DYNASTEE

NEWSLETTER ISSUE 2020/15

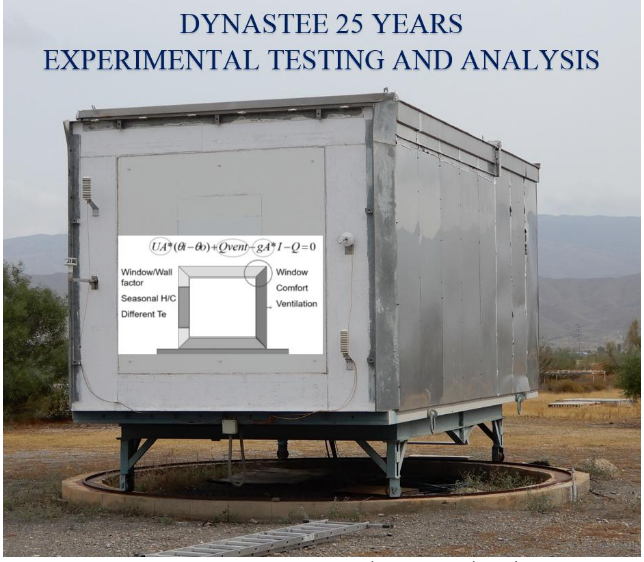
Foreword

DYNASTEE celebrates its 25th anniversary!What started as the PASLINK group in 1994, has evolved gradually into the DYNASTEE network we know today. Below, you'll find an article on DYNASTEE's past and present.

The simulation and measurement of buildings' energetic performance has been and continues to be of great interest. This 15th issue of the DYNASTEE Newsletter contains two articles dealing with the measurement of energetic performances. BBRI is working on methods to improve the traditional co-heating test method. In the CAM(B)BRIDGE research project, co-heating tests and airtightness measurements are executed to develop methods to assess and control the thermal performance of the building envelope at the design and construction phase.

Finally, this issue contains a pre-announcement of the 9th DYNASTEE Summer School on Dynamic Calculation Methods for Building Energy Performance Assessment, which is to be held in Almería, Spain in September 2020.

Twan Rovers, Saxion University of Applied Sciences



DYNASTEE 25 years experimental testing and analysis

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2019 Future of the **DYNASTEE** network

By Hans Bloem, Luk Vandaele

The EU energy research projects PASSYS, COMPASS and PASLINK (1985-1994) created the conditions to initiate the European network of outdoor test facilities, developed outdoor experimental methods, analysis methodologies and simulation techniques. In 1994 it was decided to offer the gained expertise to industry, the research community and standardization bodies which resulted eventually into the European Economic Interest Group PASLINK. The grouping profiled itself as a scientific community of experts on Testing, Analysis and Modelling. Some of the successes have been the research projects PV-HYBRIB-PAS (1998) on the overall performance assessment of photovoltaic technologies integrated in the building envelope, and IQ-TEST (2001), focussing on quality assurance in testing and analysis under outdoor test conditions as well as evaluation techniques of collected in-situ data. In 2005 after ten fruitful years, the PASLINK EEIG was converted into an informal network that today is known as DYNASTEE.

DYNASTEE stands for: "DYNamic Analysis, Simulation and Testing applied to the Energy and Environmental performance of buildings". It is offering a network of excellence and should be considered as an open platform for sharing knowledge with industry, decision makers and researchers on the application of tools and methodologies for the assessment of the energy performance of buildings. DYNASTEE functions under the auspices of the INIVE EEIG and it is open to all researchers, industrial developers and designers, involved in these items. It has been very active in supporting projects such as the IEA-EBC Annex 58 'Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurement' and recently the project IEA-EBC Annex 71 'Building energy performance assessment based on in-situ measurements', applying its expertise on dynamic analysis, simulation and testing that remains an area of high scientific interest. Dynamic analysis methods are techniques to analyse dynamic processes and to identify typical parameters of physical processes like energy flows in buildings.

It is expected that buildings will play an active role in the integration of renewable energies in the energy system. Energy flexible buildings will allow to charge, store and discharge fluctuating energy flows and to manage the energy demand. Smart and intelligent meters and data management systems will play an important role in this transition. Dynamic methods are essential for the energy performance assessment of buildings and imply that smart meters can be used for automated generation of reliable energy labels for buildings. The recent DYNASTEE symposium on "The Building as the Cornerstone of our Future Energy Infrastructure" (10-11 April 2019 in Bilbao) demonstrates the importance of making the network expertise available to other areas of interest.

DYNASTEE organises regular trainings in the form of workshops or Summer Schools, dealing with the application of dynamic methods for outdoor testing, related analysis and modelling techniques. Eight yearly editions of the Summer Schools have trained over 190 people with academic or building technical background. In general it is targeted to energy researchers, engineers, building designers and energy system managers.

Today, the strength of the DYNASTEE network lays in its multi-disciplinary nature of academic and industrial research teams. In addition, the availability of high quality outdoor test facilities at several member organisations offers a direct interaction between realistic experimental testing and dynamic evaluation and simulation. DYNASTEE, being a network of competence in the field of outdoor testing, dynamic analysis and simulation, will continue to offer this service in the future.

For more information please visit the DYNASTEE web site www.dynastee.info where regular published DYNASTEE Newsletters, publications and tools can be found as well.

25 YEARS ANNIVERSARY

Measuring the thermal performances of the building envelope?

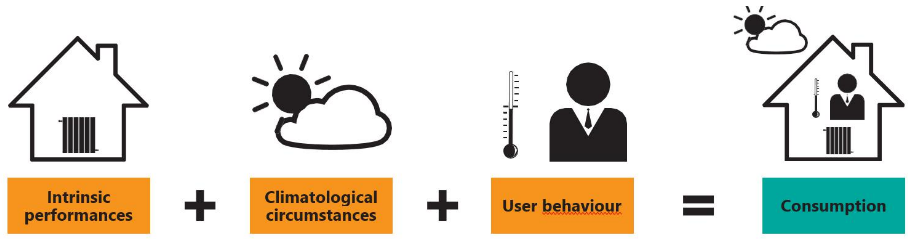
This will soon be possible!

By J. Deltour, ir., Project Manager, Energy characteristics laboratory, BBRI

Measuring the thermal performances of the building envelope would make it easier to assess the actual impact of certain design or execution choices and to determine the crucial points that could improve the actual thermal performances of buildings. In view of the numerous possible applications, research is currently being conducted in order to develop a reliable method of measurement that could be applied on a large scale.

Why carry out this measurement?

The so-called theoretical consumption can be calculated on the basis of the energy performances assessed during the design phase. When the building is completed and com- missioned, this theoretical consumption



is often compared to the measured consumption. However, there are various factors which can distort this comparison, namely:

• the actual use of the building and the climate (when they differ from the hypotheses used for the calculations)

• the quality of execution

• the setting and the maintenance of the systems.

As the intention is to reduce not only the theoretical consumption but also the actual energy consumption in particular, it may be useful to measure the intrinsic performances of the building (the building envelope, without or in combination with the systems), i.e. to measure the performances regardless of the climate and of the use of the building.

The heat loss coefficient is the indicator that results from the measurement of the thermal performances of the building envelope. This coefficient takes the heat losses due to transmission (via the walls) and infiltration (via air leaks) into account.

This measurement offers numerous benefits. For instance, it can:

• help the building professionals to better assess the impact of certain choices (relating to design and execution)

• provide an indication of the quality of the work carried out, which could increase the confidence between clients and construction companies

• in the long term, guarantee performances, regardless of the behaviour of users.

Which test protocol should be followed?

Today, the heat loss coefficient can be obtained by applying the protocol of the classic co-heating test. This test consists of keeping the indoor temperature of the building at approximately 25 °C with the help of an electrical heating system specifically for the test, and to maintain a difference of at least 10 °C compared with the outdoor temperature.

In order to guarantee a reliable and reproducible result, the test must be carried out in an empty building over a fifteen-day period during the heating season, i.e. when there is little solar radiation. The basic principles of the co-heating test are explained in a short video that you can watch by scanning the QR code in the box on the right.

A draft standard is being elaborated in order to be able to standardise this measurement method at a later stage. An initial study has shown that the degree of uncertainty concerning the result is approximately 15% if the entire protocol is followed.

What are the existing options for improvement?

Various options for improvement are currently being investigated in order to make the scope of application of this measurement method as broad as possible:

• the reduction of the test duration (dynamic co-heating)

• the use of the heating system of the building itself (integrated co-heating; see the above-mentioned video)

• the use of connected and wireless measuring devices

• performing measurements, regardless of the season.

Which aspects are currently being investigated?

A lot of research has been carried out in order to respond to these challenges. For instance, the BBRI and the KU Leuven have been studying the possibilities to reduce the test duration as part of the CoDyNi project (dynamic co-heating). Currently, there are two possible options:

• vary the measuring conditions by subjecting the heating system to on/off cycles (instead of setting the indoor temperature at 25 °C)

• apply advanced data analysis methods.

Especially the combination of these two options seems very interesting as it would allow the test duration to be reduced to 4 days (rather than 15 days for a classic co-heating test).

Although the initial results are promising, the dynamic co-heating tests have not yet been standardised. In addition, the reproducibility of the results still heavily depends on the analysis of data. This however, requires a high level of expertise of the ‘operators’.

Regardless of the investigated options for improvement, our research objectives are:

• to establish various measurement protocols for all types of co-heating (classic, dynamic,

In pictures

Scan this QR code by using the camera on your smart phone or a specific application to watch a short video on the co-heating test. The video was made within the framework of the CoDyNi project, subsidized by the FPS Economy and the NBN.

integrated ...) on the one hand, and

• to reduce the required level of expertise of future operators as much as possible, without jeopardising the reliability of the result on the other hand.

Conclusions

In order to enable co-heating tests to be performed on a large scale, the right balance needs to be found between the cost of the test, its duration and the reliability of the results.

Since these measurements are not yet fully developed, it is not desirable to generalise these measurements in their current form. However, carrying out such measurements on a large number of buildings could provide feedback on experience.

It will certainly be possible to learn from this process, not only in respect of the applicability of the measurement but especially also regarding the use of the results to improve the calculation methods or to identify the main points of interest during the execution.

Are you interested in carrying out such measurements and would you like to make your own contribution towards our research on this subject? Please do not hesitate to contact us if you would like to put one of these test protocols into practice.

This article was drawn up within the framework of the CoDyNi project, subsidized by the FPS Economy and the NBN.

This text was originally published in the CSTC Contact 2019/5 (page 8-9) and signed by the engineer J. Deltour, project manager in the "Energy Characteristics" laboratory, BBRI. Only this original article can be cited as a reference.

CAM(B)BRIDGE - Calculation and Measurements in Buildings: Bridging the Gap

By Gabrielle Masy & Denis de Grave (UCLouvain)

The world of construction is subject to growing requirements regarding the quality of buildings and contractors are requiring higher and higher levels of performance for building envelopes. In that context, there is a growing interest in the concept of 'energy performance contracting' defined by the European Directive 2012/27/EU as "a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored during the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings".

Being able to confirm that the obligation of result is achievable and achieved, is the new challenge faced by the construction industry.

CAM(B)BRIDGE is a research project gathering a Belgian construction company (Jacques Delens s.a.) and a university (UCLouvain) in order to develop reliable methods to control the thermal quality of the building envelope at the construction phase, and to assess the building airtightness performance at the design phase.

Assessment of the building thermal quality at the construction phase

The assessment method is based on on-site measurements. The measurement process is targeting the identification of the unit facade Heat Loss Coefficient in collective buildings where the testing of a unit has to be done without accessing the adjoining zones. The proposed measurement process includes 9 days monitoring without occupancy. The units are submitted to co-heating tests. Measurements are carried out on 5 different building sites. Most of the tested units are sun-exposed and benefit from significant solar gains. The data are analyzed through multiple linear regressions and dynamic state space modelling. The analysis tools are developed in connection with the work of IEA EBC Annex 58 and Annex 71.

Assessment of the building airtightness at design phase

The methodology is developed on basis of the analysis of results from on-site measurements. Different blowerdoor tests results were selected to build a database including the characteristics of buildings and aspects related to the implementation of the tests.

Based on in-situ measurements, a database will be created to correlate the description of the geometrical characteristics of the tested volume and the obtained air-tightness values. Statistical analysis tools are used to determine predictive models based on these database.

The project also aims to centralize the design parameters and the measurement results on the test cases in a structured database linked to a Building Information Modeling (BIM) environment. These data will provide the opportunity to analyze more precisely the interactions between building thermal performance and building airtightness, both at the design phase and construction phase.

Measurements made on selected buildings are accessible on line and completed by detailed descriptions of the buildings envelope parameters (https://www.cambbridge-project.be/en/home/). Those high quality data sets are a useful tools for research teams to validate their simulation tools or to develop parametric identification methods in building physics.

The Cam(b)bridge research project is funded by INNOVIRIS, the Brussels Institute for Research and Innovation, grant number n° 2016 R 59a and 2016 R 59b.

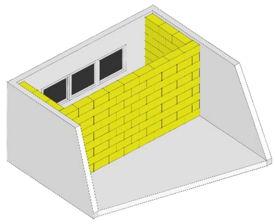


Figure: Measurement set-up (up), pyranometer and temperature probe located in the cavity adjacent to the façade (middle), measurement set-up seen form the zone adjoining the cavity (down).

Pre-announcement Summer School 2020 in Almeria, Spain

By Hans Bloem & María José Jiménez

For the 9th time DYNASTEE will organise a Summer School in 2020 on *Dynamic Calculation Methods for Building Energy Performance Assessment*. More than 190 PhD students and researchers have participated to the 8 preceding Summer Schools and their enthusiastic response has made us to decide to continue organising this dedicated course.

Dates : 8 -16 September 2020; it will be 6 + 1 day for Poster presentation of participants work. The course itself will last 3 days - weekend - 3 days. We have learned that a break is very much welcomed and a social event will be organised during the break.

Venue : CIESOL at the University of Almeria, Spain

Fee : The participation fee will be announced on the www.dynastee.info web-site before the end of March

Accommodation: The organisers will announce a special booking arrangement for early registrations together with the participation fee.

What is new: Arrival during the morning of 8 September. During the afternoon of the first day a get-to-know and poster presentation is scheduled. Participants and lecturers will learn about the work and level of experience of the participants on testing and analysis. Three days will be devoted to linear regression and discrete time methods (LORD) and after the weekend 3 days devoted to continuous time methods (like CTSM-R). The course concept will remain the same as in previous years which means, about half of the time is devoted to lectures and the other half to performing exercises using benchmark data.

Departure during the afternoon/evening of Wednesday 16 September.

Feel free to contact mjose.jimenez@psa.es or hans.bloem@inive.org to be placed on the mailing-list and you will receive updates of the announcement.

Alcazaba Almeria

ABOUT DYNASTEE

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The EU energy research projects PASSYS (1985-1992), COMPASS and PASLINK created the initial European network of outdoor test facilities, developed test methods, analysis methodologies and simulation techniques. It resulted eventually into the PASLINK EEIG network (1994). The network profiled itself as a scientific community of experts on Testing, Analysis and Modelling. In 1998, PASLINK EEIG started a new project: PVHYBRID-PAS, on the overall performance assessment of photovoltaic technologies integrated in the building envelope. The use of the outdoor test facilities in several member states situated in different climates, together with the available expertise on analysis and simulation techniques, offered the ingredients for more successful projects: IQ-TEST (2001), focusing on quality assurance in testing and analysis under outdoor test conditions, as well as evaluation techniques of collected in-situ data. The expertise of the network was also offered to other European projects, such as DAME-BC, ROOFSOL, PRESCRIPT, IMPACT and PV-ROOF.

In 2005, the EEIG was converted into an informal network that today is known as DYNASTEE. It is offering a network of excellence and should be considered as an open platform for sharing knowledge with industry, decision makers and researchers. It has been very active in supporting projects such as the IEA-EBC Annex 58 and more recently the IEA-EBC Annex 71 'Building energy performance assessment based on in-situ measurements'.