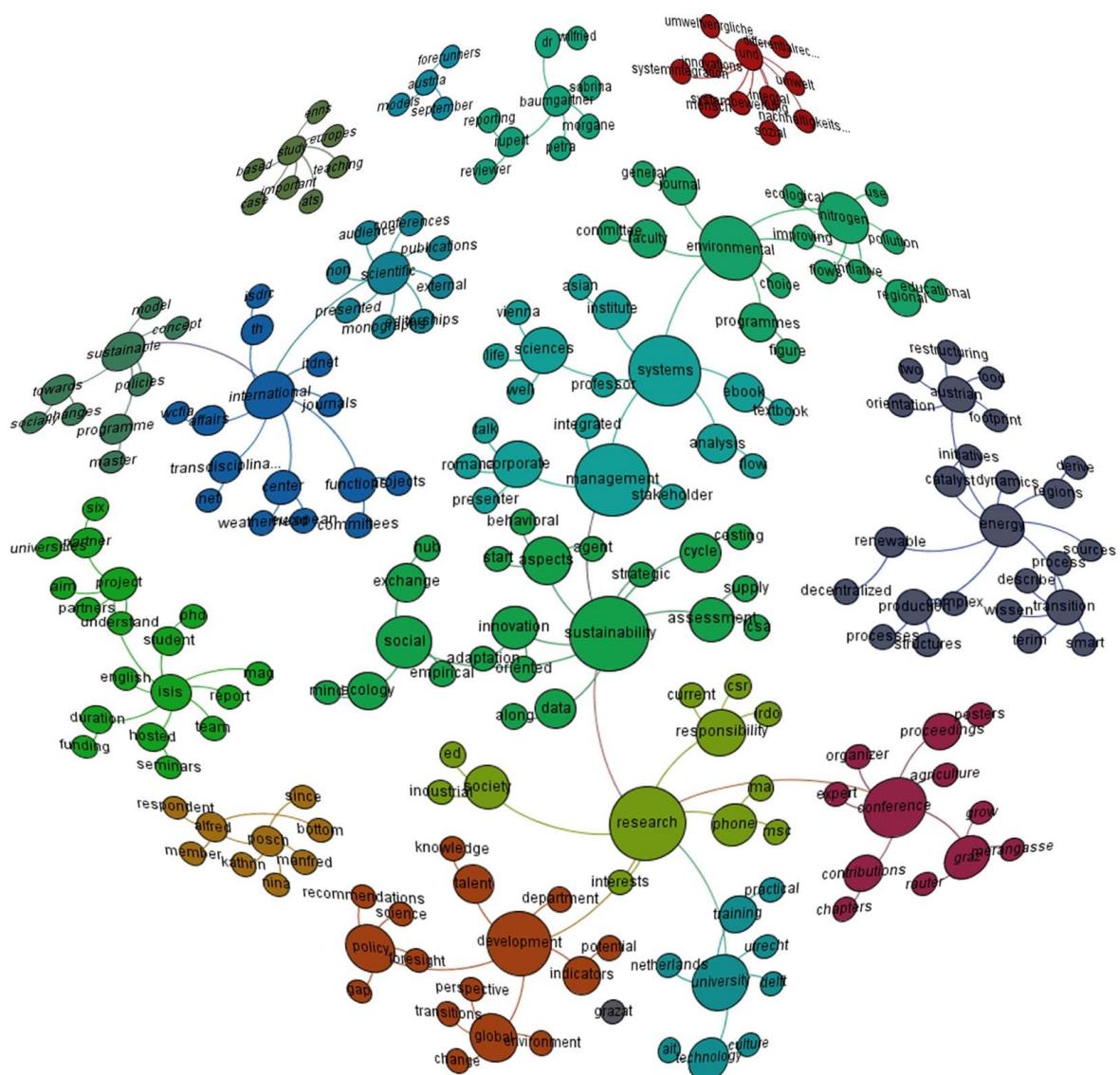


# Annual Report 2014

Institute of Systems Sciences, Innovation and Sustainability Research



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# ISiS

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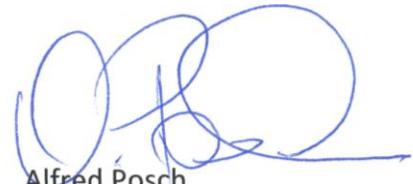
The image on the front cover shows a contextualized frequency distribution of the terms used in the ISIS annual report of 2013. For each of the 50 most frequently used words in this report the most frequent preceding and the most frequent subsequent words were selected and again checked for context (stop words excluded). Links between words indicate adjacencies. The ensuing network was analyzed in respect to betweenness-centrality of nodes (indicated by size) and modularity (indicated by color).

## Editorial

Environmental system sciences are by nature interdisciplinary. In this respect, the year 2014 marks an important milestone for ISIS: Together with colleagues from four different faculties of the University of Graz, ranging from philosophy to physics, we started the doctoral programme “Climate Change – Uncertainties, Thresholds and Coping Strategies”, funded by the Austrian Science Fund. This doctoral programme institutionalizes our dedication for interdisciplinary research and teaching at ISIS, and aligns perfectly with the other externally funded research projects, as well as the study programmes at ISIS. Our broad range of expertise within ISIS allows us to significantly contribute to this new doctoral programme, and makes ISIS a focal institute for addressing complex sustainability-related issues. Concerning our expertise, it was crucial for our profile to fill the professorship in system sciences: Prof. Füllsack succeeded to build up a highly competent team that significantly enlarges our repertoire of research methods for modelling complex systems and thus to gain a better understanding of the role of human activities in global climate and environmental change.

A short glance on the statistics shows that research and teaching at ISIS is indeed a fruitful one: In 2014 we published an impressive number of 22 articles in renowned scientific journals, while the number of conference papers and proceedings stayed stable. We were leading or contributing to 12 different research projects, all of them addressing crucial issues on the transition towards a sustainable future. The 18 PhD projects described in this annual report make us confident that Nina Braschel’s award of excellence for her outstanding dissertation was only the starting point of a series of comparable success stories. The number of enrolled bachelor and masters students in the field of environmental system sciences is already above 1,700 across all subject foci. In 2014 alone, 45 master theses were supervised at ISIS. Finally, ISIS is also heavily engaged in the transfer of scientific findings to the public. Students and lecturers of ISIS significantly contributed to the organization of the “Restl-Festl” which helped to raise public awareness regarding food waste prevention.

Such achievements are the result of our strong commitment to sustainability and to high quality teaching and research that addresses complex real-world problems. But most importantly, it is the outcome of an excellent and highly motivated team, embedded in a supportive national and international network. We hope that this annual report contributes to foster this network and leads to additional collaborative links.

  
Rupert J. Baumgartner  
Alfred Posch

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# 1 THE INSTITUTE

## 1.1 Mission statement

The Institute of Systems Sciences, Innovation and Sustainability Research is investigating possibilities for the transition towards a more sustainable world. Therefore, we study transition, innovation, and adaptation processes within human-environment systems, with a focus on firms and regions. We base our research on systems sciences, innovation and transition sciences as well as on sustainability science, and develop inter- and transdisciplinary methods to analyse and model human-environment systems, develop scenarios and transition pathways, and assess regulatory strategies.

ISIS is characterized by the disciplinary diversity of its members. Highly motivated researchers originating from diverse fields of natural, social and formal sciences collaborate along real-world problems.



Figure 1: The ISIS-team

ISIS is unique in several ways:

- Scientific work focuses on three central topics: systems sciences, innovation and transition sciences, as well as sustainability science and management.
- It is open to external collaboration with scientists from social as well as natural sciences.
- The transdisciplinary research focus facilitates high quality applied research and leads to strong collaborative ties with regional stakeholders and with business and industry.
- Research projects apply a mix of both qualitative and quantitative approaches.
- Offering one of the few curricula on Environmental Systems Sciences, ISIS grew into additionally coordinating two international joint master's programmes.
- ISIS is well embedded in international networks in both teaching and research.

ISIS is a part of the Faculty of Environmental, Regional and Educational Sciences and features a broad interface within the faculty as well as beyond. Together with the “Wegener Center” ISIS plays a central role within the university’s research core area “Environment and Global Change”.

## 1.2 Faculty and Staff members

### Professors



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Head of ISIS, Vice Dean at the URBi Faculty  
Professor for Sustainability Management

*Research Interests:* Corporate Sustainability, CSR, Strategic Management, Life Cycle Analysis, Industrial Ecology, Management systems, Sustainable Supply Chain Management, New Business Models.



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*Research Interests:* Systems, Complexity, Networks, Games and Computational Theory, Work (History, Sociology, Economy, Philosophy), Computer-Based Modelling and Simulation.



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Professor for Systems Sciences, until February 2014.

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Vice Head of ISIS, Dean for studies at the URBi Faculty  
Academic coordinator of the International Joint Master programme in Sustainable Development.

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Since October 2011 also guest-professorship at Harvard University, U.S.A

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## 2 RESEARCH PROJECTS AND ACTIVITIES

### 2.1 Research profile

Research at ISIS is based on **three pillars**: systems sciences, innovation and transition research, and sustainability research. By combining these three science fields, we seek to enhance the ability of human-environment systems to deal with global change.

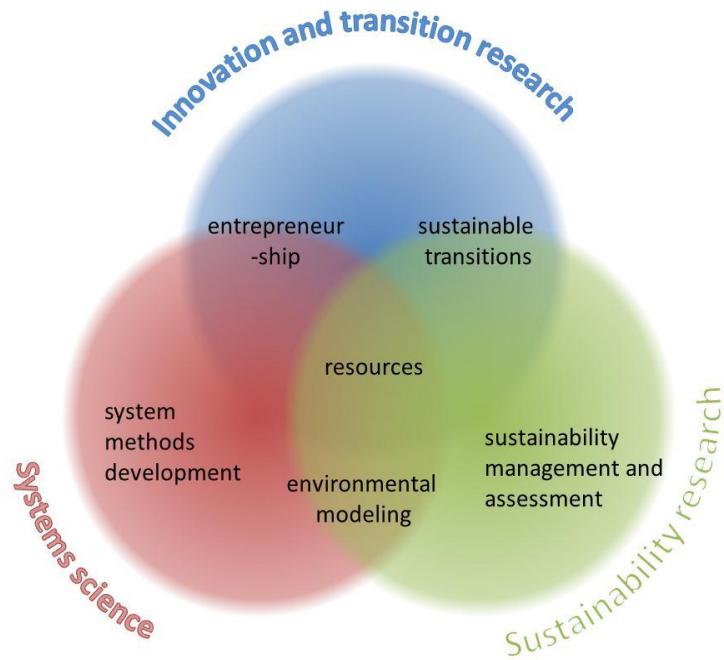


Figure 2: Science fields of ISIS

**Systems sciences.** Systems modelling (e.g. agent-based modelling or system dynamics) and environmental systems assessment provide a better understanding of different kinds of human-environment systems and their adaptation processes to challenges of global change. We are engaged in system methods development, improving computer-based (multi-agent) simulations of systems, in particular of complex adaptive systems. Our investigations include environmental modelling, covering global biogeochemical cycles, like the nitrogen cycle. Special emphasis is put on the interaction between physical and social systems in order to develop concepts and strategies for sustainable development.

**Innovation and Transition research.** Management of innovations at different levels is a significant challenge for the transition towards sustainable development. It is our goal to gain insight into innovation processes for new products, services, and technologies, but also into transition processes in society, organizations, and sectors, like the energy sector. Therefore, it is necessary to generate an understanding of logics and patterns of human decision making and action. On this basis, we can develop inter- and transdisciplinary concepts for supporting decisions that influence sustainability, and we can help initiate sustainability-oriented transition, innovation and adaptation processes in a variety of human-environment systems.

**Sustainability research.** Regions and corporations are important actors and entities for sustainable transitions. Thus, we investigate systems and processes for sustainability management and corporate social responsibility (CSR) initiatives at corporate level including the value chains and the regional level. Key aspects include developing environmental evaluation and controlling concepts and methods such as life-cycle-assessment (LCA), strategic management, corporate sustainability management and strategies, industrial ecology, integrated management systems, and management of resources (like waste or energy).

We are currently conducting research projects in the fields of regional and organizational energy systems, resources and waste, and sustainability management and assessment.

*Regional and Organizational Energy Systems* deal with the following questions: Which actors and what factors support or prevent the development of energy regions or the innovation and adoption of energy efficient technologies? How can these development processes be simulated? What policies support the creation of new and successful advancement of energy regions or the innovation and implementation of new technologies?

*Resources and Waste* considers the following questions: Which parameters lead to sustainable management of resources and waste? Which control mechanisms play a role? How can resource-waste systems be optimized from an environmental, social and economic point of view? How can nitrogen and GHG flows in agriculture be assessed and which strategies to optimize these flows are applicable?

*Sustainability Management and Assessment* responds to the following questions: How can measures for the implementation of sustainable strategies in cooperation with stakeholders be developed and evaluated? How can sustainability aspects be integrated into corporate leadership? What management tools are appropriate for (corporate) sustainability management? How can sustainability performance of organizations be evaluated? How can sustainability aspects integrated into supply chain management? How can the sustainability performance of supply chains be measured?

## 2.2 Research Projects

### 2.2.1 TERIM - Transition Dynamics in Energy Regions: An Integrated Model for Sustainable Policies

Energy regions are regional initiatives, which usually envision energy self-sufficiency by using regional renewable energy sources and building a decentralized energy infrastructure. Therefore, they provide one answer for climate change mitigation and adaptation. The aim of this project is to understand and model socio-technical transitions in Austrian energy regions to derive policy recommendations for establishing new, supporting current, and maintaining successful transitions of energy regions. In doing so, we develop a simulation model, which includes an energy flow model, depicting the development and potential for energy production at a regional level, and a behavioural model, studying the impact of policies, social norm and culture on stakeholders' investment and energy consumption decisions. The results are concrete energy policy recommendations at a regional and national scale.

Two Austrian energy regions *ökoEnergieland* and *Energieregion Weiz-Gleisdorf*, which show significant differences in their initial conditions, applied strategies and transition processes, have been selected as case study regions. Both regions have been awarded several times in national and international competitions.

Figure 3 shows how stakeholder perceptions and decision-making affect through their action the environmental system, here resources and energy flows. The changes in the environmental system, in turn, are perceived by the stakeholders, who balance the perceived effect with the goals they want to reach. This balance leads to new actions. The human-environment interaction is influenced by external boundary conditions, such as fuel prices, subsidies, etc.

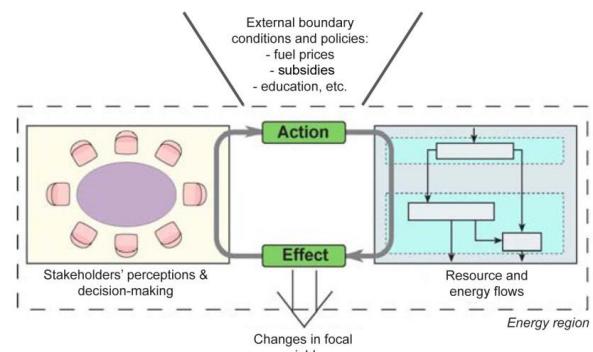


Figure 3: The TERIM Project

The main objectives of this project are to simulate the transition dynamics of energy regions and derive policy recommendations. Specifically, we...

- ...analyse the transition dynamics in two Austrian energy regions from their establishment until today.
- ...develop an integrated simulation model for studying transition dynamics in energy regions including interrelations and feedbacks between the social system and the energy infrastructure, as well as the impact of policies on individual human behaviour.
- ...derive policy recommendations for Austrian policy makers.

**Project team at ISIS:** Ao.Univ.-Prof. Dr. Alfred Posch & Univ.-Prof. Dr. Claudia R. Binder

Mag. Maria Hecher, Dipl.-Geogr. Alessandra Goetz

**Project partners:** University of Munich, Delft University of Technology, European Centre for Renewable Energy Güssing, Energieregion Weiz-Gleisdorf

**Duration:** Apr. 2011 – Mar. 2014

**Funding:** Austrian Climate and Energy Fund (ACRP Program)



## 2.2.2 Farm-CLIM – Farming for a Better Climate by Improving Nitrogen Use Efficiency and Reducing Greenhouse Gas Emissions

FARM-CLIM assesses nitrogen (N) and greenhouse gas (GHG) fluxes in Austrian agriculture and proposes measures for improvement. Those measures will undergo an economic assessment. The IPCC default emission factor for soil nitrous oxide ( $N_2O$ ) emissions will be reviewed and improved including the development of regional concepts to implement mitigation measures. IPCC reporting will be improved and uncertainties be reduced. FARM-CLIM covers the topic in a multi- and interdisciplinary approach including nationally and internationally highly recognised experts from science, reporting and commercial farming. The inclusion of the stakeholders' views at a very early project state will contribute significantly to closing the science-policy gap in the field of climate-friendly farming. Specifically, the project aims to:

- Optimize N use in Austrian agriculture
- Minimize N and GHG losses to the environment
- Identify intervention points in agriculture which are relevant for a general N and GHG strategy
- Develop a basis on which guidelines on recommendations for agricultural advisory services on potential optimization measures and their economic impact can be developed.
- Close the science-policy gap on the possibilities to optimize N use and minimize GHG losses

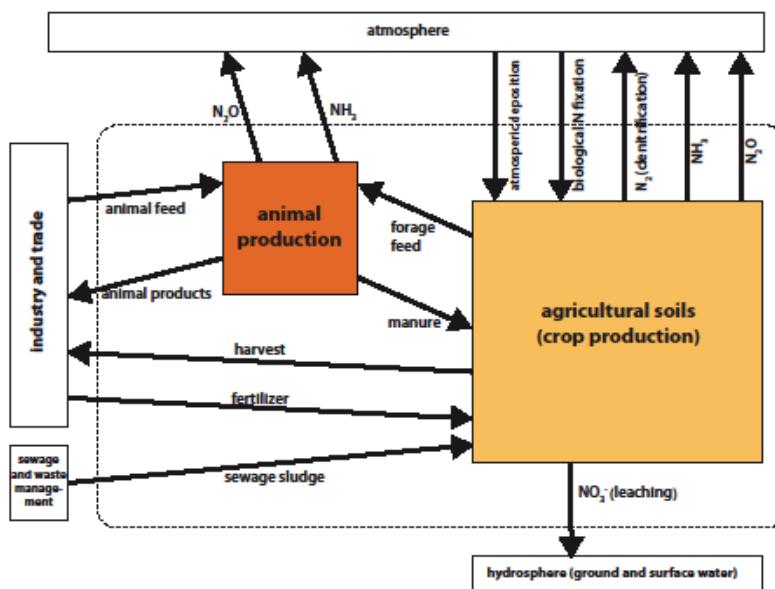


Figure 4: Nitrogen flows in the agricultural sector

**Project team at ISIS:**

Univ.-Prof. Dr. Wilfried Winiwarter, Dipl.-Ing. Andrea Schröck

**Project partners:**

University of Natural Resources and Life Sciences (Vienna),  
Federal Environmental Agency (Umweltbundesamt, Vienna)  
Austrian Agency for Health and Food Safety (AGES, Vienna),  
Chamber of Agriculture (Lower Austria), Agricultural Research  
and Education Center (Raumberg-Gumpenstein)

**Duration:**

2012 – 2014

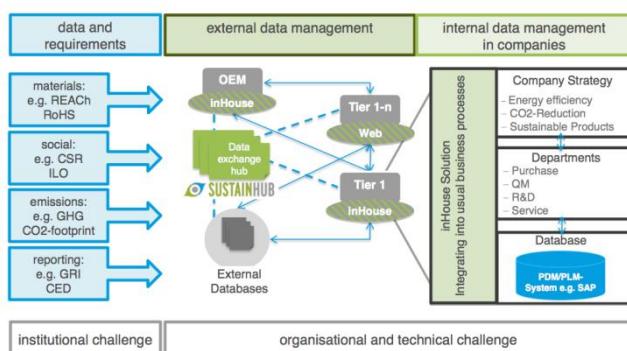
**Funding:**

Austrian Climate Research Programme

### 2.2.3 SustainHub – Sustainability Data Exchange Hub

Sustainability Data Exchange Hub (SustainHub) is a research project with the goal of developing an integrated network solution for managing product compliance and sustainability data along global supply chains. The project is carried out by a research consortium of 15 partners from 6 European countries under the coordination of the Fraunhofer Institute for Manufacturing Engineering and Automation.

There is an increasing demand for eco-efficient products and services, provoked by public opinion, and being incorporated into legislation worldwide. Customer-driven requirements and company strategic goals go beyond the law and are becoming integral to company policies. For the global Electronics and Automotive industries, eco-efficient products are emerging as a critical competitive factor in the marketplace. Large original equipment manufacturers (OEMs) have internalized this trend and passed the requirements on to their suppliers. However, due to complicated and dynamic reporting requirements, suppliers are frequently overwhelmed. The lack of data and the insufficient options for integration into internal processes have inhibited data transparency and compliance, which significantly impedes product innovation.



**Figure 5: Sustain Hub Project**

SustainHub is set to solve these problems. It will provide an efficient, integrated system for the generation, validation and transmission of sustainability data across the entire supply chains. SustainHub's data architecture is designed to meet all data exchange needs in a sustainable world, allowing for maximum traceability and transparency.

Initially, relevant sustainability aspects are defined and a new set of sustainability indicators for a holistic evaluation are created. Then, the data requirements are defined and methods for the aggregation of sustainability data along supply chains are developed. In a third phase, plausibility checks are carried out and measures for the integration into corporate decision-making are identified. Link: [www.sustainhub-research.eu](http://www.sustainhub-research.eu)

**Project team at ISIS:** Univ.-Prof. Dr. Rupert J. Baumgartner

Morgane Fritz, MBA

Josef-Peter Schögl, MSc.

Mag. Sabrina Engert

**Duration:** Feb. 2012 – Jan. 2015

**Funding:** Seventh Framework Programme  
of the European Commission



## 2.2.4 Boost Erasmus Mundus, europeAn higher educaTion and Employability through video Sharing community (tuBEMATES)

"tuBEMATES" is an Erasmus Mundus Action 3 project, aimed at enhancing the visibility and attractiveness of European Higher Education, in particular for students from South-East Asia. In order to pave the way for the new 'Erasmus+' programme, tuBEMATES creates a community where students can share impressions and expectations on Erasmus Mundus experiences through self-produced video-clips and trailers. For those video-clips, tuBEMATES initiated a competition, for which some 40 contributions have been received. The winner, Vera Dolginova from Russia, presented her clip during the final tuBEMATES conference, organized from 2 to 4 October 2014 in Hanoi. She was awarded with a mobility grant for Japan worth 1,000 €. Beside students, employers and representatives from the business sector are involved in the tuBEMATES project.

With those means, the project's concept considers two important aspects: (1) According to recent publications about perceptions of foreign students, fewer Asian graduates choose European universities for their postgraduate studies to improve their career opportunities and to enrich intercultural understanding with EU countries; (2) the new programme "Erasmus+" focuses, *inter alia*, more on including firms as partners.

In tuBEMATES, students are the key actors, as through the development of the video sharing community, Erasmus mundus students are supported in capitalizing mobility experiences and increasing employability chances. Moreover, best practices and success stories are disseminated. The project's activities are broken down into four work packages, namely "management and co-ordination", "dissemination and sustainability", "development of video sharing community" and "quality assurance". For the latter one, ISIS is the responsible project partner and has delivered a detailed quality plan and a quality report for all project activities including indicators to monitor the project's progress and success. This internal quality assurance is complemented by an external evaluator, who assessed the project's quality in terms of processes and outcomes.

As tuBEMATES has been finished by end of October 2014, the consortium is preparing a follow-up proposal, to be submitted as "strategic partnership in the field of education, training and youth" under Key Action 2 of the European Commission's 'Erasmus+' programme.



<b>Project team at ISIS:</b>	Dr. Ralf Aschemann
<b>Project partners:</b>	University of Barcelona (Spain, lead partner); Università degli Studi Guglielmo Marconi (Italy); University of Poitiers (France); Aoyama Gakuin University (Japan); Thammasat University (Thailand); Hanoi University of Science and Technology (Vietnam), University of Graz
<b>Duration:</b>	Sept. 2012 - Oct. 2014
<b>Funding:</b>	European Commission

## 2.2.5 ALISEN - Analysing Linkages of Socio-Ecological Nitrogen flows

Agricultural practices and nitrogen use are intrinsically connected. As land use management is central to nitrogen flows and often a cause of unintended environmental problems, it is worthwhile to deepen the understanding of socioeconomic and natural drivers in influencing stocks and flows of nitrogen. However, farmers are involved in socioeconomic systems, which influence their sources of livelihood, their business decisions and in direct consequence their actions on the farm. An integrated socio-ecological model study of nitrogen stocks and flows is being developed within the scope of the project ALISEN (**A**nalysing **L**inkages of **S**ocio**E**cological **N**itrogen flows) by coupling a decision-making module with a nitrogen stock and flow module. Simulating decision making employs an autonomous agent approach, with the agent's choices to be derived from the farming community in the area concerned. Stocks and flows of nitrogen will be calculated by a biophysical soil modelling. Amongst others, this project aims to identify:

- decisive factors in change of agricultural practice
- spatially explicit changes in land use
- stocks and flows of nitrogen indicating sustainability of land use

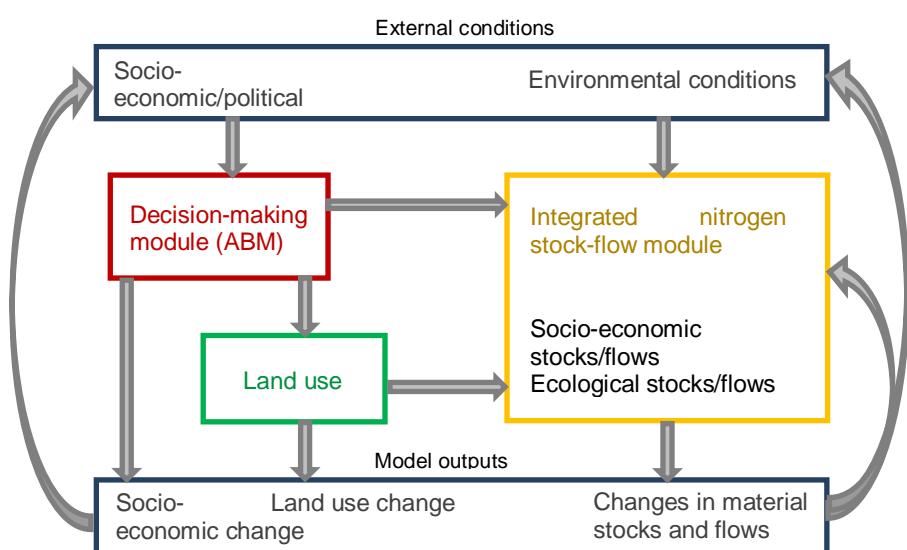


Figure 6: Concept of the integrated model system

Application area is the Upper Austrian Enns valley, a rural region, characterized by abundant natural and social science datasets since it is part of a research cluster (LTER). The chosen study region underwent dramatic changes in its society-nature relationship during the last two centuries. Nowadays, it experiences problems of marginalized rural areas such as declining agriculture, a lack of jobs, low incomes and poor infrastructure.

<b>Project team at ISIS:</b>	Univ.-Prof. Wilfried Winiwarter, Dipl.-Ing. Andrea Schröck
<b>Project leader:</b>	Institute of Social Ecology, Vienna (Veronika Gaube)
<b>Duration:</b>	Oct. 2013 – Jun. 2014
<b>Funding:</b>	Austrian Science Fund (FWF)

## 2.2.6 FLIPPR - Future Lignin and Pulp Processing Research

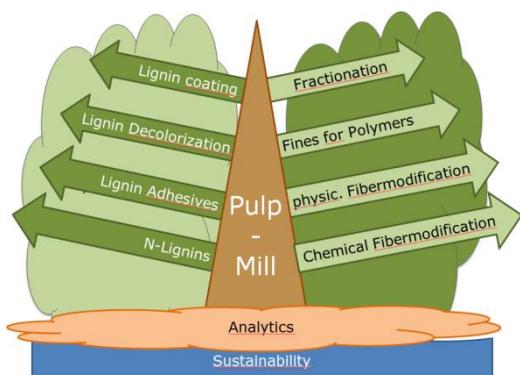


Figure 7: Integration of FLIPPR Areas

In this COMET K-Project, the efforts are focused on establishing structural know-how to make more efficient use of major raw materials streams of the paper and pulp industry – cellulose and lignin. The project focusses on applications in the pulp and paper value chain but also in areas outside the classical product chain. The goal of FLIPPR is to transform this empirical domain into a science-based endeavour and to give the current product and process development approaches in the field of lignin and fibre usage a new direction.

Together with the Wegener Center, ISIS is responsible for the area of sustainability. ISIS will conduct a life cycle sustainability assessment (LCSA) of “high potential” biorefinery-products, based on the innovations from other project partners. Besides the ecological assessment, additional emphasis is placed on social impacts, sustainability and life cycle costs. Thus an integrated system for life cycle sustainability assessment (LCSA) is developed and applied.

ISIS is specifically responsible for the following tasks:

- Environmental LCA for standard industrial feedstock of project partners from the paper and pulp industry
- Environmental LCA of state of the art products, which may be substituted by innovations coming from the pulping industry
- Life cycle sustainability assessment (including environmental LCA, social LCA and life cycle costing) of bio-refinery products based on the results of other project parts

The purpose of these tasks is to find the critical issues (hotspots) for the three pillars of LCSA – environmental LCA (E-LCA), social LCA (S-LCA) and life cycle costing (LCC) – that really determine the contribution of the lignin and cellulose-derived products to the emergence of sustainable low carbon systems. Link: [www.flippr.at](http://www.flippr.at)

<b>Project team at ISIS:</b>	Ao.Univ.-Prof. Dr. Alfred Posch, Mag. Julia Gruber, Univ.-Prof. Dr. Rupert J. Baumgartner, Dr. Ralf Aschemann, Dr. Romana Rauter, Josef-Peter Schögl, MSc.
<b>Lead Institution:</b>	Future Lignin and Pulp Processing Research Project GmbH
<b>Company Partners:</b>	Sappi Gratkorn-Produktions GmbH, Mondi Frantschach GmbH, Norske Skog Bruck GmbH, Zellstoff Pöls AG
<b>Scientific Partners:</b>	University of Natural Resources and Life Science, Graz University of Technology (Graz), University of Graz (Wegener Center)
<b>Duration:</b>	Apr. 2013 – Mar. 2017
<b>Funding:</b>	FFG, COMET K1-Project

## 2.2.7 WISSEN - Transition to Smart Living Environments: A Potential Analysis for Styria from a Social and Economic Perspective

New technologies and services for mobility, buildings, energy production, and manufacturing processes open up new courses of action for Styria and its economy. For societal usage and integration of these options not only technological but also social innovations are necessary. Therefore, the project WISSEN analyses the developments of and potentials for smart living environments in Styria with focus on the inclusion of citizens as active co-creators of this societal change. The project is working on conclusions for societal, political and economic implementations and identifies promising areas for further analysis.

Within this project, ISIS is concerned with the part of “energy transition” and focuses hereby on decentralized renewable energy production by photovoltaic facilities (PV). In recent years photovoltaic technology is increasingly gaining attention. To further promote the diffusion of photovoltaic in Styria, the establishment and development of various forms of PV adoption needs to be enhanced. Therefore the aim of our research is to investigate the role of stakeholder networks in the adoption and diffusion process of photovoltaic.

The methodology we use comprises a literature review, the analysis of secondary data as well

as qualitative and quantitative methods of empirical social research. In a further step, a SWOT analysis (strengths, weaknesses, opportunities, threats) with an integrated AHP (analytic hierarchy process) will generate strategies in order to improve policy design.

Our analysis helps to gain a better understanding of the PV adoption process in Styria and provide knowledge to possibly adapt the framework conditions for photovoltaic diffusion in Styria.



Figure 8: Stakeholder Workshop, Audimax FH Joanneum

<b>Project team at ISIS:</b>	Ao. Univ.-Prof. Dr. Alfred Posch Mag. Kathrin Reinsberger
<b>Project partners:</b>	Wegener Center (project leader) IFZ , FH Joanneum, Joanneum Research
<b>Duration:</b>	Feb. 2013 – Nov. 2014
<b>Funding:</b>	Land Steiermark – A8 Science and Health



## 2.2.8 RESHAPE - Reshaping Institutions and Processes in the Transition towards Renewable Energy: Lessons from Bottom-up Initiatives

Taking into account disappointments in recent climate negotiations on the international level as well as the lack of supranational authorities, it becomes clear that there is a need for reshaping processes and institutions for a further progress in climate policy. Here, bottom-up initiatives may become important cornerstones in the transformation towards a carbon neutral and adaptive society.

The project explores different examples of bottom-up initiatives that emerged in the recent years in Austria in the field of photovoltaics. It contains empirical analyses of different case studies and reflects the Austrian situation with experiences from Germany. The empirical analysis and selection of the cases will follow the conceptional systematization of different types of bottom-up initiatives. Qualitative and quantitative empirical research on institutional settings on the macro- and meso-scale and actor's behaviour on the micro scale go along with the development of an agent-based system model. This allows for different scenario developments regarding the diffusion of participation in those initiatives.

The methodology used in the project includes: literature research, qualitative and quantitative methods of empirical social research (interviews, survey, and statistical data analysis), system modelling (agent-based modelling) and stakeholder dialogue. In this way, the two research streams - system modelling and empirical social research - are highly interwoven.

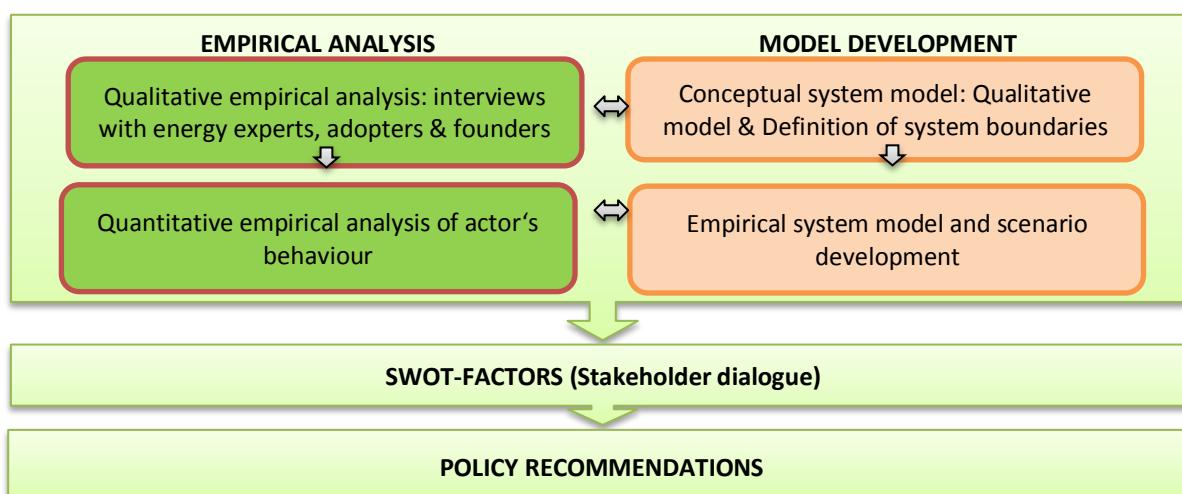


Figure 9: RESHAPE Project

The main outcome of the project will be appropriate policy recommendations for bottom-up initiatives, for reshaping institutions and processes in the transition towards a renewable energy system.

**Project team at ISIS:** Ao. Univ.-Prof. Dr. Alfred Posch, Eva Fleiß MA, Mag. Stefanie Hatzl, Mag. Martin Kislinger, Dipl.-Ing. (FH) Dr. Gernot Lechner, Univ.-Prof. Dr. Manfred Füllsack, Mag. Kathrin Reinsberger, Dr. Thomas Brudermann

**Duration:** Mar. 2013 –Feb. 2015

**Funding:** Austrian Climate Research Program (Climate and Energy Fund)

## 2.2.9 SEDE – Eco-Design Seminars for the Styrian Automotive Industry

Over the last decade, the topic of sustainable development has gained importance in the European automotive industry. Because of the significant impacts cars have on our environment and society over their life cycle, sustainability related legislations have become increasingly stringent in the recent past. Therefore, the consideration of sustainability topics throughout a car's entire life cycle has not only become a task for establishing a "green" image but also for maintaining competitiveness in a changing business environment. As Figure 10 illustrates, such a consideration should start in early phases of product development, in which the majority of a product's environmental and social impacts are determined. In order to define improvement options and making decisions strategically, implementing eco-design and sustainability assessment approaches into the product development process is promising. For successfully implementing them it is particularly important to provide product designers and engineers with specific knowledge and decision support.

Hence the goal of this project was to develop a series of six related eco-design seminars for employees from the Styrian automotive industry with a special focus on SMEs. The contribution of ISIS was focussing on basic principles and specific methods for implementing eco-design, as well as on tools for assessing sustainability aspects at different product development stages. The project was initiated together with the automotive cluster ACStyria, the Graz University of Technology, ISIS and several SMEs.

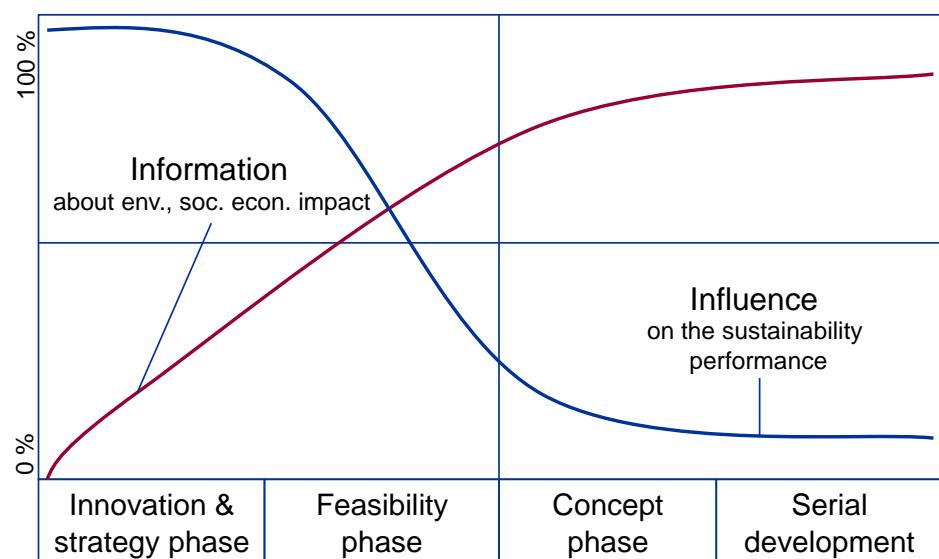


Figure 10: Sustainability related improvement potential throughout a product's life cycle

<b>Project team at ISIS:</b>	Univ.-Prof. Dr. Rupert J. Baumgartner Dr. Peter Perstel, Josef-Peter Schögl, MSc.
<b>Duration:</b>	Nov. 2013 – Jul. 2014
<b>Funding:</b>	FFG

## 2.2.10 Bioresources – The Green Heart of Styria

Bioresources are a key resource of the 21<sup>st</sup> century. Especially Styria, as a region with a strong tradition in high-quality food production as well as a strong industry, faces the challenge of ensuring an optimal use of bioresources. A paradox characteristic of bioresources is their limited infinity – they are available for an unlimited time as they are renewable, but limited by the finite surface on which they are grown. The project “Bioresources – the green heart of Styria” is coordinated by ESEIA (European Sustainable Energy Innovation Alliance), project partners are Joanneum Research, Energie Steiermark, Spar Austria, Styrian chamber of agriculture and ISIS.

The current transition of energy systems to renewable energy sources and the increasing demand for healthy and sufficient food on the one hand and the limited availability of land as production basis of bioresources on the other hand make an efficient and effective use of bioresources essential. Bioresources are the basis of many economic sectors like agriculture and forestry, food industry, pulp and paper industry, timber industry, but also the energy sector depends directly or indirectly on bioresources.

The goals of the project are to develop a scientific basis for the optimal use of bioresources in Styria, to induce a broad stakeholder dialogue about the use of bioresources and to formulate policy recommendations. The basis is to collect and synthesize regional, national and international knowledge about conventional and unconventional bioresources and to combine methods to assess environmental, social and economic benefits and impacts of different scenarios regarding bioresource-use in Styria.



Figure 11: Project workshop in Brussels

**Project team at ISIS:** Univ.-Prof. Dr. Rupert J. Baumgartner, Dr. Ulrike Gelbmann

**Duration:** Jul. 2013 – Dec. 2014

**Funding:** Government of Styria – Zukunftsfoonds

## 2.2.11 PURPUR

PURPUR is a research project with the aim of reducing the weight of automotive parts by applying several innovative lightweight materials. The project is carried out by a consortium of Austrian and German companies and the University of Graz, led by Magna Steyr Engineering AG & Co KG.

Over the last decade, the topic of sustainable development has gained importance in the European automotive industry. Because of the significant impacts cars have on our environment and society over their life cycle, sustainability-related legislations have become increasingly stringent in the recent past. Particularly in Europe automakers have furthermore recognized their responsibility for the environment and the society, and therefore voluntarily agreed on continuously reducing the CO<sub>2</sub>-emissions of their fleets. One of the most important keys to reduce a vehicle's CO<sub>2</sub>-emissions is the reduction of the vehicle's weight.

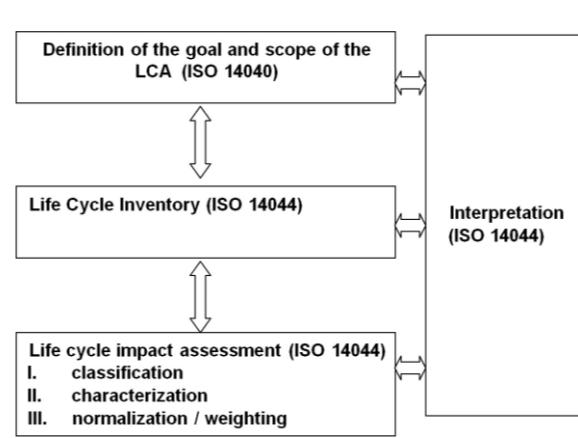


Figure 12: LCA according to ISO 14040/14044

Such a weight reduction is also the aim of the PURPUR project in which firstly the potential of certain innovative lightweight materials for optimizing automotive parts are assessed. Secondly these materials are used for producing the parts and conducting necessary tests regarding mechanical parameters and legal requirements.

ISIS firstly supports this project by applying the Checklist for Sustainable Product Development (CSPD) for finding sustainability-related improvement options. The CSPD allows integrating a life cycle perspective into automotive product engineering and supporting decisions from a sustainability perspective. Secondly ISIS conducts a Life Cycle Assessment (LCA) for estimating and comparing the environmental impacts of the newly developed part with a comparable state-of-the art part.

<b>Project team at ISIS:</b>	Univ.-Prof. Rupert Baumgartner Josef-Peter Schögl
<b>Duration:</b>	November 2013-March 2015
<b>Funding:</b>	Austrian Research Promotion Agency (FFG)

## 2.2.12 Sustainability Management with the Sustainability Balanced Scorecard in SMEs: Findings from an Austrian Case Study.

Given the economic importance of small and medium-sized enterprises (SMEs) in Austria and the increasing need for a strategic sustainability management for those companies, this project examines the concept of the Sustainability Balanced Scorecard (SBSC) with a specific focus on SMEs. This is done on the basis of a case study that describes the implementation of an SBSC for a middle-sized Austrian brewery. For this purpose an adaptation of the existing method for SBSC creation is developed in order to address the specific needs of an SME. The project highlights the success factors, barriers and experiences learnt from the implementation process. The findings reveal that the characteristics of SMEs, especially with regard to strategic management, organizational structures and resources, need to be taken into consideration when developing the SBSC and choosing the method to reduce complexity and make the implementation process more understandable. The proposed case study can help other SMEs with SBSC implementation, provided their individual requirements are taken into account. This stimulates the scientific discourse on sustainability and strategic management by highlighting challenges of its implementation in SMEs.



Figure 13: Project steps for SBSC creation

<b>Project team at ISIS:</b>	Susanna Falle, MSc, Dr. Romana Rauter, Mag. Sabrina Engert, Univ.-Prof. Dr. Rupert J. Baumgartner
<b>Project partner:</b>	Brauerei Murau
<b>Duration:</b>	December 2013 – August 2014
<b>Funding:</b>	FFG Innovationsscheck (requested)

## 2.3 PhD projects

### 2.3.1 Individual Mobility as Climate Challenge – Climate Change Risks and Corporate Vulnerability in the Automotive Sector

The transportation sector accounts for 22% of global CO<sub>2</sub> emissions. It thus significantly contributes to human-induced global warming. Moreover, CO<sub>2</sub> emissions from global transport increased by 52% between 1990 and 2011. This rapid growth of emissions is mainly driven by road traffic, i.e. passenger and freight transport, being responsible for about three quarters of total sector emissions. In face of national and international GHG emission reduction targets, the transportation sector - and especially individual transport – is therefore a major area of concern for policy-makers.

On the assumption that there has to be a significant reduction of global GHG emissions, there will be an increasing pressure to reduce the emissions of car traffic in particular. These reductions will necessitate a different usage pattern of cars and the use of different technologies and services provided by the business sector. Hence, climate change contributes to the reshaping of both the regulatory and the societal environment of the automotive industry. This is of increasing relevance both from an environmental and an economic viewpoint as the classical business model of this sector is expected to undergo a fundamental change.

**The main research objective** of this dissertation is to develop a better understanding of business responses to climate change in the automotive industry by analysing the characteristics, drivers for and barriers to corporate climate change strategies.

**The main research questions** are:

- Which uncertainties, risks and thresholds in terms of climate change are identified by companies and how are they dealt with in the automotive industry?
- Which factors influence the development, adoption and avoidance of corporate climate change strategies?
- How does the implementation of climate change strategies affect companies' economic and environmental performance?

It is planned to implement a research methodology that becomes increasingly interactive over time. After a preliminary secondary data analysis of companies' annual and sustainability reports and newspaper articles, a survey among companies will be conducted, complemented by in-depth interviews with company representatives, NGOs, chambers of commerce, etc. at a later stage of research.

**PhD student:** Matthias Damert, M.Sc.

**Duration:** 2014 - 2017

### **2.3.2 Corporate Sustainability Strategies: An Analysis of the European Automotive Industry**

Sustainable development in the context of corporations in the automotive industry is a frequently discussed issue. There is an on-going discussion relating to corporations and their commitment to sustainable development. In the centre of this discussion, stakeholders debate whether the corporations are tracking the intention to be “good citizens” or the improvement of the corporations’ image and therefore the profitability. Furthermore, topics such as: efficiency, quality and innovation capacity play a prominent role in considering ecological and social aspects in the automotive industry. In the past, numerous journal articles were dealing with the question, “why are corporations choosing to commit or not to sustainability aspects and activities”? The connection between corporate sustainability and the corporation’s performance is often discussed in the context of strategic management and the implementation process of sustainability in the corporation’s strategy. Nowadays, a significant amount of corporations assume responsibility and implement the concept of corporate sustainability in their corporate strategy. In doing so, they focus on different models and tools. Corporations are responding to external pressure by creating tailor-made sustainability strategies which may not necessarily cater to the balance between the sustainability strategy, competitive strategy, and the normative justification of the corporation. In addition corporations discriminate social and environmental issues from traditional strategic issues and therefore they interrupt the positive contribution to economic performance.

**The objective of the dissertation** is to identify influencing factors of implementing sustainability from a strategic management perspective; especially to bridge the gap of corporate sustainability strategy formulation and implementation. Managers are faced not only with crafting corporate sustainability strategies but also with translating them into action while balancing economic, ecological and social issues. The focus is on global acting car manufacturers that are already on the path to sustainability integration. The aim is to provide new insights into how the corporate sustainability strategy implementation process can be fostered and what factors prove to be relevant in literature and practice.

**PhD student:** Mag. Sabrina Engert

**Duration:** 2012 - 2015

### 2.3.3 Scenarios for a Low Carbon Society: Sector Agriculture

Accumulation of greenhouse gases (GHGs) in the atmosphere has led to rising temperatures, variable precipitation, and other extreme events like droughts and floods. In order to limit negative impacts to climate, the environment, and human livelihoods in general, emissions of these compounds need to be strongly reduced. International agreements have not been effective, in part due to missing concepts of realistic “low carbon” situations. Hence there is a need to devise scenarios for a low carbon society that is technically and economically viable.

The agricultural sector is a source of food and is indispensable to society. However, it is associated with significant GHG emissions. The Intergovernmental Panel on Climate Change’s (IPCC) 5th assessment report, identifies the agricultural sector as one of the major GHG emitting sectors, responsible for almost a quarter of GHG emissions (~10–12 GtCO<sub>2</sub> eq./yr) mainly from deforestation and agricultural emissions from livestock, soil and nutrient management. Reports have also shown that agricultural yields are vulnerable to climate impacts, as seen by a decreasing rate in production increase over recent years. Hence agriculture is not only a major source of GHG emissions but is also affected by the accumulation of the GHG’s in the atmosphere and subsequent changes in climate. The economic mitigation potential in the supply-side is estimated to be around 7.2 to 11 GtCO<sub>2</sub> eq./yr in 2030 consistent with carbon prices (IPCC 5th Assessment Report, 2014). Although it is characterized by a high level of GHG emissions, the agricultural sector is indispensable for society. Understanding the negative impacts of climate change due to GHG accumulation and accounting for the potential that exists to mitigate emissions, it is necessary to devise low carbon scenarios to reduce GHG emissions in the agricultural sector.

This study, using international emission inventories, country specific reports and the International Institute for Applied Systems Analysis’s (IIASA) Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model will assess the policies and measures undertaken by the European Union (EU) countries to mitigate GHG emissions in the agricultural sector. Additionally, the study will also identify and evaluate other novel mitigation options and estimate their subsequent costs using the GAINS model. Overall, the results would identify and describe low carbon scenarios in the agricultural sector to mitigate climate change. This holistic framework analyzing the mitigation potential of current and proposed measures is more complete than previous research. The results are helpful for farmers, crop advisors, and policy makers struggling to identify economically viable mitigation strategies and understand the impact of a changing climate on commodity agriculture.

**PhD student:** Sajeev Erangu Purath Mohankumar, MSc. Eng.

**Duration:** 2014 – 2017

### **2.3.4 Exchange of Sustainability Data Along the Supply Chain: Status Quo, Driving Factors and Recommendations**

Sustainability and supply chain management are concepts that are still under construction in the academic and business worlds. From both perspectives, further research is needed to clarify these concepts theoretically and empirically.

Indeed, research in sustainability and supply chain management focuses on the environmental and economic dimensions of sustainability, at the expense of the social dimension. Hence, the developed tools and frameworks to help companies manage their business in a sustainable manner often lack of a holistic perspective and take into consideration different data collection and exchange levels. This is an obstacle to homogenous data exchange along supply chains and to the development of comparable sustainability assessment tools. Additionally, existing tools take a developed country perspective, which may challenge companies located in different countries where, among other facts, priorities, stakeholders and values may be different. Consequently, the following question will be investigated:

**How to identify sustainability aspects to foster the exchange of sustainability data along the supply chain and engage stakeholders?**

This thesis has **four main objectives**:

- 1) Assess the status quo of sustainability reporting along the electronics and automotive supply chain (1<sup>st</sup> paper);
- 2) Provide a selection of sustainability aspects to be exchanged along these supply chains (2<sup>nd</sup> paper);
- 3) Develop a corresponding set of sustainability indicators and aggregation methods (3<sup>rd</sup> paper);
- 4) Investigate the applicability of the findings in other contexts (4<sup>th</sup> paper) and their usefulness in a multi-stakeholder environment to improve sustainability along supply chains (5<sup>th</sup> paper).

This PhD-project is embedded in the FP7 project **SustainHub**, financed by the European Commission.

**Publications:**

Schögl, J.-P., Fritz, M.M.C., Baumgartner, R. (2014). Aggregation methods for supply chain sustainability indicators. Paper presented at the CSR Conference at Humboldt University, Berlin, Germany.

Fritz, M.M.C., Enéas da Silva, M. (2014). Sustainable Supply Chain Management: A Latin-Ibero-American (Re)View. Paper presented at the CRRC Conference at the University of Leeds, Leeds, United Kingdom.

**PhD student:** Morgane Marie Caroline Fritz, MBA

**Duration:** February 2012 – June 2015

### 2.3.5 I Shine, Not Burn. An Empirical Study on Actor's Decisions in the Field of Photovoltaic in Austria

Environmental issues became a central topic in sociology since the 1970s. Environmental sociology is concerned with societal causes of and reactions to ecological problems.

One of the most prominent problems is the need to reduce CO<sub>2</sub>-emissions. This is especially important in light of the increase in global energy consumption today. One major contributor to global CO<sub>2</sub>-emissions are private households: A total of 23% of the energy consumption in OECD-countries can be attributed to private households. Studies indicate that there is a large potential for reducing energy consumption in this area. If private households would adapt their behavior in different areas, a 20% reduction of CO<sub>2</sub>-emissions could be possible. These examples depict the importance of understanding the factors influencing individuals' actions. A fitting theoretical framework often applied in environmental sociology and other disciplines – rational choice theory (RCT) – perceives ecological problems as being a (sometimes unintended) macro consequence of individuals' actions.

The work at hand aims at contributing to this field of research by analysing factors influencing individuals' actions in the field of photovoltaic (PV) in Austria using the example of Bottom-up initiatives (BUIs). Empirical results on motives of relevant actors – individuals who are involved in the founding-process or individuals who participate in already established BUIs – will be delivered by addressing the following research questions.

#### Research questions and studies:

- 1) **Study 1**, based on qualitative interviews: Which motives drive actors to initiate and/or implement a PV-BUI in Austria? Which motives/goals can be identified to be most important?
- 2) **Study 2**, based on a large-scale survey: Which motives drive actors when they decide to (not) be part in a BUI? Which motives can be identified to be most important?
- 3) **Study 3**, based on a laboratory experiment: How do people make trade-offs between themselves and benefits to the environment? How are these payoffs related to different survey measures on self-reported environmental behaviours and attitudes?

According to the research questions the goals are (study 1) to construct a typology of actors/initiatives based on motives to initiate a BUI, (study 2) to explain individuals' motives to (not) participate in a BUI according to an appropriate Rational Choice framework, and (study 3) to further investigate rational decision making by analyzing what role other-regarding preferences play in the decision making process.

The PhD-project is embedded in the project RESHAPE.

**PhD student:** Eva Fleiß, MA

**Duration:** 2013 – 2016

### **2.3.6 Energy Transition Bottom-up: Citizen Participation Initiatives for Sustainable Energy System Development**

Climate change and energy security are strong drivers toward a sustainable energy transition. Due to its high technological potential and rapidly decreasing costs, photovoltaic (PV) is an increasingly promising element of carbon neutral energy production, with the transformation potential towards an adaptive and energy independent society. Research in the field of innovation studies has increasingly come to see novel socio-technical innovations emerging from small-scale and relatively protected niches. The majority of this work has focused on market-based innovations designed for competitiveness, rather than more novel socio-technical alternatives emerging from civil society activism on sustainability. Citizen participation models developed are new business model in the field of renewable energy and are characterized as social innovation. These citizen participation models enabling active citizen engagement may be a promising pathway to promote and disseminate photovoltaic-technology towards a sustainable decentralized energy future.

In Austria, various forms of citizen participation models have emerged during the last years. These bottom-up initiatives can be characterized by different organizational forms, resource bases, divergent contextual situations, alternative driving motivations and the pursuit of qualitatively different kinds of sustainable development.

Therefore, the main objective of this research is to investigate and understand citizen participation initiatives as opportunity for transition towards a renewable energy system. The specific objectives are:

- To analyse internal structure of different business model characteristics and niche processes of PV participation models;
- To determine different social, economic, psychological factors influencing participation of citizen;
- To derive internal strengths and weaknesses and external opportunities and risks for diffusion of PV participation models based on previous findings.

Results are generated by synthesized qualitative and quantitative empirical research and are discussed in the theoretical framework of niche theory, community energy and business model insights. The aim is to examine internal and external conditions of Austrian PV citizen participation models to understand business model elements and niche development stability. Therefore results show the potential of citizen participation models and give a basis for policy recommendations.

The PhD-project is embedded in the project RESHAPE.

**PhD student:** Mag.<sup>a</sup> Stefanie Hatzl

**Duration:** 2013 – 2016

### 2.3.7 Energy Transition in Energy Regions: An Analysis of Heating System Adoption Decisions and its Impact on the Environment

An important component in the shift towards a sustainable energy system is the transition from a mainly centralized, fossil-fuel system to a more localized, renewable one. ‘Energy regions’ address the issues of energy transition at the regional level and aim at promoting energy self-sufficiency through the use of local, renewable energy sources. It is of key interest to understand how energy supply and demand as well as institutional settings in these regions change over time. In this context, the energy demand from buildings is of particular importance as it accounts for a significant amount of the final energy use, offers massive savings in terms of environmental impacts, and restricts the speed of change through the long lifetime in our built environment. State-of-the-art technologies such as heating systems present a major opportunity to reduce buildings’ energy demand and mitigate environmental impacts drastically in the next couple of decades.

The main objective of this research is to understand the socio-technical transition in energy regions especially focusing on the adoption of heating systems and its environmental consequences. The specific objectives are:

- To analyse the transition dynamics in two Austrian energy regions from their establishment until today in terms of energy generation and consumption as well as key actors, milestones and factors supporting the energy transition (based on energy flow analysis combined with actor and institution analysis);
- To develop further an agent-based building-energy model which portrays the building stock’s energy demand with behavioural elements regarding heating system adoption decisions reflecting the interplay between policy interventions, technical and social structure, and individual behaviour (empirical operationalization of decision-making process based on systematic literature review, qualitative interviews, and quantitative survey);
- To assess the environmental impact of the building stock’s heat demand for different scenarios, where the results of the agent-based model are combined with life-cycle inventory data changing over time due to expected technology-driven dynamics (link of agent-based building-energy model with dynamic LCA).

The results of this research project provide important insights into the energy transition of energy regions engaged in promoting energy self-sufficiency from a socio-technical perspective. The combination of dynamic modelling and LCA allows for developing and assessing scenarios of the building stocks’ energy demand and heating system transition for an entire region capturing the complex socio-technical interrelations typically found when it comes to energy demand of buildings. The results shed light on what policy instruments could be most effective in reducing environmental impacts caused by energy demand from buildings.

The PhD project is funded by a doctorate scholarship from the URBI Faculty.

**PhD student:** Mag.<sup>a</sup> Maria Hecher

**Duration:** 2013 – 2016

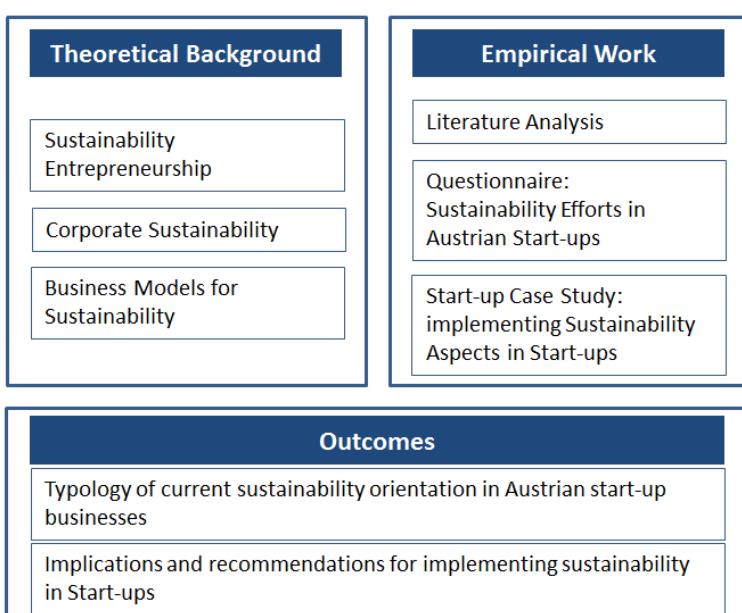
### 2.3.8 Development of Sustainability Orientation in Austrian Start-up Businesses

Mainstream discourse dealing with corporate sustainability is focusing on already existing companies and their benefits of including social and environmental aspects in business activities. Previous findings drawn from established businesses show that sustainability helps to create business value, to open strategic resources and to minimize risks but at the same time it costs money and challenges management. The context in which start-ups include corporate sustainability remains almost unexplored since characteristics of newly created businesses differ crucially from established companies. Approaches that link findings of corporate sustainability research with start-up businesses are currently missing, although the starting phase of a new business' life might be a critical starting point for its future sustainability orientation. Considering the high number of newly founded start-up businesses per year, only a slightly higher degree of corporate sustainability implementation in start-ups could already result in a broad effect and in a movement towards more sustainable businesses.

The main research questions of the dissertation are: What are the implications of a Corporate Sustainability Strategy for start-up businesses? How should a strategic concept of implementing sustainability aspects in start-up businesses be defined?

The objective of the dissertation is to examine Austrian start-up businesses and their specific characteristics that require different approaches of corporate sustainability compared to the already existing approaches for established companies.

Therefore, the research seeks to identify the different types of sustainability-oriented start-up businesses in Austria based on their actions and attitudes towards corporate sustainability. Furthermore, the research aims at enhancing the implementation of sustainability aspects in start-up businesses by identifying and proposing supportive methods that possess the potential to facilitate the implementation process of corporate sustainability.



**Figure 14: Thesis framework**

**PhD student:** Martina Hözl, MA

**Duration:** 2013 - 2016

### 2.3.9 Renewable Energy Diffusion in Austria

Due to its high technological potential and the rapidly decreasing costs, photovoltaics is a worldwide increasingly promising cornerstone of renewable energy production. In several European countries, e.g. in Germany, the PV penetration is far higher than in Austria. In Germany, recently citizen solar power plants have gained attractivity. Within citizen solar power plants ("Bürgerkraftwerke") residents jointly invest in a local PV plant and may use the electricity locally or feed it into the grid. In Austria, applications for PV investment subsidies at the household level exceeded the limited budgets for PV within minutes after opening the calls in recent years. Similar experiences were made with the subsidised feed-in tariffs for PV plants, where a long waiting list has emerged. Obviously, this is an evidence that the current subsidy regime is successful in stimulating the market uptake of PV in Austria and that there is still huge potential. However, it can be assumed that the current subsidy regime only reaches the tip of the iceberg: Individuals with strong pro-environmental values, highly interested in and fascinated by innovative energy technologies, and with good access to trustworthy information sources in their social and professional network. Thus, an unchanged continuation of the current subsidy regime might reach its limit as soon as demand within this small group of early adopters is saturated.

**The main objective of this dissertation** is to construct a dynamical system model to predict renewable energy adoption and market diffusion in Austria, aiming at an improved understanding of the decision making process for investments within and between the following three levels. The dissertation focuses mainly on photovoltaics and compares the process of innovation diffusion to other renewable energy sources, including wind, water, biomass and geothermal energy:

1. Households: How to push forward a highly decentralized energy generation e.g., with PV plants (up to 5 kWp) on the roofs of residential homes?
2. Industry: What further side conditions (peculiarities in decision making, limitations for action, etc.) need to be considered for fostering renewable energies in the business sector (manufacturing industry)?
3. Other kinds of organizations: What kind of support is needed to establish e.g., citizen solar power plants or similar concepts in a high number in Austria?

Starting from innovation theory - especially market diffusion and adoption theories - the dissertation will lead to a comprehensive understanding of the factors (including psychological, social and cultural factors) that are decisive whether an individual or an organization becomes a potential adopter at all and under which conditions. The expected outcome will include policy recommendations, such as a policy mix of economic incentives, regulations and other policy interventions and business models that foster a rapid adoption of renewable energy technologies in the Austrian energy sector.

**PhD student:** Mag. Martin Kislinger

**Duration:** 2012 – 2015

## 2.3.10 Social and Economic Uncertainties and Thresholds for the Diffusion and Adoption of Renewable Energy Systems

### Background

Due to its low environmental impact and decentralized character, photovoltaic technology is often regarded as a key technology that is able to contribute significantly to the establishment of a more sustainable energy system. Its rapid increase in competitiveness over the recent years seems to confirm the promising role of the technology. However a successful implementation on a large scale will not only require economic viability of the technology but also an enabling set of socio-technical factors including institutional and political structures, user practices and lifestyles, complementary technologies, etc.

### Theory

In order to investigate the socio-technical configuration photovoltaic technology is embedded in, the research project at hand draws on a conceptual framework that combines the multi-level perspective (MLP) approach and the technological innovation system (TIS) approach. This framework suggests that innovative technologies, which are accompanied by supporting actors and institutions (i.e. technological innovation system), usually emerge in protected niche spaces from which they assert pressure on regimes, which constitute coherent and established socio-technical configurations (e.g. fossil fuel based energy structures). External landscape factors (e.g. oil prices, climate change, etc.) either support or hamper innovation systems and their activities. The same holds for other innovation systems that emerge at the niche level - while some might act as complementary systems others might create a situation of rivalry.

### Research objective

The research at hand investigates the latter aspect; i.e. it aims at analyzing how the innovation system of photovoltaic technology correlates with other innovation systems. As the scope of the project will not allow considering every innovation system that correlates with photovoltaic technology, the analysis will focus on two exemplary cases: the first case refers to innovation systems that evolved around storage technologies, the second case to the system which encompasses solar thermal collectors. While storage technologies serve as an example of complementary technologies, solar thermal collectors are considered to be rather in conflict with photovoltaic technology.

### Method

In order to triangulate the analytical process, the research project applies multiple methods that are both quantitative and qualitative in nature. However the central method will be a qualitative as well as a quantitative content analysis of various text types (newspaper articles, scientific articles, interviews etc.).

### Relevance of the Research

The research is expected, first, to decrease the high level of uncertainty that currently exists in terms of interaction patterns within socio-technical configurations and, second, to provide decision makers with ideas on how to stimulate diffusion and adoption processes.

**PhD student:** Michael Kriechbaum, MSc

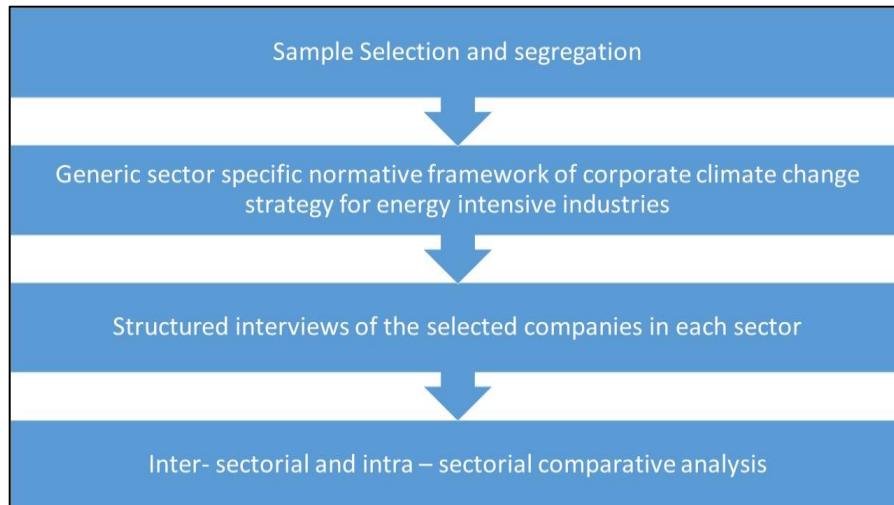
**Duration:** 2014 – 2017

### 2.3.11 Sustainable Strategies of Companies in Energy Intensive Sectors to Cope with Climate Change

The objective of the thesis is to provide a comprehensive understanding of the perception and strategic responses of energy intensive companies to the challenges and effects of climate change. The following research questions will be studied:

1. How energy intensive companies perceive the challenges and effects associated with climate change?
2. How to establish the linkages between the perception of climate change challenges and the strategic responses associated with it undertaken by the energy intensive companies?
3. How to define the thresholds for progression between various maturity levels of corporate climate change strategies in the energy intensive companies?

The following figure provides an overview of the research design. Three to four sectors with high gross GHG emissions among the energy intensive industries in Europe will be identified for assessment. A simplified methodology will be developed to choose a representative sample of companies within each sector based on their climate change performance across three categories, namely best performers, average performers and poor performers. Generic normative framework for corporate climate change strategy for each sector will be prepared based on Baumgartner (2010). These sector specific frameworks will then be used to develop structured interview questionnaires for collecting information from individual companies. This information will then be used to understand the perception to climate change challenges and



**Figure 15: Overview of the research design**

various profiles and maturity levels of corporate climate change strategies of selected companies. The profile and maturity levels will be developed following the theoretical framework of Baumgartner and Ebner (2010). These results will then be compared to establish the linkages between

perception to climate change challenges, strategic responses and maturity levels of corporate climate change strategies. These linkages are expected to reveal the thresholds for progression between each of the various maturity levels of corporate climate change strategies.

**PhD student:** Arijit Paul, MSc.

**Duration:** 2014 - 2017

### 2.3.12 The Impacts of Food Choice on the Environmental Nitrogen Pollution in Austria

Nitrogen (N) is crucial for life on our planet, primarily as component of proteins and as an essential nutrient providing the basis for our food production. Whereas it constitutes the major part of the earth's atmosphere in its molecular form N<sub>2</sub>, it is only reactive nitrogen (Nr – i.e. all biologically, chemically, and radiatively active nitrogen compounds, such as NH<sub>3</sub>, NO<sub>x</sub>, N<sub>2</sub>O, NO<sub>3</sub>) that can be used and is needed by most organisms.

As humans today artificially create amounts of reactive nitrogen (e.g. as fertilizer for food production) that far exceed natural terrestrial creation, the natural nitrogen cycle is altered. Excess nitrogen ultimately accumulates in the environment, causing significant effects on humans and ecosystems. These effects include eutrophication, soil acidification, nitrate pollution of groundwater, formation of particles hazardous to health, ozone formation and climate change. Thus, the use of nitrogen has both “good and bad” effects.

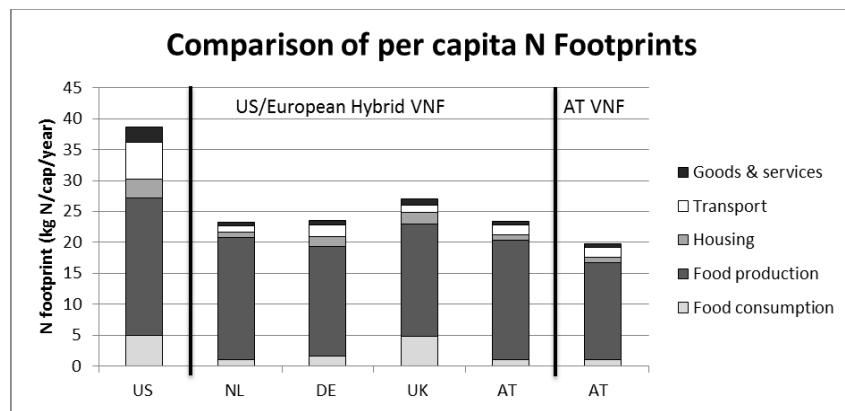


Figure 16: Comparison of per capita N footprints (source: Pierer et al. 2014)

As a starting point, the PhD project draws on the “N-Print project” ([www.n-print.org](http://www.n-print.org)), which is an integrated nitrogen footprint model focusing on food and energy consumption.

The objective of the dissertation is firstly to take stock of Austria's nitrogen footprint of food consumption by adapting and further developing one module of the N-Print, the N-Calculator. Secondly, possible points of intervention shall be identified and analyzed regarding their suitability and (cost-)effectiveness as potential policy measures. They shall serve an integrated policy approach that considers various interactions and interlinkages.

Thus, the dissertation is intended to raise awareness among the public and policymakers regarding the relationship between food consumption and nitrogen and its effects in Austria. In that sense, the dissertation might also contribute to an Austrian national nitrogen budget to be established in the future. Finally, the project shall yield recommendations regarding possible improvements and policy measures and their effectiveness. The PhD project is supervised by Prof. Wilfried Winiwarter and funded by a doctorate scholarship from the URBI-Faculty.

**PhD student:** Magdalena Pierer, MSc

**Duration:** 2012 - 2015

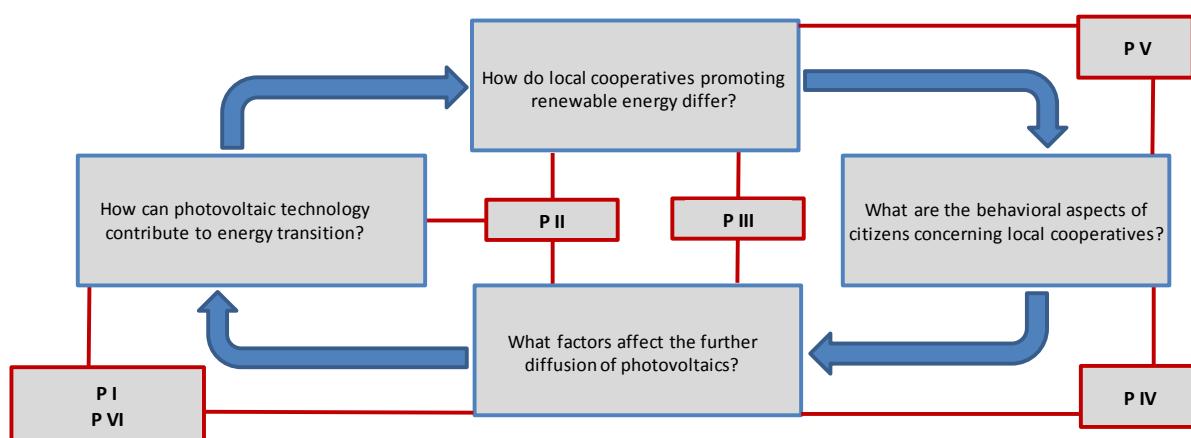
**Publication**

Pierer, M.; Winiwarter, W.; Leach, A.M.; Galloway, J.N. (2014). The nitrogen footprint of food products and general consumption patterns in Austria. *Food Policy* 49:128-136

### 2.3.13 A Socio-Technical Perspective on Innovations in Energy Transition: Empirical Research on Community Involvement to integrate Renewables

Increasing debate concerning greenhouse gas emissions and energy related issues shows that a system-wide transformation of our current energy system towards greater sustainability is becoming more necessary than ever before. This so-called 'energy transition' also involves further usage of decentralized renewable energy sources. Photovoltaic technology (PV) appears to be highly promising in this respect. It continues to offer high technological potential as well as the benefit of rapidly decreasing costs. At present, PV is the fastest growing renewable energy source worldwide, growing at an annual rate of 35–40 per cent. In Austria, which is the focus of this study, PV technology can still be seen as a niche technology, since at present approximately 1 per cent of electricity generated in Austria originates from PV plants.

In recent years scholars have used a number of different concepts and frameworks to investigate the restructuring of the energy system into a more sustainable form. In the present PhD thesis the starting point for gaining a more comprehensive view regarding the transformation of the current energy system in Austria is transition and innovation theory. Thus, the underlying approach of this thesis is to combine two closely related concepts - technological innovation systems (TIS) and the multi-level perspective of socio-technical innovation (MLP) – in order to investigate how innovations can contribute to energy transition in Austria. In terms of technical innovations the focus is on photovoltaic technology, related prospects and challenges, and the circumstances and factors influencing the further development of PV in Austria. Social innovations, in contrast, aim at involving local communities and citizens in energy provision issues. Hence, particular emphasis has been placed on providing an overview of the different models concerning local energy cooperatives and on stressing the associated key factors in their establishment. First, in order to outline the status-quo, this entailed an analysis of behavioural aspects, e.g. agent motives, concerns, and attitudes with respect to citizen participation in local energy cooperatives. It also entailed work on defining how current framework conditions for community energy in Austria can be adjusted in an effective way.



**Figure 17: Relationship between the research questions and the publications**

All the findings and conclusions of this thesis are based on the results of six publications. Regarding the prospects for photovoltaic technology it was found, that positive factors

(strengths and opportunities) dominate over negative factors (weaknesses and threats) and that as current circumstances appear to be particularly beneficial for the development of PV, a potential regime shift is conceivable. The empirical analysis on energy cooperatives in Austria revealed that the main focus of policy interventions has tended to concentrate on creating market incentives. Nevertheless, more attention needs to be placed on the social aspects of community energy projects. Thus, analysis of social learning processes, awareness raising, the provision of support for social network generation, communication and interaction, etc. are all necessary measures for engaging civil society more intensely in energy transition processes.

### **Publications**

- P I:** Reinsberger K. Brudermann T. & Posch A. (2015): The role of photovoltaics in energy transition: An integrated SWOT-AHP approach. *GAIA - Ecological Perspectives for Science and Society* (forthcoming).
- P II:** Reinsberger K. & Posch A.: Community engagement in niche development processes of social innovations. Submitted to *Renewable Energy*.
- P III:** Brudermann T., Reinsberger K., Orthofer A., Kislinger M. & Posch A. (2013): Photovoltaics in agriculture: A case study on decision making of farmers. *Energy Policy* 61, 96 - 103.
- P IV:** Hatzl S., Brudermann T., Reinsberger K. & Posch A. (2014): Do public programs in 'energy regions' affect citizen attitudes and behavior? *Energy Policy* 69, 425-429.
- P V:** Reinsberger K. & Posch A. (2014): Bottom-up initiatives for photovoltaic: Incentives and barriers. *Journal of Sustainable Development of Energy, Water and Environment Systems* 2(2), 108-117.
- P VI:** Reinsberger K. & Posch A. (forthcoming): Dezentrale Energieversorgung – Die Rolle der Photovoltaik in der Energietransition, in: Egger R. & Posch A. (Eds.): Lebensentwürfe im ländlichen Raum. Ein prekärer Zusammenhang, Springer Verlag Wiesbaden, Reihe Lernweltforschung.

**PhD student:** Mag. Kathrin Reinsberger

**Duration:** 2011-2015

### 2.3.14 Dynamic Complexity, Efficiency, and Coordination Failures in Education Systems

This PHD project is an attempt at improving our understanding of processes influencing achievement in primary education systems in developing countries covering the period 1990-2010. To attain this goal a dynamic simulation model will be constructed incorporating local idiosyncratic complexities such as positive feedbacks and nonlinear joint interactions between key variables like aggregate human capital and their effects on the efficiency and vulnerability of primary education system. The core of the model will contain a continuous-time stock-flow structure resembling a cohort chain where a flow of students enter the education system and progress throughout a number of intermediate stages, and then finish either by graduating or dropping out of school (see figure). With this, it is expected to generate new insights of the determinants of primary education attainment with specific application to the case of Nicaragua and an explanation of its historical performance. For the present study I surface the dynamics of the pattern shown by the system under study and explore the development process detailing the impact of exogenous shocks on its pattern evolution. System Dynamics methodology is used as the main research method. It is a planning tool that considers the interaction over time of key variables interacting within the system under analysis. The model to be developed seeks to capture main (nonlinear) decision rules used by different stakeholders that determine their behaviour and the effect on the selected variables. The central idea is to examine the implications of various exogenous changes that impact the productivity of one or more parts of the education process through:

- a. A systemic perspective for the analysis of human systems that explicitly includes the nonlinear and dynamic complexities of socio-economic and environmental factors influencing the development of education systems, in particularly those in developing countries. A fundamental aspect of our model definition and causal hypothesis will be the existence of positive feedbacks from endogenous aggregate characteristics in which the members of one generation, namely parents, induce decisions in the next generation.
- b. An innovative tool to evaluate the performance of education systems over time. This issue is of particular relevance for some countries, such as those in Latin America and Africa, which despite significant improvements in their education institutions and macro-economic environments have failed to experience sustained improvements in their primary school outcomes.
- c. The use of computer simulation of feasible policy actions (or exogenous shocks) that might be effective in changing the performance of an education system can provide very useful information to understand factors such as resilience, pattern formation, and system attractors.

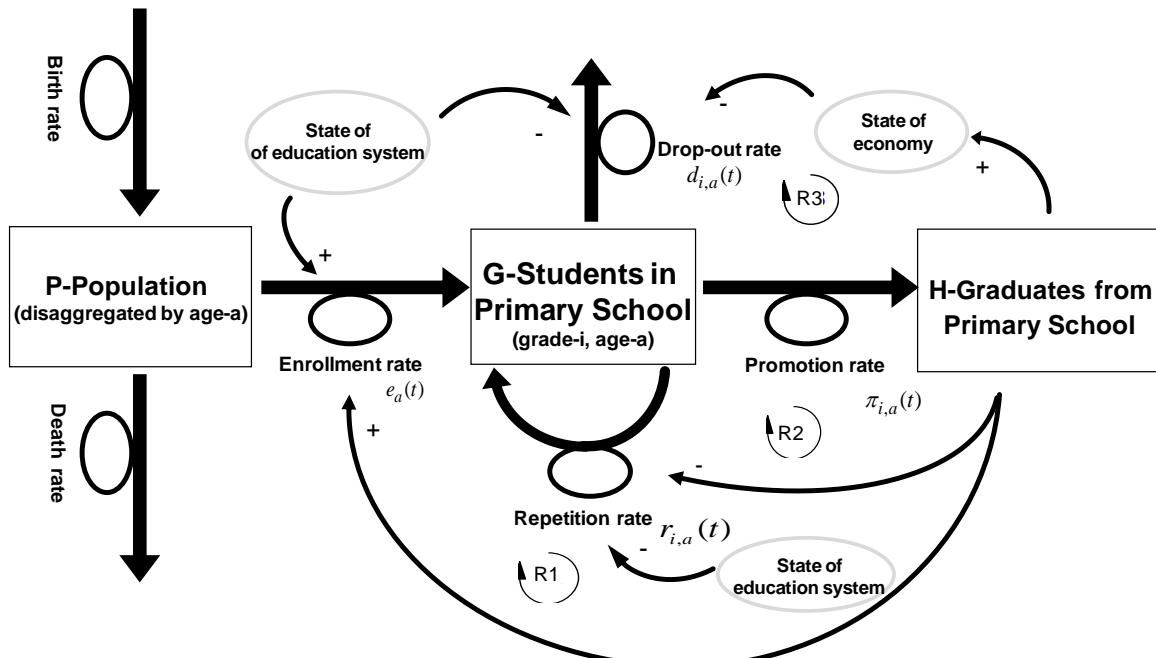


Figure 18: Overview of the Model

## Publications

Guevara Chaves, Porfirio; Lopez, Luis; Posch, Alfred; Zuniga, Roy: A Dynamic Nonlinear Model for Educational Systems: A Simulation Study for Primary Education, in: Nonlinear Dynamics, Psychology, and Life Sciences, 18, 1 (2014), 91 - 108.

Guevara Chaves, Porfirio; Posch, Alfred: Dynamic Complexity, Entropy, and Coordination in Educational Systems: A Simulation of Strategic and Exogenous Interventions, in: Systemic Practice and Action Research (2014). doi: 10.1007/s11213-014-9327-y

Guevara Chaves, Porfirio (2013). Nonlinear Dynamics of Ghost Busters: Detecting Fraud with System Dynamics, in: Proceedings of the 31st International Conference of the System Dynamics Society, Cambridge, Massachusetts, USA, July 21-25, 2013; ISBN 978-1-935056-12-06.

**PhD student:** Porfirio Guevara, MSc

**Duration:** 2010 - 2014

### 2.3.15 Measuring and Improving Sustainability in Global Supply Chains: An Example from the Electronics and Automotive Industries

During the last two decades the concept of sustainability has found consideration in different areas of business operations, from product design to post-consumer product management. Its consideration in supply chain management operations however is still lagging behind. The field of Sustainable Supply Chain Management (SSCM) intends to fill this gap. From a company's profit-oriented point of view SSCM makes sense, since it has the potential to decrease costs due to efficiency improvements. It also avoids non-compliance with increasingly stringent regulations and legislation, such as REACH, RoHS or the End of Life Vehicle Directive in the automotive industry. From an environmental and social perspective supply chain sustainability is of particular importance, because of the global impacts a product can have today. The depletion and the pollution of the environment and massive violations of human rights are just some of these challenges that have to be overcome. Thus the efficient management of natural and human resources at all supply chain stages, as well as the application of measures to minimize the negative impacts on people and the environment is a necessary and promising approach.

The objective of this dissertation is to facilitate sustainability assessment in supply chains and to shed light on important interdependencies between different supply chain actors and stakeholders. Therefore, firstly, a comprehensive set of supply chain sustainability indicators is suggested. Secondly, methods for checking the plausibility of suppliers' sustainability data as well as for aggregating sustainability information along an entire supply chain are developed. Thirdly drivers and barriers for the successful implementation of SSCM are investigated. As part of this research aim a case study with the company "Fairphone" on consumer perceptions of sustainability in supply chains is conducted.

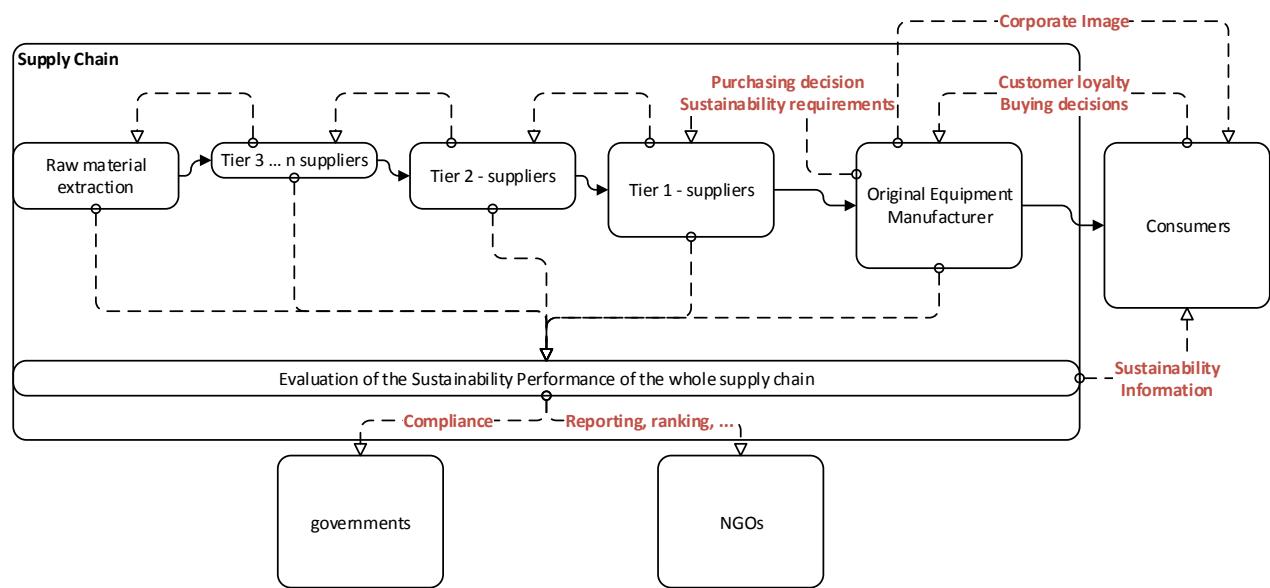


Figure 19: Sustainability related interdependencies in a supply chain

**PhD student:** Josef-Peter Schögl, MSc

**Duration:** April 2012 -March 2015

### 2.3.16 A Nitrogen Budget for Austria's Agricultural Sector

Bio-available nitrogen is an important nutrient in the agriculture. It stimulates plant growth and therefore it is added to fields as fertilizer. Further distribution of nitrogen to the environment is uncontrolled and almost impossible to avoid. Due to excess nitrogen, unintended biogenic processes are promoted and environmentally adverse substances (ammonia, nitrogen oxide or nitrous oxide) are released to the atmosphere, or (nitrate) to the ground water. Furthermore, nitrogen release may trigger eutrophication or reduce biodiversity in the ecosystems.

The objective of this dissertation is to optimize application efficiency of bioavailable nitrogen in agriculture and to minimize losses and impacts on the environment. Concrete investigative questions are:

- What are the intervention points in the Austrian agricultural nitrogen cycle?
- Which measures for optimizing the nitrogen cycle are possible?
- How can future scenarios for the application of nitrogen in the agriculture be developed, concerning the intervention points as mentioned above?

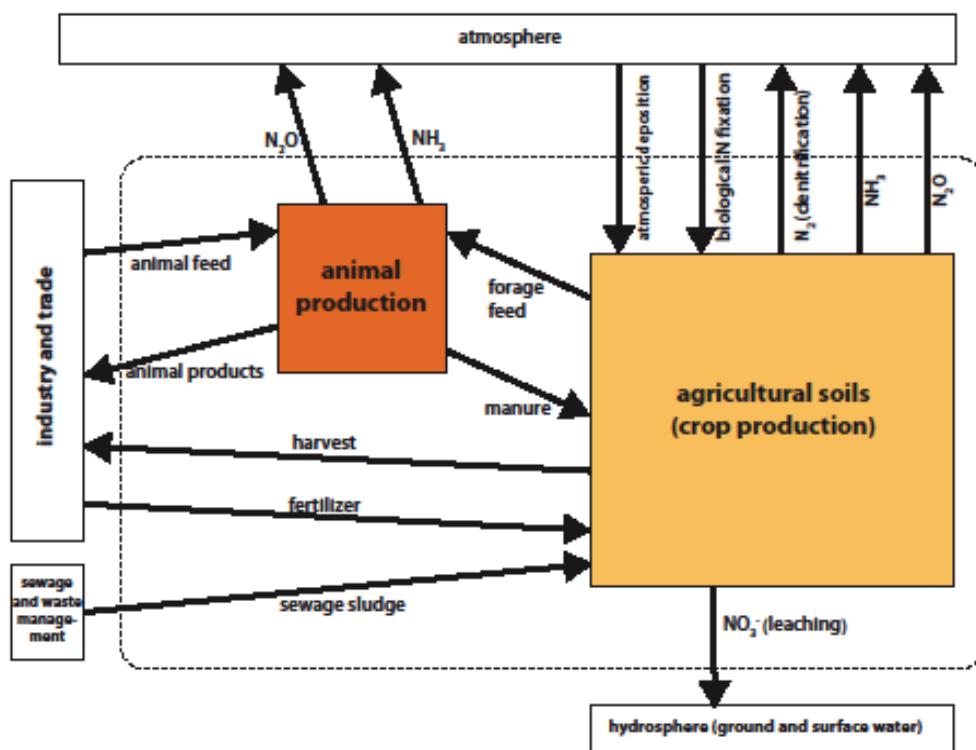


Figure 20: Nitrogen in- and output flows in the agricultural sector

Contributing to the national project “Farming for a better climate by improving nitrogen use efficiency and reduce greenhouse gas emission” (Farm-Clim), specified tasks within the PhD thesis will be developed together with the project partners.

**PhD student:** Dipl. Ing. Andrea Schröck

**Duration:** 2013 - 2015

## 2.3.17 EMAS in Tertiary Education: The Case of the EMAS-System at the University of Graz

Environmental management system (EMS) standards are available since the 1990s. Different organizations developed standards defining the structure and content of such a system. In Europe, the European Union also carried out an own environmental management system called Eco-Management and Audit Scheme (EMAS) which is in focus of this dissertation. The main goal of environmental management systems is to reduce the organizations negative impact on the environment and to achieve continuous improvement of the organizations environmental performance.

In Austria there are 277 organizations certified according to EMAS (as of 10<sup>th</sup> November 2014) but there are only two universities and one university of applied sciences certified. Although not many universities are certified according to EMAS, they play an important role in diffusion of this EMS. On the one hand, universities are often big organizations, with a high number of employees and even more “customers”, their students. As big organizations their demand of resources like energy, water or paper is comparably high. Especially as they not only provide infrastructure and resources for their employees but also for the students. On the other hand, at universities future managers and decision makers in companies as well as politicians are educated. As education is responsible for decisions, environmental awareness can be taught at this stage of education and influence future management style of the graduates. In addition, graduates can add valuable contributions to sustainability research, if the interest in this area is being drawn. But as mentioned above, only few research and teaching institutions in tertiary education (universities and universities of applied sciences) have already implemented an EMS according to the European Eco-Management and Audit Scheme.

Universities are organization meant to be pioneers in environmental responsible behaviour and spots where future managers and decision makers are educated. Therefore, the University of Graz decided to implement an EMS according to EMAS in cooperation with four other Austrian universities, starting the implementation process in the end of 2013. The University of Graz is a university with six faculties without a technical or a medical focus. With about 4,000 employees the University of Graz is one of the biggest employers in Styria, Austria. Around 31,500 students are studying at this institution. As the project is led by the author of this dissertation, a deep insight into the organizational structure, changes expected and achieved as well as different motives and barriers can be examined from an insider's perspective.

Thus, the goal of this dissertation is threefold, namely (i) to identify which reasons motivate organizations in tertiary education to implement an environmental management system (EMS) according to EMAS, (ii) to point out the expected benefits and (iii) to investigate how the EMS changes the organization. In this sense, the particular case of University of Graz will be considered.

**PhD student at ISIS:** Anita Ulz, MSc

**Duration:** 2013 - 2016

### 2.3.18 Scenarios for Future Greenhouse Gas Emissions in Austria

Future emissions and concentrations in Austria will be assessed with the help of the RCPs (Representative Concentration Pathways) and the SSPs (Shared Socioeconomic Pathways) published in the 5th Assessment Report of the IPCC. One of the main drivers at the beginning of the research project is the search for crossovers between the international scenarios and the national policies. This has to be seen as the main knowledge gap in this area as the Austrian's emission scenarios of the Austrian Environmental Agency are based on different methods and calculations than the RCPs.

The main objective of the dissertation is the analysis of future GHG in Austria in order to answer the main research question: "What are the main influences on future emissions in Austria till the end of the century?" The (theoretical) background for this analysis is based on the RCP scenarios as well as national and European emission scenarios. The main drivers for climate change and the increase in radiative forcing in Austria should be identified and qualified. The connection and similarities between the RCPs and Austria's climate policy shall be identified and, if possible, combined with adapted storylines specifically for Austria. Furthermore, it should be possible to use this method to create a framework which can be used by different single nations to assess their emissions and concentrations.

The first paper aims at comparing emission scenarios on a national, European and global level. It can be derived if the Austrian climate policy is in line with the EU climate goals and the, so called, 2°C target. The second paper is focusing on greenhouse gas emissions from livestock in Austria, comparing inventory emissions, emissions considering the whole life cycle and different emission scenarios.

The following figure gives a short overview of the thesis' framework:

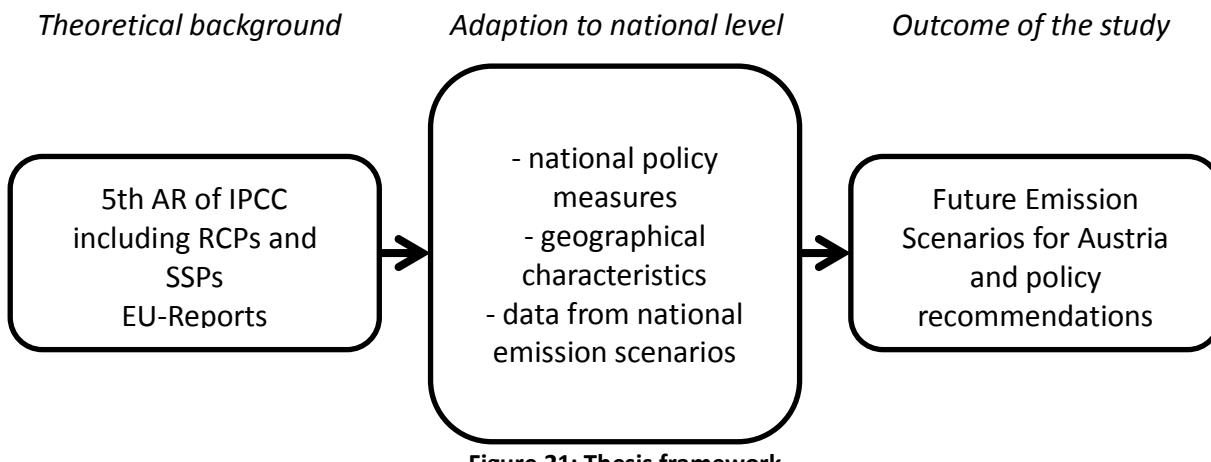


Figure 21: Thesis framework

**PhD student:** Mag. Thomas Winkler, MSc

**Duration:** January 2013 - January 2016

**Funding:** PhD scholarship by the Faculty of Environmental, Regional and Educational Sciences

## 2.4 Research cooperations and networks

### 2.4.1 EGC – Environment and Global Change

The University of Graz has defined seven “research core areas”, four of them with inter-university-cooperation. One of them is the research core area „Environment and Global Change“. Within this core area, global and regional climate and environmental changes are investigated and monitored. The role of humans contributing to this change, as well as possible ways for transformation towards a sustainable society through innovation, is the central theme of EGC. Researchers from climate and environmental physics, environmental chemistry, hydro-geology, environmental biology, environmental economics, sociology, geography and regional sciences, systems sciences and sustainability research and management, environmental ethics and law collaborate cooperate interdisciplinary in this research core area.

There are five main research areas:

- GlobEOS (Global Earth Observation and Stewardship)
- RegIMOS (Regional and Local Integrated Modelling System and Studies)
- EnviSYS (Changing Ecosystems and Earth-external Environmental Systems)
- GreenPROTEC (Green Processes and Technologies)
- RegiKNOWS (Regional Changes and Knowledge Transfer for Sustainability)



Figure 22: EGC Logo

### 2.4.2 AIT Knowledge & Talent Development Programme: Innovation & Sustainability

The Foresight & Policy Development Department of the Austrian Institute of Technology (AIT) established the Knowledge & Talent Development Programme “Innovation & Sustainability” in order to meet the „grand societal challenges“, which are characterized by increasing dynamics and complexity of the involved and interacting systems. In the field of “Sustainable innovation oriented Infrastructure Policy” (SIIP) the Foresight & Policy Development Department cooperates with the Institute of Systems Science, Innovation &



Figure 23: Structure of Knowledge & Talent Development Programme



Sustainability Research, University of Graz and the Institute of Transportation, Vienna University of Technology.

This programme provides selected master and PhD students with an excellent scientific environment that allows the flexibility to pursue in-depth research in a broad variety of critical areas related to sustainable innovation oriented infrastructure policy. PhD and master students are not only scientifically mentored by AIT- and ISIS-scholars; they are also financially supported with scholarships.

Two master projects were completed successfully at ISIS (Claudia Enzi and Thomas Wagner), and two PhD Projects (Vivianne Aggestam and Roman Seidl) are still ongoing.

#### **2.4.3 ISDRS – International Sustainable Development Research Society**

The International Sustainable Development Research Society ([www.isdrs.org](http://www.isdrs.org)) was formally founded in 2006 and builds upon a 20 year history of the International Sustainable Development Research Conferences. The vision is to establish a forum where diverse research communities can come together creating a transparent dialogue on key problems, issues, initiatives, policies and strategies needed to make sustainable development a reality. It aims to foster and communicate the importance of sustainable development in a global society, to promote high quality dialogue and collaboration and to build bridges between different research communities and also between research and its applications in society. In 2014, the 20th annual International Sustainable Development Research Conference was held from June 18-20 in Trondheim, Norway. Univ.-Prof. Dr. Rupert J. Baumgartner is board member and executive secretary of the ISDR-Society.

#### **2.4.4 ISIE – International Society for Industrial Ecology**

ISIE ([www.is4ie.org/](http://www.is4ie.org/)) was founded in 2001 and promotes industrial ecology as a way of finding innovative solutions to complex environmental problems. Its mission is to promote the use of industrial ecology in research, education, policy, community development, and industrial practices. It facilitates communication among scientists, engineers, policymakers, and managers interested in better integrating environmental concerns with economic activities.

#### **2.4.5 Weatherhead Center for International Affairs (WCFIA) at Harvard University**

The Center for International Affairs was founded in 1958 and was renamed the Weatherhead Center for International Affairs in 1998 in gratitude for the magnificent endowment established by Albert and Celia Weatherhead and the Weatherhead Foundation. The Center was created as a means of confronting the world's condition, a condition diagnosed by Robert Bowie and Henry Kissinger in their gripping '*The Program of the Center for International Affairs*' (1958):

*"Foreign affairs in our era pose unprecedented tasks....Today no region is isolated; none can be ignored; actions and events even in remote places may have immediate worldwide impact...vast forces are reshaping the world with headlong speed. Under the impact of wars, nationalism, technology, and communism, the old order has been shattered. Empires have crumbled; nations once dominant are forced to adapt to shrunken influence. New nations have emerged and are struggling to survive....Nowhere do traditional attitudes fit the new realities....Thus notions of sovereignty and independence need revision to apply to a world where a nation's level of life or survival may depend as much on the actions of other countries as on its own..."*

That diagnosis, and the challenges that shaped the Center's vision and mission then, remain pertinent and continue to inform the WCFIA's work today. As this philosophy is much based on a systems thinking perspective, it also provides a common perspective which is shared by the WCFIA and the ISIS as well. The Weatherhead Center is the largest international research center within Harvard University's Faculty of Arts and Sciences. The Center is structured to encourage the highest practical level of personal and intellectual interaction among a diverse community of scholars and practitioners. It is distinctive in its recognition that knowledge is a product not only of individual academic research, but also of vigorous, sustained intellectual dialogue among scholars and nonacademic experts. To stimulate this dialogue, the Center sponsors a wide array of seminars, research programs, workshops, and conferences.

The cooperation between the WCFIA and the ISIS started in 2011, when Gerald Steiner, a current visiting scholar at the WCFIA and Associate Professor of Systemic and Sustainability Management at the ISIS, was awarded J.A. Schumpeter Professor 2011-2012 at Harvard University. As a major benefit of this cooperation, ISIS's research focus has been further extended by policy related dimensions of sustainable development, global food security, and innovation studies.

## 2.5 Seminars hosted by ISIS – “ISIS Science Talk”

For its “ISIS Science Talk”, the institute is inviting external experts to give a presentation on core research topics of ISIS (i.e., systems sciences, innovation and sustainability research). These presentations are followed by a discussion and a small buffet. This event is held in English and open for the entire URBI Faculty, other interested colleagues and students and any friends of the institute.

The following talks were held in 2014:

- Dr. Ika Darnhofer (University of Natural Resources and Life Sciences, Vienna): "Resilience: why it matters in a turbulent world." January 15, 2014.
- Mag. Melanie Sporer (EEA Copenhagen): "Tracking progress towards Europe's climate targets." April 9, 2014.
- Dr. Veronika Gaube (IFF Vienna), "Modelling socio-ecological carbon and nitrogen flows of the land-use system in an (pre)alpine region." June 6, 2014.
- Prof. Michael Narodoslawsky (Graz University of Technology): "What makes the use of *bio-resources sustainable?*" November 26, 2014.

Up-to-date information and the whole list of speakers can be found on our website at <http://isis.uni-graz.at/en/forschen/science-talk>.

In addition to these talks, the following events were organized by the Coordination Office for Environmental Systems Sciences (USW Koordinationsbüro):

- Interdisciplinary practice presentation day – June 23, 2014
- Feedback survey for students on courses in systems sciences – June/July 2014
- Introduction to Scientific English for students – November 18, 2014

Up-to-date information on events organized by the Coordination Office for Environmental Systems Sciences can be found at <http://umweltsystemwissenschaften.uni-graz.at>.

## 2.6 Sustainability @ ISIS

The initiative Sustainability @ ISIS was launched by a group of employees that shared the idea to improve the institute's overall sustainability performance. A particular motivation was the fact that the ISIS is one of the reference institutes for the on-going EMAS certification of the University of Graz. As kick-off for the initiative, a brainstorming workshop was held to assess the status quo. Potentials for improvement as well as methods for sustainability monitoring were gathered, and an action plan was created. For each of the tasks an implementation time frame and a responsible person were defined. The long term vision of the working group is to produce a sustainability report for the institute.

### Conducted measures

The initiative already implemented a number of measures to improve the sustainability performance of the institute. One of the first measures was switching to sustainable kitchen products such as fair trade coffee and organic and regional milk. Furthermore, a list of certified sustainable accommodation possibilities in Austria, as well as a list of sustainable catering companies in Graz were compiled. These checklists facilitate the search for environmentally conscious hotels, and catering services for events hosted by the institute. Additionally, an environmental awareness program started in 2014. Stickers, designed by group members, have been applied to electronic devices, paper dispensers etc. to raise environmental awareness of both students and employees. Keeping in mind the social aspect of sustainability, a one day excursion for all ISIS colleagues had been organized in September 2013. The trip included a guided tour to the Erzberg and a visit of the voestalpine Donawitz steel company, and was completed by an enjoyable dinner at GösserBräu in Leoben. In summer 2014, a small garden was opened near the entrance area of the institute building, and institute members could harvest various vegetables and herbs which were used to prepare a number of delicious meals in the institute kitchen.

Sustainability @ ISIS Action plan	Immediate	Short-term	Long-term
Kitchen management	•		
Office management		•	
Working atmosphere	•	•	•
Mobility	•	•	
Stakeholder engagement			•
Communication		•	
Sustainability monitoring	•	•	

Figure 24: Action plan of initiative (overview)



Figure 25: Design of the stickers



Figure 26: ISIS Excursion to the Erzberg.



Figure 27: Vegetables from the garden project

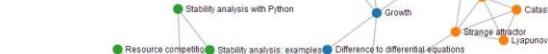
## Future Goals

The major long term goal for the next few years is a reduction of the energy demand per person. In order to achieve this, the current energy demand at ISIS will be evaluated. Based on this assessment, potentials for reduction of electricity and heating demand will be identified and respective measures will be set.

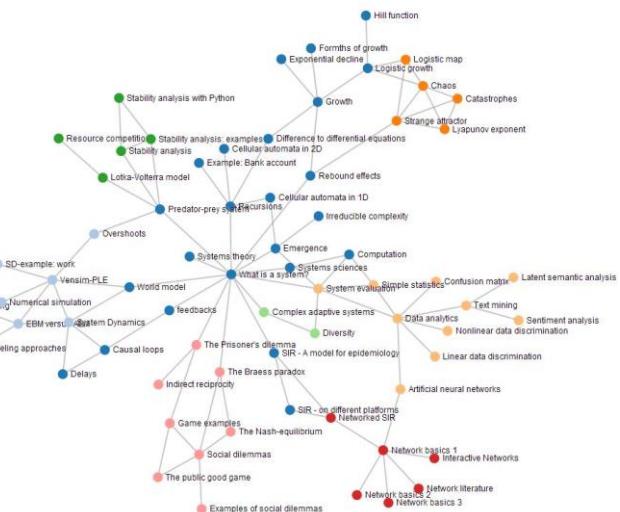
**Group members:** Morgane Fritz, Maria Hecher, Martina Hözl, Anita Orthofer, Magdalena Pierer, Josef Schögl, Andrea Schröck, Thomas Winkler

## 2.7 E-Textbook Systems Sciences @ISIS

The rise of tablet computers and smartphones is accompanied by new possibilities for students as well as professors. It allows providing eBooks and especially electronic textbooks with interactive elements. Besides the incorporation of audio and video material, educational examples like dynamic models and simulations can be made accessible out of the text, giving the students the possibility to better understand and comprehend the teaching subject.



For these reasons, Manfred Füllsack, Professor for Systems Sciences at ISIS, is creating an interactive electronic textbook for systems sciences based on software applications for tablet computers. This project is still in progress. A first version of the interactive textbook is available at <http://systems-sciences.uni-graz.at/etextbook>.



**Figure 28: Screenshot Interactive E-Textbook**

The aims of the project are:

- To allow active learning with the help of significant examples where dynamics are not presented statically as graphics, but simulated directly via software applications.
  - To give students the possibility to learn and try out the characteristic behaviour of specific impacts (for example the consequences of changing parameters) on their own, but at the same time under guidance of the text.
  - To test eBooks on their applicability for the special requirements of textbooks generally and to find a convenient, cross-platform and non-proprietary presentation method.

## 2.8 Restl-Festl

In a master's course (interdisciplinary practical training) in the summer term of 2014, a group of six lecturers from the university, public administration (City of Graz, regional Government of the Austrian province of Styria) and ARGE Abfallvermeidung, as well as a highly motivated student team developed "*Restl-Festl – Graz isst auf!*" The aim of the event was to raise public interest and awareness for the topic of food waste prevention. The target group were young students (8 to 14 years) as well as the general public. To this end we developed a plethora of activities, commencing already several months previous to the event itself with an elaborate and frequently updated Facebook account and blog. These sites were frequently visited and served also as a platform to promote the real event.

The *Restl Festl* took place in the courtyard of the 'Minoriten' (Conventual Franciscans) monastery in the inner city of Graz on October, 17th 2014. The organizational team managed to engage 15 exhibitors who have long been involved in food waste prevention, i.e. social enterprises, information campaign organizers, as well as local and regional waste authorities. The exhibitors gave their best to let their visitors experience the importance of reducing food waste. There were also presentations (on e.g. dumpster diving) and panel discussions (involving food retailers). Around 100 people were involved as exhibitors, cooks and in other jobs. Most of them volunteered free of charge, as the festival operated on a budget of € 5000.



Figure 29: Restl Festl in monastery courtyard

Prior to the event, more than half a ton of apples, half a ton of potatoes, more than 1000 bread rolls (from the day before) and other vegetables, dairies, flour, rice and other grains, but also sweets and cakes, drinks, oil, herbs and spices had been collected by the student team. All the food had either reached the expiry date, was so-called "mis-fit" or (especially the bread and vegetables) no longer really "fresh". From these ingredients, renowned Styrian chef Willi Haider, assisted by the female seminary farmers from the chamber of agriculture, cooked and served more than 1300 meals. These meals, and the remaining unprepared food, were handed out for free.

The festival attracted more than 1000 visitors, including more than 300 young students, who enjoyed the casual and relaxed atmosphere. Media coverage included newspaper, radio and TV reports, and a lot of internet presence.



**Figure 30: Students involved in Restl Festl**

All in all, the event represented a massive service learning opportunity for our students whose involvement and commitment drove and spirited the whole event. Besides being a nice event with influence on the public, *Restl Festl* bundled the forces against food waste to create a “critical mass” of attention to raise interest in and awareness of the food waste problem.

Blog and pictures from the event:

<http://restlfestl.wordpress.com/2014/10/19/impressionen-vom-restlfestl-am-17-oktober/>

Facebook fan page:

<https://www.facebook.com/pages/Restl-Festl/620539934703023>

### 3 PUBLICATIONS AND OTHER RESEARCH OUTPUT

In this section, a detailed report on the institute's research output is presented. An overview is given in the following table.

ISIS research activities and output	2011	2012	2013	2014
<b>Publications</b>				
Publications in scientific journals	7	10	18	22
Scientific monographs	1	0	1	1
Editorships of scientific monographs	2	1	2	0
Book Chapters	5	12	13	8
Contributions to conference proceedings	14	9	16	11
Posters presented at scientific conferences	3	4	5	3
Other scientific publications	5	4	3	3
<b>Projects</b>				
Third-party funded projects	20	11	12	12
<b>Functions</b>				
External scientific functions and functions in external scientific committees	5	6	17	13
Functions in international journals	8	10	9	6
<b>Networking activities</b>				
Presentations at scientific conferences and seminars	10	30	42	26
Awards	0	2	5	4
Organisational activities for scientific events	2	8	11	1
Visiting scientists (Incoming Mobility)	2	1	3	4
Travel activities (Outgoing Mobility)	7	7	4	7
<b>Transfer – Science to professionals</b>				
Publications – science to professionals	2	1	0	0
Publications in journals – science to professionals	1	0	0	0
Presentations – science to professionals	6	4	3	6
<b>Transfer – Science to public</b>				
Media appearances	1	7	9	12
Publications for non-scientific audience	0	1	2	0
Presentations for non-scientific audience	6	16	5	6

### 3.1 Publications

#### 3.1.1 Publications in peer-reviewed scientific journals

Amon, Barbara; Winiwarter, Wilfried; Anderl, Michael; Baumgarten, Andreas; Dersch, Georg; Guggenberger, Thomas; Hasenauer, Hubert; Kantelhardt, Jochen; Kasper, Martina; Kitzler, Barbara; Moser, Tobias; Pötzelsberger, Elisabeth; Prosenbauer, Manfred; Schaller, Lena; Schröck, Andrea Maria; Sigmund, Elisabeth; Zechmeister-Boltenstern, Sophie; Zethner, Gerhard: *Farming for a better climate (FarmClim). Design of an inter-and transdisciplinary research project aiming to address the science-policy gap.*, in: Gaia: Oekologische Perspektiven in Natur-, Geistes- und Wirtschaftswissenschaften, 2 (2014), 118 - 124.

Braschel, Nina; Posch, Alfred; Pierer, Magdalena: *Understanding the Side Effects of Emission Trading: Implications for Waste Management*, in: Waste Management and Research, 32, 1 (2014), 34 - 39.

Brudermann, Thomas; Bartel, Gregory; Fenzl, Thomas; Seebauer, Sebastian: *Eyes on social norms: A field study on an honor system for newspaper sale*, in: Theory and Decision: an international journal for multidisciplinary advances in decision sciences (2014). doi: 10.1007/s11238-014-9460-1.

Brudermann, Thomas; Mitterhuber, Corinna; Posch, Alfred: *Agricultural biogas plants - a systematic analysis of strengths, weaknesses, opportunities and threats*, in: Energy Policy (2014). doi:10.1016/j.enpol.2014.11.022.

Brudermann, Thomas; Yamagata, Yoshi. *Towards studying collective dynamics of electricity sharing systems.* in: Energy Procedia, 61 (2014), 975-978. doi:10.1016/j.egypro.2014.11.1007.

Celec, Robert; Globocnik, Dietfried; Kruse, Philipp: *Resources, Capabilities, Export Performance and the Moderating Role of Entrepreneurial Orientation in the context of SMEs*, in: European Journal of International Management 8, 4 (2014), 440 - 464.

Füllsack, Manfred: *Verbal Limitations of Observer-inclusion*, in: Constructivist Foundations 10, 1 (2014).

Füllsack, Manfred: *The Circular Conditions of Second-order Science Sporadically Illustrated with Agent-based Experiments at the Roots of Observation*, in: Constructivist Foundations 10, 1 (2014), 46 - 54.

Füllsack, Manfred: *IC and the Observed/Observer Duality*, in: Constructivist Foundations 9, 2 (2014).

Gabriel, Magdalena; Tschandl, Martin; Posch, Alfred: *Sustainability-oriented LifeCycle costing*, in: The Annals of Faculty Engineering Hunedoara – International Journal of Engineering (2014), 12 (1), 33 - 40.

Gelbmann, Ulrike-Maria; Hammerl, Barbara: Integrative re-use systems as innovative business models for devising sustainable producteservice-systems, in: Journal of Cleaner Production (2014). doi:10.1016/j.jclepro.2014.01.104.

- Globocnik, Dietfried; Salomo, Sören: *Do Formal Management Practices Impact the Emergence of Bootlegging Behavior?*, in: Journal of Product Innovation Management (2014). doi: 10.1111/jpim.12215.
- Guevara Chaves, Porfirio; Lopez, Luis; Posch, Alfred; Zuniga, Roy: *A Dynamic Nonlinear Model for Educational Systems: A Simulation Study for Primary Education*, in: Nonlinear Dynamics, Psychology, and Life Sciences, 18, 1 (2014), 91 - 108.
- Guevara Chaves, Porfirio; Posch, Alfred: *Dynamic Complexity, Entropy, and Coordination in Educational Systems: A Simulation of Strategic and Exogenous Interventions*, in: Systemic Practice and Action Research (2014). doi: 10.1007/s11213-014-9327-y.
- Hatzl, Stefanie; Brudermann, Thomas; Reinsberger, Kathrin; Posch, Alfred: *Do public programs in 'energy regions' affect citizen attitudes and behavior?*, in: Energy Policy 69 (2014), 425 - 429.
- Hermann, Robert; Baumgartner, Rupert J.; Sarc, Renato; Ragossnig, Arne; Wolfsberger, Tanja; Eisenberger, Martin; Budischowsky, Andreas; Pomberger, Roland: *Landfill mining in Austria: Foundations for an integrated ecological and economic assessment*, in: Waste Management and Research 32, 9 (2014), 48 - 58.
- Morone, Piergiuseppe; Tartiu, Valentina; Falcone, Pasquale: *Assessing the potential of biowaste for bioplastics production through Social Network Analysis*, in: Journal of Cleaner Production (2014). doi:10.1016/j.jclepro.2014.11.069.
- Pierer, Magdalena; Winiwarter, Wilfried; Leach, Allison M.; Galloway, James N.: *The nitrogen footprint of food products and general consumption patterns in Austria*, in: Food Policy 49, 1 (2014), 128 - 136.
- Posch, Alfred; Brudermann Thomas; Braschel, Nina; Gabriel, Magdalena: *Strategic energy management in energy-intensive enterprises – a quantitative analysis of relevant factors in the Austrian paper and pulp industry*, in: Journal of Cleaner Production. doi:10.1016/j.jclepro.2014.11.044.
- Reinsberger, Kathrin; Posch, Alfred: *Bottom-up Initiatives for Photovoltaic: Incentives and Barriers*, in: Journal of Sustainable Development of Energy, Water and Environment Systems 2, 2 (2014), 108 - 117.
- Steiner, Gerald; Risopoulos-Pichler, Philippina; Mulej, Mathias: *Social Responsibility and Citizen-Driven Innovation in Sustainably Mastering Global Socio-Economic Crisis*, in: Systems Research and Behavioral Science, (2014). doi: 10.1002/sres.2255.
- Zhang, Yanzhu; Posch, Alfred: *The Wickedness and Complexity of Decision Making in Geoengineering*, in: Challenges, 5 (2014), 390 - 408.

### 3.1.2 Scientific monographs

- Steinwender, Gerald; Dummer, Rita; Globocnik, Dietfried; Salomo, Sören: *Innovation Excellence in Österreich*. Amstetten: Plattform für Innovationsmanagement, 2014, 178 pages.

### 3.1.3 Book chapters

- Binder, Claudia R.; Hecher, Maria; Vilsmaier, Ulli: *Visionen, Institutionen und Infrastrukturen als Elemente der Energietransformation*, in: Stefan Böschen, Bernhard Gill, Cordula Kropp, Katrin Vogel (eds.): *Klima von unten - Regionale Governance und gesellschaftlicher Wandel*. Frankfurt/New York: Campus Verlag 2014, 267 - 287.
- Brudermann, Thomas: *Mass Psychology Revisited – Insights from Social Psychology, Neuroscience and Simulation*. in: Weidmann U., Kirsch U., Schreckenberg M. (eds.): *Pedestrian and Evacuation Dynamics 2012*. Springer 2014, 39 - 55.
- Füllsack, Manfred: *Soziale Interaktion und ihre Modellierung, oder: Luhmann und die Wahrscheinlichkeit des Unwahrscheinlichen*, in: Tore Bakken et al. (eds.): *Nachtflug der Eule: 150 Stimmen zum Werk von Niklas Luhmann*: Gedenkbuch zum 15. Todestag von Niklas Luhmann. LiDi EuropEdition 2014.
- Gelbmann, Ulrike-Maria; Zimek, Martina: *Analyzing Initiatives to Reduce Food Waste at Consumer Level in Styria*, in: Pomberger, R. et al. (eds.): *Depotech 2014 – Abfallwirtschaft, Abfalltechnik, Deponietechnik und Altlasten*, Montanuniversität Leoben, 2014.
- Globocnik, Dietfried; Salomo, Sören: *Kreative Devianz*, in: C. Schultz, K. Hölzle (eds.): *Motoren der Innovation – Zukunftsperspektiven der Innovationsforschung*. Wiesbaden: Gabler 2014, 165 - 183.
- Globocnik, Dietfried; Salomo, Sören: *Erfolgsfaktoren des strategischen Innovationsmanagements.*, in: Granig P., Hartlieb, E., Lercher, H. (eds.): *Innovationsstrategien - Von Produkten und Dienstleistungen zu Geschäftsmodellinnovationen*. Springer Gabler 2014, 55 - 69.
- Schögl, Josef-Peter; Baumgartner, Rupert J.; Hofer, Dietmar: *Sustainable product design and recycling optimization of innovative lightweight technologies*, in: Pomberger, R. et al. (eds.): *Depotech 2014 – Abfallwirtschaft, Abfalltechnik, Deponietechnik und Altlasten*, Montanuniversität Leoben, 2014.
- Weber, Olaf; Delince, Jacques; Duan, Yayun; Maene, Luc; McDaniels, Tim; Mew, Michael; Schneider, Uwe A.; Steiner, Gerald: *Trade and Finance as Cross-cutting Issues in the Global Phosphate and Fertilizer Market*, in: Scholz, R.W./Roy, A. (eds.): *Global transdisciplinary processes for sustainable phosphorus management*. New York: Springer 2014. doi: 10.1007/978-94-007-7250-2\_7.

### 3.1.4 Contributions to conference proceedings

- Baumgartner, Rupert J.; Fritz, Morgane; Resel, Karl; Schiffleitner, Andreas; Schögl, Josef-Peter: *Sustainhub - A Software Solution for Sustainable Supply Chain Management in the Electronics Industry*, in: Going Green - Care Innovation (eds.): *Going Green - Care Innovation*. 2014.
- Brudermann, Thomas; Reinsberger, Kathrin; Orthofer, Anita; Posch, Alfred: *Towards Collective Arrangements to Foster Photovoltaics in Agriculture*, in: Proceedings of the International Conference and Utility Exhibition 2014 on Green Energy for Sustainable Development. IEEE Computer Society 2014.

- Brudermann, Thomas; Yamagata, Yoshiki: *Towards an Agent-Based Model of Urban Electricity Sharing*, in: Proceedings of the International Conference and Utility Exhibition 2014 on Green Energy for Sustainable Development. IEEE Computer Society 2014.
- Engert, Sabrina: *Implementing Corporate Sustainability from a Strategic Management Perspective - Identified Influencing Factors of Sustainable Strategic Management.*, in: EURAM 14 (eds.): EURAM 2014.
- Fritz, Morgane: *Influencing factors for the use of by-products in the construction industry*, Poster presented at DepoTech 2014, Leoben, Austria, November 4-7.
- Fritz, Morgane; Enéas da Silva, Minelle; Baumgartner, Rupert J.: *Sustainable Supply Chain Management: A Latin-Ibero-American (Re)View*, in: University of Leeds, United Kingdom (eds.): CRRC Conference 2014.
- Gabriel, Magdalena; Perl-Vorbach, Elke; Posch, Alfred: *The Fuzzy Front End of Sustainable Innovation: Findings Based on a Case Study on the Paper and Pulp Industry*, in: The Centre of Sustainable Design (eds.): Sustainable Innovation 2014- Cities & Regions as Catalysts for Smart & Sustainable Innovation. 2014.
- Perl-Vorbach, Elke; Rauter, Romana; Baumgartner, Rupert J.: *Open Innovation in the Context of Sustainable Innovation*, in: Institute for Sustainable Leaderhsip (eds.): Proceedings. 2014.
- Schöggel, Josef-Peter; Baumgartner, Rupert J.: *Adapting sustainable product development to different industries and considering a regional context*, in: The Centre for Sustainable Design (eds.): Sustainable Innovation 2014 - Cities & Regions as Catalysts for Smart & Sustainable Innovation. 2014.
- Schöggel, Josef-Peter; Baumgartner, Rupert J.; Hofer, Dietmar: *A checklist for sustainable product development - improving sustainability performance in early phases of product design*, in: I. Horváth, Z. Rusák; Delft University of Technology (eds.): Proceedings of TMCE 2014.
- Schöggel, Josef-Peter; Fritz, Morgane; Baumgartner, Rupert J.: *Aggregation methods for supply chain sustainability indicators*, in: Humboldt University (eds.): CSR Conference. 2014.

### 3.1.5 Posters presented at scientific conferences

- Pierer, Magdalena; Schröck, Andrea Maria; Winiwarter, Wilfried: An analysis of consumer-related N flows: Food and material use, for: 18th Nitrogen Workshop. The Nitrogen challenge: building a blueprint for nitrogen use efficiency and food security, Lisbon, 2014.
- Reinsberger, Kathrin; Posch, Alfred: *Mitigating Climate Change trough Photovoltaic Adoption:An integrated SWOT-AHP Analysis*, für: Climate Change: Impacts & Responses Reykjavik, 2014.
- Schröck, Andrea Maria; Winiwarter, Wilfried: *Land use related interventions on the nitrogen cycle*, für: 2nd Global Land Project Open Science Meeting, 2014.

### 3.1.6 Other scientific publications

Ackermann, Kurt A.; Fleiß, Eva; Fleiss, Jürgen; Murphy, Ryan O.; Posch, Alfred: *Save the Planet for Humans' Sake: The Relation between Social and Environmental Value Orientations*. Working Paper, 2014. Available online: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2455990](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2455990)

Baumgartner, Rupert J.; Gelbmann, Ulrike-Maria; Rauter, Romana (eds.): *Making the Number of Options Grow. Contributions to the Corporate Responsibility Research Conference 2013*. ISIS-Report, 2014. Available online: [http://static.uni-graz.at/fileadmin/urbi-institute/Systemwissenschaften/ISIS\\_Reports/ISIS\\_reports\\_6\\_CRRC.pdf](http://static.uni-graz.at/fileadmin/urbi-institute/Systemwissenschaften/ISIS_Reports/ISIS_reports_6_CRRC.pdf)

Posch, Alfred; Reinsberger, Kathrin (eds.: FH Joanneum, KF-Uni Graz, IFZ, Joanneum Research): *Gesellschaftliche Potenziale für den Übergang zu smarten Lebenswelten in der Steiermark*. Zusammenfassung der Ergebnisse eines Dialogprozesses aus Forschung und ihrer Anwendung, 2014. Available online: <http://www.sts.aau.at/content/download/9532/83642>.

## 3.2 Functions

### 3.2.1 External scientific functions and functions in external scientific committees

Baumgartner, Rupert J.: *International Sustainable Development Research Society* (United Kingdom), Executive Board, since 01.07.2006.

Baumgartner, Rupert J.: *Reviewer Doctoral Programmes*, FCT, Portugal, 05.2014.

Baumgartner, Rupert J.: *Reviewer Förderprogramm Sozial-ökologische Forschung (SÖF)*, Deutschen Zentrum für Luft- und Raumfahrt e.V., Germany, 05.2014.

Baumgartner, Rupert J.: *Reviewer Social Sciences and Humanities Research Council of Canada (SSHRC)*, Social Sciences and Humanities Research Council of Canada (SSHRC), Canada, 02.2014.

Baumgartner, Rupert J.: *Opponent PhD-Defense*, Abo Akademie University, Finland, 12.12.2014.

Perstel, Peter: *ICOGRADA* (Canada), Executive Board, 01.10.2012 - 01.10.2014.

Posch, Alfred: *APCC* (Austria), Advisor, since 2013.

Posch, Alfred: *ITdNet* (European Union), Membership, since 2002

Winiwarter, Wilfried: *FP7 Projekt InGOS* (Belgium), Advisor, since 02.12.2013.

Posch, Alfred: *External Examiner for John Telesford: "Strategic sustainability and industrial ecology in an Island context, with considerations for a green economy Roadmap: A study in the Tourist accommodation section, Granada, PhD-thesis, Robert Gordon University Aberdeen, UK*, 28.05.2014.

Steiner, Gerald: *Member of the Scientific Board of the "Regional Center of Expertise" (RCE) at the University of Graz*, since 2007.

Winiwarter, Wilfried: *Commission on Climate and Air Quality of the Austrian Academy of Sciences* (Austria), Chair, since 01.04.2013.

Winiwarter, Wilfried: *European Center of the International Nitrogen Initiative* (Austria), Chair, since 01.01.2013.

### 3.2.2 Functions in international journals

Aschemann, R.: *Journal of Environmental Assessment Policy and Management*, Member Editorial board, since 2009.

Baumgartner, Rupert J.: *Journal of Cleaner Production*, Editor, since 01.11.2008.

Baumgartner, Rupert J.: *Sustainable Development*, Member Editorial Board, since 01.10.2008.

Winiwarter, Wilfried: *Systems. Connecting matter, life, culture and technology*, Member Editorial Board, since 01.10.2012.

Winiwarter, Wilfried: *Aerosol and Air Quality Research*, Member Editorial Board, since 01.09.2012.

Winiwarter, Wilfried: *Greenhouse Gas Measurement & Management*, Member Editorial Board, since 01.01.2011.

Reviews were undertaken for following journals:

- Central European Journal of Operations Research
- Ecological Indicators
- Energy Policy
- Environmental Impact Assessment Review
- European Management Journal
- Journal of Business Ethics Education
- Journal of Cleaner Production
- Journal of Economic Psychology
- Journal of Environmental Assessment Policy and Management
- PLOS ONE
- Raumforschung und Raumordnung
- Waste Management and Research

### 3.3 Presentations at scientific conferences and seminars

Baumgartner, Rupert J.: *Strategisches Nachhaltigkeitsmanagement – ein ganzheitlicher Ansatz zur Unternehmensführung*, for: Corporate Governance Ringvorlesung, FH Vienna Austria, 03.04.2014.

Baumgartner, Rupert J.: *Organizational Sustainability Assessment – Bewertung ökologischer und sozialer Aspekte im Unternehmensbereich*, for: Seminar zu Ressourcenmanagement und Abfallwirtschaft, Technical University Vienna, Institut für Wassergüte, Ressourcenmanagement und Abfallwirtschaft, Austria, 28.04.2014.

Baumgartner, Rupert J.: New Business Models for Sustainability: Motivations and Drivers, for: 20<sup>th</sup> International Sustainable Development Research Conference (ISDRC), Trondheim, Norway, 20.06.2014.

Baumgartner, Rupert J.: *Sustainable Supply Chain Management: Indicators, Data Exchange and Aggregation*, for: 17th European Cleaner Production Roundtable (ERSCP 2014), Portoroz, Slovenia, 16.10.2014.

Baumgartner, Rupert J.: *Nachhaltige Produktentwicklung und Recyclingoptimierung im Leichtbau*, for: Depotech, Montanuniversität Leoben, Austria, 05.11.2014.

Baumgartner, Rupert J.: Integration of Sustainability Aspects into Supply Chain Management, International Conference on Management of Technology (IAMOT 2014), Washington DC/USA, 26.05.2014.

Brudermann, Thomas: *Sustainability-related bottom-up initiatives in Styria, Austria*, invited lecture for: GCP Seminar on Rural Revitalisation, National Institute for Environmental Studies (Japan), National Institute for Environmental Studies, Tsukuba, Japan, 10.03.2014.

Brudermann, Thomas: *From Individual Decision Making to Collective Dynamics*, keynote lecture at The 2014 Social Mood Conference, Socionomics Institute, Atlanta, Georgia, USA, 05.04.2014.

Brudermann, Thomas: *Urban resilience, regional resilience and behavior*, Invited presentation for: X-Center Network Vienna 2014 Conference, X-Center Vienna, Austria, 25.04.2014.

Brudermann, Thomas: *Collective Dynamics in Community-based Electricity Sharing*, for: Workshop on Surprise Resilient Scenarios: Emergent Dialogue Approach, Global Carbon Project, Tsukuba International Office, Okinawa, Japan, 02.11.2014.

Brudermann, Thomas: *Photovoltaic Communities in Austria - Lessons from the “RESHAPE” Project*, Guest lecture for: Prince of Songkla University, Faculty for Environmental Management, Hat Yai, Thailand, 13.11.2014.

Engert, Sabrina: *Implementing Corporate Sustainability from a Strategic Management Perspective - Identified Influencing Factors of Sustainable Strategic Management*, for: 14<sup>th</sup> EURAM 14, Valencia, Spain, 06.06.2014.

Füllsack, Manfred: *Resilience and graceful degradation in cooperation networks. Experiments with simulated Public Goods Games*, for: EMCSR-2014, University of Vienna, Austria, 24.04.2014.

Füllsack, Manfred: *How to collaborate?* for: Interweaving cultures, FU Berlin, Germany, 10.10.2014.

- Gabriel, Magdalena; Perl-Vorbach, Elke: *The Fuzzy Front End of Sustainable Innovation: Findings Based on a Case Study on the Paper and Pulp Industry*, for: Sustainable Innovation 2014 - 19th International Conference, The Centre for Sustainable Design, KADK, Copenhagen, Denmark, 04.11.2014.
- Gelbmann, Ulrike-Maria: *Interrelations of resilience and sustainability: Looking back and forward*, for: 20<sup>th</sup> International Sustainable Development Research Conference (ISDRC), Trondheim, Norway, 18.06.2014.
- Hecher, Maria: *Dynamic LCA of heating technologies applied in residential building stocks*, for: 10. Ökobilanzwerkstatt - Ökobilanzielle Bewertung von Energietechnologien und Energiesystemen, Technische Universität Dresden, Germany, 09.09.2014.
- Hölzl, Martina: *CSR-Efforts of Austrian Start-Up Businesses*, for: 6th International Conference on Corporate Sustainability and Responsibility, Humboldt-Universität zu Berlin, Germany, 08.10.2014.
- Hölzl, Martina: *Austrian Re-Use Initiatives as Examples for Sustainability Entrepreneurship*, for: 20<sup>th</sup> International Sustainable Development Research Conference (ISDRC), Trondheim, Norway, 20.06.2014.
- Perl-Vorbach, Elke: *Open Innovation in the Context of Sustainable Innovation: Findings based on a Literature Review*, for: Sustainable Leadership Conference 2014, Salzburg, Austria, 05.06.2014.
- Rauter, Romana: *Sustainable Open Innovation*, for: 6th International Conference on Corporate Sustainability and Responsibility, Humboldt University Berlin, Germany, 09.10.2014.
- Reinsberger, Kathrin: *Energy Transition through Grassroots Innovations*, for: 20<sup>th</sup> International Sustainable Development Research Conference (ISDRC), Trondheim, Norway, 19.06.2014.
- Reinsberger, Kathrin: *The role of photovoltaics in transition towards a low carbon economy: An integrated SWOT-AHP analysis*, for: 20<sup>th</sup> International Sustainable Development Research Conference (ISDRC), Trondheim, Norway, 18.06.2014.
- Schöggel, Josef-Peter: *Adapting sustainable product development to different industries and considering a regional context*, for: Sustainable Innovation 2014 - 19th International Conference, The Centre for Sustainable Design, KADK, Copenhagen, Denmark, 05.11.2014.
- Schöggel, Josef-Peter: *A checklist for sustainable product development - improving sustainability performance in early phases of product design*, for: Tenth International Conference on Tools and Methods for Competitive Engineering - TMCE 2014, Budapest, Hungary, 22.05.2014.
- Winkler, Thomas: *Greenhouse gas scenarios for Austria - Comparing different approaches*, for: Österreichischer Klimatag 2013, CCCA, Innsbruck, Austria, 04.04.2014.

### 3.4 Science to Professionals Presentations

Aschemann, Ralf: *Partnership selection, joint curriculum development and financial management*. NUFFIC, Den Haag, Netherlands, 28.01.2014 - 29.01.2014.

Baumgartner, Rupert J.: *Nachhaltige Unternehmensführung*, for: Lehrgang Nachhaltiges Bauen, Vienna University of Technology and Graz University of Technology (Austria), 14.03.2014.

Baumgartner, Rupert J.; Schögl, Josef-Peter; Perstel, *Prinzipien und Methoden des Eco-Designs*, for: Seminarreihe Eco-Design, 21.03.2014.

Fritz, Morgane: *SustainHub general presentation*, Chemicals Branch/DTIE, UNEP (Switzerland), 08.05.2014

Gelbmann, Ulrike-Maria: Vorstellung des Projektes „Restl Festl – Graz isst auf“. Vernetzungstreffen der Plattform "Lebensmittel sind kostbar", 08.05.2014.

Gelbmann, Ulrike-Maria: Der Zauber der Verantwortung. Unternehmerinnenforum der "Frau in der Wirtschaft", WKNÖ, 01.10.2014.

### 3.5 Science to Public

#### 3.5.1 Press releases and media appearances

Baumgartner, Rupert J.: *Nachhaltigkeit ist mehr*, Salzburger Nachrichten, 05.11.2014.

Baumgartner, Rupert J.: *Steckt in Ihren neuen Sommerhosen verbotene Kinderarbeit?* Heureka (Wissenschaftsbeilage d. Falter, Ausgabe 1/2014), 04.2014.

Baumgartner, Rupert J.; Fritz, Morgane; Schögl, Josef-Peter: *Shoppen für eine bessere Welt - Grazer Innovationsforscher entwickeln Indikatoren für umwelt- und sozialverträgliche Wertschöpfungsketten*, Der Standard, 26.03.2014.

Baumgartner, Rupert J.; Fritz, Morgane; Schögl, Josef-Peter: *Grazer Forscher entwickeln Bewertungskatalog für nachhaltige Produktion - Europäische Datenbank soll für Unternehmen die Umwelt-, Energie- und sozialen Standards in unübersichtlichem Zuliefermarkt transparent machen*, derstandard.at, 16.02.2014.

Brudermann, Thomas: Michael Weber-Schwarz: *TZ-KOPFBALL: Kollektives Flehen*, Tauber Zeitung, 08.07.2014.

Brudermann, Thomas: *Brudermann on Moving from the Individual to the Herd. Interview with Susan C. Walker, Elliott Wave International, 13 March 2014*, Elliott Wave International, 13.03.2014.

Brudermann, Thomas: *Warum es meistens sinnvoll ist, dass wir Herdentiere sind*, Westdeutsche Allgemeine Zeitung / Der Westen, 21.02.2014.

Brudermann, Thomas: *Herdentrieb*, Stuttgarter Zeitung, 05.02.2014.

Brudermann, Thomas: *Im Zweifel folgen Menschen eher der Masse*, Weser Kurier, 01.02.2014.

Posch, Alfred: *Wenn Holzhäuser an den Wolken kratzen*, Der Standard, 10.09.2014.

Posch, Alfred: *Zweitgrößter Holz-Importeur weltweit. Studie: Österreichs Importabhängigkeit von Biomasse nimmt stark zu*, Kleine Zeitung, 09.07.2014.

Posch, Alfred: *Österreich weltweit zweitgrößter Importeur von Holz*, Der Standard, 08.07.2014.

### 3.5.2 Presentations for non-scientific audience

Aschemann, Ralf; Rauter, Romana; Brudermann, Thomas: *Umwelt-System-Wissenschaften? Und was Innovation damit zu tun hat! (Probekonferenz für Studieninteressierte)*, for: Schnupperuni 2014, University of Graz, 27.08.2014.

Baumgartner, Rupert J.: Panel discussant "Anziehen. Ausziehen. Zum Verhältnis von Mode und Nachhaltigkeit", University of Graz, 20.11.2014.

Baumgartner, Rupert J.: Panel discussant „Rohstoffe-Abfälle-Nachhaltigkeit“, University of Leoben, 06.10.2014.

Brudermann, Thomas: *Green Behavior - Environmental Decision Making*, for: Sozi-ökologischer Wandel – Nachhaltigkeit, Gerechtigkeit und Wachstum, Studienvertretung Volkswirtschaftslehre, University of Vienna, Vienna (Austria), 17.06.2014.

Hölzl, Martina: *Panel discussant at Entrepreneurship Summit – „Sustainability meets Entrepreneurship“*, Vienna, 26.11.2014.

Winkler, Thomas: *Expertendiskussion: School meets Science*, for: 15. Österreichischer Klimatag, Alp-S, Innsbruck (Austria), 04.04.2014.

### 3.6 ISIS-Reports

In 2012 ISIS decided to issue a report series of its own, called “ISIS Reports”. The series is dedicated to disseminating interesting scientific results from ISIS members and their colleagues as well as from excellent students. The aim is to provide a means of publication that works more quickly than journals would and an opportunity to publish excellent research work that has not (yet) been published in other ways. This includes research reports, excellent master’s or PhD theses as well as collections of papers from conferences (conference proceedings) or excellent reports from teaching projects. All contents suggested for publication undergo an internal review by the series editors, Wilfried Winiwarter, Ulrike Gelbmann, and Rupert J. Baumgartner.

The series appears at irregular intervals with a minimum of two issues per year. It bears an ISSN number and is available in the form of hard copies and especially as a pdf online on our ISIS website. The language of publication is German or English.

In 2013 ISIS reports #2 to #5 have been published; ISIS Report #6, with selected papers presented at the 2013 Corporate Social Responsibility Conference organized by ISIS, was published in January 2014:

ISIS Report #6: Baumgartner, R.J., Gelbmann, U., Rauter, R. (eds.): *Making the Number of Options Grow. Contributions to the Corporate Responsibility Research Conference 2013*. Graz, January 2014 (in English).

### 3.7 The ISIS Website

The ISIS website with an up-to-date news section and plenty of information about the institute can be accessed via [isis.uni-graz.at](http://isis.uni-graz.at) (English version: [isis.uni-graz.at/en/](http://isis.uni-graz.at/en/)).

While central information items like contact information, opening hours, news as well as important links can be found already on the start page, the rest of the new website is organised in four categories:

- *Institute*: This category includes a mission statement, venue information including trip advisor and public transport planning tool, the annual reports since 2010 as well as further up-to date information.
- *Studying*: This category involves information for both current and potential future students of ISIS study programmes: Environmental Systems Sciences, Joint Degree Sustainable Development, Master Industrial Ecology (MIND) and the recently founded doctoral school. A list of master theses and links to the alumni clubs can also be found there.
- *Research*: This section gives an overview on ISIS research aims and activities, ongoing projects, recent publications as well as existing co-operations with national and international partners. There is also a sub-category dedicated to the ISIS science talk, which is forum for invited (international) guests to present their research.
- *People*: Finally, one category is dedicated to introduce people who work (or worked) at ISIS, including their research interests and publications. Open positions are also announced there.

In 2014, Maximilian Mrotzek, Andreas Schober, Klaudia Kramer and Thomas Brudermann served as administrators for the website.



Figure 31: Website screenshot

### 3.8 Awards

In 2014, the following awards were received by member of the institute and persons related to the institute:

On December 4<sup>th</sup>, Mag. **Nina Braschel**, PhD, received the **Award of Excellence** granted by the federal ministry of science, research and economy for the best dissertation in 2014. Her cumulative dissertation with the title "The European Union Emissions Trading Scheme and potential effects on waste management" was written within the doctoral school for Environmental Systems Sciences. Her research was supervised by Prof. Dr. Alfred Posch (ISIS) and Prof. Roland Pomberger (Montanuniversität Leoben).



Figure 32: A. Posch, N. Braschel and R. Pomberger

**Sascha Rom**, MSc., was awarded the **Hans-Roth Umweltpreis** (Environment Award awarded by the Saubermacher company) for his master thesis "Stakeholder-analysis of the Austrian re-use-sector with special focus on the role models of the commercial waste management in the region of Graz" (supervised by Dr. Ulrike Gelmann) on November 6<sup>th</sup>.

Mag. **Barbara Rauter** was awarded the **Hans-Roth Umweltpreis** for her diploma thesis "Biological waste treatment in Styria and its contribution to climate protection" (supervised by Ao.Univ.-Prof. Dr. Alfred Posch and Dr. Ulrike Gelmann). In her work she dealt with the current situation of biological waste management in Styria and pointed out the emissions caused by aerobic and anaerobic treatment, as well as the emissions from transport of bio-waste.

The 'Restl Festl' organizer team led by Dr. Ulrike Gelmann was awarded "Gratitude and Approval" for their effort and success by the Styrian Landesrat (federal state minister) for Agriculture and Environment, Johann Seitinger on December 15<sup>th</sup>.

## 4 TEACHING

### 4.1 Study Programmes

#### 4.1.1 Environmental Systems Sciences

In teaching, ISIS is the focal institute for the bachelor and master study programmes in **Environmental Systems Sciences (USW – Umweltystemwissenschaften)** with its four subject foci: business administration (respectively sustainability oriented management), economics, geography, and NAWI-Tech.



Figure 33: USW logo

NAWI-Tech is the newest of all subject foci and was established in 2012. This unique study programme is provided by University Graz (KFUG) and Graz University of Technology (TUG) in their joint activity Natural Sciences. This study (USW Nawi-Tech) replaces the former subject foci physics and chemistry and is focussing predominantly on the aspects of natural sciences in the discussion of sustainability (for further information please see: <http://www.nawigraz.at/>).

The main idea of these study programmes is to generate interdisciplinary trained academics that are able to handle complex problems that are related to environmental protection and/or to the broader concept of sustainable development of different systems. Here, the capability to apply formal methods of systems sciences, in-depth knowledge in the respective subject focus and profound competences for working in interdisciplinary teams are the most important cornerstones of the profile of graduates in Environmental Systems Sciences.

The roots of the study programmes in Environmental Systems Sciences go back to 1991 when the first individual diploma studies were developed. Continuously increasing interests by students and high dedication of some professors finally led to the implementation of regular bachelor and master study programmes in October 2003 which are still unique in its conception in Europe. Now, about 1,300 students are enrolled in the bachelor and master programmes in Environmental Systems Sciences; the bachelor programmes comprise 180 ECTS credit points which equals a study period of six semesters, and the consecutive master programmes 120 ECTS credit points, or four semesters.



Figure 34: Teaching at ISIS

ISIS is responsible for the education in formal methods of systems sciences, mathematics and statistics, interdisciplinary education for basics in human-environment systems, for parts of the teaching subject business administration (bachelor level), for the teaching subject sustainability-oriented management (master level), and last but not least for the interdisciplinary practical courses. The latter is a special and unique course type where an interdisciplinary team of teachers and students with different subject foci work together on a complex real-world problem for sustainable development of a certain system.

Interdisciplinarity and transdisciplinarity are part of the teaching concept, aiming at the integration of stakeholders from outside the University in order to initiate a mutual learning process between academics and practitioners.

Comprehensive information on Environmental Systems Sciences can be found at [umweltsystemwissenschaften.uni-graz.at](http://umweltsystemwissenschaften.uni-graz.at) or [www.umweltsystemwissenschaften.at](http://www.umweltsystemwissenschaften.at).

#### 4.1.2 International Joint Master's Programme in Sustainable Development

In 2008, a curriculum for the International Joint Master's Programme in Sustainable Development was designed and approved by six partner universities, with the University of Graz (Austria) as co-ordinating university, Ca' Foscari University of Venice (Italy), Leipzig University (Germany), and Utrecht University (The Netherlands) as degree-awarding consortium members, and Basel University (Switzerland) and Hiroshima University (Japan) as associated mobility partners. In 2013, University of Stellenbosch (South Africa) and TERI University in New Delhi (India) joined the consortium as further mobility partners.



Figure 35: Joint Master Programme

In this master's programme sustainability issues are approached from an international as well as inter- and transdisciplinary perspective. The focus is set on applying the competences to the question of sustainable development and the needs and possibilities of societal transformation. It combines the strengths and specializations in teaching and top research of six partner universities, thereby offering the students a programme recognized in the countries of the consortium partners and the possibility of going on to PhD-studies as well as increasing the employability in the private, public and semi-public sector.

Admission to this Master's Programme is granted to students who have completed at least the equivalent of a Bachelor's or Diploma degree, and can demonstrate their research skills, their basic knowledge of the natural and/or social sciences, and a general insight in the subject of sustainable development and intervention strategies. The Master's Programme comprises 120 ECTS credits corresponding to a period of study of at least four semesters or two years. 60 ECTS credits have to be earned at the home university. Students are required to complete at least 30 ECTS credits at one of the partner universities. Besides the academic coordination, ISIS offers courses for the first semester in basics in Sustainable Development, for the third integration semester, and one specialization track (second semester) in Sustainable Business Management. Master theses are generally supervised by two teachers of two different partner universities.

Comprehensive information on the International Joint Master's Programme in Sustainable Development can be found at [www.jointdegree.eu/sd](http://www.jointdegree.eu/sd).

#### 4.1.3 Erasmus Mundus Master's Programme in Industrial Ecology (MIND)

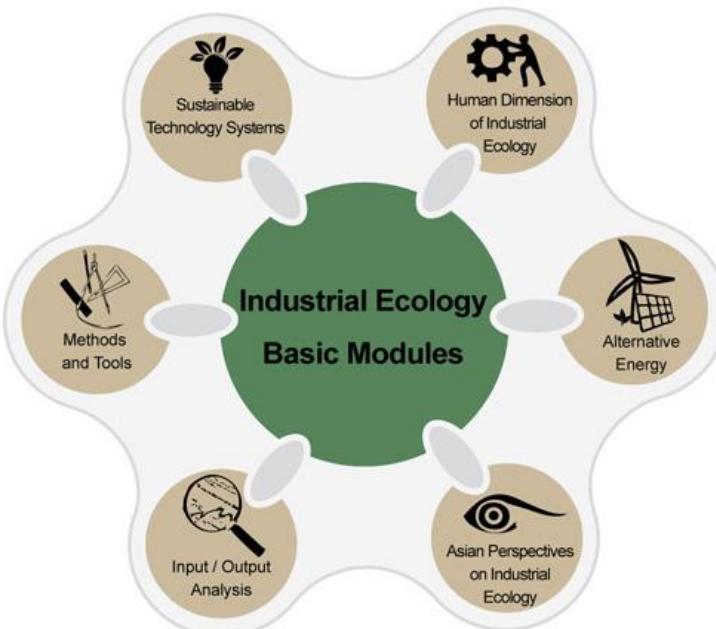
The European Commission's "Education, Audiovisual and Culture Executive Agency" (EACEA) has selected the new Erasmus Mundus Master's Programme in Industrial Ecology (MIND) in July 2010. Beside the International Joint Master's Programme in Sustainable Development, this is the second Joint Master Programme, where ISIS is the co-ordinating institute.

MIND is a two-year programme with 120 ECTS, intending to train its students

- to conduct industrial ecology analyses of complex sustainability problems,
- to design industrial ecology solutions for these problems, and
- to develop implementation strategies for those solutions identified.

MIND has started with winter term 2011/12 and is co-ordinated by Dr. Aschemann as the academic co-ordinator and Mag. Fauland from the Office for International Relations as administrative co-ordinator. Partners in the MIND consortium are Leiden University and Delft University of Technology; Chalmers University of Technology Gothenburg; Asian Institute of Technology (Thailand); Rochester Institute of Technology (USA) and Waseda University (Japan).

In the first study year, the three EU universities offer basic modules on industrial ecology. In the second study year, all consortium universities offer a specialization module in industrial ecology (third semester), cf. the figure xx below, before the master's thesis has to be conducted in the fourth semester.



**Figure 36: Structure of the MIND programme**

According to the Erasmus Mundus regulations, the MIND students have to study at least one semester at two different European countries of the consortium. Moreover, some students have the opportunity to spend one semester at one of the non-European MIND universities. It is intended to run MIND at least for five consecutive editions, i.e. study years 2011/12 to

2016/17. For the same period, the EACEA is supporting MIND by granting scholarships for students and scholars and by contributing to the running administrative costs.

In August 2014, the second generation of MIND students have been awarded with their Diplomas (see figure below) during the jointly organized MIND orientation week, summer school and graduation ceremony on the Dutch island of Ameland.



Figure 37: The 2014 MIND graduates (21 August 2014, Ameland, Netherlands)

With winter term 2014/15, MIND started its fourth edition: 13 students from three continents began their courses at one of the three European partner universities.

Comprehensive information on MIND can be found at [www.emmind.eu](http://www.emmind.eu).

#### **4.1.4 Doctoral school for Environmental Systems Sciences**

In October 2011, the new Doctoral School for Environmental Systems Sciences was founded. The main goal is to provide high-quality education for our PhD-students in the field of environmental systems sciences. The study programme is based either on the curriculum for interdisciplinary environmental systems sciences or on the curriculum for environmental systems sciences focused on natural science. The thesis has to be cumulative based on three peer reviewed journal publications instead of writing a monograph. This new form complies with international scientific standards and ensures that the valuable results achieved by our PhD-students are presented to an international audience.

#### **4.1.5 Doctoral Programme Climate Change**

In the winter semester 2014, the interdisciplinary doctoral programme **DK Climate Change** has been launched. The program is a joint effort of researchers associated with University of Graz's research core area "Environment and Global Change". Univ.-Prof. Lukas Meyer (Department of Philosophy) serves as a speaker for the programme, and Univ.-Prof. Dr. Gottfried Kirchengast (Wegener Center for Climate and Global Change) serves as co-speaker. Three of the eleven board members are affiliated with ISIS: Univ.-Prof. Dr. Rupert Baumgartner, Ao.Univ.-Prof. Dr. Alfred Posch and Univ.-Prof. Dr. Wilfried Winiwarter. The programme is coordinated by Dr. Bettina Lackner and Mag. Regina Brunnhofer.

So far, 13 postgraduate students have been selected for this highly competitive programme. Four of these students are affiliated with ISIS. They will be employed for 3 years in pre-doc research positions, with the option to extend their employment by half a year if they choose to spend at least 6 months at one of the programme's partner universities.

The programme is funded by the Austrian Science Fund (FWF). Detailed information on the aims of the programme, as well as information on all projects and involved researchers can be found on the following web site: <http://dk-climate-change.uni-graz.at/en/>

## 4.2 Course list

Winter term 2013/2014			
Type	Course title	Lecturer	Contact hours
PS	Angewandte Systemwissenschaften	Gobiet A, Kislinger M	2
SE	Applied Statistics	Best H	2
PS	Ausgewählte Themen des Innovations- und Nachhaltigkeitsmanagement (Energiemanagement im Unternehmen)	Rossbacher A	2
PS	CSR/Stakeholdermanagement	Seebacher U	2
KS	Eco-Controlling	Baumgartner R, Rauter R	2
KS	Environmental and Technology Assessment	Aschemann R	2
KS	Environmental Decision Making	Brudermann T	2
VU	Integral- und Differentialrechnungen für Umweltsystemwissenschaften	Batzel J, Hötzl E, Keeling S, Peichl G, Perko R, Rosenberger S	4
KS	Integrated Management Systems	Hölzl M, Perl-Vorbach E	2
VO	Interdisziplinäre Arbeitsmethoden	Aschemann R	2
SE	Introduction to Industrial Ecology	Aschemann R	2
AG	IP - Das Netzwerk der "Seltenen Erden" am Beispiel von Neodym	Bednar-Friedl B, Ermann U, Füllsack M, Gamse T	4
AG	IP - Emissionsreduzierung durch Verkehrsoptimierung	Dujmovits R, Hausberger S, Kozina C, Wolinger B	4
AG	IP - Entwicklung von koordinierten Maßnahmen zur Vermeidung von Lebensmittelabfällen in der Steiermark	Hammerl B, Hasler A, Himmel W	4
AG	IP - Evaluierung von Stakeholderbeteiligungsprozessen in Smart-City Projekten	Gelbmann U, Hammerl B, Rainer E	4
AG	IP - Integrated Quality Management for Re-Use	Aschemann R, Baumgartner R, Hammerl B, Sentic A	6
AG	IP - Methodische Analyse der Polymerstoffe PET und PLA	Guevara Chaves P, Kreindl G, Perstel P	4
AG	IP - Model Based Systems Engineering for Environmental Affairs (Scientific Writing)	Kreuzeder A, Maletz M, Mrotzek M, Stiegler A	6
AG	IP - Nachhaltigkeitskonzept von Schutzhütten im Alpenraum (Kommunikation, Technik, Ökonomie)	Heidinger H, Pink R	4
AG	IP - Potenziale und Indikatoren für eine nachhaltige Unternehmensentwicklung	Grasenick K, Kupsa S, Vorbach S	6

AG	IP - Risiken und sozioökonomische Bedeutung von Naturkatastrophen anhand des Fallbeispiels Oberwölz	Heinrich G, Prettenthaler F, Sass O, Seebauer S	6
PS	Kreativität in Innovationsprozessen	Perstel P	2
VO	Management nachhaltiger Entwicklung	Baumgartner R	2
SE	Masterseminar	Baumgartner R, Füllsack M, Gelbmann U, Posch A, Steiner G, Winiwarter W	2
VO	Mensch und Umwelt: Anthroposphäre	Posch A, Steininger K	2
VO	Mensch und Umwelt: Geosphäre	Lazar R, Lieb G, Sulzer W	2
VU	Methods for inter- and transdisciplinary problem-solving	Aschemann R	2
PS	Nachhaltigkeitsberichterstattung	Resel K	2
SE	Networks	Csermely P	2
OL	Orientierungslehrveranstaltung USW	Baumgartner R, Fischer W, Fuchs G, Füllsack M, Huber A, Steininger K	1
PV	PhD Privatissimum	Baumgartner R, Füllsack M, Posch A, Steiner G, Winiwarter W	2
KS	Product and Service Development	Globocnik D	2
PS	Proseminar zu Statistik für Umweltsystemwissenschaften	Ambros R, Feit T, Perko R	1
AG	Research Project Sustainability Management	Posch A, Reinsberger K	4
KS	Selected Topics of Sustainability and Innovation Management	Brudermann T	2
SE	Seminar zu Systemintegration und Systembewertung	Mrotzek M, Winiwarter W	2
SE	Seminar zu Systemmodellierung	Füllsack M, Schmickl T	2
SE	Seminar zur Forschungsmethodik	Baumgartner R, Füllsack M	2
PS	Social competences for inter- and transdisciplinary problem-solving	Seebacher U	2
VO	Statistik für USW	Feit T	2
KS	Strategic Sustainability Management	Gelbmann U	2
KS	Sustainability Entrepreneurship	Steiner G	2
AG	Sustainable Development - Integrating Perspectives	Posch A, Steiner A, Williams W, Winkler T	6
KS	Sustainable Innovation	Rauter R	2
VO	Systemintegration und Systembewertung	Winiwarter W	2
VO	Systemwissenschaften 1	Mrotzek M, Propst G	2
VU	Systemwissenschaften 3	Granigg W, Huber A	2
SE	The Sustainability Challenge	Posch A	2
VO	Umweltoorientiertes Innovations- und	Rauter R, Vorbach S	2

	Technologiemanagement		
VU	Vektorrechnung für USW	Batzel J, Desch G	3
KS	Waste and Recycling	Gelbmann U, Schmidt G	2

Summer term 2014			
Type	Courses	Lecturer	Contact hours
PS	Angewandte Systemwissenschaften	Gobiet A, Grossmann W, Kislinger M, Mrotzek M	2
PS	Ausgewählte Themen des Innovations- und Nachhaltigkeitsmanagement (Energiemanagement im Unternehmen)	Rossbacher A	2
PS	CSR-/Stakeholdermanagement	Seebacher U	2
SE	DissertantInnenseminar	Baumgartner R, Posch A	2
KS	Eco-Controlling	Baumgartner R, Engert S	2
KS	Environmental Decision Making	Brudermann T	2
VU	Integral- und Differentialrechnungen für Umweltsystemwissenschaften	Peichl G, Perko R	4
AG	IP - Biogene Treibstoffe: Agrarmärkte und Hunger	Kozina C, Kumpfmüller K, Raith D	4
AG	IP - Gemeinde- und Regionalentwicklung am Fallbeispiel Naturlabor Altenberg/Rax im Mürzer Oberland	Fischer W, Sanglhuber E, Scharf V, Vötsch G	4
AG	IP - Gestaltung eines Netzwerks von Biobauern am Fallbeispiel Kirchbach/Labilltal	Fischer W, Hasler A, Ober M	4
AG	IP - Green Office	Aschemann R, Baumgartner R, Ulz A, Zettl R	4
AG	IP - Konsum & Produkte: Nachhaltige Lebensstile und Nachhaltigkeitskommunikation	Essinger G, Klade M, Seebacher U	4
AG	IP - Mobilitätsmanagement	Dullnig K, Reiter K, Seebacher U	4
AG	IP - Nachhaltiger Wohnbau	Guevara Chaves P, Hölzl M, Kreiner H, Perl-Vorbach E, Rauter R, Tritthart W	6
AG	IP - Planspiel: Internationale Klimaverhandlungen	Aschemann R, Friedrich A, Omann I	6
AG	IP - Stadt der Zukunft: Graz	Aschemann R, Friedrich A, Schweitzer S	4

AG	IP - Stakeholderkommunikation und -aktivierung gegen Lebensmittelverschwendungen mit Fokus auf die Veranstaltung "Feed the 5k"	Friesenbichler M, Gelbmann U, Hammerl B, Hasler A, Himmel W	6
PS	Kreativität in Innovationsprozessen	Perstel P	2
SE	Masterseminar	Baumgartner R, Gelbmann U, Posch A	2
VO	Mensch und Umwelt: Biosphäre und Ökosysteme	Depisch B, Raspopnig G, Tschernatsch M	2
PS	Nachhaltigkeitsberichterstattung	Resel K	2
OL	Orientierungslehrveranstaltung USW	Baumgartner R, Fischer W, Huber A, Kramer K, Propst G, Steininger K	1
DQ	PhD Doktoratskolloquium I	Baumgartner R, Posch A	2
KS	Product and Service Development	Globocnik D	2
PS	Projektmanagement	Posch A	2
PS	Proseminar zu Statistik für Umweltsystemwissenschaften	Feit T, Perko R	1
AG	Research Project Innovation Management	Brudermann T, Posch A	4
SE	Scientific writing in English	Tiede K	2
KS	Selected Topics of Sustainability and Innovation Management	Guevara Chaves P	2
SE	Seminar zu Systemintegration und Systembewertung	Granigg W, Winiwarter W	2
SE	Seminar zu Systemmodellierung	Schmickl T	2
SE	Seminar zur Forschungsmethodik	Baumgartner R, Posch A	2
KS	Strategic Sustainability Management	Gelbmann U	2
SE	Sustainability and Environmental Management	Posch A	2
KS	Sustainability Entrepreneurship	Steiner G	2
SE	Sustainable Business Models	Jonker J	2
KS	Sustainable Innovation	Perl-Vorbach E, Rauter R	2
VO	Systemmodellierung	Desch G	2
VO	Systemwissenschaften 2	Propst G	2
VU	Systemwissenschaften 3	Granigg W	2
UE	Übungen zu Systemwissenschaften	Gebetsroither E, Kupsa S, Pierer M, Schröck A, Winkler T	2
PS	Umwelt- und Nachhaltigkeitsmanagementsysteme	Baumgartner R	2
KS	Value Chain Management	Aschemann R	2

VU	Vektorrechnung für USW	Fripertinger H, Prager W, Schwaiger J	3
KS	Waste and Recycling	Gelbmann U, Klampfl-Pernold H	2

<b>Winter term 2014/2015</b>			
Type	Courses	Lecturer	Contact hours
PS	Angewandte Systemwissenschaften	Kislinger M, Schober A, Tartiū V	2
SE	Applied Statistics	Hofrichter J	2
PS	Ausgewählte Themen des Innovations- und Nachhaltigkeitsmanagement (Energiemanagement im Unternehmen)	Rossbacher A	2
KS	Eco-Controlling	Baumgartner R, Engert S, Rauter R	2
KS	Environmental and Technology Assessment	Aschemann R	2
KS	Environmental Decision Making	Brudermann T	2
VU	Integral- und Differentialrechnungen für Umweltsystemwissenschaften	Batzel J, Fripertinger H, Glatz M, Hötzl E, Peichl G, Schwaiger J	4
KS	Integrated Management Systems	Dully S, Perstel P	2
AG	Inter- and transdisciplinary case study on Sustainable Development	Crockett S, Posch A, Winkler T	6
VO	Interdisziplinäre Arbeitsmethoden	Aschemann R	2
SE	Introduction to Industrial Ecology	Aschemann R	2
AG	IP - Gemeinwohl-Ökonomie	Felber C, Kozina C, Kumpfmüller K	4
AG	IP - Green Office	Aschemann R, Baumgartner R, Perstel P, Ulz A, Zettl R	6
AG	IP - Nachhaltigkeitsbewertung von Projekten im Rahmen der Gemeindestrukturreform Steiermark	Fischer W, Schöggel J, Vötsch G	4
AG	IP - Nachhaltigkeitsgruppen in Graz	Gelbmann U, Hammerl B, Peskoller A	4
AG	IP - Social Entrepreneurship Lab	Frühmann J, Hözl M, Kvas M	4
AG	IP - Street Magazine Megaphon: Spatial Sales Organization (Basics, Rules and Tools)	Aschemann R, Mayer P, Meyer J	6
AG	IP - Sustainable and Responsible Investment	Klatil C, Lernbass R, Pilaj H, Rauter R	6
VO	Management nachhaltiger Entwicklung	Baumgartner R	2
SE	Masterseminar	Baumgartner R, Füllsack M, Posch A	2

VO	Mensch und Umwelt: Anthroposphäre	Posch A, Steininger K	2
VO	Mensch und Umwelt: Geosphäre	Lazar R, Lieb G, Sulzer W	2
VU	Methods for inter- and transdisciplinary problem-solving	Aschemann R	2
PS	Nachhaltigkeitsberichterstattung	Resel K	2
SE	Networks	Csermely P	2
OL	Orientierungslehrveranstaltung USW	Baumgartner R, Bednar-Friedl B, Füllsack M, Huber A, Kramer K, Krenn H	1
PV	PhD Privatissimum	Baumgartner R, Füllsack M, Posch A	2
KS	Product and Service Development	Globocnik D	2
PS	Proseminar zu Statistik für Umweltsystemwissenschaften	Ambros R, Feit T, Schappacher W	1
AG	Research Project Sustainability Management	Brudermann T, Hözl M, Rauter R	4
KS	Selected Topics of Sustainability and Innovation Management	Perstel P	2
SE	Seminar zu Systemintegration und Systembewertung	Füllsack M, Huber A	2
SE	Seminar zu Systemmodellierung	Füllsack M, Schmickl T	2
SE	Seminar zur Forschungsmethodik	Baumgartner R, Füllsack M	2
SE	Social competences for managing sustainable development	Seebacher U	2
SE	Social competences for working in inter- and transdisciplinary teams	Seebacher U	2
VO	Statistik für USW	Feit T	2
KS	Strategic Sustainability Management	Gelbmann U	2
KS	Sustainability Entrepreneurship	Kenik E, Steiner G	2
AG	Sustainable Development - Integrating Perspectives	Posch A, Steiner A, Williams W, Winkler T	6
KS	Sustainable Innovation	Perl-Vorbach E	2
VO	Systemintegration und Systembewertung	Füllsack M	2
VO	Systemwissenschaften 1	Desch G, Füllsack M	2
VU	Systemwissenschaften 3	Granigg W	2
SE	The Sustainability Challenge	Posch A	2
UE	Übungen zu Systemwissenschaften	Kupsa S, Pierer M	2
VO	Umweltorientiertes Innovations- und Technologiemanagement	Rauter R, Vorbach S	2
VU	Vektorrechnung für USW	Prager W	3
KS	Waste and Recycling	Gelbmann U, Schmidt G	2

### 4.3 Completed theses

In 2014, 45 master students completed their thesis within one of the ISIS study programs Environmental Systems Sciences, Sustainable Development and Industrial ecology. The list is ordered alphabetically, supervisors are named in brackets.

1. Abayneh, Fekade Shewaye: A Study on the Possibilities of the First Steps of the Reverse Logistics Supply Chain for Circular Economy: Consumers to Business, (Posch, Alfred)
2. Buchner, Franziska Elisabeth: An analysis of chances and risks of selected products based on waste material, (Vorbach, Stefan)
3. Cabejskova, Zuzana: Sustainable Hydration in Czech Republic: Bottled versus Tap Water, (Baumgartner, Rupert J.; Aschemann Ralf)
4. Eggenreich, Sabine: Optimizing fuel payments - An analysis of the situation in the Styrian borough of Hartberg focusing on social and ecological aspects, (Posch, Alfred)
5. Falte, Susanna: Sustainability Management with the Sustainability Balanced Scorecard - concept, benefit and development using the example of a SME, (Baumgartner, Rupert J.; Rauter, Romana)
6. Fong, Lauren Chelsea: Life Cycle Assessment of Fireworks, (Posch, Alfred)
7. Ganster, Julia: Development of a waste management concept in the area of Pharmaceutical Engineering based on a case study, (Füllsack, Manfred; Aschemann, Ralf)
8. Gärtnert, Daniel Stefan: Is the ability to stock-flow thinking, elicited through graphic stock-flow tasks judged correct? A methodological investigation of individual solution processes, (Füllsack, Manfred)
9. Geißler, Bernhard: Sustainable Phosphorus Mining - Actors, Sustainability Standards and Performance Evaluation of a Business Case, (Steiner, Gerald)
10. Gsodam, Petra: Business Models for Renewable Energies in the Electricity Sector in Austria, (Baumgartner, Rupert J.; Rauter, Romana)
11. Ibrahim, Radwa Mohamed Ismail Abdou: Comparative ecological evaluation of polyhydroxyalkanoate production from industrial residues, (Baumgartner, Rupert)
12. Jernej, Peter: Promotion of renewable energies and their influence on European wholesale electricity prices, (Posch, Alfred)
13. Kathrein, Sarah: Presence of environmental problems in Austrian media, (Posch, Alfred; Brudermann, Thomas)
14. Kern, Andrea: Bottom-up initiatives in the field of photovoltaic in Austria. Specifics and actors in the founding process, (Posch, Alfred; Hatzl, Stefanie)
15. Kittl, Maximilian: A scenario analysis about the potential of reducing emissions by means of electrical mobility in Styria, (Posch, Alfred)
16. Krajisnik, Daliborka: Photovoltaik-driven innovations - Development of new business models in Styria based on current advancement in the photovoltaic sector, (Posch, Alfred)
17. Kreuzer, Verena Isabelle: Variety Management in SysML for Modern Powertrain Development, (Füllsack, Manfred)
18. Legenstein, Anita: Life cycle assessment of a green biorefinery for agricultural production conditions of the region of South East Styria, (Winiwarter, Wilfried)
19. Lesky, Sarah: Energetic status analysis and development of energy indicators in the foundry- and machine building industry, (Baumgartner, Rupert J.; Rauter, Romana)
20. Lorber, Kira: The end of growth. Growth trends illustrated by the energy consumption in Styria, (Baumgartner, Rupert J.)

21. Maric, Lovorko: PV market development in Bosnia and Herzegovina, (Posch, Alfred)
22. Moder, Lukas: Solar energy usage in the household sector - An analysis of economic efficiency and environmental impacts, (Posch, Alfred)
23. Orthofer, Anita: Implementation of an environmental management system according to ISO 14001 at a steel manufacturer in Austria, (Baumgartner, Rupert J.)
24. Perschl, Magdalena: Analysis of Carsharing in rural areas: Basic conditions, potential and implementation – with focus on the potential in Lower Austria, (Posch, Alfred)
25. Pomberger, Reinhild: Municipal Waste Containing Food Waste in Biogas Plants - Aspects of Superior Recovery, (Gelmann, Ulrike-Maria)
26. Reischl, Christiane: Potential Impacts of Climate Change on Human Health in the City of Graz - A Qualitative Vulnerability Assessment, (Posch, Alfred)
27. Rom, Sascha Josef: Stakeholder-analysis of the Austrian re-use-sector with special focus on the role models of the commercial waste management in the region of Graz, (Gelmann, Ulrike-Maria)
28. Rothbauer, Thomas: An ecological CO<sub>2</sub>-analysis concerning production, distribution and disposal of a consumer good made of natural or synthetic rubbers, (Posch, Alfred; Aschemann, Ralf)
29. Scheriau, Katharina Luise: The Liberalised Electricity Market in Austria – Market Analysis, (Posch, Alfred)
30. Schimböck, Christa: A Stakeholder Management Concept for Not-For-Profit Organisations, (Posch, Alfred; Gelmann, Ulrike-Maria)
31. Schmidt, Gerhard: Consideration of external costs of waste management methods, (Gelmann, Ulrike-Maria)
32. Schönberg, Martin: A System-dynamic Simulation of the Stocks and Flows of Carbon in the Austrian Forests, (Winiwarter, Wilfried)
33. Schopf, Kerstin: From Farm to Fork - A Life Cycle Assessment of Austrian pork, (Winiwarter, Wilfried; Aschemann, Ralf)
34. Schriebl, Katrin: Energy poverty in migrant households, (Posch, Alfred; Getzinger, Günter)
35. Schuster, Christoph: Integrating international and regional requirements and interests in the environmental management of an ISO 14001-certified industrial company as an opportunity for the future, (Baumgartner, Rupert J.)
36. Schweiger, Gerald: Analysis of the power-to-gas- technology and its role in the future energy supply, (Posch, Alfred)
37. Spanring, Maria: Resilience theory: an overview of notions, (Gelmann, Ulrike-Maria)
38. Sukic, Katharina: Awareness-raising measures to foster sustainable mobility - Change of residence as “Window of Opportunity” - Approaches and concepts for the wider area of Graz, (Posch, Alfred; Perstel, Peter)
39. Viehhauser, Martin: Impacts and options of the Austrian/German power market under the conditions of the energy transition targets, (Posch, Alfred)
40. Waldhör, Katharina: Towards an Ownerless Consumption in Western Europe - The Main Drivers for the Usage of (S)PSS on the Basis of Car Sharing, (Posch, Alfred; Rauter, Romana)
41. Weber, Julia Sarah: Methods of Systems Engineering applied with SysML, (Füllsack, Manfred)
42. Yu, Man: Life Cycle Sustainability Assessment (LCSA): The Future of Life Cycle Assessment - Application of LCSA to Solar Energy Development in Australia, (Posch, Alfred)

43. Zhang, Yanzhu: Strategic Scenario Study on International Cooperation of E-waste Management and Metal Recycling, (Posch, Alfred)
44. Zimek, Martina: Initiatives to Reduce Food Waste at Consumer Level - Qualitative and quantitative analysis of the initiatives in Styria between the years 2011 and 2013 and recommendations for the future, (Gelbmann, Ulrike-Maria)
45. Zuchi, Martin: Customer Valuation in waste management, (Gelbmann, Ulrike-Maria)

In addition, one doctoral thesis has been completed within the doctoral school for Environmental Systems Sciences. The doctoral school was founded in October 2011, and Nina Braschel became the first alumni of this doctoral school.

46. Braschel, Nina: The European Union Emissions Trading Scheme and potential effects on waste management, (Posch, Alfred; Pomberger, Roland)



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