CARL VON OSSIETZKY universität OLDENBURG

Postgraduate Programme Renewable Energy

PPRE

NEWSLETTER

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Editorial

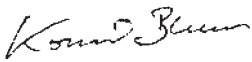
Dear Reader,

when my colleague Edu Knagge asked me to write the editorial for this newsletter, I tried to collect a few facts about the newsletter and the alumni networking. First thing that came to my mind is the fact that the e-mail discussion list ppre-l@listserv.dfn.de, to which nearly all alumni are subscribed, exists now for nearly 15 years. And just recently, when I browsed the archives of the last years at http://www.listserv.dfn.de, I realised who rich the treasures are that have been collected by many of you!

The number of contributions to this issue of the newsletter is very impressive - approx. 150 contributions (notes, profiles, reports, etc.) show the active involvement of our growing alumni network: including the recent graduates we have approximately 370 alumni (~320 PPRE & ~50 EUREC Core Oldenburg). But the contribution of the alumni is far beyond sending e-mails: as you will find listed in the respective section, they come and teach in the programme as guest lecturers – or work as tutors. We are also looking forward to re-invitations in 2009.

But things in Oldenburg are progressing as well. Research in Wind, Solar PV and Energy Meteo is active and growing and the construction site for the NextEnergy institute (funded by EWE, the local grid utility) shows real progress (http://www.ewe-next-energy.de}. We look forward to see Prof. Carsten Agert and his co-workers teach in PPRE.

Wishing you a successful 2009



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Alumni / Guests visiting PPRE

In this chapter all seminars by external lecturers presented to PPRE/EUREC-Students during the last academic year are listed. These seminars took place besides the regular classes, seminars and labs offered in the Postgraduate Programme Renewable Energy (PPRE).

Winter term 2007/08

Rural Electrification / Biomass Energy
Laurent Lecesve, France (EUREC 04705) works on his PhD on Rural Electrification and related subjects (University of Kassel).

Climate Change and Justice
Schröder/Lotze-Kampen from 'Potsdam Institute for Climate Impact Research' and 'Institute for Social and Development Studies, Munich'.

Research experiences gained at University Stuttgart and abroad
Juan José Trujillo, Colombia (PPRE 2002/03), who is doing his PhD research at Institute of Aircraft Design, Endowed Chair of Wind Energy, University of Stuttgart

Comparison of measured and simulated wind speed data in the Northeast Atlantic and the North Sea
Jörg Winterfeldt, Germany (PPRE 01/02), who is doing his PhD at Institute for Coastal Research (Coastal Climate) in Geesthacht near Hamburg, Germany. Jörg was invited by Forwind-Institute.

PV Cell Quality Control
Stelio Correia, Portugal (EUREC 04/05), who joined the Ersol Co., Germany (PV Manufacturer).

Building Physics and Energy Demand of Buildings
Ms. Herena Torio graduated from PPRE in 2007 and is doing her PhD studies at Fraunhofer Institute for Building Physics in Kassel (www.ibp.fraunhofer.de) in cooperation with the TU Munich.

Rural Electrification
Indradip Mitra, India (PPRE 03/04) who is presently doing his PhD-studies which is sponsored by Conergy AG at University of Kassel, Germany.

WindFarmer
Dr. Wolfgang Schlez from the Garrad Hassan-office Germany presented the Garrad Hassan Software package called 'WindFarmer', which is used for wind farm layouts.

Hydrothermal Carbonization
Mr. Greve, PhD-Student at Forwind-Institute Oldenburg (www.forwind.de).

Biogas Compact Course
Jan Lam, the Netherlands (PPRE 98/99) and Felix ter Heegde are well-known international Biogas experts with many years of experience. Both are attached to SNV in the Netherlands and Jan is managing at the moment the Biogas-Programme in Cambodia – for details of the 4 day workshop see article.

Biogas modelling for the project called AGROBIOGAS in Europe (www.agrobiogas.eu)
Leodegario Lopez, Mexico (Eurec 05/06) who is employed as researcher at the Technology & Transfer Center in Bremerhaven ever since he graduated in 2006.

Summer term 2007/08

Thermal Demand of Buildings / Solar Cooling / Large Solar Thermal Systems
3 seminars were given by Ms. Herena Torio Blanco, Spain (PPRE 05/07) – see previous page.

Concentrating Solar Power Applications
Miguel Gil Zapata is EUREC Graduate 06/07 and has worked on this subject in his thesis project and is working with SENER (www.sener.es) in parabolic through concentrating power plants.

Low Energy Housing
Topics include: UK Sustainability Targets, Current housing and beyond, The 'Passivhaus'
Andrew Peel graduated in PPRE in 2007 and joined the British Research Establishment <www.bre.co.uk> thereafter.

German Wind Monitor: Characterization and Improvement of the Wind Field Prediction
Ms. Jinhua Jiiang, China who is research associate at Forwind-Institute, Oldenburg, Germany.

Water Desinfection and Water Desalination - Presentation of small scale solutions
Ms. Monika Seidel, Freelancer from Munich, Germany

Sustainable Energy Supply
This 2 day Compact course was presented by Prof. August Schläpfer, Murdoch University, Perth, Australia.

Biomass to Liquid - The Future of Synthetic Biodiesel from Woody Biomass
Michael Sterner, Germany (PPRE 05/07) who presently is doing his PhD at University of Kassel.

Final PPRE Excursion – summer term 2008

On Sunday the 1st of June 2008, Mr. Hans Holtorf and Mrs. Evelyn Brudler led a group of students and tutors from Oldenburg for a 2 week long final excursion experience. The whole group consisted of 2 tutors, 15 PPRE students, 7 EUREC students and 5 non PPRE / EUREC students.

This trip was planned to cover several Renewable Energy related activities in Germany, but unlike the previous years, the dates had been adjusted to make it possible for the EUREC students to take part. This also meant that the famous Stuedl Huette in northern Austria was not going to be visited since it was too soon for it to open for visiting. The new mountain destination was Weilheimer Huette, which is located close to Garmisch Partenkirschen in the Alps.

The first stop was in Kassel city where the EUREC students were picked. Here, SMA – Technologie AG was visited. It is one of the leading technology developers and is involved mainly with PV systems, railway technology and innovative systems. The group had small seminars on SMA in general and PV technology with emphasis on the PV and battery inverters; the Sunny Boys and the Sunny Islands. They then had a guided tour around the factory while observing the solar inverter manufacturing processes.

The group then left Kassel and went to Potsdam where they visited the CO2 sequestration pilot project of GFZ (GeoForshungsZentrum) – Potsdam. GFZ is a research institute whose earth and environment arm is involved in research on the conflicting demands facing our world one of which climatic change due to CO2 emissions from energetic use of fossil fuels. Their CO2 sequestration project is located close to Ketzin within the outskirts of Potsdam. Their aim is in-situ testing of geological storage of CO2 in a saline aquifer. The work program involves intensive monitoring of the injected CO2 by using a broad range of geophysical and geotechnical methods, as well as the development and benchmarking of numerical models and risk assessment strategies. After a long debate with Mr. Krueger over certain issues during the theory session, the group was taken to see the site which was a few weeks from the start of the CO2 sequestration.

The group then proceeded to Brisensee, a small village in Brandenburg that was doing its own water recycling. This village had become a point of attraction due to a specific political situation regarding the recycling of domestic water. Using relatively simple and cheap technology, the water undergoes filtration processes till it is brought to drinking quality and then UV light is used to make the final disinfection.

The group then went to Freiberg, to Solar Ag, a company that makes all products necessary for the creation of solar modules. One of their branches – Solar Materials was involved in solar module recycling where the used modules were broken down into materials. After this an overview into solar module manufacture was given as a seminar and then the manufacturing plant was toured.

On Thursday the 5th of June, the group visited a pumped water storage site operated by Vattenfall Europe generation &Co. KG, in Markersbach near the Germany - Czech Republic border. The group both had a classroom session and then a tour where they went about 120 meters deep into the ground to the power house. There they saw many components live since part of the plant was under maintenance and repair. Earlier on, the group was able to ascend a hill to see top of the water reservoir too. The plant capacity was 6 x 175 MW.

The following day, the group was in Nuernberg and they visited Dehn & Sohne, a company dealing with lightning protection for Renewables. The group had a theory session on the lightening risks for all Renewables and the remedies Dehn & Sohne had for these risks. The group then observed some of the high voltage tests carried out on the products.

On Monday the 9th 2008, the Deutsches Museum in Munich was visited. It is a Museum where masterpieces in science and technology are collected and exhibited. It is visited every year by 1.3 million people and this year, PPRE / EUREC students were among this number. Here Mr. Frank Dittman showed the group the exhibition on renewable energy and tried to emphasise the challenges in exhibiting such a theme and how they have tried to go round them.

From the 10th to the 12th of June, the group ascended the Alps to the Weilheimer Huette which is a mountain hut with an RE based island energy supply system. It is located in the Bavarian foothills (Esthergebirge) region in Weilheim DAV section. It is approxi-

mately 2000m above sea level and due to weather constraints it is open only between May and October. The group was able to investigate the energy supply system for the hut and the energy consuming loads. These included a hybrid PV – Diesel generator system, a wind turbine and a water pumping system. A cable car was not investigated but was noted as one of the once in a while energy intensive load for the system. Observations were made on how the hut keeper applied energy saving and efficiency measures, which revealed how much he valued his energy since it was an Island system. The hut also had a biological sewage water treatment plant whose mechanism served as an additional learning experience for the group. The hut keeper Christian Weiermann was very friendly and hospitable; he recently sent greetings to the group. Another interesting experience was the snow which was still available up in the mountains. This much snow had not been experienced before by some of the excursionists.

Group picture just before leaving the Welheimer Huette.

On the 13th of June 2008 the excursion team visited a geothermal energy plant operated by Geothermie Unterhaching GmbH & Co KG. The plant was designed to make use of the energy in the area to provide district heating and electricity. The district heating part has been operating at 38 MW since November 2007 but the electricity generating part with a rated power of 3.4MW was still going through the last phases of commissioning.

On Friday the 14th of July 2008, the Intersolar trade fair was visited. It is the world's largest solar technology trade fair and an annual meeting place for everyone in the international solar industry. It focuses on Photovoltaics, Solar Thermal and Solar architecture. Here the group got enlightened on the solar business world and the possibilities for jobs as well as their master theses.

The trip was not just all work as the group got a weekend off to tour Munich and see the beauty of Hans' hometown. Museums, parks, interesting architecture and beer gardens were among the attractions that the students benefited from and many collected souvenirs along the journey. Two German families were visited during the trip, Andreas Guenther's parents in East Germany near Brisensee and Hans's father in Munich, and both of them gave the group a warm welcome. This trip was also an opportunity to make new friends as well strengthen the older friendships within the group. A pictorial story of the trip was prepared for all participants to keep the memories. All these things served to make the trip memorable and worth the while thanks to Hans, Evelyn and PPRE for this opportunity.

Ongoing PPRE co-operations

Carl von Ossietzky Universität Oldenburg and Nelson Mandela Metropolitan University in South Africa extend their collaboration into the field of Renewable Energy.

By Prof. Ernest van Dyk, South Africa

The Carl von Ossietzky University of Oldenburg (UO) and Nelson Mandela Metropolitan University (NMMU) in Port Elizabeth, South Africa, are working together on planned collaboration in the field of renewable energy. The planned collaboration will be in research and the establishment of a postgraduate programme in renewable energy at NMMU similar to the PPRE at Oldenburg. As partner universities and being relatively small newly structured universities, the UO and NMMU share many similarities. Prof. Ernest van Dyk and Dr. Freddie Vorster from the Department of Physics at NMMU spend four weeks in Oldenburg to establish links with researchers at Oldenburg and to work on the development of the PPRE with the assistance of Michael Golba and colleagues at Oldenburg. Earlier this year Prof. Joachim Peinke and Michael Golba visited NMMU to investigate collaboration and the possibility of the establishment of a renewable energy masters programme at NMMU.

South Africa is a sunny country that is blessed with a large solar resource and has many regions with a wind resource that is non utilised. Recent problems in the electricity supply from the national utility have created an awareness of alternative forms of energy. Prof. van Dyk and Dr. Vorster have been involved in renewable energy research for many years, focussing on solar energy (photovoltaics and solar thermal). Their activities form part of the newly formed Centre for Energy Research (CER) at the NMMU. Prof. Joachim Peinke of Oldenburg has also been assisting the CER to establish a wind energy research group. During his visit to NMMU in August he was involved in a workshop where wind energy research at NMMU was discussed and initiated.

Building-up Renewable Energy Postgraduate Programmes in Manaus and Curitiba, Brazil

by Dr. Rejane Moraes (PPRE 88/89) & Michael Golba, PPRE-Head

In November 2007 a project proposal was approved by the DAAD for a cooperation between the University of Oldenburg and two Brazilian universities, in the frame of the DAAD programme "Subject Related Partnerships with Universities in Developing Countries".

The major objective of this tripartite co-operation is the establishment of a long term sustainable partnership in the field of Renewable Energies between the Carl von Ossietzky University Oldenburg / PPRE and the Universities of Manaus (Universidade Federal do Amazonas, UFAM), in Northern Brazil, and Curitiba (Universidade Tecnología Federal do Paraná, UTFPR), in Southern Brazil.

A central part of the co-operation, with a four-year-target plan, will be the upgrading of the already existing Postgraduate Specialisation Programme (Fontes Renováveis de Energia) of the University in Manaus to a full-fledged Master Programme in Renewable Energy, and the establishment of a RE research area for Postgraduate Studies at the University of Curitiba.

The three partners institutions agreed in carrying out cooperation in the areas of research and education in RE, as well in others correlate scientific and academic areas. Among the planned activities are academic exchange of students and lecturers, development of teaching modules for the Brazilian universities, joint projects, and harmonisation of curriculum.

The project started in February 2008 and since then professors and lecturers of the two Brazilian universities visited Oldenburg to get acquainted with the PPRE-master degree and to discuss the next steps of the collaboration. A Brazilian student did her practical training at PPRE and a PPRE-student (**Andreas Günther from Germany**) is presently in Manaus doing his Master's Thesis about a rural electrification project in the Amazon region UFAM.

MoU with Institut Teknologi Sepuluh Nopember (ITS): Faculty of Industrial Technology / Department of Engineering Physics, Surabaya, Indonesia

The signing parties will cooperate in the areas of research and teaching as well as in other scientific and academic areas. In particular, the following areas will be emphasized :

(a) exchange of faculty members

(b) exchange of students

(c) exchange of publications

(d) joint research projects

Annual Biogas Workshop at PPRE

by Evelyn Brudler, Germany (PPRE 04/06)

The Workshop on "Project Planning for Bio-Digesters in Developing and Industrialized Countries" was taking place already in 2007 and 2008 and will be offered now for the 3rd time in February 2009. The workshop will be a regular part of the PPRE - programme in the future. PPRE is inviting all MSc-students from Oldenburg University, alumni and also other interested persons to participate.

In February 2008 beside the PPRE & EUREC students ca. 7 additional persons came to join and gain knowledge from the experts who are working for more than 20 years in planning of small-scale bio-digester in South-East Asia developing programmes and as well from experts on technical equipment, financing and other aspects of large scale bio digesters.

During the first three days of the workshop in February 2008 the focus was on small-scale digesters for developing countries, typically run by farmers in rural areas. Topics ranged from planning, construction and operation to financing, policy implementation and local market development. Long-term experiences are presented by specialists of bio digester programmes in (south-east) Asian countries. Improvements in the social, ecological and economical dimension are discussed. The lecturers work for more than

20 years in several biogas-programmes tailored to rural areas of developing countries.

On the fourth day of the workshop the perspective was opened to the technical details of bio-digesters in Europe. Fermentation plants in industrialized countries employ a huge amount of technical equipment, implement bio-chemical monitoring and process control and in almost all cases opt for co-fermentation; advanced technologies in handling and processing methane, the optimization of the slurry output for soil fertility are applied – each of these subjects shall be covered in an extended presentation by professionals in the addressed fields, while current situation and perspectives in financing of such systems will also be discussed. A session on the prospects and the sustainability of this technology completes the programme.

The feedback on the workshop and the huge interest in the knowledge of especially small scale systems bear the idea to invite, additional to students of PPRE and EUREC, international guest like planners, employees of NGO's and international guests working or planning to work in future in the field of rural energy supply and/or political decisions making. Due to the successful invitation, supported by SNV Netherlands, the overall number of participants will be limited to 50 persons for the workshop from February 2nd-5th, 2009.

Future plans for the workshop are to associate the topic of sanitation and water protection.

The detailed information on the workshop programme and other information you will find on our homepage: www.ppre.de

Some guy bought a new fridge for his house. To get rid of his old fridge,

He put it in his front yard and hung a sign on it saying: "Free to good home. You want it, you take it".

For three days the fridge sat there without even one person looking twice at it. He eventually decided that people were too un-trusting of this deal. It looked too good to be true, so he changed the sign to read: "Fridge for sale $50". The next day someone stole it.

From Oldenburg to Athens in 4 days

Experience report sent by François Veynandt, France, who went by car from Oldenburg for his EUREC specialization (Solar Energy in Built Environment) to Athens in February 2008.

3200 km from North to South Europe

"After this wonderful semester in Oldenburg we had to go to new places. I had a small heartache in the beginning to see our nice group split. OK - I would say Oldenburg was the most fun semester in my life. It's hard to put an end to it. But life continues and is still beautiful.

My five first days off Oldenburg, I spent them travelling! 3200km driving to reach Athens: a whole adventure! To sum up:

Saturday: I crossed Germany till Dresden. Visit of the town in the evening. Some nice buildings in the city centre, nice castles along the Elbe river.

Sunday: I crossed Ceska Republica, through Prague. …. Then I went through Slovenska Republica. In Hungaria (well I read "Magyarorszag" on my map... never heard of that name) I reached Budapest in the middle of the afternoon. 4 hours riding my bicycle in the town, going from a nice building to another nice place... Great pleasure to discover the hill on which Buda lies and then Pest on the other side of the Danube River.

Monday: I took the wrong motorway to get out of Budapest. So I visited Hungarian's countryside to get to the right way again. I planned to reach Greece in the evening. I still had to cross Serbia (Srbija) and Macedonia (Makedonija or Skopje if you speak to a Greek). Those two countries are not in European Union so the border is less open. That means you need a passport. The problem is I had only ma ID card... But I could enter the Serbia by buying a 65€ "tourist ticket". After 6 hours driving through the country I got to Macedonia's border: 6pm. Impossible to pass: French ID card is not enough. Sooo... I had to go back and cross Bulgaria (Balgarija) instead! A very small road in the mountain leads to the border. There was snow along the road and I met a few trucks. That was a good indication I was on a road that leads somewhere... I finally reached the Bulgarian border. It was much friendlier: a woman was even speaking French. She offered me a coffee. It was already 9pm. I continue for 2 more hours. As I could not find a hotel I stopped in a gas station which was open the whole night. I communicated with the guys in the station

by drawing on a paper.

Tuesday: The night in the car was short but very efficient. I drank one more coffee to warm up, fed my car with gas and headed onwards to Greece. It was hard to find the way to Greece. But in the early afternoon I finally crossed the border. One or two hours later Petros caught me in Thessaloniki! That was very nice to see a friend again. We went for a walk to discover the city. It's a nice place: the city centre right on the coast, the town is big but still human size. I got also a nice introduction to Greek gastronomy. After the previous day's adventures I really appreciate the very welcoming of Petros' family.

Wednesday: I already had missed Tuesday's lecture. The five hours that are supposed to separate Thessaloniki from Athens happened to be longer: traffic jams in the morning and naps... I also had difficulties finding my way in Athens. After turning around I finally found the University... But I was too late for the lecture. So I went on looking for my apartment. Same problem. Impossible to park, hard to go back (all one way streets...), hard to stop asking for your way. So I parked the car and finished to look for the place by bike! It's much more flexible. My bike turned out to be very useful in this trip. It was 7pm when I found the flat. Happy to have made it alive !

Francois with Car & Bike somewhere on the road in South of Serbia

So it was a nice trip. I saw the landscape evolving and changing. I found differences in the wealth of the countries: roads, houses, cars, quantity of waste along the road, size of fields... all give indications.

With a little bit more time, the trip would have been more enjoyable. A better preparation would also have helped... especially to cross the border. Well nice experience anyway!

After this adventure the semester in Athens could start!

The weather has been quite cold in the beginning. I wondered what the point travelling 3000 km to the south was if it was to find the same climate! Now it's warmer. The sun is particularly bright and efficient - at least compared to Oldenburg. The solar simulator in the lab was still much warmer... but for me it's like summer-holidays weather……

I was wondering if in a huge town like Athens I would see green from my window. I think we are really lucky: we have a nice wood starting right under our window. It's also nice to go running in a safe place!

Indeed Athens circulation is... let's say not like in Germany. I'll give only one example: at pedestrians crossing paths: when the light is red you look around and cross; when

it is green you also look around and cross.

We also have to make the most out of our semester in Athens to visit this very rich city and the many wonderful places in Greece: archaeology, landscapes, buildings, with various influences from Ancient Greeks, Romans, Turks.

Greece is rather mountainous which I like very much! It provides very nice landscapes on the white city that Athens is. This colour is nice with a high solar irradiation. The high reflectivity (0,9 may be down to 0,7 because of dark pollution...) of the walls prevent the building from warming. The vegetation is also indicating we are not in Oldenburg: pine trees, orange trees, palm trees, olive trees...

The car will be nice to discover Greece. Biking is also very nice: nice landscapes, smells of solar heated plants in the country side... There is a thing that puts suspense in cycling: the dogs. There are plenty. Some are peaceful... This means not all. Though great motivation to accelerate sometimes! Street dogs seem to live in a parallel society in Athens, sort of cohabitating with humans.

I went skiing too! Incredible when you come from the North (Oldenburg), where you hardly ever see snow! But at 2000 meters over see level it is completely white. And in the end of the day I was completely red... Sun is definitely more powerful here...

The lectures are from 3pm to 8pm theoretically. In reality it starts with 15min to 30min late. It can go up to 1h... And it usually finishes before 8pm. Sometimes we are free at 5h30... This is from Tuesday to Friday. The Monday off makes 3 days week-end! I never experienced that before!

So the rhythm is very relaxed. Nothing comparable to Oldenburg's!

To eat in the university, we have "passwords": we just have to say to the cashier's guy "EUREC students" and it's free. Well the rule might change tomorrow...

Though we don't really know how, but it seems to work.

The campus is green: it is basically a forest with some buildings in the middle.

In the building specialisation, we are 16: 8 from EUREC Master, 4 Greek female architects and 4 other Greeks (environmentalist, biologist, civil engineer,..).

Building is a new world for me although I live in buildings since I was born. It is interesting. But nothing very technical so far: we see more general things. And funny ideas like: "A building must be seen as a living organism." OK, good idea!

I liked the parties especially those in small bars with strange, original and unique decoration. The Greeks from the program take us to the nice places they know. The only bad thing is the smoke...

Another good thing is that we meet people from both wind and building specialisations in the parties. The wind guys are 11 or 12, only EUREC students: various nationalities, coming from all core programs. It forms a nice group. I think we'll have a nice time here too.

Last minute: we found out there are some dance courses. Some of us are taking the opportunity of learning salsa and other dances...

Experiences report from my Project at Instituto Technologico de Canarias

by Craig Wong, US (EUREC 2007/08)

I am currently working on my thesis project with the Instituto Technologico de Canarias located in Gran Canaria, which, in my opinion would have to be one of the best organizations to work with in Spain. My co-workers are very talented, helpful and friendly. I actually enjoy waking up at 6:30 in the morning to catch my carpool to the office...ok 6:30 is a little too early, but I live on Las Cantaras beach, so it is worth it. IN addition to an interesting and challenging project and nice co-workers, we have Surf, Swim, Beach, Snorkel... things on Gran Canaria are good.

What I can discuss about my project is that there is an initiative by the Government of Gran Canaria to reach certain energy goals by the year 2015. These goals deal with improved efficiencies, implementation of technology, reducing energy consumption, and renewable energy fraction goals mainly centering around Wind energy. All of this can be found in writing in a government document called Pecan 2015.

The wind resources on the barren east coast of Gran Canaria are considered to be some of the best in the world. Numbers quoted to me have been 3000-4000 hours/year of maximum wind capacity and an average wind speed of ~8 m/s (at 10 m). In addition, July hosts the wind surfing world championships, which I had the opportunity to see.

Because of wind penetration limits, Gran Canaria has reached the point where the installation of more wind turbines would be less economically feasible because the energy they feed into the grid would be limited by these restrictions meant to insure grid stability. Therefore to increase the amount of wind energy produced on the island, large storage systems must be developed.

My project is to look at the feasibility of building a wind- hydro- pump storage system by connecting some of the 60 existing reservoirs on the island to create a network of pump storage systems. This project is actually ahead of their planned schedule, so I am free to work a lot on my own and make any suggestions of crazy ideas I have. It has been a very nice opportunity to learn.

I encourage anyone interested in island systems, wind energy, hydro-pump storage, Spain or the beach to look into the work that the Instituto Technologico de Canarias is doing. They also have interesting departments dealing with fuel cell technology, micro and macro biology, water management, and a photovoltaic test lab. www.itc-canarias.org

Windfarm on Gran Canaria island

De-Carbonizing China's Supply Chain' Conference

In which **Alan Cuddihy, Ireland (EUREC 07/08)** took part actively while doing his final Master-Project at PCH International, which is an Irish owned/China based company, heavily involved in various forms of China manufacturing for numerous multinationals. PCH wants to avail of the RE incentives available in China, with a view to onsite factory integration. Alan is involved in an initial study on the recent introduction of incentivized schemes introduced as part of China's Renewable Energy Development Act. The next step is a feasibility of rooftop grid-connected hybrid system (PV/Wind) to be constructed onsite in the PCH owned assembly/kitting/packing facility in Shenzhen, China. This will involve the design, sizing and costing of the system as well as studies on payback periods etc.

Allan Cuddihy presenting his research activities at Conference in China

On Sep 18th and 19th in Guangzhou, China was the first conference on 'De-Carbonizing China's Supply Chain'. The conference was jointly hosted by 'Business for Social Responsibility' www.bsr.org and 'The Climate Group' www.theclimategroup.org, both international NGOs working on a range of environmental issues in the region,

The meeting dealt with an number of topics relating to carbon measurement and monitoring, energy efficiencies in the built environment as well as information sharing on 'best practices' from an environmental standpoint.

Alan has been in regular contact with these groups regarding his master thesis which deals with the onsite RE integration in factory buildings, with a primary focus on the Pearl River Delta region of Southern China. As part of the conference he presented a 1 hour training session on the opportunities for solar PV and solar thermal installations in the area, dealing with the technical and economic aspects as well as information on the local governmental legislation to support such programs.

The outcome was a number of interested parties, specifically from the electronic industry whereby huge amounts of energy are consumed in cooling factory floors. Companies such as HP, IBM and BYD all present, expressing an interest to learn more. The next step will be a follow-up training session in early 2009 which will also see the launch of the low-carbon industrial city project which will likely be undertaken in the neighbouring city of Zhuhai.

Field experiences gained in Ghana

by Silvia Potzmann, Germany & Simeon Nwaogaidu, Nigeria (both PPRE 07/09)

Both did their 2-month external practical training assignment at the Energy Commission of Ghana in Accra. The training was coordinated by Mr. Wisdom A. Togobo, Ghana (PPRE 1997-98), who is heading the RE Department at the Ministry of Energy in Ghana.

Silvia surrounded by school-kids while doing maintenance of a Street- & school-lighting system at a local village

The Energy Commission is mainly working on challenges that the country must meet on its quest for a well functioning competitive energy industry. This task includes creating affordable energy supplies, improving energy reliability, efficiency and security and protection of public safety, economic and environmental well-being.

Furthermore the company welcomes investors- national and international ones- doing projects and programmes in energy efficiency and as a regulatory body it also encourages energy efficiency standards of buildings and appliances.

The division household energy tries to promote and teach people in villages about rural development whilst enhancing sustainable development and most of the objectives discussed in this report were carried out under its supervision.

Silvia and Simeon were involved in various projects like:

- Solar street lighting assessment (Ashanti region)
- Solar Home System Assessment (Kpassa- Volta Region)
- Charcoal work shop (Ashanti Region)
- Wind Assessment (Volta Region)

Their overall résumé:

Although time spent in Ghana was much too short, it was still possible to gather some impressions about life in general and especially the local energy situation in a developing sunbelt country and what kind of demands the rural population has. Although it was not possible to work on a certain project for a longer period, the experiences gained by seeing so many different, local energy applications was very interesting.

Silvia joining a 2 day Seminar on 'efficient charcoal production'

Project-experiences gained in Freiburg, Germany

by François Veynandt , France (EUREC 2007/08)

Master thesis time for the 2007-2009 PPRE batch and 2007-2008 EURECs!!!

4 of us are now working in the well known Fraunhofer Institute for Solar Energy systems in Freiburg onnthe following topics:

- Chris (EUREC): "I started on June 9th, 2008, and thesis work lasts six months. Within the group in which I work, the front contacts of silicon solar cells are produced using a laser guided within a liquid jet. The liquid jet is formed inside a pressure chamber, and my task is to simulate fluid flow within the pressure chamber in order to optimize the liquid-laser-jet system. My work involves simulation, prototype construction, and laboratory testing"

- François (EUREC): "I'm there since July, using the software IDA-ICE to simulate combined heat and power (CHP) units in low energy buildings. IDA-ICE (Indoor Climate and Energy) is a dynamic simulation tool specialised in the built environment."

Chris, Francois, Rosiel & Georgos feeling good in Freiburg

- Rosiel (PPRE): "I started my Master Thesis in September 1st. Basically, what I will do is to simulate high temperature latent heat thermal energy storage in solar thermal power plant."

- Giorgos (PPRE): "I started in October my thesis about the Development (designing-construction-testing) of a Prototype Methanol Fuel Cell."

About the Solar-City:

Freiburg is a very nice city: the "Innenstadt" entirely pedestrian area is a really welcoming. Always animated and very interesting: Freiburg has indeed a rich history. The many old buildings though very well preserved contribute to the nice atmosphere.

The rest of the city is also of high interest. Green areas, parks, small lakes and the "Schlossberg" just near the city center, provides nice and peaceful areas in the city.

Freiburg is one of the greenest and the sunniest city in Germany! That is why it is known as "Solar City". This is especially visible through the many solar systems and buildings around the town. Some wind turbines are also rotating in the nearby mountain. Place of interest for renewable energy students!

The surroundings are as interesting with the wonderful "Schwarzwald". Hiking, cycling, skiing in winter... the Black Forest offers many open air leisure opportunities!

A nice place to live and to work. The Fraunhofer Institute concentrates a lot of knowledge on renewable energies technologies. We benefit of that through presentations of colleagues organised regularly.

Successfully completed MSc-Thesis Projects – PPRE 2006/08

Name	Nation	Host-Institution	Titel of Thesis
Karampela	Greece	Meteorology Group in the University of Oldenburg	Evaluation of Forecast of Power Production with Distributed PV-Systems
Khatiwora	Bhutan	Bremer Energie Institut, Bremen	Energy Efficiency Policy Instruments and Measures Review, Comparison and Evaluation of France, Germany, Italy, Sweden and United Kingdom and Recommendation for Bhutan
Khatun	Bangladesh	Green University of Bangladesh, Dhaka, Bangladesh	Sustainable Disposal of Municipal Solid Waste of Dhaka City to Electricity & Organic Fertilizer: A System Dynamics Approach
Lohani	Nepal	Fraunhofer-Institut für Bauphysik, Kassel	New ways of Renewable Energies for Sustainable Buildings - Comparision of energy/exergy analysis of fossil plant, ground and air source heat pump building heating system
Mekki Ahmed	Sudan	Fraunhofer Institute for Building Physics	Applicability of Solar Absorption Air-Conditioning Technology depending on Climate and Building Standard
Mwakatage	Tanzania	Deutsche Gesellschaft Technische Zusammenarbeit (GTZ)	Pure Plant Oil versus Bio Diesel as Bio Fuels in Sub-Sahara Africa "Selecting Technically and Economically Viable Alternative, Tanzania Case Study"
Nafiri	Indonesia	Conergy AG, Hamburg	Renewable Energies and Rural Electrification - A General Approach for Economical Optimization of Standalone Hybrid Power Systems
Patschke	Germany	Siemens Windpower A/S, Brande, Dänemark	Improvement of the Accessibility of Offshore Wind Turbines
Richert	Germany	SMA Technologie AG, Kassel	Performance Evaluation of Photovoltaic Systems
Singh	Panama	Deutsche WindGuard Consulting GmbH, Varel	The Investigation of correlation methods for long term assessment of wind resources
Surkute	India	DEWI, Wilhelmshaven	Rotor Blade Calibration (specially the analysis of Crosstalk specially the in rotor blades, i.e. the effect of flapwise bending moment on edgewise and vice-a-vera)
Turker	Turkey	Delft University of Technology, Delft, Netherlands	Simulation of SOFC Systems with Different Coal Gasification Techniques
Vasconcellos	Brazil	EWE Biogas GmbH & Co. KG, Wittmund	Evaporation of Digestate for Quality Improvement through Utilization of Excess Heat in a Biogas Power Plant
Wu	China	TÜV SÜD Industrie Service GmbH, Munich	CDM in China- Implementation and Barriers of Renewable Energy Projects
Zhang	China	Institute for Photovoltaics, Forschungsszentrum Jülich	Ion beam treatment of ZnO films for silicon thin film solar cells

Successfully completed MSc-Thesis Projects – EUREC 2006/7

Name	Nation	Host-Institution	Titel of Thesis
Bennett	UK / Canada	ETA, Florence, Italy	Biofuel production in Benin
Craig	Canada	Institute of Engineering; National University of Mexico (UNAM)	Solar, wind and biomass hybrid system for an ecological resort
Di Lorenzo	Canada/Italy	Garrad Hassan Canada Inc.	Development of Canadian Regional Wind Indices
Gil Zapata	Spain	SENER INGENIERÍA Y SISTEMAS S.A., Bilbao, Spain	Technical-economical study of a biomass based backup generation system for a solar thermal power plant
Marquesm-Malcato	Portugal	GE Wind Energy, Salzbergen, Germany	Risk assessment of the potential wind farm location using GIS
Martinez-Streignard Viana	Venezuela	Garrad Hassan, Oldenburg	Wind Farm Design Optimization
Perini	Italy	Airtricity, Dublin, Ireland	Wind Turbine Fleet Performance and Fault Analysis
Roycroft	Germany / Ireland	SunTechnics Energy Systems Pte Ltd., Singapore	Market Analysis and Technical Implementation of Biomass Combustion and Biogas in Thailand
Skarvelis-Kazakos	Greece	Garrad Hassan, Bristol, UK	Improving prediction of wind farm performrance near forests
Troncoso Lago	Spain	Airtricity, Dublin, Ireland	Enhanced Wind Farm Designs for Gigawatt Scale Projects

Ongoing MSc-Thesis Projects – PPRE 2007/09

Name	Nation	Host-Institution	Titel of Thesis
Achibiri	Nigeria	GE Wind, Salzbergen	Evaluation of Extreme Wind Estimation Methods
Anwar Hossain	Bangladesh	Bangladesh Power Dev. Board, Dhaka	Technical and Socio-economical analysis of different options for Renewable Energy supply to remote village: A case study on Bangladesh perspective
Bachtiar	Indonesia	Research Center Jülich, Germany	Optimization of Internal Manifold Design (for flat cassette design of SOFC
Elhadi Adam	Sudan	Uni Oldenburg	pv field array tester (Weiterenwticklung von Christian Henriquez' thesis)
Garcia da Fonseca	Brazil	DEWI, Wilhelmshaven	Requirements and actual status of the standards and procedures for grid connection of wind farms in Brazil and the comparison against international standards and procedures:
Güner	Turkey	Enercon, Aurich	Comparison of regulation for permission of wind farms in Turkey and Germany and technical & economical consequences on wind farm and turbine implementations
Günther	Germany	Manaus, Brasil	Rural Electrification in the Amazon Area
Millan	Mexico	ISE, Freiburg	Simulation of high temperature latent heat thermal energy storage for solar thermal power plants
Muballa	Uganda	Uni Oldenburg / Uni Delft, Holland	Village Gasifier Solid Oxide Fuel Cell Micro Turbine Systems with cooking gas for Tropical Developing countries, Case study Uganda
Nwaogaidu	Nigeria	Lahmeyer Int., RE-Dept., Bad Vilbel	Development of a solar radiation data processing toolkit
Pabon Restrepo	Colombia	Innovative Wind Power, Bremerhaven	about the mechanical design of a wind turbine
Parinyacupt	Thailand	ISET, Kassel	Performance evaluation and optimization of Gaidoroumandra minigrid
Prakash K.C.	Austria	Garrad Hasssan, Oldenburg	Wind farm wake analysis and model development
Potzmann	Nepal	Enerpro Co., Quito, Ecuador	Energy Efficiency on the Galapagos Islands
Sandris	Greece	ISE, Freiburg	Development (designing-construction-testing) of a Prototype Methanol Fuel Cell."

Ongoing MSc-Thesis Projects – EUREC 2007/8

Name	Nation	Host-Institution	Titel of Thesis
Tanguy	France	Transenergie SA	Conception of a testing platform for different PV power plant technologies
Del Cid Lemus	Guatemala	Technology Transfer Centre - TTC, Bremerhaven	Resources efficient Ethanol fermentation by means of membrane bioreactor technology (ETHAFERM)
Townsend	US	Deutsche WindGuard, Varel	Investigation of Correlation Methods for Short Term Measurement Data, especially with Respect to LIDAR Measurement Data
Phillips	US	Wind Prospect Inc., Halifax	Wind integration into isolated diesel systems
Veynandt	France	ISE, Fraunhofer Institute in Freiburg	Development and analysis of simulation models for heat pumps and CHP systems
Goy	France	INES/CEA	PV-Systems
Wong	US	INSTITUTO TECNOLÓGICO DE CANARIAS, S.A.	Analysis and optimization of an Wind-fuel-hydraulic electricity generation system for Gran Canaria Island
Baldus-Jeursen	Canada	ISE, Fraunhofer Institute in Freiburg	Optimization of pressure chamber design for a liquid guided laser solar cell wafer grooving system
Gillard	France	Laboratory of building physics & systems	Performance assessment of a naturally ventilated building in the Reunion Island
Cuddihy	Ireland	PCH International	Role of Renewable Energy in China Manufacturing Industry
Paterakis	Greece	Vestas Hellas Wind S.A.	Assessment of Power Output Estimates vs. Real Production Values in Greek Complex Terrain Sites
Owen	UK	REpower SAS	Wind assessment projects across France
Lynch	Ireland	Sustainable Energy Ireland	Zero Carbon Homes through Micro-Generation
Chacón Calderón	Guatemala	AgroEnergien, Varel	Feasibility analysis of anaerobic digestion plants in different markets

News from PPRE-alumni

Careers

Dr. Bakri Hamad, Sudan (PPRE 88/89)

who stayed for many years in Hamburg, Germany, where he also finished his PhD, got a new job at Strayer University in Philadelphia,US (www.strayer.edu) recently. He is teaching Management & business strategy, e.g. topics like business project management, project initiation and development, international management, culture and organizational behavior. Other interests include integrating cultural/social/technical factors into potentialities for human performance and institutional development.

Olivier Donat Andriamahefaparany, Madagascar (PPRE 93/94)

resigned as Energy Minister from Madagascar. He wrote "I won the election in the capital city in September 2007, and since then, I am Member of Parliament. Socially and politically, the new job is very demanding, but I can cope with it. It is not very time consuming compared to the job as Minister, so I have opportunity to re-integrate my former activity as Teacher in a Catholic University college. At the same time, I'm starting a small business dealing with Conventional Energy and fishing. I'm now in contact with other alumni who want to sell their solar products in Madagascar, but we are still exchanging information. Hope, we'll be able to do business together." Olivier informed us that he wants to further his career through the Humphrey fellowship in the US in near future.

Johnny Nahui Ortiz, Ph.D. (PPRE 93/94)

is working as RE consultant at the Centre for Energy Conservation & Environment – CENERGIA in Lima, Peru.

Ahmed Mohamed Fathy, Egypt (PPRE 93/94)

informed us that he had been a Lecturer in Ghadams University in Libya for five years but returned to his former employment at the National Research Institute of Astronomy and Geophysics, Solar and Space department in Egypt. Early 2008 he prepared himself for the exam to become Assistant Professor there.

Augustus Leon, India (PPRE 93/94)

completed his doctorate (D. Engg.) in Energy Technology in Jul 07. After 11 years in Thailand, he moved to Canada. Before he took up several part-time CDM consultancy assignments in Thailand, mostly on biogas and biomass power projects. After completing his doctorate, Augustus started working full-time as CDM consultant for a Thai company.

Augustus Leon (left) receiving his PhD-certificate from AIT, Thailand in 2007

Since there was a decline in the interest in CDM in Thailand, he moved to Canada and in May 2008 started working with Dalhousie University, Canada as a post doctoral research fellow in the Mechanical Engineering Department. His work is in cutting-edge research on Supercritical Water Gasification. He is building a research facility for Supercritical Water Biomass Gasification at Dalhousie, incorporating a continuous flow reactor. He is also carrying out research on fluidization of rice husks in BFB, managing the Circulating Fluidized Bed Lab, and co-advising a few Doctoral and Master Students. He says his work is as interesting as his CDM work, since it offers him plenty of opportunities to learn something new every day.

Enrique Fuentes, Chile (PPRE 95/96)

is working at the University of Tarapaca, Arica, Chile and has successfully coordinated German DAAD scholarships for students making applications to German Universities. Chile is also opening up to RE policy and some initiatives in solar energy in new houses are being taken there. Their University has also applied for funding of more practical applications in RE. He also asked for a PPRE / EUREC student to go over and do their external practice with them.

Diwaker Basnet, Nepal (PPRE 95/96)

is working as Senior Policy Officer at the Sustainable Energy and Transport Group in the Environmental Policy and Climate Change Division of the Department of Sustainability and Environment in Melbourne, Australia.

Bassil Al-Nawaiseh, Jordan (PPRE 99/00)

informed us in 2007 that he did every thing possible to get a position in the RE-sector, but unfortunately, no chance was available at all. Hence he started working in a tobacco company meanwhile. Recently he got an offer for Phd in Australia in Wind energy, but the fees were too high for him to bear.

Sham Sunder, Mysore, India (PPRE 99/00)

told us recently that their activities in Mysore are going on well. Sham is heading the center called NIE-CREST (Nat. Inst. of Engg. - Centre For Renewable Energy & Sustainable Technologies), which is involved in Renewable and sustainable technologies activities.

Later on he wrote “Yes, I have planned my PhD with Prof. Dr.-Ing J.Schmid. I have started the formalities now and it may take some time for everything to get settled. This crystallized during Prof. Schmid’s visit to my place.”

Prof. Schmid visited NIE-CREST in Mysore with his 9 team members of the “German Advisory council on Global Change” on 14Th and 15Th February 2008. It was really great and interesting to meet a personality like him. We were able to exchange information in detail pertaining to Integrated Renewable Energy Systems and biomass energy technologies; perspective of both of us on energy issues was also discussed. It was a nice programme.” Sham wrote an article about PPRE for the “Deutschland” Magazine which was to appear in the issue after March 2008. Additionally NIE-CREST hosted Ms. Margit Hechler, from the University of

Applied Science in Darmstadt for a three months practical training.

Mr. Sham Sunder presenting local RE-facilities to the German Advisory council on Global Change:

Improved cook stove

Solar panel making

Gasifier-System

Mr. Alois Mhlanga, Zimbabwe (alumnus of REP, Harare 2000)

After working some years for the African Development Bank, Alois changed jobs recently and joined the United Nations Industrial Development Organisation – UNIDO as an Industrial Development Officer in the Renewable and Rural Energy Branch in Vienna Austria, www.unido.org/renewables. He is basically in charge of development and implementation of technical cooperation projects in RE. They have projects in Ghana, Gambia, Cape Verde, Comoros, Pakistan etc. at the moment. Alois is focusing on biomass energy.

Jordi Avellaneda de la Calle, Spain (PPRE 01/02)

after taking his MBA last year and working for a logistics company for 2 years Jordi has suddenly become Global Environmental Manager for his company (Maersk Logistics). Now he is setting up the environmental strategy and policy for the company. He is also working in the field of carbon trading and offsetting, so he is getting closer and closer again to his green vocation and his renewable energies old memories :)

Oliver Risse, Singapore (PPRE 01/02)

informed us in February 2008 that he left Conergy after 7 years of working with them. However Oliver remained in Singapore since he joined a Cleantech investment management firm called Asia Cleantech Capital (www.asiacleantech.com) there in 4/2008. *(see summary in the back)*

Manoj Khadka, Nepal (PPRE 02/03)

informed us end of last year, that he is employed as Rural Energy Advisor for the Rural Energy Development Programme (REDP) in Kathmandu, Nepal. The REDP is financed by UNDP.

The program is supporting rural communities in Nepal fulfilling their needs for energy. They are focussing in the promotion of micro hydro technology.

Bango Alejandro, Brazil (PPRE 02/03)

informed us earlier this year that he was leaving Brazil and heading back to Europe after spending almost 4 years in Brazil working on various RE projects. Actually he is looking for contacts in Wind Energy / Wind energy development, mainly in Southern Europe.

Andreas Michel, Germany (PPRE 03/04)

who is working for the Improved Cookstove Dissemination programme in Malawi for more than 3 years already, returned for his Christmas holidays 2007/08 to Germany, where was able to check out other job possibility at GTZ-headquarters in Eschborn, Germany. His contract in Malawi was going to end in May 2008.

Indradip Mitra, India (PPRE 03/04)

successfully finished his Dr.-Ing Disputation on 24.11.2008 at the 'Institut für Solare Ener-

gieversorgungstechnik' (ISET) in Kassel, Germany – Congratulations !!

João Paulo Adler Gomes da Costa, Portugal (EUREC 04-05)

who joined CIEMAT, Madrid, right after his EUREC-studies, where they were experimenting in the field of solar thermal energy generation (using solar collectors and parabolic mirrors, with high temperatures and pressures, to try to produce electricity) , changed job recently.

Since Sept. 1st 2008 João is employed at Garrad Hassan in Barcelona, Spain. Although Garrad Hassan is known as a quite big & independent Wind Energy Consultancy based in the UK, they obviously start to enter other RE fields as well, since João will work in Solar PV.

Latest news: João quit with GH while still in the trial period and is looking for a new job at the moment

Tubtim Limsoontorn, Thailand (PPRE 04/06)

recently found a new occupation. She is now working as staff of "The National Communication Project" at the Office of the National Environment Board (under the United Nations Framework Convention on Climate Change).

Luis Montes de Oca, Spain (EUREC 05/06)

changed job end of last year. Now Luis is working for SMA Ibérica Tecnología Solar, where he is ‚Responsable de Marketing'. SMA Ibérica is a subsidiary enterprise of SMA in Kassel, Germany.

Antonio Antonopoulos, Canada (EUREC 05/06)

finished his duties at ETA Renewable Energies in Florence, Italy, in January 2008. At ETA amongst others Antonio was mainly involved in the development of the Energy Supply Strategy of the Master Plan for the Masdar Development: "The world's first 100%-renewable, sustainable city" in Abu Dhabi, United Arab Emirates

Latest news in 9/2008:

Antonio started his own consulting business (REngenuity - Renewable Energy Consulting and Services - www.rengenuity.com), with base in Toronto, where he is working as freelancer in a few independent consulting contracts. He just finished a feasibility study on a salt water pumped hydro storage scheme, and may be doing some more depending on how bids go.

Actually Anotonio moved as "special guest visitor" to Berlin, where he is trying to continue his international consulting business with respect to RE ("….since I am doing this, I can do it from anywhere in the world really - so why not Berlin!").

Theodoros Polizois, Greece (EUREC 05/06)

completed his army service and is now working for the Regulatory Authority for Energy (Renewable Energy Sources Department) in Greece. His job has to do with evaluation of renewable energy applications (mainly micro hydro).

Dwipen Boruah, India (PPRE 05/07)

Late 2007 Dwipen joined a new assignment as "Manager - Energy Group" in IT Power India, based in Pondicherry, India, which is located in southern part of India in the coastal area of the Bay of Bengal and not very far from Chennai and Bangalore. Web: www.itpi.co.in

Rodolfo Hegel Pellecer, Guatemala (PPRE 05/07)

stayed with Lahmeyer International in Bad Vibel, where he also did his final master-thesis project. He is working as a consultant, especially in Solar Thermal and PV technologies. Recently he has been involved in a very interesting project, in which he had to identify PV and CSP Projects around the world, working with energy utilities in Developing Countries (e.g. Reliance and NDPL in India)

Bhai Raja Maharjan, Nepal (PPRE 05/07)

got a new job with the TÜV SÜD company as an GHG Auditor, in Munich from July 2008.

His main responsibility is to look after all verification projects. He is working there together with Sebastian Randig (PPRE 05/07) and Cathy Wu (PPRE 06/08) in the Chinese and Indian Department.

Spyros Skarvelis-Kazakos, Greece (EUREC 06/07)

started his MPhil/PhD degree study in April 2008 in the School of Engineering, Electr. Engg. Dept. at Cardiff University, Wales (UK). The title of the PhD is "Micro-generation for 2050", and it is "divided" in the following parts:

1st: Spyros is looking at the CO2 performance of micro-generation (domestic mostly) during operation. Micro-generation for now is micro-CHP from Microturbine/Diesel ICE, using fossil fuels or biomass fuels. Some PV and Wind will also be included in the mix. Comparison of emissions with the alternative technologies (like standard grid and gas boiler) will be done as well.

2nd: Assessment of the overall life-cycle emissions of micro-generation. e.g. for production of a PV modules energy from fossil fuels is needed.

3rd Spyros is supposed to check what possibilities the micro-sources have in helping the grid with respect to voltage control, reserve, and if one can aggregate them so as to function as a virtual power plant.

…more details to come!

Mark Craig, Canada (Eurec 06/07)

started to work for CH2M-HILL in Calgary, Alberta, Canada for their Oil and Gas division. He is a junior project engineer. (www.Ch2M.com)

Valerie Bennett, Canada (EUREC 06/07)

finished her assignment at ETA, Florence, Italy, in June 2008. One of her last official duties was the participation in the European Biomass Conference in Valencia, Spain. In September she started to work as an Energy Management Consultant back home in Ottawa, Canada, at Marbek Resource Consultants (www.marbek.ca). The current project she is involved in is focused on energy efficiency calculations for her province's gas utilities. Her next project involves all kinds of energy, including renewables. Marbek is a small company, but has gotten some great recognition across Canada. They are also doing some international projects. Valerie: "I'm really enjoying being involved in the energy scene in my country these days! The experience and notes from my studies in Oldenburg have proven very useful! I also wanted to let you know that I am getting involved with volunteering with Canadian immigrants. I had such a great experience meeting people from all over the world, that I'd like to continue to do the same here in Canada!"

Lisa Di Lorenzo, Canada (Eurec 06/07)

joined as Wind Energy Analyst, Garrad Hassan office in Canada (www.garradhassan.com), where she already did her Thesis-

project before. Latest News from November 2008: Lisa quit her job with GH and applied to the teacher's college in Ontario, Canada to teach high school math and physics.

Jorifa Khatun, Bangladesh (PPRE 06/08)

She informed us that she returned to her office, the Bangladesh Power Development Board, where the chairman informed her that they were going to strengthen Renewable Energy related issues. That their board would establish a separate cell there and she was instructed to coordinate all of the activities. She was sure that the knowledge she had just received from Oldenburg University would be used efficiently. She promised to keep in touch with updates on her progress.

Cathy Wu Caiyang, Germany (PPRE 06/08)

joined TÜV-Süd Co. in Munich, Germany, after her studies with us. She is employed as CDM-auditor. Actually she is working in the same group than Sebastain Randig (PPRE 05-07).

Wind Energy

Ramesh Muthya Praneshrao, India (PPRE 88/89)

former Director of the Center of Wind Energy Technology in Chennai, India, left C-WET last year already to join ENERCON in India as a resource person for various wind resource and turbine related aspects. He wrote: "…. to change from the government side to private sector is a very big step but enjoyable. All this somehow relates to dear Oldenburg…."

Xiang-jun Ming, China (PPRE 91/92)

wrote in September '08 that he is still working in (Strategic Investment Department of) Goldwind Corp, China. The Goldwing company purchased 70% shares of Vensys recently, which is an engineering company located in Saarbrücken in Germany. Therefore some of his colleagues often visit Germany these days. Info: http://www.goldwind.cn

Dr. Alemu Tadesse, USA (PPRE 99/00)

got an energy engineer position at a Wind Energy Company in San Francisco, US in 2007. Before he completed his PhD with the topic "Convective Systems Tracking and characterization in terms of their kinematics and Electrification". He won a NASA fellowship to do the research for three years.

Kudakwashe Ndhlukula, Zimbabwe (Alumnus of REP-Zimbabwe 99/01)

who is working as Coordinator of Renewable Energy & Energy Efficiency Institute-REEEI at University of Namibia, informed us in November 2007 that they were wrapping up a Danish funded project where they were doing national capacity building on renewable energy and energy efficiency.

Actually they have identified the need to embark on a wind resource assessment for the country because they know that they have big wind potentials but are lacking the quantified resource potential information. REEEI would like to embark on a wind resource assessment exercise. Already they have identified a few and limited local partners both for human and equipment. The Mechanical Engineering Department at the Polytechnic of Namibia has a lecturer who was involved in the initial resource assessment at Luderitz and Gobabeb. A local GSM service provider has offered to use their telecommunication towers to host the measuring instruments-thus reducing the biggest cost component. Nampower - the local power utility is doing detailed measurements at two sites with big potential- i.e. Luderitz and Walvis Bay and they will share the results.

The long term plan for the institute is to use the resource assessment information to develop a wind map for the country for use in wind energy generation. It is in this regard that the institute would like to solicit some cooperation and support and is looking for expertise and vast contacts in wind energy.

Side note: REEEI hosted a German student (energy economics) from Darmstadt University in April 2008. The contacts have been facilitated by Prof. Martin Meyer-Renschhausen who visited REEEI in September 2007. Also REEEI runs an e-network for the Sustainable Energy Society of Namibia – SENSE. All correspondences can be directed to reeei@polytechnic.edu.na .

Dr. Edgar Anahua Quispe, Peru (PPRE 00/01)

joined the Department of loads & power performance Technology R&D, Verification at VESTAS Wind Systems A/S in Århus Denmark in autumn 2007 already after successfully completing his PhD at University of Oldenburg.

Ibrahim Mohtad, Bangladesh (PPRE 01/02)

who is employed at Bangladesh Power Development Board informed us earlier this year that they have selected a potential place for wind turbines, which is located near Kutubdia Island. They gathered wind data at 30m, 45m, and 60 m height (Actually it's the first time they have data at 60 m height !). Now they are working on the wind data to analyse the energy yield from a station, to see if their government could benefit from a JBIC fund for wind generation of up to 20MW (500KW to 1MW turbines).

Alejandro Umana, Colombia (PPRE 01/02)

recently left BP renewable energy alternative (www.bpalternativenergy.com) in London, UK, since they decided to pull out from wind power in Asia and Europe completely. He is now looking for another opening in Wind energy.

Juan José Trujillo, Colombia (PPRE 2002/03)

who is doing his PhD research at Institute of Aircraft Design, Endowed Chair of Wind Energy, University of Stuttgart informed us late 2007 that his research topic is the simulation of loads of wind turbines in wind farms. For his work Juan has been working not only with simulation but also with analysis of measurements with LIDAR in wake. This is a laser technique which is gaining a lot of momentum in the wind energy industry. Actually they have found encouraging results by measuring wind turbine wakes. Further experiments are going to be done on large turbines of 5MW.

In 2007 Juan went for a 6 months research stay at Riso-Folkecenter in Denmark.

Romaric Thiebaut, France (Eurec 04/05)

After working for Vestas Wind Systems in Galicia, Spain for the last 1,5 years, Romaric was offered a position in the Athens office of Vestas Co., where he started to work in May 2008 !

The offer seems to fit Romaric very well, since he will be able to open up his technical panel to all the mechanical components of the different wind turbines, given that so far he was dealing with blades only.

Steven Xuereb, Malta/Canada (EUREC 05/06)

Early 2007 he started his own consulting company called renewable generation (www.renewable-generation.com) and based in Toronto, Canada. Initially Steven did some contracts for the Spanish company where he did his thesis-project and a couple of local companies. He ended up taking a permanent contract with Airtricity, an Irish wind farm developer which was then bought by the German utility E.ON. He wrote in Mid October 2008: "That was the beginning of a very interesting (and somewhat difficult) ride, as E.ON slowly dismantled the Canadian business. So now I am back with the original founders of Airtricity who founded a new company called Mainstream Renewable Power (mainstreamrp.com). I am a senior project developer responsible for starting up the Canadian business and acquiring and advancing wind farm projects across North America. I just started this week but I am very enthused about the company's direction. We're heading to the Canadian Wind Energy Association annual conference in Vancouver next which I am very excited about, as it is the first time I will be seeing the Canadian west coast."

Seth Mahu, Ghana (PPRE 05/07)

who is Country Representative, Renewable Energy Specialist for GPCo Inc., Canada wrote end of 2007:

"Really a long break in communication. I hope life is cool out there. I am doing very well with my family here in Ghana. Presently, I am working with the Canadian firm-GPCo Inc. as the country director for Ghana and acting representative for Africa. My role has been to develop the company's Africa business and also the Ghana wind energy project development. A lot of developments have already taken place in the last

couple of months since my return to Ghana.

I hope in the near future, Ghana will register its position among nations which have chalk great success in the areas of wind power production. The most interesting point to note is that, another PPRE product is steering the affairs of activities for Ghana to realise this dream."

Pechlivanoglou Georgios, Germany (PPRE 05/07)

who is working for the R/D department at SUZLON wind company in Berlin ever since he finished PPRE informed us that he was trying to solve the over speeding problem with turbines. For this he spent several weeks early 2008 in the TU wind tunnel of Berlin trying to investigate the aerodynamic configurations for emergency stall.

As latest news George wrote in 9/2008:

"I am still working at the R&D department of Suzlon in Berlin. Since 6 months now I have started my PhD project (which is based on a current research project of Suzlon). The field of the PhD is the development of ''Smart'' blades for the wind turbines of the future, therefore as you can imagine I study aerodynamics from morning till night :-). I do it at the HFI - DLR Institute of TU Berlin (with Prof. O. Paschereit check: http://www.fd.tu-berlin.de/index.php?id=paschereit0). It includes intense wind tunnel tests and we are really lucky that the big wind tunnel of TU Berlin is available for us. For the moment the progress is quite good...and I hope that things will keep good :-)

Ivan Herraez, Germany (PPRE, 05/07)

who is employed at Nordex Energy GmbH, Central Engineering Department, Norderstedt, Germany, informed us that in 2008 among regular tasks he is supposed to start doing loads calculations for offshore wind turbines.

Patricia Castello Branco Paula Chaves, Brazil (PPRE 05/07)

She wrote end 2007,"I'm taking this opportunity, to first send you my new e-mail address (p.chaves@dewi.de) at the 'Deutsches Windenergie Institut' (DEWI), where I'm doing my PhD, and to ask for some support. Yes, my PhD title (provisory) is "Ökonomische Gesamtbetrachtung eines Portfolios aus mehreren Windparks unter beachtung der Standort und Betriebsbedingungen", in English something like: "Economic survey of a Wind Farm portofolio". The task is to analyse and quantify the influences, risks and optimization possibilities of a portfolio of Wind parks. How location, technology and O&M influence on the reduction of risks and improvement of the economical attractiveness of the investment when assembling a portfolio of wind farms. More details will follow."

Luis Enrique Domingo Vera Tudela Carreno, Peru (PPRE 05/07)

In May 2008 Luis was employer as Requisition Engineer at GE Wind Energy GmbH in Salzbergen, Germany.

He is also part of the Edison Engineer Development Program, which is a 2-years leadership program for engineers (info at: http://www.gecareers.com/GECAREERS/jsp/eedp.jsp)

Patrick Roycroft, Germany/Ireland (EUREC 06/07)

Since August 2008 Patrick is employed at TÜV-Nord (http://www.tuev-nord.de/20019.asp), where he is in charge of the inspection of towers and basements of Wind turbines. After 6 months he will become authorised technical expert. Before this assignment Patrick did an interesting internship at "CO2Sparhaus" (co2sparhaus.de), where he was involved in energy recovery and retrofit of old buildings and houses.

Vanesa Martinez, Venezuela (EUREC 06/07)

started to work for GE Windenergy in Salzbergen, Germany in June 2008, where she has a permanent contract as Application Engineer. Actually she has the same job description than Silvia Marques Malcato, Portugal (EUREC 06/07), who earlier joined GE Windenergy in Madrid, Spain.

Leonardo Perini, Italy (EUREC 06/07)

wrote in March 2008:

"Actually I dedicated my last months to the job hunting. My research has been oriented almost all over Europe, because I think that it was better for me to continue the experience abroad and also for the fact that there aren't so many big Italian companies in the RE industry.

In general it has been harder than expected. In particular, being in Italy, it has been really difficult to convince the companies about my availability to move and relocate out of Italy. They prefer locals or people that are already in the country. On top of that the process of having an answer is always so long.

After a long searching and few interviews, I ended up in a relatively small wind turbine manufacturer in Barcelona, Spain (Ecotecnia) that almost since 8 months ago was a cooperative and now is part of the big Alstom-group. I'm going to start officially the next Monday and I'll continue the experience done with my thesis on the reliability of the wind turbines, so something in mechanical engineering. Sincerely having already years of work in the mechanical industry it is really difficult to re-address the profile and to be accepted for a different field such as the "wind farm development" that I wanted since the beginning. Now I start and then I will see. This company has a department of wind farm development and I hope to end up there."

Juan Troncoso, Spain (EUREC 06/07)

informed us in February `08 that he got a permanent position at Airtricity (www.airtricity.com). He is employed as electrical engineer for wind park projects in Europe. Early 2008 Juan was in charge of the Airtricity projects in Portugal and new markets (across Europe) as the spread in Europe

mainland is starting. So far Juan had the following positions: “grid connections manager for Portugal”, “transformer expert“ for all countries and “electrical engineer” in charge of Butendiek offshore project and for new regions (Sweden mainly).

On long term Juan is supposed to move to the Airtricity office in Lisboa, Portugal.

Erik Patschke, Germany (PPRE 06/08)

Was employed right after his studies at Siemens Wind Power A/S, Denmark where he is acting as Service Proposal Coordinator – Offshore (www.siemens.com/windpower)

Panagiota Karampela, Greece (PPRE 06/08)

started to work as a siting and performance engineer for VESTAS Hellas in Athens, Greece recently. VESTAS is the biggest wind turbine manufacturer in the world and is based in Denmark.

PV

Xinan Jia, China (PPRE 88/89)

He wrote in April 2008 “Currently I am working at Centrotherm Photovoltaics AG as head of project management and project development in Taiwan, Asia. The company produces Siemens reactor (CVD about 150-250ton per year) for poly-silicon materials, PECVD and POCL3 diffusion furnaces and Co-firing furnaces for wafer-based solar cell production line as well as sputter tools for CIGS thin film production line.”

Ulrike Jahn, Germany (PPRE 89/90)

On 1st July 2008 Ulrike moved from the Bavarian Center for Applied Energy Research (ZAE Bayern) in Erlangen where she was head of the PV Module Technology Group to TÜV Rheinland in Cologne where she joined the R&D sector on Renewable Energy.

Jhantu Kumar Saha, Japan (PPRE 02/03)

He wrote ”Last March 2008, I completed my PhD from Saitama University, Japan. I am applying for my future position. My PhD research work included the fast growth of microcrystalline Si thin films from SiH4, SiH2Cl2 and SiHCl3 utilizing the high-density microwave plasma source for Si thin-film solar cells. Guiding principles for fast deposition of high quality microcrystalline Si films for Si thin film solar cells are demonstrated, highly photoconductive microcrystalline Si films were fabricated at a high deposition rate of 40 Å/s with a low defect density, the performance of p-i-n Si thin film solar cells from microcrystalline Si thin-film using the high-density microwave plasma source was confirmed for the first time.

My future research interests include to improve the efficiency for thin-film solar cells, more importantly the so-called Micromorph (microcrystalline/amorphous) tandem solar cell become more and more attractive; especially, on the a-Si/μ-Si and/or nc-Si (nanocrystalline silicon) stacked solar cells as a next generation cells.”

Latest news:

Jhantu along with his family arrived in Toronto, Canada with his work permit on Sept.25,2008. Jhantu joined as a post-doctoral fellow the University of Toronto to start his research work on thin film Si solar cells.

Ihtsham Farooq Choudhry, Bangladesh (PPRE 02/03)

In 2007 he started to work as RE consultant for psm Nature Power, Service & Management GmbH & Co. KG in Erkelenz near Aachen, Germany (http://www.psm-service.com/). End of last year Sham was looking for some companies or subcontractors who can support their services for the maintenance and operation of their solar parks in Italy. Actually they were planning 3 solar parks, two in Lamaezia Terme in the region of Calabrien (south of Italy) and one in Minturno in the region of Lazio. Recently he informed us that he is still working on the solar parks O&M in Portugal, Italy as well as Germany.

Lawless, Richard, Germany (PPRE 03/04)

Who is working with solar PV in Lahmeyer International GmbH – Bad Vilbel,(http://www.lahmeyer.de) in January 2008 wrote " Already yesterday I was in Milan for a stakeholder meeting between developers, EPC contractors, Lenders, mezzanine investors, Lawyers .... - that was pressure. OK so it was big business & suits, but projects are being born, and in the end, we, I want to learn how to make RE project happen. And the PV department is growing fast here." He was also trying to find a PPRE/EUREC thesis student during this time.

Denis Thomas, Belgium (EUREC 04/05)

who joined an NGO in Belgium called Energie Facteur 4 (ef4.be) after his EUREC-studies informed us early 2008: My initial mission at ef4 was to develop 10 PV projects on public buildings. 2 of them are almost done (with one of 21 kWp, second most largest PV system in Wallonia !) and the others should be done by the end of this year. Besides this, I've worked also on the development of an EU funded project of 42 PV systems of 5 kWp each, spread in 31 municipalities. We have the best hope this project will be accepted very soon. Now, the main part of my work is "Facilitateur photovoltaïque de la Region wallonne", which means that I am the resource person for those who want to develop a PV project in Wallonia. I must say this is a very interesting and challenging job. Until last week, we were only two persons in our non-profit organization, but we have doubled the workforce last week as we are now 4 persons at EF4, and probably we might double our team by the end of 2008 again...

Latest news from 9/2008:

Denis changed job recently (by Mid August). He joined EPIA (European Photovoltaic Industry Association) to work in the Policy department as Economist. www.epia.org

Tek Boon Jin, Singapore (PPRE 04/06)

informed us that he is still working with Suntechnics Energy Systems Pte. Ltd. (Conergy) in Singapore and that he is quite busy because their RE projects are doing well.

Adrien Clauzonnier, France (EUREC 05/06)

who was employed at Suntechnics in Madrid, informed us late 2007 about a dev. project in Angola, where he is involved as follows:

"A friend of mine and I, we are working on a project in Angola. The main aim is to install a small size PV + genset system which will provide the energy needs of an hospital (160 beds). The project came to us thru an association working mainly on energy and water. The NGO is called ENERGIA SIN FRONTERAS.

We are still in the phase of the needs assessment and trying to get as much contacts as we can.

The point is that we would like to know if someone of you has already worked /is working in the region.

We need to get some contacts (solar energy product retailers, installers, maintenance technicians). One of the main ideas, is to buy products and that the sellers could go on site to maintain the system in case of problems. The maintenance is really a critical point and we want to find an optimal alternative (cost/quality).

The other critical point is the border taxes which can represent a really high cost in a small project as the one we are developing."

Latest news from 9/2008:

"I took a new path some months ago. I am actually working for BP solar as Southern Europe Operation and Maintenance coordinator. It is a big challenge coming at me and therefore unfortunately I had to let down the project in Angola. I could not spend as much time as required for such type of project. I am actually coordinating the operation and maintenance of more than 20 MW of PV.

I will take part in another project in some months when the work load will be a bit more reasonable."

Jagwe Wyclif, Uganda (PPRE 05/07)

joined the Power & Renewable Energy Division at NORPLAN Uganda Ltd. after PPRE-studies last year, informed us in 12/2007, that he is involved in a record breaking project in

J. Wyclif checking rural water pumping PV system

Sub-Saharan Africa to design and supervise construction of a 600kWp SPV power plant, in hybrid with 2x450kVA diesel generators

J. Wyclif showing M.Golba, PPRE a recently installed PV system

with a 40km mini-grid supplying power to over 20 villages. It is challenging but moving on smoothly.

In addition Jagwe (out of his thesis-Project experience) successfully designed and supervised construction of 17-rural water pumping SPV systems each with about 10kWp solar power using heavy duty Siemens Simovert master-drive inverters. End of last year Jagwe was commissioning the systems, and 5-systems already have reached completion.

Early this year, his story was published in the wind and sun magazine, he hosted Michael Golba (head of PPRE-programme) in Uganda to show some of his RE projects.

Latest news: Jagwe joined GTZ-office in Kampala, Uganda on 1.10.08 as Project Expert for Rural Electrification. One of his tasks is Solar-PV grid-connected systems for Rural Electrification.

Faraida Nafiri, Indonesia (PPRE 06/08)

She informed us that she stayed in Hamburg for a couple of weeks after her PPRE-studies before she left for Indonesia. Back home Faraida started working with Komplek BPP Teknologie at some RE projects, mostly in PV industry, especially in Off-grid Hybrid System Integrating as well as PV technical education.

PV technical education basically is a training course for technical trainers. The demand in PV system trained operators for rural areas is very high. Therefore, they need to expand the skills and information on how to operate & maintain PV systems.

Faraida installing batteries at a Telecom Hybrid System in June 2008

Although she is no, Conergy's employee anymore, she participated in an Off-Grid Hybrid System Workshop at Conergy-office in Singapore in July, where she did a presentation and shared experiences and knowledge in Hybrid systems. During the Seminar she also met Mr. Boon Jin, Malaysia (PPRE 04/06),

who was working with Conergy as well.

PV technical education seminar at Conergy, Singapore with Boon Jin and Faraida

Wendi Zhang, China (PPRE 06/08)

started her PhD-studies at Forschungszentrum (Research Center) Jülich, near Aachen, right after her studies with us. Her topic is 'Ion beam treatment of functional layers in silicon thin film solar cell'.

Info at: http://www.fz-juelich.de/portal/

Solar Thermal / Energy Storage

Anil Kumar Misra, India (PPRE 89/90)

Finally handed in his PhD-thesis titled ‚Thermal Performances of Buildings Using Simulation' end of last year at the department of applied mechanics in Motilal Nehru National Institute of Technology, Allahabad, India.

Dr. Ibrahim Odeh, Jordan (PPRE 97/98)

informed us in 10/2007 already that after completing his PhD, he started doing private business in renewable energy mainly solar thermal in/from Amman, Jordan

Should anybody require any expertise from his region, they are welcome to contact him.

Bidzina Kekelia, Georgia (PPRE 98/99)

wrote late 2007: "I'm in the US, Salt Lake City trying to get PhD in Mechanical Engineering. I'm preparing of a qualifying exam and writing a paper. Seasonal thermal energy storage in soil - that's my research topic. One can use soil and store say solar energy during the summer and use it in winter. By summer the storage will be already cold (even frozen) and can be used as a cold sink for air conditioning. That's the idea and I'm trying to build a small experimental device to get data for my dissertation. Will see how it goes... First I have to pass this qualifier. Otherwise they will kick me out!"

Latest news from 9/2008:

"I'm still in Salt Lake City working on my PhD at University of Utah. Just finished required coursework and will be doing only research and writing dissertation this semester. I'm planning to graduate in about a year from now. We'll see how it goes. The topic I'm working directly relates to renewable energy: Seasonal underground thermal energy storage system. We are working on how to store summer heat (solar or ambient) or

winter cold in soil, so that it could be used for space heating (in winter) or air conditioning (in summer) of a house. That means households or even industry won't use fuel for heating or cooling needs. Actually it is similar to what ground coupled heat pumps do, but we are working on a passive design and improvement of a heat exchanger with soil. We want to use vertical heat pipes (with phase change working fluid) as ground coupling device instead of long plastic pipes used by regular heat pumps. Also, our goal is elimination of the heat pump equipment which works on vapour compression cycle and consumes large amount of electricity. We are starting our experiments this fall and hopefully will have preliminary results published by next spring."

Erkata Yandri / Indonesia (PPRE 03/04)

joined in 9/2007 the Dept. of Vehicle System Engineering, Faculty of Engineering, Kanagawa Institute of Technology (www.kait.jp) in Atsugi shi, Kanagawa ken, Japan, where he is attached to the Clean Energy Lab (Solar Energy System Lab). Most of the ongoing research is in PV / Thermal (PVT) and Heat Pump system. There is another Lab focussing on Solar/Photovoltaic Car.

Kanagawa Institute of Technology is a Private University, where research is supported by the Japan Government to Promote research in Solar Energy for Private University.

Yandri is employed as researcher in an Innovative project corresponding to Photovoltaic and Solar Thermal assisted by a Heat Pump system. His PhD-project is planned to finish by March 2011.

At the beginning of his PhD Yandri was investigating the performance design of Photovoltaic/Thermal (PVT) for Air and Water heating, Top Heat Thermosyphon system, and Solar Thermal assisted with Heat Pump system.

Rob Singlehurst, Canada (EUREC 05/06)

recently mentioned that he continues to work in solar thermal with EnerWorks, in London, Ontario, Canada, who are producing Solar thermal systems. There systems were used in an exciting solar community in Alberta. It is a community where solar energy is stored seasonally in the ground for extraction in the winter when space-heating needs are highest. Please check out the website <http://www.dlsc.ca/>.

Rob works in product development and support, trains installers and manages a lot of technical writing. Soon he may become the residential product manager.

Miguel Gil Zapata, Spain (EUREC 06/07)

developed his master project in SENER (www.sener.es), a Spanish consultancy, which headquarters are located in Bilbao (Bask Country). SENER carries out projects in many areas. Regarding Renewable Energies:

- SENER designs and installs turnkey pig-slurry digester plants,
- its first tower concentration power plant called SOLER 3 is to be constructed in a short time and

• finally, the field Miguel is more involved in is parabolic trough concentrating power plants.

Within the latter, Miguel has firstly developed his master project on the feasibility of the hybridization of an already designed solar thermal parabolic trough power plant rated in 50 MW. After his master project he studied the feasibility of installing power plants in different locations throughout south of Spain. Specifically Miguel is dedicated to a power plant to be located in Castilla la Mancha (where Don Quijote was supposed to wander around in his crazy adventures).

Nada M. Mekki, Sudan (PPRE 06/08)

After her PPRE experience she went back to her old job at the solar department of the Energy Research Institute in Khartoum, Sudan. She is currently working on modifying and testing of a new solar water distiller.

Biomass/Bio-energy

Ainea Kimaro, Tanzania (PPRE 88/89)

is working as managing director of the Biogas and Solar Ltd Company in Arusha Tanzania. Before he was planning, projecting and implementing big Biogas units for prisons in Rwanda.

There is a interesting small film on youtube, which shows his activities there. Please check: http://www.youtube.com/watch?v=bKfjC5Hq0hU

Resent update from Ainea:

"Back from Rwanda where we installed biogas systems for central prisons, we are now in Dares Salaam Tanzania also installing a biogas system for a prison. The idea is to put together all waste of the prisoners and that of the neighbourhood to generate fuel gas for cooking in the prison instead of using wood, which is scarce and expensive. Soon, many in the tropics will realize that tropical heat is a resource and not a hazard. It should be possible to treat sewage quicker here in the tropics with a profit!"

Kuntze Björn, Germany (PPRE 94/95)

Early this year, he left his job after about two years. He was looking for anyone interested in biogas gasification to continue after him on a gasifier development project for Germany. This offer was with Hörmann Energietechnik GmbH & Co.KG (www.hoermann-energie.de) in the south of Germany (Bavaria).

Details of his project:

Actually Björn has developed and built up a fixed bed gasifier-engine-system in the power range 150 kW electric power output. They erected the system in 2006. During 2007 test operation of the plant and several optimisation in the gas cleaning systems and the control system of the plant were done.

The plant is suitable for good quality wood chips with only a small fraction of fine particles. The plant can reach up to 180 kW electric power output with a dual-fuel turbocharged engine.

Up to now they reached about 1500 h on the engine with wood gas without any problems with the engine.

But due to the economic situation in Germany, the gasifier fuel (high quality wood chips) is too expensive. Therefore it is planned to develop a new gasifier which can handle fine, low quality wood chips. Probably this system will be a fluidized bed gasifier.

Debesai Ghebrehiwet, Eritrea (PPRE 97/98)

was awarded National winner of ENERGY GLOBE Award 2007 for his invention of the Modern Gulsha stove, which is saving energy . The ceremony for receiving the award took place on 26 May 2008 at the European Parliament in Brussels.

Laurent Lecesve, France (EUREC 04/05)

who is doing his PhD with respect to Hybrid Systems within Mini-grid for Rural Electrification and water supply at University of Kassel, set up a french NGO called Hybrid Energies, which is involved in dev. projects around the world.

Ongoing projects are:

- Biogas & Spirulina Project in Normandy, France
- Tomegbe Electrification in Togo, Africa, About 8.000 inhabitants, Hybrid System (HS) with mini-grid to supply electricity and water from Micro Hydro - Solar PV - Jatropha Oil

More info at: www.hybridenergies.org

Latest news: Additionally Laurent is settling at the moment a company in Normandy, France on Biogas and Spirulina (a precious nutritive micro-algae) farming combined.

Sithole Edwin Mwakatagi, Tanzania (PPRE 06/08)

has just joined PROKON Renewable Energy Ltd,, which is a Germany company investing in Jatropha for pure plant oil fuel in South West of Tanzania. They have started with out growers schemes and are aiming to have their own plantations in order to have good control in supply of raw seeds. He attended a conference in Dar es Salaam on "Biofuel markets in Africa" where investors in Biofuels from all corners of the world were meeting. The following link is for more information on the conference http://greenpower.msgfocus.com/c/15bAvRsFSeWzHVBP

Marcelo Vasconcellos, Brasil (PPRE 06/08)

After his PPRE-studies he joined Ros Roca company (www.rosroca.de or www.rosroca.com) in Filderstadt near Stuttgart, Germany, a Spanish enterprise that delivers Biogas and composting systems. It employs about 50 people in Spain (headquarter) and another 15 in Germany (Ostfildern, Stuttgart). Rosa Roca is large group that also deals with waste and environment. His is even more excited about his work even more now that his probation is done and his daughter is born! *(see article in the back)*

Related Subjects

Mesfin Mergia, Ethiopia (PPRE 1993/94)

started his Ph D – studies in Water Engineering & Management at the Civil Engineering Department, University of Twente, The Netherlands in late 2007. He will be working not on energy but rather on Water security issues. Actually he is doing research on 'scale issues in water security' taking Lake Naivasha (Kenya) and lower Zambezi (Mozambique) as case studies. He will calculate the global virtual water flow related to trade of agricultural goods and the water footprint (www.waterfootprint.org). Please see also his report in the back.

Satish Gautam, Nepal (PPRE 94/95)

wrote" I hope you are doing well. I just joined this program along with Ram Dhital. It's pretty much similar to Rural Energy Development Program in Nepal. By the way I'm still a PhD student at Georgia Tech, US. I still have to gather data, write my dissertation and defend it."

activities in several industries (e.g. sugar factory, steel factory, manufacture, etc), and commercial buildings (e.g. banks, official building, etc) to identify energy saving potentials as well as energy saving implementation. "

Satish Gautam, who visited Pamir region to survey potential micro hydropower sites, at entrance of Salang Tunnel, which connects Kabul to Northern Afghanistan

Joseph Kofi Nani Gbagbo, Ghana (PPRE 96/97)

informed us that he is now living permanently in Barcelona. He wrote "Sometimes, life is not straight forward for everyone. However, it later gets better and better as it continues."

Ali Salim Al-Alawai, Oman (PPRE 98/99)

left the Sultan Quaboos University to join an oil company in Oman and on part time basis, he is teaching Renewable Energy among other things in a local higher technical college. He was requesting for teaching material for this course so he could prepare his lectures as well as the Syllabus.

Juan Paredes, Washington, DC (PPRE 99/00)

wrote" I hope you all are doing well. As some of you should already know I began working as of 1st of May 2008 with the Inter-American Development Bank (IDB) as the head of Renewables for the Sustainable Energy and Climate Change Initiative (SECCI) (www.iadb.org/secci). Basically, SECCI can provide non-reimbursable technical assistance in every development as-

pect of projects considering renewable energy, energy efficiency, carbon finance and adaptation to climate change to both the public and private sector (with some additional conditions for the private sector). The projects should be located in one of the member countries of the IDB (all Latin American and most Caribbean countries)."

Al-Mas Sendegeya, Uganda (PPRE 99/00)

who is lecturing at Makerere University, Faculty of Technology, Department of Electrical Engineering, in Uganda informed us in February 2008 that they were working on a micro-hydro project in Uganda, for which he needed some experience regarding the general consultation process. He was also doing his PhD with the Royal Institute of Technology - KTH, in Sweden. He also wrote seeking information on which Institutions especially in Germany offered courses / trainings on appropriate technology. He was interested in the possibility of cooperation especially through the concept of the East – South – South – East Technology transfer.

Anand Shukla, India (PPRE 01/02)

returned to India after successfully finishing his Phd-studies in Germany at Wuppertal Institute of Climate, Environment and Energy. Presently he is "working for the Wuppertal Institute from India, looking after the Asian projects under the WISIONS-project and also trying to establish some collaborative research for the institute in India."

Ram Prasad Dhital, Nepal (PPRE 01/02)

In early 2008 he wrote: "Just wanted to inform you that I am these days in Kabul Afghanistan working with UNDP supported National Area Based Development Programme (NABDP)/Energy for Rural Development in Afghanistan (ERDA). This project will demonstrate innovative management modalities and technologies that link energy with other development activities to achieve sustainable development in rural Afghanistan. We plan to carry out demonstration community based energy activities in 7 provinces with the help of local facilitating partner. We intend to demonstrate microhydro, solar (home system and pumping), wind, biogas and improved cooking stoves in 7 clusters of 7 provinces in next 18 months period.

Mr Satish Gautam (PPRE 94/95 – see before) as Team Leader/Energy Advisor is supporting the project as RE Expert.

Santiago Sanchez, Ecuador (PPRE 2001/2002)

had an exciting 2007 working in the Ministry of Energy in his country and then in his company on RE and Energy Efficiency. He also travelled a lot lecturing in seminars and conferences in Argentina, Chile, Peru and Brussels. He says he owes it all to the excellent education he received from PPRE in 2001-2002.

Among others he wrote: "Thanks for the good job and I always have you present in my activities. Things are looking well this year at work. I am trying to establish a solar energy society in Ecuador. …. Also, the

project of renewable energies in the Galapagos Islands is becoming a reality. The wind farm in San Cristobal (www.galapagoswind.org) is already going with 3x800 kW turbines. A new wind farm is planned for Santa Cruz; initially with 2.4 kW and in a second phase with another 3.2 MW. The people in charge of the project are thinking in setting up a sort of RE lab there considering the presence of PV, wind, Biofuels and in future hydrogen and electric transport. It would be great to sign a cooperation agreement with PPRE to help us out establishing this lab and educational facility. It will be an excellent opportunity for students to have a practical training in RE there and also for faculty and experts to do some research and lecture in some courses and maybe even having a MSc in RE for Latin American professionals…..”

Aslidin Komilov, Usbekistan (PPRE 01/02)

recently joined the research team working on Micro-Gasturbines in the Department of Mechanical engineering at Vriji University of Brussels, Belgium. The purpose of his project is to optimize efficiency and production parameters of micro-gas-turbines (Turbec T100CHP) via implementation of water injection into the combustion process. This process is supposed to increase the efficiency of the turbine as well as reduce the NOx emissions due to the lower temperature of combustion. The project includes experiments with air humidification, air cooling (gas turbines are very temperature sensitive) and some more. The work considers economical analysis for possible application of the new cycle for market products.

Anteneh Tafesse, Ethiopia PPRE 02/03

is still working with GTZ under the project GTZ – SUN: Energy in Ethiopia sustainable utilization of natural resource for improved food security.

Iresha Somaratne, Sri Lanka (PPRE 03/04)

wrote in early 2008 that Sri Lanka signed the first green power agreement which is a new concept. There would be a procedure for green power exchange between the producers and consumers. He is working in a company called Brandix, which is a garment manufacturing company in Sri Lanka. He wrote, “I am handling energy and environment side of this company. All in all they have around 23 factories. Latest news is that they got Platinum status from US green building council (LEED), which is the first time in world won by a garment manufacturing facility.” (see also separate article in the back)

Shahriar Ahmed Chowdhury, Bangladesh (PPRE 04/06)

As Assistant Professor at the Department of Electrical and Electronics Engineering, United International University, Dhaka, Shahriar designed and introduced RE courses, which is the first time RE is taught as a course in the undergraduate level of EEE department in Bangladesh (see also article).

Recently Shahriar was selected as a member of the adhoc Committee of Bangladesh Renewable Energy Association (BREA) and member of Sub Committee on Solar Energy Promotion, BREA.

Besides his duties at the university, he has got a consultancy work on "Technical Audit of Solar Home Systems" awarded by IDCOL (Infrastructure Development Company Limited).

For this assignment Shahriar formed a team along with two of my junior colleagues. Their responsibilities will be to visit the factories and suppliers premises, to check the industrial production line, from where they can bring some components to test the performance in their lab. They will also visit some 40 SHSs to observe their performances. They will perform some test in the field and bring some faulty components for diagnoses.

About IDCOL: They promote solar home systems (SHSs) under the Rural Electrification and Renewable Energy Development Project (REREDP). REREDP is being jointly financed by IDA, Global Environment Facility (GEF), KfW and GTZ over 2002 to 2009. IDCOL has a target of financing 200,000 SHSs. So far, IDCOL has financed installation of more than 180,000 SHSs in all districts of Bangladesh.

IDCOL promotes SHSs under REREDP through 15 local partner organizations .

SHSs are sold mostly through micro-credit by POs to the households and business entities in the remote and rural areas of Bangladesh. IDCOL provides refinancing facility, channel grants to the POs. In addition, IDCOL also provides technical, logistic, promotional and training assistance to the POs.

Their next work could be the design of PV systems for the largest mobile phone operator in Bangladesh. They want to replace their diesel generators by solar panels to power their off grid Base Transceiver Station (BTS).

Sebastian Hermann, Germany (PPRE 04/06)

He wrote: "Perhaps some of you know that I am now (since October) working for the Rural and renewable Energy Unit at UNIDO in Vienna. I am enjoying my work a lot, even though bureaucracy is immense here... "

He also wrote asking for help from anyone experienced in renewable energy issues for rural ICT centres (Information & Communication Technology) for information services in such areas. Actually he was working on such a project in Zambia, where an ICT centre power with Solar energy is planned as pilot-project. He wrote back to thank all who responded to this request and is glad that the forum (PPRE-alumni-list) is very alive and active.

Diego Sanchez Herrera, Columbia (PPRE 05/07)

is still working with meteocontrol GmBH, a company based in Augsburg, Germany, as a Data Control Manager. Diego did his MSc-project in the same company was moved to the meteocontrol-office in Spain recently.

Michael Sterner, Germany (PPRE 05/07)

who is working with ISET (Institut für SolareEnergieversorgungstechnik e.V.) in the Division of Information and Energy Economy / Energy Supply Structures Kassel, is also now involved in high level policy preparation for the German government council on climate change (http://www.wbgu.de/wbgu_referenten.html). He requested for a practical training student and he got one from PPRE early this year.

Further Education / Training / Seminars

Cesar Rivasplata C, Peru (PPRE 88/89)

is still working in the field of RE and they are organising the next XV Symposium on Solar energy. Website: www.perusolar.org.

Krishna C Pandey, India (PPRE 90/91)

is a senior scientist with the Agricultural Energy & Power Division, Central Institute of Agricultural Engineering, Bhopal, India. He attended the DAAD organised IIT Chennai Symposium in September 08.

Chayun Budiono, Indonesia (PPRE 92/93)

is still heading the Komplek BPP Teknologi in Indonesia. He informed us that he was giving a guest lecture on Renewable Energy at Sepuluh Nopember Institute of Technology (ITS) in Surabaya. They, together with ITS, are preparing for a post graduate program on Renewable Energy starting mid of 2009. The permit from the Minister of Education for the program had already been issued. He had already proposed to establish cooperation with PPRE University of Oldenburg.

Latest News:

He was organising a 'WORKSHOP & EXHIBITION CLEAN ENERGY DEVELOPMENT' at ITS from 10 – 12 December 2009 with international experts and companies.

Detauils of the programme might be seen at: http://ep.its.ac.id/2008/10/30/workshop-exhibition-clean-energy-development/

Wisdom Ahiataku-Togobo, Ghana (PPRE 97/98)

who is Head of Renewable Energy Unit at Ministry of Energy, Accra and Project Coordinator of the UNDP/GOG Household Energy Programme, participated in a training workshop for preparing technology transfer projects for financing. This workshop was organised by UNIDO and UNFCCC and took place end of September 2008 in Vienna, Austria. Thereafter Wisdom joined Seth Mahu for the InWent-Seminar in Munich (see below).

was invited to attend the Renewable Energy Technology Seminar in Munich from October 21 to November 3, 2007 organised by INWENT.

Sham Sunder, Mysore, India (PPRE 99/00)

visited Kassel, Germany in August/September 2008 where he participated in a Summer school titled "Energy supply with a high share of Renewable energy systems" organised by Department of Energy Conversion. During this time, he stayed with Michael Sterner (PPRE 2005-07) and was able to visit Passau, Michael's home town.

He was also scheduled to visit the Institute for Ecology at Frieburg and the German Development Institute at Bonn. The Directors of these institutes had visited his Institute at Mysore , India with the WBGU delegation (German Advisory council on Global change) – please see previous article.

Ernest Mazimpaka, Rwanda (PPRE 01/02)

is doing his PhD-studies with respect to Energy & Development at the Energy Research Centre, Department of Mechanical Engineering, Faculty of Engineering and the Built Environment, University of Cape Town, in South Africa. Ernest participated in a summer course in Energy and the build environment in Dar Es Salam, Tanzania, which was organised by the Dortmund University of Technology, the University of Dar Es Salam and the ARDI University in Tanzania. Beside Ernest also other PPRE-alumni from the region participated, like **James Wafula & Dr. Gabriel Kassenga (both PPRE 92/93), David Otieno (PPRE 04/06), Al-mas Sendegeya and Mzumbe Musa (both PPRE 99/00).**

PPRE-alumni gathering at Summer Course in Dar Es Salam, Tanzania

Fernando Vega, Honduras (PPRE 02/03)

is employed as Research Associate with respect to Renewable Energies at John Brown University in Arizona, US. Most recently they designed a Bachelors Degree (4-yr program) in Renewable Energy to start fall 2009. It will be a triple track RE major: 1) Design, 2) Business and 3) International Development.

Here is the link to the program:

http://www.jbu.edu/academics/science/renewable_energy/

Indradip Mitra, India (PPRE 03/04)

was awarded 2nd prize for best poster presentation competition at the 4th European PV mini grid and hybrid conference in Athens (Details see: http://www.otti.de/pdf/energie/ipv2713.pdf).

His poster titled: 'PV-Wind Hybrid Power on the Roof of the World'

Additionally Mr. Laurent Lecesve, France (Eurec 04/05) got 3rd prize in same competition. Besides some more alumni from Oldenburg also participated in the conference (e.g. Sebastian Herrmann, Germany (PPRE 04/06). After the conference an excursion was organised to the Kythnos Island to visit Europe's oldest wind park; PV diesel hybrid, and Micro grid project done by ISET, NTUA and SMA.

In that excursion in Kythnos, Indradip was accompanied by Dr. Thomas Degner (ISET, former PRE, Uni Oldenburg), **Laurent Lecesve, Aris DIMOPOULOS and Romaric Thiebaut (all EUREC 04/05)**.

Aris, Romaric, Laurent and Indradip (fr. left to right) visiting Europe's oldest wind park on Kythnos Island, Greece

A.N.M. Zobayer, Bangladesh (PPRE 04/06)

Who is a programme officer for Sustainable

Energy Development under the German Technical Cooperation GTZ in Bangladesh (www.gtz.de/bangladesh) returned to Germany to attend an International Biogas Training Course at the University of Hohenheim near Stuttgart, Germany in September 2008.

Seth Mahu, Ghana (PPRE 05/07)

was invited by InWEnt - Internationale Weiterbildung und Entwicklung GmbH - to participate in a seminar for capacity building in "Environmental Technologies for Waste management and Renewable Energies", which took place from 26th September 08 to 12th October 2008 in Germany.

Sunil Lohani, Norway (PPRE 06/08)

wrote, "About my present status, I worked for a short time in Practical Action Nepal where I got an opportunity to look at two remote villages where my task was to develop five years energy planning for the village. I assisted field research, data processing and preparation of the report. The work was only 45 days.

Thereafter I got a Scholarship for MSc in Process Technology in Norway which I started in August 2008. Now I am in Norway brushing up my engineering knowledge..., since I already have renewable energy knowledge from Oldenburg."

Jorifa Khatun, Bangladesh (PPRE 06/08)

Who re-joined the Directorate of System Planning at Bangladesh Power Development Board as Assistant Engineer directly after her studies with us in February 2008, got a note from the Chairman of BPDB that they are going to strengthen the activities of "Renewable Energy related issues" and that they will establish a separate department, which Jorifa was instructed to coordinate.

Additionally she got a nice opportunity to receive again a DAAD scholarship for a training course called 'Decentralised management of Regional development, conflict management and conflict prevention', which took place in August 2008 for 1 month at Humboldt university (SLE Department) in Berlin, Germany.

Obituary - Michael Edge RIP, US (EUREC 06-07)

Michael died due to serious cancer just before Christmas 2007 at home in the US. Before he finished successfully the first 2 terms of his EUREC studies (Oldenburg Core and Wind Specialization in Athens) and started to work on his thesis-project at Airtricity Co. in Glasgow, Scotland.

I am speechless - still wanted to say something. Although I knew the fact that he was not well at the hands of the cruel disease, I somehow never believed that we would lose him like this. He was an interesting personality who left some marks which I shall never forget in my life. He was indeed committed in our field, indeed he had dreams. He recommended me a book last year, and he added, if I buy and read it, I should donate it to the PPRE Library so that future students of PPRE/EUREC could read and learn as well. I signed the book as a ‚donation to PPRE Library from Tad Michael Edge and myself' and I am so glad that I did this.

EUREC friends and I all missed him last week in Brussels. He could not be there although he would have loved to presenting his thesis. So we all signed some postcards for him and sent to boost his morale and to show we still remembered. He would have been happy to receive them. It wasn't to be.

PPRE 2006/08 and EUREC 2006/07 will never forget you."

Burak Turker

"Mike was my lab partner in winter term, I knew him as a hard working young man, very committed in our renewable energy field. He had a lot of dreams, good dreams, I am sad to see he died very young!

Nothing more to say because the hand that giveth is the one taketh!''

RIP Mike

Sithole, E.M

Integration of Renewable Energy in Electrical Engineering Education: The Bangladesh Perspective

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Abstract - Effective utilization of renewable energy sources to bridge the ever increasing gap between the energy demand and supply while tackling climate change impacts is a considerable challenge for the developing countries. Rapid advances in renewable energy technologies, developments in market economies and increasing societal expectations mandate that future energy professionals are well versed with the multidisciplinary skills required for sustainable implementations of renewable energy programs. In most developing countries, the responsibilities of the design, operation and management of power systems lie with classical engineering graduates, such as electrical engineers. Using Bangladesh as a case, this paper discusses the development of an undergraduate level course on renewable energy for optimized integration into an existing electrical and electronic engineering curriculum, which, like other curricula in both developing and developed countries, is already strained to address the many topics emerging from technological changes over the past decades.

I. Introduction

The technological advancement of the world is associated with the increasing demand for energy; the primary source of which is fossil fuel. Rapid depletion of fossil fuels and the resulting price increases predominantly affect the developing countries that are dependent on imported energy. Access to clean, affordable and appropriate energy is a central feature of all the millennium development goals (MDG) and is an important enabler for sustainable development [1]. On the other hand, fossil-fuel based energy production and consumption are associated with adverse local and global environmental impacts such as air pollution and climate change. Increasing concentrations of greenhouse gases (GHG) in the atmosphere, due primarily to fossil fuel use, is considered to be the reason for inevitable climate change [2]. Moreover, at the global level, energy demand is growing fast - by 15% over the decade 1990-2000 [3]. This is expected to grow faster in the future, even double the current demand in the next fifty years, to satisfy the needs of the emerging economies such as China, India, Brazil and others [4]. As a result, finding alternative energy sources has become a necessity for developing countries like Bangladesh.

The abundance of renewable energies (RE) and the recent advances in technologies to convert these energies to usable forms make renewable energy a prospective alternative source. The developments in RE over the past decades have also demonstrated a clear potential in reaching CO2 emissions reduction target, set out in the international agreements such as Kyoto Protocol [5]. With the increase in conventional fuel price, the return on investment (ROI) gap between renewable and conventional energy sources

is diminishing. Renewable sources are practically inexhaustible and have a vital role to play in the future energy supply portfolio, particularly in the oil importing developing countries [6].

About 42% of the total population of Bangladesh has access to conventional grid connected electricity [7]. To provide access to electricity to the rest of the population and to meet the growing demand, it is stipulated that the country needs to triple its energy production by 2020. To achieve this ambitious goal, effective utilization of renewable energy sources has been adopted as a policy by the government [8]. In response to this policy, several initiatives have been taken by the government, semi-government and non government organizations (NGO) to promote and implement RE production, especially in the remote off-grid areas [9]. The demand for graduate engineers with multidisciplinary skills in the design, operation and management of RE systems is increasing with the rise in RE activities.

The responsibilities for the design, operation and management of power systems in Bangladesh lie with classical engineering graduates, such as electrical engineers. Therefore, the integration of RE in undergraduate electrical engineering curriculum offers an effective way to enhance RE skills of future energy professionals. Using Bangladesh as a case, this paper discusses the development of an undergraduate level course on RE for optimized integration into an existing electrical and electronic engineering curriculum, which, like other curricula in both developing and developed countries, is already strained to address the many topics emerging from technological changes over the past decades. The emphasis is firmly placed on the integrated approaches to RE pedagogy and the development of industry-relevant skills. The motivation and the background behind the development of the course are described in the following section, followed by the discussions on the pedagogy, content and context.

II. Renewable Energy Potential in Bangladesh

To minimize the use of conventional energy sources and diversify primary energy supply, Bangladesh needs to proactively explore and utilize coal mines and gas fields in the short term. For the long term portfolio, alternative and renewable sources that are abundant in the country need to be harnessed. Energy-use efficiency of existing systems needs to be increased. Considering the socio-economic factors of Bangladesh and the maturity in exploiting technological advances, potential RE technologies are identified through an extensive review of literature and discussions with key public and private stakeholders. These are described below:

A. Biomass

Although fossil fuels play a vital role in the industrial/commercial sectors as a primary energy source, biomass fulfills the major part of the primary energy demand of the world. The majority of RE usage in Bangladesh comes from indigenous and relatively inefficient use of biomass. Biomass is used mostly for cooking in rural areas and for small and cottage industries. Most of the villagers use inefficient stoves (efficiency: 7-10%) which produce unhealthy oxides and particulates [13]. Improved cookers can increase the efficiency to 35% without a significant cost involvement, as well as contribute to the alleviation of the shortage of firewood. Biomass gasification and biogas

digesters, which reduce GHG emissions such as methane, can also contribute to the increased efficiency for domestic and small scale commercial applications.

B. Solar

Bangladesh is situated in the northern hemisphere between 20° 34′ and 26° 38′ north latitude and 88° 01′ and 92° 41′ east longitude [11]. The country is conveniently located in a high solar insolation prone area with daily average solar insolation varies between 4 to 6.5 khW/m2 [13]. There is a huge potential for harnessing solar energy by using solar photovoltaic (PV) and solar thermal technologies. According to a World Bank report in 1998 [14], 5.3 million Bangladeshi households could afford solar home systems (SHS). Due to the higher price of conventional silicon based solar modules, this technology is not viable for residential use in grid-connected regions and industries, at least in the short term. However, if the present trend of increase in fuel price continues and further advances are made in the development of non-silicon based solar modules, this technology will become economically feasible for majority of the applications, including retrofitting existing homes with building integrated photovoltaics (BiPV) [15].

C. Wind

Inland average wind speed is poor (less than 3.5 m/s) in Bangladesh, but in coastal areas the average wind speed is 4-6 m/s at a hub height of 50m [13]. The average wind speed is higher between the months of March to September than during the remaining period of the year. There is a good opportunity in islands and costal or offshore areas of Bangladesh for the implementation of wind turbines for electricity generation. But during the monsoon season strong wind speeds of 50-80 m/s can be expected. Therefore, wind turbines should be strong enough to withstand these high wind speeds [10].

D. Hydro

Bangladesh is situated in the downstream of three great river systems (the Ganges, Jamunas and Tistas). A network of river, canals, streams etc. of about 24,140 km long covers the whole of Bangladesh [10]. The northern part of the country is sloped but lacks any noteworthy river ways in these areas. The current is high enough during the rainy season. There is the possibility of harnessing hydro power from these low head water flows. The south-eastern part of the country has the hilly regions, containing the only hydro power plant with an installed capacity of 230 MW [7] and potential for 500 MW [12]. Besides this, further twenty three potential hydropower sites of 10 kW - 5 MW capacities have been identified in the flat plains that could be operational for the six months: June to October [10], which are yet to be installed.

E. Tidal

The tides at the southern region of Bangladesh are predominantly semidiurnal with a large variation in range corresponding to the seasons, the maximum occurring during the monsoon. A study, cited in [10], found that the average tidal range in 1984 was within 4-5 meters and the amplitude of the spring tide exceeded even 6 meters. It is anticipated that there are a number of suitable sites at the southern regions of the country (e.g. Cox's Bazar, Kutubdia, Moheskhali and other islands) where a permanent basin with pumping arrangement can be constructed to harness the tidal power to provide electricity to the nearby off-grid locations. Wave power could be a significant alternative source of energy in Bangla-

desh with favorable wave conditions especially during the period beginning from late march to early October.

F. Geothermal

Geothermal energy is a major contributor to electricity production in some countries. Ground source heat pumps are increasingly being used in cold and moderate climates to supply the space heating demands. Ground temperature profiles in Bangladesh have the potential for low-cost space cooling and thus enhancing energy efficiency in buildings.

III. Renewable Energy Pedagogy

A. Industry Trends

Among the different RE technologies the solar photovoltaics, wind, biomass gasifiers, biogas digesters, improved cooking stoves, solar dryers etc. have penetrated the local market. The government of Bangladesh provides subsidies in the form of financial contribution to NGOs through its subsidiary, Infrastructure Development Company Limited (IDCOL). An IDCOL project titled Rural Electrification and Renewable Energy Development Project (REREDP) has started in 2003 to bring rural households under solar power systems. The project has installed about 200,000 SHS ranging from 40-70 Wp through its 15 partner organizations with a total capacity of 7.4 MWp [16]. Other installations include 96.46 kWp by Bangladesh Power Development Board (BPDB) [17], 40.5 kWp by Local Government and Engineering Department (LGED) and 23.3 kWp by Rural Electrification Board (REB) [18]. Notable wind installations include a 900 kW plant at Muhuri, Feni (see Fig. 1) and a 1 MW in Kutubdia by BPDB [17], a 400 W plant in Kuakata by LGED, 14.5 kW in total by Grameen Shakti at various locations and 15.5 kW by Bangladesh Centre for Advanced Studies (BCAS) [18]. About 26,402 biogas plants have already been installed in Bangladesh with an average capacity of 1.8X104 ft3, mostly by Bangladesh Council of Scientific and Industrial Research (BCSIR), Grameen Shakti, BRAC foundation, LGED. A 250 kW biomass power plant has recently been installed at Kapasia, Gazipur, shown in Fig. 2. IDCOL provided concessionary loans and grants through the project sponsor Dreams Power Private Limited (DPPL) for setting up the plant. The plant uses locally available agricultural residues, e.g. rice husk as fuel for power generation [16].

Fig. 1 First grid-connected wind park at Muhuri, Feni district. 4 wind turbines of 225 kW capacity each was installed by BPDB.

Fig. 2 Biomass-based power plant of 250 kW capacity at Gazipur in which rice husk is used as fuel. Image courtesy: IDCOL.

Recent trends in the industry suggest an inclination towards solar PV and biomass with some wind installations in the coastal regions. Development of the courses to enhance the skills of the professionals, therefore, needs to reflect industry's current activities and long term goals.

B. Course Context

In response to industry demands for skilled RE professionals, a new three credit-hour elective course on RE has been designed for optimized integration into an existing undergraduate (B.Sc. Engg.) electrical and electronic engineering curriculum at United International University, Dhaka, Bangladesh. The objectives of the 4-year degree program are to cover the following core areas:

- Sound knowledge in mathematics and mathematical tools to pursue undergraduate as well as postgraduate study in Electrical & Electronic Engineering;
- Theoretical and practical skills in electric circuit theory, solid state and industrial electronics, electrical properties of materials and electromagnetic theory;
- In depth study of power generation, measurement, distribution and conversion process;
- Broader understanding of digital signal processing; and
- Skills in computer programming, computer hardware design and microprocessor based system design and interfacing circuits.

The core areas covered in the program are grouped into two areas of concentration: Communication and Power. The newly developed course EEE 483: Renewable Energy sits within the 'power' stream and has been offered to students since 2007-08 academic year. Curriculum and further details are available from [19].

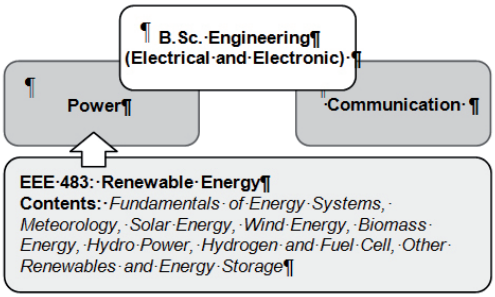

Fig. 3 The course on renewable energy in the overall context of undergraduate curriculum; EEE 483 is part of the 'power' stream of courses.

IV. Course Content

To enhance the learning experience and to bring industry relevance, the course relies heavily on the constructivist approaches to learning. The course starts with a relevant introduction to the fundamentals of energy systems and is followed by RE technologies, relevant to the local and global contexts. The contents are described in the following subsections.

A. Fundamentals of Energy Systems

This part of the course forms the basis of subsequent delivery of the teaching and learning materials and contains introductory information about overall energy resources and their current status. The concepts of energy reserve and resources, primary and secondary sources of energy are discussed in this part as well as the advantages and causes of the popularity of electricity as a secondary source of energy. An overview of conventional methods of electricity genera-

tion is given.

Sources of Energy: Different sources of primary energies are presented in this part. The discussions on energy sources are classified into two broad spectrums - conventional and non-conventional/renewable energy sources. Conventional energy mainly covers fossil fuels and non-conventional energies include different renewable sources.

World Energy Scenario: The historical evolution of fossil fuels, their present consumption scenario, reserves and how long these energy sources will be available as primary energy sources are discussed in this section. The adverse effects of fossil energy usage on the environment, in particular the contribution on climate change are introduced. The dynamics of conventional energy systems and infrastructure on our ability to mitigate and adapt to climate change is touched upon.

B. Meteorology

As solar radiation is the source of all energy available on the earth, the fundamental physics of solar radiation is introduced. Contents cover plank's radiation law, Stephen-Boltzman law, Wien's law and calculation of solar irradiation received on the earth's surface. The dynamics of solar geometry (the seasonal variation of the sun-earth distance, the inclination of earth with the sun) and interaction of solar radiation with the atmosphere (absorption, reflection, refraction and scattering of solar radiation by clouds, aerosol particles, dust particles and atoms of gases) are introduced. The calculation of maximum capture of solar irradiation on a tilted surface on earth and concepts of different angles e.g. incidence angle, hour angle, zenith angle, solar declination angle, surface azimuth angle, tilt angle etc. are covered. Reasons for wind flow, the coriolis force, the vertical wind profile are discussed along with laboratory sessions on the techniques for measuring solar radiation using radiation measuring equipments (e.g. pyranometers) and techniques for wind velocity measurements using appropriate measuring equipments (e.g. anemometers).

C. Solar Energy

Solar PV: Fundamentals of photovoltaic cells, physical processes in solar cells, influences of series and parallel resistances of solar cells, sources of losses in a solar cell, effect of irradiation and temperature on a solar cell, present solar cell materials (e.g. Si, GaAs, CdTe, CIS, organic and other thin films), properties of solar cells (frequency spectrum, efficiency, quantum efficiency, open circuit voltage, short circuit current, fill factor, maximum power point etc.), series and parallel connection of solar cells, shading effect in series and parallel connected solar cells are covered in the solar energy section. This section also covers formation of PV arrays and modules, components of solar home systems and grid connected PV systems.

Solar Thermal: The selective surfaces, the working principle of flat plate solar collectors, its important components and its usage are discussed.

D. Wind Energy

The power content of flowing wind, wind flow profile, laminar and turbulent flow, wind pressure and force, fundamentals of fluid dynamics, Bernoulli's equation, formation and different parts of an air foil, how wind force is converted into drag and lift force in an air foil are covered in this part. The basic components and construction of

wind turbine, production of wind power in wind turbine, power curve of a wind turbine and theoretical limit of wind power extraction are also discussed.

E. Biomass Energy

Biomass gasification, biogas digester and biofuels are discussed here. The working principle of biomass gasifiers, different types of gasifiers and the partial and complete combustion of bio-mass are discussed under biomass gasification. Discussions on biogas digester cover different types of biomass digestion (aerobic and anaerobic), bio methenation process and the parameters influencing bio methenation process. Biofuels include different types of biofuels, their advantages and uses. Necessity and design of efficient cooking stoves are also discussed. To enhance problem solving skills, students are tasked with the design of a biogas digester.

F. Hydro Power

The principle of hydro energy conversion, different types of water turbine based upon water head difference are discussed.

G. Hydrogen and Fuel Cell

Properties of hydrogen, process of hydrogen production, hydrogen storage, wind hydrogen system and working principles of fuel cells are covered here. The chemistry of fuel cell, loses in fuel cell, advantages and application of fuel cells, overview of fuel cell types and stacking principles of fuel cells are discussed.

H. Other Renewables

Other renewables cover geothermal energy, tidal, wave and sea current energies, the energy content and technologies to extract energy from these sources are covered briefly.

I. Energy Storage

Properties of energy storage media, technologies to store electricity, different type of batteries, working principle of Pd-Acid batteries and its classification, their advantages and disadvantages and factors that affect the performance of Lead-Acid batteries are discussed.

V. Conclusion

This paper discussed the integration of renewable energy pedagogy into an existing undergraduate electrical and electronic engineering curriculum with a view to enhance green engineering skills of the future graduates in the context of a developing country. The optimized integration resulted from an analysis of the current activities and potential for harnessing various renewable energy sources. The contents of the course are developed in the context of industry demands and aspirations. The experience of implementing RE pedagogy for human resources development and thereby contributing to the sustainable development can be replicated and further enhanced in circumstances, similar to the one described here.

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Field lessons from India

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Abstract - India manifests a great interest in Renewable Energy (RE) technologies and many projects were initiated. During three months, some of them were visited and studied in order to get some practical feedbacks shared through video documentaries and a web site.

The main focus is to build 'know-how bridges' between those who are working in the field of RE and the people who are using it daily. This paper describes achievements and main issues of at least five years old projects in the fields of Hybrid Systems (HS), solar photovoltaic, small wind turbines, micro-hydro and Jatropha bio-diesel. Then a system to reduce generator consumption is proposed.

INTRODUCTION

The Indian population is the second largest in the world and their living conditions know so much contrast. Their improvement represents a big challenge as well as a huge potential. The Indian and States governments support a large Renewable Energy (RE) policy, seen as a key for autonomy and development.

The practical approach presented in this paper has been applied in previous surveys in Africa, South America and Caribbean; more recently India has been the target and some facts and figures researched deeply. Apart of learning from existing projects, the goal was to propose on the way some RE education activities for children, teenagers and University students.

I. WBREDA PROJECTS IN THE SUNDERBAN ISLANDS

A. West Bengal Renewable Energy Development Agency and survey description

"The WBREDA continues to implement one of the country's largest broad-spectrum programmes covering the whole range of RE sources" [1], explain S. P. Gon Chaudhuri, the director. The Sunderban islands offer a great opportunity to implement RE solutions. More than 100 000 inhabitants are not connected to the National grid; so they rely on isolated systems embracing wind, PV, gasifier and diesel sources. The study was focused on two main islands, Moushuni and Sagar. 38 interviews were done with technicians, representatives and end-users to evaluate the impacts, the state of the systems and the needs for improvement.

B. Systems description

On Moushuni island, two PV power plants (Table 1) have been installed with a mini grid to supply 250 households each. The Panchayat, local responsible council, is deeply involved in the electrification program; they are in charge of collecting money for WBREDA. Operators are in charge of the O&M, the production during the day and the distribution at night. Like on Sagar Island, simple solar distillers are used to feed the batteries with distilled water.

Figure 1. 55 kWp WT of Ganga Sagar

On Sagar island, ten PV systems from 25 to 120 kWp have been installed since 1996. Some of them were visited and studied; especially the two, which are combined with two 3 kW wind turbines each. Those small windmills are not producing anything yet, they were not made to resist to very salty air. The PV panels are working quiet well although some of them are broken or damaged. Some inverters and feeders are also damaged and should be controlled manually by the operator. A Wind-Diesel HS contribute to a large part of the electricity production in the island (Table 1). The Diesel Generator (DG) as master balances automatically the three phases (Y connection). But in case of low wind velocity (less than 10 m/s), synchronization of WT/DG is difficult, so they rely three months only on DG, which cost a lot and six months with 75% on WT.

C. General results and lessons

More than 80% of the people are not satisfied. There are various reasons depending on the system, the operator or the user, nevertheless some patterns could be identified. The main frustration is the non-continuous power, e.g. 4 to 6 hours at night. Especially, schools and health centre cannot rely on those RE systems because they need electricity mainly during the day. Nevertheless light is very useful for education, children study twice more in coaching centers and at home. Then comes the consumption limitation. The population pays a flat tariff (1,5-2 €/month) for 3-5 bulbs or poles, but they say they would rather pay their consumption directly thanks to an energy meter or the so-called "smart card". In addition, PV production varies with the seasons and it is unfortunately lower, when the demand for lighting is higher. Sometimes, there is no electricity supply in case of dark week. WBREDA has been trying to diversify the energy sources.

The capacity of the systems is saturated and thousands of households are still waiting for a connection. Therefore, the Wind-Diesel HS has been upgraded with six 55 kW WT and a 150kW gasifier. A reason is also that DG costs represent huge economical losses for WBREDA. However a peak demand supplier is a key element within a HS and nowadays a generator combined with biogas, gasifier, biofuel or diesel is the most affordable alternative. So their availability and the con-

Figure 2. Ladakhi PV system

WBREDA Systems	Table 1: WBREDA systems technical description [4]							
	Installed in	*PV Power*	*Wind Power*	*Diesel Generator*	*Gasifier*	*Battery Bank*	*Water supply*	*Households connected*
Natendrapur	1996	25 kWp	2 x 3 kW	No	No	2 x 62 x 800 Ah	No	134
Kamalpur	1999	25 kWp	2 x 3 kW	10 kW (only few days in rainy season)	No	2 x 62 x 800 Ah	No	121
Moushuni 1	2001	55 kWp	2 x 6 kW (soon)	No	20 kW	2 x 80 x 1200 Ah	Yes	240
Moushuni 2	2002	110 kWp	No	No	No	4 x 80 x 1200 Ah	Yes	250
Ganga-Sagar	2002	SHS	4 x 55 kW (soon 10)	2 x 180 kVA	150 kW (soon)	2 small for SHS	No	650 + port (800 soon)

sumption reduction become the main challenge. Finally, S.P. Gon Chaudhuri, WBREDA director, has explained their plan for the next 2 years to extend each mini-grid and interconnect them with a daily service. It would be thus the world largest autonomous mini-grid relying on a mixture of RE.

II. TWO PROJECT MANAGEMENT APPROACHES IN LADAKH

Ladakh is a remote region about 3500 m high. From September to May, the road access is impossible. Obviously, the region is not connected to the National grid and relies on DG as well as PV and hydro plants. The combination of needs and local potential has offered opportunities to several RE projects. Thus two different organizations were visited, and they can fairly be seen as models of rural electrification, which will be described here.

A. Mahabodi Centre and its dying solar system

The first project is a holistic approach to bring education and health to the poorest. The Mahabodi centre has about 700 students, including 150 living at the campus. Sometimes few hours of electricity are delivered at night from the local grid, but the centre relies mostly on its own generators. Nevertheless, a HS has been installed by a foreign agency in 2002 to provide electricity and heat up the whole community.

It seems, that they didn't complete their work. On one hand, the school cannot run their 7 computers connected to 40 panels of 50 Wp (fig. 2), an inverter, a charge controller and 30 batteries (2 V /1500 Ah). On the other hand, about 150 such PV panels, five inverters, many charge controllers and 12 batteries are still sleeping aside. Nobody there has real knowledge about the system and no local or national organization have been involved in this project.

B. LEDeG, a local actor close to the people

Ladakh Ecological Development Group (LEDeG) is a NGO founded in 1983; its goal is to promote ecological and sustainable development of Ladakh. The main activities are about appropriate technology: passive solar, various solar cookers and dryers. They installed also a 100 kWp PV plant and 57 micro-hydro units. Their way of management is based on the motivation of the people, their integration in the process, their needs, habits and vision for their own development. It makes them endorse responsibility for the technology applied. "The initial hitches served as a good learning experience for LEDeG" [2].

They created the "LEDeG Campus", where trainings and demonstrations are organized. The campus has its electrical autonomy thanks to 24 PV panels of 75 Wp each, which provide electricity and water with a 100W pump. They have an isolated battery bank composed of 12 gel batteries of 450 Ah capacity. In addition, a good isolation and a passive solar trombe wall allows to keep the inside temperature above 0°C, even with an outdoor temperature of about minus 30°C. The trombe wall is composed of two layers air and earth or concrete, covered by glass. The air gap between the plain wall painted in black and the glass is heated during the day and transferred through ventilation to the room.

Since 1989, LEDeG has implemented many micro-hydro power plants all over the Ladakh. They tried to learn a maximum from past experiences and facing failures. They just summarized them in a practical book [3]. They saw that training local people properly for O&M money is very important as well as the creation of an "Electricity Management Committee". Also, the major key issue is the sense of ownership amongst the villagers; it requires them to work and finance heavily their project, up to nearly 50%.

III. JATROPHA R&D AT THE UTTHAN INSTITUTE

A. Utthan and Jatropha description

"Utthan is a professionally managed national NGO dedicated to the people for their social, economic and poverty alleviation programs."[4] Since 2001, they focused their efforts on Jatropha cultivation and bio diesel production. Jatropha is a wild tropical plant, which is well spread in South America, Asia and Africa. its fruits are poisonous, thus not used. In the past decade, a lot of interest has arisen for this suitable biofuel.

B. Jatropha Cultivation

The Utthan institute selected high yielding varieties of Jatropha from 26 states across India; the quality of plants regarding to seeds productivity and oil yielding is fundamental for final economical viability. Then they started nursery in two villages. 738 beneficiaries owning degraded land were trained in nursery raising and plantation techniques. More than 700 hectares are now cultivated. The following results were published. [5]

Intercropping with other plants, e.g. Aloe Vera, has been positively experienced thanks to the low water requirement of Jatropha plants. On each tree, they collect in average 2 kg twice a year. They obtain about 5 tones of seeds per hectare. The sampling of existing trees is the easiest way to spread the plant. Otherwise the best time to plant seeds is just before the raining season. Three first months in nursery (fig. 2) are advised. The best spacing between each plant seems to be 2 x 2 meters. At Utthan Institute, Jatropha plantations were raised on all types of soil such as mind areas, saline and alkaline. It seems that Jatropha cultivation is improving the fertility of soils; so it would be a viable way to stop desertification. Nevertheless, on really poor soil, yielding is lower, then direct economical viability is not always reached. [5]

C. Oil extraction and Bio Diesel Production

After collection of the seeds, they are dried under the sun and then crude oil is extracted at 60°C thanks to steam from a wood boiler. Afterward, oil is filtered to obtain the so-called Straight Vegetable Oil (SVO). The by-product of extraction, i.e. NPK cakes may be used as fertilizer. For the Jatropha oil, they

use a bio diesel plant (fig. 3) with a capacity of 250 L produced per hour. As primary energy, this transformation requires wood and electricity provided by the electricity grid or a 10 kW diesel generator, which consumes about 1 L of Jatropha biodiesel an hour. The process uses also NaOH/Methanol as catalyst.

D. Productivity and economical viability

Such plant costs about 1.6 million Rs (approx. 30 000 €). With 8 h of operation, the daily capacity is obtained by extracting 8 tones of seeds. So, considering 250 days of operation a year with two equal seasons, such plant requires a total of about 200 ha of Jatropha culture in order to produce enough seeds to reach a constant bio diesel production throughout the year (about 500 000 L). The overall cost of production is 23 Rs per Liter of Bio diesel (0,40 €), when diesel price is now more than 30 Rs [6]. Utthan sells it 25 Rs/L in order to stimulate this new market. So the profit of such industry could be an annual 1 million Rupees, (approx. 18 000 €). In addition, glycerin and NPK cakes are produced respectively as soap and fertilizer.

E. South-South agronomic tranfer to Togo, Africa

High yielding selected seeds from Utthan Institute have been planted in Togo to test their adaptation and compare them to the local specie. From October 2007 to May 2008, Antoine Auburtin, French agronomic student has been working there with two NGOs, ASMERADE Togo and YIL Agence for a six months internship on Jatropha development. The Indian plants, nearly a year old, show difficulty to adapt and they are much weaker than the local specie. Nevertheless, the experimental field has grown, a hybrid is planned between both and a comparative study is under process. The population has shown a doubtful interest and a demonstration is in preparation to expose several use of it as fuel for lighting, in a mill or a DG, to make soap. The approach is mainly a local production for a local market and thus sustains the local economy.

IV. A SYSTEM TO REDUCE GENERATOR CONSUMPTION

Finally, in mostly all cases, the last component working is the DG. Thus its fuel consumption is a major HS challenge and the steam booster gives exciting results. In February 2008, a workshop has been organized in Togo to modify a 7 kW DG from a health centre. A reduction of 19% has been reached directly, while the system is being run in. A fuel reduction of 30 to 50 % [7] with a significant CO2 emission reduction may be expected. In August 2008, I installed a system on a 5,5 kW DG in a Lebanese eco-village, where they use a 1,5 kW micro-hydro HS; we reached 17,5% of fuel consumption reduction.

The principle is to reuse the heat of exhaust gas with steam as a media. In the boiler (1), air is sucked through water pre-heated by the exhaust pipe at 80°C. Then the air with steam flows inside the exhaust pipe through the reactor (2), a tiny space between a tube and a rod accumulating heat. Finally, at the pricking (3), this gas is fed to the engine admission with the airflow. The whole reaction process into the reactor is not fully understood yet. With John Sievers, we just installed a system on a tractor combined to a generator in the Demo-Tech lab of the Kassel University; tests are under process.

CONCLUSION

This practical assessments have brought a large scope of field experiences on RE. A strong emphasis is given to communication in order to share the know-how through multi-media skills (web site, newsletters and video documentaries) as well as seminars in Master programs (PPRE-EUREC, SYSPEC in France). This work got the 3rd Prize of the poster presentation in the 4th European PV-Hybrid Conference in Athens, Greece, June 2008 (By the way, Indradip Mitra PPRE 2003 got the 2nd Prize, Oldenburg was represented!).

Some solutions, as Jatropha, biogas and steam booster are experienced to improve the electrification systems. But, as all we know, installing a system is far not enough to succeed a sustainable electrification. Most projects don't last properly more than five years. A great integration requires a maturity of the society before installation. It is mainly an issue of will and when the motivation of the population is firm, everything is possible. As the Buddha says, "When there is a will, there is a way!"

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Kenya cement firm details planned CO2 emissions cut

Bamburi Cement Group, which **Bernhard Osawa (PPRE 96/97)** joined late 2005, plans to cut its annual carbon dioxide emissions from plants in Kenya and Uganda by 132,000 tonnes by reducing the use of fossil fuels in cement-making, an official said on Tuesday.

Bamburi did not give an exact figure for its annual emissions but Managing Director Michel Puchercos put it at about 1.5 million tonnes, based on the production of 1.5 million tonnes of cement.

The company, which is 60 percent-owned by France's Lafarge, plans to reduce its use of fossils fuels such as coal, and substitute it with wood from its own plantations as well as coffee, rice and cashewnut husks.

The fuels are used to fire kilns that roast limestone, a key ingredient in cement.

"In Kenya and Uganda we are targeting between now and 2010 (reducing) 132,000 tonnes of carbon dioxide," said Bernard Osawa, business manager in charge of alternative fuels.

"We are looking at three projects. They are in various stages of development."

Osawa said cumulatively the company had cut its emissions by a total of over 111,000 tonnes of carbon dioxide since 2002 at a cost of 3.8 million euros and plans to invest another 14 million euros in the next two to three years.

The firm plans to substitute 20 percent of fossil fuel at its plant in the coastal city of Mombasa, which uses about 300 tonnes of coal a day. It also plans to substitute fossil fuel use by 50 percent in Uganda where it has its Hima Cement subsidiary.

The cement sector is one of the world's largest producers of greenhouse gases, producing about five percent of global emissions.

Cement production creates carbon emissions twice -- first from burning coal to heat the limestone raw material, and again as the limestone separates into carbon dioxide and lime

"We must be on a mailing list."

Latest Achievements at Brandix Casualwear

By Iresha Somarathna, Sri Lanka (PPRE 02/03), who is employed as energy and environmental advisor at Brandix Co. in Sri Lanka

The converted Brandix facility (director Johnpillai, Ajit) was ceremonially inaugurated on the 25th of April 2008 by the Chief Executive of Marks & Spencer Sir Stuart Rose.

This 30-year-old 130,000 square-foot plant was converted in to an Eco Centre at a cost of US $ 3 million has achieved a reduction of carbon emissions by 80 per cent, an energy saving of 46 per cent, a reduction of water consumption of 58 per cent and zero solid waste to landfill, eco-friendly indicators as yet unmatched by any re-designed Green Plant anywhere in the world.

We have made exhaustive changes. Previously used tarred roads have been replaced with interlocking paving blocks which greatly reduce heat build up around the factory, which in turn prevents heat flow into the factory and helps save on air conditioning.

Just off the main reception area next to the lounge room, you will find the heartbeat. The building management system housed within the heartbeat is our intelligent control center that monitors every aspect of the facility's output, wastage and consumption levels. The system also controls carbon dioxide and humidity levels in the modern air conditioning system ensuring an optimum working environment for on-site associates. This fully automated control system monitors water and electricity consumption and steam generation within the premises.

Just across from the heartbeat is Evolution, a gallery of snapshots capturing the evolution of this factory.

The use of natural light is critical to lowering heat and reducing energy consumption. The windows have been fitted with special glass material channeling sunlight into the plant's workspaces without the accompanying heat.

Further to enhance the lighting within the production floor, we have opened up 3% of the roofing area by using special prismatic sky lights. Sophisticated new light emitting diodes used as task lights provide light to the sewing machines at needle point, supplementing the natural light provided by the skylights. This has been instrumental in reducing the total electricity consumption by 10%.

The factory's steam boilers and steam distribution systems have been redesigned reducing the fuel consumption by 26%. The brand new super efficient air conditioning system has reduced electricity by 40%. All of these modifications have resulted in the reduction of the total energy consumption by 46%.

The green areas in the gardens have been increased substantially. A water feature has also been included alongside the cafeteria to enhance the outdoor natural beauty. Two indoor green patches have also been introduced in one of the plants. All of the fertilizer used on the garden areas is 100% organic.

The plant's new rainwater percolation pits allow water to soak back into the ground helping replenish the natural water table. The plant's roof has been re-designed

to harvest rainwater. The water collected, which amounts to about 115 cubic meters per day, is then initially recycled for all use except for drinking. Subsequently, a tertiary filtration system and a disinfection process allow the used water to be recycled again for toilet flushing and gardening. The overall result is a reduction of 58% in the total water consumption of the factory.

For delivery of samples between plants and for short haul of stock within the factory, we have replaced our diesel run vehicles with an electrically powered car, truck and tour bus in an effort to further reduce carbon dioxide emissions and fossil fuel usage. These vehicles are powered by the renewable energy sourced from the plant's windmill.

The factory recycles and reuses 100% of the solid waste produced. Even canteen waste is composted to contribute to biogas generation. This biogas is then used to power the gas burners in the kitchens used for food production.

The Brandix Eco Centre, the Group's lead manufacturing plant for Marks & Spencer, was awarded the Platinum rating under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System of the US Green Building Council (USGBC). The score of 76 achieved by Brandix, 12 points higher than the 64 required for Platinum status, is the highest score ever, achieved by any Platinum rated Plant and demonstrates the degree to which the Brandix Eco Centre had exceeded the global standard for a Green Facility. It is the first apparel factory in the world to receive the Platinum rating, the highest standard in eco-friendly manufacture.

Low Exergy Systems for High-Performance Buildings and Communities

by Herena Torio Blanco, Spain (PPRE 05/07), who is doing her PhD at Fraunhofer Inst. for buildings in Kassel, Germany

On a global scale, buildings are great energy consumers, representing more than 40% of the world's total end energy demand. The major contribution to this energy demand is represented by space heating and domestic hot water production, making almost 70% of it. Nowadays, only a relatively marginal of that demand is being covered by renewable energy sources. The rest is still provided by (usually quite old!) boilers and systems running on fossil fuels. Therefore, the available potential to implement renewable energy systems such as solar thermal systems or heat pumps is enormous and, fortunately, a lot of new research an implementation projects are on the move in this field.

However, probably most of you have also experienced looking twice at a window pane to check that it is neither open nor broken, due to the cold wind blowing onto your back while sitting close to it, or sweating like if you were running a marathon inside some nice and totally glazed office building in summer. So there is also a lot to

be done in order not only to use renewable energy, but also to do it efficiently.

This combination of buildings, renewable energies and energy efficiency is, very generally speaking, the framework of my PhD thesis. I began my doctoral studies on May 2007, and the idea of the project is to use the thermodynamic concept of exergy, to develop strategies for best-use and optimization of solar thermal and ground-source heat pump systems for heating and cooling of buildings. Despite the scary effect of the words "thermodynamics" and "exergy", this method allows gaining very interesting insights on how to use energy more efficiently and, thereby, shows improving potential of the regarded energy systems. Some of the key ideas that can be derived are matching the temperature levels of the energy supplied and demanded (i.e. don't provide it hotter than needed!), thereby leading to cascading the energy supply for different demands at different temperature levels, or to close the energy cycles by recovering the energy in out flowing streams, such as grey water, and using it for providing space heating or DHW requirements (via e.g. heat pumps).

I am doing my project at the Department of Energy Systems of the Fraunhofer Institute of Building Physics, in Kassel (Germany). Currently, there is an ongoing international research project on this topic being coordinated at the Department, where around 12 countries are involved and where I have the luck to also take part. The project, called "Annex 49 – Low Exergy Systems for High Performance Buildings and Communities" runs under umbrella of the IEA (International Energy Agency) ECBCS (Energy Conservation in Buildings and Community Systems), and deals, as it name says, with the application of the exergy concept to buildings and supply systems for communities. Being part of such an international group is a great experience. The participants are really engaged in the project and the sharing of knowledge and expertise, as well as the lively discussions within the group are something really motivating (…a PhD thesis can be arid, and I met quite some PhD students carrying out their projects alone within four walls for three years!). And basically, the same is what I can say from my working colleagues in Kassel. "Renewable energies" and such "green working fields" are not always run by "renewable (motivated and idealistic) people". As always, a concept might be great in theory, but in the end is the people who makes the most of it or just turns it into another grey idea. The working group in Kassel was one of the big "pros" for staying there, and I just don't regret it!

For more information on the international research project you might check www.annex49.com .

Pluralism and Engineering

Marcelo de Lima Vasconcellos, Brasil (PPRE 06/08)

My father was not a severe man. On the contrary, he was quite flexible and gave his children a lot of freedom to grow with their own strength. Certain things, however, he would not tolerate and was very strict: lights on, an open jar on the table, open fridge or any kind of waste. I had never perceived the true value of that kind of education until I was living on my own, many years later in Spain, when I started to realize that understanding comes with time.

In the University, I also learned from the good and bad experiences, lecturers, colleagues and professors. In the end of my engineering course I was glad to have grown in such a plural ambience. What does not kill a man makes him stronger.

Stronger and aware of differences I was prepared to extract the best of my PPRE course. Respecting the boundaries of each one and my own limitations, I could brighten my engineering perspective. Today, in the full exercise of my profession, I surprise myself with the richness of my PPRE experience.

I am employed in Ros Roca IMA, a Spanish company from Lleida, which works with waste management and environment around the world. The German branch, which sits in the outskirts of Stuttgart, more precisely in Ostfildern-Nellingen, comprises around 15 employers, who develop their activities on biogas and composting plants.

My role in Ros Roca is to design the basic sketch of a biogas power plant, to calculate its price and to write proposals. The interesting part is the absence of routine and the transdisciplinarity of my work, which at fist approach, seems a one-job-task. Thermal engineering, chemistry, biology, construction, material engineering, physics, electrical engineering, mechanical, agriculture, communication and many other disciplines are required every day.

I am grateful for the pluralism in which I was raised and the many challenges I needed to overcome in my studies and in my life to be where I am. Most importantly, I am very happy with what I do, and I do it with my heart.

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Marketing Photovoltaic technologies in developing countries

by Dr. Gajanana Krishna Hegde, India (PPRE 96/97), Program Officer at Climate Change Secretariat (UNFCCC), Bonn, Germany

1 Introduction

So called developing countries are home to more than three fourth of the world population while only accounting for less than a third of the global commercial energy consumption. An estimated 1.64 billion people worldwide live without access to grid electricity. In recent years that select renewable energy technologies including Photovoltaics are increasingly finding a role in mainstream response to this unmet demand; focus is now on market assessment, policy and institutional issues, sustainable business and social models integrating greenhouse gas balances as opposed to 'demonstration' projects of the past.

World annual solar cell production aggregated to 3,436 MW in 2007, up from 2,204 MW a year earlier with high contributions from Germany (50% of global marketshare) and Spain (480% growth, 640 MW installed cap). Germany's Q-Cells AG topped producing nearly 400 MW, longtime solar industry leader Sharp produced 370 MW while Chinese manufacturers raised their share from 20% in 2006 to 35% in 2007; Asian players Motech Industries (Taiwan), Yingli Green Energy (China), and JA Solar Holdings (China/Australia) rounded out the rankings, pushing aside some long-established players like Mitsubishi Electric, Schott AG, and BP Solar. Big expansions in capacity (for example in gigawatt scale at Sharp) and new technologies will significantly improve efficiency in the coming years. According to industry experts with revolutionary new technologies ready for market, 2010-2011 will be a crucial turning point; competition is likely to be stiff with 10%-11% efficient cells that the leaders will be making. Major players such as Sharp, in addition to scale up (1 GW capacity for crystalline and thin-film by 2010), are planning an expansion across the entire solar value chain including system integration business. Sharp figures the solar cells or modules themselves account for only 25% (for x-Si) to 40% (thin-film) of the added value of the finished total system. The company is not only investing in developing large-capacity, low-cost storage batteries but also aiming to bring solar systems to regions of the world with no electrical grid with government supported lease financing. Seen together with ambitious targets for PV system capacity and rural electrirication goals in several non annex I countries and rapid evolution of Clean Development Mechanism (see http://cdm.unfccc.int/about/index.html) this is likely to be good news for PV system deployment.

Given the above emerging scenarios this paper takes stock of various models that have been employed in PV programs worldwide. These models are indicative only; many times what is actually implemented in the field may be a combination of more than one model.

Discussed also is a case study of a solar pumping initiative.

2 Summary of Models for the Implementation of PV Systems

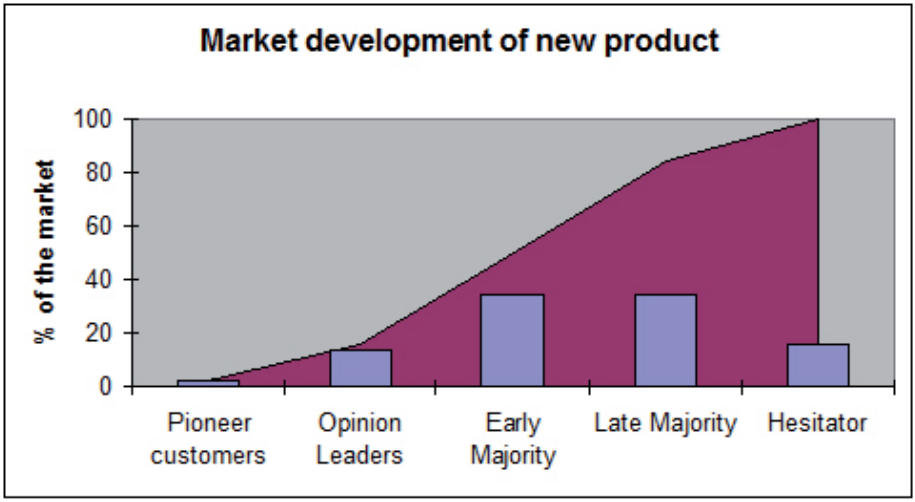

Figure 1. Stages of market development for a new product or service

Studies looking into market introduction of products have identified distinctive stages3. Pioneer customers make up for 2.5% of the market, they are willing to pay a high price for a new attractive product or solution, even if it is not economical. The pioneer customers influence the opinion leaders and if a critical number of pioneer customers have developed stage is set for the entry of opinion leaders. Pioneer customers could be the governments, educational institutions such as Universities but also could include individual investors. Opinion leaders who make up for 13.5% include professionals such as engineers, doctors, and lawyers etc who have enough free cash to spare. Early majority comprise of 34%, these investors expect the product to be technologically mature and economically viable. A significant 34% are termed 'late majority', they are hard to catch. It is almost impossible to sell the product to the hesitators who make up for 16%.

PV systems which are relatively new for many regions have to undergo the above stages, however many factors have proved to be advantageous for rapid implementation of PV projects. Those have been discussed in the next section.

2.1 Considerations in selecting an implementation model

For an informed choice of implementation model the factors below merit consideration:

- The electricity and energy service needs and expectations of the end users, the competing/conventional practices to cover the needs and the expenditure for it
- The economic activity and source of income (agriculture, services etc.) of the end users and the seasonal influences on in-

come, the willingness to pay for renewable energy services

- The existing experience of the end users with credit, existence of micro credit organizations

- Opportunities to enhance productive use of electricity/energy by the end users

- The government policies towards rural electrification, existing electrification plans and the potential role for PV

- Role of utilities in electrification, their attitude, approach, image and the relation with the customers. (Utilities are increasingly being restructured in many countries)

- The cost of grid connection, the lead-time to secure grid connection and the current electricity fees for customers, subsidies within the energy and electricity sector.

- Ways of reaching the potential market, the distribution, installation, and servicing network for the hardware and collection of payments from the end-users for systems sold on credit. It might be advantageous to use any existing infrastructure (for ex: agricultural cooperatives). Commercial practices suitable for PV implementation should be harmonised with prevailing practices and not disturb the often-fragile existing economies. It is thus necessary to identify banks and other credit institutions with local presence, PV dealers / companies, other retail networks (who may not be dealing with PV presently but who might have strong credibility with the user groups for instance a rural retail shop for agricultural tools or irrigation equipment)

2.2 Cash Sales

In this model, end user purchases the systems against payment of full cost of the system to a PV supplier.

The criticism of this model is it is prone to the initial investment barrier, resulting in a small market and it also tends to encourage the sale of smaller products such as solar lanterns or cheaper, low-quality systems. Further unlike most other after-sales agreements, PV supplier is expected to honor the warranty on PV module for a lengthy period (as many as 20 years) enforcement of which might be difficult. Competition with cheap, low quality products is a problem, especially if the market is just starting, as there is no common knowledge within the market yet about good and poor quality brands.

Factors in favor of this model include the limited number of players involved to keep the model simple and keep the transaction cost to the minimum. It is self-sustaining as it relies on market forces and not dependent on external sources such as government or program support. Capital demand for the PV supplier is one of the lowest for this model.

2.3 Dealer Credit / End User Credit

To expand his market, a PV supplier may choose to offer the PV system on credit either with his own funds or from borrowed funds. Normally these kinds of end-user credits are for short terms (mostly between one month and one year), involve high upfront payments (up to 75 %) and relatively high interest rates (rates can be in the range of 15% to 25 %). There is considerable existing experience in most countries in consumer credit systems, which are used to sell

/ buy consumer durables such as televisions, refrigerators. To minimise risks dealer usually employs cautious approach to assess the creditworthiness of the client (the client must, for example, be an employee of a reputed firm or be well known to the local dealer).

The fact that one institution handles the sales, installation, credit / recovery as well as the maintenance, training, and other after-sales services is seen as a major advantage of this model. Little involvement of the government or external agencies is also advantageous in some ways.

Criticism of this model is that it channels the expensive working capital of PV supplier and also it excludes the poorest segment of the households due to high down payments, short credit period involved and more importantly because of the credit track record that is usually required for the end user. Many times PV companies lack the skills and are not equipped to administer a credit scheme as this requires extra skills and is time consuming. The main risk lies with the PV company / dealer from non-payment of the credit from the end-user. This can be mitigated by thoroughly evaluating the creditworthiness of client before the sale is made as well as by using PV system as a collateral.

There are two variations of the dealer/ user credit model, namely end user credit and hire purchase. At times, if there is a sound financial institute with rural outlets, more importantly credibility with end users that is interested in financing PV credits. If the credit scheme can be implemented by it the responsibility and risks of the PV supplier reduces and the valuable working capital remains available for the PV Company. Although this can be advantageous such strong credit institutions are scarce and often such rural institutions would have economic development as their main objective and may have their focus on income generating credits. Further such institutions might be lacking the knowledge of PV systems and might promote low initial cost systems compromising on maintenance costs.

In the case of Hire purchase model either the PV Company or an intermediary credit institution offers the PV system on a hire-purchase basis. The client (lessee) makes periodic payments, only for limited period though, typically 2 or 3 years. The company (lessor) remains the owner of the system during the rental or lease term and the ownership is handed over to the lessee at the end of the period. The installation and after-sales service is carried out by the PV Company. The advantages of this model include the reduced initial down payment and prolonged repayment period. There is good chance that good quality products are selected because of the long repayment period involved and maintenance will receive higher priority.

Criticism of this model include the citing of instances where end users may not have treated the systems with care, as initially the maintenance and ownership do not lie with them; PV companies are usually not equipped / capable to run a hire-purchase programme as it requires additional financial administration skills and can be time consuming.

2.4 Fee for service or fee for energy

In this model, an energy service company (ESCO) invests in PV systems and sells an energy service to the end users who might be

in remote locations. ESCO remains the owner of the hardware and is responsible for installation, maintenance, repair/replacement of components. The end user pays a connection fee and makes a periodic payment (usually monthly). The end user pays as long as he receives the energy service and never becomes the owner of the system. However, most of the time end user owns the electrical loads (lamps, fan and other appliances)

As the end user does not have to invest in a solar system but only make periodic payments for the energy delivered, a large segment of the population can choose to have access to electricity. As long term agreements will be in place usually the quality of the systems installed will be high and the maintenance will receive a professional approach.

Barriers and limitations to this model include the low rate of return and long pay back period to the ESCO. The end user is not the owner of the system and hence may not treat the system as he does not own the system. Also the PV system should be theft and tamper proof. Monthly collection of the fees is time consuming and expensive. These high risks and high transaction costs may result in high monthly fees to the end user and may reduce affordability for the poor. End user expectations are also often high which might result in disappointments at certain times when system might have run out of energy purely due to weather conditions.

3 Sources of financing for PV based rural electrification

PV technologies including Solar Home Systems are usually expensive relative to the average individual income in developing countries. Securing financing is therefore an important element of a PV project. Funds could be by way of loans, grants, equity investment, or other instruments. However at times securing PV financing can be a long winding road. Successful projects had persistent project developers who were able to demonstrate the profitability as well as the non-financial merits of the project. Barriers exist at the program level (national level) as well as the project level. National Governments can access and secure financing from large multilateral and bilateral development banks only with a lengthy and complicated process. Commercial lending and investment organisations may still perceive PV lending a high-risk area owing to lack of familiarity with the technology or lack of access to well-informed advice about PV system financing. Relative small size of PV projects especially by the standards of investment organisations can also pose to be a barrier. PV project developers would have to compete with host of other important rural development projects while the funds available could be limited. Development financiers have political agendas and technological preferences around which PV programme developers will have to work. In order to navigate these barriers PV project developers should familiarize themselves with potential funding sources and initiate early conversations with them. Before arriving at a mix of financing options, a number of variables such as return on investment (ROI), the length, uncertainties, and risks of a given program should be considered. The application process will usually require considerable dialogue and substantial paperwork, hence a thoroughly worked out business plan that includes market analysis would be essential. The application time frame can vary widely from source to source, taking as long as a couple of years with the

large multilateral development banks and as little as several months with commercial sources5.

3.1 Solar Water Pumping- case study

As a case study, the pertinent issues with energy supply for water pumping in the agriculture sector as well as the case for solar water pumping and experience of implementation model involving an ESCO is described in this section.

Vicious cycle in energy and water use in agriculture begins with inefficient operation of the utilities in the public sector, results in poor voltage profiles, high distribution losses, low load diversity factor and culminates in remarkably low end use efficiency of electricity and water. For instance Agriculture sector in India consumes 27% of the electricity and 85% of available freshwater (irrigation efficiency 20%-50%) while contributing only 5%-10% for the revenue. Although the operating costs are higher diesel pumps are widely adopted due to unreliable power supply as described above. Problems in ground water management can have potentially huge implication for world carbon dioxide emissions. In the case of India, studies have projected an increase of 4.8 to 12 per cent in emissions for each meter drop in groundwater levels. If implemented with sufficient attention to demand side management, for instance including a drip irrigation system (water usage efficiency 90% or above) solar pumping can potentially provide a viable alternative.

In 2000 the government of north Indian state of Punjab initiated an innovative PV Pumping program to install 1000 PV pumps in just two years (each with a PV array of 1800 Wp). The solar pumps chosen for the program which were 1.8 kW (approx 2 HP) costing over USD 10,000 (market price by 2002 in India) had to compete with the larger pumps costing under USD 500 receiving free electricity. In the absence of concessionary financing and subsidy from the government there existed no market. However an implementation model integrating financial engineering involving a leasing company drastically reduced the upfront price for the pumps for the farmers creating a market. Ministry of Non conventional Energy Sources (MNES) in India has been implementing a unique solar pumping program (launched in 1992-93) and by 2002 some 4200 pumps had been installed under the program. The Indian Renewable Energy Development Agency (IREDA), the financial arm of the Ministry would offer a soft loan for the purchase of pumps at a rate of interest of 2.5% p.a., with a repayment period of 10 years as well as moratorium of 2 years. Over and above this Ministry would also provide a direct capital subsidy for the purchase of the pumps. Further if a profit making company was to invest in a PV project it would be eligible to claim accelerated depreciation benefit on the project amount (tax break in the first year itself which in the normal course would have happened over 10 years). So under this model a reputed company would secure loan from IREDA for a large number of pumps (at times several hundred) at a concessional rate of interest as above, absorb the accelerated depreciation benefit, obtain the necessary capital subsidy and finally lease the pumping units to individual farmers on payment of one time fee which is only a fraction of the cost (costs have ranged from USD 900 to 1500 over the years). The farmer would only make an upfront payment but theoretically would receive the ownership of the pump only at the end of 10 years however as there

is no further payment requirement from the farmer there is little cause for default and he is only bound by one condition that the PV array and pump should be used for agriculture purposes during the lease period.

Marketing efforts begin with news paper advertisements, a pre installation survey follows when the farmer expresses his interest by paying an initial deposit and then a suitable site is mutually agreed between the Energy Service Company (ESCO) and the farmer. Helped by unreliable grid supply and long waiting period for a new connection from grid, between October 2000 and March 2002 a total of 1000 pumps were successfully installed. Following this success the project is now being repeated on a yearly basis and neighboring states have picked up on the initiative and started their own programs.

Thus Punjab Solar pumping program relying heavily on subsidies has been able to establish a market for solar pumping system where there existed none before. However the sustainability of this market is dependent on how well the lessons of the past mistakes with subsidies are integrated into this program. This requires that subsides are tapered off gradually and the ESCO services are maintained and improved irrigation practices are encouraged.

My activities after PPRE 05/07

Hello dear PPRE Friends!

It is nice to share with all of you about my latest professional development.

Some of you may know that after finishing my studies on January 2007, I have joined PLANET GbR in Oldenburg to work in the simulation of a Wind-Hydrogen system (RES2H2 project) located near Athens in Greece. Once the project was finished after almost six months, I was part of the University of Oldenburg side of the project HyWindBalance, working as scientific assistant in a very interesting experiment setup to analyze the production of Hydrogen from wind energy and its later reconversion into electricity to cover high energy demand in low wind situations. At the same time I was working as Tutor of the new PPRE students in both the summer and the winter terms, also giving some short seminars to them, mainly in simulation concepts applied to Renewables.

In the middle of 2008 I applied to a company working in a very exciting topic: Solar Thermal Power Plants based on Fresnel Collectors. I was accepted, and after taking one month vacation in my Country, Colombia, I came back to Germany to move to Essen where my office is located. I'm happy here, but I miss a lot the nice Oldenburg and the University, after all I was there for almost

Mauricio at Parabolic Trough Site in Almeria, Spain

Maurico at Fresnel Solar collector Site in Almeria, Spain

three years!. The good thing is that Essen is not to far away and I can visit Oldenburg quite often.

Within Solar Power Group (my company) I'm dealing with a wide range of topics, from R&D to the company management. The company is still small but the plans for the future are very ambitious, so it has been a very nice challenge where I'm not just learning a lot, but also putting into practice what I have learnt while my time in the University.

One last word: If some of you have plans to come to Essen, and want to take a cup of good Colombian coffee, just drop me an email!

Mauricio Rojas / Colombia at www.solarpowergroup.com

The Modern Portfolio Theory applied to Wind Farms Financing

By Patricia Chaves, Brasil (PPRE 05/07)
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1. Overview

As the participation of wind energy in the global energy generation matrix increases, as it has been seen in the last years, so it rises the necessity to improve the economic characteristics and financing conditions of wind farm projects. The objective of the work being currently developed at the German Wind Energy Institut, DEWI GmbH, within my PhD work at the University on Oldenburg, is to investigate the economic benefits of investing in wind farms (WFs), by quantifying the reduction of risk obtained when bundling several wind energy projects into a portfolio.

The premise of this analysis is that an appropriate combination of several independent aspects of wind energy projects such as geographic location (local wind regime), turbine type and potential calculations, cause a reduction in the overall uncertainty in the estimation of the energy yield of WFs – The so called "Portfolio Effect".

The goal is to understand the dynamics of an efficient combination of the involved issues, by addressing key questions like: how much does a reduction in the overall uncertainties on the prediction of the annual energy production (AEP) impacts financing parameters such as the Internal Rate of Return, the Net Present Value and the Debt Service Coverage Ratio (DSCR) of the projects? It is a multidisciplinary approach where several technical and economic aspects involved in a wind farm project must be understood and explored.

2. The Modern Portfolio Theory

The Modern Portfolio Theory (MPT), or "Markowitz Portfolio Selection", conceived in the context of financial assets, proposes that the overall risk exposure of a portfolio of different risky assets with normally distributed outcomes does not exclusively depend on the risks of the single assets. Rather, it is increasingly dominated by the co-variance risks as the number of assets in the portfolio increases. More precisely saying, the strategy to reduce risk is to build a portfolio of assets which returns are low or even anti-correlated (diversification).

In general words, to apply the MPT to wind farms, is to establish a portfolio of projects, in which the individual energy production of the constituting plants is as much independent from each other as possible. In other words, to combine plants located in regions with different wind regimes, operating at different conditions, with different turbine types.

3. Methodology of Investigation and First Results

The first step to quantify the economic performance of a portfolio of WFs is to characterise the technical uncertainties related to every project individually (risk assessment). For a portfolio analysis it is necessary to extract for every farm an approximate function that relates over a fixed period of time (e.g. monthly), the energy yield with the wind conditions, the turbine's power curves and other operational characteristics of the farm. A comparison of these data between the several projects under consideration generates different "correlation coefficients" (ρ), or grades of independence, that quantify how much the production of one farm correlates with the other.

For this analysis, the principal variable of interest is the most probable energy yield of the farm expressed in GWh/year ("P50"). In the daily praxis, the values of annual energy yield production (AEP), necessary to investigate the feasibility of a determined project, are expressed through the so-called "P Values", or exceedance probability values. An energy yield assessment takes into account the most probable annual wind distribution for the site under analysis, the power curve of the turbines to be installed and their uncertainties, as well as the uncertainties related to the modelling of the wind flow considering the terrain characteristics of the project's site. In this sense, a "P50" value quantifies the energy yield to occur with a probability of 50% in the given site, when using one determined turbine. The "P75" is the energy yield to occur with a probability of 75% and so on. Banks and financial institutions normally work with P90 values, and economic calculations are always developed with basis on the "P values".

A first exemplary analysis was developed with operational data from farms located in different parts of Germany and Europe. The preliminary results indicate that a portfolio of plants solely located in Germany, which wind regime correlates 90% of the time, a reduction of 0,3% in the overall uncertainties raises the DSCR by 9%. When analysing a portfolio of projects located in different parts of Europe, with a wind correlation of about 74%, a reduction of the overall uncertainty of circa 2% was observed, generating an increase of 3% in the P90 value and an almost 25% higher DSCR.

Update of my activities

By Oliver Risse, Germany (PPRE 01/02)

After almost 7 years in Conergy, Oliver started with Asia Cleantech Capital, an Investment Management firm in Singapore in April 2008. Asia Cleantech is a 100% dedicated clean technology investment fund to focus on Clean Energy, Energy Efficiency, Waste Management and Emission Reduction. The fund has a geographical expansion covering Asia Pacific and Middle East with core focus on China, India, Southeast Asia and Australasia. The scope of investment will include enterprises that develop and own projects, service companies, manufacturing entities and late stage technology companies. In an experienced multinational team, Oliver has the role as Chief Operating Officer. Under his responsibility he's always searching for interesting deal flow and evaluating cleantech investment opportunities in the region to help to establish successful renewable energy businesses in Asia. If you have ideas, questions, or interesting deals please contact Oliver directly under oliver@asiacleantech.com.

PhD Research Project "Scale issues in water security"

By Mesfin Mergia, Ethiopa (PPRE 93/94)
Department of Water Engineering and Management
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Project summary

Water security at a certain spatial scale can be achieved in the form of (i) water self-sufficiency at that scale, (ii) water imports from upstream (or elsewhere) or (iii) import of water-intensive goods from elsewhere. For water self-sufficiency at provincial or state scale, provincial/state water supply will have to match provincial/state demand, not allowing for solutions that require basin-wide cooperation or even cooperation at a higher international level. On the other hand, solutions at higher scale levels bring along (social-political) dependencies and cross-border (environmental) externalities. The research challenge in the proposed research is to understand how water security of communities can be guaranteed by a combination of policies to bring along changes at local, basin and global level. The proposed research project will be centred around two case studies, called after their final focus area: the Lake Naivasha case (Kenya) and the Lower Zambezi case (Mozambique). The cases have been selected for practical reasons: the cooperation with WWF and the resulting availability of networks and data. In both cases, the study takes an embedded systems approach, in which the local scale (respectively the Lake Naivasha catchment and the Lower Zambezi area) are regarded as subsystems embedded in a larger system (the overall river basin), which in turn is again embedded in a larger system (the world economy). Three scenarios will be considered, one in which water self-sufficiency is to be achieved at case area level, while in the other two scenarios water self-sufficiency is to be achieved at the river basin and global level respectively. In both case studies, the implications of the three scenarios will be analysed, distinguishing between technical, economic, ecological and social-political implications. Based on the implications of the three scenarios, for each case study area, one or two more balanced scenarios will be developed, where the various positive and negative implications are brought in balance. Finally, it will be studied which types of policy at which different spatial scales are necessary to bring about the latter, balanced scenarios. The proposed research project is a 4-yr PhD study. The research builds on earlier research by Hoekstra et al, so that extensive databases are already available.

Research objective

The objective of the proposed rsearch is to develop insight in how water security of communities can be guaranteed by a combination of policies at local, basin and global level.

An assumption underlying the study is that policies at the local (subbasin, provincial, state) level alone are generally not sufficient to achieve local (subbasin, provincial, state) water security. In addition, policies at the larger river basin level are required. Also these will often not be sufficient, because river basins are not stand-alone entities but strongly influenced from outside (e.g. trade, climate change), so that cooperation beyond the river basin is required. An important question of this research is what sort of factors can and can best be handled at local level, which ones at river basin level and, finally, which ones at global level.

Wind Resource Assessment in Ghana-Challenges and Opportunities

by Mahu Seth Agbeve, GPCo, Ghana (PPRE 05/07) – The complete technical paper has been accepted by the Global WindPower for both publication and oral presentation in China at the China Wind Power and Global WindPower 2008, October 28th in Beijing

Abstract

The conversion of the kinetic energy in wind into electrical energy offers unique opportunity to the overall energy supply where resource exists as well as partial solution to the world's over dependence on exhaustible primary energy sources such as fossil fuel and their consequences which include climate change.

Wind resource assessment based on industrial practice offers a first step towards the technical establishment of the wind energy potential and the political-will to harness this resource creates a unique market opportunity for investment in wind energy development. To this end, the study "wind resource assessment in Ghana-challenges and opportunities" overall goal is to research the wind resource potential, challenges and investment opportunities in Ghana.

The research methodology included review of earlier works on Ghana's wind resource, renewable energy policies and frameworks for wind energy development, analysis of existing wind data, technical challenges for grid integrated wind energy development and availability of land for commercial wind farms.

The results showed that Ghana has regions of proven moderate to excellent wind resource. Average wind speeds of ca 5.6 ms-1 to 7.5ms-1 at 12m and 50m respectively exist along the coastline with low turbulence. Regions of excellent wind climates are the mountainous regions. Although the overall wind resource outlook is very promising, a lot more need to be done in the resource assessment.

Also, the potential wind sites coincide with good infrastructure development such as road, high voltage grid network and load centers. In terms of the overall electricity market, reforms to facilitate private sector investment in power generation, transmission and distribution are in advance stages of legislation.

Challenges include the lack of a clear government policy on renewable energy development and renewable energy laws to provide the needed incentives for taking the wind energy industry from the resource assessment state to the next level of project developments.

Access to land for commercial wind power generation could pose a drawback for wind projects development. However, major land reforms are underway to mitigate these potential setbacks.

In conclusion, there are opportunities for investment in Ghana in the of areas wind resource assessment, renewable energy policy formulation and wind power production.

WWW – links

Link	Comment	Who sent
http://green.wikia.com/wiki/Renewable_Energy	New platform for Renewable Energy info spreading.	Dr, Blum, PPRE
http://biopact.com/2007/12/germany-is-doing-it-reliable.html http://www.kombikraftwerk.de	‚Combined Power Plant' proofs that distributed RE power can replace both fossil fuels and nuclear power.	Antonio Antonopoulos (EUREC 04/05) Michael Sterner (PPRE 05/07)
http://www.soda-is.com/eng/map/	Global Solar Radiation map	Dr. Elke Lorenz, Uni Oldenburg
http://swera.unep.net/	Solar Radiation maps for different countries	Dr. Elke Lorenz, Uni Oldenburg
http://www.leonardo-energy.org/drupal/renewables	Good web resource about energy and RE material (presentations, films, etc.)	Thomas Schwarz (PPRE 89/90)
http://www.batteryuniversity.com/	Fantastic website with everything about batteries and battery charging	Everson Possamai (PPRE 03/04)

Letters to the editors

As you might know, the PPRE-team struggles a lot to keep the programme going and all alumni-network activities alive. Therefore we are really appreciating any kind of feedback – positive or negative - from our alumni, which helps to keep the fire burning.....

Dear Edu

Yesterday I received the newsletter and today I have found the time to read it, specially the section about my batch.

Thanks a lot for the effort that you take to consolidate all the information, get in touch with many of us, ... There are many things that are difficult to put a value in monetary terms, they are intangible but full of meaning. This newsletter falls in this category. Thanks a lot. Oldenburg means for me a new way to see the world. Since then I have not stopped travelling and meeting new people.

Very best regards, success and happy New year 2008!!!!

Jordi, Spain (PPRE 01/02)

Dear Dr. Blum,

Hope that u r fine with all the good people of PPRE. It is a long gap after I writing to u. U know I have designed and introduced RE course in my university (this is the first time RE was taught as a course in the undergraduate level of EEE department in Bangladesh) . I have started taking classes on those and also preparing some lecturers to teach RE. So far I could not start lab courses for RE. My next plan is to write a book on Renewable energy for the undergraduate students. I am gradually progressing for the RE research Lab. Whenever I teach my student any of the RETs my mind goes back to Oldenburg. I am really very much indebted to u all. Thanks again all the persons of PPRE who have given me almost everything which I required for the RE promotion and starting my ventures on RE in Bangladesh.

Shahriar, Bangladesh (PPRE 04/06)

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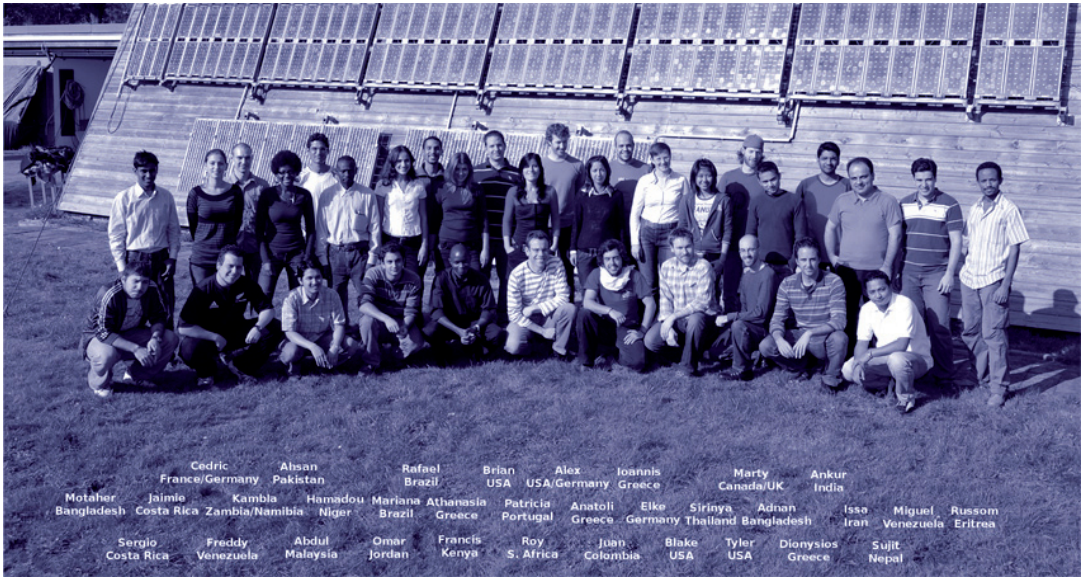

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