



## ESR's abstracts

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### Regional Scheme of Sustainable Energy Management Viera Pechancova

In California, being the top technological innovator in the USA and in the world, photo-voltaics and solar panels at rooftops at newly constructed buildings should be compulsory. Moreover, shift towards 100% renewable energy until 2045 is being discussed in the parliament. Having worked for an incumbent energy company in Prague, Czech Republic for almost 10 years I could see drastic changes in the energy sector development. Previous business models had to be adapted to the new challenging tasks of energy market liberalization, technology development, data management and consumer behavior changes. Renewable energy technologies and sustainable energy practices have been dominating the theoretical research as well as practical implementation. The dissertation intends to contribute towards answering the following conceptual research question: What elective sustainable energy business models can be implemented at the regional level. The result should be a model scheme for local sustainable energy initiatives reacting opportunities and synergies found in the cooperation of public and private sectors in the energy management. Community energy initiatives will be mapped and support schemes for promotion of sustainable energy proposed.

Keywords: Renewable energy sources, Sustainable energy management, Regional energy

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### Calculation of Solar Irradiation on building's vertical facades considering Urban Morphology Cecile Forgue

SUD is a research project fund by the ANR. It brings together researchers working on human behavior concerning the energy consumption or road traffic regulation but also researchers working on the physical phenomenon happening in cities such as solar irradiation. This is the part I am working on. The model I am building is meant to model hourly solar irradiation on Lyon's buildings. Altogether, the global model created for SUD aims to describe the city as a complex and dynamic system. By taking into account the variation over time and space concerning energy consumption we hope to offer an overview on the ways we can shape the city so production and consumption of renewable energy could match within space and time. Solar irradiation is the most important passive energy income for buildings. It is part of the inputs needed to calculate building's energy consumption as it warms them up. The way buildings receive solar irradiation has been essentially studied in order to implant solar panels [1], mainly on roofs as they are less impacted by shade effect in cities. Few researches have been lead on solar irradiation on buildings' facades. The models proposed can be applied at the scale of neighbourhood and mostly have a yearly time laps. My PhD research is close to the work done by Redweik, Catita & Brito (2013). They have approached this question with an hourly time laps over a year and have discriminated solar irradiation on facades, oor and roofs. But the following question still remains: "how can we model the energy perceived by buildings at the city scale?" as they only have implemented it at a neighbourhood scale (9 buildings).

Keywords: Solar Irradiation, Statistics, Urban Morphology, Facades, Shade, Mask Effect, Dynamic, GIS, Matlab, R, Model, System

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## Improving energy efficiency and environmental comfort in buildings through energy engagement and behavioural change programs

Verena Marie Barthelmes

Europe and its Member States are adopting and implementing policies aimed at reducing the emission of CO<sub>2</sub> into the atmosphere. Some of these policies will deal with large system changes as Europe is switching from a dependence on fossil fuels to the use of other sources of energy. Other policies will encourage changes in everyday behaviour among Europe's citizens as they adjust to a more sustainable and energy-friendly way of life. Indeed, to reach a significant change of habits and routines in everyday life, a deeper knowledge on behavioural change models is necessary to understand people's motivation, in order to determine the underlying influencing factors for behavioural change.

In line with these aspects, my research activities - next to the exploitation of numerical approaches for modelling stochastically occupant behaviour (IEA-EBC Annex 66) – include the active involvement in local and international energy engagement programs for raising user awareness means to persuasive communication in various contexts. The most recent involvement regards the Horizon 2020 project "MOBISTYLE - MOTivating end-users Behavioral change by combined ICT based tools and modular Information services on energy use, indoor environment, health and lifestyle" ([www.mobistyle-project.eu](http://www.mobistyle-project.eu)). In particular, the overall aim of MOBISTYLE is to motivate behavioural change by raising consumer awareness and by providing attractive personalized combined pro-active knowledge services on energy use, indoor environment, health and lifestyle, by ICT-based solutions. This awareness should motivate end-users to adopt a well-informed proactive behaviour towards energy use and health, thus empowering consumers and providing confidence of making the right choices. The proposed approach for behavioural change is to go beyond traditional incentives, including lifestyle monitoring in relation to health or indoor environment preferences.

Keywords: occupant behaviour, behavioural change, energy engagement

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## Farming, fracking, and renewable energy: Water scarcity and the food-energy-water nexus in the Denver Region

Sonya Ahamed

Increasing water scarcity has driven many recent attempts to identify interdependencies between food, energy, and water (FEW) systems and to operationalize understanding and management of the FEW nexus. As noted in recent critiques, environmental and urban indicators are implicitly embedded within complex sociotechnical systems, making them both irreducible to objective facts and necessary for monitoring change over time. This study identifies FEW indicators and data gaps for the semi-arid, rapidly growing Metro Denver region in the American Southwest, where sustainable management of water resources amid competing uses is of vital concern. Indicators based on publicly available data within a spatially-explicit framework are assembled for four interconnected 'hot-button' FEW issues affecting the region's dwindling water resources: aquifer depletion, local food production, hydraulic fracturing, and the changing electrical grid mix. Multi-level sustainability efforts are complicated by the difficulty of assessing transboundary flows to and from water-scarce regions. For Metro Denver and the Front Range specifically, estimates of embedded water in exported energy as well as embedded water and energy in locally produced food are difficult to construct but important for integrated land use management and water conservation. While there are significant differences in per capita FEW resource consumption within the region, demands on water resources at multiple spatial scales from current energy and food systems make the region's projected rapid population growth unlikely to be sustainable.

Keywords: Hydraulic fracking, aquifer depletion, sustainable cities, renewable energy transition, food, energy, water nexus

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The role of the institutions for the development of the renewable energy sector in selected European countries

Mariya Trifonova

The research project considers the emergence and development of the renewable power sectors of the EU countries a fraction of broader "managed" socio-technical transition accompanying the long-term process of change in the national energy systems of all member states. The importance of institutions in shaping the pace and nature of transition is widely acknowledged in the academic literature, however, a relatively small proportion of it applies institutional theory to the analysis of energy transitions. Combining theoretical models from the economic sociology, institutional economics and industry life cycle literature the thesis describes specific phases of the emergence and evolution of the economic sectors driven by the diffusion of new energy technologies. It explains the functions, which the institutional framework have on these developments. The institutions themselves are continually evaluated and dependent on the system inherited from the past. Based on the theoretical framework the work identifies five types of institutions to have an essential role for the development of the RE sector. Besides of formal institutional set-up's study, the dissertation follows a specific objective to examine the role and impact of the variety of non-governmental civic society formation that have significant effect on the policy development in Europe by their lobbying activities but also sharing knowledge, information and technology transfer. The research work focuses on characteristics and strategies of these institutions (mapping the institutions of collaboration in Europe). The empirical part of the study focuses on the case studies presenting the developments in the RE industries in Germany, Denmark, Spain, Czech Republic and Bulgaria. These countries experienced an investment boom in their RE sectors finding its expression in more than 50% increase of the RES-E share in the gross final consumption in the period between 2004 and 2014. Despite of that they are characterized by very different environmental, political, economic and cultural context. Semi-structured interviews with representatives of all institutional types defined are foreseen as method for content analysis.

Keywords: Renewable energy industry, Institutions, Energy Transition, European Energy Union

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Energy System Transition of Eastern Coastal Metropolitan Regions in China - A Scenario Study for the Year 2050

Mengzhu Xiao

With an expected accelerated urbanization and industrialization process until 2050, China is facing big challenges of continuous increasing energy demand and mitigation CO<sub>2</sub> emissions, especially in eastern coastal metropolitan regions. Since cities are also hubs for innovation both in terms of technology and institution, they are playing an important role in decision making and implementation processes on the way to achieve long-term national climate targets.

Due to the imbalanced distribution of economic growth and urbanization as well as available renewable resources in China, a regional based long-term integrated energy system model is needed to be explored in order to identify different transition pathways. Regional focuses of the study are northern region of Beijing-Tianjin-Hebei metropolitan areas and southern region of Yangtze River Delta region, which account for 20% national population, 30% GDP output and 24% energy consumption in 2014 with suffering from severe air pollution and energy shortage problems. Main research questions are how a predominantly renewable energy supply could work, how much of the locally available renewable resources can be integrated into the energy system and how much renewable energy, mainly in form of electricity, needs to be imported from western or surrounding renewable energy abundant regions to guarantee energy supply safety and contribute to local CO<sub>2</sub> emissions reduction.

Keywords: Energy policy, Energy transition, Decarbonisation, Metropolitan regions, Renewable Energy

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## Incentives and efficacy: An evaluation of renewable energy policies in Europe 1995-2015

Alex Ocinneide

Over the last twenty years the EU and its individual countries have been engaged in implementing policies to increase the use of renewable energy (RE) as a generation source.

Motivations for this support of RE generation include, but are not limited to, concerns over climate change and pollution, national security risks associated with fossil fuels, and a wish to increase the competitive position of RE in markets which have been traditionally dominated by carbon based power. The issue of climate change and renewable power's role in addressing this complex challenge has, in particular, been brought into sharper focus following agreement on emissions pledges from all the EU countries, and a new target of keeping global warming below 1.5C in December 2015 in Paris at COP 21; targets which will require a material response by policy makers throughout the EU. An understanding of what policies have been most effective in increasing RE is therefore critically important in designing new schemes, a comprehensive analysis of which has not been completed to date. I propose to conduct comparative analysis of the effectiveness of RE policies in encouraging RE generation (solar and wind, which given their advantages in cost and deployment have been the dominate focus of policy) across the EU from 1995 to 2015, with a primary focus on four countries of contrasting contexts, Ireland, UK, Italy and Portugal. While several studies have attempted to determine the effectiveness of various policies in various countries, these have been limited in scope and have not attempted to account for the variety of policy design features or individual country, market and key actor characteristics that influence policy strength. Adopting an energy transitions theoretical framework, this research would constitute the first study undertaken to determine how policy has effected the growth of renewables across Europe.

Keywords: Energy Transitions, Energy policy, Renewable Energy, Europe, Renewable Energy Investment, Climate Finance, political economy

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## Transitions pathways to a sustainable low-carbon economy

Nayeli Escalante

My research seeks to address the social, economic and technical challenges in the energy transition towards a future low-carbon economy in Mexico given the recent approved energy law, which among other things, liberalise the energy sector and increase the use of renewable energy. I am applying theoretical models from several fields including economics, energy geographies and political science. Energy transitions are fundamentally political in the sense that they depend on political decisions, and more specifically on policy change, principally when a profound energy system change is needed. These political decisions are taken in highly complex contexts, as political and policy actors face pressures from several fronts (e.g. energy security, climate change, development challenges), as well as the multiple interests (e.g. political, environmental) involved in such processes. Therefore, politics is an integral part of transitions because as stated by Meadowcroft (2011): "politics is serving alternatively and often simultaneously as context, arena, obstacle, enabler, arbiter and manager of repercussions". Elements from political economy and socio-technical transitions theory can help to explain what kind of governance is required to overcome the obstacles that energy transitions will face in a developing country, what role institutions play in the transition and how can energy transition be accelerated?

Keywords: energy transitions, low, carbon economy, political economy, socio, technical transitions, Economy

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## Implementation of Renewable Energy into the Mining Industry

Kateryna Zharan

Mining operations are energy intensive and the share of energy costs in total costs is often quoted in the range of 30 %. Saving on energy costs is therefore a key element of any mine operator. With the improving reliability and security of renewable energy (RE) sources, and requirements to reduce carbon dioxide emissions, perspectives for using RE in mining operations emerge. These aspects are stimulating the mining companies to search for ways to substitute fossil energy with RE.

The PhD project consists of three parts:

- \_ Case Studies Analysis of Implementing Renewable Energy into the Mining Industry
- \_ Survey Research Assessment of Integrating Renewable Energy into the Mining Industry
- \_ Hybrid Energy System for the Mining Industry: An Optimized Model

First part of this investigation concentrates on a case study analysis of the countries such as Australia, Canada, and South Africa. An expertise about technological, economical, and environmental issues in order to integrate of RE into the mining industry has been done. The key point was to show benefits of this projects such as costs savings (especially for o-grid mines), and greenhouse gas emissions reduction. In the second part of this investigation the survey has been applied within renewable energy and mining industry experts. The purpose was to find out the main initiatives, barriers, and government support mechanisms towards replacing diesel with renewables in the mining processing. Third part of this investigation, taking into consideration the results of survey assessment I am working on development a hybrid energy system (HES) for the mining industry. The HES will be established like an optimized model, which consolidates a combination of wind turbines, solar photovoltaics, batteries and diesel generators. This model will demonstrate an optimal amount of RE and fuel corresponding to chosen criteria such as power price, generator costs, fuel costs, RE capital costs, battery costs etc. The main purpose of the model is to find an optimized way towards making mining processing environmental friendly and economic efficient.

Keywords: Mining industry, renewable energy, hybrid energy system, carbon dioxide emissions, optimized model

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## Carbon taxation: designing compensation measures to protect low-income households

Audrey Berry

My thesis is focused on fuel poverty and equity issues in the transition to a low carbon economy. It aims to provide elements to guide climate-energy policies. First, I work on the measurement of fuel poverty in face of rising energy prices. I have developed a multidimensional indicator of fuel vulnerability in the transport sector that is based on the dual cut-o method developed by Alkire and Foster. It seeks to account for the different dimensions that constitute fuel poverty, in particular the diversity of energy needs, restriction behaviours and the unequal capacity households have to adapt. This work has been published in an academic paper in the journal Energy Research and Social Science. Second I explore the impact of the recently introduced French carbon tax on inequality. One major contribution is to have developed a microsimulation model built for this purpose for France. This model is designed to evaluate fiscal policies affecting energy taxes, which includes the carbon tax. Its strength is to simulate the impact of the carbon tax at the individual household level, which enables an accurate assessment of its distributional consequences. It allows experimenting the carbon tax and undertaking ex-ante evaluation. As such, it is particularly relevant to inform policy makers on the consequences of the carbon tax and to contribute to academic knowledge. The model is built on the most recent data available in France (Phebus 2012) that contains detailed information on energy consumption both for housing and transport. Third, I use this model to analyse the link between fuel poverty and carbon taxation, and more particularly, to design compensation measures to protect low-income households. I evaluate how the carbon tax weighs heavily on households' budget in the short-term and threatens part of the population to fall in fuel poverty. Then, I show how the revenue generated by the carbon tax provides an opportunity to finance ambitious public policies aiming at fighting against fuel poverty. The lack of funding to

finance public policies devoted to fight fuel poverty is often raised as a barrier. I demonstrate that the carbon tax, by generating an important source of revenue, provides an opportunity to protect households from rising energy prices. Different compensation measures are compared to offset the negative impacts of the carbon tax. As such my work sheds new light on the carbon tax as an opportunity to respond to the increasing crisis of fuel poverty.

Keywords: Carbon tax, Distributional impacts, Fuel poverty, Measurement, Revenue recycling

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Biomass Energy Economics and Rural Livelihoods in Sichuan, China  
Chen Qiu

As a kind of renewable resource derived from biological materials, biomass energy provides a link between agriculture and human's living. It plays an important role in rural livelihoods.

Under this circumstance, this study investigates the impacts of household biomass energy use on rural livelihoods in Sichuan Province of China.

With respect to household energy choices for cooking, an alternative-specific conditional logit model is adopted to test the determinants of household biomass energy choice behaviors from the perspectives of households' revealed preferences and stated preferences (RP and SP) based on the random utility theory. The analysis of RP data shows that the fuel switching in our study region is a process from inferior traditional biomass energy to advanced fuel (electricity) as incomes improve. Additionally, the SP data analysis indicates that raising income levels decrease the probability of the use of biomass energy, while significantly promoting the use of electricity. Moreover, this study also shows that the characteristics of the decision maker (such as age and educational level) the demographic structure of rural families and household location are all crucial factors affecting household energy transition.

On the production side, to investigate the impacts of traditional biomass energy use on agricultural production, a multioutput profit function was adopted to analyze the relationship between agricultural production and biomass collection. The estimation results show that the supply cross-price elasticities of agricultural products and biomass are -0.02 and -0.52, respectively, indicating that biomass collection could bring a negative impact to agricultural production due to the competition between these two activities for limited labor resources. The positive signs of the cross-price elasticities of biomass with respect to inputs (labor inputs and intermediate inputs such as fertilizers and pesticides) imply that biomass collection is perhaps influenced by consumption decisions.

Finally, since household's consumption, production and labor allocation decisions are interlinked, the impacts of exogenous price changes on biomass energy use are complex. A comprehensive analytical framework is thus developed in this paper based on an agricultural household model. Under the imperfect labor market, the total behavioral effect that consists of a direct (i.e. the consumption of biomass energy and the labor demand for biomass collection responds to an exogenous shock) and an indirect (i.e. the consumption of biomass energy and the labor demand for biomass collection adjustments to the endogenous variations in the shadow wage induced by this exogenous shock), is estimated by adopting a two-stage estimation strategy: the shadow wage of household labor is firstly estimated and then used to estimate consumption and labor demand systems. The results show that neglecting the indirect effect can bias the final effect on household biomass energy using behaviors, implying that market failures reduce the exibility in household's behaviors.

The findings of this research also provide important policy implications for future biomass energy development in rural China: the market prices should be adjusted to control the demand for biomass energy, and the measures aiming at eliminating the market failures should be attached importance at the same time.

Keywords: biomass energy, rural livelihoods, agricultural production, choice behaviors, labor allocation

The global market of renewable energy has experienced rapid growth in recent years. The total installed capacity of renewable energy facilities has been doubled during the last decade, as the currently global installed capacity has already exceeded 1800 GW. This is reflected in the fact that many countries around the world are starting to rely on higher rates of different types of renewable energy technologies, as renewable energies currently account for 19.2% of the global energy consumption and for 23.7% of the global electricity production. There are several leading renewable energy technologies, which vary between different countries. Some of these different technologies of renewable energy tend to experience economies of scale.

Hence, there is a global focus on medium and large scale renewable energy facilities, which therefore account for a large part of global energy production and consumption. Accordingly, global investments in medium and large scale renewable energy facilities continue to grow, in order to facilitate the establishment of additional facilities.

The establishment of many different medium and large scale renewable facilities often requires high financial investment and professional knowledge, involves finding vast empty lands and requires extensive adjustment to regulation in each country. The result of these features is reflected in the fact that in most medium and large scale facilities we find the involvement of three major players: the state, the private sector and local communities. Each of these players usually have an important role in this kind of projects: the state dictates the nature of the regulation, the private sector usually brings capital and knowledge, while in many cases, local communities provide labor force, based on local population, and land plots, as these facilities usually require vast empty lands.

While several studies have been conducted regarding the relationship between the state and the private sector and the relationship between the state and local communities, little academic attention has been paid to the relationship between the private sector and local communities, regarding renewable energy projects in general and medium and large scale facilities projects in particular. The scarce of academic research in this subject is surprising, since some scholars already recognized the importance of partnerships between local communities and the private sector, as these partnerships seem to be a significant element, which can affect the success of renewable energy projects, and have a positive impact on the usage and production of renewable energy in the future. Indeed, practice tells us that there are numerous projects, often described as success stories, which are based on such partnerships, in Europe, Australia, USA and other places. Therefore, this research aims are: (1) To identify different partnership models between the private sector and local communities, regarding medium and large scale renewable energy facilities projects; (2) To identify the major variables influencing the selected nature and extent of partnership models between the private sector and local communities; (3) To examine the influence of different partnership models on the nature and the success of various renewable projects.

Keywords: Renewable energy, Sustainable energy, Partnerships, Local communities, Community energy.

French nuclear policymakers and pro-shale gas advocates share more a simple connection to energy management. Both groups look at their own form of energy as a tool for assuring national energy security and acquiring independence from foreign sources. Both groups construct narratives focused on promises of prosperity that the new energies would bring about, in terms of economic benefits, diminished pollution, valorisation of national techno-scientific capabilities, and supply security. By virtue of the assumed objectification power of the representative and numerical tools and models on which they are based, these discourses implicitly acquire performative power, thus causing the collapse of multiple futures into a normativized, hetero-directed one. The epistemic complexity of the energy discourse is reduced to one in which parameters that are not prone to be included in models or to be framed in

economic terms are not taken into account. A parameter's controllability thus becomes the sine qua non for its inclusion in a model. Challenging the foundations of similar approaches by drawing a partial parallel between shale gas and nuclear energy discourses, my talk analyses the epistemic vulnerabilities at the basis of the narratives formulated to promote these two forms of energy in France.

Keywords: shale gas, nuclear energy, France, discourses

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Community renewable energy projects in Europe. Denmark, France and United Kingdom in comparison  
Pierre Wokuri

Our thesis is focused on renewable energy projects that imply some involvement of the public (e.g. the local community or the citizens of a region or country) in the decision-making (e.g. through democratic governance or through the ownership of the majority share of the projects) and a distribution of the benefits generated by the RE project in question (Rudinger, 2016). We have decided to study the three states mentioned before because they seem to correspond to different governance systems of the energy sector:

- A market-oriented system with economic incentives that are tailored towards preferably larger market parties (economics of scale) and therefore leaves little room for projects that are non-profit or small-scale.

- A state or bureaucratic system is guided by hierarchical control with the government as dominant actor.

- A community-oriented system leaves room for decentralized policy and local variation tailored to specific circumstances, preferences or dominant ideas within the community (Oteman, Wiering and Helderman, 2014).

United Kingdom approaches the first system while France resembles the second one and Denmark the third one.

First of all, we will look the public debates about the term of community renewable energy himself and the national policies regarding these types of projects. We will address the following questions:

What are the different definitions of community renewable energy according to energy actors? What does it say to the role and the importance of these projects in each country? Does Denmark, United Kingdom and France have specific policies regarding community renewable energy project? Can we consider the renewable energy policy frameworks as supportive or unsupportive for these type of projects?

We will analyze as well the role of tools of government regarding the dynamics of community projects and their organisation. Then, we will organize our research around the question of participation and citizen involvement. What are the degrees of citizen involvement in the three countries?

How is the balance of power when local public institutions and citizen groups are working on the same project?

Our third research question is based on the fact that "community energy" is a term used by a wide range of actors. Working on research on this topic in United Kingdom, Walker and Devine Wright met a total 12 governmental, non-governmental and industry-led initiatives that made use of the term "community" in their title or objectives (Walker and Devine-Wright, 2008).

Following this, our hypothesis is that community renewable energy has different meanings from one project to another. Our assumption is that there are common drivers across the countries:

- Community energy as an element of an existing narrative of environmentalised city marketing.

- Community energy as an alternative to other forms of energy development.

- Community energy as a tool to increase the social acceptance of renewable energy.

- Community energy as a tool for economic and social regeneration.

Keywords: community energy, wind power, photovoltaic, cooperative, social economy, public policy



The project will attempt to forge a comprehensive and extensive definition of how Energy Security necessities and threats are shaping the international relations in Asian. In particular I am focusing on some of the most important actors in the energy market on the Eurasian continent, namely: China, Russia, Kazakhstan and Turkmenistan. Economic growth is one of the primary sources of governments' legitimation in the Asian continent. As scientific literature shows, an interrupted and reliable supply of energy resources is a top priority to achieve a sufficient level of Energy Security. The rationale behind my research is that in the specific Asian context, the paradigm of supply-security face the antithetical request for a demand-security in the broad concept of Energy Security in Asia.

International sanctions are isolating Russia from the international financial market and low prices for energy resources are slowing the overall growth of Russia, Kazakhstan and Turkmenistan which are facing the limits of their economies, over-reliant on the energy of export.

Their ability to export natural resources matches the necessity of China to diversify fossil fuels' imports away from Middle East. The peculiarity of the Central Asia context is worth a deep scrutiny. All countries are striving for new investments in energy infrastructures, exploration and production and with important welfare state policies attached to both the exporting capacities and the low domestic prices for internal consumption. On the other side Chinese demand for energy resources is matching the security concerns of Post-Soviet nations. In 2013 the Chinese government introduced new general reforms, attaching energy prices to the market volatility, aimed to make Chinese industry less energy intensive and reduce marginal consumption. Understanding how Beijing is responding to its condition of energy poverty is crucial to foresee the evolution of the global energy market as China is the single largest importer of oil in the world and has led the global growth of fossil fuels in the last 20 years. Thus, it is required an analysis of those policies pursued to ensure Energy Security by each of the actors taken into account. The research will focus also on domestic policies in exploiting energy resources and on the grade of openness of their energy markets.

Through the use of case studies I am trying to shape a more exhaustive representation of Energy Security policies adopted by IOCs in the Asian context.

Predict the level of integration of demand/supply of energy resources in the Asian market will have also important repercussions on geopolitics of the entire Eurasian continent. While Xi Jinping and Vladimir Putin have stressed the importance to harmonize EEU and OBOR projects, the European Union will likely see its near-monopsonistic position very weakened, competing with the increasing demand of fossil fuels in East Asia. Moreover, if China succeeds in the attempt to become a hub for the Post-Soviet states' resources, South Korea and Japan will be able to diversify their energy imports, which now are reliant on the supplies from the unstable Middle East.

Keywords: Energy Security, Asian Energy Security, Energy Diplomacy, Central Asia, Russian Federation, People's Republic of China, International Relations, East Asia, Fossil Fuels

My research focuses on the developing technology of hydraulic fracturing to extract natural gas, and how the UK and EU can 'better protect' environmental and public health by analyzing and drawing lessons from the USA's more extensive experience. International collaboration to mitigate impacts of climate change is an important part of my work. I hope to learn more about France's role as a global climate leader, how perceived 'cultural differences' might affect approaches to difficult problems, as well as what the US and UK can learn from the French experience preparing for and mitigating climate change impacts while ensuring universal energy access. Specifically, my research examines shale gas regulation in the United Kingdom, United States, and the European Union more broadly. The UK is in the preliminary stages of exploration and testing for development of its unconventional natural gas

resources, with the first test well dug in 2010. In 2017 the UK appears poised for the first commercial drilling to begin.

Fracking remains controversial. Using data from the USA-with its much longer history of fracking - there is evidence of risk to environmental and public health from fracking processes, including effects on water supply, ground and surface water contamination, air quality, and change in 'quality of life' as communities become heavily industrialized with expansion of gas extraction operations.[1] While the UK government is promoting development of natural gas resources through fracking, communities remain concerned over safety and health issues and there has been a great deal of resistance to the technology. In this light, I am particularly interested in further analyzing and contrasting public perspectives on fracking in the USA, the UK, and France.

The United States has significant experience with the use of fracking to extract natural gas. Therefore, that country's experience provides useful analogies to the situation of the UK. In the UK, as in the USA and France, there is currently no comprehensive national regulatory framework to monitor and assess the specific environmental and health impacts of fracking. Instead, regulation of shale gas is carried out through the existing legislative and regulatory frameworks for conventional methods of oil and gas extraction and processing.

There is arguably a need for specific regulation on the environmental and health impacts of unconventional methods of gas extraction, as these processes pose new types of potential risks, and existing regulatory structures have gaps in coverage. Part of this doctoral research will aim to propose a 'best practice' regulatory framework.

Keywords: shale gas, hydraulic fracturing, energy, environmental risk, public health, regulation

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## Sustainability and Human behaviour through social network

Dario Cottafova

Generally, users and occupants are not taken into account in energy efficiency related studies and analysis. In last decades, occupants have been considered as consumers of energy and not as a smart agent which can interact with an energy systems. To overcome this technical approach, recent literature suggests to focus on the community level and to analyse a most wide system, a socio-technical systems, instead of only a static and technical system. For this purpose, this work wants to explore human perception about energy related field, and environmental sustainability in general, through most common social networks. Thanks to an open source platform called Human Ecosystem, a large scale mapping analysis will explore habits and behaviours of the population living all around the world. Data collected from the most common Social Network (Facebook, Twitter, Instagram) will be the status quo of this work, in order to introduce the human perception about sustainability.

Various research case studies on the human behaviour will be analysed starting from some keyword related to energy consumption and environmental sustainability; finally, an analysis on the network of users relations, based on users' tag on social network will be presented. The analysis network can be useful in order to better understand citizens perception, behaviours and habits in order to define a design a well-suited socio-technical systems where human beings has an active role within the model.

Keywords: social network, behavioural change, socio, technical system, energy

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## Prosumers and Electricity Networks' Regulations

Golnoush Soroush

Ongoing discussions on overcoming climate change, has directed attentions towards development of green energy resources as well as energy efficient actions. On one hand, several jurisdictions attempt to promote distributed electricity generations (see article 14/7 2003/54/EC of the EU electricity directive), while policies imposing restrictions on carbon emissions, reinforce the exploitation of renewable energy

resources such as wind and solar. Furthermore, installation cost of renewable resources is reduced because of technological developments and it is now possible to exploit them as distributed generation resources. As a result of these policies and technological improvements, traditional electricity consumers can now also become electricity producers, representing the so-called "prosumers". However, it is important to notice that implementing such directives will require significant levels of interactions between consumers and utilities on one hand and between utilities, regulators and policy makers on the other hand. Therefore, relevant policies are required to be implemented to make sure that maximum social welfare is achieved while these interactions are in sight.

On the other hand, several demand-side management programs are designed to improve energy efficiency measures. Demand-side management policies (DSMs), in overall, focus on reducing consumers' energy consumption by providing them proper incentives and introducing relevant tariff schemes. More specifically, the aim of demand response programs (DRs) is to attend the peak loads. Several empirical studies have been done on how DRs would affect electricity consumption at residential and commercial levels during peak loads. However, the effect of such programs in presence of electricity prosumers is yet to be studied more extensively.

In this context, the aim of my PhD research plan can be summarized in two parts:

a) First part of my research focuses on designing relevant tariff schemes to promote further investments in renewable resources for electricity production. To ensure that social welfare maximization standards are met, roles of prosumers, traditional consumers and utilities are taken into consideration while setting up new tariff mechanisms. Relevant policies are then discussed to facilitate higher levels of consumers' participation in exploiting renewable energy resources.

b) The second part of my research is related to execution of demand response programs while there are prosumers in electricity networks. Possible demand-side management policies (such as dynamic pricing methods) will be examined in presence of prosumers, in order to detect the most relevant ones which would promote self-consumption by prosumers and/or consumption reduction by traditional consumers. Briefly, as a future energy economist, I mostly focus on regulatory and policy related aspects of electricity networks and I do my best to integrate old and new members of these networks such that energy efficiency goals as well as social welfare maximization targets are satisfied.

Keywords: smart grids, prosumers, tariff design, electricity regulation

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## Emission Reductions and Future of Energy Policies in Turkey. Are renewables an alternative? Ozge Onenli

Climate change is considered one of the greatest threats that the world is facing today.

Human activities are the main cause of the excessive greenhouse gases (GHGs) in the atmosphere.

GHGs created by the anthropogenic effects are apart from the naturally present portion in the atmosphere and in charge of the alteration in the composition of the atmosphere.

Which human activity is responsible for the global warming? The main contributor of the GHGs is the energy sector on which human activities are deeply relying. There is no other way to think that human activities are refined from the need of energy. Therefore, there is a strong need of the improvement of the energy policies in order to fight with the global climate change.

A recent concrete step is taken as a conclusion of COP21 (21st annual Conference of Parties, also known as the 2015 Paris Climate Conference). Over 20 years of UN negotiations it was for the first time to agree upon a universal and a legally binding agreement keeping the average global temperature rise below 2°C compared to the pre-industrial level.

In this study, different scenarios investigated in order to indicate how we can shape our future energy policies regarding the mandatory reduction of CO<sub>2</sub> emissions. In addition to the first one, clarifying if renewables can be a solution in the medium term or nuclear power is a must for our future policies in order to satisfy the growing demand.

Transition of energy sector will be required in order to achieve the emission targets. Policy implications including the shift from centralization to decentralization will be also evaluated. A shift from the current production style to low CO<sub>2</sub> emissions should be evaluated. Designing an energy policy excluding nuclear and relying on renewables could be an alternative way to supply Turkey's growing energy

demand and reducing CO2 emissions. This thesis aims to clarify that there is a widespread interest in the crucial question: Can renewable energy be considered as a solution to keep the emission targets and satisfy the growing demand?

Keywords: future energies, low CO2, climate change, renewables, nuclear

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Energy transition in the Nordic countries: The case of Finland  
Pasi Toivanen

Doctoral thesis: A brief overview

Traditionally, energy-related research has been dominated by the engineering sciences and to some extent economics, while the other social sciences have so far had a negligible role.

However, in order to gain insight on the ongoing transition in the ways we produce and use energy, a more multidisciplinary approach is needed. Different actors and their perceptions and interests must be taken into consideration.

This doctoral thesis investigates the political economy of current and future energy policies in the Nordic countries and especially Finland. The Nordic countries in general, and Finland in particular form an interesting case for investigating the current energy transition. There are several reasons for this. On one hand, the Nordic energy market is highly integrated and majority of electricity traded in the Nord Pool electricity market is of decarbonised production, and the Nordic countries have set progressive climate targets when put in global comparison. On the other hand, Finland is an energy intensive economy with strong industrial lobby (esp. the forestry sector). Despite the publicly stated ambitious climate goals, Finland also aims to increase the use of forest-based biomass and peat in energy production, both of which have the potential of increasing GHG emissions instead of reducing them. By this example alone it is obvious that there are many interests at play in the formation of the future energy policy of Finland. The aim of this thesis is to shed light on the interests of different actors involved in the process of shaping the future energy policies. This way it is possible to discover potential "lock-ins" inhibiting the transition towards a climate neutral energy system, and also seek ways to reconcile the various interests involved.

Keywords: Energy transition, Nordic countries, interests, actors

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The possibilities of sustainable energy management in Hungary - Modelling energy visions with EnergyPLAN software  
Fanni Safian

Constantly growing level of energy consumption and use of fossil energy sources caused so serious environmental problems globally, that forced numerous countries to change the way how they produce energy. Since energy industry causes complex problems in different fields, changing this system (energy sources, technology and consumption) to decentralized, renewable-based systems could also solve complex socio-economic and environmental problems as well such as energy dependence, energy poverty or local development.

In my PhD Thesis, I try to find the way of a successful change in energy field to have complex solutions. As a Geographer, my focus is on ecological and social sustainability next to the technical possibilities and economic aspects. My case study is Hungary. In my research, I analyse the current situation of the Hungarian energy system, focusing on its problems and challenges. I describe and calculate its fossil and renewable energy sources and potentials, highlighting their sustainable use and limitations. I define sustainable energy production and analyse the Hungarian possibilities to maximise its potential of local environmental, economic and social benefits e.g. with community power production.

I introduce the recent official and alternative energy scenarios of Hungary. I detail three researches about long-term energy visions for Hungary, which I participated or made. These are future energy scenarios

for Hungary by 2030 and 2050, comparing different scenario narratives with or without nuclear energy and/or high renewable energy share, energy savings and efficiency.

I detail the methodology of scenario building, calculating and defining future energy demand and capacities, the most important parameters of the used software. With Energy-PLAN energy modelling tool, I made hourly detailed models of the whole energy system of Hungary for 2030 and 2050, according to the scenarios. Hourly distribution is crucial to analyse the intermittent energy production of renewable energy sources and exible solutions for their integration such as exible energy consumption, electric cars with smart charging, CHP plants with heat storages etc. With these models, the different scenarios can be further analysed and compared based on their exibility, renewable energy production, CO<sub>2</sub>-emissions, total energy supply etc. Regarding the results of the scenarios, it is possible and viable for Hungary to have an electricity system based on more 83% renewables by 2050.

Based on these results, important knowledge can be gained to plan technologically viable future energy systems for Hungary, which can be optimized by multicriteria decision methods.

Keywords: sustainable energy, energy scenarios, energy modelling, EnergyPLAN, social benefits

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Can energy empower women? A case study from the Barefoot College in rural Rajasthan.

Giulia Mininni

Around 1.6 billion people live without access to electricity, the majority of which relies on unsustainable energy sources such as biomass, charcoal, and kerosene. (OECD, 2006; WEO, 2011; IEA, 2013). Women, in particular, are affected by this lack because they are exposed to the fumes deriving from the use of these kinds of sources, and they are responsible for the domestic chores (including procuring energy).

Also, social rules and traditions, the sexual division of labour and patriarchal norms constrain women's position and condition in society, hindering, for instance, their participation in the science and technology education, the energy job market, and in the public realms. The literature on Gender and Energy (Clancy, 2005, 2012; Oparaocha and Dutta, 2011) claims that there are gender differences in relation to energy access, use, control and the benefits deriving from it. It is argued that energy access and use can support improving women's lives and their empowerment.

However, despite the recognition of energy access as a basic need for people's human, economic and social development, and notwithstanding global development goals promoting energy access for all, gender equality in education and women's empowerment (SDGs 4, 5 and 7) there is a lack of progress in social justice that is affecting women (UNDP, 2016).

This is true in rural Rajasthan, India, where gender discrimination against women is evident in regards to the distribution of resources including food and nutrition, energy, education, rights and health care (Tandon and Sharma, 2006; Singh and Kumud, 2013 cited in Mininni, 2017).

Embedded within the theoretical frames of Gender and Energy and women's empowerment, this study, investigates the extent to which training in energy technology can support the empowerment of rural women. I explore the case study of the Barefoot College from Rajasthan where illiterate women have been involved for over 20 years in training in small-scale solar energy technology solutions. The College offers a transformative approach to energy training for women's empowerment.

What is the role of NGOs in fostering rural women's empowerment? I investigate the extent to which the participation in the solar program supports women's 'effective' and 'transformative' empowerment. The latter is a transformative process that entails women's conscientisation and strategic action to overcome constraints to their empowerment.

The international development arena depicted women as victims of their oppression. Because of the universality of energy, I argue that its access combined with technology education have a tranformatory potential for rural women to become champions of change. Women's entrepreneurship in the energy sector is especially suited to rural women since they can address energy poverty issues, and it is more sustainable in terms of the long-lasting benefits for themselves, their families and community. Due to its unique model, the Barefoot College solar program that started in rural Rajasthan scaled up

internationally and has been replicated in several countries in south-east Asia, Africa and Latin America (Mininni, 2017).

Keywords: Renewable energy technology, gender, women's empowerment, education, sustainable Development

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Improving Building operational performance with Reactive management Embedding Diagnosis Capabilities  
Mahendra Singh

Currently, indoor discomfort in dwellings is one of the crucial issues along with the building energy consumption. Indeed, people spend 60-90% of their life in buildings. Since past few decades, a growing concern has been raised for the energy consumption and CO<sub>2</sub> emission. Building sector consumes a significant amount of energy and also responsible for 30 percent of CO<sub>2</sub> emission globally. Due to peak oil crises and rising energy demand, a large group of building researchers has been promoted the energy saving concern in buildings.

Indeed, in a study from world health organization (WHO) had clearly pointed out "Energy-efficient but sick buildings often cost society far more than it gains by energy savings". Building lifecycle and operational cost have a direct connection with future sustainability and the financial affair of the concerned economic zone. Nowadays, investment in building sector becomes a social cost that every country has to pay for. Energy management and efficiency became a perpetual research for building researchers.

Thus far, indoor comfort plays a vital role in occupant's health, productivity, and well-being. In lieu of, there is various optimization and rule-based anticipative or predictive building strategies have been proposed to achieve the perceived comfort taking into account the optimum energy consumption. However, in practice, anticipation or plans are far from the reality. Usually, anticipative plans are synchronized with one-hour anticipation period and do not consider the various sources of discrepancies as well as current facade configurations. Unbeknownst to many, discrepancies from different sources could cause big penalty over cost and comfort. To tackle this issue, building management system needs to be designed as reactive or almost with no planning, so that it can respond to all discrepancies reactively.

To address this problem, a multi-scale Anticipative Reactive Diagnosing-Building Management System (ARD-BMS) is proposed in the dissertation. ARD-BMS is an internal management and performs three mandatory actions i.e., Discrepancy detection, Cause isolation, and finally Corrective actions. ARD-BMS follow the short-time resolution i.e., 10-minute to analyze the fault trends and current building dynamics and take necessary corrective actions to maintain the desired level of comfort. The Thesis proposes the development of a fast dynamics simplified reactive model that can be used to estimate the current status of the building.

Modern buildings are the very sophisticated system with large numbers of sensors, controllers, and HVACs. Most of the building facilities are using a scheduled preventive maintenance services derived from periodic operations of the buildings. These preventive actions do not take into account the other inadmissible issues such as unplanned situations, weather prediction failures etc. These unplanned issues could cause unaccountable impacts over occupant's comfort during the 24-hour operation cycle. Diagnosability of short-term discomfort causes is still a challenging job at whole building operation level. Furthermore, to analyze this situation a diagnostic methodology has been developed for detection and isolation of cause (faults) in buildings. The methodology includes a rule-based HAZOP (Hazard and Operability analysis) and model based (FDI and DX) analogy.

Keywords: SmartBuildings, Diagnosing, Building Management, Energy, Anticipative management

Access to affordable, reliable, sustainable and modern energy for all is considered by the United Nations as a priority over the period 2015-2030. This Sustainable Development Goal (SDG), is one of the main challenges for developing countries, particularly in Africa. African countries are characterized by chronic energy deficit despite their potentialities in fossil and renewable energies. The statistics from IEA (2016) indicate that Sub-Saharan Africa (SSA) was the region which concentrates the greatest levels of energy poverty in 2014. In this region, 633 million of people representing 65% of the total population has no access to electricity. Moreover, in SSA, 792 million people lacking to clean cooking facilities (IEA, 2016). Several studies have highlighted the importance of access to energy in the reduction of poverty. For developing countries, Pereira et al (2010) show that the lack of electricity exacerbates poverty. If access to energy, especially for low income groups has gained an interest among international organizations, this issue has received little attention at the national level (Practical Action, 2014). Access to energy is important to generate employment opportunities, to elevate standards of education, to improve health status and to facilitate sustainable development (Pereira et al., 2010). Like most developing countries, Côte d'Ivoire facing the energy poverty issue. Basically, Côte d'Ivoire has enormous potentialities of energy supply and has abundant natural sources of renewable energy including solar and wind power, hydraulic energy, biomass energy and biogas energy (Koua et al., 2014). Access to energy is considered as one of the most important issues related to development. Most people in Côte d'Ivoire are often faced with the lack of access to modern and sustainable sources of energy. According to the National Electricity Regulatory Authority, in 2015, the electricity access rate (total population of electrified localities/total population) was 78%, the national coverage rate (number of localities electrified / total number of localities) was 42% and only 29% of households have access to electricity (ANARE, 2015). The main aim of this thesis is to provide strong empirical evidence on the extent and the level of energy poverty for Cote d'Ivoire through the calculation of the Multidimensional Energy Poverty Index (MEPI) (Nussbaumer et al., 2011; Sher et al., 2014; Ogwumike and Ozughalu, 2016). Second, this thesis also seeks to analyze the determinants of energy poverty in Cote d'Ivoire and attempts to find some policy to fight against energy poverty.

Keywords: Energy poverty, Energy services, Côte d'Ivoire, Electricity, Cooking fuels

District heating is meso-scale energy infrastructure which supplies hot water for heating buildings. In the UK, compared to electric and gas networks, it is neglected in research, despite potential to deliver similar quantities of energy. District heating is common in Denmark and Sweden, while only starting to mainstream in the UK and The Netherlands.

Transition Management is the state-supported way of supporting the transition process towards sustainability of mobility, agriculture, water, biodiversity, natural resources, energy and decarbonisation in The Netherlands, unlike in the UK, where is not. It emerged from Geels' Multi-level perspective as a way to manage and steer change of sociotechnical systems. It is characterized by adjusting, influencing and adapting. Technologies and social approaches may become locked in or locked out as transition proceeds. I will research connections between power and lock.

No published works overlay district heating in UK with Transition Management. The closest is by Hawkey, who uses Bergek's Technological Innovation Systems scheme instead. The UK's Department of Energy and Climate Change, ignores Transition Management in its report "The Future of Heating". So, research gaps exist in both theoretical analysis and implementation.

Theoretical frameworks. My underpinning framework is Geels' multi-level perspective, from which Transition Management and sustainable niche management emerge. Power analysis and frame analysis will also be used for interpretation. I may also apply Action Space interpretatively. Here, Foxon

describes, three competing logics: markets, government and civil society, contesting to deliver differing decarbonisation trajectories.

Research Questions:

1. How do the governances of the UK's and the Netherlands' emerging heat network industries align with the requirements of the process of transition?
2. How, and how effectively, might decarbonisation be delivered, as actors lock in or out technological or social approaches?
3. What role might Transition Management theory play in the new deployment of district heating? For example, might it be deployed more effectively by actors who use it to oppose decarbonisation, rather than by actors who support it?
4. Comparing two national cases as a proxy for Transition Management, in relation to lock, how does power play out differently, if it does, under a government which explicitly claims to apply Transition Management, compared to one which does not?

One policy outcome may be to assist the UK Government to explore whether Transition Management might be suitable for UK. Academically, by testing and re-contextualising existing theories in a new setting, primarily that of Transition Management in the context of power and lock regarding district heating, my work may offer critical theory challenge, development or meshing.

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#### Factors and Processes Shaping Opposition to Energy Facilities Siting

Inés Soto Reyes

The Chilean primary energy mix is based mainly on imported fossil fuels and on domestic hydropower. This leads to a high dependency on imports and on the climate and weather conditions. The Chilean economy and its energy demand have shown strong growth in the last decade. Projections until 2030 suggest an increased demand for new power generation projects to be realised in the coming years. Chile has large sources of renewable energies but up until today their potential for electrical power generation has been exploited only to a limited extent. Chile's renewable energy sources offer a way of both achieving a cost-efficient energy supply and self-sufficiency. Though renewable energies have the potential to meet the Chilean Government's target of 20% non-conventional renewable energy sources of the electrical power supply by the year 2025 they have to overcome several barriers in order to succeed within the energy matrix. Some of the obstacles are a lack of incentives for investment, limited public awareness and an increased social opposition. In the last years, societal opposition to both renewable and non-renewable energy projects has increased steadily and in some cases stopped or delayed the realisation of power generation projects. Increasing concerns about the social and environmental impact make the development and realisation of electrical power generation projects increasingly controversial. In an effort to address this situation and to make the social dimensions of electricity generation projects more visible, this article investigates the barriers to electricity generation in Chile and identifies factors that influence the public opposition to the realisation of energy projects. A multidimensional concept of social acceptance is used including a three dimension analytical framework of social acceptance. Semi-structured interviews were conducted. A non-statistical sampling approach was most suitable, with a sample of energy project stakeholders at the socio-political, community and market level. Preliminary results show that the development and realisation of both renewable and non-renewable energy projects in Chile often face opposition because of various and linked aspects related to spatial factors, technical factors, and institutional factors. Procedural justice, social trust, risk perceptions, awareness of risks and their impacts were identified as key factors that, on the one hand, guarantee local communities a fair share of the benefits derived from power generation and, on the other hand, establish a predictable, conflict-free process for investors.

Keywords: Public Opposition, Social Acceptance, Risk Perception, Social Trust, Environment, Electricity, Energy, Chile