

Modern Power For Modern Farms

How Digital Electricity™ reduces CAPEX, OPEX, and improves the growing environment

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Up to 60% of an indoor farm or greenhouse's OPEX is electricity, and between 20% and 40% of CAPEX is buying and installing the equipment necessary to distribute it to end loads - mostly LEDs. That is why one of a grower's biggest headaches is designing, installing, and managing their power distribution and control infrastructure, and why doing this better than others creates a significant competitive advantage.

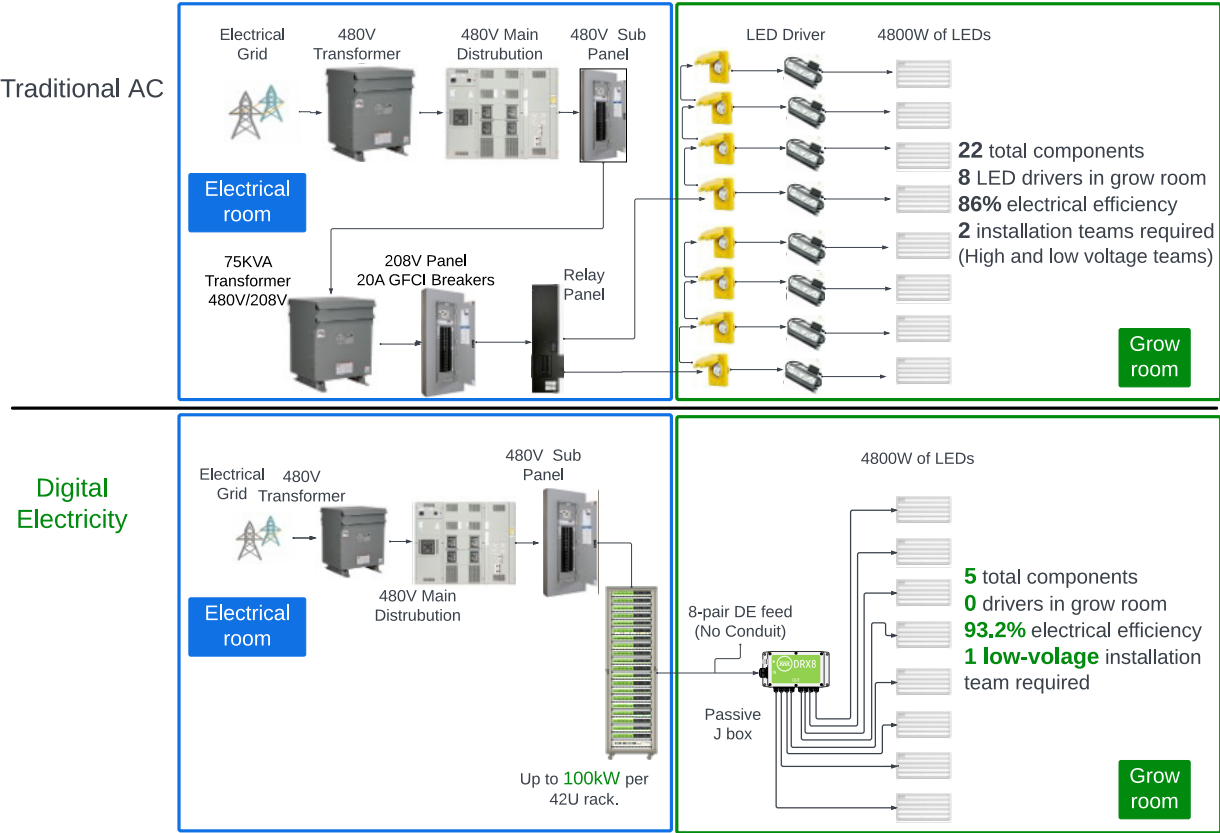
Traditional electrical distribution systems are expensive and complicated because they are dangerous if not installed correctly and managed well. Therefore, the National Electric Code requires expensive wiring methods. VoltServer's Digital Electricity™ radically simplifies this process by making electricity safe. This is accomplished using a patented protocol called **Packet Energy Transfer** that transforms dangerous high voltage DC power into a safe form called Digital Electricity (DE) that is listed to UL/IEC 62368-1 as a Limited Power Source. This means it can be installed using the same low cost and fast wiring methods as ethernet cable, typically using the same in-house installation team as the low-voltage control wiring.

For years, Digital Electricity has been powering major systems owned by several Fortune 500 companies. This article summarizes how Digital Electricity reduces CAPX, OPEX, and improves growing environments for indoor farms and greenhouses.

How Digital Electricity reduces CAPEX

Reduce the number of electrical components by 75%

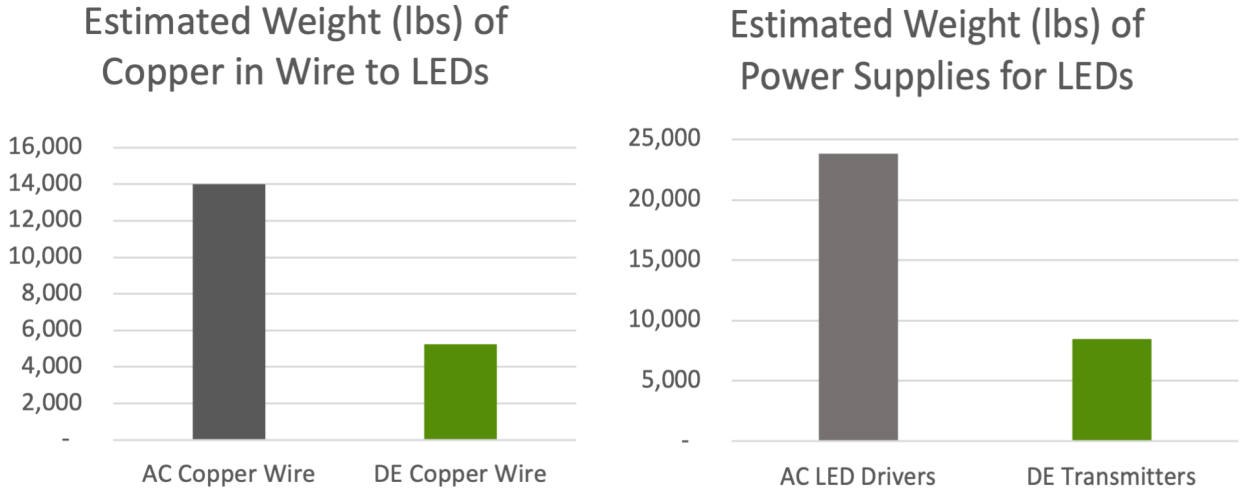
Digital Electricity radically simplifies a farm’s electrical and controls infrastructure. Compared to using traditional power distribution and control products, Digital Electricity requires a fraction of the equipment, labor, and time. For instance, delivering power and control to 4800W of LEDs using traditional AC infrastructure requires around 22 electrical components, with several active components, like LED drivers, installed in wet grow rooms or hot, humid spaces in greenhouses. This design also requires a parallel control system to dim and shut off LEDs.



The Digital Electricity system only requires just 5 electrical components. No active components or power supplies are in grow spaces, which improves reliability and safety. Because Digital Electricity is a certified Limited Power Source, it can typically be installed using non-certified labor, without many of the costly and time-consuming components like GFCI breakers and hard conduit. Because granular lighting control, scheduling, and monitoring is embedded in each cable, Digital Electricity eliminates the need for the parallel LED control system that is required for the AC system.

Digital Electricity eliminates the need for conduit or MC cable, and because it transmits at higher voltages, it significantly reduces the amount of copper wiring. It also uses much more efficient power supplies with higher power densities, further eliminating several tons of material and electrical components. For instance, for one 1.8 MW use case of LEDs, Digital Electricity eliminates nearly **8 tons** of electrical components, over **4 tons** of copper wiring, and tons (depending on the wiring method) of conduit. This not only reduces costs and complexity, but it also has important benefits for

the environment since these materials are some of the most carbon embodied materials in the world like steel, aluminum, copper, and rubber. According to the U.N, embodied carbon of building materials accounts for around 11% of global GHG emissions.



Reduce the cost of LEDs

The Digital Electricity transmitter provides DC power directly to LEDs, eliminating the need for LED drivers in the grow spaces. This typically reduces the cost of an LED fixture by at least 20%.

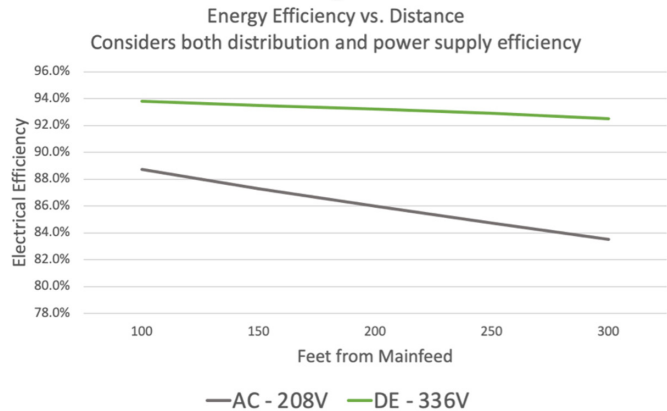
The bottom line

Compared to using a traditional power and control distribution system, using Digital Electricity reduces CAPEX by up to 20% for food growers and up to 40% for cannabis growers.

How Digital Electricity reduces OPEX

Improve energy efficiency

Because of DE's safety features, electricity can be distributed inside the farm at higher voltage levels, resulting in more efficient transmission. This combined with the highest-efficiency power supplies on the market, which are stored in a centralized location outside the grow space where the heat is easier to manage, results in energy efficiency levels that are up to **7% higher**.



A driverless, Digital Electricity enabled greenhouse LED

Improve reliability and resiliency

Typically, LED power supplies are placed in wet grow spaces. This reduces the lifespan of the drivers and the cost to replace them. The Arrhenius principle predicts that for every 10c increase in temperature, an electrical components lifespan is cut in half. The lifespan and performance of LED power supplies will significantly improve when installed in a location designed for electrical equipment.

A Digital Electricity system stores power supplies in a controlled environment, like an electrical room, where the environment is ideal for storing equipment. This increases the lifespan of the equipment. Moreover, since Digital Electricity transmitters are hot-swappable and can be replaced using in-house labor, if there ever is a failure the equipment can be replaced in a fraction of the time compared to a traditional LED driver.

Reduce shading in greenhouses

The LED's surface area can account for over 30% of a fixture's total surface area. Eliminating it can reduce shading in a greenhouse caused by luminaires by a third.

Reduce labor costs

Because Digital Electricity can be installed with uncertified labor (often in-house) using ethernet-like wiring methods, it can be installed about 5X faster than traditional AC infrastructure, slashing labor installation costs.

Reduce demand and peak-energy charges

With the ability to individually control, schedule, and monitor each 600W channel, Digital Electricity gives you unprecedented capabilities to avoid peak energy and demand charges.

How Digital Electricity improves the growing environment

Reduce heat load

About 8% of a typical LED fixture's heat load is generated by the driver. A Digital Electricity system moves the heat load associated with the driver to an electrical room, where it takes the HVAC system nearly 40% less energy to remove it, compared to the humid grow room.

Reduced shading in greenhouses

LED drivers contribute to over 30% of the shading caused by the LED fixture in greenhouses. Digital Electricity power LEDs are driverless, helping greenhouses maximize the sun's contribution to DLI.

Increase crop density and improve airflow in vertical farms

Removing drivers from LED inside LEDs improves airflow, reduces heat transfer to plant roots, and allows growers to add more levels in the same footprint.

Dynamic zone definitions

Lighting zones are typically hardwired. With DE, lighting zones can be easily software defined and redefine, enabling the grower to rapidly respond to market and environmental conditions.

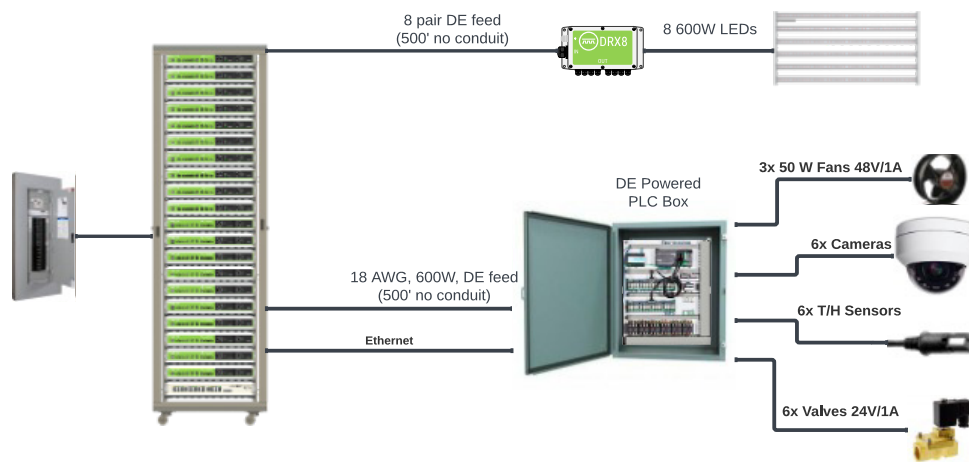
Increased safety

National Electric Code requires the use of expensive GFCIs for electrical outlets in grow rooms. The alternative is hardwiring LEDs, which means an electrician is required for even simple LED maintenance and replacements. Digital Electricity protects workers and equipment from shocks and fires without the need for dedicated GFCIs and eliminates the need to hardwire LEDs.

How Digital Electricity makes farms more intelligent

Install and enable digitally connected devices faster

Modern farms rely on lots of digitally connected devices, which can be complicated and costly to install. Digital Electricity simplifies this by allowing growers to use ethernet-like wiring methods to deliver high voltage power and communications to PLC controllers, that in turn can power and connect devices like fans, cameras, sensors, and irrigation valves. Doing this using traditional AC power requires two separate teams (a high-voltage and a controls team) and expensive, time consuming equipment like breakers, subpanels, and conduit. Using Digital Electricity, growers can deliver up to 600W up to 500 feet to a PLC controller, while eliminating lots of cumbersome equipment, as well as the need for inspections and permitting.



Monitoring and Troubleshooting

The Digital Electricity system continuously monitors the electrical characteristics of each 600W channel. This allows users to track performance for each 600W LED channel (4'x 8' section in this example) and get notified if the performance of any channel falls out of acceptable ranges. The system can also be used to monitor power usage. The system has an open API. Some of the data collected includes:

- Current
- Voltage
- Power
- Set points (intensity, scheduling, photoperiod)

In the event of a system issue, the system will send an error log for the specific transmitter and specific transmitter channel, so the issue can be quickly identified and resolved. The system will automatically re-enable the light once the issue has been corrected.

Summary

Installing VoltServer racks in your electrical room transforms your 480V power into the world's only form of high-voltage DC power that is approved to be installed using the same wiring methods allowed for ethernet. This empowers your inhouse team to distribute power hundreds of feet over 18-gauge wire rapidly and easily without using outside labor or equipment like conduit, GFCIs, or subpanels. This radically simplifies installing power, control, and device monitoring to an indoor farm's devices, like LEDs and PLC controllers. The benefits include reducing CAPEX and OPEX and improving energy efficiency. It reduces the number of components by around 75% and can be installed about 80% faster than traditional AC systems. It improves the growing environment by eliminating active electronic components, like LED drivers, from grow spaces, improving climate control and creating more space for plants. VoltSever is simply a much better way to deliver power, control and monitoring, and that is why it's already used by fortune 500 companies across North America.

Contact us to see how we can help you design your next-generation farm.



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