

Large-Scale Greenhouses Attached to Power Plants for the Productive Use of Waste Heat and CO₂ emissions

In the United States, there are approximately 800 large power plants that burn natural gas or coal. Power plants are usually situated away from population centers because of cost of land, pollution, noise and aesthetic. The area surrounding a large power plant often consists of substantial buffer land to separate the plant from housing developments. Power plants typically need to be located near water sources to facilitate plant cooling requirements. Currently, there are not enough industrial customers that can use the low-temperature waste heat from most power plants. The efficiency of power plants in converting thermal energy to electricity is less than 50%. Therefore, for each 1MW of power output another 1MW of thermal power is wasted to the environment. This represents waste on a grand scale.

We believe that the large quantities of low-temperature waste heat from power plants can be used in large-scale greenhouses that are integrated with the cooling systems of power plants. Furthermore, we propose to use the emissions from large power plants as a source of CO₂ for large-scale commercial greenhouses, boosting productivity and quality of high-value crops such as vegetables and flowers. The specific aim of this plan is to develop a prototype pilot for interfacing a power plant and a greenhouse. The pilot project will be used to demonstrate the potential of this concept, as well as allowing novel investigations into fundamental engineering processes relevant to clean energy technologies, environmental science and plant metabolism. The pilot program will use the waste heat and emissions from a natural gas combined cycle power plant. Calpine Corporation, a power company that operates nationwide 89 power plants is a strategic partner for this venture. Calpine is providing now in-kind engineering support.

Large-scale greenhouses operating in the vicinity of power plants will substantially increase revenues of power companies through sale of waste heat and emission gases and increase the commercial value of land surrounding the power plants that is now unused. Greenhouses will be leased, rented or sold to growers. The agricultural output from the greenhouses is expected to replace a substantial portion of the currently imported high-value greenhouse vegetable crops.

In the long term, it is possible that power plants will be situated closer to population centers, transforming the proximity of power plants into commercial and social goods. This concept has several potential public health benefits as well. The main health benefit will be in the form of commercial incentives for electric power companies to further clean their emissions --the input into the greenhouses – which will eventually be discharged to the atmosphere.

Large-scale greenhouses attached to power plants could become in fact the largest industrial consumers of co-generated waste heat. The greenhouses will also provide a new tax base for local communities, generate jobs, and provide additional revenues for power plants already built. Greenhouse developments are currently being discussed and anticipated in Rhode Island, Massachusetts, Maine, Ohio, Wisconsin, Texas and Arizona.

See also “Power Plant Takes on a New Meaning,”
Machine Design, Sept. 16, 2004, Page 100 at:

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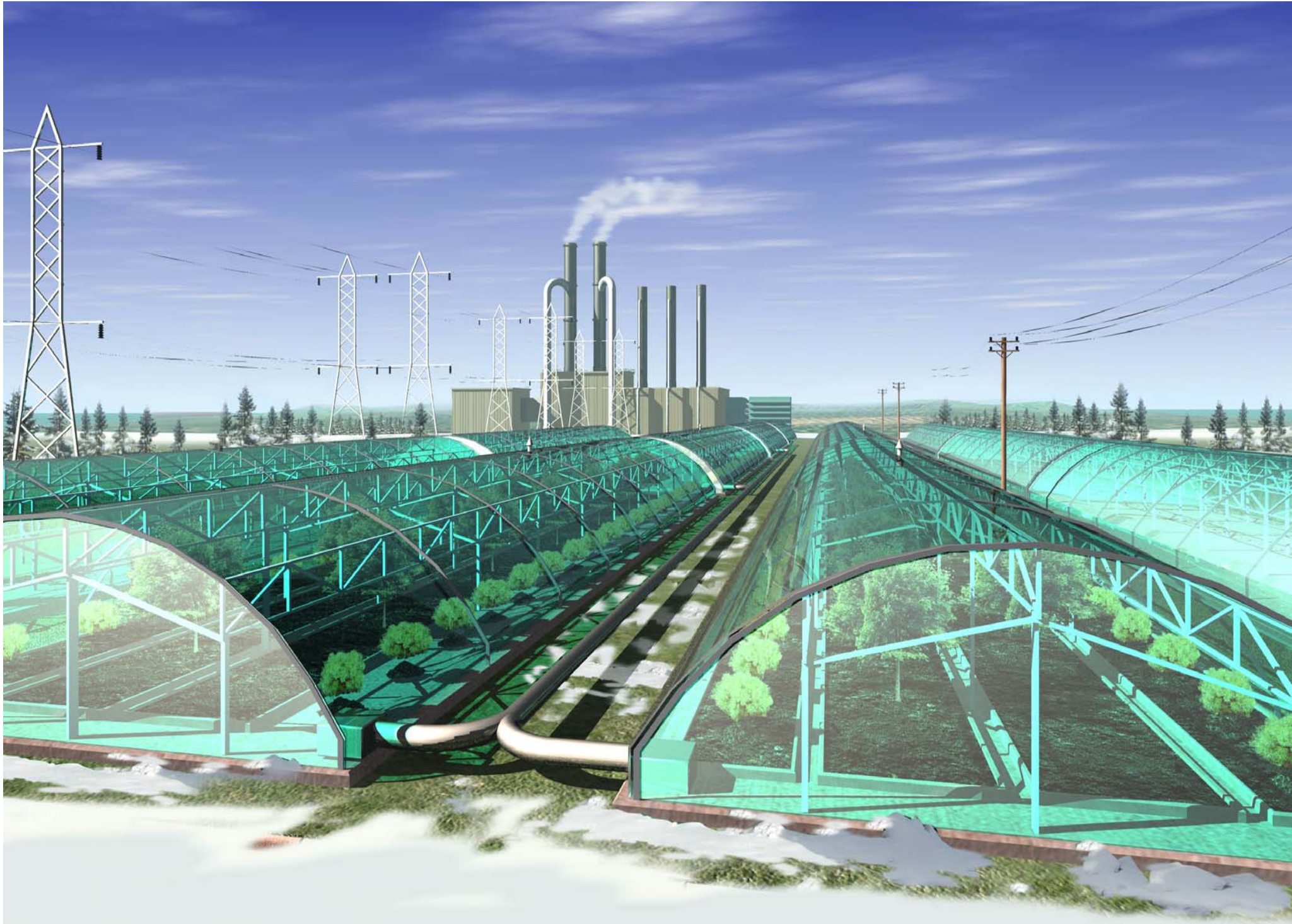
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Artistic Rendering of CO₂ Enriched Greenhouses Using Waste Heat from Power plant Exhaust Stacks



Artistic rendering of CO₂ enriched greenhouse complex built around a power plant for the productive utilization of waste heat and CO₂ emission

It is expected that the integration of greenhouses with power plants for growing high-value crops will provide substantial additional revenues for power companies. Using waste heat and emission productively will become as important a business activity as electric power production.

Currently, each megawatt production of electric power results in the wasteful creation of another megawatt of thermal energy. In the US, the waste heat from hundreds of power plants is not currently being used for industrial applications.

There are hundreds of power plants in the US that can provide waste heat and emission to a substantial greenhouse industry, helping to develop a new agricultural sector.

