A proposal to develop a LCS scenario for **Luang Prabang City**

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Introduction

Complementing existing national level policy framework (2015 NDC)

the Decree on Climate Change (Sep 19th, 2019): defines principles, regulations, and measures on management, monitoring of climate matters

Simultaneously, the Decree states that climate change must be mainstreamed into the national socio-economic development plans, sectoral as well as local strategies and plans.

Introduction

2020 NDC (Nov 2020)

- National level 2030 unconditional mitigation target: 60% GHG emission reductions compared to baseline scenario, or around 62,000 ktCO2e.

The 60% GHG emission reductions national level 2030 target demonstrates the enhanced contribution of the country to the Paris Agreement, considering the 34% GHG emission reductions compared to the baseline scenario achieved in 2020.

- 2030 Conditional mitigation scenario and targets towards net zero emissions 2050

The conditional mitigation scenario and targets are the GHG emission reductions efforts that Lao PDR could achieve by 2030 contingent upon increased levels of financial support from developed country Parties.

GHG emissions from all sectors in Lao PDR

Legend:
- Baseline GHG emissions scenario (ktCO2e)
- Unconditional 2030 mitigation scenario (ktCO2e)
- Post 2030 unconditional scenario to be confirmed in future NDC (ktCO2e)
- Conditional net zero 2050 scenario (ktCO2)

Fig. 3. GHG emissions from all sectors
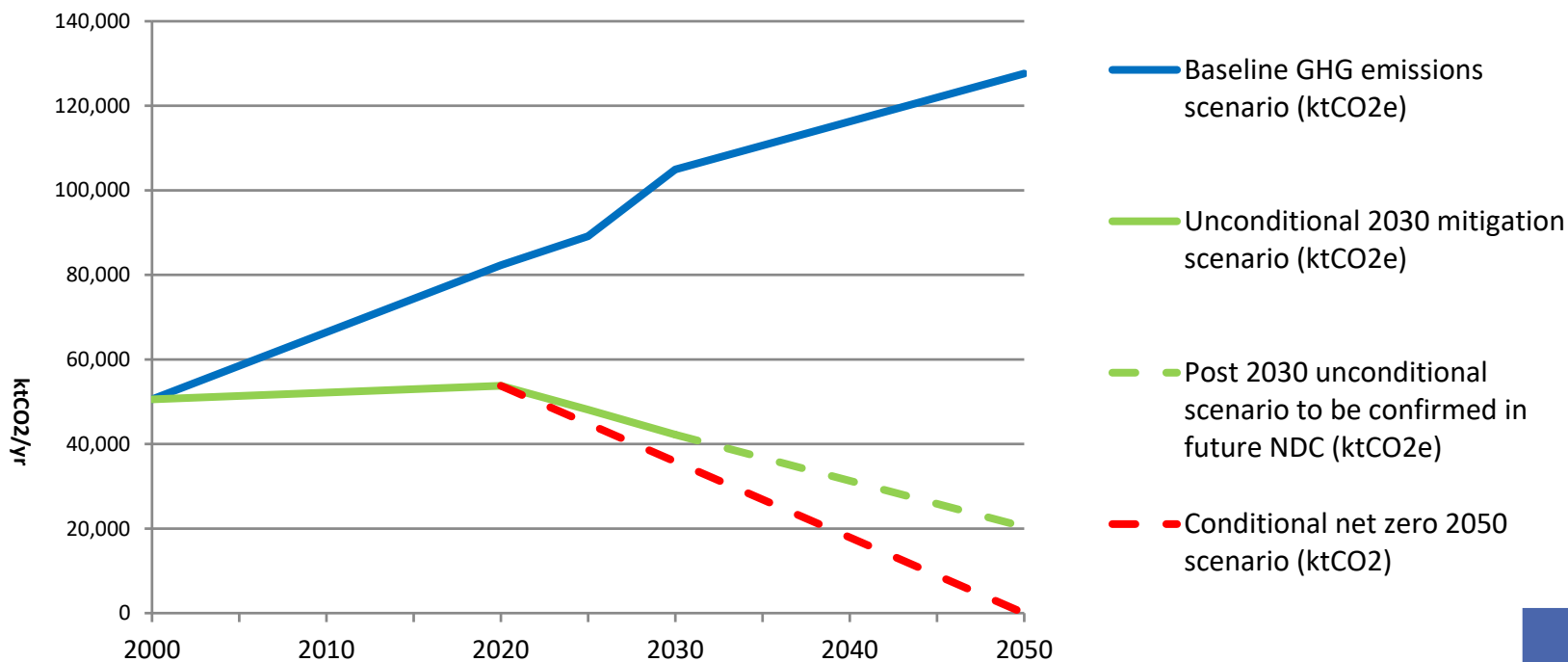
Source: NDC 2, Nov 2020

- Main sources of GHG emission are from AFOLU sector, however, the emission from energy sector is increasing significantly

Percentage of GHG emission			
	2000	2010	2014
AFOLU	96%	85%	78%
Energy	2%	10%	15%
IPPC	2%	4%	5%
Waste	0	1%	2%

Source: National inventory, 2000, 2010, 2014

Background of Luang Prabang Municipality

- Area: 760 km^2.

- Population: Approx. 92,000 persons.

- Luang Prabang is located in northern Laos at the heart of a mountainous region.

- Luang Prabang is an UNESCO World Heritage site

- In 2018, visitor arrivals to Luang Prabang more than 800,000 tourist.

- Received award for the best attraction destination from Wanderust Travel Magazine of England in **2006**, **2007**, **2008**, **2011**, **2012**, **2015** and **2017**.

Background of Luang Prabang Municipality

To 2025, vision to 2030:

– Upper-middle income and with innovative, green and sustainable economic growth

– Develop Luang Prabang to become central of tourism site, protecting sustainable world heritage site, includes ensure green and sustainable economic growth.

– Increase forest areas.

– Promote clean agricultural production.

Annual GDP growth rate and proportion of economic structure of Luang Prabang
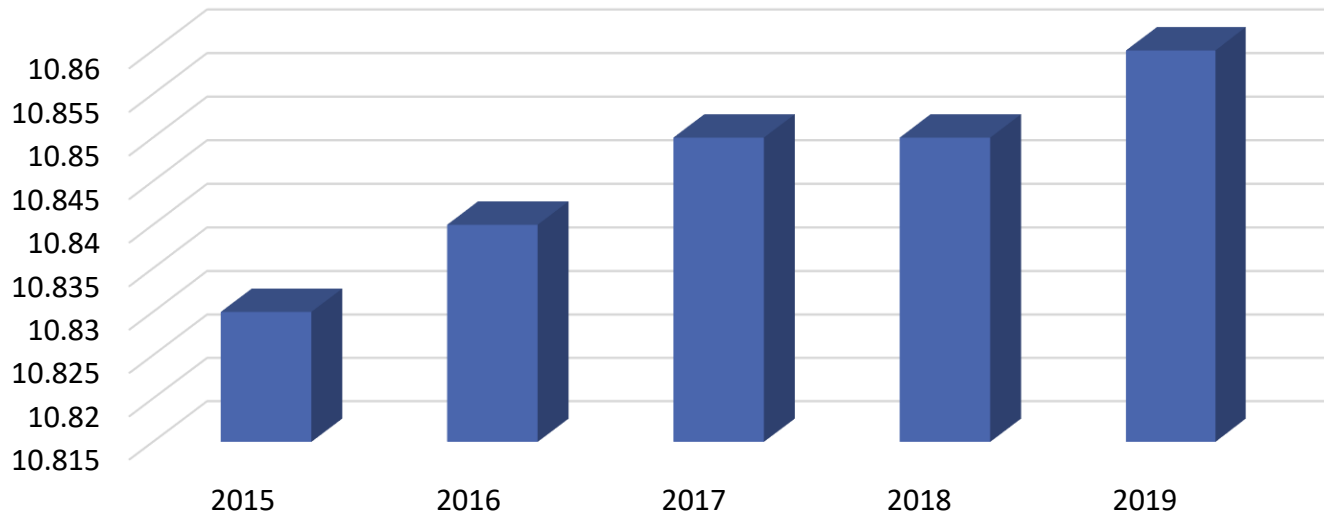
Fig. 1. Annual GDP growth rate

Source: Report on provincial social-economic development, 2020

- Average economic growth rate during 2015-2019 was 10% that very high growth needs to consider sustainably.

- Services are the main economic driver that means that urbanization growth have been very fast.
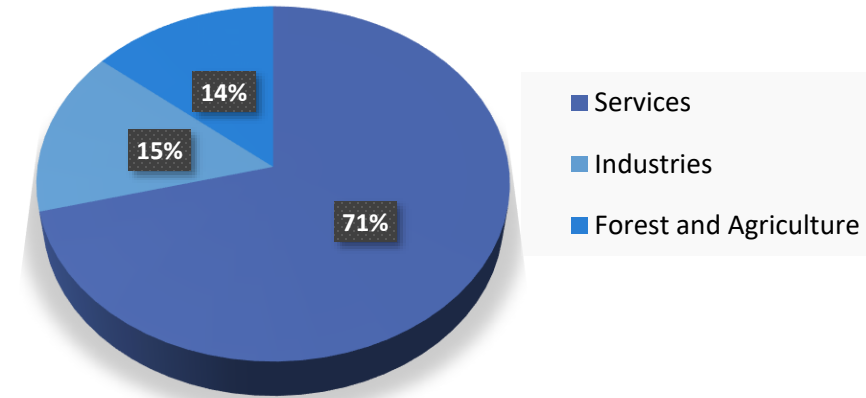
Fig. 2. Proportion of economic structure in 2019

Proportion of economic structure		
	2015	2019
Services	62	71
Industries	17	15
Forest and agriculture	21	14

GHG Inventory of Luang Prabang 2010

Total GHG emissions: 1,561 tCO_2e

Average emissions per employee: 22 tCO_2e

86% of GHG emission contributed by three major sectors:

- Waste and wastewater: 660 tCO_2e

- Materials and services: 293 tCO_2e

- Electricity and fuel: 92 tCO_2e

Source: The Bilan Carbone analysis for estimating GHG emissions by source for the Urban Development Administration Authority (UDAA) of Luang Prabang in 2010.

Objectives

- To design the Luang Prabang Low Carbon City (LCC) scenario

- To support enhancing the capacity of Low Carbon policy development of related organizations by introducing simulation models (AIM) to give comprehensive and consistent pathways

- To support Luang Prabang's government to develop actions and plans to achieve the national mitigation target.

Design Low Carbon City (LCC)

Policy Scenario development procedure

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                          ┌─────────────────────────────────┐      ┌──────────────┐
                          │  LCC visions (quantitative)     │ ◄─── │  ExSS        │
                          └─────────────────────────────────┘      └──────────────┘
┌──────────────┐          ┌─────────────────────────────────┐      ┌──────────────┐
│ LCC Scenarios│ ───────► │ Potential/Feasible Policy        │ ◄─── │  AIM/Enduse  │
│              │          │ interventions                    │      └──────────────┘
└──────────────┘          └─────────────────────────────────┘
                          ┌─────────────────────────────────┐      ┌──────────────┐
                          │ LCC Roadmaps to the vision       │ ◄─── │     BCT      │
                          │ from now                         │      └──────────────┘
                          └─────────────────────────────────┘
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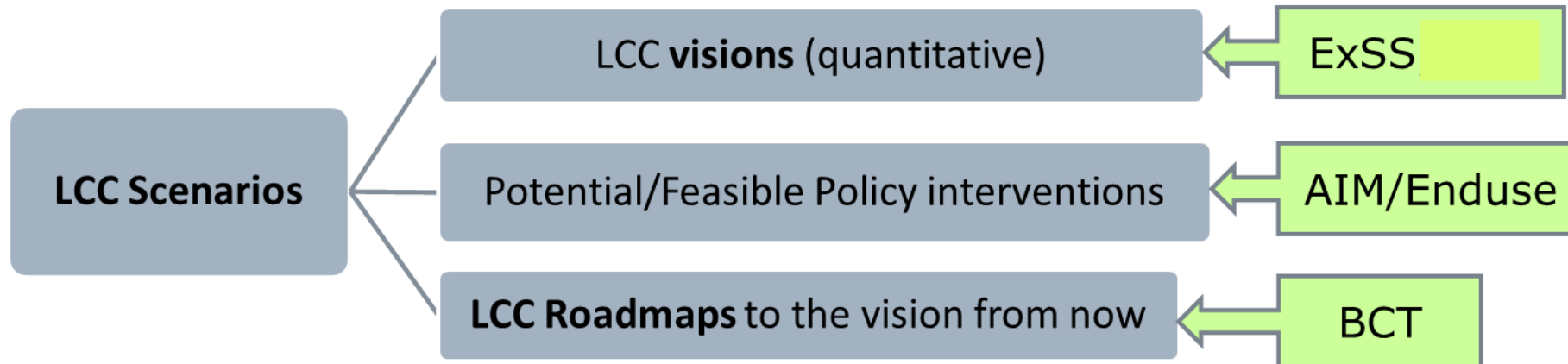
Definition of terms:

1. **LCC Scenario**: a plausible quantitative description of how the future LCC may develop based on a coherent and internally consistent set of assumptions on social, economic, and technology development and their relationships

2. **LCC Vision**: the future image and also quantitative design of a city (group of cities) under not only GHG reduction targets but also social, economic and environmental targets

3. **LCC Roadmap**: the pathway of when and how each policy should be implemented in order to achieve the vision

Framework of study (tentative)

Base year: 2015 (need to be discussed)

Target years: 2050 (follow targets of some development plans)

Sectors: Energy, Transport, Industry, Waste, (Agriculture, LULUCF)

Target GHG: CO_2, CH_4, N_2O

Scenarios:
- 2050BaU (Business as usual)
- 2050LCC (Countermeasure)

AIM/ExSS

ExSS (Extended Snapshot Tool) is a comprehensive estimation tool for socio-economic indicators and GHG emissions designed for a backcasting study.

Objectives of ExSS

◦ to illustrate quantitative future snapshot of a country, city, or region, especially as a low-carbon society

◦ to analyze relationship of socio-economic conditions, energy demand and GHG emissions

◦ to define a portfolio of the measures to meet the environmental target.

ExSS estimates

◦ socio-economic activity level of the sectors in future based on users' assumptions

◦ future GHG emissions in scenarios

◦ counter measures necessary to achieve the target

ExSS is a designing tool of a future society, rather than a projection or prediction of likely future.

Necessary information

Base year data
- ◦ Population and Household
- ◦ Input Output table (or, regional economic accounting)
- ◦ Transport demand (Passenger & Freight)
- ◦ Building
- ◦ Energy demand
- ◦ Energy supply
- ◦ etc.

Reference for future scenario: 2050BaU and 2050LCC
- ◦ Population projection
- ◦ Economic projection / planning
- ◦ Transport planning
- ◦ Energy strategy
- ◦ Potential of renewable energy
- ◦ etc.

Related projects /Researches

Luang Prabang	Luang Prabang: Climate change and rapid development	MatteoFumagalli	2020	Overview about the city
Laos	Urban-LEDS (Low emission development strategies)	UN-Habitat and ICLEI	2020	Participating cities: (Luang Prabang not included) Pakse Kaysone Phomvihane Outhoumphone Songkhone Sanasomboun Bachiangchaleunsouk
Luang Prabang	Project for Capacity Enhancement for Sustainable World Heritage Management and Preservation in Luang Prabang in Lao PDR	JICA	2020	
Luang Prabang	Estimation of Greenhouse Gas Emission from Landfill in Luangprabang, Lao PDR	Xaysackda Vilaysouk and Sandhya Babel	2013	57.75 Gg/year of MSW disposed on landfill, of which 83% is biodegradable material (food waste, garden waste, paper and textile), 2.42 Gg CH4 as GHG is produced
Luang Prabang	Benefits of improved municipal solid waste management on greenhouse gas reduction in Luangprabang, Laos	Xaysackda Vilaysouk and Sandhya Babel	2017	The lowest GHG emissions are achieved in the scenario where composting and recycling are proposed, with the total GHG emissions reduction by 18,264 tonnes/year CO2-eq.
Luang Prabang	REDD+ in Luang Prabang city	Japan Forest Technology Association, MURC, Marubeni Cooperation	2014	monitor the effectiveness of REDD+ activities and quantify the amount of GHG emissions reductions by REDD+ activities in a part of Phonxay District, Luang Prabang Province

Research	Region	Sector/Service	Parameter	Unit	Value in 2010	Value in 2015	Value in 2016	Value in 2017	Value in 2018	Value in 2019	Value in 2020	Forecast 2025	Forecast 2030	Reference
(JICA 2012) Basic Data Collection Study on Low-emission Public Transport System in Lao PDR	Luang Prabang		Population	thous.pers	82									https://openjicareport.jica.go.jp/pdf/12086088_02.pdf
			No. of households	Thous.households										
		GDP	GRDP (@ 2005 price)	bill.LAK	760.5									
			Primary	%	23.6									
			Secondary	%	17.1									
			Tertiary	%	59.2									
		Socio	Poor Household Rate	%										
			Unemployment rate	%										
		Infrastructure												
		Transport	Vehicle ownership											
			MC	No.	8963									
			Car	No.	4300									
			Public transport											
			No. bus fleet	No.	532									
			No. of bus route	No.	25									
			No. of bus paratransit	No.	283									
			Commuting mode	%										
			Walking	%	17.1									
			Bicycle	%	2									
			MC	%	63									
			Car	%	4									
			Minibus	%	0.2									
			Paratransit	%	12.3									
			Truck	%	1.4									
		Governance	Revenue	mill.LAK										
			Expenditure	mill.LAK										
		Power Supply	power coverage (2012)	%	100									
		Final consumption of households		bill.LAK										
		Final consumption of government		bill.LAK										
		Gross fixed capital formation		bill.LAK										
		Export		bill.LAK										
		Import		bill.LAK										
(AIT 2013) Action towards Resource-efficient and Low Carbon Cities in Asia: Experiences and Highlights		GHG inventory	Total emissions	tCe	337									
				tCO2e	1561									
			average emission per employee	tCe	6									
				tCO2e	22									
		Proportion of GHG emission from	Direct waste	%	53.9									
			Material & Services	%	24.7									
			Electricity & Fuel	%	7.5									
			Travel	%	4.9									
			Freight	%	4.6									
			Infrastructure & Asset	%	4.1									
			Airconditioning	%	0.3									

Research	Region	Sector/Service	Parameter	Unit	Value in 2010	Value in 2015	Value in 2016	Value in 2017	Value in 2018	Value in 2019	Value in 2020	Forecast 2025	Forecast 2030	Reference
(JICA 2020) The Study on Power Network System Master Plan in Lao People's Democratic Republic	Laos	Electricity Consumption (nationwide) - 2016	Total	GWh			5064						15500	
			Residential	GWh			1735						4175	
			Agriculture	GWh			36						28	
			Service	GWh			991						4055	
			Large industry	GWh			1342						7242	
			Non-large industry	GWh		960								
Lao PDR Energy Outlook 2020		Energy consumption (Nationwide)	Industry	Ktoe		643.79								
			Transport	Ktoe		870.23								
			other	Ktoe		1608.2								
(Ministry of Energy and Mines, 2016) Renewable Energy Data in Lao PDR		Renewable energy target	Electricity									728		
			Small hydropower	MW								400		
				Ktoe								256		
			Solar	MW								33		
				Ktoe								21		
			Wind	MW								73		
				Ktoe								47		
			Biomass	MW								58		
				Ktoe								37		
			Biogas	MW								51		
				Ktoe								33		
			Municipal solid waste	MW								36		
				Ktoe								23		
			Biofuels											
			Ethanol	ML								150		
				Ktoe								279		
			Biodiesel	ML								300		
				Ktoe								383		
			Thermal energy											
			Biomass	Ktoe								113		
			Biogas	Ktoe								178		
			Solar	Ktoe								109		
Renewable Energy Data in Lao PDR														
https://openjicareport.jica.go.jp/pdf/12087904_01.pdf														

Thank you for your kind listening!