

MIT and Masdar Institute Cooperative Program (Abu Dhabi)

Goals

MIT has worked with Masdar Institute (MI) to facilitate the development of human capacity in science and technology in Abu Dhabi. The MIT and Masdar Institute engagement began in 2006 with MIT's Technology and Development Program. As of December 1, 2011, a second five-year agreement was signed between the [MIT and Masdar Institute Cooperative Program](#) and Masdar Institute. A no-cost extension was granted that extended the program to May 31, 2018. The MIT/MI Cooperative Program has completed as of that date, and this is the final Report to the President.

During the second phase of the program that ended on May 31, 2018, MIT assisted Masdar Institute in its goal to develop a high-caliber workforce focused on research and development that could address grand challenges and underpin economic development in alternative energy and sustainable advanced technologies.

Objectives

For the period July 1, 2017 to May 31, 2018, MIT assisted Masdar Institute toward the following objectives:

- Developing a robust Masdar Institute research ecosystem for industry/government engagement by having joint researcher-to-researcher projects
- Leveraging Masdar Institute's signature focus on advanced energy and sustainability in terms of building educational links to industry and selection of new degrees and tracks within existing programs
- Seeding an innovation and entrepreneurship environment in terms of developing research mechanisms to engage industry and developing educational elements to amplify research impact
- Deepening of the Masdar Institute and MIT relationship by engaging in co-advising of PhD students, student exchanges, and summer programs for Masdar Institute students here at MIT

Academic Programs

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

The structure of the academic programs was 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 could not be confined to single disciplines. The nine master of science degree programs offered at Masdar Institute

were developed with assistance from MIT. MIT also assisted with the development of four concentrations: technology, management, innovation, and entrepreneurship; space systems and technology; water technologies; and water resources.

In May 2018, Masdar Institute graduated 71 master of science and PhD students, bringing the total to 675 since its start.

In the second phase of the program, MIT advised on curricula and structure of Masdar Institute's accredited doctoral degree in interdisciplinary engineering; and MIT also reviewed 132 course electives, and 108 MSc theses. During this time, MIT faculty served on 49 Masdar Institute PhD student doctoral committees.

A third entrepreneurship bootcamp was conducted at Masdar Institute during this reporting period by Charles Cooney and Luis Perez-Breva. The purpose of the bootcamps were to initiate a mind-set change and remove the mystery of technology-based entrepreneurship. The goal was to provide insight and tools to help translate ideas into a product and define the roadmap. Participants in the bootcamps left with an understanding of how to create the roadmap to translate their ideas into a start-up, as well as understanding their role and the importance of the team. Participants left prepared to meet with potential investors who might support their ideas either as a technology-based start-up, a new company, or as a license into an existing corporation.

Research Activities

The program sought to build a thriving collaborative research environment at Masdar Institute, and focused on three distinct processes that have contributed to and supported the development of focused research centers at Masdar Institute.

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

One-to-one research focused on the development of capacity in Masdar Institute faculty, and built a strong relationship between Masdar Institute and MIT through collaborative research between one MIT principal investigator (PI) and one Masdar Institute PI. Two new projects were awarded in AY2018:

- Multi-Vehicle Coordination with Bounded Risk, MIT professor Brian Williams and Masdar Institute professor Majid Khonji
- Modeling Physical-Biogeochemical Interactions in the Marine System of the Arabian Gulf, MIT professor John Marshall and Masdar Institute postdoc Maryam Al Shehhi, working with Masdar Institute professor Hosni Ghedira

Masdar Institute and MIT Flagship Research Projects

The Flagship Research Projects were a mechanism for broader collaborative research between Masdar Institute and MIT. They were designed to bring together teams of faculty from both Masdar Institute and MIT to address key strategic research areas, with the intent of building critical mass, making a sizeable research impact, and fostering

strategic growth of Masdar Institute research centers. Two additional Flagship Research Projects were launched between July 1, 2017 and May 31, 2018, as cited below:

- High Efficiency, Lightweight, Radiation-Resistant Space Solar Cells Enabled by 2-D Material-Based Layer Transfer (2-DLT), MIT professors Jeehwan Kim, Eugene Fitzgerald, and Jeffrey Grossman and Masdar Institute professors Ibraheem Al Mansouri, Matteo Chiesa, and Kin Liao
- MUSES: Multi-Use Space Energy Systems, MIT professors Steven Leeb, David Perreault, and James Kirtley and Masdar Institute professors Hatem Zeineldin, Mohamed El Moursi, Vinod Khadkikar, and Mohamed Al Hosani

Masdar Institute and MIT Innovation Program

The Masdar Institute and MIT Innovation Program (MMIP) helped MIT and Masdar Institute faculty and students—who proposed to work jointly—to prepare to commercialize breakthrough technologies and inventions by transforming promising ideas at MIT and Masdar Institute into innovative products and cutting-edge spin-off companies. The MMIP made modest but pivotal investments in research that was being done by some of MIT's and Masdar Institute's most talented scientists and engineers. The ultimate goal upon completion of MMIP funding was to attract sufficient investment to commercialize a product and launch a spin-off company, or to license the technology to an existing company, or both. Work continued on the following innovation research project during the July 1, 2017 to May 31, 2018 period:

- Step Cell for Multi-Junction Silicon Based Solar Cells, MIT professor Eugene Fitzgerald and Masdar Institute professor Ammar Nayfeh.

Overall Research Accomplishments

- Sixty-two one-to-one projects were undertaken jointly by Masdar Institute and MIT.
- Eleven flagship projects in total were awarded to date.
- Seven MMIP Ignition Grants were awarded to date.
- Masdar Institute and MIT participants have authored an additional 70 publications for a total of 412 to date.
- For this period one additional Masdar Institute faculty members spent four and a half to 12 months at MIT, bringing the total number of Masdar Institute faculty postings at MIT to 68.
- At MIT 270 faculty, research scientists, and postdocs, and 346 MIT students have participated since the beginning of the Collaborative Program, in one or more of the academic, research, or innovation activities detailed below.
- Over 300 exchange visits between Masdar Institute and MIT have taken place, including over 230 in the second phase of the program.

- The Cooperative Program successfully brought domestic and international visibility to Masdar Institute accomplishments through a variety of communication mechanisms both at the program and MIT Institute levels.
- MIT interviewed candidates for faculty and senior-level Masdar Institute administrative positions. The number of Masdar Institute faculty at the culmination as an independent university was 78. The Masdar Institute faculty became faculty members of Khalifa University, as a result of the merger between Khalifa University, Masdar Institute, and the Petroleum Institute in February 2017.
- Masdar Institute remained in 14th position in the second edition of *US News and World Report's* Best Arab Region Universities Rankings until Masdar Institute was merged with Khalifa University.

Governance

The Cooperative Program Steering Committee oversaw the intellectual and strategic goals of the Cooperative Program. The committee also reviewed recommendations of a joint Research Advisory Committee. The Steering Committee members at MIT during this last period were:

- Duane Boning, director, MIT and Masdar Institute Cooperative Program
- Charles Cooney, professor of chemical engineering
- Richard Lester, MIT associate provost for International Initiatives
- Patricia Vargas, executive director, MIT and Masdar Institute Cooperative Program

The Research Advisory Committee reviewed all research proposals, monitored progress on research projects, and made recommendations to the Cooperative Program Steering Committee. The Research Advisory Committee members at MIT during this period were:

- Robert Armstrong, professor of chemical engineering, and director, MIT Energy Initiative
- Munther Dahleh, professor, Electrical Engineering and Computer Science, and director, Institute for Data, Systems, and Society
- John Lienhard, professor, Mechanical Engineering, and director, Abdul Latif Jameel World Water and Food Security Lab
- Eugene Fitzgerald, professor, Materials Science and Engineering
- Duane Boning, professor, Electrical Engineering and Computer Science, and director, MIT and Masdar Institute Cooperative Program

Organization at MIT

- Fred Moavenzadeh, director of the MIT Technology and Development Program, served as the director of the MIT and Masdar Institute Cooperative Program from December 1, 2006 to June 30, 2010.
- Duane Boning, professor, Electrical Engineering and Computer Science at MIT, served as the director of the MIT and Masdar Institute Cooperative Program for the period February 2011 to May 31, 2018.
- Patricia Vargas served as the executive director from December 1, 2006 to May 31, 2018.
- Peter R. Jones served as the assistant director for Research and Communication from September 1, 2014 to May 31, 2018.
- Paul Arsenault served as the administrative and financial officer from April 1, 2011 to May 31, 2018.
- Scott Kennedy served as the assistant director for Education and Outreach from January 5, 2015 to May 31, 2018.
- Danielle Atwell served as the program's administrative assistant from December 1, 2006 to November 30, 2011 and as the manager of Outreach from December 1, 2011 to May 31, 2018.
- Leslie Quinn was the program's administrative assistant from November 17, 2014 to May 31, 2018.

Duane S. Boning
Director