

# **Independent Terminal Evaluation**

## **Overcoming policy, market and technological barriers to support technical innovation and south-south technology transfer: The pilot case of ethanol production from cassava**

UNIDO Project ID: 100264

GEF Project ID: 4037



UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION

# **UNIDO INDEPENDENT EVALUATION DIVISION**

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## Abbreviations and acronyms

<b>Abbreviation</b>	<b>Meaning</b>
AEDP	Alternative Energy Development Plan
ASEAN	Association of South-East Asian Nations
BIOTEC	National Center for Genetic Engineering and Biotechnology
CSTRU	Cassava and Starch Technology Research Laboratory
ET	Evaluation Team
EV	Electrical Vehicle
FESR	Framework for Economic and Social Reforms.
FFV	Fuel Flexible Vehicle
FIRI	Food Industries Research Institute
FSP	Full-Size Project
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GoL	The Government of Lao PDR
GoT	Government of Thailand
GoV	Government of Viet Nam
HDI	Human Development Index
HQ	Headquarters
HUST	Hanoi University of Science and Technology
IREP	Institute for Renewable Energy Promotion.
KMUTT	King Mongkut's University of Technology Thonburi
KSD	Khongsedone Ltd
KSS	Kaung Kyaw Say Group of Companies
Lao PDR	Lao Popular Democratic Republic
LDO	Liquor Distillery Organization.
LMV	Laos, Myanmar, Viet Nam
MEM	Ministry Energy and Mines
MOIT	Ministry of Industry and Trade
MOST	Ministry of Science and Technology
MTE	Mid-Term Evaluation
NRES	National Renewable Energy Strategy
NSTDA	National Science and Technology Development Agency
PDCA	Plan-Do-Check-Act
PIF	Project Information Form
PIR	Project Implementation Review

Abbreviation	Meaning
PMU	Project Management Unit
PPG	Project Preparatory Grant
PRF	Project result framework.
Prodoc	Project document
PSC	Project Steering Committee
R&D	Research and Development
RE&EE	Renewable Energy and Energy Efficiency
REMI	Renewable Energy and New Materials Institute.
RON	Road Octane Number
SE	Southeast
SS	South-South
TE	Terminal evaluation
TORs	Terms of References
TT	Technology Transfer
TTDI	Thai Tapioca Development Institute.
UNIDO	United Nation Industrial Development Organization
UNIDO ODG/IED	UNIDO Office of the Director General/Independent Evaluation Division
VHG – SSF	Very High Gravity - Simultaneous Saccharification and Fermentation

## Glossary of evaluation-related terms

Term	Definition
Activity	Actions taken or work performed through which inputs, such as funds, technical assistance and other types of resources are mobilized to produce specific outputs.
Assumptions	Hypotheses about factors or risks which could affect the progress or success of a development intervention.
Beneficiaries	The individuals, groups, or organizations, whether targeted or not, that benefit, directly or indirectly, from the development intervention.
Conclusions	Conclusions point out the factors of success and failure of the evaluated intervention, with special attention paid to the intended and unintended results and impacts, and more generally to any other strength or weakness. A conclusion draws on data collection and analyses undertaken, through a transparent chain of arguments.
Data collection tools	Methodologies used to identify information sources and collect information during an evaluation.
Effect	Intended or unintended change due directly or indirectly to an intervention.
Effectiveness	The extent to which the development objectives of an intervention were achieved or are expected to be achieved, considering their relative importance.
Efficiency	A measure of how economically resources/inputs (funds, expertise, time, etc.) are converted into results.
Evaluation	The systematic and objective assessment of an ongoing or completed project, programme or policy, its design, implementation, and results. The aim is to determine the relevance and fulfillment of objectives, development efficiency, effectiveness, impact, and sustainability.
External evaluation	The evaluation of a development intervention conducted by entities and/or individuals outside the donor and implementing organizations.
Finding	A factual statement based on evidence from one or more evaluations.
Goal	The higher-order objective to which a development intervention is intended to contribute.
Impacts	Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended.
Independent evaluation	An evaluation carried out by entities and persons that are not under the control of those responsible for the design and implementation of the development intervention.
Indicator	Quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a

Term	Definition
	development actor.
Inputs	The financial, human, and material resources used for the development intervention.
Lessons learned	Generalizations based on evaluation experiences with projects, programs, or policies that abstract from the specific circumstances to broader situations. Frequently, lessons highlight strengths or weaknesses in preparation, design, and implementation that affect performance, outcome, and impact.
Logical framework (Log frame)	A management tool used to improve the design of interventions, most often at the project level.
Mid-term evaluation	Evaluation performed towards the middle of the period of implementation of the intervention.
Monitoring	A continuing function that uses a systematic collection of data on specified indicators to provide management and the main stakeholders of an ongoing development intervention with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds.
Outcome	The likely or achieved short-term and medium-term effects of an intervention's outputs.
Outputs	The products, capital goods, and services which result from a development intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes.
Project or program objective	The intended physical, financial, institutional, social, environmental, or other development results to which a project or program is expected to contribute.
Quality assurance	Quality assurance encompasses any activity that is concerned with assessing and improving the merit or worth of a development intervention or its compliance with given standards.
Recommendations	Proposals aimed at enhancing the effectiveness, quality, or efficiency of a development intervention; redesigning the objectives; and/or at reallocating resources. Recommendations should be linked to conclusions.
Relevance	The extent to which the objectives of a development intervention are consistent with beneficiaries' requirements, country needs, global priorities and partners' and donors' policies.
Reliability	Consistency or dependability of data and evaluation judgements regarding the quality of the instruments, procedures, and analyses used to collect and interpret evaluation data.
Results	The output, outcome or impact (intended or unintended, positive and/or negative) of a development intervention.
Results framework	The program logic that explains how the development objective is to be achieved, including causal relationships and underlying

Term	Definition
	assumptions.
Review	An assessment of the performance of an intervention, periodically or on an ad hoc basis.
Risk analysis	<p>An analysis or assessment of factors (called assumptions in the log frame) that affect or are likely to affect the successful achievement of an intervention's objectives.</p> <p>A detailed examination of the potential unwanted and negative consequences to human life, health, property, or the environment posed by development interventions;</p> <p>A systematic process to provide information regarding such undesirable consequences; the process of quantification of the probabilities and expected impacts for identified risks.</p>
Stakeholders	Agencies, organizations, groups or individuals who have a direct or indirect interest in the development intervention or its evaluation.
Sustainability	<p>The continuation of benefits from a development intervention after major development assistance has been completed.</p> <p>The probability of continued long-term benefits. Resilience to the risk of net benefit flows.</p>
Terms of reference	Written document presenting the purpose and scope of the evaluation, the methods to be used, the standard against which performance is to be assessed or analyses are to be conducted, the resources and time allocated, and reporting requirements.
Validity	The extent to which the data collection strategies and instruments measure what they purport to measure.

## **Executive summary**

The project “Overcoming policy, market and technological barriers to support technological innovation and south-south technology transfer: the pilot case of ethanol production from cassava” is a full size GEF project implemented by UNIDO in Thailand, Viet Nam and Lao PDR.

This evaluation started in July 2018 and has been conducted by the international consultant, Dr. Alfredo Curbelo Alonso and the national consultant, Ms. Sopin Wachirapuwadon. The evaluation covered the whole project duration from June 2012 to December 2018.

The overall purpose of the TE is to assess whether the project has achieved or is likely to achieve its main objective, i.e. to foster technical innovation and South-South technology transfer from Thailand to neighboring countries, and to what extent the project has also considered sustainability and scaling-up factors to enhance its contribution to the sustainability of its results and further impact.

## **Key Findings of the Evaluation**

### **A. Progress to impact**

The final goal of this project is to significantly reduce imports, such as gasoline, in countries of the LMV region by replacing it with ethanol produced from cassava on a sustainable basis.

Outcomes of the project are a solid move in that direction, namely:

- The consolidation of a consortium of Thai institutions, led by KMUTT to transfer the VHGSF ethanol production technology.
- The creation of a cadre of trained and motivated farmers, entrepreneurs and specialists in Lao PDR and Viet Nam.
- The creation of a solid foundation to improve the bioenergy policy in Lao PDR for the promotion of Bioethanol production from cassava.

### **B. Project Design**

The design of the project has some shortcomings like an unsatisfactory outcome formulation. Some outcomes were designed in such a way that they cannot be achieved within the scope of the project implementation. Likewise, the selection of project partners responsible for some outputs was inadequate.

In addition, the project result framework is not, to a large extent, useful for guiding project monitoring. Most result indicators are not SMART and most target indicator formulations are inappropriate.

### **C. Project performance**

#### **Relevance**

The technology transfer supported by the project addresses significant issues for participant

countries. The use of bioethanol to reduce gasoline consumption is recognized as a national priority in the national development strategies of involved countries. These countries have biofuel development strategies that set specific targets for bioethanol use. The significance of the economic impact of the use of bioethanol has grown during the project implementation period.

#### **Effectiveness**

Most of project outputs directly contributing to achieving project objectives were achieved. Outputs not showing progress are related to project design failures. These outputs are focused on processes for implementing commercial projects by private companies for bioethanol production from cassava.

#### **Efficiency**

Use of GEF funds and co-financing support are in correspondence with completion of outputs and achievement of outcomes.

#### **Sustainability of benefits**

It is very likely that the effects of the achieved technology transfer outcomes will remain in place in the short and medium term after project completion.

The overall rating of the project is **satisfactory**

### **D. Cross-cutting performance criteria**

#### **Gender mainstreaming**

Despite the fact that gender was not considered in project design, the project management encouraged the reduction of the gender gap among the participants in project activities.

#### **Monitoring and Evaluation**

All monitoring activities were executed and related reports produced and used for the evaluation proposal by UNIDO, the PMU, and the PSC. However, there was no detailed monitoring plan with the right indicators and targets.

#### **Results-based Management (RBM)**

The annual workplan included planning of required activities for completion of every output. The work plan was annually updated and approved by the PSC meeting. There was no specific monitoring and evaluation plan focusing on output indicators. Progress reports and PMU report to PSC meeting were always result oriented.

The overall assessment of the project is **satisfactory**.

### **E. Conclusions, recommendations and lessons learned.**

#### **Conclusions**

The project addresses a problem that is relevant for most countries in the region and most developing countries. Reduction of fuel imports is a priority in every national development strategy of net oil importing countries. The technology promoted by this project to address this problem is of the utmost interest for many countries. It offers an alternative to raw materials commonly used for bioethanol production: molasses and corn.

The approach used by the project for the promotion of this alternative is highly appreciated for its potential advantages. The core project design and implementation methodology are South-South Technology transfer. However, said approach also entails a risky challenge due to the complexity and lack of a representative number of success stories at international level that could be used for reference.

Some project design failures, an extreme complex situation during the startup process, and the implementation of activities in four different countries posed additional difficulties for the coordination and management of the project.

Despite the professionalism and dedication of the project management unit, the support and adaptive approach to problem-solving shown by the staff at UNIDO Regional office and Headquarters, and the commitment to the project of relevant partners and stakeholders, the achievement of the planned project outcomes was limited.

Accomplishments of the project such as the technology package ready to be transferred for bioethanol and cassava production; the consolidation of the capacity of Thai institutions for the promotion of a genuine south-south technology transfer process of the above mentioned technology package and the cadre of technicians, farmers, researchers, entrepreneurs and governmental officials that have been trained and motivated combined, create a solid foundation for the consolidation and extension of the project for the reduction of fuel imports.

## **Recommendations**

To the GEF:

- This project is a good example of the potential of south – south technology transfer. It has shown the relevance of the transfer not only of the Know-how but also of the experience and knowledge about the needed policy environment for the sustainability of transferred technology. But this project is also an example that for developing countries relevant solutions for facing climate change involve not only the industry but also the agriculture sector. In particular for this last sector, considerations about adaptation to climate changes are very pertinent.

For this reason, it should be facilitated the presentation of South-South technology transfer GEF projects that incorporate activities both at the industrial and agriculture sector according to the add value chain and considering actions not only for mitigation but also for adaptation to climate changes.

To UNIDO

- In the case of bioenergy projects, where the energy intervention depends on the supply of biomass, base the project design on the concept of agribusiness.
- Identify opportunities to maintain support of bioethanol production TT in the region after project completion, to take advantage of the positive momentum created by this project.
- Consider improving the technical and methodological internal review of project proposals during the process for approval.
- Establish a reporting mechanism that provides information on the actual expenditure of co-finance on a regular basis.

To the governments of participant countries:

- Because international cooperation for development is a tool for keeping on the main outcomes of this project:

Participant countries should use existing mechanisms or if necessary, establish new ones, to ensure the consolidation of cross-border technology transfer activities initiated by the project focusing on supporting national biofuel development priorities. An available opportunity for doing that is the existing Thai and Regional mechanisms for cooperation for development.

In the case of Thailand, The Royal Government is very active supporting the regional development cooperation. The Thailand International Development Cooperation Agency (TICA) is principally responsible for the implementation of Thailand's development cooperation programmes in neighboring countries. TICA promotes South-South cooperation and North-South-South cooperation under partnership programmes with other donor countries including non-government organizations and international agencies for development cooperation in developing countries in various regions. TICA implements various forms of cooperation, such as the development projects, volunteer and expert programmes, fellowships, scholarship and training programmes.

At regional level the ASEAN has implemented some cooperation mechanisms with the aim of reducing the economic and development gap between member countries. Among these mechanisms are:

- The Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS), comprising Cambodia, Lao PDR, Myanmar, Thailand, and Viet Nam;
  - the Greater Mekong Sub region (GMS) that was initiated by Asian Development Bank (ADB) to promote the sub-regional cooperation of six countries including Cambodia, Lao PDR, Myanmar, Thailand, Viet Nam and Southern China PRC (Yunnan Province).
  - The ASEAN-Initiative for ASEAN Integration (ASEAN-IAI) cooperation framework aimed to provide with assistance to the development to Lao PDR, Cambodia, Myanmar and Viet Nam to improve the level of economic development and to increase competitiveness and reduce the development gap.
- While improving the effectiveness of the policy framework for promoting biofuels, special attention should be pay to policy tools for increasing the participation of private companies and farmers in bioethanol and cassava production. Among these tools are the tax and retail price incentives both for bioethanol and cassava producers, support to capacity building programmes aimed to company staff and farmers for increasing their knowledge and training on new technologies, government contribution to investments for developing needed infrastructure for bioethanol commercialization and to specific R&D project helping to adapt technology to local conditions, communication campaigns focused on increasing social acceptance of biofuels.
  - Support capacity building activities promotion using training modules developed by the project and aimed to relevant actors for bioethanol. Special attention should receive members of governmental bodies, personnel belonging to engineering and consulting companies, technical and senior staff of bioethanol companies and farmers.

Involvement of research centers and universities in these activities would be of great value.

- Consider possible collaboration actions for facilitating south-south technology transfer based on the experience of the project.

### **Lessons learned**

- Designing technology transfer projects:
  - The selection of the scope of outputs related to pilot, demonstration and commercial plants is a critical factor for achieving a good project performance.
  - Objective and in-depth considerations about existing conditions for specific technology transfer actions should be provided.
  - Special attention should be paid to time, and financial resources constraints while deciding what outputs can be planned in the scope of the project.
- Outputs focused on improving policy framework should be defined only in terms of delivery of recommendations or inputs supporting decision-making processes.
- Outputs seeking private sector involvement in the technology transfer should be business-oriented, formulated with caution, and considering their real needs and expectations.
- In technology transfer projects special attention should be paid to the selection of project partners and their roles. Conflicts of interest or ethical contradictions should be avoided.

## **I. Evaluation objectives, methodology, and process**

The terminal evaluation (TE) covers the whole duration of the project from its starting date up to the date of the evaluation. It assesses project performance considering the evaluation criteria of relevance, effectiveness, efficiency, sustainability, and impact.

The TE has an additional purpose of drawing lessons and developing recommendations for UNIDO, the Government, Donors, and project stakeholders and partners that may help improve the selection, design and implementation of similar future projects and activities in the country and on a global scale upon project completion. The TE report should include examples of good practices for other projects in the focal area, country, or region.

The TE should provide an analysis of the attainment of the project objective and the corresponding outputs and outcomes. Through its assessments, the Evaluation Team (ET) should enable the Government, counterparts, UNIDO and other stakeholders and donors to verify prospects for development impact and sustainability, providing an analysis of the attainment of global environmental objectives, project objectives, delivery and completion of project outputs/activities, and outcomes/impacts based on indicators. The assessment shall include a reexamination of the relevance of the objectives and other elements of project design according to the project evaluation parameters defined in the TORs.

The overall purpose of the TE is to assess whether the project has achieved or is likely to achieve its main objective, i.e., to foster technical innovation and South-South technology transfer from Thailand to neighboring countries, and to what extent the project has also considered sustainability and scaling-up factors for increasing contribution to sustainable results and further impact.

The evaluation has three specific objectives:

- (i) assess the project performance in terms of relevance, effectiveness, efficiency, sustainability, and progress to impact;
- (ii) Identify key learnings to inform the design and implementation of forthcoming projects; and
- (iii) Provide a series of findings, lessons, and recommendations for enhancing the design of new UNIDO projects and the implementation of ongoing ones.

The evaluation methodology to be used by the evaluation team is based on indications in the TORs.

The evaluation will have two main components:

- an overall assessment of the performance of the project,
- learning from successful and unsuccessful practices in project design and implementation.

The project team had access to relevant monitoring reports: Progress reports, Project Implementation Reviews (PIRs) and to the Mid Term Evaluation Report. All these documents are informative, include relevant information for the evaluation and provide insight about project implementation.

A group of project technical reports has allowed the evaluation team to have a deeper and better understanding of processes, circumstances and technical questions related to the achievement of project outputs.

Meetings with project stakeholders and visits to field sites during the field visit were very productive. Meetings were held with project partners, including Government counterparts, and private companies involved in project implementation.

The program of the field visit (annex 1) included five days in Thailand during and two-day stays in Viet Nam and Lao PDR. The findings of the evaluation are well sustained and based on objective and good quality information.

The evaluation team officially started this assignment in July 2018.

This evaluation benefitted from very productive teamwork among UNIDO Energy Department staff directly involved in this TE, UNIDO regional office in Bangkok, the PMU and the evaluation team.

## **II. Country and project background**

Because this project supports a South-South technology transfer process in the Southeast Asia region, it is a sub-regional project according to the geographical area of influence.

In this case, the technology transferor country is Thailand, while transferee countries initially were Myanmar and Viet Nam and potentially Lao PDR. However, at the beginning of project implementation, due to a change of energy policy in Myanmar, biofuel promotion ceased to be a national priority and this country quit the project. Lao PDR, which was initially planned to attend only capacity building activities, resulted in an active partner of the technology transfer process.

Thailand plays a leading role in this project: the advanced bioethanol production technology to be transferred was developed by a Thai institution; and market penetration of gasohol shows a significant progress in Thailand. This progress is the result of the combination of a successful process of deployment of policy measures and of science and technology developments, since 2000.

In the case of Viet Nam, it is a fast-growing country with an established ethanol industry and science, technology and engineering capacities for absorption of technologies to improve the performance of ethanol production.

Lao PDR is a least developing country, where the ethanol production industry is just starting and national science and technology sector is incipient.

### ***i. Brief country context and sector-specific issues relevant for the project and important developments during the project implementation period***

This project promotes a technology transfer process from Thailand, where the transferred technology was developed, to Viet Nam, Myanmar and Lao PDR that are to absorb it. Therefore, this epigraph includes information about all participant countries that is further supplemented in Annex 3 hereto.

## Thailand

Thailand, officially the Kingdom of Thailand, is a country at the center of the Asian Indochinese composed of 76 provinces. The area of the country is 513,120 km<sup>2</sup> and the population over 68 million people. As of 2015, 55% of Thailand's population lives in urban areas, mostly concentrated in and around the Bangkok Metropolitan Area

Thailand is bordered to the north by Myanmar and Laos, to the east by Laos and Cambodia, to the south by the Gulf of Thailand and Malaysia, and to the west by the Andaman Sea and the southern extremity of Myanmar.

Thailand has a high level of human development, is the second largest economy in Southeast Asia after Indonesia, and it is the 4th richest nation in the region according to its GDP per capita, after Singapore, Brunei, and Malaysia. It functions as an anchor economy for the neighboring developing economies of Laos, Myanmar, and Cambodia. The economy in Thailand has been growing since 2009, the GDP per capita has risen 1.27 times in the period 2009 – 2017.

Thailand's total TFEC (total final energy consumption) has been steadily increasing during the last decade. The industrial and transport sectors consumed largely three-quarters of the total. More than one-half of TFEC is met by imported energy sources<sup>1</sup>. Expenditure on energy imports reached a peak of 12% of Thailand's GDP in 2008, attributable to the oil price surge. While it had nearly halved from the peak in 2015.

Thailand has its own fossil energy resources such as crude oil, natural gas and coal, but the oil and gas are not adequate for domestic consumption and are expected to deplete in a decade if current production rates remain the same.

Thailand has a well-established electric power grid infrastructure that provides nearly universal access to electricity. Power production has been steadily increasing to meet growing demand.

Of the total amount of renewable energy consumption in 2015 (10 306 ktoe), about 64% was used for heating, 16% for electricity generation, and nearly 20% for biofuel production. Biofuel blending, namely gasohol and blended biodiesel, is now a common practice in Thailand after a decade of development. In 2015, the volumetric share of liquid transport fuel consumption that was met with biofuels stood at around 11% in the case of gasoline and 6% in the case of diesel. The overall volumetric share was close to 8%.

To reduce reliance on fuel imports, the government has developed a very aggressive policy, specifically, in the case of fuel for transport.

Thailand was the first country in Asia to announce national policies for both bioethanol and biodiesel development. Several measures have been implemented to promote the production and consumption of biofuel in the country including investment promotion, biofuel standardization, price incentives, vehicle specifications, tax incentives, and R&D programs.

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<sup>1</sup>RENEWABLE ENERGY OUTLOOK: Thailand. IRENA. 2017.

A brief description of the policy measures developed for the promotion of gasohol during the last 18 years by Government of Thailand is provided in Annex 3.

## **Viet Nam**

Viet Nam, officially the Socialist Republic of Viet Nam, is the easternmost country on the Indochina Peninsula. With an estimated 94.6 million inhabitants as of 2016, according to the 2009 census, 70.4% of the Viet Nameese population is living in rural areas. It is the world's 15th-most-populous country and the ninth-most-populous Asian country.

Viet Nam is bordered by China to the north, Laos to the northwest, Cambodia to the southwest. Its capital city is Hanoi, and Ho Chi Minh City is the most populous city.

The total area of the country is approximately 331,212 km<sup>2</sup>. Viet Nam's land is mostly hilly and densely forested. Mountains account for 40% of the country's land area, and tropical forests cover around 42%.

Viet Nam has become a major exporter of agricultural products. It is now the world's largest producer of cashew nuts, with a one-third global share; the largest producer of black pepper, accounting for one-third of the world's market; and the second-largest rice exporter in the world after Thailand since the 1990s. Moreover, Viet Nam is also the world's second largest exporter of coffee.

Manufacturing, information technology, and high-tech industries now form a large and fast-growing part of the national economy.

At the time of project proposal, it was considered that: “With limited oil reserve in the country, domestic supply in Viet Nam has continued to decline, and imports have increased steadily and have been projected to be 50-60% of the total oil share by 2050”<sup>2</sup>. This projection has been confirmed by a 2017 energy report that states: “The trends in coal import and export, together with the net oil import proportion (crude oil and oil products) is now making Viet Nam a country reliant on imports with a net import of 5% in 2015. Viet Nam has moved from a position of energy exporter to a net importer. This change is going to impact the security of energy supply. The import share of total primary energy supply is expected to increase to 37.5% in 2025 and 58.5% in 2035”<sup>3</sup>.

The economic growth of Viet Nam has brought about an increase in oil consumption. The GDP per capita has grown in 53% and the total GDP in 125%. This economic development has led to a 1.91 times oil consumption increase during the same period.

In the case of Viet Nam, there has been an improvement in the policy framework for the promotion of bioethanol for fuel during the last 10 years.

The government has approved a group of important policy measures in that regard. One of the most relevant was Decision No. 53/2012 /QĐ-TTg of November 22, 2012, that established a roadmap to apply the blending rate of biofuels with traditional fuels. This roadmap was aimed to replace nationwide consumption of pure gasoline by E10 blends or superior in 2017.

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<sup>2</sup> Project document.

<sup>3</sup> Vietnam energy outlook report 2017. MOIT. 2017.

To ensure the sustainability of cassava supply required to achieve such goal, a detailed plan for nationwide planting of cassava was developed and approved by the Viet Nameese Ministry of Agriculture and Rural Development. This plan takes into account the needs for fuel ethanol production as well as other purposes.

More information about local conditions for bioethanol promotion in Viet Nam is provided in Annex 3.

## **Myanmar**

Myanmar officially the Republic of the Union of Myanmar is a country in Southeast Asia. Myanmar is bordered by India and Bangladesh to its west, Thailand, and Laos to its east and China to its north and northeast. In the south, about one-third of Myanmar's total perimeter of 5,876 km forms an uninterrupted coastline of 1,930 km along the Bay of Bengal and the Andaman Sea. As of 2017, the population is about 54 million. Myanmar is 676,578 km<sup>2</sup> in size. Its capital city is Naypyidaw, and its largest city and former capital is Yangon (Rangoon). Myanmar has been a member of the Association of Southeast Asian Nations (ASEAN) since 1997.

In 2011, the junta was officially dissolved, following a 2010 general election, and a civilian government was installed.

Myanmar is one of the poorest nations in Southeast Asia. It was admitted to least developed country status by the UN in 1987. As of 2016, Myanmar ranks 145 out of 188 countries in human development, according to the Human Development Index.

The most significant local conditions driving the production of bioethanol for fuel are:

The pace of economic development in recent times has increased the fuel demand, especially for farm machinery and motorized vehicles.

As the demand for energy has increased and the domestic fossil fuel supply has become stringent, the government has begun to explore other alternative sources.

Production of cassava in Myanmar is subsistent, but rising rapidly in recent years. The yield has not increased noticeably over the period, but area expansion has been the driver for the increased cassava yield.

It needs both a productivity increase and the appropriate technology to keep the momentum going.

In 2008, the Ministry of Energy submitted a draft statement to the government, proposing biofuels that Myanmar could promote. This statement includes the bio-ethanol from sugar cane and cassava. However, no specific targets were set out. Biofuel production is still on a pilot project basis or at an experimental stage.

Country development priorities were modified after a change of government and governmental policy in late 2011. The Framework for Economic and Social Reforms, issued in November

2012, did not include biofuels development as a target nor as a prioritized item<sup>4</sup>.

### ***Lao PDR***

Laos, officially the Lao People's Democratic Republic is a socialist state and the only landlocked country in Southeast Asia at the heart of the Indochinese peninsula. It is bordered by Myanmar (Burma) and China to the northwest, Viet Nam to the east, Cambodia to the southwest, and Thailand to the west and southwest.

Laos's population was estimated at 6.8 million in 2016, dispersed unevenly across the country. The country is predominantly rural (68 percent of the population). Vientiane prefecture, the capital, and largest city had about 740,010 residents in 2008. The country's population density was 27/km<sup>2</sup>.

Laos has a low-income economy, with one of the lowest annual incomes in the world. In 2014, the country ranked 141<sup>st</sup> on the Human Development Index (HDI), indicating lower medium development. Laos has been referred to as one of East Asia and Pacific's Fastest Growing Economies by the World Bank, with an annual GDP growth averaging 7.8% for the past decade.

The Lao economy depends heavily on investment and trade with its neighbors, Thailand, Viet Nam, and, especially in the north, China. In 2016, China was the biggest foreign investor in Laos's economy; Thailand and Viet Nam are the second and third largest investors respectively. Laos gasoline consumption has increased by 2.5 times during the period 2008 – 2014<sup>5</sup>. All that fuel is imported from Thailand and Viet Nam.

The first policy document that indicates the support of the Government of Lao PDR for the development of biofuel production was the “Renewable Energy Development Strategy in Lao PDR” issued in late 2011.

The tentative vision for the promotion and development of biofuels is the following:

- Replace 10% of the transportation fuel demand by 2025;
- Increase deployment of biofuels technologies in rural areas.

For a more detailed description of the policy development for bioethanol promotion in Lao PDR see annex 3

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<sup>4</sup>PIR 2013 – 2014.

<sup>5</sup>Bioethanol Development Plan 2018 - 2025. UNIDO.

**ii. Project summary:**

Fact sheet of the project:

Project Title	Overcoming policy, market and technological barriers to support technological innovation and south-south technology transfer: the pilot case of ethanol production from cassava.
GEF ID	4037
UNIDO project ID	100264
Region	Asia and the Pacific
Country(ies)	Thailand, Viet Nam, Myanmar, Laos
GEF Focal area(s) and operational program	GEF-4 STRATEGIC PROGRAM: CC-SP4
GEF Agencies (implementing agency)	UNIDO
Project executing partners	King Mongkut's University of Technology Thonburi (KMUTT) <sup>6</sup> , Thailand; Liquor Distillery Organization (LDO), Thailand; Ministry of Industry and Trade (MOIT); Viet Nam, Food Industries Research Institute (FIRI), Viet Nam
Project size (FSP, MSP, EA)	FSP
Project CEO endorsement/Approval date	March 2012
Project implementation start date (PAD issuance date)	June 2012
Original expected implementation end date (indicated in CEO endorsement/Approval document)	January 2016
Revised expected implementation end date (if any)	December 2016
Actual implementation end date	December 2018
GEF Grant (USD)	2,600,000
GEF PPG (USD) (if any)	180,000
UNIDO inputs (USD)	80,000 (cash)
Co-financing (USD) at CEO Endorsement	31,623,000 (cash + in-kind)
Total project cost (USD) (GEF Grant + Co-financing at CEO Endorsement)	34,403,000
Mid-term review date	February 2015
Planned terminal evaluation date	November 2018

<sup>6</sup> The main project executing partner of the originally approved project was the National Science and Technology Development Agency (NSTDA) of Thailand. At project startup, the NSTDA quit the project and was substituted by King Mongkut's University of Technology Thonburi (KMUTT). In this evaluation report, reference to NSTDA role and tasks, coming from the approved prodoc, are referred to KMUTT that is the agency that undertook them during project implementation.

This project addresses the issue of participant countries' heavy reliance on imported fossil fuels for transportation.

The objective of the project is "to remove barriers and create a conducive environment to promote the adoption of ethanol production technology from cassava and South-South technology transfer."

The Very High Density – Simultaneous Saccharification and Fermentation (VHD – SSF) technology, developed by KMUTT, is the technology to be transferred. This technology allows the use of fresh cassava roots as raw material for bioethanol production, reduces energy consumption and production costs and increases production capacity of existing bioethanol production facilities.

Three outcomes were formulated to achieve this objective:

- Outcome 1. Enhanced capacity of KMUTT, Thailand to lend sustainable support to the region  
This outcome is focused on increasing KMUTT's capacity for the transfer of the technology for ethanol production from cassava. Expected outputs are related to establishing an information hub, prepare a technology package for technology transfer, develop training tools and a database about ethanol production.
- Outcome 2. Conducive environment to promote bio-ethanol technology and strengthened policies to promote ethanol to replace conventional fuels.  
This outcome has the aim to improve the conditions for technology absorption at country level. Plans are to achieve that goal improving pricing and environmental policy, providing training, and increasing awareness of relevant actors in recipient countries.
- Outcome 3. Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV.  
This outcome aims to create a technological platform for the demonstration and evaluation of the technology for bioethanol production from cassava in specific conditions. Its outputs point to the building and operation of one demonstration plant in Thailand and a pilot plant in Viet Nam and support the investment in a commercial plant. Originally this pilot plant should have been built in Myanmar, but it was later moved to Lao PDR. A training center should be established in FIRI, Viet Nam.

This outcome should also contribute to enhance private companies' and financial institutions' interest to participate in the assimilation of the technology developed. The indicator of this outcome is the number of new feasibility studies supported by the project in the region. Interested private companies would receive technical support and advice for the introduction of the transferred technology.

The project startup has been challenging.

The project implementation was approved to start in February 2012. The National Science and Technology Development Agency (NSTDA) of Thailand was supposed to act as the main national project executing partner. However, after Thailand's cabinet reshuffle in the fourth

quarter of 2012, the Ministry of Science and Technology, where NSTDA is under, changed NSTDA's priorities. As a result, in January 2013, NSTDA decided to drop the project.

After a period of consultancies and meetings during 2013, UNIDO and King Mongkut University of Technology Thonburi (KMUTT) agreed that the latter would take on NSTDA's planned activities. KMUTT's successful work in the field of improving ethanol production technology using cassava as raw material contributed to this decision. Said decision was also supported by recognition that this university was one of Thailand's most advanced and well-known research institutes on renewable energy technologies.

The first project steering committee meeting was held in December 2013. Hence, that is considered to be the actual starting date of the project. Real project activities commenced only in June 2014<sup>7</sup> after the agreement between KMUTT and UNIDO was signed<sup>8</sup>. That is to say, 20-28 months later than expected. In a large extent the delay was a direct consequence of Thailand's political situation at the time.

Subsequently, the project closing date has also been changing during project implementation.

While the original closing date was January 2016, the 2<sup>nd</sup> PSC meeting held in January 2015 agreed to extend the project to July 2017.

The 4<sup>th</sup> PSC meeting, in December 2016, recommended extending the project for one more quarter. Later, in June 2017, KMUTT made an official request to UNIDO, at FIRI's request for an extension of the project until December 2018. This request was approved in September 2017.

Another major change in project implementation was the role of Myanmar and Lao PDR in relation to project output "3.6 Bio-ethanol production technology commercialized with the establishment of a 400,000 l/d plant in Myanmar."

In late 2011, after a change of government and governmental policy in Myanmar, country development priorities were changed. A Framework for Economic and Social Reforms (FESR) was issued in November 2012. The FESR states policy priorities for 2012-2015 towards the Long-Term Goals of the National Comprehensive Development Plan. Nevertheless, the FESR does not include Biofuels development as a target nor as a prioritized item<sup>9</sup>. As a consequence of these policy changes, the private investor that was supporting investment in ethanol from cassava in Myanmar formally quit from the project.

The alternative to keep this technology transfer output in place was proposed by Laos. In April 2015, the Institute for Renewable Energy Promotion (IREP) sent UNIDO a letter of interest to collaborate on the project with two Laotian companies to adopt the technology for ethanol production of a total of 200,000 liters per day.

The main beneficiaries of this project are governmental departments in charge of biofuel policy,

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<sup>7</sup> Minutes of Second PSC meeting.

<sup>8</sup> 2013 – 2014 PIR.

<sup>9</sup> PIR 2013 – 2014.

private companies, and R&D and financial sector institutions from participant countries.

As per the project document the following implementation arrangements were made:

- UNIDO is responsible for:
  - The implementation of the project, the delivery of the planned outputs and the achievement of the expected outcomes.
  - The release of GEF funds at the appropriate period.
  - The selection of experts, project briefings, the approval of contracts for implementation activities, procurement, initial operations, monitoring, and reporting.
- A Project Management Unit (PMU) was established in UNIDO Regional Office, Bangkok
  - The PMU consists of a recruited administrative staff member, a national project expert that shall act as national project coordinator, a person designated by KMUTT and a Project Manager at UNIDO Headquarters.
- The project will be executed in collaboration with the relevant Ministries of respective governments, national organizations like KMUTT, FIRI and LDO and private sector stakeholders.
- A Project Steering Committee (PSC) will be established. The PSC will have a balanced representation from key stakeholders.
- The committee will be chaired by the GEF Focal point (Operations). The final composition of the PSC will be defined during the project implementation startup phase. The PSC is expected to meet twice a year.

Project counterpart organizations include governmental organizations, research institutes and universities, private sector companies and trade associations.

The most important project counterpart organizations are as below:

In Thailand:

- KMUTT,
- Thai Tapioca Development Institute (TTDI),
- Liquor Distillery Organization (LDO).

In Viet Nam:

- Ministry of Industry and Trade, and
- the Food Industries Research Institute.

In Myanmar:

- The Chamber of Commerce (UMFCCI), and
- Kaung Kyaw Say Group of Companies (KSS)

In Lao PDR:

- The Ministry of Energy and Mines (MoEM), and
- The Institute of Renewable Energy and Promotion (IREP) under the Ministry of Mine and Energy.

### III. Project assessment

#### A. Project design

Project preparation was in charge of the National Science and Technology Development Agency (NSTDA) under the Ministry of Science and Technology of Thailand.

The window “Pilot Projects” of the Technology Transfer Strategic Program under the GEF 4 replenishment was selected for project presentation.

The preparatory phase of the project lasted from July 2009 to December 2011

The main milestones of this process are:

- July 2009. The PIF was sent to GEF.
- September 2009. The PIF is resubmitted to GEF.
- September 2009. A request for project preparation grant (PPG) is sent to GEF. A GEF contribution of 100,000 US\$ to be implemented from January to June 2010 is requested.
- September 2011. The project proposal is sent for approval to GEF Sec.
- December 2011. The project proposal is resubmitted for approval to GEF Sec.
- December 2011. The project is approved.

The goal of the approved project is to “reduce GHG emissions in the ethanol production sector, as well as due to increased use of ethanol for fuel in Thailand and LMV countries.”

Although the wording of this goal is acceptable, the objective of the project is ambiguous and general.

The project objective is “To remove barriers, and create a conducive environment for the promotion of ethanol technology and South-South technology transfer.”

It should have been more specific and indicate that the transferred technology is for bioethanol production from cassava via South–South technology transfer from Thailand to LMV countries.

A more precise wording of the project objective could have been: “To remove barriers and create a conducive environment for the promotion of South-South technology transfer of bioethanol production technology from cassava among selected countries of Southeast Asia.”

Considering that technology transfer is a process where two sides are involved—one side that owns the technology (the transferor) and another one that absorbs it (the transferee) - a barrier analysis should have been provided according to the role of every participating country in the technology transfer process.

In the case of Thailand, barriers refer to bioethanol development for fuel promotion. Barriers mentioned in the prodoc have to do with the security of raw material supply, pricing, and confidence of relevant actors in the policy regulatory framework.

In the case of Viet Nam, barriers focus on the need to improve policy instruments and framework, while in the case of Laos and Myanmar stated barriers are the lack of adequate policy and technical capacity. No reference is made to financing barriers, local R&D capacities,

investment regulations, institutional capacity to support technology transfer, property rights, etc. Notwithstanding those failures in barrier analyses, project outcomes are much more focused on supporting the technology transfer process (Table 1).

Table 1. Outcomes and technology transfer process

Outcome 1: Enhanced capacity of NSTDA (KMUTT), Thailand to lend sustainable support to the region

- **Aim:** to strengthen KMUTT's institutional capacity to transfer bioethanol production technology.
- **Contribution to TT process:** enhancing the capacity of the Thai institution that developed the technology to play the role of technology transferor.
- **Via:** Improving the access of potential transferees/users to information and training activities related to the transferred technology.

• Outcome 2: Conducive environment to promote bio-ethanol technology and strengthened policies to promote ethanol to replace conventional fuels

- **Aim:** to build recipient countries' capacities for technical assimilation of the new bio-ethanol technology, raise the required awareness among policy makers to adopt the appropriate policies, and develop ethanol pricing tools.
- **Contribution to TT process:** improving conditions for technology absorption in recipient countries.
- **Via:** Raising awareness and providing training to relevant actors of the technology transfer process.

• Outcome 3: Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV.

- **Aim:** to remove some barriers to the introduction of the new technology.
- **Contribution to TT process:** facilitating technical acceptance of technology by entrepreneurs, technicians and decision makers.
- **Via:** establishing pilot and demonstration plants, and providing private companies with feasibility studies.

A first analysis of the project design aims to verify the formulation of components, outcomes, and outputs (Table 2):

Criteria for this analysis are:

- **Components:** If the title corresponds with the core activity of the component.
- **Outcomes:** If the formulation reflects the expected effect resulting from outputs and their contribution to the achievement of the project objective.
- **Outputs:** If they are products, capital goods, and services or changes resulting from project implementation.

Table 2: Formulation of components, outcomes, and outputs

Component 1	Component 2	Component 3
<ul style="list-style-type: none"> <li>• Institutional capacity strengthening for Very High Gravity – Simultaneous Saccharification and Fermentation technology dissemination.</li> </ul>	<ul style="list-style-type: none"> <li>• South South Technology Transfer, Capacity building and policy dialog with participants from Lao PDR, Myanmar and Vietnam.</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV</li> </ul>
<p>Outcome 1: Enhanced capacity of NSTDA, Thailand to lend sustainable support to the region</p>	<p>Outcome 2 : Conducive environment to promote bio-ethanol technology and strengthened policies to promote ethanol for replacing conventional fuels.</p>	<p>Outcome 3: Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV.</p>
<ul style="list-style-type: none"> <li>• Output 1.1: Information hub established for disseminating and supporting the south south technology transfer.</li> <li>• Output 1.2: Ethanol technology package finalized for dissemination</li> <li>• Output 1.3: Manuals, tool kits and structured training programs developed for technology transfer.</li> <li>• Output 1.4: Database on ethanol technology developed and maintained by ethanol information hub</li> </ul>	<ul style="list-style-type: none"> <li>• Output 2.1: Regional awareness created for the new technology package.</li> <li>• Output 2.2: Trainings conducted in Thailand for farmers, entrepreneurs and technicians.</li> <li>• Output 2.3: Trainings conducted in Thailand for engineers, scientist and researchers</li> <li>• Output 2.4: Pricing practices and policy environment improved.</li> </ul>	<ul style="list-style-type: none"> <li>• Output 3.1: A demonstration plant established in Thailand with ethanol production capacity of 200 l/day.</li> <li>• Output 3.2: Training center established at FIRI Vietnam to disseminate and provide trainings on the new technology package.</li> <li>• Output 3.3: A demonstration plant established in Vietnam with ethanol production capacity of 50 l/d capacity.</li> <li>• Output 3.4: Financing opportunities improved to finance the new technology.</li> <li>• Output 3.5: Private sector assisted in project development for replicating the projects.</li> <li>• Output 3.6: Bio-ethanol production technology commercialized with the establishment of 400,000 l/d plant in Myanmar.</li> <li>• Output 3.7: Demonstration projects evaluated. Lessons learnt and information widely distributed.</li> </ul>

Based on the criteria mentioned above, the following project design failures are identified:

- ✓ Formulation of the title of all components could be improved.
  - Component 1. The name of the component is a detailed description of a result.
  - Component 2. The title is an enumeration of activities.
  - Component 3. It is formulated like an output.
  
- ✓ Formulation of outcomes is not precise.
  - Outcomes are formulated regarding an expected effect, except for outcome 2.
  
  - Outcome 1. Its formulation is too general and inaccurate.
    - It focuses on the capacity to lend “sustainable support”, but it fails to specify what the support is for.
    - It mentions to lend this support to “the region”, but does not specify what region it is.
  
  - Outcome 2 is not formulated in terms of the effect or expected change.

Its formulation does not match the description of component 2 in the prodoc, that focuses on awareness raising and capacity building<sup>10</sup>.
  
  - Outcome 3 formulation is confusing.
    - There is a lack of connection among the title, the description in prodoc and the outputs of this component:
      - The title of the outcome, “Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV”, is about cross-border cooperation and improvement of the investment climate.
      - The description of the outcome in the prodoc focuses on “removing the existing barriers in the market so that the new technologies could be commercialized.”<sup>11</sup> It is noway related to the title.
      - Outputs of this component are aimed to the practical implementation of the technology at pilot, demonstration and commercial levels; dissemination of these experiences and engagement of private companies in the evaluation of investment opportunities using the transferred technology. In any case, these outputs seek to reduce the barrier associated to the lack of confidence in the technology, but not market barriers.

Analysis of project outputs will be provided while analyzing the project result framework. Although, most of the outputs are adequate and contribute to achieving outcomes, some of them are not.

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<sup>10</sup> Pag 24 prodoc. Component 2 includes activities that will build the capacity of recipient countries and other interested party as observers, familiarize with the new bio-ethanol technology and engage policy makers in dialogues for creating the necessary awareness and formulating the policy in support of the new ethanol technology package

<sup>11</sup> Pag 25 prodoc

**Analysis of the project result framework (Annex A.1 & A.2):**

A central component of the project design is the project result framework (PRF). This tool clearly shows the interconnection among project goal, objective, outcomes, and outputs. It also indicates how to measure project progress.

With this aim, the PRF defines the indicators, their baseline, and the targets. Some insufficiencies of the PRF are:

- Most of the indicators are not SMART (specific, measurable, attainable, relevant and, where possible, time-bound).
- Most of them are expressed in terms of achievement of the expected output but not in terms of the expected impacts of achieved outputs.
- Outputs related to training activities, pilot, and demonstration plants are an exception.
- None of the indicators are time bound.

An example of the above-described situation is output 3.2 (Table 3).

Table 3. Output 3.2 Indicators

Output	Quantified and time-bound indicator	Baseline	Target
3.2 Trainingcenter established at FIRI Viet Nam to disseminate and provide training on the new technology package.	1.Training center established at FIRI, Viet Nam. 2.Operation of the training center. 3.Toolkits and manuals adjusted to local conditions.	No technical Centre available for the development of bio-ethanol technology in Viet Nam.	Establishment and sustainable operation of the Centre.

- In some cases, output formulation is unfortunate.

An example is output 3.4 “Financing opportunities improved to finance the new technology” (Table 4).

This output is based on the assumption that a better understanding of the new technology by financial institutions will help improve financing opportunities significantly. It is a large simplification of access barriers to financing sources.

For this reason, planned activities to achieve this output are the training of officials from financing institutions. However, existing financial barriers are the key issue for improving financing opportunities.

Similarly, the selected result indicator of this output and its target are misguided. The indicator is formulated regarding approved increase of financing resources for this technology and the target in terms of readiness of financing institutions to support such projects. However, no reference is made in terms of training of personnel that was the actual

aim of this output.

Table 4. Indicators output 3.4

Output		Quantified and time-bound Indicator	Baseline	Target
3.4	Financing opportunities improved to finance the new technology.	Percentage increase in financing for new ethanol technology by the financing institutions.	Financial institutions are reluctant to finance for the new bio-ethanol production technology.	Financial institutions ready to finance the new bioethanol production technology.

- Another mistake is when the indicator and its target go beyond what could actually be achieved within the scope of the project.

For example:

- Output 2.4 “Improved pricing practices and policy environment” and its target “Adequate policy environment and pricing practices are in place.” They seek to achieve practical implementation of project recommendations during the project implementation. Project practice indicates that usually that is not feasible.

- Output 3.5 “Private sector assisted in project development for project replication.” Indicators of this output are related to the identification of private investors interested in investing in transfer of technology and “at least 5 replication projects developed in Thailand and LMV countries.”

Besides that, this output has two indicators and that is not right, it is very unlikely that the second indicator is achieved.

This indicator suggests that private investors would be able to develop a project ready to be introduced in banking institutions (“a project developed”) in a relatively short period. That is very unlikely considering existing barriers.

Likewise, according to the project concept, Thailand should not have been included in this indicator because this country is the transferor in this technology transfer process.

- Output 3.6 “Bio-ethanol production technology commercialized with the establishment of a 400,000 l/d plant in Myanmar” is very unrealistic at least for two reasons:

a. Selection of Myanmar

Myanmar is among participating countries, the one with a less developed policy framework for the promotion of biofuels. Additionally, this country has no experience in ethanol production and the cassava production is not widely deployed.

Therefore, and despite a private investor was interested in investing in Myanmar, it was possible to conclude, even during the project preparation phase, that the selection of Myanmar for implementation of such plant was inadequate.

- b. Planning installation of a 400000 l/d ethanol producer facility during the four years of the Project.

According to project planning, the effective period available to achieve this output was no more than three years.

This period is too short, especially in Myanmar conditions, at least to implement the following tasks: location of site for production facility; evaluation of availability of raw material and signing of supply agreement with cassava producers; selection of technology supplier on the basis of received commercial offers; identification of ethanol buyers and agreement on product purchasing; provision of a technical economic analysis; permits and allowances; approval of financing loans by a bank; design of engineering projects, and execution of construction works and startup process.

## B. Implementation performance

### Ownership and relevance

This project aims to support the transfer of technology for ethanol production from cassava developed by KMUTT (Thailand) to private companies and R&D institutions from Viet Nam, Lao PDR and Myanmar.

All these countries are net fuel importers and the reduction of petroleum products, including gasoline, consumption is a priority.

During the project implementation period, reliance on fuel imports has been reinforced, due to an increase in fuel consumption as result of fast economic growth.

In response to this situation, Viet Nam and Laos have declared the promotion of biofuels a priority of their national renewable energy development strategies. Viet Nam hopes to achieve a 100% substitution of pure gasoline by gasohol in 2018, and Lao PDR is seeking to achieve 10% replacement of gasoline by gasohol by 2025. Promotion of bioethanol production is supported by National Biofuel Programs or Strategies in the afore mentioned countries and Thailand.

This positive policy context is a guarantee for sustainability of project outcomes.

The technology package, developed by KMUTT, to be transferred within the scope of this project, includes both the ethanol and cassava production technology based on the Thai experience. One of the most important impacts of this technology package is the cost reduction of ethanol production from cassava. It is a relevant contribution to market penetration of bioethanol blends because it reduces market barriers linked to high ethanol prices.

Another barrier that both countries are working on has to do with the implementation of policy tools that promote the achievement of market penetration goals.

Even in the case of Viet Nam, that shows greater progress than Lao PDR in this area, project activities represent a solid contribution to advance in the improvement of the policy environment.

In conclusion, the project is **very relevant** as it helps participant countries achieve their development goals through the reduction of fuel imports through the replacement of gasoline by bioethanol mixes.

### Effectiveness

Assessment of project effectiveness will be based on the analysis of project results per outcomes and outputs.

Outcome 1. “Strengthened institutional capacity for the dissemination of the Very High Gravity - Simultaneous Saccharification and Fermentation (VHG – SSF) technology.”

This outcome aims to develop a regional capacity for the dissemination of the technology and for the training of the relevant actors to ensure the sustainability of long-term deployment of the product.

This goal was planned to be achieved through four outputs.

Output 1. Information hub established to disseminate and support the south - south technology transfer.

The ASEAN Centre for Cassava Research and Development, under KMUTT, contributes to the long-term sustainability of this output. This center maintains a website under <http://www.aseancassava.info> that was launched in 2014. This website serves as an information hub for the dissemination and support of the South-South technology transfer related to cassava and bioethanol production.

According to the project document this information hub would serve as an information-clearing house for Thailand and it should:

- Include all technical, financial and policy related issues concerning bioethanol.
- Establish, maintain and update information and data on cassava and VHG-SSF.
- Assist the PMU in undertaking all project activities such as hiring experts and others for training and other activities, procuring necessary equipment, etc.

Website design is user-friendly, and it is reportedly widely accessed by a large group of researchers and specialists from ASEAN countries.

The information and data included in the website are mainly about the situation and technical aspects of the cassava and VHG – SSF technology package. It should be noted, that dynamic data in the website, like those related to annual production of cassava and ethanol, are not updated systematically<sup>12</sup>.

The information about project activities and products is wide-ranging and updated. All manuals and guidelines developed by the project can be downloaded from the “project” menu.

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<sup>12</sup> Access to website on October 31 2018, shown that the production data of cassava and ethanol correspond to 2015.

A drawback of this website is that it does not focus on supporting technology transfer by facilitating access to relevant information for policy decision-makers, entrepreneur, and investors.

The following are examples of the information lacking:

1. Global trends in bioethanol development.
2. Biofuel national strategies, programs, and targets for the promotion of bioethanol for fuel
3. Policy support to bioethanol production and market penetration. For example, experiences about: tax exemption, pricing schemes, financial support, subsidies, etc.
4. Information about medium – long-term government plans for bioethanol production, costs, price, market penetration, etc.
5. Bioethanol and cassava production technologies, standards, indicators, good practices, etc.

It should be noted that some information about the above-mentioned topics can be downloaded from the website. However, those issues should have a much higher hierarchy and visibility in the website's menu. Some of the high-level menu entrances could have been dedicated to these topics, facilitating users' access to this kind of information.

Output 1.2 Ethanol technology package finalized for dissemination.

The technology package “Transformation of Cassava to Bioethanol” is based on a comprehensive approach that includes:

- Improved productivity of cassava root production.
- Improved in-factory raw material management and pre-fermentation practices
- Improved fermentation process

The know-how and know-why necessary for a successful technology transfer was included in the manual “Cassava Bioethanol.” It is a detailed manual for ethanol production from cassava including raw material handling, feedstock preparation, hydrolysis and fermentation technology. This manual is available in Thai and Viet Nameese languages.

Output 1.3 “Manuals, toolkits and structured training programs developed for technology transfer.”

This output aims to develop a training module to support the technology transfer for bioethanol production using cassava as raw material. This module was designed on the basis of a four-step management method used for the control and continuous improvement of PDCA (Plan-Do-Check-Act) processes.

It consists of a series of activities:

- ✓ An intensive workshop on cassava bioethanol for use as alternative energy.
- ✓ Hands-on training on bioethanol production from cassava.
- ✓ Field trip to cassava farms and bioethanol plants.

The training program was divided in two workshops:

- ✓ Workshop I: Introductory Workshop on Ethanol Production from Cassava.  
It is a five-day workshop seeking to improve understanding of bioethanol as an alternative transportation fuel, the farming of cassava, and the production of bioethanol.
- ✓ Workshop II: Intensive Workshop on Ethanol Production from Cassava.  
The program of this workshop includes the know-how for the increase of the yield of cassava, the fermentation technology, and to increase the efficiency of ethanol production facilities.

Output 1.4 Database on ethanol technology developed and maintained by the research center.

The project document offers very little guidance about the aim, scope, and content of this database. It is described as: “ethanol development database”; “Database on ethanol technology”; “ethanol database”; it also indicates that there “will be a formal launching of the database, to gain recognition and to seek broader collaboration.”

Such database, in the scope of a South-South technology transfer project, could have been conceived as a tool to facilitate access to data about ethanol production at global, regional and selected country levels, market penetration of fuels for transport, and the share of different feedstock in the raw materials used for bioethanol production. Information about the capacity of production facilities, the technologies used, their more relevant performance indicators and development trends, could have also been considered for inclusion. An independent database could have been included in the information hub.

But the project team, in charge of this output, concluded that the database to be developed by this output is the same that facilitates access to the information of the website.

The 4<sup>th</sup>Progress Report<sup>13</sup> reports the progress of this output jointly with that of output 1.1, explaining that:

- “This database provides profiles of researchers in ASEAN and worldwide.”
- “The database provides access to full text research articles for registered members.”
- “the database of full-textarticles.”

Considering the lack of guidance in the prodoc, the approach of the project team implementing this output could be considered acceptable.

Outcome 2. Conducive environment to promote bio-ethanol technology and strengthened policies to promote ethanol for the replacement of conventional fuels.

This outcome focuses on raising the awareness and knowledge of relevant actors on bioethanol technology and improving policy regulations, in particular, pricing policies, to promote the adoption of the transferred technology.

According to the description of this outcome in the project document, the organization of workshops is the main kind of activity to be implemented. These workshops should be attended by representatives of key actors from different sectors that intervene in this technology transfer process. Most of these meetings were planned to be held in Thailand and Viet Nam under the leadership of KMUTT and FIRI.

Output 2.1. Regional awareness created for the new technology package.

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<sup>13</sup>February 1, 2015 – July 31, 2017

Pursuant to the project document, it was expected that UNIDO, along with KMUTT and MOIT organize a regional workshop in Thailand. Participants in this workshop should be representatives of Thailand and LMV countries. The objective of this activity is to raise awareness on the new technology and the technology transfer package.

Moreover, the prodoc planned the organization of consecutive national workshops to kick-start national project activities in Thailand and Viet Nam. Simultaneously, surveys of potential users of the new technology package were to be conducted in Thailand and Viet Nam. A study tour to Thailand was also planned. The objective of this study tour would be to expose private sector representatives and key officials of LMV countries to this new technology.

Actually, during project implementation, no regional or national awareness raising workshops were organized.

Nonetheless, some activities organized by the project contributed to creating regional awareness on the bioethanol technology to be transferred.

The following are examples of those activities:

- ✓ A Focused Group Meeting “Bioethanol investment in Lao PDR and Myanmar” was organized in Thailand on August 2014. The objective of this meeting was to convince representatives from private sector in Lao PDR and Myanmar about the technology and its benefits. It was attended by 18 people, among them representative of three private companies from Lao PDR and the Myanmar Food Processors & Exporters Association
- ✓ Four regional training workshops on bioethanol production from cassava. They were attended by 258 people from 5 different countries of the region. These workshops were organized from March 2016 to May 2018.
- ✓ The participation of the project in the RE&EE 2016 Viet Nam Exhibition in Ho Chi Min city. November 9-11, 2016.

The project organized a stand at this exhibition as a platform to promote and disseminate the bioethanol technology. The exhibition program included the presentation “Cassava bioethanol: The Thai experience and South-South Technology Transfer to LMV” at the technical seminar.

- ✓ A Technology Study Tour in Thailand on Bioethanol Production for governmental officials, private sector companies and key investors from Lao PDR and Viet Nam on June 7-9, 2017.

The objective of this activity was to encourage the participants to apply this novel technology and to understand its benefits. Participants were representatives of companies involved in bioethanol production, of related ministries and investors from Laos and Viet Nam (a list of 10 participants is shown in Table 4.3).

Ten people attended this mission. The five people from Viet Nam were high-level staff from three different private companies involved in ethanol production. In the case of Lao PDR, four of the members were directors or deputy directors of four companies, and the other one was an official from a regional energy authority.

This output was partially achieved.

Output 2.2. Training conducted in Thailand for farmers, entrepreneurs and technicians.

The training programs for farmers, entrepreneurs and technicians pertain to Training Module I. The workshop based on this training program was called “Introductory Workshop on Ethanol Production from Cassava.”

This module has two major components: cassava production and ethanol production from cassava roots. Subsequently, two different introductory workshops were held, each one dedicated to one of those components.

The workshop on ethanol production has a five-day program. The program of this workshop is related to national and global policy experience, feedstock, standards, incentives and regulations, cassava varietal development in Thailand, good agricultural practices and ethanol production processes.

The workshop on cassava production has a three-day program. The main topics included in the program are cassava farming, including variety development, water usage, pest control, and farm management.

In every workshop, the participants received the English version of the handbook and manual Ethanol Production from Fresh Cassava Roots by Very High Gravity-Simultaneous Saccharification and Fermentation (VHG-SSF) Process.

Two workshops devoted to ethanol production from cassava root were organized:

- ✓ 1st Introductory Workshop on Ethanol Production from Cassava. Mar 21-25, 2016 in Bangkok.
- ✓ The 3rd Introductory Workshop on Ethanol Production from Cassava. February 27 – March 3, 2017. Bangkok.

This last workshop was held as a parallel session in The International Conference on Sustainable Agriculture and Bio economics 2017: AGBIO2017.

The training component devoted to cassava production was also presented in two workshops:

- ✓ 2nd Introductory Workshop on Ethanol Production from Cassava. Nov 2016.  
The Workshop was held in 2 rounds on November 15-17 and 21-23, 2016 at the Thai Tapioca Development Institute (TTDI), Nakornratchasima, Thailand.
- ✓ The 4<sup>th</sup> Introductory Workshop on Ethanol Production from Cassava. May 16 – 18, 2017. Thai Tapioca Development Institute (TTDI). Bangkok.

These workshops on cassava production were organized for Laos’ participants, according to the prioritized needs of that country. The number of participants in this training represents the 62% of the 250 people attending all training modules of the project (Table 5).

Participants’ affiliation depended on the needs of the technology transfer process: attendees directly involved in the promotion of the technology at regional level in Laos represented 62%, and at national level, the 26% of the total; the third group of participants were from universities.

In the case of the training on ethanol production, the participants included representatives from 6 ASEAN countries. Representatives from Viet Nam accounted for 56 % and from Laos 26%, that distribution corresponds with the project goal. The composition of participants by

affiliation also reflects the technology transfer promotion needs. Namely, 38% were from companies, 32% from R&D institutions, while 11% were from ministries and universities.

It should be noted, that the figure of 250 participants is higher than the one planned by the PRF, i.e. 150 participants.

Table 5. Participants in introductory workshops

		Ethanol industry			Cassava Production			Total
		W 1	W 3	total	W2	W4	Total	
Per country	Lao PDR	15	11	26	123	38	161	187
	Thailand	3	0	3	0	0	0	3
	Myanmar	4	0	4	0	0	0	4
	Viet Nam	35	20	55	0	0	0	55
	Cambodia	2	5	7	0	0	0	7
	Philippines	0	2	2	0	0	0	2
Per field of interest	Farming	8	7	15	123	38	161	176
	Business	13	21	34	0	0	0	34
	Engineering	38	10	48	0	0	0	48
Per affiliation	Company	13	24	37	0	3	3	40
	Ministry	13	2	15	20	22	42	57
	University	9	2	11	26	1	27	38
	Research	24	8	32	0	3	3	35
	Regional Authority	0	2	2	77	9	86	88
	Total	59	38	97	123	38	161	258

The quality of the program and the amount and composition of the participants in workshops organized under this output assure the achievement of its target.

### Output 2.3. Training conducted in Thailand for engineers, scientists, and researchers.

The training program for engineers, scientists, and researchers was organized as Workshop II: “Intensive Workshop on Ethanol Production from Cassava.” It is a five-day hands-on workshop dedicated to ethanol production from fresh cassava roots through the VHGS-SF process. The program of the workshop included practical sessions at the laboratory and the pilot unit, as well as analytical methods for cassava feedstock, liquefied mash, and fermented mash.

The handbook and manual on Ethanol Production from Fresh Cassava Roots by Very High Gravity-Simultaneous Saccharification and Fermentation (VHGS-SF) Process was available in English and Thai languages. They were distributed to all workshop participants.

The workshop was held from March 28-April 1, 2016 at the Cassava and Starch Technology Research Laboratory (CSTRU), the National Center for Genetic Engineering and Biotechnology (BIOTEC), and King Mongkut’s University of Technology Thonburi (KMUTT), Bangkhuntien Campus. The workshop was attended by 34 specialists from 5 countries; the most represented country was Viet Nam. That responds to the training needs of Viet Nameese specialists of the FIRI training center. As for their affiliation, 68% of the participants were specialists from research centers, that mainly act as links between companies and the new technology (Table 6.)

Table 6. Participants workshop II

By country			By affiliation		
Lao PDR	7	21%	company	1	3%
Thailand	7	21%	ministry	6	18%
Myanmar	4	12%	university	4	12%
Viet Nam	16	47%	research	23	68%
Total	34	100%		34	100%

This output was fully achieved.

#### **Output 2.4. Pricing practices and policy environment improved.**

According to the prodoc narrative:

The final aim of this output is to contribute to increase policy support for the promotion of bioethanol production. The main country target is Viet Nam.

The main activities planned under this output were:

- Expert level training to be conducted to create a better policy, pricing structure and mechanism to promote E5 in Viet Nam.
- A policy intervention and pricing tools for Viet Nam, developed by an international expert on the basis of international best practices and the experience in Thailand, will be proposed to Viet Nameese authorities.
- Policy forums would be conducted in Viet Nam, which would focus on the gasohol pricing structure.
- An awareness campaign would be conducted to popularize E5 among Viet Nameese consumers.

Improving policy environment in Viet Nam is critical to advance in the achievement of national goals for sustainable penetration of gasohol in the national fuel market.

“Although Viet Nam has a roadmap for the implementation of the bioethanol promotion policy, its implementation hasn’t achieved the expected target. That is not only due to oil, feedstock, and bioethanol prices, but also to the lack of clear policy tools to subsidize ethanol producers and farmers. As a consequence, some companies had to shut down their plants.”<sup>14</sup>

This output is mainly under the execution of MOIT who is the government body in charge of implementation of the ethanol policy in Viet Nam.

During the long startup period of the project, MOIT agreed with TORs proposed by UNIDO to take over the activities under this project output, only in November 2014.

But activities under MOIT’s contract were delayed for two years <sup>15</sup>. In this regard, MOIT has recognized that due to its ministerial responsibility and administrative rules it was very difficult to fulfill their accepted commitments. For this reason, the contract of MOIT with UNIDO was reassigned to FIRI.

<sup>14</sup> Minutes of 3<sup>rd</sup> PSC meeting. December 2016.

<sup>15</sup>PIR 2017

At the moment of the final PSC meeting on December 2018<sup>16</sup>, the only fully accomplished activity of this output is the “awareness campaign to popularize E5 among Viet Nameese consumers.”

To support this activity the report “Promotion plan of Ethanol consumption in the transportation sector” was prepared. An international expert hired by MOIT wrote this report. This report provides a comprehensive analysis of the Thai experience in the development of gasohol production and marketing, an overview of the current situation of gasohol in Viet Nam and includes an “E5 Consumption promotion plan” for MOIT.

In the scope of the E5 promotional campaign, MOIT organized training and awareness raising events in three provinces: Hanoi, Danang and Ho Chi Minh City. These events were attended by 300 participants in each location.

MOIT has developed the E5 promotion campaign on the basis of recommendations described in the above-mentioned report.

At the time of TE field visit, the implementation of the rest of the planned activities of this output in Viet Nam was pending the signing of a new UNIDO – FIRI contract. Under this contract, FIRI would take over previous MOIT’s commitments.<sup>17</sup> Later on, the Project Steering Committee final meeting report<sup>18</sup> specifies that these activities were planned to be finalized during the Q1 2019.

The Expert-level training on policy and pricing structure of bioethanol in Lao, Thailand and Viet Nam was successfully hold on November 16 – 17, 2018 in Hanoi, Viet Nam. An international expert from King Mongkut’s University of Technology Thonburi (KMUTT), Thailand was hired to design and facilitate the course.

The course had a two days program, that included presentations about the experience on policy and pricing structure of bioethanol in Thailand, Lao and Viet Nam. It was attended by 15 representatives from Ministry of Energy and Mine from Laos PDR, Viet Nam National Petroleum Group and Ministries of Industry and Trade and of Agriculture and Rural Development of Viet Nam. This course was supported with a training booklet, specially prepared for the occasion, was prepared with the information on success stories from Thailand, USA and Brazil and, on policy and pricing structure on bioethanol and current situation in Viet Nam and Laos PDR.

The policy intervention and pricing tools for Viet Nam was developed by the above-mentioned international expert form KMUTT.

The report components are:

- Assessment report on policy needs for Bioethanol in Viet Nam
- Pricing policy intervention tool strategy for bioethanol promotion in Viet Nam
- Report with policy and pricing strategy for bioethanol promotion in Viet Nam

For assuring that produced report adequately describes national circumstances and developed proposals are actually fit to Viet Nam conditions and for enriching it, it was consulted with eight high level national experts in Viet Nam and later on discussed during a national bioethanol

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<sup>16</sup> PSC 6th

<sup>17</sup> PSC 4th

<sup>18</sup> PSC 6th

## policy and pricing structures forum

The policy forum activity was accomplished as result as the organization of a national consultation meeting on Bioethanol pricing policy and intervention tool for bioethanol promotion in Viet Nam. This meeting was hold in Hanoi on February 23rd, 2019. It was attended by 50 experts and representatives from leading Viet Nameese organizations. Among these organizations were the Agency of Price Control from Ministry of Finance, Departments of the Ministry of Trade and Industry, Ministry of Agriculture and Rural Development, Ministry of Science and Technology and three different universities.

The objectives of the meeting were as follows: (i) review the draft documents and collect feedbacks with respect to the content and comprehensiveness; (ii) review current pricing policies intervention tools for bioethanol in Viet Nam; (iii) discuss the proposed pricing strategic approach for bioethanol promotion in Viet Nam; (iv) discuss policy options for bioethanol producers, gasohol traders, and prices of raw materials. These objectives were fully achieved according to available report<sup>19</sup>.

While Lao PDR was not planned to be a participant in these outputs, the participation of representatives of governmental bodies and institutions in PSC meetings, training activities and contacts with the PMU, led the Ministry of Energy and Mines to decide to request the project's support to improve the policy framework for bioethanol promotion in September 2015.

To honor this request, the project PMU organized activities like:

- Stakeholder meeting on the Bio-Ethanol Promotion roadmap. April 24-25, 2016. Vientiane.
  - 19 participants from the Ministry of Energy and Mines, Ministry of Agriculture, Ministry of Industry and Commerce, Executive Economic Department/Government Office, Lao State Fuel Company, and private sectors, attended this meeting.
  - A needs assessment in biofuel policy and regulations was conducted to develop the project activities in line with the goal of the National Development Plan.
  - According to the outputs of the needs assessment, the Project will support the development of an action plan, policy intervention tools and a pricing structure.
- Support a policy roadmap for bioethanol promotion.  
An expert, hired by the project, developed this roadmap. It includes the action plan, policy intervention and pricing tools on the basis of current laws and regulations.
- National consultations and brainstorming meetings on bio-ethanol promotion.  
These activities were implemented to raise awareness among key stakeholders, including government agencies, academic institutes, and private sectors.
- A working group on bioethanol promotion policy.  
This group made up of relevant stakeholders was established to support the ongoing efforts to promote the domestic use of bio-ethanol as renewable energy.

This output was fully achieved.

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<sup>19</sup> FIRI Progres Report, March 2019.

**Outcome3.** Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV.

This outcome seeks to create facilities for a demonstration of the technology and to facilitate the involvement of the private sector in the assimilation of the technology.

**Output 3.1** A demonstration plant established in Thailand with an ethanol production capacity of 200 l/day.

The prodoc describes this output as “The demonstration unit will produce 200 l/d of E100 using NSTDA's new bioethanol technology. This unit will be run by NSTDA and will be used as a training center to transfer this technology to ethanol producers, researchers, and investors from LMV countries.”

The Thai manufacturer of ethanol from cassava, Saphip Co. Ltd., agreed to integrate the pilot plant of the new technology into their production line, with an industrial scale ethanol production capacity of 200 l/d. The blueprint for integrating the HG/VHG-SSF technology into the existing commercial bioethanol plant of Saphip was developed by KMUTT.

The new plant has been built and tests have been run, and completed successfully.

Output 3.2. The training center established at FIRI, Viet Nam to disseminate and provide training on the new technology package.

The training center has been setup at FIRI.

A consultative workshop was organized to design a program of activities for the center during and after project implementation. The workshop was attended by representatives from the MOIT (Ministry of Industry and Trade), MARD (Ministry of Agriculture and Rural Development), Research Institutes (Institute of Chemistry, Institute of Natural Products Chemistry, FIRI), Universities (Hanoi University of Science and Technology, Viet Nam National University of Agriculture), Industry (Central Bio Fuels JSC- Petro Viet Nam, Ha Noi Liquor Joint Stock Company).

A technical committee for the training center was established to assist FIRI in making decisions about priorities and activities. This committee has 17 members from relevant organizations like FIRI, HUST, VAST, and Petro Viet Nam.

It is a virtual center where most of the research staff of FIRI is involved. To enhance and update the knowledge and skills of the staff of the center, 21 staff members were trained at KMUTT and on site.

Toolkits and Manuals, developed for the training modules by KMUTT, were tailored to Viet Nam's conditions and specific requirements (hardware availability, supply cultivation, and practice) and were translated into Viet Namese.

The 50 l/day bioethanol demonstration plant is a high valuable asset of FIRI's for the provision of training activities.

A website <http://firi.vn/bioethanol-project/> has been created by the training center.

Output 3.3. A demonstration plant established in Viet Nam with an ethanol production capacity of 50 l/d capacity

An ethanol demonstration plant with a production capacity of 50 l/day is completed at FIRI.

The plant has been designed, built and tested with KMUTT's technical assistance and expert advice (including a visit and on-site expert advice) to FIRI.

The ethanol pilot plant was completed and test run in August 2018.

This facility significantly increased FIRI's capacity to support the technology transfer of bioethanol production technologies. This contribution is not only via training and demonstration. Viet Nameese private companies have expressed their interest in using the pilot plant to test raw material, new products, and different production process regimens.

Output 3.4. Financing opportunities improved to finance the new technology.

According to the text of the prodoc, "financial institutions will be trained and will be enriched with sufficient knowledge on the new bio-ethanol technology along with the training on due diligence of the projects." These activities would help in better understanding of the new technology, and it is expected that the financing opportunities would be improved significantly."

Activities planned under this output<sup>20</sup>were:

- a. Assessment of banking capacity on bioethanol in Lao and Myanmar.
- b. One-day training organized for banks and investors in each country to be changed to mentoring interested investors.
- c. Investment Forum II and financing an ethanol production plant through South-South Technology Transfer.

- a. Assessment of banking capacity on bioethanol in Lao and Myanmar.

The report "Assessment Report of Banking Capacity for Ethanol Production from Cassava in Laos and Myanmar" was produced by an international expert hired by the project in August 2014.

This report concluded that:

- Resources allocated for planned activities under this output are very limited given the many risks and obstacles in the market.
- Providing training to banks in Myanmar is unlikely to have a tangible effect on improving access to debt financing.
- The challenges in the market are however more fundamental and they cannot be addressed with training.

It also recommended that:

- "The most cost-effective way forward is to use the resources under this output for a detailed feasibility study including a cassava resource and market assessment as well as a mentoring technical assistance programme to Myanmar investors."

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<sup>20</sup>Minutes 3<sup>rd</sup> PSC meeting.

This recommendation was not under further consideration after the private investor that was interested to invest in a commercial bioethanol plant in Myanmar quit the project.

In the case of Lao PDR, the assessment concluded that in general, there are many fundamental barriers in the market to obtain large loans in the country, particularly for this kind of large investments.

Major barriers include:

- A fiscal and foreign exchange reserve deficit which has a negative effect on the economy and banking sector and in banks' ability to provide large amounts of credit,
- Banks have capital constraints and show little interest in renewable energy lending for several reasons including real and perceived unattractive risk-return profile,
- A weak legal framework,
- Lack of experience in the production of ethanol from cassava in the country in general and no existing domestic market for ethanol,
- Additionally, the government has no clear timeframe yet of whether and when ethanol blending with gasoline might start.

While at the time of the TE most of these barriers are in place, project activities have contributed to reducing some of them. Specifically, the lack of experience in ethanol production and the design of an action plan to support the promotion of biofuel in the country.

The above-mentioned financial barriers were evinced by Khongsedon Co., Ltd's experience. This company has failed to get adequate financial support from local banks for the planned investments in bioethanol commercial plants.

This assessment concluded that training to banks in Lao PDR is not very likely to address the fundamental barriers and will not improve access to finance for this kind of large investments.

The report suggested supporting Lao investors in developing a viable business proposal. The support should include:

- A feasibility study to reduce uncertainty about market information and feasibility of the investment,
- Business support, e.g., on finding the appropriate business partners, both equity investment partners as well as partners to provide debt financing.
- To organize a study tour for Lao investors, Lao government officials as well as representatives of the Thai bank in Laos to come to Thailand to see an operation facility producing ethanol from cassava.

Most of these recommendations were successfully implemented by the PMU.

b. One-day training organized for banks and investors in each country.

An awareness training program was organized in Lao PDR. The main purpose of this meeting was to raise awareness among financial institutions, private sector, and public organizations including 20 participants.

This workshop addressed four main topics including;

- Ethanol production from cassava, experiences, and trends by a KMUTT professor.

- Cassava Bioethanol by HG/VHG-SSF technology: South-South technology Transfer by a BIOTEC expert.
- Financial feasibility and financing opportunity on ethanol production from cassava by a Creagy Co. Ltd financial expert
- Financial feasibility and financing opportunity on ethanol production from cassava using HG/VHG-SSF technology from KMUTT, by a Creagy Co. Ltd financial expert.

This one-day workshop was organized on February 12<sup>th</sup>, 2018 at Laos' Institute of Renewable Energy Promotion (IREP).

As per recommendation of the MTR, a new action was added under this activity<sup>21</sup>. It was the report "Documentation of Thailand's Experience of Oil Tax Revenue Recycling and Subsidization of Gasohol Price and Support in Conducting the Policy Makers Training". This report was elaborated by TDRI and submitted on May 2018.

This report contributes to support in conducting training programs on economic policy, best practices to promote bioethanol and to create a better policy, pricing structure and mechanism for policymakers in LMV countries.

c. Investment Forum II and financing an ethanol production plant trough South-South Technology Transfer.

Project documents and reports reviewed by the ET do not include any description of this activity and of actions for implementing it.

**Output 3.5. Private sector assisted in project development for replication of the projects**

The ultimate objective of this output is to commercialize the new technology package in the neighboring countries of Thailand, especially Viet Nam. Description of this output in the project document specify that:

- Investment forums will be conducted to introduce the new technology,
- Workshops will be conducted at FIRI on proposal development and financing strategy for project developers or investors in Viet Nam.
- Feasibility studies and investment briefs for at least ten projects will be completed.
- Efforts will be made and assistance provided by international experts in the financial closures of at least five projects.
- To develop at least one project in each of the participating countries.

Planned activities under this output are:

- Formal financing consultation assessment and bank training workshop with potential banks in Viet Nam.
- Technical assistance to formulate investment proposals in Viet Nam
- Technical assistance and expert advisory service (FIRI to the private sector) to help develop three financial proposals to invest in the new technology.

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<sup>21</sup> 3<sup>rd</sup> PSC meeting.

- Formal financing consultation workshop with potential banks in Thailand, Lao PDR and Myanmar to develop two financial proposals to invest in the ethanol production from cassava.
- Technical assistance and expert advisory service to an interested investor in Thailand, Lao PDR and Myanmar to help develop 2 financial proposals to invest in the new technology.

At the time of this final evaluation process the involvement of private investors is different in every partner country:

### **Thailand:**

Sapthip Co. Ltd has been fully involved in technology absorption. The project assisted in the development of the demonstration plant by Sapthip Co. Ltd.

Another two companies (Thai Ethanol Power PLC (Khonkaen) and Double A Ethanol Phase\_1 (Prachinburi) have expressed interest in considering the integration of VGD – SSF.

### **Viet Nam:**

Tunglum Ltd<sup>22</sup> submitted a letter of interest to cooperate in this project in December 2016. This company has expressed its interest to adjust their existing plant to adopt the technology with a production capacity of 350,000 l/d. The process of evaluation of this solution has been supported by FIRI.

### **Lao PDR:**

The project signed a contract with BIOTEC<sup>23</sup> for the provision of technical assistance and expert advisory service to interested companies and other interested stakeholders.

Khongsedone Ltd (KSD) is committed to utilizing KMUTT technology for the first pilot bioethanol plant from cassava with a production capacity of 10,000 liters/day and the establishment of an ethanol production facility with 200,000 l/d capacity in Salavan Province, Lao PDR.

BIOTEC has supported KSD to develop these proposals. BIOTEC has provided the company<sup>24</sup> the technical support on feedstock qualities, feedstock procurement plan, feedstock preparation, ethanol production process, laboratory analysis as well as the technical support for the basic plant design to integrate KMUTT technology for small-scale and commercial-scale bioethanol plants.

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<sup>22</sup>PIR 2017

<sup>23</sup>PIR 2017

<sup>24</sup>Report “Support and assistance for private sector companies in adjusting of existing bioethanol plants and/or establishing new bioethanol plants utilizing KMUTT technology in Lao PDR.” BIOTEC. September 2018.

Finally, KSD was able to gather needed financial resource for Project implementation. It is reported<sup>25</sup> that the bioethanol producer plant is completed and shown good result of the blending ethanol as a transport fuel.

Another two companies have been attending project activities:

- Phongsbthavy Road, Bridge Construction Co., Ltd, and
- NalyChaleunxub Co., Ltd.

The lack of enough confidence in the policy framework for biofuel promotion that is still under development, and the financial barriers to access loans in appropriate conditions have prevented these companies to formalize their interest to invest in bioethanol production with the VHGSFF technology.

The number of companies that have committed themselves to introduce the VHGSFF technology and that have received technical assistance is well below project targets.

Planned activity	Achievement
Formal financing consultation assessment and bank training workshop with potential banks in Viet Nam.	No progress
Technical assistance to formulate investment proposals in Viet Nam	Little progress
Technical assistance and expert advisory service (FIRI to the private sector) to help develop three financial proposals to invest in the new technology.	No progress
Formal financing consultation workshop with potential banks in Thailand, Lao PDR and Myanmar to develop two financial proposals to invest in the ethanol production from cassava.	No progress
Technical assistance and expert advisory service to an interested investor in Thailand, Lao PDR and Myanmar to help develop 2 financial proposals to invest in the new technology.	Only the case of KSD company in Lao PDR.

Consequently, it is very unlikely that planned activities that show no progress could change this status before project closing.

An exception is the bank-training workshop with potential banks in Viet Nam that is a still pending activity.

Therefore, this output has a low completion.

Output 3.6 Bio-ethanol production technology commercialized with the capacity of 400,000 l/d bioethanol plant.

The project document states that it will facilitate the establishment of one commercial-scale ethanol production plant of 400,000 l/d in Myanmar using the new VHG - SSF technology.

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<sup>25</sup> 6<sup>th</sup> PSC

The investor, a private company from Myanmar, had even signed a co-financing letter before project approval.

Once project implementation started, changes in the energy policy of the country led to the removal of biofuel promotion from Myanmar's national development priorities. Hence, the private investor of the 400,000 l/d bioethanol plant quit the project.

Besides that, the banking and financing capacity assessment of Myanmar and Lao PDR conducted by an international expert in 2014 showed that this kind of investment in Myanmar was not feasible<sup>26</sup>. Based on that, the PSC agreed to exempt Myanmar of the establishment of the 400,000 l/d commercial plant.

However, after attending the 1<sup>st</sup> introductory workshop on cassava production in 2014, the Laotian company Khongsedone Co. Ltd expressed its interest in developing ethanol production in Lao PDR using the VHG – SSF technology.

This company signed a Terms of Cooperation (TOC) with UNIDO, KMUTT, and IREP in June 2014. This TOC lays out the adoption of KMUTT's technology for the first pilot bio-ethanol plant from cassava with a production capacity of 5,000 l/d in Salavan Province, Lao PDR. The TOC also includes the intention to establish a commercial production facility with a capacity of 200,000 l/d.

At present, Khongsedon Co., Ltd. has finished the installation and test run of ethanol production from molasses production line with a 10,000 L/day capacity. This company is working on the integration of the HG/VHG-SSF technology to this production line to produce 95% ethanol using cassava roots. The project has provided technical assistance and expert advisory services for this pilot plant. The successful startup of this facility was reported during the final PSC meeting<sup>27</sup>.

A generic feasibility model was prepared by Creagy Co., Ltd<sup>28</sup> for a 200,000 l/day, commercial-scale bioethanol plant from cassava. The model concluded that a commercial scale bioethanol plant of this capacity is not recommended for investment and financing consideration as current Laos conditions pose a very high financial risk.

The report recommends “to invite experienced bioethanol plant producers and investors to join in a joint venture partnership model to build the 1<sup>st</sup> commercial scale bio-ethanol plant in Laos using KMUTT technology.” The joint venture could facilitate the transfer of know-how and foreign direct investment to Laos, which will benefit the private sector in Laos in the long run and build confidence on cassava plantation among farmers as well.

The current status of the planned commercial bio-ethanol facility, integrating the VHG – SSF KMUTT technology, with a production capacity of 200,000 l/d is<sup>29</sup>:

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<sup>26</sup>PIR 2016

<sup>27</sup> PSC 6th meeting.

<sup>28</sup>Report “Support and assistance for private sector companies in adjusting of existing bioethanol plants and/or establishing new bioethanol plants utilizing KMUTT technology in Lao PDR.”. BIOTEC. September 2018

<sup>29</sup>Report “Support and assistance for private sector companies in adjusting of existing bioethanol plants and/or establishing new bioethanol plants utilizing KMUTT technology in Lao PDR.”. BIOTEC. September 2018.

- KSD has signed an MOU with the Institute of Renewable Energy Promotion (IREP) under the Ministry of Energy and Mines, Laos to cooperate with the development of this bioethanol facility.
- KSD owns the land area required to build the plant.
- Laos State Fuel Company intends to support the study buying all the bioethanol from the project.
- The company is looking for a soft loan from foreign banks. However, the feasibility study and other necessary information to support the bank approval are not ready.

Considering that the target of this output was to have a 400,000 l/day bioethanol plant running, the completion of the output is of little progress.

Output 3.7. Demonstration projects evaluated, lessons learned and information widely distributed.

According to the project document the following activities were expected to be carried out under this output:

- After completion of the demonstration projects, project performance will be monitored to analyze the technical, financial and environmental aspects of the projects.
- A monitoring report will be prepared based on the monitoring and analysis.
- Full scale project demonstration site visits and seminars will be organized;
- Project experiences will be disseminated among stakeholders in order to increase the replication potential of the project.
- Various dissemination tools such as leaflets, websites, etc., will be used for effective dissemination.

None of these activities were accomplished. No advances were made in the commercialization of the planned 400,000 l/day bioethanol by the production plant, thus limiting the completion of this output.

On the basis of the above-described completion of outcomes/outputs a progress assessment is provided on Table 7.

Table 7. Assessment of achievement of project outcomes and outputs

<b>Project Output</b>	<b>Outcome</b>	<b>Assessment</b>	<b>Evaluation</b>
Outcome 1	Enhanced capacity of KMUTT, Thailand to lend sustainable support to the region	The capacity for the transfer of the know-how and know-why of the developed technology package for the production of sustainable production of bioethanol from cassava was enhanced. However, the capacity was not sufficiently improved as to facilitate access by policy decision-makers, entrepreneurs, and investors, to relevant information for decision making purposes.	Almost fully achieved.
Output 1.1	Information hub established for the dissemination and support of the south-south technology transfer.	A website serves as an information hub for the dissemination and support of the South-South technology transfer related to cassava and bioethanol production. The information about project activities and products is wide-ranging and updated. A minus of this website is that it does not focus on supporting technology transfer by facilitating access to relevant information for policy decision-makers, entrepreneurs, and investors.	Partially achieved
Output 1.2	Ethanol technology package finalized for dissemination	The technology package “Transformation of Cassava to Bioethanol” was produced. The know-how and know-why necessary for a successful technology transfer was included in the manual “Cassava Bioethanol.” It is available in Thai and Viet Nameese languages.	Fully achieved
Output 1.3	Manuals toolkits and structured training programs developed for technology transfer.	A training module to support the technology transfer for bioethanol production using cassava as raw material was developed. The training program was divided in two workshops: The Introductory Workshop on Ethanol Production from Cassava and The Intensive Workshop on Ethanol Production from Cassava.	Fully achieved
Output 1.4	Database on ethanol technology developed and	The database developed is the same as that of the website. However, it does not include relevant	Partially achieved

<b>Project Output</b>	<b>Outcome</b>	<b>Assessment</b>	<b>Evaluation</b>
	maintained by ethanol information hub	information related to TT like ethanol and gasohol markets, description of concerned technologies and trends in their implementation, etc.	
Outcome2	Conducive environment to promote bio-ethanol technology and strengthened policies to promote ethanol for the replacement of conventional fuels.	Project activities to increase the capacity of relevant actors to create a conducive environment, such as the training of farmers, entrepreneurs, specialists and government officials were very successful. However, they fell short to raise regional awareness about bioethanol production from cassava as planned. The delay achieving planned contribution to improve the policy environment in Viet Nam was compensated by progress in this field achieved in Lao PDR.	Almost fully achieved.
Output 2.1	Regional awareness created for the new technology package.	No regional or national awareness raising workshops were organized as per prodoc. Nonetheless, some activities organized by the project contributed to creating regional awareness on the bioethanol technology to be transferred.	Partially achieved.
Output2.2	Training conducted in Thailand for farmers, entrepreneurs and technicians.	Five workshops were organized to train participants on cassava and ethanol production. The actual number of trainees was 158 people, more than the 150 originally planned. The program of these workshops was based on outputs 1.2 and 1.3.	Fully achieved
Output2.3	Training conducted in Thailand for engineers, scientists, and researchers	A five-day hands-on workshop dedicated to ethanol production from fresh cassava roots through the VHG-SSF process was organized. It was attended by 34 specialists from 5 different countries. The handbook and manual on Ethanol Production from Fresh Cassava Roots by Very High Gravity-Simultaneous Saccharification and Fermentation (VHG-SSF) Process was used in this training program. It was available in English and Thai languages and distributed to all participants.	Fully achieved

<b>Project Output</b>	<b>Outcome</b>	<b>Assessment</b>	<b>Evaluation</b>
Output 2.4	Pricing practices and policy environment improved.	The main target country of this output was Viet Nam. The main activities to be carried out there were: an expert level training workshop to create a better policy framework, and pricing mechanism to promote E5; a policy and pricing tools intervention; a policy forum; and an awareness campaign to popularize E5 among Viet Nameese consumers. All activities were successfully developed. In addition, a number of non-initially planned activities carried out in Lao PDR at the Government's request. These activities contributed to improving the conditions to enhance the policy environment for the promotion of bioethanol production from cassava for the local fuel market.	Fully achieved
Outcome 3	Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV.	Outputs related to involvement of private sector in commercial scale technology implementation achieved little progress.	Partially Achieved
Output 3.1	A demonstration plant established in Thailand with an ethanol production capacity of 200 l/day.	The Thai manufacturer of ethanol from cassava, Sapthip Co. Ltd., has integrated a 200 l/day pilot plant using the HG/VHG-SSF technology into their production line.	Fully achieved
Output 3.2	The training center established at FIRI Viet Nam to disseminate and provide training on the new technology package.	The training center has been set up at FIRI. A total of 21 staff members were trained. Toolkits and Manuals developed for the training modules by KMUTT, were tailored to Viet Nam's conditions and specific requirements and were translated into Viet Nameese. The 50 l/day bioethanol demonstration plant is a highly valuable asset for training activities and providing technical services to private and public companies.	Fully achieved
Output 3.3	A demonstration plant established	An ethanol demonstration plant with a production capacity of 50 l/day is	Fully achieved

<b>Project Output</b>	<b>Outcome</b>	<b>Assessment</b>	<b>Evaluation</b>
	in Viet Nam with an ethanol production capacity of 50 l/d.	completed at FIRI with KMUTT's technical assistance and expert advice.	
Output 3.4	Financing opportunities improved to finance the new technology.	This output contributed to a better understanding of actual banking capacity for ethanol production from cassava in Laos and possible actions for improving it. But, the training of financial sector was provided only in Lao PDR and the Investment Forum and financing of an investment plan were not performed.	Partially achieved
Output 3.5	Private sector assisted in project development for replication of the projects.	The number of companies that committed themselves to introduce the VHGSSF technology and received technical assistance is well below project targets. Most of planned activities do not show any progress.	Little progress
Output 3.6	Bio-ethanol production technology commercialized with the establishment of a 400,000 l/d plant in Myanmar.	No 400,000 l/day bioethanol plant was established. A Laotian company is committed to develop a 200,000 l/day plant, but it has not completed the financial component.	Little progress
Output 3.7	Demonstration projects evaluated, lessons learned and information widely distributed.	None of the foreseen activities were accomplished. No progress was made in the commercialization of the planned 400,000 l/day bioethanol production plant, thus limiting completion of this output.	No progress

Used evaluation categories:

- Fully achieved
- Almost fully achieved
- Partially achieved.
- Little progress
- No progress

### Efficiency

The planned project budget is USD 34.2 Million, including USD 2.6 Million from the GEF grant that represents the 8% of the total.

The distribution per project component was very asymmetric according to each one of the specific activities.

Half (50%) of the GEF funding was assigned to component 3. The reason for that is that component 3 included the establishment of the 50 l/day pilot plan at FIRI, and also the provision of feasibility studies and technical services to private companies engaged in technology absorption.

The second component, per size of the funding assigned, is number 2. In this case, most of the funding is for the organization of training activities.

Project management costs represent 10% of the GEF contribution.

In the case of the co-financing, the planned figure was as high as USD 31.6 million. Most of those funds were related to planned investments in commercial and demonstration plants. That is why it is concentrated on component 2.

Co-financing sources that have reported expenses in this category were the IREP until 2015, FIRI from September 2016 to September 2018 and KMUTT till 2017. The actual co-financing contribution by KMUTT<sup>30</sup> amounts to USD 1.02 million, concentrated on the 2<sup>nd</sup> component of the project. Available information about co-financing by IREP reports that this figure was US\$204,400, out of which US\$53,500 in cash as of July 2015 and FIRI US\$34,018 in cash and US\$294,697 in kind<sup>31</sup>.

Table 8. Budget resources distribution

Component	Indicative		Total
	GEF	Co- fin.	
1. Enhanced capacity of KMUTT, Thailand to lend sustainable support to the region	330,500	1,187,000	1,517,500
2. Conducive environment to promote bio-ethanol technology and strengthened policies to promote ethanol for the replacement of conventional fuels.	757,500	1,253,000	2,010,500
3 Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV.	1,262,000	28,492,000	29,754,000
Project management	250,000	691,000	941,000
Total project costs as per PIF	2,600,000	31,623,000	34,223,000

In the case of project components 1 and 2, project expenses have been used very effectively. Most of the planned outputs have been fully achieved and even additional activities have been developed. That is the case of additional activities developed by the project to support the improvement of bioethanol promotion policy in Lao PDR.

<sup>30</sup> 4<sup>th</sup> project report

<sup>31</sup> Progress Report. FIRI. October 2018.

While implementing project component 3, the most resource-demanding outputs were fully achieved.

Project resources allocated for hiring experts and institutions to draw up reports and provide technical support to governmental institutions, private companies and the decision-making process of the project in Lao PDR and Viet Nam, have been effectively used.

The following are examples of such contracts:

- Individual service contract. To document the Thai campaign and develop the action plan for Viet Nam on the basis of Thailand's experience to promote the use of E5 gasohol. June 2015
- Individual services contract for developing the action plan, policy intervention and pricing tools under the current laws and regulations for the policy roadmap for bioethanol promotion in Lao PDR.
- Thailand Development Research Institute. Document Thailand's experience on oil tax revenue recycling and subsidization of gasohol Price. July 2017.
- BIOTEC, Thailand. To support the private sector in Lao PDR to commercialize ethanol production from cassava. June 2017.
- Individual service contract. To develop the action plan, policy intervention and pricing tools under the current laws and regulations for the policy roadmap to promote bioethanol in Lao PDR.

At the time of the terminal evaluation, it is reported that project expenses represent 86% of the project budget.

In conclusion, project budget has been used efficiently. As explained before, despite the initial delay in the project startup, most project activities have been accomplished in an even shorter effective period than the one originally planned (June 2014 – December 2018).

#### Likelihood of sustainability of project outcomes

The technology transfer promoted by this project addresses participant countries' heavy reliance on fuel imports. These imports even have been increasing during recent years as a consequence of the high economic growth rates of these countries.

The development strategies of the three countries involved in project implementation (Thailand, Viet Nam and Lao PDR) recognize this reliance as a problem and includes hort-medium term actions to counter it. In all cases, Governments have developed actions seeking to implement a policy conducive to the reduction of such imports, particularly of gasoline. As a result, the three countries have specific targets and roadmaps to replace gasoline with different bioethanol blends.

This situation creates an affirmative policy environment to keep biofuel promotion as a national priority.

The fact that project outcomes are the result of south-south technology transfer is a positive contribution to theirsustainability.

Besides these contributing factors to project outcome sustainability, some project outputs themselves are robust enough in terms of their sustainability.

The outcome of component 1 is associated with the capacity created in Thailand to support the technology transfer of the bioethanol technology package and the experiences in the development of an enabling policy environment for the promotion of such technologies.

This capacity is concentrated in a consortium of Thai institutions, led by KMUTT and made up of the Thai Tapioca Development Institute (TTDI), the Cassava Starch Research Laboratory hosted by Kasetsart University and the National Center for Genetic Engineering and Biotechnology (BIOTEC). All knowledge, skills and know-how that these institutions are transferring are part of their core strengths. The added value by the project has been to complement these capacities and develop synergies to achieve a common goal.

The main risk for the sustainability of this outcome is that the conditions for the provision of this kind of comprehensive services will not subsist in the future.

Some reasons for that scenario to occur could be:

- That the governmental approach seeks to develop the market through pricing strategies, instead of supporting the whole value chain of bioethanol production from cassava.
- Lack of financing to receive services by the consortium.
- Overestimation of recipient countries' national capacities to support the promotion of bioethanol production.

Long-term sustainability of this outcome is highly likely.

The outcome of component 2 is related to the increased capacity for inducing changes in the policy framework for bioethanol promotion in Viet Nam and Lao PDR.

This outcome draws on the emerging cadre of motivated, informed and aware actors as a result of training and awareness raising project activities.

One of the strengths of this outcome is that this cadre includes a wide diversity of actors from the academic, university, business, and ministerial sectors, as well as from local authorities.

The sustainability of this outcome is likely. The number of personnel, and their diverse institutional distribution, sectors and administrative levels make it very unlikely that they are going to lose their potential for influence.

The main sources of risk for this outcome's sustainability, the possible demotivation of this cadre and loss of their influence, are:

- The lack of progress in the development of bioethanol production,
- Resistance to change in the policy environment to introduce new and more effective policy tools and
- A backward movement in the priority of bioethanol production in the scope of national development strategies.

The most vulnerable outcome of the project is the still incipient engagement of private sector in the introduction of new technology for bioethanol production.

While the project was able to set up demonstration facilities and pilot plants, the process was very delayed to take advantage of the demonstration effect to engage private investors. For this same reason, it was not possible to develop a set of opportunities and feasibility studies of real cases for absorption of the VHSSSF bioethanol production technology. Additionally, progress in the development of specific recommendations for Viet Nameese authorities to improve the regulatory policy environment for bioethanol production was also very limited.

The main risks to keep the momentum to increase the number of private investors engaged in bioethanol production development using cassava as raw material are:

1. The lack of opportunities for private investors to have access to objective and direct information about the performance of VHSSSF technology in demonstration conditions.
2. That the regulatory framework for the promotion of bioethanol is not improved.
3. Shortage of technical advice and services for the assessment of potential investments and the development of adequate business plans.

In conclusion, the sustainability of project outcomes is likely.

#### Project coordination and management

Coordination and management of this project was a real challenge. This project executed activities in four different countries, with different economic situations, infrastructure, and political environment. Relevant project stakeholders include a mix of ministries and ministerial departments, research institutes and universities, and private sector companies.

According to project implementation agreements UNIDO is fully responsible for the implementation of the project, the delivery of the planned outputs and the achievement of the expected outcomes.

To undertake the coordination of the project, day to day operations and assist project partners in the organization of activities according to the work plan, UNIDO established a project management unit.

This PMU was in full composition during the whole implementation period, except the position of administrative staff that was not filled during 2018.

Membership of the PMU was very stable during the implementation period. The only changes were the person nominated by NSTDA that was replaced by a person nominated by KMUTT in 2014 and later the designation of a new project coordinator in October 2015.

This stability is one of the PMU's strengths and a real contribution to project coordination.

The PMU has been very active and has efficiently fulfilled its duties.

The adaptive approach of project management has been a relevant aspect of the implementation.

Therefore, the project team has been able to overcome situations that could have seriously jeopardized project performance. Some examples are:

- a. The need to find the appropriate institution to replace NSTDA as project leader partner institution.
- b. Delays and slow advance of output 2.4 in Viet Nam . The PMU compensated this situation developing on the opportunity presented by Lao PDR government’s interest in seeking support for the promotion of the development of biofuel in the country.
- c. To implement the agreement of the 3<sup>rd</sup> PCS meeting in August 2015 in a short period on the basis of a MTR recommendation to integrate the VHG-FSS technology in an existing ethanol plant instead of building a new pilot plant at LDO facility. A demonstration unit of this technology with a capacity of 200 l/day was successfully tested at Sapthip Co. Ltd production facility in January 2017. (Output 3.1)

Project coordination was supported by a clear assignment of tasks and responsibilities to every project partner and their systematic control. (Table 9.)

Table 9. Assignment of responsibility for outputs to project partners

Outcome/ output	Partner/ country	
	Planned	Real
Component 1 / Outputs		
1.1, 1.2, 1.3, 1.4	NSTDA/ Thailand	KMUTT/ Thailand
Component 2 / outputs		
2.1, 2.2, 2.3	NSTDA/ Thailand	KMUTT/ Thailand
2.4	FIRI/ Viet Nam	MOIT to FIRI/ Viet Nam IREP/ Lao PDR
Component 3/ Outputs		
3.1	NSTDA/ Thailand	KMUTT/ Thailand
3.2	FIRI/ Viet Nam	FIRI/ Viet Nam
3.3	FIRI/ Viet Nam	FIRI/ Viet Nam
3.4	FIRI/ Viet Nam	FIRI/ Viet Nam
3.5	FIRI/ Viet Nam	FIRI/ Viet Nam
3.6	KSS Private investor/ Myanmar	PMU
3.7	PMU	

The selection of KMUTT and FIRI as project partners and the assignment of responsibilities for specific tasks have been proven as the right decision.

However, that is not the case of the selection of institutions responsible for outputs 2.4 and 3.6.

The institution responsible for outcome 3.6 “technology commercialized with the establishment of a 400,000 l/d plant in Myanmar” was a private company that was ready to invest in the

planned bioethanol production facility.

It was a wrong selection at least for two reasons:

- a. Achievement of this output requires a lot of efforts, coordination actions and awareness raising activities in an environment as complex as Myanmar's. A private company would have never taken on such time and resource consuming tasks.
- b. There was a clear conflict of interest.

Output 2.4 "Pricing practices and policy environment improved", was assigned to FIRI by the project document. Later on, during project implementation, it was decided that MOIT will be in charge of this output.

The fact that MOIT was the ministry leading the development of the national biofuel promotion was one of the reasons that motivated this decision. However, that same reason serves to explain why it was not a good decision.

Governmental institutions at ministry level, because of their mission, are not designed to undertake such executive tasks. Practice has shown that these institutions do not have the required conditions and capability to take on those responsibilities. At the end of the project implementation period, the task assigned to MOIT is transferred to FIRI.

The project steering committee adequately played the role of leading project implementation, including project coordination and management.

The PSC has met regularly from December 2013 to December 2017. During that period, it has held five meetings all face-to-face, except the 2<sup>nd</sup> one that was organized via videoconference.

PSC meetings reviewed project progress reports, project expenses and the work plan for the next year. During PSC meetings issues hindering project advance were also considered and decisions were made to solve them.

The composition of participants in PSC meetings was representative of project stakeholders.

The chairmanship of the PSC was the main issue threatening its effective work. When NSTDA quit the project in 2013, KMUTT was nominated to be the PSC chair. It was an inappropriate decision, not only because of the evident conflict of interest but also due to the nature of the responsibilities of the chair of the PSC.

The Mid-Term Evaluation report (March – June 2015) identified this issue and recommended to designate another institution for the position of chair of this committee.

This issue was under consideration of the 3<sup>rd</sup> PSC meeting on August 2015. It was agreed to invite the Thailand International Development Cooperation Agency (TICA) and the Department of Alternative Energy Development and Efficiency (DEDE) for this position. Finally, during the 4<sup>th</sup> PSC meeting on December 2016 the Thai Tapioca Development Institute (TTDI) was introduced as new PSC chairman. The TTDI was established in 1992 with the purpose of serving as a center for research and training to support Thailand's tapioca (cassava) industry.

The fact that TTDI is a research center and an active participant in project activities, lead to the conclusion that this organization does not fulfill the requirements to chair the PSC either.

It is significant that neither DEDE, the only governmental institution that was a member of the PSC, nor any other institution of this category agreed to chair the PSC.

Assessment of monitoring and evaluation systems

The monitoring and evaluation system were established in accordance with UNIDO and GEF guidelines and procedures.

The M&E system is based on the Project Implementation Reports (PIRs), the Mid-term Review (MTR) and the Terminal Evaluation.

All the PIRs have been issued during the project implementation period and prepared according to the guidelines. Reported information has good quality and includes details that provide additional value as a monitoring tool.

The MTR was provided as planned. This report included recommendations to improve the project implementation process.

The planned monitoring and evaluation system has been complemented by the annual progress reports elaborated by KMUTT and by the project steering committee meetings.

A detailed monitoring plan for tracking and reporting on project time-bound milestones and accomplishments was not laid out.

The Budget for M&E plan was included in the general Project Budget and has been made available when needed. Table 10 provides the prodoc tentative budget for M&E system, which was included in Project Component 4.

Table 10. Tentative Budget for M&E plan

Activity	USD
Mid-term evaluation	8,000
Mid-term evaluation travel	6,000
Final evaluation	48,000
Final evaluation travel	18,000
Total	80,000

Assessment of processes affecting the achievement of project results

During the period of project approval and entry there was a complex political situation in Thailand. That external factor made it difficult to make an objective assessment of the quality of the entry process. The most evident consequence of this situation was the need to find a new main project partner as a condition to proceed with an effective project startup.

The process of selection of the new partner and the agreement of the conditions to become a new project participant were situations well managed by UNIDO office and PMU.

The process of signing a contract with Viet Nameese institutions took a long time and that brought about a delay. Subsequently, there was an additional delay in the starting date of implementation of the activities under outputs for which those institutions were responsible.

Financial planning has proven to be adequate, and co-financing by FIRI, IREP, and KMUTT effected for activities that have required this contribution. FIRI has complained that the release of funds by UNIDO, after progress reports were delivered, took too long a time.

The more critical delay in the implementation of outputs was that of outcome 2.4, which was under the responsibility of the MOIT. UNIDO and the PMU were unable to encourage the substitution of this ministry by FIRI, when the delay was not substantial yet.

The vertical implementation approach used by the PMU drove to a weak involvement of local UNIDO offices in supporting project activities and day-to-day coordination with local institutions in Laos and Viet Nam.

#### C. Gender mainstreaming

Because this project is under GEF 4 replenishment, the gender issue was not contemplated in the project design.

But project management encouraged participants in project activities to bridge the gender gap.

#### D. Evaluation rating

Project performance rating is carried out as required by GEF and UNIDO Evaluation Policies and Guidelines.

The summary of the rating of the project on the basis of the findings of the evaluation is presented in the next table.

#	Evaluation criteria	Summary comments	Rating
A	Progress to impact	<p>The final goal of this project is to significantly reduce imports, such as gasoline, in countries of the LMV region by replacing it with ethanol produced from cassava on a sustainable basis. Outcomes of the project are a solid move in that direction, namely:</p> <ul style="list-style-type: none"> <li>• The consolidation of a consortium of Thai institutions, led by KMUTT to transfer the VHGSF ethanol production technology.</li> <li>• The creation of a cadre of trained and motivated farmers, entrepreneurs and specialists in Lao PDR and Viet Nam.</li> <li>• The creation of a solid foundation to improve the bioenergy policy in Lao PDR for the promotion of Bioethanol production from cassava.</li> </ul>	Satisfactory
B	Project design	The design of the project has shortcomings that limited the effectiveness of the project and of the monitoring and evaluation system.	Moderately unsatisfactory
1	Overall design	Formulation of outcomes is not satisfactory; some outputs are not feasible to be achieved in the scope of the project implementation; selection of project partner responsible for some outputs is not adequate.	Moderately satisfactory
2	Log frame	To a large extent, the project result framework is not useful for guiding monitoring activity of the project, most of the indicators are not SMART. Most of the targets are inappropriate.	Moderately unsatisfactory
C	Project performance	It is a project of high relevance for the participant countries, relevant outcomes were achieved with an efficiency use of available funds.	Satisfactory
1	Relevance	The use of bioethanol to reduce gasoline consumption is recognized as a national priority in national development strategies of participating countries. These countries have biofuel development strategies that set specific targets for bioethanol use. The significance of the economic impact by using bioethanol has grown during the project implementation period	Highly Satisfactory

#	Evaluation criteria	Summary comments	Rating
2	Effectiveness	Most of the outputs focused on removing barriers for technology transfer were achieved. Output not showing progress are related to project design failures.	Satisfactory
3	Efficiency	Use of GEF funds and co-financing are in correspondence with completed outputs and achieved outcomes.	Satisfactory
4	Sustainability of benefits	It is possible that the effect of the achieved technology transfer outcome stays in place in the short-medium term after completion of the project.	Very likely
<b>D Cross-cutting performance criteria</b>			
1	Gender mainstreaming	Project management encouraged the reduction of the gender gap among participants in project activities.	N/A. GEF 4 project.
2	M&E	All monitoring activities were executed, and related reports produced and used for the evaluation proposal by UNIDO, the PMU, and the PSC. However, a detailed monitoring plan with the right indicators and targets was not in place.	Satisfactory
3	Results-based management (RBM)	The annual workplan included planning of the required activities for completion of every output. The work plan was annually updated and approved by the PSC meeting. Specific monitoring and evaluation plan focusing on indicators of every output did not exist. Progress reports and PMU report to PSC meeting were always result-oriented.	Satisfactory
E	Performance of partners	Most of the partners were fully committed to the project and fulfilled assigned responsibilities adequately.	Satisfactory
1	UNIDO	Has accomplished its assigned duties with some limitations.	Satisfactory
2	KMUTT	The role of leading technical partner was adequately fulfilled. Most of the assigned outputs were completed as per schedule.	Satisfactory

#	Evaluation criteria		Summary comments	Rating
	National counterparts	FIRI	This partner has shown a high commitment to project activities. FIRI could not achieve some of the assigned outputs	Satisfactory
		MOIT	MOIT is committed to project implementation. It has supported the project and attended PSC meetings. The output under MOIT's responsibility is delayed, and it is going to be difficult to be fully completed.	Satisfactory
		IREP	IREP had not been assigned any responsibility in the initial project documents. During the project implementation this institution has played an important role in supporting project implementation in Laos.	Satisfactory
3	Donor		The main donor of this project is the Global Environmental Facility, that fulfilled its role according to the rules.	Satisfactory
F	Overall assessment		It is a project of high relevance for participants countries and showing a significant progress to impact. Most of the outputs directly aimed to remove barriers and create a conducive environment to promote the adoption of ethanol production technology from cassava were achieved. The project design has shortcomings. The lack of progress of a few outputs, related to private sector involvement, is a result of project design failures.	Satisfactory

## **IV. Conclusions, recommendations and lessons learned**

### A. Conclusions

The project addresses a problem that is relevant for most of countries of the region and most developing countries. Reduction of fuel imports is a priority in every national development strategy of petroleum net importer country. The technology promoted by this project to address this problem is of the utmost interest for many countries. It offers an alternative option to raw materials commonly used for bioethanol production: molasses and corn.

The approach used by the project for the promotion of this alternative option is highly appreciated for its potential advantages. Its core methodology for the design and implementation of the project is South-South Technology transfer. However, it also entails a risky challenge due to the complexity and the lack of a representative number of success stories at international level that could be used for reference.

Some project design failures, an extreme complex situation during the startup process, and the implementation of activities in four different countries represented an additional difficulty for the coordination and management of the project.

Despite the professionalism and dedication of the project management unit, the support and adaptive approach to problem-solving shown by the staff at UNIDO Regional office and Headquarters, and the commitment to the project of relevant partners and stakeholders; the achievement of the planned project outcomes was limited.

Accomplishments of the project such as the technology package ready to be transferred for bioethanol and cassava production; the consolidation of the capacity of Thai institutions for the promotion of a genuine south-south technology transfer process of the above mentioned technology package and the cadre of technicians, farmers, researchers, entrepreneurs and governmental officials that have been trained and motivated; combined create a solid foundation for the consolidation and extension of the project for the reduction of fuel imports.

### B. Recommendations

To the GEF:

- This project is a good example of the potential of south – south technology transfer. It has shown the relevance of the transfer not only of the Know-how but also of the experience and knowledge about the needed policy environment for the sustainability of transferred technology. But this project is also an example that for developing countries relevant solutions for facing climate change involve not only the industry but also the agriculture sector. In particular for this last sector, considerations about adaptation to climate changes are very pertinent.

For this reason, it should be facilitated the presentation of South-South technology transfer GEF projects that incorporate activities both at the industrial and agriculture sector according to the add value chain and considering actions not only for mitigation

but also for adaptation to climate changes.

#### To UNIDO

- In the case of bioenergy projects, where the energy intervention depends on the supply of biomass, base the project design on the concept of agribusiness.
- Identify opportunities to maintain the support to bioethanol production TT in the region, after project ending to take advantage of the positive momentum created by this project.
- Consider improving the technical and methodological internal review of project proposals during the process for approval.
- Establish a reporting mechanism that would provide information on the actual expenditure of co-finance on a regular basis;

#### To the governments of participant countries:

- Because international cooperation for development is a tool for keeping on the main outcomes of this project:  
Participant countries should use existing mechanisms or if necessary, establish new ones, to ensure the consolidation of cross-border technology transfer activities initiated by the project focusing on supporting national biofuel development priorities.

An available opportunity for doing that is the existing Thai and Regional mechanisms for cooperation for development.

In the case of Thailand, The Royal Government is very active supporting the regional development cooperation. The Thailand International Development Cooperation Agency (TICA) is principally responsible for the implementation of Thailand's development cooperation programmes in neighboring countries. TICA promotes South-South cooperation and North-South-South cooperation under partnership programmes with other donor countries including non-government organizations and international agencies for development cooperation in developing countries in various regions. TICA implements various forms of cooperation, such as the development projects, volunteer and expert programmes, fellowships, scholarship and training programmes.

At regional level the ASEAN has implemented some cooperation mechanisms with the aim of reducing the economic and development gap between member countries. Among these mechanisms are:

- The Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS), comprising Cambodia, Lao PDR, Myanmar, Thailand, and Viet Nam;
- the Greater Mekong Subregion (GMS) that was initiated by Asian Development Bank (ADB) to promote the sub-regional cooperation of six countries including Cambodia, Lao PDR, Myanmar, Thailand, Viet Nam and Southern China PRC (Yunnan Province).
- The ASEAN-Initiative for ASEAN Integration (ASEAN-IAI) cooperation framework aimed to provide with assistance to the development to Lao PDR, Cambodia, Myanmar and Viet Nam to improve the level of economic development. and to increase competitiveness and reduce the development gap among.

- While improving the effectiveness of the policy framework for promoting biofuels, special attention should be pay to policy tools for increasing the participation of private companies and farmers in bioethanol and cassava production. Among these tools are the tax and retail price incentives both for bioethanol and cassava producers, support to capacity building programmes aimed to company staff and farmers for increasing their knowledge and training on new technologies, government contribution to investments for developing needed infrastructure for bioethanol commercialization and to specific R&D project helping to adapt technology to local conditions, communication campaigns focused on increasing social acceptance of biofuels.
- Support capacity building activities promotion using training modules developed by the project and aimed to relevant actors for bioethanol. Special attention should receive members of governmental bodies, personnel belonging to engineering and consulting companies, technical and senior staff of bioethanol companies and farmers. Involvement of research centers and universities in these activities would be of great value.
- Consider possible collaboration actions for facilitating south-south technology transfer based on the experience of the project.

### C. Lessons learned

- Designing technology transfer projects:
  - The selection of the scope of outputs related to pilot, demonstration and commercial plants is a critical factor for achieving a good project performance.
  - Objective and in-depth considerations about existing conditions for specific technology transfer actions should be provided.
  - Special attention should be paid to time, and financial resources constraints while deciding what outputs can be planned in the scope of the project.
- Outputs focused on improving policy framework should be defined only in terms of delivery of recommendations or inputs supporting decision-making processes.
- Outputs seeking private sector involvement in the technology transfer should be business-oriented, formulated with caution, and considering their real needs and expectations.
- In technology transfer projects special attention should be paid to the selection of project partners and their roles. Conflicts of interest or ethical contradictions should be avoided.

## ANNEXES

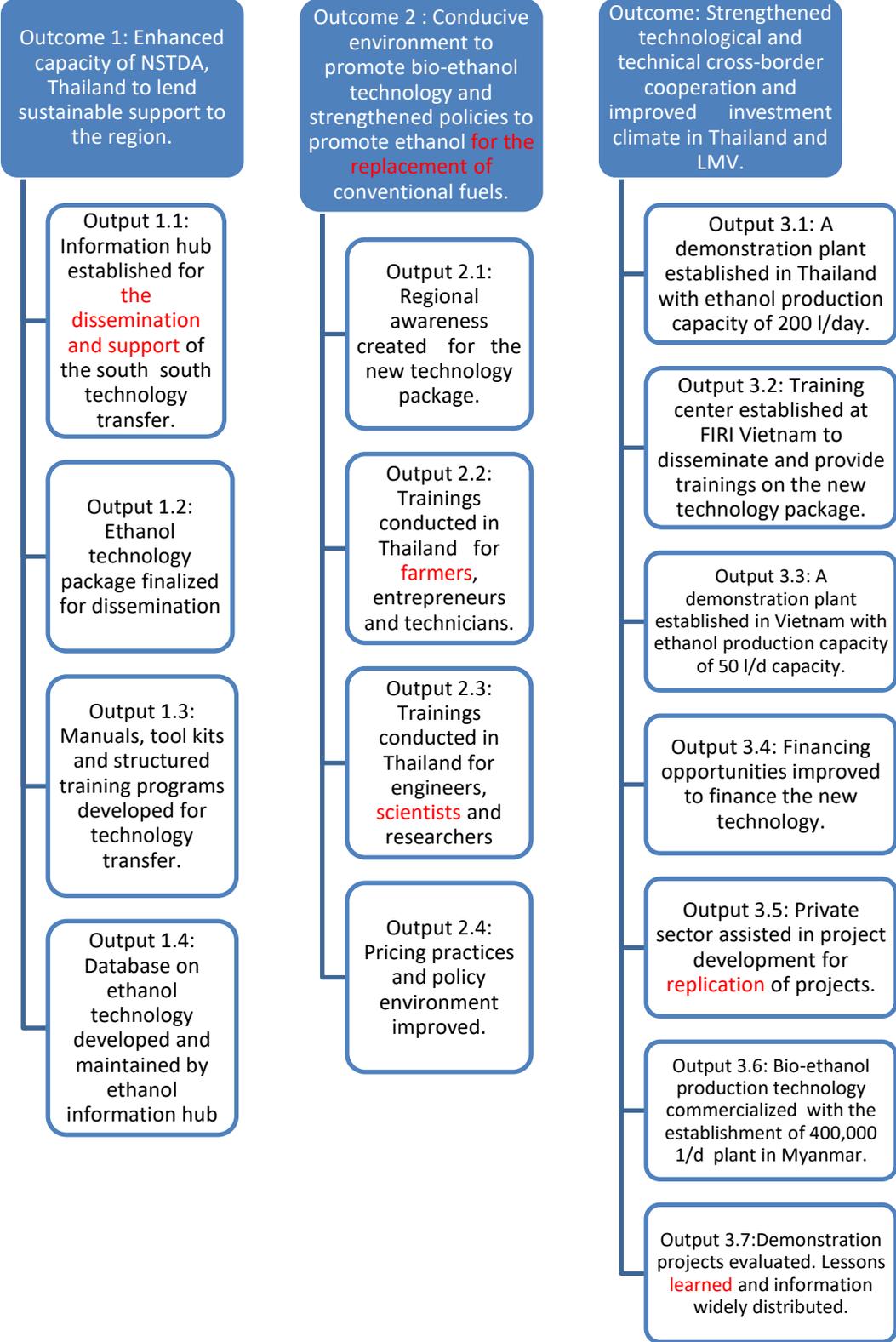
### Annex 1. Schedule of the field mission

<b>Date</b>	<b>Time</b>	<b>Activities</b>	<b>Location</b>
Monday (17.09.2018)	9:30 am– 4:30 pm?	Meeting with the Project management unit (PMU)	
Tuesday (18.09.2018)	9:30 am– 4:30 pm.	Meeting with KMUTT team	KMUTT office, Bangkok.
Wednesday (19.09.2018)	9.30 am – 11.30 pm	Meeting with the chairman of PSC	TTDI office, BKK
Wednesday (19.09.2018)	1:30 pm to 3:30 pm	Meeting with DEDE	
Thursday (20.09.2018)	9.30 am – 11.30 pm	Visit SAPTHIP Company Facilities. Private sector	SAPTHIP, Loburi (approx. 3.5 hr. travelling from BKK, ~ 230-250 km)
Friday (21.09.2018)	10.00 am – 12.00 pm	Meeting with Liquor Distillery Organization (LDO)	LDO office, BKK

Annex 1.2: Schedule of field visit to Viet Nam - Laos

<b>Day</b>	<b>Session</b>	<b>Activity</b>
Sunday 23 <sup>th</sup>		Travel to Viet Nam
Monday 24 <sup>th</sup> to Wednesday 26 <sup>th</sup>		Mission in Viet Nam
Monday 24 <sup>th</sup>	Morning	Meeting with FIRI
Monday 24 <sup>th</sup>	Afternoon	Visit to the pilot plant and training center. FIRI
Tuesday 25 <sup>th</sup>	Morning	Meeting with MOIT
Tuesday 25 <sup>th</sup>	Afternoon	Meeting with private company Thunglam
Wednesday 26 <sup>th</sup>	Morning	Travel to Lao
Thursday 27 <sup>th</sup> to Friday 28 <sup>th</sup>		Mission in Lao
Thursday 27 <sup>th</sup>	Afternoon	Meeting with IREP, Ministry of Energy and Mine.
Friday 28 <sup>th</sup>	Afternoon	Meeting with private company Khongsedone.
Saturday 29 <sup>th</sup>		Leaving for Havana

Annex 2. Project results framework.



## Annex 2.1. Project Outputs

## Annex 2.2. Project Result Indicators

	Indicator	Baseline	Target
Objective of the project	<p>Installed capacity of the demonstration projects</p> <p>2. Installed capacity of commercial plant</p> <p>3. Bio-ethanol production from these plants (l/day).</p> <p>4. No. of persons trained for the new technology.</p> <p>5. Improved policy and pricing environment in respective countries.</p> <p>6. Percentage increase in private sector investment.</p> <p>7. Percentage increase in lending by financial institutions.</p> <p>8. No. of replication projects under development in Thailand and LMV countries.</p>	<p>1. New ethanol production technology not yet disseminated and commercialized.</p> <p>2. Inadequate support policies and pricing strategies to support bio-ethanol production.</p> <p>3. Low private sector participation</p> <p>4. Not enough support from financing institutions.</p>	<p>1. To implement demonstration of cumulative 250 l/day capacity to implement commercial plant of capacity 400,000 l/day.</p> <p>2. To train at least 250 people under the project.</p> <p>3. To train banks and financial institutions.</p> <p>4. To assist at least 5 private sector project development.</p> <p>5. Cumulative bio-ethanol production of 132.1 million liters per year from project activity plants and 264.2 million liters per year from replication plants</p>
Outcome 1	<p>1. Increased capacity of KMUTT for technology transfer.</p> <p>2. Technology package developed.</p> <p>3. Manuals, training materials and toolkits developed.</p> <p>4. Database developed and operated</p>	KMUTT do not have sufficient capacity for technology transfer	Ethanol information clearinghouse and Centre for excellence established at KMUTT
Output 1.1	<p>1. Information hub established.</p> <p>2. South-South technology transfer model developed.</p>	No organization exists for technology dissemination and transfer.	KMUTT, Thailand developed an Ethanol information clearinghouse.
Output 1.2	VHG-SSF ethanol production technology developed as package.	New technology package not available.	KMUTT's new ethanol production technology is developed for dissemination

	Indicator	Baseline	Target
Output 1.3	<ol style="list-style-type: none"> <li>I. Technology training module developed.</li> <li>2. Training programs developed.</li> <li>3. Follow-up tools and procedures developed for monitoring.</li> </ol>	Manuals, toolkits, training programs not available for technology transfer	To develop manuals, toolkits and training programs for technology transfer.
Output 1.4	Database developed, tested, launched and operated.	No database available for the new ethanol technology.	To develop, operate and maintain ethanol database.
Outcome 2	<ol style="list-style-type: none"> <li>1. Improved pricing and policy environment.</li> <li>2. No. of involved with new bio-ethanol technology (farmers, entrepreneurs, technicians, researchers) trained.</li> </ol>	<ol style="list-style-type: none"> <li>L. Inadequate policies and pricing strategies for bioethanol production.</li> <li>2. Lack of interest among key stakeholders for the new bioethanol technology</li> <li>3. Lack of technical expertise for bioethanol production.</li> </ol>	<ol style="list-style-type: none"> <li>1. To improve the pricing and policy environment.</li> <li>2. To train at least 250 persons for the promotion of new bioethanol production (farmers, entrepreneurs, researchers, etc.)</li> </ol>
Output 2.1	<ol style="list-style-type: none"> <li>I. No. of regional workshops conducted in Thailand.</li> <li>2. No. of national workshops conducted in Thailand and Viet Nam.</li> <li>3. No of study tours organized for person (no).</li> </ol>	Very little awareness about new bio ethanol production technology.	To create sufficient awareness in the new technology.
Output 2.2	<ol style="list-style-type: none"> <li>I. Training materials prepared</li> <li>2. No. of farmers, entrepreneurs and technicians trained.</li> </ol>	<ol style="list-style-type: none"> <li>I. Entrepreneurs and technicians not aware of the new bio-ethanol production technology.</li> <li>2. Low productivity yield in Cassava in LMV countries.</li> <li>3. Farmers are not aware of the improved cassava cultivation practices.</li> </ol>	To train at least 150 farmers, 30 entrepreneurs and 30 technicians for the promotion of new ethanol production technology.

	Indicator	Baseline	Target
Output2.3	<p>I. Training materials prepared.</p> <p>2.No. of engineers, scientists and researchers trained.</p>	Engineers, scientists, and researchers are less aware in new bio ethanol production technology.	To train at least 40 engineers, scientists, and researchers for the promotion of new bioethanol production technology.
Output2.4	<p>I. Assessment report on policy needs.</p> <p>2. No. of experts trained in pricing and policy requirements for bio-ethanol.</p> <p>3. Policy intervention tools created.</p>	Insufficient policies and pricing strategy for the improvement of bio-ethanol.	Adequate policy environment and pricing practices are in place.
Outcome3	<p>1. Private made aware of opportunities of the technology.</p> <p>2. Technical center established as a result of cross-border cooperation.</p> <p>3. No. of replication projects developed.</p> <p>4. Capacity of demonstration and commercial projects established as a result of cross-border cooperation.</p>	<p>1. No demonstration plant exist for the new ethanol production technology.</p> <p>2. Private sector and financial institutions skeptical about the new technology.</p>	<p>1. To establish technical center at FIRI, Viet Nam.</p> <p>2. To implement demonstration projects of capacity 50l/d in Viet Nam.</p> <p>1.</p>
Output 3.1	Capacity of demonstration plant and operation of the plant.	No demonstration plants exist for the new ethanol production technology.	To implement a 200 l/d demonstration project and operate it in Thailand.
Output 3.2	<p>I. Training center established at FIRI, Viet Nam.</p> <p>2.Operation of the training center.</p> <p>3.Toolkits and manuals (KMUTT) adjusted for local conditions.</p>	No technical center available for the development of bioethanol technology in Viet Nam.	Established and sustainable operation of the center.

	Indicator	Baseline	Target
Output 3.3	Capacity of the demonstration plant and operation of the plant	No demonstration plants exist for the new ethanol production technology.	To implement a 50 l/d demonstration project and operate in Viet Nam.
Output 3.4	Percentage increase in financing for new ethanol technology by the financing institutions.	Financial institutions reluctant to finance for the new bio-ethanol production technology.	Financial institutions ready to finance the new bioethanol production technology.
Output 3.5	1.No. of interested entities identified. 2.At least 5 replication projects developed in Thailand and LMV countries.	1.Private entities less interested. 2.Lack of knowledge in project development.	1.To identify interested private project developers. 2.At least 5 replication projects developed.
Output 3.6	Capacity of the commercial plant with and its operation in Myanmar.	No commercial plants exist for the new ethanol production technology.	To implement and operate the project in Myanmar.
Output 3.7	1. Plant performance study reports. 2. Full-scaled demonstration site visits and seminars. 3. Dissemination leaflets. 4. Website.	No demonstration projects are in place to study the performance and to learn the lessons from the demonstration plants.	1. Performance assessment report. 2. Full-scaled demonstration site visits and seminar. 3. Website. 4. Project leaflet.

### Annex 3. Additional information on local conditions for bioethanol promotion

Additional information on local conditions for bioethanol promotion in project participant countries:

This Annex provides additional information to enhance the understanding of some local conditions for bioethanol promotion relevant to project implementation.

Content:

- A. Brief description of the policy measures developed for the promotion of gasohol in Thailand.
- B. Local conditions for the replacement of gasoline by gasohol from cassava in Viet Nam.
- C. Policy Development for Bioethanol promotion in Lao PDR.

Description:

- A. Brief description of the policy measures developed for the promotion of gasohol in Thailand

To reduce reliance on fuel imports, the Government of Thailand has developed a very aggressive policy, specifically, in the case of fuel for transport.

Thailand was the first country in Asia to announce national policies for both bioethanol and biodiesel development. Several measures have been implemented to promote the production and consumption of biofuel in the country including investment promotion, biofuel standardization, price incentives, vehicle specifications, tax incentives, and R&D programs.

A brief description of the policy measures developed for the promotion of gasohol is provided below.

Period 2000 – 2007.

- In September 2000, a government resolution was issued to promote the use of bioethanol.
- In 2004 the First National Alternative Energy Development Plan 2004-2011 was approved.
  - This plan considered the promotion of biofuels comprehensively with legislative support.
  - The target for renewable energy was at least 8% of the total energy consumption by 2011, of which 1.9 % was targeted to be the contribution from biofuel.
  - In particular, supported licensing for biofuel factories, expanding the number of biofuel stations and promoting public relations to give people more confidence in biofuels.
  - This year E10 was introduced in the market. There were not many problems with existing cars on the roads at that time since cars with fuel injection systems manufactured from 1995 onwards are safely fueled by E10.

Period 2008 – 2014.

- A second Alternative Energy Development Plan for 2008-2022 was approved.
- This plan continues improving policies for supporting bioethanol production and market penetration of biofuels for transport. Some of the new policy tools included were:
  - Tax privileges from the Board of Investment (BOI), tax and retail price incentives,

- R&D support, and public awareness programs.
- Special targets for biofuels (Ethanol and Biodiesel) are set so that biofuel consumption will represent 14% of total energy consumption by 2022.
- The government announced:
  - ◆ A 5 percent reduction of vehicle excise tax for E20 and E 85 compatible vehicles from previous rates.
  - ◆ A 3-year import duties waiver for parts used for E85 technology that was unavailable locally.
- E 20 and E 85 blends were introduced in the market.
- To support the deployment of Fuel Flexible Vehicles (FFVs) in the market during this period:
  - 2009. The government lowered the excise tax on all FFVs (both imported and domestically manufactured) sold in the country to 3 percent and lowered the import duty from 80 to 60 percent for imported FFVs.
  - 2010. The government halted tax privileges for imported FFVs but continued to promote domestically manufactured FFVs of all cylinder capacities.
  - 2010. All new cars in the Thai market are E20-compatible cars.
- 2012. The Alternative Energy Development Plan (AEDP 2012) is updated.
  - It sets a target to increase alternative energy consumption to 25% of the total energy consumption by 2021.
- 2013. The government banned sales of 91octane unleaded gasoline, which accounted for about 40% of the total gasoil consumption.
  - It is replaced with gasohol E10.

Period 2015 – 2018.

- 2015. The Alternative Energy Development Plan (AEDP 2015) is revised.
  - The target of penetration of renewable energy into total energy consumption is increased to achieve a 30% by 2036.
  - Of this target, 20-25 % is to come from bioethanol fuel and biodiesel.
- 2016. A new excise tax structure was enacted based on the CO<sub>2</sub> emission rate.
  - It is an effective policy to promote the use of low emission vehicles and economic cars, especially cars fueled by high ethanol blends and EVs.
  - Ecocars (1,300 cc to 1,500 cc engines) with CO<sub>2</sub> emissions lower than 100 grams/km will pay a 14% excise tax, with an additional 2% reduction for manufacturers of Eco-cars that use E85.
  - E85 compatible vehicles smaller than 3,000 cc will pay 5% less excise tax than E10 and E20 compatible vehicles of the same size and same CO<sub>2</sub> emission rates.
- 2017. AEDP 2015 target for biofuel is under revision considering that:
  - The low global price for petroleum may continue for the long run.
  - Domestic feedstock supplies for ethanol and biodiesel production may not be able to meet the current biofuel consumption goals for 2036 as the domestic

feedstock production is far below the target under the biofuel development plan implemented over the past decade.

In relation to pricing policy:

- The government has structured oil pricing to make gasohol retail prices lower than those of gasoline. Gasohol with higher ethanol contents is less expensive than gasohol with lower ethanol contents.
- Price subsidies were provided by the State Oil fund making gasohol retail prices 20 to 40 % cheaper than regular gasoline.
- Fuel ethanol is a controlled product and traders must have a license to either import or export it.

Policy for biofuel promotion has been effective, driving to a significant gasohol consumption growth during the period 2009 – 2016<sup>32</sup>.

The total combined amount of both fuels has increased by 40% during that period. However, it is significant that while the share of gasohol was 59% in 2009, in 2016 it rose to 94% of the total consumption.

Different blends of gasohol have been introduced in the Thailand’s market. The consumption of Gasohol products with 10% of ethanol is predominant. In 2008, market blends of gasoline with a 20% and an 85% of ethanol began to be introduced. Nonetheless, these gasohol qualities only covered 20% of the consumption in 2016. The reason was the little number of automobiles able to run with such high ethanol content in the fuel. (fig.1)

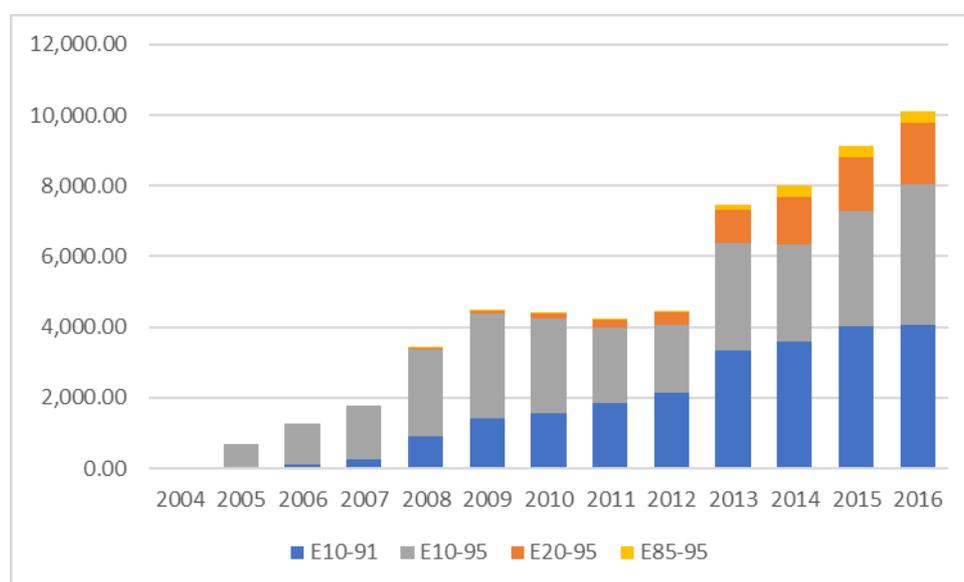


Figure 1 Consumption of bioethanol blends in Thailand

The ethanol production in Thailand<sup>33</sup> uses molasses, sugar cane and cassava in a proportion of 60 – 5 – 35. Ethanol production facilities were 27 in 2017 with a total capacity of 5.79 million

<sup>32</sup>Thailand Alternative Fuels Update 2017. US Department of Energy. Cary Bloyd. Sept 2017.

<sup>33</sup>THAILAND INDUSTRY OUTLOOK 2018- ETHANOL. Krungsri Research. Narin Tunpaiboon. May 2018.

liters per day. Molasses processing plants are 11 and cassava processing 9, the share of production capacity is 44% and 36%. An annual 4% increase of the ethanol demand for fuel is foreseen in the next future.

B. Local conditions for the replacement of gasoline by gasohol from cassava in Viet Nam. Viet Nam has shown progress in the improvement of the policy framework for the promotion of bioethanol for fuel over the last 10 years.

The government has approved a group of important policy measures in that regard.

2007. Decision No. 177/2007/ QĐ-TTg, November 20, 2007, provided “the Scheme for bio-fuel development up to 2015 with a vision toward 2025.”

This decision sought to:

- Develop a system of mechanisms, policies and legal documents aiming to create a legal corridor to attract investment and encourage industrial-scale production and use of biofuels.
- Raising public awareness about the benefits of using biofuels;
- Develop production and widespread use of biofuels to replace traditional fossil fuels. Expanding the scale of biofuel production facilities and distribution networks for transportation and other industrial purposes;
- To build and develop biofuel production and outlets throughout Viet Nam. By 2015, ethanol and vegetable oil output will reach 250,000 tons (with 5 million tons of E5, B5), meeting 1% of the country's petroleum demand.

2012. Decision No. 53/2012 /QĐ-TTg, November 22, 2012, established a roadmap to apply the blending rate of biofuels with traditional fuels.

This roadmap was aimed to replace nationwide consumption of pure gasoline by E10 blends or superior in 2017.

The main milestones defined to achieve that goal were:

- a. From December 1<sup>st</sup>, 2014, the gasoline produced, formulated and sold for use in motor vehicles in the provinces and cities of Hanoi, Ho Chi Minh City and Hai Phong, Da Nang, Can Tho, Quang Ngai, Ba Ria - Vung Tau is gasoline E5.
- b. From December 1<sup>st</sup>, 2015, the gasoline produced, processed and sold for use in motor vehicles nationwide is E5.
- c. From December 1<sup>st</sup>, 2016, the gasoline produced, formulated and sold for use in motor vehicles in the provinces and cities of Hanoi, Ho Chi Minh City and Hai Phong, Da Nang, Can Tho, Quang Ngai, Ba Ria - Vung Tau is bio-gasoline E10.
- d. From December 1<sup>st</sup> 2017, the gasoline produced, processed and sold for use in motor vehicles nationwide is E10 gasoline.

2017. The Ministry of Industry and Trade passed Directive No.11/CT-BCT on strengthening the implementation of the Roadmap for the application of the bio-fuel mixture ratio to traditional fuels.

This directive further confirms the strong commitment and urgency of the Viet Nameese government in completely replacing RON92 gasoline with E5 RON92 bio-gasoline nationwide as of January 1<sup>st</sup>, 2018.

Full implementation of this directive entails the substitution of 5.3 million m<sup>3</sup> of gasoline. It would require the production of 267,000 m<sup>3</sup>/year of bioethanol and 1,510,521 tons of fresh cassava/year.

It is evident that a sufficient production of cassava as raw material is a critical factor to achieve such goals.

During project preparation a positive assessment about the potential of cassava production as a reliable supplier for the ethanol industry was provided:

“In 2008 cassava production in Viet Nam was about 9.40 million tons, up from only 1.99 million tons in 2000. This rise was the result of both area expansion, from 237,600 ha to 555,700 ha, and marked yield increases, from 8.36 t/ha in 2000 to 16.91 t/ha in 2008.”

In 2017, this positive trend was still ongoing: while the area of cassava plantation remained the same, the agricultural yield increased in a 14% in comparison to 2008. The above-mentioned required amount of cassava for full implementation of Directive No.11/CT-BCT equates to 15% of the cassava production of 2016.

A detailed plan for nationwide planting of cassava was developed and approved by the Viet Nameese Ministry of Agriculture and Rural Development to ensure the sustainability of cassava supplies. This plan takes into account the needs for fuel ethanol production as well as other purposes.

The process of introduction of bioethanol faced some obstacles identified during the project preparation phase, including:

- Lack of specific policy instruments in areas such as investment, price, tax and a national biofuel quality standard.  
During the period of project implementation some of these instruments were put in place<sup>34</sup>:
  - National bioethanol fuel mix quality standards were established and implemented and environmental taxes introduced<sup>35</sup>.
  - The E5 bio-gasoline pricing formula in use includes incentives through excise and environmental taxes, as well as allowed to increase the average price to ensure the right benefits of the business.

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<sup>34</sup> Dong Du Xuan

<sup>35</sup> Dong du Xuan

- However, the price policy is not strong, flexible and timely enough to cope with changes in oil prices to ensure the required price difference that would encourage companies to invest in E5 petrol business.
- National bioethanol production is not enough to cover national demand for fuel mix. Actual bioethanol production capacity is based on four factories<sup>36</sup>:
  - Two biofuel plants of Tung Lam Co., Ltd: total capacity of 200,000 m<sup>3</sup>/year (200 million liters/year). That is enough to supply the bioethanol needed for the substitution of the RON 92 by E5 RON 92.
  - There are two factories with a capacity of 100,000 m<sup>3</sup>/year (100 million liters/year) in Dung Quat and Binh Phuoc, which halted production due to lack of a market for their products. These factories are urgently preparing and implementing plans to resume operations and they are expected to restart at the end of 2017.
- Supply of cassava as raw material for ethanol production.
- Public acceptance
 

People's habit of using petrol, as well as psychological concerns about the quality of E5 gasoline, discourage customers.

The information provided to the public has not been sufficient to change cognitive habits, and let people understand its benefits, nor to build trust among consumers.
- Low price incentive<sup>37</sup>.
 

The price difference between E5 gasoline and RON92, RON95 gasoline is still not big enough to encourage customers.

The cost of locally produced bioethanol is not competitive with gasoline due to high cassava prices and low crude oil prices.

Nevertheless, sells of E5 RON 92, after January 1<sup>st</sup>, 2018, has shown a positive development, but some issues should also be adjusted for further advance<sup>38</sup>. In particular, this report mentions that:

According to petrol companies' statistics, after over four months of deployment, E5 petrol consumption is showing positive signs and has increased significantly in contrast with late 2017 and early 2018. E5 sells by Petrolimex, which continues to be the company holding the largest market share, made up 50 percent of its petroleum pumps over the country.

The little price difference between E5 and RON 95 (about VND857 per liter) is considered to leave consumers uninterested in fuel switching. Additionally, container fees for transportation of E5 petrol are higher than for RON 95. That makes business more difficult for petrol dealers.

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<sup>36</sup> Dong du Xuan

<sup>37</sup> Dong Do Xuan

<sup>38</sup> Petrol firms suggest increasing E5-RON 95 price difference. Coverage report. Vietnam Investment Review. April 2018.

Therefore, gasoline companies are proposing:

- To set a reasonable price difference of VND 2,500 (US\$) per liter between E5 and RON 95 via the Environmental Protection Tax.
- To take measures to adjust the input and output special consumption taxes of E5 petrol to help increase sales.

### C. Policy Development for Bioethanol promotion in Lao PDR.

The first policy document that indicates the support of the Government of Lao PDR for the development of biofuel production was the “Renewable Energy Development Strategy in Lao PDR” issued in late 2011.

According to this document, the government policy is to promote investments in energy production from public and private sectors, and local and foreign investors. The focus is on the development of the following energy sources:

- Biofuels;
- Small power
- Other renewable energies such as solar, biomass, biogas, and wind;
- Other alternative fuels for transportation.

This strategy aims to kick-start the development of the biofuels market in the country through the provision of incentives to farmers, domestic and foreign investors to engage in the production of biofuels for domestic utilization and at the same time monitor its development and ensure proper mitigation of negative impacts.

The tentative vision for the promotion and development of biofuels is the following:

- Replace 10% of the transportation fuel demand by 2025;
- Increase deployment of biofuels technologies in rural areas.

In meeting these targets, the strategy formulates a comprehensive set of tasks:

- Issue a Biofuels Decree that provides an overall legal framework for setting the targets; stipulates specific development goals; and defines the incentives, support and assistance, and obligations of private investors including small-scale producers among others.
- Establish and strengthen the capacity of a body/agency responsible for the promotion and development of biofuels.
- Formulate a Biofuels Action Plan (biodiesel and bioethanol) as a blueprint for development.
- Provide support to research, demonstration, and field testing of high yielding fuel crop varieties.
- Provide financing to small-scale producers and encourage local financing institutions to extend financing services to small-scale biofuels feedstock producers.
- Support the establishment and development of a nationwide marketing network for biofuels feedstock.
- Support farmers’ associations and local traders in marketing biofuels feedstock.

- Establish a partnership with industry players for the processing, production, blending, and distribution of biofuels.
- Carry out an information campaign to raise consumer awareness on the use of biofuels;
- Carry out research and demonstrations on the use of biofuels in communities, farm machinery and other rural applications.
- Develop national standards for biofuels.

The report “Bioethanol Development Plan 2018 – 2025” indicates that Lao PDR’s bioethanol development is in its incipient phase. However, some advances have been made in institutional capacity for policy implementation such as:

- The Government has set up a bioenergy task force under the MEM and The Ministry of Science and Technology (MOST).
- The Ministry of Energy and Mines (MEM) has already setup the Institute of Renewable Energy Promotion (IREP) as the core bioethanol development organization.

It is still necessary to put in place a significant number of policy instruments to create an encouraging environment for the development of bioethanol production for fuel mixes. In particular, some gaps described in the report above should be reduced:

- The bioethanol development organization lacks experience in promotion programs.
- Lack of formal cooperation between different organizations for bioethanol development.
- Weak implementation mechanism from central to provincial offices.
- Research facilities such as pilot plants, laboratories, testing facilities, and learning centers are inadequate.
- Insufficient workforce and budget allocations for bioethanol development.
- Inadequate studies on bioethanol-related economic, social, and logistics issues.
- Inadequate technical capacity to build and operate commercial-scale production, blending, and storage facilities.
- Existing laws and regulations do not promote the development of bioethanol.

To overcome most of those gaps some actions were included in the NRES, but many of them have not been implemented to this date.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

## **TERMS OF REFERENCE**

Independent terminal evaluation

Overcoming policy, market and technological barriers to support technological innovation and south-south technology transfer: the pilot case of ethanol production from cassava

UNIDO Project No.: GF/THA/12/001

UNIDO Project ID: 100264

GEF ID: 4037

**JULY 2018**

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## I. Project background and overview

### 1. Project factsheet

<b>Project title</b>	Overcoming policy, market and technological barriers to support technological innovation and south-south technology transfer: the pilot case of ethanol production from cassava
<b>UNIDO project No. and/or ID</b>	UNIDO Project ID: 100264 UNIDO Project No.: GF/THA/12/001
<b>GEF project ID</b>	4037
<b>Region</b>	Asia and the Pacific
<b>Country</b>	Thailand
<b>Planned implementation start date</b>	28 March 2012
<b>Planned implementation end date</b>	31 January 2016
<b>Actual implementation start date</b>	6 June 2012
<b>Actual implementation end date</b>	December 2018
<b>GEF Focal Areas and Operational Project</b>	Climate Change, CC-SP4 Strategic Program
<b>Implementing agency</b>	UNIDO
<b>Executing partner(s)/entity(ies)</b>	King Mongkut's University of Technology Thonburi (KMUTT), Thailand; Liquor Distillery Organization (LDO), Thailand; Ministry of Industry and Trade (MOIT); Viet Nam, Food Industries Research Institute (FIRI), Viet Nam
<b>Donor:</b>	GEF
<b>Total project allotment (GEF Grant + co-financing at CEO Endorsement)</b>	USD34,403,000
<b>Total co-financing at design (in cash and in-kind)</b>	USD 31,623,000
<b>Mid-term review date</b>	February 2015

(Source: Project document)<sup>39</sup>

### 2. Project context

The UNIDO project Overcoming policy, market and technological barriers to support technological innovation and south-south technology transfer: the pilot case of ethanol production from cassava deals with technical innovation and South-South technology transfer from Thailand to neighboring countries, notably Lao PDR, Myanmar and Viet Nam (LMV),

<sup>39</sup> Project information data throughout these TOR are to be verified during the inception phase.

to address the issue of the region's high dependence on fossil fuels for transportation.

The four countries are part of the Association of South-East Asian countries (ASEAN), an Association whose total population accounts for more than 600 million people, with a combined economic power ranking the region somewhere between India and Japan.

Over the past decade, most ASEAN countries experienced a steady economic and social growth, accompanied often by relevant reductions in poverty, which resulted in rapid growth in energy consumption per capita. Despite being relatively well endowed in terms of energy resources, the region remains an energy-thirsty one, characterized by a very low level of energy efficiency, as its transport sector and its manufacturing industry are highly energy intensive.

ASEAN's primary energy need is projected to triple between 2005 and 2030 by an average annual growth rate of around 4%. Even under the most optimistic assumptions, ASEAN will face formidable challenges in securing the energy it will need over the next few decades to sustain its growth momentum. At the same time, many of ASEAN's current fossil fuel reserves will be exhausted or be far from sufficient to respond to the projected demand. On this issue, then, renewable energy has received increasing attention because of worldwide effort to mitigate global warming and alleviate soaring oil price.

The concerned Governments, then, decided to exploit the use of biofuels as an alternative to fossil fuels. Indeed, bioenergy is an important energy resource since it is renewable, widely available and carbon neutral. Using bioenergy as an alternative to fossil fuels – which are limited resources – is one way to reduce GHG emissions and improve energy security. Therefore, biomass is considered as a promising alternative energy source in future strategic energy planning in the national and regional context. The project builds upon the collaboration between UNIDO and National Science and Technology Development Agency (NSTDA) in Thailand to develop a concept note seeking an opportunity for GEF to support the transfer of Thailand's bioethanol technology production from cassava to neighboring countries.

Approved in March 2012, the project implementation started in June 2012 and the initial project end date was in January 2016. After an extension phase, the actual implementation end date is expected to be December 2018. The project document foresees regular monitoring, an independent mid-term review (MTR) carried out in February 2015 and a terminal evaluation (TE).

### **3. Project objective**

The key objective of the proposed project is to foster technical innovation and South-South technology transfer from Thailand to neighboring countries, notably Lao PDR, Myanmar and

Viet Nam, to address the issue of the region's high dependence on fossil fuels for transportation.

The following three technical **project components** have been developed to achieve the project objective:

### **Project Component 1: Institutional capacity strengthening for VHG-SSF technology dissemination**

Component 1 aims to strengthen the institutional capacity of KMUTT (replaced NSTDA) in ethanol technology by developing a full package of practices for the technology, including production know-how to increase cassava yield and new VHG-SSF fermentation technology. KMUTT, by working closely with UNIDO, has the lead for this component.

Under this component, four main outputs have been identified:

1. Information hub established for disseminating and supporting the south-south technology transfer;
2. Ethanol technology package finalized for dissemination;
3. Manuals, tool kits and structured training programs developed for technology transfer;
4. Database on ethanol technology developed and maintained by ethanol information hub.

### **Project Component 2: South-South technology transfer: capacity building and policy dialogue with participants from LMV**

Component 2 includes activities that build the capacity of recipient countries and other interested parties as observers, familiarize with the new bio-ethanol technology and engage policy makers in dialogues for creating the necessary awareness and formulating the policy in support of the new ethanol technology package. Most of these activities towards the creation of conducive environment for bioethanol will be carried out after seeing the successful operation of the demonstration units in Thailand and Viet Nam.

KMUTT for Thailand and MOIT for Viet Nam are the main responsible in these activities and they are expected to deliver the following outputs:

1. Regional awareness created for the new technology package;
2. Training conducted in Thailand for farmers, entrepreneurs and technicians;
3. Training conducted in Thailand for engineers, scientists and researchers;
4. Pricing practices and policy environment improved.

### **Project Component 3: Demonstration and commercialization of the technology and private sector development**

The private company KKS, after receiving assistance through KMUTT and FIRI, is responsible for the establishment, the operations and the maintenance of a commercial plant in Myanmar. The ultimate goal is to ensure the sustainability of this plant and to provide institutional continuity, replicability and global environmental benefits of the project.

#### **4. Project implementation arrangements**

UNIDO, as the GEF implementing Agency, is responsible for implementing the project, delivering the planned outputs and achieving the expected outcomes. UNIDO is executing the project in collaboration with the concerned Government Ministries of respective governments, KMUTT, FIRI, LDO and the private stakeholders.

Among the other responsibilities, UNIDO is responsible for:

- Releasing the GEF funds at appropriate periods;
- Selecting experts, project briefing, approval of contracts for the implementation activities;
- Procuring, initial operations, monitoring and reporting;
- Providing assistance on formal GEF procedures that apply to the project execution, including reporting issues and formal channel of correspondence between the project and the GEF secretariat;
- Coordinating with the project steering committee to review the project every 2 months during the project implementation period;
- Providing administrative support and financial budgetary follow up required for the execution of the project;
- Annual auditing of the project by following GEF procedures;
- Managing, supervising and monitoring the work of the international teams and for ensuring that the deliverables are technically sound and consistent with the project requirements.

National Science and Technology Development Agency, NSTDA (replaced by KMUTT, Thailand) is responsible for:

- Establishing the information hub in Thailand;
- Packaging of the bio-ethanol technology package for transfer;
- Preparation of manuals, toolkits and structured training programs for technology transfer;
- Operation and maintenance of the ethanol technology database;
- Conducting regional workshops on bio-ethanol production;
- Coordination of the study tour for LMV countries participants;
- Various trainings to farmers, technicians, entrepreneurs, researchers and scientists;
- Assisting FIRI in the establishment of a technical center in Viet Nam;
- Establishing the 200 l/d demonstration plant in Thailand;
- Assisting FIRI in the establishing the 50 l/d demonstration plant in Viet Nam;
- Facilitating the technical services and technology transfer for establishing the 400,000 l/d plant in Myanmar.

Food Industries Research Institute, FIRI (Viet Nam) is responsible for:

- Establishing of a technical centre in Viet Nam;
- Establishing of 50 l/d demonstration plant in Viet Nam;
- Conducting several policy forums in Viet Nam;
- Providing technical and expert advisory service to ethanol producers and investors in Viet Nam for commercialization of the technology.

Liquor Distillery Organization, LDO (Thailand), is responsible for:

- Hosting the 200 l/d demonstration unit on its industrial site in Bangkok, Thailand

Ministry of Industry and Trade, MOIT (Viet Nam), is responsible for:

- Implementing the 50 l/d demonstration unit at Hanoi, Viet Nam

Kaung Kyaw Say Group of Companies, KKS (Myanmar), is responsible for:

- Implementing the 400,000 l/d commercial plant in Myanmar.

According to the project document, UNIDO established a Project Management Unit (PMU) in UNIDO Regional Office, Bangkok, with close collaboration with UNIDO Country Office in Viet Nam. PMU would consist of recruited administrative staff, project national experts, designated KMUTT persons and a Project Manager.

The responsibilities of PMU would be as follows:

- Project coordination within the project and with other project stakeholders including experts and government agencies;
- Day-to-day project operations including management, monitoring and evaluation of activities as stipulated in the project work plan;
- Assisting KMUTT, MOIT and FIRI to organize training activities, study tours and others as shown in the work plan.

## **5. Main findings on project progress**

Conducted from mid-February to mid-May 2015, the mid-term evaluation covers the period from March 2012 to February 2015. Below a summary of main findings from the evaluation report:

Design: the project design was weak as it was prepared without full and active participation of relevant national stakeholders and with a lack of insight regarding CO<sub>2</sub> emissions abatement. As a result, the Project Results Framework (PRF) and target indicators were not developed well enough to address the key barriers and the associated risks.

Relevance: the project is relevant to the national development and environmental priorities of the countries concerned. The project is in line with UNIDO's mandate and is consistent with the GEF Climate Change focal area strategic program SP4: Promoting sustainable energy production from biomass.

Effectiveness: the project has so far achieved none of the planned outputs that would lead to the project outcomes. While a part of the delay in project execution can be attributed to reasons beyond UNIDO's control, the inordinate delays and inadequate project performance are a result of poor quality of the work plan and insufficient tracking and monitoring of the project's performance. Some partners have yet to be involved actively in the project.

Efficiency: the project implementation was delayed 2 years due to change in the main executing

partner, political turmoil in Thailand and the delay in signing of sub-contract between UNIDO and the main executing partner. However, after the project got started, not enough efforts have been made by UNIDO and its main executing partner to ensure the project's cost-effectiveness. Substantial GEF resources have been engaged but none of the outputs has been delivered and very little confirmed co-financing has materialized.

Sustainability: the participating governments realize the importance of bio-ethanol development but the formulation of transparent policies and incentives requires coordination among key government agencies. Other key stakeholders are likely to fall in line when the government sends a strong policy signal. The project has limited impacts of sharing the Thai experience of bio-ethanol promotion initiatives with the neighboring countries. There are no identified potential risks to environmental sustainability. Further details can be obtained from the MTR report.

## 6. Budget information

Table 1. Financing plan summary

Description	Project Preparation (in USD)	Project (in USD)	Total (in USD)
Financing (GEF /others)	100,000	2,600,000	<b>2,700,000</b>
Co-financing <sup>40</sup> (in cash and/or in-kind)	80,000	31,623,000	<b>31,703,000</b>
<b>Total (in USD)</b>	<b>180,000</b>	<b>34,223,000</b>	<b>34,403,000</b>

Source: Project document/GEF: CEO endorsement document

Table 2. Financing plan summary – project component breakdown

Project outcomes	GEF grant amount (excl. PPG) (in USD)	Co-financing (in USD)	Total (in USD)
1. Institutional capacity strengthening for very VHG-SSF technology dissemination	330,500	1,187,000	<b>1,517,500</b>
2. South-South technology transfer: capacity building and policy dialogue with participants from Lao PDR, Myanmar and Viet Nam	757,500	1,253,000	<b>2,010,500</b>
3. Demonstration and commercialization of the technology and private sector development	1,262,000	28,492,000	<b>29,754,000</b>
Project Management	250,000	691,000	<b>941,000</b>
<b>Total (in USD)</b>	<b>2,600,000</b>	<b>31,623,000</b>	<b>34,223,000</b>

Source: Project document/GEF: CEO endorsement document

Table 3. Co-financing source breakdown

<sup>40</sup> Co-financing types are grant, soft loan, hard loan, guarantee, in kind, or cash.

<b>Name of co-financier (source)</b>	<b>Classification</b>	<b>Type (Specify: cash and/or in-kind)</b>	<b>Total (in USD)</b>
<b>KMUTT, Thailand</b>	National Government	Cash	555,000
<b>KMUTT, Thailand</b>	National Government	In-kind	2,400,000
<b>LDO, Thailand</b>	National Government	Cash	1,500,000
<b>LDO, Thailand</b>	National Government	In-kind	630,000
<b>MOIT, Viet Nam</b>	National Government	In-kind	375,000
<b>FIRI, Viet Nam</b>	National Government	Cash	722,000
<b>FIRI, Viet Nam</b>	National Government	In-kind	250,000
<b>Kaung Kyaw Say Group of Companies (KKS), Myanmar</b>	Private sector	Cash	25,000,000
<b>UNIDO</b>	Implementing Agency	Cash	80,000
<b>UNIDO</b>	Implementing Agency	In-kind	111,000
<b>Total co-financing (in USD)</b>			<b>31,623,000</b>

Source: Project document/GEF: CEO endorsement document

Table 4. UNIDO budget execution<sup>41</sup> (Grant No.: 200000323), in USD

Items of Expenditure	2012	2013	2014	2015	2016	2017	2018	Total exp.
Contractual services		380,000.00	827,419.97	77,074.51	493,822.81	97,179.79	- 785.63	1,874,711.45
Equipment				3,403.45	3,636.26	834.50		7,874.21
International meetings	6,500.00	-1,039.59	8,493.92	-2,113.59		4,266.76		4,266.76
Local travel	1,346.84	8,715.16	9,228.77	2,482.21	6,837.04	5,029.53	2,975.71	36,615.26
Natl. Consult./Staff	10,383.77	11628.25	12,012.17	26,857.26	67,716.87	70,054.25	45,754.63	244,407.2
Intl. Consult./Staff								
Other Direct Costs	1,040.01	889.37	1,360.73	-2,168.26	3,635.39	6,903.24		11,660.48
Premises								
Staff and Intern			17,389.19	21,282.06	2,522.36	12,762.77		53,956.38
Staff Travel		19.20			-19.20			0
Train/Fellowship/Study						1,612.62	42.12	1,654.74
<b>Grand Total (in USD)</b>	<b>19,270.62</b>	<b>400,212.39</b>	<b>875,904.75</b>	<b>126,817.64</b>	<b>578,151.53</b>	<b>198,643.46</b>	<b>47,986.83</b>	<b>2,235,146.48</b>

Source: UNIDO. ERP database as of 08/03/2017

<sup>41</sup> Disbursement: Expenditure, incl. commitment

## **II. Scope and purpose of the evaluation**

The terminal evaluation (TE) will cover the whole duration of the project from its starting date up to the date of the evaluation. It will assess project performance against the evaluation criteria: relevance, effectiveness, efficiency, sustainability and impact.

The TE has an additional purpose of drawing lessons and developing recommendations for UNIDO, the Government, Donors, and the project stakeholders and partners that may help improving the selection, enhancing the design and implementation of similar future projects and activities in the country and on a global scale upon project completion. The TE report should include examples of good practices for other projects in the focal area, country, or region.

The TE should provide an analysis of the attainment of the project objective and the corresponding outputs and outcomes. Through its assessments, the Evaluation Team (ET) should enable the Government, counterparts, UNIDO and other stakeholders and donors to verify prospects for development impact and sustainability, providing an analysis of the attainment of global environmental objectives, project objectives, delivery and completion of project outputs/activities, and outcomes/impacts based on indicators. The assessment shall include reexamination of the relevance of the objectives and other elements of project design according to the project evaluation parameters defined in chapter III below.

The overall purpose of the TE is to assess whether the project has achieved or is likely to achieve its main objective, i.e. to foster technical innovation and South-South technology transfer from Thailand to neighboring countries, and to what extent the project has also considered sustainability and scaling-up factors for increasing contribution to sustainable results and further impact.

The evaluation has three specific objectives:

- (i) Assess the project performance in terms of relevance, effectiveness, efficiency, sustainability and progress to impact;
- (ii) Identify key learning to feed into the design and implementation of the forthcoming projects; and
- (iii) Develop a series of findings, lessons and recommendations for enhancing the design of new and implementation of ongoing projects by UNIDO.

## **III. Evaluation approach and methodology**

The TE will be conducted in accordance with the UNIDO Evaluation Policy<sup>42</sup> UNEG Norms and Standards for evaluation and the UNIDO Guidelines for the Technical Cooperation Project and Project Cycle<sup>43</sup>.

In addition, the GEF Guidelines for GEF Agencies in Conducting Terminal Evaluations, the GEF Monitoring and Evaluation Policy and the GEF Minimum Fiduciary Standards for GEF Implementing and Executing Agencies must to be considered.

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<sup>42</sup> UNIDO. (2018). Director General's Bulletin: Evaluation Policy (DGB/2018/08, 1 June 2018)

<sup>43</sup> UNIDO. (2006). Director-General's Administrative Instruction No. 17/Rev.1: Guidelines for the Technical Cooperation Programme and Project Cycle (DGAI.17/Rev.1, 24 August 2006)

The evaluation will be carried out as an independent in-depth evaluation using a participatory approach whereby all key parties associated with the project will be informed and consulted throughout the evaluation. The evaluation team leader will liaise with the UNIDO Independent Evaluation Division on the conduct of the evaluation and methodological issues.

In line with its objectives, the evaluation will have two main components. The first component focuses on an overall **assessment of performance** of the project, whereas the second one focuses on the **learning** from the successful and unsuccessful practices in project design and implementation.

The evaluation will use a theory of change approach and mixed methods to collect data and information from a range of sources and informants. It will pay attention to triangulating the data and information collected before forming its assessment. This is essential to ensure an evidence-based and credible evaluation, with robust analytical underpinning. The theory of change will identify causal and transformational pathways from the project outputs to outcomes and longer-term impacts, and drivers as well as barriers to achieve them. The learning from this analysis will be useful to feed into the design of the future projects so that the management team can effectively manage them based on results.

In those cases where baseline information for relevant indicators is not available, the evaluation team will aim at establishing a proxy-baseline through recall and secondary information.

## **1. Data collection methods**

The ET will be required to use different methods to ensure that data gathering and analysis deliver evidence-based qualitative and quantitative information, based on diverse sources, as necessary: desk studies and literature review, statistical analysis, individual interviews, focus group meetings/discussions, surveys and direct observation. This approach will not only enable the evaluation to assess causality through quantitative means but also to provide reasons for why certain results were achieved or not and to triangulate information for higher reliability of findings. The specific mixed methodological approach will be described in the inception report.

Following are the main instruments for data collection:

- (a) **Desk and literature review** of documents related to the project, including but not limited to:
  - The original project document, monitoring reports (such as progress and financial reports), mid-term review report, output reports, back-to-office mission report(s), end-of-contract report(s) and relevant correspondence
  - Notes from meetings of committees involved in the project
- (b) **Stakeholder consultations** will be conducted through structured and semi-structured interviews and focus group discussion. Key stakeholders to be interviewed include:
  - UNIDO Management and staff involved in the project; and
  - Representatives of donors and counterparts

- (c) **Field visit** to Thailand
- On-site observation of results achieved by the project, including interviews of actual and potential beneficiaries of improved technologies
  - Interviews with the relevant UNIDO Country Office(s) representative to the extent that he/she was involved in the project, and the project's management members and the various national [and sub-regional] authorities dealing with project activities as necessary
- (d) Other interviews, surveys or document reviews as deemed necessary by the evaluation team and/or by the Independent Evaluation Division for triangulation purposes

## 2. Evaluation key questions and criteria

The evaluation team will develop interview guidelines. Field interviews can take place either in the form of focus-group discussions or one-to-one consultations.

The key evaluation questions are the following:

- (a) What are the key drivers and barriers to achieve the long term objectives? To what extent has the project helped put in place the conditions likely to address the drivers, overcome barriers and contribute to the long term objectives?
- (b) How well has the project performed? Has the project done the right things? Has the project done things right, with good value for money?
- (c) What have been the project's key results (outputs, outcome and impact)? To what extent have the expected results been achieved or are likely to be achieved? To what extent the achieved results will sustain after the completion of the project?
- (d) What lessons can be drawn from the successful and unsuccessful practices in designing, implementing and managing the project?
- (e) What is the project's contribution and relevance to the *Poznan Strategic Program on Technology Transfer*, as conceptualized and approved by the GEF?

The evaluation will assess the likelihood of sustainability of the project results after the project completion. The assessment will identify key risks (e.g. in terms of financial, socio-political, institutional and environmental risks) and explain how these risks may affect the continuation of results after the project ends. Table 5 below provides the key evaluation criteria to be assessed by the evaluation. The detailed questions to assess each evaluation criterion are in annex 2. The **rating criteria** and table to be used is presented in annex 8.

Table 5. Summary of Project evaluation criteria

Index	Evaluation criteria	Mandatory rating
<b>A</b>	<b>Progress to Impact</b>	<b>Yes</b>
<b>B</b>	<b>Project design</b>	<b>Yes</b>
1	• Overall design	Yes
2	• Logframe	Yes

<b>Index</b>	<b>Evaluation criteria</b>	<b>Mandatory rating</b>
<b>C</b>	<b>Project performance</b>	<b>Yes</b>
1	• Relevance	Yes
2	• Effectiveness	Yes
3	• Efficiency	Yes
4	• Sustainability of benefits	Yes
<b>D</b>	<b>Cross-cutting performance criteria</b>	
1	• Gender mainstreaming	Yes
2	• Environment and socio-economic aspects <sup>44</sup>	Yes
2	• M&E: (focus on Monitoring) ✓ M&E design ✓ M&E implementation	Yes
3	• Results-based Management (RBM)	Yes
<b>E</b>	<b>Performance of partners</b>	
1	• UNIDO	Yes
2	• National counterparts	Yes
3	• Donor	Yes
<b>F</b>	<b>Overall assessment</b>	<b>Yes</b>

#### IV. Evaluation process

The evaluation will be implemented in phases which are not strictly sequential, but in many cases iterative, conducted in parallel and partly overlapping:

- UNIDO Independent Evaluation Division (IED) identifies and selects the Evaluation Team members, in consultation with project manager
- Inception phase
  - ✓ Desk review and data analysis: The evaluation team will review project-related documentation and literature and carry out a data analysis (incl. familiarization with GEF programmes and strategies, and with relevant GEF policies such as those on project cycle, M&E, co-financing, fiduciary standards, gender, and environmental and social safeguards)
  - ✓ Briefing of consultant(s) at UNIDO Headquarters (HQ)
  - ✓ Preparation of inception report: The evaluation team will prepare the inception report providing details on the methodology for the evaluation and include an evaluation matrix with specific issues for the evaluation; the specific site visits will be determined during the inception phase, taking into consideration the findings and recommendations of project progress reports or mid-term reviews.
  - ✓ Interviews, survey
- Field phase

<sup>44</sup> All GEF-4 and GEF-5 projects have incorporated relevant environmental and social considerations into the project design / GEF-6 projects have followed the provisions specified in UNIDO/DGAI.23: UNIDO Environmental and Social Safeguards Policies and Procedures (ESSPP)

- ✓ Country field visit(s)
- ✓ ET Debriefing in the field to project stakeholders
- Reporting phase
  - ✓ After field mission, HQ debriefing with preliminary findings, conclusions and recommendations by the ET leader
  - ✓ Data analysis and draft report writing
  - ✓ Draft report submission
  - ✓ Sharing and factual validation of draft report with stakeholders
  - ✓ Final evaluation report Submission and QA/clearance by IED, and
  - ✓ Two pages summary take-away message
- IED Final report issuance and distribution with the respective management response sheet and further follow-up, and publication of evaluation report in UNIDO intra/internet sites

## **V. Evaluation team composition**

A staff from the UNIDO Independent Evaluation Division will be assigned as Evaluation Manager and will coordinate and provide evaluation backstopping to the evaluation team and ensure the quality of the evaluation. The UNIDO Project Manager and national project teams will act as resource persons and provide support to the evaluation team and the IED evaluation manager.

The evaluation team will be composed of at least one international evaluation consultant acting as the team leader and one national consultant. The evaluation team members will possess relevant strong experience and skills on evaluation and evaluation management, including social safeguards and gender. Expertise and experience in the related technical subject of the project is desirable. The evaluation consultants will be contracted by UNIDO.

In some specific cases (e.g. complex projects, regional projects, projects at risk), an IED evaluation officer could be also assigned to be part of the evaluation team and hence participate in the whole conduct as such. The tasks of each team member are specified in the job descriptions in annex 3 to these terms of reference.

According to UNIDO Evaluation Policy, members of the evaluation team must not have been directly involved in the design and/or implementation of the project under evaluation.

The UNIDO GEF Coordinator and GEF OFP(s) will be briefed on the evaluation and provide support to its conduct. GEF OFP(s) will, where applicable and feasible, also be briefed and debriefed at the start and end of the evaluation mission.

## **VI. Time schedule**

- The evaluation is scheduled to take place from August to October 2018.
- The evaluation field mission is tentatively planned for September 2018.
- The Draft Evaluation report will be submitted 2 to 4 weeks after the end of the mission.
- The Final Evaluation report will be submitted 2 weeks after comments received.

## **VII. Evaluation deliverables**

### **Inception report**

This terms of reference (TOR) provides some information on the evaluation methodology, but this should not be regarded as exhaustive. After reviewing the project documentation and initial interviews with the project manager, the International Evaluation Consultant will prepare, in collaboration with the national consultant, a short inception report that will operationalize the TOR relating to the evaluation questions and provide information on what type of and how the evidence will be collected (methodology). It will be discussed with and approved by the responsible UNIDO Evaluation Manager.

The inception report will focus on the following elements: preliminary project theory model(s); elaboration of evaluation methodology including quantitative and qualitative approaches through an evaluation framework (“evaluation matrix”); division of work between the International Evaluation Consultant and the national consultant; mission plan, including places to be visited, people to be interviewed and possible surveys to be conducted and a debriefing and reporting timetable<sup>45</sup>.

### **Evaluation report and review procedures**

The draft report will be delivered to UNIDO Independent Evaluation Division (the suggested report outline is in annex 4) and circulated to UNIDO staff and national stakeholders associated with the project for factual validation and comments. Any comments or responses, or feedback on any errors of fact to the draft report provided by the stakeholders will be sent to UNIDO Independent Evaluation Division for collation and onward transmission to the project evaluation team who will be advised of any necessary revisions. On the basis of this feedback, and taking into consideration the comments received, the evaluation team will prepare the final version of the terminal evaluation report.

The ET will present its preliminary findings to the local stakeholders at the end of the field visit and take into account their feed-back in preparing the evaluation report. A presentation of preliminary findings will take place at UNIDO HQ after the field mission. The TE report should be brief, to the point and easy to understand. It must explain the purpose of the evaluation, exactly what was evaluated, and the methods used. The report must highlight any methodological limitations, identify key concerns and present evidence-based findings, consequent conclusions, recommendations and lessons. The report should provide information on when the evaluation took place, the places visited, who was involved and be presented in a way that makes the information accessible and comprehensible. The report should include an executive summary that encapsulates the essence of the information contained in the report to facilitate dissemination and distillation of lessons.

Findings, conclusions and recommendations should be presented in a complete, logical and balanced manner. The evaluation report shall be written in English and

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<sup>45</sup> The evaluator will be provided with a Guide on how to prepare an evaluation inception report and a Guide on how to formulate lessons learned (including quality checklist) prepared by the UNIDO Independent Evaluation Division.

follow the outline given in annex 4. The ET should submit the final version of the TE report in accordance with UNIDO Independent Evaluation Division standards.

### **VIII. Quality assurance**

All UNIDO evaluations are subject to quality assessments by UNIDO Independent Evaluation Division. Quality assurance and control is exercised in different ways throughout the evaluation process (briefing of consultants on methodology and process of UNIDO Independent Evaluation Division, providing inputs regarding findings, lessons learned and recommendations from other UNIDO evaluations, review of inception report and evaluation report).

The quality of the evaluation report will be assessed and rated against the criteria set forth in the Checklist on evaluation report quality, attached as annex 5. UNIDO's Independent Evaluation Division should ensure that the evaluation report is useful for UNIDO in terms of organizational learning (recommendations and lessons learned) and is compliant with UNIDO's evaluation policy and these terms of reference. The draft and final evaluation report are reviewed by UNIDO Independent Evaluation Division, which will issue and circulate it within UNIDO together with a management response sheet, as well as submit to relevant stakeholders as required.

## Annex 1: Project results framework

Project Strategy		Objectively verifiable indicators				
		Indicator(quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
Goal	To reduce GHG emission in the ethanol production sector as well as due to increased use of ethanol for fuel in Thailand and LMV countries.	<ol style="list-style-type: none"> <li>1. Incremental avoided GHG emission due to increased number of ethanol plants using VHG - SSF technology established.</li> <li>2. Incremental GHG emission reduction due to increased use of ethanol as biofuel replacing fossil fuels.</li> </ol>	<ol style="list-style-type: none"> <li>1. Usage of conventional fossil fuel</li> <li>2. CO<sub>2</sub> emission due to fossil fuel usage instead of ethanol as fuel.</li> <li>3. CO<sub>2</sub> emission due to conventional method of ethanol production technology.</li> </ol>	<ol style="list-style-type: none"> <li>1. 400,250 l/d of ethanol production plant added during the project leading to cumulative emission reduction of 2,760,524 t CO<sub>2</sub>e over a period of 10 years.</li> <li>2. At least 800,500 l/d of ethanol production added during the next 10 years leading cumulative emission reduction of 5,521,049 t CO<sub>2</sub>e.</li> </ol>	<ol style="list-style-type: none"> <li>1. Physical verification of plants in operation.</li> <li>2. End of project survey.</li> </ol>	<p>Continuous support of all participating countries, Ministries, organizations and project investors.</p> <p>Environmental protection and fossil fuel conservation becomes a priority for consumers</p>
Objective of the project	Removing barriers, and creating conducive environment for promoting ethanol technology and South-South technology transfer.	<ol style="list-style-type: none"> <li>1. Installed capacity of the demonstration projects</li> <li>2. Installed capacity of commercial plant</li> <li>3. Bio-ethanol production from these plant (l/day).</li> <li>4. No. of persons trained for the new technology.</li> <li>5. Improved policy and</li> </ol>	<ol style="list-style-type: none"> <li>1. New ethanol production technology not yet disseminated and commercialized.</li> <li>2. Inadequate support policies and pricing strategies to support bio-ethanol production.</li> <li>3. Low private sector participation</li> <li>4. Not enough support</li> </ol>	<ol style="list-style-type: none"> <li>1. To implement demonstration of cumulative 250 l/day capacity to implement commercial plant of capacity 400,000 l/day.</li> <li>2. To train at least 250 people under the project.</li> <li>3. To train banks and financial institutions.</li> </ol>	<ol style="list-style-type: none"> <li>1. Physical verification of the project.</li> <li>2. Training programmes conducted.</li> <li>3. Government papers for policy and pricing</li> <li>4. Private sector investment and documents on lending</li> </ol>	Continued support of different governments, NSTDA, LDO & FIRI

Project Strategy		Objectively verifiable indicators				
		Indicator(quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
		<p>pricing environment in respective countries.</p> <p>6. Percentage increase in private sector investment.</p> <p>7. Percentage increase in lending by financial institutions.</p> <p>8. No. of replication projects under development in Thailand and LMV countries.</p>	from financing institutions.	<p>4. To assist at least 5 private sector project development.</p> <p>5. Cumulative bio-ethanol production of 132.1 million litre per year from project activity plants and 264.2 million litre per year from replication plants</p>	5. Replication projects under development.	
Outcome 1	Enhanced capacity of NSTDA, Thailand to lend sustainable support to the region	<p>1. Increased capacity of NSTDA for technology transfer.</p> <p>2. Technology package developed.</p> <p>3. Manuals, training materials and toolkits developed.</p> <p>4. Database developed and operated</p>	NSTDA do not have sufficient capacity for technology transfer	Ethanol information clearing house and Centre for excellence established at NSTDA	<p>1. Physical verification.</p> <p>2. Published manual on technology package</p> <p>3. Published technology training modules</p> <p>4. Physical operation of the database</p>	Continuous support of the Thai Government & NSTDA
Output 1.1	Information hub established for disseminating and supporting the south-south technology transfer.	<p>1. Information hub established.</p> <p>2. South-South technology transfer</p>	No organisation exists for technology dissemination and transfer.	NSTDA, Thailand developed as Ethanol information clearing house.	<p>1. Physical verification.</p> <p>2. Government reports.</p> <p>3. End of project M&amp;E report.</p>	Continuous support of the Thai Government & NSTDA.

Project Strategy		Objectively verifiable indicators				
		Indicator(quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
		model developed.			4. Activities of the clearing house.	
Output 1.2	Ethanol technology package finalised for dissemination	VHG-SSF ethanol production technology developed as package.	New technology package not available.	NSTDA's new ethanol production technology is developed for dissemination.	Published manual on technology package	Continuous support of the Thai Government & NSTDA.
Output 1.3	Manuals, tool kits and structured training programs developed for technology transfer.	<ol style="list-style-type: none"> <li>1. Technology training module developed.</li> <li>2. Training programmes developed.</li> <li>3. Follow-up tools and procedures developed for monitoring.</li> </ol>	Manuals, toolkits, training programmes not available for technology transfer	To develop manuals, toolkits and training programs for technology transfer.	<ol style="list-style-type: none"> <li>1. Published technology training modules.</li> <li>2. Training program approved by the Project Steering Committee.</li> <li>3. Monitoring tools and procedures.</li> </ol>	Continuous support of the Thai Government & NSTDA.
Output 1.4	Database on ethanol technology developed and maintained by ethanol information hub	Data base developed, tested, launched and operated.	No database available for the new ethanol technology.	To develop, operate and maintain ethanol database.	Physical operation of the database.	Continuous support of the Thai Government & NSTDA.
Outcome 2	Conducive environment to promote bio-ethanol technology and strengthened policies to promote ethanol for replacing conventional fuels.	<ol style="list-style-type: none"> <li>1. Improved pricing and policy environment.</li> <li>2. No. of persons involved with new bio-ethanol technology (farmers, entrepreneurs, technicians, researchers) trained.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inadequate policies and pricing strategies for bio-ethanol production.</li> <li>2. Lack of interest among key stakeholders for the new bio-ethanol technology</li> </ol>	<ol style="list-style-type: none"> <li>1. To improve the pricing and policy environment.</li> <li>2. To train at least 250 persons for the promotion of new bio-ethanol production (in all sectors including farmers,</li> </ol>	<ol style="list-style-type: none"> <li>1. Policy and pricing reports.</li> <li>2. No. of persons trained/ attended workshops.</li> <li>3. Training / workshop reports.</li> <li>4. Study tour reports.</li> </ol>	Continuous support of different governments, NSTDA & FIRI.

Project Strategy		Objectively verifiable indicators				
		Indicator(quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
			3. Lack of technical expertise for bio-ethanol production.	entrepreneurs, researchers, etc.)	5. Published training materials.	
Output 2.1	Regional awareness created for the new technology package.	<ol style="list-style-type: none"> <li>No. of regional workshops conducted in Thailand.</li> <li>No. of national workshops conducted in Thailand and Vietnam.</li> <li>No of study tours organized for person (no).</li> </ol>	Very little awareness about new bio-ethanol production technology.	To create sufficient awareness in the new technology.	<ol style="list-style-type: none"> <li>Regional workshop report.</li> <li>National workshop reports.</li> <li>Study tour reports.</li> </ol>	Continuous support of government of Thai, LMV countries, respective government officials and from private investors.
Output 2.2	Trainings conducted in Thailand for farmers, entrepreneurs and technicians.	<ol style="list-style-type: none"> <li>Training materials prepared</li> <li>No. of farmers, entrepreneurs and technicians trained.</li> </ol>	<ol style="list-style-type: none"> <li>Entrepreneurs and technicians not aware of the new bio-ethanol production technology.</li> <li>Low productivity yield in Cassava in LMV countries.  Farmers are not aware of the improved cassava cultivation practices.</li> </ol>	To train at least 150 farmers, 30 entrepreneurs and 30 technicians for the promotion of new ethanol production technology.	<ol style="list-style-type: none"> <li>Published training modules.</li> <li>Training reports.</li> <li>Number of persons trained.</li> <li>End of project survey.</li> </ol>	Continuous support of government of Thai, LMV countries, local farmers, entrepreneurs and technicians.
Output 2.3	Trainings conducted in Thailand for engineers,	1. Training materials	Engineers, scientists, and researchers are less	To train at least 40 engineers, scientists,	1. Published training	Continuous support of government of Thai,

Project Strategy		Objectively verifiable indicators				
		Indicator(quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
	scientists and researchers.	<p>prepared.</p> <p>2. No. of engineers, scientists and researchers trained.</p>	aware in new bio-ethanol production technology.	and researchers for the promotion of new bio-ethanol production technology.	<p>modules.</p> <p>2. Training reports.</p> <p>3. Number of persons trained.</p> <p>4. End of project survey.</p>	and Vietnam, local engineers, scientists, and researchers.
Output 2.4	Pricing practices and policy environment improved.	<p>1. Assessment report on policy needs.</p> <p>2. No. of experts trained in pricing and policy requirements for bio-ethanol.</p> <p>3. Policy intervention tools created.</p>	Insufficient policies and pricing strategy for the improvement of bio-ethanol.	Adequate policy environment and pricing practices are in place.	<p>1. Assessment reports on policy needs.</p> <p>2. No. of experts trained.</p> <p>3. Training reports.</p> <p>4. Policy forum reports.</p> <p>5. Reports with policy and pricing strategy.</p>	Continuous support of NSTDA, MOIT, Vietnam and other respective government counterparts.
Outcome 3	Strengthened technological and technical cross-border cooperation and improved investment climate in Thailand and LMV.	<p>1. Private made aware of opportunities of the technology.</p> <p>2. Technical centre established as a result of cross-border cooperation.</p> <p>3. No. of replication projects developed.</p> <p>4. Capacity of demonstration and commercial projects established as a result</p>	<p>1. No demonstration plants exist for the new ethanol production technology.</p> <p>2. Private sector and financial institutions sceptical about the new technology.</p>	<p>1. To establish technical centre at FIRI, Vietnam.</p> <p>2. To implement demonstration projects of capacity 50 l/d in Vietnam.</p> <p>3. To implement commercial plant of capacity 400,000 l/d in Myanmar.</p> <p>4. To replicate at least 5 projects in Thai</p>	<p>1. Physical verification.</p> <p>2. Government reports.</p> <p>3. Project development activities for replication projects.</p>	Continuous support of different governments, NSTDA, LDO & FIRI.

Project Strategy		Objectively verifiable indicators				
		Indicator(quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
		of cross-border cooperation.		and LMV countries		
Output 3.1	A demonstration plant established in Thailand with ethanol production capacity of 200 l/day.	Capacity of demonstration plant and operation of the plant.	No demonstration plants exist for the new ethanol production technology.	To implement a 200 l/d demonstration project and operate it in Thailand.	1. Physical verification. 2. Government reports.	Continuous support of Thai Government, LDO & NSTDA.
Output 3.2	Training centre established at FIRI, Vietnam, to disseminate and provide trainings on the new technology package.	1. Training centre established at FIRI, Vietnam. 2. Operation of the training centre. 3. Toolkits and manuals (NSTDA) adjusted for local conditions.	No technical centre available for the development of bio-ethanol technology in Vietnam.	Establishment and sustainable operation of the centre.	1. Physical verification of the centre. 2. No. of persons trained. 3. Training report. 4. Model to ensure sustainability of the centre.	Continuous support of NSTDA, Vietnamese Government and FIRI.
Output 3.3	A demonstration plant established in Vietnam with ethanol production capacity of 50 l/d capacity.	Capacity of the demonstration plant and operation of the plant	No demonstration plants exist for the new ethanol production technology.	To implement a 50 l/d demonstration project and operate it in Vietnam	1. Physical verification. 2. Government reports.	Continuous support of NSTDA, Vietnamese Government and FIRI.
Output 3.4	Financing opportunities improved to finance the new technology.	Percentage increase in financing for new ethanol technology by the financing institutions.	Financial institutions reluctant to finance for the new bio-ethanol production technology.	Financial institutions ready to finance the new bio-ethanol production technology.	1. % increase on financing. 2. End of project survey. 3. Final evaluation.	Continuous support of financial institutions.

Project Strategy		Objectively verifiable indicators				
		Indicator(quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
Output 3.5	Private sector assisted in project development for replicating the projects.	<ol style="list-style-type: none"> <li>No. of interested entities identified.</li> <li>At least 5 replication projects developed in Thai and LMV countries.</li> </ol>	<ol style="list-style-type: none"> <li>Private entities less interested.</li> <li>Lack of knowledge in project development.</li> </ol>	<ol style="list-style-type: none"> <li>To identify interested private project developers.</li> <li>At least 5 replication projects developed.</li> </ol>	<ol style="list-style-type: none"> <li>Bankable project proposal readied for financing.</li> <li>Project reports.</li> </ol>	Continuous support of Government of Thai and LMV countries, financial institutions and private investors.
Output 3.6	Bio-ethanol production technology commercialized with the establishment of 400,000 l/d plant in Myanmar.	Capacity of the commercial plant with and its operation in Myanmar.	No commercial plants exist for the new ethanol production technology.	To implement and operate the project in Myanmar.	Physical verification of the project.	Continuous support of NSTDA, private sector and Myanmar government.
Output 3.7	Demonstration projects evaluated, lessons learnt and information widely distributed.	<ol style="list-style-type: none"> <li>Plant performance study reports.</li> <li>Full scale demonstration site visits and seminars.</li> <li>Dissemination leaflets.</li> <li>Website.</li> </ol>	No demonstration projects are in place to study the performance and to learn the lessons from the demonstration plants.	<ol style="list-style-type: none"> <li>Performance assessment report.</li> <li>Full scale demonstration site visits and seminar.</li> <li>Website.</li> <li>Project leaflet.</li> </ol>	<ol style="list-style-type: none"> <li>Performance monitoring report.</li> <li>Site visit/seminar.</li> <li>Programme evaluation form.</li> <li>Seminar material, leaflet, website.</li> </ol>	Sustained investor support to visit the project while in operation and data collection.

## Annex 2: Detailed questions to assess evaluation criteria

The evaluation team will assess the project performance guided by the questions below.

No.	Evaluation criteria
<b>A</b>	<b>Progress to impact</b>
1	<ul style="list-style-type: none"> <li>✓ <u>Likelihood</u> to contribute to the expected impact</li> <li>✓ Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended, including redirecting trajectories of transformational process and the extent to which conditions for trajectory change are being put into place.</li> <li>✓ <u>Replication</u>: To what extent the project's specific results (e.g. methodology, technology, lessons, etc.) are reproduced or adopted</li> <li>✓ <u>Mainstreaming</u>: To what extent information, lessons or specific results of the project are incorporated into broader stakeholder mandates and initiatives such as laws, policies, regulations and project?</li> <li>✓ <u>Scaling-up</u>: To what extent the project's initiatives and results are implemented at larger geographical scale?</li> <li>✓ What difference has the project made to the beneficiaries?</li> <li>✓ What is the change attributable to the project? To what extent?</li> <li>✓ What are the social, economic, environmental and other effects, either short-, medium- or long-term, on a micro- or macro-level?</li> <li>✓ What effects are intended or unintended, positive or negative?</li> </ul> <p>[The three UNIDO impact dimensions are:</p> <ul style="list-style-type: none"> <li>✓ <u>Safeguarding environment</u>: To what extent the project contributes to changes in the status of environment.</li> <li>✓ <u>Economic performance</u>: To what extent the project contributes to changes in the economic performance (e.g. finances, income, costs saving, expenditure) of individuals, groups and entities?</li> <li>✓ <u>Social inclusiveness</u>: To what extent the project contributes to changes in capacity and capability of individuals, groups and entities in society, such as employment, education, and training?] </li></ul>
<b>B</b>	<b>Project design</b>
1	<ul style="list-style-type: none"> <li>• <u>Overall design</u><sup>46</sup></li> <li>✓ The project design was adequate to address the problems at hand?</li> <li>✓ Is the project consistent with the Country's priorities, in the work plan of the lead national counterpart? Does it meet the needs of the target group? Is it consistent with UNIDO's Inclusive and Sustainable Industrial Development? Does it adequately reflect lessons learnt from past projects? Is it in line with the donor's priorities and policies?</li> <li>✓ Is the applied project approach sound and appropriate? Is the design technically feasible and based on best practices? Does UNIDO have in-house technical expertise and experience for this type of intervention?</li> <li>✓ To what extent the project design (in terms of funding, institutional arrangement, implementation arrangements...) as foreseen in the project document still valid and relevant?</li> </ul>

<sup>46</sup> All GEF-4 and GEF-5 projects have incorporated relevant environmental and social considerations into the project design / GEF-6 projects have followed the provisions specified in UNIDO/DGAI.23: UNIDO Environmental and Social Safeguards Policies and Procedures (ESSPP); is it in line with GEF Minimum Fiduciary Standards: Separation of Implementation and Execution Functions in GEF Partner Agencies? (GEF/C.41/06/Rev.01)).

No.	Evaluation criteria
	<ul style="list-style-type: none"> <li>✓ Does the project document include a M&amp;E plan? Does the M&amp;E plan specify what, who and how frequent monitoring, review, evaluations and data collection will take place? Does it allocate budget for each exercise? Is the M&amp;E budget adequately allocated and consistent with the logframe (especially indicators and sources of verification)?</li> <li>✓ Were there any changes in project design and/or expected results after start of implementation.</li> <li>✓ Did the project establish a baseline (initial conditions)? Was the evaluation able to estimate the baseline conditions so that results can be determined?</li> <li>✓ Risk management: Are critical risks related to financial, social-political, institutional, environmental and implementation aspects identified with specific risk ratings? Are their mitigation measures identified? Where possible, are the mitigation measures included in project activities/outputs and monitored under the M&amp;E plan?</li> </ul>
2	<ul style="list-style-type: none"> <li>• <u>Logframe</u></li> <li>✓ Expected results: Is the expected result-chain (impact, outcomes and outputs) clear and logical? Does impact describe a desired long-term benefit to a society or community (not as a mean or process), do outcomes describe change in target group's behaviour/performance or system/institutional performance, do outputs describe deliverables that project will produce to achieve outcomes? Are the expected results realistic, measurable and not a reformulation or summary of lower level results? Do outputs plus assumptions lead to outcomes, do outcomes plus assumptions lead to impact? Can all outputs be delivered by the project, are outcomes outside UNIDO's control but within its influence?</li> <li>✓ Indicators: Do indicators describe and specify expected results (impact, outcomes and outputs) in terms of quantity, quality and time? Do indicators change at each level of results and independent from indicators at higher and lower levels? Do indicators not restate expected results and not cause them? Are indicators necessary and sufficient and do they provide enough triangulation (cross-checking)? Are they indicators sex-disaggregated, if applicable?</li> <li>✓ Sources of verification: Are the sources of verification/data able to verify status of indicators, are they cost-effective and reliable? Are the sources of verification/data able to verify status of output and outcome indicators before project completion?</li> </ul>
<b>C</b>	<b>Project performance</b>
1	<ul style="list-style-type: none"> <li>• <u>Relevance</u></li> <li>✓ How does the project fulfil the urgent target group needs?</li> <li>✓ To what extent is the project aligned with the development priorities of the country (national poverty reduction strategy, sector development strategy)?</li> <li>✓ How does project reflect donor policies and priorities?</li> <li>✓ Is the project a technically adequate solution to the development problem? Does it eliminate the cause of the problem?</li> <li>✓ To what extent does the project correspond to UNIDO's comparative advantages?</li> <li>✓ Are the original project objectives (expected results) still valid and pertinent to the target groups? If not, have they been revised? Are the revised objectives still valid in today's context?</li> </ul>
2	<ul style="list-style-type: none"> <li>• <u>Effectiveness</u></li> <li>✓ What are the main results (mainly outputs and outcomes) of the project? What have been the quantifiable results of the project?</li> <li>✓ To what extent did the project achieve their objectives (outputs and outcomes), against the original/revised target(s)?</li> <li>✓ What are the reasons for the achievement/non-achievement of the project objectives?</li> <li>✓ What is the quality of the results? How do the stakeholders perceive them? What is the feedback of the beneficiaries and the stakeholders on the project effectiveness?</li> <li>✓ To what extent is the identified progress result of the project rather than external factors?</li> <li>✓ What can be done to make the project more effective?</li> <li>✓ Were the right target groups reached?</li> </ul>

No.	Evaluation criteria
3	<ul style="list-style-type: none"> <li>• <u>Efficiency</u></li> <li>✓ How economically are the project resources/inputs (concerning funding, expertise, time...) being used to produce results?</li> <li>✓ To what extent were expected results achieved within the original budget? If no, please explain why.</li> <li>✓ Are the results being achieved at an acceptable cost? Would alternative approaches accomplish the same results at less cost?</li> <li>✓ What measures have been taken during planning and implementation to ensure that resources are efficiently used? Were the project expenditures in line with budgets?</li> <li>✓ To what extent did the expected co-financing materialize, in cash or in-kind, grants or loan? Was co-financing administered by the project management or by some other organization? Did short fall in co-financing or materialization of greater than expected co-financing affected project results?</li> <li>✓ Could more have been achieved with the same input?</li> <li>✓ Could the same have been achieved with less input?</li> <li>✓ How timely was the project in producing outputs and outcomes? Comment on the delay or acceleration of the project's implementation period.</li> <li>✓ To what extent were the project's activities in line with the schedule of activities as defined by the Project Team and annual Work Plans?</li> <li>✓ Have the inputs from the donor, UNIDO and Government/counterpart been provided as planned, and were they adequate to meet the requirements?</li> </ul>
4	<ul style="list-style-type: none"> <li>• <u>Sustainability of benefits</u></li> <li>✓ Will the project results and benefits be sustained after the end of donor funding?</li> <li>✓ Does the project have an exit strategy?</li> <li><i>Financial risks:</i></li> <li>✓ What is the likelihood of financial and economic resources not being available once the project ends?</li> <li><i>Socio-political risks:</i></li> <li>✓ Are there any social or political risks that may jeopardize the sustainability of project outcomes?</li> <li>✓ What is the risk that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be sustained?</li> <li>✓ Do the various key stakeholders see that it is in their interest that project benefits continue to flow?</li> <li>✓ Is there sufficient public/stakeholder awareness in support of the project's long-term objectives?</li> <li><i>Institutional framework and governance risks:</i></li> <li>✓ Do the legal frameworks, policies, and governance structures and processes within which the project operates pose risks that may jeopardize the sustainability of project benefits?</li> <li>✓ Are requisite systems for accountability and transparency and required technical know-how in place?</li> <li><i>Environmental risks:</i></li> <li>✓ Are there any environmental risks that may jeopardize the sustainability of project outcomes?</li> <li>✓ Are there any project outputs or higher level results that are likely to have adverse environmental impacts, which, in turn, might affect the sustainability of project benefits?</li> </ul>
5	<ul style="list-style-type: none"> <li>• <u>Monitoring of long-term changes</u></li> </ul> <p>The M&amp;E of long-term changes is often incorporated in GEF-supported projects as a separate component and may include determination of environmental baselines; specification of indicators; and provisioning of equipment and capacity building for data gathering, analysis, and use. This section of the evaluation report will describe project actions and accomplishments towards establishing a long-term monitoring system. The evaluation will address the following questions:</p>

No.	Evaluation criteria
	<ul style="list-style-type: none"> <li>✓ Did the project contribute to the establishment of a long-term monitoring system? If it did not, should the project have included such a component?</li> <li>✓ What were the accomplishments and shortcomings in establishment of this system?</li> <li>✓ Is the system sustainable — that is, is it embedded in a proper institutional structure and does it have financing? How likely is it that this system continues operating upon project completion?</li> <li>✓ Is the information generated by this system being used as originally intended?</li> </ul>
<b>D</b>	<b>Cross-cutting performance criteria</b>
1	<ul style="list-style-type: none"> <li>• <u>Gender mainstreaming</u></li> <li>✓ Did the project design adequately consider the gender dimensions in its interventions? Was the gender marker assigned correctly at entry?</li> <li>✓ Was a gender analysis included in a baseline study or needs assessment (if any)? Were there gender-related project indicators?</li> <li>✓ Are women/gender-focused groups, associations or gender units in partner organizations consulted/ included in the project?</li> <li>✓ How gender-balanced was the composition of the project management team, the Steering Committee, experts and consultants and the beneficiaries?</li> <li>✓ Do the results affect women and men differently? If so, why and how? How are the results likely to affect gender relations (e.g., division of labour, decision-making authority)?</li> <li>✓ To what extent were socioeconomic benefits delivered by the project at the national and local levels, including consideration of gender dimensions?</li> </ul>
2	✓ Environment and socio-economic aspects <sup>47</sup>
3	<ul style="list-style-type: none"> <li>• <u>M&amp;E: (focus on Monitoring)</u></li> <li>✓ <b>M&amp;E design</b> <ul style="list-style-type: none"> <li>○ Was the Monitoring plan at the point of project approval practical and sufficient?</li> <li>○ Did it include baseline data and specify clear targets and appropriate indicators to track environmental, gender, and socio economic results?</li> <li>○ Did it include a proper M&amp;E methodological approach; specify practical organization and logistics of the M&amp;E activities including schedule and responsibilities for data collection;</li> <li>○ Did it include budget adequate funds for M&amp;E activities?</li> </ul> </li> <li>✓ <b>M&amp;E implementation</b> <ul style="list-style-type: none"> <li>○ How was the information from M&amp;E system used during the project implementation? Was an M&amp;E system in place and did it facilitate timely tracking of progress toward project results by collecting information on selected indicators continually throughout the project implementation period? Did project team and manager make decisions and corrective actions based on analysis from M&amp;E system and based on results achieved?</li> <li>○ Are annual/progress project reports complete and accurate?</li> <li>○ Was the information provided by the M&amp;E system used to improve performance and adapt to changing needs? Was information on project performance and results achievement being presented to the Project Steering Committee to make decisions and corrective actions? Do the Project team and managers and PSC regularly ask for performance and results information?</li> </ul> </li> </ul>

<sup>47</sup> All GEF-4 and GEF-5 projects have incorporated relevant environmental and social considerations into the project design / GEF-6 projects have followed the provisions specified in UNIDO/DGAI.23: UNIDO Environmental and Social Safeguards Policies and Procedures (ESSPP)

No.	Evaluation criteria
	<ul style="list-style-type: none"> <li>○ Are monitoring and self-evaluation carried out effectively, based on indicators for outputs, outcomes and impact in the logframe? Do performance monitoring and reviews take place regularly?</li> <li>○ Were resources for M&amp;E sufficient?</li> <li>○ How has the logframe been used for Monitoring and Evaluation purposes (developing M&amp;E plan, setting M&amp;E system, determining baseline and targets, annual implementation review by the Project Steering Committee...) to monitor progress towards expected outputs and outcomes?</li> <li>○ How well have risks outlined the project document and in the logframe been monitored and managed? How often have risks been reviewed and updated? Has a risk management mechanism been put in place?</li> </ul>
4	<ul style="list-style-type: none"> <li>● <u>Project management</u></li> <li>✓ Review overall effectiveness of project management as outlined in the Project Document. Have changes been made and are they effective? Are responsibilities and reporting lines clear? Is decision-making transparent and undertaken in a timely manner? Recommend areas for improvement.</li> <li>✓ Review whether the national management and overall coordination mechanisms have been efficient and effective? Did each partner have assigned roles and responsibilities from the beginning? Did each partner fulfil its role and responsibilities (e.g. providing strategic support, monitoring and reviewing performance, allocating funds, providing technical support, following up agreed/corrective actions)?</li> <li>✓ The UNIDO HQ-based management, coordination, monitoring, quality control and technical inputs have been efficient, timely and effective (e.g. problems identified timely and accurately; quality support provided timely and effectively; right staffing levels, continuity, skill mix and frequency of field visits)?</li> <li>✓ The project implemented outreach and public awareness campaigns. Outreach and public awareness materials produced are in line with the relevant UNIDO and donor advocacy guidelines?"</li> </ul>
<b>E</b>	<b>Performance of partners</b>
1	<ul style="list-style-type: none"> <li>● <u>UNIDO</u></li> <li>✓ <b>Design</b> <ul style="list-style-type: none"> <li>○ Mobilization of adequate technical expertise for project design</li> <li>○ Inclusiveness of project design (with national counterparts)</li> <li>○ Previous evaluative evidence shaping project design</li> <li>○ Planning for M&amp;E and ensuring sufficient M&amp;E budget</li> </ul> </li> <li>✓ <b>Implementation</b> <ul style="list-style-type: none"> <li>○ Timely recruitment of project staff</li> <li>○ Appropriate use of funds, procurement and contracting of goods and services</li> <li>○ Project modifications following changes in context or after the Mid-Term Review</li> <li>○ Follow-up to address implementation bottlenecks</li> <li>○ Role of UNIDO country presence (if applicable) supporting the project</li> <li>○ Engagement in policy dialogue to ensure up-scaling of innovations</li> <li>○ Coordination function</li> <li>○ Exit strategy, planned together with the government</li> </ul> </li> </ul>
2	<ul style="list-style-type: none"> <li>● <u>National counterparts</u></li> <li>✓ <b>Design</b> <ul style="list-style-type: none"> <li>○ Responsiveness to UNIDO's invitation for engagement in designing the project</li> </ul> </li> </ul>

No.	Evaluation criteria
	<ul style="list-style-type: none"> <li>✓ <b>Implementation</b></li> <li>○ Ownership of the project</li> <li>○ Support to the project, based on actions and policies</li> <li>○ Counterpart funding</li> <li>○ Internal government coordination</li> <li>○ Exit strategy, planned together with UNIDO, or arrangements for continued funding of certain activities</li> <li>○ Facilitation of the participation of Non-Governmental Organizations(NGOs), civil society and the private sector where appropriate</li> <li>○ Suitable procurement procedures for timely project implementation</li> <li>○ Engagement with UNIDO in policy dialogue to promote the up-scaling or replication of innovations</li> </ul>
3	<ul style="list-style-type: none"> <li>✓ <b>Donor</b></li> <li>✓ Timely disbursement of project funds</li> <li>✓ Feedback to progress reports, including Mid-Term Evaluation</li> <li>✓ Support by the donor's country presence (if applicable) supporting the project for example through engagement in policy dialogue</li> </ul>
F	<p><b>Overall project achievement</b></p> <ul style="list-style-type: none"> <li>✓ Overarching assessment of the project, drawing upon the analysis made under Project performance and Progress to Impact criteria above but not an average of ratings.</li> </ul>

### Annex 3: Job descriptions

#### TERMS OF REFERENCE FOR PERSONNEL UNDER INDIVIDUAL SERVICE AGREEMENT (ISA)

<b>Title:</b>	International evaluation consultant, team leader
<b>Main Duty Station and Location:</b>	Home-based
<b>Missions:</b>	Missions to Vienna, Austria and to Thailand
<b>Start of Contract (EOD):</b>	01/08/2018
<b>End of Contract (COB):</b>	31/10/2018
<b>Number of Working Days:</b>	27-35 working days spread over 3 months

#### ORGANIZATIONAL CONTEXT

The UNIDO Independent Evaluation Division (ODG/EIO/IED) is responsible for the independent evaluation function of UNIDO. It supports learning, continuous improvement and accountability, and provides factual information about result and practices that feed into the programmatic and strategic decision-making processes. Evaluation is an assessment, as systematic and impartial as possible, of a programme, a project or a theme. Independent evaluations provide evidence-based information that is credible, reliable and useful, enabling the timely incorporation of findings, recommendations and lessons learned into the decision-making processes at organization-wide, programme and project level. ODG/EIO/IED is guided by the UNIDO Evaluation Policy, which is aligned to the norms and standards for evaluation in the UN system.

#### PROJECT CONTEXT

Detailed background information of the project can be found the terms of reference (TOR) for the terminal evaluation.

The international evaluation consultant/team leader will evaluate the project in accordance with the evaluation-related terms of reference (TOR). He/she will perform, inter alia, the following main tasks:

MAIN DUTIES	Concrete/ Measurable Outputs to be achieved	Working Days	Location
Undertake a desk review of project documentation (incl. familiarization with the GEF programmes and strategies, and with relevant GEF policies such as those on project cycle, M&E, co-financing, fiduciary standards, gender, and environmental and social safeguards) and relevant country background information (national policies and strategies, UN strategies and general economic data); determine key data to collect in the field and adjust the key data	<ul style="list-style-type: none"> <li>• Division of evaluation tasks with the National Consultant</li> <li>• An adjusted table of evaluation questions, depending on country specific context</li> <li>• A draft list of stakeholders to be interviewed during the evaluation field mission</li> <li>• A brief assessment of the adequacy of the</li> </ul>	5 days	Home-based

MAIN DUTIES	Concrete/ Measurable Outputs to be achieved	Working Days	Location
collection instruments accordingly (if needed); Assess the adequacy of legislative and regulatory framework relevant to the project's activities and analyze other background info.	country's legislative and regulatory framework		
Prepare an inception report which streamlines the specific questions to address the key issues in the TOR, specific methods that will be used and data to collect in the field visits, detailed evaluation methodology confirmed, draft theory of change, and tentative agenda for field work	Inception report submitted to the evaluation manager	3	Home-based
Briefing with the UNIDO Independent Evaluation Division, project managers and other key stakeholders at UNIDO HQ.	<ul style="list-style-type: none"> <li>Detailed evaluation schedule with tentative mission agenda (incl. list of stakeholders to be interviewed and planned site visits) submitted to evaluation and project manager</li> </ul>	2 days	Vienna, Austria
3. Undertake evaluation field mission <sup>48</sup> to consult field project stakeholders, partners and beneficiaries to verify and complete preliminary evaluation findings from desk review and assess the institutional capacities of the recipient country	<ul style="list-style-type: none"> <li>Field mission conducted</li> <li>Evaluation/debriefing presentation of the evaluation's preliminary findings prepared, draft conclusions, recommendations and lessons learnt to stakeholders in the country, at the end of the mission</li> <li>Agreement with the National Consultant on the structure and content of the evaluation report and the distribution of writing tasks</li> </ul>	6-10 days	Thailand
4. Debriefing mission: Present preliminary findings, recommendations and lessons learnt to project stakeholders at UNIDO HQ for factual validation and comments Hold additional meetings with and	<ul style="list-style-type: none"> <li>Power point presentation</li> <li>Feedback from stakeholders obtained and discussed</li> <li>Additional meetings held as required</li> </ul>	2 days	Vienna, Austria

<sup>48</sup> The exact mission dates will be decided in agreement with the Consultant, UNIDO HQ, and the country counterparts.

MAIN DUTIES	Concrete/ Measurable Outputs to be achieved	Working Days	Location
obtain additional data from evaluation/project manager and other stakeholders as required			
5. Prepare the draft evaluation report, with inputs from the National Consultant, and in accordance with the evaluation TOR Submit draft evaluation report to the evaluation manager for feedback and comments	• Draft evaluation report submitted to evaluation manager for review and comments	6/8 days	Home-based
6. Revise the draft evaluation report based on comments and suggestions received through the evaluation manager and edit the language and finalize the evaluation report according to UNIDO Independent Evaluation Division standards  Prepare a two pages summary of a take-away message from the evaluation	Final evaluation report submitted to evaluation manager  Two pages summary take-away message from the evaluation submitted to the evaluation manager	3/5 days	Home-based
	TOTAL	27/35 days	

## MINIMUM ORGANIZATIONAL REQUIREMENTS

**Education:** Advanced degree in environment, energy, engineering, development studies or related areas

### Technical and functional experience:

- Minimum of 10 years' experience in environmental project management and/or evaluation (of development projects), including social safeguards and gender
- Knowledge about GEF operational programs and strategies and about relevant GEF policies such as those on project life cycle, M&E, incremental costs, and fiduciary standards
- Experience in the evaluation of GEF projects and knowledge of UNIDO activities an asset
- Knowledge about multilateral technical cooperation and the UN, international development priorities and frameworks
- Working experience in developing countries

**Languages:** Fluency in written and spoken English is required.

### Reporting and deliverables

- 1) At the beginning of the assignment the Consultant will submit a concise Inception Report that will outline the general methodology and presents a concept Table of Contents

- 2) The country assignment will have the following deliverables:
- Presentation of initial findings of the mission to key national stakeholders
  - Draft report
  - Final report, comprising of executive summary, findings regarding design, implementation and results, conclusions and recommendations
- 3) Debriefing at UNIDO HQ:
- Presentation and discussion of findings
  - Concise summary and comparative analysis of the main results of the evaluation report

All reports and related documents must be in English and presented in electronic format.

**Absence of conflict of interest:**

According to UNIDO rules, the consultant must not have been involved in the design and/or implementation, supervision and coordination of and/or have benefited from the programme/project (or theme) under evaluation. The consultant will be requested to sign a declaration that none of the above situations exists and that the consultants will not seek assignments with the manager/s in charge of the project before the completion of her/his contract with the UNIDO Independent Evaluation Division.

TERMS OF REFERENCE FOR PERSONNEL UNDER INDIVIDUAL SERVICE  
AGREEMENT (ISA)

<b>Title:</b>	National evaluation consultant
<b>Main Duty Station and Location:</b>	Home-based
<b>Mission/s to:</b>	Travel to potential sites within Thailand
<b>Start of Contract:</b>	01/08/2018
<b>End of Contract:</b>	31/10/2018
<b>Number of Working Days:</b>	25-30 days spread over 3 months

ORGANIZATIONAL CONTEXT

The UNIDO Independent Evaluation Division (ODG/EIO/IED) is responsible for the independent evaluation function of UNIDO. It supports learning, continuous improvement and accountability, and provides factual information about result and practices that feed into the programmatic and strategic decision-making processes. Evaluation is an assessment, as systematic and impartial as possible, of a programme, a project or a theme. Independent evaluations provide evidence-based information that is credible, reliable and useful, enabling the timely incorporation of findings, recommendations and lessons learned into the decision-making processes at organization-wide, programme and project level. The UNIDO Independent Evaluation Division is guided by the UNIDO Evaluation Policy, which is aligned to the norms and standards for evaluation in the UN system.

PROJECT CONTEXT

Detailed background information of the project can be found the terms of reference (TOR) for the terminal evaluation.

As evaluation team member, the national evaluation consultant will evaluate the project according to the TOR under the leadership of the team leader (international evaluation consultant). S/he will perform, inter alia, the following main tasks:

<u>MAIN DUTIES</u>	<b>Concrete/measurable outputs to be achieved</b>	<b>Expected duration</b>	<b>Location</b>
<b>Desk review</b> Review and analyze project documentation (incl. familiarization with the GEF programmes and strategies, and with relevant GEF policies such as those on project cycle, M&E, co-financing, fiduciary standards, gender, and environmental and social safeguards) and relevant country background information; in cooperation with the team leader, determine key data to collect in the field and prepare key instruments in Thai (questionnaires, logic models) as required;	<ul style="list-style-type: none"> <li>- A list of evaluation questions; questionnaires /interview guide; logic models adjusted to ensure understanding in the national context</li> <li>- A list of key data available; and to be collected</li> <li>- A brief assessment of the adequacy of the country's legislative and</li> </ul>	7 days	Home-based

<b><u>MAIN DUTIES</u></b>	<b>Concrete/measurable outputs to be achieved</b>	<b>Expected duration</b>	<b>Location</b>
<p>If need be, recommend adjustments to the tools in order to ensure their understanding in the local context;            Coordinate and lead interviews in local language and assist the team leader with translation where necessary;            Analyze and assess the adequacy of legislative and regulatory framework, specifically in the context of the project's objectives and targets.</p>	<p>regulatory framework in the context of the project            - Input to inception report</p>		
<p><b>Coordination of evaluation field mission</b> agenda, ensuring and setting up the required meetings with project partners and government counterparts, and organize and lead site visits, in close cooperation with project staff in the field;            Assist and provide detailed analysis and inputs to the team leader in the preparation of the inception report.</p>	<p>- Detailed evaluation schedule            - List of stakeholders to be interviewed during the field mission</p>	6 days	Home-based (telephone interviews)
<p><b>Participation in interviews during evaluation field missions</b></p>	<p>- Interview notes            - Input to presentations of the evaluation's initial findings, draft conclusions and recommendations to stakeholders in the country at the end of the mission</p>	6-10 days	Home based, including in-country project sites in Thailand
<p><b>Draft evaluation report</b>            Prepare inputs and analysis to the evaluation report according to TOR and as agreed with the team leader.</p>	<p>Inputs to the draft evaluation report submitted to evaluation team leader</p>	4 days	Home-based
<p><b>Final evaluation report and summary take-away message</b>            Contribute to the finalization of the evaluation report on basis of comments and suggestions received through the evaluation team leader             Contribute to the preparation of a two pages summary of a take-away message from the evaluation</p>	<p>Inputs to the Final evaluation report submitted to evaluation team leader</p>	2-3 days	Home-based
<b>TOTAL</b>		25-30 days	

**REQUIRED COMPETENCIES**

***Core values:***

1. Integrity
2. Professionalism
3. Respect for diversity

***Core competencies:***

1. Results orientation and accountability
2. Planning and organizing
3. Communication and trust
4. Team orientation
5. Client orientation
6. Organizational development and innovation

***Managerial competencies (as applicable):***

1. Strategy and direction
2. Managing people and performance
3. Judgement and decision making
4. Conflict resolution

**MINIMUM ORGANIZATIONAL REQUIREMENTS**

**Education:** Advanced university degree in environmental science, engineering or other relevant discipline like developmental studies with a specialization in industrial energy efficiency and/or climate change.

**Technical and functional experience:**

- Exposure to the needs, conditions and problems in developing countries.
- Familiarity with the institutional context of the project is desirable.
- Experience in the field of environment and energy, including evaluation of development cooperation in developing countries and social safeguards and gender is an asset

**Languages:** Fluency in written and spoken English and Thai is required.

**Absence of conflict of interest:**

According to UNIDO rules, the consultant must not have been involved in the design and/or implementation, supervision and coordination of and/or have benefited from the programme/project (or theme) under evaluation. The consultant will be requested to sign a declaration that none of the above situations exists and that the consultants will not seek assignments with the manager/s in charge of the project before the completion of her/his contract with the UNIDO Independent Evaluation Division.

## **Annex 4: Outline of an in-depth project evaluation report**

**Acknowledgement (incl. list of evaluation team members)**

**Abbreviations and acronyms**

**Glossary of evaluation-related terms**

### **Executive summary**

- Must provide a synopsis of the storyline which includes the main evaluation findings and recommendations
- Must present strengths and weaknesses of the project
- Must be self-explanatory and should be maximum 3-4 pages in length

### **I. Evaluation objectives, methodology and process**

- Information on the evaluation: why, when, by whom, etc.
- Scope and objectives of the evaluation, main questions to be addressed
- Information sources and availability of information
- Methodological remarks, limitations encountered and validity of the findings

### **II. Country and project background**

- Brief country context: an overview of the economy, the environment, institutional development, demographic and other data of relevance to the project
- Sector-specific issues of concern to the project<sup>49</sup> and important developments during the project implementation period
- Project summary:
  - Fact sheet of the project: including project objectives and structure, donors and counterparts, project timing and duration, project costs and co-financing
  - Brief description including history and previous cooperation
  - Project implementation arrangements and implementation modalities, institutions involved, major changes to project implementation
  - Positioning of the UNIDO project (other initiatives of government, other donors, private sector, etc.)
  - Counterpart organization(s)

### **III. Project assessment**

This is the key chapter of the report and should address all evaluation criteria and questions outlined in the TOR (see section VI Project Evaluation Parameters). Assessment must be based on factual evidence collected and analyzed from different sources. The evaluators' assessment can be broken into the following sections:

A. Project design

B. Implementation performance

- Ownership and relevance (Report on the relevance of project towards countries and beneficiaries, country ownership, stakeholder involvement)
- Effectiveness (The extent to which the development intervention's objectives, outcomes and deliverables were achieved, or are expected to be achieved, taking into account their relative importance)
- Efficiency (Report on the overall cost-benefit of the project and partner countries' contribution to the achievement of project objectives)

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<sup>49</sup> Explicit and implicit assumptions in the logical framework of the project can provide insights into key-issues of concern (e.g. relevant legislation, enforcement capacities, government initiatives, etc.)

- Likelihood of sustainability of project outcomes (Report on the risks and vulnerability of the project, considering the likely effects of sociopolitical and institutional changes in partner countries, and its impact on continuation of benefits after the project ends, specifically the financial, sociopolitical, institutional framework and governance, and environmental risks)
  - Project coordination and management (Report project management conditions and achievements, and partner countries commitment)
  - Assessment of monitoring and evaluation systems (Report on M&E design, M&E plan implementation, and budgeting and funding for M&E activities)
  - Monitoring of long-term changes
  - Assessment of processes affecting achievement of project results (Report on preparation and readiness / quality at entry, financial planning, UNIDO support, co-financing, delays of project outcomes/outputs, and implementation approach)
- C. Gender mainstreaming
- At the end of this chapter, an overall project achievement rating should be developed as required in annex 8. The overall rating table should be presented here.

#### **IV. Conclusions, recommendations and lessons learned**

This chapter can be divided into three sections:

##### **A. Conclusions**

This section should include a storyline of the main evaluation conclusions related to the project's achievements and shortfalls. It is important to avoid providing a summary based on each and every evaluation criterion. The main conclusions should be cross-referenced to relevant sections of the evaluation report.

##### **B. Recommendations**

This section should be succinct and contain few key recommendations. They should:

- be based on evaluation findings
- be realistic and feasible within a project context
- indicate institution(s) responsible for implementation (addressed to a specific officer, group or entity who can act on it) and have a proposed timeline for implementation if possible
- be commensurate with the available capacities of project team and partners
- take resource requirements into account.

Recommendations should be structured by addressees:

- UNIDO
- Government and/or Counterpart Organizations
- Donor

##### **C. Lessons learned**

- Lessons learned must be of wider applicability beyond the evaluated project but must be based on findings and conclusions of the evaluation
- For each lesson, the context from which they are derived should be briefly stated

For further guidance on the formulation and expected quality of lessons learned, please consult the guidance document on lessons learned prepared by the UNIDO Independent Evaluation Division (annex 6). The document also includes a checklist on the quality of lessons learned.

**Annexes** should include the evaluation TOR, list of interviewees, documents reviewed, a summary of project identification and financial data, including an updated table of expenditures to date, and other detailed quantitative information. Dissident views or management responses to the evaluation findings may later be appended in an annex.

## Annex 5: Checklist on evaluation report quality

Project title:

UNIDO Project ID:

GEF ID:

### Evaluation team

Evaluation team leader:

National evaluation consultant:

Evaluation manager (IED):

Quality review done by:

Date:

Report quality criteria	UNIDO Independent Evaluation Division assessment notes	Rating
A. Was the report well-structured and properly written? (Clear language, correct grammar, clear and logical structure)		
B. Was the evaluation objective clearly stated and the methodology appropriately defined?		
C. Did the report present an assessment of relevant outcomes and achievement of project objectives?		
D. Was the report consistent with the ToR and was the evidence complete and convincing?		
E. Did the report present a sound assessment of sustainability of outcomes or did it explain why this is not (yet) possible? (Including assessment of assumptions, risks and impact drivers)		
F. Did the evidence presented support the lessons and recommendations? Are these directly based on findings?		
G. Did the report include the actual project costs (total, per activity, per source)?		
H. Did the report include an assessment of the quality of both the M&E plan at entry and the system used during the implementation? Was the M&E sufficiently budgeted for during preparation and properly funded during implementation?		
I. Quality of the lessons: were lessons readily applicable in other contexts? Did they suggest prescriptive action?		
J. Quality of the recommendations: did recommendations specify the actions necessary to correct existing conditions or improve operations ('who?' 'what?' 'where?' 'when?'). Can these be immediately implemented with current resources?		
K. Are the main cross-cutting issues, such as gender, human rights and environment, appropriately covered?		
L. Was the report delivered in a timely manner? (Observance of deadlines)		

### Rating system for quality of evaluation reports

A rating scale of 1-6 is used for each criterion: Highly satisfactory = 6, Satisfactory = 5, Moderately satisfactory = 4, Moderately unsatisfactory = 3, Unsatisfactory = 2, Highly unsatisfactory = 1, and unable to assess = 0.

## Annex 6. Guidance and checklist on lessons learned quality criteria

### UNIDO evaluation lessons learned

#### Definition

The Organization for Economic Cooperation and Development's (OECD) Development Assistance Committee (DAC) (2002) defines lessons learned related to the evaluation of development assistance as follows: *“Generalizations based on evaluation experiences with projects, programs, or policies that abstract from the specific circumstances to broader situations. Frequently, lessons highlight strengths or weaknesses in preparation, design, and implementation that affect performance, outcome, and impact.”*<sup>50</sup>

Focus  
on  
generalization

The International Labour Organization (ILO) provides one of the most comprehensive definitions of lessons learned with relevance for evaluations in the UN system (2014) **“A lesson learned is an observation from project or programme experience which can be translated into relevant, beneficial knowledge by establishing clear causal factors and effects. It focuses on a specific design, activity, process or decision and may provide either positive or negative insights on operational effectiveness and efficiency, impact on the achievement of outcomes, or influence on sustainability. The lesson should indicate, where possible, how it contributes to 1) reducing or eliminating deficiencies; or 2) building successful and sustainable practice and performance”**<sup>51</sup>.

Focus  
on  
transferability  
&  
generalization

UNIDO evaluation lessons learned contain information about the context, challenges, causal factors, target users and success/failure, as also shown in below **Lessons learned quality criteria checklist**.

#### What is not a lesson learned?

<p><b>Lessons learned are not:</b></p>	<ul style="list-style-type: none"> <li>• Simply restating or paraphrasing existing doctrine, policy, process, etc. This does not qualify as an appropriate and bona fide lessons learned<sup>52</sup>.</li> <li>• Just applicable to a specific situation but applicable to a generic situation<sup>53</sup></li> <li>• The same as recommendations. Recommendations usually refer to very specific situations including who should take action on what by when</li> </ul>
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<sup>50</sup> <http://www.oecd.org/dataoecd/29/21/2754804.pdf>

<sup>51</sup> ILO Evaluation Unit, 2014: Guidance Note 3: Evaluation lessons learned and emerging good practices

<sup>52</sup> [www.dtic.mil/ndia/2004cmmi/CMMIT2Tue/LessonsLearnedtc3.pdf](http://www.dtic.mil/ndia/2004cmmi/CMMIT2Tue/LessonsLearnedtc3.pdf)

<sup>53</sup> [www.globalhivmeinfo.org/DigitalLibrary/Digital%20Library/Glossary%20of%20Monitoring%20and%20Evaluation%20Terms.doc](http://www.globalhivmeinfo.org/DigitalLibrary/Digital%20Library/Glossary%20of%20Monitoring%20and%20Evaluation%20Terms.doc)

## Examples of lessons learned

Source	Well-identified lessons learned in UNIDO evaluations
UNIDO, 2016: Independent UNIDO country evaluation: Thailand	<ul style="list-style-type: none"> <li>A more effective collaboration between the government of Thailand and UNIDO (<i>context; target users</i>) will be more beneficial in developing a “country programme” that identifies the priority areas in which they should work together and then seek funding from potential sources (<i>success</i>) than the choice of the projects being driven by UNIDO on the basis of the financial support the latter is able to mobilize (<i>causal factor; challenge</i>).</li> </ul>
UNIDO, 2017: Evaluación final independiente del proyecto: Centro de Automatización Industrial y Meca- trónica (Uruguay)	<ul style="list-style-type: none"> <li>It is important that UNIDO projects get adequate technical in-house support (<i>context</i>). When this capacity is limited to persons that at a later stage get detached from the project the risk emerges (<i>challenge</i>) that UNIDO can’t adequately met the expectations raised (<i>causal factor; failure</i>). UNIDO (<i>target user</i>) risks to loose its reputation as a strategic partner in such situations.</li> </ul>
UNIDO, 2016: Independent Terminal Evaluation: Demonstration of BAT/BEP in fossil fuel-fired utilities and industrial boilers in response to the Stockholm Convention on POPs	<ul style="list-style-type: none"> <li>To UNIDO programme managers (<i>target users</i>): The implementation of this regional project involving six countries (<i>context</i>) was very challenging and required more time and better planning to meet deadlines (<i>challenge</i>). One important lesson that emerged is that the design should be kept simple. For the same set of objectives, the design should consider to have smaller number of components meaning less administrative burden and more flexibility (<i>success</i>) resulting in a better and more successful implementation process (<i>causal factor</i>). <i>Lesson learned was amended for this guideline.</i></li> </ul>
UNIDO, 2016: Independent terminal evaluation. Industrial Energy Efficiency in Ecuador	<ul style="list-style-type: none"> <li>To UNIDO country director (<i>target user</i>): Lack of synergies (<i>challenge</i>) between energy efficiency projects and Clean Production activities developed by UNIDO at local level (<i>context</i>) drives to lose opportunities (<i>failure</i>) for a more efficient achievement of shared goals (<i>causal factor</i>). <i>Lesson learned was amended for this guideline.</i></li> </ul>

## Examples of statements that do not qualify as lessons learned

Statements identified in UNIDO evaluation reports in the lessons learned sections that are in fact no lessons learned
<ul style="list-style-type: none"> <li>“Focus on product development innovation methods and tools”. <i>The context, challenge, causal factors, success/failure and target users are omitted. This statement resembles more to a recommendation with suboptimal formulation.</i></li> </ul>
<ul style="list-style-type: none"> <li>“UNIDO, as the International executing Agency, was instrumental in: a) introducing new technologies such as the Vallerani System, the use of Zander in tree planting; b) linking environmental preservation to economic development; c) providing support to the HCEFLCD for upgrading its nursery network”. <i>The context, challenge, causal factors, success/failure and target users are omitted. This statement is a finding.</i></li> </ul>

**Statements identified in UNIDO evaluation reports in the lessons learned sections that are in fact no lessons learned**

- “Include in the peer review process also other agencies, such as UNEP and UNDP, which also support countries in the implementation of Enabling Activities and NIP update projects for the Stockholm Convention”.  
*The context, challenge, causal factors, success/failure and target users are omitted. This statement resembles more to a recommendation with suboptimal formulation.*

## Lessons learned quality criteria checklist

The evaluator should cite and explain the points below.

✓ **Context** – Explain the context from which the lesson has been derived (e.g. economic, social, political). If possible, point to any relevance to the broader UNIDO mandates or broader technical or regional activities.

✓ **Challenges** – Cite any difficulties, problems or obstacles encountered / solutions found - Positive and negative aspects should be described.

✓ **Causal factors** – Present evidence for “how” or “why” something did or did not work?

✓ **Target users affected by the lessons learned should be cited** (e.g. Management, programme managers, donors or beneficiaries)

✓ **Success or failure** – The lessons learned should cite any decisions, tasks, or processes that constitute reduced or eliminated deficiencies or built successful and sustainable practice and performance; or have the potential of success. Avoid repetition of failure

✓ **The lesson learned is not mistaken for a recommendation or conclusion**

(Source: ILO Evaluation Unit, 2014: Guidance Note 3: Evaluation lessons learned and emerging good practices, amended with UNIDO IEV)

For assessing the quality of evaluation lessons learned UNIDO uses a 6-point (with one point for each criterion) rating scheme:

**Ratings 4-6 are satisfactory and meet quality criteria.**

**Ratings 1-3 are unsatisfactory and fail to meet quality criteria.**

The criterion “The lesson learned is not mistaken for a recommendation or conclusion” **is an exclusion criterion**, i.e. when this criterion is met the lesson learned automatically fails the quality check regardless the quality in other criteria.



## **Annex 7. GEF Minimum requirements for M&E<sup>54</sup>**

### **Minimum requirement 1: Project design of M&E**

All projects will include a concrete and fully budgeted M&E plan by the time of work program entry for full-sized projects (FSP) and CEO approval for medium-sized projects (MSP). This M&E plan will contain as a minimum:

- SMART indicators for project implementation, or, if no indicators are identified, an alternative plan for monitoring that will deliver reliable and valid information to management;
- SMART indicators for results (outcomes and, if applicable, impacts), and, where appropriate, indicators identified at the corporate level;
- Baseline for the project, with a description of the problem to be addressed, with indicator data, or, if major baseline indicators are not identified, an alternative plan for addressing this within one year of implementation;
- Identification of reviews and evaluations that will be undertaken, such as mid-term reviews or evaluations of activities; and
- Organizational set-up and budgets for monitoring and evaluation.

### **Minimum requirement 2: Application of project M&E**

Project monitoring and supervision will include implementation of the M&E plan, comprising:

- SMART indicators for implementation are actively used, or if not, a reasonable explanation is provided;
- SMART indicators for results are actively used, or if not, a reasonable explanation is provided;
- The baseline for the project is fully established and data compiled to review progress reviews, and evaluations are undertaken as planned; and
- The organizational set-up for M&E is operational and budgets are spent as planned.

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<sup>54</sup> [http://www.thegef.org/gef/sites/thegef.org/files/documents/ME\\_Policy\\_2010.pdf](http://www.thegef.org/gef/sites/thegef.org/files/documents/ME_Policy_2010.pdf)

## Annex 8. Rating tables

The following table should be used for rating the different key evaluation criteria:

**Evaluation Rating Table**

#	Evaluation criteria	Definition	Mandatory rating
<b>A</b>	<b>Progress to impact</b>	<b>Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended, including redirecting trajectories of transformational process and the extent to which conditions for trajectory change are being put into place.</b>	Yes
<b>B</b>	<b>Project design</b>	<b>Formulation of the intervention, the plan to achieve a specific purpose.</b>	Yes
1	Overall design	Assessment of the design in general.	Yes
2	Logframe	Assessment of the logical framework aimed at planning the intervention.	Yes
<b>C</b>	<b>Project performance</b>	<b>Functioning of a development intervention.</b>	Yes
1	Relevance	The extent to which the aid activity is suited to the priorities and policies of the target group, recipient and donor.	Yes
2	Effectiveness	The extent to which the development intervention's objectives were achieved, or are expected to be achieved, taking into account their relative importance.	Yes
3	Efficiency	A measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results.	Yes
4	Sustainability of benefits	The continuation of benefits from a development intervention after major development assistance has been completed. The probability of continued long-term benefits. The resilience to risk of the net benefit flows over time.	Yes
<b>D</b>	<b>Cross-cutting performance criteria</b>	<b>Other important criteria that cut across the UNIDO intervention.</b>	
1	Gender mainstreaming	The extent to which UNIDO interventions have contributed to better gender equality and gender related dimensions were considered in an intervention.	Yes

#	Evaluation criteria	Definition	Mandatory rating
2	M&E	Refers to all the indicators, tools and processes used to measure if a development intervention has been implemented according to the plan (monitoring) and is having the desired result (evaluation).	Yes
3	Results-based management (RBM)	Assessment of issues related to results-based work planning, results-based M&E and reporting based on results.	Yes
<b>E</b>	<b>Performance of partners</b>	<b>Assessment of partners' roles and responsibilities engaged in the intervention.</b>	<b>Yes</b>
1	UNIDO	Assessment of the contribution of partners to project design, implementation, monitoring and reporting, supervision and backstopping and evaluation. The performance of each partner will be assessed individually, based on its expected role and responsibilities in the project life cycle.	Yes
2	National counterparts		Yes
3	Donor		Yes
<b>F</b>	<b>Overall assessment</b>	<b>Overarching assessment of the project, drawing upon the analysis made under Project performance and Progress to Impact criteria above but not an average of ratings.</b>	<b>Yes</b>

It is acknowledged that some issues covered by one criterion might overlap with others. Yet to enable UNIDO to learn from the deeper evaluation analyses and lessons on a number of areas, separate criteria are included such as those on Monitoring and Evaluation and Results-Based Management. The consistent use of the criteria pertinent to the evaluation object allow for comparability of UNIDO's performance over time. Evaluation questions are formulated around those evaluation criteria in UNIDO, as specified in the following section.

### Rating systems and criteria

UNIDO introduced a six-point rating system for the evaluation criteria in 2015, in line with the practice adopted by other development agencies, including the GEF. The aim of the system is to quantify the judgment of evaluators, identify good and poor practices, to facilitate aggregation within and across projects and enable tracking performance trends over a period. The six-point rating system, with six (6) representing the best and one (1) the worst score, allows for nuanced assessment of performance and results. The same rating scale is used for all rating areas as shown below.

## UNIDO evaluation rating scale

Score		Definition*	Category
6	Highly satisfactory	Level of achievement presents no shortcomings (90% - 100% achievement rate of planned expectations and targets).	SATISFACTORY
5	Satisfactory	Level of achievement presents minor shortcomings (70% - 89% achievement rate of planned expectations and targets).	
4	Moderately satisfactory	Level of achievement presents moderate shortcomings (50% - 69% achievement rate of planned expectations and targets).	
3	Moderately unsatisfactory	Level of achievement presents some significant shortcomings (30% - 49% achievement rate of planned expectations and targets).	UNSATISFACTORY
2	Unsatisfactory	Level of achievement presents major shortcomings (10% - 29% achievement rate of planned expectations and targets).	
1	Highly unsatisfactory	Level of achievement presents severe shortcomings (0% - 9% achievement rate of planned expectations and targets).	

Note: \* For impact, the assessment will be based on the level of *likely* achievement, as it is often too early to assess the long-term impacts of the project at the project completion point.

The table below contains the formula applied to transform the results of UNIDO's six-point rating scale to the GEF's four-point scale for sustainability<sup>55</sup>.

### Formula transforming UNIDO ratings into GEF ratings

UNIDO rating	UNIDO rating: sustainability	GEF rating: sustainability
6	Highly likely (HL)	Likely (L)
5	Likely (L)	Moderately Likely (ML)
4	Moderately likely (ML)	Moderately Likely (ML)
3	Moderately Unlikely (MU)	Moderately Unlikely (MU)
2	Unlikely (U)	Moderately Unlikely (MU)
1	Highly unlikely (HU)	Unlikely (U)

This formula underscores the distinction of ratings into “satisfactory” and “unsatisfactory”, both in applying UNIDO's six-point rating scale and the transformation into the GEF four-

<sup>55</sup> GEF uses a four-point scale for the criterion of sustainability.

point rating scale for sustainability. To ensure coherence in ratings, the rating is defined above. The use of benchmarks like the performance of peers for the same criteria helps to facilitate the interpretation of ratings.

## **Project design**

Criteria for rating project design are related to the logical framework approach and the quality of overall project design. These criteria include:

### Overall design quality

- Pertinence to country priorities, needs of target groups and UNIDO strategies
- Consideration and use of lessons and evaluative evidence from other projects
- Technical feasibility and validity of project design
- Budgeted M&E plan with clear timelines, roles, and responsibilities
- Adequacy of risk assessment (for example financial, sociopolitical, institutional, environmental and implementation aspects)

### Logframe/logframe-like matrix based on the project's theory of change

- Clarity and logic of results-chain, including impacts, outcomes and outputs
- SMART indicators
- Adequacy of Means of Verification and Assumptions

## **Implementation performance**

Implementation performance criteria correspond broadly to DAC criteria and need to be customized according to the context of the intervention to be evaluated.

- Relevance
- Effectiveness
- Efficiency
- Progress to Impact
- Sustainability of benefits

## **Partners' performance**

UNIDO's projects are characterized by a group of main partners with specific roles and responsibilities. UNIDO itself acts as project implementer and supervisor. Though supplemented by implementation performance criteria listed above, the criteria to assess UNIDO as a partner are more specific and help to address frequent issues in its performance. Governments are local executors, and owners of the project and donors provide project funding. Hence, rating the partners is a key part of UNIDO project evaluations<sup>56</sup>. The six-point rating scale applies<sup>57</sup>.

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<sup>56</sup> As practiced by the World Bank and the International Fund for Agriculture Development.

<sup>57</sup> 6 = Highly satisfactory; 5 = Satisfactory; 4 = Moderately satisfactory; 3 = Moderately unsatisfactory; 2 = Unsatisfactory; 1 = Highly unsatisfactory

The key issues to be addressed to rate **UNIDO's performance** are:

#### Project design

- Mobilization of adequate technical expertise for project design
- Inclusiveness of project design (with national counterparts)
- Previous evaluative evidence shaping project design
- Planning for M&E and ensuring sufficient M&E budget

#### Implementation

- Timely recruitment of project staff
- Project modifications following changes in context or after the Mid-Term Review
- Follow-up to address implementation bottlenecks
- Role of UNIDO country presence (if applicable) supporting the project
- Engagement in policy dialogue to ensure up-scaling of innovations
- Coordination function
- Exit strategy, planned together with the government
- Overall effectiveness of project management as outlined in the Project Document
- Project's governance system
- National management and overall coordination mechanisms
- UNIDO HQ-based management, coordination, monitoring, quality control and technical input

To assess the *performance of national counterparts*, the evaluation looks into the following issues:

#### Project design

- Responsiveness to UNIDO's invitation for engagement in designing the project

#### Implementation

- Ownership of the project
- Financial contributions (cash or in-kind)
- Support to the project, based on actions and policies
- Counterpart funding
- Internal government coordination
- Exit strategy, planned together with UNIDO, or arrangements for continued funding of certain activities
- Facilitation of the participation of Non-Governmental Organizations (NGOs), civil society and the private sector where appropriate
- Suitable procurement procedures for timely project implementation
- Engagement with UNIDO in policy dialogue to promote the up-scaling or replication of innovations

For the assessment of *donor performance*, the following issues require ratings:

- Timely disbursement of project funds
- Feedback to progress reports, including Mid-Term Evaluation, if applicable

- Support by the donor's country presence (if applicable) supporting the project for example through engagement in policy dialogue

## Gender mainstreaming

The UNIDO Policy on gender equality and the empowerment of women, issued initially in April 2009, and revised in March 2015 (UNIDO/DGB/(M).110/Rev.), provides the overall guidelines for establishing a gender mainstreaming strategy and action plans to guide the process of addressing gender issues in the Organization's industrial development interventions. It commits the organization that evaluations will demonstrate effective use of the UNEG guidance on evaluating from a human rights and gender equality perspective, as indicated by the Organization's meta-evaluation scores according to the UNEG Evaluation Scorecard.

In line with the UNIDO Gender Equality and Empowerment of Women Strategy, 2016-2019, all UNIDO technical assistance projects post-2015 are to be assigned a gender marker and should go through a gender mainstreaming check-list before approval. UNIDO's gender marker is in line with UN System-wide action plan (SWAP) requirements, with four categories: 0 — no attention to gender, 1 — some/limited attention to gender, 2a — significant attention to gender, 2b — gender is the principal objective<sup>58</sup>.

Besides, Guides on Gender Mainstreaming for Inclusive and Sustainable Industrial Development (ISID) Projects in different areas of UNIDO's work have been developed and published during 2015<sup>59</sup>, which have specific guidance on suitable outputs/activities/ indicators per technical area.

If the project design and gender analysis/existing indicators are not sufficient to allow for an accurate appraisal at the final evaluation, specific indicators could be created during the evaluation planning stage (preparing and revising the inception report) and assessed during the evaluation process. Together with the budget, the time required to adequately carry out a gender responsive evaluation will need to be taken into account. The evaluation time depends on the questions the assessment needs to answer, on how deep the analyses are requested to be, and on financial and human resources available as well as other external factors.

For terminal evaluations of projects that have been approved after 2015, evaluations should assess if the rating was correctly done at entry, if appropriate outputs/activities/indicators and monitoring were put in place during implementation and what results can be actually observed at the time of terminal evaluation (in line with UNIDO's organizational results reporting to SWAP). The Gender Mainstreaming six-point rating scale should then be used accordingly.

For projects that have **2a** or **2b ratings** at project design/entry at least one evaluation team member should have demonstrated/significant experience in evaluating GEEW projects. For other projects, evaluators are encouraged to further familiarize themselves with the key gender

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<sup>58</sup> [http://intranet.unido.org/intra/Gender\\_Mainstreaming\\_Tools\\_and\\_Guides](http://intranet.unido.org/intra/Gender_Mainstreaming_Tools_and_Guides)

<sup>59</sup> [www.unido.org/en/what-we-do/cross-cutting-issues/gender/publications.html](http://www.unido.org/en/what-we-do/cross-cutting-issues/gender/publications.html)

aspects and impacts of UNIDO projects, both through the foundation modules of “I know Gender” online course of UN Women and the UNIDO’s Guides on Gender Mainstreaming ISID Projects.

Annex 5. List of interviewed persons

<b>Country</b>	<b>Name</b>	<b>Organization</b>	<b>Position</b>
Thailand	Mr. Supalerk Kanasook	UNIDO, Bangkok	National Programme Officer
	Dr. Annop Nopharatana	King Mongkut's University of Technology (KMUTT)	Director of Pilot Plant Development and Training Institute
	Dr. Warinthorn Songkhasiri	KMUTT	Project Team Leader
	Mr. Terry Commins	KMUTT	International Expert,
	Dr. Scott Bamber	KMUTT	International Expert,
	Dr. Kuakoon Piyachomkiwan	BIOTEC, NSTDA	Researcher
	Mr. Sittichoke Wanlapatit	BIOTEC, NSTDA	Researcher
	Mr. Bhakkhawat Laoka	BIOTEC, NSTDA	Researcher
	Ms. Srisakul Trakarnpaiboon	BIOTEC, NSTDA	Researcher
	Mr. Tanong Chayawattana	KMUTT project team	Researcher
	Mr. Eknarin Ariyavongvivat	KMUTT project team	Researcher
	Ms. Ruenron Lerdlattaporn	KMUTT project team	Researcher
	Mr. Attawit Wanyasingha	KMUTT project team	Researcher
	Mr. Charae Chutharatkul	Thai Tapioca Development Institute (TTDI)	President
	Assoc. Prof. Dr. Vichan Vichukit	TTDI	Board of member / Chairman of PSC
	Mr. Adul Chutharatkul	TTDI	Board of member
	Ms. Supatchalee Sophonthammaphat	Bureau of biofuel development. Department of Alternative Energy Development and Efficiency (DEDE)	Director
	Mr. Dechatorn Raungkraikonkit	Bureau of biofuel development, DEDE	Officer
Mr. Kanokon Prayoonpan	Bureau of biofuel development, DEDE	Officer	

Country	Name	Organization	Position
	Ms. Sukanya Nanta	Work plan division, DEDE	Officer
	Ms. Pantla Sinsap	Work plan division, DEDE	Officer
	Mr. Chaovarat Chaochavanil	Liquor Distillery Organization (LDO)	Director
	Mr. Somkaun Charusombat	Liquor Distillery Organization (LDO)	Assistance Director
	Mr. Borisut Derasilpa	Sapthip Co., Ltd	Assistant Manager. Operation Department
Viet Nam	Dr. Vu Nguyen Thanh	Food Industry research Institute (FIRI)	Vice Director
	Dr. Dang Hong Akh	Beverage Technology Department. FIRI	Head of Department.
	Ms. Tran Nguyet Thu	Science and Planning Department. FIRI.	Secretary of the project team.
	Ms. Dinh Thi My Hang	Microbiology Center. FIRI.	Researcher.
	Mr. Dinh Duc Hien	Microbiology Center. FIRI.	Researcher.
	Ms. Nguyen Thu Van	Beverage Technology Department. FIRI	Researcher.
	Mr. Nguyen Duc Vinh	Department of Science and Technology. Ministry of Industry and Trade (MOIT)	Deputy of Head of Department.
	Ms. Tran Thi Ti	Thung Lam Company	Quality Assurance Manager
Lao PDR	Mr. Chantho Milattanapheng	Institute for Renewable Energy Promotion (IREP)	Acting General Director
	Dr. Seumkham Thoummavongsa	Institute for Renewable Energy Promotion (IREP)	Deputy General Director.
	Ms. Xaysavanh Latthachack	Bioenergy Promotion Division. IREP	Head of Division
	Mr. Phomma Soubynsih	Department of Agriculture	Officer
	Ms. Alounny Phommakon	UNIDO Ethanol Project	Coordinator
	Mr. Xaynhadeth Panthong	Khongsedone Company	Owner

Annex 6. List of documents referred

Title	Date/ Period
Project Document	December 2011
Mid-Term Evaluation Report	May 2015
UNIDO Project Mid-Term Review Report (MTR)	October 2015
Tracking Tool for Climate Change Mitigation Projects (For Mid-term Evaluation)	April 2015
Minute of Project Steering Committee Meeting	1st December 2013 2nd January 2015 3rd, August 2015 4th December 2016 5th, December 2017 6th, December 2018.
ANNUAL PROJECT IMPLEMENTATION REPORT (PIR)	2012 – 2013 2013 – 2014 2014 – 2015 (MTR) 2015 – 2016 2016 – 2017
Progress Report	1st 2014 – 2015 2nd 2015 - 2016 3rd 2016 – 2017 4th 2017 - 2018
Expert reports	<ul style="list-style-type: none"> <li>• <b>Assessment of capacities of financial institutions in Myanmar. UNIDO. June – September 2014.</b></li> <li>• Promotion plan of ethanol consumption in transportation sector. Road Map. UNIDO – MIT Viet Nam.</li> </ul>

Title	Date/ Period
	<ul style="list-style-type: none"> <li>• A Model for South-South Technology Transfer: The Pilot Case of Ethanol Production from Cassava. April 2018.</li> <li>• Documentation of Thailand's Experience of Oil Tax Revenue Recycling and Subsidization of Gasohol Price and Support in Conducting the Policy Makers Training. Thailand Development Research Institute (TDRI). May 2018.</li> <li>• Support and assistance for private sector companies in adjusting of existing bioethanol plants and/or establishing new bioethanol plants utilizing KMUTT technology in Lao PDR. BIOTEC.</li> <li>• Bioethanol Development in Lao PDR. Plan 2018 – 2025. UNIDO.</li> <li>• Feasibility study report &amp; information memorandum (IM) for modification of existing small-scale bioethanol plant of less than 10,000liters/day using conventional normal gravity (NG) SSF technology to adopt to high gravity (HG) SSF technology designed by KMUTT for production of bioethanol from fresh cassava in Laos PDR. Creagy Company Limited. December 2017.</li> <li>• Generic financial feasibility study &amp; information memorandum (IM) report for establishing a new 10,000liters/day &amp; 200,000liters/day bioethanol plant using KMUTT's HG-SSF technology utilizing fresh cassava as raw material in Laos PDR. Creagy Company Limited. February 2018.</li> </ul>
Training materials	<ul style="list-style-type: none"> <li>• <b>“Cassava Bioethanol”. KMUTT.</b></li> <li>• Practice on Ethanol production from fresh cassava roots by Very High Gravity - Simultaneous Saccharification and Fermentation (VHG-SSF) process.</li> </ul>