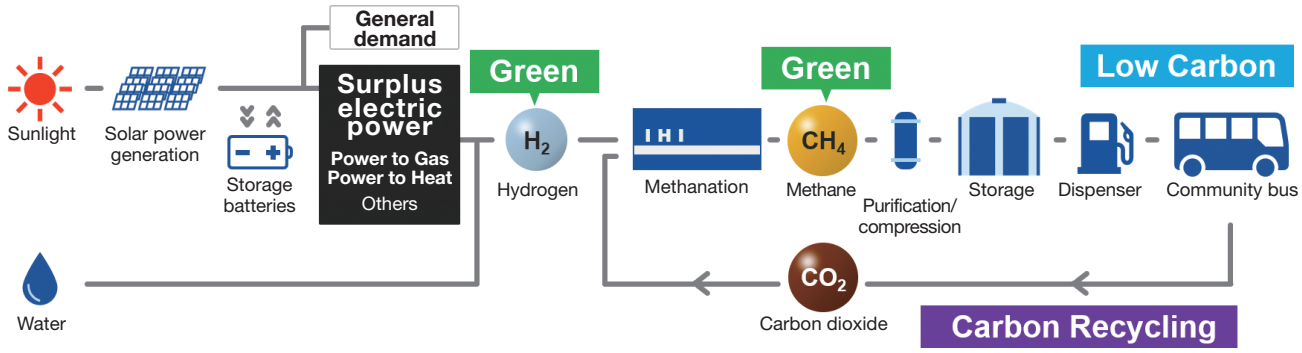
Japan's First Green Methane Supply for Community Bus Started!

A new attempt to use synthetic methane (green methane) produced by surplus electric power from renewable energy effectively as vehicle fuel

At the Soma IHI Green Energy Center, located in Soma City, Fukushima Prefecture, IHI started supplying an existing vehicle with methane synthesized from renewable energy-derived hydrogen and captured CO_2, which is the first achievement in Japan. On February 22, 2023, a bus fueled by the synthetic methane started its operation for the Odekake Minibus, a municipal community bus service for elderly people living in Soma City.



Flow from producing synthetic methane using surplus electric power to supplying the methane to the community bus

Aiming to maximize the use of renewable energy in the region

The Japanese government declared that Japan would aim to be carbon-neutral by reducing carbon dioxide (CO_2) emissions to virtually zero by 2050. Our society has begun taking various measures to reduce CO_2 emissions, one of which is increasing the use of renewable energy. While renewable energy is being introduced in various regions, the large temporal fluctuations in production of electric power and increase in surplus electric power have become problems. What is necessary to solve these problems is to store renewable energy produced locally and to use it locally when needed, in other words, local production and consumption of energy. If this concept becomes reality, electric power could be available locally even if the energy supply to the region from outside stops due to a disaster or the like. This will bring the important effect of enabling us to secure energy for local areas in an emergency.

At the Soma IHI Green Energy Center (SIGC) in Soma City, Fukushima Prefecture, IHI has put into operation a system for producing and supplying synthetic methane (green methane). To produce synthetic methane, this system electrolyzes water using solar electric power to produce green hydrogen and then applies methanation equipment to react the hydrogen with CO_2. Soma City and IHI modified one vehicle from the fleet of the Odekake Minibus service, a community bus service for elderly people living in Soma City, so that it could run on synthetic methane as the fuel, and put the vehicle into service on February 22, 2023. This is the first example of its kind in Japan, and is one form of local production of renewable energy for local consumption promoted at the SIGC.

Japan's first supply of synthetic methane to vehicles

Methane (CH_4) is the main component of natural gas. Methane synthesized from renewable energy-derived hydrogen and captured CO_2 can be used as an alternative for natural gas, leading to carbon neutrality in gas. Currently, there are various power options for vehicles other than gasoline, such as hydrogen and electricity, and natural gas

Methanation equipment and the community bus

and methane are also included. The spread of hydrogen-fueled and electric vehicles has not reached intended levels because of the high cost of the vehicles and the lack of infrastructure, such as charging stations and production sites for hydrogen and electric power especially in Japan. On the other hand, it is easier to introduce natural gas- and methane-fueled vehicles because gas supply infrastructure such as gas pipelines, has already been installed in cities around the world. Moreover, there is no need to buy new vehicles since we only have to partially modify gasoline-fueled vehicles. In fact, natural gas-fueled vehicles are already common in Europe and China.

In Japan, there are no national laws or regulations concerning the supply of synthetic methane to vehicles, but there are some laws and regulations relating to the supply of natural gas to vehicles. They categorize natural gas by calorific value etc., but do not define gas components in detail. To determine whether synthetic methane is equivalent to natural gas, we should follow United Nations Regulation No. 110, which Japan has also ratified. This regulation clearly specifies gas components. For this project, we followed this regulation to modify a gasoline-fueled vehicle and supply synthetic methane produced using renewable energy, which is the first example in Japan. By not using gasoline to run vehicles, we could greatly contribute to reducing CO_2 emissions in the region.

System for producing and supplying synthetic methane derived from renewable energy

The SIGC's system for producing and supplying synthetic methane using renewable energy has the following advantage. With the use of the IHI Group's own technologies and products, the system can produce synthetic methane when larger amounts of surplus electricity are available and the price of electricity is low, and the quality of the produced methane meets the requirements of United Nations Regulation No. 110.

The market price of electricity produced by using renewable energy varies depending on the production volume and demand. Therefore, the unit cost of methane production can be lowered by storing and using electricity purchased at a low price when production is high and demand is low. The system installed at the SIGC produces methane only when a large amount of surplus electric power is generated. By doing so, the system converts renewable energy into a valuable resource while making effective use of surplus electric power without affecting demand for electric power in the region.

The system of the SIGC produces synthetic methane so as to satisfy the requirement defined by United Nations Regulation No. 110 as hydrogen content of 2% or less. Methane gas that contains more than 2% hydrogen and so does not satisfy the requirement is collected and burned in a general gas-fired steam boiler made by IHI Packaged Boiler Co., Ltd. Steam generated in this process is used as a heat source. This boiler has been designed to burn natural gas containing no hydrogen, but in this demonstration test, it was found that the boiler can also burn synthetic methane containing a large amount of hydrogen without any trouble.

It can be said that the IHI Group's system for producing and supplying synthetic methane has advantage of several features: a control function that takes electricity unit prices into consideration, compliance with United Nations Regulation No. 110 for synthetic methane, and a boiler that can flexibly handle various fuel gas properties.

Future prospects

As described above, by producing synthetic methane at the SIGC and supplying it to the community bus as the fuel, we took the first step toward local production of renewable energy for local consumption. The community bus is now fueled by synthetic methane instead of gasoline, but the bus service operates in the same way as before as an important means for elderly people to get around their community. In the future, we will be able to contribute further to the region by increasing the number of vehicles that use synthetic methane for fuel. We are also thinking about supplying synthetic methane through city gas pipelines to meet demand of people who need heat.

Based on the experience and knowledge gained in the model town of Soma City in Fukushima Prefecture, we will expand our decarbonization initiatives nationwide through further promoting PtoG (Power to Gas, which refers to converting surplus electric power into a gas fuel, and storing and using it), PtoH (Power to Heat, which refers to converting surplus electric power into heat, and using it), and other forms of local renewable energy production for local consumption.