CALIFORNIA
ENERGY COMMISSION

Energy Research and Development Division

FINAL PROJECT REPORT-SUMMARY

Cooling Tower Water Treatment using Industrial Vortex Generator Technology for Energy and Water Savings

Gavin Newsom, Governor
May 2020 | CEC – EPC – 15-087

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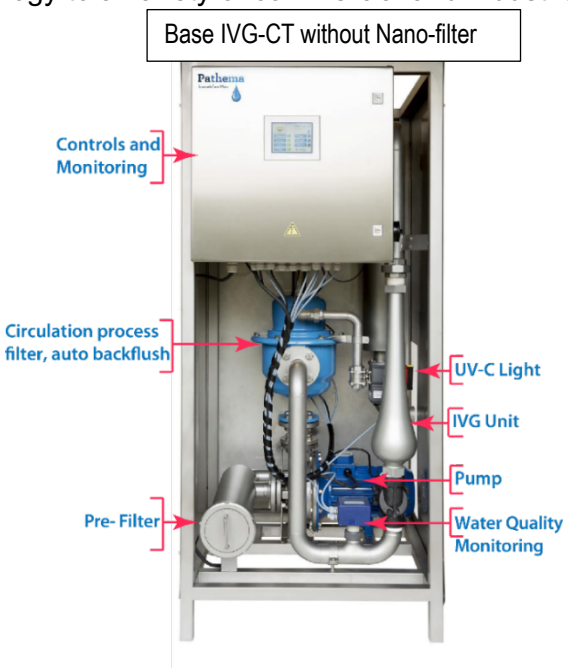
CEC-15-087 Fact Sheet – Final
Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings

The Issue

Cooling towers in the US and California traditionally use water-intensive chemical treatment processes, provided by a well-established market channel of chemical companies and service providers. Though smaller equipment can be air-cooled, larger space-cooling equipment and refrigeration systems use water cooling for higher efficiencies. Water use in this equipment has been a major concern given California's prevailing drought conditions, an estimated 1,179 million gallons per year of potable water are used in cooling towers for commercial buildings alone. Cooling tower water needs to be treated to control microbial growth, scale formation, and metal corrosion while the heat transfer performance of the cooling tower must also be maintained to sustain equipment energy efficiency. The use of non-chemical, physical water treatment (PWT) technologies for water-cooled cooling towers is growing the U.S. and has been more widely used in the European Union, where restrictions on hazardous chemical discharge and environmental policies encourage lower chemical usage. PWT, if properly applied, can offer advantages in controlling the primary water metrics of scale, corrosion, fouling and bacteria.

Project Description

The primary objectives of this project were to a) assess the efficacy of an innovative low-energy use technology, Industrial Vortex Generator Technology for Cooling Towers (IVG-CT), and b) conduct a market knowledge transfer of this technology to a variety of commercial and industrial end users and stakeholders. The IVG-CT is an innovative low-energy physical water treatment method for treating water in cooling towers for commercial and industrial applications, providing energy, water and chemical savings. The IVG-CT is a plug & play side stream water treatment unit combining multiple physical treatments:



(a) Removal of micro-bubbles
(b) Hydrodynamic cavitation
(c) UV-C light microbiological control system
(d) Filtering
(e) Monitoring and control system.

The IVG-CT system was demonstrated and evaluated for water, chemical and energy savings at two sites in California commercial building cooling towers. One site was a large hotel in California Climate Zone 15 and represented an application where cooling tower water treatment is representative of common maintenance practices for commercial buildings. The second site was a large bio-pharmaceutical company California Climate Zone 6 and is representative of the best-in-class water treatment and maintenance practices. The measurement and verification plan followed the International Performance Measurement and Verification Protocol and consisted of equipment monitoring prior to and post installation of the IVG-CT technology at both host sites.

Key findings from the field evaluation of the IVG-CT included:

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- Substantial water savings at both host sites: 30% (1.8 M gals) for the hotel site with typical practices (COC was increased from 2.3 to 5.9) and (1.5M gals) for the pharmaceutical site with best practices (COC was increased from 3.6 to 7.8).
- Chemical savings are also observed, with a larger percentage of cost reduction than water savings. The hotel site saw savings greater than 30% and the pharmaceutical site saw savings of 45%.
- Energy savings were observed, 6.4% net energy savings at the pharmaceutical site, and 5.4% net energy savings at the hotel site.
- Building maintenance staff noted that the chiller heat exchangers were much cleaner after the installation of the IVG-CT, and that the monitoring system provided an added benefit of informing them of the required maintenance of system components.

Anticipated Benefits for California

The IVG-CT provides an environmentally friendly water treatment option that requires minimal chemicals, water, and energy. It provides **significant water savings** compared to traditional chemical water treatment by increasing the cooling tower's cycles of concentration (COC), a metric for the amount of makeup water required. This is very important in California communities with limited fresh water supplies. Water that is not used onsite reduces overall system sewer treatment costs, and the embedded energy cost of the water pumping.

The IVG-CT allows for reduced chemicals usage compared to traditional chemical treatment. The chiller plant can reduce the chemicals purchased and reduce maintenance costs. It also reduces discharge of toxic elements in the blow down water, lowering sewer charges. Reduced chemical usage onsite, also has a positive impact on the reduction of the overall carbon footprint of the cooling tower chemical production and distribution supply chain.

The IVG-CT prevents scaling and keeps heat exchanger surfaces clean so the chiller cleaning maintenance period can be extended. The technology, can over time, reduce lime scale which also improves reliability and efficiency. Building maintenance facilities can also benefit from the IVG-CT through improved monitoring equipment diagnostics for improved chiller plant operation.

The IVG-CT is commercially available in Europe with over ninety (90) chemical-free installations. Increased adoption could facilitate numerous manufacturing jobs in the U.S. as the technology sees wider adoption. The savings from the reduced total cost of operating water-cooled chiller systems would flow back in the economy.

Project Specifics

Contractor: Electric Power Research Institute
Subcontractor: Cypress Ltd. Technology Provider: H2oVortex S.A.R.L. Luxembourg
Term: July 2016 to April 2020