



ASIAN INSTITUTE OF TECHNOLOGY



United Nations
Educational, Scientific and
Cultural Organization

e-learning course

Bio-energy for achieving MDGs



A. Dutta, Ram M. Shrestha, H. Jayasuria and CAPSA
April - June 2007



Education (A. Dutta)

- **August 2002: PHD** Department of Mechanical Engineering, Dalhousie University, Canada.
 - **Thesis Title:** Heat Transfer in Circulating fluidized Bed Boilers
- **August 1998: M. Eng in Energy Technology** from AIT, Thailand
 - **Thesis Title:** A Study of Biomass Gasification for Engine Applications.
- **January 1994: B.Sc in Mechanical Engineering** from BUET, Dhaka, Bangladesh



Employment

- **2005 to date:** Assistant Professor, Energy, School of Environment Resources and Development, AIT
- **2003-to 2005:** Research Manager, Greenfield Research Incorporated (GRI), Halifax, Canada
- **2002:** Post Doctoral Fellow, Dalhousie University, Canada
- **1999-2002:** Research Executive, GRI, Canada
- **1998:** Research Associate, Asian Institute of Technology, Thailand.
- **1994-1996:** Research engineer, Bangladesh Atomic Energy Commission.



Course Rational

- Energy conversion accounts for a large share of carbon emissions.
- A reliable, affordable energy resource, will power economic growth, and help us achieve environmental goals at the same time.
- Biomass is one of the most important sources of energy in the developing countries, and provides 14% of the world's energy.
- Therefore, engineers and scientists need to be able to apply modern techniques for designing efficient and cost effective biomass fuel based systems.
- This course deals with biomass resources potential, grassroots technologies and its applications, other conversion technologies of converting biomass into upgraded fuels and more importantly how bio-energy could help achieving MDG's.

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Course Objective

- One of the most important aspects of this course is to give participants an understanding on issues of how to maximize social and economic benefits, and improve economic sustainability of rural energy projects through Productive Uses of Bio-Energy.



Format

- **A total of 10 lectures (8 will be by AIT and the other 2 will by CAPSA)**
- **Each lecture will consist one hour lecture and half an hour questions and answers)**
- **Discussions/questions also through email**
- **Reference/reading material**



Bio-energy for achieving MDGs: Contents

- Energy, MDGs and Global sustainability—AD
- Biomass resources potential and estimation techniques in selected countries—HJ
- Routes of biomass conversion technologies and application of grassroots technologies---AD
- Conversion technologies for heat and power----AD
- Conversion technologies for bio-ethanol and bio-diesel---AD
- Financial aspects of a project—RMS
- Financing mechanism--- RMS
- Case studies---AD
- Social and environmental impacts-CAPSA
- Productive uses of biomass energy for rural applications -CAPSA

Lecturers:

AD –Animesh Dutta, AIT; RMS – Ram M. Shrestha, AIT; HJ - Hemantha Jayasuriya, AIT;
CAPSA-Resource person

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Course Outline

- **Module 1 (AD)**
- Energy, MDGs and Global sustainability
 - Sustainable Development
 - Relationship between energy and development
 - Energy consumption scenario and MDGs
 - Bio-energy-a means to address sustainable development
 - Characteristics of Biomass Fuels
- **Module 2 (HJ)**
- Biomass resources potential and estimation techniques



Course Outline (cont.)

- **Module 3 (AD)**
- Routes of biomass conversion and application of grassroots technologies
 - Biomass conversion routes and grassroots technologies
 - **Densification:**
 - Types of Densification Devices, Techniques
 - Properties of briquetting Fuels
 - Torrefaction of Densified Fuels
 - **Pyrolysis:**
 - Slow and Fast Pyrolysis, Charcoal Production.
 - Improved cooking stoves
 - Biogas digester



Course Outline (cont.)

- **Module 4 (AD)**
- Conversion of technologies for heat and power
 - Biomass Gasification:
 - Fixed bed Gasifiers, Fluidized bed Gasifiers, Entrained Bed Gasifiers, Success stories of biomass gasifier plants
 - Biomass combustion
 - Furnaces, Fixed bed systems, Fluidized bed systems, Emission reduction
 - Co-generation application



Course Outline (cont.)

- **Module 5 (AD)**
- Conversion of technologies for bio-ethanol and bio-diesel
 - Raw materials,
 - Ethanol production process and technologies
 - Bio-diesel production process and technologies
 - Issues that need to be addressed



Course Outline (cont.)

- **Module 6 (RMS)**
- Financial aspects of a project
- **Module 7 (RMS)**
- Financial mechanism
 - Micro-credit, CDM etc.
- **Module 8 (AD)**
- Case studies-a biomass project
- **Module 9 (CAPSA)**
- Social and environmental impacts
- **Module 10 (CAPSA)**
- Productive uses of bio-energy for rural applications



Thank you for your attention
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