Asbestos removal from industrial sites financed by implementing PV.

Terrena is the first agricultural and food-industry cooperative in France. The group is a key actor in various activities (Agriculture, livestock production, food processing, Agricultural machinery, etc.). In 2013, Terrena had 12,150 employees and 22,000 farmers members of the cooperative with 2 million hectares of usable farming land. My mission takes place inside the renewable energy service of Terrena Innovation, a Terrena’s subsidiary with 100 employees.

As an industrial and agricultural group, Terrena owned a large quantity of building and some of them are covered with asbestos cement sheets as they were built before 1997, date when asbestos was classified as dangerous and forbidden for new buildings. Today, the removal of asbestos has to comply with advanced security rules and is expensive. Thus asbestos poses a long-term financial risk for the company.

Terrena decided to take the lead and launched a large-scale study of asbestos removal and refurbishment of its sites. To reduce the cost of the process, the company studied the possibility of coupling the refurbishment with the implementation of photovoltaic projects on their new roofs.

To achieve this objective, the main steps of the project were defined as the following:

- Identifying the asbestos-contaminated sites and assess their rough potential for solar projects.
- Working with external project developers and investors to create consortiums and make advance assessment of every site.
- Select the best projects.
- Working with the administration on urbanism, security and environmental aspects.
- For each selected site, prepare with the consortiums a folder to be presented in the French PV tender process.
- For the accepted projects of the tender process, finance and build the project.

In collaboration with my tutor, my mission inside Terrena Innovation is to manage the project.
Cynthia ISMAIL (Indonesia)  
Renetech AB (Stockholm, Sweden)  
Process Design and Economic Analysis for Fertilizer and Sulfuric Acid Production in Botswana.

With a global perspective, it is Renetech’s mission to be a sustainable and environmentally adapted producer of renewable energy, vehicle fuel, electricity, heat and biogas, through solutions involving renewable sources, including waste and biomass management, hydropower, solar and geothermal energy conversion. The business focus of the company is bioresource recovery of energy and by-products (e.g., nutrients) from a variety of biomass materials including organic residues and waste streams. Renetech has been working on project development, research and consultancy projects both on a large and small scale, mostly in the EU and East Africa, in collaboration with technology providers, contractors, equity partners and local stakeholders. In correlation with waste management, this thesis involves a feasibility study of fertilizer and sulfuric acid production from copper-mine tailings at Selebi-Pikwe, Botswana. The study is carried out based on available project-related studies, followed by a suitable process design modelled in Aspen. Technology is selected based on the best available technology and an economic analysis. Generally, the study aims to provide a solution in terms of appropriate technology with an optimum economic benefit for fertilizer and sulfuric acid production from mine tailings. The project is established by also considering the local context which includes the availability of the resources such as water and electricity in order to make it sustainably viable. The results will be used for a future study and implementation of mine tailing recovery in Selebi Pikwe area.

Sai Sindhura MAMILLAPALLI (India)  
IRENA –ITC (Bonn, Germany)  
Solar PV Project development in India: Best Practices.  
A regional adaptation of Project Navigator.

The International Renewable Energy Agency’s (IRENA) mission is to “promote widespread and increased adoption and sustainable use of all forms of renewable energy.” To assist this mission and support the increasing capacity addition worldwide, IRENA has developed the Project Navigator, an online platform that assists Renewable Energy (RE) Technology project developers. It helps with enabling successful project planning and implementation and also facilitate securement of the necessary funds. The Project Navigator will provide project developers with the knowledge, tools, case studies and best practices needed for the successful completion of their projects. It will also guide them through each step of the project development process and ease the process of finding funding sources with the Financial Navigator, a database comprised of key funds available for RE project financing.

Project development process has region specific challenges and needs modifications and adaptation of the Navigator tool according to the barriers present in that particular region. As part of the development of Project Navigator, a regional adaptation for India is done. This is addressed by studying the market, assessing the barriers faced by the project developers and drafting certain best practices of project development based on the input given by selected developers, for Indian context. Hence supporting the central and state policies on accelerated deployment of renewables in India. The inputs obtained from this study along with some additional relevant factors are used to build a financial model that assists this regional adaptation of the Project Navigator platform.
Chathuri DAYANANDA  
KIC InnoEnergy (Stockholm, Sweden)  
Development of e-learning modules to create a virtual classroom for renewable energy technology education and knowledge assessments.

There's a global interest and need for the education of renewable energy in many engineering curriculums. However, as the learning resources and capacities are limited, it creates hurdles providing academic programs in various institutes. Besides, Internet based tools are getting more popular and accessible to many parts of the world today, and they could be seen as potential and capable alternative of sharing education to overcome such impediments.

KIC InnoEnergy is a European company, dedicated of promoting innovation, entrepreneurship and education in the field of sustainable energy by bringing together academics, businesses and research institutes. In the academic field one of the main objective is to promote education in energy and environment sector to broaden the knowledge of students or anybody who is concerned of energy and environmental issues. Among such, the education of renewable energy technologies and innovations has being put up to a higher priority. Along with these perspectives this thesis is dedicated to for creating a virtual classroom to learn renewable energy technology by developing knowledge materials and assessments.

The main platform will be covered with independent modules such as Bio Energy, Solar, Wind, etc. Due to the complexity and time restrictions, the scope is narrowed down to the completion of 'Introduction to RET' and 'Bio Energy' modules mainly. The thesis will be developed and facilitated by providing a comprehensive set of learning goals, learning materials and assessment tasks. The developed module will be tested in a distant campus and the performance will be evaluated at the final stage of the thesis.

Nichanut PRASOPSAILPAORNKUL  
Renetech AB (Stockholm, Sweden)  
Assessment of Biomass Conversion Technologies for Cocoa Pod Husk Residue in Republic of Côte d’Ivoire.

With a global perspective, it is Renetech’s mission to be a sustainable and environmentally adapted producer of renewable energy, vehicle fuel, electricity, heat and biogas, through solutions involving renewable sources. Renetech’s business focus is bio-resource recovery of energy and by-products from a variety of biomass materials including organic residues and waste streams. Renetech has been working on project development, research and consultancy projects both on small and large scale renewable energy projects, mostly in EU and East Africa.

Côte d’Ivoire is the world’s largest producer of cocoa. Cocoa pod husk, the shell which surrounds the cocoa beans and is not used for cocoa production, has a high potential for use as biomass for production of energy and other value-add products as it accounts for more than 75% of the fruit’s content. Biomass, particularly agricultural waste, generally has low energy density and high moisture content. Using suitable process and technology is a key to enhance the conversion of biomass into useful forms of energy and optimize its thermal efficiency.

The aim of this thesis is to study and evaluate a number of biomass conversion technologies which can be suitable for energy production from cocoa pods husk residue in Côte d’Ivoire based on technical perspective, together with process economics. Apart from an assessment based on testing results, the work includes developing a model, using Aspen Plus simulation software, to validate against actual experiment and examine the influence of main operating parameters. The thesis focuses on gasification technology with a detailed laboratory study including characterization and pretreatments to gasification, emissions and solid waste at TUBITAK Marmara Research Centre, Turkey.
Marie RUSHFELDT (Norway)
MicroEnergy International GmbH (Berlin, Germany)
Clean Energy Promotion through Microfinance in Ethiopia.

MicroEnergy International (MEI) is an alternative consulting company that mainly offers its services to developing countries. Projects are realised through collaboration with international funders and local Micro Finance Institutions (MFIs). In line with MEI’s vision of supplying the Base of the Pyramid (BoP) [low income households] with sustainable energy solutions, this project was set about in Ethiopia. The goal of the project is to extend the portfolio of the MFIs to green technology products, so that they can offer tailor-made loans for renewable energy solutions in the future. The project aims at promoting solar technologies, such as pico lanterns, solar home systems and solar pumps. But also, biodigestors and improved cooking stoves were pre-selected as potential clean energy technologies. In the end, 1-3 technologies will be offered by local MFIs as part of a pilot study. This requires stages of analysis and evaluation. As a part of the first phase, a demand assessment analysis was undertaken as an initial evaluation of the BoP’s ability and willingness to pay in each respective region, as well as the actual need for energy, and the type of technology solution that is needed.

Wolfgang STAGGL (Austria)
Rödl & Partner (Nürnberg, Germany)
Analysing the Economic Challenges of Renewable Energy Projects.

The internship host company Rödl & Partner is a German professional service company with 94 offices worldwide and its headquarter in Nuremberg. It is present in 43 countries and counts 3,700 employees, of which 1,650 are working in Germany. The turnover in 2013 amounts to more than 300 m€. The internship is performed in the Energy Industries department of the Public Management Consulting business area which is one of the most growing fields of the company. The internship at Rödl & Partner has an international context and is specialized on the field of renewable energy. The main focus of the work is to assist and take part in consultancy services in current ongoing projects, in Germany as well as abroad. Main tasks involve working on economic feasibility studies, designing accordingly excel tools, helping to increase the visibility of development projects and undertake bibliography reviews about regulatory or energy economics related topics. The Master thesis project deals with the economic situation of renewable energy projects: Small and medium-sized companies face challenges in the particular financing of own consumption renewable power generating installations. Financing institutes consider these projects as energy efficiency investments, consequently sector typical project finance [non-recourse finance] does not apply, but typical corporate finance is requested. This fact leads to substantial barriers for an increased implementation of such projects. Public risk systems could help to overcome these barriers and shall be investigated within the master thesis.

Maria BITOSOVA (Russia)
MicroEnergy International GmbH (Berlin, Germany)
Simplified energy use assessment and monitoring tool for energy efficient housing.

MicroEnergy International (MEI) is a consulting company based in Berlin, Germany with a strong background in energy engineering and economics, microfinance, management and social sciences, and more than ten years of experience in more than 30 countries in Latin America, Africa and Asia. This Master Thesis would be based on already existing micro-finance program for energy efficiency, developed by Micro-Energy GmbH and implemented in Armenia. In the bounds of this program, a simplified energy use assessment and monitoring tool (EUAMT), which supports the decision making by recommending renovation measures and investments eligible to the credit line and quantifying the associated energy savings, return on investments and environmental benefits was created. This tool is the main subject of Master Thesis. Study shows the further ways to upgrade and extent existing tool. Moreover, the further improvements that made it scalable for different regions and clients were proposed and performed. Moreover, implementation of this kind of micro-finance initiative at the reference country is studied. The behavior pattern of the possible client, as well as a technical-economic assessment of the region is done. To illustrate findings made, tool ran for most typical type of dwelling and possible energy savings as well as environmental impact [in the meaning of CO2 emissions reductions] is performed.
Ryan TULABING (The Philippines)
Lawrence Berkeley National Laboratory - University of California (Berkeley, CA, USA)


The Lawrence Berkeley National Laboratory (LBNL), is a national research laboratory of the United States that conducts investigation in almost all realms of science such as Physical Sciences, Biosciences, Computing Sciences, and Energy Sciences. The name “Berkeley Lab”, being associated with 13 Nobel Prize winners, has gained a reputation synonymous to “excellence” in the field of scientific research. True to its vision of “bringing science solutions to the world”, LBNL is currently helping China in its Smart Grid initiatives. China’s electricity demand, being the largest in the world, takes a huge toll on the environment in terms of pollution and greenhouse gas emissions. Clean energy solutions such as solar and wind exist but their intermittent nature limits its adoption. Smart grids can solve this dilemma through Demand Response (DR) where loads actively participate in the grid management. DR would enhance the integration of intermittent energy resources, minimize peak loads, and optimize the utilization of installed assets. Considering China’s size, a sustainable energy consumption through the establishment of smart grids would have a huge impact not only to the local economy and the environment but to the whole world.

In this context, the thesis aims to evaluate the DR potential of flexible loads such as electric vehicles, buildings, and grid energy storage for frequency control and power balance in the Chinese electrical grid. It also aims to recommend necessary policies, market mechanisms, and technological infrastructures that would enable to achieve such potentials.

Sara BENAVIDES CAMPOS (Mexico)
International Renewable Energy Agency (IRENA) (Bonn, Germany)

Concept for a Methodological Guideline to plan the operation of electricity networks in Small Island Developing States with high shares of Variable Renewable Energy Sources.

Electricity production systems on Small Island Developing States (SIDS) is strongly dependent of costly fossil fuel imports. In order to estrange energy systems from this strong fossil fuel dependency is evident that the transition to a Renewable Energy based energy production is an attractive and sustainable path to follow. Within this context, the International Renewable Energy Agency (IRENA), in its Work Plan 2014-15, has settled the objective of supporting the transformation of island energy systems through renewable energy by putting in place different initiatives covering topics which range from high level policy planning to technical aspects like the operation of the power networks.

The aforementioned transition represents a big challenge from the technical point of view, considering the constraints inherent to the characteristics of a traditional power network system and of the variable renewable energy resources like solar PV and wind power. Moreover, this constraints are often unknown by the SIDS power utility staff members which are forced to fully depend on expert advice.

This work aims to develop a concept of a methodology that works as a guideline to plan the operation of electrical networks when integrating renewable energy technologies, particularly the variable type (VRE) such as wind and solar photovoltaic. An assessment of the benefits and impacts of this methodology is included. It will give an overview of the technical implications, constraints and requirements of a project that requires integrating large shares of variable renewable energy sources.

Julian ROMINGER (Germany)
Mercedes-Benz Japan Co. Ltd (Tokyo, Japan)

The influence of charging infrastructure on electric vehicle adoption – a multiple linear regression and stochastic modeling analysis.

Daimler AG is a German automobile manufacturer with the brand Mercedes-Benz cars. Daimler produces, distributes and sells passenger cars, off-road vehicles, vans, trucks and buses. Daimler’s objectives for low emissions and reduced fuel consumption require the research and development of alternative drive train technologies. Alternative drive train technologies include plug-in vehicles that can store energy in a battery and can be recharged externally.

The company aims to investigate the influence of charging infrastructure on the adoption of the plug-in electric vehicles per country. Firstly, a multiple linear regression analysis of the relationship of socio-economic factors and plug-in vehicle market share is conducted for 26 national markets. Variables included in the analysis are financial incentives, charging infrastructure, quick charging infrastructure, environmental index, GDP per capita, etc. in these countries.

Furthermore, a stochastic model is developed which simulates an electric vehicle fleet and calculates corresponding optimal charging infrastructure. Driving and charging behavior is generated by a Monte-Carlo-simulation on the basis of real measurement data.
Silvia ULLOA JIMENEZ (Costa Rica)  
KTH – dESA (Stockholm, Sweden)  
Climate, land, energy and water (CLEW) interlinkages in Nicaragua.

KTH Royal Institute of Technology in Stockholm is the largest and oldest technical university in Sweden. Its Division of Energy Systems Analysis is one of the leading research groups in modelling of energy systems and renewable energy resource availability. The division has the aim of providing tools for informed energy and economic policy decision-making, especially for developing countries. Subsequently, one of its research areas is CLEWs (Sustainable Climate, Land-use, Energy and Water strategies), which seeks to address the divergent results of isolated analysis of resource systems that are connected.

This thesis focuses on CLEWs applied to Nicaragua, which despite of its substantial land, water, and renewable energy resources, continues to be one of the least developed countries in Latin America, highly dependent on oil imports, with one the lowest electrification rates, and suffering consequences from its susceptibility to climate change.

Software and tools such as the Water Evaluation and Planning System (WEAP), Open Source Energy Modelling System (OSEMOSYS) and Global Agro-Ecological Zoning (GAEZ), will be used to model the different resources. Future scenarios considering the effects of climate change will be analyzed. The project aims to present valuable insights regarding the synergies and trades-offs between resource sectors, and provide practical information that will help policy makers have a cross-sectorial approach for the country’s development strategies.

Lixiang WANG (China)  
Perspectives GmbH (Germany and Spain)  
Designing of China’s National ETS Taking into Account the Specific Characteristics of Chinese Industry.

China has ambitious goals to reduce the greenhouse gas emissions intensity by 40 – 45% by 2020, compared with 2005. In accordance to this goal, emissions trading scheme (ETS) is regarded as main instrument. The European Union’s ETS experiences show that a deliberate climate design can drastically attenuate GHG emission mitigation costs and lead to various sectoral effects. These effects within different industries have a remarkable effect on domestic and overseas competitiveness of the specific sector which mainly results from varying costs of the available emission mitigation technologies in different industries. 6 major different sectors are investigated including power generation, cement production, iron and steel production, chemical industry, coal and mining and aviation.

The currently available mitigation technologies and their cost and potential are intensively studied. Huge differences of mitigation costs and potentials across these sectors are detected, as such, comparable stringent on reduction requirements would lead to varying negative impacts and this is especially unfair to those cannot pass on the carbon prices to the consumers or face competition from market players that are not covered by emissions cap. Recommendations for the future national ETS design are that, such variations should be taken into account when designing the allowances cap and allocation. Dynamic cap scheme can be induced with regular update on available technologies. A combination of free allocation and auction is recommended with gradually increasing share auctioned. At the same time, other policy tools should be combined with ETS to bring more incentive of developing new and cost effective technologies.
Solar Irrigation Pumps (SIPs) are used to pump (ground and surface) water to irrigate farm lands. In a country with almost 120 million farm families, SIPs bring greater prospects when India is suffering from historical mismatch of energy supply and demand. Till today the market is dominated by the use of electric and diesel pumps. A SIP provides almost zero marginal cost pumping which leads to extra crop production (due to the almost costless extra irrigation) and electricity generation when not being used for pumping. Simultaneously addressing the issue of climate change due to almost zero emissions and so it can bring prosperity to the farming population.

This research attempts to understand the spread and usage of SIPs among farmers and falls under IWMI’s broader research theme on “Energy-Irrigation Nexus”. The study begins with an introduction to SIPs in India and early farmer experience of using SIPs. This is based on data and inferences from several IWMI studies in Rajasthan between 2012 and 2014. The study then explores how a financial model for SIPs will look like. This is done by comparing different financial products and interviewing bankers and farmers. The objective is to generate a set of design features that can help enhance the speed at which solar pumps are promoted and scaled up. The study ends with a technical and managerial study of what the effects would be of adding solar power to the grid and how to coop with this is in the most cost effective way.