

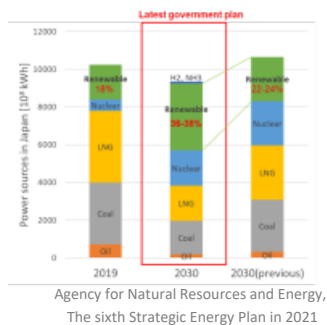
Contribution to the reduction of global environmental impact through the introduction of environmentally friendly distribution substation

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Background

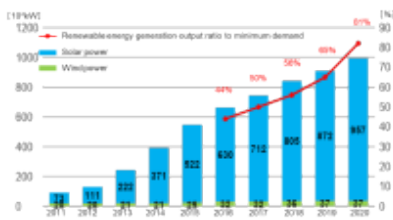
– Renewable energy expanding

- Global warming is considered to be one of the causes of abnormal weather, and there is a strong need to reduce greenhouse gas emissions.
- Japanese government has raised the target for the introduction of renewable energy as a percentage of power sources from 22-24% to 36-38% in 2030.
- Accommodate the demand of GHG emissions
 - Construction of environmentally friendly substation
 - Increasing renewable energy introductions



Rapid mass introduction of PV in Chubu area

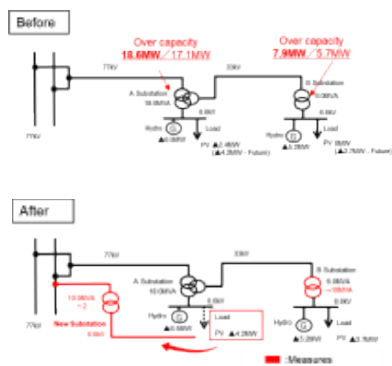
- Renewable energy resources tend to increase annually due to Feed in Tariff (FIT).
- The amount of increase in PV is dominant.



Changes in the amount of renewable energy generation introduced in Chubu Electric Power Grid

Increasing PV introductions and New substation construction

- We have found that the existing 77/6.6 kV and 33/6.6 kV transformers at our substations are expected to be over-capacity due to the increasing number of low-voltage PV introductions and connection applications in some areas.
 - **New substation is needed.**
- The transformers in the new substation will be two 10 MVA units in consideration of the future increase in PV introductions.



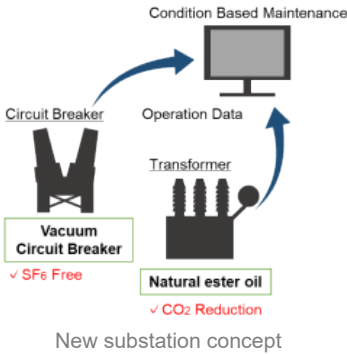
Outline of countermeasures for increasing connection of PV power



Location map of the new substation

The Policy of new substation

- We are considering the construction of a new substation, and as a policy for adopting equipment, we are aiming to achieve GHG reduction by adopting SF₆ free circuit breakers and transformers that use natural ester oil from vegetable.
- Sensors attached to the equipment will be used to monitor the condition of the equipment to reduce inspection and parts replacement opportunities.



Vacuum Circuit Breaker

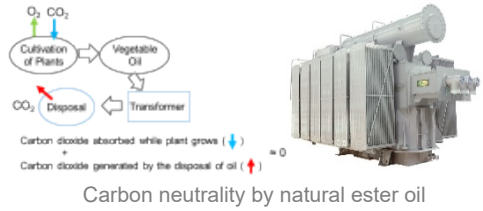
- We have been using VCBs for 6.6 kV circuit breakers since the 1960's
- More than 16,000 units of VCBs are in use, contributing to the reduction of GHG emissions.
- The 77 kV VCB uses dry air as the insulating medium instead of SF₆ gas, and a vacuum valve is applied. Since dry air with a GWP of zero is adopted, it contributes to GHG reduction by eliminating SF₆ gas.



Vacuum Circuit Breaker

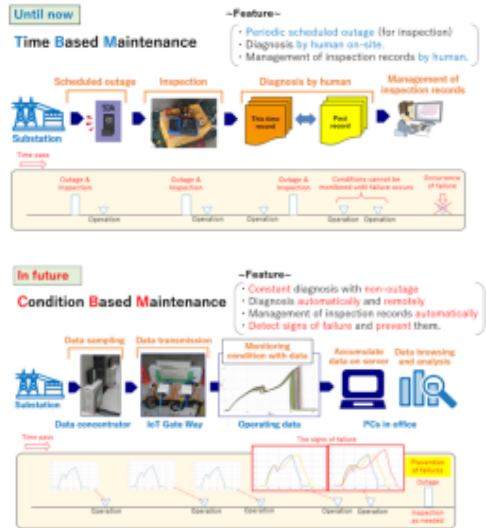
77/6.6 kV natural ester oil transformer

- The development of transformers using natural ester oil from vegetable, which can reduce the environmental impact, is underway.
- Insulating oil emits CO₂ when it is finally disposed of, but plants, which are the raw material for vegetable-based insulating oil, absorb CO₂ in the process of growth, making it possible to reduce total CO₂ emissions and thus reduce GHGs.
- The proposed location of the new substation is surrounded by fields and river, so the use of biodegradable vegetable oil-based insulating oil will increase the understanding of local stakeholders and further reduce the environmental impact.



Condition Based Maintenance using IoT devices

- Instead of conducting inspections periodically according to the cycle specified for each device, we will switch to a maintenance method that uses IoT sensors to conduct inspections on equipment that are found to be in abnormal condition.
- This will enable us to reduce the number of parts that have been replaced during periodic inspections, and thus reduce CO₂ emissions by reducing the amount of parts procured.
- It will also enable a reduction in the number of opportunities to be dispatched to the site, and reduce CO₂ emissions from the vehicles used when dispatched to the site.



Maintenance using IoT devices

Conclusion

- We are working to expand the introduction of renewable energy, and this time we are building a new substation to handle the increased amount of PV power generation. The new substation will be equipped with environmentally friendly equipments (vacuum circuit breakers and transformers that use natural ester oil from vegetable), as well as condition based maintenance using IoT devices, which will contribute to reduce GHG and environmental impact.