**Project proposal**

JISEOK AHN, 안지석(20235575)

* 1. **objective/questions of your project;**
* Energy technologies have a tendency to become locked in. When considering the size of technologies, small-scale and modular technologies are likely to be more responsive to the rapid innovation needed to mitigate climate change(Trancik 2006).
* Under certain conditions, more granular technologies are empirically associated with faster diffusion, lower investment risk, faster learning, more opportunities to escape lock-in, more equitable access, more job creation, and higher social returns on innovation investment(Wilson et al. 2020).
* A study that uses a dataset of cost overruns in 350 electricity generation projects found that investment risk tends to increase for larger hydro, nuclear, and thermal plants but to decrease for larger solar and wind plants.(Sovacool, Gilbert, and Nugent 2014).
  1. proposed scenarios;
* The proposed scenario targets only for **electricity generation sector in South Korea.**
* **Coal power plants** that are considered one of the main greenhouse gas emitters are replaced with granular technologies such as photovoltaic and wind.
* No modifications are needed for **LNG power plants**. LNG power plants are expected to act as a buffer for fluctuating renewable sources.
* Given the government’s energy policy on nuclear power plant, we need to consider a place for **SMR(Small Modular Reactor) nuclear technologies** to be introduced to be consistent with expected government’s energy policy.
  1. methodology (assumptions, GCAM inputs to be used, edited);
* Prospective units of technologies that are valid for fostering technology diffusion in South Korea’s energy sector.
* A variation of unit capacity of photovoltaic and wind turbine is needed. But, not clear how to differenciate the scale(the granularity) of technology in GCAM.
* Following question. Can a technology diffusion speed be an input variable of GCAM?
* Can granular technogies compensate for expected stranded assets like coal power plants and other lumpy technologies?
  1. data required and sources of information;
* To be found.
  1. expected results and conclusions.
* Granular technologies can foster the decarbonization of south korea’s generation sector.
  1. In case this propesed scenario seems difficult to operate in GCAM
* Much of the world's data are stored, managed, and distributed by data centers. Data centers require a tremendous amount of energy to operate. Large amounts of water are also required to operate data centers, both directly for liquid cooling and indirectly to produce electricity(Siddik, Shehabi, and Marston 2021). There are growing needs to calculate detailed carbon and water footprints of data centers operating within South Korea.

Siddik, Md Abu Bakar, Arman Shehabi, and Landon Marston. 2021. “The Environmental Footprint of Data Centers in the United States.” *Environmental Research Letters* 16(6):064017. doi: 10.1088/1748-9326/abfba1.

Sovacool, Benjamin K., Alex Gilbert, and Daniel Nugent. 2014. “An International Comparative Assessment of Construction Cost Overruns for Electricity Infrastructure.” *Energy Research & Social Science* 3:152–60. doi: 10.1016/j.erss.2014.07.016.

Trancik, J. E. 2006. “Scale and Innovation in the Energy Sector: A Focus on Photovoltaics and Nuclear Fission.” *Environmental Research Letters* 1(1):014009. doi: 10.1088/1748-9326/1/1/014009.

Wilson, C., A. Grubler, N. Bento, S. Healey, S. De Stercke, and C. Zimm. 2020. “Granular Technologies to Accelerate Decarbonization.” *Science* 368(6486):36–39. doi: 10.1126/science.aaz8060.

**Objective**: Understanding of the role and impact of granular technologies in achieving South Korea’s net-zero in 2050.

**Research question**: How can the implementation of granular technologies in energy sector contribute to achieving decarbonization, and what are the key challenges and opportunities associated with their adoption for effective decarbonization?