Academic year 2011 - 2012 #1 | December

MOLLIER

Study Association
Building Physics and Systems

INSIDE INFORMATION

MOLLIER | UNIT BPS | STUDENTS | ACTIVITIES | MEMBERS

The 16th Board of s.v.b.p.s. Mollier

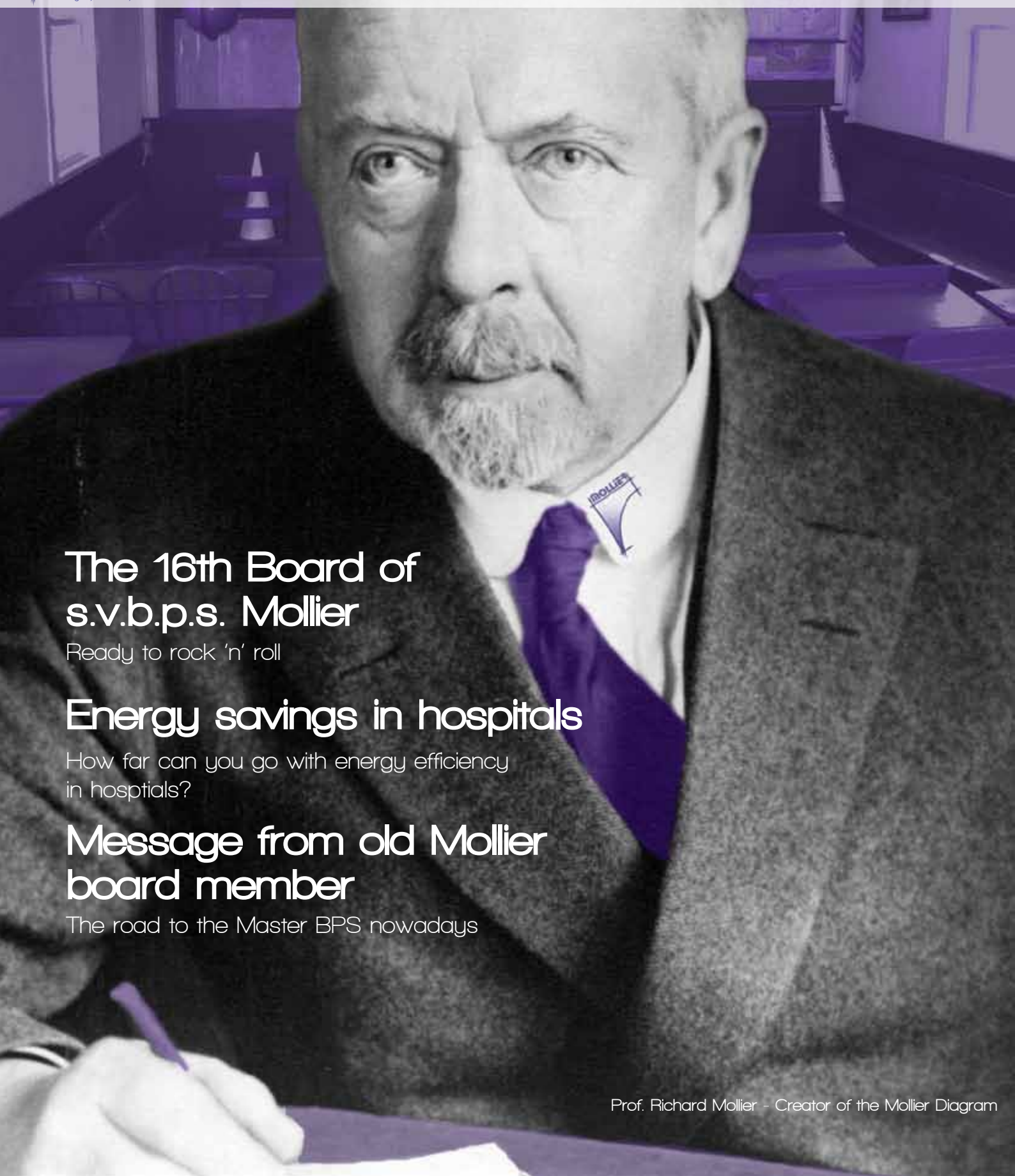
Ready to rock 'n' roll

Energy savings in hospitals

How far can you go with energy efficiency in hosptials?

Message from old Mollier board member

The road to the Master BPS nowadays



Prof. Richard Mollier - Creator of the Mollier Diagram

Editor's note

Dear reader,

The academic year has already started a few months ago and the first exam results have been received. With the projects coming to an end, most students are having a very busy period. I hope everybody will enjoy the holidays celebrating Christmas and of course New Year's Eve. With the second exam period coming in January I hope everybody is able to prepare for the best and passes the exams with good grades.

I proudly present you the new improved 23th edition of the INSide Information. In the previous year a new lay-out has already been presented given the fusion of Mollier and Flux. However, an INSide committee was formed this year to create a more modern magazine. This is the first year that a devoted commission assists and helps to perform editing tasks. The commission has started to improve the INSide Information on all fronts.

In this edition you'll find the usual academic articles of students, professors and companies. This gives students the opportunity to get familiar with the companies sponsoring the association. On the other hand, the companies get an insight in research performed on the TU/e by our members. Furthermore, this edition offers an introduction of the 16th board of s.v.b.p.s. Mollier, a summary of the end and start activity and much more.

In addition to the topics mentioned above also a summary of the study trip from the MSUCE students ofMoscow to the Netherlands is published, an article regarding the 'Langstudeerregeling', statistics of Mollier, an introduction of a PhD student and the benefits of fulfilling a board function

Finally, on behalf of the entire board of Mollier we wish you a pleasant reading of this edition and of course a happy and prosperous 2012!

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EDITOR

Rik Maaijen

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COLOPHON

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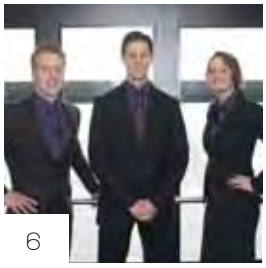
This INSide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Rik Maaijen, Tom Thomassen & Ellen Boesten

New board of Mollier

Tom Thomassen President & Education Commissioner

After presenting myself in the last edition of the INSide Information two years ago as a new member and in the first edition of last year as treasurer of Mollier, this year I have the honor to present myself as the President of the association. My name is Tom Thomassen I was born on 20-07-1985 in a little village called Elsloo (L). At this moment I have been living for more than a year in Eindhoven.

Last year was a year of uniting Flux and Mollier into the Study Association Building Physics and Systems Mollier. Accomplishing the fusion of two associations was not the only thing we had to do. Our faculty came up with an unpleasant surprise, all the associations on floor five of the Vertigo building had to move to one corner on this floor. After moving we experienced an uncomfortable pressure between the board and its members. All the study associations boards on floor five expierenced this strange perception not being directly connected with former and ofcourse new members.

At the beginning of the academic year news of the education Building Services (BS) and Master track Physics of the Built Environment (PBE) reached the association. This academic year the programs will be united into two Master tracks of the faculty of the Built Environment, BS and BP. In the next edition of the INSide Information more information concerning the master program will be provided.

Besides my function as President I will fulfill the function of Education Commissioner. As Education Commissioner, I will make myself useful promoting our educational program and giving input of the students in the board meetings of our unit and Education Committee meetings. Students can always contact me for questions and remarks regarding courses and the educational program.

Another struggle was to find a new board for this year. Rik Maaijen is the new additional board member, whom I got to know in my graduation internship at KVMC and the study Building Services, hence he is not a stranger.

As the new board we have committed ourselves to improve several areas. Together with Ellen Boesten, as treasurer, and Rik Maaijen, as secretary, we want to tighten the link between sponsors and members.This way we want students to get acquainted with future employers and industries. The board will try to achieve this necessary and challenging goal by organising a year full of educational activities.

Rik Maaijen
Secretary and Vice-President

Of this 16th board I'm the only person who has not been introduced previously. Luckily I have the possibility to do this here briefly. My name is Rik Maaijen, born on the 23th of September 1987 in a small town in Utrecht called Oudewater. I lived happily for many years in this historic town surrounded by pastures, cows and sheep. After graduating from highschool I went to the Hogeschool Utrecht for the course 'Algemene Operationele Techniek'. After 3,5 years, I successfully completed this study and had the honor to call myself Bachelor of Engineering. However, I still felt eager to learn and certainly had the feeling that I could do better. I noticed my interest in buildings and technique so logically I started with Building Services at the TU/e.

After travelling between the Eindhoven and Utrecht for a while I found myself a wonderful student room in Eindhoven. Meanwhile I have been studying at the TU/e for more than two years. The study also provides sufficient depth and scope widening. In addition to the regular curriculum I have obtained the technical management certificate which I find a valuable contribution to any technical training. Currently I am graduating in cooperation with Royal Haskoning.

Fortunately, my life is not just school and work. In my spare time I like to spend as much time as possible on sports such as volleyball, tennis, running and now I can even call myself a member of the Mollier indoor soccer team. I'm a big fan of music. That's why I sometimes sit behind the piano to improvise. Maybe you can call it a runaway hobby, but next to my course I'm busy with the rental of disco equipment. Now and then I also get behind the controls as a DJ doing my best to get everyone moving on the dance floor.

During my study I acquired the necessary experience in organising by participating in various committees of Mollier. The next step was to become a secretary. I will largely be concerned with the issue of this magazine, the INSide Information, and want to improve the links between industry and students. My experience is that the cooperation with the other board members is good, so I'm convinced that we will make a successful year of it!

"Mollier version 16.0 is born with a mission which hopefully inspires future boards."

Ellen Boesten
Treasurer & commissioner external relations

My name is Ellen Boesten, 24 years old and living already two years in Eindhoven as a student Building Physics. My history has already been explained twice in the INSide Information, therefore I will illustrate the progress and state of events relating to Mollier's performance, up to now.

In the previous (academic) year, I carried out the functions of secretary, commissioner extern relations and editor in chief. This year I switched to treasurer, however as the former secretary I will assist this year's secretary.

To come back to the topic "changes in the last year" I would like to add that changes are not always negative. Last year's drama was namely also stimulating, resulting in a critical evaluation of almost every board function, committee and activities to achieve a more efficient functional working organization.

The number of committees and committee members organizing activities have never been this high. This could be related to the excessive promotion of creating more committees. Board functions have become more appealing, since the support of the (especially new) members has been increasing drastically. This support leads also to bonding between first years and graduates master students. This has not only been achieved by participating in activities, however working together realizing the same goal is most effective in bonding.

In short, Mollier version 16.0 is born with a mission which hopefully inspires future boards.

MOLLIER
Study Association
Building Physics and Systems

Constitution event Mollier

Written by: Bob Helwig, Marije Dorman and Nanda Latten

Last Thursday the 24th of November was the momentous occasion of the inauguration of the 16th board of Mollier.

During the General Members Meeting one member of the old board was replaced, Rik Maaijen will strengthen the board, while Ellen Boesten and Tom Thomassen will continue their duties fulfilling their new functions as treasurer and president. This enjoyable news was, of course, accompanied by much applause, and the Mollier Anthem. The meeting also discussed several interesting and important subjects, such as, the evaluation of last year, and the new plans for this year.

After the meeting the party swiftly moved to the Brazilian Restaurant Carioca in the center of Eindhoven. Here many members, alumni and family members were waiting to join with the newly appointed board to have a nice dinner. Instead of the traditional constitution drink(s), the board had decided to combine the constitution feast with a much enjoyed dinner.

The evening continued with many congratulations, (im)practical gifts and some sound advice to the board, all the whilst, enjoying a varying amount of singing skills. To encourage vocal highlights a newfound tradition was implemented, with the introduction of the "Mollier Liederenbundel (songbook)". This resulted in many spontaneous and enthusiastic ballads of sometimes questionable quality of different members.

Due to the presence of both alumni and new members, the friendly atmosphere triggered interesting discussions between all parties. It can be said that integration on the highest level was achieved. Several drinks and spare-ribs later the party continued at Stratum were the evening was brought to an indescribable end.

Hoe lang steken we onze kop nog in het zand?

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Renovatie volgens Loes

“Met al die leegstaande kantoorpanden is het eigenlijk onbegrijpelijk dat er nog nieuwe worden gebouwd,” vindt Loes. “Dat is duurder dan een gebruikt gebouw duurzaam te renoveren.” Loes bewijst dat het anders kan. Met haar team boog zij zich over een van de eerste kantoortuinen van Nederland, het karakteristieke hoofdkantoor van DHV zelf. Door met een integraal team een uitgekiend pakket van verbetermaatregelen toe te passen is het gebouw weer toekomstgericht gemaakt: comfortabel en energiezuinig, met hergebruik van duurzame materialen. Bij de renovatie wordt het energielabel verhoogd van G naar A.

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Rural Spark

Spark villagers to grow future networks

CONTEXT

In the Building Services graduation project of E. Mertens (2011) and the follow up Industrial Design graduation project of M.M.G. van Heist (2011) it was shown that there is a large potential for enabling villagers to share energy, and thereby grow their own distributed energy network in India. Moreover, research by H.A. van Heist (2011) supports the potential success in poverty alleviation through a sustainable (economically, socially and environmentally) business initiative. All findings and experiences encourage us to continue the action-based bottom-up approach to empower local entrepreneurs in creating home-grown energy and information networks in rural India.

BACKGROUND

In India, most developments are taking place in urban areas. Unequal divided growth in combination with a large rate of urbanization is driving the increase of a gap between urban and rural living conditions. The energy situation for rural Indians has only slowly changed in the last decades. Many villagers still lack access to electricity, and the use of inefficient firewood stoves are still a source for many problems.

Programs have been performed which aimed at improving the living conditions and energy situation of villagers.

> "The prospects are that electricity demand per rural Indian will multiply by 5 before 2030"

However, for decades these programs have failed to make a significant improvement. Despite the fact that technological energy solutions exist, most households choose the traditional options. The Indian government is mainly focussed on a top-down approach of distributing energy. By extending and subsidizing the centralized electricity and Liquefied Petroleum Gas (LPG) network, villagers are 'forced' to use unsustainable sources of energy. Moreover, this central supply is unable to keep up with the demand and suffers from corruption.

Figure 1: Rural Indian home, 2010

Evan Mertens MSc [Technical Innovator]

Graduated on "a Bottom-up Energy and Information Network Concept for Rural Indian Households"
Degree in Building Services at TU Eindhoven
Department of Building, Physics and Systems

Marcel van Heist MSc [Design Integrator]

Graduated on "Enabling simple energy sharing in the field through the design of tangible tools"
Degree in Industrial Design at TU Eindhoven
Department of Industrial Design

Harmen van Heist MSc [Strategic Developer]

Graduated on "Homegrown Development at the Base of the Pyramid"
Degree in Organization Studies at Tilburg University
Department of Social and behavioral Sciences

TRENDS

Despite the lacking energy infrastructure, the prospects are that electricity demand per rural Indian will multiply by 5 before 2030 (IEA, 2007). Moreover, the number of mobile subscriptions in rural areas is prospected to keep growing fast. The unsustainable top down supply of LPG, kerosene and electricity by the government is unable to keep up with the demand. Consequently, in rural Indian areas there is a large potential for improvements of the living conditions and for the creation of a more sustainable energy infrastructure.

> "In contrast to many existing schemes, Rural Spark focusses on the total network instead of the different parts"

VISION

In contrast to the structured top-down approach of the government, Rural Spark focusses on a more organic bottom-up approach for energy distribution. By the use of specially designed tools, the villagers are able to share information and energy and lower their threshold for access to (sustainable) energy sources. As a result, existing sustainable standalone energy generators can become part of this network and thereby possibly become profitable.

APPROACH

Instead of confronting rural villagers with difficult plans unable to grasp and far away from their daily life, Rural Sparks designs tangible tools together with the users, allowing them to unleash entrepreneurship. It is very difficult to gain insight in the Indian people and their way of interaction. Therefore, to get results, a method where we move the design studio into the context is required. We aim to transform our research and technological insights into concrete tools which stimulate the local people and local stakeholders in India to design the actual energy and information network. These tools to meet the vision should be designed from within the culture.

Figure 2: Kerosene Lamp, 2010

Figure 3: Father explaining a rented lamp to his son, 2010

Rural Spark accepts the local people and stakeholders and allows them to design the energy network with all the systems and schemes involved in it. The vision, based on technological improvements and our search towards a more sustainable energy future, will be translated into their language to spark local entrepreneurship and creativity. Many systems and products have been designed to

bring electricity in villages in India, however still today, firewood and kerosene are the primary energy sources. As Easterly (2006) puts it, we should find out what is in demand instead of determine what to supply.

UNIQUE POWER OF RURAL SPARK

The strength of Rural Spark lays in the strong link between innovation and direct implementation together with the users. By designing in context, the feedback loop is very short. Every action performed by the designer is reacted upon by the culture and the local people. This results in a large amount of feedback contributing to direct new actions. To go beyond theoretical models into practical results, which are scalable and successful, every new concept (the need to share information, maintenance schemes, etcetera) is applied and optimized with the user to find the most promising solution.

In contrast to many existing schemes, Rural Spark focusses on the total network instead of the different parts. As a result, tools for all kind of appliances and from different companies can all be used as long as they fit the network.

> "The network has to be flexible to adapt to changes and innovations, and thereby it should withstand drawbacks"

Figure 4: Family using a rented solar-charged LED lamp, 2011

5 YEAR GOALS

Within 5 years, Rural Spark aims to establish a growing network in rural Indian areas in which at first information and electricity is shared. Similar to energy and information, the support and maintenance has to be distributed among multiple entrepreneurs as well. Consequently, the network has to be flexible to adapt to changes and innovations, and thereby it should withstand drawbacks. After realizing a strong network in practice, the network can continue to grow autonomously and improve the living conditions of many.

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Figure 5: Simplistic representation of the sharing of energy and information

Project Manager

By
Anne Berkers

Khaled has found his new challenge at "Deerns Raadgevende Ingenieurs", an engineering consultancy firm, KP&T offered him this opportunity. In this firm he has the role of Project Manager, responsible for various projects, e.g. managing a data center and cleanroom in Moscow. In his previous job he worked on the expansion of the head office of Rabobank in Utrecht.

After having finished his degree in Electrical Engineering at the Tripoli University in Libya in 1989, Khaled came to the Netherlands in 1991 to continue studying. He completed a Masters degree in "Hydraulica Engineering" (Hydraulics) at the Technical University of Delft. With these two degrees in his pocket he made his next step: looking for a job.

Khaled: "During my career I've had several employers with whom i fulfilled several functions. This gave me the opportunity to gain experience in different facets. For example: I've worked at Brow & Root Overseas Ltd. in England as a Mechanical Engineer, at ULC Groep in Utrecht as a Planning Engineer and at Valstar Simonis Raadgevende Ingenieurs as a Project Manager."

KP&T

Last spring, after a working experience of approximately 20 years, Khaled decided that it was time for a new challenge. A colleague mentioned KP&T and he decided to contact them.

Khaled: "What I've read on www.kpt.nl, appealed to me. My colleague gave the contact details of Tom Zentjens, Senior Advisor Installation Technology at KP&T in Weert. I called Tom and we agreed that he would inform me about the possibilities and interesting vacancies. Each selection of vacancies Tom sent me, matched my interests."

From the moment the vacancy of Project Manger Testing and Commissioning at Deerns came along, everything went quickly. On Monday Tom called Khaled for the vacancy. On Tuesday Khaled was invited for the first interview and only a few weeks later Khaled started in his new job as a Project Manager Testing and Commissioning at Deerns

Khaled: "KP&T is first of all a company that knows it's business. What started as a "matching mission" ended in a perfect job.

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EXPANSION OF RABOBANK'S HEAD OFFICE

At his previous job, Khaled worked on the expansion of Rabobank's head office in Utrecht. They realized an expansion of approximately 56,000 m BVO. This expansion took place through a high-rise of 50.000 m and a central Plaza of approximately 6,000 m at the Croeselaan in Utrecht. They also equipped an underground, so called "split level", parking lot with a surface of approximately 15,000 m. The basic assumptions for the hole complex are a modern office complex and a very high ambition for sustainable construction. This project will be part of the new control centre of Rabobank Utrecht. The tower is located near Utrecht Central Station and 'Jaarbeurs' convention centre, at the front of the already existing office building of Rabobank Nederland. The design consists of two towers, slightly turned towards each other and attached by intermediate floors. De tower consists of twenty-seven floors and is 105 meters high. The basic assumption was to create both an architectural and installation technical design that is as modular and flexible as possible, in order to be able to easily redesign the functions of divers spaces and cubicles. The technical installations are executed in a way that an expansion of 15% of the total staff is achievable in the future. Khaled: "I was able to take part in the realization of this special office tower. In the beginning as an Assistant Project Manager (2006), later on I got promoted to Project Manager."

In March 2007 the construction work for the Tower, Plaza and parking lot started. In April 2010 the parking lot was partly in use. At this moment the completion of the Tower and the Plaza is still ongoing. Khaled: " With the new building, Rabobank Nederland and Utrecht city have gained a distinct building. It's an important contribution to the skyline of Utrecht."

MOST SUSTAINABLE OFFICE COMPLEX IN THE NETHERLANDS.

Khaled:" An important spear-point in the design was sustainability. The transparent frontage made a big contribution. Because of maximum entry of light, less energy is needed. And besides that, the building is equipped with optimal isolation, climate ceilings, the use of green electricity, city heating and WKO underground."

Based on the policy objectives for this project, formulated by Rabobank Nederland, the Rabobank has spoken about Sustainable Accommodation. The ambition level is way above the legal minimum requirements. The ambition level is based on the 'National Package of Sustainable Buildings in Utility / New Buildings'. With regards to the energy use, the Energy Performance Coefficient required was lower than the legal requirement based on NEN2916: "Energy performance of utility buildings and new buildings". This led to Rabobank having the most sustainable office complex in the Netherlands.

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Statistics of Mollier

To give an insight in the statistics of Mollier, the 3 displayed figures are specially made for this occasion.

Written by: Ellen Boesten (BP)

Figure 1: Distribution of students Building Services and Building Physics

These data are based on the total amount of members of the study association.

To start with, figure 1 is illustrating the distribution between the two studies. 52% of the Mollier members studies Building Service (BS) and 48% studies Building Physics (BP). The difference is not significantly large.

Figure 2 shows the ratio women to men. The total amount of women currently is 24% compared to 76% men. Most of the women study BP. Analyzing the numbers of students studying BS, 16% are women and 84% men. The amount of female members who study BP is 34%, which is more than double. These numbers are not in the figure.

Finally, figure 3 illustrates which academic background our members have.

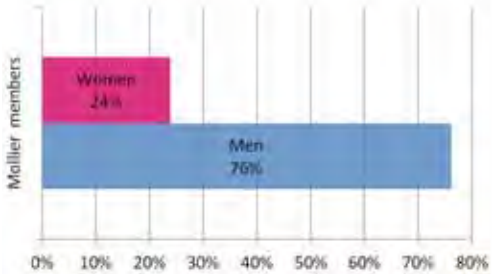

Figure 2: Ratio women to men

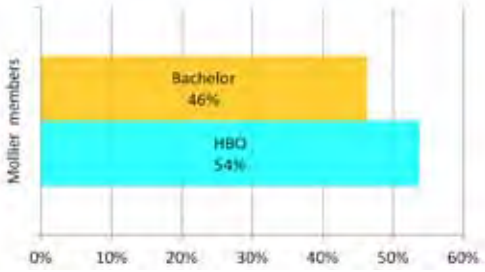

Figure 3: Academic background of students

Just to keep you focussed...

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less easily

End Activity

At the end of the academic year 2010-2011 again a legendary Mollier end-activity was planned. Organized by a group of fresh study association members, a weekend full of activities was arranged. For brotherly closing a successful study year and preparing ourselves for the productivity change called 'summer vacation'.

By Senna Chraibi

Department of Built Environment, Eindhoven University of Technology

With a group of 15 students, the Belgian Ardennen were visited for a weekend of sportive and cultural activities all in theme of bonding and brothering. A luxurious cottage, owned by a crippled but friendly old dwarf, seven dogs, five cats and a few chickens, was arranged for the whole weekend, only a stone's throw away from the picturesque village Beffe.

Divided over a few cars the tour through Limburg could begin. Through small villages and non paved roads we started our survival weekend in cars loaded with too many people, too little air conditioning options and lots of bread, meat and beverages of all kinds.

After the wearisome journey the evening was started with a satisfying barbecue with even more satisfying cold drinks. To encourage the team spirit, after dinner the first games of ping-pong and an always sensational game of hide and seek were played. Unfortunately the game had to be ended because of an injury. Thankfully there were still some frozen hamburgers to treat the patient's injuries.

Later that night another appeal was done on team spirit. The organization had prepared a quiz we had to play in two groups. Hereby knowledge, creativity, persistence and dedication were tested in the struggle for a beer barrel. The quiz resulted in some memorable moments; What to think of the lady gaga dance moves of team A and the legendary practical joke of Arjan, about the crying horse (you should have been there).

The second day of the weekend, some sportive activities were planned. Everyone started fairly optimistic with the mountain bike tour, consisting of a combination of the green, yellow, red and blue route. Unfortunately, after cycling our butts off for more than 3.5 hours, we were totally out of food supply and the end was still not in sight. This resulted in Mollier cyclists

begging for some water from the Belgian locals. Crying and starving the finish line was finally reached where fresh sandwiches where waiting for us.

The risk of canoeing was too high, due to an inflatable crocodile plague in the local river. Therefore, the second activity was suggested to be a climbing track. The tiring but satisfying afternoon was concluded by a culinary masterpiece prepared by the organization; liquid spaghetti in a tomato sauce with soup vegetables.

Before the journey back home took off, we stopped at an abbey were we had a tour through the brewery given by another gentle dwarf. The friendly little man told us about all the ins and outs of brewing Belgian beer. By tasting the Belgian beers on the terrace, the end activity came to an end. Which was also a perfect moment for a final toast for a successful members weekend, without too many victims.

Coupled Thermal Solar Collector & Heat Pump Simulation for Improved System Performance

A comparative study of parallel & serial solar collector & heat pump systems for the Czech Republic

In recent years, the design requirements for the primary energy consumption of dwellings have been radically reduced, making it difficult, if not impossible, to meet the required levels using only a combination of construction measures and fossil fuel-based heating systems. This has set in motion a transition to alternative energy systems within domestic construction. Heat pump systems and solar collector systems in particular form an often-used alternative to provide heating and hot water in dwellings as they reduce the use of fossil energy sources. Both, however, have downsides when it comes to energy generation for heating. Solar collectors tend to provide high temperatures, but the availability of solar energy is intermittent and the amount of solar energy available is at its lowest when the heat loads are highest. Heat pumps are able to provide a stable supply of energy throughout the year and provide higher efficiencies at lower temperatures, making them very useful for floor heating and other low-temperature heating systems. However, the production of domestic hot water (DHW) requires higher temperatures, causing the efficiency of the heat pump to drop [1].

This research consists of a comparative simulation of three heat pump systems supplying space heating and DHW for a reference building in Prague, Czech Republic. The first model consists of a ground-source heat pump (GSHP), while the second model adds a solar collector in parallel operation with the former system [2]. In the third system, the solar collector operates in series with the GSHP. The hypothesis is that a parallel system is not energetically efficient, whereas a serial is, despite having to provide DHW without the assistance of a solar collector. This is determined through the construction of simulation models of the aforementioned systems and comparing them through performance indicators.

SYSTEM DESCRIPTION

The reference building is a townhouse with a low-temperature heating system with a supply and return temperature of 42°C and 34°C [3] respectively, covering the maximum heat loss of 3.14 kW at a design temperature of 20°C. For the purposes of this simulation, the influence of solar irradiation on the heat load of the building is omitted for simplicity.

Based on average daily water consumption and household size a profile is used to simulate DHW consumption throughout the year. Using the IEA-SHC Task 26 Realistic Domestic Hot-Water Profile for 100 l/day simulates the uncertainties in DHW draw-off [4]. Due to limitations in the capacity of heat pumps to produce high temperatures, the buffer is kept at 55°C while an auxiliary heater is placed in the buffer to top-off the outlet temperature to 60°C.

System I is a GSHP system as it is applied in today's construction projects. As the system is applied to a dwelling, no cooling is used due to the already higher investment compared to a conventional new home, where the use of ventilation heat recovery is the standard. In System II, a thermal solar collector is used next to the GSHP, working independently of each other. Both supply energy for space heating (SH) and DHW. System III uses the thermal solar collector to increase the inlet temperature for the GSHP directly. The vertical ground heat exchanger (V-GHX) is regenerated through higher return temperature from the GSHP and directly by using collector gains when the heat pump is not in operation.

SYSTEM I

A heat pump with a V-GHX is used to supply energy to the building using two buffers for the high and low temperature (SH) water (Figure 1). During the summer months only the high temperature (DHW) buffer is generated. The rest of the year, in case of simultaneous energy requirement, the regeneration of the DHW buffer takes precedence over the SH buffer. Two auxiliary heaters are used; one to sustain the required temperature in the DHW buffer, the other to cover the peak loads in the space heating system.

SYSTEM II

System I is expanded by addition of a thermal solar collector in parallel operation with the heat pump (Figure 2). Two collector panels are attached on the south facing roof of the reference building. The collector model is based on performance data of a solar collector from the SRCC database [5]. This circuit is connected to the same buffers as the heat pump system. The operation of the parallel systems can be simultaneous for either buffer as there is no intercommunication between the systems.

SYSTEM III

The heat pump circuit to the space heating and DHW buffers, as well as the circuits on the demand side, are as described in System I. The circuit between the heat pump and the V-GHX is adapted to include the solar collector (Figure 3). During heat pump operation with insufficient collector gains the brine exiting the V-GHX bypasses the solar collector and directly enters the heat pump. In the case of sufficient collector gains, the brine flow is diverted to the solar collector before entering the pump to increase the inlet temperature of the flow and reduce the work required by the heat pump. Any residual temperature increase is used to regenerate the V-GHX. If the heat pump is not active, the circuit operates based on the availability of sufficient collector gains. The heat pump is then bypassed and the collector gains are directly used to regenerate the V-GHX.

B.P. (Peter) van Mierlo, MSc

Supervised by:
Prof.dr.ir. J.L.M. Hensen (TU/e)
Doc. Ing. T Matuška, PhD (CVUT)
ir. G. Boxem (TU/e)

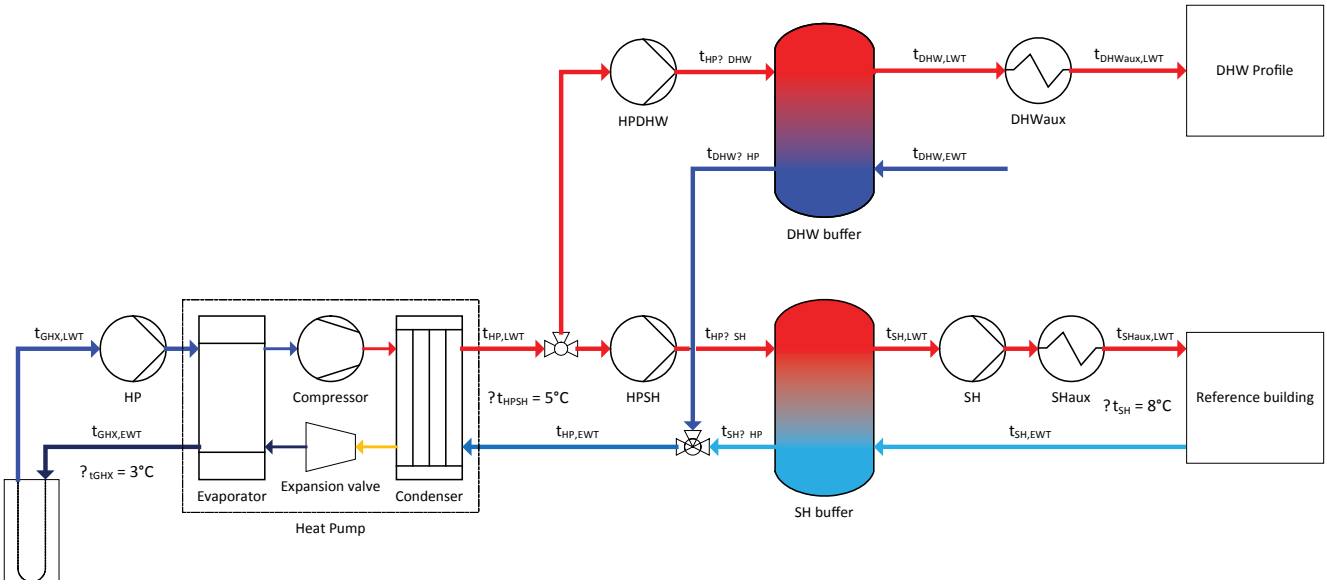

Figure 1: System I, Reference system

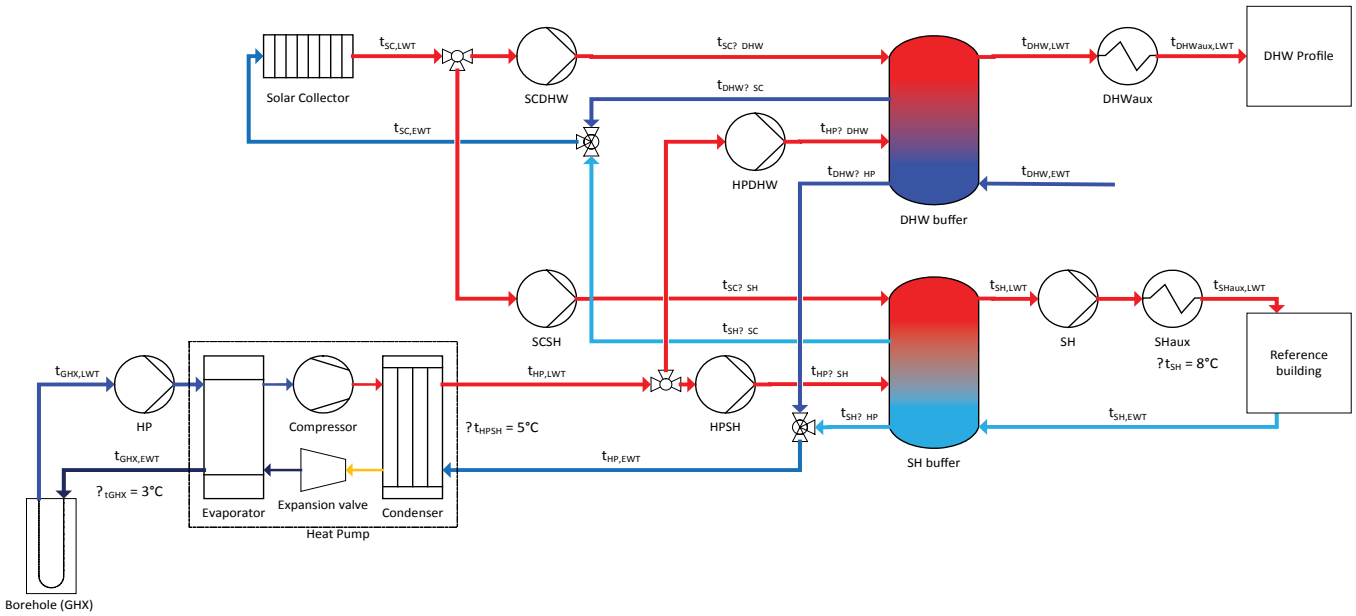

Figure 2: System II, operating in parallel with a thermal solar collector

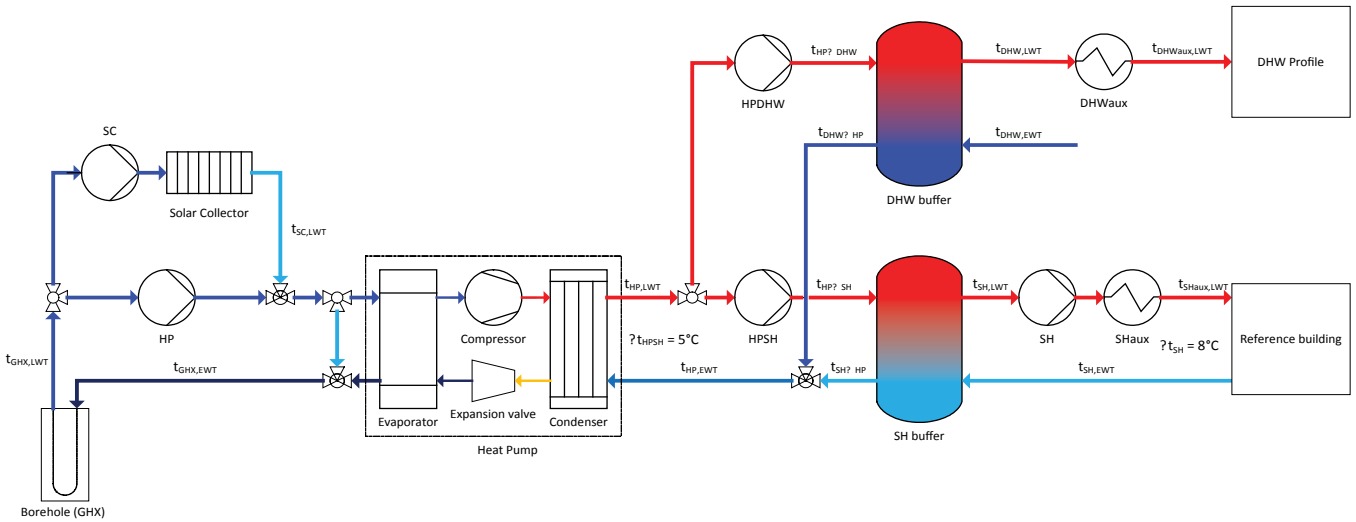

Figure 3: System III, operating in series with a thermal solar collector

RESULTS

Simulations of the three systems were conducted for a period of three years, with time steps of 6 minutes. The results from the third year of simulation were used [6] to compare the performance of the systems, so to remove any run-up effects. The systems are assessed in three ways. Firstly, the COP provides insight on the performance of the heat pump used. Secondly, the season performance factor is used to assess the performance of the system as a whole. Lastly, the efficiency ratio determines the energetic efficiency of the different systems.

COEFFICIENT OF PERFORMANCE

The COP is calculated from the monthly energy sums of electrical energy and energy extracted from the vertical ground heat exchanger. This provides an overview of the annual performance of the heat pump, as shown in Figure 4. We can see that for all systems, the COP drops significantly in the summer (June-September), during which energy is only supplied to the DHW buffer, requiring higher average temperatures and therefore lowering the COP. System II has the lowest COP of the compared systems on an annual basis. This is due to the simultaneous operation of the solar collector and heat pump, resulting in higher entering water temperatures to the heat pump on the load side if both circuits are operational. Since the heat pump is controlled independently from the solar collector, it will supply energy to the buffer even when the collector gains are sufficient for regeneration of the buffer. This effect is therefore most pronounced during the summer, when collector gains and temperatures increase.

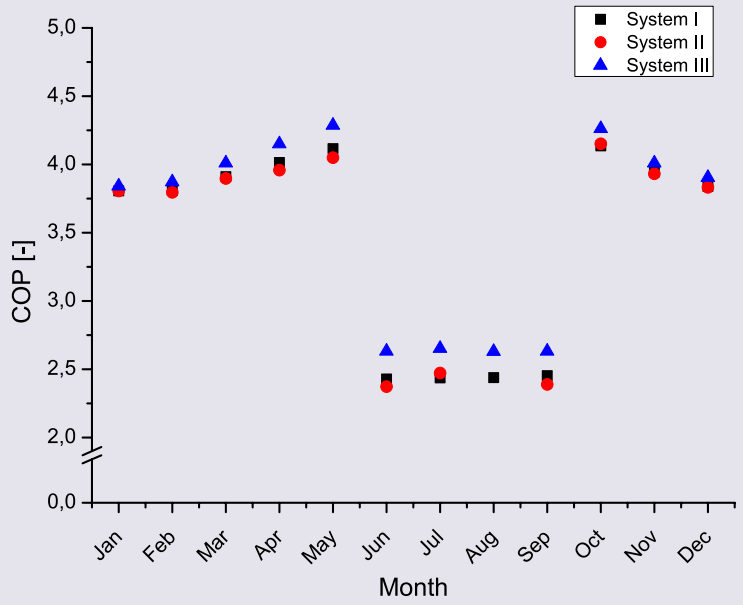

Figure 4: Monthly Coefficient Of Performance of the heat pumps

The COP of System III is increased compared to that of System I. As

collector gains increase in the summer, the inlet temperature of the heat pump on the source side is increased, requiring less electrical energy to produce the required temperatures on the load side. As operational time decreases during the summer and collector gains increases, the improvement in COP grows. The average increase in COP for System III is 3.8%, whereas the increase for System II is 1.9% on average.

SEASONAL PERFORMANCE FACTOR

The seasonal performance factor is defined in various ways by different institutions [7]. For the purposes of this project, the SPF is defined as the ratio between the sum of the energy used per interval and the electrical power supplied to the system:

The SPF is plotted for each month in Figure 5. For System I, the SPF drops in the summer months as the regeneration of the space heating buffer is stopped and the heat pump only supplies the DHW buffer with energy. As the frequency of the DHW draw-off is small, the losses from the buffer become significant, resulting in a SPF of around 1.

The SPF for System II increases in the summer months where increased availability of solar irradiation and decreased energy use. The collector gains are able to cover the bulk of the load, requiring only electric energy for the circuit pumps to deliver a relatively large amount of energy. The SPF during the heating season is only slightly increased from that of System I.

For System III, the SPF is only increased from that of System I due to the higher inlet temperatures of the heat pump on the source side. This improves the SPF for space heating, but virtually does not change the SPF for the supply of DHW. Compared to System I, the annual SPF for System II is increased by 87%. For System III this increase is only 4%. As the solar collector operates in series with the heat pump, electrical energy to the heat pump is always required to supply energy to the buffers, contrary to System II where the solar collector can supply energy to the buffers directly. This explains the difference in SPF increase between the systems.

EFFICIENCY RATIO

To incorporate the collector gains and the energy used for regeneration of the soil and compare the systems, an energy efficiency ratio is used. For this project it is defined as:

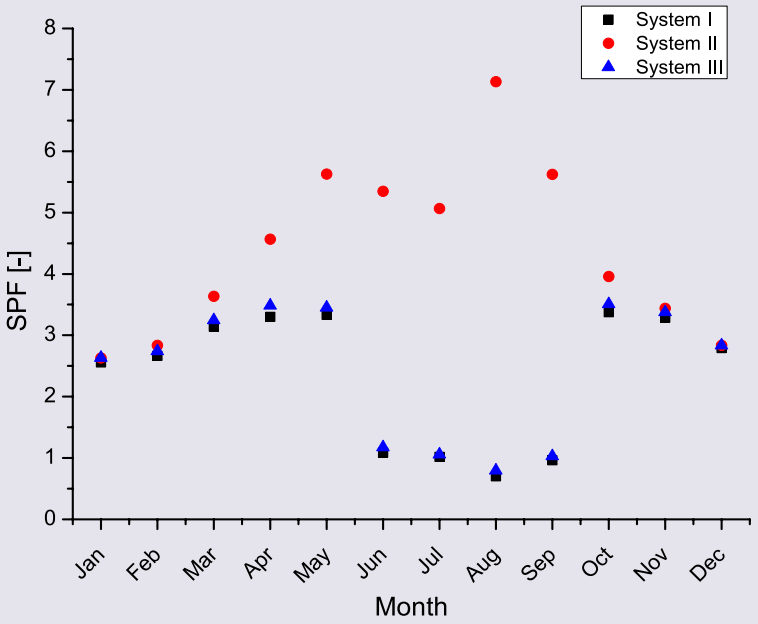

Figure 5: Seasonal performance factors of the heat pump systems

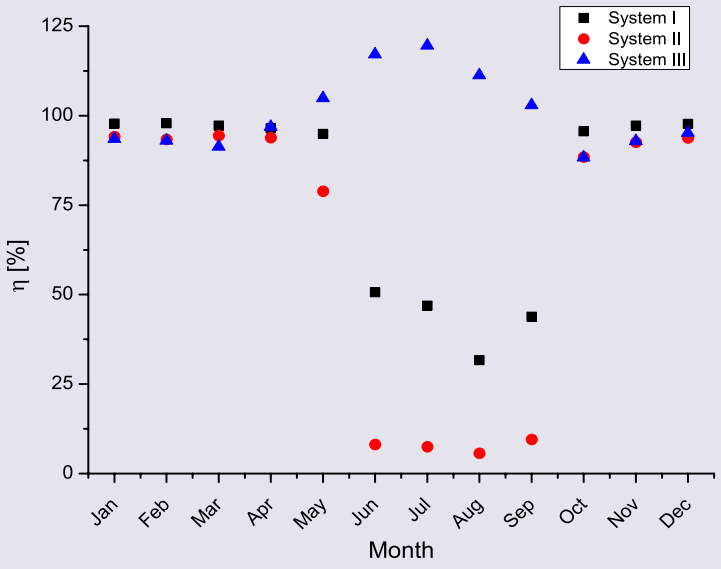

Figure 6: Energy efficiency ratio of the systems

Performance indicator	System I	System II	System III
COP [-]	3.44	3.51 (102%)	3.57 (104%)
SPF [-]	2.35	4.39 (187%)	2.44 (104%)
η_{eff} [-]	0.79	0.63 (80%)	1.01 (127%)

Table 1: Overview of performance indicators

$$\eta_{eff} = \frac{Q_{SC} + Q_{HX} + Q_{DHW}}{Q_{GHX} + Q_{elec} + Q_{aux} + Q_{solar}}$$

Formula 1: Efficiency ratio

For System I, both the solar irradiation and the collector gains are irrelevant. The ratio between energy used and energy supplied is only influenced by the losses from the energy buffers. For the space heating buffer, the draw-off is more frequent than for the DHW buffer, therefore reducing the percentage of energy being lost. During summer, the space heating buffer is not regenerated, which increases the percentile loss from the buffers (Figure 6).

The energy efficiency ratio of System II is influenced by the amount of collector gains used in comparison to the available solar irradiation. Due to inlet temperatures for the solar collector being often higher than the ambient temperature, the solar irradiation level has to be high enough to compensate for the convective losses due to the temperature difference between fluid and ambient air. During the winter this influence is small when the solar irradiation levels are lower. In summer when the ratio drops, when solar irradiation levels are higher and energy demand is at its lowest.

System III's energy efficiency ratio increases in summer, as collector gains are used for regeneration, during which time the system makes more use of the available solar irradiation. Due to lower entering temperatures to the collector, the difference between ambient temperature and collector temperature adds to the available solar irradiation and raising the energy efficiency ratio over 100%. The average difference of the ratio compared to System I is -20% and + 27% for System II and System III, respectively.

The performance indicators and results discussed provide insight into the performance of the system as a whole, the performance of the main components, and the durability of the system. An overview of these indicators is provided in Table 1.

CONCLUSION

Compared to System I, System II has an improved SPF, suggesting an improvement to the system. However, it is only able to use 23% of the available solar irradiation, thus not improving the energetic efficiency. In fact, its energetic efficiency is only 80% of that of the reference system. For System III, the collector gains are almost equal to the solar irradiation. By using the collector to actively regenerate the soil, an improvement of 25% is achieved in terms of energy efficiency. The active regeneration of the soil can either extend the operation time of the V-GHX or allow for shorter or less boreholes; both effects can translate into economic advantages.

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Messages of the coordination education

MASTER TRACK BP & BS

In the academic year 2012-2013, the new track 'Building Physics and Services' will be launched. A long expressed wish of the branch organization a course with a coherent building physics and building services program becomes reality.

Students of the master track BPS get a dedicated package of building physics and building services subjects. The master students have the opportunity to specialize in the direction Building Physics (BP), Building Services (BS) or BS & BP. This can be done by carefully choosing their master projects, the master assignment and their specialisation and elective subjects. Students who have followed this track get the diploma MSc ABP, track BPS. The Chair of the Unit Building Physics and Systems takes care of the education of this dedicated package. The electives are offered through the faculties of the TU/e.

CONGRATUALATIONS

In the subsequent paragraph, we would like to congratulate the students of BS and PBE who recently received their diploma and we will close with the usual New Year's wishes.

On 28 June 2011 Tom Krikke and Bart Postma received their diploma. Tom is a graduate on 'Assessment tools for sustainable development district'. Prof. dr.ir. Bert Blocken was his graduation professor. For Tom it is time for travelling. At this moment he is travelling through Australia. Bart is a graduate on 'History of acoustic design before 1900 '. Ir. Constant Hakl was his graduation professor. Bart now works at the K + Advisory Group.

On 30 August 2011 Rik Molenaar, Robin Scholten and Esther van Bavel received their diplomas. Rick is a graduate on 'Application of surface water heat pump system just heat-/cold buffers. Dr.ir. Henk Schellen was his graduation professor. As a dual student Rik has combined work and study. Rik has been working several years at Advisory Engineering Agency Techniplan. Robin is a graduate on 'Concrete core activation in schools'. Prof. ir. Wim Zeiler was his graduation professor. Also Robin was a dual student and now works at IV-Industry b.v., Arnhem and is head of Climate. Esther van Bavel is a graduate on 'Sustainable Appreciation'. Prof.ir. Paul Rutten was her master professor. Esther now works in the province of North Brabant.

On 27 September 2011 Jikke Reinten has received her diploma. 'Speech intelligibility in the elderly care' was her subject. Dr.ir. Heiko Martin was her graduation professor. Jikke now works with DHV.

On 25 October 2011 Peter van Mierlo received his diploma. Peter is a graduate on 'Coupled thermal solar collector and heat pump simulation for improved performance in Czech Republic'. Prof.dr.ir. Jan Hensen was his graduation professor. For the time being Peter thinks about his next step in his professional career.

We conclude this list of graduates by expressing our congratulations on obtaining their diploma MSc Building Service and MSc ABP Building Physics, diplomas that opens doors and opportunities for future developments.

NEW YEAR WISHES

It looks like there is a harsh winter on arrival which is promising for Christmas. Sharpen your skates, but be careful. We wish you all the best for New Year 2012!

dr. ir. Rinus van Houten
TU Eindhoven
Unit BPS

dr. ir. Henk Schellen
TU Eindhoven
Unit BPS

The bouwkunde winkel

Marco van de Griend
Winkelier Bouwkundewinkel

INTRODUCTION

The Bouwkundewinkel Eindhoven is one of the Science shops and is connected to the Technical University of Eindhoven. It offers students the opportunity to apply their knowledge and solve real live problems within the educational system of the faculty Built Environment. These problems are submitted by non-profit organizations and individuals who don't have the means to contract a regular design studio or consulting agency.

PROJECT EXAMPLES

Our latest finished project is research towards the indoor climate of a health centre, located in a converted church. Because of the monumental state of the church, the offices and rooms were built using the box-in-box concept; other rooms are located adjacent to the original church walls (see figure 1). The main complaints were: too cold in the winter, too hot in the summer and stale inside air.

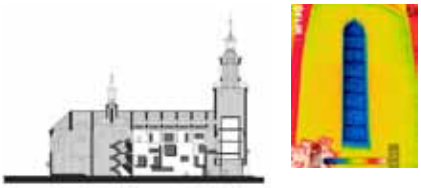

Figure 1: Churchbuilding and infrared image

During two weeks in the summer and two weeks in the winter the indoor climate air temperature, surface temperatures, relative humidity and CO2 concentration - were monitored in the rooms with the highest complaints. Using an infrared camera, an initial assessment of the surface temperatures was made. Using clear graphs, showing the monitored data and the boundary values of a "good" indoor climate according to the SBR (Stichting Bouwresearch), the indoor climate was made comprehensible for the client (figure 2). The report resulted in possibilities for the improvement of the indoor climate.

In a completely different project the applause of a poetry competition was researched. The organization used an

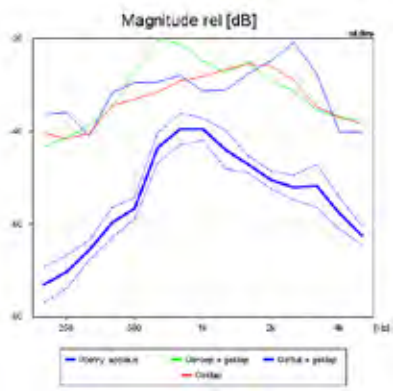

Figure 3: Recorded applause

Figure 2: Air temperature with lower and upper boundary

applause meter, over a period of 3 seconds, to determine the winner. They were concerned that the whistling during the applause had the upper hand, and not the clapping.
During a pop-concert, given in the same venue as the poetry competition, also the applause was recorded. Using audio fragments on which only clapping; clapping with yelling and clapping with whistling was hearable, the spectrums of whistling, yelling and clapping were researched. In these recordings they all had their own distinctive spectrum.
The spectrum of the recorded applause fragments during the poetry competition was compared with these spectrums (figure 3). According to these results the sound level of the applause during the poetry competition was mainly determined by yelling.

COMING OBJECTS

As shown by the above examples, our projects differ a lot. Three projects which are currently on our constantly changing waiting list are listed below:

- The municipality of Oss is interested in the state of the thermal insulation of their community centers and in which way they can be improved. The municipality is the owner of the centers and responsible for the maintenance. Using the results of this research they want to optimize the long-range maintenance plan, reducing the energy costs.
- The students dance association Footloose is located in the student centre 'de bunker'. They have multiple problems with their ventilation system, concerning both draft problems in one room and stale air and overheating problems in the ballroom. Footloose would like to have some advice on how they can improve their ventilation system.
- Playground 'de Splinter' has four hectare of playing ground including a swimming pool and a children's farm. They want to expand their playground with a sustainable and educational 'tree house'. The client asked us for a solution how they can make a sustainable design of the 'tree house' (see figure 4).

Figure 4: Design of a sustainable and educational **'tree house'**

Are you interested in solving one of these real live problems for credits, or curious about the other projects we have on our waiting list? Take a look at our website: www.Bouwkundewinkel.nl . For questions you can always contact us, or visit us between 11:00 and 13:30 on workdays At Vertigo 6.15 .

Travel journal Russian students

This September our University (MSUCE) gave 20 lucky bargees the great opportunity of visiting the Netherlands in order to observe the education process in TU/e, building and energy-efficient technologies in that country. Due to the excellent organization of the Dutch colleagues we didn't just get new information but had time for exploring a new country, its attractions, traditions and culture. Even if we knew a lot of things about the Netherlands visiting that country and meeting the people face to face was more exciting than we had expected.

MONDAY, 19TH OF SEPTEMBER

At 6 p.m. Moscow time our group took off by plane, destination Netherlands. From that moment we could feel that Europe was getting closer and closer. From the first moments in the seats we noticed a recognizable Dutch hairstyle of a flight attendant and tried the Dutch cuisine which tasted like shawarma. There was another surprise waiting for us immediately after landing. None of the passengers applauded the pilot and the attendants for the safe flight. Well, we thought "There are other rules. We are in Europe!"

We had to take a train to Eindhoven from the Schiphol airport. It was really difficult to find a timetable and besides that we got confused and got into a wrong train. It was funny when we found that out It was dark outside, we were in a foreign country and we didn't know where that train was taking us. Fortunately, friendly passengers helped us by telling us what we should do. We got out of the wagon at the first stop and eventually took the right train to Eindhoven. It was very late when we arrived to our hotel, which seemed to be very comfortable and have a good staff. We were exhausted and fell asleep quickly after accommodation.

TUESDAY, 20TH OF SEPTEMBER

According to the schedule of our trip to the Netherlands everybody had to become an early bird. It was hard for some of us to get up early and we had some difficulties with bringing all students together in the mornings. Anyway there was one positive thing, every morning we had an excellent breakfast in our hotel with fresh baked bread and amazing yogurts. We "loaned" a lot of snacks and sandwiches from the canteen. The hotel staff was so kind to us!

On that day we were supposed to visit TU/e. We started walking to the University by foot. That was a pleasant way of discovering Eindhoven. It was so unusual for us to see so many cyclists had their own part of the road and their own traffic lights. We experienced some kind of culture shock that nobody curtained house windows and we could see everything that was going on in the rooms. The town seemed to be like a toy with its smooth and clean paved streets, lots of lawns and the European town's architecture.

In TU/e we were given interesting presentations about the University, researches which were taken there. We had a very warm welcome. Dutch students brought us tee, coffee, cakes and we had the opportunity to have conversations with them. It was very cognitive to listen to the presentations of association Mollier and international students about studying process and students` life. After all the presentations and our conversations with the foreign students we found out that relationship between people in that country was being built on equality, even between a student and a professor. It is common or somehow a rule for senior students to help their junior colleagues at studying. We would really like to see that happen in our University. Maybe it will be possible in the future.

Further on we had a tour through the Vertigo from the bottom to the top. The building services system that was applied to the building was shown and explained to us. Those were the aquifer system, the system for collecting solar energy, the wind facility for ventilation and the green facade. During our familiarization with these systems we felt that we were like in a museum of energy-efficient technologies. After that we went on a tour through laboratories. We liked the laboratory for testing structures and materials the most. We were shown

The Lichtjesroute is a festival held every autumn in Eindhoven, in the southern Netherlands. It starts with a parade on 18 September, celebrating the liberation of Eindhoven during WOII

experiments that PhD candidates were doing. It was also interesting listening about a new type of concrete (fiber-reinforced concrete) studied there. Some of us were lucky to take a piece of this concrete home.

WEDNESDAY, 21TH OF SEPTEMBER

Our group went to TU/e in the morning where we were supposed to see some presentations. The day began with exploring scientific researches of different types of concrete. Our students were very interested in that topic and asked many questions about it. During next presentation we found out many interesting facts about the TU/e, its structure and departments. Then, the moment which we had been preparing for so long had come. It was our turn to give our presentation to the Dutch students about the concept of the Sochi 2014 Olympic facilities. The main question worrying our audience was if bicycle's parking places would be present in Sochi.

After that we continued our introduction to the TU/e. We listened to a presentation about a new building of TU/e (Metaforum) which was under construction. We were taken to a walking trip around the campus and shown a few fascinating views of the neighborhood. It was so exciting that we even lost one of our photographers. In the evening we experienced the full range of sensations from the tour we took by bicycles. That night was also a bit unlucky for one of our cyclist-student who got to hit a few cars, fall inside a tunnel and get some bruises. It is difficult to say what the bicycle trip meant for everybody. If it was 3 hours of real pleasure or torment. Anyway Eindhoven was beautiful, so enigmatic and entrancing during the twilight! Ice cream and bright lights were amazing. Unfortunately nature tested us by not letting us finish the tour without experiencing some Dutch rain. But then we got warm easily with a good company in a local pub.

> "we look again at quickly passing citizens on their two-wheeled vehicles with a sinking heart."

THURSDAY, 22TH OF SEPTEMBER

Thursday was not less rich in emotion than the previous days. After yesterday's cycling we didn't want to be left without means of transportation, to which we had grown accustomed, and to look again at quickly passing citizens on their two-wheeled vehicles with a sinking heart.

But our Dutch guides tirelessly pleased us with new exciting events: on the way to bicycle rent they prepared us a fascinating tour of some significant places, which are parts of the history of Eindhoven. At the end we had to part with our bikes and then we found ourselves in front of the building called Van Abbe Museum, which embodies contemporary art. We were impressed by many things. There were a lot of unusual exhibits, but the weirdest thing was waiting for us in the most unexpected place. We were about to go down and pressing the button of the elevator we thought that we would simply descend. But what was our surprise when it began singing! Accompanied by some kind of spiritual music we were transported out of reality for some seconds. These moments will definitely remain in our memories for a long time. And it's impossible to imagine the better completion of such an eventful day than a students' party. Plenty of positive emotions going from Dutch youths overflew us immediately. Amazing music, a lot of dancing, friendly smiles around and a lot of free beer (thanks to Mollier) these are our pleasant memories and the true atmosphere of the Netherlands.

FRIDAY, 23TH OF SEPTEMBER

This was the day we were most looking forward to because Friday was supposed to be our first day in Amsterdam. At the same time it was the worst morning we have ever had. After night party we had to leave the hotel at 8 a.m. Thank God the bus was parked close to the hotel so there wasn't much need to walk very far. Then, on our way to Amsterdam, we had to pick up some guys who were going to join us. Our first stop after arriving in the city was at the Dutch national museum (Rijksmuseum). This museum will be under renovation until 2013 and that's why we couldn't see the painting collections by Jacob Van Ruisdael, Rembrandt and other outstanding artists.

Next we put on uniforms and helmets and went to the building site. We entered the museum, where we could observe the process of renovation of some halls and rooms. At the end of the tour we took a lot of group photos and went back to the bus to have the lunch we brought with us from the hotel. While we were having our lunch the bus was heading to take us to our next stop, Frans Otten Stadion, which is a sport complex built in 2004 and has 20 courts for playing squash, 16 open tennis courts and 6 covered. It also has a gym for working out and a cafeteria. In other words it's an amazing place for practicing sports and we liked it a lot, although it was a pity we weren't allowed to play tennis there. It would have been great! So, a bit disappointed, we headed back to the bus. We had one more stop to make. Of course, some of us were really exhausted, but when we arrived at the destination everyone seemed to be excited, expecting to take a tour of the building that was supposed to be built on water. Again, uniforms, helmets, rubber boots and we were more than ready to go check it out. We took a look at the outside part and half an hour later we went inside and the first thing we saw was a big isle in the building, which explains why there were so many temporary metal structures. We started climbing a stairway to a high floor, which offered us an almost surreal view of the river. As usual, we took hundreds of photos. Using a temporary elevator, we came back down and went back to the bus. The tour was over and we started heading back to Eindhoven.

SATURDAY, SEPTEMBER 24TH

Saturday was our only internship day off. So we had some arguments about how to make the best out of this day. Unfortunately, we couldn't reach a decision and that's why some of us chose to go to Rotterdam and Hague and some of us chose Amsterdam. Our group got to Amsterdam by train and we decided to split into small groups and take a walk around town. It was mostly a day of shopping, buying souvenirs and taking a sightseeing tour around the Red Light District and Dam Square. Some of us visited the Nemo Museum and Madame Tussauds Wax Museum. Late that evening we all got back to our hotel in Eindhoven.

SUNDAY, SEPTEMBER 25TH

Early morning we met with some Dutch students from TU/e at the railway station in Eindhoven. We were all supposed to go to Amsterdam, where we spent almost one hour taking a boat tour through the canals. We were able to observe the beautiful architecture, the "straight" front walls of the buildings, and also enjoy the fresh air, the perfect warm and sunny weather... It was an amazing trip. After this tour, we spent some time enjoying some coffee and cake, followed by more shopping. Some of us, who weren't so exhausted, went to visit the Van Gogh Museum and the Rembrandt House Museum.

MONDAY, 26TH OF SEPTEMBER

On that day we had to wake up earlier than usual because a trip to Zeeland was in prospects. During this trip we were going to visit the Deltaworks and see how engineers of the Netherlands secure land against flooding. A bus was waiting for us near the hotel. We picked up a few Dutch students at TU/e and set off to our journey. Unfortunately we couldn't

enjoy views of neighborhood nature, farms and infrastructure through windows for long. The lack of sleep forced us to close our eyes and fall into dreams. Unlike us, Dutch students were very energetic and fun. We arrived to Deltapark "Neeltje Jans" in 2 hours where the first thing we did was listening the presentation about the Delta Project. We knew about building storm surge barriers and dams and step-by step technique of construction. Then a guide took us for a trip to the barrier where we could see it inside and outside with our own eyes. After that we were suggested to have a short voyage by ship around the North Sea. We had a little time before it and we used it to rest and to take photos with wind turbines, the Sea, brushwood of sea-buckthorn in the background. The bravest of our students swam in the salt water of the North Sea. The ship voyage would have been more fascinating if it hadn't been so windy and chilly on the board, so we went down on a lower deck and got warmer by hot coffee and chocolate. On the ground the performance of fur-seals was waiting for us. It was amusing. But the next activity could be easily called the funniest of the day. It was water slides. This extreme entertainment helped us sleep deeply to the accompaniment of the "lullabies" of the Dutch students during our return to Eindhoven.

TUESDAY, 27TH OF SEPTEMBER

It was the last full day in the Netherlands and we thought it would be the most difficult. That day we were going to have a workshop in TU/e. Before the event we were given additional information about energy-efficient and sustainable technologies used in the Netherlands. Also we were told about workshop`s competitions between students of TU/e. It helped us very much. We had never had such an activity in our University so it was kind of a challenge for us. We were divided into 4 groups and each group had to design a building. We should choose a location, materials, an energy provider and a flexibility of a building. Our students didn't want to become rivals so we decided to design an ophthalmologic center consisting of 4 buildings (one unit for every group). Those were educational centre for medical students, medical labs and hospital, office and dormitory for students. We liked the workshop a lot, it forced our brains to work quickly and to come up with different ideas. At the end of the day we gave presentations to

each other about our designs. That was a little bit embarrassing for us because we thought some teacher should judge our work. Our students spent the rest of the day shopping, going to pubs, wandering around Eindhoven and so on.

WEDNESDAY, 28TH OF SEPTEMBER.

The last day in Eindhoven had come. Leaving the hotel was planned at 2 p.m. We spent the morning doing some last minute shopping and packing our luggage. The weather was really warm. But the majority of our group had a little problem. We couldn't cram all of our things and presents into suitcases. We had to wear warm clothes in order to find room for other things. Well and we experienced hell on the train to Amsterdam. It was very hot in the wagon. Anyway we were happy. We were going home with unforgettable memories from our internship. The flight to the motherland passed great with a glass of wine. By the way drinking alcohol is forbidden on Russian airlines.

That trip to the Netherlands was very memorable, full of useful and surprising information in different types of activities such as education, leisure, means of transportation, protecting of nature. We hope that cooperation between our MSUCE and TU/e will continue and students will be able to exchange experience and knowledge.

By: Klochok G., Rovny I., Sandolskaya D., Marchenko E., Mashkova M.

Building performance simulation to support building energy regulation

A case study for residential buildings in Brazil

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INTRODUCTION

In terms of implementing energy efficiency policies for buildings, Brazil is the leading country in Latin-America [1] and introduced a voluntary label system for commercial buildings in 2009 and for residential buildings in 2010. This is a result of the Energy Conservation Act, implemented in 2001 after a major electricity generation crisis in 2001 [2, 3]. For residential buildings in Brazil the energy efficiency is indicated by an energy label, which ranges from 'A' (high efficient) to 'E' (low efficient). The label is determined by the Standard for Energy Efficiency in Residential Buildings (RTQ-R) and is based on a geographic based ratio between the efficiency of the thermal envelope (65-95%) and of the domestic hot water system (5-35%). The efficiency of the thermal envelope is based on a ratio between performance indicators for overheating, heating and cooling, which depends on whether the residential building is natural ventilated or air-conditioned. These indicators are determined by a Simplified Method consisting of linear equations as prescribed in the RTQ-R [4].

However, in order to control and limit energy consumption effectively with building energy regulation it is important to use an appropriate performance indicator and an appropriate method to assess the performance indicator. An appropriate indicator (1) indicate a quantitative amount of energy per year, (2) include basic elements of energy consumption, (3) is expressed in primary energy demand and (4) limit the total energy demand, from both renewable and non-renewable sources [5, 6]. Important issues for the method of assessment of the indicator are: accuracy, scope, reproducibility, complexity, sensitivity to energy parameters and user skills should be considered because they have a great impact on its success [7]. But successfull building energy regulation depends mostly on: (1) the ability to obtain better labels cost effectively, (2) the credibility achieved by real energy savings and (3) the degree of commitment to environmental problems of stakeholders in the building sector [7].

This research assessed the Simplified Method of the RTQ-R on its ability to represent energy efficiency of the thermal envelope of residential buildings in Brazil. This assessment consists of comparing the results of the Simplified Method with the results from Building Performance Simulations in terms of energy labels, performance indicators and sensitivity to parameters. To perform the assessment, results from the Simplified Method compared with Building Performance Simulations for detached houses and apartments with variations in 22 input parameters. Figure 1 shows an overview of the research method.

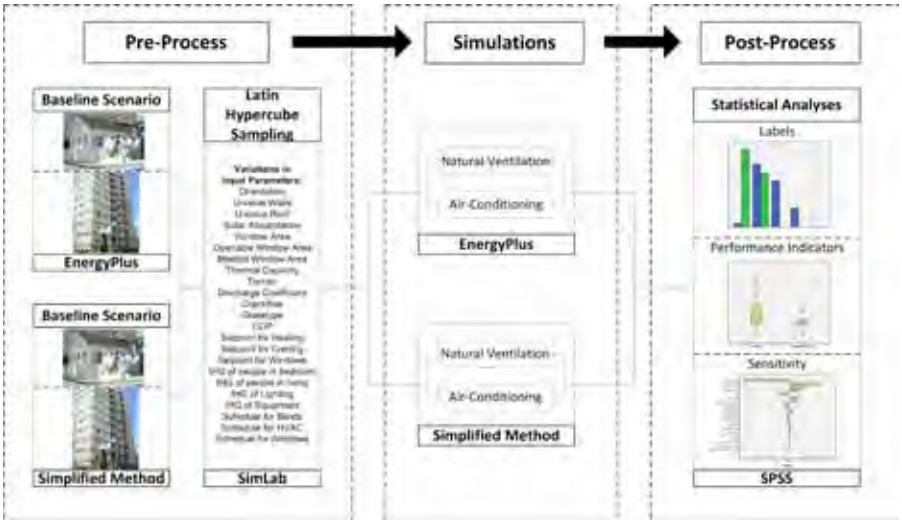

Figure 1: Overview of research process

RESULTS AND DISCUSSION

The assessment of the ability of the simplified method cover (1) the representation of energy efficiency by energy labels as shown in figure 2, (2) the role of the performance indicators for overheating and cooling as shown in figure 3 and (3) the sensitivity to variations in input paramters as shown in figure 4. The results indicate that the Simplified Method underestimate labels for natural ventilated residential buildings compared to building performance simulations. This is a result of the Simplified Method overestimating the number of degree hours of overheating. The effect of residential buildings with underestimated labels is that in reality overheating will be lower than expected. This is favourable for the residents and contribute to the credibility of the label by society. However, taking measures to improve the label are likely to be less cost-effective, because the potential for saving energy is lower [6].

The results also indicate that the Simplified determine a high number of similar labels for air-conditioned residential buildings compared to building performance simulations. This caused by the narrow range in the energy consumption for cooling, determined by the Simplified Method. The effect of the high number of similar labels is the risk of underestimation and overestimation of the actual energy consumption in residential buildings. This is a threat for successful implementation of building energy regulation, due to a lack of credibility by society if higher energy consump-

tion occurs. Also the effect of energy saving measures is not likely to improve the label with the simplified method. Therefore, increasing the representation of the simplified method will improve the credibility of the label by the residents and improve the incentive to improve the label, which will both contribute to more successful implementation of building energy regulation in Brazil [6].

The results for the sensitivity to input parameters indicate that the solar absorptance and thermal capacity are important parameters in the Simplified Method. Building performance simulations indicate solar absorptance as an important parameter, but indicate thermal capacity as not important. Therefore, increasing or decreasing the thermal capacity will improve the label in the Simplified Method, but is not likely to improve the energy efficiency of residential buildings. This show importance for reconsideration of how to take thermal capacity into account in the Simplified Method. The results for sensitivity also indicate that the setpoint for cooling is an important parameter. Therefore, taking the setpoints into account in the Simplified Method would improve its representation, but this is complicated due to the influence of residents on the setpoints. However, including a treshold value for nominal capacity of the HVAC-system per square meter of conditioned area is a possibility to increase the representation for heating and cooling. The nominal capacity depends on design indoor and outdoor temperatures and thus on the setpoint. Combining this treshold value with the COP of the HVAC-system should then be considered, since this is another important parameter.

CONCLUSION

This research assessed the ability of the Simplified Method to determine energy efficiency labels that represent energy efficiency of residential buildings in Brazil. Based on the results of the assessment of the Simplified Method this research concludes that:

- The Simplified Method underestimate energy efficiency of natural ventilated residential buildings, due to overestimation of the performance indicators for overheating and heating
- The Simplified Method under- and overestimate energy efficiency of air-conditioned residential buildings, due to limited representation of energy consumption for cooling.
- The setpoint for cooling is an important parameter for determining the annual energy consumption for cooling.
- The simplified method is correct sensitive to solar absorptance of the thermal envelope, but incorrect sensitive to thermal capacity of residential buildings.

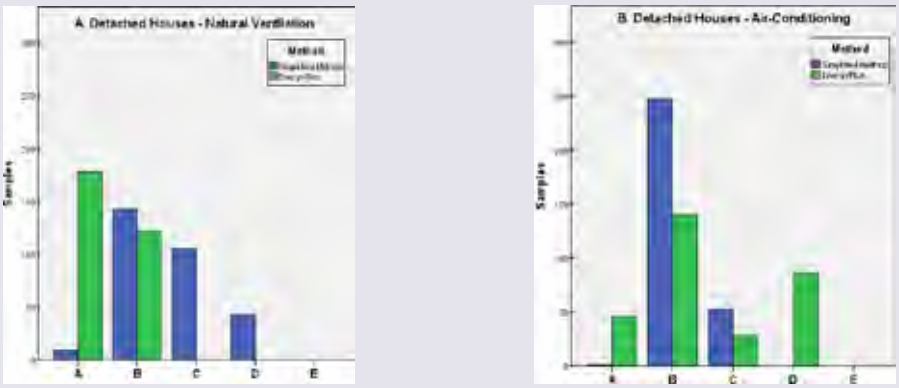

Figure 2a-b: Results of energy labels for natural ventilated and air-conditioned residential buildings by the simplified method and simulations.

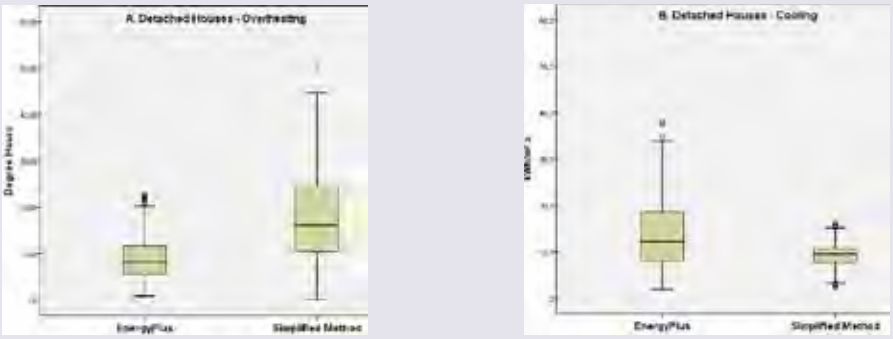

Figure 3a-b: Results of performance indicators for overheating and cooling by the simplified method and simulationsresidential buildings by the simplified method and simulations.

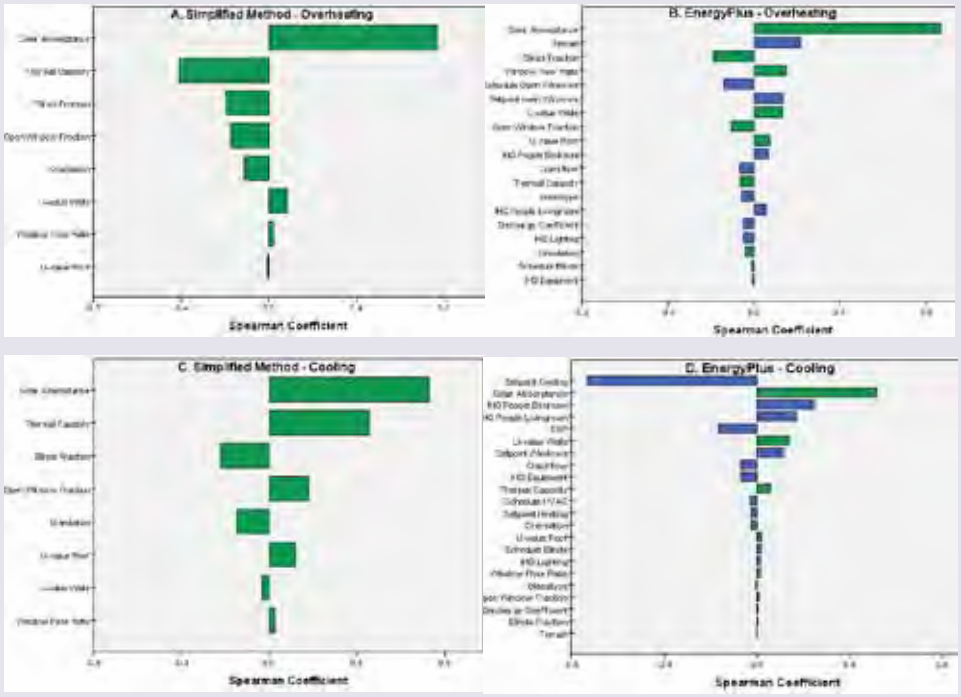

Figure4a-b-c-d: Sensitivty of performance indicators to variations in input parameters for the simplified method and simulations.

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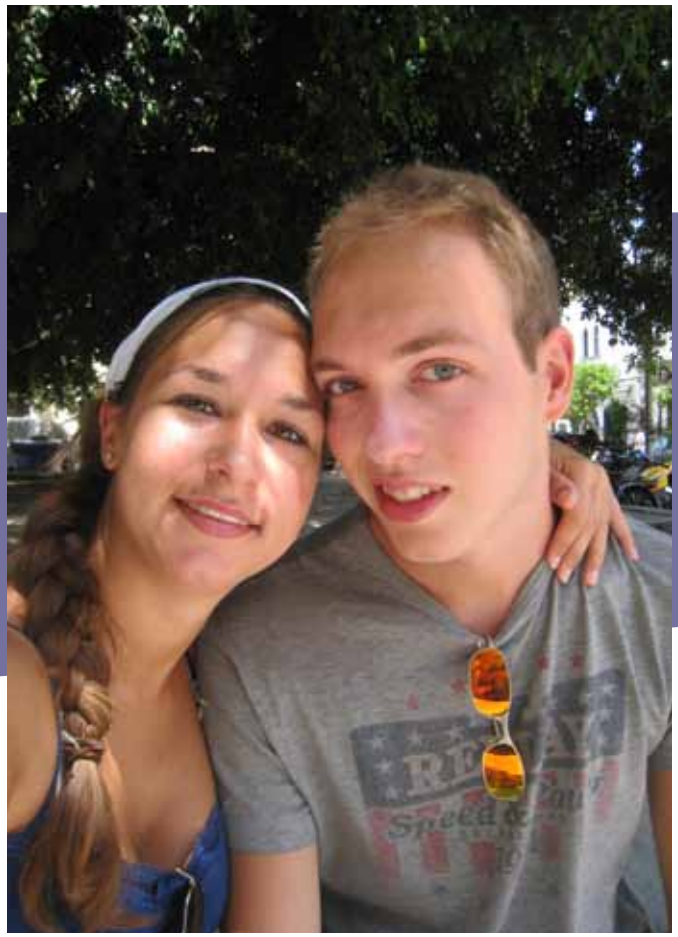
ICE-BREAKER

Suzanne Deckers



Hello, my name is Suzanne Deckers. I am 22 years old and I grew up in a little village in the south of the Netherlands, called Amstenrade. After I finished my VWO, I started my study in building engineering at the Eindhoven University of Technology. The first year of my bachelor was very hard, because I still lived with my parents and I needed to travel a lot every day. The second year I found a room college dorm. After living here for a year a friend of mine asked me to move in with her in her apartment. We have been roommates for two and a half years now. She studies Architecture and we are still very good friends, so it's really nice to be living together.

At the end of the first year we needed to choose a section. I made the wrong choice, choosing for architecture. My real interest was the technical section. So I decided to continue my study in the section: technique and management. When I finished my bachelor I found that the building physics part was my favorite. That's why I decided to start the master: Physics of the Built Environment.

I am working on my master for two months now and I must say it is a big change compared to my bachelor. I wasn't used to the English lectures. Also the difficulty was much higher. But I am sure I made the right decision by choosing physics of the built environment.

In my spare time I like to have fun with friends and to spend time with my boyfriend Peter, who lives in Landgraaf. This means that I can only see him in the weekends. He is a mechanic and works at his parents company. In the weekends we like to party with friends, go to the movies or visit a soccer game of Roda JC.

I also like to travel, in the beginning of the semester I went to Bologna with Mollier. It was an introduction weekend and I got to meet a lot of people of Mollier. We spend the weekend in bungalows at a camping site and we visited the city of Bologna. I had a really nice time and I am looking forward to the next trip. Last year I organized a study trip to China for the study association 'KOers'. I didn't visit China myself, because I had to take some exams in this period. But I hope I can make such a study trip this year and maybe I will organize it myself again.

The 'langstudeer-regeling'

Recently the Dutch government introduced new legislation to limit the amount of time a student is allowed to complete a study; the 'langstudeerregeling' (freely translated: long studying law). This sudden change in the student's finances has caused a lot of questions and sad faces. In the following text a summary of this law and its foreseen consequences for our current and new students.

Written by: Rick van Pruissen (BS)

NEW RULES

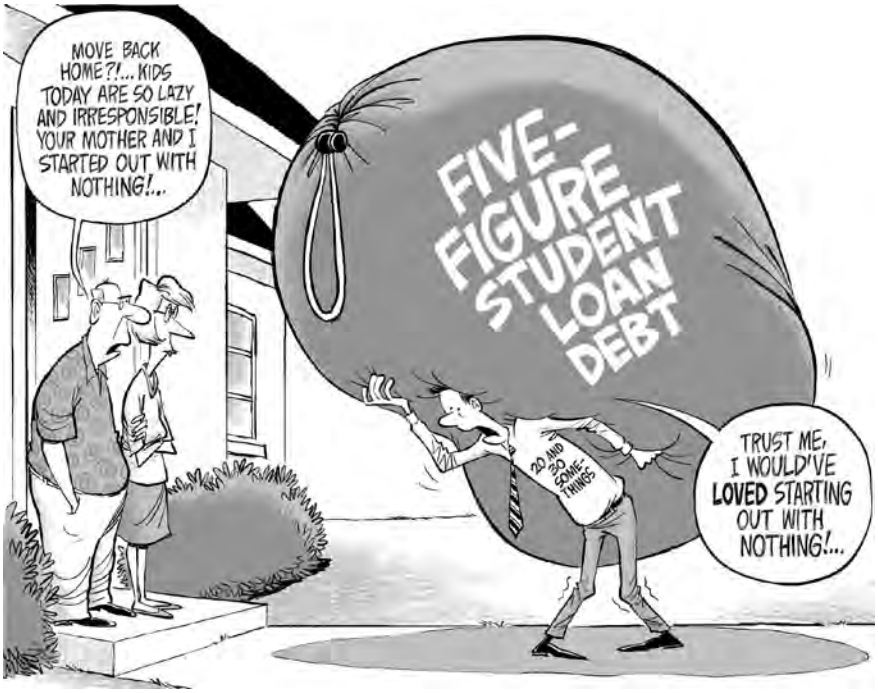
The new rules, which will take effect from September 2012, urge a student to complete his or her study within the nominal time of the curriculum plus one year. This applies for bachelor as well as for master programmes and for current as well as for new students. For the 2-year master programmes Building Services and Physics of the Built Environment this results in a maximum of 3 years. This does not include the deficiency programme, which is included in the bachelor time, making the effective maximum time for a bachelor programme 3 years. If this amount of time is exceeded, the Dutch government will fine the student for € 3.000 per year on top of the standard tuition fee (€ 1.713 in 2011) with a maximum of € 4.700. The average time it took to complete a bachelor in engineering in the academic year 2009/2010 was 63 months; 15(!) months more than the maximum (excluding the deficiency programme). [1]

THE REALITY

The Dutch national trade union for students LSVB (Landelijke Studenten VakBond) conducted a survey on the matter under 3.500 students (bachelor and master) and published a few interesting results. Firstly, on a lot of occasions the study delay in not voluntary. In almost half of the cases the reasons of the delay included illness (23%) and wrong study choice (25%). Apart from this, a lot of the respondents indicate that a combination of factors lead to the delay. This raises the question whether the maximum delay of 1 year is reasonable to be able to complete a study. On average the respondents have a delay of 13 months, which differs between studies with technical studies having the largest deviations above this average. [2] Apart from the Langstudeerregeling, many more measures have been taken in the last years which influence the delays: introduction of the coupling between study performance and scholarships from the government (Dutch: prestatiebeurs), the Bachelor-Master system, increased tuition fees, the Bindend Studie Advies (Binding Study Advice), limitation of the maximum amount of retakes, the obligation to finish the first year in one year and finishing the bachelor before being allowed to start with the master programme. All these measures have the intention to increase the average study performance and ultimately lower the cost per student for the government.

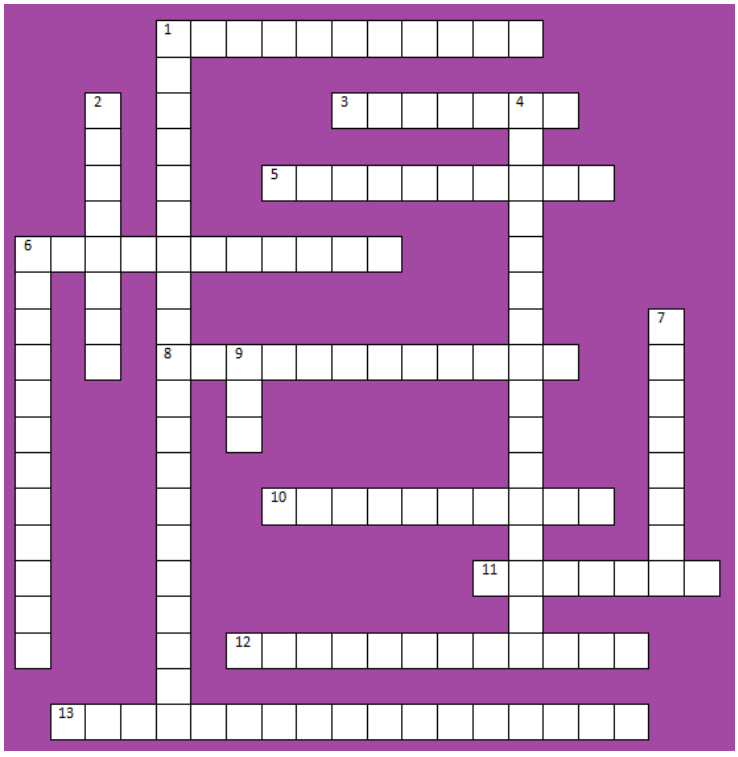
"The average time it took to complete a bachelor in engineering in the academic year 2009/2010 was 63 months; 15(!) months more than the maximum"

Not only the concept of cuts in the educational system surprises me but also the way in which the government intends to introduce these new rules. To me it seems like for current students, the rules of the game are being changed while the game ('studying') is still being played; a potential new student often makes the choice to start a new study based on a lot of factors, including the financial part which will now change considerably during his or her study. Things are even worse for the part-time (Dutch: duaal) students who often work for 3 or 4 days a week and now suddenly need to finish their study in the same time as their full-time colleagues.



This is the end of our part-time programme if you ask me. And as the pressure on the curriculum is raised to this degree a lot of valuable learning opportunities in the broader scope of an academic education will also become less attractive. With this I am referring to the studententijd (student time) in general, experience obtained in commissions or boards of associations, etc. etc. All in all, the new rules have a lot of consequences for the educational climate possibly without the intended outcome. Is (lack of) money a good motivation anyway or should a student be encouraged and guided in such a way that he or she wants to finish out of interest for the technology and science...

[1] Centraal Bureau voor de Statistiek, www.cbs.nl, visited November 21st, 2011
[2] Landelijke StudentenVakBond (LSVB), De (on)schuld van langstuderen, March 2011



Across

1. When scientists make discoveries by accident
3. A statement of what you aim to achieve by doing an experiment
5. A „if-then" statement that describes how you intend to solve a problem and is based on past observations
6. The type of data that does not involve counting or measuring; rather observations made through your 5 senses
8. As you carry out an experiment, one of the things you will do is...
10. A means by which you can test your hypothesis
11. A question or issue that needs to be solved
12. A type of error that varies and cannot be predicted
13. A theory that explains scientific observations is also known as a...

Down

1. Knowledge that is acquired using the scientific method is also known as...
6. When carrying out experiments and collecting data, it is important to do so in a way that is...
4. An error in your experiment that causes your measurements to be skewed by the same amount every time you take a measurement
6. The type of data you would most likely count or measure
7. To make a decision based on experimental results
9. A theory that can experimentally be confirmed time-and-time again and usually without change is a...

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Voor*elkaar*

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The Sustainable Building Accelerator

A method and a tool have been developed to assist the designers from the beginning of the design phase. The costs and benefits for different design options are calculated using Life Cycle Costing (LCC) and are presented in an insightful way to the stakeholders. The ''Sustainable Building - Accelerator'' supports stakeholders to decide on sustainable solutions by giving them cost and benefit information of design solutions. This information provides them with valuable input to create their sound business cases. This article describes the concept and illustrates the added value of the ,'Sustainable Building - Accelerator''.

Original article written for the ICEBO Conference 2011, New York

INTRODUCTION

The 'Sustainable Building - Accelerator" evolved from the vision that was presented on January 13th, 2010 at the Technical Council TVVL symposium (Maassen, 2010). Now the first version of the ''Sustainable Building - Accelerator'' has been developed. This first version can be used to compare the performances of different building designs over a longer period of time. The performances include Lifecycle costs.

Many people in the Netherlands and worldwide call out, that it is necessary to accelerate innovations in the built environment, to achieve the high ambitions on sustainability in time. The ideas for the ''Sustainable Building - Accelerator'' originated from the assumptions that the required acceleration of innovations within the built environment is not yet achieved due to:

- the small amount of innovative solutions which are generated by design teams, because (i) the design process is characterized by mono-disciplinary sequential steps and (ii) the design is most of the time constructed from partial existing solutions;

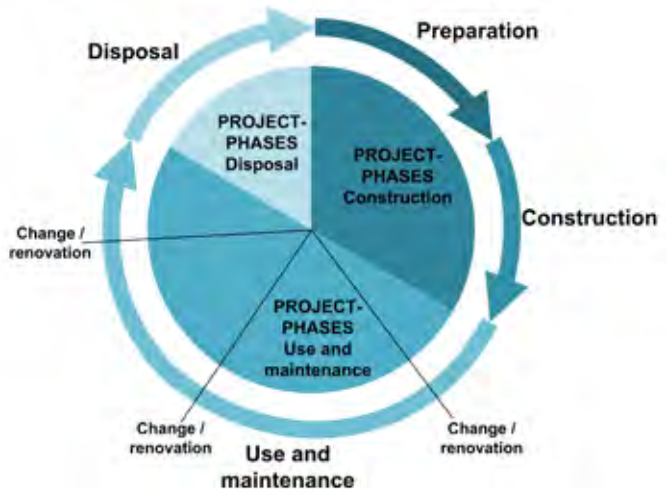


Figure 1: Representation of the life cycle costs compared to the cost of construction and the different costs of which the lcc consist

- the application of innovative design solutions is not considered adequately (not often, not all the pros and cons are considered) and not considered over the lifetime of the building, see Figure 1. This is because: (i) the pros and cons over the lifetime of the building are not within a contract of one single party, or are not clearly linked to parties, (ii) there is no clear method prescribed and (iii) there is no adequate tool available.

THE ''SUSTAINABLE BUILDING - ACCELERATOR''

To innovate and accelerate, in addition to develop innovative products and systems, also a new way of working and designing is necessary. This will lead to demand driven innovations which will accelerate the realization of a sustainable built environment. The 'Sustainable Building - Accelerator'' supports a new way of working, designing and making design decisions.

Innovations and the application of sustainable solutions in buildings are stimulated and realized with the 'Sustainable Building - Accelerator'' by using a structured and systematic approach during the design phase of the building. Therefore a design methodology and a tool are developed, to support the design team during the early stages of the design with:

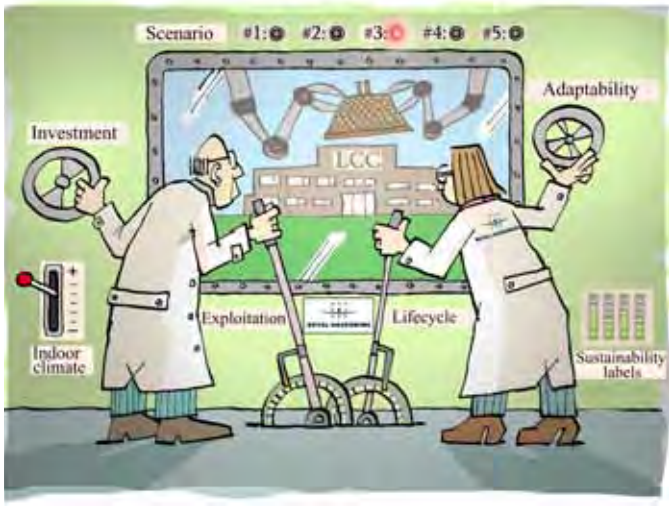
- the generation of innovative sustainable building design solutions;
- the selection of innovative sustainable building design solutions (including adjustments and changes over time) considering a longer period.

Generation Of Innovative Building Design Solutions

The research focus of the part 'generation of concepts'' of the 'Sustainable Building - Accelerator'' was formulated with reference to previous research in this area (Savanovic, 2009). The argument here is that designers in the early stages of the design of an ambitious and innovative project need methodological support. Hereby it is assumed that the designers are experienced and can work on a highly knowledge-intensive level.

Important aspects in the required design methodology are the design process, the applied design tools and the organization of the design team (roles and tasks).

Figure 2. Schematic representation of part of the ''Sustainable Building Accelerator'': method and tool to make design decisions



Selection Of Sustainable Building Design Solutions LCC Part Of The ''Sustainable Building Accelerator'

Design decisions are increasingly made by developers and a growing number of consortia, with an integrated contract (e.g. DBFMO: Design, Built, Finance, Maintain and Operate), based on a Life Cycle Cost and Life Cycle Performance considerations. The total costs, performances and variations in the use of housing (incl. building services), are taken into account over a longer period. This is to achieve optimum solutions, where:

- the value of the building for the user and his environment (the environment) is as large as possible;
- a financial benefit is achieved in a market where energy prices rapidly rise, the prices of innovative (e.g. energy saving) products quickly reduce and the flow of new innovative products accelerates;
- in the design innovative solutions are applied and in for the future the application of innovative solutions (adaptation) and changes in the use of the building (flexibility) is taken into account.

This is different from the traditional way of making design and housing decisions. Traditionally, these decisions are taken by a static approach that includes only the initial investment and simple pay out times (SPOT). Using this traditional approach large profit will be missed, see (Nelissen, 2010), and there is no anticipation to dynamic aspects: (a) the targets within integrated contracts to maximize resale value and minimizing operating costs, (b) the rapid changes in the market and (c) the possibilities for adaptation of new techniques.

The LCC part of the ''Sustainable Building Accelerator'' provides a clear, useful and reliable method and tool, which can be used to make design and housing decisions based on a lifecycle approach, see Figure 2. The ''Sustainable Building Accelerator'' is broadly applicable and can be used for new and existing buildings from the start until the end of the design stage.

THE 'SUSTAINABLE BUILDING - ACCELERATOR'': LCC PART

The LCC method and tool, as part of the ''Sustainable Building Accelerator'', is developed and presented in this article.

"The LCC part of the Sustainable Buidling Accelerator provides a clear, useful and reliable method and tool, which can be used to make design and housing decisions"

The requirements for the development of this method and tool version where:

- Broadly applicable dynamic financial accounting tool where changes over the lifespan (including replacement and improvement investments, energy costs, other operating costs) are clearly specified for four design variants;
- Strong presentation / communication tool that gives insight and a good overview using indicators (per m2) and a graphically display of the results of the design variants, Figure 2;
- Insight in the sensitivity of the results for variations in the different input parameters;
- Applicable to carry out a LCC-study fulfilling the requirements of BREEAM-NL (BRE Environmental Assessment Method for the Netherlands) credit MAN 12 (Dutch Green Building Council, 2010);
- Making clear the benefits: such as savings in labor costs by reducing absenteeism and/or higher productivity due to a better indoor climate. The LCC approach is thus extended to a LCP (Life Cycle Performance) approach.

The available version of the LCC is now a strong communicative and versatile financial calculator. Changes over time can be discounted. The required input depends on the specific design question and should be determined before the 'Sustainable Building - Accelerator'' can be used.

Table 1: Schematic presentation of workplace air conditioning concepts. A. Induction unit (reference/base concept), B Thermally active building

Costs		Concept			
		A	B	C	D
CAPEX - investment building services	[€/m²]	172	201	247	300
CAPEX - construction costs > 850 €/m²	[€/m²]	30	140	5	170
OPEX - maintenance	[€/m² yr]	0,30	0,03	0,25	0,35
Replacements costs after 16 years	[€/m²]	79,6	101,3	160,6	123,7
Energy costs - gas	[€/m² yr]	0,94	0,85	0,89	0,70
Energy costs - electricity	[€/m² yr]	5,50	5,08	4,98	2,91
SPOT	[yr]	-	178	81	97

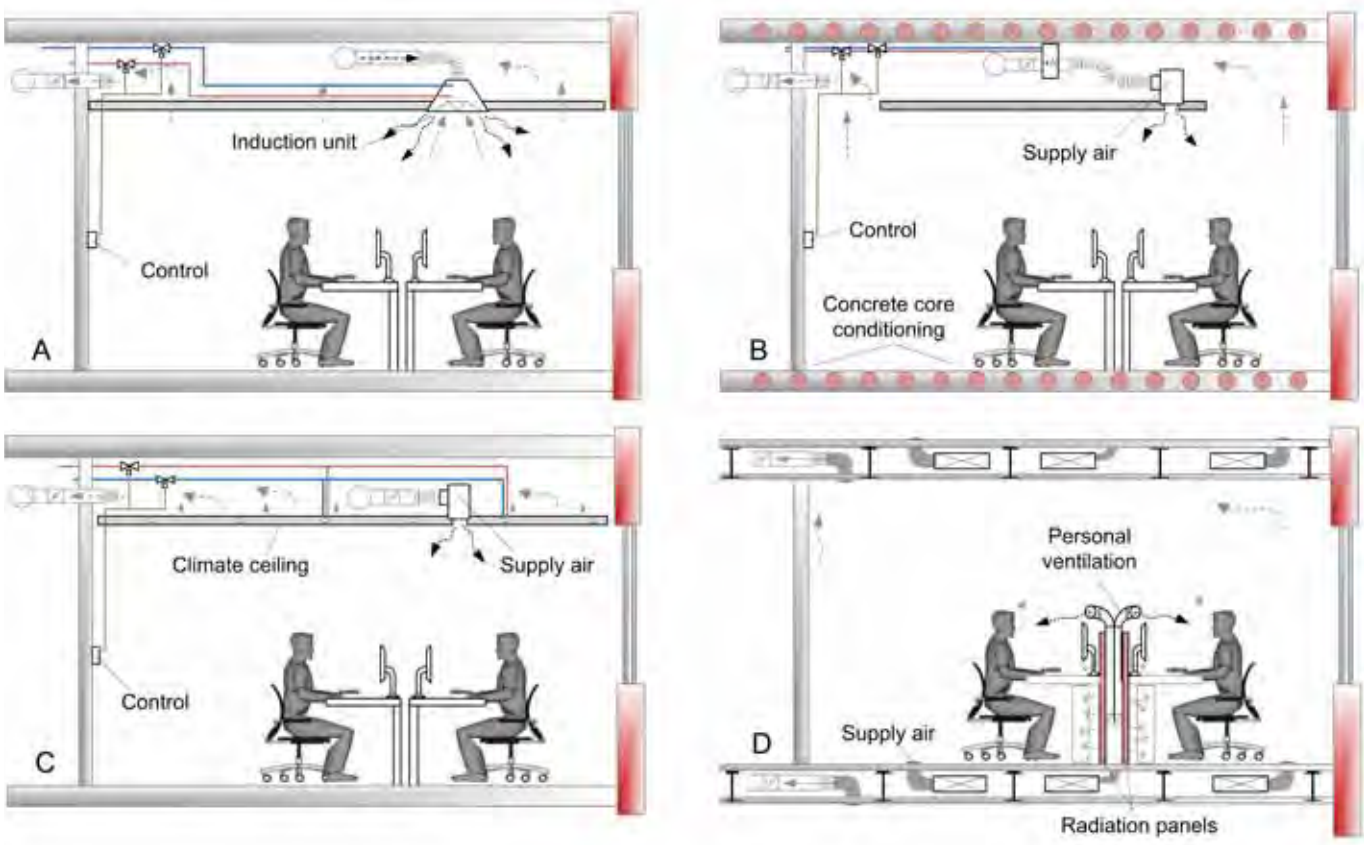


Figure 3: Schematic presentation of workplace air conditioning concepts. A. Induction unit (reference/base concept), B Thermally active building structures, C Climate ceiling, D Individual climate concept

EXAMPLE WORKPLACE AIRCONDITIONING

To illustrate how the "Sustainable Building Accelerator" works is was used to calculate the Life Cycle Costs and benefits of workplace airconditioning concepts. Four concepts were considered, see Figure 3.

Life Cycle Costing

For all concepts the same level of thermal comfort and air quality is realized. The investment costs (CAPEX) are determined considering an office building of 10,000 m2. For the different concepts the investments cost above 850 €/m2 are determined. The building services other than the workplace concepts are considered equal. Also Energy, OPEX and replacement costs are considered, see Table 1.
The individual workplace air conditioning system (D) uses significant less ventilation (Zeiler, 2010). This results in large reduction of energy consumption and energy costs. However concept D requires a relatively high investment.
Within the dynamic calculations also fluctuating energy consumption and different maintenance costs are considered over a period of time. It is assumed that the project is financed by a third party using the same discount for each concept. In Figure 4 circular histograms with the different LCC values for system A and D are presented.

"It was shown that the effect of productivity increase on the LCC results for different workplace air conditioning concepts is very large"

The breakdown in costs is different for each concept. It can be seen in Figure 4 that the energy costs are the highest cost using concept A (Induct) and the investment costs (CAPEX) are the highest costs using concept D (Pers. Clim.).

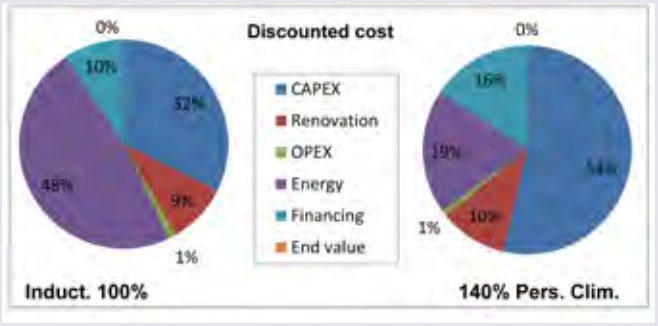
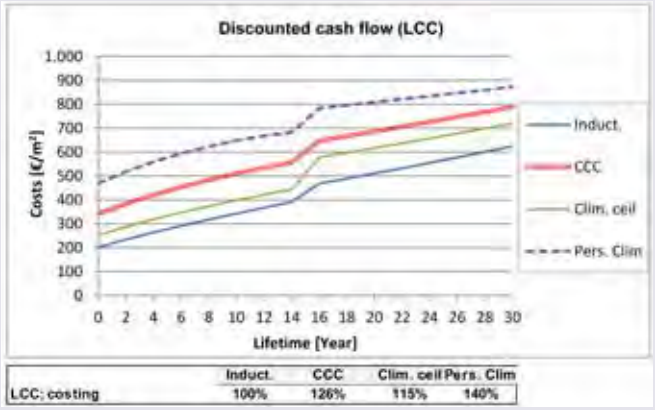


Figure 4: Circular histograms of concept A and D with LCC results.

Productivity

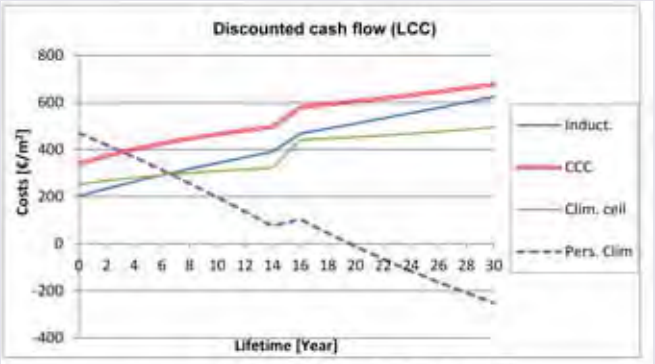
From research and literature (REHVA, 2006) it is known that a better indoor climate results in a higher performance of the building users. Within office buildings the productivity can be improved up to 3%. Considering that 94% of the total costs over the life time are labor costs, a productivity increase of 3% represents a large benefit (ASHREA, 2008; REHVA, 2006). Typical labor costs are € 2.000,- per m2/year. Considering for each concept the air velocity, temperature radiation, individual temperature control and thermal comfort in between seasons the increase of productivity for each concept compared to the reference concept is: B: 0,25%, C: 0,50% en D: 2,50%.

The LCC results without and with the effect of productivity are presented in Figure 5 and Figure 6. The LCC costs in these figures are discounted cumulative costs over the considered period of 30 years. Although the energy costs for concept D are low the LCC costs are high compared to the other concepts.



	Induct.	CCC	Clim. ceil	Pers. Clim
LCC; costing	100%	126%	115%	140%

Figure 5: LCC results of workplace air conditioning concepts without the effect on productivity.



	Induct.	CCC	Clim. ceil	Pers. Clim
LCPC; productivity integrated	100%	108%	79%	-40%

Figure 6: LCC results of workplace air conditioning concepts with the effect on productivity.

When the effect of productivity is considered it can be seen in Figure 6 that the effect on LCC costs is high.

The concept C has lower LCC costs than concept A (Pay Out Time 7 years) and concept D has even a negative LCC meaning that the income due to the increase of productivity is larger than all LCC costs for workplace air conditioning.

CONCLUSION

The 'Sustainable Building - Accelerator'' is a method and a tool that supports the design team making design decisions in the design stage (beginning to end) by using a dynamic instead of a traditional static approach. The dynamic approach consists of a LCC calculation based on discounted cash flows and the use of scenarios. The static approach uses only a calculation of the simple pay out time for different variants and no changes and/or modifications over the life time are considered.
The 'Sustainable Building - Accelerator'' supports design teams and therefore accelerates sustainable innovations in the built environment using a demand driven approach. The LCC component compares the performance of different scenarios. This enables the consideration of adjustments to enhance the performance of the building in the future.

The developed version of the LCC part of the 'Sustainable Building - Accelerator'' allows energy studies, which are not based on a LCC approach, to be extended with a LCC calculation and to extend the variants with scenarios (considering changes and modifications over a longer period or the lifetime). Roadmapping, planning modifications in the future to achieve a better performance, is supported.

It was shown that the effect of productivity increase on the LCC results for different workplace air conditioning concepts is very large. Therefore it is advised, when selecting a workplace air conditioning concept, to consider the effect on the indoor climate and the productivity. The effect of productivity increase on the LCC is high and there is already a lot of data available to estimate a productivity increase.

The quality of the data is important to get reliable LCC results. It is advised to perform sensitivity analyses considering the most critical parameters, e.g. increasing energy prices and productivity. When the initial investment costs are too high to choose the concept with the best LCC performance it should be considered to take necessary measures that the concept can be applied at a later time.

FUTURE DEVELOPMENT

In 2010 Royal Haskoning formulated a research and development proposal in collaboration with Eindhoven University of Technology, SBR and the Dutch Green Building Council to develop the ''Sustainable Building - Accelerator''. To perform research and development for the full scope of the proposal funding is still required.
Nevertheless Royal Haskoning has already started the development of the ''Sustainable Building - Accelerator'' as their own product and service. The priority in the near future is now providing insight into: (a) variations in flexibility (functional changes, shrinkage, expansion) and (b) adaptability (new techniques) for each variant/scenario.

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How to increase fire safety in buildings:

Fire safety engineering

Fire means beside direct (financial) damage often far more indirect costs caused by interruption of operations and loss in sales, market share, property and, in the worst case people can get injured or even get killed (on average around 80 persons a year). Fire in buildings is clearly a disaster and for this reason, fire prevention and fire protection must be given top priority in building design. Prevention consists of a combination of different measures meant to protect primarily the occupants of a building and to prevent damage to adjacent buildings as well as the environment. It is important to be aware that the fire-safety chain of the different fire prevention and protection measures is only as strong as its weakest link.

Fire safety engineering is the application of engineering principles, rules and expert judgments based on a scientific analysis of fire phenomena, of the effects of fire and of the reaction of people, in order to:

- save lives, protect property and
- preserve the heritage;
- quantify the hazards of fire, its effects and risks;
- evaluate analytically the level of protective and preventive measures necessary to limit, within prescribed levels, the effects and risks of fire.

As a result fire safety engineering is multidisciplinary, having substantial relations with the domains of architecture, building physics, building services, structural and civil engineering, assistance to fire repression. Traditionally, the way to increase fire safety is by a prescriptive approach, were all measures are written down in building codes and regulations to reach the minimum level of fire safety.

> "As a result, fire safety engineering is multidisciplinary"

Fire safety engineering specialists can suggest alternatives to prescriptive approaches, especially when designing for unusual or difficult' buildings. Using a more flexible probabilistic approach to building codes, focusing on risk objectives, may be the only viable way to achieve a satisfactory standard of fire safety in complex buildings. With a probabilistic approach of fire safety it is possible to optimize safety measures, regarding the fire and building characteristics. This approach can be used in different risk subsystems with their own specific objectives:

1. Safety of people in the threatened compartment (risk objective: the allowable failure probability of the safe evacuation time);
2. Safety of evacuation (risk objective: the allowable failure probability of evacuation routes);
3. Safety of other compartments in the building (risk objective: the allowable failure probability of compartment boundaries, fire spread to a multi-compartment fire);
4. Safety of building structure (risk objective: the allowable failure probability of the building structure);
5. Safety of the adjacent buildings and environment (risk objective: the allowable failure probability of building boundaries).

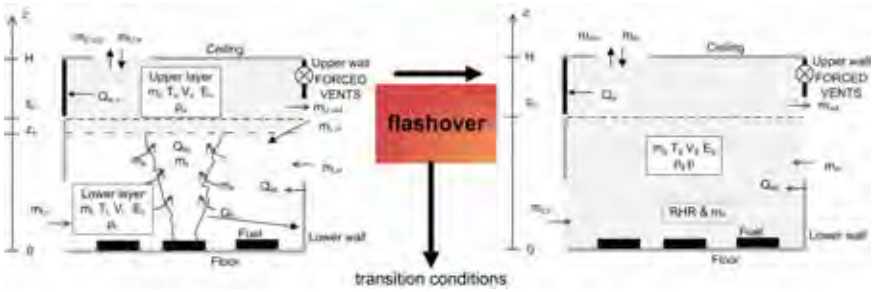
In order to establish the failure probability of the subsystem, the response under fire conditions has to be determined. In the first risk subsystem, the local fire in

the threatened compartment is the main event. In the other risk subsystems, the compartment fire is the main event. Both the probability of these main events are important as well as the consequences in the fire compartment. Modelling of fire development is crucial in a risk-based approach and essential in a consistent fire safety concept.

The natural fire concept (NEN 6055: 2011) describes the fire development in both the pre flashover as the post flashover phase in the compartment. The fire development depends on fuel (fire) characteristics and building characteristics. During the pre flashover phase the fuel characteristics are most important. These fuel characteristics are fire load, rate of heat release per unit area, time constant for fire spread, caloric value of the fuel, stoichiometric constant, soot production and extinction coefficient. Also during the post flashover phase the building characteristics are important such as dimensions of the fire compartment, openings in the compartment boundaries, material layers in the boundaries, ventilation devices, etc. With the natural fire concept the heat release rate can be calculated in the pre flashover and the post flashover phase. Also the time to flashover can be determined, taking into account fuel and building characteristics.

The rate of heat release determines the temperature development in the fire compartment. It is necessary to take into account the convective heat transport through openings in the compartment boundaries, the conductive heat transport in the compartment boundaries and the radiation heat transport between fire and boundaries. The building characteristics influence in that way the temperature development in the fire compartment.

Gas temperature, calculated according to the natural fire concept, is a project specific temperature-time curve,



suitable to use as the thermal load in a probabilistic approach of fire safety. The main events for a risk based approach (fire start and flashover) are clearly visible. The time lapse between these main events is important in a risk-based approach. Preventing flash-over may be possible with a large time lapse, while on the other hand this is almost impossible with a small time laps.

> "Fire in buildings is clearly a disaster and for this reason, fire prevention and fire protection must be given top priority in building deisgn"

Whilst many aspects of the analysis may be quantified, others will require expert judgment and will be subject to discussion with the building code and fire authorities. This may include, for example, the consequences of fire (which will be subject to construction standard and maintenance) or people movement (subject to a motivation or mobilization time which may be improved with training or stewarding). Whatever particular expertise the designer possesses, or whichever discipline the designer is from, it is important that he/she has an understanding of critical aspects of fire safety. At the TU/e several researchers from different units are involved in aspects of fire safety engineering. One of the most crucial aspects of a building's safety is safe escape in case of a fire. This aspect is one of the research topics of the group of Bauke de Vries. The structural strength of constructions in case of fire is studied by the group of Bert Snijder. In different courses there are lectures about specific aspects of fire. As such our faculty has the opportunity to give fire safety engineering the attention that it should have, given its importance to future occupants of buildings designed by our graduates. To further strengthen this topic there is an initiative to appoint a fellow Fire safety engineering to coordinate the domain of fire safety throughout our faculty.

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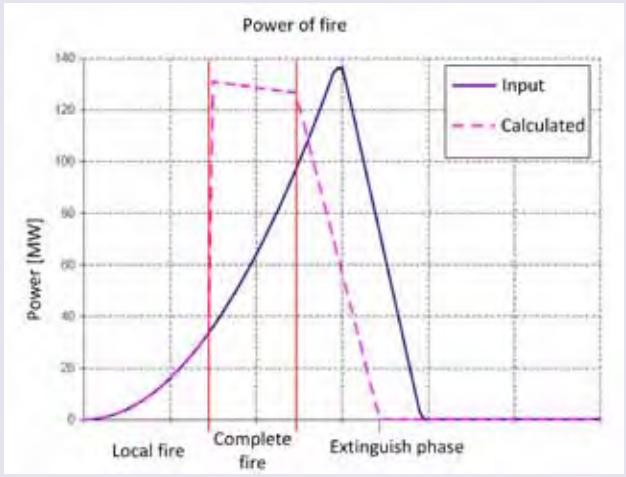
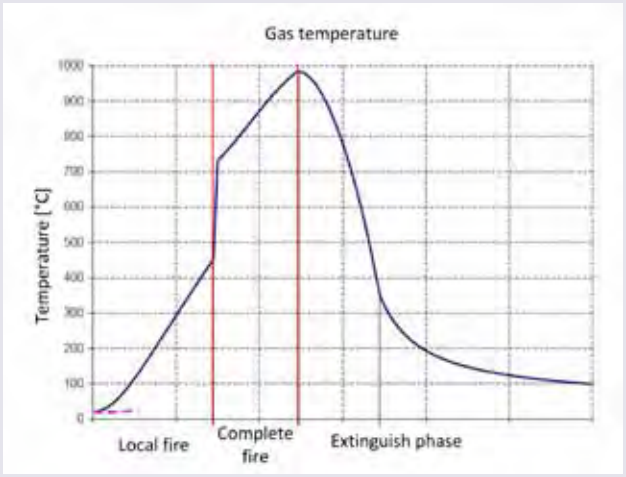
Ruud van Herpen
Nieman Raadgevende Ingenieurs
Lector Brandveiligheid in de bouw Saxion





South Africa internship experience

Back where I started. Yesterday I took a flight from Cape Town to Johannesburg, back to the town (Centurion) where I started my internship three months ago. And now, on my first day of my holiday, I'm sitting by the pool (clear sky, 30°C, nice!) reflecting my exiting South Africa internship experience.

My internship adventure started about six months ago (in the Netherlands). I had stated for myself that I wanted to do an internship abroad (for ECTS..) and I was looking for a company. I tried several paths to find the company (Bouwkunde bedrijven dagen, open solicitation, etc...). Asking my portfolio mentor, professor Rutten, for a little help turned out to be the best method. Professor Rutten gave me a list with companies which might be interesting. Spoormaker and Partners (mechanical engineers) in South Africa sounded very interesting. One open solicitation letter and a small phone call, and it was settled. I would go to South Africa!

I started my internship at the Spoormaker and Partners (S&P) head office in Centurion (near Pretoria). Of the three months of my internship I would spend one month at the head office in Centurion and two months in Cape Town. During the one month in Centurion I was involved in different activities. The two main activities were helping with the commissioning of the new undergrad science centre (USC) at the WITS university (Johannesburg) and help to test and to improve a experimental radiant ceiling which was installed at the drawing office of (S&P).

The commissioning of the USC was a great experience. Next to that it was my first time commissioning a system, the building site was a special experience. The building site was very crowded. All over the site there were workers who seemed to be on a generally accepted and continuous work slow/ take a break strike. And while commissioning you come across some interesting mistakes, like room temperature sensors regulating the system located outside the building.

The experimental radiant ceiling was also a very interesting experience. The drawing office is actually an experimental playground and the poor employees in the office are excellent guinea-pigs. The concept of the radiant ceiling was to create a budget radiant ceiling to condition the space (both cooling and heating). The ceiling panels consisted of PEX-piping attached to a metal framework. One of the first changes we made was to add metal slabs to the piping to improve the radiant effect. Next to this I performed a comfort analysis (the ceiling in heating mode caused discomfort...) and I was involved in developing alternative solutions for the system in heating mode.

From Centurion my internship moved to Cape Town. In Cape Town my internship took place at two different companies. The one was the Cape Town office of Spoormaker and Partners, the other was PJCarew Consulting (PJC), a green building consultant. PJC and S&P are very different companies. The main difference is that most S&P employees are mechanical engineers and that most PJC employees are architects. (In South Africa there is no study like Architecture Building and Planning, and there is no study like Building Physics. So in the field of my internship you are either an architect or a mechanical engineer)

Figure 2: A snapshot of Voortrekkersmonument

My main task in Cape Town was to develop a TABS tool (thermally activated building slab, betonkernactivering) which the engineers could use to design a TABS system. While doing so I came across some interesting cases. One of those was a TABS system at the beach near Durban (hot humid climate). Another was a villa in Cape Town with a large glass facade (without shading), an expensive antique wooden floor and no secondary conditioning system.

Figure 1: Dinner at Green Building Conference, with colleagues

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Figure 3: Enjoying waterfront

Figure 4: Lions inside a drive-in zoo

Figure 5: View of mountains from the frontyard (Company gardens)

Figure 6: Radiant Ceiling with the metal slabs

Figure 7: S&P Workplace Centurion.

Figure 8: S&P Workplace in Cape Town, at that moment, working with 4 computers.

At the end of the internship the Tool itself turned out nice. However, given that I had only 1.5 month to develop the tool there is still a lot of room for improvement... The tool is created in excel, and by entering the heat loads and the composition of the activated slab in an easy input screen. The tool would calculate the temperature over the slab and the room temperature over time.

Next to working very hard I also got to enjoy South Africa. In Centurion I'd been to wild parks, braais, watched rugby etc. I met a lot Afrikaners and I got introduced to the Afrikaner lifestyle. In Cape Town there was also a lot to do. Next to some basic tourists activities, Company Garden, Table Mountain, Robben Island and wine routes. I got to hang out with the real Captonians, who introduced me to fantastic places and activities; tiny restaurants in basements, doggy karaoke, underground innebandy (is like indoor hockey), a sport which is a combination of soccer and tennis, pirate boat sunset cruise arrrrr!!, drum-ballet shows (nice one time experience, wouldn't go again though), best view ever hikes, drink Jack Black, Springbokie and Soweto dumb, eat pojtie-kos, gatsby and bunny woo, etc. etc.

I really enjoyed my time so for, and I would advise anybody to go to South Africa for an internship. Don't just think about doing so, just do it! If you are interested; both S&P and PJC are interested in other Dutch students... (just contact me or Mollier for more information!).

So, the end. I am going to enjoy my holiday in South Africa!

Research and education in urban physics and environmental fluid mechanics

Prof. dr. Ir. B. Blocken
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Research and education in Building Physics and Systems (BPS) could be divided in three main groups, which are however strongly related: BPS for the indoor environment of buildings, BPS for the outdoor environment of buildings, and BPS for the building envelope, i.e. the building components that separate the indoor from the outdoor environment: facades, roofs and floors. Traditionally, most attention in BPS has focused on the indoor environment of buildings and on the building envelope. This choice is motivated by the fact that people spend most of their time indoors (about 90% according to many estimates), by the fact that the indoor environment is easier to control than the outdoor environment, and by the fact that the building envelope is used to separate the indoor from the outdoor environment and to realize and maintain different (better) indoor environment conditions: temperature, humidity, air quality, etc.

> "Eindhoven University has a strong tradition and strong international reputation in research and education in Building Physics and Systems"

In the past decades however, research in BPS has also increasingly focused on the outdoor environment of buildings. Indeed, when people spend 90% of their time inside buildings, this means that they spend 10% of their time outside buildings, and also during that time they want to be comfortable, healthy and safe. Also, in spite of high-quality building envelopes and building systems, the outdoor environment strongly influences the indoor environment. Outdoor air pollution leads to indoor air pollution. Outdoor heat waves and the urban heat island effect causes indoor overheating and indoor heat stress, morbidity and mortality. In addition, many of the grand challenges that our society is facing today require a holistic approach, integrating the indoor and the outdoor environment and the building envelope. These challenges are energy, climate change, mobility and healthy ageing.

Eindhoven University has a strong tradition and a strong international reputation in research and education in

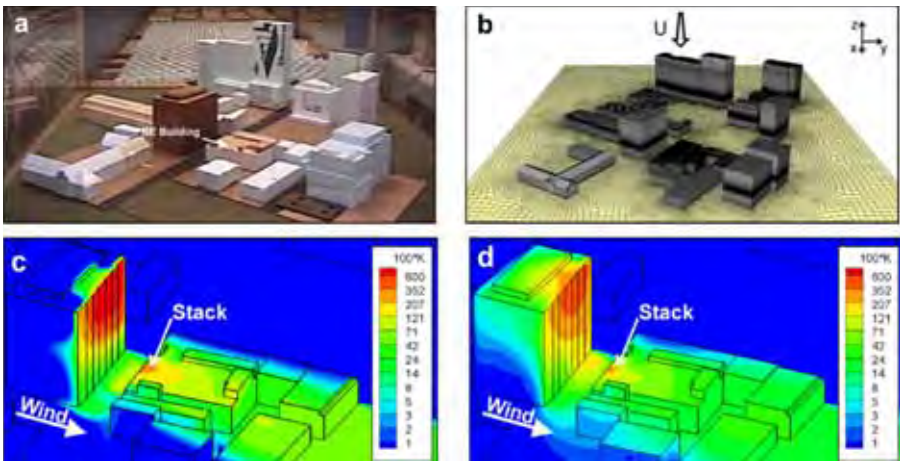

Figure 2: Study of air pollution in downtown Montreal (Gousseau et al., 2011)

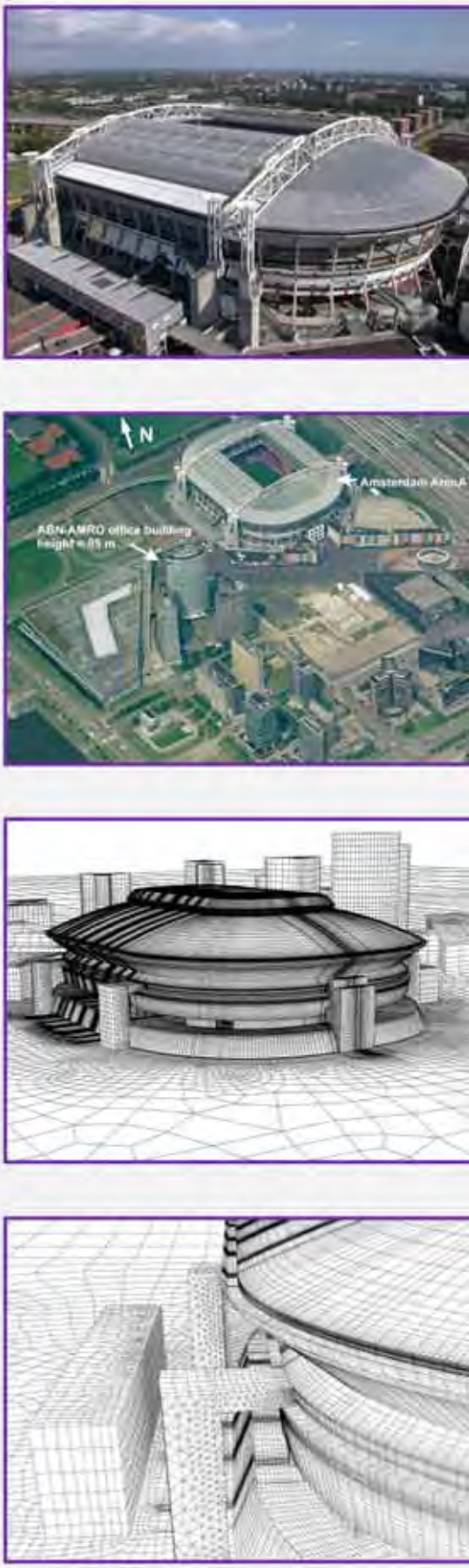

Figure 1: CFD study for Amsterdam ArenA Stadium, Holland (Van Hooff and Blocken, 2010)

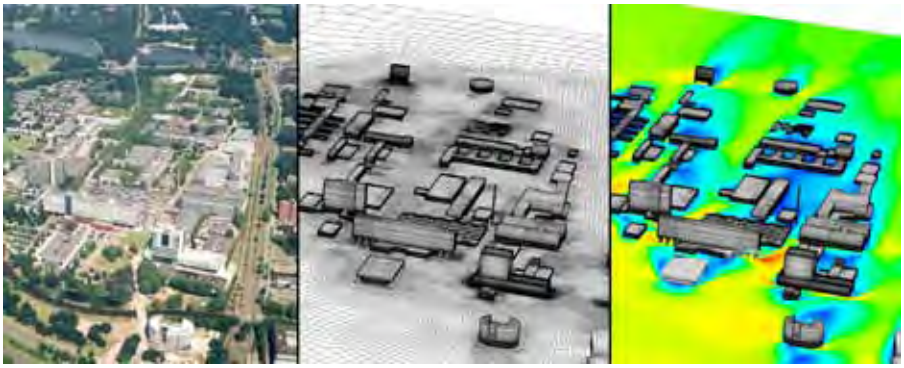

Figure 3: Wind comfort and wind safety study, Eindhoven (Janssen et al., 2011)

Building Physics and Systems. At the Department of the Built Environment, these tasks are concentrated in the Unit Building Physics and Systems. In this unit, the research team of the author mainly focuses on BPS for the outdoor environment, also referred to as "Urban Physics" or, more generally, as "Environmental Fluid Mechanics". Urban Physics is the engineering discipline that deals with physical processes in urban areas, including the transfer of heat, air, moisture and pollutants. Example topics are outdoor air pollution, the urban heat island effect, wind comfort and wind safety around buildings, natural ventilation and wind energy in the built environment. Environmental Fluid Mechanics is a somewhat wider research area that also encompasses topics such as off-shore wind energy, aerodynamics of ships, helicopters and airplanes, etc. It should however be noted that this research group is not the only one at the unit BPS that is dealing with Urban Physics. E.g. the team of Prof. Hensen also deals with energy efficiency in urban areas, the team of Prof. Brouwers also develops and analyses air-purifying pavement materials and the team of Prof. van Luxemburg also studies urban acoustics.

The research team of the author consists of ten PhD students, who work on a fairly wide range of topics in Urban Physics. Many of these students have received recognitions and awards for their work, such as publications in high-quality journals and best paper awards. Ir. Twan van Hooff studies mechanical and natural ventilation at laminar, transitional and turbulent slot Reynolds numbers.

Figure 5: Wind energy roof on Vertigo building (Ferraro and Moonen, 2011)

Among others, he has performed the case study of natural ventilation of the Amsterdam ArenA stadium (see Figure 1) and the study of the Ventec roof© for natural ventilation. His work involves full-scale measurements as well as numerical simulations with Computational Fluid Dynamics (CFD). Ir. Pierre Gousseau from France focuses on air pollutant dispersion in urban areas. He has performed the case study of pollutant dispersion for downtown Montreal, Canada (see Figure 2). His work is targeted at the development and application of CFD techniques for this topic. Ir. Wendy Janssen investigates complex environmental flow processes over heterogeneous terrain by on-site measurements and CFD. She has performed the wind comfort and wind safety study for the Eindhoven University campus (see Figure 3), and she is also involved in the large research project to map the wind environmental conditions for the entire harbour of Rotterdam. Ir. Rubina Ramponi from Italy is performing a bi-doctorate between Eindhoven University and Politecnico di Milano, focused on natural ventilation of buildings in urban areas, which she analyses with wind tunnel measurements and CFD (see Figure 4). Ir. Hamid Montazeri from Iran and Ir. Mike van der Heijden are part of the large research project Climate Proof Cities, which investigates approaches to adapt the Dutch cities to Climate Change. In this project, Hamid studies direct and indirect evaporative cooling of urban areas and Mike studies the relation between outdoor and indoor environment, mainly focused on heat waves and their impacts on the indoor thermal environment of buildings. Ir. Zara Huijbregts investigates the potential effects of climate change on cultural heritage. Ir. Okke Bronkhorst studies wind loads on buildings, more specifically the interference effects between high-rise buildings. Finally, Ir. Thijs van den Brande from Belgium (bi-doctorate with K.U.Leuven) and Ir. Aytac Kubilay from Turkey (ETH Zurich) investigate wind-driven rain on buildings and rain water runoff.

The research team has a strong collaboration with other groups in the unit, and also with other units, in particular with Dr. Faas Moonen and Dr. Rossella Ferraro (Intra-European Marie Curie Fellow from Italy) from the unit Structural Design. Together, we focus on new developments on wind energy in the built environment. Our team has won the University Anniversary Award in the theme Energy, which will be used to build a wind energy roof on top of the Vertigo Building (see Figure 5). From April 2012, a new Marie Curie Fellow from Germany will join our team, Dr. Christof Gromke, with specific expertise in modelling the effects of vegetation on air pollutant dispersion.

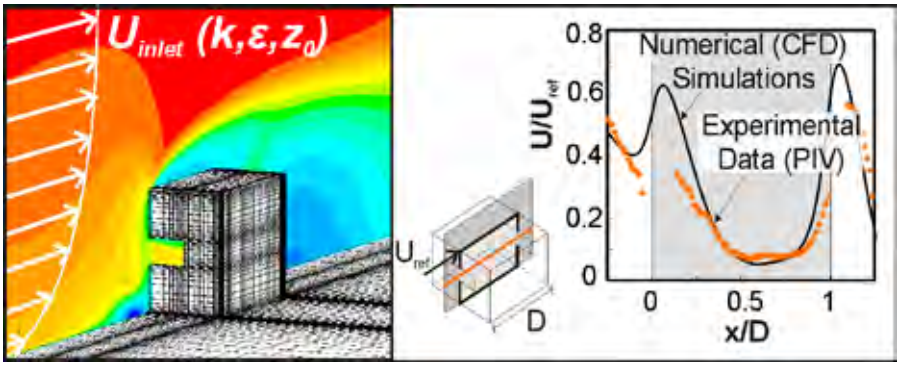

Figure 4: Natural ventilation of buildings (Ramponi and Blocken, 2011)

Apart from PhD student supervision and the above-mentioned collaborations, the author also collaborates with researchers at other universities and other institutes. These include, but are not limited to, ETH Zurich, Delft University, K.U.Leuven, Concordia University, TNO, Deltares, MARIN and NLR. The collaboration with MARIN (Maritime Research Institute in the Netherlands) involves wind environmental conditions in harbours and their effects on ship maneuverability. An example is the study of wind environmental conditions for LNG Carriers in Ria de Ferrol in Galicia, Spain (Figure 6). With MARIN and NLR (National Aerospace Laboratory) we also have a large project focused on developing safe criteria for helicopter landing operations on ships (Figure 7). These can be very dangerous operations, for which no science-based guidelines exist, and in which every year many accidents occur. Our project is intended at the development of science-based guidelines and criteria for safe and practical landing operations.

What does the future hold for our team and for Urban Physics and Environmental Fluid Mechanics at our Department? In line with the philosophy of our University Board and our Department Board, we remain very ambitious in spite of the national budget cuts and the international financial crisis. We are working here in a very stimulating university environment. Our University Board and our Department Board keep working very hard to provide us the best working circumstances possible. In turn, our task is to deliver high-quality teaching and high-quality research. Our team consists of extremely talented PhD students, and we will keep looking to recruit new talented students to join our team. Furthermore, in the past year, we have assembled a small atmospheric boundary layer wind tunnel (cross-section 0.5 x 0.5 m2), that can now be used by our students together with our Laser-Doppler Anemometry system that allows high-resolution measurements in time and space. In addition, in the coming year we will assemble a second and larger atmospheric boundary layer wind tunnel (cross-section 1.5 x 1.5 m 2), which will allow testing at higher Reynolds numbers and higher accuracy. In the meanwhile,

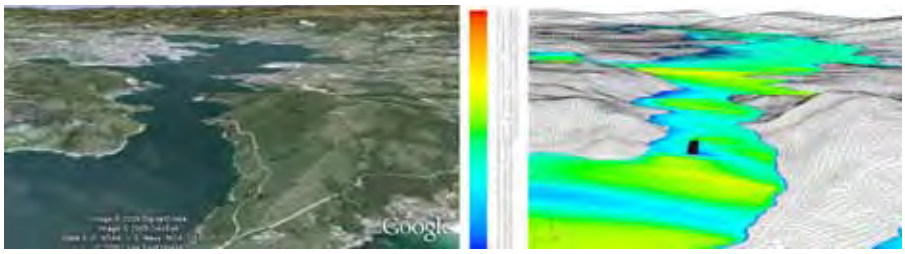

Figure 6: Wind study for Ria de Ferrol, Galicia, Spain (Blocken, 2009)

the Laboratory of BPS keeps extending our computing cluster. While many bachelor, master and PhD students here might take these facilities for granted, it should be noted that at many universities worldwide, students are not allowed or not able to use these kind of facilities.

In conclusion, while there is always bad news, certainly these days, there is also a lot of good news. Our Department of the Built Environment is increasingly and successfully building a strong reputation as a Research Department, rather than only an Education Department. Every year, our Department and our Unit are expanding with more PhD students, and concerning our Unit, we hope this trend will also incur more MSc students. The quality of the MSc and PhD students at our Unit is and remains very high and our graduates generally have a wide range of options. They are wanted by consultancy companies, construction companies, government organizations and so on. It is also important to realize that there are and will be opportunities for our graduates at universities, including our own university. Because, whatever the economic circumstances, whatever the financial problems, the need to educate (y)our society will always remain.

Durf jij in een dynamische situatie een sprong te wagen?

BAM Techniek is op zoek naar talentvolle, ambitieuze collega's die willen samenwerken aan innovatieve en duurzame oplossingen. Collega's die 'techniek in hun genen' hebben en verder willen kijken dan wat voor de hand ligt. Wij moedigen je aan om anders te denken en te handelen.

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PHD

By Miruna Florea

Let's start with the basics. So far, you know my name is Miruna and that I'm doing a PhD in the BPS unit and... well, that's about it, really. So I'll start by shedding some light on the bigger picture. Better start at the beginning... here are the basics:

I am a chemical engineer specialized in construction materials. I grew up in Bucharest, Romania and that's also where I finished by Engineering Diploma (which is the equivalent of a Bologna-system MSc title). I came to the Netherlands a little over 3 years ago to start my PhD in the University of Twente in the group of Prof. Brouwers, and in September 2009 I moved to the TU/e.

Every time I start telling this story (and it happens every time I meet someone, which in my field is rather frequent) this is the exact point when questions start pouring. *Why the Netherlands? Do you like it here? And why building materials- especially given the fact that (if you haven't figured out by now) I am -gasp!- "a girl"??? And why a PhD- isn't it boring, or too much work, or un-practical, or...?*

Ahem. Well, because I was lucky. And because it's interesting. And -to be short- no, no, and no. Now, for the long answers... in reversed order.

For me, a PhD is the most interesting thing I could have done after getting my diploma. I've always been interested in research in pushing the boundaries of what we know and what we can do at least a little bit further. A PhD is in part a job and in part a hobby, because you have to be passionate about what you're doing. That way, it won't feel like work even when you spend long evenings and weekends on it. Well, at least most of the time. I love it when I have the time to spend some hours on just catching up with recent publications in my field, with a cup of hot tea in my hands. At the other end of the spectrum, but just as enjoyable, are the "practice" days, when I get to go and see the production process of one of the materials I'm working on. I'm sure your eyes have already jumped to the funny picture of me wearing safety gear, *but how does a PhD student get to do that? Isn't it all fundamental research and laboratory work and modeling and so on?* Well, again -- no. Or, at least, not in the Building Materials group. And definitely not, if your work involves bringing new materials into the building process. And here we are, finally, I will tell you more about what I'm really doing, and you get to give the answers to some of the questions yourselves.

I have the chance to be involved in a number of projects, all related to the area of sustainability in building materials. *What does that mean?*

Oh good, another question! I'll answer this one with a small story. Let's say you want to build a house, a scenario most of the students of the Built Environment Department can probably relate to. First you need materials, usually natural raw materials. When mining or dredging rivers for them, a certain amount of waste materials is generated. (By the way, these materials are a rather limited resource- keep that in mind for now!). Further on, you will need other man-made materials- like steel, or glass. Their production, in turn, will also generate

solid waste. Let's jump ahead- we use concrete, steel, glass, plastics... and the house is finished, people move in. The waste generated by them will be collected, sorted, partly recycled, and partly incinerated. Again, some waste materials will be left over. Lets now jump ahead even further and the house we've been building over the last paragraph now has to be demolished, generating a large amount of rubble. How many times have I used the word waste in this short story? **Too many**, it's true.

And changing that last answer is the core of my research. I am looking for ways to incorporate solid wastes- coming from mining, from industrial processes, from waste incineration, from demolishing buildings, just to name a few- into new building materials. Or at least to reduce their environmental impact through stabilization techniques- but most times, they find their way back to the built environment.

I guess I could say it in a fancier way, that I'm trying to close the circle. To make sure nothing goes to waste, to landfills or salt mines, but that it becomes useful again, re-entering that cycle. But it does not need a fancy name. It is about being sustainable in using our resources in general, and in building in particular. Did I answer your question about the interesting and practical side of research?

I would like to stress one more thing about the way we work in the Building Materials group and that is, in close cooperation with companies and industry. Remember that funny picture? My colleagues and I visit external facilities and deal with real, practical problems brought to our attention by our partners. It's a great satisfaction to know that the recommendation you made means an optimization in production in just a few short weeks- or the reduction of landfilled materials, or an increase in desirable properties of a product. My colleagues are involved in a number of interesting projects -- self-cleaning or air-purifying materials, high-strength concrete, waste immobilization, durability issues, setting up new test methods, building reactors to synthesize new materials- just to name a few. We try to bridge the gap between science and practice, and the fact that we are always being approached with new issues confirms that we are doing something right.

There are many other aspects which I love about doing a PhD. Perhaps my greatest hobby is travelling and international projects and conferences are a great way to do just that. This year I was involved with an EU-ACP project on cooperation with South- and East-African countries, which took me to Rwanda and Tanzania. I've been to conferences all over Europe, from Portugal to Turkey and from Denmark to Spain and met so many interesting people on the way. I also love teaching and enjoy the time I spend with students sharing my research interests and generating new ideas and approaches.

To answer the first question at the end, thus once again closing a circle -- I'm enjoying my time in the Netherlands. I came here following a job offer which turned out to be much more than I had expected. My personal life soon fell into place when my then-- boyfriend also started a PhD here. Somehow this summer we found the time and energy to organize our wedding, and then travel to the US and Mexico. We still go to Romania a few times a year, thanks to the relatively short distance and the existence of a direct connection from Eindhoven. We travel a lot, work on our house, and split the remaining time between our social life and other nice past times- be it sports, reading, photography or crafts. I'm also involved with the PhD Network Bouwkunde, which is the PhD association of our department (and as you can see, we still know how to have fun). Looking back to what I hoped my life would be the day I first came to the Netherlands, I can honestly say it's all that and more...

Opportunities for extensive energy savings in hospitals

By ir. Ragna Clocquet
consultant sustainable building,
DHV B.V.
Unit Buildings.

How far can you go with energy efficiency in hospitals? Engineering consultancy DHV has performed research on extensive energy savings in hospitals. This study was part of a national research program called Building Brains, which focused on an energy neutral environment. Based on this research and experience with other industries, it seems that hospitals can save energy up to fifty percent. This article describes the approach and results of this study.
The policy in the Netherlands is aimed at reducing energy consumption. In the long term, buildings must even be energy neutral. DHV concludes that even the most energy consuming buildings can take a big step towards energy neutrality.

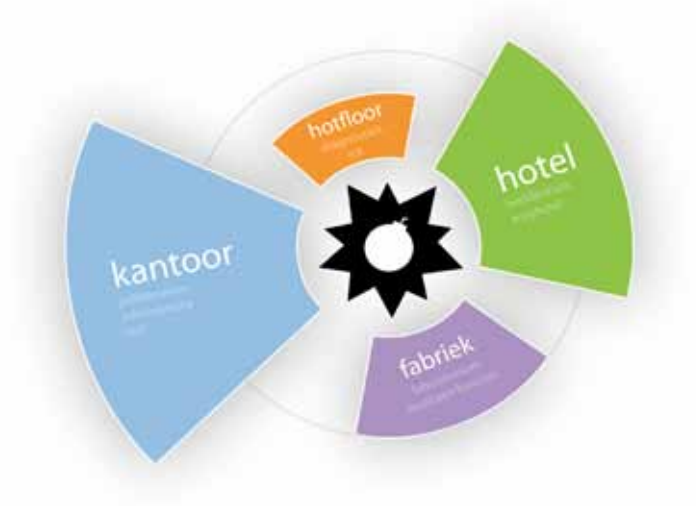

Figure 1: Hospital divided into four housing typologies: hot floor, factory ('fabriek'), office ('kantoor') and hotel.

The study on energy savings in hospitals is partly based on a method called 'schillenmethode [1]'. This method is used for considering investment decisions in hospitals. In this method, functions with similar demands are grouped, with the aim of optimizing the property. A hospital is hereby divided into four housing typologies: hot floor, offices, hotel and factory, see figure 1. The hot floor includes high-tech, capital-intensive functions specific to a hospital. In the hotel, functions are positioned to house patients. Rooms for consults, simple medical examinations and treatment are grouped in the office function. Offices for staff accommodation, administration and management are also included. The factory houses all medical facilities and support.

A NEW PERSPECTIVE

The idea is that the so called 'schillenmethode' not only offers opportunities to financial optimization, but also provides new insights in energy savings. Using this method, it seems to be possible to achieve higher energy savings.

The first step was to calculate the energy use per typology. This seems to be simple, but concrete data on energy consumption per section in hospitals was not available. By the collection and combining of various data, like energy use, the allocation of this and square meters for each function, we made a general breakdown of square meters per category and the associated energy use, see figure 2. The conclusion of this step is that both hot floor and factory have relatively high energy consumption per square meter. The offices generally use 40% of the floor area of a hospital; their energy consumption is just over 25% of the total energy use.

The next step we made was dividing the four categories into sections and associated energy use. Sections of the hotel are for example general nursing, children's care and an obstetric department. Within this category, general nursing is the biggest energy consumer, particularly for heating and cooling. Within the office category, rooms for consults use the most energy.

OFFICE AND HOTEL

From as well national as international studies and practical examples, we know that an office can be built energy neutral. We assume that this is also possible for a hotel. If we translate this information to our research, we can assume that both categories office and hotel can be energy neutral. This is half of the total floor area of a hospital!

In the Netherlands more and more energy neutral offices are being built. An office in a hospital of course differs from a standard office. The office category not only includes standard office rooms, but also waiting areas, consult rooms, plaster room(s) and rooms for medical examination. Yet there are

many similarities and the measures to achieve energy neutrality may be largely applicable to the office functions in hospitals. These measures include thermal storage for space heating and cooling, energy efficient lighting with advanced (daylight) systems, energy efficient ventilation and office equipment and turning off (medical) equipment. Also, the use of renewable energy is possible, such as photovoltaic cells on the roof to generate electricity.

The category hotel contains the staying rooms for patients. These rooms are located near the façade. Therefore, optimizing the façade leads to energy savings for these rooms. There's a substantial demand for energy for space heating. So optimizing insulation and optimal use of passive solar energy, similar to the passive house concept, will reduce this demand of energy for space heating. Sun blinds are necessary to reduce the risk of thermal heating. Sufficient day lighting and advanced daylight systems (this means that lighting is dimmed or switched off as soon as there is a preset level of light in the room) will reduce the energy demand for lighting. As well as for the offices, the roof and façade can be used for renewable energy.

HOT FLOOR AND FACTORY

Energy reduction in the categories hot floor and factory is more difficult. We are dealing with high-tech, highly specific functions. Yet here are also opportunities. Think about turning off medical equipment (if possible), using a corridor as a thermal buffer or using thermal surplus from the hot floor for space heating in another part of the building.

EXTENSIVE COST AND ENERGY SAVINGS

If all mentioned measures are performed, maximum energy saving can be achieved. This means energy neutral hotel and office functions. We assume another 20% energy reduction for the hot floor and factory category. Chart 3 shows these energy reductions. Regarding only the energy neutral office and hotel, an energy reduction of 40% can be achieved. Assuming an additional 20% energy reduction for the factory and the hot floor, an energy reduction of 50% seems to be possible.Energy reduction also leads to cost savings. Looking at an average hospital, almost 1900 MJ primary energy is used per square meter. This means about 25 euro per square meter per year. If we assume a floor area of 30.000 square meters, the energy costs amount to a total of more than 750.000 euro per year. Substantial energy savings result in substantial cost savings.

"an energy reduction of 40% can be achieved."

CONCLUSION

This study shows opportunities for substantial energy reduction in hospitals. If we can find a way to exploit these opportunities, we can take a big step towards energy neutrality even for an energy consuming and specific building such as hospitals!

[1] 'Gebouwdifferentiatie van een ziekenhuis - schillenmethode', College bouw zorginstellingen, Utrecht 2007.

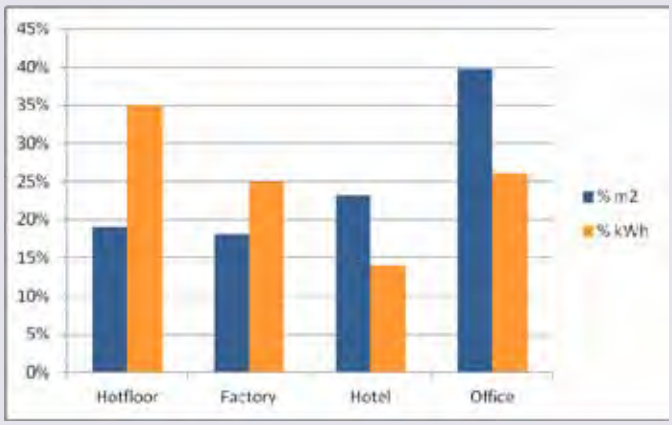

Figure 2: Energy use per typology.

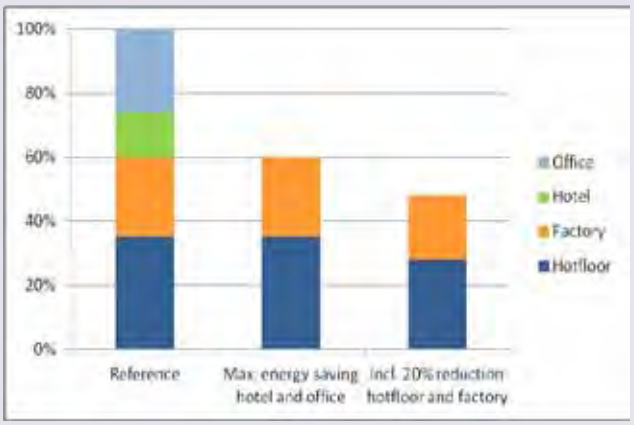

Figure 3: Maximum energy reduction in hospitals.

Alumni board member speaking

Things are changing, or not...

Francesco Franchimon was the president of the 4th board of Mollier. He graduated in 2003 for the education and promoted at the chair of Public Health Engineering for Built Environments. At this moment, Francesco works as Innovation Manager at BAM Techniek.

An integrated program on Building Physics and Building Systems is almost there. According to my information this program will start at September 2012. Although I am disappointed that it will be a Track within the Master of Science Architecture, Building and Planning instead of an independent Master of Science program, this was absolutely unthinkable at my time. Maybe it is good to introduce myself. I am Francesco Franchimon, president of Mollier of the 4th board. Currently Innovation Manager at BAM Techniek. I will tell you, those days things were totally different.

When I started the program in 1998, the Master of Building Services was under pressure. The Faculty of Built Environment decided to cancel this Master of Science program. The main reason, limited number of new students. This was the second time in the short history of the program they intended to cancel the program. The first board of Mollier was exposed to the same situation. This was way before the introduction of the Bachelor / Master structure. At that time the first year, where the propaedeutic diploma could be attained, and the candidate degree were two different programs. There was only a program of Building Services for the candidate degree. As said, the Faculty intended to cancel that program. Therefore the first board of Mollier made an important report about why and how. They offered this report to the Ministry of Education, Culture and Science. For a few years the program remained but it appeared to be only a delay. The retirement of Professor Leijendeckers, the chairholder of Building Services, was taken to cancel the program. We are now in 1999.

Personally I was involved at Mollier since 1999. The 3rd Board of Mollier were seeking for new Board members. Being a board member was the only change to fight for the rights of an own scientific independent program. I knew that the industry was my partner in crime. I had a lot of good contacts with the major companies and also the Dutch association of contracting installing companies and technical retailers were acting as a back-up. This complex situation resulted in an interesting playing field. An opportunity to improve different kind of skills. In fact, it was an impossible job to do but therefore very interesting. Another issue that was important to me, if the program would be cancelled, what will be the value of your own Master's degree. Secondly, if you are graduated and being in the position to recruit young talents this program was absolutely necessary to find the right people. Both issues forced me to become a board member.

> "The Faculty of Built Environment decided to cancel this Master of Science program."

There was one minor problem to be solved, there was only one candidate... Therefore the 3rd board members were willing to stay one year in the board. Lots of experiences were covered. Starting point of the board: no authority inside the university, no sponsors, no grants to cover a lost year, and no independent scientific Master program. The former board members of Mollier didn't had an official suit. This was one of the reasons why Mollier was not taken seriously by other student associations. As you

know, wearing an official suit is an important tradition during formal events. We used the last money to invest in suits. To be honest, we already bought the suits without an approval of the General Assembly. The suits were bought on the budget of Mollier since the board members did not received a grant to cover the lost year. After a very emotional discussion in the General Assembly it was approved. Now we were an association with suit but without money left. Therefore we developed a new sponsorship program with three different categories. We made a database that was filled with all TVVL companies and institutional members. This new sponsorship program was very successful. Within a few months our bank account was loaded. We were the richest student association per student. A third step was to get grants for future board members. The Federation of Student Association of Eindhoven was authorized to divide the grants they received from the university. Since there was a fixed number of grants other association had to give up at least one grant. Lots of official and unofficial meetings passed before Mollier was officially a member of this federation. We needed a campaign the achieve this official membership. Most important was the future of building services. Formally the program was cancelled but with the power of the industry a new scientific Master program was under construction. Finally, a new program was designed by dr. Van Houten. He was new employed and appointed to set up this program. The Ministry of Education, Culture and Science approved the program resulting in an official recognition, formalized by a GROHO number (a central register system of programs). An official recognition means an own identity!

It was a very interesting year. Although it was very intensive, the results were very satisfying.

Today the Master program Building Services will probably end after we lost the Bachelor program already. Most important we are losing our GROHO number and subsequently our identity. The good news: the integration of Building Services and Building Physics is there. However, it would be better to design the new program as a Master program instead of a Track. We lost control.

Many changes have occured, so finally our future is not independent anymore. That's something which has changed for sure.

Start Activity

At the start of the new college year 2011-2012 a special activity was planned. After a long quest, affordable tickets where found to a foreign destination. For a very nice price we were able to go to the beautiful sunny Italian city, Bologna. The weather forecast promised us 20 degrees Celsius and a 100% possibility of sunshine which was very promising for a good weekend.

By Ilse Schoenmakers

Department of Built Environment, Eindhoven University of Technology

On the Friday morning 14th of November we departed at 8.30 AM from Eindhoven with a group of 22 enthusiastic and extremely happy members to Weeze airport, from where we booked a direct flight to Bologna. After some short rides in two super trendy rented Lancia Ypsilons, risking our lives on the Italian highway, the group arrived safe and well within an hour on the camping ground. Five beautiful bungalows and one romantic chalet where waiting for us on the camping. Because the trip to Bologna went much faster than expected, we had a free afternoon on which a large number of culture lovers already went down discovering Bologna. Everybody enjoyed some delicious drinks under the pleasure of the last Italian sunshine of the day. The first evening was completed by a real culinary Italian camping pizza. During this diner and the drink afterward new and old members had the opportunity to better get to know each other.

After a very early rise and shine we travelled in the morning to Bologna by bus. Within 15 minutes the bus transported us from the camping and dropped us at the centre of the city. Nobody can deny that Bologna is indeed a beautiful city. At 1 PM we had an appointment with a number of Italian students of the university who showed us the pretty and nice spots in the city.

We sniffed culture, tasted high quality ice-cream and enjoyed the sunshine. After an intensive afternoon program we went as typical and proud Duchies at the time of 6.30 PM for a bite in a local small restaurant. Pizza, tagliatella, lasagne (which was the specialty by the way) and tortellini (another of their specialties): everybody enjoyed all the Italian delicacies. On a full stomach we had a good evening stroll in the city. Somewhere between sunset and sunrise the group members returned safely back at the camping by taxi.

We had to get up early to catch the plane back to the Netherlands. After a fantastic weekend we had a little bit of bad luck back in Weeze! One of the cars refused to start. Even we, as real technicians, could not solve the problem. Luckily the ADAC lent us a helping hand. Finally everybody got home safe and sound. It can be said that is was a prosperous weekend, giving everyone the opportunity to look back happily on the good time we had back there in Bologna.

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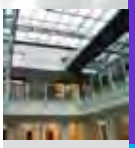

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Nelissen stelt jaarlijks een aantal stage-plaatsen beschikbaar voor studenten van de TU/E. In overleg formuleren we de stage-opdracht, je wordt door ons begeleid en krijgt ruim de gelegenheid om de theorie in de praktijk toe te passen. Tevens bieden wij de mogelijkheid om bij Nelissen af te studeren of om je studie met een parttime baan te combineren.

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MsC and Then ...

Engineer and then? That's a question on which the answer seems trivial during your study. After graduating: you party, work at a company, leave your student house, burn your study books, your master thesis changes into a dust collector and most of all you're glad that you don't have to see our professors, teachers and supervisors anymore. Right?

Written by: Lester van Ree

Engineer and then... you are allowed to put MSc behind your name! Indeed, the presented answer to the question above is correct. After graduating and attending the graduation ceremony, suddenly there are no more obligations. During this time off, it is time to party and recover from the graduation efforts.

After a while, it is time to become serious and find a job. In January, I started working as engineer at the Building Services department of Tebodin Consultants & Engineers BV in Eindhoven. Tebodin offers a range of consultancy and EPCM services (engineering, procurement, construction management) and is mainly active for industry. What I like most about my job is the variety. During the last year I worked on many different projects and subjects. Amongst others, I have been busy for production locations, offices, an innovation centre and clean rooms. The work varies from engineering to being at the construction site. Luckily, (for those who ask themselves why they are studying) it turns out that a master in Building Services offers a good basis to start working. Another nice thing is that I am still in contact with the study association and students for my job. In November of this year I, was able to represent my company on the 'Bouwkunde Bedrijven Dagen' in the Vertigo building. As my work is located in Eindhoven, I left my student house and moved inside the city to a new place. Nowadays, I am still able to play indoor soccer with a 'Mollier' team in the student sports centre.

Amongst the best memories of my study time are the fun and unforgettable activities with Mollier. Especially the (study) trips to places in Austria, Belgium, China, Czech Republic, Denmark, France, Germany, Malaysia, Italy, the Netherlands, Singapore, Sweden, and the United Arab Emirates. Afterwards you start to realize how exceptional these experiences were. Looking back on all these great trips, I guess that my study time activated the traveller inside me. Actually it is true what people say, once you started working there is more money available but less time off. It takes some planning, but it is still possible to travel a lot! Last year, I went to Austria for winter sports with some fellow students and alumni from Mollier. This was such a great trip, that we will go again to Austria next January! During the summer break, I went to Budapest with a friend from my old student house to visit the Sziget Festival and enjoy Budapest.

After my graduation, I chose to stay in the Netherlands. That's one of the reasons why I decided to travel to South East Asia in October. During three weeks, I visited Thailand, Laos, Cambodia and Vietnam with a group of total strangers. This was such a great experience! Laos is not really touristic yet and very colourful as well; the Buddhist Monks are dressed in orange robes and their temples are decorated in bright colours and gold. In Vietnam, the history of the Vietnam War was very impressive and the monsoon season which changed one of our hotels into an island. The climax of the journey was Cambodia. The temples of the old Khmer Empire in Angkor are magnificent! Bangkok was the last stop of the holiday. And then there was even more water, we had to leave the city earlier (evacuation) because of the floods. Nevertheless, it was a great trip!

Engineer and then? Things change, but I can look back on a pleasant and interesting study time during which I learned a lot, had a lot of fun and made friends for life. My advice to you is to enjoy your freedom but also study hard...

And one day, you are also allowed to look back on a pleasant study time and write MSc behind your name!

BTL 2012

Destination: Mumbai

Commission

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Ke Li

Ilse Schoenmakers

Mark de Waard

Richard Claessen

Zuokui Ning

After a late formation period, many fierce discussions, and long deliberation, the destination for this years' foreign trip is set,

Mumbai, India!

The lively and exiting capital of India, with and estimatied population of around 20 million people, offers a great deal of India's traditional culture, oriental cuisine, and of course Bollywood. Besides these features, many interesting historical and modern buildings and strutures are present in Mumbai.

So all the ingredients are present in this destination to make this years trip a memorable, exciting, and of course enriching experience!

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