INDIVIDUAL APPRECIATION OF AIR CONDITIONED SURROUNINGS

Samuel Hassid
Technion- Israel of Technology
Faculty of Civil and Environmental Eng.
Haifa, Israel
**Corresponding author: cvrhasd@tx.technion.ac.il*

ABSTRACT

This work is based on the RESHYVENT project in which the effectiveness of hybrid (i.e. combined natural and mechanical ventilation) was measured and investigated in the urban canyon of Athens, Greece – the most important conclusion being that natural ventilation is dominant. It is suggested that the individual reaction to Air Conditioned Buildings should be better investigated, since many people ask for the comfort associated with natural ventilation.

KEYWORDS

Air Conditioning, Ventilation Natural and Mechanical

1 INTRODUCTION

Till 20 years ago air condition in Mediterranean Countries – and among them Israel - was the exception and was used almost exclusively in offices and even there only for higher level staff. For most people, the main "passive" cooling method was ventilation – be it during the day, so that even though the temperature may rise, the subjective evaluation of the environment was that it became cooler, or as a result of night cooling. The last method was particularly used in Israel and in dry regions, when the best policy was to close the windows during the day and open them during the night. During this period requests from the Israeli ministry of energy for investigating the energy performance of buildings were turned down because it was thought that the investment was not justified.

Despite with the start of some passive cooling research in which Mediterranean Countries played a leading role (PASCOOL), in the 1990ies Israel, together with all the Mediterranean countries, were characterized by an explosion in Air Conditioning. On one hand, air conditioning entered the residential sector (where it is today the rule rather than the exception, since it means that the air conditioners can be used for heating during the winter, where the COP means that the electrical energy consumption is reduced) and on the other hand, the development (in Israel) of many shopping centers to which the commercial establishments have moved means a multiplication of AC energy consumption and also of top demand during the summer months – which in many cases bring all the reserve energy production capability of Israel to zero in the hottest days of the summer, but also during the Hamsins of the spring and autumn.

2 THE AIR CONDITIONING EXPLOSION OF THE 1990S AND 2000S

Despite the start of some passive cooling research in which Mediterranean Countries played a leading role (PASCOOL), in the 1990ies Israel, together with all the Mediterranean countries, were characterized by an explosion in Air Conditioning. On one hand, air conditioning

entered the residential sector (where it is today the rule rather than the exception, since it means that the air conditioners can be used for heating during the winter, where the COP means that the electrical energy consumption is reduced) and on the other hand, the development (in Israel) of many shopping centers to which the commercial establishments have moved result in a rapid i of AC energy consumption and also of top demand during the summer months – which in many cases bring all the reserve energy production capability of Israel to zero in the hottest days of the summer, but also during the Hamsins days of the spring.

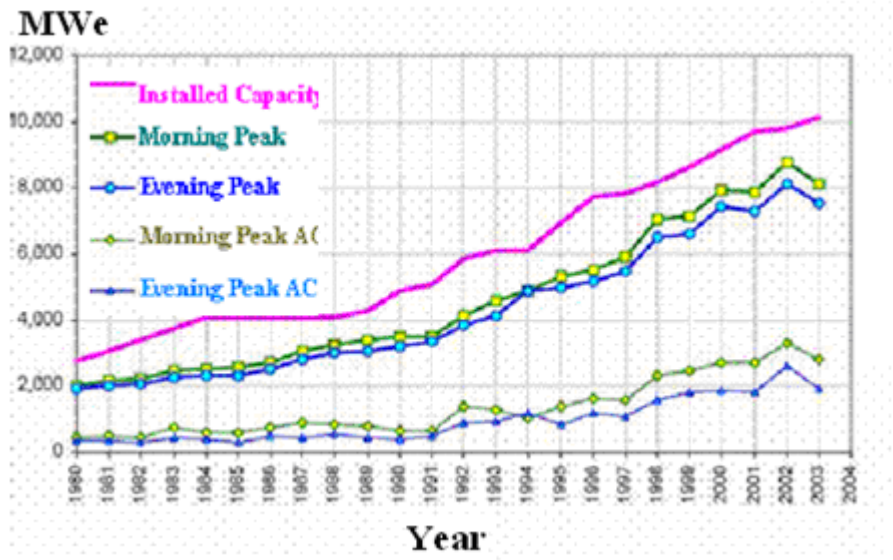

Fig. 1. Peak demand and grid capacity in Israel.

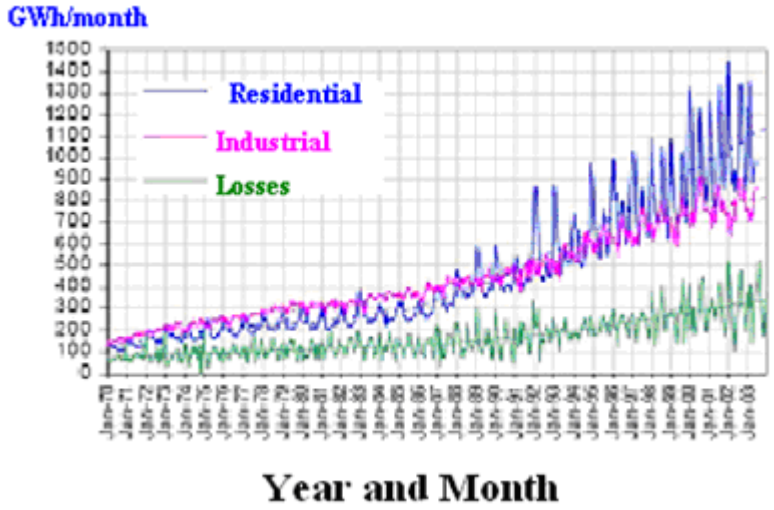

Fig. 2. Monthly electricity consumption in Israel according for different tarifs

The electric grid has difficulties keeping in line just ahead of peak demand, Israel being particularly vulnerable because of the insular nature of its grid. Last summer power stoppages were prevented because that particular summer was very mild – but power stoppages are on the horizon. Building more power plants is opposed by many environmentalist associations.

The increase in peak energy demand and the monthly energy consumption are shown in Figures and 2 on the basis of Ref. 4.

3. INDIVIDUAL REACTION TO AIR CONDITIONING

The psychological acceptance of air conditioning by the public has been mixed. Mediterranean life is based to a large extent on open windows – especially for hot thermal discomfort, but to some extent during winter too. People tend to a large extent to ask for open windows, even if air-conditioning is operated. This often leads to strong arguments between occupants, some of whom want the windows closed and some demand the windows open. The real reason for this attitude is not clear. One could argue that the problem is the internal air quality (IAQ) or the sick building syndrome, but this is not necessarily true – increasing the make-up outside air is not a substitute for open windows. The circulation that can be achieved using internal fans is not either.

In Israel there have been several examples of civil servants in prestigious government buildings designed to serve as an example of energy conservation in both Jerusalem and Haifa leading a “revolt” of sorts by people demanding openable windows – some of them even saying that they will achieve their goal "whatever it takes", the implication being even by force – an attitude totally unsuited for what is perceived as one of the most conservative parts of the population (See Ref. 3). The result was several strikes and work stoppages in both Jerusalem and Haifa. “We became blue out of suffocation” is an exaggerated, but common expression. Senior staff admit that they try to fix meetings outside the building in pursuit of an opportunity to leave the building. Experts express apparently opposing opinions, some putting the blame on the air conditioning system and other expressing a different opinion. It was finally decided to have in some of those buildings at least 20 % openable windows, at an enormous cost – but this was not implemented.

All around the Mediterranean coolness is associated with open windows. The author has often expressed his frustration when he is teaching a course in Climatology of Buildings in his Faculty Building– including a lecture on ventilation – which was supposed to be a Intelligent Building and students keep on opening the windows of an air-conditioned room. On another occasion, during his work in a research institution specializing in energy efficient buildings the very students of energy efficiency including ventilation techniques also kept on opening the windows – the claim being that otherwise the air is "scruffy", perhaps an inexact term, which does however express non-satisfaction with the indoor air quality. The author has also witnessed in a bus a violent clash between two passengers on opening a window when the bus was air-conditioned.

4. THE RESHYVENT PROJECT

The RESHYVENT (Residential Hybrid Ventilation) project is a multi-participant EU-funded project (between the years 2003 and 2005) which focused on Hybrid (combined natural and mechanical) Ventilation for the domestic sector in the residential sector in Urban Environments. The author was involved in the part of the RESHYVENT project that was carried out in Athens, Greece during the summer of 2003 in which the effect of several ventilation strategies were investigated during the Greek summer in the urban canyons in Athens under different climatic conditions. The project involved many measurements of ventilation rate (using the multiple tracer gas method to measure ventilation through the decay of two tracer gasses in the different rooms of the apartments).

In all those experiments it was found that Natural Ventilation is far more often than not a far more effective method of ventilation than mechanical or partly mechanical ventilation. Although this could not be measured – it was found that in rooms naturally ventilated the personal thermal comfort was far better than in the case of mechanical ventilation, even if the doors were open making communication between the rooms free. Even in the case of rather small wind velocities the ventilation rates were rather bigger for natural ventilation in comparison to hybrid and mechanical ventilation.

Although the target of the experimental program was not the calculation of the thermal comfort, but rather the ventilation rate, it was obvious that natural ventilation is not only far more effective but also results in higher velocities, felt through the entire room, rather than in the vicinity of the vents. The exception was in the case of one-sided ventilation during the time of very small outside velocities. The above results were only little affected by the urban canyon phenomena which did not prevent in most cases an effective ventilation.

5. DISCUSSION AND CONCLUSIONS

It can be concluded from the previous sections that the thermal comfort as perceived by many individuals is very much dependent on whether the environment is under natural or artificial ventilation. It is proposed to repeat a program similar to RESHYVENT but focusing on the criteria for thermal comfort during the summer. It would be advisable to include in this study both air conditioned and non-air-conditioned environments and ask for human appreciation of the environment – even if air-conditioning is combined with open windows – in order to address the problems of thermal comfort under summer conditions without preconceived ideas.

6. REFERENCES

1. Niachou K. (2007). *A study of natural and hybrid ventilation in the urban environment – Experimental and Theoretical Study in Urban Canyons*. PhD Thesis, Athens University, Physics Department – Environment and Meteorology Sector.

2. Niachou K., Hassid S. , Santamouris M. and Livada I. (2008). Experimental Performance Investigation of Natural, Mechanical and Hybrid Ventilation in the Urban Environment. *Building and Environment, 43*, 1373-1382.

3. http://hagada.org.il/hagada/html/modules.php?name=News&file=article&sid=4918 (On the reaction of civil servants on the air quality in some air-conditioned buildings in Israel)

4. http://www.neaman.org.il/publications/publication_item.asp?fid=590&parent_fid=490&iid=2587 (on the Development of Air Conditioning in Israel)

5. http://www.aivc.org/medias/pdf/LitList%2033_Reshyvent.pdf (on RESHYVENT)