CARL VON OSSIETZKY universität OLDENBURG

Postgraduate Programme PPRE
Renewable Energy

NEWSLETTER

2009 | Vol. 28

Editorial

Dear Reader,

in a period of worldwide financial and economic crisis the renewable energy sector seems to be relatively stable or even still expanding. This also holds for RE activities at the University in Oldenburg: the NextEnergy research institute (see resp. article) has recently been completed on Wechloy campus and there are promising initiatives and activities to enlarge the scope of wind energy research around the ForWind centre. We also see that RE related companies, situated at TGO close to the campus, have increased their number of employees, some of them being PPRE alumni.

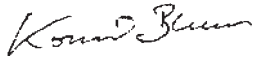
The numbers of applications and of actual students in PPRE/EUREC in the Winter term 2009/10 have increased further and the structure of the curriculum has been adapted and developed, allowing specialisations in the summer term for PPRE students.

A recent survey shows that an overwhelming majority of the PPRE graduates of the last five years found employment in the field of Renewables -- more than half of them work in the private sector and approximately 20% are involved in research projects.

We hope that you will enjoy to read the 2009 edition of the PPRE Newsletter, with news from Oldenburg and the alumni, plus articles about RE, and are looking forward to fruitful discussions in our alumni online forum: ppre-l@listserv.dfn.de !

Sending season's greetings and wishing you a prosperous new year

Edu Knagge



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PPRE - Change in Course Structure

PPRE and EUREC-Oldenburg are presently in the process of re-accreditation (after 2005) and accreditation respectively.

Starting already with the present course 2009/2011 PPRE will see some changes in its structure:

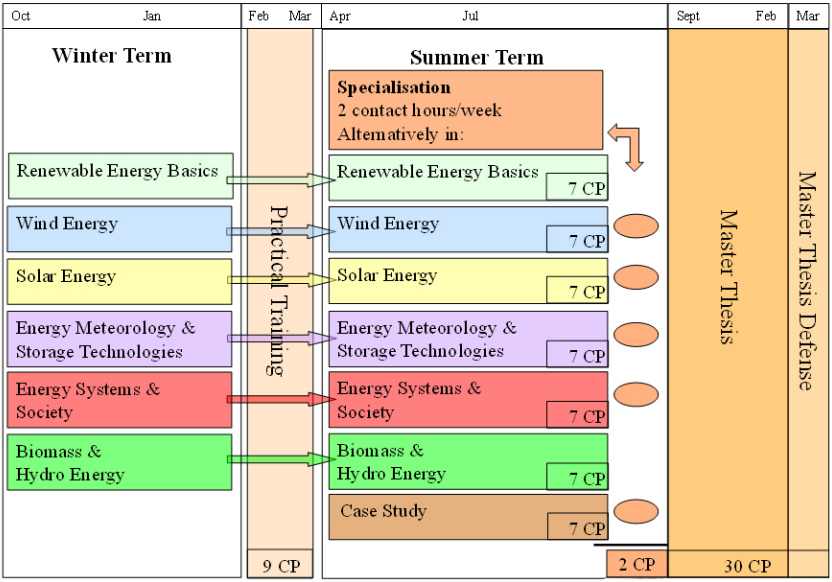
i) Instead of 16 months PPRE will now run regularly over the complete period of three semesters, 18 months. This gives students and staff some extra time, particularly in the summer term and will synchronise and couple the programme closer to the university sequences.

ii) Probably even more important is the start off with core electives. For the first time PPRE 2009/11 will offer six core electives, one in the winter and the other five in the summer term. Thus students can choose between specialisations in PV, Wind Energy, Energy Meteorology, Storage Technology, Energy Policy/Sustainability and Rural Energy Supply Systems. All but the last one will be conducted by lecturers from the according research groups at Oldenburg University. Lectures concerning Rural Energy Supply Systems will be conducted and organised respectively by PPRE staff and guest lecturers. For the time being we will start with no more than two lecture hours (2 Credit Points) per week, but we see this as an opening only.

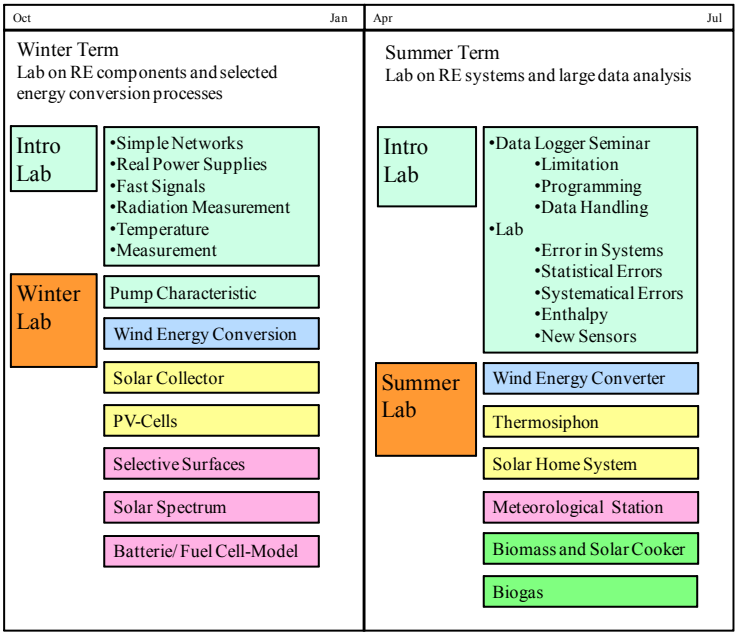
iii) Finally, PPRE will limit its lecture hours to no more than 27 h per week, to give students more time to experience and organise their studies according to their own interests.

The following graphs show the New PPRE Course of Studies.

PPRE - Modules/Course of Studies



PPRE - Lab Structure



NEXT ENERGY Institute

General Information

The EWE-Research Institute Next Energy recently opened its doors in the new building at Carl von Ossietzky University Wechloy Campus in Oldenburg on the 13th August 2009. Though it was only founded in 2008, the concept dates back to 2005 where EWE had the wish of having its own renewable energy research centre directly in Oldenburg. Starting 2008, Prof. Carsten Agert, the director of Next Energy, managed to establish the institute from scratch. To the benefit of PPRE, Prof. Agert also recently joined the PPRE staff as a lecturer. At present, he is lecturing energy storage.

Next Energy is organised under the umbrella of a non-profit association, the EWE-Research Centre for Energy technology e.V. Members of the association include EWE AG, Carl von Ossietzky University Oldenburg and the state of Lower Saxony. It is advised on the setting of priorities by an advisory council and is significantly supported by EWE AG. There are currently 40 employees with various backgrounds, including engineers and physicists.

Research Areas

Next Energy works as an application oriented research centre. The focal points of the research work are renewable energy, energy efficiency and energy storage. With this background, Next Energy develops materials, components, systems and production techniques in the following three areas: Photovoltaics, fuel cells and energy storage.

Photovoltaics

Dr. Karsten von Maydell is the Head of the Division of Photovoltaics. There are currently 8 employees in the department, two of whom are PhD students and one is a mas-

The new Next Energy Institute at Wechloy

ter student. The division aims at developing more efficient solar cells. In the area of thin film solar cells, the focus is on the material of silicon in amorphous and micro-crystalline configuration, fabricated as multispectral solar cells. The focus is mainly on the following subject fields:

- Achieving high levels of efficiency
- Process control
- Alternative substrates
- Simulations

Fuel Cells
Electrochemistry / fuel cell materials

For the widespread use of fuel cells, superior and lower cost materials are needed. High temperature polymer membranes and fuel cells free of precious metals. The durability, cost and efficiency of fuel cell systems can be further optimised through modern material concepts. Against this background Next Energy is researching new types of polymer membrane, electrode architectures and platinum free catalysts. Division is directed by Dr. Olaf Conrad.

Combined heat and power generation / fuel cell systems

Combined heat and power generation is an indispensible element of efficient energy systems. These systems, which are designed to provide heat and electrical power, more attractive become lower with levels of exhaust heat. In this context, fuel cells are superior to all other approaches to combined heat and power generation. The goals of the research in this division directed by Marco Zobel are improved durability, reduced costs and optimised operational management strategies. At the same time they also focus on membrane fuel cells which function both at high temperatures and on the basis of water-free ion-conducting mechanisms. These activities are focused in three subject areas:

- Components development
- System characterization
- Home and grid integration

Energy storage

Energy storage division of Next Energy runs under the direction of Dr. Bettina Lenz. Applied research on various energy storage technologies is carried by this division. These include lithium ion (Li-Ion) batteries research, flow batteries research, and storage systems design for large scale applications (e.g. for the power grid). Energy storage division employs researchers from various backgrounds including physicists, chemists, and engineers. Following subjects are being addressed in the division:

- Power grid integration of energy storage
- Reduced ageing of Li-Ion batteries
- Packaging of Li-Ion batteries
- Energy storage systems for electric vehicles

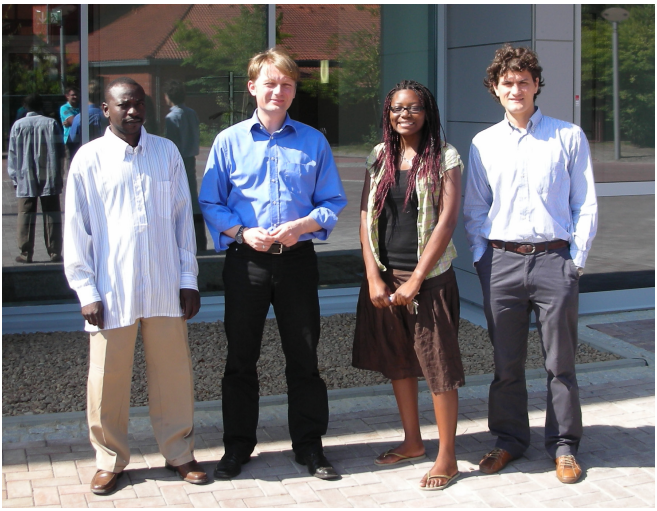
PPREs at Next Energy

At present, there are two current PPRE students writing their master theses at Next Energy. Hamadou Tchiemogo from Niger is employed in the Energy Storage Division and Kambulakwao Chakanga from Zambia/ Namibia in the PV Division. Furthermore, a former PPRE student Burak Türker from Turkey is working as a researcher at Energy Storage Division since May 2009.

Burak Türker (PPRE 2006/08)

After working for PPRE and Overspeed GmbH for one year and half, in May 2009 he

started working as a researcher at Next Energy, energy storage division. He is working with various projects related to electric mobility. His work involves investigating energy storage technologies for electric vehicles. Meanwhile, Türker is working on his PhD project on 'Grid Integration of Wind Energy Using Vehicle-to-Grid Technology'. From his PPRE/EUREC batch, Türker is the only person who still lives in Oldenburg.



fr. left: Hamdou, / Prof. Agert (head of Next Energy) / Kambla / Burak

Hamadou Tchiemogo (PPRE 2008/10)

"I started my Master Thesis in August 17th, 2009 in the Division of Energy Storage. The working environment is really excellent. The thesis deals with the Design, Construction and Optimisation of a Single Vanadium Redox Flow Cell. The behaviour and properties of the constructed cell will be examined in the laboratory using charge/discharge procedures and electrochemical techniques in order to optimize the performance of the cell."

Kambulakwao Chakanga (PPRE 2008/10)

"My master thesis topic is: Texturing ZnO layers on glass for the use as a light-scattering layer in micromorphous silicon thin film solar cell. The ZnO layer is to be textured by etching with an acid. HCl is used as the reagent. The experiments are carried out in various reagent concentrations, temperatures and etching time. The topography of the etched layer is examined. The optical characteristics are analysed by means of a spectrometer, and the electrical characteristics by means of AFM and SEM amongst others. "

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'Wattwanderung' - Mudflat hiking in North Sea

by Chandra Prakash KC, Nepal (PPRE 07/09)

I was born in the Himalayas and an acquaintance with the sea has always been fascinating for me. The experience of walking across the hill passes with steep cliffs on either side has always been a very common part of my life. While studying engineering in India, I had first seen the mighty Indian Ocean and the calm waves strolling across the beach. I had seen the same facets on

Morning shows the day. On 31.05.2009, a shiny blue sky mixed with cool breeze welcomed us when we reached Neßmersiel at around 9 AM. It was just a week before that I came to know about Wattwanderung for the first time in my life when I was invited by some friends. Although I had visited North Sea a couple of times, I had never heard about Wattwanderung.

Sunbathing seals in the North Sea

North Sea as well. I had never imagined that it would go completely empty and shallow in some parts to let me observe its inner beauty. Thanks to the Watt guide who had a fabulous skill to make the trip exciting. He was equipped with a communication set in case of an emergency and a plough on his shoulder that he utilised to show us the Sea snails and timid Shale.

It was a completely different experience for me. I could sense the spongy clay encouraging my feet to heed forward. In most of the areas my toe sank completely underneath the clayish jelly; whereas in few parts there was hard crust. Shells were scattered everywhere on the empty Sea. Not to mention the fragrance that I never smelt before. It was more like shells mixed with clayish and fishy smell. Droplets of sweat flew around my face and my T-shirt was already wet, however I was not tired. In between

we passed by flowing currents and safely crossed from the shallow side as directed by our guide. When I turned back I could see the coastal region covered with innumerable wind turbines. I was really very excited by this mesmerising experience. I never felt that I had already walked three hours long when I reached Baltrum, a beautiful island crowded with visitors and holiday makers. We spent around 5 hours on the lovely island and tasted the delicious sea food. We swam on the other side of the island facing north and on our way back to the ship's deck; my friend's son was so tired that I had to carry him on my shoulder.

We came back by ship. The nature has lifted off its permission to walk back in again; the tide was high. There were no traces left around to show us that we had walked across the channel. In the final moments, we were captivated by seals claiming their territory on the mighty Sea. They were clustered and were enjoying the water to and fro. It took around half an hour by boat to get to the Shoreline. There was heavy rush of gulls and other sea birds to catch the fish stranded at the muddy strip created on the beach when the ship made its final stop.

It seems that beautiful moments always elapse quickly. I made a final glance towards the Sea before proceeding to our parked car. I know that what I have written so far could hardly express the charismatic Wattwanderung until one really experiences it.

Don't miss it!

Small Scale-farmers from Bolivia and Tanzania visiting PPRE

by Evelyn Brudler PPRE (04/06)

During their stay, organised by VEN (Verband Entwicklungspolitik Niedersachsen, http://www.ven-nds.de/), farming women from Tanzania and Bolivia visited PPRE to get themselves informed on energy supply systems for their home countries. Facing the situation of extending dry seasons and occasionally heavy rain falls they visited the PPRE-Outdoor-Lab to gain insight in functioning and construction of systems like photovoltaic pumping, solar home systems, domestic bio digesters and improved cook stoves.

The objective of their visit to Germany (in cooperation with VEN) was to raise public awareness on the effects of climate change, especially on food security. The central target of this cooperation is the empowerment of women and community members as a whole to adapt to a changed climate and thereby ensure food security and create awareness and a network between industrialised and developing countries.

Besides the demonstration of the energy supply systems and the discussion on primary (energy) demand, like potable water/low salt concentration, light and cooking/fuel, it became clear that changes in cultural and traditional ways of using water and fuel are difficult to realize.

The women were highly interested in understanding, how the systems work in principle. They were particulary interested in knowing how desalination can work on an altitude of 3300m and daily temperatures of 3-7°C.

The farming women delegation visiting PPRE (left: E.Brudler)

After two hours of many questions and explanations on the technologies and their working principles, the picture-posters on advantages of domestic bio digester from Vietnam and Nepal were able to catch the attention once gain, more then words could have done. How to explain that solar energy is powering every energy source? How does one explain, that dung still contains energy? How does one explain, if the one asking is not an engineer?!

I learnt a lot this morning from our visitors.

PPRE Biogas Workshop 2009

After 2007 and 2008 a four-days workshop on biogas organised by the ***Postgraduate Programme Renewable Energy*** *took place in February 2009 at the University of Oldenburg. The programme covered planning and technology of* ***domestic bio-digesters in developing countries (3 days) and large-scale technology in industrialized countries (1 day).***

Participants of PPRE Biogas-Workshop 2009 at entrance of Wechloy campus

For the first time participants from international NGO's and students from other German postgraduate programmes with relevance to developing countries participated in the workshop, which was originally specific for PPRE and EUREC students. Funding by DAAD enabled the participation of external students. Apart from PPRE and EUREC students twenty additional participants could be welcomed in the workshop.

On the first three days the focus was on small-scale digesters for **developing countries**, as 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 were presented by specialists of bio-digester programmes in (south-east) Asian countries. Small scale anaerobic fermenters counteract deforestation, save and improve soil fertility. They also have a positive impact on the health situation of rural families by using bio-methane instead of fire wood. The changes in workload, mainly for women, and financial effects (credits payments, benefits and CDM) were discussed. The experts, Jan Lam and Felix ter Heegde from SNV Netherlands (http://www.snvworld.org) have been working for more than 20 years in several biogas-programmes tailored to rural areas of developing countries. They were accompanied by their colleague Bastiaan Teune.

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 (electricity generation or feeding to the gas grid) and the optimisation of the slurry output for soil fertility are applied – each of these subjects was covered in an extended presentation by professionals in the addressed fields, while current situation and perspectives in financing of such systems in a market showing critical changes at short time intervals were

discussed.

The workshop was accompanied with an evening session on the prospects and the sustainability of biogas technology in competition with food and raw material production. The presentation on these issues was held by Dr. Guido Reinhardt from the *Institut für Energie-und Umweltforschung Heidelberg* (**www.ifeu.de**).

The biogas workshop will again take place in 2010. From October/November on you will find the next workshop announced on our homepage www.ppre.de.

PPRE EXCURSION 2009

by the 'North Americans' of PPRE 2008/10

The class of PPRE 09/10 had heard rumors that this year the PPRE excursion would be canceled due to a chaperone being unavailable. Much to our disappointment these rumors were confirmed in summer term. Some students were especially angry, like Tyler Goepfert who thereafter maintained high blood pressure.

Discussion then commenced amongst many students about attending InterSolar. To our delight and surprise we were approached last minute by Mr. Holtorf and told that a supervisor and financial assistance from DAAD might be available for a one week excursion. This materialized and we were off to Southern Germany with smiles on our faces. Our first stop was Ulm, where we attended the Small PV Applications Symposium.

Claiming to be the renewable energy center of Germany (might be disputed by Oldenburg or Freiburg), Ulm was a very green, peaceful and pleasant place. We managed to make it to the quiet, heavily vegetated outskirts of Ulm where the hostel was located. This hostel catered to hosting athletic and sports teams. After cleaning up at the hostel and wrestling for the best beds we walked to a beer garden for some eats and drinks. Rafael got Hefeweizen and was extremely disappointed since he ordered Pils and thinks wheat beer is for girly men. With full tummies and reduced motor skills some students headed to the river and others to downtown Ulm. In the downtown of Ulm a few of us gazed at the nostalgic, night lit church and toured the area. Apparently the river gang had a snail-paced hike returning after dark to the remote hostel, but chatty-Binda and laughy-Kambla enjoyed themselves immensely.

We were off to the conference the following morning where plenty of snacks and drinks were made available to us. Additionally, a plethora of free yet valuable information was at our disposal in the form of a conference reader, magazines, presentation, poster stands and many industry/institution players. This conference was greatly enjoyed by all students since it was very practically focused. One of the most interesting parts of the conference was when a large number of people who submitted papers were given 4-minutes to speak. It was like an auction of information and it was impressive to see the speakers be concise and efficient with what information they presented. The conference wrapped up with a presentation from Grameen Shakti. Their work has been extremely influential and unorthodox in promoting renewable energy dissemination and improving the lifestyles of low income families with its microloan concept.

Though we enjoyed the intellectual stimulation and conferences always keep you up to

date on current practice in the field, let's be honest, we were all most enthusiastic and excited to see the Southern Alps and climb to the hut where we would stay for two nights (called Brunsteinhuette). The train ride to our interim destination was gorgeous, with fresh, crisp mountain air and jagged intimidating mountainous terrain. Some of my colleagues had never seen mountains like this before so it was especially a big treat for them. To maximize the experience many of us stood up on our seat with our heads out the train windows; like panting dogs off to the park. The hike up to the hut was awesome and took about 1-hour. It is always enjoyable to find an excuse to quasi-train and push yourself. But the most fun was pushing Cedric Ulrich and his 30 kilo backpack to exhaustion. His third degree black belt in Judo wasn't helping him at that time. One thing did disturb us from the hike though; Hans Holtorf's white rippling muscular upper body and pink boot laces. This was definitely the pinnacle of manliness and fashion sense. Upon arriving at the hut we were welcomed with much needed 'Leitungswasser' (not the Kohlensaeure rubbish) and by the owners and staff of Brunsteinhuette. The hut was small and robust, nestled into the side of the mountain with just a small tow line for carrying up and down goods.

PPRE Students and Staff experiencing the Alpes in South Germany

The hut owner, Hans-Peter, enjoys the company of his wife and two handsome rescue dogs. Everyone and everything has a purpose at this hut and unites to provide a simultaneously rustic but relatively luxurious (warm, lit, and entertaining) stay. Some of the interesting sustainability oriented technology included composting toilets, efficient lighting and appliances, wood-fired stoves, and a stand-alone PV system. During our visit we focused on the PV system and energy management aspects of the Hut's energy scheme. The PV system is composed of three roof-mounted arrays installed over the years from new and re-used panels which sum up to a capacity of 1.9 kWp. The impressive age of the battery bank (now >13 years!) is a testament to the excellent load management, system care, and design over the years. A detailed report on the hut experience was posted on the PPRE website.

The next morning we challenged the neighboring mountain. Much bonding amongst students and teachers happened here as the experienced ones assisted the ones new to this type of outdoor activity. Near the top, two mountain peaks seemed to open up, portraying a vast panorama of Austria and the forever extending mountains. The hikers of perpetual warm country origins jumped straight for the vast amounts of snow and slid down the side of the mountain using their bottos as sleds. Snowballs were tossed to keep Udo

on his toes. Even though when flat footed his head still seems to penetrate into the heavens. Adjacent to this site the Austrian border stared at us. We did a double look and ran for it. We were now in Austria illegally. We sat, relaxed reflected and some people took pictures. Others headed for some alone time to listen to the wind, watch the mountain goats and stare at the all mightiness of the natural world. I think it made us all feel proud to be engulfed in what we study to protect. Disappointingly we never made it to the peak due to time constraints and differences in fitness level. But we were a group and we were to stay as one as we have throughout the whole program.

In Munich we enjoyed a personal tour of the old down-town with our guide, Mr. Hans Holtorf. Those too tired from an already full day of traveling stayed behind for some personal free-time. Meanwhile the city-tour gang looked out over the beautiful city from the top of Peterskirche. Perhaps the most charming sights at this height were the Frauenkirche, and a giant Glockenspiel in Marienplatz.

Some of us enjoyed tea at the home of Hans Holtorf's father. Here we enjoyed some stories about our beloved teacher Hans, as well as the bicycling adventures in China and a very global perspective from this delightful Mr. Holtorf 1.0. Dinner included traditional Bavarian dishes and then a return to the city where we eventually met up with some former PPRE alumni. The service was perhaps typically Bavarian, and not what we are accustomed to, so it was quite an experience, but really we were there to enjoy the company of PPRE students of years past – and that we did!

The next and last day was dedicated to what is probably the largest solar trade-fair and convention in existence – InterSolar2009.

PPRE-Students in front of the Phaesun stand at Intersolar 2009 in Munich

Nearly 1,500 exhibitors presented products and services in a huge venue totaling over 100,000 m2. It is boasted that InterSolar attracted some 60,000 visitors from 145 nations. Certainly this was a great opportunity to learn about the "latest and greatest" products on the market and in addition to some excellent visits arranged for private audience with Phaesun and Phoenix Solar AG we all got an overview of a large number of innovations.

content. I think everyone would agree that the memories from this last minute excursion will last a lifetime.

Do you agree?

Special Thanks to:

All people from staff involved in organizing and guiding

Hans Peter (for being awesome and Ty's idol)

The companies Phaesun & Phoenix Solar for hospitality

DAAD for co-sponsoring

Oldenburg - 1st impressions

For nine new PPRE-students from Bangladesh, Brazil, Chile, Costa Rica, Eritrea, Kenya, Lebanon, Mexico and Tanzania a seven-weeks intensive German Language summer course for beginners started in the beginning of August 2009. For the most of them it was the first time to travel outside their countries.

Three of them wrote a report about their impressions and experiences during their first weeks in Oldenburg.

New PPRE-students at German Language class (fr. Left): Yonas (Eritrea), Ibrahim (Lebanon), Federico (Costa Rica), Daniel (Tanzania), Sebastian (Chile), Elisa (Mexico), Edwin (Kenya), Rafael (Brazil) and Hirak (Bangladesh)

Rafael, Brazil:

My first impressions of Germany were quite good. Despite the language I did not find any difficulties to settle in the city of Oldenburg. Everything was just a couple of questions away and our German Language teacher and the 'OLD PPREs' were always ready to help us. I took only two days to realize the most important thing about living in Oldenburg: To have ein Fahrrad (a bike). That is serious. You cannot be considered an Oldenburg resident without one. In the first weeks I met a lot of new people; people from Germany and from everywhere else in the world. That has been a unique and great experience for me. Also, I found a lot of opportunities to do my favourite hobby: Practice sports. As soccer, basketball, volleyball, swimming and jogging.

The German weather is quite different from my country and I already have the feeling that it would be one of my biggest challenge here.

So far so good!! I have been here for 36 days and for me that is enough to be sure that I will have a really good time in Germany.

Daniel, Tanzania:

I have now stayed more than 4 weeks in Oldenburg and generally, I have enjoyed my stay here and in Germany in general. The town is very nice to walk around and also to ride a bicycle which I have enjoyed very much. The road networks are extremely good that you can go anywhere easily by bike. The good thing that I have found in Oldenburg and Germany in general is that when you ride a bike on the road you are the boss that even the car drivers respect you very much! This is

quite different from our countries and even in the Netherlands where I have been for some time. It is very safe to ride a bike here in Oldenburg than in our country. Also Oldenburg has a lot to offer, from the shops, supermarkets, museums, foods (Döner kebab) and a lot of drinks. I also have enjoyed the shopping and especially on Saturdays at the 'Flohmarkt' (flea market) where you can get almost everything depending on your "pocket". Oldenburg streets are well planed and it is possible to use a map to walk or ride around the town even in your first days. The people of Oldenburg are very nice people and they usually greet you whenever you come across them, all day long. Also the weather at this moment is very good and we enjoy the nice sun and sometimes the rain showers.

About the University and German Language course, things are going very well, because now I can be able to understand some of the German words.

In general my stay at Oldenburg, I am very happy and I feel like I am at home, and if I choose a place to stay in Germany, Oldenburg will be my first choice.

Yonas, Eritrea:

It was my first time ever to go out of my country Eritrea (East Africa). Due to the long way I have come and I was really tired when I put my legs in Frankfurt. I start to realize that my assumption was even lower. I come from a city which has moderate temperatures so the weather in Germany in August made me feel like at home. When I see the big trees and the green alongside my way I realized that the Germans do really great job for their country. My way from Frankfurt to Oldenburg was so good since I have found someone to drive me to Oldenburg. When I reach the city I called a guy, a contact from the university and he has directed and gave me the keys of my room in the dorm. But I did not know what to do and where to go. He just left me there; it seemed like hell for me as I come from a big family. It's on the third day that I started talking with my flat mates.

Since Asmara my home city and the capital of the country is very clean I was always thinking that my city is as clean as Europe. When I saw the Germany cities I called my friends back home to tell them we still have a long way to make it as clean and neat as the Germany cities. And the architectural designs, which is the blend of trendy and old style buildings especially some castles with rooftops covered with copper were one of the best things that I have admired. One thing that strikes me the most is that in public buses and trains people don't greet each other if don't know each other. They are engaged in their own business, some read fictions, magazines and some put earphones in their heads or they are in deep thought. As an African this was the most unimaginable thing, but I have convinced myself, that I have to accept such things. But in contrary I found a lot of people willing to help you, if they think you are in trouble or got lost. As my first intuition most of my expectations were good but some of them were totally different and since I have time yet to see many things I am eager to learn as much as possible things from such people.

Graduation PPRE 2007/09 and EUREC 2007/08

February 6, 2009 by Craig Wong, US (EUREC07/08)

"Five Eurec students….that's pretty good" reflected **Burak Turker (PPRE 06/08)** in reference to how many Eurec (07/08) students would be present to graduate with their fellow PPRE class of 07/09. "Last year I think we had four."

"Well it's because they are all over-seas working (or poor and searching for work)". Luckily I was able to land two part time jobs in Oldenburg, one with vehicle design and the other tutoring at PPRE, so I would be one of the five able to attend the ceremony.

PPRE & EUREC-graduates 2009

I was asked to be the Master of Ceremonies, since Hans Holtorf was out of town.

The inauguration speeches were given by the two PPRE head: Konrad Blum and Michael Golba.

In addition, I was asked to accompany **Ritah Mubbala (PPRE 07/09)** and **Scott Townsend (EUREC 07/08)** as they sang and I played the guitar…something I only do for fun (not performance). They sang such chart-topping hits as "Learn PV" (to the tune of "Let it Be" by the Beatles)

Sample of 'Learn PV':

"When we find ourselves in times of trouble; Energy Meteorology,

Speaking words of Holtorf, Learn PV.

And climbing to the mountain hut and carrying all the things we need,

Speaking words of Holtorf, Please Hurry. (He always says that.)"

Scott and Ritah also sang a second song which was a medley of "House of the Rising Sun", "Hey Jude" and "No Woman No Cry" with altered lyrics:

Rising.Sun→ "There is a house in Oldenburg…its called the Energie Labor… etc.."

Hey Jude→ "Hey Blum…etc." (lyrics on demand by the authors...)

Nancy Chacon (EUREC 07/08) presented a well-done sentimental slideshow with music and pictures from the past and present. **Stanley Achibiri (PPRE 07/09)** also sang a bold a capella song stating "Congratulations".

That message was directed not only at the class of 07/09, but also to **Burak Turker, Marcelo de Lima Vasconcellos**, and **Bodo Richert (PPRE 06/08)** who were also present and graduated on this day.

The guest speaker of the ceremony was Prof. Martin Holthaus, the vice chair of the Physics instituite, who humorously stated that we are probably wondering who this man is standing before them, but that we are all indeed connected. He then continued on to quote Leonardo DiCaprio in the Titanic, the quote of which he improved upon and the message he was to leave us with: 'Make everyday count.'

At first I was nervous about trying to steer this graduation ceremony for which I had planned little. However, upon standing in front of the crowd of 40 attending the ceremony, I was assuaged by how many familiar and friendly faces I saw: professors, lecturers,

German teachers, classmates, their spouses, lab tutors, alumni and current students. I realized that in addition to what we had learned about renewable energy, we had also gained an enviable brut-squad of friends…enviable in quality, quantity and variety of origins. I find it fair to say that few people on the planet have this opportunity.

We would like to thank all of the Alumni who wrote with well wishes and fond memories of their experience of the program, but to end particularly with a quote sent by **Kahfi Bachtiar (PPRE 07/09)**: *„ Choice means a few among the abundant. The one who chooses means he takes the few from the common. If he takes the common, it can not be said that he chooses, but he only follows. Those who take a choice are the selected, and those who take the common are the followers, crowding the crowded.'*

Congratulations to PPRE for being "The Selected" !!

Alumni / Guests visiting PPRE 2008/09

In this chapter all seminars presented by external lecturers 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 2008/09:

Energy Policy

Compact course presented by Prof. Dr. August Schläpfer, Murdoch University, Perth, Australia

Building Physics and Heat Demand of Buildings

Seminar by Ms. Herena Torio, who 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 TU Munich

Case Study Energy Policy Indonesia

Compact course by Prof. August Schläpfer, Murdoch University, Perth, Australia

Short History of Energy Awareness in Policy

Compact course by Prof. August Schläpfer, Murdoch University, Perth, Australia

Wind Energy Technology

Compact Course by Rainer Klosse, DEWI, the German Wind Energy Institute in Wilhelmshaven

Kyoto Protocol and Effectiveness of CDM

Seminar by Prof. August Schläpfer, Murdoch University, Perth, Australia

Wind Turbine Technology and Design

Seminar by George Pehlivanoglou, who graduated from PPRE in 2007 and is doing his PhD at TU Berlin.

Project Engineering - Wind Energy

Seminar by Luis Vera Tudela, PPRE 2005-07, who is working for GE Windenergy Germany.

Wind Energy Site Assessment: MCP Procedures

Seminar by Scott Townsend, who graduated from EUREC in 2008 and joined Deutsche Windguard Co., Varel thereafter.

Biogas Compact Course

By Jan Lam, the Netherlands (PPRE 98/99) Felix ter Heegde and Bastian Teune 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

Summer term 2009:

Gasification / SOFC

Seminar by Dr. P.V. Aravind, now TU Delft The Netherlands, who graduated from PPRE in 2001.

Thermodynamic Modelling and Efficiency Improvement of Gasification, Solid Oxide Fuel Cell (SOFC; high temperature fuel cell), and Combined Cycle Systems

Seminar by Burak Türker, who graduated from PPRE in 2008 and now started his PhD at Next Energy Institute in Oldenburg (see also article).

Evolution or Revolution; Wind technology trends 1990 – 2009

Seminar by Eize de Vries, Owner/Director Rotation Consultancy, The Netherlands - in connection with Forwind Institute, Oldenburg

Sizing of stand-alone PV systems

Seminar by Prof. T. Markvart, University of Southampton, UK

Thermal Demand of Buildings / Solar Cooling / Large Solar Thermal Systems

3 Seminars by Ms. Herena Torio Blanco, Spain (PPRE 05/07) – see winter term.

Concentrating Solar Power Applications

Seminar by M. Rojas, who is PPRE 2007 graduate and is now working with CSP at Solar Power Group GmbH in Essen.

Concentrating solar power: focus on linear Fresnel reflector technology

Seminar by Francois Veynandt, who graduated from Eurec in 2008. Francois started his PhD with respect to concentrating Solar Power in Alby (near Toulose, France) – see also article..

Energy Storage Technology,

Seminar by Prof. Carsten Agert, Head of Next Energy Institute, Oldenburg

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.

Technical Problems of Solar Home Systems in Rural Bangladesh

By Shahriar Chowdhury, Bangladesh (PPRE 2004/06), who visited PPRE as Guest-lecturer for 2 month sponsored by DAAD (see also detailed article in the back).

Adaptation to Climate Change: Science, Policy, Politics

Presented by Richard Klein, who is senior research fellow at the Stockholm Environment Institute (SEI) and a visiting researcher at the Potsdam Institute for Climate Impact

Research (PIK).

My EUREC-Project Experience in Brussels

by Athanasia Arapogianni (Greece)
EUREC 2008/09

It was somewhere in the beginning of May that I finally had a reply for my thesis in the European Wind Energy Association. After a semester full of wind Energy engineering I was more than happy to go and work for EWEA. Being happy after a long time of waiting and being stressed about where and when my thesis would start, and after a week full of difficult exams, finally I get to the plane: Direction Brussels...

Leaving your family and friends and good moments back and landing for a second time in a year at an unknown place with bad weather in the beginning of the summer was difficult. A friend of mine was living in Brussels so he picked me up from the airport and hosted me for the first days.

The first two weeks were a nightmare: start working in a professional environment, with colleagues that are of your age but they are not new in the city so they don't really feel like excited to show you around, at the same time looking for a place to live, visiting all the crappy places with mice walking around (the budget is low) and having to go next day to work again.

My stomach was about to burst because of stress, a week had passed and I hadn't found anything for accommodation. My friend was really helpful and let me stay as long as I needed. The second week went better. My colleagues start to realize that I am a new person who would like to talk to people and make friends, so they actually started talking to me… When one thing starts getting better, everything seems to follow. So by the end of the second week I found a place to stay, a shared apartment with a 30 year old man. The choice of a man was a challenge for me, but I took it!

I move in and I realize that I have to clean SO MUCH so the third week is again so bad because I feel out of my shoes… I started missing the comfort of my house; I was laughing and crying at the same time watching myself carrying tones of cleaning liquids alone after work… It was a disaster… I had to install a curtain to the bathroom so I had to find the right drill and to do these kinds of things that I could never imagine doing. All these details made the situation really difficult, at least for me. On top, I was almost alone in the city, my colleagues worked hard and just showing me their sympathy for my first days… There were some times that I really thought of giving up and taking the next plane to my home. But, believe it or not, I made it! And I feel so proud of myself, it might sound silly but I do.

Finally after one month, I realized that it's time to start living in this city. I was feeling all right at my place now and I started concentrating on other aspects of life. First of all I started realizing that my dream I was coming true! I am in a foreign city doing the final stage of my master's degree, in a field that I love! So I started giving my energy to my work. My thesis is about developing a tool to compare the cost of energy, generated by different power stations: wind on- and offshore, coal, gas and nuclear. I started collaborating with my colleagues, invited them to have lunch with me, told them that I want them to show me the city, and yes finally it worked! I am now here for almost 2 months and I can say that I really enjoy it! Brussels is a crazy city, full of young people doing their internships in the European Commission. The nightlife is good; there are always parties for no reason, live music festivals and lots of other "summer" activities. I personally started playing badminton (before I came here, the only thing I knew about badminton, is

that we had to build a Badminton stadium in Greece for the Olympic Games of 2004, which stayed in the city and there were some interesting concerts in there…)

Concluding, I want to say that this experience of the master thesis is like a wave. You are on the top and next second you dive very deep and then surge again to the top – and these changes are happening so quickly that you get kind of dizzy at the beginning. But once you realize what the period of this wave is, you realize that no matter what, you are going to go up again, so you start enjoying every single moment. And believe me, it is worth all the money, all the anxiety and all the fears of the world!

So keep on and get the most out of it!

EUREC – the Greek experiences

by Juan Esteban Hernández R., Columbia (EUREC 08/09)

One of the main reasons for choosing an international Masterprogram is that it gives you the possibility to gain experience that goes beyond the classroom and makes this stage of your life unforgettable.

I enrolled in June 2008 to EUREC Program and went to Oldenburg for the first semester. The time was very nice, but actually I have to say that it was very quick. Once we began lectures and had our first labs, we were already near November, temperatures were reaching 0° and the pressure and complexity of some lectures made it easy for time to pass unseen. I can assure you, that the smell of the library and the sound of the coffee machine are well known for some of us. Suddenly December came and we had to prepare for our winter exams and a few of us had to arrange our stay in Athens, where we were going to start the Wind energy specialisation in the National Technical University of Athens.

The first days in Athens were shocking. You have to understand that I was coming from Germany a country where the train arrives not a minute later than it is supposed to, no traffic jam, imperceptible cars on the street, and of course, a lot of sausage, schnitzel, potato salad and beer – please, try the weizenbier!

So, I arrived in Athens in February and quickly I began to feel the dramatic change of going from one small German town to the capital of the ancient world. That feeling is overwhelming. The incredible Acropolis, the inexplicable atmosphere of monasteraky square, and the similitude between the Latin-Americans, and the Greeks, were among my most important discoveries; although I have to accept that eating Pita Giro with extra zaziky is still one of my top 5 as well.

Greece is amazing, as time goes by, and you begin to live like a student, you start to notice that you are drinking more coffee than you were used to, that you are going to restaurants 5 times per week and that olive oil as well as olives and feta cheese have become an important part of your daily gastronomy.

Moreover you begin to observe and to pay more attention to the signs on the streets. You unexpectedly begin to recognize the letters of the Greek alphabet and start to see the words as more than just physics equations. You read absolutely everything that passes in front of your eyes; at first, it's unbelievable

to think that you recognize almost all the letters and that you already know how to pronounce them, well as an engineer you have learned them during all your student life. But still what surprises you most, is that it would be easier to identify any physical coefficient, or even any equation of heat or motion, than to read “Pharmacy” in Greek.

One of the main features of the Greek culture is the food. The occasion doesn’t matter really; it could be a birthday party, a studying session or just two guys doing business, but some feta with olives, and a little bit bread with oil have to be present always. What is really amazing is the perfect combination between quality and QUANTITY. The Greeks, they just like to take it easy, why rush? They smoke one or two cigarettes while chatting, eating and drinking; they don’t mind eating the food cold or drinking their famous Greek coffee after 1 hour; they just don’t feel the need to finish everything at once nor to eat up to the very last piece what they have on the plate.

As shown, living in Germany can be very different from the life in Greece, and in fact, living as a student in both parts of Europe gives you diverse experience. In the end, however, you see clearly that, both, the University Carl von Ossietzky from Oldenburg and the National Technical University of Athens have qualified staff that transmit to you, not only their devotion for renewable energy, but also the effort that has to be made in order to take the steps that are required to succeed.

Experiences gained after EUREC-studies

by Craig Wong, US (2007/08)

Part time work does have its advantages. One of which is a great variety in work, and the semi-freedom of a semi-adjustable schedule. Since graduating from EUREC in 2008, I have been working contract jobs in Oldenburg. One of which is to help Dr. Robert Steinberger-Wilkens from Planet GbR Oldenburg, to develop one of his Fuel Celled Vehicles. We are currently testing an existing vehicle and making modifications to improve it. A great part of my day is spent connecting test equipment to the vehicle, obtaining test data and trying not to electrocute myself.

I was also fortunate to be offered a tutoring position with the University of Oldenburg with the current group of PPRE students. This is great on many levels but probably the foremost is the opportunity to meet an additional class of students and work with the PPRE staff which I have found to be technically challenging and very enjoyable.

Those two small jobs aside, I have also had the time to play some soccer (Fútbol Americano, Fussball, whatever you want to call it) with some of the PhD students, current PPRE guys, and RANDOM GERMANS IN THE PARK. I would never have touched a soccer ball as a child, but I figured „when in Germany...“. Plus it is another perspective into German culture, and it is a lot of fun.

Now something perhaps more interesting on a renewable energy level:

The Hauselberg project:

The Hauselberg-family surrounded by EUREC-PPRE students/graduates (fr. left: C. Wong, R. Emmerich, M. Amoureux and T. Goepfert) in front of some adventurous but functioning electric wiring

I have volunteered some time with some old EUREC classmates of mine because we had contacts to a 400 year old organic farm in the south of Germany just outside of Freiburg, which to our disbelief had no electricity.

Through various contacts, the two women (and a baby) who live there (grandma, daughter and granddaughter) have collected a couple of PV panels, two small wind turbines, 4 fork-lift batteries, and solar thermal panels. The farm has a fresh source of running water which they sometimes use for refrigeration purposes. They also have about every farm animal you can name. However, nothing is connected and they live by candle light.

So the weekend of July 21, 2009, Manfred Amoreux (the planner, EUREC 2009), Tyler Goepfert (instead of studying for finals, PPRE 2008/10), Roy Emmerich (EUREC 2008/09) and myself, spent 3 days living on the farm in order to test existing equipment and hook up the PV panels and the wind turbines.

In the end, we found that one of the two 900 W turbines was broken, and we didn't have enough time to run all of the wires in the house which we would have liked, but we were able to hook things up in a safe manner and give them light in the kitchen and bathroom. In addition there is an outlet with which they can charge their cell phones.

Still, there is a lot of work to do. Possibilities for the future may include a biogas digester, connecting the solar thermal panels which are sitting unused in their barn, repairing and re-installing the broken wind turbine, and fitting the running water supply with a simple water turbine.

Anyways, we all had a nice experience and left very excited about organic living and the practical experience we gained.

The 'rural' experience gained in Nepal

by Solène Goy and Xavier Gillard, both France and EUREC 07/08

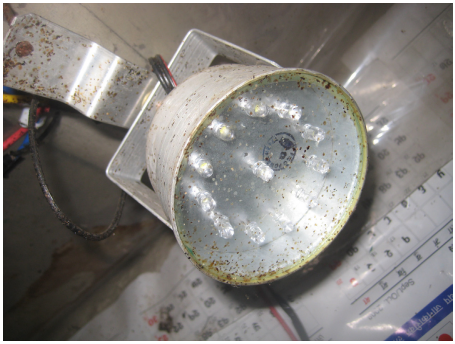
We are three EUREC alumni from the 2007/08 batch -2 graduated from Oldenburg, 1 from Ecole de Mines in Sofia Antipolis, France - and we recently volunteered 5 months with an NGO in Nepal; it was a short but memorable experience and we would like to take the chance to share it with all of you in this newsletter.

We had been thinking about volunteering in developing countries in the field of RE for quite some time. We wanted to, first, do something useful where people need it. Then, we were eager to get a broader view on how RE could be used outside Europe and especially in the field of rural electrification. Well, basically our motivation was to help and learn at the same time.

We got in touch with this particular NGO called "RIDS Nepal" thanks to our former lecturer Hans Holtorf from Oldenburg University. RIDS stands for "Rural Integrated Development Services"; it is a Nepali NGO with its headquarters in Kathmandu and other offices in different places in Nepal. Most of the staff is local people. The NGO is active in the Humla region, which lies in the North-West of the country and is accessible only by plane or by a 10-days trek from the closest road. RIDS Nepal's aim is to improve with a holistic approach the living conditions of the Humlis, who are among the poorest and the most remote people in the world. Thus, RIDS Nepal is active in various fields such as rural electrification, education, sanitation… For more info about the NGO, please check out the website:

http://www.rids-nepal.org/.

Our collaboration with RIDS lasted 5 months, from February to July 2009. We worked almost 2 months (March and April) in the field in the villages and three months in Kathmandu.



12 LED lamp

Our work in the villages actually focused on the rural electrification part, which is achieved through solar PV systems mainly and a pico-hydro plant (in one of the villages where the irradiation is too low). Those systems power several 1W LEDs installed in the houses and the schools. More precisely, we worked on the monitoring systems of the installations.

Monitoring some of the installations can be costly but it is a great source of information about the villagers' electricity consumption and benefit to them indirectly. For example, thanks to the monitoring system, RIDS realized that several Humlis keep the lights on throughout the night; after discussing with them, they got to know that, according to the villagers, the light allows to chase away the devils that could come during the night. This is an important fact that should be taken into account when designing the next systems to fit at best with the villagers' needs and way of life.

In the village Kholsi, where the 1kW hydro plant was set up years ago, we started the monitoring system from scratch. In the other villages, where PV systems were installed, we improved the monitoring part. Monitoring is

done using to a datalogger (from DataTaker, an Australian brand) and several sensors (pyranometers, current and power transducers, thermocouples...). The datalogger runs on a program which has to be adapted to each system depending on the parameters measured.

Back in Kathmandu we wrote a detailed documentation on each monitored system; this will be useful for the staff and the next volunteers as it is difficult to improve/repair the systems without technical information about it (as it was the case until now). A system has to be documented to be well maintained.

300 Wp tracking PV system for the whole village of Tulin

Those 5 months volunteering in Nepal were definitely a great experience: we carried out useful tasks and learned a million things that we would not have learned by reading textbooks or working in Europe.

We worked with Nepali staff members, some of whom were engineers like us and we realized that our approaches were complementary. Indeed, our Nepali colleagues were much more practical, whereas our background is more theoretical, so it was beneficial for both groups to work together.

The example of RIDS' work highlighted important points to be considered when working on rural development. First, the hierarchy of needs and services – the "holistic" approach of RIDS: pit latrines and smokeless stoves are installed before PV and LEDs (hygiene before light; and the smoke of an open fire would dirty the lamp and reduce the light anyway). Second, a local staff, or at least trained villagers, should be present and able to react well and quickly to a possible system failure.

PV system for 7 households in Pamlathum

By working in the field and trying to interact with the villagers we understood better the importance of the social aspects of rural electrification (such as the feeling of ownership, the actual need of the people…). Two months are too short to catch all the new aspects, but at least we got a good insight into the matter.

It was exciting to get to know such a different way of life. The Humlis are extremely poor people but they often shared food with us when we were working in their villages. Same kind of attitude in Kathmandu even if the people are less poor in the city. Their way of life made us think a lot about our life style in France.

In a nutshell, we are glad we went through this rewarding experience; we came back with more experience about RE and hundreds of good souvenirs. We do hope we will keep in mind the Humlis, the other Nepalis and all what we learned thanks to them.

Experiences in PV gained after PPRE

by Tek Boon Jin, Singapore (PPRE 04/06)

Since May 2006, I have been working with Oliver Risse (PPRE 2000/01) in SunTechnics in Singapore by doing anything that has to do with Solar PV. First, I supervised an installation of 20kWp on the top of a roof, without any experience at all, and without guidance from any experienced engineer. But it was successful. Then, after sometime, there was an off-grid wind installation in Thailand, this time in the palace ground of the king of Thailand, 6 kW (rated @ 10 m/s).

Afterwards I participated in an installation of a telecom system, which was a collaboration project with the Indonesian company from Chayun Budiono (1992/93), on an island of Borneo called Maratua.

At the end of 2007, I was sent to China to finalise 2 installations, which were initiated by another more experienced engineer from SunTechnics. Due to time constraint and language problems, the said engineer couldn't finish what he started.

Since the begining of 2007, we've seen that our projects in South East Asia are typically off-grid in nature. For the most part of the year, I've been in touch with a number of charge controller companies and came up with a telecom package (took me some months to develop this with the help of suppliers). And in March, we managed to land a project to provide the energy management systems of 63 rural schools in Sabah (Malaysian state in Borneo). We had to provide systems up to 50kW and in total the project size was around 1.3 MWp.

Conergy at this time doesn't have access to off-grid inverters that are suitable for this project. We came up with the idea of taking Inverters (stackable ones, from Studer) and charge controllers (parallel ones, from Morningstar) and built them into boxes (we decided to call this system, ModEx, for Modular Extendable), so that when it arrives on-site as Plug & Play systems. Settings of the charge controllers and Inverters are all done, the Inverters are more interesting. The settings are done using SD Cards that are pre-programmed, so that when they arrive on-site, all voltage regulation is done within minutes. This project took me to India, Switzerland and many times to Sabah itself.

Latest news: Boon Jin resigned from Suntechnics, Singapore end of 2008 to start working with Sopogy, a micro-CSP technology company located in Hawai. After 6 months he also left Sopogy.

Rural School in Sabah

Master Thesis in the Brazilian Amazon

by Andreas Günther, Germany (PPRE 2007/09)

My intention for my Master Thesis topic was to study a rural electrification project in a developing country. Fortunately, Prof. Rubem Souza from the Federal University of Amazonas in Manaus / Brazil visited the University of Oldenburg in July 2008 to talk with the PPRE staff about a possible cooperation. During his stay in Oldenburg, I had the chance to meet Prof.Souza as well. He introduced me to the projects they are working on. I was very excited about both the projects and on the possibility to spend six months in the Amazon. Michael Golba and Dr.Blum encouraged me to go to Manaus and thus, a few weeks later I was already sitting in the plane to Brazil.

Manaus - Teatro Amazonas

Manaus is the capital of the Brazilian state Amazonas with about 1.7 million inhabitants. During the rubber boom between the end of the 19th and the beginning of the 20th century the city got very rich was called "Tropical Paris". Today, only some historical buildings like the famous opera house "Teatro Amazonas" serve as a reminder of the old times, but Manaus became a very popular ecotourism destination due to its location in the middle of the jungle.

Prof.Souza and his team work on a project called "NERAM", whose main objective is to gain experience with the electrification of isolated communities in the Brazilian Amazon with the help of renewable energy sources. Additionally, a market oriented approach has been developed to generate income for the local population. Therefore, a pilot project has been set up in a small community about 100km from Manaus. A local productive chain has been established where local fruits (açaí) are processed to fruit pulp and the agricultural waste (açaí seeds) is used as feedstock for a gasifier system. The gasifier is connected to a diesel genset in order to produce electricity for the plant and the village. My topic was the development of a Results-Based Management methodology for monitoring and evaluation of this type of project.

NERAM Project Site

As my work was rather theoretical, I spent most of my time at the university in Manaus. The project team at the university was very friendly and I enjoyed the cooperation very much. In the beginning, there were some communication problems due to my limited knowledge of the Portuguese language but with time the situation improved and I felt more and more comfortable.

Besides the theoretical work, I got also the possibility to visit the site of the pilot pro-

ject. Not only was the journey to the village exciting – we went by boat on the Amazon river – but also the gasifier system and the fruit plant was very impressing.

Experimental Farm called "Fazenda"

Another interesting site which belongs to the university is the "Fazenda", an experimental farm located about 50km north of Manaus. Besides agricultural and biological research facilities – including cattles, pigs and fishes – there are is a research lab for renewable energy. The main focus is biomass including two original biogas digesters, a biodiesel cracking unit, a gasifier system and lab equipment for the analysis of biomass. A lab with photovoltaic equipment for education purposes is also available.

In February 2009, six people from the current PPRE batch came to Manaus for their two-months practical training: Mariana and Rafael from Brazil, Blake and Tyler from the United States, Marty from Canada and Cédric from France. They lived and worked all the time at the Fazenda. The work was coordinated by Prof.Souza and guided by several researchers of the university. Several tasks were completed, including characterisation of biomass, dismantling and reassembling of a cracking unit for the production of biodiesel from palm oil and some studies related to the NERAM project.

Of course, especially during the weekends some time remained for leisure activities. A jungle tour with the possibility to see many alligators, dolphins, tarantulas or anacondas is an impressive experience. Another nice trip was a tour to the water falls of Presidente Figuereido which I did together with the Practical Training team.

End of February my time was over and I had to go back to Oldenburg to present my thesis. Altogether, my time in Manaus was an unforgettable experience and I am very happy that I had the chance to spend six months in this unique environment.

Practical Training Team from Oldenburg taking a break

PPRE 2007/09 – The following thesis projects were successfully completed in 2009

Name	First Name	Nation	Institution	Location	Titel of Thesis
Achibiri	Nna Stanley	Nigeria	GE Wind	Germany	Evaluation of Extreme Wind Estimation Methods
Anwar Hossain	Mohammad	Bangladesh	Power Dev. Board, Dhaka	Bangla-desh	Technical and Socio-economical analysis of different options for Renewable Energy supply to remote village: A case study on Bangladesh perspective
Bachtiar	I. Kahfi	Indonesia	Research Center Jülich	Germany	Optimization of Internal Manifold Design (for flat cassette design of SOFC
Elhadi Adam	Rania M.	Sudan	Uni Olden-burg	Germany	PV field array tester
Garcia da Fonseca	Leila	Brazil	DEWI	Germany	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	Bedrettin	Turkey	Enercon, Aurich	Germany	Comparison of regulation for permission of wind farms in Turkey and Germany and technical & economical consequences on wind farm and turbine implementations
Günther	Andreas	Germany	University of Manaus	Brazil	Rural Electrification in the Amazon Area
Millan	Rosiel	Mexico	ISE, Freiburg	Germany	Simulation of high temperature latent heat thermal energy storage for solar thermal power plants
Mubbala	Ritah M.	Uganda	Uni Olden-burg / Uni Delft	Germany/ Holland	Village Gasifier Solid Oxide Fuel Cell Micro Turbine Systems with cooking gas for Tropical Developing countries, Case study Uganda
Nwaogaidu	Simeon O.	Nigeria	Lahmeyer Int., RE-Dept.	Germany	Development of a solar radiation data processing toolkit
Pabon Restrepo	Giovanni A.	Colombia	Innovative Wind Power, Bremerhaven	Germany	about the mechanical design of a wind turbine
Parinyacupt	Unchalee	Thailand	ISET, Kassel	Germany	Performance evaluation and optimization of Gaidoroumandra minigrid
Prakash K.C.	Chandra	Nepal	Garrad Hasssan	Germany	Wind farm wake analysis and model development
Potzmann	Silvia	Austria	Enerpro Co., Quito	Ecuador	Energy Efficiency on the Galapagos Islands
Sandris	Georgios	Greece	ISE, Freiburg	Germany	Development (designing-construction-testing) of a Prototype Methanol Fuel Cell.”

EUREC 2007/08 – The following projects were successfully completed and defended in Brussels in December 2008 already.

Name	First Name	Nation	Institution	Location	Titel of Thesis
TANGUY	Yann	France	Transenergie SA	France	Conception of a testing platform for different PV power plant technologies
DEL CID LEMUS	César Roberto	Guatemala	Technology Transfer Centre - TTC	Germany	Resources efficient Ethanol fermentation by means of membrane bioreactor technology (ETHAFERM)
TOWNSEND	Michael Scott	US	Deutsche Wind-Guard, Varel	Germany	Investigation of Correlation Methods for Short Term Measurement Data, especially with Respect to LIDAR Measurement Data
PHILLIPS	Ian	US	Wind Prospect Inc., Halifax	Canada	Wind integration into isolated diesel systems.
VEYNANDT	François, Charles, Auguste	France	ISE, Freiburg	Germany	Development and analysis of simulation models for heat pumps and CHP systems.
GOY	Solène	France	INES/CEA	France	PV Systems
WONG	Craig John	US	INSTITUTO TECNOLÓGICO DE CANARIAS, S.A.	Spain	Analysis and optimization of an Wind-fuel-hydraulic electricity generation system for Gran Canary Island
BALDUS-JEURSEN	Christo-pher	Canada	ISE, Freiburg	Germany	Optimization of pressure chamber design for a liquid guided laser solar cell wafer grooving system
GILLARD	Xavier	France	Laboratory of building physics & systems	Réunion, France	Performance assessment of a naturally ventilated building in the Reunion Island
CUDDIHY	Alan	Ireland	PCH International	China	Role of Renewable Energy in China Manufacturing Industry
PATERAKIS	Petros	Greece	Vestas Hellas Wind S.A.	Greece	Assessment of Power Output Estimates vs. Real Production Values in Greek Complex Terrain Sites
OWEN	Emma Louise	UK	REpower SAS	France	Wind assessment projects across France
LYNCH	Mairead	Ireland	Sustainable Energy Ireland	Ireland	Zero Carbon Homes through Micro-Generation
CHACÓN CALDERÓN	Nancy	Guatemala	AgroEnergien, Varel	Germany	FEASIBILITY ANALYSIS OF ANAEROBIC DIGESTION PLANTS IN DIFFERENT MARKETS

1. Biomass/Bio-energy

Mr. Melis Teka, Ethiopia (PPRE 94/95)

After working in biofuels in the Ministry of Mines and Energy in Ethiopia, Melis joined the biogas program of the Dutch Organisation SNV Ethiopia earlier in 2009.

Mr. Andreas Michel, Germany (PPRE 03/04)

who is working since his PPRE-studies with GTZ-headquarters in the Energizing Development Department attended a Household Energy for Sustainable Development – Conference, which took place Mid December 2008 in Bonn, Germany. Some other PPRE-alumni, who are also working in the Household Energy sector for GTZ, were involved in the conference as well:

Ms. Anna Naftal Ingwe, Tanzania (PPRE 01/02) gave a presentation about 'Dissemination Strategies – case study for Kenya' and

Ms. Hiwote Teshome, Ethiopia (PPRE 96/97) gave a presentation about 'Providing jobs through new marketing measures for improved cook stoves'.

Mr. Laurent Lecesve, France (EUREC 2004/05)

changed direction of his PhD-studies at ISET, Kassel, which is now more focused on the combination of spirulina and biogas. 'Besides' Laurent is working to set up a kind of ecovillage in the Normandy, France. He'll also become a spirulina farmer and in addition to his NGO activities he is involved in the start-up of a Hybrid Energies Company.

Ms. Donnalyn Caag Cabaces, Philippines (PPRE 05/07)

was appointed Assistant Director for Engineering, Science and Technology Research at Batangas State University, Philippines. They are recently focusing on development of prototypes in the field of energy and environment, e.g. they are now exploring Jatropha as source of biodiesel and as solid fuel in the form of briquettes.

Mr. Sithole Edwin Mwakatage, Tanzania (PPRE 06/08)

is working for PROKON Renewable Energy Ltd, Tanzania. They are planning a large scale pure Jatropha oil fuel milling plant to attain DIN 5106 biofuel quality standards. They have tested about three oil mill manufacturers in Germany for Jatropha seeds, surprisingly they give widely varying oil quality, which may be is due to the fact that these machines were primarily designed for rape seeds pressing.

2. Solar Thermal / CSP

Mr. Erkata Yandri / Indonesia (PPRE 03/04)

Since 2007 Yandri is doing his PhD in the Faculty of Engineering, at Kanagawa Institute of Technology (www.kait.jp) in Atsugi shi, Kanagawa ken, Japan.

His research field is Solar Thermal energy system for water heating and space heating application, combined with a heat pump system and he is also developing a unique thermosyphon apparatus for water heating. It seems that a lot of professors are very interested to know more details about his thermosyphon, which is really an innovation.

Yandri presented two papers of his research

in Eurosun 2008, Lisboa - Portugal. Unfortunately, he could not come to Oldenburg before or after the conference due to time constraints. Last year he also presented at ISES-AP in Sydney - Australia. In August 2009 he presented two papers in an International Conference on Applied Energy in Hongkong.

Dr. Indradip Mitra, India (PPRE 03/04)

After successfully finishing his PhD at ISET in Kassel, Indradip is employed as a Research Scientist at 'The Energy, Environment and Water Research Centre' (EEWRC) at Cyprus Institute, where he is currently working on the Cogeneration of Electricity and Desalinated Sea Water using Concentrated Solar Power project (CSP-DSW) – http://www.cyi.ac.cy.

Mr. Tek Boon Jin, Singapore (PPRE 04/06)

After 2,5 years he quit his job with Conergy, Singapore to join in early 2009 a Hawaiian company, which is specialized in micro CSP. One of the applications of the heat is for solar cooling! The company is called Sopogy (sopogy.com), short for Solar Powered Technology.

Latest news from 8/2009: Boon Jin was retrenched during probation since the market seems not to be that good at the moment. He is looking for new challenges.

Ms. Rosiel Millan, Mexiko (PPRE 07/09)

is still employed at the Department Materials Research and Applied Optics in 'Fraunhofer-Institut für Solare Energiesysteme –ISE', Freiburg, where she already finished her Msc project titled 'Simulation of high temperature latent heat thermal energy storage for solar thermal power plants'

Mr. François Charles Auguste Veynandt, France (EUREC 07/08)

started his PhD at Ecole des Mines d'Albi, South France (near Toulouse) on 'Concentrating Solar Power based Cogeneration using Linear Fresnel reflectors'. He is supposed to work for 3 years on this project. (Please see details in separate article).

3. PV

Mr. Thomas Schwarz, Germany (PPRE 89/90)

wrote: "We at Phoenix Solar are still almost exclusively busy trying to sell/install as many grid coupled PV systems as possible in Europe (which may be not so exciting for many students/alumni from outside Europe). I am still working in the central Technical Department, and mainly in charge with the evaluation and introduction of new technologies and components.

But now&then I get to do some „extra tour", like planning/installing in 2005 the (then) largest grid coupled PV system in Latin America, at the German school in El Salvador (see ppre newsletter 2006).

And exactly this system, and the publicity

Installation of monocrystalline PV-modules

that was created around it, has triggered the launch of another „large“ grid coupled PV project in San Salvador, for which I was hired as consultant and responsible engineer by the local solar company SEESA (www.seesa.com.sv/IS).

24,5 KWp Solar PV-system - CEL, El Salvador

Ordering customer was und operating agency will be the „Comision Ejecutiva Hydroelectrica de Rio Lempa (CEL)“, the body responsible for all state-owned power plants in El Salvador (which are in large part hydro power plants, as the name suggests).

The construction team (T. Schwarz 4th fr. left)

They want to enter in the construction of Solar power plants, with the aim to conserve water from the hydro power plants during the dry summer months (so Solar energy can even be used to save water :-).

As a first step they wanted to have a 25kWp test PV system on top of their administrative building, with different cell technologies (monocrystalline, polycrystalline, amorphous Si), with which they could gather operating experience and data. Therefore the system is equipped with all the sensors and monitoring equipment that one can think of - in fact they now have probably the best meteorological station in EL Salvador.

Needless to say that a couple of obstacles had to be overcome (availability of specific modules, financing troubles, transport/customs delays, installation problems, etc.), but in the end we succeeded with a „historical“ accomplishment:

On 1.June 2009, incidentally(?) on the same day that the first ever left wing government in El Salvador went into office, the now biggest PV system (25 kWp) in Central America (?anyone knows a bigger one?) started feeding into the grid of El Salvador.”

Mr. Orlando Perez, Bolivia (PPRE 96/07)

who is working for the local energy utility Electropaz S.A. in La Paz ever since he finished PPRE joined a project-team to prepare a feasibility study about connecting Photovoltaic Systens (> 1 kW) to their existing utility grid. Actually he is looking for contacts and inputs about utility‘s experiences gained with such issues, facing legal and technical aspects.

Mr. Sebastián Sancho Dobles, Costa Rica (PPRE 96/97)

wrote in January 2009: “I am still in Madrid, four years now. The adventure with the solar photovoltaic business continues but less hectic as in previous years. The market has changed substantially in Spain. After a tremendous growth we are currently suffering

the consequences of a non-very well structured government policy. It is likely that many players will be forced to shut down activities soon. We are not surprised, that's the way it is when the whole system does not think beyond today and without long term vision. Anyways, we will see.

Perhaps you have heard that Ralos has become a listed company in 2008. Former partners of Ralos GmbH sold their shares to a listed German company. The Spanish branch is now owned by two local partners (myself and another colleague of mine) and the new Ralos GmbH partners. The business is nowadays more related to O&M and management of PV plants, but perspectives do not promise much due the market situation and the new partnership policy. On the long run I am also looking forward to start doing something in solar in Costa Rica and Panama. Maybe in a couple of years the market will be ready to take off.

Latest news: as indicated earlier already Sebastian left Ralos for good and is now offering consultant freelance services for RE enterprises.

Mr. Santiago Sanchez, Ecuador (PPRE 2001/2002)

informed us in August this year that he is preparing a standard for photovoltaic systems and that he needs respective information about the symbols and diagrams of components, like panels, charge regulators, inverters, others. Any help is appreciated.

Mr. Antonio Antonopoulos, Canada (EUREC 05/06)

As of April 2009, Antonio joined CarbonFree Technology, a Solar Power project developer with operations in the USA (Arizona, California, New Jersey, etc.), and in the Canadian province of Ontario (www.carbonfreetechnology.com). Antonio will act principally as their regional manager for Ontario, but also in other markets as business needs may dictate. The main activity of CarbonFree is originating and financing PV projects. Last year, 6 MW of rooftop and parking PV were developed or financed in the US, and for the first half of 2009 they have 10 MW of potential projects in the pipeline.

Latest news: He has been accepted to present a paper on the Canadian PV market at the European PV Conference and Exhibition in Hamburg in September. He is looking forward to being in Europe again for this event.

Dr. Yann Tanguy, France (EUREC 07/08)

Currently Yann is employed with Transénergie, as a project engineer, and involved in several R&D projects, concerned with photovoltaics and smart electricity networks. Practically this means writing specifications, do the monitoring of PV, reading about PV inverters and their current norms, looking to be involved in EU projects, reading reports from subcontractors, etc..

4. Wind Energy

Mr. Ming Xiangjun, China (PPRE 91/92)

is still working for Goldwind Co. In China (http://www.goldwind.cn). Actually Goldwind purchased 70% shares of Vensys Co., Germany last year. Vensys is a German company which designs direct-drive permanent magnet wind turbine generators. They also bought a building with yard, offices and assembling workshop in Germany.

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

changed job in 2009. Before he was working as meteorologist with NaturEner, San Francisco, USA, where his duties included:

- Developing software for different wind resource analysis tasks, for in house use by different engineers in the wind energy analysis group
- Long term correlation between wind sites and reference stations
- Hub height wind speed calculations
- Qality control of meteorological parameters for effect of Icing, instrument failure, replacement and other related causes
- Conducting research for better energy production estimates

Now he is employed as an Associate Scientist at the National Center for Atmospheric Research in Boulder, Colorado. He is working on meteorological case studies for ramp up (sudden increase in a wind energy production -- not expected) and ramp down (sudden decrease in wind energy production - without being anticipated). These ramp cases are very bad for utility companies. In the case of ramp up they are losing energy which they could have sold instead of buying non alternative sources for the day and in the case of ramp down they will be forced to buy non alternative sources of energy at a very expensive price (as the planning of energy distribution for the customers takes place minimum of 12 hours ahead).

His research group is also working on wind energy prediction using in house software. Besides Alemu is also doing wind resource analysis and energy production assessment. His group is working on xcel energy (a utility company in Colorado) as a case study.

Mr. Panagiotis Triantafyllos, Greece (PPRE 01/02)

is living and working in Wilhelmshaven, Germany since end of last year, He joined the German Wind Energy Institute (www.DEWI.de) to work in the Mechanical Loads Measurement group.

Dr. Jörg Winterfeldt, Germany (PPRE 01/02)

joined GE Energy Wind, Salzbergen, Germany as Micrositing Engineer in May 2009 after finishing his PhD-studies successfully at at the Institute for Coastal Research at the GKSS

PPRE/EUREC gathering at GE WindEnergy in Salzbergen: 4 generations of RE student are employed at GE Wind these days: (fr. left: Mariana Pereira, Brasil (PPRE 08/10), Dr. Jörg Winterfeld, Germany (PPRE 01/02), Vanessa Martinez, Venezuela (EUREC 06/07) & Luis Vera Tudela, Peru (PPRE 05/07), who is missing in the picture.

Research Centre near Hamburg. At GE Wind he will be mainly in charge of the implementation of scientific approaches/methods with respect to micrositing (MCP, extreme winds, etc.)

Mr. Alejandro Umana, Columbia (PPRE 01/02)

left UPC Renewables in the beginning of 2007 and moved to BP Alternative Energy to manage the development activities (Wind) in Central and Eastern European countries. He worked for BP for a period of almost 2 years and they were doing very well but unfortunately BP decided to close down all clean energy related activities in Europe and Asia and consequently Alejandro changed job and is now working with Platina Partners in London.

Platina Partners is a London and Paris based private equity fund manager, specialising in two areas of investment: European renewable energy assets and businesses at all stages of development, and buyouts in turnaround and special situations in the lower mid-market. Platina has been investing in renewable energy since 2002 and currently has over 270 million dedicated to the sector. Through its funds, Platina is able to invest in renewable energy companies and projects at all stages from early stage development through to construction and operations. Their principal focus is on European renewable energy projects and companies involved at all stages from development through to operation.

Mr. Alejandro Bango , Spain (PPRE 02/03)

After several years living and working in Brazil, last year October Alejandro was hired by a Spanish company in Madrid. Actually he is involved in major wind energy projects in Europe and maybe also in Latin America.

Mr. Nicolás Enrique Veneranda Mola; Argentina (PPRE 03/04)

He is still employed at the Energy Division of Lahmeyer International GmbH (www.lif.de), where he is involved with Wind Energy Projects. In early 2009 Nicolas was in charge of putting up a wind measurement system in Latvia.

Mr. Aris Dimopoulos, Greece (EUREC 04/05)

Since May 2006 Aris is working for a consulting/developer company mainly on wind energy projects in Greece, but recently they are trying to expand also into the PV project field. The name of the company is ENTEKA (www.enteka.gr). His position is wind & site engineer for the wind energy department (he is doing all the energy studies for the wind department). But since they are growing fast in the PV-field as well, Aris is also doing some basic (for the moment) energy studies for PV-projects.

Mr. Georgios Pechlivanoglou, Greece (PPRE 05/07)

Here is an update from my side for the PPRE Newsletter:

I am still in Berlin, working in the field of Wind Energy and doing my PhD in Wind Turbine Aerodynamics at Technical University o Berlin.

More specifically I have moved from Suzlon Energy to a small Aerodynamics' Research Company called Smart Blade GmbH where my work is much closer to my PhD topic and I can focus entirely on aerodynamic issues.

The headquarters of this company are located the South of Germany, but I am in Berlin working from my home-office and in collaboration with TU Berlin.

We are focusing on aerodynamic flow control solutions for the „smart" wind turbine blades of the future; therefore my daily life now includes tons of studying, CFD simulations and very frequent Wind Tunnel test campaigns.

Things look promising but the required effort is also very high. However as long as it is fun.... and it is actually great fun...then everything is fine.

Ms. Panagiota Karampela, Greece (PPRE 06/08)

Since about one year Giota is employed as Siting and Performance Engineer in the Product Support Department at Vestas Hellas Wind Technology S.A. (www.vestas.com). Meanwhile she considers herself as a 'Wind' person, who would like to stick to this interesting and for Greece promising technology on the long run.

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

joined the Department of Dynamic Systems of TÜV NORD SysTec GmbH & Co. KG in Hamburg. TÜV Nord is a large testing and certification body. His department is dealing with certification of wind turbines; they check calculations for tower, foundations, rotor blades as well as doing site assessments for wind energy projects.

Mr. Leonardo Perini, Italy (EUREC 06/07)

After the good experience with a Wind Turbine Manufacturer in Spain, Leonardo decided to move to the Wind farm development side.

Now he is working for an Italian subsidiary, in Rome, of a German company called WPD (www.wpd.de - headquarters are in Bremen).

In Italy they are developing Wind and Solar projects. In particular Leonardo is taking care of 2 bigger offshore projects planned. Actually he is in the interesting phase of the Environmental Impact Assessment.

Ms. Mairead Lynch, Ireland (EUREC 07/08)

joined Wind Prospect SAS in Paris as Junior Consultant. She carries out due diligence reviews of wind projects in operation, construction and development in France for vendors and also for those interested in acquiring wind far Ms. This involves a very detailed audit of all project documents, liaison with the client to clarify issues and site visits to verify project advancement and compliance. She is currently working on a vendors portfolio with 65MW in operation and over 700MW in development. However in the long run she is hoping to find work in which she would have a more direct involvement with smaller scale solar/wind projects.

Wind Prospect (http://www.windprospect.com/) has offices worldwide with its head office located in the UK, where there is a focus on development, advisory services and construction. In France they work only in advisory services for operation, construction and due diligence. Actually Mairead was initially contacted by Wind Prospect through „Linked In" and then arranged a meeting with them at the EWEC conference in Marseilles, so it is really worthwhile for any of the current class looking for work to join up to such networks and get out to conferences to meet as many people as possible.

Mr. Bedrettin Güner, Turkey (PPRE 07/09)

started to work for Garrad Hassan Deutschland GmbH in Oldenburg right after PPRE. He works in EDS (Energy Development Services) for projects mainly in Turkey and Eastern Europe. After four months training period in Bristol office, he came back to the German office in Oldenburg, where he is located permanently since August 2009.

Mr. Chandra Prakash KC, Nepal (PPRE 07/09)

also joined Garrad Hassan Deutschland GmbH in Oldenburg. He already did his Msc thesis project with GH (www.garradhassan.com)

He was also asked to complete a 2 months training in Bristol, UK, before joining the Deutschland office from GH in Oldenburg.

Mr. Giovanni A. Pabón Restropo, Colombia (PPRE 07/09)

wrote about his job/company after PPRE:

It is called Innovative Windpower AG and is located in Bremerhaven. They are working on the design and construction of a new wind turbine for the emerging markets with a rated power of 1.25 MW. Actually it is planned that two prototypes will be ready for September 2009.

During the time of my thesis I was working with the design of the handling tools for the assembling, transport and installation of the turbine, now that this handling tools are ready and I got a new contract, I will be in charge of being the interface person between the people working in the factory and the people working in the office, that is to clarify the assembling sequence, make control of quality of the components arriving in to the factory and record the assembly sequence to write down at the end the installation manual.

Ms. Leila Garcia da Fonseca, Brasil (PPRE 07/09)

joined the Sales & Marketing Department of Vestas do Brasil Energia Eólica Ltda. in Brazil directly after she finished her PPRE-studies in Oldenburg – www.vestas.com

Mr. Stanley Achibiri, Nigeria (PPRE 07/09)

Started to work as Project Assistant for Wind Resource with CUBE Engineering GmbH in Kassel, a Wind Energy Consultancy, which offers a range of services that cover nearly every aspect of wind energy: from technical reports, simulations, feasibility studies, and consultancy for planning right through to the development of total energy concepts.

Mr. Scott Townsend, US (Eurec 07/08)

joined Deutsche WindGuard GmbH in Varel (approx. 30 km north from Oldenburg) right after his EUREC-Studies. Dt. Windguard is a Wind Consultancy with over 20-years of relevant experience in output production, wind farm operation, financing, electricity supply, project development and policy (www.windguard.de).

Mr. Petros Paterakis, Greece (Eurec 07/08)

also joined Vestas Hellas Wind Technology S.A., Athens, Greece for 6 months as a siting and performance engineer after his EUREC studies. After this limited contract he needs to do his military service for 1 year starting August 2009.

5. RE related Subjects

Various PPRE-generations met up in Nairobi while participating in the GTZ Micro Hydro Power Workshop for East Africa which was held in Nairobi (5.5 -7.5.2009):

(fr. left:) J. Wyclif, Uganda (PPRE 05/07), S. Potzmann, Austria (PPRE 07/09), A. Michel, Germany (PPRE 04/05) and C. Zarate, Peru (PPRE 87/88 !)

Mr. Patrick Mugisha, Uganda (PPRE 91/92)

is still lecturing at Faculty of Technology, Makerere University, Kampala, Uganda. He is actually involved in the preparation of teaching materials (Renewable energies; Energy and Environment/Climate change; Sustainable development; Information Technology; Gender and Environment). This programme is supposed to greatly influence Development and Poverty Alleviation especially in rural areas of developing countries.

Dr. Rolf Georg, Germany/Bolivia (PPRE 92/93)

wrote:

"Recent history shows, that our topic, the RE-Technologies are worth to be developed. When I was working in GTZ Biogas Dissemination Project, me and my colleagues were often the target of bad jokes made by people who were working with „real technologies". Nowadays a lot more of people know better than then about the importance of RE-Technologies and they are being accepted more and more.

I am living since 1986 in Bolivia and at the moment me and my wife run an own a private school. RE-Technologies form part of our curriculum and we hope that some of our students in the future will work in the field of RE. I am working with the elder students in the „Workshop for Renewable Energies and Appropriate Technologies", where we build solar cookers, models of bio digesters, wood saving stoves, solar dryers etc.

I would appreciate if some of you could send me information materials about RE, specially building instructions for RE models to my E-mail address."

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

As RE expert Wisdom is working nowadays for the Ghana Energy Development and Access Project (GEDAP) from the Ministry of Energy in Ghana.

Besides he is also actively involved as lecturer (together with other PPRE-alumni from Ghana) in the 'Renewable Energy Education Project', which consists of several short courses (3-4 days each) with respect to different RE-technologies at the College of Engineering, KNUST, Kumasi.

If the first courses are successful, they would like to establish these summer schools on a yearly basis.

Additionally Wisdom was quite involved in the preparatory activities towards the establishment of the International RE Agency (IRENA), where he took part as representative

of Ghana in the founding Conference, which took place in Bonn, Germany in January 2009.

As member of the Administrative Committee of the Preparatory Commission for IRENA he went to Austria from 13-18 April where he attended a retreat to discuss the work-programme for IRENA and arrangements towards the selection of IRENA headquarters and the Director General.

Latest news: *Wisdom travelled to China in June 2009 to inspect solar PV systems his Government is importing from China to support their solar PV electrification in remote off-grid health centres. The visit has taken him through the length and breadth of china, where the different components (PV model, batteries, lamps, inverters, charge controllers etc. are being produced. The Ghana Government is importing systems worth only US$1.0 million.*

In his opinion China is becoming a cheaper source of quality solar PV products. His trip took him to from Guangzhou, via Shenzhen, Nanjing, Wuhan and finally Beijing.

Mr. Srikanth Subbarao, India (PPRE 00/01)

is currently doing his PhD with respect to CDM at the Department of Physics, University of Otago, New Zealand (please see details in separate article). Besides he is also working as a consultant to the Asian Development Bank looking after the Pacific region for development of small-scale Clean Development Mechanism (CDM) projects under the Kyoto Protocol.

Mr. Santiago Sanchez, Ecuador (PPRE 2001/2002)

As General Manager of Enerpro Consultancy he informed us that his company bought and moved to a new building within Quito in May 2009. There seems to be a lot of things going on in the RE business and his company is actively involved, in spite of the general situation in the nation and the worldwide crisis ("Our crisis is permanent so this is no new to us"). Besides Santiago is still trying to establish an Ecuadorian Solar Energy Society, for which he is looking for valuable contacts still.

At the beginning of 2009 he wrote: "…..This year we are looking at some interesting projects: one of them is a small wind farm of 3 MW for the Galapagos Islands, where we are working on our proposal with a Chilenian company called 'Servicios Eolicos'.

There is a need of the Government to reduce the consumption of LPG for water heating with solar thermal systems. We have imported some samples of vacuum tube collectors so that the Ministry of Electricity and Renewable Energies can do some tests on them. Solar PV is still our strong area and we are installing several systems for isolated rural areas and also introducing the use of LED lighting systems and grid connected inverter systems. Who knows we might introduce also this year the pellet solution for water heating….".

Mr. Manoj Khadka, Nepal (PPRE 2002/03)

is working in UNDP supported Rural Energy Development Program (REDP) for past 3 years in the capacity of Rural Energy Development Advisor(REDA). His major role is to support for planning and implementation of rural energy schemes especially micro hydro in the remote parts of Nepal without access to electricity grid and more focused on central level strategic planning and monitoring works. In the mean time, he also worked in UNDP country office Nepal for 6 months as a programme officer in Energy and Environment unit.

In mid of August 2009 he got an opportunity to visit Tajikistan for 2 weeks to work as Rural Energy Expert for the project that is provi-

ding energy advisory support to Government of Tajikistan with support of UNDP. It was a good opportunity for me to provide recommendations from my experience to implement similar program in Nepal.

They are still associated with the Oldenburg programme by forming a group which is called Nepal Oldenburg Renewable Energy Center (NOREC); though not active at the moment they do gather quite often to remember those days. Actually many alumni from Nepal are abroad. Last year they could organise a Training on Micro Hydro to Afgan Engineers with the support from our alumni there.

Mr. Naveed Akhtar, Pakistan (PPRE 04/06)

informed us that he is about to finish his PhD with respect to Fuel Cell (SOFC) Modelling at University in Birmingham, UK by end of October 2009.

Mr. Shahriar Ahmed Chowdhury, Bangladesh (PPRE 04/06)

who is working as Assistant Professor at the Department of Electrical and Electronic Engineering, United International University, Dhaka, informed us in late 2008 that the Council of Advisors in the Bangladesh Government has approved the New Bangladesh Renewable Energy Policy. No doubt this will create a significant impact on the RE activities in Bangladesh, since now the investors in RET projects will get relief from corporate income tax for the next 5 years. This will encourage many entrepreneurs to invest and contribute in this sector.

Additionally Shahriar wrote in May 2005:

"It is my great pleasure to inform you that a student team (from United International University, Bangladesh) under my supervision has been selected as the finalist for International Future Energy Challenge- 2009 (Topic A) organised by IEEE (http://www.energychallenge.org/main_2009.html)

Only three teams around the whole world have been selected for the final competition, which will be held in Chicago, Illinois, USA in July 15-17.

The challenge was to design an Integrated Starter/ Alternator-Motor Drive for Automotive Applications.

Latest news: *On his travels to the US, his machines and the control circuits were damaged by the airport authority during security checking. Shahriar wrote: "It was very much painful to see this awful conclusion after a yearlong hard work that was required to reach the final position. None of the team could fulfil the challenges, but we could do that. Now we are trying to patent our machines."*

Please see also the detailed report about his ongoing activities in different chapter.

Mr. Panagiotis Mantas, Greece (EUREC 04/05)

After working with Lahmeyer International in Frankfurt, Panagiotis returned to Greece to work as freelancer in the field of geothermal energy (brine to water heat pumps etc.) and solar heating.

Mr. João Paulo Adler Gomes Dacosta (EUREC 04/05)

rejoined former INETI (now: INEG) in Lisbon, Portugal, where he had been working before doing the EUREC master in 2005. He is now working in two projects: the supervision of a hot water installation in an apartment complex (solar thermal system, which serves a set of three apartment buildings with a total of around 20 houses); and the POLYSMART project, which is part of an international effort to develop and test CHPC absorption machines

to produce heat, cold and electricity using different power sources (the ones he is working on will use either biogas or biodiesel).

Mr. Seth Agbeve Mahu, Ghana (PPRE 05/07)

In September 2009 he sent an update about RE developments in Ghana:

The RE sector is gradually gathering steam with two major activities in the ongoing. The first and most important activity is the development of a national renewable energy policy and law for Ghana. PriceWaterHouse Coopers are the main consultants for this project. The first and second draft of this important work has already been reviewed. Actually Mahu was privileged to be part of the review team on this project. Tentatively, this document should be at cabinet for consideration by December 2009. After which, it will be presented to parliament for passage into law.

The second most important development is that the world bank in collaboration with the Ministry of Energy and the Ghana Energy Commission are in the process of completing a terms of reference for a big wind resource assessment programme. The RFP is likely to take off in tandem with the RE Policy and Law.

"For me, these are two major milestones we are chalking as a country in our quest to push renewable energy development from its current state to a utility/commercial scale. It is heart-warming that, two products of PPRE -he probably means himself and Wisdom A. Togobo (PPRE 97/98)- are at the hem of issues and earnestly pushing the drive for the development of the RE sector of Ghana.

Ms. Valerie Bennett, Canada (EUREC 06/07)

wrote: "I'm enjoying my work at Marbek Resource Consultants and I've become involved with more aspects of energy policy/program planning and evaluation. Currently, I'm involved with demand-side management (DSM) through conservation potential review for various natural gas and electricity utility companies. I've also been providing technical review of applications for renewable energy and energy efficiency projects in Canada including onsite energy auditing of public buildings. Finally, I am involved in a project regarding best practices in renewable policy and programs in Europe, North America and Asia. I'm enjoying the pace and the variety of projects, as well as the opportunity to meet so many people in the energy field, both in Canada and abroad.

Mr. Nar Bahadur Khatiwora, Bhutan (PPRE 06/08)

returned to the Renewable Energy Division, Department of Energy at his Ministry. He is involved in solar thermal and biogas projects and promised to send more details when projects are over (see also article).

Mr. Alan Cuddihy, Ireland (EUREC 07/08)

stayed with PCH International in Shenzhen, China, where he already did his Master project. PCH 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.

Mr. Giorgios Sandris, Greece (PPRE 07/09)

is still working for the Energy Technology Department at Fraunhofer-Institut für Solare Energiesysteme - ISE in Freiburg. There he was already doing his MSc-project on 'Development (designing-construction-testing) of a Prototype Methanol Fuel Cell'.

Mr. Ibnu Kahfi, Indoensia (PPRE 07/09)

returned home after successful completion of his PPRE studies. In Indonesia he would like to implement the knowledge gained in Germany. Actually Ibnu is already involved in the Indonesia Renewable Energy Society (IRES/METI) and he joined a group who are trying to build up a complete database about renewable energy in Indonesia.

He also plans to establish a company with some friends and one of the business fields will be energy.

Ms. Unchalee Parinyacupt, Thailand (PPRE 07/09)

rejoined the energy business development section of the Provincial Electricity Authority back home in Thailand.

6. Careers

Mr. Gimba Hassan, Nigeria (PPRE 90/91)

After 9 years living in the US, Gimba left in February 2009 for good. He is currently in Al Ain (near Dubai), United Arab Emirate (UAE) teaching Electrical Engineering at a Higher College of Technology (HCT).

Dr. Jagjit Kaur, India (PPRE 91/92)

wrote after a long silence:

"Hi Edu, I don't know if you remember me (1991-1992 batch). I was browsing through the PPRE website and remembering my sweet memories.

After getting PhD in Civil Engineering from the State University of New York at Buffalo, New York in 2002, I have been working as a consultant/modeller in USA. I have been working in a large civil engineering consulting firm, CH2M HILL, Inc. We have been working all over the world. We have offices in Germany also. Currently, I am working from the Los Angeles, California office. In fact, I work in projects from various parts of USA including Santa Barbara, San Diego, San Francisco, Los Angeles, Thousand Oaks, Florida, New York, Michigan etc.

Professionally, I have been successful and managing many projects including water quality modelling and environmental engineering as Project Scientist/Project Manager."

Mr. Udayan Pandya, India (PPRE 92/93)

is currently working for a company called Raman Development Consultants Private Ltd (www.ramanagroup.org). They are contracted by National AIDS Control Programme (Govt of India) to manage a technical support unit to support national AIDS Control programme in Delhi State. Udayan has joined as a team leader (TSU & Strategic Planning). His duty is to manage this project as a project manager. His unit monitors and provides technical assistance by handing about 70 projects being implemented by NGOs to provide various services to population (such as sex workers, injecting drug users, homosexuals) that is at risk of contracting HIV infection due to unsafe sexual practices or exchange of infected needles (injecting drug users).

Mr. Olivier Donat Andriamahefaparany, Madagscar (PPRE 93/94)

started a non-degree program in Mid 2009 with an International Fellowship Program at the Hubert H. Humphrey Institute of Public Affairs, University of Minnesota, US.

The programme is structured in 3 parts:

- Academic study at the University (Public Policy, Public leadership and Public Administration)
- Professional development: Learning some useful skills for the future job
- Professional affiliation/internship: Olivier will probably do it at the legislative branch of the State Government of Minnesota.

Mr. Björn Kuntze, Germany (PPRE 94/95)

After working for many years with gasifiers Björn left the RE field for the time being and joined the Hansa Ventilatoren- und Maschinenbau Neumann GmbH in Strücklingen, Germany in 2008. They are manufacturing air condition and ventilation devices.

Mr. Raveendra Sellahewa, Sri Lanka (PPRE 94/95)

informed us end of last year that after 15 years of working in IT he is thinking of moving into Wind Energy, which has started picking up in Australia as people are willing to spend a bit more for environment friendly energy than before. Maybe Ravi is able to use the existing market to get into Wind Energy again (actually during PPRE he did internship and thesis about Wind Energy!).

Mr. Awa Celestine Anyam, Cameroon (PPRE 96/97)

is still working for the Cameroon government. Recently he was appointed 'Regional Delegate of Energy and Water Resources for the North West Region of Cameroon'. As head of Energy and Water Resources in this Region of the country, they are in charge of a strict follow up that all Government policies in the different Energy forms and Water Resources are respected. They also carry out rural electrification projects and portable water supply projects to urban and rural areas in the region.

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

is living since several years in Spain, where his last employment was as Maintenance planner, investigator and as researcher with an international organization called Multiserv Iberica S.A. in Barcelona.

Mr. Sibusiso Dlamini, Zwasiland / South Africa (PPRE 98/99)

informed us that he is employed at General Electric, Johannesburg, South Africa.

Dr. Khishigbayar Jamiyansharav, Mongolia (PPRE 98/99)

is doing her PhD-studies entitled 'Long-term analysis and appropriate metrics of climate change in Mongolia' at the Graduate Degree Program in Ecology at Colorado State University here in Fort Collins, Colorado. Actually she will officially graduate in the coming fall but has already defended her thesis. She will send some graduation pictures in December.

Dr. Butchaiah Gadde, India (PPRE 00/01)

informed us that he successfully defended his PhD at the School of Energy and Environment, The Joint Graduate King Mongkut's University of Technology Thonburi, Bangkok, Thailand, and fulfilled the academic requirements (two published international journals papers) to graduate doctoral study in July 2009.

He is working as a consultant for UNDP, located in Bangkok, Where he is expected to stay for one more year.

Mr. Sham Sundar, India (PPRE 00/01)

Director, NIE-Centre For Renewable Energy & Sustainable Technologies (NIE-CREST - www.niecrest.org), National Institute Of Engineering(NIE) in Mysore was invited by the Project TREE Program to participate in the „Off-grid PV" Training program at Berlin from 19th to 23rd Jan 2009. The training was organized by RENAC, Berlin. This project was facilitated to transfer of know-how in renewable energy technologies, energy efficiency and climate protection for decision makers and engineers from developing and emerging countries. The program was sponsored by the Federal Ministry for the Environment & Nature conservation & Reactor safety in Germany.

Additionally Sham informed us about the following recent activities at NIE-CREST:

Shamsundar (middle) with fellow participants at TREE-program in Berlin

- Dr.Anna Pegels, Researcher from the German Development Institute, Bonn, Germany visited NIE-CREST from 31st September to 6th August 2009 for a study project on Renewable Energy in India.
- Mr. Frank Hofmann, Bio Energy Consultant from ECOFYS, Berlin, Germany visited NIE-CREST on 19th Feb 2009.
- Mr. Frank Hofmann, Bio Energy Consultant from ECOFYS, Berlin, Germany visited NIE-CREST on 19th Feb 2009.
- NIE-CREST along with "Arunodaya" TATA BP Solar India Ltd, Bangalore completed a series of 30 awareness programs on "Renewable Energy Technologies" for schools/ Colleges/SHGs/NGOs/ Industries in and around Mysore. „Arunodaya" is a programme under TATA BP and the aim of the programme is to disseminate Renewable Energy Technologies through lectures and demonstration programmes. The program imparted awareness about the importance of renewable technologies and the natural resources available around us.
- NIE-CREST conducted a one-day seminar on Integrated Water Resource Management for Drinking Water Supply and Sanitation in association with the Karnataka Environment Research Foundation, Bangalore on February 28, 2009.
- Shas been invited to participate and also give a presentation in the International Summer School on "Mobility & Renewable Energies" at the Department of Efficient Energy Conversion at Kassel University, Germany from 13Th to 23rd September 2009. Thereafter he might visit PPRE, Oldenburg.

Mr. Ram Prasad Ghimire (PPRE 00/01)

moved to Kabul, Afghanistan to work with the Norwegian Church Aid in the field of development.

Mr. Henry Nota Nanji, Cameroon (PPRE 01/02)

wrote in early 2009: "I am currently in the UK where I am teaching science (sounds strange) in a college and offering some courses in Renewable Energy. I had to move to UK three years ago from Cameroon because my wife picked up a job here and it was imperative that we stay together. I am not working directly in RE because it has not been easy getting a job in that sector. However, I am considering doing PhD around biofuels.

I have visited Germany once since I left Oldenburg, and I am hoping to visit Germany again before 2009 runs out. I will definitely visit Wechloy campus (the picture is still fresh in my mind).

Mr. Loukas Pilalas, Greece (PPRE 01/02)

quit his job in October 2009 to join an annual programme to qualify as a teacher in technical education.

Mr. Everson Possamai, Brazil (PPRE 03/04)

Together with his family Everson was transferred by his Brazilian company for an undefined period in July 2009 to Texas, USA. His job is to develop a waste to energy project. The waste is from polymeric compounds. The technology to get the energy from this waste is to be studied and that is his main task.

Mr. Iresha Somarathne, Sri Lanka (PPRE 03/04)

Iresha Somarathne meets Dr. Blum in Oldenburg

was invited to and actually participated as representative of his company in the Global Energy Award Ceremony, which took place in the Czech Republic on 12th April 2009. The Brandix Eco Centre, Iresha is working for, was appointed National Winner for Sri Lanka and was named one of the three nominees for the Energy Globe award in the 'Air' category. Although they did not receive the global energy award in the end, it was still an impressive honour to be selected for the final round, because overall 769 projects in 111 countries were evaluated for the 5 categories. He visited Oldenburg on this occasion and presented his company's achievements.

Mr. Mathieu Sarran, France (PPRE 03/04)

informed us in July 2009 that he just quit his job in Operation and Maintenance of wind and solar farms in order to get involved more into project management and construction of RE power plants.

Mr. Prakash Sapkota, Nepal (PPRE 04/06)

is living in Edinburgh, Scotland for 2,5 years and is working in an Engineering Consultancy called ‚Ramboll Whitbybird'. Ramboll group is a big company with its head office in Copenhagen, Denmark and Ramboll Whitbybird is one of its business units located in London. (www.ramboll.co.uk/)

Mr. Burak Türker, Turkey (PPRE 06/08)

Earlier this year Burak started his PhD studies with respect to Energy storage at the Next Energy Institute (EWE-Forschungszentrum für Energietechnologie e.V.) - www.next-energy.de at Wechloy campus in Oldenburg (see also previous article)

Before he was working as lab & research assistant at PPRE.

Mr. Simeon Obinna Nwaogaidu, Nigeria (PPRE 07/09)

enrolled as PhD student at Institute for Material Science at University of Münster, Germany, right after his PPRE-studies. His research work is on Atom Probe Tomography of all solid state batteries. The research is aimed at reducing solid state batteries into thin films and improving the performance.

Almost simultaneously Simeon got a fixed-term contract (1,5 years) with the UN, where he joined the Communications and Information Technology Section in the Democratic Republic of Congo. Apart from other designated special assignments, his main terms of reference include:

- to plan and evaluate the requirements for certain units, such as raising requests for the spare parts required for Uninterruptible Power Supplies (UPS), Inverters, Batteries, Solar panels, Regulators and other renewable energy generators.
- Electrical wiring and Installation of communications equipment
- Programming and troubleshooting of heavy duty UPS from 0.7 to 200 KVA
- to carry out preventive maintenance of these equipments and
- to provide training and guidance in relation to all renewable energy sources.

Simeon (right) installing Inverter for PV-system

5 KVA PV-system for Satellite Communication

Recent PPRE meeting in Uganda: Silvia & Simeon

5 KVA PV-system for Satellite Communication
Within his three weeks of resumption Simeon already successfully implemented some grounding and protection projects as well as 5.0 KVA Solar generators for the Satellite Communication equipments.
Simeon is planning to really start with his PhD in Mid 2010.
In June 2009 Simeon met up with his former fellow.....

Ms. Silvia Potzmann, Austria (PPRE 07/09),

who joined the GTZ-office in Uganda after PPRE. Her boss is Mr. David Otieno, Kenya (PPRE 04/06), who is the Program Manager of GTZ in Kampala, Uganda. Well, this is probably called 'PPRE-Networking at its best!'

Mr. Ian Phillips, US (EUREC 07/08)

spent 4 months in Ashikaga, Japan as a guest researcher. The local research institute (Ashikaga Institute of Technology) has a triple hybrid system on-site (solar, wind, biofuel/gasification), and the majority of his time was spent investigating the gasification of woody biomass component. It was definitely an interesting experience, but now his job search continues...

Silvia P. at her GTZ - desk

Case Study for a large scale PV power plant in Rajasthan, India

Dwipen Boruah PPRE 2005-07 *

1. BACKGROUND

Power capacity in India has risen at the rate of 5.87% per annum over the last 25 years. The total supply of electrical energy has risen at the rate of 7.2% per annum over the same period. This reflects a gradual improvement in the average Plant Load Factor (PLF) of thermal plants (which stood at 74.8% in 2004-05) as well as a decline in the share of hydro in the power generation mix . As on Jun 30, 2009, the installed Electricity Generation capacity of India stands at 1,50,323.41MW and the plan is to almost double this capacity by end of 12th plan (year 2017). With a targeted GDP growth rate of 7-8% the energy growth rate expected to rise at 5.6 - 6.4 percent per annum. This implies 5-6 times increase in Electricity Supply by year 2031-32. An estimated power generation capacity of 800GW will be required to meet the demand.

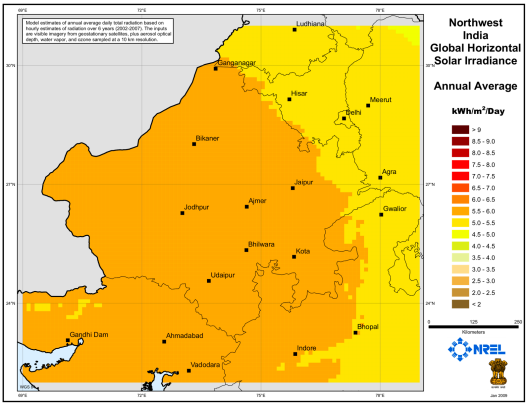


Figure 1: Solar map of northwest India

Solar energy is the most readily available source of non-polluting renewable energy. With about 200 clear sunny days in a year, India's theoretical solar power reception, just on its land area, is about 5 EWh/year (i.e. = 5000 trillion kWh/yr ~ 600 TW). The daily average solar energy incident over India varies from 4 to 7 kWh/m2 with about 2300 - 3200 sunshine hours per year, depending upon the location.

The highest annual global radiation in India is received in Rajasthan and northern part of Gujarat. Rajasthan with a vast availability of wasteland receives highest solar insolation equivalent to 2185 kWh/m2/annum. As a result, Rajasthan is likely to emerge as the solar powerhouse of the country with the possibilities of setting up installed capacity of more than 100,000 MW.

Government of India Initiatives

Ministry of New and Renewable Energy (MNRE), GOI has been promoting new and renewable energy sources in a big way in India. Government of India envisages 14,000 MW capacity additions during 11th five year plan (2007-12) from renewable power generation. While about 10,000 MW is expected to be from wind power, the balance is to be realized by solar and other renewable energy systems. The Electricity Act 2003 clearly mandates state electricity boards to adopt minimum percentage for procurement of electricity from renewable energy sources. Accordingly, about 13 state electricity board regulatory commissions have initiated action to meet this requirement. MNRE has formulated the guidelines on generation-based incentive for grid interactive solar power projects.

The draft **National Solar Mission** dated 29th April 2009 indicates India's ambitious target to generate 20GW solar power by 2020. The plan covers both grid and off-grid solar energy generation and distribution. In the first stage, the draft envisages generating 1-1.5 GW of

solar power by 2012, 6-7 GW by 2017 and 20 GW (installed) by 2020. It calls for using 40-50 million sq metres of surface area in domestic, industrial and commercial areas. The Central Electricity Regulatory Commission (CERC) in its draft Regulations (Terms and Conditions for Tariff determination from Renewable Energy Sources) notified on 15th May 2009 suggested favourable tariff structure for solar PV and solar thermal power plant.

The state government of Rajasthan has received a number of proposals from private investors to set up solar power plant in various locations in the State. The Government of Rajasthan is creating a land bank with technically feasible potential sites for solar power projects.

2. THE SITE

The proposed 5MWp (STC) PV power plant site is located in a hot dry desert area of Jaisalmer district of Rajasthan State of India. The topography of the site is apparently flat and free from trees or any kind of permanent vegetation. Average monthly temperature in winter is 20-30 degree Celsius and 35-44 degree Celsius in summer. The annual average rainfall is around 500 mm to less than 100 mm with high variability from year to year and four out of every 10 years on an average are drought years. Strong winds blow for four to five months in a year over a large part of the desert region. Dust storms during summer are a common feature.

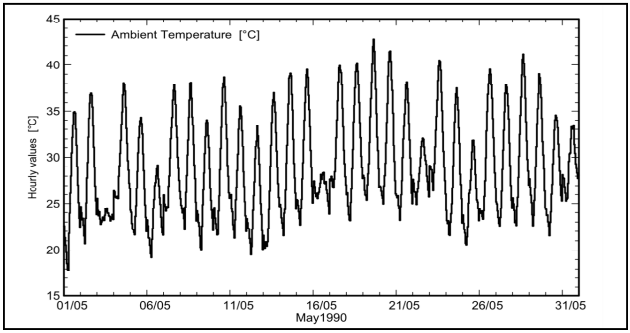


Figure 2: Hourly average ambient temperature in the site

3. TECHNOLOGY PERFORMANCE EVALUATION

Annual Energy Yield for the proposed PV power plant was estimated after due consideration of all kinds of generation and distribution losses. PVSYST v4.37 was used to simulate annual energy yield from the power plant. The following types of IEC standard modules manufactured by world's renowned companies were used for simulation.

(i) Polycrystalline silicon

(ii) CdTe thin film

(iii) Amorphous silicon single junction thin film

Solar and mean hourly temperature data from Meteornom was used for energy yield simulation for a seasonally tilted array surface considering 0o azimuth angle. The optimum tilt angle was found to be 15° during summer and 50° during winter.

Generation Loss

Simulation result for losses in the PV power generation process is summarised in the Table 1. The result shows that, generation loss due to temperature is highest for c-Si module (-11.2%) and lowest for a-Si thin film modules (-7.7%). Similarly generation loss due to irradiance level is highest for c-Si module (-3.2%), while for a-Si thin film modules there is a gain of +2.7% due to better performance in diffuse sunlight. The estimated life of PV modules is considered as 25 years. Performance degradation over lifetime was considered @0.8% per annum at the output of the inverters.

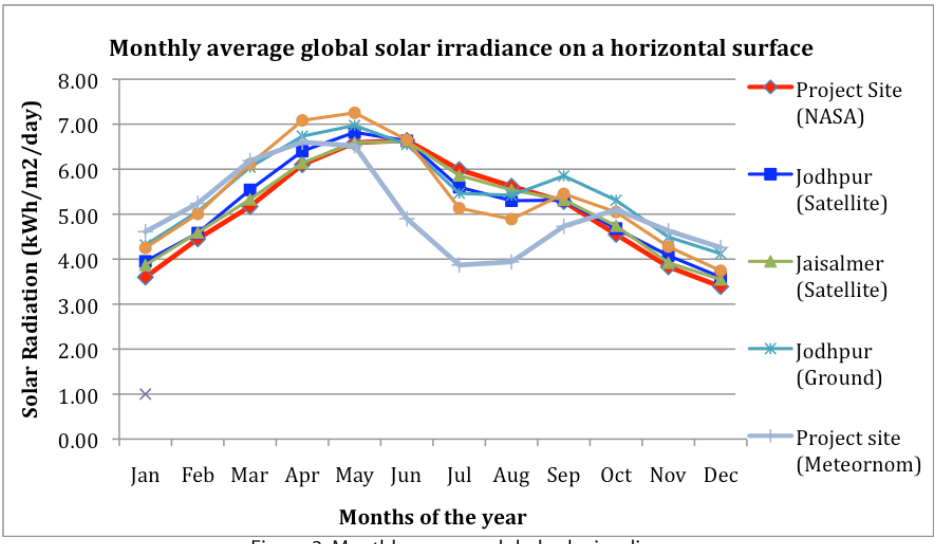


Figure 3: Monthly average global solar irradiance

Loss in the Electrical Systems

The transmission and transformer losses beyond the inverter output will depend on the quality of power equipments and conditions specific to the location and state utility infrastructure. Loss in the electrical systems will occur due to transmission system outage, self-consumption, control and protection and no load losses of step-up transformers. The total losses from the Inverter output till the Busbar output considered as 4.5%.

Monthly and annual average energy yield from the power plant for different PV technologies are presented in Table 2 considering all losses during generation and transmission.

Table 1: Loss in PV generation

Efficiency/ Losess	c-Silicon (Poly)	CdTe	a-Si (Single jn)
Efficiency	12.4%	11.3%	6.6%
PV loss due to irradiance level	-3.2%	-1.9%	+2.7%
PV loss due to temperature	-11.2%	-9.3%	-7.7%
Module quality loss	-3.2%	-3.2%	-2.9%
Module array mismatch loss	-2.2%	-2.1%	-1.9%
Spectral correction for amorphous	0.0%	0.0%	-0.6%
Ohmic wiring loss	-2.2%	-2.2%	-2.0%
Inverter loss during operation	-2.8%	-2.8%	-2.8%

Table 2: Energy yield for different PV systems at the proposed site

Months of the year	Monthly average global solar irradiance on a horizontal surface (KWh/m²/ day)	Energy Yield from 5MW PV Power Plant at the proposed site (kWh) with seasonally optimized tilted array					
		c-Si		CdTe		a-Si	
		Inverter Output	Energy Exported to Grid	Inverter Output	Energy Exported to Grid	Inverter Output	Energy Exported to Grid
Jan	4.61	899582	859101	923205	881661	940007	897707
Feb	5.24	792825	757148	815636	778932	841832	803950
Mar	6.19	793586	757875	816656	779906	863239	824393
April	6.6	776562	741617	800812	764775	853252	814856
May	6.52	751963	718125	777861	742857	836967	799303
June	4.9	541469	517103	564513	539110	623101	595061
July	3.87	438502	418769	461606	440834	515018	491842
August	3.94	458978	438324	481426	459762	536473	512332
Sep	4.73	565199	539765	587039	560622	635316	606727
Oct	5.1	728657	695867	752613	718745	792727	757054
Nov	4.63	808837	772439	831373	793961	856984	818420
Dec	4.26	870243	831082	893874	853650	906341	865556
Annual	5.05	8426404	8047216	8706615	8314817	9201257	8787200
Variation in annual energy yield with respect to c-Si			0.00%		3.33%		9.20%
Total area required		27 acres		29 acres		46 acres	

The result in the table shows that annual average energy yield from amorphous silicon thin film is 9.2% higher than that from c-Si modules. However, total area required for a 5MWp a-Si thin film PV power plant is much higher than other PV technologies. Amorphous silicon single junction thin film solar PV module was recommended for the proposed project in Rajasthan due to the following reasons:

(i) Lower cost than crystalline modules

(ii) Higher energy yield than crystalline modules

(iii) Low cost of land

4. CONCLUSION

At higher ambient temperatures and low and diffuse light conditions (such as cloudy weather as well as dawn and dusk conditions), Si based thin-film solar modules gives greater annual average energy yield per rated watt

than the crystalline silicon modules. Si based thin film solar modules are also less expensive to produce on a per watt basis. Traditionally, crystalline silicon technology had been the preferred choice of the PV market place due to its higher energy conversion efficiencies and easy availability. In this study, efficiency of poly-crystalline modules is 12.4% and that of CdTe and a-Si thin film modules is 11.3% and 6.6% respectively. However, in spite of the lower conversion efficiency, thin film technologies have better field efficiency in terms of electricity production per installed watt. Generally this is not recognized because modules are rated at Standard Test Conditions (STC) of 1000 W/m2, 25ºC, and AM1.5. However, a module deployed in the field in a hot climatic zone like India generally will be exposed to these conditions for only a brief amount of time during its life, and therefore STC ratings are of limited use in evaluating the actual performance of modules and systems and STC efficiency can not be a good metric when comparing different technologies. The decisive criterion for evaluation of the photovoltaic modules should not be the technical module efficiency, but the costs to be paid for generated kWh of electricity.

* Dwipen Boruah is presently working as the "General Manager – Energy" in IT Power India (www.itpi.co.in)

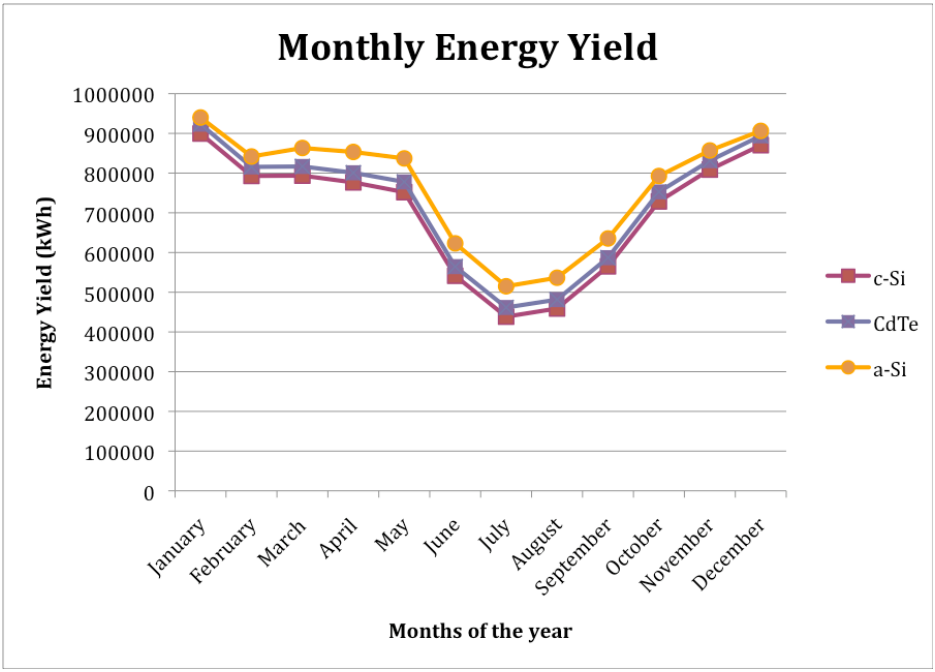


Figure 4: Annual average energy yield

Challenges of Knowledge Transfer: A Case of Replicating Rural Energy Development Activities in Afghanistan

Satish Gautam (PPRE 94/95)* and Ram Prasad Dhital (PPRE 01/02)* *

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Abstract

Afghanistan is at the crossroads between Southern and Central Asia. It has been besmirched by over three decades of strife including invasion by a world power and civil wars among different groups. The country has one of the lowest per capita commercial energy consumption in the world. Although the country is rich in energy resources, only about 25% of the population has access to electricity and in rural areas the estimates vary from 6% to 14%. Most of the rural population depends on animal waste and agricultural residues for their cooking and heating needs and kerosene for lighting.

Ministry of Rural Reconstruction and Development (Mr.RD) with the support of various donors has been very active in the supply of rural energy in Afghanistan. In spite of recent investments in renewable and rural energy, the sector still faces many challenges at different levels. To address some of the issues at program and sectoral, UNDP is supporting the Mr.RD to implement a component called "Energy for Rural Development in Afghanistan (ERDA)'. This project has been designed to replicate UNDP's extensive experiences in community led rural energy activities including its flagship program of Nepal. This paper highlights the challenges faced by ERDA in replication of Rural Energy Development Activities from Nepal in Afghanistan.

1. BACKGROUND

Afghanistan is at the crossroads between Southern and Central Asia. It has been besmirched by over three decades of strife including invasion by a world power and civil wars among different groups. Whatever infrastructure the country had had been destroyed and only recently Afghanistan is rebuilding with infusion of massive international support. Today, Afghanistan is one of the poorest countries in the world. More than half of the total population of 30 million lives under the poverty line and another 20 percent is close to the poverty line and is at risk of falling into poverty [1].

The rural areas like in most developing countries lack basic infrastructures like schools, health care, clean water supply and electricity. It is estimated that only about 25% of the population has access to electricity and in rural areas the estimates vary from 6% to 14% [2]. Per capita energy consumption of Afghanistan has drastically fallen from 2 million BTU in 1980s to just around 0.5 million BTU today, which is among the lowest in the world [3]. Most of the rural population depends on animal waste and agricultural residues for their cooking and heating needs and kerosene for lighting. Given the fact that over 75% of the population in Afghanistan lives in rural areas, provision of modern energy services coupled with other development activities can help enhance livelihoods of the people. "Lack of energy services means that children cannot

study in the evening. Health care options are limited at primary health care centers. Girls and women spend significant amount of time per day in rural Afghanistan collecting fuel and more time for collecting and carrying water. Animal dung is being burned as fuel instead of agricultural input" [4].

2. RURAL ENERGY DEVELOPMENT IN AFGHANISTAN

In a short duration since the fall of the Taliban Regime in 2001 to the end of 2008, Afghanistan has made an impressive stride in provisioning electricity to rural areas mainly through stand-alone systems like micro hydropower plants, solar home systems and small diesel generators. Besides the Provincial Reconstruction Teams (PRT), which are basically the foreign militaries involved in quick impact development projects, The Ministry of Rural Rehabilitation and Development (Mr. RD) has been the lead agency in promoting rural energy particularly through its flagship National Solidarity Program (NSP). Communities with the financial support of NSP have installed more than 750 micro hydropower plants and another 500 are in different stages of development with the total installed capacity of 20 MW. Likewise, over 100,000 solar home systems have been installed and 1700 diesel generators distributed to the communities. So far, NSP has spent around $50 M for rural energy projects since mid 2004. Though the numbers are very impressive given the fact that NSP started supporting rural energy activities only from the mid 2004, sustainability of most of these systems is doubtful. The operating cost of diesel generators has become a burden on the rural community and it is estimated that most of the 1700 systems that were distributed are not operational consequently NSP discontinued supporting diesel generator projects.

The government plans to electrify at least 65% of households and 90% of non-residential establishments in major urban areas, and at least 25% of households in rural areas by 2010[5]. The government's effort to increase the access of energy services is being supported by different donors. The donors like Asian Development Bank (ADB), European Commission (EC), India, JICA, KfW and GTZ (German), United States Agency for International Development (USAID), UNDP, DFID and the World Bank (WB) are heavily investing in the renewable energy sector in Afghanistan [5].

3. STATUS OF MICRO HYDROPOWER IN AFGHANISTAN

As the main focus of both the Government of Afghanistan and the international community was in providing quick relief to the rural people through development projects identified by the communities themselves, issues related to sustainability were not addressed properly. An audit of micro hydro-power projects undertaken in 2006 reveals that there are many problems with the micro hydropower projects in Afghanistan [6]. Though NSP supported projects are in better shape overall compared to PRT supported one, they also face serious problems. A preliminary survey of these projects undertaken by Mr.RD shows that almost half of the micro hydropower plants are not operational as expected.

The Audit mentions that micro hydro-power development was not seen as a part of overall rural development, which is understandable as the government was more concerned in providing quick relief measures as mentioned above. The Audit further mentions that multiple use of water was also not taken into account and there are many cases of conflicts between different uses of water - primarily irrigation and electricity generation. Likewise, productive uses of electricity were not incorporated in the project and almost all projects

lack financial resources to undertake major repairs. Moreover, in many cases the communities do not collect fees for use of electricity and have little resources to undertake even minor repairs which again raises the sustainability question. Lack of trained operators and managers and repair and maintenance service providers are other obstacles for sustainability of these plants. The report concludes that in most cases the community doesn't take 'ownership' and the projects have failed to improve livelihoods.

On the other hand, anecdotal evidences indicate that the micro hydro-power projects undertaken in recent days are of much better quality and the performance is also better compared to the earlier ones. Some of NSP's Facilitating Partners (FP) most of which are international Non-Governmental Organizations working in Afghanistan and are primarily responsible for supporting the communities to identify and undertake micro hydro-power projects have themselves enhanced capabilities by involving expatriate engineers with extensive experience in developing micro hydro-power projects. Likewise, the local workshops involved in fabrication of turbines and accessories and installation of plants have also gained experience over the years and are producing.

4. ENERGY FOR RURAL DEVELOPMENT IN AFGHANISTAN (ERDA) [7] [1)]

To address some of the issues mentioned above and to help realize the priority of the Government of Afghanistan, Mr.RD with the support of UNDP launched ERDA project in early 2008 initially for 18 months and later for 5 years. ERDA, one of the components of National Area Based Development Program (NABDP) aims to enhance the rural livelihoods and preserve the local environment by supporting renewable energy projects as an entry point for sustainable development. This project has been designed to replicate UNDP's extensive experiences in the region. UNDP's global experiences in community-based energy systems, including its flagship program called Rural Energy Development Program in Nepal has demonstrated how local communities can be empowered to own, manage, and benefit from energy systems and their livelihood options expanded. These projects further show that when they work well, in addition to providing economic benefits energy systems can add significantly to social wellbeing, provide social cohesion and build social capital within communities.

The objective of ERDA is to support the government and rural communities to implement and manage sustainable rural energy systems that are linked to economic regeneration activities through;

a) Demonstration of successful community based models for energy supply in rural Afghanistan

b) Capacity building for operation and management of rural energy systems at the community level; decentralized planning, and implementation monitoring of sustainable energy projects at the district level and planning, survey, design and policy formulation related to rural energy within Mr.RD.

c) Preparation of a platform for Mr.RD/Government of Afghanistan to scale up rural energy development activities covering the whole country.

In a short duration since its inception in February 2008, ERDA has initiated activities to realize its goal of promoting sustainable rural energy systems in Afghanistan. Given the fact that micro hydro-power is the most extensively used renewable energy resource

1) This section draws from Energy for Rural Development in Afghanistan (ERDA) Project Document and various reports prepared by ERDA

in Afghanistan and also the one facing sustainability issues as described above, ERDA has focused on this sector. ERDA has already completed detailed feasibility study of 32 micro hydro-power plants and initiated implementation of 9 of them; prepared formats for detailed study, pre-feasibility, baseline study, etc.; prepared micro hydro-power implementation and technical guidelines and operation and management manual in Dari and provided inputs in the draft of ANDS.

ERDA supported rural energy projects are selected from the District Development Plan (DDP). ERDA undertakes the pre-feasibility and detailed study of these projects and prepares detailed project reports and proposal for funding. The proposals are reviewed by the Quality Control Unit of NABDP before approval by the Program Manager. NABDP/ERDA provides technical assistance to the communities to undertake implementation of renewable energy projects. ERDA implementation modality provisions for establishing a rural energy cell in the DDAs to undertake rural energy planning and to supervise construction of community implemented energy projects. Based on the proposal prepared by ERDA, Community Development Council (CDC) announces for bid through national and local news media. Only prequalified company can participate in the bidding process. The bid is then evaluated by DDA technician with the help of ERDA. The construction and installation activities are supervised by DDA technician and ERDA Engineers. ERDA also supports the communities to identify and install electricity driven micro industries, which will both provide financial income for the plants and essential services in rural areas.

4.1 BRIEF DESCRIPTION OF RURAL ENERGY DEVELOPMENT PROGRAM OF NEPAL[8] 2)

Micro hydro-power technology to generate motive power and electricity has been initiated in Nepal since the 1960s.The government of Nepal initiated a subsidy program in 1980s to promote rural electrification through isolated micro hydro plants with the installed capacity up to 100 kilowatts (kW). There are over 2000 micro hydro plants in Nepal with the total installed capacity of 13,000 kW. Most of the equipment and machinery required for a micro hydro plant are locally available and there are about a dozen companies involved in survey, design, manufacturing and installation of micro hydro-power plants.

A survey of 100 randomly selected micro hydro plants undertaken by ICIMOD/ITDG in the mid 1990s revealed that only 40% of the plants were operating satisfactorily and another 30% were operating with difficulties and the rest were either abandoned or moved to other places. According to the survey, the problems related to micro hydro development begin from the early stage in the implementation process and are prevalent even after completion of the schemes. Many plants were abandoned after extensive flooding or landslides, experts opine that inadequate survey and improper plant sitting are the main reasons for such destructions. The survey also revealed that the lack of operation and management knowledge in the rural areas was the main reason for the unsatisfactory performance of most of these plants followed by lack of technical backstopping. Absence of productive end-uses other than lighting in rural areas is the important reason for less than satisfactory financial performance of micro hydro plants that generate electricity. These plants generally provide electricity for a few hours in the evening for lighting and have a very low use ratio compared to their energy production capacities. On the other hand, most of the plants that use motive power for processing agricultural products

2) TThis section is from the Dissertation Proposal submitted by S.Gautam to Georgia Institute of Technology, Atlanta, USA.

are in financially better conditions. Because of high installation costs and low return on investment even with government subsidies, government allocation for subsidies for rural electrification through micro hydro-power was underused in the early 1990s.

Rural Energy Development Program

In this context, the government initiated Rural Energy Development Program (REDP) with UNDP's support in 1996. REDP being executed by Alternative Energy Promotion Centre (AEPC) has a holistic and multi-sectoral approach to development of rural energy. It supports not only the diffusion of technologies through additional subsidies but also lays more emphasis on building up the capacity of the rural community to plan, install, operate and manage rural energy systems like micro hydro, photovoltaic, biogas and improved cooking stoves. The program also promotes productive end-uses and emphasizes integration of micro hydro with irrigation and drinking water schemes and watershed protection activities. Furthermore, REDP helps the rural communities and their elected representatives to integrate energy development within the overall local governance related activities by supporting the local governments in decentralized energy planning and establishment of energy development sections.

Project Selection: According to Micro Hydro Implementation Guidelines of REDP project selection is integrated in the government's decentralized planning process. Communities identify potential projects that are then endorsed by Village Development Committees (VDC) and District Development Committee (DDC) and included in the annual district program. Besides the technical and financial viability, commitment of the communities and the VDC, which is the elected body at the village level, is the main selection criterion.

Community Mobilization: Once a project is selected for implementation, DDC facilitates community mobilization activities. Community Mobilization Guidelines of REDP mentions that at least one male and a female from all beneficiary households are required to get involved in different community activities through participation in self-governing and broad based Community Organizations (COs). About 15 to 20 men and women form separate COs and meet every week discuss their common problems, identify solutions, mobilize resources and carry-out the identified activities. The CO also practices micro-financial activities to help start income enhancing activities. Male and female are segregated to ensure female participation in decision-making, which has traditionally been rare in the Nepalese society. Likewise, COs are kept small to allows meaningful participation of all ethnic groups. To ensure that the local elites cannot capture the community institutions, all the decisions at the community level are consensus based. Once the people are in the habit of undertaking community activities, they are encouraged to form the Micro Hydro Functional Group (MHFG). All the beneficiary households are members of MHFG. They form an Executive Committee (EC) with equal representation from all Community Organizations for construction and operation of the micro hydro-power plant.

Detailed Design and Resource Mobilization: DDC provides technical assistance for the survey and detailed design of the micro hydro plant. Technical experts explain the technical requirement and encourage active participation of the communities to determine the best sites for the MHP components. Involvement of the community in selection helps integrating local knowledge with the technical requirements. Communities are better placed to provide information like historical flood levels and water flows during droughts, potential landslide zones, conflict over water and property rights etc.

Based on the technical details, MHFG collects quotations from at least three installers and prepares a Detailed Project Report that includes all the technical design, breakdown of costs and various financial scenarios, resources required and potential sources, participation required and project implementation plan.

The community is responsible for mobilizing all the local costs such as local materials and unskilled labor and local transportation. REDP/AEPC subsidizes the project based on the households electrified. DDC and VDC invest 5% of the total non-local costs each. The community has to meet the rest of the cost. Usually, they take out a loan from a bank to meet this cost.

Construction & Operation: MHFG is responsible for the construction of the micro hydro-power plant and the distribution network. REDP provides technical assistance. The community itself mobilizes the labor for construction. To ensure overall participation all decisions made by the executive committee, including financial transactions are put before the entire community for approval. During the construction period, all beneficiaries meet at least once a month to discuss the decisions of the Executive Committee. The beneficiary community is responsible for operation and management of the system. They hire a manager/operator from among themselves for daily operation. Continuous involvement of all beneficiaries is required in most schemes as the diversion and intake are either temporary or semi-permanent and are damaged during the rainy season. REDP provides training to local men/women identified and selected by the community on operation and management of micro hydro plants.

Productive End-uses: Sustainability of a micro hydro system also depends on its ability to make earnings. As the rural people use electricity mostly for lights, their consumption is limited to the nighttime. REDP supports the community to use excess power for commercial purposes. Processing of agricultural produces like de-husking rice, grinding wheat or corn and extracting oil from mustard seeds are the most common commercial end-uses and about half of the REDP supported communities have these facilities. Other popular end-uses include using electric heat and light for raising chickens, battery charging, sawmill, bakery, ice plant, photo studio, cable television network and cinema halls. Two villages have their own computer training institutes.

Ownership and Management: The MHFG is responsible for management of the plants. In some other cases, communities have given away the management to private parties. In such cases, the community calls for proposals from among its members and picks up the best offer. The contractor is responsible for daily operation and management including tariff collection and minor repair works. In other cases, communities have formed Cooperatives to manage their plants.

Monitoring: Proper and continuous monitoring is one of the key requirements to ensure that the collective action does not fizzle out. The beneficiaries meet at least once a month during the construction period and discuss all financial transactions. When the construction is over, each transaction is again subjected to a public audit. During the regular operation phase too, all transactions are subjected to community review and endorsement. The manager is responsible for the proper operation and management of the system and has to continuously monitor the activities of the operators. Whereas, the Executive Committee that meets at least every month has the oversight of both the manager and the operators. If there is any irregularity in supply of electricity all the consumers hold the manager and the operators responsible. Monitoring the activities of the electricity consumers is also important in micro hydropower schemes to discourage pilferage

and timely collection of revenues.

4.2 CHALLENGES IN REPLICATION

Community Level:

Community Mobilization under taken previously for development activities in NSP supported projects like building irrigation canals, school, roads, etc. is not adequate for installation and operation of rural energy systems, which are technically complex. Extensive community mobilization is thus required for active participation of both men and women in installation and operation of energy systems. As mentioned above REDP has been able to undertake extensive community mobilization in Nepal. REDP's community mobilization practices are based not only on other successful UNDP supported programs that mobilize the community but also on community mobilization practices of other programs practiced in Nepal. Capital formation through weekly saving and credit scheme is an integral part of REDP's mobilization package which also provides community members a forum to discuss their problems and plan activities. The socio-economic situation in Afghanistan and limited experience of such community mobilization activities doesn't allow exact replication. Especially involving women in development activities is difficult in mostly conservative rural Afghan communities and saving and credit practice is considered un-Islamic by some.

Community Contribution to development projects benefitting them is not as strictly followed in Afghanistan as in Nepal. It is a general belief in Nepal that the more the local people contribute to these projects the more 'ownership' they take for operation and management. In REDP, the local people contribute all the necessary labor and locally available materials and take out loans to meet parts of the total cost not covered by external financial support. In case of development projects there are varying local contributions in Afghanistan – from providing local labor to nothing at all. ERDA follows Mr.RD's practice of not more than 10% of the total project cost should be provided by the beneficiary communities. If there is a positive correlation between the percentage/amount of contribution and ownership feeling, this practice will need to be reviewed.

Water Use Registration Afghanistan has traditional mechanisms of allocating water-uses. Every village or large canal has a person called Mirauba dedicated to ensure water rights of the farmers called Haqauba. However, this system has not been formalized yet.

District Level

District Development Assemblies (DDAs) are still in the early stage of development and it is difficult to work with them. They don't have any secretariat office or personnel and most of the members live in their own villages. However, DDA is a potent vehicle for promoting rural development in Afghanistan. ERDA is supporting DDAs to undertake decentralized energy planning so that the exercise results in identification of more meaningful projects rather than mere 'wish list'. More importantly, ERDA is supporting to institutionalize rural energy development activities within DDA by helping establish Rural Energy Cell that will be responsible for both decentralized energy planning and providing technical assistance to energy systems. ERDA has provisioned a position of technician for every DDA it works with to monitor and supervise construction work and facilitate energy planning. Though this mechanism is still evolving and needs to be assessed, it could be the foundation upon which future NABDP and other development activities could be built. Provisioning specialized cells within DDA and helping build their capacity could be a means for sustainable rural development in Afghanistan.

Furthermore, DDAs don't have resources to contribute to the energy projects unlike District Development Committees and Village Development Committee in Nepal which contribute about 5% of the total project cost and take partial ownership and monitor. DDC and VDC in Nepal also support micro hydropower projects in case major repairs are required by mobilizing their own resources.

Provincial Level

Ministry of Rural Rehabilitation and Development (Mr.RD) has Provincial Rural Rehabilitation and Development (PRRD) divisions in every province to implement and oversee development activities. However, these divisions do not have energy cell or personnel dedicated to rural energy development. ERDA plans to help establish energy cells within PRRD in future to help the communities in undertaking micro hydro and other renewable energy development projects.

Central Level

Roles and responsibilities unclear: One of the major issues related to rural energy in Afghanistan as discussed in details by ANDS is undefined roles and responsibilities between Mr.RD and Ministry of Energy and Water. Though MEW is responsible for the development of the energy sector as a whole, Mr.RD is the most active government agency promoting rural electrification. ERDA is supporting Mr.RD to prepare a Memorandum of Understanding between the two ministries that will clarify their roles and responsibilities.

Lack of an agency for rural energy: There is no government agency dedicated to promotion of rural/renewable agency like Nepal (Alternative Energy Promotion Center) in Nepal. Within Mr.RD there are five different projects and departments with some roles in the rural energy sector. Their activities are not coordinated. It is envisaged that in future ERDA will consolidate rural energy activities of Mr.RD and gradually evolve into a national rural energy development program and incubate an independent agency for rural/renewable energy.

Standards and Quality Control: Afghanistan has no standards and quality control mechanisms related to rural energy technologies. Though NSP has formulated some guidelines and also pre-qualifies companies, these measures are not strictly followed. Moreover, NSP's practice of providing block grant of US$ 200 per family or US$ 60,000 per CDC has been detrimental to the quality of micro hydro-power projects. Instead of the quality and standards affecting the project costing, available resources determines the quality of the project. Communities are forced to use equipment that fall within their budget and end up compromising on quality and in many cases discarding vital components altogether.

Turbine Technology and Manufacturers: Turbine fabricating workshops played critical and pioneering role in the development of micro hydro-power sector in Nepal. Companies like Balaju Yantra Shala, Kathmandu Metal Industries, DCS, etc. have been at the forefront in developing the technologies and ensuring standardization. For many years, private workshops provided services to rural people by fabricating and installing water mills with minimal government intervention.

Selection of cross-flow turbine as the vehicle for micro hydro-power development in Nepal was done very carefully taking the characteristics of potential sites and capabilities of the metal workshops into consideration. On the other hand, Afghanistan imported the same technology with little consideration for the characteristics of its potential micro hydro-power sites. In Nepal, most of the potential sites have high head and low water flow whereas in Afghanistan there are more

sites with very high flow but little head where cross-flow is not the best option. Due to lack of local capacity to produce other types of turbines, Afghan manufacturers/installers use cross-flow even with heads of a couple of meters. Promotion of technologies like Kaplan and Propeller would have been more appropriate for Afghanistan.

Unfortunately, there are no programs to support the manufacturers/installers in building up their capacities to fabricate quality products and trying innovative ideas.

Capacity: Afghanistan lacks human resources for development of rural energy in general. There are very few engineers and technicians with experience of developing micro hydro-power or other rural energy systems Though NSP has organized a couple of training for engineers on designing micro hydro-power projects primarily through Nepali professionals, these trainings are sporadic and not institutionalized. Lack of engineers and technicians to undertake survey, design, fabrication, installation, supervision, etc. is a big hurdle for further development of the sector. The fact that Afghanistan has embarked on vigorous rural electrification program through infusion of international money has further exacerbated the situation as retention of qualified technicians is a big issue for most organization working in the sector. There is no systematic plan to produce the required human resources in Afghanistan so far.

5 CONCLUSIONS

As Afghanistan lacks human resources with experience in rural energy sector, it has relied heavily on expatriates for the development of micro hydro-power and other energy systems. Exact replication of experience of other countries doesn't always translate into sustainable systems. Even modifying experience from outside to fit the Afghan context requires a certain amount of local capability. A lot of nuances of processes and modalities from outside get lost in translation while applying in Afghanistan. Thorough exercise and homework during the project formulation not only helps preparing implementable projects but also goes a long to translate the best practices and knowledge transfer to new circumstances.

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Technical Design, Installation and Commissioning of a Solar Thermosyphon System in Bhutan

By Nar Bahadur Khatiwora, Bhutan (PPRE 2006/08)
Executive Engineer, Renewable Energy Division, Department of Energy

Background

Hot water production is amongst the most efficient solar energy applications, particularly for collective systems in residential and tertiary buildings where the hot water demand is important and steady; notably, for collective housing, hotels and health establishments. The present requirements for collective buildings (housing, hotels, hospitals, etc.) show a growing demand for hot water, not only for the sanitary needs but also for the domestic tasks. The usefulness of a hot water supply system is characterized by the availability of the hot water, in a sufficient quantity, at a given temperature, when it is needed and at a cost as low as possible. The preliminary studies prior to designing a solar hot water supply system are aimed at estimating the potential interest of a future installation in relation to the demand for hot water (quantity and regularity throughout the year) and the existence of technical or architectural constraints.

Hot water supply and heating represent the highest service expense connected with housing in developed country and could be in developing country though the analysis has not been conducted. Depending on the location, solar energy can be used to cover partial water heating energy needs from 40% to 70%.

A domestic hot water supply system using solar energy is composed of 5 sub-systems:

- A collector sub-system,
- An energy transfer sub-system,
- A storage sub-system,
- A back-up energy sub-system,
- A distribution sub-system.

The energy saved with reference to a conventional water heater, depends on the climate, the collector layout, the sizing and system design, as well as the components and their maintenance.

In view of the first demonstration work, the 1000 litres per day (LPD) heating system is being designed for the Gidakom Hospital particularly to meet the hot water requirement for about 20 people assuming the consumption of 40 litres per person.

Objectives

The main objective of this scope of work is to reduce electricity demand for water heating systems, particularly in winter. This will in turn help to make available electricity for other useful purposes thereby enhancing the energy security of the country. The testing of 1000 litres per day system is first of its kind provided in the public institution in order to create awareness among different walk of people and to test its technical viability.

Immediate objective

The immediate objectives of the project are as follows:

- To test and standardise the design of the Solar Thermal system for promotion in future.
- To encourage the public in using alternate water heating facilities in order to reduce the electricity

consumption particularly in winter when there is a shortage of electricity supply.

- To develop institutional capacity in the energy sector for sustainability of the development infrastructures and enhance in-house capacity for development of sustainable programmes and projects responsive to the objectives of the National Plans.

Detail Technical Design Analysis

Determination of the hot water demand and storage tank volume

Hot water production is amongst the most efficient solar energy applications, particularly for collective systems in residential and tertiary buildings where the hot water demand is important and steady; notably, for collective housing, hotels and health establishments. For the Gidakom Hospital, the hot water demand was estimated based on the number of beds in the general ward sufficient for bathing. In actual practice, hospital requires more water due to laundry applications. However, for this analysis, the demand is solely based on the assumption that the entire hot water is used for bathing purpose only. The patients could use this facility to take shower and thereby a reduction in the electricity consumption could be achieved. The detail hot water demand analysis is shown in table 1:

From the mass-energy balance calculation using the above assumptions, the required water per person was obtained as 50 litres/person. Therefore, the hot water adequate for 20 beds (1 person/bed) is 1000 litres per day.

From the hot water demand analysis, the storage tank capacity could be estimated to be 1000 litres.

Collector Size Estimation

The number of collectors required could be estimated based on the estimated amount of water to be heated at required temperature and solar intensity at the site location. Since, there is no specific measurement at the Gidakom Hospital in the determination of the solar intensity, an average of 4.5 sun hours duration is used. Since the solar intensity at the standard test condition is 1000 W/m^2/day and assuming the collector efficiency of 50%, the amount of solar radiation converted by the collector is 2.25 kWh/m^2/day.

The actual heat energy required to heat 1000 litres of water from 15 ^{o}C to 60 ^{o}C using spe-

Table 1: Hot Water Demand

Particular		Unit
Hot water requirement for Bathing		
Number of person	20	pl
Amount of water per person	40	l
Required water temperature	40	^{0}C
Solar hot water can raise the temp.	60	^{0}C
Cold water inlet temperature	15	^{0}C

cific heat capacity of water 4.286 kJ/kgK is 52.28 kWh. Therefore, the total collector area required for heating 1000 litres of water is 23.24 m^2. One collector has approximately 2 m^2, therefore number of collector required is 12. Therefore, to heat 1000 liters of water at the site location, 12 collectors having an area of 2m2/collector are required.

The present requirements for collective buildings (housing, hotels, hospitals,..) show a growing demand for hot water, not only for the sanitary needs but also for the domestic tasks. The usefulness of a hot water supply system is characterized by the availability of the hot water, in a sufficient quantity, at a given temperature, when it is needed and at a cost as low as possible.

Estimation of Mass Flow Rate

From the analysis of power demand to heat the water and the temperature difference, the mass flow rate could be determined. From the calculation, the mass flow rate obtained is 0.28kg/sec. Using the average density of water/glycol mixture (978.235 kg/m^3) and collector area, the volumetric flow rate obtained is 43.76 litres/h/m^2. Since, we are within the range of 40 l/h/m^2 to 70 l/h/m^2 the designed Thermosyphon system should work properly.

Estimation of Pipe Size

The pipe dimensions are estimated on the assumption that the Galvanised Iron (GI) pipes are used. The pipe data are used for the analysis is shown in table 2.

Using the dynamic viscosity and density of glycol/water mixture, the pipe friction factor is determined calculating the Reynolds number (obtained in our case 302 - < 500, laminar flow) is 0.212. Using the pipe dimensions, and the friction factors, the pressure drop in the pipes was determined using the Darcy–Weisbach equation. Since, the pressure drop in the pipes is directly proportional to the length and inversely proportional to the diameter of the pipes, different pipe size calculation were performed. Since, the length of the pipe is constant, the only variable then we have is the diameter of the pipes. Smaller pipes cause higher pressure drop and head loss for the system. As a thermosyphon system works with the principle of the density difference with minimum head, it is important to keep the pressure drop/head loss to the minimum. Therefore, it was decided to use pipe of diameter 1″ rather than the normal practice of using ½″ diameter pipes.

Table 2: Analysed data for pipe dimensions

Material	Galvanized Iron	Unit
Roughness, ε	0.1524	mm
Diameter, D	50.08	mm
Relative roughness, ε/D	0.0030	
Flow area, A	0.0020	m^2
Length, L	30	m
Velocity, V	0.006	m/s
Volume of water inside pipe	0.059	m^3
	59.101	l

Table 3: Summary of Design Parameters

SL #	Particular	Qty	Unit
a	**Assumed**		
	Number of person	20	pl
	Amount of water per person	40	l
	Required water temperature	40	^{0}C
	Solar hot water can raise the temp.	6ß	^{0}C
	Cold water inlet temperature	15	^{0}C
b	**Calculated**		
	Required amount of hot water/person	50	l
	Storage tank capacity	1000	l
	Required heat equivalent in kWh (Energy Required)	52.5	kWh
	Required Collector Area	23.3	m^2 daily
	Area of one collector	2.0	m^2
	Number of collectors	12	
	volumetric flow in liters per m2 of collector area	43.7587	l/h/m^2
	Pipe Diameter, D	25.4	mm
	Pipe Length, L	30	m

System Layout Design/Plan

Based on the design parameters, the system design layout plan was prepared as shown in figure 1. The collectors need to be placed on the concrete foundation. The collector stands have to be manufactured at a tilt angle of 40o. The 12 collectors are designed to be placed in three different rows connected in parallel with four collectors connected in series in each row. This requires minimum area of floor space. The distance between the rows is estimated to be about 1.5 meters. This would avoid shadow falling from one collector to the other and therefore, all the collectors would receive equivalent amount of radiation.

The hot water storage tank is placed at a distance of 1.5 meters from the collector stand. The insulation of 100 mm rockwool was placed over this tank and the metal cladding using aluminium was done in order to maintain the temperature of hot water in the storage tank. Also, a 1000 liters overhead tank was designed to maintain a continuous flow of water into the storage tank. In case if the cold water supply fails, then there might be risk of overheating the collector systems and possible damage of the system installed.

The piping and associated materials for the supply of hot water from the storage tank to various location is designed using ½" pipe diameters.

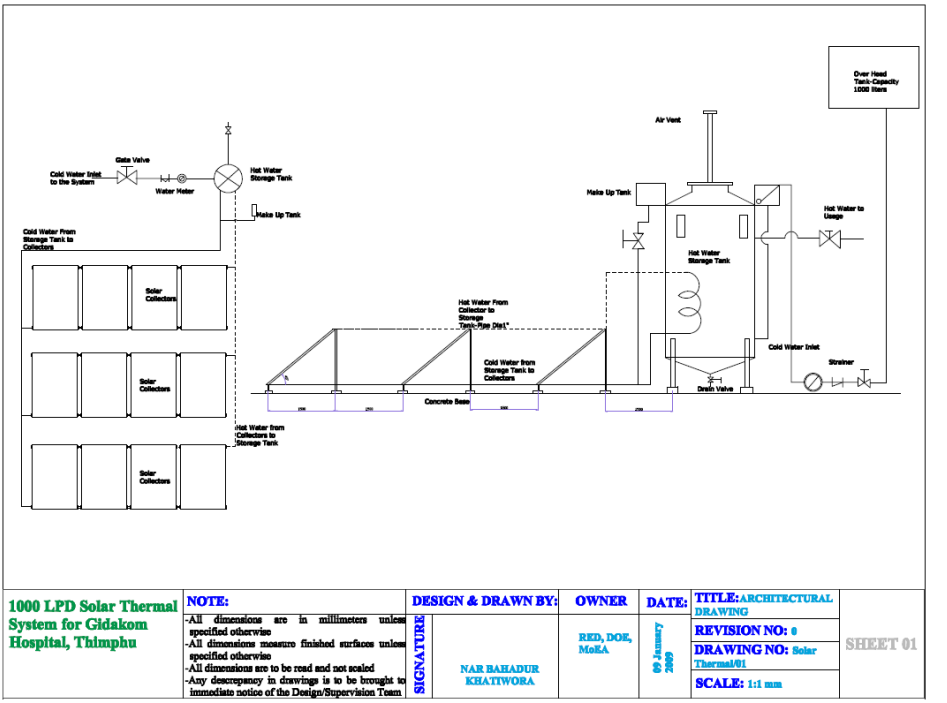

Figure 1: System Design Layout Plan

Installation and Commissioning of Solar Water Heating System

The installation of 1000 liters per day solar water heating system commenced on 12 June 2009 and completed on 30 July 2009. The six technicians under my supervision continuously worked on the installation from foundation to insulation and commissioning.

Figure 2: Mounting of Collectors

Conclusion

The solar water heating system of 1000 liters per day capacity was successfully designed, installed and commissioned at Gidakom Hospital, Thimphu. This scope of work is the first of its kind implemented by the Department of Energy as a means of promoting alternate energy sources to enhance energy security in the kingdom.

Lack of capacity within the Renewable Energy Division was of main concern and therefore, it was decided that RED staffs will be involved during the installation and commissioning works. This scope of work gave an opportunity and enough time for RED Officials and Technicians to remain at the work location, understand the technology, play with the equipments and the systems to gain hands-on practical training. The Technicians were trained on the proper installation of such systems of 1000 liters capacity and now they can provide inspection of such systems and hands-on practical training to interested private firms to promote the technology. However, the training has limitation for installation of bigger units as it needs much advanced tools and skills.

The owner, Gidakom Hospital Management was receptive of the technology and is very happy of the performance of the system.

Figure 3: The complete system

My activities in Bangladesh

by Shahriar Ahmed Chowdhury, Bangladesh (PPRE 2004/06)

Shahriar joined the department of Electrical and Electronic Engineering in United International University, after completing PPRE, as an assistant Professor. There he started RE as an undergraduate course in the EEE department in his University, which is the first RE course in EEE in Bangladesh. He designed the course through expertise gained in Oldenburg and in Stuttgart (during his thesis research in ZSW).

Shahriar testing the solar home system equipment in the remote rural area in Bangladesh as part of the technical audit of SHS.

He is also working towards starting an Msc course in his university in energy, majoring in RE. He is furthermore working towards establishing an RE research lab in his University. To promote RE further and make his University the hub of RE research in the south Asian region, he is organizing a bi-yearly international conference on the developments in Renewable Energy Technology (ICDRET, web site: www.icdret.uiu.ac.bd). The first event will be held in December 17-19 in Dhaka, Bangladesh. The IEEE-PES is the technical cosponsor of the event. All the papers of the conference proceedings will be available in the IEEE explore. GTZ has become the prime sponsor of the first event and seven other RE dissemination companies have become the cosponsors of the event. The excess money from the conference will be used in developing the RE research lab. Recently Shahriar has completed the technical audit of the SHS project in Bangladesh, where he was the project team leader. The project objectives were surveying the field performance of solar home system components, sampling the performance of the SHS components from the manufacturers production line, investigating the causes of malfunction of the components through laboratory testing and recommending for proper specifications of the SHS components

He is recently planning to offer professional courses on RE from his university for those engineers and professionals who are already working in the RE sector but lacking proper knowledge.

Shahriar presenting his machines in IEEE-International Future Energy Challenge competition workshop in Washington DC, USA in February this year.

Recently Shahriar has been selected as a committee member of Bangladesh Renewable Energy Society (BRES) and the head of the Solar Energy promotion. (BRES is the professional organization for the RE disseminating organizations in Bangladesh.)

He has also designed a low cost microcontroller based charge controller for SHS units

in Bangladesh.

Shahriar helping the current PPRE students in SHS lab (summer lab).

Recently, a student team under his supervision became the finalists of International Future Energy Challenge Competition 2009. The competition involves the development and control of an integrated Starter/Alternator for automotive applications. It is to conceptualize, design, and develop a low cost-high efficient 1 kW, 3000 rpm machine which will operate as a motor and generator. The competition was announced in April 2008. There were 4 steps of selecting the finalists and on 10th June 2009 Shahriar's team was informed officially that they were among the finalists.

Recently Shahriar visited Uni Oldenburg as a guest researcher / lecturer to guide the PPRE students in case study and SHS lab in summer semester.

International conference on Renewable Energy in December in Dhaka, Bangladesh

by Shahriar Ahmed Chowdhury, Bangladesh(PPRE04/06)
Organizing Secretary and Member of Technical Committee

We all know that the increased awareness about the adverse effects of global warming has encouraged more research activities in the field of renewable energy. The importance of renewable energy is gradually penetrating the minds of the general population of the world. The International Conference on Developments in Renewable Energy Technology (ICDRET) has been organized with a view to exchanging ideas on research, implementation and dissemination of renewable energy technology in different parts of the world, with particular interest in the South Asia region.

The scope of the conference will not be limited to technology alone; rather it will also address the economic and sociological aspects of renewable energy. The conference will be a forum for sharing experiences, exchanging the views from different tiers of this sector and helping to forge a long lasting bond between the academia, industry and the people involved in the dissemination of the technology at the grass root level.

I would like to request you all to inform your friends and colleagues of this event, specifically those who are interested in renewable energy and/or involved in renewable energy technology research and dissemination. I also invite you to contribute to the conference by sharing your research findings and experiences.

For further details about the conference please visit the conference website:

www.icdret.uiu.ac.bd

South Asia Women in Energy (SAWIE)

by Jorifa Khatun / Bangladesh (PPRE 2006/08)

I would like to share with you some information on SAWIE -- South Asia Women in Energy. The aim of SAWIE is to develop Woman through Renewable Energy and Efficient Energy Management. As you know in South Asia the majority of people live in rural areas and they suffer a shortage of energy. SAWIE is supported by eight South Asian Countries. The most interesting thing is that SAWIE members are only women.

The first SAWIE workshop was held in Kerala / India in July and the second in Dhaka in November 2008. The third workshop will be held in Islamabad / Pakistan. I was a participant in the recent Dhaka workshop and gave a proposal of what I will present next time in Pakistan. I am looking forward to make a good contribution and to gain new information and contacts.

Assembling the Lamp Circuit

Example of women earning money by assembling solar lamp circuits

Why Rural Women development through RE Technology?

Rural area women's Characteristics:

1. Women are very conservative
2. Women have no power to take any decision because their economic status is very poor
3. No access of electricity, so there is very little scope to work after evening as well as security problem
4. Most of the women have a very little academic qualification

How to develop them Through RE?

Objectives of SAWIE

1. Role of rural area women in Household Energy Sector
2. Equipping the South Asian women reps with the required skills
3. Transfer of best practices in the region
4. Introducing rural women to household renewable energy applications and scope of income generation activities
5. Involving rural women in energy sector decision making

Implementing RE-labs in Uzbekistan

by Asliddin Komilov, Uzbekistan (PPRE 2001/02)

Background

Only about ten years ago many scientist pointed the main disadvantage of use of renewable energy sources (RES) such as biomass, solar, wind and hydro energy in Uzbekistan to be the low inland prices for conventional energy sources.

Since then very rapid growth in number of manufacturing and production plants increased the total energy consumption of the country. Present days require us to have at least one vehicle in the household (that was not the case in the past). And today we realize that our petrol price is equal to the world price and cost of liquid gas (produced locally) is even higher than in some developing countries. We do already suffer from shortage of electricity and fuel not only in winter but around the year. This fact is another social challenge we must face from now on.

Qashqadaryo province, due to its geography, has a big advantage to use renewable energy technologies (RETs), especially for solar and biomass energy. Counting over 300 sunny days a year and having mainly agricultural structures, there is not a single solar or biomass device which is used to cover energy demand or to produce portable water. However, use of renewable energy sources could very much improve the life of people, as in rural areas so of the urban population.

Statistically, in Qashqadaryo Province there are half a million people who do not have access to centralized water and gas supply. Even those that have the access suffer from uncontrolled shut-offs. The use of alternative energy sources is becoming an indispensable issue, because 77% of the power plants in Uzbekistan use gas and the major gas fields of the country inevitably decline and no new reserves have beenfound to replace them .

Objectives

Evidently the interest in use of renewable energy sources in Uzbekistan has risen. But the dissemination has slowed down by the factors of unawareness and lack of expertise.

The course of renewable energy sources is one of the main “subject” courses for the students of heat power department, and taught through the last two years (3, 4-years) of their education. Theoretical study of renewable energy sources does not give enough insight into the technology without hands on practice. As there are not many companies in the field in Uzbekistan, possibility of practical training for the students is no existent.

My own experience of study PPRE gave me an awareness of necessity of hands-on practice for in depth comprehension of the sub-

ject. Therefor I initiate the project "renewable energy laboratory" for the Karshi engineering economic institute to enable my students to learn about renewable energy technologies in practice and help them to realize the essence of the subject as such, to awaken interest not only for work in the field but also research for the sake of more sustainable energy applications for the people of Uzbekistan.

Moreover, the laboratory will be organized in such way that will make it possible to be used for demonstration purposes for students of the Institute's associate colleges and schools. Thus renewable energy awareness can be spread amongst the younger generation.

My trip to Oldenburg

by Anna Ingwe, Tanzania (PPRE 91/92)

Lisa & Anna at Wechloy entrance

My name is Anna Ingwe, PPRE alumni from 1991/92, working with GTZ in Kenya, where I am responsible for the Kenya Stove project, which is co-financed by the German and Dutch Government. The project has reached 1,029, 300 people (Jan 2006 – Dec 2008) with the household stoves in Kenya on purely commercial basis.

In Dec 2008, I participated in Household Energy Symposium in Germany where various German Organizations and International organization such as WHO and FAO were meeting to explore opportunities for collaboration in the stove sector.

During this period I made an appointment of visiting Oldenburg after more than 15 yrs. It was like going back in time. I was accompanied by my daughter Lisa (13 yrs old).

The Wechloy campus and also the main campus of University of Oldenburg has changed significantly with new constructions coming up all over. Unfortunately it was Sunday and it was all closed.

But I also had the chance to meet my good old friend Edu with his beautiful children to share a 'Glühwein' at the lovely Christmas-market at city centre of Oldenburg.

Anna, Lisa & Edu with two of his three kids

Summary of the Doctoral Research at University of Otago, New Zealand

by Srikanth Subbarao, India (PPRE 00/01

Small-scale, community based renewable energy projects are contended to have potential to accelerate access to basic energy services through the use of local, renewable energy resources contributing to meeting local and national and international development objectives. The proposed research aims to evaluate the opportunities and challenges for uptake of such projects under the Clean Development Mechanism (CDM) in developing countries including the implications of energy payback time on such projects and priorities of different stakeholders involved during their development and implementation. The research also seeks to find out whether or not and in what ways rural communities in developing countries meet the capacity requirements to handle the Clean Development Mechanism (CDM) projects and envisages to provide information to support the development of clear guidelines and criteria which will help to ensure that the benefits of investments in CDM and similar projects are more equitably shared between stakeholders at local, national, regional and international levels. The proposed research will also provide substantial comparative insights into potential, progress and limits of the community based approaches for uptake of RE CDM projects for poor communities in developing countries which till now have been bypassed by the emerging global carbon finance market.

Further, the research also envisages examining the „Sustainable Development" aspect of the Clean Developmental Mechanism (CDM) under the Kyoto Protocol with regard to its current impact on crucial developmental issues with the main focus on the poor in developing countries. As poverty alleviation constitutes one of the major dimensions of sustainable development and as access to affordable energy is one of the key issues to mitigate poverty it can be concluded that renewable energy CDM (or energy CDM) projects have the potential to combat poverty.

Potential options for a meaningful sustainable development concept under CDM and the requirement for changes to the current structure will be discussed in terms of status of post 2012 negotiations, benefits of community based small-scale RE CDM projects and the possible way forward with emphasis on the immediate priority required for streamlining the CDM including the framework for post 2012 regime in terms of providing long awaited benefits to the poor communities in developing countries.

My PhD in the field of Concentrating Solar Power in France

by François Charles Auguste Veynandt, France (EUREC 07/08)

I started my PhD in January 2009, just after completing my EUREC master. I am working in the „Ecole des Mines d'Albi", in south-west of France, in the research centre RAPSODEE. My PhD topic is dealing with the exciting field of Concentrating Solar Thermal technologies. It is getting momentum these years and many large scale projects are making commercialization of Concentrating Solar Power (CSP) real. There are different ways of concentrating sun light.

I work on Linear Fresnel Reflector (LFR) technology. The study is ordered by the R&D department of EDF, the leading French electricity company. The aim is to use this CSP technology as a cogeneration system in buildings. The electricity can be consumed or fed into the grid. The remaining heat can be used

for different purposes, depending on the building needs: adsorption chiller, domestic hot water or space heating, process heat, etc.

I am developing a simulation tool to help design and optimize the whole concentrating solar cogeneration unit from the LFR system to the thermodynamic cycle. I use specialized software for optics, thermal and thermodynamics simulation. One challenge is to couple the different software to be able to optimize the whole system in a go. The key part of the system is the receiver on which we will concentrate our efforts. Because it is where there are highest temperatures and it is critical to keep the losses as low as possible. I have started with simple simulations to find out the main trends of the key parameters of the CSP plant. The investigation is just starting. To be continued!

Optimum Utilization of Renewable Energy for Electrification of Small Islands in Developing Countries

By Dr. Mitra, Indradip, India (PPRE 04/05)

PhD thesis at University of Kassel, GER

This Doctoral research investigated selected themes from the general research question "What are the impacts of past experiences and present developments on power supply systems on small islands in developing countries utilizing renewable energy and how to improve the situation?" It focussed particularly on techno-economic aspects and attempted to investigate the state-of-the-art in several aspects of technology, tools and practices for island electrification. It also documented good practice cases concerning technology as well as sustainability. The research developed a generic type methodology for small island electrification with renewable energy and validated it in a real small island in India. It also investigated the impacts of existing island electrification projects on the local society.

The research had a combination of detailed literature review, survey, analysis of real power plant performance, extensive field works in islands, interviews with several authorities, experts, consumers and stakeholders and rigorous computer based energy modelling and simulation exercises.

The study showed that with appropriate renewable energy technology, organisation and tariff structure the existing projects in the island clusters of Sundarbans in India are creating positive impacts on the islands' society.

The detailed case study was performed for two villages, with a total load of about 98 kW peak and 670 kWh per day, in Bali Island in Sundarbans region in India. In this task, the time series modelling was conducted for power generation via Solar Photovoltaic and Biomass energy technologies. Two optimisation tools, HOMER for power generation and ViPOR for distribution layout, were used in this work and special biomass gasification modules had been developed in HOMER environment. Simulation, optimization and sensitivity analyses had been performed for designing rudimentary power systems. Time and cost saving approach was developed by integrating HOMER-ViPOR combination with remote sensing and Geographical Information System techniques. Easily available high resolution satellite data were used for preparing suitable inputs accounting for the effect of the spatial features in the distribution layout optimisation tasks.

The research was concluded with optimistic note that many small islands in developing countries throughout the world are holding opportunities for greater deployment of renewable energy based.

Dear Edu,

Today I received the PPRE Newsletter, and inside my heart I was like....wow, thanks to EDU, BLUM the spirit of PPRE is alive. Wherever you go, PPRE will find you. Thank you so much for keeping us in the loop, and updating us on what is going on round the world in the field of Renewables, and our colleagues as well.

It is amazing to discover that almost everyone is doing well, and contributing to the GREEN FUTURE of our planet. The experiences and skills being attained on a day-to-day basis within the PPRE fraternity is just evidence of the fact that, the future lies in Renewables, and the hot fire flames cannot be quenched.

Just watch this space, big things are yet to happen and I will be there to update you. The contract to implement the super-hybrid 600kWp project I talked about in the newsletter, has just been signed, we are getting contractors on board and I am so excited, looking forward for events to unfold.

My best Regards to you All. PPRE forever!!!

Wycliff Jagwe (PPRE 05/07)

Project Expert-Rural Electrification

GTZ-PREEEP, Kampala, Uganda

Dear Edu,

I was reading the PPRE newsletter with a new look those days. I realise how critical your role is. With some former EUREC student we have started an association whose aim is to create a professional network. Our idea was to get people working on a common project, a website providing information on renewable energy. Through this common work you get to know people and this keeps your contacts alive. With some experience now we see how hard it is to find time to work on this project. And as we are in different places, it is hard to motivate people to join their efforts to ours. Working as a team from different places seems to work if you know the people you work with from before. In short, we discover how hard it is to get people involved and create a working network. So we are changing our strategy at the moment and our first aim is going to be networking. I think we have a lot to learn from PPRE experience. And I find it so nice to read even small articles from PPRE alumni: it is like an anthill where everybody contributes to developing renewable energy. I find it really motivating to read about the numerous projects going on all over the world. So I was thinking of giving news to keep the PPRE anthill alive. I'm sorry you had to remind me of contributing though. But this shows you do a good job! A king ant-job!

François Veynandt (EUREC 07/08)

RAPSODEE

Ecole des Mines d'Albi, France

	Course	Family Name	1st Name	Tit.	Origin
	1987-88	Bekdach	Hussein	Dr.	Lebanon
	1987-88	Demel	Lothar	Mr.	Germany
	1987-88	Dibor	Alfred	Mr.	Nigeria
	1987-88	Fischer	Eric	Mr.	Brasil
	1987-88	Heilscher	Gerd	Mr.	Germany
	1987-88	Zarate	Carlos	Mr.	Peru
	1988-89	Hamad	Bakri	Dr.	Sudan
	1988-89	Kimaro	Ainea	Mr.	Tanzania
	1988-89	Holtorf	Hans G.	Mr.	Germany
	1988-89	Morares-Duzat	Rejane	Dr.	Brasil
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	1988-89	Lu	Bai	Ms.	China
	1988-89	Jia	Xi-Nan	Dr.	China
	1988-89	Maiga	Alhousseini Issa	Mr.	Mali
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	1988-89	Pietscher	Jochen	Mr.	Germany
	1988-89	Rakha	Hassan	Dr.	Egypt
	1988-89	Camillo	Roger R.	Mr.	Nicaragua
	1988-89	Ramesh	Muthya Praneshrao	Mr.	India
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	1989-90	Mukherjee	Partha Sarathi	Mr.	India
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	1989-90	Park	Myong-Sik	Mr.	Korea
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	1991-92	Gyi	Aung	Mr.	Myanmar
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	1992-93	Mutwaly	Safaá	Ms.	Sudan
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	1992-93	Georg	Rolf	Dr.	Germany
	1993-94	El-Ghany	Ahmed Fathy	Dr.	Egypt
	1993-94	Tubail	As'ad	Dr.	Palestine
	1993-94	Tommy	Henry J.M	Dr.	Sierra Leone
	1993-94	Nahui-Ortiz	Johnny	Dr.	Peru
	1993-94	Leon	Mathias Augustus	Dr.	India
	1993-94	Rommel	Mathias	Mr.	Germany
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	1993-94	Gadah Eldam	Nagwa	Ms.	Sudan
	1993-94	Siefert	Oliver	Mr.	Germany
	1993-94	Andriamahefaparany	Olivier Donat	Mr.	Madagascar
	1993-94	Rodrigues dos Santos	Rosana	Dr.	Brasil
	1993-94	Hurmuzan Kanam	Senda	Mr.	Indonesia
	1994-95	Lingbo	Cui	Mr.	China
	1994-95	Yanzhao	Dong	Mr.	China
	1994-95	Teka	Melis	Mr.	Ethiopia
	1994-95	Tolessa	Samson	Mr.	Ethiopia
	1994-95	Primo	Gayle	Ms.	Guyana
	1994-95	Myint	Mu Yar	Ms.	Myanmar
	1994-95	Gautam	Satish	Mr.	Nepal
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	1994-95	Ntoga	Julius	Mr.	Tanzania
	1994-95	Gassir Farouk	M´med Ibrahim	Mr.	Sudan
	1994-95	Ghebrehiwot	Debesai	Mr.	Eritrea
	1994-95	Mesfin	Yohannes	Mr.	Eritrea
	1994-95	Ksoll	Michael	Dr.	Germany
	1994-95	Kuntze	Björn	Mr.	Germany
	1995-96	Negash	Bereket	Mr.	Eritrea
	1995-96	Fraser	Orville	Mr.	Guyana
	1995-96	Rosyid	Oo Abdul	Dr.-Ing.	Indonesia
	1995-96	Basnet	Diwaker	Mr.	Nepal
	1995-96	Ahmed	Maqbool	Mr.	Pakistan
	1995-96	Magpoc	Godofredo Jr.	Mr.	Philippines
	1995-96	Maltsev	Alexandre	Mr.	Russia
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	1995-96	Kingu	Elizabeth A.	Ms.	Tanzania

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	1995-96	Baba	Abdallah	Mr.	Tunesia
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	1995-96	Nikolic	Milorad	Mr.	Germany
	1995-96	Woelk	Karsten	Mr.	Germany
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	1996-97	Yimer Woldetekle	Nebiyu	Mr.	Ethiopia
	1996-97	Gbagbo	Joseph Kofi Nani	Mr.	Ghana
	1996-97	Hegde	Gajanana Krishna	Dr.	India
	1996-97	Osawa	Bernard	Mr.	Kenya
	1996-97	Ballesteros Perez	Miguel Angel	Mr.	Nicaragua
	1996-97	Projestus M.	Rwiza /	Mr.	Tanzania
	1996-97	Morris	Richard	Mr.	Australia
	1996-97	Sancho	Sebastian	Mr.	Costa Rica
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	1997-98	Zhang	Yin	Dr.	China
	1997-98	Castillo Arguello	Guillermo Eduardo	Mr.	El Salvador
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	1997-98	Ahiataku Togobo	Wisdom	Mr.	Ghana
	1997-98	Parthan	Binu	Mr.	India
	1997-98	Odeh	Ibrahim	Dr.	Jordan
	1997-98	Sichali	Francis	Mr.	Malawi
	1997-98	Petrucci	Fernando	Mr.	Argentinien
	1997-98	Schröder	Christoph	Mr.	Germany
	1997-98	Jackson	Thomas	Mr.	USA
	1997-98	Delamo Duch	Alex	Mr.	Spain
	1997-98	Endres	Manuela	Ms.	Germany
	1997-98	Vanginé	Wooslène	Ms.	Haiti
	1997-98	Lustig	Konrad	Mr.	Germany
	1997-98	Gomez Vilar	Ramon	Mr.	Spain
	1998-99	Masum	Syed Ehteshamul Huq	Mr.	Bangladesch
	1998-99	Liu	Hui	Ms.	China, VR
	1998-99	Yang	Na	Ms.	China, VR
	1998-99	Urena Vargas	Wesly	Mr.	Costa Rica
	1998-99	Kekelia	Bidzina	Mr.	Georgien
	1998-99	Patil	Samudragupta Ashok	Mr.	India
	1998-99	Tiako Ngalani	Christophe	Mr.	Cameroon
	1998-99	Jaoko	Hancox Wilson	Dr.	Kenya
	1998-99	Chima	Timothy Freeman	Mr.	Malawi
	1998-99	Al--Alawi	Ali Salim	Dr.	Sultanate of Oman
	1998-99	Chirvase	Dana	Dr.	Rumänien
	1998-99	Dlamini	Sibusiso Ndumiso	Mr.	Swaziland
	1998-99	Jamiyansharav	Khishigbayar	Ms.	Mongolia
	1998-99	Lam	Johannes (Jan)	Mr.	Netherlands
	1998-99	Straub	Christoph	Mr.	Germany
	1998-99	Oehrens	Juan Sebastian	Mr.	Chile

	1999-00	Tadesse	Alemu	Mr.	Ethiopia
	1999-00	Khan	Md Mesbah	Mr.	Bangladesch
	1999-00	Hoque	Mozammel	Mr.	Bangladesch
	1999-00	Ambe	Roseline	Ms.	Cameroon
	1999-00	Wang	Di	Mr.	China, VR
	1999-00	Paredes	Rodriguez	Mr.	Colombia
	1999-00	Subbarao	Sham	Mr.	India
	1999-00	Al-Nawaiseh	Bassil	Mr.	Jordan
	1999-00	Gamula	Gregory	Mr.	Malawi
	1999-00	Dahal	Yubaraj	Mr.	Nepal
	1999-00	Musa	Mzumbe	Mr.	Tanzania
	1999-00	Sendegeya	Al-Mas	Mr.	Uganda
	1999-00	Ziesmer	Andrea	Ms.	Germany
	1999-00	Ulziisuren	Enhbold	Mr.	Mongolia
	1999-00	Gläser	Bernhard	Mr.	Germany
	1999-00	Kuyvenhoven	Simon	Mr.	Holland
	2000-01	Islam	Mazharul	Mr.	Bangladesh
	2000-01	Fuh	Veronica Manka	Ms.	Cameroon
	2000-01	Mu	Yundong	Mr.	China
	2000-01	P.V.	Aravind	Mr.	India
	2000-01	Srikanth	Subbarao	Mr.	India
	2000-01	Gil Guerrero	Algert	Mr.	Mexico
	2000-01	Ghimire	Ram Prasad	Mr.	Nepal
	2000-01	Anahua Quispe	Edgar Narciso	Dr.	Peru
	2000-01	Magessa	Finias Bryceson	Mr.	Tanzania
	2000-01	Nguyen	Quoc Khanh	Dr.	Vietnam
	2000-01	Islam	MD. Saiful	Mr.	Bangladesh
	2000-01	Tang	Hui	Mr.	China
	2000-01	Risse	Oliver	Mr.	Germany
	2000-01	Abbas	Mushahid	Mr.	Pakistan
	2000-01	Tardón Ruiz de Gauna	Saioa	Dr.	Spain
	2000-01	Nino	Raul	Mr.	Venezuela
	2000-01	von Hauff	Elizabeth Leoni	Ms.	Canada
	2001-02	Mohtad	Ibrahim (Shafi)	Mr.	Bangladesh
	2001-02	Belle	Vivian	Mr.s.	Cameroon
	2001-02	Nanji	Henry Nota	Mr.	Cameroon
	2001-02	Sanchez Mino	Santiago Jorge	Mr.	Ecuador
	2001-02	Shukla	Anand	Dr.	India
	2001-02	Gadde	Butchaiah	Mr.	India
	2001-02	Heang	Bora	Mr.	Cambodia
	2001-02	Ochieng	Xavier	Mr.	Kenya
	2001-02	Dhital	Ram Prasad	Mr.	Nepal
	2001-02	Poudel	Om Prasad	Mr.	Nepal
	2001-02	Mazimpaka	Ernest	Mr.	Rwanda
	2001-02	Abd El Messih	Bahy Saad Abdalla	Mr.	Egypt
	2001-02	Umana	Alejandro	Mr.	Colombia
	2001-02	Pilalas	Loukas	Mr.	Greece
	2001-02	Triantafyllos	Panagiotis	Mr.	Greece
	2001-02	Manssen	Thomas	Mr.	Germany
	2001-02	Winterfeldt	Jörg	Mr.	Germany
	2001-02	Avellaneda de la Calle	Jordi	Mr.	Spain
	2001-02	Shah	Sayed Faruque	Mr.	Bangladesh
	2001-02	Komilov	Asliddin	Mr.	Usbekistan
	2002-03	Asaah	Alice Ghopai	Ms.	Camerroon
	2002-03	Saha	Jhantu Kumar	Mr.	Bangladesh

	2002-03	Tafesse	Anteneh Gulíltat	Mr.	Ethiopia
	2002-03	Vega	Fernando Alberto	Mr.	Honduras
	2002-03	Irasari	Pudji	Ms.	Indonesia
	2002-03	Lee	Joo Yeol	Mr.	Korea
	2002-03	Kumar Khadka	Manoj	Mr.	Nepal
	2002-03	Mishra	Subhash Kumar	Mr.	Nepal
	2002-03	Shao	Jie	Ms.	China
	2002-03	Trujillo Quintero	Juan José	Mr.	Colombia
	2002-03	Peter	Marco	Mr.	Germany
	2002-03	Nacci	Gianpiero	Mr.	Italy
	2002-03	Choudhry	Ihtsham Farooq	Mr.	Pakistan
	2002-03	Bango Cascon	Alejandro	Mr.	Spain
	2002-03	Galsan	Sevjidsuren	Ms.	Mongolia
	2003-04	Veneranda Mola	Nicolás Enrique	Mr.	Argentina
	2003-04	Ahmed	Firoz Uddin	Mr.	Bangladesh
	2003-04	Aman	Julia	Ms.	Bangladesh
	2003-04	Ferdinand	Ajamah	Mr.	Cameroon
	2003-04	Sanchez Contreras	Julio Rene	Mr.	Colombia
	2003-04	Mitra	Indradip	Mr.	India
	2003-04	Lawless	Richard	Mr.	Ireland
	2003-04	Han	Seong-sook	Ms.	Korea
	2003-04	Trinh Viet	Hieu	Ms.	Vietnam
	2003-04	Sarran	Mathieu	Mr.	France
	2003-04	Bröer	Torsten	Mr.	Germany
	2003-04	Michel	Andreas	Mr.	Germany
	2003-04	Bandlamudi	George-Chakravarthy	Mr.	India
	2003-04	Joppich	Farida Damirovna	Ms.	Kyrgyzstan
	2003-04	Dosmailov	Meirzhan A.	Mr.	Kazakhstan
	2003-04	Possamai	Everson	Mr.	Brazil
	2003-04	Palle Badalge	Iresha Somarathna	Mr.	Sri Lanka
	2003-04	Bajracharya	Prashun Ratna	Mr.	Nepal
	2003-04	Yandri	Erkata	Mr.	Indonesia
	2004-06	Chowdhury	Mohammad Shahriar Ahmed	Mr.	Bangladesh
	2004-06	Zobayer	A.N.M.	Mr.	Bangladesh
	2004-06	Pena Diaz	Alfredo	Mr.	Colombia
	2004-06	Toropov	Maksim	Mr.	Kyrgyzstan
	2004-06	Sapkota	Prakash	Mr.	Nepal
	2004-06	Aderinto	Suraju	Mr.	Nigeria
	2004-06	Henriquez Prevoo	Christian	Mr.	Peru
	2004-06	Limsoontorn	Tubtim	Ms.	Thailand
	2004-06	Ochieng	David Otieno	Mr.	Kenya
	2004-06	Akhtar	Naveed	Mr.	Pakistan
	2004-06	Brudler	Evelyn	Ms.	Germany
	2004-06	Hermann	Sebastian	Mr.	Germany
	2004-06	Tek	Boon Jin	Mr.	Malaysia
	2004-06	Moreno M.	Juan Carlos	Mr.	Venezuela
	2005-07	Khan	Ahmed Jahir	Mr.	Bangladesh
	2005-07	Boruah	Dwipen	Mr.	Indien
	2005-07	Maharjan	Bhai Raja	Mr.	Nepal
	2005-07	Vera Tudela Carreno	Luis Enrique Domingo	Mr.	Peru
	2005-07	Caag Cabaces	Donnalyn Atienza	Ms.	Philippines
	2005-07	Jagwe	Wyclif	Mr.	Uganda
	2005-07	Mahu	Seth Agbeve	Mr.	Ghana
	2005-07	Wickramarathne	Widana G. Hashini K.	Ms.	Sri Lanka
	2005-07	Paula Chaves	Patricia Castello Branco	Ms.	Brasil

	2005-07	Sanchez Herrera	Diego Alejandro	Mr.	Columbia
	2005-07	Wilches Tamayo	Camilo Andres	Mr.	Colombia
	2005-07	Beyn	Mulugeta Weldetnsae	Mr.	Eritrea
	2005-07	Sterner	Michael	Mr.	Germany
	2005-07	Hegel Pellecer	Rodolfo	Mr.	Guatemala
	2005-07	Pechlivanoglou	Georgios	Mr.	Greece
	2005-07	Peel	Andrew	Mr.	Canada
	2005-07	Randig	Sebastian	Mr.	Germany
	2005-07	Rojas	Carlos Mauricio	Mr.	Colombian
	2005-07	Herráez Hernández	Iván	Mr.	Spain
	2005-07	Torio Blanco	Herena	Mr.	Spain
	2006-08	Khatun	Jorifa	Ms.	Bangladesh
	2006-08	Khatiwora	Nar Bahadur	Mr.	Bhutan
	2006-08	Vasconcellos	Marcelo de Lima	Mr.	Brazil
	2006-08	Nafiri	Faraida	Ms.	Indonesia
	2006-08	Lohani	Sunil Prasad	Mr.	Nepal
	2006-08	Singh	Nanik	Mr.	Panama
	2006-08	Mekki	Nada Mohamed	Ms.	Sudan
	2006-08	Mwakatage	Edwin Sithole	Mr.	Tanzania
	2006-08	Patschke	Erik	Mr.	Germany
	2006-08	Türker	Burak	Mr.	Turkey
	2006-08	McGraw	Sabin	Mr.	USA
	2006-08	Wu	Caiyang	Ms.	China
	2006-08	Zhang	Wendi	Ms.	China
	2006-08	Kaklamanakis	Emmanouel	Mr.	Greek
	2006-08	Surkute	Dnyanoba M.	Mr.	India
	2006-08	Richert	Bodo	Mr.	Germany
	2006-08	Karampela	Panagiota	Ms.	Greece
	2007-09	Anwar Hossain	Mohammad	Mr.	Bangladesh
	2007-09	Prakash K.C.	Chandra	Mr.	Nepal
	2007-09	Nwaogaidu	Simeon Obinna	Mr.	Nigeria
	2007-09	Elhadi Adam	Rania Mohammad	Ms.	Sudan
	2007-09	Parinyacupt	Unchalee	Ms.	Thailand
	2007-09	Mubbala	Ritah M.	Ms.	Uganda
	2007-09	Cendrawati	Dian Galuh	Ms.	Indonesia
	2007-09	Garcia da Fonseca	Leila	Ms.	Brazil
	2007-09	Pabon Restrepo	Giovanni Andres	Mr.	Colombia
	2007-09	Achibiri	Nnadozie Stanley	Mr.	Nigeria
	2007-09	Potzmann	Silvia	Ms.	Austria
	2007-09	Günther	Andreas	Mr.	Germany
	2007-09	Bachtiar	Ibnu Kahfi	Mr.	Indonesia
	2007-09	Millan	Rosiel	Ms.	Mexico
	2007-09	Güner	Bedrettin	Mr.	Turkey
	2007-09	Sandris	Georgios	Mr.	Greece
	2008-10	Alcazar	Freddy	Mr.	Venezuela
	2008-10	Binda Pereira	Mariana	Ms.	Brazil
	2008-10	Butler	Blake Allan	Mr.	USA
	2008-10	Chakanga	Kambulakwao	Ms.	Zambia
	2008-10	Farmani Marzankalateh	Issa	Mr.	Iran
	2008-10	Goepfert	Tyler	Mr.	USA
	2008-10	Hossain	Md. Motaher	Mr.	Bangladesh
	2008-10	Javed	Ahsan	Mr.	Pakistan
	2008-10	Mahmud	Abdul Muhaimin	Mr.	Malaysia
	2008-10	Njoka	Francis Namu	Mr.	Kenya
	2008-10	Paradine	Martin D.	Mr.	Canada

	2008-10	Pereira Santos	Rafael	Mr.	Brazil
	2008-10	Semere Tesfaselasie	Russom	Mr.	Eritrea
	2008-10	Shah	Adnan	Mr.	Bangladesh
	2008-10	Tchiemogo	Hamadou	Mr.	Niger
	2008-10	Temponeras	Dionysios	Mr.	Greece
	2008-10	Thakuri	Sujit	Mr.	Nepal
	2008-10	Ullrich	Cédric	Mr.	France
	2008-10	Wannapin	Sirinya	Ms.	Thailand
	2008-10	Agarwal	Ankur	Mr.	India
	2009-11	Al-Hammad	Hirak	Mr.	Bangladesh
	2009-11	Arroyo Klein	Sebastián Allejandro	Mr.	Chile
	2009-11	Brown	Nicholas	Mr.	USA
	2009-11	Bussières	Frederic	Mr.	Canada
	2009-11	Chhatbar	Kaushal	Mr.	India
	2009-11	De Vecchi	Rafael	Mr.	Brasil
	2009-11	Dola	Edwin Ochieng	Mr.	Kenya
	2009-11	Gómez Padrón	María Gabriela	Ms.	Venezuela
	2009-11	Hamzeh	Ahmad	Mr.	Palästina
	2009-11	Martin Gomez	Juan Pablo	Mr.	Mexico
	2009-11	Montealegre	Federico	Mr.	Costa Rica
	2009-11	Montoya Rojas	Juan Pablo	Mr.	Venezuela
	2009-11	Moreno Chiunti	Celia	Ms.	Mexico
	2009-11	Ngoma	Daniel H.	Mr.	Tanzania
	2009-11	Noureddine	Ibrahim	Mr.	Lebanon
	2009-11	Rodriguez Sanchez	Diana Elisa	Ms.	Mexico
	2009-11	Rudenko	Vladislav	Mr.	Russia
	2009-11	Weldemicael	Yonas Tesfay	Mr.	Eritrea
	2009-11	Wen	Chia Chia	Ms.	Taiwan

EUREC/REMA-students

	Course	Family Name	1st Name	Tit.	Origin
	2004/05	Aymard	Caroline	Ms.	France
	2004/05	Thomas	Denis	Mr.	Belgium
	2004/05	Lermitte	Tristan Eugene William	Mr.	UK
	2004/05	Clauzonnier	Adrien	Mr.	France
	2004/05	Ansell	Duncan Peter	Mr.	UK
	2004/05	Adler Gomes Dacosta	João Paulo	Mr.	Portugual
	2004/05	Lecesve	Laurent	Mr.	France
	2004/05	Avraamides	Stelios	Mr.	Cypress
	2004/05	Correia	Stélio	Mr.	Portugual
	2004/05	Carrell	Justin	Mr.	UK
	2004/05	Mantas	Panagiotis	Mr.	Greece
	2004/05	Dimopoulos	Aris	Mr.	Greece
	2004/05	Stromboni-Prevost	Estelle	Ms.	France
	2004/05	Thiebaut	Romaric	Mr.	France
	2005/06	Adnan	Mohammad	Ms.	Pakistan
	2005/06	McCracken	Philippe	Ms.	Canada
	2005/06	Xuereb	Steven	Ms.	Malta / Canada
	2005/06	Lopez Alcala	Leodegario	Ms.	Mexico
	2005/06	Sader	Hadi	Ms.	Lebanon
	2005/06	Rouze	Jerome	Ms.	France
	2005/06	Antonopoulos	Antonios	Ms.	Canada
	2005/06	Polizois	Theodoros-Theodoritos	Ms.	Greece
	2005/06	Gulliot	Bertrand	Ms.	France
	2005/06	Montes De Oca Arjon	Luis	Ms.	Spain
	2005/06	Singlehurst	Robert	Ms.	Canada
	2006/07	Skarvelis-Kazakos	Spyros	Ms.	Greece
	2006/07	Roycroft	Patrick (Paddy)	Ms.	Germany /Ireland
	2006/07	Craig	Mark Kenton	Ms.	Canada
	2006/07	Bennett	Valerie	Ms.	UK / Canada
	2006/07	Perini	Leonardo	Ms.	Italy
	2006/07	Di Lorenzo	Lisa	Ms.	Canada/Italy
	2006/07	Martinez-Streignard Viana	Vanesa	Ms.	Venezuela
	2006/07	Gil Zapata	Miguel	Ms.	Spain
	2006/07	Edge	Tad Michael	Ms.	USA
	2006/07	Troncoso Lago	Juan Antonio	Ms.	Spain
	2006/07	Marques Malcato	Silvia	Ms.	Portugal
	2006/07	Teksan	Yunus	Ms.	Turkey
	2007/08	Tanguy	Yann	Mr.	France
	2007/08	Chacon Calderon	Nancy	Ms.	Guatemala
	2007/08	Del Cid Lemus	César Roberto	Mr.	Guatemala
	2007/08	Townsend	Michael	Mr.	US
	2007/08	Phillips	Ian	Mr.	US
	2007/08	Veynandt	François Charles A.	Mr.	France
	2007/08	Goy	Solène	Ms.	France
	2007/08	Wong	Craig John	Mr.	US
	2007/08	Baldus-Jeursen	Christopher	Mr.	Canada
	2007/08	Cuddihy	Alan	Mr.	Ireland
	2007/08	Paterakis	Petros	Mr.	Greece

	2007/08	Qwen	Emma Louise	Ms.	UK
	2007/08	Lynch	Mairead	Ms.	Ireland
	2007/08	Gillard	Xavier	Ms.	France
	2007/08	Manginas	Georgios	Ms.	Greece
	2008/09	Adams	Brian	Ms.	USA
	2008/09	Arapogianni	Athanasia	Ms.	Greece
	2008/09	Chatzipanagi	Anatoli	Ms.	Greece
	2008/09	Emmerich	Roy	Ms.	South Africa
	2008/09	Gammoh	Omar	Ms.	Jordan
	2008/09	Gkinis	Ioannis	Ms.	Greece
	2008/09	Hernandez Rodriguez	Juan Esteban	Ms.	Columbia
	2008/09	Kwapis	Elke	Ms.	Germany
	2008/09	Loosen	Alex	Ms.	USA
	2008/09	Perez	Miguel	Ms.	Venezuela
	2008/09	Rojas	Sergio	Ms.	Costa Rica
	2008/09	Teixeirinha	Patricia Alexandra	Ms.	Portugal
	2008/09	Thomas	Jaimie	Ms.	Costa Rica
	2009/10	Jalia	Aquil A	Mr.	India
	2009/10	Konstantinos	Asproulakis	Mr.	Greece
	2009/10	Adham	Atallah	Mr.	Lebanon
	2009/10	Paola	Cadau	Ms.	Italy
	2009/10	Andreea	Costache	Ms.	Romania
	2009/10	Alberto	Cuellar	Mr.	Spain
	2009/10	Luis Felipe	Gonzalez Munoz	Mr.	Mexico
	2009/10	Can	Ibrahimoglu	Mr.	Turkey
	2009/10	Theodoros	Kotsonis	Mr.	Greece
	2009/10	Pedro	Peno Gama	Mr.	Spain
	2009/10	Giuseppe	Petrazzuolo	Mr.	Italy
	2009/10	Sundus	Ramli C.	Ms.	Malaysia
	2009/10	Juan Luis	Ramon Suarez	Mr.	Spain
	2009/10	Etienne	Thomassin	Mr.	France
	2009/10	Jose F.	Zuniga	Mr.	Mexico

PPRE 08/10 students visiting Brunnsteinhütte in the German Alps in June 2009