PARC is developing massively scalable and low-cost metamaterial films that can “self-cool” in broad daylight, without the need for electricity or consumption of water. The focus of the ARPA-E project is in dissipating heat loads to increase thermal power plant efficiency, especially in conjunction with other dry cooling approaches.

In the U.S. today, 139 billion gallons per day of fresh water are withdrawn for thermoelectric generation, of which 4.3 billion gallons per day are dissipated to the atmosphere by cooling towers and spray ponds. As the demand for fresh water approaches or exceeds supply, there is a dire need for innovative dry-cooling systems that eliminate net water usage in power plants. Relative to conventional air cooling systems based on conduction and convection, PARC’s cooling module is expected to drop condenser temperatures by at least 13 °C (23 °F), with zero net water dissipation to the atmosphere. This correlates to at least 3% increase in power plant efficiency.

PARC’S COOLING FILM
PARC’s scalable cooling architecture is designed to reflect solar light, while simultaneously radiating heat to the cold sky through the atmospheric infrared transparency window. PARC’s innovative design is a departure from other more complex radiative cooling schemes, and its cooling performance exceeds that of competing technologies. The low-complexity architecture enables mass-production of the films by roll-to-roll processing. We have experimentally demonstrated that the cooling film can cool surfaces up to 13 °C (23 °F) below ambient temperature. The envisioned deployment of this technology is in the form of multiple radiative cooling panels tiled over large areas, similar to a solar farm, resting on top of enclosures of water channels.

RADIATIVE COOLERS THAT CAN MOLD THE FLOW OF HEAT
PARC’s passive radiative cooling film is flexible, sturdy, low cost, and can be adapted for a broad range of applications, including cooling of buildings, car rooftops, spacecraft, and military tents and supplies in hot desert climates. In addition, it can be designed to self-adjust its cooling power under varying insolation to maintain an approximately constant temperature.