

1. Background

- Two types of imported fossil fuels are being supplied for road transport in Laos and demand in fossil fuel has been increased every year (fig 1)
- The increasing number of vehicles in Laos resulted in increment of emission from energy sector
- Laos is currently facing with a rapid increase of vehicles, urban traffic congestion, increasing fossil fuels demand and city air pollution
- Electric vehicle (EV) technology is one of solutions is being considered and promoted.

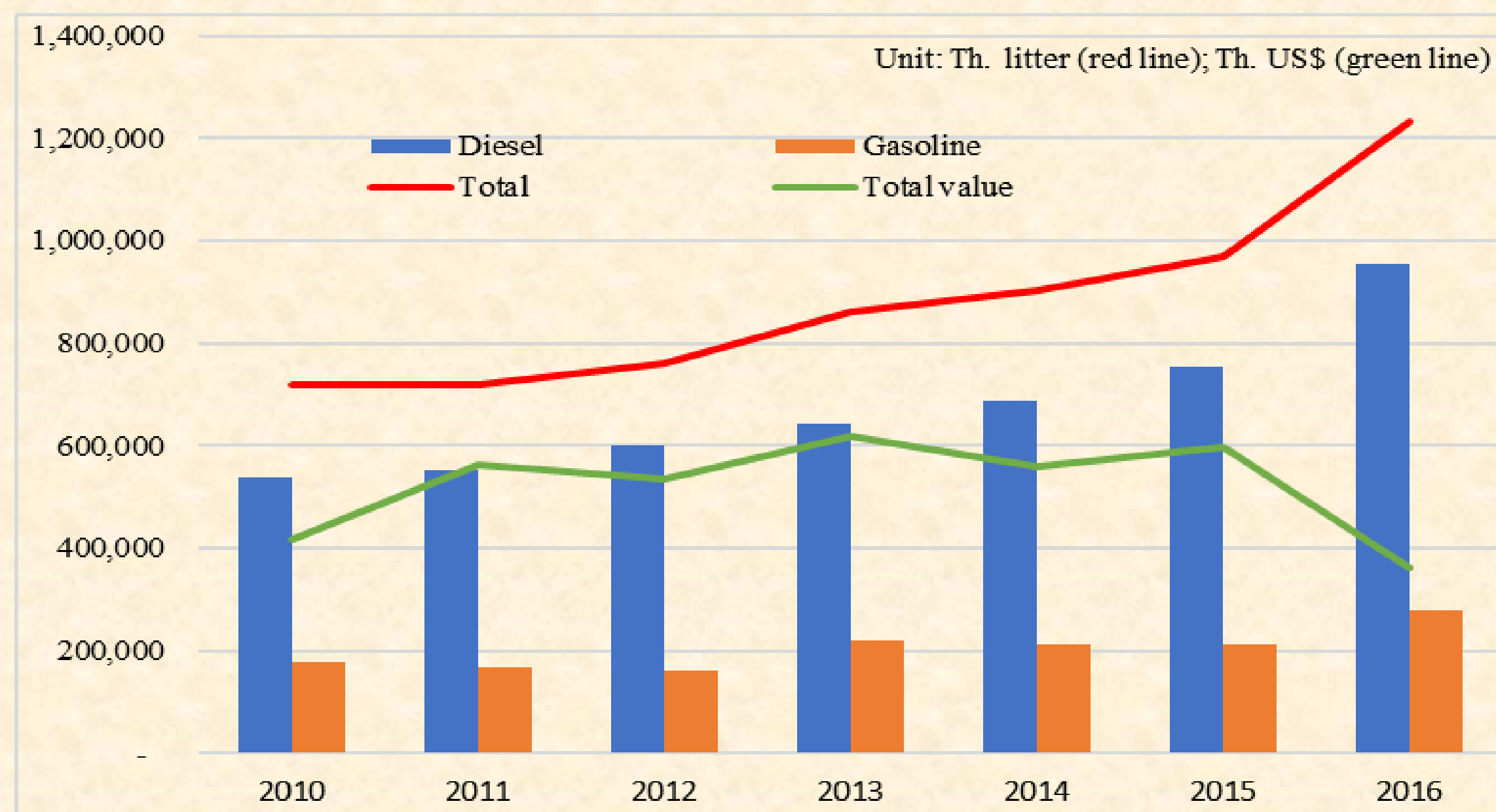
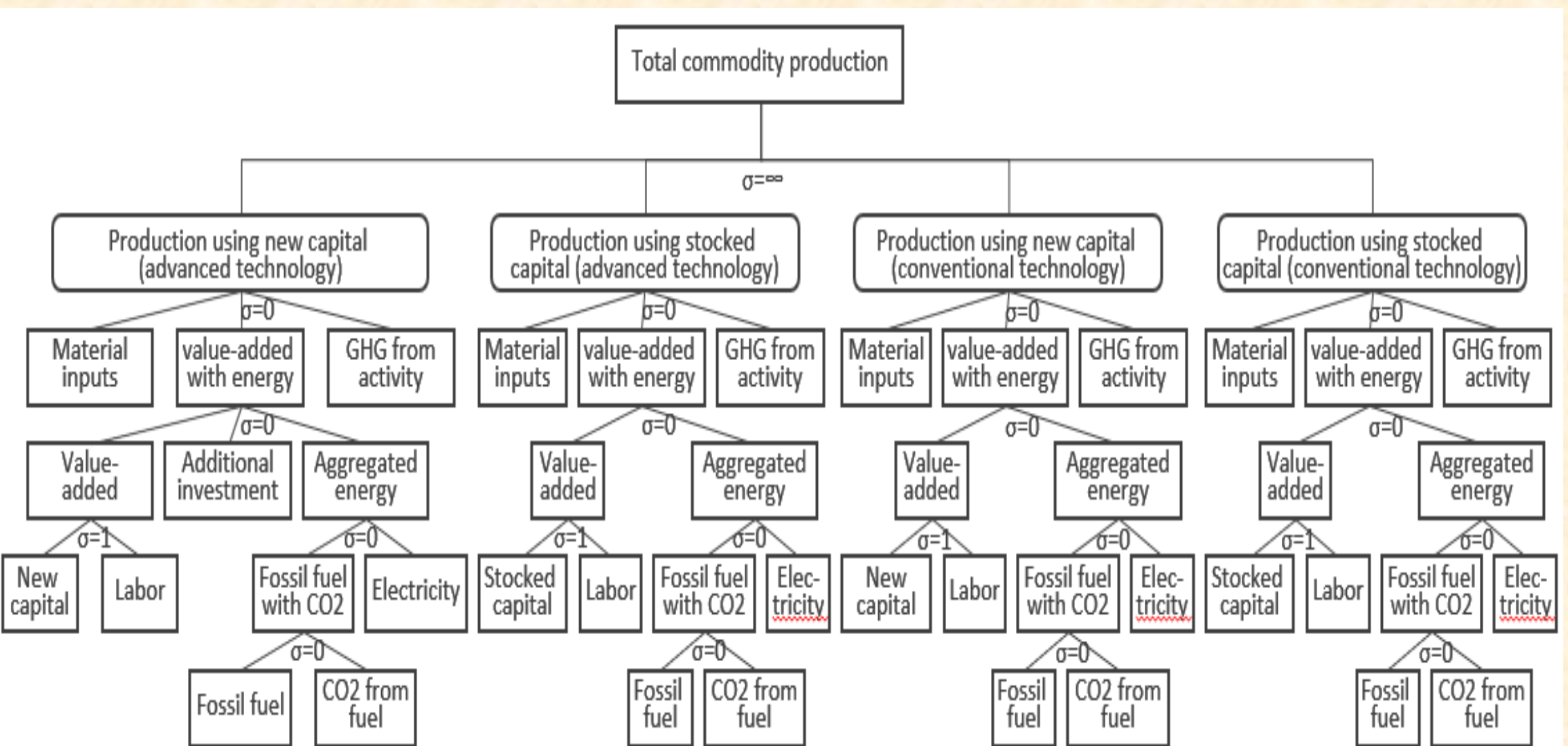


Figure 1. Import of petroleum products and value, 2010-2016
Source: Laos energy statistic, Ministry of Energy and Mines, 2018

- Table 2. shows the number of vehicles in Laos would have around 2.4 million vehicles in 2020, and 3.8 million, 6.6 million in 2030 and 2050, respectively.
- In 2019, the number of 2-wheelers was accounting for 75.2%; pick-up accounting for 12.9% of total registered vehicles. While the ratio of buses was only 0.2%.

2. Data and Methodology



Note: σ means elasticity of substitution among the inputs.
Stocked capital cannot be moved to other sectors, but new capital is decided internally to maximize the profit.
"Additional investment" must be paid when the advanced technology is introduced new. After installed, the additional cost is not needed.
Input-output coefficient is calculated year by year according to the deployment of new capital.

Figure 2. AIM/CGE [Laos] structure for this study

Table 1. Expectation of EV share and impacts

Description	Unit	2020	2025	2030	2050
Share of EV	%	0.1	14	30	50
Electricity demand	million (KWh)	7.07	994.4	1,709.9	214.6
Reduction of fuels import	Million (litter)	1.8	225	438.4	459.1
	million (US\$)	10.6	149.9	257.9	323.1
Reduction of trade balance	million (US\$)	1.1	195.3	283.0	350.9

Source: Strategy on Clean Energy Use in Transport Sector. Ministry of Energy and Mines. 2020

- In order to lessen the import of fossil fuel, government defined the ambitious EV penetrating targets by 0.1% begging in 2020 then the expected EV share is 14%, 30% and 50% by 2025, 2030 and 2050, respectively (as shown in table 1).

Table 2. Projection of vehicles in Laos

Vehicle types	Number of vehicles in Laos (Th. Vehicle)				
	2010	2019	2020	2030	2050
Motorcycle	804	1,656	1,796	2,788	4,773
Motor-tricycle	8	9	9	10	11
Sedan	21	84	5	170	321
Pick-up	109	284	306	512	922
SUV	24	60	64	104	185
Van	12	37	40	8	123
Truck	25	63	9	114	205
Bus	2	6	6	9	15
Total	1,008	2,202	2,388	3,778	6,558

Source: Author's projection

- The objectives of this study are to assess the impacts of EV promoting on the GDP and CO2 emission from road transport.
- In this study, we determined vehicles into two categories, namely, private cars and business cars. And EVs are assumed to penetrate to both vehicle types.

Method:

- The CGE model is applied to assess the penetration of electric vehicles in road transport in Laos.
- Conventional vehicles consume fossil fuels 100 percent. But EV will be able to be introduced as a new technology in the future. Therefore, we modified household sector and road transport sector to deploy EV technology to replace conventional vehicles.

- Under this modified CGE model, we assumed that the infiltration of EV technology can mitigate GHG emission from transport sector since electric vehicles consume clean energy.

Data:

- Laos IO table 2014 is used. The base year data is selected as year 2014.
- Additional input socio-economic data, in order to set a future scenario, are potential gross domestic product (GDP), the trade balance, capacity of power generation, and population growth.

Scenario analysis:

- Two scenarios are introduced; BaU scenario and EV scenario as a countermeasure scenario.
- In both scenarios, an average of GDP growth rate from 2020 to 2050 is assumed to be 5.7% per year. A population growth rate from 2020 to 2050 is assumed to be 1.2% per year.
- In BaU scenario, EV will not be introduced. On the other hand, in EV scenario, the EV technology will be introduced in both household sector and road transport service sector.
- In order to introduce the EV, each sector will need to pay more. In this analysis, the cost of EV is 50% more compare to the conventional vehicle, and these costs come from electric equipment including battery. Through the comparison of GDP and CO2 emissions in these scenarios, the impacts of EV in Lao will be assessed in this analysis.

3. Result and Discussion

- Fig. 3. shows the expected vehicle stocks. The private conventional cars are expected to increase by 40% in 2025, 48% in 2030 and 84% in 2050, comparing with based year 2014. While the private EV cars are expected to share about 6% in 2025, 18.9% in 2030 and 78% in 2050.
- Business conventional cars will increase by 65.3% in 2025, 74% in 2030 and 91.2% in 2050 comparing with base year 2014.
- Business EV cars are projected to be 6% in 2025, 20% in 2030 and 90% in 2050.

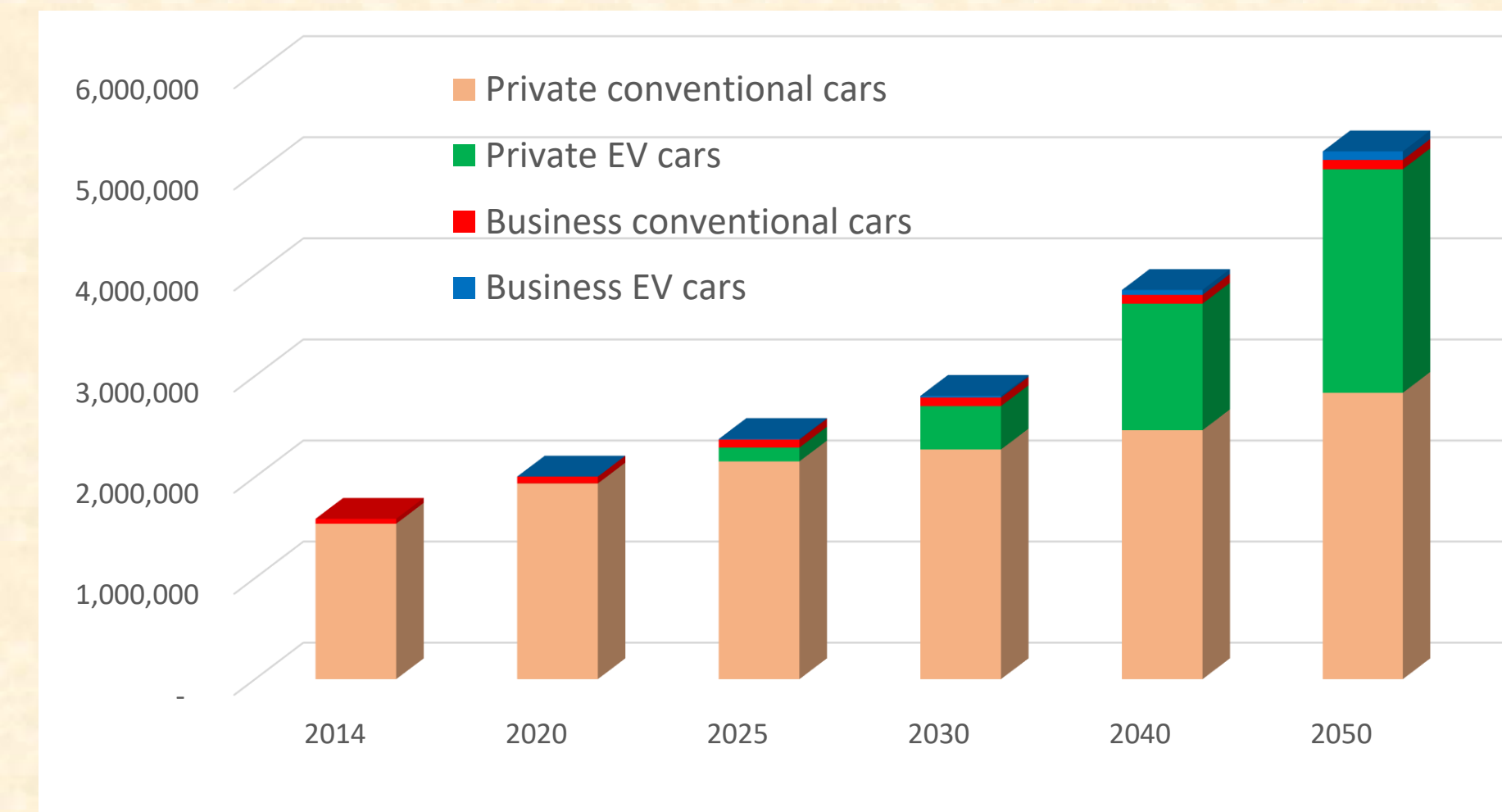


Fig. 3. Projection of private and business cars and EV penetration in road transport in Laos

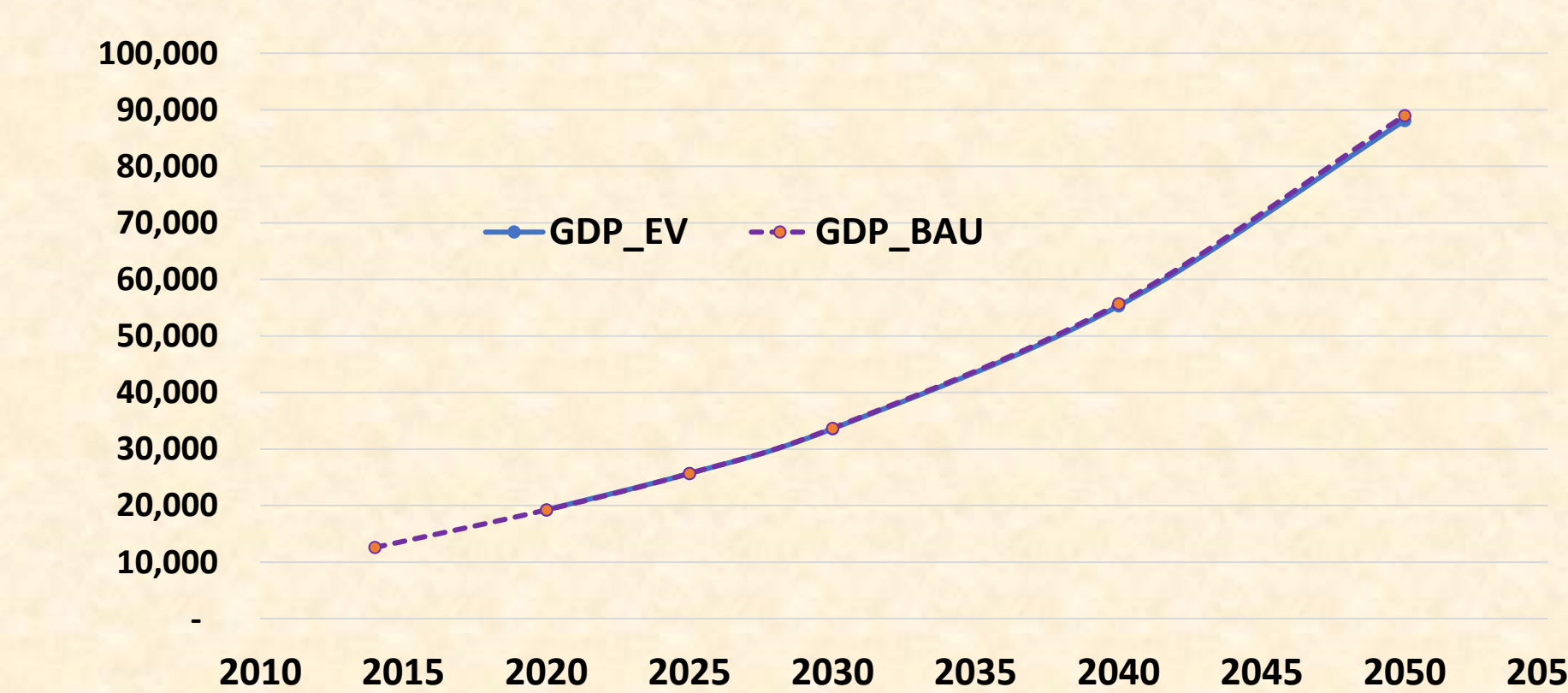


Fig. 4. Comparison of GDP value in the BaU and EV scenarios (million USD) in Laos

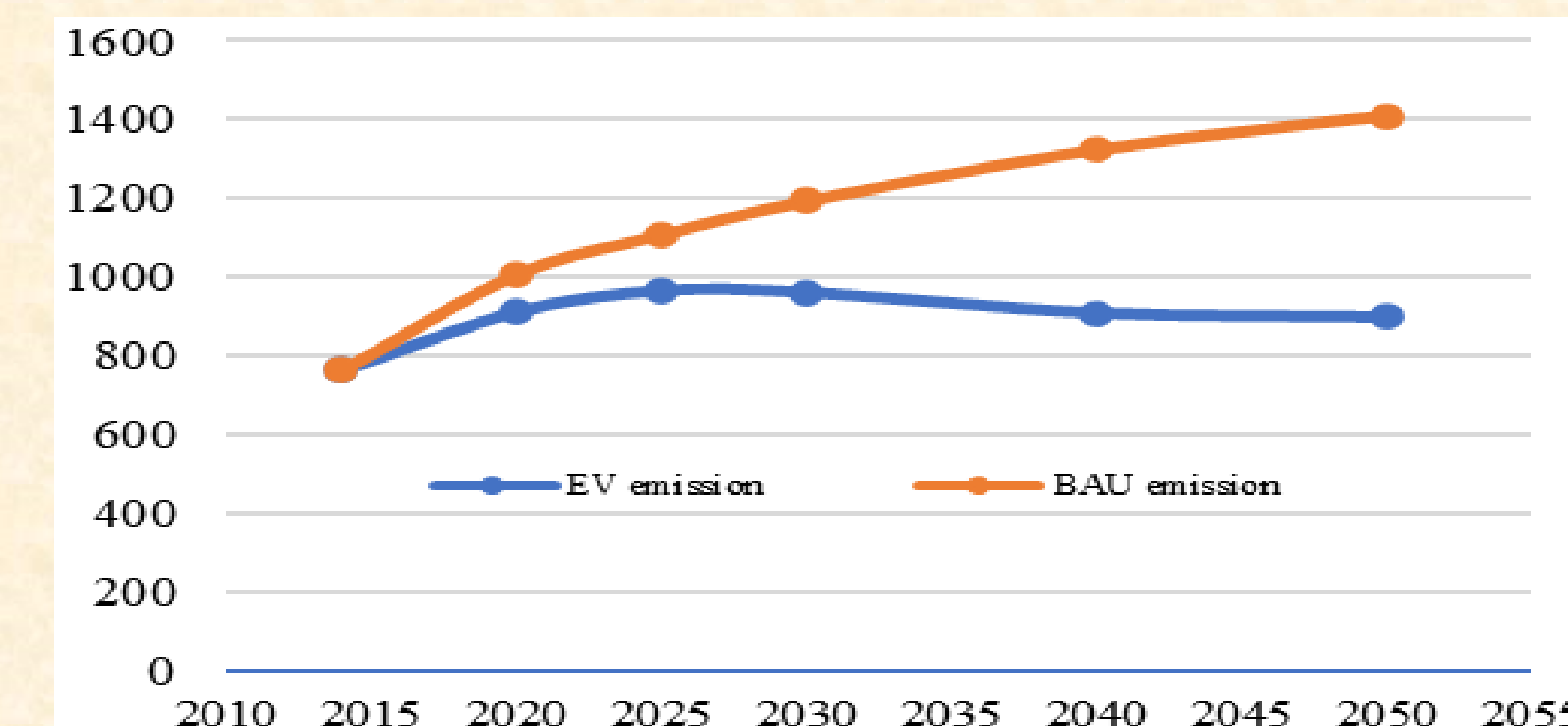


Fig. 5. Comparison of total CO₂ emission from transport sector in BaU and EV scenario (GgCO₂).

- Fig. 5. shows the comparison of total CO₂ from transport sector in BAU and EV scenario
- Average potential CO₂ emission in the EV scenario would be lesser than the BaU case 23.2% during 2020-2050.
- 2025, the emission gap would be 12.9% and total emission from EV case would be around 963.8 GgCO₂ while the BAU emission at 1,107.4 GgCO₂eq.
- 2030, the BaU emission will be 1,192.8 GgCO₂, the EV will emit smaller by 959.5 GgCO₂, accounting for 19.5% lower.
- The difference of emission between the BaU and EV scenarios in 2050 will be 36.3%.
- The cumulative CO₂ emission from 2020 to 2050 in BAU case will be 12,000 GgCO₂ and EV will be 9,300 GgCO₂ which accounting for 23.2%
- Due to the cost of the electric vehicles generally higher than the cost of the conventional ones.
- To import new electric vehicles, the GPD loss (DGP_EV) will be about 112.1 million US\$, accounts for 0.3% in 2030, however this loss is still lower than the average expenditure during 2010-2016 that Laos spent for fossil fuel import at 522 million US\$.
- In the long-term by 2050, the GDP value will reduce up to one percent with a lost amount of 891 million US\$..

Conclusion:

- GDP will be gradually damaged due to Laos will spend more budget for import the EVs.
- The replacement of the EV cars for conventional private and business cars will gradually increase during 2020-2030 and this will dramatically extend in the long-term during 2030-2050.
- The EV technology will significantly contribute to mitigate CO₂ emission in road transport sector.