BGUEnergy Initiative

אוניברסיטת בן-גוריון בנגב
Ben-Gurion University of the Negev

Feel the Energy

"Ben-Gurion University of the Negev has been at the forefront of energy research for over 30 years with an emphasis on the development of novel concepts and applications."

Prof. Moti Herskowitz,
Vice-President and Dean for Research & Development

Fueling the Future

In a world facing an increasing energy crisis, the search for alternative and renewable energy sources is of paramount importance. Research and development is vital in bringing renewable energy to the marketplace. With an outstanding scientific and technological track record, Israel, the start-up nation, is the ideal country to lead the way into a bright future based on renewable sources of energy.

A University with a Passion for Research

BGU promotes advanced fundamental research while searching for potential applications. Through recruitment of excellent researchers in relevant fields, increased R&D budgets, enhanced national and international cooperation and improved research infrastructure, BGU has positioned itself as a leader in the field. Looking to the future, the University has developed specific undergraduate and graduate multidisciplinary programs in diverse areas of alternative energy sources.

BGU Energy Initiative brings together a number of multi-disciplinary groups in emerging fields of energy R&D that incorporate basic scientific theory with applied systems technologies.

The University's faculty members are at the vanguard of Israel's research community, working at a national level to create strategies for developing alternative and renewable energy sources. It is a member of the Israeli Center for Research Excellence in the field of renewable liquid fuels and works with industry leaders to find cost-effective solutions to secure Israel's future energy sources.

I-CORE is Excellence

Ben-Gurion University of the Negev, The Technion – Israel Institute of Technology, and the Weizmann Institute of Science won the tender to create an Israeli Center for Research Excellence (I-CORE) focusing on renewable liquid fuels in 2011.

The group of 27 senior researchers includes nine researchers from Ben-Gurion University who are leaders in the production of biomass, photo-catalysis of CO_2 and water to fuels, gasification of biomass and production of liquid fuels from biomass and mixtures of CO_2 and water.

The BGU team participates in four of the five topics of the CORE program:

- Development of plants, algae and cyanobacteria – genetically selected or engineered – for large-scale production (under conventional or dryland growth conditions) of energy-rich biomass as a biofuel feedstock by exploiting recent advances in metabolomics, genetics, genomics and agrotechniques;

- Efficient and cost-effective direct conversion of solar energy into liquid fuels by photoelectrolytic and photocatalytic water splitting and CO_2 reduction;

- Non-catalytic conversion of low-grade biomass of any type into a mixture of H_2 and CO_2 that will serve as a feedstock for liquid fuel production by a catalytic process;

- Development of catalysts and catalytic processes for the sustainable and environmentally friendly production of liquid fuels from a variety of feedstock materials.

Promoting excellence through interdisciplinary research groups

Alternative and Renewable Fuels

The research infrastructure for renewable and alternative liquid fuels spans the Marcus Family and Sede Boqer campuses and is well-suited for a wide range of activities related to R&D of renewable liquid fuels. It encompasses energy crops research, algae biotechnology and desert oilseeds. A wide variety of activities are related to liquid fuels from gasified biomass, electrochemical and photoelectro-chemical conversion of carbon dioxide to fuels, second generation renewable diesel, nanostructures for advanced photocatalysis and hybrid nanowires for water splitting and catalytic liquid fuel production from carbon dioxide and hydrogen.

Prof. Sammy Boussiba, incumbent of the Miles and Lillian Cahn Chair in Economic Botany in Arid Zones, and director of the Landau Family Microalgal Biotechnology Laboratory (MBL), has participated in the “Biodiesel from Microalgae” project of the US-NREL and demonstrated feasibility of oil production by outdoors cultivation of microalgae 25 years ago. MBL scientists have contributed to outlining the opportunities and shortcomings of various proposed strategies for development of algal biofuels by participating in the FP7 consortium Aquafuels. MBL is currently coordinating the FP7 project GIAVAP for genetic modification of microalgae, and participates in project BIOFAT for demonstration of algal biofuels production at the 10 hectare scale.

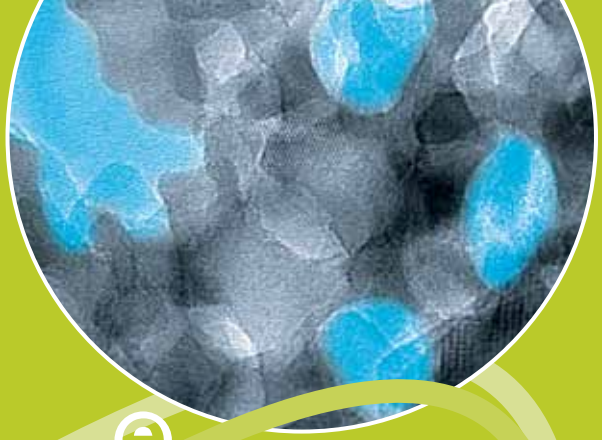
Promoting excellence through interdisciplinary research groups (cont.)

Solar

As quantities of fossil fuels dwindle and as their adverse impact becomes more and more evident, increased attention has been paid to alternative energies, especially solar energy. Israel in general and BGU in particular have long recognized the importance of developing solar energy technologies. With advances in technology occurring at an ever more rapid pace, research at BGU spans the gamut from nano-materials to heliostats, panels and entire installations.

Concentrated Photovoltaics (CPV) use a relatively inexpensive, large, mirrored surface to collect and concentrate light into a small, highly-efficient PV module. A breakthrough by Prof. David Faiman led to the licensing agreement and creation of the start-up company ZenithSolar, which has recently launched its first commercial solar farm based on this technology with hopes to expand commercial operations throughout Israel and the world. A by-product of the process is hot water, which is produced in quantity and serves as an added economic benefit of the solar energy.

Researchers believe that the tiniest nano-particles offer the largest solutions for solar energy today. At BGU's Ilse Katz Institute for Nanoscale Science and Technology in Beer-Sheva and The Ben-Gurion National Solar Energy Center on the Sede Boqer campus, scientists are exploring nano-materials and nanotechnology-based processes for photovoltaics and solar energy. They believe that this research has the potential to develop alternative energy solutions that are both cost efficient and environmentally benign.



Fuel cells

As the world searches for cleaner, longer-lasting fuels, one promising option is the fuel cell. Research today could lead to the breakthrough that will power the cars of tomorrow. Fuel cell research focuses on developing catalysts using cheaper metal complexes to reduce costs. Electrode systems are being explored in photoelectro-chemical cells in which hydrogen is produced. Molecular biology is employed to improve the electrode-living cell interaction.

Energy efficiency

Architectural design and planning affect the ability of buildings to adapt to environmental constraints and use them to their advantage, thus affecting energy usage. BGU researchers have been working for decades on bio-climatic, energy-conserving, green design and planning. Remarkable progress has been made on energy efficient circuits and systems, low voltage digital design and energy efficient design techniques for digital and analog VLSI chips. Development of efficient thermoelectric converters for utilizing waste heat to large scale power generation applications is an ambitious task undertaken by BGU researchers.

Energy economics

The development of optimal policy regulation is a challenging task as renewable energy is associated with several public goods: reducing global climate change, reducing the dependence on imported fossil fuels, supporting local economic development and reducing financial risk by increased portfolio diversity. Renewable energy poses challenges to policy and economics that require new models of analysis and interpretation.

Powered by People

Alternative & Renewable Fuels Team

L-R: Prof. Zeev Wiesman, Prof. Moshe Sagi, Dr. Stefan Leu, Dr. Inna Goldberg-Khozin, Dr. Naftali Lazarovich, Dr. Claude A
Prof. Pedro Berliner, Prof. Ira Weinstock, Prof. Sammy Boussiba, Prof. Moti Herskowitz, Prof. David Katoshevski, Prof. Mirc

Solar Team

L-R: Dr. Rafi Shikler, Dr. Iris Visoly-Fisher, Dr. N
Dr. Taleb Mokari, Prof. Daniel Feuermann, Prof.

flalo, Dr. Maya Bar-Sadan,
on Landau, Prof. Eran Sher

urit Ashkenasy, Prof. Yuval Golan,
. David Faiman, Dr. Eugene Katz, Dr. Sergey Biryukov

Fuel Cells Team

> L-R: Prof. Eli Korin, Dr. Lital Alfonta, Prof. Armand Bettelheim

Energy Economics Team

L-R: Dr. Meidad Kissinger, Dr. Ofir Rubin

Energy Efficiency Team

L-R: Prof. (Emeritus) Moshe Dariel, Prof. Nachum Frage, Prof. Isaac Meir, Dr. Yaniv Gelbstein, Prof. David Pearlmutter, Dr. Raziel Riemer, Dr. Alex Fish

Turning research into applied technologies – BGN Technologies

BGN Technologies, the Technology Transfer Company of Ben-Gurion University of the Negev, is responsible for the commercialization of the know-how and inventions of the University's researchers. Through the development of novel technologies and creative partnering with industry and investors, BGN brings value to the technological marketplace.

BGN files patent applications worldwide in the name of BGU and manages the University's patent and IP portfolio. BGN continually seeks prospective strategic partners, licensees and investors to bring the University's breakthroughs to the world.

- **Exxon Mobil Corporation (NYSE:XOM)** has partnered with QuestAir Technologies, Plug Power Inc. and Ben-Gurion University of the Negev to commercialize an on-vehicle hydrogen production system for use in a fuel cell-powered lift truck application. Under the arrangement, Plug Power will seek to commercialize unique technologies developed by ExxonMobil, QuestAir Technologies and BGU's Blechner Center for Industrial Catalysis and Process Development that take liquid fuels – gasoline, diesel, ethanol or biodiesel – and convert them into hydrogen onboard the vehicle where it will be used in a fuel cell power train.

- **ZenithSolar** has developed the most reliable cogeneration solar power system – with a full vertically-integrated strategy – that can be deployed as a distributed energy network. Founded in 2006, the ZenithSolar system is price competitive with traditional forms of energy without government subsidies. The ZenithSolar concentrated solar energy generation system is based on a new paradigm in optical design and high-efficiency solar. Developed by Prof. David Faiman, Chairman of the Department of Solar Energy and Environmental Physics at the University's Jacob Blaustein Institutes for Desert Research, the system will harvest more than 70% of incoming solar energy (as compared to industry norms of 10% to 40%).

- **PTT Chemical Public Company Limited (Thailand)** and BGU's Landau Family Microalgal Biotechnology Laboratory signed a research and development collaboration agreement for the production of dihomo-gamma-linolenic acid (DGLA – Omega 6) using BGU's proprietary mutant strain of the green microalgae *Parietochloris incisa*. The joint research focuses on optimizing DGLA production through advanced algae cultivation methods and large-scale processing in a commercially viable setting with hopes of developing additional valuable biochemicals from microalgae as well as using these microorganisms as potential feed stocks for biofuels.

At the Helm

Prof. Moti Herskowitz, Vice-President and Dean for Research and Development, guides BGU Energy Initiative and is responsible for promoting and facilitating all aspects of fundamental and applied aspects of R&D, including the diverse infrastructure, marketing and management. Prof. Herskowitz was also recently appointed to head the National Committee on Energy R&D which is part of the Israel National Council for R&D.

He is a professor of chemical engineering and a researcher in the fields of advanced materials, catalysis and liquid fuels. He established and became the director of the Blechner Center for Industrial Catalysis and Process Development in 1995, leading many of its research programs. He has published over 120 papers and taken out 20 patents based on basic and applied research. Some patents deal with novel renewable and clean fuels as well as processes for their production. Others are related to environmental catalysis and green chemistry.

Ben-Gurion University of the Negev aspires to fulfill the vision of Israel's first prime minister, David Ben-Gurion, who believed that Israel's future lay in the development of the Negev, a desert area comprising more than sixty percent of the country. Today, at its campuses in Beer-Sheva, Sede Boqer and Eilat, more than 20,000 students are enrolled in the Faculties of Engineering Sciences, Health Sciences, Natural Sciences, Humanities and Social Sciences, the Guilford Glazer Faculty of Business and Management, the Joyce and Irving Goldman Medical School and the Kreitman School of Advanced Graduate Studies. Major University research institutes include the National Institute for Biotechnology in the Negev, the Jacob Blaustein Institutes for Desert Research with the Albert Katz International School for Desert Studies, the Ilse Katz Institute for Nanoscale Science and Technology and the Ben-Gurion Research Institute for the Study of Israel and Zionism. Repeatedly voted the most popular choice of Israeli undergraduate students, the University is known for its dynamic atmosphere and commitment to excellence in teaching and research.

Ben-Gurion University is a world leader in arid zone research, offering its expertise to many developing countries. In keeping with its mandate, it plays a key role in promoting industry, agriculture and education in the Negev. Thousands of its students take part in community-oriented activities and special tutoring projects. The University welcomes exciting challenges in innovative fields of research and strives to bring new opportunities to Beer-Sheva and the Negev while continuing its pursuit of academic excellence and expanding its contribution to the community.

www.Energy2u.co.il

How to partner with BGU

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