

# Cross border Lesson Plan between Japan and Russia - final version -2-

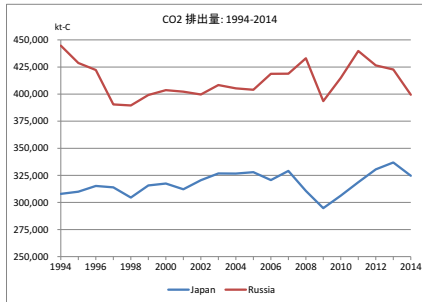
10:40-11:30, 14 Dec 2017

Japan: Tottori University Attached Junior High School (7<sup>th</sup> grade)

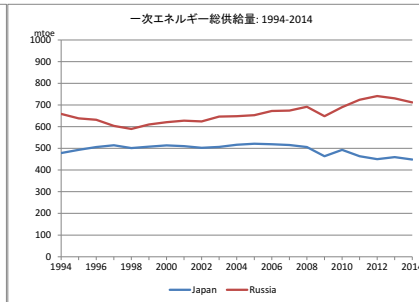
Russia: Yakutsk Physics and Technics Liceum named after V.P.Larionov (8<sup>th</sup> grade)

## 1. Outline of the problem in the lesson

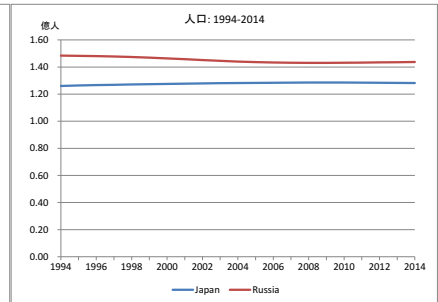
In the lesson, students analyze and predict the situation(s) of environment and energy issues based on characteristics and changes of the statistical graphs. When questioning that ‘*what can we claim on CO<sub>2</sub> emissions from energy supplies and populations of Japan and Russia*’, it will be concluded that ‘*more energy supplies and populations are, the more CO<sub>2</sub> emissions*’ based on the correlation of the transition of the graphs.’ At first glance, although Russia has more CO<sub>2</sub> emissions, it can be verified that it is almost the same as Japan if converted per citizen or energy supply. As for the data, we use those provided by the Asia-Pacific Energy Research Center (APEREC) and the World Bank.



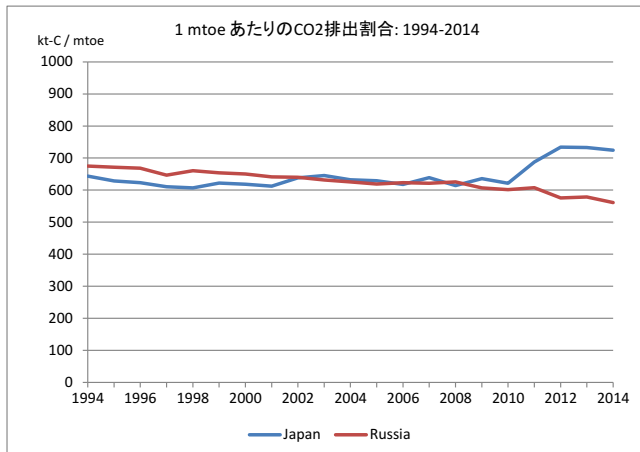
Graph1: CO2 emissions



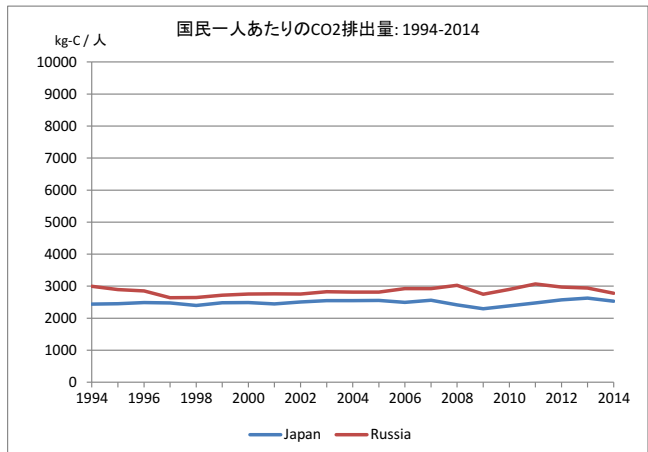
Graph2: Total primary energy supply



Graph3: Population



Graph4: Ratio of CO2 emissions to total primary energy supply



Graph5: Ratio of CO2 emissions to population

## 2. Concept of the lesson

Students analyze changes of the data mathematically. Changes in CO<sub>2</sub> emissions, energy supplies, populations depend on various factors such as economic and social conditions. In the lesson, we do not emphasize imagining these causality for both students. Rather, it focuses on the discussion of recognizing similarity in the transition (shape) of the graph(s) and concluding that there is correlation.

As a precondition for problem solving, it is necessary to understand some terms. We, both teachers, will

explain (in advance) about “primary energy<sup>1</sup>”, “primary energy supply” and its unit: *mtoe*<sup>2</sup>, “CO<sub>2</sub> emissions” and its unit: *kt-C*, *kg-C*. Also, as homework, students make their questions with their own data, *i.e.*, each home country, on the task to be described below. At that time, teachers give a viewpoint to grasp the shape of the graph locally.

The lesson starts with students' questions created in their homework and these answers. Then, teachers conduct activities to compare data between Japan and Russia. In particular, it is compared CO<sub>2</sub> emissions per citizen or per *mtoe* to consider differences in the size of the country. Through these discussions, teachers expect that students find similarity of the data of both countries. By seeing the data of both countries comprehensively from the similarity, teachers show a scatter diagram combining energy supply and CO<sub>2</sub> emission. In the scatter diagram, the sequence of points can be approximated by straight lines.

### 3. Teaching and Learning process

(preparation):

- At the previous lesson, teachers will explain the following terms and units:  
“primary energy”, “(total) supply of primary energy”, “*mtoe*”, “CO<sub>2</sub> emission”, “*kt-C*”.
- As homework, teachers give graphs (Graph 1, 2, 3) and the format of the question and make ones on the data of own country.
  - *How much energy (mtoe) [Japan / Russia] supplied in year ( )?*
  - *What year [Japan / Russia] supplied energy ( ) mtoe?*
  - *When did the CO<sub>2</sub> emissions of [Japan / Russia] be ( ) kt-C [increased / decreased]?*
  - *(open ended questions by students)?* \* Teachers should catch the students' questions beforehand.
- equipment setting: Video Camera (Skype) and its projection, PC (Prezi) and its projection  
\*PC (Prezi) projection should be writeable, such as white board.

Phase of activity	○Main teacher's question / • Expected activities of students	Role of teacher(s)	equipment
<b>Opening remarks and Introduction</b> (3 min)	* Greeting each other's class. * The teacher (Japan or Russia) confirms that we think about environment and energy issues by comparing the data/graph of Japan and Russia in today's lesson.	* Introducing an interpreter and the class of partner country by each * posing the theme of the lesson	*VC takes the teacher and students in home country, the screen is projected from the partner country. * Prezi is set the home slide (1st slide).

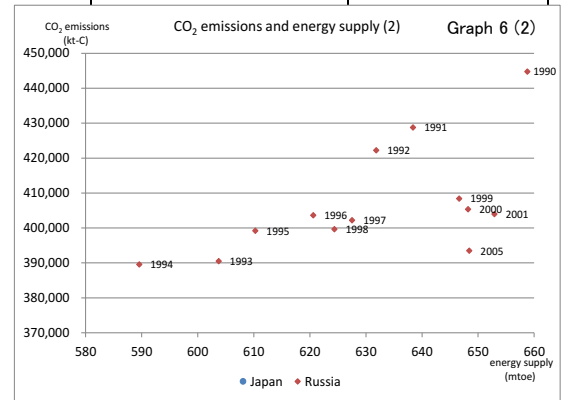
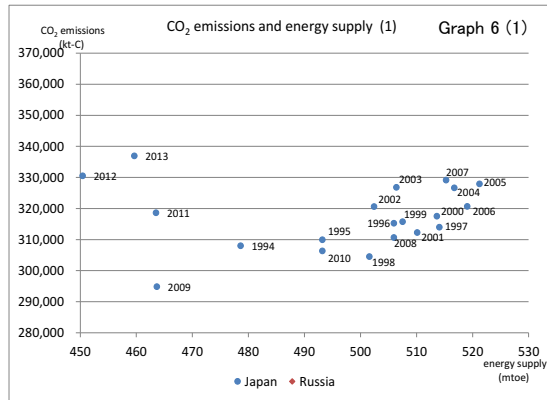
<sup>1</sup> ‘Primary energy’ is energy originating from natural substances such as natural gas, fossil fuels such as petroleum and coal, nuclear power, hydroelectric power and so forth. ‘Secondary energy’ is the energy that converted and processed primary energy such as city gas, electricity, gasoline.  
<sup>2</sup> MTOE stands for Million Tons of Oil Equivalent. 1 toe = 10<sup>7</sup> kcal = 41.868 GJ

<p><b>Activity 1:</b> Activities to interpret what data indicates (12 min)</p>	<p>○Let's question each other on the graphs of own country. * Japanese students ask question(s) to Russian students and Russian students to Japanese students alternately. <i>Examples:</i> •How much energy (mtoe) [Japan] supplied in (1998)? •What year [Russia] supplied energy (400,000) mtoe? •When did the CO<sub>2</sub> emissions of [Japan] be (about 80) kt-C [increased]? •(How about has CO<sub>2</sub> emissions changed from 1994 to 1997 in [Russia]?)</p>	<p>*Asking each other * The teacher intentionally nominates the asking student(s) * The order of nomination will be such that the answer is identified as one, the answer is more than one, and the the question is freely created (easy → difficult)</p>	<p>* VC takes student(s) and the questioning problems. * Prezi is set the slide of the relevant graph.</p>
<p><b>Activity 2:</b> Activities to compare and analyze data of both (12 min)</p>	<p>○<b>Japanese Teacher:</b> What can be said by comparing CO<sub>2</sub> emissions between Japan and Russia? How about energy supply? •Russia has more CO<sub>2</sub> emissions and energy supplies. •When CO<sub>2</sub> emissions increase or decrease in Russia, Japan is also changing in roughly the same way.  ○<b>Russian Teacher:</b> Russia has more population than Japan. Can you say the same thing by comparing CO<sub>2</sub> emissions per citizen? •Russia is a little more than Japan. •From the graph (Graph5), the difference between Russia and Japan is small.  ○<b>Japanese Teacher:</b> As you compare CO<sub>2</sub> emissions by the ration of per citizen, what can be said by comparing it by the ratio of per energy supply? •Japan and Russia are about the same. •Almost the same until 2010.  * The amount of CO<sub>2</sub> emissions is larger in Russia than in Japan, but when comparing per citizen or energy supply, the difference is small / nearly the same. * Japan and Russia are similar in terms of energy supply and CO<sub>2</sub> emissions (the same trend).</p>	<p>* After that, the teachers in each classroom nominate their students so that students in Japan and Russia can speak alternately * Present a graph of CO<sub>2</sub> emissions per citizen (Graph5)  * Present the graph of CO<sub>2</sub> emissions per energy supply (Graph4)  * Organizing students' cross border discussion</p>	<p>* Or later, VC will take presentation(s) of student(s) and teacher of the home country. * Prezi is set the slide of the relevant graph.  * Or later, Prezi is set the slide of the problem and the graph according to the question.</p>

**Activity3:**  
Further  
development  
(15 min)

- **Russian Teacher:** Regarding the relationship between CO<sub>2</sub> emissions and energy supply, it was plotted not the annual trend but each amount as coordinates. If the amount of energy supplied at a certain point increases, how will the position of that point change?
  - It moves to the upper right.
- \* As energy supply increases, CO<sub>2</sub> emissions tend to increase. This can be said to each other.

- \* Presenting scatter plots of energy supply and CO<sub>2</sub> emissions.
- \* Teacher asks about the position of the point whether it is a trend of either Graph 6(1) or 6(2).

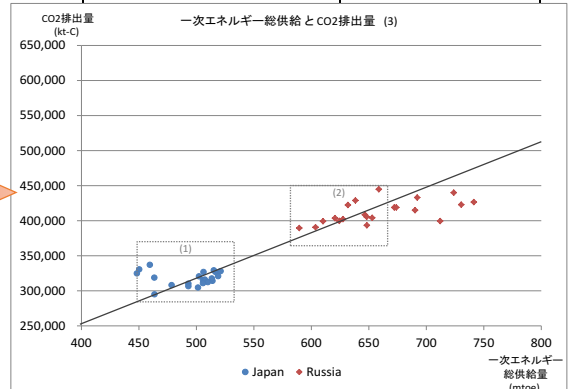
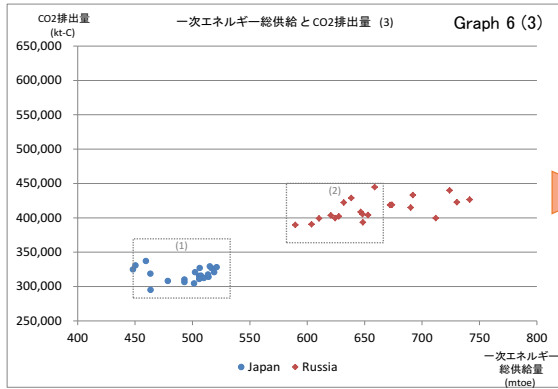


- **Russian Teacher:** So, what kind of graph could these points draw?
  - Straight line
  - Rise curve
- \* It is impossible to judge whether it is the same or not, and whether it is regarded as a straight line or a curve.

- \* Teacher asks again whether the graphs 6(1) and 6(2) are the same, and whether they are straight or curved, in terms of the approximate shape of the graph.

- **Japanese Teacher:** I zoom out graphs 6(1), 6(2) so that the data of both countries can be seen on the same coordinate plane. From this graph, do you think what kind of graph these points could draw? I zoom out graphs 6 (1), 6 (2) so that the data of both countries can be seen on the same coordinate plane.
- **Japanese Teacher:** I zoom out graphs 6 (1), 6 (2) so that the data of both countries can be seen on the same coordinate plane.
- **Japanese Teacher:** I zoom out graphs 6 (1), 6 (2) so that the data of both countries can be seen on the same coordinate plane.

- \* Showing Graph 6(3)



- Since both countries have the same tendency, they can be judged as being the same (common) graph.
- By zooming out, if points of both countries are common graphs, it is better to consider them as a straight line.

○**Japanese Teacher:** If the data trends of both countries are represented by a common graph, what relationship can energy supply and CO<sub>2</sub> emissions be?

- By considering it as a straight line, if primary energy increases / decreases, CO<sub>2</sub> emissions increase / decrease.

\* CO<sub>2</sub> emission and energy supply can be regarded as being on a straight line (positive correlation is seen).

\* From this tendency, CO<sub>2</sub> emissions can be seen depending on energy supply.

\* Teacher asks again on how CO<sub>2</sub> emissions to energy supply amount are judged with based on the same trend in both countries in Activity 2.

\* Summarizing the conclusion

**Closing remarks and Farewell greetings**  
(8 min)

- Comment your impressions of this learning.
- \* Students from Japan and Russia give impressions alternately.
- \* Praise for each other's learning and say "good-bye".

\*Nominating in each class.