TRUST
EPC SOUTH

Case studies from the South European tertiary sector

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METHODOLOGY

KEY STEPS

Detailed energy audit in the building

- Building plans and data about building envelope
- Energy and water bills
- Operational data (operation times, schedules, occupancy, control systems)
- Equipment inventory

- Close cooperation and interviews with owners for defining priorities, specific needs and characteristics and discussing the investigated energy saving interventions

Dynamic thermal simulation of the building

to validate the building construction and details of fabrics used to set up the thermal model

GREPCon BY BUREAU VERITAS

Application of GREPCon

- Energy breakdown
- Savings achieved by standardized measures applied
- Financial assessment →feasibility rating potential for EPC

Key points of methodology

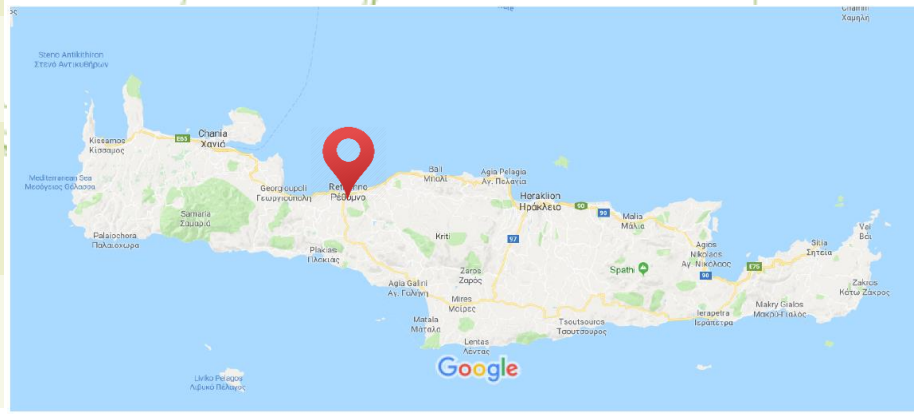
Important remarks of methodology steps

- ✓ **On-site energy audits and personal meetings with owners, identifying the key points on the functionalities and specificities of each building**
- ✓ **The owners' opinions and priorities for energy upgrading interventions in the building are being valued**
- ✓ **Owners' preferences are important key points for effective cooperation between the energy auditor and the owner, as well as for the effective implementation of the project**
- ✓ **After the technical completion of the project (financial assessment, EPC rating), a final important step is the integrated presentation of the results to the owners and the investigation of a possible Energy Performance Contracting.**

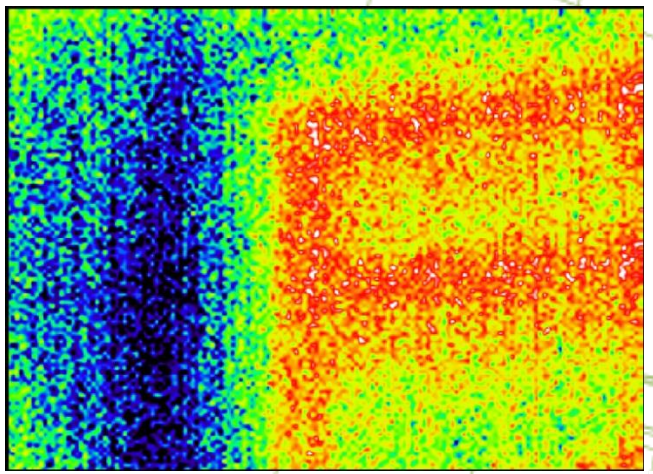
HOTEL IN CRETE

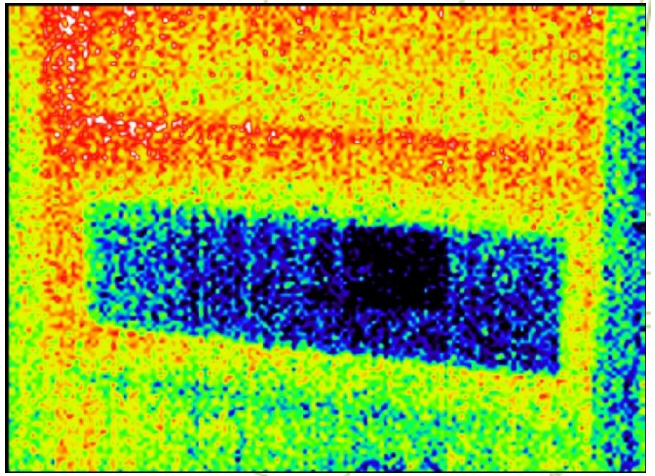
PROJECT OVERVIEW

Building type	Family resort hotel
Location	Crete, Greece Urban location, proximal to the sea
Main features	7 buildings complex, 324 beds, kitchen, restaurant, 3 pools
Built in	1991
Operation	May-October
Average occupancy	84% (during period of operation)
Environmental labels	ISO 14001:2004, Green Key

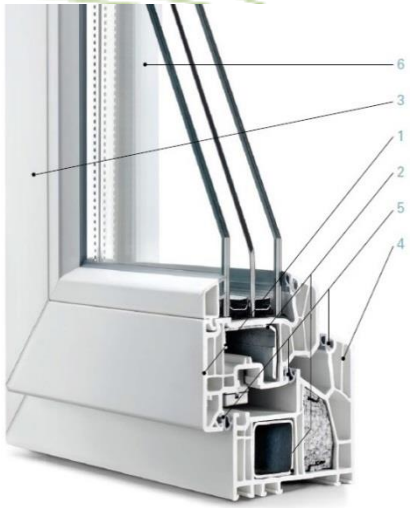


ENERGY AUDIT





Building envelope



ENERGY AUDIT

Cooling systems

ENERGY AUDIT

Domestic Hot Water

ENERGY AUDIT

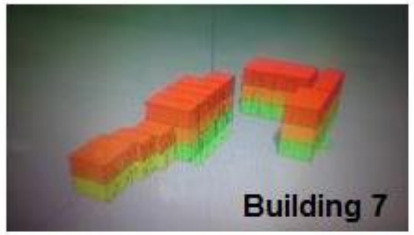
Lighting

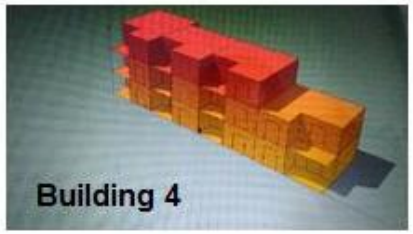
ENERGY AUDIT

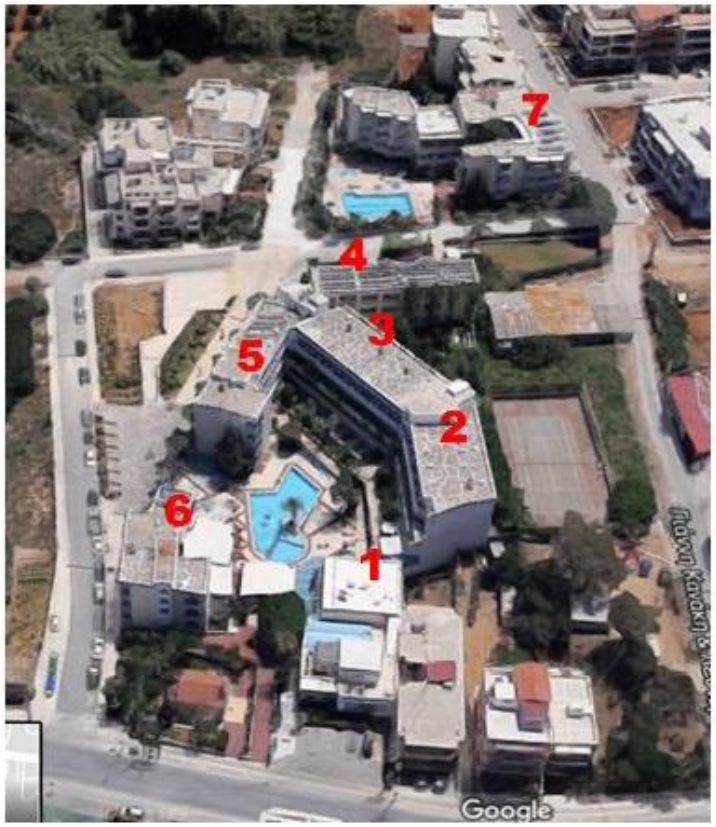
Laundry

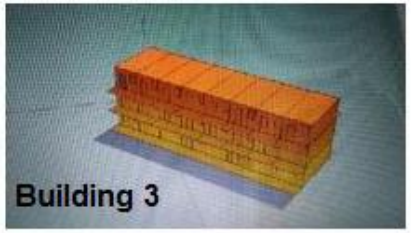
Kitchen

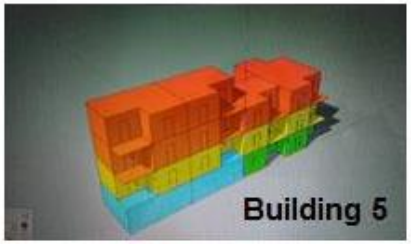
DYNAMIC THERMAL SIMULATION

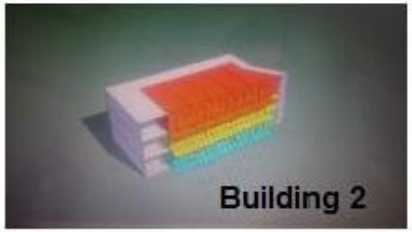


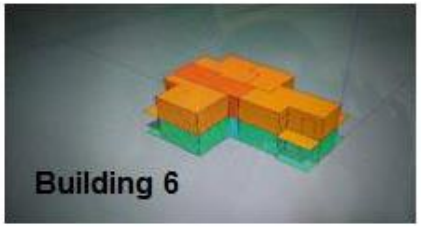


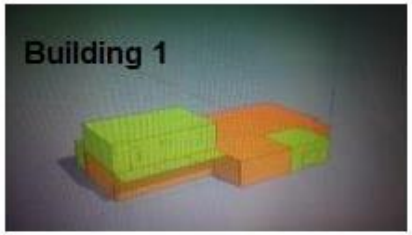








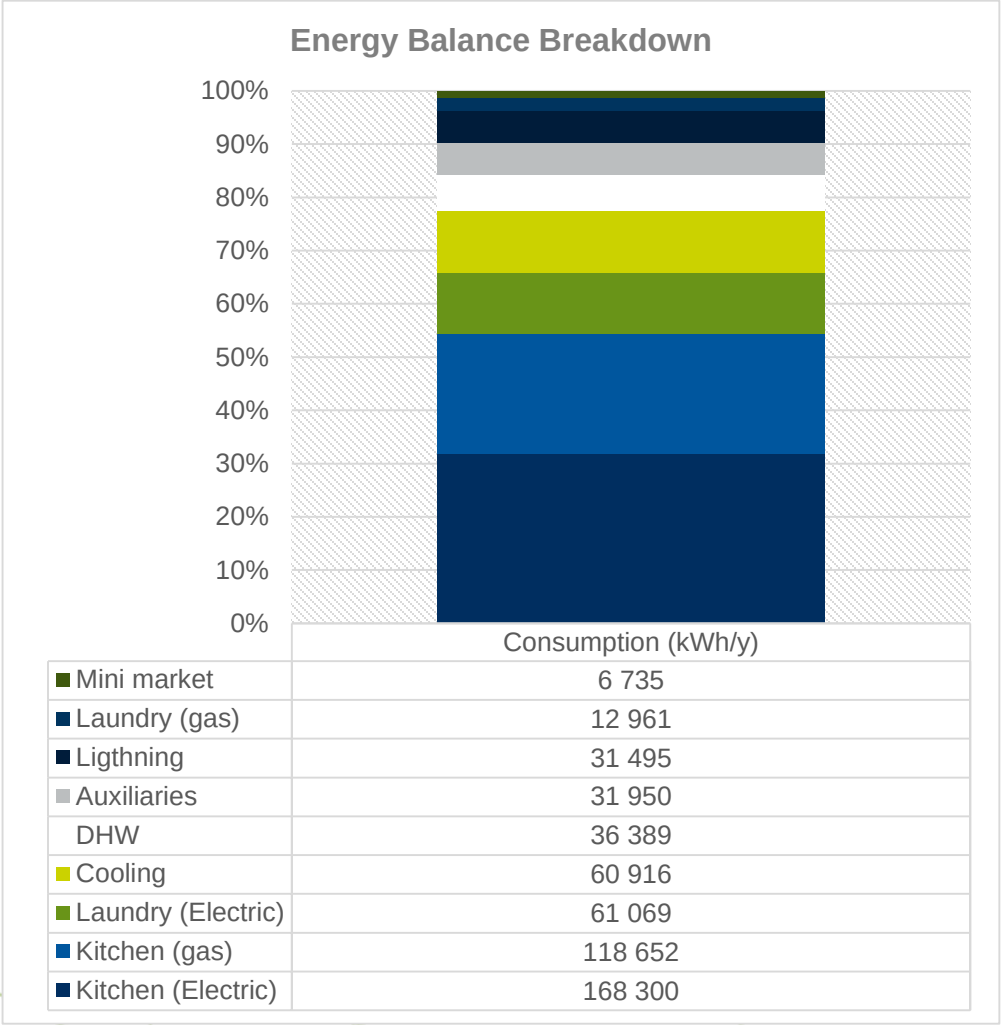




PROJECT OVERVIEW

ENERGY BALANCE

- Main energy sources are **electricity, LPG, solar**.
- Building area: **4.450 m²**
- Overall annual energy consumption is **517 MWh/year**
- The corresponding annual energy costs of the building account for **62.000 €/year**
- The emissions associated are of 396 tCO_2eq/year
- The **kitchen** is the main energy consumption use

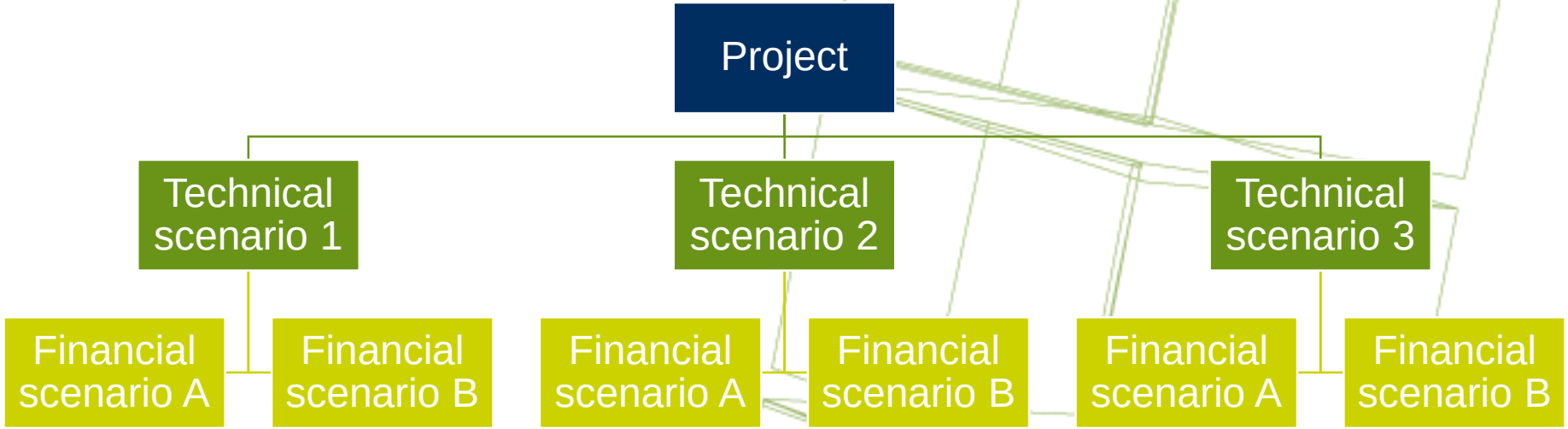


	Consumption (kWh/y)
Mini market	6 735
Laundry (gas)	12 961
Ligthning	31 495
Auxiliaries	31 950
DHW	36 389
Cooling	60 916
Laundry (Electric)	61 069
Kitchen (gas)	118 652
Kitchen (Electric)	168 300

PROJECT OVERVIEW

PROJECT SCENARIOS

- Three scenarios of technical solutions were assessed
- For each technical scenario, two financial EPC scenarios were assessed, a total of **6 scenarios**



- EPC Financial scenario A implies: 60% loan, 40% own financing
- EPC Financial scenario B implies: 40% grant, 30% loan, 30% own financing

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PROJECT OVERVIEW

TECHNICAL SCENARIO 1: ENERGY SAVING MEASURES EXAMINED

Measure	Savings [kWh/year]	Savings [€/year]	% Financial savings	Investment [€]	Simple payback [years]
Substitution of conventional lamps	7.207	1.009	1,6 %	863	0,9
Occupancy and presence sensors	819	115	0,2 %	1.110	9,7
Thermal insulation of building envelope	7.919	1.109	1,8 %	25.275	22,8
Photovoltaic plant	75.000	10.500	17,0 %	57.500	5,5
Laundry-Substitution of conventional appliances with efficient appliances	16.107	2.255	3,6 %	9.249	4,1
Kitchen-Substitution of electric appliances with gas appliances	63.518	2.859	4,6 %	9.883	3,5
Installation of ceiling fans	32.000	4.480	7,2 %	25.000	5,6
TOTAL	**202.570** (39% of total consumtpion)	**22.327**	**36,0 %** of total yearly costs	**128.880**	**5,8**

PROJECT OVERVIEW

TECHNICAL SCENARIO 2: ENERGY SAVING MEASURES RECOMMENDED

Measure	Savings [kWh/year]	Savings [€/year]	% Financial savings	Investment [€]	Simple payback [years]
Substitution of conventional lamps	7.207	1.009	1,6 %	863	0,9
Occupancy and presence sensors	819	115	0,2 %	1.110	9,7
Photovoltaic plant	75.000	10.500	17,0 %	57.500	5,5
Laundry-Substitution of conventional appliances with efficient appliances	16.107	2.255	3,6 %	9.249	4,1
Kitchen-Substitution of electric appliances with gas appliances	63.518	2.859	4,6 %	9.883	3,5
Installation of ceiling fans	32.000	4.480	7,2 %	25.000	5,6
TOTAL	**194.651** (38% of total consumtpion)	**21.218**	**34,3 % of total yearly costs**	**103.605**	**4,9**

PROJECT OVERVIEW

TECHNICAL SCENARIO 3: ENERGY SAVING MEASURES EXAMINED

Measure	Savings [kWh/year]	Savings [€/year]	% Financial savings	Investment [€]	Simple payback [years]
Substitution of conventional lamps	7.207	1.009	1,6 %	863	0,9
Occupancy and presence sensors	819	115	0,2 %	1.110	9,7
Laundry-Substitution of conventional appliances with efficient appliances	16.107	2.255	3,6 %	9.249	4,1
Kitchen-Substitution of electric appliances with gas appliances	63.518	2.859	4,6 %	9.883	3,5
Installation of ceiling fans	32.000	4.480	7,2 %	25.000	5,6
TOTAL	**119.651** (23% of total consumtpion)	**10.718**	**17,3 %** of total yearly costs	**46.105**	**4,3**

KEY MEASURE

PHOTOVOLTAIC PLANT

RENEWABLE ENERGY PROPOSAL

It is proposed to install **50 kW of PV panels** on the roof of the hotel, through **net-metering**. In net-metering installation, the produced energy fed into the grid is compensated with the consumed energy in the facilities of the self-producer, so that he/she pays only for the difference. Any excess energy is fed into the grid without the utility company having the obligation to pay the self-producer.

Energy savings (kWh/yr)	75.000
Economic savings (€/yr)	10.500
Investment required (€)	57.500
Payback (yrs)	5,5

Depiction of hotel building with installed PVs on the roof

COMPARISON OF SCENARIOS

	TECHNICAL SCENARIO 1		TECHNICAL SCENARIO 2		TECHNICAL SCENARIO 3	
	EPC Financial Scenario A	EPC Financial Scenario B	**EPC Financial Scenario A***	EPC Financial Scenario B	EPC Financial Scenario A	EPC Financial Scenario B
Investment (€)	**128.800**		**103.605**		**46.105**	
Financial savings (€/year)	**22.327**		**21.218**		**10.718**	
Project Rating	D	A	**B**	A	A	A
IRR (%)	3,5	23,1	**10,8**	30,5	16,5	36,6
NPV (€)	-11.466	25.856	**3.283**	33.263	6.341	19.683
Discounted payback (years)	7,0	4,0	**6,0**	4,0	5,0	3,0
Min DSCR	1,2	2,4	**1,4**	2,8	1,6	3,2
Average DSCR	1,7	3,4	**2,0**	4,7	2,3	4,5
Negative FCF (years)	0,0	0,0	**0,0**	0,0	0,0	0,0

The most probable scenario for implementation, based on the building owner priorities; the financial analysis follows in the next slides

Technical scenario 2

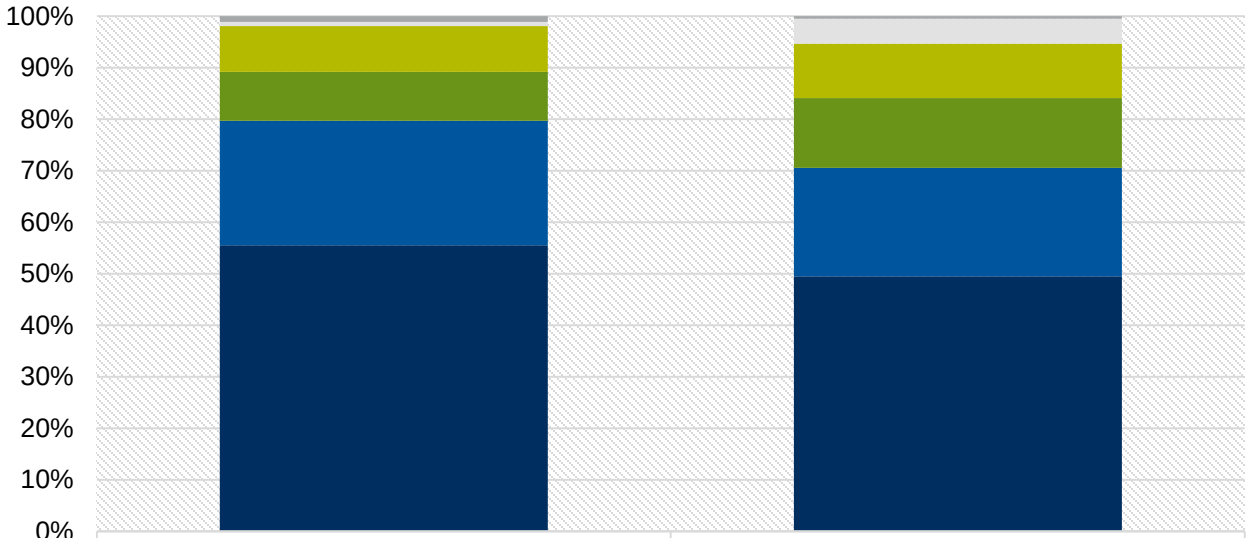
All measures, excluding insulation

EPC Financing Scenario
Financial scenario A:
60% loan, 40% equity

PROJECT OVERVIEW

ENERGY BALANCE

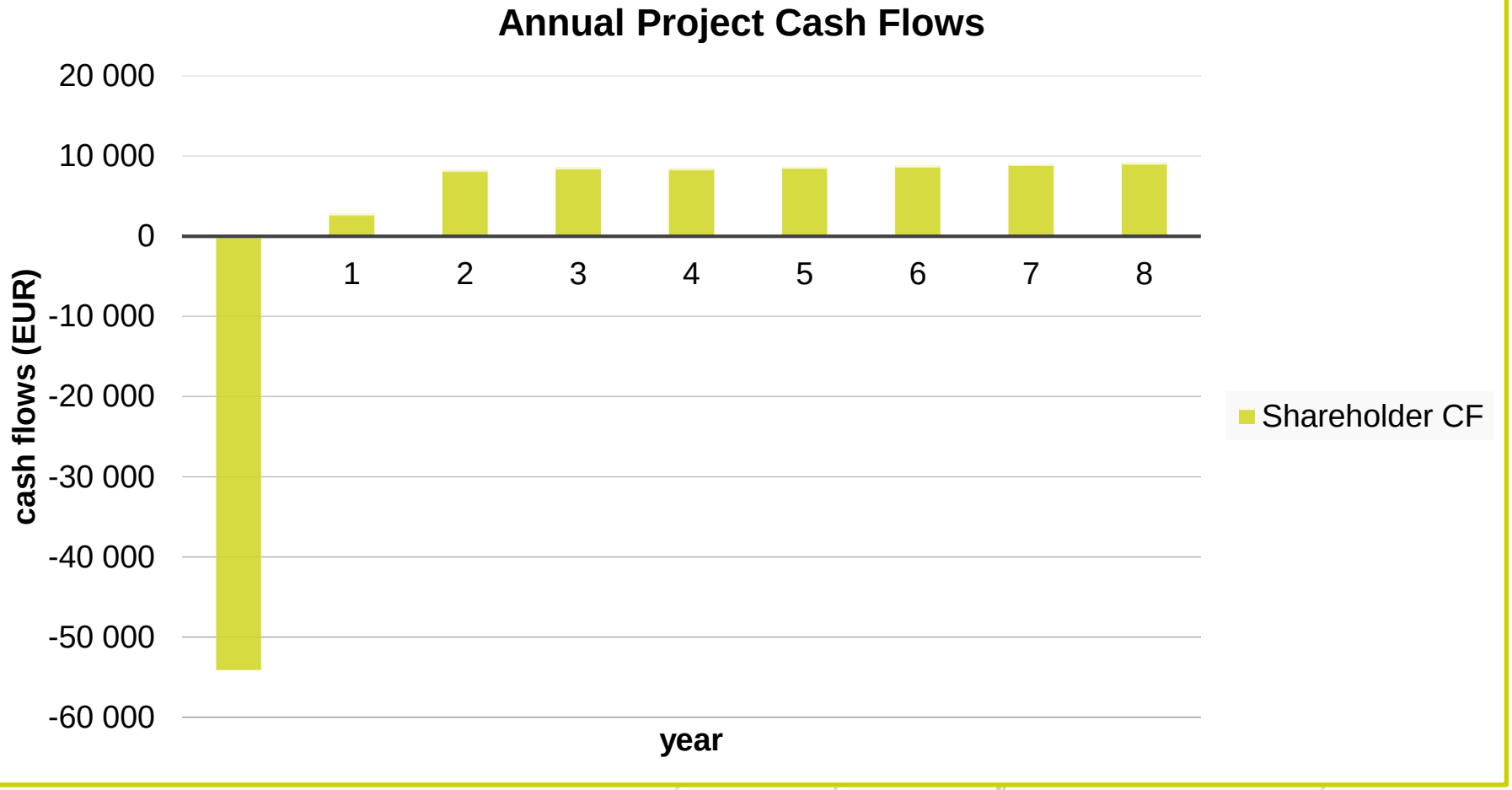
Investment and Savings



	% investment	% savings
Occupancy and presence sensors	1,1%	0,5%
Substitution of conventional lamps	0,8%	4,8%
Laundry-substitution of conventional appliances with more efficient ones	8,9%	10,6%
Kitchen-substitution of electric with gas appliances	9,5%	13,5%
Installation of ceiling fans	24,1%	21,1%
Photovoltaic plant	55,5%	49,5%

FINANCIAL ASSESSMENT

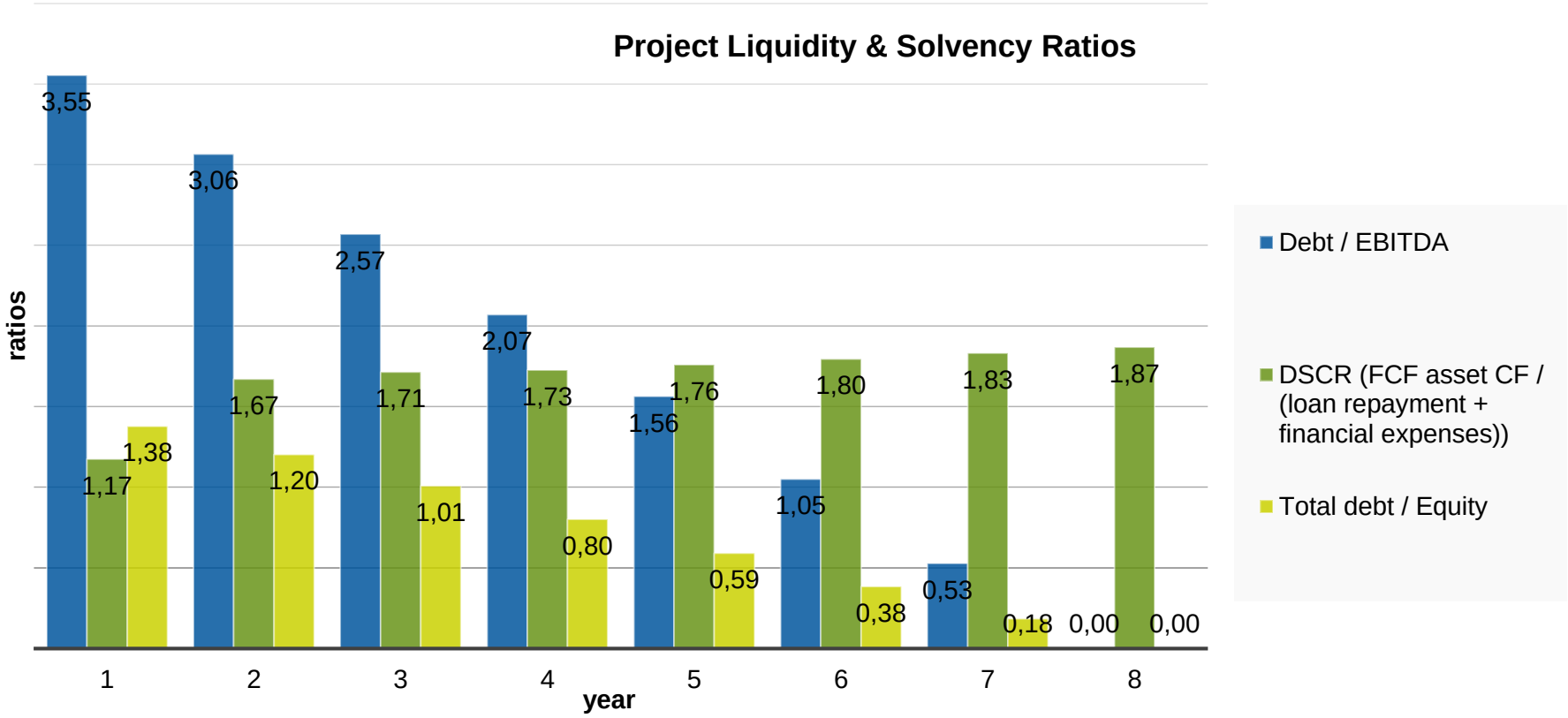
PROJECT CASH FLOWS



CF = Cash Flow

FINANCIAL ASSESSMENT

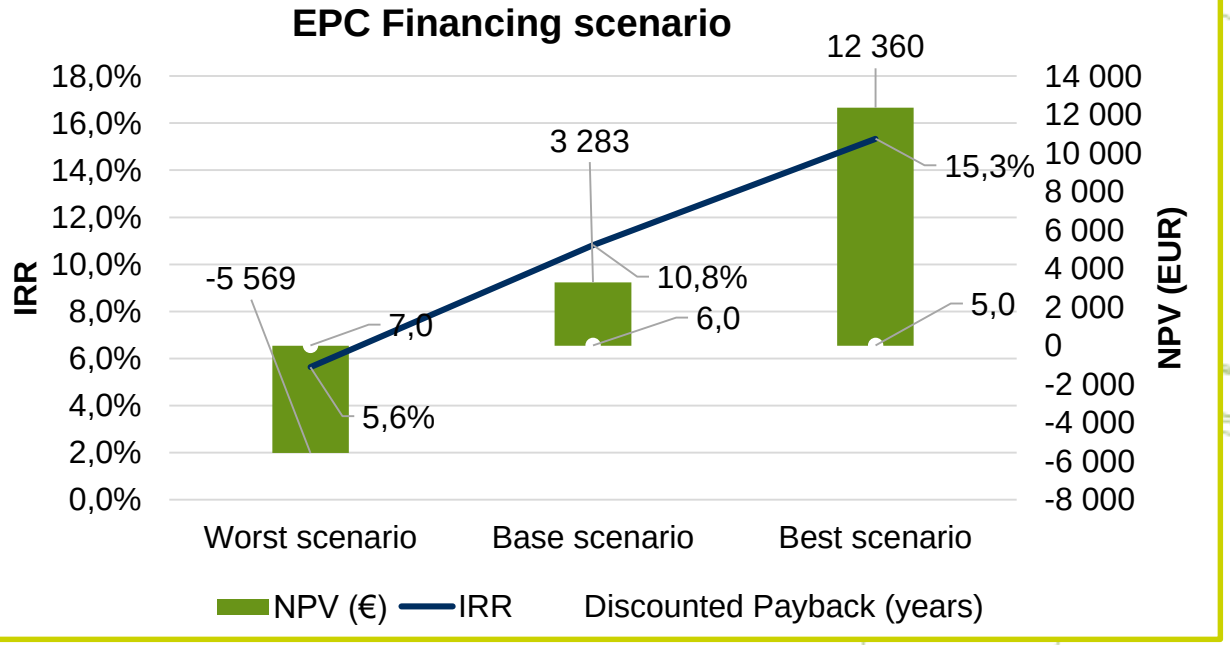
LIQUIDITY & SOLVENCY RATIOS



EBITDA = Earnings Before Interest, Taxes, Depreciation and Amortization
DSCR = Debt-Service Coverage Ratio
FCF = Free Cash Flow

FINANCIAL ASSESSMENT

SENSITIVITY ANALYSIS



PROJECT RATING
B

IRR = Internal Rate of Return
NPV = Net Present Value
DSCR = Debt Service Coverage Ratio
FCF = Free Cash Flow

EPC Financing scenario

FINANCIAL KPIs	IRR	NPV (€)	Discounted Payback (years)	Min DSCR	Average DSCR	Negative FCF (years)
Worst scenario	5,6%	-5.569	7,0	1,3	1,7	0,0
Base scenario	**10,8%**	**3.283**	**6,0**	**1,4**	**2,0**	**0,0**
Best scenario	15,3%	12.360	5,0	1,5	2,3	0,0

FINANCIAL ASSESSMENT

EPC PROJECT RATING

PROJECT RATING

Hotel in Crete

Energy Performance Contract Potential

Financial savings:	**21.218**	**€**
Energy savings:	**194.651**	**kWh/year**
Energy savings percentage:	**37,66**	**%**
Carbon savings:	**170.419**	**kgCO_2/year**
Investment:	**103.605**	**€**
Equity percentage:	**40,00**	**%**
IRR:	**10,8**	**%**
NPV:	**3.283**	**€**
avg. DSCR:	**2,0**	
min. DSCR:	**1,4**	
Discounted payback:	**6,0**	**years**

IRR = Internal Rate of Return
NPV = Net Present Value
DSCR = Debt Service Coverage Ratio

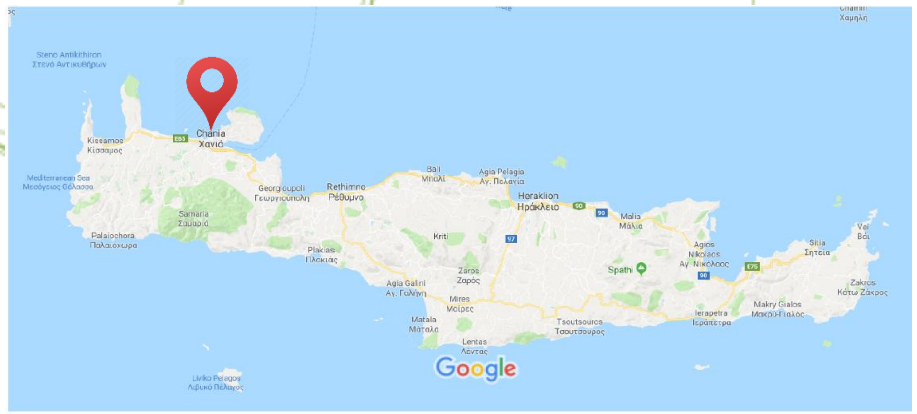
PROJECT RATING
B

LABEL	DESCRIPTION
A	High Profitability, low likelihood of bad performance, very robust structure, short payback time, with a high level of security in the loan
B	Medium-High Profitability, medium-low likelihood of bad performance, medium-short payback time, with a medium-high level of security in the loan
C	Medium Profitability, medium likelihood of bad performance, medium payback time, with a medium level of security in the financing
D	Medium-Low Profitability, medium-high likelihood of bad performance, medium-long payback time, with a medium-low level of security in the financing
E	Low Profitability, high likelihood of bad performance, long payback time, with a low level of security in the financing

OFFICES BUILDING

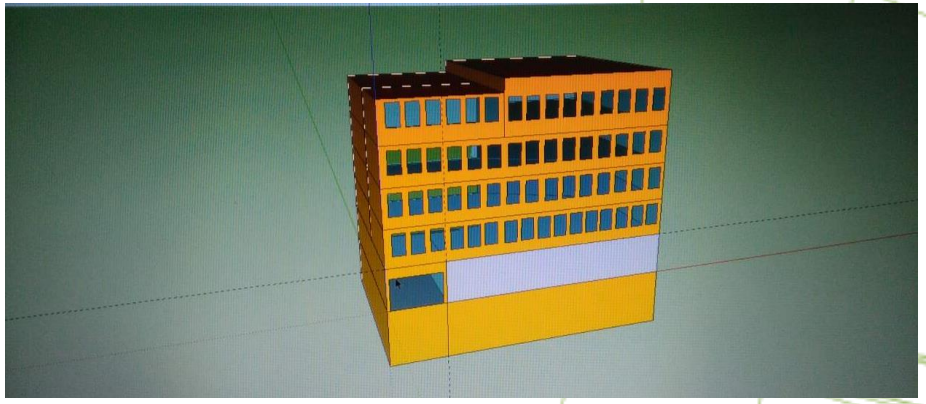
PROJECT OVERVIEW

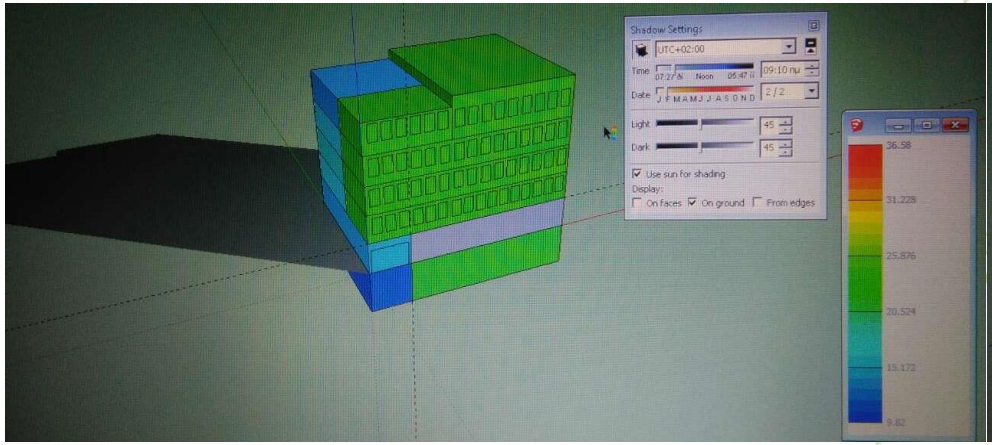
Building type	Office building
Location	Crete, Greece Urban location, town center
Main features	Building consists of basement and 5 floors. The only source of energy used is electricity. The building has a lot of losses from the openings (windows and door).
Built in	1968
Operation	All-year
Average occupancy	22%

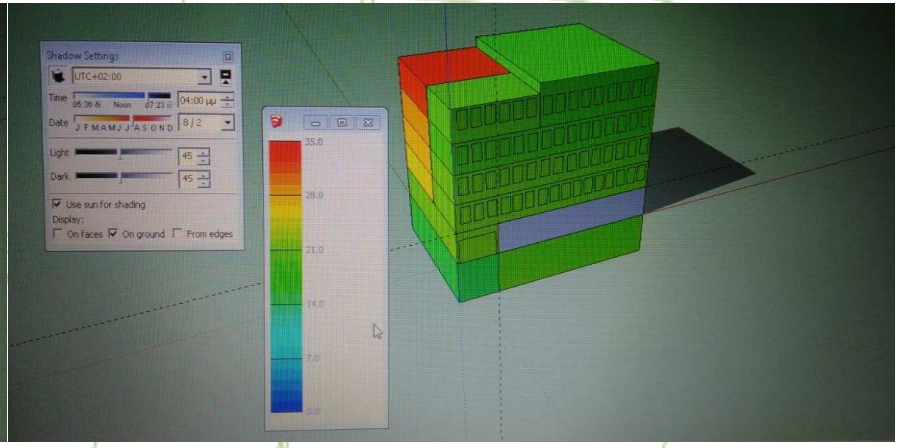


PROJECT OVERVIEW

DYNAMIC THERMAL SIMULATION



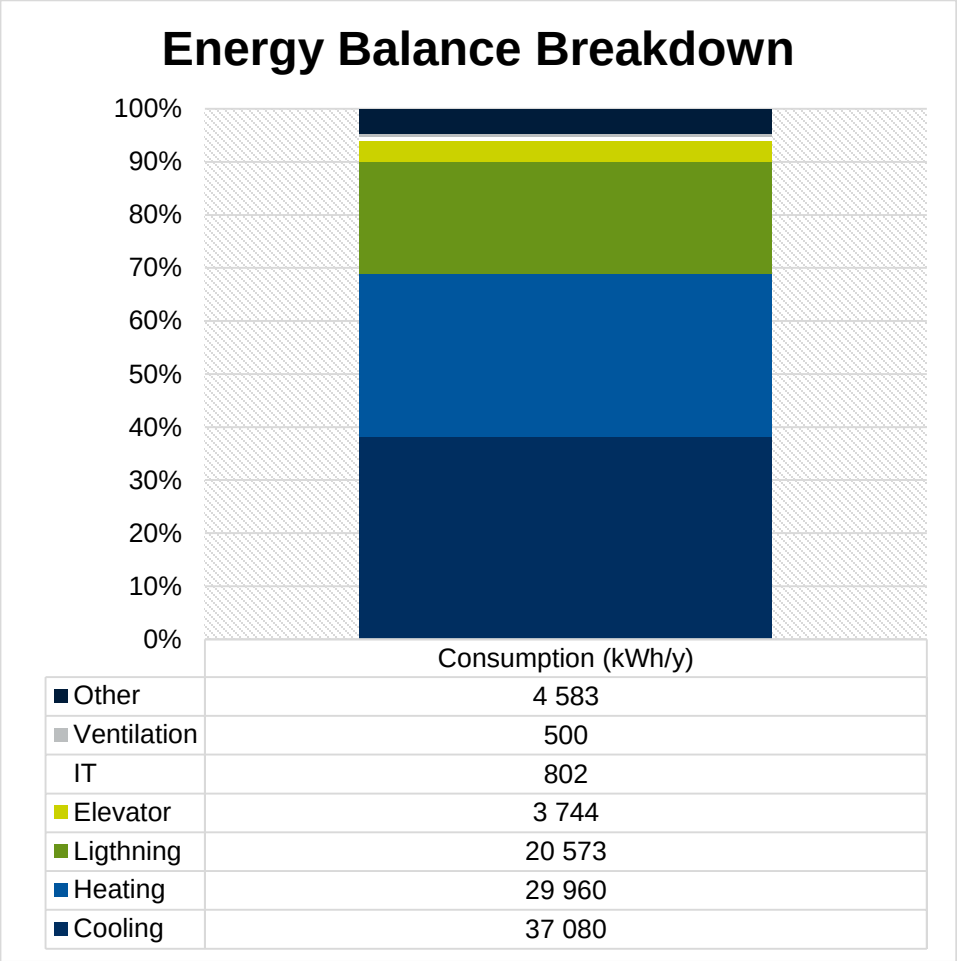




PROJECT OVERVIEW

ENERGY BALANCE

- The overall annual energy consumption is **97.200 kWh/year**
- The corresponding annual energy costs of the building account for **17.400 €/year**
- The emissions associated are of **96.200** kgCO2eq/year
- Cooling and heating are the main consumption items, summing a total of around 70% of energy consumption



	Consumption (kWh/y)
Other	4 583
Ventilation	500
IT	802
Elevator	3 744
Ligthning	20 573
Heating	29 960
Cooling	37 080

PROJECT OVERVIEW

ENERGY SAVING MEASURES RECOMMENDED

Measure	Savings [kWh/year]	Savings [€/year]	% Financial savings	Investment [€]	Simple payback [years]
Substitution of conventional lamps	10.551	1.891	10,8 %	6.772	3,6
Occupancy and presence sensor	332	59	0,3 %	510	8,6
Substitution of doors (automatic door)	6.467	1.159	6,6 %	6.000	5,2
Substitution of windows	25.219	4.519	25,9 %	24.293	5,4
TOTAL	**42.569** (44% of total consumption)	**7.628**	**43,8 %** of total yearly costs	**37.575**	**4,9**

The implemented scenario and the measures recommended are based on the building owner priorities and intentions; the financial analysis follows in the next slides

KEY MEASURE

SUBSTITUTION OF WINDOWS

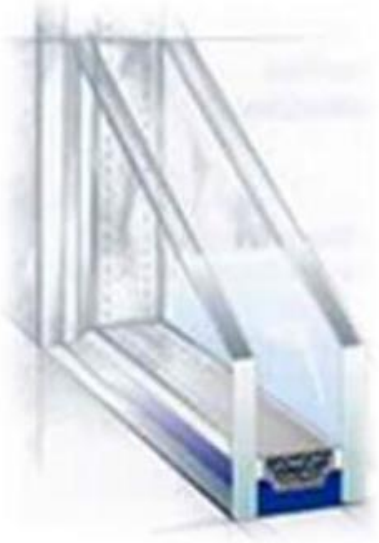
CURRENT SITUATION

The windows of the building are **obsolete** (single glazing, old fixture) and this results in significant **energy losses**, as well as **poor indoor conditions**, in terms of **thermal comfort** and **noise** from the busy road outside the building.

SAVINGS PROPOSAL

The **replacement** of these old windows with **aluminum frame double glazing windows** will significantly improve the indoor conditions for the building occupants and at the same time reduce the energy required to heat/cool the building.

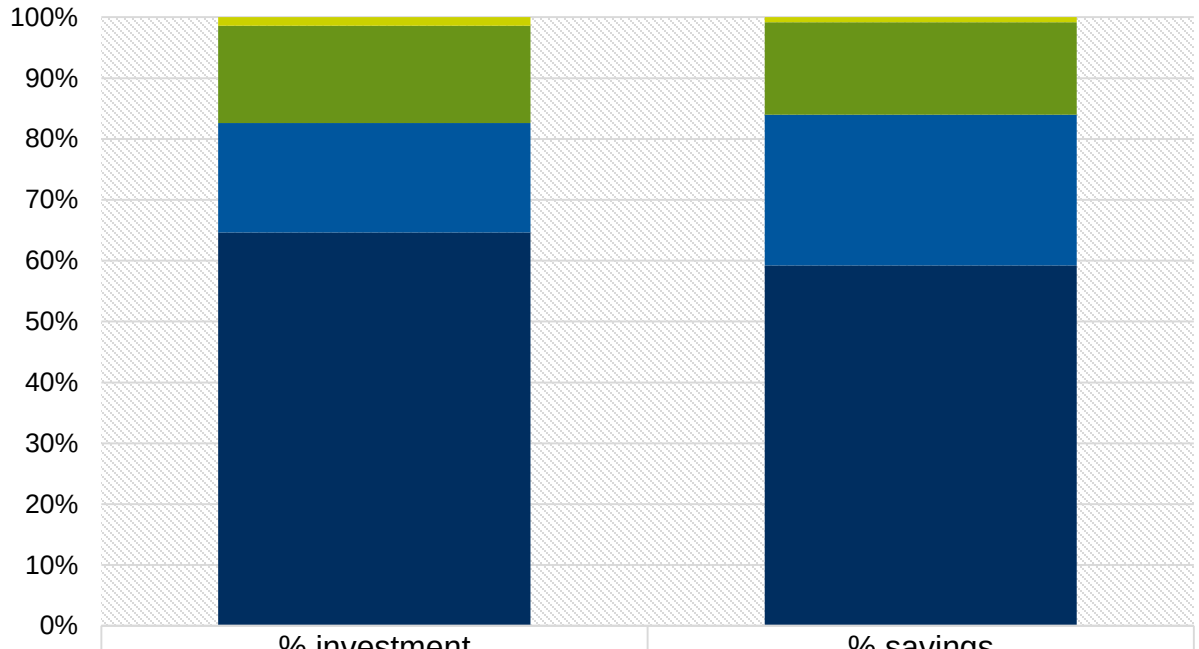
Energy savings (kWh/yr)	25.219
Economic savings (€/yr)	1.891
Investment required (€)	24.293
Payback (yrs)	5,4



PROJECT OVERVIEW

ENERGY BALANCE

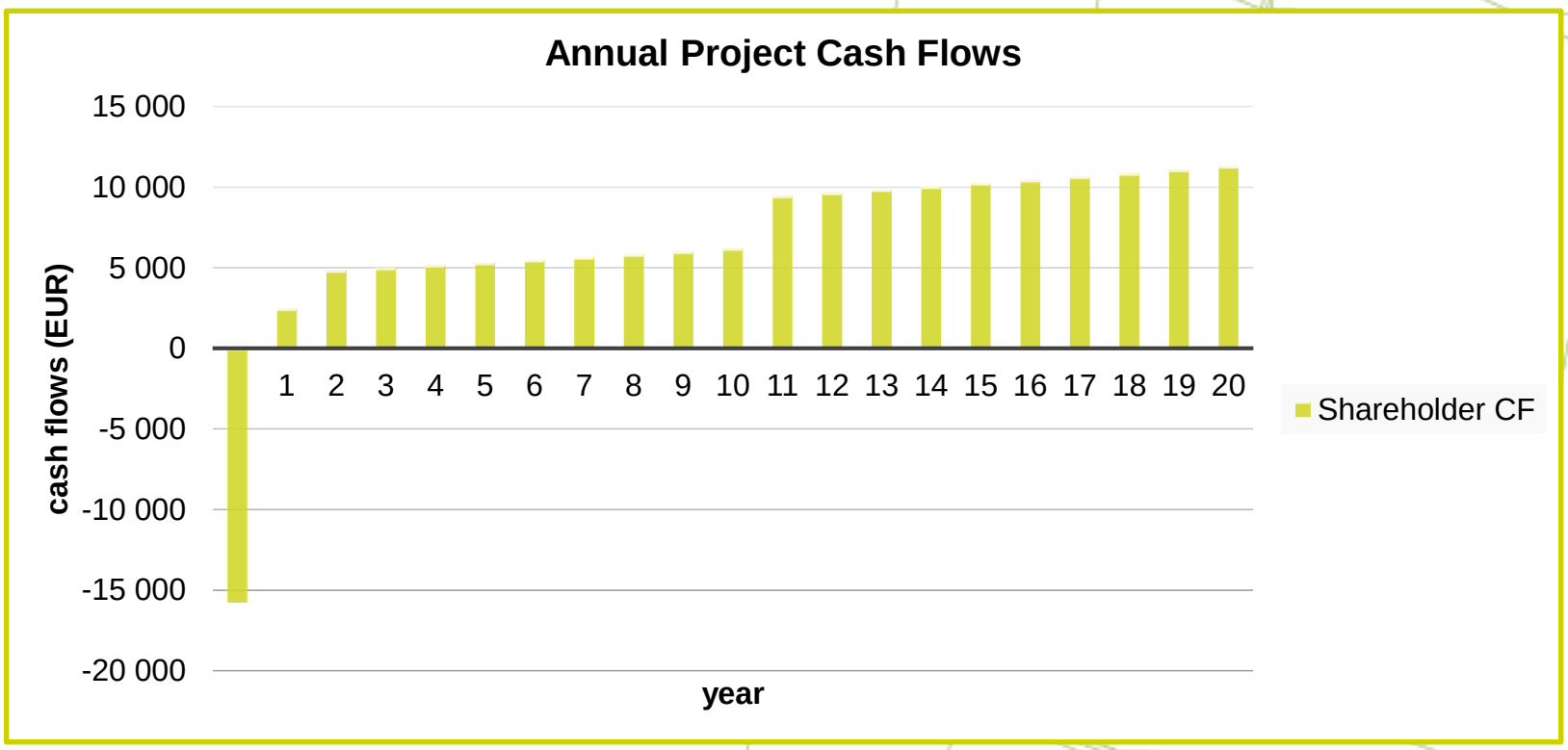
Investment and Savings



	% investment	% savings
Occupancy and presence sensors	1,4%	0,8%
Substitution of doors	16,0%	15,2%
Substitution of conventional lamps	18,0%	24,8%
Substitution of windows	64,7%	59,2%

FINANCIAL ASSESSMENT

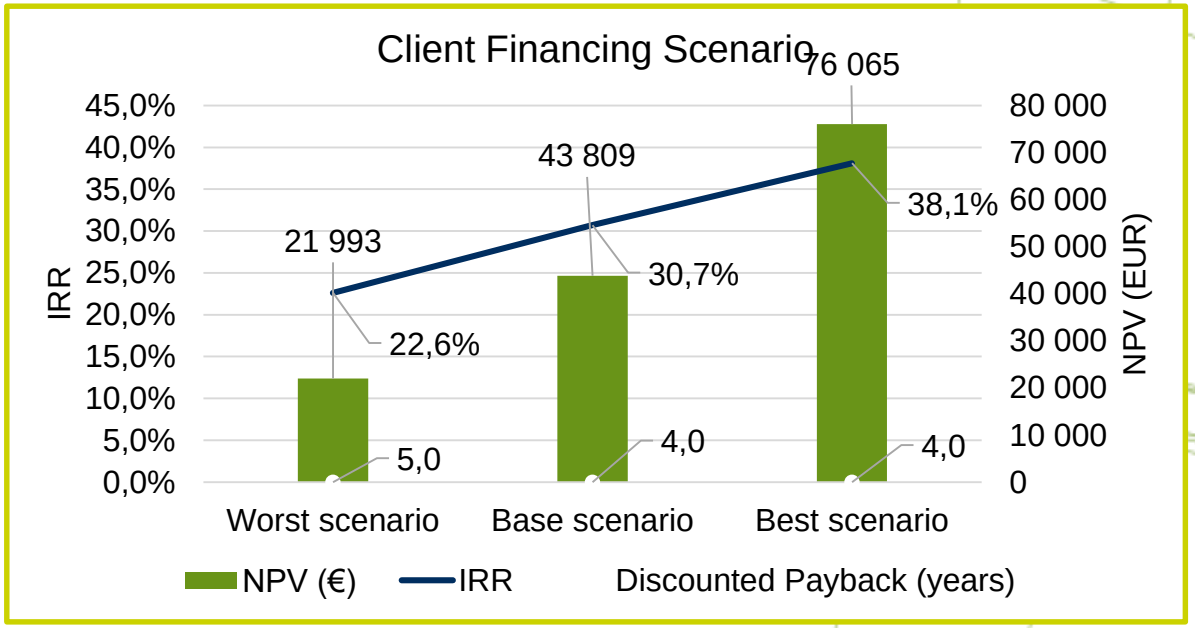
PROJECT CASH FLOWS



CF = Cash Flow

FINANCIAL ASSESSMENT

PROJECT RATING



PROJECT RATING
A

IRR = Internal Rate of Return
NPV = Net Present Value
DSCR = Debt Service Coverage Ratio
FCF = Free Cash Flow

Client Financing scenario

FINANCIAL KPIs	IRR	NPV (€)	Discounted Payback (years)	Min DSCR	Average DSCR	Negative FCF (years)
Worst scenario	22,6%	21.993	5,0	1,5	2,0	0,0
Base scenario	**30,7%**	**43.809**	**4,0**	**1,6**	**2,7**	**0,0**
Best scenario	38,1%	76.065	4,0	1,8	3,5	0,0

* Key Performance Indicators

FINANCIAL ASSESSMENT

PROJECT RATING

PROJECT RATING

Office Building in Chania

Energy Efficiency Project Potential

Financial savings:	**7.628**	**€**
Energy savings:	**42.569**	**kWh/year**
Energy savings percentage:	**43,78**	**%**
Carbon savings:	**42.101**	**kgCO_2/year**
Investment:	**37.575**	**€**
Equity percentage:	**40,00**	**%**
IRR:	**30,7%**	**%**
NPV:	**43.809**	**€**
avg. DSCR:	**2,7**	
min. DSCR:	**1,6**	
Discounted payback:	**4,0**	**years**

IRR = Internal Rate of Return
NPV = Net Present Value
DSCR = Debt Service Coverage Ratio

PROJECT RATING
A

LABEL	DESCRIPTION
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C	Medium Profitability, medium likelihood of bad performance, medium payback time, with a medium level of security in the financing
D	Medium-Low Profitability, medium-high likelihood of bad performance, medium-long payback time, with a medium-low level of security in the financing
E	Low Profitability, high likelihood of bad performance, long payback time, with a low level of security in the financing

CONCLUSIONS - RECOMMENDATIONS

- ✓ The analysis in the tool is based on **real data from the energy audit** and the **dynamic thermal simulation** of the building.
- ✓ The energy saving scenarios and corresponding interventions **emerged after interviews and personal discussions** with owners to investigate the investments priorities/interest.
- ✓ The project actors can **compare the different scenarios on equal terms,** following a standardised approach and decide which is the most appropriate
- ✓ In the case of the hotel, the preferred scenario was an **8-year EPC project with a GREPCon rating of B**.
- ✓ In the office building case, where the investment was lower, the preferred scenario was client financing with a **GREPCon rating of A.** An EPC could be possible if a grant can be obtained.
- ✓ The selected scenario can be optimized by fine-tuning the financial parameters.
- ✓ This approach is expected to lower project risk perceived by the financial institutions and unlock access to financing for energy efficiency projects.

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THANK YOU FOR YOUR ATTENTION

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