



Options for Determining Grid Emission Factors in Lao PDR

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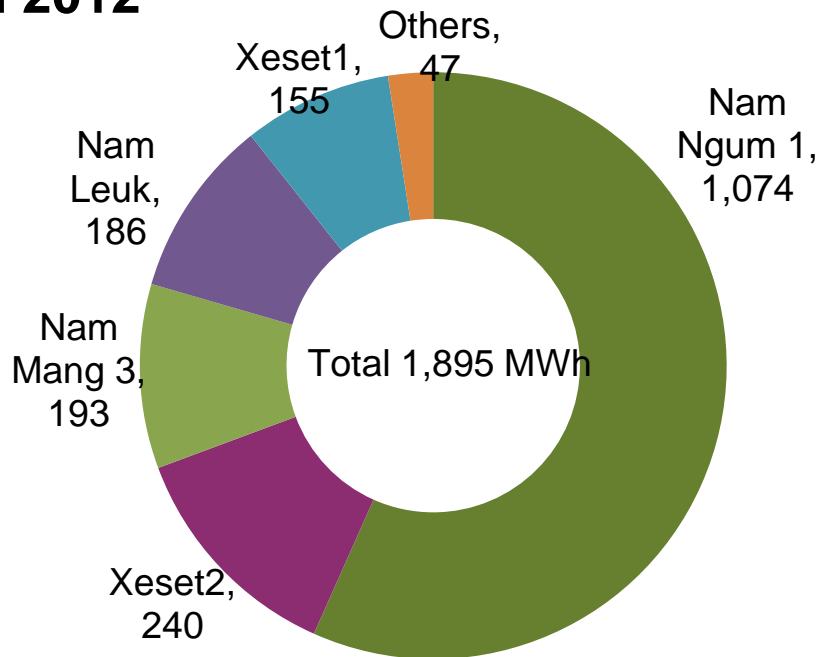
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2015/01/15

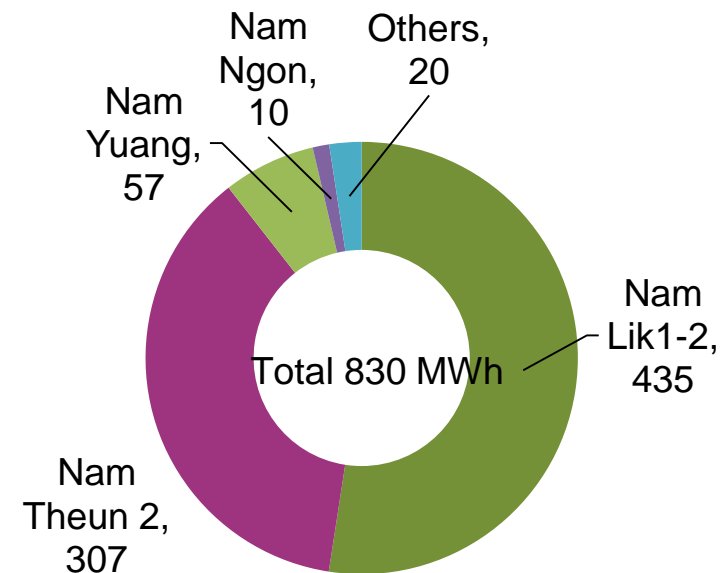
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All power generators in Lao PDR are hydro power

Electricity supply to EDL grid
from power plants owned by EDL
In 2012



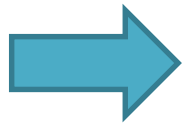
Electric supply to EDL grid from
power plants owned by IPP in 2012



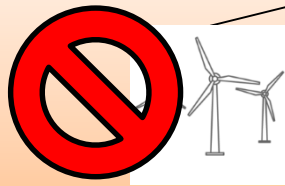
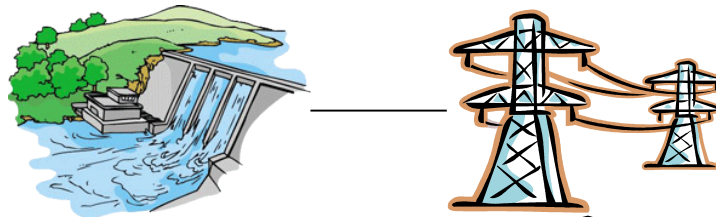
Source: Author based on EDL internal data

0 tCO₂/MWh of Emission factor does not promote renewable energy or energy efficiency projects

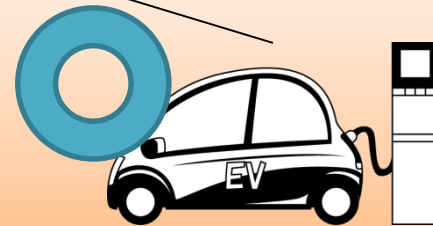
- If electricity import from Thailand and other neighbor countries are not included, the emission factor is 0 tCO₂/MWh.
- 0 tCO₂/MWh promotes electrification projects such as electric car, but cannot promote renewable energy or energy efficiency projects



Need to consider option to include import electricity under the JCM context

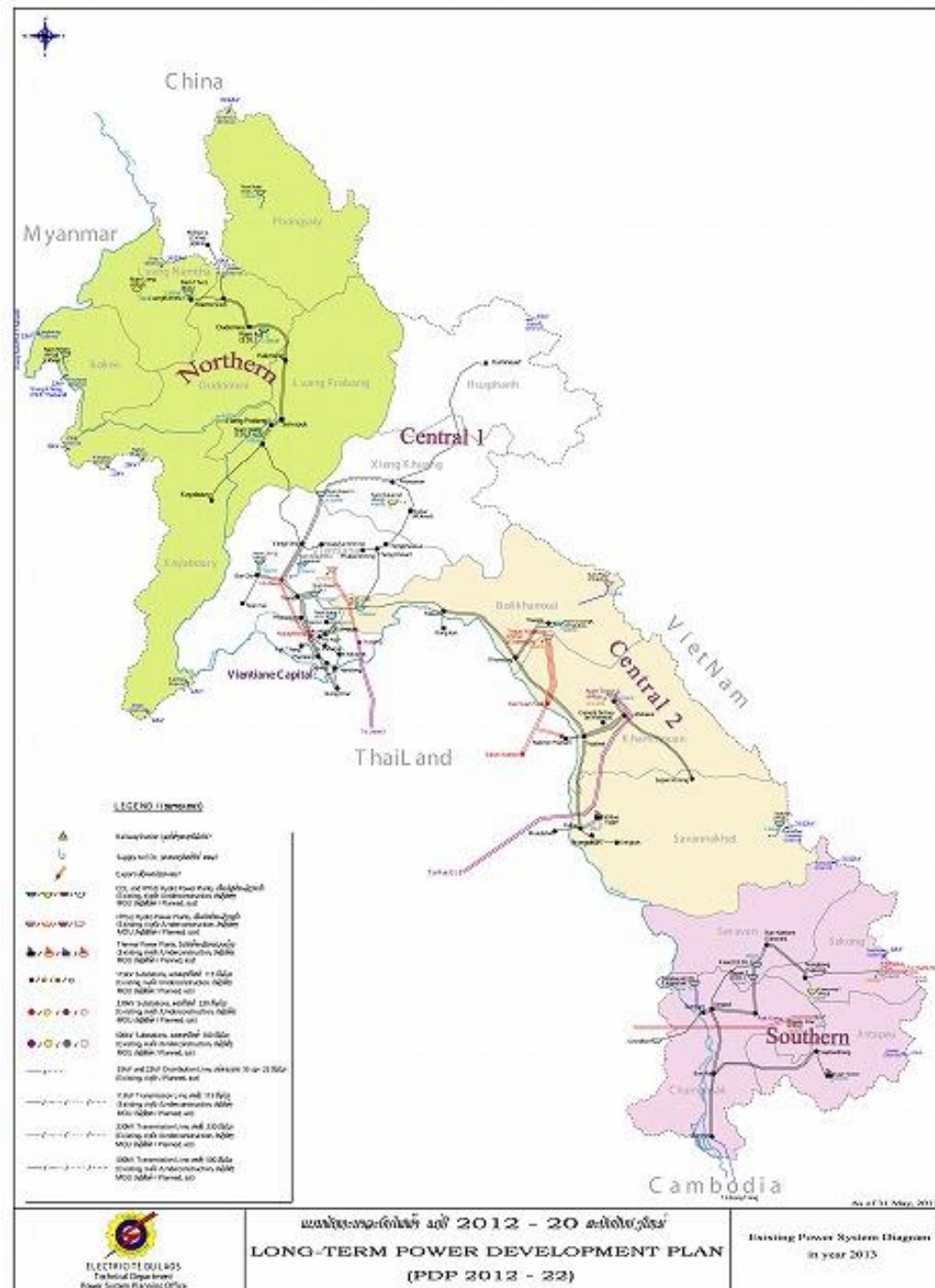


Construction of new wind power



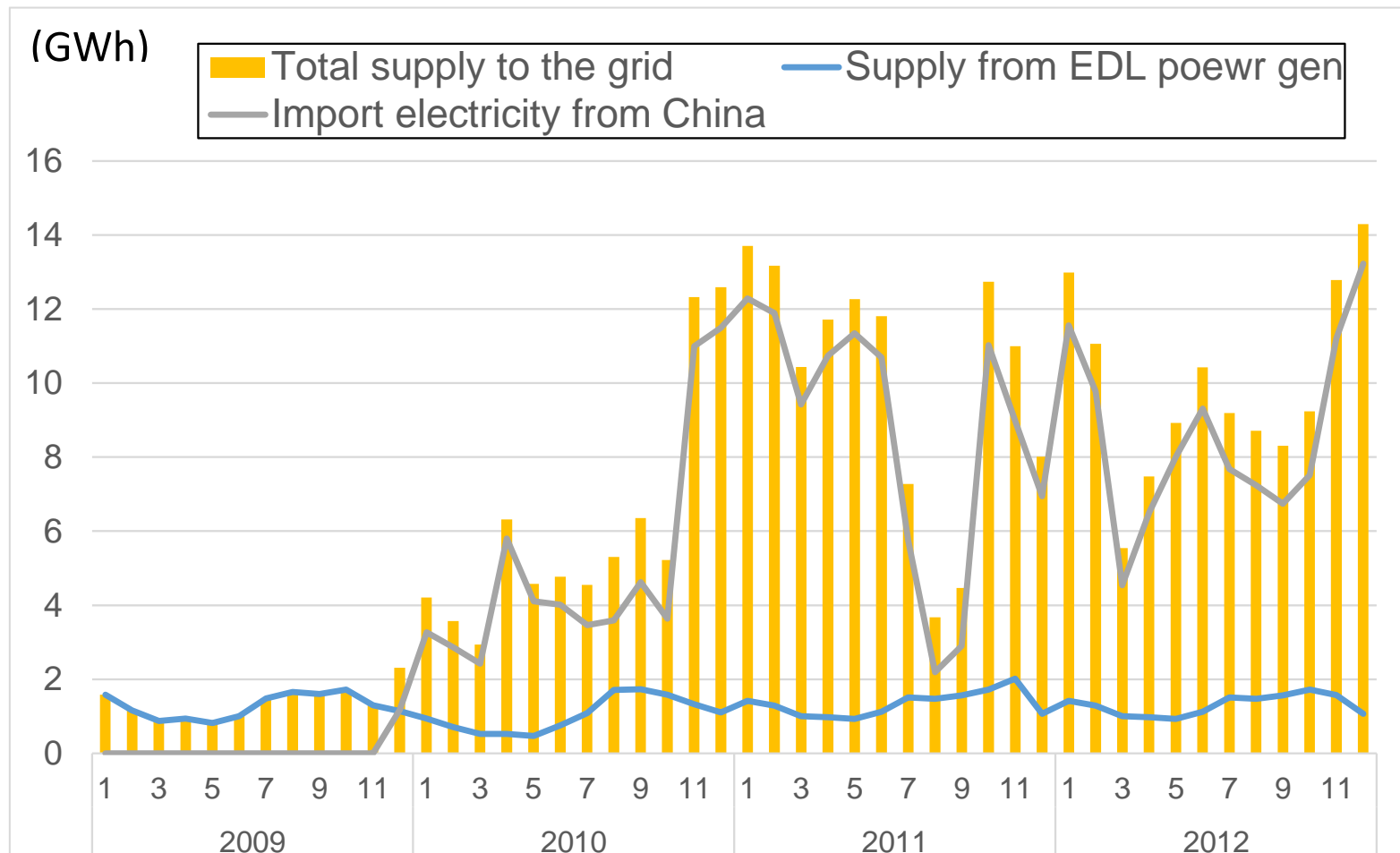
The Lao Grid is separated into 4 grids

- The Northern Grid
 - The Central1 Grid
 - The Central2 Grid
 - The Southern Grid
- Those are separated grids in Lao PDR



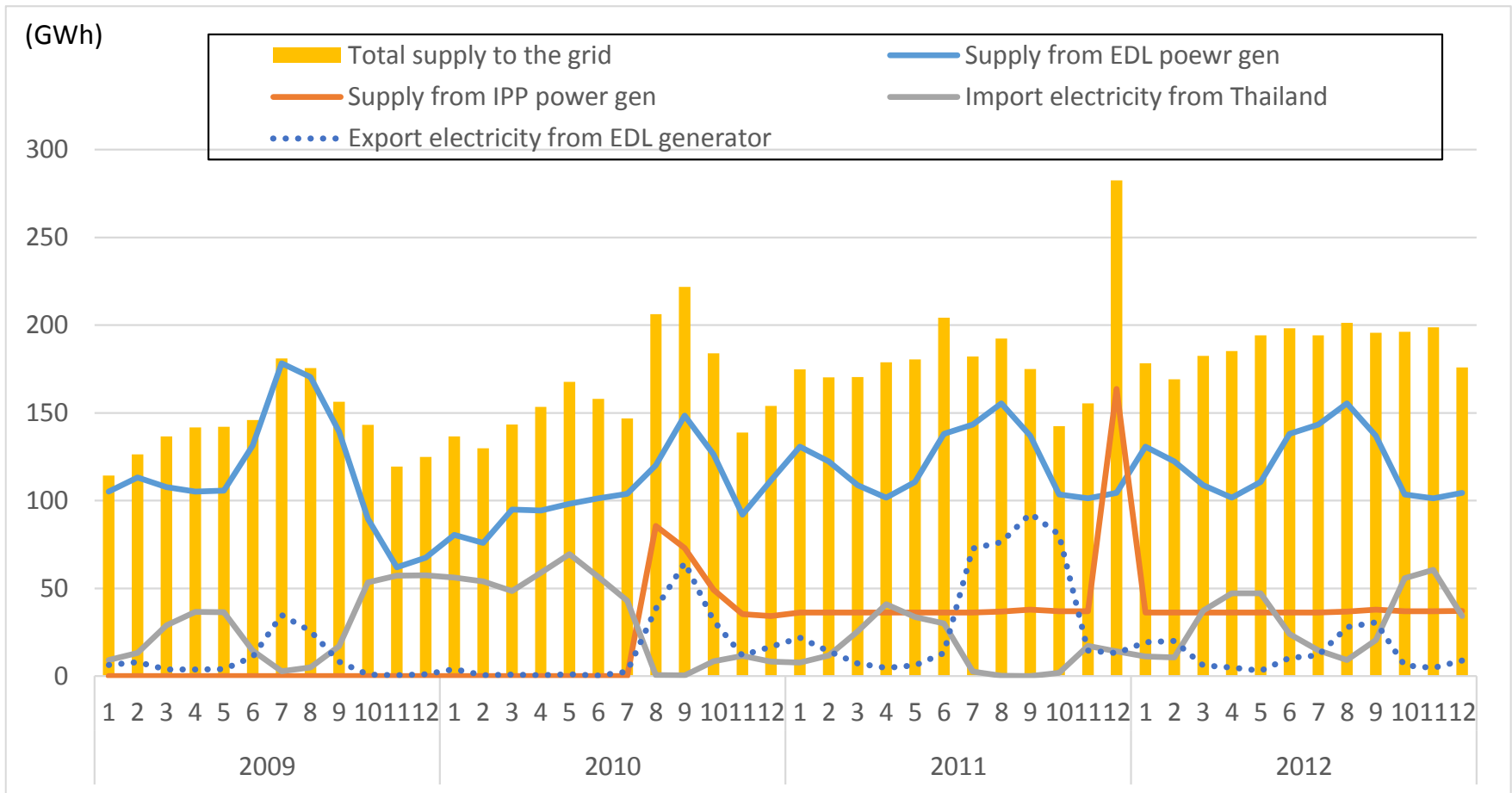
The Northern Grid

- Electricity demand were increased around 2010- 2011
- Import electricity from China is major power source
- No electricity export from the Northern grid to neighbor countries



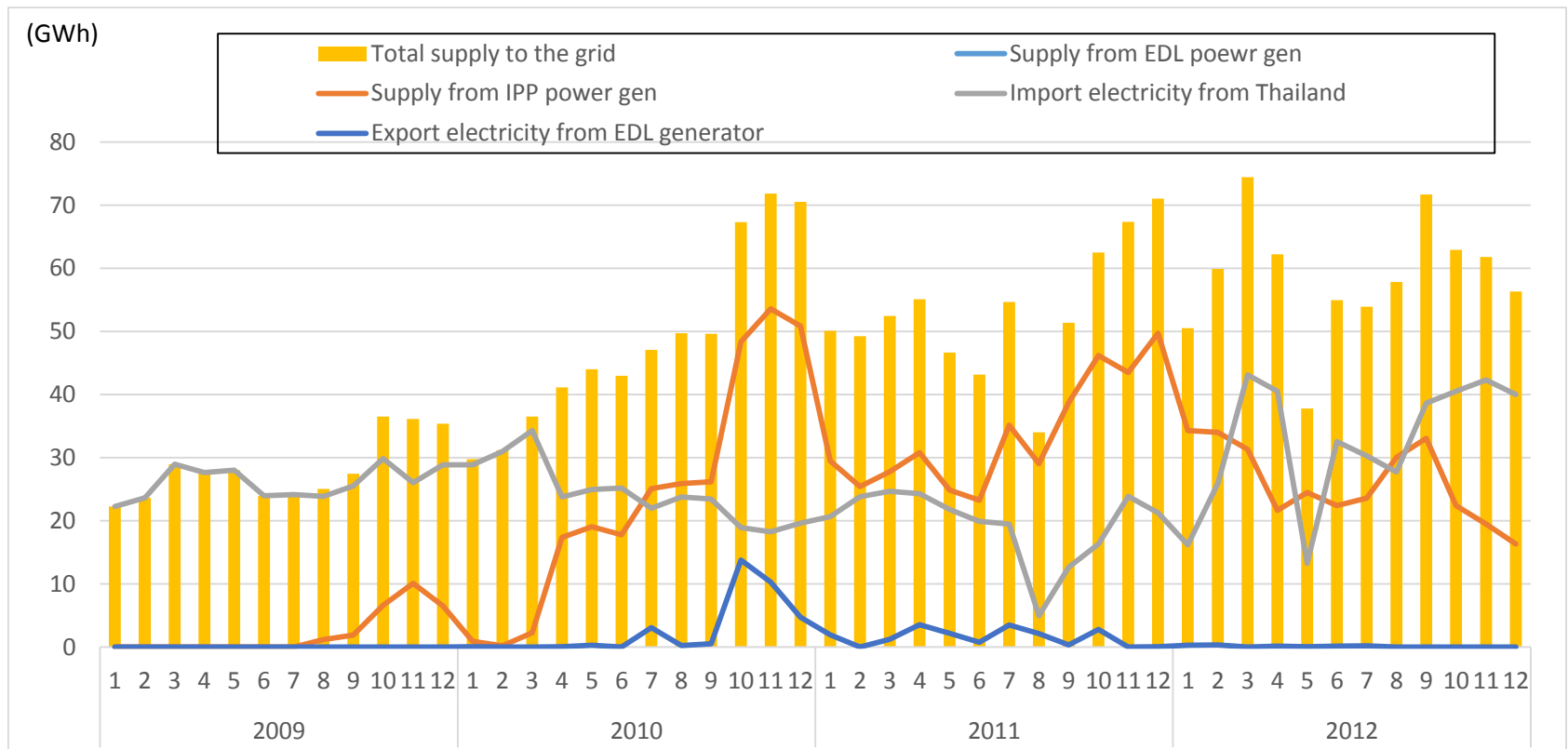
The Central 1 grid

- Electricity demand has been gradually increased.
- During dry season, electricity import exceeds its export
- Electricity supply from IPP power generation has been basically stable due to its contract with EDL



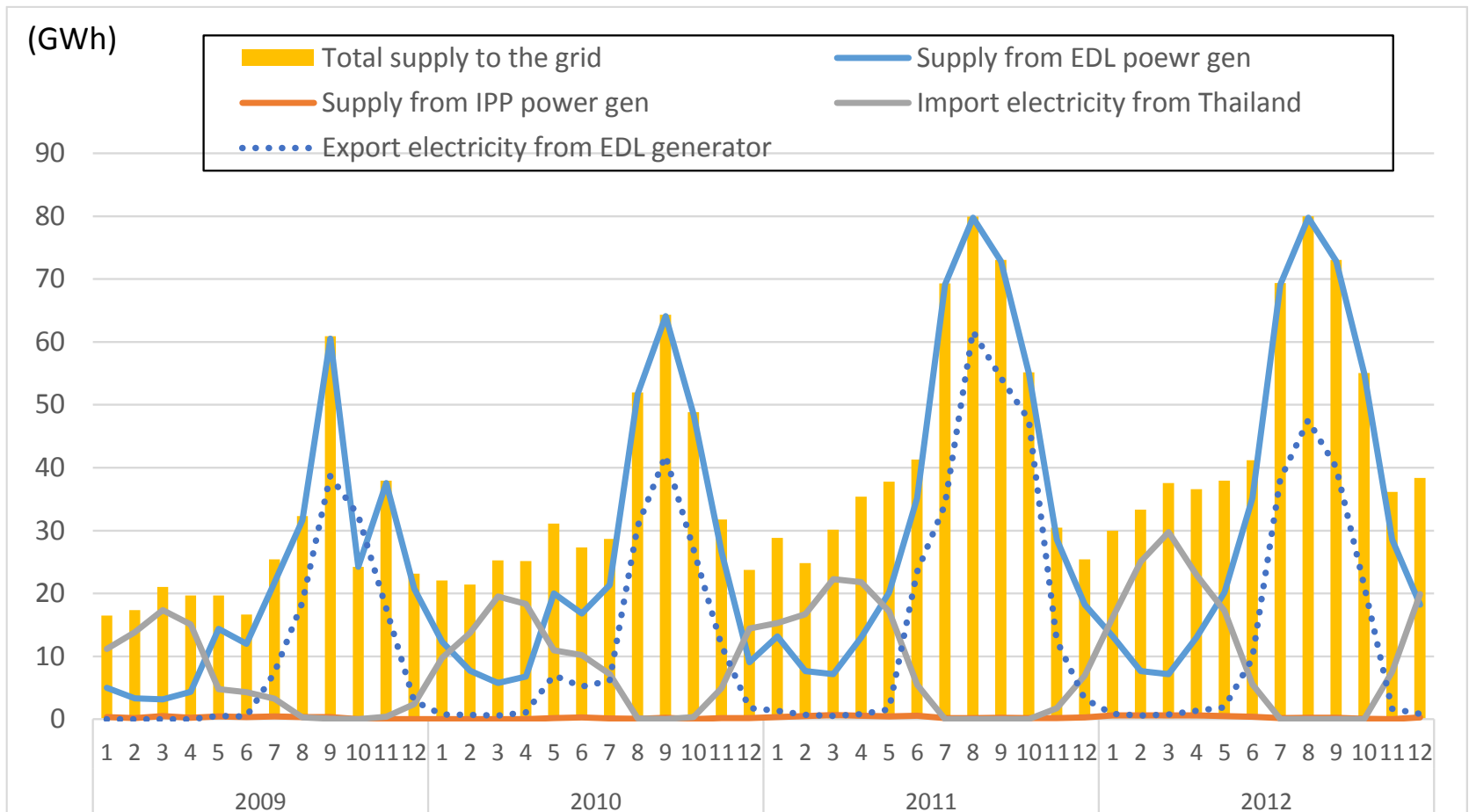
The Central 2 grid

- Electricity demand has been increased.
- Electricity supply relies on IPP power generation and import
- Electricity import has been increased since 2012



The Southern grid

- Electricity demand has been increased.
- Electricity supply relies on IPP power generation and import
- Electricity import has been increased since 2012



How to calculate Grid Emission Factor

$$EF_{grid,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y})}{EG_y}$$

IPCC guideline provides default values

Where:

- $EF_{grid,y}$ = Average operating margin CO₂ emission factor in year y (tCO₂ /MWh)
- $FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
- $NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
- $EF_{CO_2,i,y}$ = CO₂ emission factor of fossil fuel type i in year y (tCO₂ /GJ)
- EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, including low-cost/must-run power plants/units, in year y (MWh)
- i = All fossil fuel types combusted in power sources in project electricity system in year y
- y = The data available in the most recent 3 years

Two types of grid emission factors are considered

- $GEF_{consume} = GEF_{supply} \times (1 + TDL)$

Where:

GEF_{supply} : Grid emission factor for electricity supply or demand side energy efficiency

$GEF_{consume}$: Grid emission factor for electricity consumption from the grid

TDL : Average technical transmission and distribution losses for providing electricity
default value is 20%.

Source: Tool to calculate baseline, project and/or leakage emissions from electricity consumption

GEF_{supply} is for renewable energy or energy efficiency projects



$GEF_{consume}$ is for electrification projects



Option 1: Reflect GHG emissions of import electricity from Thailand

- Central 1, Central 2 and Southern grid are combined into Thailand grid
- This option enable to develop renewable energy project which export electricity to other countries



For GEF_{supply} of Central 1 + Central 2 + + Southern Thailand grid

From 2009-2010

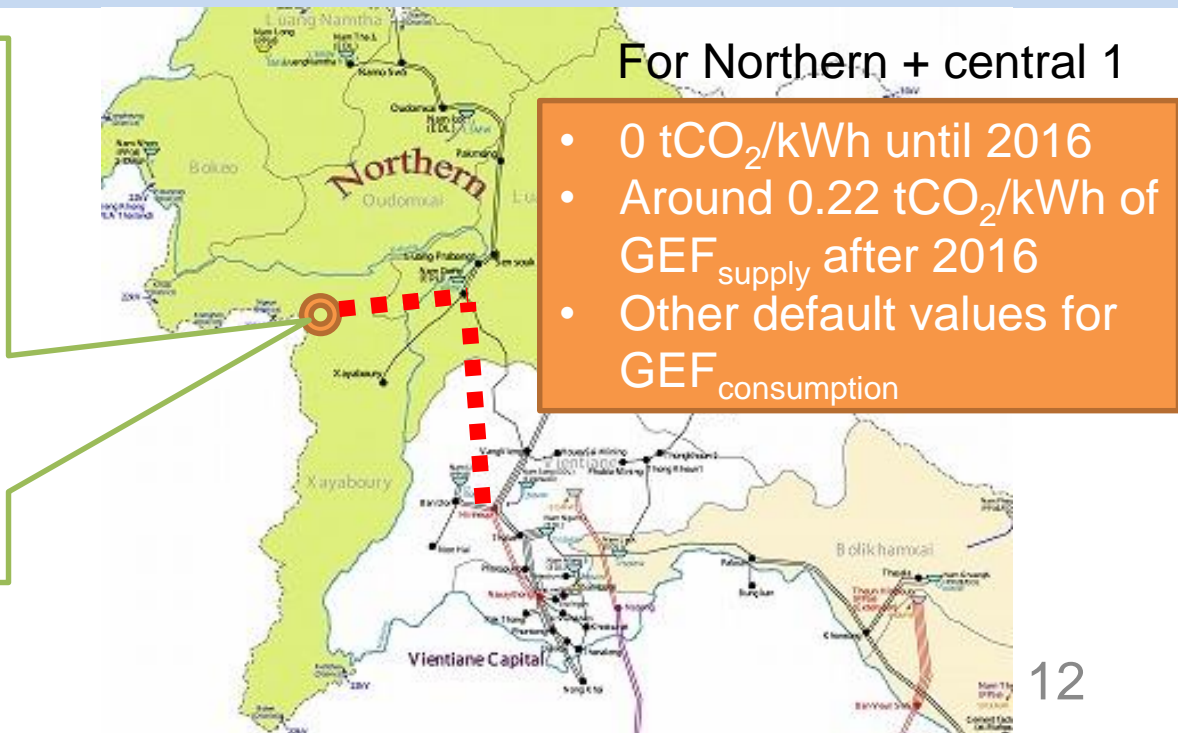
Around 0.587 tCO₂/MWh
for GEF_{supply}
Around 0.704 tCO₂/MWh
for GEF_{consumption}

Option 2: Update grid emission factors when coal fire plant operates

- The boundary of grid is limited into Lao PDR
- Hongsa Lignite power plant (1878 MW in total) is planned to be operated from 2016 and transmit 5.3% of electricity to Lao grid.
- Only northern grid will be affected so far, while now transmission line from northern grid to central 1 grid is under construction.
- GEF can be calculated after its operation.



Picture from Hongsa Power Company Limited (HPC)



List of hydropower project register in the CDM

Name of Hydro power plant	Host party	GEF	Boundary of GEF*1
Xe Namnoy 2, Xe Katam 1	Lao PDR	0.5595 in 2010	Lao PDR, Thailand
Xenamnoy 1	Lao PDR	0.5595 in 2010	Lao PDR, Thailand
Nam Ngiep 3A	Lao PDR	0.5595 in 2010	Lao PDR, Thailand
Nam Sim	Lao PDR	0.5537 in 2008	Viet Nam
Nam Ngum 5	Lao PDR ; Thailand	0.586 in 2007	Lao PDR, Thailand
Xeset II	Lao PDR	0.5048 in 2007	Lao PDR, Thailand
Nam Lik 1-2	Lao PDR ; Thailand	0.58604 in 2007	Lao PDR, Thailand
Xekaman 3	Lao PDR ; Viet Nam	0.5764 in 2008	Lao PDR, Viet Nam

Process of determining GEF in Lao PDR

- Raised concern here
 - Use of Data
 - Grid definition
 - Letter of approval by a neighboring country
- Consult with MOEJ and other ministries
- Use the proposed GEF in a proposed methodology
- Approve the Joint Committee