

A life cycle assessment of the sustainability of accelerator facilities is needed. To this end, accelerator researchers should first design accelerator facilities to reduce energy consumption from the design stage. Next, it is necessary to understand the causes of greenhouse gas emissions during the construction phase of accelerator facilities, and to work with the companies involved in the construction to reduce CO₂ emissions. The main cause of CO₂ emissions during accelerator operation is electricity consumption. For this reason, the power composition of the region where the accelerator facility is located should be understood, and efforts should be made to realize operation using green power as much as possible. Electricity used in accelerators is ultimately cooled by cooling water and discharged from the cooling tower. This thermal energy is low-grade, but should be recovered and returned to society as much as possible. These efforts will be more effective if they are made in cooperation with local governments and industries in the areas where accelerator facility is located. This poster discusses the roles that should be played by HEP researchers together with the communities where ILC candidate site is located.

Why global warming is accelerating

- Before the Industrial Revolution, CO₂ emitted by human activities and CO₂ absorbed and accumulated by the natural world were **in balance**.
- CO₂ is stored in **forests, soil, oceans, and atmosphere**.
- After the Industrial Revolution, that **balance has been lost**, and the concentration of CO₂ in the atmosphere is increasing.
- In addition, human activities, especially agricultural land expansion and concentration of specific crops, also impair nature's ability to absorb and store CO₂.
- In other words, what we need to do today is clear: (1) make efforts to reduce the excessive emissions of greenhouse gases and (2) work to restore nature's ability to absorb CO₂.

What HEP researchers should do in the first place

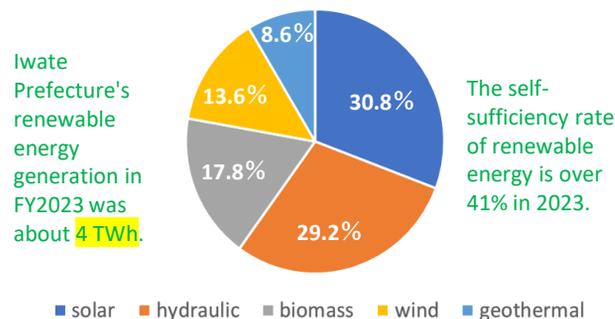
- HEP researchers should try to achieve the highest possible performance per power consumption from the design phase of their research facilities, and they should also strive to bring their facilities' availability close to 100% by increasing MTBF (mean time between failure) and shortening MTTR (mean time to repair).
- Recover low-grade thermal energy emitted from accelerator and research facilities and return it to society.

Researchers should further work with the community

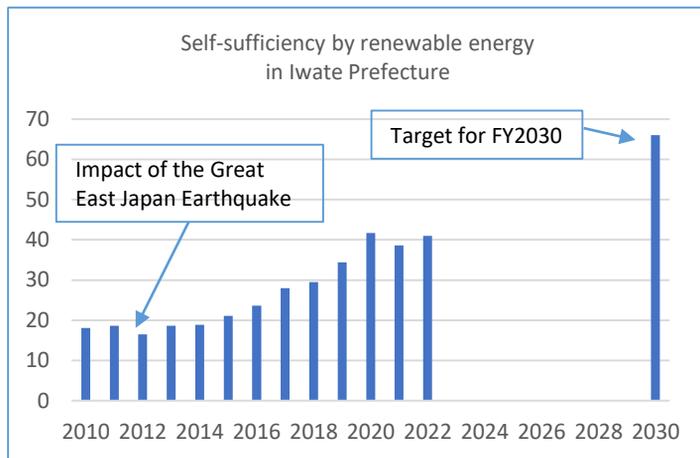
- To cooperate in increasing the renewable energy rate of local electricity and to operate research facilities with green electricity as much as possible.
- Understanding and, where possible, cooperating with efforts by steel, cement, and other GHG emitting companies to reduce their emissions (including CCS/CCUS).
- Cooperate with local efforts to restore forests (green carbon) and oceans (blue carbon), which are inherent to the natural environment.

Iwate Prefecture, where the ILC candidate site is located, has a very high self-sufficiency rate in renewable energy in Japan

Electricity generation by power source



Iwate's current self-sufficiency rate for renewable energy is **41%**, twice the national average, and is aiming for **66%** in FY2030.



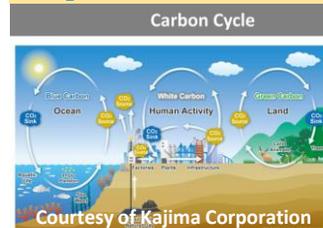
Large-scale factories in Iwate Prefecture, including semiconductor, automobile factories and etc., are located, and it is expected that there will eventually be a "competition" for green power. Therefore, the HEP community needs to cooperate with electric power companies to further increase green power generation.

Researchers should cooperate with the community



Each municipality in the vicinity of the ILC candidate site is located a system to address GX, in line with government policy that aims for carbon neutrality by 2050. The HEP community must coordinate with this movement in the region.

CO₂ is accumulated in forests, soil, atmosphere, and oceans



Forests absorb a large amount of CO₂ in the current situation. Iwate Prefecture has a large forest area with very high CO₂ absorption potential.



Estimation by Hiroshi Kikuchi, advisor to the Ichinoseki City Agricultural Land and Forestry Department: **The entire Ichinoseki forest absorbs 303.53 kilotons of CO₂ per year**. The average annual CO₂ absorption per unit area is **4.57 t/year/ha**. This amount of CO₂ absorbed each year is more than the total amount of CO₂ emitted during the ILC construction period (10 years).

Refer to the poster of Iwate Industrial Promotion Center about the low-grade waste heat recovery project.