APPLICATION FORM
ASEAN Renewable Energy Project Awards
ASEAN Energy Awards 2024

Rai Ruen Rom

Sustainable Living Learning Center & Off-grid Organic Farm

ASEAN Energy Awards 2024
Off-grid: Power

APPLICATION FORM

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Introduction
Established on 1 January 1999, the ASEAN Centre for Energy (ACE) is an independent intergovernmental organisation within the Association of Southeast Asian Nations (ASEAN) structure that represents the 10 ASEAN Member States' (AMS) interests in the energy sector. The Centre accelerates the integration of energy strategies within ASEAN by providing relevant information and expertise to ensure the necessary energy policies and programmes are in harmony with the region's economic growth and environmental sustainability. It is guided by a Governing Council composed of Senior Officials on Energy from each AMS and a representative from the ASEAN Secretariat as an ex-officio member. The Ministry of Energy and Mineral Resources of Indonesia hosts ACE's office in Jakarta. First held in 2000, the ASEAN Energy Awards is Southeast Asia's highest recognition for excellence, creativity, practicality and dedication to a cause in the energy field. It is an annual event organised by ACE in collaboration with the ASEAN Specialised Energy Bodies (SEBs), particularly the Renewable Energy Sub-sector Network (RE-SSN), for the ASEAN Renewable Energy Project Awards. The ASEAN Energy Awards aim to promote awareness and greater private sector participation.

Objective
1. To promote and disseminate best practices in renewable energy projects in the ASEAN member countries. 2. To encourage all sector participation in adopting and implementing innovative and creative RE projects to enhance business growth. 3. To promote RE as another form of energy resource; to complement and improve environmental quality in the ASEAN region. 4. Ultimately, the objective of the competition is to exchange knowledge and experience in developing and maintaining the RE projects as part of the ASEAN spirit.

SUBMISSION GUIDELINE

Application Form for Category:

1. **OFF Grid**
   a. Power
   b. Thermal
2. **ON Grid**
   a. National Grid
   b. Local Grid
3. **Combined Heat and Power**
4. **Biofuels**

Application Format, Terms and Conditions

The following is the general guideline for the submission of an application:

1. Prequalification: RE source and at least one (1) year in operation
2. No. of page maximum 15 pages
3. A4 size, 12cpi and Times New Roman
4. Endorsement: By the focal point and authorisation letter by the owner for the site visit

APPLICATION FORM

ASEAN Renewable Energy Project Awards
ASEAN Energy Awards 2024

Application Number *(Office Use Only)*	

Category	**OFF Grid** ☑ **Power** □ **Thermal**
	ON Grid □ **National Grid** □ **Local Grid**
	□ **Combined Heat and Power**
	□ **Biofuels**

Title of Activity/Project/Theme	
Rai Ruen Rom: Sustainable living learning center and off-grid Organic Farm	
Source of Energy	Solar / Biogas / Battery hybrid microgrid
Age of Project/Commercial Operating Date (COD)	January 2016

Applicant General Information	
Name of Company	Rai Ruen Rom
Primary Contact Person	Mr. Somsak Phohom
Designation	General Manager
Business Address	97, Moo 10, Ngio Subdistrict, Thoeng district, Chiang Rai, 57160, Thailand
Project Site Address	97, Moo 10, Ngio Subdistrict, Thoeng district, Chiang Rai, 57160, Thailand
Telephone	+66 95 134 8821
Mobile Phone	+66 84 433 1161
Fax	-
Email	noonperfect@gmail.com
Website	www.rairuenrom.com

Nature of Business
Integrated off-grid organic farm powered by solar and biogas. Learning center for sustainable living.
Project Abstract
In 2014, founders of Rai Ruen Rom had the idea of developing a social enterprise which would create maximum benefit to all parties; farmers, consumers and the overall ecosystem. The project created a solid foundation by developing a core team in agriculture, integrated organic farm, renewable energy, organic waste management. Beyond being a social enterprise, the organisation gives everyone the opportunity to participate and create a self-development atmosphere for the team. Everyone has the motivation to self-develop, self-value and with a purpose in life. Let Rai Ruean Rom be a community space that will open up experiences and inspire people to return to finding balance with nature and themselves. This is through the experience of organic farming, healthy eating and sustainable living. Rai Ruen Rom orgnises activities and courses to study organic lifestyles, being close to nature through fresh agricultural and organic products that meet international standards to deliver the best health to all consumers. The concept of sufficiency economy is applied to drive the operations for a sustainable development. The goal is to be a role model for using clean energy in agricultural businesses that grow together with the community. Solar and biogas is used in all processes from farming, production and accommodation. A new experience for customers and those who come and learn the way of sustainable living. The key is to showcase that emission reductions is possible while creating an affordable and accessible product to everyone. Rai Ruen Rom believes that every living organism is valuable and every life depends on each other.    
Employment Opportunities Executive: (Technical) ____3____ (Non-Technical) _____ Non-Executive: _____90_____

APPLICATION FORM

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CERTIFICATION AND ENDORSEMENT

Rai Ruen Rom hereby agreed to allow the ASEAN Board of Judges and other experts that may be designated by ACE to visit the RE project site and verify the authenticity of the data. However, two weeks advance notice is required to allow for necessary arrangements.
We also hereby agree that ACE can publish the whole submission in ACE publications and website without any prior consent of the owner of the RE project. If the submission is published in other publications, the consent of the concerned RE project owner would be required.
We, the undersigned, certify that the information given is true, accurate, and prepared with the consent of the party/ies involved.

…… **(Ms. Siriwimol Kitapanich)** Managing Director, Rai Ruen Rom Tel.: +66 81 616 5313 Fax: - E-Mail: rairuuenom.chiangrai@gmail.com	…… **(Mr. Somsak Pohom)** *General Manager, Rai Ruen Rom* Tel.: +66 84 433 1161 Fax: - E-Mail: noonperfect@gmail.com

Endorsed by Focal Point

……
(Mr. Pongsak Prommakorn)

Position: Executive Director, Energy Research Division
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A. ORIGINALITY

A.1 Project Profile

Design

Establishment of the microgrid (2016-2020)
In 2016, Rai Ruen Rom made a decision to start their own renewable energy microgrid in an off-grid area. All activities inside the organic farm are powered by solar, from agricultural plots, product processing to restaurants and accommodation. With a solar capacity of 200 kWp instead, the system is capable of supplying 1-2 small villages in Thailand. Being off-grid, the system stores energy during the daytime in batteries which are then used to supply the nighttime loads. In 2016, diesel generators were used as the last source of energy when there is no solar and no battery capacities available. To save energy, walkways were lit with solar streety lights to help reduce the loads on the main microgrid system.

However, after using the system for 4 years, the system production and storage capacity deteriorated. The system capacity became too small, batteries degraded and too small to match the demands of the growing business. This meant increased usage of the diesel generator, where Rai Ruen Rom had to pay high energy costs for fuel.

Problems of the previous microgrid:

1 **Shortage of energy**: System was not anymore capable of supplying 24 hours of electricity
2 **Increased production cost**: Higher diesel consumption lead to high total cost per production unit
3 **Lack of energy management system:** No monitoring and control capabilities led to inaccurate planning of energy supply-demand

Microgrid advancements (2020-2024)
In the year 2020, Rai Ruen Rom decided to improve and expand the system and energy management to be more efficient. The technical design of the microgrid resulted in the following advancements:

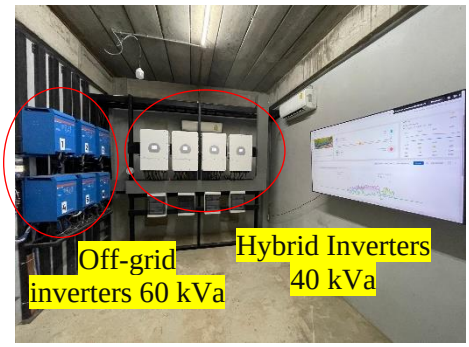
1. Increased battery capacity (2021&2022): Battery capacity increased to 576 kWh (240 new batteries) to replace the old 96 kWh battery that has deteriorated. Due to the increased nighttime demand, new deep cycle Gel batteries were added instead of flooded type lead acid batteries.

Before (2016)

After (2020+)

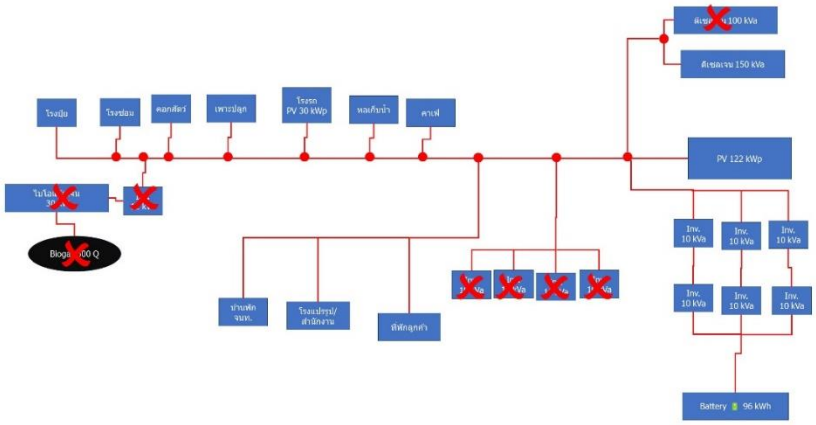
2. Added a biogas generator (2021): a 30 kW biogas system was put in place to produce electricity from organic waste. Raw material from food waste, animal manure, vegetable scraps and other organic waste from the agriculture fields are used to produce biogas. A biogas generator is put in place to make use of the biogas to produce electricity, substituting the use of diesel fuel.

3. Additional 40 kW inverters (2023): New 40 kVA hybrid inverter to work with the original 60 kVA inverter for a total of 100 kVA. New inverters are able to do DC coupling between PV and batteries, avoiding high power inrush which may overload the old inverters.'

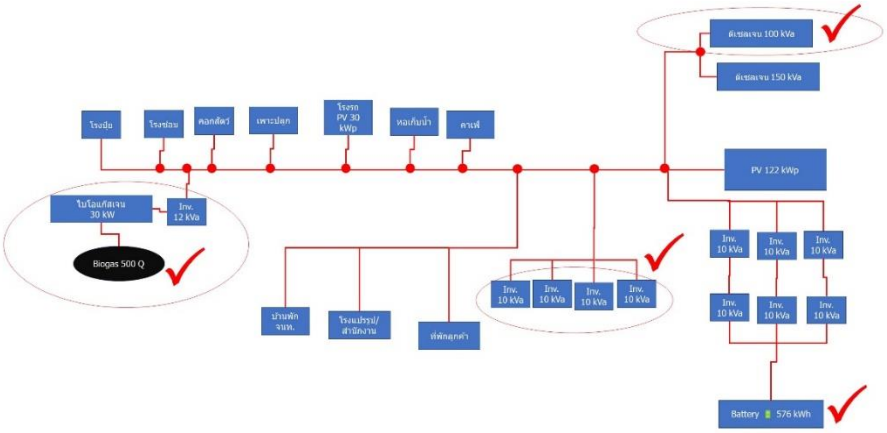


Energy management system (EMS): Energy metering, monitoring and control system put in place. The EMS is capable of monitor total supply (from Solar PV / battery / biogas / diesel genset) and monitor demand by sector (Restaurant, Bakery, residences, production, etc.). The information is used for energy cost tracking and prioritization of loads.

Before



After



Application

Using an automatic control system connected to the network. The project also aims to showcase a state-of-the-art type of microgrid system; Solar PV, batteries, biogas and diesel hybrid. Increasing the proportion of renewable energy use to an optimum level, the project shows that the microgrid system can achieve sustainabilty and have an appropriate cost of electricity for sustainable business operations.

Approach

1.) After improvements to the microgrid system, electricity is produced during the daytime and directly use to power activities within the organic farm. Excess electricity goes to charging and storage in the battery. On a day with plentiful sunshine, the batteries are sufficiently charged to 100% state of charge and can power the nighttime load of 288 kWh or approximately 18 hours of usage.
2.) The biogas generators are designed as back-up power that work during the night in place of diesel fuel. The biogas can supply approximately 100 kWh or a consumption of approximately 6 hours during the nighttime. The last source of energy is the diesel genset, which is only used with a backup diesel generator for stability during peak periods of customer service. or during the rainy season when there is little production of electricity from sunlight

B. ENVIRONMENT CONSIDERATION

B.1 Amount of Emissions/Pollution Avoided				
No.	**Parameters**	**Value and unit**		
		Before	**After**	**Carbon Emission Reduction**
1	Primary GHG emission (Carbon dioxide, Methane, Nitrous oxide, CFC)	**344,418.89** kg CO2 eq/year	**49,202.7** kg CO2 eq/year	**145,836** kgCO2 eq/year
2	Electricity consumption	**127,624** kWh/year from diesel	**18,232** kWh/year from diesel	
3	Fuel consumption	**63,046** L/year	**9007.26** L/year	
Total Potential Carbon Emission Reduction				**145,836 kgCO2 eq/year**

Total Potential Carbon Emission Reduction	

B.2 Discussion (Simple calculation of conversion)

Rai Ruen Rom is an off-grid area, there is no electricity transmission line connected to the main grid. As a result, they have to rely on their own fuel sources or those imported from outside. In the past, before the system was improved Rai Ruen Rom relies on solar power generation which produced 30% of total electricity demand, another 70% comes from diesel fuel. which must be imported to the farm. The total demand is 182,320 kWh per year, in which approximately 70% comes from diesel 127,624 kWh/year and the rest from solar 54,696 kWh/year.

After the system has improved by increasing the production of electricity from biogas together with solar PV, resulted in a higher proportion of renewable energy (90%). Solar PV contributed to 136,740 kWh (75%), biogas 27,348 kWh (15%). The remaining 10% comes from diesel generator.

Compared to the baseline, Rai Ruenrom had avoided approx. 54,039L of diesel fuel which is equivalent to an GHG emission of 145,836 kgCO2 per year or 2,916,700 kgCO2 per year over the project life of 20 years.

Assumptions for calculating the amount of greenhouse gases that can be reduced from using renewable energy to produce electricity.
1. Fuel efficiency factor: It was found that to produce 1 kWh of electricity, the fuel efficiency is 0.494L/kWh.
2. Emission factor: When combusting 1 liter of diesel fuel, the default emission factor is equal to 2.6987 kgCO2/L according to IPCC database.

B.3 Project Objective & Criteria

The project has multiple benefits to the socio economic and environment

1. **Climate action – Emission reduction**
   Rai Ruenrom had avoided approx. 54,039L of diesel fuel which is equivalent to an GHG emission of 145,836 kgCO2 per year or 2,916,700 kgCO2 per year over the project life of 20 years. The emission reduction is also reducing the carbon footprint of products and services provided from Rai Ruen Rom

2. **Waste management**
   Rai Ruen Rom utilises organic waste as en energy source which not only improves the renewable energy utilisation but also eliminates waste products by producing biogas. The biogas allows higher self-sufficiency and eliminates a portion of the diesel fuel which would've otherwise been imported into the organic farm.

3. **Social enterprise**
   The social enterprise nature of the project means that all stakeholders related to Rai Ruen Rom and the project receives benefit. Communities around the project site are hired as employees, in which now Rai Ruen Rom employs 90 employees in total. The product in which is sold are of low carbon emission and follows the organic concepts.

4. **Sustainable living learning center**
   Finally the project becomes a learning center for sustainable living and its showcase. People who visit Rai Ruen Rom experience the living with nature concept keeping a balance between people and nature.

C. SOCIAL CONSIDERATION

C.1 Benefits (User, Community, Country)

Benefits to entrepreneurs as project owners (user or owner)

The fact that Rai Ruen Rom uses renewable energy in the production process of organic agricultural products, hospitality and learning tours. Low Carbon tourism is one that is environmentally friendly, it interferes with nature as little as possible. Reducing energy consumption and carbon dioxide emissions. Systematically separating and managing waste, such as selling, fertilizing, reusing, including using clean energy as an alternative for travel and accommodation. People who visit Rai Ruen Rom will be able to eat vegetables from the organic vegetable garden. Use solar energy from PV panels to pump water for irrigation. Solar drying plant for processing to extend product life. To cook and eat natural and healthy food. Gift as souvenirs, conveying the meaning of raw materials created by nature. Whether it is good seeds, good soil, good water, clean energy, good air, which are important elements that lead to the creation of value in many things. and is the value of life that aims towards the goal of sustainability. Through organic farming and processing which is full of awareness of....the possibilities of the world environment and the possibility of living into the future with quality. As a results, in 2021, Rai Ruenrom received an outstanding award at the 14th Thailand Tourism Award in the Learning & Doing Tourism category.

Benefits to the community/people living around the project (community)

At Rai Ruen Rom, dedication to community advancement in the Chiang Rai province is evident through innovative initiatives. The impactful projects, including the promotion of local produce with a giving back schemes, in which 10% of the profit is given back to the community. By fostering a marketplace that nurtures local farmers. The holistic approach, prioritizing both economic development and social responsibility, serves as a learning center for energy and sustainability practices.

Benefits to the country

Insights gleaned from the implementation of Rai Ruen Rom's integrated renewable energy system highlight valuable lessons. Stakeholders from relevant agencies can engage in studies to formulate policy recommendations for electrifying remote areas inaccessible by traditional transmission lines. Key considerations include leveraging the declining costs of renewable energy technologies. Moreover, emphasis should be placed on increasing capabilities in self-management to ensure the sustainability of microgrid systems. This approach aims to meet the energy demands of the area at reasonable and affordable costs.

C.2 Corporate Social Responsibility Program

The utilization of renewable energy has effectively reduced reliance on fossil fuels by up to 60%, demonstrating Rai Ruenrom's capacity to sustain itself using locally accessible resources. Through the utilisation of solar energy and biogas, Rai Ruenrom minimizes environmental impact, as these sources are free of air, noise, odor, and water pollution. Furthermore, the organization's strategy prioritizes grassroots empowerment, fostering community involvement rather than solely depending on comprehensive government initiatives.

C.3 Community/People Awareness, Participation and Acceptance

Rai Ruen Rom's management uses the principle of having a platform that gives stakeholders the opportunity to take part in improving services to meet the needs of 5 levels of operations

Level 1: Providing information to stakeholders about the various activities of Rai Ruen Rom (To Inform) with information that is true, accurate, up-to-date and accessible to everyone.

Level 2: Allowing stakeholders to express opinions about the operations/operations of Rai Ruen Rom. Independently and systematically, there is a process for listening to opinions. Consultation through both formal and informal channels. These suggestions, opinions, and issues of concern are used as guidelines for improving policy, decision-making, and developing work methods in Rai Ruen Rom (To Consult).

Level 3: Stakeholders are allowed to participate or be involved in the policy-making process. Project planning and how to work (To Involve) This level of participation is often carried out in the form of committees with representatives from the public sector participating.

Level 4: Allowing stakeholders to participate in the role of partners or partners in the activities of government agencies (To Collaborate).

Level 5: Empowering staff and employees (To Empower) is a level that gives stakeholders the opportunity to play a full role in decision-making, administration, and carrying out any activities. To replace the operation within the organic farm or carry out any work. The management mission is to be responsible for promoting and supporting empowerment.

Therefore, lessons learned from the guidelines for creating participation in energy development at the area level in the Rai Ruen Rom case will be a guideline for making policy recommendations. A reflection on the current state of electricity development in remote areas in Thailand and how the government wants to drive complete electrification of various areas in Thailand.

D. TECHNICAL, ECONOMIC & MARKET CONSIDERATION

D.1 Technical Design

No	Parameters	Unit	Value
1	Year of the project's commencement	Years	2016
2	Period of construction	Year	2
3	Capacity	kW	200
4	Capacity factor	%	15
5	Energy Generation	GWh/year or GJ/year or ktoe or litres/year(for biofuel)	**Total: 182,320 kWh /year** *Solar: 136,740 kWh/year* *Biogas: 27,348 kWh/year* *Diesel: 18,232 kWh/year*
6	Useful Life	Year	20 years

The electricity production system at Rai Ruen Rom relies on an integrated renewable energy microgrid, serving various facilities including restaurants, accommodations, and agricultural plots. This system, equivalent to powering 1-2 villages, features 200 kWp of solar panels organized into a 3-phase configuration.

With a solar capacity of 200 kWp instead, the system is capable of supplying 1-2 small villages in Thailand. Being off-grid, the system stores energy in a 576 kWh batteryduring the daytime in batteries which are then used to supply the nighttime loads. Additionally, biogas and diesel generators provide backup power when battery reserves are insufficient. This hybrid setup ensures reliable energy supply.

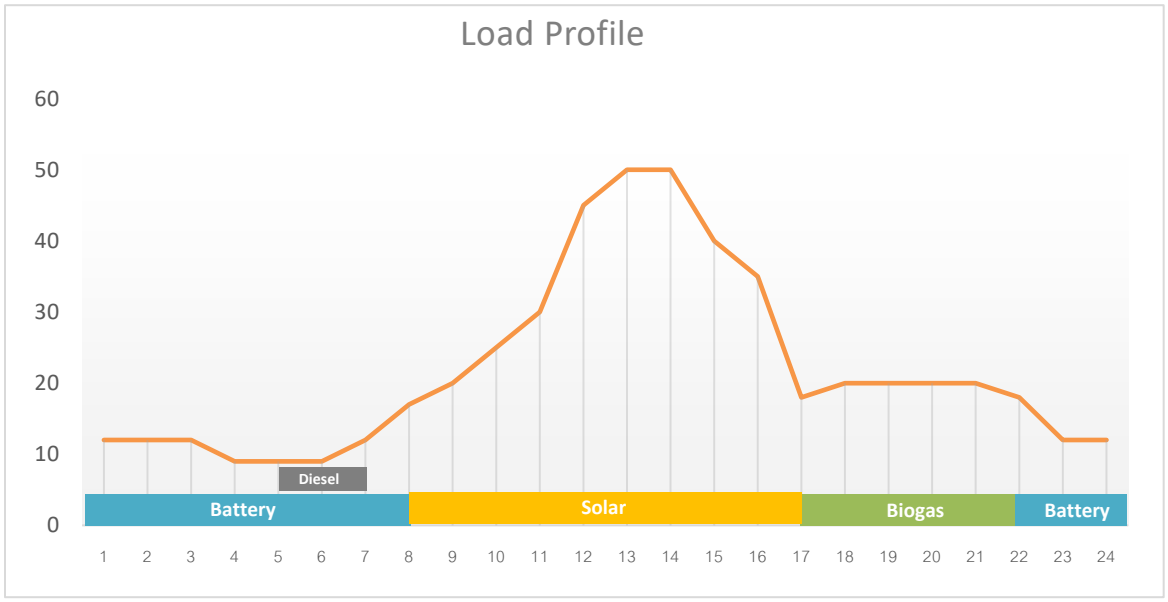
Moreover, solar-powered lamps illuminate walkways, reducing the strain on the main electrical system during nighttime. To optimize efficiency, the system's design is informed by Rai Ruen Rom's load profile data collected from 2016 to 2020. Analysis reveals that the original energy storage system experienced deterioration, leading to a significant increase in diesel usage.

Following the system upgrade, a new operational strategy is implemented, prioritizing the most cost-effective energy sources. Solar energy takes first priority to supply the load, with excess power stored in batteries during the daytime. Biogas generators are used as first source to supply the evening peak loads and batteries are used to support the remaining loads during the night. Diesel is only used as a last resort on cloudy and rainy periods.

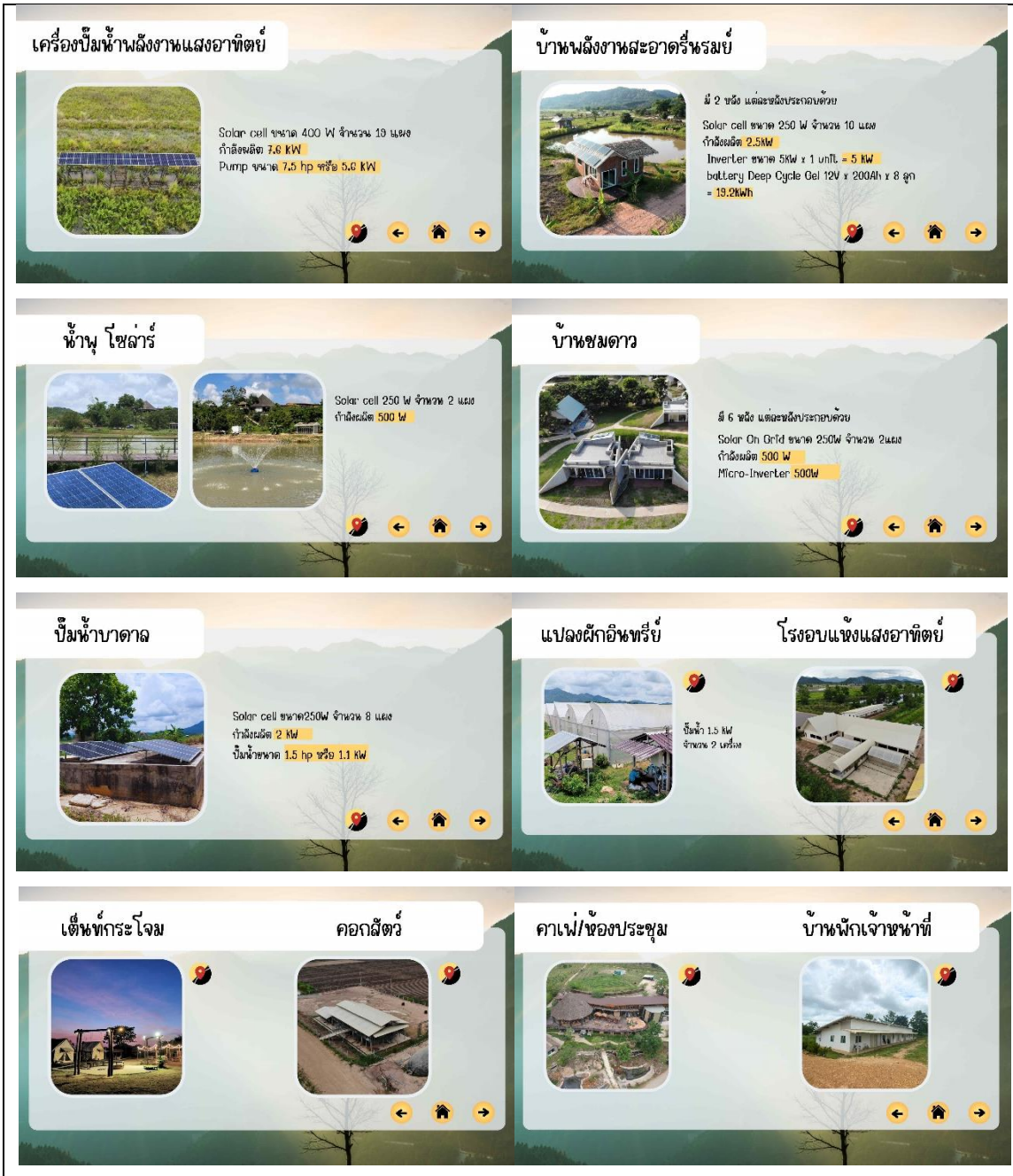
The current electricity distribution pattern is as follows:

Battery power is utilized from 11:00 p.m. to 6:00 a.m.
From 06:00 to 16:00, surplus solar energy charges batteries.
Biogas-generated electricity is used from 17:00 to 22:00.
On regular days, 100% renewable energy suffices, with diesel serving as a backup during the monsoon season when sunlight is limited. Diesel runs from 05:00-07:00 on bad irradiance days.

Diesel usage accounts for only 10% of total electricity production annually. This optimized system ensures efficient and sustainable energy provision at Rai Ruen Rom.


Load Profile
60
50
40
30
20
10
0
Diesel
Battery
Solar
Biogas
Battery
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24


แผนที่พลังงาน ไร่รื่นรมย์
โรงไฟฟ้าไร่รื่นรมย์
ที่จอดรถพลังงานแสงอาทิตย์
BioGas

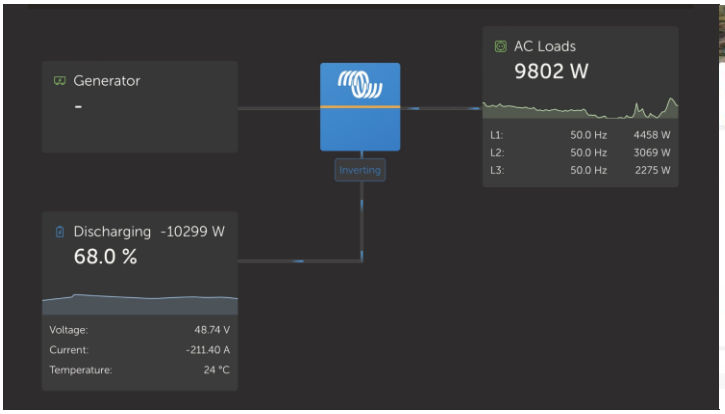

เครื่องปั๊มน้ำพลังงานแสงอาทิตย์
Solar cell ขนาด 400 W จำนวน 19 แผง
กำลังผลิต 7.6 kW
Pump ขนาด 7.5 hp หรือ 5.6 kW
บ้านพลังงานสะอาดรื่นรมย์
มี 2 หลัง แต่ละหลังประกอบด้วย
Solar cell ขนาด 250 W จำนวน 10 แผง
กำลังผลิต 2.5kW
Inverter ขนาด 5KW x 1 unit = 5 kW
battery Deep Cycle Gel 12V x 200Ah x 8 ลูก
= 19.2KWh
น้ำพุ โซล่าร์
Solar cell 250 W จำนวน 2 แผง
กำลังผลิต 500 W
บ้านชมดาว
มี 6 หลัง แต่ละหลังประกอบด้วย
Solar On Grid ขนาด 250W จำนวน 2แผง
กำลังผลิต 500 W
Micro-Inverter 500W
ปั๊มน้ำบาดาล
Solar cell ขนาด250W จำนวน 8 แผง
กำลังผลิต 2 kW
ปั๊มน้ำขนาด 1.5 hp หรือ 1.1 kW
แปลงผักอินทรีย์
ปั๊มน้ำ 1.5 kW
จำนวน 2 เครื่อง
โรงอบแห้งแสงอาทิตย์
เต็นท์กระโจม
คอกสัตว์
คาเฟ่/ห้องประชุม
บ้านพักเจ้าหน้าที่

D.2 Technical Performance

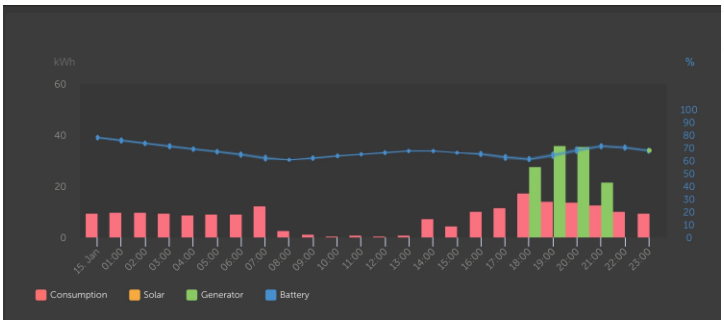
Once the profile has been loaded into the system design Rai Ruen Rom has designed and improved a hybrid renewable energy microgrid. The design problem is to find the most appropriate system size. With a target system cost that is most worthwhile for investment or Highest NPV.

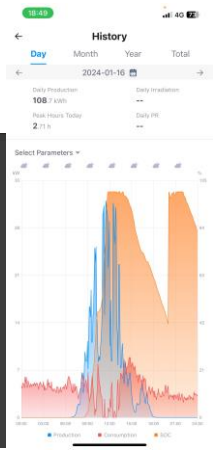
For Rai Ruen Rom, after improving the results are
• New 200 kWp solar panels.
• Lead-acid battery size 576 kWh
• Off Grid Inverter / PCS size 100 kW
• On Grid Inverter / PCS size 170 kW
• Biogas generator size 30 kVA
• 100 kVA diesel generator.

Energy Management System (EMS)
System management can be done online through the Cloud, with data being transmitted via the internet. Therefore, it can be easy to track and evaluate the data. and can be controlled and ordered automatically For example, if the battery is less than 30% remaining, install an automatic generator, eliminating the need for humans like when improving the system.



Cloud Monitoring





D.3 Investment Indicator

Financial Model

No	Parameters	Unit	Value
1.	Total Capital Cost/Expenditure (CAPEX) – If available, please also provide the detail breakdown of capital cost, such as : pre construction stage, construction stage (equipment, machinery, etc.), installation/EPC, grid connection, etc.	USD	225,000 USD
2.	O&M cost	USD or % CAPEX	5% of CAPEX/year
3.	Discount rate	%	10
4.	IRR	%	12.8
5.	ROI	%	178%
6.	Payback period	year	7 years

D.4 Financial Scheme/Livelihood Projects

Rai Ruen Rom utilises 100% equity with no support mechanism from the government. The equity investment was judeged as a feasible investment with considerable returns compared to before.

D.5 Funder (Government and Non-Government)

Self-financed from equity of the owners of Rai Ruen Rom.

D.6 Market Size (Potential Within 5 Years)

Currently, there are still regions in Thailand without access to electricity transmission lines, affecting approximately 1% of the population. These areas resembles Rai Ruen Rom in size and characteristics, which are equivalent to serving two villages. However, due to the high investment required for installing distribution lines or underwater cables, traditional methods of electrification may not be feasible to electrify the last 1%. It is estimated that there are 200,000 people in Thailand who are still not connected to the grid.

In response to this challenge, establishing hybrid renewable energy microgrids presents a viable solution. These microgrids utilize a combination of renewable energy sources, such as solar and wind power, along with energy storage systems like batteries. This approach allows for decentralized energy generation and distribution, bypassing the need for extensive infrastructure investments associated with traditional grid expansion.

Implementing hybrid renewable energy microgrids in underserved areas aligns with Thailand's goal of achieving 100% electrification. These microgrids can be deployed quickly and efficiently, providing reliable and sustainable electricity access to remote communities. Furthermore, their scalability allows for expansion as demand grows, making them a practical solution for addressing energy access challenges in Thailand and similar regions worldwide.

D.7 Local Manufacturing/Content of System

The project utilises the following components
Solar PV panel: Perlight Tier 1 Panel
Inverter: Victron, Prime Volt and Deye
Installation team/EPC: Local Thai technicians within the project
Civil construction: Local Thai technicians within the project

D.8 Amount of Fossil Energy Avoided (ktoe, etc)

Rai Ruen Rom avoids the consumption of 109,392 kWh or 54,038.74 liters of diesel per year by having solar and biogas generators

No.	Parameters	Value and unit		
		Before	**After**	**Savings**
1	Electricity consumption	**127,624** kWh/year from diesel	**18,232** kWh/year from diesel	**109,392** kWh/year from diesel
2	Fuel consumption	**63,046** L/year	**9007.26** L/year	54,038.74 L/year

D.9 Life of Project

The project has a design life of 20 years, this is equivalent to the expected lifetime of the solar panels which are the main source of electricity. After components have reached end of life, the project has planned to assess the most optimal solution for electricity production at that point in time.

E. OPERATION & MAINTENANCE SCHEME

E.1 Operation Hours (Day/Month/Year)

Operation of the electrical supply system 24 hours a day
• From 11:00 p.m. to 6:00 a.m., using battery power.
• From 6:00 a.m. - 4:00 p.m. use the remaining electricity from solar cells to store in batteries.
• From 17:00-22:00 hrs. use electricity from biogas.

E.2 Maintenance Scheme (In-House, Contracted Out Service, Government, Others

5.2 Maintenance plan
• There is a plan to clean the solar panels 4 times per year.
• Trees are trimmed. Do not allow shadows to cover the solar panels 3 times per year.
• Generators are maintained according to the usage cycle. Change engine oil, air filter, oil filter
• Electrical preventive maintenance is checked every 6 months.
• There is a plan to replace the battery and inverter in the 6th year based on the life of the equipment. that has deteriorated

		เดือน											
ข้อ		มกราคม	กุมภาพันธ์	มีนาคม	เมษายน	พฤษภาคม	มิถุนายน	กรกฎาคม	สิงหาคม	กันยายน	ตุลาคม	พฤศจิกายน	ธันวาคม
1	ภารกิจเกี่ยวกับระบบ												
1.1	ล้างแผง		✓		✓						✓		✓
1.2	ตัดต้นไม้				✓			✓			✓		
1.3	เปลี่ยนน้ำมันเครื่อง						✓						✓
1.4	เปลี่ยนกรองน้ำมัน						✓						✓
1.5	เปลี่ยนกรองอากาศ						✓						✓
1.6	ตรวจสอบกรองอากาศตู้แบตเตอรี่			✓			✓			✓			✓
1.7	ล้างแอร์						✓						✓
2	ภารกิจเกี่ยวกับสถาพสิ่งแวดล้อม												
2.1	ทำความสะอาดโดยรอบ			✓			✓			✓			✓
2.2	ตัดหญ้า			✓			✓			✓			✓
2.3	การทำความสะอาดและความสวยงามโดยรอบ	ตามตกลง											

E.3 Other Maintenance Measures (Training, After-Sales Service)

Rai Ruen Rom has trained local technicains which are responsible for solving technical problems within the project.

E.4 Energy Conservation and Cost Reduction System
Being an off-grid system, before using equipment or start production activities which uses high electricity consumption there needs to be an approval process. For example, if the bakery which uses a lot of electrical heating device wants to start production, then an approval process must be granted before operations. This ensures that the energy supply and demand is in balance. This is also applicable in a demand response scenario, when there is not enough energy from solar PV, then non-critical loads must be shut down, this command is automated and/or given the managers.
E.5 Local Service Content
Installation and construction services are done by local technicians and people in the community, accounting for the entire percentage. 30% of the investment is raw materials/equipment. and services within the country
E.6 ISO for Environment and Quality
Follow the Energy Regulatory Commission's COP (Code of Practice) as a guideline for environmental standards.
E.7 Farm Management, Sustainability Supply and Resources of Raw Materials – For Biofuels Category Only
Monitoring of renewable energy production through the Renewable Energy Credit mechanism and is in the process of selling to REC buyers.

F. REPLICABILITY

F.1 Relevance, Impact, Efficiency
It is a prototype of a hybrid renewable energy microgrid. For the agricultural social business sector. Mix in areas where electricity is not accessible. which is linked to the Sustainable Development Goals (Sustainable Development Goal: SDG) and is linked to Thailand's policy on access to electricity. equally Rai Ruenrom demonstrates how effective project design can be.connect networks and project sponsors for maximum benefit to the organization and service users.
F.2 Cost Effectiveness (No, Low, High Cost)
The investment budget for improving the Rai Ruen Rom system is approximately 3,000,000 baht as an investment. Starting out, you can reduce the cost of diesel fuel by 36,062 liters per year (diesel fuel 35 baht per liter).Save energy costs After deducting money into the battery replacement fund, 333,333 baht per 6 years makes it economical. Earn 964,899 per year, resulting in a project payback period of 3 years.
F.3 Sustainability of Project
The project has a lifetime of 20 years,which in the meantime the project will generate sufficient savings for the next round of re-investment into a new system. An assessment will be made a the end of the lifetime for the most optimal technology at that point in time.

F.4 Others

There are 4 standards that the farm has received.

- Agriculture 3 standards
    1. Organic Thailand
    2. Rice Department (in the process of continuing)
    3. Department of Fisheries
- Factory Department 1 Standard
    1. FDA standards
- restaurant
    1. SHA standard
    2. Certificate of notification of establishment of food distribution location
- product
    1. LAB analysis results (FDA certificate)

กรมวิชาการเกษตร
กระทรวงเกษตรและสหกรณ์
ใบรับรองเป็นไปตามข้อตกลง
บริษัท เชฟไลฟ์ โปรดักส์ จำกัด
ที่อยู่ 97 หมู่ 10 ตำบลงิ้ว อำเภอเชียงราย
ได้รับการรับรองมาตรฐานเกษตรอินทรีย์ มกษ. 9000 เล่ม 1 - 2552
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พื้นที่รวม 31.5005 ไร่ จำนวน 65 ชนิดพืช (ตอสามแบบ 2 หน้า)
วันที่รับรอง 30 สิงหาคม 2564 วันที่หมดอายุ 29 สิงหาคม 2566
(นางสาวรัชนี ใบไพบูลย์)
นักวิเคราะห์นโยบายและแผนชำนาญการพิเศษ
รักษาราชการแทน
ผู้อำนวยการสำนักวิจัยและพัฒนาการเกษตร เขตที่ 1
ปฏิบัติราชการแทนอธิบดีกรมวิชาการเกษตร

G. FIGURES, TABLES, PHOTOS

Main Solar PV
PV: 122 kWp
On-grid Inverter: 15 kW x 10 units =150 kW
Off-grid Inverter: 10 kW x 6 = 60 kVA
Lead-acid Battery 48V / 4800 Ah = 230.4 kWh
Diesel generator: 150 kVA