VSB TECHNICAL UNIVERSITY OF OSTRAVA

CENTRE FOR ENERGY AND ENVIRONMENTAL TECHNOLOGIES

ANNUAL REPORT 2023

A LETTER FROM THE DIRECTOR

Dear colleagues,

It is my honor to welcome you on the occasion of evaluating the past year, which has been truly extraordinary for our university institute. Despite facing various challenges and complications, we managed to achieve remarkable successes and strengthen our position not only in the academic environment but also in the wider context of society.

I am proud that our work and efforts have produced excellent results, which can be seen on several key fronts. Our successes have been noted in the field of academic publication activities, not only in the quantitative sense, but especially in the qualitative sense, through publications in prestigious international journals, whose significance is confirmed by high citation rates. These achievements not only bring us joy but also motivate us to further pursue excellence in scientific work.

Another significant milestone we accomplished last year, which I would like to highlight, is the acquisition of strategic national and especially international projects. The opportunity to participate in prestigious projects is not only proof of the quality of our work, but also allows us to push the boundaries of research and innovation on a global level.

Equally important is the increased cooperation with industry and public administration that we have achieved, which allows us to link theory with practice and contribute to solving current problems in society. We are proud that our efforts to improve the links between the academic and social world are confirmed by effective collaboration within the innovation ecosystem of which we are an integral part.

It is important to emphasize that our achievements are even more significant in the context of the current global environment in which the whole world is grappling with the impact of Russian aggression. Our ability to adapt, actively engage in helping to address the negative impacts of Russian aggression, and still achieve outstanding results in such an environment, is a reflection of our resolve and resilience.

In conclusion, I would like to underscore that our successes are not accidental, but are the result of the right direction for our Institute anchored in vision, mission, and strategy. We are aware of our responsibility and commitment to continue our journey towards excellence in all areas of our work.

Thank you all for your work and contribution to our collective success. Together, we are stronger and ready to face the challenges of the future with firm belief in our potential and ability to deliver outstanding results.

With respect,

Stanislav Mišák
Director of CEET

To effectively manage and use the capacities of the CEET
Related to the operational objective of VSB-TUO: C 5.1.

STRATEGIC OBJECTIVE 5

MANAGEMENT OF CEET

TO EFFECTIVELY MANAGE AND USE THE CAPACITIES OF THE CEET

Quality and modern infrastructure alone is not a guarantee of success. The changes we are facing together, whether they are global changes triggered by Russian aggression, negatively affecting global society, or local changes such as those affecting funding for public universities in the Czech Republic, present significant challenges. It is essential to respond to these realities with appropriate operational and strategic management, which cannot be done without rationalising management and decision-making processes while reducing administrative burdens wherever possible.

ESTABLISHMENT AND APPROVAL OF THE BOARD OF EXPERTS

In an effort to continuously strengthen our position in the field of energy and environmental technologies, our future direction will be crucial. For matters concerning the concept of applied research aimed at enhancing its excellence, a consultative body, the Board of Experts, has been established and approved. This advisory body to the director of CEET is composed of managers and leading scientists delegated based on recommendations from all research areas. Its purpose is to provide recommendations for determining the main directions of CEET‘s scientific research activities with the potential for excellence, regarding funding systems, evaluation methods, and strengthening the center‘s international standing.

INTERNAL AUDIT OF THE QUALITY MANAGEMENT SYSTEM

The quality management system underwent an internal audit. The results of this audit confirmed that the system is not only functional but also aligns with our internal standards and documentation. Among other findings, the audit confirmed the effectiveness of the use of electronic tools for personal development planning and employee evaluations. The chosen approach was appreciated as an inspiring management tool that efficiently directs, plans, and evaluates employee performance.

Support of the sustainable development of the university
Related to the operational objective of VSB-TUO: C 5.3.

SUPPORT OF THE SUSTAINABLE DEVELOPMENT OF THE UNIVERSITY

The energy crisis has clearly demonstrated that supporting sustainable university development is essential for achieving ecological, social, and economic stability. In this regard, we are proud of our commitment to sustainable development and firmly believe that through collective effort, we can create a better and more sustainable future for our community and for society as a whole.

NEW CONCEPT OF ENERGY MANAGEMENT

Last year, we introduced the concept of university energy management, outlining potential savings and an effective approach to managing our energy consumption with the support of the CEETe (Centre for Energy and Environmental Technologies – explorer) new campus management system.

INTEGRATION OF THE NEW BUILDING OF THE FACULTY OF ECONOMICS INTO THE ENERGY MANAGEMENT CONCEPT

In addition to the CEETe building, we have also integrated the new building of the Faculty of Economics into this system, and our ambition is to expand this concept to the entire campus of VSB-TUO in Ostrava – Poruba. This solution will significantly support the strategic goal of SDG-7 - Clean and Affordable Energy for the entire university.

TEST RUN OF THE BATTERY STORAGE SYSTEM

We have continued testing a battery storage system, which will be utilized for balancing the flow of electrical energy on the VSB-TUO campus with the support of sophisticated control methods.

BUILDING PERMIT FOR THE HYDROGEN PRODUCTION, FILLING AND STORAGE TEST STATION

In the past year, we have been addressing the building permit for a hydrogen production, filling, and storage testing station, which is a crucial step towards the utilization of this technology and will contribute to the realization of the decarbonization scenario at the Moravian-Silesian Region level.

CONSTRUCTION OF PHOTOVOLTAIC SYSTEMS ON 22 UNIVERSITY BUILDINGS

We evaluated the technical feasibility of installing photovoltaic systems on all campus rooftops. Thanks to the close cooperation of the Energy Research Centre, the Faculty of Electrical Engineering and Informatics, and the University‘s Halls of Residence and Dining Facilities, we were able to submit and process a total of four applications for photovoltaic installations with a planned capacity of 2.33 MWp.

GRAND OPENING OF THE CEETe BUILDING

In October, we ceremoniously opened the innovative CEETe polygon, which represents the future of energy, moving away from fossil fuels towards energy sustainability. The CEETe building fully utilizes renewable resources and serves as an example of their efficient use. We are working with water management, using alternative and renewable energy sources and engaging in the energy transformation process through hydrogen management. All these processes are managed by a sophisticated distributed control system.

MODERNIZATION OF THE VSB-TUO CAMPUS, CONSTRUCTION OF CEETe

The modernization of infrastructure, facilities for science and research, and overall sustainability of the university campus follow technological progress and innovations, which are essential components for improving conditions not only for students but also for researchers and academics. The construction of the CEETe building is one of the cornerstones for a future based on sustainability and efficient use of available resources. It is the first building within the campus area with comprehensive energy consumption management through a local distribution system, which includes a photovoltaic power plant, a set of wind turbines, and other sources of electrical energy. The construction also includes the university‘s first hydrogen filling station and additional charging stations for electric vehicles.

COMMISSIONING OF THE CEETe BUILDING

Thanks to the hard work of the CEETe investment and inspection team and colleagues from the CEET CENET, we were able to open the CEETe building and start operations in October. We are very pleased to have contributed to the modernization of the VSB-TUO campus with this step.

RELOCATION OF TCO WORKPLACES FROM OSTRAVA-VÍTKOVICE

At the beginning of last year, preparations and dismantling of selected parts of the research infrastructure took place, allowing us to move to modernly equipped spaces that offer a wider use of capacities according to the changing needs of research directions and projects.

INSTALLATION AND COMMISSIONING OF TECHNOLOGIES

With the assistance of university operational units, including close collaboration with the university bursar, we were able to install sub-technologies, including the supply and installation of brand new ones. This included technologies such as the hydrogen technology laboratory or the thermochemical conversion laboratory. All activities were carried out in accordance with the proposed project. Everything proceeded in accordance with the proposed project.

EMPLOYEES

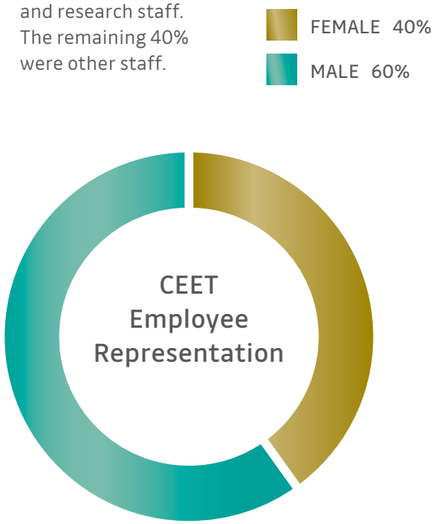
In 2023, the number of employees at the Centre for Energy and Environmental Technologies increased to 268, which represents an average full-time equivalent (FTE) of 214.20 employees. The 5.5 % increase compared to the previous year indicates the dynamic development and growth of our centre. Employees of CEET are 60 % male and 40 % female, which is above average in terms of female representation in the Czech scientific environment.

The most numerous group of employees in the Centre for Energy and Environmental Technologies are people aged 30-39, with a share of 34 %. Slightly more than 30 % of employees fall into the age category of 40-49, which guarantees our knowledge base and stability. We also have a significant representation of young talented colleagues under the age of 29 and employees aged 50-59, who bring their experience and know-how to our work environment. The broad representation of age groups reflects our openness and inclusion, which corresponds to the values of our organization.

Age Category	
under 29 years old	13,8%
30-39 years old	34,0%
40-49 years old	30,2%
50-59 years old	13,4%
60-69 years old	4,5%
over 70 years old	4,1%

Employee Type	Number of Employees	FTE
Academic Staff	23	19.75
R&D	138	95.44
Others	107	99.01

The majority of CEET employees, 60 % in total, were academic and research staff. The remaining 40% were other staff.



STRATEGIC OBJECTIVE 3

TO BE A RECOGNIZED CENTRE OF ORIENTED RESEARCH

PUBLICATION OUTPUTS

High-quality publication outputs, preferably with international impact, and the associated increase in citation rates are essential prerequisites for increasing our prestige and awareness of CEET. We have linked our publication activities to the employee evaluation system in accordance with the available guidelines, and we regularly evaluate the scientific performance of CEET employees with a frequency of once a year. We try to systematically inform both the scientific community and the general public about our successes.

CEET researchers and academics published a total of 175 scholarly publications indexed in the WoS database in 2023. The distribution of publications according to individual quartiles shows that a full 87 % of the publications were published in journals in the first and second quartiles. The shift from quantity to quality is evidenced by the fact that we managed to publish 45 articles in journals belonging to the top 10 % in their field (D1).

„Compared to 2022, the number of articles published in D1 has increased by 8.7%, making CEET one of the most successful research institutions nationally and internationally.“

Prof. Lucie Obalová, Ph.D. - Director of IET and Director for Science and Research

Science and Research Results

D1	45 (25,7 %)
Q1	87 (49,7 %)
Q2	65 (37,1 %)
Q3	18 (10,3 %)
Q4	5 (2,9 %)
Number of Publications per 1 FTE *	1,5
Total	**175**

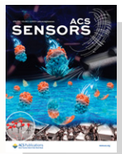
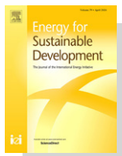
** 1 full-time R&D and academic staff*

Source: Web of Science, as of 4TH april 2024, Central Library of VSB-TUO

PROFESSIONAL ARTICLES PUBLISHED IN JOURNALS IN THE 1ST FIELD DECILE

Authors	Title	Journal, IF	Field
Ezhilarasan G.; Mohanraj K.; Vishnuram Pradeep; Bajaj Mohit; Blažek Vojtěch; Prokop Lukáš; Mišák Stanislav	An empirical survey of topologies, evolution, and current developments in multilevel inverters	Alexandria Engineering Journal IF 6.8	Multidisciplinary Engineering
Růžičková Jana; Raclavská Helena; Kucbel Marek; Pfeifer Christoph; Juchelková Dagmar; Hrbek Jitka; Šafář Michal; Slamová Karolina; Švédová Barbora; Kantor Pavel	Incidence and spread of additives from co-combustion of plastic waste in domestic boilers in indoor and outdoor environments around the family house	Energy IF 8.9	Energy & Fuels Thermodynamics
Wojnarová Petra; Rusín Jiří; Basinas Panagiotis; Kostejn Martin; Němec Josef; Stanovský Petr; Kim Albert S.; Izak Pavel	Unveiling the potential of composite water-swollen spiral wound membrane for design of low-cost raw biogas purification	Separation and Purification Technology IF 8.6	Chemical engineering
Zdrazil Lukas; Panacek David; Sedajova Veronika; Badura Zdenek; Langer Michal; Medved Miroslav; Paloncyova Marketa; Scheibe Magdalena; Kalytchuk Sergii; Zoppellaro Giorgio; Kment Štěpán; Cadranel Alejandro; Bakandritsos Aristides; Guldi Dirk M.; Otyepka Michal; Zbořil Radek.	Carbon Dots Enabling Parts-Per-Billion Sensitive and Ultraselective Photoluminescence Lifetime-Based Sensing of Inorganic Mercury	Advanced Optical Materials IF 9	Optics Multidisciplinary material sciences
Češpiva Jakub; Skřínský Jan; Vereš Ján; Wnukowski M.; Serenčíšová Jana; Ochodek Tadeáš	Solid recovered fuel gasification in sliding bed reactor	Energy IF 8.9	Energy & Fuels Thermodynamics
Burdova Hana; Kwoczynski Zdenka; Nebeska Diana; Al Souki Karim Suhail; Pilnaj Dominik; Grycová Barbora; Klemencová Kateřina; Leštinský Pavel; Kuran Pavel; Trogl Josef	The influence of diesel contaminated soil on Miscanthus x giganteus biomass thermal utilization and pyrolysis products composition	Journal of Cleaner Production IF 11.1	Environmental engineering Environmental Sciences Green & Sustainable Science & Technology
Kulišťáková Alena	Removal of pharmaceutical micropollutants from real wastewater matrices by means of photochemical advanced oxidation processes-A review	Journal of Water Process Engineering IF 7	Water resources Chemical engineering Environmental engineering
Zeng Kai; Tian Meng; Chen Xin; Zhang Jinlei; Rummeli Mark H.; Strasser Peter; Sun Jingyu; Yang Ruizhi	Strong electronic coupling between single Ru atoms and cobalt-vanadium layered double hydroxide harness efficient water splitting	Chemical Engineering Journal IF 15.1	Chemical engineering Environmental engineering
Zdrazil Lukas; Badura Zdenek; Langer Michal; Kalytchuk Sergii; Panacek David; Scheibe Magdalena; Kment Štěpán; Kmentova Hana; Thottappali Muhammed Arshad; Mohammadi Elmira; Medved Miroslav; Bakandritsos Aristides; Zoppellaro Giorgio; Zbořil Radek; Otyepka Michal	Magnetic Polaron States in Photoluminescent Carbon Dots Enable Hydrogen Peroxide Photoproduction	Small IF 13.3	Physical Chemistry Material Science Multidisciplinary Nanoscience & Nanotechnology Chemistry multidisciplinary

ARTICLES WITH CITATION RESPONSE OF 20TH OR MORE

Authors	Title	Journal, IF	Citation, Field (WoS)	
Xie Maomao; Gao Meng; Yun Yang; Malmsten Martin; Rotello Vincent M. M.; Zbořil Radek; Akhavan Omid; Kraskouski Aliaksandr; Amalraj John; Cai Xiaoming; Lu Jianmei; Zheng Huizhen; Li Ruibin	Antibacterial Nanomaterials: Mechanisms, Impacts on Antimicrobial Resistance and Design Principles	Angewandte Chemie-International Edition IF 16,6	60 citation Chemistry multidisciplinary	
Zeng Kai; Tian Meng; Chen Xin; Zhang Jinlei; Rummeli Mark H.; Strasser Peter; Sun Jingyu; Yang Ruizhi	Strong electronic coupling between single Ru atoms and cobalt-vanadium layered double hydroxide harness efficient water splitting	Chemical Engineering Journal IF 15.1	32 citation Chemical engineering Environmental engineering	
Pang, J., S. Peng, C. Hou, H. Zhao, Y. Fan, C. Ye, N. Zhang, T. Wang, y. Cao, W. Zhou, D. Sun, K. Wang, Mark Hermann Rümmeli, H. Liu a G. Cuniberti	Applications of Graphene in Five Senses, Nervous System, and Artificial Muscles	ACS Sensors IF 8.9	22 citation Chemistry multidisciplinary, Nanoscience & Nanotechnology Analytical chemistry	
Nazari Mohammad Alhuyi; Rungamornrat Jaroon; Prokop Lukáš; Blažek Vojtěch; Mišák Stanislav; Al-Bahrani Mohammed; Ahmadi Mohammad Hossein	An updated review on integration of solar photovoltaic modules and heat pumps towards decarbonization of buildings	Energy for Sustainable Development IF 5,5	22 citation Green & Sustainable Science & Technology Energy & Fuels	

Overview of professional articles published in 2023 with a citation response of 20 or more (citations as of 5th April 2024, source WoS).

INCREASING EXCELLENCE IN KEY AREAS OF ORIENTED RESEARCH

If we want to compete internationally, we must continue to work intensively and purposefully on solving research tasks and achieving excellent results. Last year, successes in the areas of nanomaterials for environmental technologies and research on materials for energy conversion, transfer and storage were complemented by other key topics. In total, we have identified another six areas where we have the potential to engage in international collaboration and achieve excellent results.

- Utilization of electron beams for targeted synthesis of new materials with precise structures for applications in energy, biomedicine, electronics, and environmental protection.
- Methods for environmentally friendly production, storage, and safe use of hydrogen.
- Digital modeling of energy network technologies for optimizing energy distribution and consumption.
- Photocatalytic conversion of CO_2 into usable products, photocatalytic water splitting.
- New materials and nanostructures for energy storage in batteries and supercapacitors, as well as in environmental technologies.
- Utilization of recyclates from industries (metallurgical, nuclear, and batteries) for modification and improvement of conventional materials.

DEVELOPMENT OF THE CENTRE'S BUSINESS POTENTIAL

Keeping pace with the private sector and providing answers to upcoming challenges is an integral part of our strategy. We continuously seek opportunities and offer our services in applied and contract research to existing as well as new potential partners. Through contract research, we support the growth of contract volumes, and our wide portfolio allows us to collaborate with the VSB-TUO Technology Transfer Center and partial partners in preparing and executing licensing agreements. We communicate our achievements not only to the professional community but also to the general public about our achievements. In addition to traditional media outputs, we participate in workshops, training sessions, seminars, corporate events, trade fairs, exhibitions, as well as demonstration events with existing and potential partners. Thanks to our hard work, we have succeeded in expanding business cooperation into further areas.

DEVELOPMENT OF NEW COMPOSITE MATERIALS FOR SECONDARY BATTERIES

The development of secondary batteries poses two main challenges: increasing product performance and improving their safety while considering environmental impact. The utilization of nanotechnological approaches enables the enhancement of their functional properties, including the reduction of the resulting battery size. Collaboration with foreign companies allows the direct application of researched materials with the potential for immediate integration into the production lines of major corporations.

ASSESSMENT OF THE ENERGY CONSUMPTION OF COMPRESSED AIR PRODUCTION IN COMPRESSORS WITH TWO-STAGE COMPRESSION

The ENET Centre provides independent expert testing of performance and efficiency of PEMA compressors, which are currently being introduced to the market. The tests themselves are conducted in accordance with the international standard ISO 1217, which sets out the basic conditions for a reliable and comparable determination of compressor efficiency, even among competing products.

SOLUTION FOR SLUDGE MANAGEMENT – ASSESSMENT OF SLUDGE HANDLING PROCEDURES FROM AN ENVIRONMENTAL PERSPECTIVE

The utilization of sludge and water recycling holds significant potential, which gradually increases its value, especially in the context of changing European legislation related to climate change and the efficient use of primary raw material sources. Maximizing the potential of wastewater sludge requires energy and material utilization of sludge, which can only be achieved through conceptual solutions, effective cooperation, and implementation of the latest innovations in practice.

ASSESSMENT OF THE LIFESPAN OF CATALYSTS FOR SELECTIVE CATALYTIC REDUCTION OF NO_X

Currently, a significant portion of our energy is still derived from the combustion of fossil fuels, leading to one of the fundamental issues, air pollution. Among these harmful substances are nitrogen oxides (NO_x). The aim of the project is to assess the actual lifespan of catalysts for selective catalytic reduction of NO_x.

HYDROGEN TECHNOLOGIES

As part of accredited activities, the cooperation has been expanded to the area of hydrogen purity using the OFCEAS, GC/MS, and GC/TDC methods, which also involve sample collection.

APPLIED RESULTS

The year 2023 was also successful for us in terms of applied results created at CEET, as evidenced by the registration of a total of 42 such outcomes. Beyond these achievements, a total of 7 patents were granted during the past year, including 1 international patent.

Patent/Application	7
Utility model/Application	6
Industrial pattern / Application	1
Implemented methodology	1
Software	5
Function sample	15
Verified technology	7
Pilot plant	2
Prototype	5
Total	**49**

Source: Internal materials of the R&D Commercialization Department – Intellectual Property Protection, 2023, as of February 7th, 2024.

A PULSE DETONATION ENGINE AND A BIOGAS ENERGY RECOVERY UNIT

PATENT WO/2022/174844 (2023)

MADRY, F., RIEMEL, D., VÝTISK, T., RUSÍN, J.

A pulsed reactive engine for burning a mixture of biogas and hydrogen, comprising a valve assembly and a combustion chamber connected to the valve assembly. The valve assembly includes a suction diffuser, a fuel supply tube, a partition, an air baffle with holes for air intake, a support plate, and a valve with closures. The valve flaps are flexible so that in the closed position of the valve, the flaps abut the air baffle, thereby covering the perforations and blocking the air supply to the combustion chamber and the expansion of exhaust gases into the suction diffuser. In the open position of the valve, the closures abut the support plate, leaving the holes open and allowing airflow into the combustion chamber. Also described is a unit for energy recovery from biogas, comprising a pulsed detonation engine, and a method for burning a mixture of biogas and hydrogen in a pulsed detonation engine or in a unit for energy recovery from biogas.

AN ADAPTIVE MONITORING SYSTEM FOR LARGE GRID NETWORKS OF THE ELECTRICAL DISTRIBUTION SYSTEM AND A METHOD OF ITS SETTING AND OPERATION

PATENT CZ 309907 (2023)

TOPOLÁNEK, D., LAMPART, M., MIŠÁK, S., PTÁČEK, M., MLÝNEK, P., VYČÍTAL, V., PRAKS, P., VYSOCKÝ, J.

An adaptive monitoring system for large grid networks of the electrical distribution system, which has a central control unit (CCU) connected to the control station (PDS) of the distribution system operator and is equipped with distributed measuring units (DMU) at the nodes on the communication paths, which are intended to measure the values of at least voltage U and current I, which are adapted for the remote setting of parameters and have a hierarchical structure consisting of superior measuring units (DMU-M), to which subordinate measuring units (DMU-S) are subordinate, wherein the central control unit (CCU) is equipped with computing technology with software for calculating the evaluation factor H from the measured values by some of the analytical methods of (QDC) quantitative dynamic characteristics.

A DEGRADABLE POLYMER COMPOSITE MATERIAL, ESPECIALLY WITH ANTIMICROBIAL EFFECTS

PATENT CZ 309811 (2023)

ŠKRLOVÁ, K., PLACHÁ, D., MALACHOVÁ, K., RYBKOVÁ, Z.

A degradable polymer composite material against bacteria and viruses for the production of medical material and filaments containing 90 to 99.9 % by weight of a biodegradable polymer matrix and 0.1 to 10 % by weight of a hybrid filler / nanofiller. Through its gradual degradation, it uncovers the fillers that are built into its structure, thereby maintaining, in the long term, an antimicrobial environment that prevents the formation and growth of biofilm. The aforementioned degradable polymer composite material is used for the preparation of implantable medical devices or surgical devices or antibacterial fillings, anti-adhesion partitions, membranes, pockets or packaging or filaments for 3D printing.

COMPLEMENTARY ACTIVITY

The complementary activity of the centre consists of cooperation with industry, municipalities, and other organizations. The scientific potential of research teams is used in its implementation, and we have the opportunity to fill the capacity of instrumentation and technological equipment of research centres.

In 2023, the supplementary activity was very successful. We managed to increase the overall financial volume of the activity, including profit, expand the scope of research centres into new areas, and confirm CEET's position as a leading institution in this field of activity at the University. Significant cooperation was also established with foreign customers, which significantly increases the institution's prestige compared to domestic market competitors.

The cooperation is focused on joint scientific research projects funded by research agencies and on contracts for so-called contract research, funded by the clients' own resources. The scientific research projects focused on issues such as alternative fuels, circular economy, development of ecological heating sources, technologies for emission reduction, modern decentralized and decarbonized energy systems, diagnostics of traction batteries for electric vehicles, diagnostics of electrical equipment, and more. Contract research has involved developmental work on products and technologies, activities of accredited laboratories, design, consulting, and expert services. Given the highly diverse activities of individual centres, there is significant interest from external organizations in collaborating on contract research. It should be stressed that supplementary activity takes place in a competitive environment with many renowned entities operating in the same fields as CEET in both domestic and foreign markets.

The most important activities of the individual centres in the implementation of contract research include, for example, the development of heating equipment, including technologies for greening their operation, projects on heat and electricity production technologies including renewable energy sources (RES), hydrogen technology applications, emission reduction from energy sources, development of waste energy and material utilization technologies, thermochemical conversion of biomass and alternative fuels, utilization of waste heat in industry, and more. In the field of material research, contract research has included testing the lifespan of materials in a hydrogen atmosphere, research on protective coatings for eyeglass lenses, evaluation of surface impurities and oxide layers on aluminium alloys, topographic analysis of nitride layers deposited by the PVD method, the use of lithography for hologram printing, and determination of the Zeta potential of sugar mixtures.

CEET operates two accredited laboratories, focusing on the analysis of fuels, waste, and emission analysis, construction materials, testing explosive properties of gases, liquids, and their mixtures.

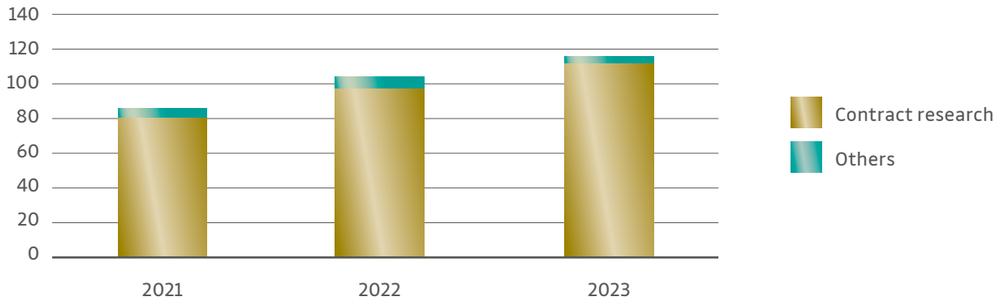
Collaboration with municipalities is carried out through studies as well as advisory and expert activities. Extensive cooperation with municipalities involves conceptual solutions for their energy management. Similar activities are conducted for regions through studies, complemented by exploring hydrogen utilization in transportation, integrating ORC systems for waste heat utilization, and proposing ways to increase the use of renewable energy sources in heat and electricity production.

„The Centre for Energy and Environmental Technologies is also significantly involved in consulting activities for government and financial institutions."

Assoc. Prof. Dr. Ing. Tadeáš Ochodek - director of ERC

In 2023, the University had revenues from supplementary activities amounting to €9,549,894. CEET contributed 50.44 % to this amount, totalling €4,817,221.

Revenues from the sale of Services in the years 2021-2023 (in € mil., excluding VAT)



EXAMPLES OF THE MOST SIGNIFICANT COOPERATION

Industry: ČEZ a.s., Veolia Energie a.s., Armádní servisní s.r.o., Romotop s.r.o., Benekov s.r.o., ENVEZ a.s., Moravskoslezské energetické centrum p.o., Kompresory PEMA s.r.o., Orgrez a.s., Mondi Štětí a.s., Schneider Electric CZ, s.r.o., SMS CZ s.r.o.; RANIDO s.r.o., DEKONTA a.s., Technické služby ochrany ovzduší Ostrava s.r.o., PRECHEZA a.s., AmpluServis a.s., Technický a zkušební ústav stavební Praha s.p., Vitesco Technologies Czech Republic s.r.o., CCL Secure Pty Ltd, Technological Institute of Plasma Aplication s.r.o. etc.

Public Administration: Moravian-Silesian Region, Pardubice Region

Cities and municipalities: Ostrava, Praha, Opava, Havířov, Kladno, Znojmo, Liberec, Pardubice, etc.

DEVELOPMENT OF INTERDISCIPLINARY AND INTERNATIONAL CO-OPERATION

Our goal is to be a leading initiator of innovation in the field of science and research. To achieve global success, it is essential to develop international collaboration, which is why we focus on preparing and submitting ambitious interdisciplinary projects for major grant calls. Due to the dynamic changes in EU policies aimed at strengthening energy and raw materials self-sufficiency and increasing the resilience of the energy system, we monitor their development to take advantage of all opportunities to participate in international projects. Through cooperation with renowned foreign partners and leveraging our established university system to support the submission of international projects, we are one step closer to achieving our long-term vision. In 2023, we secured support for eight significant interdisciplinary projects with international participation. By working with reputable international partners and using our established university system to support international project submissions, we are one step closer to achieving our long-term vision.

In 2023, we received support for eight major interdisciplinary projects with international participation.

EBEAM - Electron Beam Emergent Additive Manufacturing

Project number	101087143
Provider	European Union, Horizon Europe
Duration	2024–2028
Principal investigator	Prof. dr. Mark H. Rümmeli

SAFER – Self-healing Fiber Ceramic Matrix Composite

Project number	TH82020004
Provider	Technology Agency of the Czech Republic, EPSILON
Duration	2023–2026
Principal investigator	prof. Ing. Daniela Plachá, Ph.D.

ExPEDite-Enabling Positive Energy Districts through a Planning and Management Digital Twin

Project number	101139527
Provider	European Union, Horizon Europe
Duration	2024–2026
Principal investigator	prof. Ing. Stanislav Mišák, Ph.D.

H2GEO-New Technology for Hydrogen and Geopolymer Composites Production from Post-mining Waste

Project number	101112386
Provider	European Union, Research Fund for Coal and Steel (RFCS) 2027, RFCS-2022 Call
Duration	2023–2026
Principal investigator	prof. Ing. Silvie Heviánková, Ph.D.,
Co-principal investigator for CEET	Ing. Jan Najser, Ph.D.

HESS-Hybrid Energy Storage System Using Post-mining Infrastructure

Project number	101112380
Provider	European Union, Research Fund for Coal and Steel (RFCS) 2027, RFCS-2022 Call
Duration	2023–2026
Principal investigator	Ing. Jan Najser, Ph.D., Ing. Jaroslav Frantík, Ph.D.

Doctoral Program of Science with a Mention in Physics, Call for Financial Scheme „Alliances for Doctoral Programs“

Project number	E033-2023-01 – BM
Provider	Peru, CONCYTEC (Consejo Nacional de Ciencia, Tecnología e Innovación Tecnológica).
Duration	2024-2027
Principal investigator	Universidad nacional de Ingeniería (Peru)
Co-principal investigator for VSB-TUO	Ing. Lenka Matějová, Ph.D.

Long-term Heat Energy Storage in a Supercooled Substance

Project number	TM04000021
Provider	Technology Agency of the Czech Republic, DELTA 2
Duration	2023–2025
Principal investigator	Assoc. Prof. Dr. Ing. Tadeáš Ochodek

Catalysis of Phase-change Materials for Sustainable Heat Accumulation in Buildings

Project number	20334
Provider	Technology Agency of the Czech Republic, DELTA 2
Duration	2024–2025
Principal investigator	RANIDO, s.r.o., National Taipei University of Technology, Industrial Technology Research Institute (ITRI) a Ing. Čespiva Jakub

SIGNIFICANT SCIENCE AND RESEARCH PROJECTS

Last year, we managed to prepare and obtain a whole range of interesting projects, which illustrates our expertise and determination to be a leading scientific research centre not only in the Czech Republic, but also at the supranational level.

NATIONAL CENTRE FOR ENERGY II

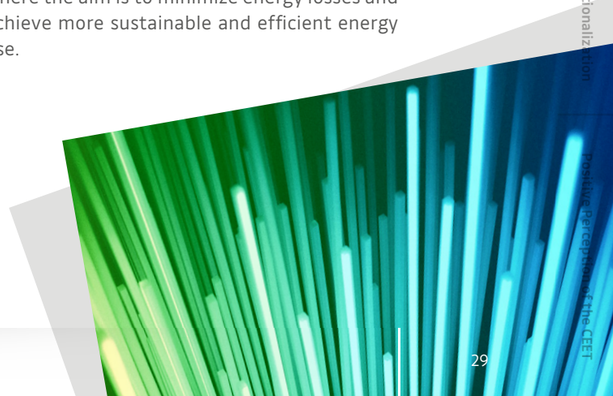
Project Number
TN02000025

The aim of the project is to stimulate long-term cooperation between leading research organizations and key industry players in the energy sector. Through applied research and the development of new methods, materials, and technologies, the project focuses on increasing the efficiency, safety, and reliability of existing energy systems, increasing the reliability and security of energy networks, the efficient deployment and operation of decentralized energy sources, and the use of alternative fuels to ensure the raw material independence and energy self-sufficiency of the Czech Republic. The goal is to develop a comprehensive strategy for modern, low-carbon, and sustainable energy taking into account the current geopolitical and socio-economic situation to fulfil the commitments of the Czech Republic to reduce greenhouse gas emissions, achieve carbon neutrality by 2050, and simultaneously ensure energy and raw material independence. The principal investigator of the project National Centre for Energy II (NCE II) is Prof. Ing. Stanislav Mišák, Ph.D.

ExPEDite - ENABLING POSITIVE ENERGY DISTRICTS THROUGH A PLANNING AND MANAGEMENT DIGITAL TWIN

Project Number
TN101139527

The project will be carried out by the Research Group of Intelligent Networks led by Assoc. Prof. Ing. Lukáš Prokop, Ph.D., focusing on the digitization of technologies in the energy sector. The main goal of the researchers within the project is to develop, for example, mathematical models in the form of Digital Twins (DT) aimed at monitoring, visualization, and control of energy flows at the level of positive energy districts, almost in real-time. This mainly concerns areas where the aim is to minimize energy losses and achieve more sustainable and efficient energy use.



REFRESH

PROJECT REFRESH

Project Number
CZ.10.03.01/00/22_003/0000048

The key tool for fulfilling the vision of SMARAGD, which aims to build a unique European infrastructure for research and technology transfer in the areas of sustainable energy, industrial production digitization, transport automation, environmental technologies, and smart materials technology. The project consists of four live laboratories: the Energy Lab led by Prof. Ing. Stanislav Mišák, Ph.D., the Materials & Environment Lab led by Prof. RNDr. Radek Zbořil, Ph.D., the Industry 4.0 & Automotive Lab led by Assoc. Prof. Ing. Petr Šimoník, Ph.D., and the Social Lab led by Mgr. Ondřej Slach, Ph.D.

BEAM

EBEAM ELECTRON BEAM EMERGENT ADDITIVE MANUFACTURING

Project Number
ERA CHAIRS HORIZON EUROPE 101087143

The project aims to establish a new international research team led by renowned materials scientist Prof. Dr. Mark H. Rümmeli, who will utilize electron beams for the targeted synthesis of new materials with precise atomic-level structures. The goal of the project is not only to push the boundaries in developing new materials with enhanced properties for applications in energy, biomedicine, electronics, and environmental protection but also to strengthen the internationalization of the university, support young scientists, and stimulate structural changes in research and science management at VSB-TUO.

SAFER

SAFER SELF-HEALING FIBER CERAMIC MATRIX COMPOSITE

Project Number
TH82020004

A project focused on the development of materials arising from a combination of ceramics and carbon fibers, led by Prof. Dr. Ing. Daisy Nestler from Chemnitz University of Technology. The project also involves collaboration with scientists from one of the most important universities in Brazil, the University of Sao Paulo, and experts from the domestic company Diafrikt Components. Scientists plan to produce the material using large-scale injection moulding, followed by pyrolysis and the Laser Shock Induced Fracture (LSI) process. This is an advanced technique used for manipulating and modifying materials using laser pulses. Another objective is the recycling of the prepared material to reduce the carbon footprint of the manufacturing process and production costs. Experts will also focus on assessing the impact of the material and its production on the environment to be able to prevent undesirable effects if necessary.

MATUR

MATUR MATERIALS AND TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT

Project Number
CZ.02.01.01/00/22_008/0004631

The project aims to establish the Centre for Advanced Research in Materials and Technologies for Sustainable Development (MATUR). The aim is to conduct interdisciplinary research with high potential for creating applicable research outcomes that extend into various fields of human society, both nationally and internationally. The solution will involve major Czech and international workplaces, which will decisively influence the directions of development in sectoral scientific research and development activities. Effective communication and infrastructure connections among the involved institutions will enable the efficient acquisition of new knowledge and the development of interdisciplinary approaches in materials engineering.

Overview of Science and Research Projects

STRATEGIC OBJECTIVE 4

TO BE AN INCUBATOR FOR PROMISING EMPLOYEES

SUPPORT FOR THE DEVELOPMENT OF THE R&D POTENTIAL OF CEET EMPLOYEES

An integral part of all CEET activities is also the teaching and mentoring of students in bachelor's, master's, and doctoral study programs. This is carried out in cooperation with all faculties of VSB-TUO, except for the Faculty of Economics, which, however, has also been involved thanks to the REFRESH project. Our staff provide and guarantee specialized courses, incorporating the results of conducted research, and supervise final theses and dissertations addressing current project topics.

CEET has a number of young researchers and doctoral students, as well as many outstanding Czech and foreign scientists who can offer the younger generation the best experiences and approaches to scientific work leading to excellent results. In addition to providing quality facilities and cutting-edge equipment, we support their personal growth and development. Ongoing education leads to their improvement and further professional growth. Students completing their final projects at one of CEET's centres often receive awards for outstanding results and the best work in their field. In their work, they can benefit from many contacts with top international centres across the Institute, which broaden their knowledge and skills.

Various courses and training sessions organized not only within the university but also externally help them on their professional journey. Increasing the scientific research erudition and capacity of young researchers and doctoral students is essential for them to thrive in a highly competitive environment. We know that beginnings are never easy, which is why we support the publication activities of young researchers by paying publication fees in Q1 (WoS) journals.

„Our employees and colleagues have the opportunity to attend inspiring lectures led by experts, which we regularly organize, and at the same time actively participate in educational events and lectures intended not only for professionals but also for the general public."

prof. Ing. Daniela Plachá, Ph.D.
- Director for Education

INSPIRATIONAL LECTURES AND EDUCATIONAL EVENTS

Employees of CEET also contribute to educational events outside of teaching by organizing various courses for the public and giving lectures at public events.

Last year, we managed to organize several lectures led by experts and inspirational figures:

Ecotoxicity of Nanomaterials
5th April 2023
Prof. Jose L. Solis a Dr. Monica Gomez
National University of Engineering Lima, Peru

Preparing a Scientific Manuscript: the Process, the Correct Behaviors and the Unethical Shortcuts
15th May 2023
Prof. Paolo Fornasiero
Department of Chemical and Pharmaceutical Sciences, Università degli Studi di Trieste, Trieste, Italy

NanoOstrava – Series of Lectures Led by Foreign and National Experts.
15th to 18th May 2023

Synthetic Fuels and Green Hydrogen: Paving the Way for a Sustainable Development
19th May 2023
Prof. Joaquim Luís Faria
LSRE-LCM – Laboratory of Separation and Reaction Engineering – Laboratory of Catalysis and Materials, Faculdade de Engenharia da Universidade do Porto, Porto, Portugal

Catalysis from and for Waste
23rd May 2023
Prof. Josephine M. Hill
University of Calgary, Canada

Step-by-step Approach to Writing a Scientific Paper: from Figures to Title
18th October 2023
Carlos V. Melo, Ph.D.
Charles University

Biotechnological Potential of Endophytic Funghi in Nanotechnology
22nd November 2023
Associate Professor. Beata Zimowska, Ph.D.
Department of Plant Pathology, Subdepartment Phytopathology and Mycology, Faculty of Horticulture and Land Scape, University of Life Sciences in Lublin, Poland.

Fabrication and Characterization of Chitosan Nanoparticles Stabilized Emulsion-based Delivery Systems; the Story so Far
22nd November 2023
Dr. Bakht Ramin Shah
Department of Organic And Bioorganic Chemistry, The Faculty of Pharmacy, Charles University.

Two-dimensional Nanomaterials: Synthesis and Electron Microscopic and Spectroscopic Characterisation
28th November 2023
Dr. Ehsan Rezvani
University College Dublin, UK

Artificial Intelligence Landscape
5th December 2023
MUDr. František Koukolík

Nanomaterials and Nanorobots
6th December 2023
prof. RNDr. Martin Pumera, Ph.D.
VSB – Technical University of Ostrava, Faculty of Electrical Engineering and Computer Science

COOPERATION WITH FACULTIES

CEET also contributes to spreading the good name of VSB-TUO and actively recruits students by promoting its scientific fields. A significant step towards increasing the number of students in the coming years and also the internationalization of VSB-TUO with close links to CEET was the signing of an agreement between VSB-TUO and Sakarya University in Sakarya, Turkey (SAU) for a double-degree master's program in Nanotechnology. This program is implemented at the Faculty of Materials Science and Technology (FMT). The agreement was signed by the rector of SAU in December 2023, Prof. Ing. Daniela Plachá, Ph.D., Assoc. Prof. Tugrul Cetinkaya, PhD (SAU), in cooperation with Prof. Ing. Kamila Janovská, Ph.D., now the dean of FMT, participated.

At the same time, we cooperate intensively with secondary schools, such as the Secondary Industrial School of Chemistry, whose students regularly carry out their internships at the Institute of Environmental Technologies and the Centre for Nanotechnologies (in 2023, a total of 6 students). We consider cooperation with secondary schools to be an important step in arousing the interest of the younger generation in technical sciences, and therefore, we participate in almost all promotional events of VSB-TUO and open our doors to high school students in their internships. We appreciate the interest of every student who decides to join us in building the good name of CEET and the entire VSB-TUO, and we believe that together we will create a top university centre that will contribute to the development of the university and the entire Moravian-Silesian Region. Last year, we reached out to students from Ostrava's high schools, offering them the opportunity to participate in the NanoOstrava 2023 conference. Two students took advantage of this unique opportunity and presented their high school research projects at the conference.

The Number of CEET Employees Involved in Teaching and Supervising Students' Theses

Faculties of VSB-TUO	CEET Employees Involved in Teaching	CEET Employees Supervising Final Theses
FEECS	1	6
FMST	27	17
FME	6	2
Total	**34**	**25**

In total, 26 bachelor's and master's theses were defended in 2023, which were developed at CEET. Theses were defended at the Faculty of Electrical Engineering and Computer Science (FEECS) within the study programs of Power Engineering and Informatics, at the Faculty of Materials Science and Technology (FMST) within the study programs of Chemical and Environmental Engineering and Nanotechnology, and at the Faculty of Mechanical Engineering (FME) within the study programs of Mechanical Engineering and Energy and Environmental Engineering. Seventeen CEET employees were part of the examination boards for state final examinations at FEECS (Power Engineering), FMST (Chemical and Process Engineering, Nanotechnology), and FME (Power Machines and Equipment).

In 2023, a total of 33 PhD students worked on their dissertations under the supervision of scientific and academic staff from CEET (in three cases, supervisors were affiliated with FMST/CNT and FMST/IET) at the workplaces of CENET, CNT, IET, and ERC. CEET employees actively supervise doctoral theses in the study programs of Chemical and Environmental Engineering (FMST), Nanotechnology (FMST/USP), Process Engineering (FMST), Thermal Engineering and Fuels in Industry (FMST), Power Machines and Equipment, and Power Processes (FME), and Power Engineering (FEECS). A total of 6 students across CEET successfully defended their doctoral theses in 2023.

A total of 88 bachelor's, master's, and doctoral students worked in the CEET research centres. The topics of these theses were focused on the research directions of the individual centres and were part of the projects carried out at CEET.

Overview of the Total Number of Students Working at CEET in 2023

CEET research centre / Faculty	FMST	FSE	FEECS	FME	FMG	USP	Total
CENET	0	0	3	4	2	0	9
CNT	17	0	0	0	0	2	19
IET	27	0	0	0	0	0	27
ERC	0	15	0	18	0	0	33
Total	**44**	**15**	**3**	**22**	**2**	**2**	**88**

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AWARDS

In 2023, students won awards for the best projects, as well as for thesis and dissertation projects supervised by our staff. These achievements included:

2nd place for the best two-year project titled „Determination of Oxidation Catalysts Characteristics during the Flue Gas Purification," which was solved at CEET-ERC as part of the Doctoral Grant Competition project. The main investigator of the project was **Ing. Jiří Ryšavý** (PhD student at the Faculty of Mechanical Engineering, conducting doctoral research at CEET-ERC).

The thesis by **Ing. Ondřej Říha**, „Analysis of Explosion Parameters of Hydrogen at Low Initial Temperatures," under the supervision of Ing. Jan Skřínský, Ph.D., which was developed within CEET-ERC in collaboration with the Faculty of Safety Engineering, was selected among the TOP 6 graduate theses focusing on Smart Infrastructure and Energy in the Werner von Siemens Award competition.

Ing. Pavel Czernek received an award from the Scientific Council of FMST for the best presentation of a doctoral thesis within the Doctoral Day event (Nanotechnology study program). Under the supervision of his mentor, Prof. Ing. Daniela Plachá, Ph.D., he presented his work on the topic „Flower-like carbon coating on carbon spheres by chemical vapor deposition with overpressure."

STRATEGIC OBJECTIVE 8

INTERNATIONALIZATION

Increasing the number of study abroad trips and practical internships available to students outside Europe
Related to the operational objective of VSB-TUO: C 8.1.

PROGRAMME OF INTERNATIONALIZATION

We support the active participation of employees, especially young staff and doctoral students, in national and international courses, conferences, and internships offered by the University and organized with the support of the EU. Participation in these events is associated with establishing and expanding contacts with international partners, which positively impacts the perception of the Centre for Energy and Environmental Technologies on a global scale.

CEET also significantly supports student mobility and their connection with foreign partner institutions. In 2023, a total of 9 students were supported for international trips. Within the scope of cooperation, CEET was visited by 23 foreign students.

Overview of Students Travelling Abroad and Coming From Foreign Countries

CEET Research Centres	Number of Students Travelling Abroad	Number of Students Coming from Foreign Countries
CENET	3	1
CNT	4	0
IET	2	2
ERC	0	20
Total	**9**	**23**

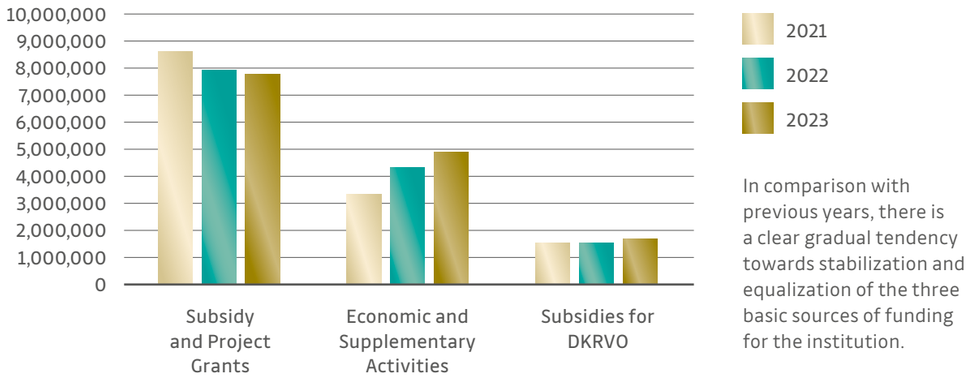
FINANCIAL OVERVIEW

Financial performance of the Centre for Energy and Environmental Technologies of VSB – Technical University Ostrava in the calendar year 2023 with a financial turnover of the total amount of €14,365,767 achieved a positive balance of €1,62 millions with a profit €1,4 millions after tax.

The sources of funding consisted of income from national and international scientific projects and grants (net of amounts transferred to co-principal investigators and refunds), funds to support the long-term conceptual development of the research organisation net of mandated expenditure, income from contract research and complementary activities, and own income.

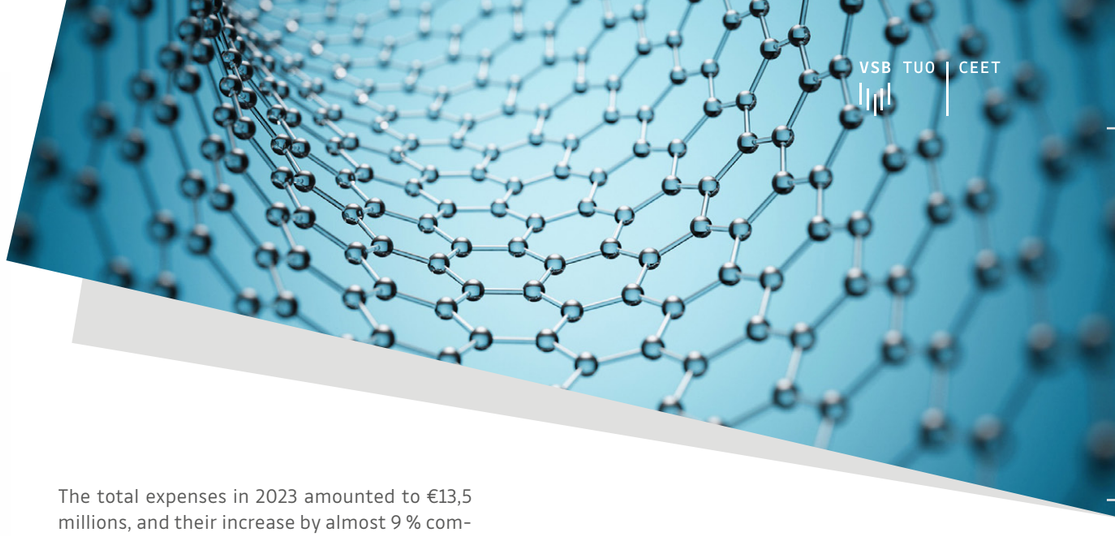
CEET‘s Revenues in 2023

(in €)

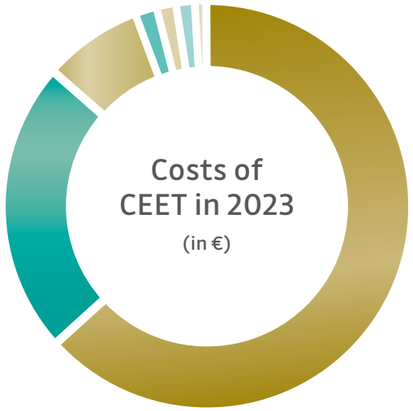


In comparison with previous years, there is a clear gradual tendency towards stabilization and equalization of the three basic sources of funding for the institution.

A single exchange rate in partial years was used for the calculation.



The total expenses in 2023 amounted to €13,5 millions, and their increase by almost 9 % compared to the previous year was a result of inflation, price hikes, and primarily wages, which, together with contributions, constitute the largest portion of the institution‘s expenses.



Personal Expenditures and Scholarships	8,554,933 €
Services	3,171,699 €
Consumption and Inventory	1,053,977 €
Overhead Costs	236,853 €
Travel	205,556 €
Repairs, maintenance	193,419 €
Other Expenditures	128,450 €
Total	**13,544,887 €**

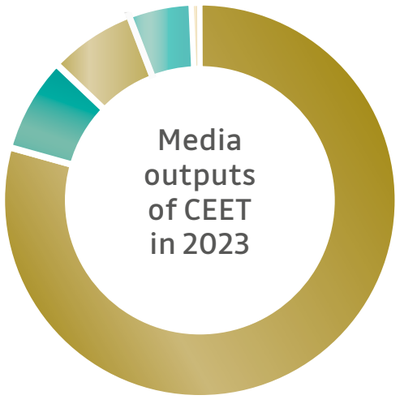
A single exchange rate in partial years was used for the calculation.

STRATEGIC OBJECTIVE 7

TO CHANGE PERCEPTION OF THE CEET BRAND INTERNALLY AND EXTERNALLY

SYSTEMATIC STRENGTHENING OF THE CEET BRAND

In our interest is the promotion of the achievements of scientific research and applied results to both the professional and general public. The media coverage of CEET's results with societal benefits is an integral part of building our brand and positive awareness of our institution. We are very pleased to be consolidating our reputation not only at the national but also at the international level. Cooperation with scientific and industrial partners and universities is one of the key prerequisites for quality outputs that meet the demands and current societal needs. Over the past year, we have succeeded in expanding awareness of our institution and were mentioned in a total of 504 cases. These included print media, online websites, social media, television, as well as radio appearances.



	Number of Outputs
Internet articles	400
Print	39
TV	36
Social media	26
Radio	3
Total	**504**

POPULARIZATION OF SCIENCE AND RESEARCH

In addition to these achievements, our colleagues also participated in a number of conferences, workshops, and other events whose common denominator is the introduction of CEET and the presentation of its excellent staff and their results.

International Fair InfoTHERMA 4

January 23rd – 26th, 2023

We participated in the 28th edition of the international exhibition InfoTHERMA, aimed at presenting both professionals and the general public with the latest trends and directions in modern heating and construction. Following the opening conference, there was a video premiere of Smokeman attended by Professor Mišák, Director of CEET, Ing. Valdman, Director of the State Environmental Fund of the Czech Republic, Ing. Tošenovský, and Dr. Unucka.

Ecoheating Lectures at the Energy Research Centre

March, April, June, October and December

Lectures on ecological heating are given at CEET ERC and are intended for a wide range of audiences from preschoolers to the general public. The lectures are interactive with plenty of practical demonstrations adapted to the age of the audience.

Two-day Educational Courses on Proper Heating

March 13th – 16th, 2023, and November 6th – 9th, 2023.

The aim of the accredited educational program is to deepen and update knowledge in the field of legislation, standards, principles, and best practices in heating, and to acquaint officials with the practice addressed and regulated by this legislation. The educational program focuses on the combustion of solid fuels in small combustion appliances presented in an understandable manner and with the assistance of many practical demonstrations for better understanding.

Earth Day with VSB – Technical University of Ostrava

April 25th, 2023

We are an integral part of Earth Day, an event for schools and the public. Together with the Faculty of Materials Science and Technology, we presented topics such as „Waste around Us," „World under the Microscope," „Magic of Surface Tension," and „Dilatant Fluid."

Educational Roadshow „Smokeman Teaches" in Czech cities

April, May, September, October

The aim of the show is to familiarize the general public with proper combustion in local heating systems, allowing them to estimate the efficiency of their combustion devices at home. Participants also have the opportunity to learn about the basic types of combustion device constructions, their fundamental characteristics, and how to correctly operate and maintain boilers, stoves, and fireplaces. The educational roadshow „Smokeman Teaches" was implemented in 2023 as part of the 28th edition of the international exhibition Infotherma 2023, and an additional 17 one-day educational events were held in Czech cities.

Tenth International Chemical-Technological Conference (ICCT)

April 24th – 26th, 2023

The tenth edition of the International Chemical-Technological Conference (ICCT) served as a traditional gathering of participants from research, educational, and industrial institutions. The main topics of the program included decarbonization of energy-intensive industries – Green Deal, the economics of the chemical industry, oil, petrochemistry, organic technology, biotechnology, speciality chemical technologies, new materials, energy resources, hydrogen strategy, advanced processes and apparatuses, and environmental protection technologies.

First SAN4fuel Summer School

May 15th, 2023

On this day, the first Summer School of the SAN-4fuel project – Single atom-based photo(electro)catalysts for green fuel, took place. The project focuses on the utilization of a groundbreaking scientific approach, where scientists from CATRIN, Palacký University in Olomouc, and CEET, VSB – Technical University of Ostrava, along with two globally recognized universities from Germany and Italy, aim to develop new materials for obtaining „green" energy or reducing carbon dioxide emissions in the atmosphere. This initiative aims to demonstrate possibilities for ending reliance on fossil fuels and preventing potential energy and climate crises in the future.

Science Fair 2023

June 8th – 10th, 2023

This marked our debut at the Science Fair. We presented our research to visitors, ranging from nanotechnologies and materials for low-carbon and sustainable energy to environmental technologies.

Meeting of World Experts on Catalysis

August 27th – September 1st, 2023

At the end of August, Prague hosted the international conference EuropaCat 2023, bringing together global leaders in catalysis. The Institute of Environmental Technologies, under the auspices of CEET, not only participated in the technical program but also contributed to the activities of the Czech organizing committee. Additionally, employees of the Institute presented the services of the large research infrastructure ENREGAT to conference participants. Researchers from the Institute further showcased research results focused on catalytic pyrolysis, photocatalytic reduction of carbon dioxide, and hydrogen production by photocatalytic splitting of aqueous solutions.

Art & Science 2023

September 7th, 2023

We were part of the Art & Science 2023 festival, where we conducted commented demonstrations in chemistry, waste management, and nanotechnologies.

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Czech European Researchers' Night

October 6th, 2023

We also participated in the popular nationwide science popularization event, Researchers' Night. In addition to universities and dozens of scientific institutions, smaller organizations also joined in organizing Researchers' Night for the first time. This included new high schools, Czech Academy of Sciences workplaces, and libraries. The Centre for Energy and Environmental Technologies hosted several workshops and guided tours during this event. Examples included „Secrets of Energy," „Mysterious World of Nanotechnologies," „The Hidden Life of Water," „Mysterious Power of Materials and Waste," „Micro World," „Secrets of Catalytic Reactions," and more.

Energy in Transition – Powering Tomorrow

October 16th – 26th, 2023

In collaboration with the German Embassy and the Fraunhofer Innovation Platform, we organized the travelling exhibition „Energy in Transition – Powering Tomorrow." The aim was to provide the general public with insight into the global dialogue on energy transition.

Business Tour and Transformation of the Moravian-Silesian Region

November 7th – 8th, 2023

The two-day event aimed to introduce guests from France to business opportunities and the industrial transformation in the region, bringing more than twenty French members of the French-Czech Chamber of Commerce (FCCHC) to the region. Discussions focused on the transformation of local industry and its adaptation to new technologies. Special attention was also given to the role of universities in the region, particularly VSB-TUO. The forum also included a visit to the new CEETe polygon, where visitors were introduced to new technologies located on the polygon, providing them with an interesting and inspiring experience.

Celebration of the 10th Anniversary of the Opening of the Institute of Environmental Technologies Building

November 10th, 2023

On November 10th, 2023, the celebration of the 10th anniversary of the opening of the Institute of Environmental Technologies building took place. Many of our colleagues from Czech universities and representatives from industrial partners attended this festive occasion. The VSB - Technical University of Ostrava was represented not only by IET employees but also by colleagues from other research centres under CEET, as well as representatives from faculties.

INFORM EU 2023

November 14th – 16th, 2023

Participants of this prestigious meeting had the opportunity to visit the new CEETe polygon and attend a presentation of one of the key sub-projects of the National Centre for Energy II (NCE II). During the presentation, participants learned about the project's goals, including information on project outputs focusing on innovations in decarbonization and green transition. Following the presentation, participants visited the hydrogen laboratory and thermochemical conversion laboratory to gain a better understanding of the practical applications of these innovations.

IMPORTANT EVENTS

International Conference NanoOstrava 2023

From May 15th to 18th, 2023

The international conference NanoOstrava took place in the unconventional place of the Lower Area of Vítkovice. Scientists, students, and companies used this platform for discussions in the field of research and development of nanomaterials and nanotechnologies. The conference was organized by the Nanotechnology Centre team led by Mrs. Daniela Plachá and was held in a combined mode, allowing for both in-person and online interactions. Various topics were presented by renowned scientists, experts, and industry representatives. Mrs. Gražyna Simha Martynková presented on materials and technologies for energy and transportation, while Mr. Radek Zbořil, along with Mrs. Daniela Plachá, focused on materials and technologies for the environment, healthcare, and safety. Mr. Jan Neuman addressed advanced material characterization. Special guests included the rector of VSB – Technical University of Ostrava, Mr. Václav Snášel, and the vice-rector for science and research, Mrs. Jana Kukutschová. The conference was also attended by the deputy mayor of the Moravian-Silesian Region, Mr. Stanislav Folwarczny, the director of the Institute of Geonics of the Czech Academy of Sciences, Mr. Josef Foldyna, the director of the Centre for Energy and Environmental Technologies, Mr. Stanislav Mišák, and the director of the Department of Environmental Risk and Damage at the Ministry of the Environment of the Czech Republic, Mr. Karel Bláha.

Workshop CEET

December 7th, 2023

In December, the third CEET Workshop took place under the motto E pluribus unum which translates to „Out of many, one, or unity in diversity" referring to the fact that four originally separate scientific centers have joined forces and collaborated under the CEET. In addition to reviewing the year's accomplishments, the program included presentations of scientific achievements from the individual CEET centres. The workshop also featured presentations on research results in materials for energy and environmental technologies, which have been published in top-tier scientific journals. A major success highlighted during the workshop was the completion of the construction of the Centre for Energy and Environmental Technologies – explorer (CEETe). The entire event and the direction of CEET was framed by a new promo video that premiered at the workshop.

Educational Video Courses on ČTEdu: „How to Properly Heat? Smokeman's Ten Commandments"

The Research Energy Centre has entered into a licensing agreement with Czech Television for the placement of educational videos on ČT edu and iVysílání for a period of ten years. The educational videos are available on the ČT edu website.

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VSB TECHNICAL UNIVERSITY OF OSTRAVA | CENTRE FOR ENERGY AND ENVIRONMENTAL TECHNOLOGIES

ANNUAL REPORT 2023

VSB-Technical University of Ostrava

CENTRE FOR ENERGY
AND ENVIRONMENTAL TECHNOLOGIES

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The Annual Report of CEET for the year 2023
was approved by the Scientific Council of CEET on May 15th, 2024
and is available electronically on the website

ceet.vsb.cz

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ochman.cz

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