FIW München

Annual report 2011

FIW München

Content

Dear readers,

The 2011 Business and Activity Report of the Forschungsinstitut für Wärmeschutz e. V. in Munich (Research Institute for Thermal Insulation) is intended to offer you an overview of the institute's many activities over the past year. One important task was continuation of the investment and refurbishment measures begun four years ago in old and new buildings as well as in the building purchased in 2009. These measures establish the key conditions for the institute to complete its testing and research work much more efficiently – especially considering the gratifying increase in the order volume. I consider it very important to also mention the research activities of the institute here, which are also an important factor in its reputation. More detailed information can be found in this annual report.

Since additional research proposals already exist, I expect good developments in this area during 2012. Moreover, the extensive lecturing, standardisation and committee activities of the scientific employees of the institute described in this report not only ensure a transfer of knowledge into the realms of policy, industry and science but also elevate the reputation of the institute.

The medium-term business plan for the institute approved by the board of directors describes a further increase in the overall productivity of our institute in order to meet rising demand from the market. Accommodating this growth will require adjusting our staffing and workspace resources. Looking forward, I would like to discuss the succession issue concerning the executive management. As is well known, Dr. Gellert is leaving FIW on June 30th, 2012, for reasons of age. His successor is Prof. Dr. Andreas Holm, until August 2011 an employee of the Fraunhofer Institute in Holzkirchen and professor at the Munich University of Applied Sciences. Professor Holm took up his duties at FIW already on September 1st, 2011, in order to begin familiarising himself. As of June 1st, 2012, he will take on the role of general director.

Returning to the year 2011: One event that was very important for the institute in my opinion was the "FIW Thermal Insulation Day" on May 26, 2011, at the "Haus der bayerischen Wirtschaft" in Munich. Our co-hosts for the event were dena, the German Energy Agency, represented by chairman of the board, Mr. Kohler, as well as "Bayern Innovativ", represented by Mr. Schirmer. The large number of participants made clear to me the great interest in the energy turnaround and energy efficiency and how current these topics are to architects, planners, manufacturers in industry, insulation technology companies, the energy economy and policy-makers.

The greatest energy savings potential that can be realised in the short term is known to reside in buildings. As a result, this sector is an extremely important component of a successful energy turnaround.

There are 17 million residential buildings and another 6 million administrative, commercial and cultural buildings in Germany. With a roughly 30% share in the total German energy consumption, these represent an enormous and so far insufficiently tapped efficiency potential. As you will learn in detail in the section of this report on "Public Relations Work", the renowned speakers from the areas of politics, business and science indicated corresponding solutions for realising this potential.

A second focus of the event, in addition to buildings, was to demonstrate opportunities to improve the energy efficiency of operating equipment and plants.

It would be a mistake to believe that energy-efficient working methods or appropriately optimised operational equipment are a given at today's companies. We can be sure, however, that energy efficiency in the broad sense will become a critical competitive factor in the globalised economy of the future. We are therefore unavoidably confronted with core issues such as energy availability and supply security, increased energy costs and

profitability as well as CO2 reduction as an approach to climate policy and environmental impact, alongside all their resulting consequences. CO2 emissions, raw materials scarcity and energy prices are increasingly becoming cost and risk factors.

A market-economy-based environmental approach can improve competitiveness and develop growth markets or contribute to defending one's own domestic markets from others. It is also wise to employ such an approach to increase competitiveness in terms of both material and energy efficiency.

The contributions of our institute therefore coincide with the goal formulated by the European Commission of making Europe's buildings climate-neutral and outfitting them with new technologies for the improved energy efficiency of operating equipment.

If we succeed on this path and overcome the challenges to create a low-CO2 economy and a climate-neutral building population, we will have achieved our goals and lived up to an important social obligation: relieving the broadest sections of the population from the ever-increasing burden of energy costs while also increasing our competitiveness in order to preserve jobs.

Munich, March 2012

Klaus-W. Körner
Chairman of the Board

Energy efficiency of buildings
Gerhard Breitschaft (DIBt)

The energy efficiency of buildings is one of the most important social challenges for today and the future. Nearly 40 per cent of the carbon emissions of industrial nations can be attributed to buildings. Even though considerable efforts have already been made here in the past, the savings potential remains enormous, particularly in the area of existing buildings.

Implementing the national and European climate protection goals requires not only energy-optimised construction but also the development of new and improvement of existing construction products and methods. The German Institute for Construction (DIBt) has long supported innovations in this area by issuing general technical approvals for construction products.

The Research Institute for Thermal Insulation (FIW) also makes important contributions to these evaluations. Whether testing thermal insulation products in the course of the approval process or participating in research, FIW is an indispensable partner to the DIBt. For example, FIW assisted in the approvals for vacuum insulation panels (VIPs), which hinged not only on determination of the basic product properties but also on evaluation of the ageing and thermal bridging properties at the panel joints.

The increasing insulation thicknesses, due in part to requirements of the Energy Conservation Regulation, play a growing role in the issuing of approvals. Here as well, FIW has made important contributions in the form of tests and analyses as well as research on the long-term creep behaviour of insulation materials in perimeter insulation applications under load-bearing foundation slabs.

The representatives of FIW are considered competent experts on the committees of DIBt, and special weight is given to their opinions and years of experience. As an independent testing, monitoring and certification agency for both compliance verification and conformity certification processes, FIW is also a reliable partner to industry and the competent construction supervisory authorities.

With the new Construction Products Regulation entering into effect on July 1st, 2013, to replace the Construction Products Directive, major changes are coming to the construction industry, especially for companies that produce construction products or place them on the market. For example, new developments include the clear obligation to obtain a CE mark if the construction product corresponds to a harmonised technical specification as well as the requirement of issuing a performance declaration for products bearing the CE mark.

Other changes apply to notified bodies such as FIW, which contribute as independent parties to ensuring that construction products have the required properties.

The requirements for notified bodies and the notification process are now regulated directly in the Construction Products Regulation. The Construction Products Regulation is one of the first laws in Europe that expects agencies presenting an accreditation document of the national accreditation body as a verification of competence to have fulfilled the requirements for a notified body. This presumption of conformity applies in cases involving an accreditation according to harmonised accreditation standards and when the accreditation body confirms that the requirements of the Construction Products Regulation have been met.

The member states are expressly granted the option of making accreditation a binding requirement for notification. A legal provision is also in preparation for Germany that should name the German Institute for Construction (DIBt) as a notifying authority. Agencies that want to act in future as independent bodies for evaluating and inspecting the performance and properties of construction products must then apply for notification from DIBt and also submit an accreditation of the Deutsche Akkreditierungsstelle GmbH (DAkks) as verification of competence.

The regulation also contains important changes with regard to the obligations of the notified bodies. Worth mentioning here are the obligation to preserve the principle of proportionality in order to avoid unnecessary burdens on manufacturers and defined information-sharing obligations with respect to the notifying authorities. The notified body may only issue subcontracts with the approval of the customer.

I assume that FIW will remain active as a notified body under the new conditions of the Construction Products Regulation, sharing its extensive experience with other notified bodies and thereby making a major contribution to standardising the conformity evaluations of thermal insulation products.

I am also certain that FIW will continue to provide us with the typically high level of support as we strive to achieve the “zero energy building” according to the European Energy Efficiency Directive.

Gerhard Breitschaft
President
German Institute for Construction (DIBt)

From FIW Munich to "FIW Europe"

Dr. Roland Gellert

"Changes favor only
the prepared mind."
Louis Pasteur (1822 – 1895)

Since the Construction Products Directive of 21 December 1988 entered into force, FIW Munich has participated in many ways in the (politically desired) creation of a European internal market:

- By participating in European and national committees for creating CEN product and testing standards
- Through research activities accompanying the standardisation process
- By sharing information and advising customers in the process of obtaining CE marks for their products, with FIW acting in the function of a "notified body"

This "Europeanization process" (the first set of ten harmonised EN insulation material standards went into effect nationally in 2003) is far from completed. The Construction Products Regulation was passed on March 9, 2011 and published on April 4, 2011; as of July 1st, 2013, this will replace the Construction Products Directive of 1988 and make CE marks mandatory for construction products in all EU countries.

In addition to strengthening the CE mark, special product and structure requirements have been redefined or simply intensified, such as:

- Consideration of sustainability aspects
- Expansion of health and safety aspects
- Increased labelling of construction products, especially with respect to hazardous contents
- Introduction of performance declarations
- Accreditation as a prerequisite for notification

For many years, FIW Munich has been accredited according to DIN EN ISO 17025 for specific testing services (see section 9 of this report).

DIBt and DAkks (German Accreditation Body) currently inform all "candidates" of the future accreditation and notification modalities – FIW Munich will definitely also offer itself in the future as a notified body according to the EU Construction Products Regulation.

The president of DIBt, Mr. Breitschaft, made detailed reference to these new requirements for testing and certification bodies in his guest commentary (found above).

Reference was also made above to an expansion of the health aspects in the new regulation, which involves inter alia the following aspects: "the emissions of dangerous substances, volatile organic compound (VOC), greenhouse gases or dangerous particles into indoor or outdoor air" (EU Construction Products Regulation, Appendix I).

Even though the work in the standardisation committee CEN/TC 351 for creating the (final) relevant testing standards has not yet been completed (although the content is already firmly defined in the predecessor form of the standard, the "technical specifications"), FIW Munich has positioned itself by investing in an emissions testing laboratory to be able to offer the foreseeable testing services to its customers as of mid-2012 (see section 9 "Scope of Services"). The corresponding expansion of the mandate M/103 regarding

“hazardous substances” was already sent by the EU Commission to CEN for implementation some time ago for parallel expansion of the thermal insulation product standards. An associated work programme recommended by the competent standardisation committee CEN/TC 88 is still “waiting” for approval by the EU Commission. The experts of FIW Munich will also contribute to this programme to ensure a rapid revision of the product standards.

These two examples show the path taken by FIW Munich to become an increasingly Europe-focused service provider for the construction industry – all in the interest of satisfying future customer expectations.

Dr. Roland Gellert
General Director

4.1 Association

The association was founded on October 1st, 1918, as the "Forschungsheim für Wärmewirtschaft, München" (Research Centre for Thermal Efficiency, Munich) and was registered on June 21, 1921 in the association registry with the name Forschungsheim für Wärmeschutz e.V. München and the number VR 1925. The institute was given its current name in 1966 when it was renamed to become the "Forschungsinstitut für Wärmeschutz e.V. München" (Research Institute for Thermal Insulation, Munich). The registered office of the institute is München-Gräfelfing, Lochhamer Schlag 4.

The association is exclusively and directly non-profit as defined by the section of the German revenue code entitled "Tax-Privileged purposes".

The purpose of the association is the promotion of science in the sector of thermal insulation.

In particular, the association lives up to its established purpose in the following ways:

- Researching the laws of thermal and material transmission, particularly the scientific basis of heat and cold insulation
- Disseminating this knowledge
- Thermal testing of construction and insulation materials and structures built with them (practical implementations)
- Cooperation with thermal efficiency associations, technical associations and scientific institutions

4.2 General Assembly

The general assembly was held during the reporting period on May 27, 2011, in the "Hotel Vierjahreszeiten Kempinsky" in Munich. The members came from industrial sectors or from other associations and were legal entities or persons interested in FIW's goals.

Talks following the general assembly:

- Vacuum Panel Measurements and Calculations – BBR Research Projects for Optimisation of VIP
Dipl.-Ing. Christoph Sprengard, FIW Munich
- Quality Verification of Insulation Materials – Effectively Combining Monitoring Systems
Dipl.-Ing. (FH) Claus Karrer, FIW Munich
- Third-Party Monitoring of Thermal Insulation: What Can Voluntary System Achieve in the Future?
Dipl.-Ing. (FH) Wolfgang Albrecht, FIW Munich
- Ageing and Design Values of Low-Emission Films
Dr.-Ing. Martin H. Spitzner, FIW Munich

4.3 Board of Directors

The association is represented by the Chairman and the Deputy Chairman of the Board of Directors.

The members of the Board of Directors are elected for a period of three years by the general assembly. Since the elections in the general assembly on May 27, 2011, the Board of Directors has the following composition:

- Klaus-W. Körner, Landsberg, Chairman
- Dipl.-Phys. M. Wörtler, Ludwigshafen/Rh., Deputy Chairman
- Dipl.-Ing. Helmut Bramann, Berlin
- Dipl. oec. V. Christmann, Gladbeck
- B. Deyle, Pliezhausen
- Dipl.-Ing. H. Elter, Munich
- Dr. J. Fischer, Ludwigshafen/Rh.

- J. M. Pradler, Abstatt
- Dipl.-Ing. Marin Schouten, Bremen
- Min. Rat. Dr. W. Schubert, Munich, departed in September 2011 (retirement)
- Dr. rer. oec. W. Setzler, Baden-Baden
- K. Steenheuer, Hanover

4.4 Scientific Advisory Board

In accordance with the association's statutes, the Scientific Advisory Board advises the general management in all matters of scientific and research policy; it makes recommendations on research topics, research funding and ensuring research quality.
It is composed of the following members:

- Prof. Dr. Nabil A. Fouad, Hanover
- Prof. Dr. G. Hauser, Munich
- Prof. Dr.-Ing. G. Hausladen, Munich
- Min.Rat Dipl.-Ing. H.-D. Hegner, Berlin
- Dr.-Ing. E.-G. Hencke, Düsseldorf
- Prof. em. Dr. Dr. habil. Dr. h. c. G. Wegener, Munich

4.5 Institutional organisation

General Management	Dr. rer. nat. R. Gellert
Deputy	Dr.-Ing. M. Zeitler
Institute director	Prof. Dr. A. Holm (as of 09/2011)
- Quality management	Dipl.-Ing. R. Alberti
- Calibration and measurement technology	T. Winterling
- Device manufacturing project management	M. Guess (as of 08/2011)
Accounting and human resources	Dipl.-Betrw. R. Opp (dept. head)
Insulation in building construction	Dipl.-Ing. (FH) W. Albrecht (dept. head)
	Dipl.-Ing. (FH) R. Hirmer
	Dipl.-Ing. (FH) C. Karrer
	Dipl.-Ing. (FH) S. Koppold
	Dipl.-Phys. S. Sieber
	Dipl.-Ing. (FH) J. Uhrhan
	Dipl.-Ing. (FH) S. Kutschera (as of 02/2011)
Industrial insulation	Dr.-Ing. M. Zeitler (dept. head)
	Dipl.-Ing. R. Schreiner
	Dipl.-Ing. R. Alberti
	Dipl.-Ing. K. Wiesemeyer (as of 04/2011)
Building physics and structural elements	Dr.-Ing. M. H. Spitzner (dept. head)
	Dipl.-Phys. J. Cammerer
	Dipl.-Ing. C. Sprengard
	Dipl.-Ing. (FH) H. Simon

Prof. Dr. A. Holm

Dipl.-Ing. K. Wiesemeyer

4.6 Manpower

The association has the following employee statistics:

	31 Dec. 2011	31 Dec. 2010	Average 2011	Average 2010
Permanent, full-time employees	50.0	43.0	45.7	40.7
Permanent, part-time employees by performance	7.1	7.9	7.3	7.8
Temporary workers by performance	2.3	2.3	2.3	3.7
Total	**59.4**	**53.2**	**55.3**	**52.2**
Part-time employees by person	10.0	11.0	10.3	10.1
Number of permanent employees in partial retirement	1.0	1.0	1.0	1.0

Since April 1st, 2005, the work week has been 40.0 hours.

Service milestones

- 10 years of service
  Dipl.-Ing. (FH) Renate Hirmer
  Dipl.-Ing. Christoph Sprengard

- 15 years of service
  Uwe Glöß
  Christian Rank

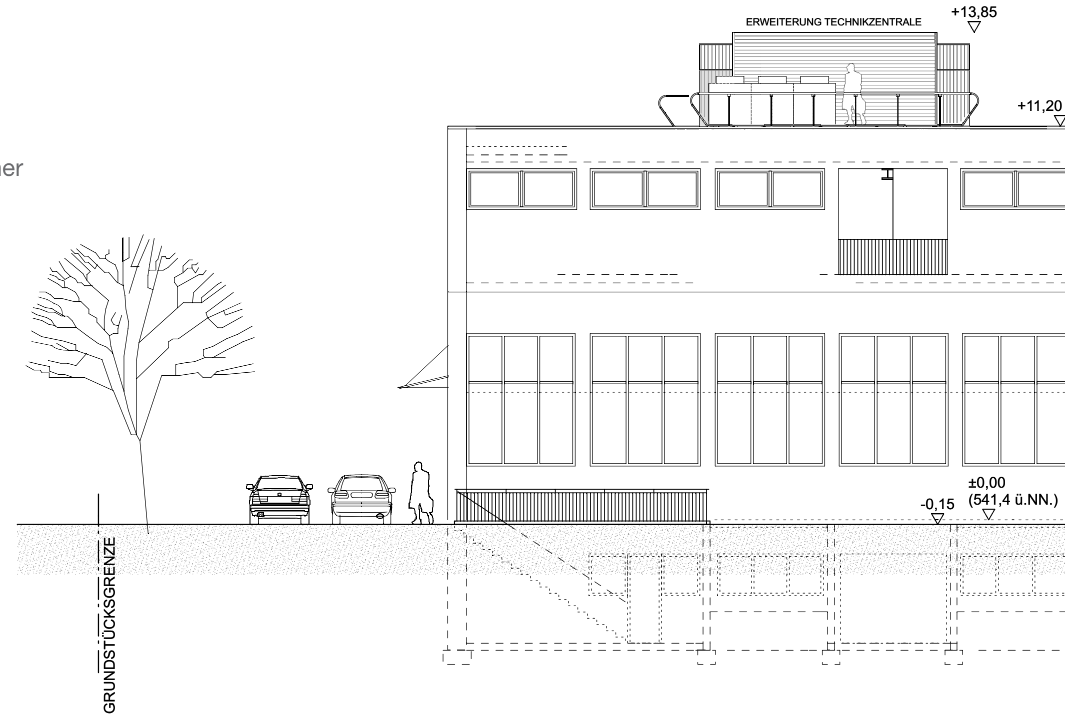
- 20 years of service
  Thomas Fischer

- 25 years of service
  Rainer Künzl
  Dipl.-Ing. Roland Schreiner

- 30 years of service
  Dipl.-Ing.(FH) Wolfgang Albrecht
  Sonja Preußer

- 35 years of service
  Gerhard Treiber

- 40 years of service
  Dr.-Ing. Martin Zeitler



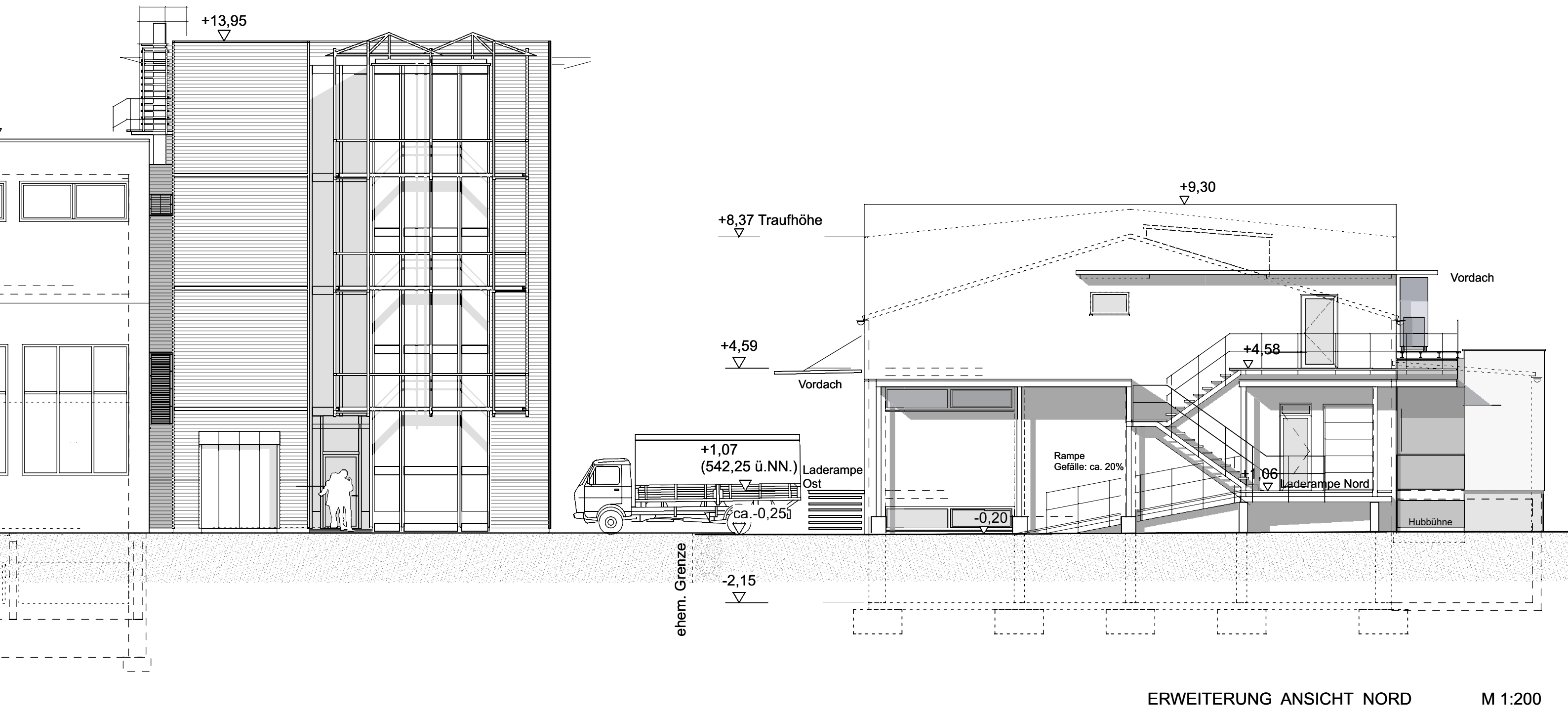
Institute building

4.7 Land ownership

FIW is owner of a property in Gräfelfing, Lochhamer Schlag 4, with a gross area of 2,609 square metres. A building from the year 1965 (BT 1) is situated on this property and was expanded in 1997 with an annex (BT 2). This building complex was completely renovated in recent years. The building services and the air-conditioning and ventilation equipment in particular was adapted to meet current technological developments.

In 2009, FIW purchased the property in Gräfelfing, on the street “Am Kirchhölzl”. The two properties were merged and registered under parcel no. 901 in the land register of the District Court of Munich for Gräfelfing, page 10110. This increased the property area from 2,609 square metres to a total of 4,495 square metres. The appreciation of the neighbouring plot took place on the September 24th, 2009.

The property contains a building (BT 3) from the year 1964 with 1,665 square metres of storage space and 240 square metres of office space. The northern storage area was renovated further in 2011 and adapted structurally to the logistics requirements (goods receipt, storage and disposal of large volumes of insulation).



Extension building

5.1 Regular members

According to Article 5 of the association statutes, natural or legal persons as well as groups or associations interested in the purpose of the association may become regular members.

The following companies were admitted according to the statutes in the General Assembly of 27th of May 2011:

- Schütz GmbH & Co. KGaA, Selters
- Topox-foam S.L., Vallmoll, Spain
- Giessener Dämmstoffe GmbH, Heuchelheim
- Flumroc AG, Flums, Switzerland
- Aspen Aerogels, Inc., Northborough, USA

The following companies have punctually announced termination of their membership as of the end of 2011:

- DOW Deutschland Anlagengesellschaft mbH, Ahlen plant

List of members:

- 3i International Innovative Insulation S.A., Athens (Greece)
- AEROFLEX GmbH, Ulm
- Gebr. Allendörfer - Betonwerk GmbH, Gießen-Lützellinden
- aprithan Schaumstoff-GmbH, Abtsgmünd
- ARMACELL GmbH, Münster
- Aspen Aerogels, Inc., Northborough (USA)
- AUSTROTHERM GmbH, Waldegg (Austria)

- KARL BACHL GmbH & Co. KG, Röhrnbach
- BASF SE, Ludwigshafen
- BASF Polyurethanes GmbH, Lemförde
- Bau-Fritz GmbH & Co. KG, Erkheim
- Baustoffwerke Horsten GmbH & Co. KG, Friedeburg
- Bayer MaterialScience AG, Leverkusen
- Bilfinger Berger Industrial Services GmbH, Munich
- BIS OKI Isoliertechnik GmbH, Pforzheim
- BOHLE ISOLIERTECHNIK GMBH, Gummersbach
- Brohlburg Dämmstoff- und Recyclingwerke GmbH & Co. KG, Andernach
- BUNDESVERBAND PORENBETON, Berlin

- Celotex Limited, Hadleigh (Great Britain)

- Deutsche Amphibolin Werke, DAW Stiftung & Co. KG, Hirschberg-Großsachsen
- Deutsche FOAMGLASÒ GmbH, Schmiedefeld
- Deutsche Isolahn Werke GmbH, Jever
- Deutsche Rockwool Mineralwoll GmbH & Co. OHG, Gladbeck
- Dieckhoff GmbH, Moers
- DOW Deutschland Anlagengesellschaft mbH, Eschborn
- DUNA-Corradini S.p.A., Soliera-Modena (Italy)

- EDILTEC SRL, Modena (Italy)

- Fachverband Wärmedämm-Verbundsysteme e.V., Baden-Baden
- FIBRAC ISOLANTI S.p.A, Carru (Italy)
- FIRO GmbH, Warstein
- FLUMROC AG, Flums (Switzerland)
- Forschungsvereinigung “Kalk-Sand” e.V., Hannover
- FRAGMAT TIM d.d., Lasko (Slovenia)

- G + H ISOLIERUNG GmbH, Ludwigshafen
- Giessener Dämmstoffe GmbH, Heuchelheim
- glapor Werk Mitterteich GmbH, Mitterteich
- Gonon Isolation AG (SA), Schleitheim (Switzerland)
- Grupor® Kunststoffwerk Katzbach GmbH & Co. KG, Cham-Katzbach
- Güteschutzgemeinschaft Hartschaum e.V., Celle

- HAACKE Energie-Effizienz GmbH + CO. KG, Celle
- Hauptverband der Deutschen Bauindustrie e.V., Berlin

- IIG Industrieisolierungen GmbH, Gelsenkirchen
- IsoBouw Dämmtechnik GmbH, Abstatt
- L’ISOLANTE K-FLEX S.r.L., Roncello (Italy)
- Innolation GmbH, Lauingen/Donau
- ISOQUICK GmbH & Co. KG, Niederzissen
- IVH – Industrieverband Hartschaum e. V., National Quality Assurance Department, Heidelberg
- IVPU – Industrieverband Polyurethan-Hartschaum e.V., Stuttgart

- JACKON Insulation GmbH, Steinhagen
- JOMA-Dämmstoffwerk GmbH, Holzgünz
- JUNG & EBERLE Dämmtechnik GmbH, Bietigheim-Bissingen

- KAEFER ISOLIERTECHNIK GmbH & Co. KG, Bremen
- Kaimann GmbH, Hövelhof
- Kingspan Insulation B. V., LL Tiel (Netherlands)
- KLB KLIMALEICHTBLOCK GMBH, Andernach
- Knauf Dämmstoffe GmbH, Wadersloh
- Knauf Insulation Technology GmbH, Ferndorf (Austria)
- Knauf Insulation SPRL, Vise (Belgium)
- Körner, Klaus-W., Munich
- Kolektor Missel Insulations GmbH, Fellbach
- KORFF & Co. KG Isolierbaustoffe, Dietzenbach
- Korff Isolmatic Sp.z.o.o., Sobotka (Poland)

- LACKFA Isolierstoff GmbH + Co., Rellingen
- Landesinnungsverband des Bayerischen Zimmerer-handwerks, Munich
- LAPE Srl, Empoli (Italy)
- Lindner Isoliertechnik & Industrieservice GmbH, Arnstorf

- Monier Braas GmbH, Oberursel
- Münzinger + Frieser Holding GmbH, Reutlingen

- NAFAB GmbH, EPS-Schaumstoffe, Bonn

- PAROC GmbH, Hamburg
- PHILIPPINE GmbH & Co. Dämmstoffsysteme KG, Bochum-Gerthe
- PITTSBURGH CORNING EUROPE SA/NV, Lasne (Belgium)

- ReadyTherm Maschinen-Dämmung GmbH, Essen
- Georg Rimmele KG, Ehingen (insolvency proceedings)
- ROCKWOOL INTERNATIONAL A/S, Hedehusene (Denmark)
- Rockwool BV, Roermond (Netherlands)
- RYGOL DÄMMSTOFFE Werner Rygol GmbH & Co. KG, Painten

- SAGER AG, Dürrenäsch (Switzerland)
- SAINT-GOBAIN ISOVER G+H AG, Ludwigshafen
- SAINT-GOBAIN Construction Products CZ a.s. Division Isover, Castolovice (Czech Republic)
- Saint-Gobain Rakennustuotteet OY, Hyvinkää (Finland)
- Saint Gobain Rigips GmbH, Düsseldorf
- SCHLAGMANN Baustoffwerke GmbH & Co. KG, Zeilarn
- SCHÜTZ GmbH & Co. KGaA, Selters
- SCHWENK Dämmtechnik GmbH & Co. KG, Landsberg
- Sebald Iso-Systeme GmbH & Co. KG, Sinzing
- SIRAP INSULATION SrL, Verolanuova (Italy)
- STEINBACHER Dämmstoff Ges.m.b.H., Erpfendorf (Austria)
- Storopack Deutschland GmbH & Co. KG, Metzingen
- Styron Deutschland GmbH, Schkopau
- swisspor AG, Steinhausen (Switzerland)

- Technoform Bautec Kunststoffprodukte GmbH, Fuldabrück
- TEKTON-Werk GmbH, Neudenau-Siglingen
- Thermaflex International Holding B. V., AM Waalwijk (Netherlands)
- Thermal Ceramics de France SAS, Wissembourg (France)
- THERMOPOR ZIEGEL-KONTOR ULM GMBH, Ulm
- TOPOX-FOAM S.L., Poligono Industrial “EL Mas Vell”, Vallmoll/Tarragona (Spain)
- TROCELLEN GMBH, Troisdorf

- ÜGPU Überwachungsgemeinschaft Polyurethan-Hart-schaum e.V., Stuttgart
- UNIDEK Gefinex GmbH, Steinhagen
- UNION FOAM S.p.A., Bellusco (Italy)
- UNIPOR Ziegel Marketing GmbH, Munich
- Uponor GmbH, Ochtrup
- URSA Deutschland GmbH, Leipzig

- VARIOTEC GmbH & Co. KG, Neumarkt

- Wienerberger GmbH, Hanover
- Wilhelm Brohlburg Kunststoff- und Kaschierwerke GmbH & Co. KG, Andernach
- WKI Isoliertechnik GmbH, Berlin

- Xella Technologie- und Forschungsgesellschaft mbH Emstal, Kloster Lehnin

- Zentralverband des Deutschen Baugewerbes, Berlin
- Zentralverband des Deutschen Dachdeckerhandwerks e.V., Cologne
- ZERZOG GMBH & CO. KG, Ottobrunn
- Ziegelwerk Bellenberg Wiest GmbH & Co. KG, Bellenberg
- Ziegelwerk EDER GmbH & Co. KG, Peuerbach-Bruck (Austria)

5.2 Honorary members

According to Article 5 of the statutes, scientifically trained persons in prominent public and private positions can become honorary members as well as persons who have done special service to the research institute.

The voting honorary members in 2011 were:

- Dr.-Ing. Joachim Achtziger (General Director until 2000)
- Dr. Walter F. Cammerer (General Director and Scientific Director until 1985)
- Heinz Gass (formerly Deputy Chairman)
- Univ.-Prof. (em.) Dr.-Ing. habil. Dr. h.c. mult. Dr. e.h. mult. Karl Gertis (professor emeritus for construction physics at the University of Stuttgart)
- Peter Hefter (formerly Chairman)
- Prof. Dr.-Ing. Hans-Gerd Meyer (long-standing member of the Scientific Advisory Board)

Total voting members on January 1st, 2012: 111

5.3 Membership of FIW Munich in institutions

- American Society for Testing and Materials (ASTM), Philadelphia
- DIN Deutsches Institut für Normung e. V., Berlin
- DKV Deutscher Kälte- und Klimatechnischer Verein, Stuttgart
- DVM DEUTSCHER VERBAND FÜR MATERIALFORSCHUNG UND– PRÜFUNG e. V., Berlin
- Energy Efficient Buildings Association E2BA, Brussels
- FACHINSTITUT GEBÄUDE-KLIMA e. V., Bietigheim-Bissingen
- Fachverband Luftdichtheit im Bauwesen e. V., Kassel
- Forschungsgesellschaft für Straßen- und Verkehrswesen, Cologne
- L'Institut International du Froid, Paris
- Technischer Überwachungsverein Bayern, Munich
- Vereinigung der bayerischen Wirtschaft e. V. vbw, Munich; sustaining member
- VMPA Verband der Materialprüfungsämter e. V., Berlin
- Verein zur Förderung der Normung im Bereich Bauwesen e. V. VFBau, Berlin
- Allianz für Gebäude-Energie-Effizienz, geea, Berlin
- BDI – Initiative "Energieeffiziente Gebäude"

6.1 Completed research projects

Dipl.-Ing. Christoph Sprengard, Dr.-Ing. Martin H. Spitzner

Project title: "Optimisation of the energetic properties and efficiency of VIPs (vacuum insulation panels) through the optimum combination of silicic acid, mineral fibre and EPS insulation materials"

Project managers: Dr.-Ing. Martin H. Spitzner

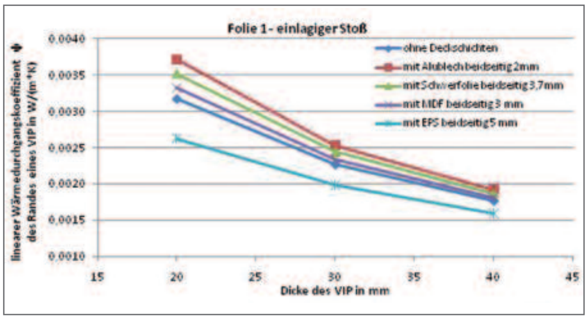
Project processor: Dipl.-Ing. Christoph Sprengard

Research locations: FIW Munich
Industrial partners:
Saint-Gobain G+H Isover AG; Ladenburg
Rigips GmbH; Rheda-Wiedenbrück
Variotec Sandwichelemente GmbH; Neumarkt

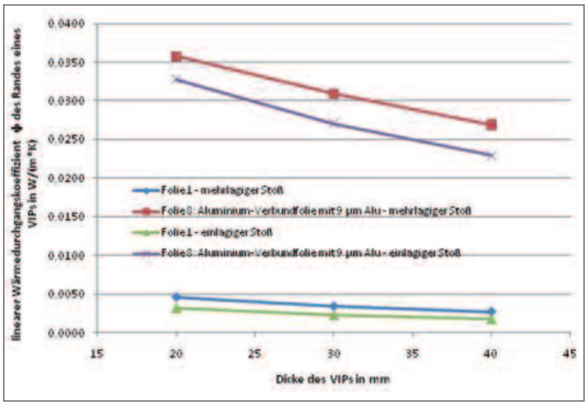
Subsidised by the: Federal Office for Building and Regional Planning (BBR)
(Reference number: Z6–10.08.18.7–08.11 / II 2 – F20-08-1-075)

At this time, only fumed silica is used as the support core in VIPs for construction applications. This project researched the combined use of mineral fibres and fumed silica to improve vacuum insulation panel (VIP) products from an energy perspective and increase their efficiency. Investigations into envelopes and edge designs establish a bridge between the basic panel properties and construction applications.

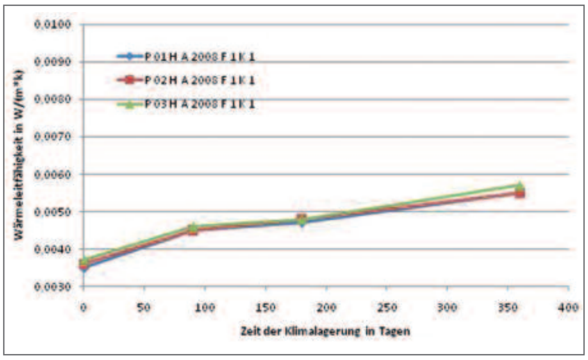
Due to the pore size, significantly lower internal pressures are required in the VIP in order to use support core alternatives other than fumed silica cores. Theoretical considerations and detailed analysis of extensive thermal conductivity measurement series help define conditions for achieving the permeation and ageing behaviour of film envelopes required to use alternative support cores. Supplemental research into the thermal bridge effect at the edge of the panel and on the VIP system takes a thermal perspective on the VIP elements. Vacuum panels are still significantly more expensive than other insulation materials. The production of pyrogenic silicic acid is very energy-intensive and demands elaborate process equipment. The films used are also difficult to produce and therefore expensive as well. The manufacturing process requires many individual steps – particularly when manufacturing the panels to specific dimensions, which still requires mostly manual work. As part of the re-



Linear thermal transmittance of panel edge of VIPs with various cover materials



Linear thermal transmittance of high-barrier and ultra-barrier films



Long-term increase of thermal conductivity for temperature storage of VIPs search project, two designs for new buildings and renovated buildings were investigated with and without VIP in regards to costs and achievable yields.

The metallised films currently available on the market are unsuited for encasing VIPs with support cores whose pore structure is not as small as that of pyrogenic silicic acid. Aluminium composite films have very tight seals, but the thermal bridge effects exhibited at their borders are so large that they cannot be recommended for small or medium panels. There is currently no alternative to pyrogenic silicic acid as a support core material. At best, a portion of the silicic acid could be replaced in the foreseeable future by fibres, or the like, while using films with very good seals. The computational analysis of the thermal bridges at the element borders provided quantitative confirmation of the theoretical considerations relating to the production parameters of VIP envelopes. In addition to the seal quality of the aluminium layers used, the principal factors are the type of border design, the gaps between installed panels and the top layers applied to the VIP. Silicic acid panels can already be used efficiently in new and existing buildings assuming a good yield situation. Several general technical approvals with third-party monitoring are now available for silicic acid VIPs. In addition, a RAL quality mark for vacuum insulation panels has been applied for by several manufacturers. Such quality-assuring and trust-building measures help spread the use of VIP construction techniques.
(completed in January 2011)

Dr.-Ing. Martin H. Spitzner, Dipl.-Phys. Johannes Cammerer

Project title: "Development of a sandwich element with energy accumulation, energy distribution and insulation (SEA)"

Project participants: The Research Institute for Thermal Insulation, Munich (FIW) is working on this research project with the Koschade engineering consulting office, Deggendorf, with professional assistance and financial support from the Forschungsvereinigung Stahlanwendung e. V. (Research Association for Steel Applications) and using funds from the Stiftung Stahlanwendungsforschung (Steel Applications Research Foundation). Supplementary expertise has been obtained from the companies of ThyssenKrupp Steel Europe AG, Elastogran GmbH, Hermann Otto GmbH, Hilti AG, KKT Innovations GmbH & Co. KG with IBB Ingenieurbüro-Andreas Birlenbach and Prebeck GmbH.

Project end: July 2011

Project managers: Dr.-Ing. Martin H. Spitzner with Dipl.-Ing. (FH) Rolf Koschade (Koschade engineering consulting) and Dipl.-Phys. Johannes Cammerer

Content of project:
The project investigates the harvesting of solar energy with a solar collector of industrially manufactured sandwich elements with polyurethane hard foam core and metallic top layers as well as hollow steel sections (trapezoidal sections) affixed to the outside. As these hollow steel sections mounted to all façade and roof surfaces are heated by the sun, energy can be obtained from the heated air flowing through them. The described **S**andwich design with **E**nergy **A**ccumulation, energy distribution and insulation is referred to as "**SEA**" for short, although this is not an established technical term.

The heated air is collected and can be used for room heating or passed through heat exchangers to heat utility water or supply process heat. In addition to harvesting energy, the immediate removal of the heated hair reduces the heating of the building shell, lowering the amount of cooling energy required. In Germany, around 14 million m² of sandwich panels are manufactured and installed annually, while the figure for

Europe is around 130 million m². The sandwich design presented here is particularly well suited for façade and roof elements in industrial and commercial construction.

A test cell is being erected to evaluate the productivity of the SEA system. SEA collectors will be installed on the roof and south wall, with conventional PU sandwich elements mounted adjacent to these for comparison purposes. The test cell will be situated on the roof garden of FIW Munich, where it will be exposed to unshaded sunlight and natural weather conditions. The measurements will be taken from July 2010 to June 2011. The test cell contains an air collector with connected fan for each of the two SEA collectors.

The energy obtained from the heated air is calculated based on the air flow volume and air temperature. In addition, the surface temperatures of the trapezoidal sections and the PU sandwich elements are being measured at 5-minute intervals and the global solar radiation and weather data are also being recorded. The measurements extending over an entire year will be analysed to identify fundamental relationships between the operating parameters of the SEA element. An efficiency curve for the SEA collector will be determined from the data. Combined with the solar atlas of the German Weather Service, this curve will allow calculation of the average expected energy yield for specific regions with any facing or inclination of the SEA collector.

6.2 Current research projects

Dipl.-Ing. (FH) Wolfgang Albrecht, Dipl.-Ing. (FH) Stefan Koppold

Project title: “Long term behaviour of VIPs in bonded applications”

Project sponsor: Deutsches Institut für Bautechnik (DIBt), Berlin

Project end: Expected end of 2012

Project managers: Dipl.-Ing. (FH) Wolfgang Albrecht, Dipl.-Ing. (FH) Stefan Koppold

Content of project:
This research project concerns the advancement of vacuum insulation panels (VIPs), especially improving the scientific understanding of the compatibility between various adhesive compounds typically used in construction.

With the currently produced VIPs, it is generally possible to achieve an initial heat conductivity value of about 0.004 W/(m·K) and a rated thermal conductivity value of 0.007 W/(m·K). In order to ensure this low rated value of 0.007 W/(m·K) over the entire lifetime of 25 - 30 years, the entire envelope, including the weld seams, must exhibit an extremely low leak rate and therefore a very low pressure increase over the entire lifetime.

In recent years, these VIPs are increasingly bonded at the factory to protective layers of wood, plastic, granulated rubber, etc. In construction applications in particular, VIPs come into contact with polymers or alkaline construction materials such as concrete and are subjected to diverse stresses, such as temperature loads and mechanical stresses.

However, the influence of these substances and stresses on the long term behaviour of the high-barrier films is practically unknown.

Project steps:
ift Rosenheim and FIW Munich are therefore jointly engaged in a research project for testing the influence of various adhesives on the longevity of films and welds.

Various VIPs, both bonded and unbonded, are being stored in an accelerated ageing climate, and the effects of the bonding on mechanical properties, internal pressure and thermal conductivity are being investigated.

In a second step, the focus lies on the delayed setting behaviour of two selected alkaline adhesives that are typically used in construction as well as the influence of washed-out salts and moisture on the metallised high-barrier foil.

When completed, the project could result in a classification of various adhesives into those that pose no problems and those that should/must be avoided. The insights obtained here also promote a better material understanding and contribute to the optimisation of vacuum insulation panels, especially with regard to long term behaviour.

Dipl.-Ing. (FH) Wolfgang Albrecht, Dipl.-Ing. (FH) Stefan Kutschera

Project title: "Long-term creep behaviour of EPS and XPS insulating materials under pressure loading in accordance with DIN EN 1606 - round-robin test"

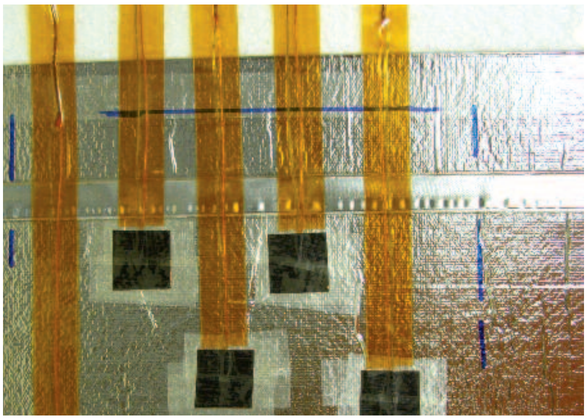
Project sponsor: German Institute for Construction (DIBt), Berlin

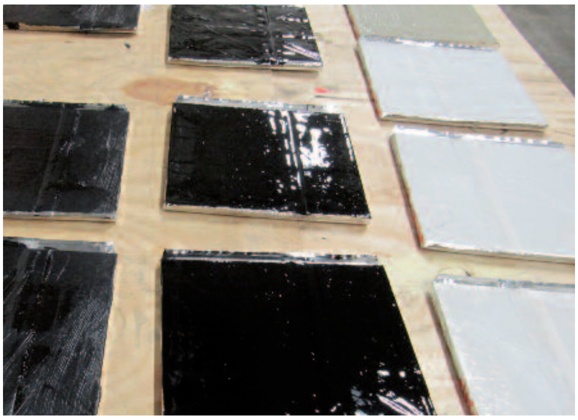
Project end: 2012

Project managers: Dipl.-Ing. (FH) Wolfgang Albrecht

Content of project:
For several years now, thermal insulation has been increasingly used under the load-bearing foundation slabs of buildings. Designers of buildings and the building supervision authorities require "resilient" design values for stability and for the thermal insulation design of buildings.

The standardised test procedure DIN EN 1606 for testing the long-term creep behaviour of thermal insulation and compressive loads has existed since 1997. The standard does not contain any information on the measurement uncertainty of the test procedure. So far, no round-robin tests have been performed for assessing the various influencing factors, such as installation of the test specimen and extrapolation of the measurement results.


Measurement of thermal conductivity of VIP


VIP with different adhesives

In order to rectify this deficiency, DIBt is supporting a round-robin investigation in which five German testing institutes and four manufacturer's laboratories across Europe are participating. FIW Munich is organising the round-robin test, carrying out the preliminary study and evaluating the round-robin test.

Results from EPS samples

The sample selection and preparation are critical for an informative comparison of the creep tests in the participating laboratories. Due to the relationship between bulk density and creep behaviour in EPS, samples were selected for testing from a very narrow bulk density range.

Analysis of the measurement data at a nominal thickness of 100 mm at 8 participating laboratories showed that the measurement value of 7 laboratories lied within a range of ± 0.13 mm. At a nominal thickness of 300 mm, the measurement values of the 3 participating laboratories fell within a range of ± 0.08 mm. This corresponds to relative deformations from 0.1% to 0.2%.

These low measurement value distributions are excellent considering the tolerances that are typically expected in construction. The measured distributions of the extrapolated deformations of 0.1% to 0.2% can also be considered very low in relation to the permissible deformations for insulation materials under foundation slabs of 2% to 5%.

It was therefore possible to prove that the test methods according to EN 1606 in the thickness range 100 mm to 300 mm yield easily comparable, reproducible measurement values, given careful sample selection and preparation as well as a sufficiently stable room climate.

The results of this round-robin test offer designers and evaluators at public authorities and industrial enterprises the assurance that the measurement methods can produce measurement values of the required precision and reproducibility.

Not covered here are material variations and possible errors in sampling and sample preparation.

Previous results from XPS samples

The last part of the research project saw investigations into the extremely complex creep processes of XPS rigid foam. Due to the existence of various cell gases (caused by varying propellants), the influencing factors are more varied and, in particular, time-dependent. A parameter study investigated the various parameters such as thickness, bulk density, compressive strength over the width, flatness of surface/foam skin and change in compressive strength over time.

In a second step, a round-robin test is currently being performed on XPS panels and should provide information about the various parameter influences and the associated measurement uncertainty. So far, the round-robin test has been running for 5000 hours. An evaluation of the interim results is currently under way. The final analysis is expected by the end of 2012.

Conclusions from the results to date

Based on the various measurement logs and analyses, it is possible to draw several conclusions that could enter into a revised edition of EN 1606 in order to make the test standard easier to use and promote more reliably informative test results.

The individual observations support the following recommendations:

- The application of the load and determination of the first measurement value after 1 minute should be described more precisely.
- Instruction that the number of measurement values and time intervals must be complied with very precisely; otherwise, different results can be expected during the extrapolation.
- The start of analysis for the extrapolation should be delimited more precisely.

- Sample selection and grinding/milling of the samples should be described in more detail since they can have enormous consequences on the test result.
- The influence of temperature fluctuations, linear expansion and the need for a climate-controlled environment must be added to the test standard.

Dipl.-Ing. Christoph Sprengard

Project title: "Influence of block geometry, mortar and moisture on the equivalent thermal conductivity of masonry walls with good thermal insulation properties"

Proposer: FIW Munich

Project managers: Dipl.-Ing. Christoph Sprengard

Project sponsor: German Institute for Construction (DIBt), Berlin

Project end: Jan. 2013

Content of project:
The equivalent thermal conductivity of masonry walls has been lowered significantly in recent years thanks to major progress in production technology and now lies almost at the level of insulation materials. Improvements in the blocks, however, have considerably increased the impact of systematic influences on the equivalent thermal conductivity, such as the type and dimensions of mortar joints, grip recesses and thumb holes, block dimensions and moisture content. For some products, this means influences that could previously be neglected because they did not worsen the U-value of the wall by more than 3% may now need to be considered (e.g. adhesive in aerated concrete wall, grip recesses, thumb holes, etc.). For this reason, the existing research results must be expanded. The project should investigate whether certain "threshold U-vales" can be determined as of which the above influences must be considered.

A number of procedures are used for converting the equivalent thermal conductivity of masonry walls to other block dimensions and other mortar types: e.g. 3-dimensional and 2-dimensional numerical analyses according to DIN EN ISO 10211, conversions by the simplified procedure in DIN EN ISO 6946 and area-proportional conversions as well as table-based procedures, such as in DIN V 4108-4. The results sometimes differ widely. Within this project, the procedures should be compared with regard to precision. Measurements on half blocks, block material and entire walls will be performed to verify the procedures.

Many highly insulating masonry blocks are now produced with a filling of insulation material. For insulation materials and masonry blocks with insulation materials, however, the thermal values are determined according to different procedures. This project should investigate whether and under what conditions it is possible to harmonise the procedures for determining the rated values for the thermal conductivity of masonry walls and insulation material.

The influence of the statistical factors (e.g. depending on the scope of random sampling) and moisture (for application of the e-functions from DIN EN ISO 10456 with DIN EN 1745) on the equivalent thermal conductivity and the U-value of masonry walls will be investigated based on sample calculations. A recommendation should also be prepared on how the procedures and designations in DIN EN 1745 can be better depicted in DIN V 4108-4.

Project title: "Development of permeation measurement technology for determining the critical gas permeability for vacuum insulation panels (VIPs)"

Proposer: Fraunhofer Institut für Werkstoff und Strahltechnik (IWS), Dresden

Second research site: FIW Munich

Project sponsor: Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) within the Federal Office for Building and Regional Planning (BBR)

Industrial partner: variotec GmbH & Co. KG in Neumarkt, Opf.

Project end: 2012

Content of project:
Thanks to their low thermal conductivity and minimal space requirements, vacuum insulation panels (VIPs) are a highly attractive alternative for buildings in high-priced locations, whether for new buildings or for the renovation of existing ones.

The longevity is primarily determined by the barrier properties of the envelope film used. Even very low gas permeation rates through the foil (through the surface and at the seal seams) result in a pressure increase in the VIP, causing its thermal conductivity to rise considerably.

In the interests of targeted material and technology development, the use of a precise and highly sensitive measurement methodology is essential for more accurate measurement of permeation rates and to allow film products as well as seal seam types to be compared directly with each other.

To date, comparative film studies were performed almost exclusively based on indirect investigation of the thermal conductivity on entire panels.

In this research project, the new permeation measurement system based on laser spectroscopy developed by Fraunhofer IWS, Dresden, should be used for the first time in evaluating the film and further developed for measurement of the seal seams.

Detection sensitivities of P<10-5 gram H2O per m^2 and day permit reliable statements about the long term behaviour of VIPs and their further development as the basis for better products and as a foundation for the standardisation process of VIPs at the international level, which is now under way.

Investigation methodology:
The films to be investigated are clamped into a two-chamber permeation cell. Sealing strategies were developed that prevent damage to the film and reduce measurement errors. The measurement of multi-layer seal seam areas in particular demands an adaptation of the sealing strategy. By establishing a defined moisture level in the first chamber, it is possible to measure the concentration of the permeated water vapour in the measurement chamber based on the attenuation of a laser beam passing through the measuring cell. Based on the sample size and measuring cell parameters, the concentration can be converted into a permeation rate for the material. The permeation investigations are being carried out by the Institute for Material and Beam Technology (IWS) in Dresden.

The thermal investigations and accelerated ageing of the films are being performed at FIW Munich. For this purpose, the thermal conductivity of VIPs with various barrier films and seal seam types are measured in fresh and artificially aged conditions. The permeation-related ageing influences are determined and compared with the rates measured directly on the films and seams. From this, it is possible to derive the fresh permeation rates of VIPs. Maintaining these rates should ensure the thermal insulation quality of VIPs over the desired useful life of 30 to 50 years. The inclusion of the industrial partner Variotec GmbH & Co. KG ensures that the results of the project will directly enter into further development of the panels.

Dr.-Ing. Martin Zeitler, Dipl.-Ing. Karin Wiesemeyer

Project title: Potential energy savings with technical insulation materials in industry and commercial applications

Project managers: Dr.-Ing. Martin Zeitler, Dipl.-Ing. Karin Wiesemeyer

The research project is being funded by the Bavarian State Ministry for Economy, Infrastructure, Transportation and Technology.

Initiator: State Union of Bavarian Construction Guilds (Landesverband der Bayerischen Bauinnungen – LBB)
Bavariaring 31
80336 Munich

Industrial partners and supporters:
Armacell GmbH, Münster; Bilfinger Berger Industrial Services, Munich; Peter Baum GmbH, Munich; COM CAD Burghardt GmbH, Hiltenfingen; Deutsche Rockwool Mineralwoll GmbH & Co. OHG; European Industrial Insulation Foundation (EiiF), Gland, Switzerland; Kaimann GmbH, Hövelhof; Knauf Insulation Sprl, Vise, Belgian; Landesverband der Bayerischen Bauinnungen (LBB), Munich; Sebald ISO-Systeme GmbH & Co KG; Saint-Gobain ISOVER G+H AG, Ludwigshafen

Partner companies: Forschungsgesellschaft für Energiewirtschaft mbH (FfE GmbH)
Dr.-Wi.-Ing. Serafin von Roon
Am Blütenanger 71
80995 Munich

COM CAD Burghardt GmbH
Richard Burghardt
Krautgartenweg 1
86856 Hiltenfingen

Scientific-technical support and platform for knowledge transfer:
VDI GEU
Dr.-Ing. Ernst G. Hencke
VDI-Platz 1
40468 Düsseldorf

Project support and platform for knowledge transfer:
Bayern Innovativ
Cluster Management Energietechnik
Constantin Schirmer
Dr. Robert Bartl
Gewerbemuseumsplatz 2
90403 Nuremberg

Content of project
The energy demands of operating equipment and plants in industrial and commercial enterprises amount to roughly 40% of Germany's total energy consumption. The objective of the research project is to assess the savings potential from insulation on operating equipment and plants. Based on a systematic study of selected existing plants and facilities, a practical, computer-aided methodology for relatively simple yet systematic facility surveys should be devised.

The goal of the research project is to develop a calculation procedure that takes into account the specified perspectives and forms the basis for meaningful and sustainable energy renovation measures, thereby establishing the prerequisites for economical and environmental protection from heat and cold. To depict the heat losses via thermal bridges, a thermal bridge catalogue will be developed for operating facilities. A calculation tool for mobile electronic devices will also be developed that is suitable for efficient but effective recording of the existing conditions and as well as for new construction.
More information about the project can also be found in the Business and Activity Report 2010.

Project status
The software tool for surveying existing facilities is complete and can be installed and run on a tablet PC.

Forschungsgesellschaft für Energiewirtschaft mbH, various industrial partners as well as FIW Munich itself have already visited numerous operating facilities and inspected the facilities or their system components with regard to total heat loss.

The range of conditions found was extremely broad, ranging from plants with no or completely insufficient insulation to plants with insulation urgently in need of repairs and plants with fully intact thermal insulation.

It was even possible to perform energy evaluations on a few plants both before and after renovation measures.

Forschungsgesellschaft für Energiewirtschaft mbH analysed as-built plans to determine the total thermal losses of the individual operating locations. Some of the operating locations were subjected to a detailed analysis in order to estimate the savings potential. (Figure 1)

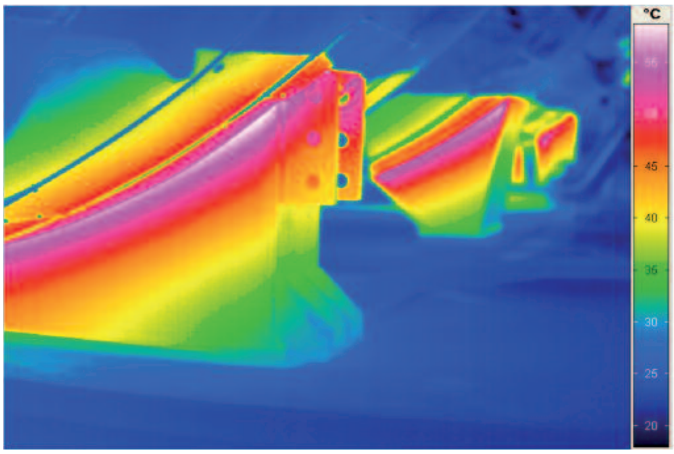


Figure 1: IR image of the uninsulated support of a boiler during operation

Measurement and calculation procedures were developed at FIW for determining the heat loss flow coefficients of components.

Fittings, flanges and pipe clamps were measured with and without insulation on the “hot box pipe” test bench; a test pipe with a diameter of 324 mm was used to investigate various bearing structures.

Finite element methods as well as analytical equations for heat transfer were used to produce a calculated estimate of the energy losses.

The results of the measurements and computations are being evaluated for plausibility with the regression analysis according to VDI 2055 page 3. An adjusted value will be determined so that the desired heat loss flow coefficients can be stated with a credible level of uncertainty. (Figure 2)

The heat loss flow coefficients will be compiled into a thermal bridge catalogue (VDI 4610 page 2) as formulas and approximate table values.

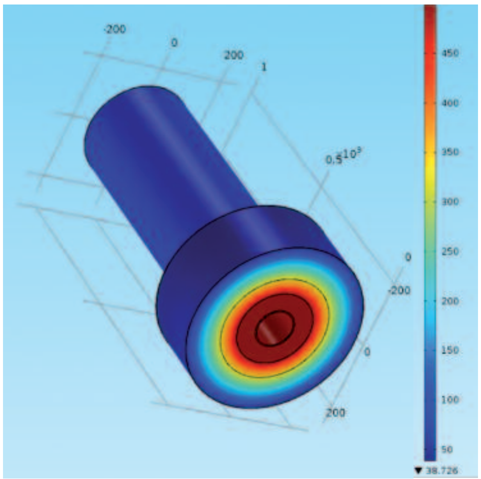


Figure 2: Insulated flange in finite element analysis

The developed calculation procedure for optimising a multi-layer insulation structure and the procedure for determining optimal insulation were taken directly from the guideline VDI 4610, page 1.

The energy savings potential corresponds to the reduction of heat losses through energy renovation. In existing facilities, this is the difference between the heat losses before and after renovation. In new facilities, the potential between two different design criteria is calculated, such as between an insulation thickness determined according to technical operational perspectives and one determined according to financial perspectives.

The energy savings from better insulation are highly individual and depend on numerous factors. A savings potential relevant to the initial value can only be credibly calculated from a holistic consideration of the heat loss across all plant components. It is therefore useful to apply a specific value for the heat loss flow as an indicator for evaluating the quality of an insulation measure.

Another important result of the research is the recommendation to evaluate the effectiveness of the insulation via energy efficiency classes. This assumes a system component that evaluates the heat loss via the insulation system and the heat loss of its parts. The diagram in Figure 3 shows a rough depiction of the energy efficiency classes.

- If the facility walls are completely uninsulated or insufficiently insulated, the insulation is classified in energy efficiency classes G or F.
- If all facility walls are insulated, but parts such as fittings and flanges are uninsulated, the applicable energy efficiency class is E.
- Class D has been achieved when all facility walls have insulation designed according to technical operational perspectives and all parts are insulated.
- The state of the art is energy efficiency class C. Here, the facility walls are insulated at least with the economical thickness or according to the Energy Conservation Ordinance (EnEV). All parts are insulated.
- In order to achieve energy efficiency class B, the same insulation as in energy efficiency class C can be used, the parts (e.g. flanges, fittings) must be insulated such that their heat loss flow corresponds to the heat flux density through the insulation (optimally insulated parts).
- For energy efficiency class A, all facility walls and parts have optimal insulation. In addition, all bearings and suspension mounts have also been optimised from a thermal insulation perspective.

Project end: May 2012

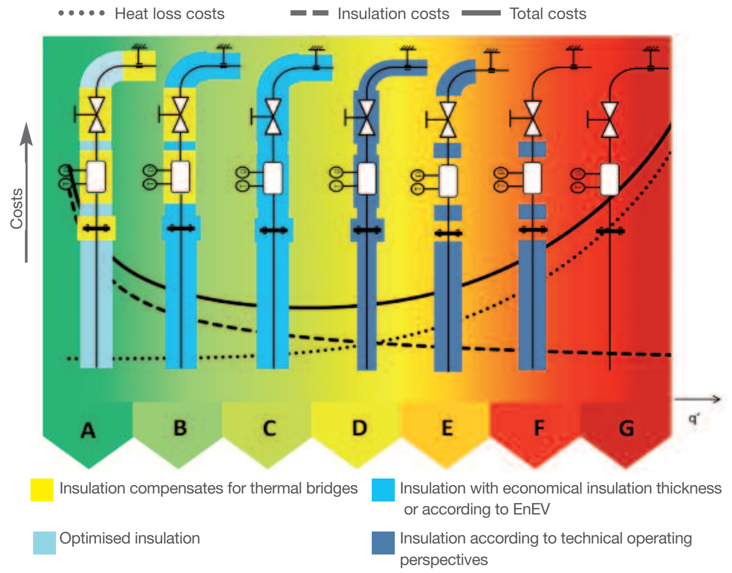


Figure 3: Energy efficiency classes of insulation based on longitudinal heat loss flow

6.2.2 Additional research topics
Dipl.-Ing. (FH) Wolfgang Albrecht

- Thermal, moisture-related investigations of thermal insulation materials with new, more environmentally friendly additives
  Industrial contract

- Inspection of the ageing allowances for foam plastics with cell gases other than air for other thicknesses and propellants
  Industrial contract

- Investigations of the behaviour of flat roof insulation panels under dynamic compressive loads
  Industrial contract

- Thermal, moisture-related and mechanical investigations of insulation materials with “nano-structures”
  Industrial contract

7.1 Participation in committees and other bodies

Dipl.-Ing. R. Alberti

GSH

The GSH working committee PUR In-Situ Foam (casting foam) is revising the quality and testing provisions for water/CO_2-driven polyurethane in-situ foam produced at the construction site for heat and cold insulation on operating equipment and plants (RAL-RG 710/7)

IVPU

Technical committee of the polyurethane rigid foam industrial association

ÜGPU

Technical committee (evaluation of the third-party monitoring results of ÜGPU)

IVH

Technical committee (definition of the monitoring process, advising on results and the certification body)

Dipl.-Ing. (FH) W. Albrecht

DIN NABau

NA 005-56-60 AA Thermal insulation materials
NA 005-56-92 AA Performance indicators and required conditions for thermal transmission; rated values of thermal conductivity (DIN V 4108-4) and minimum requirements for thermal insulation materials (DIN 4108-10)
NA 005-56-98 AA Thermal measurements

CEN

TC 88/WG 1 General test methods – ad hoc group ageing (rapid ageing method for XPS, PUR, PF)
TC 88/WG 7 Phenolic Foam
TC 88/WG 12 Expanded Perlite Boards

CEN CERTIFICATION

SDG 5 Thermal Insulation Products TG λ - Expert Group (creation of a uniform thermal conductivity level for insulation materials in Europe)

DIBt

SVA-A Construction materials for heat and sound insulation
SVA-B1 Thermal conductivity
SVA-B3 Exterior thermal insulation
Ad hoc committee: Load-bearing thermal insulation of high thickness under foundation slabs
ABM colloquium of fire protection laboratories
Exchange of experience in thermal insulation-related measurements (EWM)
Exchange of experience between testing, inspection and certification bodies, foam plastics and wood wool
Exchange of experience between testing, inspection and certification bodies, mineral wool

Dipl.-Phys. J. Cammerer

DIN NABau

NA 005-56-93 AA Air sealing
NA 005-56-99 AA Moisture (Sp CEN/TC 89/WG 10)
NA 005-02-07 AA Prefabricated accessories for roofing (Sp CEN/TC 128/SC 9)
NA 005-02-09 AA Waterproof sheeting (Sp CEN/TC 254)
NA 005-02-91 AA Flexible sheeting under roofing materials (Sp CEN/TC 254/WG 9) (Convenor)
NA 005-02-92 AA Sarking boards (Sp CEN/TC 128/SC 9/WG 5) (Convenor)
NA 005-02-10 AA Roof sheeting and vapour barriers (Sp CEN/TC 254/SC 1)
NA 005-02 FBR Steering committee FB 02 – sealing, moisture protection
AA DIN 18530 Solid ceiling structures for roofs (suspended)

DIN Certco

ZA-UDB Certification committee for sarking membranes and underlay sheeting for roofing (Convenor)

CEN

TC 128 Roof covering products for discontinuous laying and products for wall cladding
TC 128/SC 09 Prefabricated accessories for roofing
TC 128/SC 9/WG 05 Rigid underlays (Convenor)
TC 254 Flexible sheets for waterproofing
TC 254/WG 09 Underlays for discontinuous roof coverings (Convenor)

ISO

TC 163/SC 01/WG 07 Ageing of thermal insulation

Dr. rer. nat. R. Gellert

DIN NABau

NA 005-56-FBR Thermal insulation (steering committee 06) (Deputy Convenor)

NA 005-56-60 AA Thermal insulation materials (SpA for CEN/TC 88, ISO/TC 163 and ISO/TC 61) (Convenor)

Ad hoc 16 conformity process

CEN

TC 88 Thermal Insulating Materials and Products (Convenor)

TC 88/WG 16 Evaluation of Conformity

TC 88/TG "Liaison to TC 350/351" (Convenor)

Notified Bodies-CPD/SG 19 Thermal Insulation Products

CEN CERTIFICATION

SDG 5 – KEYMARK Thermal Insulation Products

GSH

Quality committee

Prof. Dr.-Ing. A. H. Holm

ASHRAE

TC 1.12 Moisture Management in Buildings

TC 4.4 Building Envelope Performance and Building Materials

TC 9.3 Transport Air Conditioning

SPC 62.2 Ventilation and Acceptable / AQ in Low-Rise Residential Buildings

SPC 55 Thermal Environmental Conditions for Human Occupancy

SPC 160 Criteria for Moisture Control Design Analysis

Dipl.-Ing. (FH) C. Karrer

DIN NABau

NA 005-56-60 AA Thermal insulation materials

CEN

TC 88/WG 1 General Test Methods

IVH

TAA (technical working committee)

Dipl.-Ing. R. Schreiner

CEN

TC 88/WG 10 Building equipment and industrial installation (Convenor)

TC 88/WG 10 Building equipment and industrial installation – Task group Test methods TGTM (TG – Leader)

TC 89/WG 11 Thermal performance of buildings and building equipment – Task group 1 Measurements of thermal conductivity at high and low temperatures

prCEN/TS 15548-1:2007

Thermal insulation products for building equipment and industrial installations – Determination of thermal resistance by means of the guarded hot plate method –

Part 1: Measurements at elevated temperatures from 100 °C to 850 °C

QAC (Quality Assurance Committee)

CEN/VDI Keymark scheme for thermal insulation products for building equipment and industrial installations, the voluntary product certification scheme (deputy chairman)

Dipl.-Phys. S. Sieber

DIN NABau

NA 005-56-60, Ad hoc 04 EPS

NA 005-56-60 AA, Ad hoc 09 wood wool panels

CEN

TC 88/WG 4 Expanded Polystyrene Foam (EPS)

TC 88/WG 4 / Drafting Panel

TC 88/WG 4 / TG ETICS

TC 88/WG 4/TG Test Methods and Test Results

TC 88/WG 9 Woodwool (WW)

TC 88/WG8 Cellular Glass (CG)

GSH (Güteschutzgemeinschaft Hartschaum [Rigid Foam Quality Association])

Working committee for polystyrene (AAPS)

Dipl.-Ing. (FH) H. Simon

GSH

GFA-PUR – Joint technical committee polyurethane roofing injection foam and polyurethane injection foam

Dr.-Ing. M. H. Spitzner

DIN NABau

NA 005-56-20 GA Energetic assessment of buildings (DIN V 18599, inter alia).
NA 005-56-90 HA Thermal insulation and energy saving in buildings (SpA to CEN/TC 89 and ISO/TC 163) (Convenor) (standard series DIN 4108, inter alia).
NA 005-56-91 AA Thermal transport (SpA to ISO/TC 163 SC 2 WG 9) (Convenor). DIN 4108-2, DIN 4108 Supplement 2, DIN specialist report "4108-8 Avoidance of mould in residential buildings", inter alia).
NA 005-56 FBR "KOA 06 Energy savings and thermal insulation" (Deputy Convenor) (steering committee)

CEN

TC 89 Thermal performance of buildings and building components.
TC 89/WG 12 Reflective Insulation Materials
TC 371 Project Committee on Energy Performance of Buildings

ISO

TC 163 Thermal performance and energy use in the built environment.
TC 163 WG 4 JWG 163/205 Energy Efficiency of Building using holistic approach
TC 163 SC 2 WG 9 Calculation of heat transmission

Dipl.-Ing. C. Sprengard

DIN NA Bau

NA 005-56-97 AA Transparent structural elements
The committee reflects the work of ISO/ TC 163/ SC 1/ WG 14 at the national level, among other activities

ISO

TC 163/SC 1/ WG 14 Hot-Box Test Method for windows and doors
This workgroup is concerned with the hot box measurement standards for construction elements. The committee is currently suspended
TC 163/ WG 5 Vacuum Insulation Panels (VIPs)
This workgroup is developing an international standard for measuring the thermal properties of vacuum insulation panels (VIPs)

Dipl.-Ing. Karin Wiesemeyer

VDI

Guideline committee VDI 4610
Guideline committee VDI 4662
Technical committee "Energy Application"
Steering committee: "Energy Efficiency of Operating Equipment" (Convenor: Mr. Körner)

Dr.-Ing. M. Zeitler

DIN NABau

NA 005-56-10 AA "Insulation work on building equipment and industrial installations"
NA 005-56-69 AA "Insulation materials for building equipment and industrial installations"

CEN

CEN/TC 088/WG 10 "Building equipment and industrial installations"
CEN/TC 089/WG 03 "Calculation of thermal insulation of equipment in buildings"
CEN/TC 107/WG 10 "Flexible pipe systems for district heating"

CEN CERTIFICATION

SDG 5/TG 5 (VDI-AG "Quality Assurance"/Keymark) Thermal Insulation Products for Industrial Installations with various ad-hoc workgroups

VDI

VDI AG "Quality Assurance" VDI 2055 (Chairman)
Guideline committee VDI 2055 (Convenor)
Guideline committee VDI 4610 (Convenor)
Technical committee "Energy Application"
Steering committee: "Energy Efficiency of Operating Equipment" (Convenor: Mr. Körner)
VDI- Gesellschaft Energie und Umwelt (VDI-GEU) technical division 3

AGI (Arbeitsgemeinschaft Industriebau)

AGI worksheets of series Q

Central Association of the German Construction Industry (HDB)

National technical department for heat, cold and sound insulation and fire protection: Technical committee (TA)

German Construction Federation (ZDB)

Society for the Promotion of Insulation Technology: Consultancy and Internet circle

7.2 Quality assurance of insulation materials
Quality Assurance Committee

Members of the Working Group VDI Gütesicherung and the Scheme Development Group 5 as the founding committee of the QAC

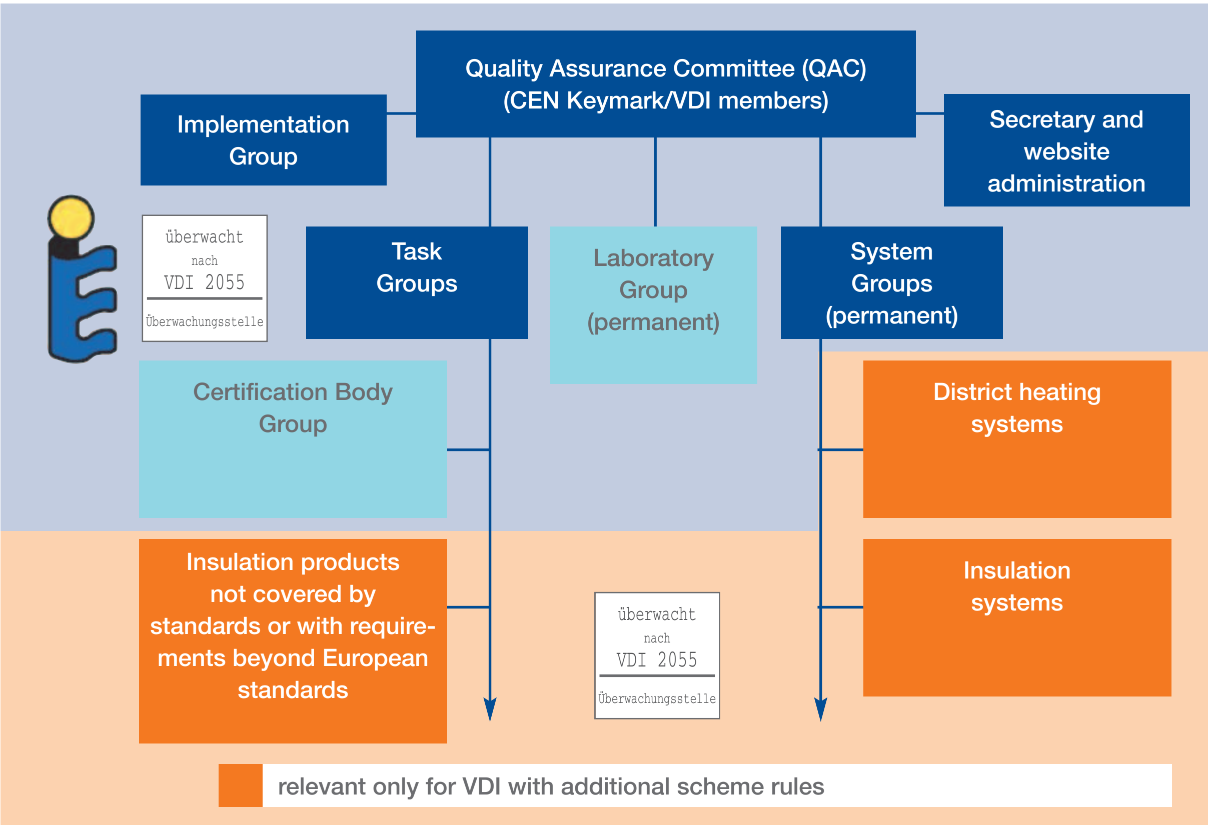
The QAC – Quality Assurance Committee – was established on July 12, 2011, as the first European technical body in VDI and is also backed by the CEN Certification Board.

The committee is dedicated to the certification of insulation materials for industrial installations according to European standards. These insulation materials can receive either the Keymark of CEN or the mark “Überwacht nach VDI 2055” (monitored according to VDI 2055). By agreement between CEN and VDI, both marks are recognised as equivalent. Exclusively the VDI mark will be employed for monitoring the properties declared by the manufacturer in the case of new types of insulation materials that are not yet covered by European standards.

In the future, the committee will also become involved with the certification of entire insulation systems and create a body of rules for this purpose.

On July 12th, Erik Rasmussen of Rockwool International was elected chairman of the QAC, and Roland Schreiner of FIW Munich was elected deputy chairman.

Organisation of the QAC



8.1 Presentations

■ **Dipl.-Ing. (FH) W. Albrecht**
Third-Party Monitoring of Thermal Insulation Materials: What Can Voluntary Systems Achieve in the Future?
FIW General Assembly on 27 May 2011 in Munich

■ **Dr. rer. nat. R. Gellert**
Presentation of the PROGNOS study "Economic Evaluation of the Energy Conservation Ordinance 2009"
Session of the vbw Building Renovation workgroup on October 28th, 2011, at the Haus der Bayerischen Wirtschaft in Munich

■ **Prof. Dr.-Ing. A. H. Holm**
Energy efficiency made in Germany
21 October 2011, Greenville Ohio (USA)

The uncertainty hypothermal insulations
25 October 2011, San Antonio, Texas (USA)

Drying masonry
05 November 2011, 22nd Hanseatic Renovation Days in Heringsdorf

Climate change demands new ways of thinking
09 November 2011, Tegernsee city

Quality assurance in construction work – instruments for high-quality concrete repair
21 November 2011, Dena – Congress 2011 – Berlin

■ **Dipl.-Ing. (FH) C. Karrer**
"Quality Verifications for Insulation Materials – Effectively Combining Monitoring Systems"
FIW General Assembly on 27 May 2011 in Munich

"High-Performance Insulation Materials for High Efficiency Construction Elements"
Research Day of ift Rosenheim on 8/9 November 2011 in Osnabrück

■ **Dipl.-Ing. R. Schreiner**
Workshop "Certification Procedures"
18 October 2011, Garching

■ **Dipl.-Ing. (FH) H. Simon**
Interior Insulation – Physical Principles
International Craftsmanship Fair on 16 March 2011

Roller Shutter Housings in Existing Buildings – Evaluation and Renovation Options
Expert conference in Rosenheim on 18 March 2011

Roller Shutter Housings in Existing Buildings – Halving Energy Losses
Bauzentrum München on 12 November 2011

Thermal Bridge Examples in Reveal Insulation and Roller Shutter Housings – Thermal Renovation of Roller Shutter Housings in Existing Buildings
Cham Architects' Day on 25 November 2011

■ **Dr. -Ing. M. H. Spitzner**
Lecture "Presentation of the New Lime Sandstone Thermal Bridges Catalogue – What consequences do thermal bridge calculations have on the Energy Conservation Ordinance?" as part of the Lime Sandstone Construction Seminar 2011
31 Jan. Aachen, 1 Feb. Cologne, 2 Feb. Neuss, 3 Feb. Duisburg, 7 Feb. Dortmund, 8 Feb. Bielefeld, 9 Feb. Paderborn, 10 Feb. 2011 Münster

Lecture "DIN Technical Report 4108-8: 2010-09: Avoiding Mould Growth in Residential Buildings – Background and Objectives" as part of the Aachen Construction Expert Days 2011
12 Apr. 2011, Aachen

Introductory Lecture on the Continuing Education Event "Avoiding Mould Growth in Residential Buildings – Technical Discussion of DIN Technical Report 4108-8" of LVS Bayern, Landesverband ö.b.u.v. and the qualified experts of Bavaria.
12 July 2011, Munich

Lecture "New DIN Technical Report 4108-8: Avoiding Mould Growth in Residential Buildings and Its Influences on a Holistic Approach to this Problem" as part of the SKZ & WTA construction conference "Winter is Coming – Mould Too?"
20 Oct. 2011, Berlin

Lecture “Energy Efficiency with Glass, Daylight, Blinds, Roller Shutters” as part of the symposium “Out of standard” by AIT and ClaussMarkisen in the AIT Architecture Salon
17 Nov. Cologne, 8 Dec. Hamburg

Lecture “Renovation, energy saving and adequate insulation practice” as part of the National Intersectorial Workshop “Renovation and Health: Developing national guidelines” of the Lithuanian health ministry and the WHO.
20 Dec. 2011, Vilnius, Lithuania

Dipl.-Ing. C. Sprengard

Investigations into the Ageing of Vacuum Panels with Accelerated Ageing Test Methods
Expert conference “Application of Vacuum Insulation in Construction”
17 March 2011, Berlin

New Materials and Components – from the Perspective of Building Physics
Customer Days of the company Rollladen Folgner 2011
18 March 2011, Kolbermoor

Measurements and Calculations on Vacuum Panels – BBR Research Project for the Optimisation of VIPs
General Assembly of FIW Munich 2011
27 May 2011, Munich

Investigations into VIPs – Measurements, Rapid Ageing, Calculations
Kick-off for the research project “VIP Permeation”
15 Sept. 2011, Dresden
Preliminary Energy Dimensioning for Building Envelopes and Industrial Plants
Concepts for Avoiding Thermal Bridges in New and Existing Buildings
Draft of DIN 4108-2
Practical examples
Grupor Architecture Day 2011
25 November 2011

Dr.-Ing. M. Zeitler

VDI 2055 - Seminar
VDI knowledge forum “Heat and Cold Insulation on Operating Equipment” on
April 5 and 6, 2011, in Düsseldorf and
November 22 and 23, 2011, in Mannheim

Lecture “Recording the Total Heat Losses of Operating Equipment and Optimisation of Insulation Systems in VDI Guidelines.”
As part of the VDI expert forum:
“Energy Efficiency in the Cities of Today and Tomorrow”
on February 22 and 23, 2011, at KIT, Karlsruhe

Lecture on the status of the research project:
“Potential energy savings with technical insulation materials in industry and commerce”
At the BFA board meeting: Heat, cold and sound insulation and fire protection department of the Central Association of the German Construction Industry (HDB) in October 2011

Workshop of the ÜGPU:
“CE Marking According to DIN EN 14308 for Industrial Operating Equipment and Technical Building Equipment”
on 22 Mar. 2011 at FIW, Gräfelfing

8.2 Publications

Dipl.-Ing. (FH) W. Albrecht

Television programme “Galileo”
Segment on thermal insulation materials under the title of construction tips. pro sieben, 2 Dec. 2011, 7 pm

Dr. rer. nat. R. Gellert

The GSH and FIW Munich :“On the right path to Europe”
Article in the commemorative publication of the Güteschutzgemeinschaft Hartschaum e.V. for its 50-year anniversary (May 2011)

Opinion: “Quality Assurance for Thermal Insulation Products Is Indispensable”
Special construction planner “Insulation Technology 1” 6/2011, page 2, supplement in the Deutsche Ingenieur-Blatt

“The Energy Conservation Ordinance is being intensified in 2012”
Interview for the on-line stock market magazine “Nachhaltigkeit & Investment”, issue 08/2011, 16 Aug. 2011

Opinion: “Interior Insulation and Preservation of Building Groups”
Special construction planner “Insulation Technology 2” 12/2011, page 2, supplement in the Deutsche Ingenieur-Blatt

FIW Thermal Insulation Day 2011 “Energy Efficiency and Its Challenges”
Special construction planner “Insulation Technology 2” 12/2011, pages 17 – 18, supplement in the Deutsche IngenieurBlatt

Prof. Dr.-Ing. A. H. Holm

Integrated sound absorption in thermally activated concrete floors – acoustic and thermal effectiveness of periodic sound absorption strips
Ernst & Sohn Verlag für Architektur und technische Wissenschaften GmbH & Co. KG, Berlin – Bauphysik 33 (2011), issue 5

Comparative investigations of the moisture and thermal behaviour of various wooden construction elements
Ernst & Sohn Verlag für Architektur und technische Wissenschaften GmbH & Co. KG, Berlin – Bauphysik 33 (2011), issue 5

22nd Hanseatic Renovation Days in Heringsdorf
"Thermal Insulation and Building Renovation"
Dehydration behaviour of masonry of various qualities and with different insulation variants
Author: Antretter, F.; Holm, A.; Sauer, F.;
Pages: 249-256, 2011

Dipl.-Ing. (FH) S. Koppold

Albrecht W., Koppold S.: “Long-Term Behaviour of Insulation Materials”
2010 Construction Physics Almanac
Published by Nabil A. Fouad
Verlag Ernst & Sohn, ISBN 978-3-433-02938-1

Dr.-Ing. M. H. Spitzner

Spitzner M. H.: Calculation of the Thermal Envelope. In: Team of authors: dena Practical Guidelines for Calculation of Energy Building Balance Sheets According to DIN V 18599. Berlin: dena Deutsche Energie-Agentur 2011

Sprengard C., Spitzner M. H.: Investigations into Ageing and Thermal Bridges in Vacuum Insulation Panels (VIPs) for Construction Applications. Bauphysik 33 (2011) issue 4

Spitzner M. H.: Don't Give Mould a Chance – DIN Technical Report 4108-8; Ventilation, Heating and Furnishing Recommendations. Special Insulation Technology 1, enclosure to the Deutsche Ingenieurblatt 2011 issue 6

Sprengard C., Spitzner M. H.: Light Climate Block – Thermal Insulation Planning Manual. Published by: KLB Klimaleichtblock GmbH, Andernach, 2011

Spitzner M. H., Sprengard C., Simon H.: Lime Sandstone Thermal Bridges Catalogue. Published by: Bundesverband Kalksandsteinindustrie e.V., Hannover. Düsseldorf: Verlag Bau+Technik 2011

de Anda González L., Spitzner M. H.: Avoiding Mould in Residential Spaces. Beuth kompakt. Published by: DIN Deutsches Institut für Normung e.V. ISBN 978-3-410-21082-5. Berlin: Beuth-Verlag 2011

■ **Dipl.-Ing. C. Sprengard:**
„Statement VIP“
In bine Themeninfo I/2011 – Insulation with a Vacuum – Highly Efficient Thermal Insulation for Building Envelope and Windows; p.13
“Hard Shell, Soft Core – Filled Masonry Blocks: Part 1 – Development and Thermal Insulation”
In ZI Ziegelindustrie International; 6/2011

“Optimisation of the Energy Properties and Profitability of VIP Panels Through the Optimal Combination of Silicic Acid, Mineral Fibre and EPS insulation materials”
Forschungsinitiative Zukunft Bau, volume F 2776
Christoph Sprengard, Martin H. Spitzner
Forschungsinstitut für Wärmeschutz e.V. München - FIW Munich-2011, 143 S., numerous figures and tables, Order No. F 2776 (copy of the manuscript)
Fraunhofer IRB Verlag ISBN 978-3-8167-8521-7

“Investigations into Ageing and Thermal Bridges in Vacuum Insulation Panels (VIPs) for Construction Applications”
In Bauphysik 33 (2011), issue 4

■ **Dr.-Ing. M. Zeitler**
(2011): Quality Assurance of Insulation Materials. In: ISOLIERTECHNIK, vol. 37, issue 3, p. 19

Hencke, Ernst G.; Zeitler, Martin (2011): Energy Efficiency of Operating Equipment. An Interim Report. In: ISOLIERTECHNIK, vol. 37, issue 2, p. 40–43

(2011): Thermal Insulation is the Future. Thermal Insulation Day. In: ISOLIERTECHNIK, vol. 37, issue 3, p. 20

Zeitler, Martin; Hencke Ernst-Günter (2011): Recording of the Total Heat Losses of Operating Equipment and Optimisation of Insulation Systems in VDI Guidelines. In: MCKENNA, R.; FICHTNER, W. (pub.): ENERGY EFFICIENCY. Conference proceedings of the VDI expert forum “Energy Efficiency in the Cities of Today and Tomorrow” from February 22 and 23, 2011, at KIT, Karlsruhe

Zeitler, Martin (2011): Energy Efficiency Classes for Insulation Measures on Operating Equipment. In: ISOLIERTECHNIK, vol. 37, issue 4, p. 12 -17

8.3 Public Relations Work
FIW Thermal Insulation Day 2011

“Energy Efficiency: Concepts – Perspectives Implementation”

FIW Thermal Insulation Day 2011 – carried out in cooperation with Bayern Innovativ and dena – was thoroughly dedicated to the issue of energy efficiency, both in buildings and industrial installations, according to the FIW’s areas of focus. A brief account of the central statements of a number of talks covering the area of buildings is given below.

By way of introduction, Klaus-W. Körner, Chairman of the Board of FIW Munich, makes clear that the essential key to every energy concept, including the energy turnaround, must be consistently making the greatest possible use of “native energy”. “Native energy” he defines as unconsumed energy, i.e. energy savings, a perfect supplement to green energies. This is not just about our lifestyle. It is a long-term endeavour for our environmental and economic survival and an effort to solve the national, European and global challenges threatening us with socioeconomic upheaval.

Stabilised incentives, a reliable, predictable regulatory policy and unbureaucratic implementation mechanisms are the central elements of state policy for implementing such an energy concept.

The private sector must act as a partner in supplying the required market instruments and ensuring transparency.

Buildings – the keys to energy efficiency
Stephan Kohler from the German Energy Agency,


Stephan Kohler

dena, once again makes clear that the thermal demands of buildings represent the greatest share of total energy consumption and that the situation with existing low-energy houses is not a utopia, as has been shown in pilot projects at schools, for example. Kohler notes that 50 per cent of all buildings must be renovated for technical reasons in the next 20 years, and these opportunities must be used for energy modernisation. He also refers to the significant backlog of renovation work in Germany. The target renovation rate would be 2.5 per cent of the building population per year, but the actual renovation rate is only about 1 per cent. A subsidy volume of five billion per year would be required to double the renovation rate. The construction and energy industries therefore established a building energy efficiency alliance consisting of companies, associations and research institutes, including FIW, for the further development of regulatory laws, subsidy policy and elimination of market barriers.


FriedrichSeefeldt

Why buildings play a central role in the energy concept of the German government

After presenting various energy efficiency scenarios, Friedrich Seefeldt from prognos answers the question very clearly: Because there are certain segments of the economy in which alternatives to carbon-based/fossil energy carriers either do not exist or can only be utilised to a very limited extent. Examples include control energy, aviation and heavy cargo transport. However, buildings do not fall into this category. Savings are therefore required in this area so that the “last” allocated (!) quantity of carbon-based energy carriers can be consumed by the aforementioned segments, says Seefelder. A very clear reference to the end phase of the increasing petroleum scarcity. After addressing questions of profitability, he draws the following conclusions:

- “There is (still) sufficient potential that can be profitably realised”
- The targets of the German government appear definitely reasonable.
- However, the regulatory laws are increasingly reaching the limits of the efficiency principle.

The path toward nearly zero energy buildings in Europe


Dr. Karl Kellner

Dr. Karl Kellner, European Commission, Directorate-General Energy, describes the various activities of the Commission, from the Energy Performance of Buildings Directive (EPBD) to the Energy Efficiency Plan (EEP) and the Nearly Zero Energy Policy (NZEP). The latter means that by December 31st, 2020, all new buildings within the EU must be nearly zero energy buildings. This requirement applies to public buildings as of December 31st, 2018. For existing buildings, the Member States must take corresponding measures, including the definition of goals. The increased use of renewable energies is also an aspect of this policy.

Energy efficient construction and modernisation


Peter H. Richter

Peter H. Richter, General Director of ENERGIEregion Nuremberg, first describes in general the costs of energy modernisation and then reports on a specific project in a Nuremberg housing association. The investor-user dilemma and the issue of profitability arise here as well if the costs of the energy modernisation cannot be covered by the legally permissible rent increases. Profitability for the lessee means that the value of the energy savings is greater than or equal to the net rent increase after the modernisation. For the owner, profitability means that the resulting costs can be recouped through the potential for further increased rents on new leases. Summary by Richter: “Anyone who says, ‘The gross rent will remain the same after energy modernisation,’ may not be entirely honest. . .”


Hans-Dieter Hegner

Sustainable construction with sustainable construction products
Hans-Dieter Hegner, head of the Civil Engineering, Building Research Department at the Federal Ministry of Transport, Building and Urban Development, spoke first about the main features of the "Sustainable Building Guide", which was introduced for the federal government in March 2011 and can be downloaded from the BMVBS website. He also describes the positive energy building – in particular the one of the Darmstadt University of Technology – and the result of the BMBVS competition as well as a few research projects on detailed problems, such as coloured solar panels, integral acoustic ceilings, the energy efficiency of atria, PCM cooling ceilings, intelligent energy management and the process for evaluating sustainable construction.


Prof. Dr. Eichener

Does energy renovation pay off?
Prof. Dr. Eichener of the EBS Business School adds a second question: Is demolition and rebuilding a meaningful alternative? Before answering the questions, he discusses the current situation of increasingly vacant buildings in poor condition that can be bought cheaply but would generate significant costs for energy modernisation or for which such modernisation might be practically impossible. Added to this are requirements for utilisation quality arising from the higher ages of residents, for example. The investor-user dilemma is explained in great detail, revealing that the required rent increases often cannot be achieved on the market.

Summary by Prof. Eichener: Modernisation is less worthwhile the lower the inflation rate, the lower the rent level at the location, the more heavily demand is declining due to demographics and the higher the vacancy rate. Subsidising the replacement of existing buildings with a demolition bonus and new construction subsidy accomplishes more than subsidising renovation, but most of all, it generally promotes socially sustainable, demographically sound, age-appropriate and financially sound (i.e. efficient) apartments.


Prof. Dr.-Ing. Wolfgang Mauch

Energy savings potential with "technical insulation"
Prof. Dr.-Ing. Wolfgang Mauch begins his talk by explaining Germany's energy balance sheet from the year 2007 in the form of a flow chart. In addition to domestic energy demand and losses in the energy sector of 31.2% of the primary energy input, the industrial and commerce/trade/service sectors require approximately 27% of the primary energy input.
The total useful energy in Germany is only 31.3% of the primary energy input. The final energy demand of the industrial and commerce/trade/service sectors is approx. 44% of Germany's total final energy demand. An informative graphic shows the distribution of industrial waste heat production, whereby 44% of this is lost in concentrated form in the medium and high temperature range and 56% represents diffuse emissions. Several examples are presented to show that more energy could be saved through better insulation of operating equipment. With respect to the energy demand of production sites and companies in the commerce/trade/service sector, a potential savings of 0.2 to 0.6% initially appears low. In absolute terms, however, the saved energy can supply many households with heat, not to mention the fact that insulation can be quite worthwhile if the lifecycle costs are more fully taken into account.


Frank Jakobs

Energy efficiency of operating equipment - tapping the potential of insulation
After a brief introduction of the European Industrial Insulation Foundation (EiiF), EiiF President Frank Jakobs addresses the energy consumption by industry, transportation and buildings. He compares the specific heat losses of industrial installations and buildings. This comparison shows that the requirements for standard real estate are up to 15 times higher than for industry. The difference is even clearer when the planned passive houses are included in the comparison.

Compared with the specific heat loss of a passive house, heat losses up to 450 times higher are accepted by industrial operations.
With another informative comparison from an American study, Mr. Jakobs shows that 10 billion trees would be required to achieve the same reduction in CO2 emissions as could be accomplished through better insulation of industrial installations.
In conclusion, he offers an impressive example with extremely short amortisation times of just 6 months and extremely high annual savings that can be achieved through targeted insulation measures.


Andreas Gürtler

Energy savings through insulation measures in industry
Andreas Gürtler begins be explaining the mission of the EiiF and describes the organisation's goals. With a comparison between a smelting works and a single-family home, he illustrates the different energy needs of industrial operations and households. In several examples, he shows how effective an investment in insulation can be for industrial companies. He highlights ways in which the foundation could convey this message to companies and introduces the EiiF TIP-CHECK programme. TIPCHECK stands for Technical Insulation Performance and Quick Check. This offers a fast method for determining the heat and/or cold losses of existing insulation and identifying the energy savings potential.

Energy savings through implementation of the Energy Conservation Ordinance
After a brief introduction of the organisational structures of the German Construction Federation (ZDB), Thomas Graber addresses the activities the industry has already initiated with regard to the topic of "insulation for climate protection". He presents the agreement between the two central associations, specifically the association of chimney sweeps and the National Technical Department of Heat, Cold and Sound Insulation and Fire Protection of the insulation industry. This agreement should introduce measures to support full implementation of the Energy Conservation Ordinance. This service can be performed by the chimney sweeps as part of their fireplace inspections. The condition of the existing insulation should be determined, and a fault report should be created. Corresponding training in material science and practical examples for current district chimney sweeps are already available.

Heat losses from operating equipment in consideration of thermal bridges


Roland Schreiner

After a brief definition of terms, Mr. Schreiner transitions to the topic of heat losses in consideration of thermal bridges. The all-important factor here is the specific heat loss flow. It determines the efficiency and the energy losses of a operating equipment and must not be confused with the heat flux density through the insulation system. The heat flux density only provides information about the quality of the selected insulation system. With various graphs and formulas, Mr. Schreiner illustrates the parameters and the factors influencing the specific heat loss flow. He demonstrates potential energy savings that are possible with insulation-related measures and by insulating components.

Energy-efficient insulation in industrial plants – criteria and design procedures


Dr.-Ing. Hencke

As an introduction to the topic, Dr.-Ing. Hencke presents a simplified scenario detailing how energy demand in Germany could develop in relation to the gross national product up to 2050. Industrial plants can also contribute to reducing the energy demand, such as by making use of waste heat. This is most easily done if there is also a demand for useful heat. If this is not the case, effective storage measures must be employed. In particular, the objective is to optimise the insulation systems or, better yet, the entire insulation to minimise diffuse emissions leaving the system as anergy. Naturally, the costs for the insulation system itself and the insulation of components must be taken into consideration in the optimisation project. Mr. Hencke presents the calculation methods that he developed for this in the research project "Energy efficiency of operating equipment from the perspective of heat and cold insulation" and shows that a holistic perspective of the heat losses of all parts and components of the industrial installation is required and that the specific heat loss is the key to success. In conclusion, he announces the introduction of energy efficiency classes for evaluating insulation measures according to the system of energy classes for white goods.

8.4 Teaching positions

Prof. Dr.-Ing. A. H. Holm

"Building physics applications in existing and new buildings". University of Stuttgart, Department of Construction and Environmental Engineering Sciences, online construction physics master's programme.

"Principles of Building Physics". Munich University of Applied Sciences, 2010.

"International Construction". Munich University of Technology, Department of Construction Engineering and Surveying.

Dr.-Ing. M. H. Spitzner, Dipl.-Ing. (FH) H. Simon

Munich University of Technology, Professorship for Building Physics, Professor Dr. Hauser, lecture series "Advanced seminar in building physics according to DIN, EN and ISO" in the MSc study programme

Dr.-Ing. M. H. Spitzner

Principles of thermal and hygral building physics
Free University of Bozen-Bolzano, MSc course "Casa-Clima / KlimaHaus", contract professorship

Advanced seminar in building physics according to DIN, EN and ISO, Munich University of Technology, Professorship for Building Physics (Professor Dr. Hauser), MSc study programme (with the partial assistance of Dipl.-Ing. (FH) Simon)

8.5 Master and graduate theses supported by FIW

Arch. Andreas Haller:

Low-e coating on woven fabrics and films in sustainable architecture.
Master thesis at the Free University of Bozen-Bolzano, MSc course CasaClima/KlimaHaus;
Advisor: Dr. Spitzner

Abstract:
New technologies have always influenced architecture and the ideas of planners. Thanksto improved quality in thermal insulation, low-e coatings offer planners new possibilities that were initially utilised in only windows but are now also used in woven fabrics and films.

Technical fabrics and films are still rarely used in construction. This is mainly because of a lack of knowledge transfer during the education of construction workers as well as the complex planning processes. Low material requirements, improved properties thanks to the low-e coating and modern, user-friendly software are securing an important place in the future for technical fabrics and films.

The master thesis elaborates and evaluates some of the many possibilities for using these innovative materials in sustainable architecture and develops energy calculations for the following three examples:
- Roofing of building interspace
- Temporary vertical façade
- Roller shutters

Wolfgang Brunner B.Sc.:

Dynamic 3D thermal bridge calculation of room corners in various construction styles and their influence on mould growth via technical measurement and validation.
Master thesis at the Munich University of Technology, Professorship of Building Physics, Prof. Dr. Gerd Hauser. Advisor: Dr. Spitzner (FIW), Dipl.-Ing. Simon Schmidt (TUM), with the assistance of Dipl.-Ing. (FH) Simon (FIW) and Dipl.-Ing. Sprengard (FIW).

Abstract:
In this work, the static and dynamic behaviour of three-dimensional corners with respect to surface temperatures and the risk of mould are examined. Calculations are performed for various structures in solid and wood frame construction styles.

After clarification of the basic principles, the calculations for the various structures are carried out. It was found that for structures with continuous, sufficiently thick insulating layers, such as walls with core insulation or external wall insulation systems, the 3D corner almost attains the temperature of the outer edge. A 3D calculation is not absolutely necessary in this case. For structures with an inhomogeneous layer, on the other hand, such as walls made of insulating brick or timber frame constructions, the corner deviates strongly from the edges, making a 3D calculation useful. Each construction that is mould-free under static analysis is also mould-free under dynamic analysis. The timber frame construction exhibits inferior behaviour in the dynamic analysis compared with the solid construction style.

The measurement and validation addresses the fact that, in practice, statements about the risk of mould are often issued on the basis of short-term measurements even though short-term measurements are not suitable for this. It was determined that only measurements of sufficient duration can support quantifiable statements about thermal bridges. Based on the results of the measurement, a criterion for evaluating the f_{Rsi} value $\Theta_e < \Theta_{si}$ is formulated for the DIN technical report 4108-8 section 8.1.3. In conclusion, the 10.0 °C criteria for computational verification of the corner according to DIN E 4108-2:2011 is checked and validated.

In summary, it can be stated that dynamic three-dimensional analysis of thermal bridges with respect to surface temperatures yields more realistic results, but the static analysis is sufficient in practice. A 3D calculation can certainly be useful depending on the type of construction and should be performed in addition to the 2D calculation. In consideration of the new discoveries concerning dynamic behaviour of wood frame constructions, more research into this topic is clearly needed.

9.1 Overview

Research,
testing, monitoring, certification,
measurement and calculation,
consulting and appraisal,
informing and training

In accordance with the organisation's statutes, our RESEARCH ACTIVITIES encompass the following areas of heat and cold protection:

- Determination of physical factors on thermal transmission in insulation materials and systems
- Measurement of moisture movements in insulation materials and systems
- Investigation of thermal, hygral and mechanical properties of insulation materials
- Investigation and optimisation of structures and insulation systems for buildings, industrial installations and technical building equipment
- Testing of insulation materials from the standpoint of practical utilisation and long-term behaviour
- Basic research for the development of test standards, material standards, guidelines and worksheets
- Development of measuring devices and testing equipment for new applications

The research work is partially financed by the ministries of both the federal government and the state of Bavaria and in particular with the association's own resources. The research projects are also supported by industry associations and consortia.

With respect to CERTIFICATION, MONITORING AND TESTING ACTIVITIES, FIW Munich is:

- A testing, inspection and certification body (BAY 08) for the Building Rules List, Part A, recognised according to the state construction ordinance
- A European notified testing, inspection and certification body for thermal insulation products, doors, gates and windows according to system 1 and 3 (code 0751) in accordance with Article 11 of the Building Products Act (BauPG)
- Accredited testing laboratory according to DIN EN ISO/IEC17025/DAP-PL-3449.00 (see accreditation document from DAP, Deutsches Akkreditierungssystem Prüfwesen GmbH). This accreditation is accepted worldwide due to a multilateral agreement (MLA) between EA (European Cooperation Accreditation) and DAP and a reciprocal recognition agreement (MRA) between DAP and ILAC (International Laboratory Accreditation Cooperation).
- Keymark registered testing laboratory for the voluntary European third-party monitoring system
- Lead testing institute according to VDI 2055 (see recognition document from DIN CERTCO) for insulation systems and insulation materials for insulating industrial installations

The certification, inspection and testing activities encompass:

- Insulation materials in accordance with DIN, EN or ISO standards and general building authority certification in addition to European technical approvals (ETAs)
- Insulation materials according to AGI worksheets of the Q series
- Taking of samples for the Mineral Wool Quality Association (GGM) and EUCEB

Scope of services

Depending on the monitoring basis, FIW Munich issues EC certificates of conformity, certificates of compliance, quality seals or testing certificates for the tested materials and components as the basis for external certification agencies.

The CONSULTING ACTIVITIES of FIW Munich encompass:

- General issues of cold, heat and moisture protection
- Development and optimisation of insulation materials
- Development and optimisation of structural elements and insulating structures.

The consulting is free for customers within the scope of measurement and calculation orders and also free for members of FIW Munich in regards to general questions on cold, heat and moisture protection.

The CALCULATION ACTIVITIES include:
Calculation of thermal insulation and moisture protection for

- Industrial installations in accordance with VDI 2055
- Building and insulating structures,
- Roller shutter housings
- Thermal bridges
- Masonry blocks
- Windows and profiles
- Buildings in accordance with EnEV, DIN 4108-3, DIN V 4108-6, DIN V 18599
- Structural elements in accordance with DIN EN ISO 6946
- Evaluation of calculation and verification processes (EnEV, DIN V 18599, energy conservation certificate) with regard to the thermal insulation and energy requirements of buildings

The APPRAISAL ACTIVITIES include assessing defects and/or damage relating to cold, heat and moisture protection, such as damage to

- Insulation on industrial installations
- Buildings
- Structures
- Components

This work is also performed for the courts.

The INFORMATIONAL EVENTS (especially “Thermal Insulation Day”, which takes place every two years) and FIW announcements allow us to inform our members and interested parties within the industry about current issues and/or research results.

General and special knowledge concerning heat and cold insulation can be acquired in TRAININGS.

The informational or training events normally take place in our conference room, which can also be made available to our members for conferences and special events.

Conference room on the 3rd floor used for meetings

9.2 Scope of departmental services

Measuring and testing services provided by the Department of Insulation in Building Construction

Insulation in Building Construction

- Initial type tests acc. to EN 13162 – EN 13171

- Approval tests for new insulation materials according to testing plans of DIBt or according to European Technical Approval Guidelines (ETAG)

- Third-party monitoring according to test plans of DIBt and monitoring associations (partially voluntary tests)

- Testing of samples from the market (construction materials dealers or from construction sites)

- Real-world investigations and appraisals of insulation materials installed in functional buildings and installations for verification of longevity of designs

- Semi-real-world investigations in support of the market introduction of new insulation materials

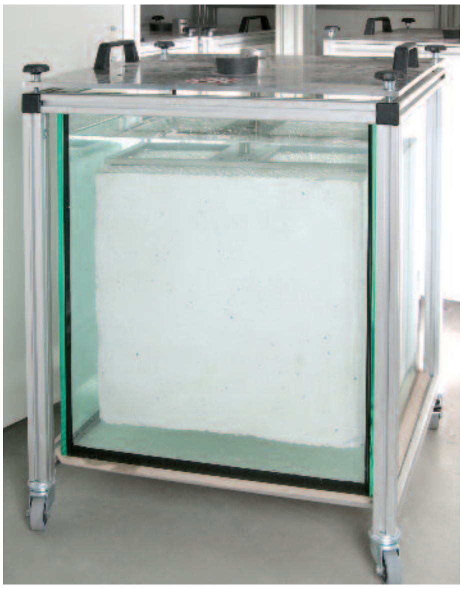
- Expert appraisals of individual construction projects for non-standardised or unapproved applications.

- Measurement and testing of the thermal conductivity of construction and insulation products according to the testing procedures specified in DIN EN 12664, DIN EN 12667, DIN EN 12939, ISO 8301, ISO 8302, ASTM C–177 and guidelines of DIBt, Berlin
  - In a temperature range of -30 °C to +80 °C mean temperature
  - At 10 °C mean temperature

- Inspection of building material class DIN 4102-B2 and determination of flammability acc. to DIN EN ISO 11925-2

- Measurement and testing of mechanical properties Composition, dimensions, density, bulk density Thickness under load (insulation materials under floating screed acc. to DIN EN 12431)
  - Tensile strength, bond strength, lateral load strength
  - Deformation under defined pressure and temperature conditions acc. to DIN EN 1605
  - Pressure test acc. to DIN EN 826
  - Shearing stress acc. to DIN EN 12090
  - Bending strength acc. to DIN EN 12089, point loads acc. to DIN EN 12430
  - Dynamic stiffness acc. to DIN EN 29052-1
  - Expansion and contraction coefficients acc. to DIN EN 13471
  - Slump after shocks
  - Slump after climatic storage 40 °C / 90 % r.h.
  - Long-term crushing behaviour, long-term creep test acc. to DIN EN 1606 up to a thickness of 300 mm. The testing capacities in this area have been expanded considerably
  - Anchor pull-through resistance acc. to ETAG 004

- Measurement and testing of hygral properties and behaviour in frost
  - Water absorption acc. to DIN EN 12087
  - Temperature change 20/40 °C
  - Diffusion tests 50/1 °C acc. to DIN EN 12088
  - Freeze-thaw cycle testing and pressure tests acc. to DIN EN 12091
  - Equilibrium moisture acc. to DIN EN 12429
  - Sorption moisture for building materials acc. to DIN EN ISO 12571 (DIN 52 620)
  - Water absorption under partial immersion acc. to DIN EN 1609
  - Moisture content acc. to DIN EN 322


Water absorption of EPS with high thickness

- Measurement and testing of shape retention
  - Dimensional stability acc. to DIN EN 1603
  - Dimensional stability under defined temperature and moisture conditions acc. to DIN EN 1604

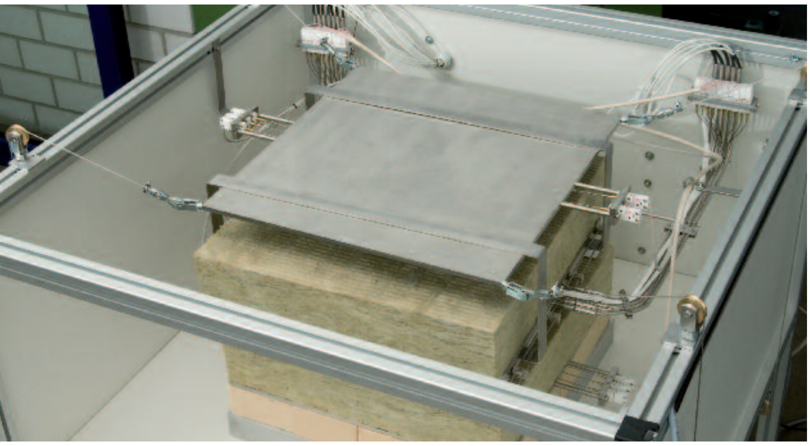
- Measurement and testing of other properties
  - Closed cell structure acc. to ISO 4590
  - Cell gas composition
  - Chloride content of wood wool panels acc. to DIN EN 13168
  - Length-specific flow resistance acc. to DIN EN 29053

Industrial Insulation Department

- Measurement and testing of the thermal conductivity of construction and insulation products in accordance with the test procedures contained in DIN EN 12664, DIN EN 12667, ISO 8301, ISO 8302, ASTM C 177 and guidelines of DIBt, Berlin
  - In a temperature range of -180 °C to 900 °C
  - At 10 °C mean temperature
  - At 40 °C mean temperature

- Measurement and testing of the thermal conductivity of pipe insulation materials, pipe insulation and pipe systems according to the test procedures of DIN 52613, DIN EN ISO 8497
  - In a range of -70 °C to + 300 °C mean temperature
  - At 10 °C mean temperature for cold insulation
  - At 40 °C mean temperature for insulation materials for insulating heating systems
  - At 50 °C mean temperature for district heating lines

- Measurement and testing of shape retention
  - Dimensional stability acc. to DIN EN 1603
  - Dimensional stability under defined temperature and moisture conditions acc. to DIN EN 1604



Guarded Hot Plate

- Determination of the behaviour at higher temperatures (DIN 52271, ISO 8142)
  - Application limiting temperatures acc. to EN 14706 and EN 14707
  - Application temperatures with and without vibration

- Measurement of heat transmission and temperature fields on
  - Insulation systems
  - Building components

  with standardised and special measurement and testing equipment

- Testing of requirements for the area of fire protection / fire behaviour of building materials
  - Non-flammability test acc. to DIN EN ISO 1182
  - Combustion heat acc. to DIN EN ISO 1716
  - Combustibility under direct flame influence DIN EN ISO 11925-2

- Measurement and testing of mechanical properties
  - Composition, dimensions, bulk density acc. to DIN EN 1602 and DIN EN 13470
  - Tensile strength acc. to DIN EN 1607, bond strength, lateral load strength
  - Deformation under defined pressure and temperature conditions acc. to DIN EN 1605
  - Pressure test acc. to DIN EN 826
  - Shearing stress acc. to DIN EN 12090
  - Bending strength acc. to DIN EN 12089, point loads acc. to DIN EN 12430
  - Expansion and contraction coefficients acc. to DIN EN 13471
  - Long-term crushing behaviour, long-term creep test acc. to DIN EN 1606

- Measurement and testing of hygral properties and behaviour in frost
  - Water absorption acc. to DIN EN 12087
  - Temperature change 20/40 °C
  - Diffusion tests 50/1 °C DIN EN 12088
  - Water absorption under partial immersion acc. to DIN EN 1609
  - Moisture content acc. to DIN EN 322

- Measurement and testing of water vapour permeability (DIN EN 13469 and DIN EN ISO 12572)

- Measurement and testing of other properties
  - Closed cell structure acc. to ISO 4590
  - Cell gas composition
  - Chloride content acc. to DIN EN 13468
  - Thermal stability
  - Length-specific flow resistance acc. to DIN EN 29053
  - Non-fibrous components (melted beads)
  - Loss on ignition acc. to DIN EN 13820
  - Fibre diameter
  - Determination of the lack of silicone in insulation materials

- Acceptance measurements
  On-site measurements on industrial installations with heat flow gauges and/or infrared cameras

- Building components and thermal bridges
  Measurement and/or calculation of the heat loss flow coefficients of valves, flaps, bearings and suspension mounts

- Calculation software ISOWTC
  Web-based calculation software for the heat and cold insulation of bindustrial installations based on VDI 2055 page 1 version September 2008

- Energy evaluation of insulation on industrial installations
  Determination of the total heat loss and savings potential of an industrial installation via energy renovation according to VDI 4610 page 1 (official draft adopted)

New service offered by the "Industrial Insulation" Department

ISOWTC web-based program for calculating the heat and cold protection of industrial installations and technical building equipment according to VDI 2055 page 1 September 2008

The heat and cold protection of operating equipment can be calculated according to VDI 2055 page 1 using ISOWTC. The calculations are performed online using a web-based program.

ISOWTC is an expert program with which the heat and cold protection of operating equipment can be designed based on the relevant conditions and influencing factors for the target values.

It is available in three versions:

- User mode
- Expert mode
- Professional mode

Various calculation depths are available based on the selected version. The energy savings relative to uninsulated structures are calculated in all versions. In expert and professional modes, the insulation of an existing plant can be specified as a starting point for the energy savings calculation.

A database contains reference values for the properties of insulation materials according to VDI 2055 page 1 table A6 and limit curves according to various AGI Q worksheets. Rated values of insulation materials from major manufacturers are also included. These cannot be changed by users. If the conformity of the product properties is verified by a valid certificate, this is confirmed with the note "FIW monitored".

The results output by the program depend on the selected mode. The table below contains the implemented calculation rules of VDI 2055 page 1 September 2008 and the structure of the program.

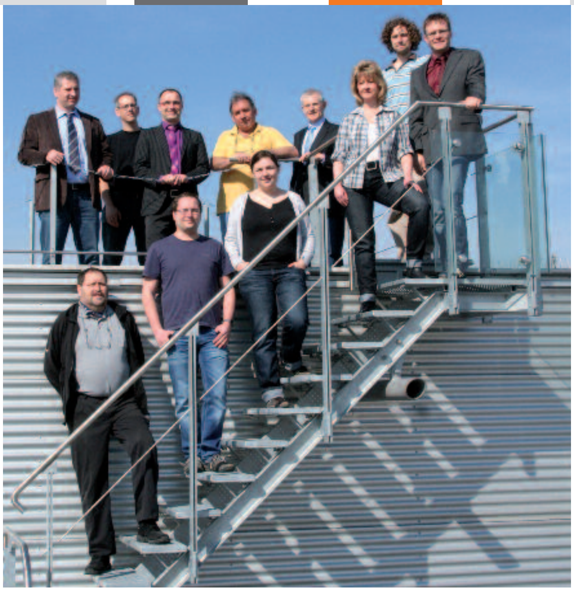
Purification filters for intake-air

Table: Structure of ISOWTC and implemented sections of the guideline

	Sections of VDI 2055 page 1			Additional
Target value	Thermal conduction equations	Heat transfer	Operating thermal conductivity	Energy savings
Heat flux density, (heat transmission)	Section 2.2.3, for walls (without equation (55)) and pipes.	Section 2.2.2 and table A10 row 2 to 4, depending on the selected structure shape, materials and ambient conditions.	Section 4.2.1.1 c) in consideration of the requirements of table A3.	Energy savings are calculated with the help of the total heat loss for the specified utilisation period and with reference to the uninsulated structure or to existing insulation conditions, depending on the software version.
Surface temperature Contact protection and prevention of condensation	Section 4.2.4 for walls and pipes, calculation of the dew point acc. to equations (A16.2) and (A16.3)	Wind speeds can be specified for free-tanding structures. The equation (34) is implemented for mixing convection.	The factors $f_{\Delta\vartheta}$, f_{oF}, f_{VD}, f_F are calculated depending on the influencing parameters and in consideration of the form of delivery. The factor f_{oF} and the μ-value for cold insulation materials are stored in the material database.	Energy savings are calculated with the help of the total heat loss of the period of loss of the dynamic process and relative to the uninsulated structure.
Total heat loss and total thermal transmission coefficient according to	Section 5.1 and section 5.1.3 in connection with table A14 row 3.1 and 3.2 without equation (85a)	The radiation term for heat transmission is calculated with the emissions levels of the stored materials for the envelope.	The factor f_K for taking convection in insulation into account is only implemented in expert and professional modes.	
Change in temperature section 5.2.1 b) Temperature change along a pipe, section 5.2.1 a) Cooling of a suddenly closed pipe, section 5.2.2.3	*Note: Preparation of Data for kxA for thermal bridges for equations (83) and (85)*	The internal heat trans-mission is preset. For gases with 30 W/(m².K) and for fluids with 1000 W/(m².K). No calculation based on the applicable conditions is performed. *Note: The heat transfer coefficient cannot be changed in user mode.*	The length-specific flow resistance is stored in the material database for the respective insulation materials. The factors f_A and f_s are not implemented.	Energy savings are calculated with the help of the total heat loss for the specified utilisation period and with reference to the uninsulated structure or to existing insulation conditions, depending on the software version.
Determination of insulation layer thicknesses	Section 6.2.1.1 without equation (144a) Section 6.2.1.3 without equation (152) Section 6.2.1.4 Section 6.2.1.5 Section 6.2.2 with Section 6.2.2.4		Calculation of the supplemental value for support structures takes place according to the requirements of tables A4 and A5. *Note: In the current version, only one $\Delta\lambda$-supplemental value per insulation can be taken into account.*	

All calculations are iterative to take into account the non-linear thermal conductivities and influencing factors as well as the heat transfer equations based on the target values. The dynamic processes are limited to small temperature changes. A linear temperature change is assumed.
ISOWTC was developed by
COM CAD Burghardt GmbH
Krautgartenweg 1
86856 Hiltenfingen
Development took place in cooperation with FIW Munich on the basis of VDI 2055 page 1 version September 2008, and the calculation software is available on the homepage of FIW.

More information is available at
www.fiw-muenchen.de and www.isowtc.de



Employees of the Department of Building Physics and Building Parts

Building Physics & Building Parts

The department of building physics & structural elements can offer a complete range of investigations and tests concerning the thermal and moisture protection of structural elements and energy savings. We support our customers in the development and optimisation of insulating and building materials in addition to structural elements and insulating structures.

In the context of FIW Munich's recognition as a testing, inspection and certification body (PÜZ agency) the department of building physics and structural elements covers the following areas:

- Thermal insulation and moisture protection values
- Masonry
- Windows and profiles
- Suspended panels
- Adhesive tapes and compounds
- Insulation with polyurethane (PUR) in-situ foam
- Urea formaldehyde resin in-situ foam (UF in-situ foam), e.g. for subsequent insulation of cavities in masonry walls (curtain walls)

Our customers can rely on the high-productivity testing facilities and state-of-the-art testing procedures, such as façade and structural element test benches, emissions level measurement, thermography, U-value and thermal conductivity measurements as well as advanced analysis.

The testing and assessment of new building products and structural components is an important field of activity for the department of building physics and structural elements. We welcome direct research orders from our customers for new materials and construction methods, such as vacuum insulation panels (VIPs). New developments are increasingly achieved through calculation and simulation using the most modern computer software available. The reliability of such calculations can often only be verified through measurement of the thermal properties as a supplemental test. Reliable material values as the basis for calculation are often very limited or entirely unavailable, especially for new types of insulation materials and construction products, such as vacuum insulation panels (VIPs), reflective films as roof insulation or masonry blocks filled with insulation. Such values are determined for the construction product manufacturers, public agencies and building supervision authorities within the framework of certification testing or product labelling. Then, for example, computations and simulations are employed to determine and evaluate the technical thermal properties of the product on its own and within the specific installation situation.

The hot-box process is the first choice for coatings that reflect infrared. One of our hot-box test benches, which is calibrated to DIN EN 12567-1, can be rotated by 360°, which makes it possible to observe roof structures at their normal inclination. Tests, including dynamic ones, such as with rising or falling temperatures, are also possible under realistic moisture conditions. Investigations in the temperature range from -20 °C to 40 °C and/or over specified temperature progressions can be employed to evaluate the static behaviour as well as the behaviour in summer and winter. In parallel to this, the effects of diverse building and insulating structures can be analysed for thermal comfort in summer as well as regarding their energy requirements using dynamic building simulation.

With our façade test bench, we offer customers the capability to measure even very thick, highly insulating walls of masonry blocks in compliance with relevant standards.

For CE labelling of sarking membranes and underlay sheeting and for the DIN Certco quality seal, we test mechanical properties, ageing behaviour, fire behaviour, resistance to water penetration and water vapour permeability, among other parameters.

Measuring and testing services provided by the Department of Building Physics & Building Parts:

- Building and insulating structures,
- roofs, façades, lightweight constructions,
- masonry blocks, walls, solid construction elements,
- anchors for external wall insulation systems,
- vacuum insulation panels (VIPs) for buildings
- window profiles, glazing, windows, building components
  - Measurement of the U-value, the heat transmission and the temperature distribution with standardised, specially adapted or individually constructed test equipment
  - Calculation of the U-value, the heat transmission and the temperature distribution using finite difference and finite element programs
  - Computational and measurement-based investigation of condensation
  - Calculation of the static and dynamic heat and moisture behaviour; long-term thermal-hygral behaviour
  - Measurement of moisture permeation and moisture enrichment in the structure
  - Calculation of thermal bridges, thermal bridge catalogues
  - Investigation of the air-tightness of structural components and films
  - Accompanying characterisation using the infrared camera
  - Moisture transport
  - Half-brick masonry measurement

- Building insulation materials, solid construction elements, loose fills, insulation fills, insulation tubes, in-situ foams, vapour-impermeable sleeves and wraps, plastic tubes, any materials:
  - Water vapour permeability, μ-value
  - Diffusion test
  - Equilibrium moisture, sorption moisture content
  - Slump of loose insulation materials
  - Determination of screening separation in accordance with DIN 4226-3
  - Determination of the radiation emission level

- In-situ foams in construction (PUR spray foam, PUR spray foam roofing, UF in-situ foam):
  - Testing of all relevant insulation material properties (bulk density, compressive strength, shape retention, dimensional stability, water absorption, equilibrium moisture, diffusion resistance, thermal stability, thermal conductivity, ageing of thermal conductivity, cell gases, cell diameter, fire behaviour) for the certification of new products and for ongoing third-party monitoring of manufacturers and processors.
  - Performance of third-party monitoring and testing of self-monitoring by system manufacturers and processors
  - Appraisal reports and statements

- Buildings:
  - Calculation of summer thermal comfort (dynamic building simulation)
  - Calculation of winter and summer energy demand with static (verification procedures) or dynamic methods; energy conservation certificate

- Accompanying scientific research and quality assurance alongside energy modernisation measures and regarding energy efficiency aspects of buildings
- Determination and evaluation of the actual energy consumption of renovated buildings as a success check
- Thermal bridges
- Characterisation of imperfections using infrared camera
- On-site measurement of the thermal transmission of walls
- Private and court appraisals of building damage and the insulation materials to be used

■ Sarking membranes and underlay sheeting for roofing and walls acc. to DIN EN 13859-1 and 2 (plastic, elastomer and bitumen sheeting) and plastic and elastomer vapour barrier sheeting acc. to DIN EN 13984:
- Tensile elongation behaviour
- Tear propagation resistance (nail shank)
- Cold bending behaviour
- Length, width, straightness and levelness
- Thickness and mass per unit area
- Dimensional accuracy
- Water vapour permeability
- Freeze-thaw cycle
- Water-tightness
- Resistance to water permeation
- Procedure for artificial ageing with combined sustained exposure to UV radiation and elevated temperature
- Procedure for artificial ageing with combined sustained exposure to elevated temperature
- Water-tightness under the influence of tensides
- Resistance to the penetration of water
- Fire behaviour
- Shear resistance of the joint seams
- Visible defects
- Resistance to impacts
- Longevity after artificial ageing
- Longevity when exposed to bases
- Resistance to deformation under load
- Determination of the radiation emission level

■ Training, seminars, talks

■ Lectures; support for graduate and master theses

New measurement and testing services

Dipl.-Ing. (FH) G. Bartonek

Emissions measurements

Instrument-based and analytical determination of the emissions of volatile organic compounds (VOCs) and evaluation according to the AgBB system. The documentation can also take place in accordance with the French VOC label and the French CMR ordinance.
The emission laboratory has a 1 m3 chamber, a 24 L chamber and three FLEC cells with subunit and air control.

The following DIN EN ISO procedures can be ordered by our customers:

■ Emissions determination: Sampling, storage and preparation according to DIN EN ISO 16000 - 11:2006 - 06

■ Determination of the emissions according to the test chamber method (1 m3 chamber and 24 L chamber) DIN EN ISO 16000 - 9:2006 - 06

■ Determination of the emissions according to the test cells method DIN EN ISO 16000 -10:2006 - 06

■ Determination of VOC on TENAX TA therm. desorption and GC/MS analysis according to DIN ISO 16000 - 6:2002 - 09 (other adsorption media available after consultation)

■ Determination of carbonyl compounds and formaldehyde according to DIN ISO 16000 - 3:2002 - 08

Air purification for the emission lab

- Analysis and documentation according to the DIBt approval principles for health-related evaluation of indoor construction products (AgBB system) and AgBB / DIBt analysis interface ADAM

The emissions analysis is certified according to DIN EN ISO/IEC 17025.

B. Eng. M. Guess

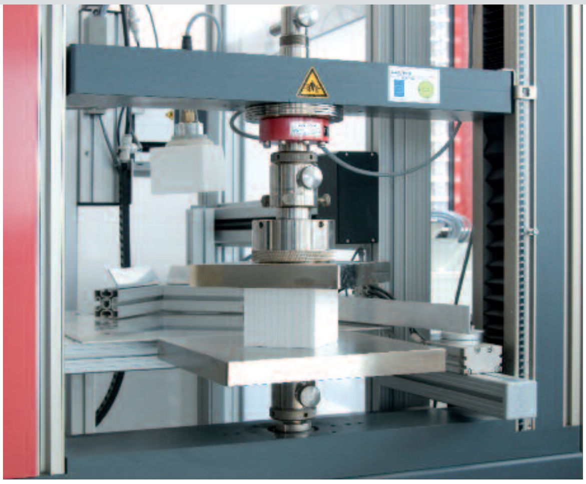
Device manufacturing

The device manufacturing department has been reinforced. Since August 2011, B. Eng. Michael Guess has taken over technical leadership of the department.

He completed a training programme as mechatronic technician at Siemens and Infineon, then studied mechatronics and precision mechanics at the Munich University of Applied Sciences. His specialisation in device manufacturing and the bachelor thesis he was assigned qualified him for this task.

To live up to the increased testing volume, the Research Institute for Thermal Insulation is expanding its testing capacities.
Automation of the pressure application was a major step into the future. With automatic sample isolation and feeding into the test system of the company "Zwick und Roell", it is now possible to test up to 11 sample sets of 5 samples each. It should be mentioned here that mixed operation with any types of samples is possible. Thanks to transport with a vacuum lifter, it is possible to test samples with an edge length of 100, 120, 150 or 200 mm and a thickness of 20-200 mm.

Samples in an oven for the determination of the deformation under temperature and load



Automation of the compressive test

Mr. Guess developed and built the system during his practical semester. He did the programming as part of his bachelor thesis.

Another test that had hit its capacity limits was the dimensional stability according to DIN EN 1605. The new "dimensional stability oven" went into active testing service at the end of 2011. Twenty-four samples can now be tested simultaneously in this device. Sample sizes of 50-150 mm edge length as well as 150 mm thickness can now be tested with various loads.

In the area of water absorption, the submersion test according to DIN EN 12087 was expanded with a few more testing stations.
81 testing stations for 200x200 mm samples up to 200 mm thickness
6 testing stations for 300x300 mm samples up to 200 mm thickness
6 stations for 300x300 mm samples up to 300 mm thickness
6 stations for 400x400 mm samples up to 400 mm thickness

A manual two-plate device for high temperatures is currently being completed. This will be able to test samples of 500x500 mm with a thickness of 120 mm. The maximum test temperature is 550°C.

2012 projects:
A swivelling two-plate device for determination of the thermal conductivity of samples up to a width of 1000x2400 mm and a thickness up to 300 mm
6 testing stations for the diffusion test according to DIN EN 12088.

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