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A Study to Improve the Efficiency of Buildings using Nanomaterials

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***Abstract*: In light of the remarkable development in nanotechnology, and it is one of the most important applications that directly affect the building materials used in buildings in the internal and external environment in order, to achieve greater efficiency and access to environmentally friendly buildings to achieve sustainability.**

Through some nanomaterial applications, and the selection of analytical examples applied to nanotechnology, as well as an application study on an administrative building for the application of nanotechnology in order, to reach the goal of study which is the role of nanotechnology to raise the efficiency of administrative buildings to achieve sustainability.

***Keywords*: Nanotechnology, Nano Architecture, Nano architecture application (Nano material).**

1. Introduction

The most sought after in the current and future global challenges was the provision of new technologies and materials with qualifications that would lead to a leap in the world of architecture, and the largest share was nanotechnology, a technological means by which climate change can be addressed and help reduce future gas emissions. The building has a significant impact on the surrounding world, and in the way buildings are designed and nanotechnology is able to change the way it is built, and nanotechnology has a significant impact on building materials and their characteristics.

In past years the term 'nanotechnology' has been used in many fields (architecture, medicine, space, construction, etc.), and we will address the explanation of the definition of nanotechnology, Nano-architecture, Nano applications in architecture and a study case through which we apply nanomaterials, as nanotechnology has a profound impact on the architecture industry in all standards of interior design, and building design.

2. Methods

Definition of Nanotechnology

Nanotechnology is extremely diverse, ranging from new extensions to traditional device physics to a completely new approach based on molecular self-assembly, to developing new nanometer-scale materials, to predicting how to control matter on an atomic scale.

It has the potential to create a plethora of new materials and devices with wide-ranging applications, and nanotechnology raises many issues that any new technology introduces, such as nanomaterials and their environmental impact, And its potential economic impact. [1].

Nano architecture:

Nanotechnology + Architecture = Nano Architecture

Science at the molecular level is set to change the way we build.

Nanotechnology is responsible for the major changes that led to the development of architecture, as things on a one-to-a-hundred-billion-meter scale make changes to materials and construction. However, the question is how willing we are to embrace these changes through which architecture can make a big difference.

Nano Architecture allows us to develop designs that better interact with the senses of man. Experience this architecture and look more 'natural' than the many designs which we face today. [2].

The grandest ambitions are actually very, very tiny for the future of our built environment. The nanotechnology industry has already begun transforming our buildings and using them on eight billion dollars a year; if their potential is realised, they can unbelievably transform our world. Nanotechnology has the potential to significantly alter our built environment and the way we live. It's potentially our most transformational technology, attracting more inquiry and discussion than nuclear weapons, space travel, computer systems or any other technology that has altered our lives.

What is the future of the building, for example, if we each have thermosafe skin that protects us from elements?

How can we interact, if walls and ceilings become thin and permeable or even invisible with our surroundings, and with each other? [3].

Nano architecture application- Materials: [4]

1. Thermal insulation: Vacuum insulation panels (VIPs).
2. Thermal insulation: Aerogel

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Thermal insulation: Vacuum insulation panels (VIPs)

The vacuum insulation Panels (VIPs) have a considerably thinner insulation thickness than usual for providing very good thermal insulating. Thermal conductivity is up to ten times lower in comparison to traditional insulation materials such as polystyrene. Max. thermal resistance with minimum isolation thinness can be achieved with this result. The thickness of these VIPs ranges from 2mm to 40mm [4]. Vacuum insulation panels can be used for both new building construction and conversion and renovation work, and they can be applied to both walls and floors.

It is generally estimated that the ages of modern paintings are 30-50 years old. It can also be used in electronic packages and to isolate pipelines. [4] (Fig. 1.).

Fig.1. Different sized vacuum insulation panels in storage [4]

Thermal insulation: Aerogel:

Almira - 'Nanogel' is formerly the brand name of Cabot Corporation's. It is a unique material, lighter and best solid insulating material made of silica (silica), is a lattice network of glass filaments with very small pores, for Mira (Lumira) consisting of 5% of solids and 95% air, its structure creates Insulation, improves the spread of light and water repellent [5]. With a solid-touch environment and tremendous insulation capabilities [6].

Aerogel, which was developed in 1931, currently holds the record for the lightest known solid. It is a highly light-weight ventilation foam with about 100% air. The remaining foam material is silica, a glass-like material. The nano dimension in the pores of the foam is so important: air particles trapped inside the micro Nano theme - with each average size of only 20nm - are unable to move, lending.

Fig. 2. Aerogel in combination with glass [4].

It is used as an insulating filling material in cavities between glass parts, u-glass, or multi-walled acrylic glass panels, making it ideal for use in the construction of external envelopes.

Aerogels can significantly reduce heating and cooling costs. Aerogel conveys light well because it is transparent. The light spread evenly and comfortably. Aerogel also acts as an acoustic insulator, and contributes to energy efficiency in addition to its thermal insulating properties.

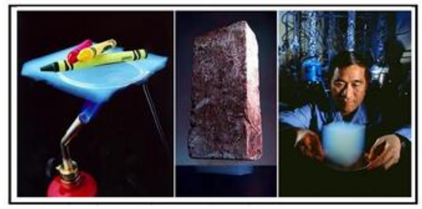


Fig. 3. Aerogel and its ability to withstand different forces and high insulation capacity with the small size of the sample section [7].

Aerogel's daily lighting capabilities:

Aerogel supports you in achieving energy code requirements in overcoming design issues, as it provides unprecedented thermal efficiency, high quality lighting and sound reduction, Aerogel has gained widespread acceptance throughout the United States and Europe for use in daylight systems as a result of the following [8]:

1. Transmission to light 91 % - per cm2.
2. Reduce solar heat acquisition and noise.
3. Resistance to discoloration – mold.
4. Reducing energy consumption and reducing carbon emissions.
5. Green Manufacturing Processes (Sustainable).

Fig. 4. Glass sample with black edging & aerogel-filled glazing cavity [4]

Architectural destinations of the building:

The front façade (the main façade is the northern façade) of the university administration building is dominated by solid flats where it is 60%, and the open surfaces (void) are 40% of the building, while the side facades are also dominated by the flats on the southern façade the proportion of flat flats is about 70% of the entire facade.

Fig. 7. University Administration Building in Mansoura

Analytical study:

Table 1
Indigo Tower: Bio Purification Tower

Architect	10 Design Architects Team: Ted Givens Benny Chow , Mohamed Ghamlouch.
Site	Qingdao, China
Classification	Multi-use (residential- administrative- merchant)
Nanomaterials used	➢ *Nano coating:* titanium dioxide, (TIO_2)-Air purification ➢ Solar Nano cells.
Sustainability standards	■ *Site*: (No negative impact on the site- Carbon dioxide absorption). ■ *Water efficiency*: (Use of rain water to feed the building- Wastewater recycling) ■ *Energy efficiency*: (Wind power- Solar Energy). ■ *The internal environment*: (Day lighting) ■ *Materials* : (Use of Nano casing- Use of Nano coating)
Project Description:	The Indigo Tower project is designed as an attempt to address urban air pollution by cleaning air by combining passive solar and nanotechnology technologies [9]. It works to combat air pollutants' through Nano coating where it performs photo stimulation as a result Of the interaction of titanium dioxide (TIO) with ultraviolet radiation (UV) and also works at night light on night lighting thanks to the negative solar energy through UV radiation collected during daylight [10].  Fig. 5. Indigo Tower, nightly UV [11]

Table 2
Bank of America Tower

Architect	Cook + Fox Architects
Site	New York, American
Executing Company	Israel Berger & Associates; Permasteelisa Group
Classification	Multi-use (Administrative-Service)
Nanomaterials used	➢ Low emission glass.
Sustainability standards	■ *Site:* (No negative impact on the site- Carbon dioxide absorption). ■ *Water efficiency*: (The system of facades to collect rainwater and reuse it again) ■ *Energy efficiency*: (Solar Energy). ■ *Materials*: (Use of Low emission glass). ■ *The internal environment*: (Day lighting).
Project Description:	The building is the fourth tallest skyscraper in New York city, with a height of 366 m. Consisting of 55 floors and containing 2,100,000 square feet of office space, three escalators and 50 service desks. *Referred to as 'BOAT', a boat, which is an abbreviation for Bank of America Tower*. The project has been implemented with a 1 billion U.S. dollars to be one of the most efficient and friendly buildings in the world. Nano glass has been used as a low-emission glass with the aim of creating the highest quality in the workplace through daylight and fresh air, and essential urban-level outdoor contact, representing the tower in its local environment as well as downtown Manhattan [12].  Fig. 6. Bank of America Tower [12]

3. Methods

Table 3
University Administration Building in Mansoura

Architect	*Prof. D.*Eng. Adel Ahmed Deaf
Site	Mansoura City Egypt
area	6400m^2
Time	2000

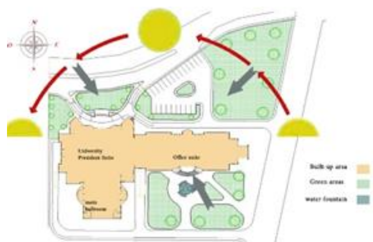


Fig. 8. Analysis of the climate conditions surrounding the general site of the management building of The University of Al-Mansoura

Steps to use DESIGN BUILDER in simulations:

All data for the building are entered in terms of (general location - climate conditions - and dimensions of the building) on the program and a model is formed mimicking the reality of the building so that it simulates everything related to energy consumption, internal thermal environment, openings and guidance. (Fig. 11.).

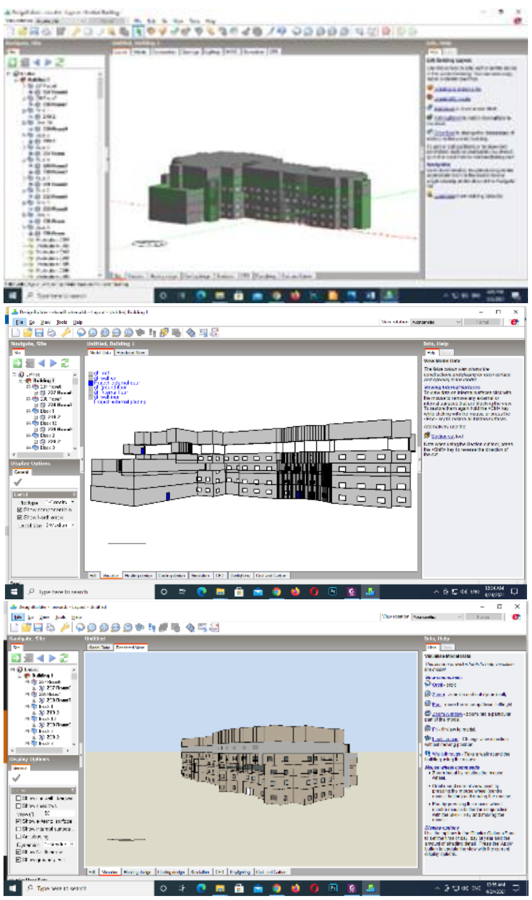
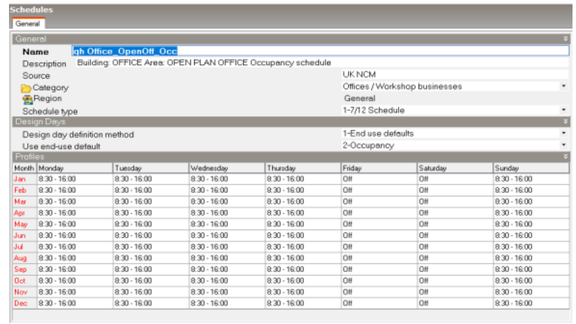


Fig. 9. The model that mimics the university administration building in Mansoura University

The materials built are identified in terms of materials used in roofs, floors, internal and external walls and external openings.

- Periods of use of the building and its division into working hours, official working days and weekly and annual vacation days.



Schedules

General

General

Name	gh Office_OpenOff_Occ
Description	Building: OFFICE Area: OPEN PLAN OFFICE Occupancy schedule
Source	UK NCM
Category	Offices / Workshop businesses
Region	General
Schedule type	1-7/12 Schedule

Design Days

Design day definition method	1-End use defaults
Use end-use default	2-Occupancy

Profiles

Month	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Jan	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Feb	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Mar	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Apr	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
May	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Jun	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Jul	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Aug	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Sep	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Oct	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Nov	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00
Dec	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	8:30 - 16:00	Off	Off	8:30 - 16:00

Fig. 10. Sometimes the blanks that are known within the program are filled

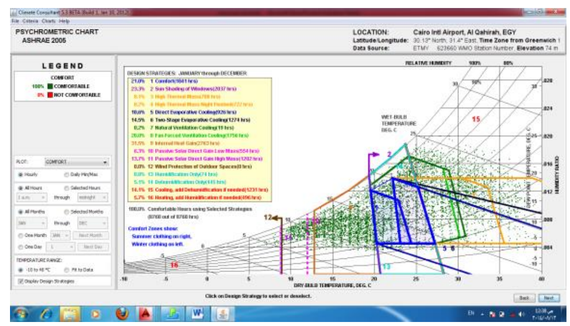


Fig. 11. Analysis shows bio-climatic for the city

First case: No insulation (Status quo)

Output data:

Cooling design: In-building energy consumption rate in the summer months (July-August-September).

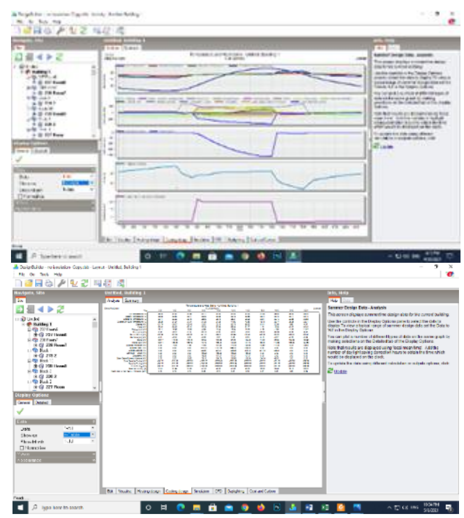


Fig. 13. In-building energy consumption rate in the summer months (July-August-September) in the program

Cooling energy consumption rates in internal spaces: The rate of energy consumption in the interior of all parts of the building in this case without adding any insulation materials:

Total Cooling =2912.53 kW.

The total energy consumed in cooling operations in the summer months (July-August-September) is within the building's spaces as described in (Fig. 16), (Fig. 17).

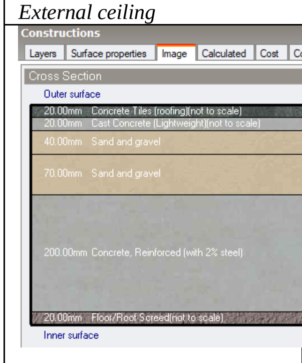
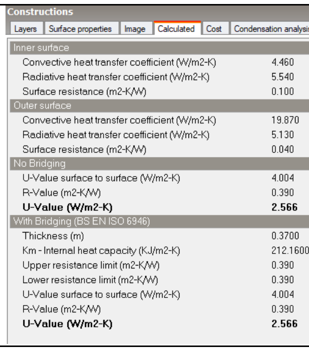
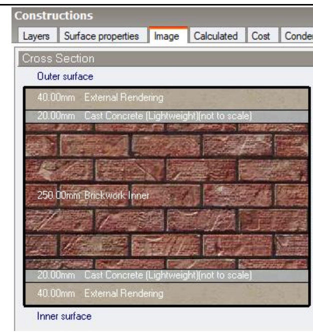
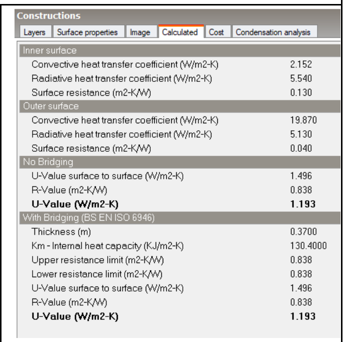
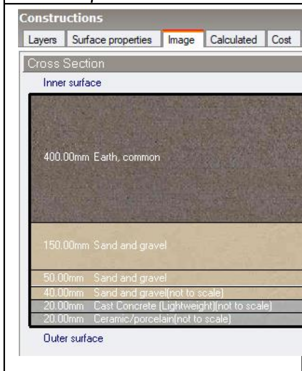
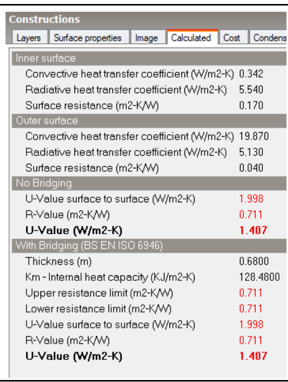
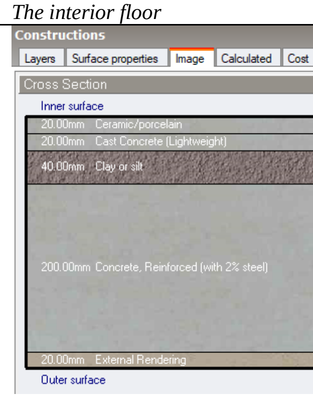
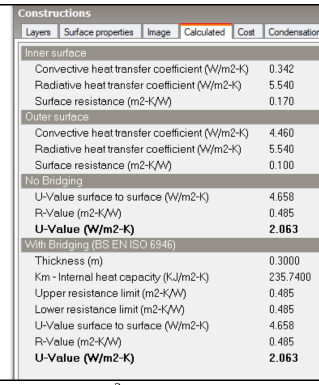
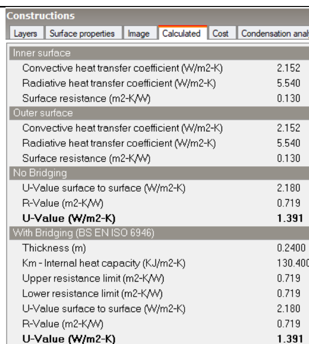
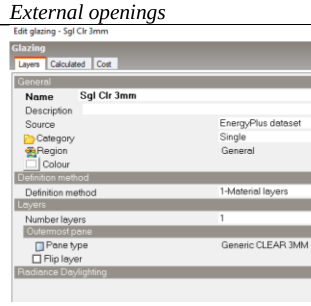
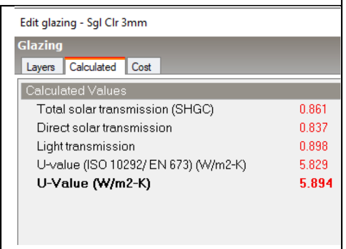
Description in the program	*Its thermal properties*	*Description in the program*	*Its thermal properties*
External ceiling		*External walls*	
			
U-value =	2.566 (W/m^2.K)	U-value =	1.193 (W/m^2.K)
Ground floor		*The interior floor*	
			
U-value =	1.407 (W/m^2.K)	U-value =	2.063 (W/m^2.K)
Inner walls		*External openings*	
			
U-value =	1.391(W/m^2.K)	U-value =	5.894(W/m^2.K)

Fig. 12. Characteristics of materials used and openings in construction elements within the program

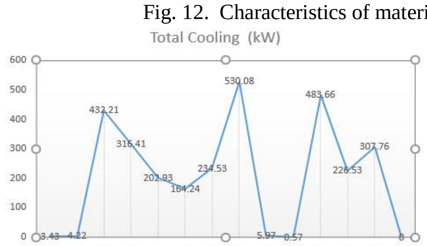
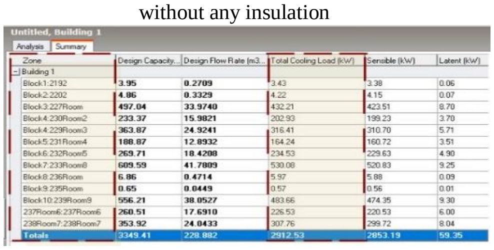


Fig. 14. Cooling energy consumption rates for the current situation without any insulation



Untitled, Building 1

Analysis | Summary

Zone	Design Capacity...	Design Flow Rate (m3...	Total Cooling Load (kW)	Sensible (kW)	Latent (kW)
Building 1					
Block1:2192	3.95	0.2709	3.43	3.38	0.06
Block2:2202	4.86	0.3329	4.22	4.15	0.07
Block3:227Room	497.04	33.9740	432.21	423.51	8.70
Block4:230Room2	233.37	15.9821	202.93	199.23	3.70
Block4:229Room3	363.87	24.9241	316.41	310.70	5.71
Block5:231Room4	188.87	12.8932	164.24	160.72	3.51
Block6:232Room5	269.71	18.4208	234.53	229.63	4.90
Block7:233Room8	609.59	41.7809	530.08	520.83	9.25
Block8:236Room	6.86	0.4714	5.97	5.88	0.09
Block9:235Room	0.65	0.0449	0.57	0.56	0.01
Block10:239Room9	556.21	38.0527	483.66	474.35	9.30
237Room6:237Room6	260.51	17.6910	226.53	220.53	6.00
238Room7:238Room7	353.92	24.0433	307.76	299.72	8.04
Totals	3349.41	228.882	2912.53	2853.19	59.35

Fig. 15. Cooling energy consumption rates for the current situation without any insulation

External thermal energy rates for internal vacuums:

Rates of thermal energy consumption in force to internal spaces through architectural building elements (ceilings, exterior walls, windows and floors). During the summer months, it's clear:

- Glazing Gains and Solar Gains = 186.269 kW.
- Wall Gains = 62.975kW.
- Floor Gains = 117.244 kW.
- Roof and Ceiling Gains =129.942 kW.

The second case: By adding nanotechnology-modified insulation materials.

By adding Nano-mineral fibers, adding insulation materials to the ceilings, exterior walls and floors, and adding aerogel as an insulation material on window glass.

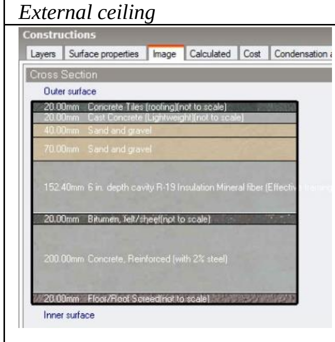
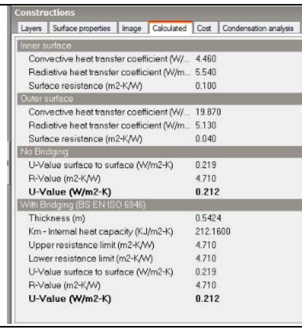
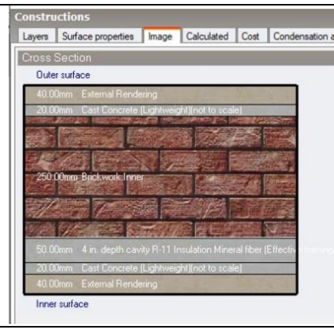
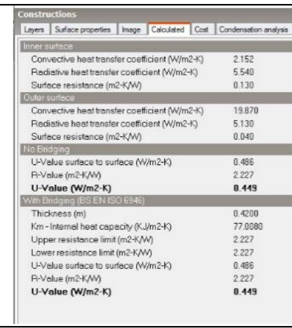
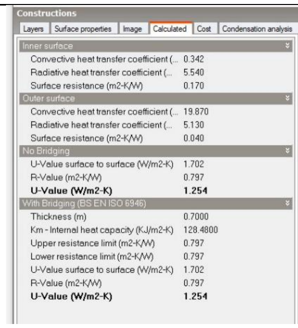
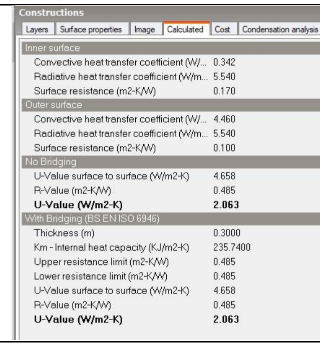
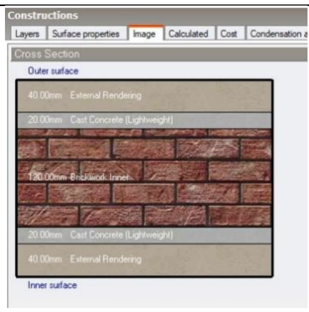
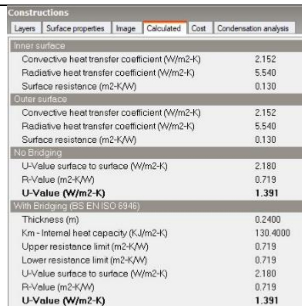
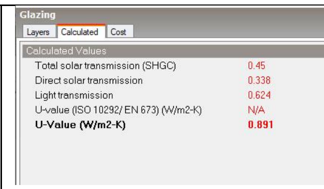
Description in the program	Its thermal properties	Description in the program	Its thermal properties
External ceiling		*External walls*	
			
U-value =	.212 (W/m^2.K)	U-value =	0.449 (W/m^2.K)
Ground floor		*The interior floor*	
			
U-value =	1.254 (W/m^2.K)	U-value =	2.063 (W/m^2.K)
Inner walls		*External openings*	
			
U-value =	1.391(W/m^2.K)	U-value =	0.891(W/m^2.K)

Fig. 17. Characteristics of materials used and openings in construction elements within the program

Untitled, Building 1 — Analysis | Summary

Zone	Glazing Gains (kW)	Wall Gains (kW)	Floor Gains (kW)	Roof and Ceiling Gains
Building 1				
Block1:2192	0.000	0.639	0.419	0.483
Block2:2202	0.000	0.576	0.364	0.513
Block3:227Room	4.505	13.610	-30.663	10.639
Block4:229Room3	4.002	7.957	24.653	12.818
Block4:230Room2	2.495	4.281	17.988	4.737
Block5:231Room4	2.134	3.261	19.234	3.335
Block6:232Room5	1.949	4.207	22.996	6.451
Block7:233Room8	0.000	10.404	38.854	57.808
Block8:236Room	0.044	1.096	0.484	0.526
Block9:235Room	0.000	0.221	0.035	0.036
Block10:239Room9	4.719	13.236	-0.672	23.101
237Room6:237Room6	21.967	-0.002	-3.517	0.452
238Room7:238Room7	23.916	0.001	17.393	0.383
Totals	**65.730**	**59.486**	**107.567**	**121.281**

Untitled, Building 1 — Analysis | Summary

Zone	Electric Equipment Gains...	Lighting Gains (kW)	People Gains (kW)	Solar Gains (kW)
Building 1				
Block1:2192	0.138	0.235	0.089	0.000
Block2:2202	0.194	0.329	0.125	0.000
Block3:227Room	24.553	31.826	15.853	10.227
Block4:229Room3	15.161	13.910	9.789	11.151
Block4:230Room2	9.889	11.632	6.385	4.052
Block5:231Room4	10.048	12.651	6.488	3.879
Block6:232Room5	13.957	15.263	9.012	8.215
Block7:233Room8	23.962	40.717	15.472	0.000
Block8:236Room	0.224	0.162	0.145	0.070
Block9:235Room	0.016	0.026	0.010	0.000
Block10:239Room9	25.434	25.425	16.423	11.792
237Room6:237Room6	18.284	21.603	11.806	36.806
238Room7:238Room7	24.431	37.174	15.775	28.699
Totals	**166.291**	**210.952**	**107.372**	**114.891**

Fig. 16. The thermal energy gained in this case without insulation of internal spaces through windows, ceilings, walls and floors

Output data:

Cooling design: In-building energy consumption rate in the summer months (July-August-September).

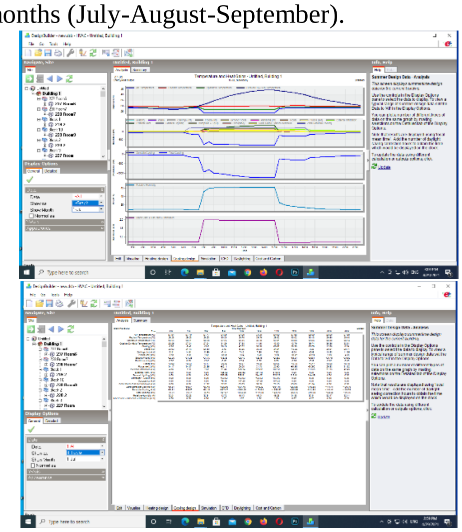


Fig. 18. In-building energy consumption rate in the summer months (July-August-September) in the program

Cooling energy consumption rates in internal spaces:

The rate of energy consumption in the interior of all parts of the building in this case without adding any insulation materials:

- Total Cooling = 1257.51kW.

The total energy consumed in cooling operations in the summer months (July-August-September) is within the building's spaces as described in (Fig. 19), (Fig. 20).

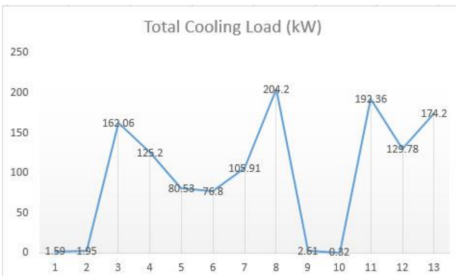
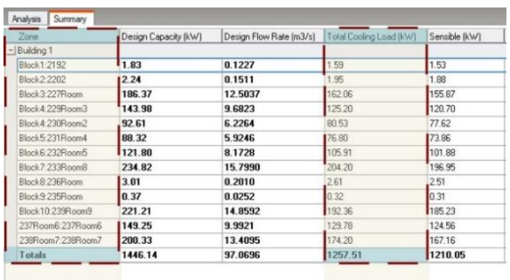


Fig. 19. Details cooling energy consumption rates of the condition with the insulation layer used nanotechnology (aerogel and Nano Mineral Fibers) within the interior spaces



Analysis | Summary

Zone	Design Capacity (kW)	Design Flow Rate (m3/s)	Total Cooling Load (kW)	Sensible (kW)
Building 1				
Block1:2192	1.83	0.1227	1.59	1.53
Block2:2202	2.24	0.1511	1.95	1.88
Block3:227Room	186.37	12.5037	162.06	155.87
Block4:229Room3	143.98	9.6823	125.20	120.70
Block4:230Room2	92.61	6.2264	80.53	77.62
Block5:231Room4	88.32	5.9246	76.80	73.86
Block6:232Room5	121.80	8.1728	105.91	101.88
Block7:233Room8	234.82	15.7990	204.20	196.95
Block8:236Room	3.01	0.2010	2.61	2.51
Block9:235Room	0.37	0.0252	0.32	0.31
Block10:239Room9	221.21	14.8592	192.36	185.23
237Room6:237Room6	149.25	9.9921	129.78	124.56
238Room7:238Room7	200.33	13.4095	174.20	167.16
Totals	1446.14	97.0696	1257.51	1210.05

Fig. 20. Cooling the state's energy consumption rates with the isolation layer used by nanotechnology (aerogel and Nano Mineral Fibers) within internal spaces.

External thermal energy rates for internal vacuums:

Untitled, Building 1

Analysis | Summary

Zone	Glazing Gains (kW)	Wall Gains (kW)	Floor Gains (kW)	Roof and Ceiling Gains
Building 1				
Block1:2192	0.000	0.604	0.139	0.110
Block2:2202	0.000	0.359	0.129	0.114
Block3:227Room	2.907	6.754	-28.045	5.231
Block4:229Room3	2.806	4.397	6.750	3.457
Block4:230Room2	1.563	2.433	4.518	1.678
Block5:231Room4	1.450	1.808	4.892	2.515
Block6:232Room5	1.650	2.275	5.578	1.905
Block7:233Room8	0.000	6.700	11.759	9.998
Block8:236Room	0.017	1.062	0.150	0.108
Block9:235Room	0.000	0.210	0.011	0.007
Block10:239Room9	3.279	6.657	-1.830	4.688
237Room6:237Room6	16.389	0.004	-4.983	-0.212
238Room7:238Room7	16.765	0.004	-1.510	-0.102
Totals	46.825	33.269	-2.443	29.497

Untitled, Building 1

Analysis | Summary

Zone	Electric Equipment Gains...	Lighting Gains (kW)	People Gains (kW)	Solar Gains (kW)
Building 1				
Block1:2192	0.130	0.221	0.084	0.000
Block2:2202	0.194	0.329	0.125	0.000
Block3:227Room	24.381	35.839	15.743	3.346
Block4:229Room3	15.161	19.467	9.789	3.243
Block4:230Room2	9.889	13.286	6.385	1.591
Block5:231Room4	9.964	14.228	6.434	1.519
Block6:232Room5	13.957	19.795	9.012	2.148
Block7:233Room8	23.962	40.717	15.472	0.000
Block8:236Room	0.224	0.269	0.145	0.025
Block9:235Room	0.016	0.026	0.010	0.000
Block10:239Room9	25.434	33.171	16.423	3.889
237Room6:237Room6	18.284	25.941	11.806	12.792
238Room7:238Room7	24.431	38.367	15.775	12.153
Totals	166.028	241.658	107.202	40.707

Fig. 21. The thermal energy gained in this case is the presence of (Nano mineral fibers) in the roofs, walls, floors and (Aerogel) in the windows through the interior of the building

Rates of thermal energy consumption in force to internal spaces through architectural building elements (ceilings, exterior walls, windows and floors). During the summer months, it's clear:

- Glazing Gains and Solar Gains = 87.532 kW.
- Wall Gains = 33.269kW.
- Floor Gains = -2.443kW.
- Roof and Ceiling Gains = 29.497kW.

Compare the results of the study case simulation using materials before and after you used Nano technology:

From previous results can be observed the extent of changes in the internal thermal environment of the external layers of the building of walls, ceilings and glass windows by the difference in energy consumed in cooling and the rates of passage of thermal energy to and from the external environment and consumption of electric power during the whole months of the year.

Energy consumed in refrigeration processes:

First case: No insulation (Status quo)

- Total Cooling =2912.53 kW.

Second case: By adding nanotechnology-modified insulation materials.

- Total Cooling = 1257.51kW.

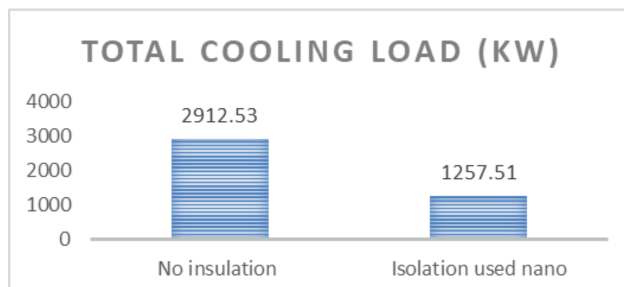


Fig. 22. Comparison between energy consumed in refrigeration processes between studied cases

Thermal energy window through building elements:

Comparison of thermal energy through windows:

First case: No insulation (Status quo)

- Glazing Gains and Solar Gains = 186.269 kW.

Second case: By adding nanotechnology-modified insulation materials.

- Glazing Gains and Solar Gains = 87.532 kW.

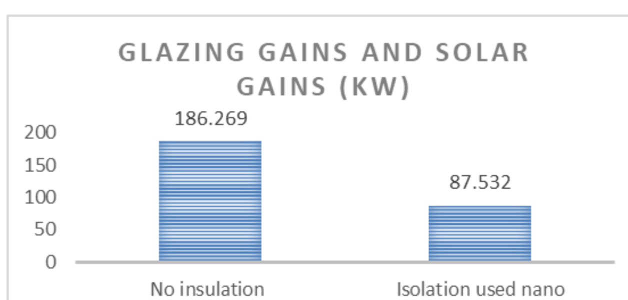


Fig. 23. Comparison of thermal energy through windows in areas of studied cases

Comparison of thermal energy through walls:

First case: No insulation (Status quo)

- Wall Gains = 62.975kW.

Second case: By adding nanotechnology-modified insulation materials.

- Wall Gains = 33.269kW.

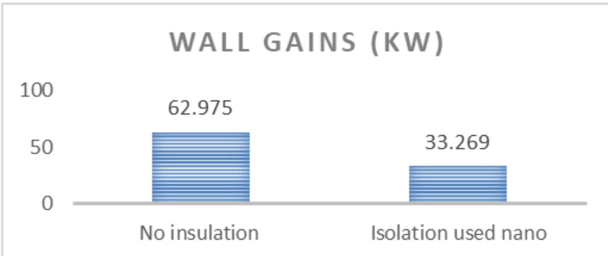


Fig. 24. Comparison of thermal energy through walls in areas of studied cases

Comparison of the thermal energy that is in effect through the roofs:

First case: No insulation (Status quo)

- Roof and Ceiling Gains =129.942 kW.

Second case: By adding nanotechnology-modified insulation materials.

- Roof and Ceiling Gains = 29.497 kW.

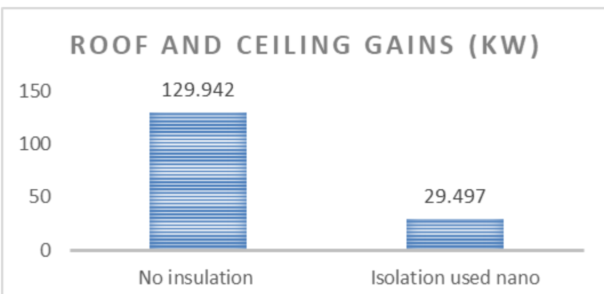


Fig. 25. Comparison of the thermal energy that is in effect through the roofs in the areas of studied cases

Analysis of the results of the applied study:

Energy results consumed in the cooling process:

- Achieving integrated nanomaterials with the outer shell the lowest scientific and applied recorded values of the values of the thermal transition laboratory (U-value), where cooling in the summer months is with nanomaterials 1257.51kW, and traditional insulation materials 2839.6kW, the cooling rate of Nano-insulation materials reduced is much lower to 56.8%.

Window thermal energy results by roof and ceiling in studied cases:

- The power of the roof without insulation was 129,942 kW, and with the addition of Nano-insulation materials, the energy in force became 29,497 kW, as the energy in force through the roof reduced is in the case of the addition of nanomaterials 77.29%.

Window of thermal energy results through walls in studied cases:

- The window power from the walls without insulation materials was 62.975kW, and with the addition of nanoscale insulation materials, the power in force became 33.269kW. Since the energy that is powered through the walls reduced, if nanomaterials are added, it's a percentage46.98%.

Window of thermal energy results through windows in studied cases:

- The power of the roof without insulation was 186,269 kW, and with the addition of Nano-insulation materials, the power in force was 87,532 kW, where the power that is in the window reduced is in case of the addition of nanomaterials, it is by53%.

4. Conclusion

The research aims to the importance of nanotechnology in the building and the areas of construction to activate the efficiency of buildings for an appropriate internal and external environment, (1) Nanotechnology allows us to move into new high value areas through new structures or traditional changes. (2) The connection between nanotechnology and architecture leads to a change in architectural thought and the emergence of new patterns of buildings. (3) The use of nanomaterial applications in the building from early design stages to the final finishing stages of the building leads to increased efficiency of the building. (4) Employing applications and nanomaterials in all parts of the building in analytical examples, the cover of the building and the internal and external environment that achieves sustainable standards. (5) Cooling in the summer months is with nanomaterials 1257.51kW, conventional insulation materials 2839.6kW. The cooling rate of nano-insulation material reduced is much lower to 56.8%. (6) The energy from the roofs with the addition of nano-insulation materials is better, reducing by 77.29%. The power through the walls using nanomaterials is also 46.98% better. In openings and windows, they are 53% better at using nano-insulating materials.

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