

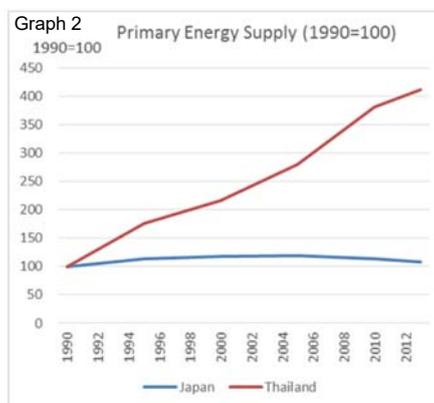
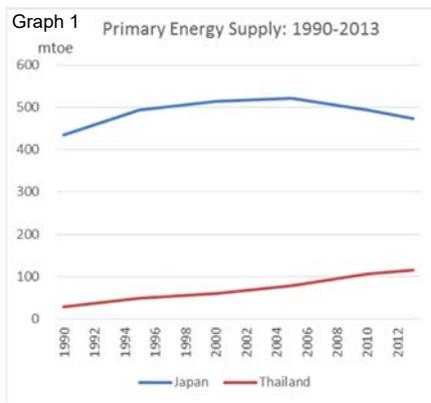
## Lesson Plan for Cross-border on the Matter of Energy

### 1. Theme of lesson study for mathematics

Imagine hidden variables and relations through the questioning the graphs, and appreciate the significance of being able to analyze the situation and predict the future by using them.

### 2. Task Design

The cross-border lesson study enables us to communicate the different status of energy efficiency for every economy and share the idea necessary for further economic development. At APEC-Tsukuba Conference, Keynote, Dr. Masazumi HIRONO, Head of Energy Statistics & Training Office (ESTO), Asia Pacific Energy Research Centre (APEREC) shows several data.



Primary Energy Supply means supply of coal, oil, natural gas, atomic, etc. Secondary Energy means energies such as electricity supplied from primary energy. 'MTOE' is million tons of oil equivalent. 1 million is 1,000,000.

When we read both graphs, we may be able to have questions with two contexts:

On the context of mathematics and statistics:

Could you explain what every graph represents? How much MTOE did Thailand use in 1990? Could you find it appropriately using Graph 1 and 2. How many times of Thailand does Japan use? Can you imagine when Thailand will overtake Japan? Can you imagine when did Japan use primary energy as same amount as current Thailand?

On the context of life/social-economical-welfare:

How do you explain the difference between Thailand and Japan? Why can you explain like that? What is the hidden variable? If we read the graphs in relations to GDP which country uses more energy to product and why?

On the context of Sustainable Development Goals, the goal is to grow with less energy.

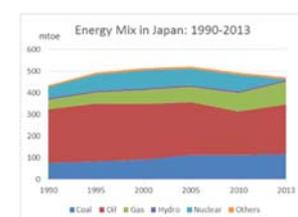
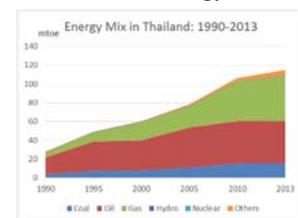
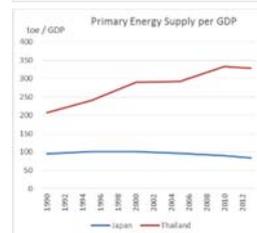
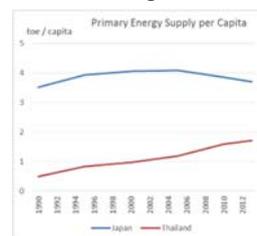


<http://www.worldometers.info/>

'per capita' means per population.

GDP means gross domestic product, here USD.

<http://www.criced.tsukuba.ac.jp/math/apec/apec2016/>



### 3. Class Objective

Based on simple and primordial questions for comparing the graph 1 and 2, students begin to explain the different economic development status and realize the difference of society with comparison and necessity of sharing the issues for sustainable development.

### 4. Preparations

Homework: Problem Posing for Graph 1 and 2 and translate it into English by Google or so.

Class: Use **three** projectors and computers, two modems for **two skype addresses**, one is for **sharing the board**, another for **sharing the class**. **Three video cameras** are necessary: tow for skype and one for recording. Teaches should select the problems from students' homework and arrange for the class.

Print for Class: Worksheet with graphs will be distributed in the class, not before.

### 5. Lesson Plan

Phases	Activities	Camera work
Exchange Mathematics through Problem posing and Solving (25 min)	<p>Thai students pose the question: Eg. Can you imagine when Thailand will be able to overtake Japan? Can you imagine when did Japan use primary energy as same amount as current Thailand?</p> <p>Both classroom students solve and share.</p> <p>Japanese students pose the question: Eg. How much MTOE did Thailand use in 1990? Could you find it appropriately by using Graph 1 and 2. How many times of Thailand does Japan use?</p> <p>Both classroom students solve and share.</p>	<p><b>Video Camera 1</b> takes the class, especially teacher's and student's explanation and send it to another-classroom-projector 1.</p> <p><b>Video Camera 2</b> takes the presentation and send it to another-classroom-projector 2.</p>
Understanding others by additional information (15 min lecture)	<p>The teacher shows the graph of population and ask both students to read, and confirm that the both countries are reducing the growth of population. (5 min) *1</p> <p>The teacher shows the graph of Energy Mix and asks both students which source is increasing. (5 min) *2</p> <p>The teacher shows the graph of GDP and asks both students to read and explain. (5 min) *3</p>	<p><b>Video Camera 1</b> takes questioning teacher and answering students.</p> <p><b>Video Camera 2</b> takes graphs which is presented on the third screen (projector 3) and send it to another-classroom-projector 2.</p>
Resume	<p>Ask students to write down what they enjoyed and learned through the communication on their note. (5min)</p> <p>The teacher explains what s/he would like to teach.</p>	<p>Good samples (three students) in every class are taken by photo and send it to the post classroom discussion</p>



\*1 Japan uses energy 5 times of Thailand, or so, however per one person, it become twice times or so.

\*2 In the case of Thailand, gas increase every year.

\*3 On per GDP, Thailand uses much energy than Japan.