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Advancing Free Trade
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Smart Power Management for Self-Sustained Community in the APEC Region

APEC Policy Partnership on Science, Technology and Innovation

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OBJECTIVES

APEC ACABT hosted a 3-Day Event (including workshop, O2O educational platform and technique forum) under the APEC project PPSTI 02 2017A APEC ACABT - Smart Power Management for Self-Sustained Green Community in the APEC Region.

ACABT invites the professionals from the academia, research institutes, and private sectors (renewable energy product and service providers, Energy Service Companies etc.) to exchange their experiences on bio-energy and sustainable renewable energy by delivering speeches, sharing current information, and providing comments during the event. Besides, ACABT also creates an online and offline educational platform for the researchers and students in universities or institutes in the APEC region to disseminate the ideas of smart power management for self-sustained green community in APEC region through real case learning, discussion and interaction between members. It is trying to solve the problems on air pollutions that caused by burning agro-industry organic wastes and water pollutions that caused by discharging high organic content wastewaters without post-treatment.

The objectives of the project are as follows:

1. To demonstrate and provide practices of the smart power management system software through the 3-Day Event so that to enhance and expand the existing collaborative framework which the self-fund project has already built up among the academia, research institutes, and private sectors.

2. To ensure participants of 3-Day Event will be fully able to participate and share their domestic experience so that the smart power management system software could be developed and benefit well in the APEC regions.

3. To build capacity for the bio-based smart power grid and bio-economy issues, and to strengthen connectivity and cooperation among APEC economies so that to strongly build up green growth and sustainable environment in the APEC regions.

EXECUTIVE SUMMARY

Recently, there are some air pollutions issues that caused by burning agro-industry organic wastes and water pollutions that caused by discharging high organic content wastewaters without post-treatment. However, organic wastes from cellulosic materials and liquid type of wastewaters are actually abundant in the APEC region. The treatment process is accordingly a vital issue in the APEC region. To solve the problems addressed above, the smart power management software had already on the creating process with the self-fund project. To enlarge the benefit, this project set up a platform demonstrating and sharing the experiences of building a smart power management. Moreover, this project is to disseminate and scale-up this science-based collaboration framework among academia, research institute, and private sectors, then to transfer organic wastes to bioenergy and smart power grid technologies through the workshop, educational platform and technique forum. This also confirms the APEC goals to promote green growth and sustainable environment, also help to build up the green energy bio-based smart power grid and bio-economy systems in APEC's economies

This project was funded by the APEC Energy Efficiency Sub-Fund: PPSTI 02 2017A- APEC Research Center for Advanced Biohydrogen Technology (ACABT) managed the implementation of the project. This project aimed at developing the smart power management system in the APEC Region. The outputs of this project were included：

1. O2O Educational Platform: The O2O educational platform was divided into 3 stages, which are the preliminary round, semi-final, and final pitch. The first and second stages were online and the final pitch was offline. All the teams look up the information online on ACABT YES Challenge website: yes.apec-acabt.org/2018 . At the first beginning, the teams were uploaded two pages of the prelimirary plan, and for the semi-final stage, the teams need to register on a MOOCs platform before Semi-pitch round starts. The Semi-pitch was divided into 2 Modules, which is online for participatory learning. The teams also prepared 2-3 minutes of video clip and clearer project plan. The 8 teams that join the final pitch were chose by the juries and attend 3-Day event.
2. 3-Day Event: This 3-Days event included workshop, an O2O educational platform and a real case technique forum. The researchers, experts, the managers of private sectors and stakeholders for sustainable renewable energy were invited to the event as well. The 3-Day event interlocks with the concept of smart power management for self-sustain green energy in APEC region.
   a. Workshop: The workshop focuses on the preliminary findings in light of the desired outcomes. It was included the best practice and experience exchanging, also offers an opportunity to assess the validity of the preliminary findings and provide the check, peer reviews and consultations.

b. Final Presentation of Trainign Program: It was a training competition program based on a well-designed Online/Offline (O2O) platform with a competition method to build a discussion and reinforce the motivation of the participants and brainstorming a better model for APEC Economics. The platform holds back-to-back with the workshop in Bangkok. This project invited young entrepreneurial teams across APEC Economies to join the platform of social innovation proposal of the green economy, for not only tackling climate change and our community problems but also promoting sustainability awareness in the APEC region.
c. Real Case Technique Forum: This project embeds bio-based energy and develop the smart power management software to control self-sustained green community in Thailand. After the back-to-back meeting, we arranged the real case technique forum discussing the practice of smart power management software. Within the demonstration site, it conducted project experiments and show the best practice model for developing and disseminating the smart power management system in the APEC region.

3. Project Report: The final project report was constituted the record for the 6 months O2O education platform, the results of 3-Day Event, and a guidebook of the smart power management system software. The guidebook produced by ACABT, which is the manual of the smart power management system software and the information and notice of the case study.

This project starts from O2O educational platform 6 months before 3-Day event. Through online information, team project organization, juries viewing, workshop sharing experiences and real case forum guiding, its help the participants to develop the application of smart power management system for domestic circumstance. Also, it could build up the capacity of young participants about self-sustained green energy and gather into talent pool among APEC regions. Through the activities, the particpants have chances to interact face-to-face, exchange current research development on bio-energy technologies, and experience how to transfer organic wastes into bio-energy. This project also provided opportunities to enhance renewable energy boom, and reduce the cost of compliance. It also meets the APEC aspirational goal to double the share of renewables including in power generation by 2030 in APEC’s energy mix shown in 2014 APEC Leaders’ Declaration and lead to the further development of modern renewable energy system in the APEC region for helping APEC on developing economies to ensure universal access to modern energy services.

3-DAY EVENT

1. DATES

28 August 2018 to 30 August 2018

2. VENUE

KMUTT Knowledge Exchange for Innovation Center (KX), Bangkok, Thailand. Its located at 110/1 Krung Thonburi Road, Banglamphulang, Khlongsan, Bangkok 10600 Thailand and the contact number is +66 2470 7993.

3. PARTICIPANTS

There were 79 participants attended the 3-Day Event. All participants from 11 economies including China, Indonesia, Japan, Korea, Malaysia, New Zealand, Russia, Chinese Taipei, Thailand, Turkey and Viet Nam. Also, 41 participants of 79 participants are female that reaches to the gender-friendly issue.

4. AGENDA

28 August 2018 (Day 1) Workshop	
8:30- 9:00	Registration
9:00- 9:30	Welcoming & Opening Remarks
9:30-10:10	Green Energy Policy for Smart Thailand Dr Chaiwat Muncharoen Senior Advisor, Climate Change and Energy Energy Policy and Planning office (EPPO), Ministry of Energy, Thailand
10:10-10:30	Group photo and Coffee break
10:30-11:10	Proposed Energy Innovation Strategies of Thailand Prof. Dr Jeong Hyop Lee Senior Advisor, Science Technology & Innovation Policy Institute of Thailand
11:10-11:50	BioHydrogen -A General View and the Introduction of Artificial Intelligence, A new Method of Study Prof. Dr Jun Miyake Osaka University, Japan
11:50-13:10	Lunch Break
13:10-13:40	Smart Power Management Mr Yin-Che Huang Intelligence 4.0 planner, InSynerger Technology Co. Ltd, Chinese Taipei
13:40-14:10	Policy, Research and Implementation of Integrated Model of NRE [New And Renewable Energy for Villages, Botanic Gardens and Other Areas in Indonesia Prof. Dr Enny Sudarmonowati Deputy for Life Sciences , Indonesian Institute of Sciences (LIPI), Indonesia

14:10-14:40	Transitioning to Low Emissions Energy Ms Laurie Boyce Senior Policy Advisor, Energy Markets Policy, Energy & Resource Markets Branch, Ministry of Business, Innovation & Employment, New Zealand
14:40-15:10	Oil Palm Residues for Energy and High Value Products Prof. Dr Jamaliah Md Jahim Universiti Kebangsaan Malaysia, Malaysia
15:10-15:40	Coffee Break
15:40-16:10	Utility no more? – The IoT-5G smart infrastructure for the disruption in energy sector Dr Jesada Sivaraks Consultant, G-able Co. Ltd, Thailand
16:10-16:40	Bioenergy for Biodiesel Substitutes Fuel Dr Sri Djangkung Sumbogo Murti Program Director for Bioenergy, Agency for the Assessment and Application of Technology (BPPT), Indonesia
16:40-17:10	An Insight into Valorization of Recycling Waste into Biofuels: Recent Progress Dr A.E. Atabani Energy Division, Department of Mechanical Engineering, Faculty of Engineering, Erciyes University, Kayseri, Turkey
18:30-20:00	Welcome Dinner
29 August 2018 (Day 2) Final Presentation of Training Program	
8:30-9:00	Juries Pre-meeting (Invited Only)
9:00- 9:15	Introduction of O2O Educational Platform Draw Lots for the Presentation Sequence Announcement of Rules
9:15-9:30	Preparation for Each Team
9:30-10:00	Team 1 (15 minutes presentation/ 15 minutes Q&A)
10:00-10:30	Team 2 (15 minutes presentation/ 15 minutes Q&A)
10:30-11:00	Coffee break
11:00-11:30	Team 3 (15 minutes presentation/ 15 minutes Q&A)
11:30-12:00	Team 4 (15 minutes presentation/ 15 minutes Q&A)
12:00-13:30	Lunch Break
13:30-14:00	Team 5 (15 minutes presentation/ 15 minutes Q&A)
14:00-14:30	Team 6 (15 minutes presentation/ 15 minutes Q&A)
14:30-15:00	Team 7 (15 minutes presentation/ 15 minutes Q&A)
15:00-15:30	Team 8 (15 minutes presentation/ 15 minutes Q&A)
15:30-16:00	Coffee break
16:00-16:30	Team 9 (15 minutes presentation/ 15 minutes Q&A)

16:30-17:00	Comments from Juries
17:00-17:30	Juries Meeting
18:30-20:00	Award Ceremony/ Dinner
30 August 2018 (Day 3) Real Case Technique Forum	
8:30- 9:00	Gathering at the Lobby of Ibis Bangkok Riverside Hotel
9:00-10:00	Travel to CES Solar Cells Testing Center (CSSC) at King Mongkut's University of Technology Thonburi (Bang Khun Thian)
10:00-10:30	Introduction of CES Solar Cells Testing Center Mr Panom Parinya Manager of Research and Development Department; Head of PV Module Testing Unit CES Solar Cells Testing Center (CSSC), King Mongkut's University of Technology Thonburi
10:30-11:00	Coffee break
11:00-11:30	Introduction to Smart Community - Living Laboratory at Chiang Mai World Green City, Chiang Mai, Thailand Dr Worajit Setthapun Dean of Asian Development College for Community Economy and Technology (adiCET), Chiang Mai Rajabhat University
11:30-12:00	Smart Grid Scenarios: Self-Sustained Green Community in APEC Region Assoc. Prof. Dr Chen-Yeon Chu Director of Master's Program of Green Energy Science and Technology, Feng Chia University Executive Secretary of APEC ACABT
12:00-13:30	Lunch Break
13:30-14:30	Demo Site Visit and Practices Introduction
14:30-15:00	Panel Discussion -Mr Panom Parinya -Dr Worajit Setthapun -Assoc. Prof. Dr Chen-Yeon Chu
15:00-15:30	Closing Remarks
15:30-17:00	Travel back to Ibis Bangkok Riverside Hotel and Farewell Dinner

5. SUMMARY

5.1 Day 1 Workshop

On the first day workshop, the President of King Mongkut's University of Technology Thonburi (KMUTT) Bangkok, Thailand, Assoc. Prof. Dr Sakarindr Bhumiratana and the CEO of ACABT, Prof. Dr Shu Yii Wu both gave the welcome and opening remarks to all the guests and participants. There were more than 70 participants attending to the event. ACABT were also honored to have Ms Kalaya Jinliang and Mr Tran Rukruam from the Office of International Cooperation to be the representatives of Ministry of Science and Technology (MOST), Thailand.

The theme of this conference is "Smart Power Management for Self-Sustained Green Community in the APEC Region". ACABT invited ten speakers from nine economies to give speeches. Dr Chaiwat Muncharoen, the senior consultant of Climate Change and Energy Policy and Planning Office (EPPO) from Ministry of Energy of Thailand first shared the Green Energy Policy for Smart Thailand. He introduced about the policy of Green Energy in Thailand and also reveals the trends for future Thailand.

Dr Jeong Hyop Lee, the senior consultant of the Science Technology and Innovation on Policy Institute (STIPI) talked about the energy innovation of Thailand and proposed five policy recommendations to facilitate the new energy system in Thailand.

Prof. Dr Jun Miyake from Osaka University in Japan reviewed the studies of BioHydrogen research and the potential for energy conversion using photosynthetic and anaerobic bacteria. And also introduced a new tool for the analysis of enzymatic reactions and big-view of renewable energy, how to realize the energy supply system.

Next, Mr Yin-Che Huang from InSynerger Technology Co. Ltd, Chinese Taipei mentioned about the current IoT technology and cloud management platform for cultivating machine learning and big data analytics, and providing cloud AI manager services for 24-hour factories and campuses.

Prof. Dr Enny Sudarmonowati from LIPI, Indonesia talked about that the development of Indonesia has to prioritize the utilization of bioresources and for increasing the quality of life of communities live in remote villages with no or lack of electricity. Biomass, wind, hydro/water and solar based energy have been investigated of their usage in several areas. And now, policy and regulation are part of the key issues that played a role in the success NERN implementation.

Ms Laurie Boyce, the senior consultant of Ministry of Business, Innovation & Employment of New Zealand introduced about the existing technologies in New Zealand. It can use its highly renewable power system to achieve low-emission energy. It also brings challenges, such as ensuring a safe power supply.

Prof. Dr Jamaliah Md Jahim from Malaysia mentioned that through active engineering practice, Universiti Kebangsaan Malaysia has successfully produced a variety of fine chemicals. In addition, her team also operates a fully integrated pilot scale of biohydrogen and biomethane production from POME in palm oil mill.

Dr Jesada Sivaraks, the consultant from G-able Co. Ltd in Thailand mentioned that the smart grid is a vision of the future electricity delivery infrastructure that improves network efficiency and resilience, while empowering consumers and addressing energy sustainability concerns.

Dr Sri Djangkung Sumbogo Murti introduced that 20% of biodiesel in petro-diesel (B20) has been implemented recently in Indonesia. This policy also raises energy resilience since biodiesel is produced from local palm oil. The use of palm oil as fuel for electricity generator engine also has been encouraged. The implementation of biofuel in transportation and electricity sector is supported by research and socialization in order to ensure its smooth implementation. Enormous variety of biomass resources for biofuel production in Indonesia also has been explored to provide economic impact and energy resilience.

Finally, Dr A.E. Atabani, the professor from Erciyes University in Turkey gave speech about the various types of biofuels such as biodiesel, biogas and bio-alcohols can be produced from waste through different biofuels production technologies. Moreover, various added-value products such as antioxidants, fertilizers, fodders, fuel pellets, adsorbents and etc. can be also produced from waste. This talk reflected the huge potential and on-going research of recycling waste to energy.

Photo 1. The VIPs, Speakers and Experts attend the 3-Day-Event

Photo 2. All the participants took photo together for the precious moment. The fifth one from the left is the CEO of ACABT, Prof. Dr Shu-Yii Wu. The lady next to him is Ms Kalaya Jinliang from Ministry of Science and Technology(MOST), Thailand.

3-Day Event: Workshop

Trends

Dr Chaiwat Muncharoen
Senior Advisor
Ministry of Energy, Thailand

Dr Chaiwat Muncharoen is a Senior Advisor on Energy and Climate Change at Energy Policy and Planning Office (EPPO), Ministry of Energy, Thailand. Dr Muncharoen is responsible for the integration of energy policies and climate change plan including NDC, PDP, AEDP, EEP, Oil plan and Gas plan. He developed the model for Thailand Integrated Energy Blueprint (TIEB) to forecast energy demand and GHG Mitigation in energy sector and prepared NDC Action Plan in energy sector. Dr Muncharoen provided strategic direction and advised on the development of Power Development Plan 2018 (PDP 2018) and the development of Big Data and Analytics for Energy sector. He worked closely with EGAT and IEA to conduct the study on the assessment of Thailand RE integration.

Prior to join EPPO, Dr Muncharoen worked as a Senior Advisor on Energy and Climate Change with German International Cooperation (GIZ). He led Policy/Regulatory Component under Refrigeration and Air Conditioning- Appropriate Mitigation Action (RAC NAMA) project to introduce safety standard and amend the existing building code for the use of natural refrigerant, advised Technical Component for product design and production line conversion and capacity building for service sector on installation and maintenance of appliance using natural refrigerant, and advised Market Component to build awareness of stakeholders and establish RAC NAMA Revolving Fund to provide financial support for producers and users. He developed mechanism to transfer fund from NAMA facility to Thai Government agency and engaged in the design of financial instruments to promote higher efficiency products and green cooling technologies.

In 2014-2015 Dr Chaiwat Muncharoen joined the USAID LEAD program team as Director of the Asian Greenhouse Gas Management Center (AGMC). In collaboration with the Asian Institute of Technology (AIT), Dr Muncharoen developed and delivered regional trainings and conducted economy-driven research through the Center that promotes GHG emission reductions and green growth for 11 economies in Asia. Dr Muncharoen led the AGMC's long-term strategy and development plans, shaping the Center's offerings and broadening its reach.

Dr Muncharoen is a technical expert who internationally recognized on topics of energy and climate change policy; energy planning and strategies; greenhouse gas (GHG) emission inventories and reduction strategies; measurement, reporting and verification (MRV); and carbon management. In particular, he has developed GHG databases and information systems, tools and models for inventories, baseline projections and impact analyses, GHG inventory methodologies, MRV systems, as well as a registry system for emission reduction projects and programs across sectors. Dr Muncharoen is a leader in his field and brings decades of experience in capacity building, program development, and organizational management.

Dr Jeong Hyop LEE Senior advisor
Science Technology and Innovate on Policy Institute (STIPI), Thailand

Lee, Jeong Hyop received his Ph.D. in economic geography from the Seoul University. He is now a senior advisor of the Science Technology and Innovation Policy Institute (STIPI), Thailand. Before he joined STIPI, he worked for the Science & Technology Policy Institute (STIPI) and the Korea Information Society Development Institute (KISDI) in Korea. He has actively engaged in various planning and evaluation committees in Korea. A few of the major programs are the Enterprise City Program of the Ministry of Construction & Transportation, the Techno-park Program of the Ministry of Knowledge Economy, the Research Hospital and the Medi-Cluster Program of the Ministry of Health and Welfare, the S&T and ICT Globalization Committee of the Ministry of Science, ICT and Future Planning and the University Reform Committee of the Ministry of Education. He has also served as a full time advisor for the Korean Presidential Committee. He also has various consulting experiences for developing economies. He helped the Ministry of Science and Technology prepare a five-year S&T plan and provided a master plan of industrial technology centers for the Egyptian Ministry of Industry and Technology. And he has experience working with various international organizations such as OECD, the World Bank, APEC, UN agencies. He has initiated a three year consulting project on innovation system diagnosis and STI strategy development for least developed economies from 2012 in partnership with the Asian and Pacific Center for Transfer of Technology (APCTT), UN-ESCAP. He has also worked with ASEAN economies to develop strategic STI roadmaps to address global challenges such as water (Indonesia), food (the Philippines), green energy (Viet Nam) and other issues. Lastly he has cooperated with the African Network of Drugs and Diagnostics Innovation (ANDI) to develop STI strategies to overcome neglected diseases in Africa.

Proposed Energy Innovation Strategies of Thailand

Abstract

Thai energy sector has grown with the single buyer model. It has successfully provided cheap energies and built the vertically integrated energy production and distribution systems. The single buyer model has legacies of technology dependency, a lack of Economy-wide innovation management capacity and a partial success with the middle income trap .These characteristics became bottlenecks for the deployment of the new decentralized and data science based energy system. To overcome the general uncertainties, path dependence of the energy sector, Thai specifically inherited bottlenecks of high domestic cost structure and low system capacity, the regulation-based procurement and industrial promotion, and the low market ability, a digital technology-based incubation of new energy system for the transition into a new energy system is proposed with leveraging the integrated system of the conventional energy capacity and strategic foreign partnership . Moreover, five policy recommendations are suggested which aim to facilitate the new energy system in Thailand.

3-Day Event: Workshop

Artificial Intelligence

Jun Miyake, Ph.D.
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Dr Jun Miyake is a Professor, Global Center for Medical Engineering and Informatics, Osaka University. He was educated at BS. School of Science, Osaka Univ. (1975), Ph.D. (1980). His research carrier is: 1980-2009 AIST. 2007-2009 Director, Institute of Cell Engineering. 2009-2017 Professor, School of Engineering Science, 2017- Specially Appointed Professor, Global Center for Medical Engineering and Informatics, Osaka Univ. Adjunct Positions are: 2001-2010 Univ. Tokyo School of Engineering, Invited Professor, 2005-2010 Operating Agent, IEA-HIA Annex21/34. His research topics are bio-hydrogen production, combination of anaerobic and photosynthetic bacteria, collection of bacteria for energy conversion. His research is artificial intelligence for the analysis of energy conversion reactions in bacteria for understanding and improvements of the hydrogen production.

Achievements and Main Awards are: over 450 publications and 100 patents. He received the prize of Minister of Science and Technology Agency, the prize of Minister of International Trade and Industry, Akira Mitsui-Memorial Award from International Association of Hydrogen Energy. His personal Interests are bicycle and modern arts.

Biohydrogen-A General View and the Introduction of Artificial Intelligence, A new Method of Study

Jun Miyake
Global Center for Medical Engineering and Informatics, Osaka University 1-3 Yamadaoka, Suita Osaka, Japan 565-0871 jun_miyake@bpe.es.osaka-u.ac.jp

Abstract

I would like to review the studies of Biohydrogen research and the potential for energy conversion using photosynthetic and anaerobic bacteria. Here also I would like to introduce a new tool for the analysis of enzymatic reactions and big-view of renewable energy, how to realize the energy supply system. In this abstract I describe mainly on Deep Learning on reaction analysis. Biological reaction is a complex system, which consists of many interacting components. There are too many reactions in organisms and are too many combinations of interactions between the components. The interactions between the components are non-linear relations. To figure out the behavior of complex systems, we can use I/O relation (Input stimuli and Output reaction) of the whole complex system. I used deep learning to the complex system based on its whole I/O relation. We do not need to set the internal mechanism condition; we can construct models if we don't understand the details of reaction paths. The I/O relation of the complex system, considering about the internal mechanism of the model, gives some insights to investigate the interactions between components of the complex system. We took up solar energy conversion reaction to bio-hydrogen by photosynthetic bacteria as a complex system. Solar energy conversion reaction is considered that it is constructed with several tens or hundreds reaction paths, and there is time delay between the peak time of light intensity and that of H2 production rate. We propose the modeling method using Deep learning heading for investigation of complex system. To acquire dataset for learning, we measured H2 production rate of photosynthetic bacteria with three pattern light irradiations which simulate temporal transition of sunny, cloudy, and rainy day's sun light intensity. Using the data of H2 production rate, we constructed a model of the solar energy conversion reaction. We constructed a new neural network model which consists of three steps of networks. As a result, the model had reproduced the I/O relation of solar energy conversion reaction with the coefficient of determination up to 0.99. By examining three steps-model's I/O relation, I got some insights that the second step reaction cause time delay. We estimate the second step correspond to the reaction which produce ATP and Fdred.

Mr Yin-Che Huang
InSynerger Technology Co. Ltd, Chinese Taipei

Michael Huang, 20 years of experience on OEM/ Channel Business development, account management, marketing and project management for Personal Computer, information technology and IoT industries. He completed a Marketing bachelor's degree in York University, Toronto, Canada, with courses including international business, economics, management, advertising and marketing.

His 15 years working experience after graduating, I once lead the sales teams for the company of ATi, Samsung Electrics, and Acer Peripheral Inc to response for the OEM and channel business development and account management. Since 2013, he moves to IoT business and became the sales VP on an IoT PaaS company to run the service of data collection, data analytics and prediction for global business. Now I work as Intelligence 4.0 planner for “InSynerger Technology Inc.” which target on the smart factory, smart building, smart communality energy management planning. The major challenge is combining the electricity and information technology to one solution.

Smart Power Management

Yin-Che Huang

Abstract

Insynerger Technology Co.Ltd., provides smart factory, smart part total solution service since 2008, We base on IoT technology and cloud management platform to cultivate machine learning and big data analysis to service 24 hours factory and park cloud AI manager.

Smart factory AI manager, help factory service people to understand and manage the factory's Power data for multiple application in 1 Platform, the solution including electricity Management, Demand Management, Renewable Energy management, Indoor Lighting Management and Community Lighting-Lamp control. The smart factory AI manager help you to manage and do the energy saving plan by data analytics and prediction for the service time frame.

In addition, we also serve Smart Community AI Manager, which could help end user to understand the power consumption and forecast on each home appliances. Mover, we do provide the Big Data Analysis on Behavioral Identification and base on the daily behavior to detect whether the of Elder is abnormal and notify relatives.

Workshop

Practices

Prof. Dr Enny Sudarmonowati Deputy
Chair for Life Sciences
Indonesian Institute of Sciences (LIPI), Indonesia

Prof. Enny Sudarmonowati has been in charge of the Deputy Chair for Life Sciences of Indonesian Institute of Sciences (LIPI) since 2014 as well as a Chairperson of Indonesia Committee of Man and Biosphere (MAB) UNESCO, and a senior researcher at Research Centre for Biotechnology LIPI – Laboratory of Plant Molecular Genetic and Biosynthesis Pathway Alteration. Four research centers of LIPI and five botanic gardens belongs to LIPI are under her authority. Since August 2018 at the 30th Session of International Coordinating Council (ICC) MAB UNESCO, she is the President of MAB ICC UNESCO.

She joined LIPI in 1986 after graduated from Bogor Agricultural University in October 1985 and obtained a Ph.D degree at School of Biological Sciences of University of Bath, UK in January 1991. During the period of 1992 - 2012, she was research coordinators of various collaborative programs concerning plant biotechnology and relevant aspects with various institutions including private sectors in Indonesia and in other economics such as IPGRI-APO based in Malaysia, IAEA/FAO based in Austria, ETH Zurich, Wageningen University and Radboud University in Netherlands, AVEBE Netherlands, and Indonesian private/semi private companies such as PERHUTANI, INHUTANI, Sinar Mas Forestry. Other international funds obtained were from KNAW and other agencies (such as WOTRO) in The Netherlands. Her main research areas are genetic conservation and genetic improvement of plants involving various techniques including molecular markers and genetic engineering including feedstock for biodiesel d bioethanol. Her former positions among others, are the Director of Education and Training Centre for Researcher Development - LIPI, Head of Division of Microbial and Genetic Engineering, Head of Subdivision of Scientific Cooperation of Research Centre for Biotechnology – LIPI, the Indonesian Coordinator of Agriculture beyond Food Program of Indonesia-Netherlands collaboration.

She has published more than 203 scientific publications and one (2) granted patents and two (2) candidate patents which have been under processed by the Indonesian Directorate General of Patent and Intellectual Property Right. She is a promotor or co-promotor of Ph.D students of various universities in Indonesia and abroad. She involves in Indonesian Delegation in International fora including Convention of Parties (COP) Convention on Biological Diversity (CBD), program in utilizing bioresources sustainably as well as human resources capacity building.

Policy, Research and Implementation of Integrated Model of NRE [New and Renewable Energy] for Villages, Botanic Gardens and Other Areas in Indonesia

Enny Sudarmonowati[1] and Dwi Susilaningsih[2]
[1]Deputy Chair for Life Sciences – Indonesian Institute of Sciences (LIPI)
[2]Research Centre for Biotechnology – Indonesian Institute of Sciences (LIPI)

Abstract

Considering rapid development of technology especially industry 4.0 era on new and renewable energy, Indonesian institutions and universities have been restructuring research based on grand design 2017-2045 and the involvement of private sectors to meet ABGC scheme and to support SDGs. As Indonesia is rich in bioresources, the development has to prioritize the utilization of bioresources and for increasing the quality of life of communities live in remote villages with no or lack of electricity. Biomass, wind, hydro/water and solar based energy have been investigated of their usage in several areas including in two Botanic Garden in West Java and Lampung Provinces in Indonesia although the two latter ones are more for education and awareness. Innovation on energy provision is prerequisite as well as appropriate technology to be readily applied by the community. Research and implementation utilizing those resources are discussed. Some obstacles remain to be solved in conducting research, implementation of research results and the utilization in remote areas and other areas. Policy and regulation are part of the key issues that played a role in the success NERN implementation. There are various but scattered institutions conducting research but most of them have given very little significant output and outcomes so far. A multisector and multidiscipline scenario to improve the condition is proposed, involving both domestic and international institutions.

Keywords: Industry 4.0, Grand Design 2017-2045, SDGs, New and Renewable Energy (NRE), Indonesia.

Laurie Boyce
Ministry of Business, Innovation & Employment, New Zealand

Laurie Boyce is a Senior Advisor in the Energy Markets Policy team at New Zealand's Ministry of Business, Innovation and Employment (MBIE). Her particular areas of expertise are regulatory policy, New Zealand's electricity sector, and energy efficiency policy. She recently led the Energy Markets Policy team's work on climate change issues. Since June 2018, Laurie has been seconded to the Interim Climate Change Committee (ICCC) as a Senior Analyst. The ICCC is gathering evidence and preparing advice for the soon-to-be established Climate Change Commission, including on transitioning New Zealand to 100 per cent renewable electricity.

Laurie has worked in the public sector for over 17 years, including two years at Maritime New Zealand, and in energy-related roles at the Ministry of Economic Development (a predecessor to MBIE). During this time, she was seconded to the Energy Efficiency and Conservation Authority for 18 months to work on product regulation. In her energy-related roles, she has worked on Numerous sets of regulations and the passage of the Energy Innovation (Electric Vehicles and Other Matters) Amendment Act 2017. Electric vehicles policy Development of the New Zealand Energy Efficiency and Conservation Strategy 2017-2022. Minimum energy performance standards and labelling requirements for energy using products, and Monitoring the Electricity Authority, which is an independent Crown Entity responsible for the efficient operation of the New Zealand electricity market, including regulating the electricity market.

Transitioning to Low Emissions Energy

Abstract

New Zealand already has one of the highest levels of renewable electricity in the world, at about 80 per cent. It also has one of the highest rates of greenhouse gas emissions per person, compared to similar economies.

A large part of the New Zealand is based on primary industries, such as agriculture and forestry. Emissions from agriculture make up nearly half of all of New Zealand's emission, while forestry offsets about a third of emissions through the sequestration of carbon.

The other half of emissions are largely from energy use, nearly half of which are from transport. New Zealand relies on fossil fuels for most of its transport needs and for industrial heat processes, such as drying milk to make milk powder. Emissions from electricity generation are about four per cent of total emissions.

New Zealand has a goal of reaching 90 per cent renewable electricity by 2025, but has ambitions to go further, potentially to 100 per cent renewable by 2035. Medium to large-scale renewable generation is economic to build without subsidies in New Zealand, and there are projects that have planning 'consent' to proceed. However, demand for electricity has not increased, so companies have not been wanting to make the investments yet.

There are opportunities though. New Zealand can use its renewable electricity for transport (e.g. electric vehicles) and industrial heat processes, instead of fossil fuels. This will create more demand and stimulate investment in new generation.

New Zealand could also be smarter about how it uses electricity (e.g. demand management), as well as make more use of small scale generation and storage options. Micro-grids are already used in some situations.

Existing and new technologies mean there are viable options for New Zealand to take advantage of its highly renewable electricity system to move towards low emissions energy. It will come with challenges, such as ensuring a secure supply of electricity.

The Government wants to take action on climate change. It intends to work with many stakeholders and change its institutions and rules and regulations to do this

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Chairman
Research Center for Sustainable Process Technology (CESPRO) Faculty of Engineering & Built Environment
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Jamaliah Md. Jahim received a PhD degree in Chemical Engineering from University of Bradford, United Kingdom. She has 20 years of teaching and research experience in Chemical and Biochemical Engineering field. She is an expert in bioprocess engineering, Biohydrogen production, biomass and bioenergy. Her research interest includes but are not limited to development of bioprocess and microbial cultivation strategy, process optimization, kinetic evaluation and process scale-up; microbial community analysis; pretreatment and hydrolysis of lignocelluloses biomass for fine chemicals; waste-water treatment for Biohydrogen and biogas production and reuse for bioelectricity generation in microbial fuel cell and microbial electrolysis cells; process integration of biogas production. She has published more than 100 high impact journal articles and several book chapters with over 1600 citations and h-index of 22. To date, she has successfully supervised over 15 PhD doctorates and 25 master's students with 13 PhD candidates and 10 master's student currently on board. With the most recent achievement, she has been appointed as Chairman of Research Centre for Sustainable Process Technology, Universiti Kebangsaan Malaysia and also as Chairman of Malaysian Chapter for Asian Pacific Economic Corporation (APEC) Research Centre for Advanced Biohydrogen Technology.

Oil Palm Residues for Energy and High Value Products

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Abstract

Palm oil is a remarkably high efficient vegetable oil. However, substantial amounts residual byproducts generated from this industry are much less noteworthy in term of economic value as compared to palm oil. Oil palm industry's byproducts includes oil palm frond (OPF), oil palm trunk (OPT), palm kernel cake (PKC), palm kernel shell (PKS), mesocarp fiber (MF), empty fruit bunches (EFB) and palm oil mill effluent (POME). All of these byproducts are known to have high nutrients value and vast potential to be converted into numerous value added products via biological and chemical synthesis pathways. Liquid POME is readily available in large quantity all year around and can be used as feedstock for fermentation without any major modifications. Whereas other solid palm oil biomass usually need to be liquefied through pretreatment and hydrolysis prior to fermentation. Through vigorous engineering practices, we at UKM has successfully produced wide range of fine chemicals including succinic acid, xylitol, 1,3-propanediol, and xylo-oligosaccharides from oil palm residues. Additionally, our team also operating a fully integrated pilot scale of Biohydrogen and biomethane production from POME in palm oil mill. Further experimentation and exploration are being actively carried out in order to strengthen the sustainability status of palm oil plantation along with additional wealth creation for all industrial stakeholders.

Dr Jesada Sivaraks
G-able Co.Ltd, Thailand

Dr Jesada Sivaraks is the Head of Government and Industry Relations, Ericsson Thailand and takes responsibility on 5G and IoT issues.

Dr Sivaraks has worked with Colonel Settapong, one of the two Vice-Chairmen of the Broadcasting and Telecommunications Commission (NBTC) of Thailand and Chairman of the Telecommunications arm of the NBTC from November 2011 to December 2017

Dr Sivaraks has worked in the telecommunications sector for more than 25 years, having started his career as a systems analyst in the Supreme Command of Armed Forces of Thailand in 1991. He moved into working with the Telephone Organization of Thailand, and worked for some years in The United States before coming back to Thailand in 2004. He took up his current role at the NBTC in 2011.

He was appointed to the Board of Government Housing Bank as well in 2014.

Dr Sivaraks gained his Ph.D. in Electrical Engineering from Florida Atlantic University, an M.S., Electrical Engineering, Oklahoma State University and has a Bachelor's degree of Engineering in Telecommunications Engineering, King Mongkut's Institute of Technology Ladkrabang, Thailand. He also has a number of Patents pending.

Utility no more? – The IoT-5G Smart Infrastructure for the Disruption in Energy Sector

Abstract

Decentralized energy, as the name implies, is produced close to where it will be used, rather than at a monopolized large Electric provider elsewhere and sent through the domestic grid. This localized generation reduces transmission losses and lowers carbon emissions. Security of supply is increased as customers don't have to share a supply or rely on relatively few, large and remote power stations. There can be economic benefits too. Long term decentralized energy can offer more competitive prices than traditional energy. While initial installation costs may be higher, a special decentralized energy tariff creates more stable pricing. However, decentralized energy need the new kind of Grid. The smart grid is a vision of the future electricity delivery infrastructure that improves network efficiency and resilience, while empowering consumers and addressing energy sustainability concerns. In contrast, Centralized energy is on the conventional (Fossil-based) Grid. The 5G-IoT is a vital part of Smart Grid. The 5G-IoT connected smart grids driving dynamic pricing, enabling two-way communication and allowing citizens to choose where they buy their energy could lead to a percentage of reduction in household energy use. Clearly the technology fundamentals are there, and yet it is hard to find a utility provider that is achieving scale and profitability in the decentralized energy services and flexibility arena. The monopolized energy markets will be not as favorable as once were. Decentralized energy services are on a pathway to achieving scale (and therefore profitability) in contrast with centralized energy services are on the rising down pathway and may be extinction in the future.

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Education

1989 – 1990 : International Japanese Course, Takushoku University, Japan 1990 - 1994 : Department of Applied and Environmental Chemistry, Faculty of Engineering, Saitama University (Bachelor Course)

1998 – 2000 : Department of Quantum Processing Science and Engineering, Graduate School of Science and Engineering · General Science and Technology Kyushu University (Master Course)

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Biofuel for Diesel Fuel Substitution and Energy Resilience

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Abstract

Energy needs for the transportation and electricity sector continue to increase, especially liquid fuels. Fulfillment of liquid fuels still relies on petroleum, which is limited by the availability of petroleum and creates environmental problems The depletion of oil reserves requires the development of renewable fuels to replace petroleum as fuel. Diesel fuel consumption in Indonesia has reached 30 million kl per year. Biofuel could provide solutions to substitute diesel fuel. Biofuel that derived from local biomass provide lower emissions and reduce import. Some regulations have been issued as a form of domestic energy supply security. MEMR Regulation 12/2005 regarding mandatory of biodiesel has targeted the utilization of biodiesel (B100) minimum of 30% in 2020. Recently, 20% of biodiesel in petro-diesel (B20) has been implemented. This policy also raises energy resilience since biodiesel is produced from local palm oil. The use of palm oil as fuel for electricity generator engine also has been encouraged. The implementation of biofuel in transportation and electricity sector is supported by research and socialization in order to ensure its smooth implementation. Enormous variety of biomass resources for biofuel production in Indonesia also has been explored to provide economic impact and energy resilience.

Keywords: Biofuel, biodiesel, SVOs

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Abdulaziz Atabani received his Master's Degree in 2010 (First Class) and Ph.D Degree in 2014 from Department of Mechanical Engineering (Energy), University of Malaya, Malaysia in 2014 under Bright Spark Program (BSP) (Outstanding Researchers). Currently, he is working as Assistant Professor Dr at Energy Division, Department of Mechanical Engineering, Erciyes University, Turkey since September 2014. His main research area is Alternative Fuels Production and Waste Recycling. He is the head of Alternative Fuels Research Laboratory (AFRL), Erciyes University. Dr Atabani is a member of World Bioenergy Association (WBA) since 2014.

Dr Atabani has published more than 40 papers in archival journals such as Energy, Renewable and Sustainable Energy Reviews, Energy Conversion and Management, Industrial Crops and Products, Energy Technology, Journal of Cleaner Production, RSC Advances, Biofuel Research Journal (BRJ), Waste and Biomass Valorization and etc. His current H-Index is 25 (Google Scholar) and 21 (Scopus) with more than 4000 citations. He has been awarded the best Poster Prize at the 7th International Green Energy Conference on 28-30th May, 2012. This prize was offered by Energy & Environmental Science Journal (ISI, Q1 Journal) (http://blogs.rsc.org/ee/category/poster-prize/). His article 'Non-edible vegetable oils: A critical evaluation of oil extraction, fatty acid compositions, biodiesel production, characteristics, engine performance and emissions production' has appeared in the Most Cited Renewable & Sustainable Energy Reviews Articles since 2013. Apart from that, he is a regular reviewer at many high impact factor journals. Dr Atabani is the founder and series chair of the International Conference on Alternative Fuels, Energy and Environment (ICAFEE series) (http://icaf-e.com/).

Dr Atabani acted as a managing Editor at Biofuel Research Journal (May2014-May2017) and Special Issue Guest Editor at International Journal of Hydrogen Energy (April 2017-Decemebr 2017, SI: Alternative Energies (Becherif). Currently he is acting as Associate Editor at Malaysian Journal of Catalysis (April 2017-up to date), Special Issue Managing Guest Editor at International Journal of Hydrogen Energy (December 2017-up to date, SI: ICAFE2017 (Atabani), Special Issue Managing Guest Editor at Waste and Biomass Valorization Journal (Springer) (December 2017-up to date, S.I.: 2nd International Conference on Alternative Fuels and Energy-ICAFE) and Special Issue Managing Guest Editor at Energy and Environment Journal (SAGE) (December 2017-up to date, (Special Issue: ICAFE2017-Atabani).

An Insight into Valorization of Recycling Waste into Biofuels: Recent Progress

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Abstract

The ongoing research on renewable energy is being faced with the challenge of escalating energy demand. This targets 30% of total energy supply to be obtained from renewable. To achieve this goal, extensive research is needed to assess the potential of biofuels and alternative fuels. Consequently, waste can play a key role in this regard not only to reduce the dependence on fossil fuels and mitigate emissions but also to help assist proper waste management disposal system. Wastes are much available, and their recycling potential can be of great interest to the policy makers in APEC. It is believed that 34.1% of waste are recycled or composted, whereas 11.7% are combusted for energy and 54.2% are landfilled. Current legislations and zero-waste strategies demand finding appropriate technologies for the treatment of waste. This talk aims to valorize and shadow the light into various waste resources such as waste cooking oil (WCO), spent coffee grounds (SCG), spent tea waste (STW), food waste (FW) and sewage sludge (SW) for biofuels production and products of added-value that can be valorized in APEC. Various types of biofuels such as biodiesel, biogas and bio-alcohols can be produced from waste through different biofuels production technologies. Moreover, various added-value products such as antioxidants, fertilizers, fodders, fuel pellets, adsorbents and etc can be also produced from waste. This talk is believed to reflect the huge potential and on-going research of recycling waste to energy.

5.2 Day 2 Final Presentation of Training Program

This project starts from O2O educational platform 6 months before the 3-Day event. Through online information, team project organization, juries reviewing, workshop sharing experiences and real case forum guiding, the participants developed the application of smart power management system for domestic circumstance. Moreover, it built up the capacity of young participants about self-sustained green energy and gather into the talent pool among APEC regions.

One 29 August 2018, it is the final presentation of training program. During April to July, there were 17 teams for the online preliminary and semi-final round. Among these 17 teams, the juries selected 8 teams through their project proposal, interaction and group discussion. Finally, the best top 8 teams entered to the final pitch in Bangkok, Thailand. The teams are AI SMART (Chinese Taipei), Beauty Squad (Indonesia), Detritus Valore (Republic of Korea), GCS Project (China), I_Mechanics (Russia), SENESol (Thailand), Serious About Science (Malaysia), Smart Grid (Viet Nam), and adiCET Elephant Fuel (Thailand).

These 9 teams get their presenting orders by drawing lots before the presentation started. There were 7 juries for this final presentation. They are Dr Teow Yeit Haan (Malaysia), Dr Worajit Setthapun (Thailand), Prof. Dr Alissara Reungsang (Thailand), Assoc. Prof. Dr Kim Anh TO (Viet Nam), Assoc. Prof. Dr Chen-Yeon Chu (Chinese Taipei), Prof. Dr Jamaliah Md Jahim (Malaysia), Prof. Dr Jun Miyake (Japan), Ms Laurie Boyce (New Zealand) and Prof. Dr Enny Sudarmonowati (Indonesia). Each team has 15 minutes of presentation and the juries have 15 minutes for the Q&A time. There are 40% of the score from the semi-final round and 60% from the final presentation.

The team from Malaysia called Serious about Science won the first prize. The leader is Ms Shalini Narayanan from Universiti Kebangsaan Malaysia(UKM) who also won the Best Tomorrow's Leader Award. The team mentioned about that recycled cooking oil is collected from restaurants in the UKM campus. After collected, they used scientific strategies, smart monitoring and smart management to produce biodiesel. The test will firstly try to operate the bus in UKM. Besides, this team provides the estimated supply and demand market status of biodiesel of the first year. In the initial stage, UKM campus and the adjacent residential area, Bandar Baru Bangi, will be the target of community service to promote the concept of sustainable green management of smart energy management in local communities in Malaysia.

The Second Place is Team AI Smart from Chinese Taipei. It introduced about using AI technology to pig farm biogas plants and farms It is to monitor crops, forecast seasonal crops, analyze crop sustainability supplies, assess disease and pest status on farms, and supply markets. At the same time, the hyper-local data combined with learning machine led to the most convenient way to find sources of consumption and provide products. The team mentioned the use of AI to establish partnerships with local farmers, applying high-tech methods to upgrade agriculture, helping farmers improve the economic environment, and helping to attract younger generations into agriculture.

Smart Grid from Viet Nam won the Third Place. This team expressed that they chose a community near Mekong River in Viet Nam as the target audience. The team briefly described the problems found in three aspects: environmental, social and economic. Besides, they proposed to put microgrid into the community. The main benefit of microgrid is energy stability, including community security, economic security, and environmental sustainability, which is expected to help improve the living standards of local community residents, make extensive use of electricity, and reduce high-cost electricity (reduced 35 % of energy costs). It is also expected to reduce 18,500 tons of carbon dioxide emissions per year.

Except for these 3 teams which won the top 3 prizes, Ms Huang Xin Mei from GCS Project (China) won the Best Performance Award for her outstanding presentation.

Photo 3. All the team members and mentors took a photo together with the juries for the final presentation day

Photo 4. A presenter from Team AI Smart is presenting their project proposal

Photo 5. All the winners took photo together with the CEO of ACABT, Prof. Dr Shu-Yii Wu. The winners from left to right are 1) Ms Huang Xin Mei for the Best Performance; 2) Ms Shalini Narayanan from Team Serious about Science for the First Place and the Best Tomorrow's Leader; 3) Mr Tan Phat Vo form Team AI Smart for the Second Place; 4) Mr Tran Duc Minh from Smart Grid for the Third Place; 5) Ms Safa Senan Mahmod from Team Serious about Science; 6) Kyle Lin from Team Serious about Science

Photo 6. After the award ceremony, all the participants took a phot for the happiest moment

5.3 Day 3 Real Case Technique Forum

On the third day, all the participants headed to CES Solar Cells Testing Center (CSSC) at King Mongkut's University of Technology Thonburi (Bang Khun Thian Campus).

For the morning session, three speakers introduced the real case practice in Bangkok, Chiang Mai in Thailand and Taichung in Chinese Taipei. Mr Panom Parinya firstly introduced CES Solar Cells Testing Center. He mentioned about the trends and information about Solar panels and the services and products of CSSC center. Then, Dr Worajit Setthapun from adiCET, Chiang Mai Rajabhat University introduced her World Green City in Chiang Mai. She built a Smart Community which is self-sustained and students now live in there as a living laboratory. Lastly, Assoc. Prof. Chen-Yeon Chu from Feng Chia University, Chinese Taipei introduced his pig farm and the smart grid scenarios for self-sustained green community.

After these 3 speeches, all the participants visited CES Solar Cells Testing Center to understand the testing criterion such as temperature, humidity and stability etc. for solar panels. When it’s time to close the 3-Day event, the participants expressed their ideas and feelings about this event. And they are looking forward to meeting each at the event next year.

Photo 7. Mr Panom Parinya introduced the CES Solar Cells Testing Center.

Photo 8. Mr Panom Parinya introduced the zero-waste house in KMUTT

Photo 9. Participants took a photo in front of the zero-waste house in KMUTT

6. CONCLUSIONS

The workshop delivers the lectures' research expertise, experiences, and consultations, which includes green energy, empowerment community, human resources etc. to the participants among APEC regions. After the event, the participants could develop the application of smart power management system for domestic circumstance and the presenters of the second day also gained more information about their project proposal and fixed it better before their final presentation. As for the final presentation, each team reported their project proposal for their economies. The juries gave suggestions and tutorial to motivate and encourage the team members. All the participants gained lots of useful information to disseminate back to their economies. On the third day, the forum and the real-site learning discussed about the practice of smart power management system software to demonstrate the software at one of the demonstration site in Bangkok. It also conducted project experiments and show the practice model for disseminating the smart power management system software in the APEC region. All the participants of 3-Day Event participated and shared their domestic experience so that the smart power management system software could be developed and benefit well in the APEC regions.

Through the 3-Day Event, it disseminated and scaled-up this science-based collaboration framework, and also demonstrated and provided practices of the smart power management system software to enhance and expand the existing collaborative framework which the self-fund project has already built up among the academia, research institutes, and private sectors. It also built capacity for the bio-based smart power grid and bio-economy issues, and strengthened the connectivity and cooperation among APEC economies to strongly build up green growth and sustainable environment in the APEC regions.

APPENDIX

3-Day Event: Workshop

Trends

APEC-ACABT YES Challenge
28 August 2018
KX, Bangkok, Thailand

Thailand Energy Innovation Strategies

Jeong Hyop LEE
STIPI, KMUTT

Contents

- Thai context: Energy goal achievement is not guaranteed and transition to new energy system is blurred
- Achievements and legacies of the "Single Buyer Model"
- New energy system and limitations of current energy policies
- Global and Thai energy stakeholder mapping
- Alternative solutions and policy recommendations

2

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Thai context: Energy goal achievement is not guaranteed and transition to new energy system is blurred

3

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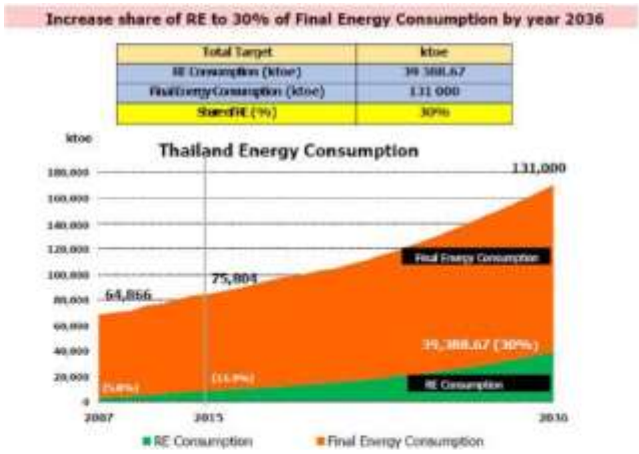
Foreign technology reliance without domestic energy innovation strategies may hamper the deployment of energy efficiency and renewable solutions

- Thai government has adopted several energy plans, one of which is the energy efficiency solution that believes to decrease 30 per cent of expected increasing energy consumption while another 30 per cent will be replaced by renewable energies by 2036.
- Until now most of solutions are derived from other advanced while domestically developed solutions are mostly the lab-scale and not suitable for industrial utilization.
- Thailand might achieve the energy target with imported technologies, solutions and equipment as they would provide cheap conventional energy during the industrialization period.
- The whole energy system is locked in the conventional energy system, especially the single buyer model.



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Thailand is not ready for the transition to new energy system with change of regulation and market structure

Global electric power systems are under the unprecedented set of changes (MIT Energy Institute 2016)

(1) the increasing decentralization of power systems with the growing penetration of distributed generation and energy storage and more active and price-responsive energy "consumers";

(2) a proliferation of information and communication technologies (ICTs) that enables energy to be produced, transmitted, and consumed more intelligently and efficiently by agents of any size;

(3) the growth of variable renewable energy sources such as wind and solar energy;

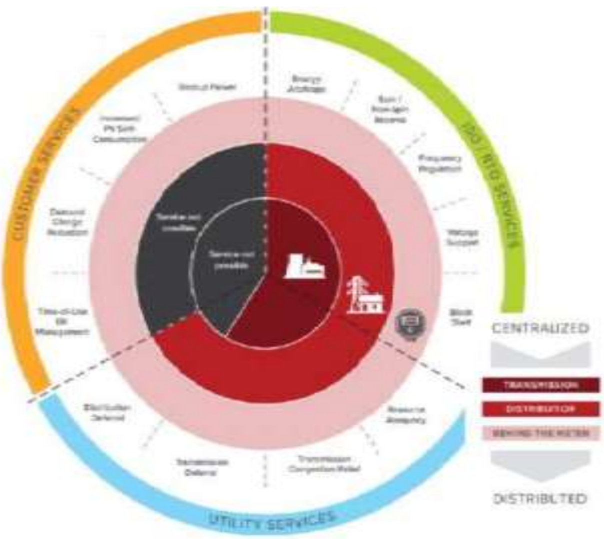
(4) the de-carbonization of the energy system as a part of global climate change mitigation efforts; and

(5) the increased interconnectedness of electricity with other critical infrastructure such as communications and transportation.

5

To facilitate the transition to new energy system, various technologies and new business models are required.

- It is found that the energy storage can be applied to three different levels: behind the meter level, at the distribution level, and at the transmission level.
- The energy storage deployed at all levels on the electricity system can add value to the grid.
- In the new energy system, the customer-sited and behind-the-meter energy storage can technically provide the largest number of services to the electricity grid at large.
- The storage deployed behind the meter is not always the least-cost option.
- Moreover, the customer-sited storage is optimally located to provide the most important energy storage service of backup power.
- Regulators, utilities, and developers should look as far downstream in the electricity system as possible when examining the economics of energy storage and analyzing how those economics change depending on where energy storage is deployed on the grid.



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Transition to a new and renewable energy system as wider system changes because of the carbon and techno-institutional lock-in

- The current energy system is locked-in as the fossil fuel-based energy systems have benefitted from increasing returns for long period. Thus market and policy failures persistently inhibit the diffusion of carbon-saving renewable technologies. Policies to address the transition to the new energy system require a comprehensive approach beyond the typical market and system failures as the sector is challenged by uncertainties combined with the existence of path dependence on conventional energy system.
- Thai energy system has grown with the single buyer model with the centralized and monopoly system based on conventional energy sources. The previous system is now challenged by the energy security and it is required to prepare toward the new decentralized system. During the transition Thailand may rely on foreign technologies as it used to do in the conventional energy system.
- Energy innovation strategies and relevant policy recommendations will be proposed after the systemic diagnosis of the current energy system and the critical review of relevant policies of Thailand.

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Achievements and legacies of the "Single Buyer Model"

4

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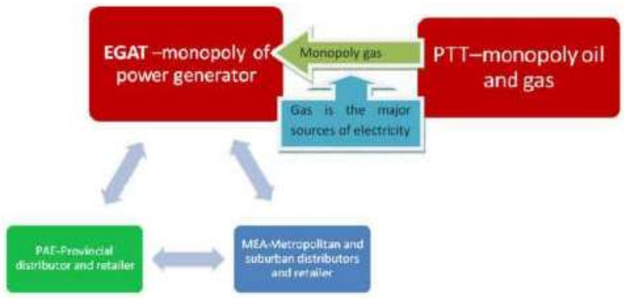
Thai energy policies focused on the industrial development of the country

- Thai government could provide cheap energies to companies and households by deploying the foreign direct investment (FDI) that has been facilitated since early 1960s to drive the economic development. Despite of two times of the global energy crises happened during 1973-1975 and 1979-1980, Thailand was one of the fastest growing economies in South-East Asia in the period of 1985-1994.
- To ensure the energy security during the economic growth, Thailand built the energy production and distribution capacity shortly. A few state-owned enterprises (SOEs) were created; namely the Electricity Generating Authority of Thailand (EGAT) for power generation, the Metropolitan Electricity Authority (MEA)for distribution, the Provincial Electricity Authority (PEA) for retail, and the PTT Public Company Limited (PTT) for petroleum and gas. They are based on the conventional energy sources.



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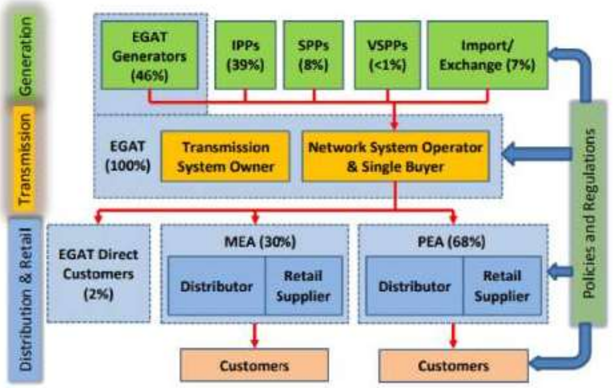
The single buyer model, the institutional foundation of the Thai energy system

- After the economic development expansion, Thai government could not supply electricity, oil, and gas to meet the increasing energy demand.
- The government has been forced to allow the private sector investment in energy business which was resulted in the current and new energy business model called the "single buyer model".
- The policy of single buyer model was successfully managed with the monopolies of gas and petroleum by PTT, of electricity production by EGAT, and of electricity distribution by MEA and PEA. While these organizations have provided cheap energies, they have built vertically integrated production and distribution systems which have been proven and verified in the market.



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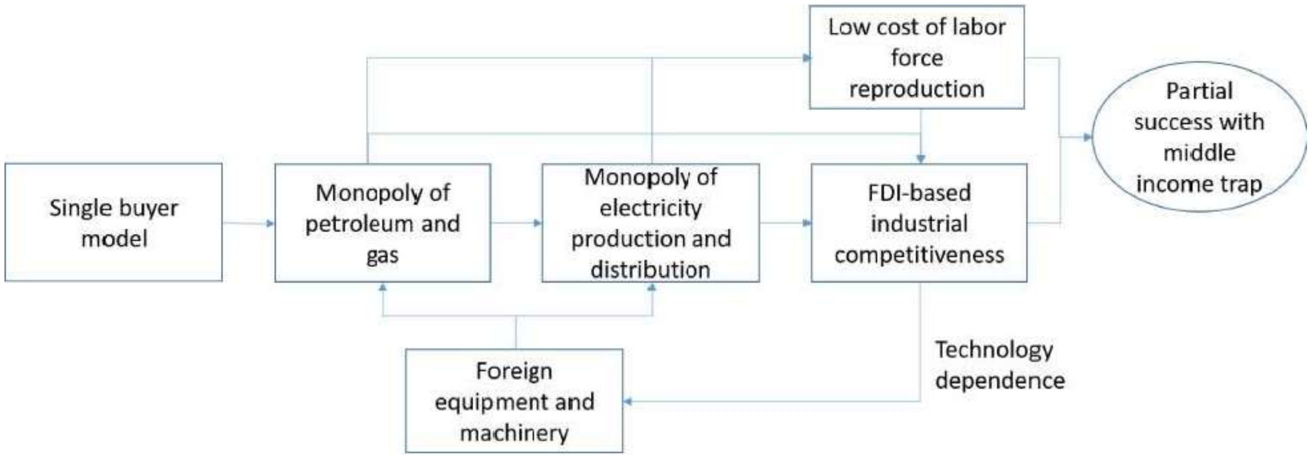
The single buyer model resulted in technology dependence and a partial success with the middle income trap of Thailand



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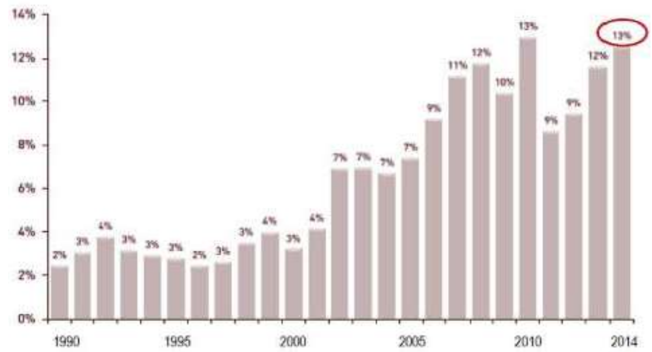
Lacking innovation management and susceptible to sustainability

- The single buyer model was implemented only with the regulation change that has resulted in strong legacies of the lack of innovation management of the government.
- These legacies became known as bottlenecks in the deployment process of the energy efficiency program in 1990s.
- The current energy system in Thailand is susceptible to sustainability and then the energy security in the near future. Thailand primarily depends on fossil fuel together with imported natural gas and oil for energy consumption and this is leading to non-security, low competitiveness, and poor environment.



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New energy system and limitations of current energy policies

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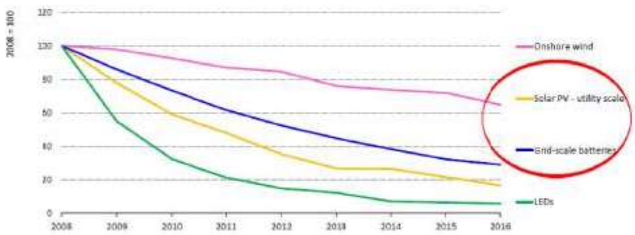
High competition and market uncertainty, high possibility of sub-optimal options and premature systems locked-in

- Enabling infrastructure of the decentralized system relies on distributed generation, energy storage and demand response. In addition, distributed generation facilities may be connected to the grid or simply serve a particular site without feeding potential excess generation into the grid.
- Data science is used to cut costs, minimize risk and optimize investment in the field of energy sector. Cost minimization with data science is now widely applied in the energy industry. Investment optimization takes several forms, such as assisting investors and internal resource allocation. Moreover, data science contributes to the enhancement of public safety through the provision of better oversight and monitoring.
- It is expected that the current situation of renewable energy will lead to high competition and the market uncertainty will be high in the near future. The smart grid, energy storage, renewable energy, and electric vehicles, all will lead to the new service business in the energy industry, such as mobile applications, car sharing, safety system, and energy management system.

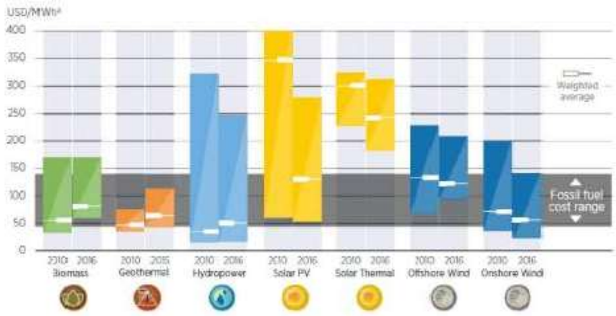
4

Technological advancement and hence continuous cost reduction of the new system pave out the road to the system deployment.

Index cost of onshore wind, utility scale PV and LED lighting, 2008-2015



Leveled cost of electricity for utility-scale power (ranges and average) in 2010 and 2016



Not completely coherent and lacking relevant implementation schemes, comprehensive innovation strategies needed

Energy Plans	Target in 2036	Strategy	Key Technology
Energy Efficiency Plan 2015 (EEP 2015)	Energy intensity (EI) reduction by 30%	EI reduction by sectors: Transport, Industry, Public and Private real estate and Residence. EEP execution with 3 strategies of 1) Compulsory 2) Voluntary 3) Complement	• EV and Rail • Industrial specific energy saving • Energy Management System (EMS)
Alternative Energy Development Plan 2015 (AEDP2015)	Renewable energy (RE) share increase to 30%	Target by energy type: 1) Power generation: ~ 20% of electricity substitution 2) Heat: ~ 37% of heat substitution 3) Biofuel: ~ 25% of fuel substitution	• Electric power generation (Solar, Wind, Municipal Solid Waste (MSW)) • Heat generation (Biogas, MWS, Solar) • Biofuels for transportation • EMS
Power Development Plan 2015 (PDP2015)	Electricity from natural gas 37%, coal 23%, renewable and hydropower 20%, energy import 15%, nuclear power 5%	Smart Grid, EV, Storage, Small Power Producer (SPP) Hybrid Firm, etc.	• Electric power generation (Conventional technology) • EMS (Smart grid)
Gas Plan 2015	Natural gas usage management and sufficient provision for future demand	• Natural gas demand reduction in accordance with PDP, EEP & AEDP • Domestic natural gas supply extension & LNG management • Infrastructure for LNG import: gas pipelines, LNG receiving terminals etc.	• Electric power generation (Conventional technology)
Oil Plan 2015	Management of petroleum consumption and provision at the optimal level and external risk hedge	• EE measures (EEP) support in the transportation sector • Renewable energy (AEDP) promotion: Biofuels • Fuel mix rebalance by setting appropriate fuel price structures that reflect actual costs (diversify types of fuels)	• Fuel for transport (Conventional technology)
Smart Grid 2015	Full implementation for utilization and supply chain localization	• Pilot implementation and infrastructure purchase • Human and technology development in mid and long term	• EMS • Digital (IoT, AI, Big Data, Cloud Computing)

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Thai energy governance

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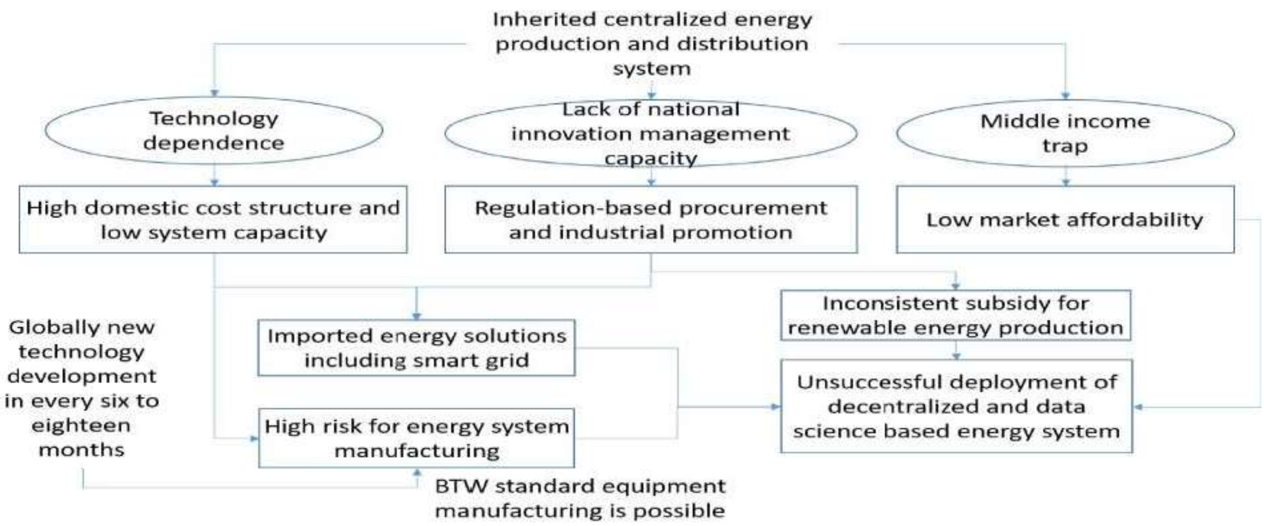
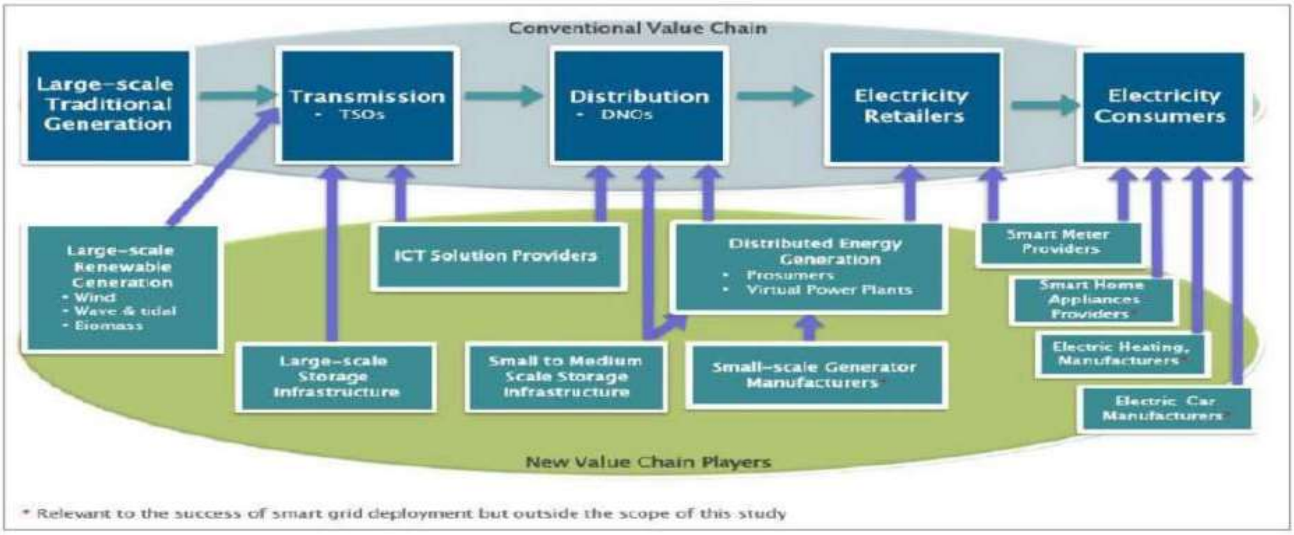
Thailand's unique integrated energy production and distribution system becomes a strong bottleneck of the new energy system deployment.



4

AP 1-10

Without specific innovation programs, it is not easy to explore new businesses since Thai energy market is small.



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Global and Thai stakeholder mapping

4

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Global technology and market trend and major stakeholders

Key Technology	Market Driver	Target	Key Players in Global Market
Energy Storage and Battery	Smart Grid Smart City, RE	High energy capacity	ABB, Panasonic, AESC, LG Chem, BYD, Samsung, and Tesla
Electric Vehicles	Energy Storage, Smart Grid-Smart City, and RE	Zero Emission	PHEV: Volkswagen, BMW, Mercedes Benz, Toyota, and Daimler BEV: Tesla, BYD, Nissan, Volkswagen, Mitsubishi, BMW, Kandi, Zotye, Ford, GM
Renewable Energy	Smart Grid Smart City, Energy Storage	Zero Emission	Vestas Wind System, Tesla, Enel, China Longyuan,
Power Transformers	Smart Grid-Smart City, Asset monitoring, RE, and Energy Storage	High energy Efficiency	ABB, CG, General Electric (GE), Schneider Electric, and Siemens
Smart Grid and Energy Management System	RE and Energy Storage	High level of energy management	ABB, Continental, Delta, Samsung, GE, Schneider Electric
Power Electronics	Smart Grid Smart City, EMS, RE, and Energy storage	High energy Efficiency	ABB, Continental, Delta, Samsung, GE

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Germany: the LichtBlick's IT platform

- The LichtBlick started in 1999 with eight members. Now it has over one million LichtBlick community members of pure energy generation with 500 skilled employees. The company sales are 2,600,000,000 kWh electricity and 700 million Euros.
- The LichtBlick is leading the radical change of the global energy system which is becoming distributed and digital. The company expands its international business for digital energy solutions and it offers its cloud-based IT platform SchwarmDirigent® (swarm maestro) worldwide.
- SchwarmDirigent® has been in operation since 2010 to integrate and orchestrate a swarm of more than 1,000 distributed energy resources (DER), including smart grid, cogeneration, photovoltaics, wind, battery storage and electric vehicles. This IT platform will promote the transition to the new energy system in around the world.
- It is found that the LichtBlick has tried to integrate IT systems of energy service providers on the platform for the collaboration among international stakeholders.

4

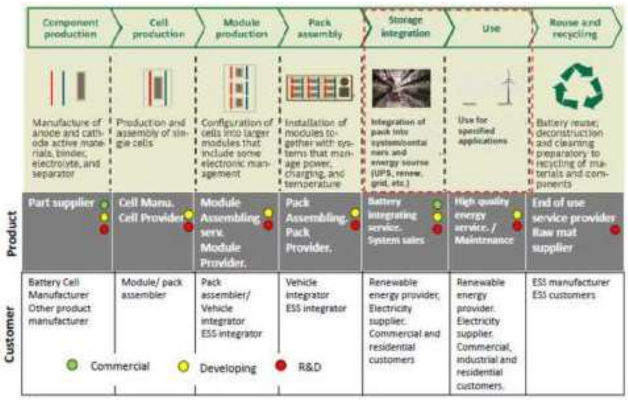
Korea: KT's MEG Platform

- Korea Telecom (KT) is a Korean telecom company. It consumes 25,000 GWH annually. The paradigm shift in the energy industry from government leading energy production and distribution to consumers and the private sector leading the open market has provided a new business opportunity for KT.
- KT has developed a core technology of the Micro Energy Grid (MEG) platform with Artificial Intelligence (AI) engine of e-Brain leveraging 5G, BIC (Big data, IoT and Cloud) and AI for total management of energy production, consumption and trade.
- The KT-MEG platform accommodates GiGA energy managers, GiGA energy Gen, GiGA energy DR (demand response) and GiGA energy Charge. Currently this system is connected to 226,000 sites in Korea. Among them there are 8,088 energy managers, 247 energy generators, 619 energy DR, and 1,707 energy charger. Beside these sites, there are another 15,525 mobile chargers.

Thailand could catch up the global technology in the area of power transformers, but most of the fully used in operation are low-value-added parts of the biotechnology and most of the value chain of energy storage system and batteries development are just in the R&D process.

Status of MSW technology	R& D	In operation		Future
		Partially used	Fully used	
Thermal conversion				
Incineration			•	
Gasification, Pyrolysis, Plasma arc	•			•

Status of Biogas technology	R& D	In operation		Future
		Partially used	Fully used	
Pretreatment				
Mechanical			•	
Thermal, Acid/Alkaline		•		
Enzyme	•			•
Conversion				
AFF/AF, UASB EGSB, Hybrid (AFF+UASB), CSTR, Plug flow, ABR, ACL, MCL			•	
IC		•		
Cleaning				
Bioscrubber, Chemical, Water absorption			•	
Air injection, Iron oxide		•		
Membrane, Pressure swing	•			•



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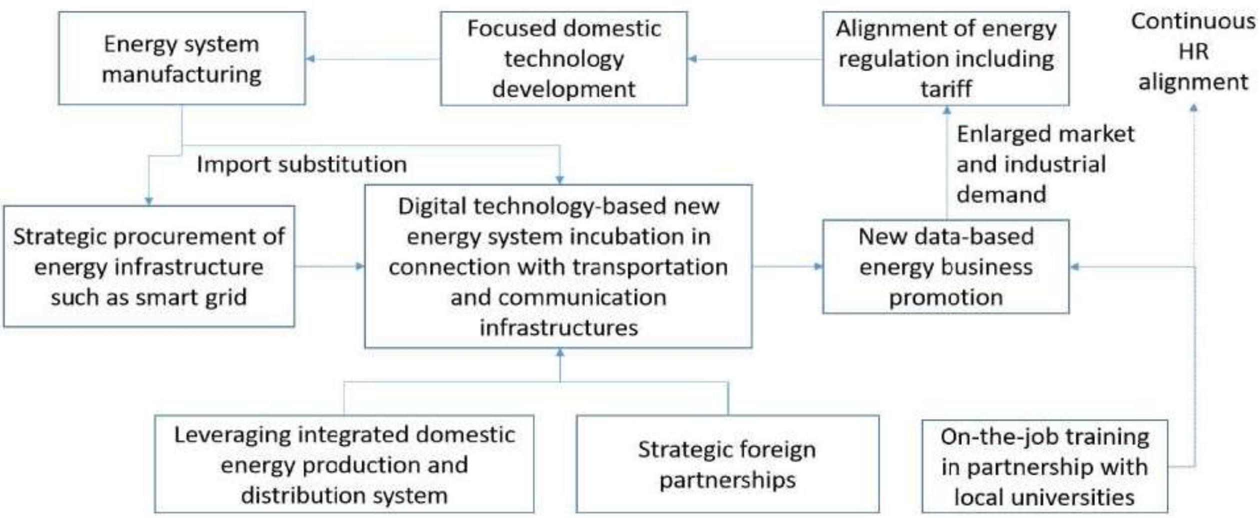
Alternative solutions and policy recommendations

25

KMUTT STIPI

Without strategic decisions, losing long-term impacts with small change in the near future and an excessive delay locking out low carbon options and locking in to the incumbent technology or system by default



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Policy recommendation 1: Strategic foreign partnership to incubate digital technology-based new energy(s)

- In the western advanced picking winners by targeting particular technologies are generally avoided and general frameworks to encourage more sustainable innovation by creating carbon market have been recommended for the transition to the new energy system. The lingering wisdom is now challenged because of the lack of resources and urgency. The limited resources may spread too thinly and the high carbon price may not enable to develop market viable technologies. Thailand may need stronger intervention to overcome the double bottlenecks of low supply capacity and market affordability.
- The digital technology-based new energy system was proposed as a target solution. Thai government may focus on building the data science and energy service development capabilities, with which various energy service industries can be promoted. A few strategic international consortia are to be leveraged to build the core capacities while the existing integrated system capacity of conventional energy sector can be aligned in the process.
- Thai government smart grid project can facilitate the strategic foreign partnership and needs to be aligned with the integration process of the digital technology-based energy platform with other infrastructures of telecommunications and transportation (German LichtBlick and Korean KT).
- For Thailand to prepare for the new energy system, it is required to incubate the system outside of the conventional energy system. The system incubation may be launched in partnership with local companies such as AMATA, which is now promoting the smart city with focus on renewable energy in the Eastern Economic Corridor (EEC) industrial estate and this can be designed as a proof of concept for expansion. Energy management, smart grid, smart cities/infrastructure, e-mobility and energy storage are prioritized to build the data capabilities.

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Policy recommendation: 2 New data-based energy service industry promotion

- The SET-listed BCPG Plc, the renewable power arm of state majority-owned refiner Bangchak Corporation Plc, has announced that they developed a mobile application by which its clients can buy and sell power they generate in their community without any engagement with the Electricity Generating Authority of Thailand (EGAT) or other state utilities. The BCPG is now planning to diversify into solar rooftop installation services and working with another SET-listed Sansiri Plc to develop a 'smart green energy community' platform and to facilitate the internal power trade with block-chain technology.
- The new data-based energy service has already started in Thailand and the efforts of this private sector can be facilitated with a new program of energy service industry promotion. Three important components of the new energy system; adequate Infrastructure, data sciences and services can accommodate various new business models.
- Followings are proposed scenario in the context of Thailand new energy demand and production. Rural electrification and continuous increase of renewable energy can be aligned with the new energy service promotion. focus on distributed generation for rural electrification either through off-grid or mini-grid systems and the grid integration of distributed generation and storage requires major technical upgrades and new service models. As the share of renewable energy increases, a decentralized energy system is promoted to accommodate many energy sources, including the renewable sources with intermittent production such as wind and solar. The distributed generation, demand management and storage can all facilitate the increased inflows of renewable generation and cultivate new energy service businesses.

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Policy recommendation 3 On-the-job training program for new energy industries

- The specific capacity and skill development is essential to build the digital technology-based energy system, to promote data-based energy services, and later on to pursue the import substitution strategies on energy system manufacturing. However, it is reported that the engineers graduating from local universities are often not fully qualified to meet the current and future demand of the energy industry. They typically lack the practical experiences and problem-solving capabilities skills. The gap between supply and demand of human resources in the energy sector is steadily getting worse in the vicious circle loop. Students after graduation cannot get the quality jobs in the market. Consequently less students are majoring in the energy sector and hence local universities are losing opportunities to work with industries.
- On-the-job program is geared to break the vicious circle and to transform into the virtuous circle in the energy sector. Local universities are invited to provide a few anchor programs for the new energy infrastructure development and relevant energy service promotion. Those students who are engaged in the program can be hired by the future energy industry, which will facilitate better qualified students to major in the energy and the industry-university partnership.
- The focused capacity building areas are not only on the service and operation of decentralized energy generation, storage and distribution systems but also on data sciences and service innovation models. Detailed strategies and programs of the various capacity building need to be designed in due courses in the context of Thai universities which are lacking domestic industrial partnership and partly dominated by foreign journal article publication orientation.

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Policy recommendation 4 Alignment of energy regulation and governance

- As the new energy infrastructure and industry are cultivated in Thailand, a few of regulations such as energy market transformation for diversification, incentive schemes of differentiated feed-in tariffs and standards for interconnecting distributed energy system need to be aligned. Increasing the number of sites of electricity generation requires a degree of energy market diversification which will be linked to energy market transformation.
- A set of incentive schemes may promote distributed generation by establishing differentiated feed-in tariffs for grid-connected renewable energy sources and ensure that utilities will accept the excess power from distributed generators and make it available to the local network.It is also necessary to set standards for making sure of the interconnection requirements to reduce technical and legal difficulties associated with feeding electricity to the grid. This will make entering the energy market more enticing to private entities and cooperatives.
- Since Thailand energy governance is fully or heavily state-controlled, institutions and policies must be overhauled to support the participation of local governments, community cooperatives and private businesses in electricity production and distribution.

30

Policy recommendation 5 Focused technology and human resource development for import substitution in the area of energy system manufacturing

- In the diagnosis of Thai energy sector in Section 3, the energy system manufacturing such as inverters, modules and batteries, was not targeted and the standard equipment manufacturing like transformers, switches, cables, balance equipment, and others was proposed.
- After Thailand has a certain level of market demand for the new energy system, then unique solutions and systems to meet the market demand can be developed with specifically articulated programs until Thailand can develop and produce affordable products and services. These products may firstly target the domestic market import substitution and later can explore neighboring markets.
- Multi-year technology development programs and high caliber engineer programs are to be designed in advance to effectively and efficiently coordinate with the process among companies, research institutes and universities in Thailand.

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3-Day Event: Workshop

Artificial Intelligence

AP 2-1

InSynerger AI Manager

"Smart Energy Management "

Present by: Michael Huang

InSynerger Technology Co., Ltd.

InSynerger
Synergize your Factory and IoT with Intelligence

Where is this ?

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2

AP 2-2

North Pole - Arctic

Heavy !!!

To change the situation, we need to Work Together

3

4

Global Heat Wave, High Temperatures Swept Through Asia, thousands more injured

- Japan
  - Detected a high temperature of 41 °C on the 7/23, setting a new Economy record high.
  - Caused at least 65 deaths and more than10,000 people are sent to hospital.
- Korea
  - During the period 7/15~ 7/21, 10 people died of high temperature- related diseases. Up to 550 people are sent to hospital
  - 8/1, Seoul's temp reached 38.8 °C, setting a record for the economies highest temperature since 111 years.

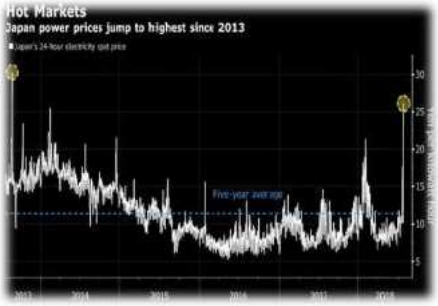
5

Continued High Temperature

Tight Electricity Supply

Asia Power Supply Impact by Deadly Heat Wave

- Japan spot power prices rise to Highest level (July 2018) High
  - temperatures have increased the use of Air-Conditioning, resulting in tight power.
  - According to data from the Japan Electricity Exchange (JEPX), the spot price of electricity in Japan has soared by 25%, the highest since August 2013.



- China (July 2018)
  - The Hunan Province suffering 'very severe' power situation and held an emergency meeting to discuss the severe power supply problem.
  - The power consumption of six major power plants in the coastal area has reached a new high. It is expected that the peak power load will break through again.

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Top 10 issues Faced by Human Beings in the 21st Century

8

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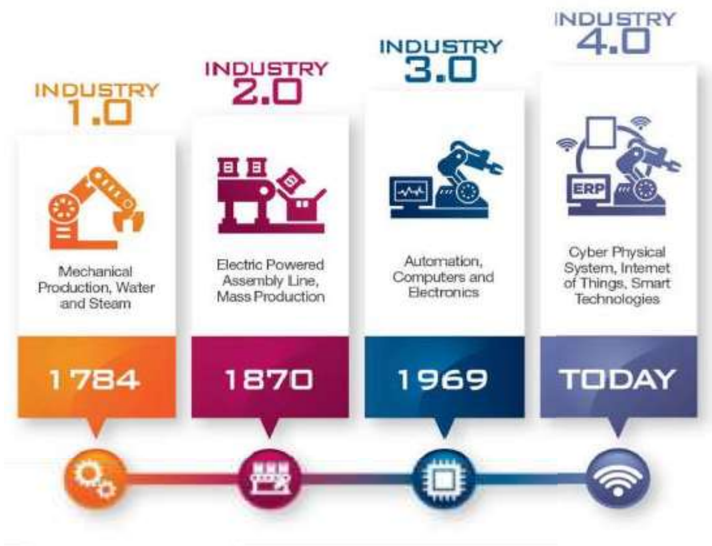
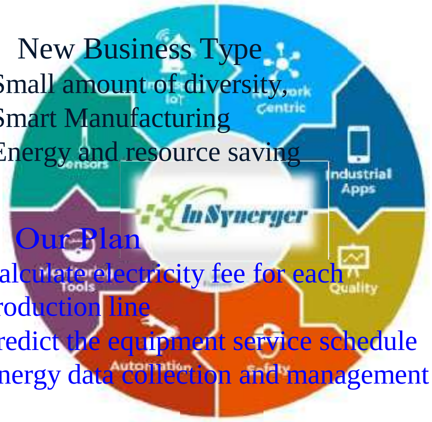
AP 2-5

Industry 4.0 (Hannover, Germany , 2013)





New Business Type

- Small amount of diversity,
- Smart Manufacturing
- Energy and resource saving

Our Plan

- Calculate electricity fee for each production line
- Predict the equipment service schedule
- Energy data collection and management

Energy Management Mode

Human Power

Single Computing Power

AI+IoT Super Power

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InSynerger Evolution Timeline

財團法人資訊工業策進會
INSTITUTE FOR INFORMATION INDUSTRY

Your Smart Energy InSnergy

2009

EMS and BMS

IOT Modules and Products
Cloud platform、Application services

IOT total solution services and Global Deployments

AI、IOT、Cloud platform
Connoted Service Solutions

Spin Off in Q4'17

2017

2018

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The IoT Technology for Factory and Industrial Parks of the Cloud AI Manager

10 InSynerger

...lution in Hand (10 yrs.)

First

Software RD100 award From Chinese Taipei

Hundreds

Cloud platform System

10 Millions

Field connecting Points

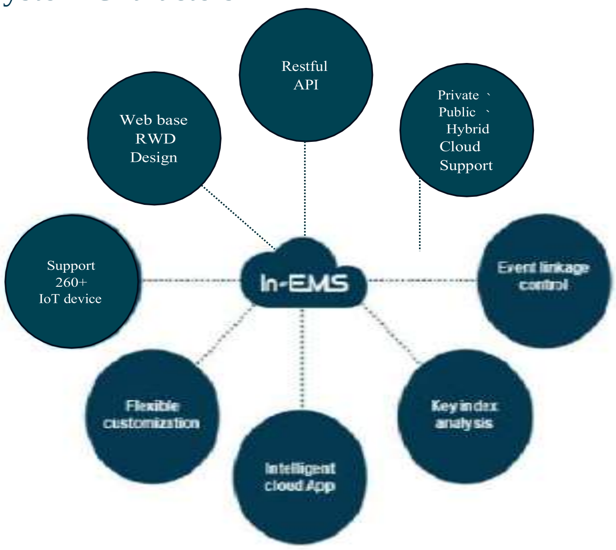
1 Billion

Data Information

IoT Architecture

InSynerger AIoT Manager

System Characters



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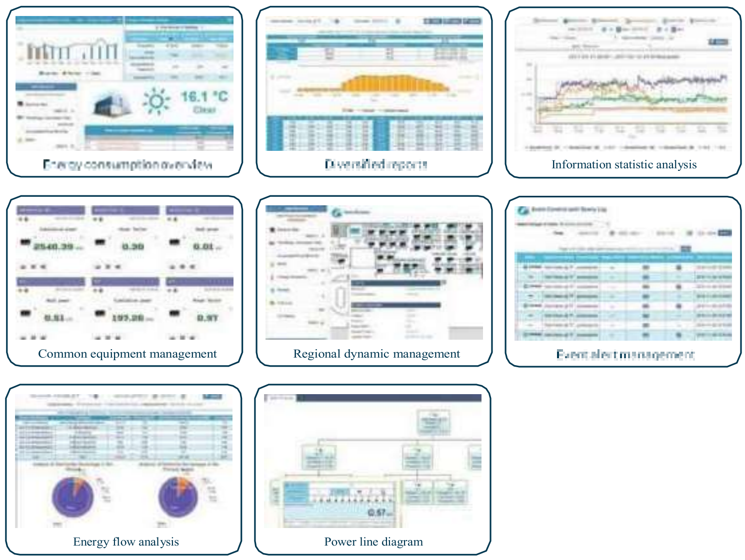
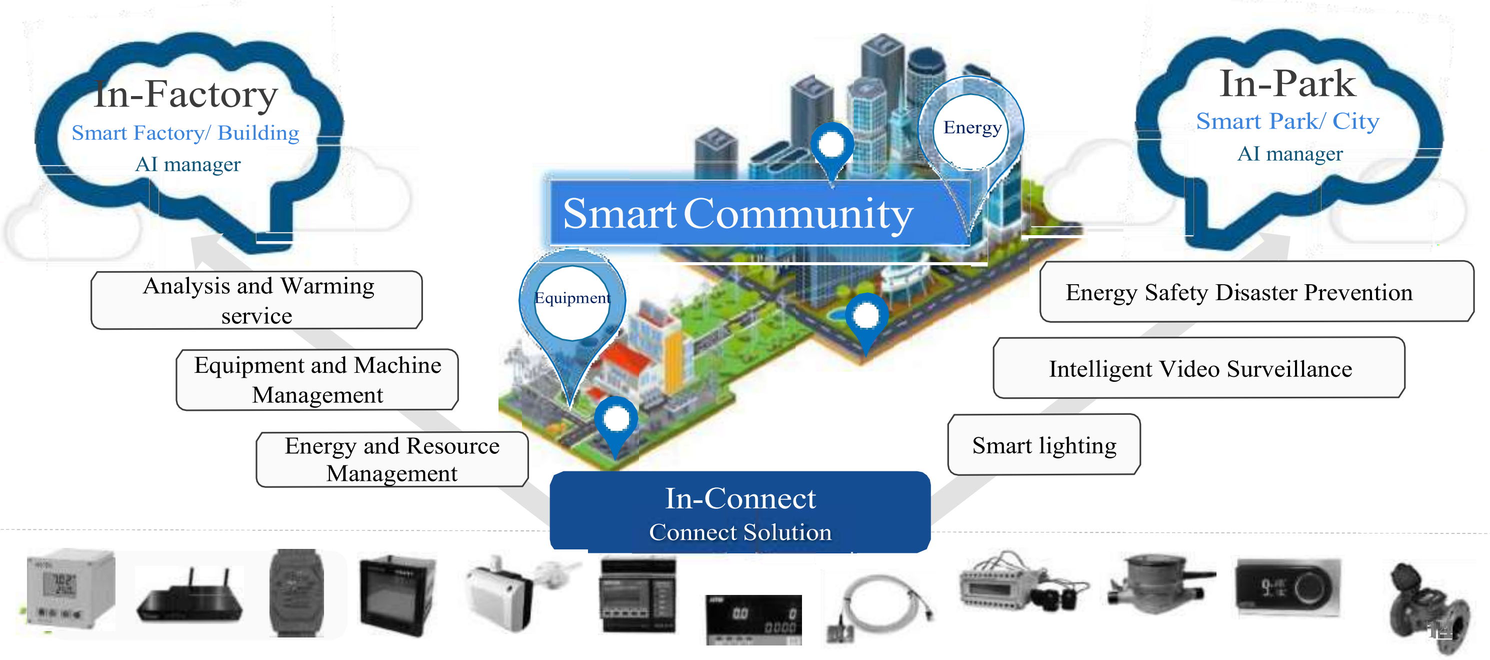
System Functions



Our Solution and Service for Smart Community



AP 2-8

Our Mission of EnergyManagement

Electricity price rise, cause production cost increase

Energy waste, need to be responsible

Saving energy is everyone's responsibility

Unstable power and energy
Affecting production yield rate

Labor costs and set up errors cause major losses

Global warming mission

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InSynerger Smart Community

In-Factory AI Manager

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The 3 Stages of Smart Factory AI Manager

Energy and Resource Management → Equipment and Machine Management → Analysis and Warning Service

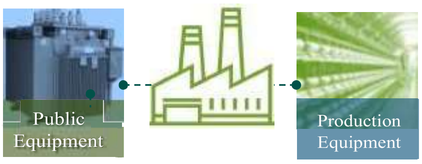
Energy Saving and Energy Efficiency Improvement

- Smart factory energy management solution
- ISO 50001、14001 Certification and CSR written base

Equipment analysis

Efficiency and yield increase

- equipment and machines to cloud Energy saving and management of equipment



Predict Equipment Service Schedule

Machine equipment AI patent build up Avoid equipment out of service and production interruption

- Condition analysis Life cycle simulation
- Visualization of device status
- Equipment failure prediction
- Service schedule suggestion

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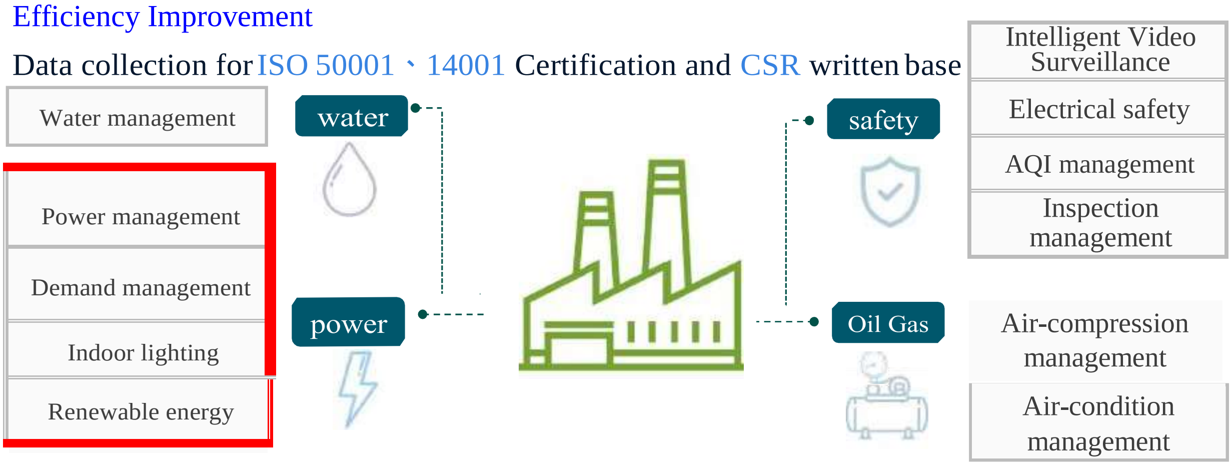
5

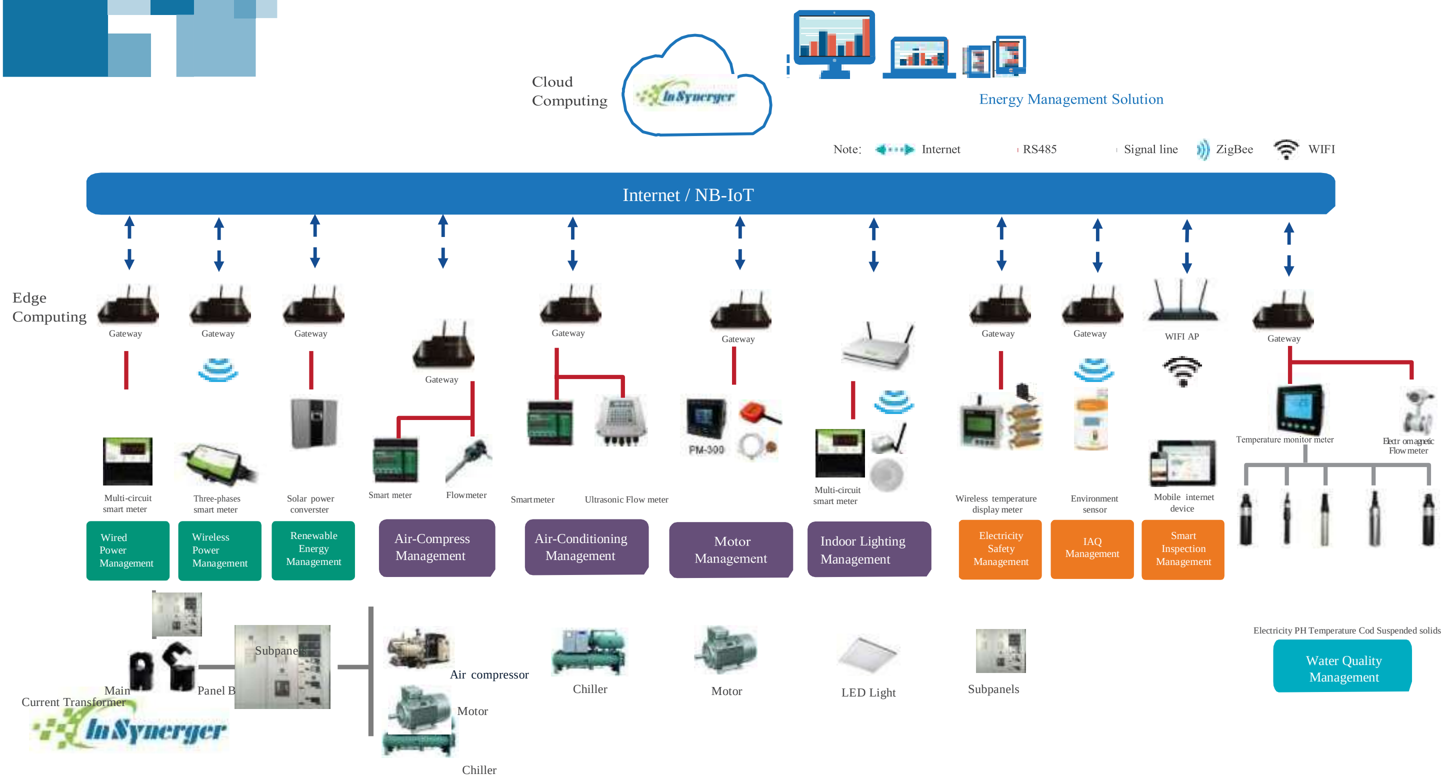
Smart Factory AI Manager – Stage I

Energy and Resource Management → Equipment and Machine Management → Analysis and Warning service

- Provide comprehensive Energy Manage Solutions as smart factory base, achieve Energy Saving and Efficiency Improvement
- Data collection for ISO 50001、14001 Certification and CSR written base



In-Factory System Diagram



Smart Power Management

Application

The platform provide multiple fields & real time data display statistic reports power consumption and analysis charts for electricity management, in order to find out the unknow energy lost and reducing energy and personnel management costs.

Functionality data collection by every

1. Cloud platform can management the multiple fields by Web APP
2. Customized Dynamic real-time display (Dashboard)
3.
4. Display power analysis parameters group such as power consumption, real power, virtual power, power factor, three-phase voltage and current parameters

Equipment

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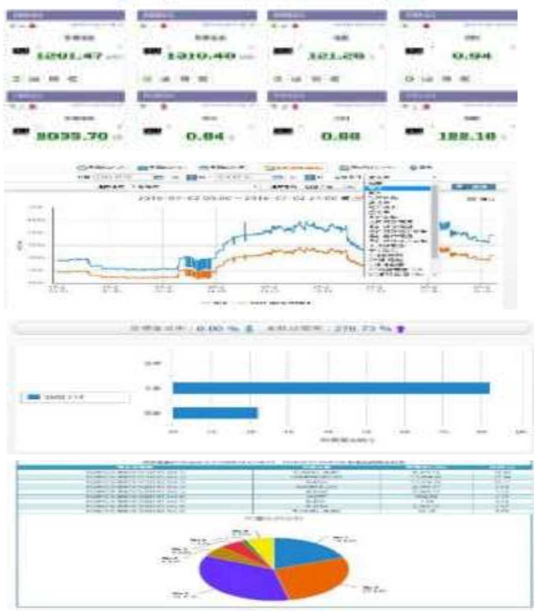
System Interface

Dynamic Real-time Display on Muti-field

Electricity History Chart

Energy Efficiency Performance Evaluation (Comparison)

Power consumption analysis chart



Demand Management

Application

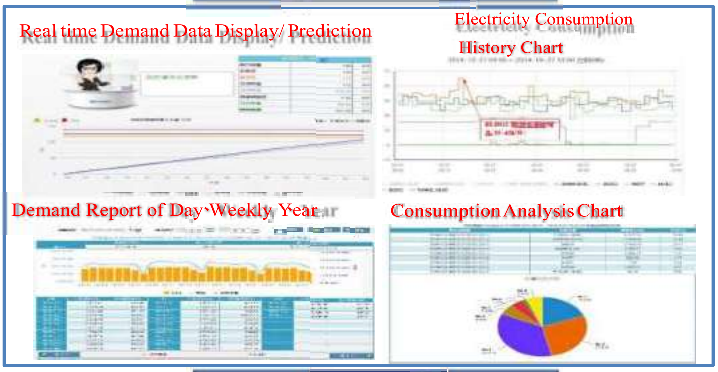
Visualize current electricity demand and the forecast alarms
Provide optimal dispatch decisions and contract capacity for electricity use, to help companies effective manage and control electricity demand

Feature

1. Daily sending demand statistics reports and analysis charts
2. Smart analysis to advise the optimal demand capacity
3. Set demand overloading (80%)and abnormal alarm, and uninstall feature on High power consumption equipment (90% high, non affect production)
4. Smart analysis to Increase the accuracy to predict the power demands

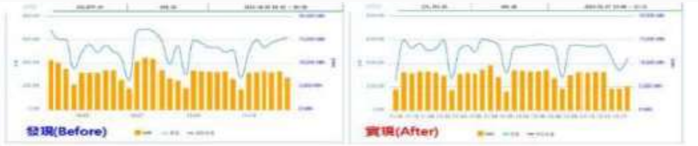
Equipment

System Interface



Advantage

Through the analysis to known the maximum electricity demand.
According to the analysis data to Implements the start-stop strategy and controls the maximum demand within a reasonable target range, customer can reduce the demand electricity consumption by 12.3%(Avg).



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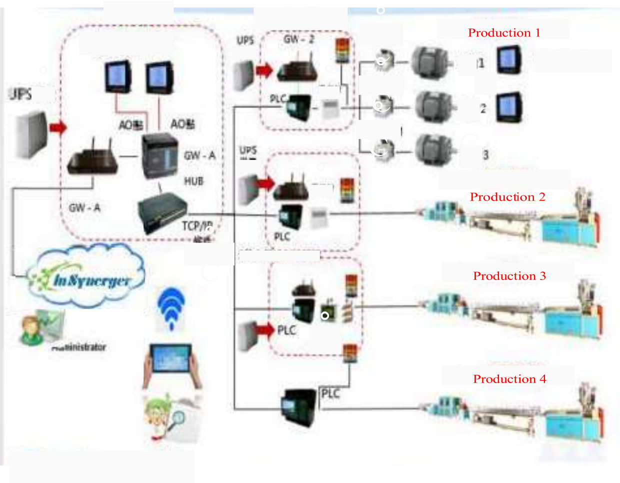
22

Case study: Smart Power Management for Viet Nam Factory

1. Energy Management System – Electricity (consumption ‧ expense), demand management
2. Smart safety system – automatic tripping and production line adjustment
3. Factory management system – Chiller, air compressor monitoring



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23

Renewable Energy Management

Application

- Collect renewable energy power generation data collaboration
- and integrate with WW major inverter brands Supporting
- multiple communication technologies
- Remotely monitor the power generation efficiency of each field

Feature

1. Analyzes power generation efficiency and maintains renewable energy availability
2. Monitor real-time power generation status、power usage and Solar panels status。
3. Analyze power generation performance, provide abnormal checking analysis and timely alarm。
4. Connect and synchronize with open Meteorological data, monitor the status of equipment by 24/7

Equipment

All-in-One Detector | Inverter | DC 12 circuit meter | DC Meter

System Interface

Case and Architecture

Case Study：Renewable Energy Management

Burkina Faso (South African) Solar field

- Implement renewable energy management solution to improve the system reliability、reduce cost and increase the power generation efficiency。
- Combine solar energy and storage systems to provide energy management information to solve power outages and equipment failures.

Renewable energy report

Inverter analysis

Indoor Lighting Management

Application

- Switching lights, effective control of indoor illumination
- Reduce energy and manpower waste.
- Remote manage the lighting status, and provides a bright and energy-efficient operation mode.

Feature

1. Support various lighting control methods(groups and situation lighting control
2. 10 different situational control settings
3. Daily, weekly and monthly three schedule customization modes
4. Calculate electricity expense and compare with the electricity price with pervious months and same month last year

Equipment

System Interface

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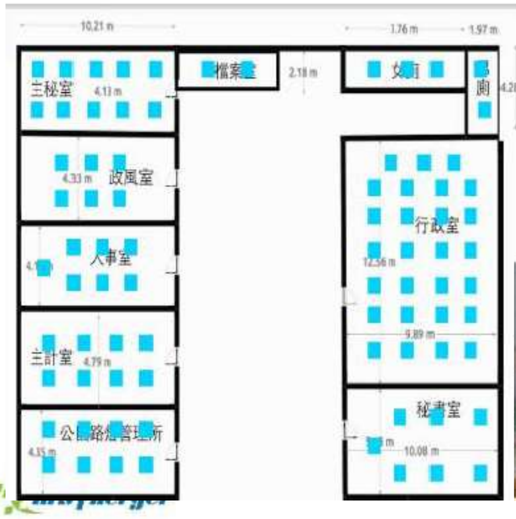
Case Study：Smart Lighting Management

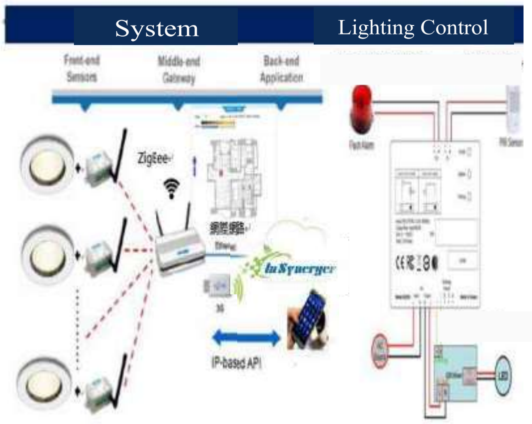
Town office(+100)

Issue: lighting waste, increase operating costs.

- Through intelligent lighting scheduling and setting for different situation needs, instead of full opening and closing to avoiding the lighting waste on way of use



Public Area



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Community Lighting-Lamp control

Issue
Issue

Heavy burden of patrolling	Long time to repair	Low efficiency eco-light

Problem Solving

Problem Solving

No longer have to patrol, everything is under control by management system.

- Notifications and send to repair inquiry as soon as events happened to shorten repair time
- Predictive maintenance is available by 24/7 power monitoring
- Provide scheduled control to reduce power usage

Function

Function

- 2 kinds of scheduled mode, 3 kinds of real-time control and 4 kinds of execution frequency to choose.
- Offers power consumption reports, including historical power consumption and energy-saving comparisons.
- Offers diagnoses, including abnormal power consumption, power theft, lamp malfunctions, abnormal activation, and abnormal deactivation.

Cases of Smart Lightings

Street Lighting Case

University Campus Case

Parking Lot Case

80% Energy Saving
28.6% Utility Bill saving
1095Km Labor inspection saving

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Smart Power Management for Self-Sustained Green Community

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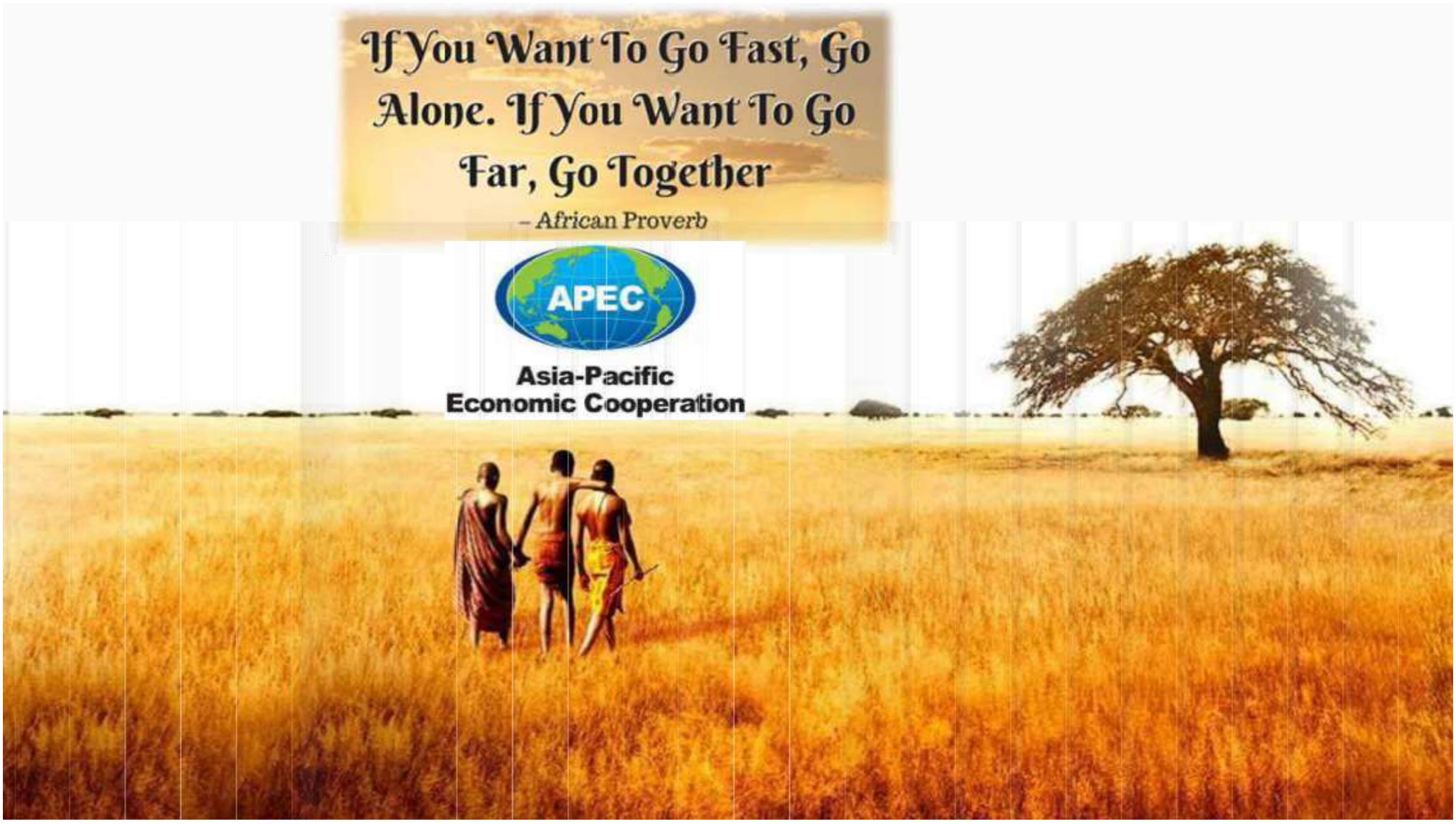

Workshop

Practices

AP 3-1

LEMBAGA ILMU PENGETAHUAN INDONESIA
(INDONESIAN INSTITUTE OF SCIENCES)

LIPI

POLICY, RESEARCH AND IMPLEMENTATION OF INTEGRATED MODEL OF NEW AND RENEWABLE ENERGY FOR VILLAGES, BOTANIC GARDENS & OTHER AREAS IN INDONESIA

Prof. Dr Enny Sudarmonowati

(Deputy Chair for Life Sciences, Chair of APEC Biohydrogen - Indonesia Branch) and

Dr Dwi Susilaningsih

(Senior Researcher of RC Biotechnology; Co-Chair of APEC Biohydrogen- Indonesia Branch)

OUTLINE

LIPI

NRE

I. BACKGROUND

II. INDONESIA'S POLICY: NATIONAL GRAND DESIGN OF ENERGY AND RENEWABLE ENERGY (NRE)

III. RESEARCH STATUS OF NRE AND ITS DEVELOPMENT

IV. IMPLEMENTATION NRE IN VARIOUS SITES /COMMUNITY

V. PROBLEMS FACED AND POSSIBLE SOLUTIONS

VI. WAY FORWARD AND CONCLUSION

www.lipi.go.id 2

AP 3-2

LIPI

BACKGROUND

- Indonesia is rich of natural resources, biomass, rich of resources, rich of traditional knowledge.
- Depletion of fossil fuel and natural resources
- Uneven distribution of electricity access
- The improtant role of sustainability science
- Shifting paradigm: conservation area as a model to implement NRE + education

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Potency of lignocellulose waste biomass in Indonesia: agriculture and oilpalm

LIPI

Biomass	Waste quantity (million ton)*	Bioethanol produced from cellulose (million ton)**	Bioethanol from hemicellulose (million ton)**	Total Potency bioethanol (million ton)
Rice straw	6,85	0,79	0,36	1,15
Rice husk	5,19	0,56	0,23	0,80
Corn cob	2,32	0,27	0,17	0,44
Sugarcane bagasse	0,51	0.07	0.03	0.09
Oil palm empty fruit bunch	7,44	0,90	0,50	1,41
Oil palm leave sheath	12,62	1,13	0,49	1,62
Total				5,55

* 1/3 from total waste potency in 2014, **calculation was based on Badger (2002)

National Energy needs in 2006-2025: 4.99 millions ton (Blue Print & Roadmap of National fossil fuel)

www.lipi.go.id

Sudiyani et al., : Energy Sci and Tech, 2015

5

AP 3-3

OTHER POTENTIAL RESOURCES: biomass of Indonesia: 146.7 million tons/year, equivalent to 470GJ/y

LIPI

- Other than agriculture waste

Biomass	Place	Million L./Y	Million G.I/Y
Rubber wood	Sumatera, Kalimantan, Jawa	41	120
Logging residues	Sumatera, Kalimantan	4.5	19
Plywood and veneer	Sumatera, Kalimantan, Jawa, Papua, Maluku	1.5	16
Sawn timber residues	Sumatera, Kalimantan	1.3	13
Coconut residues	Sumatera, Jawa, Sulawesi	Shell: 0.4 Husk: 0.7	7

Abdullah, 2006)

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BACKGROUND (2)

Energy Problem and Security

LIPI

Energy → problems in Indonesia:

While potency:
Energy fossil, Biomass, sea, solar, geothermal

1. Availability
2. Access
3. Efficiency

1. Energy Security
2. Energy Equity
3. Energy Sustainability

1. How to increase energy eficiency.
2. Develop environmentally friendly energy

Korsub Material & Energi LIPI (2017)

AP 3-4

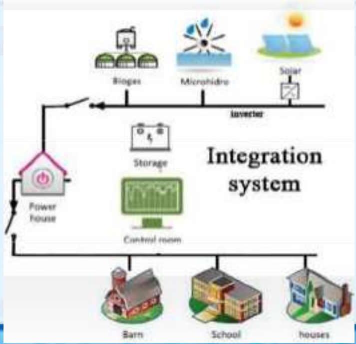
Priority Programme on Energy and Manufacture

Local natural resources-based Self sufficient Energy

For households

For remote areas

Even energy distribution.
Optimation of existing natural resources based energy.
Integration system.



For Industries

Optimation existing energy resources

Multi function utilization (waste processing and Energy)

Energy convertion Technology.
Energy Material technology
Material Technology
Engineering Technology

Source: Korsub Materials, Energy Eng.Manufacture, LIPI, 2016

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POLICY: evolution of policy related to biomass from 2005-2014: 9 regulations

Presidential Regulation no. 5 on Energy Policy, 2006	• To set energy diversification targets for 2025; including 5% biofuel, and 5% geothermal and other renewables such as biomass • To set an energy conservation target of reducing energy intensity by 1% per year
Ministerial regulation No. 27/2014	• Increase the portion of renewable energy to at least 23% by 2025 and 31% by 2050 • Utilization of biomass is focused for electricity and transportation • Using feed-in-tariff for the renewable energy • To encourage government and private companies in using biomass and biogas as fuel of power plant • To increase the electricity tariff from biomass fueled power plant

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AP 3-5

Indonesia's Grand Design on New Energy and Renewable Energy: 2017-2045

LIPI

PENCIPTAAN DAN PEMANFAATAN ENERGI BARU DAN TERBARUKAN

TEKNOLOGI SUBSTITUSI BAHAN BAKAR
- Teknologi pendukung konversi ke bahan bakar gas (BBG)
- Dimethyl ether untuk energi rumah tangga dan transportasi
- Pengembangan komponen konverter kit

KEMANDIRIAN TEKNOLOGI PEMBANGKIT LISTRIK
- Rancang bangun PLT panas bumi
- Rancang bangun PLT mikro hidro darat dan marine
- PLT bioenergi (biomassa, biogas, biofuel) massif

TEKNOLOGI KONSERVASI ENERGI
- Bangunan hemat dan mandiri energi
- Sistem smart grid dan manajemen konservasi energi
- Teknologi komponen listrik hemat energi

TEKNOLOGI KETAHANAN, DIVERSIFIKASI ENERGI DAN PENGUATAN KOMUNITAS SOSIAL
- Teknologi pendukung EOR
- Penyiapan infrastruktur PLTN
- Teknologi pendukung clean coal

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Renewable (Green) Energy Development Programmes

LIPI

- **Non Commercial-based:**
  - Carried out by the Government through Rural Electrification Program and Energy Self-Sufficient Village Program (ESSV)
- **Commercial-based: ABCG !!!**
  - Private entities are expected to play a major role in its development
  - Government will support the pilot projects, such as solar photovoltaic for urban area

Source: Annual Report 2016, ESDM

https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf
https://www.esdm.go.id/

www.lipi.go.id

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf
https://www.esdm.go.id/

AP 3-6

Renewable Energy Development Programmes Non Commercial-based:

1. **Rural Electrification Program.**
   Government: to replace diesel power with renewable power plant

2. **Renewable Energy Power Generation Interconnection Program**
   Government will assist the interconnection of small and medium renewable energy power plant to PLN's (state-owned utility company) electricity grid: electricity purchasing tariff from RE power: 80% from PLN local production cost → connected to medium voltage; and 60% for low voltage

www.lipi.go.id

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf
https://www.esdm.go.id/

Renewable Energy Development Program Non Commercial-based:

3. **Solar PV for Urban Area Program**
   MoEnergy and Mineral Resources, MoResearch and Technology & MoEnvironment: 2003 launched solar energy for urban area.

4. **Energy Self-Sufficient Village (ESSV)**
   - Launched in 2007 to improve the rural energy supply based on renewable energy → locally available to fulfill basic energy needs as well as productive activities. Approx. 70,000 villages in Indonesia, 45% of them are located in remote areas: 6,200 villages have not been supplied with electricity

AP 3-7

NRE: solar, wind, wave/current, bioenergy: applied in Indonesia from the west (Aceh Province) to the eastern part (Papua Provinsi) of Indonesia → different level, different types depending on **local condition and local sources → principles**

- **BIOENERGY:** Bioethanol; Biodiesel; BioOil; Biogas; Biohydrogen

FEEDSTOCK/RESOURCES (at least 4 categories)

- Plants (including engineered plants): food crops, energy crops, forest trees
- Microalgae; Microorganism (including:engineered ones) in supporting biorefinery
- Biomass: sugarcane bagasse, oil palm empty fruit bunch, other waste;

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RESEARCH on NRE: including: socio-economic-culture studies → sustainable science: multi disciplines
BY LIPI's RESEARCH CENTRES

Mainly: at least 6: RC Biotechnology, RC Biomaterial, RC Biology, RC Chemistry, RC Electrical Power and Mechatronic, RC Electronic and Telecommunication, RC for Economy.

Other institutions:

- Research institutions/universities: BPPT. UNAS; Univ.of Sam Ratulangi,
- Private sectors/state owned company: estate crop company (oil palm), PLN, PERTAMINA
- Research centres of ministrial: Ministry of Energy and Mineral Resources, Provincial Government

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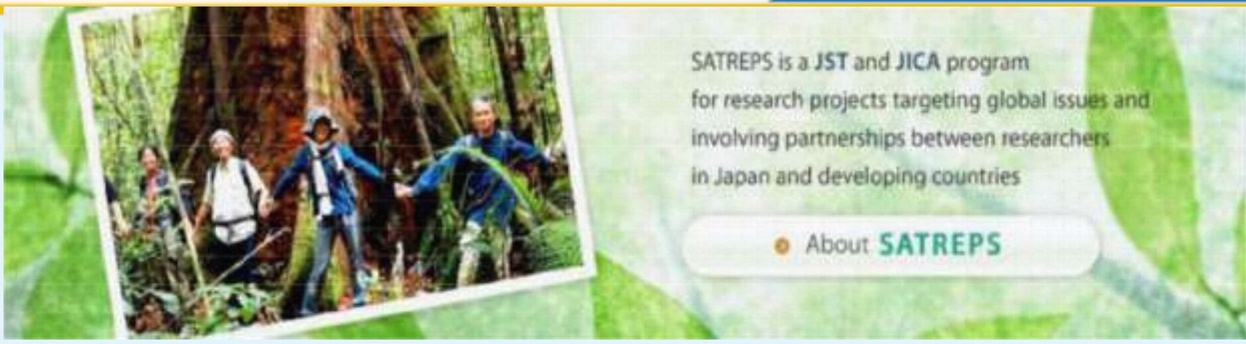
AP 3-8

Science and Technology Research Partnership for Suitainable Development (SATREPS) → continuation from previous programmes



FY 2013-2018

Innovative Bio-Production Indonesia (iBioI) : Integrated Bio-Refinery Strategy to Promote Biomass Utilization using Super-microbes for Fuels and Chemicals Production

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Main Acivities & Indonesia Team for Bio-Refinery Research

[1] Establishment of pretreatment protocol
[2] Screening of degradation enzymes for ligno-cellulosic
[3] Microbe breeding for chemical and fuel fermentation
[4] Establishment of efficient separation technology
[5] Challenging of chemical synthesis of bio-based polymer from separated chemicals
[6] Feasibility study of integrated process
[7] Promotion of bio-refinery platform into industry ect.

SATREPS PROGRAM: 2017-2020

PRODUCING BIOMASS ENERGY AND MATERIAL THROUGH REVEGETATION OF ALANG -ALANG (Imperata cylindrica) FIELDS): sorghum, planted in several areas: Cibinong West Java, Central Kalimantan and Nusa Tenggara Timur Province

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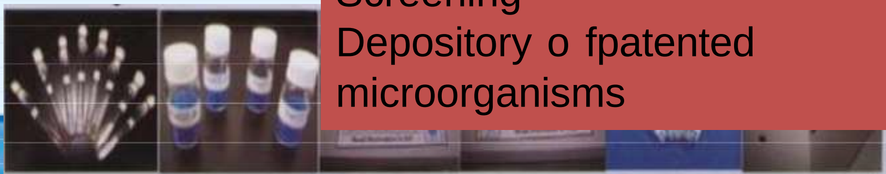
AP 3-9

INDONESIAN CULTURE COLLECTION (Ina-CC)= international standardized facility, depository for living microorganisms → inaugurated in 2014; 51 new species found by LIPI scientists

725 strains yeast
350 strains fungi
89 strains bacteria
110 actinomycetes
380 species microalgae



Tasks:

Depository microorganisms
Depository microorganisms type
Distribution of identified isolates
Screening
Depository o fpatented microorganisms

FEEDSTOCK: improved plants clones: cassava → for community: bioethanol

LIPI

Training Production of Bioethanol at household scale for local community in Central Kalimantan

AP 3-10

FEEDSTOCK: TREE SPECIES vs genetically improved → irradiated or genetically engineered

LIPI

- Ethanol production form transgenic *A. mangium over-expressing xyloglucanase gene*

- Production of ethanol from transgenic sengon over-expressing cellulase gene

- Producing Bioethanol from Shorea uliginosa Foxw. by Enzymatic Saccharification and Fermentation (collected from GSK-BB Biosphere reserve, Riau Sumatera)
-

- ENZYMATIC SACCHARIFICATION and ETHANOL PRODUCTION of XYLEMS from CIBODAS BOTANICAL GARDEN TREES

- Enzymatic saccharification and ethanol production from tree species

www.lip

Roadmap Bioethanol from biomass waste (RC Biomaterial LIPI): Centre of Excellence for Lignocelullose

LIPI

-2015: Pretreatment of sugarcane bagasse biomass optimation using LHW reactor and organic acid; utilization of dissolved xilose fraction yielded from acid catalyst pretreatment

2016: Pretreatment of Oil palm branch waste biomass optimation using microwave and organic acid; Pretreatment of sugarcane bagasse biomass optimation using LHW reactor and organic acid and surfactant

- 2017:

Pretreatment of Oil palm branch waste biomass optimation using LHW reactor and organic acid; isolation and characterisation of side yield of saccharification and fermentation of lign

- **2018**: Scale –up pretreatment using digester (LHW reactor), capacity 10 kg per day; Financial analysis of biomass pretreatment process of lignocellulose using by product of xilose and lignin

- 2019: Application of biorefinery concept on bioethanol production in lab scale.

Various pretreatment of OPEFB (using Organic Acid in Pressurized Reactors; Oxalic Acid in Microwave) and Sugarcane Bagasse Using Sulfuric Acid

20

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Challenges in pretreatment experiments

LIPI

SACCHARIFICATION AND FERMENTATION → REQUIRED ENZYME → CHALLENGE: CHEAP ENZYME SHF-SSF; OPTIMATION OF FERMENTATION: RC Chemistry LIPI

- Effectivity in degrading lignin and hemicellulose
- To obtain cellulose with specific character → e.g. crystalline and amorf
- Recycling used chemicals → affecting techno-economy analysis
- Considering environmental aspects → waste analysis

Alvira et al, 2010 Biores Tech 101:4851-4861

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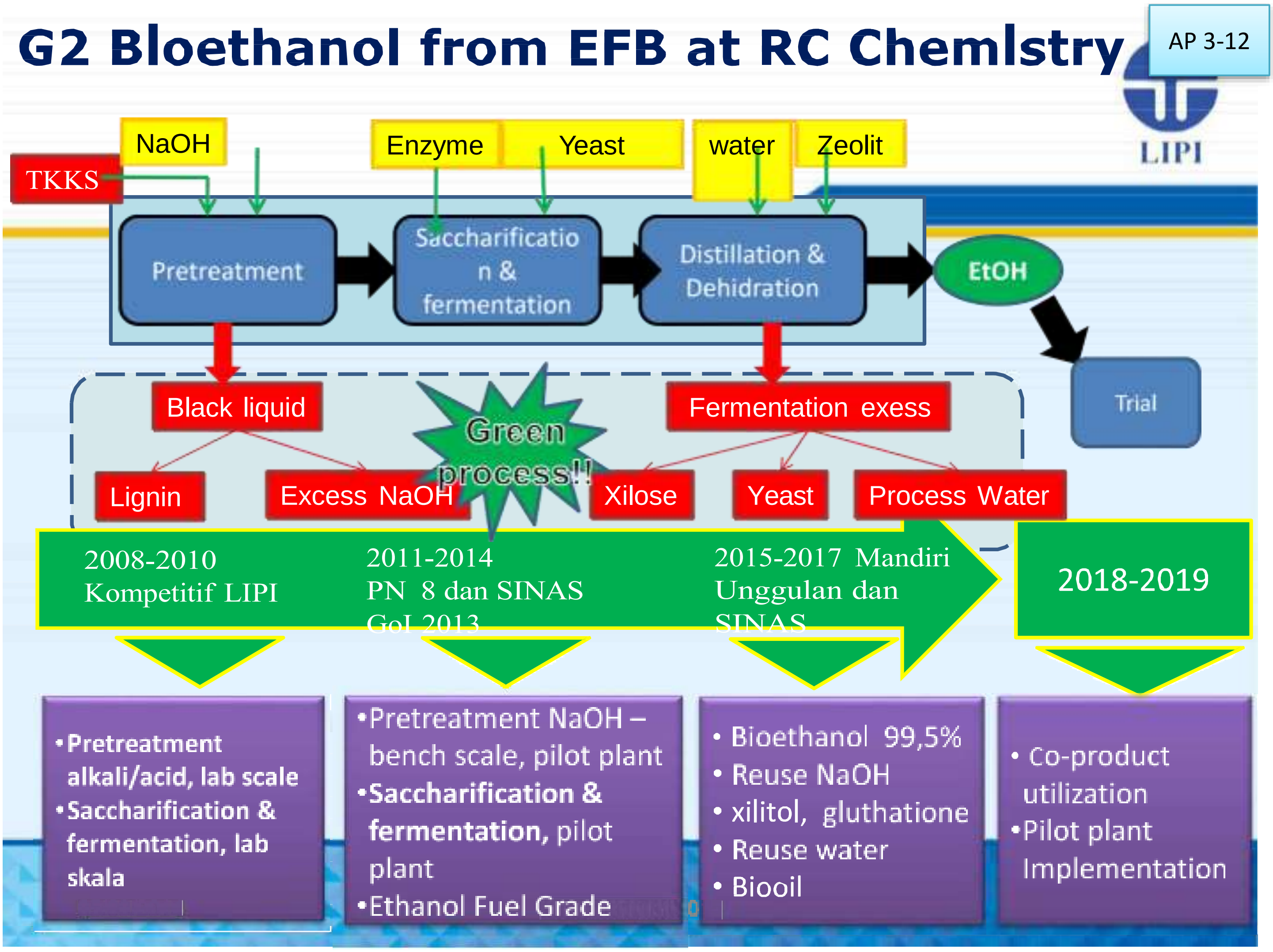
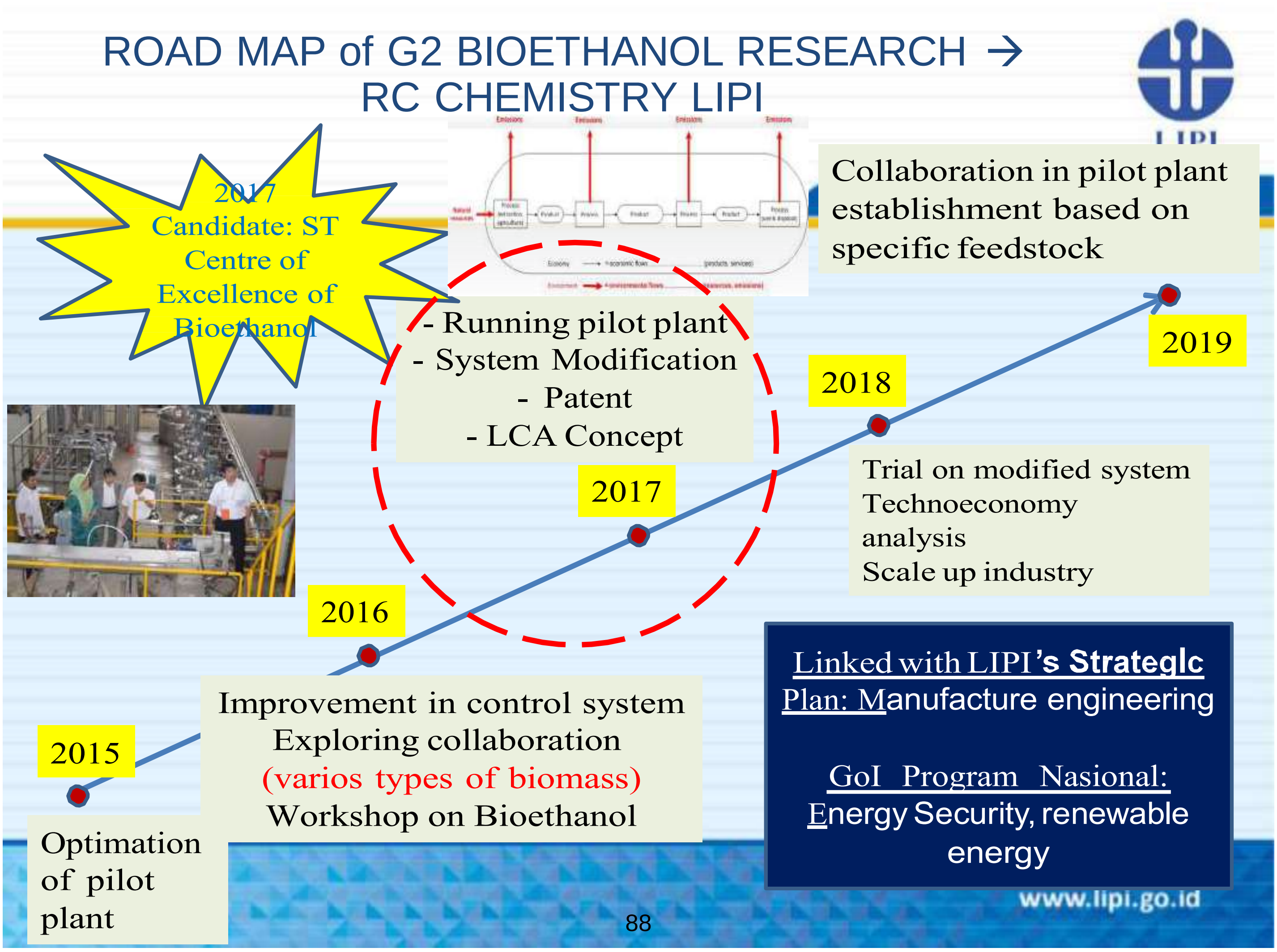
Implementasi Kegiatan

LEMBAGA ILMU PENGETAHUAN INDONESIA
(INDONESIAN INSTITUTE OF SCIENCES)

PILOT PLANT BIOETHANOL 2nd GENERATION: RC Chemistry LIPI – KOICA: EFB


G2 Bioethanol from EFB at RC Chemistry
AP 3-12
LIPI
NaOH
TKKS
Enzyme
Yeast
water
Zeolit
Pretreatment
Saccharification & fermentation
Distillation & Dehidration
EtOH
Trial
Black liquid
Green process!!
Fermentation exess
Lignin
Excess NaOH
Xilose
Yeast
Process Water
2008-2010 Kompetitif LIPI
2011-2014 PN 8 dan SINAS GoI 2013
2015-2017 Mandiri Unggulan dan SINAS
2018-2019
•Pretreatment alkali/acid, lab scale
•Saccharification & fermentation, lab skala
•Pretreatment NaOH – bench scale, pilot plant
•Saccharification & fermentation, pilot plant
•Ethanol Fuel Grade
• Bioethanol 99,5%
• Reuse NaOH
• xilitol, gluthatione
• Reuse water
• Biooil
• Co-product utilization
•Pilot plant Implementation


ROAD MAP of G2 BIOETHANOL RESEARCH → RC CHEMISTRY LIPI
2017 Candidate: ST Centre of Excellence of Bioethanol
Collaboration in pilot plant establishment based on specific feedstock
- Running pilot plant
- System Modification
- Patent
- LCA Concept
2019
2018
2017
2016
2015
Trial on modified system
Technoeconomy analysis
Scale up industry
Improvement in control system
Exploring collaboration
(varios types of biomass)
Workshop on Bioethanol
Optimation of pilot plant
Linked with LIPI's Strategic Plan: Manufacture engineering
GoI Program Nasional: Energy Security, renewable energy
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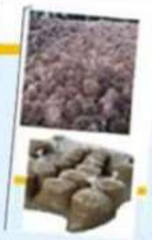
Master Plan of G2 Bioethanol Centre of Excellence

AP 3-13

LIPI

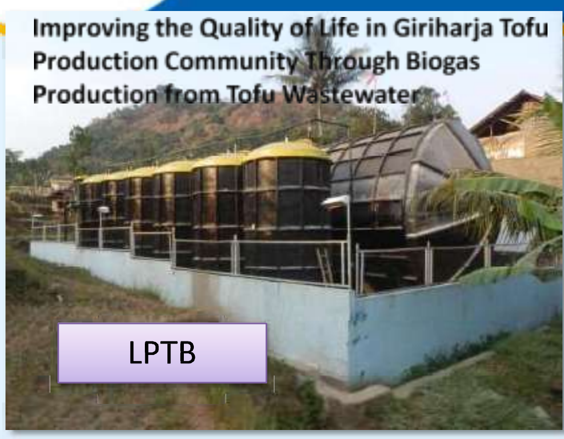


- 2017 — Running pilot plant; By product
- 2020 — Collaboration on pilot plant development on sepcific feedstock
- 2023 — Trial of E5; Process Efficiency; By product xylitol; Green process
- 2026 — Trial E10; Bioethanol purification and techno economy; By product: gluthatione
- 2032 — Trial E20; Economic Scale up

BIOGAS including from biohydrogen: LIPI with partner including local governemnt → for food industry → more areas

LIPI

RC Electricity and Mechathronic)



LPTB

RC Biotechnology

By 2019: establishment of hybrid system: with NTU Singapore

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AP 3-14

Development of Biogas Power Plants

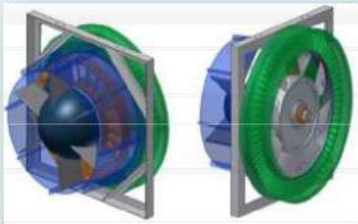
LIPI

North Sumatra, Riau

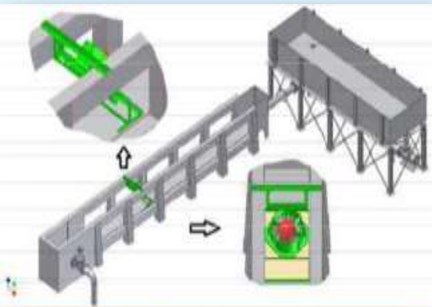
Reference: RGE Updates and Latest News from the Group / Sustainable Operations

PICO HYDRO for LOW HEAD WATER
(RC for Electrical Power and Mechatronics – LIPI)

LIPI



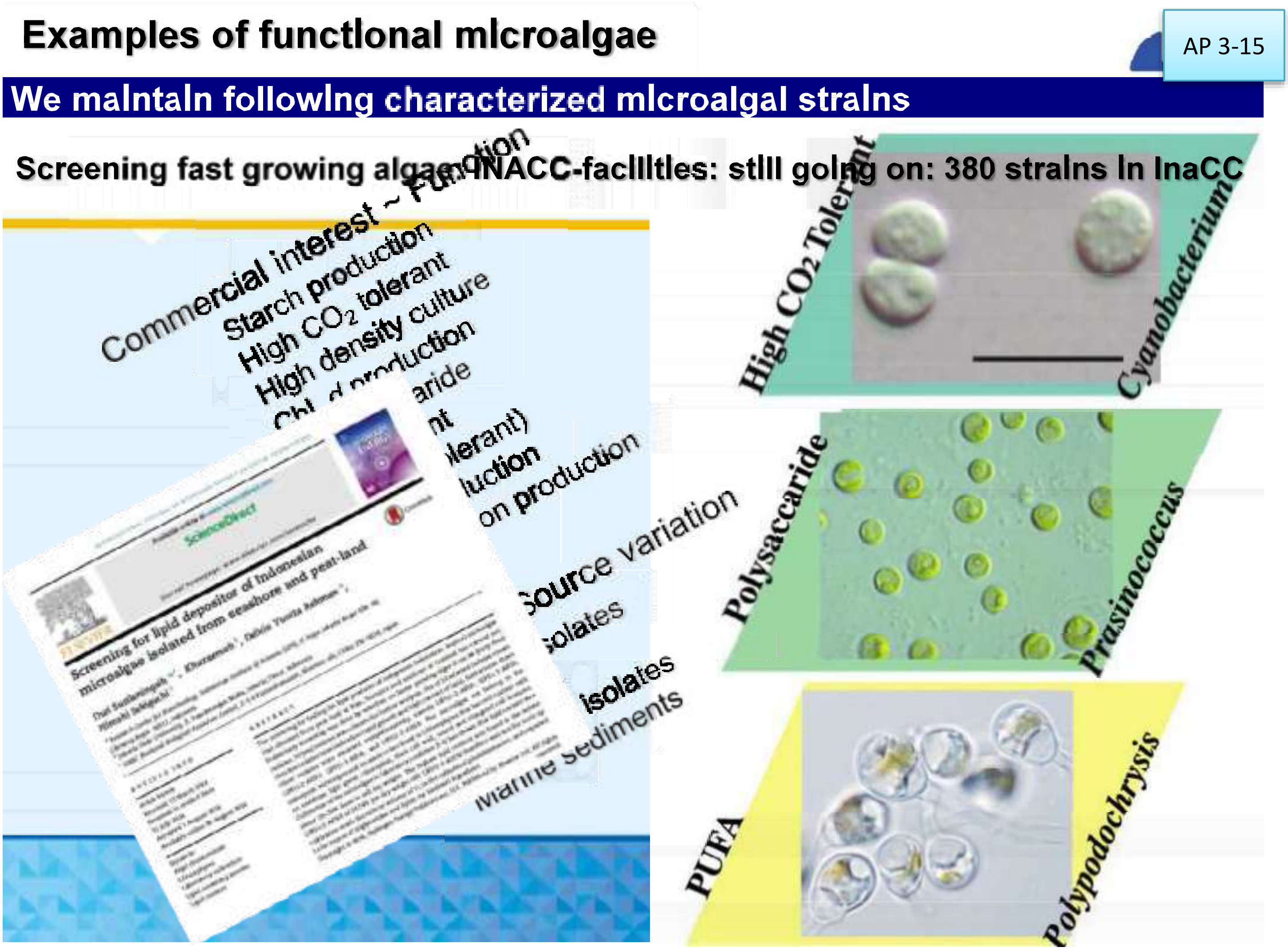
Structure design of axial turbine PMG construction system

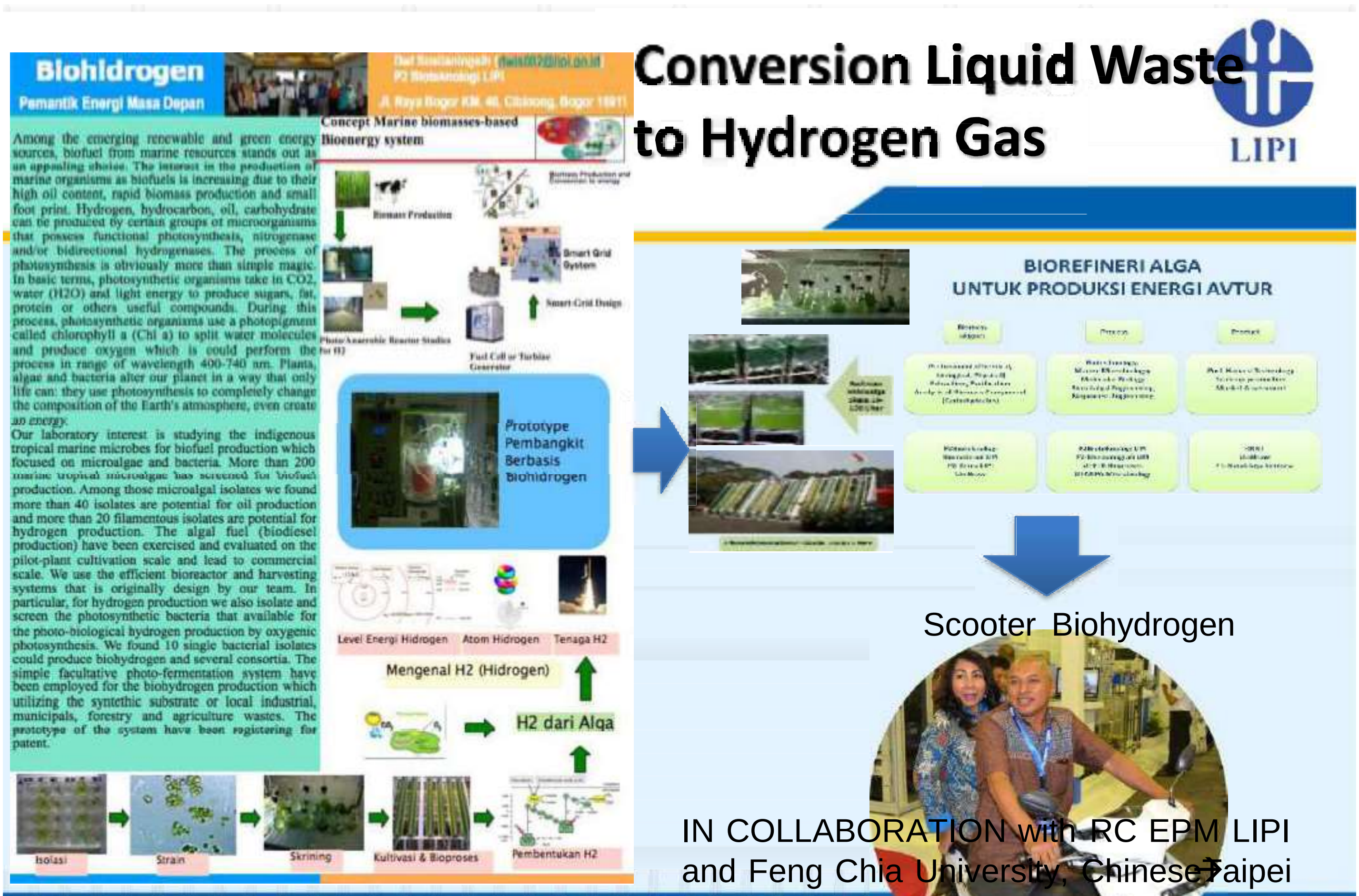


Instalation system of axial turbine with permanent magnet generator

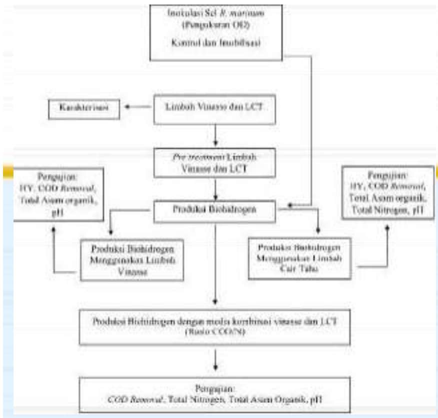
- ❑ Types of turbine that have been developed by RCEPM were turbine cross flow and propeller
- ❑ The output of the system was depend on the location, it can produce up to 150 kW electricity
- ❑ The Head/elevation from water intake-outtake → 1 m – 60 m

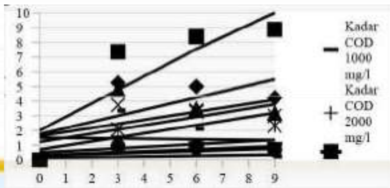
Setting of permanent magnet generator examination


Examples of functional microalgae
AP 3-15
We maintain following characterized microalgal strains
Screening fast growing algae: INACC-facilities: still going on: 380 strains in InaCC
Commercial interest ~ Function
Starch production
High CO2 tolerant
High density culture
High ... production
Source variation
isolates
Marine sediments
Screening for lipid depositor of Indonesian microalgae isolated from seashore and peat-land
High CO2 Tolerant
Cyanobacterium
Polysaccaride
Prasinococcus
PUFA
Polypodochrysis


Biohidrogen
Pemantik Energi Masa Depan
Among the emerging renewable and green energy sources, biofuel from marine resources stands out as an appealing choice. The interest in the production of marine organisms as biofuels is increasing due to their high oil content, rapid biomass production and small foot print. Hydrogen, hydrocarbon, oil, carbohydrate can be produced by certain groups of microorganisms that possess functional photosynthesis, nitrogenase and/or bidirectional hydrogenases. The process of photosynthesis is obviously more than simple magic. In basic terms, photosynthetic organisms take in CO2, water (H2O) and light energy to produce sugars, fat, protein or others useful compounds. During this process, photosynthetic organisms use a photopigment called chlorophyll a (Chl a) to split water molecules and produce oxygen which is could perform the process in range of wavelength 400-740 nm. Plants, algae and bacteria alter our planet in a way that only life can: they use photosynthesis to completely change the composition of the Earth's atmosphere, even create an energy.
Our laboratory interest is studying the indigenous tropical marine microbes for biofuel production which focused on microalgae and bacteria. More than 200 marine tropical microalgae has screened for biofuel production. Among those microalgal isolates we found more than 40 isolates are potential for oil production and more than 20 filamentous isolates are potential for hydrogen production. The algal fuel (biodiesel production) have been exercised and evaluated on the pilot-plant cultivation scale and lead to commercial scale. We use the efficient bioreactor and harvesting systems that is originally design by our team. In particular, for hydrogen production we also isolate and screen the photosynthetic bacteria that available for the photo-biological hydrogen production by oxygenic photosynthesis. We found 10 single bacterial isolates could produce biohydrogen and several consortia. The simple facultative photo-fermentation system have been employed for the biohydrogen production which utilizing the synthetic substrate or local industrial, municipals, forestry and agriculture wastes. The prototype of the system have been registering for patent.
Concept Marine biomasses-based Bioenergy system
Biomass Production
Smart Grid System
Fuel Cell or Turbine Generator
Prototype Pembangkit Berbasis Biohidrogen
Level Energi Hidrogen
Atom Hidrogen
Tenaga H2
Mengenal H2 (Hidrogen)
H2 dari Alga
Isolasi
Strain
Skrining
Kultivasi & Bioproses
Pembentukan H2
Conversion Liquid Waste to Hydrogen Gas
LIPI
BIOREFINERI ALGA
UNTUK PRODUKSI ENERGI AVTUR
Scooter Biohydrogen
IN COLLABORATION with RC EPM LIPI
and Feng Chia University, Chinese Taipei
next: cars/buses???
www.lipi.go.id

LIPI





Tabel 4. Laju Pembentukan Hidrogen (HPR) pada pH 7 dan 8

No.	Kadar COD (mg/l)	HPR (ml H2/mg COD/d) pH 7	pH 8
1.	10.000	0,922	0,995
2.	20.000	2,681	3,395
3.	30.000	4,242	5,450
4.	40.000	2,717	7,142
5.	50.000	2,754	7,884

No.	Parameter Uji	Vinasse	LCT	Satuan
1.	COD	58 433	5199,88	mg/L
2.	Total N	83,10	149,20	mg/L
3.	Total As. Organik	11,15	2,79	%
4.	pH	3,63	4,57	-

Research on Enhancing Biohydrogen Production from Liquid Waste

To be submitted at ABBS 2018, Zenshou, Henan, China 14-17 September 2018

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Challenges for H2 ICE

LIPI

- Refuelling Hydrogen Gas to the Canister is Relatively take Longer Time
- Hydrogen Canister Capacity is Relatively Small (140 gr H_2) equal to 300-375 gr Gasoline
- Bio-Hydrogen Producer with Standart Gas Product
- Advanced Security Sistem to Ensure the Safety when Accident is Occur

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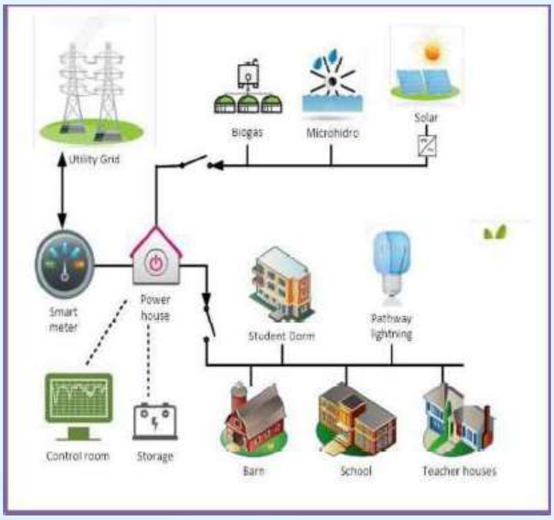
HYBRID POWER PLANT

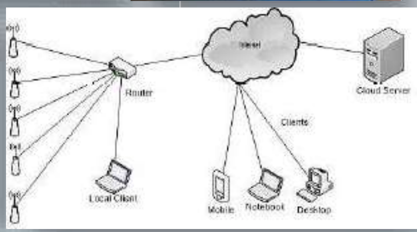
(RC for Electrical Power and Mechatronics – LIPI)

LIPI

Hybrid system :

- Energy sources : Biogas, PV, microhydro
- Location: Pondok Pesantren Baiturrahman Ciparay





Design & Installation of Hybrid Power Plant (Biogas, PV, Microhydro) → Instalation & Sistem Testing Hybrid Power Plant → Integration Sistem Hybrid Power Plant → Online Connection System & Distribution to User

(RC for Electrical Power and Mechatronics – LIPI)

COLLABORATION RCEPM

WAITRO

Basic Technology Adoption Training for Young Grass Root Leaders in Remote Area: Biogas Power System in West Java Indonesia

Sumitomo

A comparative study of waste and landfill management in Jakarta-Bandung Indonesia and Fukuoka-Okinawa Japan

muRata INNOVATOR IN ELECTRONICS

a demo project since 2015 to evaluate Energy Core's performance in real life setting in Indonesia, and demonstrate how effective the technology is → in Pulau Raja Ampat

World smallest Inverter including MPPT, Battery Converter and Grid Tied Inverter (3kW)

Energy Management System: Smart Inverter Technology

ASEAN COST

Focal Point for: Sub-Committee on Sustainable Energy Research (SCSER)

2nd ASEAN-SCSER (SCNCER) Seminar Workshop 2013
"Capacity Building on Landfill Gas Utilization in ASEAN"

Botanic Gardens Status In Indonesia
(Presidential Decree no.93 Year 2011]

PRESIDEN
REPUBLIK INDONESIA

PERATURAN PRESIDEN REPUBLIK INDONESIA
NOMOR 93 TAHUN 2011
TENTANG
KEBUN RAYA

GSPC Target 8: at least 75% threatened sp conserved *ex situ*, and at least 20% reintroduced to nature.

Function of Botanic Gardens: 5 pilars:

1. Conservation
2. Education (environment edu)
3. Research
4. Environmental services
5. Tourism (eco tourism)

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Keterangan:

1	1a	Hutan hujan pamah Kepulauan Nias
2	1b	Hutan hujan pamah Sumatera
3	2	Hutan hujan pegunungan Sumatera
4	3	Hutan hujan Kepulauan Mentawai
5	4	Hutan rawa gambut Sumatera
6	5a	Hutan rawa gambut Kalimantan bagian barat
7	5b	Hutan rawa gambut Kalimantan bagian timur
8	6	Hutan rawa air tawar Sumatera
9	7	Hutan rawa air tawar Kalimantan bagian Selatan
10	8a	Hutan kerangas Bangka Belitung
11	8b	Hutan kerangas Kalimantan
12	9	Hutan hujan Jawa bagian barat
13	10	Hutan hujan Jawa bagian timur
14	11	Hutan hujan pegunungan Jawa bagian Barat
15	12	Hutan hujan pegunungan Jawa bagian Timur-Bali
16	13	Hutan hujan pegunungan Kalimantan
17	14	Hutan hujan pamah Kalimantan
18	15	Hutan tropis pinus Sumatera
19	16a	Hutan mangrove Sumatera bagian utara
20	16b	Hutan mangrove Sumatera bagian selatan
21	16c	Hutan mangrove Kalimantan bagian timur
22	17a	Hutan hujan pamah Kepulauan Sangihe-Talaud
23	17b	Hutan hujan pamah Sulawesi
24	17c	Hutan hujan pamah Kepulauan Banggai-Sula
25	18	Hutan hujan pegunungan Sulawesi
26	19	Hutan gugur daun Kepulauan Sunda Kecil
27	20	Hutan gugur daun Pulau Timor dan Wetar
28	21	Hutan gugur daun Pulau Sumba
29	22	Hutan hujan Pulau Halmahera
30	23	Hutan hujan Pulau Buru
31	24	Hutan hujan Pulau Seram
32	25	Hutan gugur daun lembab Kepulauan Banda
33	26	Hutan hujan pegunungan Vogelkop
34	27a	Hutan hujan pamah Vogelkop;
35	27b	Hutan hujan pamah Pulau Aru
36	28	Hutan hujan Biak-Numfoor
37	29	Hutan hujan Yapen
38	30	Hutan hujan pegunungan Papua bagian Utara
39	31	Hutan hujan pamah dan hutan rawa air tawar Papua bagian utara
40	32	Hutan pegunungan Papua bagian Tengah
41	33	Hutan rawa air tawar Papua bagian selatan
42	34	Hutan hujan pamah Papua bagian Selatan
43	35a	Hutan mangrove Papua bagian utara
44	35b	Hutan mangrove Papua bagian selatan
45	36	Savana dan padang rumput
46	37	Padang rumput sub-alpine bagian tengah
47	38	Hutan hujan Kepulauan Riau

Sumber: Olson *et al.* (2001) dimodifikasi

Indonesia has 47 ecoregion types, so at least 47 Botanic Gardens to conserve Indonesian plants

Ex situ CONSERVATION: INDONESIA BOTANIC GARDENS: 37 (managed by LIPI: 5)

Of 16 Targets of GSPC (Global strategy for Plant Conservation)

Target 8: At least 75 per cent of threatened plant species in *ex situ* collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programmes

Bogor Botanic Gardens
Indonesian Institute of Sciences

38

Indonesla's Botanlc Gardens have developed thematic parks and representing specific themes, e.g: New and Renewable Energy Parks, Save Energy Building., in addition to main task to build the plant conservation

Balikpapan BG

Baturaden BG

Enrekang BG

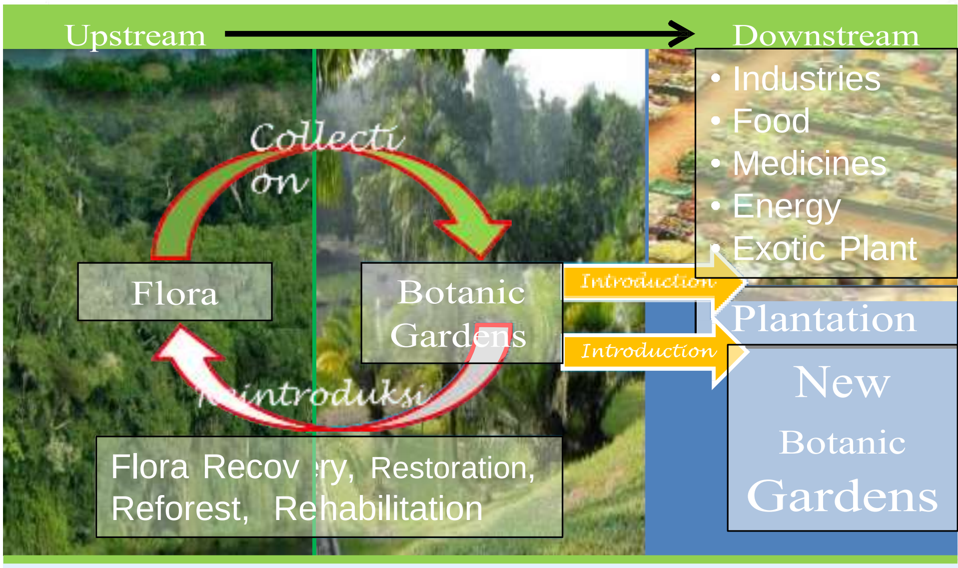
AP 3-20

Eco House: energy saving building in Indrokilo BG, Boyolali, Central Java → recycled water for watering nursery

LIPI

Identification Energy Use in Botanic Gardens

LIPI



The Tasks of Indonesian Botanic Gardens

Botanic Garden Energies Needs:

1. Irrigation
2. Lighting
3. Transportation
4. Cutting trees and branches
5. Pumping
6. Building Maintenance
7. Collection Maintenance

Assessments of Energy Sources at Botanic Gardens [Batam (Sumatera), Liwa/Lampung (Sumatera), Enrekang (Sulawesi), Cibinong (West Java]:

1. Solar Photovoltaic system (Liwa, Cibinong)
2. Biomass conversion
3. Wind Power [only Liwa/Lampung]
4. Hydro Power {Enrekang, Liwa/Lampung]

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AP 3-21

Model of Technology/Energy Application:
- In Botanic Gardens

LIPI

1. As environment and science education.
2. More effective as many people visit to Botanic Garden
3. Reducing operational and maintenance cost
4. Solving problems in quota of staff recruitment
4. Supporting SDGs implementation

- In other conservation areas: Biosphere Reserves

1. To solve energy shortage in Provincial/District areas
2. Awareness and education on appropriate technology related to energy
3. As Blosphere Reserve Is a part of UNESCO's Man and Biosphere, programme conducted in BRs have higher leverage

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NRE CONCEPT for BGs OR RURAL AREAs

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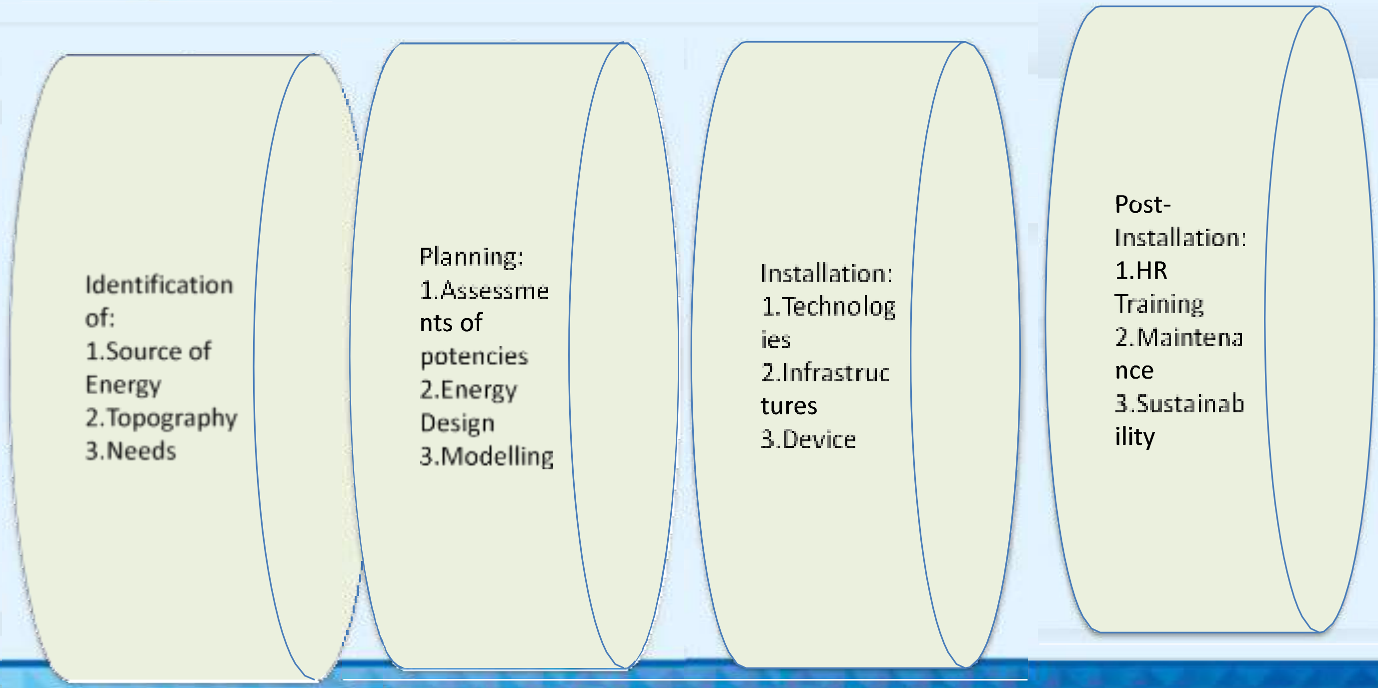

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AP 3-22

Concept Solar PV for Irrigation in Botanic Gardens (BG)

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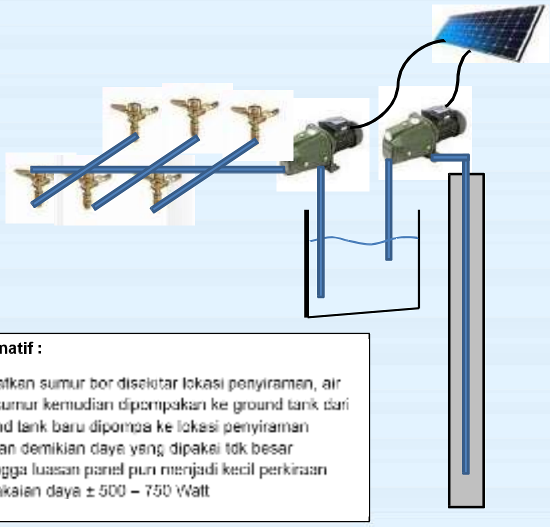
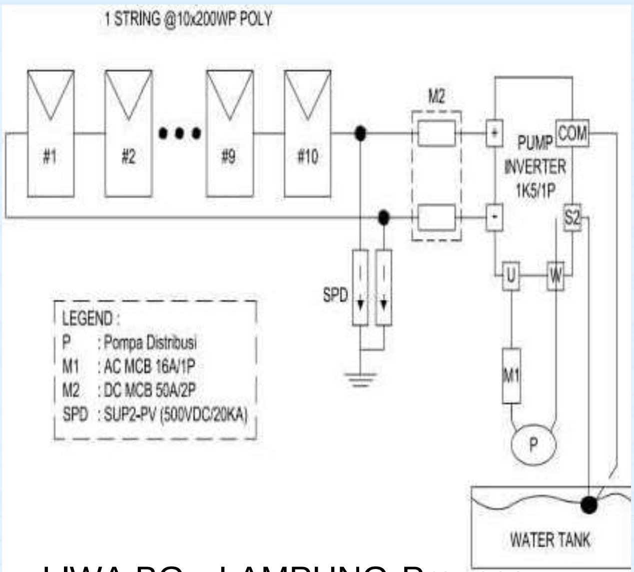


Alternatif :

Dibuatkan sumur bor disekitar lokasi penyiraman, air dari sumur kemudian dipompakan ke ground tank dari ground tank baru dipompa ke lokasi penyiraman dengan demikian daya yang dipakai tdk besar sehingga luasan panel pun menjadi kecil perkiraan pemakaian daya ± 500 – 750 Watt

CIBINONG BG, CSC-BG, Cibinong, West Java province



LIWA BG, LAMPUNG Provnce

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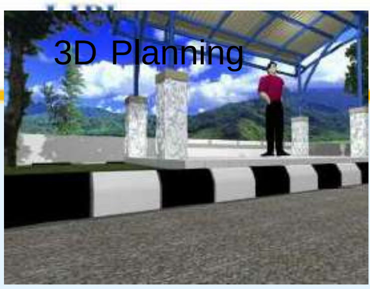
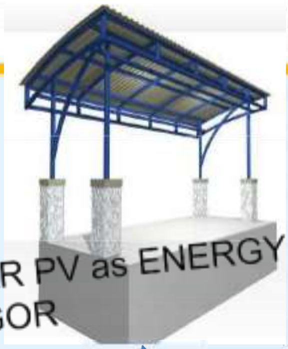
LEMBAGA ILMU PENGETAHUAN INDONESIA
(INDONESIAN INSTITUTE OF SCIENCES)



3D Planning



IRRIGATION WITH SOLAR PV as ENERGY S

CSC-BG CIBINONG BOGOR

Construction Process

Solar Panel and its utilization

IRRIGATION WITH SOLAR PV as ENERGY SOURCES, LIWA BOTANIC GARDENS, LAMPUNG PROVINCE

AP 3-23

Planning

Education port Solar energy charger plug

Harvesting Solar Energy

Dissemination: capacity building

1. TECHNOPARK → edutainment on NRE: BARON TP Gunung Kidul, Yogyakarta → by BPPT.
2. Local University: Univ. Sam Ratulangi Manado with Feng Chia Uni → International Seminar on Renewable Energy,

LIPI

24 August 2018 , Manado

- Solar, wind, fuel cell, biodiesel

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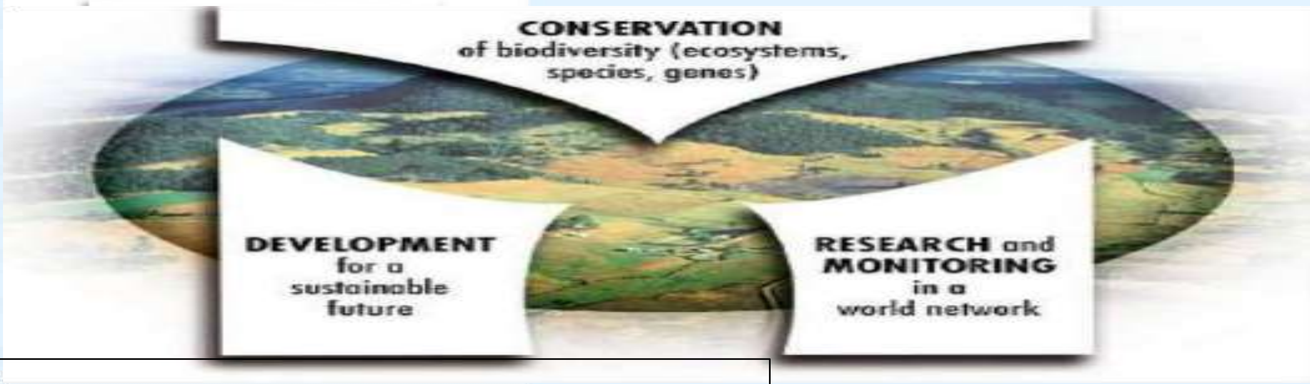
In situ CONSERVATION

AP 3-24

BIOSPHERE RESERVES: UNESCO designated, internationally recognised → NEW PARADIGM for Conserving Sustainable Development → LIPI as a national focal point.

LIPI

Areas of terrestrial and coastal ecosystems promoting solutions to reconcile the conservation of biodiversity with its sustainable use: SDGs



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AP 3-25

APPLICATION OF NRE IN TANJUNG PUTING BIOSPHERE RESERVE Central Kalimantan→ TO SUPPORT ECOTOURISM

LIPI

APPLICATION OF NRE IN BIOSPHERE RESERVES BY UNIVERSITIES

LIPI

CSERM UNAS Indonesia and Plymouth Inst.,UK in Takabonerate BR

GCRF Blue Communities

MaB

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SOLAR ENERGY

LIPI

Potential	4.5 – 5.1 kWh/m² daily insolation
Installed Capacity	0.5 MW
Current applications	rural electrification, water pumping, telecommunication, solar drying of crops, solar home system

Gili Terawangan, connected to grid

Water pumping

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WIND ENERGY: Sidrap, South Sulawesi, inaugurated by President RI in June 2, 2018 (75 Mwatt, 1st in Indonesia), Yogyakarta

LIPI

Potential	average wind speed 3 – 6 m/s
Installed capacity	0.5 MW
Current applications	water pumping, charging of batteries
Future plans	small and medium-scale –

Pandansimo, Yogyakarta

www.lipi.go.id

WIND ENERGY: for prawn farm community in Aceh → CUSP RGU UK-CSERM Unas – Unsyah Aceh, Prov.Govt

LIPI

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WIND ENERGY: South Sulawesi, inaugurated by President RI in 2 June 2018 (75 MW, 1st in Indonesia)

LIPI

- Source: Liputan 6 News.
- In 100 ha area, 30 wind turbin generator (WTG), 40% local component, 1150 human resources

Source: Tribunenews.com

www.lipi.go.id

Wave and current energy: Aceh and Lombok, Papua → based on a study by CSERM UNAS Indonesia, CUSP RGU UK

Aceh is one of the potential sites for marine current, wave, and offshore wind energy pilot project sites. It is strategically positioned for the first marine energy test centre and pilot project to be built South East Asia. Key message → capturing opportunities of leading a pilot programme in marine energy

Papua Raja Ampat:

(Kri Island: a model site RC EPM LIPI and Murata company → 24 h electricity access: 40-60 kW).

- **Current energy: CUSP RGU – Aquatera UK – CSERM Unas Indonesia**

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HYDROPOWER ENERGY: West Java, Central Java (including pico hydro)

Estimated capacity	75,670 MW (35,000 MW in Papua)
Installed capacity	5,940 MW, incl. 229 MW from mini/mikro-hydro plants
Current applications	Urban and rural electrification
Future plans	Installed capacity to 9700 by 2015

Hydroelectric dam in Cirata

Micro-hydro plant in Kalimaron

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GEOTHERMAL ENERGY:

Kamojang and Salak, West Java. Potency: 29,000 MW, only 10% utlised (2,000 MW)

LIPI

Estimated capacity	28,100 MW
Installed capacity	1,190 MW
Future plans	installed capacity to 5,000 MW by 2014, rising to 9,500 MW by 2025

Indonesian geothermal hot spots

Kamojang power plant

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf https://www.esdm.go.id/

www.lipi.go.id

BIOMASS ENERGY: East Java and Bengkulu Provinces

LIPI

Estimated capacity	50,000 MW	
Installed capacity	450 MW	
Feedstock	Forest	15.45 million m^3/year
	Oil palm plantation	64 million ton/year
	Agriculture	145 million ton/year

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf https://www.esdm.go.id/

www.lipi.go.id

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf https://www.esdm.go.id/

AP 3-30

ENERGY SELF-SUFFICIENT VILLAGE (ESSV)

LIPI

ESSV is a village having capability to produce a part/ whole their energy demand for consumptive and productive use from renewable energy sources through the utilization of local resources (biofuel, solar energy, wind energy, micro-hydro energy and biogas from manure and garbage

CRITERIA:
- Utilization of locally available energy (renewable energy)
- Creation of productive activities
- Job creation & income generation

PROGRAM:
- Utilization of locally available energy resources
- Development of productive activities
- Development of applicable technologies
- Development of institution and people participation

pi.go.id

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf https://www.esdm.go.id/

Energy source	No. of ESSV
Hydropower (MH)	244
Biofuel	237
Solar	125
Biogas	14
Wind	12
Biomass	1
Total (in 2009)	633

LIPI

Recent Achievement of ESSV-Program

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf https://www.esdm.go.id/

AP 3-31

LIPI

ESSV in Central Java

Production of bioethanol from cassava in Banjarnegara and Pati or from salak (snake fruit) in Blora

Biomass crushing

Hydrolysis

Fermentation

Distillation

www.lipi.go.id

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf https://www.esdm.go.id/

LIPI

ESSV in Haurgombong, West Java

Production of biogas from cattle manure

Biogas Tank

Usage

Lighting

Biomass crushing

Cooking

www.lipi.go.id

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf
https://www.esdm.go.id/

AP 3-32

LIPI

ESSV in Different Provinces

Biodiesel from Jatropha oil in South Sumatra

Micro-hydro plant in Malang, East Java

Solar energy in Mamuju, West Sulawesi

Wind energy in Srandakan, Yogyakarta

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LIPI

Renewable Energy Development Program Non Commercial-based:

1. **Installed Capacity**
   Bioethanol : 0.153 million kL/year
   Biodiesel : 4.3 million kL/year
2. **Current Production:**
   Bioethanol : 1 million L/year
   Biodiesel : 0.4 million kL/year

Source: Annual Report 2016, ESDM https://migas.esdm.go.id/uploads/post/Laptah-Migas-2017-OK_Final.pdf
https://www.esdm.go.id/

PROBLEMS

LIPI

- Instability of research results → more standardized procedure is required
- High production cost → resulting in high price of bioenergy → needs a collaboration including: to obtain efficient methods and appropriate enzymes produced locally utilizing local resources
- Due to localities, handling and solving problems related to NRE is mostly case by case
- Sustainability: needs nurturing and partnership

www.lipi.go.id

CONCLUSIONS

- New paradigm concerning research and application of NRE is a good sign contributing in solving global problems → a speedy implementation of researh results in several areas in Indonesia as models could boost the impact
- Strengthened collaboration and coordination/sinergy involving sustainable science is prerequisite to enhance research targets/achievement and its development in NRE.
- The level of research and development and implementation on NRE is varied influenced by local needs, local resources, stakeholder commitment → require different approaches
- Enhanced awareness programmes is critical to widen the knowledge and building trust (including for young generation)

AP 3-34

LIPI

ACKNOWLEDGEMENTS

- LIPI (RC Biotechnology, RC Chemistry, RC Electrical Power and Mechatronic, RC Electronic and Telecommucation, RC Biomaterial, RC Biology, InaCC)
- SATREPS Integrated Biorefinery; Kobe University
- BPPT, PLN, BSN, Ministry of Energy and Mineral Resources
- CSERM UNAS

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THANK YOU

AP 4-1

12 APRIL 2018

Planning for the future with climate change – we owe this to you

RT HON JACINDA ARDERN

Prime Minister

Tena koutou katoa

I want you for a moment to think about what you will be doing in 2048. Hopefully you will of course have graduated. You may well have a mortgage. A partner. Kids. If my attempts to predict the future as a teenager was anything to go by, you will also travel on a hover board.

But what will our world be like? Our environment, and New Zealand's place in the world?

17 APRIL 2018

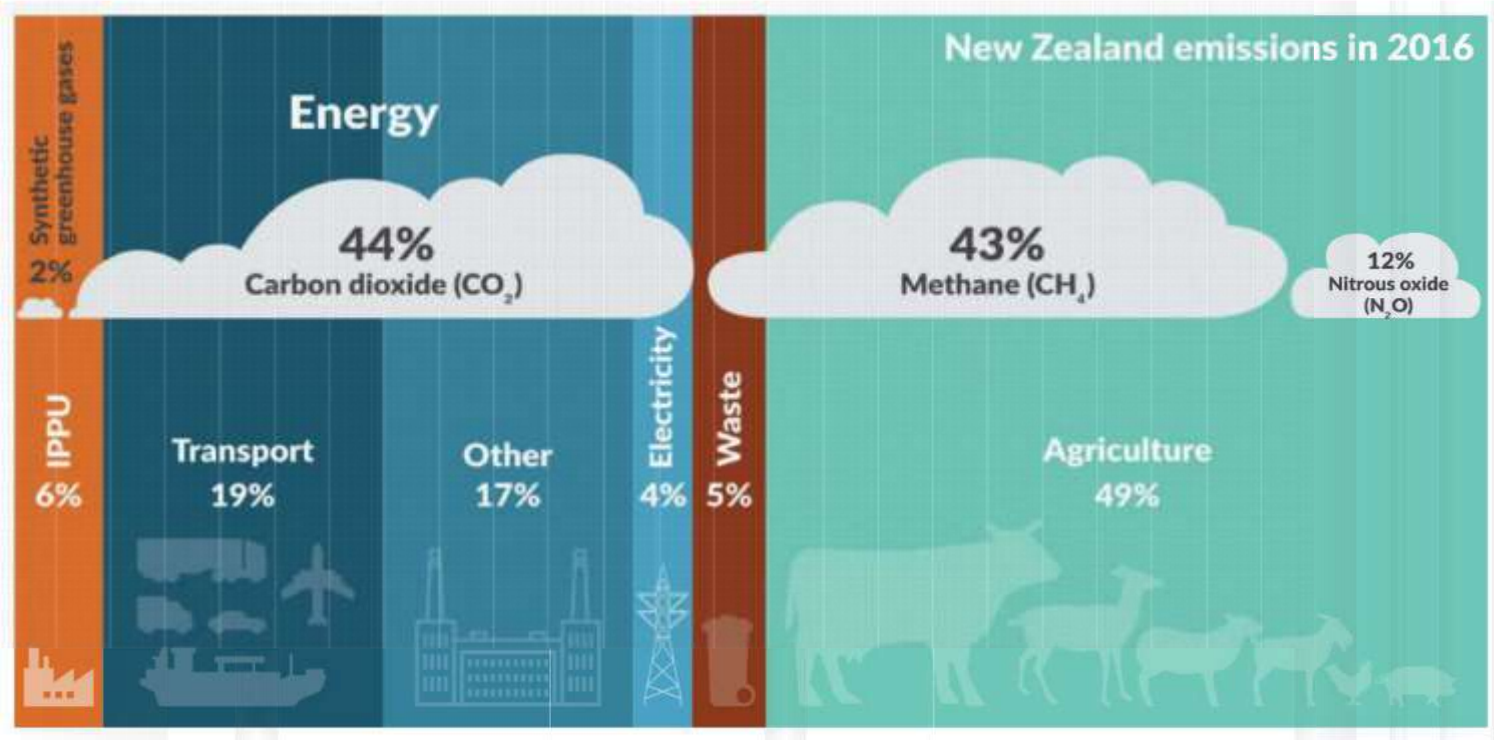
Interim Climate Change Committee announced

HON JAMES SHAW

Climate Change

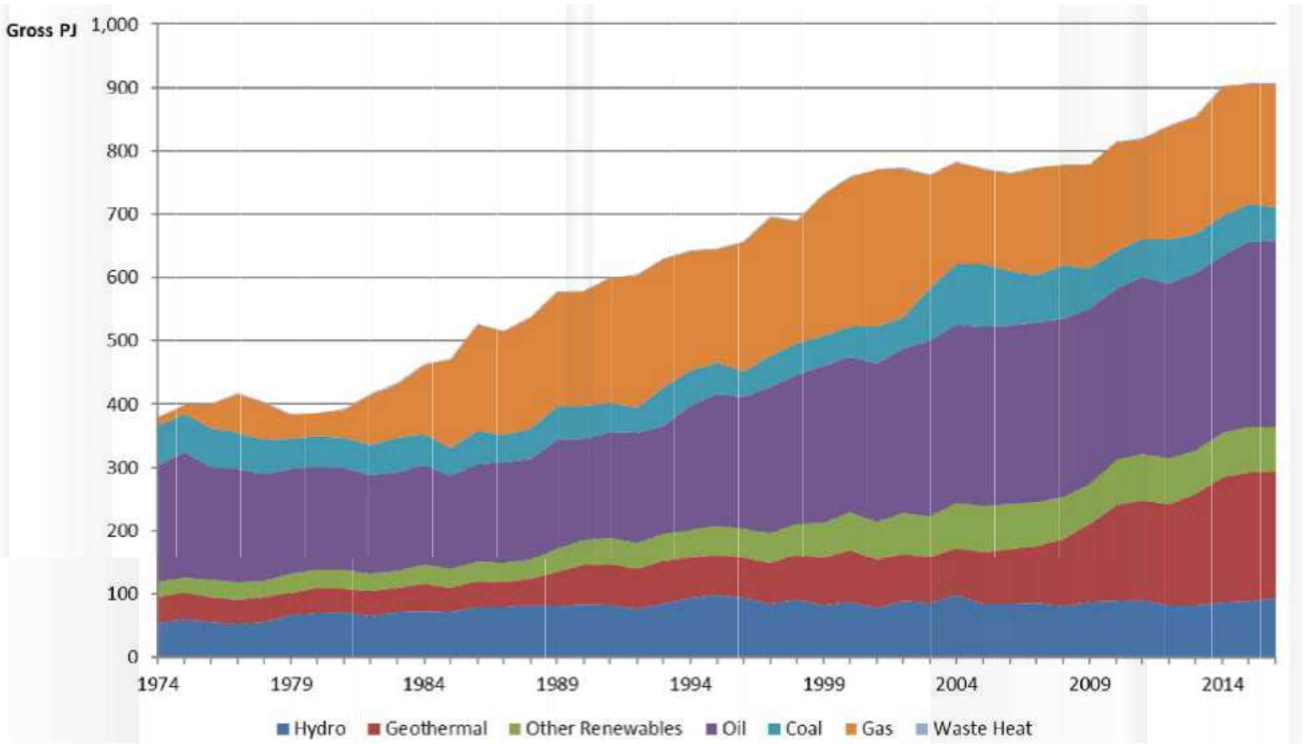
The Minister for Climate Change today announced the membership of the Interim Climate Change Committee, which will begin work on how New Zealand transitions to a net zero emissions economy by 2050.

"We need work to start now on how things like agriculture might enter into the New Zealand Emissions Trading Scheme (NZETS), and we need planning now for the transition to 100 percent renewable electricity generation by 2035," says James Shaw.

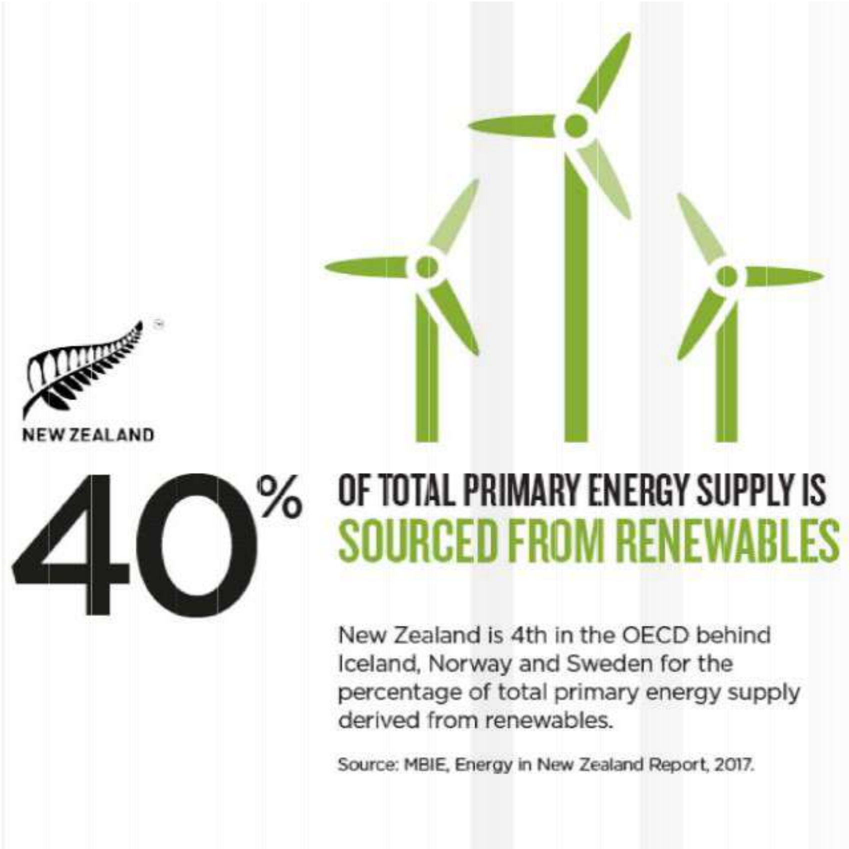


Source: Ministry for the Environment

Our current energy mix: primary energy supply by fuel



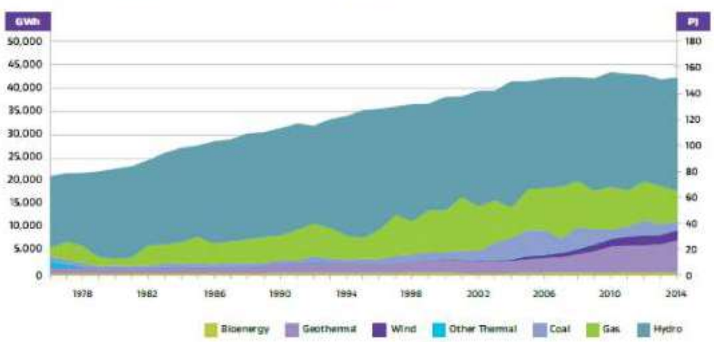
AP 4-3



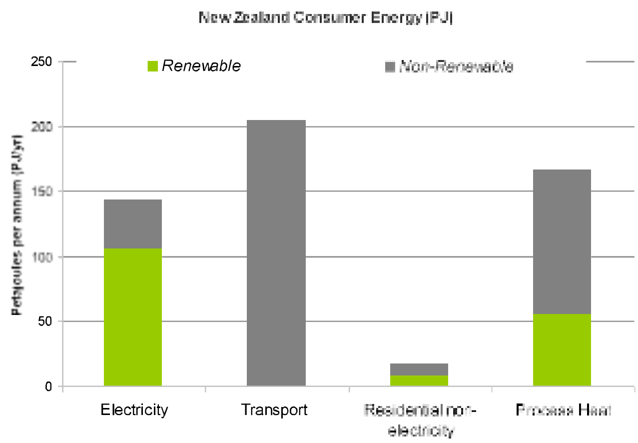
Mostly because of our electricity generation mix...

about 80% renewable

Figure F.3: Annual Electricity Generation by Fuel Type



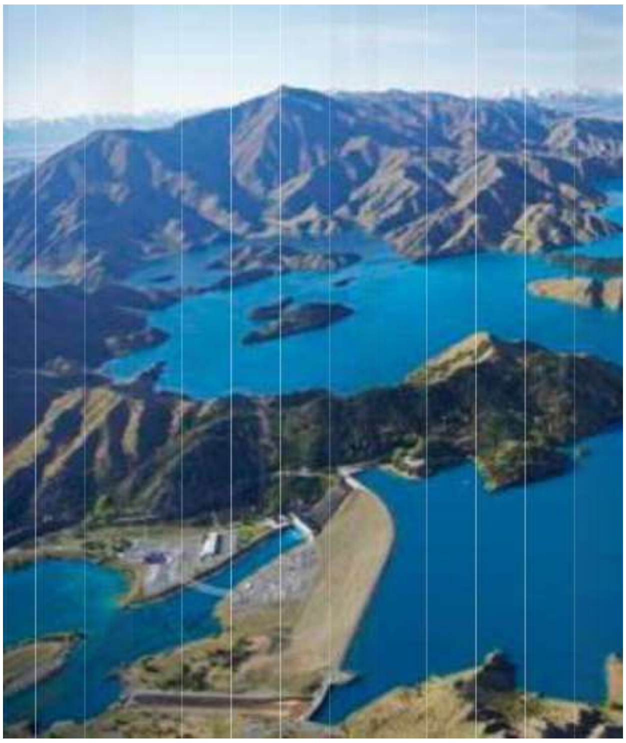
Transport still relies heavily on oil




Te Uku
Te Rapa
Kaimai Scheme
Karapiro
Arapuni
Kawerau
Kawerau
Kinleith
Atiamuri
Ohakuri
Matahina
Aniwhenua
Waipapa
Maraetai
Whakamaru
Poihipi
Mokai
Aratiatia
Wheao and Flaxy
Ohaaki
Ngatamariki
Nga Awa Purua
Rotokawa
Kaitawa
Tuai
Piripaua
Wairakei
Tokaanu
Rangipo
Type of generation
Hydro
Wind
Gas
Cogeneration
Geothermal
Other
(biomass/waste heat)
Coal
Diesel
Ngawha
Glenbrook
Huntly
McKee
Stratford Peaker
Kapuni
Taranaki CC
Whirinaki
Whareroa
Patea
Te Apiti
Te Rere Hau
Tararua
Mangahao
Cobb
West Wind
Mill Creek


Coleridge
Highbank
Tekapo A
Tekapo B
Ohau A
Ohau B
Ohau C
Benmore
Aviemore
Waitaki
Clyde
Roxburgh
Teviot
Mahinerangi
Manapouri
Waipori
Whitehill

Issues with reliance on hydro…



- Usually around 50-60% of total electricity generation, but:
  - small storage capacity (10% of annual demand) and big difference between wet and dry years
  - inverse correlation between main inflows (spring/summer) and main demand (winter)
- Makes system volatile and hard to manage
- Substantial backup required
- 2017 was a particularly dry year (as was 2012), but the system was well managed

AP 4-6

Government role in geothermal development

Ngatamariki Power Station (geothermal)

- No specific policy or fiscal support – do provide research funding and indirectly part of Development Programme (e.g. funding for advising in Eastern Caribbean)
- Renewable energy resources such as geothermal are cost-competitive with fossil fuels – likely to remain so for some time

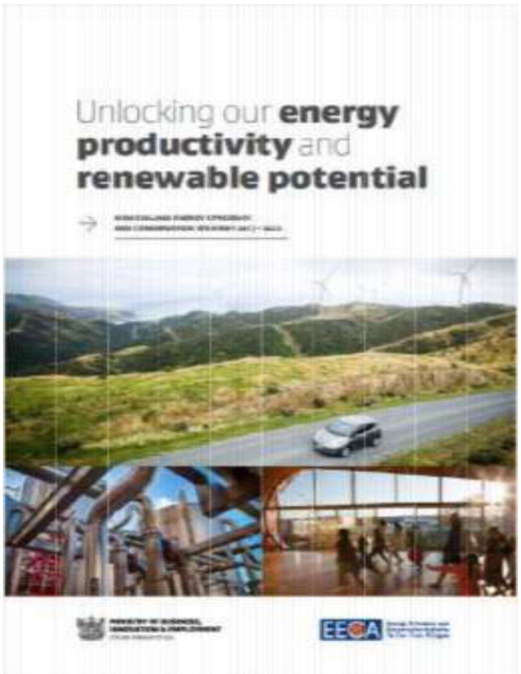
New Zealand Energy Efficiency and Conservation Strategy 2017-2022 (NZEECS)

Goal: for New Zealand to have an energy productive and low emissions economy

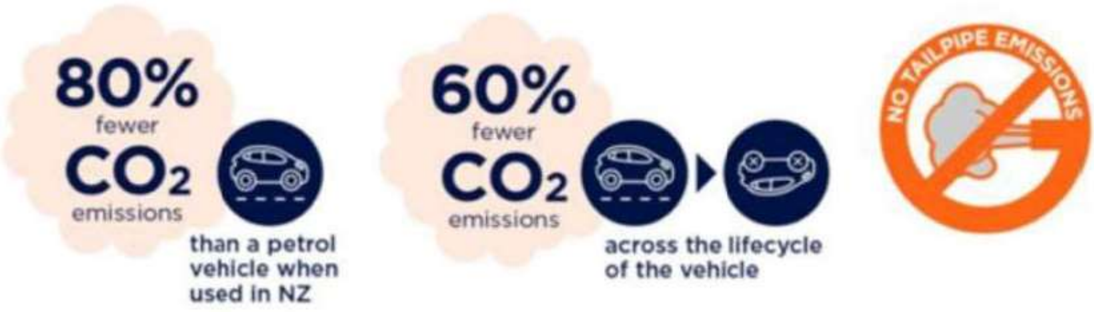
There are three priority areas:

- Renewable and efficient use of process heat
- Efficient and low-emissions transport
- Innovative and efficient use of electricity

www.mbie.govt.nz/info-services/sectors-industries/energy/documents-image-library/NZEECS-2017-2022.pdf



Electric Vehicles – encouraging uptake

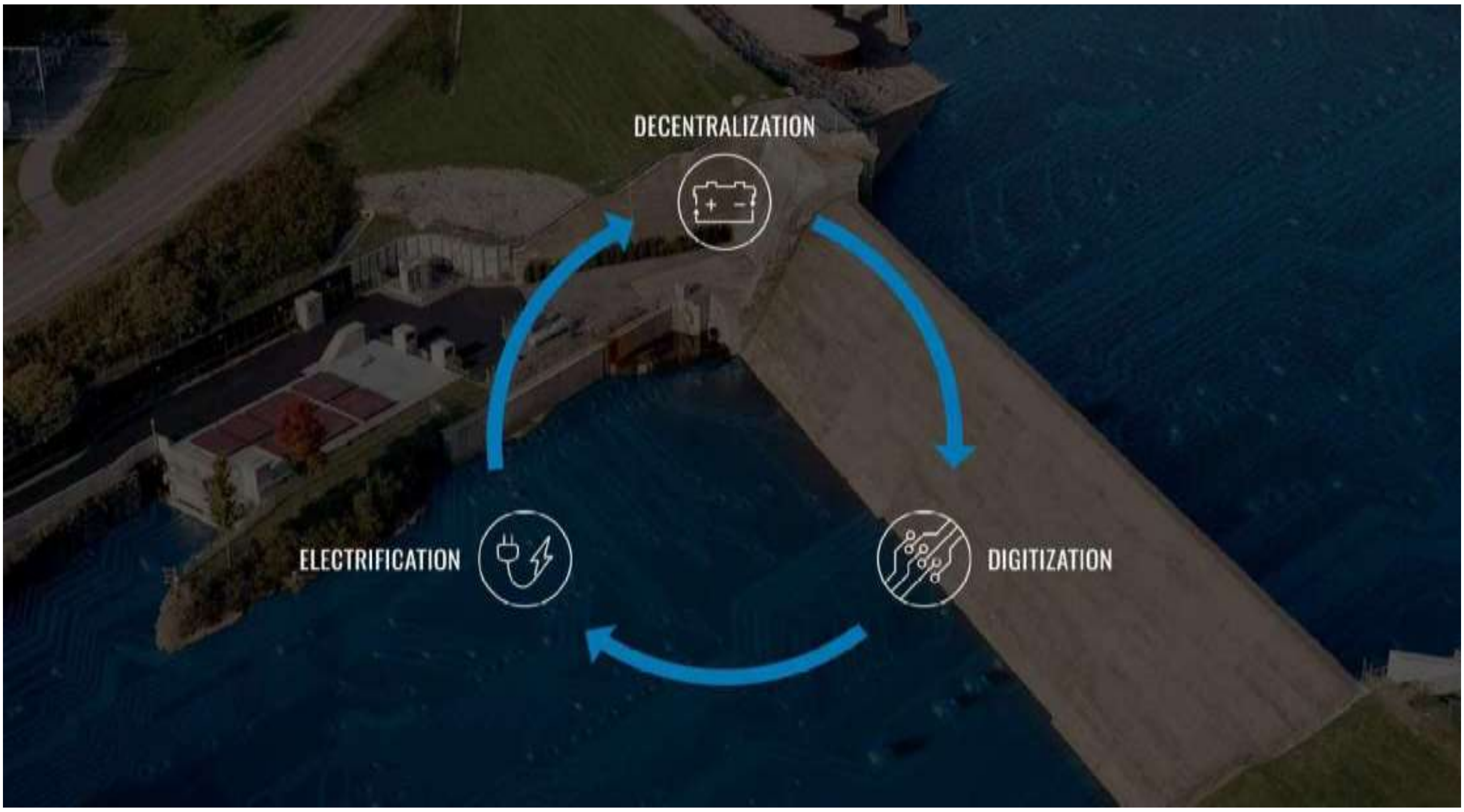


www.iccc.mfe.govt.nz

Photos and info graphics sourced from New Zealand Story Group, www.nzstory.govt.nz

AP 5-1


UTILITY NO MORE? – THE IOT-5G SMART INFRASTRUCTURE FOR THE DISRUPTION IN ENERGY SECTOR
Smart Power Management for Self-Sustained Green Community in APEC Region
28-30 August 2018
Bangkok, Thailand
Jesada Sivaraks


DECENTRALIZATION
ELECTRIFICATION
DIGITIZATION

AP 5-2

Major Digital Energy Trends

The power grid will become increasing diverse
Affordable, Reliable, more sustainable

Solar PV fastest growing gen Technology
...moving towards a combination of centralized+distributed multi-directional system

Battery storage becoming more economical
Paradigm shift on generation dispatch and decarbonization

Micro grids becoming more prevalent in emerging and mature markets
... providing affordable and resilient access to power

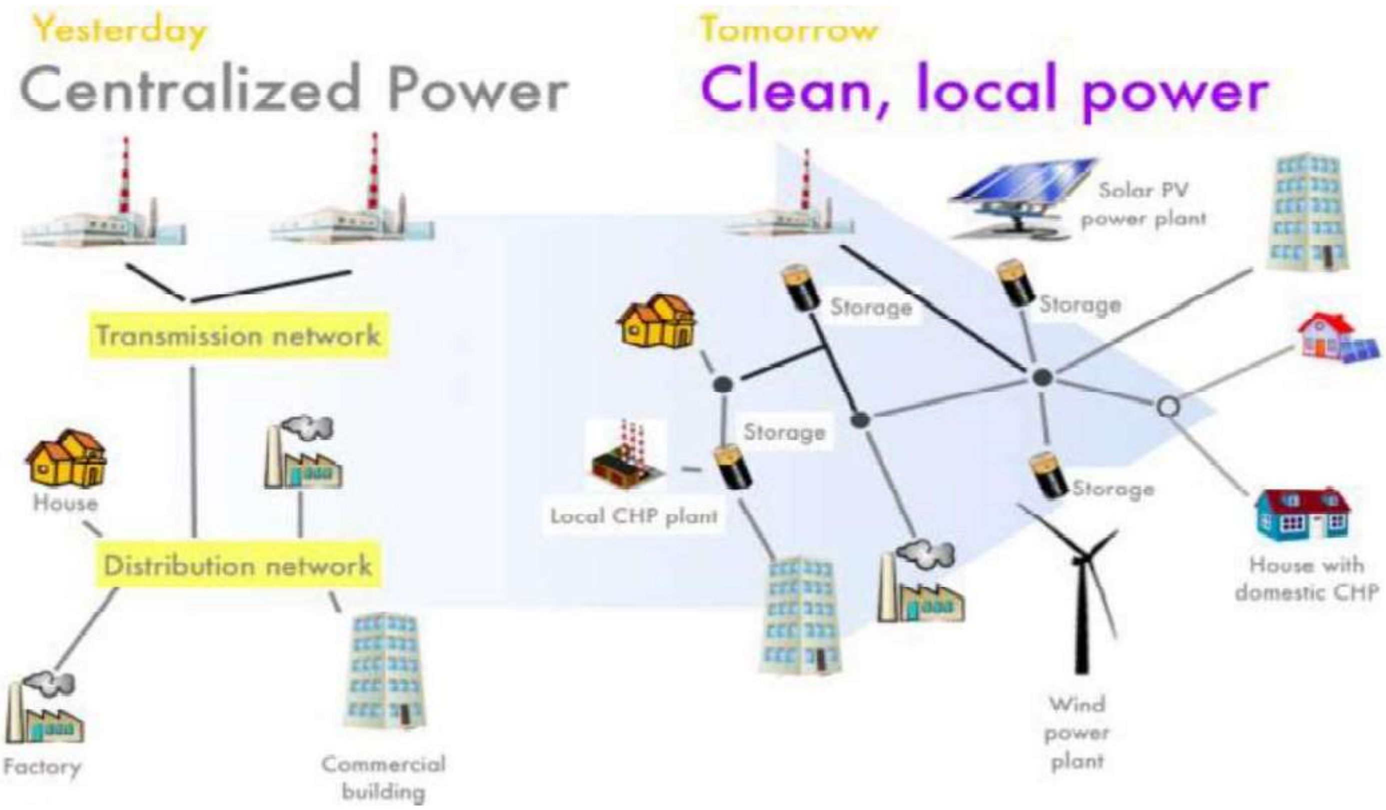
Convergence of energy and transportation sectors
...creating new business models & transforming the roes of the utility & consumer

AP 5-3

PÖYRY POINT OF VIEW BLOG / 23 Apr 2015

Utility no more - how must energy companies adapt to survive?

Under the impulse of change in renewable generation, European utilities



Energy & utilities pain points

where IoT-5G could make a difference

1. Integrating new technologies within the current infrastructure
2. Reducing energy consumption
3. Handling large volumes of data
4. Automation across distribution, operations, energy efficiency and other areas

Source: Ericsson - The industry impact of 5G – insights from 10 sectors into the role of 5G.

Energy & utilities sector, survey highlights

3 of 4 pain points in network	#1 use case attract 37%	52% in 5G trials by 2019	~50% in production by 2020
	Connect and monitor remote sites.	Measured across the Top-4 use cases to be trialed in 2018/2019.	

Energy & utilities paint points, where 5G can make a difference

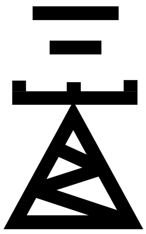
Integrating new technologies within the current infrastructure

Reducing energy consumption

Handling large volumes of data

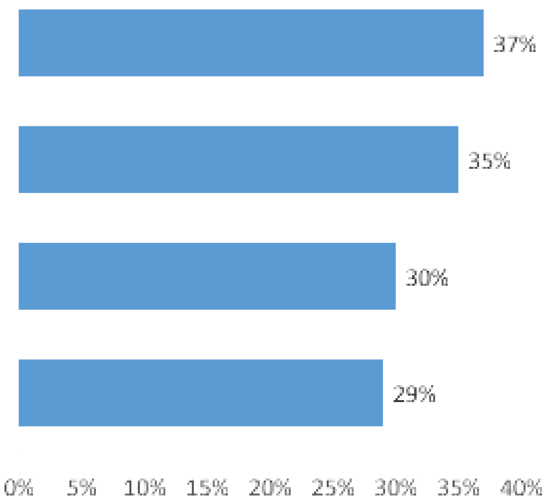
Automation across distribution, operations, energy efficiency and other areas

3 of 4
pain points require innovative network solutions for digitalization of grids



Source: Ericsson - The Industry Impact of 5G – insights from 10 sectors into the role of 5G.

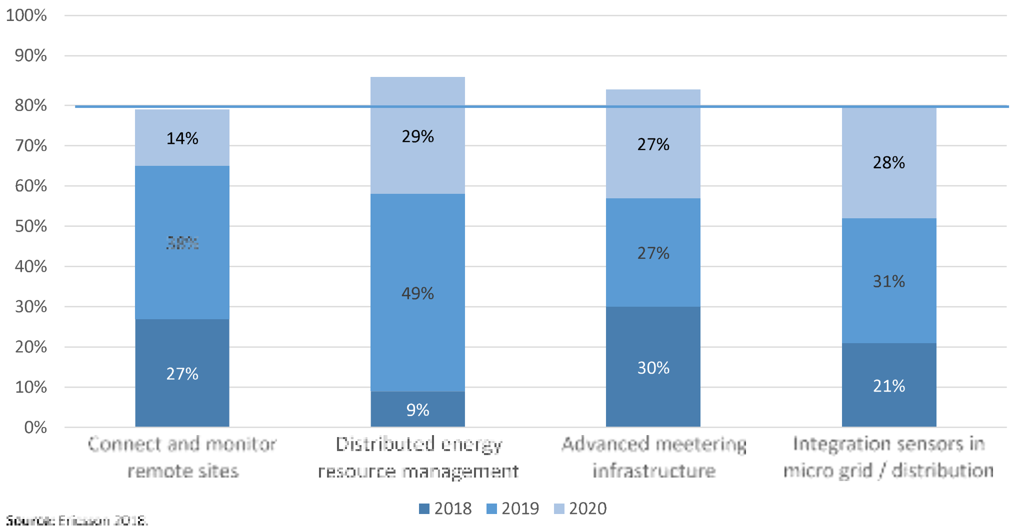
IoT-5G for energy & utilities sector, top-4 use cases in order of importance



Source: Ericsson - The Industry Impact of 5G – insights from 10 sectors into the role of 5G.

37%
Suggest connecting and monitoring remote sites as the most important use case

5G for energy & utilities sector, expected timing for use case in trials

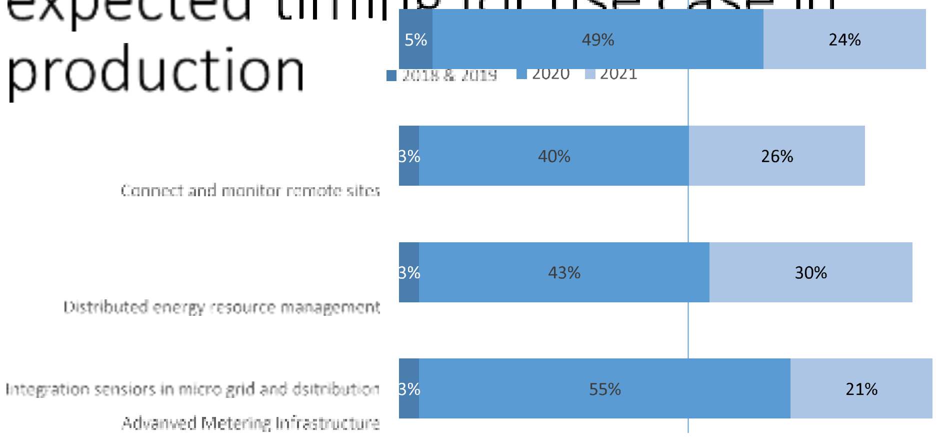


Source: Ericsson 2018.

80%

Expect to do trials across all 4 use cases by 2020

IoT-5G for energy & utilities sector, expected timing for use case in production



~50%

of all top-4 use cases expected to go in production in 2020 alone.

AP 5-7

Energy and utilities – industry opportunity

Manufacturing | Automotive | Public transport | **Energy & utilities** | Public safety | Financial services | Healthcare | Media & entertainment | Retail | Agriculture | Logistics

2026, USDbn

Key industry trends

- **Oil supply imbalance** and instability, fracking advancements and carbon constraints
- **Structural shifts** with increasingly retiring assets
- New **decentralized** business models
- **Electrification** and renewable energy generation

Use case categories

	Digitalization	5G enabled
Smart grid	269	188
Smart energy management	387	53
Other	57	9
Total:	713	250

5G Operator addressable

	Current service revenues	5G operator addressable
Network developer	1,736	42
Service enabler	1,736	80
Service creator	1,736	101

+6%

Energy & Utilities – use case deep dive

Manufacturing | Automotive | Public transport | **Energy & utilities** | Public safety | Financial services | Healthcare | Media & entertainment | Retail | Agriculture | Logistics

Key challenges/trends

- Increased share of renewables means **more producing units over a larger area** that often is more remote
- Assets are often **located in remote locations**
- **Fines from authorities** for power outages
- Power companies increasingly monitoring **transmission and distribution grid**

Use case – Drone field service and maintenance

The use case includes drones being **controlled remotely to monitor and/or maintain transmission or production assets**

30%

Cost reduction potential compared to regular monitoring

Reduced costs

Role and key dimensions of 5G

- Providing connectivity to the drone enabling **real time transfer of information** (video, sensor data, etc.) back to the control center
- Enabling **long range and flexible remote control of drones** (that today often are being controlled over local wifi networks)

Availability | Position accuracy | Peak data rate

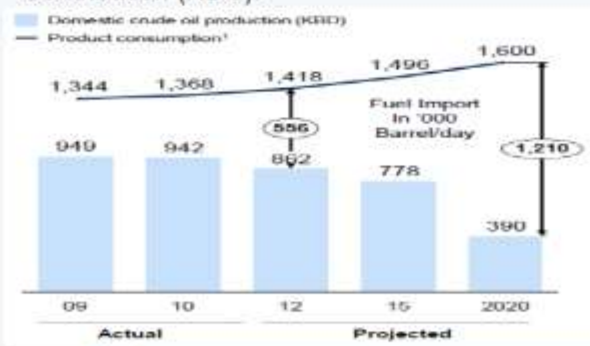
Biofuel for Diesel Fuel Substitution and Energy Resilience

Eniya L. Dewi, SD Sumbogo M, Maharani DS

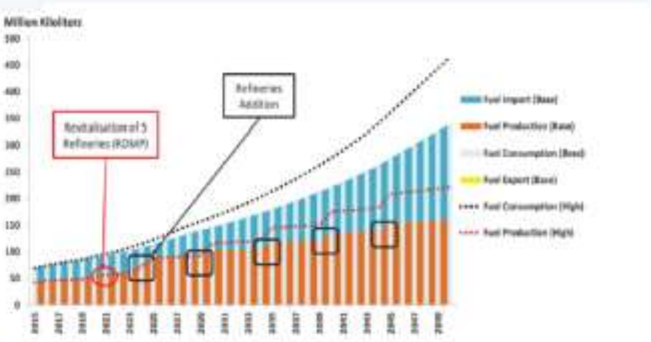
INTRODUCTION

BPPT

- The source of fossil energy is limited and one day it will run out so that the transition to renewable energy is not only an option but a necessity. Indonesia has become *net oil importer* since 2004
- Fuel consumption increase 4-5% per year → Fuel import at 2020 is projected at 1 million barrel per day.
- Revitalisation and addition of refineries are required, however it is COSTLY.
- BPPT-OEI 2017 takes the theme "Clean Energy Technology Development Initiative" which is in line with the "Paris Agreement", to mitigate Greenhouse Gas Emissions as stated in the Determined Contribution (NDC).



Source : PT Pertamina (Persero)



Source: Outlook Energi BPPT 2017

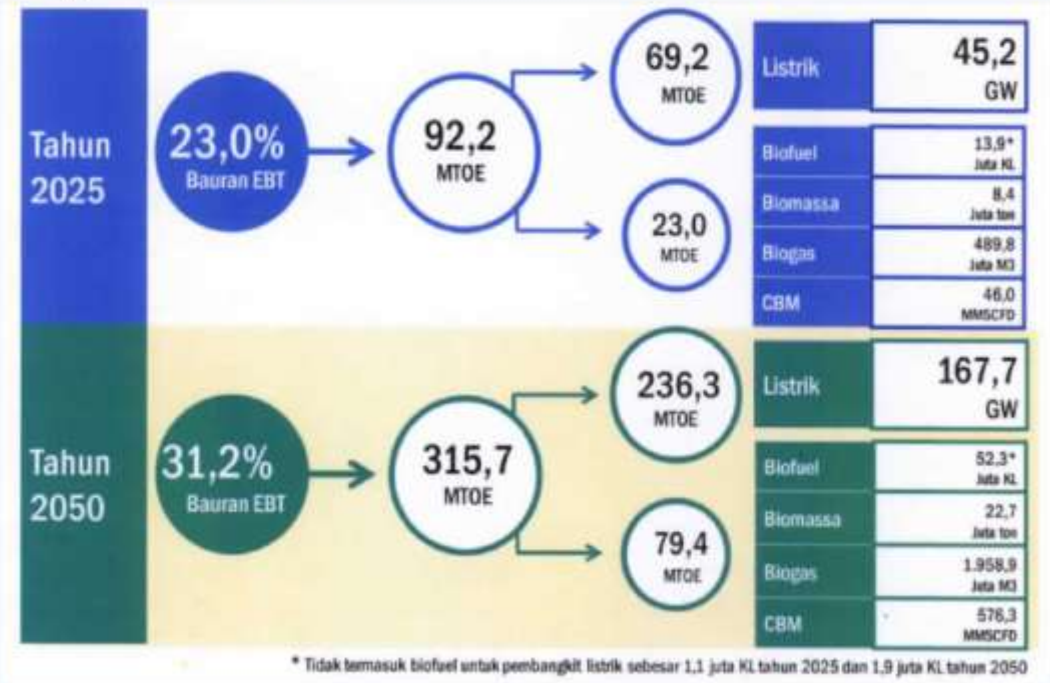
Fuel alternative ? → BIOFUEL

AP 6-2

President Decree (Perpres) No.22/2017 about
" Energy General Plan"

BPPT

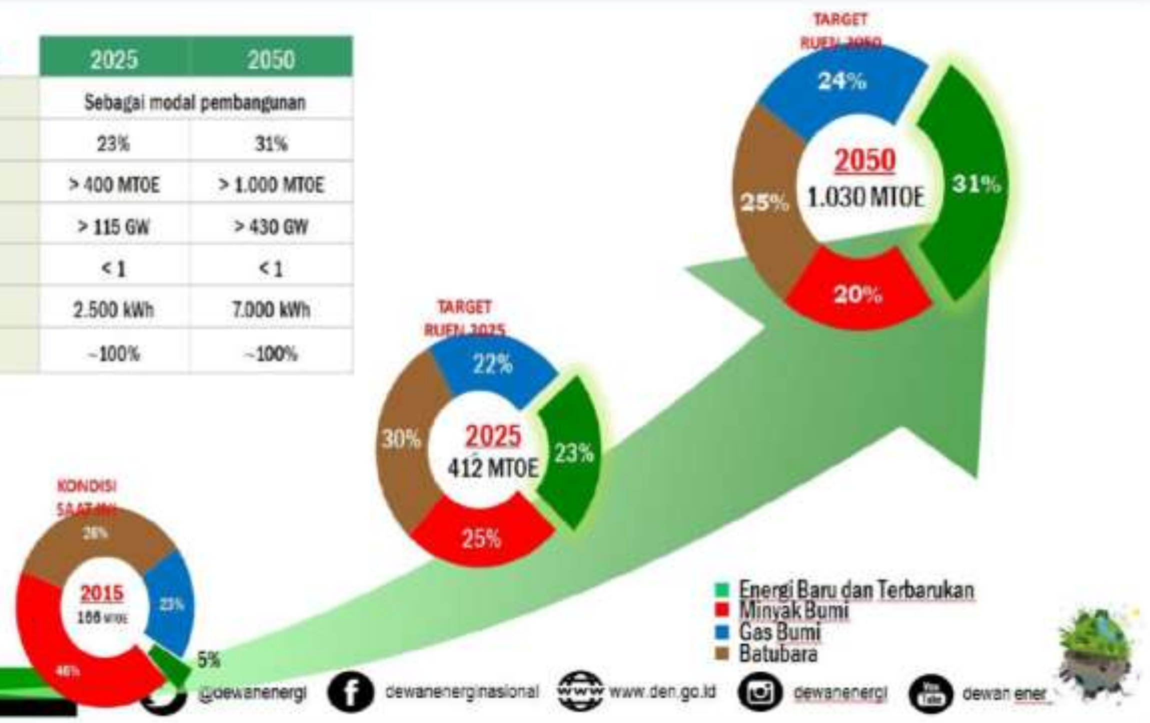
Target for 2025 &2050



President Decree (Perpres) No.22/2017 about
"Rencana Umum Energi "

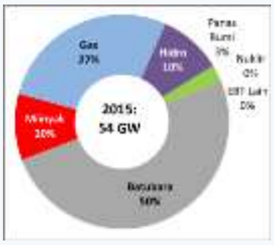
BPPT

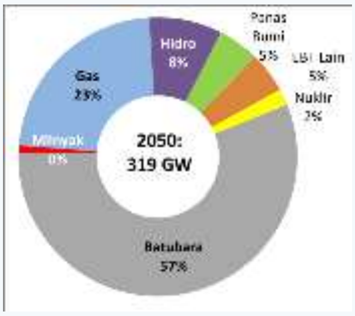
TARGET KEN	2025	2050
Peran energi	Sebagai modal pembangunan	
Bauran EBT	23%	31%
Penyediaan energi	> 400 MTOE	> 1.000 MTOE
Pembangkit Listrik	> 115 GW	> 430 GW
Elastisitas energi	< 1	< 1
Listrik /kapita/thn	2.500 kWh	7.000 kWh
Rasio elektrifikasi	~100%	~100%



AP 6-3

NUCLEAR POWER PLANT (NPP)





- ➢ Energy mix for power plants is still based on coal use, in 2050 the capacity reached 329 GW with the coal power plant share reaching 57% (183 GW).
- ➢ Renewable energy generators are only PLTP and hydropower plants that are prospective for large scale, but have maximum capacity, namely PLTP 29.5 GW and PLTA 26.3 GW (PLN screening results).
- ➢ Prospective long-term large-scale power plant development is nuclear power plants.
- ➢ It takes 7-10 years to build a nuclear power plant

Badan Pengkajian dan Penerapan Teknologi

Status and Planing Geothermal Resources

- Total Potential Geothermal Resources > 28 GW ; for small geothermal power plant development about 900 MW
- The installed capacity of geothermal power plants in Indonesia is 1 808.5 MW, and all plants adopting foreign technology.

Indonesia Geography & Wind

GEOGRAPHY

Equatorial islands between: (latitude) 6° north – 11° south, and (longitude) 95° east – 141°45' east

17,504 (island); 1,922,570 km² (land); 3,257,483 km² (sea)

99,093 km² (coastal line) → many sites with wind power potential

8

Solar PV Potential in Indonesia

- Located in the equator, most geographical area of Indonesia is exposed to maximum sun intensity year-round.
- Average daily insolation in the range between 4.5 kWh/m2 and 5.1 kWh/m2, - good solar potential.
- Present Installed capacity only 27.2 MW, but PLN, plans to scale up Indonesia's solar to 620 MW by 2020

PV Rooftop

- Net Metering has been mandated by PLN in Regulation 0733.K/DIR/2013 (December 2013), which obliges PLN to 'credit' energy produced by solar to a customer's account.
- One million home PV roof top by 2025
- The Government will construct 2941 kWp PV Rooftop for 30 government buildings and 4 airports

BIOENERGI

- BIOFUEL as alternative of Fuel from Petroleum
  - Biodiesel (alternative for diesel fuel)
  - Bioethanol (alternative for gasoline)
  - Bioavtur (alternative for aviation fuel/avtur)
  - Biokerosene (alternative kerosene)
- Alternative of Natural Gas
  - Biogas

Badan Pengkajian dan Penerapan Teknologi

BIOMASS RESOURCES

- Biomass as resources of biofuel and power generation.

Badan Pengkajian dan Penerapan Teknologi

RESOURCES TO PRODUCE BIOFUEL

BPPT

- Resources for Biofuel Generation 1 in the form of **oil/glycerides** → palm oil, coconut oil, jatropha oil, pongam oil, etc.
- Resources for Biofuel Generation 2 → Woody Biomass.
- Resources for Biofuel Generation 3 → Algae

(foto dari berbagai sumber)

Badan Pengkajian dan Penerapan Teknologi

12

BIOMASS IN INDONESIA

BPPT

PALM TREE

SOURCE OF BIOMASS :

OIL PALM PLANTATION

10.5 million ha

FRESH FRUIT BUNCH

CPO

EMPTY FRUIT BUNCH

PALM LEAVES

PALM FROND

PALM WOOD/LOG

Badan Pengkajian dan Penerapan Teknologi

SOURCE AND TYPES OF OIL PALM RESIDUES

Source of Residue	Type of Residue	Quantity (ton/ha)
Fresh fruit bunch (from palm oil mill)	Palm Kernel Shell	1.10
	Empty Fruit Bunch	4.42
	Mesocarp Fiber	2.71
Oil palm tree at felling (from plantation)	Trunk*	41.07
	Frond	16.00
	Leaf	7.69
	Other	19.44
Oil palm tree at pruning (from plantation)	Frond**	10.40

* Palm trunks felled once every 25-30 years

** Consists of the leaf and measured in dry weight

Source : Abnisa et al., 2013

Indonesia :
10.5 million ha of palm plantation
→30 ton CPO
→109 million tons of palm frond.
→46 million tons of empty fruit bunch (EFB).

BIODIESEL

MINIMUM MANDATORY OF BIODIESEL IMPLEMENTATION (B100)

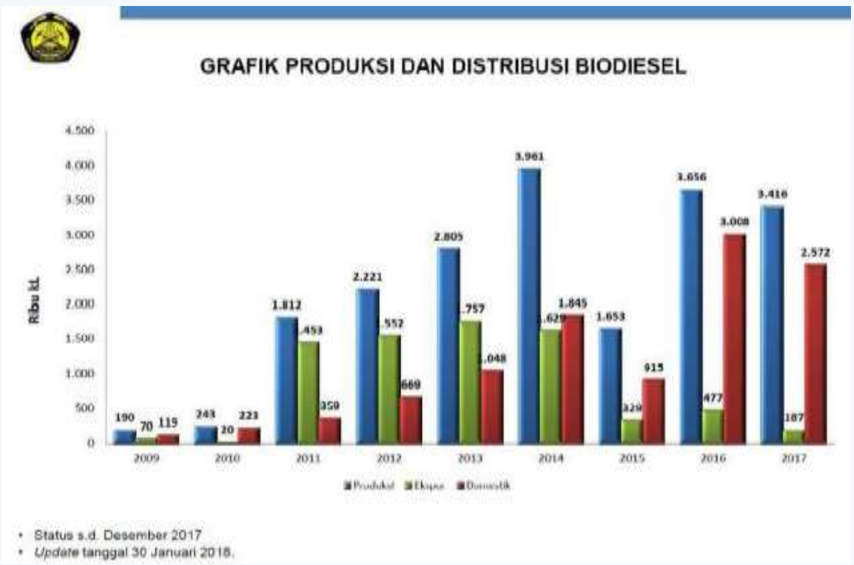
According to Decree of Ministry of Energy and Natural Resources No. 12/2015 on Supply, Utilization, and Trading System of Biofuel as Other Fuel

Sector	Ap ril 2015	January 2016	January 2020	January 2025	Note
Household					Not regulated
Micro Economy, Fishery, Agriculture, Transportation, and Public Service Obligation (PSO)	15%	20%	30%	30%	To total demand
Transportation non-PSO					
Industry and Commercial	15%	20%	30%	30%	
	15%	20%	30%	30%	To total demand
Power Generation	15%	20%	30%	30%	To total demand

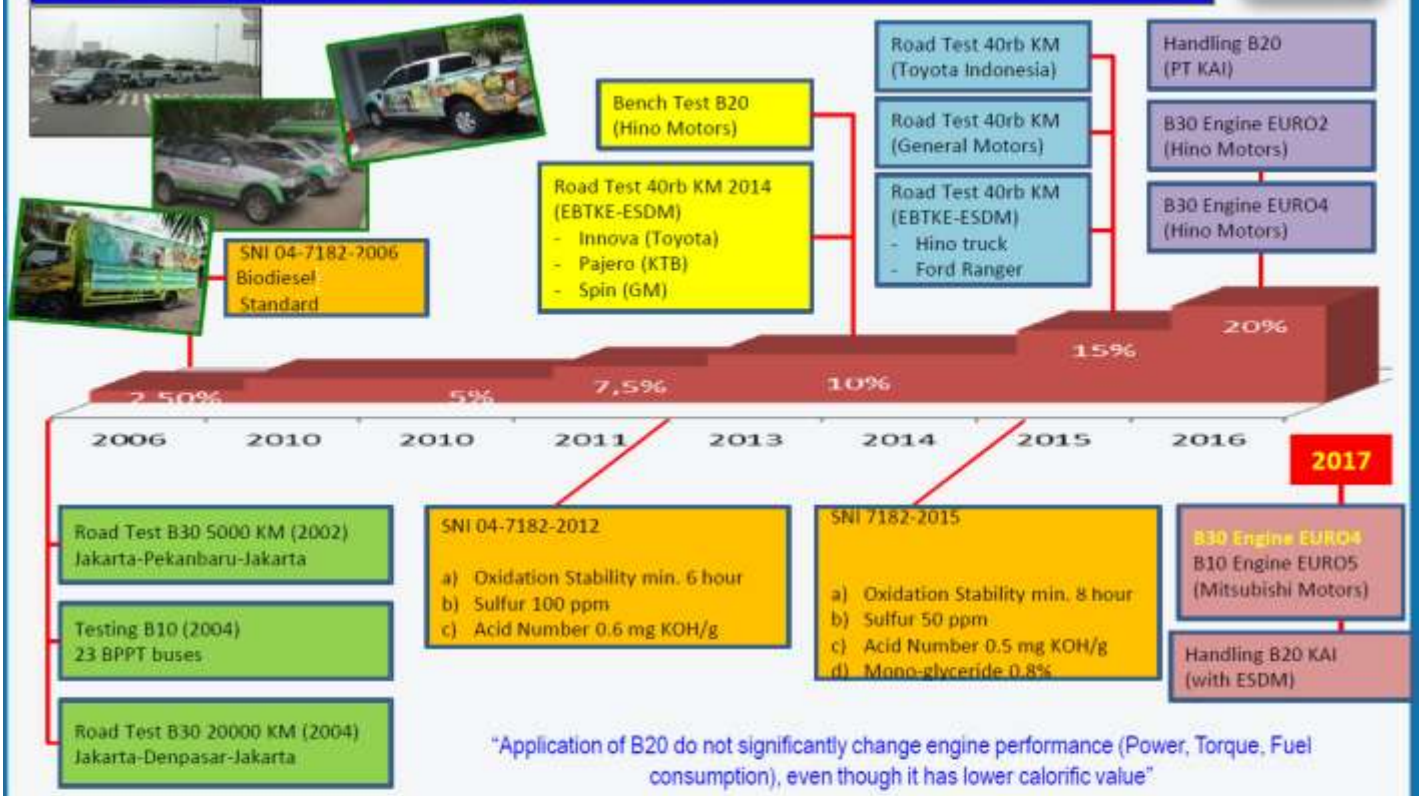
→ Currently Indonesia has been implementing B20, the most progressive in the world

IMPLEMENTATION OF BIODIESEL

- Currently, implementation of B20 only at PSO (Public Service Obligation)
- From total diesel fuel consumption around 28.7 million kL, implentation B20 should require 5.7 million kL of Biodiesel. However, domestic use was only 2.5 million kL.
- *If the implementation of B20 runs well then there is potential savings from decreasing crude oil imports:* Rp 22.8 trillion
- *If the implementation of B30 in 2020 runs well then there is potential savings from decreasing crude oil imports:* Rp 62 trillion



Role of BPPT on the Implementation of Mandatory of B20



Badan Pengkajian dan Penerapan Teknologi

Challenges in Implementation of Biodiesel

- **Biodiesel prices**
  - When biodiesel price is higher than diesel fuel, the different price between Biodiesel Price and Solar Price is 'paid' by BPDP-KS. The amount of biodiesel distributed is affected by the fund collected by BPDP-KS.
- **Biodiesel Quality needs to be improved**
  - Related to moisture, sediment, and mono-glycerides levels in biodiesel
  - Other impurities should be noted (glycerides, glycerol, residual catalysts)
  - SNI 7182-2015 needs to be improved
- **Quality of B20**
  - Currently there are no specific standards on the use of biodiesel fuel mixtures
  - Problems in Handling and Storage
  - Technical handling and storage instructions are being compiled
  - Certification is required for manufacturers and sellers of biodiesel
  - Wide range socialization about biodiesel knowledge and implementation in the industry is required.

Badan Pengkajian dan Penerapan Teknologi

STRATEGY AND INOVATION IN BIODIESEL

Preparation for Implementation of B30 at 2020 is Required

- Improvement in Biodiesel quality to produce B30 is required
  - ➢ Research to improve SNI biodiesel.
  - ➢ Compromise fuel specification between engine manufacturer and biodiesel producer is required.
- A comprehensive B30 road test supported by all stakeholder is required (ESDM, Aprobi, Pertamina, Gaikindo, BPPT, ITB, etc.)
  - – Testing method approval.
  - – Testing to assess the effect of quality to the maintenance, emission, and engine performance.

An Insight into Valorization of Recycling Waste into Biofuels

By: Dr A.E. Atabani Energy Division Department of Mechanical Engineering Erciyes University Turkey

fppt.com

Outline

- Introduction
- Types of waste
- Importance of recycling
- Types of biofuels
- Factors to be considered when recycling
- Selected waste to biofuels
- Biorefinery
- Conclusion

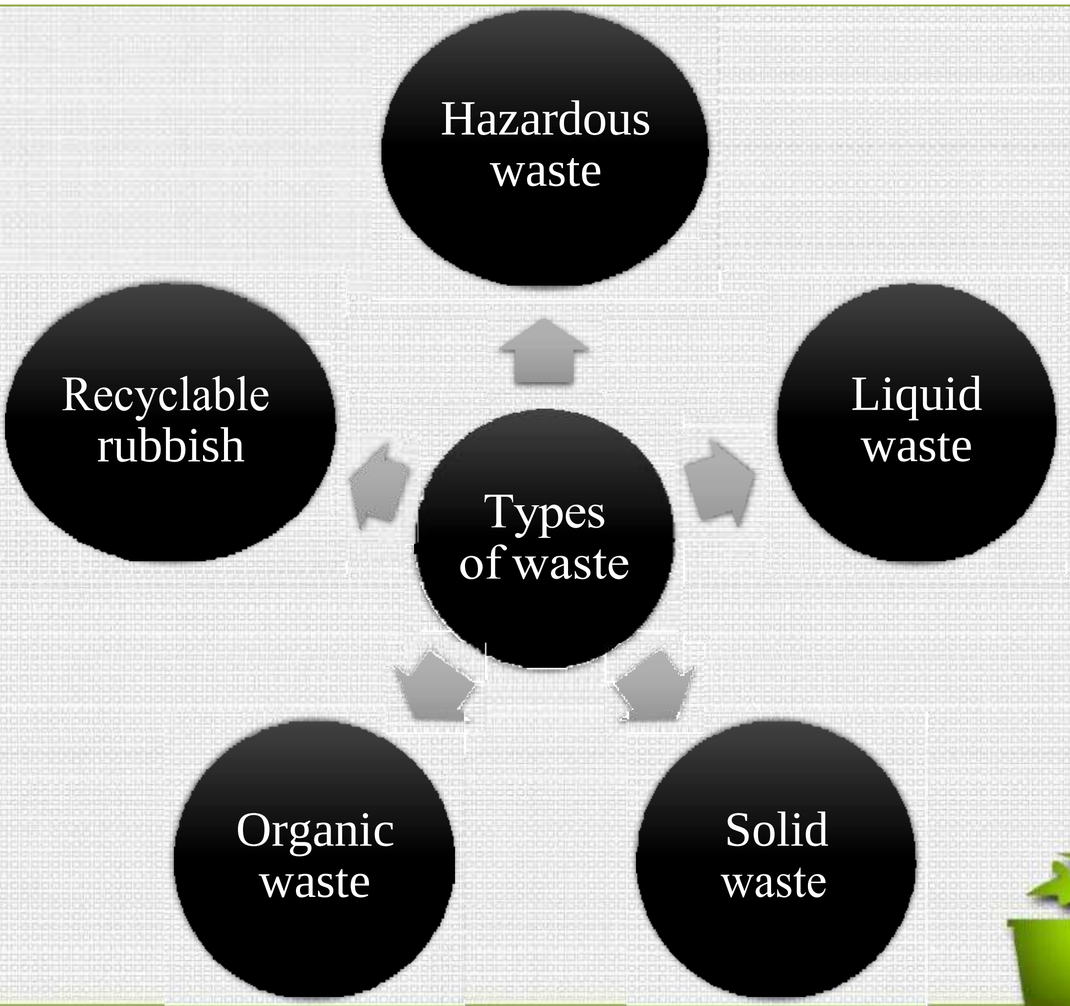
fppt.com

World is producing huge amount of waste in a daily basis.

Dumping these wastes into landfills is very harmful if not disposed or recycled in an appropriate manner as they are toxic and may cause serious environmental problems

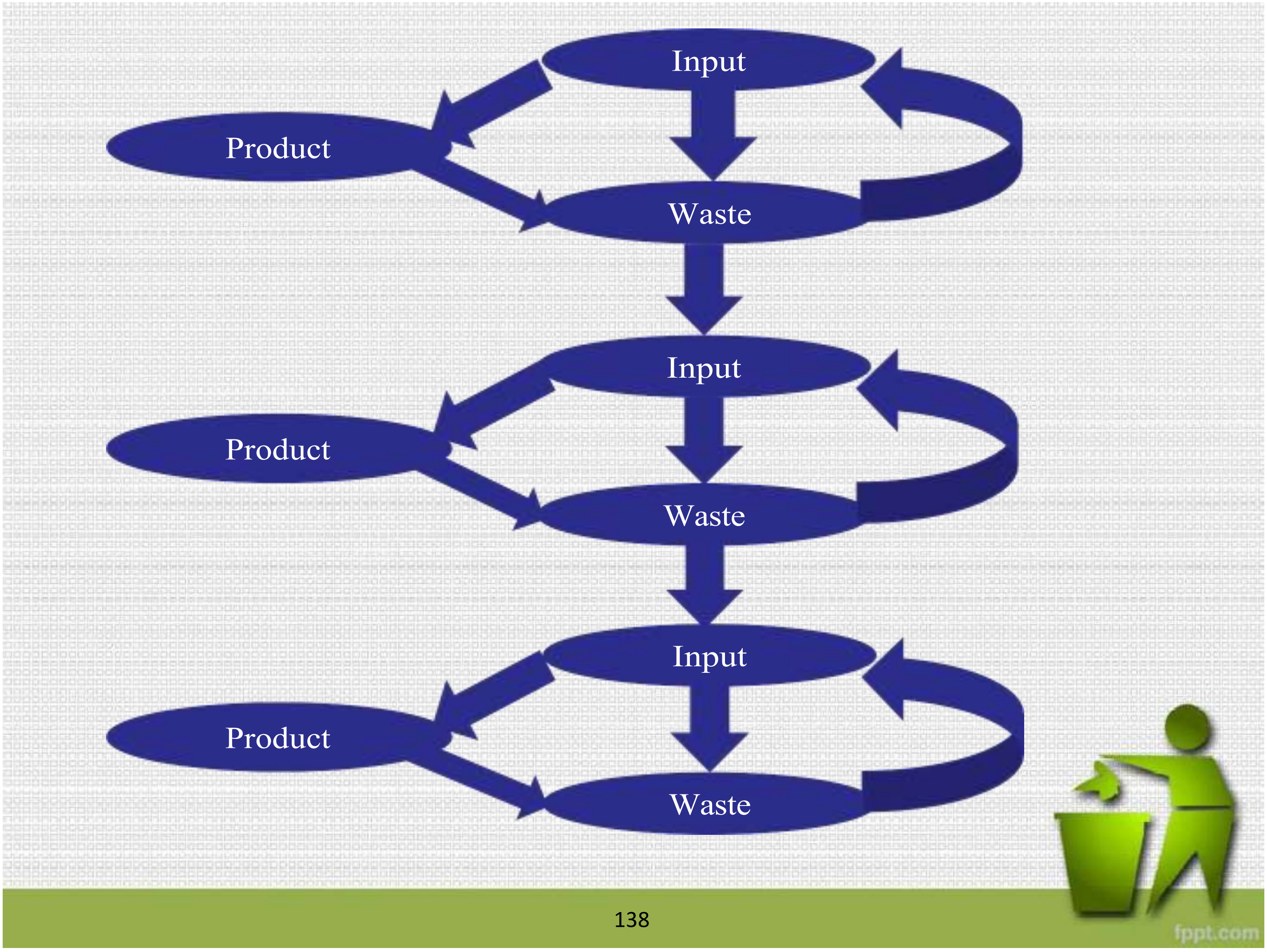
This is because of existence of some organic compounds that demand excessive amounts of oxygen to degrade.

- Moreover, direct disposal of waste without assessing its recycling potential may contribute towards huge financial cost on tax payers who run and maintain landfills.



- Recycling of waste to energy is one effective way to solve the problem of waste.
- Waste recycling offers many environmental, social and financial benefits.
- It also contributes to producing biofuels without the need to growing plants (edible or non-edible) or converting food (edible oils) to fuel.


METAL
PAPER
GLASS
PLASTIC
ORGANIC
BATTERIES
LIGHT BULBS
E-WASTE


Input
Product
Waste
Input
Product
Waste
Input
Product
Waste
fppt.com

- Restaurants and beverage shops generate huge amount of organic waste such as waste cooking oil (WCO), spent coffee grounds (SCG), spent tea waste (STW), food waste (FW) etc.
- Their direct disposal to landfill can emit methane, carbon dioxide and greenhouse gases that contribute to global warming.
- Thus, creating proper waste management plans that are consistent with existing regulation is needed.

Types of biofuels

- Liquid biofuels
- Biogas
- Solid biomass

Factors to be considered when recycling

Waste characteristics

•Before deciding the pathway of recycling organic waste, several characteristics have to be identified as follow:

1- Lipids content → acid value → biodiesel production

2- Elemental compositions → C, H, N, O, C/N

3- Proximate analyses → Volatile matter (VM), moisture, Ash, Fixed carbon (FC)

4- Higher heating value (HHV)

5- Scanning electron microscopy SEM (SEM)

6- Thermogravemetric analyses (TGA)

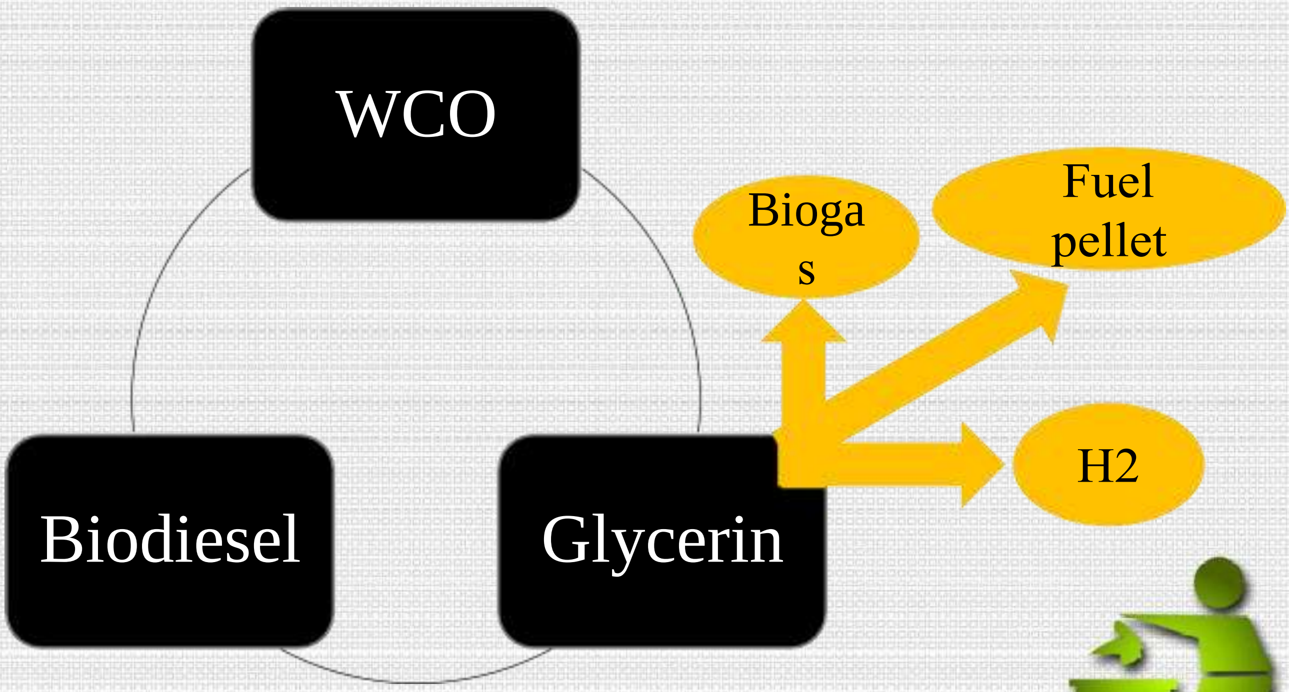
Possible biofuels production

- Biogas (Anaerobic digestion)
- Biodiesel (Transesterification)
- Bioethanol (Fermentation)
- Biohydrogen (Dark fermentation, Biophotolysis, Photo fermentation)
- Fuel pellets (Pelleting)
- Hydrocarbons (Hydrogenation)

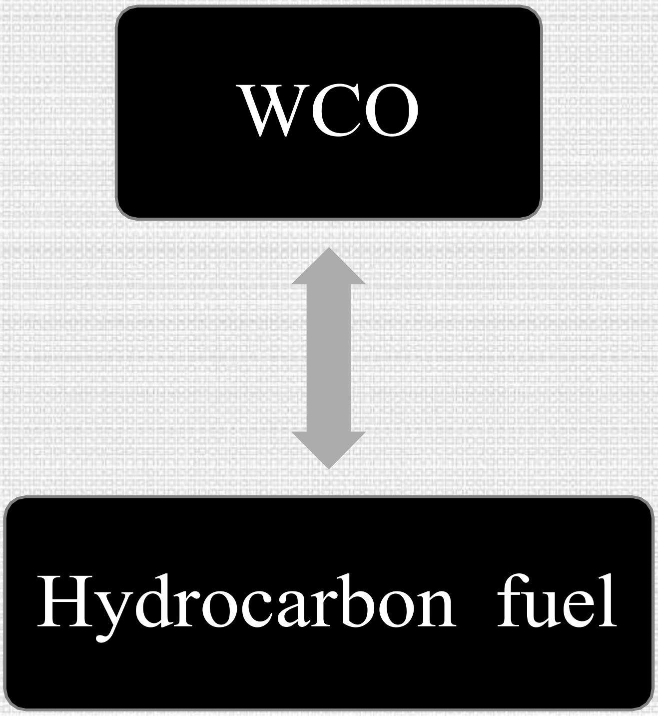
Waste Cooking Oil (WCO)

- ✓ Official statistics on the production and consumption of fats and vegetable oils are available.
- ✓ Nevertheless, actual statistics on the actual level of collection of WCO oil is far more erratic and inhomogeneous.
- ✓ This is due to the absence of appropriate collection management system in many economies.
- ✓ Direct disposal of WCO to the environment may cause serious problem such as polluting rivers, drainage choking, propagations of unpleasant smell and bugs.

Recycling of Waste Cooking Oil (WCO)

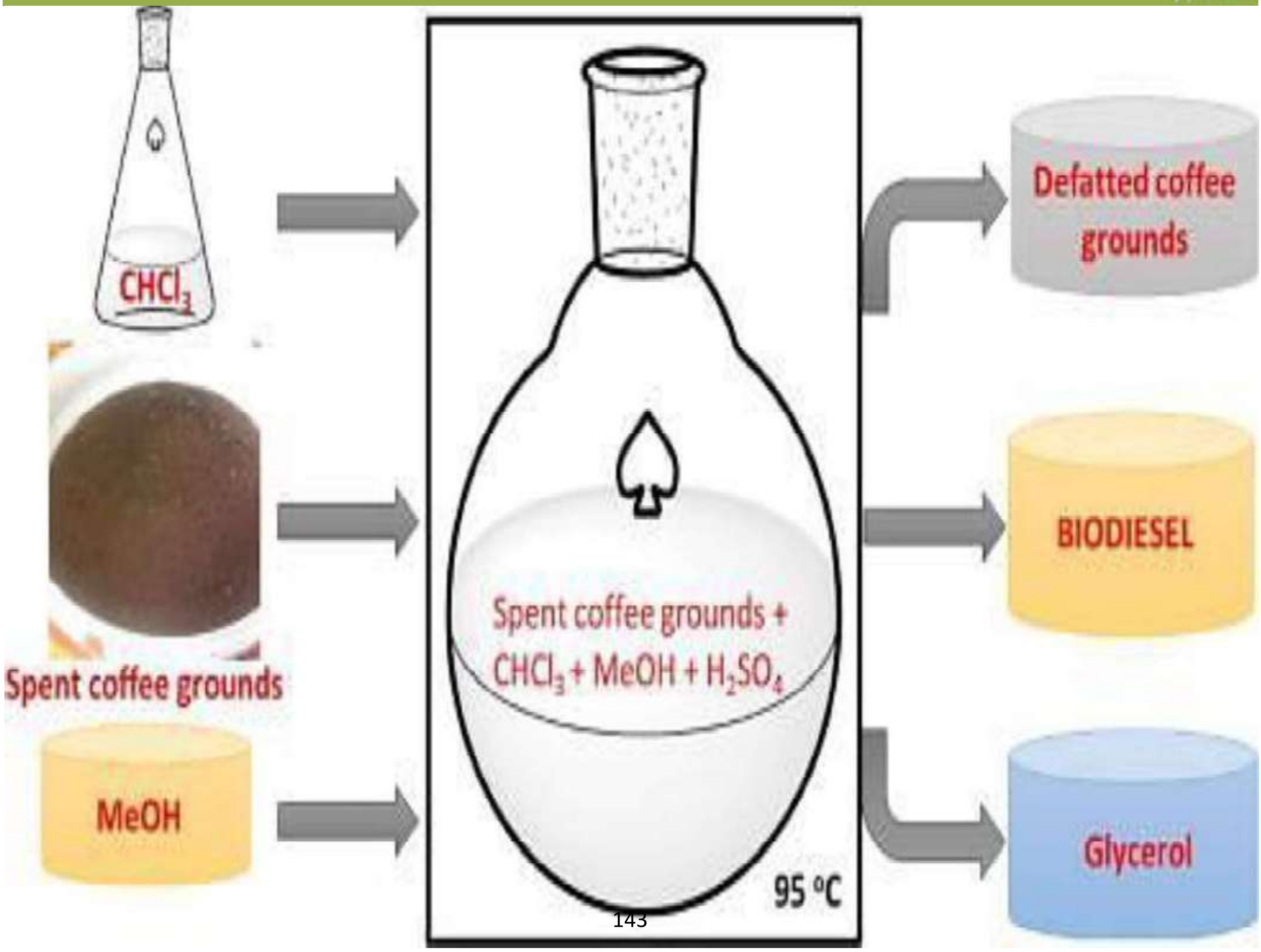


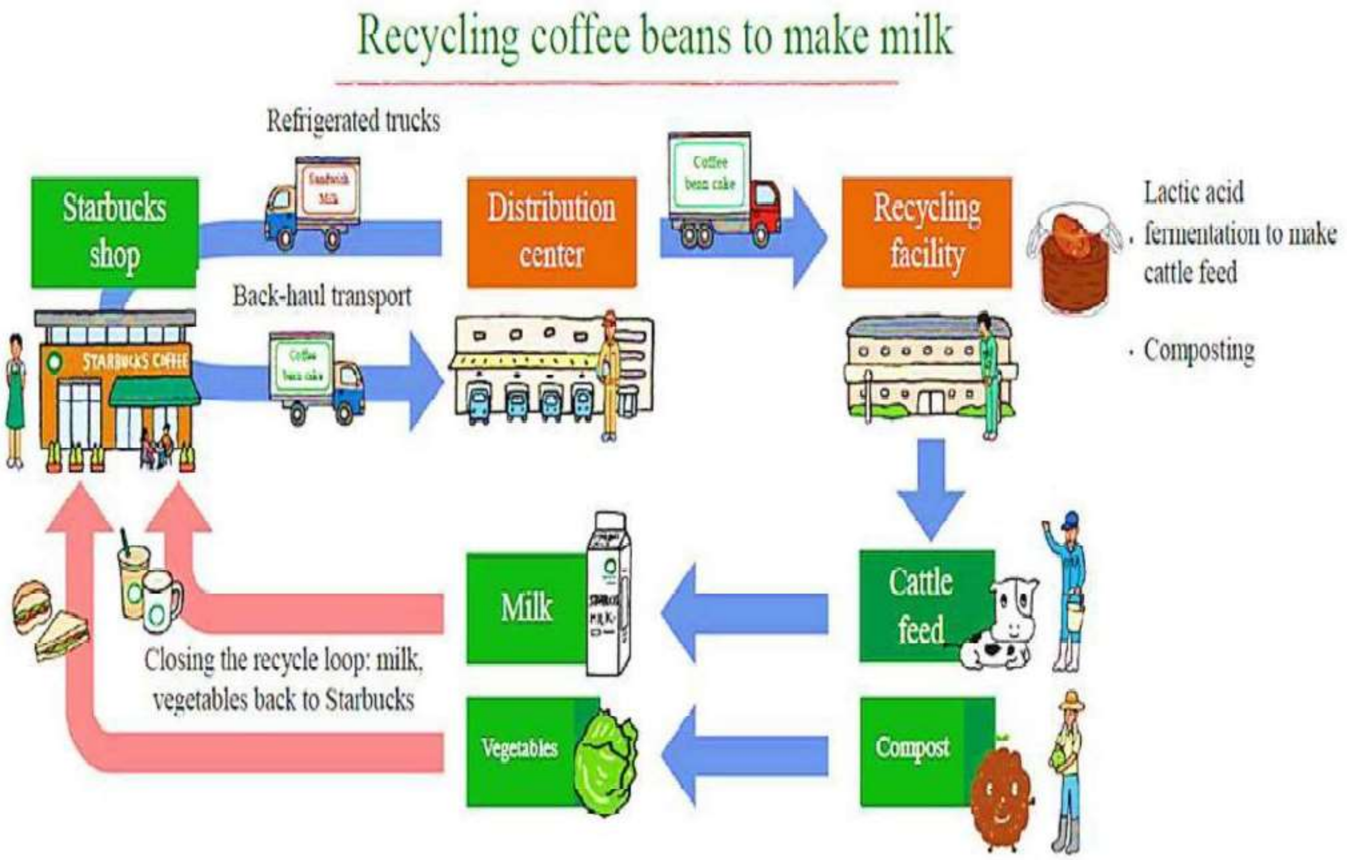
Recycling of Waste Cooking Oil (WCO)



Recycling of Spent Coffee Grounds (SCG)

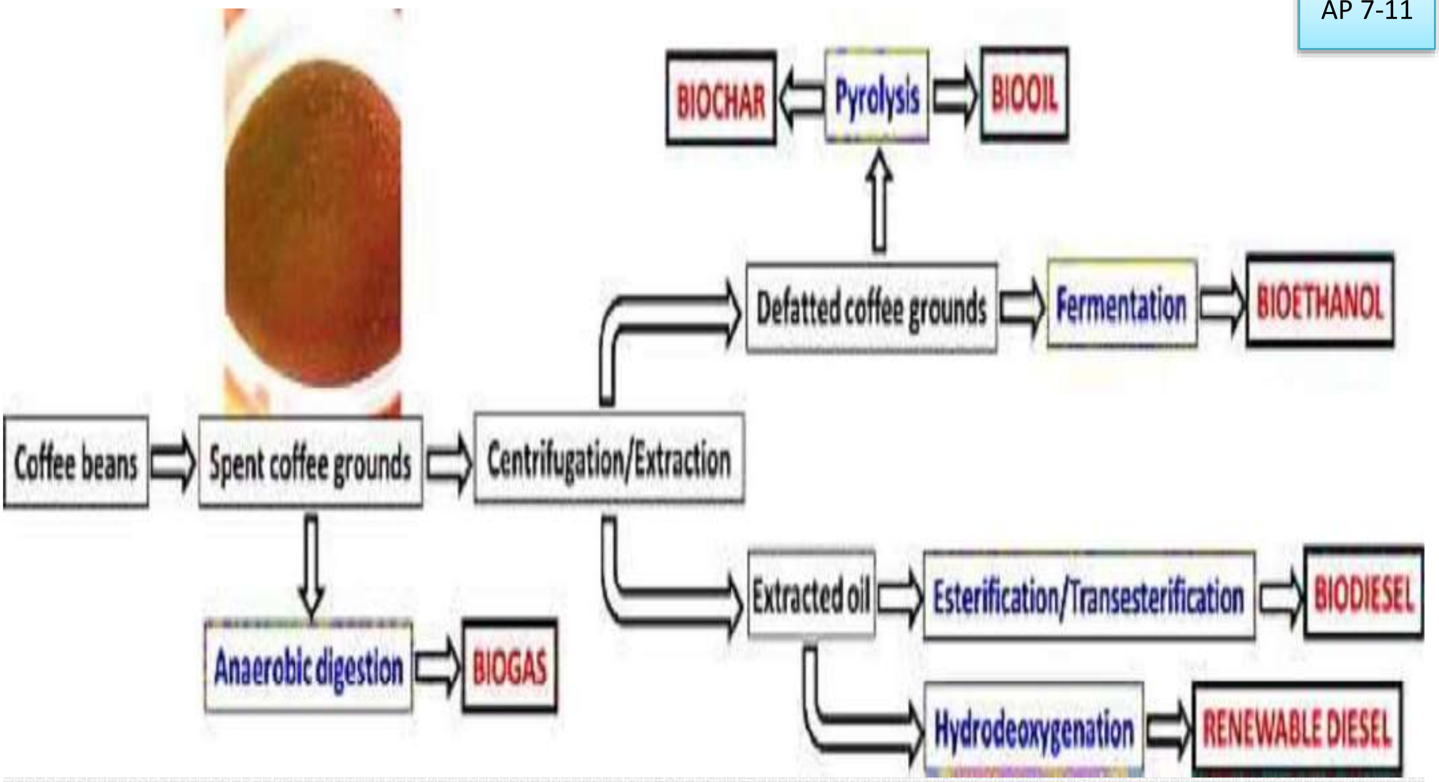

WASTE COFFEE
RECYCLING
Paper Round collect waste coffee grounds in wheeled bins and caddies.
Waste coffee grounds are generated at your business.
The waste coffee recycling truck collects waste coffee grounds from your premises and transports them to the bio-bean factory.
In partnership with bio-bean powered by coffee
bio-bean produces biomass pellets used for heating buildings.
bio-bean recycles waste coffee grounds into advanced biofuels and biochemicals.
fppt.com

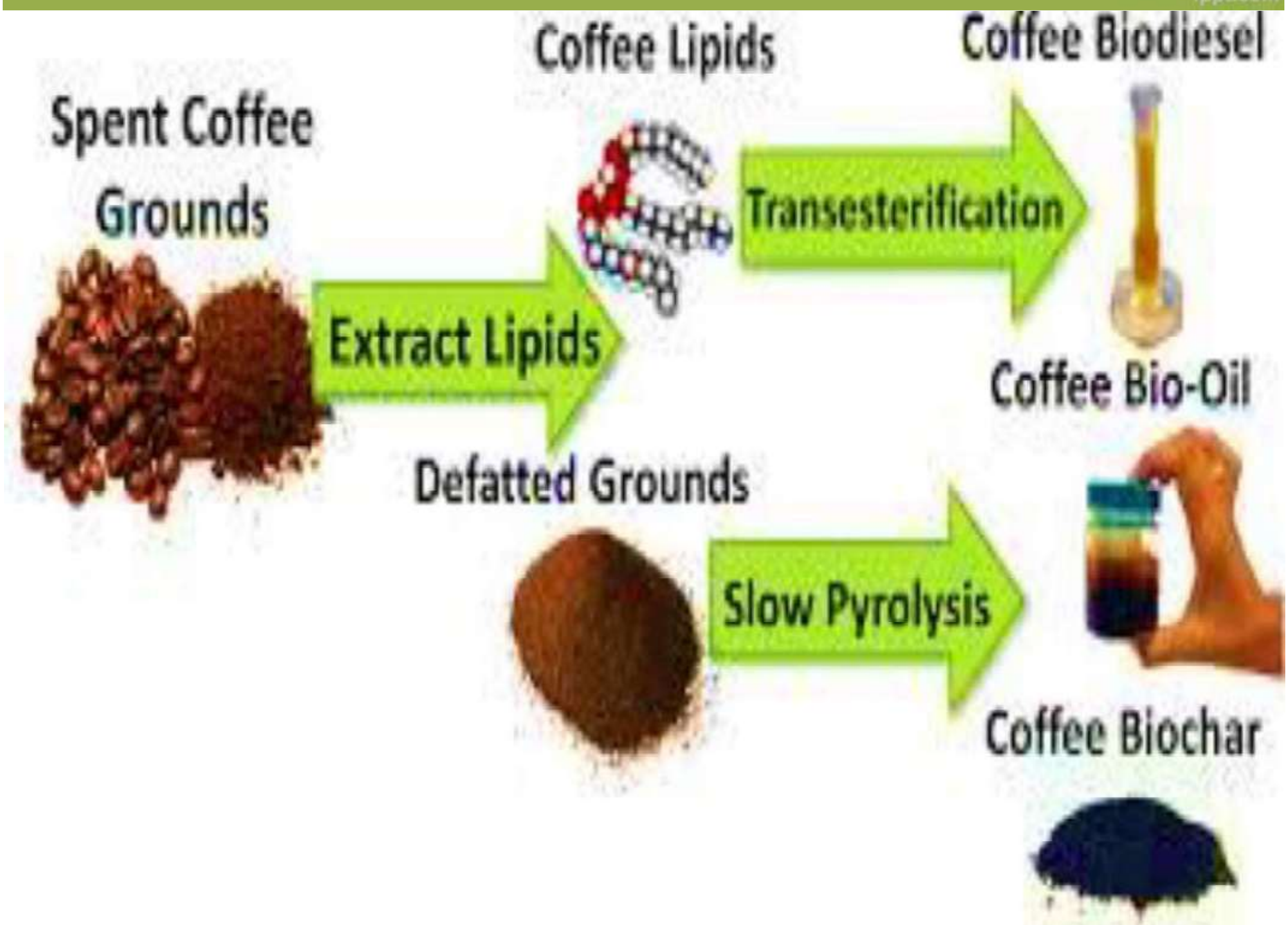

CHCl3
Spent coffee grounds
MeOH
Spent coffee grounds + CHCl3 + MeOH + H2SO4
95 ºC
Defatted coffee grounds
BIODIESEL
Glycerol


Recycling coffee beans to make milk
Refrigerated trucks
Starbucks shop
Distribution center
Recycling facility
Lactic acid fermentation to make cattle feed
Composting
Back-haul transport
Milk
Cattle feed
Closing the recycle loop: milk, vegetables back to Starbucks
Vegetables
Compost


Extraction
Hydrotreating
Spent coffee grounds
Coffee oil
Bio-hydrotreated fuel

AP 7-11


Coffee beans
Spent coffee grounds
Centrifugation/Extraction
Defatted coffee grounds
Fermentation
BIOETHANOL
Pyrolysis
BIOCHAR
BIOOIL
Anaerobic digestion
BIOGAS
Extracted oil
Esterification/Transesterification
BIODIESEL
Hydrodeoxygenation
RENEWABLE DIESEL


Spent Coffee Grounds
Extract Lipids
Coffee Lipids
Transesterification
Coffee Biodiesel
Defatted Grounds
Slow Pyrolysis
Coffee Bio-Oil
Coffee Biochar

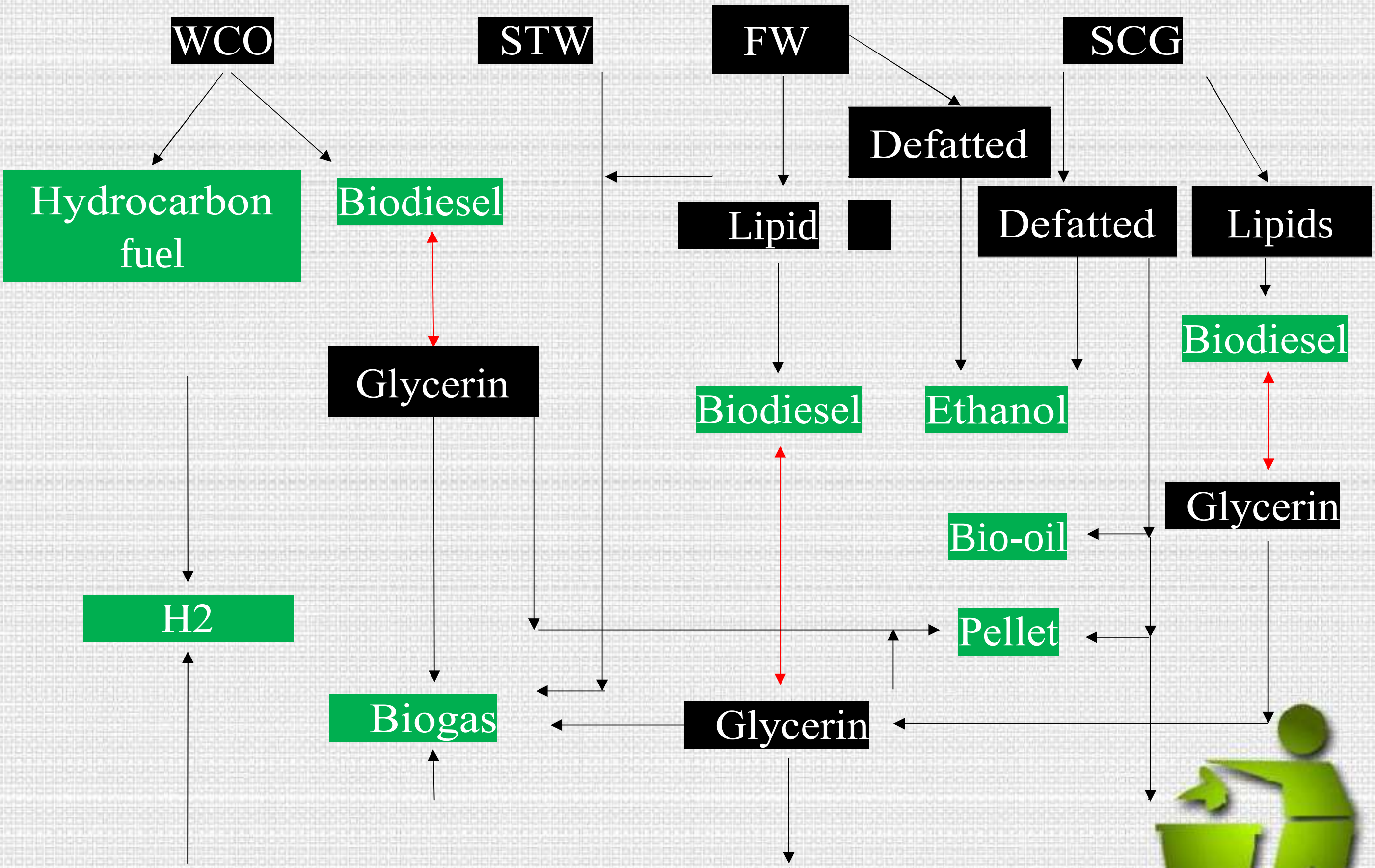
Recycling of Spent Tea Waste

( )

Proximate, ultimate and heating value analysis

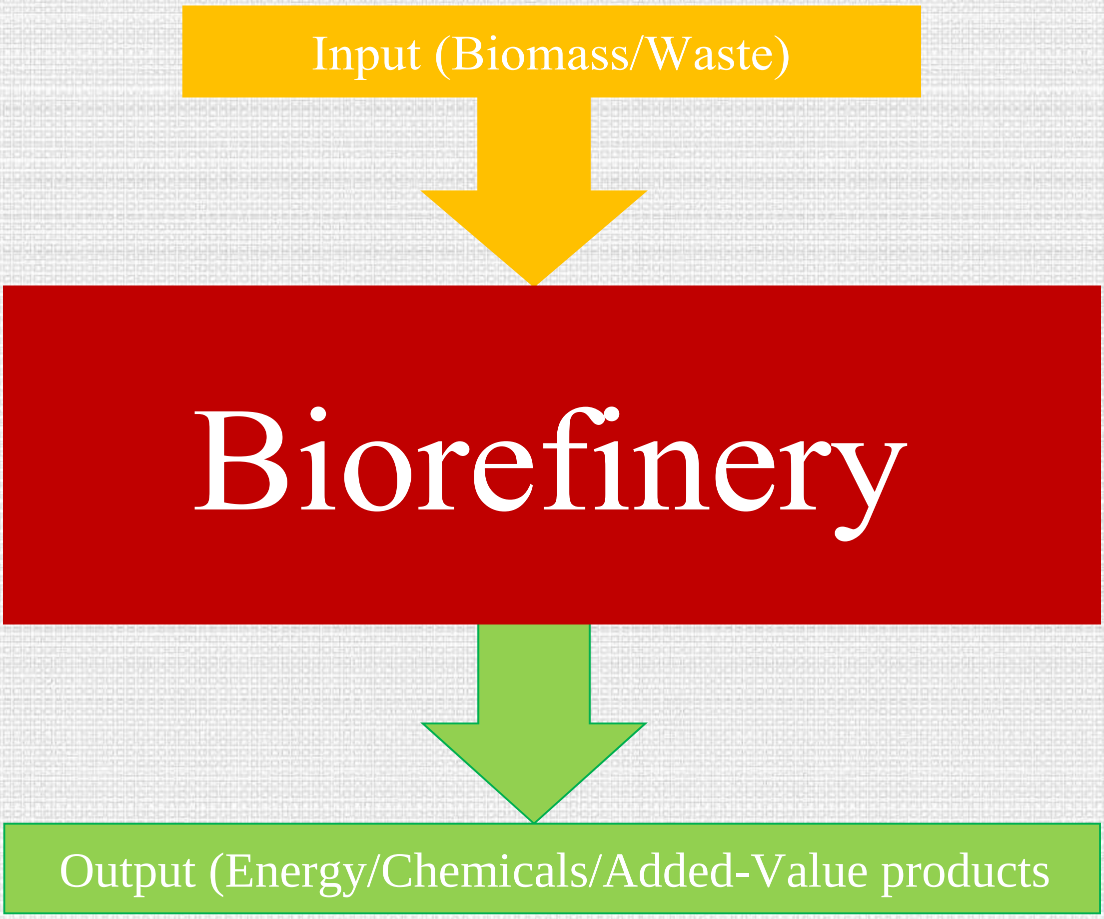
	VM	Moisture	Ash	FC	C	H	N	C/N	LHV
TW	64.17 ± 0.1	12 ± 0.2	5.06 ± 0.1	18.77 ± 0.4	48.60 ± .2	5.43 ± 0.1	2.6 ± 0.1	18.69	27.63 ± 0.4
FW	36.05 ± 0.3	44.99 ± 0.1	3.88 ± 0.2	15.08 ± 0.3	47.7 ± 0.3	7.6 ± 0.2	2.9 ± 0.3	16.44	15.27 ± 0.5
CD	66.2 0.1	9.88 0.4	12.35 0.1	11.57 0.1	35.2 0.5	6.2 0.3	1.55 0.2	22.7	8.92 0.3

Recycling of Food Waste (FW)

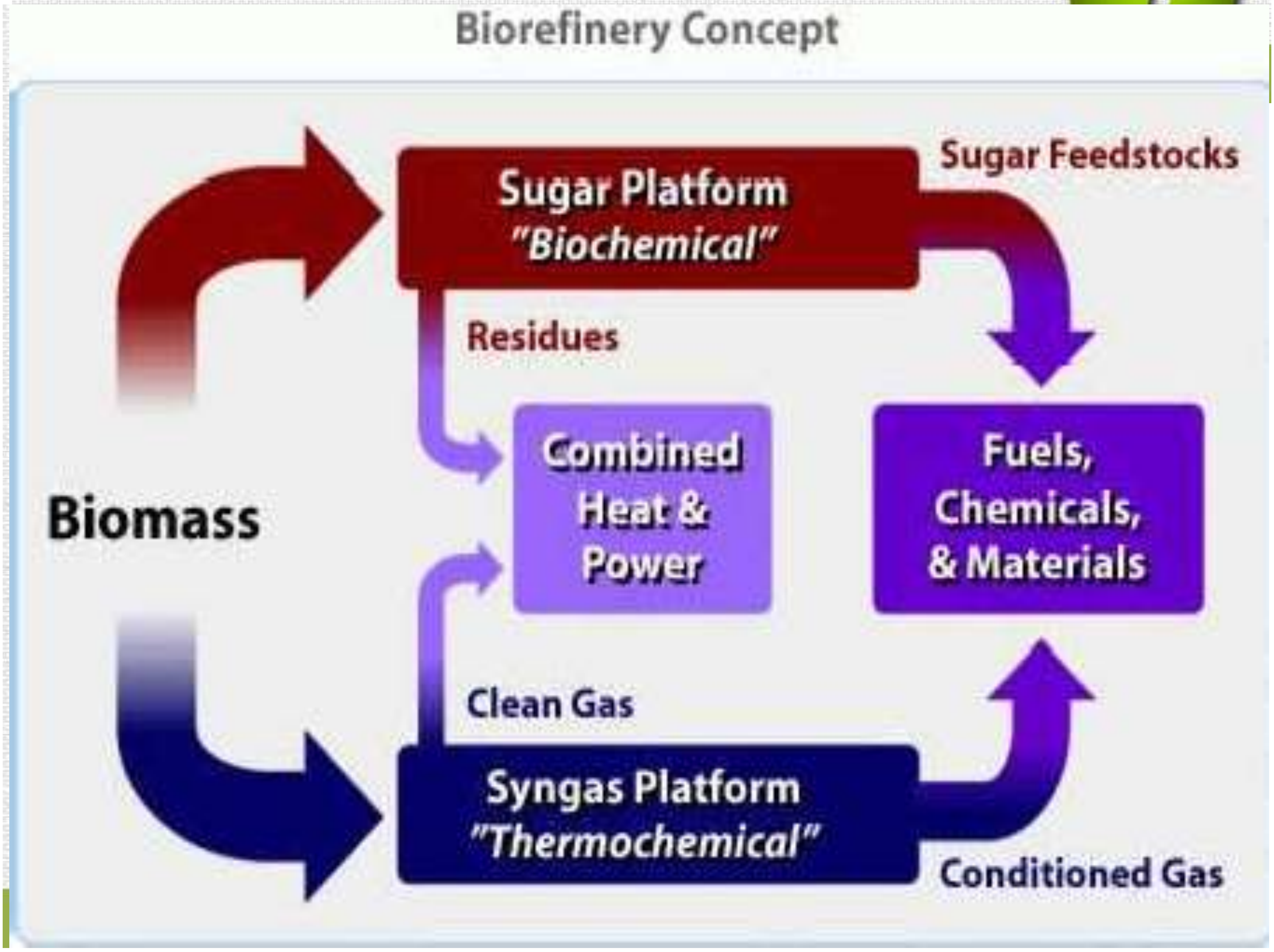


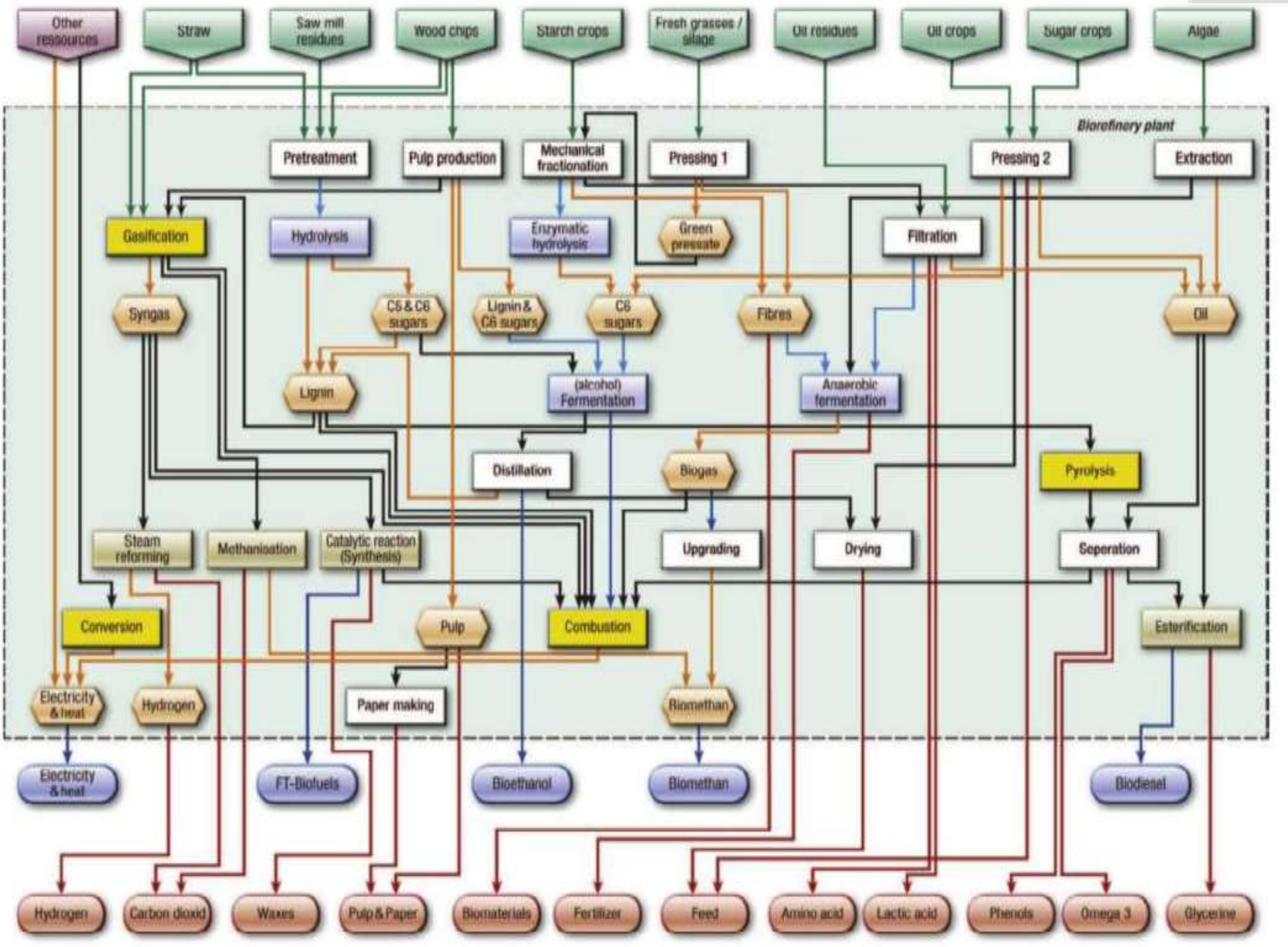
Introduction to biorefinery

- A biorefinery is a facility that integrates biomass conversion processes to produce bio-fuels power, and added-value products.
- Biorefinery is analogous to today's petroleum refinery, which produces multiple fuels and products from petroleum.
- By producing several products, a biorefinery takes advantage of the various components in biomass, therefore maximizing the value derived from the biomass feedstock.



- The most important Energy Products which can be produced in biorefineries are:
  - ✓ Gaseous biofuels (biogas, syngas, hydrogen, biomethane),
  - ✓ Solid biofuels (pellets, lignin, charcoal),
  - ✓ Liquid biofuels (bioethanol, biodiesel, bio-oil).
- The most important Chemical and Added-value products are:
  - ✓ Chemicals (fine chemicals, building blocks, bulk chemicals),
  - ✓ Organic acids (succinic, lactic, itaconic and other sugar derivatives),
  - ✓ Polymers and resins (starch-based plastics, phenol resins, furan resins),
  - ✓ Biomaterials (wood panels, pulp, paper, cellulose),
  - ✓ Food and animal feed,
  - ✓ Fertilizers.





Conclusion

- Recycling is a neccessity to protect the environment.
- Recycling can turn waste into Biofuels and Added- value Products.
- Biorefinery is the solution to make recyling a reality.
- Advancement in Conversion Technologies of waste to biofuels is an important aspect to produce high quality biofuels.
- Techno-economic Analysis and Life-cycle Assessment of bio-refineries is needed to penetrate the market.

O2O Training Program

Module 1

AP 8-1

Module 1

Discovering the problems and identifying the stakeholders

1.

Understanding electricity supply and the access gap in Kenya's rural communities

AP 8-2

WHAT'S THE PROBLEM?

The problem is a lack of access to basic electricity demand and services for families in Kenya's rural communities

People living in rural communities in Kenya, and this number is rapidly growing. Conditions in these communities are often unfit for people to live in. Universally accepted, basic needs, are simply missing.

WHAT'S THE PROBLEM?

ACCESS TO SERVICES

Many communities are not connected to grid electricity or mains water supply, forcing people to go without, or to resort to unsafe products. Families rely on harmful kerosene for their lighting needs, they drink unclean water, and cook with dirty cookstoves.

AP 8-3

WHAT'S THE PROBLEM?

KNOWLEDGE OF ALTERNATIVES

Families are not educated about the better alternatives out there. They have no way to access them, and no idea how these alternatives could be used to improve their lives.

WHAT'S THE PROBLEM?

SAVINGS AND SERVICE

Due to their low earning and transitory nature, families living in rural communities have no access to finance to enable them to purchase the products they need. The current solutions are low quality and have no warranty, and the companies that sell them do not provide post-sales servicing.

AP 8-4

2.

Who are the people living in rural communities in Kenya?

LIVING IN Rural Communities

Who are the people living in rural communities in Kenya?

Typical rural areas have a low population density and small settlements. Agricultural areas are commonly rural, as are other types of areas such as forest. have varying definitions of *rural* for statistical and administrative purposes.

The value for Rural population in Kenya was 35,834,900 as of 2016. As the graph below shows, over the past 56 years this indicator reached a maximum value of 35,834,900 in 2016 and a minimum value of 7,508,718 in 1960.

Definition: Rural population refers to people living in rural areas as defined by statistical offices. It is calculated as the difference between total population and urban population. Aggregation of urban and rural population may not add up to total population because of different coverages.

LIVING IN Rural Communltles

Geography & Climate

Kenya's rural areas include a variety of landscapes, climates and ways of life.
Altitudes range from 8,200 feet in the central highlands to 1,600 feet in the southern lowlands down to sea level in the coastal region.
Temperatures range from an average low of 53 degrees in the highlands to an average high of 91 degrees along the coast.

AP 8-6

LIVING IN Rural Communltles

Economy

In the more populated highland regions, rural Kenyans are primarily subsistence farmers.
Those in the more arid, less populated areas generally are cattle herders.
Kenyans who live along the Indian Ocean coast in the southeast or the shores of Lake Victoria in the west tend to earn a living from fishing.
Unemployment in Kenya's rural areas is as high as 65 percent, due in part to low education levels.

LIVING IN Rural Communltles

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AP 8-7

Children at Home

Rural homes are typically small, crude constructions made from local materials.

Homes of the nomadic Maasai people in the arid south have stick frames covered with cow dung. In other regions, homes have mud walls and thatched roofs, or walls and roofs built of iron sheets.

In the rural regions, only about half of the people have ready access to safe water, and only 30 percent have adequate sanitation.
Typically, each rural family has five children. However, in some rural areas the number of children per family averages eight to 10.

LIVING IN Rural Communities

Economy

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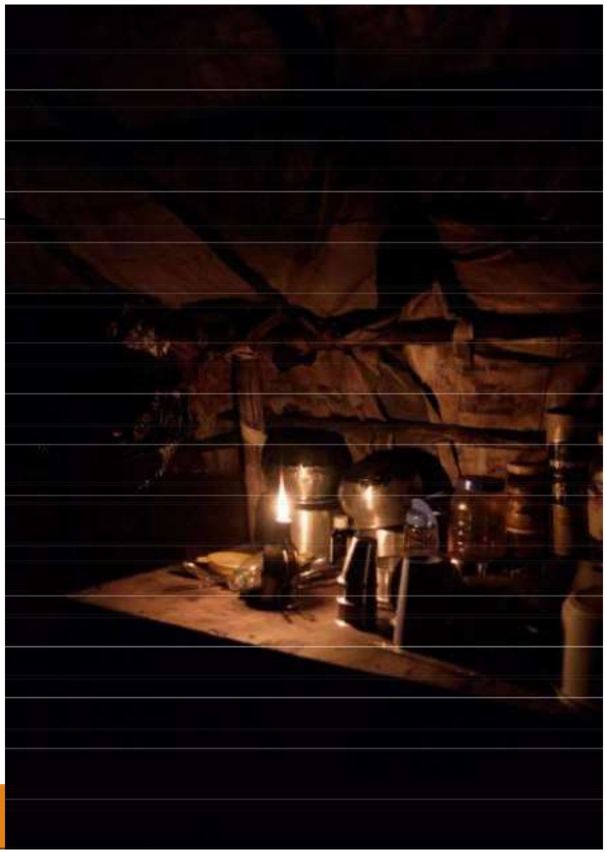
AP 8-8

3.

Issues and Concerns?



EVERYDAY CHALLENGES

What is life like for a family living in Kenya's rural communities ?

Life in Kenya's rural communities come with many challenges that families face everyday. These challenges have both immediate and long term impacts on quality of life.

AP 8-9

EVERYDAY C■ALLENGES

LIGHT

Toxlc Kerosene

People in Kenya's rural communities living in energy poverty, and the vast majority of these people rely on kerosene for lighting. Use of kerosene has direct adverse effects relating to a person's health, safety and general well-being.

EVERYDAY C■ALLENGES

LIGHT

Toxlc Kerosene

When kerosene is burnt, it releases particulate matter, carbon monoxide, sulphur dioxide and various nitrogen oxides. Exposure to these pollutants has a multitude of detrimental effects on a person's health, primarily an **increase in the risk of respiratory infections**. In addition, families using kerosene lamps **risk being burnt by the open flame**, as well as fires in their home that can destroy what little property they have.

AP 8-10

EVERYDAY CHALLENGES

LIGHT

Toxic Kerosene

The light from a kerosene lamp is very weak, meaning **people cannot work and children cannot study after the sun goes down**. A typical kerosene lamp delivers between 1 and 6 lux of light. In contrast, typical western standards suggest a minimum of 300 lux for tasks such as reading.

EVERYDAY CHALLENGES

LIGHT

Toxic Kerosene

Kerosene also **emits carbon which contributes to climate change**. For every liter of kerosene burnt, around 2.5kg of carbon dioxide is produced. Around 8% of carbon emitted by kerosene is in the form of black carbon, which is much more potent than ordinary CO_2. It is estimated that 1kg of black carbon in the atmosphere for a month contributes as much warming as 700kg of CO_2 in the atmosphere for 100 years!

AP 8-11

Challenges faced by people living in rural areas of kenya (1/2)

i) Poor road network- a place or region will not develop if it is not accessible and hence there is need to construct good roads that will help them move products in and out.

ii) Lack of technical know how- most rural dwellers have little or no education at all and thus its quite difficult for them to do their work scientifically. Its the responsibility of the government and any organization to ensure that the remote areas get attention in terms of education.

iii) iii) Insufficient health centres - its an important area which should be give more attention. People do not get proper treatment because of lack of this important facilities or qualified personnel. With regard to health many productive people die and also their will be no family planning which leads to many children that the parent can not afford to gather for their needs.

Challenges faced by people living in rural areas of kenya (2/2)

i) Inadequate lending institution especially banks or saccos- when there is no source of capital to start businesses or to expand your projects then the rate of expansion is very slow.

ii) culture, traditions and norms- most rural dwellers are still following their traditions in their way of doing things. They don't believe in change and hence become very difficult for the to get new ideas and information.

iii) Lack of technology- rural parts have difficulties in accessing new technologies and since we are in a computer era they will not catch up with the base at which other people are moving. All the above challenges are just but a few and this areas should be given more emphasis in terms of resource allocation.

Opportunities to produce renewable energy from sources such as wind, solar and hydro are generally higher in rural areas compared to urban areas.

Communities located near these natural assets may, in turn, have greater potential to benefit from these energy sources.

However, a range of technological, economic and behavioural factors can limit the extent to which rural communities can take advantage of these opportunities.

Significant portions of distribution networks in rural areas face grid constraints which show the extent of the challenge in fulfilling the potential of rural areas to exploit renewable energy resources.

In addition, homes in rural areas are typically less energy efficient and can be more reliant on potentially more expensive heating fuels. Smart technology, including smart meters, can increasingly help communities overcome barriers to harnessing local sources and to benefit from energy that is cheaper, more efficient and more secure.

SteamaCo example (1/3)

In Kenya, businesses are looking to broaden access to energy by fusing micro grid technology with the significant uptake of mobile phone payment systems.
Margaret Mwangi runs a salon in Kenya. With her business not connected to Kenya's main grid, she makes use of a local solar micro grid operated by smart metering technology business SteamaCo to get electricity.

SteamaCo says that it operates in nine [illegible] serving 3,000 homes and businesses, using mini grids as well as biogas digesters and solar irrigation pumps.
"I just have to use my phone, and go through M-Pesa (a mobile phone payment and money transfer system)," she told CNBC's Sustainable Energy. "I put the amount that I want – as low as 50 shillings ($0.48), and onwards up to 1000 – depending for what I want to use."

The town of Entesopia is now the site of an eight kilowatt solar micro grid, which provides electricity to roughly 65 households and businesses. The micro grid is helping to smooth the transition from expensive, polluting diesel generators to cleaner, solar powered grids.

AP 8-13

SteamaCo example (2/3)

SteamaCo's Lumumba Lameck explained how the micro grid system works.

"Power is primarily generated by solar panels, it has an inverter which converts power from direct current to alternating current," he said. "We have a battery bank that, during the day, when the sun is a lot, some of the energy is... stored for night time use by the customers," he added.

"It has a system that allows the customers to pay as they go using their mobile devices, and... the providers like ourselves are able to monitor remotely without necessarily having anyone on the ground," Lameck went on to add.

SteamaCo example (3/3)

As well as helping businesses to trade for longer, the micro grid is also changing the lives of young people, including student Celestine Periperi. "We used to have a kerosene lamp at home, it... hurt my eyes and I couldn't study after the sun went down," she said.

"Now that we have the solar lamp I'm able to do my evening homework and I'm improving my grades at school."

AP 8-14

O2O Training Program

Module 2

AP 9-1

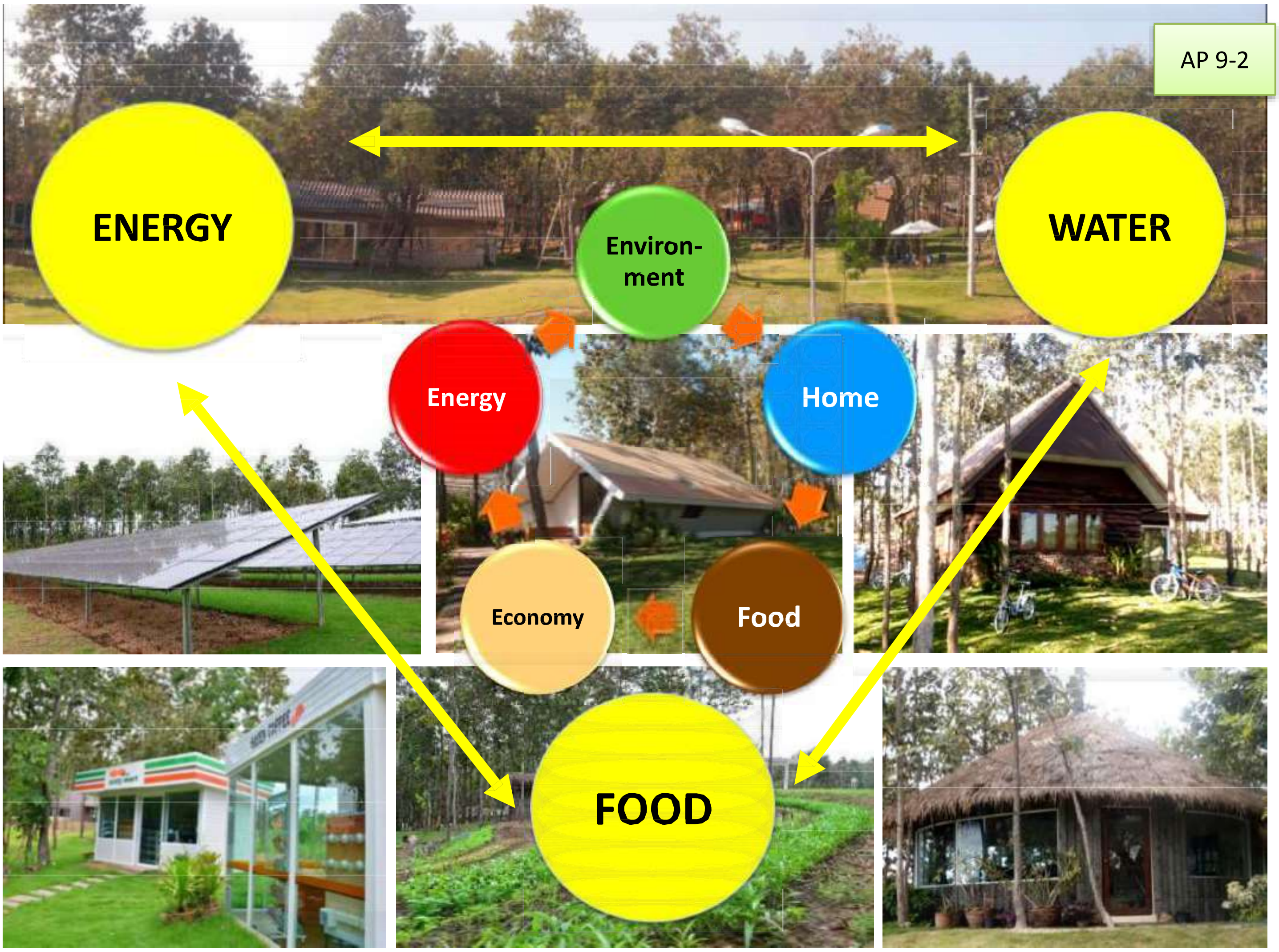
Best Practice for Smart Community in Chiang Mai World Green City

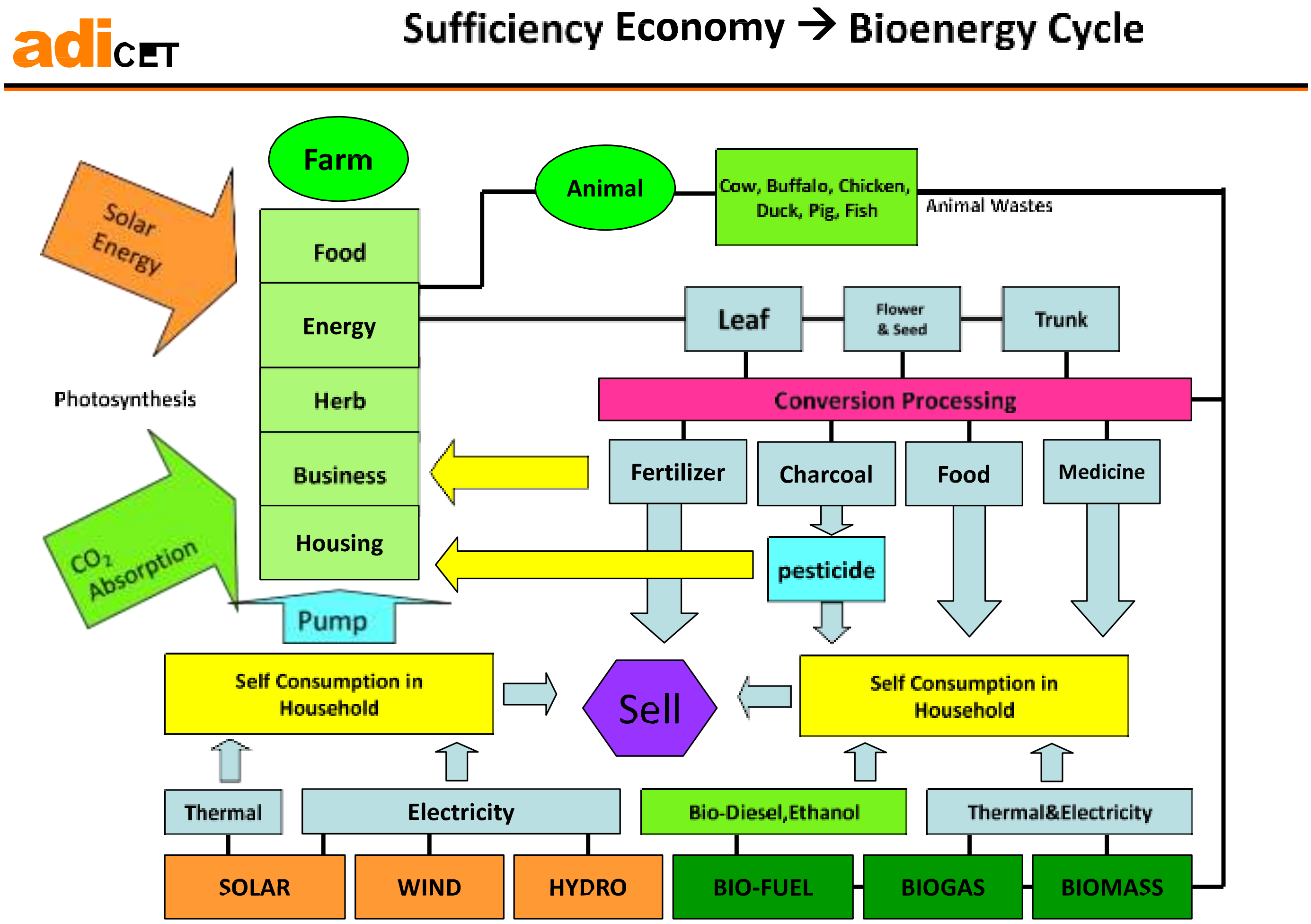
Asian Development College for Community Economy and Technology
Chiang Mai Rajabhat University
Thailand

adiCET **Module 2 of APEC-ACABT YES Challenge 2018**

adiCET, CMRU

- Academic – R&D – Training institution for the well-being of the community by using green technologies.
- adiCET campus is on Chiang Mai World Green City (CMGC).
- Smart Community – Model Community uses 100% renewable energy.



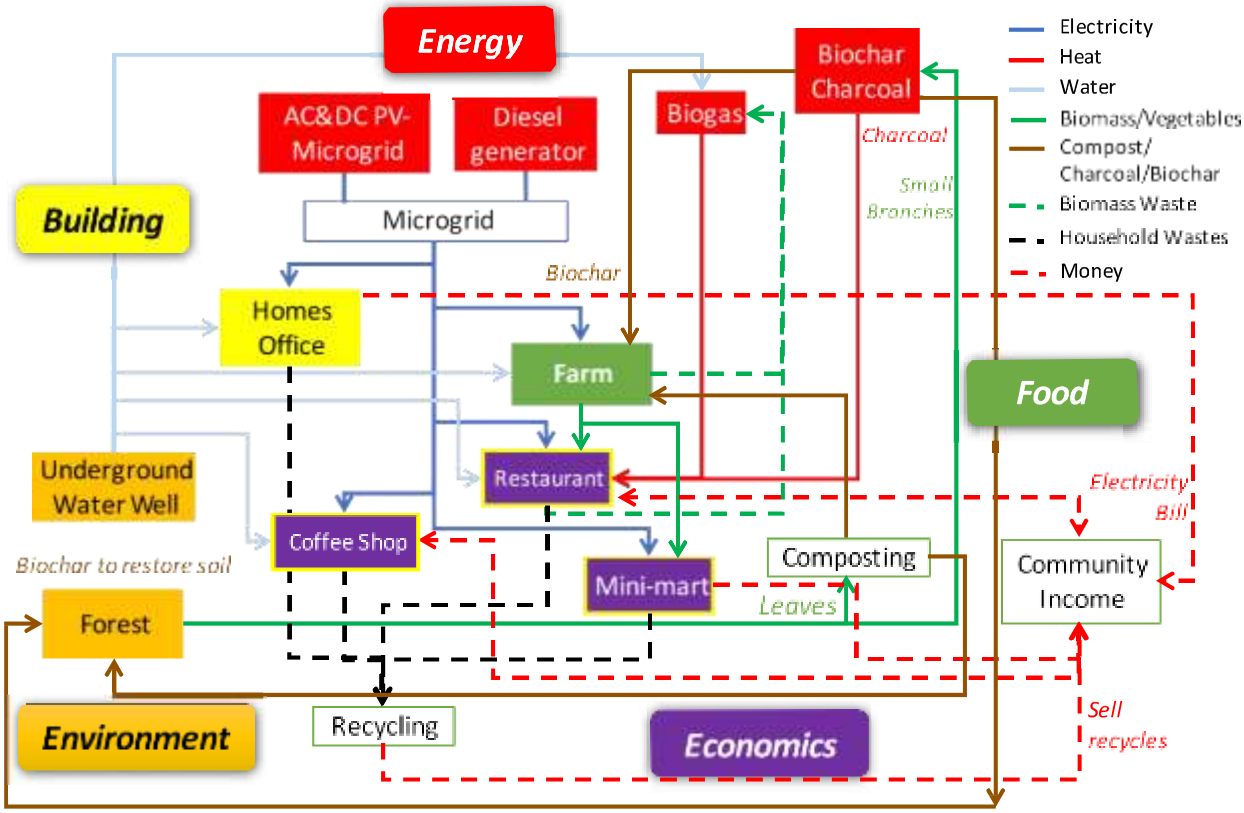


W. Rakwichian

AP 9-3

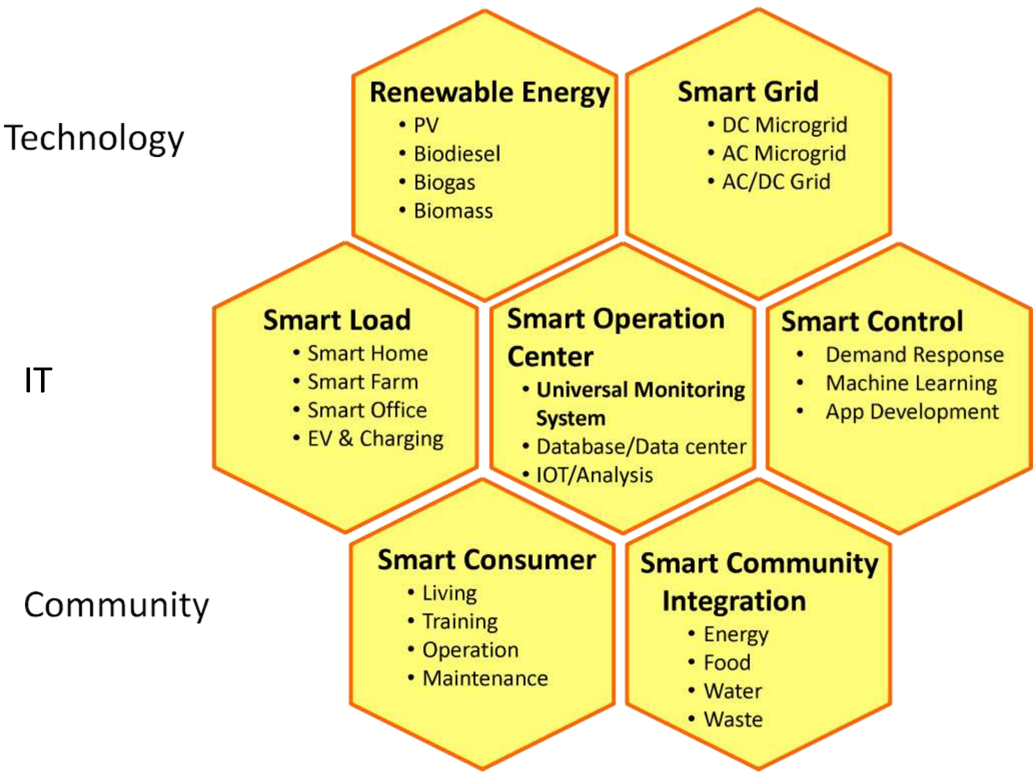
adiCET

Realtime - Smart Community Monitoring



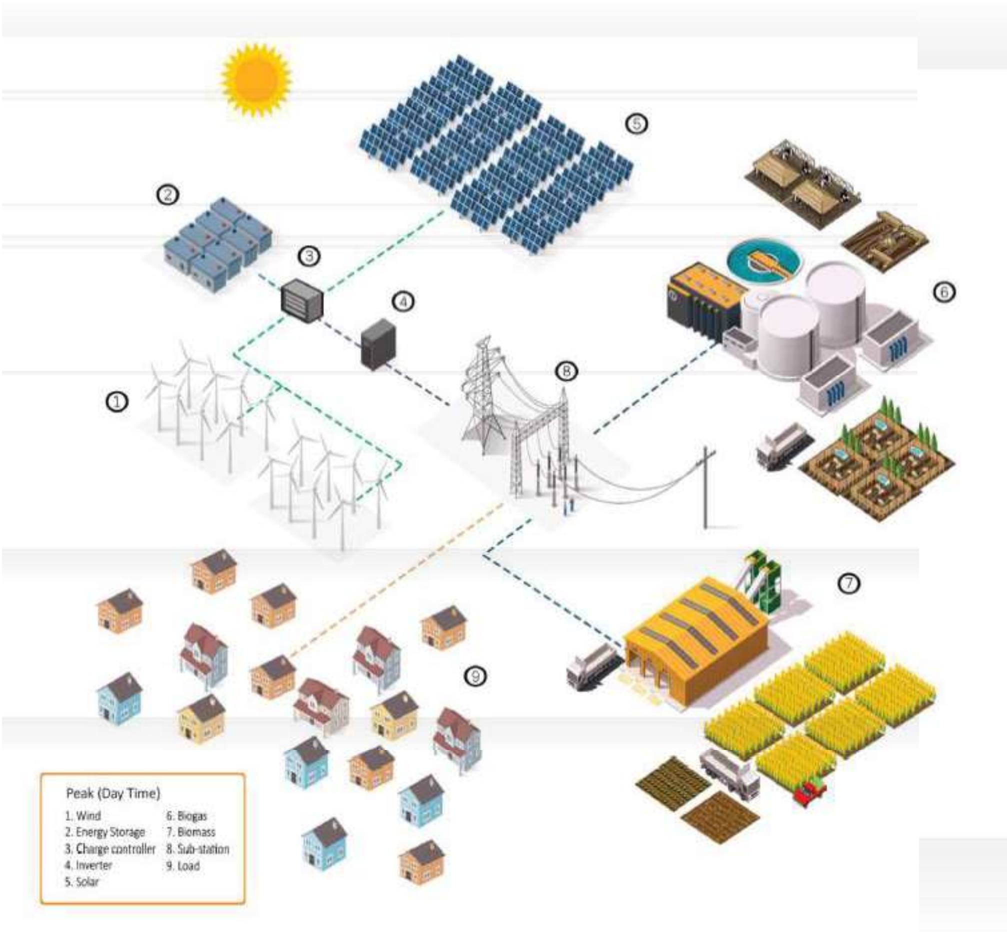
adiCET

adiCET Community Smart Grid Component

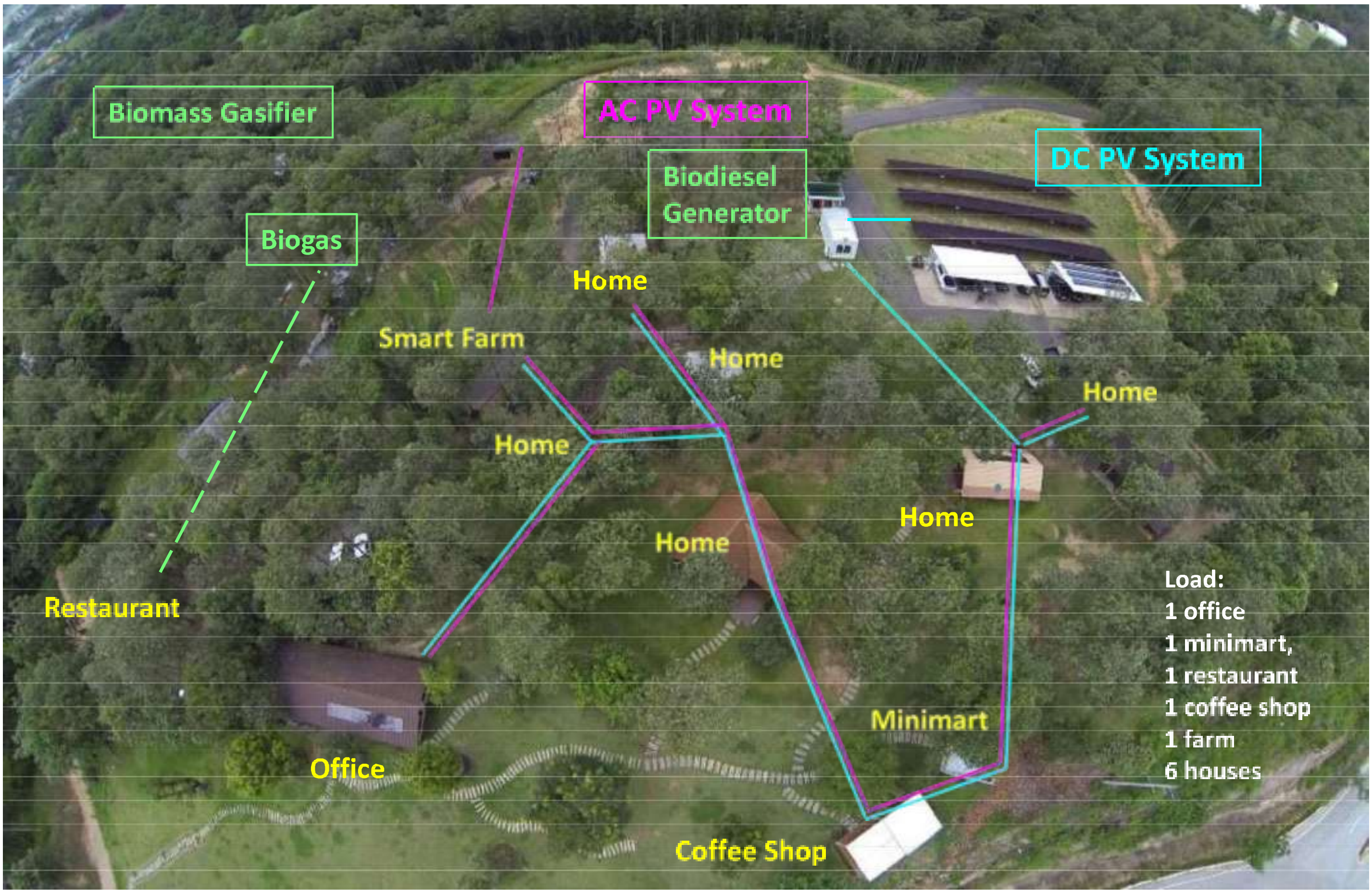


AP 9-4

Goal “Smart Infrastructure for Green Community Development”



Smart Community – AC/DC Smart Grid



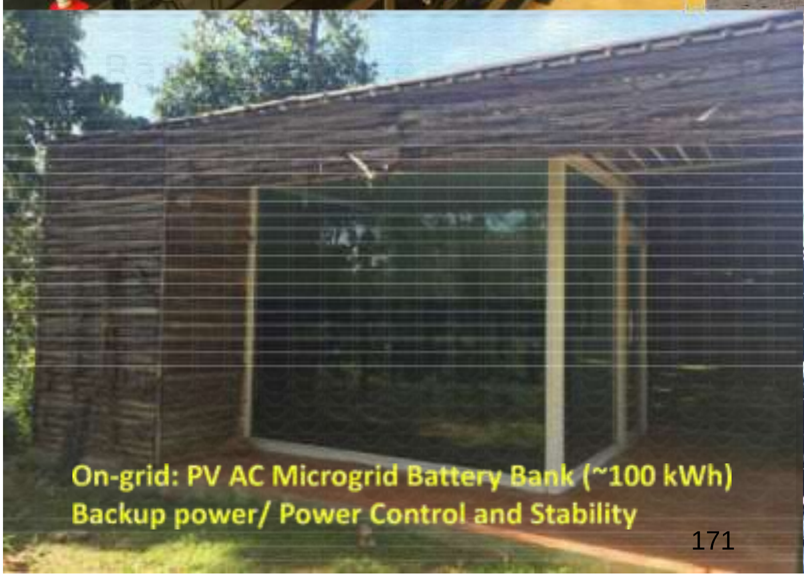
adiCET

Biomass Gasifier

Biomass Gasifier: electricity for base load
Biochar/Charcoal: food, heat, soil conditioner

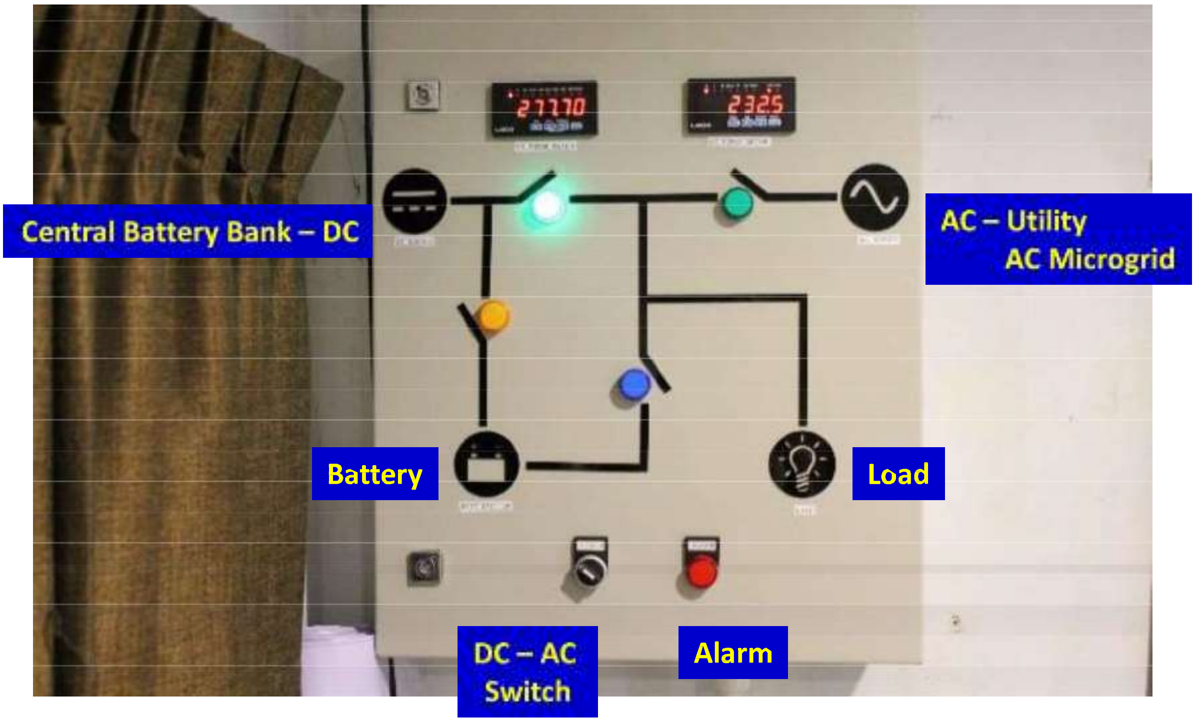
Energy from waste agriculture products
"Solve open field burning"

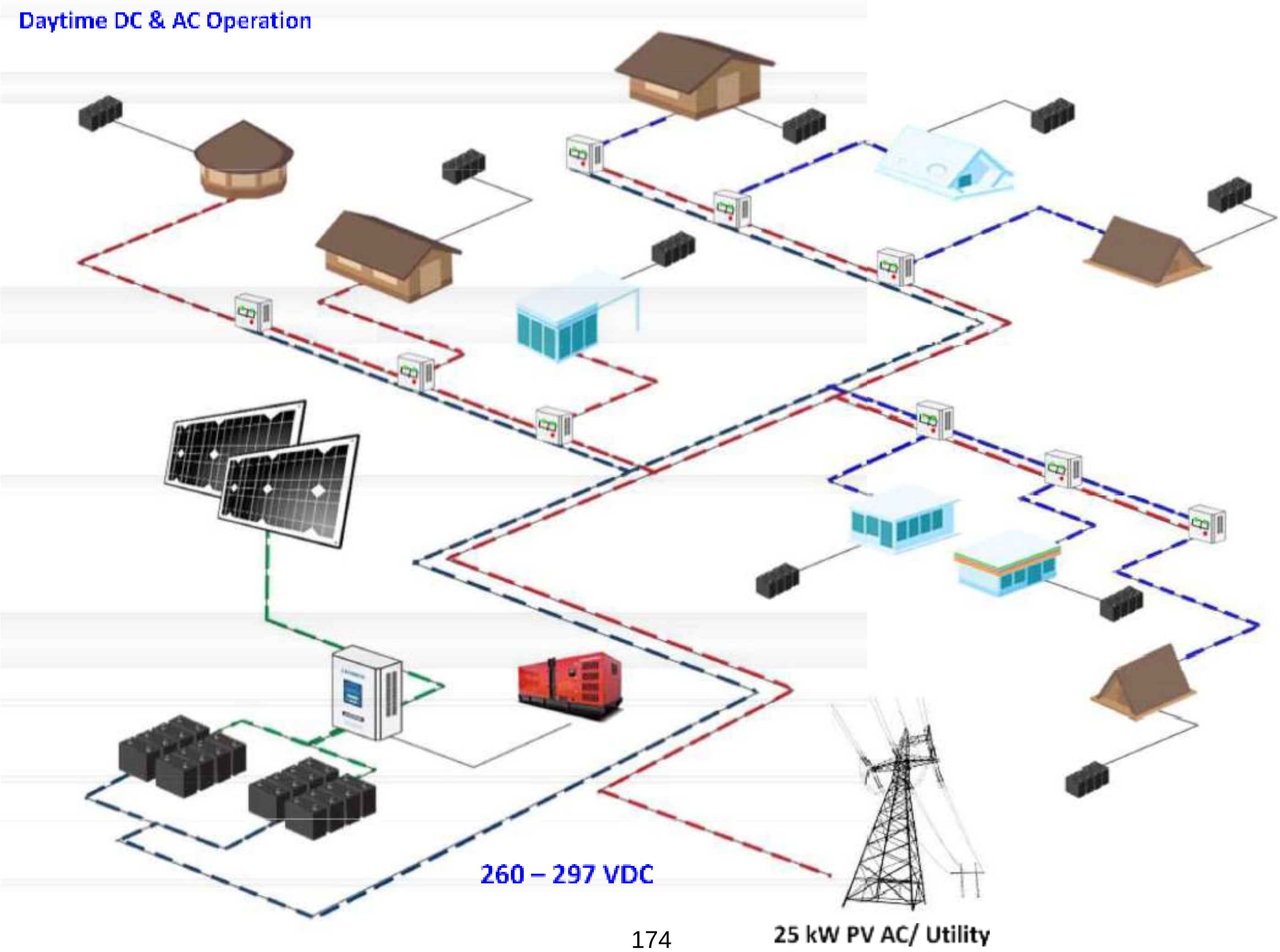
D. Kantayos – Intern
W. Photacharoen - Researcher

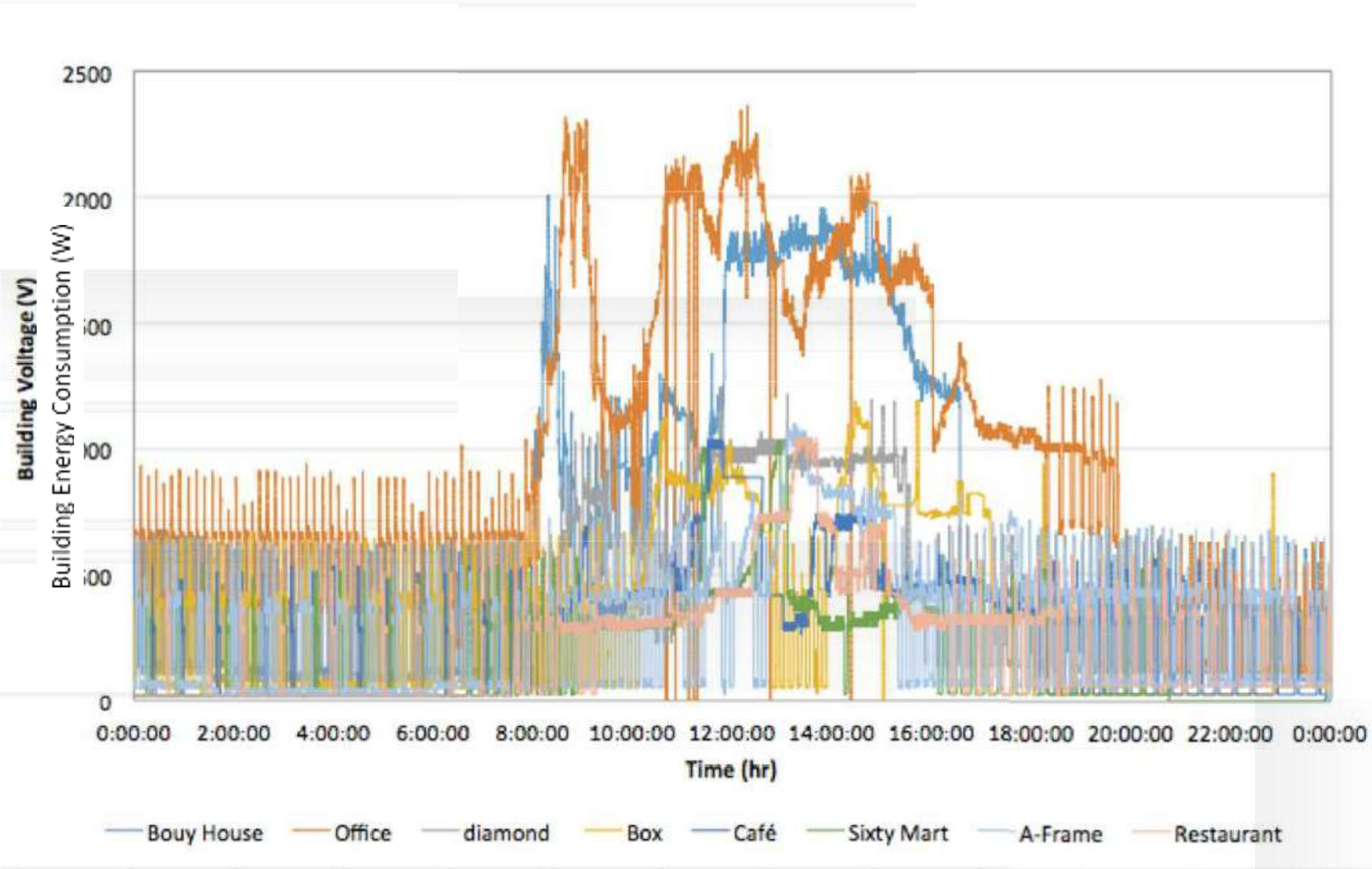


AP 9-7

AP 9-8


Central Battery Bank – DC
AC – Utility
AC Microgrid
Battery
Load
DC – AC
Switch
Alarm


Daytime DC & AC Operation
260 – 297 VDC
25 kW PV AC/ Utility


2500
2000
0
Building Voltage (V)
Building Energy Consumption (W)
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00
Time (hr)
Bouy House
Office
diamond
Box
Café
Sixty Mart
A-Frame
Restaurant

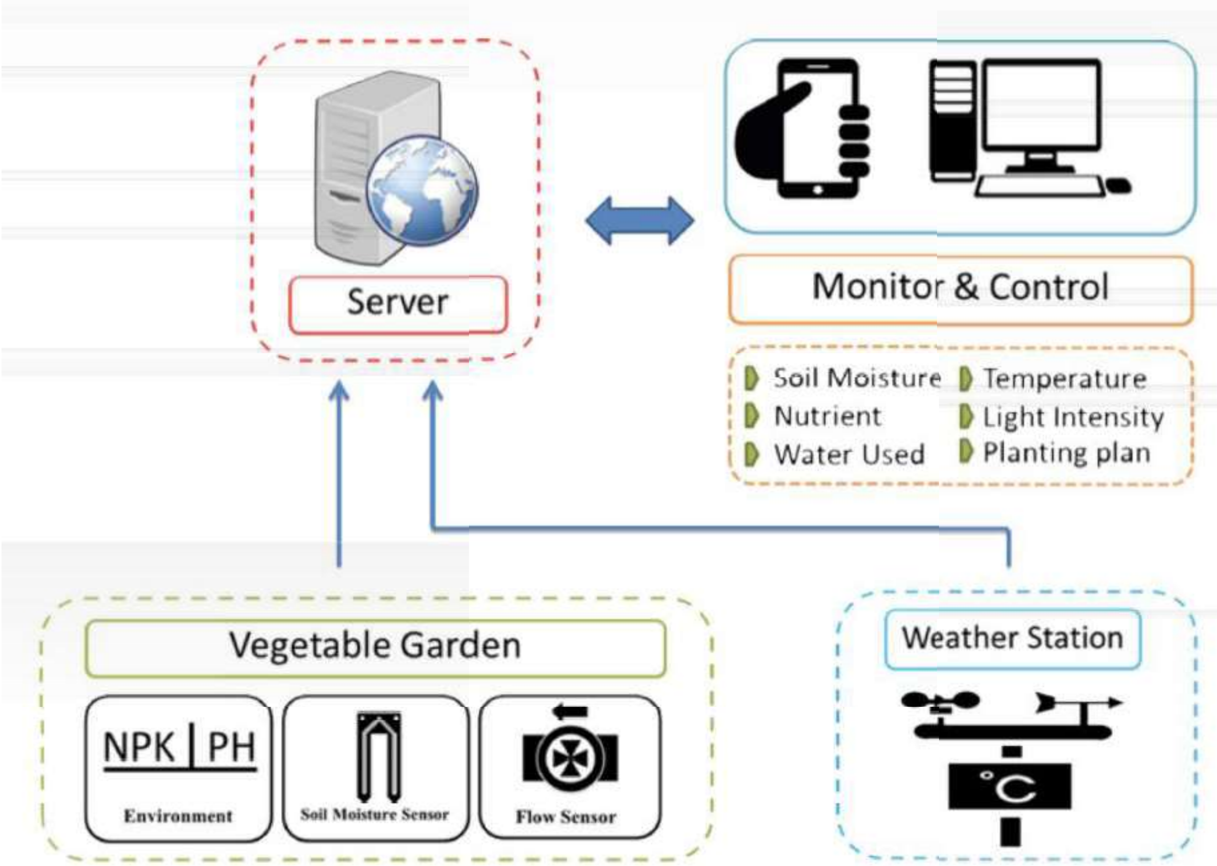

Community Kitchen


Community Biogas
AP 9-11


Smart Farm
PV Water Pumping
Moisture Sensor

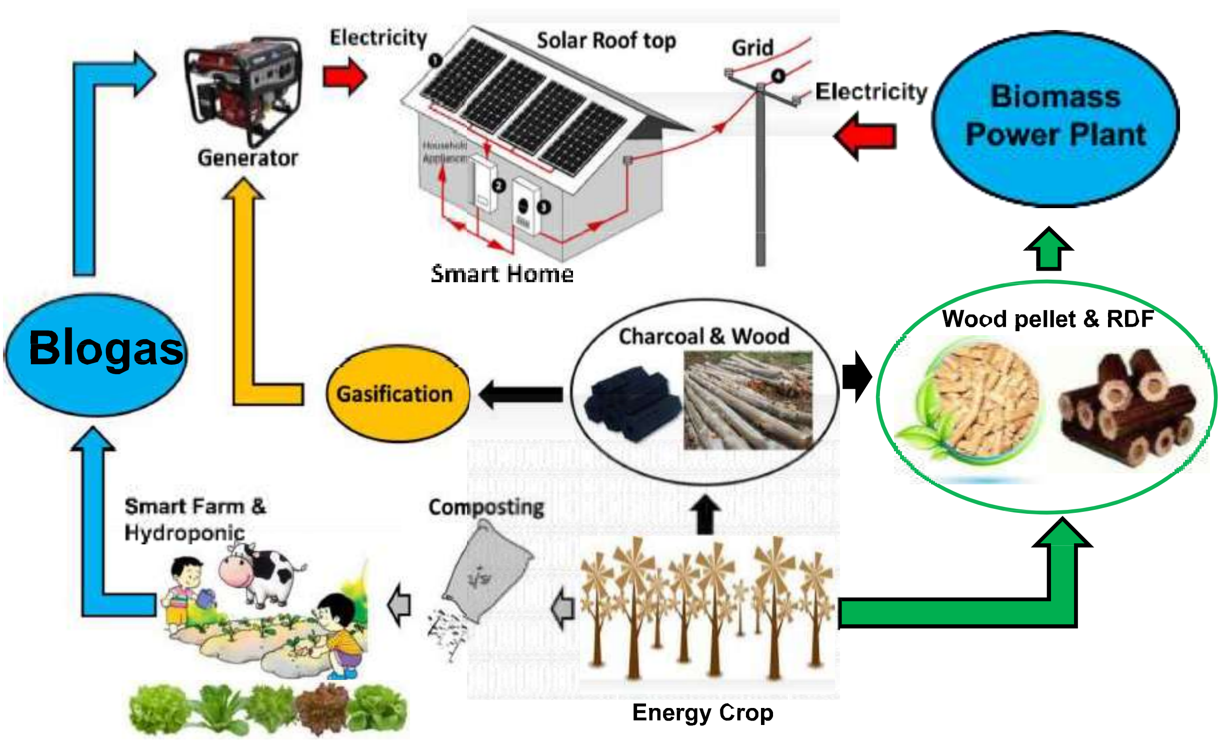
Smart Farm

AP 9-12



adiCET

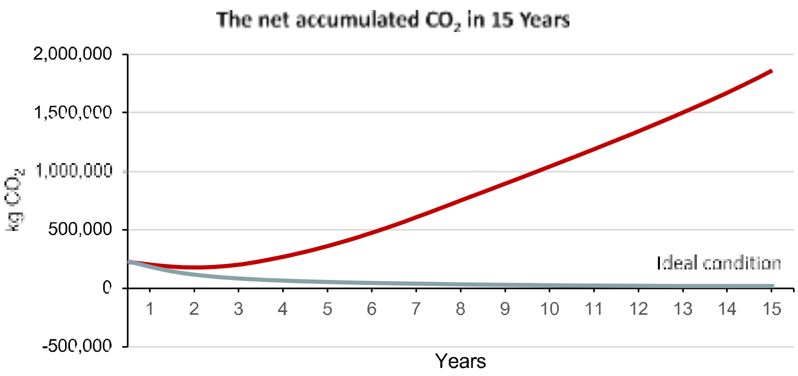
Zero Waste – BioEnergy Cycle



Waste Plastic Road

Solar Bus Stop EV Charging Station

Business as Usual/ Ideal Condition



No activity of CO_2 Mitigation (BAU)

- No use of Renewable Energy
- No change in energy efficient device
- No recycling and waste management
- Inefficient transportation
- Excess energy usage

Green Activity

- Green Space, Tree planting
- Renewable Energy usage
- Efficient Lighting/ No. 5 Devices
- Waste management and biomass usage
- Water management
- Energy efficient transportation and biofuel

Summary

- Renewable Energy and Green Technology for Local Community
  - Integrate with Community Resources - Ways of Living
  - Sufficiency Economy + Green Technologies (RE & EE)
  - Smart Grid as Infrastructure for Low Carbon City Development
- Smart Community
  - Living/ learning/training center for student, researchers, and general public
  - Projects focus on appropriate technology andmethods to solve real green city problems
- Moving Forward
  - Appropriate Technology; Monitoring/Optimization
  - Integration with Social Development and Economic Development
  - Train-the-trainers; General Public; Policy Maker
  - Create awareness
  - Share best practices – Database
  - Create Demonstrations Sites → Community Implementation

Acknowledgments

- Ministry of Energy, Thailand
- APEC Secretariat
- Chiang Mai Rajabhat University
- Office of Naval Research, USA
- National Research Council of Thailand
- University of Phayao
- ASEAN – U.S. Science and Technology Fellowship

Thank you

Website: www.adicet.cmru.ac.th
Facebook: www.facebook.com/adicetfan

O2O Training Program

Final Presentation

Appendix 9

Team 1 - adiCET Elephant Fuel
(Thailand)

Sustainable Waste Management to Renewable Energy in Mae Taman Elephant Camp

adiCET

Sustainable Waste Management to Renewable Energy in Mae Taman Elephant Camp

adiCET Elephant Fuel (adiELF)

Member: Sataklang T., Sawetrattanakul S., Kaewdang S.

Mentor: Dr Surachai Narrat Jansri and Dr Nuttiya Tantranont

AsiAsian Development College for Community Economy and Technology (adiCET)

APEC-ACABT YES Challenge 2018 (27 - 31 August 2018)

Outline

Why: the problem contexts and project goals

What: the base of the project

Where : the scope **How:** the implementation **When:** the time intervals

Who: the leadership, team and HRD

How Much: the efficiency of funding and output

What will happen: the outcome and impact

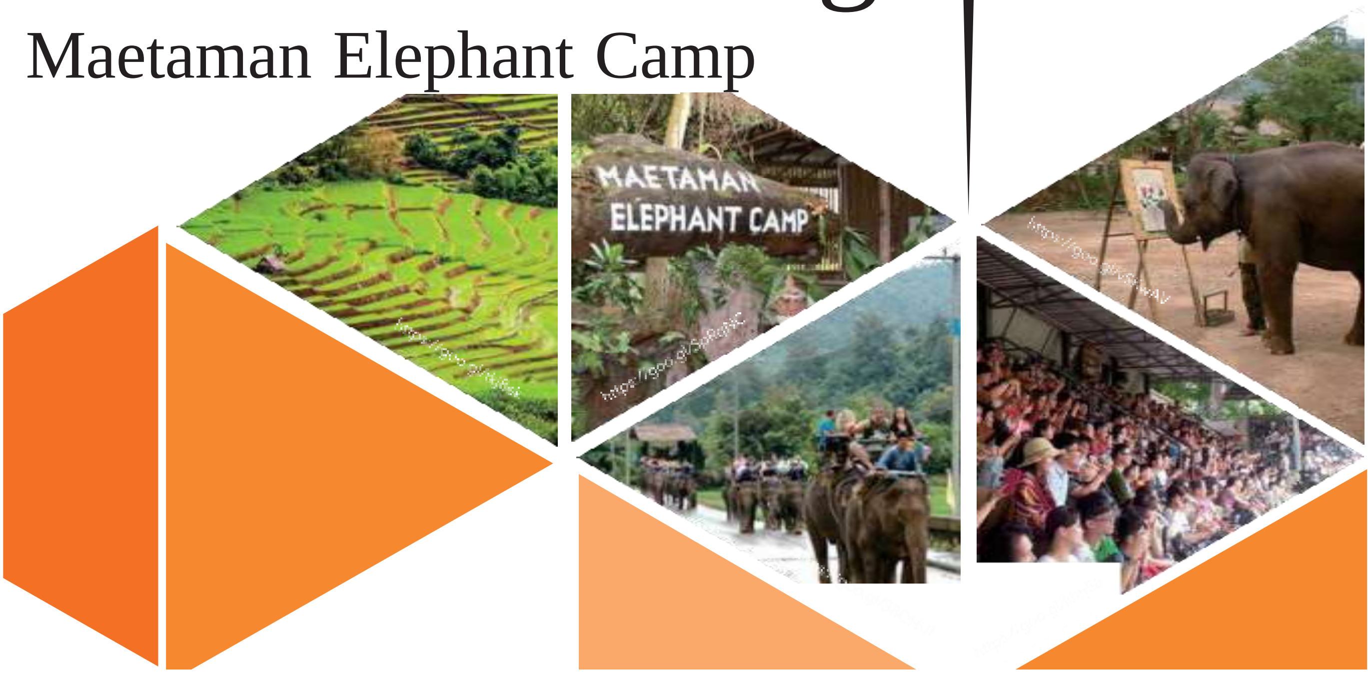
1

Why?

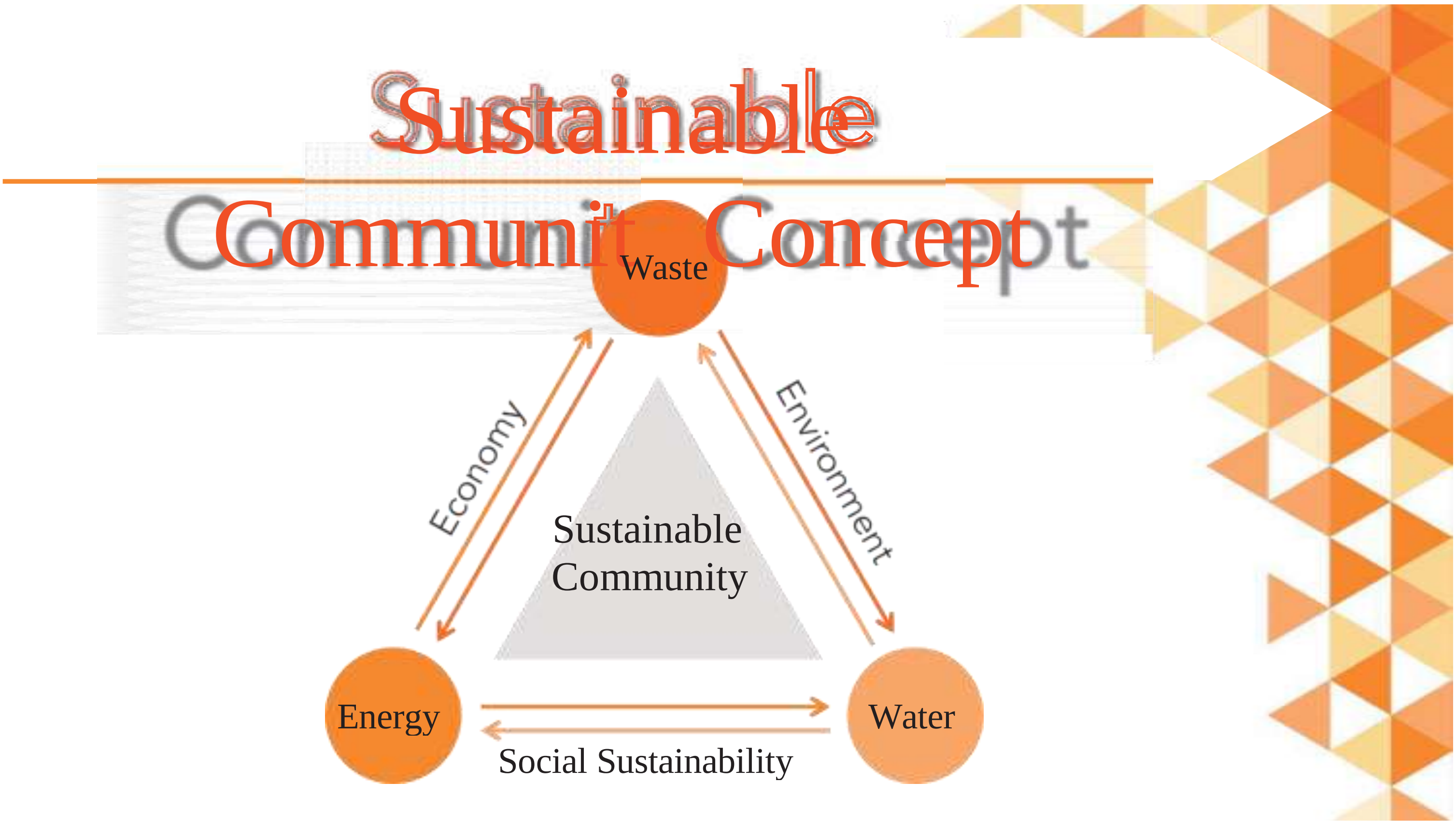
The problem contexts and project goals

Chiang Mai

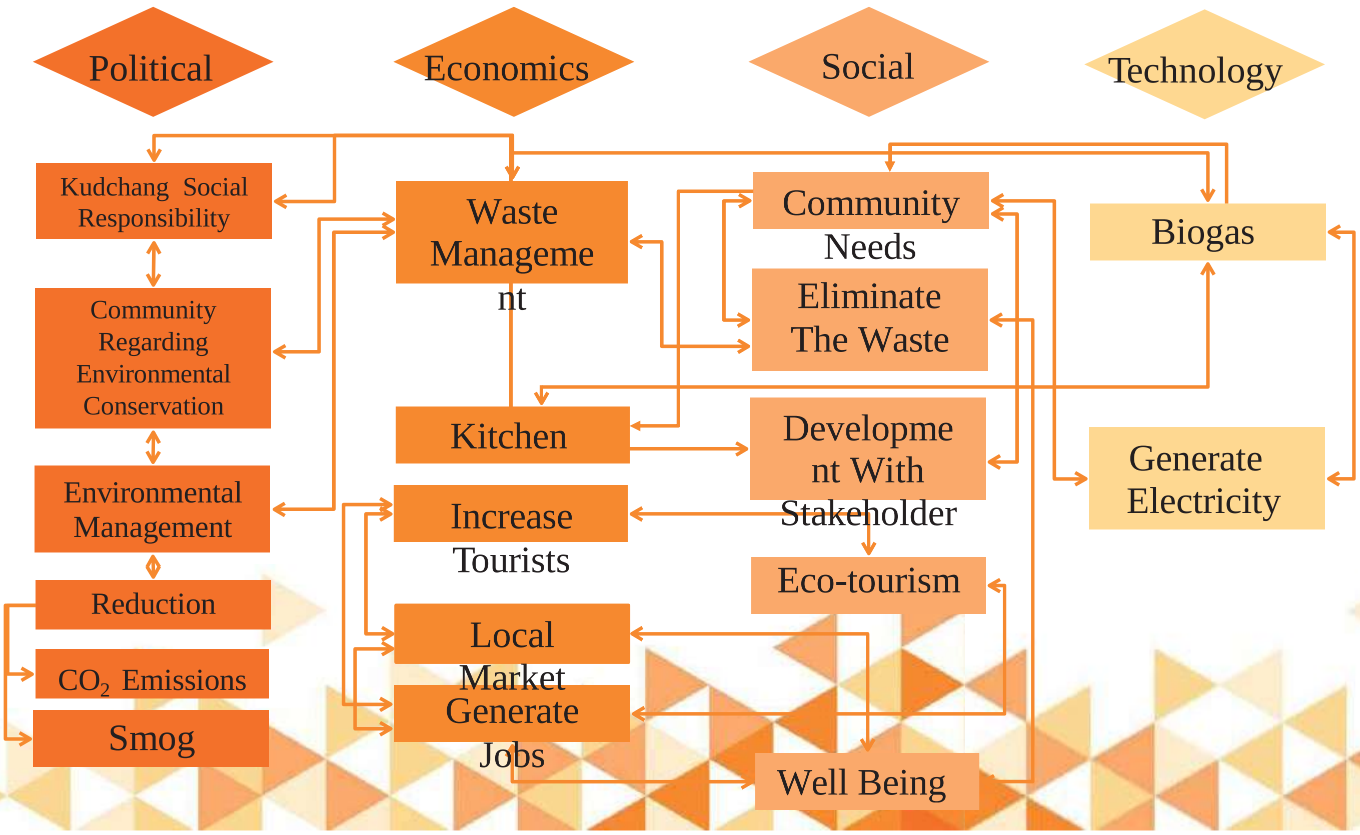
Maetaman Elephant Camp




Chiang Mai
Maetaman Elephant Camp
540,000 USD/Month
Income local community
15,000 kWh /Month High
Energy operating cost
Fuel & LPG
36,250 person & 60
Total tourists, worker and elephants
Elephants/Month
69+ ton/Month
Total wastes in camp (15,000 General/recyclable
ดีเซล

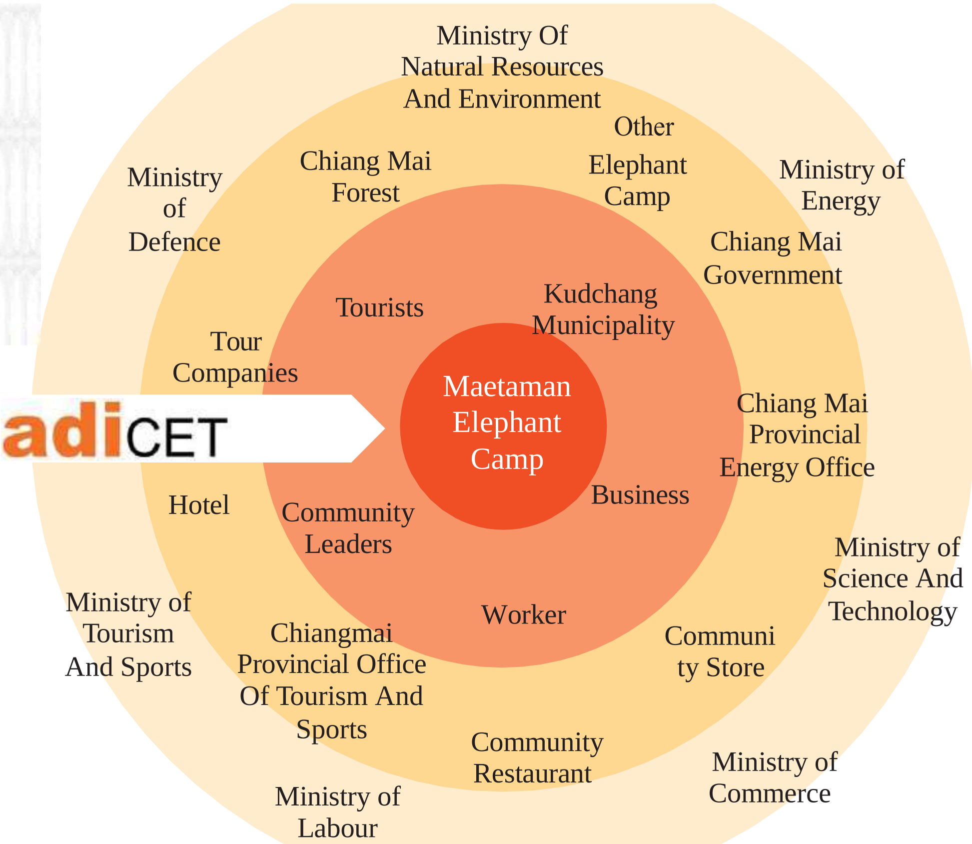

Sustainable
Community Concept
Waste
Economy
Environment
Sustainable Community
Energy
Water
Social Sustainability

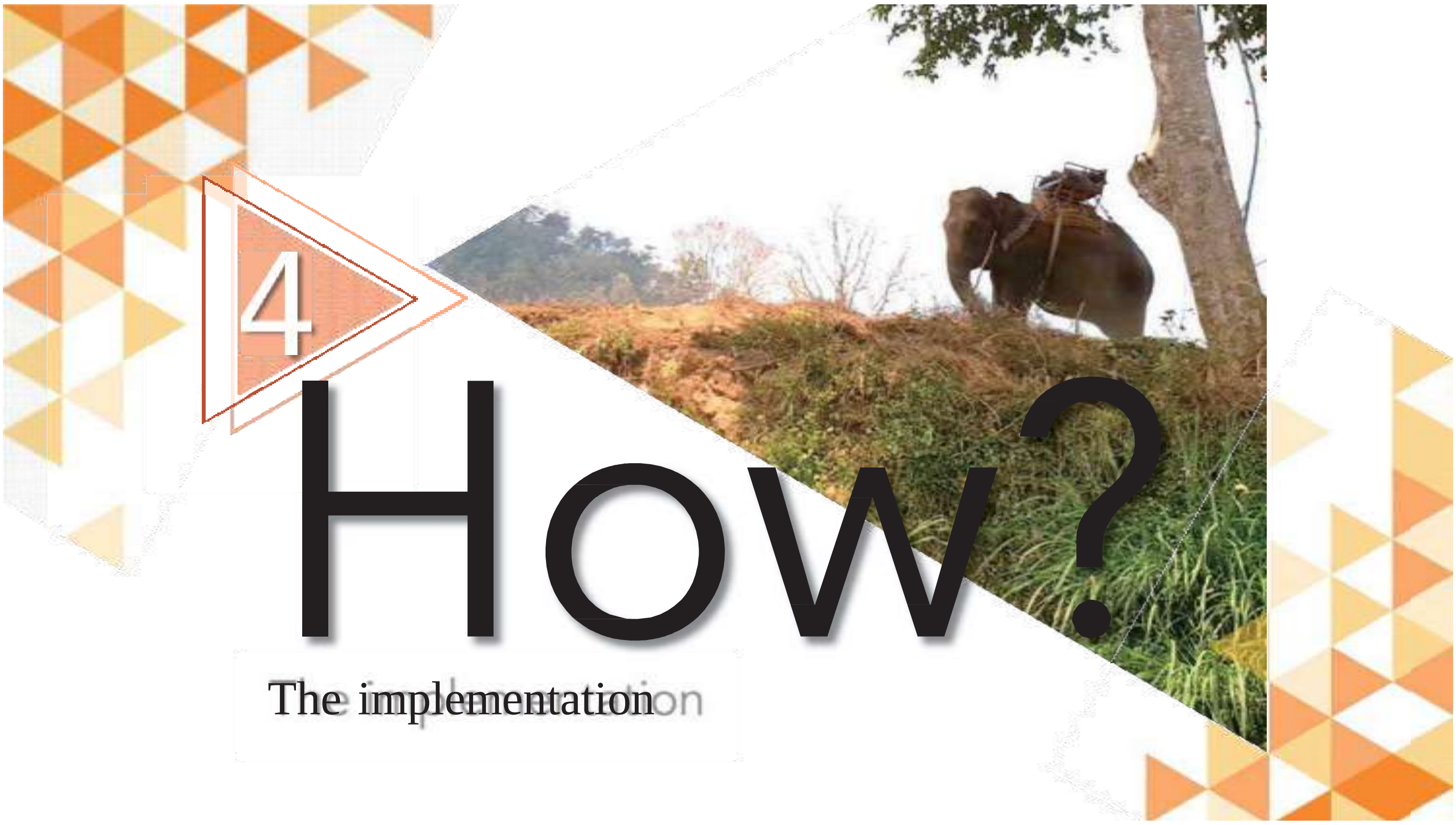

2
What?
The base of the project


Political
Economics
Social
Technology
Kudchang Social Responsibility
Community Regarding Environmental Conservation
Environmental Management
Reduction
CO_2 Emissions
Smog
Waste Management
Kitchen
Increase Tourists
Local Market
Generate Jobs
Community Needs
Eliminate The Waste
Development With Stakeholder
Eco-tourism
Well Being
Biogas
Generate Electricity

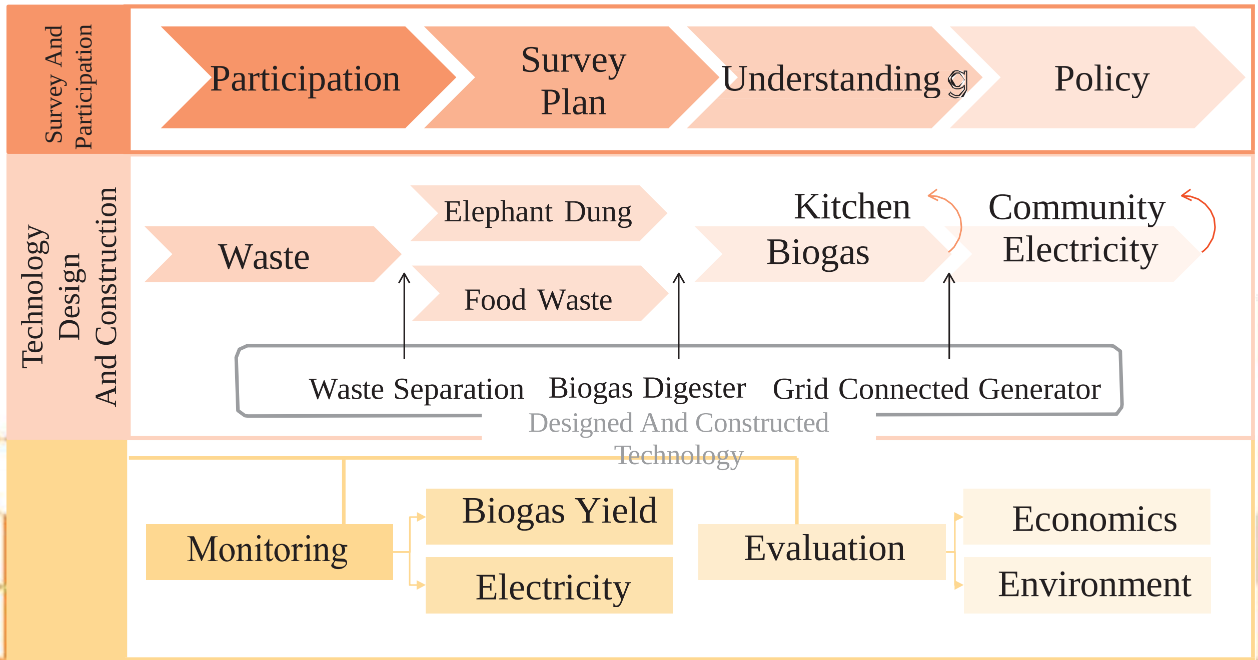
3 Where

The scope





Project Implementation



5

When?

The time intervals

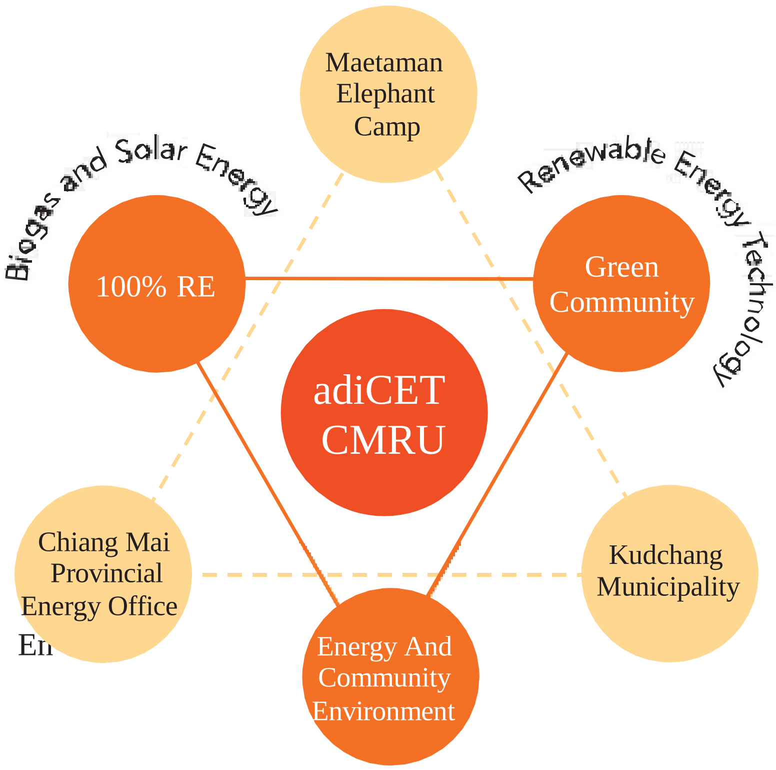
4 Year

1. Survey and Participation
   - Participation
   - Survey, Plan
   - Understanding
   - Policy
2. Technology Design and Construction
   - Data Analysis
   - Design
   - Biogas Digestion
   - Construction
3. Operation and Adaptation
   - Biogas
   - Generator
   - Collect Data
   - Adaptation
4. Monitoring and Evaluation
   - Monitoring
   - Evaluation
   - Economics
   - Environment

6

Who?

The leadership, team and HRD

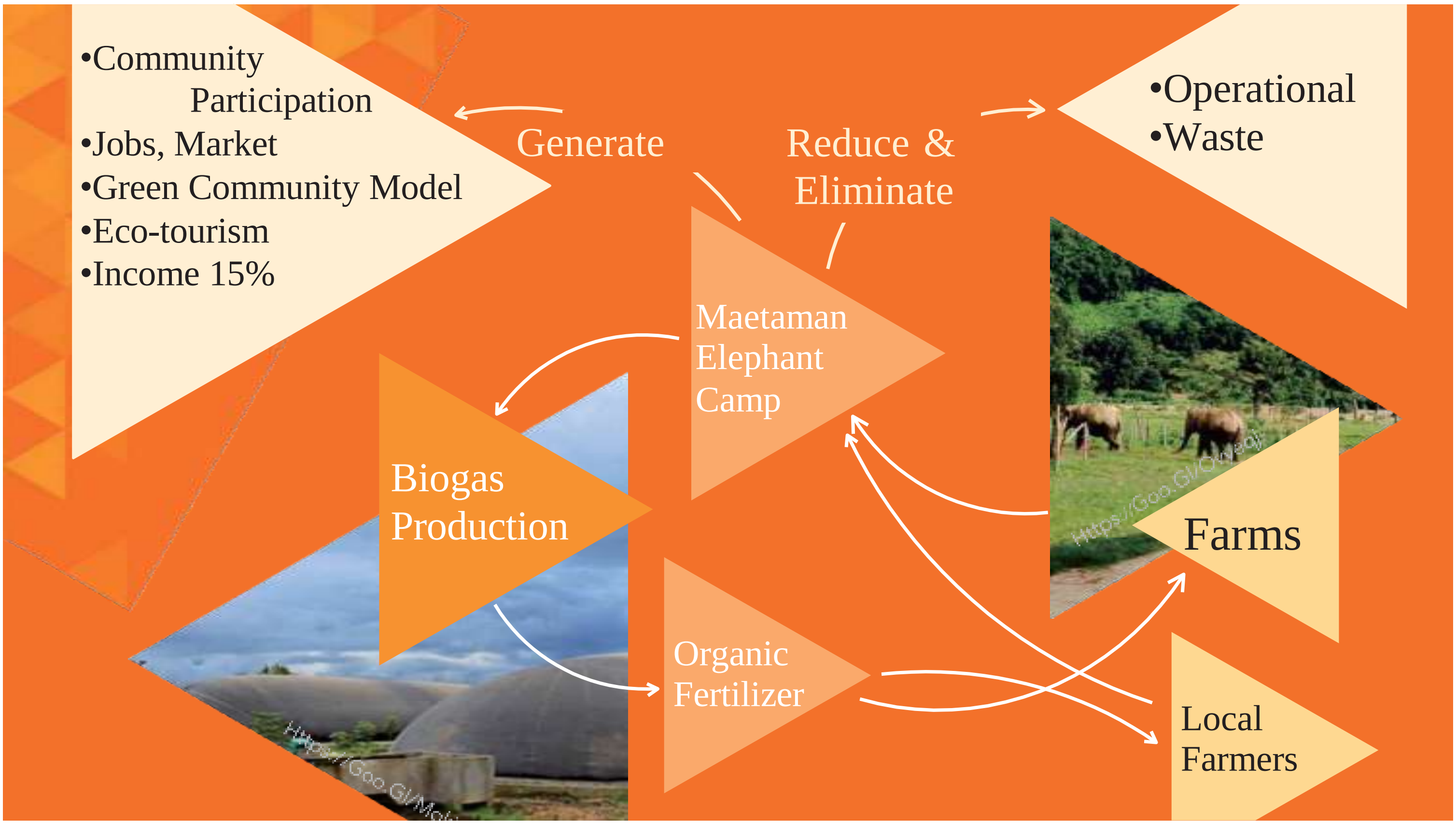


8

What?

will happen: the outcome and

impact

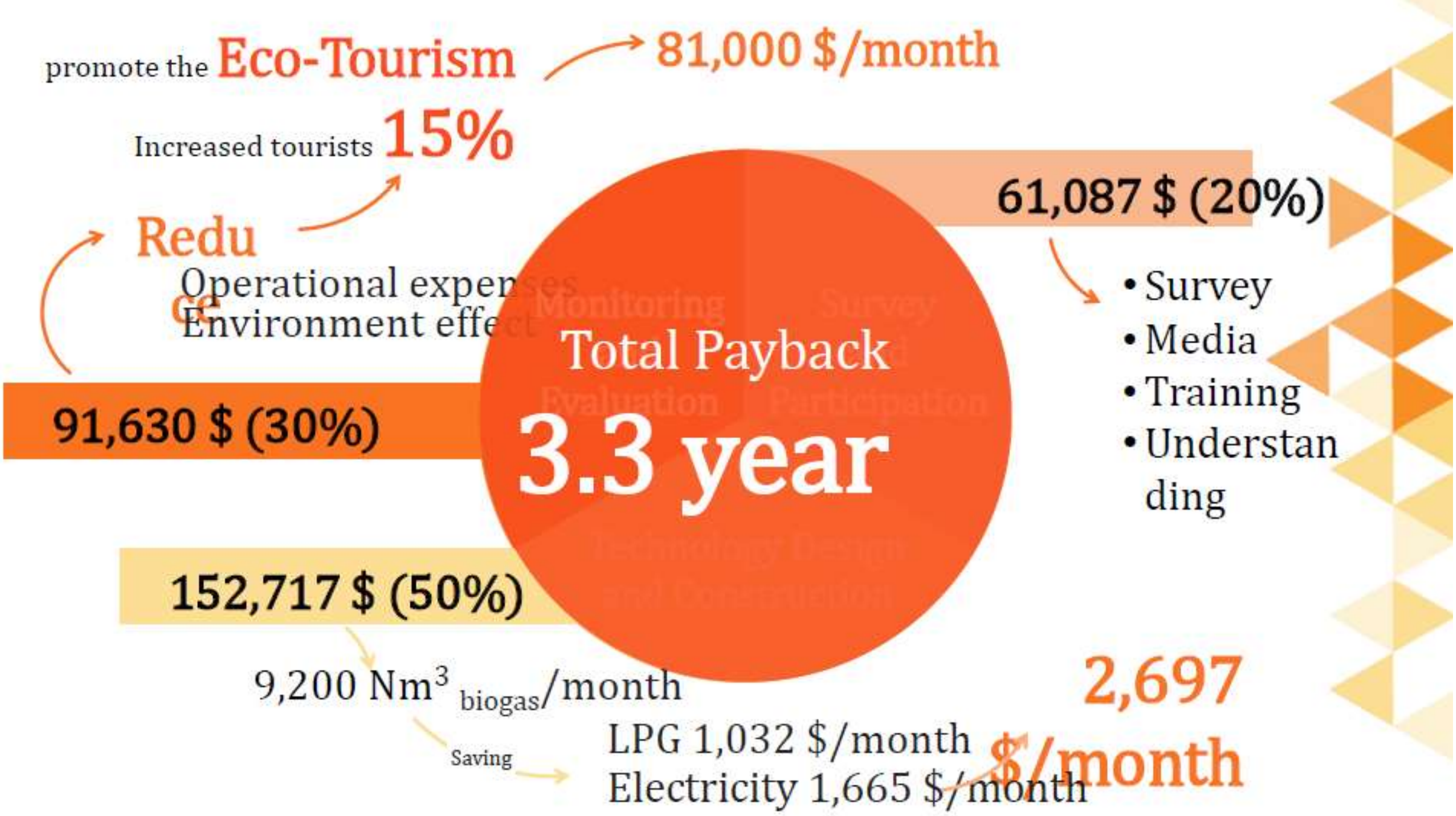


7

How Much?

The efficiency of funding and

output



- Business and Community → Understanding on waste management for green community
- Solve elephant dung waste with renewable energy → biogas → electricity & cooking (Elephant Camp) → Community Electrification
- Achieve eco-tourism for Maetaman Elephant Camp → 15% Increase Tourist → Income to community and business
- Project 4 years → 300K → 3.3 years

- **Model: Eco-Tourism based Self-Sustainable Green Community**
  - **Social**
  - **Economical**
  - **Environment**

adiCET

Sustainable Waste Management to Renewable Energy
in Mae Taman Elephant Camp

THANK YOU FOR YOUR ATTENTION

Asian Development College for Community Economy and Technology (adiCET)

Chiang Mai Rajabhat University, Thailand

Appendix 10

Team 2 - Smart Grid (Viet Nam)

SUSTAINABLE ENERGY FOR RURAL COMMUNITY

APEC
Asia-Pacific Economic Cooperation

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

SUSTAINABLE ENERGY FOR RURAL COMMUNITY

SMART GRID TEAM

MENTOR:
Dr. Nguyen Thi Mai Linh

TEAM MEMBERS:
Tran Duc Minh
Nguyen Phan Kim Ngan
Tran Vuong

APEC
Asia-Pacific Economic Cooperation

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

Electricity Abundant

Smart Home

Shortage of Electricity

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

PROBLEM STATEMENT

PROBLEMS

ENVIRONMENTAL

- Increasing carbon footprint due to usage of bad energy sources; ex: fossil,kenosene..
- Adding greenhouse gas emission and global warming
- Polluting air, water, and soil due to unethical waste disposals

SOCIAL

- Lacking of electrical supplies
- Long outage and blackout duration
- No usage of sustainable energies
- The fluctuation of renewable energy due to the weather effect

ECONOMICAL

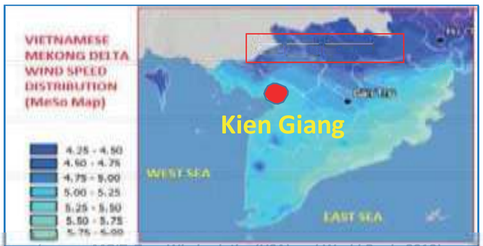
- High cost of electricity compares to metropolitan areas
- Unstable electrical prices
- Inefficient energy management
- Causes stagnation in economic growth due to electricity shortage

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

- **Renewable energy potentials in Kien Giang province**

Wind power potential

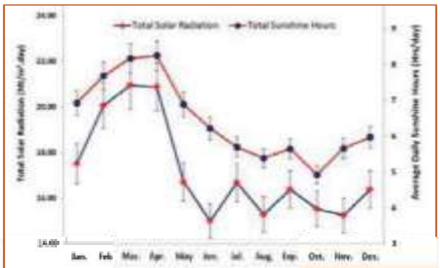
Kien Giang Province



Wind speed (m/s) distribution map in Mekong Delta based on the simulation

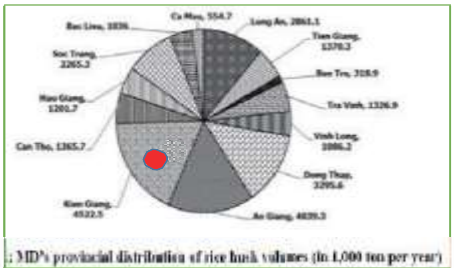
(source: MOIT, True Wind solution(USA) and World Bank, 2010)

Solar power potential



Monthly average of daily solar radiation and daily sunshine hours

Biomass power potential



(Source: the rice production statistical data in 2014 (GSO,2015))

The coastal lines in the height of 80m above the coastal land surface, with the average wind speed can be reached at rank of 5.75 6 m/s.

The absolute minimum/maximum temperatures rarely exceed 15/39 deg.

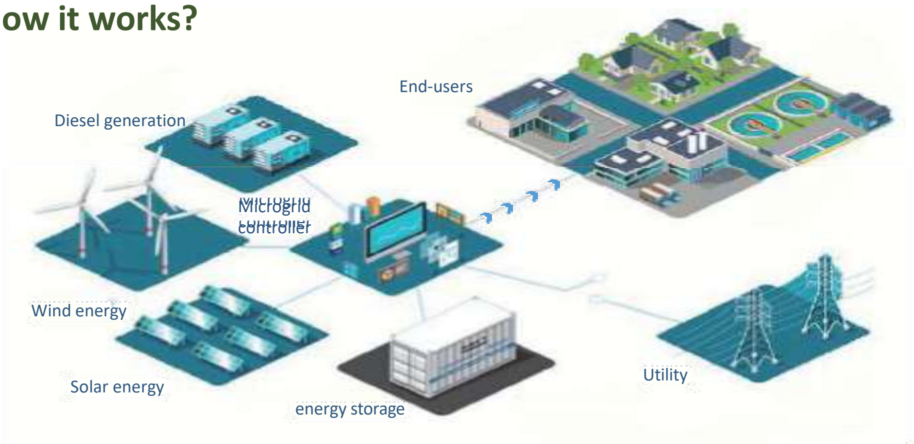
APEC Research Center for Advanced Biohydrogen Technology (ACABT)

Asia-Pacific Economic Cooperation

What is MICROGRID?

- A microgrid is a small-scale power grid that can operate independently or collaboratively with other small power grid.
- It can effectively integrate various sources of distributed generation, especially renewable energy sources.

How it works?



Microgrid system

cloud and big data
d

Energy storage

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

Asia-Pacific Economic Cooperation

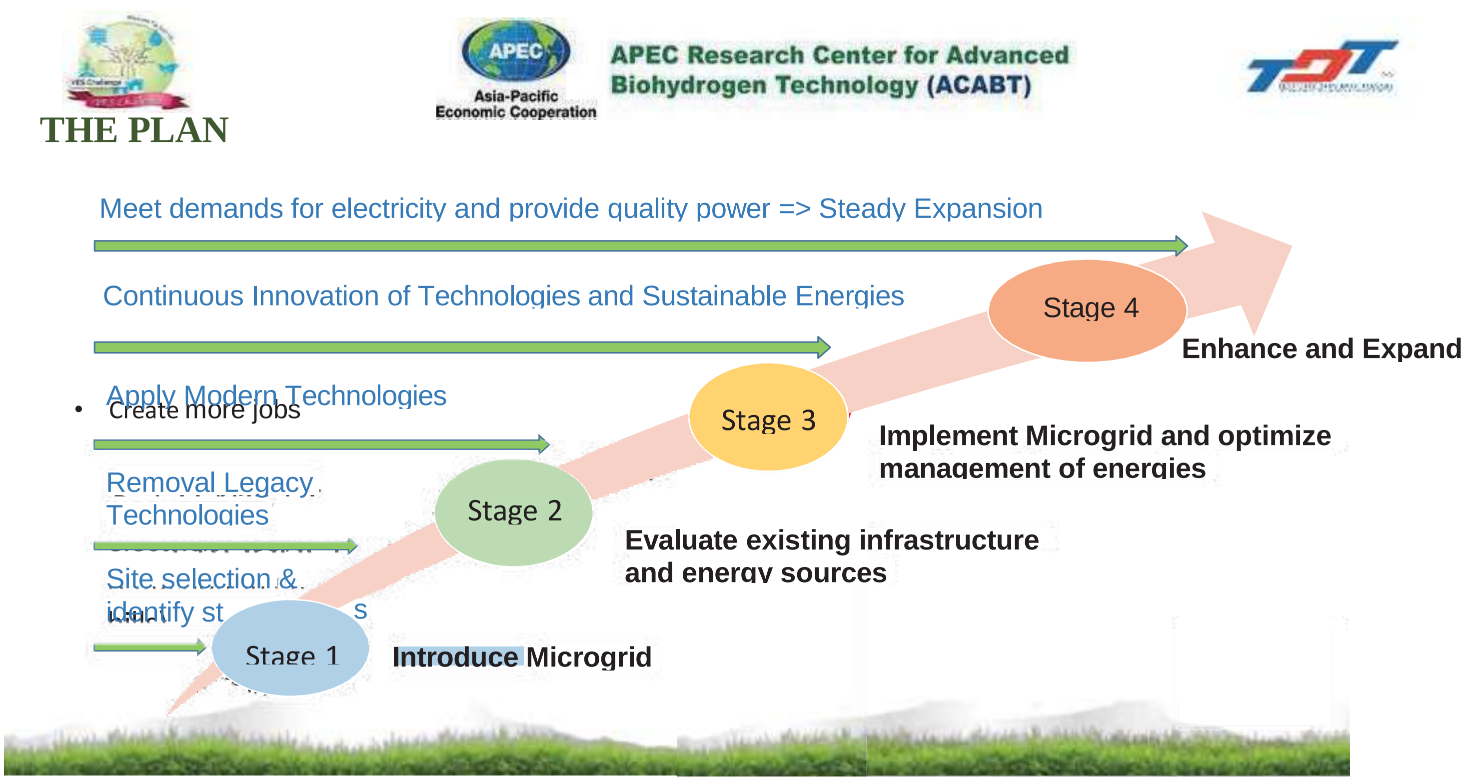
STAKEHOLDERS

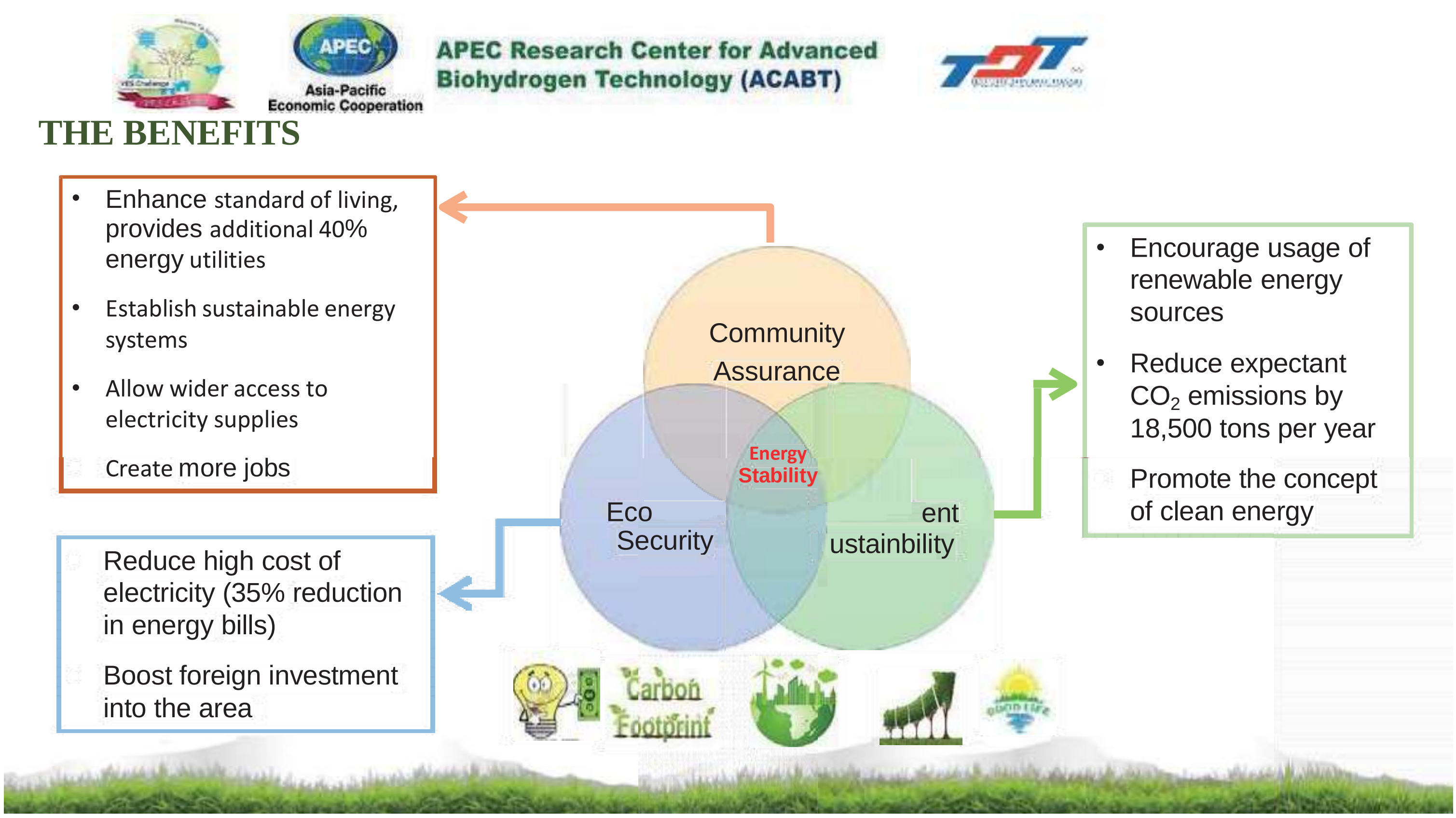
LOCAL GOVERNMENT

CONSUMERS

TECH SERVICE PRODUCERS

UTILITIES PROVI ERS


THE PLAN
APEC
Asia-Pacific Economic Cooperation
APEC Research Center for Advanced Biohydrogen Technology (ACABT)
Meet demands for electricity and provide quality power => Steady Expansion
Continuous Innovation of Technologies and Sustainable Energies
Apply Modern Technologies
Create more jobs
Removal Legacy Technologies
Site selection & identify st s
Stage 1
Introduce Microgrid
Stage 2
Evaluate existing infrastructure and energy sources
Stage 3
Implement Microgrid and optimize management of energies
Stage 4
Enhance and Expand


THE BENEFITS
APEC
Asia-Pacific Economic Cooperation
APEC Research Center for Advanced Biohydrogen Technology (ACABT)
Enhance standard of living, provides additional 40% energy utilities
Establish sustainable energy systems
Allow wider access to electricity supplies
Create more jobs
Reduce high cost of electricity (35% reduction in energy bills)
Boost foreign investment into the area
Community Assurance
Energy Stability
Eco Security
ent ustainbility
Encourage usage of renewable energy sources
Reduce expectant CO_2 emissions by 18,500 tons per year
Promote the concept of clean energy
Carbon Footprint

APEC
Asia-Pacific Economic Cooperation

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

"Empowering the world with sustainable energy, one grid at a time! Microgrid!"

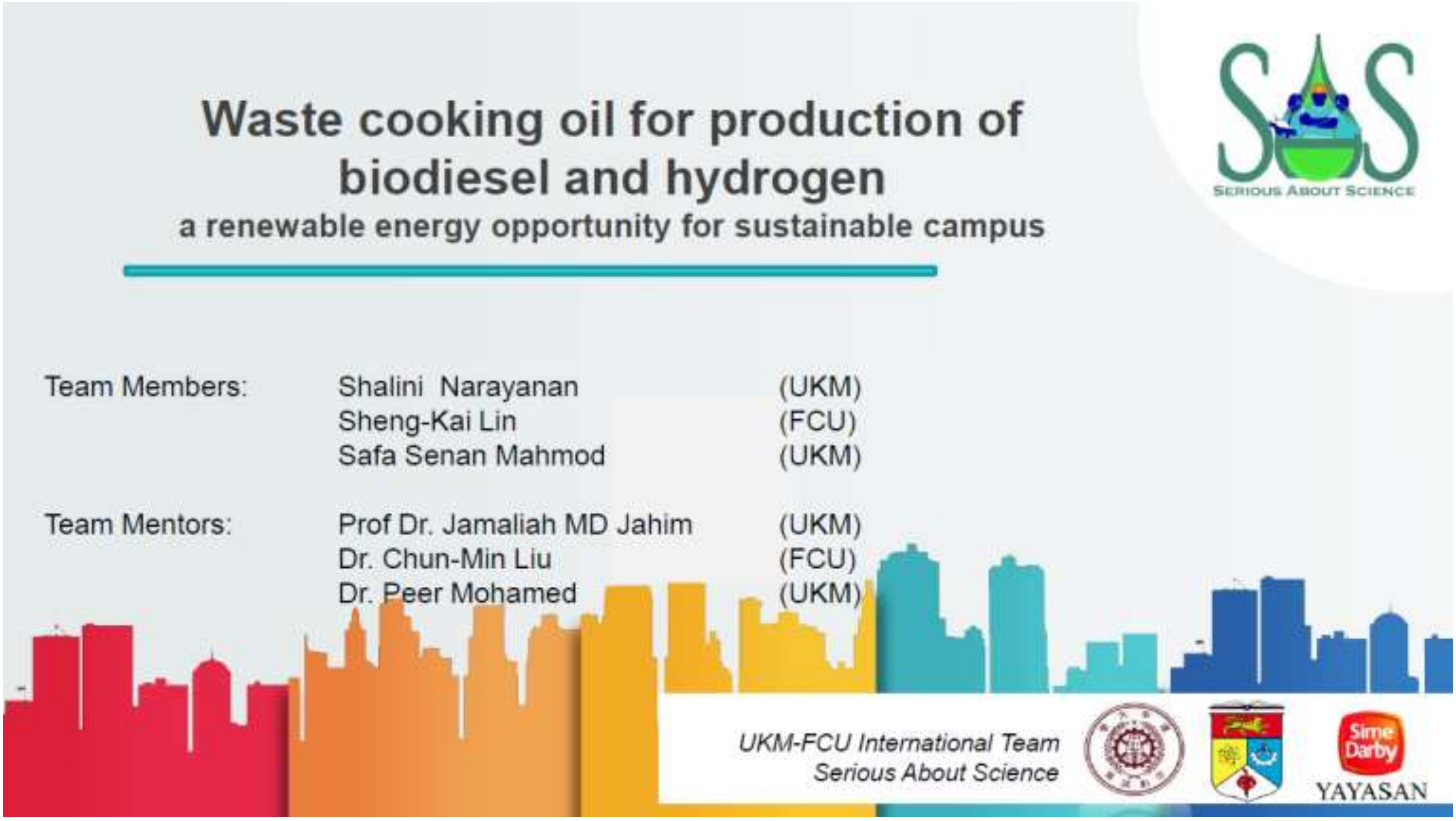
THANK YOU FOR LISTENING

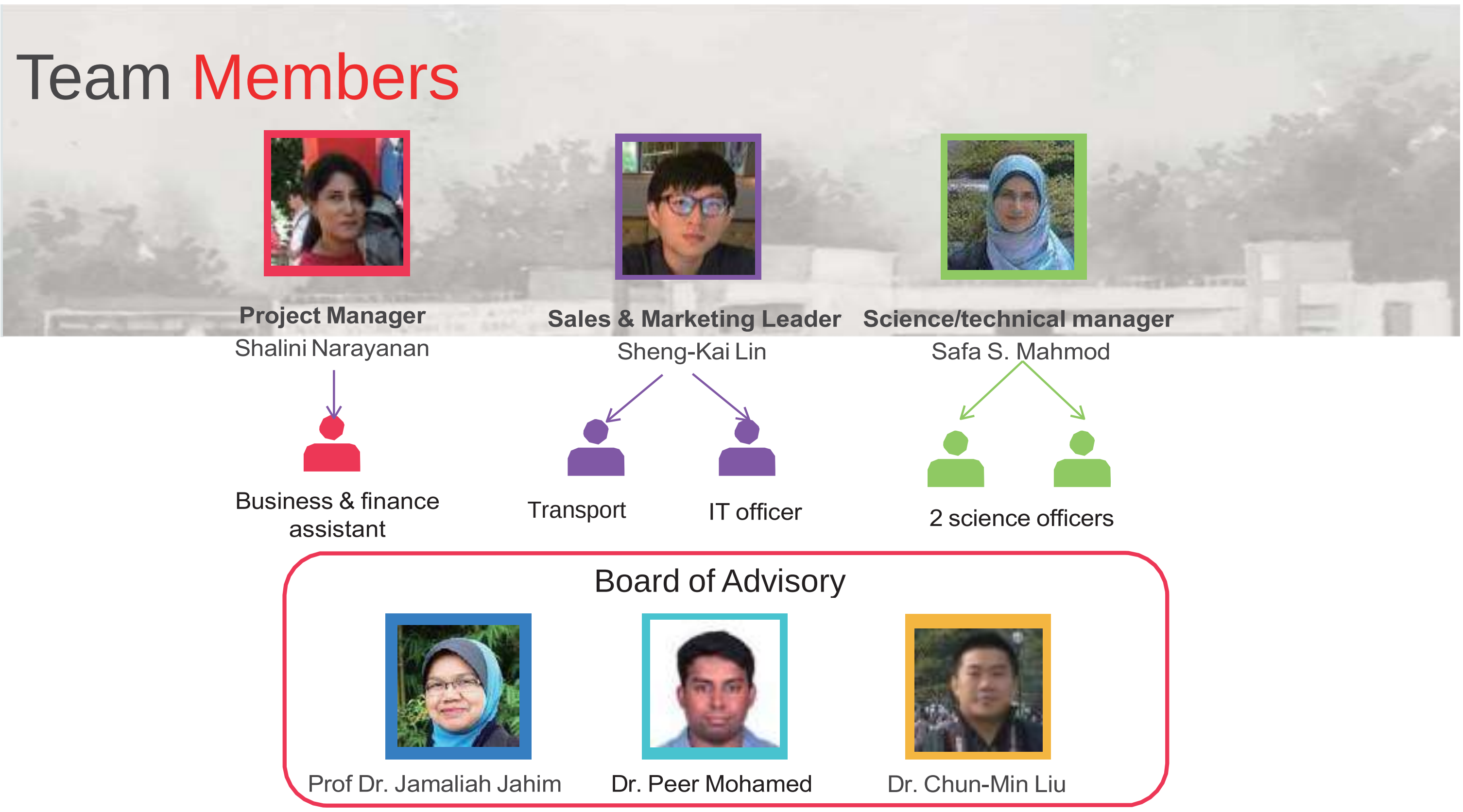
Appendix 11

Team 3 - Serious About Science (Malaysia)

Waste cooking oil for production of biodiesel and hydrogen

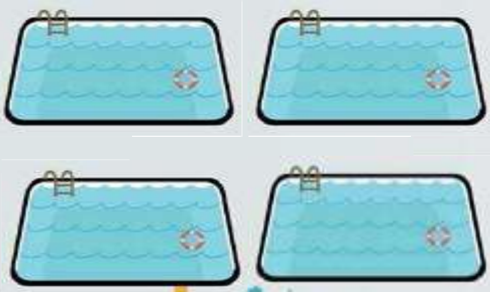
a renewable energy opportunity for sustainable campus

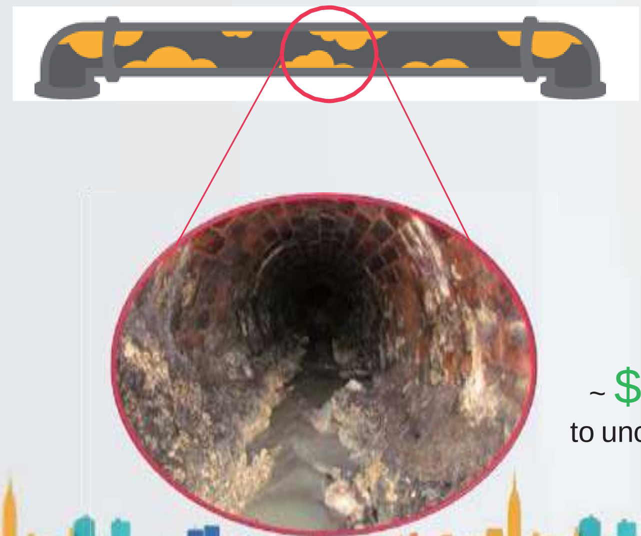

Waste cooking oil for production of biodiesel and hydrogen
a renewable energy opportunity for sustainable campus
Team Members: Shalini Narayanan (UKM)
Sheng-Kai Lin (FCU)
Safa Senan Mahmod (UKM)
Team Mentors: Prof Dr. Jamaliah MD Jahim (UKM)
Dr. Chun-Min Liu (FCU)
Dr. Peer Mohamed (UKM)
SERIOUS ABOUT SCIENCE
UKM-FCU International Team
Serious About Science
Sime Darby
YAYASAN


Team Members
Project Manager
Shalini Narayanan
Business & finance assistant
Sales & Marketing Leader
Sheng-Kai Lin
Transport
IT officer
Science/technical manager
Safa S. Mahmod
2 science officers
Board of Advisory
Prof Dr. Jamaliah Jahim
Dr. Peer Mohamed
Dr. Chun-Min Liu

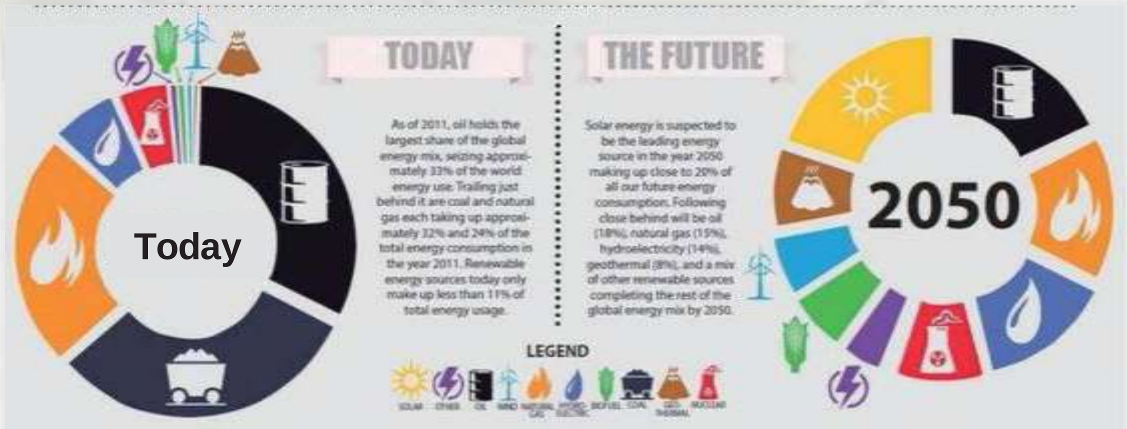
Current Situation..

130 tonnes of FOG





~ $$
to unclog

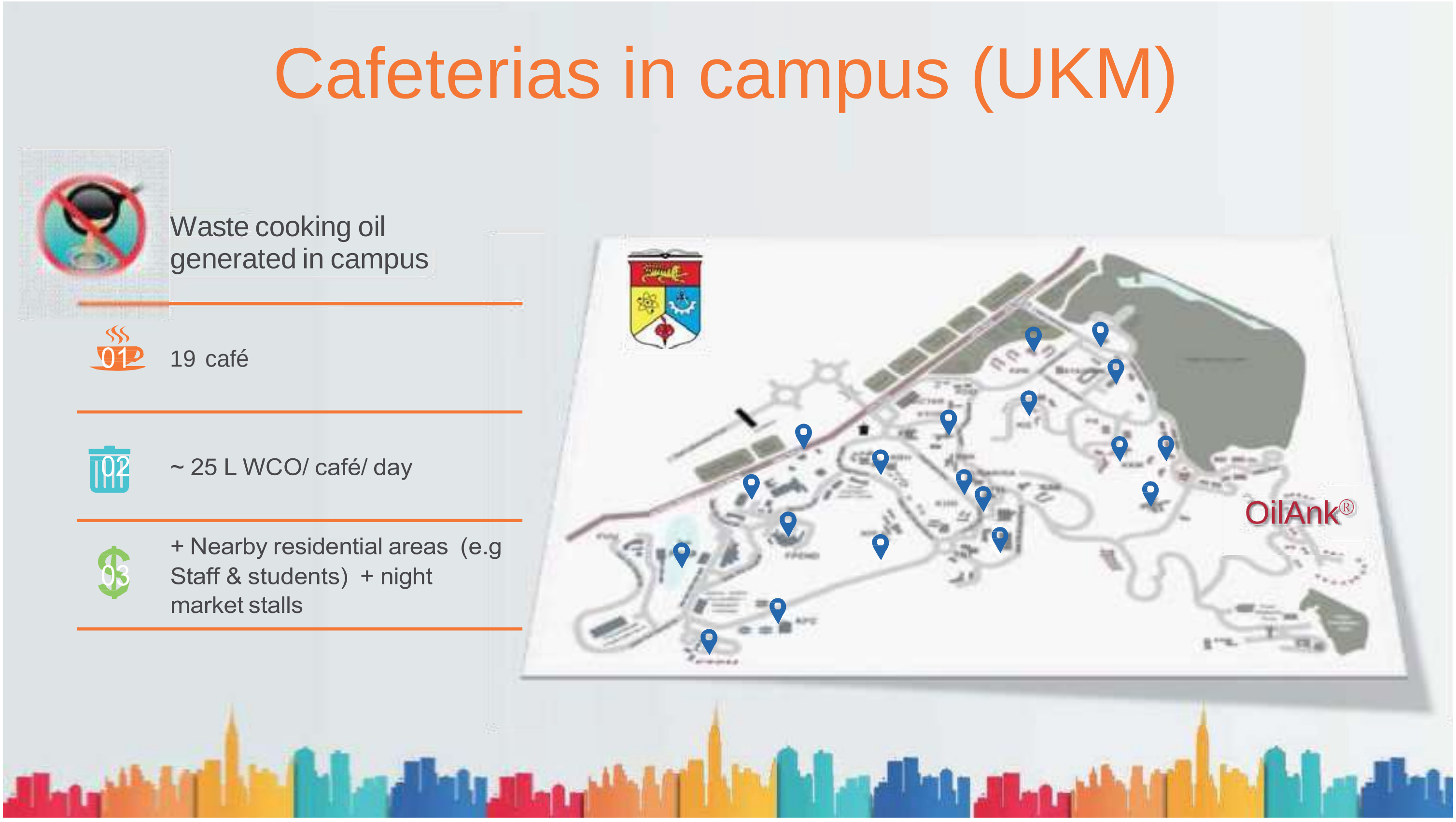


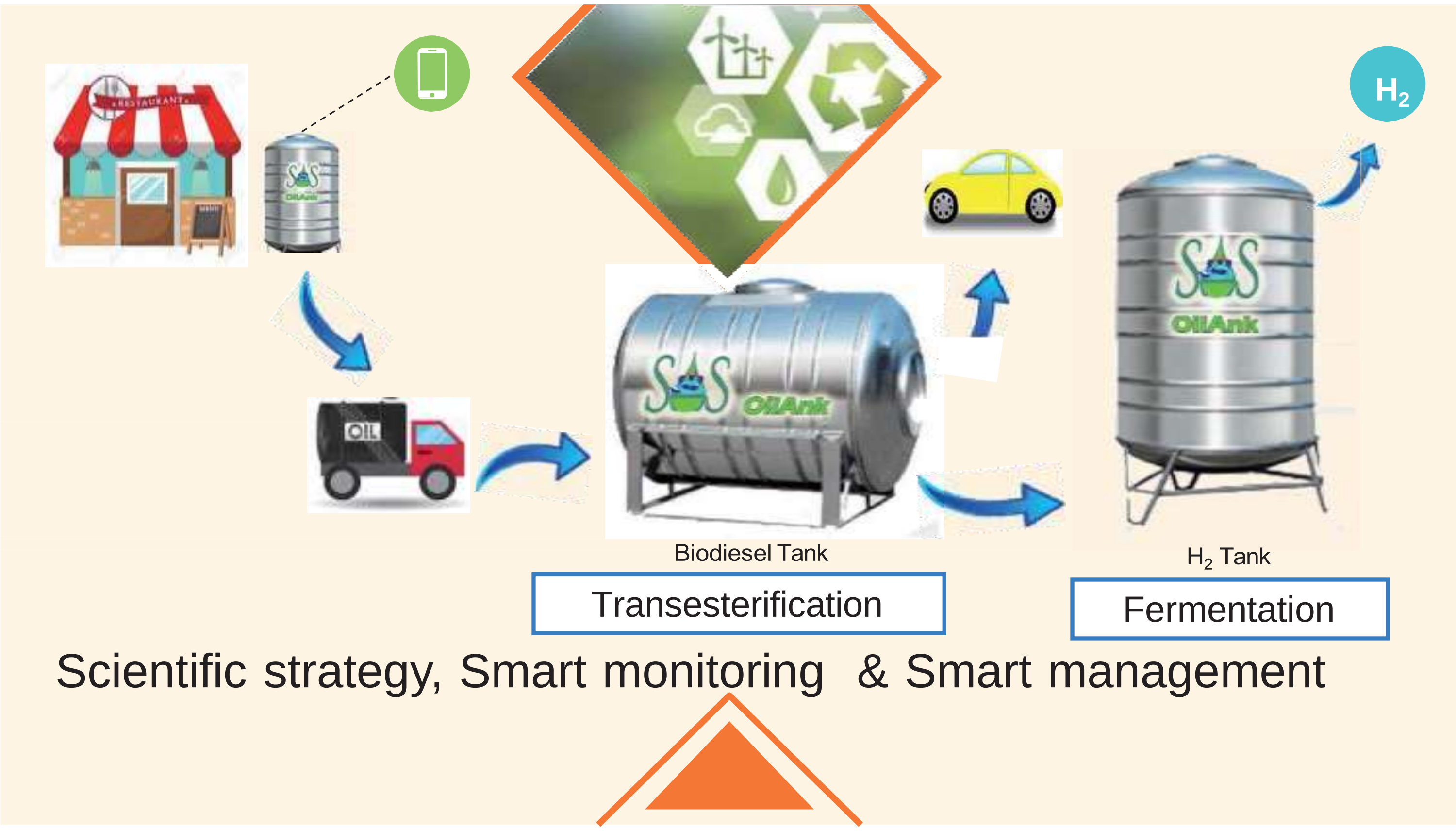
Vision
To promote the revitalization of waste cooking oil as valuable resources

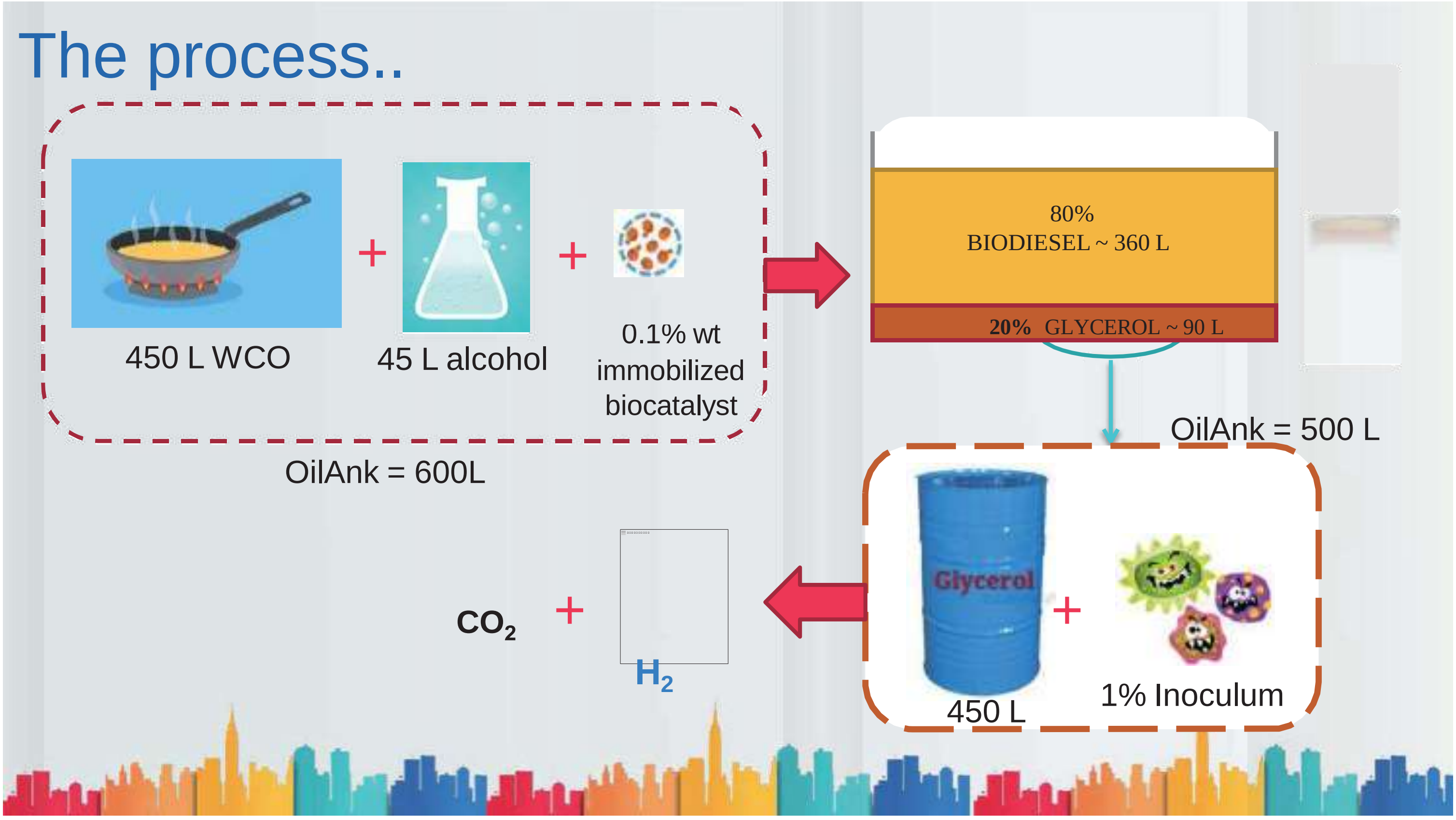
Mission
To convert used cooking oil to biodiesel and H_2 at sustainable levels of profitability with lower impact and environmentally responsible manner

Importance
To promote the commercial growth of recycling used cooking oil into biodiesel and hydrogen with the aide of **Artificial intelligence**
.

Novelty
The WCO conversion system in Malaysian university campus (targeted community) which promotes **Circular economy** strategy.


Cafeterias in campus (UKM)
Waste cooking oil generated in campus
01
19 café
02
~ 25 L WCO/ café/ day
03
+ Nearby residential areas (e.g Staff & students) + night market stalls
OilAnk®


OIL
H2
Biodiesel Tank
Transesterification
H2 Tank
Fermentation
Scientific strategy, Smart monitoring & Smart management



The process..
450 L WCO
+
45 L alcohol
+
0.1% wt immobilized biocatalyst
OilAnk = 600L
80%
BIODIESEL ~ 360 L
20% GLYCEROL ~ 90 L
OilAnk = 500 L
Glycerol
450 L
+
1% Inoculum
CO2
+
H2

Market
Strategy
Smart bioenergy monitor system on-campus
Market growth
Biodiesel Market Growth Rate: 7.3% by 2025
Key Trend
Advances in bioenergy technologies
Key Driver
Increasing concerns about energy security and GHG emissions

Targeted community

At initial stage, UKM cafes, UKM community

Future Expansion Concerns

01 Nearby residential communities

02 Food companies/ Restaurants

03 Companies interested to generate renewable energies and reduces the GHG emission

04 Hospitality industries gravitating towards environmentally conscientious establishment

Business Partners & Key stakeholders

School of ICT-UKM
Mobile app developers

Faculty of Science-UKM
Providing the recyclable biocatalyst and inoculum.

Institute of Fuel cell-UKM
For the secondary product of OilAnk, biohydrogen gas.

Restaurants & café-UKM
Providing WCO in OilAnk collection units installed at their locations.

Transportation Unit-UKM
Mainly university buses, cars, etc…

Funding Struct ure & Stakeholder Be nefits

- Successful commercialization in ar
  economy importance
- Opportunity to prove business/ac
  collaboration project

ea of

ademic

Revenue genera

Fuel Security

Waste to wealth to health

Climate sustainability

Investments implementation

- Planning & consultation
- Administration & insurance
- Building, location & infrastructure

Capital Cost (CAPEX)

	Price (USD)
Construction cost	5,000
Collection tanks (150L x 16)	6,000
Pumps x3	3,600
Bio-catalyst / inoculum	5,000
Analysis	3000
Labour (~ 6)	6,000
Total	28,600

Operation Cost (OPEX)

	Cost (USD)/month
Salaries x 8	4,000
Repairs & maintenance	500
Advertising & Marketing	-
Domain Name	10
Tax	Exempted
Transportation	500
Utilities &Equipment	300
Total	5,310

Market size test on UKM buses @ first year

450 L cooking oil collected/ day
360 L biodiesel generated/ day
9000 L biodiesel generated/ month
108000 L biodiesel per year ~ 23,000 gallon

25 Buses,
8 Km traveled * 25 trips = 200 km
80 L of diesel is needed per bus * 25 Bus
= 2,000 L diesel

18% biodiesel blend
= 360 L biodiesel ÷ 25 buses = 14.4 L biodiesel/bus

Year 1 (2018)

Diesel price (August 2018)= RM 2.18
Savings = 14.4*1.90 = RM 30/day/bus
~ USD 5,800/MONTH

Year 2 (2019)

Savings = 20*1.80

= ~USD 5,620/month/25 bus

Year 3 (2020)

1,260 *12= 1,560

Year 1 = RM 18,720

Year 2 = RM 15,120

Total= ~USD 8,500

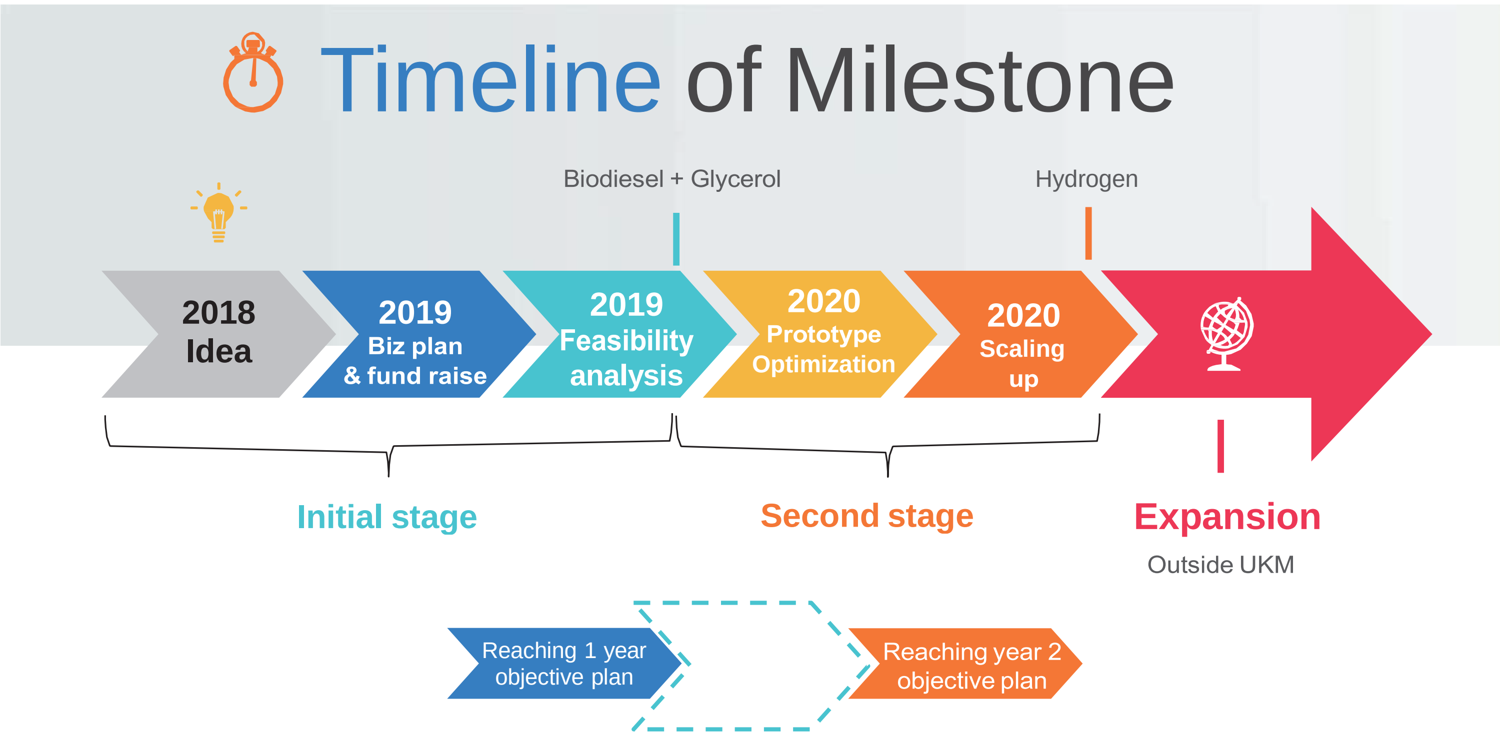
Investment: USD 127,440

Annual revenue
YEAR 1: USD 68,400
YEAR 2: USD 67,500

Total gain from investment = USD 135,900

Return-on- investment (ROI)= 6.64% in the first two years


Key promotional activities
OilAnk helps in achieving zero-waste campus goal, green buses and vehicles, cleaner environment.
Awareness campaigns in campus
Channels used to promote ideas
Internships
Towards zero-waste sustainable community


Timeline of Milestone
Biodiesel + Glycerol
Hydrogen
2018 Idea
2019 Biz plan & fund raise
2019 Feasibility analysis
2020 Prototype Optimization
2020 Scaling up
Initial stage
Second stage
Expansion
Outside UKM
Reaching 1 year objective plan
Reaching year 2 objective plan

Competitive Matrix

Product	Inbuilt substrate filter	Reusable catalyst	One step Biodiesel recovery	Energy recovery	Substrate for biopharmaceutical	Towards Industry 4.0
OilAnk®	✓	✓	✓	✓	✓	✓
Malaysia - UPM Selangor	✓		✓		✓	
Chinese Taipei -Sunho Biodiesel corporation		✓	✓			
China - Sinopec, Shanghai		✓		✓	✓	
India - Bengalore	✓		✓			
UK - Green Lizard Technologies			✓			
USA - Solfuels,	✓	✓				
Columbia - Bioils + Triogroup	✓	✓	✓		✓	
Canada -Huiles Biocycle		✓		✓	✓	

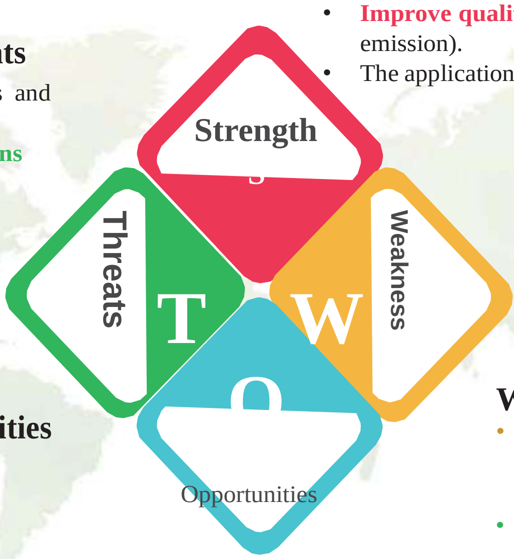
SWOT Analysis

Strength

- The necessary **sustainable management know-how** exists.
- Efficiency **improvement of FOG clogs** in waste water treatment plants.
- **Improve quality of local environment** (decrease car bon emission).
- The application of **AI & IoT** for monitoring.

Threats

- **Lack of coordination** between suppliers and consumers.
- Can work **only if accepted by the citizens** (UKM student and staff).
- **Low participation levels** from citizens.
- **Drop** in diesel price



Opportunities

- Increase in **diesel price**
- **Reduced dependence** of petrodiesel.
- Results in **new permanent jobs**.
- Decrease in **UKM transportation cost**.

Weaknesses

- **Lacking cooperation** between political authorities and enterprises.
- **Lacking involvement** of private persons in most of energy policy coordination.
- **Strained budget situation** in the communities.

Environmentally

- Reduce local **GHG emissions** of the transport sector
- **Indirect land use change impact** for biofuels.

Socially

- Create **on-campus economic opportunities** to help university students
- **Social Enterprise** maximizing social impact alongside profits

Economically

- Generates revenue.
- Create a base for sustainable local economies.
- Develop environmental solutions for energy efficiency.

Thank You

Let’s start frying !!

Appendix 12

Team 4 - Beauty Squad (Indonesia)

Facial mist from velvet apple extract for antibacterial

“FACIAL MIST FROM VELVET APPLE EXTRACT FOR ANTIBACTERIAL”

Achrimidiasti Oktariflani, S.Si (Leader Team)
(Pakuan University)

Nadya Mauranti Fachruddin
(Bogor Agricultural University)

Fuji Lestari
(Bogor Agricultural University)

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APEC
Asia-Pacific Economic Cooperation

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

Introductions

The background that is the basis of our project, namely:

1. **Green economy:**
   - Sustaining and advancing economic,
   - Environmental, and
   - Social well-being
2. **Natural Resources**
3. **Sustainability awareness**

WHY VELVET APPLE??????

Velvet Apple

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BENEFIT THE VELVET APPLE

Use to bioplastic and compost

Reduces inflammation and irritation on the skin

Stimulates hair growth and speeds up healing process

Helps to prevent premature aging and chronic diseases

Reduces stress on cardiovascular system and blood vessels

Strengthens immune system

Eliminates constipation and other gastro-intestinal issues

Boots red blood cell count in body

The Velvet Apple

CLASSIFICATION

Kingdom : Plantae
Divisio : Magnoliophyta
Classis : Magnoliopsida
Ordo : Ericales
Family : Ebenace
Genus : *Diospyros*
Species : Diospyros blancoi

DESCRIPTOIN:

Plant high: up to 20 m or more, Fruit diameter: 5.13-9.88 cm, Fruit flesh color: Creamy Yellowish, Flavor: sweet.

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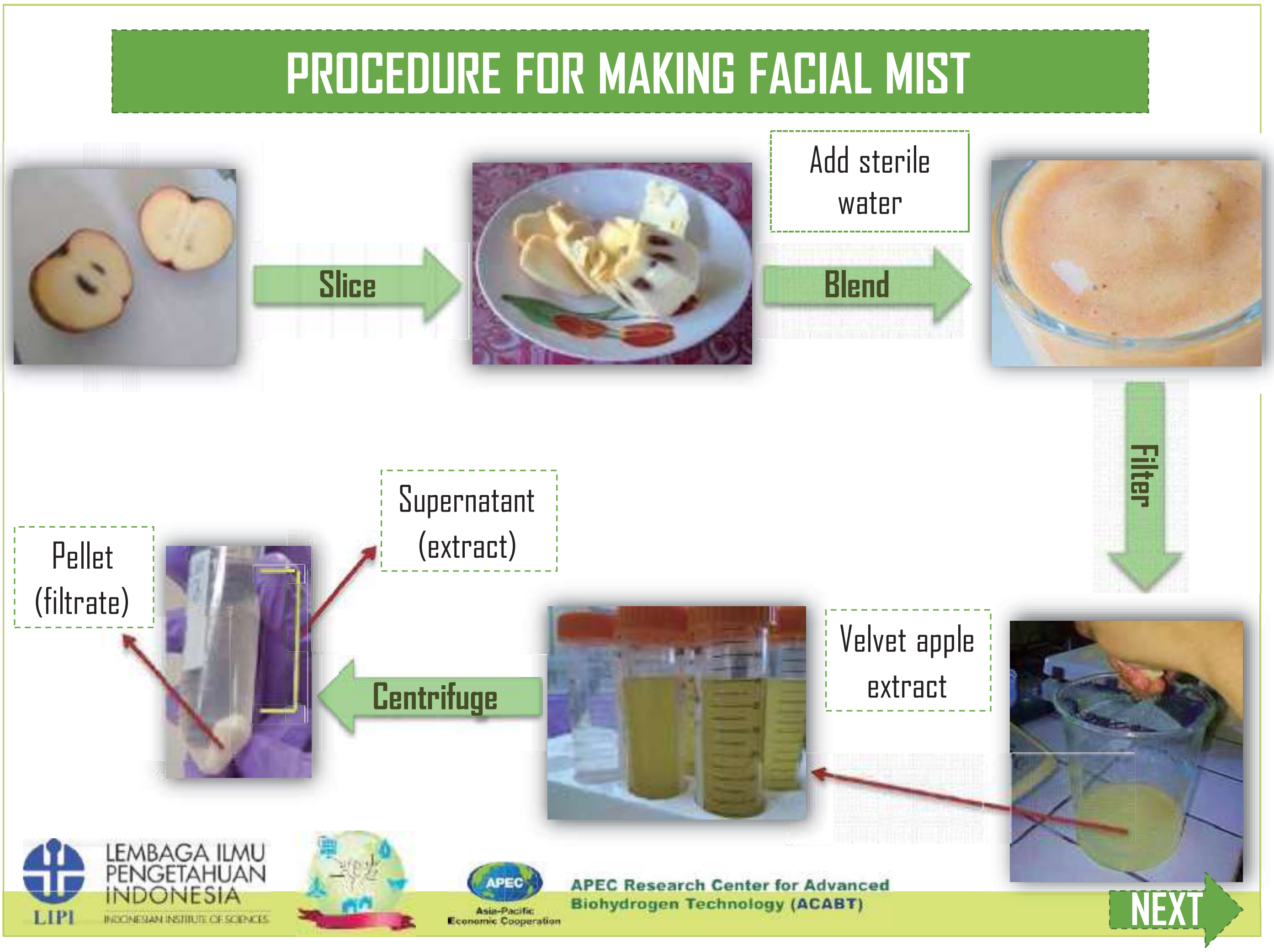
The Velvet Apple

IN TERMS OF ITS CHEMICAL COMPOSITION:

- Water content 68.9 %
- Protein content 1.99 %
- Lipid content 0.24 %
- Starch content 14.7 %
- Sugar content 16.3 %
- Total acid content 2.1 (mg KOH/G)
- Vitamin C content 0.15 %
- Carbohydrate 28.03 %

Source : Antarlina 2009

Velvet apple can be used as a facial mist because it has a good **vitamin C** content for skin nutrition.


PROCEDURE FOR MAKING FACIAL MIST
Slice
Add sterile water
Blend
Filter
Velvet apple extract
Centrifuge
Supernatant (extract)
Pellet (filtrate)
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NEXT

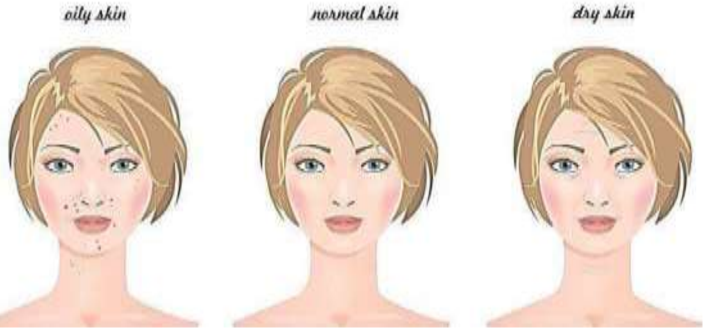

PROCEDURE FOR MAKING FACIAL MIST
Filter again
Add some steril water
Put the extract into a spray bottle

ANTIBACTERIAL TESTS

1. NUTRIENT AGAR ADDED VELVET APPLE EXTRACT
2. NUTRIENT AGAR FOR POSITIVE CONTROL

Skin Types

1. Normal Skin
2. Oily Skin
3. Dry Skin



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Result

Skin Type	Time (Hours)			
	0	12	24	36
Normal Skin (+Extract)				
Control				

Bacteria

Result

Skin Type	Time (Hours)			
	0	12	24	36
Oily Skin (+Extract)				
Control				

Bacteria

Result

Skin Type	Time (Hours)			
	0	12	24	36
Dry Skin (+Extract)				
Control				

Bacteria


TESTIMONIALS USING FACIAL MIST
Use in Face Acne
Use in Skin Irritation
ACNE
Before
After
Irritated hand skin
Before
After
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TESTIMONIALS USING FACIAL MIST
USE FACIAL MIST FOR A DAILY

CONCLUSION

Velvet Apple Extract Contain Antibacterial

Using Facial Mist From Velvet Apple Extract Make the Skin Fresher , Smoother, and Relieve Irritation

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SUGGESTION

ACKNOWLEDGMENT

We would like to thank you to:

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- Ms Delicia Yunita Rahman, M.Sc (Mentor)
- Bioenergy and BioprocessLaboratory, the Biotechnology Research Center, LIPI (Indonesian Institute of Sciences)
- All staff- Bioenergy and Bioprocess Laboratory
- APEC-ACABT
- Yes Challenge Committee 2018

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Velvet Apple Beauty Squad Indonesia

SUPPORTED BY:

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Appendix 13

Team 5 – SENESol (Thailand)

Participatory P2G Electricity Storage

Img source
http://101fundraising.org/wp-content/uploads/2014/05/5484651-535312-welcome-word-in-different-languages.jpg

There are two serious community problems we face today…

Oh dear… What are those?

First problem:

Our (human) civilization is

now heavily depend on electricity…

However, the electricity system itself is ***NOT*** reliable…

Electricity systems are NOT Reliable

Conventional Energy

- Nuclear Energy, Coal Energy
  - Stable, but Flat and Rigid
  - Uneasy to adjust
  - System take a long time to restart
- Oil Energy: Expensive
- Nat. Gas: Limited resources

Renewable Energy

- Solar Energy -> Night?
- Wind Energy -> Still Air / No wind / Storm?
- Wave Energy -> Storm?
- Hydropower -> Drought / Flood?

I see... we can solve this problem, right?

Ooops… slowly… we haven’t even talk about the second problem yet…

Ah, yeah... what is our second problem, then?

Second problem:

World population requires food -> agricultural production -> agricultural waste -> water pollution, air pollution, bad smell/odor

Hmmm... it seems that these two problems are not related...

Well… actually we can solve both problems with a single snap… just like killing two birds with one stone

Really? How?

Participatory Power-to-Gas system networks for Giga-Watt electricity storage via Hydrogen from agricultural waste

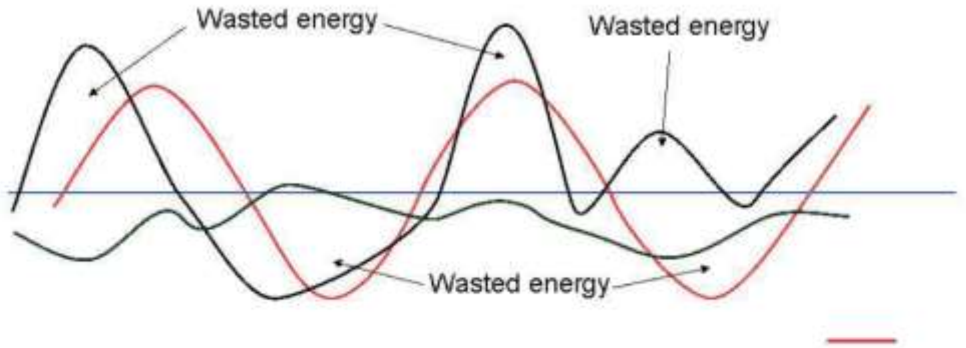
By:
SENESol Team
(Alam Surya Wijaya, Lamin K. Marong, Luke Makarichi)
Mentored by Assist. Prof. Dr. Prawit Kongjan

Prince of Songkla University, Thailand

So... what can we do?

OK… Let’s see our options…

Electricity Supply-Demand Pattern



Base Load Supply: Energy supplies that cannot be quickly varied. Includes coal and nuclear options.

Intermittent Supply: Energy supplies that vary with natural phenomena such as waves, wind or sunlight available.

Adjustable Supply: Energy supplies that can be easily adjusted such as from water (hydro).

Demand: Generally demand follows a sinusoidal pattern that peaks during the day and troughs at night. It is usually predicable depending on the weather and economic circumstances.

1. http://www.renewablegreenenergypower.com/wp-content/uploads/2012/04/energySupplyandDemand.jpg

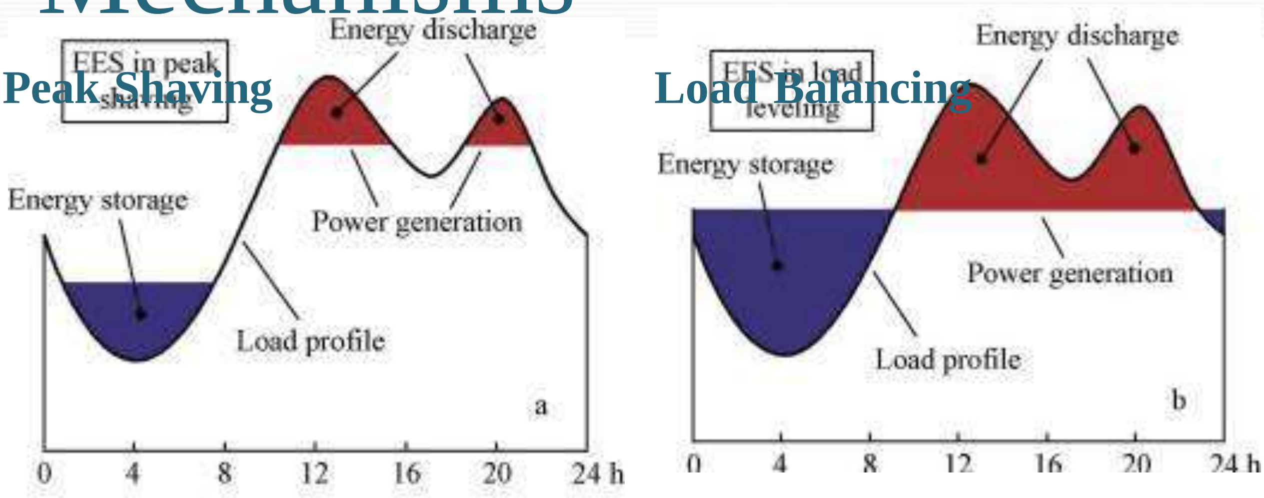
Oh dear... you're right. It's not reliable...

Now… how to improve the reliability of the electricity?

Electricity Storage

Electricity Storage Mechanisms

Peak Shaving **Load Balancing**



Img sourcehttp://ars.els-cdn.com/content/image/1-s2.0-S100200710800381X-gr1.jpg

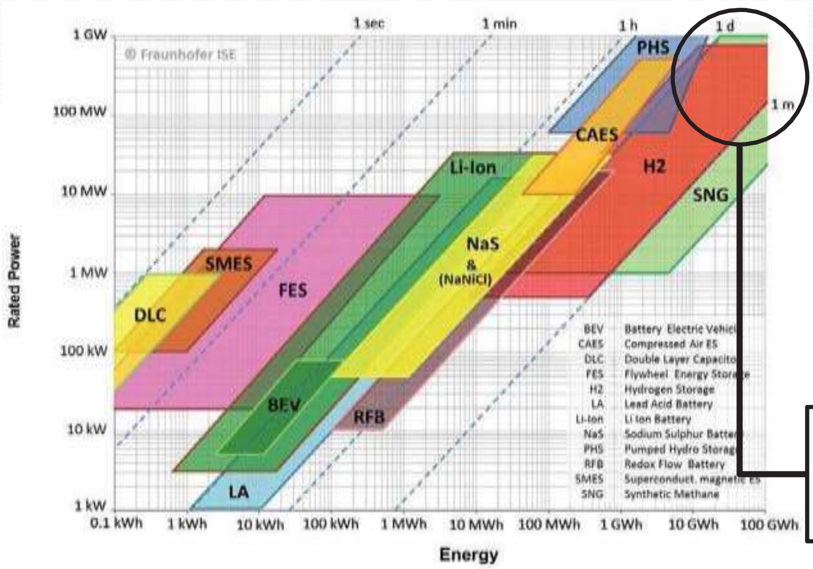
OK… let's use some batteries…

Well, batteries are good for small-scale storage… However, if we would like to use a storage for ***Giga-Watt*** scale, we need something much better…

Ummm…

So, what will we use?

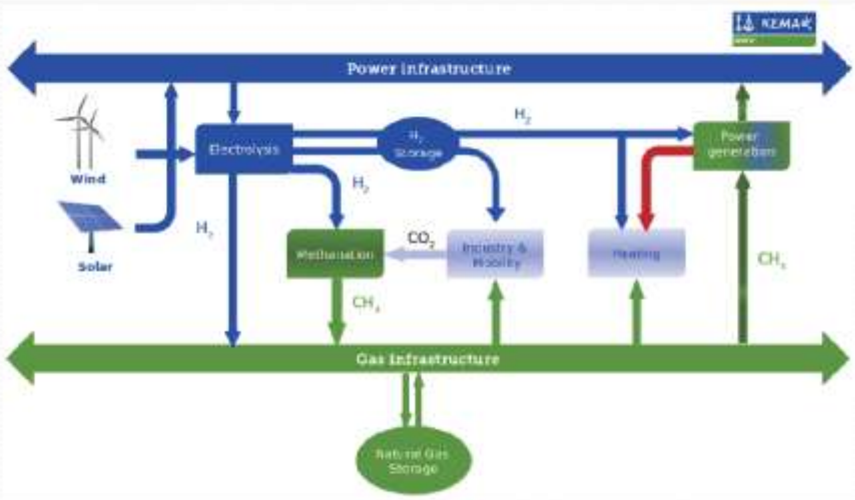
Energy Storage Technologies



- Small Capacity & Short Term: FES, SMES, DLC
- Medium Capacity & Medium Term: PHS, CAES, Batteries
- Large Capacity & Long Term: H2, P2G

Power-to-Gas (PtG or P2G)

- Converting Electricity into Gas
- Gas can be easily stored, fed to industry, or injected into Gas pipe network
- The gas for storage may be Hydrogen (H_2) or Methane (CH_4),



Img source http://www.europeanpowertogas.com/media/files/power_to_gas_flowchart.png

OK, P2G sounds good…

But wait…

What about the second problem?

What does P2G have to do with agricultural wastes?

Well, interestingly, agricultural wastes can be used as feedstock for P2G system!

P2G Applications

P2G of agricultural wastes

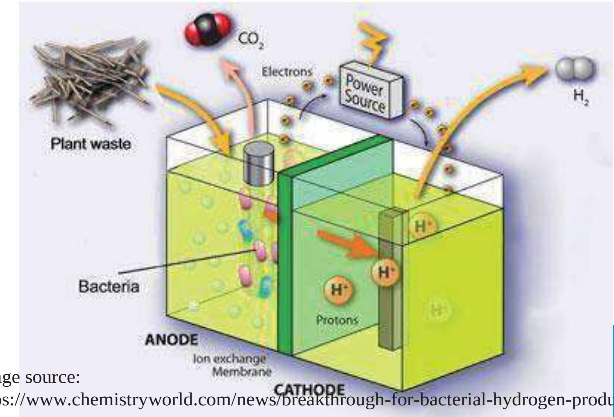


Image source:
https://www.chemistryworld.com/news/breakthrough-for-bacterial-hydrogen-production-/3000628.article

Key points

- Converts excess electricity into H_2 gas for convenience storage
- May use agricultural wastes as substrates
- Can be used in tandem (H_2 production as the first stage) with CH_4 production in dual- stage biogas reactor

We can only produce H_2 with this system, right?

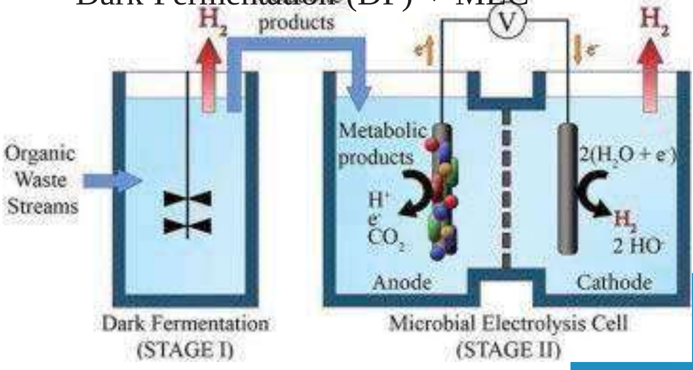
No…

We have ***at least* 2** options: producing H_2 gas or CH_4 gas

Product options

H_2 gas

Dark Fermentation (DF) + MEC



CH_4 gas

Anaerobic Digestion (AD) + MEC

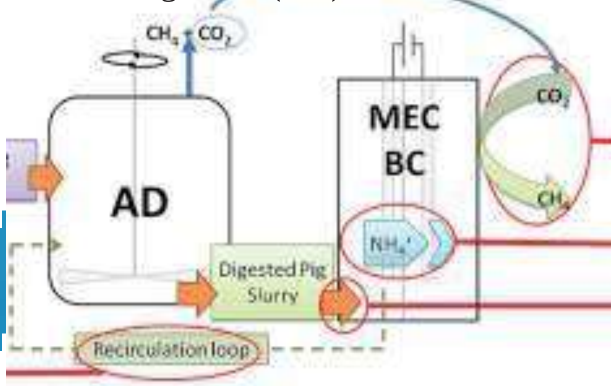


Image source:
1. https://ars.els-cdn.com/content/image/1-s2.0-S0360319916312071-fx1.jpg
2. https://ars.els-cdn.com/content/image/1-s2.0-S0960148117312661-fx1.jpg

Sounds great... What's the electricity source can be used?

For a ***Giga-Watt*** scale, electricity from the grid can be stored using this system.

However, renewable energy received the most benefits from this system.

Sources of Electricity

The Grid

- Depends on the source of the grid: coal, nuclear, hydro, or other sources
- Mainly to improve the supply-side energy management
- Depends on the electricity tariff & pricing mechanism

Renewable energy (RE)

- Answer the problem of intermittency of RE, such as from wind, solar, etc.
- Can be used to capture the excess electricity only, or to capture all produced electricity from the RE
- Due to the current trend in green energy, RE is more preferred for the P2G system

Interesting...

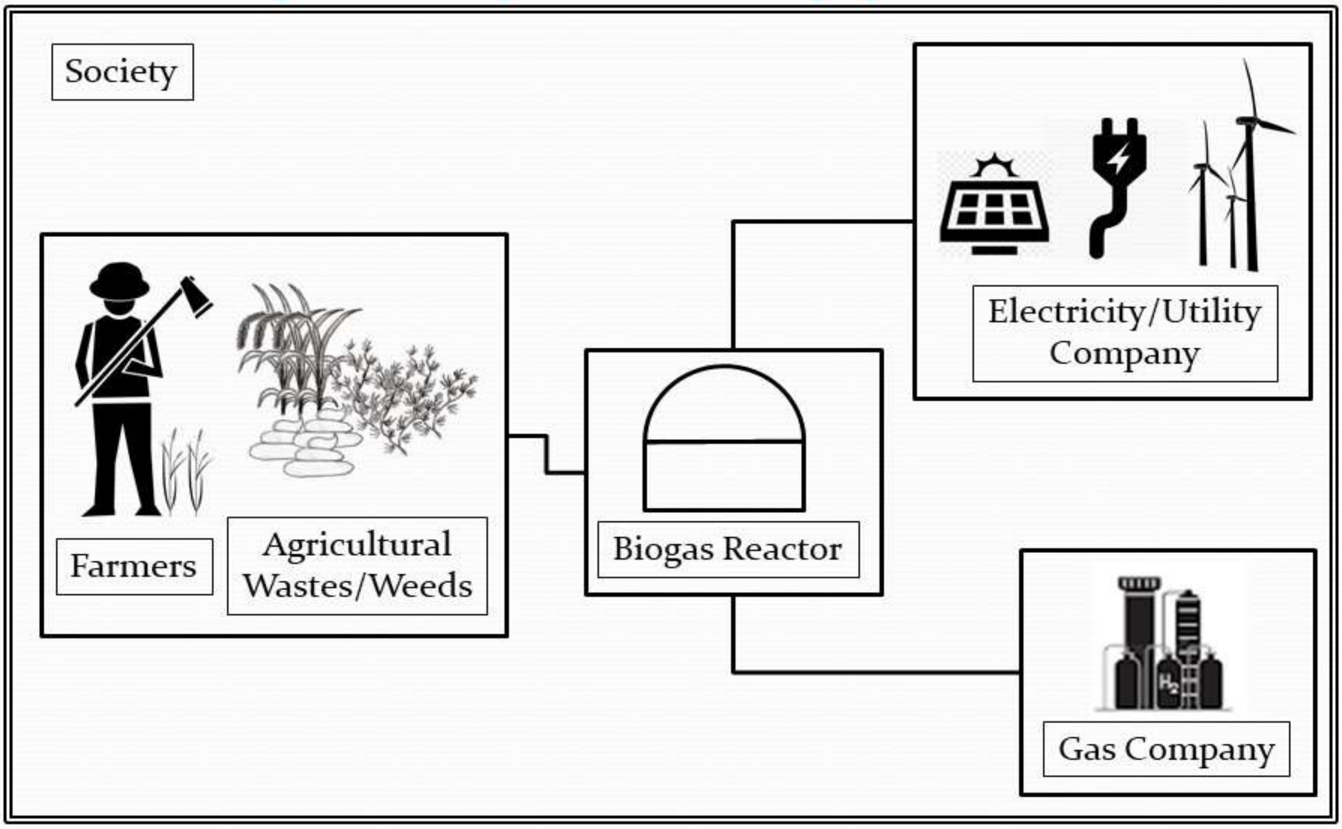
However, this system may be more powerful & useful if marginalized people (e.g. farmers) were involved...

This arrangement is possible, isn't it?

Indeed.

This system is tuned for a wide societal involvement with farmers as one of the main actor

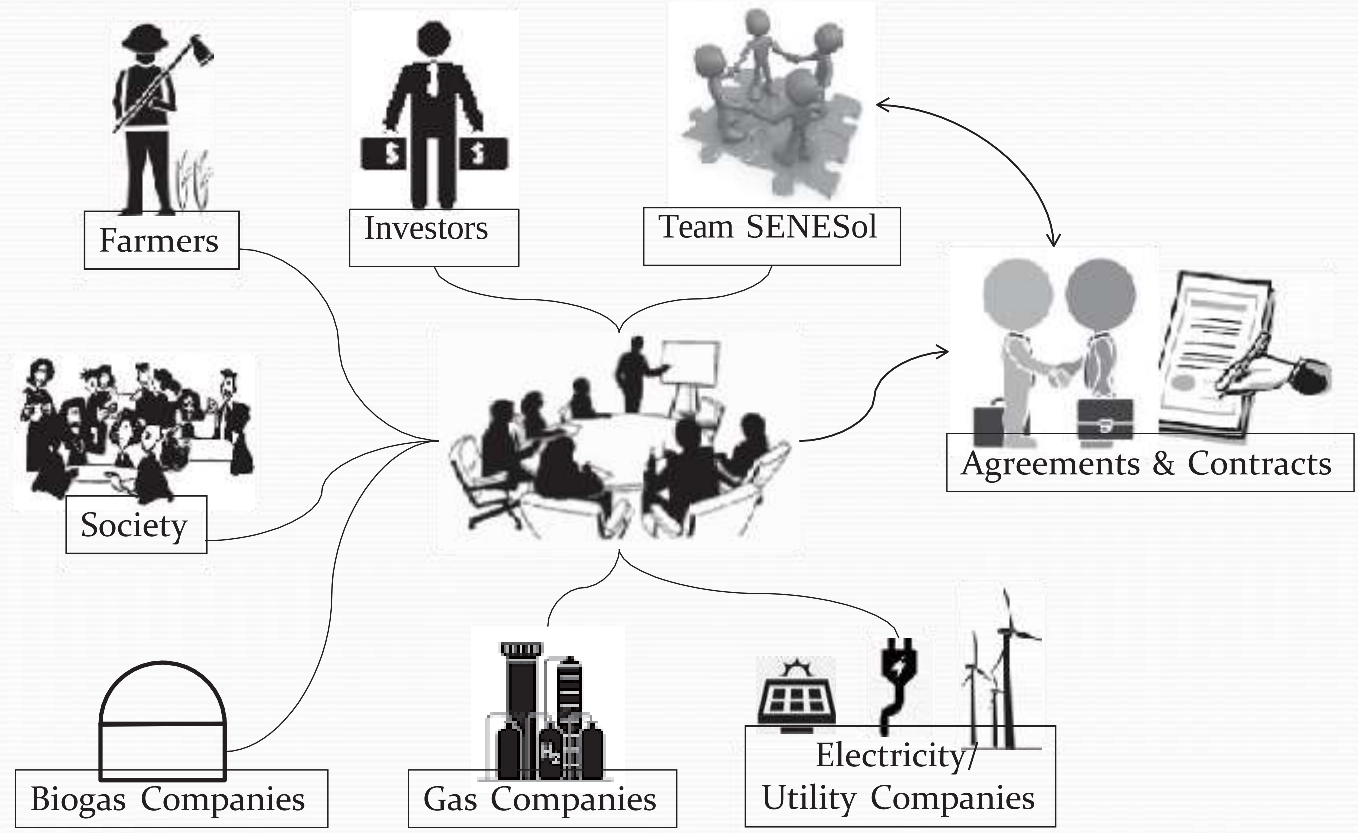
Participatory P2G Application

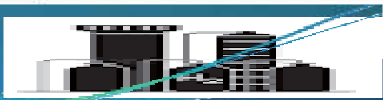


So… what's the plan?

We will set up and manage contracts/agreements among the actors/stakeholders involved in this system

Participatory P2G System





Well… that will be our business…

Team SENESol will manage this

Participatory Power-to-Gas system to up & run sustainably…


FIN
THANK YOU

Appendix 14

Team 6- GCS Project (China)

Domestic Waste Treatment System (DWT System) In Rural Areas

Domestic Waste Treatment System (DWT System) In Rural Areas

Presented By
GCS Project, USTB, China

Contents

1. Domestic Waste Situation in Rural China
2. Introduction of DWT System
3. Analysis of DWT System Establishment

1 Domestic Waste Situation In Rural China

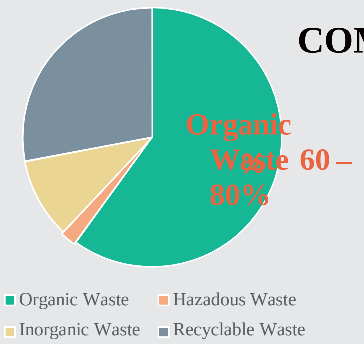
Domestic Waste Production

LARGE AMOUNT

- 0.65 kg domestic waste is produced in rural China per day per capita (2017)
- 600 million rural residents in rural China (2017)
  143 million tons of domestic waste is produced every year

Han Zhiyong, Yield and Physical Characteristics Analysis of Domestic Waste in Rural Areas of China and Its Disposal Proposal, 2017

COMPOSITION & RECOVERY VALUE



- Organic waste (kitchen waste, excrement)
- Recyclable waste (plastic, paper, glass)
- Inorganic waste (ash)
- Hazardous waste (battery)

Gao Qingbiao, Classification and Comprehensive Utilization of Rural Domestic Garbage Disposal, 2011

Urgency & Opportunity To Change

Urgency: Environment & Health Problem

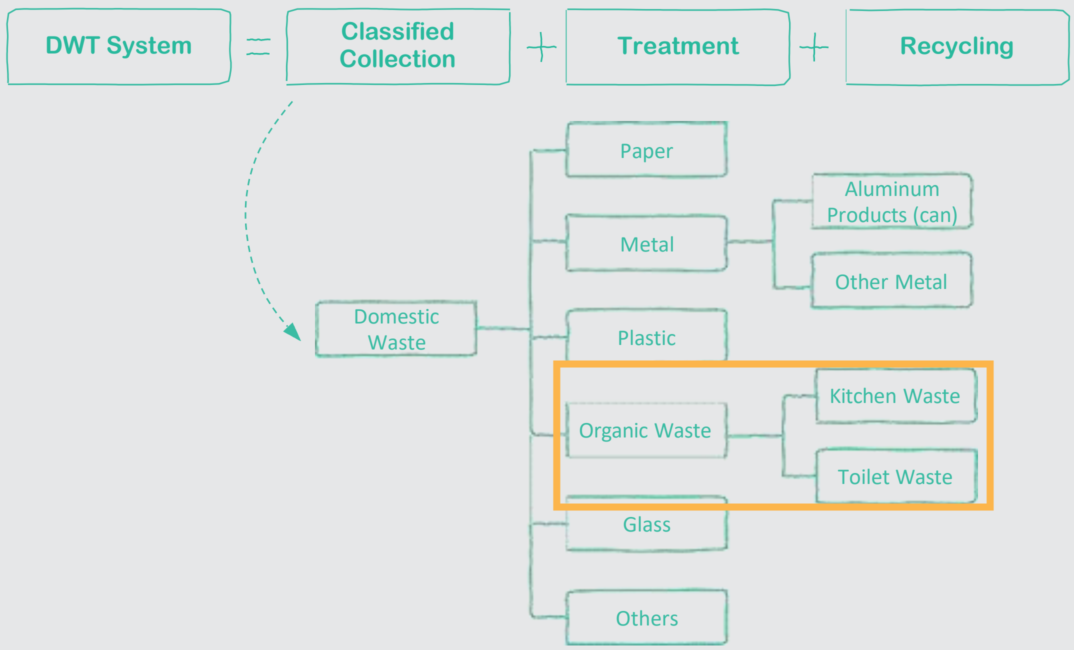
- Polluted farmland and unhealthy agricultural products
- Contaminated drinking water
- Spread of pathogens and odor problem

Opportunity: Central Government Support

- "No 1 Central Document“ (2017) and “Three-Year Action Plan for the Rehabilitation of Rural Human Settlements” (2018) promote the management of rural domestic waste

2 Introduction of DWT System

DWT System

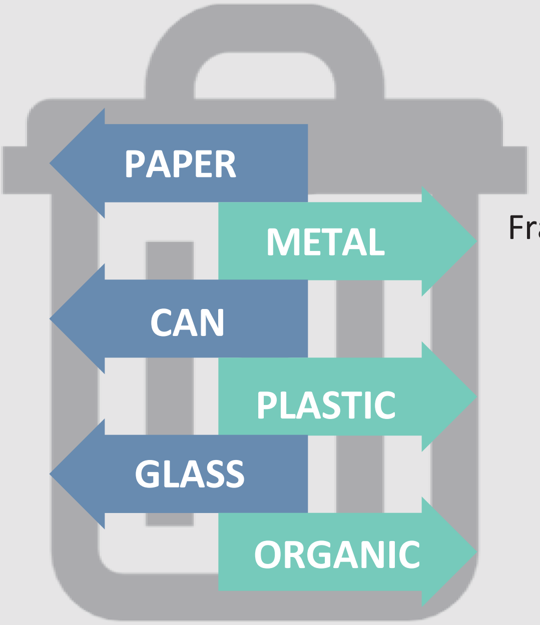


Treatment: Build Waste Separation Station

Compress, sell to Paper Mill

compress and sell to aluminum factory

Fracture, classified by color, and sell to glasswork or steel mill

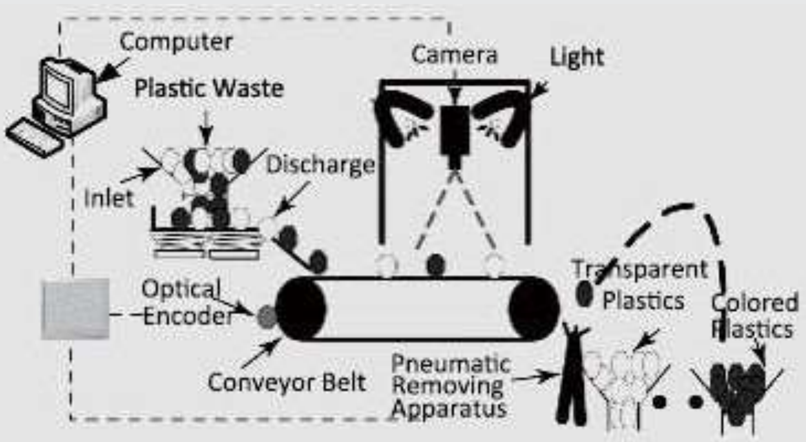


Fracture, magnetic separation, compress and sell

classified by color, compress and sell

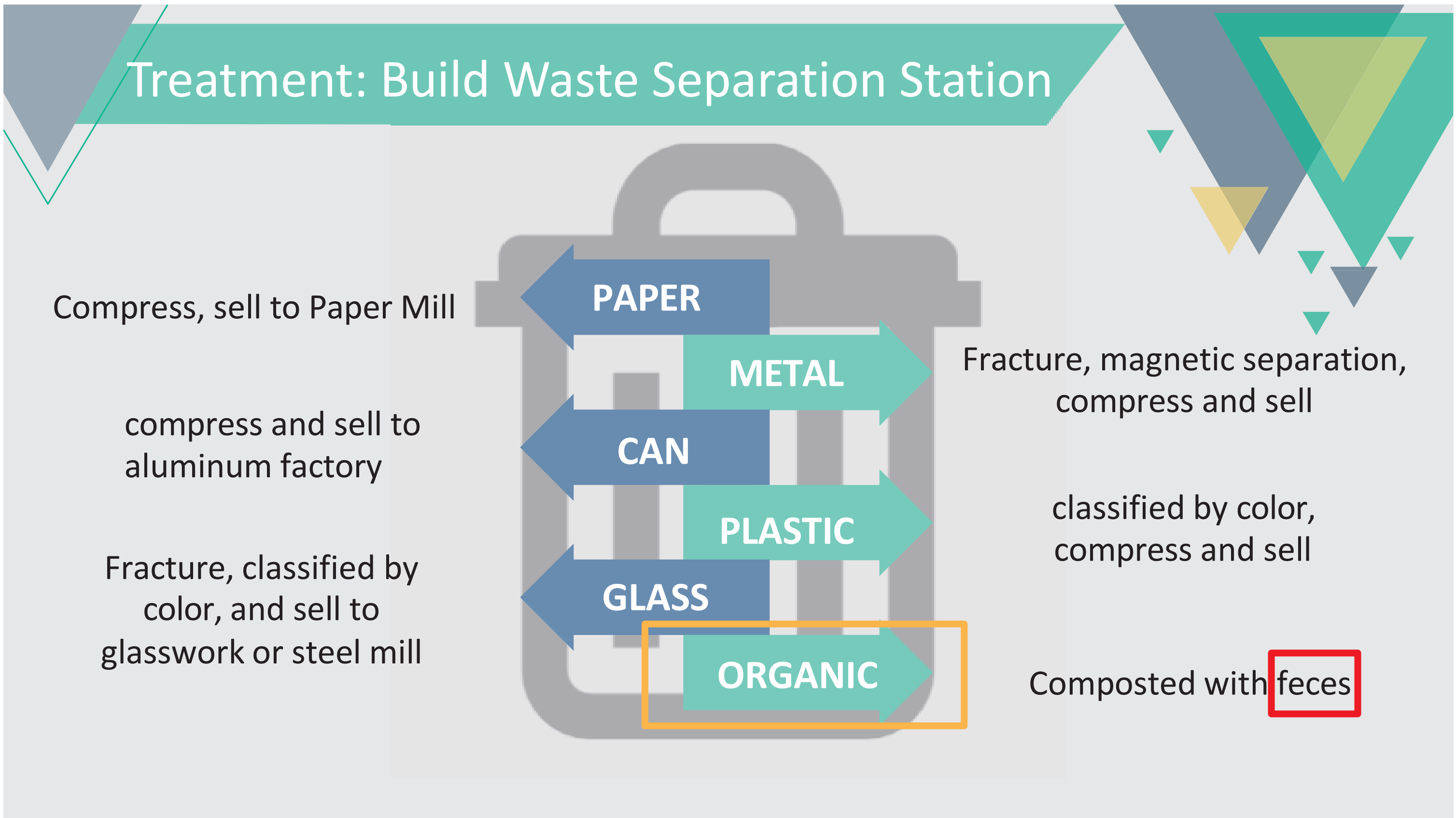
Composted with feces

Machine



Color Detection and Separation System

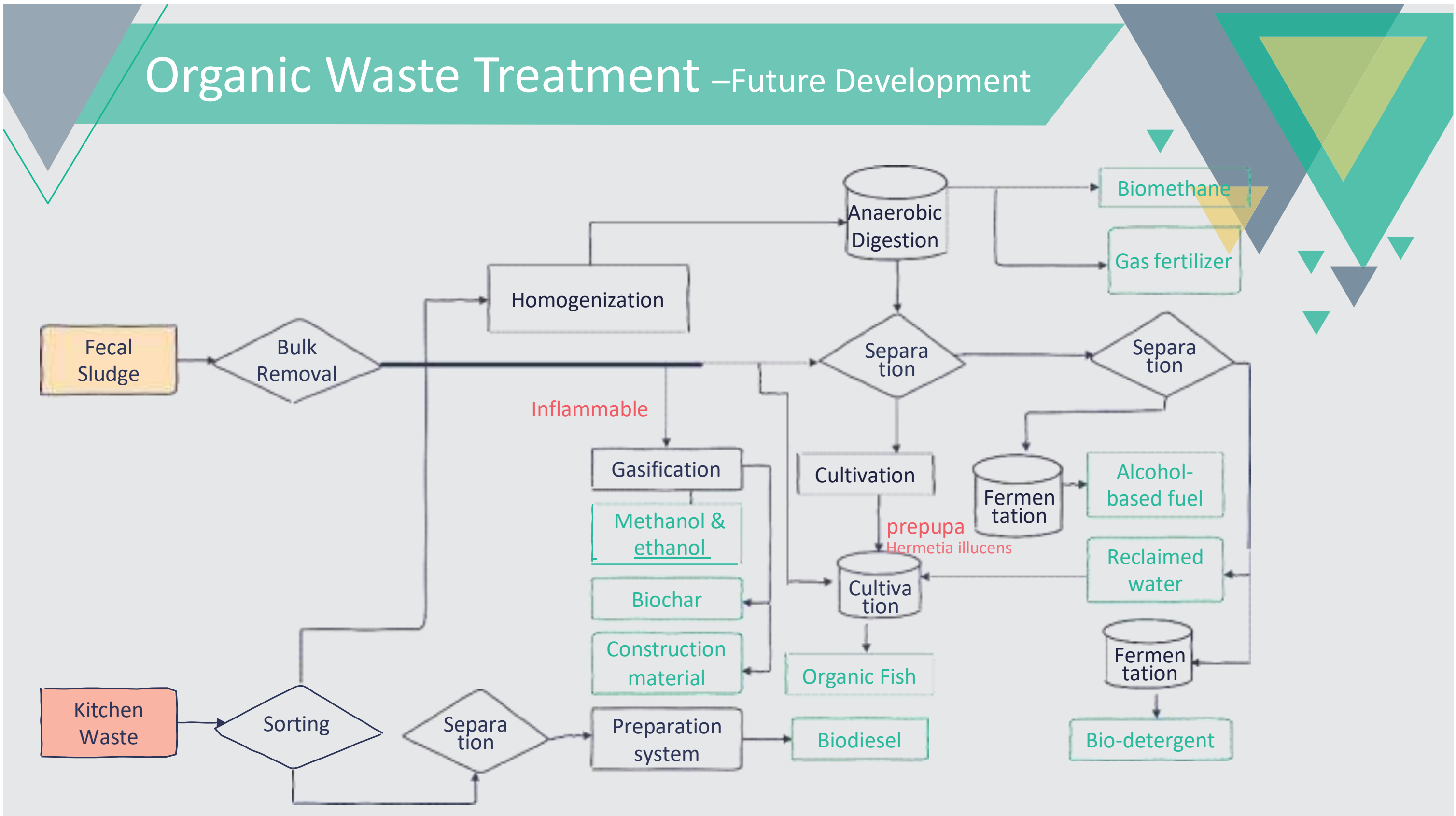
packing machine



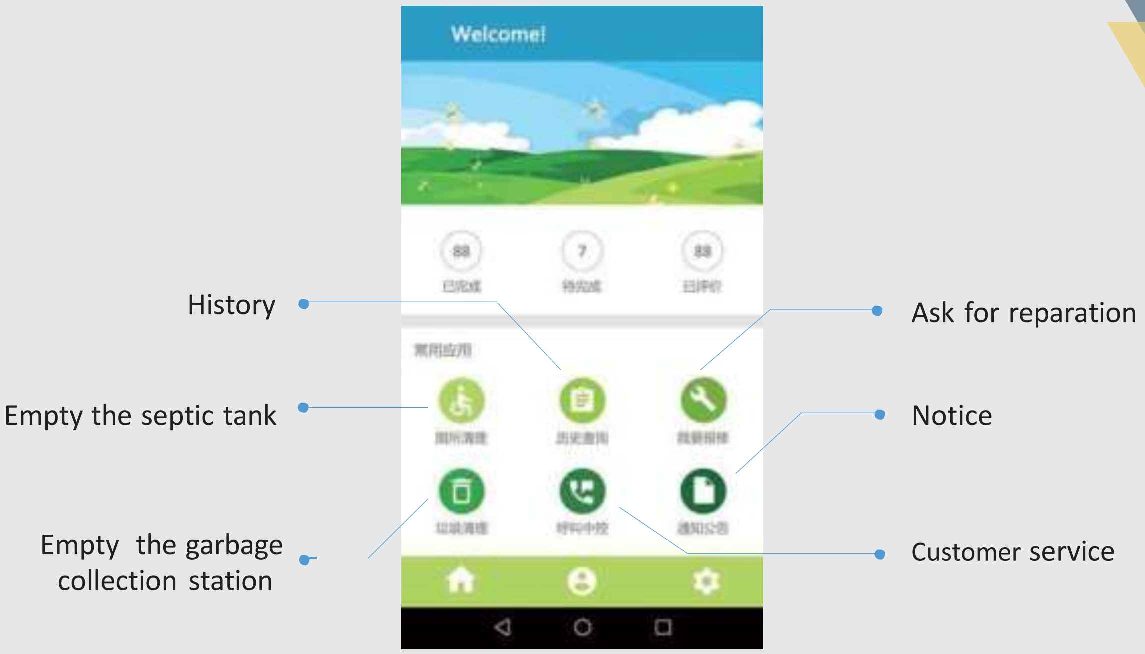
Urine Diversion Toilet

(per person per year)	Total Mass/kg	N/kg	P/kg	K/kg
FECES	25~50	0.83	0.27	0.56
URINE	400~500	4.5	0.45	1.0


Urine Diversion Toilet
HOW TO SEPARATE & TREAT ?
Treatment of Urine
• Sealed in a sealed container for 6 month
• The urine should preferably not be diluted– higher pH (around 9) increases the die-off rate of pathogens
• Relatively higher temperature
• Use as fertilizer after storage
Attentions
leaking into feces
ature of urine tank


Organic Waste Treatment –Future Development
Fecal Sludge
Bulk Removal
Homogenization
Anaerobic Digestion
Biomethane
Gas fertilizer
Separa tion
Separa tion
Inflammable
Gasification
Methanol & ethanol
Biochar
Construction material
Cultivation
prepupa
Hermetia illucens
Cultiva tion
Organic Fish
Fermen tation
Alcohol-based fuel
Reclaimed water
Fermen tation
Bio-detergent
Kitchen Waste
Sorting
Separa tion
Preparation system
Biodiesel

For Residents: Cell Phone Application



3 Analysis of DWT System Establishment

Public-Private Partnership

- Input
  - Enterprise
    - Starting money
    - Technique people, management people, etc
  - Government
    - Financial support (lower land-renting price; lower taxes; price support for production, etc)
    - Publicity and Policy (popularizing urine diversion toiles; regulation of garbage classification, etc)
  - Local People
    - The awareness of garbage classification
    - Protect public infrastructure

SWOT Analysis

- Promoting Green Economic Development
- Profitable Companies and More Jobs
- Reducing Government Expenditure on Environmental Protection
- Beautiful Environment
- Better Health

- Low Acceptability and Cooperation
- Production being Limited by the Number of Inhabitants

- Promoting New Technologies
- Expansion of the System

- Relatively Longer Investment Period
- Alternative Treatment Systems

Pilot Scheme

White: the County
Yellow: Villages

Pilot Scheme

Cost

Capital Construction(Garbage Classification Plant, Composting Plant); Operating Costs; Wages; Maintenance Costs;

Profit

- Company: making money from selling recyclable resources
- Jobs: 100 – 200

THANKS FOR YOUR ATTENTION

Appendix 15

Team 7- I_Mechanics (Russia)

Smart wind power for biogas farms

I_Mechanics

Lomonosov Moscow State University

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

Asia-Pacific Economic Cooperation

FUEL

THE PROBLEM

ENERGY DEPENDENCY

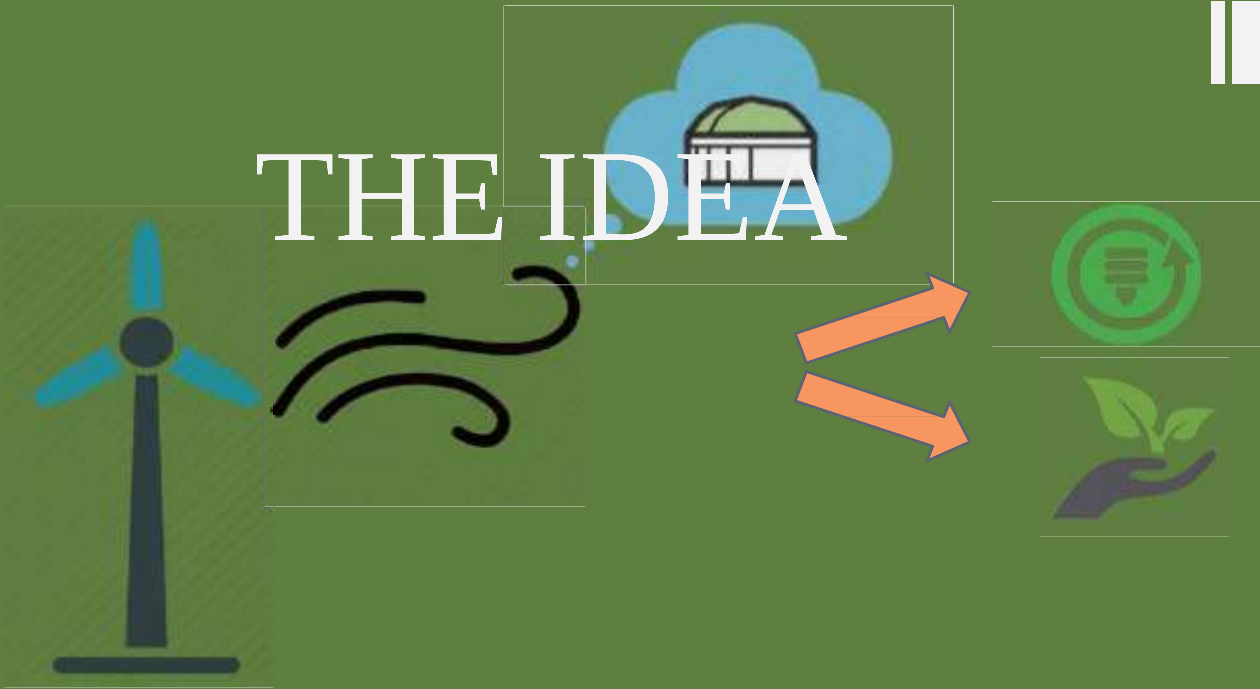
OVER USAGE OF FUELS

POLLUTION

UTILIZATION OF RENEWABLE ENERGY

SUSTAINABLE DEVELOPMENT

THE IDEA



4

7

PER ANNUM:

3bn non food biomass
403 mln ha agricultural land

Great biogas production potential

LESS

2500 tons CO
4500 tons NO_2
500 tons Soot

MORE

60-70 bln cubic meters of biogas – possible generation

BUT

Low price of natural gas on domestic market
High CAPEX
High transformation costs of existing plants
Low level of government support

THE POTENTIAL

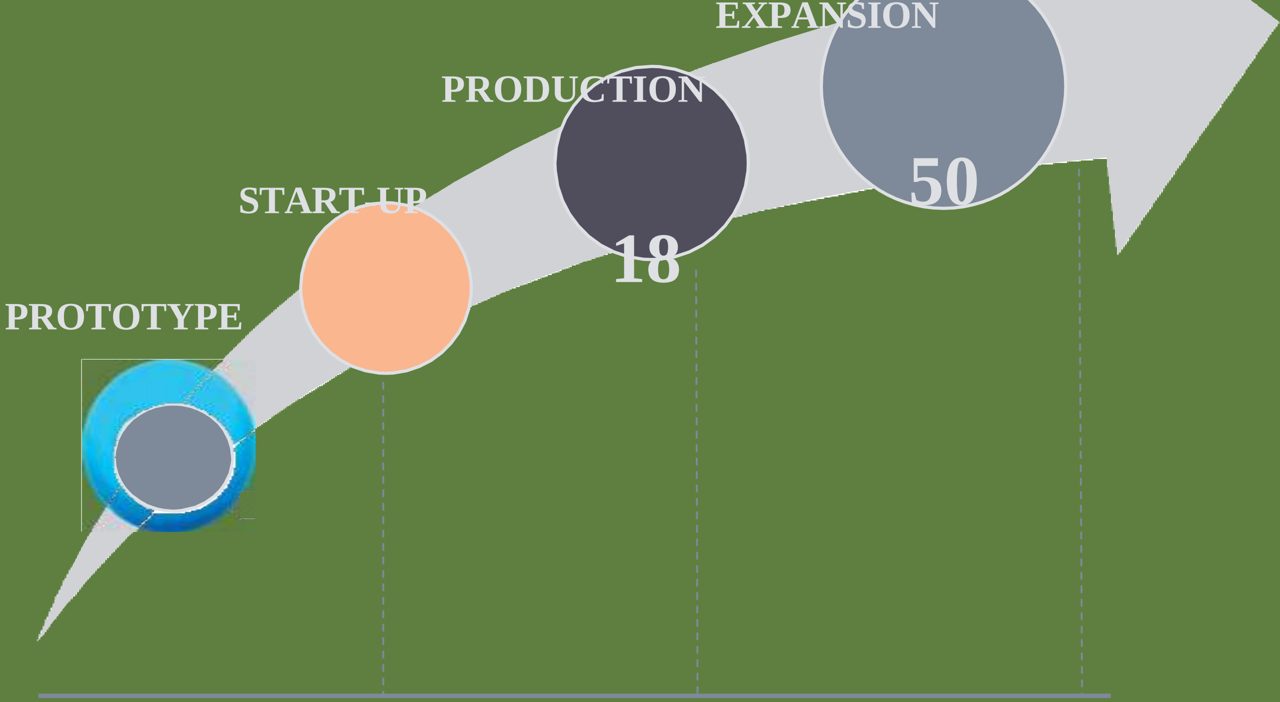
- Russian biogas

LLC Engineering Center "Progress"

- New opportunities

9

THE PLAN



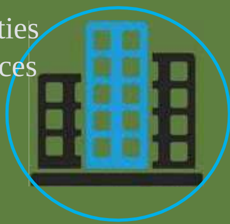
THE IMPACT

-new work places
-positive public image
-new investments
-new collaborations with businesses and scientific institutions

-introduction of new eco-friendly technologies
-opportunity for scientific and government collaboration
-financial support of new research

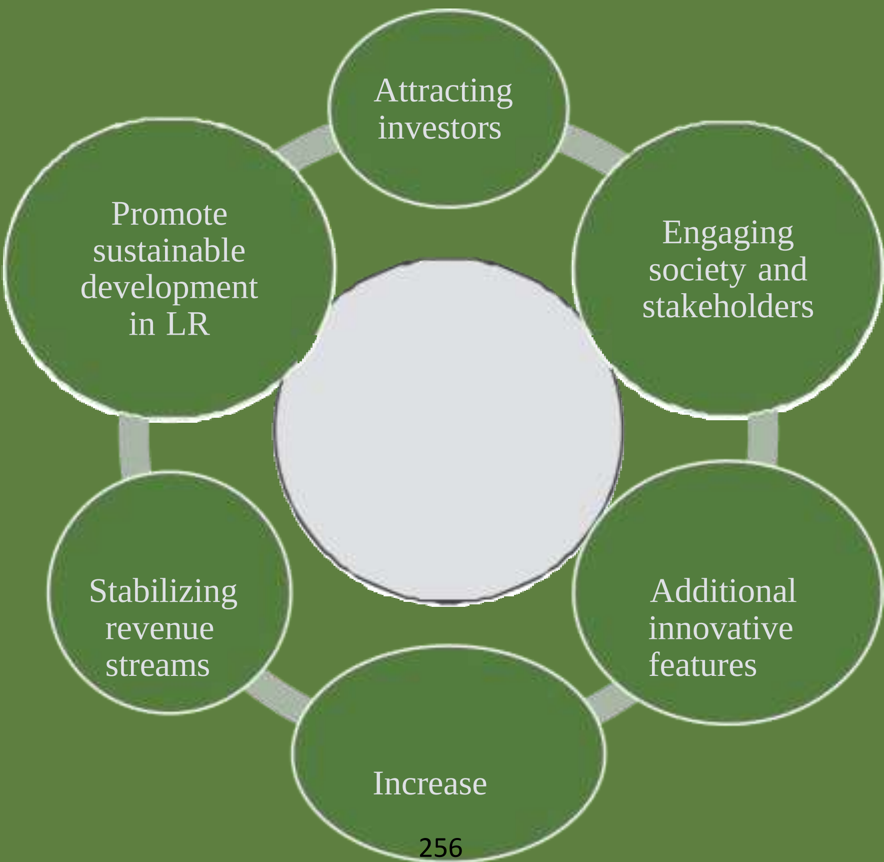
-healthy ecological environment
-community of closeminded people formation

-new financial opportunities
-efficient business practices
-cost saving
-possible new markets



11

THE FUTURE



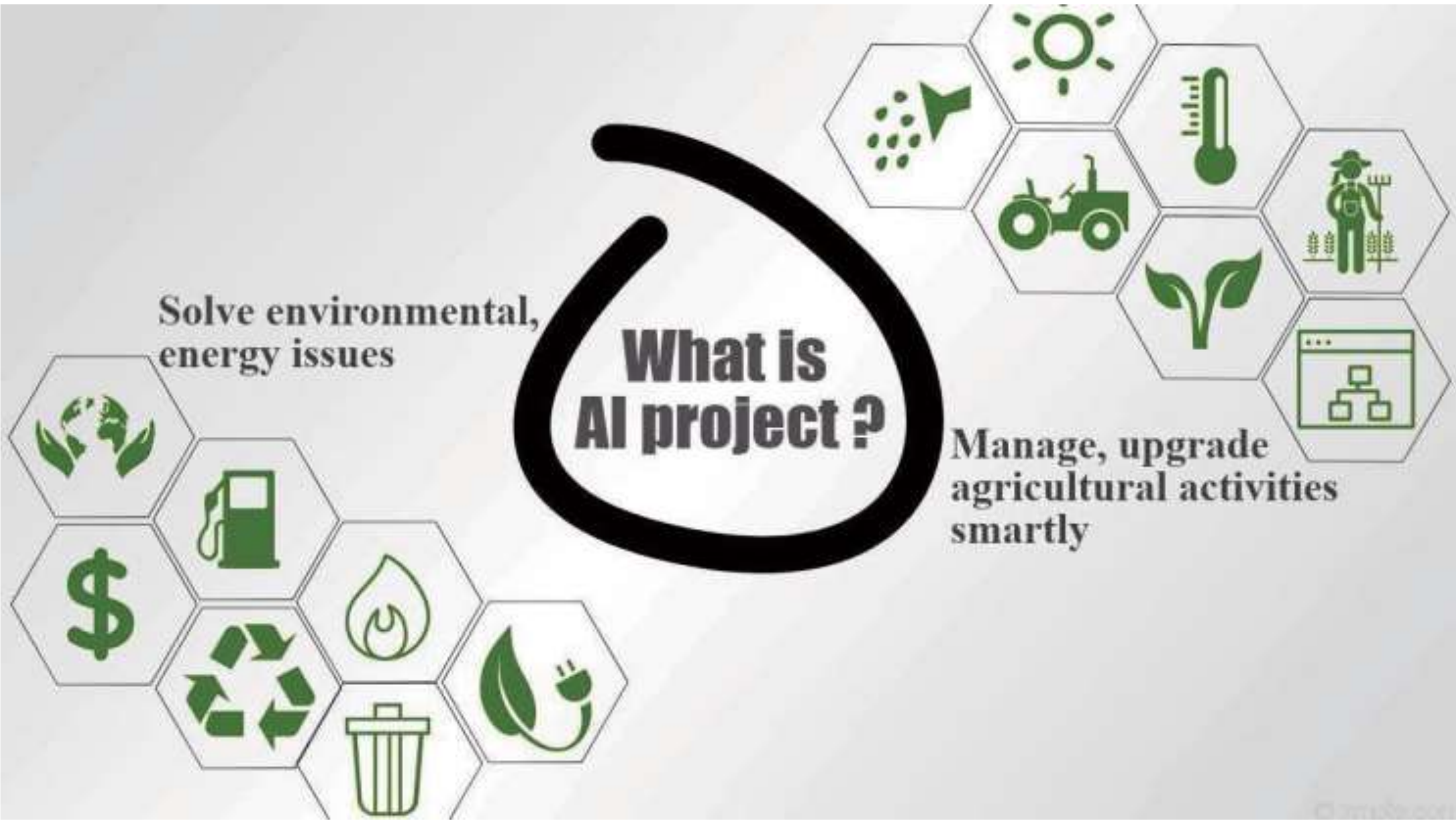
THANK YOU!

Appendix 16

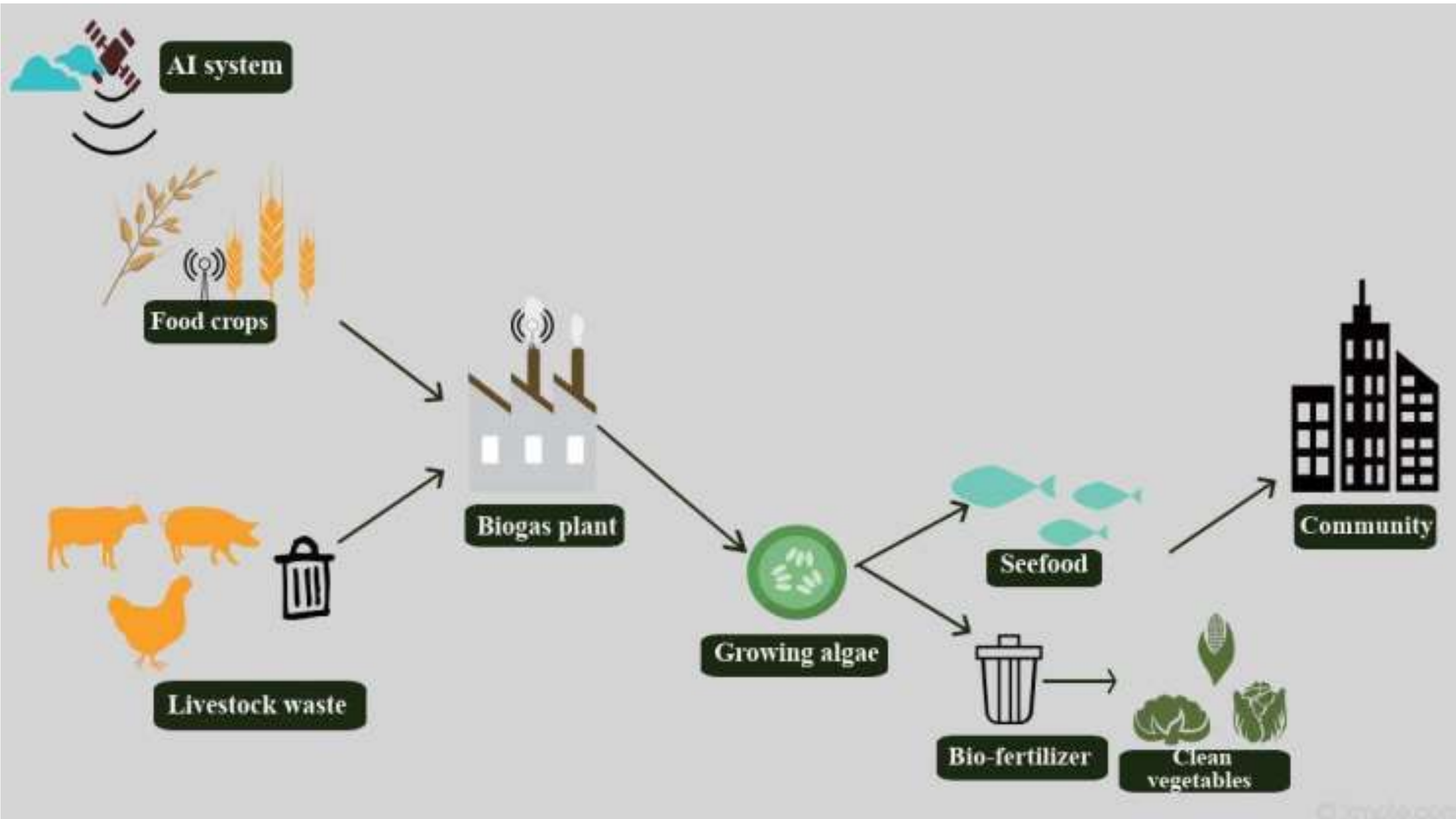
Team 8- AISMART (Chinese Taipei)

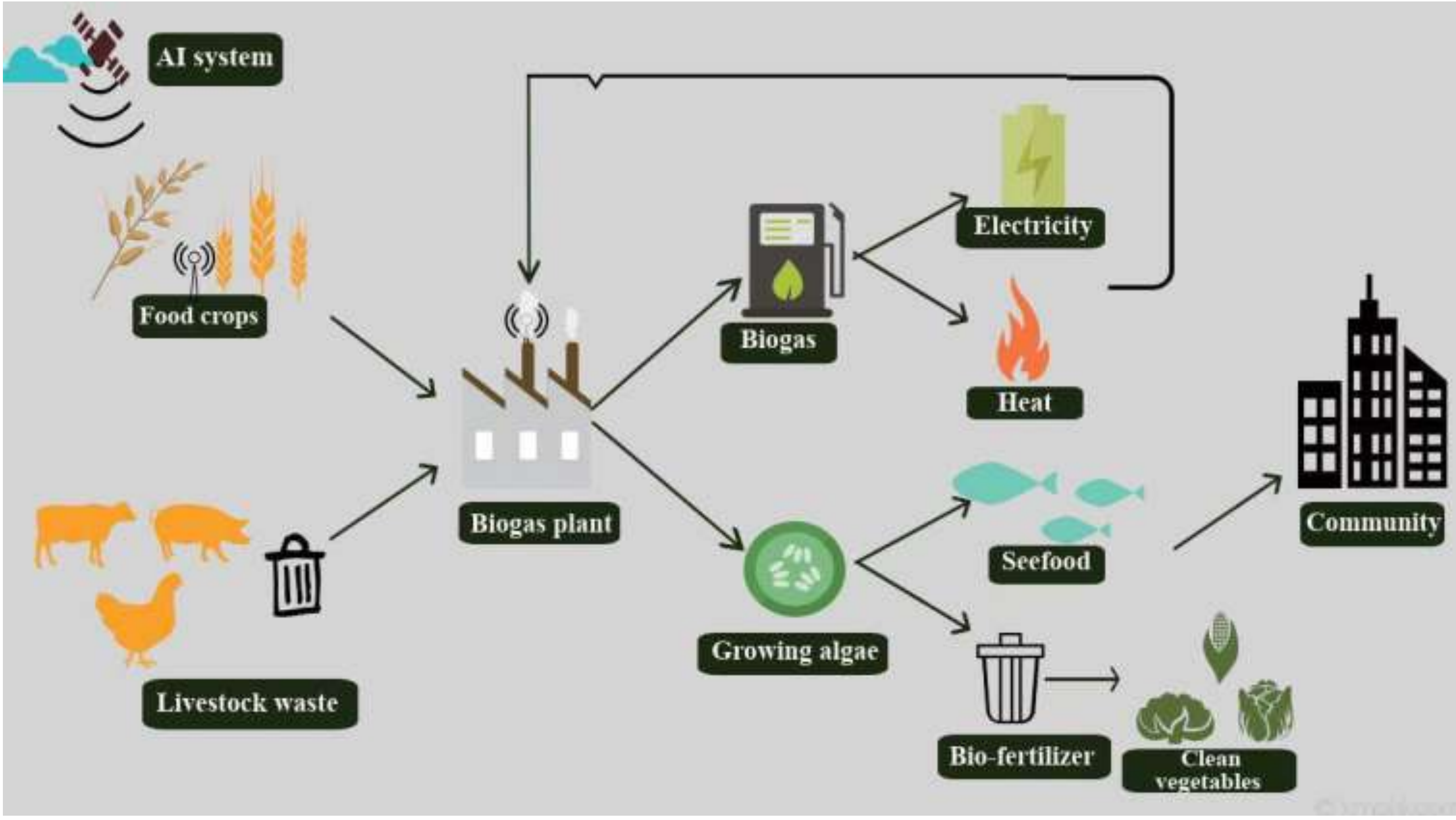
Ai smart management in agriculture-self sustained biogas plant

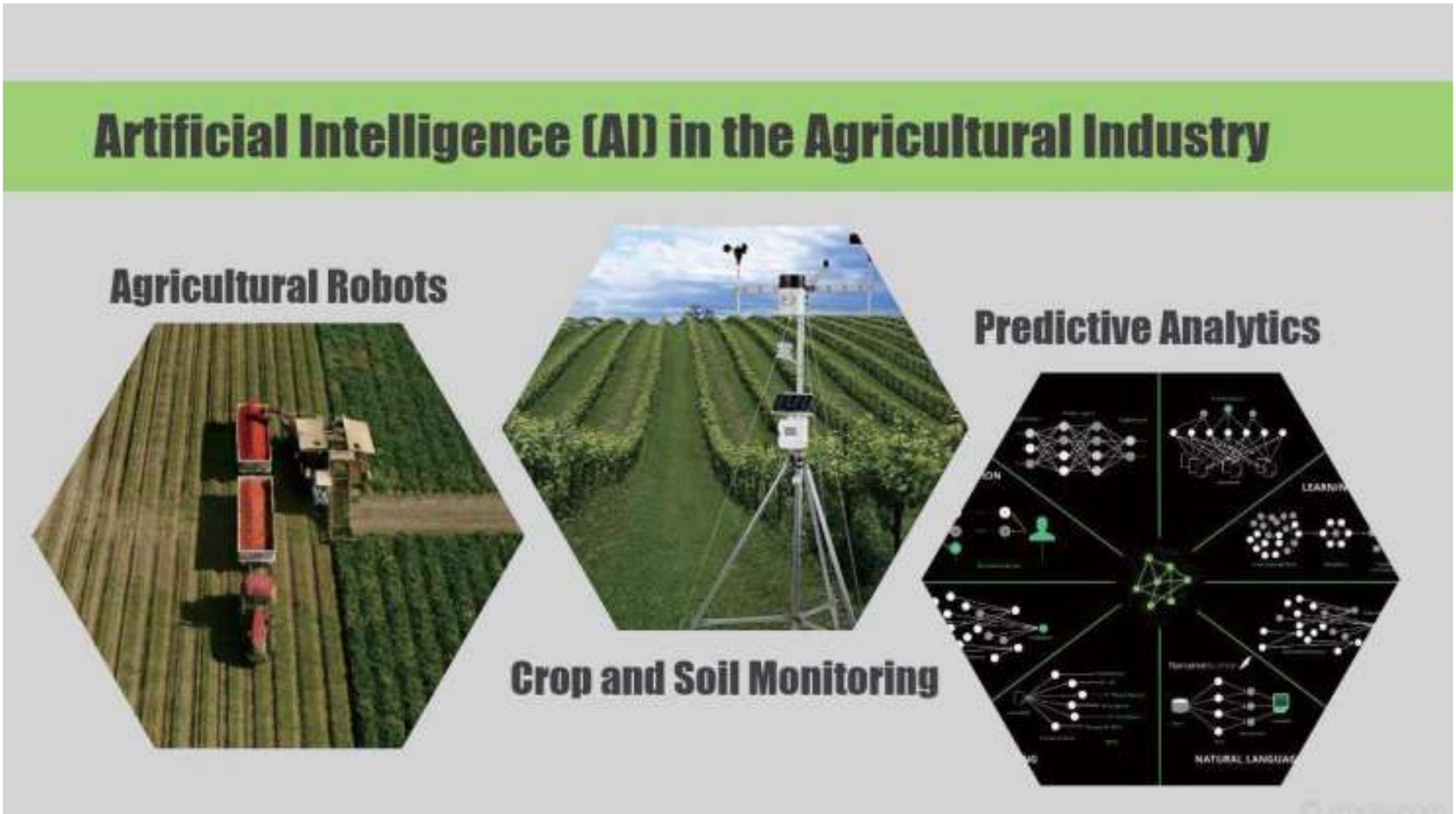

AI SMART MANAGEMENT
IN AGRICULTURE – SELF SUSTAINED BIOGAS PLANT
AISMART TEAM

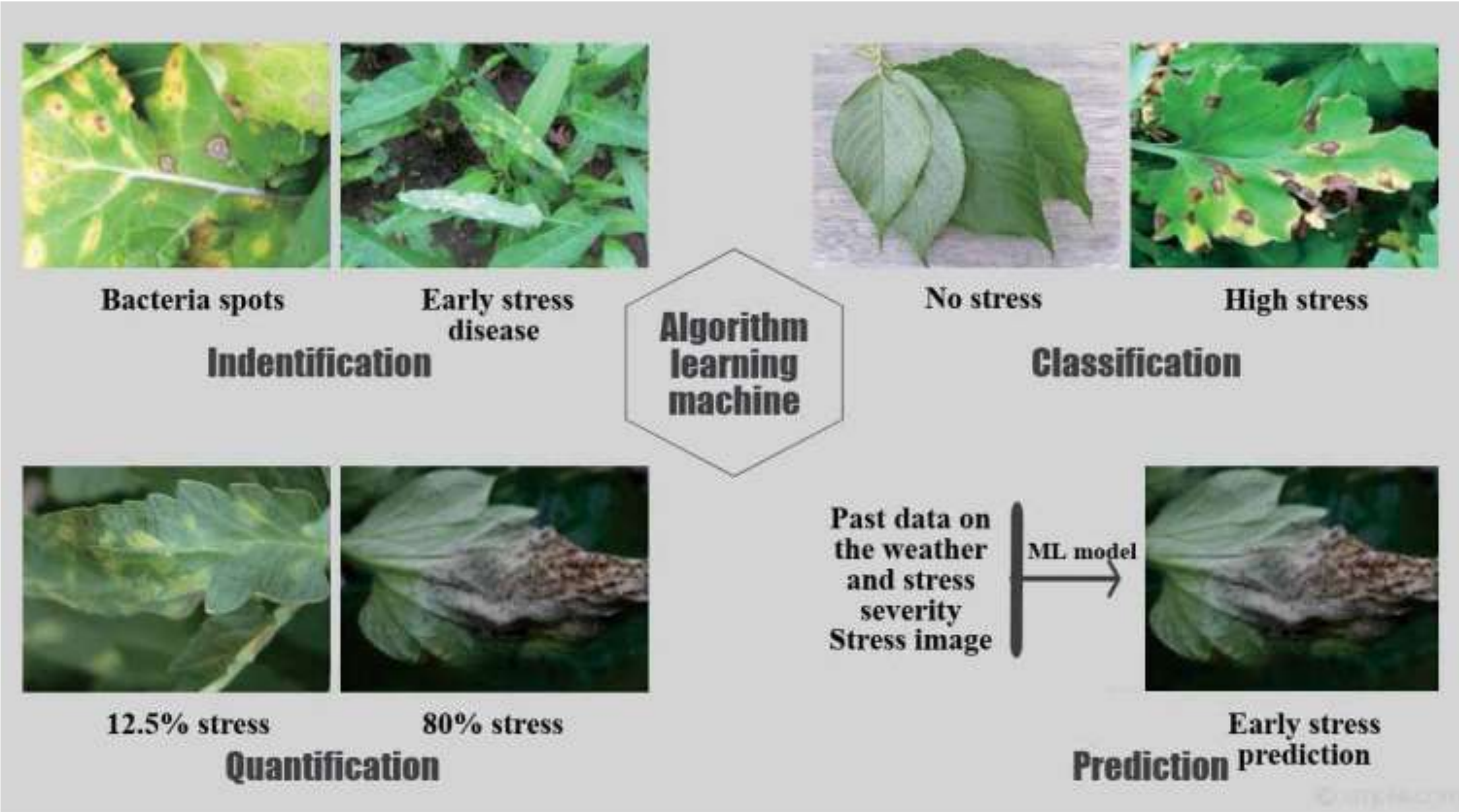

Solve environmental,
energy issues
What is
AI project ?
Manage, upgrade
agricultural activities
smartly

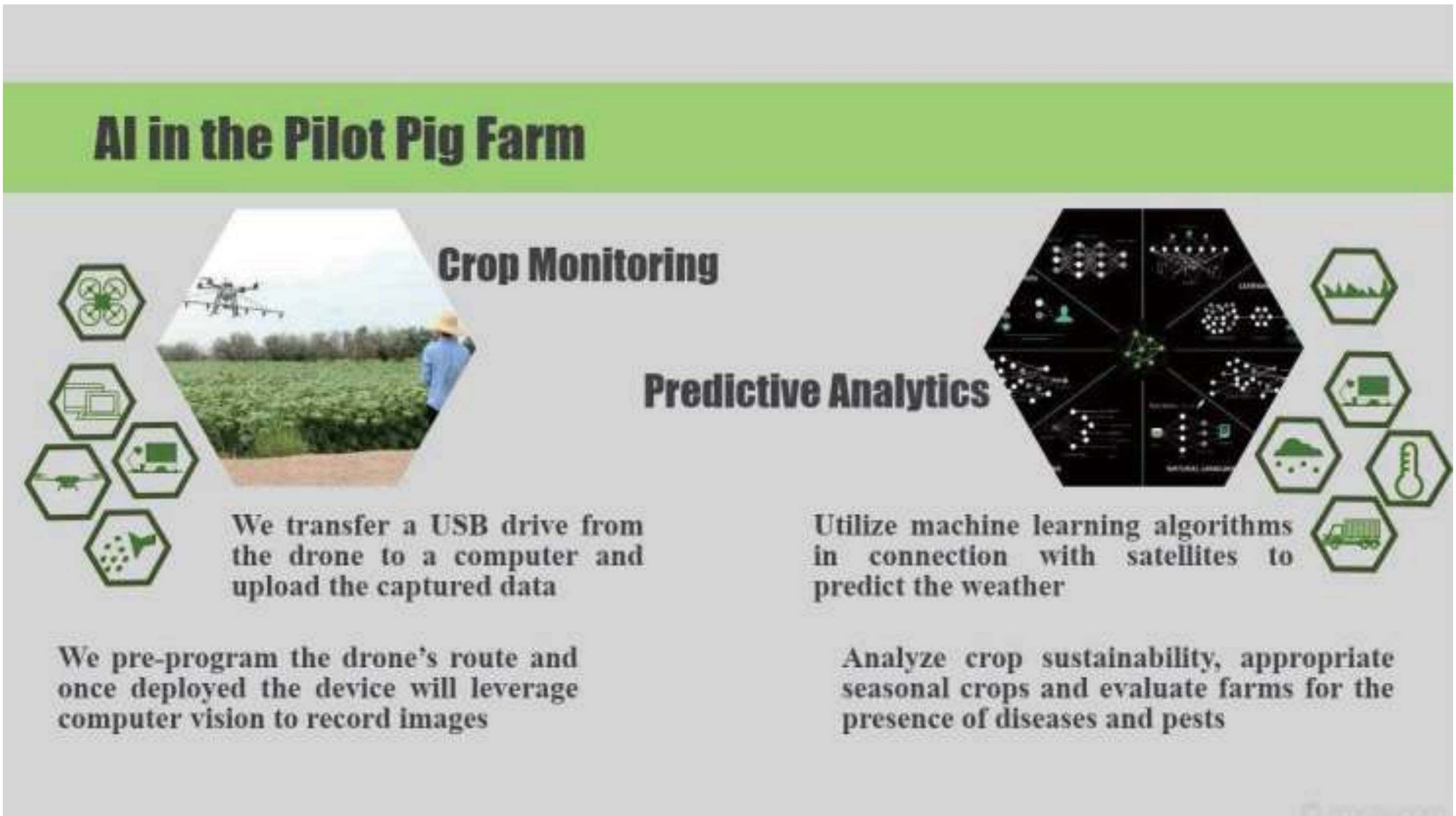

PROJECT GOALS
ECO FRIENDLY
AI SMART
ECO FRIENDLY
Visions
Revolutionize traditional agriculture into industry models, utilize smart software to manage automatically
Attempt to use self-sustained energy sources for all operating aspects
Missions
To shape sustainable duties for all stakeholders (resourceful farmers/ technical team/ management team) in a pilot area
Inspiring a modern agriculture to bring cultivation and livestock activities closer to young generations
Objectives
Achieve zero husbandry waste for the pilot farm and energy recovery via biogas plant
To attract investment capital to expand the farm as well as implement project

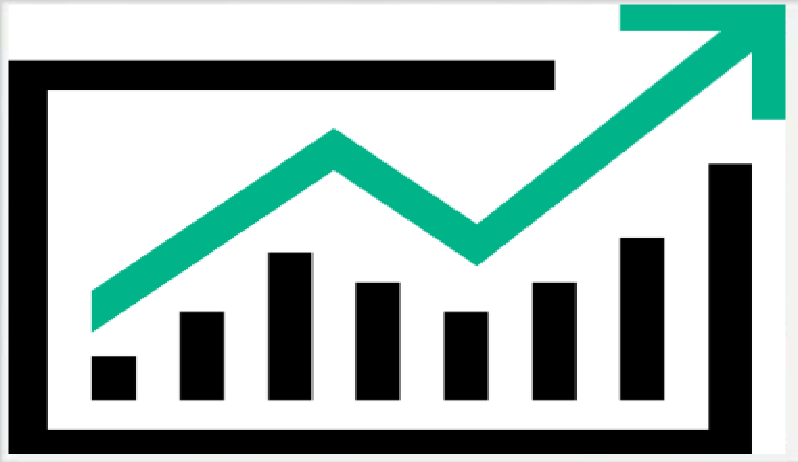

AI system
Food crops
Livestock waste
Biogas plant
Growing algae
Seefood
Bio-fertilizer
Clean vegetables
Community


AI system
Food crops
Livestock waste
Biogas plant
Biogas
Electricity
Heat
Growing algae
Seefood
Bio-fertilizer
Clean vegetables
Community


Artificial Intelligence (AI) in the Agricultural Industry
Agricultural Robots
Predictive Analytics
Crop and Soil Monitoring


Bacteria spots
Early stress disease
Indentification
Algorithm learning machine
No stress
High stress
Classification
12.5% stress
80% stress
Quantification
Past data on the weather and stress severity
Stress image
ML model
Early stress prediction
Prediction


AI in the Pilot Pig Farm
Crop Monitoring
Predictive Analytics
We transfer a USB drive from the drone to a computer and upload the captured data
Utilize machine learning algorithms in connection with satellites to predict the weather
We pre-program the drone's route and once deployed the device will leverage computer vision to record images
Analyze crop sustainability, appropriate seasonal crops and evaluate farms for the presence of diseases and pests



Transportation

Accurate hyper-local data combined with machine learning is allowing us to find the consumption sources as well as shortest convenient ways to deliver products

Consumption market

Conduct statistics from large data to find the potential markets for consuming products
Investigate the market needs to provide info back to farmers

Agricultural Robots - Modernizing production methods for local farmers

Cooperate with local farmers

Cooperate between AI project and local farmers in a win-win manner

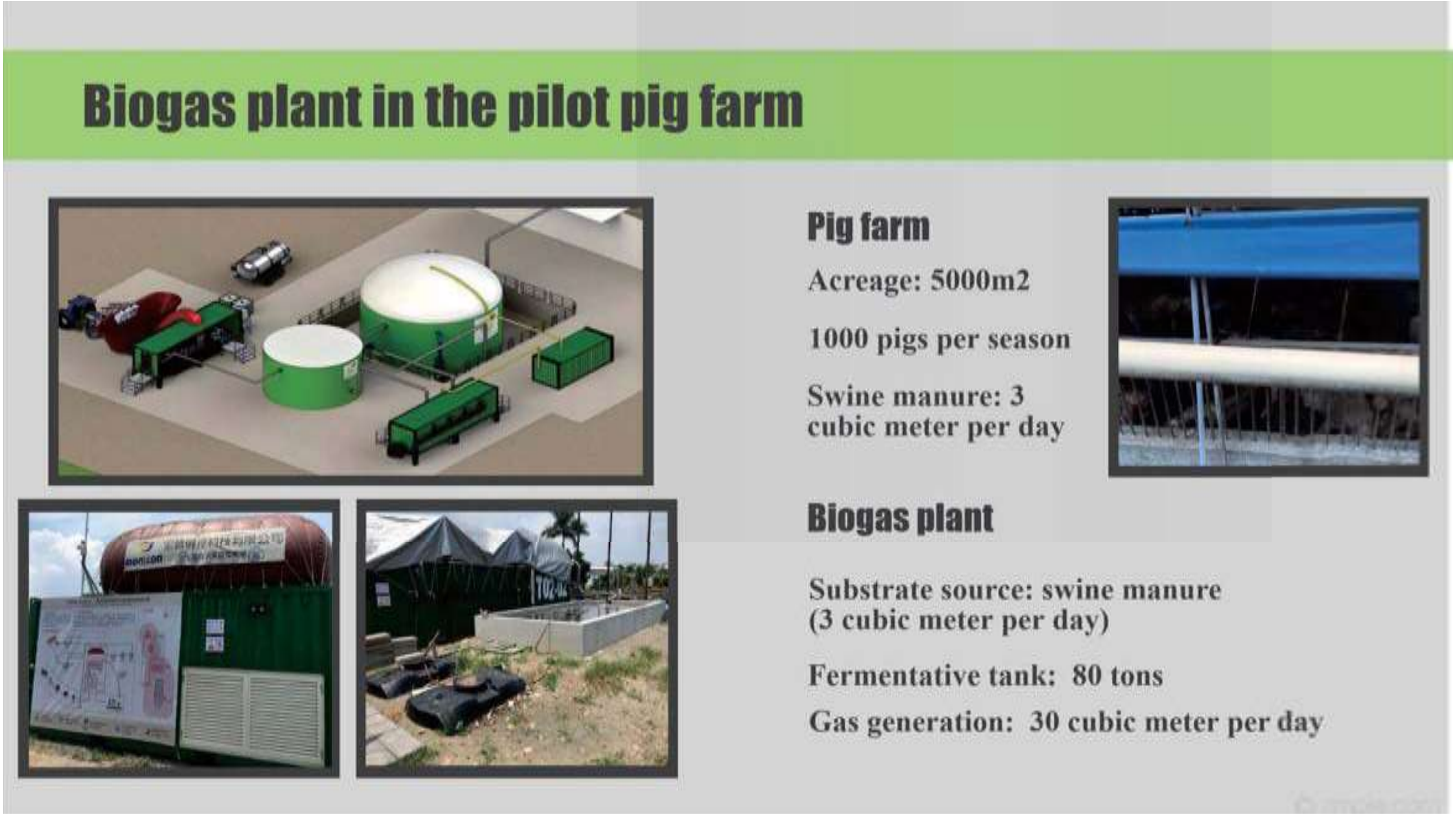
Apply high-tech methods to upgrade agriculture

Help farmers to improve the economic circumstances contributing to attracting young generations into agriculture

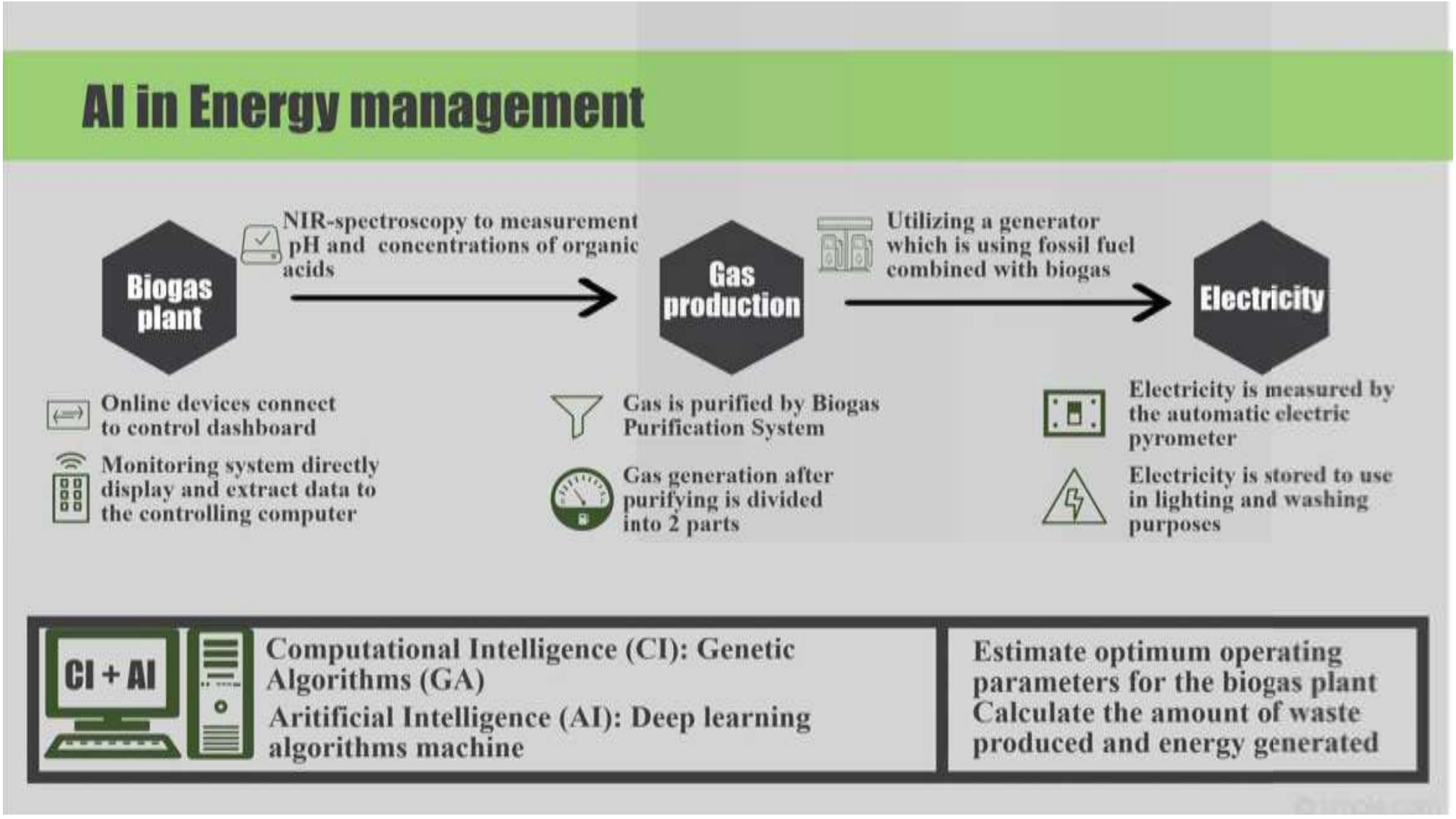
Provide information

Potential seasonal crops - high productivity

Preventing pests/ severe weather

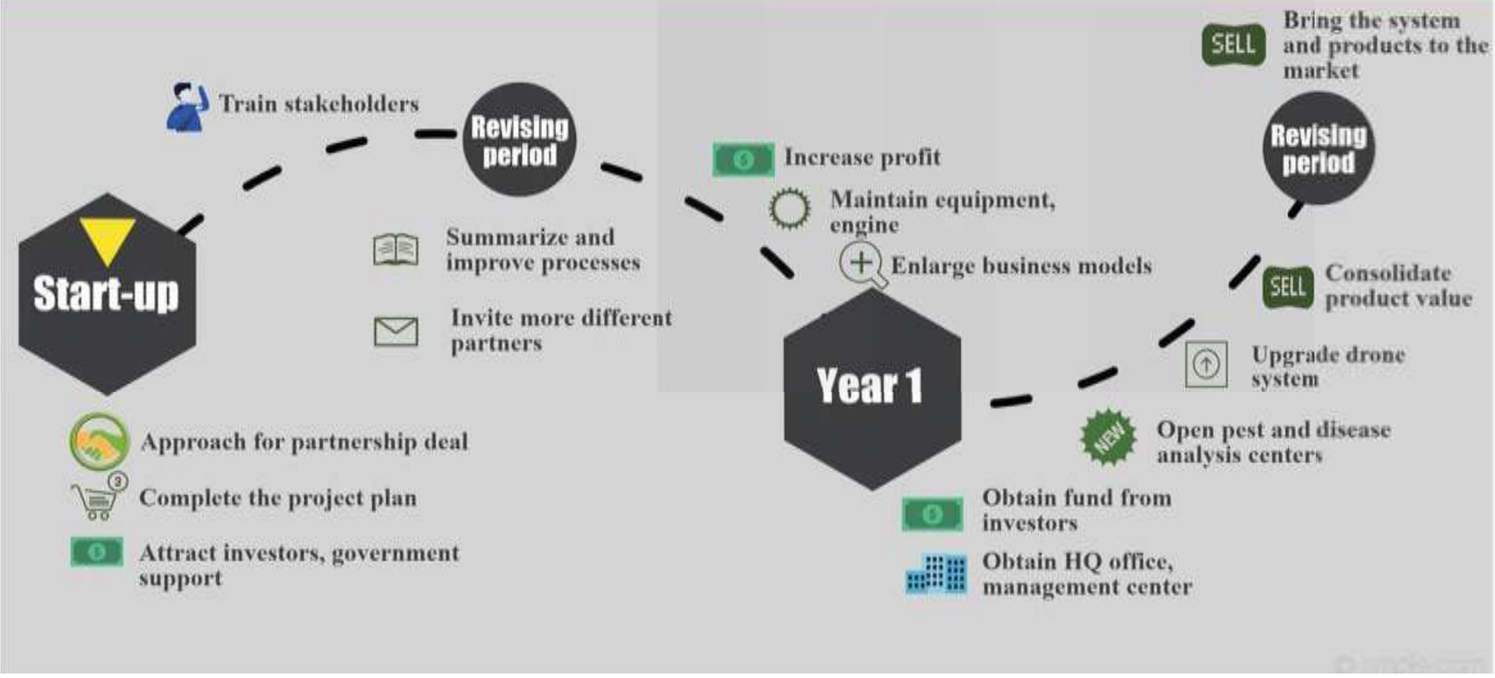

Biogas plant in the pilot pig farm
Pig farm
Acreage: 5000m2
1000 pigs per season
Swine manure: 3 cubic meter per day
Biogas plant
Substrate source: swine manure (3 cubic meter per day)
Fermentative tank: 80 tons
Gas generation: 30 cubic meter per day


Alley 12, Lane 31, Dali Street
Pig farm
Guozhong Road
Lane 433, Dali Road
Google
2D
Map


AI in Energy management
Biogas plant
NIR-spectroscopy to measurement pH and concentrations of organic acids
Gas production
Utilizing a generator which is using fossil fuel combined with biogas
Electricity
Online devices connect to control dashboard
Monitoring system directly display and extract data to the controlling computer
Gas is purified by Biogas Purification System
Gas generation after purifying is divided into 2 parts
Electricity is measured by the automatic electric pyrometer
Electricity is stored to use in lighting and washing purposes
CI + AI
Computational Intelligence (CI): Genetic Algorithms (GA)
Aritificial Intelligence (AI): Deep learning algorithms machine
Estimate optimum operating parameters for the biogas plant
Calculate the amount of waste produced and energy generated

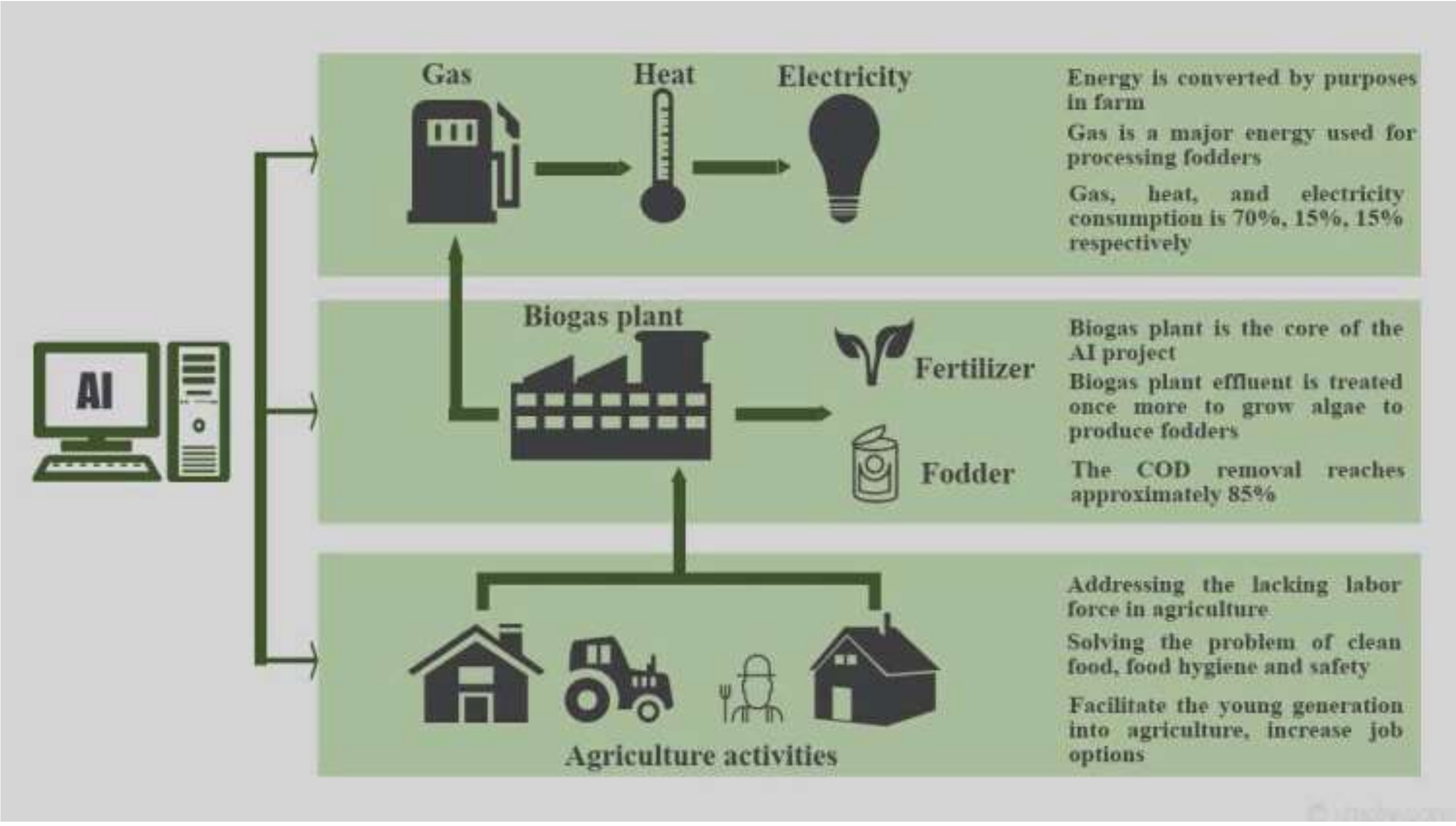

Economy
Farmer economy is stable contributing to the economy
Reduce management costs by using smart managing system and reducing labor costs
Promote agricultural economy
Saving energy and fodder costs
Net profit after tax NTD 9,256,813 in first year of operation (initial plan)
Agricuture
Apply high technology to upgrade traditional agriculture
Increase crop productivity, decrease labor force
Attract investors and government attention to develop agriculture
Prevent abandoning farmyard, fields
Facilitate the younger generation concentrate on agriculture, increase job options
Society
Prevent the discharge of husbandry wastewater into nearby canals
Create environmentally friendly products
Limit migration from rural areas to big cities
Proper solid waste management to avoid releasing GHG into the atmosphere
Diversify farming models contributing to supporting food balance

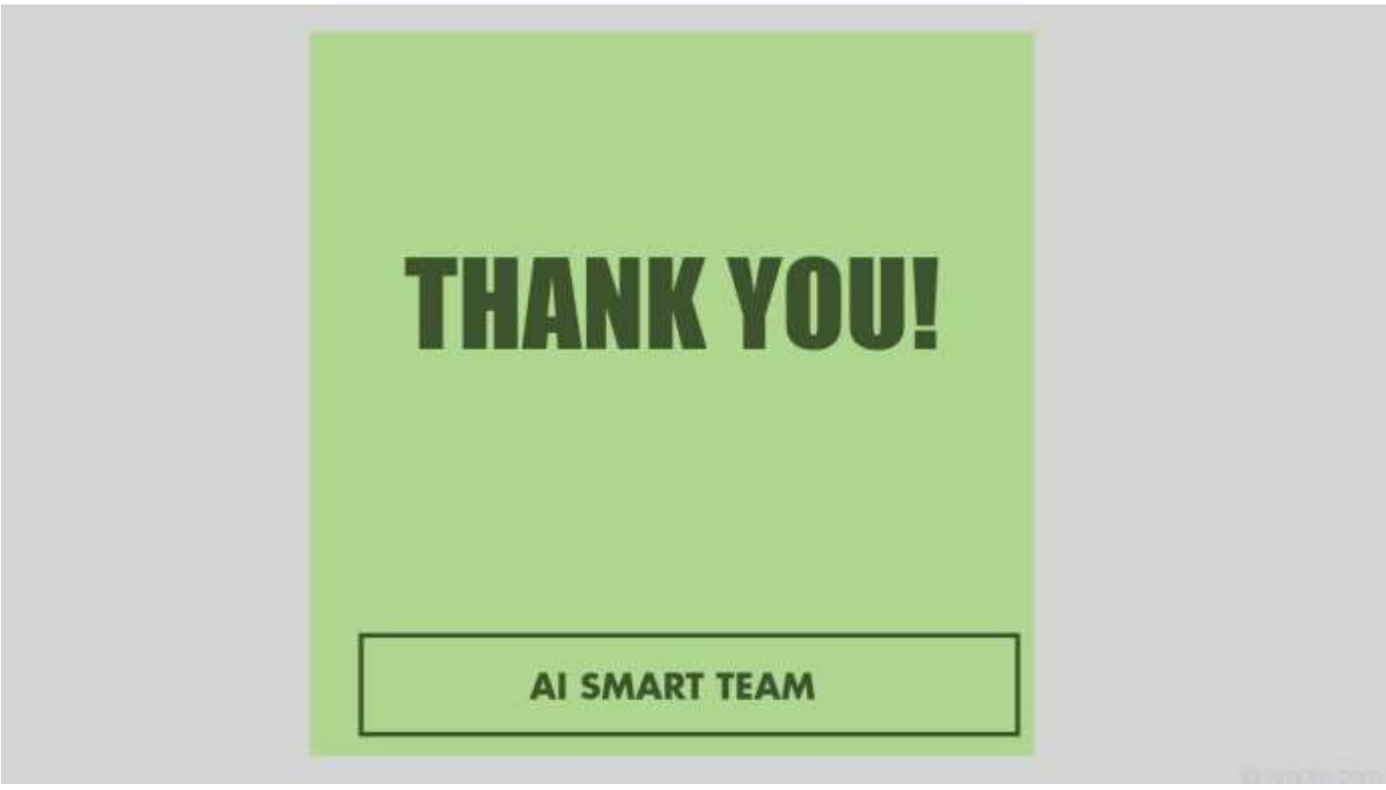
PROJECT TIMELINE



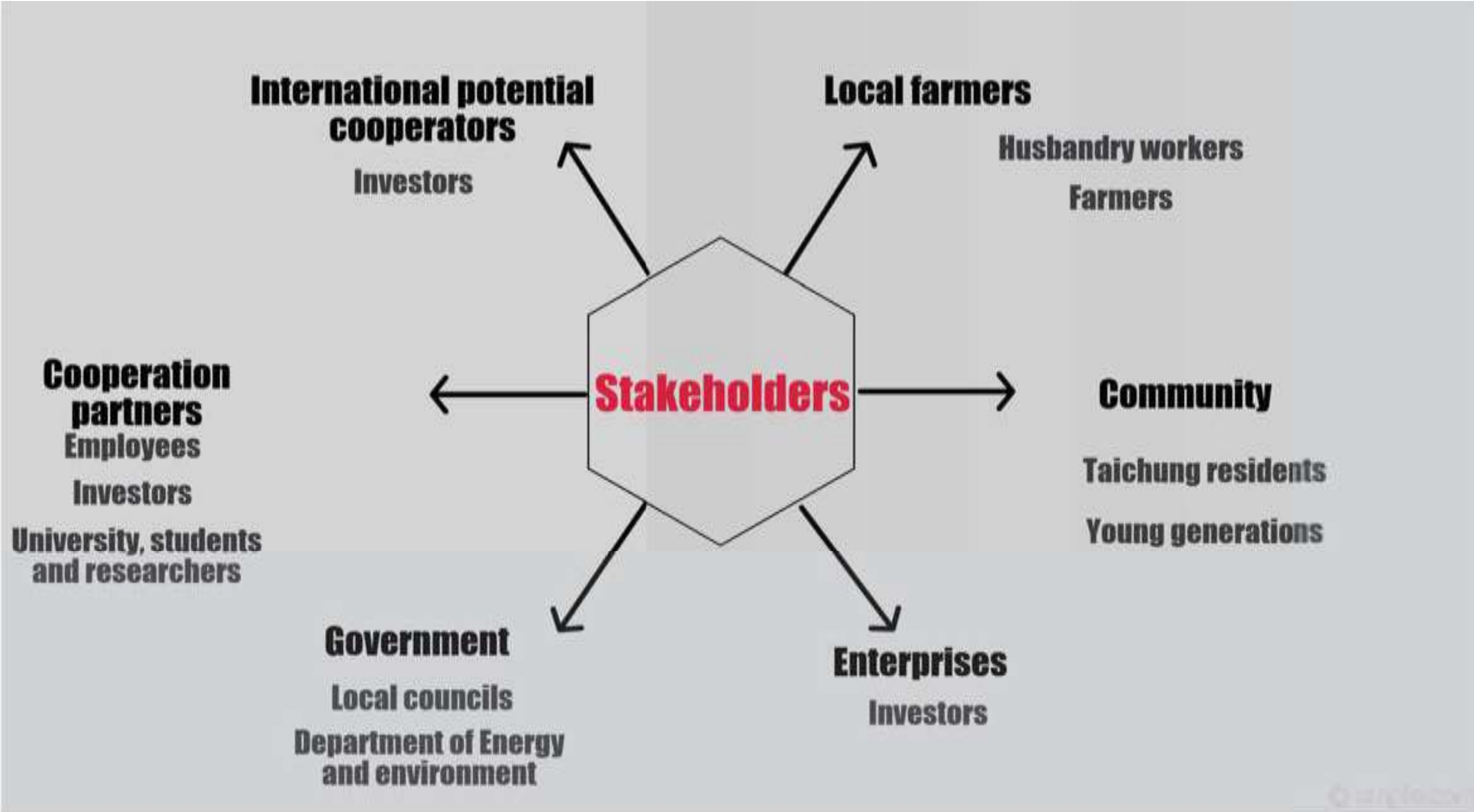
INCOME STATEMENT-FIRST YEAR OF OPERATION

Income	$85,437,500
Cost of electricity consumption	66,130,815
Gross profit for sale	$19,306,685
Operating expenses	2,550,000
Operating net profit	$16,756,685
Interest expense	3,900,000
Community feedback	1,285,669
Net profit before tax	$11,571,016
Income tax	2,314,203
Final profit	$ 9,256,813

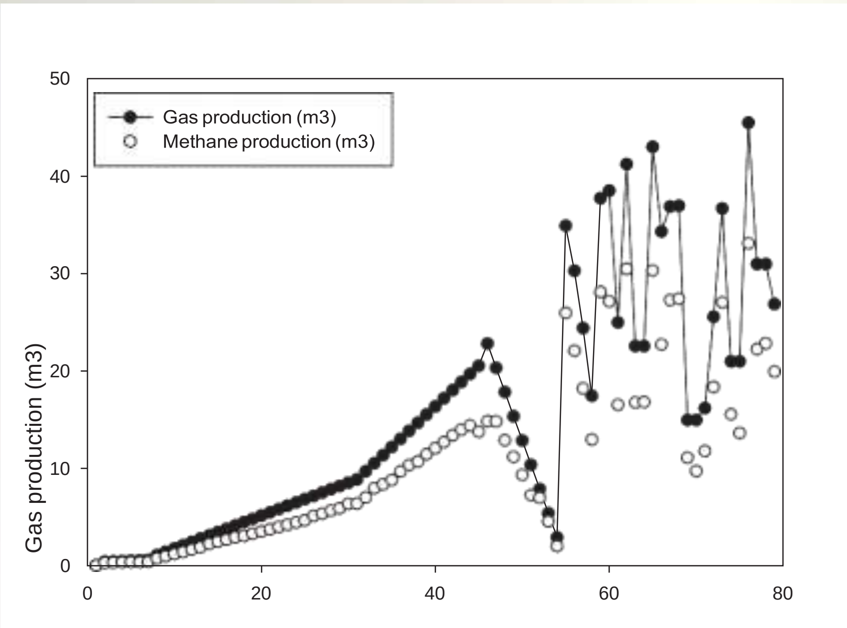

Gas
Heat
Electricity
Energy is converted by purposes in farm
Gas is a major energy used for processing fodders
Gas, heat, and electricity consumption is 70%, 15%, 15% respectively
AI
Biogas plant
Fertilizer
Fodder
Biogas plant is the core of the AI project
Biogas plant effluent is treated once more to grow algae to produce fodders
The COD removal reaches approximately 85%
Agriculture activities
Addressing the lacking labor force in agriculture
Solving the problem of clean food, food hygiene and safety
Facilitate the young generation into agriculture, increase job options


THANK YOU!
AI SMART TEAM

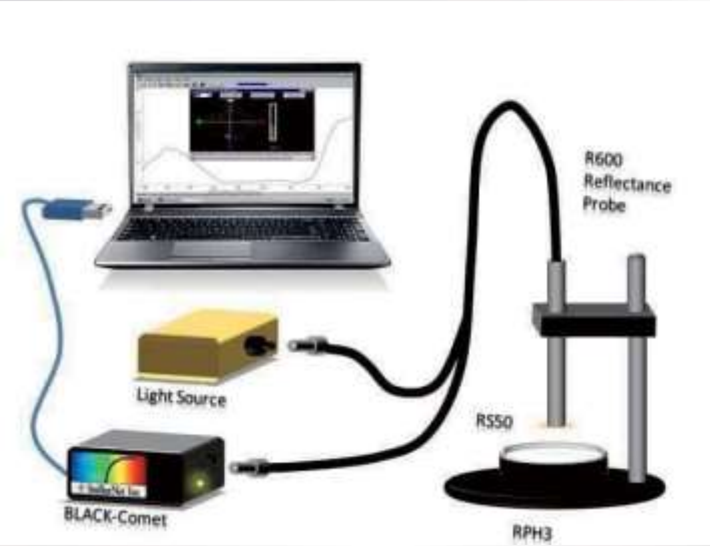
RESERVED SLIDES



Gas production



UV/vis-spectroscopy probe.



Generator

Biogas is used as a fuel on a generator using fossil fuel as its primary fuel, either diesel fuel or petrol.
This particular method, The generator uses pure biogas or hybrid system along with the diesel fuel or petrol
The reason is that this method enable hybridisation with other fuel and has the highest level of efficiency

Biogas purification system and generator

The main scale in Europe

The green electricity project includes purifying about 8,000 cubic meter per day (m3/ day) of biogas to serve as fuel for a generation plant with a capacity of 252 kW.
The green electricity would be sold to the grid at a price that is determined by renewable electricity auction–market prices.

This system can purify the gas to have 75% methane (CH4) for electricity generation or up to 97% CH4 for RNG generation.

Money flow

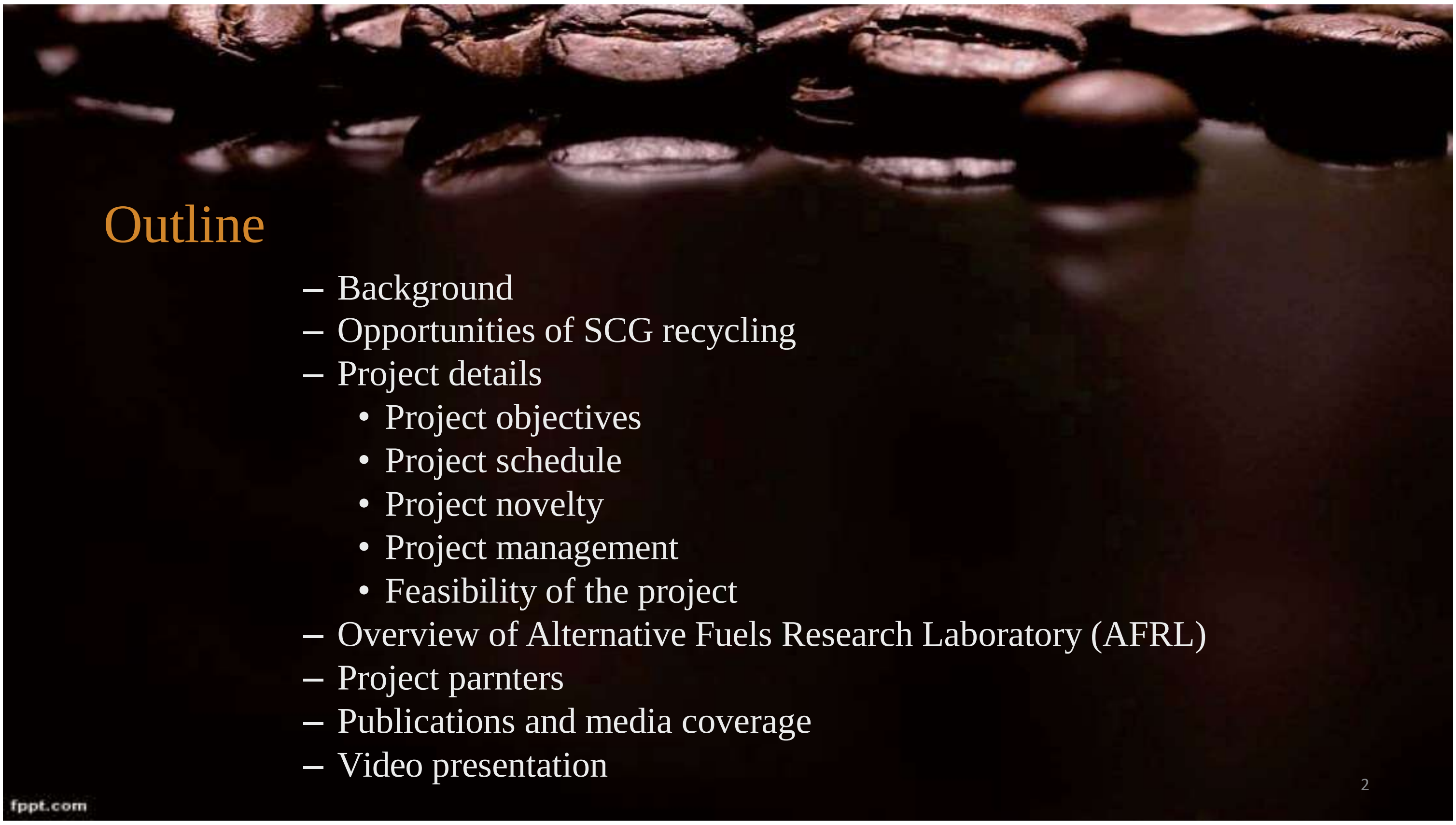
- **Establishment period(Building factory and Trial operation)**
  - **Business activity** **($ 15,311,860, Outflow)**
  - Investment activity ($282,500,000, Outflow)
  - Fundraising ($302,500,000, Inflow)
  - Estimated cash at the end of the period $4,688,140
- **First year of operation**
  - Business activity ($ 22,126,217, Inflow)
  - Investment activity (0)
  - Fundraising (0)
  - Estimated cash at the end of the period $26,814,357

Appendix 17

Team 9- Detritus Valore
(Republic of Korea)

Valorization of Spent Coffee Grounds (SCG) into Biofuels and Added-value Products: Pathway towards Integrated Bio-refinery


ERCİYES ÜNİVERSİTESİ 1978
SİİRT ÜNİVERSİTESİ 2007
Valorizati of Spe t Coffe Groun (SC) in Biofue and Added value Produc Pathw towards Integrat Bio refinery
1
fppt.com


Outline
– Background
– Opportunities of SCG recycling
– Project details
• Project objectives
• Project schedule
• Project novelty
• Project management
• Feasibility of the project
– Overview of Alternative Fuels Research Laboratory (AFRL)
– Project parnters
– Publications and media coverage
– Video presentation
2
fppt.com

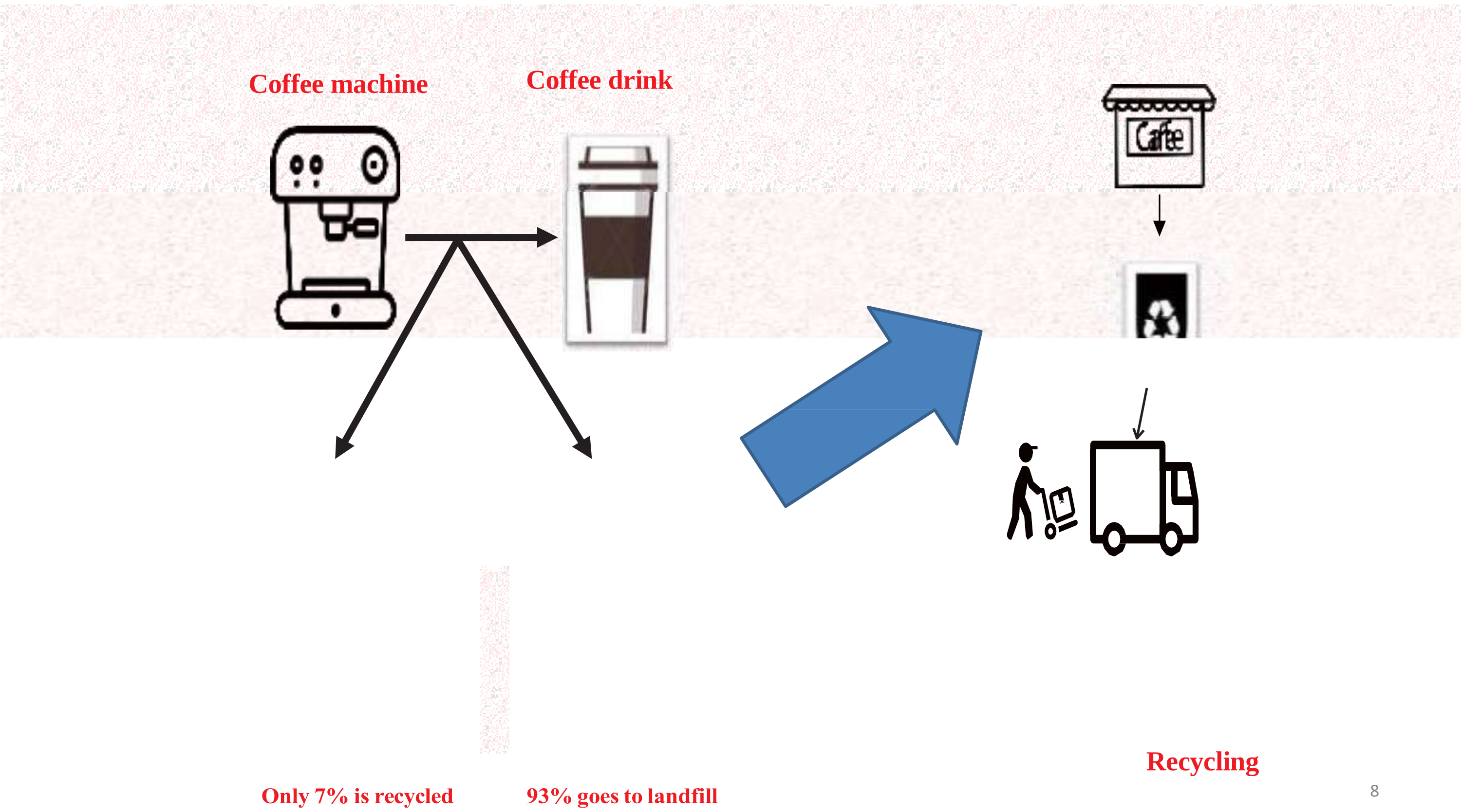
- **Huge amount of waste is generated daily including municipal, food, agricultural, and industrial waste.**
- Waste contains many **organic compounds** that demand excessive amounts of oxygen to degrade.
- Direct disposal of wastes to landfills is very harmful as they are toxic and generate **methane, carbon dioxide and greenhouse gases (global warming)**.
- This contributes towards huge **financial cost on tax payers** who run and maintain landfills. This cost is passed to customers via **higher collection fees**.
- **For example, In the UK, a landfill tax (currently around £85/tonne) is levied on landfill site operators.**

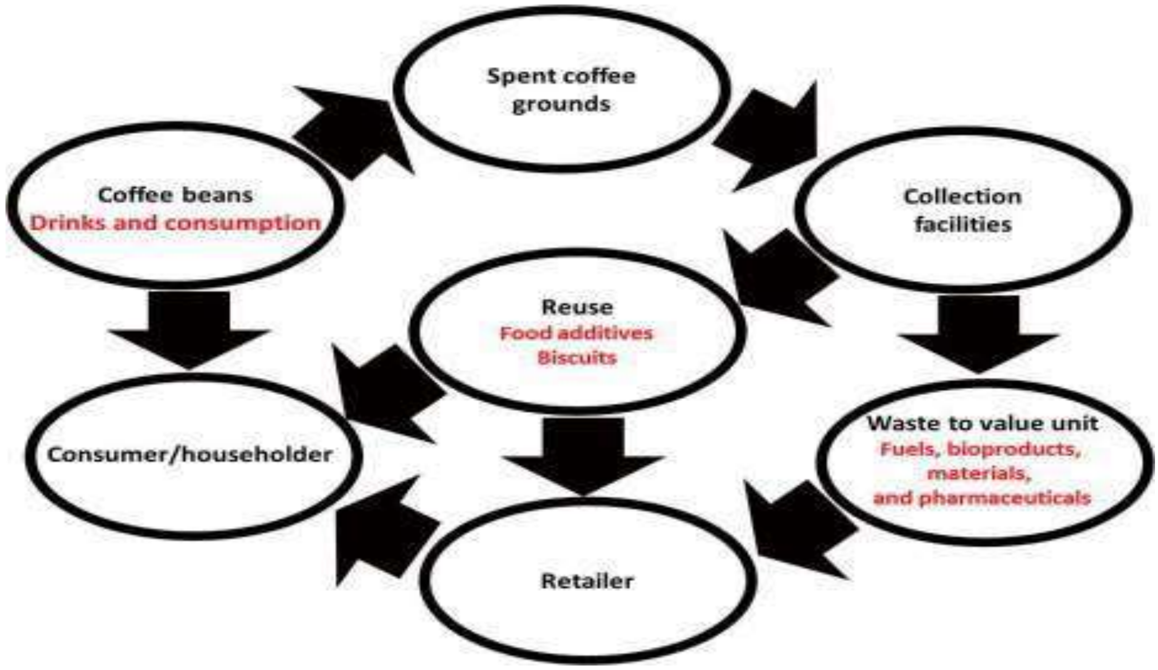
- **Recycling** of waste to energy and added-value products is one effective way.
- Recycling contributes to producing **biofuels** without the need to growing plants (edible or non-edible) or converting food (edible oils).
- Coffee is the second largest traded commodity after petroleum.
- Coffee is the second consumed beverage after water.
- Its beverage has many health benefits (reduce the risk of cancer, Neurodegenerative disease and cardiovascular disease.
- Due to its refreshing properties, approximately **4.9 billion cups** of coffee are consumed every day worldwide.


• According to International Coffee Organization, between 2015-2016, more than 9 million tons of coffee products were consumed worldwide.
• Coffee industry generates around 6 million tons of waste per year.
• Coffee drink making process, generate huge amount of a valuable dark colored waste as 550-670 g of SCG are generated from 1 kg of Robusta coffee.
• Moreover, wastewater generated from this industry contains dissolved and suspended organic carbon that can be also harmful to the enviroment.
fppt.com
5


Coffee industry: How big in size!!!!!
Starbucks ground coffee package size = 6.6*9.9*17,78 cm, 340 grams
Length of Great wall of China = 21.2 million meters
Annual coffee production can surround the wall 15 times.

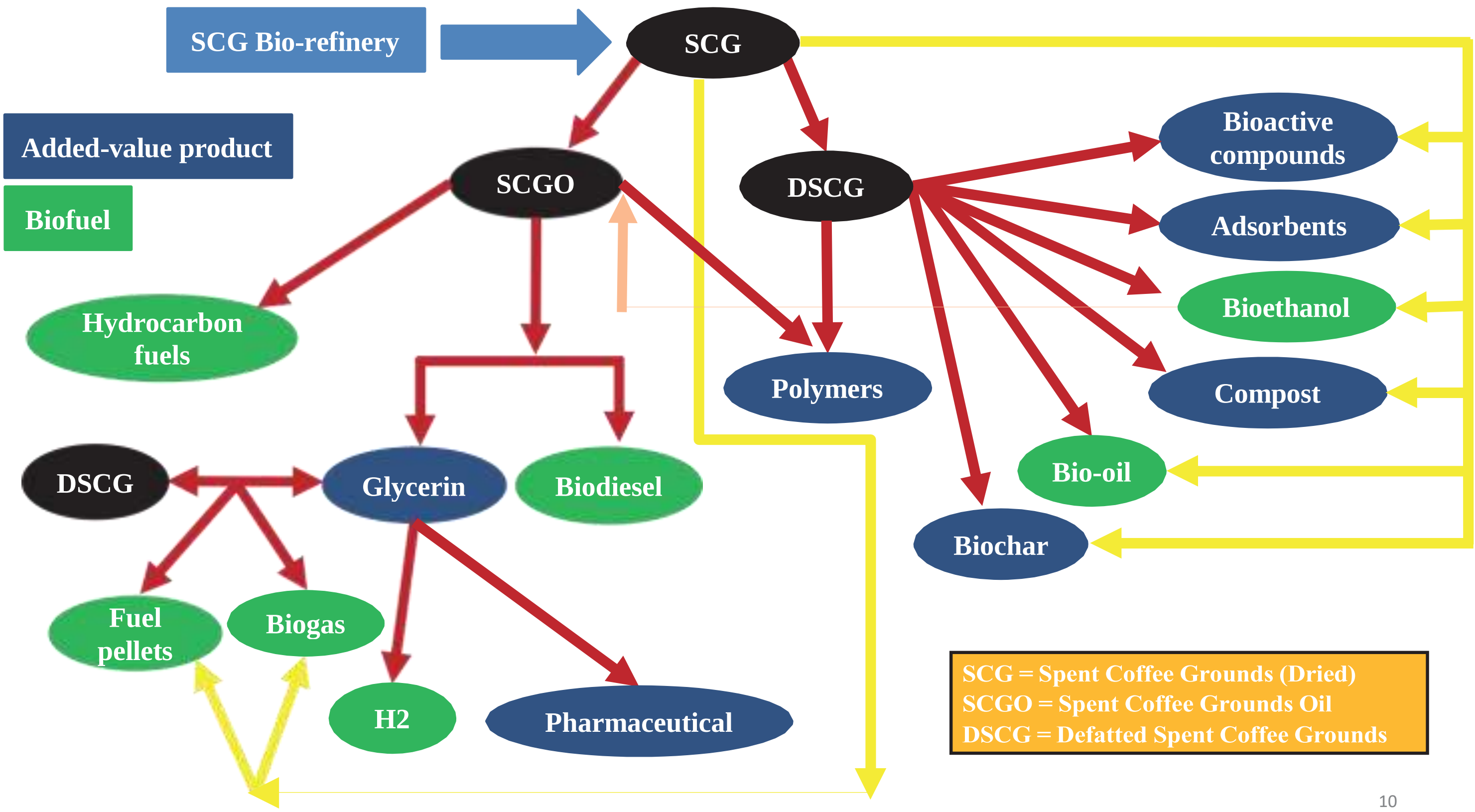

• After making coffee from CG, 55-60% of coffee is wasted.
fppt.com
7


Coffee machine
Coffee drink
Only 7% is recycled
93% goes to landfill
Recycling
8



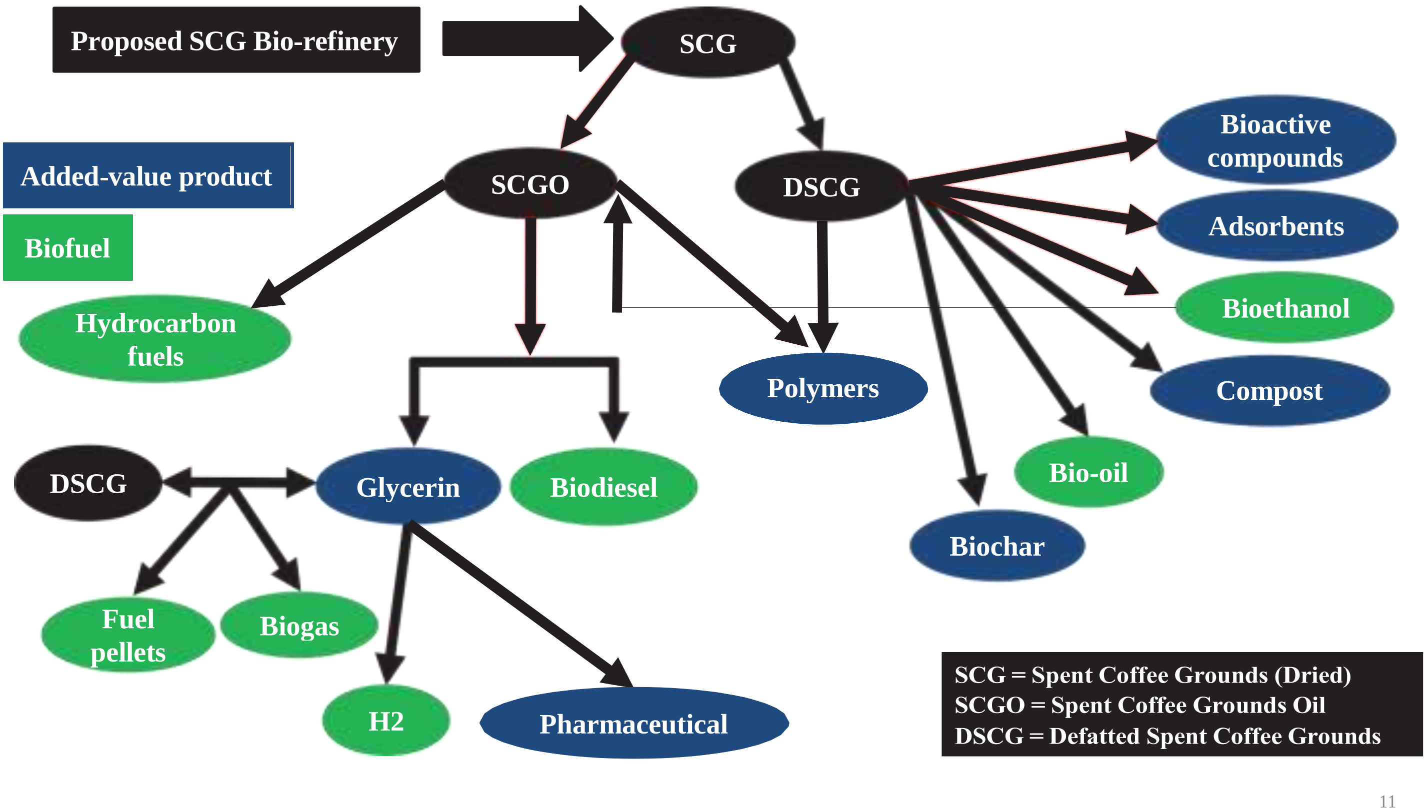
Spent coffee grounds
Collection facilities
Waste to value unit
Fuels, bioproducts, materials, and pharmaceuticals
Retailer
Consumer/householder
Coffee beans
Drinks and consumption
Reuse
Food additives
Biscuits

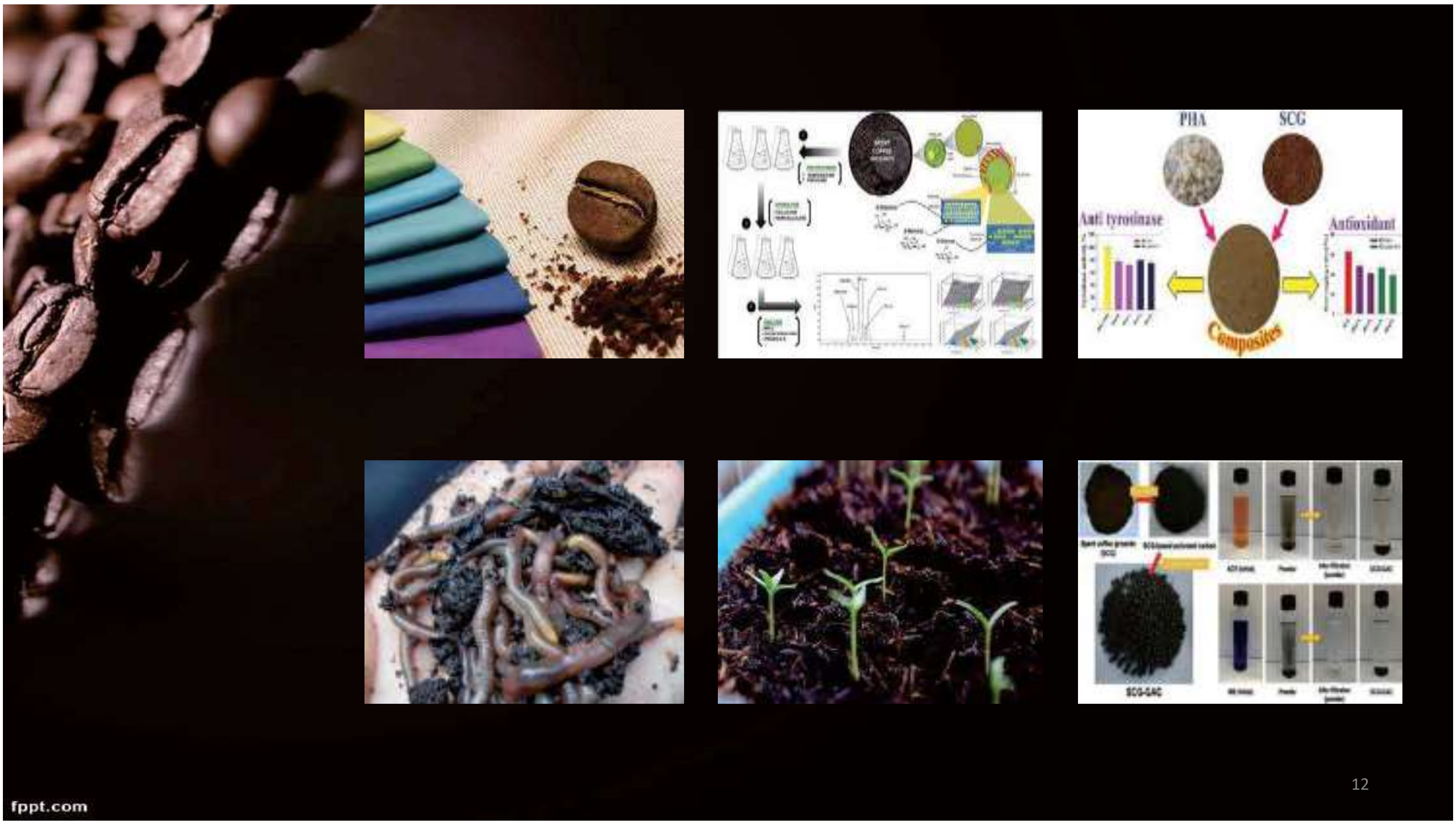
9



SCG Bio-refinery
SCG
Added-value product
Biofuel
SCGO
DSCG
Bioactive compounds
Adsorbents
Bioethanol
Compost
Bio-oil
Biochar
Polymers
Hydrocarbon fuels
Glycerin
Biodiesel
DSCG
Fuel pellets
Biogas
H2
Pharmaceutical
SCG = Spent Coffee Grounds (Dried)
SCGO = Spent Coffee Grounds Oil
DSCG = Defatted Spent Coffee Grounds

10


Proposed SCG Bio-refinery
SCG
SCGO
DSCG
Added-value product
Biofuel
Hydrocarbon fuels
Bioactive compounds
Adsorbents
Bioethanol
Compost
Polymers
Bio-oil
Biochar
DSCG
Glycerin
Biodiesel
Fuel pellets
Biogas
H2
Pharmaceutical
SCG = Spent Coffee Grounds (Dried)
SCGO = Spent Coffee Grounds Oil
DSCG = Defatted Spent Coffee Grounds
11

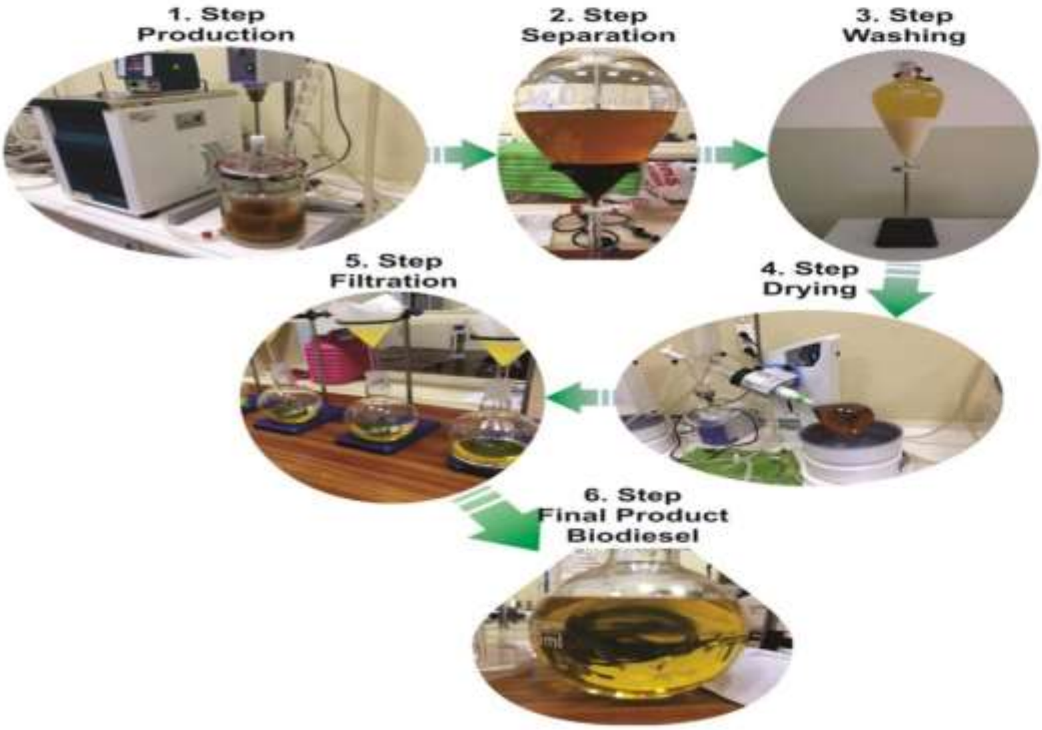

PHA
SCG
Anti tyrosinase
Antioxidant
Composites
12
fppt.com

100 kg of SCG yields12 kg oil and 88 kg DSCG

Before Extraction **After Extraction**

Biodiesel Production from SCG

13



14

Biogas Production from SCG

15

Project objectives and Schedule

16

Phase 1

Erciyes and Siirt Universities and Siirt Municipality

- Biodiesel and biogas production (quality assessment).
  - Co-substrates evaluation prior to the anaerobic digestion process (AD).
  - CH_4 optimization by co-digesting at different ration and various process parameters (AD).
- To produce electricity and supply the electricity to **battery operated wheelchair** of handicapped people by collaboration with Siirt municipality.

Phase 2

Erciyes, Siirt and Yonsei Universities

To further investigate the potential of SCG into other biofuels and added-value products.

Project Objectives

17

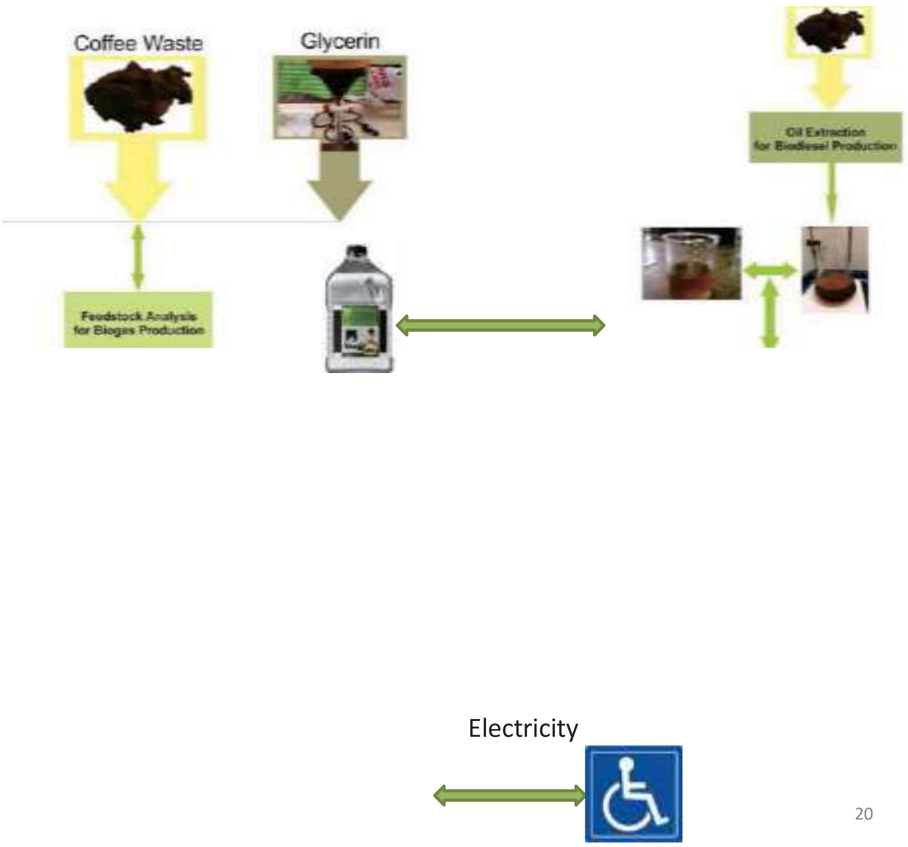
No	Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Phase 1																								
1	Collection of SCG	■																							
2	Characterization of SCG and oil extraction		■	■	■																				
3	Production and characterization of biodiesel			■	■	■	■																		
4	Biodiesel blending with alcohols and diesel				■	■	■	■																	
5	Characterization of defatted SCG						■	■	■	■															
6	Biogas experimental set-up						■	■	■	■															
7	Production of biogas from SCG and other waste								■	■	■	■													
8	Modelling of biogas proudction									■	■	■	■												
	Phase 2																								
9	Preparation of fuel pellet with partner													■	■	■	■	■							
10	Biethanol production from SCG with partner													■	■	■	■	■							
11	Production of added-value products with partner																		■	■	■	■	■	■	■

- This project is **100% recycling** project that aims to save the environment and produce biofuels and added-value products through achieving **zero-waste** of coffee beverage shops.
- **Biogas enhancement** (co-digestion of glycerin and SCG).
- Findings will be shared with both **policy maker and market** to realize the Project as case of Turkey.

Project Novelty

19

Project Management



20

- This project is sustainable due to **3 important factors**:
  - ./ SCG is **generated in bulk** in a daily basis.
  - ./ SCG recycling saves environment from **harmful emissions (landfills)**.
  - ./ SCG has **excellent characteristics,** making it very promising feedstock to produce **biofuels and added-value products (Bio-refinery)**.
    - Some of these characteristics are its reasonable oil content, elemental composition and heating value.

Project Sustainability

Preliminary findings proved the **Feasibility and the Promising Market Potential of the Project** in Turkey as it is a touristic-hub with thousands of coffee shops across the economy (Istanbul, Antalya, Izmir, Trapzon, Ankara, Siirt etc).

For this we have achieved the following:

D Agreement with **Siirt municipality** to apply the project to charge wheelchairs (handicapped). **(Confirmed)**

D Positive feedbacks from some companies to commercialize the Project products **(FazlaG1da company, Istanbul)**. **(Initial Discussion)**

Feasibility and Marketing Potential

AFRL

23

24

Project Partners

Published Papers

Improved service and being green city

Being green shop and increasing costumers

Getting more attention and obtaining more comfortable live

25

Publications and media coverage

Valorization of spent coffee grounds recycling …..

26

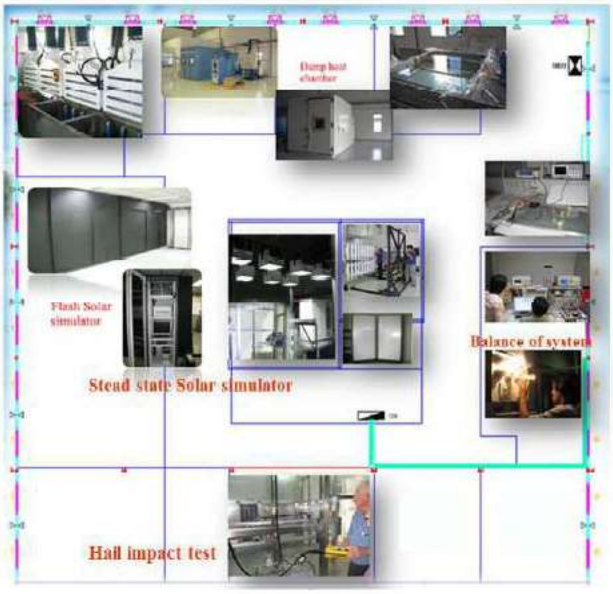

Conclusion
✓ SCG is abundant organic waste available at low price.
✓ Recycling SCG save the environment and creates new jobs.
✓ SCG has excellent characteristics for recycling.
✓ It can be recycled to produce biofuels and added-value products.
✓ The Project is feasible in Turkey.
✓ Biorefinery turn this valuable waste into useful products.
✓ If everythings goes on our plan, we hope we will be able to take our market within 2 years.
SCG
Environment
Jobs
Excellent Characteristics
Biofuels
Added-value products
Feasibility
Bio-refinery
Market
27


Thank you for your listening!
~ END ~
Remember Recycling!!!
Watch Our Video
fppt.com
28

Technique Forum

Real Case Practices

CES Solar Cells Testing Center (CSSC)

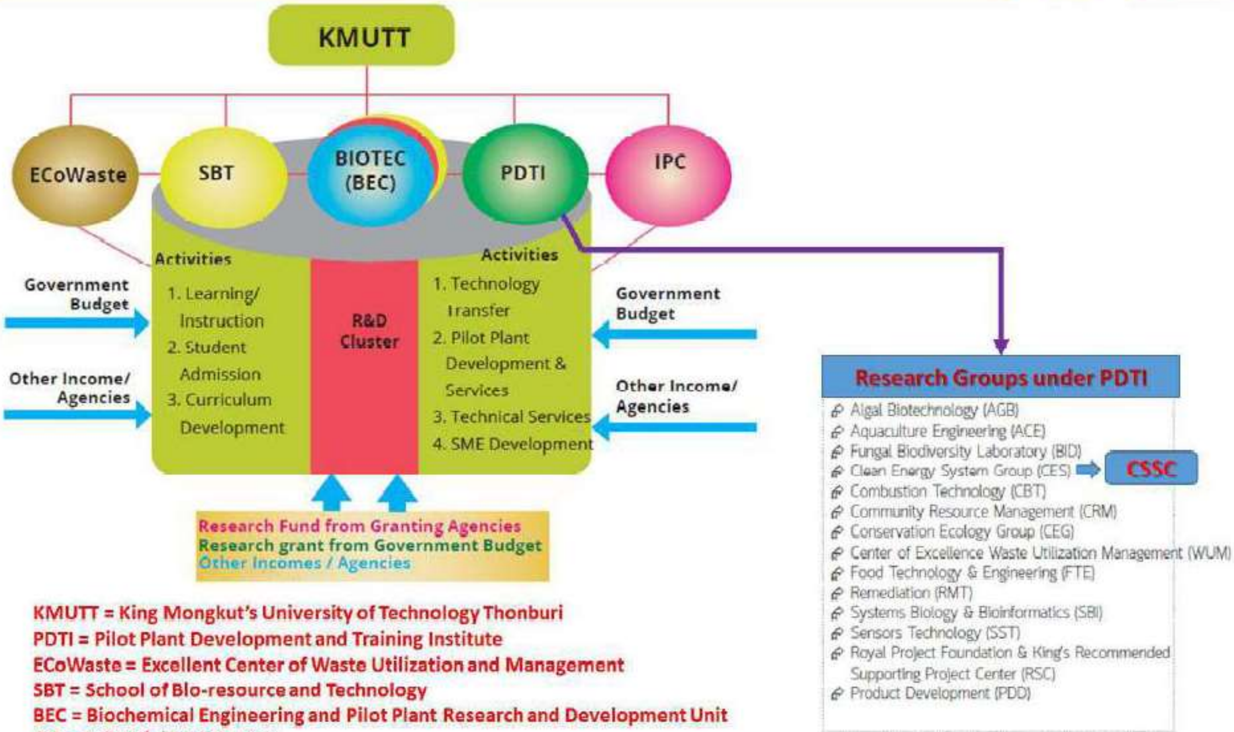


Testing laboratory according to ISO/IEC 17025 : 2005,

TLAS accredited testing laboratory No. TESTING 0343*

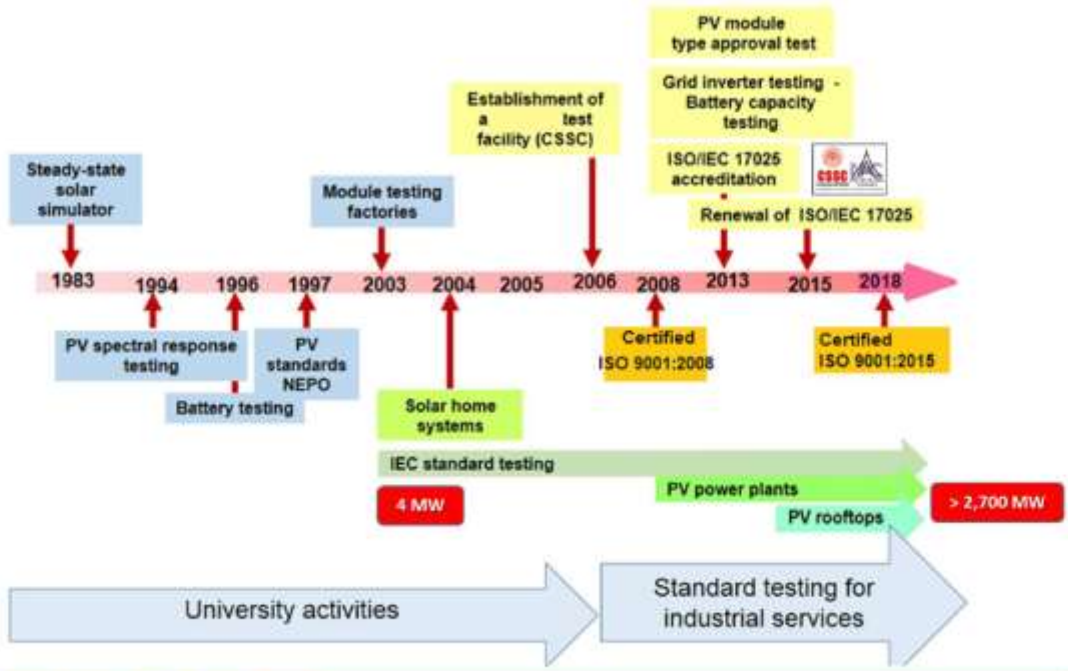
- CSSC had been funded by the Department of Alternative Energy Development and Efficiency (DEDE) – Ministry of Energy, and Energy Conservation Promotion Fund.
- CSSC was established and supported by the King Mongkut's University of Technology Thonburi (KMUTT).

CES Solar Cells Testing Center (CSSC) in KMUTT



KMUTT = King Mongkut's University of Technology Thonburi
PDTI = Pilot Plant Development and Training Institute
ECoWaste = Excellent Center of Waste Utilization and Management
SBT = School of Bio-resource and Technology
BEC = Biochemical Engineering and Pilot Plant Research and Development Unit
IPC = Industrial Park Center

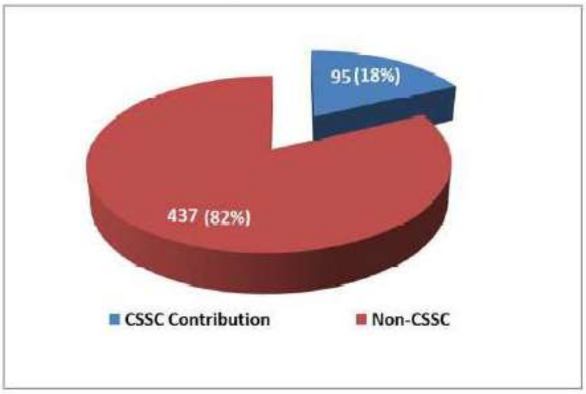
Solar Cells Testing Activities and Facilities



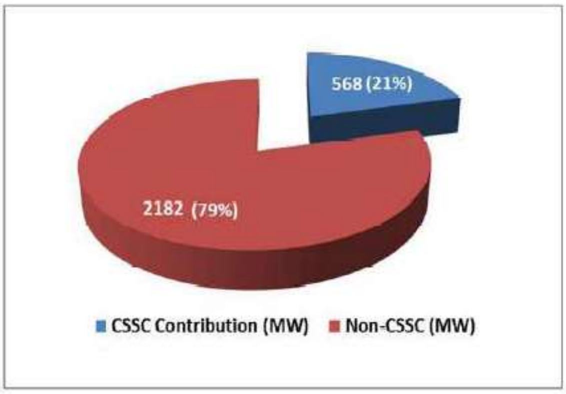
CES Solar Cells Testing Center (CSSC)
Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi 3

PV System Testing and PV Industry in Thailand

Share of small and very small PV power producers contributing to CSSC (Projects, %)



Share of installed capacity of small and very small PV power producers contributing to CSSC (MW, %)



For PV system installation cost of 50-100 million baht/MW (about 1.5 -3.0 million$/MW), the contribution of CSSC to PV industry is about 56,800 million baht (1,738 million$)

Reference:

SPP/VSPP Database of Office of Energy Regulatory Commission (www.erc.or.th), accessed date: 22 August 22, 2016

CES Solar Cells Testing Center (CSSC)
Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi 4

CSSC – Activities in PV systems

- Standard testing for PV products
- Research and Development
- Training

CSSC CES SOLAR CELLS TESTING CENTER
KING MONGKUT'S UNIVERSITY OF TECHNOLOGY THONBURI

NAC THAILAND NSC-TISI-TIS 17025 TESTING 0343

globalgroup ISO 9001 UKAS MANAGEMENT SYSTEMS 5965

Provision of Testing and Training on Photovoltaic system and Renewable Energy

http://www.globalgroup.net/certification/certification-check/

The present CSSC capacity

To test the following equipments according to IEC standards

(1) Type approval of PV modules

Size 2 x 2 m^2

(2) Battery

(3) BOS: Inverter, Battery Charge Controller

IEC61727, มอก.2606

IEC62116, มอก.2607

PEA, MEA

CSSC CES SOLAR CELLS TESTING CENTER
KING MONGKUT'S UNIVERSITY OF TECHNOLOGY THONBURI

CSSC – Testing Activities (ISO/IEC17025:2005)

"CSSC is the testing laboratory according to ISO/IEC 17025 : 2005, TLAS accredited testing laboratory, Accreditation No. : TESTING 0343*"

*** The scope of testing: [https://ssj-tisi.com/tislab/testing/test343e.html]**

1. - Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval

-Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval

IEC61215 and IEC61646 and IEC61730-1, IEC61730-2 and IEC TS 62804-1:2015

TIS 1843 and TIS 2210 and TIS 2580-1, TIS 2580-2

2. Grid-connected inverter

IEC61727 and IEC62116 and IEC62093

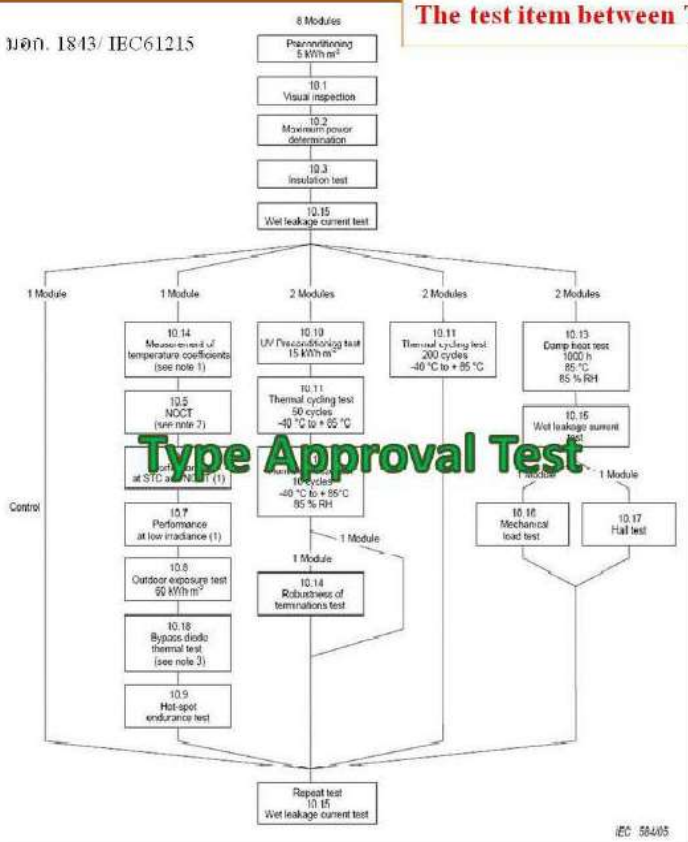
TIS 2606 and TIS 2607

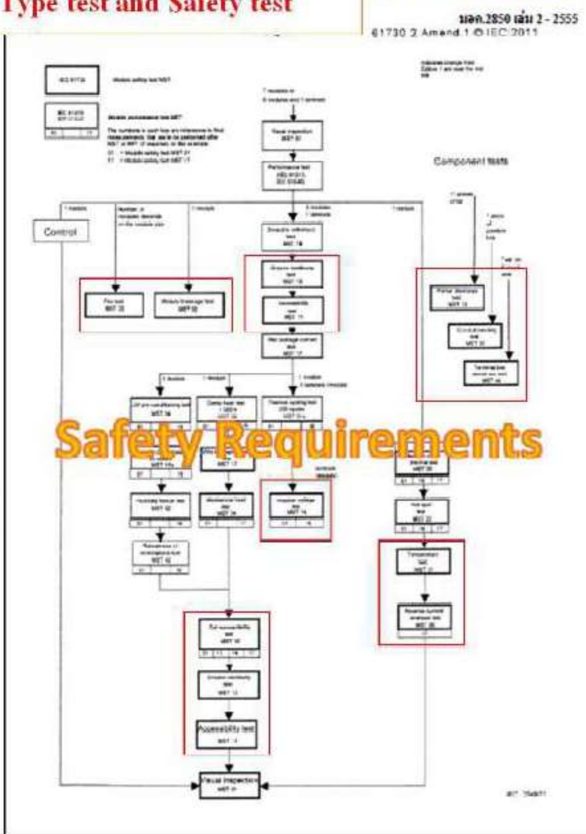
3. Stationary lead-acid batteries : Vented types

IEC61427 and IEC60896-11

CSSC
CES SOLAR CELLS TESTING CENTER
NSC TISI TIS 17025
TESTING 0343
KING MONGKUT'S UNIVERSITY OF TECHNOLOGY THONBURI

The test item between Type test and Safety test






CSSC – Testing Activities (PV modules)
CSSC
SOLAR SIMULATOR FLASH TYPE
STEADY STATE SOLAR SIMULATOR
Cells and Modules Characterization
Isc
Imp
Pmp
Performance at STC
• Irradiance 1000 W/m²
• Module Temperature 25 °C
• Air Mass (AM) 1.5 (as defined in IEC 60904-3)
Mechanical Load Testing Set
TEST ITEM
- Mechanical Load Test
CAPABILITY
- Area of module ≤ 2x2 m2
- Uniform load
CES Solar Cells Testing Center (CSSC)
Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi
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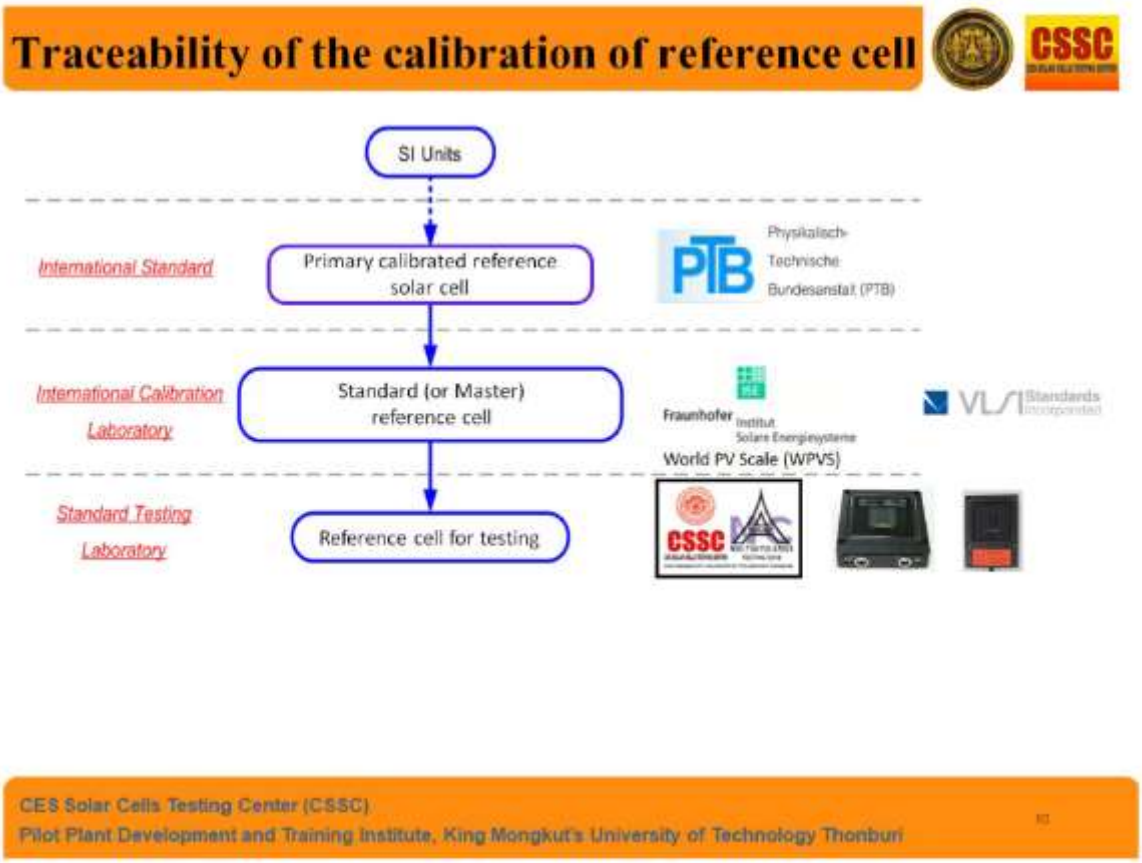
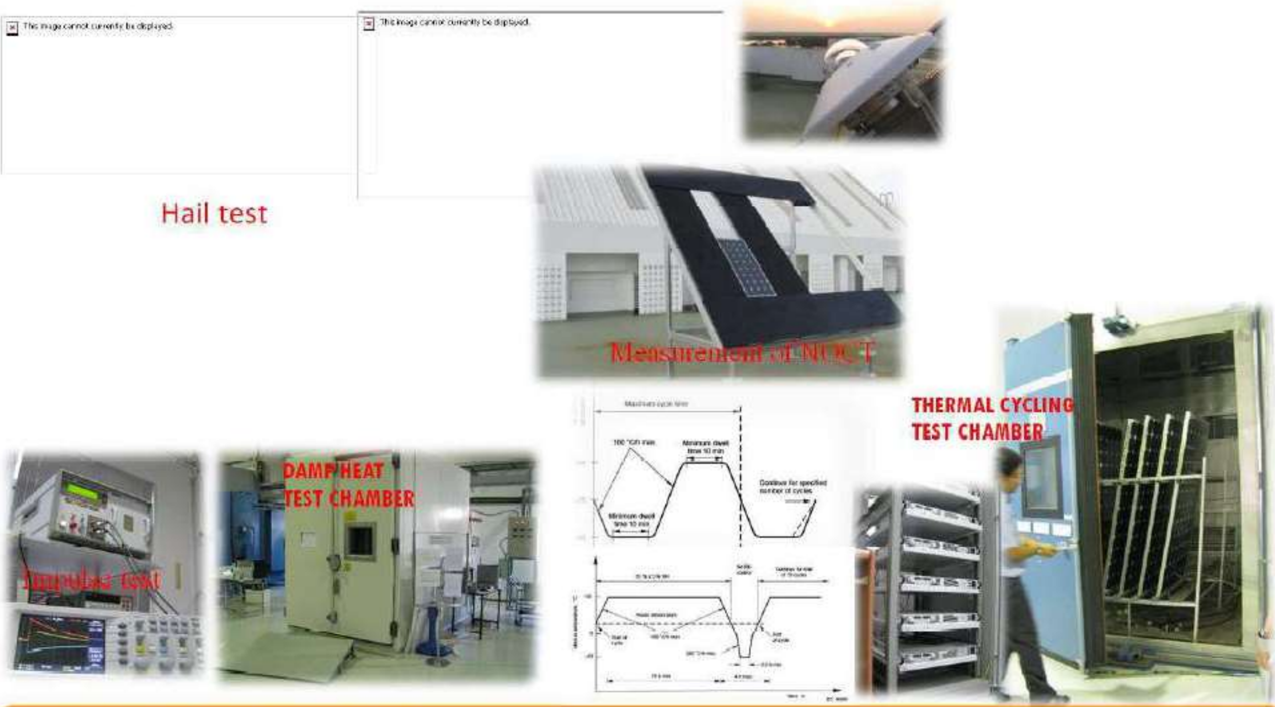

Traceability of the calibration of reference cell
CSSC
SI Units
International Standard
Primary calibrated reference solar cell
PTB
Physikalisch-Technische Bundesanstalt (PTB)
International Calibration Laboratory
Standard (or Master) reference cell
Fraunhofer Institut Solare Energiesysteme
World PV Scale (WPVS)
VLSI Standards Incorporated
Standard Testing Laboratory
Reference cell for testing
CSSC
CES Solar Cells Testing Center (CSSC)
Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi

CSSC – Testing Activities (PV modules)

IEC61215 and IEC61646 and IEC61730



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Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi

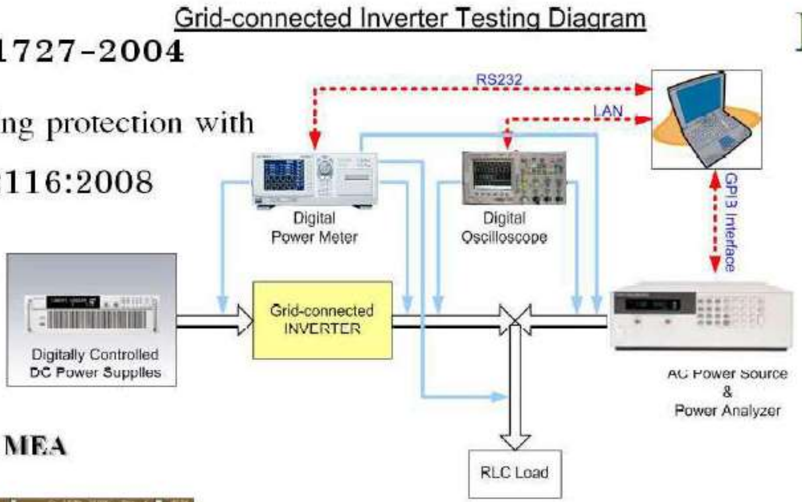
11

CSSC – Testing Activities (BOS & Battery testing)

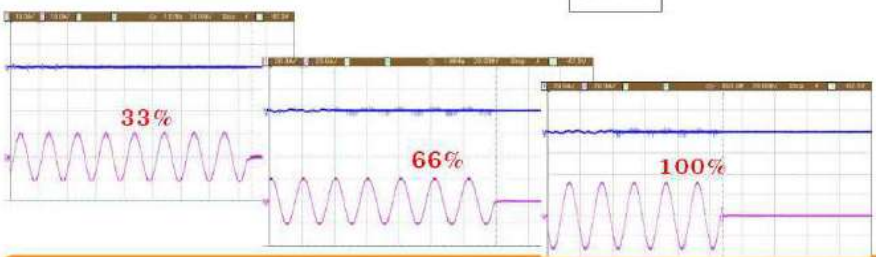
IEC61727-2004

Islanding protection with

IEC62116:2008



PEA, MEA



Battery Testing Facilities

IEC60896-11 clause 14

IEC60896-21 clause 6.11

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CSSC – R&D Activities - Directions

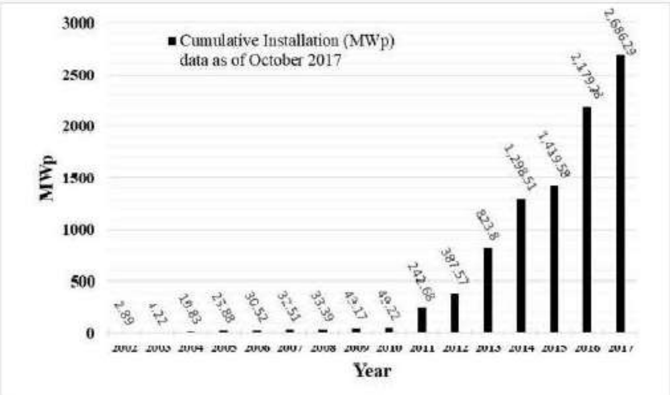
CSSC

- Standard development
- Long term evaluation and monitoring
- Characterization and Measurement
- Aging and Reliability
- PV systems investigations – On-grid and Off-grid

  such as:- system design, Impacts of PV penetration, power values

CSSC / KMUTT – R&D Activities: PV status in Thailand

CSSC



AEDP 2015 (2015-2036) → 6,000 MW (cumulative target)

Current ongoing PV program :

- **800 MWp (PV ground mount units) of government and agricultural cooperatives (≤ 5 MWp)**
- **In August 2016 : 100 MWp of pilot projects of self-consumption scheme of PV rooftop program was announced. Application date until October 2016.**

- Before 2004, cumulative installation ~ 6 MW
- During 2004-2006 SHS ~ 24 MW
- 2004, the first PV power Plant by EGAT ~ 500 kW
- Since 2006, the "Adder measure" had been launched

and also revised in 2009

- Since 2007 – PV power plants in MW size by private sector
- Until 2008 - cumulative installation ~ 34 MW
- 2009 – Ministry of Energy launched REDP 15 Yrs (target. 2,000 MWp)
- 2012 – Ministry of Energy launched AEDP (target: 3,000 MWp)
- 2013 - Power purchase from solar PV rooftop,

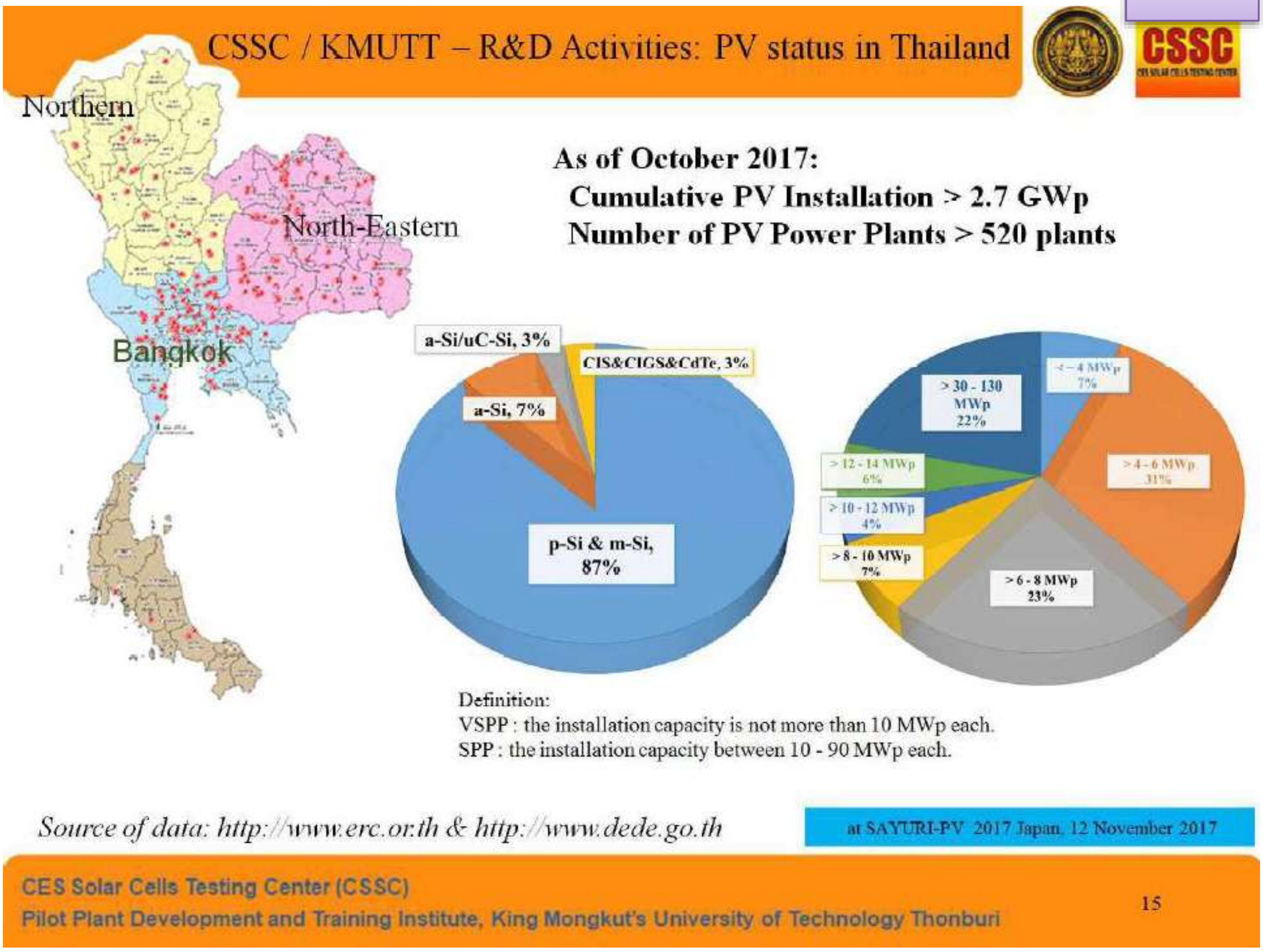
feed-in tariff (FiT) for 25 year.

- 800 MWp (PV ground mount units) of

government and agricultural cooperatives

- 100 MWp PV rooftop : self-consumption

at SAYURI-PV 2017 Japan, 12 November 2017


CSSC / KMUTT – R&D Activities: PV status in Thailand
CSSC
Northern
North-Eastern
Bangkok
As of October 2017:
Cumulative PV Installation > 2.7 GWp
Number of PV Power Plants > 520 plants
a-Si/uC-Si, 3%
CIS&CIGS&CdTe, 3%
a-Si, 7%
p-Si & m-Si, 87%
> 30 - 130 MWp 22%
< 4 MWp 7%
> 4 - 6 MWp 31%
> 12 - 14 MWp 6%
> 10 - 12 MWp 4%
> 8 - 10 MWp 7%
> 6 - 8 MWp 23%
Definition:
VSPP : the installation capacity is not more than 10 MWp each.
SPP : the installation capacity between 10 - 90 MWp each.
Source of data: http://www.erc.or.th & http://www.dede.go.th
at SAYURI-PV 2017 Japan, 12 November 2017
CES Solar Cells Testing Center (CSSC)
Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi
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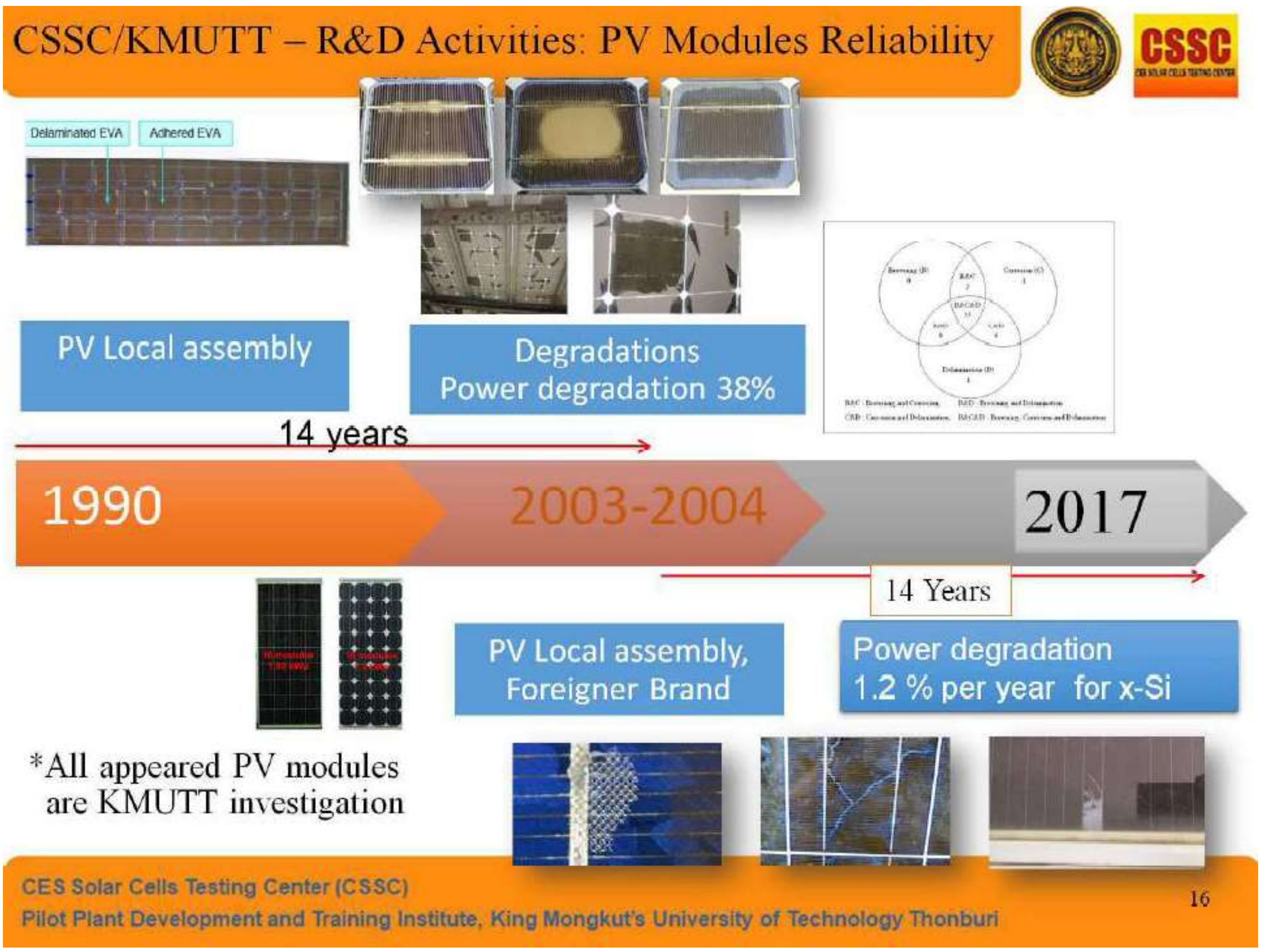
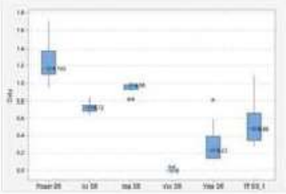

CSSC/KMUTT – R&D Activities: PV Modules Reliability
CSSC
Delaminated EVA
Adhered EVA
PV Local assembly
Degradations
Power degradation 38%
14 years
1990
2003-2004
2017
14 Years
PV Local assembly, Foreigner Brand
Power degradation
1.2 % per year for x-Si
*All appeared PV modules are KMUTT investigation
CES Solar Cells Testing Center (CSSC)
Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi
16

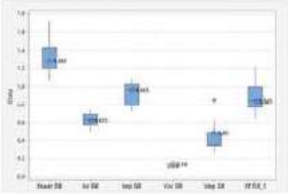
AP 18-9

Area 4 3-0023 : Long- Term (13-year) Monitoring and Reliability of PV Module Degradation in Thailand

INTERNATIONAL PVSEC-26



Degradation rates of electrical parameters for mono-Si PV modules (16 samples).

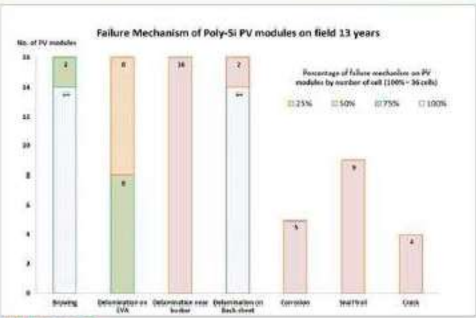


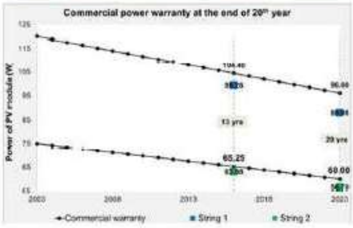
Degradation rates of electrical parameters for poly-Si PV modules (16 samples)

The 26th edition of the International Photovoltaic Science and Engineering Conference ("PVSEC-26")

24 to 28 October 2016, Singapore

Visual inspection result





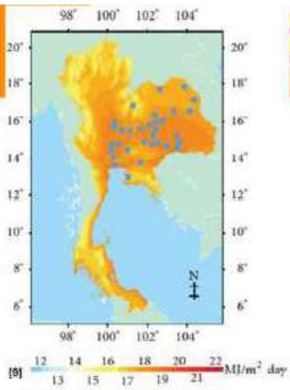
PVSEC-26

Power of PV modules (mono and poly Si) at the end of the 20 year warranty might decrease by more than 20% from the nameplate values.

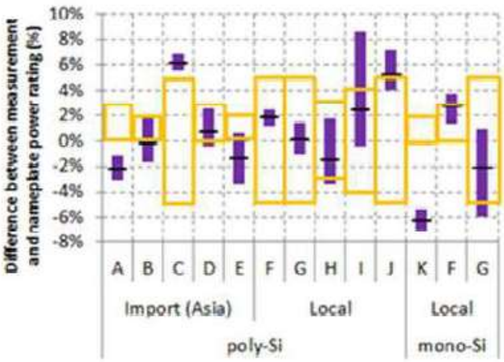
CSSC / KMUTT – R&D Activities: PV Module Reliability

PV System Reliability Focusing on the Power Degradation and Power Deviation from Nameplate Rating of PV Modules in Thailand

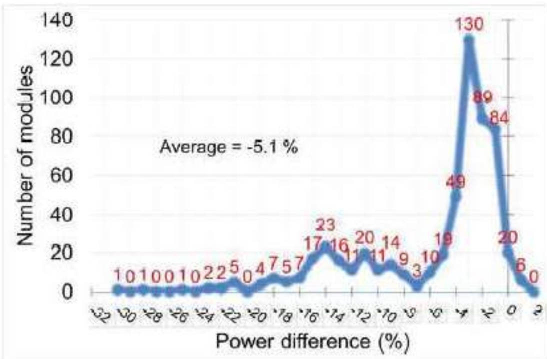
ICMAT 2017 | 22 June 2017 | Suntec Singapore



The power deviation from nameplate rating of PV modules before installation



Power degradation of the modules from the system installations during 2010-2012

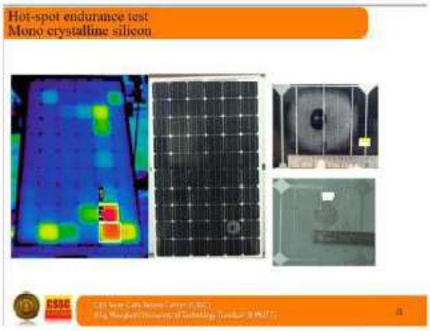


CSSC / KMUTT – R&D Activities: PV Module Reliability

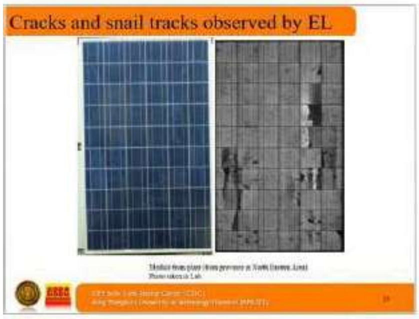
Typical physical failures of PV modules found

Various types of failures :
- cell discoloring
- EVA delamination
- bypass diode failure
- broken module and micro-cracks
- discolouring
- torn back sheet

Physical Failure of PV Modules observed in the Field versus Aging Test



ICMAT 2017 | 22 June 2017 | Suntec Singapore



CSSC / KMUTT – R&D Activities: PV System Performance Analysis

INTERNATIONAL PVSEC-26

Area 5 4-0015 :
Performance Evaluation of Solar PV Rooftop Program in Thailand

Total system 2,688 units
Systems under study 576 units

	Total		
	Residential	Commercial	Industrial
Quota (MW)	100	100	
Installed (MW)	20.889	12.760	78.089
No. of Systems	2,510	89	89

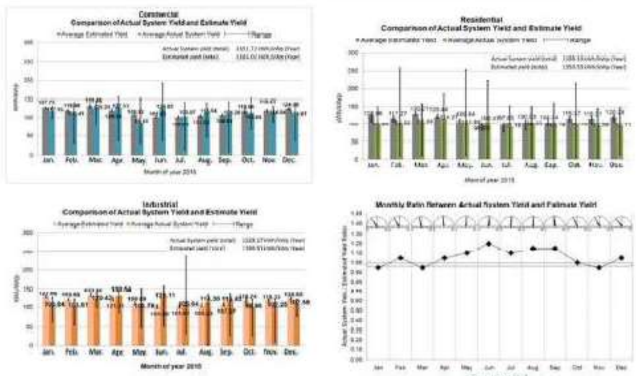
	Provincial Electricity Authority (PEA)		
	Residential	Commercial	Industrial
Quota (MW)	60	60	
Installed (MW)	17.510	3.832	50.136
No. of Systems	1,996	26	54

	Metropolitan Electricity Authority (MEA)		
	Residential	Commercial	Industrial
Quota (MW)	40	40	
Installed (MW)	3.379	8.928	27.953
No. of Systems	514	63	35

FiT Announced on July 16, 2013

Comparison of actual system yield and estimated yield of solar PV rooftop systems

PV output from all rooftop units could be estimated from the Solar Radiation Map



Area 5 3-0005 : Effects of dust deposition on performance of PV systems and suitable cleaning methods for PV power plants in Thailand

Study on 3 solar power plants and 1 rooftop unit with different environment.

Without cleaning for 2 months, dust could reduce up to 8% of power output.

System 1

Mangrove forests

System 2

Rice farm

Cassava farm

Eucalyptus farm

System 3

Rice farm

Oil depot and biofuel oil refinery

Soot

System 4

Cassava farm

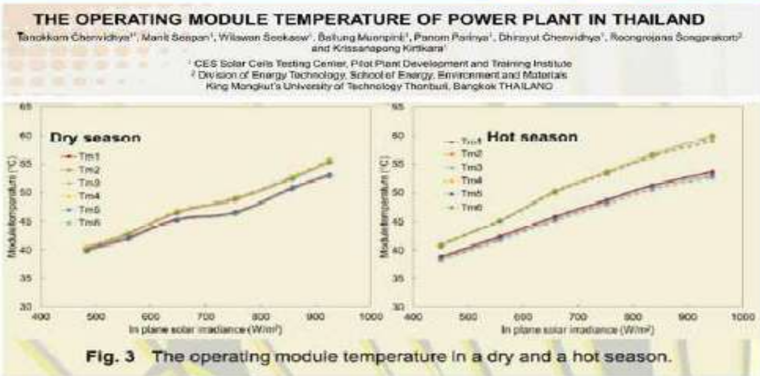
Sugar farm

Corn farm

KMUTT PVGIS Interactive Map for the Grid-connected PV Systems in Thailand

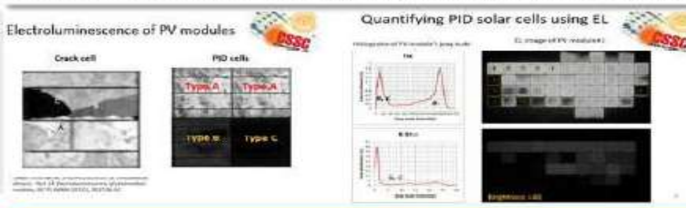
Year 2012
COD:264MW
(1-55MWp)

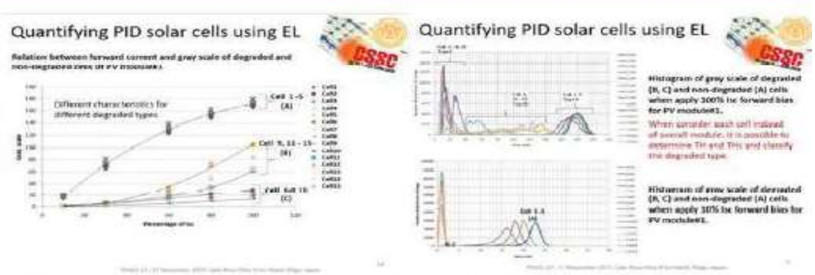
CSSC / KMUTT – R&D Activities: PV System Performance Analysis and Standard Development



Improvement on the Verification Method of electroluminescence imaging of the degraded PV modules

Panom Parinya, Manit Seapan, Chamnan Limsakul, Krissanapong Kirtikara, Dhirayut Chenvidhya, Tanokkorn Chenvidhya, Ballang Muenpinij, Yaowanee Sangpongsanon

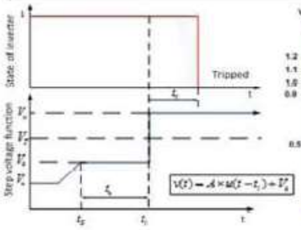


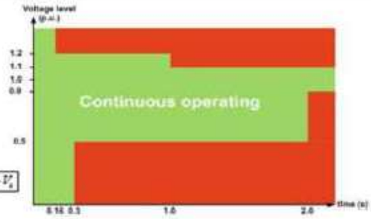


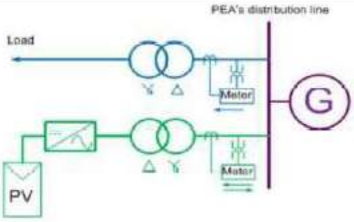
CSSC's Contribution on the PVSEC-27, 12 – 17 November 2017, Japan

Area 5 2-0016 : Over/Under Voltage Protection Testing for Grid-Connected Inverters in Thailand

INTERNATIONAL PVSEC-26







How to test the over and under voltage protection for the 3P3W centralized technology inverter according to PEA requirements.

Proposed procedure

Phase A changes follow scaling factor A of each condition.

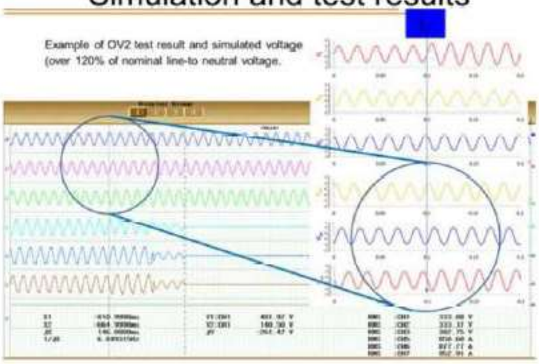
Condition	V_A	V_B	V_C
UV2	0.44∠0°	1.0∠−120°	1.0∠120°
UV1	0.80∠0°	1.0∠−120°	1.0∠120°
OV1	1.22∠0°	1.0∠−120°	1.0∠120°
OV2	1.32∠0°	1.0∠−120°	1.0∠120°

Voltage vector changes in delta side.

Condition	V_{AB}	V_{BC}	V_{CA}
UV2	[illegible]	[illegible]	[illegible]
UV1	[illegible]	[illegible]	[illegible]
OV1	[illegible]	[illegible]	[illegible]
OV2	[illegible]	[illegible]	[illegible]

Simulation and test results

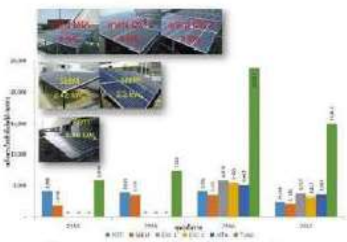
Example of OV2 test result and simulated voltage (over 120% of nominal line-to neutral voltage.



CSSC / KMUTT – R&D Activities: PV Modules Reliability

CSSC

Energy production of PV systems monitoring in campus



PV systems performance in long-term and degradation

CSSC

CSSC

อาคาร CSSC อาคาร PIP1-2 อาคารเอนกประสงค์

ทุ่นลอยน้ำ บ้านสาธิต

รูปที่ 4 แสดงการติดตั้งระบบผลิตไฟฟ้าเซลล์แสงอาทิตย์ ณ แต่ละอาคาร

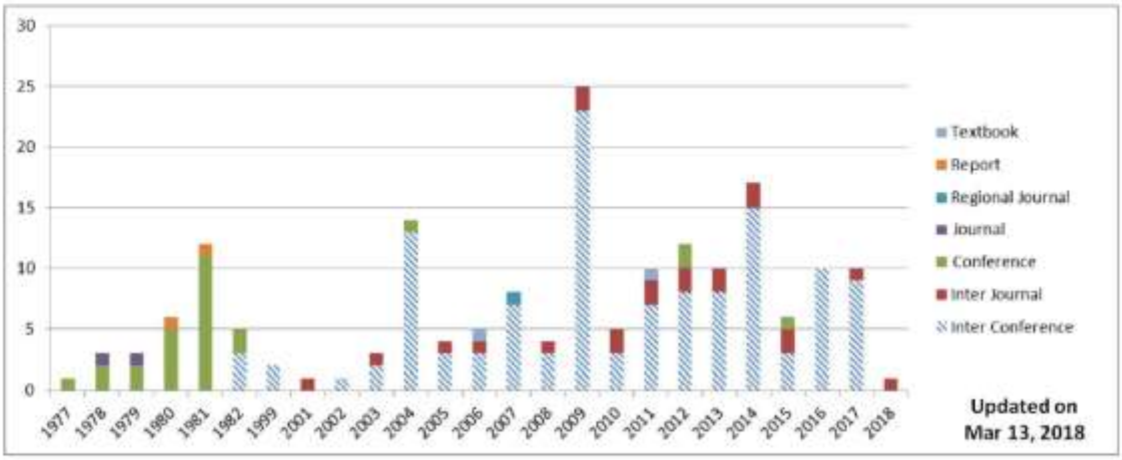
Renovation of Net Zero Energy House

Renovation of Net Zero Energy House

Campus Power PV System Monitoring

CSSC – R&D Activities

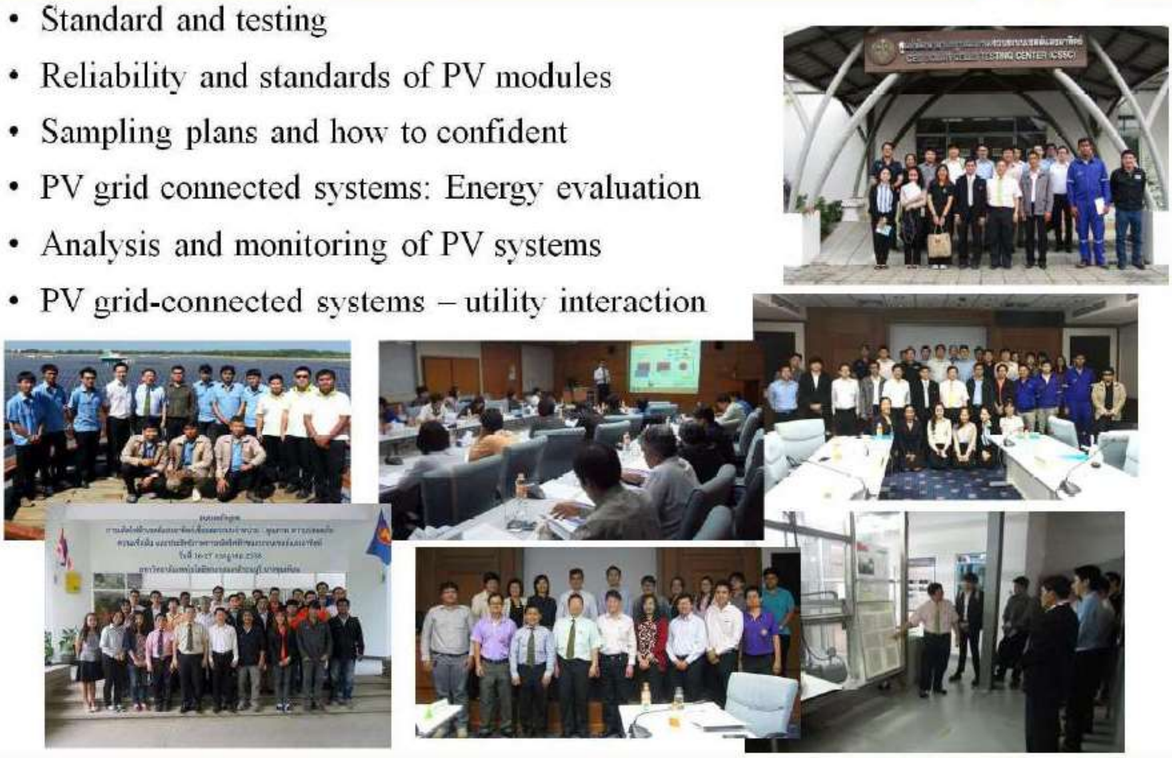
Research publications by type since 1977 – 2018



CSSC – Training programs and Seminar

CSSC

- Standard and testing
- Reliability and standards of PV modules
- Sampling plans and how to confident
- PV grid connected systems: Energy evaluation
- Analysis and monitoring of PV systems
- PV grid-connected systems – utility interaction



CSSC – Collaborations

CSSC

กรมพัฒนาพลังงานทดแทนและอนุรักษ์พลังงาน
กระทรวงพลังงาน
Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

สำนักงานกองทุนสนับสนุนการวิจัย (สกว.)
The Thailand Research Fund (TRF)

กองทุนเพื่อส่งเสริมการอนุรักษ์พลังงาน

คณะกรรมการกำกับกิจการพลังงาน
Energy Regulatory Commission

Electricity Generating Authority of Thailand
การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

การไฟฟ้านครหลวง
Metropolitan Electricity Authority

การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

NECTEC
a member of NSTDA

ESCO EGCO GROUP

SCG

CSSC – International Collaborations

JET Japan Electrical Safety & Environment Technology Laboratories

AIST NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)

FLORIDA SOLAR ENERGY CENTER

Fraunhofer

AREW Asia Renewable Energy Workshop

WCPEC-6 PVSEC 24 41st IEEE PVSC 30th EU PVSEC

IEA PVPS Task 13

UM University of Malaya

TÜVRheinland

Underwriters Laboratories

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY TOMORROW TODAY

CES Solar Cells Testing Center (CSSC)
Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi 33

CSSC – Collaborations

CES Solar Cells Testing Center (CSSC)
Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi 34

Thank you for your attention

CSSC

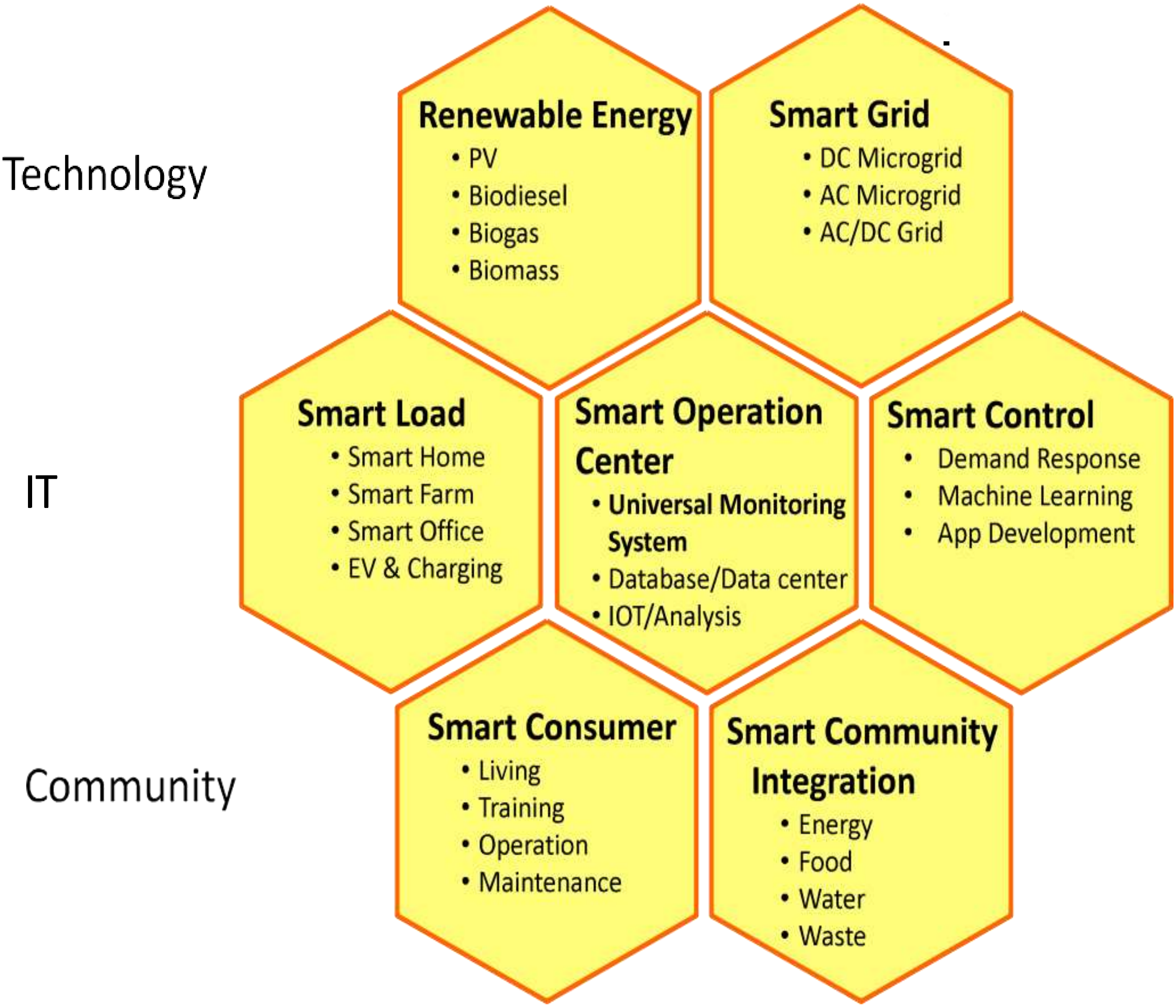
CSSC มุ่งผลิตผลงานมาตรฐานด้วยบุคลากรคุณภาพอย่างมืออาชีพ
และเป็นองค์กรแห่งการเรียนรู้

CSSC emphasizes to produce the quality standard portfolio with professional staff and the learning organization.

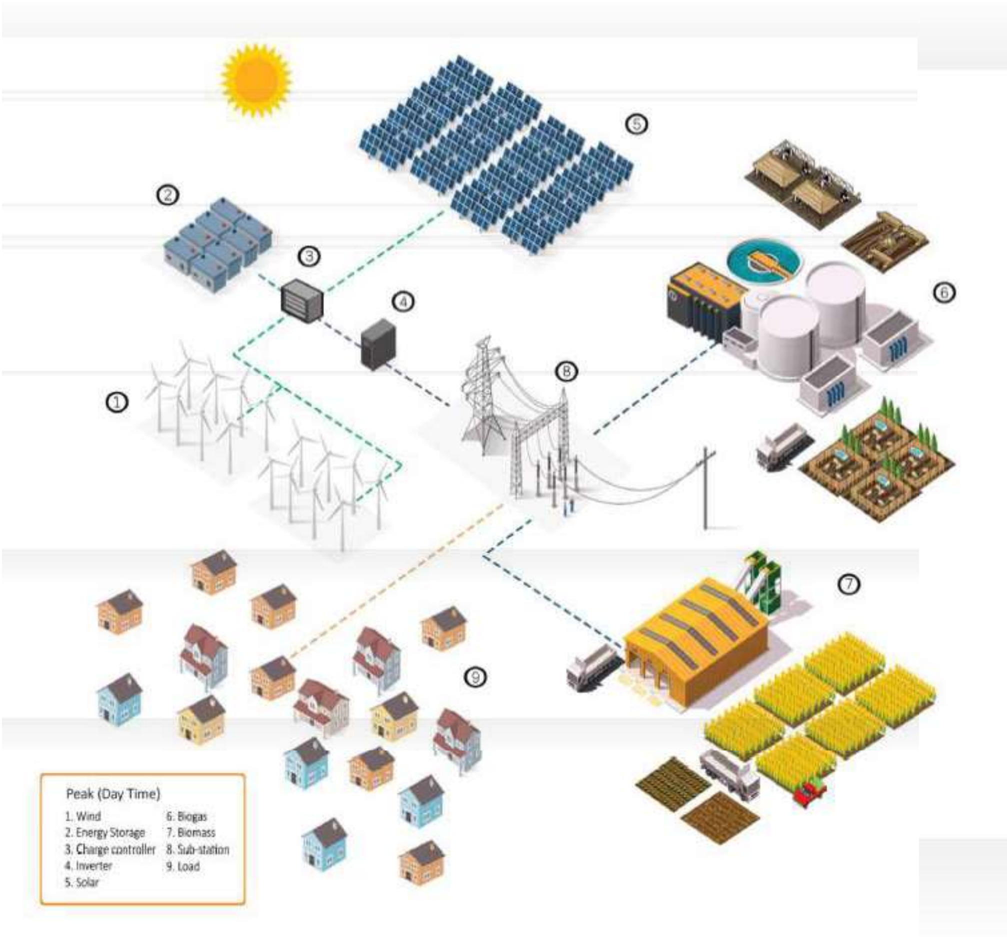
Best Practice for Smart Community in Chiang Mai World Green City

Asian Development College for Community Economy and Technology
Chiang Mai Rajabhat University
Thailand

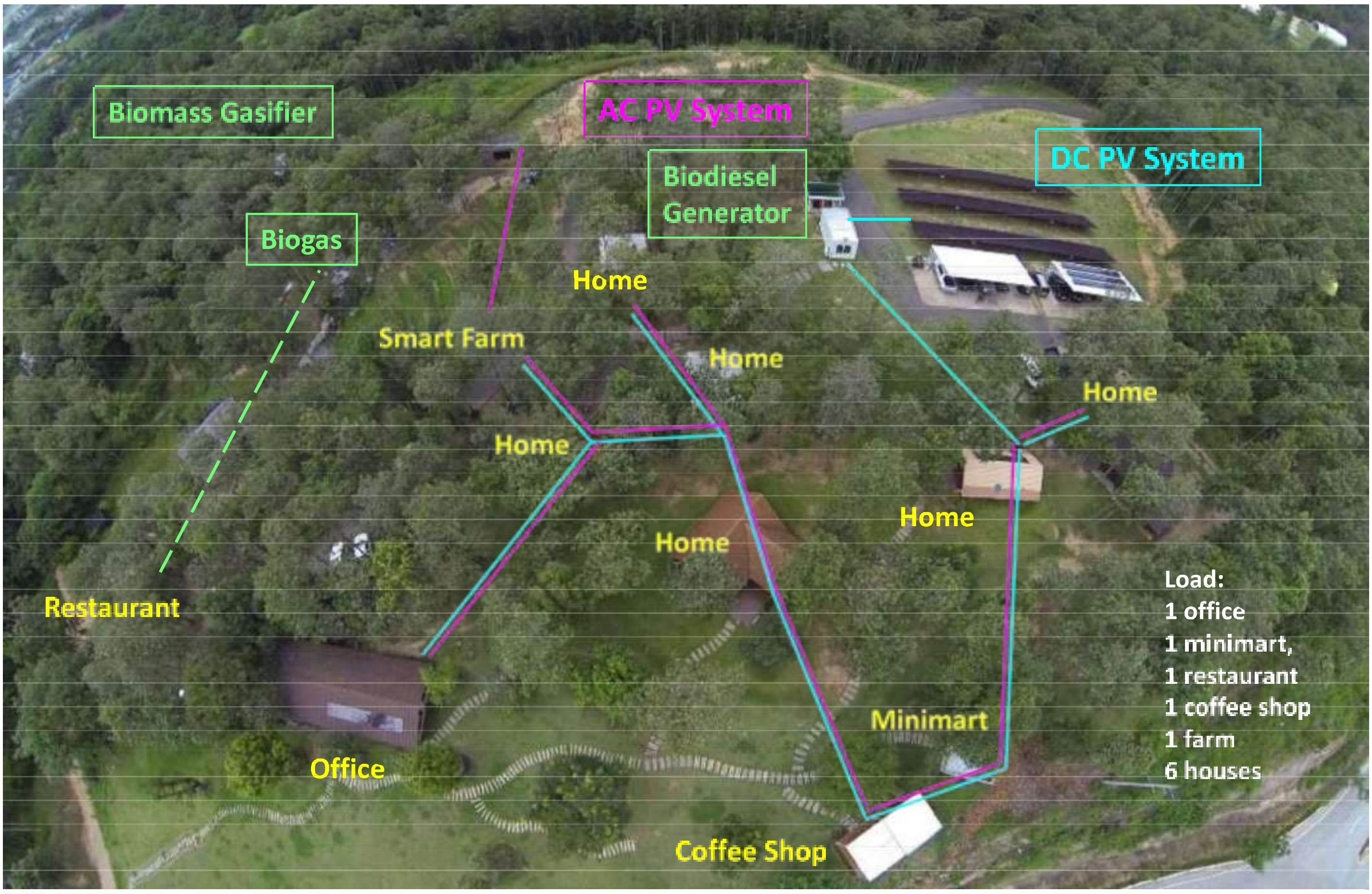
Sufficiency Economy → Bioenergy Cycle


Technology
IT
Community
Renewable Energy
• PV
• Biodiesel
• Biogas
• Biomass
Smart Grid
• DC Microgrid
• AC Microgrid
• AC/DC Grid
Smart Load
• Smart Home
• Smart Farm
• Smart Office
• EV & Charging
Smart Operation Center
• Universal Monitoring System
• Database/Data center
• IOT/Analysis
Smart Control
• Demand Response
• Machine Learning
• App Development
Smart Consumer
• Living
• Training
• Operation
• Maintenance
Smart Community Integration
• Energy
• Food
• Water
• Waste

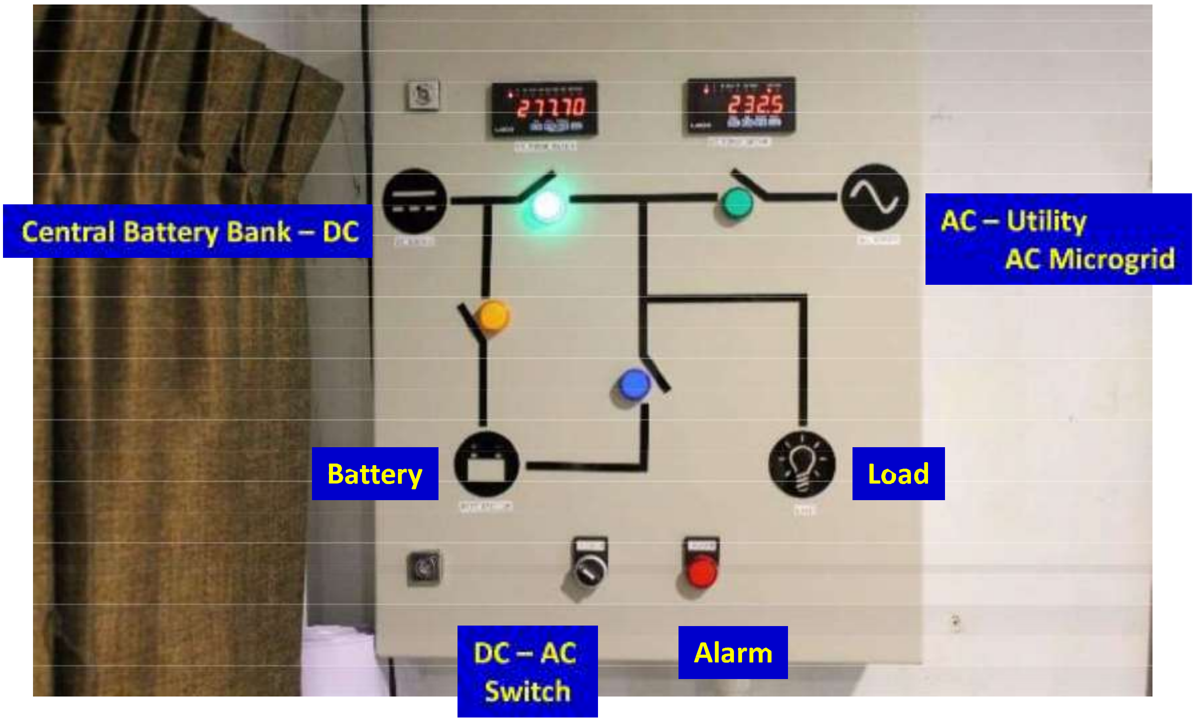
Goal "Smart Infrastructure for Green Community Development"

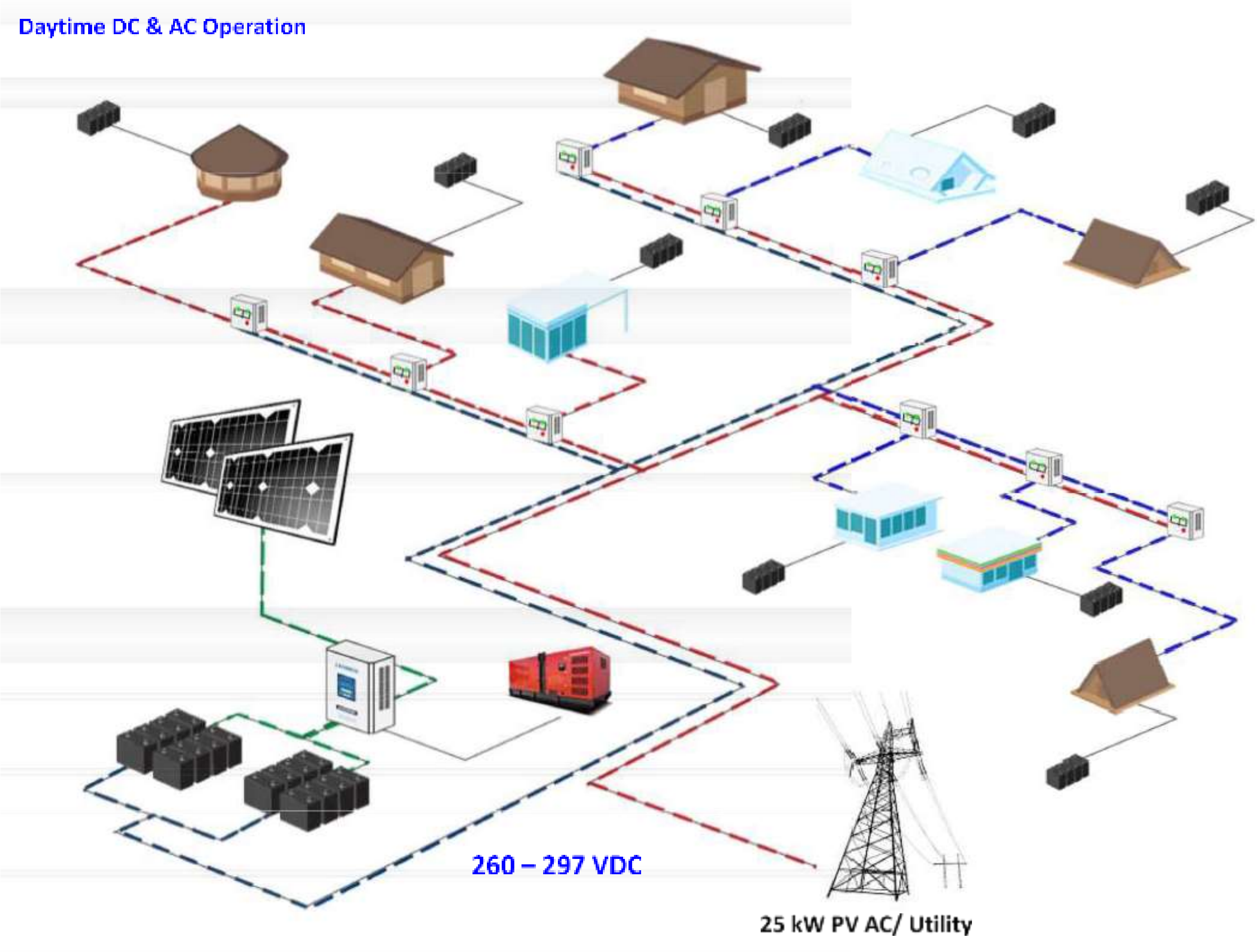


Chiang Mai World Green City: Real Living Learning Park
Smart Community – AC/DC Smart Grid



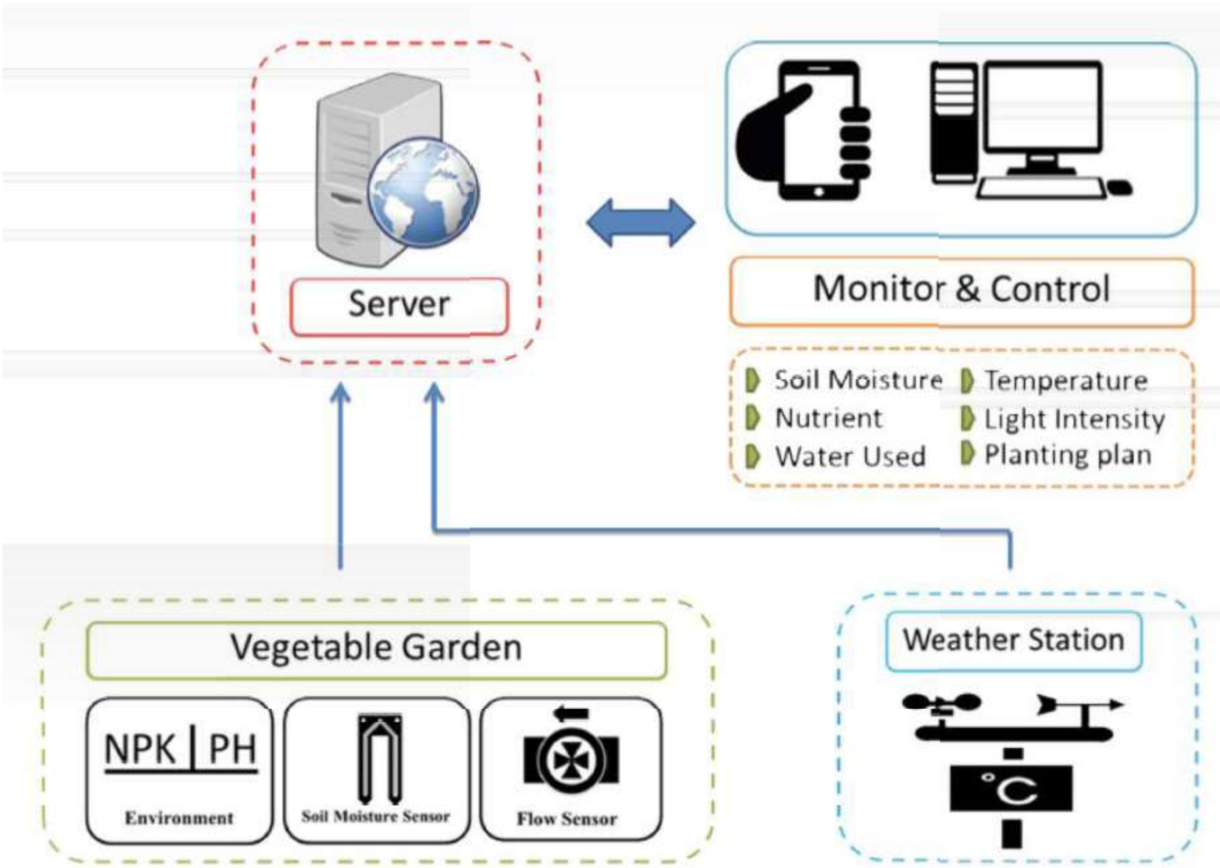
Power Supply Controller





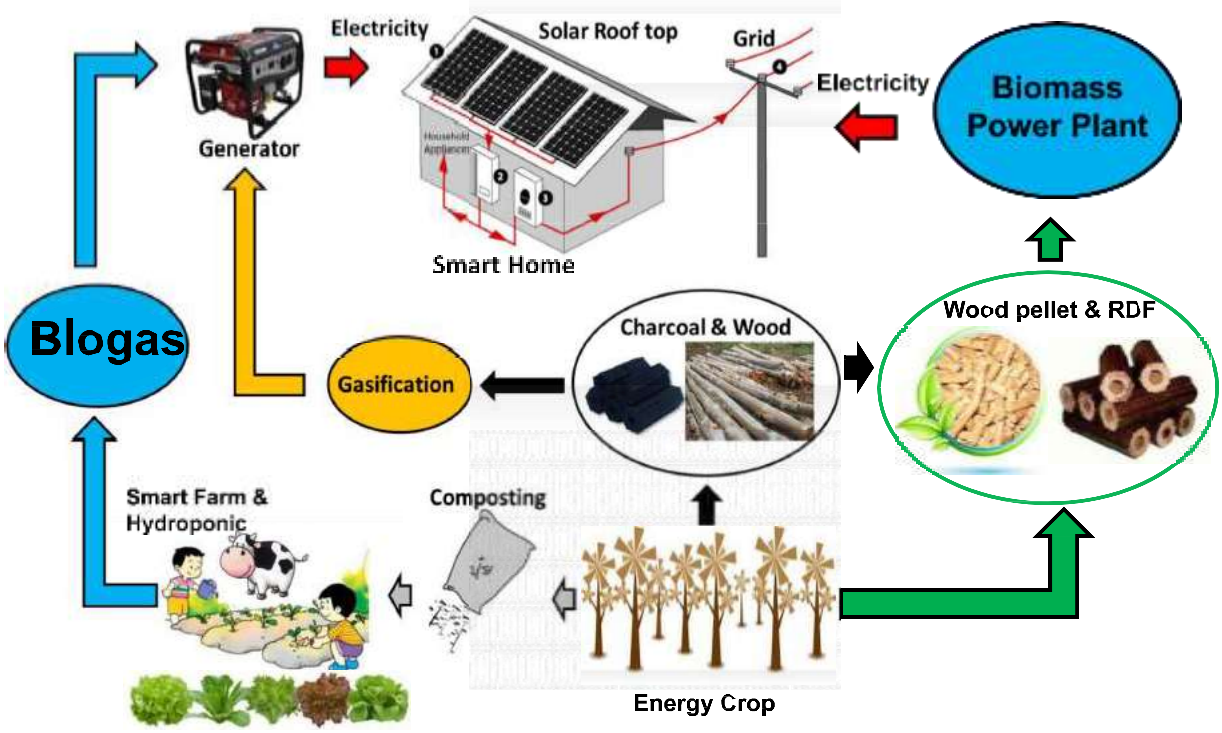
adiCET

Smart Farm



adiCET

Zero Waste – BioEnergy Cycle

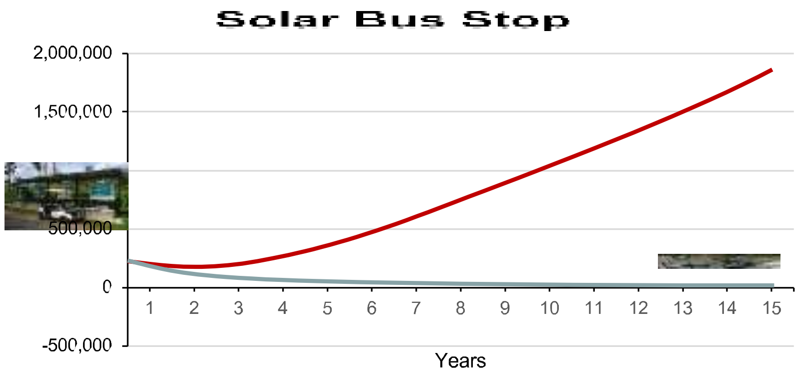


Solar Bus Stop
EV Charging Station

adiCET

Business as Usual/ Ideal Condition

AP 19-8



- No use of Renewable Energy
- No change in energy efficient device
- No recycling and waste management
- Inefficient transportation
- Excess energy usage

Solar Bus Stop
EV Charging Station

- Green Space, Tree planting
- Renewable Energy usage
- Efficient Lighting/ No. 5 Devices
- Waste management and biomass usage
- Water management
- Energy efficient transportation and biofuel

adiCET

Summary

- Renewable Energy and Green Technology for Local Community
  - Integrate with Community Resources - Ways of Living
  - Sufficiency Economy + Green Technologies (RE & EE)
  - Smart Grid as Infrastructure for Low Carbon City Development

- Smart Community
  - Living/ learning/training center for student, researchers, and general public
  - Projects focus on appropriate technology andmethods to solve real green city problems

- Moving Forward
  - Appropriate Technology; Monitoring/Optimization
  - Integration with Social Development and Economic Development
  - Train-the-trainers; General Public; Policy Maker
  - Create awareness
  - Share best practices – Database
  - Create Demonstrations Sites → Community Implementation

adiCET

Acknowledgments

AP 19-9

- Ministry of Energy, Thailand
- APEC Secretariat
- Chiang Mai Rajabhat University
- Office of Naval Research, USA
- National Research Council of Thailand
  University of Phayao
- ASEAN – U.S. Science and Technology Fellowship

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Thank you

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Asia-Pacific Economic Cooperation

APEC Research Center for Advanced Biohydrogen Technology (ACABT)

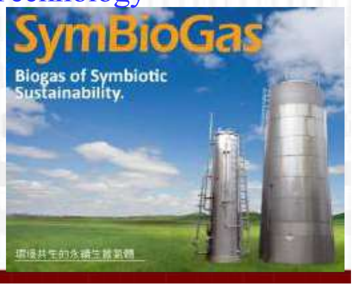
APEC-ACABT YES Challenge

Smart Grid Scenarios

Self-Sustained Green Community in APEC Region

Associate Professor: Andrew Chen-Yeon Chu Ph.D

Director, Master's Program of Green Energy Science and Technology
Director, Institute of Green Products, Feng Chia University
Head, International Cooperation Division, Green Energy Development Center
Feng Chia University
Executive Secretary, APEC Research Center for Advanced Biohydrogen Technology (ACABT)
CEO, Green Chemistry Bionet Asia Pacific Association
Secretary, IAHE-Chinese Taipei Chapter



28 August 2018 - 30 August 2018
Bangkok, Thailand

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Problems

- Organic wastes are abundant in APEC region which mainly from cellulosic materials and liquid type of wastewaters. Their treatment process is a big issue in the APEC region

- Air pollutions caused by burning agro-industry organic wastes
- Water pollutions caused by discharging high organic content wastewaters without post-treatment

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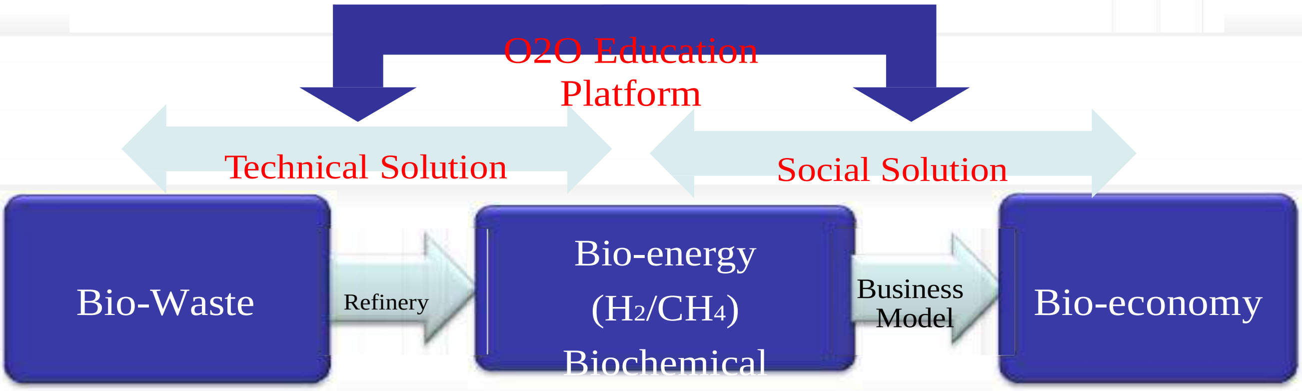
AP 20-2

ACABT Long Term Mechanism

ACABT Long Term Mechanism



Networking, Platform and Policy Partnership

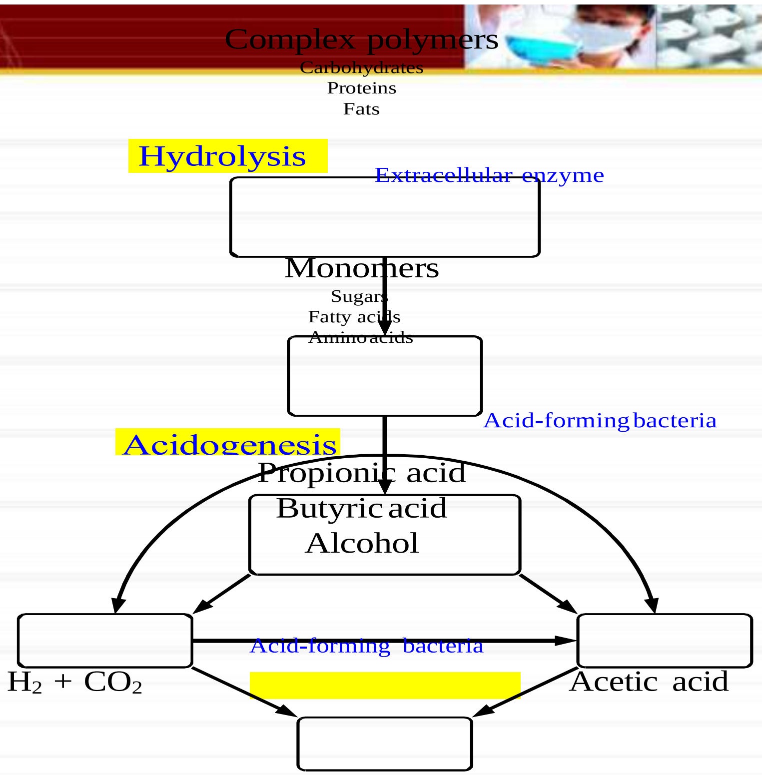
- website, technology information sharing
- people mobility, such as visiting, exchange program
- regulations, policy partnership

Training course, Technology sharing and symposia

- Workshop & Short-term training course
- Symposia shift in different economies

2012 (China), 2013 (Japan), 2014 (Malaysia);2015 (Chinese Taipei), 2016 (Korea), 2017 (YES in Chinese Taipei; ABBS-KKU Thailand); 2018 (YES in Bangkok; ABBS-Zengzou China)

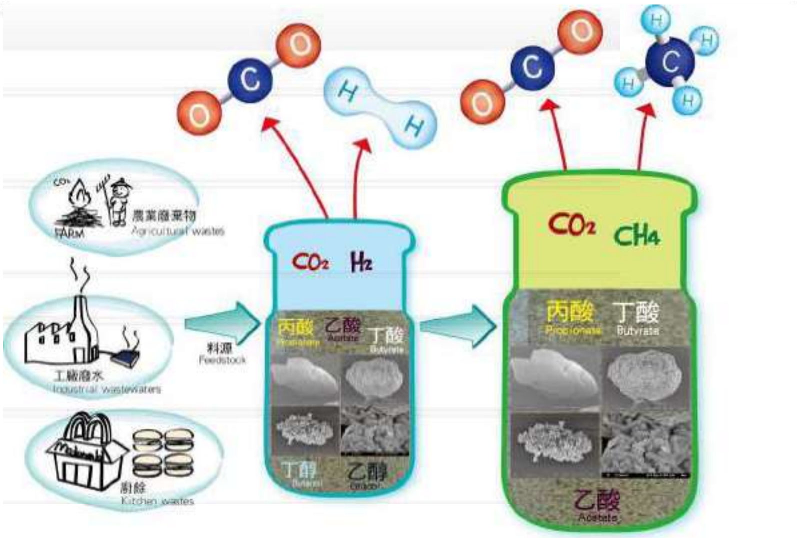
Anaerobic Digestion



AP 20-3

Our Core Technology

Innovative Hydrogenesis & Methanogenesis Technology (HyMeTek)



The international trends of gaseous bioenergy technology

[Source: EBA website]

Year 2013 15,000 plants in Europe	Year 2013 280 plants in Europe	The most popular technology now

- Biogas → Biomethane gas

Two-stage gaseous biomass energy system

Biogas purification technology

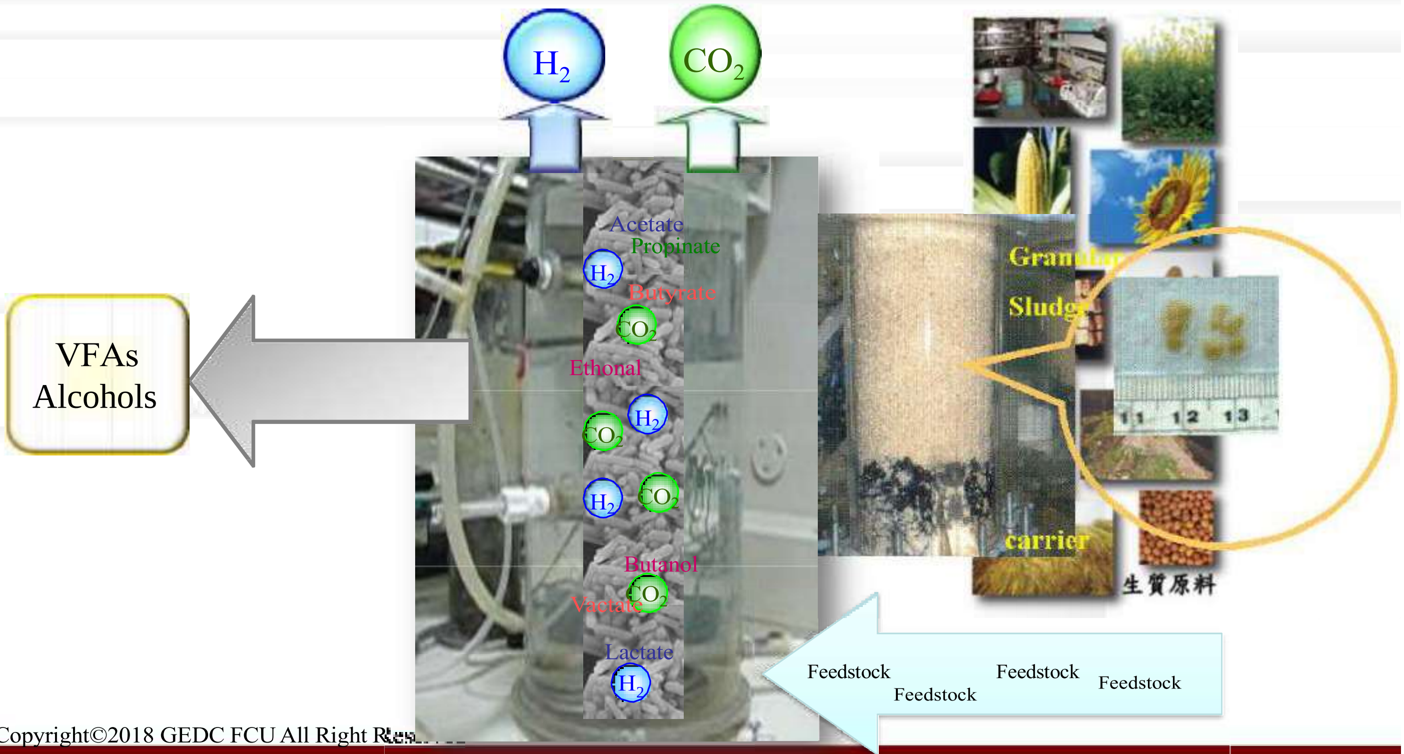
Biological hydrogen production technology

The main technology to recover more energy (25%)

Two-stage energy recovery technology is always more than one stage of 8-43%.

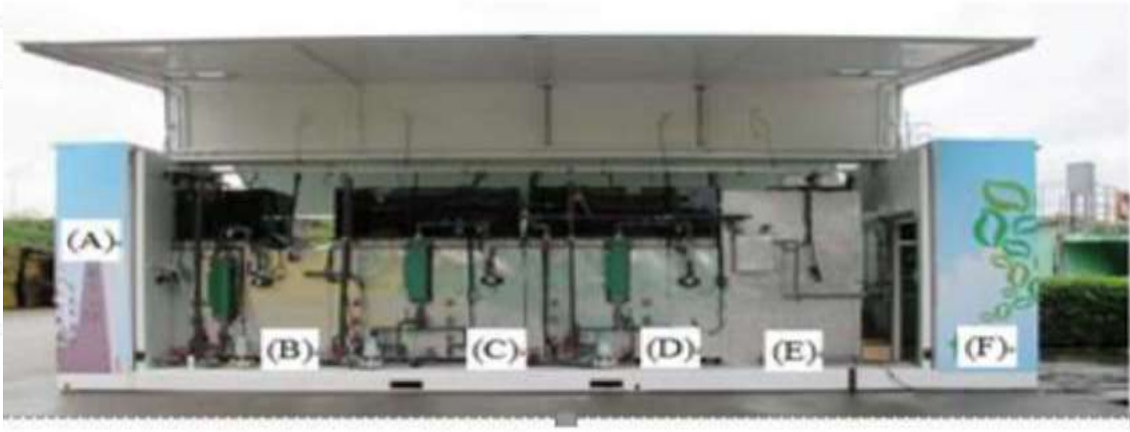
From Biomass Waste to Biohydrogen

Fermentative H_2 production



BioH2 Technology Evolution at FCU

Mobile (synergy) power station



Mobile system: (A) 10 m^3 Feedstock Tank, (B) 2 m^3 H_2 Reactor, (C) 4 m^3 CH_4 Reactor, (D) 4 m^3 CH_4 Reactor, (E) MBR, (F) Control system

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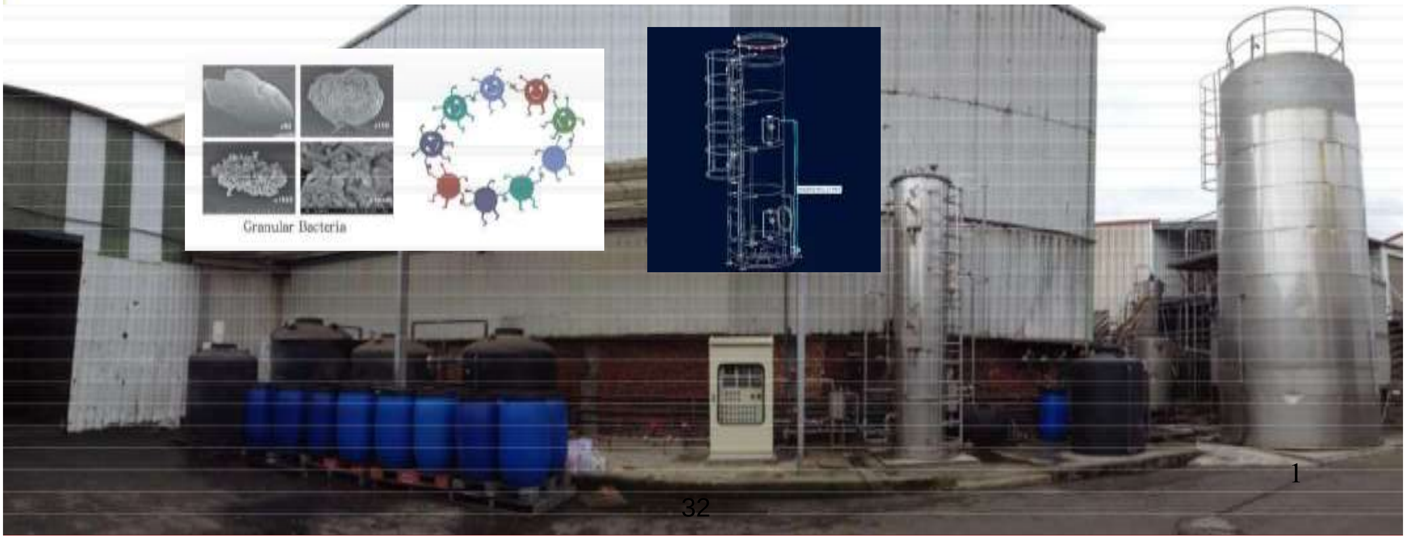
HyMeTek Applications in food industry

- We have established a cost-effective large-scale pilot plant
- We have established the key technology of design and SOP instructions



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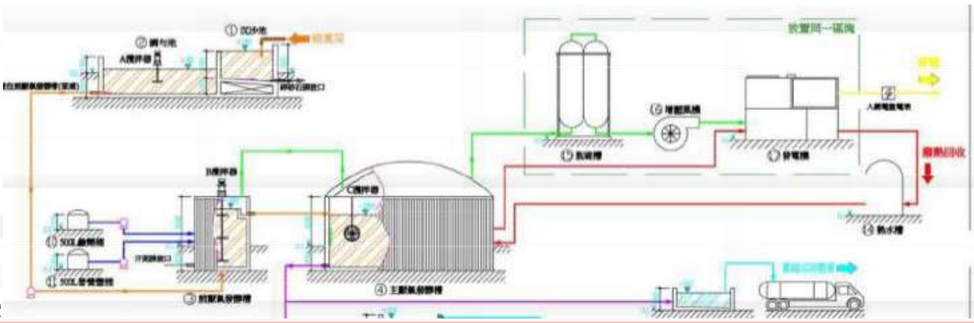
HyMeTek system established in Central Chinese Taipei this year (1500 pigs/30 CMD/25 kW)



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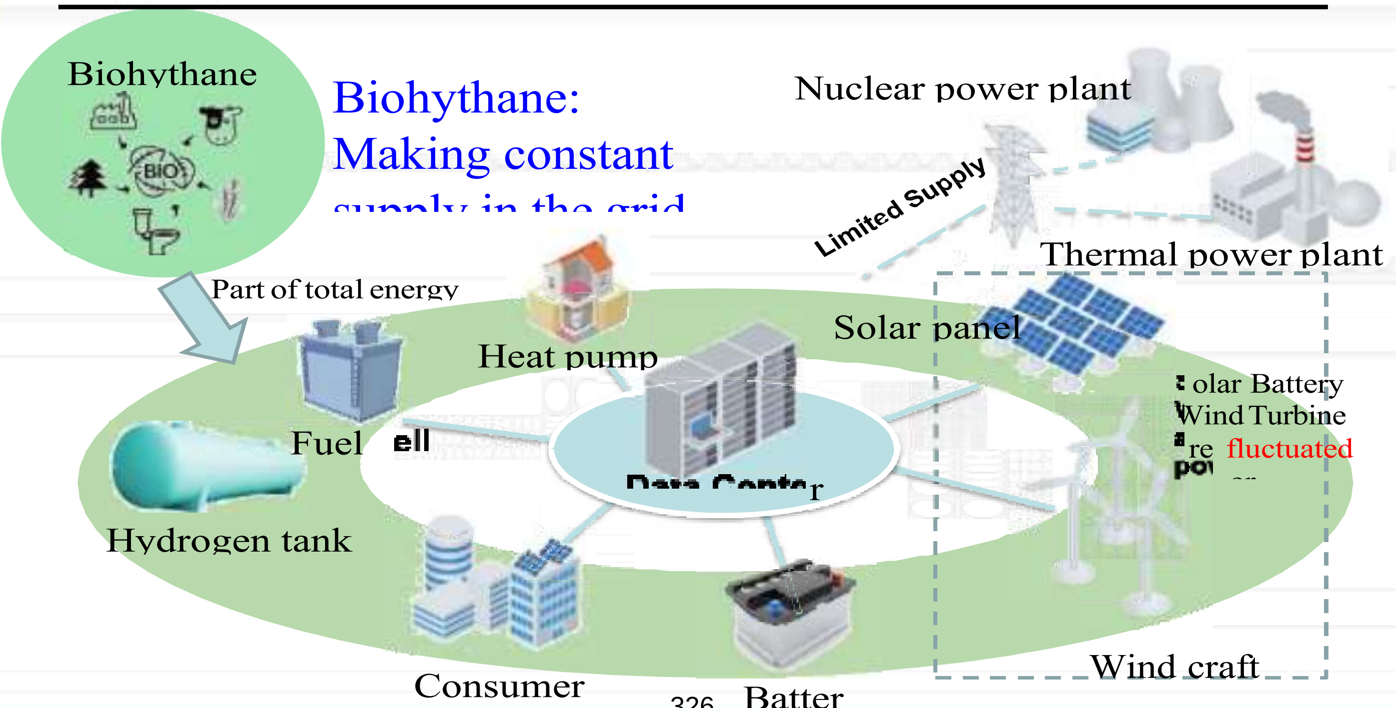
Self-Sustained Green Community

Biohythane Smart Power and Green Cycle Managements



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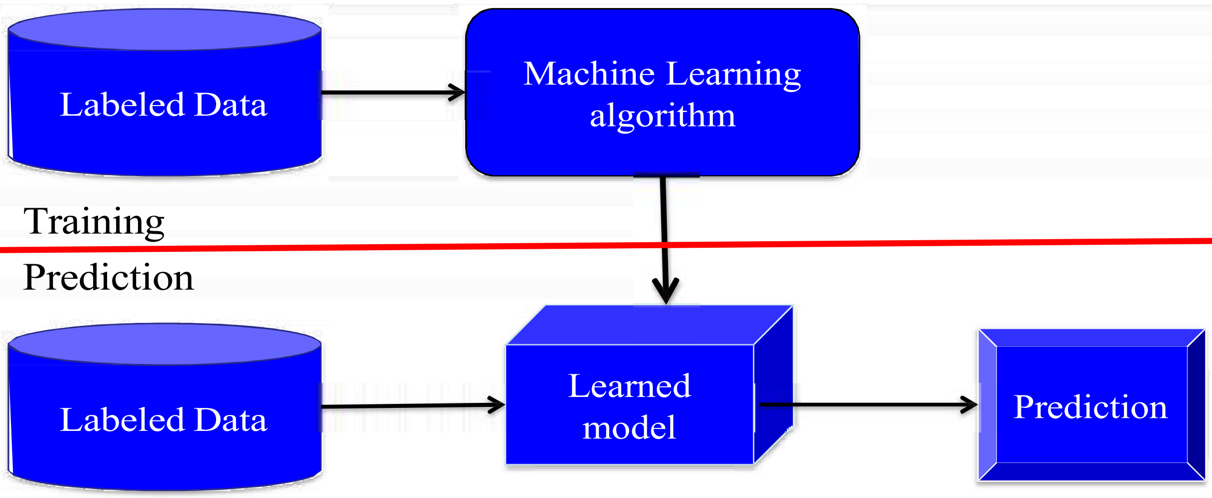
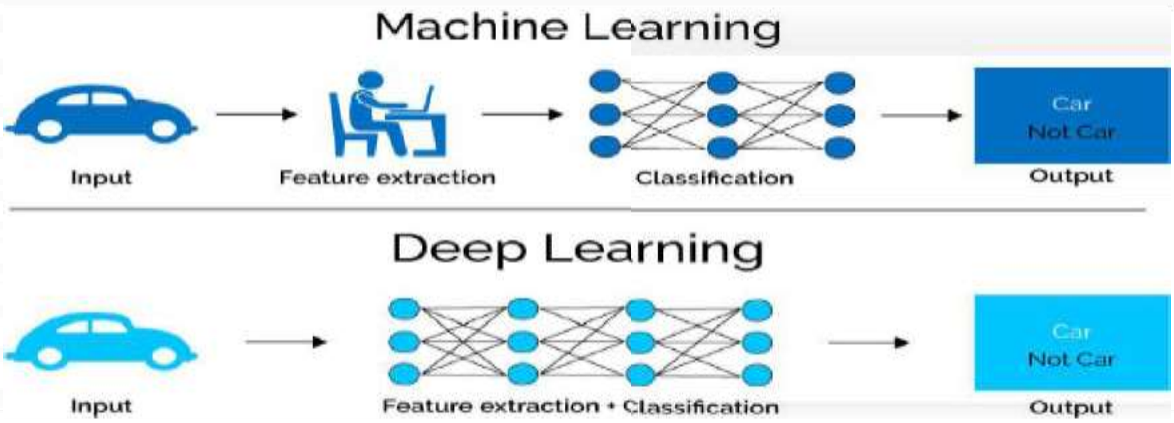
Machine Learning Basics

Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed methods that can learn from and make predictions on data



What is Deep Learning (DL) ?

A machine learning subfield of learning representations of data. Exceptional effective at learning patterns.
Deep learning algorithms attempt to learn (multiple levels of) representation by using a hierarchy of multiple layers. If you provide the system tons of



Why is DL useful?

- Manually designed features are often overspecified, incomplete and take a long time to design and validate
- Learned Features are easy to adapt, fast to learn
- Deep learning provides a very flexible, (almost?) universal, learnable framework for representing world, visual and linguistic information.
- Can learn both unsupervised and supervised
- Utilize large amounts of training data

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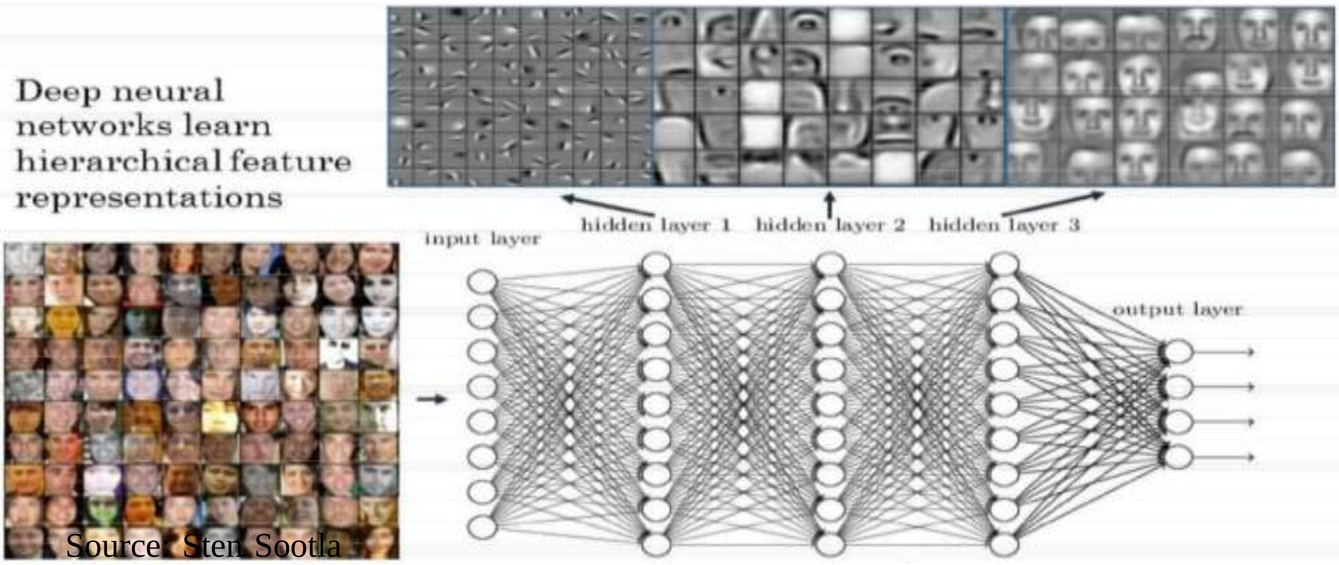
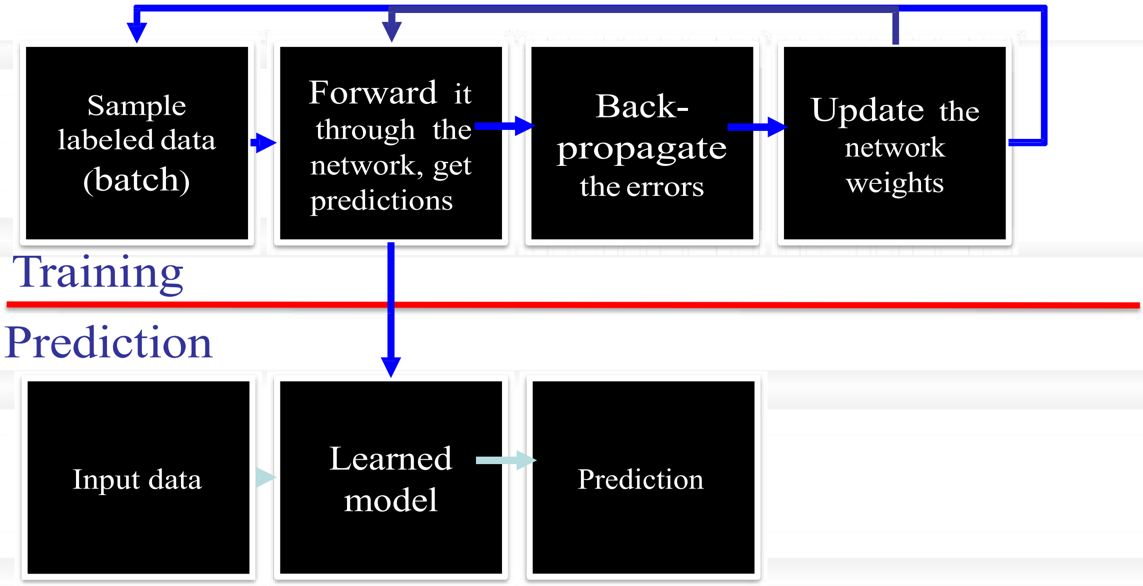
Neural network for image classification



DL training process



Input Data

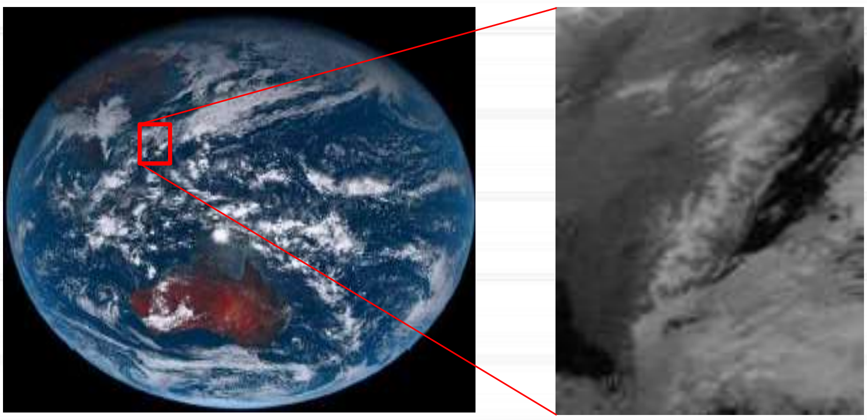


Image from satellite

- Power production from solar panels
  - kWh

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Partial code of our program

```
for step in range(1,training_steps+1): #
    # Run optimization op (backprop)
    batch_xs, batch_ys = next_batch(batch_size)
    batch_xs = batch_xs.reshape([batch_size, n_steps, n_inputs])
    batch_ys = batch_ys.reshape([batch_size,n_classes])
    #print("batch_xs",batch_xs.shape[0:3])
    #print("batch_ys",batch_ys.shape[0:2])
    sess.run(train_op, feed_dict={
        x: batch_xs,
        y: batch_ys,
    })
    if step % display_step == 0 or step == 1:
        # Calculate batch loss and accuracy
        loss = sess.run(cost, feed_dict={x: batch_xs,y: batch_ys})
        print("Step " + str(step) + ", Minibatch Loss= " + "{:.8f}".format(loss


        plt.subplot(1,2,2)
        y_output = sess.run(pred, feed_dict={x: test_xs})
        curr_img = np.reshape(y_output[batch_size-1], (height, width))
        img2=plt.imshow(curr_img, cmap=plt.get_cmap('gray'))
```


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- Our Device for Deep Learning
  - HP Z8 workstation
  - 2 CPU
  - 256GB memory
  - nVidia GTX 1080 GPU x2

- Training Parameters
  - More than 25000 pics image per year (Satellite
  - image one picture per 10 min)
  - 50 samples per batch (training randomly) otal

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Forecasting results (10-min-ahead)

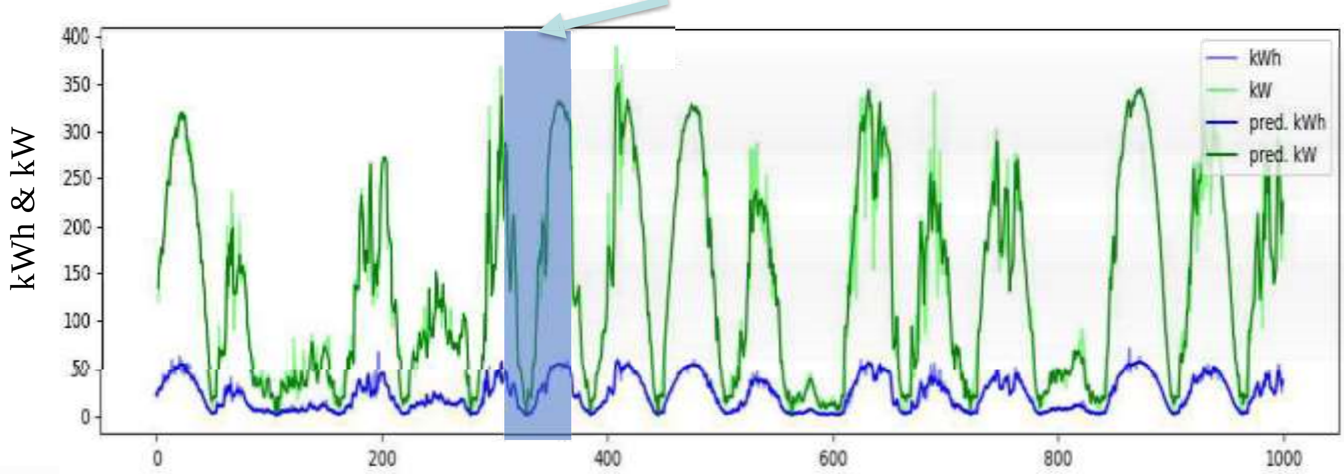
Mean Absolute Deviation Percent

- kWh MADP: 13.07%
- kW MADP: 8.87%

MADP: $\frac{\sum_{k=1}^{N} \|F_k - A_k\|}{\sum_{k=1}^{N} \|A_k\|}$

F_k:forecasted value
A_k:actual value

Day time of one day



Time step [10 mins] (night data removed)

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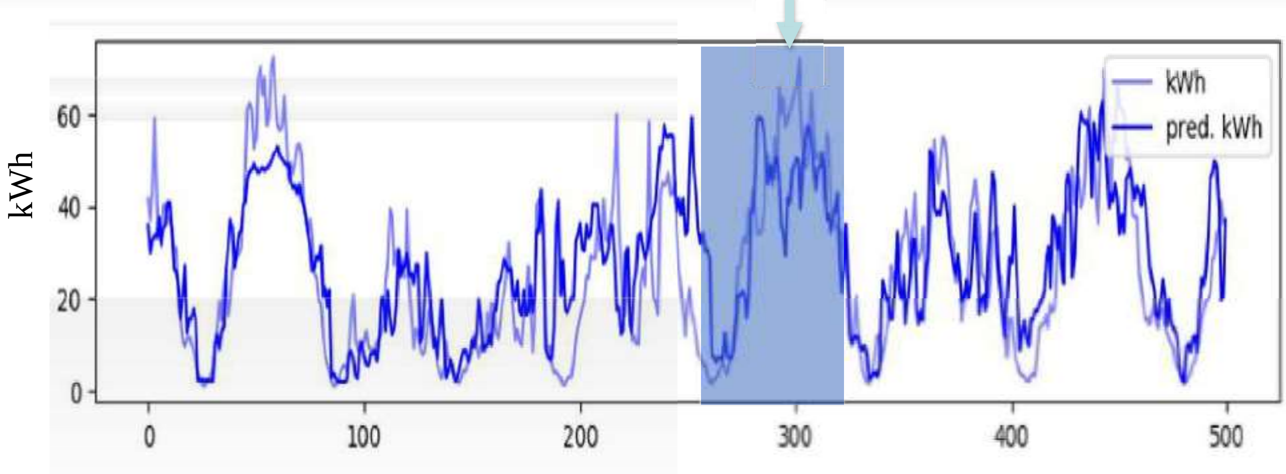
Forecasting results (40-mins-ahead)

- kWh MADP: 21.48%

Daylight time of one day



Time step [10 mins] (night data removed)

Case Study in Green Farm

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Eco Village Recommendation

HyMeTek of FCU

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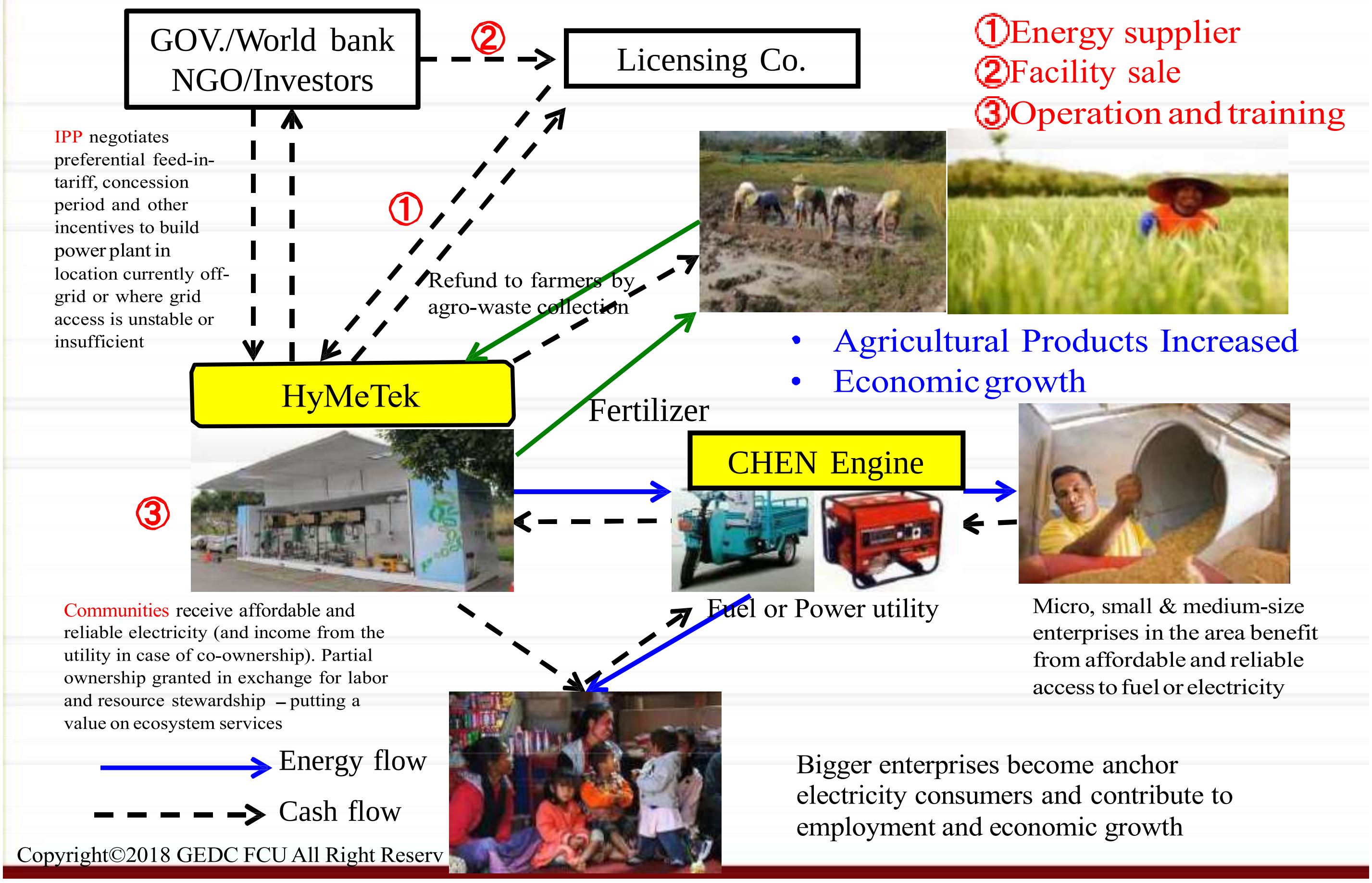
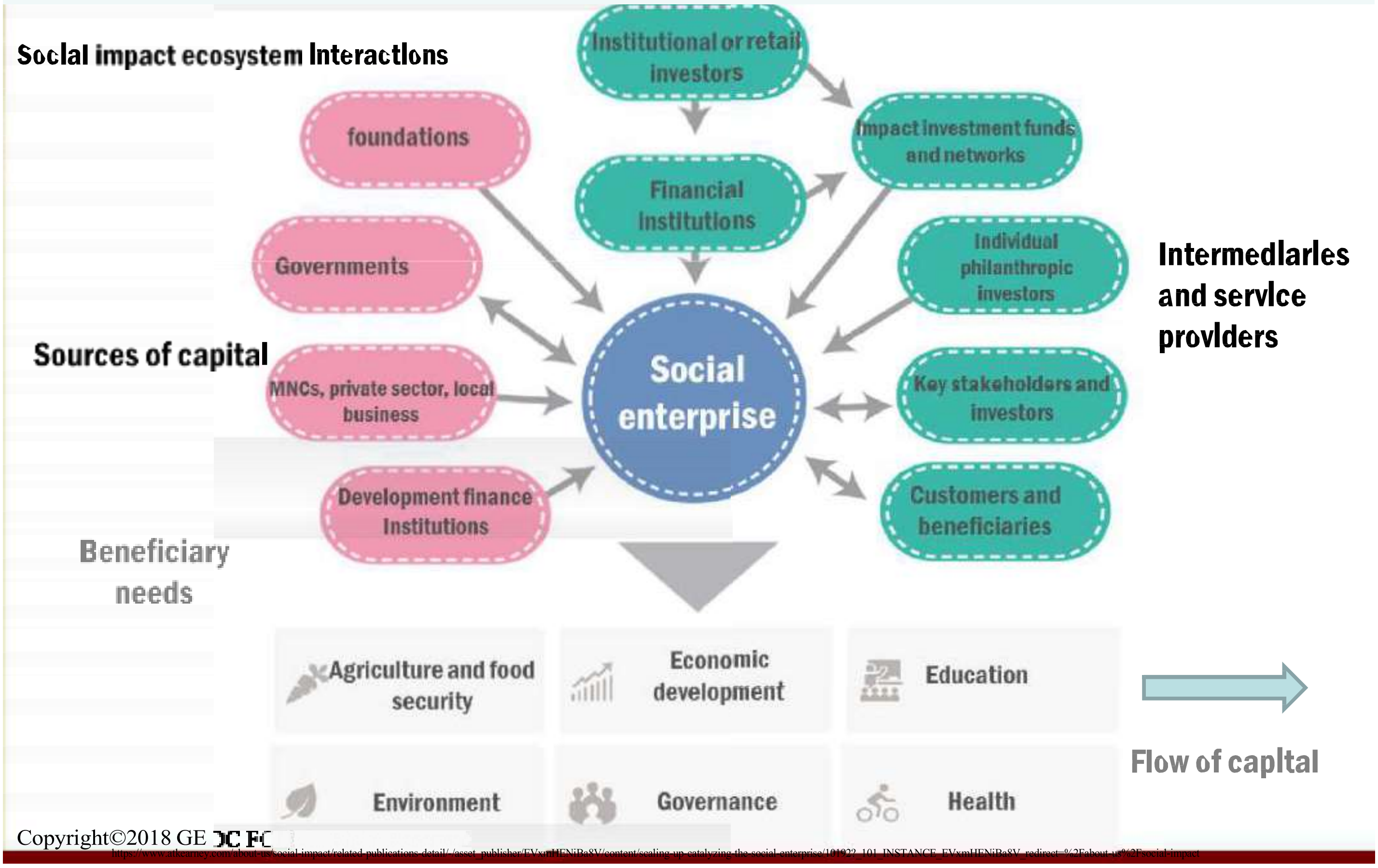
Green Farm Ecosystem by Two-stage Biogas Production Technology

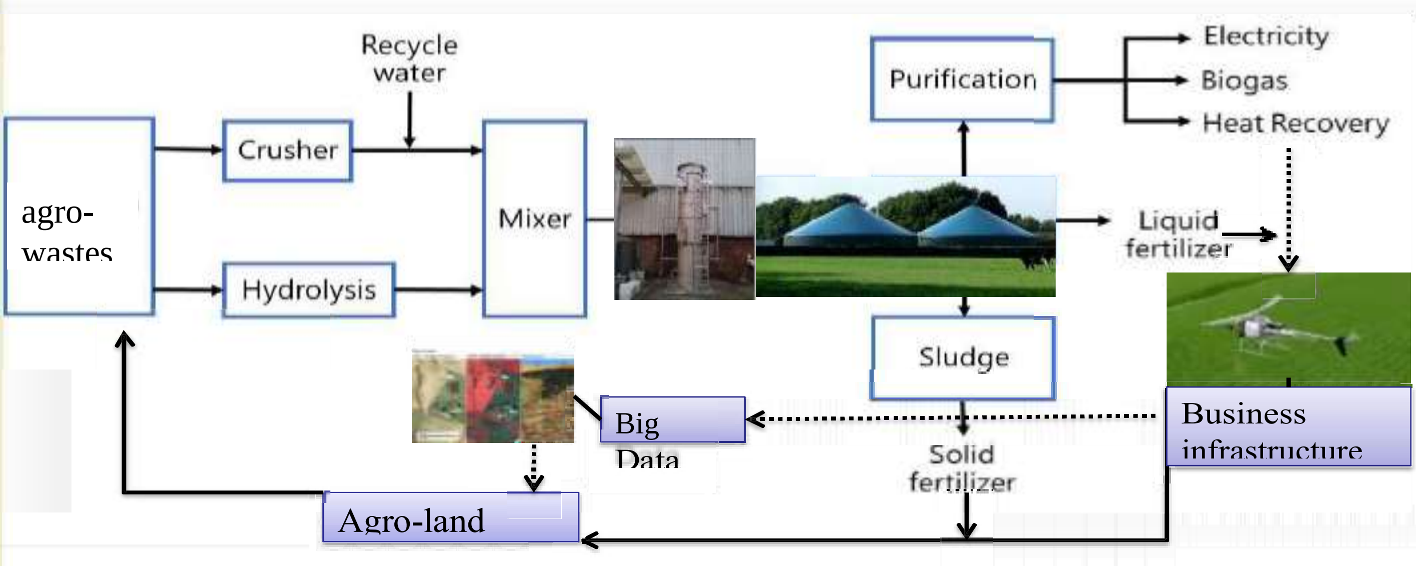


Scenario for promoting community empowerment In APEC's rural area by using agro-wastes recycling biotechnologies and GIS assistance– cycled Infrastructure

Technologlcal drlven start-ups and the entrepreneurlal tralnlng for community empowerments/Investment



The flow chart of turn-key solutions by agro-wastes recycling biotechnologies and GIS assistance, Intra-circle (tech application and waste accumulation circle)



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AP 20-15

FLOOD DISASTER 2014

- Data from the Regional Disaster Management Agency (BPBD) of Manado City 2014:
  - 101 houses were lost;
  - 18 died,
  - 2 were missing,
  - 86,355 people or 25,103 families were displaced by the floods.
- January 2017, victims of th floods can be relocated to Pandu village, Bunaken District, Manado City, by th support of government.

Photos by Liny Tambajong

PROBLEM :

power shortage because of high cost of power transmission.

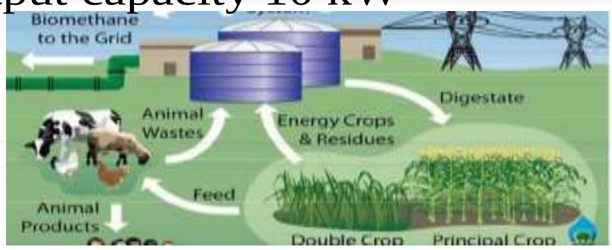
PILOT PROJECT OBJECTIVES

- To give the model and to introduce the technology of Biogas system to Manado City.
- Based on Manado surrounding area with many plantations and farming, Biogas is suitable for sustainable renewable energy system.
- To give an education facility to university students around Manado city who are interest to study about this technology.
- NEP-II Project agreed to fund the Pilot Project of advanced Biogas system which result the output capacity 10 kW

Looking forward…

- If this project suitable and successful, can be duplicate or build the bigger capacity

Idea…



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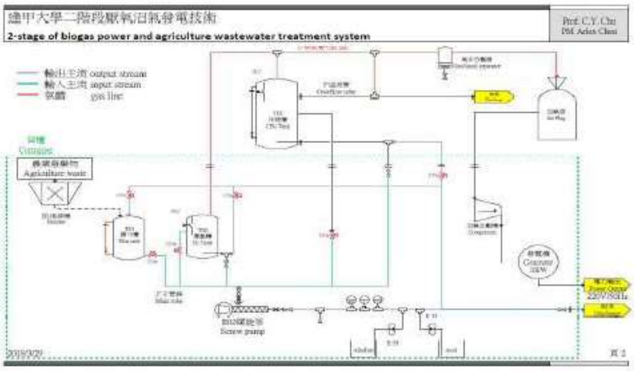
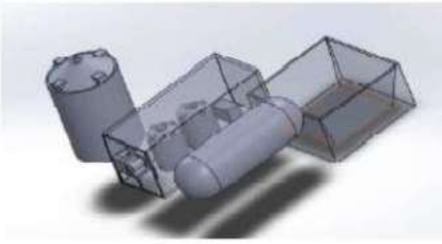
IMPLEMENTATION

- Designing the system of **“Power Statlon of Two**-stage Biohythane Production (HyMeTek)**” wlth output** capacity of 10 kW
- Build the system designed
- Shipped the built system to Bitung Harbour, Indonesia
- Install the system at Manado site





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HyMeTek create Win-Win-Win Strategy

Economy policies, the world's responsibility
- Human Being Win

Transformation and upgrading, stable earning
- Company Win

Environmental protection, resource conservation
- Earth Win

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Thanks to All Participants!

No	Name	Gender	Economy
1	Tan-Phat Vo	M	Chinese Taipei
2	Delicia Yunita, M.Si	F	Indonesia
3	Achrimidiasti Oktariflani, S.Si	F	Indonesia
4	Cheng Shikun	M	China
5	Huang Xinmei	F	China
6	Andrei Holub	M	Russia
7	Vasiukov Evgenii	M	Russia
8	Prawit Kongjan	M	Thailand
9	Alam Surya Wijaya	M	Thailand
10	Shalini Narayanan	F	Malaysia
11	Peer Mohamed	M	Malaysia
12	Tran Duc Minh	M	Viet Nam
13	Nguyen Phan Kim Ngan	F	Viet Nam
14	Muhammed Rasit ATELGE	M	Republic of Korea
15	Thananchai Sataklang	M	Thailand
16	Sakollawat Sawetrattanakul	M	Thailand
17	Sasiprapha Kaewdang	F	Thailand
18	Nadya Mauranti Fachruddin	F	Indonesia
19	Fuji Lestari	F	Indonesia
20	Tran Vuong	M	Viet Nam
21	Leyi Cai	F	China
22	Yahui Huang	F	China
23	Nuttiya Tantranont	F	Thailand
24	Namphon Srikham	M	Thailand
25	Kyle Lin	F	Chinese Taipei
26	Nikannapas Usmanbaha	M	Thailand
27	Kalaya Jinliang	F	Thailand
28	Tran Rukruam	M	Thailand
29	Victor Chung	M	Thailand
30	Grey Huang	M	Thailand
31	Paiboon Chanvalaiporn	M	Thailand
32	Diana Dosayeva	F	Russia
33	Marat Dosayev	M	Russia
34	Santi Charoerpornpattanu	M	Thailand
35	Chai Sung Lim	F	Thailand
36	Athipthep Boonman	F	Thailand
37	Natchanan Pitakjiwanon	M	Thailand
38	Temduan Sayatanant	F	Thailand
39	Kanokchat Buranasiri	F	Thailand
40	Jaewon Kim	F	Thailand

41	Peangjai Talalux	F	Thailand
42	Pongsakorn Taechakijviboon	F	Thailand
43	Neeranuch Rukying	M	Thailand
44	Budsarakam Prapatsorn	F	Thailand
45	Ekkaphop Ketsombun	F	Thailand
46	Supanan Chuboonsang	M	Thailand
47	Onnicha Jutarosaga	F	Thailand
48	Tula Jutarosaga	M	Thailand
49	Nutipon Sriwiangya	F	Thailand
50	Thanchanok Kasorn	F	Thailand
51	Pijitra Saelao	M	Thailand
52	Naruesorn Anuraksap	F	Thailand
53	Chamnan Limsakul	M	Thailand
54	Panom Parinya	M	Thailand
55	Sakarindr Bhunmirattana	M	Thailand
56	Safa Senan Mahmod	F	Malaysia
57	Anittha Jutarosaga	F	Thailand
58	Claire Chen	F	Chinese Taipei
59	Pei-Ying Kwan	F	Chinese Taipei
60	Mei-Yi Lee	F	Chinese Taipei
61	Abdulaziz Atabani	M	Turkey
62	Jamaliah Md Jahim	F	Malaysia
63	Yin-Che Huang	M	Chinese Taipei
64	Jun Miyake	M	Japan
65	Sri Djangkung Sumbogomurti	M	Indonesia
66	Enny Sudarmonowati	F	Indonesia
67	Laurie Boyce	F	New Zealand
68	Chaiwat Muncharoen	M	Thailand
69	Jesada Sivaraks	M	Thailand
70	Jeong-Hyop LEE	M	Thailand
71	Suneerat Fukuda	F	Thailand
72	Teow Yeit Haan	F	Malaysia
73	Worajit Setthapun (Sai)	F	Thailand
74	Alissara Reungsang	F	Thailand
75	Kim Anh TO	F	Viet Nam
76	Daniel Scheerooren	M	Thailand
77	Paisarn Sonthikorn	M	Thailand
78	Shu-Yii Wu	M	Chinese Taipei
79	Chen-Yeon Chu	M	Chinese Taipei