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French Embassy at Hanoi, AAP Objectif labos USTH

Research Program and Joint Lab Implementation

Clean Energy and Sustainable Development lab activity report

2014-09-31 to 2015-12-31

Minh HA-DUONG, Hoang Anh TRAN

Hanoi, January 27th, 2016

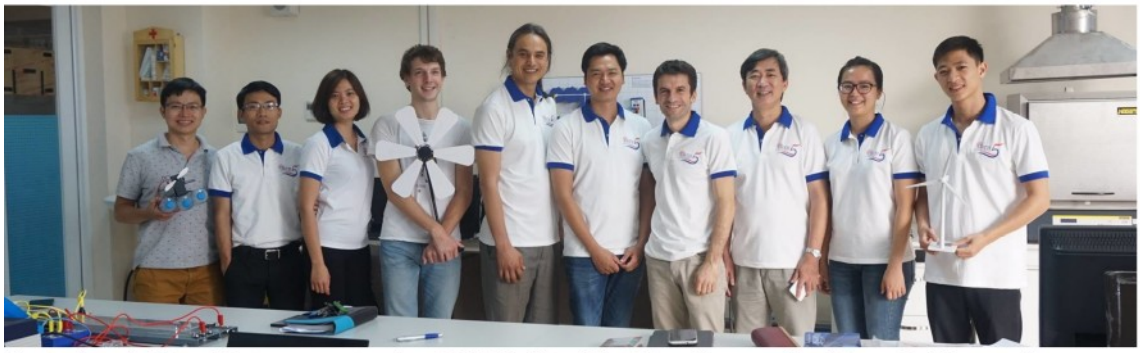

Illustration 1: CleanED team, september 2015. Left to right: Msc. Nguyen Hoai Son, Dr. Nguyen Xuan Truong, Msc. Truong An Ha, M. Luc Bachelet, Prof. Ha-Duong Minh, Msc. Pham Xuan Huynh, Dr. Laurent van de Steene, Dr. Nguyen Dinh Quang, Msc. Tran Hoang Anh, Msc. Nguyen Hong Nam. Not shown here: Dr. Nguyen Trinh Hoang Anh, Msc. Pham Duy An.

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1. Presentation of the laboratory

The Clean Energy and Sustainable Development laboratory – CleanED – was established in December 2014 with support from USTH and French Embassy in Hanoi. In September 2015, as Illustration 1 on the cover page shows, CleanED lab counted five researchers from France and Vietnam, five doctoral fellows and two internationally qualified staff.

This international and interdisciplinary research team gets the mission to contribute to the green growth of the energy sector in Vietnam. Its expertise ranges from engineering to public policy on:

- Natural resources characterization and management
- Biomass and waste to energy conversion process technologies
- Energy systems optimization from smart grid to national plans

2. Laboratory setup

Our CleanED lab has one 40m² office room and one 60m² experimental room.

The office room is located on the third floor of Institute of Chemistry building A18, 50 meters from USTH's main building. This office is fitted to capacity with six faculty desks, in one open space. There are four identical 160cm desks for permanent members and two smaller 90cm desks for visitors and interns. We thank USTH for providing all office furniture we requested such as desks, separators, computer tablets, office chairs, storage cabinets, bookcases, multifunction printer, computer, internet and fixed telephone lines. We also get access to the other facilities of the university at no added charge, including common campus services: meeting room, security services, mail; common information technology services: mail, web hosting. We purchased using the Objectif Labo 2014 budget one foldable meeting table, six better office chairs and six 23" LCD screens.

The experimental room is on 6th floor of USTH's Education and Service building, with a surface area of 60 square meters, see Illustration 2. Our laboratory is equipped with recent pedagogical material, testing apparatus and measuring equipment directly imported from Europe, via Consortium USTH. The room is organized in two zones: Bio - Energy to the left, Electrical Engineering to the right, with a shared lab bench in the middle.

- For the Bio - Energy part, we installed equipment for basic biomass analysis, purchased by USTH Consortium. In the room we have: an analytical balance (with a precision at 0.1 mg), a drying oven, an electric muffle oven, a grinder, a calorimeter and other small related equipments. This allows determining basic chemical properties (qualitative and quantitative compositions) and physical properties (moisture content, ash content, density, volatility matter content, fixed carbon content) for any kind of biomass. To complete these, USTH purchased from CIRAD a macro-thermogravimetry analysis reactor. Its construction in Montpellier, France is finished. We expect transport to Vietnam, delivery to Hanoi and installation early 2016. Laurent VAN DE STEENE, CleanED co-director will personally supervise the implementation of this machine. He arrived in Hanoi in August 2015. The department received pedagogic modules for bachelor level climate engineering practicals: air compressor, fuel furnace, two tubes hot water heating system, air conditioner. They are located in room adjacent to the lab.
- For Electrical Engineering, three pedagogic modules for photovoltaic system, wind power and electro-hydrogen system have been installed in the room and used for Master's experimental courses of Energy department. We also have small benchtop pedagogical kits for renewable energy TP. In addition, we have recently purchased two computer workstations for modeling and simulation-based research on electrical systems.

Illustration 2: CleanED lab in USTH room 610, October 2015.

Setting up a lab's information infrastructure is as important as the physical infrastructure. We used a mix of solutions, mostly in the cloud and external from the University. Domain, web and blog hosting are purchased from a commercial provider, Gandi. For file sharing we use Dropbox. The 2Gb storage capacity of the free plan is not enough for our needs already. For email, agenda, collaborative document editing, and mailing list we use Google. Both the price and quality are the best possible, but this was a choice dictated by

convenience rather than by University policy. For international conference calls we use Skype, having tried the Renavisio service provided for the French academic community without success. For archiving and indexing the scientific productions of the lab, we use the French open archive HAL and its PontParisTech gateway. This works well, we are looking forward to the development of the scientific open archive culture in Vietnam. For accounting we use GnuCash because it is free and multiplatform. There is certainly no software which is easy to learn, multicurrency, and compatible with both Vietnamese and French public accounting rules. For backup, print server and multimedia files archiving and sharing we purchased a Synology NAS.

This physical and information infrastructure allowed us to start building up our intangible assets. We started writing up our procedures, both for the office and for the manipulation room. For branding and reputation we published a lab's flyer, a website (www.cleaned-usth.com), a blog, a monthly newsletter. The website is trilingual (English, French and Vietnamese) and updated with a weekly editorial meeting. Our social networks presence focuses on Facebook, the most used platform in Vietnam. CleanED faculty and staff regularly participate in academic conferences and events for the general public.

3. Results and publications

The publications of the team are deposited in the French open-archive and collected together at the website: http://publis.cleaned-usth.com. They include:

3.1. Peer-reviewed articles

Four publications in peer-reviewed international journals, three of those published during the project's period:

- V. Griseri, Xuan Truong Nguyen, L. Berquez. Analysis of the Pulsed Electro-acoustic signal treatment recorded on electron beam irradiated dielectrics. Journal of Electrostatics, Elsevier, 2012, pp.422-428
- Sonia Stita, Marta Galera Martinez, Huynh Pham Xuan, Doan-Pham Minh, Ange Nzihou et al. Metal-doped apatitic calcium phosphates: preparation, characterization, and reactivity in the removal of hydrogen sulfide from gas phase. Composite Interfaces -Zeist-, V.S.P., 2015, pp.1-22. <10.1080/09276440.2015.1049096>
- Huynh Pham Xuan, Doan Pham Minh, Marta Galera Martínez, Ange Nzihou, Patrick Sharrock. Valorization of Calcium Carbonate-Based Solid Wastes for the Treatment of Hydrogen Sulfide from the Gas Phase. Industrial and Engineering Chemistry Research, American Chemical Society, 2015, pp.1-27. <10.1021/acs.iecr.5b00764>
- Hoang Anh Nguyen Trinh, Minh Ha-Duong. Perspective of CO2 capture & storage (CCS) development in Vietnam: Results from expert interviews. International Journal of Greenhouse Gas Control, 2015, 37, pp.220-227. <10.1016/j.ijggc.2015.03.019>

Two publication in a national journal, both describing research performed at the lab during the project:

- Hong Nam Nguyen, Minh Ha-Duong, Laurent Van de Steene. A critical look at rice husk gasification in Cambodia: Technology and sustainability. Vietnam Academy of Science and Technology Journal of Science and Technology, 2015, pp 247- 252.
- Xuan Truong Nguyen, Dinh Quang Nguyen, Tung Tran. Power control of a photovoltaic system connected to a distribution grid in Vietnam. Vietnam Academy of Science and Technology Journal of Science and Technology, Vol 53 (3A), 2015, pp.331-336.

3.2. Scientific communications and posters

The archive inculdes eleven communications in international conferences, most of those (Toulouse, Shenzhen, Berlin, Colombo, Bangkok, Hue, United Kingdom...) pronounced during the period.

- Xuan Truong Nguyen, Dinh Quang Nguyen, Tung Tran. Grid synchronization for Photovoltaic generation systems, case of study: a low-voltage distribution grid in Hanoi. The International Conference on Green Growth and Energy for ASEAN, Hanoi-Vietnam, December 2014.
- Xuan Truong Nguyen. Caractérisation de matériaux isolants irradiés sous faisceaux d'électrons par méthode Électro-Acoustique Pulsée. Congrès annuel de l'Ecole Doctorale Génie Electrique, Electronique et Télécommunication du système au Nanosytème GEET, Apr 2013, Toulouse, France. 2013
- Minh Ha-Duong. The challenges of Climate Change and the COP21: ambition and aims. Climate change forum: Favouring a green economy and sustainable urban development, Jun 2015, Colombo, Sri Lanka. 2015
- Xuan Truong Nguyen, V. Griseri, L. Berquez. In-Situ Space Charge Measurements on Dielectrics during

Electronic Irradiation by PEA. Electrical Insulation and Dielectric Phenomena (CEIDP) 2013, Oct 2013, Shenzhen, China. Electrical Insulation and Dielectric Phenomena (CEIDP), 2013 IEEE Conference on, pp.226-269, 2013, <10.1109/CEIDP.2013.6748252>

- Hong Nam Nguyen, Minh Ha-Duong. A critical look on rice husk gasification in Cambodia: engineering and sustainability. In 2nd European TA Conference: The Next Horizon of Technology. Assessment, Berlin, Germany, February 27 2015
- Hong Nam Nguyen. A critical look on rice husk gasification in Cambodia: engineering and sustainability. 5th International Forum on Green Technology and Management (IFGTM 2015), Hue University of Sciences, Vietnam, 28-30th July, 2015.
- Duy An Pham, Benoit Delinchant, Stéphane Ploix. Modélisation statistique d'équipements électriques en vue de la simulation des gestionnaires énergétiques de l'habitat. XXXe Rencontres AUGC-IBPSA, Jun 2012, Chambéry, France. 2012
- Xuan Truong Nguyen, S. Bouchareb, V. Griseri, L. Berquez. Post-electronic irradiation measurements by PEA and FLIMM methods on dielectric films. Electrical Insulation and Dielectric Phenomena (CEIDP), Oct 2011, Cancun, Mexico. Electrical Insulation and Dielectric Phenomena (CEIDP), 2011 Annual Report Conference on, pp.812-815, 2011,<10.1109/CEIDP.2011.6232780>
- Nguyen Trinh Hoang Anh. Institutional change and market conditions for low-carbon electricity transition in Vietnam. The Regional Forum on Climate Change (RFCC) - Low Carbon and Climate Resilient Societies: Bridging Science, Practice, and Policy. 1-3 July 2015, AIT, Thailand.
- An Ha Truong, Minh Ha-Duong, Hoang Anh Nguyen Trinh. Feasibility and sustainability of co-firing biomass in coal power plants in Vietnam. 5th workshop on co firing biomass with coal, Sep 2015, Yorkshire, United Kingdom. 2015
- Xuan Truong Nguyen, Quang Hung Nguyen. Service issues: overview of electric vehicles use in Vietnam. *Armand Peugeot Chair International Conference: 3 rd Electromobility Challenging Issues*, Dec 2015, Singapore. 2015, <hal-01239618>

Two (02) posters published in an international conference in France, organized for a preparation phase of COP21 in the end of the year, describing our current research:

- Hoang Anh Nguyen Trinh, Minh Ha-Duong. Costs and benefits of a greener alternative for the development of Vietnam's power sector. Our Common Future under Climate Change (CFCC). UNESCO HQ, Paris 7-10 July 2015.
- Hoang Anh Nguyen Trinh, Y. Rizopoulos. Institutional change and market conditions for low-carbon electricity transition in Vietnam. Our Common Future under Climate Change (CFCC). UNESCO HQ, Paris 7-10 July 2015.

3.3. Joint research seminar

We organize, in collaboration with Institute of Energy Science IES of Vietnam Academy of Science and Technology VAST, a research seminar on Energy, Environment and Sustainable development in Hanoi. The Spring session 2015 from February to June counted eleven (11) presented seminars, as follows:

- Nguyen Hong Nam - USTH student - Energy department – USTH. A critical look on rice husk gasification in Cambodia: engineering and sustainability. February 2015
- Nguyen Xuan Truong - Research Engineer - Energy department – USTH. Method of Control and Grid synchronization for Photovoltaic generation system, case study: a low-voltage distribution grid in Vietnam. March 2015.
- Tran Thi Tu Quynh - Researcher - Institute of Energy science IES. Environmental constraints in Vietnam energy supply-demand balance. March 2015.
- Ha-Duong Minh - CNRS, Director of CleanED lab - Renewable Energy Department - USTH. Climate change 2014 - Mitigation of climate change. March 2015.
- Laurent Van de Steene - CIRAD, Co-Director of CleanED lab - Renewable Energy Department - USTH. Biomass gasification: challenges, processes, and obstacles. April 2015.
- Stephan Astier - Teacher and Researcher - Institute National Polytechnique de Toulouse INP. Solelhada: sun power into the motor for an adventure - Solar energy and future transport systems. April 2015.
- Luu Le Quyen - Researcher - Institute of Energy science IES. Rice husk based bioelectricity vs. coal fired electricity: life cycle sustainability assessment case study in Vietnam. May 2015.

- Nghiem Thi Ngoan - Researcher - Institute of Energy science IES. Using LEAP Program to calculate GHG emission 1990 to 2030 in energy sector. May 2015.
- Pham Xuan Huynh - CleanED lab technician - USTH. Valorization of iorganic solid wastes from industrial activities into active materials for removal of hydrogen sulfide in gas phase. June 2015.
- Dang Hoang Anh - Teacher and Researcher - Hanoi University of Industry. Toward autonomous photovoltaic building energy management: Modeling and control of electrochemical batteries. June 2015.
- Sylvain Ouillon - Head of the Department Water Environment Oceanography- USTH. Climate change and water resources. June 2015.

Presentations can be downloaded from the seminar's website: http://www.cleaned-usth.com/seminar.html

3.4. Annual conference and scientific workshop

In December 2015 we held a set of events to celebrate the one-year anniversary of the lab and completion of the set-up phase, as follows:

- On the 16th morning, we held a strategic orientation meeting with representatives from French partner institutions.
- On the 16th afternoon, we organized a public conference on "Investing in clean energy in Vietnam after COP21" at l'Institut Français de Hanoi. See the reporting at : http://goo.gl/zc9BKU
- On the 17th and 18th we held an international academic workshop at USTH. Sessions were "Visions and scenarios", "BioEnergy" and "Green Electricity". The presentations are at: http://workshopcleaned.sciencesconf.org/program
- On the 18th afternoon we formally presented this annual activity report to a peer assessment exercise, see page 14.

4. Interactions with strategic partners

4.1. Partners in Vietnam

Interactions within USTH were unconditionally positive, the lab was strongly supported by the university at all levels. Having the office room in a close building is a good thing overall, and having to set up physical and information infrastructure ourselves also has advantages. Two CleanED lab members also have key roles in the University administration. We have had warm and efficient working relationships with the hierarchy, both Vietnamese and French, whom we gratefully thank.

- Our office offered short term (1-3 months) stays to five USTH M2 and doctoral students of the Renewable Energy department, before and after their internships in France. They not only benefited from the logistics of having a good desk to study on, but also from intellectual and spiritual support from the team. Improving the excellency of USTH students is a pedagogical achievement for now, which is certain to yield scientific results later.
- The lab room is open to all serious persons who are interested in clean energy and sustainable development science and technology. We actually hosted for three months one young student who builds a prize-winning windmill model, to help him to prepare USTH's admission. We opened our lab room more formally to USTH Technology Club and the incubating Hanoi Fablab. The goal is to build a community in order to pave the way for USTH's FabLab. The population we want to serve the needs comprises our students first, and also all personnel working on the VAST campus, as well as other DIY and makers in the Cau Giay area.

Interactions with VAST, more precisely the Institute of Energy Science, have definitely started. IES is our strategic partner, as USTH brings international excellence in the VAST campus where IES belongs. Senior IES researcher Dr. Nguyen Dinh Quang, co-director of the Energy Department participates in the life of the lab. He leads the "Electric systems" theme. Given his workload at VAST hiring another senior researcher on this theme still appears necessary. IES and CleanED co-hired our lab technician, who worked to our mutual complete satisfaction. IES and CleanED organised a joint scientific seminar, where IES participated more than symbolically. It confirmed that our research interest on: macroeconomic-energy modeling, biomass, electric PV systems were indeed common interests. Next year we will modify the presentations rules at the seminar to remove the language barrier.

We had a few interactions with other research organisations and universities in Hanoi, on a personal level: HUST, CFVG, Institute of Energy, Electric Power University, Economics University, Water Resources University, ISPONRE. CleanED co-director Laurent van de Steene shares his time between USTH and HUST, bringing some collaboration on biomass research.

Interactions with the Vietnamese government have mostly been in reply of call for proposals: two from the Bureau of Renewable Energy at the Ministry of Industry and Trade, and one from the FIRST project of the Ministry of Science and Technology.

4.2. The USTH-CIRAD agreement

The Memorandum of Understanding (MOU, 9/7/2015) is established between USTH and Centre de Coopération Internationale en Recherche Agronomique pour le Développment (CIRAD) in contributing to sustainable energy development and to improved natural resource management, towards sustainable livelihoods in Asia. Both organizations will carry out collaborative research and tertiary education activities on sustainable resource management for clean energy technology development, with emphasis on biomass resources focusing on Vietnam and South-East Asia.

In order to implement this cooperation, CIRAD has assigned the services of Dr Laurent VAN DE STEEN, a senior scientist at CIRAD, Research Unit Biomass, Wood, Energy, Bioproducts (BioWooEB), to the USTH Energy Department for a period of 3 years at part time. He was officially appointed as Co-Director of CleanED lab throughout the Decision N° 109/QD-DHKHCN.

4.3. CNRS project

In order to support international scientific collaboration, one Projet International de Coopération Scientifique - PICS about “Measuring the sustainability of renewable energy development in Vietnam” between CleanED lab - USTH and CIRED (UMR 8568) - CNRS was submitted to CNRS in June this year. The aspects studied by this project included biomass energy, wind energy and clean coal technologies in Vietnam that will be analyzed in collaboration by researchers of both sides. The research to be conducted during the PICS would be oriented by two PhDs already started, and two under consideration. These PhDs are by Vietnamese doctoral students, supervised by the French project leader. Both USTH and CNRS were asked to contribute to the project.

- For French partner, the contribution is used for organizing each year a seminar at national or international scale, hosting the researchers from France who work collaboratively with CleanED lab, participate to the international seminar and other expenses.
- From other side, the contribution from USTH for the budget project includes a scholarship for a three months internship in France for a 3rd year student who is selected annually among 10% of excellent students and reception of two French researchers or teacher - researchers who are sent by Consortium USTH for a period of two weeks.

This PICS covers the "Economy and Society" activities of Cleaned lab. Collaborations with French labs in engineering sciences will be formalized later, for example with G2Elab of Grenoble or INP lab of Toulouse.

5. Researchers, staff and students

5.1. Vietnamese researchers

Refer to Table 1.

Dr. Nguyen Xuan Truong is a teacher-researcher (doctor-engineer in Electrical engineering) already enrolled by USTH and member of CLEANED lab staff. He is preparing for teaching permanent at USTH. In this academic year, he is involved in our lab and in the Energy department with the role: researcher and teaching assistant: TP, TD, research

Name	Email	Institution	# hours teaching at USTH	%FT (actual) in the Lab
Dinh Quang NGUYEN	nlquang@gmail.com	Institute of Energy Science - VAST	10	20%
Xuan Truong NGUYEN	nguyen-xuan.truong@usth.edu.vn	Energy dpt – USTH	40	50%
Nhat Quang DOAN	doan-nhat.quang@usth.edu.vn	Information and Communication Technology dpt - USTH	10	10%
Hoang Anh DANG	hoanganh.inpg@gmail.com	Hanoi University of Industry	5	10%
Hoai Son NGUYEN	hoaisonkt@gmail.com	National Economics University	0	30% since may
Hoang Anh NGUYEN TRINH	hoanganhelec@gmail.com	Returning Dr. from 911 program	18	12 month (11 abroad)

Table 1: Vietnamese researchers involved in CleanED lab in 2015

Name	Email	Institution	# hours teaching at USTH	Involvement
Minh HA-DUONG	minh.haduong@gmail.com	CNRS	18h M2 + 3 PhD	9 month
Laurent VAN DE STEENE	laurent.van_de_steene@cirad.fr	CIRAD	5	1 month
Pascal LENORMAND	lenorman@chimie.ups-tlse.fr	Institute Carnot CIRIMAT - Toulouse III University	25	6 weeks
Stéphane ASTIER	stephan.astier@laplace.univ-tlse.fr	Institute National Polytechnique de Toulouse	30	2 weeks
Philippe GIRARD	Philippe.girard@cirad.fr	CIRAD	6	2 weeks
Benoit DELINCHANT	benoit.delinchant@G2Elab.grenoble-inp.fr	Joseph Fourrier University - France	0	0
Frédéric WURTZ	frederic.wurtz@g2elab.grenoble-inp.fr	CNRS – France	0	0

Table 2: French researchers involved in CleanED lab in 2015

Name	Email	Status	Involvement
Hoang Anh TRAN	tranhoanganh2808@gmail.com	Master, Engineer USTH lab manager	Full time
Xuan Huynh PHAM	huynh52xd@gmail.com	USTH Master Lab technician	12 months (3 abroad, 3 shared with IES)

Table 3: Master-level USTH staff working at CleanED lab in 2015.

Name	Email	Status	Involvement
Hong Nam NGUYEN	nguyen-hong.nam@usth.edu.vn	Graduate student at USTH doctoral school	50% (other 50% USTH staff)
Duy An PHAM	phamduyan.iph@gmail.com	Graduate student in France, 911 program	12 month (10 abroad)
An Ha TRUONG	truonganha87@gmail.com	USTH Master student	10 month (6 abroad)
Vu Trung TRUONG	tvtrung@gmail.com	USTH Master student	6 months '(2 abroad)
Nguyen Tri LE	trytri@live.com	USTH Master student	4 month (3 abroad)
Manh Tuan DUONG	manhtuan228@gmail.com	USTH Master student	6 month (5 abroad)
Minh Long HOANG	hoangminhlong94@gmail.com	USTH Bachelor student	3 month
Luc BACHELET	luc.bachelet@gmail.com	Agro ParisTech 2nd year student	4 months

Table 4: USTH and foreign graduate students involved at CleanED lab in 2015

project supervisor, Internship supervisor, and Co-PI in the project of our lab “Micro Smart Grid Development and Application for Building Energy Management”.

Dr. Nhat Quang DOAN is a teacher-researcher (doctor-engineer in Computer Science) already enrolled by USTH and member of ICT lab staff; he is involved in one project of our lab “Micro Smart Grid Development and Application for Building Energy Management” in developing multimedia communication and Human-Machine interaction systems.

Dr. Hoang Anh DANG - teacher/researcher in Hanoi University of Industry is very pleased to join the team for the same project.

Msc. Hoai Son Nguyen, teacher researcher at the National Economic University, associated with the CleanED lab in May 2015 for his PhD research. His University granted him a 2 days/week teaching load reduction, to be present at the lab for his research.

5.2. French Lecturers

See Table 2.

Two French researchers - Benoit DELINCHANT and Frédéric WURTZ - experts in the field of smart building are involved in one research project of our lab about “Micro Smart Grid Development and Application for Building Energy Management”. It is an opportunity to create a new relationship between USTH and Grenoble University. In order to do so, Benoit DELINCHANT, Associate Professor in UJF (USTH consortium) at Grenoble, intends to participate as a lecturer to the Energy master and more specifically to the “Green Electricity” specialty. A two weeks research visit is planned in 2015, if funding allows.

5.3. USTH master and graduates

See Table 3.

USTH hired Msc. Hoang Anh TRAN full time on staff, as a lab manager for CleanED, in December 2014.

Mr Xuan Huynh PHAM - a former USTH Master student - graduated in 2014 and was hired as CleanED lab technician since January 2015 for a period of nine months. He worked part time for first six months between CleanED lab and Institute of Energy Science (VAST) and then full time until the end of his contract. He continue the PhD in France with 911 program of USTH since October 2015. His research direction is based on the topic “Pyrolysis of biomass and waste in 2-stage gasifiers : How to improve the syngas quality?”

See Table 4.

Dr Hoang Anh NGUYEN TRINH defended his thesis in December 2015. He came back to CleanED lab and continues his line of work on the clean development of the power sector in Vietnam.

Among USTH Master students, Mrs An Ha TRUONG started her PhD in 2015, under the French and Vietnamese supervision. She will first develop and evaluate indicators for the feasibility and sustainability of co-firing biomass in coal-fired power plants in Vietnam.

Mr. Minh Long HOANG - a former USTH Bachelor student - was graduated in july 2015. His research subject is “Contribution to the study of the distributed system PV stand alone. Optimization of output power for PV system by using MAC method”, under supervision of Dr. Nguyen Xuan Truong.

In addition, we received Mr. Luc BACHELET , a French engineering student at AgroParis Tech, for a 6 months internship starting in September 2015.

6. Funding

6.1. Existing funding for equipment

Type of funding	Year	Amount
ADB package 1	2015	176 k$
ADB package 2	?	700 k€
French Consortium	2011-2015	94,6 k€

Table 5. Equipment funding granted to CleanED in the period

6.2. Existing operation funding

Type of funding	Year	Amount
Objectif labos 2014	2014 - 2015	78,1 k€
CIRED international mobility support	2015	16 k€
USTH Project “Micro Smart Grid...	2016-2017	20 k$
USTH Project ExpanGas	2016-2017	20 k$
Objectif labos 2015	2016	10 k€

Table 6. Operations and missions funding granted to CleanED in the period.

7. Perspectives for the lab development

7.1. Ongoing and proposed PhDs

Thesis 1: “Research on gasification of rice residues” by MSc NGUYEN Hong Nam (on-going)

It is estimated that Vietnam produces 8 million tons of rice husk per year, and only 40% of it is being utilized mostly for traditional purposes. The excess amount of rice husk could become a considerable source of energy. Regarding lignocellulosic biomass, gasification is a promising route for the conversion of this type of biomass into "useful energy": heat, electricity or motive power. Gasification is a process that converts organic or fossil fuel based carbonaceous materials into syngas, a fuel gas mixture consisting primarily of carbon monoxide (CO) and hydrogen (H2). The syngas is very similar to the town gas that used to be produced from coal and can be reticulated for domestic and industrial use. Biomass gasification is still in the very early stage in Vietnam, but this technology draws attention of many organizations in developed as well as developing countries (see Illustration 3) because of its potential to promote the development of renewable energy technologies. The aim of this thesis is to evaluate opportunities to enhance the use of rice husk in Vietnam for energy purpose with gasification technologies.

Illustration 3: Unmanaged solid waste from rice husk gasification in Cambodia.

The thesis thus aims specifically to:

- Identify suitable gasification technology for the conditions of Vietnam. Rice husk gasification can be divided into two scales: small-scale, more focused on household cooking and large-scale for industrial purposes. It is mandatory to determine in the first place what kind of gasification technology is suitable for the condition of Vietnam.

- Identify the target market and assess the commercial market potential for rice husk gasification technology in Vietnam. The product for this market assessment could be a gasifier cook stoves for cooking to large scale such as gasifier systems for electricity production, depending on the result of the first phase.

- Investigate the possibilities to improve technical performance of the existing product. This will especially involve studying the impact of rice husk properties (ash and moisture content, particle-size distribution, density, etc.) and behaviour (reaction kinetics, gas emissions, solid and liquid waste) on the energy and environmental performances of the processes.

Thesis 2 (started): Production networks and the wind turbine industry for Vietnam by MSc NGUYEN Hoai Son.

Inspired by the emergence of wind turbine industry as a clean energy source and the importance of production network in economic development in East Asia, this research investigates what determines the participation of East Asia developing countries in wind turbine industry’s production network.

Production network is the cross-border dispersion of component production/assembly within vertically integrated production processes. In the network, each country specializes in a particular stage of the production sequence. So far, literature on determinants of East Asia developing countries’ participation in production network has paid no attention to wind turbine industry but machinery and transport equipment sectors. The literature also has no research on the role of China as designer and coordinator of production network. In addition, the literature has paid little attention to

the determinants at firm level. Therefore, this research will focus on three determinant groups. Group 1 represents for the unique characteristics of the wind turbine industry. Group 2 are Chinese Original Equipment Manufacturers' (OEMs) decisions. Group 3 are internal factors of developing countries in East Asia at firm level. Due to data availability, the setting for the research will be 2009. The findings from this research will broaden our understanding on production network and its implications. Besides, the findings will also hopefully shed light on the measures or institutional changes that developing countries in East Asia should apply to enhance their opportunities in entering the wind turbine production network.

Thesis 3 (started): "Sustainability indicators for biomass energy in Vietnam" by Ms. TRUONG An Ha.

Many organizations have identified measures to document practices for more sustainable agriculture [e.g., the Millennium Ecosystem Assessment (2005) and Dale and Polasky (2007)], forestry [United Nations Food and Agriculture Organization, FAO (2011)], bioenergy feedstock production [e.g. FAO (2012), Mata et al. (2011)], biofuels [Global Bioenergy Partnership (2011), Council on Sustainable Biomass Production (2011)] and economic development (USAID, 1998). Our work builds from those efforts as well as consideration of modifying some indicators to get better measures in the Vietnamese bioenergy contexts. Yet there are a few indicators of energy security in general and biomass in particular developed and calculated in Vietnam (Doan, 2012). However, there is no completed set of indicators specifically designed to assess the sustainable development of bioenergy for Vietnam so far.

The objective is to build a set of science-based indicators regarding the sustainability of various forms of bioenergy, linked with national and provincial statistical systems, describing the environmental, social and economic dimensions of sustainable development. Indicators will be thought as a cohesive set for multi-criteria evaluation, articulated with the national and international sustainable development goals. They will be framed in the more general context of energy and development sustainability issue, such as the need for more access to modern energy services; energy diversity; and capacity and flexibility.

These indicators will be pilot tested in a diverse range of contexts in Vietnam to establish their feasibility and enhance their practicality as a tool for policymaking in the country. The first context will be co-firing of waste from rice production into coal power plants.

The target groups for use of sustainability indicators include policy makers, business people, and other stakeholders in all stages of the supply chain from land managers or waste suppliers to those involved in logistics, conversion facilities and end users.

Thesis 4 (proposed): Modelisation and identification of models for simulation and control of the USTH micro-grid for building

- Deployment of monitoring tools and collect of measurement data in the USTH micro-grid
- Development of models for simulation of all the components (PV, batteries, load…)
- Confrontation of measurement data and simulation results
- Development of identification method in order to correct and increase the quantitative capacity of prediction of models

Thesis 5 (proposed):

Development and implementation of models and optimisation strategies for optimal anticipative management for the USTH micro-grid for building. Development of models and optimisation strategies for optimal reactive management. The goals of the anticipative and reactive optimal management strategies can be minimising the economical cost. But one more interesting scientific and technological goal should be to increase the auto-consumption, what means maximizing the capability of the building, by using its own energy production, and its storage capacity, to produce its own energy.

Thesis 6 (proposed)

We are also investigating the fundability of a research thesis on solar electricity solutions toward urban sustainable development in Vietnam. The variable nature of solar PV poses challenges to traditional electricity generation, transmission and distribution that can act as a barrier for scale-up and increase system costs. Even with incentive schemes in place, such as the feed-in tariff currently under preparation, additional investments in power system planning and operation are necessary to facilitate a cost-effective solar PV integration. Several options could be explored for a solar PV pilot project, aiming to focus scarce public investment where it allows maximum leveraging of investments. The options could range from large, centralized PV power plants connected to the grid at medium to high voltage levels, to rooftop installations connected at the distribution level.

7.2. Ongoing research papers

Working paper 1. Development prospects of carbon capture and storage in Vietnam

The study aims to provide hindsights on the prospects for CCS deployment and capture-ready in Vietnam, with regards to potential stakeholders. We will explore the future of CCS in Vietnam up to the year 2050 in two scenarios. Given depleting oil wells, the first scenario examines captured CO2 used in Enhanced Oil Recovery (EOR) which could help the country extract more oil from existing fields and defray the cost of CCS. The second additionally considers CCS deployment in coal-based power plants. To illustrate the opportunity for CCS deployment in the sector, an economic analysis of capture ready for a typical coal-fired power plant will be carried out.

Working paper 2. Institutional change and market conditions for low-carbon electricity transition in Vietnam

The work develops a mesoeconomic approach to the low-carbon electricity transition in Vietnam. We argue that political will is a necessary but insufficient condition for such a change. In this perspective, we identify key players, and point out the institutional and structural characteristics of the electricity market which may impede the take-off of renewable resources. Indeed, the transition process depends on interdependent organizational decisions and implies a fundamental transformation of the stakeholders' positions and relations. In particular, it necessitates the existence of a critical mass of initiating actors that perceive the benefits of investing in renewables and have the leverage to redefine the rules of the game, therefore modifying the institutional framework and enabling the constitution of new structural interdependencies inside the electricity system. During the current period, the conditions of the wholesale market appear as a determining factor in relation to the pace of the low-carbon transition. Then, we propose an analytical grid to apprehend the change path by following the trend in some focal variables. Key observables which indicate the balance of power between the major stakeholders and reflect the stages of the transition process are feed-in tariffs and subsidies to the single-buyer.

Working paper 3 (accepted). Social and environmental acceptability of large infrastructure projects in Vietnam

Viet Nam is one of the fastest developing countries in the East-Asia-Pacific region. Economic and population growth has led to a multiplication of new infrastructure projects. Their execution is hampered by limited human resources and institutional capacity to regulate, plan, operate, and manage infrastructure assets and provide infrastructure services. Over 40% of infrastructure is still financed from Official Development Assistance sources, while local governments have a poor record of mobilizing sources of funds other than central government transfers. In this context, there is a gap between the environmental and social impact assessment guidelines given by international funding organizations and the current practices in the country. We examine the causes and extent of this gap; discuss whether the actors see it as a necessary leeway to do business justified by the immense complexity of procedures – or as a problem which can and should be corrected; and how.

7.3. Research projects started

Project ExpanGas: Expanding biomass range in small gasifiers for decentralised energy production.

This two years USTH funded research project is led by Laurent Van De Steene and Hoang Anh Nguyen. The scientific objectives are to assess the gasification potential of new target resources and propose technological solutions (or adaptations to existing solutions) that are mutually compatible. From a scientific standpoint, results are expected concerning the characterization of new biomass and knowledge on the phenomena that currently hamper use of these resources in gasification processes. Current approaches generally involve empirical studies on the gasification of new products that are carried out to validate (or invalidate) their compatibility with the applied processes. The scientific approach proposed here is intended, through preliminary laboratory studies, to identify and understand the mechanisms or properties that control the conversion of biomass into syngas in fixed bed reactors, and to come up with ways to optimize the use of these new resources. Then demonstration will be performed.

Project MSGBEM: Micro Smart Grid Development and Application for Building Energy Management

This two years USTH funded research project is led by Benoît Delinchant and Xuan Truong Nguyen. The main objectives of this project are to benefit from photovoltaic power supply, to improve energy efficiency and to reduce cost of electrical consumption in different scenarios. To reach these objectives, the theoretical research of the project shall include two phases. Phase 1 will be about research object modeling and simulation. It will include a literature review, the design of a micro smart grid for the USTH building, its modeling and parametrization according to equipment providers specifications, measurements and validation. Phase 2 will be about intelligent control algorithm, the "smart" part. It will include specifying electrical production and consumption

predictors based on weather and occupant behavior forecast, and then developing and testing anticipative and real-time control algorithms considering three different goals: 1) auto-consumption, 2) cost reduction 3) load peak shaving. The optional third year will allow to implement the algorithms in the platform for empirical validation and performance assessement.

7.4. Research projects proposed

The following projects have been proposed but not funded in 2015. We look forward to improve according to the evaluation results and resubmit in 2016.

Project 1: Projet International de Coopération Scientifique - PICS titled “Measuring the sustainability of renewable energy development in Vietnam” between CleanED lab - USTH and CIRED - CNRS. See section 4.3 page 7.

Project 2: “Integrated Renewable Energy Database IRED project” of Ministry of Industry and Trade MOIT. This project will support MOIT and relevant governmental agencies/local authorities in policy development, planning, monitoring and evaluation of renewable energy development; and investors, consultants, research institution and other commercial partners in identifying business opportunities and developing specific investment projects. The IRED is expected to be a part of the overall Vietnam National Energy Database (VNED) and will be widely published and accessed by both governmental agencies, commercial partners and other stakeholders. The database will be widely published and accessed by both governmental agencies, commercial partners and other stakeholders. The database shall include but not limited to following information (i) Legal and policy frameworks on or related to renewable energy development; (ii) Strategic planning and target of renewable energy development at national and provincial/city level; (iii) Renewable energy potential, allocation, exploited and current uses; (iv) related information such as power network, transportation, etc.; (v) Implementation procedures and applicable incentives (vi) Available technologies and information on projects/ proposals/ scientific researches related to renewable energy; (vii) Training materials, awareness enhancing, and guidance related to renewable energy. We will support the MoIT by reviewing the international experiences to provide lessons learned for Vietnam, reviewing Vietnam’s energy data situation and readiness, and proposing a design for the database and its management.

Project 3: The proposal to FIRST consists of organizing “Bio-Energy Week Hanoi 2015 (BEWH 2015)” - a week of academic events (graduate course, international scientific conference, and meeting) on biomass energy in south-east Asia in December 2015. That will be an opportunity to provide training, business networking opportunities, academic knowledge dissemination, and share research directions between international and domestic experts in the field. The output of this project concludes video presentations, electronic proceedings, media briefing and a final report project to FIRST owners.

8. Future organization of the lab

The lab is organized in three research themes: resources, biomass, and electricity. The question of separating into three different labs or formal teams is not relevant at this stage. We will reconsider it when we move to Hoa Lac.

The lab works with a weekly plenary meeting. Should the lab's growth make these impractical, the weekly meetings may be replaced by a smaller committee meeting.

8.1. Publications goals

The annual publication objective is one article per student or research engineer, two articles per researcher or teaching assistant.

Given the interdisciplinary nature of the research, the list of target international journals is broad. Here is an example of where CleanED team members have published:

- Journal of Electrostatics
- Composite Interfaces -Zeist-
- Industrial and Engineering Chemistry Research
- Energy Policy
- Energy Economics
- Nature Climate Change
- GMSARN International Journal
- Climatic Change
- Environmental and Resource Economics
- International Journal of Greenhouse Gas Control
- Greenhouse gases: science and technology
- Clean Technology and Environmental Policy
- International Journal of Environment and Pollution
- Vietnam Academy of Science and Technology Journal of Science and Technology

8.2. Requested equipment and budget

Name of equipment	Funding source	Cost
Voltage and current transducers	ADB Package 3	10 k$
Customized interface boards	ADB Package 3	90 k$
Cablings	ADB Package 3	10 k$
CHONS analyser	ADB Package 3	60 k$
Gas chromatograph/mass spectrometer	ADB Package 3	60 k$
Sampling line	ADB Package 3	30 k$
Specific surface BET	ADB Package 3	40 k$

Table 7: Equipment ordered through ADB Package 3,

The budget for 2016 needs support for young grad students's research and mobility. CleanED director also needs to discuss with CNRS how his position can be stabilized.

8.3. Infrastructure needs

The information system constraints are as important as the constraints in the material space. The lab's information system has been grown mostly autonomously, but in the future we will need to fit with the University's system. From IT, we need strong connectivity for international real time audio video conferencing, a system to provide backup, recovery and emergency management, information security against viruses and attacks. From communication, we need artwork, design and language elements. From accounting, we need interfaces to coordinate with. We need leadership in pedagogical methods, with a vision on using the Moodle electronic platform. We need an open archive to deposit all our scientific production into.

We believe we have enough space until March 2016. Then we anticipate the need for an open space for 4 students in spring 2016. At any point, moving the CleanED office from the Institute of Chemistry building to the IES building or to the USTH building may be discussed, since it makes more sense from a scientific perspective.

By 2017, it is likely that having one manipulation room for Biomass and another for Electric Systems will be necessary.

Time-sharing the Renewable Energy lab room for USTH's FabLab is only a kick-starting procedure. The electronic prototyping, CNC machines, cutters, 3D printers and other flexible manufacturing equipment that will be progressively acquired by the FabLab should be located on their own. They have to be close to a facilities management services where tools for experiments of all departments can be fabricated.

9. External evaluation report

See fac-simile on the next 2 pages.

Job Job

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Binh Duong, 23.12.2015

Evaluation report of the Clean Energy and Sustainable Development lab from December 2014 till December 2015

The evaluation of the Clean Energy and Sustainable Development (CleanED) lab for the period from December 2014 till December 2015 is based on the lab's activities report, which was sent by Email on December 2015, and an on-site visit on December 18, 2015. During the on-site visit the lab's experimental room with its teaching and research equipment was inspected and the lab's activities were presented by Prof. Ha-Duong Minh and Ms. Tran Hoang Anh, followed by a discussion on the presentations. The presentations covered the scientific and the administrative activities and the following evaluation is separated accordingly.

Administrative assessment

The physical infrastructure of the lab was established with one office and one experimental lab room. Experimental equipment suitable for the overarching target of the lab was procured and is operational. The experimental lab room even hosts a (very) small FabLab which in my understanding is serving the entire University of Science and Technology Hanoi (USTH) and external interested parties. For the future it should be critically evaluated whether the lab's space will be sufficient to further host the FabLab and whether the staff's capacity will be sufficient to maintain and manage the FabLab. If not, USTH should be asked to provide sufficient space and staff for that task.

The information infrastructure was also set up and is operational, contributing well to the dissemination of the lab's activities and scientific results. Thanks to the relatively large number of staff in the lab and the involvement of Vietnamese and French researchers, the contribution of the lab to teaching and research is already visible.

The plan for the lab's development is suitable to continue the positive development of the lab. Priorities are additional space, especially experimental space, the improvement of the information infrastructure and the number and qualification of additional staff.

The need for an own open archive for the lab's publication is not seen by me. On one hand the usage of the French open archive seems to work well. If, on the other hand, a local open archive is seen to be necessary, one should strive at least for a University of Science and Technology Hanoi (USTH) wide solution, but ideally for an open archive for Vietnam as a whole.

Scientific assessment

Thanks to the already relatively large number of staff, the lab created already a good visibility in the national and international scientific community. Research was published internationally and nationally in journals and at conferences. As organizer of a series of research seminars, the lab also attracted audience, at least from Hanoi. As organizer of the recent Conference "Investing in clean energy in Vietnam after COP21" and scientific workshop "Clean energy in Vietnam after COP21" international audience was attracted.

The lab has already strong links with the USTH and the Institute of Energy Science at the Vietnam Academy of Science and Technology (VAST) in Vietnam, and CIRED, CNRS, Bio-WooEB and CIRAD in France, and is continuing to extend its scientific network in both countries and beyond.

The lab staff acquired already several projects within 2015 and applied for further national and international projects. Furthermore, first topics for the lab's own PhD students were generated. To enable adequate supervision of these theses, and also of the Post Docs returning with a PhD degree to the lab, it is necessary that the lab will soon get two Senior Lecturers, one in field of Electricity Systems and one in the field of Advanced Materials for Energy, as foreseen in the lab's recruitment plan.

Suggestions for improvement

The overall performance of the lab in its first year of existence was very good. Existing shortcomings in the physical and information infrastructure were identified and suitable solutions proposed. The only minor point for improvement in the next assessment is, that an inventory of the tangible assets should be provided, including also the respective funding sources for these assets.

Conclusions

The lab had a very good start in its first year, establishing its infrastructure and at the same time still being very active scientifically. This could only be achieved with the strong motivation of the lab staff and the strong support of the lab by the involved partners from Vietnam and France. Therefore it is hoped that this strong support will also continue in the next year, to allow the lab to implement its plans for administrative and scientific development. If so, then the lab will become an even more valuable contributor to the green growth of the energy sector in Vietnam.

Dr.-Ing. Jörg Franke

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Business Information Systems (BIS)