



DIPLOMARBEITSTHEMEN

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Vorwort

Diese Sammlung in diesem Dokument beinhaltet einen Überblick über einen Teil jener Diplomarbeiten die am EEG angeboten werden. Die Hauptbetreuung der Arbeiten in diesem Katalog übernimmt Prof. Reinhard Haas in Kombination mit den Postdocs und Assistenten die den folgenden Arbeiten zugeordnet sind.

Wie Sie dem Inhaltsverzeichnis entnehmen können, sind die Arbeiten spezifischen Themengebieten zugeordnet. Sie werden im Rahmen von europäischen oder nationalen Projekten bearbeitet und bieten somit eine gute Möglichkeit erste Erfahrung in der Projektarbeit zu gewinnen. Durch die Bindung an die Projekte, können diese Diplomarbeiten nur einen kurzen Zeitraum angeboten werden und gehen mit der Erwartung einer zeitgerechten Durchführung einher.

Wenn Sie an einer Diplomarbeit interessiert sind, beachten Sie bitte folgendes:

- Sie besitzen die wichtigsten Kenntnisse der Energiewirtschaft.
- Sie haben die vom Institut angebotenen Lehrveranstaltung besucht.
- Sie haben einen Großteil Ihrer Prüfungen absolviert um eine rasche Bearbeitung Ihrer Diplomarbeiten zu garantieren.

Falls Sie interessiert sind, können Sie jederzeit den zugeordneten Betreuern eine Email schreiben (klicken Sie dazu auf den Namen). Die höchste Wahrscheinlichkeit einer schnellen Antwort haben Sie, bei einem gleichzeitigen Anschreiben aller aufgelisteten Personen. Alternativ können Sie auch am Institut vorbeikommen.

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1 Erneuerbare Energie / Renewable Energy

1.1 Analyse der Förderstrategien erneuerbarer Energien in den USA

An analysis of promotion strategies for renewable energy sources (RES) (Renewable portfolio standards) in the USA.

■ **Motivation:** Renewables are considered to contribute to an environmentally benign electricity supply. Yet due to high costs still subsidies are necessary

■ **Objective:**

- Analysis of efficiency and effectiveness of various Renewable portfolio standards in the USA
- Comparison with European countries (data available)

■ **Method of approach:**

- Analysis of quantities and costs of various Renewable portfolio standards in the USA
- Creation of a database and a simple model in MATLAB or EXCEL

■ **Supervisor:** [Dr. Gustav Resch](#) , [Prof. Reinhard Haas](#)

1.2 Analyse der Wechselwirkung von Förderstrategien für Erneuerbare Energieträger vs CO2-Emissionshandel

An analysis of interactions between promotion strategies for renewable electricity (RES-E) and carbon emission trading countries

■ **Motivation:** Renewables are considered to contribute to an environmentally benign electricity supply. There is discussion to what extent it impacts CO2-emission trading. And there are critical voices that claim that promotion of renewables distorts the CO2-emission trade.

■ **Objective:**

- How does currently the promotion of renewables influence the price for CO2 certificates?
- Analysis of efficiency and effectiveness of various promotion schemes for RES-E in Europe and how it impacts the CO2-emission trading
- How should emission trading systems and promotion strategies for renewables be linked?
- How would corresponding optimal allocation plans look like e.g. for Austria and Germany?

■ **Method of approach:**

- Analysis of quantities and costs of various promotion schemes for RES-E and the parallel CO2 emission allocation plans
- Creation of a database and a simple model in MATLAB or EXCEL

- Comprehensive Data collection and analyses, Literature review, develop a simple market model (static and dynamic) in Excel or MATLAB and conduct econometric approaches.

■ **Supervisor:** [Dr. Gustav Resch](#) , [Prof. Reinhard Haas](#)

1.3 Ökonomische, ökologische und energetische Bewertung verschiedener Biomasse-Umwandlungstechnologien und biomassebasierter Energieträger

Economic, ecological and energetic assessment of different biomass technologies, energy carriers and fuels

■ **Motivation:** The use of biomass as a renewable energy carrier is of high relevance for the future energy system. Increasing demand for biomass in the EU-28 (and other world regions) and the continuing exploitation of locally available biomass resources, also puts economics and environmental aspects in the core of the discussion.

■ **Objective:**

- The core objective of this work is to assess the economic, ecologic and energetic properties (costs, greenhouse gas emissions, specific energy consumption etc.) of various biomass conversion technologies and fuels.
- Identify the most efficient ways/ energy carriers for the use of biomass by end use.
- The focus of the assessment should be on different types of biomass technologies and fuels (e.g. wood chips, biogas, pellets, SNG, liquid biofuels).
- Analysis whether TL (Technological Learning) did take place?
- The results should provide insight into the economic feasibility and the ecologic and energetic efficiency of biomass supply chains under various framework conditions.

■ **Method of approach:**

- Literature and internet research (cost data, specific emissions and energy consumption)
- Analyses of cost effectiveness
- Implementation of a computer model / calculation tool suitable for analyzing different scenario settings (transport distances, fuel types, supply chains etc.)

■ **Supervisor:** [Prof. Reinhard Haas](#) , [Dr. Lukas Kranzl](#)

2 Energienachfrage / Energy demand models

2.1 Ökonometrische Untersuchung des Stromverbrauchs unterschiedlicher Länder

Econometric analysis of the electricity consumption of different countries

■ **Motivation:** Um den Einfluß von Preisen, Einkommen und anderen Parametern auf den Stromverbrauch zu ermitteln, werden ökonometrische Modelle verwendet. Speziell im Strombereich gibt es allerdings auch möglicherweise beträchtliche Unterschieden zwischen Regionen und Ländern, z.B aufgrund unterschiedlicher Kulturen und Life-styles.

■ **Aufgabenstellung:** Im Rahmen dieser Arbeit ist ein geeignetes Statistikprogramm zu nutzen um eine ökonometrische Panel data –Analyse für den Stromverbrauch in einzelnen EU-Ländern durchzuführen. Dabei geht es eben neben den Effekten innerhalb eines Landes auch um Unterschiede zwischen den einzelnen Ländern.

■ **Methode:** Die Daten sind weitgehend vorhanden, einige Zusatzrecherchen sind aber notwendig. Auswahl und Anwendung eines geeigneten Statistikprogramms ist eigenständig durchzuführen.

■ **Betreuer:** [Prof. Reinhard Haas](#)

2.2 Pooled vs. Panel Data Analyse des Energiekonsums unterschiedlicher Länder weltweit

Pooled vs. Panel data analysis of energy consumption in various countries worldwide

■ **Motivation:** Um den Einfluss von Preisen, Einkommen und anderen Parametern zu bestimmen kommen ökonometrische Analysen zum Einsatz. Allerdings kann es - möglicherweise - beträchtliche Unterschiede zwischen Regionen und Ländern geben.

■ **Aufgabenstellung:** Im Rahmen dieser Arbeit ist ein geeignetes Statistikprogramm zu nutzen, um eine ökonometrische Panel-Data-Analyse für den gesamten Energieverbrauch ausgewählter Länder weltweit durchzuführen. Dabei geht es eben neben den Effekten innerhalb eines Landes auch um Unterschiede zwischen den einzelnen Ländern. Das heißt, es geht darum herauszufiltern, welche Effekte in den Ländern gleich sind und welche unterschiedlich. Ein spezifischer Aspekt ist, ob zwischen einzelnen Ländern signifikantere Einkommenselastizitäten ermittelt werden können als innerhalb einzelner Länder. Weiters ist das Modell auf Strukturbrüche zu testen.

■ **Methode:** Die Daten sind weitgehend vorhanden, einige Zusatzrecherchen sind aber notwendig. Auswahl und Anwendung eines geeigneten Statistikprogramms ist eigenständig durchzuführen. Weiters wird die Durchführung der Pooled Data- im Vergleich zu Panel Data Analyse mit klarer Dokumentation der schrittweisen Vorgangsweise verlangt.

■ **Betreuer:** [Prof. Reinhard Haas](#)

3 Energiemärkte und -preise / Energy Markets and Energy Prices

3.1 Ein Vergleich von Energiesubventionen in unterschiedlichen ökonomischen und gesellschaftlichen Systemen

A comparison of energy subsidies across different economic and social systems

■ **Motivation:** Often it is argued that energy subsidies warp the energy prices and thus impede completion, energy intensity reductions and many other salient energy-systems improvements. However, one third of the global population cannot afford modern energy services and they are a pre-requisite for human development and well being. Subsidies to a part help make some minimal levels of energy services affordable and indispensable in some sectors such as transport and agriculture. Yet, often it is the rich who benefit more from energy subsidies than the poor who are supposed to be targeted. All told, global energy subsidies are estimated to be in the regions between 300 and 1000 billion USD per year, a sum comparable to the total annual energy investments. The main objective is to collect from the literature estimates of subsidies across different countries and regions based on the published literature and undertake a comparative analysis of the benefits and disbenefits generated by energy subsidies.

■ **Objective:** Collect energy-subsidies data from different sources in the literature:

- Collection of data on subsidies, costs and prices fuels and electricity across the world.
- Assessment of economic consequences of energy subsidies.
- Analysis of possible alternatives to energy subsidies.
- Comparison of subsidies with other energy-price instruments such as feed-in tariffs.

■ **Method of approach:** Literatureresearch, collection of energy price data in different countries and sectors, analysis or resulting prices and economic and social implications.

■ **Supervisor:** [Dr. Gustav Resch](#) , [Prof. Reinhard Haas](#)

3.2 Eine Analyse des Designs und der Merkmale von Kapazitätsmärkten in Spotmärkten anhand von weltweit ausgewählten Ländern (USA, Europa, Asien, Australien ...)

An analysis of capacity markets design and major features in spot markets in selected countries world-wide (USA, Europe, Asia, Australia ...)

■ **Motivation:** In recent years in many countries the idea of capacity payments for power generators in addition to revenues from the energy-only market, has gained attention in the energy

economic discussion, e.g in Germany, USA, France and UK. The reason for this is that a significant number of market players claim that the long-term reliability of the electricity system is at risk, as long as there is no politically organized mechanism for capacity payments in place. Indeed, however, in many countries such CPs have been introduced.

■ **Objective:** The goal is to document currently implemented capacity mechanisms world-wide in a systematic way and to analyse the lessons learned regarding costs, excess capacities and so on. This analysis should mainly be based on literature research.

■ **Method of approach:** Systematic approach for analysing different features of CM, Analysis of historical data Econometric model, Regression analysis

■ **Supervisor:** [Prof. Reinhard Haas](#)

3.3 Ein Vergleich verschiedener Ansätze zur Modellierung des Strompreises in day-ahead-Märkten inkl. Analyse des Einflusses von temporär großen Mengen Strom aus erneuerbarer Energie auf die Preisbildung

An analysis of different approaches for modelling electricity prices incl. the impact of Renewable Energy Sources (RES-E) on prices in day-ahead electricity markets

■ **Motivation:** Modelling future electricity prices is currently one of the most challenging tasks in energy economics and different methods of approach exist. In addition in recent years temporarily large quantities of renewable electricity have influenced the wholesale electricity market prices.

■ **Objective:**

- To review the literature
- To compare different approaches and their major impact parameters
- To identify a new approach based on residual load and to verify it for Austria/Germany

■ **Method of approach:**

- Conduct a comprehensive literature and internet survey
- Data collection and putting together a database for Germany and Austria
- Econometric approach
- Compare/use use a fundamental approach (Price=marginal costs) to model the price in the electricity market on an hourly basis based on scarcity
- Creation of a simple model in MATLAB or EXCEL.

■ **Supervisor:** [Prof. Reinhard Haas](#)

4 Energieverbrauch für Heizen, Warmwasser und Kühlen / *Energy Consumption for Space, Water Heating and Cooling*

4.1 Vergleich der zentralen- gegenüber der dezentralen Wärmeversorgung verschiedener Regionen und Klassifizierung von Eignungsgebieten in Österreich und ausgewählten europäischen Ländern.

Comparison of centralized vs. decentralized heat supply of different regions and classification of these regions in Austria and selected EU countries

■ **Motivation:** District heating is considered to be a cheap method for the reduction of CO₂ emissions. Therefore both the European Union as well as local authorities seek further expansion of existing district heating systems or construct new ones in feasible areas. A classification of regions into certain types allow for a first estimation of the feasibility of a district heating system.

■ **Objective:**

- Identify the relevant parameters for the installation of a district heating network (heat density, plot ratio, sold heat, structure of costumers, linear heat density, market share of DH,...) and evaluate their thresholds for the feasibility of a district heating system vs. local heat supply technologies.
- What are the relevant parameters for the installation of a district heating system? Technical and economical parameters, barriers or conditions in favor of DH systems. To which extent will the future development of these parameters (e.g. heat density) impact the result?
- Develop a model to compare the feasibility of central vs. local heat supply structures
- Classify areas according to the evaluated parameters into different types feasible for district heating or for local heat supply

■ **Method of approach:**

- Literature review of relevant parameters for the economic feasibility and of existing classifications of district heating systems;
- Develop a model to compare central vs. local heat supply technologies
- Sensitivity analysis of the relevant parameters
- Classification of regions into district heating areas or areas suitable for decentralized heat supply

■ **Supervisor:** [DI Richard Büchele](#) , [Dr. Lukas Kranzl](#)

4.2 Analysen zur Nutzung industrieller Abwärme

Analysis on the use of industrial excess heat

■ **Motivation:** The use of industrial excess heat increases the efficiency of the overall energy system remarkably. However, many aspects of economic efficiency and potentials for its use still remain unclear. Within this topic different research questions can be worked on in course of the master thesis, some of them are stated in the following.

■ **Objective:**

- Analyse the influence of different load profiles and temperature levels of available/usable excess heat streams on the economic efficiency of excess heat projects on the basis of detailed technical modelling of excess heat systems
- Derive comprehensive cost data for excess heat integration projects for different types of projects (internal vs. external, combination of heat sources and sinks) and show the sensitivity to various influencing factors

■ **Method of approach:**

- Literature research
- Technical modelling of excess heat systems on hourly basis including a storage tank
- Techno-economic analysis
- Sensitivity analysis

■ **Supervisor:** [Dr. Lukas Kranzl](#) , [Prof. Reinhard Haas](#)

5 Energieverbrauch im Verkehr / *Energy Consumption in Transport*

5.1 Eine Analyse der historischen Entwicklung des grauen und direkten Energie-/Stromverbrauchs und der CO2-Emissionen im Verkehrsbereich

An analysis of the historical development of the embedded and direct energy and CO2-emissions of transport

■ **Motivation:** Transport is the sector with the fastest growing energy consumption and CO2-emissions. The share of the embedded energy consumption and CO2-emissions is of specific relevance.

■ **Objective:**

- The direct as well as the embedded energy consumption and the related CO2-emissions have to be calculated including embedded energy of infrastructure.
- Which role played efficiency improvement
- Investigation of embedded energy saving potentials as well as reduction of the related CO2-emissions of transport.
- Analysis of different transport modes (road, rail, waterways and overseas transport) and fuels.

■ **Method of approach:**

- Conduct a comprehensive literature and internet survey.
- Data collection and creation of a database.
- Creation of a simple model in MATLAB or EXCEL.
- Maybe conduct a simple life-cycle analyses with GEMIS.

■ **Supervisor:** Priv.-Doz. Dr. Amela Ajanovic , Prof. Reinhard Haas

5.2 Ökonomische, ökologische und energetische Bewertung verschiedener Kategorien von Biokraftstoffen

Economic, ecological and energetic assessment of different categories of biofuels

■ **Motivation:** The discussion on the promotion of biofuels is ambiguous: on the one hand benefits like reduction of greenhouse gas emissions and increase of energy supply security are expected, on the other hand low effectiveness with respect to reducing greenhouse gas emissions and high costs are being criticized.

■ **Objective:**

- The core objective of this work is to assess the economic, ecologic and energetic properties (such as costs, greenhouse gas emissions, specific energy consumption, etc.) for biofuels 1st and 2nd generation
- Document biofuels use in different countries/regions
- Identify major drives and barriers
- Document and analyze policy framework and development of investments
- Analysis whether TL (Technological Learning) did take place?
- Prospects for the 2nd generation biofuels
- The results should provide insight into the economic feasibility and the ecologic and energetic efficiency of biofuels under various framework conditions.

■ **Method of approach:**

- Conduct a comprehensive literature and internet survey.
- Data collection and creation of a database.
- Creation of a simple model in EXCEL.

■ **Supervisor:** Priv.-Doz. Dr. Amela Ajanovic

5.3 Optimizing the interaction between a decentralized PV-system, a battery storage and an Electric vehicle

■ **Motivation:** Electric vehicles as well as Photovoltaics electricity are considered to contribute to an environmentally benign future electricity system. However, it is not yet clear how these technologies could interact in an optimal way.

■ **Objective:** The core objective of this work is to analyse for a single-family dwelling how the own consumption of a household of electricity from a PV system including a Electric Vehicle can be economically optimized, considering with and without a stationary battery storage. Different sizes of the PV system are analysed.

Finally the analysis has to be conducted in a dynamic framework taking into account possible Technological Learning effects of the EV, the battery and the PV system.

■ **Method of approach:** A combination of a static and a dynamic model has to be developed. The static model simulates on an hourly basis over a year the solar insolation, the corresponding electricity generation from the PV system, the charging demand from the EV and the possibilities of the stationary battery. The dynamic model considers the possible Technological Learning effects of PV, the battery and the EV.

In addition, a comprehensive data collection and analysis has to be conducted as well as a literature review. The simple simulation market model (static and dynamic) has to be developed in Excel or MATLAB.

■ **Supervisor:** Priv.-Doz. Dr. Amela Ajanovic

5.4 An analysis of the effects of policies for promoting Electric Vehicles (world-wide)

■ **Motivation:** Electric vehicles (EVs) are considered to contribute to an environmentally benign future electricity system. Targets for increasing their number exist in different countries and several policies for promoting Electric Vehicles are implemented in different countries.

■ **Objective:** The core objective of this work is to analyse which monetary and non-monetary promotions systems for EVs exist in selected countries (world-wide) and what were their effects on the market penetration of EVs.

■ **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 or MATLAB.

■ **Supervisor:** [Priv.-Doz. Dr. Amela Ajanovic](#)

5.5 An analysis of the development of indicators in the transport system in selected countries

■ **Motivation:** Indicators (e.g. CO₂/km driven, cars/GDP) are used to assess the effects of prices, policies in different sectors.

■ **Objective:** The core objective of this work is to conduct analyses of indicators and impact parameters on energy consumption and CO₂ emissions in the transport sector and to analyse their dynamic development from about 1990 to 2016.

■ **Method of approach:** A comprehensive literature review as well as a data collection and analysis has to be conducted. A database (ODYSSEE) is already available and can be used. A model has to be developed in Excel.

■ **Supervisor:** [Priv.-Doz. Dr. Amela Ajanovic](#) , [Prof. Reinhard Haas](#)

6 Energiepolitik / *Energy policies*

6.1 An analysis of the effects of policies in the energy system (world-wide)

■ **Motivation:** In most countries (world-wide) several energy policies are implemented in different countries, taxes, subsidies, standards.

■ **Objective:** The core objective of this work is to analyse which major policies were implemented in major countries since the 1970s and what their effects were.

■ **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. Some databases e.g. ODYSSEE are already available.

■ **Supervisor:** [Prof. Reinhard Haas](#)

6.2 An analysis of the maximal/optimal market penetration of PV in different countries

■ **Motivation:** Electricity from PV systems is promoted in many countries. However, PV generates most electricity in summer. Over a year it is distributed quite uneven

■ **Objective:** Analysis of the maximal/optimal market penetration of PV in different countries (Austria, Germany, Nordic, Italy, Africa . . .)

■ **Method of approach:** Analysis on an hourly base over a year (8760 hours) using demand profiles and solar insolation numbers. Creation of a database and a simple model in EXCEL.

■ **Supervisor:** [Prof. Reinhard Haas](#)

6.3 Eine (weltweite) Analyse der Effizienz und der Effektivität handelbarer Zertifikate zur Förderung von Strom aus EET

A (world-wide) analysis of the efficiency and effectiveness of tradable certificates for electricity from Renewable energy sources

■ **Motivation:** Electricity from renewables is promoted in many countries. One instrument to do this are tradable Green Certificates.

■ **Objective:** How effective (deployed quantities) and efficient (costs) are trading systems in different countries? Which role play the potentials of different sources (hydro, wind, biomass)

■ **Method of approach:** Analysis of quantities and costs of various Renewable portfolio standards in the USA. Creation of a database and a simple model in EXCEL.

■ **Supervisor:** Prof. Reinhard Haas

6.4 Eine (weltweite) Analyse der Effizienz und der Effektivität von Ausschreibungen zur Förderung von Strom aus EET

A (world-wide) analysis of tendering/bidding systems for electricity from RES

■ **Motivation:** Electricity from renewables is promoted in many countries. One instrument to do this are tendering/bidding systems.

■ **Objective:** How effective (deployed quantities) and efficient (costs) are trading systems in different countries? Which role play the potentials of different sources (hydro, wind, biomass)?

■ **Method of approach:**

- Analysis of quantities and costs of various Renewable portfolio standards in the USA
- Creation of a database and a simple model in MATLAB or EXCEL

■ **Supervisor:** Prof. Reinhard Haas

6.5 Perspektiven der Direktvermarktung von Ökostrom in Österreich und Deutschland

Perspectives of direct marketing of green electricity in Austria and Germany

■ **Motivation:** Renewables are considered to contribute to an environmentally benign electricity supply. Of special interest in this context is how RES-E can be “promoted“ w/o subsidies. What happens to plants which do no longer get subsidies?

And currently there are increasing amounts of RES-E marketed directly (-> PPA, purchasing power agreements).

■ **Objective:** To analyse under which conditions it is attractive for a RES-E generator to sell electricity on non-subsidized markets

■ **Method of approach:**

- Analysis of existing business models for direct marketing in AT and DE currently.
- Develop a model under which conditions it is attractive for a RES-E generator to sell electricity on non-subsidized markets

■ **Supervisor:** Prof. Reinhard Haas , Dr. Gustav Resch

7 Extern