






## Impacts of Cross-Border Electricity Trade on Local Livelihoods in Nong Khai, Thailand



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<https://doi.org/10.18280/ijstdp.190838>

### ABSTRACT

**Received:** 28 September 2023

**Revised:** 19 January 2024

**Accepted:** 18 March 2024

**Available online:** 29 August 2024

#### **Keywords:**

*sustainable livelihood outcomes, cross-border electricity trade, policy participation, poverty reduction, well-being, adaptation*

While Thailand's cross-border trade of electricity with Laos has positive impacts on the national economy, its local livelihood effects remain uncertain. This study evaluates livelihood impacts of electricity consumption in the border trade area of Nong Khai, Thailand by conducting a survey with 339 local households and key informant interviews with six local leaders and residents based on the sustainable livelihood framework. The data were analyzed mainly using descriptives and inferential statistics with some insights from content analysis. The results revealed moderate levels of livelihood outcomes. The lowest impact area was the creation of job opportunities, while the highest impact area was well-being and individual capabilities. Households' participation in border electricity trade policies was at low level. Multiple regression analysis indicated that perceived benefits of border electricity trade, participation in policy processes, and community-level fixed effect contributed to livelihood outcomes, while income, expenditure, energy expenditure, and policy awareness did not have significant effects. While the direct impacts on job opportunities and poverty reduction were limited, perceived benefits had a positive influence on well-being, adaptation, and collaborative natural resource sustenance. The findings suggest a need to increase local participation in border electricity trade policy.

## 1. INTRODUCTION

Electricity trade with Laos is essential for Thailand's economic development not only at the macro level [1, 2] but also at the local level, especially in the northeastern region, the largest region in Thailand with the lowest income per capita and rate of growth [3]. While electricity generation is part of the national economy, building new power plants is not as easy today as in the past because it tends to face opposition from the local communities. At times, national-scale economic development adversely affects local communities. For instance, some projects aiming to construct a dam to generate electricity for domestic economic growth have led to local communities being forced to relinquish their land, leaving them limited areas suitable for farming [4]. Therefore, the pursuit of electricity sources outside the country is an option

for future development. Cross-border electricity trade has been studied in a wide variety of academic circles [5, 6], some of which point to positive effects of international electricity exchange trade on the economy [7-9]. On the other hand, some studies found negative livelihood impacts of electricity trade between Thailand and Laos, especially economic and environmental impacts [10-13]. Previous studies have emphasized the significance of electricity trade between Thailand and Laos in terms of economic development and its impact on the people, society, and the environment. However, there is a research gap concerning the specific influence on the livelihoods of local residents, calling for further investigation.

The literature focused on different aspects of cross-border energy infrastructure and its impact on local and national markets. Siddiqui et al. [14] investigated North America's energy infrastructure and found that changes in electricity

transmission and natural gas transport lead to increased production and trade across borders. Backe et al. [15] explored the European electricity and heating system with the development of energy communities, showing that it reduces costs and national capacity expansion requirements. Adeoye and Spataru [16] analyzed the West African Power Pool and found that increasing cross-border electricity trade reduces unserved demand but increases generation costs and emissions. Spodniak et al. [17] examined electricity wholesale markets and highlights the growing importance of markets closer to real-time due to the rise of wind power. These studies provide insights into the implications of cross-border energy infrastructure on market dynamics and offer opportunities for cost reduction and renewable integration.

After conducting extensive searches across multiple databases, it is evident that there is a scarcity of research concerning the correlation between cross-border electricity trade and the sustainable livelihood framework. What is more, there is a notable absence of studies that consider both factors simultaneously. Nevertheless, similar research exists, including Debnath et al. [18] which focused on the challenges faced by the Indian power sector due to increasing renewable generation, highlighting the impact on asset utilization, cost, and social disruption. Their findings emphasized the need for a socio-technical framework to facilitate a just energy transition. Meanwhile, Do and Burke [19] analyzed the barriers to multilateral cross-border electricity trade in the Association of Southeast Asian Nations (ASEAN), recommending a gradual approach with bilateral power purchase agreements and investments in solar and wind power. Zhong et al. [20] addressed the importance of hydropower development in the Lancang-Mekong River Basin, emphasizing the need for systematic assessment to minimize risks and uncertainties and establish a collaborative framework for sustainable livelihoods of farmers. These studies contribute valuable insights to inform policymaking, promote renewable energy adoption, and support regional development goals.

One of the elements important in analyzing livelihood outcomes is policy participation. Begum et al. [21] conducted a study on women's participation in managing mangrove forests in the Sundarbans and identified a lack of understanding regarding the impacts of women's involvement. Their research investigated women's role in forest co-management, utilizing qualitative data from focus group discussions and key informant interviews. The findings revealed that women participate in various levels of co-management institutions, leading to increased awareness of conservation regulations, expanded social networks, and opportunities for alternative income generation. However, women's representation in co-management remains lower than men's. The study highlights the need for policy interventions to address gender disparities and promote equal participation. Another study by Su et al. [22] examined the role of rural communities in sustainable tourism management in Hetu Town, China. Their research indicated that tourism influences livelihoods positively, but limitations in assets and unequal income distribution create social risks. The study suggests practical implications to enhance tourism participation and ensure fair benefit sharing, emphasizing the role of government. Furthermore, a study is being conducted to facilitate collaborative decision-making among the government, related sectors, and diverse societal groups. This effort aims to foster sustainable development in rural areas [23-25].

There is a limited number of studies that explore the application of the sustainable livelihoods concept in the context of agricultural development in Thailand. However, one notable example is the study by Chaya and Gheewala [26]. They conducted a study using the United Nations Development Programme (UNDP) sustainable livelihood framework and found that feedstock security is crucial for the growth of Thailand's bioethanol industry. They emphasized the need to assess and monitor farmer livelihood sustainability. The study proposed 10 sustainable livelihood outcomes and 22 indicators, highlighting the importance of group formation for enhancing the sustainability of farmers' livelihoods. Yet, no research has been conducted on the relationship between Thai and Lao electricity trade policies and the livelihood outcomes of local communities, indicating a research gap in this area.

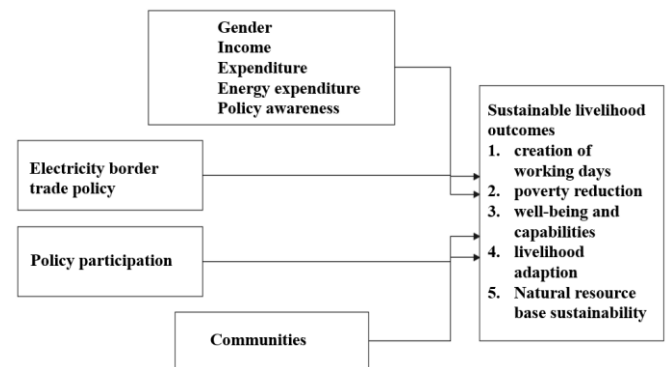
Based on all the previous reviews, it has been determined that cross-border energy trade and policy participation are factors contributing to livelihoods. In addition, factors such as gender, socioeconomic status, and livelihoods in various communities are also relevant.

The objective of this paper is three-fold. First, it evaluated the characteristics of the border electricity trade, and participation in related policy by local residents in Nong Khai province, Thailand. Second, it assessed livelihood outcomes of locals in Nong Khai according to the sustainable livelihood framework. Lastly, it investigated the livelihood effects of border electricity trade, policy participation, gender, energy expenditure, policy awareness, and community factors.

## 2. MATERIALS AND METHODS

### 2.1 Framework

The quantification of the livelihood outcomes used a five-point Likert scale: very high, high, medium, low, and very low [27], based on the five aspects of the sustainable livelihood framework by Scoones [28]: creation of working days, poverty reduction, well-being and capabilities, livelihood adaptation, and natural resource base sustainability. This framework was expanded to analyze the context of livelihoods in the border trade area (Figure 1).



**Figure 1.** The sustainable livelihood framework in the context of border electricity trade with Laos

Source: Adapted from Scoones (2015)

Creation of working days encompasses five sub-aspects: 1. Employment of people in the community; 2. Salary of private-sector employees in the area; 3. Production of consumer goods such as food, beverages, clothes, and footwear; 4. People from

different provinces being attracted to work in Nong Khai; and 5. Suitable proportion of working-age population in light of the local unemployment rate.

Poverty reduction encompasses five sub-aspects: 1. Increased income levels; 2. Increased consumption of goods produced in the community; 3. Lowered poverty levels; 4. Reduced income disparity; 5. Increased ownership of properties (e.g., houses, land, cars).

Well-being and capabilities encompass five sub-aspects: 1. Greater sense of self-dignity and self-esteem; 2. Safety in daily life; 3. Better sense of happiness; 4. Less psychological stress; and 5. Less risk of life danger.

Livelihood adaptation encompasses five sub-aspects: 1. Tolerance of the level of ascent and descent of the Mekong River; 2. Adaptation to changing careers of family members; 3. Alternative choices of occupation; 4. Coping with natural disasters caused by changes in the Mekong River; 5. Avoidance of disasters with the Mekong River in the future.

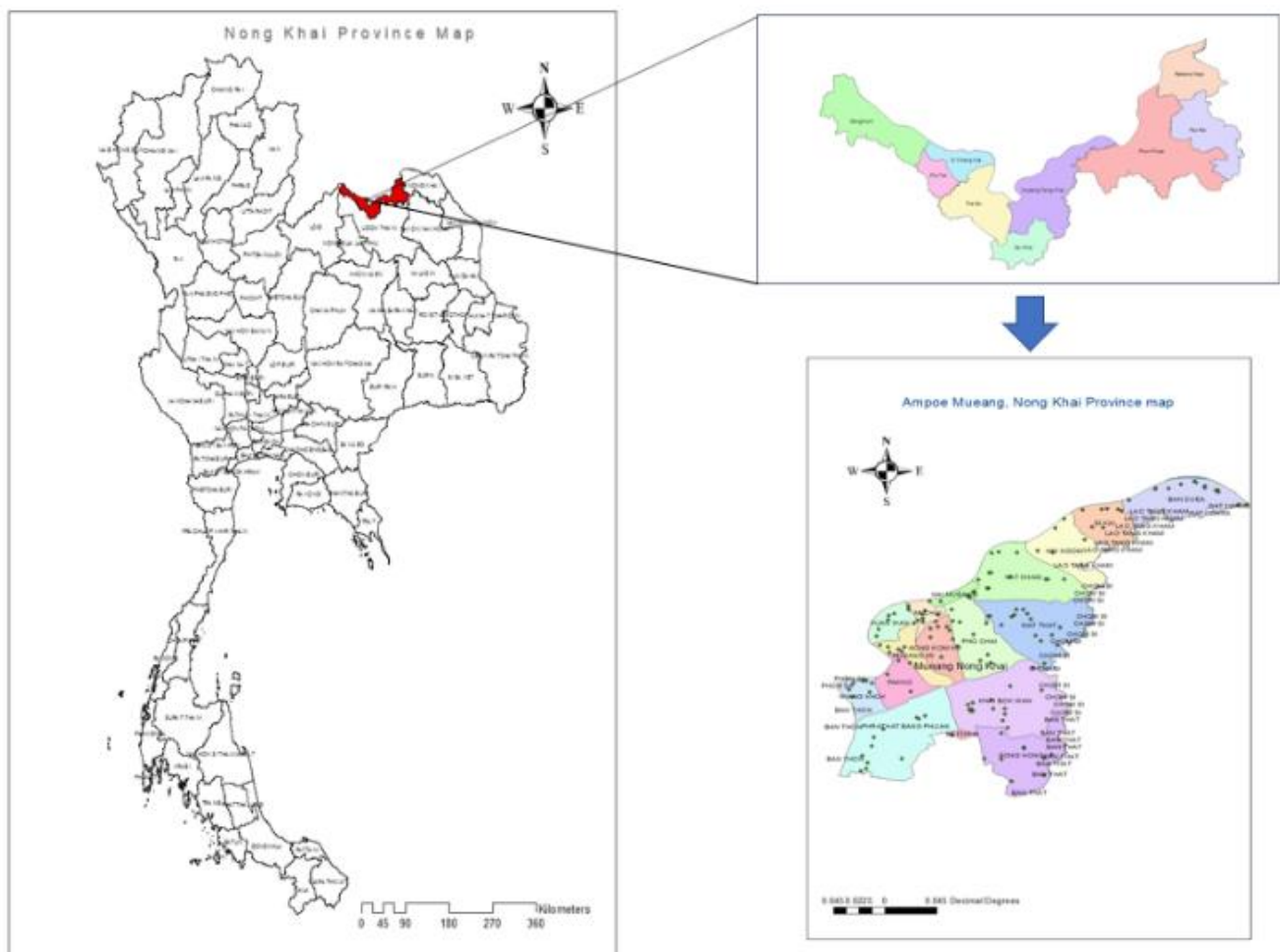
Natural resource base sustainability encompasses five sub-aspects: 1. Increase productivity of agriculture, livestock, and fishery; 2. Avoidance of damage and degradation of the Mekong River; 3. Joint efforts of local communities and local governments to reduce damage and degradation of the Mekong River; 4. Community committees deal with damage and degradation of the Mekong River; and 5. Community members contribute to the protection of the Mekong River.

These five aspects are supposed to have complementary relationships with each other. This structured framework allows for a concise and nuanced measurement of respondents'

perceptions or experiences regarding the comprehensive scope of livelihood outcomes.

## 2.2 Study site

The study site is Nong Khai municipality, which is the pioneer area for electricity trade with Laos (Figure 2), where electricity supply is totally dependent on border import from Laos [29]. This area was selected over other Thai border areas for two reasons. First, Nong Khai shares the border with the Laotian capital of Vientiane. No other border areas in Thailand have a direct border with a foreign capital. The adjacency to the major foreign city implies opportunities for development in tandem, leading to increased demand for electricity. Second, Nong Khai was the first border to sign a cross-border electricity purchase agreement between with Laos. Hence, public awareness of cross-border electricity trade is higher than in other border areas. In subsequent years, electricity trade in other border areas has followed the model of Nong Khai. The majority of the electricity consumed in the area is generated at the Mekong dams. The Mekong River features a series of dams, including the Xayaburi, Don Sahong, and Pak Beng dams, among others, which have been constructed along its course for hydropower generation and, have an ecosystem-related impact on the river both directly and indirectly [30, 31]. The study assesses the livelihood outcomes of people in the municipality living next to the Mekong River. It assesses whether the construction of dams has affected the livelihood outcomes of people in Nong Khai municipality.



**Figure 2.** Study area (map of Thailand, Nong Khai Province)



The study focuses on Mueang District, which is situated close to the Lao capital Vientiane. Mueang District is the main gate for the cross-border trade with Laos via the First Thai-Lao Friendship Bridge across the Mekong River. Moreover, this is the site where high-voltage electric poles are situated, connecting electricity from Laos to Thailand by spanning across the Mekong River. The specific sites are Village No. 1, Jommanee, MiChai subdistrict; Village No. 3, Hai Sok, Nai Mueang subdistrict; and Villages No. 5 and No. 6, Sri Saket-Sri Mueang, Nai Mueang subdistrict, Nong Khai province, Thailand (Table 1).

Village No.1 Jommanee is situated at the Thai-Lao Friendship Bridge, which bears the largest value of border trade with Laos in Nong Khai Province (Figure 3). Moreover, it is the place where the high voltage transmission line from the Thai side connects to the Lao side. Village No.3 Hai Sok is the place for Nong Khai Port Border Checkpoint, transporting both people and goods by using a long-tail boat and passenger ships. It is the gate through which people can travel and local goods can be exchanged with Laos. Villages

No. 5 and 6, Sri Saket-Sri Mueang are the place for Tha Sadet Market, the biggest market in Nong Khai where goods arrive from around the world, such as dry food, processed food, and utensils for communities and tourism. Along these lines, the unit of analysis is households of the three communities impacted by the cross-border electricity trade with Laos.

Nong Khai stands out as an exceptional border area due to its significant role in the cross-border electricity trade between Thailand and Laos. According to data from the Nong Khai Municipality, the provision of electricity within the municipality relies on the Electricity Authority of Nong Khai Province, which sources its supply from Laos [29].

Thailand's electricity trading with Laos plays a crucial role in the development and sustainability of Nong Khai Province. By collaborating with Laos, Nong Khai benefits from a diversified energy portfolio, ensuring the availability of electricity for its residents, businesses, and public services. This strategic partnership enables Nong Khai to meet its energy needs effectively and contributes to the overall progress and welfare of the province.

**Table 1.** Study areas and characteristics

Characteristics of Communities	Jommanee	Hai Sok	Sri Saket-Sri Mueang
Village No.	1	3	5, 6
Sub-district	Mi Chai	Nai Mueang	Nai Mueang
Households	302	716	1189
Population	870	1021	1681
Significant place	Thai-Lao Friendship Bridge	Nong Khai Port Border Checkpoint	Tha Sadet Market
Border trade logistics	Thai-Lao Friendship Bridge and the high voltage transmission line from the Thai side to the Lao side. Phon Khong - Nong Khai 115 kV	Water transport, transporting both people and goods on a long-tail boat and passenger ships	Product distribution center from many countries such as Laos, Vietnam, China, Thailand and Europe



**Figure 3.** Study area, Nong Khai province map  
Source: Google Earth Pro (2022)

**Table 2.** Sample size per community

Village No.	Communities	Households	Percentage (%)	Sample Size
1	Jommanee	302	13.7	46
3.	Hai Sok	716	32.4	110
5, 6	Sri Saket-Sri Mueang	1189	53.9	183
	Total	2,207	100	339

## 2.3 Data collection

The study adopted mixed methods using a household survey and key informant interviews.

### 2.3.1 Household survey

The target population of this study is households in the three villages introduced in Table 1. The relevant population size is 2,207 households [32]. The minimum suggested sample size was calculated by the Taro Yamane [33] method as Eq. (1):

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

where,  $n$  is the minimum suggested sample size,  $N$  is the population size, and  $e$  is the margin of error. Applying the 5% margin of error and plugging in the population size, the minimum suggested sample size was obtained as Eq. (2):

$$n = \frac{2,207}{1 + 2,207(0.05)^2} \quad (2)$$

Accordingly, the survey covered 339 households.

The sample was divided into three communities: Jommanee community, Hai Sok community, and Sri Saket-Sri Mueang community. The sub-sample size for each community was determined in proportion to the population breakdown (Table 2).

The questionnaire comprised five sections:

Section 1: General information of respondents and households.

Section 2: Respondents' views of cross-border electricity trade patterns.

Section 3: Respondents' perspectives of cross-border electricity trade policies.

Section 4: Households' livelihoods.

Section 5: Household recommendations regarding border electricity trade policy.

A pre-test was conducted on the initial questionnaire with respondents outside the actual sample. Accordingly, the instrument was improved for enhanced clarity. The questionnaire used for the actual survey is attached in Appendix A. The collected raw data were cleaned and validated. The Cronbach's alpha reliability measure was also calculated for the five dimensions of the sustainable livelihood framework, which was 0.920, 0.879, 0.916, 0.747, and 0.903 for creation of working days, poverty reduction, well-being and capabilities, livelihood adaptation, and natural resource base sustainability, respectively, suggesting internal consistency among the sub-indicators.

The five-level ordinal measurements of the sub-indicators in each dimension was aggregated by arithmetic mean to the level of each dimension as Eq. (3).

$$Y_j = \frac{1}{5} \sum_{k=1}^5 y_k \quad (3)$$

where,  $y_k$  is the sub-indicator for sub-aspect  $k$ ,  $Y_j$  is the aggregate indicator for aspect  $j$ . As the aggregate indicators take many possible values, they can be regarded as numerical variables, as opposed to ordinal variables, in the subsequent statistical analysis.

### 2.3.2 Key informant interviews

Six key informants were chosen from two groups. The first group was community leaders from the three communities and the other group was local traders from the three communities. The selection criteria for traders were local birth and occupation being economically relevant to the local community and associated with the utilization of natural resources of the Mekong River. Accordingly, a tour boat operator on the Mekong River, a food raft operator on the Mekong River, and a vendor in Tha Sadet Market in Nong Khai province were interviewed.

An interview checklist was prepared, focusing on factors related to livelihoods of households in Nong Khai municipality. The insights from the key informant interviews were used to supplement and expand the findings from the survey data analysis, especially in terms of the impacts of the border electricity trade. The checklist used for the key informant interviews is attached in Appendix B.

## 2.4 Analytical methods

### 2.4.1 Quantitative analysis

Descriptive statistics were used to provide a summary of the key variables such as mean, standard deviation, and frequencies. This provides insights into the central tendencies, variabilities, and distributions of the data.

Multiple regression analysis was utilized to investigate the relationship between dependent variables and independent variables. This helps assess factors influencing the livelihood outcomes at the household level. More specifically, it examined the effects of gender, income, expenditure, energy expenditure, policy awareness, community factors, and policy participation on livelihood outcome among households in Nong Khai (4).

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i \quad (4)$$

where,  $Y_i$  is the overall livelihood outcome aggregated from the five dimensions for respondent  $i$ ,  $\beta_0$  is the intercept term,  $\beta_1$  is the vector of coefficients to be estimated,  $X_i$  is the vector of the respondent's characteristics, and  $\varepsilon_i$  is the random error term.

R Programming was used to conduct this analysis. The results illustrate the marginal effects of each variable, controlling for covariates.

### 2.4.2 Qualitative analysis

Information collected through the key informant interviews with the local leaders and traders was collated and categorized by informant category. Subsequently, content analysis was employed to align the information with the framework of sustainable livelihood outcomes of Scoones [28].

The five dimensions served as keywords for coding the analysis. The interview content was thoroughly examined, and the coding was applied to represent the identified themes. Once the coding process was completed, connections between informants were examined and presented as findings. To explore the relationships between variables, such as electricity purchase policy and the livelihoods of the community, various codes were used to identify patterns and trends in the responses. The results were presented in a matrix table format to help address the research objectives and supplement the findings obtained from the quantitative analysis.

### 3. RESULTS

#### 3.1 The socioeconomic profile of the households

It was found that many (66.1%) of the respondents were female, while male household heads outnumbered female household heads (63.3%). The majority (66.7%) of the household heads and members did not have a high school diploma. The most populous age segment for household heads was 51-60 years old, while the same for household members was 41-50 years old. The most common occupation of household heads and members were personal business or merchant.

These socioeconomic data revealed potential challenges and opportunities toward sustainable livelihood outcomes. High proportions without a high school diploma may limit access to well-paying jobs, impacting income and economic opportunities. The prevalent occupation being in personal business/merchant suggests a focus on small-scale enterprises, which warrant consideration for sustainability and growth. The gender imbalance among household heads may affect the distribution of benefits from sustainable practices.

#### 3.2 Descriptive results

##### 3.2.1 Perceived benefits of border electricity trade of Thailand with Laos

Table 3 shows that the respondents perceived a medium level of benefits from border electricity trade with Laos. The mean scores for the four sub-indicators were 3.23 for high profit, 3.12 for monopoly (reverse-coded), 3.09 for geographical benefits, and 2.99 for cost advantage, in descending order.

**Table 3.** Perceived benefits of border electricity trade of Thailand with Laos: five-point Likert scale ( $n = 339$ )

Dimension	Border Electricity Trade	Mean	S.D.
EBT 1	High profit	3.23	1.51
EBT 2	Monopoly*	3.12	1.45
EBT 3	Cost advantage	2.99	1.44
EBT 4	Geography benefit	3.09	1.40
	<b>Aggregate</b>	<b>3.11</b>	<b>1.35</b>

\* reverse-coded

##### 3.2.2 The household's policy participation in border electricity trade of Thailand with Laos

Table 4 shows that the majority (53%) of the locals expressed a low level of household participation in policy on border electricity trade with Laos. Only 16% of the locals reported that they had voted during the policy making process.

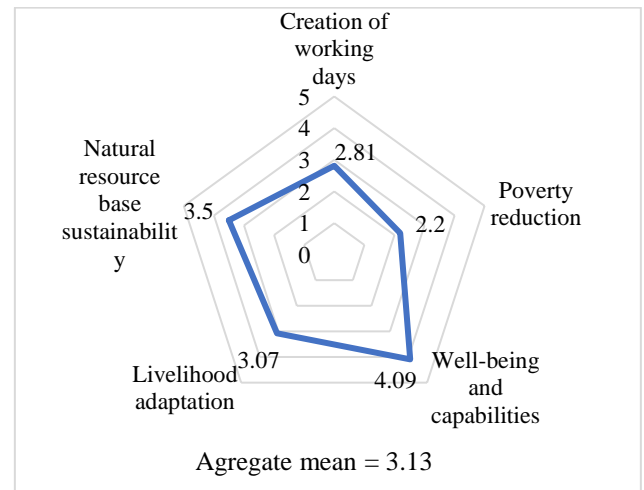
**Table 4.** Households' perceived participation in policy on border electricity trade with Laos ( $n = 339$ )

Level of Participation	Description	Percentage of Sample
1	Heard about policy or was informed by the government	53.1
2	Attended meetings	30.7
3	Voted on policy	16.2
Total		100

##### 3.2.3 The households' agreement with livelihood outcomes

Figure 4 shows that the respondents had a medium level of

agreement overall with the livelihood outcomes, with an average of 3.13. At the disaggregate level in descending order of agreement, well-being and capabilities had 4.09, natural resource base sustainability had 3.50, livelihood adaptation had 3.07, poverty reduction had 2.20, and the creation of working days had the mean score of 2.18.



**Figure 4.** Level of livelihood outcomes as perceived by locals ( $n = 339$ )

**Table 5.** Multiple regression analysis of the livelihood outcome indicator in Mueang District, Nong Khai Province, Thailand

	Coefficient	Std. Error	P-Value
Gender (dummy, 1 if male)	-0.030	0.056	0.592
Income (dummy, 1 if THB15,001-20,000/month)	-0.005	0.104	0.963
Income (dummy, 1 if above THB20,000/month)	-0.206	0.180	0.253
Expenditure (dummy, 1 if THB15,001-20,000/month)	-0.005	0.119	0.969
Expenditure (dummy, 1 if above THB20,000/month)	-0.468	0.516	0.364
Energy Expenditure (dummy, 1 if THB1,501-2,000/month)	0.158	0.121	0.191
Energy Expenditure (dummy, 1 if THB2,001-3,000/month)	0.076	0.121	0.532
Energy Expenditure (dummy, 1 if above THB3,000/month)	0.250	0.167	0.135
Awareness of policy (dummy, 1 if aware)	-0.010	0.094	0.915
Level of participation in policy	-0.310	0.041***	0.001
Perceived benefits of border electricity trade	0.395	0.032***	0.000*
Hai Sok community (dummy)	0.158	0.088***	0.000
Srisaket-Sri Mueang community (dummy)	0.164	0.096***	0.000
Constant	2.069	0.160***	0.000

Dependent Variable: Livelihood Outcome Indicator  
 $n = 339$ , F-statistic = 35.43 (13, 325),  $p$ -value = 0.000,  $R^2 = 0.586$

Notes: Perceived benefits of border electricity trade is the aggregation of EBT 1-4 in Table 3.

The reference levels or categories for the dummy independent variables are as follows:

Household monthly income (THB): Less than 15,000 is the reference level;  
 Household monthly expenditure (THB): Less than 15,000 is the reference level;

Household monthly energy expenditure (THB): Less than 1,500 is the reference level;

Community: Jommanee community is the reference category

### 3.2.4 The effects of border electricity trade and policy participation on livelihood outcomes

Table 5 above presents the regression results for factors influencing livelihood outcomes. The coefficient of determination indicates that the set of the independent variables included in the analysis explained 59% of the variation of the livelihood outcome.

The results revealed that household participation in policy on border electricity trade and perceived benefits of border electricity trade had statistically significant and positive effects on the livelihood outcome indicator. A one-unit improvement in perceived benefits of border electricity trade was associated with an increase in the livelihood outcome indicator by 0.158 unit. Similarly, a one-level increase in household policy participation was linked to a 0.164-unit increase in the livelihood outcome.

Residents in Hai Sok community had lower levels of livelihood outcomes than those in Jommanee community, while those in Srisaket-Sri Mueang had higher levels of outcomes.

### 3.3 Qualitative component

The key informant interviews highlight the interplay between electricity trade policies and various livelihood dimensions in the border areas. The content analysis of the impacts of electricity trade on livelihood outcomes revealed several key points, as summarized below for each dimension.

#### 1) Creation of working days

The direct effects of electricity trade on employment were limited. Employment patterns, such as personal business and civil servants, remained dominant in the studied communities. However, electricity trade indirectly stimulated job creation through the development of tourist attractions, generating additional income for locals.

#### 2) Poverty reduction

Electricity trade policies did not have a substantial impact on poverty reduction in the communities. Economic

development and increased income were observed, but these outcomes were primarily attributed to the opening of the Thai-Laos friendship bridges and community enterprises rather than the direct effects of power trade.

#### 3) Well-being and capabilities

The availability of sufficient electricity positively influenced the well-being of community members. Improved access to electricity enhanced the comfort and convenience of daily life, particularly in urban areas. However, negative consequences, such as environmental damage from dam construction, were also identified.

#### 4) Livelihood adaptation

Community members demonstrated a degree of adaptability to changing environments. Urban residents were more flexible in adjusting to societal transitions, benefiting from increased career options. Concerns were raised about the potential long-term impacts of electricity trade on the natural resource base, particularly the Mekong River.

#### 5) Natural resource base sustainability

Efforts to protect and manage natural base resources varied across the communities. Local leaders and citizens collaborated in safeguarding these resources, evident through the construction of river barriers and communal initiatives. However, attention to environmental issues differed among communities, with urban areas displaying less interest compared to rural counterparts.

Table 6 provides an overview of the insights obtained from the key informant interviews with leaders and traders of the three communities in the studied border communities, in relation to the five dimensions of sustainable livelihood framework. Direct effects were limited, while indirect effects were observed in terms of stimulated employment. The impact on poverty reduction was limited, and well-being and capabilities were positively affected by improved access to electricity. Livelihood adaptation to changing environments was noted, but no statistical data was available for the specific measures of adaptation. The management and protection of natural base resources varied across the communities.

**Table 6.** Summary of insights obtained from the key informant interviews with the three leaders and three traders

Aspect	Creation of Working Days	Poverty Reduction	Well-Being and Capabilities	Livelihood Adaptation	Natural Resource Base Sustainability
Direct effects	Limited	Limited	-	-	-
Indirect effects	Stimulated	-	-	-	-
Poverty reduction	-	Limited	-	-	-
Well-being and capabilities	-	-	Positive	-	Negative
Livelihood adaptation	-	-	-	-	-
Natural resource base sustainability	-	-	-	-	Varied

## 4. DISCUSSIONS

### 4.1 The socioeconomic profile of the households

The research focuses on the socioeconomic profile of the sampled households. The majority of respondents were female, suggesting an active involvement of women in household decision-making. However, male household heads outnumbered female household heads, raising questions about gender dynamics and decision-making processes within the households. Most households lacked a high school diploma, indicating potential limitations in accessing better

employment opportunities and socioeconomic status. Addressing educational disparities could be essential in improving household prospects. A significant number of household heads were aged between 51 and 60 years, while many members were in the 41-50 age range. This demographic composition calls for tailored support programs to ensure financial security during retirement. The most common occupation among household heads and members was personal business/merchant, underscoring the significance of entrepreneurship in the local economy. Understanding challenges faced by these businesses can inform targeted support initiatives to enhance economic growth and

sustainability within the community.

## 4.2 The descriptive findings

### 4.2.1 Characteristics of border electricity trade of Thailand with Laos

The survey participants indicated that large electricity companies had a moderate level of relevance (3.11/5) to the characteristics of the border electricity trade policy. The aspect that the respondents agreed with the most is that Thai energy companies have gained substantial profits from their business operations (3.23/5). Most of the electricity comes from the construction of the Mekong dams, where questions have been raised about the impact on the resources in the Mekong River and the way people live around the Mekong River. It has been questioned who benefits or loses. This trade-off between gaining access to electricity and the potential degradation of local resources undermines the long-term sustainability of electricity usage in the community. The aforementioned issue is consistent with Matthews [12]. He observed that the people who benefited the most were the companies that had invested in the production of electricity. Those who lose include locals who are reliant on natural resources and habitats that may be lost when dams are built.

### 4.2.2 The households' policy participation in border electricity trade of Thailand with Laos

Local participation in the border electricity trade policy contributed significantly to the well-being of local residents. In Nong Khai province, household participation in policy processes was low (2.30/5), which would inevitably impact economic, social, and environmental aspects of the livelihood outcomes. In principle, according to the UNDP Guidance note [34], participation by stakeholders has an impact on sustainable livelihoods. From our results, it was found that active participation in household policies significantly contributes to sustainable livelihood outcomes. This is in line with Wiebe et al. [35] who argue that forest policies should engage with local people and pursue long-term development consistently with human well-being. Furthermore, Yoganand and Gebremedhin [36] agreed that participatory management of watersheds by local people would help raise agricultural productivity, employment, and conservation of soil and water resources.

### 4.2.3 The households' livelihood outcomes

The livelihood outcomes of Nong Khai municipal households were examined, revealing a moderate level of the overall outcome. The economic outcome, particularly in terms of creation of working days and poverty reduction, was rated low. The aspects of well-being and capabilities were the most positively influenced, followed by social and environmental factors such as livelihood adaptation and natural resource base sustainability. The moderate overall livelihood outcomes in Nong Khai municipality can be attributed to several reasons. The low economic outcome, particularly in terms of creation of working days and poverty reduction, may be influenced by limited employment opportunities, resource constraints, and structural challenges such as inadequate infrastructure and skills mismatch. The electricity trade with Laos was controlled by monopolistic companies authorized by the government. This situation explains why local residents perceive the least significance in terms of job creation or income increase. On the other hand, the positive impact on well-being and

capabilities indicates the success of the border electricity trade policy with Laos. The moderately positive ratings for social and environmental factors, such as livelihood adaptation and natural resource base sustainability, suggest the presence of initiatives promoting sustainable practices.

## 4.3 The effects of border electricity trade and policy participation on livelihood outcomes

The results on community dummies indicate that the specific characteristics, resources, or conditions in each municipality or community can influence the overall livelihoods. Factors such as access to resources, infrastructure, economic opportunities, and social support systems differ between municipalities, leading to variations in livelihood outcomes. Furthermore, the significant effects of benefits of border electricity trade suggest that when benefits from border electricity trade in the different dimensions are perceived, the overall well-being and livelihoods in the communities will improve. The significant effects of household policy participation on livelihood outcomes imply that when households are involved in decision-making processes, their well-being and overall livelihoods tend to be better, which is consistent with Maguire-Rajpaul et al. [37].

## 5. CONCLUSION

While cross-border electricity trade of Thailand with Laos has yielded positive effects on the national economy, it is important to acknowledge that these projects may have some adverse effects on local communities. Our quantitative analysis revealed limited household participation in policy processes and insufficient economic outcomes such as the creation of working days and poverty reduction on the Thai side of the border trade area with Laos.

The regression analysis underscores the crucial role of policy participation in sustaining livelihood outcomes. Nonetheless, the descriptive results reveal minimal levels of involvement of local residents in such policies yet. It is thus suggested that the government rigorously facilitate public participation in policy processes.

Other findings highlight the importance of considering factors such as benefits of border electricity trade in policy processes when planning on initiatives to promote livelihood improvement for local communities. The relatively low levels of livelihood outcomes observed in the Hai Sok community suggest a need for targeted interventions in certain communities, where practices in Srisaket-Sri Mueang community may provide a clue to replicable strategies.

While this research contributes to the literature on livelihood impacts of Thailand's cross-border electricity trade, there are certain limitations in the study. First, the research is focused on the Nong Khai urban municipality, which does not cover rural areas where people tend to engage in agriculture. Second, scientific evidence investigating environmental impacts is absent. Future research should encompass rural areas and extend its focus to cross-border electricity trade in other provinces, while drawing comparisons with Nong Khai province. Moreover, the research scope should be broadened to encompass environmental impacts, incorporating scientific data collection or laboratory experiment results as corroborative evidence.



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- Q1-1a. Sex of the HH head  
(1) Male (2) Female
- Q1-1b. Sex of the respondent (if not the head)  
(1) Male (2) Female
- Q1-2a. Education of HH head  
(1) Below high school diploma  
(2) High school diploma  
(3) Bachelor's degree  
(4) Master's degree  
(5) Ph.D. degree
- Q1-2b. Education of the respondent (if not the head)  
(1) Below high school diploma  
(2) High school diploma  
(3) Bachelor's degree  
(4) Master's degree  
(5) Ph.D. degree
- Q1-3a. Age (years) of HH head  
(1) 18-30  
(2) 31-40  
(3) 41-50  
(4) 51-60  
(5) 61 and above
- Q1-3b. Age (years) of the respondent (if not the head)  
(1) 18-30  
(2) 31-40  
(3) 41-50  
(4) 51-60  
(5) 61 and above
- Q1-4a. Main Occupation of HH head  
(1) Government officer/State enterprise officer  
(2) Company employee  
(3) Personal business/Merchant  
(4) Farmers/Fisheries  
(5) Student  
(6) Retired  
(7) Unemployed  
(8) Other (Please specify) .....
- Q1-4b. Main Occupation of the respondent (if not the head)  
(1) Government officer/State enterprise officer  
(2) Company employee  
(3) Personal business/Merchant  
(4) Farmers/Fisheries  
(5) Student  
(6) Retired  
(7) Unemployed  
(8) Other (please specify) .....
- Q1-5. Total income of the household (Thai baht/month)  
(1) Less than 15,000  
(2) 15,001-20,000  
(3) 20,001-30,000  
(4) 30,001-40,000  
(5) 40,001 and above
- Q1-6. Out of the HH income in Q1-5, your income earned by selling agricultural or industrial products in cross-border trade between Thailand and Laos? (Thai baht/month)

## APPENDIX

### Appendix A

The questionnaire for the local residents survey

**Section 1.** General information of the respondent and household

(1) Zero (Skip to Q1-9. if the household is not engaged in border trade between Thailand and Laos.)

- (2) Less than 15,000
- (3) 15,001-20,000
- (4) 20,001-30,000
- (5) 30,001-40,000
- (6) 40,001 and above

Q1-7 What kind of agricultural or industrial goods does your family buy or sell in the Thai-Laos border trade?

Buy	Value (Baht/Year)	Sell	Value (Baht/Year)
(1) Vegetables		(1) Vegetables	
(2) Fruits		(2) Fruits	
(3) Vegetable processed products		(3) Electronic products	
(4) Jewelry, silver, and gold		(4) Textiles	
(5) Electrical machinery and components		(5) Other metal ores, scrap metals, and products.	
(6) Other (specify)		(6) Other (specify)	

Q1-8 Your household bought or sold with Laotian merchants/vendors. Before and after the opening of the Thai-Lao Friendship Bridge in Nong Khai province, how much is the amount per month?

Before the opening of the Thai-Lao Friendship Bridge	After the opening of the Thai-Lao Friendship Bridge
(1) Less than 300 Baht	(1) Less than 300 Baht
(2) 301-1,000 Baht	(2) 301-1,000 Baht
(3) 1,001-3,000 Baht	(3) 1,001-3,000 Baht
(4) 3,001-4,000 Baht	(4) 3,001-4,000 Baht
(5) 4,001 and above	(5) 4,001 and above

Q1-9. Total expenditure of the household (Thai baht/month)?

- (1) Less than 15,000 Baht
- (2) 15,001-20,000 Baht
- (3) 20,001-30,000 Baht
- (4) 30,001-40,000 Baht
- (5) 40,001 and above

Q1-10. Out of the total expenditure in Q1-9, how much is spent on energy? (Thai baht/month)

Before the opening of the Thai-Laos Friendship Bridge	After the opening of the Thai-Laos Friendship Bridge
(1) Less than 15,000 Baht	(1) Less than 15,000 Baht
(2) 15,001-20,000 Baht	(2) 15,001-20,000 Baht
(3) 20,001-30,000 Baht	(3) 20,001-30,000 Baht
(4) 30,001-40,000 Baht	(4) 30,001-40,000 Baht
(5) 40,001 and above	(5) 40,001 and above

Q1-11. Energy is purchased in what form?

Form of energy purchased	Expense (Baht/month)
(1) Electricity on the grid	
(2) Gasoline for vehicle	
(3) Diesel for vehicle	
(4) NGV for vehicle	
(5) Diesel for pump	
(6) Kerosine	
(7) Electricity in battery	
(8) LPG for cooking	
(9) Other (Specify)	

Q1-12. Energy is used for which items?

Item	Form of Energy*
(1) Light	
(2) Stove	
(3) Air conditioning	
(4) Vehicle	
(5) Water pump	
(6) Fan	
(7) T.V. or Radio	
(8) Refrigerator	
(9) Microwave and Kitchen appliances	
(10) Other 1 (Specify)	
(11) Other 2 (Specify)	

Form: 1. Electricity on the grid, Gasoline for the vehicle, 3. Diesel for the vehicle, 4. Diesel for the pump, 5. Solar, 6. Kerosine, 7. Electricity in battery, 8. Other 1 (Specify ), 9. Other 2 (Specify )

Q1-13a Government policy to buy electricity from Laos produced from the Mekong River dams for sale in Thailand has affected trade in agricultural products, industrial handicrafts, and Laotian merchants/vendors of your household.

- (1) Affected (Continued with Q1-13b)
- (2) Unaffected (Skip to Q1-14a)

Q1-13b Government policy to buy electricity from Laos produced from the Mekong River dams for sale in Thailand increases or decreases value of trade in non-energy goods such as agricultural, and other industrial products.

- (1) Increased
- (2) Decreased
- (3) Unchanged

Q1-14a Does your HH perceive any positive or negative impact since the electricity border trade with Laos in Nong Khai province occurred?

- (1) Positive
- (2) Negative
- (3) None (Skip to Q1-14c)

Q1-14b If (1) or (2) in Q1-14a, what kind of impact did you perceive since the electricity border trade with Laos in Nong Khai province occurred?

- (1) Economic impact (Explain )
- (2) Social impact (Explain )

(3) Environmental impact (Explain )

- (4) Vice president
- (5) President
- (6) Other (Specify )

Q1-14c What is the unit price of oil that your HH pays before and after the opening of the Thai-Laos Friendship bridge in Nong Khai province (Baht per liter)?

Before	After
(1) Less than 20 Baht	(1) Less than 20 Baht
(2) 21-30 Baht	(2) 21-30 Baht
(3) 31-40 Baht	(3) 31-40 Baht
(4) 41-50 Baht	(4) 41-50 Baht
(5) 51 and above	(5) 51 and above

Q1-15a Does your HH know the government policy of the Thai-Laos electricity-border trade in Nong Khai?

- (1) Yes (Proceed to Q1-15b)
- (2) No (Skip to Section 2)

Q1-15b How does your HH know about the Thai government policy of the Thai-Laos electricity-border trade in Nong Khai?

- (1) Hear from news in journalism and online media
- (2) Be informed by community leaders, such as chiefs, Municipalities
- (3) Attend meetings to hear from government agencies/local government organizations
- (4) Be a member of the community committee
- (5) Be part of working group of local authorities/central government agencies on such policies
- (6) Other (specify)

Q1-15c What is the role and membership of your HH in relation to government policy of the Thai-Laos electricity-border trade in Nong Khai?

- (1) Non-member
- (2) Member
- (3) Committee member

Q1-15d The frequency of the meetings attended by your HH for the government policy of the Thai-Laos electricity-border trade in Nong Khai

- (1) No meeting
- (2) Once a month
- (3) Twice a month
- (4) Every week
- (5) More than (4)

Q1-15e The topic discussed in the meeting attended by your HH for the government policy of the Thai-Laos electricity border trade in Nong Khai?

- (1) The price of traded energy
- (2) The quantity (quota) of traded energy
- (3) Tariff on imported energy
- (4) Quality control for energy products
- (5) The compensation for the project
- (6) The regulation
- (7) The benefit of the project
- (8) Others (please specify)

Q1-15f Degree of influence your HH has on the government policy of the Thai-Laos electricity-border trade in Nong Khai?

- (1) Control and set policies
- (2) Authorize the responsible person, such as the municipality, to act on their own behalf
- (3) Be a partner in the project
- (4) Policy changes can be made
- (5) Policy consulting
- (6) Being notified to acknowledge the policy
- (7) Receiving relief
- (8) Do not know the information about this policy at all, it's unilaterally determined by the government

**Section 2.** Respondent's opinion toward energy border trade of Thailand with Laos in Nong Khai

	Level of Agreement				
	Very High (5)	High (4)	Moderate (3)	Low (2)	Very Low (1)
<b>Thailand's electricity border trade between with Laos</b>					
1. Thai electricity firms have reaped high profits from electricity cross-border trading with Laos.					
2. Thai electricity firms engage in a monopolistic, high-tech electricity trading.					
3. Thai electricity firms have gained cost advantages by purchasing electricity from Laos rather than building dams in Thailand.					
4. Thai electricity firms benefit geographically, reducing the cost of power transmission lines for selling electricity in Thailand.					

**Section 3.** Respondent's perception of HH's relation with the policy network of Thai-Laos border trade in Nong Khai

	Level of Agreement				
	Very High (5)	High (4)	Moderate (3)	Low (2)	Very Low (1)
<b>Electricity trade policy</b>					
1. Your household has heard about Thailand's cross-border electricity trading policy with Laos.					
2. Your household has been informed by local authorities about Thailand's cross-border electricity trading policy with Laos.					

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3. Your household attended a public meeting on Thailand's cross-border electricity trading policy with Laos.
  4. Your household has the right to vote on Thailand-Laos cross-border electricity trading policy.
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**Section 4.** Respondent's perception of the effects of cross-border trade of electricity

	Level of Agreement				
	Very High (5)	High (4)	Moderate (3)	Low (2)	Very Low (1)
<b>Creation of working days</b>					
1. Local employment in Nong Khai province has been enhanced.					
2. Private company employees in Nong Khai province are experiencing significant salary increases.					
3. Communities are increasing their production of consumer goods such as food, beverages, and clothing.					
4. The population living and working in Nong Khai province is steadily increasing.					
5. People of working age in the province secure suitable employment.					
<b>Poverty reduction</b>					
6. People in the community have higher income levels.					
7. People in the community consume higher levels of goods produced within the community.					
8. People in the community have relatively low poverty levels.					
9. People in the community can reduce income disparities.					
10. People in the community have more ownership of property (e.g., houses, land, cars).					
<b>Well-being and capabilities</b>					
11. People in the community have a greater sense of self-dignity and self-esteem.					
12. People in the community feel safer in their daily lives.					
13. People in the community feel happier.					
14. People in the community experience less psychological stress.					
15. People in the community are less at risk of life danger.					
<b>Livelihood adaptation</b>					
16. You can adapt to the current fluctuations in the Mekong River's water levels.					
17. You can adjust to the shifting conditions of the Mekong River, which have impacted traditional family livelihoods such as agriculture and fisheries.					
18. In the case the Mekong River's changes make agriculture, fishing, or tourism impossible, you have alternative options available.					
19. Your experience enables you to handle natural disasters resulting from Mekong River changes, whether it's dry conditions in the dry season or flooding during the rainy season.					
20. You can mitigate potential future disasters on the Mekong River, including large-scale flooding or severe dry spells that might leave your community without tap water.					
<b>Natural resource base sustainability</b>					
21. Local communities are able to increase household productivity (e.g., agricultural, livestock or fisheries) as a result of the increased use of resources in the Mekong River.					
22. Local communities can avoid the damage and degradation of the Mekong River in Nong Khai province.					
23. Local communities and local government organizations can work together to reduce the damage and degradation of the Mekong River in Nong Khai province.					
24. Local communities have internal mechanisms (e.g., community committees) to deal with the damage and degradation of the Mekong River in Nong Khai Province.					
25. People in the local community contribute greatly to the protection of the Mekong Rive in Nong Khai Province.					

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**Section 5.** Suggestions for improving the cross-border energy trade policy with Laos

- 5.1: To improve the livelihoods of local residents
- 5.2: To improve the local economy and businesses
- 5.3: To reduce inequalities
- 5.4: To reduce the gender gap
- 5.5: To improve the environmental quality.

**Appendix B**

The checklist for the key informant interviews

1. Profile of the respondent

- Name
- Job title
- Name of organization
- Work experience

2. Creation of working days

- How has the enforcement of electricity border trade policies affected the creation of working days in Nong Khai province, particularly in industries reliant on cross-border trade?
- What challenges or opportunities have emerged for businesses and workers in Nong Khai province as a result of the electricity border trade, and how are these factors taken into consideration when establishing jobs?
- How does the electricity border trade impact the availability and reliability of electricity supply in Nong Khai province?
- Are there any notable differences in the creation of working days between areas in Nong Khai province that are directly affected by electricity border trade and those that are not, and how are these disparities addressed, if any?

3. Poverty reduction

- How has the implementation of electricity border trade contributed to poverty reduction in Nong Khai?
- Can you discuss the direct and indirect effects of electricity border trade policy on income improvement for residents of Nong Khai, particularly those living in poverty?
- What role do local businesses and entrepreneurs play in leveraging the opportunities created by electricity cross-border trade to alleviate poverty in Nong Khai?
- How does access to affordable and reliable electricity resulting from the border trade impact the daily lives and economic prospects of individuals and families living in poverty in Nong Khai?
- Are there any targeted programs or interventions supported by the government or non-governmental organizations aimed at harnessing the benefits of the electricity border trade for poverty reduction in Nong Khai, and what outcomes have been observed?

4. Well-being and capabilities

- How has the implementation of electricity border trade influenced the overall well-being and

capabilities of individuals and communities in Nong Khai, and what specific aspects of well-being have been most affected?

- Can you discuss the ways in which access to electricity resulting from the border trade has enhanced the capabilities of residents in Nong Khai, such as improved education, healthcare, and economic opportunities?
- What role do community-based initiatives and social enterprises play in leveraging the benefits of electricity border trade to enhance the well-being and capabilities of marginalized populations in Nong Khai?
- How are traditional and cultural practices in Nong Khai province impacted by the introduction of electricity border trade, and what efforts are being made to ensure that these changes contribute positively to overall well-being and capabilities?

5. Livelihood adaptation

- How has the implementation of electricity border trade influenced the livelihood adaptation strategies of individuals and communities in Nong Khai, particularly those engaged in border trade-related activities?
- Can you discuss specific examples of how access to affordable electricity resulting from the border trade has facilitated the diversification of livelihoods and income sources in Nong Khai?
- What role do local industries and businesses play in adapting their operations and business models in response to changes in electricity availability and affordability driven by the electricity border trade?
- How do shifts in energy consumption patterns influenced by the border trade impact the sustainability and resilience of livelihoods in Nong Khai, particularly in sectors such as agriculture, manufacturing, and tourism?

6. Natural resource base sustainability

- How has the implementation of electricity border trade influenced the sustainability of natural resources, particularly the Mekong River, and what specific measures are in place to mitigate any negative impacts on the ecosystems?
- Can you discuss the potential environmental consequences resulting from changes in energy production and consumption patterns driven by the electricity border trade, and how are these impacts monitored and addressed?
- What role does community participation and local governance play in ensuring the sustainable management of natural resources along the Mekong River in Nong Khai amidst the implementation of electricity border trade?
- Are there any notable conflicts or tensions arising from competing interests between economic development driven by the electricity border trade and the conservation of natural resources, and how are these conflicts being managed or resolved?

7. Recommendations for enforcement of policies on cross-border electricity trade with Laos.