2022年度 ITS-SIT-IHI グローバルプロジェクトベースドラーニング（GPBL）プログラム実施レポート

1. Program Summary

インドネシアスラバヤ工科大学（ITS）、芝浦工業大学（SIT）、そして日本の主要エンジニアリング企業である株式会社IHIは、2021年における優れた成果を継続する形で、2022年にも産学官連携形式でのグローバルプロジェクトベースドラーニング（GPBL）プログラムを、全14回のオンライン形式で実施した。前回からの変更点として、ゼロカーボン社会を実現するために、アンモニア、バイオマス、森林関連における技術導入の実現性について、よりよい理解と習得を目的に設定した。

プログラムを通して、各大学からの参加学生は5〜8人の小グループに分かれ、それぞれのテーマであるアンモニア、バイオマス、森林関連技術に関して、各地域、各自の国レベル、そして国際規模における、現在の技術動向、導入可能性、そして活用方法の提案などについて、情報の収集と分析に取り組んだ。そして各トピックにおいて、大学、政府機関、産業界それぞれからのステークホルダーからのレクチャーを受けた上で、ディスカッションを通して理解を深めた。

さらに参加者は、That's What I Learnt (TWIL) 、Group Discussion Canvas (GDC)などのフォーマットに則してディスカッションを進めた。そして最終的に、各トピックスの管理運営における、グループでの検討内容、抽出項目、技術導入の提案について、それぞれ発表を行った。

トピック、技術面ともに、未開拓の新領域が多く、前例や正解がないために、開始段階では参加学生の中にも戸惑いが見られた。そうした中、両国の学生が英語での試行錯誤を通して、前述のフォーマットを活用しながら自分たちのアイデアを創り出し、最終的には体系的なプレゼンテーションにまとめ上げることが出来た。そして、参加学生からは、「未知の困難を乗り越えたことで大きな自信を育むことができた」、「これからさらに国際社会に飛び出してみたい」といった声が聞かれた。また主催者であるITS、SIT、IHIにとっても、このプログラムの継続的な実施が、３者間の更なる連携強化と、グローバル教育およびビジネスにおけるノウハウ醸成に繋がっている。この確たる蓄積を元に、今後も本GPLBを継続する予定である。

2. Agenda

Meeting	Day, Date	Time (GMT+7)	Duration (Mins)	Agenda	Detail
1	September 2, 2022	15.00 - 17.00	120	Program & Learning Plan Overview	For ITS students
2	September 9, 2022	15.00 - 17.00	120	The Use of 5W-1H, 5M-7M+1, PDCA, I-P-O, CIMOSA Methods for Case Study Analysis	ITS, SIT & UGM
3	September 16, 2022	15.00 - 17.00	120		
4	September 23, 2022	15.00 - 17.00	120	- Case Study Writing - Pre-Program Questionnaire & Social Challenges Writing	
5	September 30, 2022	15.00 - 17.00	5	Opening	ITS
			5	Group Introduction	ITS
			10	Remark by ITS	Vice Rector IV ITS

Meeting	Day, Date	Time (GMT+7)	Duration (Mins)	Agenda	Detail
			10	Remark by SIT and Introduction to SIT, Tokyo University of Science and Nihon University	Prof. Hitoshi Nakamura (SIT)
			10	Remark by IHI	Mr. Kensuke Ide (IHI Jakarta)
			20	Program Overview	Assoc. Prof. Maria Anityasari, Ph.D (ITS)
			40	Introductory Lecture & Roadmap by IHI	Mr. Mohamed Faeze (IHIAP)
			20	Group Interaction	ITS
6	October 7, 2022	15.00 - 17.00	5	Opening	ITS
			25	Ammonia Fuel Cells and Their Potential Applications	Prof. Dr. Ir. Heru Setyawan (ITS)
			25	Green Ammonia Prospect and Production	Dr. Rendra Panca Anugraha (ITS)
			25	Technology Ammonia from Industry Perspective	Mr. Kota Yamada (IHI Japan)
			35	QnA	ITS & IHI
			5	Certificate Awarding & Closing	ITS
7	October 14, 2022	15.00 - 17.00 IDN	5	Opening	ITS
			25	Biomass Production	Dr. Ratna Ediati (ITS)
			25	Local Co-Firing & Applied Biomass	Dr. Totok Soehartanto (ITS)
			25	Technology for Biomass fuel: Opportunities and Challenges	Mr. Iwan Setiawan (IHI Jakarta)
			25	Technology for Biomass fuel: Opportunities and Challenges	Ms. Nabila (ISBM KL)
			15	QnA, Certificate Awarding and Closing	ITS & IHI
8	October 21, 2022	15.00 - 17.00 IDN	5	Opening	ITS
			25	Lecture for Forestry Management	Mr. Ahmad Basyiruddin Usman (Ministry of Environment and Forestry)
			25	Forest Land Use Planning and Land Arrangement	Dr. Wahyu Wardhana (UGM)
			25	Forestry Technology	Mr. Kota Yamada (IHI Japan)
			35	QnA and Certificate Awarding	UGM, IHI, Ministry
			5	Closing	ITS
9	October 28, 2022	15.00 - 17.00 IDN	120	Feasibility Study Questionnaire Preparation and Review	Assoc. Prof. Maria Anityasari, Ph.D (ITS)

Meeting	Day, Date	Time (GMT+7)	Duration (Mins)	Agenda	Detail
10	November 4, 2022	15.00 - 17.00 IDN	90	Sharing and Focus Group Discussion about Ammonia	1. PT PLN Nusantara Power 2. Dr. Zainal Arifin (PT PLN)
			30	Group Discussion	ITS, SIT, IHI, UGM
11	November 11, 2022	15.00 - 17.00	90	Sharing and Focus Group Discussion about Biomass	1. Ditjen EBTKE KESDM 2. Anita Puspita Sari (PT PLN Bioenergy)
			30	Group Discussion	ITS, SIT, IHI
12	November 18, 2022	15.00 - 17.00	120	Group Discussion	ITS, SIT, IHI
13	November 25, 2022	15.00 - 17.00	120	· Presentation rehearsal · Group Discussion	ITS, SIT, IHI
14	December 2, 2022	15.00 - 17.00	120	· Final Presentation · Closing Ceremony	ITS, SIT, IHI

3. Participants

- SIT: Students 18, Lecturers 4
- Nihon University: Students 4, Lecturers 3
- Tokyo University of Science: Students 2

- ITS: Students 22, Lecturers 6, Staff 4
- Universitas Gadjah Mada: Students 9, Lecturers 3

- IHI: Staff 5

(Guest Speakers)
- Indonesian Governments: 2
- Indonesian Companies: 2

Learning Worksheet

TWIL Worksheet

Global Project-Based Learning
ITS-SIT-IHI 2022

TWIL – THAT's WHAT I LEARNT

University: Sepuluh Nopember Institute of Technology

Group: Ammonia (A1&A2)

Day & Date: Friday, 28 October 2022

Topic/Title: Ammonia Fuel-Based

Curiosity (Fill in before you listen to the presentation of the speakers)	Interesting Facts or Information (Fill in during the presentation of the speakers)	Identified Problems or Needs (Fill in during the presentation of the speakers)
1. How does ammonia can be applied as a fuel? 2. What are the disadvantages of ammonia fuel-based? 3. Why ammonia fuel will is a good choice for renewable energy to replace fossil fuel? 4. What is the drawback in generating green ammonia? 5. How ammonia used as a power plant and how it works? 6. What the advantages of using ammonia as a plant fuel? 7. Can the price of green ammonia be competitive in the market compared to conventional ones? 8. Haber Bosch is old technology, is it still relevant to apply this technology today? 9. What makes ammonia price high? 10. How to produce electricity from	1. Ammonia can be applied to a combustion system in power plant 2. Ammonia Fuel Cells provide a pathway to decarbonise a variety of applications reliant on fossil fuels. 3. Green ammonia production by electrolysis method. 4. Relations between Indonesia and Japan in the export of raw materials from fuel. 5. Direct ammonia solid oxide fuel cells (SOFCs) that has an advantage of using such elevated temperatures is that the cracking of ammonia and	1. Ammonia is expensive 2. Production of green ammonia is still in development that required many years to properly build facilities for producing green ammonia 3. Using gray ammonia as fuel in power plants will contribute to the increase of CO2 emission produced from ammonia production 4. It is difficult to catalytically produce hydrogen from ammonia at low temperature. 5. The chemical industry faces significant challenges, there are growing carbon emissions, finite, resources, security of supply for both energy and raw materials. And the most of materials that used as fuel produced CO2. And the obstacle of using ammonia as a fuel or power plant is because it has expensive

GROUP TWIL – THAT's WHAT I LEARNT

Group: Biomass Fuel (B1, B2, B3)

Day & Date: Friday, 28-10-2022

Topic: Biomass Fuel

Curiosity (Fill in before you listen to the presentation of the speakers)	Interesting Facts or Information (Fill in during the presentation of the speakers)	Identified Problems or Needs (Fill in during the presentation of the speakers)
• What natural resources are used to produce the fuel? • How is it more/less sustainable compared to other means of producing energy? • In what stage is Indonesia in in terms of our feasibility to produce and utilise this form of energy? • How much is the efficiency of biomass energy production compared to other material sources? • Why is it the biomass is still not commonly used in developing countries regarding the amount of biomass that its countries have? • Does the amount of biomass sources to be converted into energy influence how much energy could be produced? • What are the challenges we face so far? • Why does biomass fuel featured? • How to make a good biomass based fuel for industry ? • How much energy can be produced by biomass based fuel ? • The use of biomass is one of many efforts to gain net zero emission of CO2, why is that? • What is the future of biomass fuels? • What sort of materials that could be used to optimize biomass for a	• Rice husk actually can become one of the biomass sources of energy to produce. • 2030-2060 is targeted for massive development of renewable energy (we are currently in the transitional period). • 10x the amount of biomass is still needed to realise the goal. • OPT Pellet, EFB Pellet, and POME are means of waste utilisation for biofuel. • That photosynthesis is actually a model of biomass produced by plants. • Biomass is divided into three categories namely biomassa (energy), biogas (daily needs, electricity), biofuel (transportation fuel, electricity). • Biomass fuels are highly regarded as a renewable energy source. • Biomass is cheaper than coal based on its calorific value • For the electricity the form of biomass used is in gas, for the fuel its liquid. • Lignin is the component	• The problem to overcome on implementation of renewable energy, especially on biomass are the readiness of sources that will be used to power up energy • The capability of resources and equipment to convert energy usage is needed in developing countries • That producing biomass based fuel have some types of boiler in Co-Firing, namely PC Boiler (have 5% limit of Co-Firing without CAPEX), CFB Boiler (have 10% limit of Co-Firing without CAPEX), Stoker Boiler (have 20% limit of Co-Firing without CAPEX). • For the production itself have some challenges i.e. there are still many products that are still not operating commercially, the test methods in Indonesia are still many that use coal, have a limited preparation time. • Due to the covid-19, increased need for electricity, so we must use low-cost fuel such as biofuel and ammonia fuel. • There needs to be further resource and technological development. • There needs to be implementation of strict standard and policy in regards to the use of safe RDF usage. • Commercialization of biomass energy • Technology used • Influence people to understand the importance of using renewable energy • Biomass fuels are produced in very small

Group Discussion Canvas

GDC – GROUP DISCUSSION CANVAS

Group:

Topic:

Focus:

*Use real data to support your discussion.

PROBLEM	VISION	BENCHMARKING	UNIQUE VALUE PROPOSITION
AFFECTED STAKEHOLDERS	EXISTING ALTERNATIVES	SOLUTION ALTERNATIVES	IDENTIFIED CHALLENGES
KEY ACTIVITIES REQUIRED	POLICY OR HIGH-LEVEL CONCEPTS REQUIRED	COST STRUCTURE	REVENUE OR BENEFIT STRUCTURE
KEY SUCCESS FACTORS		IMPLEMENTATION STRATEGY	

Final Presentation Result

GLOBAL PROJECT BASED LEARNING

GREY AMMONIA

for energy transition era

A-1

01 BACKGROUND

02 WHAT AND WHY GREY AMMONIA?

03 CURRENT SITUATION

04 THE OBSTACLE

05 THE SOLUTIONS

06 THE IMPLEMENTATION

07 THE FUTURE DEVELOPMENT

FLOW OF CONTENTS

05 OUR SOLUTION

Carbon capture technology

Combined cycle power generation

- Reduce NOx by capturing it (Denitration)
- Use carbon capture technology to produce less CO2
- Use the combined cycle power generation
- Increase the proportion of ammonia in co-firing
- Introduce the greener and cheaper method to produce grey ammonia

06 IMPLEMENTATION

Increasing Carbon Tax

Implementing carbon tax can force the industries to produces in greener way

Collaboration & Investment

Technology in Indonesia is still immature. And Japan need to import ammonia

Campaign

Government, coorporation, and university create a campaign for the society

Feasibility Study of Green Ammonia

Group A2

NH_3 GREEN AMMONIA

Table of Contents

1. Problems
2. Green Ammonia
3. Challenges of Green Ammonia
4. Short Term Solution
5. Long Term Solution

Green Ammonia

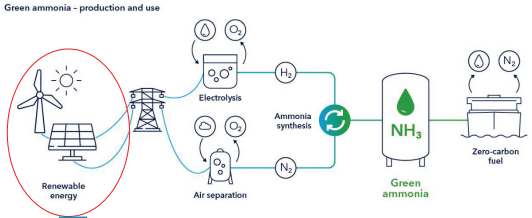
Properties of green ammonia

1) No carbon , environmentally friendly
2) Potential to be used as a hydrogen carrier (It has three hydrogen atoms)
3) Easier and simpler to produce, store, transport and distribute than many other fuels.
4) Potential alternative to gasoline, diesel and kerosene.
5) Potential fuel solution for clean power generation in remote areas.
6) It can be considered for all combustion systems from engines to gas turbines.

AMMONIA ENERGY ASSOCIATION

Green Ammonia

Green ammonia production



Green ammonia uses green hydrogen produced by water electrolysis, powered by renewable energy, making green ammonia production virtually carbon dioxide–free.

Feasibility Study of

BIOMASS IN JAVA

Group B-1

PROBLEM

- East Java is one of Indonesia's largest provinces, where rice production always rises every year.
- The average rice yield from 2008 to 2018 was 247,014.32 tonnes.
- In 2018, the 38 East Java areas had a combined rice straw and rice husk potential of around 415,970.61 and 55,462.75 tonnes, respectively, equivalent to 238,526 TJ and 32,752 TJ of electrical power potential of around 66 GWh and 9 GWh.

How to utilize existing available reserve of Rice Husk in Java area for fuel?

1. Production cost of Rice husk in java
2. Resources availability in Java
3. Lack of support from the government

SOLUTION ALTERNATIVES

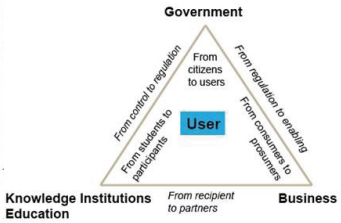
Rice Husk Briquette Machine

Rice Husk → Rice Husk Briquette Machine → Product

- Rice husk briquette machine uses often-underutilized rice husks to produce useful fuels.
- It works via a machine that grinds and compresses rice husks, producing solid briquette fuels.
- No binders or adhesives are needed, which represents its greatest feature.
- It can be used in place of firewood or charcoal, boosting forest preservation efforts.

KEY ACTIVITIES REQUIRED

Supporting government policy



Feasibility Study of Wood-Based Biomass Co-Firing Indonesia

Presentation Outline

01 Introduction

02 Purpose

03 Constraints

04 Methods

05 Conclusion

Co-firing Biomass 5%

Wood
8,207,057.21 ton

Source : (Bergman et al., 2000; Triani et al., 2022)

Electrical Energy Output From Wood & Coal

Fuel 1 = Wood 5 wt%
Fuel 2 = Coal 95 wt%
Electrical energy output from wood = 0.287 GJ/ton fuel
Electrical energy output from coal = 8.393 GJ/ton fuel
Total electrical output = 8,68 GJ/ton fuel
Percentage output from coal = 96,70%
Percentage output from wood = 3,3%

Electrical Energy From Wood (8,207,057.21 ton)

Electricity energy from wood (8,207,057.21 ton)
Electricity = 110,069.897 MWh/year
Electricity = 30,852.774 MWh/day

https://intip.in/calculation

Key Success Factors

01 Project Planning and Development

02 Community Participation

03 Raw Materials

04 Maintenance Program

05 Government Support

Hermawati, W. and Rosaira, I. (2017)

BIOMASS IN INTERNATIONAL GLASSES

B-3 Group

TABLE OF CONTENTS

SOLUTIONS

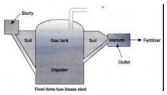
Supply and Demand

Availability is mainly reduced to forest areas, but residues have much lower costs, are dispersed and available almost everywhere. We can help maintain the ecosystem with reforestation. So we can keep the price of biomass in the market stable (secure inexpensive biomass).

Challenges

Several countries such as Japan and Indonesia have supported shifting fuel for energy like biomass or ammonia. By doing a mix of power generation, market liberalization, and raising awareness of energy conversion to the wider community. So we can contribute by helping the government to spread awareness in our community.

Affordability



Renewable energy from plants that are converted into biogas can be stored or injected into the electricity grid to reduce dependence on fossil-fuel energy, which can help reduce our carbon footprint. Therefore, they can help fight climate change.
As domestic and industrial users rely less on the energy produced with fossil fuels, greenhouse gas emissions become lower. By gathering organic matter and controlling the fermentation process, fewer methane emissions get into the atmosphere for improved air quality.

SOLUTIONS

Operational

In addition to food waste generated by restaurants and households, used fried oil generated by supermarkets, convenience stores, food processing companies, etc. can be used as a material . Using materials that would normally be thrown away in this way can help solve not only the energy problem but also the garbage problem.

Social

As domestic and industrial users rely less on the energy produced with fossil fuels, greenhouse gas emissions become lower. At the same time, by gathering organic matter and controlling the fermentation process, fewer methane emissions get into the atmosphere for improved air quality.

Policy

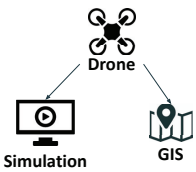
We can increase the frequency of renewable energy production later, so the price will be balanced, cause the production is in tune with the price. As for regulations on the development of biomass, there is still no way, but several countries have regulations that are still sustainable on biomass. For example, in Sri Lanka, in the paper titled "Policies and Regulations Affecting Biomass-Related Energy Sector Development in Sri Lanka"

Final Presentation
Forest Management Group

Global Project-Based Learning ITS-SIT-IHI

Unique Value Proposition

Identified Challenges



The way to analyze

How to establish the flow of analysis?

Biodiversity

What is the best situation of forest for the better biodiversity?

Involve and Agreement

How to gather participants?

Implementation Strategy

Mobile vehicle

- Investigate the forest with a small probe.
- We can know the ground surface, which cannot be grasped by drones observing from the air.
- It is possible to manage spaces where people cannot enter (such as places with many animals)