University of Liverpool, Institute for Risk and Uncertainty

Founded PhD Project

Name of Project: **Optimal risk and benefit sharing and management in large energy projects**

http://liv.ac.uk/risk-and-uncertainty/postgraduate/phd/OptimalRisk.html

Supervisors: Edoardo Patelli (Engineering)
Eunyoung Moon (Economics)
James Cooper (Environmental Sciences)

with support by Jan Wenzelburger (Economics), Michael Beer (Engineering)
co-supervision adjustable to student's background/interest

Outline of Project:

Large energy projects possess an enormous economic dimension not only for the energy companies or for consortia but also for the host countries, for the society and even for associations of nations such as the European Union. In the light of this magnitude it is vitally important that these projects are successful, beneficial, sustainable and safe. This includes the two major aspects of ***risk sharing*** and ***benefit sharing*** among the parties involved, which span across various disciplines. Essentially, benefits and risks have to be considered from an economic, environmental, engineering and societal point of view. The involved parties include energy companies, banks, insurance and re-insurance companies, state and local governments, environmental agencies, the society in both a local and a global context, construction companies, service & maintenance industry, etc. This complexity requires a sophisticated multi-disciplinary approach to secure a robust balance among all parties in view of sharing risks and benefits. It is obvious that an optimum solution is often not achieved in practice as disasters such as Fukushima have shown. If benefits and risks are not appropriately distributed as in those cases, this can result in quite tragic consequences. In other cases, the consequences may rather be of an economic nature, which may lead to tax losses for a state or to inappropriate energy cost for the society. These issues do not only concern traditional energy concepts including nuclear energy, but also innovative green energy concepts such as wind and solar energy.

The project is devoted to approach this comprehensive and complex challenge in a systematic manner for both traditional and green energy concepts. It is investigated how an optimum structure and mechanism for sharing risks and benefits should look like for the different energy concepts and how they perform in the optimum set up. Eventually it is envisaged to rank the energy concepts according to their performance in the context of risks and benefits. Technically, the complex problem can be evaluated by cost-benefit analysis and policy issues related to benefits corresponding to risks can be modeled using mechanism design: relevance of a project is examined by cost-benefit analysis and how to set a fair rule for balancing risks and benefits in the project is the main concern of mechanism design.

Precisely, large energy projects typically involve a huge number of costs and benefits which differ not only in magnitude but also in risks. Cost-benefit analysis

aggregates these various costs and benefits from multiple sources into a single decision criterion in order to decide whether a project is socially worthwhile. Some modern methods such as contingent valuation are also used for evaluation of complicated aspects of interest conflicts.

Once a given project is decided to proceed, energy policies related to the project need to be considered from a benevolent social planner's perspective. Market failure such as pollution control or energy resource usage is commonly observed in energy issues due to the conflicts of interest. When individual agents' decentralized decisions do not guarantee to implement socially desirable outcomes in energy projects, a policy maker can design incentives to achieve a goal (e.g. efficiency) based on individual agents' truthful revelation of risks and benefits to the society. Government intervention such as taxation or quotas, internalizing externalities by payment, and international treaties about environmental issues are a common example of mechanism design for energy policies.

Any special features: (e.g. equipment, collaboration, industrial links, underpinning expertise)

The project requires:

(i) a sound background in systems engineering (or related disciplines e.g. energy/civil/nuclear/mechanical/electrical) combined with interest in economics and environmental sciences

or

(ii) a sound background in economics, or environmental sciences with strong interest in systems engineering/energy production and distribution.

Further, curiosity, creativity and a strong interest to work in a multi-disciplinary set-up are essential requirements**. Applicants should also have a strong background in mathematics** as well as sound skills in computer programming.

A combined education in two or more areas would be a significant advantage.

The student will join a multi-disciplinary research group at the Institute for Risk and Uncertainty (www.liv.ac.uk/risk-and-uncertainty).

Funding details: **Stipend £13,590 pa (36 months project) (paid tax-free)**

Closing date for receipt of applications: **16th September 2012** *(Please note that applications may close early once a sufficient number of applications are received)*

Restrictions on student nationality: Restricted to applications from the UK/EU

Starting Arrangements: start date as soon as possible

For further details, please send a copy of your curriculum vitae to either Dr. Edoardo Patelli (email: edoardo.patelli@liverpool.ac.uk) or Professor Michael Beer (mbeer@liverpool.ac.uk).

Further information regarding the online application process can be found at

http://www.liv.ac.uk/study/postgraduate/applying/