Spectrally Tuned All-Polymer Technology for Inducing Cooling (STATIC)

SRI and PPG Industries Inc. are collaborating to design a system that uses radiative cooling to reduce the temperature of power plant discharge water, day or night, while preventing its evaporation.

In thermoelectric power generation, only about 40 percent of energy in the fuel is used effectively for power generation. The remainder is in the form of low-grade heat that must be carried away by condenser-based cooling systems. To reject the heat, these systems typically use water from a river, lake or ocean, pass it directly over tubes containing the condenser water and then return the water—now warmer—to its source.

**Project Innovations and Advantages**

STATIC technology uses a two-layer polymer structure to cover a pool that holds power plant condenser discharge water. The polymer-based top-layer STATIC film prevents sunlight from penetrating the structure and warming the water while allowing thermal energy to radiate to the sky, even during the day. The structure provides an insulating air gap to prevent conductive and convective heating.

Both layers work in concert to reject solar energy. The bottom layer acts as an emitter at the water temperature and radiates heat to the sky. The top layer and key component, produced using STATIC technology, enables transmittance of the thermal radiation. The cooling power can achieve greater than 100 W/m² without evaporation. All materials are inexpensive and amenable to scalable manufacturing techniques.

A 2500-megawatt power plant may require as much as 1.5 billion gallons of cooling water a day.

SRI is co-developing a system for cooling water discharge ponds at thermoelectric power plants.
Potential Impact

If successful, SRI's technology could provide power plant operators a low-cost way to supplement power plant cooling without consuming additional water resources. Benefits could include:

- **Security**: SRI’s structure could reduce dependence on water for power plant cooling by providing an inexpensive means of supplemental cooling without sacrificing power plant performance. STATIC is passive; no power input is needed to achieve cooling.

- **Environment**: The STATIC system enables passive radiative cooling, reducing the need for additional water or power inputs to cool power plant condenser water.

- **Economy**: With no input power required, and by applying low-cost manufacturing techniques, SRI estimates the structure could cost less than $150 per kW, which would not notably raise the levelized cost of electricity for operators.

In addition to the power plant cooling market, the technology may have applications in sectors where cooling is needed but limited infrastructure is available to provide it.

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