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| Country | Lao PDR |
| Request ID# | 2020000009 |
| Title | <i>Developing a power to gas masterplan in Lao PDR</i> |
| NDE | <i>Syamphone Sengchandala (Mr.) Acting Director General, Department of Climate Change, Ministry of Natural Resources and Environment Email: syamphone.s@gmail.com / Mobile: (+856 20) 5550-8961</i> |
| Proponent | <i>Seumkham Thoummavongsa (Ph.D) Deputy Director General, Institute of Renewable Energy Promotion, Ministry of Energy and Mines Email: seumkham@gmail.com / Mobile: (+85620) 2221-2619</i> |

Summary of the CTCN technical assistance

The summary should provide a brief description of the problem (barrier to climate technology deployment) and how the technical assistance will address it (brief summary of outputs and activities). Please also briefly indicate national actors involved and the anticipated timeline. Please note this summary will be used for public communication purposes so it is important that it is well written. (maximum 1250 characters including spaces)

Owing to its relatively high annual rainfall and the geographical proximity to the Mekong River, Laos PDR has been providing most of the country's electricity from hydro electricity generation. On the other hand, the country is also experiencing an increasing demand for and reliance on imported fossil fuels for the transport and industry sectors, contributing to a CO₂ emission that is expected to rise to 526,000 tons per year by 2030. While there are a several factors contributing to this increase, some of the most notable ones are population growth, urbanization, and GDP growth.

With the current population growth rate, the country's total population is expected to increase by at least 1.71 million between 2015 and 2030, and 10.25 million between 2015 and 2050. Of these, up to 50% will live in urban areas by as early as 2030, pushing the population in Vientiane to 2 million. For economic development, Laos has enjoyed an average GDP growth rate of 7.7% over the past decade, which resulted in a GDP per capita of 2,460 USD in 2018. At this current rate, Laos is expected to move into the middle-income class as early as 2030, joining other South-eastern countries including Vietnam, Indonesia, and the Philippines.

With such socio-economic growth, motor vehicle ownership is expected to increase to approximately 3 million units by 2030, nearly doubling in number in comparison to 2015. This will be accompanied by an increase in the amount of imported liquified petroleum gas (LPG), which has so far nearly doubled between 2005 (1,936 tons) and 2015 (3,650 tons) , and will continue to increase in the coming years.

To mitigate the growing GHG emissions from increasing demand for fossil fuels for the transportation sector, as well as to reduce the amount of imported LPG and ensure energy security and continued sustainable socio-economic growth, Laos has been striving to deploy various technologies to increase the share of renewable energy within the country, as illustrated in the National Determined Contributions (2015) and the Renewable Energy Development Strategy in Lao PDR (2011). While there are several ways to lower GHG emissions particularly from the transportation and industry sector, the Ministry of the Energy and Mines (MEM) has identified the

power-to-gas technology, which can be used to produce carbon-neutral gases to fuel motorized vehicles, as one of the promising technologies to replace fossil fuels. Power-to-gas process includes, first of all, splitting water into hydrogen and oxygen via electrolysis using electricity, which is mostly generated from hydropower plants in Laos. This hydrogen can be used on its own, or it can be combined with carbon dioxide to produce methane gas, which can be used to in place of LNG to fuel motorized vehicles. Gases produced via the power-to-gas technology, when using renewable energy generated from hydropower which is the case of Laos, is not only carbon-neutral, but it will also contribute to reducing CO2 emission.

Various ministries, including the Ministry of the Energy and Mines (MEM) and the Ministry of the Natural Resources and Environment (MONRE), are beginning to explore ways to undertake feasibility and demonstration studies on the power-to-gas technology to produce hydrogen and methane fuels, in some cases with support from the world’s leading private companies such as Hitachi Zosen Corporation from Japan.


At the same time, as a country with no existing source of natural gas within its borders, Laos currently lacks gas-related laws, regulations, and infrastructure to allow commercial use of hydrogen and methane produced via power-to-gas process. While the Ministry of the Energy and Mines has been tasked to create such regulations by the executive order from the President of Laos, the challenge still remains as there is little to no expertise on this topic in the country to begin the process of preparing to use green gas at a commercial scale.

As such, guidance and assistance from CTCN to create a gas-related masterplan, which will guide the MEM and other concerned parties on what steps are needed to be taken in order to use green gases widely will greatly benefit the overall efforts to make green gas produced by power-to-gas technology commercially available and replace fossil fuels in the future.


Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)


**National Designated Entity to the UNFCCC
Technology Mechanism**

Name: Syamphone Sengchandara
Title: Mr
Date:
Signature: 

Proponent (signature of the Proponent is optional)

Name: Seumkham Thoummavongsa
Title: Ph.D
Date:
Signature: 

UNFCCC Climate Technology Centre and Network (CTCN)

Name: Rose Mwebaza
Title: CTCN Director
Date: 08/07/2020
Signature: 

Background and context

Please provide a brief description of the background and context for the CTCN Response Plan. Please include national and sectoral information using recognized and publicly available sources. (maximum 2500 characters including spaces).

Lao PDR (hereafter Lao) is providing most of the country's electricity from hydro electricity generation.¹ On the other hand, the country is also experiencing an increasing demand for and reliance on imported fossil fuels for the transport and industry sectors, contributing to a CO₂ emission that is expected to rise to 526,000 tons per year by 2030². While there are several factors contributing to this increase, some of the most notable ones are population growth, urbanization, and GDP growth. With the current population growth rate, the country's total population is expected to increase by at least 1.71 million between 2015 and 2030, and 10.25 million between 2015 and 2050.

With such socio-economic growth, motor vehicle ownership is expected to increase to approximately 3 million units by 2030, nearly doubling in number in comparison to 2015. This will be accompanied by an increase in the amount of imported liquefied petroleum gas (LPG), which has so far nearly doubled between 2005 (1,936 tons) and 2015 (3,650 tons), and will continue to increase in the coming years.

To mitigate the growing GHG emissions from increasing demand for fossil fuels for the transportation sector, as well as to reduce the amount of imported LPG and ensure energy security and continued sustainable socio-economic growth, Lao has been striving to deploy various technologies to increase the share of renewable energy within the country, as illustrated in the National Determined Contributions (2015) and the Renewable Energy Development Strategy (2011). The Ministry of the Energy and Mines (MEM) has identified the power-to-gas technology, which can be used to produce carbon-neutral gases to fuel motorized vehicles and in industrial applications, as one of the promising technologies to replace fossil fuels. Power-to-gas process includes first of all splitting water into hydrogen and oxygen via electrolysis using electricity, which is mostly generated from hydropower plants in Lao. This hydrogen can be used to store excess hydro power or it can be combined with carbon dioxide to produce methane gas, which can be used in place of LNG to fuel motorized vehicles. Gases produced via the power-to-gas technology, when using renewable energy (RE) generated from hydropower, which is the case of Lao, is not only carbon-neutral, but it will also contribute to reducing CO₂ emissions.

1. Problem statement

Founded on the national and sectoral context as detailed in the section above, please include a brief problem statement clarifying the main problems and barriers for climate change mitigation and/or adaptation in terms of climate technologies that the CTCN Response Plan will address and overcome. (maximum 1250 characters including spaces).

As a country with no existing source of natural gas within its borders, Lao currently lacks gas-related laws, regulations, and infrastructure to allow commercial use of hydrogen and methane produced via power-to-gas process. While the Ministry of the Energy and Mines has been tasked to create such regulations by the executive order from the President of Lao, the challenge still remains as there is

¹ OECD, <http://www.oecd.org/dev/asia-pacific/saeo-2019-Lao-PDR.pdf>

² JICA, http://open_jicareport.jica.go.jp/pdf/12086070_02.pdf
http://open_jicareport.jica.go.jp/pdf/12086088_02.pdf

little to no expertise on this topic in the country to begin the process of preparing to deploy green gases at a commercial scale.

As such, guidance and assistance from CTCN to prepare a power to gas-related masterplan is sought. This plan will guide the MEM and other concerned parties on what steps are needed to be taken in order to use green gases widely and will greatly provide benefit to the overall efforts to produce green gas via power-to-gas technology commercially available and replace fossil fuels in the future.

Two online meetings will be organized to kick-start Activity 3.1 and 3.2⁴. Relevant stakeholders in the country will be invited to join in order for them to contribute to the discussion and provide information required for the technical assistance. Private sector is strongly encouraged to be present in the meetings.

Activity 3.1: Energy mix assessment and hydrogen/biogas production estimate

An analysis of the whole energy mix of the country is necessary in order to assess the potential of P2G production and utilization in key sectors with the aim of replacing fossil fuels and prepare the master plan accordingly.

Detailed and updated info on the current national energy production mix should be supplied by NDE and request proponent (IREP/MEM) along with updated info on hydro power (and other renewable energy sources as applicable) and electricity grid expansion plans. A study carried out by Hitachi Zosen Corporation analysed the potential of P2G production and deepened the application in the cement sector. According to this study Lao has a hydro power potential up to 23 GW, including future expansion plans linked to electricity export to neighboring countries. This feasibility study will be taken as the starting basis and reference for the execution of Output 3. Though it should be complemented and updated as applicable in close collaboration with NDE and IREP, taking into consideration the objectives of the country INDC⁵ and the 2030 target.

The energy analysis should evaluate how the production of green hydrogen can contribute to de-carbonising the energy sector of the country by reducing the fossil fuels utilization, focusing on the industrial and transport sectors. The P2G analysis will pay particular attention to the seasonality factor of hydro power production in Lao that implies a growing involvement of fossil resources during the dry season.

In view of the P2G master plan preparation, the entire energy chain should be analysed, meaning production, storage and distribution, final use. Green hydrogen production potential from hydro power via water electrolysis is the first energy stream to be calculated. Subsequently hydrogen applications for heating, electricity and mobility purposes should be investigated according to country's energy needs. Mixing of green hydrogen to produce other renewable gases and synthetic gases and fuels (i.e. with natural gas, with CO2 to form biomethane, biogas, etc.), to fulfill a variety of energy purposes should be also evaluated as applicable to the specific case of Lao. The country assessment final report will represent a detailed photograph of the country energy mix as a whole, entailing all energy final uses including transportation. This will depict the business as usual (BAU) scenario that will be taken as a reference for the elaboration of the cost benefit analysis (CBA) and the P2G master plan (respectively Output 4, 5). Basically this is a scenario where no P2G technology is available in the country.

Activity 3.2: Industrial sector analysis

⁴ CTN web platform can be used to host the meetings
⁵ The Hitachi Zosen Corporation study and country INDC will be provided to the implementer

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|--|--|---|--|---|--|---|--|---|----------------------------|
| <p>The results of output 3 and 4 will inform the master plan (MP). The MP should consider the country's goals set in their NDC (see section 2). Thus it should:</p> <ul style="list-style-type: none"> • be designed within an energy scenario 2030, featuring hydropower as main energy source; • take into account the renewable energy target that aims to increase the share of small scale renewable energy to 30% of total energy consumption by 2030, and the hydro power expansion plans. • provide a clear pattern regarding the opportunity for P2G technologies introduction to complement renewable energy production and lead to a net zero carbon future for the country by 2050. | | <p><i>Activity 5.1: Master plan layout: country roadmap</i></p> <p>Country roadmap till 2030 will pave the way towards P2G technology adoption and commercialization. It shall contain a chronological actions' list for the country to follow in order to introduce P2G technology. According to the scenarios drafted and budgeted in the CBA, required policies and government measures (lows, incentives, subsidies, etc.) to accompany the implementation of the MP shall be elaborated in a chronological fashion. While 2030 is the principal time horizon of reference, due to the innovative nature of P2G, a country perspective till 2050 should be also outlined in the plan.</p> <p>An on-line meeting to present the master plan draft to NDE and IREP/MEM and discuss about the action plan will anticipate the conclusion of this activity. This meeting will give the opportunity to relevant country stakeholders to make their final comments before the finalization of the masterplan.</p> | | <p><i>Activity 5.2: Action plan</i></p> <p>An action plan till 2030 will be prepared to introduce P2G technologies. It will present a list of selected projects that are actionable in the short, medium and long term. A review of potential financiers that could support the funding of such projects shall be identified. The review should include international financial mechanism (i.e. GCF, GEF, World Bank, etc) as well as private sector investors (companies and private capitals). A proposal till 2050 will also be drafted having in mind the net zero emission goal.</p> | | <p><i>Activity 5.3: Final webinar.</i></p> <p>The webinar will present the master plan and its successive implementing phases to relevant country stakeholders selected in collaboration with NDE and request proponent. CTCN web platform can be used to host the webinar. Depending on the global situation vis-a-vis the COVID19 pandemic at the time of the TA implementation, a country workshop could be also foreseen.</p> | | <p><i>Deliverables 5.1: Master Plan Report</i></p> <p><i>Deliverable 5.2: Action plan report</i></p> <p><i>Deliverable 5.3: Webinar material prepared</i></p> | <p>X</p> <p>X</p> <p>X</p> |
|--|--|---|--|---|--|---|--|---|----------------------------|

3. Resources required and itemized budget:

Please provide an *indicative overview* of the resources required and itemized budget required to implement the CTCN technical assistance, including for M&E-related activities, using the table below. Important to note that minimum 1% of the budget should explicitly target gender specific activities related to the technical assistance (please see section 10 for further information on gender). Once the Response Plan is completed, a Response Implementation partner(s) will be selected by the Climate Technology Centre (CTC). A detailed activity-based budget for the CTCN assistance will be finalized by the CTCN and selected Implementer.

| Activities and Outputs | Input: Human Resources (Title, role, estimated number of days) | Input: Travel (Purpose, national vs. international, number of days) | Inputs: Meetings/events (Meeting title, number of participants, number of days) | Input: Equipment/Material (Item, purpose, buy/rent, quantity) | Estimated cost | |
|--|---|--|--|--|----------------|---------------|
| | | | | | Minimum | Maximum |
| Output 1: Development of implementation planning and communication documents | 11 days; IC, NC, E1, E2, GE | | | | 9,000 | 12,500 |
| Activity 1.1: Formulation of i) Detailed work plan | 2 days | | | | 2,000 | 2,500 |
| ii) Monitoring and evaluation plan | 3 days | | | | 2,000 | 3,000 |
| iii) CTCN Impact Description | 3 days | | | | 2,000 | 3,000 |
| iv) Closure and Data Collection report | 3 days | | | | 3,000 | 4,000 |
| Output 2: : P2G state of the art | 30 days, IC, E1, E2 | | | | 10,000 | 15,000 |



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**Technical Assistance Response Plan –
Terms of Reference**

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| Activity 2.1: P2G state of the art analysis | IC 8 days, E1 18 days, E2 2 days | | | | 10,000 | 15,000 |
| Output 3: Country assessment | 60 days, IC, E1, E2, NC, GE | | | | 45,900 | 58,000 |
| 3.1: Energy mix assessment and hydrogen/biogas production estimate | IC 15 days E1 25 days NC 40 days | | A meeting with local stakeholder may be foreseen in lieu of a online meeting depending on COVID19 situation in the country | | 23,000 | 28,000 |
| 3.2: Industrial sector analysis | IC 8 days, E1 15 days, NC 21 days, GE 5 days | | | | 14,200 | 20,000 |
| 3.3 Transportation sector | IC 5 days, NC 7 days, E2 15 days, GE 1 day | | | | 8,700 | 10,000 |
| Output 4: Cost benefit analysis | 60 days, IC, E1, E2, NC, GE | | | | 52,500 | 63,000 |
| Activity 4.1: CBA study | IC 30 days, E1 48 days, E2 38 days, NC 20 days, GE 6 days | | | | 46,600 | 55,000 |
| Activity 4.2: Online meeting to present the CBA | IC 3 days, E1 8 days, E2 3 days, NC 1 day, GE 3 days | | | | 5,900 | 8,000 |
| Output 5: P2G Master Plan | 80 days, IC, E1, E2, NC, GE | | | | 88,400 | 100,000 |

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|--|---|--|--|----------------|----------------|
| <i>Activity 5.1: Master plan layout: country roadmap</i> | <i>IC 30 days, E1 35 days, E2 25 days, NC 35 days, GE 15 days</i> | | | 44,500 | 50,000 |
| <i>Activity 5.2: Action plan</i> | <i>IC 30 days, E1 days, E2 20 days, NC 20 days, GE 8 days</i> | | | 36,400 | 40,000 |
| <i>Activity 5.3: Webinar</i> | <i>IC 5 days, E1 10 days, E2 3 days, NC 1 day, GE 3 days</i> | | | 7,500 | 10,000 |
| Estimated range of costing for the entire Response Plan | | | | | |
| | | | | 205,800 | 248,500 |

4. Profile and experience of experts

Based on the required Human Resources identified in section 4 (Resources required and itemized budget) please provide a description of the required profile of all involved experts for the implementation of the CTCN Response Plan.

| Experts required | Brief description of required profile |
|--|---|
| <i>Please use the same titles for all experts as applied in section 4.</i> | <i>Please provide a short description of expertise and experience needed (education, sectors of expertise, years of experience, country experience, language requirements, etc.).</i> |
| International Consultant (IC) (Project manager) | Economist or engineer, M.Sc., with experience in the design and development of industrial master plans and strategies/road maps, knowledge and experience on policies and development in energy, sustainability and circular economy related topics; strong project management experience, knowledge of technological innovation, industry 4.0, lifecycle assessment of products and services, climate change, SDGs and NDC with a minimum of 10 years of experience. Experience in interacting with senior government officers is desired. Knowledge of green hydrogen technologies and renewable gases is an asset. Fluency in English is required. |
| National consultant (NC) | Engineer or economist, expert in evaluation and development of industrial policies (technology innovation, roadmaps, national programs) and environmental policies (climate change, NDC (nationally determined contributions), TNAs (technology needs assessments), NAPs (national action plans) or NAMAs (nationally appropriate mitigation actions), according to the experience of each country), with a minimum of five years of experience. Fluency in English is required. |

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| Expert 1 (E1) | Industrial or chemical engineer (or similar background) with specific experience and knowledge in power to gas technology, i.e hydrogen energy technologies, biogas and synthetic fuels with a minimum of seven years of experience. Fluency in English is required. |
| Expert 2 (E2) | Transport engineer with experience in electro-mobility and gas powered mobility (public and private transport). Experience in transportation planning and in conducting transportation master plan with a minimum of seven years of experience. Fluency in English is required. |
| Gender expert (GE) | Social science professional (sociologist, anthropologist or psychologist) expert in gender studies and management of equality policies, with experience in research methodologies and data processing, with a minimum of seven years of experience. Fluency in English is required. |

5. Intended contribution to impact over time

Please provide a brief description of the intended contribution to impact over time of the outcome and outputs provided by this technical assistance on resilience to climate change and/or carbon abatement. To the extent possible, please quantify the intended impact contribution, for example by indicated estimated number of people potentially impacted over time, GDP contribution of the focus sector, carbon emissions by the focus sector, etc. This intended contribution to impact is what will happen if the objective (as articulated in section 3) is met. Please ensure relevant complementarity with text in sections 7 to 12. (maximum 1250 characters including spaces)

The intended contribution over time of this technical assistance can be summarized through the following elements:

- Lower GHG emissions in the industrial and transport sector. A detailed assessment of the reduction potential through P2G will be quantified, having as a long term objective the achievement of a net zero emission status by 2050.
- Contribute to the energy independency of the country and introduce innovation into the private sector, industrial sector and national energy system.
- Raise ambition of country NDC by introducing innovative clean climate technologies that can become an integral part of successive updated versions of NDC.

The implementation of the P2G master plan would impact the whole population of Lao as the P2G technologies, if considered suitable and applicable by the analysis to be undertaken in the TA, will affect the industrial and transportation sector, creating also new jobs in a high innovative sector. Moreover P2G can be also applied in isolated communities, as such the benefits could be potentially observed at rural level and not only in main cities and industrial conglomerates. Finally this TA may also bring opportunities to Lao for south-south cooperation with neighboring countries thanks to the capacity building module that will train national stakeholders on P2G technologies.

6. Relevance to NDCs and other national priorities

Please identify relevance and contribution from the technical assistance to the Nationally Intended Contributions (NDC) and other relevant national prioritized efforts (TNAs, TAPs, NAPs, NAMAs, etc.). (maximum 2500 characters including spaces)

As per the mitigation targets in the country INDC, the Government of Lao has defined the following targets:

Implementation of Renewable Energy Development Strategy

To increase the share of renewable energy to 30% of energy consumption by 2025. (Note that large scale technologies with installed capacity equal to or greater than 15MW are not included in this policy's target.)

For transport the objective is to increase the share of biofuels to meet 10% of the demand for transport fuels by 2025.

To make electricity available to 90% of households in rural area by the year 2020. This will offset the combustion of fossil fuels to produce power where there is no access to the electricity grid.

Expansion of the use of large scale hydroelectricity

The objective of this activity is to build large scale (>15 MW) hydropower plants to provide clean electricity to neighbouring countries. Approximately total installed capacity of the hydropower plants will be 5,500 MW by 2020. In addition, 20,000 MW of additional hydroelectric capacity is planned for construction after 2020.

The study behind the P2G master plan is very important for the country to evaluate if and how P2G can contribute to the achievements set in the NDC. In fact, it would analyse both the storage potential for surplus renewable energy and synergies between P2G applications and small scale RE, in order to achieve the RE target (30% of energy consumption by 2025) as well as the transportation target (10% of the demand for transport fuels by 2025).

The country so far has undertaken a TNA focusing only on adaptation to climate change. Therefore this technical assistance will provide a valuable contribution not only to the planning for the mitigation targets of the NDC, but will also represent an assessment of a climate technology that could be part of a mitigation TNA to select the most appropriate technologies to fulfil the country climate mitigation targets.

7. Linkages to relevant parallel on-going activities:

Please identify relevant previous and ongoing public and private sector initiatives, projects or programmes that the CTCN assistance will specifically build on and contribute to. To the extent possible, please add practical and operational details on the linkages between existing activities and the CTCN assistance. (maximum 2500 characters including spaces)

A series of activities directly correlated with this TA have been undertaken in the country. The potential to produce green gas from animal and livestock wastes, agro-industrial wastes, municipal solid wastes and waste-water treatment plants has been explored. So far, two small-scale demonstration projects to produce electricity using biogas, with a total installed capacity of 290 KW for self-consumption at livestock farms, have been undertaken. During output 3 the country assessment will take into account this installation and the potential for the hydrogen produced from hydro power to be used in combination with biogas at local level. In 2016, the Institute of Renewable Energy Promotion (IREP), located within the MEM, signed a Memorandum of Cooperation (MOC) with Hitachi Zosen Corporation from Japan to conduct a feasibility study and undertake a long-term plan to utilize power-to-gas technology at a commercial scale. The purpose of the feasibility study is to analyze the content of exhaust gas/CO₂ from cement factory; the test-run methanation reactor with auxiliary parts such as electrolyzer and CO₂ separator; and conduct other analyses to understand necessary changes to be made to the future facilities. This study will represent the main starting basis for the TA country analysis and will be scaled up to cover the whole industrial and transportation sectors.

In addition, IREP created and endorsed a renewable energy development plan for 2021-2025, which includes goals relevant to this TA, such as development of regulations for hydrogen, as well as production of 10,000 tons of hydrogen with support from Hitachi Zosen Corporation. The CTCN TA will take into account the development plan objectives and will draft scenarios entailing climate targets that will not only try to meet the plan's goals but will also outline a net zero emission pathway for the country by 2050.

Lastly, MEM is organizing a one-day workshop to be held in March 2020 on power-to-gas technology. This workshop will be used as an occasion to disseminate information and benefits of the technology, and it will be attended by the Ministry of Natural Resources and Environment (MONRE); Ministry of Industry and Commerce (MOIC); Ministry of Science and Technology (MOST); Ministry of Foreign Affairs (MOFA); Ministry of Planning and Investment (MPI); Prime Minister's Office; National Electricite du Laos (EDL); and the National Institute of Economic Research (NIER). Findings and presentations from the workshop will be requested to MEM so to collect the input from

the participants who will be invited to join the country analysis discussion foreseen at the beginning of the TA and the subsequent webinars.

8. Anticipated follow up activities after this technical assistance is completed:

Please describe the expected future use of the outputs and deliveries produced by this technical assistance, after the CTCN implementation is completed, towards contributing to the anticipated impacts over time articulated in section 6. For example, what organizations or stakeholders will use the outputs of the technical assistance after it is completed, for what purpose, at what scale and scope the outputs and deliveries will be applied, when and what will be the next steps undertaken, etc. (maximum 2500 characters including spaces)

Lao does not produce nor import LNG, and it relies on imported LPG which comes in barrels. This implies that the country lacks regulations, codes and standards to oversee the production, storage, distribution, and usage processes within the country, required for the power-to-gas technology to become a viable option to replace fossil fuels. While the successful deployment of the power-to-gas technology requires overcoming a range of non-regulatory challenges that are technical and financial in nature, including, for instance, identifying optimal specifications for the facilities; verifying its commercial feasibility; and securing adequate finance, it is of equal importance that regulatory and policy preparation takes place simultaneously to the technical development. At the moment, however, Laos is in its early phase of this endeavor and does not have any concrete plans. Hence, this TA will endow the country with a decision making tool that will enable MEM and other relevant ministries to definitely decide whether and how to introduce P2G into national plans and NDC and understand what set of policies are needed to be put in place for its implementation. The capacity building module (in the form of a webinar) and the P2G state of the art report (deliverable 2) will train selected ministry’s officials on P2G technologies and will provide guidelines on the masterplan structure. Finally the TA will identify financial mechanisms suitable to fund its implementation so that the country can immediately start to operationalize the action plan for P2G after the work completion.

9. Gender and co-benefits:

Imbedded in design of the activities:

A gender mainstreaming analysis is mandatory to include for all technical assistances. A gender expert will be assigned to carry out an assessment and evaluation regarding gender mainstreaming during the implementation of the TA.

In addition, please describe all support to gender aspects, women’s equality and other co-benefits embedded into the Response Plan (please include a reference to the actual activities and outputs as described in section 3).

A gender expert (GE) will be required for the implementation of this TA. Since the objective of the work is to produce a country masterplan, the gender aspect takes a relevant role so to make sure that the plan incorporate a balanced gender mainstreaming. For this purpose the GE involvement has been foreseen in the main outputs of the TA and, in order to assure the

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| | effectiveness of his/her contribution, a gender mainstreaming budget of approx. 5% of the total has been allocated. |
| Gender and co-benefits intended as result of the activities: | <p><i>Please describe all gender aspects, women's equality and other co-benefits expected as a result of the CTCN technical assistance.</i></p> <p>The benefits in terms of gender will be the inclusion of women into new business models based on P2G technologies that will contribute to form skilled labor, offer new and quality opportunities for their education and training. Thanks to the innovative nature of P2G technologies, women will have the possibility to get involved in economic activities featuring circular business models, as well as in the creation of new ventures and academic research. These new opportunities have the potential to improve women's living conditions, offering economic stability, security, health and equal opportunities for access to jobs, whilst at the same time reducing the wage gap, in compliance with SDG 5 on gender equality.</p> |

10. Main in-country stakeholders in implementation of the technical assistance activities:

Using the table below, please list and describe the role of in-country stakeholders, participants and beneficiaries who will be involved in or directly consulted during implementation of the assistance.

| In country stakeholder | Role in implementation of the technical assistance |
|--|---|
| National Designated Entity - Ministry of Natural Resources and Environment | Liaison with CTCN and TA implementer |
| Request Applicant - Ministry of Energy and Mines/Institute of Renewable Energy Promotion | Interaction with NDE, CTCN and TA implementer to provide relevant country data to allow a smooth study by the implementer |
| <i>Ministry of Industry and Commerce</i> | <i>To support information for industrial sector and participate consultation meeting</i> |
| <i>Ministry of Public Works and Transport</i> | <i>To support information for transport sector and participate consultation meeting</i> |
| <i>Ministry of Agriculture and Forestry</i> | <i>To support information for transport sector and participate consultation meeting</i> |

11. SDG Contributions:

Instructions: Please complete the grey section below for a maximum of three SDGs that will be advanced through this TA. A complete list of SDGs and their targets is available here:

<https://sustainabledevelopment.un.org/partnership/register/>.

| Goal | Sustainable Development Goal | Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs) |
|-------------|---|---|
| 1 | End poverty in all its forms everywhere | |
| 2 | End hunger, achieve food security and improved nutrition, and promote sustainable agriculture | |
| 3 | Ensure healthy lives and promote well-being for all at all ages | |
| 4 | Ensure inclusive and equitable quality education and promote life-long learning opportunities for all | |
| 5 | Achieve gender equality and empower all women and girls | |
| 6 | Ensure availability and sustainable management of water and sanitation for all | |
| 7 | Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7) | |
| | 7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services | The TA will innovative the current national energy system and provide guidance on how to maximise |

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| | | the renewable energy potential of the country through RE storage via (green) hydrogen |
| | 7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix | |
| | 7.3 - By 2030, double the global rate of improvement in energy efficiency | |
| | 7.a - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology | |
| | 7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support | This TA will contribute to assess and plan for Lao energy infrastructure expansion and increase the clean energy provision of power, heating and transportation services having hydrogen and renewable gases as energy carriers |
| 8 | Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all | |
| 9 | Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation | The TA promotes sustainable industrialisation by means of the introduction of P2G technologies while bringing industrial innovation |
| 10 | Reduce inequality within and among countries | |
| 11 | Make cities and human settlements inclusive, safe, resilient and sustainable | |
| 12 | Ensure sustainable consumption and production patterns | |
| 13 | Take urgent action to combat climate change and its impacts | <i>All TAs should indicate relevance to Goal 13 and at least one target below (13.1 to 13.b).</i> |
| | 13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries | |
| | 13.2 - Integrate climate change measures into national policies, strategies and planning | The masterplan to be prepared by the TA will contain a GHG emission reduction plan through the introduction of P2G technologies to be then considered for national policies implementation |
| | 13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning | |
| | 13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible | |
| | 13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities | |
| 14 | Conserve and sustainably use the oceans, seas and marine resources for sustainable development | |
| 15 | Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss | |
| 16 | Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels | |
| 17 | Strengthen the means of implementation and revitalize the global partnership for sustainable development | |

12. Classification of technical assistance:

Please indicate primary type of technical assistance. Optional: If desired, indicate secondary type of technical assistance.

| <i>Please tick off the relevant boxes below</i> | <i>Primary</i> | <i>Secondary</i> |
|--|--------------------------|--------------------------|
| <input type="checkbox"/> 1. Decision-making tools and/or information provision | <input type="checkbox"/> | X |
| <input type="checkbox"/> 2. Sectoral roadmaps and strategies | X | <input type="checkbox"/> |
| <input type="checkbox"/> 3. Recommendations for law, policy and regulations | X | <input type="checkbox"/> |

| | | |
|---|--------------------------|--------------------------|
| <input type="checkbox"/> 4. Financing facilitation | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> 5. Private sector engagement and market creation | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> 6. Research and development of technologies | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> 7. Feasibility of technology options | X | <input type="checkbox"/> |
| <input type="checkbox"/> 8. Piloting and deployment of technologies in local conditions | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> 9. Technology identification and prioritisation | <input type="checkbox"/> | X |

Please note that all CTCN technical assistance contributes to strengthening the capacity of in country actors.

13. Monitoring and Evaluation process

Upon contracting of the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. The monitoring and evaluation plan must include specific, measurable, achievable, relevant, and time-bound indicators that will be used to monitor and evaluate the timeliness and appropriateness of the implementation. The CTCN Technology Manager responsible for the technical assistance will monitor the timeliness and appropriateness of the Response Plan implementation. Upon completion of all activities and outputs, evaluation forms will be completed by the (i) NDE about overall satisfaction level with the technical assistance service provided; (ii) the Lead Implementer about the knowledge and learning gained through delivery of technical assistance; and (iii) the CTCN Director about timeliness and appropriateness of the delivery of the activities and outputs.

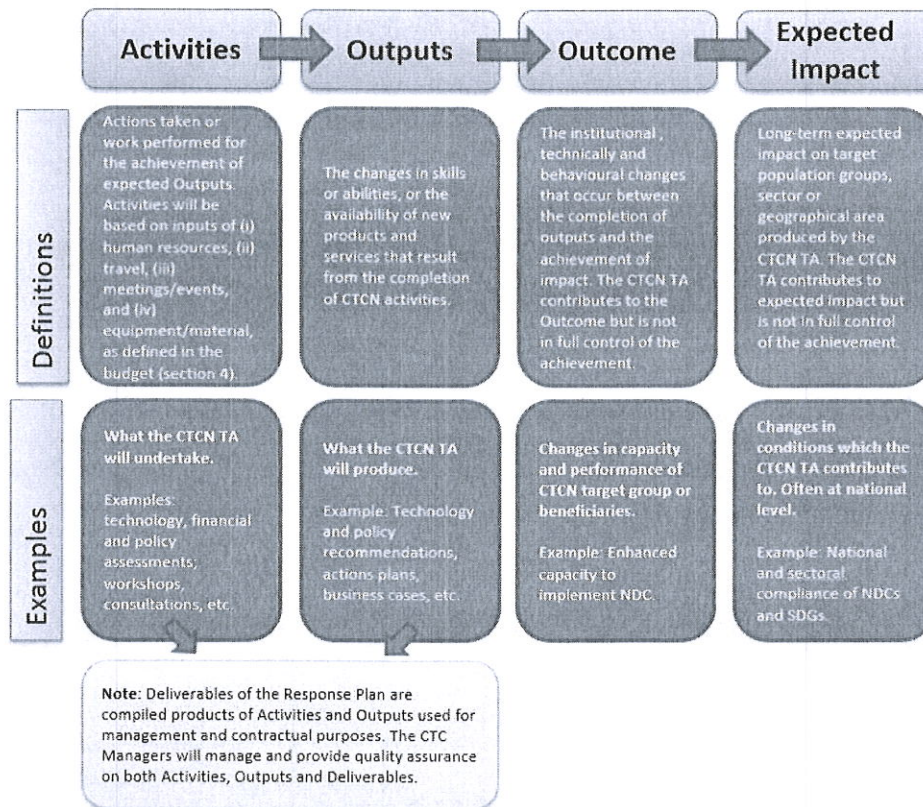
Annex 1: Guidance note for designing a Response Plan (to be deleted when submitting the Response Plan)

1. Objective of the Response Plan

The Response Plan is developed by CTCN specialists in response to a country request for technical assistance. It constitutes the Terms of Reference of the CTCN technical assistance that will be provided to the country and it provides the formulation of and subsequent basis for the monitoring and evaluation of the Response Plan implementation, as well as its expected outcomes and anticipated impacts.

2. Results chain and Logical Framework Approach to be defined in the CTCN Response Plan

The result chain is the causal sequence that stipulates the necessary flow of actions and processes to achieve desired objectives and results – beginning with inputs, moving through activities and outputs, and culminating in individual outcomes. The outcome will contribute to the desired impact in the society. The Logical Framework Approach is an analytical process used to support objectives-oriented project planning and management. It provides a set of pre-defined concepts which are used as part of an iterative process to aid structured and systematic analysis and management of the CTCN technical assistance.



3. Role of the Response Planning Design Team

The Response Planning Design Team is selected by the Climate Technology Centre (CTC). The composition of the team depends on each particular request but may include the National Designated Entity (NDE), the request Proponent, Climate Technology Manager of the CTCN, experts from the CTCN Consortium, UNIDO and UNEP experts from regional offices and other experts as needed.

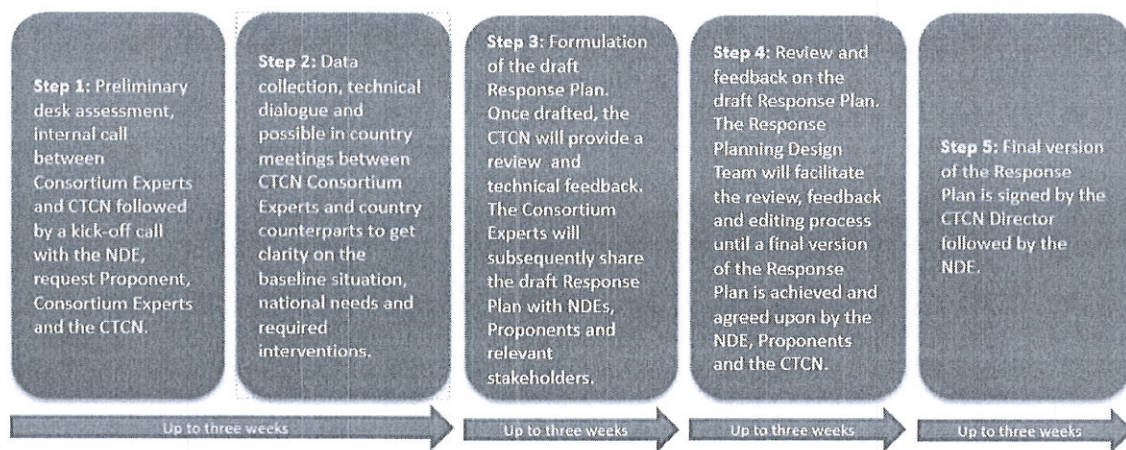
The role of CTCN Consortium experts is to lead the design of the Response Plan. The NDE will provide overall guidance on national context and priorities whereas the request Proponent will provide more detailed information on the sector, barriers and requested assistance. The Climate Technology Manager of the CTCN will provide quality assurance of timeliness and appropriateness of the Response Plan.

The Response Planning Design Team will draft all sections of the Response Plan template building on the information contained in the CTCN Request, based on expertise on the given topic and potentially further data collection, as required. This will be done by the CTCN Consortium Experts in consultation with the NDE, request Proponent and relevant stakeholders. The Response Plan has to be agreed to and approved by the NDE and the CTCN Director. This Response Plan will serve as the basis to identify, select and engage an expert institution from the Climate Technology Network or Consortium to lead the implementation of the CTCN Response Plan in the requesting country.

To the extent possible, staff from UNEP and UNIDO Regional, Sub-Regional and/or National Offices should be involve in all stages of formulation of the Response Plan to maximize synergies and avoid overlap with ongoing initiatives, as well as ensure relevance to regional and national context.

4. Process for designing the Response Plan

The Response Planning process should be completed over a period of up to 60 working days (12 weeks). Indicative steps and related timelines are laid out below:



5. Design Considerations

In order to maximize the impact of the technical assistance provided by the CTCN and provide an effective M&E process, the Response Plan should integrate as much as possible the considerations below:

Climate Technology focus: The Response Plan should have a clear focus on climate technologies, and identify activities that enable the identification, development, deployment or diffusion of one or several specific technologies (including equipment, techniques, knowledge and skills).

Barrier removal / Problem solving: The activities should contribute to address the specific problem statement identified in the Request. The barriers identified should be those hampering the identification, development, deployment or diffusion of one or several climate technologies or climate actions. Therefore, it may be necessary to limit the CTCN Response Plan to a set of activities for technical assistance commonly agreed with the NDE (and Proponent when needed) compared to the original request submitted. The CTCN will liaise with NDEs and Proponent in case the scope of the technical assistance deviates from the original request.

Use of the CTCN assistance by stakeholders: The Response Plan should identify clearly how the products of the CTCN assistance will be used in the short term once support is delivered, by who and when, to ensure it will lead to specific impacts in the country. The activities should engage the stakeholders that will use the concrete results of the assistance to deploy the technologies, including from the private sector, the public sector, research institutions, etc.

Within the scope of CTCN resources: The cost of the technical assistance provided by the CTCN cannot exceed USD 250,000 per Response Plan. Therefore, it may be necessary to prioritize activities and limit the CTCN Response Plan to a set of priority activities commonly agreed with the Proponent and the NDE to remain under this value. Under section 4 of the Response Plan template, an indicative activity based budget should be presented. The proposed budget is indicative and should present an estimated costing range per activity, output as well as a total costing range for the delivery of the Response Plan. Once the Response Plan is finalised and published for tendering, interested parties will provide competitive offer against the indicative budget.

CTCN activities and outputs should be linkable to monitoring and evaluation indicators: All proposed activities and outputs must be linkable to monitoring and evaluation indicators that are specific, measurable, achievable, relevant, and time-bound. The monitoring and evaluation process and corresponding indicators will be developed by the Lead Implementer as part of the work plan and will allow the CTCN technology Manager to monitor the timeliness and appropriateness of the implementation.

Synergies with existing efforts: The Response Plan should focus on activities that are not already being fully supported or that are in the process of being fully supported by another national, regional or international organization. Synergies and complementarity also require that the CTCN assistance is not duplicating past activities. It is possible in the Response Plan to indicate co-financing from the government, the Proponent or another stakeholder, that will maximize the effectiveness of the CTCN assistance.

Gender mainstreaming: The CTCN mission is to build or strengthen developing countries' capacities to identify technology needs, to facilitate the preparation and implementation of technology projects and strategies taking into account gender considerations. The Response Plan must therefore describe how gender considerations will be included and monitored within the proposed activities, and any gender co-benefits that will be gained as a result of implementing the CTCN technical assistance.