RENEWABLE ENERGY AND SUSTAINABLE DEVELOPMENT

COURSE SYLLABUS | THE GREEN PROGRAM – ISE 01
DISTANCE LEARNING EDITION

PREPARED FOR: THE GREEN PROGRAM
PREPARED BY: ICELAND SCHOOL OF ENERGY

COURSE SYLLABUS

THE GREEN PROGRAM – ISE 01

COURSE DESCRIPTION

The GREEN Program is a 50-hour intensive, 3 ECTS (1.5 credit-hour) experiential education program held in partnership between The GREEN Program (TGP) and Iceland School of Energy (ISE) at Reykjavík University. In this Distance Learning Edition of our Course Syllabus, Reykjavik University faculty and industry experts will provide online learning material for registered students via our Canvas portal. A modularized Lecture Series is presented on the topics of sustainable entrepreneurship and policy, geology, geothermal energy, hydroelectric power, and electric power systems. Each module will contain a lecture, two readings, and a short quiz based on both the lecture and the readings.

In conjunction with the Lecture Series, students are required to write a short, 3-page report detailing their proposal for an innovative, sustainability-focused solution to a modern energy problem. This idea may be used for TGP's Capstone Project that will be conducted during the on-site portion of the program. Students must consider the financial, engineering and social impact aspects of their innovative idea and detail these aspects in their report.

TEACHING METHODS

Students will explore the numerous fields associated with renewable energy and sustainable development by completing the following Lecture Series and Project Proposal. The knowledge gained in the Lecture Series is intended to provide context and insight when developing the Project Proposal.

LECTURE SERIES

Registered students are provided online content on Reykjavik University's Canvas portal in the form a six-part Lecture Series. This series is sequential and modularized. Each module contains:

- Specialized learning outcomes.
- A one-and-a-half-hour video lecture.
- Associated lecture slides.
- Curated reading material.
- A short quiz.

Each lecture serves as a platform for accelerated learning. After watching the lecture and studying the lecture slides, students are expected to be able to read and understand the main points discussed in related scientific literature. Accompanying each lecture are a short list of curated articles detailing present-day developments on the respective subject matter. Students are then quizzed on their comprehension of this material.

PROJECT PROPOSAL

Students will need to create a short, three-page summary detailing a solution to a modern energy sustainability problem. A full feasibility study is not required here. Instead, each report will approach a specific energy niche, detail a proposed sustainable solution with reference to modern scientific literature, and will be hypothetical in nature. Students should consider the social, environmental, technical and economic challenges their proposal might present.

Each report should answer the following questions:

- What is the problem and who is affected by it?
- What is the proposed solution?
- What are the anticipated results of this solution?
- What are some potential issues with this proposal?

All sources used must be reputable and may include peer-reviewed journal articles, conference papers, articles or papers from government agencies sources such as the IEA, the EIA or reputable NGO sources such as the BP Statistical Review, IRENA, etc. Sources should be referenced using APA referencing style. Consult the APA style guide if you have any questions regarding formatting.

We invite students to reach out during the process of putting together the proposals. The open office hours are mentioned in the Schedule and Office Hours section below.

This proposal will be the basis for development of a Capstone Project during the on-site portion of The GREEN Program.

LEARNING OUTCOMES

This section will outline the contents and learning outcomes of the six lectures held by Reykjavik University. The content presented here is complimentary to the Course Outcomes for the Iceland Summer Program detailed by TGP, which can be reviewed through the following link.

https://thegreenprogram.members-only.online/icelandwinter-lntl

INTRODUCTION TO ICELAND ENERGY

This lecture focuses on understanding how natural forces have influenced the development of Iceland and its inhabitants, both to their detriment and to their benefit. The aim is to highlight and create an understanding of the interplay between human activity and the environment.

Lecture Content

- Geoscience background of Iceland – geophysical processes, mantle convection, Iceland hotspot, volcanism
- Earth science background of Iceland – oceanography, thermohaline circulation, climate, glaciology
- Energy history background of Iceland – settlement to modern ages
- Modern Icelandic energy systems – generation and primary energy use, hydro, geothermal, wind, future of Iceland energy (Master Plan), long term research projects

GEOTHERMAL ENERGY – PART 1

This lecture provides a broad overview of geothermal energy and assumes no background knowledge in the subject matter. Students will learn what geothermal energy is, where and how it can be accessed, how geothermal energy is explored and utilized and will be presented with an overview of geothermal energy use in Iceland and worldwide.

Lecture Content

- The origin of geothermal energy
- Geothermal exploration
- Drilling technology
- Geothermal utilization (direct use and power production)
- Environmental, economic and social aspects of geothermal utilization

GEOTHERMAL ENERGY – PART 2

After having received an introduction to geothermal energy, this lecture takes a deeper look at geothermal systems. How natural resources are classified, with an explanation of the geothermal electric power production process. Policy and regulations pertaining to geothermal resources are explored as well as potential social and environmental impacts, finishing with thoughts on the future of geothermal power production.

Lecture Content

- Types of geothermal systems
- Classification of geothermal systems
- Electricity generation processes
- Challenges for geothermal electricity generation
- Worldwide geothermal generation & geothermal jobs

HYDRO POWER

Presented by the manager of Climate and Hydrological Research at Landsvirkjun, the National Power Company of Iceland, this lecture discusses the basics of hydropower, with specific reference to hydropower in Iceland. The student will learn about the hydrologic cycle, electricity production, hydropower design, and types of hydropower plants and turbines.

Lecture Content

- What is hydropower
- Definition of hydro power plants and types of turbines
- Global challenges in hydropower
- Hydropower in Iceland

ENERGY POLICY AND ENTREPRENEURSHIP

In this module, students are presented with the main themes driving energy policymaking by focusing on the why from a political, economic and planning perspective. With this context, the lecture then focuses on environmental perspectives through the lens of environmental resource economics.

Lecture Content

- What does the world energy system look like?
- Balancing political interests
- Economic policy – why and what?
- Planning an energy system
- Environmental costs
- Tools for quantifying non-market value in public policy research
- Regulation

ELECTRIC POWER SYSTEMS & RENEWABLE GENERATION

The audience is assumed to have no technical education in electric power systems. The lecture covers the history of power systems in the United States and Iceland, with basic physical principles are introduced as driving proponents for historical developments. Following this primer, modern concepts of reliability and resilience are discussed in the context of increased intermittent renewable generation.

Lecture Content

- Historical development of power systems in the United States and Iceland.
- Fundamental laws of physics that govern power systems.
- Structure and major components of a modern power system.
- Characteristics of different types generation.
- Concepts in reliability and resilience.
- Power system architectures and microgrids.

SCHEDULE AND OFFICE HOURS

Students are expected to complete the Lecture Series at their own pace, within three weeks of the start date of their GREEN program. The start date for their respective programs will be announced by their GREEN coordinator.

Open office hours will be available via Zoom on Wednesdays from 14:00 UTC until 16:00 UTC during the three-week period, except during Winter Holidays. The Zoom link and login information will be listed under the Syllabus in The GREEN Program course, ISE 01, on the Canvas learning management system.

GRADING

Course grades will be based on six quizzes (one per module) each worth 10%, and the final paper worth 40%. Each quiz will be available via Canvas after the completion of the respective module. Each quiz is based on slides, readings and lectures from its respective module. Questions will be randomized for each student.

TRANSCRIPTS AND CREDITS

This course is worth 3 ECTS (1.5 US credit-hours) and transcripts can be requested by the students after a grade is given (generally 1 week after the end of the program) by emailing nemendabokhald@ru.is. Instructions are given on the Home page of the Canvas course.