

# Development of an Eco-Friendly Agricultural Product Storage System Using Adsorption Cooling

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## Submission category

(A) Technical research proposal to solve concrete problems

## SDGs targets and indicators

Food security is the main part of the 2030 Agenda (SDG). The imbalance in food distribution is emerging as a problem for the world to solve together. And an environmentally friendly solution should be devised for sustainable development. Devising eco-friendly agriculture product storages can be one solution for the problem, because it can enhance the independence of each country. The agriculture product storage using adsorption cooling system, as an environmentally friendly and sustainable technology, has the potential to give answers to the food and energy portion of the 17 goals of SDGs. Of the 169 targets of SDGs, our targets and indicators are as follows. <sup>1 2</sup>

Target	Indicator
2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situation, including infants, to safe, nutritious and sufficient food all year round.	2.1.1 Prevalence of undernourishment 2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES).
7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.	7.a.1 International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems.
7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states and landlocked developing countries, in accordance with their respective programmes of support.	7.b.1 Investments in energy efficiency as a proportion of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services.

## Abstract

### The problem of storing agriculture products in energy-poor areas

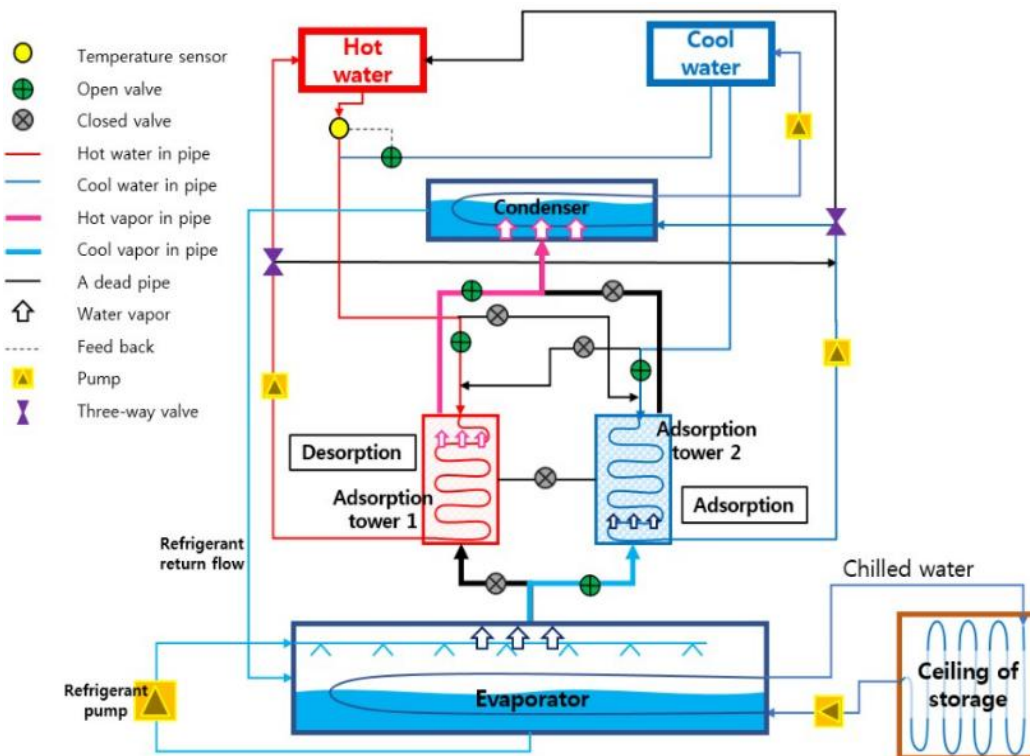
One reason for poor self-sufficiency in farming population is that there is no adequate agriculture product storage system. Sub-Saharan agricultural countries, for example, produce relatively many crops during the rainy season but periodically suffer from undernourishment for lack of storage technology. So, we intend to solve this problem by applying adsorption cooling system to storing agricultural products.

### Designing a agriculture product storage system using adsorption cooling

The important part of this study is to devise an electro-independent system by using adsorption cooling with solar heat generation. The principle of it is that refrigerant is evaporated by adsorbent to take away heat and produces chilled water to cool the storage. It uses eco-friendly refrigerants and heat sources with relatively low temperatures such as waste heat or solar heat. According to a recent study, adsorption cooling system uses only 10 percent of the amount of electricity that conventional electrical compression cooling devices use. In addition, an electro-independent system is possible if solar heat is used not only as a heat source, but also for power generation.

From preliminary study, we selected adequate adsorbent that is energy efficient, economical, and eco-friendly.

The system schematic that we made is as follows:



Further research will be done as follows:

1. Simulation using Aspen+
2. Theoretical estimation including performance analysis, economic analysis, suitability to regions.
3. Prototyping this storage system based on the results.
4. Real performance evaluation through experiment.

### Prospect

Food security is the main part of the 2030 Agenda. Proposed agriculture product storage system will be an answer to the 17 goals of SDGs by enabling long-term storage. In particular, the hybrid solar power grafted adsorption cooling system will also solve food problems in energy poor areas in an eco-friendly way.