



Capacity development and strengthening for energy policy formulation
and implementation of sustainable energy projects in Indonesia

Capacity development and strengthening for energy policy formulation and implementation of sustainable projects in Indonesia

CASINDO

DELIVERABLE NO. 14:

Fast-track program at UNDIP and UNCEN

Edited by Mara Wijnker (Eindhoven University of Technology)



**Bilateral energy cooperation between
Indonesia and the Netherlands BECIN**



NL Agency
Ministry of Foreign Affairs

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Preface

This report on Fast-track program at UNDIP and UNCEN is deliverable No. 14 of the project 'Capacity development and strengthening for energy policy formulation and implementation of Sustainable energy projects in INDONESIA (CASINDO)'. The CASINDO project aims to establish a self-sustaining and self-developing structure at both the national and regional level to build and strengthen human capacity to enable the provinces of North Sumatra, Yogyakarta, Central Java, West Nusa Tenggara and Papua to formulate sound energy policies and to develop and implement renewable energy and energy efficiency projects. Information on upcoming events, the presentations and meeting minutes of project team meetings and completed project reports can be found on the CASINDO website www.casindo.info

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- Indonesian Ministry of Energy and Mineral Resources, Jakarta.
- Muhammadiyah University of Yogyakarta, Yogyakarta.
- Diponegoro University, Semarang.
- University of Sumatra Utara, Medan.
- University of Mataram, Mataram.
- University of Cenderawasih, Jayapura.
- Institute of Technology of Bandung (ITB), Bandung.
- Technical Education Development Centre (TEDC), Bandung.
- Technical University Eindhoven, Eindhoven.
- ETC-Nederland, Leusden.
- Energy research Centre of the Netherlands ECN, Petten.

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Abstract

The relationship between UNDIP and TU/e has improved because of organising two additional activities together. The chosen topics of the two workshops offered a good opportunity to get to know each other. The level of knowledge in sustainable energy and energy efficiency at UNDIP is already on a high level.

The relationship between UNCEN and TU/e has also improved much through the organisation of two additional activities. Staff of UNCEN took the opportunity to organise two workshops improving their knowledge in the field of sustainable energy and energy efficiency.

1. Introduction

The fast track was initiated to offer UNCEN and UNDIP the opportunity to co-operate with TU/e in two activities and to offer them possibility to catch up in terms of knowledge generation in the field of sustainable energy and energy efficiency. UNCEN and UNDIP have only been partners of TU/e since the beginning of the Casindo project in 2009 while the other three universities have already co-operated with TU/e for three years.

Both UNDIP and UNCEN chose to organise two additional workshops for which experts of TU/e were also invited. The objective of the workshops at UNCEN was to educate the lecturers more in-depth on the topics of: solar energy, biomass, and micro-hydratechnology and energy efficiency. Basic idea was similar to the workshops organised at UNRAM, USU and UMY as part of CAREPI in December 2007.

UNDIP organised the first workshop on the topic of setting-up and coordination of research in sustainable energy. Topic of the second workshop was co-operation with local industry and companies at which local industry/companies were invited. Objectives and results of these workshops will be presented in the following chapters. The workshops will be dealt with chronologically, meaning that first the two workshops organised by UNDIP will be presented. The two workshops organised by UNCEN follow.

2. Workshop 1: Improvement of research ability and networking of UNDIP to stimulate sustainable energy

2.1 Introduction

Dr. Camilo Rindt, lecturer at Mechanical Engineering and Ir. Patrick van Schijndel participated in the workshop on behalf of TU/e. The main objectives of the visit were to explore the possibilities for cooperation and to introduce one another to running research activities at UNDIP and TU/e on sustainable energy and energy

2.2 Day 1

Session 1 was started with a presentation of Dr. Joko Windarto who spoke about historical, current and future programs of UNDIP on sustainable energy planning, followed by Dr. Nazaruddin Sinaga who discussed energy efficiency as research and business opportunity. Session 2 and 3 on the first day were devoted to research on sustainable energy at the TU/e (invited presentation) and joint research and cooperation possibilities between UNDIP and TU/e (group discussion).

To assess research and cooperation possibilities the attendants were divided into 4 groups. Each group was asked to formulate current research interests, continued by brainstorming about research and cooperation possibilities. Results had to be presented in a central feedback session. This led to the formulation of 16 research topics. At day 2 the list was extended to 28. In the feedback session possible contacts at TU/e were given that best fitted to the formulated research topic (see table on next pages)

2.3 Day 2

Day 2 consisted of 4 sessions by several lecturers and discussions by TU/e, UNDIP, local government and the director of ENTEC, which is an Indonesian micro hydropower construction company.

TU/e gave a presentation providing an overview of the different renewable energy resources. Also several slides were devoted to energy efficiency and the urgency to change towards renewable energy feed stocks and thus the demand for UNDIP to do their share of researching and teaching.

Furthermore, a presentation on renewable energy potential in Indonesia was given, followed by government policy in this field.

ENTEC gave a presentation on their experience and development in Indonesia. The fourth session was used for discussion.

2.4 General remarks and conclusions

- a) The location and setup of the workshop was good. All was functional and everything started in time. A lot of students were recruited for assistance and that worked out well.
- b) It was a pity that there was no real workshop organizer (chairman) who clearly explained the objective and tried to stimulate people to actively participate in the discussions. Positive was that the Rector of UNDIP and the Dean of the Faculty of Engineering were present at the start of the workshop. The Rector even provided the opening speech.
- c) From discussions in the workshop but also from personal communications it became clear that staff members are rather pessimistic about raising research funds. They

seem to show a hesitating attitude towards research development. It shows that only part of the staff is actually involved in research activities and others are not (yet).

2.5 Recommendations

1. It is advisable to define the objective of a workshop well beforehand and to make sure there is one staff member who can motivate the participants during all sessions. It is also important that at the end of the workshop the topics discussed and concluded are summarized and also that some kind of follow up is defined.
2. The presentation of TU/e on sustainable energy didn't cover all research themes as defined within the master program Sustainable Energy Technology and didn't match always with the scientific level of the participants. For TU/e it is advisable to prepare a presentation which also includes easier accessible material for a broader public and covers more themes.
3. Use of bilingual sheets can always be recommended if time allows for translation.

Table 1: Research topics, status and contacts at TU/e.

| Nr | Topic | Status | Name | Dept. | Contact TU/e |
|----|--|---------|--|---------------------------|----------------|
| 1 | Energy consumption efficiency of air conditioning by centralized operation using RS 485 interface | Idea | Budi Setiyono | Electrical Engineering | Steinbuch |
| 2 | Implementation of corona discharge for removing NO _x and CO _x gases in biomass energy conversion | Ongoing | Abdul Syakur | Electrical Engineering | Pemen |
| 3 | Driving simulator to improve fuel consumption efficiency and reduce emission | Idea | Tabah Priangkoso | Mechanical Engineering | de Goey |
| 4 | Driving strategy to improve fuel consumption efficiency and reduce emission in Indonesia | Idea | Tabah Priangkoso | Mechanical Engineering | de Goey |
| 5 | Increasing electric power quality to minimize electric power losses | Ongoing | Nugroho | Electrical Engineering | Blom |
| 6 | Optimization substation location to reduce electric power losses in accordance with spatial position of demand load | Ongoing | Nugroho | Electrical Engineering | Blom |
| 7 | Effect of oxidized biodiesel in diesel engine performance and emission | Ongoing | Didik Ariwibowo | Mechanical Engineering | de Goey |
| 8 | Monitoring driver behaviour device for efficient fuel consumption driving | Ongoing | Tabah Priangkoso Didik Ariwibowo | Mechanical Engineering | Automotive Lab |
| 9 | Scaled-up demonstration units for community application of production of bio-fuels from organic waste streams | Idea | Nita Aryanti Budiyono Diah H.Wardhani M.Zaini | Chemical Engineering | de Goey |
| 10 | Effects of energy use behavioural changes on efficiency increase in | Idea | Winardi Dwi Nugraha | Environmental Engineering | Midden |

| | | | | | |
|----|--|---------|------------------------------|--|----------------|
| | households | | | | |
| 11 | Gasification of sewage sludge from wastewater treatment plant for energy generation | Idea | Sri Hapsari Budisulistiorini | Environmental Engineering | de Goey |
| 12 | Landfill methane production enhancement for electricity generation | Idea | Sri Hapsari Budisulistiorini | Environmental Engineering | de Goey |
| 13 | Selection of waste materials as additive in pavement materials in order to reduce the use of non-renewable material in road construction | Ongoing | Bagus Hario Setiadji | Civil Engineering | none |
| 14 | How to explore the sea tidal current energy | Idea | Prakosa Rahwibowo | Geological Engineering | none |
| 15 | The use of microalgae to be used as bio-fertilizer for waste water treatment | | | | none |
| 16 | Development of a solar cell from local materials | Idea | Qatro Endang W | Chemical, Mechanical, Electrical Engineering | van der Sanden |
| 17 | Synthesize of TiO ₂ & InGaN particle by spray pyrolysis method for solar cell | Idea | Iis Nurhasanah | Physics | van der Sanden |
| 18 | Synthesis of carbon nana-tubes by spray pyrolysis method | Ongoing | Iis Nurhasanah | Physics | none |
| 19 | Deposition of TiO ₂ thin film by spin-coating technique for solar cell | Ongoing | Iis Nurhasanah | Physics | van der Sanden |
| 20 | Development of BCND for phosphor material (solid state lighting) by electro spinning | Idea | Iis Nurhasanah | Physics | van der Sanden |
| 21 | Development of Nd-CeO ₂ for electrolyte SOFC | Ongoing | Iis Nurhasanah | Physics | van der Sanden |
| 22 | Geophysical observations and modelling hydrothermal (geothermal) system of Ungaran volcano | Ongoing | Agus Setyawan | Physics | none |
| 23 | Geological and geochemical observations at Ungaran geothermal prospect | Idea | Agus Setyawan | Physics | none |
| 24 | Development of geothermal energy at Ungaran volcano for conventional electric power | Idea | Agus Setyawan | Physics | none |
| 25 | Research on dehumidifying system using solar energy | Idea | Eflita Yohana | Mechanical Engineering | van Steenhoven |
| 26 | Decision Support System (DSS) to determine geothermal source | Idea | Sukmawati Nur Endah | Computer science | Weffers |
| 27 | Conversion of vegetable oils to bio fuels using nanocomposite pillared clay | Idea | Sriatun | Chemistry | de Goey |
| 28 | Increasing lipid production from microalgae biomass by biotechnological approach as alternative energy for bio-fuels | Ongoing | Hermin Pancasakti K | Biology | none |

3. Workshop 2: Innovation in Energy Technology will start when industry meets university at UNDIP

3.1 Introduction

The number of registered participants was around fifty, spread out over two days. The participants originated from (local) industries, government, SMK's and UNDIP. The mix was good; about twelve participants of industry, six of local government, sixteen of UNDIP /universities and five of SMK's.

Ir. Elco van Burg, researcher in the field of co-operation between entrepreneurs and universities and Ir. Patrick van Schijndel represented TU/e at this workshop.

The main objective of this second workshop was to improve the understanding between UNDIP and local industries in particular regarding energy issues. Therefore participants presented these issues from their respective backgrounds, i.e. business, government and universities. During the workshop parties were able to discuss the different needs, challenges and possibilities for future collaboration. The TU/e staff members have participated in this workshop and gave presentations regarding university-business collaboration and renewable energy technology and have stimulated the participants to be active during the workshop.

3.2 Day 1 and 2

At the first day the following was the outcome:

- Current business-university collaboration is not really developed

Business does not know how UNDIP can help them, and how to make contact

Representatives from the larger companies have a number of suggestions and/or questions with regard to the cooperation with the university:

- companies would like to establish official relationships opposed to the unofficial ones
- they would like university to be more proactive in solving problems of the larger industries
- They argue not to know sufficiently of university (UNDIP) and say they only send students and questionnaires but have not provided much support yet.
- The required equipment at the university is outdated or lacking.

On the other hand university researchers state that it is very difficult to acquire research funding from big companies. Moreover, they see a number of difficulties:

- industry is only oriented towards their practical problems, not towards development and research,
- laboratories are not equipped for the industry,
- they assume that personal relationships work, but the official relationships do not,
- companies don't pay for research efforts,
- many of the (foreign) companies don't have the autonomy to cooperate with the university,

Finally, a number of representatives from the government state that there is indirect cooperation with the university regarding audits, knowledge and surveys. A number of industry participants ask for a larger role of the government in supporting cooperation

between university and industry, but the government representatives did not explicitly react to this request.

3.3 Conclusions

First of all the industry representatives would like to have a continued and increased R&D cooperation with the university. This cooperation could be on the following (practical) issues:

- Possibilities for energy reduction. Knowledge is needed on: energy efficiency (of steam installations (Pepsi Cola), heaters (PT Simoplan), drying installations (PT Djarum) and ovens (PT Nissin)), including energy audits,
- reuse of waste (from a sugar plant) (PT Festo),
- opportunity exploration of wind energy (PT Simoplan),
- blending and bottling (Pepsi Cola),
- marketing (Pepsi Cola),

Suggestions by industry for cooperation:

A number of conclusions from the discussion groups with regard to the role of the university:

- more formal cooperation is wanted and possible, the university will take this request serious,
- university staff could and should act more as a sparring partner of industry, to solve problems together,
- the university could produce a website and leaflets for industry in which they explain the knowledge/facilities they could offer to industry
- The university could enable and arrange visits to campus for industry, to demonstrate work, projects, research at university and possible implications for business/industry.

A number of conclusions include the role of the government:

- there is a problem in energy regulation (related to the monopoly of PLN) that is not supportive to the new energy / standardization of tariffs to end-users,
- Standardisation of energy systems.

3.4 Results

The industry representatives have been relatively specific about their needs. The university staff seems to have quite some knowledge to support industry. To enable effective and sustainable cooperation, both sides need to be supportive to create win-win situations. In the discussions in the two days, it seems that such cooperative programs should be possible. One of the first steps seems to be that UNDIP will take the lead to open up their laboratories, enable site visits and provide information for industry. In this sense, UNDIP will take the lead to enable cooperation

4. Workshop 3: Solar Energy and Biomass at UNCEN

4.1 Introduction

At request of UNCEN the workshops were given simultaneously instead of chronologically to give the lecturers of UNCEN the opportunity to learn in more details about the topic of interest. Mr. Han van Kasteren and Mr. Jasper Frunt, each being an expert in one of the topics, agreed to give these two-day workshops to an audience of approximately 12 lecturers each. Both prepared a presentation including an introduction, specifications of the technologies, applications, installation etc. and exercises. Mr. Jasper also brought 4 small solar panels (credit card size) which were used for practical measurements during the workshop.

On each of the two days a Studium Generale was included on one of the topics for an audience of about 60 students.

The objectives set before execution of the workshop are presented here:

- To provide the audience with basis theoretical knowledge on biomass/biofuels and solar energy
- To address given problems on biomass/biofuels and solar energy
- To provide the audience with an understanding of the conversion of biomass/biofuels and solar energy

4.2 Day 1

Solar Energy

An introduction on solar energy was given, explaining the concept of irradiation. First the advantages of applying solar energy (renewable, environmentally friendly, reliability, silent, autonomous operation) were addressed in detail. The concept of solar energy, converting sunlight into electricity was discussed. Different types of cells were discussed; mono- and multi-crystalline, amorphous and organic cells and their advantages and disadvantages. Furthermore attention was paid to: semi-conductor functioning, p-n junctions, characteristics of the solar cell, diode functioning, connection of PV systems, maximum power point tracking, basic electrical properties of a panel (Peak power, open voltage, short circuit current, diode functioning), relation between voltage and current of a panel, etc. etc.

During the last part of the workshop, all lecturers were invited to go outside and in groups of 4 to 5 lecturers the open voltage and short circuit current of the credit card size multi crystalline solar panels were measured when receiving full sunlight (at this time of the day; around 16h00) and when pointed towards the other way. Afterwards, two panels were coupled, both in series and parallel to evaluate the effect of parallel and series connection on open voltage and short circuit currents.

Biomass

After an introduction into the potential of biomass for Indonesia, the principle parameters concerning biomass were dealt with: organic content, water and ash. Based on an elemental analysis the energy content can be calculated of a biomass stream.

Biomass conversion technologies were discussed: physical methods: pressing oil out of seeds and transesterification; biochemical methods: digestion and fermentation; thermo chemical methods: pyrolysis, hydrothermal upgrading, gasification and incineration.

Examples were treated with concerning pyrolysis and gasification. Also questions of the teacher were discussed:

1. Molecular adhesive catalyst preparation from clay for removal of water from ethanol / water streams.
2. Issues about the biodiesel production from a special fruit species from Papua region.

4.3 Day 2

Solar

During the second day of the solar workshop the following topics were addressed.

- Relation between voltage and current of solar panels (IV curves)
- Relation between output voltage and power of solar panels
- Systems with multiple PV panels
- Information on grid connected systems with inverters. Parallel and series (and combinations of both) connections. Different connections for different system sizes.
- Information on autonomous system (e.g. solar home systems are autonomous systems as well as systems for water pumping stations)
- Information on how to position the panel (azimuth and elevation) was discussed. Different systems to track the sun during the day / year were mentioned and discussed.
- How to install and maintain a panel
- Discussion of the experimental results
- Different batteries, the effect and use of battery chargers, costs and lifetime of battery systems, different battery connections
- Calculating system size, panel capacity, battery capacity, cable dimensions, charger capacity, and inverter capacity.
- Effect of cloudy (rainy) days on a solar home system
- Design of larger systems (clinics)
- Fluctuation of irradiation during the day
- Fluctuation of irradiation during the year
- Costs of PV systems and comparison with current diesel generator solutions
- Possibilities for research at the university

Directly after lunch more experiments were performed using the available credit card size panels. Using available multi-meters (2 per setup) and variable resistances the IV curve and power output were determined with different irradiation by two groups (each consisting of 10 people). Afterwards the results from the measurements were discussed in detail. The experiments took about 45 minutes. Conclusions were:

- High yield during the day, more than the previous day
- Difficult to achieve good measurement results in a relatively brief period
- Nice experiments to do with students as well

Biomass

The second day digestion was treated in detail in the morning. What is the potential? What are the parameters to be handled for a good process and maximization of gas production? Some examples of topics: functioning of digester; adding of feedstock, micro organisms producing enzymes, methane and CO₂ (and some other particles); production methane can be used for cooking. Percentage of methane produced out of dry material is 55-70%

The temperature of the digester can be between 30 and 55 C. Higher temperature increases the speed of the process, but energy needs to be added. At low temperature, this is a slow process.

Furthermore, digestate is produced which can be used for example as a fertilizer. Types of biomass that can be used are discussed. In the afternoon calculations were dealt with concerning when a biomass stream can be incinerated auto thermal.

Finally the energy efficiency of digestion is compared to direct incineration, pyrolysis and/or gasification. This was done via calculation of examples

4.4 Conclusions and recommendations

The presentations were given in English but at a slow pace and the presentation slides on solar energy had been translated beforehand. The handouts were presented to the participants. This made understanding the presentation very easy. Furthermore the presentation was given in a way which allowed for immediate questions. An open atmosphere was created which allowed interruptions by the audience in case of any questions/difficulties.

The lecturers of UNCEN paid very well attention and some of them understood very well and posed many questions. Often the level was good and quite high. This high level of questions indicates that most of the members of the audience understood the matter very well. At the end of the session sometimes some members were even able to answer and explain matter to other members which is an even stronger signal about the high level of understanding.

Already some research proposals have been submitted. Also in the solar course research proposals were discussed in great detail. Some ideas for further research were given by Jasper Frunt and the audience showed great interest in this.

The attendees of the solar energy course would like to have more of the experimental solar panels (credit card size). The price of these panels is approximately 5 euro a piece. In case of experiments by students the ideal number of panels is 1 per 2 students. Furthermore the attendees of the solar course had interest in literature (papers and books) about solar energy.

It was concluded that photovoltaic generation could play a big role in Papua due to the available solar irradiation. Furthermore PV can be used to set up autonomous systems (solar home systems). During the experiments it was concluded that it is difficult to set up a good experiment but that very basic results can be achieved with the currently available material.

At the end of the second day research proposals were discussed for research in photovoltaic. It was concluded that the first research should focus on the availability of solar irradiation in Jayapura. Furthermore research on how to position (or how to change the position during the year) should be performed. Also research into how to set up solar home systems would be very useful.

Recommendations for future courses:

For future courses on photovoltaic generation the following aspects should be taken into account:

- Bring experimental (4) solar panels
- Bring literature for the lecturers (perhaps e-books can be found)
- Bring more information on prices of systems (in Africa and in Europe) as a reference. The price information should be for panels but also for batteries and chargers.

5. Workshop 4: Energy Efficiency and Micro hydro power at UNCEN

5.1 Introduction

On October 5th and 6th 2010, workshops on Hydropower and Energy Efficiency were organised simultaneously at the Technical Faculty of the University of Cenderawasih (UNCEN), Jayapura. The classes covered presentations and workshops. Dr. Jacob van Berkel was workshop leader on behalf of TU/e during the workshop on hydropower. Ir. Patrick van Schijndel led the workshop on energy efficiency.

5.2 Day 1 on Hydropower

For Hydropower the two-day classes covered:

1. Studium General, for students, as a first introduction to the topic.
2. Presentation (dealing with theoretical insight in hydropower and practical implications)
3. Workshops, in which practical cases (assignments) were elaborated and discussed with the lecturers.

Topics dealt with during the first day: energy equation (conservation of energy) to calculate energy potential of hydropower stations. Integral impulse equations to understand power transfer in hydraulic turbines.

Derivation of dimensionless, specific diameter and angular speed of hydro turbines to facilitate categorization and selection of turbines

After this lecture, the attendants were invited to elaborate in cases (assignments). Participants did this with enthusiasm. After about half an hour one of the attendants was invited to come forward and give the elaboration on the whiteboard.

The skills obtained during this workshop are:

1. Understanding of physical principles of hydro systems and turbines
2. Understanding in variety of hydro systems (high head, low head, tidal, wave and salinity)
3. Capability to do calculations of energy performance, efficiency and turbine selection.

5.3 Day 2 on hydropower

Where the first day focused on theoretical background (necessary to understand working principles on energy + momentum transfer in hydropower installations), the second day focuses on applications.

The lecture outlined the skills necessary to make a site evaluation:

1. Determination of available head and flow rate. Over a whole year the flow-duration curves.
2. Then fixing the design parameters (head and flow rate), on the basis of the flow duration curve.
3. Selecting system components & control.

Also some non-technical matters like legislation, environmental issues (fish damage) and costs were addressed.

Also for basic understanding, sample exercises are elaborated on basic energy technology and application of the knowledge of the past days.

At the end of day 2, the laboratory was visited by Mr. Perlindungan (lecturer electrical department) and Mr. Van Berkel. The experimental and machining facilities are basic and do not (yet) cover micro hydro power.

5.4 Main findings during hydropower workshop

- General level of knowledge and experience during workshop is sufficient: After the lecture, attendants were able to make assignments.
- Within de hydropower classes English was OK. No translation was needed during the lecturer's workshops.
- The enthusiasm of the lecturers was evident as they explicitly asked to continue the exercises, rather than to stop at the agreed time.
- Lecturers showed interest, broader than Micro-hydro, also in Hydropower outlook (including tidal, wave and salinity) and also in practical exercises.
- Hydro power is a good candidate for further development at UNCEN, for two reasons:
 1. It stimulates cooperation between the four departments within the Technical Faculty (Mechanical-, Electrical-, Civil and Mining Engineering) and
 2. Around UNCEN and Jayapura there is hydro potential in hills and perhaps seas & oceans. South Papua is reported to have a tidal range of 12 meters (amongst the highest on earth) and very near Jayapura is a large fresh water lake that runs off to the sea with considerable head. A report about the hydro potential, written by a UNCEN university lecturer who is currently in Japan will be sent to Mr. van Berkel.
- Within the mechanical Engineering department plans already exists for:
 - Hydro-power test set-up (turbine, flow metering)
 - Site surveys regarding the test set-up, missing parts are pump, tank and tubing.
- The electrical department currently focuses on power transmission, but wants to adjust focus towards sustainable power generation.
- Valuable equipment for site evaluation is already available in the Mining Engineering department. With relatively low cost (<1000 Euro) tools for flow measurements can be realized.

5.5 Discussions on Energy Efficiency

Discussion summary

In October 5 and 6th Patrick van Schijndel has lectured for a group of 10-15 persons regarding energy efficiency issues at UNCEN, Papua, Indonesia.

The participants in the energy efficiency workshop class were partly lecturers from UNCEN and partly lecturers from private universities in Jayapura as well as members of Dinas (Department of mining) in Jayapura. This can explain that language barriers in this group were very large, compared to the experiences in the parallel session (hydropower, Jacob van Berkel). Without the very supportive lecturer from UNCEN, Ibu Libertina, who translated many parts of presentations and answers and questions this training would have been almost impossible due to language barriers.

During the first day all participants were asked several questions, for instance their interest in the topic and their background. Most participants had an engineering background. For some the level was vocational training, for others Bachelor level, e.g. electrical engineering and a few mechanical engineering. As the group was of a very mixed nature it was necessary to focus on the basics of energy technology and let the participants try to solve simple questions.

In summary most participants in the energy efficiency training group were interested in the efficiency of power generation and renewable energy systems. Many mentioned to be interested in the efficiency of hydropower. This was an indication that they had maybe chosen to do the hydropower training but were told to participate in the energy efficiency training, one participant explicitly told so.

During both days lecturers would be away for a certain time, as they gave classes or had other activities. Also many of the registered participants never showed up. This made it not easy to teach in more detail and become less superficial. Adding up the difficulty in understanding the English language it was not easy to get all the attendants in a productive mode at the start, though some of the participants were active throughout the complete training, fortunately. There also was a lively discussion during both the two training days. On day two the studium generale meeting with the students was held. Studium generale focused on sustainable development, waste and energy efficiency matters. It was well understood by the students who came up with many good questions. To give an illustration of what was dealt with during SG: a lot of plastic waste washes away from Jayapura city and will end up in a vast 'Sea of plastic' almost the size of the USA within the Pacific. The value of the amount of plastic floating in that sea is estimated 100 billion US dollars, as plastic is basically just a different form of crude oil. The Indonesian culture is such, like in other non European areas, that waste and energy issues are problems of the central or regional government and not of individuals. Energy efficiency is not an issue in which people are interested in.

Furthermore, there was discussion regarding the power supply, power disruption and the fact that when all inhabitants use energy more wisely there will be less power disruptions. The lecturers asked many questions regarding efficiency. It is clear from these discussions that there are many misconceptions on energy topics and the level was not yet high in average with a few exceptions. One of the things was e.g. 'why should we be energy efficient, as PLN gets 25.000 litre fuel a day so why save?'. As there are many power outages this question is a clear misconception regarding energy issues and efficiency. Luckily this question could be discussed with all participants.

Also the participants wanted to be taught 'a simple equation to calculate energy efficiency', but there are only specific equations depending on the type of efficiency (generation, supply, equipment, mobility).

5.6 Recommendations

- For this short mission on hydro to sustain, follow-up is recommended on teaching and especially experimental (practical) work. This work may focus on: experiments with a laboratory test setup of a micro-hydro system and field work: recognisance, head and flow measurement and performing a technical-economical-ecological feasibility study. A research (recognisance) project for the local prospects from hydro: Run off the river (mountains, high and low head); tides; waves and salinity. Reported are high tidal ranges in the South of Papua and very near Jayapura is a large fresh water lake that runs off to the sea with considerable head. Further work on hydropower strengthens the cooperation between the four departments within the Technical Faculty.
- Affinity for basic questions was also observed within Energy Efficiency, having 10 persons in this workshop, both from UNCEN and industry and DINAS. It is recommended to organize a workshop on basic energy technology, prior to workshops dedicated to sustainable sources (Solar, Biomass, Hydro).
- Advised is also to consider wind energy. Wind energy has been suggested in the past but rejected on the basis of a one person's opinion. Possibly some potential is present, especially at hill-tops. A report on local wind energy resources is available at ITB. It is suggested to have a closer look into this.

6. Conclusions on fast-track UNDIP

Soon it became clear that UNDIP did not need to catch up with the three universities with whom TU/e already co-operated earlier considering the level of knowledge on sustainable energy and energy efficiency, because education and research of UNDIP is already on a high level. Therefore, during these workshops it became more important for TU/e and UNDIP to get to know each other. These two workshops offered a good opportunity because the first workshop was used as a general introduction to each other and each other's knowledge in the field of sustainable energy and energy efficiency. The second workshop dealt with a topic which is important for as well TU/e as UNDIP, namely valorisation of knowledge. As TU/e staff members have experience in searching for possibilities of co-operation with companies/industry, this workshop was very useful to UNDIP as well as the local companies and industry which participated. UNDIP staff members also have a lot of experience with working in projects/doing research for companies/industry, but thinking about long-term co-operation and searching for benefits in this co-operation is new. Staff members of UNDIP responded actively to this topic. After the workshop more meetings with interested companies have been organised and another knowledge valorisation workshop on the topic of energy auditing has been organised half a year later.

Below considering UNDIP's participation in the other parts of the co-operation between universities in the Casindo project:

- curriculum development
- Setting-up research agendas
- demonstration equipment
- knowledge valorisation.

UNDIP has demonstrated to easily start-up and develop itself in all activities involved. Six lecturers of UNDIP have been trained at TU/e in spring of 2010. Their knowledge will be used for the development of courses which will be part of the new master program in energy planning and sustainable energy. The research proposals and proposals for use and purchasing of demonstration equipment were finalized as first of the five universities involved. The department of Mechanical Engineering of TU/e and the Faculty of Engineering of UNDIP have already signed a formal agreement, namely a Memorandum of Action.

7. Conclusions on fast-track UNCEN

Before starting the Casindo project, it was difficult to obtain a good idea of the level of English let alone the level of knowledge in the sustainable energy field at UNCEN. It turned out that the level of English of a group of lecturers is (more than) sufficient. Some of the lecturers have been involved in (research) projects on sustainable energy, but the level of knowledge in this field for most lecturers was still basic. UNCEN therefore wisely decided to use the additional offered activities to train their lecturers by means of workshops in specific fields that are interesting for the region and therefore also for staff of UNCEN.

TU/e staff members of all four topics were enthusiastic about the participants of the workshops and their active approach. Only during the energy efficiency workshop it seemed the level of English hampered the level of outcomes. Furthermore, knowledge on this topic was also very basic and there were several misunderstandings concerning concepts related to this topic. Compared to the other topics, in which it was most likely expected that the audience would only have very basic knowledge, energy efficiency seemed more complicated to deal with.

When looking at the other parts of the co-operation between universities, as mentioned above, UNCEN is well on its way:

Research proposals have been submitted as well as proposals for purchasing demonstration equipment. A course dealing with four topics in which UNCEN staff was trained in Eindhoven has been developed for students of three directions within the faculty of engineering. In January 2011 UNCEN will organise its first knowledge valorisation workshop.

The relation between TU/e and UNCEN has improved especially because of the motivated group of lecturers working at UNCEN.

Annex 1: Timetable Workshop

Schedule of International Workshop: Improvement of UNDIP Research Ability and Networking to Stimulate Sustainable Energy Planning

October 19-20th, 2009, venue Grand Candi Hotel, Jl Sisingamangaraja, Semarang

| Day 1, October 19th, 2009 | | |
|---|--|-----------------------------------|
| Time | Topic and Speaker | Moderator |
| 08.00-08.30 | Registration | - |
| 08.30-08.35 | Report by PIC : Dr. Joko Windarto | |
| 08.35-08.45 | Opening Speech by Rector of Diponegoro University | - |
| 08.45-09.30 | <i>History, current and future programs of Diponegoro University on sustainable energy planning</i> by Mr. B. Purwanggono | Dr. Sukamta |
| 09.30-10.00 | Coffee break | |
| | Session 1 | |
| 10.00-11.00 | <i>Improvement of energy efficiency as a research and business opportunities</i> by Dr. Nazarudin Sinaga (Diponegoro University) | Sukiswo, ST, MT |
| 11.00-11.45 | Discussion | |
| 11.45-13.00 | Lunch break | |
| | Session 2 | |
| 13.00-14.00 | <i>Research on Sustainable Energy</i> by Mr. Camilo Rindt (Technical University of Eindhoven, The Netherlands) | Dr. M. Zaini |
| 14.00-14.45 | Discussion | |
| 14.45-15.15 | Coffee Break | |
| | Session 3 | |
| 15.15-16.15 | Group Discussion Topic: <i>Joint Research and Cooperation on Sustainable Energy</i> | Dr. Nazarudin Mr. Camilo Rindt |

| Day 2, October 20th, 2009 | | |
|---|---|--|
| Time | Material and Speaker | Moderator |
| | Session 1 | |
| 08.00-09.00 | <i>Demand and Feedstock of Sustainable Energy</i> by Prof. Patrick Van Schijndel (Technical University of Eindhoven, The Netherlands) | Rizal Isnanto, ST, MT |
| 09.00-09.45 | Discussion | |
| 09.45-10.15 | Coffee break | |
| | Session 2 | |
| 10.15-11.30 | <ul style="list-style-type: none"> • <i>Potential renewable energy resources in Indonesia</i> by Dr. Hermawan (Diponegoro University) • <i>Energy Policy in Central Java</i> by Mr. Teguh Dwi Paryono (Head of Office of Energy and Mineral Resources of Central Java Province) | Dr. Tony Suryo U. |
| 11.30-12.00 | Discussion | |
| 12.00-13.00 | Lunch break | |
| | Session 3 | |
| 13.00-14.00 | <i>Business Opportunities of Micro Hydro Project in Indonesia</i> by Mr. Gerard Fischer (Entec.ch) | Dr. Joko Windarto |
| 14.00-14.45 | Discussion | |
| 14.45-15.15 | Coffee break | |
| | Session 4 | |
| 15.15-16.15 | Group Discussion Topic: <i>Implementation and Business Opportunities on Renewable energy in Indonesia</i> | Prof. Patrick Van Schijndel Mr. Gerard Fischer Mr. Teguh Dwi Paryono Dr. Hermawan |
| 16.15-16.30 | Concluding Remarks | Dr. Joko Windarto |
| 16.30 | Closing ceremony | Organizing Committee |

Annex 2: Time Table Workshop UNDIP

| Day 1, 18 January 2010 | | |
|------------------------|--|--|
| Time | Topic and speaker | Remark |
| 11.30-12.30 | Check in to the hotel Registration | Venue Nugraha Wisata Hotel Bandungan |
| 12.30-13.30 | Lunch | Organizing Committee |
| 13.30-14.00 | OC Report Opening | OC Chairman Dean of Engineering Faculty |
| 14.00-15.00 | Introduction of Participants and Speakers Explanation of CASINDO Project and Workshop Goal | Vice Dean IV /Mr Bambang |
| 15.00-17.00 | TU/E Speaker Session I Topic <i>'Relationship between business and university What does business think about university and university think about business</i> Discussion | CASINDO Team Leader/Mr Joko Speaker : Elco Vd Burg/Patrick VS Moderator : Dr. Hadiyanto, ST, MT |
| 17.00-18.30 | Free & Pray | Responsible by Committee |
| 18.30-19.00 | Dinner | |
| 19.00-20.30 | TU/E speaker Session II Topic <i>Relationship between United Brains and Innovation Lab introduction / ALSO INTRODUCTION on the topic of "New innovation of technology on Renewable Energy (solar, wind, biogas, biomass) was implanted in Industrial, rural and urban area</i> | Speaker : Patrick Van Schijndel & Elco vd Burg Moderator : Dr. Djaeni |
| 20.30-20.45 | Discussion | |
| 20.45-21.30 | Coffee Break | |
| | Group Discussion (A, B, C) | Patrick Van Schijndel Dr. Hadiyanto, ST, MT Dr. M. Djaeni |

| Day 2 , 19 January 2010 | | |
|---|---|---|
| Time | Topic and speaker | Remark |
| 07.00-08.00 | Breakfast | Organizing Committee |
| 08.00-09.00 | Speakers from -Industry : PT. Citra -Government: Directorate of Renewable Energy and Energy Conservation, MEMR. Discussion | Moderator : Dr. Ir. Joko Windarto |
| 09.00-10.00 | Speakers from UNDIP : – <i>Implementation Biogas for household</i> : Dr. M. Djaeni – <i>Implementation of solar cell for communal system of household</i> : Ir. Agung Nugroho & Abdul Syakur, MT – <i>Implementation of energy efficiency for transportation</i> : Dr. Nazaruddin Sinaga | Moderator Rizal Isnanto, ST, MM, MT, |
| 10.00-10.15 | Coffee Break | |
| 10.15 – 11.45 | Group Presentation (A, B, C) Discussion | Moderator : Patrick Van Schijndel , Elco vd Burg and Dr. MSK Toni |
| 11.45-12.00 | Concluding Remarks Closing Ceremony | Organizing Committee/Dr Sukamta Vice Dean IV/ Mr. Bambang |
| 12.00-13.00 | Lunch, pray and check out | Organizing Committee |
| 13.00-14.00 | Travel to visit Textile Industry (PT APAC Inti Corp) / Food Industry (Coca Cola) | Organizing Committee |
| 14.00-15.00 15.00-16.00 16.00-17.00 | Visit to Industry Discussion Travel to Semarang | Organizing Committee |

Annex 3: Time table: Solar and Biomass Workshop, UNCEN

Location : Jayapura, Papua
 Venue : Engineering Faculty, University of Cenderawasih (UNCEN)
 Date : 15th and 16th June 2010

Lecturers : Dr. Han van Kasteren and Ir. Jasper Frunt

Tuesday 15th June

| Time | Topic/lecturer | Remark |
|-------------|---|---|
| 8h30-9h00 | Registration | Committee |
| 9h00-9h30 | Opening ceremony | By Vice of Rector 1 |
| 9h30-10h30 | Stadium general to Biomass | For students Half an hour introduction/lecture by Dr. Han van Kasteren; half an hour questions |
| 10h30-11h00 | Short break | Committee |
| 11h00-12h00 | Introduction to Biomass | By Dr. Han van Kasteren |
| | Introduction to Solar Energy | By Ir. Jasper Frunt |
| 12h00-13h00 | First assignments/calculations & discussion Biomass | By Dr. Han van Kasteren |
| | First assignments/calculations & discussion Solar Energy | By Ir. Jasper Frunt |
| 13h00-14h00 | Lunch and prayers | Committee |
| 14h00-15h00 | Assignments/calculations & working out of assignments Biomass | By Dr. Han van Kasteren |
| | Assignments & discussion Solar Energy | By Ir. Jasper Frunt |
| 15h00-15h30 | Coffee break | Committee |
| 15h30-17h00 | Discussion of calculations/assignments and summary of first day | By Dr. Han van Kasteren & By Ir. Jasper Frunt |

Wednesday 16th June

| Time | Topic/lecturer | Remark |
|-------------|--|---|
| 8h30-9h00 | Registration | Committee |
| 9h00-10h00 | Stadium general to Solar Energy | For students Half an hour introduction/lecture by Ir. Jasper Frunt; half an hour questions |
| 10h00-10h30 | Short break | Committee |
| 10h30-11h30 | Second lecture Biomass | By Dr. Han van Kasteren |
| | Second lecture Solar Energy | By Ir. Jasper Frunt |
| 11h30-13h00 | Assignments/calculations & discussion Biomass | By Dr. Han van Kasteren |
| | Assignments/calculations & discussion Solar Energy | By Ir. Jasper Frunt |
| 13h00-14h00 | Lunch and prayers | Committee |
| 14h00-15h00 | Third lecture Solar Energy | By Dr. Han van Kasteren |
| | Third lecture Solar Energy | By Ir. Jasper Frunt |
| 15h00-15h30 | Coffee Break | Committee |
| 15h30-16h30 | Discussion on | By Dr. Han van Kasteren & Ir. |

| | | |
|-------------|---|--------------|
| | outcomes/assignments and Wrap up of the workshop; summary of second day | Jasper Frunt |
| 16h30-17h00 | Closure of the Workshop and handing out certificates & take group picture | Committee |

Annex 4: Timetable Workshop Micro hydro Technology and Energy Efficiency, UNCEN

Location : Jayapura, Papua
 Venue : Engineering Faculty, University of Cenderawasih (UNCEN)
 Date : 5th and 6th of October 2010

Lecturers : Ir. Jacob van Berkel and Ir. Patrick van Schijndel

Tuesday 15th June

| Time | Topic/lecturer | Remark |
|-------------|--|---|
| 8h30-9h00 | Registration | Committee |
| 9h00-9h30 | Opening ceremony | By Vice of Rector 1 |
| 9h30-10h30 | Stadium general of Micro hydro Technology | For students Half an hour introduction/lecture by Ir. Jacob van Berkel; half an hour questions |
| 10h30-11h00 | Short break | Committee |
| 11h00-12h00 | Introduction to Micro hydro Technology | By Ir. Jacob van Berkel |
| | Introduction to Energy Efficiency | By Ir. Patrick van Schijndel |
| 12h00-13h00 | First assignments/calculations & discussion Micro hydro Technology | By Ir. Jacob van Berkel |
| | First assignments/calculations & discussion Energy Efficiency | By Ir. Patrick van Schijndel |
| 13h00-14h00 | Lunch and prayers | Committee |
| 14h00-15h00 | Assignments/calculations & working out of assignments Micro hydro Technology | By Ir. Jacob van Berkel |
| | Assignments & discussion Energy Efficiency | By Ir. Patrick van Schijndel |
| 15h00-15h30 | Coffee break | Committee |
| 15h30-17h00 | Discussion of calculations/assignments and summary of first day | By Ir. Jacob van Berkel & By Ir. Patrick van Schijndel |

Wednesday 16th June

| Time | Topic/lecturer | Remark |
|-------------|--|--|
| 8h30-9h00 | Registration | Committee |
| 9h00-10h00 | Stadium general to Energy Efficiency | For students Half an hour introduction/lecture by Ir. Patrick van Schijndel; half an hour questions |
| 10h00-10h30 | Short break | Committee |
| 10h30-11h30 | Second lecture Micro hydro Technology | By Ir. Jacob van Berkel |
| | Second lecture Energy Efficiency | By Ir. Patrick van Schijndel |
| 11h30-13h00 | Assignments/calculations & discussion Micro hydro Technology | By Ir. Jacob van Berkel |
| | Assignments/calculations & discussion Energy Efficiency | By Ir. Patrick van Schijndel |

| | | |
|-------------|---|---|
| 13h00-14h00 | Lunch and prayers | Committee |
| 14h00-15h00 | Third lecture Micro hydro Technology | By Ir. Jacob van Berkel |
| | Third lecture Energy Efficiency | By Ir. Patrick van Schijndel |
| 15h00-15h30 | Coffee Break | Committee |
| 15h30-16h30 | Discussion on outcomes/assignments and Wrap up of the workshop; summary of second day | By Ir. Jacob van Berkel & Ir. Patrick van Schijndel |
| 16h30-17h00 | Closure of the Workshop and handing out certificates & take group picture | Committee |