



CLIMATE RESILIENT STRATEGIES BY
ARCHETYPE-BASED URBAN ENERGY MODELLING

Atlas of the typical urban context configuration: KPIs to assess the resilient strategies under future urban climate

DELIVERABLE 4.3

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Index

1.	<i>INTRODUCTION</i>	6
1.1	Purpose.....	6
1.2	Deliverable structure	6
1.3	Contribution of partners	7
2.	<i>APPLICATION OF THE RESILIENT STRATEGY IMPLEMENTATION FRAMEWORK</i>	7
2.1	Climate resilient strategies	7
2.2	Scenario configurations and assessed KPIs	8
3.	<i>RESULTS OF UBEM SIMULATIONS WITH RESILIENT STRATEGIES UNDER CURRENT AND FUTURE CLIMATE CONDITIONS</i>	9
3.1	Turin.....	9
3.1.1	<i>Scenario 1: Urban-scale resilient strategies</i>	10
3.1.2	<i>Scenario 2: Urban and building resilient strategies (targeted application)</i>	11
3.1.3	<i>Scenario 3: Urban and building resilient strategies (whole block application)</i>	13
3.2	Rome	15
3.1.1	<i>Scenario 1: Urban-scale resilient strategies</i>	15
3.1.2	<i>Scenario 2: Urban and building resilient strategies (targeted application)</i>	16
3.1.3	<i>Scenario 3: Urban and building resilient strategies (whole block application)</i>	18
3.3	Bari.....	19
3.1.1	<i>Scenario 1: Urban-scale resilient strategies</i>	20
3.1.2	<i>Scenario 2: Urban and building resilient strategies (targeted application)</i>	21
3.1.3	<i>Scenario 3: Urban and building resilient strategies (whole block application)</i>	23
3.4	Discussion	24
4.	<i>GENERAL REMARKS AND CONCLUSIONS</i>	27
	<i>NOMENCLATURE</i>	28
	<i>REFERENCES</i>	28

1. INTRODUCTION

1.1 Purpose

Global climate change leads to increased ambient temperatures, causing buildings to overheat and demand more energy while worsening indoor environmental quality. Urban Heat Island (UHI) effects, caused by local warming in urban areas, further exacerbate these challenges. Existing Urban Building Energy Modelling (UBEM) struggles to address UHI due to limited data on microscale climatic conditions and detailed mapping of urban areas. The CRiStAll project aims to address these gaps by creating detailed climatic datasets and exploring different urban configurations at the microscale.

Under the CRiStAll project, three interconnected research lines are developed. These include:

- A. building an urban climate model that incorporates the impacts of the UHI at the microscale, as well as the short-, mid-, and long-term (future weather data) consequences of climate change;
- B. putting the archetype-based UBEM into practice using typical urban environment configurations (street canyons);
- C. evaluating the impact of climate resilience and UHI reducing methods in urban locations.

Within Work Package 4, “*Resilient and Mitigating Strategies*” which addresses Research Line C, the effect of climate-resilient UHI mitigation strategies in urban context configurations is evaluated across short-, mid-, and long-term scenarios. Task 4.3, “*KPIs assessment of the strategies in the short, middle and long term*” concerns the simulation of the selected resilient and mitigating strategies applied to the urban models defined in Task 3.2, following the implementation framework defined in Task 4.2.

The present deliverable, D4.3 – “*Atlas of the typical urban context configuration: KPIs to assess the resilient strategies under future urban climate*”, reports the simulation results for the mitigation strategies and their key performance indicators (KPIs) based assessment. It represents the final stage of WP4 and supports the achievement of Milestone M3, consisting of a database of resilient strategies for different typical urban context configurations, containing the KPIs in short, mid and long-term.

1.2 Deliverable structure

This deliverable is structured into four main sections, aimed at presenting the results for the representative urban blocks across three distinct Italian climatic zones.

- **Section 1** introduces the document, outlining its objective (1.1), the deliverable structure (1.2), and partner contributions to Task 4.3 development (1.3).
- **Section 2** describes the application of the resilient strategy implementation framework adopted in the study, including the selected climate-resilient strategies (2.1), the scenario configurations and the assessed KPIs (2.2).
- **Section 3** presents the results of the UBEM simulations, with resilient and mitigating strategies applied to Urban Blocks A in the municipalities of Turin (3.1), Rome (3.2), and Bari (3.3), under current, mid-term, and long-term climate scenarios. A discussion section is presented in 3.4.
- **Section 4** is dedicated to general remarks and conclusions.

1.3 Contribution of partners

POLITO and unibz applied the climate-resilient scenario configurations, automated the calculation of the KPIs, and carried out the simulations. POLITO defined the structure of the present deliverable and contributed to its drafting. All the partners reviewed and finalised the deliverable.

2. APPLICATION OF THE RESILIENT STRATEGY IMPLEMENTATION FRAMEWORK

2.1 Climate resilient strategies

The climate resilient strategies analysed in this study are selected according to the implementation framework defined in Deliverable 4.2. The selection of strategies is based on two main criteria: their applicability to the analysed urban contexts and their compatibility within the adopted simulation tools. Based on these criteria, a set of strategies acting at urban and building scales is considered.

At the urban scale, the strategies focus on measures that modify the local microclimate, such as increasing street tree coverage and adopting more reflective pavements to mitigate UHI effects and improve outdoor thermal conditions. At the building scale, the analysis includes envelope-related measures such as cool roofs and cool façades, high performance glazing, enhanced thermal insulation, and operational strategies based on natural ventilation to dissipate heat and reduce the building cooling demand.

Depending on the tool capabilities, the strategies are applied in the Urban Weather Generator (UWG) tool, in the CitySim simulation environment, or in both tools. [Table 1](#) summarises the selected Climate Resilient Strategies (CRSs) considered in this analysis, together with their adopted values or criteria and the corresponding input parameters used in the simulation framework. The values adopted for the simulations were selected within the parameter ranges identified in the implementation framework presented in Deliverable 4.2. These strategies form the basis for the scenario configurations described in the following section.

Table 1: Climate-resilient strategies and adopted modelling parameters

Climate Resilient Strategies (CRSs) – Urban scale				
CRS	Adopted values/criteria	UWG input parameter	CitySim input parameter	Note
CRS1 Street tree cover	Coverage percentage = 20 %	treecover = 0.20	n.a.	If a coverage percentage had already been defined, an additional + 20 % was assumed.
CRS2 Reflective pavements	Shortwave reflectance = 0.70	albroad = 0.70	ShortWaveReflectance = 0.70	CRS applied to all ground meshes. The assumed baseline value was $\rho = 0.10$.
Climate Resilient Strategies (CRSs) – Building scale				
CRS3 Cool roofs	Shortwave reflectance = 0.75	albroof = 0.75	ShortWaveReflectance = 0.75	The assumed baseline value was $\rho = 0.40$.
CRS4 Cool façades	Shortwave reflectance = 0.75	albwall = 0.75	ShortWaveReflectance = 0.75	The assumed baseline value was $\rho = 0.70$

CRS5 Glazing technologies	Window thermal transmittance in W/(m ² ·K)			n.a.	Glazing U-value in W/(m ² ·K)			The adopted U-values are aligned with the Italian NZEB minimum requirements, for the corresponding climatic zones (Italian Republic, 2015).		
	Turin	Rome	Bari		Turin	Rome	Bari			
	1.40	1.80	2.20		1.40	1.80	2.20			
	Glazing g-value = 0.35			SHGC = 0.35	Glazing g-value = 0.35					
CRS6 Natural ventilation	ACH = 4 ÷ 8 vol/h and temperature-based activation criteria			n.a.	Openable Ratio = 0.50 (A 50 % window opening fraction was assumed)			Windows opened and ACH calculated (wind + stack effect) if $\vartheta_{a;i,i} > \vartheta_{H;set} + 1$ and $\vartheta_{a;i,i} > \vartheta_{a;e;i} + 1$.		
CRS7 Thermal insulation	Opaque envelope thermal transmittance in W/(m ² ·K)				n.a.	U-value in W/(m ² ·K)			The adopted U-values are aligned with the Italian NZEB minimum requirements, for the corresponding climatic zones (Italian Republic, 2015).	
		wall	roof	floor			U_{wl}	$U_{fl;up}$		$U_{fl;lw}$
	Turin	0.26	0.22	0.26		Turin	0.26	0.22		0.26
	Rome	0.29	0.26	0.29		Rome	0.29	0.26		0.29
	Bari	0.34	0.33	0.38		Bari	0.34	0.33		0.38

2.2 Scenario configurations and assessed KPIs

To evaluate the effectiveness of the selected climate-resilient strategies, the measures are combined into three scenario configurations, which are compared with a baseline case without mitigation strategies. Each scenario represents a different level of intervention at the urban and building scales, allowing the assessment of their effects under different time horizons.

Scenario 1 (Sce.1) represents an urban-scale intervention. In this configuration, only urban strategies are implemented, including increased street tree cover (CRS1) and reflective pavements applied to all ground surfaces (CRS2). These measures aim to modify the urban microclimate and mitigate UHI effects. This scenario is evaluated under current, mid-term, and long-term conditions.

Scenario 2 (Sce.2) combines urban-scale measures with building-scale strategies. In addition to the urban interventions, a renovation package including cool roofs, cool façades, high-performance glazing, natural ventilation strategies, and enhanced thermal insulation (CRS3-CRS7) is applied to 43 % of the residential buildings, representing the worst-performing share of the building stock. This proportion reflects the prioritisation of inefficient buildings in the early phase of the renovation trajectory defined in the fourth Energy Performance of Buildings Directive (EPBD) recast (EU 2024/1275), which targets the least efficient buildings as a first step in the decarbonisation pathway of the residential stock. For each analysed urban block, these buildings are identified based on the absolute sum of the energy need for space heating and cooling under current climate conditions and are therefore considered the most energy-intensive. For this reason, this configuration is analysed under current and mid-term conditions, representing the initial stage of the renovation process, and is not extended to the long-term horizon. The urban resilience actions implemented in Scenario 1 are maintained.

Scenario 3 (Sce.3) represents a full renovation configuration, in which the same building-scale renovation package (CRS3-CRS7) is extended to 100 % of the buildings within the analysed urban block. This scenario reflects a more advanced stage of the renovation trajectory, in which renovation measures are no longer limited to the worst-performing buildings but are applied to the entire building

stock. Accordingly, the analysis is carried out under mid-term and long-term conditions, while the current period is not considered for this scenario, representing a more realistic long-term perspective. The urban resilience actions implemented in Scenario 1 are maintained.

The effectiveness of the scenarios is assessed through different Key Performance Indicators (KPIs), depending on the scale of intervention. In particular, the mean monthly ground temperature (\mathcal{J}_{gr}) is used for the urban-scale scenario (Sce.1), while the thermal energy need for space heating and cooling ($EP_{H/C;nd}$), and the peak heating and cooling loads ($\phi_{H/C;ld}$) are used for scenarios including building-scale measures (Sce.2 and Sce.3).

Table 2 summarises the considered scenario configurations, indicating the scale of intervention, the adopted coverage, the corresponding time horizons, and different KPIs used for the assessment of urban microclimate and building energy performance.

Table 2: Climate resilient scenario configurations and assessed KPIs

Scenario	Scale	Coverage	Time horizon	KPI
Sce.1	Urban	$\left\{ \begin{array}{l} + 20 \% \text{ green areas (CRS1)} \\ 100 \% \text{ of ground surfaces (CRS2)} \end{array} \right.$	Current	J_{gr}
			Mid-term	
			Long-term	
Sce.2	Urban + Building	CRS3-CRS7 applied to 43 % of the worst-performing residential buildings (EU 2024/1275)	Current	$EP_{H/C;nd}$
			Mid-term	$\phi_{H/C;ld}$
Sce.3	Urban + Building	CRS3-CRS7 applied to 100 % of buildings	Mid-term	$EP_{H/C;nd}$
			Long-term	$\phi_{H/C;ld}$

3. RESULTS OF UBEM SIMULATIONS WITH RESILIENT STRATEGIES UNDER CURRENT AND FUTURE CLIMATE CONDITIONS

In this section, the results on building energy performance with the adoption of the climate resilient strategies are presented for urban block A in Turin (Section 3.1), block C in Rome (Section 3.2), and block B in Bari (Section 3.3).

At the beginning of each subsection, an illustration of the analysed urban block with the corresponding building IDs is provided. The results are then categorised according to the scenario configurations defined in Section 2.2 and discussed through the relevant KPIs for each case.

3.1 Turin

Figure 1 shows the geometrical representation and building IDs of Urban Block A in the municipality of Turin.

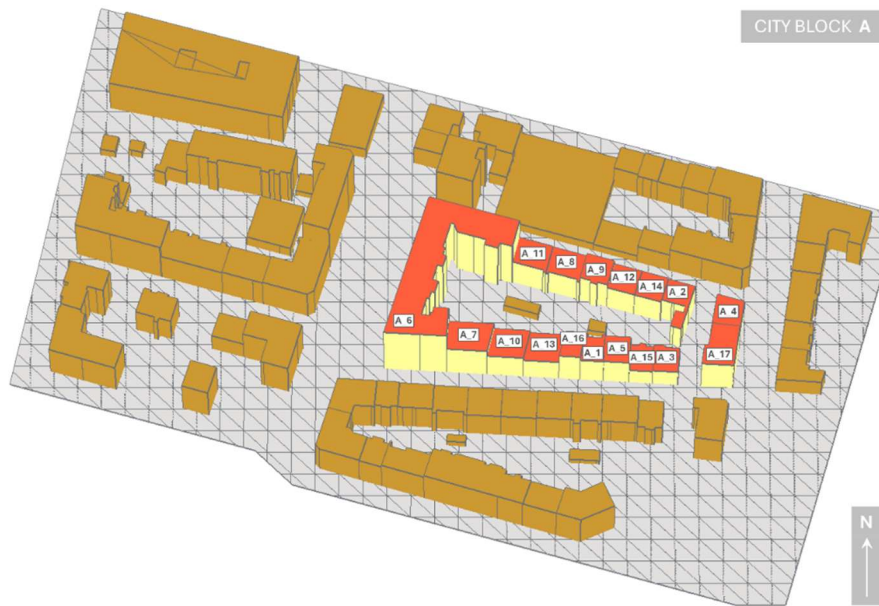
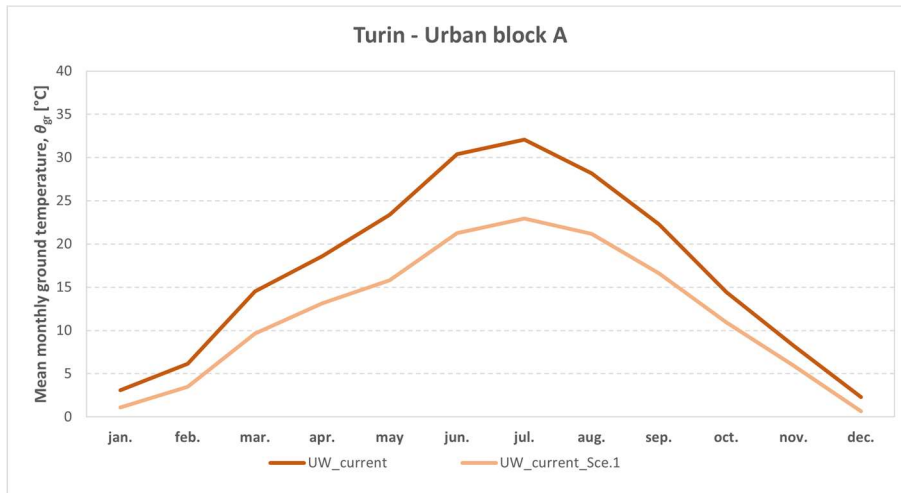


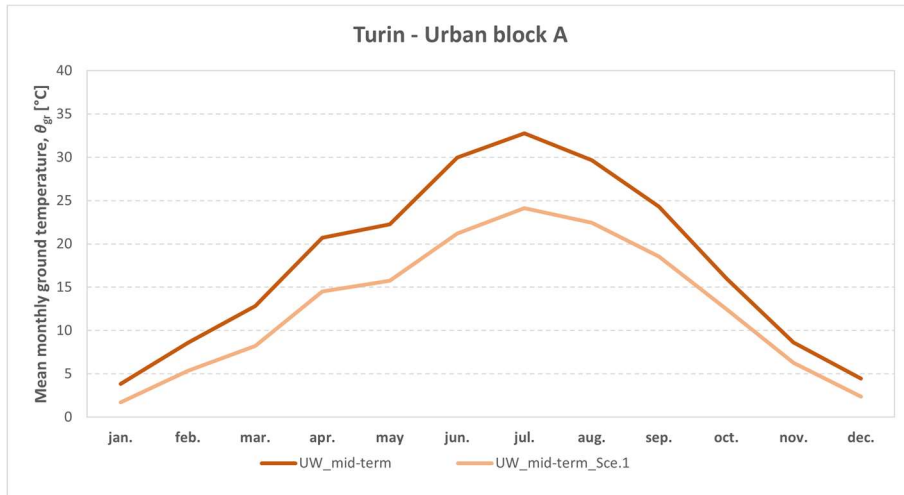
Figure 1: Urban block A (Turin) visualised in CitySim Pro

3.1.1 Scenario 1: Urban-scale resilient strategies

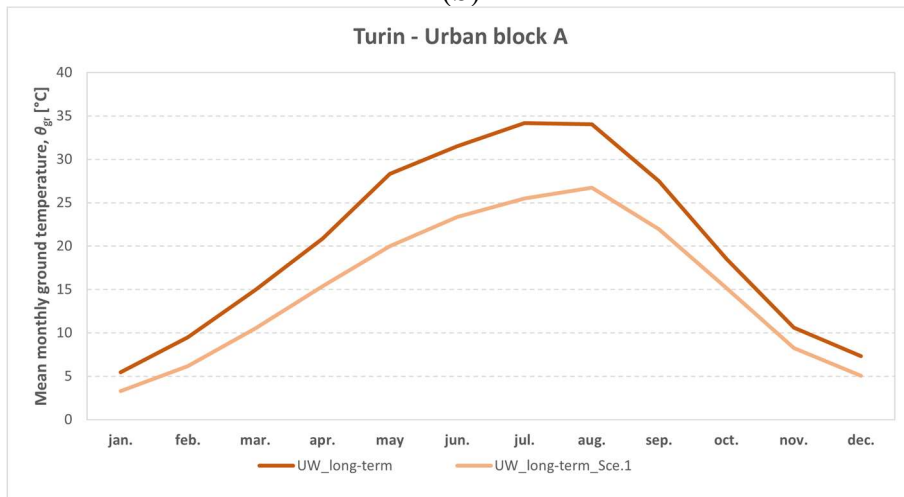
Figure 2 reports the mean monthly ground temperature for urban block A under current, mid-term, and long-term climate conditions, with and without urban-scale resilient strategies, including increased green coverage and reflective pavements.



(a)



(b)



(c)

Figure 2: Mean monthly ground temperature for urban block A under current (a), mid-term (b), and long-term (c) climate conditions, with and without urban-scale resilient strategies

3.1.2 Scenario 2: Urban and building resilient strategies (targeted application)

Figure 3 identifies the worst-performing 43 % of residential buildings under current UW conditions for urban block A in Turin. These buildings are considered the most energy-intensive.

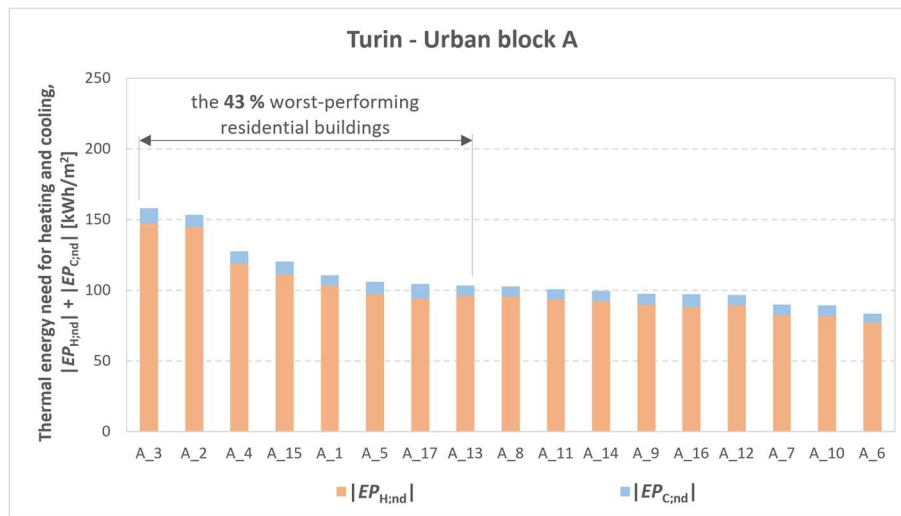


Figure 3: Identification of the 43% worst-performing residential buildings under current UWS conditions

Figure 4 presents the thermal energy need for space heating (a-c) and cooling (b-d) under short- and medium-term climate conditions. Specifically, the histograms compare the building energy need with and without the adoption of climate resilient strategies applied to the worst-performing buildings: A_3, A_2, A_4, A_15, A_1, A_5, A_17, and A_13.

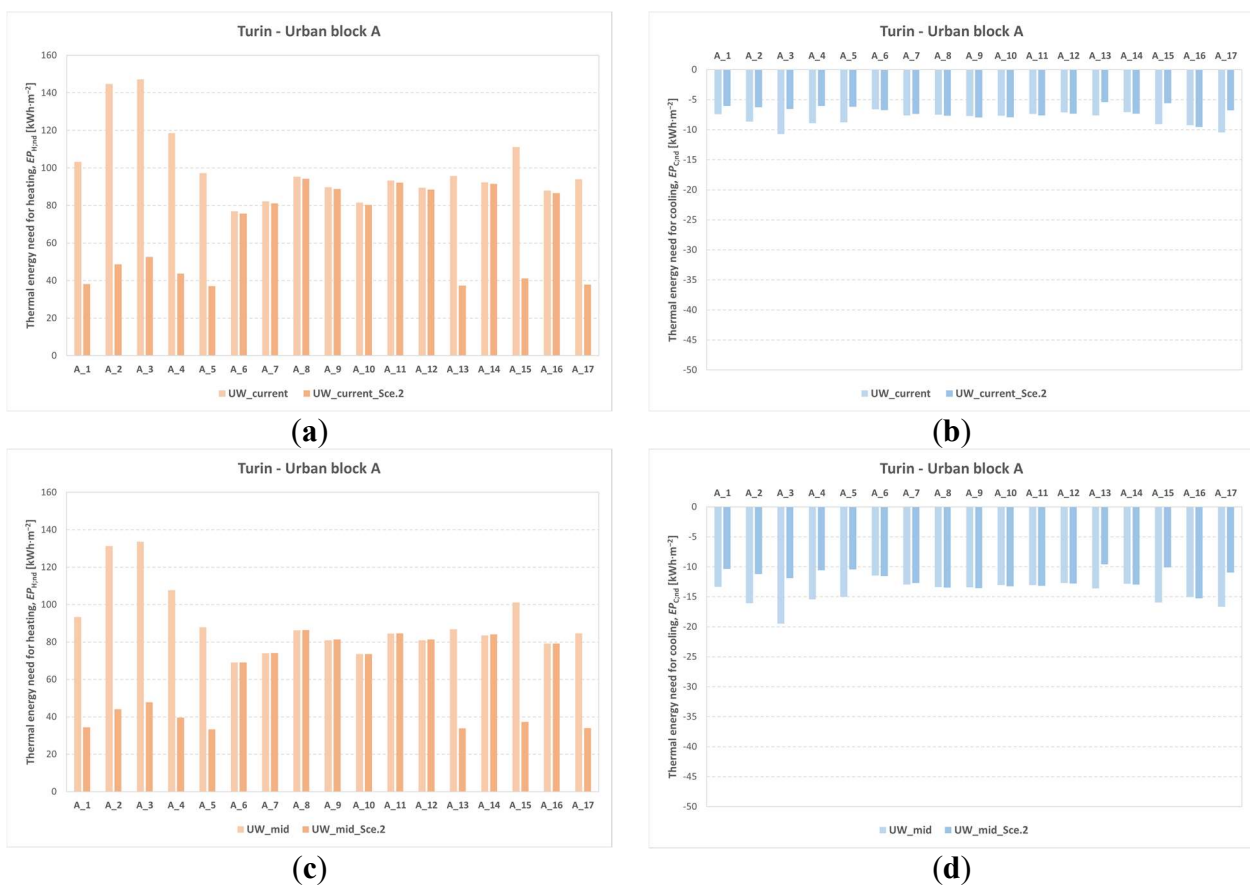


Figure 4: Thermal energy need for space heating (a-c) and cooling (b-d) under current and mid-term climate conditions, with and without the resilient strategies of Scenario 2

For the most energy-intensive residential buildings, [Figure 5](#) reports the results in terms of peak heating (a-c) and cooling (b-d) loads under short- and medium-term climate conditions, comparing the baseline case with the results obtained after the implementation of Scenario 2 measures.

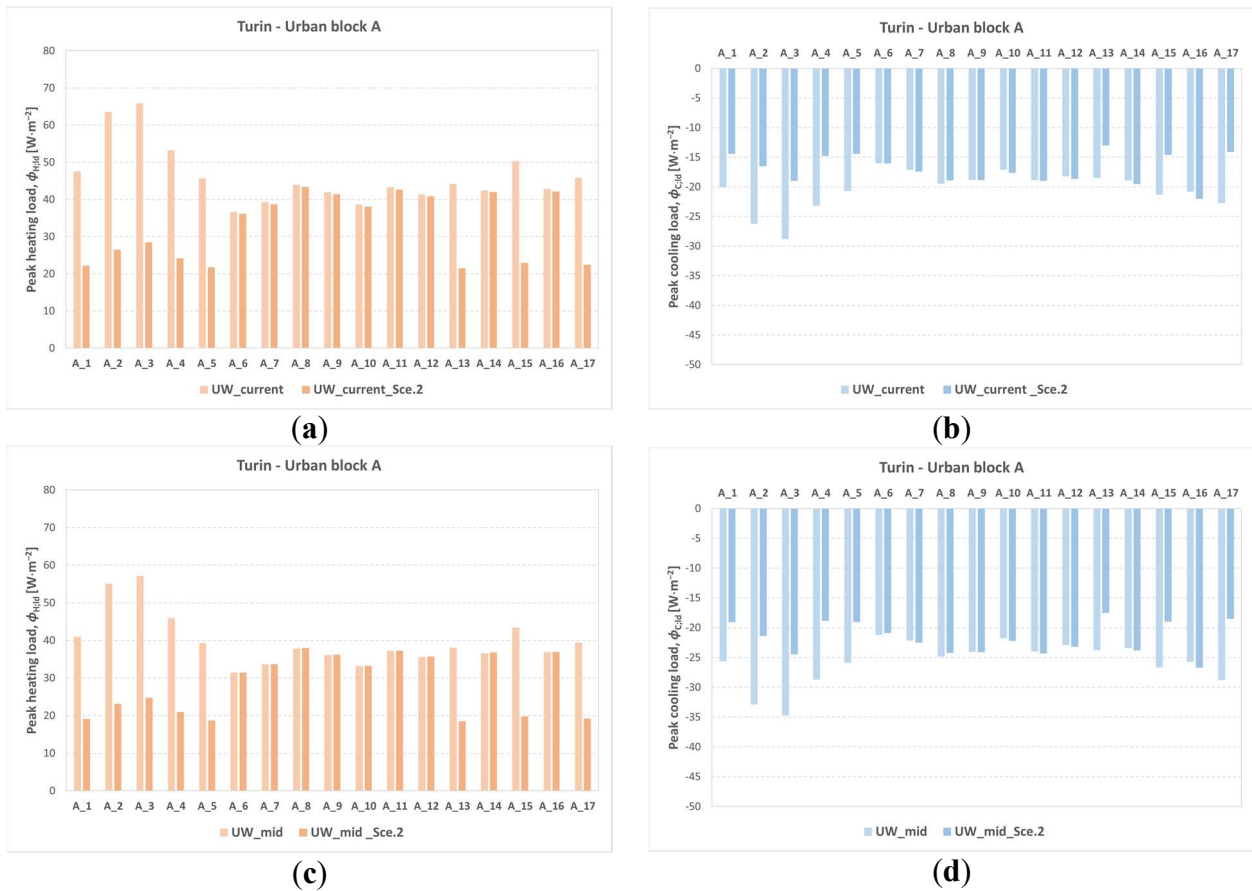
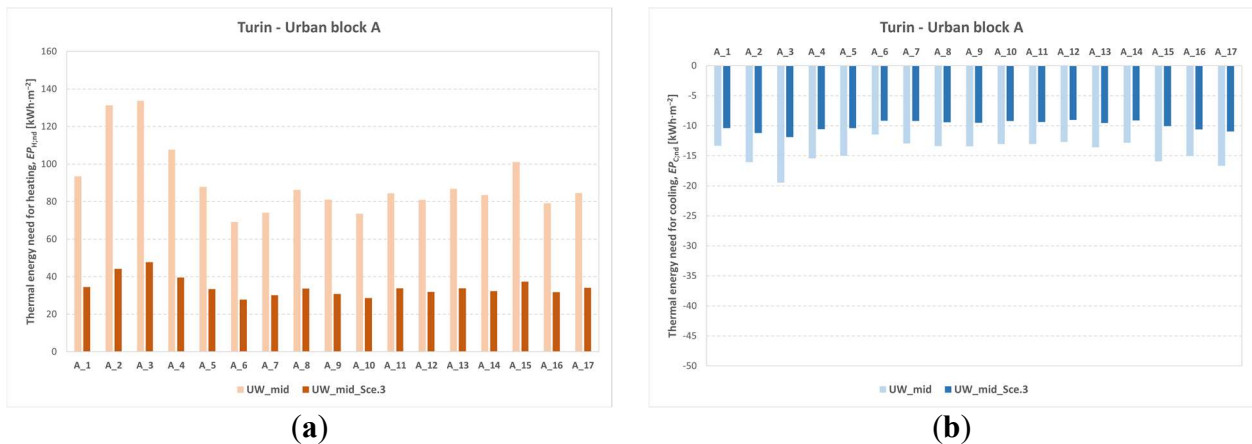
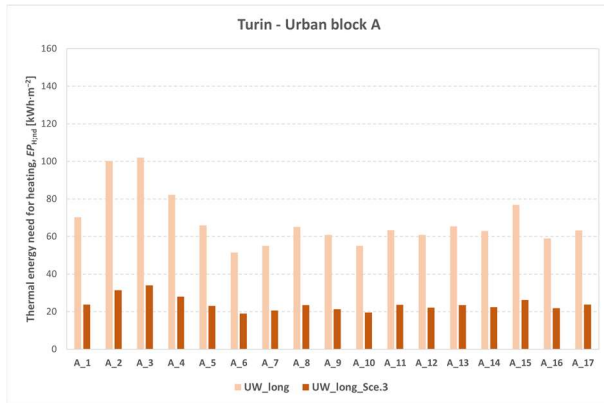


Figure 5: Peak heating (a-c) and cooling (b-d) loads under current and mid-term climate conditions, with and without the resilient strategies of Scenario 2

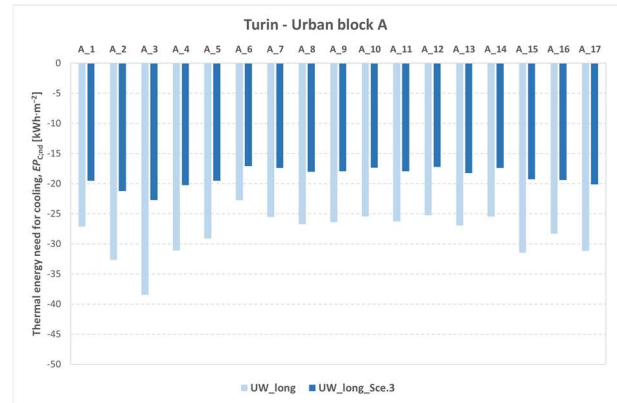
3.1.3 Scenario 3: Urban and building resilient strategies (whole block application)

Figure 6 presents the thermal energy need for space heating (a-c) and cooling (b-d) under medium- and long-term climate conditions, comparing the baseline case with the effects of adopting the climate-resilient measures for all the buildings in the assessed urban block.





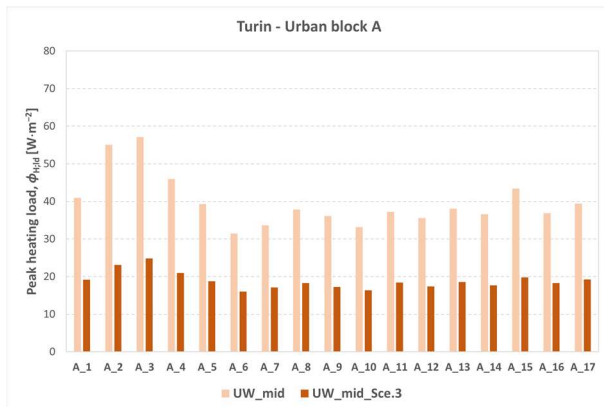
(c)



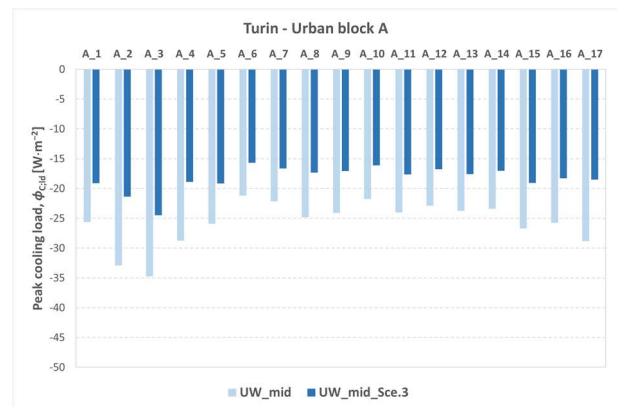
(d)

Figure 6: Thermal energy need for space heating (a-c) and cooling (b-d) under mid-term and long-term climate conditions, with and without the resilient strategies of Scenario 3

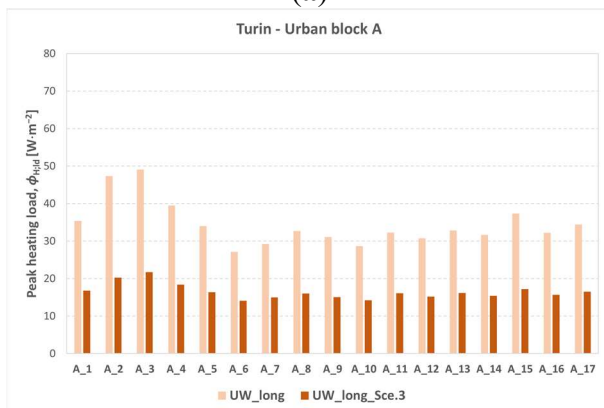
Figure 7 presents the peak heating (a-c) and cooling (b-d) loads under medium- and long-term climate conditions, comparing the baseline case with the results obtained after the implementation of Scenario 3 measures.



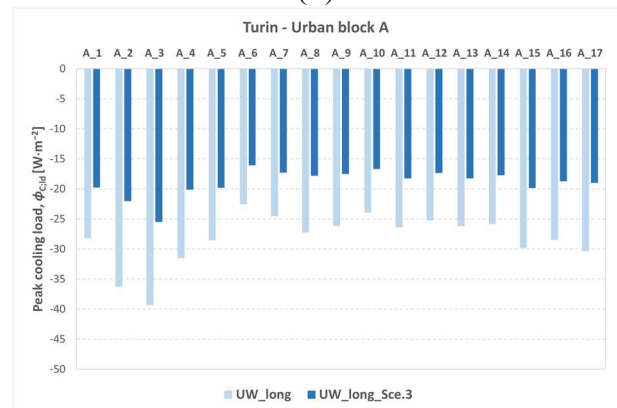
(a)



(b)



(c)



(d)

Figure 7: Peak heating (a-c) and cooling (b-d) loads under mid-term and long-term climate conditions, with and without the resilient strategies of Scenario 3

3.2 Rome

Figure 8 shows the geometrical representation and building IDs of Urban Block C in the municipality of Rome.

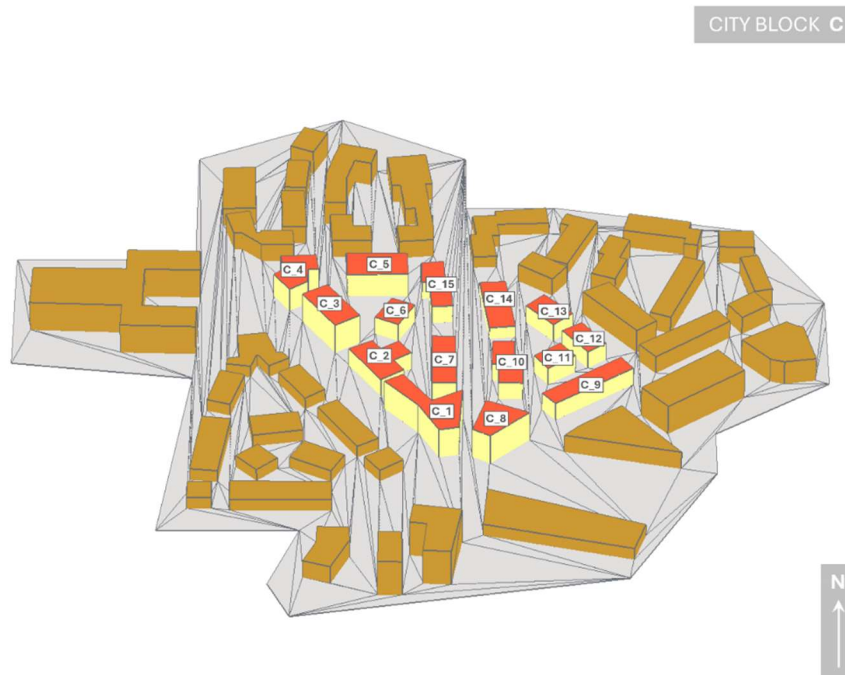
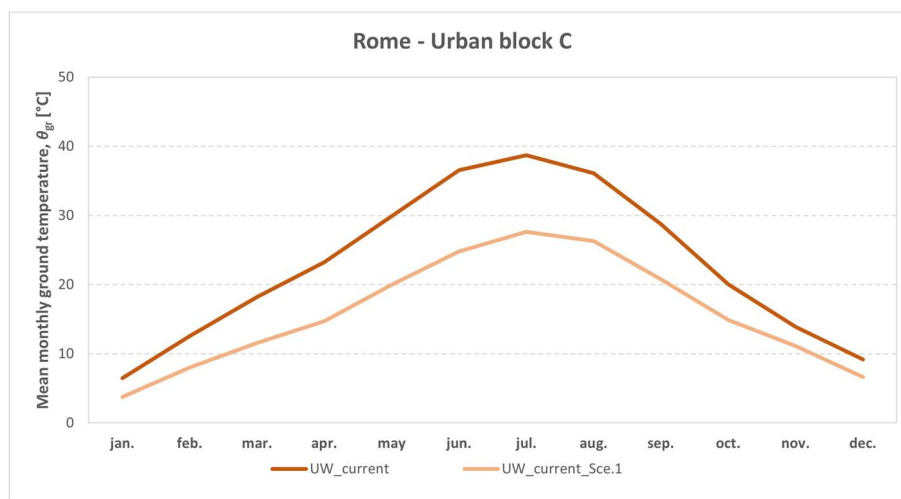


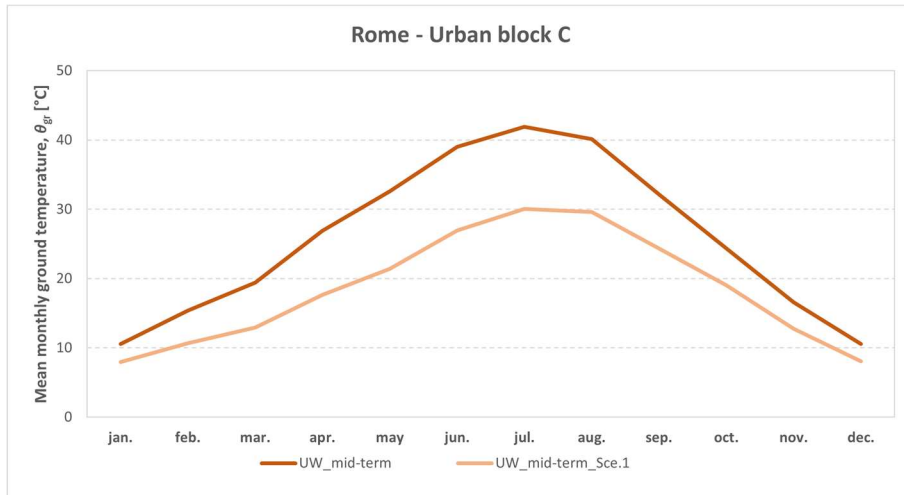
Figure 8: Urban block C (Rome, Garbatella district) visualised in CitySim Pro

3.1.1 Scenario 1: Urban-scale resilient strategies

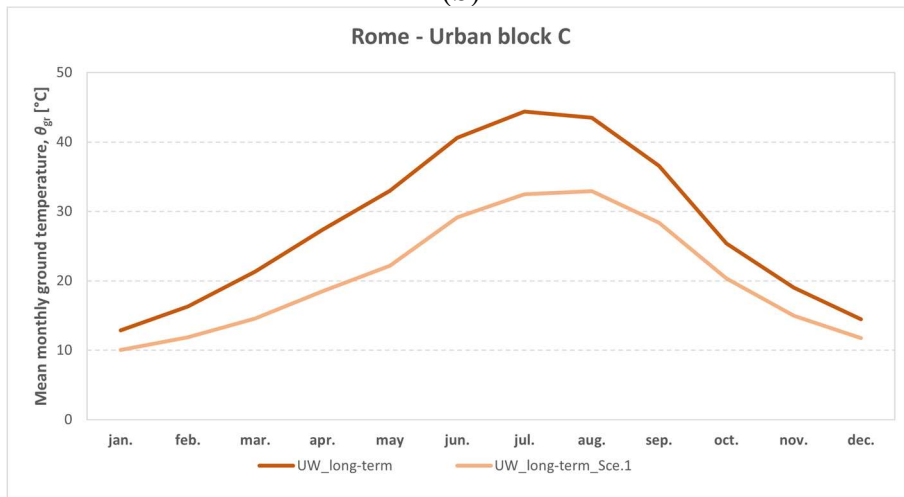
Figure 9 reports the mean monthly ground temperature for urban block C under current, mid-term, and long-term climate conditions, with and without urban-scale resilient strategies, including increased green coverage and reflective pavements.



(a)



(b)



(c)

Figure 9: Mean monthly ground temperature for urban block C under current (a), mid-term (b), and long-term (c) climate conditions, with and without urban-scale resilient strategies

3.1.2 Scenario 2: Urban and building resilient strategies (targeted application)

Figure 10 identifies the worst-performing 43 % of residential buildings under current UW conditions for urban block C in Rome. These buildings are considered the most energy-intensive.

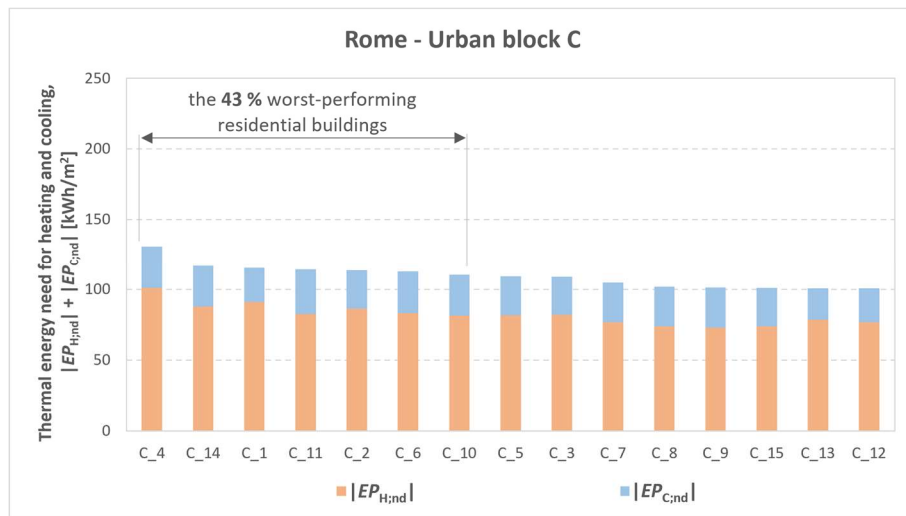


Figure 10: Identification of the 43 % worst-performing residential buildings under current UWS conditions

Figure 11 presents the thermal energy need for space heating (a-c) and cooling (b-d) under short- and medium-term climate conditions. Specifically, the histograms compare the building energy need with and without the adoption of climate resilient strategies applied to the worst-performing buildings: C_4, C_14, C_1, C_11, C_2, C_6, and C_10.

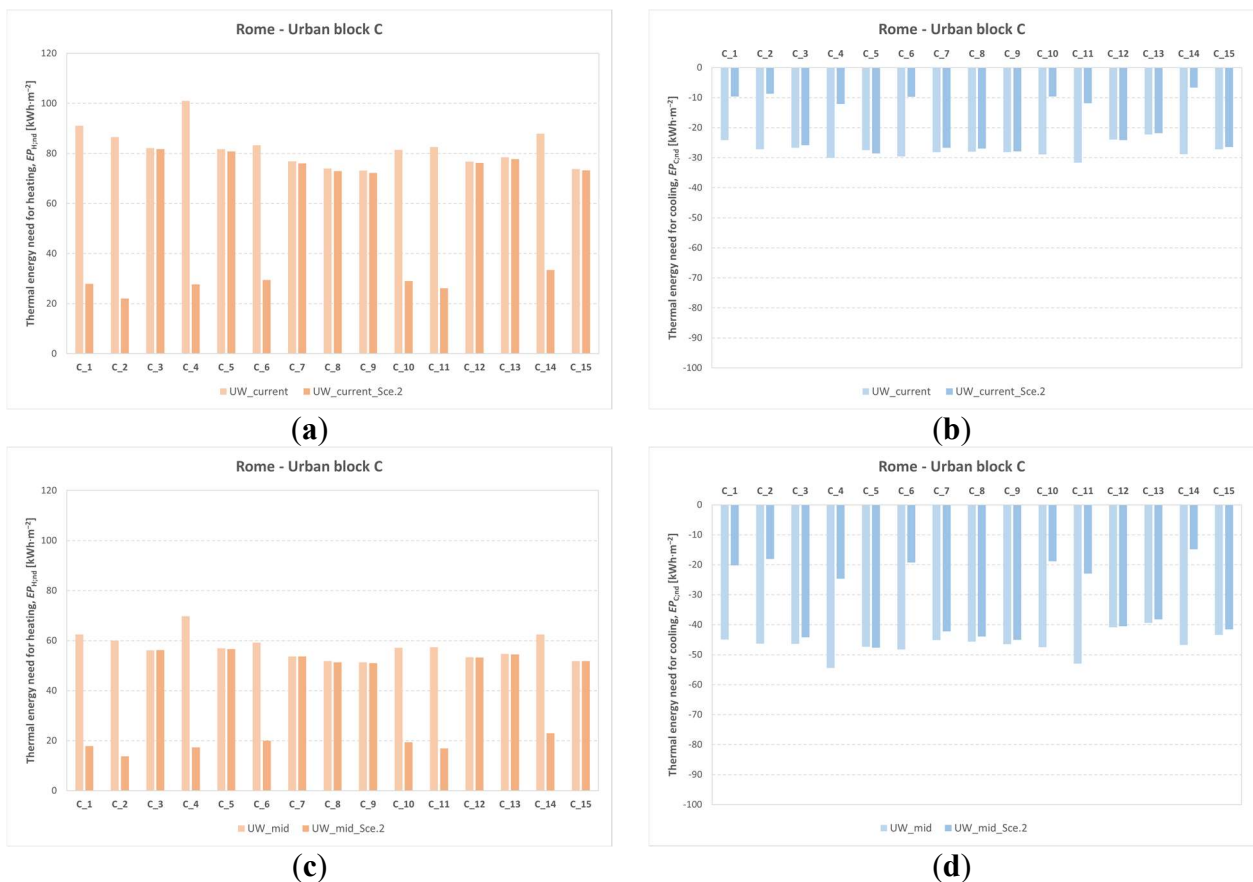


Figure 11: Thermal energy need for space heating (a-c) and cooling (b-d) under current and mid-term climate conditions, with and without the resilient strategies of Scenario 2

For the most energy-intensive residential buildings, Figure 12 reports the results in terms of peak heating (a-c) and cooling (b-d) loads under short- and medium-term climate conditions, comparing the baseline case with the results obtained after the implementation of Scenario 2 measures.

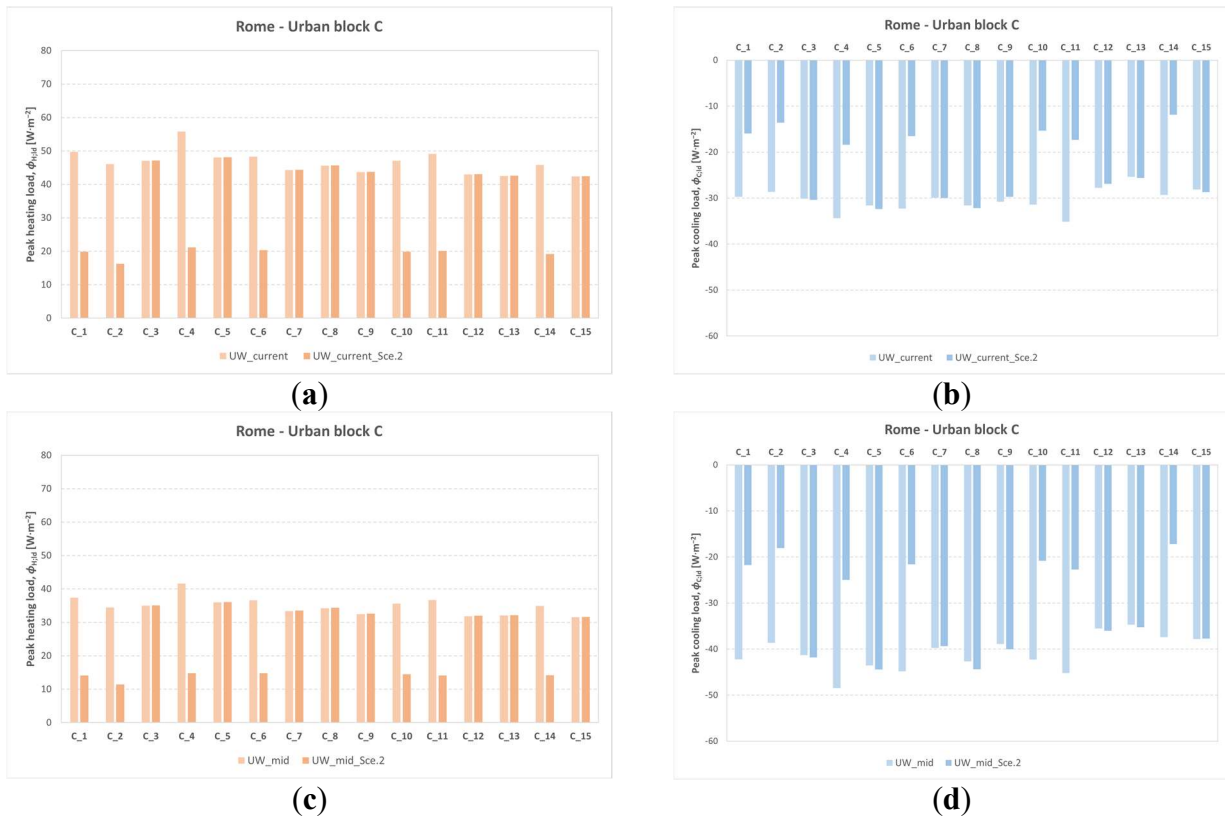
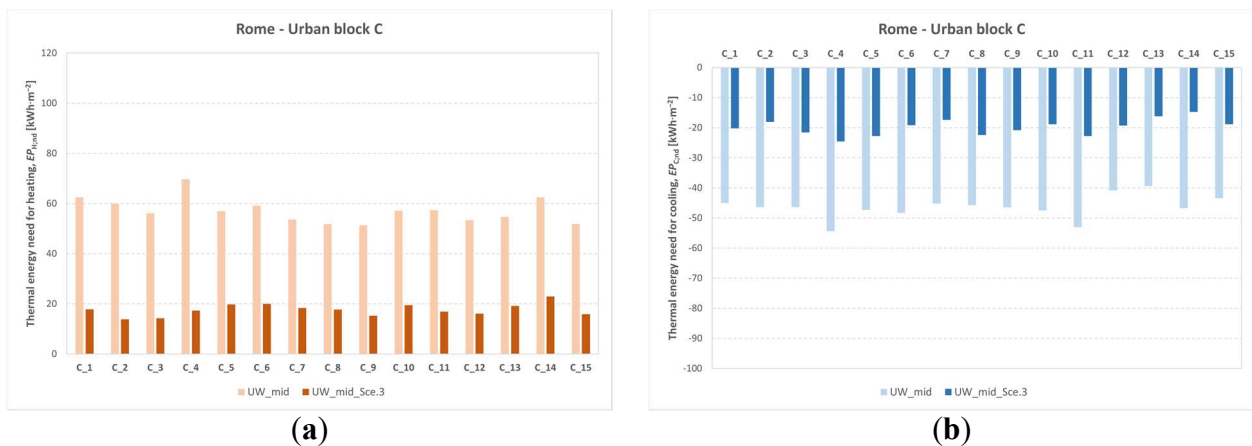


Figure 12: Peak heating (a-c) and cooling (b-d) loads under current and mid-term climate conditions, with and without the resilient strategies of Scenario 2

3.1.3 Scenario 3: Urban and building resilient strategies (whole block application)

Figure 13 presents the thermal energy need for space heating (a-c) and cooling (b-d) under medium- and long-term climate conditions, comparing the baseline case with the effects of adopting the climate-resilient measures for all the buildings in the assessed urban block.



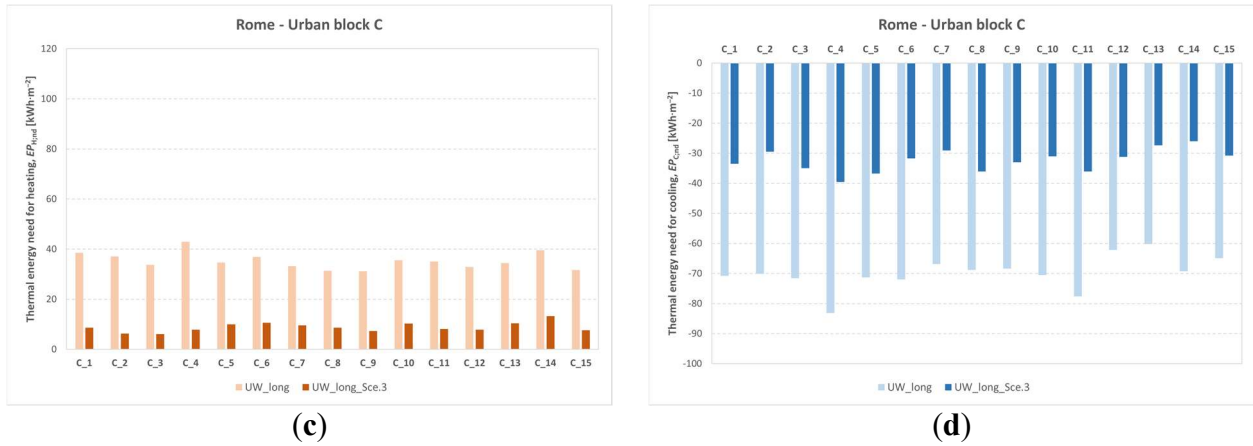


Figure 13: Thermal energy need for space heating (a-c) and cooling (b-d) under mid-term and long-term climate conditions, with and without the resilient strategies of Scenario 3

Figure 14 presents the peak heating (a-c) and cooling (b-d) loads under medium- and long-term climate conditions, comparing the baseline case with the results obtained after the implementation of Scenario 3 measures.

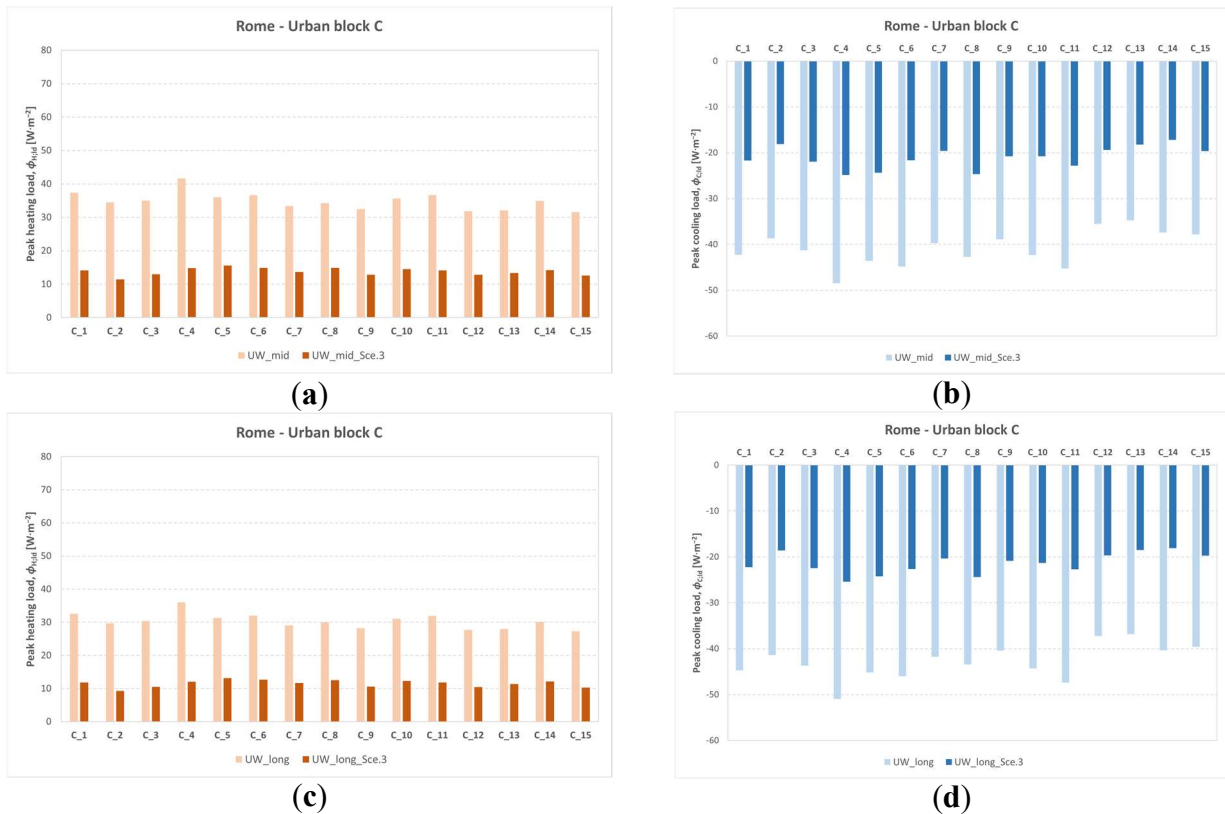


Figure 14: Peak heating (a-c) and cooling (b-d) loads under mid-term and long-term climate conditions, with and without the resilient strategies of Scenario 3

3.3 Bari

Figure 15 shows the geometrical representation and building IDs of Urban Block B in the municipality of Bari.

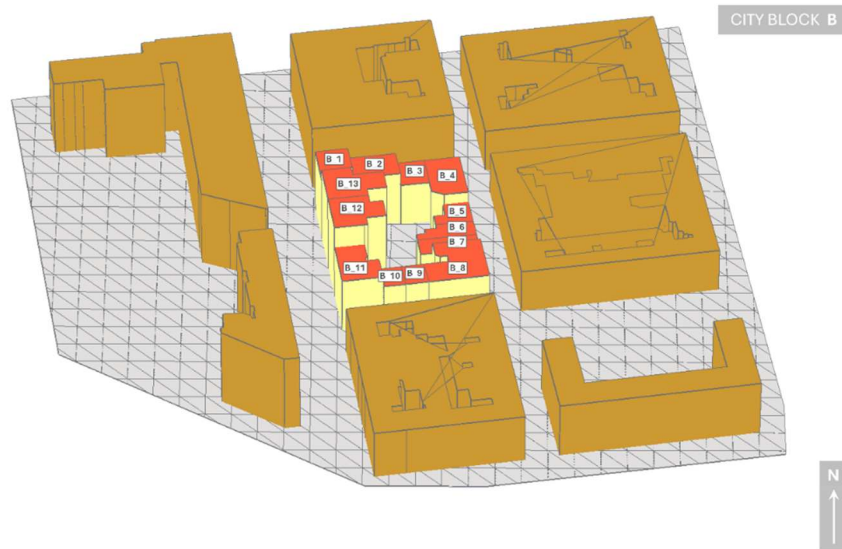
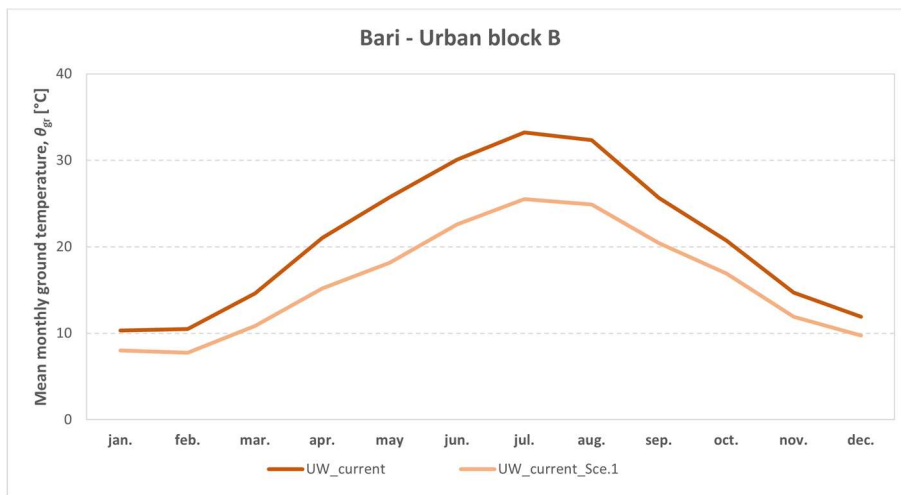


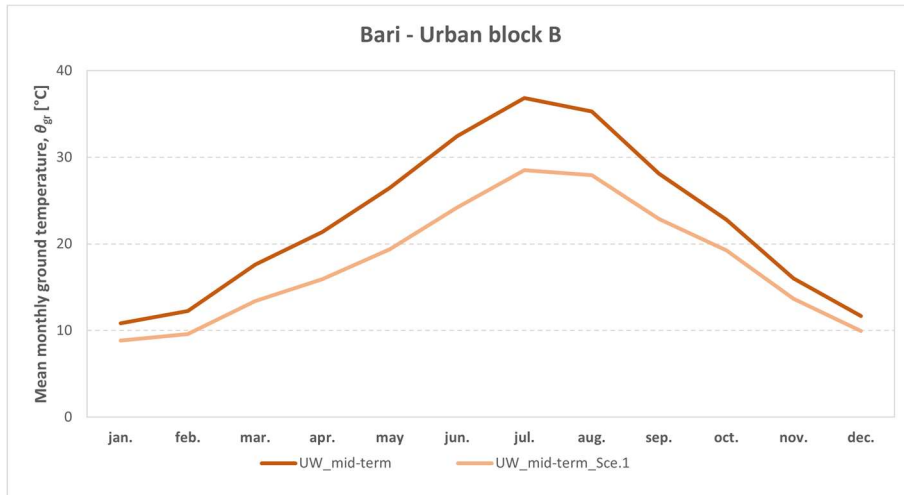
Figure 15: Urban block B (Bari) visualised in CitySim Pro

3.1.1 Scenario 1: Urban-scale resilient strategies

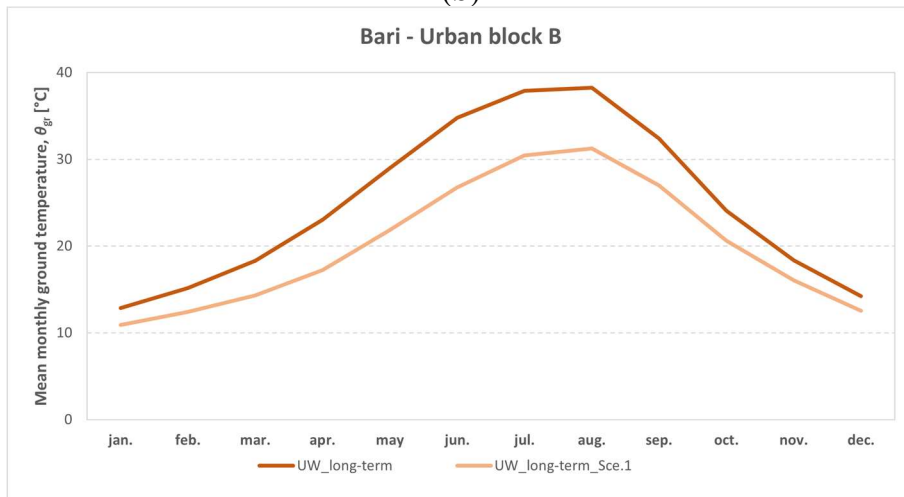
Figure 16 reports the mean monthly ground temperature for urban block B under current, mid-term, and long-term climate conditions, with and without urban-scale resilient strategies, including increased green coverage and reflective pavements.



(a)



(b)



(c)

Figure 16: Mean monthly ground temperature for urban block B under current (a), mid-term (b), and long-term (c) climate conditions, with and without urban-scale resilient strategies

3.1.2 Scenario 2: Urban and building resilient strategies (targeted application)

Figure 17 identifies the worst-performing 43 % of residential buildings under current UW conditions for urban block B in Bari. These buildings are considered the most energy-intensive.

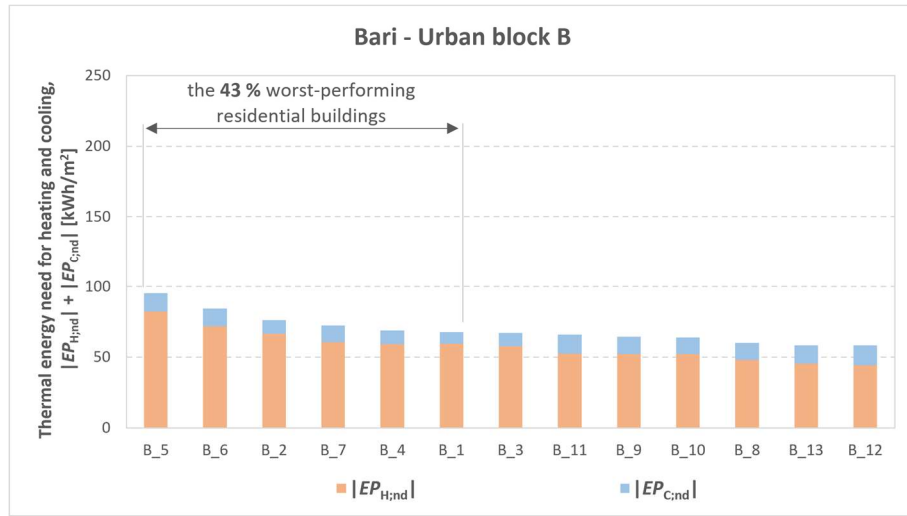


Figure 17: Identification of the 43 % worst-performing residential buildings under current UWS conditions

presents the thermal energy need for space heating (a-c) and cooling (b-d) under short- and medium-term climate conditions. Specifically, the histograms compare the building energy need with and without the adoption of climate resilient strategies applied to the worst-performing buildings: B_5, B_6, B_2, B_7, B_4, and B_1.

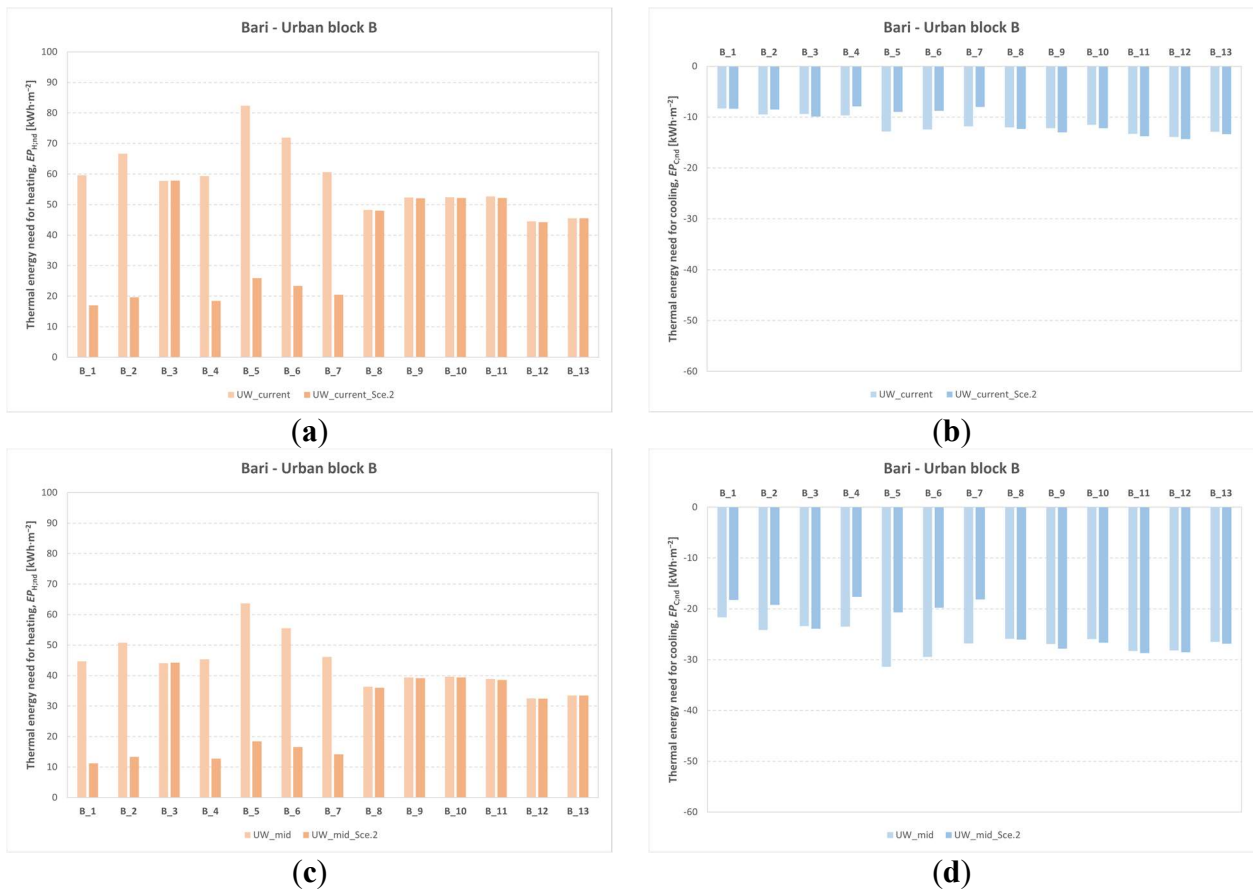


Figure 18: Thermal energy need for space heating (a-c) and cooling (b-d) under current and mid-term climate conditions, with and without the resilient strategies of Scenario 2

For the most energy-intensive residential buildings, Figure 19 reports the results in terms of peak heating (a-c) and cooling (b-d) loads under short- and medium-term climate conditions, comparing the baseline case with the results obtained after the implementation of Scenario 2 measures.

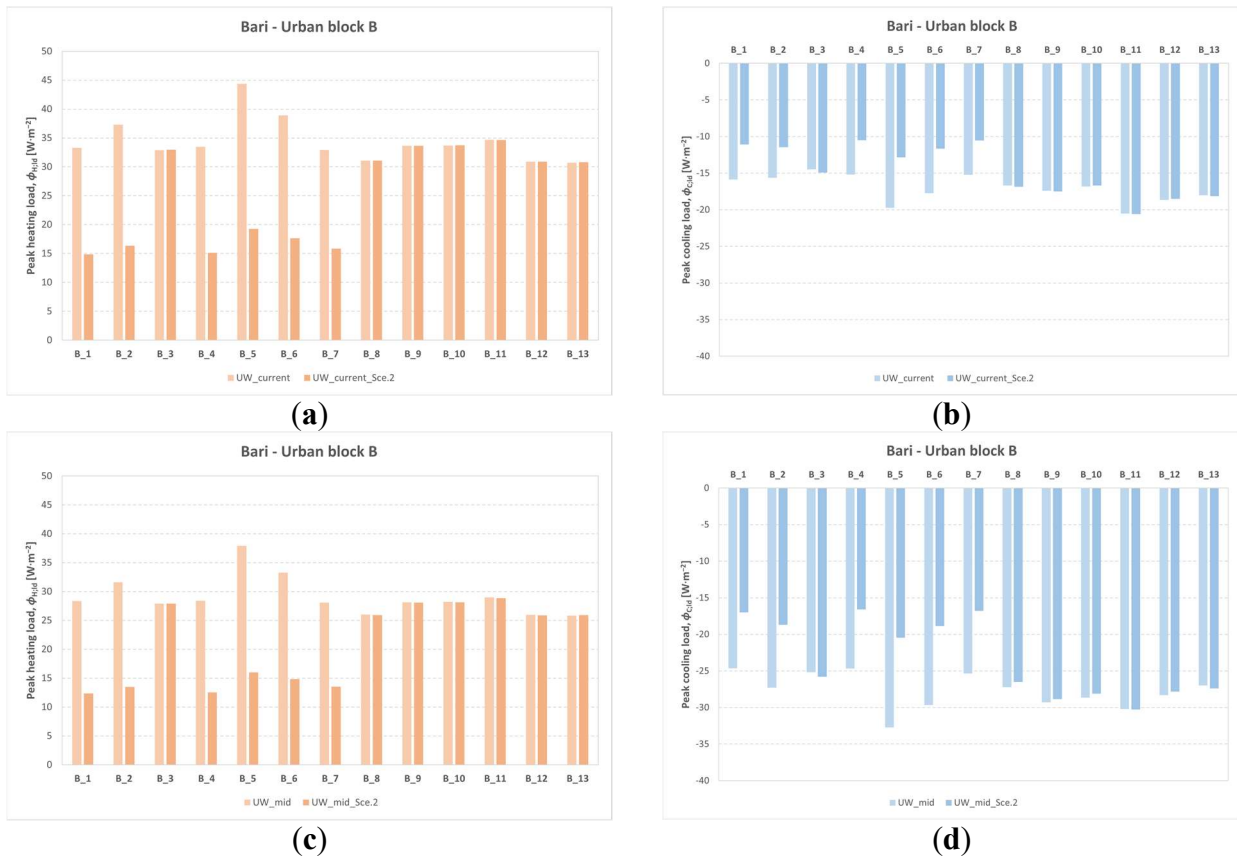
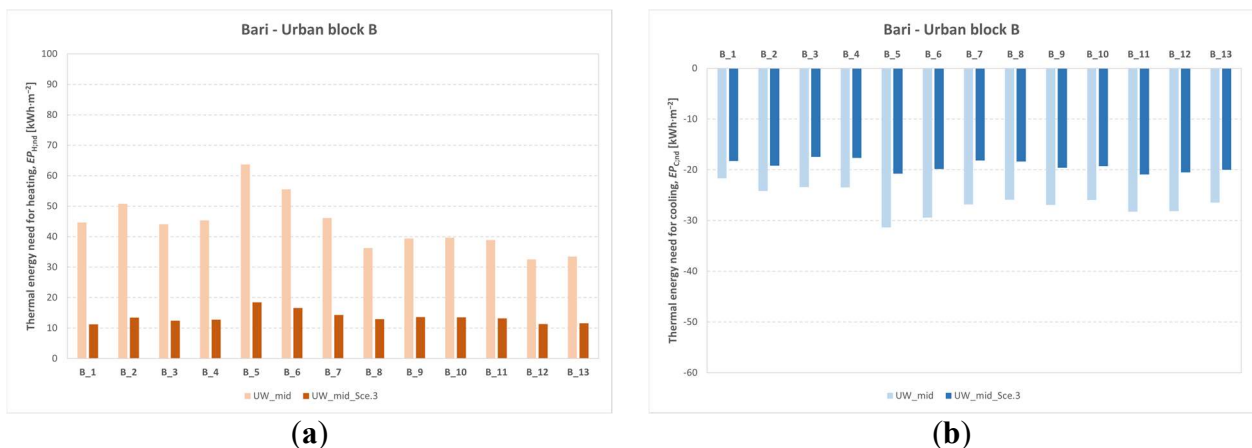
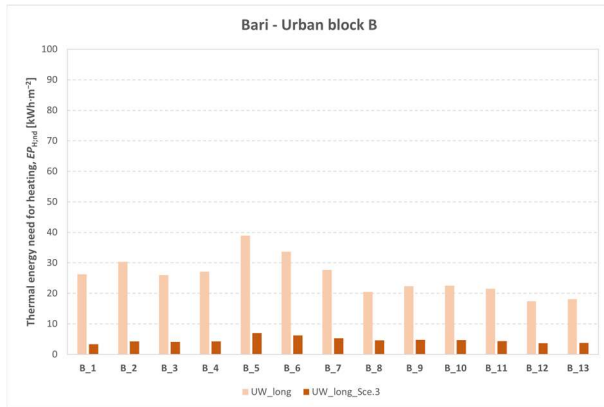


Figure 19: Peak heating (a-c) and cooling (b-d) loads under current and mid-term climate conditions, with and without the resilient strategies of Scenario 2

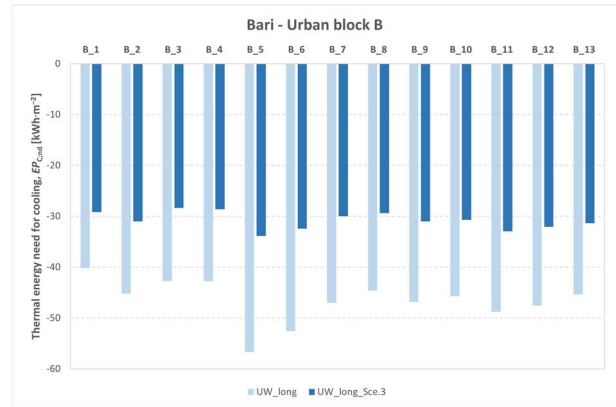
3.1.3 Scenario 3: Urban and building resilient strategies (whole block application)

Figure 20 presents the thermal energy need for space heating (a-c) and cooling (b-d) under medium- and long-term climate conditions, comparing the baseline case with the effects of adopting the climate-resilient measures for all the buildings in the assessed urban block.





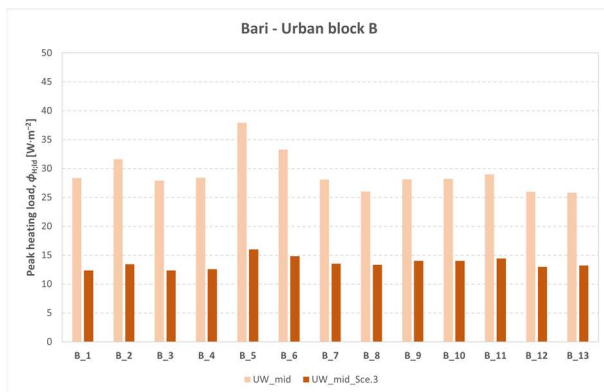
(c)



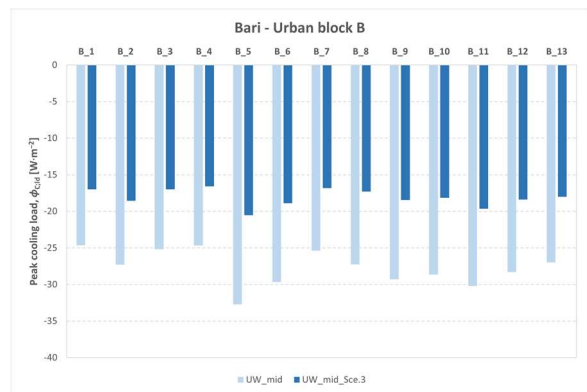
(d)

Figure 20: Thermal energy need for space heating (a-c) and cooling (b-d) under mid-term and long-term climate conditions, with and without the resilient strategies of Scenario 3

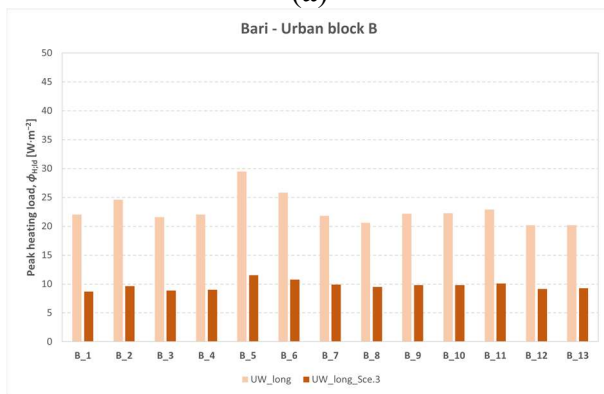
Figure 21 presents the peak heating (a-c) and cooling (b-d) loads under medium- and long-term climate conditions, comparing the baseline case with the results obtained after the implementation of Scenario 3 measures.



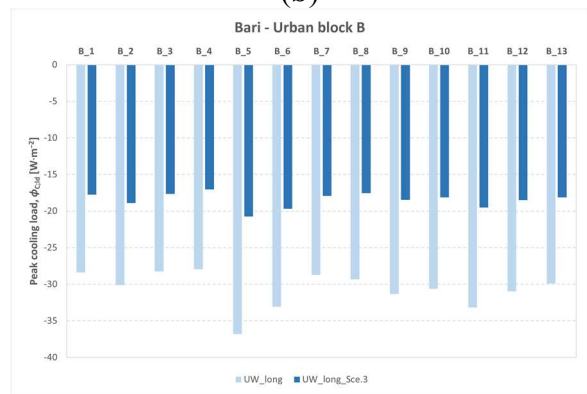
(a)



(b)



(c)



(d)

Figure 21: Peak heating (a-c) and cooling (b-d) loads under mid-term and long-term climate conditions, with and without the resilient strategies of Scenario 3

3.4 Discussion

According to the EPBD IV (EU 2024/1275), each EU Member State must define, by 29 May 2026, a national trajectory for the progressive renovation of the residential building stock. This trajectory

must be aligned with the national renovation roadmap and the 2030, 2040, and 2050 targets, with the objective of achieving a zero-emission building stock by 2050. It must be expressed as a reduction in the average primary energy use of the residential building stock between 2020 and 2050, and should specify the annual number or floor area of residential buildings to be renovated, including the share corresponding to the 43 % worst-performing buildings. At least 55 % of the required reduction in average primary energy use must result from the renovation of these worst-performing buildings.

In this work, the 43 % worst-performing residential buildings within each assessed urban block were identified based on the sum of the thermal energy needs for space heating and cooling, expressed in absolute values. Specifically, [Figure 22](#) shows the trajectories of the combined energy need of these two energy services, calculated as a net floor area-weighted average for the buildings in the representative urban blocks of Turin ([Figure 22a](#)), Rome ([Figure 22b](#)), and Bari ([Figure 22c](#)). In the graph, each line represents a different scenario: the baseline case, Scenario 2 (applied under current and mid-term climate conditions), and Scenario 3 (applied under mid-term and long-term climate conditions).

Considering the scenario trajectories illustrated in [Figure 22](#), in cooling-dominated climates (i.e., Bari and Rome) an increase in the overall energy need of the building stock can be observed when moving from one time horizon to another. This trend is mainly driven by the increase in the thermal energy need for space cooling.

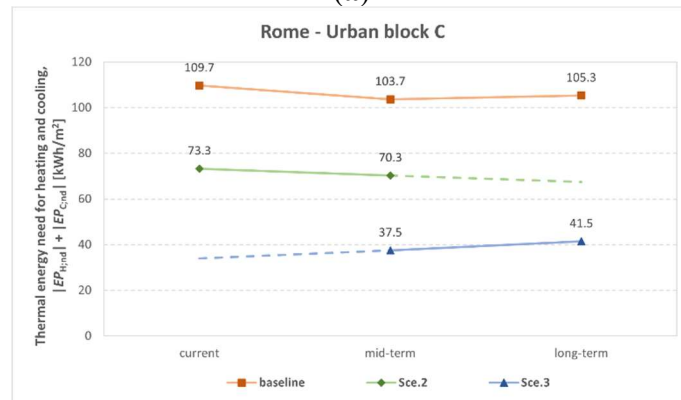
[Table 3](#) reports the energy savings, in terms of thermal energy need for space heating and cooling, obtained by comparing the climate resilient strategies foreseen in Scenario 2 and Scenario 3 with the baseline case, calculated under current climate conditions. Considering the EPBD IV objective of targeting the 43 % worst-performing residential buildings, the comparison between mid-term climate conditions (approximately corresponding to 2050) and current conditions (approximately corresponding to 2020) shows a percentage decrease between – 19 % and – 36 %. This result provides a first indication of the potential energy savings, which can be proportionally translated into primary energy savings, for which at least 55 % of the overall reduction must be achieved through the renovation of the worst-performing buildings.

Under long-term climate conditions, compared with the baseline case calculated with current climate data, the building stock energy balance shows a reduction ranging between -47 % and -66 %.

It should be underlined that the analysis considers only the thermal energy need of buildings and does not include the efficiencies of technical building systems, primary energy factors, and other energy services (e.g., domestic hot water, artificial lighting, mechanical ventilation, etc.). These energy savings should therefore be combined with the additional reductions achievable through the electrification of the building sector, as heat pumps typically achieve efficiencies two to three times higher than conventional gas boilers.



(a)



(b)



(c)

Figure 22: Trajectories of thermal energy need for space heating and cooling, summed in absolute values, under different climate conditions and scenarios for the case studies of Turin (a), Rome (b), and Bari (c)

Table 3: Decrease in thermal energy need between the scenarios and the baseline case under current climate conditions

	Turin			Rome			Bari		
	C (*)	M (*)	L (*)	C	M	L	C	M	L
Sce.2 - baseline	- 17 %	- 19 %	n.a.	- 33 %	- 36 %	n.a.	- 25 %	- 21 %	n.a.
Sce.3 - baseline	n.a.	- 57 %	- 59 %	n.a.	- 66 %	- 62 %	n.a.	- 51 %	- 47 %

(*) C = current, M = mid-term, L = long-term

4. GENERAL REMARKS AND CONCLUSIONS

Within the CRiStAll project, Work Package 4 focuses on the assessment of climate resilient and mitigating strategies aimed at improving the energy performance and climate resilience of urban districts under current and future climate conditions. To highlight the importance of evaluating these strategies through an integrated perspective, analyses were carried out on representative urban configurations located in Turin, Rome, and Bari.

Urban-scale measures, such as increased vegetation coverage and reflective materials, contribute to modifying local microclimatic conditions and mitigating UHI effects, while building-scale interventions improve the thermal performance of the building stock. The combined implementation of these strategies therefore represents a key aspect in addressing both UHI effects and building energy performance under changing climatic conditions.

Within this framework, the analyses indicate that the combined application of urban-scale measures and building-scale ones on the targeted worst-performing buildings can achieve reductions of up to 36 % in the combined thermal energy need for space heating and cooling. When the same integrated package of strategies is extended to the entire building stock, the more advanced configuration can reach reductions of up to 66 %. At the same time, the effectiveness of these strategies varies according to both the considered time horizon and the climatic zone of the analysed urban contexts. In particular, the effectiveness increases from the current to the mid-term horizon in all cities, whereas toward the long-term period it continues to increase slightly in Turin but decreases in Rome and Bari. This trend highlights the importance of evaluating resilient measures under different climatic zones and time horizons.

Overall, the outcomes contribute to the development of a database of resilient strategies for different typical urban context configurations, containing the KPIs in the short, mid, and long term. They also provide a structured knowledge base to support integrated urban renovation and climate resilience pathways.

NOMENCLATURE

Symbols

EP	energy performance indicator [kWh/m ²]
θ	temperature [°C]
ϕ	areic heat load [W/m ²]

Subscripts

C	cooling
gr	ground
H	heating
ld	load
nd	need

Acronyms

CRS	Climate Resilient Strategies
EPBD	Energy Performance of Buildings Directive
KPI	Key Performance Indicator
UBEM	Urban Building Energy Model/Modeling
UHI	Urban Heat Island
RW	Rural Weather data
UW	Urban Weather data

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European Commission, 2024. “Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the Energy Performance of Buildings (recast)”, *Official Journal of the European Union*, 24 April 2024.

Italian Republic, 2015. “Interministerial Decree of 26 June 2015 on the Calculation Methodologies of Building Energy Performance and Minimum Energy Performance Requirements”, Italy, 26 June 2015.