



Project : TA-8830-REG: Harmonizing the Greater Mekong Subregion Power Systems to Facilitate Regional Power Trade (47129-001)

Contract Number: 139061-S53235

GREATER MEKONG SUBREGION RPTCC-26 MEETING LAOS-MYANMAR INTERCONNECTION INTERIM REPORT °1

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HANOI VIETNAM
NOVEMBER 26TH, 2019

EDF Group: a Responsible Industrial Firm with corporate social responsibility goals

1 Low carbon policy

Go beyond the requirements of the 2 °C trajectory set by COP21 by drastically reducing our CO₂ emissions.

17g of CO₂/kWh in France

2 Respect for people

Integrate best practice in the way we develop our people: health and safety, gender diversity and internal development.

3 Responsibility

Offer all vulnerable people information about and support with energy use and energy benefits.

4 Innovation

Innovate through digital energy efficiency solutions to enable all customers to use energy better.

5 Concertation

Systematically organise a process of transparent and open dialogue and consultation for every new project around the world.

6 Environment

Launch a positive approach to biodiversity, not limited to understanding and reducing the impacts of our activities in the long run but having a positive effect on biodiversity.

36.7 million
customers worldwide

160 000
employees

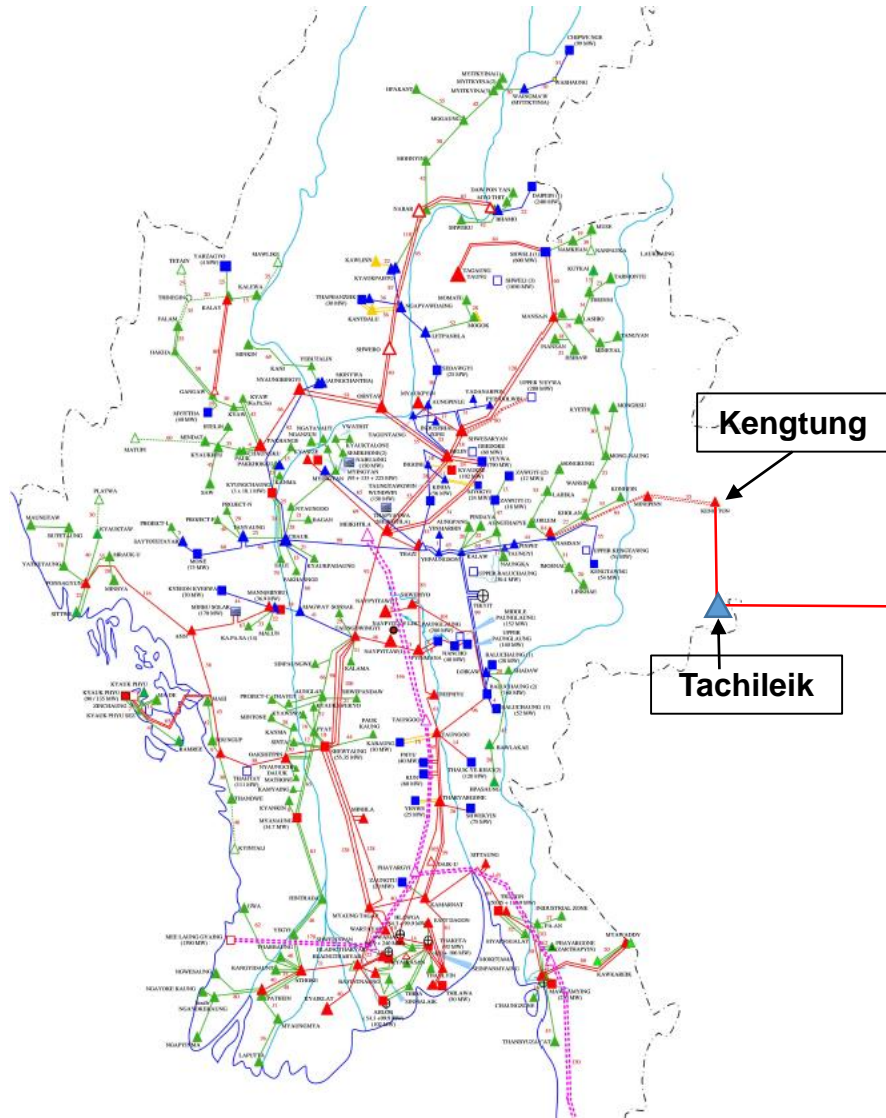
€71 billion
sales

584TWh
electricity generation

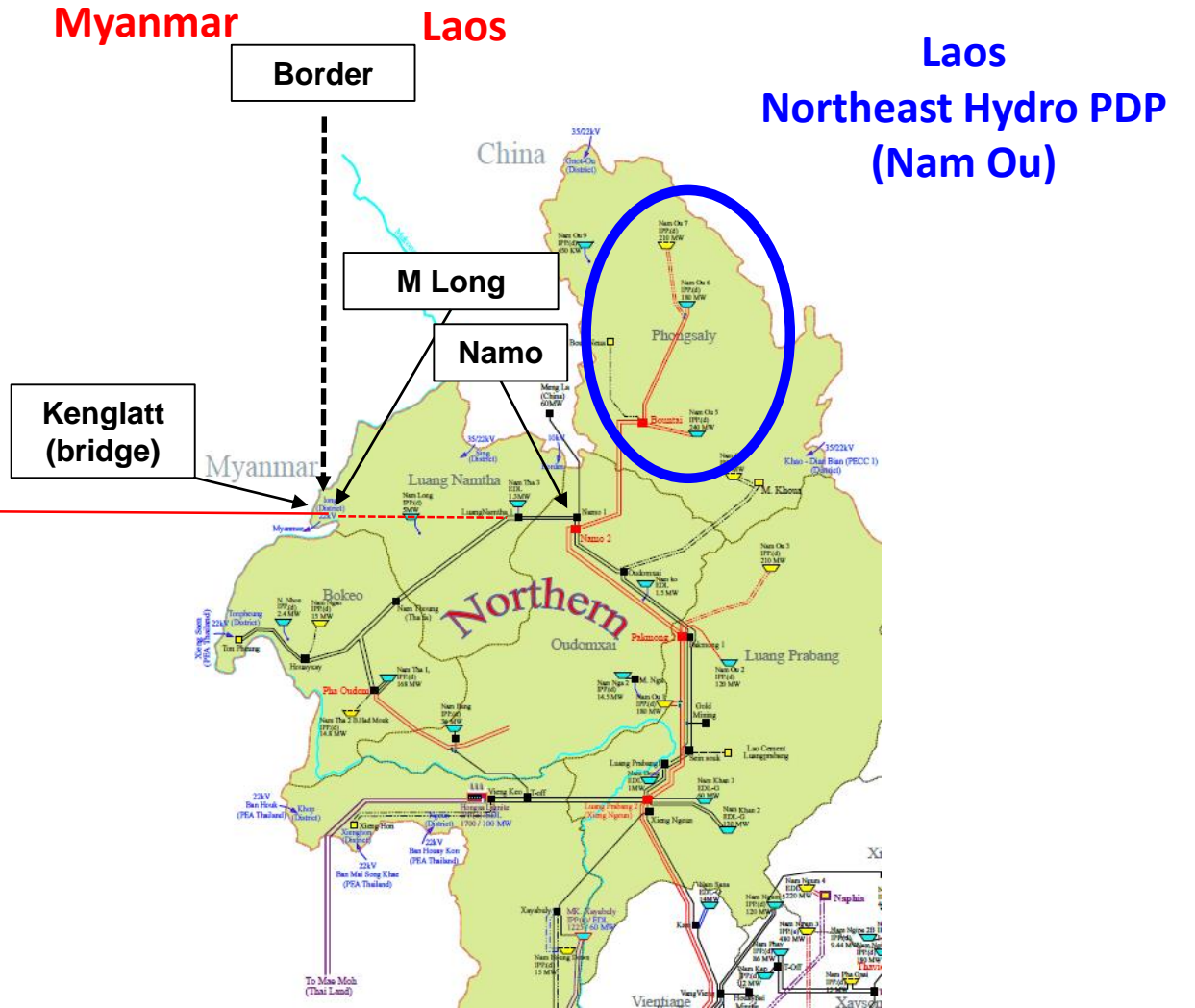
Summary

- EDF introduction
- Project Scope and Organization
 - Main Outlines of the scope
 - Myanmar Task Force
 - Laos Task Force
- Cross Border Line feasibility study
 - Interim report
 - Myanmar
- System studies
- Recommendations for synchronizing Lao and Myanmar Systems

General Overview



Myanmar main grid



Laos Northern main grid

Main outlines of the scope

- A. **Feasibility study of Tachileik- Kengtung and Tachileik-Kenglatt (border) transmission lines development to be commissioned in 2023**
 - **EDF on tracks: interim report at RPTCC meeting November 26-27th, 2019**

- B. **Conduct system study of high voltage power transmission systems in Myanmar (230 kV, 66 kV and future 500 kV) and Lao PDR with the objective of interconnecting the two power systems**
 - **MOEE, EDL/MEM and EDF use the same model : PSS/e**
 - **Data collection on tracks**
 - **Need to agree on a common Supply-Demand Assumptions compliant with GMS Framework: to be discussed during the November 28th meeting with ADB, Lao PDR, JICA, Manitoba, EDF**
 - **Study result may affect Laos-Myanmar interconnection recommendation**

- C. **Assess the technical gaps and recommend options in synchronizing Myanmar power system with Lao PDR and Thailand power systems.**
 - **Data collection on tracks**

Myanmar Task Force

- **September 13th JWG Meeting at Yangon Electricity Supply Corporation in Myanmar**
- **Task Force team members from MOEE was designated:**
 - **Mr. Kyaw Swar, Deputy Director, DEPP**
 - **Mr. Myo Win Zaw, Deputy Director, DPTSC**
 - **Ms. Yin Yin Mon, Deputy Director, DPTSC**

+ EDF Project Team
- **Task Force Team Meetings with EDF/EDL by using Viber Application**
 - **October 18th , 2019**
 - **November 20th, 2019**
- **Non Disclosure Agreement – MOEE thinks there is no need**

Laos Task Force

- **September 13th JWG Meeting at Yangon Electricity Supply Corporation in Myanmar**
- **Task Force team members from EDL was designated:**
 - **Ms. Santisouk Phimpachanh Director Power System Planning Division**
 - **Mr. Somsanith Sadetan Deputy Manager EDL**
 - **Mr. Chitpanya Panmisith Deputy Manager System Planning Office, EDL**
 - **Mr. Soukvilay Phimmasen Technical Officer,**
 - **Mr. Peeza Latthasing engineer EDL**

+ EDF Project Team
- **Task Force Team Meeting**
 - **22 November, 2019**
- **NDA is signed by EDL/MEM dated October 22nd, 2019**

Interim report on Cross Border Line feasibility study

Feasibility study of (i) Tachileik – Kengtung, 145 km transmission line and Tachileik substation; and (ii) Tachileik–Kenglatt (Border Location), 100 km Transmission line

1. **Conduct technical studies for Tachileik – Kengtung transmission line development project, including proposal for initial line route using GIS mapping, and preliminary engineering design.**
 - 1.1 Technical meeting with MEM and EDL – *13 Sep 2019*
 - 1.2 Prepare data collection forms and obtain data from MOEE and MEM – Sep 2019 **Done thanks to the Task Forces**
 - 1.3 GIS Mapping and remaining data collection – Oct 2019 **Done**
 - 1.4 Preliminary Engineering Design and route mapping (using PLS-CADD) – Oct 2019 **Done**

2. **Conduct techno-economic studies of the project considering various options and confirm technical viability of the project.**
 - 2.1 Based on validated routing and technical preliminary design, with or without options, make assessment of project cost – *End Nov 2019*
 - 2.2 Propose technological options including advanced technologies, voltage levels and HVAC or HVDC, smart grid components and possible future evolutions and provide recommendations – *End Dec 2019*
 - 2.3 Carry out risk assessment and confirm viability – *End Dec 2019*

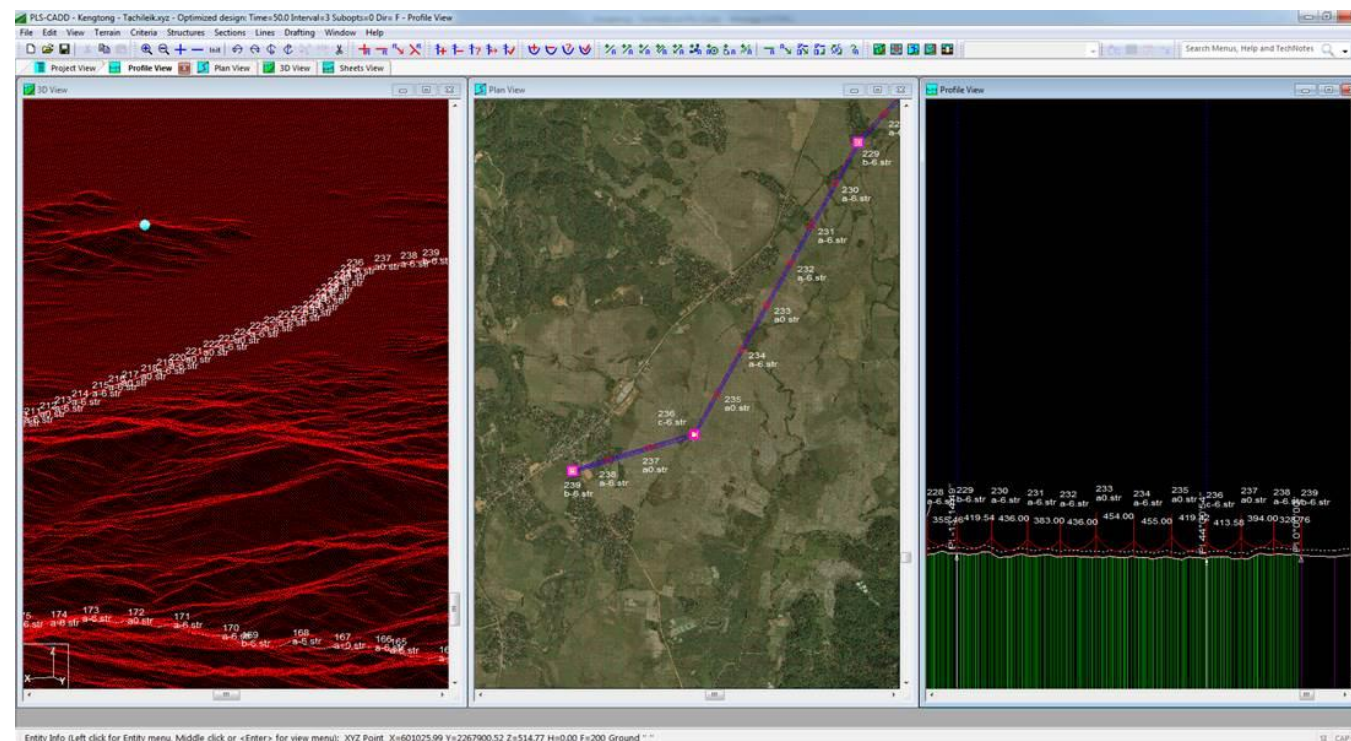
3. **Reports for 1 and 2**
 - Intermediary Report – 15 Nov 2019 RPTCC Meeting **November 26-27th, 2019**
 - Presentation and obtaining comments: **November 26-27th, 2019**
 - Draft final report – Mar 2020

Interim report on Cross Border Line feasibility study

PLS CADD: 3D, Plan & Profile Views

Tools

- A. Google Earth
- B. Google Mapper Software
- C. PLS CADD Software



Interim report on Cross Border Line feasibility study

1. Feasibility study of Tachileik – Kengtung transmission line development to be commissioned in 2023

2. Feasibility study of Kenglat Border crossing point - Tachileik transmission line development to be commissioned in 2023

Confirmed by MOEE and MEM

- **The 230kV OHL border crossing point shall be near Kenglat (Bridge)**
- **Kenglet is only crossing point and ‘No’ Substation in Kenglat**
- **Kengtung Substation is completed and ready for operation**
- **Tachileik Substation is new to be built.**
- **Existing 230kV MOEE Specifications shall be followed**

Interim report on Cross Border Line feasibility study

Data Collection by Myanmar Task Force

- Confirmation of EDF assumptions
- Confirmation of 230kV OHL border crossing point
- Kengtung 230kV Substation
- Tachileik New 230kV Substation precise location with base Map Review
- Climatic data to analysis including wind and temperature zones
- MOEE technical standards and drawings

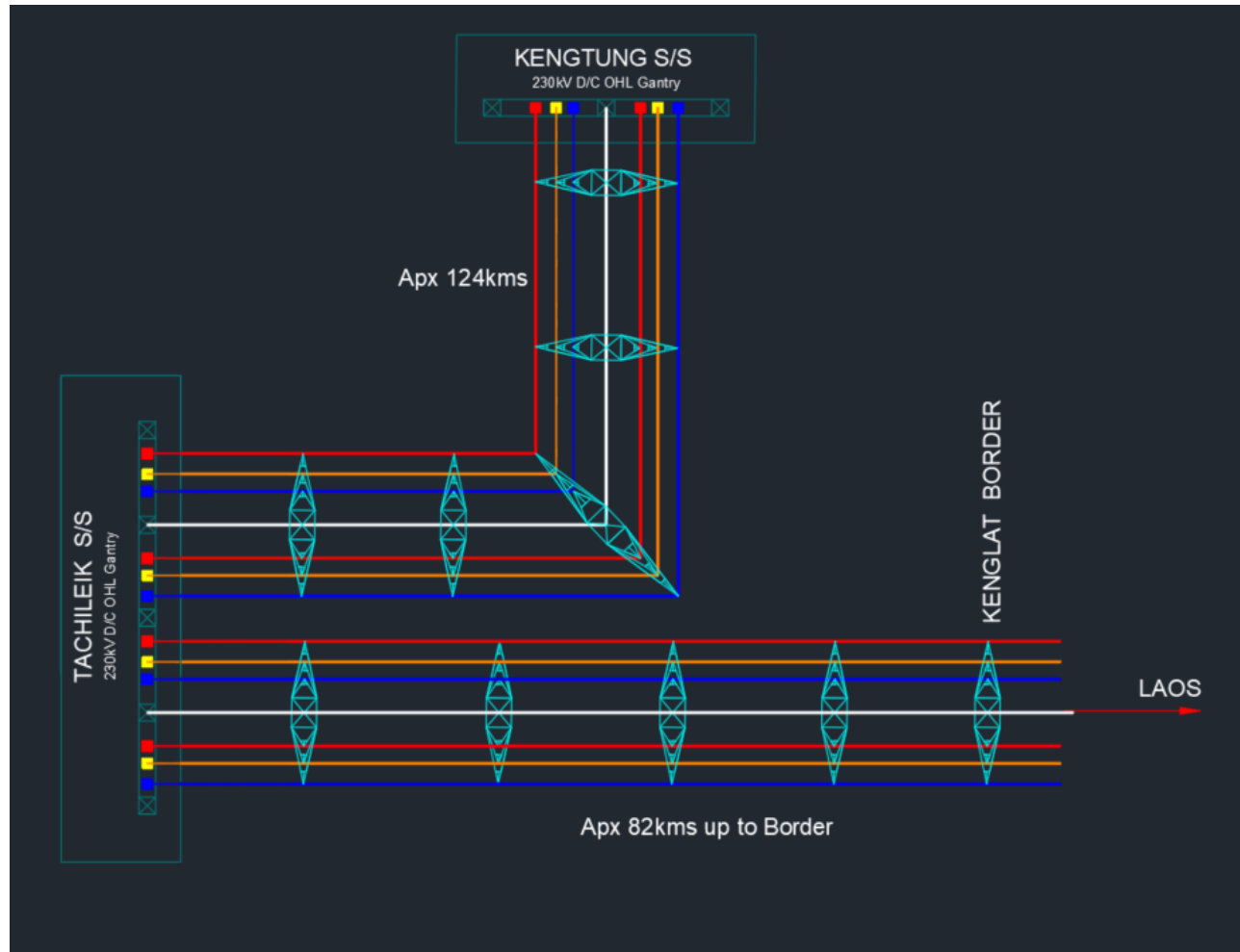
Data Collection by Laos Task Force

- Confirmation of 230kV OHL border crossing point (tower near Kenglatt bridge)
- Technical standards regarding weather conditions compliance

Information : Feasibility study BOOT M Long-Border is not yet realized

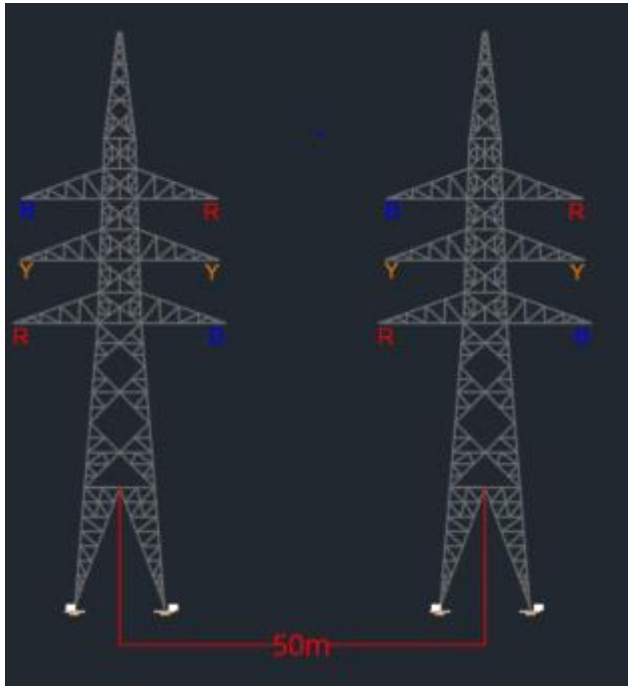
Interim report on Cross Border Line feasibility study

230kV Kenglat - Tachileik SS – Kengtung SS transmission line Single Line Diagram

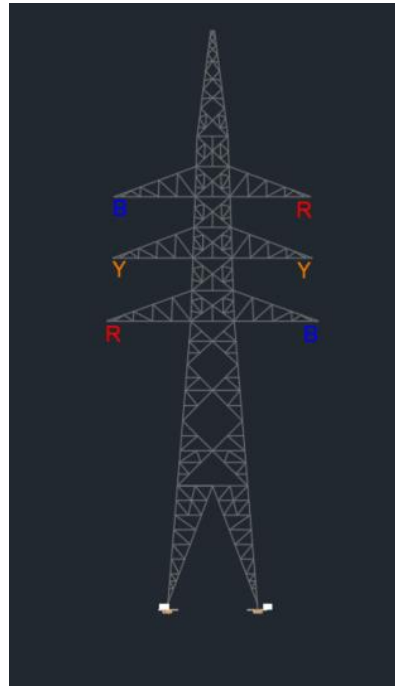


Interim report on Cross Border Line feasibility study

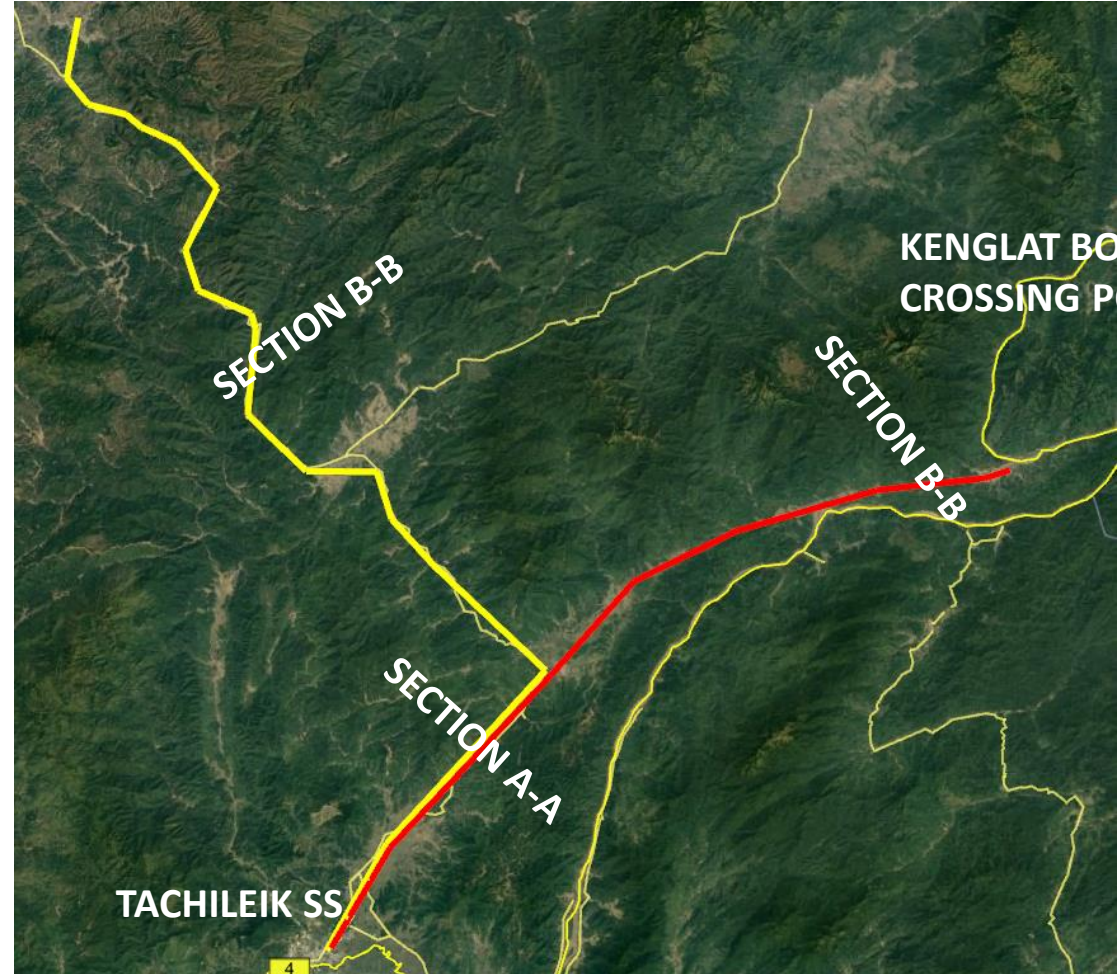
Line routing of 230KV OHL by EDF



SECTION A-A



SECTION B-B



Interim report on Cross Border Line feasibility study

A. Feasibility study of Tachileik – Kengtung transmission line development to be commissioned in 2023

EDF has proposed the following assumptions to be confirmed after system study (B)

- 230 kV double circuit OHL
- Conductor: ASTER570
- Type of tower: double circuit + 1 OPGW
- Capacity: 400 MW à 25°C for each circuit (Conductor temperature : 75 °C)
- Length: Apx **117** km

B. Feasibility study of Kenglat Border crossing point - Tachileik transmission line development to be commissioned in 2023

EDF has proposed the following assumptions to be confirmed after system study (B)

- 230 kV double circuit OHL
- Conductor: ASTER570
- Type of tower: double circuit + 1 OPGW
- Capacity: 400 MW à 25°C for each circuit (Conductor temperature : 75 °C)
- Length: Apx **82** km

System study

B. Conduct system study of high voltage power transmission systems in Myanmar (230 kV, 66 kV and future 500 kV) and Lao PDR with the objective of interconnecting the two power systems

EDF needs to agree with MOEE and MEM the assumptions for the system study

- Supply-Demand projections on Myanmar Main Grid
- Supply-Demand projections on Northern Laos Grid
- Hydro project development in North East

compliant with GMS Framework: to be discussed during the November 28th meeting with ADB, Lao PDR, JICA, Manitoba, EDF

Proposed scope: Laos-Myanmar exchanges in 2025 2030 2035 2040

- 1. Balancing study with PLEXOS to assess future power market exchanges**
- 2. PSSE to assess the best voltage level (230 or 500kV) and technology:**
 - One synchronized system with AC interconnection
 - Interconnected systems with DC
 - Interconnected systems with AC and Back-to-Back station

System study

Data Collection by Myanmar and Laos Task Forces

- Grid Maps including generation sites
- Single Line Diagrams
- PSS/e Data + excel Lines, Grid and Generation Transformers and Substations
- Demand: existing Peak load/Substation
 - Myanmar: Load Curve 2013-2018
 - Laos : Forecast 2018-2030 by region
- Supply: detailed Generation past 2014-2018 et future existing 2018-2025
- Tariff (Myanmar)
- Electricity law (Myanmar)

JICA reports

- Myanmar National Electricity Master Plan (NEMP) December 2014
- Myanmar Data Collection Survey October 2017
- Laos Draft Report on Domestic Power Supply June 28th, 2019

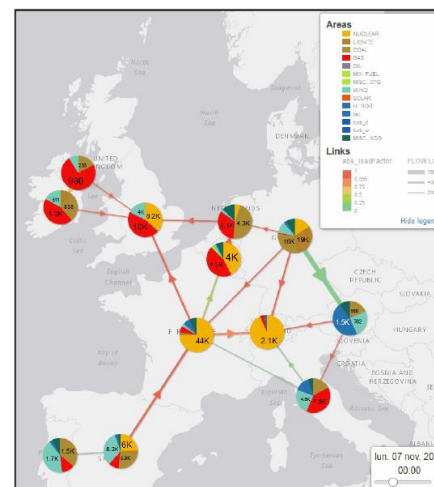
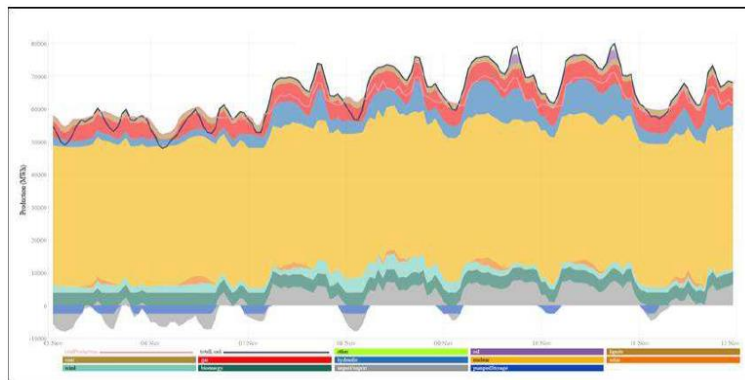
Manitoba

- GMS Transmission Master Plan. Presentation June 2018 (on GMS web Site)

System study

Economic study with PLEXOS: a software to simulate balance between supply & demand & interconnections

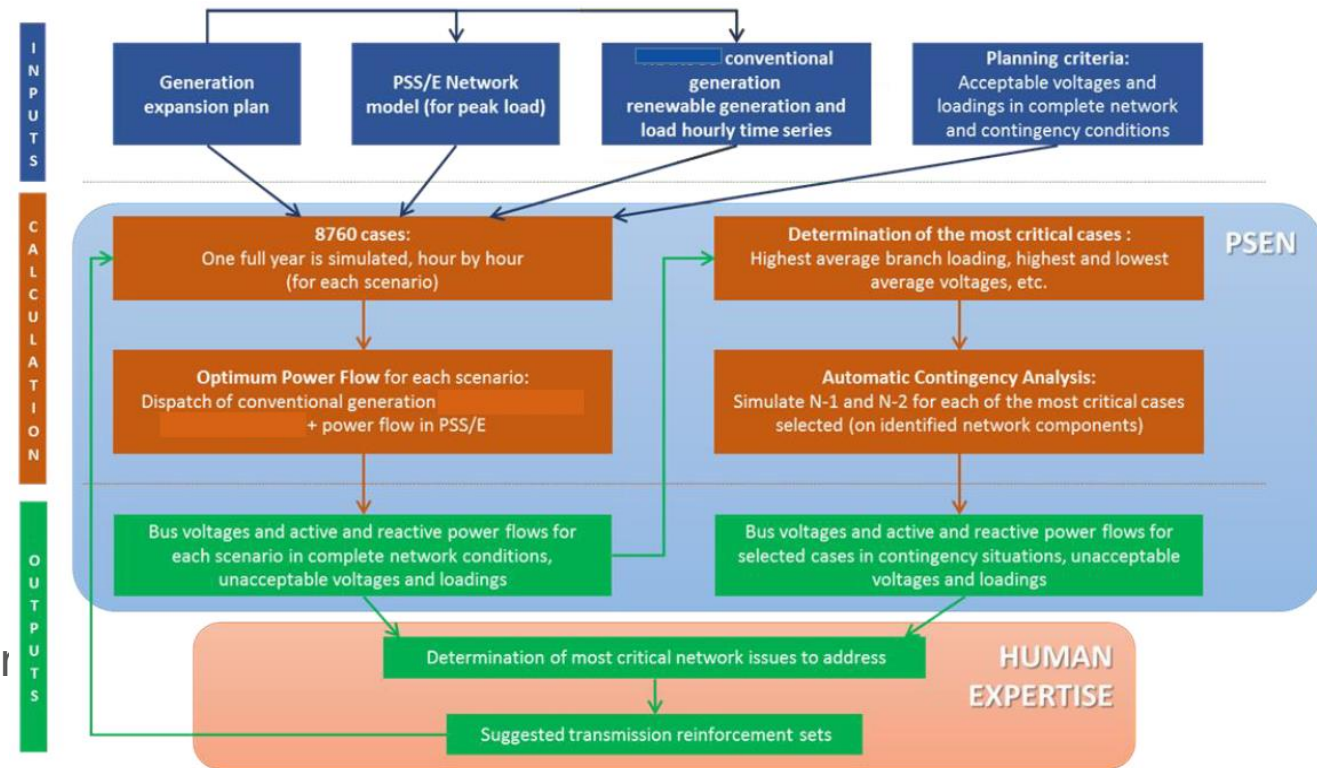
- Methodology: Overall CBA of the interconnected PS based on the difference of the yearly power systems cost with and without interconnection.
- Period of study: from 2021 (year of commissioning) to 2040
- Sensitivity analysis: can be performed on various physical values (load, hydro generated power, wind, solar, etc.).
- Output: Optimal capacity of the interconnection (MW) and Net profit (\$)



System study

Static Study with PSS/e software for power system modelling

- Methodology: AC load flow study.
- Scenarios (to be adjusted):
Years of study to be adjusted: 2030 (at least)
Typical load spot: Peak load, off-peak load and average load
- Outputs: Design assessment
Network constraints in N and N-1 configuration
List of proposed internal network reinforcement in each country
Maximal short-circuit current for each network node
Reactive compensation needs



Recommendations for synchronizing Laos and Myanmar System. Option Thailand

Data Collection by GMS Working Group on Performance Standards and Grid Code of the RPTCC

GAP ANALYSIS AND NECESSARY INFRASTRUCTURE REQUIREMENTS

- Lao PDR
- Myanmar
- Thailand

Key criteria

- capacity planning margins for each country,
- transmission voltage standards,
- acceptable ranges of system frequencies and frequency control methods,
- acceptable ranges of system voltages, in normal and contingency conditions,
- acceptable levels of total harmonic distortion and fault clearance time,
- the range of transmission system planning studies and criteria which are applied by the GMS countries.

Comparison with Europe UCTE: GMS Standard partially applicable for the 3 countries

Recommendations for synchronizing Laos and Myanmar System. Option Thailand

Policies to be harmonized:

- Load frequency Control and Performance
- Scheduling and Accounting
- Operation security
- Co-ordinated Operational planning
- Emergency Operations
- Communication Infrastructure
- Data exchanges
- Operational Training

Main activities for achieving the harmonization:

- Review of Thailand, Lao and Myanmar regulations and conducting of gap analyses
(refer to Gap Assessment Analysis, March 2019, Michel Caubet)
- Consultations & Study visits,
- Drafting a first set of harmonized regulations → in compliance with the GMS Grid Code
(A Draft Final Version of the GMS Grid Code has been delivered to the WGPG Members on January 10Th, 2019)
- Training activities.

The GMS Grid Code

Structure of the Draft Final Version GMS Grid Code (WGPG Members on January 10th, 2019):

1. Governance
2. Connection Codes
 - a) Demand Connection Code
 - b) Requirements for Generators
 - c) High Voltage Direct Current Connections
3. Operational Security Code
4. Operational Planning and Scheduling Code
5. Load Frequency Control and Reserves Code
6. Emergency & Restoration Code
7. Market Codes (Operational Aspects)
 - a) Capacity Allocation and Congestion Management
 - b) Electricity Balancing
 - c) Forward Capacity Allocation
8. Metering Code
9. Training Code

END