TECHNISCHE
UNIVERSITÄT
WIEN
Vienna University of Technology

Institut für Energiesysteme und Elektrische Antriebe
Energy Economics Group (EEG)

DIPLOMARBEITSTHEMEN

Prof. Dr. Amela Ajanovic & Team

Dieses Dokument beinhaltet Diplomarbeitsthemen, die am EEG von mir angeboten werden.

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Ich freue mich auf Ihr Interesse!

Herzlichst,

Amela Ajanovic

Contact:
Associated Prof. Dr. Dipl. Ing. Amela Ajanovic
ajanovic@eeg.tuwien.ac.at

Topics for Master Theses

1. An analysis of the economic performance of electric vehicles in the EU countries depending on unsecure electricity prices

Motivation: Electric vehicles (EVs) are considered to contribute to more sustainable development of the transport sector. However, current economic performance of EVs is one of the major barriers for a broader market penetration. In spite of this, many countries have set a goal to increase a number of EVs. Moreover, different monetary and non-monetary measures are implemented with the goal to support use of EVs.

Objective: The core objective of this work is to analyze the economic performance of EVs compared to conventional cars in the EU countries, as well as to analyze impacts of policies on the market penetration of EVs. Of specific interest is also correlation between uptake of electric cars and GDP.

Method of approach: A comprehensive literature review as well as a data collection and analysis has to be conducted. An economic model simulating the effects of policies has to be developed in Excel.

2. On the economic and environmental prospects of large battery electric and fuel cells trucks compared to conventional diesel trucks

Motivation: Currently, the transport sector is one of the largest contributors to the increasing CO2 emissions. Especially trucks are an increasing problem worldwide. Heading towards more environmentally benign trucks could be an important step in the currently discussed transition towards a low carbon energy system. Hydrogen powered fuel cell trucks as well as battery electric trucks (in the following: alternative trucks) could be such environmentally benign solutions.

Objective: The core objective of this work is to analyze the economics and the CO2 balance of alternative trucks compared to convent trucks considering technical constraints and barriers such as driving range and limits of the battery. For the environmental assessment, the CO2 emissions from fuel use, as well as the embedded CO2 emissions have to be considered (life-cycle-analysis). In addition, the costs of CO2 reduction (€/kgCO2) of the alternatives has to be calculated. Furthermore, the current state of research as well as relevant pilot projects have to be documented. Finally, scenarios up to 2050 should be developed, discussing the future prospects.

Method of approach: First, the relevant literature should be reviewed, analyzing also the maturity of the technologies. A data search for the economic and environmental analysis has to be conducted.

The economic analysis should be done based on the Total cost of use (TCU) approach and the annuity approach calculating the costs per ton and km driven. First, the current state of the investment costs, fuel costs and the O&M costs of the alternative trucks compared to diesel has to be done. In addition, for electric trucks the driving distance, fuel demand and required battery size has to be considered.

The ecologic analysis should be conducted based on the LCA approach calculating the WTT, TTW and embedded emissions of car production and salvage.

Finally, the future perspectives should be analyzed using a dynamic model (e.g. in Excel). For this purpose, possibilities of technological learning, possible efficiency increases and reductions of (embedded) CO2 emissions have to be modeled.

3. Economic and environmental assessment of hydrogen fuel cells in aviation

Motivation: Although, only about 2–3% of global carbon emissions are coming from the aviation sector, the pressure to develop more environmental-friendly aircraft concepts is increasing. The major focus is currently put on short- and medium-range aircraft segments, since they are the major contributors to emissions with around two third of the total aviation's CO2 emissions. In addition to CO2 emissions, also other non-CO2 emission effects are relevant for aviation's climate impact.

Objective: The core objective of this work is to document current situation in the aviation sector and to make an economic and environmental assessment of alternative solutions for aviation in comparison to conventional aviation. Of interest are technical barriers and limitation, costs and emissions. Furthermore, the current state of research on hydrogen fuel cells use in aviation as well as relevant pilot projects have to be documented. Finally, scenarios up to 2050 should be developed, discussing the future prospects.

Method of approach: First, the relevant literature should be reviewed, analyzing also the maturity of the technologies. A data search for the economic and environmental analysis has to be conducted.

The economic analysis should be done based on the Total cost of use approach and the annuity approach calculating the costs per km driven. The economy of H2 aviation as well as corresponding emission should be compared to the conventional aviation. The ecologic analysis should be conducted based on the LCA approach calculating the WTT, TTW and embedded emissions of airplane production and salvage.

Finally, the future perspectives should be analyzed using a dynamic model (e.g. in Excel). For this purpose, possibilities of technological learning, possible efficiency increases and reductions of (embedded) CO2 emissions have to be modeled.

4. Economic and environmental assessment of the use of e-fuels in road transport

Motivation: To reach ambitioned emission reduction targets, it is necessary to increase use of alternative vehicles and fuels. Some carmakers, suppliers as well as oil and gas industry are heavily advocating for the use of so-called synthetic fuels/e-fuels for the decarbonisation of mobility. The main idea here is to decarbonise the fuel instead of engine.

Objective: The core objective of this work is to document different types of e-fuels as well as their technical and economic state of the art. Of special interest is to make an economic and environmental assessment of their use in the transport sector in comparison to conventional fuels and vehicles. Based on technological learning the future prospects in scenarios up to 2050 have to be analyzed.

Method of approach: First, the relevant literature should be reviewed and documented. A data search for the economic and environmental analysis has to be conducted.

The economic analysis should be done based on the Total cost of ownership approach and the annuity approach calculating the costs per km driven. The environmental assessment should be conducted based on the LCA approach calculating the WTT, TTW and embedded emissions of vehicle production and salvage.

Finally, the future perspectives should be analyzed using a dynamic model (e.g. in Excel). For this purpose, possibilities of technological learning, possible efficiency increases and reductions of (embedded) CO2 emissions have to be modeled.

5. An economic and environmental comparison of biomass-based synthetic natural gases

Motivation: Natural gas is an important energy carrier in the European Union and is used for electricity generation, heating, etc. However, the consumption of fossil fuels like natural gas leads to rising CO2 concentrations in the atmosphere, also known as the greenhouse gas effect. Furthermore, the EU imported large amounts of natural gas from non-EU member states and became dependent on these imports. The search for alternatives gained high interest in recent years.

Objective: The core objective of this work is to analyze the production costs and process emissions of synthetic natural gases. For SNG, various feedstocks shall be considered in the analyses as well as how policy interfaces could be justified.

Method of approach: The first step is a comprehensive literature review and data collection. An economic model has to be developed in excel. The environmental analysis should be conducted for the whole life cycle with a comprehensive life cycle assessment (LCA). Required emission values will be taken from databases like ProBas and from the country's specific electricity mix.

6. An analysis of carbon capture and utilization from an economic, environmental and energetic point of view

Motivation: The reduction of greenhouse-gas emissions and climate change mitigation is the central goal of the Paris Agreement. The problem is that the current energy systems in many countries are still based on the use of fossil fuels. Carbon capture and utilization can be used as CO2 mitigation tool and act as compensation for sectors with hard-to-abate emissions. However, for the broader implementation, it is important to reach economic competitiveness.

Objective: The core objective of this work is to analyze costs compared to the benefits. The meaning of carbon capture for the energy system shall be critically discussed in this work.

Method of approach: Comprehensive literature research on the energy consumption, economic aspects and applications of carbon capture and utilization. The investment costs for existing carbon capture technologies, as well as efficiencies and capture rates shall be analyzed. An excel model has to be developed for the calculation of selected use cases.