Educational Modules for Sustainable Manufacturing Developed and RCN Case Studies Funded

Recently, the NSF has funded a project titled: Sustainable Manufacturing Advances in Research and Technology (SMART) Coordination Network. The funding has been provided through the NSF Research Coordination Networks-Science, Engineering and Education for Sustainability (RCN-SEES) track. A primary objective of the project is to bridge the gap between the academic knowledge discovery and industrial technology innovation for sustainable manufacturing. Various research, educational, and outreach activities are underway. In the area of education, the project will generate a number of case study educational modules for sustainable engineering education that should be widely adoptable for undergraduate/graduate education and professional training in industries. Proposals were solicited from educators to develop modules on sustainable manufacturing case studies (SMCSs). An SMCS comprises both an interactive, graphically-oriented case study with supporting materials (e.g., data, models, simulations) that help the instructor and the student learn about some aspect of sustainable manufacturing design. A typical SMCS will have the following structure:

• Introduction and Background, describing the physical system represented by the case study and its importance. This includes basic concepts such as the relevant properties that appear as inputs or outputs of the manufacturing system.
• Engineering Principles and Models, providing a thorough overview of the fundamental principles and engineering models that exist, which may be applied to describe the process trade-offs.
• Problems, relevant to the case study and suitable for an instructor to assign as homework activities, focused on the connection between the sustainability and the manufacturing process.
• Design activity, which exposes the student to the use of an engineering model in a design setting. The activity would have the student use the model to develop a design related to the targeted systems and which meets sustainability metrics.

The SMCSs will be disseminated to the academic community and will be published using CACHE (Computer Aids in Chemical Engineering) resources (e.g., http://cache.org/teaching-resources-center).

It is expected that four SMCSs will be developed annually**.** An honorarium of $4,000 will be provided to the developer(s) of each SMCS.

In December 2012, the SMART CN announced the funding of the following five projects:

1. Evaluation of Biodiesel Production from Refined Vegetable Oils and Waste Greases. Developer: Dr. Richard Cairncross, Drexel U.
2. Sustainable distillation columns for sustainable manufacturing. Developer: Dr. Yaşar Demirel, U. of Nebraska Lincoln
3. Teach Root Cause Analysis in Design to Encourage Critical Thinking about Sustainability. Developer: Dr. Helen Lou, Lamar U.
4. Application of Green Chemistry to Manufacture Specialty Chemicals from Renewable Resources. Developer: Dr. Jeffrey Seay, U. of Kentucky.
5. Process Modeling and Life Cycle Analysis of 1,3-Propanediol from Fossils and Biomass. Developers: Drs. Robert A. Urban and Bhavik R. Bakshi, Ohio State U.

In March 2013, two more projects were selected for funding:

6. Assessment of the Presidential Green Chemistry Award Winners using Green Chemistry Metrics. Developer: Christopher Kitchens, Clemson U.
7. Green Process Design, Industrial Ecology, and Sustainability: Educational Modules related to Mercury Cycling. Developers: Dr. Urmila Diwekar, Vishwamitra Research Inst., and Dr. Yogendra Shastri, Indian Inst. of Tech.

Note that all the modules will be submitted to the CACHE during summer, 2013. They will be disseminated to the academic community and will be published using CACHE resources (e.g., http://cache.org/teaching-resources-center).

Yinlun Huang
Professor, ChE/MSE, Wayne State University
Technical Advisor, AIChE SEF