

الآية

(وَاللَّهُ جَعَلَ لَكُمْ مِمَّا خَلَقَ ضَلَالًا وَجَعَلَ لَكُمْ مِنَ الْجِبَالِ أَكْنَانًا وَجَعَلَ لَكُمْ سَرَابِيلَ تَقِيكُمْ الْحَرَّ وَسَرَابِيلَ تَقِيكُمْ بِأَسْكُمْ كَذَلِكَ يَتِمُّ نِعْمَتُهُ عَلَيْكُمْ لَعَلَّكُمْ تُسَلِّمُونَ (81) فَإِنْ تَوَلَّوْا فَإِنَّمَا عَلَيْكَ الْبَلَاءُ الْمُبِينُ (82) يَعْرِفُونَ نِعْمَةَ اللَّهِ ثُمَّ يُنْكِرُونَهَا وَأَكْثَرُهُمُ الْكَافِرُونَ (83).

سورة النحل

الآيات (81-83)

Dedication

Strange days had passed ... fast like a dream

Behold, I am closer to completing my master studies .. and writing my supplementary thesis

Dedicate it to you ... oh you who fed me with your sympathy ..

My beloved mother may Allah bless you..

I dedicate it to you ... oh you who struggled for my comfort .. and bore my burden, suffered with my pain and the joy of my success ..

My beloved father may Allah bless you..

Dedicate it to you ... oh my path companion and the love of my heart ..

Dear brother Mohammed may Allah grant you what pleases you ..

I dedicate it to you the ornament of my soul, the source of my inspiration, the ideals of life and the source of my strength ..

My precious sisters May Allah bestow happiness upon your hearts and may he guide you .

Dedicate it.. to the apple of my eyes ..

My Nephews... Ali, Osman, Faroug , Mazin and Aya ... May Allah bless you ..

To y'all as we walked this path together and shared the sorrows of the days and the long late nights... **Dear friends** May your love never be deprived by Allah ..

Dedicate it to... those who held the same name and aim ..

My Master batch, the 8th batch .. especially Building Services specialization ..

Dedicate it to the one who handled my worries and provided me with knowledge ..

Dear supervisor, Professor: Dr. Saud Sadig Hassan .

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Abstract

The research is concerned with the applications of sustainable passive cooling in hot- dry climate zones. Its deals with sustainable passive cooling techniques, and how they are applied in private residential buildings.

The research aims to investigate thermal comfort for occupants of residential buildings in hot -dry climate zones, and to get the suit passive cooling techniques to our environment, also it aims to examine ways that reduce energy consumption and rush out in consideration of renewable energy sources (wind, solar energy), to study how to apply these methods in both the design and planning stages of residential buildings in hot- dry climate zones, to activate sustainable passive cooling techniques, and provide ways to improve indoor air quality in all seasons of the year.

The research method is based on a comparison between local models (in Greater Khartoum, area of the study) and global models to arrive at the most important results of the search. In conclusion, the research shed light on the current situation in the area of the study, and concentrating on a local residential model (Architect Osman Elkheir own house).

The research concluded with some results, the most important of which are to promote passive cooling and sustainability applications by using renewable energies in the study area (sun, wind, ..) and reducing the usage of the modern building materials of concrete, which increase the amount of incoming heat to the building, and the development of the use of local building materials in a modern way.

In conclusion, the research has recommendations for the case study and other public of the ability to apply the passive cooling techniques in the case study area such; as taking into account the climatic design requirements in the study area (hot dry climate), develop natural techniques, try to apply other techniques and provide support for its application, application of sustainability concepts in the area of study and make it part of the basic laws either in designing process or planning.

المستخلص

البحث دراسة لتطبيق إستدامة التبريد التلقائي في مناطق المناخ الحار جاف، ويتناول تقنيات التبريد التلقائي المستدام، وكيفية تطبيقها في المباني السكنية خاصة.

يهدف البحث إلى توفير الراحة الحرارية لشاغلي المباني السكنية في مناطق المناخ الحار جاف والحصول على أنواع التبريد التلقائي التي تتناسب مع هذه البيئة، كما يهدف إلى دراسة الطرق التي تقلل من إستهلاك الطاقة والأخذ في الإعتبار مصادر الطاقة المتجددة (رياح، طاقة شمسية..ألخ)، مع دراسة كيفية تطبيق هذه الطرق في كل مراحل التصميم والتخطيط للمباني السكنية في مناطق المناخ الحار جاف وذلك بتفعيل التبريد التلقائي المستدام، وتقديم طرق لتحسين جودة الهواء الداخلي في جميع فصول السنة.

طريقة البحث تعتمد على المقارنة بين النماذج المحلية (في منطقة الدراسة الخرطوم الكبرى) والنماذج العالمية للوصول لأهم النتائج من البحث، وفي الختام سلط البحث الضوء على الوضع الراهن في منطقة الدراسة وركز على النموذج المحلي السكني (منزل المهندس المعماري عثمان الخير).

خلص البحث إلى نتائج أهمها تعزيز التبريد التلقائي المستدام وذلك بالإستفادة من الطاقات المتجددة الموجودة في منطقة الدراسة (الشمس، الرياح، ..) والتقليل من إستخدام مواد البناء الحديثة الخرسانية التي تزيد من كمية الحرارة الداخلة للمبنى، وتطوير إستخدام مواد البناء المحلية بصورة حديثة.

وفي الختام قدمت الباحثة توصيات بالنسبة لحالة الدراسة وأخرى عامة للقدرة على تطبيق تقنيات التبريد التلقائي المستدام في منطقة الدراسة منها : الأخذ بعين الإعتبار متطلبات التصميم المناخية (المناخ الحار الجاف) في منطقة الدراسة (الخرطوم الكبرى)، وتطوير التقنيات الطبيعية ومحاولة تطبيق تقنيات أخرى، وتقديم الدعم لتطبيقها وتطبيق مفاهيم الإستدامة في منطقة الدراسة وجعلها جزءاً من القوانين الأساسية في عمليتي التصميم والتخطيط.

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List of Symbols / Abbreviations

No.	Title
(ALT)	The Altitude.
(AZI)	The Azimuth.
(DBT)	Dry Bulb Temperature.
WBT	Wet Bulb Temperature.
(RH)	Relative Humidity.
ET*(ET star)	New Effective Temperature.
(USGBC)	United States Green Building Council.
(LEED)	Leadership in Energy Environmental Design.
(ASHRI)	American Society of Heating, Refrigerating , and Air Conditioning Engineers.
(IAQ)	Indoor Air Quality.
(Tn)	Neutrality Temperature.
(IRENA)	International Renewable Energy Agency.