

# Integrated Energy and Macroeconomic Modelling

*Challenges, opportunities and risks associated with the decarbonization of a small open economy*

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## Relevance, challenges, problem or opportunity?

Denmark is in the midst of a fundamental transition towards a low carbon economy. The agreed upon policy states that this transition should be completed by year 2050. This transition will have repercussion throughout the wider economy. It is hence a challenge to evaluate what is the best strategy to accomplish this goal taking into account both what is technically feasible and economically viable. On this background it may be stated that the ideal situation for policy makers is to have access to a model that can evaluate the effect of economy-wide policies working in concert with technology- and fuel-specific measures, and that incorporate regulations as well as market-based policies (Jaccard, 2009). This is exactly the key purpose of the PhD-project. The purpose will be pursued by further developing on an existing hybrid energy macro economic model covering Denmark.

## Research questions?

1. What are the energy system and macroeconomic impacts of reforming the financing of renewable energy subsidies in Denmark?
2. What is the ideal tax system that ensures: 1. Tax revenue; 2. Economic growth; 3. Transition to low emission economy?
3. How may macro economic savings and capital formation behavior best be introduced in a hybrid energy economic model?

## Conceptual model/theory

The research approach used in the PhD is a mix of two different quantitative methodologies: That is applied energy system analysis and applied general equilibrium modelling. The former may be said to fall under a broader framework of system theory; as described further in Krook Riekkola (2015). Whereas the applied general equilibrium modelling conforms to the tradition of neoclassical economic theory in describing the economy as consisting of rational profit/utility optimizing agents.

## Expected results

Demonstrate the usefulness of hybrid energy macro economic modelling in making recommendations for policy makers concerning:

- Trade-off faced when determining the design of financing scheme for renewable energy subsidies in Denmark
- The design of the ideal tax system, taking into account the multitude of policy goals related both to energy, climate and fiscal sustainability.

Another expected result of the PhD is the development of new methodology for taking into account the interaction between investment in the energy system and the macro economic savings and capital formation behavior.

## Literature

Krook Riekkola, A. (2015). National Energy System Modelling for Supporting Energy and Climate Policy Decision-making: The Case of Sweden (Doctoral dissertation, Chalmers University of Technology).

Jaccard, M. 2009. Combining Top-Down and Bottom-Up in energy economy models, Chapter 13 in: International Handbook on the Economics of Energy, Edward Elgar, Cheltenham, UK.



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