

ODTÜ RESEARCH FOR A GREENER WORLD

HORIZON 2020

h2020.metu.edu.tr



ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY





HYVOLUTION - Non-Thermal Production of Pure Hydrogen From Biomass

Project Coordinator from ODTÜ: Prof. Dr. İnci EROĞLU	Funding Scheme: FP6 - IP	Project Budget: 9,900,000.00 EUR
www.biohydrogen.nl/hyvolution		

“WHO KNEW BACTERIA COULD BE FUTURE POWER GENERATOR? ENERGY HAS NEVER BEEN SO GREEN...”

HYVOLUTION is an Integrated Project funded (2006-2010) within FP6 and is entitled “Non-Thermal production of pure hydrogen from biomass”. ODTÜ coordinated the "Work Package 3: Photofermentation." The aim of contributing to the development of a blue-print for an industrial bioprocess for hydrogen production from locally produced biomass adds to the number and diversity of H₂ production routes giving greater security of supply at the local and regional levels. The novel approach in HYVOLUTION is based on a combined bioprocess employing thermophilic and phototrophic bacteria to provide the highest hydrogen production efficiency in small-scale, cost-effective industries. This process achieves the conversion of biomass into hydrogen with optimized yield and rate through integrating fundamental and technological approaches. Novel pilot scale bioreactors developed for industrial applications.

Prototype panel and tubular photobioreactors are successfully operated in outdoor conditions in Aachen-Germany and Ankara-Turkey. New devices are designed and constructed for monitoring and controlling hydrogen production. Dedicated gas upgrading is developed for efficiency at small-scale production units. The impact of small-scale hydrogen production plants is addressed in socio-economic analyses.

In HYVOLUTION, 11 EU countries, Turkey, Russia and South Africa are represented to assemble the critical mass needed to make a breakthrough in cost-effectiveness. The participation of prominent specialists from academia, industries and SME's warrants high quality and commercial exploitation of the project results. This project will facilitate the development of new agro-industrial enterprises by enabling small-scale sustainable hydrogen production from locally produced biomass



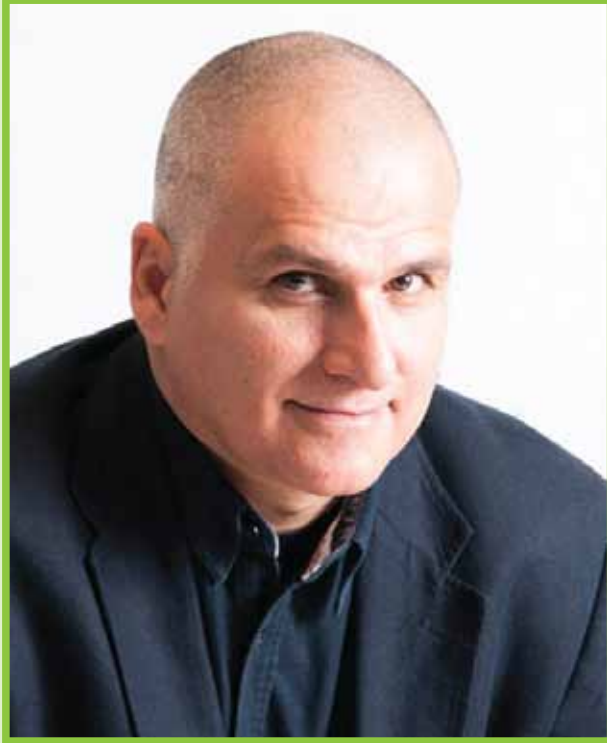
CHANGE - Combined morphing Assessment software using flight Envelope data and mission based morphing prototype wing development

Project Coordinator from ODTÜ: Prof. Dr. Yavuz YAMAN	Funding Scheme: FP7 - RTD	Project Budget: 4,490,348.00 EUR
cordis.europa.eu/projects/rcn/104265_en.html		

“TO PERFORM VARIOUS MISSIONS AND REDUCE ENVIRONMENTAL POLLUTION, USE MORPHING WINGS”

Morphing wings can provide aerodynamically optimized shapes for various flight regimes. Hence, a single aircraft can perform different missions while always consuming less fuel and generating less aerodynamic noise. The main objective of CHANGE (2012-2015) is to study and develop a novel morphing system that integrates up to four different morphing mechanisms into a single wing and to show this developed capability in flight. In order to achieve this, four main flight phases will be considered and various materials will be studied, and if necessary developed, for aerodynamically efficient as well as structurally durable and producible wing/control surfaces. The design will first be verified by computational aerodynamic and structural analyses. The produced wing/control surfaces then will be subjected to ground vibration tests and wind tunnel tests. Finally the aircraft, having the developed wings, will undergo flight tests.

The CHANGE consortium is composed of TEKEVER ASDS-Portugal (Coordinator), DLR Deutsches Zentrum für Luft und Raumfahrt-Germany, ARA Aircraft Research Association-UK, Universidade da Beira Interior-Portugal, Cranfield University-UK, Swansea University-UK, INVENT GmbH-Germany, Orta Doğu Teknik Üniversitesi-Turkey, and Delft University of Technology-Netherlands.



Dr. Hakan GÜRSU

**“125 AWARDS IN 8 YEARS WITH
UNUSUAL SOLUTIONS TO
COMMON PROBLEMS”**

Design for Innovation and Sustainability

Dr. Hakan Gürsu is a professor and full-time lecturer at the Industrial Design Department of ODTÜ and also the founder and leader of the innovation focused product development centre “Designnobis” at ODTÜ Teknokent.

Dr. Gürsu graduated from the same department and continued his studies with an M.Sc. degree in Architecture and a Ph.D. degree in City Regional Planning. He worked as a designer in Russia and Japan in the fields of product design, interior design, architecture and city planning. He was awarded with the ‘Pioneer of Design’ award for his urban designs for the Tokyo Subway. Dr. Gürsu has also taken part in several EU projects.

He is teaching primarily Product Design, Design Communication, Modeling and Presentation Techniques; while his main areas of interest are Industrial Design with a focus on Innovation and Sustainability. He has also lectured in Estonia on design management.

Creating solutions to the world’s contemporary problems about water, energy, food, space and waste with his visionary projects; Dr. Gürsu has been honored with several prestigious awards and accolades in this field. His work has been featured worldwide through press and media, including BusinessWeek, Popular Science, Wired, Fast Company, etc. In 2006, he co-founded the design firm Designnobis, which received more than 125 awards in 8 years.

Among his designs there are Volitan; a “sailboat” powered by solar and wind energy, and Fire Knight vehicle, which sprays soil instead of water to extinguish forest fires. With these inventions, he focuses on sustainability, future visions, energy and waste problems.

He is also the head of the Automotive Industrial Design Department at ODTÜ BİLTİR Centre, a member of the Brand-C Corporate Identity Unit and a founding member of the Industrial Design Association of Turkey. He served as an expert for the Intellectual Property Court, and has several patented designs and IPs developed in various projects for companies and business partners. Contributing to several magazines and publications including BusinessWeek, Bilim ve Teknik, Forbes and Infomag; he has also served as jury in various design competitions. Dr. Gürsu is also lecturing at several conferences, organizations and institutions on design, innovation and business, he is a fellow at TEDx as well.

He has earned the Forum Istanbul Award in 2008 for “Outstanding National Representation in International Field” with his contributions, as well as the “Designer of the Year” award by the Association of European Journalists and “Outstanding Contributions to Sustainable Development” award in the Sustainable Development Conference. His product designs and architectural work have been awarded in renowned competitions, including the International Design Award, Green Dot Award, A’ Design Award and Design Turkey Award.

Dr. Gürsu continues his career as an educator and as a designer who contributes to sustainable development of companies and businesses. Also teaching on creative thinking, he serves as a consultant for nurturing the innovation culture and creativity in corporations and foundations. In 2014, he was granted with the ‘Designer of the Year’ award by the International Association of Designers. Dr. Gürsu holds the first place in the Designer Rankings for the last four years.



Dr. H. Emrah ÜNALAN

“NANOTECHNOLOGY FOR GREENER WORLD:
NANOWIRES AND NANOTUBES FOR
ENERGY GENERATION

Field of Research: Nanotechnology

Prominent Project: “Development of Supercapacitors with Carbon Nanotubes”

Funding Scheme: The Scientific and Technological Research Council of Turkey (TÜBİTAK)

Project Coordinator: Dr. H. Emrah ÜNALAN

Project Budget: 152,000.00 EUR

H. Emrah Ünalán received a B.Sc. degree in Metallurgical and Materials Engineering from Orta Doğu Teknik Üniversitesi, Turkey in 2002 and his M.Sc. and Ph.D. degrees in Materials Science and Engineering at Rutgers University, USA in 2004 and 2006, respectively. From 2006 to 2008, he was a Research Associate in the Electrical Engineering Division in the Engineering Department at University of Cambridge, UK. At Cambridge, he worked on two projects entitled “Enhanced energy and power density for mobile devices” and “Development of novel nanoscale materials for electronics” funded by Nokia Research Center and Samsung Electronics, respectively.

In 2008, he joined the Department of Metallurgical and Materials Engineering, ODTÜ, where he is currently an Associate Professor.

Dr. Ünalán’s research interests include synthesis of nanotubes/nanowires and their utilization in flexible and transparent electronics and energy harvesting devices. The aim of his research is not only the utilization of nanomaterials for unforeseen applications through the fabrication of novel devices but also seeking possibilities for new device concepts and form factors. His most prominent projects at ODTÜ include “Development of Light Emitting Diodes Utilizing Hydrothermally Grown Zinc Oxide Nanowires” and “Development of Nanowire Enhanced Solar Cells”. He is a member of the Materials Research Society (MRS), American Chemical Society (ACS) and a recipient of the MRS Graduate Student Silver Award in 2005, Turkish Academy of Sciences Young Scientist Award in 2009 and Incentive Award from The Scientific and Technological Research Council of Turkey in 2014.



ODTÜ - INSTITUTE OF MARINE SCIENCES (IMS)

“Carrying out research to better understand our marine waters and ecosystems and to train graduate students for the benefit of both the environment and society”

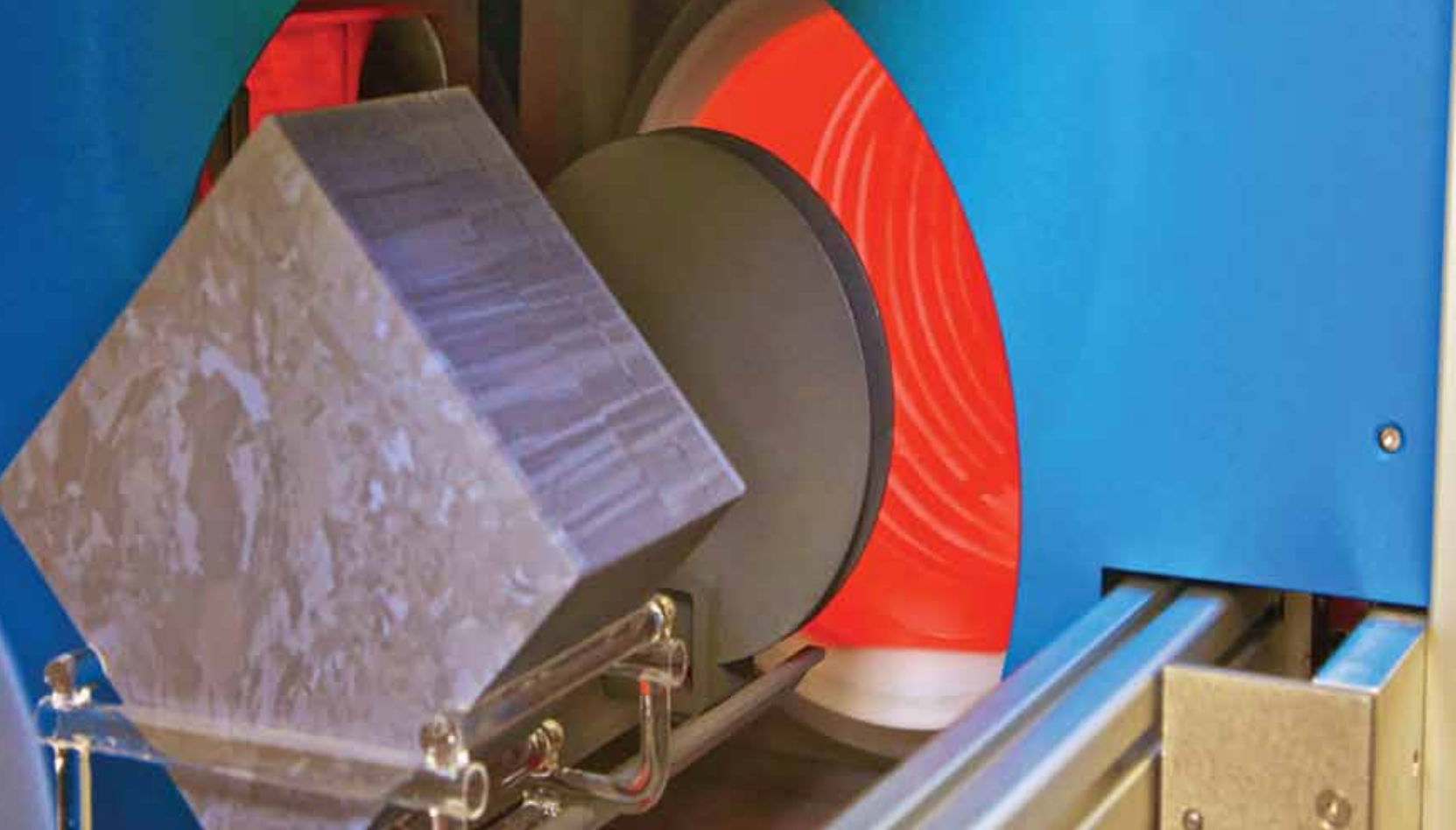
www.ims.metu.edu.tr

23 EU Framework Programme projects with a total budget of 4 Million Euros

The main mission of ODTÜ IMS is to carry out research to better understand our marine waters and ecosystems and to train graduate students for the benefit of both the environment and society. With its innovative and interdisciplinary structure, ODTÜ IMS is one of the leading research institutes of Turkey. In addition to producing important scientific outcomes, ODTÜ IMS strives to translate the results of this research for the enlightenment of ordinary citizens and policy-makers, while providing a solid information base for better resource management. Main research topics range from fundamental understanding of the physical processes that regulate biochemical and ecosystem dynamics to geological oceanography, marine genomics, fisheries, biodiversity, protection and even socio-economy.

ODTÜ IMS is further strengthening its research capacity by establishing a new centre named DEKOSIM (Centre for Marine Ecosystem and Climate Research). DEKOSIM is an interdisciplinary centre of excellence funded by the Turkish Ministry of Development, established at the Institute of Marine Sciences of the Orta Doğu Teknik Üniversitesi located on the Eastern Mediterranean coast of Turkey. The main objective is to create an infrastructure that focuses on interdisciplinary research linking physical, chemical, biological and geological marine research. The majority of the ODTÜ IMS academic staff together with several researchers from other national institutions have contributed to the program. DEKOSIM aims to become a marine research centre serving all national and international researchers within the fields of marine ecosystems and climatic sciences.

ODTÜ IMS has led many projects together with the main oceanographic institutes of the USA as well as Mediterranean and Black Sea countries. Recently, within the scope of the FP6 and FP7 programmes ODTÜ IMS is increasingly working closely with EU countries including those of Northern Europe. For instance, within the PERSEUS project, there are 55 partner institutes from 23 countries working on the objective of providing policy-makers with new support tools for taking measures that will protect our seas both in the present and the future. ODTÜ IMS has successfully contributed to 23 EU Framework Programme (FP6 and FP7 only) projects with a total budget of 4 Million Euros.



ODTÜ - CENTRE FOR SOLAR ENERGY RESEARCH AND APPLICATIONS (GÜNAM)

“Producing PV technologies for industry and academia and improving PV based conversion systems beyond the current state-of-the-art”

Director: Prof. Dr. Raşit TURAN www.gunam.metu.edu.tr

A centre of excellence with 190.4 M\$ research awards in 2010-2011 and 4000 co-op employers worldwide

GÜNAM (Centre for Solar Energy Research and Applications) is a centre of excellence on photovoltaic technology. GÜNAM, the laboratories of which are capable of producing PV technologies for industry and academia, executes research programs to improve PV-based conversion systems beyond the current state-of-the-art. It has strong industrial partnerships with investors for know-how and technology transfer. GÜNAM laboratories are open to all national and international researchers who are expert on photovoltaics and it provides a high level education and training for young researchers and students.

Photovoltaic technology has become more and more popular and PV based energy systems are increasing continuously. Although Turkey has a high solar potential, PV industry is currently limited to module production. However, with recent support and incentives, more sophisticated investments like solar cell production is expected in the coming years. Large scale power stations started to be installed as of the beginning of 2014. Local content in these systems is supported by government regulations. GÜNAM researchers promote this local technology development and thus serve the national stakeholders to secure their investments in the field. At international level, GÜNAM has several cooperations and projects with leading institutions and universities around the world.

Although GÜNAM is an academic institution, it has worldwide networks and co-operations with industrial partners. All infrastructure in GÜNAM labs are designed to improve industrial production methods. GÜNAM tools are able to produce solar cells at industrial sizes. Experience and know-how developed in GÜNAM is very critical for investors in Turkey.

The critical facilities of the centre include clean rooms for crystalline silicon solar cell R&D; 6 inch crystalline silicon doping furnace for PV applications; 6 inch crystalline silicon solar cell SiN coating PECVD chamber; Crystalline Silicon metallization, laser processing and chemical processing tools; 25cmx25cm a-Si thin film solar panel production tool (Multichamber system with 3 CCP, 1 ICP and 2 Sputter Systems); Several Sputter systems for Silicon, CIGS and TCO materials; E-beam and thermal evaporators for thin film R&D; Organic Solar Cell and Dye sensitized solar cell labs; Optical and electrical characterization labs for PV and thin film technologies; PV module test platform; Photolithography lab; and Carbonnanotube production lab.



RÜZGEM - CENTRE FOR WIND ENERGY

“Providing new aerodynamic data that could help improve the performance of current wind turbine systems”

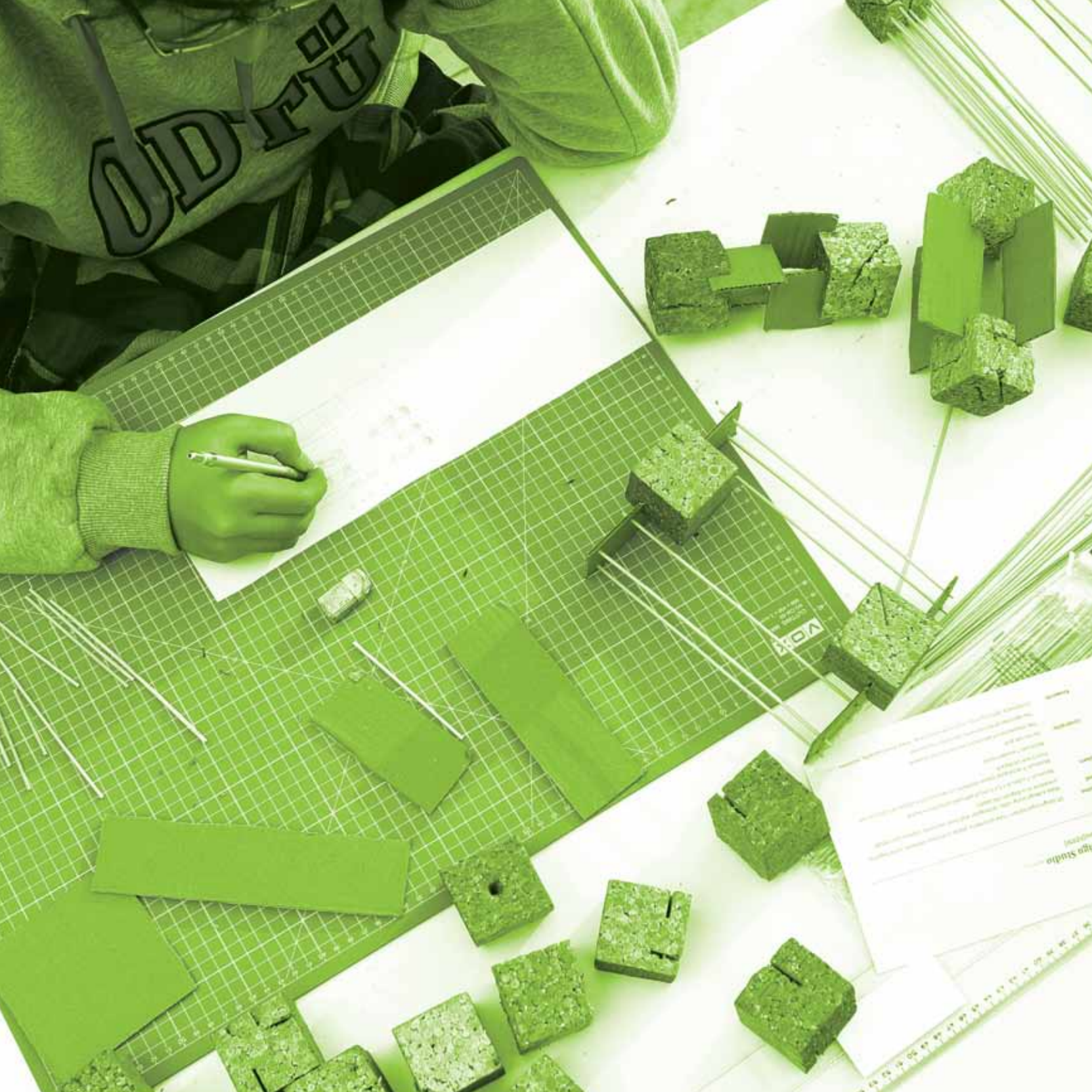
Director: Dr. Oğuz UZOL ruzgem.metu.edu.tr/en/

“The Large Scale Multi-Purpose Wind Tunnel is one of the largest and unique test facilities both in Turkey as well as in Europe”

RÜZGEM is the first and only interdisciplinary centre of excellence funded by the Turkish Ministry of Development in the field of wind energy research and its applications in Turkey. Its core competency is its test facilities and research infrastructure that are also essential for the aeronautical and civil engineering sectors. The two major research test facilities are the Large Scale Multi-Purpose Wind Tunnel and the Structures and Materials Laboratory.

The RÜZGEM Wind Tunnel, upon completion, will be one of the largest and unique facilities both in Turkey as well as in Europe. Variable test sections provide a unique testing capability for both research and contract work related to turbine aerodynamics. It can also be used for research on various rotary and fixed wing aeronautical systems as well as testing many civil engineering structures. It will play an important role in the production of new aerodynamic data. Airfoil characterization at high Reynolds numbers, model wind turbine tests and investigation of new aerodynamic or flow control concepts, tests of flow over wind farm models and topography will all be possible in the new wind tunnel. There is a growing interest in the new tunnel from the wind energy community in Europe as well as from the aeronautical industry in Turkey.

Structural tests and composite material characterization are essential for all parts of a wind turbine system. Fatigue testing capabilities of the Structures and Materials Laboratory enable RÜZGEM to compete with other wind energy research centres in the world. Its facilities cover from coupon level to full scale tests up to 10 m blade length. The tension-torsion-fatigue test capability is unique in Turkey and has great potential in providing service for the composite wind turbine/helicopter rotor industry. Furthermore, wind assessment, turbine wakes and numerical weather/power production prediction studies are being conducted in the High Performance Computing (HPC) laboratory. The computational resources in the HPC laboratory is one of the most powerful units amongst the research centres in Turkey.





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