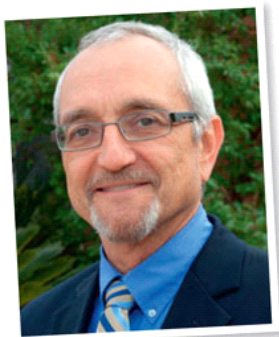


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Co-location & Co-generation

Dr. Gene Giacomelli



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In the Spring issue, I presented an interpretation of sustainability with the basic premise of managing our actions in a manner that doesn't limit or prevent future similar actions. A tactical approach with our thoughtfully planned actions, such as co-location, can help maintain process quality, as well as mitigate environmental impacts while supporting desirable actions in the future.

Co-location specific for CEA greenhouse crop production was defined in 2025 by Resource Innovation Institute (RII) as "... *the strategic placement of multiple industrial and agricultural facilities in close physical proximity to shared resources, infrastructure and utilities while enhancing operational efficiency and sustainability.*" Co-location with the massive data centers that must

dissipate heat has recently been proposed for CEA crop production. It combines resources at one site of an industrial process with greenhouse agricultural production. Electrical resources power the data center computers while downstream heating the plant environment of the greenhouse.

The goals are valuable, but there are challenges to overcome. Management becomes more complex, as the grower is dependent on the continuous availability of an off-site heat source. A partnership must be established to provide a mutual benefit between the facilities. Additional infrastructure is required and these costs must be offset by the reduction of expenses from purchase of the fuel for heating the greenhouse and hardware to cool the data center. Such application requires a monitored and controlled pumping network to access the hot water and return the cooled water. A backup heating source must be included to meet heating demand should the waste heat source be offline for any reason. Plus, consider that the heat demand for the greenhouse will vary seasonally, and will not always be required, while cooling the data center must be continuous.

Other co-location possibilities include rooftop greenhouses for energy savings for heating/cooling with the benefit of hyper-local vegetable products (Gotham Greens in New York City facility above Whole Foods Market); landfill biogas (methane and CO₂) for heating/powering CEA (Eco-Complex, New Jersey Agricultural Experiment Station); and carbon dioxide from food processing (fermentation byproduct from brewery/distillery).

Agriculture has historically benefitted from co-use of resources. The dairy industry can produce biogas (primarily methane) from animal manure. An engine-generator (or CHP, combined heat and power unit) using a biogas-fired internal combustion engine provides electricity from its generator and heat from its cooling

system for the milking parlor. The farm-grown feed nourishes the cows housed within a protected barn that collects their waste (an energy rich resource of manure, bedding and feed) into a biodigester adjacent to the barn for processing and biofuel production. Feed in, energy out and it is uninterrupted. The remaining solids after fermentation become fertilizer, thus producing more animal feed. And around it goes!

Co-generation with CHP adapts well with CEA greenhouse operations. My experience as a graduate student at Rutgers University (circa 1980) was with a natural gas engine-generator that provided not only electrical power for HPS lighting—a high-quality resource—but also engine cooling water that warmed a 5,000-sq. ft. research greenhouse growing year-round tomatoes (with funding from the local gas and electric utility), creating an ideal market for an interruptible application. A 25-kilowatt engine-generator unit powered the HPS lamps (no LEDs back then) and was cooled by linkage into a concrete warm-floor heating system as the primary heat source for the greenhouse. The large thermal mass of the floor uniquely benefited the unit by creating long operational heating cycles with demand based on the floor temperature (~80F).

A two-way electrical service panel enabled sales to the power company when the lighting demand cycle was off, but heat was required for the floor from the engine, and it provided normal purchase of power when the co-gen was inactive. One month during the project a small refund was received from the electrical company!

Co-location could readily function in such a greenhouse system by plumbing a waste heat source such as from a power plant. The greenhouse wouldn't be located at the farm, but near to the source of heat.

Finally, on a pleasant finishing note, the 2026 Indoor Ag-Con in Las Vegas with its trade show, educational aspects and awards, again met the expectations of those in the CEA industry. The events added a shocking personal surprise that included being honored with the *2026 Trailblazer Award* that acknowledged my compassion and love to the development and promotion of the CEA industry, now 46 years in progress. Many thanks for this award! **IG**

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