QUARTERLY BENCHMARKING REPORT OVERVIEW

Report Sections & Topics

Each Resource Benchmarking Report conveys efficiency insights about farms, greenhouses, and indoor cultivation facilities across the Ranked Data Set of records from the PowerScore database.

Each report summarizes key findings in two sections:

1. Cannabis Cultivation Benchmarks
   o Performance metric ranges and comparative analysis of facilities by cultivation method and flowering canopy area

2. Special Feature
   o Unique analysis of a subset of the Ranked Data Set to dive deeper into the strategies used to achieve high-performance cultivation facilities

PowerScore Analytics & Terminology

PowerScore historically gathered information from growers about their electric energy usage. This basic electricity-only benchmarking platform is called **PowerScore Grow**.

The PowerScore resource benchmarking platform expanded in July 2020 due in part to funding from the Massachusetts Department of Energy Resources. PowerScore now gathers information about whole facility energy consumption from not only electricity, but also natural gas, delivered fuels, renewable energy sources, and fuel for back-up generation equipment. This enhanced benchmarking platform is called **PowerScore Pro**.

As trends in PowerScore Pro records will begin to emerge, future reports will highlight insights from complete energy use profiles of facilities and will begin to address whole-facility energy impacts from all other fuel sources.

Energy Units

PowerScore performance metrics are described in units of both kilowatt-hours (kWh) and kBtu, which equals 1,000 British thermal units (Btu).

1 kWh = 3.412 kBtu

Key Performance Indicators (KPIs)

The metrics used for RII's benchmarking reports are described using KPIs. These are metrics expressing performance as a percentile relative to the Ranked Data Set of the PowerScore.

Performance Metrics

The metrics used for KPIs in this report describe the performance of farms, greenhouses, and indoor cultivation facilities using the PowerScore Grow platform, which includes the impacts of only electricity consumption.

<u>PowerScore Grow</u> Resource Impacts

- Electric Facility Efficiency: kWh/sq ft and kBtu/sq ft
- Electric Production Efficiency: g/kWh
- Electric HVAC Efficiency: kWh/sq ft
- Electric Lighting Efficiency: kWh/day
- Water Efficiency: gal/sq ft
- Waste Efficiency: lbs/sq ft

Future reports will use new metrics to describe the performance of farms, greenhouses, and indoor cultivation facilities using the PowerScore Pro platform, which will include the impacts of all energy sources.

<u>PowerScore Pro</u> Resource Impacts

- Facility Efficiency: kBtu/sq ft
- Production Efficiency: g/kBtu
- HVAC Efficiency: kBtu/sq ft
- Lighting Efficiency: kWh/day or kBtu/day
- Water Efficiency: gal/sq ft
- Waste Efficiency: lbs/sq ft

Glossary

We have developed a list of terms and definitions related to PowerScore and have included a summary of key benchmarking verbiage below. The glossary of these terms is available online for your ongoing reference at https://powerscore.resourceinnovation.org/about-powerscore-calculations.

Electric Facility Efficiency - Annual electric energy use per square foot, in units of kWh/sq ft or kBtu/sq ft of flowering canopy. A lower value is better; a higher value is worse.

Facility Efficiency - Total (all fuels) energy use per square foot, in units of kBtu/sq ft of flowering canopy. A lower value is better; a higher value is worse.

Electric Production Efficiency - Efficiency of produced grams of dried cannabis flower per kWh of electric energy use, using a facility's annual production and electricity consumption totals. A higher value is better; a lower value is worse.

Production Efficiency - Efficiency of produced grams of dried cannabis flower per kBtu of total (all fuels) energy use using a facility's annual production and whole-facility energy consumption totals. A higher value is better; a lower value is worse.

Lighting Efficiency - Efficiency of electrical energy use from lighting equipment in units of kWh per day. A lower value is better; a higher value is worse.

Electric HVAC Efficiency - Efficiency of electrical energy use from HVAC equipment in units of kWh/sq ft from HVAC systems in units of kBtu/sq ft of flowering canopy. A lower value is better; a higher value is worse.

Water Efficiency - Efficiency of water use in units of gallons/sq ft of flowering canopy. A lower value is better; a higher value is worse.

Waste Efficiency - Efficiency of waste production in units of lbs/sq ft of flowering canopy. A lower value is better; a higher value is worse.

Interpreting Our Data

In the later sections of this report, data from records of the PowerScore's Ranked Data Set is summarized using values and ranges of KPIs.

Data from PowerScore is voluntarily self-reported by cultivators. The Ranked Data Set of existing PowerScore records is skewed to the West Coast, given the timeline of cannabis legalization in the United States. For this reason, cultivation operations in the Ranked Data Set

contend with the milder, warmer climates of many states with the most mature regulated markets.

This report uses average (mean) values in the analysis of the key metrics, rather than the median. Given the relatively limited number of cultivators in the PowerScore Grow database and the large distribution in the responses, the use of mean instead of median is intended to address the possible influence of outliers. As the number of cultivators entering data into the PowerScore platform increases, future reporting may use median values of the expanded data set.

This report also uses ranges in the analysis of the key metrics, rather than relying on average values alone. As the amount of data available for resource benchmarks in the PowerScore is still relatively small, and as PowerScore's sample of the market shows a wide variety in performance and efficiency, it is important to look at the ranges of average values for a certain metric by cultivation method, rather than looking at a specific average value for the metric.

On the PowerScore website, when you are logged in and viewing reports on your Dashboard, you will see data displayed like the figure at right. In this example, the KPI being described is Facility Efficiency, the value is the average for that particular KPI, and the number of records used to calculate the average is 80. The value of the average is 752 kBtu/sq ft.

	Averages	80
Facility kBtu / sq ft	752	80

Feedback

As a stakeholder-engaged non-profit organization, we invite peer review and we welcome your input. Please direct your feedback and questions to Gretchen at Gretchen@ResourceInnovation.org.

Coming Soon + An Invitation to Collaborate

Upcoming Special Features could include analysis of the:

- Prevalence of different types of indoor growing environments
- Effects of vertical stacking strategies in indoor cultivation facilities
- Comparisons of facilities and their lighting and controls systems and performance
- Impacts of automated HVAC controls on controlled indoor environments
- KPI changes associated with economies of scale
- Participation by growers in utility incentive programs
- Volume of capital projects planned in the next 12 months for cannabis facilities
- Resource benchmarks of controlled environment agriculture facilities growing non-cannabis crops

Analysis performed by professional service members of RII, and peer-reviewed by our Technical Director, may also be included in future editions of the Quarterly Resource Benchmarking Report. Please reach out to Gretchen at Gretchen@ResourceInnovation.org with collaborative ideas.

POWERSCORE DATA PRIVACY & VALIDATION

Our Commitment to Privacy

Above all else, RII respects the privacy of cannabis cultivators who have historically risked legal action. No facility- or personally-identifiable data is ever shared with any party. Aggregate PowerScore data is shared with governments and utilities with the express purpose of advancing policies and programs that support cultivators in finding affordable solutions to decrease resource impacts while improving profit. Individual PowerScore record data is only shared with RII members in an anonymized fashion, like in the Special Feature section of this report. Cultivators and business owners are encouraged to provide real data so they can get reliable feedback on how their facility can be more efficient. This is an important component of data integrity.

Technical Advisory Council Engagement

RII's Technical Advisory Council (TAC) has played a critical and ongoing role in the design and implementation of PowerScore. From agreement on key underlying metrics in 2017 to input on improved HVAC analytics in 2019, RII's TAC provides an invaluable peer-review and governing structure over the aggregate data and findings.

Establishment of Data Integrity Protocols

In early 2018, as initial survey responses were being collected, it became clear that there was some "noise" in the data, possibly because survey questions were inadequately asked or misunderstood, or because wrong information was entered or because the system was incorrectly calculating submitted numbers.

RII set out to assess how to improve the integrity of PowerScore data. Through in-kind support from Energy Trust of Oregon, program delivery contractor Energy 350 provided anonymized data from Energy Trust projects to be added the PowerScore dataset and recommended utilizing a simple test called 1.5 inter quartile range (1.5 IQR) to flag and filter out bad incoming data. This outlier analysis has since been automated within the software engine.

As *The Cannabis Energy Report* was being written throughout the summer of 2018, further manual clean-up was performed on the existing data. In 2019, draft aggregate findings were shared with RII Founders Circle members, resulting in identification of inconsistency in reported Lighting Power Density (LPD). Given the lack of clarity in the marketplace around the calculation of LPD, RII asked for volunteers from its Lighting and HVAC Working Groups to evaluate submitted lighting data to determine if certain records should be set aside so they do

not compromise the aggregate findings. ERS and E Source performed the review and RII accepted their recommendations on how to improve the quality of lighting performance data.

Current Quality Control Process

In 2020, PowerScore uses automated data checks throughout the survey to flag performance metrics for potential inaccuracies based on values outside of a range deemed typical for cannabis cultivation operations.

RII staff regularly reviews submitted PowerScore records for quality, and archives records that are obviously tests or include 'fake' data used for evaluating the benchmarking platform. Archived records are completely withheld from all reports.

RII staff also use a PowerScore Outliers report to check for submitted records that have flagged performance metrics. If an individual record has one or more flagged performance metrics, then RII staff reviews the record and checks the individual KPIs and the details submitted for the record that contribute to the flagged metric(s). If a KPI is deemed suspect, its box is unchecked, and that KPI is not factored into our PowerScore and quarterly resource benchmarking reports.

A second QC process looks for outliers within the Ranked Dataset only. If certain KPIs are flagged, RII staff re-opens the record detail summary to better understand how the facility is set up according to the detailed data provided by survey selections. If RII staff can determine a plausible explanation for the farm to be a legitimate/accurate/true outlier, the record is retained in the Ranked Data Set; otherwise, the record is archived.

Data Working Group

In 2020, RII initiated a Data Working Group of its Technical Advisory Council to align with its internal software upgrade process. One of the missions of the Working Group is to ensure an ongoing PowerScore evolution that is in tune with market needs related to driving resource optimization of cultivation facilities.