Complementary Strengths and Opportunities for Collaboration: Results of a Survey on Water Resources, Treatment and Quality

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Tuesday December 9, 2008
2nd International Symposium on Energy and Environment

Acknowledgments
• Professor Herbert Fang (Hong Kong University)
• Professor Rafael Semiat (Technion)
• Yanjiao Xie (Washington University)
• Respondents from 8 partner universities

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Scale of Activities

• Education and research on water resources, treatment and quality are conducted in different departments, centers, and institutes.
  – Departments include Environmental Science and Engineering, Chemical Engineering, Civil Engineering, Food and Biotechnology Engineering, Mechanical Engineering, Geography and Resource Management, Biological Sciences, Chemistry, Earth and Planetary Science
  – Centers and institutes of Environmental Science and Engineering and Resources Engineering

• Partner universities have significant personnel involved in research and education. Departments of the eight universities include:
  – more than 300 professors
  – over 4000 undergraduate students
  – approximately 500 masters students and 500 doctoral students
• Areas of universal coverage (biological treatment, environmental microbiology, and water chemistry) offer opportunities for multilateral collaboration.

• Collaboration can incorporate research expertise in areas not universally covered (membranes, groundwater, risk assessment, nanotechnology).
• Greatest research depth is in treatment processes.

• Opportunities for collaboration within and between research areas.
Research Focus and Collaboration

- **Universities have Different Areas of Focus**
  - Membrane Processes: Hong Kong University and Technion (4)
  - Environmental Nanotechnology: Washington University (6)
  - Physical-Chemical Processes: IIT Bombay (8)
  - Biological Processes: Bogazici, Hong Kong University, IIT Bombay (3+)

- **Provide Opportunities for Existing Collaboration**

- **Unique Facilities**
  - Pilot Scale Facilities: Membranes (Technion), Biological Treatment (Bogazici and Fudan)
  - Marine Science Laboratory (Chinese University of Hong Kong)
  - Specialized Analytical Facilities
Educational Collaboration

- Many courses are taught at most of the universities.
- Strong interest in developing educational modules to share.
- 75% of universities have facilities for internet-based distance learning.
Educational Modules

• A short stand-alone unit used to teach a given concept or subject.
  – web-based tutorial
  – a project based on a case study
  – particular interesting set of focused problems.

• Potential Early Targets for Shared Educational Materials
  – *Introduction to Environmental Engineering* will benefit from a collection of problems and case studies with international perspectives.
  – *Water Chemistry or Environmental Nanochemistry* will draw on our respective areas of expertise.
  – *Water and Wastewater Treatment Process Design* can involve collaboration on shared projects.
Shared Design Projects

- Water or wastewater treatment design courses at different universities can use the same project.
  - Multi-university student teams formed for collaboration or
  - Single university teams review and critique designs from other universities.
  - Provides students with practical experience in international collaboration.

- Example: WERC Environmental Design Contest
  - Teams design a full-scale system and build a bench-scale prototype.
  - 2008 Task: design a system for energy and water efficient desalination of inland brackish water.
Mechanisms for Collaboration

• Electronic Communication for Research and Distance Learning

• Personnel Exchange
  – student exchange on research projects
  – faculty visits (sabbaticals)

• Resources to Support Collaboration
  – McDonnell Academy Global Energy and Environment Partnership
  – Other Private Organizations
  – Internationally-focused Initiatives of Government Agencies
    • U.S. National Science Foundation Partnerships for International Research and Education (PIRE) and International Research Experience in Engineering (IREE)
    • Turkish Research Council (TUBITAK)
Conclusions

• Our universities conduct substantial interdisciplinary research and education on water quality, water treatment, and water resources.

• Research efforts can benefit from collaboration in areas of complementary interests.

• Educational collaboration can target one or two courses for the development of modules and can involve design courses.

Next Steps

• Assemble information for additional universities.

• Make survey results available to all partner universities.

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