



UNIVERSITY NETWORK FOR CLIMATE AND ECOSYSTEMS CHANGE ADAPTATION RESEARCH

POSTGRADUATE COURSES ON

# RENEWABLE ENERGY

SPRING 2014

The United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS), Tokyo, invites applications for its intensive four-week postgraduate course on Renewable Energy, developed under the framework of the University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR). UN-CECAR is a collaborative initiative of more than 20 leading universities across Asia. It is committed to developing postgraduate educational and research programmes on climate and ecosystems change, and sustainability science. UNU-IAS acts as the Secretariat for UN-CECAR. This course is organized with the support of the Graduate Program in Sustainability Science-Global Leadership Initiative (GPSS-GLI) of the University of Tokyo.

The course conducted at UNU-IAS will cover a range of issues on the science, technology, economics and policies on renewable energy, including such hard topics as small hydropower, solar, geothermal, bio-, wind, marine, fuel cell and hydrogen energy and soft topics as energy demand and supply, economics and policies. Students will also receive practical training

with RETScreen Clean Energy Project Analysis Software and HOMER Energy Modelling Software.

The assessment for this course will be based on a research paper, presentations, class participation, and intermediate tests. The course is practically oriented and will be taught by a highly qualified and diverse team of natural and social science scholars. This course is equivalent to a regular 4 credit postgraduate course in Japan.

Target applications for this course are those who:

- are currently enrolled in a masters or Ph.D. programme, in any discipline;
- are postgraduate students, researchers, faculty/staff of universities, government officials, international agencies and professionals in relevant professions;
- wish to deepen their knowledge on, and gain practical training in, renewable energy.

# Course Information

The course runs for four weeks from 2 April 2014 to 25 April 2014. The courses focus on the science, technology, economics and policies on renewable energy. Students who successfully complete the courses will be awarded a certificate of completion and a transcript from UNU-IAS.

The course is designed to be worth 4 credits and comprise of 30 hours of teaching time. While a number of universities have negotiated credit transfer agreements with UNU-IAS, the final decision will be made by the student's university.

## Renewable Energy Course

4 credits

### 1. Introduction: Energy, Climate Change and Global Sustainability

- The Basics of Energy and CO2 Emission
- Life Cycle Assessment
- The Importance of "Energy Efficiency"
- The Difference Between Ordinary Energy Currently Used and Renewable Energy
- The Status of Global Environment in Relation to Energy

### 2. Energy Resources Classification, Potential and Characteristics

- Energy and Utilization
- Classification of Energy Resources and their Characteristics
- Reserve and Potential of Fossil and Renewable Energy
- Types of Renewable Energy
- Future Options for Developing Countries

### 3. Energy Demand and Supply

- Forms of Energy and Energy Conversion
- Energy Unit and Conversion Factor
- Global and National Energy Demand and Supply
- Energy Balance in the Global and National Context
- Energy Planning Concept

### 4. Energy Economics and Policies

- Energy Policies Development and Trends
- Subsidies, Incentives and Taxes
- Renewable Energy Promotion
- Climate Mitigation Policies and Renewable Energy
- Life Cycle Cost of Renewable Energy
- Economic Decision Making of Energy Project

### 5. Small Hydropower

- Introduction and Operating Principle
- Potential/ Resource Assessment
- System Components
- Basic Turbine Classifications
- Performance
- Environmental and Social Impacts
- Applications and Case Studies
- Future Prospects, Constraints and Trends

### 6. Geothermal Energy

- Terminologies and Classifications
- Global Distributions of Geothermal Resources
- The Nature of Geothermal Systems
- Advantages of Geothermal Energy
- Challenges for Geothermal Resource Development
- Geothermal Resource Discovery, Characterization, Energy Production & Energy Utilization

### 7. Wind Energy

- Technology for Wind Energy
- Economics of Wind Energy
- Environmental Issues
- Future Prospects, Constraints and Trends

### 8. Marine Energy Systems

- Operating Principles
- Resource Estimation
- Technology
- Economic and Environmental Issues
- Future Prospects, Constraints and Trends

### 9. Solar Energy- Resource, Photovoltaic Technologies, Solar Thermal Energy & Technologies

- The Solar Resource
- PV Description
- Solar PV System
- Solar Thermal Description
- Solar Thermal System

### 10. Bioenergy

- Introduction
- Types of Bio-resources
- Potential
- Characteristic of Bio-resources
- Conversion Technology and Applications (Thermal, and Biochemical Conversion)

### 11. Energy Storage Systems

- Introduction
- Type of Energy Storage Systems- Chemical, Mechanical, Thermal, Electrical and Electrochemical
- Overview on the Performance of Energy Storage Systems and Cost Considerations
- Case Studies, Trends and Constraints

### 12. Fuel Cell and Hydrogen Energy Systems

- Introduction to Fuel Cell
- Overview of Fuel Cell Types
- Overview of Hydrogen Production Systems
- Characteristics of Fuel Cell Performance and Cost
- Case Studies, Trends and Constraints

### 13. Renewable Hybrid Systems

- Overview of RE Resources and Technologies
- The Why for RE Hybrid Systems
- Classification of RE Hybrid Systems
- Components of RE Hybrid Systems
- Future Prospects for RE Hybrid Systems

### 14. Renewable Energy and Environment

- Greenhouse Gas Emission and Climate Change Impacts
- GHG Mitigation through Renewable Energy Resources and Technologies
- Co-benefits of Renewable Energy Application
- Future Prospects for Renewable Energy

### 15. Renewable Energy and Society

- The Growth of Renewable Energy
- The Impacts of Renewable Energy
- Public Participation in Energy Decisions
- Towards Low Carbon Society

### 16. Renewable Energy Policies and Targets Around the World

- Typology of Support Policies for Renewable Energy
- History, Evolution, Justification and Role of Support Policies in Market Development
- Linkage of Renewable Energy Policy with Climate Policy, Industrial Policy, Energy Security

### 17. Renewable Energy Market and Future Trends and Prospects

- Technology Market Characteristics
- Sectoral Markets and Integration
- Investment Trends and Magnitudes
- Prospects for further technology development, cost reduction and commercialization

### 18. Renewable Energy Project Planning and Development

- Introduction to Project Planning Methodology
- Problem Based Project Approach
- Logical Framework Analysis
- Scenario Analysis Applications and Grid-Connected Systems

## Practical Training

### RETScreen Hands-on Training

- Overview of RETScreen Clean Energy Project Analysis Software
- Use of RETScreen for the Analysis of RE Projects including Financial, Greenhouse Gas Emissions, Risk and Sensitivity Analysis, and Databases and Engineering Tools
- Conduct the RE Case Study
- Prefeasibility Report of the Case Study

### HOMER Hands-on Training

- Introduction to HOMER- A Micropower Optimization Software
- Compare, Evaluate, and Optimize Micropower Technology Options for a Wide Range of Applications Including Hybrid Renewable Energy Stand-Alone Applications and Grid-Connected Systems



# Other Information

## Faculty and Learning Environment

Students will benefit from working closely with highly experienced faculty members comprised of distinguished UN-CECAR scholars and practitioners, and UNU-IAS academic staff. UNU-IAS also shares a building with many UN agencies which makes it a unique learning environment.

The UNU Library offers access to a wide range of academic books, over 10,000 electronic journals, World Bank and OECD publications, and official UN documents. All students will receive a comprehensive library orientation session at the beginning of the course.

A dedicated computer lab will be provided for students, with software to cater to the needs of each course. An online tool will be provided for students to lecture notes, reading lists and other materials specific to each course, as well as a message board and forum to facilitate discussion among faculty and students.

## Student Support Services and Housing

UNU-IAS will assist students through the courses, acknowledging that students may experience difficulties in adjusting to a new country and culture. Students will be provided accommodation (in an affordable hotel close to UNU) during their stay in Tokyo.

## Daily Schedule

There will be three sessions of courses each weekday: 10:00–12:00, 13:00–15:00 and 16:00–18:00 hours.

## Please address specific queries to:

- Application procedure, acceptance policies, and student education and research on adaptation to climate change and ecosystems logistics (Ms. Wilma James, UNU-IAS, james@unu.edu)
- Program content, resource persons and collaboration (Ms. Soo Huey Teh, UNU-IAS, teh@unu.edu)

## Fees

Tuition fee: USD 3,000 (JPY 300,000)

A limited number of fellowships (covering tuition fees, and/or living expenses) are available for outstanding students from developing countries and who could demonstrate a need for financial assistance. All students are expected to pay for their own travel expenses.

## Eligibility and Application

Applicants must provide:

- A completed Application & Fellowship Form with photo and signature;
- Proof of enrolment in a master's or Ph.D. degree programme if you are a postgraduate student;
- Original transcript of academic record;
- A detailed proposal of the research topic, and explain how it will link the current university thesis topic to that of climate change if you are a postgraduate student;
- TOEFL scores or equivalent proof of English-language proficiency for non-native speakers or those who do not have an academic degree in an English-speaking country; and
- Minimum of two references.

The application deadline for the Spring 2014 course is **February 14, 2014** for students from abroad and for students within Japan.

For detailed information on the application and admission procedures, please visit the UN-CECAR website at: <http://cecar.unu.edu/re-courses> and to apply, please visit: <http://cecar.unu.edu/apply>.

## University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR)

Established in 2009 as the first of its kind in the region, UN-CECAR is an institutional platform of universities across Asia that seeks to enhance education and research on adaptation to climate change and ecosystems change, and to build the emerging sustainability science discipline. Specific objectives of the Network are to:

- collect international-level knowledge on climate change adaptation and customize it to the local level;
- assess existing and emerging climate change-related research and degree programmes in the region, and identify areas of most need;
- initiate and support the development of joint- or dual-degree educational programmes, credit-sharing common courses, joint research and training programmes



Visit  
<http://cecar.unu.edu>

## Institute for Advanced Study of Sustainability

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## United Nations University

*Promoting science for human security, peace and sustainable development*

The mission of the United Nations University is to contribute, through collaborative research, capacity development and advisory services, to efforts to resolve the pressing global problems of human survival, development and welfare that are the concern of the United Nations, its Peoples and Member States.

The UN University comprises a worldwide network of institutes, presently located in 13 different countries and coordinated by the UN University Centre in Tokyo.

## UNU Institute for the Advanced Study of Sustainability (UNU-IAS)

Located in Tokyo, UNU Institute for the Advanced Study of Sustainability (UNU-IAS) was established in January 2014. UNU-IAS takes an innovative, integrated approach to sustainability — one that encompasses global change, development, peace and security. The Institute bridges these cross-cutting issues through research, educational and collaborative initiatives with the aim of solving current problems and anticipating future challenges. UNU-IAS works in collaboration with other UNU institutes as well as through co-operative relationships with the global academic and policy-making communities.

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