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Renewable energy performance contracting in the tertiary sector Standardization to overcome barriers in Greece

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A B S T R A C T

The European Union targets for 27% renewable energy share by 2030. At the same time, all new buildings should be nearly zero energy buildings from 2020 onwards. A major obstacle to these objectives is a combination of current economic stagnation and limited investors' confidence, which leads to low investment proportion. Despite many renewable energy technologies are already at a competitive level, the implementation rate in buildings is still low. In this paper, we focus on advances in efficient mechanisms to overcome non-technical barriers to the increase of renewable energy applications in buildings, such as Energy Performance Contracting (EPC). Tertiary sector holds a huge untapped potential for such applications, especially in Southern Europe. The Trust-EPC-South European initiative, implemented in six southern EU countries with a mix of beginner and intermediate energy service markets, aims at encouraging the financing of sustainable energy solutions in the tertiary sector, by creating a framework for standardization, assessment and benchmarking, thus improving trust and confidence in the financing parties. This paper presents three case studies in Greece, a Mediterranean family resort hotel, a resort and spa hotel and an office building. The installation of renewable energy measures, including photovoltaic systems, solar thermal systems and heat pumps, was examined and their EPC potential was rated, by using the described standardization and benchmarking methodology. Their economic savings range from 3 to 23% on yearly energy costs, at a discounted payback of 3–6 years, depending on the measure. A sensitivity analysis shows the impact of the variation of technical and economic parameters on the EPC projects feasibility. The standardization practice applied is expected to support the project actors in securing appropriate financing and eventually proceed with the renewable energy installations through the EPC.

1. Introduction

The European Union (EU) targets to 20% reduction of overall energy consumption by 2020, according to the 2012/27/EU Energy Efficiency Directive [1] and to 20% final energy consumption from renewable sources by 2020, as set in the 2009/28/EC Renewable Energy Directive [2]. These targets will be expanded to 30% and 27%, respectively, by 2030, following the European Commission's proposals for revised directives [3]. According to the latest report on the progress of EU Member States [4], the share of Renewable Energy Sources (RES) in 2014 reached to 16% of gross final consumption in the total of 28 Member States.

At the same time, the transition to nearly Zero Energy Buildings assumes that a large percentage of buildings' primary energy use will come from renewable energy produced on site or nearby. According to the Energy Performance of Buildings Directive 2010/31/EU (EPBD recast) [5], from 2020 onwards, all new buildings should be built with nearly zero energy standards, as these are set in the national regulations.

As regards Greece in specific, other mandatory requirements in the national legislation foresee that all new or refurbished buildings meet at least 60% of their needs for Domestic Hot Water (DHW) through solar thermal systems, unless covered through other decentralized energy generating systems that are based on RES, Combined Heat and Power, district heating or heat pumps [6]. In Greece, the estimated share of RES in tertiary sector buildings was 27% in 2015 and it is planned to reach 39% in 2020 [7]. Although current RES technologies have the potential to cover this, there are

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Abbreviations

DHW	Domestic Hot Water
DSCR	Debt Service Coverage Ratio
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Contracting
EU	European Union
IRR	Internal Rate of Return
NPV	Net Present Value
PV	Photovoltaics
RES	Renewable Energy Sources

still other non-technological barriers hindering the investments in RES applications in buildings, these being mainly the economic stagnation faced by many southern European countries, including Greece, in combination with limited investors' confidence.

Even though governments can encourage ambitious energy efficiency renovation goals [8], the market is currently shifting away from feed-in tariffs for RES and therefore needs new and flexible mechanisms to mobilise private investments in this sector. Energy Performance Contracting (EPC) is such a mechanism, which, by definition, offers an integrated solution to the final user, including planning, financing, installation and monitoring of RES systems, helping to overcome barriers such as access to financing for project developers, lack of certification schemes, insufficient public support. There are also cases where EPC is used in the context of a public-private partnership; a fee-for-service model is applied, in which the State provides incentives to building owners to install RES systems, but the responsibility of maintenance is allocated in the private sector [9]. EPC provides the opportunity to the end-user to install energy efficiency and RES measures in their facilities without making an investment in equipment. The advantages for the end-user are numerous: energy saving tasks are outsourced to external service providers, which are remunerated based on their performance; long-term, guaranteed cost savings with zero or minimal investment are provided; technical risks and responsibilities are covered by EPC provider; planning process coordinated by EPC provider; less consumption with desired comfort levels; refurbishment of buildings and facilities; asset value of the premises is increased; the end-user's environmental impact is consistently reduced.

The EPC market is considered mature in several EU countries (such as Germany, Sweden and Austria), but this is not the case in southern European countries, where lighthouse projects are still rare in the tertiary sector. The market in Greece is at an early stage; EPC projects are estimated to 70–100, with only a few completed [10]. These were mostly pilot projects, in the context of national or EU projects, focused on schools, local administrations, healthcare facilities and hotels and some in the industry. A number of projects, less than 10, were implemented in municipal street lighting and in public hospitals [11]. At the time this paper was written, the EPC providers registered in the official registry [12] were no more than 60, but not all of them not all of them have actual EPC projects implemented or running. A national programme, expected to run in the period 2015–2020 foresees the renovation of 3.000 tertiary sector buildings, through EPC, with an estimated 50,8 ktoe energy savings [13].

In a previous work, the authors conducted an EPC market mapping in Greece, which included interviews with 18 EPC providers; the results showed that the customers of 85% of the interviewed companies come from the tertiary sector. The market is focusing on hotels, private offices, shops and hospitals, as shown in Fig. 1.

The most common RES applications are photovoltaics (PVs) for electricity production, solar collectors for DHW production and heat pumps (Fig. 2).

The study revealed that the main barriers for the EPC market uptake are: the problematic access to financing, the absence of flagship projects, the inefficient supporting regulatory framework, the lack of suitable bank products, the lack of credible verification and measurement tools and methods and the complexity of the EPC concept and process, as such. For potential end users, the lack of trust and transparency is also a major barrier. Financial actors consider that among the roadblocks are also the lack of guarantees and equity, the little capacity to deal with the complexities of EPC projects and the small investments, which make the projects less profitable for the banks [15].

Trust amongst involved parties needs to be enhanced; certification, validation, and assessment tools are needed to create bankable projects with a clear business case, thus unlocking access to third-party financing [16]. High transaction costs need to be reduced, since they pose a barrier to the development of EPC markets, as was identified in previous studies [17]. The rating of projects as "investment grade" with independent risk assessment tools, can enhance private investment and reduce costs for RES technologies, through reduced technical risk and reduced financial risk [18]. Moreover, EPC providers need to transparently demonstrate and justify the measurable benefits of the EPC projects for their clients and banks [19]. With this premise, standardization and benchmarking methods were identified among the potential solutions to address barriers, as they can provide a basis for assessing an EPC project with common criteria and transparency. A model based on Analytic Network Process for sustainable building energy efficiency retrofits through EPC for hotels was introduced by Ref. [20]. A financial tool for the cost-effective renovation of buildings was presented by Ref. [21], whereas [22] provides an interesting review of methods used for EPC business model selection, that impact the EPC project performance.

In this paper, we present a standardization and benchmarking framework, developed in the context of the Trust EPC South European initiative [23], and the results from its application in selected pilot projects from the tertiary sector in Greece, focusing on RES measures.

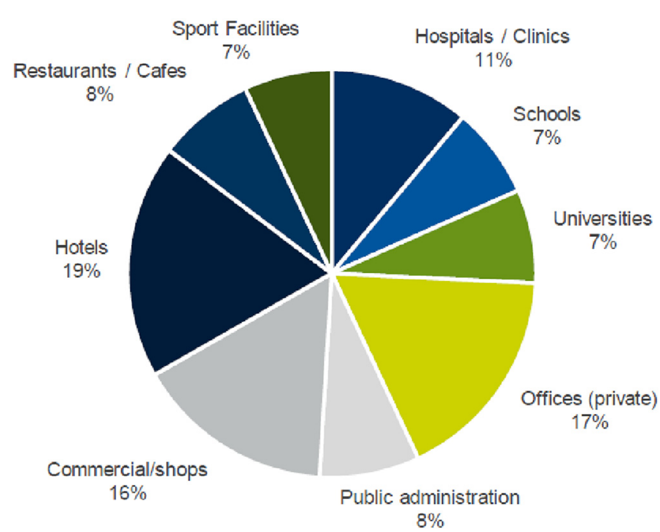

Fig. 1. EPC market segmentation per building type/use in Greece [14].

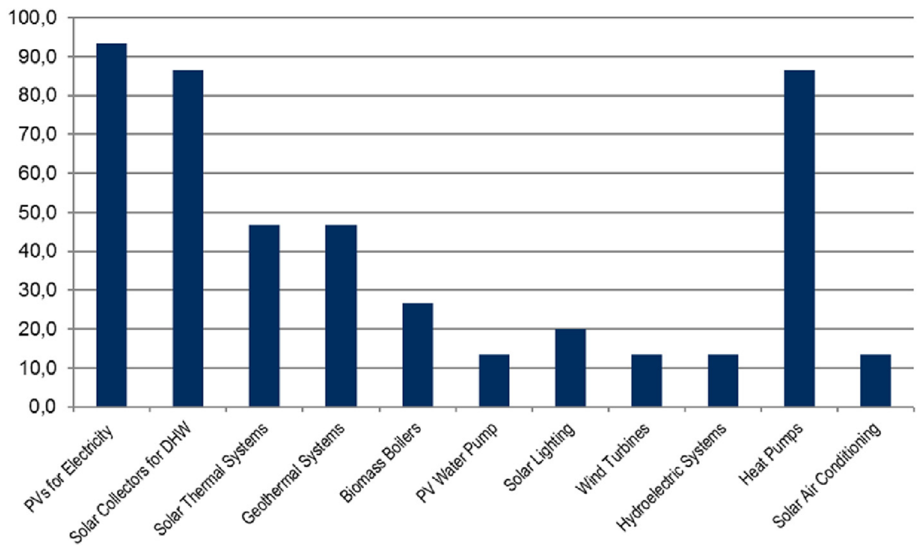

Fig. 2. Renewable Energy applied solutions in EPCs in Greece [14].

2. Methodology

A standardization and benchmarking methodology was applied in order to appraise the feasibility of the installation of RES measures in tertiary sector buildings through EPC and to support their access to financing.

The methodology is represented graphically in Fig. 3 and comprises the following steps:

- Detailed energy audit in the buildings to: collect building plans, data about building's fabrics, energy bills (electricity, oil, gas, biomass etc.) and water bills, perform technical equipment inventory, as well as to collect building operational data, such as operation times and schedules, occupancy patterns, control systems (e.g. heating and cooling set-points) and occupancy levels;

- Thermal simulation of the building, using a dynamic or semi-dynamic thermal simulation software, in order to validate the building construction and details of fabrics used to set up the thermal model;

- Application of the standardization and benchmarking framework, based upon an analytical tool called GREPCon (described in 2.1), to calculate the energy breakdown, the savings achieved by standardized RES measures applied in the building and eventually to perform the financial assessment, resulting in a feasibility rating potential for EPC.

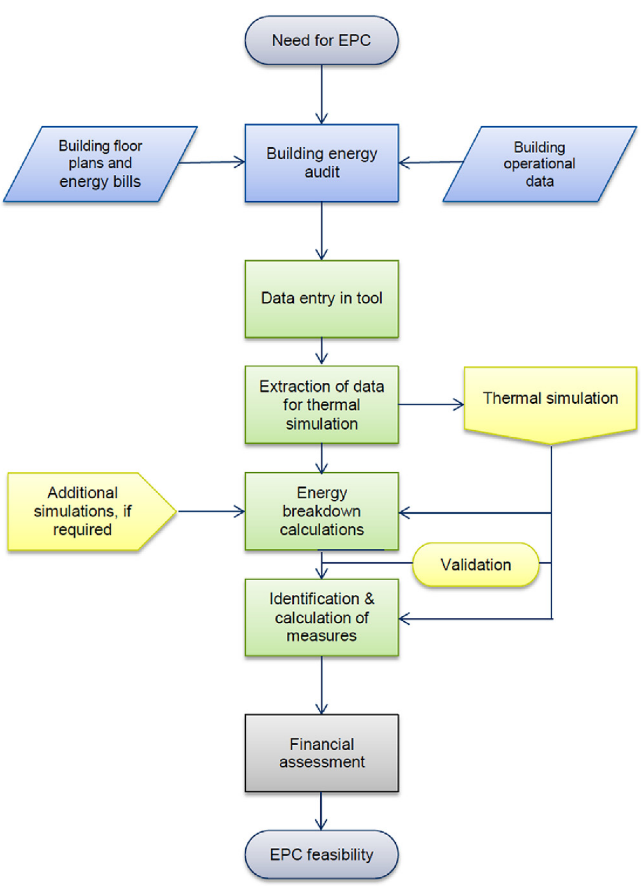

Fig. 3. Standardization and benchmarking methodology followed.

The key point in the methodology is the qualification and training of the person who conducts the energy audits, the data collection, the thermal simulation and the insertion of data in the tool. More importantly, the energy auditor should have the experience and knowledge to propose the proper energy interventions for each case. The qualified professional in Energy Efficiency and RES will have subsequently the opportunity to be properly trained for the optional tool use in order to investigate the EPC feasibility of each case. Another important issue detected during the study and implementation steps is the investigation of interest with the owner/operator of the building for energy efficiency investments. The exchange of useful information with a long-standing user of the building is necessary.

The methodology was applied in three pilot projects with lighthouse significance, belonging to the priority segments of the tertiary sector, as identified during the national market mapping (hotels, offices) and in addition have the potential to become flagship cases in their respective sectors. The projects from the hospitality sector are typical hotels in their category (resort hotels, urban and coastal respectively) and climate zone (Mediterranean), so the solutions proposed are highly replicable by other similar hotels in the area. The positive results from this methodology can be easily showcased in SME hotels, which constitute 90% of the European hospitality market and, generally, face more barriers, when it comes to improving their energy efficiency, due to their difficult access to financing [24]. At the same time, improving their energy efficiency can have many benefits, not only energy cost savings, but also other benefits for the hotel business [25]. As concerns the office building, it was chosen as a pilot project since it has a great potential to become a flagship project, not only for the private, but also for the public sector; furthermore, the organization operates under EN ISO 50001:2011 and already is familiar with energy management issues.

2.1. Standardization and benchmarking tool

The standardization and benchmarking method is based on an analytical tool called GREPCon; the tool builds on the existing Green Rating™ methodology developed by Bureau Veritas and further enhanced in the framework of the Trust EPC South project, to support the technical and financial assessment of EPC projects (Fig. 4). The tool supports a standardized and certified approach towards building representation and modelisation of up to 46 technical energy saving and generation measures, categorized in lighting, HVAC, DHW, RES and others, to foster a common understanding of EPC project risks and benefits, thus improving transparency and trust in the potential returns among all investment stakeholders.

The inputs of the tool are the technical, environmental and operational data from the energy audit, as well as the heating and cooling needs and reference floor area from the thermal simulation. Based on that, the tool calculates the energy breakdown for the building, and then identifies potential EE and RES measures for the particular building. The auditor chooses the preferred measures and then for each one, the tool calculates the returning expected savings in kWh of final energy, € (or other chosen currency), kg of CO_2 equivalent and expected payback time.

These technical results are fed automatically into the financial module of the tool, which creates different financial scenarios, by combining different sets of measures. The optimum scenario can be further studied and fine-tuned, by adjusting financial parameters, such as loan percentage, EPC project duration, client shared savings etc. The financial model calculates the project cash flows, the project liquidity and solvency ratios and various economic indices. A sensitivity analysis is performed on the basis of three scenarios (Worst, Base, Optimal), considering the variation of the technical risks (actual financial savings achieved, possible investment overcost, operation & maintenance overcost) and the external risk (general inflation rate, energy inflation rate and interest rate). A set of EPC ratings is provided to allow for a clear overview and benchmarking of the technical and financial feasibility of EPC projects assessed.

The framework is being tested on 40 + pilot projects with lighthouse relevance in six Southern European countries (Croatia, France, Greece, Italy, Portugal and Spain), representing a variety of typologies (office buildings, hotels, schools, hospitals, sport centres, retail stores) and different sizes (900–200.000 m^2).

2.2. Dynamic thermal simulations

Each standardization project requires running a dynamic or semi-dynamic thermal simulation and this is an integrated part of the methodology. The purpose is to provide reference floor area, to provide validation of building construction data against energy bills and to provide quantification of heating and cooling energy needs, where sub-metered data are not available.

For the buildings studied in this paper, TRNSYS simulation software was used. The multizone buildings were designed with importing geometry and specifications in TNRSYS3D plugin for SketchUp™, according to data collected from the detailed energy audit. It should be mentioned that only scheduled set points for cooling and heating (if any, depending on occupancy schedule of the building) were required to be inserted in TRNBuild, considering the GREPCon tool requirements. Heating, cooling and ventilation systems were not taken into account in the simulation, as they were directly inserted into the GREPCon tool along with lighting and other systems.

As regards the occupancy schedule, in office buildings it was easily determined according to the office opening hours. However, in hotels, the determination of the occupancy schedule was based mainly on assumptions and assessments based on collected data. Average occupancies in hotels' spaces were assumed, according to the type of space use and hotel's occupancy data, especially in facilities such as restaurants, spa, bars, nightclubs and others. A typical schedule of cooling and heating systems daily operation was

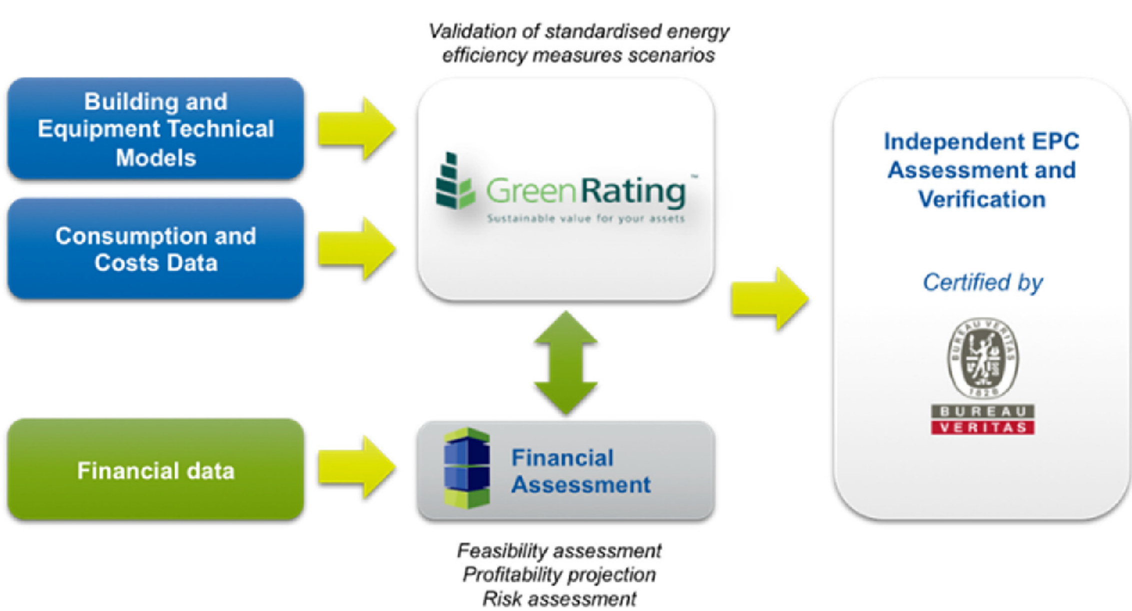

Fig. 4. GREPCon approach for EPC assessment and verification [26].

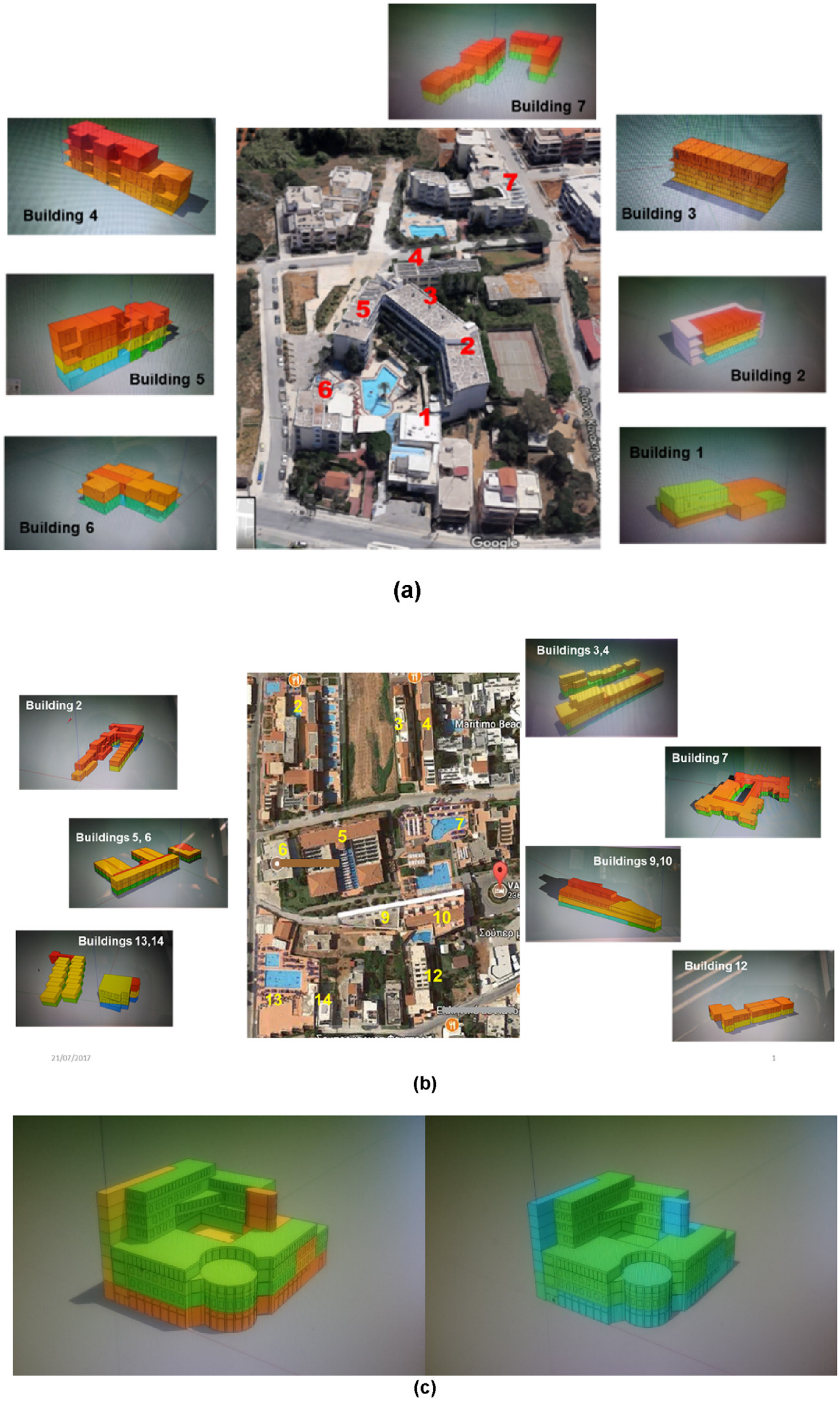

Fig. 5. Thermal simulation of (a) family resort hotel (heating loads), (b) Resort and Spa hotel (heating loads) and (c) office building (heading loads-left, cooling loads-right).

Table 1
Key energy profile data for the three examined buildings.

		Pilot case 1	Pilot case 2	Pilot case 3
Building type		Family resort hotel	Resort & spa hotel	Office building
Location		Crete, urban	Crete, coastal	Athens, urban
Main features		7 buildings complex, 324 beds, restaurant, 3 pools	15 buildings complex, 1.036 beds, restaurants, bars, spa, kids club, pools (1 indoor, 5 outdoor, 21 private)	7 floors, 1 basement, 5 level underground parking
Main energy consuming facilities		kitchen, restaurant, laundry, rooms	rooms, kitchen, restaurant, spa centre	Server, offices
Operation		May–October	April–October	All year
Average occupancy during period of operation (%)		84	78	85
Size (m^2)		4.450	18.018	6.575
Energy consumption ($kWh/m^2/y$)	Electricity	82	73	120
	LPG	38	15	–
	Natural gas	–	–	26
	Oil	–	5	–
	Biomass	–	24	–

set, in parallel with occupancy.

Validation of the building model is done against energy bills. Electricity bills were used for the cooling demands validation in both the hotels and the office building, and natural gas invoices for heating demands in the office building. Heating or cooling needs to be exported from simulations should be within 10% difference to the ones calculated by the tool, in order to ensure that a representative model of the building has been created and that energy efficiency interventions are satisfactorily rendered. Identification and calculation of savings from measures determine the financial assessment results.

As concerns the two hotels, both were complexes of buildings, as shown in Fig. 5 (a) and (b). The energy consumption is not submetered per building, therefore in both cases, we had to deal with the whole complex as a single project, in order to be able to validate the model against bills. The case of the office building was simpler, as shown in Fig. 5(c).

3. Results & discussion

The results from the application of the described methodology on three pilot buildings in Greece are presented here. It should be mentioned that the pilot buildings are representative cases of office buildings with annual use and medium scale hotels with common facilities for residents in summer destinations, like restaurants, bars, swimming pools etc. More specifically, seasonality in case of hotels is an important issue for general application of energy efficiency measures (no need for corresponding dimensioned heating systems for instance) in order to deliver the expected economical savings. Additionally, the three pilots are located in Crete and in Athens, representative locations for Mediterranean regions with corresponding climate conditions, mild winters and hot summers.

The first case is a hotel, with seasonal summer operation (May–October), consisting of seven buildings and accommodation capacity of more than 300 beds. It features services, such as swimming pools, pool bars, restaurant, mini market, playground, conference room. Due to the seasonal summer operation, only cooling needs were exported from TRNSYS simulation. Fuel and electricity invoices were used for the validation of the model, in which there was a 7% deviation of the real data from simulation results. A 50 kWp photovoltaic installation through EPC was studied, which will allow the hotel to save up to 21% of its electricity consumption, with a discounted payback of 5 years. Various other parameters have been examined, such as the possibility to install the system through net-metering, integration in the building, environmental benefits, other benefits for the hotel. It was decided to install the PV system on the free available rooftop space of the buildings, through net-metering. According to the national legislation and the new RES law (L.4414/2016), net metering for commercial PV plants allows installations up to 500 kWp. In non-interconnected islands with Greece's mainland grid, installations can reach up to 20 kWp, except for the island of Crete, where the limit extends to 50 kWp (300 kWp for public bodies). Considering the installed peak power and the solar radiation conditions, the annual energy savings from the PV plant were calculated to 75.000 kWh/year.

The second case is a 15-building complex, operating as a resort and spa hotel, with an accommodation capacity of 1.036 beds. The hotel features multiple services, such as spa centre, five heated swimming pools, restaurants, bars, kids club. Similarly to the first case, only cooling loads were exported from the simulation and validation of the model showed an 8% deviation from real data. Cooling loads for internal spaces are significantly high, with the current cooling system consisting of 300 air-conditioning units with large space requirements, while DHW needs are covered by oil and biomass burners. The first measure studied in this case was the substitution of split units, oil and biomass burners with 60 heat pumps, combined with heat recovery, in order to cover cooling and DHW requirements. Results showed 30% savings of cooling electricity consumption and 89% of the fuel for hot water. Combined with a heat recovery system, this solution results in the overall abolition of oil burners and a reduction of biomass consumption for DHW by 70%. Besides energy savings, this solution has the important advantage of increased available free space by replacing oil and biomass burners with high space requirements. The noise level in the hotel outdoor spaces, where split units are currently located, will be significantly improved. The second RES measure adopted is a 50 kWp rooftop PV system to be installed through net metering. The facility has already 144 m^2 of solar thermal panels for DHW needs installed, covering though only the 22,5% of DHW requirements. The installation of additional 170 m^2 of solar thermal panels was investigated, allowing the hotel to cover up to 50% of its DHW energy demand from solar energy.

An interesting fact as regards the two simulated hotel cases was the differentiation of results among the buildings of the same hotel in relation to previous energy saving interventions in the envelope, windows etc., highlighting lack of capitals for energy saving interventions to the whole building complex. The most inefficient parts of the building complex, with higher energy needs and losses, were located for targeted interventions.

The third case is a relatively new office building in Athens, built in 2008 following bioclimatic architecture and operates under EN

ISO 50001:2011. The building is covered fully with a metal frame on exterior surfaces, having an external atrium and plenty of openings. Both cooling and heating needs were exported in this case from the simulation, due to annual building operation, with 6% deviation from actual heating and cooling data. A number of energy efficiency and RES measures have already been installed, such as geothermal-aided free cooling. The organization has a strategic goal to become a nearly Zero Energy Building by 2020 and is therefore interested to cover a large percentage of their energy consumption with RES. For this case, the installation of a 64 kWp rooftop PV system was studied. In mainland Greece the legislation allows for up to 500 kWp commercial PV systems, covering up to 50% of total power consumption of the customer. Rooftop construction contributes to optimal PV functionality as it has 30° slope and unobstructed solar radiation. Annual energy savings are estimated at 86.700 kWh corresponding to 11% of total yearly energy consumption. The investment will reach to 74.000 € at a discounted payback period of 6 years.

The key data for the three examined buildings are presented in Table 1. Fig. 6 (a)–(c), presents the annual energy breakdown for each case.

In Table 2, the feasible scenarios for the installation of the discussed measures through EPC are presented. It is assumed that 60% of the investment will come from a third-party financing to the EPC provider, a usual loan percentage according to EPC providers, while the rest 40% of the investment is considered to be covered by own funds. The interest rate is determined by the Euribor rate and a typical spread used by banks in green loans currently available in the market. The methodology allows to calculate the EPC potential of each project, as a benchmark-based rating (A-E). By modifying financial parameters, the project developer can compare different scenarios to reach the optimum solution.

The contract duration is amongst the critical parameters that concern EPC projects and especially the risk regulation for the contract parties. Typically, EPC providers prefer longer contracts to avoid cash flow uncertainty; on the other hand, building owners prefer short contracts to have fewer payments [27]. The EPC project duration has a direct impact on the project rating. Fig. 7 shows the dependence of IRR from the EPC duration. PV projects, for instance, can achieve satisfactory ratings if the EPC project duration is above 10 years. In the case of the heat pump with heat recovery, we can achieve a good IRR even with a 7 years contract, whereas in a solar thermal installation even lower contract durations are feasible.

The financial feasibility of the projects is also affected by factors such as the actual financial savings achieved, the possible investment overcost, the operation & maintenance overcost, the energy inflation rate, the general inflation rate and the loan's interest rate. The impact of the variation of these factors on the EPC project are examined in a sensitivity analysis and is reflected in three scenarios (Worst, Base and Best scenario), as shown in Figs. 8–12. The sensitivity analysis is an important decision making instrument for the financing side.

4. Conclusions

The tertiary sector will benefit from a wide use of EPCs for RES installations, as it will allow building owners to increase RES share in their facilities, thus improving their energy efficiency, without the need for upfront investment and with the additional benefit of monitoring the performance of their installation. Standardization approaches in EPC project assessment can support building owners and energy service providers to have easier access to financing, as well as to reduce financing cost, due to lower project risk perceived by the bank.

In this work, we mainly focused on hotels and office buildings in

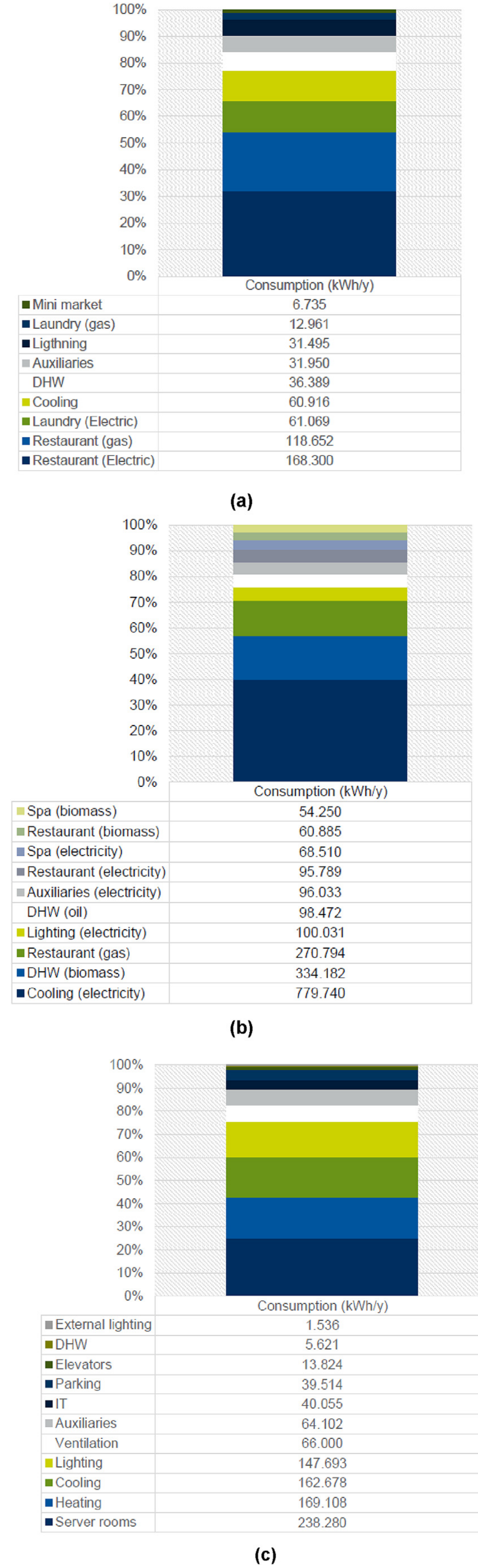

Fig. 6. Annual energy breakdown for each pilot case: (a) Family resort hotel, (b) Resort & spa hotel and (c) Office building.

Table 2
EPC scenarios for RES measures installations in the pilot buildings.

Building	Pilot case 1 -Family resort hotel	Pilot case 2 - Resort & spa hotel			Pilot case 3 - Office building
Measure description	50 kWp rooftop PV system	50 kWp rooftop PV system	60 heat pumps with heat recovery	170 m^2 of additional solar thermal panels	64 kWp rooftop PV system
Annual energy savings (kWh)	75.000	75.000	1.191.820	18.000	86.700
Investment (€)	57.500	57.500	300.000	46.500	74.000
Economic savings (€/yr)	10.500	10.390	73.170	18.500	10.580
% economic savings (on yearly energy costs)	17	3	23	5	10
Investment cost (€/kWh saved during the system lifetime)	0,04	0,04	0,03	0,02	0,04
Investment cost (€/kg CO_2eq saved during the system lifetime)	0,03	0,04	0,03	0,03	0,04
Loan percentage		60%			
Interest rate		4,9%			
EPC loan repayment term (yrs)	12	12	10	10	12
EPC project duration	12	12	10	10	12
Client shared savings		5%			
Project rating	A	A	A	A	A
IRR[a] (%)	19,8	19,5	28,1	52,8	15,0
NPV[b] (€)	15.729	15.313	131.280	53.564	11.122
Discounted payback (yrs)	5,0	5,0	4,0	3,0	6,0
Min DSCR[c]	1,9	1,9	2,4	3,6	1,5
Average DSCR	2,8	2,8	3,2	5,2	2,2

[a] Internal Rate of Return.
[b] Net Present Value.
[c] Debt Service Coverage Ratio.

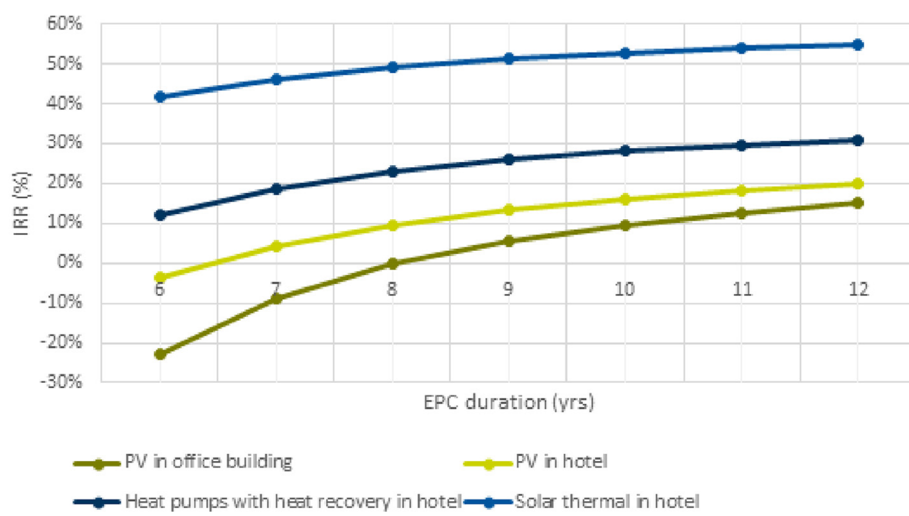

Fig. 7. Dependence of IRR from EPC duration.

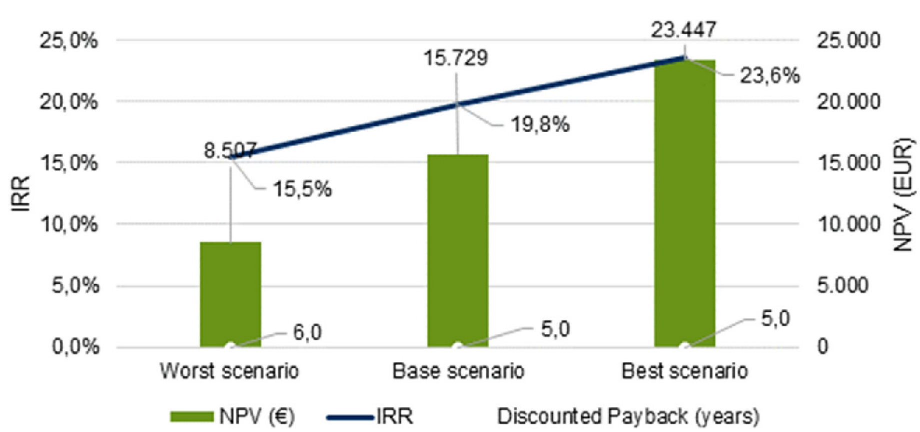

Fig. 8. Sensitivity analysis for the PV EPC project in the family resort hotel.

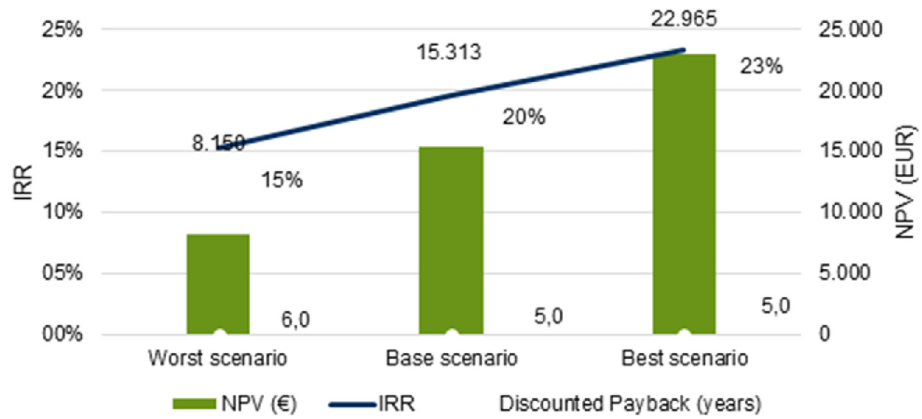

Fig. 9. Sensitivity analysis for the PV EPC project in the resort and spa hotel.

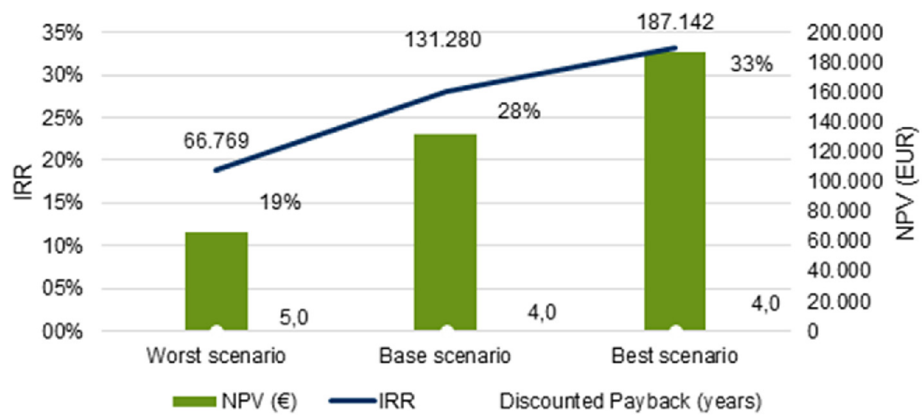

Fig. 10. Sensitivity analysis for the heat pumps & heat recovery EPC project in the resort and spa hotel.

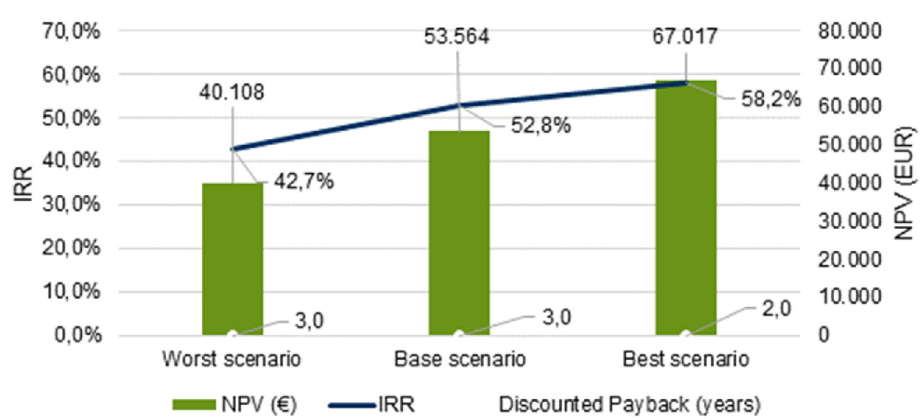

Fig. 11. Sensitivity analysis for the solar thermal EPC project in the resort and spa hotel.

Greece and the RES measures examined were PV, solar thermal panels and heat pumps. The limited number of alternative measures was based on the current owners-potential investor attitude. The standardization and benchmarking methodology used, allowed the assessment of RES measures in terms of energy, environmental and financial savings achieved and provided a full economic assessment and EPC potential rating for each project. This allowed the extraction of comparable benchmark scenarios, which is particularly useful not only for the financing side, but also for the EPC provider and the building owners.

The results lead us to the following conclusions:

- Depending on the measure and the building, a percentage of 3–23% savings on the total yearly energy costs can be achieved, at an investment cost of 0,02–0,04 € per kWh saved during the system lifetime.
- The discounted payback is in the range of 3–6 years.
- The economic feasibility of the EPC project is strongly dependent on the contract duration. The results indicate that the PV

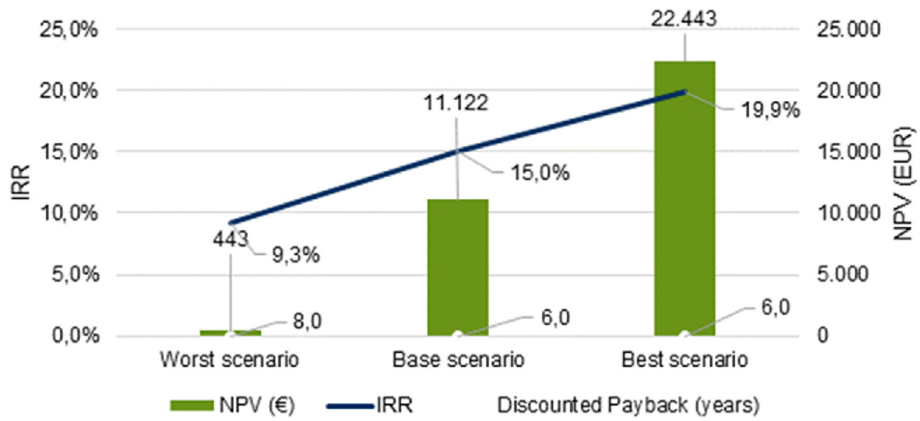

Fig. 12. Sensitivity analysis for PV project in the office building.

projects are more feasible for EPC, when the contract duration is more than 10 years.

The eventual goal is to scale-up this approach to a critical mass of RES projects in the tertiary sector, managing to mitigate barriers in financing, stemming from the lack of trust, and unleash the market's potential for private energy efficiency and RES investments in Southern Europe.

In possible future research, the standardization approach can be further expanded and completed with the inclusion of user behaviour aspects, to allow the quantification of the effect they can have on the expected savings. As EPC will be further established in the market, as a mainstream project implementation mechanism over the next years, more data from EPC projects in the tertiary sector will become available. These data can help to further fine-tune the benchmark ratings of EPC projects and increase the trustworthiness and credibility of the methodology for project developers and financial institutions.

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