WALK THIS WAY: IMPLEMENTATION OF BME RESEARCH UNIVERSITY STRATEGY

Dear reader,

Péceli Gábor

Two years have passed since we were awarded the title of Research University and received the grant associated with it. It is now time to give an account of the plans we have successfully implemented and those we have not. From the outset, we set ourselves a definite goal to reposition BME in the eyes of its students, tutors, partners and all other parties who intend to draw on its services.

We decided that this process should be part of the reform programme "BME of the Future". This research university programme was formulated by BME knowing that its scope of activities and competences make it a key factor for the competitiveness and sustainable development of Hungary. The university has unique competence centres in many fields, its detainment and development being of fundamental importance to Hungary's interests.

We are constantly striving to ensure that an ever increasing section of society regards our institution as a research university – playing a leading role in environmentally aware and human-oriented innovations in technology and the economy.

To this end, we have given priority to the actions and processes aimed at the improvement of our RDI capacities. We have fine-tuned certain aspects of our management and organization; made efforts to improve the standards and efficiency of our training programmes; strengthened our professional relationships and increased the efficiency of our partnerships. Whilst we use numerous indicators to measure our progress, we continuously challenge what we are doing by asking such questions as: Are we going in the right direction? Is this in line with our social mission and responsibility? Does the educational and scientific performance of BME in 2012, sufficiently serve the interests of Hungary and its development programme?

We are also deeply concerned about employment opportunities for our graduates and how satisfied their employers are and will be with their competences. We also need to know the opinions of our direct professional partners; about the expertise and RDI activities of BME associates; their use and effectiveness thereof in Hungary and at international level.

We sincerely hope that, when looking at the results of the past two years, the majority of our partners will agree on one point: BME is on the right track and has effectively used the subsidy it has received to promote its objectives and goals.

However, it may become impossible to maintain the level of efficiency we have achieved if funding opportunities for BME continue to dwindle, or cease permanently. The university could lose the management powers that earlier has ensured its freedom of action. We respectfully request our operator and all our partners, to utilise all means available to help maintain the support environment and keep BME – our principal national treasure – on its permanent upward development course, even in crisis-laden periods. Finally, I would like to express my thanks and appreciation to all my participating associates as well as the many people who have contributed to and continue to support the implementation of the research university programme of BME.

Budapest, 21. June 2012. *Gábor Péceli, Rector*

KEYWORDS

Strategy, cooperation, changing attitude, supporting environment

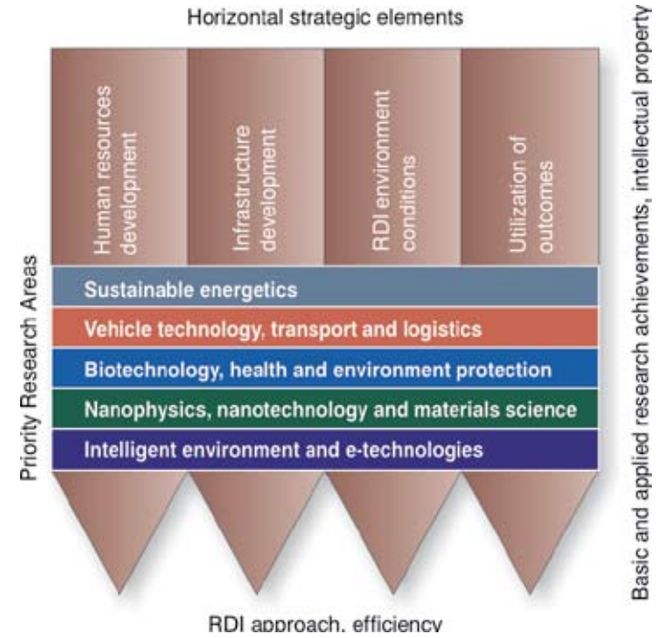
Tömösközi Sándor

Summarising a creative process with many diverse elements, involving numerous participants and spanning over several years would/ should require the analysis of a multitude of results, values, human and professional experiences. Whilst a detailed summary will be prepared in the following months, we shall however, only perceive the genuine value and impact of these results in subsequent years.

The TÁMOP grants contributing to the implementation of research institute goals have had many tangible and individually demonstrable results. Priority research areas (PRA), i.e. drawing up and reviewing the comprehensive strategy of the institution, have provided an opportunity to implement longer term R&D planning and establish its methodology. The design of the project and topic structure of PRAs may be a functioning model for organizing future RDI activities of the institution. These indicators also demonstrate the professional achievement of the people working in all research areas: it is encouraging to see the progress made to protect intellectual property by submitting patents, the publication of monographs and the publishing activity which significantly has outperformed the original objectives.

A call for Advisory Panels to be attached to the PRAs may provide a new solution – which may also apply in the future - to monitor and ensure the quality of its professional activities. I think there should be the opportunity to retain and recognise the people who have done their utmost to ensure the basic requirement of professionalism every day, officially called human resources development. We have succeeded in involving undergraduates in the research work and demonstration activities, and many postgraduate students and doctoral candidates have also participated. All of these promote the talent support process, ensuring the education of the next generation of teachers and researchers, and improving the standard and efficiency of R&D work.

We could have easily considerably increased the amounts of instruments and equipment used for R&D activities and improved the operating infrastructure; the public cluster of the latter is under development. We have consciously built and expanded domestic and international relations with communities pursuing similar activities at the research centres of the Hungarian Academy of Sciences, elite universities and business partners and leading foreign institutions. We have established horizontal working groups with the participation of all faculties covering eight topics to improve the institutional criteria system of RDI activities. This fresh inter-faculty partnership forum - besides its decentralised operating model - may provide



an opportunity for institutional-level consultation, and learning awareness-raising from each other through recommendations and management proposals based on consensus. We have striven to utilise the synergic effects of parallel applications. The asset management model developed in our technology and knowledge transfer programme has promoted the patenting processes. We have also launched pilot projects to promote the utilisation of the results from the research work; the Demola Budapest initiative is a good example of student and research innovation collaboration, the publicly available eCurriculum system, the SME programme proposal and the concept for an industrial campus aim to shape innovation culture and the investment landscape.

Another unique initiative is the BME Innovation Club established a year ago with the participation of faculty representatives. The Club is a new format for RDI and TT cooperation within the university contributing to awareness-raising. The TÁMOP project, focusing on talent management, could guarantee the continuation of certain horizontal programmes at the research university. In my opinion, of utmost value is the development of human and professional relations and the improvement of cooperation culture. It is essential to know each other, share tasks and knowledge, identify, recognise, manage and utilise our results to perform the social and business functions of a research university. I want to believe that the work recently performed has been instrumental in that success and that we will have the opportunity to maintain these processes with positive impact. In conclusion, I would like to thank all participants for their contribution to the fulfilment of the project and the research university objectives

MILESTONES 2012: THE FIGURES

Kálmán Kovács director, Federated Innovation and Knowledge Centre (BME)

The total contractual budget of the Research University is HUF 3,034,993,884 of which 95% is EU grant funded, the remaining 5% being the university's own contribution. The whole budget by utilized by successfully completing the planned activities. We spent nearly equal amounts (cca. 30% of the budget) on priority research activities - research infrastructure development and horizontal elements in service of research potential development (Figure 1). Some 1500 people in priority research areas were supported. When compared to the first half of the project, we significantly increased the number of undergraduate and postgraduate students (Figure 2) who were primarily allocated to horizontal tasks. We purchased almost 100 pieces of research equipment and 300 external services for the development of the infrastructure. 5% of the project was appropriated to the development of professional relationships and supporting participation at conferences.

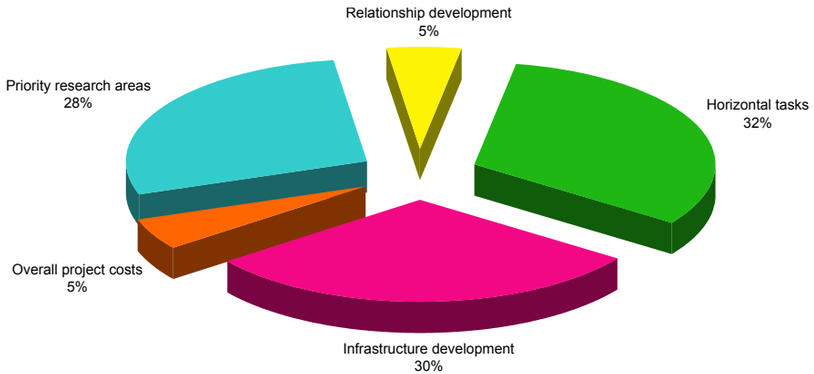


Figure 1.
Rate of support of implemented activities of the project *

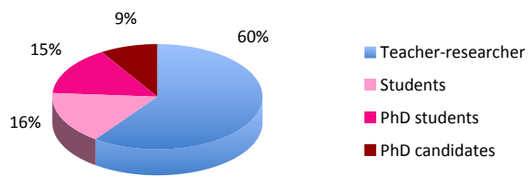


Figure 2.
Distribution of participants in professional implementation*

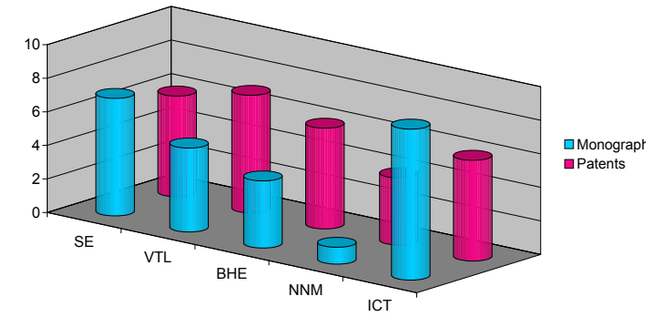


Figure 3.
Number of monoraphs and patents by priority research areas*

It is anticipated that the Research Institution project will exceed all the indicators it undertook to achieve. Also, more patents have been submitted and monographs published than earlier anticipated (Figure 3).

The quality of research partnerships as one of the key project goals has shown substantial improvement (Figure 4).

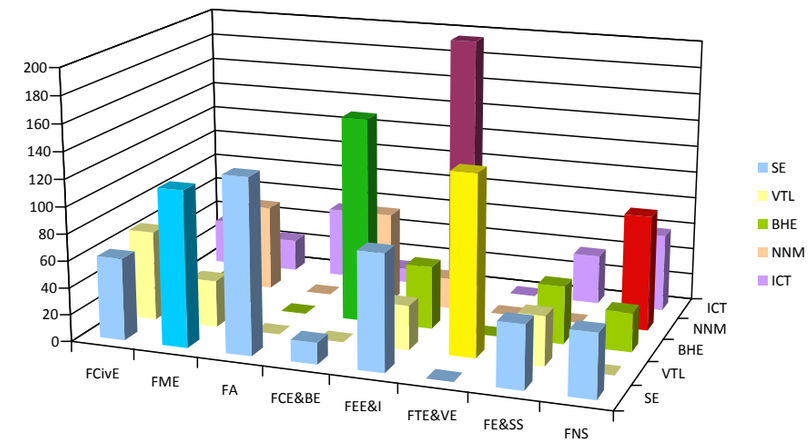


Figure 4.
Cooperation of faculties in priority research areas (number of persons involved in research projects)*

*Data reflect the processing of September of 2012.

DEVELOPING THE HORIZONTAL ELEMENTS OF THE RDI ENVIRONMENT

Products of collective thinking at the institution: Theses and proposals

Research, development and innovation activities, developing the standard of education, the implementation of research university goals or sending the initiated processes on a sustainable course are not possible without an established institutional support environment and continuous awareness-raising. This requires the knowledge of the related areas and the prevailing best practices in such areas, the analysis of external and internal processes, the maintenance of professional relations, providing an institutional forum for consultation and disputes, as well as the escalation of mature concepts to management level. BME set up a new horizontal cooperation model by establishing eight inter-faculty working groups. The working groups collected and analysed the activities pursued, experience and best practices prevailing at the faculties as well as in Hungarian and international institutions, identified the institutional obstacles to the development of areas, and drafted their recommendations for the future in the form of executive proposals.

Foreign language training

The reform and enhancement of foreign language training constitute a critical part of the "BME of the Future" strategy. We endeavour to provide actual multicultural and expressly quality-oriented training where Hungarian and foreign students of diverse training forms study together in their selected foreign language. For that, we have to enhance the services available to foreign students, intensify our application activities to provide funding, motivate the trainers and coordinate faculty-level training processes. Foreign language training development may rely on the Erasmus exchange programmes to be renewed in 2013, the globally growing student and trainer mobility, international applications, partial scholarships, partial academic paid trainings and private sponsors' scholarships. A priority for determining the future course of foreign language training is to monitor the constantly changing expectations of Hungarian and foreign students, while developing the set of means and operating structure that can adapt flexibly thereto.

Talent management

(1) Next generation of students: In addition to the traditional Open Day organised for the first and second year secondary school students, we open the university laboratories for study trips and create a technical study trail in the university campus. We are looking forward to the participation of our students, particularly special college students. (2) The talent management activities of teachers and the recognition thereof: We are working toward to make the tutors deal with talented students as part of their naural mode and make this approach to be an expectation for teachers and the heads of organisational units alike. (3) Organisation

of talent management and presentation outside the university: We are planning to establish a university giftedness point operating under the National Talent Support Council to coordinate talent management within the university and presenting our activities across the country.

Institutional relations

Institutional relations are to be handled as key resources of the university. An enforceable institutional strategy must be developed with respect to all forms of cooperation in support of research activities. It is the task of the university to nurture relations with secondary schools. Maintaining alumni relations requires university coordination assisted by the alumni experience gained at the various faculties. Institutional relations should rely on the BME "brand". We need much more international presence to expand our international activities, especially on an institutional level (international professional exhibitions, training fairs, conferences, visits to partner institutions, etc.). It is imperative to have continuously updated electronic and printed English language information material. We have to strengthen our participation in Erasmus while consistent exceptionally high standard course offers. At the same time, significantly more foreign lecturers must be invited (extension of applications).

Infrastructure development and availability

We have to upgrade the whole process of research equipment registration into an IT-supported system that will facilitate - inter alia - access to the instruments, purchased in the framework of TÁMOP ERDF, for stakeholders within and outside the university and ensure the level of utilisation. It is important for us that external partners are aware of the university laboratory equipment and the availability thereof for rented periods. This requires the development and regular updating of the laboratory websites, as well as the accreditation of laboratories.

Development of the RDI environment and administration services, databases

The foremost job is not the question of technical, but organisational culture: we need to revise our approach. We need to develop our operation to be in line with the eUniversity concept. This requires drafting new rules, processes and criteria. Information sharing is just another cultural issue. We have innumerable methods at hand to manage data and databases, so it is only subject to determination and human resources if knowledge sharing actually takes place or not. The introduction of document management requires two basic technical requirements to be met: (1) University-level standard user identification (authentication). (2) Authentica-

Accredited laboratories currently in operation::
Faculty of Civil Engineering - Department of Highway and Railway Engineering: Pavement Laboratory;
Faculty of Civil Engineering - Department of Geotechnics Laboratory;
Faculty of Civil Engineering - Department of Construction Materials and Engineering Geology: Material Testing Laboratory;
Faculty of Civil Engineering - Department of Structural Engineering: Structural Analysis Laboratory;
Faculty of Mechanical Engineering - Department of Polymer Engineering: Material Testing Laboratory;
Faculty of Mechanical Engineering - Cooperation Research Centre for Biomechanics;
Faculty of Chemical Technology and Biotechnology - Department of Inorganic and Analytical Chemistry: Air Pollution Testing Laboratory;
Faculty of Electrical Engineering and Informatics - Department of Telecommunications and Media Informatics: Telecommunications Testing Laboratory;

tion of electronic documents by introducing digital signatures.

Quality assurance of university RDI activities

In the course of developing the elements of the quality management system - according to the proven TQM principles and methods at the university - a set of tools must be created for managers and associates at various levels that supports the assessment and continuous improvement of their processes and performance. The operation of the system elements should promote managers' and associates' autonomy and responsibility. The elements of the quality assurance of RDI activities, namely (1) coordination, (2) regulation, (3) cost efficiency and (4) clear evaluation facilitate decisions related to launching new projects and the performance of data-based risk assessment. The application of the organisational self-assessment model approach and set of tools is required in the field of RDI quality assurance. We have to make efforts for the increased utilisation of the synergies of the quality assurance system during the establishment and development of the management information and controlling system.

Trainers' training

Regular joint courses for BME professors and postgraduate students in the following specialities: history of science and technology, project management, management skills, research methodology, innovation management, marketing, application writing, utilisation and protection of intellectual property and assets, psychology skills for management, research and economy, negotiation skills, presentation skills, teaching methodology. The inclusion of the Institute of Continuing Engineering Education in postgraduate education and the organised advanced training of instructors; the involvement of the Language Institute for advanced technical language trainings and in general to acquire the so-called "teacher competences

Succession, doctoral candidates, post-doctoral staff

(1) Make the annual reporting of faculty postgraduate students a practice pervade the whole university. (2) Organisation of BME Postgraduate Conference every year. (3) Launching joint Ph.D. training with foreign universities. (4) Make the university research budget available to postdoctoral students of outstanding quality. (5) Periodical control of the standards of education provided by postgraduate students. (6) Ph.D. students should formally be the supervisors for TDK works and Bsc theses.

"József Pálinkás, President of the Hungarian Academy of Sciences opened last year's ""Útközben"" (En route) Conference"

"Útközben" Conference 21.06.2011

Horizontal programme	Host faculty	Workgroup coordinator
Infrastructure development and presentation	Faculty of Civil Engineering (ÉMK)	Kiss Rita associate professor *kissrit@t-online.hu*
Institutional relations	Faculty of Mechanical Engineering (GPK)	Lajos Tamás university professor *lajos@ara.bme.hu*
Foreign language training	Faculty of Architecture (ÉPK)	Benkő Melinda associate professor *benko@urb.bme.hu*
Talent management	Faculty of Chemical Technology and Biotechnology (VBK)	Borsa Judit university professor *jborsa@mail.bme.hu*
Development of the RDI environment and administration services, databases	Faculty of Electrical Engineering and Informatics (VIK)	Balássy György engineer *balassy@aut.bme.hu*
Trainer training	Faculty of Transportation Engineering and Vehicle Engineering (KSK)	Eleőd András university professor *eleod@kge.bme.hu*
Succession, doctoral candidates, postdoctoral staff	Faculty of Natural Sciences (TTK)	Kézsmárki István associate professor *kezsmark@dept.phy.bme.hu*
Quality assurance system of RDI activities	Faculty of Economic and Social Sciences (GTK)	Topár József assistant professor *topar@mvt.bme.hu*

SUSTAINABLE ENERGY

By sustaining continuity

Gyula Gróf

In the area of **Sustainable Energy** (SE) priority research, the achievements obtained were a result of joint efforts. The correct choice of the objectives and methods as defined in the research strategy, are shown by the fact that most components of the situation analysis, goals, methodology and solutions laid down in the National Energy Strategy and its related action plans, have already appeared in our previous research strategy. The research topics defined on the basis of this strategy serve the aims formulated in these documents. The topics and achievements of the research projects also conform to pan-European objectives, while creating of possibility of taking part in the implementation of the energetic goals set out in the Horizon 2020 program. As a result of the energy policy paradigm shift, its previous three pillars – competitiveness, environmental protection, supply security – have now been supplemented with the additional requirement of social acceptance. Therefore, we continue with the topics in this spirit during the reformulation of our research strategy. The obtained results are worth mentioning in each of the **ten projects** and research continues in nearly all topics. However, the successful work of researchers not mentioned in this brief overview is also very much appreciated. The award winning **ODOO** project (Solar Decathlon) is a wonderful example for inter-faculty collaboration and its involvement of students in the research programme. The construction of a building which is to be transported to Madrid has been started. The "**Virtual Power Plant Program**" is an "external" project of the SE Unlimited Partnership and it is a good example showing how the successful cooperation between Hungarian research institutes and industrial energy consumers, provides a good opportunity for the practical use of various research findings which improve energy efficiency.

The topics of electric power are closely linked to the directives set out in the National Action Plan. The most successful research topics include the examination of the modelling and controlling issues of smart grids; the modelling of the participation of distributed power generation small power plants using conventional and renewable energy in market and system integration; the modelling of small isolated system conditions of small power plant areas; the use of power electronics in electrical energy production, storage and control. The research areas also involve the quality issues of the electricity supply; grid losses; the use of superconductivity; the research of zero emission electrical vehicles and the construction of an experimental prototype. The scaling procedure applied to large-scale distributed networks has also attracted attention at an international level. Nuclear energy safety has been improved by the examination of the fuel assemblies at the Paks Nuclear Power Plant with CFD simulations, the results of which are also now used in the software of the power plant's zone control system.

We successfully participated in the European GoFastR project during which we performed detailed reactor physical and thermohydraulic analyses in relation to the planned **Allegro** experimental gas-cooled fast reactor. New scientifically established resource evaluation and demand prediction methods have been worked out that can be used to estimate the energy needs and the consequences of meeting these needs at the national economy level in a complex way. The other area of research has been the development of methods helping the optimum allocation of producer resources, during which the procedure developed was also used under industrial circumstances. The research university program was an essential prerequirement for the results of the energy consumption survey research program that was successfully completed because of the unprecedented cooperation between technical sciences and humanities. The same also refers to the development of several new economic and accounting centred approaches related to energetics. Several research topics have helped the participants to obtain scientific degrees, thereby making their individual work which they had previously started more efficient. During the two-year period, the research carried out in some topics resulted in **patentable** solutions, such as developments related to the harvesting of energy crops or the complex utilization of biomass.

Contact

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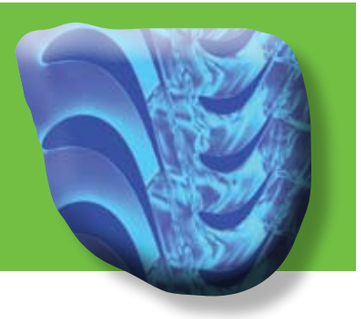


Energy plantation harvester

Renewable energy laboratory

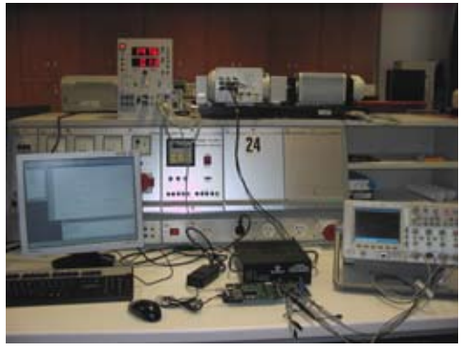
BME Solar Decathlon-ODOO project

Research projects and topics

	Energy efficiency, energy saving	
FE-P1	**Technical tools of the energy rationalization of buildings, structures and energy demands**	**Mályusz Levente**
FE-P1-T1	Alternatives of reducing the environmental load of building renovation	Horváth Sára
FE-P1-T2	Energy conscious rehabilitation of residential buildings with facades to be maintained	Kakasy László
FE-P1-T3	Fire protection of low energy consumption buildings	Takács Lajos
FE-P1-T4	Time and cost relations of efficient and environmentally conscious implementation	Mályusz Levente
FE-P1-T5	Comprehensive heat and moisture technical assessment and life cycle analysis of new and old buildings	Tóth Elek
FE-P2	**Correlation between planning and energy efficiency, the architectural and building structure-related opportunities of reducing environmental load**	**Mályusz Levente**
FE-P2-T1	ODOO - Solar Decathlon	Varga Tamás
FE-P2-T2	Designing buildings from the aspect of integrated energetics with the building-specific analysis and determination of sustainable criteria	Varga Tamás
FE-P2-T3	The impact of renewable energy resources on the future of the blocks of flats of the city centre of Budapest	Alföldi György
FE-P3	**Rational energy consumption**	**Gróf Gyula**
FE-P3-T1	New diagnostic methods of color-blindess	Ábrahám György
FE-P3-T2	Energy-conscious air conditioning	Kajtár László
FE-P3-T3	Development of fluid dynamics processes, machines and equipment in order to improve energy efficiency and to reduce environmental load by using computational fluid dynamics devices and fluid dynamics measurement techniques	Vad János
FE-P3-T4	Minimum energy consumption of municipal pump networks with the consideration of stochastic consumption needs	Hős Csaba
FE-P3-T5	Energy-saving process planning and energy integration	Pátzay György
	Carbon-neutral technologies	
FE-P4	**Nuclear energetics**	**Aszódi Attila**
FE-P4-T1	Sustainable nuclear energetics	Aszódi Attila
FE-P4-T2	New static calculation methods for the design and inspection of nuclear energetic equipment	Kovács Ádám
FE-P4-T3	Examination of rock environments serving as storage of radioactive waste	Török Ákos
FE-P5	**Renewable energy resources**	**Lezsovits Ferenc**
FE-P5-T1	Development of the biomass thermal conversion procedure	Lezsovits Ferenc
FE-P5-T2	Complex energy crop harvesting and processing system	Jóri J. István
FE-P5-T3	Development of a more efficient production technology of biofuels	Réczey Istvánné
FE-P5-T4	New generation wind power towers	Dunai László
FE-P5-T5	Geothermal energy in the building sector	Viczai János
FE-P5-T6	Geothermal energy in Hungary	György László

	Electric power technology and grid	
FE-P6	**Electric power grid and storage**	**Prikler László**
FE-P6-T1	Integration of small power plants into the system controlling, examination of Smart Grid systems from the aspect of balancing, efficient system integration of customer storage capacities	Dán András
FE-P6-T2	Hardware and software tools of intelligent energy grids	Dán András
FE-P6-T3	Strategy of the integration of the Hungarian organised electricity market	Raisz Dávid
FE-P6-T4	Improving the availability of medium voltage grids	Dán András
FE-P6-T5	Power electronics and information technology relations of intelligent energy grids	Dán András
FE-P6-T6	Optimum converting units of the exploitation of renewable energy resources	Nagy István
FE-P7	**Electric power technology and environment**	**Dán András**
FE-P7-T1	Distribution mains loss management	Raisz Dávid
FE-P7-T2	Examination of issues related to integrated solid-state illumination engineering solutions	Poppe András
FE-P7-T3	Development of the measurement and classification procedures of solar cells	Tímárné Horvát Veronika
FE-P7-T4	Examination of the energy efficiency of large-scale distributed networks	Trinh Anh Tuan
	Decision support knowledge	
FE-P8	**Energetic investment analysis methodology**	**Tóth Tamás**
FE-P8-T1	Financial-economic relations of the evaluation of EU projects	Szabó Márta
FE-P8-T2	The role of financial withdrawals and feeding systems in energetics	Lakatos Mária
FE-P8-T3	Environmental and geoengineering	Galántai Zoltán
FE-P8-T4	Financial accounting of emission rights	Karai Éva
FE-P8-T5	Presentation alternatives of sustainability aspects in the executive financial accounting	Laáb Ágnes
FE-P8-T6	Performance analysis of log-optimal portfolio strategies with transaction costs, Non-parametric and semi-parametric asset pricing, and requisites for long-term growth in financial markets	Ormos Mihály
FE-P9	**Energy consumption survey**	**Gróf Gyula**
FE-P9-T1	Technical tools of the energy consumption survey	Gróf Gyula
FE-P9-T2	Energy consumption survey and the sociological tools of city development planning	Janky Béla
FE-P10	**Evaluation of energy resources**	**Bihari Péter**
FE-P10-T1	Prediction and impact assessment methods of the source and use structure of energy resources	Bihari Péter
FE-P10-T2	Development of the allocation methods of energy resources	Bihari Péter
FE-P10-T3	Carbon capture technologies	Gács Iván
FE-P10-T4	Improving the efficiency of power plant technologies with model-based control	Szentannai Pál
FE-P10-T5	Economic evaluation of electric power storage	Bohák András
FE-P10-T6	Economic analysis of energy efficiency projects	Dülk Marcel

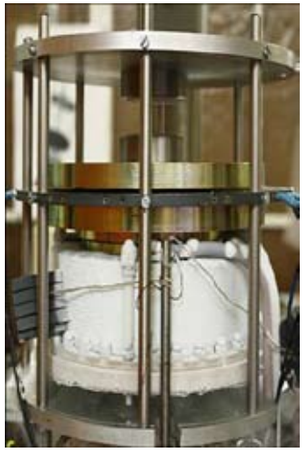
TERALED measurement system



Laboratory measurement of the electrical energy converting unit

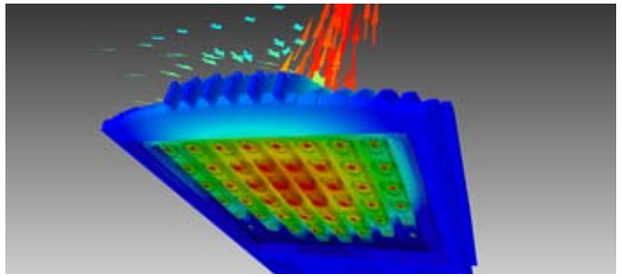
Reactor used for technology development

On-site analytical measurement of biomass gasification



Superconductor energy storage

New methods of heat physical laboratory



CFD simulation of LED luminaires
(Perlight family of Hungarolux Kft)
(Mentor Graphics FloTHERM)

Opinion of the Advisory Board

The Advisory Board has reviewed the respective documentation (reports, staff numbers, publication statistics, etc.) of all projects of the Sustainable Energy priority research area. The Board accepts the numerical data and their successful conclusions. Consequently, the Advisory Board has arrived at the following conclusions about its general validity: The topics pursued in the priority research area are in harmony with the objectives set in the National Energy Strategy and EU directives. They are considered to be relevant also at an international level and they are worthy of the traditions of the Budapest University of Technology and Economics. Research can be classified into the following two groups:

1. Research that deals with areas affected by global problems and which point towards the distant future: new generation reactors, superconductivity, SmartGrid, Smart City, Solar Decathlon, new generation bio-heating fuels, CCS technologies.

2. Areas which cover Hungarian energetics and environmental protection where the solutions have to be worked out by Hungarian professionals in harmony with international trends before delivering them to practical users. As a near-industrial activity, it is an important mission of the University. This area is associated with several findings which have attracted the interest of industry even during the research phase and have resulted in patentable solutions.

The systems conditional to the pursuit of these topics are also provided and the cooperation launched with the participation of several inter-faculty and other higher institution and academic institutions. The extent of student participation is different in each topic, as it ranges from a very high number of participants to just one or two students. In the period following the closure of the program, the findings obtained and the subsequently development of Hungarian and international relationships provide a good basis for the continuation of these topics and also to connect new and current topics to these projects.

Experimental flame image

Members of the Advisory Board

Sustainable Energy priority research area

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Members István Bakács, president, ETE
Károly Gerse, general manager advisor, MVM
Tamás Katona, honorary scientific manager, Paks Nuclear Power Plant
Zoltán Korényi, project development manager, E.ON

VEHICLE TECHNOLOGY, TRANSPORT AND LOGISTICS

Smoothly

István Varga

The strategy and the achievements of the **Vehicle Technology, Transport and Logistics** (VTL) priority research area show that the designated and on-going R&D activities conform to the respective development policy concepts, both at national level (New Széchenyi Plan, preparation of the National Transport Strategy) and at an international level (EU Common Transport Policy, Horizon 2020). The strategic documents pertaining to this professional area set out the aims of considering the aspects of competitiveness and sustainability in a balanced way and, determining the nature of the development tools to support this concept. The topic delineation of VTL is in harmony with this basic principle, as it focuses on innovative technological and organizational solutions which take both requirements into account – although sometimes to a different extent. Basically, the priorities have not changed during recent years, but focal points such as the pan-transportation approach, the preference of supply networks, or the efficiency of vehicle production and operation are more intensively scrutinized.

During the regular actualization of the VTL research strategy and the follow-through of research topics, we adjusted our research program to take into account the current main innovations at both Hungarian and International levels. More specifically, the dynamic determination of the focal points was done on the basis of continuous evaluation of the excellence competences.

During the last two years, in the area of VTL, **25 topics were selected and divided into 8 different projects** involving the co-operation of 6 faculties and 15 departments of the Budapest University of Technology and Economics. In addition to the research and development aspects, this collaboration also resulted in several joint industrial commissions in several of the departments. **Six patents** were submitted in the priority research area, several scientific papers and five books were published. More than 100 students and doctoral candidates were involved in the research work.

In **research into the vehicle industry**, successful measurements performed on

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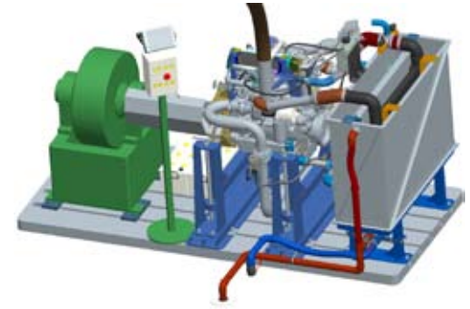
a dynamometer, installed as a part of the project investments, provided significant results leading to efficiency improvements in internal combustion engines. Furthermore, the development of intervention methods, also built on these measurements, and experiments aimed at the detection of the water solubility of CO_2 gas bubbles using fluorescence methods as a simplified modelling of multiphase flows, are also significant. In the research project into the energetic conditions of vehicles, a connection-thermodynamic-attrition algorithm was developed on the basis of the brake block measurements of railway vehicles; this meant that the attrition calculations were significantly more accurate. The examinations that took place concerning the relation of the vehicle to the rail track revealed correlations between the sliding and microvibrations of the vehicle wheel.

Whilst carrying out **transport research**, important findings were obtained in the intelligent control of transport networks, mainly by an algorithmic implementation of the robust control methods – with special attention paid to the MPC based control. The method of modelling large-scale transport networks and the program required to do it was also developed further.

The collaboration of several faculties resulted in a method of positioning and routing, based on the cell information of mobile phones. The algorithm, developed in the field of features and methodology of maintenance services, makes it possible to revise the dimensions from the measurement system by using the help of its evaluation functions which represent the company's own set of values.

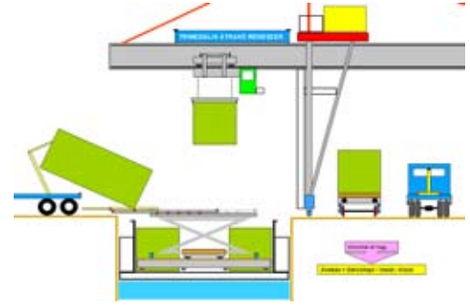
In the field of **logistic research**, the preferred areas were the quality service of intensive sectors, and competitive logistic services with high added value. During the project, effective control methods were worked out on several developed models (e.g. trade flows) and simulations. Furthermore, new findings were obtained in the field of electronic freight and storage exchange - the use of artificial intelligence based technologies and logistic systems.



Engine dynamometer for engine air management measurements

Computerized (Vissim) traffic model of one of the partial networks of Budapest

BME control station of the Budapest Traffic Control Centre



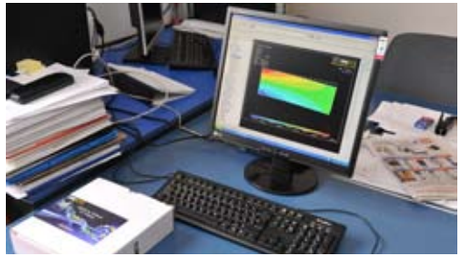
Trimodal transshipment system

Research projects and topics

JKL-P1	**Improving the efficiency of internal combustion engines**	**Németh Huba**
JKL-P1-T1	Air management of internal combustion engines	Németh Huba
JKL-P1-T2	Fuel supply systems of engines	Vad János
JKL-P1-T3	Comparison, simplification and generation of combustion models, sensitivity analysis	Tóth János
JKL-P2	**Development of vehicle industry mechatronic components**	**Gubovits Attila**
JKL-P2-T1	Calculation and simulation of mechatronic components used in vehicles	Gubovits Attila
JKL-P2-T2	Advancing natural speech communication in car environment	Németh Géza
JKL-P2-T3	Improving the life duration and reliability of vehicular electronic devices, equipment and systems	Gordon Péter
JKL-P3	**Researching the energetic conditions of vehicles**	**Sábitz László**
JKL-P3-T1	Alternatives of reducing the energy need of moving vehicle sets	Szabó András
JKL-P3-T2	Heat progression, frictional and attrition simulation of railway brake systems	Goda Tibor
JKL-P3-T3	The impact of tyre microvibrations on the roll resistance	Csernák Gábor
JKL-P4	**Intelligent control of public road transport networks**	**Tettamanti Tamás**
JKL-P4-T1	Modelling and control of public road vehicle transport	Varga István
JKL-P4-T2	Connection of transport subsectors to information technology tools	Csiszár Csaba
JKL-P4-T3	Modern road pricing systems in traffic control	Mészáros Ferenc
JKL-P4-T4	Controlling vehicle formations	Kiss Bálint
JKL-P4-T5	Satellite technologies for the improvement of transport security	Lovas Tamás
JKL-P5	**Development of public road transport models and measurement methods**	**Bocz Péter**
JKL-P5-T1	Simulation, analysis and control of large-sized public road networks	Péter Tamás
JKL-P5-T2	Using radar sensors in the measurement of public road vehicle traffic	Seller Rudolf
JKL-P5-T3	Working out self-reproducing road network transport models in order to classify developments	Fí István

CarSim car simulator

JKL-P6	**The logistic set of conditions of the division of labour in the transport subsector**	**Mészáros Ferenc**
JKL-P6-T1	The set of conditions of setting up the logistics industry in the transport network in accordance with the co-modality priorities	Kulcsár Béla
JKL-P6-T2	Organizational and controlling aspects of integrated transport chains	Nagy Zoltán
JKL-P6-T3	Development of the elements of the supply chain management	Topár József
JKL-P7	**Development of technologies serving the operation of logistic systems**	**Benkő Gábor**
JKL-P7-T1	Determination of equipment furthering the material flow of plants working in bi- and trimodal junctions, as well as their optimum operation parameters	Kulcsár Béla
JKL-P7-T2	Use of electronic freight and storage exchanges in order to reach the optimum utilisation of the modality opportunities of traffic junctions	Bóna Krisztián
JKL-P7-T3	Using artificial intelligence-based technologies in planning logistic systems and the support of tasks arising in their operative control	Bóna Krisztián
JKL-P8	**Quality service of logistics intensive sectors with competitive logistic services with high added value**	**Topár József**
JKL-P8-T1	Opportunities of developing city logistic services serving the goods supply of large cities in Hungary	Bóna Krisztián
JKL-P8-T2	Development of the vehicle industry supplier quality management system	Topár József

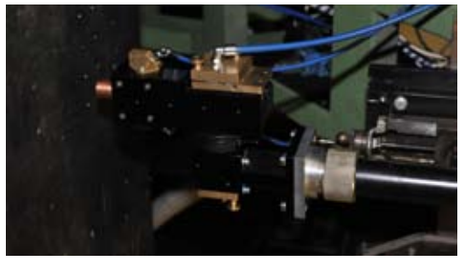


ANSYS planning software

Audi vehicle simulator, Audi TT

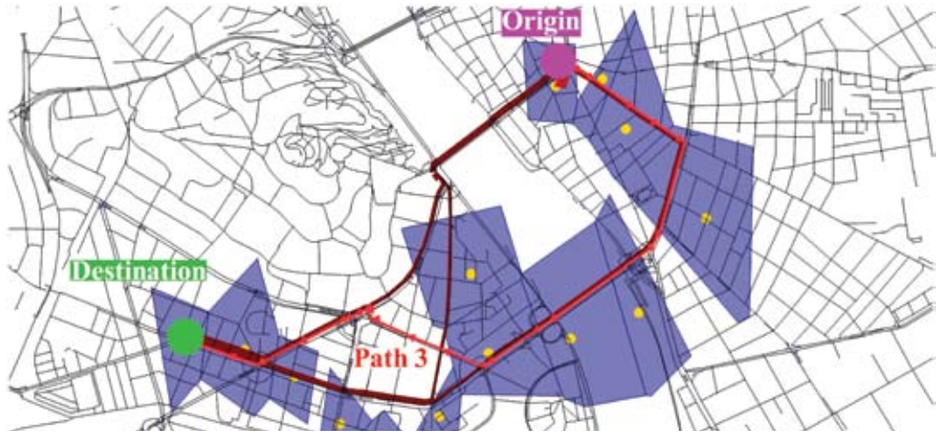
Public road traffic control equipment with "miniloop" vehicle loop detector

Public road traffic lights and control platform



Laser optical system

The container used in the project



Comparison of alternative routes - based on mobile phone zones - in a computerized traffic model (Visum)

Opinion of the Advisory Board

The professional report of the BME Research University Program „Vehicle Technology, Transport and Logistics" priority research area was reviewed by the VTL Advisory Board on three occasions (24th May, and 20th October 2011, 26th January 2012) within the framework of a widely advertised professional report. During the three reviews all 25 topics were examined. Based on the statements and project reports the Advisory Board arrived at the following conclusions.

The research topics compiled in the VTL field are up-to-date and their implementation has, for the most part, been successful. It can be concluded that the conditions required to pursue these topics have been fulfilled and that they have resulted in new scientific findings. One of the main objectives of the project has been to induce a closer collaboration between the organizational units of the University and then to familiarize the different research areas and directions with each other. The research topics provided a good basis for this objective, as the cooperating departments had to work together in several topics fields, sometimes even with departments from different faculties.

The grouping of the topics and projects has been sufficiently well grounded, and the utilization of cooperation opportunities between each organizational unit of the University is shown by specific examples. In a few cases, the research university program has also resulted in joint industrial commissions. Therefore, it can be stated that the research university program has also been successful in the field of strengthening synergies. Based on the reports, it can also be stated that a large number of students were involved in the research work in all topics, both from the BSc and the MSc training, and also several doctoral candidates worked on each topic. Furthermore, the Advisory Board concluded that these research areas had generated a large number of BSc/MSc theses, studies of the Scientific Students' Association (TDK) and PhD research activities. Therefore, in addition to the practical aspects, the number of scientific publications and findings will also be expected to increase. Whilst determining the areas of research in VTL, the topical character and practical focus and efforts to make the expected results not only useful for science but for Industry and the Market as wide as possible, were also important aspects. Consequently, it can be stated that the research topics were practice-focused and provided several connection points to the needs of Industry.

Members of the Advisory Board

Vehicle Technology, Transport and Logistics priority research area

President: Éva Kövesné Gilicze, University Professor, Department of Transport Engineering, BME Faculty of Transportation Engineering and Vehicle Engineering **Members:** Ákos Detrekői, University Professor, Rector Emeritus, Department of Photogrammetry and Geoinformatics, BME Faculty of Civil Engineering • Péter Gáspár, Scientific Sonsultant, University Professor, HAS Computer and Automation Research Institute • Béla Illés, University Professor, Head of Department, Dean, University of Miskolc, Faculty of Mechanical Engineering and Informatics • Béla Karsai, General Manager, Karsai Műanyagtechnikai Holding Zrt.

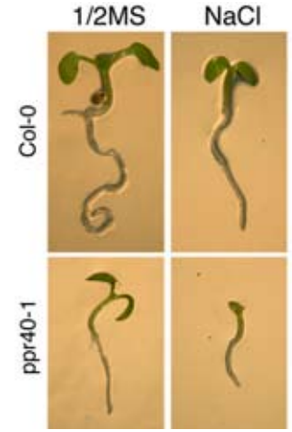
BIOTECHNOLOGY, HEALTH AND ENVIRONMENTAL PROTECTION

Effective catalyser

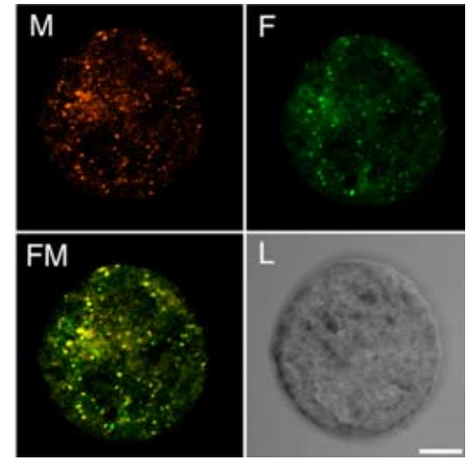
András Szarka

Feeding, health care and environmental sustainability is an unquestionable challenge for 21st century human beings. Modern biotechnology aims to find solutions for this triangular set of problems; this is why the name "technology of hope" has been coined. By following the European (Horizon 2020) and Hungarian (New Széchenyi Plan) tendencies and action plans, we wanted to direct our thinking in terms of the modern dimensions of sustainability and, in the case of **biotechnology, the health and environmental protection** priority research area (BHE), thus promoting the processes of training and education as well. During the preparation of the strategy of the priority research area and in addition to the leading tendencies, we also considered the **special aspects of BME** itself. This meant that we could supplement the tools of biotechnology with other professional areas: electronics; information technology; economic and nanotechnology, which resulted in a **more intensive cooperation** with the other priority research areas and also resulted in **more effective research background.** More than 50 researchers and their 100+ doctoral candidate colleagues, together with several hundred students across 20 departments of the 6 faculties, participated in the priority research area. The infrastructure development element of the program provided visibly effective help in the establishing of the **molecular biotechnology** area which in turn, started the current prospering of biotechnology. It also contributed to the launching of molecular biotechnology as a core facility at the Budapest University of Technology and Economics. As a result of this, we managed to reveal the manifold role of **plant mitochondria in stress sensation and stress responses**. The analyses also uncovered the yet unknown aspects of **ascorbate** and various **stress** conditions. These findings can now be used by **agricultural biotechnology** in breeding to develop more stress tolerant (e.g. drought, UV) crop species. During the program, we developed and tested a model product, a realistic food matrix which could be used as a **reference substance** in the reliable analysis of **allergy-inducing proteins in cereals** and wheat. In the **milling industry** – which currently uses a fully **developed technology** – we managed to increase the grist recovery by 1.5% using these technical developments, and the grist fraction extracted with this new technology was also rich in healthy ingredients. The continuously ever-increasing quantity of medical-biological data made the data and knowledge fusion one of the focal problems of the biological and medicine research and clinical applications. The use of the **data fusion research methods** developed during the program in pharmaceutical research is now very close to that required for practical use. During the research of **environmental friendly technologies**, it could be seen as an important step forward that we managed to perform the direct esterification and amidification of phosphine acids which have a manifold use (bioactive compounds, flame retardants and Li batteries) under **microwave and solvent-free conditions**, reactions which do not happen under normal circumstances.

Based on the interdisciplinary researches of the BME, **efficient and cost-saving biotechnological procedures were worked out** which took into full account that **wastewater** quality and its **purification** requirements might change in Hungary depending on the specific location, and also that they might significantly differ from that of foreign countries which serve as reference examples in traditional practices. **Health care** can become sustainable by means of **individually tailored** procedures which are based on the contribution of all those involved. Research projects which aimed to provide a basis for this sustainability were carried out in several departments of the BME. The harmonization and the establishment of relations between the affected researchers and the companies to which they are connected resulted in an effective, BME-centred research capacity. **The infrastructural developments** and the **working relationships** established during the program resulted in new, **successful projects** which could further provide the conditions of the successful work being carried out within the priority research area.



Salt stress sensitivity of the ppr-40-1 mutant



Mitochondrial localization of the ppr-40 protein on fluorescent immunohistochemical images

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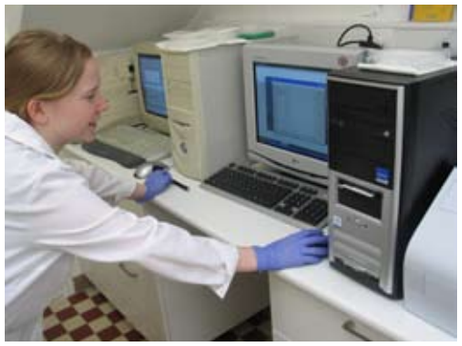
Research projects and topics

BEK-P1	**Health care and molecular biotechnology, biocatalytic technologies**	**Salgó András**
BEK-P1-T1	Development and application of biosensors and microbioanalytical systems	Gyurcsányi Róbert
BEK-P1-T2	Molecular imprinted polymers	Horvai György
BEK-P1-T3	(Nano)formulation and examination methods of living cells, proteins, vaccines	Marosi György
BEK-P1-T4	Biotechnology-based medicine production and the development and application of examination methods capable of controlling its processes	Salgó András
BEK-P1-T5	Chemical biology - Examination of enzyme mechanisms, selective biotransformations	Poppe László
BEK-P1-T6	Chemical biology - Examination of enzyme mechanisms	Nyulászi László
BEK-P1-T7	Examination of the opportunities to use biotechnology in the textile industry	Csiszár Emília
BEK-P1-T8	Individually tailored chemotherapy	Vértessy Beáta
BEK-P1-T9	The examination of stress-induced adaptation mechanisms in the animal, human and plant mitochondrion	Szarka András
BEK-P2	**Food, agricultural and industrial biotechnology**	**Tömösközi Sándor**
BEK-P2-T1	Research of white biotechnological methods and procedure development	Sevella Béla, Németh Áron
BEK-P2-T2	Indulgent treatment of plant products, indulgent extraction of plant active ingredients	Simándi Béla
BEK-P2-T3	Health-promoting cereal-based product development, food allergy and intolerance	Tömösközi Sándor
BEK-P2-T4	Indulgent separation and purification of biofeedstocks	Cséfalvay Edit
BEK-P3	**Bioinformation technology**	**Antal Péter**
	Bioinformation technology service provider centre	
BEK-P3-T1	Development and installation of bioinformation technological databases and statistical methods	Sárközy Péter, Millinghoffer András, Hajós Gergely, Antal Péter
BEK-P3-T2	Repositioning-based drug active ingredient prioritization	Arany Ádám, Antal Péter
BEK-P3-T3	Protein modeling, structure and function	Poppe László
	Individually tailored medicine	
BEK-P3-T4	Measurement technique of phenotypes: quantitative measurement of phenotypes, especially the measurement technique of blood pressure check and the progression of neurodegenerative diseases. Examination of the quantitative measurement and the disturbing character of stress (mental load). Examination and improvement of the reliability of parameters serving home monitoring and patient care.	Jobbágy Ákos
BEK-P3-T5	Planning and analysis of genetic association and pharmacogenomic experiments, establishment of knowledge bases	Hullám Gábor, Gézsi András, Temesi Gergely

BEK-P4	**Environmental friendly technologies (reducing environmental load, preventing pollution)**	**Keglevich György**
BEK-P4-T1	Environmental friendly materials and technologies in the construction of infrastructural establishments	Farkas György
BEK-P4-T2	SO_2 and CO_2 emission reduction technologies and equipment development	Örvös Mária
BEK-P4-T3	Sustainability / sustainable development	Valkó László
BEK-P4-T4	Climate protection / global climate change	Valkó László
BEK-P4-T5	Solid waste treatment: solid/waste analysis, recycling, waste burning prevention, waste burning, pyrolysis, material technology of waste containers	Marosi György
BEK-P4-T6	Environmental friendly and phosphorus-organic reconstructions	Keglevich György
BEK-P4-T7	Chirotechnological research	Faigl Ferenc
BEK-P4-T8	New resolving methods	Fogassy Elemér
BEK-P4-T9	Chiral crown ethers and lariat ethers	Huszthy Péter
BEK-P4-T10	Stereoselective syntheses catalysed with chiral crown ethers	Huszthy Péter, Bakó Péter
BEK-P4-T11	Examination of environmental friendly technologies with life cycle analysis	Benkő Tamás
BEK-P4-T12	Environmental friendly materials and technologies in the electronic industry	Hajdu István
BEK-P5	**Restoration of environmental damages, wastewater purification**	**Jobbágy Andrea**
BEK-P5-T1	Improving the detachment efficiency of fluffy suspended solids with magnetic field-controlled nano-particles	Búzás Kálmán
BEK-P5-T2	Environmental load caused by antropogeneous material flows through rainwater and the conditions of rainwater utilization in municipal circumstances	Clement Adrienne
BEK-P5-T3	The impact of air pollution on our built cultural heritage	Török Ákos
BEK-P5-T4	Selective extraction/removal of biologically active pollutants and the physical and chemical analysis of their degradiation in the atmosphere	László Krisztina
BEK-P5-T5	Complex, physical-chemical and biological treatment of industrial process waters	Mizsey Péter
BEK-P5-T6	Spontaneous and controlled biodegradation in wastewater purification	Jobbágy Andrea
BEK-P5-T7	Modelling environmental damages: computerized simulation, working out efficient numerical procedures, mathematical analysis of the models	Horváth Róbert
BEK-P6	**Integrated health protection and medication technologies**	**Marosi György**
BEK-P6-T1	Chemical support of rational active ingredient planning, selective synthesis of drug active ingredients and their intermediates	Szántay Csaba, Keglevich György, Faigl Ferenc
BEK-P6-T2	Product technological and product analytical developments	Marosi György
BEK-P6-T3	Development of inorganic nanocarriers and antibacterial products	Hórvölgyi Zoltán
BEK-P6-T4	Development of products with controlled and targeted active ingredient release	Szilágyi András
BEK-P6-T5	Development of nano-structure active ingredient release systems, diagnostic and tracing tools based on biocompatible and/or biologically degradable polymer, soft, inorganic and hybrid materials.	Pukánszky Béla

Respiration analysis with a Clark electrode

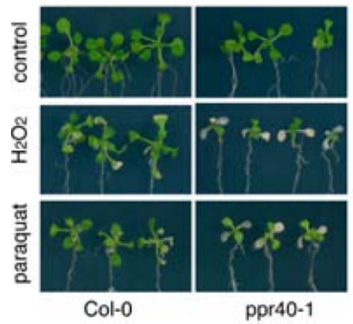


DNA quantity determination

Photometric determination of ascorbic acid

Working in the laminar box under sterile conditions

BEK-P7	Engineering methods in medicine and lifestyle support	Jobbágy Ákos
BEK-P7-T1	Studying the cell growth and division of yeast fungi with microscopic measurements and mathematic modelling	Sveiczer Ákos
BEK-P7-T2	Numerical biomechanical simulations of the human organ system	Bojtár Imre
BEK-P7-T3	Numerical analysis of the mechanical transformations of the human spine as a result of surgical interventions and conservative treatments	Bojtár Imre, Kurutzné Kovács Márta
BEK-P7-T4	Flow simulation (flow analysis of cerebral aneurysms)	Paál György
BEK-P7-T5	Working out new methods for the examination of physiological processes	Benyó Balázs
BEK-P7-T6	Medical visualization	Csébfalvi Balázs
BEK-P7-T7	The impact of joint prosthesis implant on locomotor functions	Kiss Rita
BEK-P7-T8	Applicable sensors in "Ambient Assisted Living" systems	Sántha Hunor
BEK-P7-T9	Planning of biosensor-based sensors and their control devices to fit production requirements	Sántha Hunor
BEK-P7-T10	Environmental protection monitoring	Szabó Sándor
BEK-P7-T11	Intelligent feeder of spray material	Holczer Tamás
BEK-P7-T12	Research and development of autonomous functioning, low power microdiagnostic tools	Bognár György



Oxidative stress sensitivity of the ppr-40-1 mutant

Working on human cells in the molecular biotechnological laboratory of the BME under sterile conditions

Opinion of the Advisory Board

In the opinion of the Advisory Board, BME BHE is the result of a complex direction which integrates several research topics and requires the collaboration of several faculties. During its activities, a molecular biological, biotechnological core was developed which is a gap-filler at BME and clearly adapts to the international tendencies. It is very pleasing that numerous cooperations were formed with other research universities and academic institutions. The research profile of BHE aligned well with both international and Hungarian basic and applied research trends, although the efficiency of operation could be further improved if the research profile focused on fewer topics.

We observed with pleasure that several cooperations were formed as a result of the program and there are already successful, common projects that are fully funded. It is also a successful outcome that the profile rationalization process previously mentioned, has started. In the opinion of the Advisory Board, excellence is an explicit requirement of any participation in the research university program. In order to assure excellence, we recommend the setting up of an independent competition and tendering system. 'Striving for excellence' could be a key motivational sentence for the forthcoming research university program at BME.

Members of the Advisory Board

Biotechnology, Health and Environment Protection priority research area

President: Dénes Dudits, member of the Academy, vice-president of the Hungarian Academy of Science, Plant Biology Institute, HAS Szeged Biology Centre

Members: Gábor Bánhegyi, university professor, institute director, Semmelweis University, Institute for Medical Chemistry • Radomir Lásztity, professor emeritus, BME Department of Applied Biotechnology and Food Sciences • György Thaler, director of development , Richter NyRt. • Antal Tungler, scientific consultant, HAS Energy Science Research Centre • Sándor Zettwitz, director general, 77 Eletronika Kft.

NANOPHYSICS, NANOTECHNOLOGY AND MATERIALS SCIENCE

Achievements and cooperation

György Mihály

The strategy of the **Nanophysics, Nanotechnology and Materials Science** (NNM) priority research area was to determine its objectives by considering international trends, national opportunities and the professional strengths of BME. Phenomenon-focused research in the fields of natural sciences, along with developments based on technical experience, revealed a significant research potential. Examples of the high standard of inter-faculty collaboration included the operation of the **Nanotechnology Laboratory Network** established at the beginning of the project; the participation at the **EuroNanoForum 2011** scientific conference organized within the remit of the FP7 Framework Project; the organization of a **nanotechnology exchange** (Hungexpo-2012) aiming at strengthening industrial collaboration and demonstrating the capacities of the BME in nanotechnology. The research activities focused on four areas. It involved 70 researchers and 30 PhD students working for 13 departments at four faculties in the BME. Significant technological developments were carried out within the framework of the **nanoelectronics** project concerning the fabrication of graphene-based nanocircuits, and molecular electronic units and semiconductor based quantum electronic devices. The latter is exemplified by the fabrication of a single electron transistor implemented by electron beam litography in an InSb nanowire. One of the largest-scale laboratory developments carried out within the framework of the Research University Program was the establishment of new research facilities capable of achieving the ultra-low temperatures required by quantum electronic experiments, which is also related to the research field of nanoelectronics. The low temperature experiments performed within the project have led to the investigation of nanometer-scaled AgS_x **memristors.** However, such a device is also functional at room temperature and its "resistive memory" feature makes it a promising base material for the realization of various potential applications including analogue computers, neural networks, analogue memories or programmable logic units. The research into **surface nanostructures** contributed valuable innovative results to the materials science aspects of modern soldering technologies. An accurate knowledge of the intermetallic layer structure formed during the procedure is indispensable when setting the optimal parameters of the optical control used in production technology and characterization of its mechanical stabilization. Among the **structural and functional materials** synthetized within the framework of the project, self-healing polymers containing nanocapsules as well as various polymer nanocomposites were highlighted. The method and equipment patented for the production of nano- and microparticles coated by electrostatic sputtering and spinning, offered a wide range of applications: utilization in the pharmaceutical industry; medical diagnostics; food industry and chemical procedures. Amongst the research activities focusing on **active nanostructure materials** and the development of potentiometric sensors, based on solid-state ion channel or more specifically their fabrication, geometrical and electrochemical characterization of nanopores suitable for nanoparticle counting, were highlighted. The establishment of individual biological ion channels in a solid state environment was similarly successful. A real high-tech hit was the fabrication of thin polymer films with a surface imprint capable of selectively binding proteins. A controllable microfluidic valve was patented which enables significant developments of 'lab-on-a-chip' systems. The extensive equipment upgrades carried out in the framework of the project, along with the typically 5-year-long grants, have assured the successful continuation of the nanotechnology research in the medium term. Of the large-scale grants launched during the program's duration, the NIH program (2010), two ERC grants (2011), and the founding of two HAS research groups and two Lendület grants (2011, 12) have to be mentioned.

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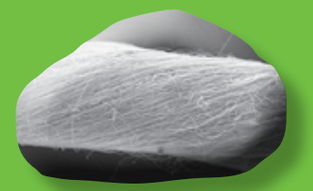
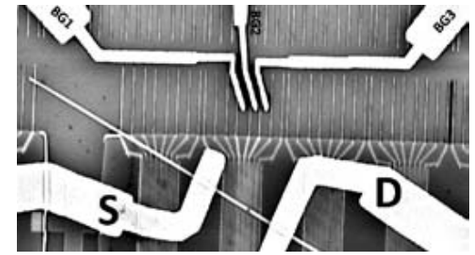
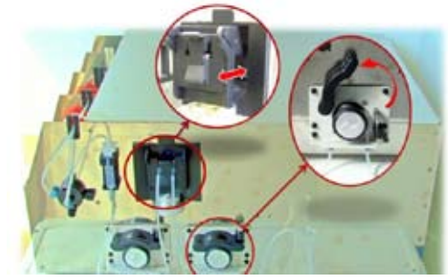


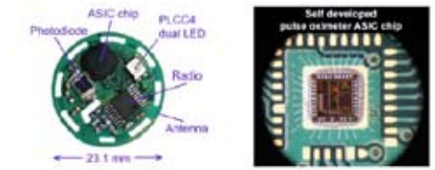


Electron microscope image of a semiconductor nanowire based nanocircuit fabricated by electron beam lithography

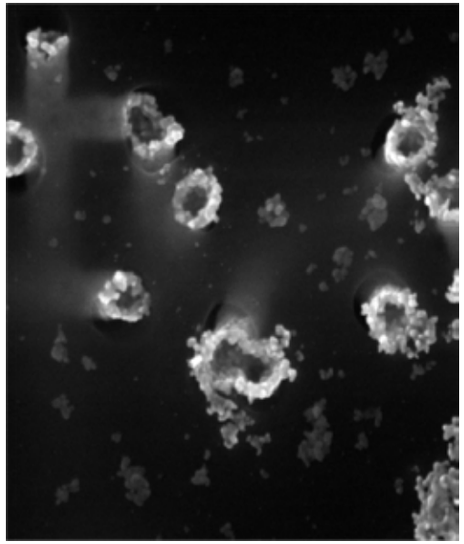
Part of the nanoelectronics laboratory



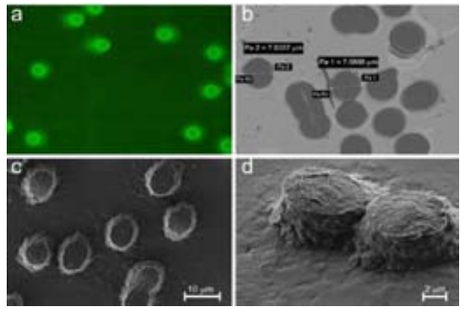
Surface plasmon resonance imaging equipment: a biosensor chip plated with a 50 nm thick gold layer, capable of acquiring real-time analytical and kinetic information at more than 100 locations.



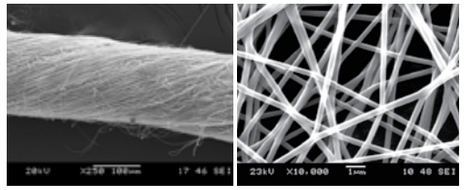
The world's smallest wireless pulse oximetry sensor head. The wearable device head which enables the continuous monitoring of the oxygen level in the blood of the patient.



Functionalized gold nanopores



Polymer films with a surface imprint: selective protein binding



Electrospinning: threads and thinned nanofibres fabricated from nanofibres by applying pulses of electrostatic power.

Research projects and topics

NNA-P1	**Nanoelectronics**	**Csonka Szabolcs**
NNA-P1-T1	Spintronics	Simon Ferenc
NNA-P1-T2	Hybrid nanostructures, molecular electronics	Halbritter András
NNA-P1-T3	Nanoelectronic devices	Mizsei János
NNA-P2	**Surface nanostructures**	**Harsányi Gábor**
NNA-P2-T1	Characterization of surface nanostructures	Illés Balázs
NNA-P2-T2	Analytics and optoelectronic applications of nanolayers	Kocsányi László
NNA-P3	**Structural and functional materials**	**Czigány Tibor**
NNA-P3-T1	Polymer nanocomposites - I	Czigány Tibor
NNA-P3-T2	Polymer nanocomposites - II	Pukánszky Béla
NNA-P3-T3	Surface modification of biomaterials	Dobránszky János
NNA-P4	**Active nanostructure materials**	**Hórvölgyi Zoltán**
NNA-P4-T1	(Bio)chemical sensing with functionalized nanostructures	Gyurcsányi E. Róbert
NNA-P4-T2	Functional and responsive materials for nano(bio)technological applications	Hórvölgyi Zoltán
NNA-P4-T3	Investigation of biofunctionalized surfaces by scanning microscopy techniques.	Sántha Hunor

Opinion of the Advisory Board

The Advisory Board has examined all of the project reports of the Nanophysics, Nanotechnology and Materials Science priority research area, surveyed all statements as well as the list of publications and theses. The Board has accepted the numerical data in the reports and the successful conclusions within. Consequently, the Advisory Board has arrived at the following general conclusions:

Scientific results. The modern nature of the topics selected in the priority research area clearly testify that it is at the forefront of science in two ways.

1. There are several topics and reports which clearly belong to, or aim at, the "Nature-interpreted" forefront of nanosciences. Certain topics are even unique in character - the memristor of the nanoelectics project and the functionalized nanostructures of the active nanostructure materials project – and which stand out amongst the basic research-oriented subjects. The results of these two topics are worthy of patent protection, indeed it would be a mistake not to do so. It is difficult to predict how long this uniqueness can be maintained, but efforts must be made to reach patent protection and SME establishment. It is also conceivable that the above written steps are required for selling products at a later stage. The Advisory Board congratulates the participating researchers and their supervisors.
2. The second group of topics is as important as the first one, as they involve near-industry areas and pursuit of these topics can be considered also as the mission of BME. They represent the domestication and application of important measurement and fabrication methodologies which are indispensable for the establishment of the desired massive infrastructure that is a key to maintaining its success. We recommend that financial support to the best topics in both categories should be provided to enable further research into these areas..

With a large number of participating students and the resulting scientific papers and theses, it is hoped that research into these topics can be successfully continued during the upcoming decade as their timeliness should be foreseen on this time scale.

The Advisory Board has been happy to conclude that, for the sake of efficiency (especially in the cases of extremely successful topics), the research collaborations have been handled pragmatically and the national resources properly exploited.

In terms of fabrication facilities, the success required the utilization of the topmost national opportunities - provided primarily by two (merging) HAS institutes. The HAS institutes were also happy to collaborate in solving exciting research tasks requiring peak performance, both from them and their equipment. This exemplifies an especially positive and marketable scientific attitude.

Members of the Advisory Board

Nanophysics, Nanotechnology and Materials Science priority research area

President: József Gyulai, member of the Academy, HAS Natural Sciences Research Centre, Institute for Technical Physics and Materials Science

Members: Péter Arató, full professor, BME, Faculty of Electrical Engineering and Informatics
János Ginsztler, full professor, BME, Faculty of Mechanical Engineering
Miklós Kellermayer, director, Semmelweis University, Institute for Biophysics and Radiation Biology
János Szépvölgyi, director, HAS NSRC, Institute for Material and Environmental Chemistry

INTELLIGENT ENVIRONMENT AND E-TECHNOLOGIES

Joint ICT applications:
The concept is good; the process of system integration is progressing well

Hassan Charaf

Within the framework of the research university programme, the priority research area (PRA) strategy of the Intelligent Environment and E-technologies (ICT) has been designed with international economic and professional trends in mind.

A clear proof of the interdisciplinary nature of this area is that all eight faculties of BME have taken part in this research. The role of „system integrator" resulting from BME's three competences (technical, economic and social/natural sciences) has had a favourable impact on the results. The research university's programme greatly contributed to the successful coordination and harmonization of the work performed by the various research teams.

Both the theoretical and practical results have confirmed the correctness of the strategy defined at the outset. The forecast for 2012-2015 issued by Gartner - a leading international firm of IT market analysts – pointed in the direction of ten major developments in this field. The applications realized in ICT stand right at the centre of these priorities.

The Efficient software and Hardware solutions project focused on research in both these areas. The software themes included modelling work, tests, study of highly complex systems, data storage, data encryption and data processing. Among the hardware themes, signal processing, sensors and FPGA-based solutions of high computing demand were closely examined.

The Future network solutions project concentrated on privacy issues raised by location-based mobile social networks. Social applications may lead to situations where personal data (including information about the user's former geographical positions!) must be processed or stored on a third party device or server. Special attention was also paid to establishing energy efficiency as well as to the efficient storage and updating the weighted set of

Contact

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Contest of robonauts (robots built by students)

BME ROBOT debut at EUROROBOT

geographical positions (e.g. probability of occurrence). In turn, it has created the need for a secondary task including protocol development and the optimization of the communication of such space-time data.

The E-economy and E-society project analysed the situation today where the rapid growth of the Internet often hinders the use of subjective responsibility, resulting in a weakened notion of culpability. Researchers of the Efficient man-machine interaction project have developed a direct adjunct combined Monte Carlo particle transport method; it is able to simultaneously follow the physical particles (photons) and the importons which are travelling in the opposite direction, and to combine the advantages of the two methods. The Intelligent machine and physical world project team performed wide ranging activities in the field of embedded systems including the elaboration of hardware and software co-design methodologies, development of algorithms and some important and rightfully interesting applications. Researchers on the Intelligent ICT applications project have devised several applications that clearly demonstrate the importance of the results of this new research.

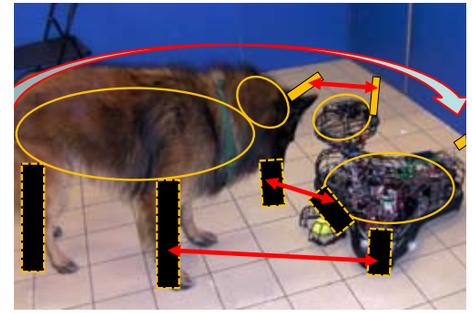
The new applications include a measuring system assisting location-specific planning; an indoors positioning system; a robot that was successfully introduced at the EUROBOT international contest; a book reader; a model-based framework system supporting efficient software development on multiple platforms.

150 lecturers/researchers and 50 doctoral candidates were involved in the 45 themed aspects of the project. A major success among the research themes studied within this project was the link error monitoring of optical networks, the project leader of which became the winner of the MTA Lendület 2012 Programme. Most themes will be continued after the end of the research university support. At the time of the strategy review, the research directions are being adjusted to reflect the Horizon 2020 paradigm.

Installation of the measuring system assisting location-specific planning

Development of the measuring system assisting location-specific planning

EUROBOT



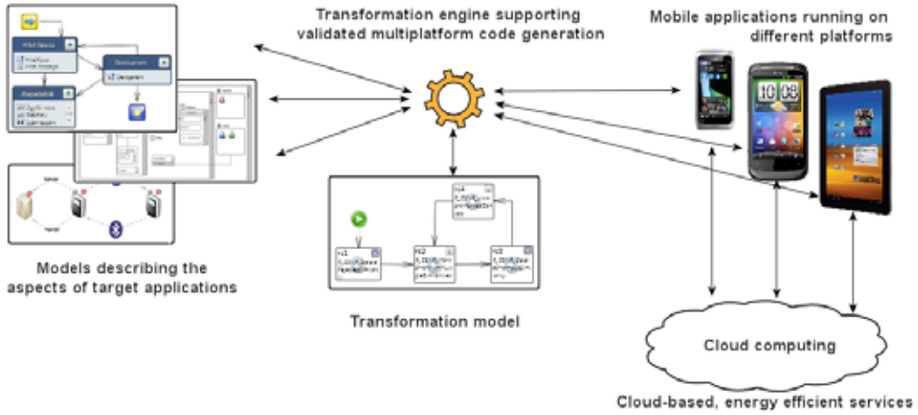
ETO robotic dog

Location-based mobile social network

Research projects and themes

IKT-P1	**Efficient software and hardware solutions**	**Charaf Hassan**
IKT-P1-T1	Modelling and model processing	Lengyel László
IKT-P1-T2	Data processing technologies	Kovács Ferenc
IKT-P1-T3	Automatic testing and performance evaluation of IT systems	Do Van Tien
IKT-P1-T4	Component metamodel and high-availability system testing and software quality assurance	Kondorosi Károly
IKT-P1-T5	Heterogeneous high-output computations	Fehér Béla
IKT-P1-T6	Efficient signal processing architectures	Fehér Béla
IKT-P1-T7	Intelligent sensor systems and their use for plant sample analyses	Barócsi Attila
IKT-P1-T9	Model-based engineering methods for medical and technical applications	Benyó Balázs
IKT-P2	**Future network solutions**	**Imre Sándor**
IKT-P2 -T1	Location-based mobile services	Forstner Bertalan
IKT-P2 –T2	MIMO multi-user wave propagation models, coverage optimization	Nagy Lajos
IKT-P2 –T3	Future Internet architectures and protocols: scalable routing	Gulyás András
IKT-P2 –T4	Reassessment of the scalability of network design and network analysis problems in massive parallel computing environment	Horváth Gábor
IKT-P2 –T5	Fame-based safety solutions in the future architecture of Internet	Félegyházi Márk
IKT-P2 –T6	Link error monitoring of optical networks	Tapolczai János
IKT-P3	**E-economy and e-society**	**Szakadát István, Verebics János**
IKT-P3–T1	Integration of company management systems	Szikora Béla
IKT-P3–T2	Technical conditions for integrated e-services	Kondorosi Károly
IKT-P3–T8	Interaction-navigation-interface	Szakadát istván
IKT-P3–T9	Identity, loyalty, community - in digital environment	Horányi Özséb

IKT-P4	**Efficient man-machine interaction**	**Szirmay-Kalos László**
IKT-P4-T1	Virtual world and visualizations based on analogies	Szirmay-Kalos László
IKT-P4-T2	Eto-communication	Korondi Péter
IKT-P5	**Intelligent machine and physical world**	**Horváth Gábor**
IKT-P5-T1	Intelligent devices, microcontroller-based systems	Tevesz Gábor
IKT-P5-T2	Intelligent lighting technique	Poppe András
IKT-P5-T3	Development of the design methodology for task-oriented multiprocessor systems	Arató Péter
IKT-P5-T4	Health applications based on 3D movement analysis	Loványi István
IKT-P5-T5	Development of model-based design and analysis methods for critical computer systems	Majzik István
IKT-P5-T6	Development of algorithm design environment for intelligent autonomous systems	Dobrowiecki Tadeusz
IKT-P5-T7	Development of test environment for autonomous systems	Majzik István
IKT-P6	**ICT applications**	**Barsi Árpád, Szoboszlai Mihály**
IKT-P6 –T2	Safe homes for elderly people - fall detection system	Vajda Ferenc
IKT-P6 –T4	Computerized modelling at atomic level	Kugler Sándor
IKT-P6 –T5	IT solution for reconfigurable production systems	Monostori László
IKT-P6 –T6	Civil engineering sensor networks	Barsi Árpád
IKT-P6 –T7	Mobile-based traffic data collection	Barsi Árpád
IKT-P6 –T8	E-technology in architectural design	Szoboszlai Mihály
IKT-P6 –T10	Intelligent house - intelligent environment	Perényi Tamás



Model-based framework system for the development of applications on multiple platforms

A display of applications already developed

Advisory Board's opinion

The Advisory Board evaluated the research work done during the project on the basis of the documentation, reports and publications of the forty-five themes of the six projects attached to the ICT subproject and following the introduction of the individual themes, their related scientific activities and the results embodied in the realized applications. Though the general evaluation was made more difficult by the dynamically developing IT content, the series of applications proved that the use of IT scientific results can greatly contribute to the marketability and improved international competitiveness of faculties with a smaller IT focus.

One of the most important indicators was that - through TÁMOP project support and relying on former scientific results - 11 PhD dissertations and one MTA doctoral dissertation were presented in the ICT field. As there is a great demand for the development of various mobile platforms, the choice of this theme was proved fully justified. Such abstract handling of the network design will lead to the introduction of new approaches. Due to its very nature however, this theme will not produce quick practical results or immediate publication opportunities, though the structured and abstract handling of the task is a sign that the theme is on the right track. A special value of the ICT subproject is the emergence of interdisciplinary themes. The cooperation between experts in engineering, natural sciences, social sciences, economics, legal issues and IT, has resulted in several specific applications such as the measuring system assisting location-specific planning developed in conjunction with the architects.

In summarizing the evaluations of individual themes, it has been concluded that the relevant research university project has made a great strides in starting an in-depth scientific IT cooperation between the faculties of BME and also has created a framework for the expansion of such relationships.

Monograph about Android

Members of the Advisory Board

Intelligent Environment and E-technologies priority research area

President: Bálint Dömölki, Honorary Chairman of John von Neumann Computer Societyro
Members: Győző Drozdy, Consultant, Telenor
Tibor Gyimóthy, Head of Department, Szeged University of Sciences
László Jereb, Dean, University of West Hungary
Rozália Lakner, Dean, Pannon University

IN-HOUSE RELATIONSHIP MANAGEMENT

Faculty of Civil Engineering (1782)

Antal Lovas

Though the Faculty of Civil Engineering was not given a principal investigatory role in the Research University project, it actively participated in four of the five main programmes.

In the priority research area of Intelligent Environment and e-technologies, our Faculty aimed at increasing the use of our latest IT developments and devices in the field of civil engineering. In the Vehicle Technology, Transport and Logistics priority research area, we concentrated on satellite technologies and vehicle communication developments.

Being involved in several directions in the Sustainable Energy priority research area, we took part in research designed to optimize the supporting structure of a new generation of wind power stations and also in the environmental testing of the rocks in the Bátaapáti repository which is currently under construction for the storage of waste of low and medium activity from the Paks Nuclear Power Plant.

In the Biotechnology, Health and Environment Protection priority research area, one of our main activities was the application of healthcare engineering methods where we performed biomechanical research.

In the field of Construction Industry Environmental Protection research, we also conducted an environmental life-cycle analysis within the project.

The main benefit of the Research University programme for the Faculty was that people in various departments experienced hitherto unprecedented working relationships with people from other departments. For certain research targets, 97 of our 131 professors and lecturers in some way took part in this programme. In addition, 26 doctoral candidates (half of whom were assistant lecturers) and more than 40 students, curious to learn the directions of future research, also took part. 110 publications were also produced and 12 doctoral theses were submitted by the staff and doctoral candidates of the Faculty of Civil Engineering in the course of the Research University project. When the monograph was finally compiled it was double in size to that proposed in the original plans.

Within the framework of the Research University project, the Faculty received funds of more than HUF 100 million for infrastructure development. This amount was later increased by one and a half times due to the Faculty's own resources and by funds obtained through applications. The only problems we encountered were the huge amount of administrative work, which at times seemed superfluous, and a series of changes which were not necessarily well thought out. However, we completed the work required of us and will be able to comply with the indicators at a similar level.

SYSTEM INTEGRATION

Faculty of Mechanical Engineering (1871)

Gábor Stépán

As far as the university is concerned, the main result of the Research University programme was that it integrated our wide range of high-level research work into a single system. In particular, it was able to achieve an improved utilisation of the university's existing potential along focal points which had been previously selected. Among the five priority research areas, the Faculty of Mechanical Engineering was the principal investigator in the SE area. Its strategic research areas were related to the threefold requirements of environment and climate protection, supply security and competitiveness. However, the thing that I was most proud of was that the core activities of mechanical engineering and the related field of electrical engineering were able to integrate with the knowledge of researchers from other faculties. A good example of this was that the sociologists at the Faculty of Economic and Social Sciences were assigned an important role in the research of energy consumption habits. The Faculty could also fully join in with all the Research University projects. In the VTL project, the analysis of fluid machinery, fuel supply systems and other vehicle subsystems were at the forefront of our research. In the BHE project, our primary task included the modelling of living organisms in relation to the engineering methods of medicine. The research objective of our Faculty in the IEE project was to seek solutions capable of providing real-time management of complex engineering and economic systems in volatile, uncertainty-laden environments, with a further need to balance optimization, autonomy and cooperation. The direction of Faculty researches in the NNM project was the analysis of the characteristics improving the effects of nanoadditives and the elaboration of hybridization procedures. The programme enabled us to retain our young researchers and to help their career development. Actually, it had been a growing problem for years that, due to lack of pre-doctoral scholarships, doctoral candidates were not protected against alluring offers from Industry. With the financial support of their research work however, several of them were able to obtain their PhD degrees. Amongst the other factors, the strict bookkeeping of the projects allowed us to see areas that greatly outdid the initial expectations and showed a dynamic flow of results. There was a great leap in the field of patents and knowledge transfer where we outperformed the publication requirements and produced English language monographs at an international level which were published abroad. Once the public financing comes to an end the current themes should be sufficiently financed but, for such a purpose, the five areas must be made subject to a certain screening. Successful themes will still appear in international projects but then be forced to obtain funds from the limited budget of domestic public financing and adjust to the fluctuations in the research activities of private business. We must try to obtain finances from the EU funds that are available. The past two years have provided us with a good preparatory period in this regard. We must keep going along this road.

ART AND RESEARCH

Faculty of Architecture (1873)

Becker Gábor

As a training institution, BME has always enjoyed good reputation. However, it may not be well known for its vast intellectual potential which is available for research purposes. It is particularly true of our Faculty where the perception is that most of the work is either in design or art. This explains why the Faculty is less widely known for its research activities. Thus, one of the major benefits of the project was that it allowed the Faculty to demonstrate its research capabilities. Furthermore, the programme also became popular within our design departments, making it clear to everyone that they too can also be involved in research work and enjoy its successes. A major example of this was an instrument – complete with a system of measurement and simulation software – which was developed in cooperation with the Faculty of Electrical Engineering and Informatics at the Department for Residential Building Design. This system is able to collect data on a construction site that is then used in the concept design phase to increase environmental and energy awareness during the actual design work. Another important achievement for the Faculty was a building powered only by solar energy which was developed in a student project named 'Solar Decathlon'. Though mainly the work of students, the Research University programme allowed many other colleagues to join in with the project. An important advantage to us was the major infrastructural development at the Faculty totalling a value of HUF 73.5 million. This development affected three laboratories: instruments were almost fully replaced at the building acoustics laboratory; huge capital investments were made in the building physics laboratory and third, in the mechanical laboratory at the Department for Statics and Support Structures. Due to the current crisis in the building industry, a fly in the ointment has been that some of the newly purchased instruments have not been fully utilised although they are now mostly used for our own research purposes. During the two years of the Research University programme, our major discovery was our recognition that we were able to work together with others in different departments and even outside the fields of Art and Design. The two year period has given a meaningful kick to horizontal cooperation both among the departments of our Faculty and in other various organisational units in BME. Coming up. We are now making great strides in the field of construction practice based on environmental awareness. The results have allowed us to launch a post-gradual training course. Furthermore, we are currently working on an inter-faculty MSc training in English based on our research results. We also have a series of specific ideas for further research work regarding energy awareness in the renewal of existing buildings. For such purposes, all we need to do is maintain our pace and intensity of research as much as it is possible to do so.

WELL-PONDERED STRATEGY

Faculty of Chemical Technology and Biotechnology (1873)

György Pokol

The formal and financial recognition that needs to be given by the State to the quality work in higher education has always been a long standing issue. That is why I greatly appreciate the title 'Research University' and the related TÁMOP project which was implemented for the first time. It is a reference point for everyone and we hope that it will continue into the future.
The Research University project had a double effect on the Faculty of Chemical Technology and Biotechnology where there has always been a strong tradition of research both in technology and chemical science.
On the one hand, the project has forced us to review our research strategy and the priority areas that we intend to study. On the other hand, the project offered us a format for establishing new relationships within and outside BME. It also gave us the opportunity to work more closely with our partners.
According to the requirements of the Research University project, the work performed was not just evaluated by ourselves. Both the research and the results were assessed in each main research area both during the work and at project closure by an independent body of professionals. The opinion and proposals made by the Advisory Board - consisting of outstanding academic and industrial experts - provided us with substantial benefits. We would like to rely on the continuing support of these professionals in the future.
Many of our results make me proud, including the important achievements in the field of custom-tailored therapies or a new type of chemical and microbiological treatment of waste water. As someone normally working in another field, I was surprised to see the development of a new process in cereal processing technology that enhances the yield of groats and the biological value of the edible parts, both at the same time.
It is a good example of how a good set of R+D+I conditions may lead not only to scientific results but also to their practical application on an industrial scale. So too, there has been a strong correlation between the two years of the Research University project and the recent increase in the number of new patent applications.
It clearly confirms that we need to keep our research work up to this level. The benefits of the Research University project include the advantages resulting from the sheer fact that the Faculty has reviewed its strategy and achieved most of the goals of the project.
It gives me satisfaction to see the relatively large number of new professional relationships both within and outside BME that have been established. For example, the nanotechnology subproject led to the emergence of a regular technical forum that will certainly strengthen future research work.
This summary contains lots of pros with only one con: as we had never had to carry out such a huge project before, the administration of the project involved many uncertainties. We had difficulties in following-up some of the changes. Hopefully, we will handle this aspect more easily in the future.

INFRASTRUCTURAL DEVELOPMENT

Faculty of Electrical Engineering and Informatics (1949)

László Vajta

The results of the Research University projects include three primary components for BME. Infrastructural investments represent the first component. The second component is that we have identified the strategically important research areas to which BME should assign its resources and which can be managed as interdisciplinary research themes through the collaboration of faculties. The third component requires the launch of horizontal programmes serving as a framework for the harmonized cooperation between faculties to address the development issues of BME as an organization.

As far as the Faculty of Electrical Engineering and Informatics is concerned, the main benefits of the Research University period include infrastructural developments as well as the establishing of new type of relationships with fellow faculties. During the past two years, our Faculty has concentrated mainly on the issues of IT development and applications, and on their use in other special areas with the aim of starting joint research work.

The results of the Research University programme include the following: research and development of a building energy monitoring and IT system within the Faculty of Architecture; geo-information systems developed with the Faculty of Civil Engineering; the sociological and social science surveys conducted jointly with the Faculty of Economic and Social Sciences to map the behaviour of the consumers using the services of large power networks.

We were able to realize our Research University objectives despite the fact that, in general, two years represents a short period in the routine flow of university procedures. Though we have had to face many difficulties the final balance is very promising. However, the challenge now is whether we will be able to maintain this period of success and development at a time when the termination of priority project funding coincides with dramatic restrictions in the state budget. An important factor in the success of the Research University project is that, at the same time it was taking place, BME also implemented a technology and knowledge transfer development programme. Due to the co-existence of the two programmes, we not only could improve our research abilities but also our utilization and an innovation-based approach to our results. We must develop further projects that can be instigated in close cooperation with Industry. In other words, we must set up and then strengthen a future research development strategy with industrial companies that will bring benefits to research, education and its resulting utilization. In fact, the Faculty of Electrical Engineering and Informatics has signed numerous cooperation agreements during the Research University programme and plans to continue to do so in the future.

INTEGRATION BETWEEN FACULTIES

Faculty of Transportation Engineering and Vehicle Engineering (1951)

Béla Kulcsár

The Research University project launched two years ago was basically meant to integrate the existing capacities of each of the BME faculties involved into five priority research areas.

At our Faculty it was represented by the successful integration of our research and education areas into a single large project. However, in addition to creating integration at university level, the project has also led to strong integration within the Faculty itself.

As a follow-up to the Research University project, we have strengthened our relationships with third parties including logistic-intensive companies such as the Hungarian players representing the multinational automotive industry, Audi, Opel and Mercedes.

The Faculty has implemented research and development programmes by which it can provide new knowledge and development results. These can be directly utilized by transport and vehicle industry companies and the logistics services sector.

Among the many results of the Research University programme, research work aimed at improving the efficiency of internal combustion engines, the impact assessment of "large-scale" logistic enterprises and a complete Audi simulator must be mentioned. Born as a combination of the most innovative and most spectacular results achieved in automotive technology during the past few years, this car can be used either when in stationary position for the modelling and simulation of any driving task or for normal use out in the streets.

At the start of the Research University programme, the maximum was the aim when the targets in the Vehicle Technology, Transport and Logistics priority research area had to be specified. Good performance and in certain cases, excellent performance indicators were achieved. The lack of money will surely be felt after the last two years. During the maintenance period, we must arrange for a growing share of industrial sponsors to make up for missing state funds. The Research University programme has helped to create a theme and research oriented integration within the university. However, in certain fields this in-house integration is insufficient by itself, which means that research integration among universities must surely become inevitable.

RELEASE OF ENERGY

Faculty of Natural Sciences (1998)

Pipek János

Our Faculty played the role of principal investigator in one of the priority research areas of the Research University programme at BME. As senior coordinator to the Nanophysics, Nanotechnology and Materials Science priority research area, our Faculty worked mostly with the Faculty of Electrical Engineering and Informatics and the Faculty of Mechanical Engineering.

This cooperation - just like the entire Research University programme at institutional level - highlighted a lot of unused and dormant potential and bought about a much needed release of energy. What actually happened at the university was that researchers studying similar areas from various aspects at the various faculties were brought together to work on joint projects.

As a beneficiary of the Research University project, the Faculty of Natural Sciences used project funding to strengthen its research equipment and potential. Together with other faculties, we agreed to redirect a large part of our personal resources into investment. As a result, we purchased expensive state-of-the-art equipment required for world class research work. On a more human level, a second benefit of the project was that we could provide scholarships for many talented young people and the package we now offer them will help us to manage the issue of workforce replenishment at our Faculty in the future. A third benefit is that inter-faculty cooperation has been renewed not only in research but also in the field of education.

Special, cooperation arrangements were established by allowing electrical engineering students to enter our laboratories, often on impulse and conversely, our students were allowed to visit electrical engineering laboratories for the purpose of gaining insight to the measuring and problem-solving processes of certain issues.

However, some of the inter-faculty cooperation arrangements were haphazard and produced only limited results. Sometimes, there was a notable lack of in-depth consultations in the system. That explains why certain high-level research themes with an international reputation were ignored. Also, there were some inconsistencies during the coordination work between the project office and the faculties. This was due to the simple reason that the project layout and the faculty structure turned out to be partly incompatible with each other.

As to the period following the Research University project, it is most probable that as a result of our efforts towards machinery modernization, we will be able to keep our position in the forefront of international research. Also, we will be able to comply with the publication requirements for the next three years in the field of the Nano project.

SCIENTIFIC POTENTIAL

Faculty of Economic and Social Sciences (1998)

János Kövesi

In terms of the Faculty of Economic and Social Sciences, it was very important that among the five universities applying for the title as Research University, only BME successfully applied using its entire organization, while other universities only concentrated on their most successful divisions. In other words, BME won the Research University title in part using the results and scientific potential of the Faculty of Economic and Social Sciences. This potential is evident from the fact that our Faculty employs 100 full time lecturers and researchers, including 74 persons with academic qualifications. The main result has been that the engineering faculties responsible for priority research areas are understood and recognized as the research potential of our Faculty. The programme also urged third parties to strengthen their business relationships with Industry. In fact, this played a crucial role not only in the performance of R+D+I tasks but also in education itself. The Department of Management and Corporate Economics participated in two projects in the VTL area. At AUDI Hungária, we made generic statements -applicable to the whole automotive sector - about the development of reliability-based production systems and maintenance services. In the second project we devised assessment methods for supplier development that helps through self-review, the evaluation of market entry opportunities and the improvement of management cultures. The Department of Finance conducted research into corporate valuation methods of investments in Sustainable Energy projects. The Department of Business Law studied various e-society and e-economy issues – including the international regulatory models of data protection, competition law, normative frameworks of business communication, e-commerce and protection of intellectual property in the information society – in the ICT area. Attached to the BHE priority research area, the Department of Environmental Economics took responsibility for two themes: sustainability/sustainable development and climate protection/global climate change. This work focused on the potential offered by micro regions and organizational adjustments, and included the preparation of sustainability analyses sector by sector. With the involvement of students, the Department of Sociology and Communications joined the Hungarian team of Solar Decathlon (an international competition for the design of solar housing by students) in the SE area. In the ICT field, we addressed interfaces, navigation techniques and the relationship between cultural industries and consumer communities. As a result, the horizontal programme managed by our Faculty was rated as successful by R+D+I quality assurance in higher education. We have achieved many more results than originally intended. The departments in our Faculty have been able to reveal their "hidden" potentials during this project. We have had good experiences in our cooperation with other faculties. We hope that there will be a continuation of our research work in conjunction with the relevant engineering faculties in the priority research areas, and of the horizontal programme managed by us. New resources will be needed to strengthen relevant conditions and to reduce the bureaucratic components.

SYSTEM OF TECHNOLOGY AND KNOWLEDGE TRANSFER AT BME

BME has been deliberately developing its own technology transfer services since 2009. Supported by the European Union, this programme is coordinated by the BME Technology and Knowledge Transfer Office (MTTI) in order to improve the general conditions of R+D+I activities, to utilize better the intellectual products developed at BME and to establish an environment where the players have mutual interest in the correct introduction of the latest results to the market.

BME's system of technology transfer has developed (TÁMOP-4.2.1-08/1/KMR-2008-0001) simultaneously with the implementation of the research university project. The two activities of the university, i.e. the enhancement of the research potential and the utilization of the resulting intellectual products, must be interlinked and integrated.

The TTI project targets include the identification, registration and assessment of BME's knowledge base and utilizable intellectual products/results; the enhancement of the prestige of university research jobs; the establishment of competitive training; the increase of BME's strategic partnership share in industrial R&D; the protection and utilization of intellectual products. As a consequence, there may well be an improvement in BME's innovative output and in the extent to which the latest results are utilized in practice.

The BME Technology and Knowledge Transfer Office (MTTI), BME's organizational unit for technology transfers, was set up within the framework of the project. The main task of MTTI is to set up an efficient portfolio of services for supporting the utilization of intellectual products created at the university, coordinate the acquisition of intellectual property rights and manage the protection and utilization of intellectual products (licences, spin-off ventures). As a starting point for the service activities, BME's intellectual property management rules have been changed with a view to assisting and encouraging both researchers and students in the creation of utilizable intellectual products.

As a result of the newly established legal and incentive system, it is hoped that the number, value and share of intellectual products created at the university will increase and bring about qualitative and quantitative changes in the products and services available on the market and in the fulfilment of social needs. Several pilot projects have been launched for the creation of the required services and their background expertise.

Following the business feasibility and market potential studies of the selected intellectual products, and after the acquisition of the required industrial property right protection, the purpose of such pilot projects is to arrange for licence agreements and new (spin-off, start-up) ventures that will generate income for the university.

The creation of services would be useless without the right "clients". Participation in the various technology transfer events requires a change of attitude from the stakeholders. In particular, MTTI seeks to cooperate with the Centre for Student Innovations, aiming to involve as many university students in the process as possible and to provide assistance for the utilization of the intellectual products created by students.

DEMOLA hall in building V1 at the BME

"The most productive innovation platform in Europe"

A key project component is to give overall training and further training for university students in the field of technology transfers, business ventures and entrepreneurship.

The BME's model of in-house cooperation and attitude development includes the set-up of a TT network through faculty representatives to provide a platform for managing inter-faculty discussions; to learn about good practices and organizing technical forums. The BME Innovation Club established by this network, has been operating for one year now.

MTTI coordinates the operation of Innovation Laboratory in wing C of BME Building V1. This multifunctional place, established in the area of the former machine hall, is suitable for the acceptance of a wide range of innovation projects. The Innovation Laboratory is also the centre of DEMOLA Budapest. DEMOLA™ is an open innovation platform for students and companies.

After Tampere and Vilnius, this freshly launched BME programme represents the third international venue for complex and multidisciplinary projects realized in partnerships. The purpose of projects implemented within DEMOLA Budapest is, on one hand, to demonstrate the feasibility of new/modified products and services on the basis of company concepts and on the other hand, to develop the teamwork ability of students and to convert their theoretical knowledge into practical skills.

Demola Demo

A lecture in the Demola laboratory

www.tti.bme.hu • www.demola.hu
www.demola.net

COOPERATION AND COORDINATION

An unusual research project

Kovács Kálmán

In terms of management aspects, the research university project was very different from BME's usual research projects.

First of all, the project size was unusual. However, the challenge was represented not only by the project budget of HUF 3,000 million but also by the wish of BME's senior management to involve the entire BME in the research university project and in the subsequent application. Accordingly, a large share of BME's ongoing research activities was included in the research university strategy and programme. Finally, the five priority research areas – requiring the cooperation of 5 to 7 faculties in general – were identified on the basis of integrated projects encompassing more than 160 research themes. Some two-thirds of BME's lecturers/researchers, 130 doctoral candidates, 220 doctoral students and 250 students joined the project. Acting as project organization, the BME Federated Innovation and Knowledge Centre concluded more than 3,500 work contracts (wage supplements, assignments, etc.) during these two years.

Special treatment was needed to address the fact that, instead of administering the usual research applications, we had to establish and manage an operational model for the coordination of training and research activities. Cooperation and coordination represented the key project component. These helped us in the creation and daily operation of several new forums and operative bodies. Upon the numerous initiatives by Technical Manager Sándor Tömösközi, we set up a research management system with the aim of regular technical monitoring and quality assurance. A main element in it was the appointment and operation of Advisory Boards consisting of independent experts of the various research areas. At the same time, we set up horizontal work teams under faculty supervision to coordinate the research environment (infrastructure, talent care, international relations, etc.).

The systems set up and operated during the project provide BME's senior management and research leaders with non-stop updates of the R&D potential of BME and the changes of research environment. In order to ensure a place for summary, we launched an annually organized public university forum.

Given that the research activities included in the integrated cooperation are eventually performed at the faculties or departments, we set up a system of faculty representatives in order to ensure transparent project operation and inner coordination within the faculties. The meeting of faculty representatives is the main operative body of the project, functioning as a link between project management and faculties/departments.

Due to its size and complexity, the research university project represented a huge administrative task. Compliance with the bureaucratic EU requirements, the changing domestic regulations and BME's in-house rules and newly developed financing system placed a heavy burden on the project team, on the department administrators and, in many cases, even on the lecturers/research involved in the project. We must express our thanks for the patience and perseverance of all persons involved in this task. Also, special thanks to the faculty representatives and project managers for their hard work that helped us in the establishment of an efficient and uniform administrative system. We will be able to use it for other projects in the future.

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Leaders of Priority Research Areas

- see the description of PRA programmes

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GRANT AMOUNTS

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HUNGARY'S RENEWAL

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Budapest University of Technology and Economics (BME)

Content

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