

- Student worksheet for case study - How much energy do data centers use?



Generic green skills

Cognitive competencies:

- Environmental awareness and a willingness to learn about sustainable development
- Ability to make judgments based on both evidence and sustainability values
- Innovation skills to identify opportunities and create new strategies to respond to green challenges

Interpersonal competencies:

- Communication and negotiation skills to discuss conflicting interests in complex contexts
- Strategic and leadership skills to enable policymakers and business executives to create conditions conducive to cleaner production, cleaner transportation, etc.

Technological competencies:

- Quantification and monitoring (energy)



Learning objective

You will be able to:

1. Recognize how much energy data centers use and what solutions there are for this issue.
2. Find out how Hong Kong responds to data center energy consumption issues and how it can be further improved.



Format

Individual learning and small group work



Resources needed

A3 paper, case study



Time required

1 hour



Assessment

You will be assessed based on:

Your presentation, according to the clarity and accuracy of your arguments.

Before the class:

1. Read an assigned case study from Apple, Microsoft or Google and identify **the major solutions** that have been implemented, or proposed, by the companies in relation to the high-energy consumption issue. You are encouraged to search online for more information.
2. Read a part of the case study about Hong Kong and think **how the Hong Kong Broadband Network (HKBN) responded to these challenges** and what solutions have been implemented in Hong Kong. How do they work?



During the class:

Part 1: Warm-up activity

Individually calculate the energy bill for running a data center in Hong Kong. Assuming you are a data center operator in Hong Kong, running 2,000 racks of servers round the clock, how much is your energy bill likely to be each year?

1. When taking into account cooling and redundant power usage, each server rack consumes about 3kVA (three units of power) per hour. Given each rack consumes 3 power units per hour, how many power units does one server rack consume in a year?
2. Assuming each data center houses 2,000 racks, how many power units will the entire data center consume?
3. Assuming your power company, CLP, charges HK\$1.5 per power unit, how much will your total energy bill be for running a data center in Hong Kong for one year?

Part 2: Group discussion

1. What green technologies have been used by the Microsoft, Apple and Google data centers? Please specify how these solutions help save energy, or which green technologies have been used to address the energy consumption issue.
2. What solutions have been implemented in Hong Kong? How do they work?
3. If you are the owner of Hong Kong Broadband Network (HKBN) and you want to further improve the energy issue of this data center, what solutions do you think could be applied, based on the experience from the data centers introduced in this case study and why? Can the cost of electricity be reduced?
4. Write the results of your discussion on A3 paper.
5. Present your group's findings and conclusions to the class.



Reference:

- Apple's next US data center will run on 100% renewable energy | REVE. (2017). Retrieved from <https://www.evwind.es/2017/08/28/apples-next-us-data-center-will-run-on-100-renewable-energy/60832>
- Baker, B. (2013). Microsoft, Apple, Google Power Data Centers with Renewable Energy. Retrieved from <https://www.ecowatch.com/microsoft-apple-google-power-data-centers-with-renewable-energy-1881810029.html>
- Branscombe, M. (2018). How Microsoft is Keeping Its Cloud More Efficient Than Your Data Center. Retrieved from <https://www.datacenterknowledge.com/microsoft/how-microsoft-keeping-its-cloud-more-efficient-your-data-center>
- HKBN Energy Initiatives – “Something for Nothing” - Sustainable Business HK. Retrieved from <http://sustainablebusiness.org.hk/hkbn-energy-initiatives/>
- Lardinois, F. (2018). Google gives its AI the reins over its data center cooling systems. Retrieved from <https://techcrunch.com/2018/08/17/google-gives-its-ai-the-reins-over-its-data-center-cooling-systems/>
- Moss, S. (2017). Sun, wind and sea: Apple details data center renewable energy initiatives. Retrieved from <https://www.datacenterdynamics.com/analysis/sun-wind-and-sea-apple-details-data-center-renewable-energy-initiatives/>
- Sverdlik, Y. (2018). Google is Switching to a Self-Driving Data Center Management System. Retrieved from <https://www.datacenterknowledge.com/google-alphabet/google-switching-self-driving-data-center-management-system>