



ABSTRACT

**For Sustainable Development of the Whole World by Renewable Energy**

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The atmospheric carbon dioxide concentration has been increasing at the rate of about 2.4 ppm/year since 2007, and reached about 410 ppm in 2017, in spite of the fact that we had lived in the atmosphere containing 280 ppm of carbon dioxide since the dawn of history to the industrial revolution. It has been said in 2007 that the atmospheric carbon dioxide concentration reached the level in 3.5 million years ago. All current living things have no experience to live in such climate. The world average temperature increased 0.3°C for 6 years after 2010. There is no solution to avoid global warming as far as we continue to burn fossil fuels. Extrapolation of recent increase in the world primary energy consumption indicates that all reserves of fossil fuels and uranium will be completely exhausted until the middle of this century. In order to avoid the crisis of intolerable global warming and no fuels for combustion we have to establish and spread the technologies to use only renewable energy by which the whole world can keep sustainable development.

There are superabundant renewable energy sources on our planet.

We have been performing research and development of global carbon dioxide recycling for about 30 years to supply renewable energy to the world in the form of methane by electrolytic hydrogen generation and subsequent formation of methane by the reaction of carbon dioxide and hydrogen. We created necessary key materials. Those are anodes and cathodes for water electrolysis and catalysts for carbon dioxide methanation. We constructed a prototype plant consisting of solar cell, water electrolyzer, carbon dioxide methanation unit, methane combustor with oxygen and piping connecting methane production and combustion units in 1995. Industrialization is in progress.

We are recommending the construction of local energy supply system. The power generated from renewable energy will be used directly. The surplus electricity must be used for water electrolysis to form hydrogen and oxygen. Hydrogen will be used to form methane by the reaction with carbon dioxide. Methane will be used for regeneration of steady electricity at a natural gas power plant for covering shortage and leveling of intermittent and fluctuating power generated from renewable energy. For combustion of methane at the power plant oxygen formed by the water electrolysis will be used after dilution with carbon dioxide of exhaust gas, so that the exhaust gas will be composed of only carbon dioxide after removal of water. Thus, carbon dioxide of the exhaust gas will be recycled for methane formation and oxygen dilution. Hot waste water of the power plant will be used in the local area for heating, farming and industries.