

# Energy Issues in Korean Education

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# Homework

- Energy issues are being discussed in Korean society actually. But, in educational areas, the issues are not dealt actively.
- I am very happy to have a chance to think about energy in STEM perspective including mathematics.
- I had three homeworks on:
  - What is your major issue on Energy in your economy?
  - In relation to STEM, what reform is going on in your economy?
  - In relation to lesson study for Cross Border, what is possible

# 1<sup>st</sup> Homework

What is your major issue on Energy in you economy?

# Issue 1: Inconvenient truth

- About the necessity of new kinds of **clean energy to replace fossil fuels** like coal, natural gas and oil.
- Oil will be dried up within 32 years, natural gas 60 years, coal 133 years, at the earliest date.
- Fossil fuels have destroyed global environment severely for the last 100 years.
- We need to develop new kinds of clean energy for maintaining human existence on the Earth.
- Nobody know how it is important and urgent!!

# Issue 2: Strategic Decision

- What kinds of **the new and the renewable energy** we need to develop at this moment considering our current technical level?
- Government chose the 12 kinds of energy: sunbeams, solar heat, wind power, geothermal power, water power, tidal power, steam power, fuel cell, hydrogen gas, bioenergy, waste material energy, coal liquid & gas
- This issue might be the most hot national agenda as a turning point for the future development of Korea.

# Issue 3: Economic Efficiency

- How to get these new kinds of the new and the renewable energy with **lower costs or more efficiently?**
- The essential factor in the energy development process is how to promote **"efficiency of investment"** i.e. we have to get the higher quality of energy with lower costs.
- This process requires a very high level of ultramodern technology.

# Issue 4: Manpower

- How to train **experts of jobs related with energy?**  
And, where?
- It is a integrated job merging IT, BT, NT(Nano Technology), Agricultural engineering, Chemical engineering and Industrial engineering.
- This is a huge task to change the structure of universities in Korea.
- Government wants more science and technology major students in universities to train experts in high and intergrated technology areas like the new and the renewable energy.

# Issue 5: Thrift

- How to **save energy** in ordinary life?
- Everybody knows that we have to save electricity, heating energy, traffic energy, water for making slow the shortage of natural resource, and the greenhouse effect as well as for improving our health.
- However, how to practice it? How to educate students and people?



# Issue 6: Energy Intensity

- How to reduce **Energy Intensity** which is total energy consumption per unit GDP?
- Energy consumption includes coal, gas, oil, electricity, heat and biomass.
- In 2011, Korea used 10726 BTU(1 BTU=0.252Kcal) to earn 1 USD. Japan 4574, HK 5682.
- It is very inefficient energy consumption.

# Issue 7 : National Trust

- How to reduce 37 % of **BAU amount of CO2 emission** by 2030, which is a promise Korean Government made at the Paris Agreement on Climate in 2015.
- BAU(Business As Usual) is the expected amount when we will not have done any constraint and any effort.
- This might be a political promise, but it is a promise of Korean Government done to international society. Is there a concrete road map to keep it?

# Issues 8: Educational Preparedness (Curriculum)

- How to develop **formal (national) curriculum** related with energy?
- This is not simple task. Curriculum on energy needs the integrated procedure by educators working in various areas because “energy” has very complex topics.
- Do we need to develop it as an independent subject or if not, how do we need to determine teaching items on energy in each of S, T, E, M and other subjects? For example, how do we put energy issues into formal mathematics curriculum which has a systematic hierarchy.

# Issue 9: Educational Preparedness (Teacher Training)

- How to train **teachers** to teach students energy issues in schools?
- We have to develop curricula both of pre-service and in-service education which must be designed commonly by scientists and educators.
- It is also not easy step.

# Issue 10: Assessment

- How to make assessment items to evaluate educational effect in K-12 educational system?
- It is not difficult to develop teaching materials on energy for projects separated from the formal curriculum with a small scale and evaluate their educational effect on the experimental level. But, it is very difficult to connect lesson and assessment on the formal national curriculum.
- This is another difficult task in Korean society.

# 2nd Homework

In relation to STEM, what reform is going on in your economy?

# STEAM in Korea

- In Korea we use STEAM rather than STEM.
- We added **Art** to STEM and **S** includes social science, cultural science and human studies.

# Educational Reform on Energy

- We have no educational reform on energy topic even though it is very very important issue.
- In my sense, in order to make a reform, we need to touch with our national curriculum on the national level.
- But it is not possible at this moment.
- Instead, KNUE has developed small scale experimental teaching materials **hoping** to move to the reform at the national level.



# Energy related education with STEM

- KNUE project in 2014 supported by MOE and Korea Foundation for the Advancement of Science and Creativity
- It is a project to develop textbook/teacher' guide to make:
  - A Plant Factory with sunbeams(grade 3-4)
  - A lighthouse with wind power(grade 5-6)
  - A Lamp with pro-environment Fuel cell(middle)
  - A rotating hosue toward the sun(high)

# A Plant Factory with sunbeams (1)

- A natural disaster like flood and drought has caused a desperate shortage of food in many countries.
- Can we secure foodstuffs stably without a problem from natural disaster?
- It is a long desire of mankind
- It is a concept of a plant factory.

# A Plant Factory with sunbeams(2)

- In this project, students study the following things:
  - By which scientific process, sunbeams are changed to electrical energy?
  - Which vehicles are needed to change sunbeams to electricity?
  - How to change electric energy to light?
  - The process of photosynthesis
  - hydroponics

# Making Plant factory and Cultivation

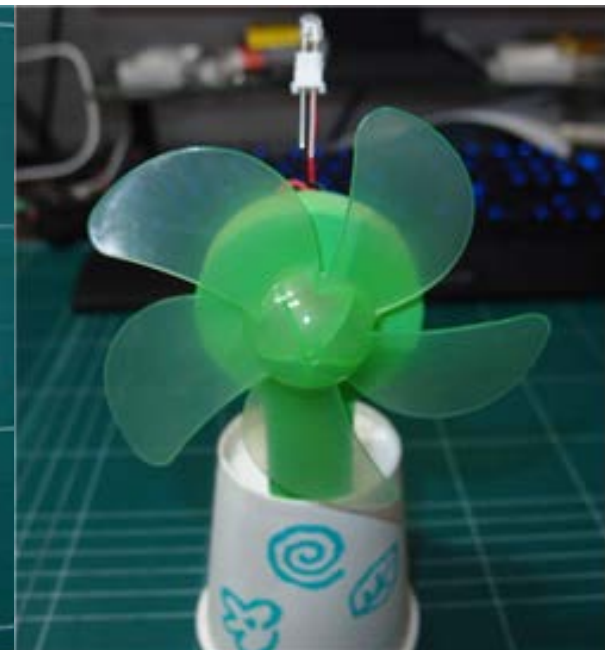
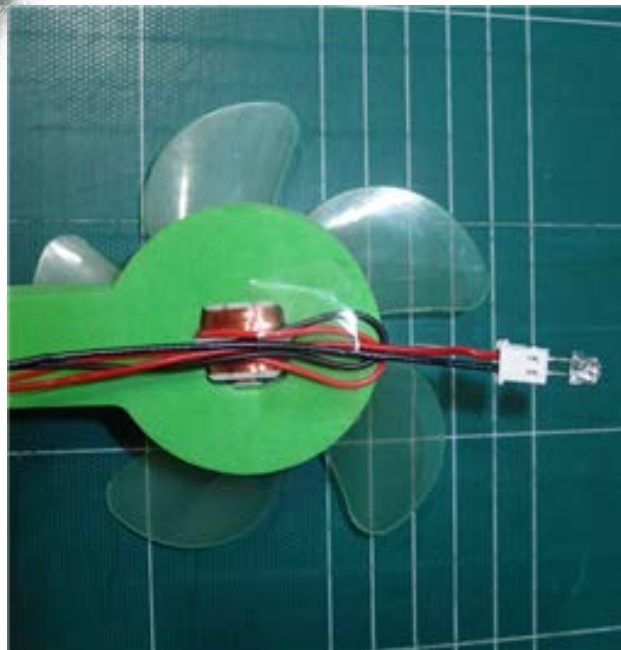


# A lighthouse with wind power

- In this project, students will learn the following things:
  - The importance of wind power.
  - How to change wind power to electrical power?
  - Job related with wind power



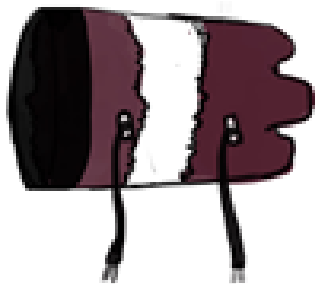
# Making a lighthouse with wind power



# A Lamp with pro-environment Fuel Cell

- In this project, students study the following things:
  - What is a problem of existing battery?
  - The importance of fuel cell.
  - Promising jobs related with fuel cell.

# Making pro-environment of Fuel Cell

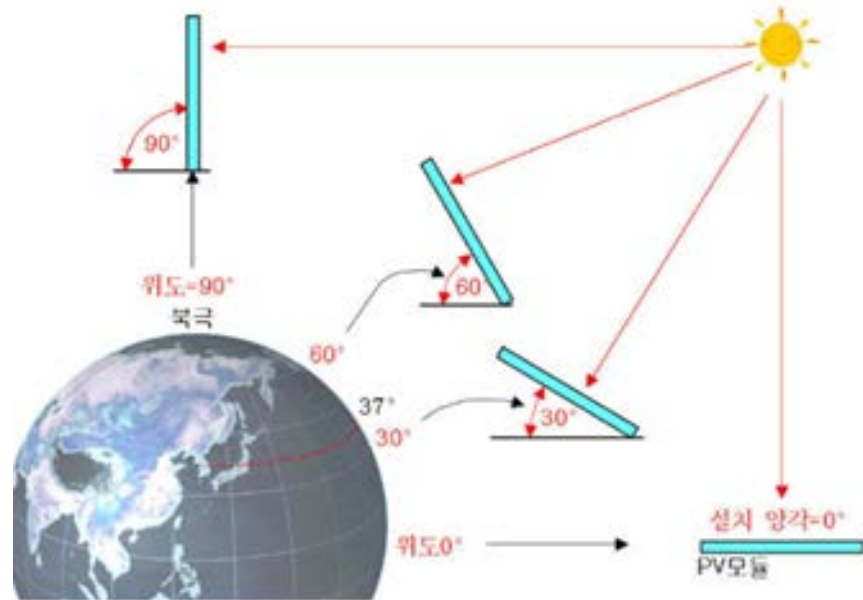




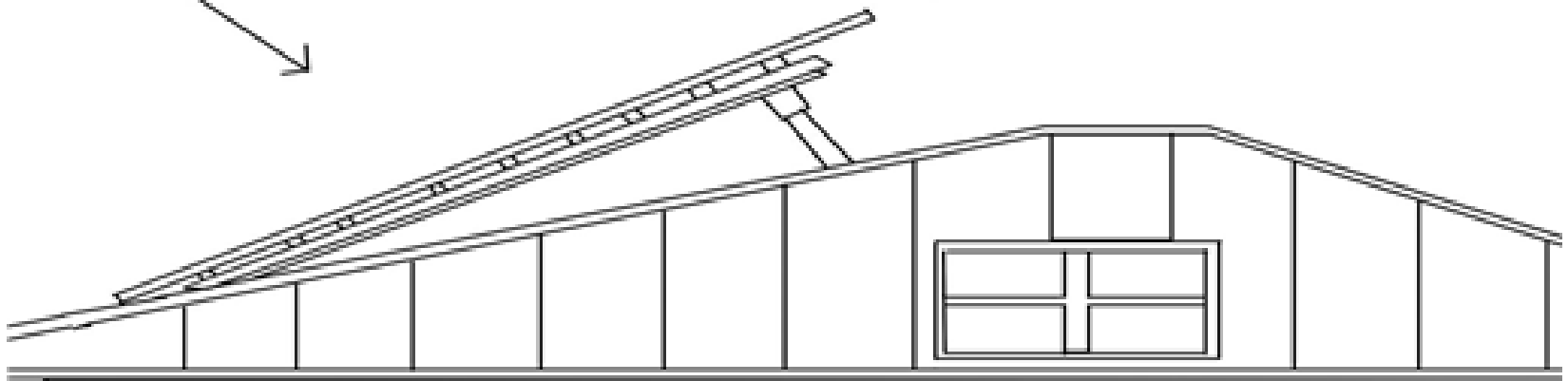
# A rotating house toward the sun

- In this project, students will learn the following things:
  - The importance of sunbeams
  - How to change sunbeam to electrical energy?
  - What are ideas to promote the efficiency of sunbeams
  - Promising jobs related with sunbeams.

# Designing A rotating house toward the sun



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# 3<sup>rd</sup> Homework

In relation to lesson study for  
Cross Border, what is possible?

# Customizing

- The most important step on the cross-border education is to develop textbooks and assessment items on energy, which can be used commonly in many countries.
- We need customizing process for fitting teaching/evaluation ideas to situations of each economy.
- We need additional meetings to APEC lesson study meetings of two times per year to focusing on editing textbook and developing assessment items for many countries.
- Only if we make the textbooks, we can apply them on the practical classrooms.

- Thank you for your attention!!