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## **TO MITIGATE AND/OR TO ADAPT: OPTIMAL CLIMATE POLICIES IN THE ENERGY SECTOR**

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### **Overview**

Climate change has shown to impose significant effects to our natural, social and economic systems. These actual as well as expected impacts have brought about challenges to our current energy systems to shift toward more efficient, reliable and sustainable energy systems. Mitigation has been seen as an inevitable and most effective means to reduce the likelihood of the occurrence of adverse impacts. At the same time, current energy systems are exposed to changing climate and adaptation is required to reduce the vulnerability of the system. In the long term, the chosen mitigation responses will also create changes in the whole energy system and appropriate adjustments or adaptation are needed for a smooth transition to resilient, efficient and sustainable energy systems.

Investment decisions in mitigation or adaptation will always involve uncertainties and risks. In the context of resource scarcity, investment in mitigation measures will reduce that for adaptation measures. However, the relationship between mitigation and adaptation responses will also influence the effectiveness of each chosen response. Hence, there is a concept of the optimal mix of climate policies

The paper will examine how different mixes of climate policies under assumed risk probabilities will influence the value of the chosen objectives. Firstly, this paper will identify the vulnerability of the energy system in question and the potential adaptation as well as mitigation options. Then, the combination of these options will be examined against the objectives to see the interaction between adaptation and mitigation measures, and their effects in achieving optimal climate policies for the system in question.

### **Methods**

The assessment of optimal mix of climate policies is built upon a theoretical model of Ingham, Ma and Ulph (2003). The model uses a simple model of a single social planner which can choose the optimal mix of mitigation and adaptation responses to minimise the total costs. This paper will examine the applicability of the model in the context of the energy system of interest.

### **Results**

The Ingham, Ma and Ulph model predicts that mitigation and adaptation has substitutability relationship in achieving optimal climate policies. However the model has not taken into account the local (private) benefits of adaptation which can be reaped in nearer term as opposed to the global or shared benefits of mitigation that can only be felt in longer term. The paper will look at how the incorporation of these benefits will change the optimal mix of climate policies.

### **Conclusions**

It is expected that with higher risks, investment in adaptation measures will be increased when the marginal benefit of adaptation will increase accordingly. The effects to investment in mitigation will depend on the effects of increase adaptation to the marginal benefit of mitigation. These are described as direct and indirect effects by Kane and Shogren (2000).

**References**

- Ingham, A., Ma, J., and Ulph, A.M., (2005b) "Can Adaptation and Mitigation be Complements?", *Working Paper 79, Tyndal Center for Climate Change Research*.
- Kane, S. and Shogren, J.F. (2000) "Linking Adaptation and Mitigation in Climate Change Policy", *Climatic Change*, 45 (2000), 75-102.