Workshop:

How to Develop Statistical Tasks on Energy Resiliency Using Data from the APEC Energy Database

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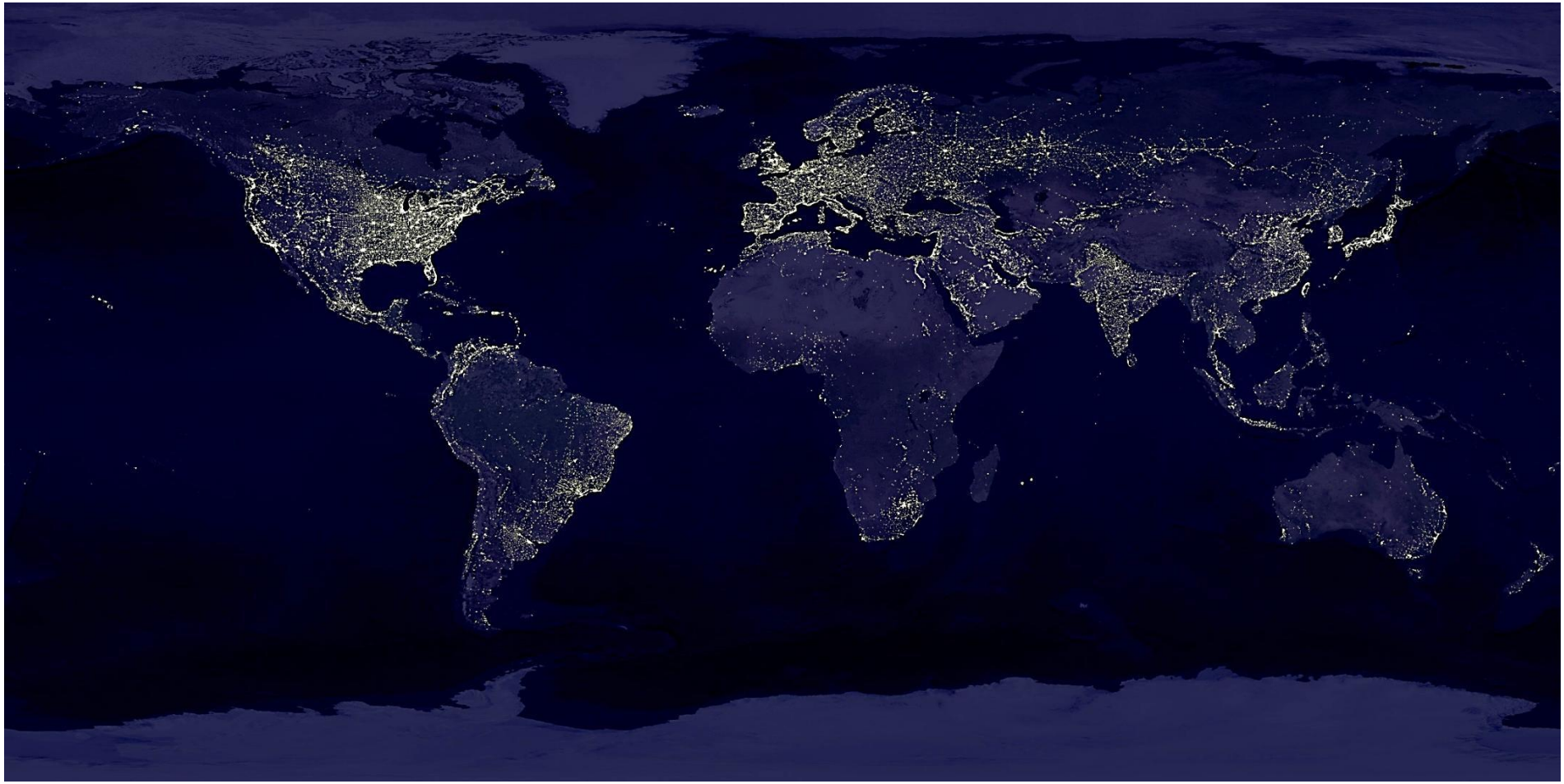
Outline

This workshop will last 50 minutes, organized as follows:

- Introduction to the Development of Statistical Tasks on Energy Resiliency and workshop data distribution (5 min.)
- Participants' development of graphs using Excel and sample data from the APEC Energy Database (10 min.)
- Participants' presentations of their statistical analyses and observations (30 min.)
- Workshop summary (5 min.)

Introduction to the Development of Statistical Tasks on Energy Resiliency

- Take a look to the following satellite picture of the light cities generate at night (NASA, 2012).



Introduction to the Development of Statistical Tasks on Energy Resiliency

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The cost of lighting the world

Electric light is one of the greatest advances of the modern world, but, with the rise of light pollution, it has proved to be something of a mixed blessing.

Light pollution means cities like London are visible from space

The twinkles of the stars are fewer these days - drowned in the glare of Earthly light sources. Light pollution has become a problem, and not just for astronomers - although they are among the most frustrated with it.

Much of the light generated on Earth is wasted, spilling out into space.

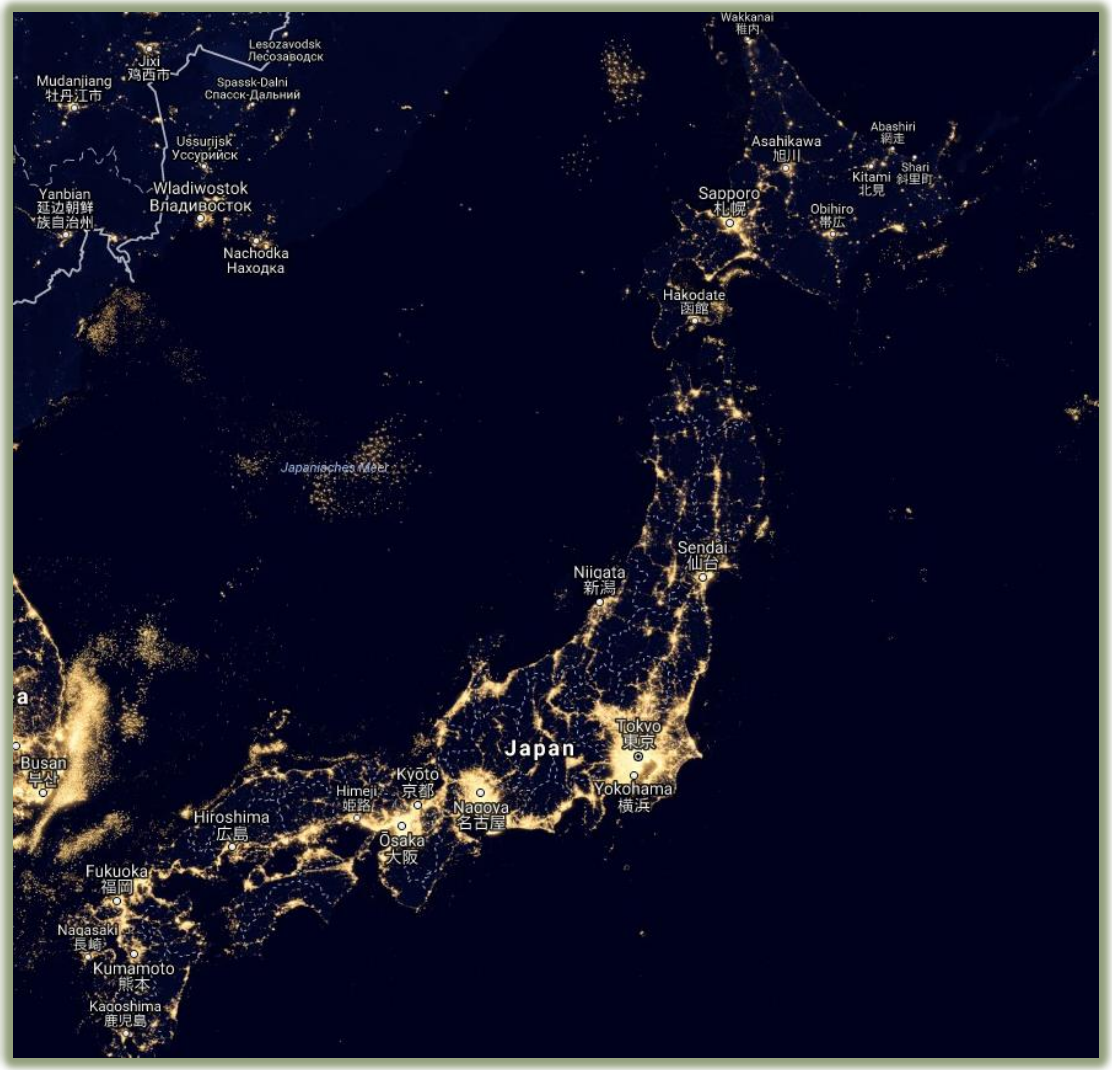
In terms of energy consumption, this is not very efficient.

Incandescent lightbulbs, the type which have a filament inside, account for around half of the lightbulbs in homes around the world. But only about 5% of the energy they use is actually turned into light. The other 95% is wasted.

It now estimates that replacing all the standard lightbulbs in Europe with new energy-efficient ones could cut carbon emissions by 28million tonnes a year - the equivalent of 50million barrels of oil.

(http://news.bbc.co.uk/2/hi/technology/6067900.stm)

Introduction to the Development of Statistical Tasks on Energy Resiliency



(http://www.blue-marble.de/nightlights/2012)

Introduction to the Development of Statistical Tasks on Energy Resiliency

- What kind of questions, involving data representation and data analysis, would you pose from this lighting scenario?

- Remember: When analyzing data, the role of a student or a statistician is to be a "data detective," to uncover the stories that are hidden in the data.

Introduction to the Development of Statistical Tasks on Energy Resiliency

- As “data detectives”, people are expected:
  - to note important signals in the variability of the data,
  - to develop and share their reasoning about sources of variation in data over time, and
  - to engage in informal inferential reasoning by using data as evidence of estimations, predictions and generalizations.

(English & Watson, 2015; Makar & Rubin, 2009; Shaughnessy, 2007).

Introduction to the Development of Statistical Tasks on Energy Resiliency

- By doing so, we will have opportunities to engage in the following 4 levels of reading graphs (Shaughnessy, 2007):
  - Reading the graph/data
  - Reading within the graph/data
  - Reading beyond the graph/data
  - Reading behind the graph/data
- When “reading behind the graph”, one might conjecture about the possible causes that might affect the phenomenon represented over time (i.e., historical, economic, or demographic potential sources of variation in the data), and use some “data detective” skills to analyze graphical information.

Introduction to the Development of Statistical Tasks on Energy Resiliency

- From a data-detective point of view, important signals in the data variability should be noticed.

- Such signals are particularly evident in data that are collected over time.

- http://www.ieej.or.jp/egeda/ for APEC DATABASE

Introduction to the Development of Statistical Tasks on Energy Resiliency

Electricity Power Generation:
http://www.ieej.or.jp/egeda/database/electricity_select_form.html

Electricity Power Capacity:
http://www.ieej.or.jp/egeda/database/egcapacity_select_form.html

Final Energy Consumption:
http://www.ieej.or.jp/egeda/database/newfinal_select_form.html

Fuel Consumption for Electricity Power Generation:
http://www.ieej.or.jp/egeda/database/newfelectricity_select_form.html

Primary Energy Supply:
http://www.ieej.or.jp/egeda/database/newprimary_select_form.html

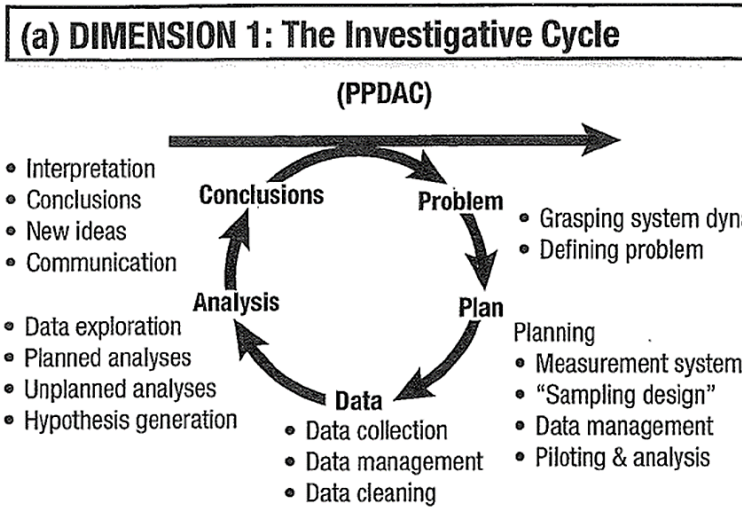
Fuel Demand and Supply by Energy Sources (Coal, Crude Oil, Gas):
http://www.ieej.or.jp/egeda/database/newdemand_select_form.html

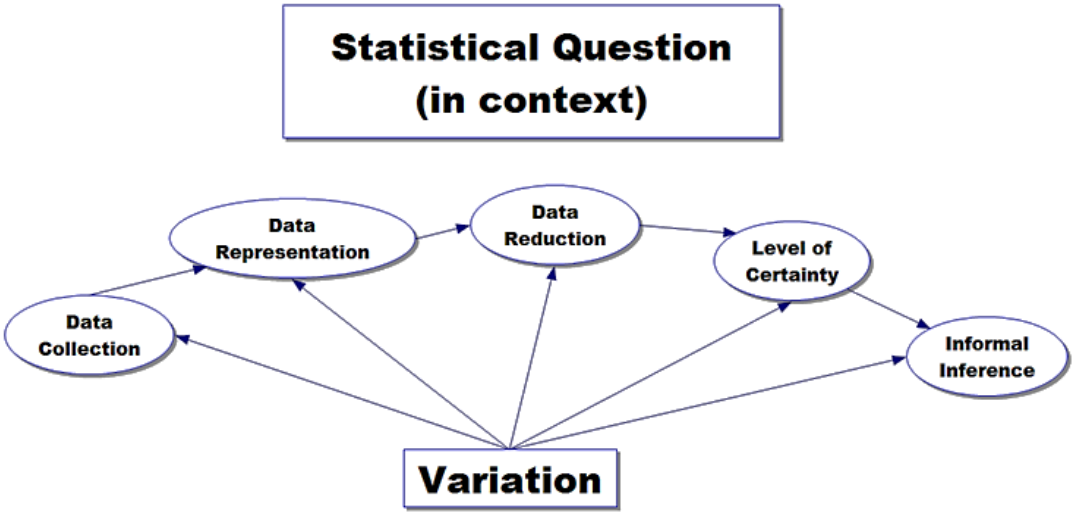
CO_2 Emission:
http://www.ieej.or.jp/egeda/database/co2_select_form.html

Let's develop statistical tasks and graphs using Excel and data from the APEC Energy Database! (10 min.)

Workshop Summary

- During our workshop in November 2016 at KKU, we discussed the models for the Practice of Statistics at school level developed by Wild and Pfannkuch (1999) and Watson (2009).





- Challenging students with problems and questions in which they have to analyze data collected over time using graphical representations, provide students with opportunities to empower them as statistically literate citizens (e.g., English & Watson, 2015; Gal, 2004; Shaughnessy, 2007).

Workshop Summary

- Shaughnessy (2007, p. 991) also listed the following eight behaviors regarding understanding of graphs, considered to be critical to develop students' basic graph sense, as well as critical, mathematical and statistical literacy:

1. Recognizing components of graphs (*Reading* the data).
2. Speaking the language of graphs (*Reading* the data).
3. Understanding relationships among tables, graphs, and data (Reading *within* the data).
4. Making sense of a graph, but avoiding personalization and maintaining an objective stance while talking about the graphs. (Reading *within* the data).
5. Interpreting information in a graph and answering questions about it (Reading *beyond* the data).
6. Recognizing appropriate graphs for a given data set and its context (Reading *beyond* the data).
7. Looking for possible causes of variation (Reading *behind* the data).
8. Looking for relationships among variables in the data (Reading *behind* the data).

Workshop Summary

- Using the graphical representation shown before, we can ask students "critical questions" such as:
  - What was the overall pattern in the data?
  - Why might be the data varying in the way it is?
  - Why does this variable have a similar/different trend that the one shown by SE Asia and North America?
  - What might happened in a particular period of time (e.g., the early 90's) in the regions under examination, to explain the behavior of the variable during that period?
  - What might happen in the next five years, and why?

Workshop Summary

- When analyzing data, one safe first approach is to start by asking what the overall pattern in the data was, and why the data might be varying.
- What could you say regarding the distribution of economic activity and populations in both countries? How about the impacts on our environment (e.g., transformation the landscape and the soil, which alters the surrounding ecosystem and the climate)?
- How about the electric bill in different APEC countries? Do you remember the “Electric Bill Task” from the last meeting? How would you connect that task to the city night lights picture and your statistical analysis?

Workshop Summary

- Starting with a counterintuitive idea (e.g., the refrigerator acting as a heater, or city lights as light pollution) will motivate students to collect data, and then engage in statistical investigations.
- Law of Conservation of Energy (on an intuitive level, before the formalization)
- The heat doesn't vanish, it's transferred to the room and after to the outside.
- "Country glow" as a informal (simple) indicator of pollution, fuel demand, CO_2 emissions, …

Workshop Summary

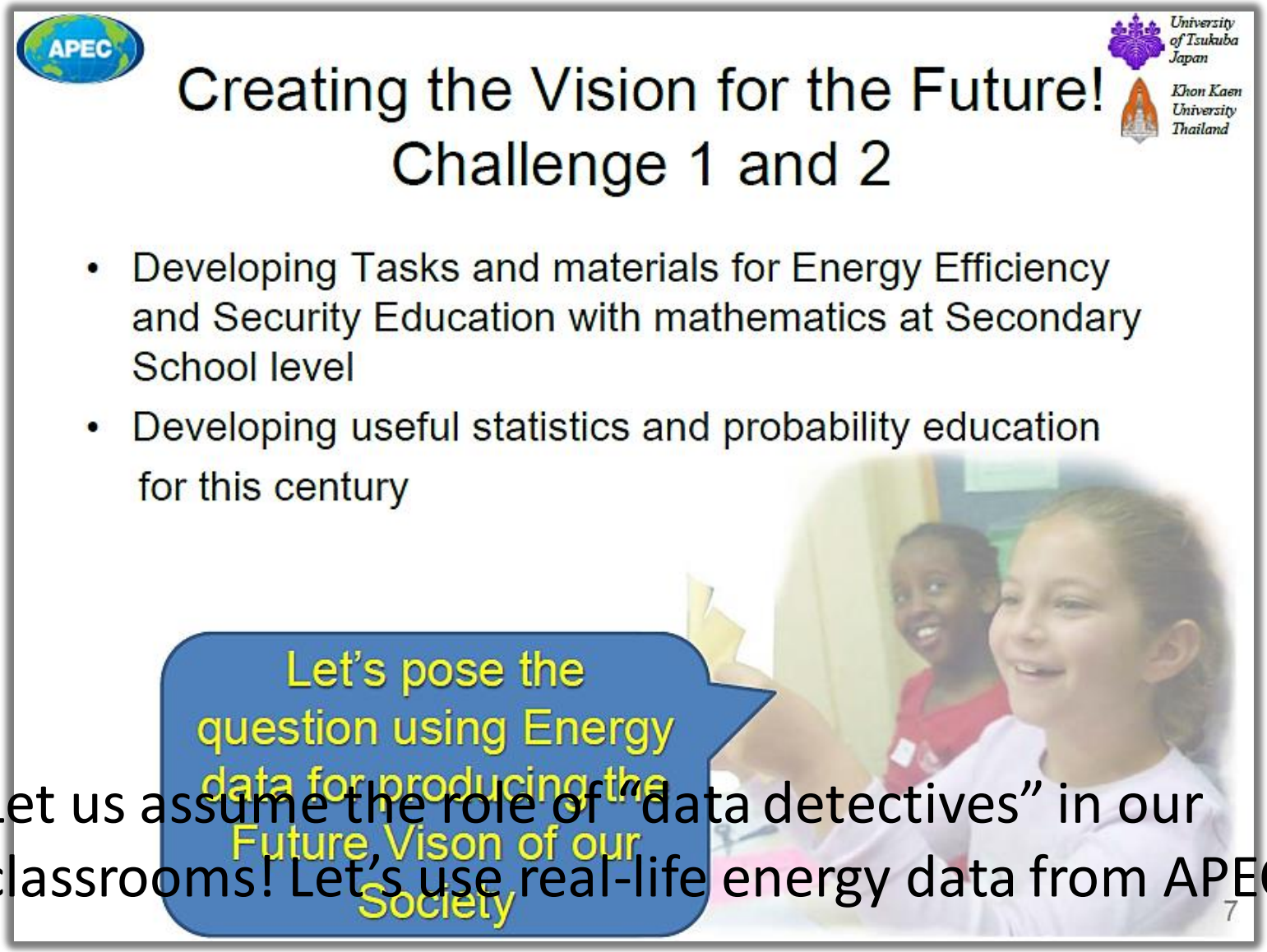
- Estimate the energy spent by a washer machine by kilogram of laundry load.
- Water consumption, electric consumption, coal consumption, oil consumption, ...
- Comparison between the energy consumption of mercury-filament light bulbs, LED bulbs, fluorescent lamps.
- Make sure students take into account the difference in climatic conditions (Thailand and Canada for example).

Workshop Summary

- Students will have the opportunity to compare their own empirical results with national and regional data, using the APEC Energy database.

- Data on energy sources, energy consumption, CO_2 emissions, etc., are available in the database, very useful for verifying students' hypotheses.

Workshop Summary



- Let us assume the role of "data detectives" in our classrooms! Let's use real-life energy data from APEC!

Questions and Comments are Welcomed

Thank You for your Attention!

Using the APEC Energy Database as a Resource for Developing Statistical Tasks on Energy Resiliency

Using the APEC Energy Database as a Resource for Developing Statistical Tasks on Energy Resiliency

- We have access to the APEC Energy Database, compiled by the Asia Pacific Energy Research Centre (APERC).
- 100% real data, 100% free.
- http://www.ieej.or.jp/egeda/

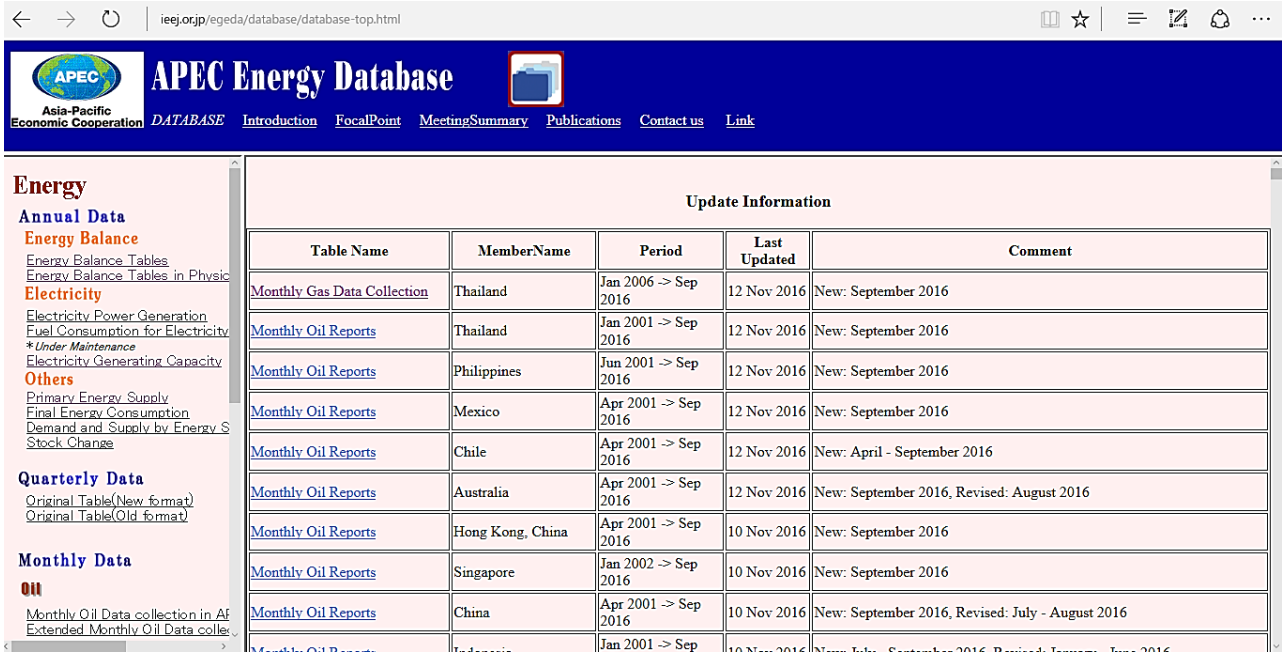
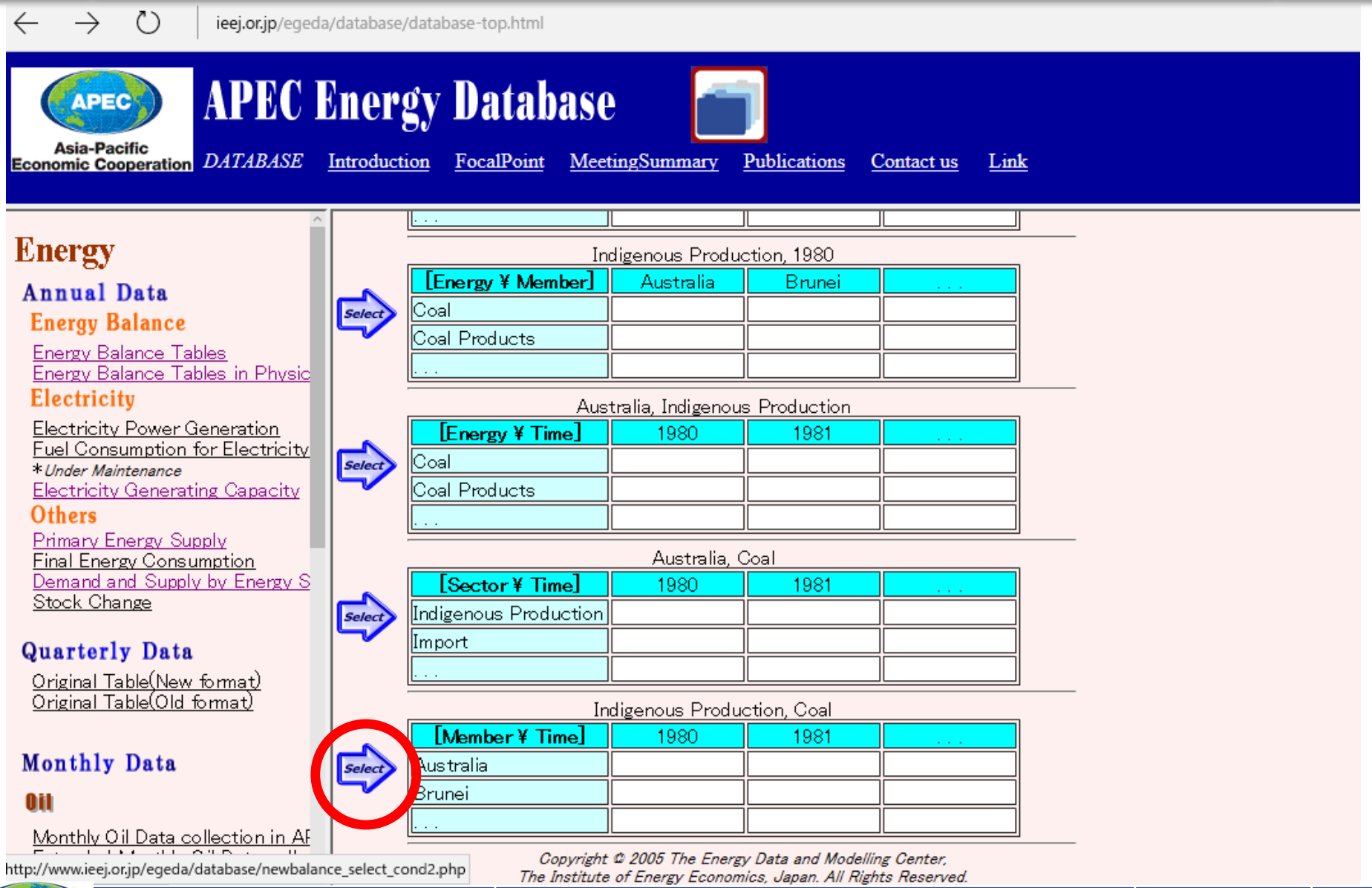


Table Name	MemberName	Period	Last Updated	Comment
Monthly Gas Data Collection	Thailand	Jan 2006 -> Sep 2016	12 Nov 2016	New: September 2016
Monthly Oil Reports	Thailand	Jan 2001 -> Sep 2016	12 Nov 2016	New: September 2016
Monthly Oil Reports	Philippines	Jun 2001 -> Sep 2016	12 Nov 2016	New: September 2016
Monthly Oil Reports	Mexico	Apr 2001 -> Sep 2016	12 Nov 2016	New: September 2016
Monthly Oil Reports	Chile	Apr 2001 -> Sep 2016	12 Nov 2016	New: April - September 2016
Monthly Oil Reports	Australia	Apr 2001 -> Sep 2016	12 Nov 2016	New: September 2016, Revised: August 2016
Monthly Oil Reports	Hong Kong, China	Apr 2001 -> Sep 2016	10 Nov 2016	New: September 2016
Monthly Oil Reports	Singapore	Jan 2002 -> Sep 2016	10 Nov 2016	New: September 2016
Monthly Oil Reports	China	Apr 2001 -> Sep 2016	10 Nov 2016	New: September 2016, Revised: July - August 2016
		Jan 2001 -> Sep		

Using the APEC Energy Database as a Resource for Developing Statistical Tasks on Energy Resiliency



ieej.or.jp/egeda/database/database-top.html

APEC Asia-Pacific Economic Cooperation

APEC Energy Database

DATABASE Introduction FocalPoint MeetingSummary Publications Contact us Link

Energy

Annual Data

Energy Balance

Energy Balance Tables
Energy Balance Tables in Physic

Electricity

Electricity Power Generation
Fuel Consumption for Electricity
*Under Maintenance
Electricity Generating Capacity

Others

Primary Energy Supply
Final Energy Consumption
Demand and Supply by Energy S
Stock Change

Quarterly Data

Original Table(New format)
Original Table(Old format)

Monthly Data

Oil

Monthly Oil Data collection in AF

Indigenous Production, 1980

[Energy ¥ Member]	Australia	Brunei	. . .
Coal			
Coal Products			
. . .			

Australia, Indigenous Production

[Energy ¥ Time]	1980	1981	. . .
Coal			
Coal Products			
. . .			

Australia, Coal

[Sector ¥ Time]	1980	1981	. . .
Indigenous Production			
Import			
. . .			

Indigenous Production, Coal

[Member ¥ Time]	1980	1981	. . .
Australia			
Brunei			
. . .			

http://www.ieej.or.jp/egeda/database/newbalance_select_cond2.php