New Energy Solutions Optimised for Islands

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EUROPEAN ISLANDS FACILITY

RENEWDAMMUSI

Renewable and energy efficient solutions for local dwellings dammusi

Cristina Becchio
cristina.becchio@polito.it

Politecnico di Torino
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IEEM INDOOR ENVIRONMENT & ENERGY MODELING

TEBE-IEEM Research Group,
Energy Department,
Politecnico di Torino
in cooperation with Ing. A. D'Ancona

Introduction

TEBE-IEEM Research Group supported *Ente Parco Nazionale dell'Isola di Pantelleria* (PNIP) in developing RENEWDAMMUSI project.

RENEWDAMMUSI project aims to enable and encourage **the spread of renewable and energy efficient solutions** for typical local dwellings "dammusi" by proposing an innovative approach in the management of permitting procedures at the island scale.

The project engages institutional actors responsible of environmental and landscape permission procedures (PNIP and Superintendence for the cultural heritage) to define and discuss a set of **technical guidelines** to enable the implementation of energy efficiency actions on the public and private buildings of Pantelleria.

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Methodology 1/2

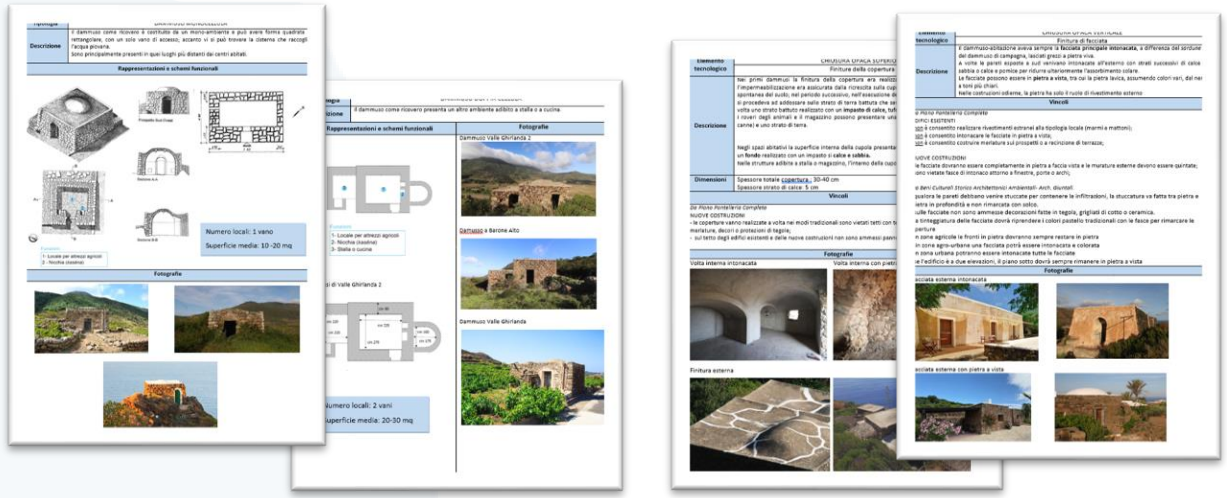
Investigation and description of dammusi building features

Definition of dammusi building archetypes

Development of the energy model for each dammuso building archetype

Abacus of dammusi building typologies

Abacus of dammusi building components



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Methodology 2/2

Definition of energy efficiency measures for energy retrofit of dammusi buildings

Energy performance assessment of different retrofit scenarios, implementing the energy model developed for each dammuso building archetype

Development of technical guidelines for energy efficiency improvement of dammusi buildings and definition of the required environmental permitting procedures

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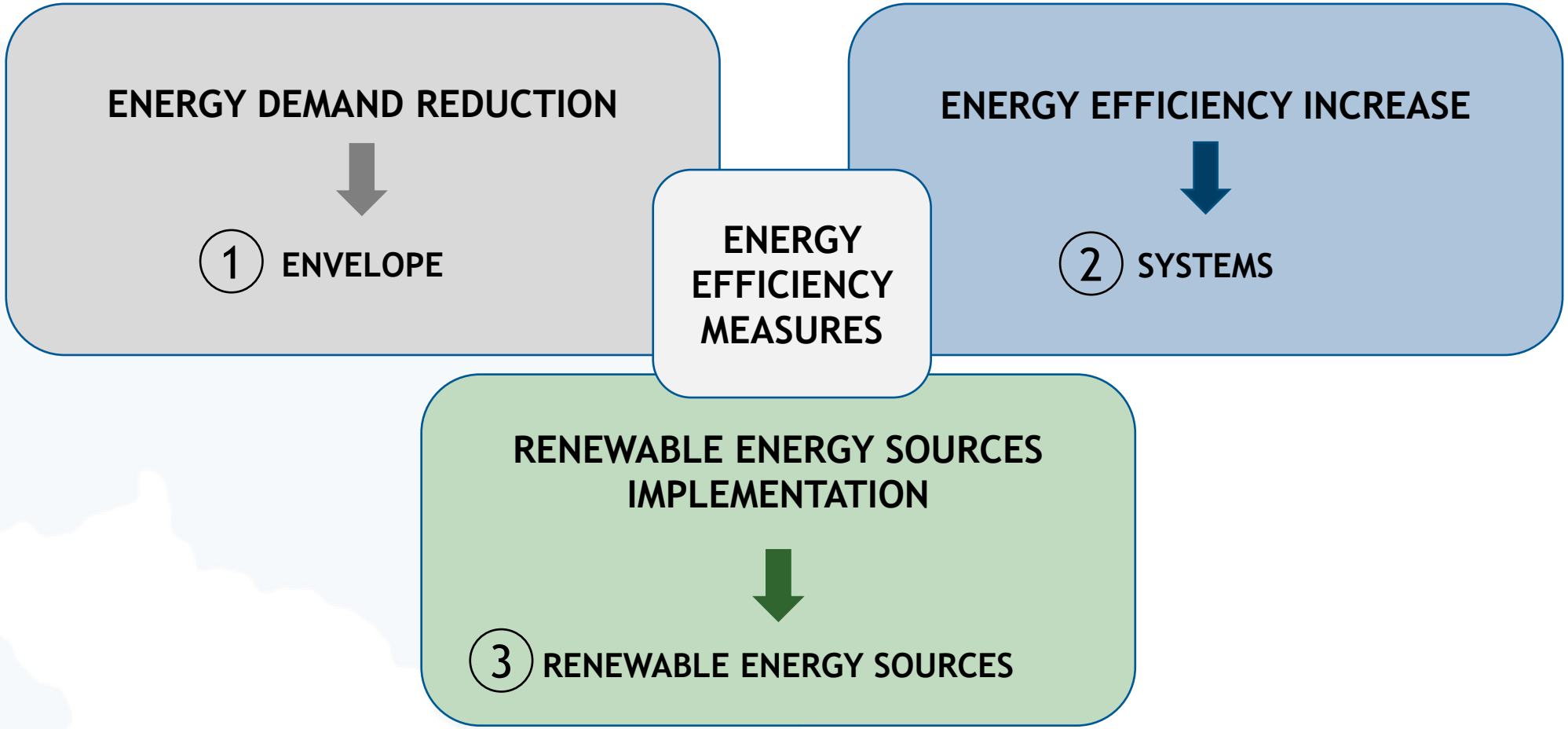
Building energy efficiency strategy



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Building energy efficiency strategy

1 Envelope

REGULATORY CONSTRAINTS

Walls:

- It is not allowed to realize façade cladding alien to traditional types (brick and marble)
- Plastering stone façade is not permitted
- Façade plaster must be made up of lime and sand

Windows and doors:

- Windows and doors frame must be made of wood
- Windows and doors must be set back from the edge of the façade
- Roller shutters are not allowed

Roof:

- It is not allowed to install false ceiling on vaults
- External roof surface must be waterproofed with a tuff and lime layer

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Building energy efficiency strategy

1 Envelope

ENERGY EFFICIENCY STRATEGIES

- No interventions involving envelope
- Interventions on vertical envelope (opaque and transparent) and roof

Walls

Insulating plaster on internal and/or external surface:

- Innovative nanocomposite plaster

or

- Natural mineral lime-based plaster

Windows

Windows replacement:

- Wooden frame
- Low-e double glazing filled with air
- Internal integrated shutters

Doors

Doors replacement:

- Wooden panels

Roof

Insulating plaster on internal surface of vault:

- Innovative nanocomposite plaster

or

- Natural mineral lime-based plaster

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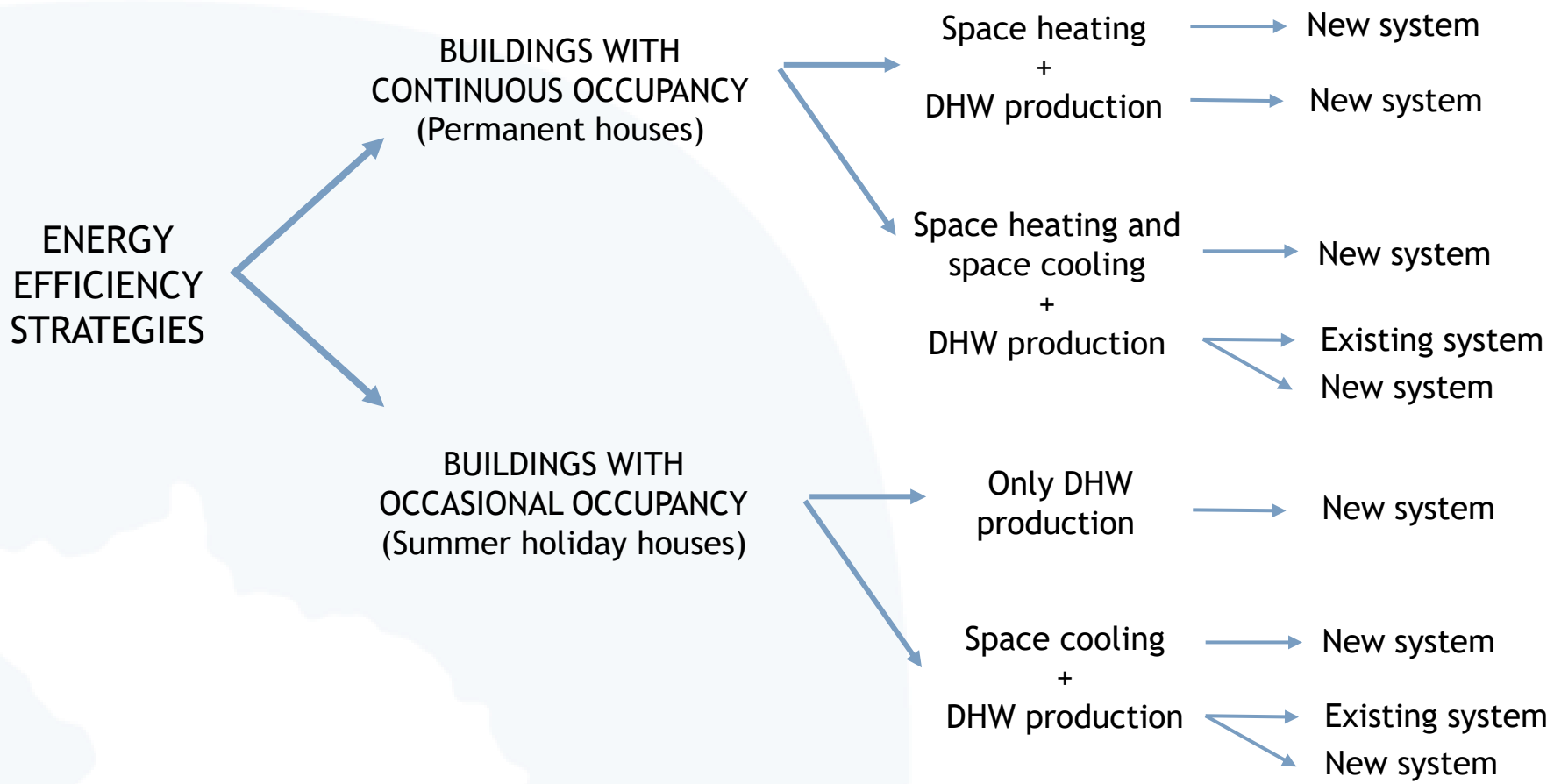
Building energy efficiency strategy

2 Systems



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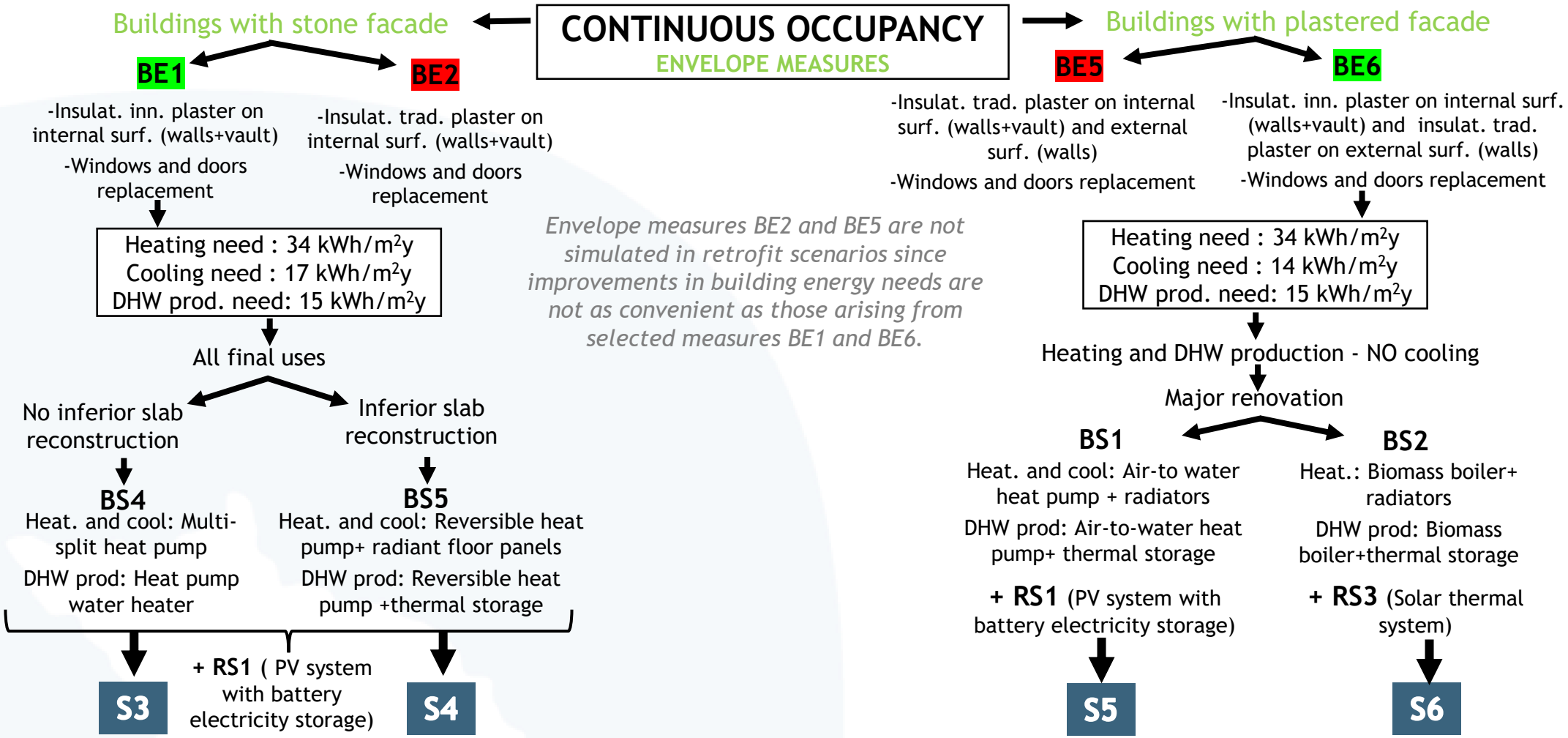
Definition of retrofit scenarios



Envelope measures BE2 and BE5 are not simulated in retrofit scenarios since improvements in building energy needs are not as convenient as those arising from selected measures BE1 and BE6.

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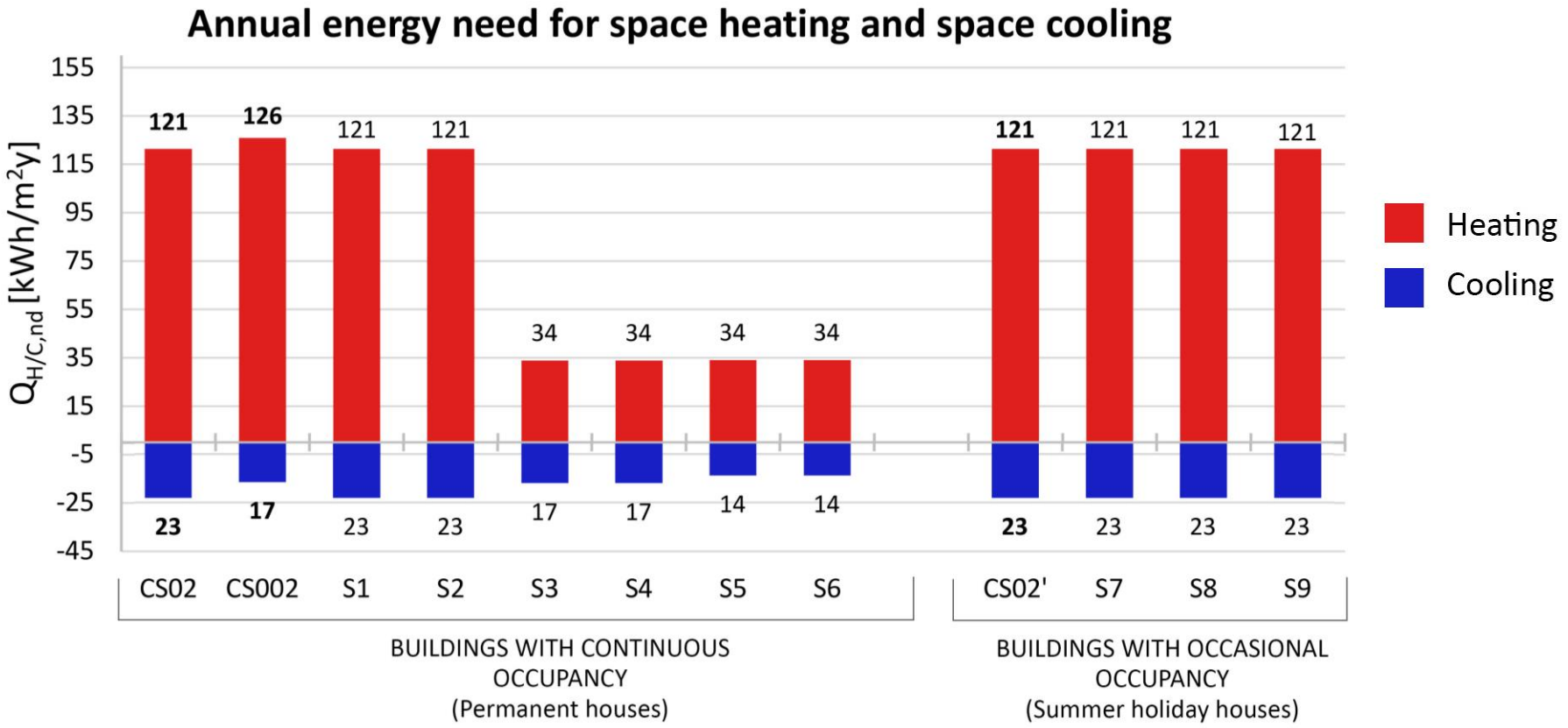
Retrofit scenarios results

Building energy needs

ARCHETYPE 2 : Dammuso per aggregazione complessa



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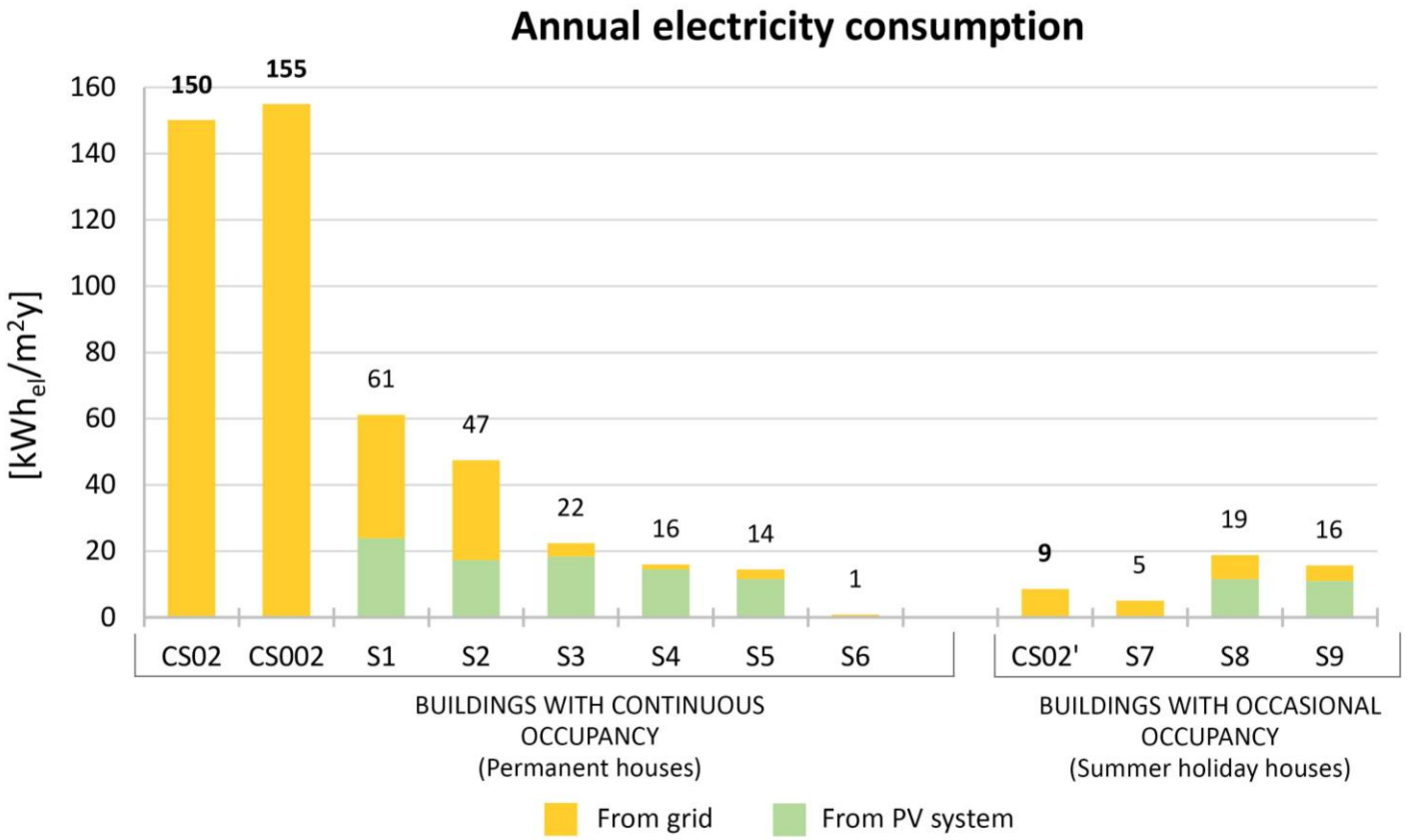
Retrofit scenarios results

Final energy uses

ARCHETYPE 2 : Dammuso per aggregazione complessa



Results are obtained considering a 1kWp south oriented PV system with optimal slope (31°)

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Conclusions on definition of retrofit scenarios

BUILDING WITH CONTINUOUS OCCUPANCY

- In case of a slight renovation, where envelope is not involved, non-invasive systems for space heating and space cooling are proposed with eventual replacement of existing system for DHW production (BS3, BS4).

- In case of slight renovation, where envelope is partially involved (BE1), non-invasive systems for space heating and space cooling are proposed. In case of major renovation, where inferior slab has to be reconstructed, air-to water heat pump is proposed as combined system for space heating, space cooling and DHW production. Radiant floor panels are proposed as terminal devices (BS5).

- In case of complete major renovation, where envelope is totally involved (BE6), space cooling is no longer needed. Invasive systems are proposed for space heating and DHW production: radiators are proposed as terminal devices (BS1,BS2).

In all cases, renewable energy sources are introduced.

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Conclusions on definition of retrofit scenarios

BUILDING WITH OCCASIONAL OCCUPANCY

- For any situation, replacement of existing system for DHW production is proposed (BS6). In this case, it is not necessary to introduce renewable energy sources. Introduction of renewable energy systems, indeed, is expensive if compared to their actual exploitation, which is limited to summer months from May to September.

- In cases in which space cooling is needed or required, non-invasive system is proposed with eventual replacement of existing system for DHW production (BS7, BS8). Since cooling system is assumed as not present at the current state, its introduction implies higher final consumption than the current ones; to overcome this, photovoltaic system, has to be introduced. Photovoltaic system is proposed without battery electricity storage, since its introduction is expensive if compared to its actual exploitation, which is limited to summer months from May to September.

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Guidelines

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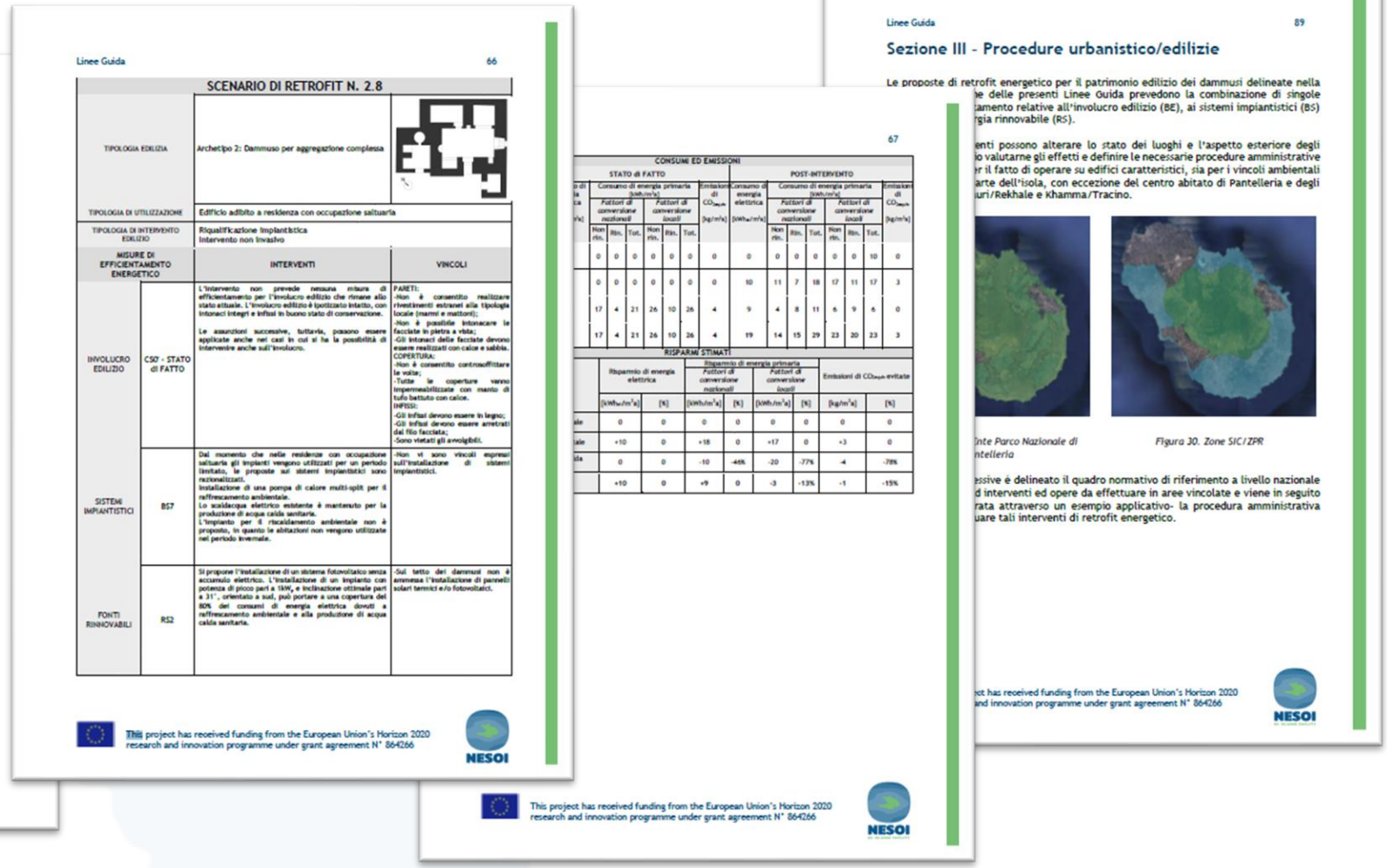
Linee guida per la riqualificazione energetica del patrimonio architettonico dell'isola di Pantelleria



Linee Guida 66

SCENARIO DI RETROFIT N. 2.8

TIPOLOGIA EDILIZIA	Archetipo 2: Dammuso per aggregazione complessa		
TIPOLOGIA DI UTILIZZAZIONE	Edificio adibito a residenza con occupazione saltuaria		
TIPOLOGIA DI INTERVENTO EDILIZIO	Riqualificazione impiantistica Intervento non invasivo		
MISURE DI EFFICIENTAMENTO ENERGETICO		INTERVENTI	VINCOLI
INVOLUCRO EDILIZIO	CS0' - STATO di FATTO	L'intervento non prevede nessuna misura di efficientamento per l'involucro edilizio che rimane allo stato attuale. L'involucro edilizio è ipotizzato intatto, con intonaci integri e infissi in buono stato di conservazione. Le assunzioni successive, tuttavia, possono essere applicate anche nei casi in cui si ha la possibilità di intervenire anche sull'involucro.	PARETI: -Non è consentito realizzare rivestimenti estranei alla tipologia locale (marmi e mattoni); -Non è possibile intonacare le facciate in pietra a vista; -Gli intonaci delle facciate devono essere realizzati con calce e sabbia. COPERTURA: -Non è consentito controsoffittare le volte; -Tutte le coperture vanno impermeabilizzate con manto di tufo battuto con calce. INFISSI: -Gli infissi devono essere in legno; -Gli infissi devono essere arretrati dal filo facciata; -Sono vietati gli avvolgibili.
SISTEMI IMPIANTISTICI	BS7	Dal momento che nelle residenze con occupazione saltuaria gli impianti vengono utilizzati per un periodo limitato, le proposte sui sistemi impiantistici sono razionalizzati. Installazione di una pompa di calore multi-split per il raffrescamento ambientale. Lo scaldacqua elettrico esistente è mantenuto per la produzione di acqua calda sanitaria. L'impianto per il riscaldamento ambientale non è proposto, in quanto le abitazioni non vengono utilizzate nel periodo invernale.	-Non vi sono vincoli espressi sull'installazione di sistemi impiantistici.
FONTI RINNOVABILI	RS2	Si propone l'installazione di un sistema fotovoltaico senza accumulo elettrico. L'installazione di un impianto con potenza di picco pari a 1kW$_p$ e inclinazione ottimale pari a 31°, orientato a sud, può portare a una copertura del 80% dei consumi di energia elettrica dovuti a raffrescamento ambientale e alla produzione di acqua calda sanitaria.	-Sul tetto dei dammusi non è ammessa l'installazione di pannelli solari termici e/o fotovoltaici.

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CONSUMI ED EMISSIONI

STATO di FATTO								POST-INTERVENTO							
	Consumo di energia primaria [kWh$_{ep}$/m^{2}a]						Emissioni di CO_{2eq} [kg/m^{2}a]	Consumo di energia elettrica [kWh$_{ep}$/m^{2}a]	Consumo di energia primaria [kWh$_{ep}$/m^{2}a]						Emissioni di CO_{2eq} [kg/m^{2}a]
	Fattori di conversione nazionali			Fattori di conversione locali					Fattori di conversione nazionali			Fattori di conversione locali			
	Non Rin.	Rin.	Tot.	Non Rin.	Rin.	Tot.			Non Rin.	Rin.	Tot.	Non Rin.	Rin.	Tot.	
	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
	0	0	0	0	0	0	0	10	11	7	18	17	11	17	3
	17	4	21	26	10	26	4	9	4	8	11	6	9	6	0
	17	4	21	26	10	26	4	19	14	15	29	23	20	23	3

RISPARMI STIMATI

	Risparmio di energia elettrica		Risparmio di energia primaria				Emissioni di CO_{2eq} evitate	
			Fattori di conversione nazionali		Fattori di conversione locali			
	[kWh$_{ep}$/m^{2}a]	[%]	[kWh/m^{2}a]	[%]	[kWh/m^{2}a]	[%]	[kg/m^{2}a]	[%]
	0	0	0	0	0	0	0	0
	+10	0	+18	0	+17	0	+3	0
	0	0	-10	-46%	-20	-77%	-4	-78%
	+10	0	+9	0	-3	-13%	-1	-15%

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Linee Guida 89

Sezione III - Procedure urbanistico/edilizie

Le proposte di retrofit energetico per il patrimonio edilizio dei dammusi delineate nella ...e delle presenti Linee Guida prevedono la combinazione di singole ...amento relative all'involucro edilizio (BE), ai sistemi impiantistici (BS) ...rgia rinnovabile (RS).

...enti possono alterare lo stato dei luoghi e l'aspetto esteriore degli ...o valutarne gli effetti e definire le necessarie procedure amministrative ...r il fatto di operare su edifici caratteristici, sia per i vincoli ambientali ...arte dell'isola, con eccezione del centro abitato di Pantelleria e degli ...uri/Rekhale e Khamma/Tracino.

...nte Parco Nazionale di ...ntelleria

Figura 30. Zone SIC/ZPR

...essive è delineato il quadro normativo di riferimento a livello nazionale ...d interventi ed opere da effettuare in aree vincolate e viene in seguito ...rata attraverso un esempio applicativo- la procedura amministrativa ...uare tali interventi di retrofit energetico.

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