

# Strategies for Energy, Water, and Agriculture Development in Ethiopia

A Bass Connections project led by the Energy Access Project at Duke  
ENERGY 395.10 and 795.10

When: Thursdays, 11:45-1pm; Fridays TBD

Where: Virtual and perhaps in-person optional for some sessions. Room TBD.

## Overview and Course Goals

The Government of Ethiopia has laid out an ambitious vision for expanding electricity access over the next 5 years—enshrined in the National Electrification Plan 2.0—and has made increased agricultural productivity and renewable energy sources a central pillar of that approach. With 85% of Ethiopian livelihoods tied to agriculture, improving productivity in the sector has the potential to not only increase rural incomes, but also provide the anchor loads to support reliable, financially sustainable power system expansion to remote areas, including through off-grid approaches. To achieve this goal, however, a deeper understanding is needed of the critical inputs to improved agriculture productivity in the Ethiopian context: appropriate crop mix, water needs and availability, productive use equipment demands and supply chains, energy service options, the role of value added processing, and the type of supportive policy that would be most efficacious. Aiming to support this, Duke University's Energy Access Project (EAP) is launching an effort focused on providing analysis that informs energy, agriculture, and water policymaking and which ultimately de-risks related investments in these sectors. This Bass Connections course and the participating students are part and parcel to that effort.

Over the last year, project leaders have been hard at work developing relationships with key Ethiopian stakeholders involved in policymaking, government and donor financing, philanthropic grant making, and private sector investment across the rural energy and agriculture landscape. We are in close communication with the Ethiopian Ministry of Water, Irrigation, and Energy (MoWIE); the Agricultural Transformation Agency (ATA); Veritas Consulting (implementors of a key technical assistance package funded by the Rockefeller Foundation); Haramaya University; and other key local stakeholder organizations.

We aim to utilize these relationships to give the project vision, structure and organize the many moving pieces in this rapidly evolving space, leverage partners' boots-on-the-ground, and, most importantly, provide evidence and guidance to support this ambitious, first-of-its-kind electrification and development initiative. These stakeholders have invested time and energy in bringing us into this partnership and we have a responsibility to follow-through with nimble, high-quality work that leverages the skills and capacity of an extensive group of project participants. In addition to the Duke team, RTI International and the Rocky Mountain Institute will be involved in this project. Both of those organizations have local teams in Ethiopia. This is not a purely academic exercise and we expect a high level of professionalism.

Project participants will engage with these partners and also play a central role in determining and executing the ultimate deliverables for the course. Opportunities for filling knowledge gaps on the "productive use" landscape are vast, including:

- reviewing and consolidating lessons learned in other contexts, which, though perhaps dissimilar, nonetheless offer valuable insights on constraints and opportunities, and synergies and conflicts, within the food-energy-water nexus in developing and agriculturally-dependent economies;
- developing tools to identify hotspots for investment in technologies such as microgrids and solar-powered groundwater pumps to expand irrigation opportunities;
- modeling new business approaches for enhancing agricultural value chains in the presence of off-grid power sources;
- supporting the development of a unified roadmap for integrated energy access with a focus on electrification in rural areas where agricultural production is the dominant source of income;
- helping policymakers understand the gains that come with energy access and productive use in the agriculture sector by extending a methodology for quantifying specific benefits and applying the approach with local data;
- evaluating the impacts of pilot efforts to provide off-grid energy in the agricultural commercial clusters, including, for example, a solar pumping pilot with 160 farmers that is currently underway in 4 areas;
- analyzing the future energy requirements of a more productive and demand-responsive agriculture sector—optimized in terms of crop mix, sustainable irrigation, and increased capacity for processing and storage— and examining the relevant energy business models, capital requirements, and linkages to tariff-setting and policy.

The first nine weeks of the course is intended to “tool-up” the team on the context and skills relevant to doing work in these sectors in Ethiopia. The balance of the fall semester will be spent developing a proposal for producing action-oriented research products, which will be executed in the Spring.

This course is intended to enhance students’ understanding of the complex challenges facing people across the developing world and to design innovative solutions to address those challenges, grounded in local needs and resources. Through readings, classroom discussion, guest lectures, simulations, skill-building, and individual and team assignments, we aim to nurture an experiential learning environment built around the idea that our project team, in partnership with local stakeholders, can support the development of complementary agriculture, water and energy solutions in Ethiopia.

**Note:** An experiential course of this nature faces certain challenges given the current global COVID-19 pandemic. Ideally, and originally, we imagined that some or all of the team would have travelled to Ethiopia to meet and engage with stakeholders, and to gain first hand experience with a very unique development context. We hope that travel will be possible in spring 2021, but want to emphasize that we will all need to work within the constraints of existing circumstances, and that safety and individual responsibility for the good of others will help guide our thinking on whether such a trip is appropriate.

Furthermore, students in this course are expected to abide by the commitments they made in signing the Duke Compact to protect the health and safety of their fellow students, faculty, staff, families and neighbors. First time, minor violations of COVID-19 conduct expectations will be met with appropriate

educational responses. However, anyone who fails to comply with the expectations of the Duke Compact more than once, or who flagrantly commits a serious violation that creates a health or safety risk to others in the Duke community, will be subject to more significant consequences, beginning with loss of the privilege to attend courses in-person and/or loss of access to campus, and moving up to suspension or expulsion.

If you need special accommodations due to physical or learning disabilities, medical needs, religious practices, or other reasons, please inform us as soon as possible so we can work to accommodate those needs.

### **Structure of the course**

**Chapter one.** Essential background about Africa, Ethiopia, socioeconomic trends, development, challenges, and opportunities

- Examination of the broader development factors/challenges facing Ethiopia, including hunger, malnutrition, poverty, water availability, resource constraints, low agricultural productivity, low energy access, rapidly growing population
- Key social, political, economic, geopolitical, and development context and challenges in Ethiopia, including GERD and hydro potential, economic liberalization, tribalism/regionalism, state control, Abiy administration approach/dynamics.
- Avoiding major development potholes, including sector-specific strategies, the Santa Claus approach, the white savior, neo-colonialism

**Lead instructor(s) and facilitator(s): Jonathan, Marc, Kalkidan**

**Readings:**

- 1. Prisoners of Geography, Tim Marshall. Chapter 5, Africa. Pages 115-142.**
- 2.**

**Chapter two:** Why Energy? Why Ethiopia? What are the goal posts?

- SDG7 and the role of energy in development
- Productive use of energy
- Electrification 101: How is the world, SSA, and Ethiopia doing on electrification?
- Frameworks, technologies, and business models for delivering access: grid, stand-alone distributed systems, mini-grids, tiers of access, smart and pre-paid metering, mobile money
- Electricity planning negotiation simulation: Power Play

**Lead instructor(s) and facilitator(s): Jonathan, Rob**

**Readings:**

- 1. SETI Systematic Review summary (?)**
- 2. Power Play**

- a. **Negotiation Systems and Strategies**
- b. **General Instructions**
- c. **Role**

**Chapter three:** The energy opportunity and plan in Ethiopia

- NEP 2.0: Ethiopia's electrification vision
- Integrated energy planning

**Lead instructor(s) and facilitator(s): Jonathan**

**Readings:**

1. **NEP 2.0. Pages X**
2. Off-Grid Solar Market Assessment Ethiopia, Power Africa Off-grid Project, **Table 5**

Guest Speakers:

**Chapter four.** Intro to methods and data.

- GIS
- Role of surveys and statistical methods
- Impact evaluation
- Cost/Benefit
- Data analytics and "big data"
- Bass Zambia examination

**Lead instructor(s) and facilitator(s): Marc, Rob, Kalkidan**

**Readings:**

1. New Data and Technologies are Transforming Energy Access – Public Policy Must Catch Up
2. Pattanayak (2009). "Rough Guide to Impact Evaluation of Environmental and Development Programs"
3. Freeman et al. (2014). "Resource Evaluation and Public Policy". Ch.1 in: The measurement of environmental and resource values: theory and methods.
4. Fetter and Baker (2020). "Harnessing Data Analytics to Accelerate Energy Access: Reflections from a Duke-RTI Convening on Data for Development"

**Chapter five.** Institutions: the role and structure of key government, multilateral, and bi-lateral institutions

- Government structure, legal jurisdiction, renewable energy and development policies
- Development finance 101: how do LMICs countries pay for stuff?
- Ethiopian utility operations and regulation

- Major donor programming
- Electricity subsidies 101

**Lead instructor(s) and facilitator(s): Jonathan, Frances Elisha**

**Readings:** [Lessons for Modernizing Energy Access Finance, Part 1: What the Electrification Experiences of Seven Countries Tell Us about the Future of Connection Costs, Subsidies, and Integrated Planning.](#)  
(Summary blog here)

Guest Speakers:

### **Chapter six.** Off-grid energy sector in Ethiopia

- Sector overview and challenges, including enabling environment, foreign exchange, affordability and tariffs
- Key players, institutions, and legal/regulatory jurisdiction
- Market segmentation
- Key donor programs
- Knowledge gaps, opportunities, outlook

**Lead instructor(s) and facilitator(s): Jonathan**

**Readings:** Off-Grid Solar Market Assessment Ethiopia, Power Africa Off-grid Project

**Guest Speakers:** Melat Gebeyehu, RTI

### **Chapter seven.** Agriculture and water development: policies, markets and tools

**Lead instructor(s) and facilitator(s): Justin Baker, Marc**

Guest Speakers: Dawit Mekonnen, IFRPI?

Candice, RTI (Using the RTI model)

### **Chapter eight.** Deep dive on productive use and supply chains

**Lead instructor(s) and facilitator(s): Frances Elisha, RMI**

**Readings:** RMI productive use work

Veritas publication

Guest Speakers:

### **Chapter nine. Mobilizing off-grid energy financing: World Bank deep dive**

- Process and overview: how the WB works with governments to support energy infrastructure and access
- Advantages/disadvantages of working with WB and multilaterals
- Types of support and financing for electricity: IDA funds, min subsidy tenders, results-based financing, technical assistance
- How do we think about structuring new large-scale financing for currently non-existent mini-grid sector?
- Role of the private and public sectors

Guest Speakers: World Bank

### **Assignments and Grading**

We will ask you to prepare one major assignment in the fall semester, and several closely related assignments in the spring semester. In the fall, we will ask you to complete a proposal for a team project (approximately 1200 words, or 4-5 double-spaced pages), working in teams of two to three people. This should include background and context based on the readings, lectures, and discussions conducted to date, as well as the description of a problem of interest or area that you would like to investigate further. We will provide additional details for this assignment during the fall semester. The expected due date is Thursday, November 12.

In the spring, we expect you to (i) write a capstone paper, (ii) deliver an oral presentation (with slides), and (iii) write a brief summary, suitable for publication in blog format. All three of these deliverables would be team efforts, working in teams of two to three people (probably, but not necessarily, the same team as you worked with in the fall). The capstone paper would provide a detailed summary of your work over the spring; the specific topic / project will unfold over the late fall and early spring, and would be the same as (or closely related to) the paper you write in the fall. The capstone paper would summarize background and context, as well as a review of relevant literature (policy / grey literature as well as relevant academic literature), description of data that you collected or assembled, documentation of analytical methods, and a detailed analysis of the problem and solution that you developed over the course of the year.

The presentation and brief summary / blog publication would develop the same ideas, but in somewhat different formats. We will provide additional details for all three (related) assignments during the course of the year. Note that we may ask for intermediate deliverables over the course of the spring semester to help you refine your ideas and ensure you are receiving feedback in an organized manner as you develop your solution / analysis.

Finally, we will ask the entire class to work together to produce a final poster. This is a requirement for all Bass Connections teams: to produce a team poster to display at the Bass Connections Showcase Symposium in April 2021. We'll talk more about this over the year.

**Class participation.** (Something about grading based on class participation – Marc or Jonathan, is there boilerplate text from a previous class you like and would use here?)

**Late/missing assignments.** Late assignments will not be accepted after the deadline, and a grade of 0 will be assigned. If you feel that you are not able to make a deadline, please raise this question well before that deadline and ask if an extension is possible.

**Grading criteria.** Your participation on this Bass Connections project team will receive course credit. You will receive a letter grade (A-F), and the final grade will be calculated as follows.

<b>Graded component</b>	<b>Percent of Grade</b>
Fall Team paper – project proposal	20%
Class participation (fall)	10%
Capstone paper (spring)	30%
Team presentation (spring)	10%
Blog / summary of capstone paper (spring)	10%
Class participation (spring)	10%
Contribution to class poster (spring)	10%