



The MIT Low-Carbon Co-Design Institute

We propose to establish a new multidisciplinary institute at MIT called the Low-Carbon Co-Design Institute (LC-CDI). It will provide comprehensive decision support and capacity building for the design and operation of resilient, low-carbon energy systems in emerging market and developing economy (EMDE) countries. Our design specifically incorporates emerging supply- and demand-side technologies that enable climate-positive economic development, accounting for technological risks such as those created by intensified electricity use, as well as the risks posed by climate change itself.

Engaging more than 20 MIT faculty and researchers and leveraging MIT's extensive expertise in multiple related fields, the LC-CDI will collaborate directly with EMDE governments and other stakeholders from industry, academia, civil society, and the international development finance community to adopt and implement ambitious low-carbon development strategies, while also engaging in knowledge creation, capacity building, and outreach efforts to reach a broader audience.

Our intent is to collaborate with more than 20 EMDE countries representing at least 20% of global emissions as of 2018, including both high-emitting, fast-growing economies (e.g., India, Indonesia) but also energy-access-limited countries (e.g., Burkina Faso). Representatives of agencies from seven countries have provided letters expressing their enthusiasm for the program. By taking a multi-disciplinary, multi-stakeholder "co-design" approach grounded in rigorous analysis of available technological options and strategies, and informed by social science research and empirical evidence from around the world, we will enable ambitious but socially and financially feasible low-carbon planning and policy design. The new institute will provide quantitative tools and information, training, and other forms of decision support to ensure that a wide range of technologies and strategies are considered,

including expanded generation and use of low-carbon electricity, as well as carbon-capture technologies, low-carbon fuels, and novel processes in hard-to-decarbonize end-use sectors such as industry, marine transport, and aviation.

SCOPE

Our implementation timeline will be synchronized with the five-year UNFCCC recommitment cycle, beginning with COP 26. Accordingly, one of our tangible objectives will be for partner countries to bring to COP 31 a set of achievable and credible national plans that are backed by informed policy and consistent with the global goal of achieving carbon neutrality by mid-century.

Several multilateral, bilateral, and national organizations, including UN agencies, development banks, and NGOs, are already actively supporting EMDE decarbonization planning efforts. The distinctive role of the LC-CDI will be to fill the unmet need for an authoritative, independent, knowledge-based institution that can serve as a focal point for engagement with EMDE countries as they address the dual challenges of meeting growing energy demands while minimizing greenhouse gas emissions.

In years one and two, our national engagement program will focus on representative “first action countries” where we have established relationships and can work with leaders to quickly refine our co-design methodology. With them we will create a standard workflow comprising an initial energy system analysis, identification of potential decarbonization pathways, and development of technologically, socially, and economically feasible plans for energy system transformation. In years three through five, we will scale up to engage all of our intended national partners.

STRATEGY

Our national engagement activities will be supported by three pillars.

1. Knowledge Creation

We will develop an open-access, interoperable modeling toolbox for low-carbon energy transition planning that leverages numerous existing models (including models for projecting energy demand, supply and demand balancing, and assessing sustainability) and incorporates new tools to be developed by the LC-CDI. Our modeling team will also build nation-specific information resources and a “living technology database” of key energy supply and demand technologies at all levels of technical readiness.

In parallel, we will launch a faculty-led “Successful Transitions Research Program” to develop cutting-edge data and methodological tools for energy and climate planning and for addressing related considerations, such as social equity, as part of the energy transition. Findings from this program will be publicly shared, including through frequent publications, workshops, and conferences. Key topics will include demand forecasting under uncertainty; mitigating climate-related risks to energy infrastructure; equitable power-sector regulation with intensive renewable generation; regional cooperation on energy infrastructure; climate finance for lower income countries; and retirement of stranded fossil resources.

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2. Capacity Building

We will make extensive use of MIT's digital learning platform, MITx, to rapidly scale our multi-country engagement plan and build expertise in energy system planning and policy design among our partners. Our capacity-building program will have six distinct elements:

1. a Global Low-Carbon Expert Network that meets regularly
2. a Modeling Certificate Program that educates holders in the use of LC-CDI's open-access databases and models
3. a MicroMasters Degree for Energy Professionals that will augment the existing, MITx-based Low-Carbon Energy MicroMasters program
4. a Clean Energy Corps to inspire and engage talented graduate students in national planning activities
5. an online Low-Carbon Academy to strengthen organizational and interorganizational capabilities
6. a Visiting Fellows program that brings highly qualified leaders to work with the LC-CDI team at MIT for short periods

3. Outreach

From the outset, we will work to build awareness of the LC-CDI in the international stakeholder community including among development finance Institutions, UN agencies, bilateral development agencies, civil society organizations, and research institutions. To help foster a global movement and disseminate research findings, we will hold an annual conference linked to an annual two-week summer "best practices" modeling workshop at MIT.

TEAM

The leadership includes **Robert Stoner**, deputy director of the MIT Energy Initiative and director of the Tata Center for Technology and Design, who will serve as director of the Institute, along with **Dharik Mallapragada** and **Audun Botterud** who will together lead the Knowledge Creation Program. They are joined by a team of 24 MIT faculty collaborators representing Energy Education and Digital Learning, Climate Science and Risk, Energy and Environmental Economics, System Modelling and Control, Urban Energy Infrastructure, Energy Finance Policy and Regulation, and Energy Technology.

PLAN

Our program budget will have resources in years one and two skewed toward engaging first-action countries, developing our capacity building program, and launching our advanced modeling and Successful Transitions research programs. In succeeding years, funding will shift to scale-up activities and expanded outreach.