

MIT and Masdar Institute Cooperative Program

MIT works with the [Masdar Institute of Science and Technology](#) (Masdar Institute) in Abu Dhabi to facilitate the development of human capacity in science and technology in Abu Dhabi. Now in its second phase, the [MIT and Masdar Institute Cooperative Program](#) (MIT&MICP) is helping develop a high-caliber workforce and is focused on research and development that can keep pace with ever-increasing technological changes, particularly in alternative energy and sustainable advanced technologies.

Objectives

The second five-year agreement between MIT and the Masdar Institute has concentrated its efforts on:

- Developing a robust Masdar Institute research ecosystem for industry/government engagement by having joint researcher-to-researcher projects and, thus far, two proposal calls for Flagship Research Projects, which have resulted in six project awards of three years each.
- Leveraging the Masdar Institute's signature focus on advanced energy and sustainability by building educational links to industry and selecting new degrees and tracks within existing programs.
- Seeding an innovation and entrepreneurship environment by developing research mechanisms to engage industry and developing educational elements to amplify research impact.
- Deepening the Masdar Institute and MIT relationship by engaging in the co-advising of PhD students, student exchanges, and summer programs for Masdar Institute students at MIT.

Academic Programs

The educational mission of the Masdar Institute follows directly from the university's vision and mission. This educational mission is to provide students with the knowledge, skills, and experience necessary for successful careers in industrial or academic roles in their chosen fields, and with domain expertise and broad awareness in advanced energy and sustainable technologies and policies.

The academic programs are based on the US graduate educational model that integrates courses and seminars with multidisciplinary research. At the completion of the two-year master of science academic program, students will have acquired advanced knowledge of a specialized body of theoretical and applied topics and high-order skills in analysis, critical evaluation, or professional application, along with the ability to solve complex problems and think rigorously and independently.

The structure of the academic programs does not follow the traditional colleges and departments model and is designed to encourage students and faculty to study and research across program boundaries. This enables researchers to tackle complex problems in energy and sustainability that cannot be confined to single disciplines.

The nine master of science degree programs currently offered at the Masdar Institute were developed in consultation with MIT. They are Chemical Engineering, Computing and Information Sciences, Electrical Power Engineering, Engineering Systems and Management, Material Science and Engineering, Mechanical Engineering, Microsystems Engineering, Sustainable Critical Smart Infrastructures, and Water and Environmental Engineering. Masdar Institute also offers an interdisciplinary doctoral degree program.

With MIT's assistance, the Masdar Institute has introduced a new practice engineering master's program that enables strong interface with industry and provides flexible and general models across programs, with a part-time option. In addition, MIT has worked with the Masdar Institute to develop two new tracks within the existing Engineering and Systems Management program: Entrepreneurship and Innovation, and Management of Technology.

MIT faculty are currently serving on 18 Masdar Institute student doctoral committees.

MIT has provided scholarly assessment for the hiring of 78 faculty, including 38 at the assistant professor level, 22 at the associate professor level, 12 at the full professor level, and six professors of the practice.

Students

Masdar Institute enrollment was 231 students in September 2012 and is expected to reach 375 for September 2013, with students coming from over 22 countries.

Current Research Activities

The program is committed to building a deeper research environment, and focuses on two distinct processes that will lead to the development of focused research centers at Masdar Institute.

Masdar Institute and MIT One-to-One Joint Collaborative Research

One-to-One research builds upon and strengthens the strong relationship between the Masdar Institute and MIT and involves one MIT principal investigator (PI) and one Masdar Institute PI. Fifty one-to-one projects have been undertaken jointly by the Masdar Institute and MIT. Currently there are 18 active projects, with six awarded in AY2013:

- Integrated Regional Management of Water Resources in Arid Regions (PIs: professors Dennis McLaughlin and Elfatih Eltahir)
- Transforming Material Architecture (PIs: professors Mary Boyce and Pedro Reis)
- Novel Control Strategies for Smart Grid Interface with High Penetration of Wind Power Generation (PI: professor James Kirtley)
- Thin Cost-effective Silicon Wafers for Heterojunction-based Photovoltaic Devices: High Throughput Surface Passivation (PIs: professors Tonio Buonassisi and Harry Tuller)

- Strategically Adaptive Sustainable Mobility Systems (PI: professor Christopher Zegras)
- Achieving the Abu Dhabi Economic Vision 2030: The Economic Impact of Advanced Technology and Automation (PI: professor Erik Brynjolfsson)

Masdar Institute and MIT Flagship Research Projects

The Flagship Research Projects are a mechanism for broader collaborative research between the Masdar Institute and MIT. They are designed to bring together teams of faculty from both the Masdar Institute and MIT to address key strategic research areas, with the intent of building critical mass, making a sizeable research impact, and potentially evolving into full-fledged research centers. Six flagship projects were awarded in AY2013:

- Development of Advanced Membrane Water Purification Systems Fabrication, Fouling Resistance, and System Configuration (PIs: professors John Lienhard, Karen Gleason, and Gregory Rutledge)
- Ultimate Solar: High Efficiency Multi-junction SI-based Cells and Optical Concentrators (PIs: professors Eugene Fitzgerald, Marc Baldo, and Judy Hoyt)
- Climate, Water, Health, and the Environment in Arid Regions (PIs: professor Dara Entekhabi and professors McLaughlin and Eltahir)
- Information and Decision Architectures for Robustness, Resilience, and Risk Mitigation in Power Grids (PIs: professors Munther Dahleh, Asu Ozdaglar, and Konstantin Turitsyn, and principal research scientist Madavij Roozbehani)
- BIOREFINERY – Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizer (PIs: professors George Stephanopoulos, Kristala Prather, Bradley Olsen, and Yuriy Roman)
- High Performance Compact Solar Thermal Power and Cooling System (PI: professors Evelyn Wang, Gang Chen, and Nicholas Xuanlai Fang)

Accomplishments

The MIT and Masdar Institute engagement began in 2006, with MIT's Technology and Development Program, and as of December 1, 2011, a new five-year agreement was signed with the Masdar Institute. Since that date,

- More than 102 MIT faculty and 50 research scientists or postdoctoral researchers from 22 departments, laboratories, and centers at MIT have participated. No posting to Abu Dhabi is required.
- More than 196 MIT graduate students from 19 departments, laboratories, and centers have had funded interactions with Masdar Institute faculty, students, and staff.
- MIT students have travelled abroad under the program to participate in over 40 conferences and workshops.

- The program has helped build MIT experience and capacity for collaborative institution building and research.
- There have been more than 150 MIT faculty and staff visits to Abu Dhabi and more than 150 Masdar Institute faculty and staff visits to MIT.
- More than seven invention disclosures have been filed.
- Masdar Institute and MIT participants have authored 109 papers that have been published in a broad array of international refereed journals and as chapters in books and conference papers. In addition, Masdar Institute faculty have independently authored 354 papers.

Impact of Social or Cultural Policies and Events

Social and cultural policies can dramatically influence the success or failure of any endeavor; buy-in and communication are essential and must be ongoing throughout the life of the project.

The success of a new venture such as the creation and sustainability of the Masdar Institute is highly dependent on the government's acceptance of the idea of a private, not-for-profit, research-based university operating in Abu Dhabi. The Masdar Institute is an agent of change for the diversification of the Abu Dhabi economy, and long-term commitment is crucial in terms of human capital development, institutional independence and flexibility, and financial support. This commitment applies to all aspects of building a research-based university. Recent effort has focused on a new and important development initiative to foster an awareness and appreciation for the building of an ecosystem that will support entrepreneurship and innovation that can help bring about the economic transformation desired in Abu Dhabi and the United Arab Emirates (UAE).

On April 30, 2013, MIT&MICP jointly sponsored a workshop on innovation and entrepreneurship at the Masdar Institute. The purpose of the workshop was to provide a framework to work towards the design and implementation of a unique brand of innovation and entrepreneurship in the UAE, addressing the challenges to the innovation systems that were discussed at the Forum on Entrepreneurship and Innovation, held on April 20, and jointly sponsored by the Masdar Institute and MIT.

These challenges include the cultivation of innovative and entrepreneurial human capital, the promotion of research and development that addresses societal needs, and the creation of a national model that establishes coherent linkages within the innovation ecosystems. To realize these goals, it was agreed that strong ties must be forged among all stakeholders in the innovation ecosystem that permits coordination of policy, convenes stakeholders with a shared agenda, and supports the national agenda of economic growth and prosperity.

The Masdar Institute seeks to build a complete and fully integrated innovation ecosystem that integrates innovative and entrepreneurial behavior in its education and research programs.

Governance

The Cooperative Program Steering Committee oversees the intellectual and strategic goals of the cooperative program. The committee also reviews recommendations of the Research Advisory Committee. Committee members from MIT are professor Duane Boning, director of MIT&MICP; professor Charles Cooney, faculty director of the Deshpande Center for Technological Innovation; professor Martin Schmidt, an associate provost; and Patricia Vargas, executive director of MIT&MICP. Masdar Institute members are Dr. Sultan Ahmed Al Jaber, UAE Minister of State and chief executive officer of the Abu Dhabi Future Energy Company; professor Fred Moavenzadeh, president of the Masdar Institute; professor Nidal Hilal, acting provost of the Masdar Institute; and Hamza Kazim, vice president of operations and facilities at the Masdar Institute.

The Research Advisory Committee reviews all research proposals, monitors progress on research projects, and makes recommendations to the Cooperative Program Steering Committee. Members from MIT are professor Robert Armstrong, deputy director of the MIT Energy Initiative; professor Vladimir Bulovic, director of the Microsystems Technology Laboratories; Professor Lienhard, Department of Mechanical Engineering; professor David Simchi-Levi, codirector of Leaders for Global Operations; and Professor Boning, director of MIT&MICP, *ex officio*. Masdar Institute members include professor Samir El Hedhli, Engineering Systems and Management program; professor Steve Griffiths, executive director of Institute Initiatives; Professor Hilal, acting provost; professor Youssef Shatilla, dean for graduate education; and professor Scott Kennedy, dean of research, *ex officio*.

Organization

The director of MIT&MICP is Professor Boning, Department of Electrical Engineering and Computer Science. Ms. Vargas is the executive director; Dr. Charles Hsu is the assistant director for education and research; Paul Arsenault is the administrative and financial officer; Susan Cass is the director of communications; and Danielle Atwell is the manager of outreach.

Duane Boning
Director