/DHW	0	0	1,5%	0,0	15
Integration into the facade of VMU with ducts	0	92800	1,5%	1392,0	50
Micro-HP single room (H/C/Air)	0	103356	1,5%	1550,3	15
Double flux VMC with recovery integrated an	0	0	1,5%	0,0	15
trickle vent to be added to the window	0	12672	1,5%	190,1	25
modular technical room	0	0	1,5%	0,0	50
New electrical system	0	25106	1,5%	376,6	25
Photovoltaics (roof)	0	21250	1,5%	318,8	25
	0	19120	1,5%	478,0	25
	0	40000	1,5%	600,0	15
	0	16000	1,5%	240,0	15
	0	153216	1,5%	2298,2	25

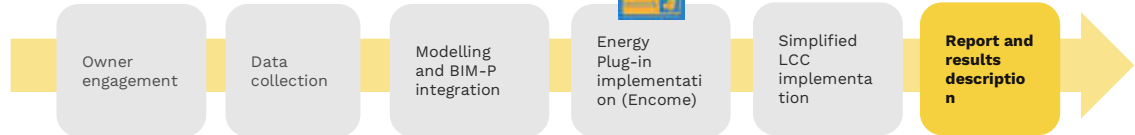
INDUSTRIALIZED SCENARIO					
Operational costs					
Interest rate (R _{int})	151	141	151		Energy price [€/kWh] 0,230
inflation rate (R _i)	1	0	0		
inflation energy price	150	150	150		
Equity interest	0	0	0		
Year	0	1	2	3	4
Discount rate (R _{disc})	1,800	0,995	0,990	0,985	0,980
Energy price [€/kWh]	0,230	0,23338	0,23681	0,24029	0,24383
Heating					
Energy cost - system 2 [€/kWh]	0,000	0,000	0,000	0,000	0,000
Energy consumed cost [€]	8,570	552	560	568	576
Energy consumed cost actualised [€]	8,570	549	554	559	565
Cumulated energy consumed cost [€]	8,570	9,118	9,672	10,232	10,797
Cumulated energy consumed cost [€]	8,570	9,118	9,672	10,232	10,797
Cooling					
Energy cost - system 1 [€/kWh]	0,230	0,233	0,237	0,240	0,244
Energy cost - system 2 [€/kWh]	0,000	0,000	0,000	0,000	0,000
Energy consumed cost [€]	744	755	766	777	789
Energy consumed cost actualised [€]	744	751	758	766	773
Cumulated energy consumed cost [€]	744	1,495	2,254	3,020	3,793
DHW					
Energy cost - system 1 [€/kWh]	0,100	0,101	0,103	0,104	0,106
Energy cost - system 2 [€/kWh]	0,100	0,101	0,103	0,104	0,106
Energy consumed cost [€]	205	208	211	214	217
Energy consumed cost actualised [€]	205	206	208	210	212
Cumulated energy consumed cost [€]	205	208	415	625	838
Energy [€/kWh]	0,230	0,233	0,237	0,240	0,244

Simplyfied LCC tool to compare Industrialized and Traditional Building Renovation			
Industrialized deep retrofit (nZEB)		Deep traditional retrofit	
Preparatory works	€	Preparatory works	€
Cleaning facade and fixing system preparation	4.134 €	Cleaning facade and fixing system preparation	3.423 €
movable crane for the facade installation (5 m pole in 2 days)	80 €	movable crane for the facade installation (5 m pole in 2 days)	11.834 €
movable scaffolding/crane for the finishing	740 €	movable scaffolding/crane for the finishing	
Main components		Main components	
Prefabricated facade passive module w/o external finishing	335	Insulation layer installed on facade (III) the room terrace/area for glazing	80
Prefabricated roof passive module w/o external finishing	105	Insulation layer installed on roof (II) the terrace	87
Windows installed offsite (overall costs)	400	Windows installed on site (overall costs)	500
New prefabricated balconies	1000	Parasol of balconies (rains, freezing, insulation, water-proofing)	85
Energy system		Parasol the roof structural part (wood/roof)	325
Technical room with HP for H/C/DHW	5800	Energy system	
Integration into the facade of VMU with ducts (H/C/Air)	150	Technical room with HP for H/C/DHW	5800
Micro-HP single room (H/C/Air)	€	On-site works on small splits and all the works (distribution) from the technical room to each apartment	2600
Double flux VMC with recovery integrated around window (Air)	€	Changing radiators	300
		Punctual VMC	300



Results

The result is a synthetic 4 page report



eurac research **Virtual Demo Case - SPAIN** **INFINITE**

OBJ: Techno-economic analysis for a deep industrialized renovation with INFINITE technologies



The municipal housing board of Alicante (social housing provider) will retrofit 740 homes distributed in 53 buildings in the Juan XXIII neighbourhood of Alicante using own funds and state aid. The forecast is that the works begin in 2022. In addition, other buildings in the same neighbourhood and the same typology were retrofitted about 7 years ago and the results of the traditional rehabilitation performed with insulation from the outside could be compared with the INFINITE concept and preliminary study. Energy Efficiency studies were performed and could be used.



BUILDING TYPE: The building is characterised by two blocks joined by a staircase, facing east and west. The building has four floors and four flats per floor, for a total of 16 dwellings. The north and south walls are bordered by other residential buildings in line. The floor area of the building is approximately 400 sqm. The external walls are composed of two layers of brick with an air space in between, with a total transmittance of 1,64 W/m²K.



As a reference, the building is modelled in Revit. Only the heated spaces are modelled, leaving out the staircase. The structures of walls, floors, roof and windows are modelled, with their properties, transmittance and thermal capacity values.

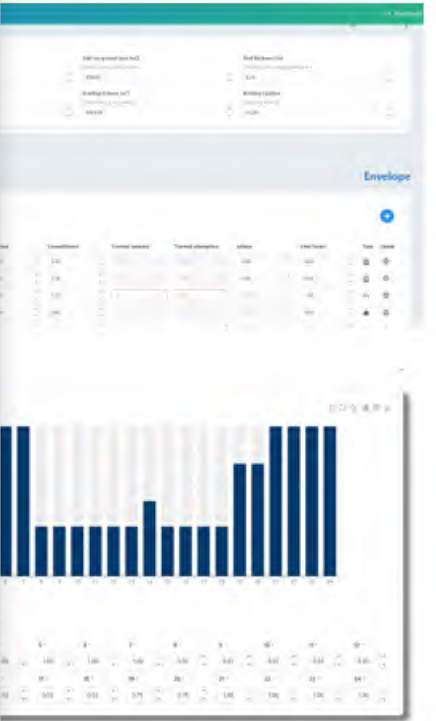


SVD BIM Model_240521

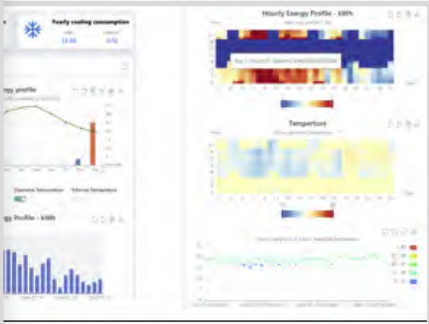


The model is exported in IFC format and imported into INFINITE BIM-p with verification of the model. Element groups are created in BIM-p and the model is imported

The model is connected with the Encom tool, where all the geometrical data and properties of the different structural elements are imported. The model is then used to generate data on occupancy on working days and



The data is used to obtain the energy consumption data.




SUMMARY - Heating

Results: Several configurations have been simulated related to the heating load. The results show that it could be avoided working on envelope solutions.

The cooling in the first step was not implemented because it was not planned. The absence of the cooling underlines a high discomfort level.

Needs to use the Cooling system and shading to assure COMFORT (as already done by the inhabitants)



mi attesi con i vari scenari da analisi dei tool sopra

general feedback on COSTS and TECHNOLOGIES to be

Let's boost the industrialized renovation together!

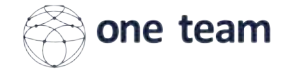
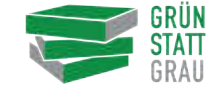
We need to act now! No more excuses....

Consortium

Coordinator



Project Partners





Thank you

Martino Gubert

Eurac Research

martino.gubert@eurac.edu

eurac
research



INFINITE project has received funding from the European Union's Horizon 2020 research and Innovation programme under grant agreement No 958397