



ENERGIZING GREEN ENERGY

Endless Commitment
to Actualize the Sustainable
Energy Transition





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the Sustainable Energy Transition**

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Growing With Renewable Energy

PT PERTAMINA GEOTHERMAL ENERGY is a subsidiary of Pertamina Power Indonesia that is engaged in harnessing geothermal energy. We are committed to grow together with the communities and environment. We consistently carry out environment and social responsibilities through five pillars: Education Quality Improvement, Health Quality Improvement, Care for the Environment, Infrastructure and Social Development, and Community Economic Empowerment.

This book explains the environmental and social responsibilities programs carry out in six working areas of PT Pertamina Geothermal Energy: Kamojang, Ulubelu, Lahendong, Karaha, Sibayak, and Lumut Balai. The description depicts top programs and community empowerment innovations in each of the area.

We hope *Energizing Green Energy: Endless Commitment to Actualize the Sustainable Energy Transition*, can inspire the efforts of community development synergy on conservation basis and facilitate the public to access information about our activities.

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CHAPTER 1

Introduction



Our nation lies across the dwelling of behemoths, who are the keepers of geothermal power. High above these majestic volcanoes, water poured from the sky, soaking into the reservoir rocks deep in the earth. The magma heats the water, transforming it into a hot vapor of 240 to 310 degrees Celsius. Explorations conducted by PT Pertamina Geothermal Energy (PGE), have revealed that the archipelago is well-endowed with an abundance of geothermal energy potential.

The geothermal energy is an alternative renewable energy source that is unaffected by climate nor weather condition. The Indonesian government entrusted PGE to lead the green energy transition by taking full advantage of its vast geothermal

potential in Indonesia using integration of knowledge, experience, and technology.

Indonesia stands to gain greatly from the future of geothermal industry. In the future, the immense geothermal potential can make this archipelago to become a major hub of the worldwide geothermal industry. Roughly half of the world's geothermal capacity lies within our motherland.

PT Pertamina Geothermal Energy, a subsidiary of PT Pertamina (Persero), engaged in harnessing geothermal energy, certainly will not just sitting around watching.

If this country makes full use of its gigantic potential, in 2025 Nusantara's national energy sovereignty will be stronger. Thus, in 2060 Indonesia will achieve Net Zero Emission target.



The village of Karangrejo with Mount Duduk looming at the back in Ulubelu District. There are four Geothermal Energy Power Plants here, located in Muara Dua Village, Ulubelu District, Tanggamus Regency.

82% of the total geothermal capacity installed in Indonesia is within the Geothermal Working Area (GWA) of PGE



Geothermal Working Area

PGE manage 13 Geothermal Working Areas (GWA) with total capacity of 1,877 MW or about 82% of total national installed capacity.

According to data publication from New and Renewable Energy (NRE) map in June 2022, total national installed capacity is 2,292 MW.

Based on that number, total installed capacity within PGE's GWA is 1,877 MW. The 672 MW of that capacity is self-managed by PGE and the remaining 1,205 MW is managed

through joint operation contracts.

In Electricity Supply Business Plan 2021-2022, geothermal energy expansion is targeted to have 3,355 MW additional installed capacity from Geothermal Power Plant in 2030.

By first semester 2022, among countries harnessing geothermal energy into electrical power,

Indonesia is in the second place in total installed capacity, comes only after the United States, the country that has the most installed capacity in the world.

Real Commitment in Building Sustainable Business

With the slogan *Energizing Green Energy* and along with the tag line from PT Pertamina (Persero) *Energizing Community & Environment*, PT Pertamina Geothermal Energy presents the spirit to keep supplying energy ceaselessly while holding tight the commitment to maintain the business that is sustainable, adaptable, high resistant to global energy transition, and adhere to environmental protection regulations.

PT Pertamina Geothermal Energy is highly committed to do Social and Environmental Responsibilities (SER), with utmost care to the life of communities around PGE's exploration areas.

Our care is reflected in PGE's intention to become a reputable global energy company that is acknowledged as environmentally friendly and has high social responsibility and good corporate governance.

To achieve our intention, PGE shows clear commitments, among which are:

1. Ensuring the security of national electrical energy supply.

2. Reducing greenhouse gas emissions, non-greenhouse gas emissions, releases, waste, effluents, and to address broader climate change issues through managing regulatory, reputational, and/or market-related risks from climate change by integrating them into our strategies and operations.
3. Protecting and preserving the environment, water, natural resources, and energy through a continuously monitored environmental management system.
4. Managing and mitigating the impact of projects and activities on the biodiversity by avoiding operational activities in areas with high biodiversity.
5. Rehabilitating land after the operations are ended to restore the ecosystem and set aside adequate fund for operational closure and rehabilitation.
6. Implementing the highest Health, Safety and Environment standards to maintain the health, safety and security of employees, contractor's workers, communities, and customers.



The Ogan River flows at Kelumpang Village, Ulu Ogan Sub-district, Ogan Komering Ulu Regency. People love to travel alongside the river and watch the scenery. This village is located near PGE's Lumut Balai Area.



7. Becoming leader of social development to encourage social and economic development in society.
8. Consulting with the stakeholders and local communities on environmental issues.
9. Honoring indigenous community/society's rights in operating sites.
10. Working with partners and suppliers to achieve environmentally friendly and sustainable procurement of goods and services.
11. Supporting the provision of products and services

- to customers comply with sustainability principles.
12. Encouraging sustainable employee's development, fair treatment, and diversity in work place.
13. Increasing the recruitment of local manpower and contractors so long as it meets the operational needs.
14. Ensuring compliance with all legal requirements and upholding Good Corporate Governance in all activities.
15. Upholding anti-corruption and anti-fraud practices assessments within the Company.



Promoting Human Welfare and Environmental Sustainability

To ensure the Social and Environmental Responsibilities (SER) program performs optimally, five major pillars were created to sustain it. They are Education Quality Improvement, Care for the Environment, Community Economic Empowerment, Health Quality Improvement, and Infrastructure and Social Development.

This program is the actualization of company's commitment to sustainable development, by bringing the benefits using more integrated, directed, and accountable principles with more measurable impacts, and becoming part of company's business approach.

The implementation of state-owned enterprise's SER program is oriented to the achievement of

Sustainable Development Goals (SDGs). The guidelines for its program implementation are in accordance with ISO 26000.

The technical implementation of the SER program in managing the economy, environmental, and social aspect is executed with the concept of Triple Bottom Line (People, Profit, and Planet) that is integrated with seven core subjects of ISO 26000. The purpose is to have a more directed and on-target SER program implementation.

Quoted from 2021 Sustainability Report, PT Pertamina Geothermal Energy's CSR costs amounted to Rp12,875 billion, an increase of 13.6% compared to Rp11,329 billion the previous year. This CSR program is held to fulfill the five supporting pillars of SER program.

The report also stated that the



Health, Safety, Security, and Environment (HSSE) for workers are vital to accomplish optimal work productivity.

With the slogan *Energizing Green Energy*, PT Pertamina Geothermal Energy presents the spirit to keep supplying energy ceaselessly.

level of public acceptance of the CSR programs is decent, with the Community Satisfaction Index (IKM) reaching 83.9 out of a scale of 100.

PGE also carries out programs concerning biodiversity, community and social development, and community economy empowerment.

SER accomplishments of PT Pertamina Geothermal Energy are depicted in this book through a variety of narrations.

This publication will also help public to acquire information about all activities of SER and the policies set by the company to execute this program.



The highest point in Mount Sibayak complex lies on the peak of Mount Pintau, 2,212 meter above sea level.

This mountain is located in Merdeka Sub-district, Karo Regency, North Sumatera. PGE's Sibayak Area is at the foot of the mountain.



CHAPTER 2

Story of the Pioneer

Since 1900s, all nations globally are competing to generate electrical energy from geothermal resources including Indonesia.

When the Dutch colonized Nusantara, in 1926 they managed to drill the ground at Kamojang to build a geothermal well that spewed hot steam. This event marked the first successful milestone of geothermal exploration in Indonesia.

This success story will never be forgotten from the history of world geothermal exploration. This event was a big phenomenon. And the area is still well kept today.

As time went by, World War II began and Japan invaded. Kamojang was abandoned when the Dutch administration left. After the independence, Indonesia had never had the opportunity to explore geothermal potential.

Until in 1960s, some foreign and local researchers underwent collaborative geothermal surveys in Indonesia. And finally in 1974, the company that now becomes PT

Pertamina (Persero) was appointed to do geothermal survey in the island of Java.

This appointment was unexpected because during the geothermal research, the company was never involved. But accepting challenge is in the company's vein. And so, the Geothermal Division was born. Its headquarters is in Jalan Teuku Umar 19, Menteng Central Jakarta.

The assignment from the government to survey geothermal sources and to explore and exploit them to generate electrical power is based on the Acts (Undang-Undang) No. 8 year 1971 and Presidential Regulations (Keppres) 64/1972 and Presidential Regulations (Keppres) 16/1974.

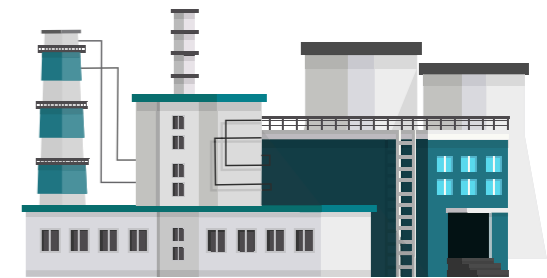
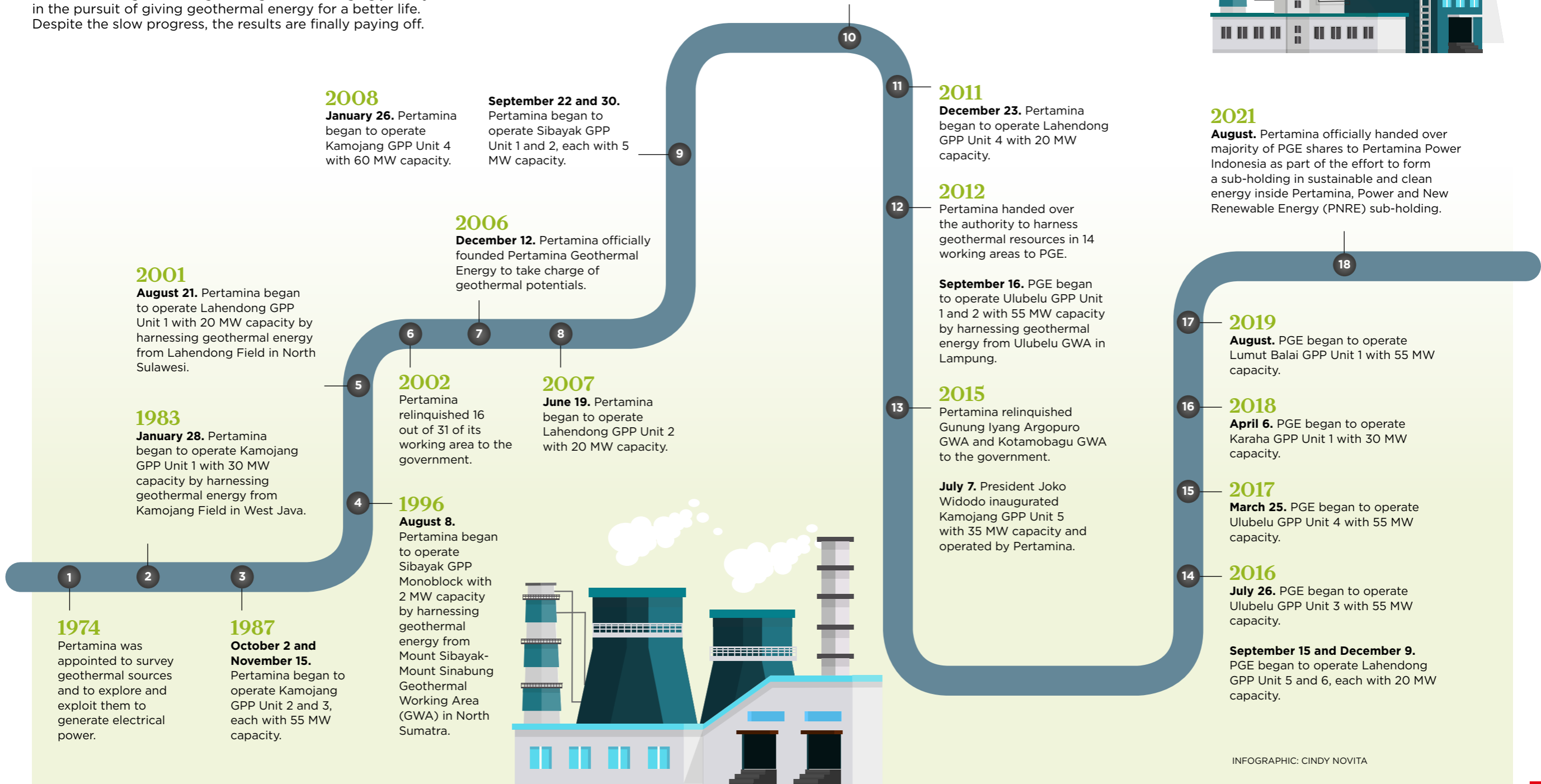
Kamojang Geothermal Power Plant/GPP Unit 1 with 30 MW capacity then began to operate on January 28, 1983, harnessing geothermal energy from Kamojang Field, West Java.



•••••
The initial success in geothermal exploration took place in 1926, when the Dutch experts succeeded in making a geothermal well in Kamojang. The exploration was postponed due to World War, but then in 1960s foreign and local scientists underwent geothermal surveys in Indonesia. In 1974 Pertamina was appointed by Indonesian government to do geothermal survey in the island of Java and to explore and exploit the energy to generate electrical power.

Indonesia's geothermal exploration footprint

Pertamina has gone through a long and challenging journey in the pursuit of giving geothermal energy for a better life. Despite the slow progress, the results are finally paying off.



INFOGRAPHIC: CINDY NOVITA

The Frontline in Indonesian Geothermal Energy

The global energy map is changing. At the very least in 2050, the use of fossil fuel will decrease to two third of world consumption today. With the shift of this consumption pattern, the choice to use renewable energy will be a strategic one.

When compared to fossil energy, renewable energy has long been conceived as a solution for a better energy to use, but limited support and policy for clean energy are still the problems.

But from now on, renewable energy is not something to look down upon. This energy has been predicted to be the main drive for a big change in global energy transformation.

Quoted data from Think Geoenergy reveals that up to August 2022 Indonesia is in second position among 10 countries with highest number of geothermal installed capacity in the world, with 2,282 MW capacity.

United States is still in the first position with total 3,752 MW geothermal installed capacity.

As the frontline in national geothermal energy, PT Pertamina Geothermal Energy (PGE) contributes a great deal with 672 MW installed capacity from self-operated GWA and other 1,205 MW from joint operation contract GWA.

As the pioneer of Indonesian geothermal development, PGE has received direct appointment from government to take the lead for geothermal development project. To answer the challenge, PGE has strong commitment to increase installed capacity of Geothermal Power Plant in Indonesia even further.

PGE's commitment to develop geothermal clean energy is carried out with consideration to environment protection and community empowerment, whilst retaining the mandate to provide the best benefits for Pertamina.

As the frontline, PT Pertamina Geothermal Energy (PGE) contributes a great deal with 672 MW installed capacity from self-operated GWA and other 1,205 MW from joint operation contract GWA.





Lumut Balai and Margabayur GWAs possess a considerable geothermal potential, reaching up to more than 300 MW.

PT Pertamina Geothermal Energy continues to maintain its achievements in Performance Rating Program in Environmental Management (PROPER) 2021 conducted by the Ministry of Environment and Forestry. Kamojang Area, West Java, succeeded in maintaining the achievement of Gold PROPER for 11 times in a row from 2011 up to 2021.

The presentation of the most prestigious Gold PROPER award was held in front of the Vice President of Indonesia Ma'ruf Amin and presented by the Minister of Environment and Forestry Siti Nurbaya. This event was held in Vice President Palace on Jalan Medan Merdeka Selatan Number 6, Jakarta, on December 28, 2021.

Today, PT Pertamina (Persero) has significantly restructured itself with holding and sub-holding scheme. There are six sub-holdings in the new structure.

Those sub-holdings are: Power & New Renewable Energy; Upstream; Refining & Petrochemical; Commercial & Trading; Shipping Company; and Gas. PT Pertamina Geothermal Energy is in Power & New Renewable Energy sub-holding along with other renewable energy

businesses under PT Pertamina Power Indonesia (PPI).

PT Pertamina (Persero) is even successful in making the New Normal momentum during pandemic as an opportunity to run business in a new way in order to achieve the best result.


This organization change also broaden PT Pertamina (Persero)'s business portfolio in the future. It also drives business expansions outside conventional energy value chain, such as renewable energy, biofuel, and digital technology. PGE's actual operational performance in 2020 exceeded the target even though the world was in Covid-19 pandemic.

During the pandemic, PGE managed to record electricity equivalent production (Electric Volume Produce—Geothermal) of 4,618.27 Giga Watt Hour (GWh) or 14 percent higher than 2020 target of 4,044.88 GWh.

This achievement above the target was due to the application of Operation Excellence supported by the implementation of Geothermal Integrated Management System. The production by PGE alone contributed 31 percent of 2020 national geothermal production that was set



During the pandemic, PGE managed to record electricity equivalent production (Electric Volume Produce—Geothermal) of 4,618.27 Giga Watt Hour (GWh) or 14 percent higher than 2020 target of 4,044.88 GWh.

A large, dark, cylindrical industrial pipe runs horizontally across the middle of the frame, supported by a metal structure. To the left, a concrete staircase leads up a grassy slope towards the pipe. The background is a dense forest of tall, thin trees under a bright sky. A small yellow horizontal bar is located in the top right corner of the image.

In addition to maintaining electricity supplies from currently operating power plants, PGE also conducts studies to increase geothermal installed capacity in operational areas.



by the Ministry of Energy and Mineral Resources by 14,774 GWh.

In detail, Kamojang GWA managed to obtain 1,650 GWh electricity equivalent production, 13 percent higher than 2020 Company Budget and Working Plan's target of 1,454 GWh. Lahendong GWA obtained 828 GWh electricity equivalent production or 10 percent higher than the target of 754 GWh. Then, Ulubelu GWA obtained 1,613 GWh electricity equivalent production or 21 percent higher than the target of 1,335 GWh. Lumut Balai GWA obtained 442 GWh electricity equivalent production or 12

percent higher than the target of 395 GWh.

In addition to maintaining electricity supplies from currently operating power plants, PGE also conducts studies to increase geothermal installed capacity in operational areas. The initial focus areas for this study are Ulubelu Area (in Lampung) and Lahendong Area (in North Sulawesi).

PT Pertamina Geothermal Energy will never give up and is always committed to increase Sustainable Clean Energy portion in national energy mix to 23 percent in 2025



Kamojang GWA managed to produce 1,650 GWh electricity. This number exceeded the 2020 Company Budget and Working Plan's target of 1,454 GWh.

in geothermal sector. This will be conducted in measured business strategies. The purpose of this hard work is to become a world class green energy company.

PGE operates 13 Geothermal Working Areas (GWA) with total Geothermal Power Plant (GPP) installed capacity of 1,877 MW or about 82% of total national geothermal installed capacity. 672 MW of this is self-operated by PGE and 1,205 MW is operated with joint operation contracts. With these, the total CO₂ Emission Avoidance Potential is about 9.7 million ton CO₂ every year.

Among PGE's self-operated GWAs are:

- **Sibayak** Mount Sibayak—Mount Sinabung GWA, North Sumatra;
- **Kamojang** Kamojang GWA, Darajat, West Java;
- **Lahendong** Lahendong GWA, North Sulawesi;
- **Ulubelu** Mount Way Panas GWA, Lampung;
- **Karaha** Karaha Cakrabuana GWA, Tasikmalaya, West Java;
- **Lumut Balai** Lumut Balai and Margabayur GWA, South Sumatra.

As for the 2021 Domestic Component Level—or the amount of domestic components in goods

Kamojang Area, West Java, succeeded in maintaining the achievement of Gold PROPER for 11 times in a row from 2011 up to 2021.

and services of the operations— PGE recorded the total of Domestic Component Level to 67.86%. This is way exceeded the 30.00% target.

PGE's achievement and commitment to work safety is also astonishing. In 2021, PGE recorded total 15,519,106 safe working hours without any fatal work accidents. This is a very crucial aspect in energy business.

Moreover, PGE's Lahendong Area received Zero Accident Award from the Ministry of Manpower of the Republic of Indonesia.

In environmental concerns, PGE succeeded to continue its achievement of PROPER Awards up to 2021. One of them is PGE's Kamojang Area, West Java, that achieved Gold PROPER for 11 times in a row since 2011. PGE also received Green PROPER Award 2 times for


Lahendong Area, North Sulawesi, in 2019 and 2021, and 5 times for Ulubelu Area, Lampung, in 2017, 2018, 2019, 2020, 2021.

PGE was also awarded Blue PROPER. For Sibayak Area, North Sumatra, 2 times, in 2019 and 2021. For Karaha Area, West Java, 3 times, in 2019, 2020, 2021. Lahendong Area received it in 2020.

PGE's commitment in implementing Good Corporate Governance (GCG) is no less important. PGE has obtained ISO 37001:2016 certificate on Antibribery Management System (Sistem Manajemen Anti-Penyuapan/ SMAP) from PT Business Standards Institutions (BSI) Group Indonesia.

PGE has also implemented ISO 14001:2015 on Environment Management System. To prevent the negative impacts of decisions and activities, PGE has had various policies and monitoring mechanisms and also complain handling mechanisms.

PGE's GCG assessment score has also increased from 93.88 percent in 2018 to 94.90 percent in 2020 and described as excellent. ISO 37001:2016 SMAP itself is an acknowledgement from international certification organization.


Working gears and equipments that meet the safety standards ensure the safety and health of the workers.





Stronger Energy Sovereignty, Better Quality of Life

PT Pertamina Geothermal Energy is one of business players whose activities are related to natural resources. Due to this relation to natural resources, the company has an obligation to conduct Social and Environmental Responsibilities (SER). Such responsibility is required by law. In implementing sustainable development, ESR is a new framework of thinking in State-Owned Enterprises (Badan Usaha Milik Negara/BUMN) with the purpose to make the most of the company for the economy, social, environment, and law.

The SER program governance is carried out with more-integrated principles, in the right direction, with measurable impacts, and is accountable. All of this is part of the company's business approach. The implementation of the SER program is oriented to accomplish the Sustainable Development Goals/SDGs (Tujuan Pembangunan Berkelanjutan/TPB) with ISO 26000 as a guideline.

As part of the company's responsibilities to the communities around the operational areas, PGE

is highly committed to enhance Indonesia's energy resilience, independence, and sovereignty while keeping low the impacts of energy use to the environment. The company carries out all of these to achieve business' prosperity with sustainability and responsibility in mind.

PGE is committed to conduct various sustainability programs and activities that are in line with the seven core subjects of ISO 26000 and supporting the Sustainable Development Goals (SDGs).

PGE's commitment is implemented based on Indonesia's law that regulates the implementation of Social and Environmental Responsibilities (SER) activities, such as:

1. Government Regulations (Peraturan Pemerintah) No. 47 in 2012 about Environmental and Social Responsibility of a Company (Perseroan Terbatas).
2. Presidential Regulations (Peraturan Presiden) No. 59 in 2017 about The Implementation of Sustainable Development Goals' Attainment.



Reflecting a strong awareness of the value of natural resources, the Kamojang Eagle Conservation Center exhibits PT Pertamina Geothermal's dedication to preserving Javan eagles.

CHAPTER 3

Building Strategies for the Future

Foundations for the Action

On June 2022, Social and Environmental Responsibility (SER) Program of PT Pertamina Geothermal Energy (PGE) received three awards at the Business Indonesia Social Responsibility Award (BISRA) event. The awards that the company received were in three categories. PGE's Kamojang Area won the Platinum Award. PGE's Ulubelu Area won the Gold Award. PGE's Lahendong Area won the Silver Award.

In Kamojang, PGE won the Platinum Champion category—the best award—through its leading CSR Program Kang Dedi (Kamojang Desa Digital or Kamojang's Digital Village), an innovation of community empowerment program. Village digitalization was carried out by developing environment friendly innovation.

On March 2022, PGE also won The Best title in Indonesia Green

Award (IGA) 2022 event held by The La Tofi School of Corporate Social Responsibility. In this event, PGE was the best for eight categories. Two of them are the Plastic Waste Treatment and the Development of Integrated Waste Processing Facility.

As for the other six categories PGE won are the Development of Nature Conservation Tourism; the Water Resources Rescue; the Technology Engineering in Saving Sustainable Clean Energy; the Development of Biodiversity; the Pioneer of Pollution Prevention; and the Nature Conservation Digitalization.

Quoting IGA's official statement, PGE received the awards because the company brought changing stories to environment and community that gave big impact for the subject of the program.

"So, what's carried out was not merely used up the budget," said La Tofi, head of the IGA Assessor Team 2022.

2022 Awards

Energy & Mining Editor Society (E2S) Awards 2022

- BEST CEO for New & Renewable Energy Company
- Best Corporate Secretary for New & Renewable Energy Company
- Best Social Innovation Program Rangers App: PGE's Kamojang Area

E2S: Energy & Mining Editor Society

- E2S CSR Proving League Platinum: Kamojang Area
- E2S CSR Proving League Gold: Ulubelu Area

Business Indonesia Social Responsibility Awards (BISRA) 2022

- Platinum Champion: CSR Kamojang
- Gold Champion: CSR Ulubelu
- Silver Champion: CSR Lahendong

K3 Awards 2022

- Zero Accident Awards for Lahendong Area from the Ministry of Manpower of the Republic of Indonesia.
- Received the platinum category for the Covid-19 prevention and management program in Kamojang Area from the Ministry of Manpower of the Republic of Indonesia.
- Awards for HIV-AIDS prevention and management program.

Annual Pertamina Quality Award (APQA) 2022

- PGE received the Best of the Best Award in the APQA 2022 event.



PGE's President Director, Ahmad Yuniarto, received the Gold PROPER 2022 Award for PGE's Kamojang Area from The Ministry of Environment and Forestry. This Gold PROPER Award reception for the 12th times for Kamojang Area is presented in person by the Vice President of the Republic of Indonesia, Ma'ruf Amin, and the Minister of Environment and Forestry, Siti Nurbaya Bakar.

Gulf Sustainability Awards 2022 Dubai

- Silver Award Winner: PGE's Ulubelu Area for Best CSR Initiative

Sustainable Fitch

- ESG Entity Rating '2', which is second highest rate, assessed by Sustainable Fitch

The Ministry of Environment and Forestry

- Gold PROPER for Kamojang Area
- Gold PROPER for Ulubelu Area



The Executor's Working Line

PGE today has formed a systematic line that incorporate the supervisors and executors of Social and Environmental Responsibility (SER) programs. In the working line and flow that has been made, we can see clearly the supervisors, the job executors, and the authority delegation.

In the structural flow, the Government & Public Relations division is responsible for the plan, execution, evaluation, and report of the activities, as stated in the company's policies and SER pillars. Government & Public Relations Senior Supervisor and Area CSR Assistant from each of the areas are responsible to Area General Manager while maintaining coordination with the Government & Public Relations and Corporate Secretary divisions in the head office.

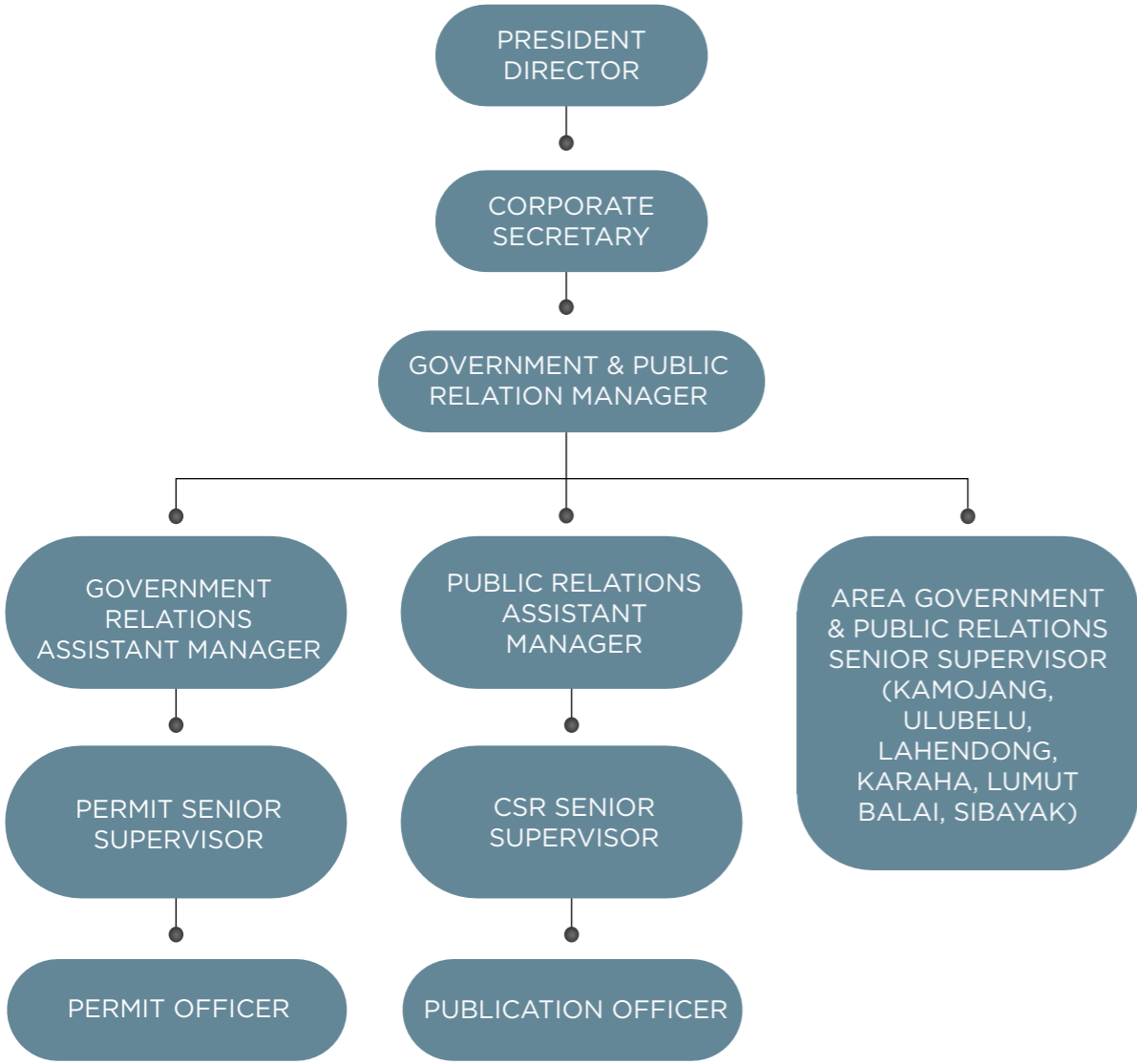
As mentioned by the President Director of PT Pertamina Geothermal Energy, Ahmad Subarkah Yuniarto, PGE's SER also has the purpose to create an effective, efficient, and mutually beneficial coordination in order to form a conducive working environment.

"A well-controlled working environment will support company's operational activities," he said.



PGE implements public security and comfort procedure to anticipate the spread of the Covid-19 virus. A working environment that's safe from the threat of virus will support company's operational activities.

Organization Structure SER Supervisors and Executors



PGE's SER also has the purpose to create an effective, efficient, and mutually beneficial coordination in order to form a conducive working environment.





Activate the Programs, Thrive the Partners

The community empowerment, development, and enhancement programs must be activated. Therefore, the company and community's relations need to be strong to make it beneficial for both parties.

To build the relations, we need a budget. For the budget to be spent effectively, the SER programs have to be well-planned. PGE internally provides a fund for the SER programs, while PT Pertamina (Persero) as the mother entity finances them too.

One of the CSR programs carried out by PGE is tourism development, like the CSR program in Kelumpang Village, Ulu Ogan District, Ogan Komering Ulu Regency, that is located near the area of PGE's Balai Lumut Area.





Source, Budget, and Spending of SER Fund

To build a good and mutually beneficial relation between the company and the neighboring community and environment, SER has to have a well-planned budget.

Social Responsibility Cost 2021

12.855 Rp million
 2020 > 11.329
 2019 > 11.830



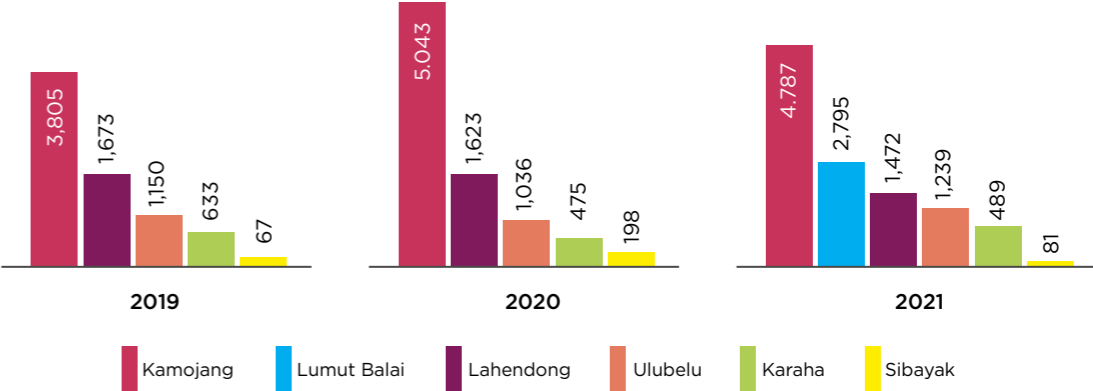
Foster Partner Empowerment 2021

106 Partners
 2020 > 98



Actual ESR Fund Spending*

(In Million Rupiah)



*Operational Area

To answer green energy provision challenge, we need innovations and researches to ensure future supplies.

CHAPTER 4

Two Main Foundations in Implementing Sustainable Responsibility

The energy transition for the sustainability and the future of the Earth is a long and big process. All of the countries in the world need to do it now to lower carbon emissions that have a big contribution for the climate change. We definitely need an agreement between countries on this energy transition to maximize global clean energy harnessing. And we need the right scheme for the energy transition.

In our country, President Joko Widodo firmly stated that Indonesia has to accomplish Net Zero Emissions (NZE) by 2060. And if it is possible, the energy transition must be done faster than what has been planned. In the scheme, the Indonesian government has set the Renewable Energy Mix target of 23% in 2025 and 31% in 2050.

In addition to the Renewable Energy Mix target, Indonesia also expressed its commitment to lower

its carbon emission to 29% in 2030.

The importance of this sustainable energy transition makes it one of the main issues in 2022 Group of 20 (G20) discussions during Indonesian Presidency.

This is a collaboration forum comprises 19 countries and 1 region which are the main economic players in the world. Concerning this, countries around the world should follow up the sustainable energy transition globally.

PT Pertamina (Persero) is a national energy company and one of the biggest State-Owned Enterprises (Badan Usaha Milik Negara/BUMN) in Indonesia. This company plays an important role in leading Indonesia's energy industry transition, with some targets for energy mix and Emission Avoidance Potential.

As part of Pertamina's Power & New Renewable Energy (PNRE) sub-holding, PGE also joins the effort.



The world has acknowledged the quality and production of Ulubelu's coffee and as a result it is exported to various countries. The primary species and the most favorable to grow by coffee farmers is robusta coffee (*Coffea canephora*).



Improving the education quality of young generation in every PGE's working area becomes a big contribution in the effort to create access to education.

PGE initiated a pilot project to increase geothermal installed capacity with the implementation of Binary technology. A Binary Unit is constructed in Lahendong, North Sulawesi, to generate the potential for additional electrical capacity.

PGE's President Director, Ahmad Yuniarto, revealed this initiation in G20 Sustainable Finance for Climate Action in Nusa Dua, Bali, in July 2022. "The company has set out a road map for the development of installed capacities in PGE's Geothermal Working Areas for the next five years. This road map is made in order to prepare the geothermal [energy] as a sustainable clean-energy base-load plant in Indonesia, because to this day only fossil-based plants serve as base-load plants—the steam power plants (Pembangkit Listrik Tenaga Uap/PLTU) that use coals as the fuel," he said.



The education pillar is very essential as it is strongly correlated with the quality of human resources in the future.

SER Commitment to Actualize Sustainable Responsibility

In the scope of sustainable clean energy, geothermal energy in Indonesia has a bright future amidst the massive energy transition toward sustainable clean energy. Moreover, the nature of geothermal energy that is clean, enormous in supplies, and affordable in price, makes it one of the best alternatives energies for Indonesia.

Today, Indonesia is the country with the second largest geothermal potential in the world, just below the United States. Indonesia has about 40 percent of world geothermal reserves. Part of this big potential is still hidden deep in the ground. To accomplish the sustainable energy transition as committed, PGE will not remain idle to see the condition of communities around the working area.

The core business of PGE is geothermal energy. It means PGE carries out business activities in

close relation to natural resources. The company depends on nature sustainability around the working areas. This makes nature sustainability a main attention for PGE. If nature is harmed, there won't be any business.

Therefore, PGE is obliged to do Social and Environmental Responsibility (SER) according to the law.

To a State-Owned Enterprise, ESR is a new framework of thinking to implement Corporate Social Responsibility (CSR) commitment.

ESR commitment is needed to make program implementations or activities can really increase the prosperity of local community and the sustainability of nature and the environment around the working area. PGE believes that local community and the environment where they live are strategic stakeholders that cannot be ignored.

❖
In order to keep the nature sustainable, it needs effort to protect the land ecosystem. This can be done by measuring, managing, and minimizing impacts on ecosystem and natural resources.





To create effective and well-oriented ESR programs, PGE has vision, mission, and goal as followed:

Vision

Become a foremost geothermal company that promotes community independence, has environmental orientation, and capable to give added value to the stakeholders.

Mission

Execute ESR activities that put emphasis on sustainability, environment protection, and biodiversity.

Goal

Create a conducive situation for company's operational activities.

Transportation service provision, tourism service partner, online sale media, and promotion mobile applications are parts of Kang Dedi (Kamojang Desa Digital— Kamojang Digital Village), an innovation in community empowerment program.

**7
CORE ISO
26000
SUBJECTS**

Organizational Governance

Environment

Employment, Health, and Safety Practices

Fulfillment of Human Rights

Product and Customer Issues

Community Engagement and Development

Fair Operating Procedures

Main Axis of Sustainable Development

In implementing Sustainable Development Goals and agendas, PGE connects the company's working programs with the Social and Environmental Responsibility (SER) programs to make a synergy. Hence, the company comes up with the Community Development program. The main axis in developing the SER program is to suit the community's needs.

PGE's Commitment through ESG Implementation

As a company engaged in clean energy, there is a big intention to become a prominent global green energy company with the biggest geothermal capacity and be acknowledged as a company that implements three principles of ESG (Environmental, Social, and Governance).

• ENVIRONMENTAL

Climate change and the decline of biodiversity are environmental threats that become everyone's big challenge

today. PGE will be always committed to play an active role in maintaining nature balance and sustainability, especially in the working areas.

• SOCIAL

A strong community is an important part in the effort of transition toward greener energy in the future. PGE has a strong commitment to grow and thrive with the community in order to build a better life.

• GOVERNANCE

To implement a fair and sustainable company governance, PGE is also committed to uphold transparency and fair accountability in the company. PGE also believes that a right decision can act as a drive to accomplish greener energy in the future.

In running the business, this geothermal company always maintains the commitment and ensures the implementation of ESG is always be an integrated part of geothermal operational business.

PGE strives to improve the quality of education by developing educational services to remove barriers that impede access to education and increase the quality of learning.



The implementation of these ESG aspects is an effort to give additional values and support to government programs, especially in harnessing new and renewable energy that is environmentally friendly.

ESG Implementation of PT Pertamina Geothermal Energy

To enhance Pertamina's reputation and competitiveness in the world, integrated ESG implementation is very important. Especially if it is concerning increasing investor's trust to support the need for investment in PGE.

For this, PGE has set 10 sustainability focuses as a guideline for ESG implementation. PGE also formed a Sustainable Committee that involves top management level to ensure the ESG's aspects well-implemented. PGE has implemented a number of policies concerning ESG such as Sustainability Policy, Human Right Policy, Green Procurement Policy, and many more, to support a comprehensive ESG

implementation.

Some sustainability targets from environmental aspects have been set. For instance, PGE contributes to global decarbonation by increasing geothermal installed capacity as green energy. The Biodiversity Management System and the Water and Waste Management are beyond PROPER's standard for management.

In the social sector, PGE improves the working safety and health aspect as well as safety process management, supports human rights and diversity, conducts researches and makes innovations that are focused on sustainability, and manages the relations to neighboring community. In governance aspect, PGE improves the management of Good Corporate Governance (GCG), business ethics, and cyber security.

PGE will always incorporate ESG aspects into the company's business strategies and refers to international standard to actualize the company's vision to become the world class green energy company with the largest capacity globally.

PGE's Commitment to Actualize Sustainable Development

The forming of five ESR pillars also considered community's needs, this is in line with the result of focus group discussions that have been held with the local people and the local government.

Through these five pillars, PGE conducts top programs that give sustainable utility to community in each PGE's geothermal working area. PGE always tries to build good and mutually beneficial relations, to the community as well as to the environment.

Education for Quality Manpower

Improving the education quality of young generation in every PGE's working area becomes a big contribution in the effort to create the access to high quality education.

PGE is certain that the education pillar is very important because it has close relation to human resources quality in the future.

PGE's execution of education quality improvement programs is

the company's action to support the government efforts to actualize **SDGs 4th Agenda: Quality Education**. The program is carried out in various ways such as:

Cooperate with government entities and educational institutions.

Develop educational services to eliminate obstacles in access to education and improve learning quality.

Some implementations of 4th SDGs agenda in five PGE's GWA are:

- School clinic equipment aid
- Trees plantation
- Paper and plastic waste utilization training
- Karaha Goes to School & Campus management
- Community education on geothermal renewable energy utilization and management
- Juvenile offenders training in juvenile detention center: making coconut oil
- Making Geothermal Zone in Taman Pintar (Smart Park) in Yogyakarta
- Teacher quality improvement di Lumut Balai



Nature Conservation as the Core

Because PGE's main business is related with natural resources, natural sustainability around its working areas becomes the company's primary consideration. Therefore, through care for the environment pillar, PGE tries to support environment protection and biodiversity conservation in each GWA.

PGE's attention to environment is showed in various form, from some

activities to conserve and restore biodiversity to household waste management program. PGE carries out these in cooperation with other parties.

These activities in every PGE's GWA are held to support the government efforts to actualize **SDGs 15th Agenda: Protect Land Ecosystem**. The support is actualized by measuring, managing, and minimizing impacts on ecosystem and natural resources. Other than that, PGE



Increase society's economic level is one of PT Pertamina Geothermal Energy's SER pillars to empower communities around PGE's GWA. This empowerment implements 15 SDGs, some of them are poverty elimination, gender equality, and sustainable consumption and production.

also funds degraded land recovery for the purpose of conservation and production, minimize impact on ecosystem, stop the diminishing of biodiversity, and reduce carbon emission.

Some examples of SDG's 15th agenda implementations can be found in Kamojang Area. They are:

- Formation of conservation area and conservation of protected species
- Garbage bank
- Innovations for environment

management and energy efficiency

Strong Community, Prosperous Economy

Increase society's economic level is one of PT Pertamina Geothermal Energy's SER pillars to empower communities around PGE's GWA.

This commitment is implemented in an effort to actualize the Sustainable Development Goals (SDGs).

At least there are three agendas to accomplish from Community Economic Empowerment pillar. They are:

- **SDG 1st Agenda: Eliminate Poverty**, is PGE's commitment to vulnerable groups around PGE's GWA.
- **SDG 5th Agenda: Gender Equality**, broaden women's opportunity to be independence by helping them building their own businesses.
- **SDG's 8th Agenda: Decent Work and Economy Growth**, grow entrepreneurship in local community, especially the young people.
- **SDG's 12th Agenda: Sustainable Consumption and Production**.

Some implementations for the 1st, 5th, 8th, and 12th SDG's agendas in five PGE's GWA are:

Group empowerment for the purpose of eliminating poverty in the neighborhood of PT Pertamina Geothermal Energy Kamojang Area:

- BEYOND SEHATI (Eduplay therapy)
- Punker group "Wani Robah" empowerment

Empowerment of farmers and farmers group:

- Coffee farmers empowerment
- Potato and mushroom farmers empowerment
- Application of automatic pest control system
- Introduction of integrated farming system
- Saburai goat and garut sheep farmers empowerment
- Waste bank management
- Agrobusiness development

Development of tourism area and community's economy:

- Ecovillage development
- Geothermal tourism village
- Community Economy Area (Bumala & Bulastri, Belanting River Tubing)

Improving Health Quality

PGE's care to the health level of communities around PGE's Geothermal Working Areas is the company's contribution to the effort to increase community's health quality as well as environment quality.

The company carries out all of these to actualize some goals as set in SDG, such as:

- **SDG's 3rd Agenda: Community Health and Well-being**, executed through partnership program with community groups and local

health facilities. This program is conducted to give better health service access for women and family and to facilitate affordable treatment for people with low income.

- **SDG's 6th Agenda: Clean Water and Sanitation Recovery**, implemented through clean water and sanitation facility investment in the area around GWA and ensuring that women and children receive the benefit from clean water and sanitation availability.

Some implementations of SDG's 3rd and 6th agendas in five PGE's GWA are:

- Companionship for pregnant women, breast milking women, toddlers, and children with disability in Kamojang, Ulubelu, and Lumut Balai Areas.
- Free health check in Sibayak Area
- Facilities construction in Karaha and Lahendong Areas by building mother and children health service post (posyandu), septic tank, and clean water facilities.

Infrastructure Development for Community Well-being

As part of the efforts to increase community well-being, infrastruc-



ture and social development is an aspect that cannot be disregarded.

Therefore, Infrastructure and Social Development pillar plays as PGE's support to actualize some SDGs agendas such as:

- **SDG's 7th Agenda: Affordable and Clean Energy**, by ensuring that the community has access to reliable and affordable energy source. This is carried out by building local infrastructure.
- **SDG's 9th Agenda: Industry, Innovation, dan Infrastructure**, by contributing in the investment of local infrastructure.
- **SDG's 13th Agenda: Action for**

Climate Change, by ensuring that the community has electrical access from Solar Power Plant and Micro Hydro Power Plant.

Some implementations of SDGs 7th, 9th, and 13th agendas are:

- Help the provision of electricity from solar and micro hydro energies for the community in Talang Dikun Hamlet, Pekon Air Abang Village, Ulubelu District, Tanggamus Regency, Lampung.
- Fixing the road from Talang Barisan to Pulang Panggung, executed by PGE's Lumut Balai Area.

PGE's Geothermal Working Areas make every effort to provide health facilities for the communities around the areas in order to improve the quality of the community's health. It is one of SDGs program that is incorporated to PGE's agenda.

CHAPTER 5

Manifestation of Community Empowerment in Geothermal Fields

A strong and tough society—whether in economy or social aspect—is the key to sustainable energy transition scheme in the future.

Having the same vision and mission with the community is a crucial thing, especially in conservation and environment recovery efforts. The same vision and mission will definitely help PT Pertamina Geothermal Energy (PGE) to achieve the big dream of national energy transition.

PGE firmly believes that protecting the environment's ecosystem and empowering the community need to be the focus of attention in implementing five pillar programs.

Those programs are part of the Social and Environmental Responsibility (SER) that the company bears.

Therefore, based on good relations with the community, PGE, together with the communities around PGE's Geothermal Working Areas discuss and decide what are the community's needs.

The good relations will help to form strategies that will be transformed into programs to answer challenges in each PGE's GWA.

The programs that PGE executes in every GWA is for the future of the Earth and Indonesian people. Therefore, in each program, PGE always involves the young people.

This young generation is involved in community's empowerment programs. They also participate in environment conservations. Thus, they will give positive and sustainable impact for the better of the nation.



Kamojang



**Kamojang, Darajat,
West Java**
Geothermal Working Area (GWA)



235 MW
Installed Capacity



522.000 houses
Electrical supplies estimation



5 Unit
Geothermal Power
Plants



1,222,000 tCO₂ eq./year
Emission Avoidance Potential




11,115 BOEPD
Saving potential of oil & gas
foreign exchange reserves



Building a Digital Ecosystem on Sustainable Energy Basis

Kamojang is a volcanic area that lies at the border of Bandung Regency and Garut Regency, West Java. It is in this area, the government assigned Pertamina to conduct geothermal survey, exploration, and exploitation for the first time. This oldest PGE's exploration area is located about 40 kilometers on the south east of Bandung City, in Laksana Village, Ibum District, Bandung Regency, West Java. It lies at the average height of 1,500 meters above sea level.

 In Kamojang Area, there are five unit of Geothermal Energy Power Plant.

In Kamojang, there is a crater that now becomes one of alternative natural attractions in Bandung Regency area. It is located inside Kamojang Geothermal Area.

Located at the height of more than 1,500 meters above sea level, geographic condition of this area is a challenge for PGE as well as the community. Its steep and precipitous topography and its remote location make transportation and internet access very limited. Therefore, there is only a small chance for employment. And the global Covid-19 pandemic in

2020 only makes it worse. The community that resides around the area of PGE's Kamojang Area is affected by this global pandemic. But PGE is in Kamojang area not only to support national electricity system. The young people that live around this PGE's operational area has been involved in PGE's activities. PGE's Kamojang Area also presents the energy that in the end drives the local community to be empowered and independent. The better Kamojang community's local economy is the result.

TOP INNOVATION PROGRAM

Digital Innovation to Answer Social Challenge

In 2021, PGE's Kamojang Area received many awards for KANG DEDI (Kamojang Desa Digital or Kamojang Digital Village) program. Therefore, in 2022 PGE's Kamojang Area tried to enhance the company's Environmental and Social Responsibility with another top innovation program, KANG ELIE (Kamojang Green Living Ecosystem).

The main axis of the program is in harnessing the sustainable clean energy, to make an environmentally friendly ecosystem for the community's life.

PT Pertamina Geothermal Energy's Kamojang Area's Government and Public Relations Senior Supervisor, Adi Rahmadi, admitted the biggest challenge in executing this innovation program is in introducing or educating people about the use of technology in daily life, whereas this exactly is the heart of KANG DEDI and KANG ELIE program implementation.

"Since 2019 this education about technology has become our biggest challenge. But now, thank God, the community slowly understands and

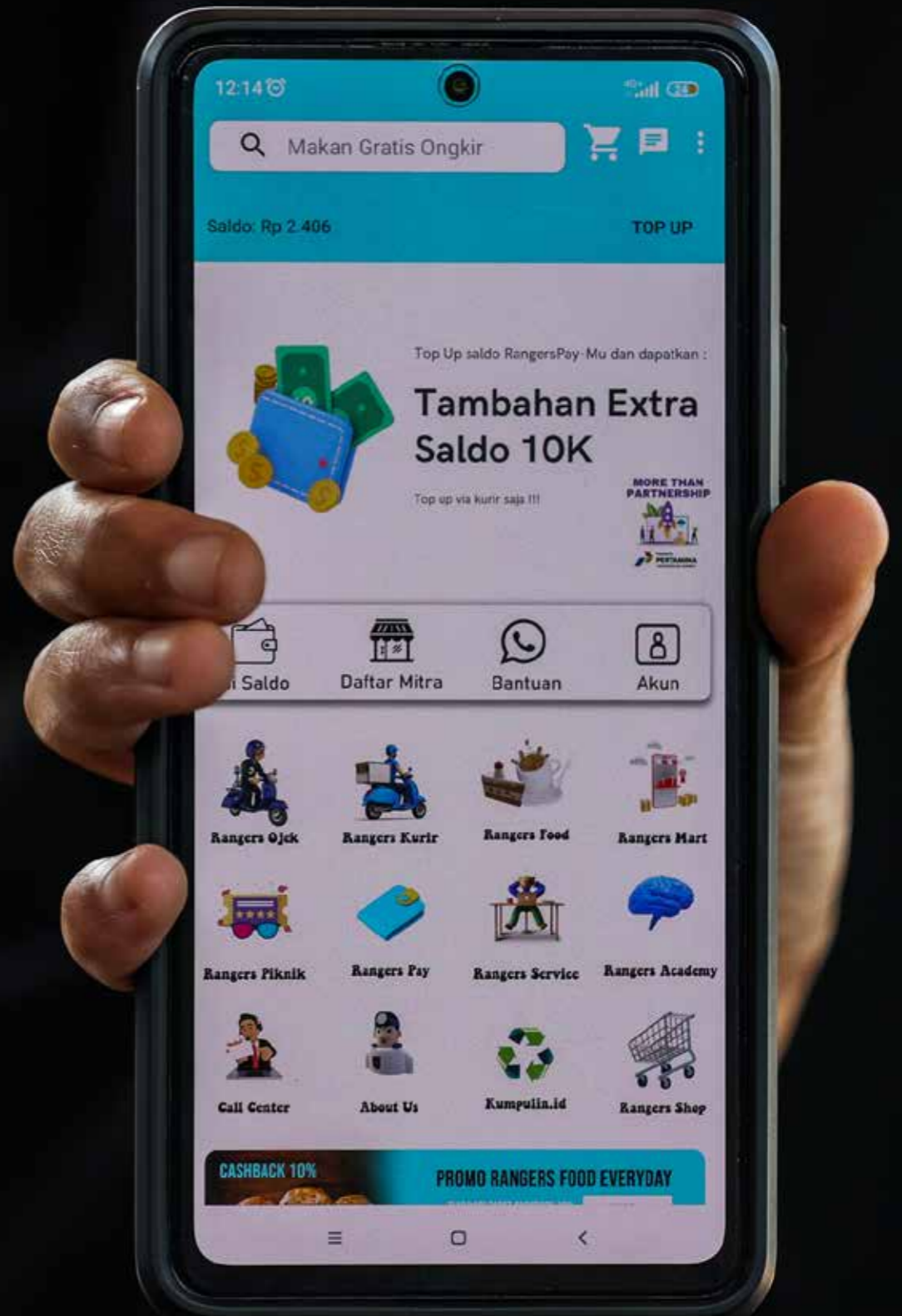
realizes that technology can make their lives easier," Adi recalled the challenge at the beginning of KANG DEDI program.

Today at least there are three top innovation programs in KANG ELIE that is ongoing and will continue to be developed. They are the provision of electrical motorcycles for Rangers App, online garbage bank, and the internet access program Sinyal Kita (Our Signal).

Rangers App: Local Online Taxibike, the Pride of Kamojang Young People

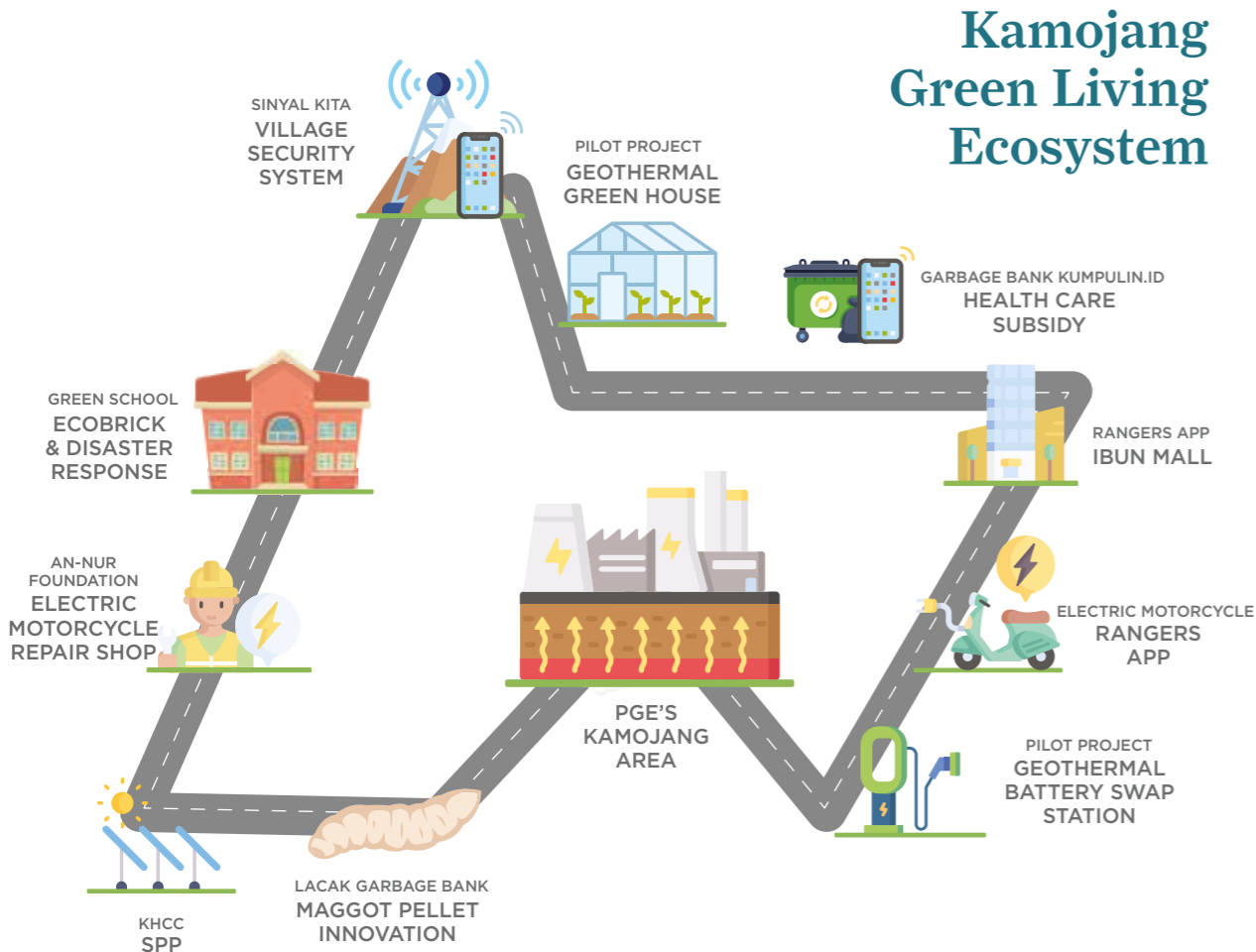
Covid-19 pandemic has upset almost all economic activities and social lives. But we can overcome the downturn with the spirit of cooperation, collaboration, creativity, and a touch of innovation. One of them is the multiservice application innovation Rangers App, a product of some young persons in Kamojang. This application was born out of their concern to see Kamojang's potential as a tourism village but has limited transportation service.

This multiservice application is called Rangers App. This application is developed by a group of Kamojang's young people that becomes a part of KANG DEDI (Kamojang Desa Digital or Kamojang Digital Village) program.



KANG ELIE Working Plan 2022

Rangers App Beyond Services



Because of this minimal transportation infrastructure, online *ojek* or taxibike service cannot access this area. Thus, they came up with the idea to make local online taxibike application that answers all transportation and information needs of the community and name it Ranger App. One of the innovations that has environment impact is Rangers Pay top-up feature—the top up of digital balance using garbage—in this application.

In 2022, in line with KANG ELIE program’s mission that tried to actualize Ecosystem in Sustainable Energy Basis, Rangers App started to do trials for transportation service using electrical motorcycle and install Geothermal Battery Swap Station which gets the energy from Kamojang geothermal source.

Prialdi (25) CEO of Rangers App mentioned that Rangers App has run some trials by using one electrical motorcycle as its main transportation. In these trials they found some challenges such as steep

tracks and many sharp inclines. From here, they modified and made some changes to the electrical motorcycle specifications. In 2022 they have 16 electrical motorcycles, each with up to 6.7 horse power, uses 2 batteries, and has 100 kilometers riding range.

“These trials are quite successful because [we] found the right specifications for the electrical motorcycle that [we] are going to use,” he said.


In the end, this electrical motorcycle utilization at least gives impacts on certain aspects. For instance, the number of Emission Avoidance Potentials is projected to decline, from 69 g CO₂eq/km when they use fossil fuel to 4.5 g CO₂eq/km when they use electrical motorcycle. In addition, there is also a projection of fuel cost efficiency. For example, oil fuel costs Rp7,650/liter for 40 km riding range. As for electrical motorcycle, it costs Rp6,000/4 kWh for 40 km riding range.

This fuel cost calculation is made before 2022 oil fuel price rise.

Pillars for the Program

The young people of Kamojang and PGE are able to create the Rangers application due to a shared vision of developing human resources to create economic power. They believe this vision is able to answer community's problems.

The mobile application can also answer the challenges in the implementation of programs in five pillars of PGE's Social and Environmental Responsibility, especially the community's empowerment pillar.


Rangers App multiservice application is actualized by the young people of Kamojang. This application was born out of their passion to develop Kamojang's potential as a tourism village but has limited transportation facilities.





THE EDUCATION QUALITY IMPROVEMENT PILLAR

Education, the Core Key to Quality Human Resources

• **AN-NUR CLC**

The An-Nur Foundation is a Community Learning Center (CLC) in Iibun and PGE's Kamojang Area's foster partner since 2004. This program gives free access to education and catch-up education to those in need.

• **GREEN SCHOOL**

The Green School program gives education on environment, disaster

response, and waste treatment. The Green School program in PGE's Kamojang Area is targeted to elementary students in Iibun District and the cadres of Sangkan Amanah, Lacak, and Taliber Garbage Bank.

Some of the Green School activities are giving health equipment aid to school clinics, tree planting and greening the schools, education and training in

making ecobrick for students in grade 4 to 6 and garbage bank cadres, and training in making useful items from plastic waste as a reduce the plastic waste campaign.

• **FEMALE LOCAL HERO SCHOOL**

This is a program of character education and potential development for local women, especially those lives in and around Iibun District.

Elementary school students are gaining understanding of their environment, the handling of plastic waste, for a more beneficial future for humankind and the world.



THE CARE FOR THE ENVIRONMENT PILLAR

Praising the Nature Conservation Efforts

• KAMOJANG HAWK-EAGLE CONSERVATION CENTER

Kamojang Hawk-eagle Conservation Center or Pusat Konservasi Elang Kamojang (PKEK) is build and managed collaboratively by many groups of people. PT Pertamina Geothermal Energy's Kamojang Area works together with West Java's Natural Resources Conservation Office or Balai Besar Konservasi Sumber Daya Alam (BBKSDA) in managing this conservation center. In addition, some people from Indonesian Raptor Forum are involved as technical executors. All to actualize the environment protection pillar.

PKEK functions as the rescue, release, rehabilitation, and education center that is special for hawk-eagle, especially the species of elang jawa or javan hawk-eagle (*Nisaetus bartelsi*).

Javan hawk-eagle has the status of endangered based on IUCN Red List of Threatened Species.

PKEK's activities are a series of comprehensive hawk-eagle conservation processes. They are:

- Main conservation activities: hawk-

eagle rescue, rehabilitation, and release

- Empowerment for the farmers that provide food and nutrition for hawk-eagle health
- Animal study/research
- Education on the importance of hawk-eagle conservation
- Management, maintenance, and improvement of PKEK's infrastructures

Until June 2022, there are 136 hawk-eagles in rehabilitation process in PKEK. They are in various species and number:

- 2 brown goshawks
- 3 crested goshawks
- 1 rufous-winged buzzard
- 2 black-winged kites
- 12 brahminy kites
- 2 black eagles
- 3 black kites
- 8 javan hawk-eagles
- 55 changeable hawk-eagles
- 5 crested honey buzzards
- 43 serpent eagles

• GREEN SCHOOL

The Green School program gives education about environment and things related to disaster response. Other than that, this program



Elang jawa or javan hawk-eagle (*Nisaetus bartelsi*) is a fawn endemic to Java Island. According to IUCN Red List of Threatened Species, it has the status of endangered. Javan hawk-eagle is a monogamy animal, faithful to its partner until the end of its life.



Until July 2022, the accumulation of Rangers Pay top-up that is using garbage has reduced pile of garbage as much as 6.3 tons around the neighborhood of PGE's Kamojang Area.

❖ After Rangers App was implemented, a digital garbage bank called kumpulin.id was developed. People can access this digital garbage bank through the menu in Rangers App.

❖ Organic waste management program for maggot farming in Lacak Garbage Bank. The maggots will be processed with other organic waste to become pellets for fish and bird feed. The other organic waste will be processed into liquid organic fertilizer.

also invites people to participate in environment protection by planting trees and understanding endemic floras and fawns.

• REFORESTATION

Reforestation program is an effort to maintain the quality of environment. Until today, PGE's Kamojang Area carries out the reforestations in collaboration with the West Java Natural Resources Conservation Office, PERHUTANI, and the community around PGE's Kamojang Area.

• GARBAGE BANK

PGE's Kamojang Area has had the Garbage Bank program for quite a long time. This program is executed from 2018 until now. But the monitoring to the garbage bank cannot be done in real-time because it is still carried out conventionally. Consequently, the percentage of

utilization and pile of garbage that is delivered to the garbage bank cannot be counted.

But since the Ranger App exists, monitoring the garbage bank becomes easier. Online monitoring becomes possible. The Ranger App program has caused system change and in turn changes the process flow in PGE's program.

PGE's Kamojang Area initially managed wastes by using the garbage bank conventionally. After the Rangers App exists, the process flow from requesting to transporting to weighing can be carried out online and in real-time.

In addition to helping the monitoring process, Rangers App also has an outstanding feature that gives positive impact to the environment. It is Rangers Pay, in which you can top up using garbage bank through an integrated digital garbage bank called kumpulin.id.

The customer of PGE's Kamojang Area's Garbage Bank can participate in collecting the waste through this digital garbage bank by using Rangers App. Then, the income from the garbage sale will go into Rangers' balance.

The Rangers' balance is integrated in Rangers Pay. The customers can use it for their daily needs such as to order some food or to use online

transportation service.

Until July 2022, the accumulation of Rangers Pay top-up that is using garbage has reduced pile of garbage as much as 6.3 tons around the neighborhood of PGE's Kamojang Area. The waste reduction impact from Rangers Pay top up using garbage that is collected by digital garbage bank kumpulin.id has been verified by PT ITS Tekno Sains. This is stated in 2022 Environment Management Performance Verification Report of PT PGE's Kamojang Area.

Other than savings, the garbage bank also has waste treatment program for organic and inorganic waste. PGE's Kamojang Area have 4 active garbage banks and each of them has innovations:

- Lacak Garbage Bank: maggot farming and maggot pellet innovation
- Sangkan Amanah Garbage Bank: biodigester and social aid for bank costumer
- Taliber Garbage Bank: waste sorting and management
- Kumpulin.id Online Garbage Bank: local health insurance subsidy.

Accomplishment of Environment Innovation Program

Finally, there are trees endemic to Kamojang along Cibenteng River and now the community has a sense of belonging to the environment.

• ENHANCE HWP MOTOR OPERATIONAL RELIABILITY WITH ECC DETECTOR TOOLS IN GPP UNIT 5

Development of "Enhance HWP Motor Operational Reliability with ECC Detector Tools in GPP unit 5" innovation program is based on the electrical maintenance team investigation finding in 2018. During the investigation, this team found a defect indication in the electronic control card of CVX MV Switchgear of HWP B Motor. The defect indication that they found is a black mark on the capacitor in the circuit breaker of HWP B.

The "Enhance HWP Motor Operational Reliability with ECC Detector Tools in GPP unit 5" program changed the monitoring process of CVX control card. Before the innovation, there is no monitoring method for CVX control card, only OEM recommendation testing.

This process has a weakness. It is incapable to detect weak spots on the control card. As a result, back then there were 4 times trips of the plant because the control card was troubled. To mitigate this, the control card was replaced in every Unit 5 shutdown.

After the innovation, the workers can monitor the control card with CVX Smart E-Card Reader tool that is capable to detect the quality of the control card. It works by measuring two critical voltage points. Then, the measurement data are processed using Arduino programming language and the result is displayed in an LCD screen. This way, the control card's condition is monitored only within 5 minutes.

With this innovation program, quality performance of electronic control card of CVX MV Switchgear can be monitored regularly in every checkup inspection, thus assured the MV Switchgear reliability. The company is also able to save 3,679,200 kWh or equal to 15.768 GJ with this program.

• CLAMP-SEAM INNOVATION TO REDUCE GENSET EMISSION

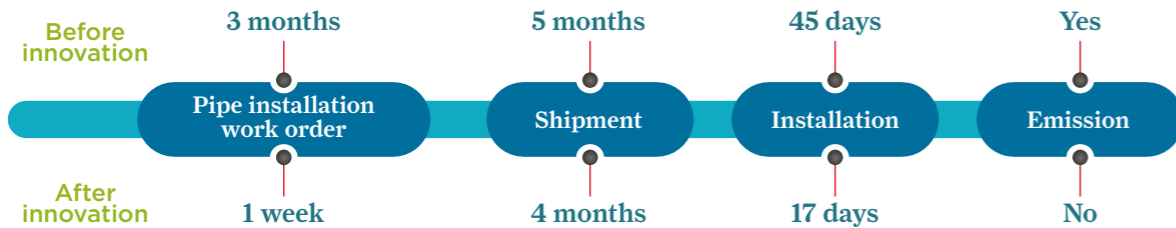
In 2020 to 2021, PGE's Kamojang Area had a program to do Hole

Cleaning (HC) in 19 geothermal wells, using Coil Tubing Unit (CTU) or Hydraulic Worker Unit (HWU). To meet the needs for water in HC operational, PGE's Kamojang Area needs to construct drilling pipes from Water Pump Station (WPS) to each of the well. In this work, PGE's Kamojang Area had to build 24,600 meters drilling water pipes with 4,100 joint points.

Usually, the drilling water pipes are connected using welding construction technique that use heat to melt the main material or metal and the electrode (welding rod). The heat is produced by electrical ion jumps between cathode and anode (the tip of the electrode and the surface of the metal plate to be welded).

The electrical ion jumps can produce the heat up to 4,000 degrees Celsius. They are obtained from a genset operational. But this means additional exhaust gas emissions. To avoid emission from genset operational, PGE's Kamojang Area develop a pipe joint technique called Clamp Seam innovation.

Clamp Seam is a technique to connect the pipes using "clamp" method, in which the ends of grooved pipes are brought closer and then locked using bolts and nuts so it can



PGE's Kamojang Area developed a pipe joint technique called Clamp Seam innovation. This innovation's main purpose is to reduce genset emission (no emission). It also supports less fuel usage, much lower pipe joint cost, and faster material arrival because it does not require provision mechanism.

stand high pressure and vibrations from the change of fluid velocity and the sludge. To prevent leaks, the groove on the pipe is filled with rubber before the pipes are clamped.

The Clamp Seam innovation has environmental impact ever since it was implemented. The 2020 load emissions have decreased to 45.3478 tons CO₂, 0.0018 tons CH₄, 0.0004 tons N₂O, 0.0890 tons SO_x, 1.3531 tons NO_x, and 0.0951 tons particulate which are equivalent to Rp225,090.000 cost saving.

There are also some added values from this innovation. The company can have some budget savings that are gained from less fuel usage, much lower pipe joint cost, and faster material arrival because it does not require provision mechanism.

• REUSE OF WATER FROM WWTP AS COOLER WATER IN DISTILLATION INSTRUMENT

In gas analysis process in laboratory, gas sample has to be boiled until it becomes vapor, then the vapor has to be cooled down (distillation process). This distillation process in laboratory needs cooler water about 15 liters/sample. The cooler water comes from regular groundwater. Then the used water is passed to the sink and flows to the tanks of laboratory's Waste Water Treatment Plant (WWTP). Unfortunately, the increasing volume of samples also means more groundwater to use in the distillation process.

The "Reuse of Water from WWTP

Acid conversion (ACONV) method is developed to overcome problems in CO₂ test that uses titration method.

as Cooler Water in Distillation Instrument" innovation program came up because PGE's Kamojang Area uses plenty of groundwater. With this innovation, PGE's Kamojang Area tries to use less groundwater as coolant in the distillation instrument and use the outlet water from WWTP instead.

• GREEN SPACE ACCESS PROGRAM

PGE's Kamojang Area has the commitment to safeguard protected floras and faunas in Indonesia and therefore initiates the Green Space Access Program (Program Akses Ruang Hijau/PARI). This program is conducted in collaboration with Natural Resources Conservation Office (Balai Besar Konservasi Sumber Daya Alam/BBKSDA) and the Rangers App. The Green Space Access Program is an effort to

protect the biodiversity around PGE's Kamojang Area.

The Green Space Access Program has an impact in increasing community's participation through digital application (for example, the conservation of Javan rusa/ rusa timor by using ranch system and virtual tour method) and converting degraded land into land of biodiversity function by planting trees endemic to Kamojang.

Before the implementation of this program, the soil in the bank of Cibenteng River has been eroded by the river flows. The illegal sand mining in the bank of the river also makes the bank area prone to landslide.

After the implementation of the program, finally there are trees endemic to Kamojang along Cibenteng River and now the community has a sense of belonging and helps preserving the bank area of Cibenteng River. The trees also reinforce the soil so that the landslide is avoidable.

• CO₂ TEST OPTIMALIZATION USING ACID CONVERSION (ACONV) METHOD IN KAMOJANG AREA

Acid conversion (ACONV) method is developed to overcome problems

in CO₂ test that uses titration method. The titration method takes longer time, gives less accurate result, and has toxic waste problem.

Acid conversion (ACONV) method innovation changes the process flow of CO₂ measurement. The released CO₂ is directly measured using a device that is excellent in selectivity, accuracy, and detection limit, and also faster in analyzing.

Before the innovation, the sample is prepared and the titration process begins, by using HCl solution of pH 8.3 to pH 4.5. Then, nitrogen gas is flowed to the sample to release

CO₂ that has been formed and the second titration process begins, by using NaOH up to pH 8.3 to determine the correction value.

After the innovation, the sample is injected to the chamber reaction containing H₂SO₄ solution. When the sample reacts to H₂SO₄ solution, CO₂ gas that is previously dissolved in the sample is released and turns back into gas phase. Nitrogen as the gas carrier flows through the chamber reaction and brings CO₂ gas to an infrared detector which directly measure the concentration of CO₂.



To optimize CO₂ test, acid conversion (ACONV) method is developed. Testing with ACONV method has faster analysis time and better accuracy.



THE COMMUNITY ECONOMY EMPOWERMENT PILLAR

Stronger Community, Better Economy

• RANGERS APP

Rangers App is an empowerment program on transportation basis that is using multiservice application and enhancing local potentials.

Prialdi (25), Rangers App CEO, explained, Rangers App is a local multiservice mobile application on transportation basis, developed by PGE and a group of Kamojang young people.

This application can be downloaded through android operation system. The mobile application is made as a solution

specially for the problems of Kamojang's people and has never been developed by other developer.

Rangers App is a solution during pandemic. It offers a series of transportation services with menus like Rangers Ojek, Rangers Kurir, Rangers Food, Rangers Mart, Rangers Piknik, Rangers Service, Rangers Academy, Rangers Shop, and Digital Garbage Bank kumpulin.id.

Quoted from the Document of Environment Management Performance Summary (Dokumen Ringkasan Kinerja Pengelolaan Lingkungan/DRKPL) 2021,



Integration of Rangers App with KANG ELIE (Kamojang Green Living Ecosystem) program. KANG ELIE has started the trials of electrical motorcycle transportation service.

Integration of Rangers App in KANG ELIE program

- 1 Electrical motor usage with energy source from Battery Swapping Station (Dock Charging System) in Kamojang GPP office.
- 2 Rangers App Pay (digital balance) top-up using garbage, through a digital garbage bank.
- 3 Internet access provision that can be paid by using garbage and planting trees in blank spot areas.

today there are 50 riders for this application. These riders have the chance to join Rangers Academy business trainings. They can also implement their knowledge in 10 business units that Rangers App manages.

Until 2021, there are 3,300 users of Rangers App. This mobile application also becomes online sales platform for Micro, Small, and Medium Enterprises/MSMEs (Usaha Mikro, Kecil, dan Menengah/UMKM). They are 31 culinary partners, 20 MSME partners, 51 reselliates, 10 homestays, and two tourist destinations.

Rangers App empowerment system has produced significant impacts to the community, some of them are:

- Unemployed persons get jobs as Rangers App management and riders with average income of Rp2,037,000 per month.
- Other than being a rider, a Rangers App partner can also become a unit business manager for additional income.
- The MSMEs impacted by pandemic gain some income with Rangers App product sales platform.

Program Impact Potential

TOTAL IMPACT:
Rp106,987,500

Fuel cost efficiency 15 motorcycles
Rp29,023,144
Fossil fuel cost saving /10,000 km

Motorcycle care cost efficiency
Rp6.3 million/Year

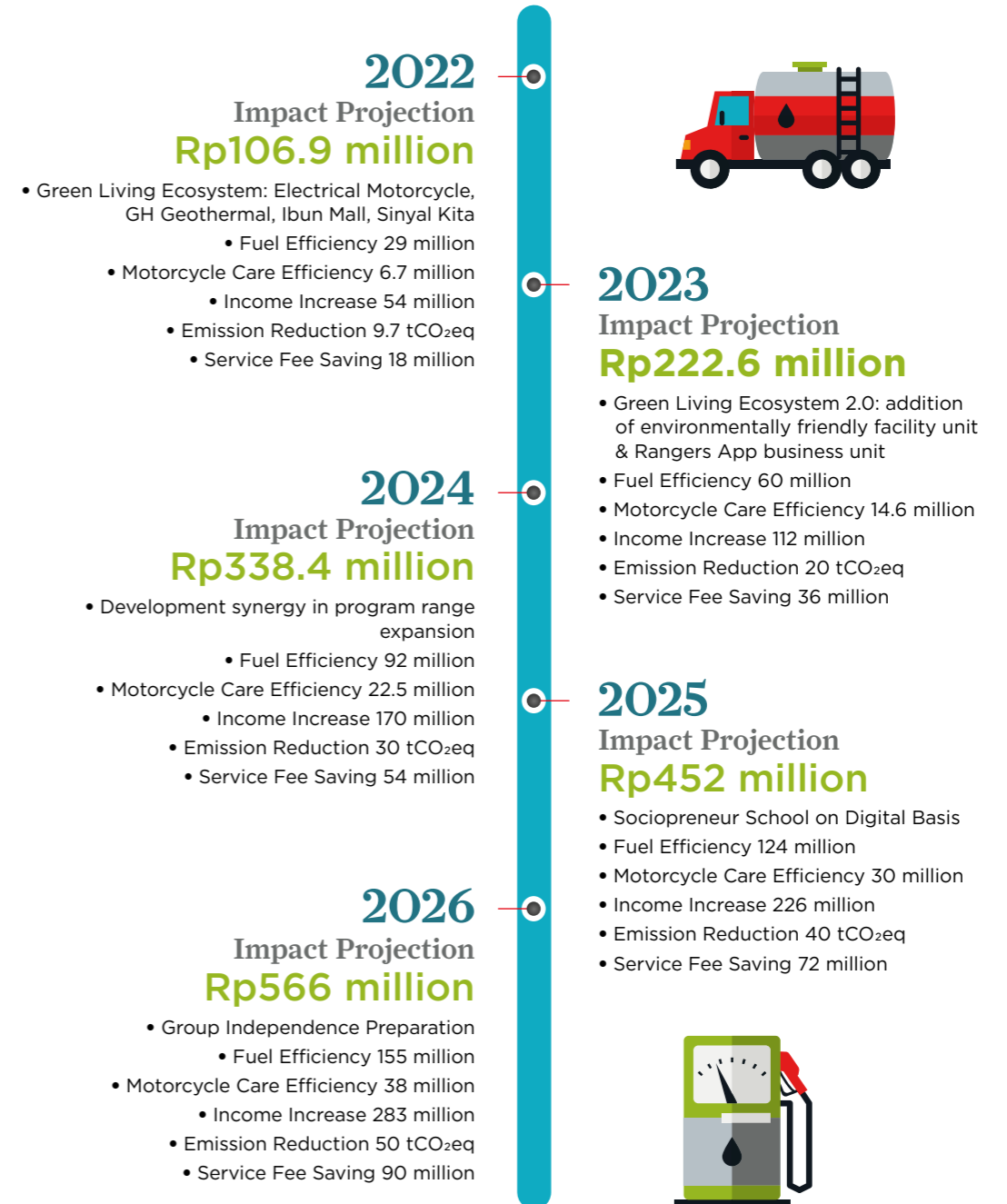
Emission reduction
9.7 tons CO₂eq/Year

Income increase 15 drivers
Rp54 million/Year

Reduction (per motorcycle)
68-81 dB (Fossil Fuel Motorcycle)
<30 dB (Electrical Motorcycle)

Transportation fee saving
Rp18 million/Year
For 10,000 km riding range

KANG ELIE Implementation Plan





They are promoted through the application and their gross revenue is increasing to Rp 7,291,667 per month.

- People in Ibum District, Majalaya District, and Samarang District can save up to Rp550,000 per month for transportation and service cost.
- In education and training, there is Rangers Academy that gives knowledge in business development.
- Rangers App and the community also protect the environment through the integrated digital garbage bank kumpulin.id. They have managed the garbage with average value of Rp1.155.556 every month.

For the community, Rangers App has created value chain at system level by involving community in general, riders, culinary partners, MSMEs, tourism services, the nature, and the company. Various services are integrated and show real impacts such as new employments, better economy, better community capacity, and sustainable nature and environment.

• IBUN INDEPENDENCE WOMEN

Ibum Independence Women (Wanita Mandiri Ibum) is a woman empowerment program for women in Ibum District. The program helps the women to develop MSME's products.

❖ Ibum Mall Studio is a place to collectively market the products of 24 MSMEs in Ibum District.

In this program, the housewives join C Package (Paket C) class in the Community Learning Center of An-Nur Ibum Foundation. Started from only 5 members, Ibum Independence Women Group now has empowered 50 women in Ibum District, Bandung Regency, West Java.

The empowerment is carried out by giving education about entrepreneurship and organizational capability, developing education institution, and collectively marketing products such as wood waste recycled products, typical Ibum weaving sarong, snacks, cuisines, other recycled products, and some types of clothes.

This group has produced 50 types of products and has participated

in 29 national and international exhibitions. With this empowerment, Ibum Independence Women Group has made its members accomplish their economic independence, with average gross revenue up to Rp4.9 million per month for each member.

• SINYAL KITA

Sinyal Kita is an internet access provision program that can be paid with garbage and planting trees in blank spot area. The purpose is to open access to education and online sales for the community.

The system not merely sells internet vouchers, but also applies "pay internet with garbage" concept.

Since developed in early 2021 until

❖ To have the internet access in the areas that is not covered with phone signal, there is the Tree Wi-Fi service: Sinyal Kita. Internet access will open the access to education. The internet can be paid with garbage or planting tree.



Aside from basic trainings, the coffee farmers were given an overview and development programs concerning the management of Kamojang coffee in the Geothermal Coffee Empowerment Program.



“Wani Robah Punks” empowerment program for punkers and street children in Majalaya, carried out by PGE’s Kamojang Areas with An-Nur Community Learning Center in Ibun. The subjects of this program are the street children in Majalaya District, Bandung Regency, West Java.

now, about 200 people has used the service of Tree Wi-Fi: Sinyal Kita.

Total garbage managed through this program until 2022 has reached 15.7 tons.

Other than contributing in environment protection through garbage management, in this continuation program of Kang Dedi Ngenet, environment protection is also carried out by planting trees along the river bank to reduce water erosion.

• WOMAN FARMERS EMPOWERMENT

The woman farmers empowerment program is carried out by Woman Farmers Group or Kelompok Wanita Tani (KWT) Mekarsari, in Legok Pulus, Sukakarya Village, Samarang District, Garut Regency. The farmers in this group plants vegetables and other plants typical to this area. After harvesting, they then process the crops into foods and drinks of Samarang’s specialty, such as *dawet ganyong*, corn milk with *kewer* topping, and other unique delicacies.

• “WANI ROBAH” PUNKERS

Wani Robah Punks Program is an empowerment program for punkers and street children in Majalaya that is carried out by PGE’s Kamojang Areas in collaboration with An-Nur Community Learning Center in Ibun. In this program the young persons are educated in developing traditional music potential, entrepreneurship, and character building.

The subjects of this program are the street children in Majalaya District, Bandung Regency, West Java. The empowerment is carried out in soft approach while giving them behavior

education and skill training, including the skill to play angklung and other musical instruments.

Until 2021, there are 21 foster street children and they sometimes perform in events. Now they can earn Rp1.5 million per month income, from the previous Rp900 thousand. Moreover, they also show better behavior.

• GEOTHERMAL MUSHROOM

Geothermal mushroom is a program of mushroom farmers empowerment. In this program farmers use baglog sterilization device equipped with geothermal power.

• GEOTHERMAL COFFEE

Geothermal coffee is a program of coffee farmers empowerment. In this program, farmers are introduced to and given basic training on Kamojang coffee, including how to develop their business. There are some coffee farmers groups involved in this program, such as Farmers Group Pulus Wangi in Sukakarya Village, Samarang District, Garut Regency, West Java.

The empowerment is given by improving the farmers’ basic knowledge about coffee, about marketing, and also giving them the farming tools they need.

The empowerment is conducted in sustainable basis. It is started with giving the farmers the superior coffee seeds and then giving them the accompaniment in the farming process. The farmers also received trainings about coffee processing.

After the production succeed, the program helps the farmers in marketing phase. They participate in many exhibitions.

PGE's Kamojang Area also made innovation in coffee beans drying process. During the rainy season, the drying process can take up to two weeks. The company made an innovation by creating a dryer machine with geothermal vapor called "Geocoffee". With this machine, the coffee beans' drying process is reduced to 1-2 days.

This "geocoffee" dryer has been used by one of the coffee farmers groups coached by PGE called Pulus Wangi Farmers Group in Sukakarya Village, Samarang District, Garut Regency, West Java.

The coached coffee farmers group also received trainings in coffee processing. After the production, they are assisted to market the coffee beans and join some exhibitions. The machines for production are given according to the development of program. The first machine aid is a pulper, a machine to separate the fresh coffee beans from the skin. The next machine is a huller, a machine to separate the dry coffee beans from the skin.

• GEOTHERMAL POTATO

Geothermal potato is a program of potato farmers empowerment. In this program, PGE's Kamojang Area works together with Bogor Institute of Agriculture or Institut Pertanian Bogor (IPB). This program has been

conducted since 2018, using the technology innovation of sterilization device called Geotato. This machine is an innovation that utilize geothermal vapor to sterilize potato's growth medium (cocopeat).

The Geotato sterilization device is developed based on the interpretation analysis of life cycle impact assessment. This analysis is published in the Life Cycle Assessment (LCA) Study Report of PT Pertamina Geothermal Energy's Kamojang Area, a collaboration report made by PT PGE's Kamojang Area's LCA team and PT ITS Tekno Sains LCA team.

In the analysis, PT PGE's Kamojang Area's LCA team found out that the hot spot process of electrical and steam production process is the cooling tower process unit. Therefore, there are some program recommendations as efforts to minimize the impact potential. One of them is to reduce the emission before entering cooling tower by using the left-over vapor from Blowdown PL-402 line to sterilize potato seed growth medium. This is the analysis base for the utilization of geothermal vapor for potato seed growth medium sterilization device Geotato.

The introduction of innovative sterilization mechanism in the farming process of potato variety is a good step in developing farming activity that supports environment



The Geotato sterilization device, developed based on the interpretation analysis of life cycle impact assessment.

This analysis is published in the Life Cycle Assessment (LCA) Study Report of PT Pertamina Geothermal Energy's Kamojang Area, a collaboration report made by PT PGE's Kamojang Area's LCA team and PT ITS Tekno Sains LCA team.

sustainability. Although still conducted in small scale, this practice is in accordance with global effort in preventing the impacts of climate change (in line with SDGs 12th and 13th Agenda)

This program succeeds in reducing CO₂ that is released by gas fuel as much as 1,992.23 kg CO₂eq/year. This accomplishment is in accordance with the national target set in the Presidential Regulations (Peraturan Presiden) No. 61 year 2011, that is in 2020 Indonesia is expected to reduce greenhouse gases to 26%.

The main programs of Geothermal

Potato are:

- Geotato Device Innovation: direct utilization of geothermal vapor to sterilize potato seed growth medium. This device has been patented.
- Superior seed innovation PAUS PERTATO (Pusat Antar Universitas Satu Pertamina Potato), a product collaboration with Bogor Institute of Agriculture (Institut Pertanian Bogor/IPB) and breed independently by Forest Village Community Institution (Lembaga Masyarakat Desa Hutan/LMDH) Mustika Hutan.

THE HEALTH QUALITY IMPROVEMENT PILLAR

Improved Health Quality

• BEYOND SEHATI: EDUPLAY THERAPY

The program is a therapy innovation for children with special needs. At least there are 17 children with special needs and 18 health cadres in Mekarwangi Village and 12 children with special needs and 12 health cadres in Sudi Village. The Eduplay Therapy also gives special supplementary food for the children with special needs. The food is made from local ingredients of the village.

• BEYOND SEHATI: VOPAPID

VOPAPID is the continuation program of Beyond SEHATI: Eduplay Therapy program. This program gives vocational assessment for children with special needs for the purpose of mapping and training their vocational capabilities.

• SUPPLEMENTAL FOOD GIVING

PGE's Kamojang Area works with Patra Women Association and local health cadres to carry out the Supplemental Food Giving (Pemberian Makanan Tambahan/ PMT) program. The purpose of this program is to improve the health and nutrition quality of toddlers and elderly people. The Supplemental Food Giving activities are held in 37 mother and children health service posts (posyandu) in Iibun District and Samarang District, Garut Regency, West Java Province. The food is given to 1,746 toddlers and babies every month and to 60 elderly people every two months.



Eduplay therapy is a therapy for children with special needs to help them become independent. Not only for the children, the program also gives parenting education for their parents.



THE INFRASTRUCTURE AND SOCIAL DEVELOPMENT PILLAR

Infrastructure Development for Community's Well-being

PGE's Kamojang Area always ready to give help and aid for various social activities and public facilities development that the people need, such as:

- Disaster aids
- Public facilities development aids
- Infrastructure development aids
- Educational aids
- Health aids
- Social and religion activities aids

- Covid-19 Pandemic aids
- Vaccination aids
- SAMBIL SALTO/Sabilulungan Masyarakat Iibun Saling Tolong Menolong (Sabilulungan: Iibun Community Help Each Other). SAMBIL SALTO is an initiative program from PGE's Kamojang Area's foster partners to help the community impacted by Covid-19 pandemic in Iibun District, Bandung Regency.




Ulubelu

 **Mount Way Panas Lampung**
Geothermal Working Area (GWA)

 **220 MW**
Installed Capacity

 **244.000 houses**
Electricity supplies estimation

 **4 Unit**
Geothermal Power Plants


 **1,144,000 tCO₂,eq/year**
Emission Avoidance Potential

 **10,406 BOEPD**
Saving potential of oil & gas foreign exchange reserves

Coffee for Farmers Prosperity

Ulubelu District is one of the biggest coffee producers in Lampung Province. In this area, at 800 meters above sea level on the slope of Mount Rindingan, PT Pertamina Geothermal Energy's Ulubelu Area holds its operational activities. Quoted from the official website of Lampung Agriculture Quarantine Office (Balai Karantina Pertanian Lampung), up to 2020, there are 10,843 hectares of coffee plantations area in Ulubelu with production capacity of 4,722 tons/year.

The world has acknowledged the quality and production of coffee from this highland in Lampung and as a result it has exported to various countries. The top species and the most favorable to grow by coffee farmers in Ulubelu District is robusta coffee (*Coffea canephora*). Unfortunately, this big potential is not followed with coffee farmers knowledge about coffee plantation products and management, from upstream operations to downstream operations. There are still a lot of farmers who do not have the Business Permit for Community Forest Management (Izin Usaha Pengelolaan Hutan Kemasyarakatan/IUPHKm). This gives negative impacts to the environment, such as land degradation and forest conversion in uncontrollable extent.


 The coffee farmers in Ulubelu only focus on the farming process up to harvesting the crops. Ngopi Doeloe (literally means: have some coffee first) program educates coffee farmers about coffee management from upstream operations to downstream operations.





TOP INNOVATION PROGRAM

Learning to “Ngopi” from Upstream to Downstream

His name is Kukuh Diki Prasetya. He is now 31 years old. He is the owner of the café and robusta coffee brand Kopi Beloe. Coffee brands from Ulubelu has travelled around the world to Europe. Since he was 18 years old, this alumnus of Yogyakarta Muhammadiyah University for the program study of nursing has opened a home coffee industry in Yogyakarta with one of his friend.

In 2016, he came home to his hometown in Ulubelu, Lampung. Here he continued his coffee business. During his business time, Kukuh saw the fact about how low the farmers' knowledge is, from plantation management to the downstream operations when the coffee product is ready to sell.

The coffee farmers only manage the plantation process until the harvest time, not until the post-harvest process. This makes many farmers get low price from brokers. Kukuh saw that the plantations' conditions were very far from good and proper plantation standard, especially in plant rejuvenation. The

farmers also harvested the coffee carelessly.

Based on these, Kukuh started to focus in developing coffee plantation and learning house for the coffee farmers. This learning house educate the farmers about coffee business operations, from the planting process until post-harvest process.

In 2018, people from PGE's Ulubelu Area who often buy and drink coffee (*ngopi*) in his café saw big potentials in the café and learning house. Then, a collaboration between PGE's Ulubelu Area Corporate Social Responsibility (CSR) program and Kukuh's initiative created Ngopi Doeloe program, a top innovation program.

The Ngopi Doeloe program is conducted in Tegalrejo Hamlet, Sukamaju Pekon/Village, Ulubelu District, Tanggamus Regency, Lampung Province. The main subject is the Beloe Coffee Group. This assistance program focuses on strengthening and developing the group in terms of coffee management from upstream to downstream operations. Until now, Beloe Coffee Group has 12 members who works in



The Ngopi Doeloe program created Rumah Belajar Kopi or Coffee Learning House. One of the innovations in this learning house is the using of high-pressure coffee machine to roast coffee beans.

several divisions or work specialties.

The Ngopi Doeloe program is formed to improve coffee farmers capacity, in skill and in capital investment. The Beloe Coffee Group has various independent activities. This group has one top program, Coffee Learning House. Public use this place to learn about coffee, from upstream operations to downstream operations. PGE saw the program potentials for actualizing coffee farmers capacity improvement.

“The Coffee Learning House is expected to be capable to educate the farmers so the brokers will not take advantage of them by buying low price coffee,” Kukuh said.

Quoted from the Document of Environment Management Performance Summary (Dokumen Ringkasan Kinerja Pengelolaan Lingkungan/DRKPL) 2021 Ulubelu Area, today there are 671 persons who directly receive the benefit from the Ngopi Doeloe program. They are the members of Beloe Coffee Group, people who join plantation workshops, and coffee product marketing partners. Before the program, in 2016, the members average income was Rp350,000 per month. After the implementation of Ngopi Doeloe program, their income increased. At least in 2020, their

income becomes Rp2,200,000 per month.

In implementing the program, Ngopi Doeloe has three interconnected activities, they are farming, postharvest activities, and marketing. In the farming phase, PGE’s Ulubelu Area gives coffee seeds aid and plantation maintenance fund. In the postharvest phase, there are some activities such as equipment and Mini Lab tools aid, high pressure roasting machine aid, Kafe Beloe renovation aid, and coffee processing machines and equipment aid for Kafe Beloe. There are also plantation workshops that involve local farmers other than the members of Beloe Coffee Group. In the marketing phase, PGE’s Ulubelu Area enlists Beloe Coffee Group in a trade fair during the events held by PGE’s Ulubelu Area, even in national and international expos.

In the environment matter, Ngopi Doeloe program tries to educate farmers about water source utilization efficiency in postharvest coffee processing. Coffee trees also contribute in Emission Avoidance Potential. Coffee tree as a perennial plant can also reduce land degradation potential, and this means cost saving for tree provision in reforestation.



Coffee packaging before sending them to the market. Ulubelu coffee now has marketed internationally.



THE EDUCATION QUALITY IMPROVEMENT PILLAR

Educating Young Generation for Sustainable Earth

One of PGE's Ulubelu Area's target to educate the community about renewable energy and environment sustainability is actualized in Green School program in the education pillar. The program has been carried out since 2019 and has 8 schools as foster partner. There are various activities and regular programs in Green School, such as Geothermal Class, Environment Education, dan Greening the School Area.

This program is important because the community's knowledge about geothermal energy or the company's operational activities is still low. Some people still view that the company's operational activities is disturbing environment sustainability. This has become one of the things to be anticipated by PGE in conducting public relations program.

The Green School is also a PGE's contribution in the effort to accomplish SDGs 4th Agenda through the collaboration with educational institution. The Green School program is carried out by PGE's Ulubelu Area in coordination with the school SDN 01 Gunung Tiga, Air Abang Pekon/ Village, Ulubelu District, Tanggamus Regency, Lampung.

Environment sustainability comprehension need to be nurtured from childhood. Green School program for elementary students will be a strong foundation for them to help preserving Earth sustainability.





The saburai goat has good quality in production and reproduction. The farmers are given trainings about cattle health care and how to improve pen's quality.

THE CARE FOR THE ENVIRONMENT PILLAR

Snatching the Economic Opportunity

• TARKAM DERAI: ENDEMIC GOAT WITH HIGH ECONOMIC VALUE

Saburai goat is an endemic animal of Lampung and a crossbreed between local goat of etawah/jamnapari goat descent and boer goat that has good meat quality.

On June 8, 2015, the Decree of the Agricultural Minister (Surat Keputusan Menteri Pertanian) Number 359/Kpts/PK.040/6/2015 has declared the saburai goat as a new cattle strain in Indonesia.

Saburai goat has high economic value to breed, compare to other goat species. Based on this, in 2018, PGE's Ulubelu Area conducted Endemic Saburai Goat Protection (Pelestarian Kambing Endemik Saburai or Tarkam Derai) program in collaboration with Berkah Jaya Farm Group. This farm group, that has 15 members, is in Karang Rejo Village, Ulubelu District, Tanggamus Regency, Lampung.

PGE's Ulubelu Area assists the farm group by providing the kids, making the pens, and giving cattle health service.

PGE's Ulubelu Area also carries out empowerment programs in two schemes. They are improving pens quality and giving trainings on cattle health care.

The farm group also learn about regular feed management, pen hygiene, how to use the pens based on their utility, and how to process goat droppings into manure.

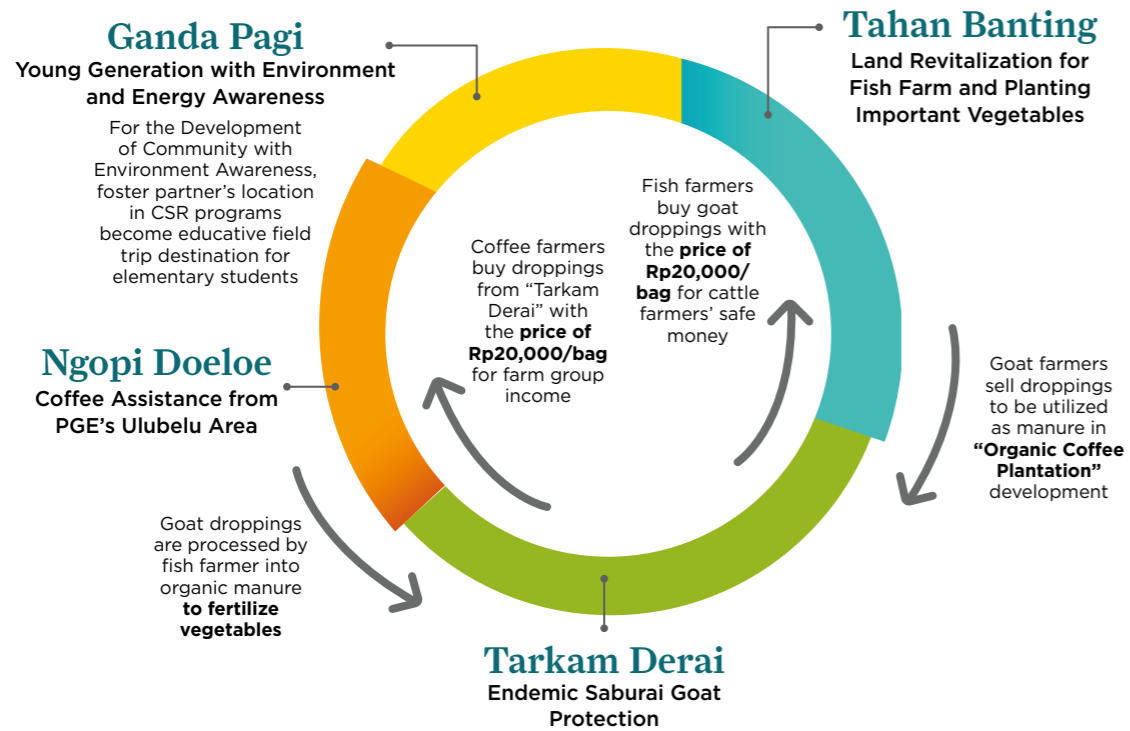
"Superior cattle like saburai goat needs comfortable pen," expressed Arif Mulizar, PGE's Ulubelu Area External Relations Supervisor.

Therefore, the farmers need a special assistance to modify the pens that they already have in order to adopt a better pen system. A good goat's pen has certain temperature, humidity, and air ventilations that meet the goat's tolerance level, so that the goat is not stressed.

In implementing Tarkam Derai program, PGE's Ulubelu Area and Berkah Jaya Farm Group have two main partners. They are Gajah Mada University and Tanggamus Regency ASPONAK/Asosiasi Kelompok Ternak (Cattle Group Association).

UGM is active as the partner in organizing activities, group activity

TOP PROGRAM INTEGRATION



development, and also income achievement for every member. ASPONAK's role is to give technical assistance in farming activities. Until 2022, the program has succeeded in breeding 228 goats. It also gives Rp725,000 additional income per month for every member of the farm group, whether from selling the cattle or selling the manure that they produced.

• INVOLVING YOUNG PERSONS IN DISASTER RESPONSE

Just as Kukuh predicted, farmers' limited knowledge about sustainable

and environmentally friendly plantation brings environment degradation and damage in Ulubelu District.

PGE's Ulubelu Area then created another program, Pemuda Tanggap Bencana of Emergency Response Group Millenials (ERMi). This disaster response group works in 4 provinces (Lampung, Bengkulu, South Sumatera, West Java).

ERMi is a community empowerment program that is responsible in disaster and environment management in Datarajan Pekon/Village, Ulubelu District, Tanggamus Regency, Lampung Province.

The innovation in this program is The Participation of the Community in Disaster and Environment Management Using Digital Information Technology. The actualization of this program is the community's participation in the installment of landslide detector and Reksa Embung activity.

Before the program, the community's comprehension and attitude in disaster management is still reactive. In addition, the utilization of information technology system is still low. Hence, disaster cannot be anticipated long before it happens.

PGE's Ulubelu Area then gave disaster response training to the group so they know that preventive effort is important in disaster countermeasure acts. As a result, they carry out environment protection in some points that are prone to landslide.

Today ERMi has 12 members with different skills and specialty.

Environment Innovation Program Accomplishment

• ELECTRICAL LOAD EFFICIENCY THROUGH OPTIMUS PRIME

One part of the electrical production facilities in Geothermal Power Plant (GPP) Unit 3 and 4

in PGE's Ulubelu Area is the Main Transformer Unit System.

This main transformer consists of a Unit 3 UST that serves Unit 3 electrical load, a Unit 4 UST that serves Unit 4 electrical load, and an SST that serves essential and non-essential electrical load.

The SST has a very crucial role in GPP Unit 3 and 4's electricity generation because the SST serves the electrical load of instruments that should not go off. The 2020 energy audit and an LCA study conducted in 2021 found that the electrical loading in SST transformer unit was very small and consumed energy that can be used for other purpose.

The Unit 3 UST or Unit 4 UST transformers can take over this electrical loading in order to avoid instrument trouble in the generator if someday the SST unit needs to be repaired or is not working. To overcome these two problems, PGE's Ulubelu Area developed an energy efficiency program called "Electrical Loading Efficiency through Optimus Prime".

This innovation gives 23.31 GigaJoule (GJ) energy efficiency absolute value and Rp9.3 million company saving in 2020. There is a change took place in this innovation. The UST 3 and UST 4 transformers take over the SST

transformer unit load. The load itself is about 1,153.2 kVA or 46.13% which means still within the optimal limit of transformer loading.

• UTILIZATION OF ELECTRICAL BUS TIE SYSTEM OF GPP UNIT 3 AND 4

When there is a trip trouble or the generator inactivity for some period of time due to operational failure of the instruments in generation system, the normalization will take a long time because it has to be done manually. To shorten this normalization time, the company provide Emergency Diesel Genset (EDG) that supplies electricity to the main equipment that should never go off.

In the long run, the EDG operation will mean a waste of oil fuel consumption and the increase of the greenhouse gasses emission (GGE) load that has the conventional air pollutants (CAP) potential. Therefore, PGE's Ulubelu Area made an innovation called "The Utilization of Electrical Bus Tie System of GPP Unit 3 and 4".

In this innovation, the interlock system is added to the medium voltage circuit breaker bus tie. The interlock system will automatically

divert the load when there is a trip trouble in one of station load unit. The electricity in the station load will be supplied by an online unit so the EDG is not necessary anymore to supply electricity for the online station load.

This innovation has decreased the greenhouse gasses emission (GGE) absolute value to 6.66 tons CO₂eq and conventional air pollutants (CAP) emission to 0.000085 tons SO_x. Thanks to this program, the company can save Rp9.3 million in 2020 from EDG's oil fuel saving that is equal to the diverted energy multiplied to the electricity base tariff.

The company also receive some benefits from the saving of diesel fuel cost for genset due to less running hour for EDG operation. In addition, the normalization time is faster because the company does not use the manual system anymore.

• T&M APPLICATION PROGRAM

Ulubelu's T&M application is an application that can monitor the purchasing and inventory of all consumable items across all different functions in PGE's Ulubelu Area. This mobile application enables users to avoid unnecessary purchase. Before this innovation, the data collection

of material inventory, especially for consumable items in PGE's Ulubelu Area, is still conducted manually.

The manual data collection often is ineffective and causes multi-purchase and excess stock for the same item because there is not any system to monitor in and out items. This will cause negative impact of the increasing volume of toxic waste from the leftover packaging of the consumable items that is classified as toxic, especially the dominant toxic waste, that is the leftover packaging of the toxic.

One of the best features in the application is the approval feature for every item going in or out, so it is easier for the supervisor to control items consumption in operational activities. With this innovation, the company receive some benefits because the monitoring process for the purchasing activities and the utilization of consumable items can be carried out in real time. And in turn, the budget of operational activities will be much lower.

• SILAGE FEED AS A SOLUTION FOR CATTLE FEED RESILIENCE

One of the main challenges in facing climate change for traditional

farmers who carry out ruminant farming is ensuring feed resilience for their cattle. The Berkah Jaya Goat Farm Group in Karang Rejo Pekon/Villages also faces this. Until now, there are still a lot of groups practicing the *ngramban* or finding grass and leaves for their cattle. This makes the feed resilience low because the supply depends so much on the climate change, especially during the time of food scarcity.

To overcome this community problem, PGE's Ulubelu Area made an innovation in collaboration with the Cattle Group Association/Asosiasi Kelompok Ternak (ASPONAK). They made the "Silage Feed Development for Berkah Jaya Goat Farm Group's Saburai Goat Growth" program. PGE's Ulubelu Area gives them the main silage and molasses and also trains the farm group.

This innovation has some added values in form of product sharing. Thanks to this innovation, some other goat farm groups from outside Karang Rejo Pekon/Village come for comparative studies and trainings given by Berkah Jaya Goat Farm Group. Other than that, some other villagers also start to do similar activity to provide feed that can face climate change.



The University of Lampung's Community Research and Service Institution (Lembaga Penelitian dan Pengabdian kepada Masyarakat/ LPPM) also visited Saburai goat farm location in Karang Rejo to do some research on the effort of feed development that is adaptable to the climate change, especially concerning feed resilience for cattle.

• **USED PLASTIC TO MAKE SILAGE IN SABURAI GOAT GROUP**

One of the challenges in the stages of silage feed making is the great deal amount of the use of plastic because the process needs a lot of plastic container which means a lot of cost for Berkah Jaya Goat Farm Group. Through the circular economy approach, PGE's Ulubelu Area tried to offer an alternative solution to the group and at the same time overcome plastic waste problem in PGE's office. With this innovation, the absolute value of the utilization of nontoxic waste is 0.03578 tons used plastic packages.



Silage is cattle feed made through fermentation process in an airtight plastic bag. To reduce disposable plastic waste, Berkah Jaya Goat Farm Group utilizes plastic containers that they can use many times.

This innovation emphasizes the economic value of plastic waste and extends the cycle period of the waste by having some use for the goat farmers. Finally, the utilization of plastic containers can reduce the impact on environment, especially save the water and land from microplastic pollution by 0.03578 tons.

• **UTILIZATION OF TRAC-114 FOR WATER USE IN AUXILIARY COOLING WATER SYSTEM**

The Auxiliary Cooling Water System (ACWS) is a closed system cooling process unit that uses cooling water from surface water that will be circulated over and over. The water quality in ACWS will get worse with time. This can cause malfunctions in the operational equipment of generator unit such as seal pump problem, heat exchanger clog, and line leak due to corrosion.

If all of these happen, the whole generator operational activities will be disturbed and the use of surface water in ACWS facility will increase. To overcome this, PGE's Ulubelu Area create an innovation "Utilization of TRAC-114 for Water Use in Auxiliary Cooling Water System".

The utilization of plastic containers finally can reduce the impact on environment, especially save the water and land from microplastic pollution by 0.03578 tons.

With this innovation, the company can accomplish water efficiency as much as 10.6 m³. The company can also save Rp25 million from the maintenance budget of ACWS and other related supportive equipment's components for corrective maintenance.

In this innovation, PGE's Ulubelu Area added a mixing chamber for TRAC-114 injection. This will maintain the quality of water in the system. In the utilization of TRAC-114, the quality of water is kept by maintaining the level of pH, nitrite (NO₂), and iron (Fe). Thanks to this innovation, the seal pump problem, the heat exchanger clog, and the line leak due to corrosion have been overcome.



THE COMMUNITY ECONOMIC EMPOWERMENT PILLAR

Strong with Young Generation

Other than Ngopi Doeloe program, PGE's Ulubelu Area also has Environmental and Social Responsibility programs that are formed based on the five pillars. Through these five pillars, the company implements some top programs that give sustainable benefits for the communities in around the area of PGE's Ulubelu Area.

All of the PGE's Ulubelu Area assistance programs are integrated. They are connected to each other, such as the integration of Ngopi Doeloe, Tarkam Derai, Tahan Banting, and Ganda Pagi or the Green School.



The planting of shade trees for rich plantation soil. Before the Ngopi Doeloe program, plantations condition is far below the good and proper standard, one of them is the plantation's soil quality.

• YOUNG GENERATION'S AGROTOURISM EFFORT

The Ulubelu Triumphant is a community empowerment group that focuses its attention on young persons' potential optimization in the neighborhood area of PGE's Ulubelu Area. The emphasis of the group is in farming or agro-activities, environment and

education, and also social activities.

This community empowerment group has 8 young members. They manage a greenhouse for tourism activity such as grapes and melons picking.

This program is created as the young persons of Ulubelu District's response, especially when the pandemic came and caused unemployment and economic difficulties. This has become one of the efforts to maintain economic resilience during pandemic.

• TAHAN BANTING

Tahan Banting (which literally means resilience) is a collaboration between PGE's Ulubelu Area with community groups that work in fresh water fish farming. Fakhrina Fresh Water Fish Farm Group in Tegalrejo Hamlet, Sukamaju Village, Ulubelu District becomes the PGE's Ulubelu Area partner for business development activity.

This Fresh Water Fish Farm Group began in 2019 with the main focus to develop fresh water fish potential to meet the need of fish consumption

in Ulubelu and the surrounding area.

The Fakhrina Group has 5 members that are led by Ahmadi. They run the group since 2019.

The members of Fakhrina Group have main income from coffee plantation. But because the time for harvest is in 1 to 2 years, to fulfill the daily needs they need another income or side business with relatively fast income.

In 2020, 15 people from one MSME (Micro, Small, and Medium Enterprise) has received benefit from this farming group.

The Tahan Banting program in the end will achieve fish farmers independence through activities such as increasing the capacity of production pond and the making of *rumpilam* culinary tourism as one of cooked fish marketing forms.

• DEVELOPING YOUNG FARMERS

Karda Farm is a capacity enhancement and community empowerment program for hydroponic farmers group. The hydroponic farm development in Ulubelu District is created because of high consumers' demand on quality fresh vegetables with affordable price.

PGE hopes the community can make the pilot farm as a direct learning medium for hydroponic farmers or other community members.

Today the farmers still plant the vegetables in home scale. Their garden space is not sufficient to meet the demands from outside Ulubelu area. This positive economy potential needs support in the form of assistance, whether in farmers capacity or in increasing the production capacity of the farm.

With PGE's Ulubelu Area made a pilot farm with hydroponic method, the company hopes the community can make the farm as a direct learning medium for hydroponic farmers or other community member who wants to learn. The vegetables that have been harvested will be distributed to some traditional markets and supermarkets outside Ulubelu District.

Coffee trees are trimmed to increase harvest production. The trimming will stimulate the growth of new branches of fruit.



THE HEALTH QUALITY IMPROVEMENT PILLAR

Enhancing Healthy Life Style with Kamasetra

The Kamasetra (Keluarga Mandiri, Sehat, dan Sejahtera or Prosperous, Healthy, and Independent Family) program is made as a PGE's Ulubelu Area's response when it found out there are still some health problems such as stunting, malnutrition, and a lot of vulnerable groups (pregnant mother, breast milking mother, toddlers, and elderly people) in Ulubelu District. This is a program in health basis that is incorporated in the main program, Pertamina Sehati. The Kamasetra began in 2021.

The vision of this program is creating a good and healthy environment for the whole community, especially the community in Ulubelu District. The mission of Kamasetra program is to increase community awareness that healthy life style is the beginning of a better community life.

PGE's Ulubelu Area has a big

role in this program by providing nutritious food to the vulnerable groups and creating proper posyandu or mother and children health post's service by building the infrastructure. PGE's Ulubelu Area also formed a group of posyandu's cadres. These cadres can give health service for those who needs special attention or has special need.

In implementing the program, PGE's Ulubelu Area is collaborating with some partners. They are the Tanggamus Regency Health Office, the Ulubelu District Community Health Center (puskesmas), all posyandus in Ulubelu District, the Tanggamus Regency BKKBK (Badan Kependudukan dan Keluarga Berencana Nasional or National Population and Family Planning Board), and Ulubelu District's PLKBs (Pendamping Lapangan Keluarga Berencana or Family Planning Field Companion).

The Kamasetra program works together with puskesmas (community health center) and posyandu (mother and children health post) to give primary health service to the vulnerable groups. This service can be monitored through this Kamasetra application.



THE INFRASTRUCTURE AND SOCIAL DEVELOPMENT PILLAR

Smooth the Road, Overcome the Obstacle

In actualizing the SER infrastructure pillar, PGE's Ulubelu Area focuses on fixing the road that people use from Muaradua Village to Ngarip Village. This program is the priority

in the pillar of Infrastructure and Social Development because the community needs the access to the center of government and economy activities that is located in Ngarip Village.



Lahendong



Lahendong
North Sulawesi
Geothermal Working Area (GWA)



120 MW
Installed Capacity



133.300 houses
Electricity supplies
estimation



6 Unit
Geothermal
Power Plants



624.000 tCO₂eq/year
Emission Avoidance Potential



5,676 BOEPD
Saving potential of oil & gas
foreign exchange reserves




Protecting *Macaca nigra* for North Sulawesi Forest Sustainability



Geothermal business sustainability depends on how the company manage the nature and the biodiversity around the geothermal source. The programs for energy transition and the fulfillment of green energy need have to be implemented right away, but it does not mean the effort has to sacrifice nature and biodiversity in geothermal working area.

In line with the implementation of the environment pillar, PGE's Lahendong Area that is located in the Town of Tomohon and Minahasa Regency, North Sulawesi Province, works together with institutions, the community, and the government in conducting a series of conservation programs. One of them is the conservation of wolai monkey or Sulawesi black monkey or yaki.

 GWA Lahendong operates six units GPP. GPP Unit 1 has been operating since 2001 and GPP Unit 6 has been operating since 2016.

TOP INNOVATION PROGRAM

Habituation that Becomes Innovation

Sulawesi black monkey or red butt yaki (*Macaca nigra*) is a monkey endemic to the Minahasa Peninsula, North Sulawesi. This monkey lives in primary and secondary tropical rain forest, from down the shore up to the mountain. But the number of yakis in its original habitat is decreasing. They even almost face extinction. The yaki cannot be found anywhere else in the world because the fauna is endemic to Sulawesi.

The downsizing of yaki population in its original habitat has been confirmed by many researches. One of them is a thesis titled “The Study of Habitat Quality and the Density Rate of Sulawesi Black Monkey (*Macaca nigra*) in Tangkoko Conservation Forest Management Unit (Kesatuan Pengelolaan Hutan Konservasi/KPHK) North Sulawesi”. The thesis made by Dwi Yandhi Febriyanti, a postgraduate student of Sam Ratulangi University in Manado, showed the decline of yaki population in Tangkoko forest.

“The density rate of sulawesi black monkey in KPHK Tangkoko is 9.00 individuals per square kilometer. That number is obtained with line transect method in research locations comprise 13 observation tracks with

122.50 kilometers total track’s length,” wrote Dwi Yandi in her thesis.

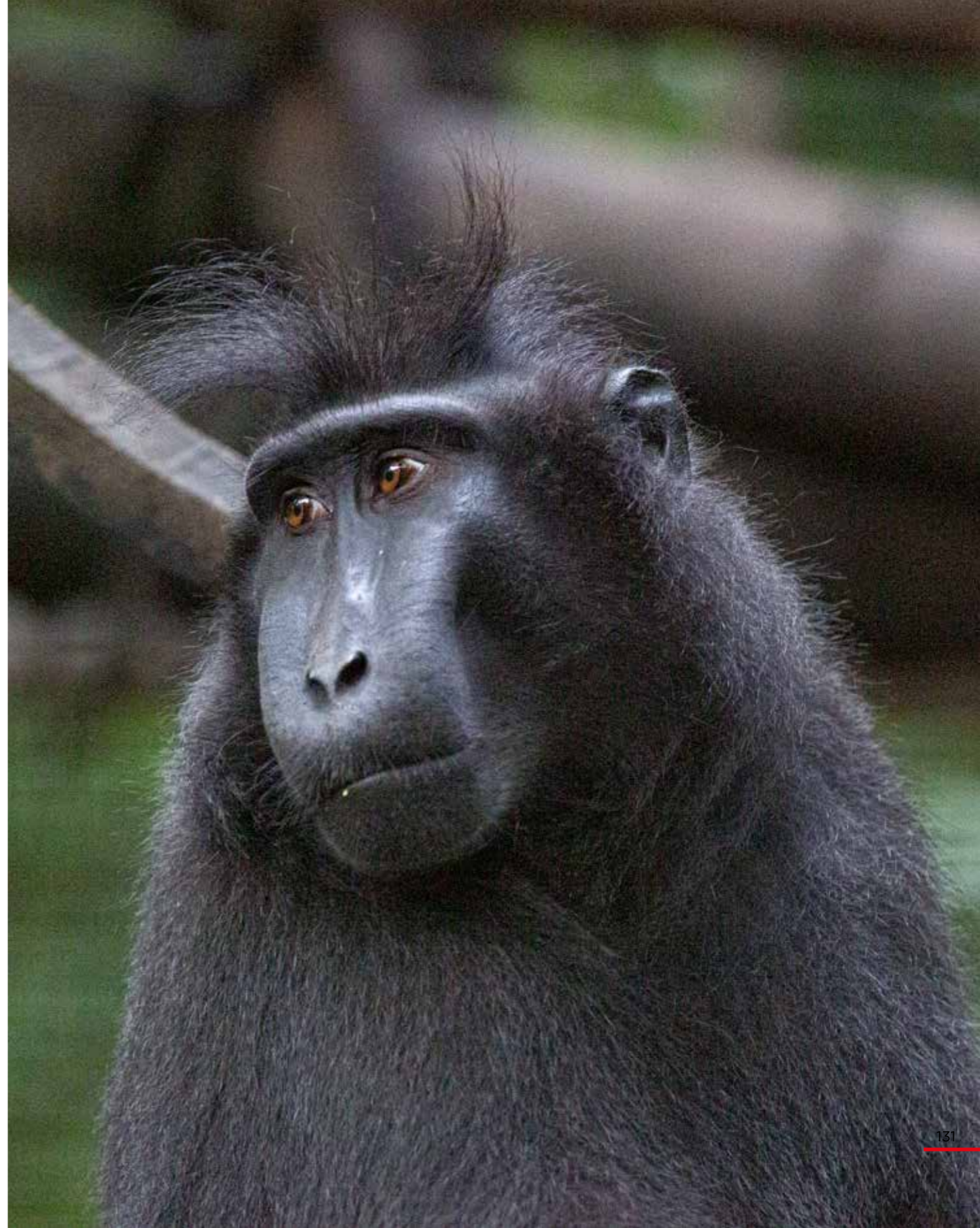
Now Yaki has listed as a protected wild animal in Indonesia based on the Republic of Indonesia Laws (Undang-Undang) no. 5 year 1990 on the Conservation of Biotic Natural Resources and Its Ecosystem, and the Environment and Forestry Ministerial Regulations No. 20 year 2018 on the Enactment of the List of Protected Flora and Fauna. By International Union for Conservation of Nature (IUCN), yaki is categorized as critically endangered.

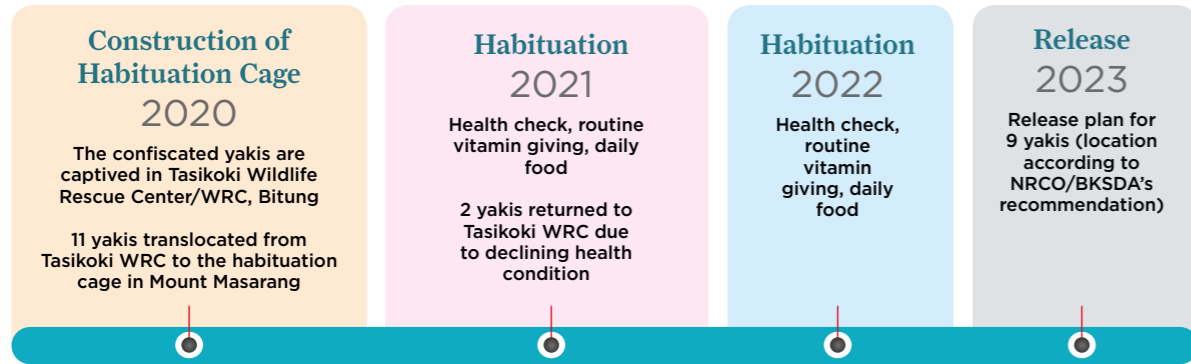
Since 2020, PGE’s Lahendong Area that operates in North Sulawesi has undergone Yaki Fauna Conservation program for the animal with declining population.

For this program, PGE’s Lahendong Area works together with Masarang Foundation, a foundation that works for the protection of endangered animal, and the North Sulawesi Natural Resources Conservation Office/NRCO (Balai Konservasi Sumber Daya Alam/BKSDA). The first activity was building a place for yaki conservation, a cage of 100 square meters in area and eight meter in height. This cage is enough to hold eleven yakis in habituation process in Masarang forest.



Macaca nigra or yaki lives in groups. Each group is led by an individual called alpha male.





This habituation cage is located in the property of Masarang Foundation. The conservation location is selected based on analysis result and the mapping of Masarang Mountain, a place that is considered as the most similar to the original ecosystem of wolai monkey. The comparison has been done, including with the rehabilitation center in Tasikoki Wildlife Rescue Center/WRC (Pusat Penyelamatan Satwa/PPS), North Minahasa, North Sulawesi. PGE's Lahendong Area funds the tending activities, including food, vitamins, and medical check-up.

The Masarang Foundation provides the land, vets, keepers, and rangers. Other than as the implementation of Social Responsibility in the environment pillar, for PGE, the habituation program like this is the first program of its kind in Indonesia that is implemented by a Geothermal Power Plant sector.

PGE's Lahendong Area with its partners has been conducting this habituation program since 2020, started with the construction of habituation cage in 2020. At that time, this conservation program received confiscated yakis and

followed them up with the translocation of 11 yakis from the Tasikoki WRC.

After some time, in the habituation process, health conditions of two yakis were deteriorating because they could not compete in getting the food and thus did not get enough food. They were returned to Tasikoki WRC to be treated. Hence, there were only 9 yakis in habituation.

In the end, the plan to release 9 yakis will be held in a location according to the recommendation from NRCO/BKSDA.

In addition to the habituation, PGE's Lahendong Area's Government and PR Senior Supervisor, Bagus Dimas Wibisono, hopes that the implementation of this program will give another benefit, that is the sustainable environment campaign especially to the community around Rurukan Village, and in larger scope to the community of the Town of Tohomon and its surroundings.

"We take care of each other. So, gradually there will be community awareness that yaki is not an animal to be consumed or traded, and must be protected for its sustainability," said Dimas.

THE CARE FOR THE ENVIRONMENT PILLAR

Accomplishments of Environment Innovation Program

• IMPLEMENTATION OF SIRINGGO INNOVATION

SiRingo or Sharing Load in GPP Unit 6 of PGE's Lahendong Area, is an innovation program of sharing load supply system of 6.3 kV electricity from GPP Unit 5 to GPP Unit 6. The system works by modifying the house load electrical supply line of GPP Unit 5 and Unit 6 in order to make GPP Unit 6 house load can receive electrical supply from Unit 5 electrical system so that it can operate normally. The idea for this innovation program came up after there was a loss production potential in PGE's Lahendong Area because GPP Unit 6 cannot be operated.

Before the innovation, normally UAT Unit 6 worked to supply 6.3 kV electricity that was used for GPP Unit 6 house load. For the system in Unit 6 to operate normally, 1.2 MVA electricity is needed to supply main cooling water system, auxiliary cooling water system, condensate system, gas extraction system, oil lube system, control & instrumentation, and other supportive systems.

After the innovation program, the electricity of the main cooling water system, auxiliary cooling water system, condensate system, gas

extraction system, oil lube system, control & instrumentation, and other supportive systems of GPP Unit 6 can be supplied from Unit 5 UAT. With the electrical supply from Unit 5 UAT to Unit 6 house load system, the unit 6 GPP can operate again.

• SELECTOR METHOD: MODIFICATION LOGIC DCS TO REDUCE WELL'S SHUTDOWN TIME

The innovation program was developed because in PGE's Lahendong Area there was a late potential in startup process during unit shutdown because it has to do well maneuver. To overcome this, PGE's Lahendong Area made an innovation program "Time Optimization of Well Shutdown During Scrubber Repair in Unit 5 and 6 by Using Selector Method". The company modified the logic system in DCS and made a selector model for the pressure reading sensing points in PCV operation to optimize shutdown time, thus made the unit startup faster without the production well maneuver and reinjection.

The Selector program caused a subsystem change because there is a change in the process flow. Before the program, the workers needed

to shut down or do well maneuver during the maintenance of scrubber's downstream side. The well maneuver needs additional 20 working hours and income loss potential about Rp600,000,000 during unit shutdown for each GPP unit.

After the program, the shutdown or well maneuver is not necessary during the maintenance of scrubber's downstream side. With no shutdown necessary, the company can reduce income loss potential and avoid additional working hours due to well maneuver during unit shutdown for each GPP unit. Other than eliminate the revenue loss potential, the program also has an environment impact in the form of emission reduction in 2020 as much as 41.71 tons CO₂eq.

• **OPTIMIZING WELL 23'S ACIDIC FEEDZONE IN LAHENDONG CLUSTER 5**

“Optimizing Well 23's Acidic Feedzone in Lahendong Cluster 5” is a program created to extend the lifetime of surface facilities and reduce NaOH or Natrium Hydroxide's packaging waste by closing the feedzone or source of Lahendong's Well 23. The development of this innovation program is carried out to answer the problem of damage potential and declining lifetime of

Well 23's surface facilities in PGE's Lahendong Area.

Through “Optimizing Well 23's Acidic Feedzone in Lahendong Cluster 5”, the company succeeded in closing the acidic feedzone of Well's 23 and thus reducing the usage of NaOH which gives positive impacts of the increasing lifetime of surface facilities and reducing NaOH's packaging waste.

Before this program, Lahendong's Well 23 was acidic. This can lower vapor quality and decrease the lifetime of and damage surface facilities. An injection of NaOH chemical was needed to lower the damage potential. But this caused toxic waste in the form of NaOH's used packaging.

After the closing of the feedzone of Well 23, the geothermal fluid becomes neutral dan there is no need to add NaOH chemical, thus eliminating NaOH's packaging waste. The closed feedzone will be substituted by another one. With this innovation, PGE's Lahendong Area succeeded in reducing 2020 toxic waste to 5.83 tons.

• **GEO-CLEAN TECHNOLOGY**

The use of fresh water to clean the basin's screen means bigger number of ground water usage, because the

Si Ringgo Innovation Implementation: Sharing Load Electrical Supply from GPP Unit 5 to GPP Unit 6 as PGE's Lahendong Area Energy Efficiency

Before Innovation	Innovation	After Innovation
1 UAT for 1 Unit	<p>Unit Auxiliary Transformer (UAT)</p> <p>Modification of house load electrical supply line in GPP Unit 5 and Unit 6</p>	1 UAT can cover 2 Units
UAT Unit 5 supplies electricity for GPP Unit 5		Electrical supply from Unit 5 to Unit 6, so that Unit 6 can operate again.
UAT Unit 6 supplies electricity for GPP unit 6		

Optimizing Feedszone

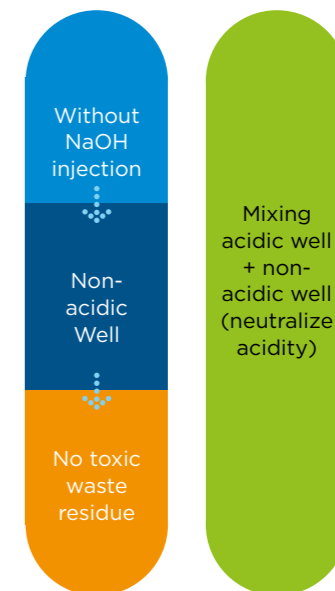
WELL SCHEME BEFORE INNOVATION



Innovation:
Close the acidic zone, stop NaOH injection, thus reduce toxic waste.

To keep the flow of supply stable, need to make a new feedzone.

WELL SCHEME AFTER INNOVATION





screen basin cleaning is carried out 6 times a month. If the company does not overcome this, there will be less and less ground water around Lahendong's power plant unit 5 and 6. Therefore, PGE's Lahendong Area conducts a program innovation "Fresh Water Saving Using Geo-Clean Technology". The Geo-Clean (Geothermal Condensate Cleaner) technology constantly uses condensate water in the cooling tower of the basin and can control basin cooling tower's level to clean the screen basin.

After the program, the basin's screening filter is cleaned using the

condensate from basin cooling tower, then the waste water is collected and processed for future use. The environment impact is lower load of waste water in 2020 as much as 36 tons.

• **DECREASING THE DISPOSABLE FACE MASK WASTE PROGRAM**

The development of this innovation program came up after the disposable face mask waste is abundant during the Covid-19 pandemic, not only in PGE's Lahendong area but also



Geo-Clean is a program to clean the screening filter of the basin—which has to be done 6 times a month—by using the condensate in basin cooling tower. The waste water is then collected and processed for future cleaning use.

all over the place, including the Town of Tomohon and Minahasa Regency. Through this program, the company succeeded in empowering the community. The Maria sewing group that is located near PGE's Lahendong Area, was empowered to make face masks from cloth that conforms to the qualification from the Health Ministry of the Republic of Indonesia.

The added value from this program is the company succeeded in developing Maria Sewing Group into Prosperous and Empowered Joint Business Group (Kelompok Usaha Bersama Maju dan Berdaya/

KUBEMADA). The program is also decreasing solid non-toxic waste in form of disposable masks around the area of PGE's Lahendong Area. The amount is about 0.4099 ton/year, given the total number of workers and work partners in PGE's Lahendong area is 350 persons and the weight of 1 mask is 3.2 grams.

Other than increasing the income of Maria Sewing Group, the program also gave 11,000 cloth masks to the communities in 26 wards and villages in the Town of Tomohon and Minahasa Regency because at that time masks supply was very limited.

THE EDUCATION QUALITY IMPROVEMENT PILLAR

Promoting Education Since Early Childhood

• ENVIRONMENT-CARED-CHILDREN EDUCATION WORKSHOP

PGE's Lahendong Area works together with North Sulawesi's PKBI (Perkumpulan Keluarga Berencana Indonesia or Association of Family Planning of Indonesia) to carry out the program of Education Workshop Binaprasa ECE/Early Childhood Education (Pendidikan Anak Usia Dini/PAUD). This program is PGE's Lahendong Area's efforts to participate in providing quality education facilities in accordance with the education pillar of ESR program.

The actualization of the program was carried out in January to December 2021 by constructing the building for the children education workshop and giving trainings to the new teachers in Kasuratan Village's ECE, Remboken District. PGE's Lahendong Area also carried out learning activities in Talikuran Village's ECE, Tompasso District, and in Tondangow Ward's ECE, South Tomohon District.

Those who directly received the benefits of this program are the ECE's students and teachers, as for the students' parents and the local government received indirect benefits. The program has undergone very well in the second semester of 2020-2021 school year in 3 ECEs, all

of which has graduated Binaprasa ECE students. The ECE in Tondangow Ward graduated 11 students and received 0 new student; Binaprasa ECE in Kasuratan Village graduated 8 students and received 8 new students; and Binaprasa ECE in Talikuran Village graduated 9 students and received 15 new students.

Because it was the time of Covid-19 pandemic, the program is executed in certain arrangement. The teaching was carried out in small group between students whose houses were near to each other, then the teacher came to the small group to teach them with paying attention to the health protocol.

• COCONUT OIL PRODUCTION: EFFORT IN EMPOWERING JUVENILE OFFENDERS

On the other side, still in the pillar of education, PGE's Lahendong Area also gives some trainings to juvenile offenders (Anak Didik Pemasarakatan/Andikpas) in the juvenile detention center (Lembaga Pembinaan Khusus Anak/LPKA) Class II in Tomohon. The juvenile offenders/andikpas are children trained in the juvenile detention center/Lembaga Pemasarakatan with age range from 14 to 18 years old. This PGE's Lahendong Area's program is intended for children who got into a law case



Learning activity to teach the students about environment protection.

and sentenced to the detention center.

The juvenile offenders are included in the vulnerable groups because they are under age. PGE is certain that this group still needs attention and guidance in their growth. Therefore, PGE's Lahendong Area together with the juvenile detention center/LPKA class II Tomohon conducted a program in the form of Coconut Oil Production Skill Training.

The program for these juvenile defenders started from January 2021 until December 2021. The children were trained to scrape the coconut meat from its shell, squeeze the shredded coconut meat to get the coconut milk, cook it until oil is formed, filter the oil, sterilize it in the last filtering process, and package it.

There are 11 children joined this coconut oil production skill training.

They are divided in two groups. In these groups there are two ex-prisoners of Amurang Detention Center. They are the instructors of the training. They had the coconut oil production training di Amurang Detention Center two years before.

Until December 2021, the coconut oil production groups in the Juvenile Detention Center Class II Tomohon had produced the coconut oil 6 times with total production of 108 liters. This coconut oil production groups have had regular customers from the people in the government offices of the Town of Tomohon.

The income from the coconut oil sale is used to buy the raw materials for the production, additional tools, and supplementary food for the group, and also to do minor equipment repairs in the production center.

THE COMMUNITY ECONOMIC EMPOWERMENT PILLAR

The Main Axis of Sustainable Development

The Environmental and Social Responsibility program is an investment for the sustainability of geothermal energy harnessing and management. Without a sustainable environment and a prosperous community, the geothermal project cannot be well executed.

In doing its commitment, PGE's Lahendong Area has five supporting pillars that become love foundation to the community and environment. Therefore, PGE's Lahendong Area is not only fulfill the electrical energy need, especially in North Sulawesi and Gorontalo, but its programs are also implemented based on sustainability principle.

• SATEBI: PIG FARM UNDER THE SUN

The majority of people in the Town of Tomohon and Minahasa Regency consume pork. The demands for pork in these areas never stops. Pork price in North Sulawesi can compete with those of other meat. One kilogram of pork can reach the price as low as 50 thousand rupiah.

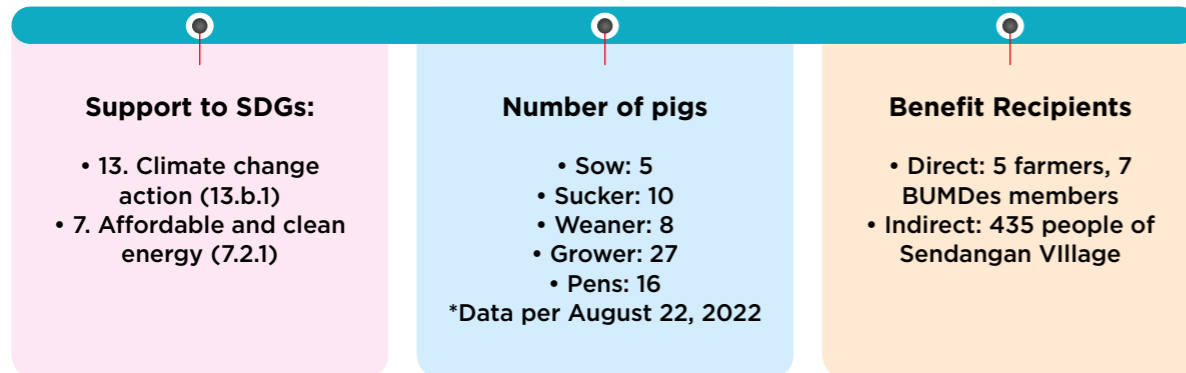
Based on the data from Statistics Indonesia (Badan Pusat Statistik/ BPS), North Sulawesi Province has become the province with the biggest number of livestock pig. At least there are 70,404 pigs slaughtered in the province in 2020.

One of the regulations that becomes attention in pig farming in Tomohon is the farming area must be far from people's settlement. Consequently, a lot of farms do not have access to electricity and use genset fueled with gasoline. Electricity is needed even more when there is a sow that is in pig (pregnant) and then farrows some piglets or when the farm has piglets less than one month old.

❖
To prevent the piglets from harming other piglet or the sow's nipples, their teeth and tails must be cut immediately.



SATEBI data update and pen's condition



What is more, in average a sow farrows a litter of 10-13 piglets, with in pig time around 3 months and 3 weeks. After born, the piglets' teeth and tails must be cut immediately to prevent them from harming other piglet or the sow's nipples. In 14-17 days after the piglets are born, pig farmers need the light from incandescent light bulb to make the pen's temperature as warm as the sow's uterus. This is to keep the piglets warm and avoid death.

"So, it's no wonder electricity dependency is very big," Bagus Dimas Wibisono said.

In the operational area of PGE's Lahendong Area, there is one pig farm managed by a Village-Owned Enterprise/VOE (Badan Usaha Milik Desa/BUMDes). This farm is in Sendangan Village, Tompasso District, Minahasa Regency, North Sulawesi. This farm has operated

since 2019. When PGE's Lahendong Area was about to give some aids, the company conducted some requirement assessment first.

Harnessing solar energy is not a sudden idea here. From January to December 2021, the company and the farmers discussed what kind of renewable energy is suitable and efficient for the pig farm's development. After a long discussion, Solar Power Plant/SPP (Pembangkit Listrik Tenaga Surya/PLTS) was chosen to fulfill the need for electricity.

PGE's Lahendong Area works together with the Energy Board of North Sulawesi Students (Dewan Energi Mahasiswa Sulawesi Utara) and the government of Sendangan Village to harness the renewable energy in the Pig Farm Business (Usaha Ternak Babi/Satebi) program. They apply the Solar

Power Plant/SPP with 200 watt/12 hours capacity. This solar energy's application can accommodate the need of electricity in the pen during night time.

The Energy Board of North Sulawesi Students started the process of assembly and installation, and educated the farmers about the use of SPP in the pen.

In addition to SPP initiative, PGE's Lahendong Area also initiated the use of CCTV as a monitoring system that can be accessed from the farmers and BUMDes members' phone.

The SPP fulfills the whole electricity needs of this CCTV system so that the BUMDes does not need to use gasoline fueled genset as the main energy source.

The energy transition will eliminate the gasoline purchasing cost and give profit to the BUMDes.

In turn, a part of the profit will be returned to the village, in the form of Original Village Revenue (Pendapatan Asli Daerah/PAD).

The village government will use the PAD fund for the people, such as giving them groceries during pandemic and also after pandemic.

The electricity in BUMDes owned pig pen is also used to warm new born piglets, so the temperature

The energy transition will eliminate the gasoline purchasing cost and give profit to the BUMDes, a part of which will be returned to the village.

around the piglets is not much different from the temperature inside the sow's uterus.

Temperature is an important thing for new born piglets because pig's death rate caused by temperature gap is up to 30 percent.

Since the SPP was installed in April 2021, there are 3 farrows in the BUMDes owned pig farm assisted by PGE's Lahendong Area. The first farrow was a litter of 12, the second farrow was a litter of 10, and the third farrow was a litter of 9. The farmers have also harvested the pigs three times with the average pig weight is 80 kg and the price of a living pig is 30 thousand rupiah for every kilogram.

"With this program, BUMDes can save pen operational cost from fuel purchase with cost estimation about 50 thousand rupiah per day," Dimas said.

• REVIVING THE EMPOWERED WOMAN SPIRIT

The Prosperous and Empowered Joint Business Group (Kelompok Usaha Bersama Maju dan Berdaya/ KUBEMADA) is an innovation of PGE's Lahendong Area to actualize community economic empowerment potential and as a response to the growing tourism in Minahasa Regency. Before PGE's Lahendong Area conducting the program, KUBEMADA's name was Maria Sewing Group. It is a woman sewing group that has received a training from the government of Minahasa Regency in 2019. They had the skill to sew and create bean bag products.

But the training was carried out only for three days without further assistance activities such as training result monitoring. Consequently, this woman sewing group in Toure Village, West Tompaso District, Minahasa Regency, only lingered for two years. They did not have customers or big market for sewing products.

Seeing this big but neglected potential, PGE's Lahendong Area acts through Social and Environmental Responsibility programs from Community Economic Empowerment pillar. PGE wants to revive the spirit and develop the sewing group's abilities so that they have bigger market.

"We want to encourage new products creation that can answer the tourism market need in North Sulawesi," Bagus Dimas Wibisono said.

With PGE's Lahendong Area assistant, Maria Sewing Group is capable to make 500 bean bags sold in all over North Sulawesi. These bean bags are sold in some types, they are 450 triangular bean bags, 20 round bean bags, and 30 mini bean bags. All of these bean bags are produced from April to December 2021. With the empowerment program, the members of this woman sewing group can have additional income about 3 million rupiah in 2021.

• AGRIBUSINESS DEMPLOT OPENS TOMOHON FARMERS' EYES

Minahasa is a regency in North Sulawesi Province that is considered to have big potential in developing agriculture products, one of them is chilli pepper.

Unfortunately, this big potential is not followed by the production level. The low production of chilli is caused by limited farming technology. In addition, a lot of farmers still use local seed and has not implemented proportional fertilization technique. If this situation keeps going, the low production problem will never be solved.



As a strategy to overcome this problem, PGE's Lahendong Area implemented a training program and bird's eye chilli pepper agribusiness demonstration plot (demplot) which use hybrid seeds and mulch, do proportional fertilization, and apply intensive cultivation.

Demplot or demonstration plot is an information giving method by directly showing the whole process of farming in a field to the farmers. Mulch is a layer of material that is put on the soil around the plant to conserve soil moisture, reduce weed growth, and improve the health of plants so that plants can grow well.

The program is carried out in coordination with the Agricultural Advisory Office (Balai Penyuluh

Pertanian) of South Tomohon District, from July to December 2021. The program is conducted in 3 fields that are belong to 3 farmer groups in Tondangow Ward, Tomohon City.

The three farmer groups who received the assistance with demplot method are Mahsawa Sawangan group with 28 members, Patar Farming Group with 23 members, and Tember Farming Group with 19 members.

PGE's Lahendong Area believe that an agricultural assistance program can create a conducive learning situation for the main actor of farming, hence make them ready to compete and have strong bargaining position in facing other groups related to their business development.



One of Tomohon's big potential is bird's eye chilli pepper. Hybrid seeds are used to enhance the production of bird's eye chilli pepper.

THE HEALTH QUALITY IMPROVEMENT PILLAR

Extending People's Livespans

• FINANCING JAMSOSTEK FOR VULNERABLE AND INFORMAL WORKERS

As a synergy in supporting the government of the Town of Tomohon's program and based on the health pillar of ESR programs, PGE's Lahendong Area gave aid in the form of helping financing JAMSOSTEK's (Jaminan Sosial Tenaga Kerja or Workers Social Insurance) dues for the informal or vulnerable workers in three wards around the operational area of the company. The wards are Lahendong, Pangolombian, and Tondangow. The dues' financing is for 300 informal or vulnerable workers. The dues are paid according to the regulation, that is Rp16.800 per month per person. PGE's Lahendong area paid them for 12 months until 2022.

• COVID-19 MANAGEMENT FOR THE COMMUNITY

PGE's Lahendong Area gave some funds to the Local Government Secretariat (Sekretariat Daerah/ Setda) of Minahasa Recency to help the government in the acceleration of vaccination program in Minahasa Recency. The implementation of the vaccination program was on December 29 to 31, 2021. In those three days, 315 persons in Minahasa Recency could have their first dosage of vaccine. The mobile vaccination was carried out by the Health Office of Minahasa Recency. Those who received vaccination also received a goodie bag to make more people participate in the vaccination program.

Other than in the acceleration of vaccination program, PGE's Lahendong Area also shows that it cares to the community around its operational area by giving social aid in the form of 2,700 kg of rice to the community in Tompasso Raya. This aid was presented through the Minahasa Local Government Secretariat.



THE INFRASTRUCTURE AND SOCIAL DEVELOPMENT PILLAR

Saving Life with Light

• STREET LIGHTING IN GPP UNIT 5 AND 6

As the form of company's responsibility, PGE's Lahendong Area installed 30 units of Public Street Lighting (Penerangan Jalan Umum/ PJU) on the streets in the area of Tompasso and West Tompasso District, especially around the area of GPP Unit 5 and 6. This installment was carried out in response to the minimal

lighting in some areas, which can lead to criminal acts and traffic accident.

The installment of the street lighting infrastructure was a form of effective responsibility that was carried out in ring 1 area of the company. After the street lightings were installed, PGE's Lahendong Area gave them to the government of Tompasso and West Tompasso District to be managed sustainably.

With 120 MW installed capacity, Lahendong GWA is estimated capable to supply electricity for 133.300 houses.



Karaha

 **Karaha Cakrabuana
West Java**
Geothermal Working Area (GWA)

 **30 MW**
Installed Capacity

 **33.000 houses**
Electricity supplies
estimation

 **1 Unit**
Geothermal
Power Plants

 **156,000 tCO₂eq/year**
Emission Avoidance Potential

 **1,419 BOEPD**
Saving potential of oil & gas
foreign exchange reserves





Reviving the History, Bringing Back the Heyday of Silk

Empowering nature's big potential to improve community's economy is the main purpose in PGE's Environmental and Social Responsibility program. Based on this responsibility, PGE's Karaha Area tries to help weavers and silk worm farmers in Karanganyar Hamlet, Cipondo Village, Sukaresik District, Tasikmalaya Regency, to restore their businesses that almost bankrupt during the Covid-19 pandemic.

Historically, it turns out that Tasikmalaya District has long become the home of silk worm farmers.

When Indonesia was in the monetary crisis in 1998, most of the people, including the young ones, chose to find works out of their village. When tried to help the community, PGE's Karaha Area saw that the silk worm farmers potential in Tasikmalaya Regency is still very big, even now.


Operate since 2018, PGE's Karaha Area is in Karaha Cakrabuana GWA with one unit of GPP.

TOP INNOVATION PROGRAM

A Cool Breeze When the Pandemic Strikes

Tasikmalaya Regency is the home of silk worm farmers with excellent quality product and potential big profit. These producers of silk cloth are never out of order. But during monetary crisis in 1998, the silk business that was run by almost everyone in the village was ruin. Consequently, the majority of men from the village chose to find some works in the city and left those who still tried to maintain silk cloth business in the village.

Kholip (50) is one of the silk worm farmers and silk cloth producers in Karanganyar Hamlet, Cipondo Village, Sukaresik District, Tasikmalaya Regency. He really feels the ups and downs of the business that becomes the pride or the village.

Kholip and his families each have silk businesses. In 2016, Kholip initiated to establish a natural silk woven cloth business group “Mardian Putera Sutera” with legal establishment letter from the village’s government office.

“At the beginning, our group has 10 members,” Kholip recalled.

The silk cloth woven by the group

led by Kholip has the best quality. He said this probably because his silk cloth is woven using ATBM (Alat Tenun Bukan Mesin or Non-Machine Weaving Device, a kind of treadle loom). It means, the silk cloth is woven using a simple loom, which movements are human operated.

As time goes by, there are more members of the group, from 10 to 25. The market of the silk cloths made by Mardian Putera Sutera business group is middle and upper economic group. The orders come mainly from Jakarta and Bandung. Indonesia’s reputable designers such as Itang Yunasz and Harry Ibrahim also ordered silk cloth from this group. This is because the group often take part in trade fairs and fashion shows in big cities.

“From here, the designers begin to know our weaving products,” Kholip said.

In a month, the group led by Kholip is able to sell 12 to 15 cloths with average price of Rp600 thousand for 220 cm and Rp4 million to Rp5 million for 270 cm cloth. But just when business was doing well, the Covid-19 pandemic came. All activities stopped and the group’s income plunged down to 70 percent.

Before the silk worm inside the cocoon turns into moth, the cocoon must be harvested immediately.



Indonesia's reputable designers such as Itang Yunasz and Harry Ibrahim also ordered silk cloth from this group.



In 2021, PGE's Karaha Area came to give assistance in developing the business from upstream to downstream. The program from PGE's Karaha Area is called Bu Lastri or Budi Daya Ulat Sutra dan Agro Industri (Agro-Industry and Silk Worm Farming). Assistance in upstream operations is for the silk worm farming, including soil preparation, providing the superior mulberry seed for caterpillar's food, tending the silk worm house, and revitalization of cocooning tool. In downstream operations, the assistance activities are enhancing the group management capability, giving training on coloring technique, and helping branding the product.

"After the presence of PGE Karaha, our members became 37. They have

different roles, from planting the mulberry trees as the main food for silk worms, the silk worm farming, spinning the silk thread, weaving the silk cloth, to marketing," Kholip added.

Widodo Suwanto, PGE's Karaha Area Health Safety Security and Environment Manager, said that the program from PGE's Karaha Area is a subsystem innovation program because it can help the community to protect the environment through integrated silk worm farming. One of the innovations of this program is the utilization of mulberry leaves to make mulberry tea.

"The innovation program can create new business opportunity to the group," he said.

THE EDUCATION QUALITY IMPROVEMENT PILLAR

Broaden the Access to Education

In order to ensure good quality education activities, PGE's Karaha Area conducting programs of educational aids and development of the service of education with the purpose to eliminate obstacles to the access to education and improve learning quality both for the teacher and the student. The aids given by PGE's Karaha Area include loud speakers aids, the construction of school field to support extra curriculum activities, and the construction of school fences.

Other than that, PGE's Karaha Area also repaired education facilities in five villages, which have not had proper access to education.

• PGE KRH GOES TO SCHOOL

In terms of environment education, PGE's Karaha Area also actively gives the education about geothermal energy to the people of Karaha, from elementary to university students to the communities, through the program of PGE KRH Goes to School.

PGE's Karaha Area supports traditional art community to preserve Sundanese performing art such as dance, song, and music.



THE CARE FOR THE ENVIRONMENT PILLAR

From Waste to Animal Feed

• UTILIZING MAGGOT AND AZOLLA FOR ECONOMY AND ENVIRONMENT

At the time of “stay at home”, when people’s movement was limited, food consumption was increasing. The effect from this is real, that is more and more uncontrollable piles of domestic waste. Seeing this, PGE’s Karaha Area committed to assist the community in domestic waste management which at that time was almost uncontrollable.

Together with the community, PGE’s Karaha Area actualized the program BuMala (Budidaya Maggot dan Azolla or Maggot and Azolla Farming). This program is a community empowerment one where people are educated to manage the domestic waste to become maggot’s feed and in turn these maggots will become cattle’s or other animal’s feed. Apart from maggot, utilization of azolla which previously unknown to the community is also become an education of its own.

Before the program, people do not know that azolla can be used as animal’s feed, so they only leave the plant as it is.

From maggot and azolla farming, the community can earn income for their daily need or use it for their own cattle. Maggot farming has been proved to be able to overcome the domestic waste problem and meet the need of alternative animal’s feed for the community’s cattle and poultry.

About 12 thousand larvae of black soldier fly (BSF) can consume about 2 kilograms organic waste only in 24 hours. A female BSF can produce 600 eggs. Therefore, only 20 female BSF are needed to have 12.000 larvae to get rid of organic waste every day.

Accomplishments of Environment Innovation Program

• VERANDINE (T-CELUP) ENERGY EFFICIENCY INNOVATION

This innovation came up because not every point in PGE’s Karaha Area production pipe line had lamp installed, thus it was not safe for operators or security guards to monitor production facility. Therefore, PGE’s Karaha Ares utilizes



According to the website of the Agriculture and Food Resilience Office of Bali Province, the azolla contains essential amino acids, vitamins, minerals, and high in protein. It is also low in lignin, so it is easy to digest by animals.

wind energy to power Verandine device that will give power to turn on the lamps.

Before the program, street lighting in some points is very limited, hence increase accidents' potential for workers and neighboring community while they are on the road. After the program, the company is capable of providing good quality lighting for the road and the traveling from GPP to the geothermal well cluster is faster, safer, and more comfortable.

• LOWER OWN USED ENERGY USING PASSIVE INFRA-RED INDOOR LIGHTING SENSOR

PGE's Karaha Area developed this innovation program to lower own used electricity, thus electrical usage efficiency is achieved and energy emission is lower. The MCC room is equipped with infra-red sensor to control the lamps to be on or off in the room. If the infra-red sensor detects there is a human movement in MCC room, the lamps will automatically turned on. But if there is no movement, in a few minutes the lamps will automatically turned off.

This innovation is implemented in Indonesia for the first time for GPP sector since it is not yet recorded

in the documents of Best Practice 2017 up to Best Practice 2020 of The Ministry Of Environment and Forestry. Before this innovation, the lamps in the well cluster's MCC room were on for 720 hours/month. After the innovation, this duration was lower as much as 20% and thus gave impact in lowering the emission as much as 0.3875 ton CO2 on 2020 which was equal to Rp52,692 cost saving.

• LOWER OIL USE WITH EQUIPMENT PERFORMANCE MONITORING

PGE's Karaha Area developed this innovation program to reduce used oil waste by utilizing the equipment performance monitoring. With this program, the oil change period becomes longer thus reducing used oil waste. This program gave impact on components change activity. The oil lubricant change procedure is now based on the condition or performance of an equipment.

Before the program, the oil change process is conducted periodically according to the manufacture change table. After the program, the use of oil lubricant to maintain equipment is lowered by 50% in average and in turn lower used oil waste by 0.3875 ton in 2020.

• IMPROVING THE QUALITY OF DOCUMENTATION AND OPERATIONAL DATA INFORMATION SYSTEM WITH OASIS APPLICATION

PGE's Karaha Area made the innovation of OASIS application to enhance documentation and information system through mobile application or digitalization. With this application, it is not required anymore to use paper for things such as operator regular check sheet, ROT, or shift handover. Before the program, the information and documentation system of operational function was not yet effective nor efficient. In one year, there were 249 mistakes in documenting data, in form of data loss/flawed, unclear data, or mistake in writing the data.

Before the use of OASIS application, the whole activities in the operational function used paper to record things and in one year it could reach up to 2,769 pieces of paper. After the application, paper use drops to 100%.

• OPTIMIZING MUD CLEANING PROCESS IN BASIN COOLING TOWER USING SCBA (SMART

The company is capable of providing good road quality lighting and now the travel is faster, safer, and comfortable.

CLEANING BASIN AREA) TOOL

This program was developed due to PGE's Karaha Area's problem in cleaning the mud in basin cooling tower, during which process the whole water in basin cooling tower (1,392 m3 in volume) must be pumped out during unit shutdown. The SCBA (Smart Cleaning Basin Area) tool is made to reduce loss water potential during the cleaning process. It utilizes vacuum mechanism to reach certain range. The tool is designed to vacuum with the help of water from the condensate booster pump.

Before this program, the whole water inside the basin cooling tower with the volume of 1,392 m3 must be pumped out during the cleaning process. After the program, the discharged water is only 311 m3 or there are 77.62% saving (from full volume of the basin).

THE COMMUNITY ECONOMIC EMPOWERMENT PILLAR

Developing the Community through Nature

Not only the silk worm farming, PGE's Karaha Area also implements Social and Environmental Responsibility program which comes from the five pillars. The SER program is PGE's Karaha Area commitment to nature conservation and community economic empowerment.

• KARAHA COFFEE FARMERS EMPOWERMENT

The coffee farmer group empowerment is given to Mekar Harapan Farmer Group which has 40 members and located in Dirgahayu Village, Kadipaten District, Tasikmalaya Regency, West Java. PGE's Karaha Area give assistance to enhance farmers capability in coffee farming in an area of 40 hectares plantation.

This farmer group supplies about 40 kilograms of roasted coffee beans every week to be distributed domestically. They also export wet ground coffee to European market. Other than Mekar Harapan Farmer Group, PGE's Karaha Areas also empowers Talaga Coffee Farmer Group in Sukahurip Village, Garut Regency.

Both of these farmer group are empowered under the Eco Eduwisata Kampung Kopi (Coffee Village Eco-Edu-Tourism) program which is one of the top programs of PGE's Karaha Area.

Seeing that the nature and human potential of this area can be optimized, in 2021 PGE's Karaha Area along with Mekar Harapan Farmer Group established 2 other groups. They are Kelompok Wanita Tani (KWT) Mekar Harapan (Mekar Harapan Woman Farmer Group) and the Mekar Harapan Millennial Group.

The KWT Mekar Harapan is in charge for processing food ingredients into coffee snacks. This group comprises 15 women. The Millennial Group is a group of teenagers and young persons of Dirgahayu village. They are in charge of managing the social media and the merchandise. Through the assistance, PGE's Karaha Area tries to integrate all parts of community in developing their business, especially to highlight the special character of Karaha coffee.

In October 2021, PGE's Karaha Area implemented the program of training about the coffee tourism village merchandise making. People were trained to make screen printed shirt, food from coffee ingredient,

❖ The coffee farmer group empowerment is given to Mekar Harapan Farmer Group which has 40 members and located in Dirgahayu Village, Kadipaten District, Tasikmalaya Regency, West Java. PGE's Karaha Area give assistance to enhance farmers capability in coffee farming in an area of 40 hectares plantation.





DOC BY FREEPIK

coffee perfume, and souvenirs from low quality coffee beans to eliminate production waste.

PGE's Karaha Area also gives training on product serving and marketing in social media. This training is for KWT Mekar Harapan and the Millennial Group of Dirgahayu Village.

• **SUNFLOWER VILLAGE AGROTOURISM**

This program has a big potential in the plan of developing tourism village in Karaha.

The implementation in carried out in Kadipaten Village, Cinta Village,

and Cikadondong Hamlet. Hard roots are planted every 500 meters area to give impact to the environment sustainability.

PGE's Karaha Area gives trainings, improves human resources, and helps to manage sunflower agrotourism and improve the quality of seed. The company also gave infrastructure aids such as built the green house, irrigation, and welcome gate at the tourist location.

In 2022, this program will be replicated in Kadipaten Village, which will be managed by local community and the students of Islamic boarding school.



PGE's Karaha Area gives trainings, improves human resources, and helps to manage sunflower agrotourism and improve the quality of seed. The company also gave infrastructure aids such as built the green house, irrigation, and welcome gate at the tourist location.

THE HEALTH QUALITY IMPROVEMENT PILLAR
“Sehati” for the Future Generation

PGE's Karaha Area emphasizes the Pertamina Sehati (Sehat Anak Ibu Tercinta/ Beloved Mom's Child is Healthy) program to achieve the implementation of Sustainable Development Goals (SDGs) in health aspect. It is a replication of the same program in PGE's Kamojang Area.

PGE's Karaha Area assists pregnant mothers dan health cadres with trainings about local food management and innovation to prevent stunting. Children with disability also receive assistances. There are also supplemental food giving for toddlers.

Those who receive benefits from this program are the people who live in 5 villages around ring 1 of operational area of PGE's Karaha Area. In 2022, PGE's Karaha Area also duplicated the Eduplay Therapy program from PGE's Kamojang Area with the theme “Inclusive Community Environment for Progressive Growth of Children with Disability”.

The program is a social innovation for children with special need. PGE's Karaha works in coordination with GWYN (Grow with Your Needs) Foundation dan Pangatikan Community Health Center (puskesmas) in Garut, West Java.

PGE's Karaha Area assists pregnant mothers dan health cadres with trainings about local food management and innovation to prevent stunting. Children with disability also receive assistances. There are also supplemental food giving for toddlers.





Lumut Balai



**Lumut Balai
& Margabayur**
South Sumatra
Geothermal Working Area (GWA)



55 MW
Installed Capacity



61.000 Rumah
Electricity supplies estimation



1 Unit
Geothermal
Power Plants



300.000 tCO₂eq/year
Emission Avoidance Potential



2.600 BOEPD
Saving potential of oil & gas
foreign exchange reserves



Bringing Back the Coffee Brand in Kelumpang Village



In Lumut Balai Area PGE operates 1 GPP with 55 MW installed capacity.

The working area of PGE's Lumut Balai Area is in Lumut Balai dan Margabayur, about 108 kilometers from the town of Baturaja, Ogan Komering Ulu Regency, South Sumatera Province. The Ogan Komering Ulu (OKU) area has coffee plantation potential that almost unknown to public. Until now, most people only know Lampung coffee because when the coffee from Ogan Komering Ulu is sent out of the area, the name of Ulu Ogan coffee is disappear.

One of the reasons is because the majority of the farmers sell the coffee in the form of green beans

and without any name nor brand. This condition might happen because the farmers have not understood postharvest management strategy and do not have proper product packaging to market the coffee.

Seeing this condition, PGE's Lumut Balai created a program to develop coffee farmers group and enhance their skill in coffee farming. Ryan Dwi Gustriandha, PGE's Lumut Balai's Government and Public Relations Senior Supervisor, said that the profession of majority of people who live in Kelumpang Village, Ulu Ogan District, Ogan Komering Ulu Regency, South Sumatera Province is coffee farmer.



After harvested, coffee beans are dried under the sun. To make them dried evenly, the coffee beans have to be turned over from time to time.

TOP INNOVATION PROGRAM

Ulu Ayakh, Local Coffee with Big Ambition

PGE's Lumut Balai Area through Environmental and Social Responsibility (ESR) program in the pillar of Economic Empowerment gives assistance and training on coffee farming to the farmers so that they can have better quality coffee. With the training, the farmers can work more efficiently and effectively. One of the farmer groups that became foster partner to PGE's Lumut Balai is Ulu Ayakh Coffee.

"Ulu Ayakh Coffee as a foster partner of PGE's Lumut Balai Area has received equipment aid in the form of one set of roasting machines with five kilograms capacity and one unit coffee grinder machine and coffee press machine," revealed Ryan.

After the economic empowerment program from PGE's Lumut Balai Area, the coffee farmers started to understand how to manage their business after harvest.

In addition, the coffee farmers finally have product packaging with proper branding for marketing, thus

increases the demand and coffee production number.

Darul Qutni (45), the owner of Ulu Ayakh coffee brand admitted that he is eager to make the coffee that is original from Kelumpang Village to be known outside the island of Sumatra and not known only as Lampung coffee without name anymore. With Ulu Ayakh Coffee, Darul Qutni hopes they can bring the name of Ulu Ogan that is rich in nature potentials—including coffee—and make it renowned to a lot of people.

"With people know the name Ulu Ogan through Ulu Ayakh Coffee, it will open business opportunity to the whole community in Ulu Ogan District," said Darul.

One problem that they still face today is the road condition to Ulu Ogan District. People have difficulty travelling to and from the district by road, especially in cars due to the poor condition of the road. This condition has a quite big effect to the comfort of guests or tourists that come from outside the district.

THE EDUCATION QUALITY IMPROVEMENT PILLAR

Supporting the Teacher for the Future of New Generation

• **TEACHER EMPOWERMENT FOR THE FUTURE GENERATION**

With the advancement of technology, PGE's Lumut Balai Area feels there have to be facilities to improve the capacity and prepare the professional skill of Indonesian young generation in many areas of profession. To form the future generation that is smart, it needs good quality teacher. Based on this concern, PGE's Lumut Balai create a program to improve the quality of teachers, in capacity, skill, and prosperity.

Other than that, PGE's Lumut Balai Area also gave aids of supporting facilities for learning activities. They are for students of Elementary Grade 6 and Junior High Grade 8 in Semende Darat Laut District, Muara Enim Regency, and students of Elementary Grade 4, Junior High Grade 7, and Madrasah Ibtidaiyah

Muhammadiyah Grade 2 in Ulu Ogan District, Ogan Komering Ulu Regency.

The purpose of these programs is to enhance teacher's professional ability in improving the process and result of learning, through aids that mainly have teacher professional service in nature. If the process of learning is improved, the result of learning will be improved too. Hence, a series of teacher professional assistance efforts will give way to the achievement of learning purpose.



“There is no bad student, only bad teacher.” That was what Miyagi teacher said in the movie *The Karate Kid* (1984). It needs quality teacher to make the future generation smart.





THE CARE FOR THE ENVIRONMENT PILLAR

Tiny Garbage Eater

• TRAINING ON GARBAGE MANAGEMENT AND MAGGOT FARMING

One of the quite disturbing problems in Pulau Panggung Village, Semende Darat Laut District, Muara Enim Regency, South Sumatera is the community's low awareness to properly dump the garbage and manage them. This caused a big pile of garbage at the edge of the village which certainly is not good for health, makes the passersby uncomfortable, and erodes the land on the side of the road.



The people in Muara Enim, South Sumatera, now know how to use maggot as a solution for environmentally friendly garbage management.

Seeing this situation, PGE's Lumut Balai Area tried to begin a garbage management program that utilizes maggots as a medium to manage organic waste. The garbage management program plays as a bridge to the development of maggot farming program in Semende Darat Laut District, where people are still foreign to this environmentally friendly garbage management technique.

Before the program from PGE's Lumut Balai Area, there were piles of garbage in some points of the village and on the road sides of Pulau Panggung Village. In addition, portable garbage bins were still limited and people had not known the technique to sort organic waste. After the program from PGE's Lumut Balai Area entered the village, the community in Pulau Panggung Village have a standardized dumping place, organic garbage bins in every part of the village, and knowledge about the organic waste sorting.

THE COMMUNITY
ECONOMIC EMPOWERMENT PILLAR

Supporting Creative Young People Initiative

Lumut Balai area has high economic and tourism potentials. Therefore, the Social and Environmental Responsibility (SER) program executed by PGE's Lumut Balai Area is mostly implemented in the pillar of Economic Empowerment, while also paying attention to other pillars.

- **DEVELOP NATURE TOURISM, CHANGE THE HABBIT**

Belanting River Tubing is viral. The new tourist destination is in Kelumpang Village, Ulu Ogan District, Ogan Komering Ulu Regency, South Sumatera Province. Now the spot is packed with tourists.

When first launched in 2021, this nature tourist destination immediately attracted many people. Moreover, they were already bored because they have been contained at home too long since they had to stay at home to prevent the spread of the Covid-19 virus.

Travel along a river using an inner tube of truck tire or river tubing is a top tourist activity in Kelumpang Village that is managed by Belanting River Tubing group.



In this tourist destination, tourists travel along the Ogan River for 2.5 kilometers using an truck tire inner tube. *Belanting* is believed to be the term used by Ogan people for playing with water in a river using used car tires.

This tourist destination is located about 70 kilometers from the town of Baturaja or about two hours travel using two or four-wheel vehicle. The tourists only have to pay Rp50 thousand per person to enjoy the activity and they can get photos and a videos of their activities and also a cup of hot coffee after finished playing in the water.

• CREATIVE INITIATIVE FROM OKU YOUNG PERSONS

Belanting River Tubing came from a man's dream. Darul Qutni (45) dreams that someday Kelumpang Village will be famous for its nature potentials. Seeing how big the natural resources potential in Ogan River, with clear water, big boulder stones, and small rapids, Darul felt

it is very suitable to become a water tourist destination that family can enjoy.

"Nature potential as a gift from The Creator has to be used and managed well," said Darul.

Like a stroke of luck, when Darul mentioned this idea, PT Pertamina Geothermal Energy's Lumut Balai Aera had ESR program. The company then gave some trainings including increasing the management skill on river tubing tourist activity to the members of Belanting group, and gave equipment aids to support the management of the tourist destination, such as the tubes, helmets, life jackets, camera, location signage, and other supporting tools.

Ryan Dwi Gustriandha, PGE's Lumut Balai Area's Government and Public Relations Senior Supervisor, said that before this tourism program, Ogan River was a place to dump trash and all kind of waste, including to defecate. After the tourism program executed, bit by bit the community's habits changed and they realized the importance to preserve the river for the

sustainability of life.

Apart from the behavior change, community's economy also began to thrive with the tourism program of Belanting River Tubing. Since the area is a coffee producer, the community now starts to market its coffee-related products as gifts and souvenirs for the tourists.

One of their big challenges now is they still do not have sufficient tourism infrastructure. "We don't have the change room yet. The road infrastructure also needs more attention. These may be our focus for the next program," said Ryan.

• THE UNTOUCHED BIG POTENTIAL

Other than coffee, bamboo trees are also abundant in Ulu Ogan District. Actually, this clustered tree has long been used to make bamboo weaving crafts by some groups of people in Kelumpang Village, but the craft have not had high sale value. The bamboo weaving craft made by the artisans in Kelumpang Village have unique characteristic as a culture with

"Nature potential as a gift from The Creator has to be used and managed well," said Darul.

local wisdom. Most of the bamboo weaving crafts produced in this area are used in agriculture sector, such as farmer's hats, baskets, coffee scoops, and many other crafts.

As a form of environmental and social responsibility to surrounding community that has craft potential, PGE's Lumut Balai Area gave bamboo craft training to improve the community's skill in developing bamboo craft and producing weaving products with high value. The artisan groups also have passion in developing business of bamboo crafts as the form of their local wisdom art.

THE HEALTH QUALITY IMPROVEMENT PILLAR

The importance of the First 1,000 Days of Life



• STUNTING THREAT AS COMMON CONCERN

Stunting is a chronic nutrition problem caused by insufficient nutrition intake in quite a long time. Generally, this happens because food intake does not meet the nutritional need. Other than obstructed growth, stunting at times is associated with delayed brain development.

PGE's Lumut Balai Area responded the stunting situation with a program to give health information about the importance of giving good nutrition in the first 1,000 days of a child's life to prevent malnutrition. PGE's Lumut Balai Area also gave education about giving nutritious food for babies and toddlers.

• Palembang's traditional outfit is called aesan gede. This South Sumatera's traditional outfit is dominated with red and golden color.



• Good infrastructure will support the community's social and economic activities really well.

THE INFRASTRUCTURE AND SOCIAL DEVELOPMENT PILLAR

Infrastructure Development for Community's Well-being

To make sure that PGE's Lumut Balai Area's business operates well, it needs the involvement of all stakeholders that are impacted directly or indirectly by PGE's Lumut Balai Area's geothermal business activities. This stakeholders' involvements are necessary to make all geothermal developing activities capable to give direct benefit to the life of the community around the company's working area.



Sibayak



**Mount Sibayak &
Mount Sinabung
North Sumatra**

Geothermal Working Area (GWA)



12 MW
Installed Capacity



13.300 houses
Electricity supplies
estimation



3 Unit
Geothermal
Power Plants



62,400 tCO₂eq/year
Emission Avoidance Potential



568 BOEPD
Saving potential of oil & gas
foreign exchange reserves





Warmhearted to Earn Hearts


As an implementation of Social and Environmental Responsibility, PGE's Sibayak Area tries to build good relations with the stakeholders around the working area of PGE's Sibayak Area, such as the community.

The company does this to support the operational activities in the area. The programs conducted by PGE's Sibayak Area have the purpose to drive local economy and also improve the quality of life and health of the community around the working area.

Suheri, PGE's Sibayak Area's

Health Safety Security and Environment (HSSE) Operation Senior Supervisor, said that this program is executed as a form of commitment of the company's responsibility and to make a bond in the company and community's relations.

"If the community have a sense of belonging, we hope the community around the working area can help us create a safe situation for the company. This kind of situation will protect the company from the threat or disruption from outside of the company," he said.

 PGE's Sibayak Area is located in Mount Sibayak-Mount Sinabung GWA. Here PGE operates one unit monoblock and two units GPP.

THE COMMUNITY ECONOMIC EMPOWERMENT PILLAR

Capturing the Big Potential

The Pertamina Geothermal Energy (PGE)'s Sibayak Area is located in Mount Sibayak-Mount Sinabung Geothermal Working Area (GWA), in North Sumatra Province. In this area, in Sibayak Valley to be precise, bamboo grow abundantly. Unfortunately, people have not used that potential very well.

PGE's Sibayak Area saw this and tries to make the most of this resource. Hence, the company created the program: Development of Bamboo Artisan as Creative Community Resources.

The subjects of this program are the Sibayak Valley's bamboo artisans who live in Doulu Village and Semangat Gunung Village, Karo Regency.

One of the purposes of this program is to support the hot water spring bath tourism in Sibayak that has operated some time before.

In 2022, the training for the bamboo artisans was held in the artisan workshop in Semangat Gunung Village, to be exact in the area of PT Pertamina Geothermal Energy's Sibayak Area, every week.

There are four artisans to assist in this program. They are Ranga Purba, Erni Sitinjak, Supri Tarigan, and Laksana Ginting. The four artisans are now capable to make 22 types of bamboo weaving products.

Before the program, the bamboo craftsman community only made baskets and had minimal knowledge about marketing.

After the assistance, the members of the group realize and understand that creativity is an important key in selling craftsmanship products. Now bamboo baskets are not the only thing they sell. They have various products and each have a market of its own.



This bamboo basket is one of bamboo crafts products made from the creativity of Sibayak people, North Sumatra.



DOC BY FREEPIK



THE HEALTH QUALITY IMPROVEMENT PILLAR

The Malnutrition Demolition

PGE's Sibayak Area has big attention to stunting cases and nutrition for toddlers. Stunting is a condition when a child is too short for his or her age.

Based on Nutrition Status Monitoring (Pemantauan Status Gizi/PSG) data for the last three years, short height problem has the highest prevalence among other nutrition problems. And the North Sumatra Province is listed in number four as the province with highest stunting prevalence, that is 42.3 percent.

Based on this condition, PGE's Sibayak Area gives education and seminars about nutrition, stunting, toddlers nutritional food giving, pregnant mother, and nursing mother. The subjects of this program are the community and posyandu's (mother and child health post) cadres in ring 1 zone of PGE's Sibayak Area's operational area (Semangat Gunung Village and Doulu Village). The purpose of this activity is to create human resources that is healthy and free from malnutrition, help the community to get free health service, and monitor community's health condition.

Stunting can cause hindrance in child's growth, low immune system that makes them easily sick, and poor cognitive performance.



CHAPTER 6

Facing the Future

Indonesia is surrounded by volcanic trails—the Pacific Ring of Fire. Owing to the large number of volcanoes, Indonesia is blessed with the abundant natural resources, particularly the geothermal resources.

At least 40 percent of global geothermal reserves are located in Indonesia. If this nation can take full advantage of the immense potential, it will certainly be the leading center of the international geothermal sector in the future. PT Pertamina Geothermal Energy (PGE) will certainly not be idle on this.

Indonesia's enormous geothermal potential is one of the important keys to actualize the accomplishment of national target on electrical power generated by renewable energy. To this day, PGE has contributed about 82 percent of total national installed capacity in geothermal energy. PGE will never stop to actualize its commitment and give contribution to

increase Renewable Clean Energy in national energy mix into 23 percent by 2025, especially in geothermal energy.

Commitment to Reduce Greenhouse Gas Emissions

In every climate change conference, the Indonesian government constantly affirms that the country is ready to take genuine steps in reducing green house gas emissions. PGE certainly plays a role.

Today, with self-operated working area's capacity of 672 MW and joint operation contract's capacity of 1,205 MW, PGE as part of Pertamina's Power and New Renewable Energy (PNRE) sub-holding has participated in reducing carbon emission to more than 9 million tons CO₂eq per year.

Toward Zero Net Emission 2060

The Earth is in dire state. This is acknowledged around the globe. The carbon emission that has been released to the atmosphere is now suffocating the world. Thereby, the world leaders have come up with Net Zero Emissions commitment which targeted to accomplish in 2060 or sooner.

The Net Zero Emissions is a condition when the amount of carbon emissions that is released to the atmosphere is not surpassing the amount that the Earth could absorb. To achieve this, the world needs a transition from dirty energy system to clean energy system to accomplish balance between human activity and nature sustainability.

The big idea of Net Zero Emissions came up and began its popularity after the Paris Climate Agreement 2015. Indonesia is one of the countries that ratified this agreement by making Laws (Undang-Undang) No. 16 year 2016 about the Ratification of Paris Agreement to the United Nations Framework Convention on Climate Change.

Through this Laws, the government of Indonesia implements five main principles. They are: increasing the utilization of Renewable Clean Energy; reducing fossil energy; using electrical vehicles in transportation

sector; increasing the utilization of electricity in households and industries; and utilizing Carbon Capture and Storage (CCS).

In clean energy sector, PT Pertamina Geothermal Energy has big intention to guard Net Zero Emission 2060 target. One of PGE's commitments in the efforts to reduce carbon emission is showed by applying Clean Development Mechanism (CDM).

The CDM is a project to reduce greenhouse gas emissions by effectively managing the carbon, which in certain aspect also opens economic potential through carbon credit. Until now, there are five carbon credit projects in type of Clean Development Mechanism Gold Standard (CDM-GS) that have been implemented by PGE. They are:

- Kamojang unit 5
- Karaha Unit 1
- Lumut Balai Unit 1 and 2
- Lumut Balai Unit 3 and 4
- Ulubelu Unit 3 and 4

Other than obtain "Gold Standard" level, PGE also has a carbon credit project in type of Verified Carbon Standard (VCS) in Lahendong Unit 5 and 6. This certification focuses on developing new methodologies other than CDM with relatively more simple mechanism and lower cost transaction.





Sustainable Responsibility

One of the efforts to maintain the quality of the environment and community around the company's projects area is by conducting Social and Environmental Responsibility programs. It needs commitment to ensure the implementation of programs and activities can really increase the prosperity of local community.

The SER programs can also become foundations in maintaining the sustainability of nature and the environment of the working

area, since local community and its environment are strategic stakeholders that cannot be neglected.

The policies cannot be implemented without high commitment in executing sustainable development. Paying attention to the stakeholders in every operational area is an important lesson. By listening, accepting, and discussing what the community needs, this company will be closer to the community's conditions and needs, and will understand what the next step should be.

ENERGIZING GREEN ENERGY
**Endless Commitment to Actualize
the Sustainable Energy Transition**

This book outlines the environmental and social responsibilities programs carried out in six working areas of PT Pertamina Geothermal Energy: Kamojang, Ulubelu, Lahendong, Karaha, Sibayak, and Lumut Balai.

The narrative illustrates the flagship programs and community empowerment innovations in each area, accompanied by visuals that bring together stories of people and the landscape.

We hope that this book will foster the ideas of conservation-based community development initiatives and enable the public to obtain information regarding our activities.

GREEN GREEN



“PGE has set out a road map for the development of installed capacities in PGE Geothermal Working Areas for the next five years in order to prepare the geothermal [energy] as a sustainable clean-energy base-load plant in Indonesia.”

- PT PGE PRESIDENT DIRECTOR, **AHMAD YUNIARTO**,
“G20 SUSTAINABLE FINANCE FOR CLIMATE ACTION”, NUSA DUA, BALI, JULY 2022.