**Instruction Plan: Sustainable Energy Planning and Policy Analysis**

**Year/part: I/II Instructor: Prof. Amrit M Nakarmi**

**Lecture/tutorial: 4 hrs Start Date: 01 Aug 2016**

 **End Date: 15 Aug 2015**

# Level: M.Sc. Program: MSESSD

Energy plays a vital role in the socio-economic development of a country. In a developing country like Nepal, where energy poverty is high in rural areas, access to modern energy services is of utmost importance. In the present context global concern over climate change, energy and environmental issues remain of great importance to the policy-makers globally and continue to find growing awareness among the general populations of many developed and developing countries. As ideas of sustainable energy are taking root, new technologies are emerging. There is a strong awareness of the need for better harnessing of hydro and non-hydro indigenous renewable resources for sustainable development in the country. In many countries, policy- makers are proposing new energy and environmental policies that will attempt to assure a reasonable quality of life to future generations. This course provides the students to understand energy planning, analyzing energy systems economically and familiarizing with different energy policy options for better energy planning and sustainable energy policy development.

**Objective of the course**

This course aims to provide basic understanding of finance and economics concepts in energy sector especially the following:

1. To familiarize different energy carriers such as solid biomass, fossil fuels and renewable energy for providing energy services to the people
2. To focus on hydro and non-hydro renewable energy technologies for sustainable development
3. To have ample knowledge on energy services and energy demand, and energy supply and its conversion in society
4. To understand energy in the social context, and the nexus among energy, economy and environment
5. To understand energy systems analysis using different scenario developments
6. To get familiar with existing energy policies and to analyze different policy options to find out better energy policies for sustainable social development

**Prerequisite**: good knowledge of Microsoft Excel, Word, and Powerpoint. If the students are not familiar with these software, they have to get the knowledge of them on their own during the course. Students have to learn Long Range Energy Alternatives Planning (LEAP)system software and basic tutorial will be taken in the afternoon classes on needs basis.

**Mark distribution**: **total marks =100**

**Assessment: =40**

1. Attendance =2 (no attendance would be entertained if the student came late or became absent. If absent due to illness, medical certificate has to be furnished)
2. Class assignments =8
3. Assessment =10
4. Final course presentation and report =20 (on energy planning and analysis of different policy scenarios for a community; village/town etc. especially household sector or health sector)

**Final Examination =60**

1. **Text book: Kornelis Blok, 2006. *Introduction to Energy Analysis*. Techne Press, Amsterdam, Netherlands.**
2. **Emanuela Colombo, S. Bologna, and D. Masera (ed.), 2013. *Renewable Energy for Unleashing Sustainable Development.* Springer International Publishing, Switzerland.**
3. **Ram M. Shrestha, J.S. Acharya, 2015. *Sustainable Energy Access Planning. A framework.* Asian Development Bank, Manila, Philippines.**
4. **Ragsdale, Cliff T., “Spreadsheet Modeling and Decision Analysis, A Practical Introduction to Management Science”, 5th edition, South Western, Cengage Learning, 2008.**
5. **Chan S. Park, 2002. Contemporary Engineering Economics. Prentice -Hall of India, New Delhi, India.**

Apart from above, reading materials -handouts and notes, journal papers -will be provided to the students from time to time. Students have to prepare the presentation and report based on their knowledge gained through their studies during their experience and this program.

| **S. no.** | **Class Day** | **Month** | **Topics** | **Remarks** |
| --- | --- | --- | --- | --- |
| 1 | 1 | August | Current/Future Energy Scenarios of Nepal and need for sustainable energy development and energy security; what is sustainable development and energy security? Energy conversion; primary, final and useful energy. | Lecture notes and handouts, book chapter readings 1 on student’s own sake |
| 2 | 2 | August | Power and energy carriers; Energy Balance and statistics; energy use and electricity load factors and load curves | Chapter 2 reading and assignment #1; tutorial on energy conversion |
| 3 | 3 | August | Energy services and energy demand; energy use in households (buildings); energy use in industrial sector; energy use in commercial (services) sector | Chapter 3 reading and assignment #2; tutorial on energy balance |
| 4 | 4 | August | Energy Extraction and conversion; non-renewable energy sources; reserves and resources; renewable energy resources and conversion; electricity production and conventional power plants; transmission and distribution of electricity and refineries. Some basic knowledge on optimization techniques in spreadsheet environment. | Chapter 4 reading and assignment #1 submission and issue of assignment #3 |
| 5 | 5 | August | Energy markets; oil and oil markets; coal; electricity markets; and price elasticities of energy commodity | Chapter 5 reading and assignment #2 submission and issue of assignment # 4  |
| 6 | 6 | August | Energy in the social context; energy and economy; social aspects of energy use; environmental aspect of energy use; sustainable development; sustainable energy development and energy security | Chapter 6 reading and assignment #3 submission and issue of assignment # 5 |
| 7 | 7 | August | Capital budgeting techniques contd.; cash flows –free cash flows (FCF) and discounted cash-flow modeling on spreadsheet; Net Present Value (NPV) and Internal rate of return (IRR) calculations | Chapter 11reading and assignment #4 submission and issue of assignment # 6; Chapter 7 and 8 (Chan S. Park, Contemporary Energy Economics) |
| 8 | 8 | August | Economic analysis: benefit-cost analysis; life-cycle cost analysis; levelized cost of electricity | Chapter 11reading and assignment #5 submission and issue of assignment # 7; Chapter17 (Chan S. Park, Contemporary Energy Economics) |
| 9 | 9 | August | Risk analysis and simulation in energy project evaluations | Chapter 12 (Ragsdale’s book on spreadsheet modeling); tutorial on monte carlo simulation using Crystal Ball; submission of assignment #6 |
| 10 | 10 | August | Scenario analysis  | Submission of assignment # 7; Tutorial on LEAP |
| 11 | 11 | August | Energy Systems modeling using Long Range Energy Alternatives Planning (LEAP) software | Tutorial on LEAP |
| 12 | 12 | August | Policies for renewable energy and energy efficiency for sustainable energy development and energy security using LEAP | Tutorial on Energy Policy analysis using LEAP  |
| 13 | 13 | August | Existing energy policies in Nepal |  |
| 14 | 14 | August | Energy Derivatives |  |
| 15 | 15 | August | Final Report Submission and presentation of energy systems analysis for a village, town, community and etc. | To be done after 2 weeks from the class 10 |

## Curriculum Vitae of Instructor (lectures)

Title Professor& Coordinator, Energy Systems Planning & Analysis Unit, Center for Energy Studies, IOE/TU

Academic background PhD (Public Policy in energy sector**)** in energy systems planning and policy analysis from SJM School of Management, IIT Bombay, India,

M.Eng in engineering management, University of Alberta, Canada

MSc (honors) in mechanical engineering, Kharkiv National Automobile and Highway University, FSU,

Experience Teaching experience of more than 38 years & experience of more than 26 years in private and public enterprises

**Local Appraiser, Review Team/Appraisal Team, GIZ, December 2013/ March 2015/Feb 2016**

 **Member, Alternative Energy Promotion Board, Alterative Energy Promotion Centre, Feb 2013 – Feb 2015**

**Member, Selection Committee for Executive Director, AEPC, 2012/2014**

 **Deputy Team Leader & Energy Systems modeler, Low Emission Economic Strategy for Nepal, AEPC, Ministry of Science, Technology and Environment, Government of Nepal, April 2013 –Oct 2014**

 **Deputy-Team Leader, Long term vision 2050 of the water resources and energy sector, Water & Energy Commission Secretariat, Government of Nepal, April 2012 - December 2013.**

 **Lead Consultant, Rapid Assessment/Gap Analysis for achieving main objectives of UN's Sustainable Energy for All (SE4ALL) program Dec 2012 - April 2013**

**Member, High Level Committee on operations and reform of Nepal Oil Corporation, Nepal Government, March –April 2011**

 **Co-Team leader**, **Energy Resources Strategy for Nepal Project under Water & Energy Commission Secretariat, Government of Nepal**, 2007 - 2010

**Vice-President (CG Group)**, 1997 –2004

**GM, Nepal Oil Corporation Ltd.,** 1991-1995

 **Chairman & Director, Nepal Lube Oil Ltd.** (Ex)

 **Director, Gorakhkali Rubber Udyog Ltd.** (Ex)

 **Chairman & Director, Nepal Bitumen & Barrel Udyog Ltd.** (Ex)