



# GLOBAL ENERGY SYSTEM IN TRANSITION: CHALLENGES AND SOLUTIONS

## MODULE'S CONTENT

Managing investments in the energy sector is impossible without knowledge of the basics of modern energy technologies and energy management, and without understanding the environmental and social problems of global energy.

The proposed proprietary modules allow students to gain a general understanding of sustainable energy technologies (in particular, renewable energy sources), and learn to assess environmental and social impacts, barriers, and potential market reforms to promote sustainable energy development.

## APPROBATION OF MODULES

The training modules were developed as a part of the international program "Alternative Energy". More than 100 students from the Gubkin University the Royal Technical University (KTH) were trained in the frame of this program in the period 2012–2021. Currently, some of the modules are used in several Master's degree programs at KTH.

## MODULE'S FORMAT

The modules are developed in English and Russian in both online and offline formats. Each module corresponds to 1 credit unit (1 ECTS), which is 15 hours of classroom teaching. It is possible to prepare shorter versions of the modules. Modules can be used:

- within the framework of the bachelor's program "International Finance and Investment Management", specialization "Renewable Energy Sources"
- as apart of the Master programs, for example, "Investment Management in the Energy Sector"
- through summer and winter schools for students, including students from the existing joint exchange program between the University of Lausanne and the Royal Technical University.

## MODULE 1. GLOBAL ENERGY SYSTEM IN TRANSITION

The module provides an in-depth overview and analysis of the structure, functions, and drivers of the global energy system, as well as its transformation, from a technical, economic, political and environmental perspective.

It is expected that after successfully completing the module, students will be able to:

- M1.1. Analyze the structure and function of the global energy system in relation to energy type, industrial and political structure.
- M1.2. Assess the main drivers of the global energy system, compare technical and economic conditions and relationships between different types of energy/energy markets.
- M1.3. Interpret the technical, institutional, and political mechanisms of energy system transformation.
- M1.4. Conduct a critical analysis of the conditions and processes surrounding future company-level technology and policy changes associated with the transformation of energy markets.



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## MODULE 2. INTRODUCTION TO RENEWABLES TECHNOLOGIES

In the frame of this module, students will receive a basic understanding of the most important renewable energy sources and related technologies. In addition to a brief overview of fundamental energy transformation concepts and supply and demand prospects, the module also includes a case study of the development of the solar energy sector as part of the transformation of the global energy system. The module includes developed at the Royal Institute of Technology remote laboratory on the study of photovoltaic panels.

It is expected that after successfully completing the module, students will be able to:

- M2.1. Assess supply and demand prospects for various types of renewable resources.
- M2.2. Analyze the characteristics of renewable energy sources and compare them with fossil fuels.
- M2.3. Analyze the development prospects of various energy systems for certain countries and regions.

## MODULE 3. INTRODUCTION TO ENERGY MANAGEMENT

The purpose of this module is to enhance students' ability to solve analytical and strategic issues related to energy systems and their management through systems thinking and modeling. The “smart” urban landscape has been selected as the object, which will be analyzed and studied within the module, taking into account local opportunities for increasing the share of renewable energy sources, reducing demand, local energy production, intelligent load management, economic efficiency, waste management, etc.

It is expected that after successfully completing the module, students will be able to:

- M3.1. Model energy systems at the district/city level.
- M3.2. Assess the cost-effectiveness of sustainable energy systems using appropriate economic methods.
- M3.3. Develop innovative business models that solve local socio-techno-economic problems at the city scale.