Lao People's Democratic Republic

Peace Independence Democracy Unity and Prosperity

Intended Nationally Determined Contribution

30 September 2015

Contents

1 National Context

Lao PDR has a long term goal for national development which is set out in the 8th Five Year National Socio-economic Plan (2016-2020), with a Vision to 2030. According to this vision, the goal is for Lao PDR to make the transition from a Least Developed Country (LDC) to a middle income country by 2030 supported by inclusive, stable and sustainable economic growth whilst alleviating poverty. Lao PDR recognises the strong link between economic development, sustainability and the need to mainstream environmental considerations, including action on climate change into its development plans.

The Climate Change and Disaster Law is being developed and the overarching legal framework for climate change and disaster management is provided in the law. The law is expected to be approved in 2017.

The National Strategy on Climate Change (NSCC) of Lao PDR was approved in early 2010, and states a vision on how to address climate change[1]:

> "To secure a future where Lao PDR is capable of mitigating and adapting to changing climatic conditions in a way that promotes sustainable economic development, reduces poverty, protects public health and safety, enhances the quality of Lao PDR's natural environment, and advances the quality of life for all Lao People"

In addition to the overarching strategy set out in the NCCS, climate change action plans for the period 2013-2020 define mitigation and adaptation actions in the sectors of agriculture, forestry, land use change, water resources, energy, transportation, industry and public health.

Lao PDR is highly climate-vulnerable, and the country's greenhouse (GHG) emissions were only 51,000 Gg[2] in the year 2000, which is negligible compared to total global emissions. Despite this, Lao PDR has ambitious plans to reduce its GHG emissions while at the same time increasing its resilience to the negative impacts of climate change. Examples of such plans include the following:

- An ambitious target is set out in the National Forestry Strategy to the Year 2020 for increasing forest cover to a total of 70% of land area by 2020, and maintaining it at that level going forward. This will reduce the risk of floods and prevent land degradation, yet at the same time the greenhouse gas mitigation potential of such a target is substantial and long lasting.
- In terms of Lao PDR's large scale electricity generation, the electricity grid draws on renewable resources for almost 100% of its output. Lao PDR also aims at utilising unexploited hydropower resources to export clean electricity to its neighbours. By supplying neighbouring countries such as Cambodia, Viet Nam, Thailand and Singapore with hydroelectricity, Lao PDR is enabling other countries in South East Asia to develop and industrialise in a sustainable manner.
- The Government of Lao PDR has also laid the foundations for the implementation a renewable energy strategy that aims to increase the share of small scale renewable energy to 30% of total energy consumption by 2030.

[1] National Strategy on Climate Change (NSCC) (2010). Available at: http://www.undp.org/content/lao_pdr/en/home/library/environment_energy/climate_change_strategy.html

[2] The latest GHG inventory in Laos presented in the Second National Communication on Climate Change of Lao PDR (2013) used data of the year 2000.

Climate change is already causing economic loss and affecting the livelihoods, food security, water supply and health of much of the country's population. The frequency and intensity of climate related hazards such as droughts and floods are expected to increase in future, so Lao PDR must also urgently take steps to build its resilience by enhancing its adaptation efforts across all sectors. A more detailed summary of the vulnerabilities to climate change and the adaptation actions proposed to address them are discussed further in Section 3 of this INDC.

Lao PDR is committed to the implementation of its NCCS and its sectoral climate change action plans, for the national, regional and global benefit. However, it will require technical and financial support to deliver the mitigation and adaptation actions identified herein. With such support, the NCCS will be most efficiently implemented, the potential GHG reductions identified will be optimised, and Lao PDR can most effectively adapt to the negative and immediate effects of climate change.

2 Mitigation

2.1 Mitigation Contribution

Lao PDR has identified a number of actions which it intends to undertake in order reduce its future GHG emissions, subject to the provision of international support. These are outlined in Table 1 together with preliminary estimates of the projected emissions reductions which will occur as a result. These estimates have been drawn from a variety of sources and need to be reviewed and updated to address consistency and accuracy in analytical methods once more reliable data and information are available. Details of the mitigation actions, implementation plans and support needs are outlined in Section 4 and Annex 1 respectively.

Table 1: Intended Mitigation Activities to be implemented by Lao PDR in 2015-2030

No	Name of activity	Objectives of the activity	Estimated CO_{2eq} reductions
1	**Implementation of "Forestry Strategy to the year 2020" of the Lao PDR**	To increase forest cover to 70% of land area (i.e. to 16.58 million hectares) by 2020. Once the target is achieved, emission reductions will carry on beyond 2020.	60,000 to 69,000 $ktCO_{2e}$ (once the target has been met, by 2020 onwards)
2	**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 fuels the objective is to increase the share of biofuels to meet 10% of the demand for transport fuels by 2025.	1,468,000 $ktCO_{2e}$ (by 2025).
3	**Implementation of Rural Electrification Programme**	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.	63 $ktCO_2$ /pa (once the target has been met in 2020)
4	**Implementation of transport focused NAMAs**	In one NAMA feasibility study, road network development is identified as a first objective which will reduce the number of kilometres	Road network development is 33 $ktCO_2$/pa,

No	Name of activity	Objectives of the activity	Estimated CO_{2eq} reductions
		travelled by all vehicles. The second objective is to increase the use of public transport compared to the business as usual (BAU). In addition to a reduction in GHG emissions the activity will lead to a reduction in NO_X and SO_x emissions which will have significant co-benefits such as improvement in air quality which in turn will have positive impacts on human health.	and 158 $ktCO_2$/pa for public transport development
5	**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.	16,284 $ktCO_2$ per annum (2020-30)
6	**Implementation of climate change action plans**	To build capacity to monitor and evaluate policy implementation success, with a view to producing new policy, guidance and data. The objective is to develop and implement effective, efficient and economically viable climate change mitigation and adaptation measures.	To be estimated as part of the implementation plan

2.2 Ambitious and Fair

Lao PDR's GHG emissions are very low in the global context, and its historic contribution to climate change has been minimal. Despite this and its status as a Least Developed Country (LDC), the Government of Lao PDR intends to implement policies that support the long term goal of limiting global GHG emissions in line with the objectives of the UNFCCC and the findings of the IPCC's 5th Assessment Report. These represent the first time that Lao PDR has made an international undertaking to take action on mitigation and therefore fulfils the requirements of the Lima Call for Climate Action to go beyond existing efforts.

In order to maximise the ambition of its mitigation contribution while taking into account the need for economic development, Lao PDR has prioritised mitigation actions that both address the main causes of future increases in emissions and also have significant development co-benefits. This is considered to be a fair approach to the nation's first INDC. Forestry based actions will not only increase the amount of GHG sinks in Lao PDR, but will also provide adaptation co-benefits contributing to prevention of flooding, soil erosion and landslides, protection of biodiversity and ecosystem services. Improving public transport will not only result in less GHG emissions as a result of travel, but will also improve air quality and support more sustainable economic growth. The rural electrification programme will reduce GHG emissions, promote rural development and reduce poverty. Finally, the export of hydropower to other countries in the region will allow their economies to grow in a more sustainable manner, by replacing consumption of fossil fuels.

This INDC includes a mix of plans which are being undertaken by the Government of Lao PDR including those supported by overseas development assistance. Lao PDR is also implementing other relevant national and local plans such as the allocation of approximately USD 12 million annually for disaster emergency response plans. This demonstrates that Lao PDR is not content to wait for international support to take action on climate change. However, reforestation and maintenance of forests for example is a major challenge for a country such as Lao PDR, so there is strong desire to achieve success with international programmes and assistance such as REDD+ and FLEGT.

Overall, in order to achieve maximum mitigation potential, further international support is required by Lao PDR. The main support needs are as set out in the Section 4 and Annex 1 of this INDC.

3 Adaptation

As set out in the vision for the NSCC referred to in Section 1, Lao PDR intends to balance its need for development without compromising its environment. For climate change adaptation this translates into the following goals which are articulated in the NSCC:

- Increase resilience of key economic sectors and natural resources to climate change and its impacts
- Enhance cooperation, strong alliances and partnerships with national stakeholders and international partners to achieve national development goals
- Improve public awareness and understanding of various stakeholders about climate change, vulnerabilities and impacts in order to increase stakeholder willingness to take actions.

Lao PDR's economy is already experiencing the impacts of climate change, and the majority of population remains highly vulnerable to climate hazards in particular floods and droughts. This is because Lao PDR's economy and over 70% of population depends on natural resources for their livelihoods and to ensure food security. The agriculture sector is responsible for 29.9 % of GDP and approximately 70% of the population are dependent on the sector for their livelihoods. Increasing climate resilience with respect to agriculture is therefore a high priority especially food security. Another high priority is the provision and management of water resources as this contributes to social wellbeing, economic productivity and water supply for agriculture, industrial processes and energy production.

Flooding is a major climate risk in the country, threatening livelihoods almost every year. 14 out of 17 provinces as well as the Vientiane capital have experienced floods since 1995. The country's annual rainfall is expected to increase its variability which, accompanied with increase in temperature could have significant impact on water resources, ecosystems and agricultural production. In addition floods have an adverse impact housing, health and education, industrial activities, and infrastructure (transportation, water and sanitation). As an example the flooding in 2005 caused widespread disruption and the estimated economic costs were USD 29 million[3].

Lao PDR is also experiencing increasingly frequent episodes of drought. Severe drought occurred in 1996, 1998 and 2003. It is estimated that 6 out of 17 provinces are already at high risk of droughts. Droughts adversely affect water resources, hydroelectricity generation and agricultural production resulting in widespread economic losses.

[3] Lao PDR Second National Communication (2013)

The National Adaptation Programme of Action (2009) maps out a country-driven programme to address immediate and projected climate change adaptation requirements in the agriculture, forestry, water resources and public health sectors. The adaptation programme was further developed in the NSCC to cover the main sectors of the economy which are identified as the agriculture and food security, forestry and land use change, water, energy and transport, urban development, industry and public health sectors, which are intended for implementation by 2020.

One of the guiding principles of the NSCC is to develop and implement integrated adaptation and mitigation solutions, i.e. that are low-cost, improve energy efficiency, promote cleaner production, and provide adaptation/mitigation synergies as well as economic, environmental and socioeconomic benefits. Hydroelectricity has great potential in Lao PDR providing clean energy, an opportunity to reduce GHG emissions and also meet other objectives such as flood, irrigation and water supply management. The forestry sector contributes to both national economy and also livelihoods of many Laotians for example. Sustainable forest management therefore improves the resilience of communities and ecosystems and at the same time reduces GHG emissions by absorbing carbon dioxide.

In order to work towards achieving the NSCC's vision and goals and effectively implement the climate change action plans for all sectors, development of an M&E system is an immediate need for Lao PDR. Table 2 and Annex 2 reflect the nation's adaptation priorities given the current understanding of expected climate impacts. These actions will be continuously assessed and improved when monitoring and evaluation (M&E) data and new information about climate change and impacts become available.

Table 2: Focus of Adaptation Projects in Key Sectors

No	Sector	Focus of Projects and Programmes
1	**Agriculture**	• Promote Climate Resilience in Farming Systems and Agriculture Infrastructure • Promote Appropriate Technologies for Climate Change Adaptation
2	**Forestry and Land Use Change**	• Promote Climate Resilience in Forestry Production and Forest Ecosystems • Promote Technical Capacity in the Forestry Sector for Managing Forest for Climate Change Adaptation
3	**Water Resources**	• Strengthening Water Resource Information Systems for Climate Change Adaption • Managing Watersheds and Wetlands for Climate Change Resilience • Increasing Water Resource Infrastructure Resilience to Climate Change • Promotion of Climate Change Capacity in the Water Resource Sector
4	**Transport and Urban Development**	• Increasing the Resilience of Urban Development and Infrastructure to Climate Change
5	**Public Health**	• Increasing the Resilience of Public Health Infrastructure and Water Supply System to Climate Change • Improving Public Health Services for Climate Change Adaptation and Coping with Climate Change Induced Impacts.

4 INDC Development Process and Implementation Plan

This INDC has been prepared through an inclusive stakeholder consultation process including line ministries, research insitutions, civil organizations, provincial governments, private sector and international development partners. The main sources of information to prepare this document were the 7th and 8th five year National Socio-Economic Development Plan 2011-2015 and 2016-2020 , with a Vision to 2030 (2011 and 2015), National Climate Change Strategy (2010), Forestry Strategy to the Year 2020 of the Lao PDR (2005), Renewable Energy Development Strategy (2011), Sustainable Transport Development Strategy (2010), Climate Change Action Plan of Lao PDR for 2013-2020 (2013), National Adaptaion Programme of Action (2009) and the Second National Communication to the UNFCCC (2013) and Investment and Financial Flows to address climate change in Energy, Agriculture and Water Sector (2015).

The cross-ministerial National Disaster Management Committee (NDMC) will oversee the overall implementation of the INDC. Using the NDMC's existing structure, the Ministry of Natural Resources and Environment (MoNRE) will act as secretariate. This will involve coordination with relevant ministries and cooperation with international stakeholders to access finance and capacity building for the implementation of the INDC including the establishment and implementation of MRV.

MoNRE will disseminate the INDC and later the results of the COP 21 to relevant ministries in the central and line agencies in the local levels. The INDC will also be incorporated in the 8th National Socio-Economic Development Plan to ensure the continued mainstreaming of climate related policy in overall national plans.

The INDC will be implemeneted in a coordinated manner with the NCCS, climate change action plans and the sectoral plans. The current climate change action plans run until 2020 and Lao PDR will start devising the next set of action plans to continue to implement the NCCS before the end of the year 2020. Details of the implementation of the mitigation and adaptation actions identified in Sections 2 and 3 of this INDC are set out in Annexes 1 and 2 respectively.

To facilitate the implementation of the INDC and ensure climate change action plans are executed in the most effective, efficienct and economic manner, MoNRE will carry out four elements as follows:

1. **Overall strategy, coordination of INDC implementation and regulatory framework:** will be established by MoNRE. Effective arrangements for liaison with line ministries responsible for aspects of the INDC, international stakeholders and development partners, at national and local levels to facilitate implementation of the INDC will be put in place. This will also include strengthening the policy and regulatory framework especailly continue development and promulgation of the Climate Change and Disaster Law, which is expected to be in 2017. This law will be a continuum for earlier achievements on climate change polices and plans such as the Environmental Protection Law, Revised Urban Planning Law, Strategic Plan on Disaster Management 2020 (2003) and the National Strategy on Climate Change (2010).

2. **Capacity building**: one of the biggest requirements above all is to instigate the development of technical capacity – not just across sectors, but at all levels of engagement from central government decision-makers through to local levels and technical staff. In mitigation capacity building is needed for example in feasibility studies, mitigation analysis and policy development.

Regarding adaptation capacity building is needed in understanding the climate change impacts, adaptation measures including technical requirements of the adaptation measures such as drought- and flood-resistant varieties of crops, research into new crops and climate resilient technologies as well as on how the adaptation measures will impact on communities and environments.

3. **Finance:** in summary, there are broadly eight main steps that will need to be followed in order to ensure that domestic and international finance is successfully acquired, utilised and accounted for[4]:

   a. Assess needs, define priorities, and identify barriers to investment
   b. Identify policy mix and sources of financing
   c. Identify access routes to multilateral finance
   d. Blend and combine resources
   e. Formulate projects, programmes and sector-wide approaches to access finance
   f. Implementation and execution of planned action
   g. Implementation and management of project coordination systems
   h. MRV / M&E of climate finance

With respect to domestic resources for climate action, Lao PDR has apportioned USD12.5 million for climate change which represented approximately 0.14% of GDP in 2012. In order to implement the mitigation actions and address adaptation needs international support in the form of financial, technology transfer and capacity building is needed. An initial estimate of the financial needs for implementing identified mitigation and adaptation policies and actions is US$ 1.4 billion[5] and US$ 0.97 billion[6], and details are provided in Annex 1 (mitigation) and Annex 2 (adaptation) respectively.

4. **Monitoring, Reporting and Verification (MRV):** an MRV system is the cornerstone of effective national implementation as it allows progress against implementation plans to be demonstrated and provides data for learning for future project development. Lao PDR recognises that its capacity with respect to MRV requires development if the climate change goals set out in this INDC are to be realised. Specifically, a GHG inventory system, NAMA MRV framework, adaptation evaluation indicators and tracking systems for climate finance need to be developed. In the immediate term, in order to develop MRV system, Lao PDR intends to carry out the following:

[4] http://www.tr.undp.org/content/dam/turkey/docs/Publications/EnvSust/UNDP-Readiness_for_Climate_Finance.pdf

[5] The cost was calculated based on the cost estimated in the Investments and Financial Flows to Address Climate Change in Energy, Agriculture and Water Sectors; the Forestry Strategy to the year 2020 of the Lao PDR, Renewable Development Strategy in Lao PDR; Country Partnership Strategy between ADB-Lao PDR, 2012-2020; Mitigation Cost in Different Sectors presented in the IPCC Fourth Assessment Report; Resources Requirements for Aichi Targets 11-Proected Areas; Global Review of the Protected Area Budget ad Staff and expert judgements.

[6] The cost was calculated based on the cost estimated in the Investments and Financial Flows to Address Climate Change in Energy, Agriculture and Water Sectors, NAPA and expert judgements.

- **Readiness assessments**: these will identify the current state and barriers on data, organisational arrangements, personnel capacity, national policies, and any existing domestic MRV systems.
- **Capacity building**: once the readiness assessment is complete, a capacity development plan will be produced and implemented, and tools will be provided in order to carry out MRV inclusively.

Annex 1: Mitigation Measures

Please note that investment estimates will need to be investigated further as one of the first steps of implementing the INDC. Figures presented in these Annexes are indicative estimates.

Forestry Strategy to the Year 2020 of the Lao PDR	
Description	Trees and forests are GHG sinks, i.e. they absorb carbon dioxide. They also preserve land quality which mitigates the risk of flooding and landslides. Increasing and maintaining total forest cover therefore has significant mitigation impacts and development co-benefits.
Objectives	The objective of this activity includes increasing total forest cover to 70% of land area (i.e. to 16.58 million hectares). Once the target is achieved, emission reductions will carry on beyond 2030 as forest cover is maintained.
Base year	2000
Methodology for assessing base year and anticipated future emissions	Please refer to the calculations presented in Lao PDR's Second National Communication to the UNFCCC, chapter 4, sections 4.4.2 and 4.4.5 and the Technology Needs Assessment (2013). The base year of 2000 is selected as this is the latest emissions inventory calculated, which was part of the process of compiling the Second National Communication.
Anticipated emission reductions	If these measures are implemented effectively, the country successfully increases its natural forest coverage to 70 percent (about 16.58 million ha) with additional 500,000 ha of plantation, logging and conversion forest under control until 2020. In this scenario, the forests in the Lao PDR would be able to sequestrate about 60,000-69,000 $ktCO_2e$ by 2020.
Plan to Achieve the Goal	• Implementation of the plans set out in the Forestry Strategy to the Year 2020 of the Lao PDR. As the strategy runs until 2020, Lao PDR will start revising the next set of action plans to maintain forest cover at 70% after the target date of 2020. Work on developing the new strategy will begin in 2018. • Implementation of REDD+ programme which has provided a framework for the development of the forestry sector in Lao PDR since around 2007. As early as 2009, a number of REDD+ pilot activities and projects supported through development partners were initiated, and in 2010, Lao PDR became one of the first pilot countries under the Forest Investment Program (FIP) too which is a multilateral programme under the Climate Investment Funds (CIFs). • Implementation of the voluntary partnership agreement (VPA) which is bilateral trade agreement between the EU and a timber-exporting country outside the EU, that the Government of Lao PDR announced its interest in negotiating a VPA in February 2012. • Continue to carry out the Forest Law Enforcement, Governance and Trade (FLEGT) which has begun since October 2013, with support from Germany´s agency for international cooperation (GIZ).
Main barriers for implementation	• Ineffectiveness of existing forest management systems including law enforcement especially on forest harvesting, conversion as a result of development projects, collection and management of forest fund • Forest inspection system is not systemized and effectively enforced • Resources and capacity for forest inventory, planning and restoration is limited • Poverty and limited livelihood options, leading to forest encroachment • Unclear or lack of policies and guidelines to promote forest restoration, and reforestation.
Support required	Capacity building, technology transfer and financial support on: - Law enforcement, - Forest monitoring and inspection system,

Forestry Strategy to the Year 2020 of the Lao PDR	
	- Forest restoration and rehabilitation, - Sustainable community forest management and agro-forestry for mitigation and poverty reduction, - Policy for investment on forest restoration, - Forest inventory and planning system, - Research on forest ecosystem, economic and best practices in relation to climate change mitigation.
Estimated cost	USD180 million [7] This is assuming that the cost for forest management is approximately 10.84 US$/ha[8, 9,10] . Note that this does not include costs related to plantations and therefore it provides a lower bound of the total cost related to this measure.

Implementation of Renewable Energy Development Strategy	
Description	The Renewable Energy Strategy (2011) outlines actions and plans to increase the use of small scale hydropower, solar energy, biomass, biogas, municipal solid waste to energy and wind technologies, as well as transport fuels (bioethanol and biodiesel) to provide clean energy to consumers.
Objective	• To increase the share of renewable energy to meet 30% of energy consumption by 2025. • To increase the share of biofuels to meet 10% of the demand for transport fuels by 2025.
Base year	2011
Methodology for assessing base year and anticipated future emissions	For further information please see the Renewable Energy Development Strategy (2011) of Lao PDR. Note: these are preliminary estimates and will be reviewed and updated once technical capacity has been built and more reliable data is made available.
Anticipated emission reductions	1,468,000 $ktCO_{2e}$ (by 2025).
Plan to Achieve the Goal	The Renewable Energy Strategy was approved at the national level in 2011. The Ministry of Energy and Mines is the main agency responsible for renewable energy coordination and its main functions include the following: • Develop an overall renewable energy policy and support the achievement of sustainable development goals • Set-up objectives and goals based on resource potentials and develop renewable energy database • Carry out studies and demonstration projects utilising renewable energy technologies. In addition, other ministries have responsibilities under the Renewable Energy Strategy:

[7] The Forest Strategy to the year 2020

[8] Current cost of forest management especially protected area management in Laos is estimated to be few US$ per ha

[9] The global mean budget for protected areas is $893 per km² in 1996 US$. The developed countries mean is $2,058 per km² while the developing countries mean is $157 per km² (WCPA, 1999).

[10] Estimated costs to develop and manage protected area effectively are: a) a low scenario of US$8,000/km²; b) a medium scenario of US$16,000/km²; and c) a high scenario of US$24,000/km² (Ervin and Gidda, 2012).

Implementation of Renewable Energy Development Strategy	
	• The Ministry of Agriculture and Forestry, in collaboration with Ministry of Natural Resource and Environment and provincial authorities, will determine and develop policies related to the most effective use of lands for plantation of crops for fuel and industrial uses, carry out participatory land use planning and local land use zoning, and monitor and enforce the implementation of the policy • The Ministry of Natural Resources and Environment is responsible for undertaking research on the use of water resources and will collaborate with the Ministry of Energy and Mines on studies concerning production of hydrogen fuels. Further, they are responsible for developing and enforcing requirements and guidelines and to minimise the environmental and social impacts of renewable energy development through oversight of Initial Environmental Examinations and carrying out environmental impact assessments • The Ministry of Science and Technology has the role of conducting research and pilot tests on science and technologies developed from different countries, for renewable energy applications • The Ministry of Industry and Commerce facilitates the importation of equipment and machinery, seeds and vehicles related to the development of renewable energies, as well as supporting the construction of gas stations for biofuel distribution • The Ministry of Public Works and Transportation will be responsible for the introduction of policies that promote the use of alternative fuels in individual vehicles, public transportation systems, freight and air transport • The Ministry of Finance determines appropriate tax and duties policies for land use, vehicles and equipment to be used for renewable energy projects while at the same time assisting in raising funds for renewable energy development • The Central Bank of Lao PDR will consider carbon credits and low interest loans as sources of financing for renewable energy projects and activities, agricultural promotion and fuel crops plantation development and projects carried out by small and medium enterprises. Regarding implementation, the first step would be an assessment and update of the Renewable Energy Strategy including analysis of: i. Resources available, identifying gaps and opportunities for improvements in technology selection and sources. Specifically, the gaps that require analysis in Lao PDR include: i. Political, legal, regulatory and institutional gaps ii. Economic, financial and market gaps iii. Technology, human capacity and infrastructure gaps j. Current levels of deployment and their management k. Current targets for supply and how they are aligned with demand forecasts l. Support policies such as feed-in tariffs, tax incentives and import duties m. Market readiness to encourage investment by the private sector. As a result, Lao PDR's energy focal points and related organisations will be able to comply with all related international agreements with respect to energy supply and trading. Its regulatory system would be strengthened, giving Lao PDR a more organised and authoritative voice when negotiating with potential partners.

Implementation of Renewable Energy Development Strategy	
Main barriers for implementation	• Lack of reliable data on renewable energy including its sub-sectors: e.g. actual potential and feasibility of each renewable energy source and optimal locations, • Knowledge and capacity on renewable technologies are limited, • Promotion and investment is limited, • Lack of policy to promote renewable energy technology development, import-export and subsidy mechanism.
Support required	• Strengthen capacity for research on the potential and feasibility of each renewable energy source and location • Strengthen financial mechanism, policy on promotion and development of renewable energy, technologies including its supply chain.
Estimated cost	USD 658.75 million[11] (2007-2030) including investment costs, operation and management costs and financial costs.

Expansion in the use of large-scale hydroelectricity	
Description	Lao PDR has great potential for hydroelectricity generation and is often referred to as "the battery of South-East Asia". Exporting of clean energy powers green growth in neighbouring countries and provides foreign exchange earnings and employment in Lao PDR.
Objective	The objective of this activity is to build large-scale hydropower plants to provide clean electricity to neighbouring countries. 2.3GW will be added by 2020 and increase total hydropower electricity production to approximately 5.5GW by 2020. In addition, Lao PDR has over 20GW of additional hydroelectricity capacity to be constructed after 2020.
Base year	2015
Methodology for assessing base year and anticipated future emissions	The estimate is based on the following assumptions: 85% of the hydropower electricity is exported to Thailand and Viet Nam. 1 MW generates 3.5 GWh and 1 GWh produces 3.6 TJ and the default emission factors is 0.67 tonnes of CO_2 per MWh . Note that this is a preliminary estimate and need to be reviewed and updated to address consistency and accuracy in analytical methods once more reliable data and information are available
Anticipated emission reductions	16,284 ktCO_2 per annum, once the target is reached in 2020.
Plan to Achieve the Goal	Implementation of the electricity export agreement along with development of a NAMA, and preparedness for future carbon market mechanism.
Main barrier for implementation	Limited budget and access to finance.
Support required	Capacity building and financial support for strengthening environmental safeguard systems, resettlements, dam safety, climate resilience and development of multi-purpose financial mechanisms.
Estimated cost	USD 320 million

[11] MoNRE, NDF and ADB, 2015. Investments and Financial Flows to Address Climate Change in Energy, Agriculture and Water Sectors

Rural electrification program	
Description	Rural communities require a clean and secure source of energy, particularly when there is no access to the electricity grid. By increasing the level of rural electrification, reliance on woodfuel and fossil fuels will be reduced.
Objective	Lao PDR has set a target of making electricity available to 90% of the households by the year 2020. Electrification has already improved from a low of 15% in 1995 to 73% in 2010.
Base year	2010
Methodology for assessing base year and anticipated future emissions	Nationally Appropriate Mitigation Action (NAMA) on Rural Electrification in Lao PDR, produced with support by the UNDP lays out the plans for the implementation of the NAMA which will assist Laos to meet its goal of 90% electrification by 2020. The estimate of the emissions based on following assumption: 90% or 1,108,609 households will be electrified by 2020. 60% of the household lives rural area and consumes on average 30 litres of kerosene and diesel per year. Therefore the achievement of the rural electrification goal would reduce the use of kerosene and diesel about 19.95 million litres. With the use of default value for net calorific value and emission factors, electrification in Lao PDR would reduce CO2 emissions of about 63 ktCO2 per year. Note that this is a preliminary estimate and need to be reviewed and updated to address consistency and accuracy in analytical methods once more reliable data and information are available
Anticipated emission reductions	63 ktCO2 per year
Plan to Achieve the Goal	Implementation of nationally appropriate mitigation action (NAMA), with the support from the United Nations Development Programme (UNDP) and measures on rural electrification particularly following five underlying concepts: • Maintenance and expansion of power supply based on economic efficiency, reliability, and sustainability, in order to promote economic and social development • Promotion of electric power development and expansion of electricity exports, in order to secure finances targeted by the government • Development and strengthening of laws and regulations, in order to effectively develop the electricity sector through the government, the private sector, or partnerships between public and private sectors • Increasing the nation's capabilities, while developing international-standard techniques, expertise, and experience • Achieving sustainable development by identifying impacts and responsibilities related to society and environment.
Main barriers for implementation	• Limited access, scattering resettlement and inexistence of integrated rural infrastructure development plan • Existing transmission networks are limited • Limited finance for development of rural electricity systems • Lack of comprehensive policy and facilitation to access to finance and private sector investment.
Support required	• Capacity building and financial mechanism for access to finance and resource mobilization • Financial support and investment in electricity grid expansion, system and facilities.
Estimated cost	USD160 million [12] (for transmission lines only) for the next five years.

[12] Asian Development Bank Country Partnership Strategy (2012-2016) for Lao PDR.

Implementation of transport focused NAMAs	
Description	Systematic development of a road network and provision of buses to meet increasing demand for travel will mitigate GHG emissions while promoting economic development.
Objective	The objective of road network development is to provide better networks so that vehicle kilometres travelled will be reduced against the business as usual (BAU) scenario. In addition to reduction in GHG emissions, the activity will lead to a reduction in NO_x and SO_x emissions which will have significant co-benefits such as improvement in air quality which in turn has positive implications for human health.
Base year	2007
Methodology for assessing base year and anticipated future emissions	The reference scenario is determined as BAU which is the scenario reflecting traffic volume trends between 2007 and project start. The scenario is pre-determined and based on transport demand forecast surveys conducted prior to the project's implementation. The Japan International Cooperation Agency (JICA)-supported NAMA document from which projections are taken employs the ASIF (activity-structure-intensity-fuel) approach to calculate emission reductions *ex-ante.*
Anticipated emission reductions	A feasibility study for a JICA proposed NAMA estimates that emission reductions due to road network development is approximately 33 kt CO_{2e}/pa, and emission reductions due to public transport development 158 kt CO_{2e}/pa by against BAU by 2025, using 2007 as a base year for comparison.
Plan to Achieve the Goal	The actions are to be completed as part of a NAMA. Projects in road network development, public transport development and transport management sectors are planned to be implemented in three phases; short, medium and long term.
Main barriers for implementation	• Uncertain or unclear carbon market and mitigation incentives; • Limited budget for road network and transport system improvement; • Existing road network is rather complicated and it has not been integrated sustainable urban planning. Improving existing one might take time and costly.
Support required	• Capacity building on: - Sustainable and integrated urban planning - Law enforcement - Financial models for road planning - Traffic controls - Sustainable and climate resilient transport / technologies. • Access to favourable terms for infrastructure funding.
Estimated cost	USD 105 million (until 2020)

Annex 2: Adaptation Measures

Agriculture	
Objective 1 and related activities	**Promote Climate Resilience in Farming Systems and Agriculture Infrastructure** • Improve appropriate resilient agricultural farming system practices and technologies to address climate change impacts • Develop and improve crops and animal diversification and resilience especially in the risk, flood and drought areas.
Objective 2 and related activities	**Promote Appropriate Technologies for Climate Change Adaptation** • Promote and enhance development of appropriate technologies to cope with climate change. This may include the conservation of agricultural soil, animal health and disease outbreak monitoring and control, long term feed storage improvement, climate resilience crops, efficient water use cropping systems, short rotation cropping and maximising the use of indigenous climate resilient knowledge. • Upgrade agricultural research and extension services to define and promote existing agricultural practices to reduce the negative effects of climate change • Promote two seasons rice cultivation in flood area by adaptive and short rotation rice verities • Promote appropriate techniques for crop and animal productions and meteorological-agricultural technologies in natural disaster risk areas.
Main barriers for implementation	• Limited knowledge, capacity and technology on appropriate conservation farming systems, integrated and sustainable agriculture, agro-forestry, soil degradation and quality restoration, pest outbreak management and tolerant crops and different animal varieties • Limited information, knowledge and capacity on the vulnerability assessment of the conservation farming systems, integrated and sustainable agriculture on mitigation and adaptation • Ineffective law enforcement especially land concession, conversion, chemicals and environmentally friendly agriculture • Lack of comprehensive land development policy including effectiveness • Limited budget on promotion and investment on climate resilient agriculture
Support required	• Capacity building including research on appropriate conservation farming systems, integrated and sustainable agriculture, agro-forestry, soil degradation and quality restoration, pest outbreak management and tolerant crops and different animal varieties. • Financial support to pilot and promote appropriate conservation farming systems, integrated and sustainable agriculture, agro-forestry, soil degradation and quality restoration, pest outbreak management and tolerant crops and different animal varieties -
Estimated cost	USD709 million [13] (2007-2030).

Forestry and Land Use Change	
Objective 1 and related activities	**Promote Climate Resilience in Forestry Production and Forest Ecosystems** • Develop and enforce appropriate laws, regulations and implement guidelines for sustainable forest management • Strengthen capacity in integrated land use planning, watershed forest management, reduction of slash and burn practices to increase the resilience of forests to cope with climate change • Promote integrated actions on watersheds, reservoir management, water storage for agro-forestry, wildlife management, fisheries and tree varieties, prevention of drought

[13] MoNRE, NDF and ADB, 2015. Investments and Financial Flows to Address Climate Change in Energy, Agriculture and Water Sectors.

Forestry and Land Use Change	
	• Forest surveys and allocation for sustainable management and rural development • Strengthen the capacity of technical staff and village forest volunteers to enable optimal planting, managing and utilising community forests in response to climate change • Promote forest seed and seedling production for reforestation and forest restoration • Research and select forest species which are resilient to pests, diseases, drought, and soil erosion.
Objective 2 and related activities	**Promote Technical Capacity in the Forestry Sector for Managing Forests for Climate Change Adaptation** • Increase awareness and technical capacity of village forest volunteers on climate resilient natural forest management, agro-forestry and plantation technologies • Assess capacity limitations and needs in the management of the forestry sector in relation to climate change adaptation

Main barriers for implementation	• Limited knowledge and capacity on climate change impact on the forest sector, on adaptation technologies such as ecosystem-based approaches, on climate resilient flora and fauna species and sustainable forest management for addressing climate change impacts and wood demand management
	  • Capacity on sustainable production forest and ecosystem management is limited
	  • Sustainable production forest law enforcement and management is ineffective
	• Lack of financial support and investment

Support required	• Strengthening capacity building on planning and establishment of information management systems, development of an action plan for different types of forests and technologies; climate change adaptation technologies e.g. ecosystem-based approaches, resilient species and forest systems; sustainable production forests and ecosystem-based forest management techniques; access to international finance and systematic sector investment planning • Strengthening capacity building for access to international finance and systematic sector investment planning • Financial support and investment in commercial forest carbon projects including financial mechanism, market, technology, calculation and monitoring.
Estimated cost	USD40.5 million [14] (until 2020)

Water resources	
Objective 1 and related activities	**Strengthening Water Resource Information Systems for Climate Change Adaptation** • Strengthen information gathering, modelling and vulnerability assessment for climate change in priority river basins in Lao PDR; • Develop and implement reliable early warning flood systems, reporting and information disseminating services.
Objective 2 and related activities	**Managing Watersheds and Wetlands for Climate Change Resilience** • Strengthen the protection of watersheds to safeguards and moderate downstream flow during periods of high and low flow; • Study and promote the conservation of wetlands as part of a climate resilient ecosystem-based approach.
Objective 3 and related activities	**Increasing Water Resource Infrastructure Resilience to Climate Change** • Develop and strengthen standards and procedures to ensure the safety of dams and other water resource related infrastructure; preparation of investment plans for upgrading and safeguarding infrastructure for water resource management

[14] National Adaptation Programme of Action, NAPA, 2009

Water resources	
	• Design and build multi-purposes dam and reservoirs to ensure sufficient water supply in drought prone areas and seasons; • Construct / rehabilitate dykes and enhance river bank protection and irrigation systems to increase climate resilience.
Objective 4 and related activities	**Promotion of Climate Change Capacity in the Water Resource Sector** • Increase awareness and technical capacity of staff regarding climate change impact on water resources and appropriate technologies, and wetland management; • Increase capacity on water resource management for climate change adaptation; • Study water treatment which has ground water impacts, ground water and ecosystem
Main barriers for implementation	• Knowledge and capacity on climate change impacts on water resources, early warning systems, wetland management, climate resilient technologies and financial assessments are limited and inadequate • Early warning system and flood risk management is limited and adequate • Integrated watershed management is not effectively promoted Lack of comprehensive water storage and water quality plan • Lack of financial mechanism to access to finance, resources mobilization and investment.
Support required	Capacity and financial support for: • Flood/drought management and early warning systems • Development of a policy for dam safety and multi-purpose for water supply • Climate resilient water resources infrastructure • Law enforcement
Investment for adaptation	USD 44 million (until 2030)[15]

Transport and Urban Development	
Objective 1 and related activities	**Increasing the Resilience of Urban Development and Infrastructure to Climate Change** • Conduct climate risk audits for key infrastructure services; • Ensure flood protection and drainage design for urban infrastructure (roads, drains, flood protection works, water and wastewater facilities, landfills, hospitals, other public buildings) are adequate for climate change conditions; • Ensure that urban water supply systems have adequate design and operational standards for climate change impacts, including access to low flows in water sources, water treatment capability and flood protection; • Build storm surge / flood protection works for urban infrastructure
Main barrier for implementation	• Research, information and capacity on sustainable and climate resilient urban planning and development technologies • Limited knowledge and capacity on sustainable and climate resilient urban planning and development, and technologies, • Lack of financial mechanism, access and resources mobilization
Support required	• Strengthen human resources capacity and financial capacity on: - Development of financial and investment plan for implementation of climate resilient urban planning and development and technologies deployment - Mainstream appropriate climate resilient technologies in the environmental impact assessment

[15] MoNRE, NDF and ADB, 2015. Investments and Financial Flows to Address Climate Change in Energy, Agriculture and Water Sectors

Transport and Urban Development	
	Strengthen cooperation and partnership, financial mechanism, access to finance and resource mobilization
Investment for adaptation	USD190 million (until 2020)

Public Health	
Objective 1 and related activities	**Increasing the Resilience of Public Health Infrastructure and Water Supply System to Climate Change** • Development of climate resilient health related infrastructure and facilities such as health care centres, laboratories, rural water supply and sanitation systems • Increase capacity on climate change impact assessments, estimating financial needs, and implementing resilience plans in the health sector
Objective 2 and related activities	**Improving Public Health Services for Climate Change Adaptation and Coping with Climate Change Induced Impacts** • Improve education, research on climate change induced disease and health impacts, its treatments (by both modern and traditional methods), monitoring and reporting • Improve access to human resources and increase service coverage in vulnerable communities • Improve medical and food supplies, nutritional surveillance, drinking water improvement by better management of its supply network • Increase public and vulnerable community awareness on climate change induced health risks and provide advisory and warnings, enhance first aid and promote self-help and access to health care service of communities • Develop policies to increase the ability of vulnerable groups and the poor to access health services.
Main barrier for implementation	• Inadequate capacity to conduct climate change vulnerability and impact assessment, Inadequate capacity and human resources • Limited budget, quality and quantity of human resources.
Support required	• Capacity building on disease outbreak monitoring, response plans and human resource development planning • Technical and financial support on awareness raising on climate change impacts and health risks • Capacity and financial support to develop monitoring centres, laboratories, mobile teams and stations, treatment centres.
Investment for adaptation	USD5 million[16] (until 2020)

[16] National Adaptation Programme of Action, NAPA, 2009.