

## Technology and Development Program

The primary mission of the Technology and Development Program (TDP) is to provide a focus at MIT for research and education related to the role of technology in the socioeconomic development of newly industrialized nations. TDP works with other academic departments and research centers throughout MIT to:

- Promote awareness of the relationship between science, technology, and development among faculty and students at MIT
- Provide a focal point for the technology and development activities of faculty, students, and visiting scholars interested in the field of technology and development
- Assist the faculty, students, and staff of collaborating institutions in other countries to develop research and academic interests consistent with their national needs
- Serve as a contact for interested organizations outside MIT (government, academic, private sector) to access the Institute's resources and its knowledge of developing countries, particularly of their socioeconomic and technological problems

TDP carries out these objectives through research, academic programs, and contacts with international and national organizations that have an interest in broad areas of technology and development. To fully utilize available resources, TDP is structured to interact with other academic departments and research centers throughout MIT.

### Current Research Programs

TDP's main research focus is in Abu Dhabi. Centrally located and having a tradition of addressing issues critical to the Middle East, Abu Dhabi is intent on diversifying its oil-dominated economy and boosting its non-oil economic profile. To this end, Abu Dhabi has initiated the Masdar Initiative, a multifaceted response to the need for a global focus on resource conservation and the alternative energy sector. It is designed to ensure in the long term that Abu Dhabi retains and even grows its share of the global energy market. It is a new economic program in Abu Dhabi aimed at fostering the development and commercialization of advanced and innovative technologies in renewable energy.

One of the Masdar Initiative's objectives is to establish a new institution dedicated to premier engineering research and education. The Masdar Institute of Science and Technology (Masdar Institute) will serve as the nucleus of the Masdar Initiative, feeding it with talent and innovative technologies to enhance economic development and promote new industries using renewable energy and resources in the emirate and the region. It is envisioned that over the next decade, the institute will subsequently lead to the establishment of an intellectually elite, private, not-for-profit, and independent institute of science and technology devoted to graduate-level education as well as research.

In December 2006, MIT signed a cooperative agreement with Abu Dhabi to assist in the establishment of a graduate institute and to collaborate on research projects of interest

to both parties. In order for the Masdar Institute to make important contributions to national human resource development in Abu Dhabi and the United Arab Emirates, it is undertaking a wide range of activities. These activities are comprehensive in terms of research, industrial and governmental linkages, and academics. Also, they encompass a diverse set of disciplines including science, technology, management, and public policy. To expedite this development, the Masdar Institute has taken a three-pronged approach: although major emphasis has to be on research and development in several research fields of interest to the region, the institute should also emphasize its efforts in forging strong partnerships with industry and government and in providing research and development and educational services such as short courses, conferences, and internships to its industry and government partners.

### **Academic Program**

Graduate classes leading to a master of science degree began in September 2009 at Abu Dhabi's Masdar Institute of Science and Technology. The five academic program offerings are mechanical engineering, materials science and engineering, engineering systems and management, computing and information science, and water/environment. A master of science program in microsystems engineering and electrical power engineering will be offered beginning in September 2010.

### **Research Projects**

The following projects have been approved and are ongoing:

- Professor Matteo Chiesa (Masdar Institute) with professor Gang Chen (MIT)—Hybrid Solar Thermoelectric and Photovoltaic Energy Conversion
- Professor Peter Armstrong (Masdar Institute) with professors Leon Glicksman and Leslie Norford (MIT)—Low-Energy Future for the Built Environment
- Professor Isam Janajreh (Masdar Institute) with professor Ahmed Ghoniem (MIT)—Renewable Energy and Fuels from Waste: Thermochemical Pathways
- Professor Marwan Khraisheh (Masdar Institute) with professor Mary Boyce (MIT)—Proton Exchange Membrane Fuel Cells: Innovative Design and Manufacturing Concepts
- Professor Toufic Mezher (Masdar Institute) with professor Nazli Choucri (MIT)—Modeling Technology Policy for Energy and Water: Applications and Extensions of System Dynamics
- Professor Hatem Zeineldin (Masdar Institute) with professor James Kirtley (MIT)—Power System Planning with Integrated Renewable Energy Sources
- Professor I-Tsung Tsai (Masdar Institute) with professor Michael Greenstone (MIT)—Modeling and Predicting the Impact of Climate Change on Health in the Middle East, South Asia, and Africa
- Professor Georgeta Vidican (Masdar Institute) with professors Richard Lester and Michael Piore (MIT)—The Development of Innovative Industries and the Role of Public Research Institutions: The Case of Renewable Energy

- Professor Wei Lee Woon (Masdar Institute) with professor Stuart Madnick (MIT)—Semantics-Enabled Technology Forecasting
- Professor Sgouris Sgouridis (Masdar Institute) with professor R. John Hansman (MIT)—Commercial Aviation in a Carbon-Constrained Future: Effective Technological, Operational, and Policy Responses from an Enterprise of Enterprises View
- Professor Scott Kennedy (Masdar Institute) with professor James Kirtley (MIT)—Examining Power Market and System Operation Interactions
- Professor Ali Diabiat (Masdar Institute) with professor David Simchi-Levi (MIT)—Sustainable Supply Chain Networks Design: Recycling and Waste Management Systems Optimization
- Professor Farruk Ahmad (Masdar Institute) with professor Gregory Stephanopoulos (MIT)—Biologically Catalyzed Electron Donor Processes for Water Treatment and Cellulosic Waste Treatment
- Professor Iyad Rahwan (Masdar Institute) with professor Alex (Sandy) Pentland (MIT)—Influencing Collective Human Behavior Using Distributed Intelligent Systems
- Professor Clara Dimas (Masdar Institute) with professor Lionel Kimerling (MIT)—Infrared Quantum DOT Light Source on a CMOS Compatible Platform for Gas and Chemical Sensing
- Professor Jerald Yoo (Masdar Institute) and professor Anantha Chandrakasan (MIT)—Energy Efficient Wearable Sensor with Body Area Network
- Professor Ammar Nayfeh (Masdar Institute) and professors Judy Hoyt and Dimitri Antoniadis (MIT)—Thin-Film Photovoltaics

To date, 17 MIT departments and all five schools have actively participated in the Abu Dhabi Cooperative Program.

In addition, in January 2009, MIT, under the auspices of TDP, signed a Founding Member's Agreement between the Masdar Institute of Science and Technology and the MIT Energy Initiative (MITEI).

### **Governance of Cooperative Program**

The Cooperative Program Steering Committee oversees the intellectual and strategic goals of the program, as well as any modifications or extensions to the agreement.

The Joint Executive Committee is responsible for reviewing and approving the activities to be developed under the cooperative agreement and, through its program directors, implementation thereof.

At MIT the implementation of the cooperative program has been directed by TPD director Dr. Fred Moavenzadeh and Dr. David H. Marks, professor of civil and environmental engineering. In Abu Dhabi, the implementation of the cooperative

program and cooperation with MIT over the past year was directed by Dr. John Perkins, provost of the Masdar Institute.

### **Future Research Initiatives**

TDP will continue to work cooperatively with the Masdar Institute. It is anticipated that another 10 to 12 joint research projects will be initiated in the coming period, including interaction with MITEI.

### **Organization**

The director of TDP is professor Fred Moavenzadeh of the Department of Civil and Environmental Engineering. Professor Nazli Choucri, of the Department of Political Science, is the associate director; Patricia Vargas is the executive director. Dr. Steven Griffiths is the executive director of the Abu Dhabi Cooperative Program. Susan Cass serves as TDP's communications officer.

**Fred Moavenzadeh**

**Director**

**James Mason Crafts Professor of Engineering**

*More information about the Technology and Development Program can be found at <http://web.mit.edu/mit-tdp/www/>.*