



**Paper presented at IEPPEC 2014 Berlin**

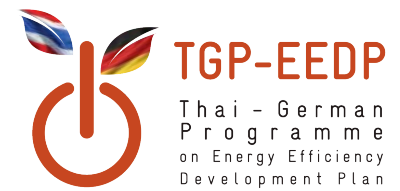
## **An ex-ante evaluation of the economy-wide benefits of the Thai Energy Efficiency Action Plan (EEAP)**

**Presentation:**

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Johannes Thema

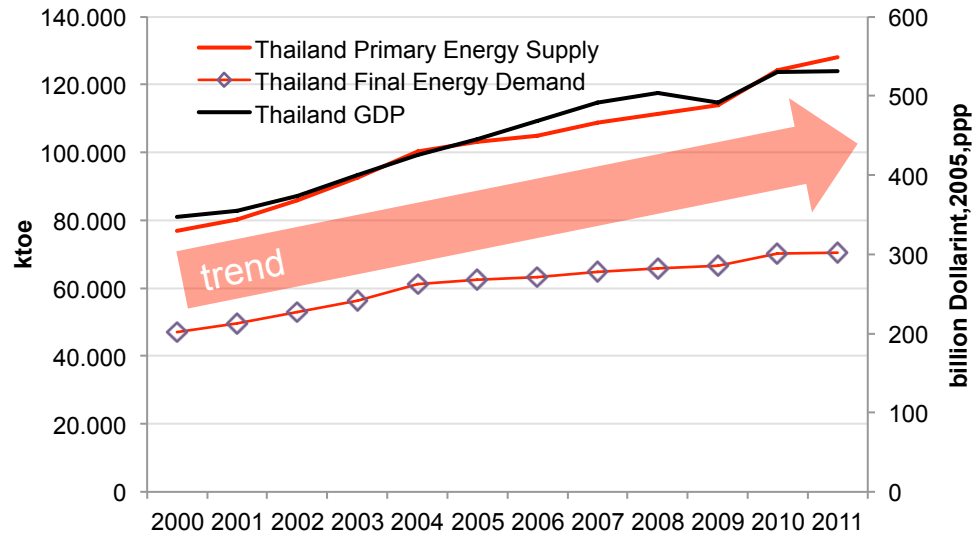
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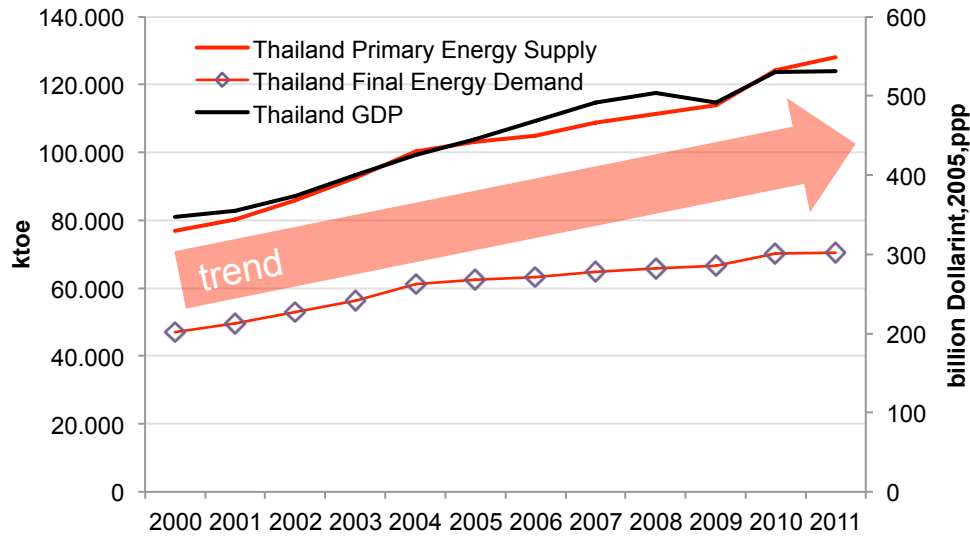
# Background: Thai energy situation

## GDP, Primary energy, final energy

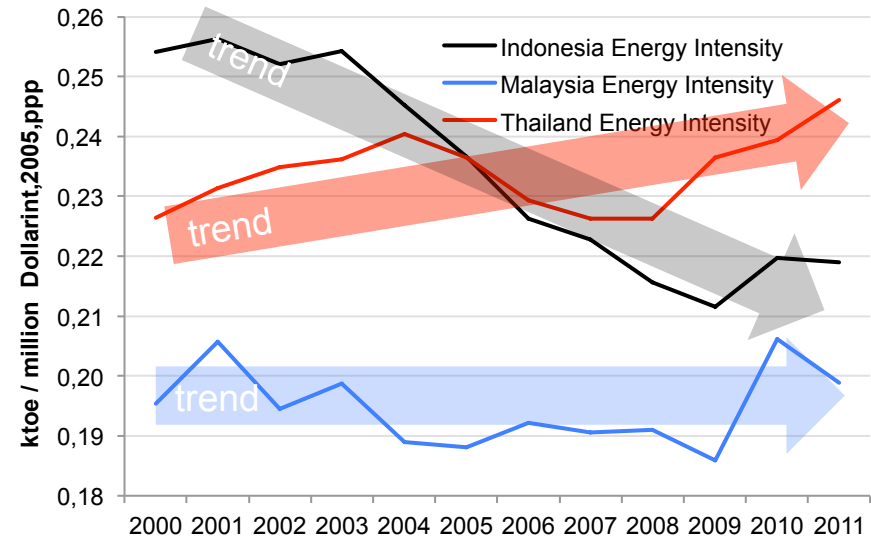


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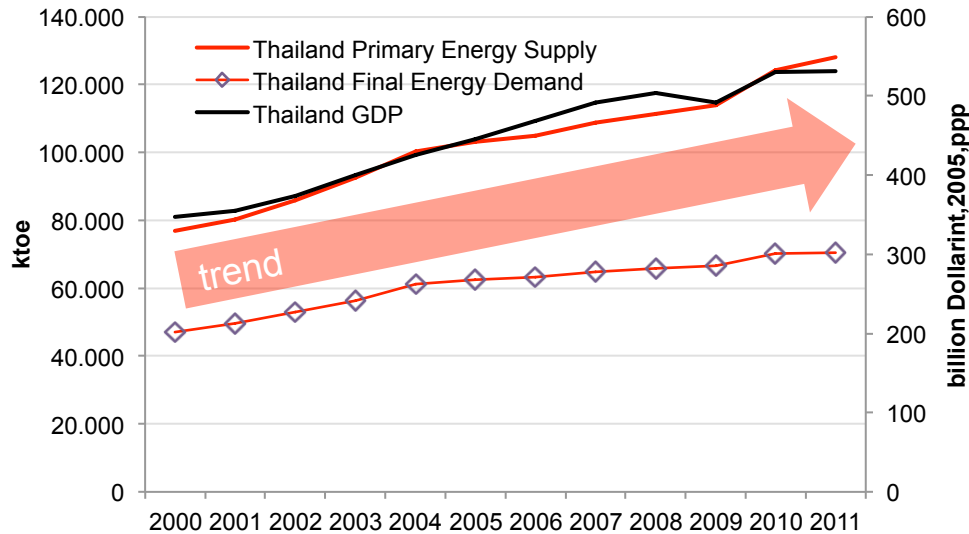


## Energy intensity in East Asia

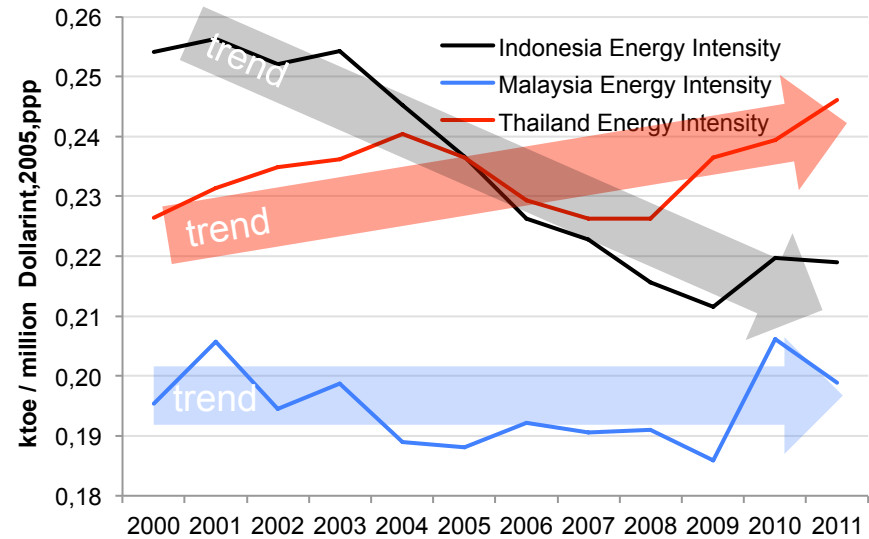


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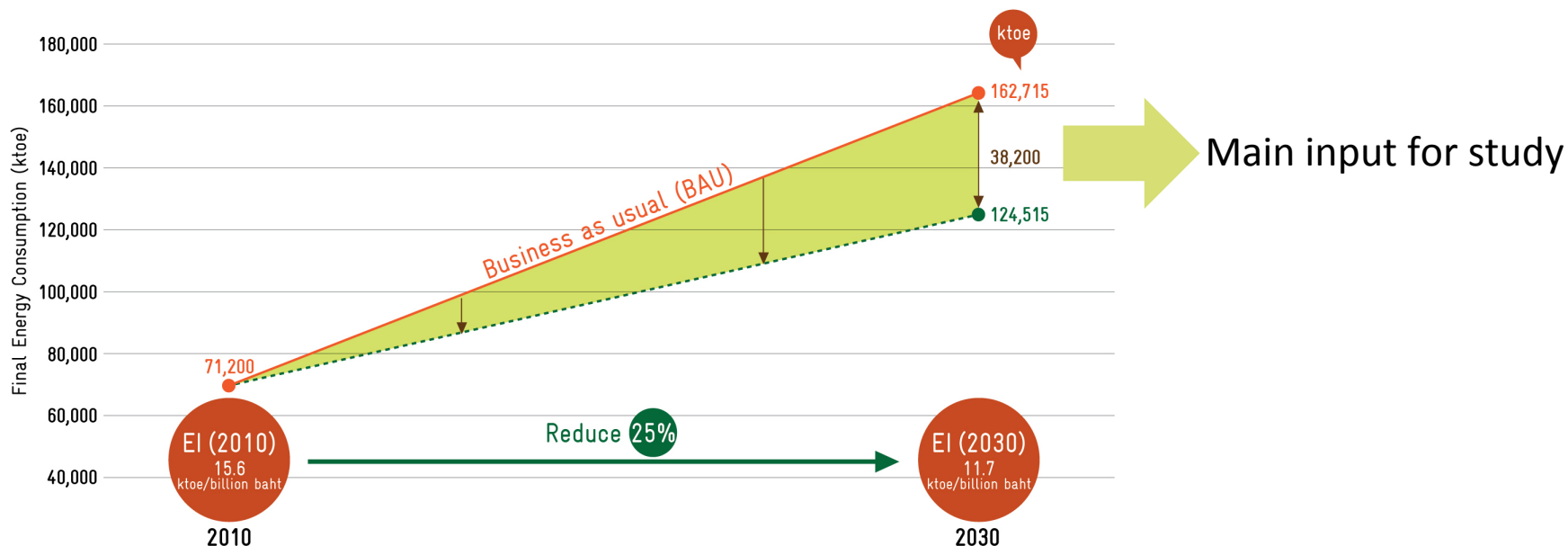
## Energy intensity in East Asia



- Need for addressing energy challenges
- 20-year Energy Efficiency Action Plan (EEAP)

# Background: Thai Energy Efficiency Action Plan (EEAP)

## ■ Aim of the EEAP:



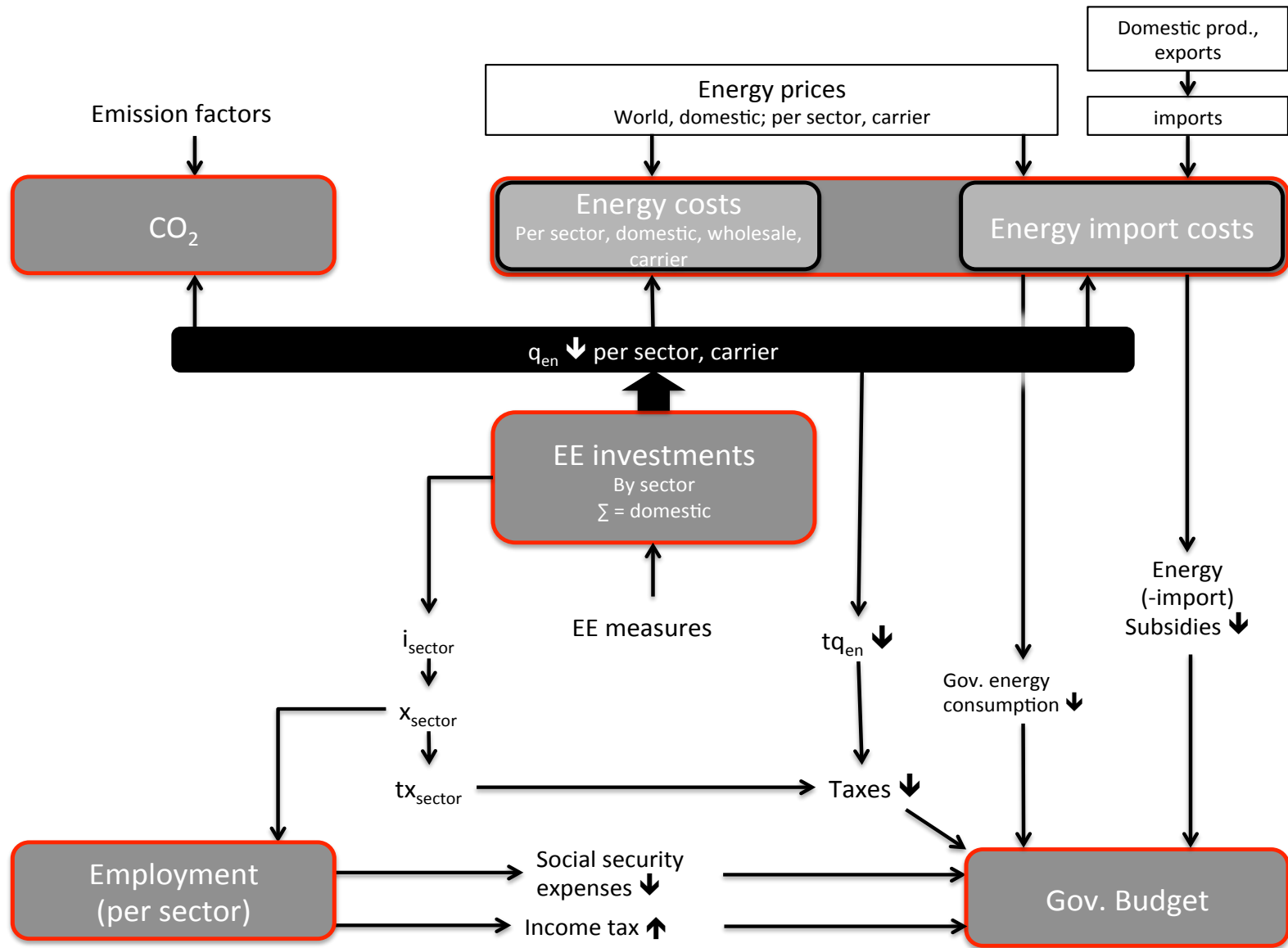
## ■ Objective of the study:

Ex-ante evaluation of benefits that may result from EEAP energy savings

## Indicators evaluated

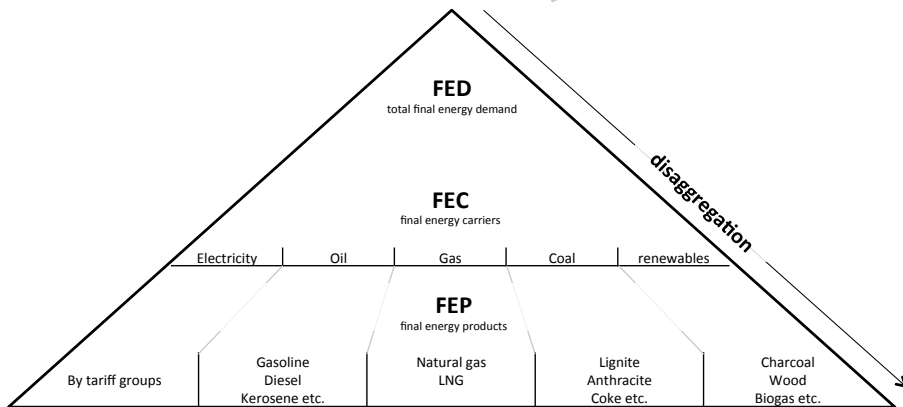
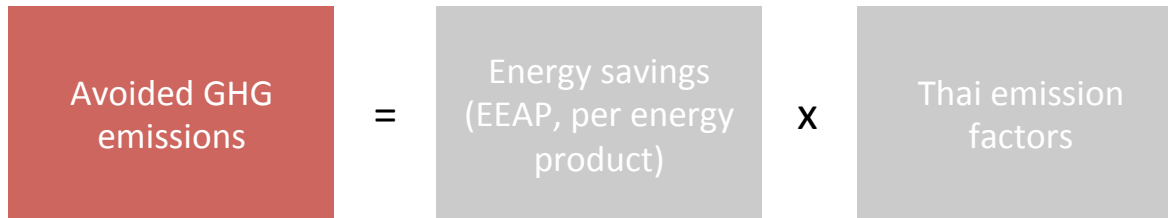
1. Reduced CO<sub>2</sub> emissions
2. Sector-specific energy cost reductions
3. Reduced energy import costs
4. Induced energy efficiency investments
5. Employment effects
6. Effects on governmental budget

# Overview of the evaluation approach



# Avoided greenhouse gas emissions in CO<sub>2eq</sub>

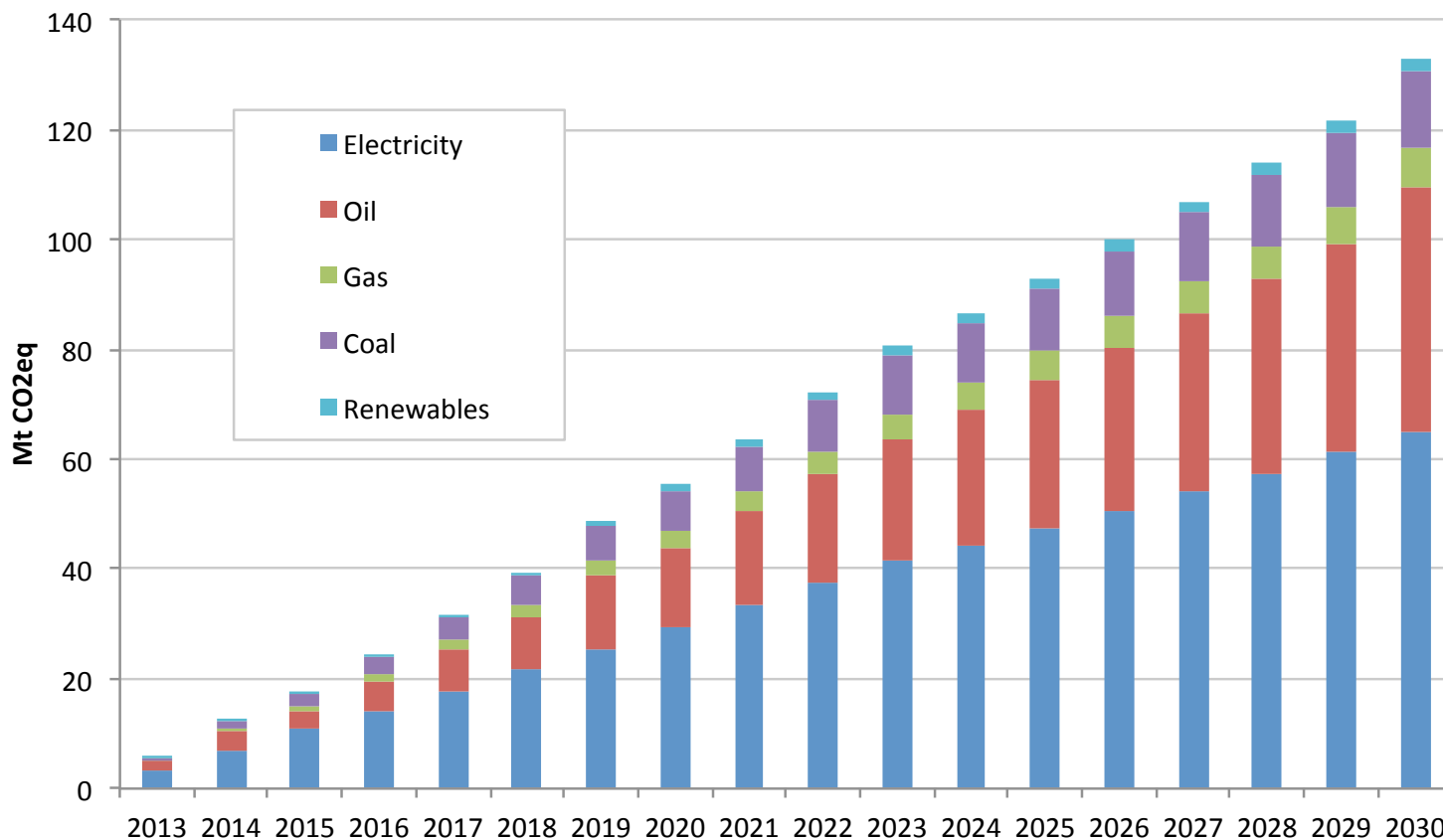
## Calculation approach:



Electricity/Fuel	unit	CO <sub>2</sub> emission factors (f) (t CO <sub>2eq</sub> per unit)	Source
Electricity	GWh	561	Ministry of Energy 2013
Natural Gas	ktoe	2,369	Ministry of Energy 2013
Coal	ktoe	3,996	Ministry of Energy 2013
LPG	kt	789	Ministry of Energy 2013
Bunker oil	million litre	839	Ministry of Energy 2013
Biomass charcoal	thousand ton	478	Ministry of Energy 2013
Benzene	ktoe	2,927	Ministry of Energy 2013
Diesel	ktoe	3,130	Ministry of Energy 2013
Jet fuel / kerosene	million litre	2,575	EPA 2011



## Avoided greenhouse gas emissions in CO<sub>2eq</sub> per year and energy carrier (Mt of CO<sub>2eq</sub>)



→ highest CO<sub>2</sub>-reductions from electricity and oil savings

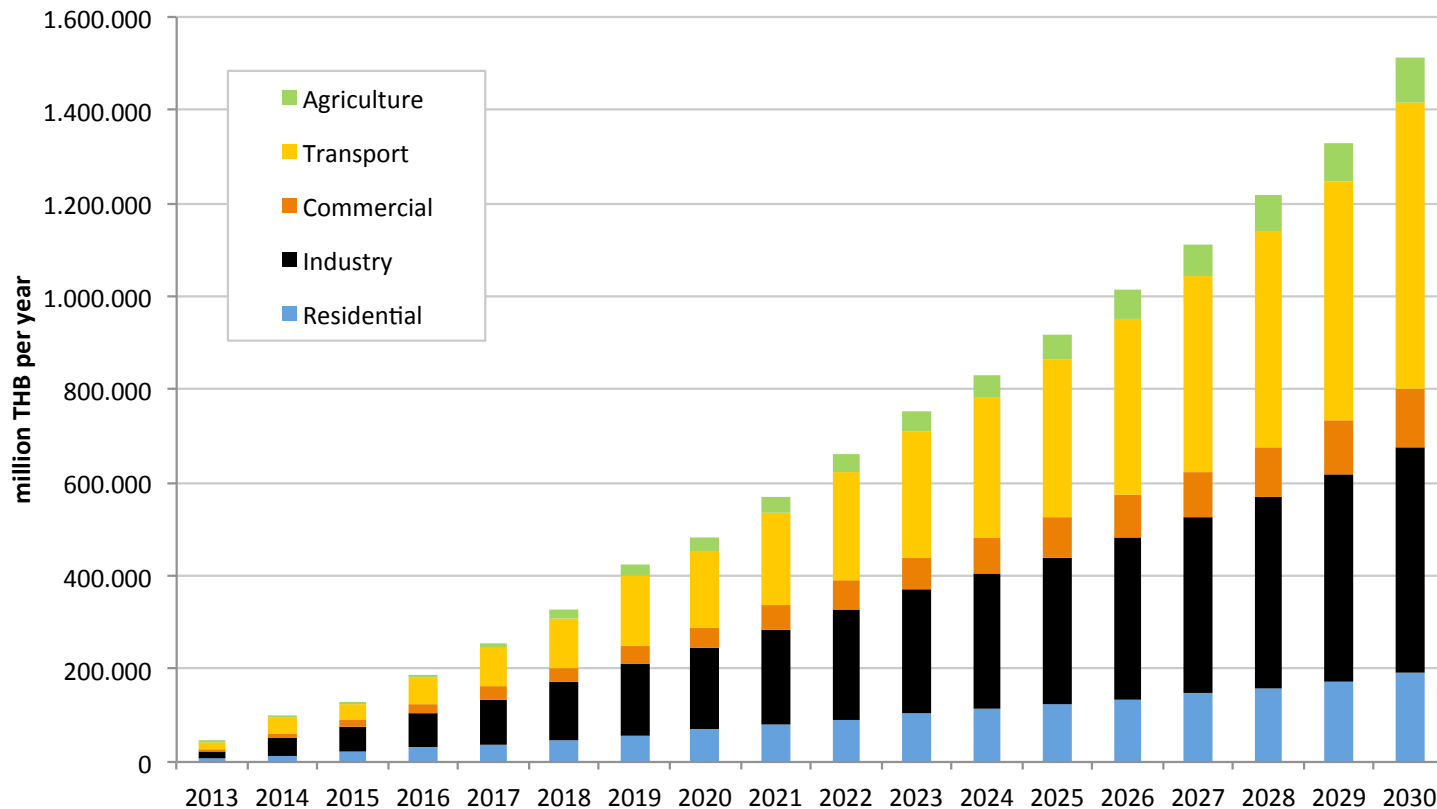
Note: CO<sub>2</sub>-emissions in Thailand in 2010: 221 Mt CO<sub>2</sub> (EPPO 2011)

## Sector-specific energy cost savings

### Calculation approach:

$$\begin{array}{c} \text{Sector-specific} \\ \text{energy cost} \\ \text{savings} \end{array} = \begin{array}{c} \text{Energy savings by} \\ \text{sector (EEAP)} \end{array} \times \begin{array}{c} \text{Sector-specific} \\ \text{energy prices} \end{array}$$

## Sector-specific energy cost savings per year and sector (in million THB)

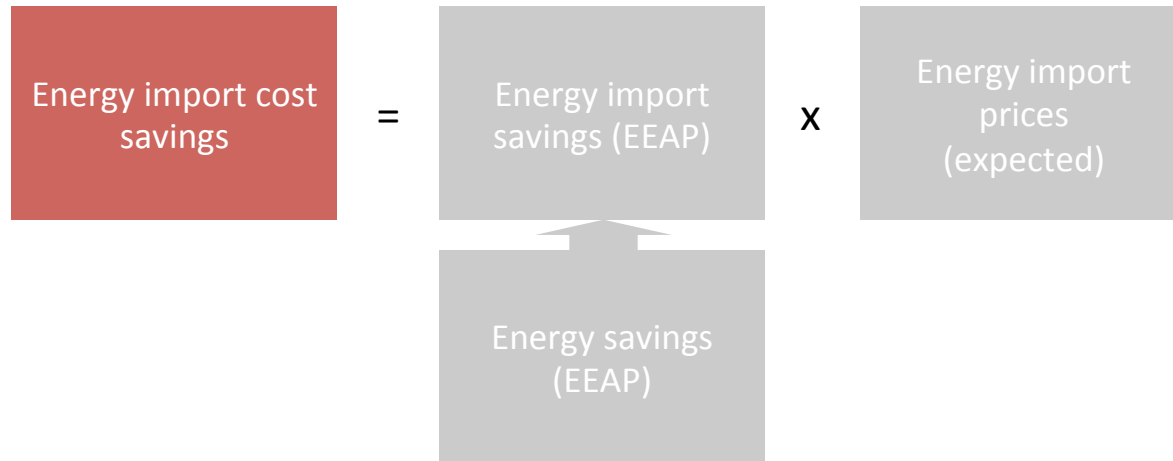


→ overall cost savings of 37.7 bn € in 2030

→ highest cost savings in transport and industry sectors

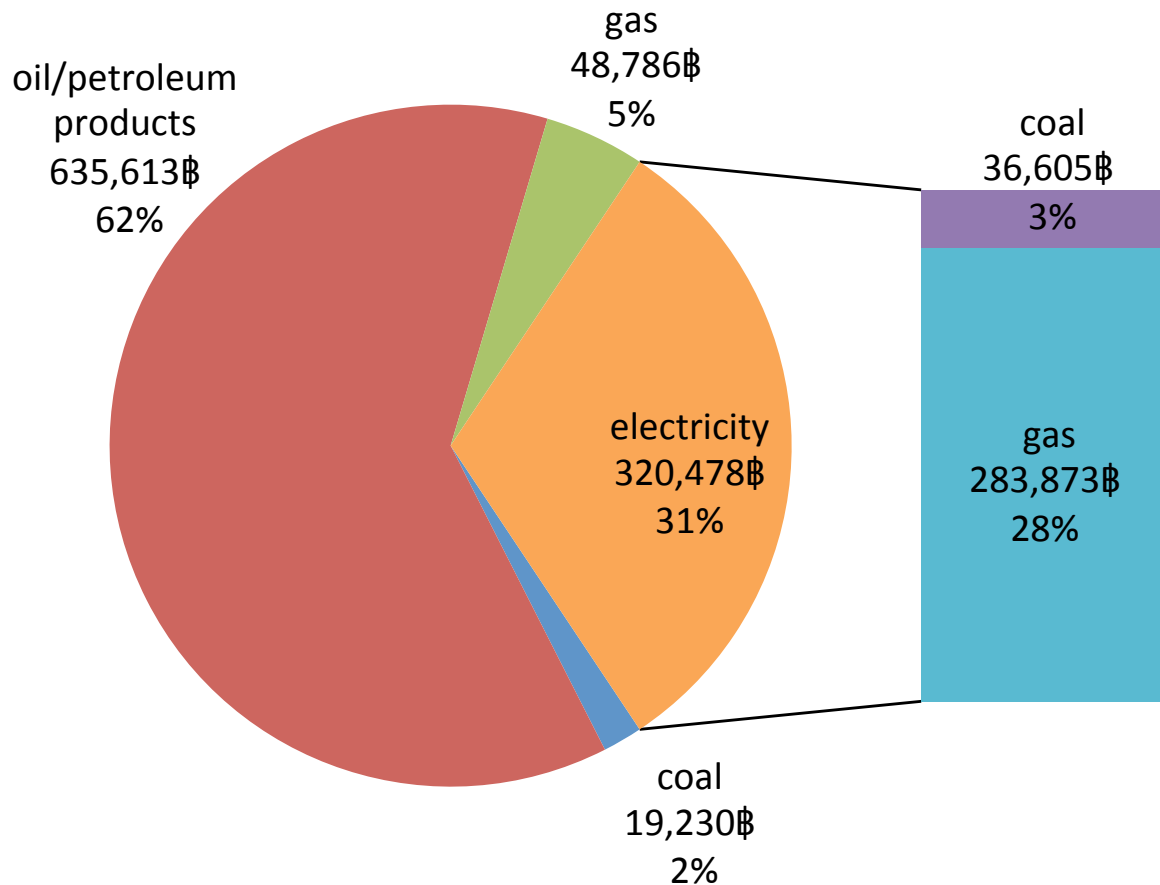
# Energy import (cost) savings

## Calculation approach:



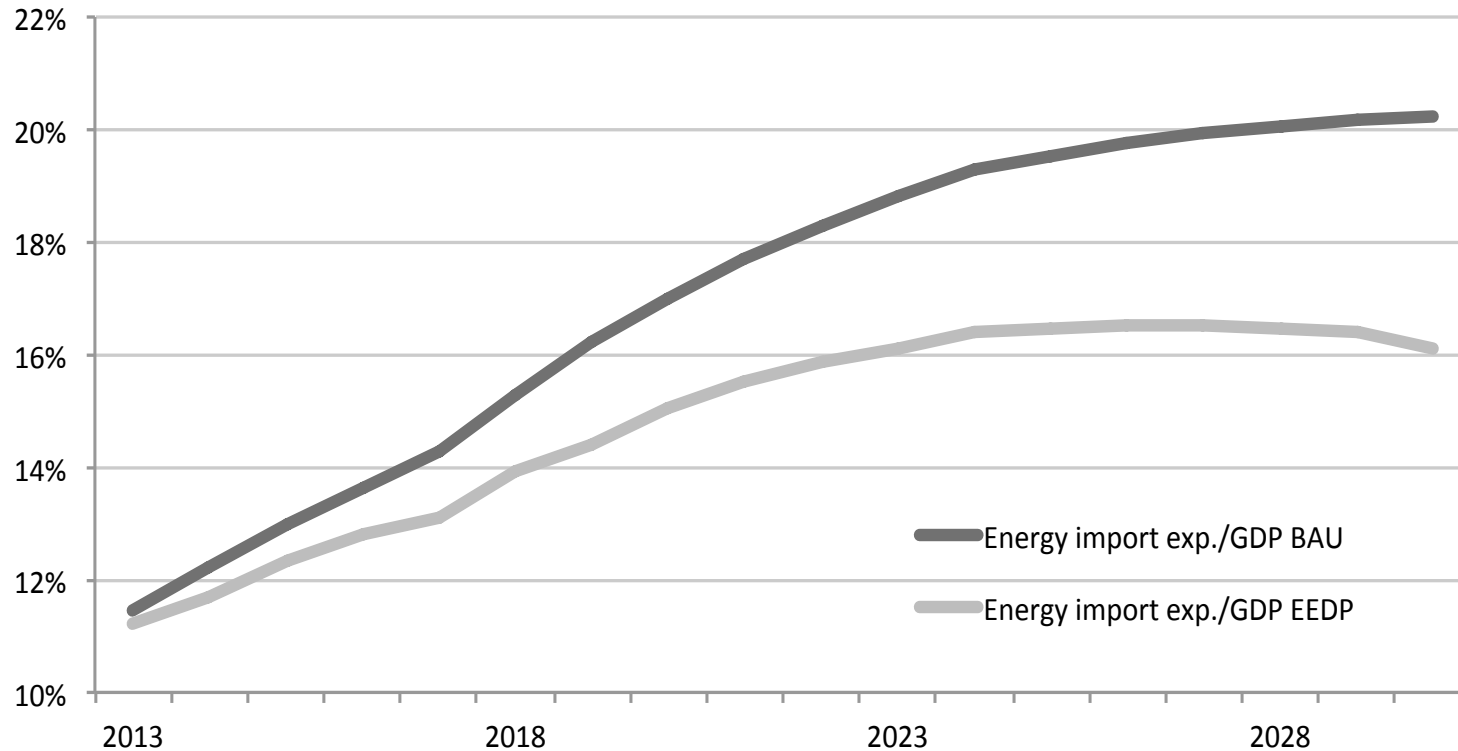
Thai energy demand already today met mainly with energy imports  
BAU/EEAP: energy demand expected to rise further (economic growth)  
Assumption: Energy savings → direct reduction of energy import costs

# Energy import cost savings by energy carrier in 2030 (million THB)



→ highest import cost savings from reduction of oil/petroleum and gas for electricity generation

## Energy import expenses as share of GDP (% of GDP)

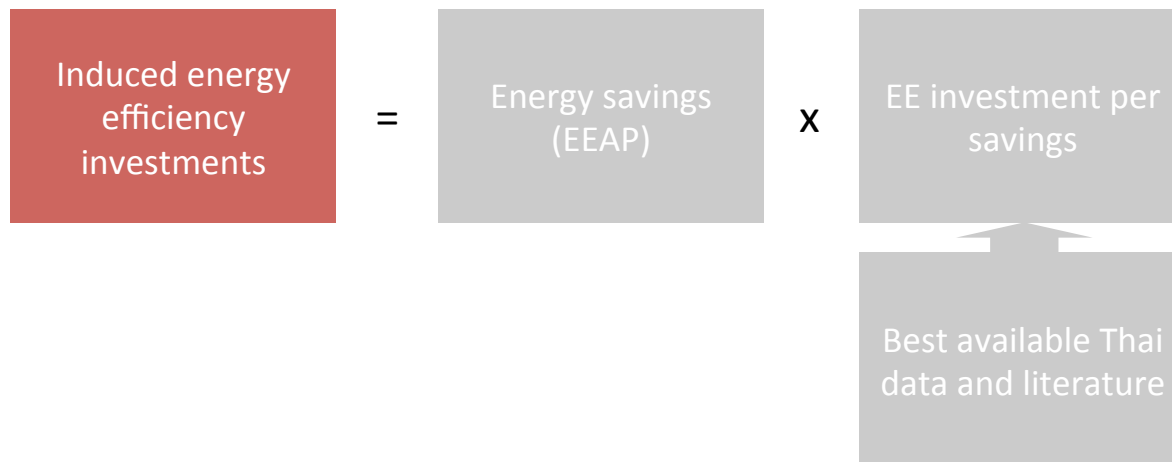


- Thai energy import expenses already today very high (>10% GDP)
- EEAP may save around 4% of projected 2030 GDP

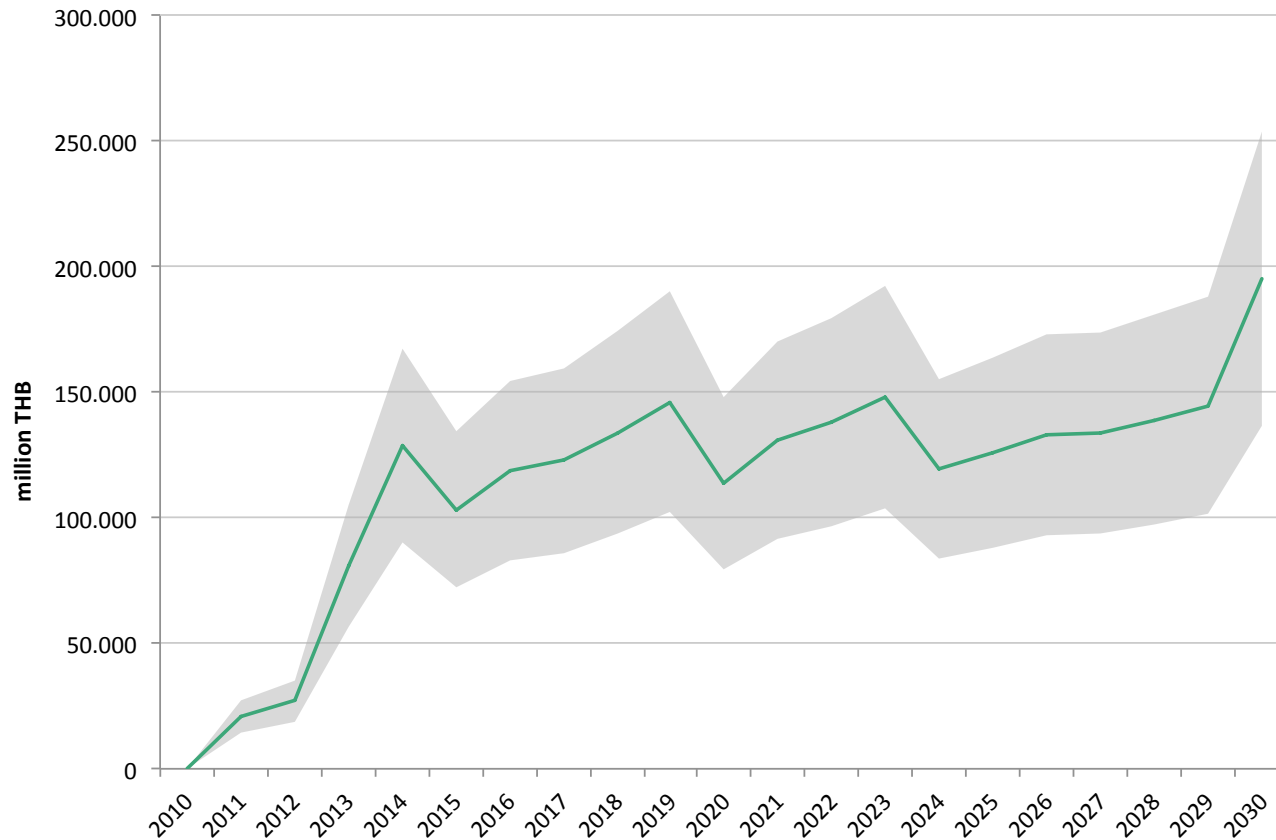
## Induced energy efficiency investments

### Calculation approach:

- Data on technological investments are not available in the EEAP
- High uncertainty: +/- 30% high/low scenario calculated



# Induced energy efficiency investments per year (million THB)



→ Estimated annual investments in 2030: 2.5-5bn€



## Direct employment effects

### Calculation approach:

- Rough estimation using Thai statistics of sectoral turnover and employment and combining it with induced EEAP investments



Sector	Employment (1000 pers.)	GDP (Mio THB)	% of labour force	% of GDP	Labour intensity (L <sub>s</sub> /GDP <sub>s</sub> )
residential	253.02	11,101	0.65%	0.10%	22.79
industry	8,121.62	4,955,509	20.86%	43.56%	1.64
commercial	10,368.84	3,144,833	26.63%	27.65%	3.30
transport	925.94	592,657	2.38%	5.21%	1.56
agriculture	15,433.58	1,395,743	39.63%	12.27%	11.06
public	2,914.77	1,021,346	7.49%	8.98%	2.85
<b>total</b>	<b>38,017.77</b>	<b>11,121,189</b>	<b>98%</b>	<b>98%</b>	

## Direct employment effects employed persons per year



- Not considered: indirect effects (e.g. second-round, changing prices, rebound)
- Estimated additional direct employment about 250,000

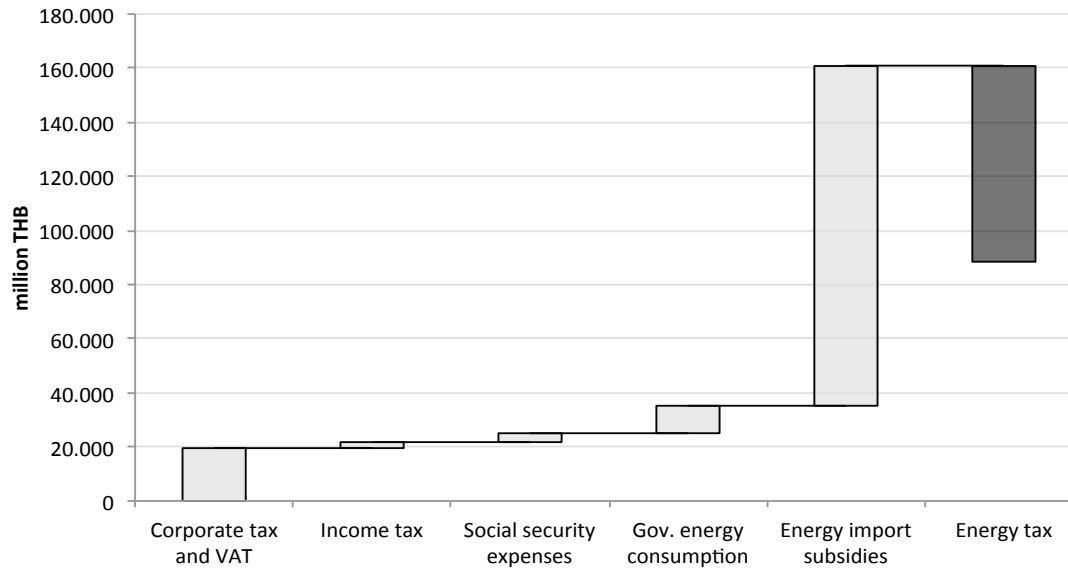
## Effects on governmental budget

**Calculation approach:** The public budget is affected through changing tax revenues and expenses. Different effects are considered:

1. Additional corporate tax revenue
2. Additional income tax and reduced social security expenses
3. Reduced governmental energy consumption
4. Reduced expenses for energy import subsidies (incl. high/low scenarios)
5. Reduced energy tax income

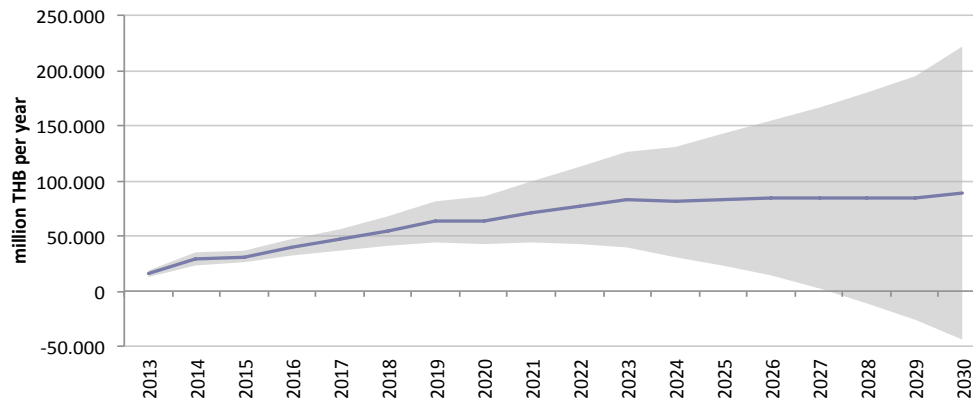
# Effects on governmental budget (million THB)

average effect  
2030



2030: 2.6 bn €

effect incl.  
uncertainties



2030: -1.1 to 6.2 bn €

- High uncertainty (on investments, energy subsidisation)
- Main effects: lower energy subsidies, energy tax revenue losses
- positive total effect likely

## Discussion & conclusions

- Major limitations: further research needs
  - investments and employment effects not calculated with complex macro-model (CGE/IOM)
  - Major uncertainties: Thai EE-investment data, energy subsidy development

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  - investments and employment effects not calculated with complex macro-model (CGE/IOM)
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- Major results
  - 37.7 bn € of energy cost savings
  - Import cost savings of around 4% of 2030 GDP
  - annual investments in 2030: 2.5-5bn€
  - additional direct employment: 250,000
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  - investments and employment effects not calculated with complex macro-model (CGE/IOM)
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- Major results
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  - effect on gov. budget positive but level uncertain
- Policy recommendations
  - effective implementation of EEAP to reap full benefits
  - develop effective evaluation & monitoring strategy
  - communication of benefits to the public for strengthen support

Thank you for your attention!

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## Summary of results

Effect	unit	Impact in 2030		
		low	high	average
<b>Energy cost savings</b> (consumer perspective)	<b>billion THB/yr</b> <i>(billion €/yr)</i>			<b>total 1,515</b> <i>(37.70)</i>
Agriculture				100 <i>(2.49)</i>
Transport				612 <i>(15.22)</i>
Commercial				129 <i>(3.22)</i>
Industry				484 <i>(12.04)</i>
Residential				190 <i>(4.72)</i>
<b>Savings on energy import costs</b>	<b>billion THB/yr</b> <i>(billion €/yr)</i>			<b>1,026</b> <i>(25.53)</i>
<b>Avoided CO<sub>2</sub> emissions</b>	<b>Mt CO<sub>2</sub>/yr</b>			<b>133</b>
<b>Induced energy efficiency investments</b>	<b>billion THB/yr</b> <i>(billion €/yr)</i>	137 <sup>a</sup> <i>(3.40)</i>	254 <sup>a</sup> <i>(6.32)</i>	<b>195<sup>a</sup></b> <b>(4.86)</b>
<b>Employment effect (total)</b>	<b>1000 employees</b>	<b>235</b>	<b>436</b>	<b>335</b>
Commercial		145	270	207
Industry		90	166	128
<b>Governmental budget effect (total)</b>	<b>billion THB/yr</b> <i>(billion €/yr)</i>	<b>-44.7</b> <i>(-1.11)</i>	<b>221.6</b> <i>(5.51)</i>	<b>88.5</b> <i>(2.20)</i>
Corporate tax		13.7 <i>(0.34)</i>	25.4 <i>(0.63)</i>	19.5 <i>(0.49)</i>
Energy taxes		-72.4 <i>(-1.80)</i>	-72.4 <i>(-1.80)</i>	-72.4 <i>(-1.80)</i>
Income tax		1.6 <i>(0.04)</i>	2.9 <i>(0.07)</i>	2.2 <i>(0.06)</i>
Social security expenses		2.3 <i>(0.06)</i>	4.3 <i>(0.11)</i>	3.3 <i>(0.08)</i>
Governmental energy consumption		10.2 <i>(0.25)</i>	10.2 <i>(0.25)</i>	10.2 <i>(0.25)</i>
Energy subsidies		0 <i>(0)</i>	251.3 <i>(6.25)</i>	125.6 <i>(3.13)</i>