# Call for Participants for the Joint-Research and Training Program on

# Low Carbon Green Energy and Environmental Green Technology for Sustainable Development

## ■ Introduction

The rapid economic development and serious environmental pollution of the Association of Southeast Asian Nations, ASEAN), India, and other Asian countries make their governments a great need on development of cutting-edge green technology. However, the emission of pollutants from the use of fossil fuels and biofuel energy deteriorates the environmental quality in ASEAN, India and other Asian countries. The Southeast Asia region is subject to a very complex pollution scenario, especially in terms of air pollution and atmospheric chemistry, due to a large number and wide variety of emission sources and varying ambient conditions. Although most countries including ASEAN and India produce petroleum and natural gas, these countries are still in shortage of electricity. Consequently, combustion of biomass releases an even larger amount of pollutants, especially the carbon dioxide. Due to the pressure of global warming and reduction of $CO_2$ emission, both ASEAN and Asian countries gradually change the use of fossil fuel to low carbon and nuclear energies to reduce the emission of $CO_2$ and the cutting-edge technology for low carbon and renewable energies as well as the treatment technology for pollutants are urgently needed. During the past forty years, Taiwan has successfully changed from an agricultural society into an industrial society and has developed good systems for energy management and environmental protection. This "Taiwan experience" will be a treasure for ASEAN countries and India during their transition stage.

**The purpose of this joint-research and training program is to strengthen the academic and educational cooperation between Taiwan and Southeast Asian and other developing counties, including Philippines, Indonesia, Malaysia, Thailand, Vietnam, India, Jordan and Mongolia in the fields of energy and environment. A 10-day course containing sustainable environment, low carbon energy, environmental green technology, and laboratory and field trip will be offered to at least 30 trainees. Through this training course, the trainees will learn knowledge in cutting-edge technology for low carbon energy and sustainable**

**environment. This would significantly reinforce the close academic collaboration between Taiwan and Southeast Asia in the areas of energy and environment.**

## ■ Curriculum Planning

This training program, funded by the **Ministry of Science and Technology (MOST)**, Taiwan, will mainly address the impact of industrialization and utilization of fossil fuels on the environmental pollution and global climate change as well as the development and application of low carbon green energy to environmental sustainability. The main concept for curriculum design is mainly based on the life cycle of pollutants and their impacts on environmental sustainability. As shown in Figure 1, the use of fossil fuel will produce large amounts of $CO_2$ and pollutants to deteriorate the environmental quality as well as to cause the global warning. The introduction of energy-saving and low carbon technology to develop environmentally green technology and low carbon technology are thus needed and urgent to achieve the environmental sustainability.
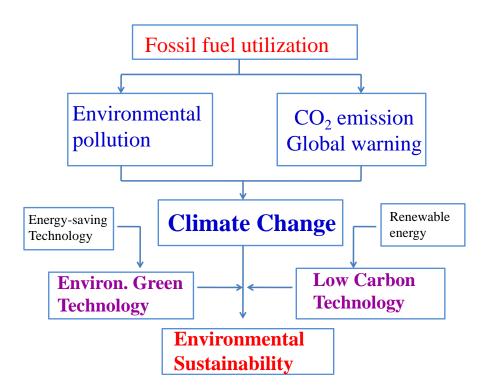
Figure 1. The main concept for curriculum design.

Through the designed course, the trainees will first learn the comprehensive knowledge in world energy sources and distribution and current status of energy usage in the world, especially the ASEAN, India and Middle East. The release of toxic chemicals and $CO_2$ from the combustion of fossil fuels and the impact of these toxic chemicals on global warming as well as human health will be addressed and discussed in the curriculum. In addition, the concept and application of low

carbon and renewable energies including solar energy, hydrogen energy, and energy storage will also be introduced. After 53 hours of lecture courses, 4 field trips including laboratory tours, wastewater treatment plants, and Center for Space and Remote Sensing Technology at National Central University will be arranged to link and reinforce the lecture courses. The detailed description of course contents is listed below:

## (I) Environmental Sustainability

The Southeast Asia region and developing countries are subject to a very complex pollution scenario, especially in terms of air pollution and atmospheric chemistry, due to a large number and wide variety of emission sources and varying ambient (e.g., meteorological) conditions. Specifically, the region has seen fast and large economic growth over the previous few decades, while environmental impacts were largely disregarded. Consequently, the urban areas, especially the string of cities situated along the coastlines (from southern China down to the Malay Peninsula), have been severely impacted by the multitude of anthropogenic emissions, such as from traffic, power generation, and industry. Aside from characterizing and quantifying the various emission source strengths, it is of crucial importance to better understand the ambient chemical and physical processes and the method to remote sensing and monitoring. Through these introductions and learning, the trainees can understand the meaning of environmental sustainability.

| Subject | Time | Subject Description |
|---|---|---|
| Global Warming and Extreme Environments | 6 hrs | The course will briefly introduce atmospheric structure and composition, the most important chemical reactions in the gas and aqueous phase, and the various types of air pollution. The role of aerosol particles in the atmosphere, including their formation, transport, transformation and environmental effects will be introduced. The influence of greenhouse gases and light-absorbing aerosols on global warming will be addressed in the context of global climate change, with an emphasis on anthropogenic influence. |
| Environmental Remote Sensing Technology | 3hr | This course will address the principles of remote sensing in the atmosphere and their application to monitor the environmental quality and pollutants. |
| Fate and Transport of Chemicals | 3 hr | This course will introduce the basic concepts of chemical mass and concentration, mass balance and chemical distribution among phases. This would help trainees to understand the formation pathways of pollutants and their |

| Subject | | Time | Subject Description |
|---|---|---|---|
| | | | impacts on environmental sustainability. |
| Environmental Planning and Management for Sustainability | | 3 hr | The course will briefly explain the planning and evaluation method for urbanization. The mass balance of carbon foot print in urban will be introduced. |
| Industrial Ecology and Sustainable Engineering | | 2 hr | This course will emphasis the importance of life cycle assessment and industrial ecology on the sustainability of environment. |

## (II) Low Carbon and Renewable Energy

This series of courses focuses on introduction to green energy technologies. In addition to a comprehensive coverage on low-carbon and renewable energy sources, special attention will be given to the applications of hydrogen energy and solar energy to reduce the emission of carbon dioxide. In the meantime, novel technologies for energy storage and conversion will also be discussed. A total of 20 hours is allocated for this series of courses, which are categorized into the following five areas. The overall curriculum design and outline for the twenty four-hour course is as follows:

| Subject | Time | Subject Description |
|---|---|---|
| Overview of Low Carbon and Renewable Energy | 3 hr | Briefly introduce the low carbon energies. The socioeconomic impact of clean energy as well as the energy management will be discussed. |
| Solar Cells | 5 hr | This course will describe the principles of solar cell and various applications of different types of solar cells. |
| Hydrogen Energy and Fuel Cells | 5 hr | Explain the fundamental properties of hydrogen, describe the working principles of fuel cells, and introduce various fuel cells. |
| Biomass and Biofuel Cells | 3 hr | This course will briefly introduce the concept of biofuel cells and the conversion of food and agricultural wastes into biomass and biofuel. |
| Energy storage | 3 hr | This course will briefly introduce the principles of energy storage and the devices of Li-ion battery and supercapacitors. |

## (III) Environmental Green Technology

The development of environmentally benign and green technology for treatment of toxic pollutants is of most urgent important because of the pressure on the reduction of emission of green house effect gases. Therefore, the goal of this series course mainly focuses on the introduction to energy-saving green technology to treat wastewaters and toxic chemicals. The

development of carbon dioxide capture, storage and utilization will be introduced and discussed. Environmental nanotechnology has emerged as one of the most fascinating techniques in modern era and it can actually help solve some of environmental problems. Along with all these benefits, it is important to recognize that nanoparticles are a still relatively unknown area, and therefore their effects must be researched thoroughly as soon as possible.

| Subject | Time | Subject Description |
|---|---|---|
| Principles and Application of Environmental Green Technology | 4 hrs | The course will briefly introduce the fundamental concept of environmental technology and green chemistry. The application of green chemistry to the environmental technology will be addressed and emphasized to elucidate the environmental green technology. |
| Energy-Saving Biological Treatment Technology | 3hr | This course will combine the energy saving concept and biological treatment technology to develop the energy-saving biological system for treatment of pollutants in swages and wastewaters. |
| Carbon Dioxide Captures, Storage and Utilization | 3 hr | This course will address the chemical and physical methods for capture and storage of $CO_2$. The techniques for conversion of $CO_2$ into biomass or hydrocarbon will be discussed. |
| Nanotechnology in Environmental Sciences | 3 hr | The course will briefly introduce nanotechnology in environmental applications, including heavy metal detection, characterization and distribution of pollutants and their health effect. |
| Environmental Toxicology and Risk Assessment | 3 hr | This course will address the fundamental concept of toxicology and the toxic effect of toxicant on human beings. The method for risk assessment and the importance on risk assessment on green technology will be introduced |

## (IV) Field Trips and Cultural Tours

### (a) Center for Space and Remote Sensing Research

The Center for Space and Remote Sensing Research (CSRSR) is a prime research center at National Central University, Chungli. Its primary missions are in the research and teaching of space and remote sensing related sciences, and in the development of new remote sensing technology and applications. The center strives to advance into a world-class remote sensing research facility that encompasses basic technical developments, widespread educational services, and promote relevant applications in various fields in order to strengthen remote sensing

technology and fundamental development infrastructure. One of the development policies for CSRSR is the application of remote sensing in Asia Pacific region's environmental changes development. With the implementation and execution of these goals, it is expected to uplift further the center's technological level in remote sensing, and contribute more to government policies on land use, environmental monitoring and disaster preventions.

### (b) Laboratory tours of University System of Taiwan

The University System of Taiwan (UST) is a consortium of four top research universities in Taiwan, namely National Central University (NCU), National Chiao Tung University (NCTU), National Tsing Hua University (NTHU) and National Yang-Ming University (NYMU). The UST has launched environmental Science and Technology (UST-EST) program which focuses on the research fields of Environmental Remote Sensing, Environmental Engineering, Environmental Chemistry and Molecular Science, and Environmental and Occupational health Science. The visit of UST laboratories will integrate state-of-the-art environmental science and technology.

### (c) Field trip of Wastewater Treatment Plant

Science-based industrial park, located in Hsinchu city, is one of the most important semiconductor bases in Taiwan. To fulfill the strict environmental regulations and environmental sustainability, the science park wastewater treatment plant has been established since 1986. Now this treatment plant uses biological and chemical method to treat $1.1 \times 10^5$ CMD wastewater. In addition, the science park wastewater treatment plant has established the carbon footprint in their wastewater treatment system to develop the low carbon and energy saving technologies.
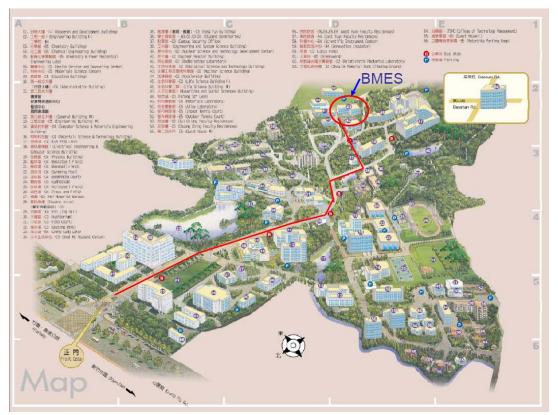
## ■ Tentative course timetable (November 4~14, 2014)

| Date | 8:30-10:00 | 10:30-12:00 | 12:00-1:30 | 1:30-3:30 | 4:00-6:00 |
|---|---|---|---|---|---|
| 11/4(Tue) | Registration Opening | Lectures | Lunch | Lectures | Lectures |
| 11/5 (Wed) | Lectures | Lectures | Lunch | Lectures | Lectures |
| 11/6 (Thu) | Lectures | Lectures | Lunch | Lectures | Laboratory tour at NTHU |
| 11/7(Fri) | Lectures | Lectures | Lunch | Lectures | Lectures |
| 11/8(Sat) | Visit CSRR | | Lunch | Laboratory tour at NCU | |
| 11/9 (Sun) | Cultural tour (National Palace Museum and Taipei city) | | | | |
| 11/10 (Mon) | Lectures | Lectures | Lunch | Lectures | Lectures |

| | | | | |
|---|---|---|---|---|
| 11/11 (Tue) | Lectures | Lectures | Lunch | Lectures | Laboratory tour at NCTU |
| 11/12 (Wed) | Lectures | Lectures | Lunch | Lectures | Lectures |
| 11/13 (Thu) | Lectures | Lectures | Lunch | Wastewater treatment plant tour |
| 11/14 (Fri) | Lectures | Lectures | Lunch | Lectures | Closing remarks |

## ■ Training Venue

Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University, Hsinchu, Taiwan.



## ■ Application

Applicants who are interested in this training program can be applied on-line or from e-mail with the application form and necessary documents (PDF files are preferred).   Followings are the details of application.

➢ **Qualification**

Candidates should be, but not limited to, postgraduates, lectures, faculties, or researchers who are highly interested in learning environmental science and low carbon energy. No previous experience in environmental and/or energy science and technology is necessary.

➢ **Selection criterion**

The training program will select at least 30 trainees from ASEAN, India, Sri Lanka, Middle East, Mongolia and other developing countries. The selection criterion is based on the CV, statement of purpose and other documents the applicants provided.

➢ **Award details**

Once selected as the trainees, the round-trip air flight ticket directly from hometown to Taiwan, housing, foods, and fees for field and cultural trips will be provided during the training period.

➢ **Reimbursement for overseas transportation expenses**

We offer every participant a subsidy for purchasing round trip economy-class airflight tickets directly from home country to Taiwan. The reimbursement will follow the standards of Ministry of Science and Technology..

➢ **Airport Pick-up**

Airport pick-up will be arranged according to every participant's flight schedule.

➢ **Accommodation**

Two participants share one room with two single beds. Each room is equipped with TV and wireless internet.

➢ **Meals**

Breakfast, lunch and dinner are all included. If you have any special dietary requirement, please inform us in advance.

➢ **Handout and 8G USB**

■ More information about this training program can be found

http://nucl-eei.vm.nthu.edu.tw/

■ **Contact us**

**For further information or questions, please contact the College of Nuclear Science, National Tsing Hua University, Taiwan**

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