



Energy Trust of Oregon Residential Grow Light Research Project

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Project Sponsor:
Energy Trust of Oregon

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I Executive Summary

Energy Trust of Oregon hired Evergreen Economics and D+R International to conduct research on Oregon's residential cannabis market. The study goal was to identify if there is an opportunity to acquire cost-effective energy savings through the promotion of energy-efficient products in the state's residential cannabis market, specifically related to home growing. Energy Trust developed a set of research questions, which are listed in Section 2. To answer these questions, we conducted a web survey with home growers and interviews with market actors including specialty retailers, lighting distributors, and lighting manufacturers. The key findings and recommendations from this research are presented below.

I.1 Key Findings

Key findings directly related to our recommendations are summarized below, with additional details on the findings and analysis methods in the main body of the report. Key findings are organized by the following two categories: home grower characterization and lighting market characterization.

Home Grower Characterization

Home growers who responded to our web survey answered demographic questions, which helped us to characterize people growing cannabis in Oregon. We also used the demographic information to identify if growers were more likely to grow using certain lights, in certain types of set-ups (indoor, outdoor, or greenhouse), and have different levels of experience, based on income, age, or home type. The data also indicated the channels and market actors that might be ripe for an energy efficiency program offering.

While home growers who responded to the web survey are most likely to live in single-family detached homes, **there is no significant variation in how respondents set up their grow operations in terms of location (outdoors, indoors, or in a greenhouse) or with regards to lighting usage across different home types (single family detached, single-family attached, duplex, triplex, fourplex, apartment, condominium, or manufactured home).**

Lighting Market Characterization

In the current lighting market, home growers can choose from three categories of lighting: LEDs, fluorescent lamps (CFLs, T5s, T8s, T12s), and high intensity discharge lights (HIDs, which include high-pressure sodium [HPS], metal halide [MH] and ceramic metal halides [CMHs]), or they may opt not to use any artificial lighting at all and rely only on natural

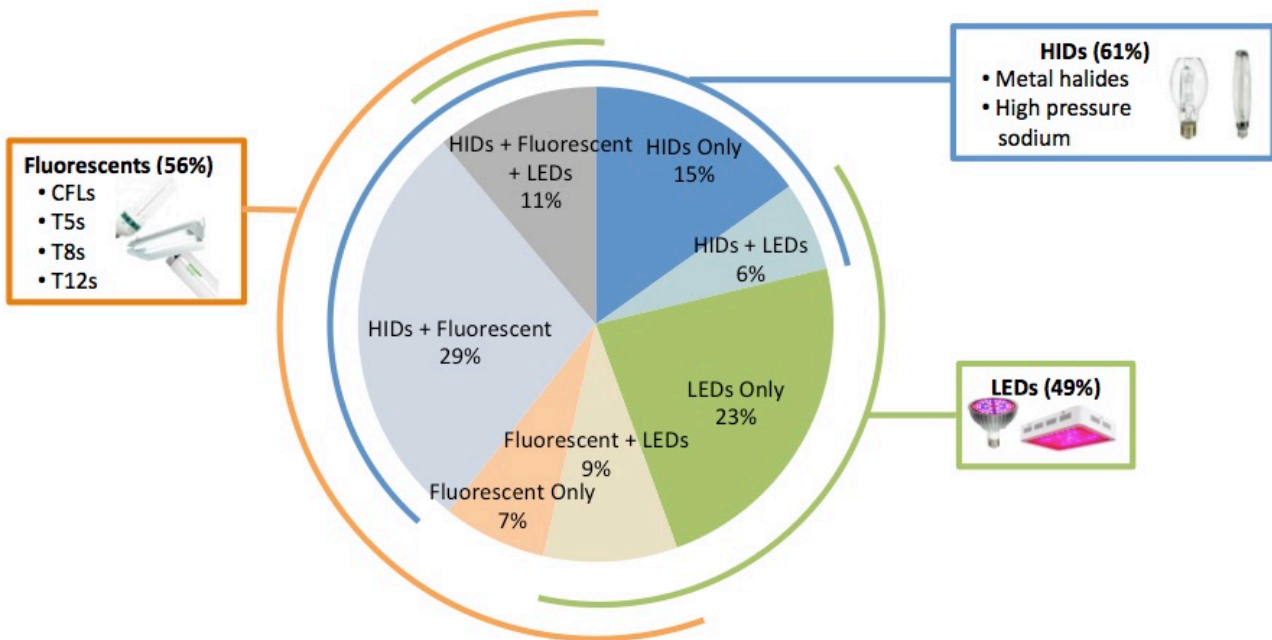
light.¹ Specialty retailers reported that LEDs and ceramic metal halides are the most energy-efficient options for home growers who use artificial lighting, with comparable systems using as much as 40 to 60 percent fewer watts. We included a surface level review of the pricing across different lighting types to compare which types may have lower cost barriers to purchase than others.

Fifty-five percent of web survey respondents who use lighting for cannabis growing use more than one type of lamp. The most commonly reported combination of lighting was fluorescent with HIDs (Figure 1). Our web survey results align with specialty retailer interview responses, which indicate that over 50 percent of growers purchase HIDs. There were no notable geographic differences with regards to the type of lighting growers use indoors, according to the specialty retailers we interviewed in different regions of Oregon.

The remaining 45 percent of web survey respondents who use artificial lighting use only one lighting type to grow cannabis. **Nearly half of this group relies only on LEDs across all growth cycles.** Specialty retailers who we interviewed reported that LEDs were not very popular with their customers. However, this is inconsistent with the web survey findings, likely because **the majority of growers who use LEDs purchase them online, rather than in a specialty retail store.**

¹ Survey recruitment focused on indoor growers specifically, but respondents were comprised of indoor, outdoor, and greenhouse growers. Twenty-three percent of the web survey respondents reported growing only outdoors, thus using no artificial lighting in their cannabis home grow operation.

Figure 1: Types of Grow Lighting Used, Web Survey Respondents



We also asked web survey respondents their reasons for purchasing the specific types of lighting they reported using. The most frequently reported reason for purchasing each lighting type is shown in Table 1. Additional findings regarding each lighting type are included in Section 4.

Table 1: Most Frequent Reason for Purchasing Lighting Type

Lighting Type	Most Frequent Reason for Purchasing Lighting Type	Percentage Of Purchasers Who Chose Reason as Most Frequent Reason for Purchasing Lighting Type	Number of Growers Who Have Used Lighting Type
High-Pressure Sodium (HPS)	Color Spectrum	36%	38
Metal Halide (MH)	Color Spectrum	52%	30
LEDs	Operating Costs	66%	40
CFLs	Low Initial Costs	56%	12
T5s	Effectiveness/Performance	48%	31
T8s	Effectiveness/Performance	83%	9
T12s	n/a	n/a	2
Other (Ceramic Metal Halides and Plasma)	Color Spectrum	80%	5

Oregon home growers are limited to four recreational plants per household under state law, but can grow additional plants for medical use if they are registered as a medical grower. As expected, **we found that growers who produce cannabis for medical use are more likely to report having more than four plants in their household.** Overall, 61 percent of respondents reported having more than four plants, which means that those indoor growers likely have more grow lights compared to those who only grow four or fewer plants.

Nearly half of all web survey respondents use their LEDs and/or fluorescent lights to grow plants in addition to cannabis. The large majority of these respondents reported that despite growing other plants, **cannabis growing is the main use of these lights.**

We attempted to better understand the market size of indoor lighting sales for cannabis growing in Oregon by requesting sales data from specialty retailers, but were only able to acquire sales data from two retailers. Even with this data, retailers alone do not capture the entirety of the lighting sales as growers reported purchasing bulbs online and in big box stores.

According to web survey results, while organic gardening and hydroponic retailers were the most common lighting purchasing channel, **purchasing behavior varied across lighting types.** For example, over half of respondents who use HPS, metal halides and T5s purchased them at specialty (hydroponic) retailers, compared to only 18 percent of respondents who purchased LEDs. Online purchasing was the most prevalent retail

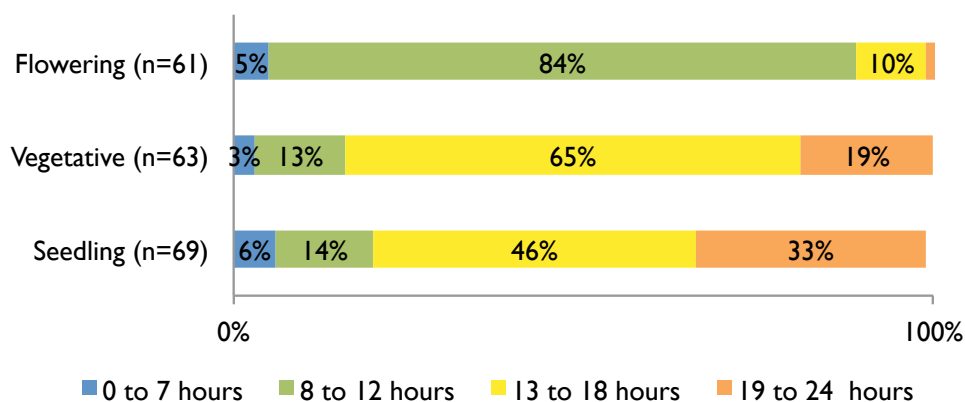
channel for growers purchasing LEDs, as 58 percent of respondents reported buying their lights on either Amazon or an alternative online retailer.

Grow Cycle Characterization

One grow cycle includes three main stages: seedling, vegetative, and flowering. These stages can range from two to three weeks for the seedling stage, two to eight weeks for the vegetative stage, and six to eight weeks for the flowering stage.

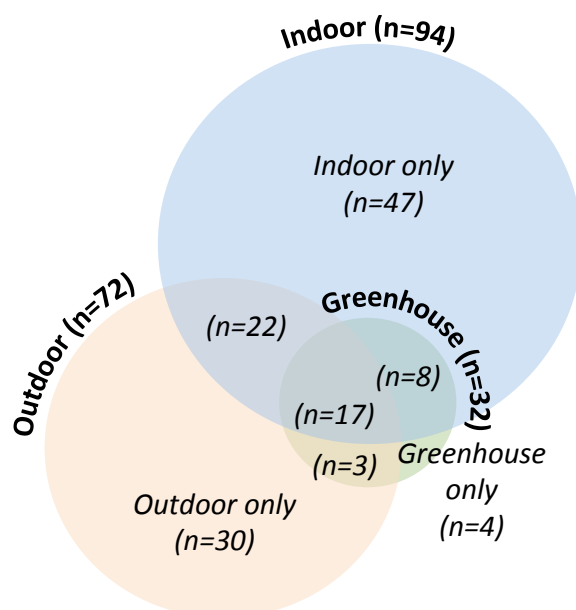
The daily run time for lighting differed across each stage, with lights running much longer in the vegetative and seedling stages, as shown in Figure 2.

Figure 2: Daily Lighting Run Times by Growth Stage from Web Survey Respondents



Many web survey respondents grow across some combination of indoors, outdoors, or in a greenhouse as shown in Figure 3.

Figure 3: Grow Types (n=131)



Sixteen percent of respondents who grow indoors said that they grow indoors during the non-summer months only. These respondents all have access to outdoor grow areas that they can use during the summer months, suggesting that **change in seasons may have some influence on when and where home growers decide to grow.**

1.2 Recommendations

Below, we make recommendations regarding what type of energy-efficiency program intervention may be appropriate for Oregon home growers to reduce their energy consumption.

At least half of the web survey respondents use at least one LED in their home grow operation, suggesting that there is some acceptance of this technology in the market. About half of these growers who use LEDs *also* use other lighting, suggesting that **any program that promotes LEDs needs to account for the fact that growers may be only using these for some of their plants or for only a portion of the growing cycle.** This may change as LED technology advances to allow users to change the spectrum of lighting across the grow cycle. Allowing growers to use LEDs alongside other lighting may be an important step in having growers test and trust the technology before using it exclusively in their cannabis home grow operations.

Over the course of our research, we heard from specialty retailers that ceramic metal halides (CMHs) are often offered as an energy-efficient lighting option in lieu of LEDs. While our web survey asked respondents about metal halides, we did not specifically inquire about *ceramic* metal halides. **Given the finding that these are being recommended**

in specialty retail shops and are rebated through some utility energy efficiency programs, we suggest further research be done to understand if ceramic metal halides are a viable energy efficiency lighting option for home growers.

Any program design should consider that the majority of LEDs are purchased online, and not in a specialty retail store. There also may be a lack of independent quality verifications on LEDs sold online. Most non-energy-efficient lighting is purchased in retail shops. By focusing a program in the specialty retail channel, Energy Trust may have a better chance of reaching growers who are less inclined to purchase LEDs. Energy Trust could also work to increase the stocking of LEDs in specialty retail stores.

If Energy Trust decides to proceed with a program offering for this sector, **we recommend that it consider the distinction between home growing for recreational use and home growing for medical use.** Oregon regulation allows medical growers to also grow cannabis for other medical patients, thus using additional energy to light additional plants. Our web survey results show that respondents who grew for medical use were more likely to report growing more than four plants (which is the legal recreational limit per household). There may be larger potential for energy savings from medical growers, and **we recommend that any program design include medical growers. Energy Trust also should be careful not to limit the number of incentives per household to a number that only considers the recreational four-plant limit.**

MEMO

Date: May 11, 2018
To: Board of Directors
From: Katie Wallace, Residential Project Manager
Ryan Crews, Residential Program Manager
Subject: Staff Response to the Residential Grow Light Research Report

In 2014, Oregon voters legalized recreational cultivation and use of cannabis. With this change, there is potential for increased frequency of home growing activities, and although the Oregon Liquor Control Commission (OLCC) oversees licensing for commercial cannabis operations, it does not track or issue permits for recreational home growing. Therefore, very little is known about residential growing due to a lack of available research or public records.

Energy Trust contracted with Evergreen Economics to conduct primary and secondary research to help understand home growing activity, the grow lighting market, and the methods, equipment, and energy used by home growers. The goal is to understand whether or not there is an opportunity for Energy Trust to acquire cost-effective energy savings by helping home growers adopt efficient lighting technologies that reduce energy use.

The research suggests that the demographics and characteristics of people who grow cannabis at home are generally representative of the state population. Home growers span income and age ranges, reside in all regions of the state, and the vast majority of growers live in single-family homes, with more than half of growers owning their home. More than 60 percent of home growers who grow indoors use inefficient high-intensity discharge (HID) lighting that typically uses between 600 and 1,000 watts of energy per bulb, indicating there is a viable market of home growers Energy Trust could influence to transition to efficient lighting.

The research indicates that many growers use multiple types of lighting, occasionally including LEDs, throughout their grow cycles. This implies some acceptance of efficient lighting technology among growers, but suggests that efficient lighting options may only be used during certain portions of the grow cycle. Energy savings could be acquired by transitioning growers using inefficient bulbs to use LEDs and encouraging growers to use LEDs for more than one stage of the grow cycle. The research contractor recommended ceramic metal halides (CMHs) as an efficient lighting option that should be considered in a program offering in addition to LEDs. Although CMHs are more energy efficient than HID lighting, the cost is about the same for both technologies, meaning that there is no incremental cost for CMHs above the most inefficient lighting option. If Energy Trust decides to intervene in the home grow lighting market, the focus would likely be solely on LED technology.

The research contractor also recommended that if a grow light measure is approved it should be implemented through the specialty retail supply channel, such as hydroponic or grower supply shops, and that it be designed to include medical home growers by not placing strict limits on the quantity of incentivized lighting purchases. Both of these recommendations are substantiated by the research: nearly three quarters of growers using HID lighting purchase their bulbs at brick-and-mortar specialty retailers, and medical growers make up a large portion of people growing cannabis in residential structures.

Because the research indicates savings potential for LEDs used in a home grow, Energy Trust will conduct a full measure screening in fall 2018 to determine whether to move forward with a measure in 2019. Energy Trust will take into account the researcher's recommendations as staff begin the measure development process.

2 Introduction

Oregon is one of a number of states (including Colorado, Washington, Alaska, Washington D.C., Nevada, Maine, Massachusetts, and California) that have legalized recreational cannabis cultivation since 2012. The last four states only recently legalized recreational cultivation and usage in November 2016.

With the passage of Measure 91,² as of July 1, 2015, residents in Oregon can legally grow up to four cannabis plants per residence for recreational use. There are exceptions to this four-plant rule when growing for medical purposes (which has been legal in Oregon since 1998); 2017 legislation limits patients and caregivers growing for themselves to possess a total of six mature plants and a dozen immature plants.³ Medical grow sites registered with the Oregon Liquor Control Commission (OLCC) may have a maximum of 12 mature plants in residential areas *and* 48 plants in non-residential areas such as sites designated as commercial or agricultural zones.⁴

The home grow market poses a unique challenge to utilities because home grow operations are difficult to track and may be consuming more energy than their local infrastructure is equipped to handle. While there is a licensing process for medical and commercial growers, there is no such process for home growers. This lack of data adds to the difficulty of tracking these energy consumers. One Oregon utility noted seven outages in the first three months of legalized home growing in 2015, caused by intense power use by growers overloading local power grid equipment.⁵ These outages may be exacerbated if multiple growers are operating on the same circuit. One way to combat these issues is to incentivize home growers to use more energy-efficient equipment for growing cannabis.

The study goal was to identify if there is a need and/or an opportunity to intervene and promote energy-efficient products in the state's residential cannabis market. We designed the study to address a series of research questions, which are organized by topic, below:

² The legislation also outlined provisions for personal possession limits. The licensing process is overseen by the Oregon Liquor Control Commission (OLCC). <http://www.oregon.gov/olcc/marijuana/Pages/FAQs-Personal-Use.aspx>

³ 79th Oregon Legislative Assembly. *Enrolled Senate Bill 1057*. 2017.

<https://olis.leg.state.or.us/liz/2017R1/Downloads/MeasureDocument/SB1057/Enrolled>

⁴ Medical grow sites that were "grandfathered" in (registered before January 1, 2015) and are zoned as residential may grow between 12 and 24 mature plants while non-residential sites that were "grandfathered" in may grow between 48 and 96 mature plants.

⁵ James Cronin. "Indoor marijuana grows cause headaches for Oregon utilities." *Portland Business Journal*. November 5, 2015. <https://www.bizjournals.com/portland/blog/sbo/2015/11/indoor-marijuana-grows-cause-headaches-for-oregon.html>

Home Grower Characterization

- What are the demographics, including income range, of home growers?
- Where are home grows occurring (i.e., single-family residences, apartment buildings, manufactured homes)?
- Where in the home are grows located (e.g., closet, basement) and how are lights configured (e.g., number of lights, are timers used, proximity to plants)?
- What grow light features are most important to customers and how well do products from each lighting category deliver these features?

Lighting Market Characterization

- What lighting products are currently being sold for home grows, and is there a distinct class of products that is appropriate for the four-plant limit and not for large scale grow operations? Include both efficient and less efficient lighting options (e.g., LED, high-pressure sodium, metal halide, CFL, others).
- What is the market share for each lighting product type (e.g., LED, high-pressure sodium)?
- What are the channels through which lighting products are sold (e.g., specialty retailers, big box/DIY stores, online) and what is the market share for each channel?
- What are the specifications and retail prices of efficient and less efficient lighting products?
- What is the ratio of lumens per watt for each lighting product type?
- What is the experience of other states regarding the home grow market that can help answer any of the above questions?
- How important do grow light retailers and other market actors feel that the following product attributes are to their customers? (e.g., lumens, wattage, light spectrum, heat output, etc.)
- Are integrated 'grow kits' being sold that are designed for home growers in Oregon (i.e., a pre-packaged option that includes all equipment needed to grow cannabis)?
 - What is the market share for kits? How does their energy use compare to a piecemeal setup or other configuration?
- Are products used for home grow operations also being used for other indoor horticulture/agriculture (non-cannabis) production that would affect hours of use?
- What is the expected useful life of home grow lighting products (i.e., length of warranty and/or number of hours before equipment burns out or fails)? How are these lighting products typically used by customers? Specifically:
 - How many hours are these lighting products used per day throughout the grow cycle, and for what duration of time is the grow cycle in Oregon?

- What is the typical number of grow cycles per year by the average home grower?
- How long do customers typically use these types of products – that is, do home growers use these products for only a short period of time (one to two years), or do they use lighting products consistently over a long period of time (complete grow cycles for multiple years)?
- Does the seasonality of the Oregon climate impact the number of grow cycles per year (e.g., do customers switch from indoor to outdoor growing during the summer or grow indoors all year)?

Ancillary Products

- Are there ancillary products (such as cooling equipment or fans) that impact the expected energy consumption of home growing operations?

Market Size

- What is the size of the home grow lighting market?
- What area(s) of the state contain(s) most home growers?

3 Research Methods

Evergreen Economics used three main research methods to address the study objectives and answer the research questions:

- **Secondary research** of any recent legislative changes that may impact the home grow market, literature review, and **data analysis** of sales data from select horticulture retailers, where available;
- **Market actor interviews** with lighting manufacturers, distributors, and indoor agriculture/specialty retailers; and
- An anonymous **web survey** targeting home growers across Oregon.

3.1 Secondary Research and Data Analysis

We researched which counties in Oregon do not allow commercial cannabis activity (including growing, processing, and sales) and conducted online research on the local cannabis market to identify retail stores, market actors, and events geared toward home growers. We conducted a review of any recent changes in legislation or the home grow market that helped frame the findings from the market actor interviews and grower web surveys.

To supplement the online research, we asked specialty retailers we interviewed to provide recent sales data to support the characterization of the Oregon cannabis lighting market. While five of eight indoor agriculture specialty retailers initially agreed to supply sales data, only two subsequently provided data despite multiple requests; we analyzed and summarized the data in this report. The majority of retailers noted they did not have the available time or resources – or in two cases, the approval of management – to supply the data during the research period. The retailers that provided data also noted that they were unable to distinguish sales to commercial customers versus home grower customers.

The sales data we received from the indoor agriculture retailers helped contextualize the findings from the market actor interviews and the grower web survey by supporting findings on which types of lights were most common among growers, what the typical wattages are for each lighting type, and how available LEDs and other efficient lighting types are in the Northwest market.

During the sales data request, one of the indoor agriculture retailers also provided product catalogues from two of the largest cannabis lighting distributors in the Pacific Northwest (Sunlight Supply and Hydrofarm). We reviewed the product catalogues to help characterize the different types of lighting available in the market and identify the product specifications (wattage, cost, spectrum, etc.) for each lighting type.

3.2 Market Actor Interviews

One key component of documenting the current cannabis lighting market structure is identifying the role market actors – such as specialty lighting manufacturers, distributors, and retailers – play in the cannabis home grow market and understanding their perceptions of grower equipment preferences. Evergreen conducted a total of 14 in-depth interviews with market actors familiar with the Oregon home grow market, as shown in Table 2.

Table 2: Market Actor Interviews⁶

Market Actor Interview Group	Target Completes	Sample⁷	Actual Completes
Lighting Manufacturers	4	46	4
Lighting Distributors	6	10	2
Home Improvement and Hardware Retailers	4	111	-
Indoor Agriculture / Specialty Retailers	8	71	8
Total	22	127	14

We developed comprehensive lists for each group of market actors based on D+R's⁸ existing contacts in addition to web research. We set targets by market actor group, randomized each list, and made up to four attempts to schedule an interview by phone with a single contact until we reached our target number of completed interviews.

Our initial target completes included four interviews with home improvement and hardware retailers (for example, The Home Depot and Lowe's). Recruitment with this group was particularly challenging given that 6 of 15 hardware retailers we were able to reach on the phone reported that they were unaware of growers shopping for cannabis lighting equipment at their stores and thus were unfamiliar with the home grower market. Given these responses and preliminary web survey findings indicating that this type of

⁶ Geographic data for market actor interviews can be found in Appendix E

⁷ The hardware retailer sample included multiple locations for the same retailers, including 29 Sears, 13 Lowe's, 7 The Home Depots, and 5 George Morlan Plumbing locations.

⁸ D+R is a founding member of the Resource Innovation Institute (RII), a nonprofit organization dedicated to delivering energy efficiency in the cannabis industry. Through RII, D&R has developed a network of cannabis specific market actors including growers, manufacturers, distributors, and retailers.

store was only popular among growers who bought CFLs, we decided to stop attempting interviews with these specific market actors.

We also faced challenges in reaching indoor agriculture and specialty retailers by phone as staff found it difficult to perform interviews while working the retail floor. As a result, Evergreen shifted our approach to conduct in-person interviews and to accommodate the increased time needed for each interview.

3.3 Web Survey

We conducted an anonymous web survey with home growers to understand the following:

- Home grower demographics, including their locations across Oregon, their age, and income levels;⁹
- The grower decision-making process when selecting equipment;
- How and where home growers choose to set up their growing operation (indoors, outdoors, or in a greenhouse);
- The number of plants and lights used by home growers; and
- Potential receptiveness and barriers to using energy-efficient equipment.

Home growers may not be entirely comfortable sharing that they grow cannabis given that federal law does not recognize legalization at the state level, and because some growers may be cultivating more than the Oregon legal limits. In order to increase our response rate, we promised respondents that they would not need to share any personally identifying information with us. We also rarely required responses to web survey questions, allowing respondents to only answer questions with which they felt comfortable.

Our recruitment strategy included multiple channels for recruiting respondents in order to increase our total number of responses. This approach included in-person events, recruitment emails, and social media marketing.

In-Person Cannabis Events

In an effort to reach home growers directly, we attended cannabis events in Portland and Salem in the second half of 2017 that specifically targeted growers. Through online research, we attempted to identify events that covered a variety of topics – including

⁹ Ninety percent of all web survey respondents reported being located in the state of Oregon. With the exception of results about location within the state, we included the additional 10 percent of respondents from outside of Oregon in our analysis in order to better understand various types of home grow operations.

growing techniques, plant science, and cannabis business-to-business opportunities – and that looked like they might attract a wide array of grower types. These events included:

- **The Summer Fair** (July 29, 2017): A festival-type event focused on promoting smaller cannabis growers, processors, and producers with the Portland cannabis consumer market;
- **Indo Expo Portland** (August 4, 2017 – August 5, 2017): A large business-to-business trade show held at the Oregon Convention Center for buyers and manufacturers of cannabis equipment and services;
- **Oregon Cannabis Growers' Fair** (August 12, 2017 – August 13, 2017): A two-day event in Salem that targets cannabis growers throughout the state to showcase their cannabis in a "live plant competition" and provides a variety of other market actors (marketers, distributors, and researchers) an opportunity to exhibit their products and services; and
- **Cannabis Science Conference** (August 27, 2017 – August 28, 2017): An annual event targeting cannabis industry experts, research scientists, and policy makers with a goal to improve cannabis science.

At each of the events, Evergreen distributed flyers advertising the web survey and engaged with attending growers to encourage participation in the study. Additionally, Evergreen hosted a booth at the Oregon Cannabis Growers' Fair with information regarding the study and an on-site laptop set up for growers to take the survey at the event itself. Growers who completed the survey at the booth were entered into a \$150 winner-take-all raffle at the end of each day of the event.

Recruitment Emails

Evergreen compiled a list of 376 contacts to recruit for the web survey via email using existing contacts from prior research, registered attendees of the Oregon Cannabis Growers' Fair, and contacts made by D+R through other industry efforts.¹⁰ While several of these contacts were not growers themselves, the goal was to leverage their knowledge of the industry and existing contacts to reach additional home growers. Email recipients that came from the Oregon Cannabis Growers' Fair list were offered a \$10 incentive for either completing the survey themselves or sharing the link with a grower they knew, as we were more confident that they were actual home growers.

¹⁰ Three hundred of these contacts (80%) came directly from the Oregon Cannabis Growers' Fair attendee list provided by the organizers of the event, Cannabis Collaborative Conference PDX.

Social Media Marketing

Evergreen created a Facebook page for the web survey under the brand Oregon Home Grow Study and posted daily Facebook and Instagram advertisements that drove traffic to the web survey. Facebook marketing helped us reach a traditionally hard-to-reach population by leveraging Facebook's algorithms and targeting residents in Oregon over the age of 21.

Two distinct advertisements ran on desktop and mobile platforms. We focused on clearly recognizable images of cannabis with select language that conveyed that we were interested in learning more about home growing to our audience of home growers without direct mention of "cannabis" or "marijuana." This text also allowed the ads to adhere to Facebook's advertising policies, which strictly prohibit the direct advertisement of marijuana products on their network.¹¹ Each of the ads were in place from September 1 to September 26, 2017, and reached 58,441 social media users at least one time.

Recruitment Results

The various recruitment strategies we employed resulted in a total of 146 home growers answering one or more survey questions, as shown in Table 3. We utilized Urchin Tracking Module (UTM) codes¹² in order to understand which sources of recruitment resulted in which completed surveys. Social media marketing was responsible for recruiting approximately half of the participating home growers (52%), followed by outreach and recruitment at the cannabis events (16%) and email follow-ups to attendees of the Oregon Cannabis Growers' Fair (14%). Other recruitment sources included growers who may have heard about the study at one of the events and completed the survey later and growers who may have been recruited by previous participants.

¹¹ Facebook advertising policies. Drugs & drug-related products, prohibited content.
https://www.facebook.com/policies/ads/prohibited_content/drugs

¹² A UTM code can be hidden within a URL in order to track the success of various types of outreach.

Table 3: Recruitment Source of Web Survey Participants

Recruitment Source	Partial Completes	Total Completes	Total	Percentage
Facebook marketing	30	45	75	52%
Cannabis events	1	22	23	16%
Oregon Cannabis Growers' Fair attendee follow up	4	16	20	14%
Personal emails	2	6	8	6%
Other	10	10	20	14%
Total	47	99	146	100%

Given the sensitive nature of the topic, we did not require responses to the majority of the web survey questions in order to allow growers to share information whenever they were comfortable doing so. A respondent who answered questions about lighting equipment may not have shared demographic information, but is still included in our analysis of lighting preferences. This resulted in variation in the total number of respondents who answered each question.

3.4 Efficacy Assessment

As with any research, there are limitations with the data collected as part of this study. Some of the limitations are likely due to the general reluctance of some residential growers to discuss cannabis growing. Home growers may not be entirely comfortable sharing that they grow cannabis given that federal law does not recognize legalization at the state level, and because some growers may be cultivating more than the Oregon legal limit for recreational or medical use. We recruited growers using a variety of methods, and the use of multiple data collection channels helps mitigate issues of response bias. Energy Trust may wish to consider doing additional outreach with these growers, which in turn may result in a greater willingness by growers to share information and make the data more representative of the broader market.

Sales data presented in this report was provided by two specialty retailers, and specialty retailers represent only a portion of lighting sales (as reported, many growers purchase LEDs online). Consequently, the data used for this study are only a snapshot of a partial year at just two stores in the Portland Metro and Salem areas. Collecting sales data required in-person visits and for our team to build relationships with staff at these two specialty retailers. Evergreen had originally requested data from all eight retailers interviewed, with five initially agreeing to provide data. However, three of them ultimately did not submit data because the retail contacts were either leaving the

company, too busy with other work, and/or did not receive approval from upper management.

In working with the specialty retailers, the Evergreen Economics team also noted that at least three of the participating retailers did not have a back-end data system that would easily allow them to aggregate their sales data. Additionally, because the interviewees often were also working the floor of their retail stores, they were too busy to prioritize the data request or set aside time to focus on tasks outside their normal day-to-day responsibilities.

4 Findings

This section includes research findings from web surveys with home growers, interviews with manufacturers, and interviews with specialty retailers, organized by the following topics:

- Home grower characterization
- Lighting market characterization
- Ancillary products
- Market size

In Section 5, we summarize the implications of these findings for program design.¹³

4.1 Home Grower Characterization

To help characterize the participating home growers, web survey respondents provided information about their age, income level, home type, and geographic location (zip code). Some of the key findings included:

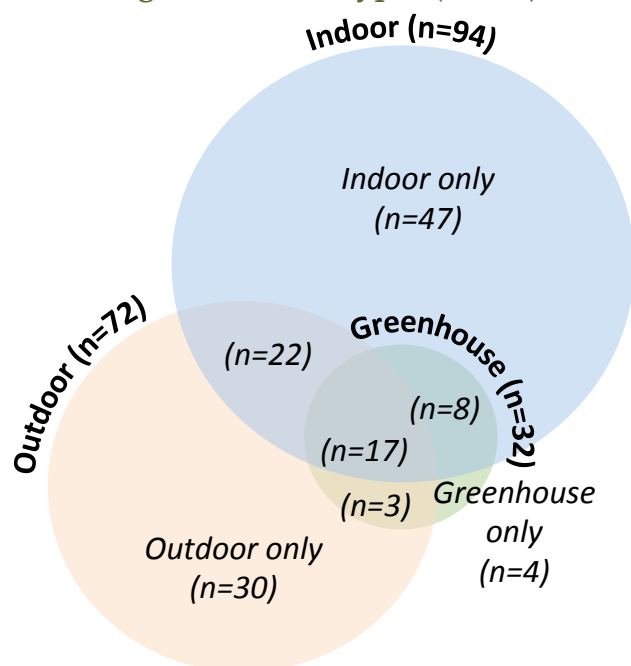
- Income ranges for the web survey respondents skewed slightly lower than the general Oregon population, as only 26 percent of respondents reported incomes greater than \$75,000, as compared to 36 percent of the general Oregon population. The most commonly reported income range was \$35,000 to \$74,999 (34%).
- Age ranges for the web survey respondents were similar to that of the general Oregon population.
- 83 percent of web survey participants live in a single-family home, while 6 percent live in manufactured or mobile homes and 6 percent live in apartments, condominiums, duplexes, triplexes, or fourplexes.
- Approximately half of web survey respondents (51%) live in the Portland Metro region, with 32 percent living in Northwest Oregon, 13 percent living in Southern Oregon, and 4 percent living in Central or Eastern Oregon. These responses largely mirror the general Oregon population.

We present more detailed analysis on the key demographic topics throughout Section 4.

¹³ Results presented in Section 4 include percentages based on the number of responses recorded for each question, excluding growers who did not provide a response.

We also used the web survey results to characterize home growers and the way they set up their home grow. Due to our focus on the energy usage of home grow operations, we focused recruitment on indoor or greenhouse growers (where lighting and sometimes HVAC systems are used).¹⁴ However, as shown in Figure 4, some web survey respondents reported growing cannabis outdoors (exclusively, or sometimes in combination with indoor and/or greenhouse growing). Thirteen percent of respondents had cannabis growing in all three environments: indoors, outdoors, and in a greenhouse. The majority of respondents (72%) grew indoors, exclusively, or in combination with outdoor or greenhouse growing.

Figure 4: Grow Types (n=131)



As detailed below, web survey respondents ranged in location, income, age, and experience, substantiating the claims from each of the eight participating indoor agriculture retailers that the home grower market remains very diverse with a variety of grower types. Home growers also use a variety of techniques when deciding where in their home to grow, the types of equipment to use, and how to configure the equipment.

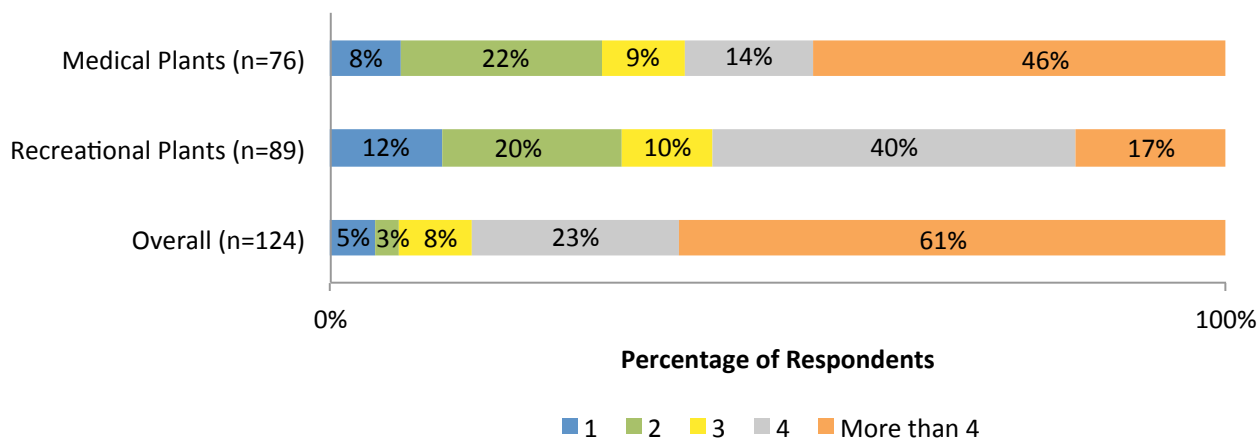
¹⁴ We did this by including recruitment language specifying our interest in indoor grows as shown in the Social Media ad examples in the appendix.

4.1.1 Quantity of Cannabis Plants

Oregon home growers can grow cannabis that is either used for medical purposes or for recreational use, which has implications for the number of plants allowed in a household. Oregon law allows no more than four plants to be grown in a household for recreational use, although additional plants can be grown for medical purposes. The largest segment of respondents (44%, n=131) grows both medical and recreational cannabis. Thirty-five percent of respondents grow only recreational cannabis, and the remaining 21 percent grow only medical cannabis.

In adherence to state law, 83 percent of respondents who grow recreational cannabis reported growing four or fewer cannabis plants; while the remainder of recreational growers (17%) reported that they grow more than the legal amount of four recreational plants, as shown in Figure 5. It should be noted that there is a motive for respondents to misreport the number of plants that are growing for recreational purposes given that anything over four recreational plants would be admission of growing more than the legal amount. Only 30 percent of the respondents who told us the total number of plants they grow in each space (Q5-Q7) decided to respond to our follow up question about how many were for each purpose (recreational or medical, Q8), suggesting that some respondents may have wanted to avoid answering questions that would implicate themselves in an illegal activity. We combined the question about quantity of plants (Q5-Q7) with a question asked earlier in the survey regarding the type of cannabis grown (Q3) to create Figure 5. As expected, a much larger portion of respondents that grow medical cannabis reported that they were growing more than four plants. When combining across end use, 61 percent of respondents reported having more than four plants in their home.

Figure 5: Number of Cannabis Plants per Household by Medical or Recreational End Use (n=120)



4.1.2 Growers by Region

Given our recruitment strategy, our goal for the web survey was to reach home growers across Oregon, as growing preferences may differ across regions given land availability, climate, and local restrictions.¹⁵ As shown in Table 4 below, 51 percent of responding growers in Oregon who provided geographic information live in the Portland Metro region, followed by 32 percent in Northwest Oregon, 13 percent in Southern Oregon, and 4 percent in Central/Eastern Oregon.¹⁶ These percentages were consistent with the share of the total population accounted for within each region according to 2016 U.S Census data.¹⁷

Table 4: Home Grower Respondents by Region

Region	Percentage of Total Growers (n=87) ¹⁸	Percentage of Total State Population
Portland Metro	51%	44%
Northwest Oregon	32%	31%
Southern Oregon	13%	14%
Central/Eastern Oregon	4%	11%

One goal of this research was to better understand where there may be higher concentrations of home growers in the state. Fifteen out of 36 counties across the state have prohibited the establishment of commercial cannabis producers, processors, wholesalers, and retailers. With some exceptions,¹⁹ these are mostly in more rural areas of Central and Eastern Oregon and have average populations of under 20,000. Of all of the web survey respondents who shared their region (beyond the state level), **there did not appear to be a higher concentration of growers in the Central/Eastern Oregon region vis a vis the percentage of the population that lives there, suggesting there may not be an increase in home growing in areas where residents cannot buy cannabis legally.** Three of the participating specialty retailers we interviewed also noted that the amount and proximity of commercial dispensaries may not impact the number of home growers because the

¹⁵ Cities and counties were allowed to opt out of allowing commercial cannabis facilities, both for cultivation and retail.

¹⁶ Complete region description available in Appendix E

¹⁷ <https://www.census.gov/quickfacts/fact/map/OR#viewtop>

¹⁸ Thirty-eight percent of web survey respondents did not provide locational information beyond the state level.

¹⁹ Exceptions include Marion County (population 336,316) in the Northwest Oregon region, Douglas County (population 108,457) in the Southern Oregon region, and Klamath County (population 66,443) in the Southern Oregon region.

home grow industry is viewed by many as the “craft brew” segment of the cannabis market and attracts more hobbyists who would prefer to try growing their own cannabis.

4.1.3 Home Type

The vast majority (83%) of respondents reported that they live in single-family detached homes. This finding is consistent with reports from the local indoor agriculture retailers, as all seven that discussed the topic said that most growers utilize single-family homes because they have more space and often have less conflict with rental agreements that may ban growing in multi-family settings.

Table 5: Home Type (n=97)

Home Type	
Single-family home	83%
Multi-family home	6%
Mobile home (n=93)	6%
Other	5%

There were no significant differences across home type for respondents:

- Who grow with or without lights, suggesting that growing with lights is not more or less common depending on the type of home in which a respondent resides;
- Who grow outdoors compared to those who do not grow outdoors;
- Who grow outdoors and/or in a greenhouse compared to those who do not.

While mentioned as a barrier by two of the indoor agriculture retailers because of the potential lack of permission from a landlord, 36 percent of the total number of web survey respondents rent their home, as shown in Table 6.

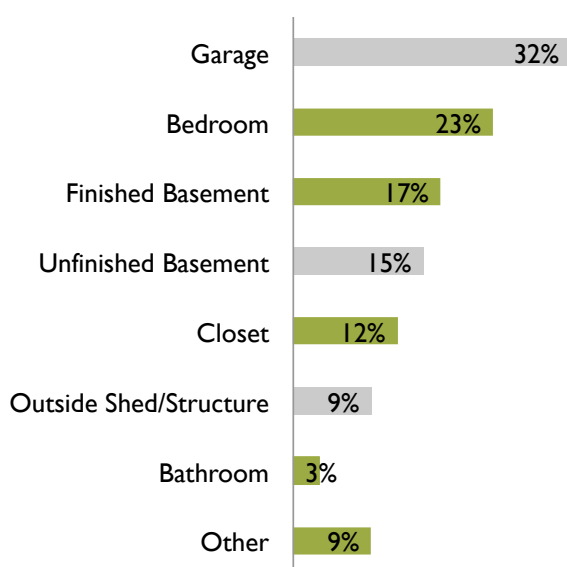
Table 6: Own or Rent by Home Type (n=93)²⁰

Home Type	Own	Rent
Single-family home (n=87)	67%	33%
Multi-family home (n=6)	17%	83%
Either type of homes (n=93)	64%	36%

²⁰ Thirty-six percent of web survey respondents did not provide home type information.

Where growers decide to place their plants inside their homes can have implications on energy usage, as some spaces are more likely to be unconditioned than others, including unfinished basements, outside sheds, and garages, and may require additional heating or cooling of plants. Almost half of respondents (47%) reported growing in at least one or more of the following spaces: unfinished basements, sheds, and garages. Those spaces are shown with grey bars in Figure 6. Note that in the figure, the total does not equal 100; multiple responses were allowed, as respondents may grow in more than one area of their home.

Figure 6: Location of Indoor Grow Reported by Web Survey Respondents (n=66)²¹



4.1.4 Grow Type Selection

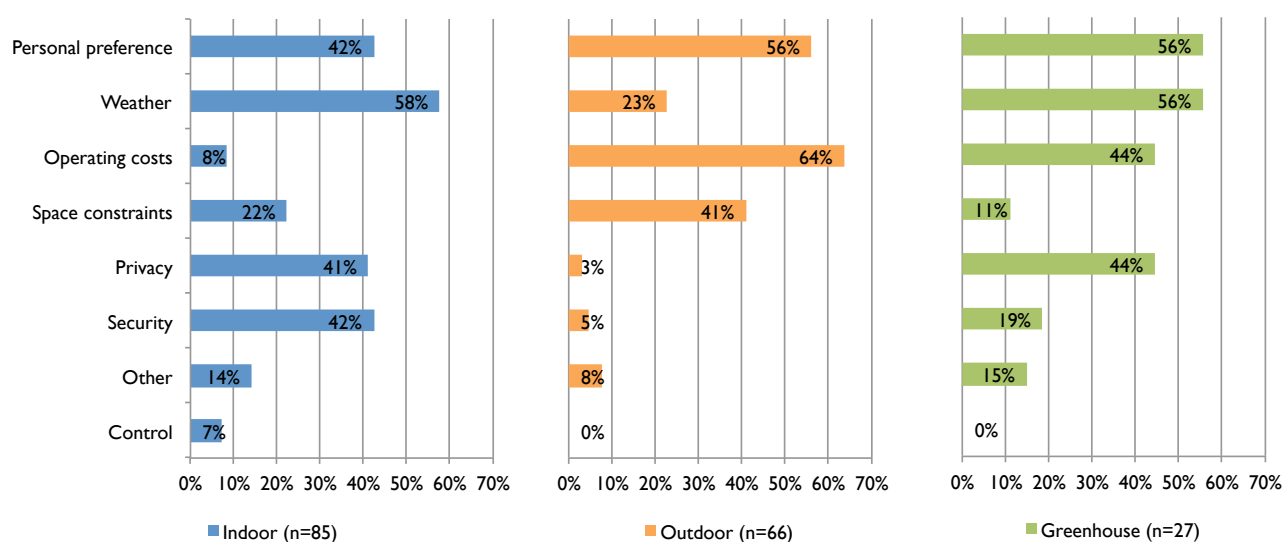
When home growers begin to plan out their growing operation, several factors can influence the location (indoor, outdoor, or greenhouse) they choose, including:

- Weather
- Operating costs
- Space constraints
- Privacy
- Security
- Personal preference

²¹ Other spaces include a pool house, a barn, a shop, a detached structure, and other responses that did not fit into the more general categories.

Besides the more general response of “personal preference,” respondents reported choosing outdoor growing because of the lower operating costs (64%) and due to space constraints (41%), as shown in Figure 7. Greenhouse growers also reported that they are concerned with operating costs (44%), though to a lesser extent than outdoor growers. Greenhouse growers may or may not use lighting, which can increase operating costs. In greenhouses, lighting may only be used to supplement natural daylight, lowering the cost of lighting usage compared to indoor growers. Indoor growers were concerned with avoiding weather (58%), security (42%), and privacy (41%), and less so with operating costs, which can be much higher indoors due to lighting and HVAC usage.

Figure 7: Reasons for Choosing Between Indoor, Outdoor or Greenhouse Growing



Responses prompted. More than one response allowed.

Five of the specialty retailers who we interviewed also noted that costs become a primary consideration for their home grow customers in planning their growing operations, especially for newer growers who are trying out cannabis growing for the first time. For example, as one Portland Metro retailer noted:

“We get a lot of first-timers in here asking about lights and once we show them the costs and let them know they can maybe grow outside during the summer, a lot of them decide just to throw a few plants outside and see how they do.”

Another participating retailer added that they have seen a number of new home growers decide to first try growing outdoors during the summer and then plan on shifting to indoors after their first cycle. However, the retailer estimated 75 percent of those growers “drop out” after learning about the costs of indoor operations.

Given that operating costs drive respondent choice regarding where to grow, we also wanted to understand whether respondent income level was correlated with the type of

grow set up that they may use. To do this analysis, we separated growers into two groups: respondents who use lights for cannabis growing and respondents who do not. As shown in Table 7, respondents who use lights more often fell into higher income categories than growers who do not use lights. The growers who responded to the web survey and gave information on their incomes were skewed slightly toward lower income categories compared to the general Oregon population. This difference is statistically significant for the \$75,000 to \$149,999 income level.

Table 7: Income Range of Respondents by Lighting Usage

Income Level	Percentage of Growers with Lights (n=67)	Percentage of Growers without Lights (n=26)	Percentage of Total Growers (n=93)	Percentage of Oregon Population²²
\$150,000 or more	6%	12%	7%	10%
\$75,000 to \$149,999	25%	4%	19%	26%
\$35,000 to \$74,999	34%	35%	34%	29%
\$15,000 to \$34,999	24%	35%	27%	21%
Under \$15,000	10%	15%	12%	12%

4.1.5 Age and Experience of Web Survey Respondents

Web survey respondents' ages ranged from 18 to 74. Table 8 shows the percentage of respondents that fit into each age range. Note that the age ranges of survey respondents may be biased because of the recruitment methods we employed. As an example, Facebook placed the social media marketing in front of a higher proportion of users who are over the age of 45.

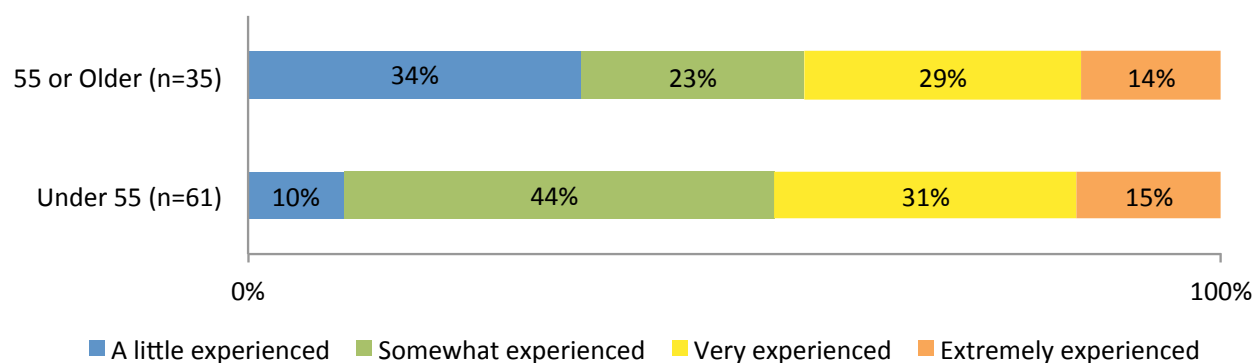
²² Based on U.S. Census Bureau data analysis (https://datausa.io/profile/geo/oregon/#category_income)

Table 8: Age Ranges of Participating Home Growers By Growing Type

Age Range	Recreational Only (n=32)	Medical Only (n=19)	Both Recreational and Medical (n=45)	Percentage of Total Growers (n=96) ²³	Percentage of Oregon Population ²⁴
18 - 24	3%	0%	2%	2%	9%
25 - 34	41%	21%	13%	24%	14%
35 - 44	19%	11%	24%	20%	13%
45 - 54	9%	16%	24%	18%	14%
55 - 64	13%	37%	27%	24%	13%
65 - 74	16%	16%	9%	13%	8%

Respondents were split with regards to how experienced they considered themselves to be with cannabis growing. Of the 96 respondents who felt they could rank their level of experience, 45 percent said they were either very or extremely experienced growers, with the remaining 55 percent indicating they considered themselves to be only a little or somewhat experienced.²⁵ This result varied by age group. As shown in Figure 8, older growers (55 years or older) reported lower relative experience levels than younger growers, as 34 percent of them reported only a little experience compared to only 10 percent of growers under the age of 55 who did so.

Figure 8: Self-Reported Experience Growing Cannabis by Age of Respondent (n=96)



²³ Thirty-four percent of web survey respondents did not provide age information.

²⁴ Based on U.S. Census Bureau data analysis; 29 percent of the population falls outside of designated age ranges.

²⁵ Thirty-four percent of web survey respondents did not rank their level of experience.

We also looked at experience across indoor versus outdoor growing respondents and did not see any significant differences. Due to the large overlap between growers who grow indoors and outdoors, it is challenging to compare growers who are only growing indoors or only growing outdoors as these sample sizes are small.

These findings were consistent with the insights from the participating specialty retailers, as all eight noted their customer base includes a wide range of experience levels and ages. Three of the retailers noted specifically that they feel the split in experience level is close to 50/50, while two of the retailers noted that their specific market includes a larger percentage of experienced growers.

4.2 Lighting Market Characterization

In order to characterize the lighting market, we reviewed results from interviews with manufacturers and specialty retailers as well as responses from the web survey. This discussion begins with a description of the types of lighting that are available for this market (Section 4.2.1), where these lights are likely to be purchased (Section 4.2.2, 4.2.3), and finally, which types of lighting are most popular among growers (Section 4.2.4).

We asked questions about lighting to all responding indoor growers, and to growers with greenhouses that use lighting. Given the growth requirements of cannabis, we assume that all indoor growers use some sort of artificial lighting. From our literature review, we understand that greenhouse growers sometimes use supplemental lighting to speed up the cannabis growing cycle. As shown in Figure 9, close to half of the responding greenhouse growers use lights in their greenhouses. There is also a large overlap between greenhouse growers and indoor growers, with 78 percent of responding greenhouse growers also growing indoors.

Figure 9: Lighting Usage in Greenhouses (n=32)²⁶

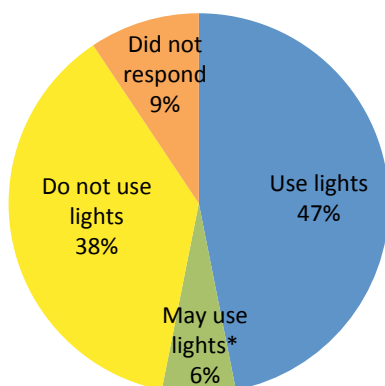
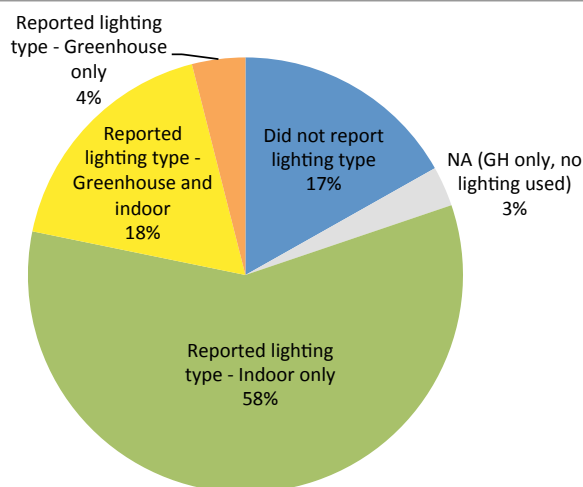


Figure 10 shows that of the respondents who grow either indoors or indoors and in a greenhouse, 80 percent reported the type of lighting that they use.

Figure 10: Breakout of Grow Type of Indoor and/or Greenhouse Growing Respondents (n=101)



²⁶ The 6 percent that “may use lights” did not respond to a question asking if they use lights in their greenhouse, but did share information on using lighting. They could have been sharing this information about their indoor grow instead of their greenhouse, so it is unclear in which setting their lights are used. (Q4, Q15)

4.2.1 Available Lighting Equipment

The primary lighting options for home growers include high-pressure sodium, metal halide, fluorescents, and more recently, LEDs. These different lighting types are introduced in Table 9. This table summarizes information we gathered from prior literature reviews and interviews with market actors, including pros and cons and relative prices. We did not include lumens per watt in this table as it is not an important metric to cannabis growers. In the table, usable light refers to the wavelengths that can be absorbed by the cannabis plant. We include the range of values across these lighting products in Appendix C. Any usage of this data should consider the number of each lamps that are typically used per plant, as this number differs across lighting types.

Table 9: Grow Light Descriptions

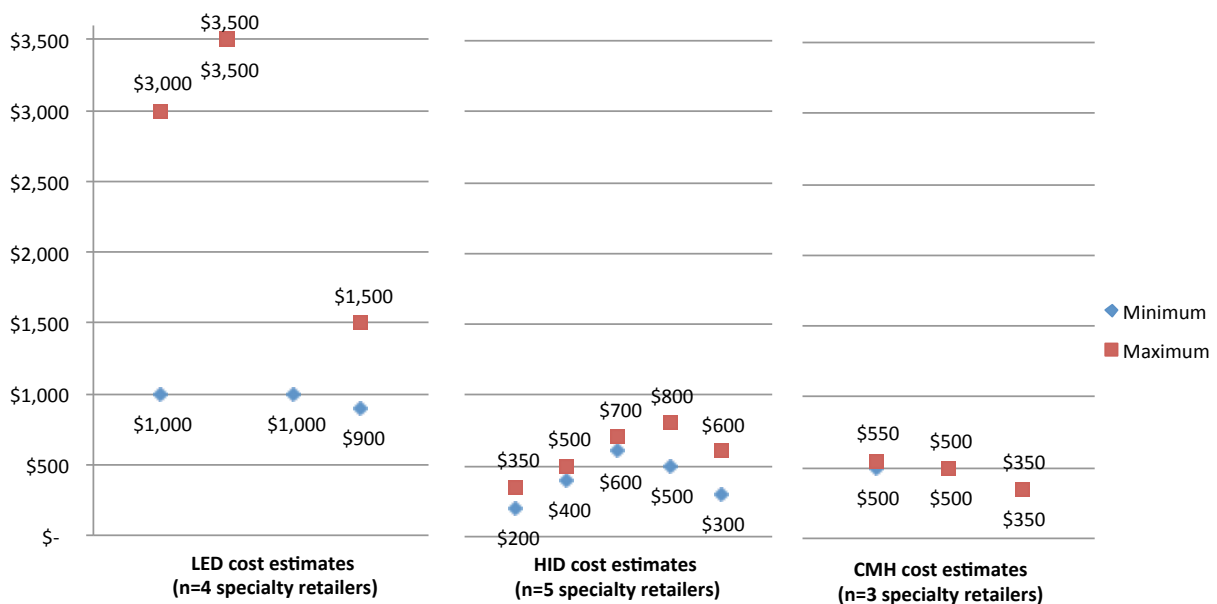
	Lighting Type	Pros	Cons	Common Wattages²⁷	Use (growing stage, historical uses)	Relative Price Category
High Intensity Discharge (HID) Lights	High-Pressure Sodium (HPS)	Amount of usable light, dimmable, color spectrum	High heat output, requires ballast and reflector, short useful life for bulbs	600W-1000W	Historically used in the flowering stage because they have a high “yellowish” lighting output. Commonly used in conjunction with MH lights.	Medium
	Metal Halide (MH)	Amount of usable light, dimmable, color spectrum	High heat output, requires ballast and reflector, short useful life for bulbs	600W-1000W	Historically used in the vegetative stage because they have a high “bluish” lighting output. Commonly used in conjunction with HPS lights.	
	Ceramic Metal Halides (CMH)	More efficient and longer useful life than traditional HID lights, color spectrum	High initial cost compared to other HID lights, requires magnetic ballast	315W, 640W	This is a newer HID technology that is more energy-efficient than traditional HPS and MH lights and can be used in vegetative and flowering stages.	
Fluorescent Lamps	CFLs, T5s, T8s, T12s	Availability, cost, small form factor, long useful life, can be placed close to plants due to lower heat output	Low output, requires more bulbs, low production yield, poor light penetration	Various (40+ watts)	Best suited for smaller grows in the seedling stage because not enough output for vegetative and flowering stages. Can be installed close to top of canopy without heating concerns.	Low
LEDS	Bulbs	Customizable spectrum, can be used for various grow stages, long useful life, small form factor, energy-efficient, cooler operating temperature	Perceived lower yield, high initial cost, requires close proximity to plant, variable quality, may require additional heating	Various (5-40+ for bulbs)	This is a newer technology, and growers have a range of opinions on how these work for their plants. Can be used for all stages of growing.	High (but decreasing)
	Panels			300W, 600W, 1000W for panel systems		

²⁷ Additional data on wattage levels from our sales data analysis can be found in Appendix C.

All of the cannabis lighting types outlined above are offered by specialty retailers, although four of the retailers noted that some LEDs are sold as special orders because they may not stock that specific LED lighting product. In general, all eight retailers stock and promote HID and fluorescent lamps and ballasts on their shelves, with six of the retailers also noting they offer more ceramic metal halide (CMH) options now as they are becoming more popular, and four noting they carry limited quantities of LEDs.

Sales prices vary across manufacturers and retailers, but general estimates from six of the participating retailers for the total purchase cost of traditional HID lighting for a home grow operation ranged between \$300 and \$800. Estimates for LED set ups were \$900 and higher based on manufacturer and specialty retailer responses. The cost range for LED setups is larger than more traditional HID lighting equipment given the variety of fixture price, wattage, product options (dimmability, spectrum control, wattage, etc.), and the overall perceived quality of the manufacturers. The cost of CMHs lies in between the other two lighting types, with average prices of between \$350 and \$550.²⁸ Note that the minimum numbers given may reflect what would be sold in stores and may exclude products retailers think are of low quality.

Figure 11: Estimates of Total Purchase Cost by Lighting Type for a Home Grow Operation by Specialty Retailers (n=6)



²⁸ Some types of lights are more likely than others to have higher heat output which may create the need for ventilation and cooling, resulting in higher energy use and associated costs for the home grower.

The lamps used in home grows are similar to lamps used in commercial grows, though on a much smaller scale and with a few exceptions. All of the lighting manufacturers and specialty retailers we interviewed noted that most of the equipment available to home growers is the same indoor agriculture equipment offered to larger commercial growers. However, one manufacturer noted they offer a 125W panel version of their LED lighting specifically for home growers, which is comparable to a 600W HPS. This is a lower wattage than their commercial LED (250W) and is marketed as easy to install and appropriate for small grow spaces. One lighting manufacturer and two of the indoor agriculture retailers also noted that the 1000W double-ended HPS lamps are not as common with smaller home growers because of the excessive heat they produce and because of the height restrictions within most home grow locations. Instead, they expect that home growers use lower wattage HID lights (600W) or new technologies such as LEDs or CMHs (outlined below).

One of the recent trends the indoor agriculture retailers noted during interviews was the increased adoption of CMHs by home growers. The most common CMH options run at 315W, considerably lower than the traditional 1000W HIDs to which most growers are accustomed. While there remains some debate on whether a 315 CMH performs the same as a 1000W HPS, the CMH options are marketed as direct swap-out options for traditional 1000W lamps, and cost about half as much as a comparable LED system. Six of the indoor agriculture retailers said that they commonly suggest CMH options over LEDs for home growers because they provide some of the energy-efficiency benefits of LEDs (over traditional HPS) at a lower price.²⁹

4.2.2 Lighting Retail Channels

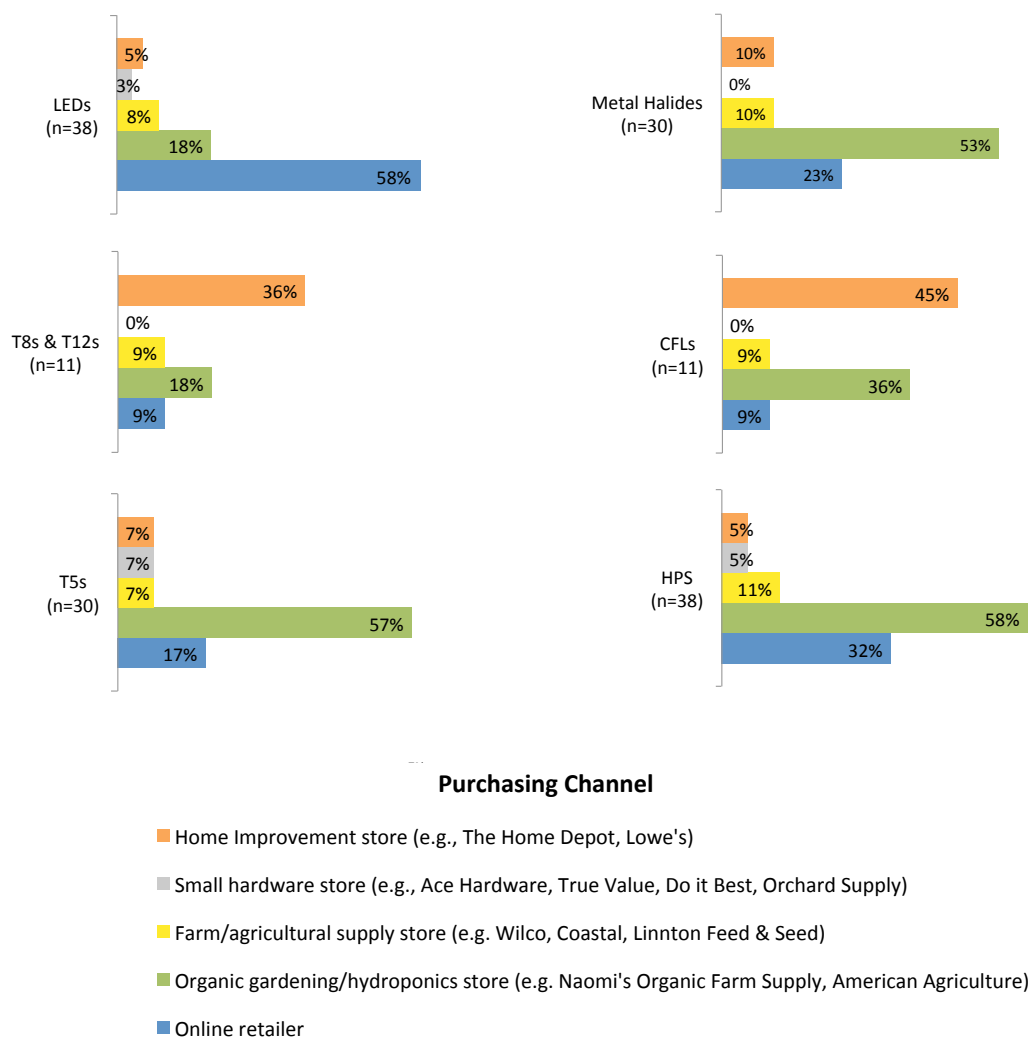
Since the expansion of legalization in Oregon, grow lighting equipment has become more accessible to home growers as more retail channels – including specialty retailers, online retailers and even traditional hardware stores – now offer a variety of lighting equipment options.³⁰ To help estimate the market share of these various retail channels, Evergreen asked survey respondents where they had purchased each type of lighting equipment they used. As shown in Figure 12 below, while organic gardening and hydroponic retailers were the most common channel, purchasing behavior varied across lighting types. For example, over half of respondents who use HPS, metal halides and T5s purchased them at hydroponic retailers, compared to only 18 percent of respondents who purchased LEDs.

²⁹ Cost comparisons include pricing estimates provided by indoor agriculture retailers of \$350 and \$550 for a CMH system compared to \$900+ for an LED system.

³⁰ IBISWorld. "Hydroponic Growing Equipment Stores in the US: Market Research Report." October 2017. <https://www.ibisworld.com/industry-trends/specialized-market-research-reports/consumer-goods-services/lifestyle-stores/hydroponic-growing-equipment-stores.html>

Online purchasing was the most prevalent retail channel for growers purchasing LEDs, as 58 percent purchased their lights on either Amazon or an alternative online retailer.³¹

Figure 12: Purchasing Behavior by Lighting Type³²



These findings were corroborated in our interviews with indoor agriculture retailers; seven of the retailers noted that while they offer LEDs for interested customers, they do not stock significant amounts of LEDs because of their higher price and relatively lower

³¹ Amazon was the online retailer respondents referred to between 50 to 60 percent of the time, with the exception of CFLs (0% of the time) and T8s and T12s (100% of the time). The figure excludes “other” and “don’t know” responses.

³² Fifteen percent of web survey respondents who use lighting equipment did not provide lighting type or purchasing behavior information.

demand. Additionally, two retailers noted that LED prices online – particularly among less reputable LED brands – are lower than prices offered by retailers, making online purchasing more attractive for growers.

We received sales data from two of the eight participating indoor agriculture retailers – including one of the larger Portland-area retailers and one smaller retailer in Marion County – that corroborated the web survey finding that HID lamps are often purchased from specialty retailers. HIDs accounted for 74 percent of the lighting sold over the past year by the two retailers who shared data with us (Table 10).³³

Table 10: Sales Data from Specialty Retailers for Residential and Commercial Sector, January 2017 through November/December 2017 (n=2)

Lighting Category	Lighting Type	Portland Retailer (2,993 products)	Salem-Area Retailer (448 products)	Total By Lighting Type (3,441 products)	Total By Lighting Category
HID	HPS ³⁴	53%	37%	51%	74%
	MH	9%	0%	8%	
	CMH	17%	10%	16%	
Fluorescent	CFLs	0%	24%	3%	9%
	T5s	1%			
	T8s	0%	29%	5%	
	T12s	1%			
LED ³⁵	LED	19%	1%	17%	17%
Other	Plasma	1%	0%	1%	1%

We also asked specialty retailers (regardless of whether they provided sales data) to estimate the market share for each lighting type to supplement the sales data. Five of the retailers noted that over 50 percent of home growers typically purchase HID lighting –

³³ Additionally, approximately 62 percent of HID sales came from lamps, compared to 28 percent from lighting systems that typically include ballasts and lamps, and 10 percent from standalone ballasts. These results were impacted significantly by one of the retailers that sold 495 of one specific HPS lamp (Eye Hortilux Super HPS) which accounted for 31 percent of their total HID sales.

³⁴ For the first retailer, this number includes ballasts that may be used for both HPS and MH lamps.

³⁵ For LEDs, the vast majority of sales (approximately 95%) came from replacement lamps, while the remaining 5 percent was from lighting systems that included a ballast and a lamp component. The most common lamps were the AgroLED iSunlight lamp (n=374) and the MK8 HO Horticulture lamp (n=111) that were T5 replacement lamps designed to fit with existing T5 fixtures.

primarily double-ended HPS— while two said that CMHs are becoming the most common lighting type, although that only has been the case recently.

The two specialty retailers that provided sales data covered different home grower markets across the state and consequently had different product sales over the last year. For example, while the Portland-area retailer had minimal fluorescent sales for cannabis over the last year (2%), fluorescent sales accounted for over half (53%) of the Salem-area retailer's sales. Additionally, while the Salem-area retailer noted they only sold three LED systems over the last year, LEDs accounted for 19 percent of the Portland-area retailer's sales. These discrepancies may be reflective of the different markets, as the Salem market may include more price-sensitive home growers— who are not as receptive to LEDs— than the Portland market.

4.2.3 Lighting Distribution Channels

The specialty retailer interviews also identified the major lighting distributors for the Oregon cannabis market. Seven of the participating retailers noted that there are three primary lighting distributors for the Pacific Northwest market that account for the vast majority of distribution (estimates ranged from 60-80%) within specialty retailers. These distributors include:

- Hydrofarm
- Sunlight Supply
- Bloomington Supply (BWGS)

Both Hydrofarm and Sunlight Supply include their own indoor agriculture lighting brands that include HID, CMH, and LED lighting options in addition to other manufacturers' products. The distributors provide detailed product catalogues to the retailers, who maintain close relationships with the lighting distributors to order various lighting equipment for their stores.

While the primary distributors account for a large percentage of lighting distribution, three of the retailers also noted that specific brands— such as Nanolux— are sourced directly from the manufacturer and do not go through the traditional distribution chain. One retailer noted that they are approached frequently by smaller manufacturers that are forced to self-distribute because of their relative obscurity in the market and the competitiveness of working with the larger distributors. As one manufacturer noted:

“If I’m a new, smaller manufacturer, I start by going directly to growers. If that doesn’t work, then I partner with retailers. Then, I try to grow [large enough] to get into that distributor spot. I can’t just approach Hydrofarm or Sunlight. I’d say 1/1000 gets product into Sunlight.”

One other retailer added that it can be difficult for smaller manufacturers – especially smaller LED brands – that do not go through one of the major distributors to work with retailers because of the lower wholesale prices the large distributors can offer.

4.2.4 Lighting Purchases

Lighting Types

While market actor interview responses and the limited amount of sales data obtained from retailers help shape the framework for characterizing the home grower lighting market by identifying what products are *available*, we used web survey results from home growers to identify what products growers have *purchased* and used in their homes.

As shown in Figure 13, over half of all web survey respondents who shared information on lighting have HID (61%), and over half of all web survey respondents have fluorescent lighting (56%).

Figure 13: Types of Grow Lighting Used in a Household, Web Survey Respondents (n=81)³⁶

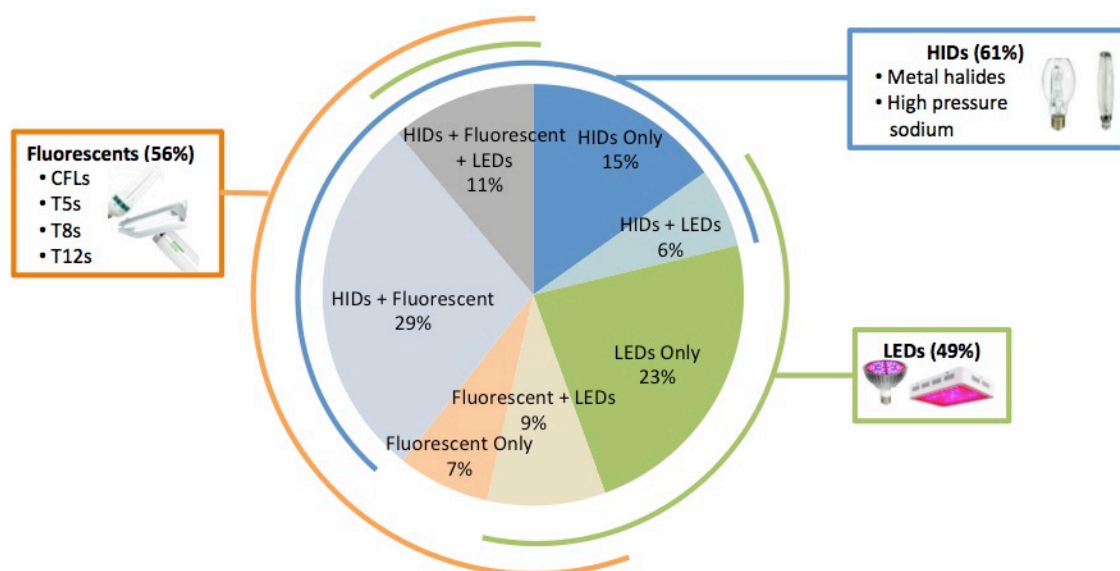


Figure 13 also shows that:

³⁶ This figure accounts for the fact that many growers use a combination of these lights rather than just one type of lighting type for their grow operations. Additionally, 17 percent of growers who use lights did not provide information on the specific types of lights they use.

- **Fifty-five percent of the respondents who use light to grow cannabis (n=81) use more than one type of lamp.** Among growers who only used one lighting type, LEDs were the most common (23% of all respondents who reported about their lights used only LEDs) followed by HID.
- **The most common combinations of lighting installations included using some type of fluorescents (CFLs or T5s/T8s), with some type of HID (MH or HPS).** This was the setup used by 29 percent of respondents.
- **LED users are more inclined to rely on LEDs throughout the entire growth cycle** compared to fluorescent and HID users that utilize different lighting types depending on the growth cycle stage. Forty-seven percent of LED users grow with LEDs only compared to only 13 percent of fluorescent users (that use only fluorescents) and 24 percent of HID users. Participating lighting manufacturers and specialty retailers added that the spectrum control on newer LEDs allows growers to use them throughout the growth cycle, including both the vegetative and flowering stages. Full spectrum LEDs can be used for multiple cycles, and users may be less inclined to swap to HID for another type of light. Growers who are using LEDs currently may be using them because they want to promote efficiency as much as possible or may be testing out LEDs and thus would be less inclined to swap to other lighting types.

Growers who reported using multiple lighting types (compared to just one) are:

- **More likely to rate themselves as very or extremely experienced** (63 percent compared to 32 percent of growers with only one type of light). Specialty retailers we interviewed noted this may be due to the fact that experienced growers have had more growing opportunities and use multiple lighting types in various cycles to compare yields and overall output.
- **More likely to grow more than four plants** (73 percent of growers who use multiple lighting type grow more than four plants compared to only 38 percent of growers who use a single lighting type).

Number of Lamps

On average, growers reported using 1.37 bulbs (or panels, in the case of some LEDs) for each cannabis plant (n=41).³⁷ There are some types of lighting for which web survey

³⁷ Calculations for the total number of plants include responses to a question (Q5 – Q7) about how many plants are grown in each space (greenhouse, outdoors, or indoors). Growers who, in response to this question, indicated that they had five or more plants were excluded from this analysis unless we could make an assumption about the total number of plants they had from their response to a question about the number of medical or recreational plants that they were growing (Q8). Note that we were unable to analyze the

respondents are more likely to buy a larger quantity of lamps than others, though we were unable to analyze the number of plants under each type of lamp. Web survey respondents were more likely to report having four or fewer HPS, metal halides, or CFLs (82% or more of respondents depending on the type of lamp), compared to respondents who reported on their quantities of linear fluorescent lamps (ranging from 41 to 47 percent having four or fewer bulbs). These results may reflect the fact that added fluorescent bulbs are required for comparable results to a single HID light given the fluorescent bulbs' lower intensity.

Additionally, approximately half of growers who purchased HPS and/or metal halides said they only have one bulb in their configuration. This finding is reflective of the high wattage of these HID lights (1000W), which allows growers to use a single ballast and bulb for small home grow operations with four or fewer plants.

Respondents who used LEDs had four or fewer LED lamps 77 percent of the time. Two potential reasons a majority of LED users had fewer than four lamps is because LEDs are often bought in panels – which consist of hundreds of LED diodes configured together to cover a broader plant canopy than a bulb – that a home grower would only need one or two of, or, as three specialty retailers pointed out, because growers may purchase a limited amount of LEDs initially to test them out on a smaller scale. LED purchasers can opt to buy individual bulbs like they would for other lighting types or, more commonly, purchase LED panel systems that inherently cover a broader area. Among respondents that bought LEDs, 91 percent purchased panel systems as opposed to individual bulbs. Thirty percent of those growers purchased only one LED panel, while an additional 33 percent purchased two panels.³⁸ Six LED growers said they have six or more LED panels in their configuration, including the largest that has 12 panels. There were no significant differences in the number of plants grown by respondents that used LEDs versus those that did not.

General Purchasing Decisions

In order to better understand the mix of lighting that is used in Oregon home grow operations, and how Energy Trust may be able to influence this mix in the future to include more efficient lighting options, we asked home growers about the importance of various factors in their decision to purchase lighting. The web survey prompted home growers to rate the importance of 18 factors on their lighting purchases using a scale of 1

number of lamps per plant since our data did not allow for analysis of the number of plants under each lighting type.

³⁸ Most high-end LED panels are designed and marketed to be a 1:1 comparison to a 1000W HPS bulb. However, there is a lack of consensus in the industry as to whether this is true for all LED panels, as some experts, including at least four of the participating market actors, indicated this ratio is often 2:1 in home grow configurations.

to 5, where 1 is not at all important and 5 is extremely important. As shown in Table 11 growers indicated that color spectrum (mean score = 4.3, n=68), energy efficiency (4.0, n=70), wattage (3.9, n=70), heat output (3.9, n=72), expected life (3.9, n=67), and purchase price (3.8, n=71) were the most important factors when deciding which lighting type to install. Conversely, growers indicated that advertisements (1.6, n=63), in-store recommendations (2.5, n=67), brand (2.5, n=66), and online advice (2.9, n=68) were the least important factors when deciding which lighting type to install.

We also compared responses between growers who use LEDs and those who use other lamp types and found that respondents who use LEDs place more importance on heat output (43% of respondents with LEDs said it was extremely important compared to 21% of non-LED users). There were no significant differences between LED users and non-LED users regarding color spectrum and expected lifespan, which one might expect to be reasons for growers to choose (or not to choose) LEDs over non-LED lighting, suggesting these are less likely to be drivers in a grower's decision to purchase LEDs.

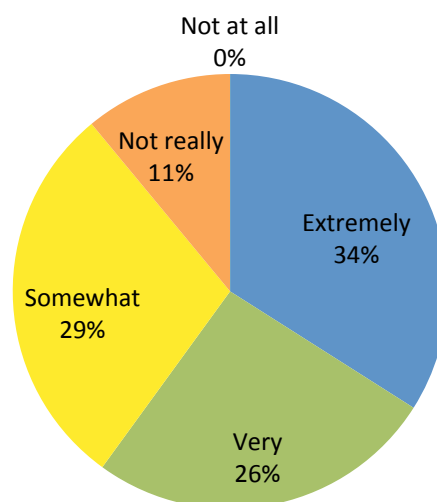
Table 11: Important Factors in Deciding Which Type of Lighting to Install

Importance Factors	Growers with LEDs	Non-LED Growers	Total
Color spectrum (n=68)	4.3	4.3	4.3
Energy Efficiency (n=70)	4.4	3.8	4.0
Wattage (n=70)	3.8	4.0	3.9
Heat output (n=72)	4.2	3.7	3.9
Expected lifespan (n=67)	3.9	3.8	3.9
Purchase price (n=71)	3.8	3.9	3.8
Operating costs (n=71)	3.9	3.7	3.8
PAR (n=58)	3.5	3.7	3.6
Availability (n=70)	3.4	3.7	3.6
PPFD (n=53)	3.2	3.3	3.3
Past experience with product (n=68)	2.9	3.5	3.3
Ease of installation (n=68)	3.2	3.1	3.2
Industry recommendation (n=64)	3.2	3.1	3.1
Word of mouth (n=66)	3.3	3.0	3.1
Online advice (n=68)	3.1	2.9	3.0
Brand (n=66)	2.5	2.5	2.5
In-store recommendation (n=67)	2.4	2.5	2.5
Advertisement (n=63)	1.8	1.4	1.6

Note: Scale is from 1 to 5 with 1 being not at all important and 5 being extremely important.

Overall, respondents rated energy efficiency relatively high on the scale of importance, compared to other factors. We asked respondents about their willingness to change their current lighting to a more efficient option. Results are shown in Figure 14. Among respondents who use non-LED grow lights only, between 60 and 89 percent of the home growers are willing to purchase energy-efficient grow lighting in the future.

Figure 14: Willingness to Purchase Energy-Efficient Grow Lighting in the Future (Reported by Respondents Who Currently Have Only Non-LED Grow Lighting) (n=38)³⁹



Five of the indoor agriculture retailers we interviewed reported that energy efficiency is generally *not* a priority among most of the home growers with whom they interact. This may be because respondents typically buy LEDs online. The indoor agriculture retailers noted that energy efficiency is important to *select* home growers, but as one retailer stated, it “plays second fiddle” to overall budget for the majority of home growers.

All together, these results reflect that there is interest in energy-efficient lights but that energy efficiency may not be the main reason why growers purchase these lights. Web survey respondents who have LEDs reported valuing things like heat output. When compared with respondents who do not use LEDs, there were no significant differences in the valuation of lifespan, energy efficiency, or color spectrum. Respondents with LEDs are more likely to value what they read online compared to non-LED using respondents. This aligns with the finding that the most common place for LED-using respondents to purchase LEDs is in an online store.

Both photosynthetically active radiation (PAR) and photosynthetic photon flux density (PPFD) – two metrics that have recently emerged as key measurements of lighting output as it relates to plant growth – received relatively low importance scores (3.3 and 2.9 respectively) from home growers. This was corroborated by our interviews with retailers who reported that many customers are not familiar with the technical aspects of the lighting equipment that impact performance – such as spectrum or PAR – and instead

³⁹ Thirty-three percent of growers did not respond to this question.

simply tell the retailers they want a recommendation on what lighting type may work best. The web survey included the definition of PAR to ensure that respondents were aware of what the metric meant. These findings may indicate that technical components of the lighting equipment that impact yield quantity and quality are not primary drivers for home growers in the same manner they would be for commercial growers producing for retail operations.

Cost was also an important factor for growers, as 64 percent of participating home growers said purchasing and operating costs were either very or extremely important. All eight of the interviewed indoor agriculture retailers also indicated that they perceive initial cost as one of the primary factors (along with available space and ease of installation) for their home grower customers purchasing lighting equipment. They also believe it is often a motivating factor in growers opting for less expensive and less efficient HID lighting over LEDs. For example, one retailer that does not stock LEDs due to their relative price point compared to other options noted:

“Basically 70-80 percent of new home growers come in asking about LEDs, thinking that’s where they want to go because of what they looked up online [in terms of price and quality]. I tell them that what [manufacturers] claim on Amazon has nothing to back it up...Someone who is serious, I’d say 90 percent, end up switching over to the lighting options we have in stock [CMH and HIDs] because of the lower costs.”

While six of the retailers noted that lighting performance metrics – such as PAR and PPF/D – are important factors for their home grow customers, only more experienced growers typically discuss these performance metrics specifically with retailers. More commonly, home growers will simply ask the retailers about the overall performance of the lighting equipment in general terms or relative to other lighting types.

Purchasing Decisions Specific to Lighting Types

In addition to general questions about what home growers look for when purchasing lighting, we asked home growers about why they bought specific lighting equipment. Not all growers responded, but Table 12 shows the most frequent response for each type of lighting. Below the table, we discuss all of the reasons for purchasing each type of light (as more than one response was allowed). This discussion is intended to inform the types of messaging or market interventions that may drive growers to buy more energy-efficient lighting.

Table 12: Reason for Purchasing Lighting Type

Lighting Type	Most Frequently Mentioned Reason for Purchasing Lighting Type	Percentage
High-Pressure Sodium (HPS) (n=28)	Color Spectrum	36%
Metal Halide (MH) (n=23)	Color Spectrum	52%
CFLs (n=9)	Low Initial Costs	56%
LEDs (n=32)	Operating Costs	66%
T5s (n=25)	Effectiveness/Performance	48%
T8s (n=6)	Effectiveness/Performance	83%
T12s (n=2)	n/a	n/a
Other (Ceramic Metal Halides and Plasma) (n=5)	Color Spectrum	80%

High-pressure sodium and metal halide lights:

For HPS and metal halide lights, color spectrum (36% for HPS and 52% for metal halide) and effectiveness/performance (39% for HPS and 43% for metal halide) were the most common reasons for purchase. Initial lower cost was only mentioned by 14 percent of HPS purchasers and 9 percent of responding metal halide purchasers, despite indoor agriculture retailers indicating costs are the primary driver of purchasing behavior among home growers, and web survey respondents reporting it as a key importance factor in general.

Fluorescent lights:

For growers who purchased CFLs, T5s, T8s, and T12s, initial costs were mentioned more frequently as a primary reason, including 56 percent of CFL purchasers and 66 percent of T5 purchasers. Four of the specialty retailers also noted that customers concerned only about costs – potentially more than product quality – typically look for low cost fluorescent options. Initial lower cost was cited as a primary reason for purchasing florescent lamps by 43 percent of users (n=42) compared to only 12 percent of respondents who provided their reasons for buying metal halide and HPS lamps (n=51). This indicates that cost-conscious customers – who prioritize initial costs over performance factors – may be more drawn to buy inexpensive florescent lamps over HPS and metal halides, despite the potential differences in lighting output or performance.

LED lights:

Operating cost was the most recorded reason among LED purchasers for choosing to buy LEDs, as 66 percent mentioned lower operating costs as a main reason they opted for LEDs. This suggests that while fluorescent lights are more often purchased due to initial cost savings, LED lamps are more likely to be purchased for the operating cost savings.

Some web survey respondents were not currently using LEDs, but had done so in the past (26%, n=11). The reasons they gave for not currently using LEDs included:

- Performance issues (n=6), either in terms of color spectrum, production yield, or heating output;
- High initial costs (n=2);
- Eye strain (n=1); or
- Need to reconfigure lighting setup to switch to LEDs (n=1).

4.2.5 Lighting Applications

While considering the type and quantity of lamps is important to gain an understanding of the energy use in the residential cannabis growing sector, it is also important to understand how lighting is used in terms of hours per day, variation by grow cycle, and expected useful life, and if it is used for purposes other than growing cannabis. This information can inform how frequently a grower may be ready to replace lighting, and if rebated lighting measures would be used for additional purposes.

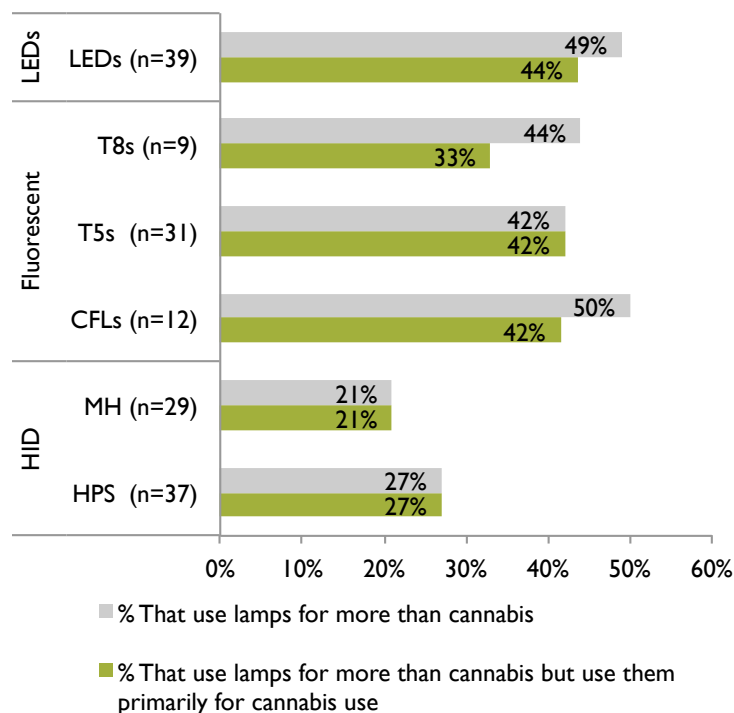
All of the indoor agriculture retailers we interviewed indicated that while cannabis growing may be the most common use for the various lighting types outlined above, the lamps themselves are not necessarily designed specifically for cannabis, but instead are specified for all types of indoor horticulture or agriculture. Often, for advertising purposes or to avoid legal issues as cannabis is still considered to be illegal by the federal government, products are shown to work with plants such as basil or tomatoes.

According to cannabis growers who responded to the web survey, it is common for them to use their lights to grow non-cannabis products in addition to the cannabis that they grow. Figure 15 shows that this is more common among respondents with florescent lights (42 to 50%) or LEDs (49%), although the difference is only significant between LEDs and metal halides (21%).

When indoor agriculture lighting systems are used for both cannabis and non-cannabis growing, they are typically used *primarily* for cannabis. The green bars in Figure 15 show the percentage of responding growers who use a type of light who reported that they use their lights for both cannabis and non-cannabis. The grey bar shows the percentage of

responding growers who use a type of light and reported that cannabis is the *main* purpose of those lamps.

Figure 15: Use of Lighting Types for Non-Cannabis Related Growing, of Web Survey Respondents



We did not probe on what the specific applications were other than cannabis, but common indoor agriculture applications include herbs and vegetables.

Seven of eight indoor agriculture retailers estimated that the vast majority of customers who purchase lighting equipment at their stores are cannabis growers, most of whom openly discuss their growing intentions with the retailers. Two of the lighting manufacturers noted that while in the residential setting cannabis may be a primary application, they have significant commercial greenhouse segments of their business that sell lighting for cut flower businesses as well as vine crops (such as tomatoes, cucumbers, and peppers) and leafy greens.

4.2.6 Grow Cycles

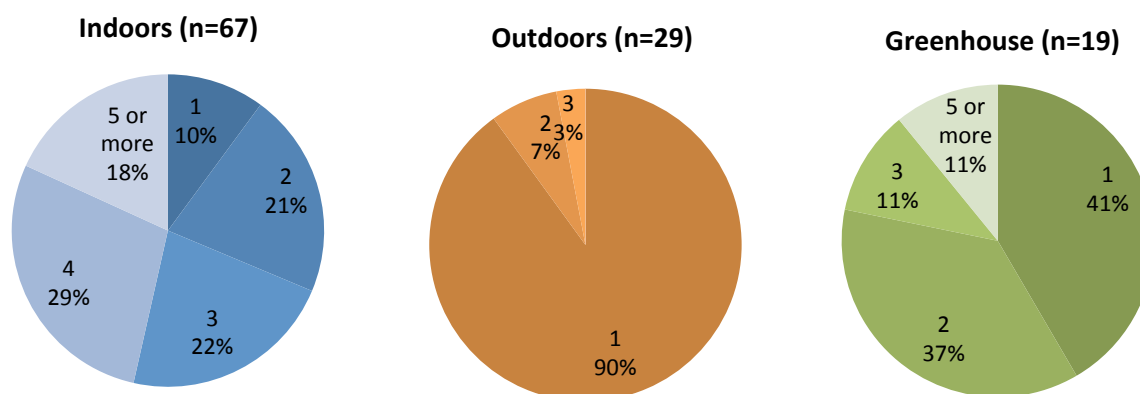
For home growers in Oregon, one of the primary differences between indoor and outdoor grow operations is the effective length and number of grow cycles per year. While indoor growers can supplement lighting needs for cannabis plants throughout the year, outdoor growers are generally dependent on the warmer months for production. Seventy-two

percent of indoor growers who responded to our survey (n=73) said they grow indoors all year round. Web survey responses indicate that Oregon’s seasons affect grower choices:

- **Sixteen percent of respondents who grow indoors said that they grow indoors during the non-summer months only.**⁴⁰ These respondents all have outdoor grow operations that they can use during the summer months.
- Only 20 percent of outdoor or greenhouse growers said they grow in their outdoor or greenhouse facility year round, **while the majority of outdoor and greenhouse growers (69%) grow in those facilities from late spring (April) through fall (October).**

Figure 16 below highlights how these grow types impact the number of expected grow cycles per year. Sixty-nine percent of indoor growers expect three or more grow cycles per year, compared to only 22 percent of greenhouse growers and 3 percent of outdoor growers. No outdoor growers expected four or more cycles.

Figure 16: Expected Number of Annual Grow Cycles By Grow Type⁴¹



These findings for indoor growing are consistent with grow cycle estimates provided by market actors we interviewed, who said 90 days (which equates to four cycles in a year) is a standard cycle length. However, they did note that configuration – including the number and types of lights and plants and the distance from the plant to lights – can impact the length of the grow cycle for home growers, potentially making their grow cycles longer

⁴⁰ This 16 percent accounted for 12 growers, all of whom grew both indoors and outdoors, indicating that Oregon’s seasonality may have some influence on when and where home growers decide to grow.

⁴¹ No greenhouse growers reported four annual cycles.

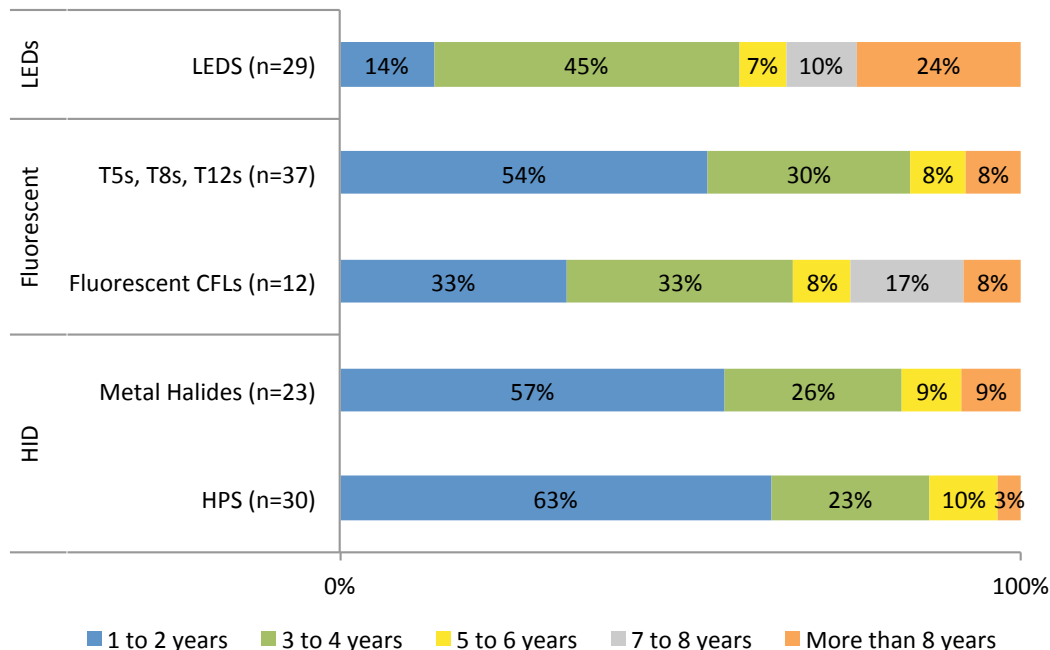
than an established commercial grow operation. This may be done by growers intentionally in the vegetative stage to increase the yield of the plant.

4.2.7 Expected Useful Life and Operating Hours

Given longer run times and high wattages, indoor grow lights typically have a lower expected useful life (EUL) than other types of home lighting. The EULs also vary between different lighting types. For example, five of the market actors we interviewed noted that most LED options have five-year warranties and may be expected to last up to 10 years depending on usage, compared to higher wattage HID lighting – such as HPS and metal halide – that have shorter warranties and require bulb replacements every six to 12 months.

Growers who responded to our web survey also have different lifetime expectations for different lighting types. Figure 17 shows that LEDs and CFLs are expected to last longer than HIDs. Over half of growers with HPS and metal halide lights expect them to last only one to two years (63% and 57% respectively), compared to only 14 percent of growers with LEDs. While 45 percent of growers with LEDs expect their lights to last only three to four years, an additional 34 percent of those growers expect them to last seven or more years.

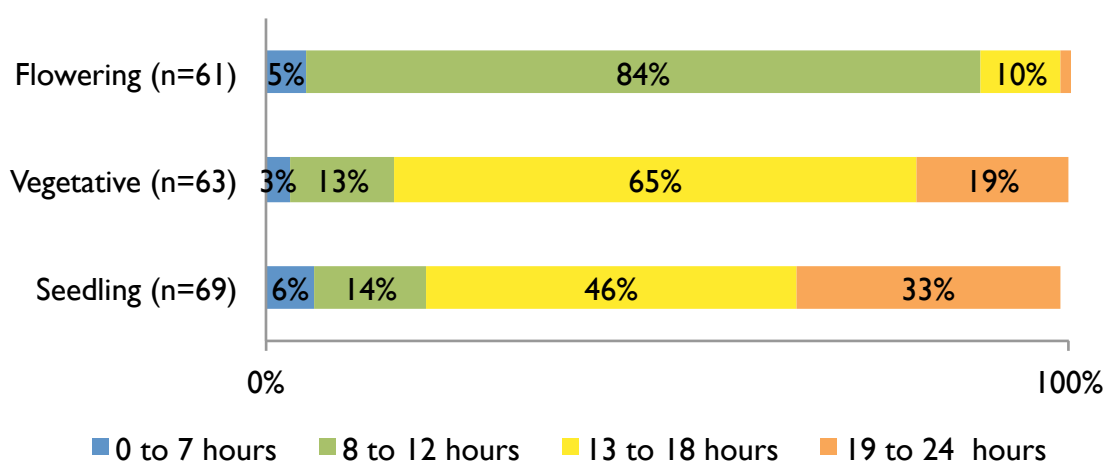
Figure 17: Expected Lifetime from Web Survey Respondents by Lighting Type



To better understand how web survey respondents came up with their EUL estimates, Evergreen also asked growers how many hours they used their lights during the different growth cycle stages. As shown in Figure 18, the majority of respondents who use grow

lights run them longer in the seedling and vegetative stages than in the flowering stage, with 33 percent of respondents running their lights 19 hours or more per day in the seedling stage and 19 percent who do so in the vegetative stage. Lights are run much less frequently during the flowering stage. During the flowering stage, the majority of respondents who use lights run their lights between eight and 12 hours per day (84%). These findings are consistent with estimates provided by four of the market actors we interviewed who frequently discuss expected operating times with less-experienced home grower customers.

Figure 18: Lighting Run Times from Web Survey Respondents by Growth Stage



Given the long run times throughout the growth cycle, a majority of home growers indicated in the web survey that they utilize their lights across the early morning, late morning, early afternoon and evening. In the flowering stage, the most common run time schedule was using lighting in the early morning and evening or in the morning and early afternoon, not throughout the entire day like other stages in the growth cycle.

4.3 Ancillary Products

In this section, we discuss other energy-consuming equipment that home growers may use, including HVAC equipment and timers.

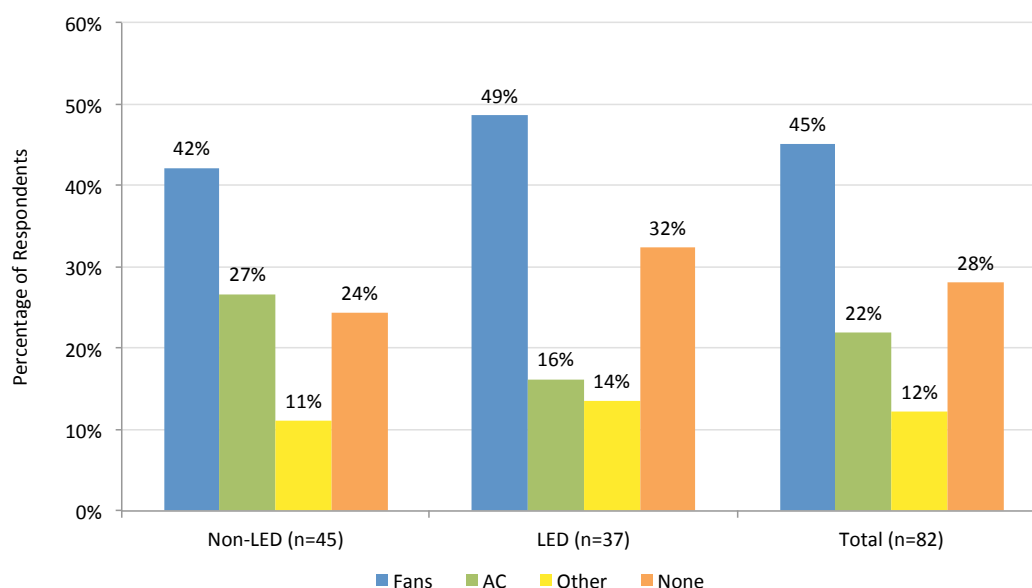
While lighting remains the primary driver of energy usage for home growers, ancillary products that are required to heat, cool or ventilate the plants also increase indoor growers' energy consumption. Given that grow lighting equipment often consists of high wattage lamps, growers may utilize cooling and ventilation to help combat the excess heat produced by their lighting equipment. Previous national research found that cooling and ventilation together could account for up to 50 percent of the energy requirements for certain commercial indoor grows; however, there are no statistics on the cooling and

ventilation load in the residential market given the diversity in grow set ups and lack of formal permitting and tracking.⁴²

4.3.1 Cooling

Among indoor growers who responded to our web survey questions related to cooling (n=82), 72 percent said they use at least some type of equipment for cooling their cannabis plants. As shown in Figure 19 the most common cooling equipment types reported by web survey respondents who use cooling equipment (n=59) included basic fans (ceiling, oscillating, exhaust, etc.) (67%) and air conditioners (central, portable, and window) (29%). While there were no differences in the reported frequencies of fan usage across growers with LEDs versus those without LEDs, 42 percent of growers without LEDs who used cooling equipment (n=33) reported using air conditioners compared to only 24 percent of LED users (n=25), presumably because of the lower cooling requirements for LEDs. Other cooling methods included constant air intake setups and, in one case, a ductless mini-split system.

Figure 19: Percentage of Respondents with Cooling Equipment Types, by Respondents with LEDs and Those Without LEDs



4.3.2 Heating

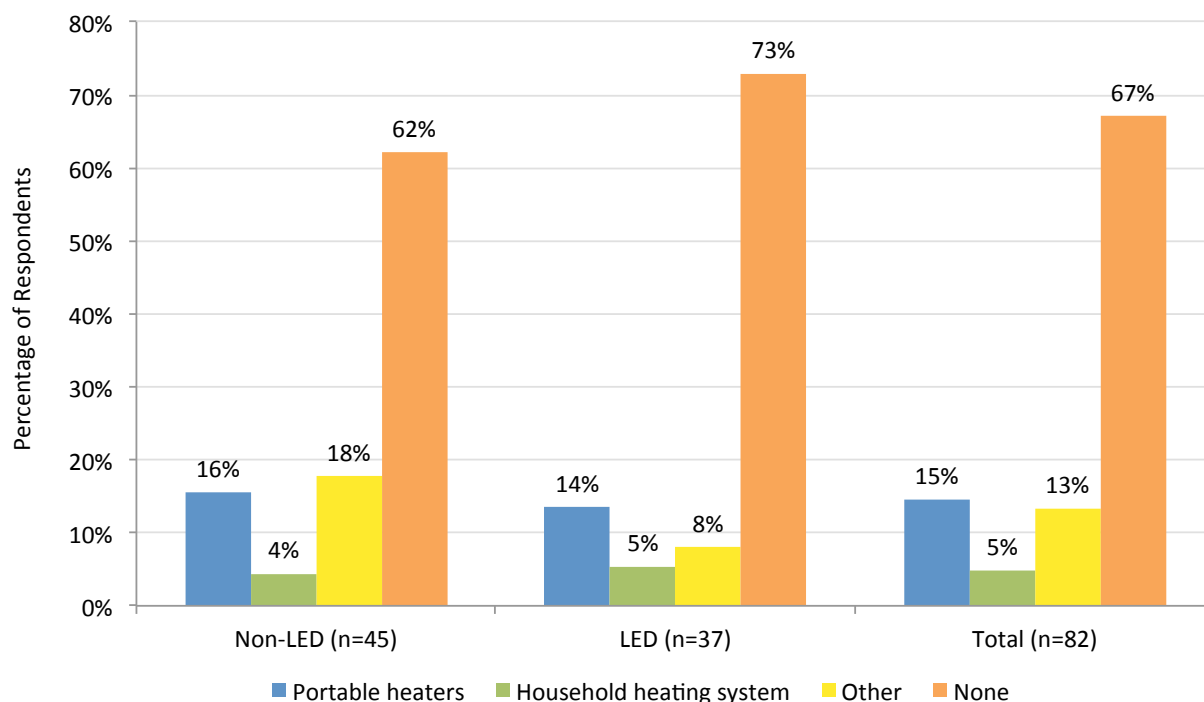
Heating is generally less of a concern for home growers, as the most common lighting types – such as HID lighting like metal halides and HPS – sufficiently heat the plants. We

⁴² David Podorson. "Harvesting Energy Savings in Cannabis Cultivation Facilities: Quick Wins for Cultivators and Utilities." September 2015. <https://www.esource.com/TAS-F-18/CannabisCultivation>

found this to be the case based on web survey respondents who use lighting (n=82) who responded to questions regarding HVAC needs; only 33 percent said they use some heating elements in their home grow beyond any heat output from their lighting.

As shown in Figure 20 of indoor growing web respondents who use heating (n=39), the most common equipment was some type of portable space heater (56%) that could be turned off and on as needed. Despite the fact that LEDs produce less excess heat than other types of lighting, there were no statistically significant differences in the frequency of supplemental heating equipment used by LED-using and non-LED-using growers. Other heating equipment that was mentioned included propane burners (n=4) and household heating equipment (such as a heat pump or dual split system) (n=3).

Figure 20: Percentage of Respondents with Heating Equipment Types, by Respondents with LEDs and Those Without LEDs



The following table presents information on grow location in homes, drawing on information provided by web survey respondents.

Table 13: Location of Home Grow in Home

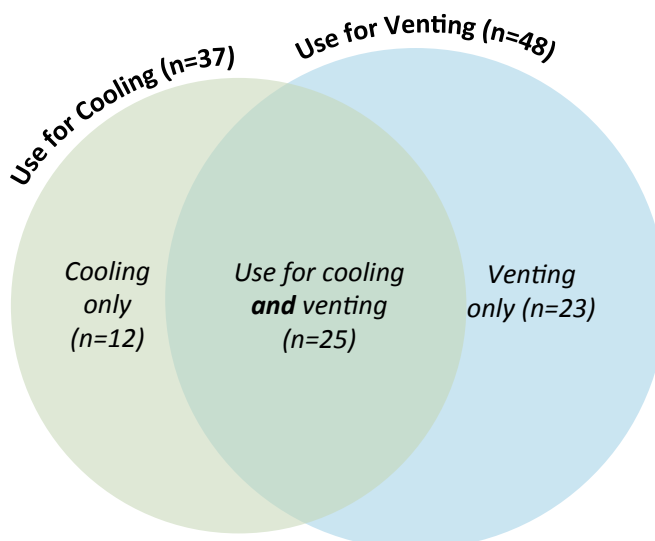
Location of Home Grow	Percentage of Total Growers (n=66⁴³)	Percentage with Cooling	Percentage with Heating
Garage	32%	81%	43%
Bedroom	23%	87%	40%
Finished Basement	17%	73%	64%
Unfinished Basement	15%	80%	80%
Closet	12%	75%	13%
Other	9%	33%	33%
Outside Shed/Structure	9%	50%	50%
Bathroom	3%	50%	0%

4.3.3 Ventilation

Seventy-six percent of indoor growing survey respondents said they use exhaust and inline fan equipment for ventilation (n=48). In general, these are smaller fans ranging from 6 to 10 inches; however, a couple of the home growers in our sample who grow more than four plants indicated they have larger fans between 24 inches and 50 inches. As shown in Figure 21, 42 percent of fan users (across cooling and ventilation) reported using fans for both cooling and ventilation purposes, 38 percent reported using fans just for venting, and 20 percent reported using them just for cooling.

⁴³ This total reflects the total number of indoor growers who completed this survey question. The percentages reflect the number of mentions for each location divided by the total number of growers, not responses, as some growers reported having grows in multiple locations. (Q49, Q4)

Figure 21: Fan Purpose Among Web Survey Respondents Who Use Fans (n=58)



Additionally, one of the specialty retailers we interviewed noted that more complex home grow systems also include carbon filters and ducting – usually in conjunction with fans – which help blow the exhaust out of the grow site without containing the smell of the cannabis plants.

While heating, cooling, and ventilation are reportedly used by a significant segment of home growers, the indoor agriculture retailers (n=8) described these needs as secondary to lighting given that most home growers are growing on a smaller scale than commercial indoor facilities and do not require additional HVAC systems like a commercial grower would. Nevertheless, these ancillary products still impact overall energy consumption for home growers, as they typically have long operating hours to support the energy-intensive lighting they are often installed to support.

4.3.4 Grow Kits

Over half of the indoor agriculture retailers we interviewed noted that they sometimes offer small grow kits for home growers that include equipment beyond just lighting. At a basic level, these kits may include lights, nutrients, small grow tents, small fans, and timers, while complex versions may include pH control kits, trimming equipment, and additional soil. Eight of the market actors – including six retailers and two manufacturers – noted that these kits are generally not packaged by the lighting manufacturers, but are more commonly assembled by distributors or retailers. Additionally, while the grow kits are attractive to some less-experienced home growers, four of the retailers noted that they are not typically used among growers in Oregon – especially the more experienced growers – and do not comprise a notable percentage of sales. Results from the web survey indicate that 27 percent of respondents who use

lighting purchased their equipment as part of a kit. Some web survey respondents think of a “kit” as a set of equipment that they purchase at the same time rather than a specific pre-packaged kit to which retailers are referring.

4.3.5 Timers

Because growers traditionally need to operate on long 12 to 24 hour lighting cycles, timers may be used to maintain grow schedules. Within our sample, 91 percent of growers who use lights reported using timers for their lights across all three growth stages (n=73).

Overall, the timer settings varied by stage, as a majority of growers with lighting reported using 24 hour timers during the seedling stage (53%, n=17), 18 hour timers during the vegetative stage (73%, n=37), and 12 hour timers during the flowering stage (100%, n=34).⁴⁴

4.4 Market Size

Given the lack of licensing and historical data, estimating the market size of the residential cannabis market is considerably more difficult than estimating the size of the commercial market. However, using a combination of web survey results and market actor input, we developed preliminary estimates of the potential number of home growers across Oregon. We summarize the estimates in Table 14 below.

⁴⁴ Percentages are based on the number of growers who reported timer settings specific for that stage of the growth cycle.

Table 14: Market Estimate Data

Estimate Subject and Source	Residential Specific	Geographic Area	Estimate	Year
Manufacturer Estimate	Yes	US	500,000 households nationwide	2015
Medical grow sites - Oregon Health Authority	No	Oregon	33,194 medical marijuana grow sites	2015
Marijuana Usage in Past Year – Substance Abuse and Mental Health Services Administration ⁴⁵	N/A	Oregon	23.19% of residents age 18 and over (compared to 13.85% nationally). This is up from 14.01% in 2008-2009.	2015-2016
Percentage of users who grew their own cannabis ⁴⁶	N/A	US	2.3% in 2013 1.1% in 2014* *Significantly higher in states where medical marijuana was legalized at time of interview (1.92% compared to 0.55%). ⁴⁷	2014

Using the national and state level numbers from the Substance Abuse and Mental Health Services Administration, we estimate that the total percentage of the population (over 18) that grows their own cannabis in Oregon is 0.45 percent (1.92 percent of the 23.19 percent of the population that uses cannabis).⁴⁸ This estimate uses a combination of national and state level data and assumes that recreational cannabis is illegal, which means this estimate may be on the low end of the actual percentage of growers.

⁴⁵ 2015-2016 National Survey on Drug Use and Health: Model-Based Prevalence Estimates: 50 States and the District of Columbia.

<https://www.samhsa.gov/data/sites/default/files/NSDUHsaePercents2016/NSDUHsaePercents2016.pdf>

⁴⁶ Results from the 2014 National Survey on Drug Use and Health: Detailed Tables.

<https://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs2014/NSDUH-DetTabs2014.htm#tab6-44b>

⁴⁷ Substance Abuse & Mental Health Data Archive. *National Survey on Drug Use and Health, 2014.*

[http://pdas.samhsa.gov/#/survey/NSDUH-2014-](http://pdas.samhsa.gov/#/survey/NSDUH-2014-DS0001?column=MEDMJST2&results_received=true&row=MMGETMJ&weight=ANALWT_C)

[DS0001?column=MEDMJST2&results_received=true&row=MMGETMJ&weight=ANALWT_C](http://pdas.samhsa.gov/#/survey/NSDUH-2014-DS0001?column=MEDMJST2&results_received=true&row=MMGETMJ&weight=ANALWT_C)

⁴⁸ We did not put this as a total percentage of the population since this number is a rough estimate.

Extrapolation should not be done without understanding the full context and the calculations behind the rough estimate.

We expand upon the manufacturer and medical estimates below.

Manufacturer Estimates

As a result of the legalization of commercial grows for recreational cannabis, three of the participating grow lighting manufacturers noted that the majority of their sales have shifted toward commercial grows. However, none of the market actors we interviewed knew exactly how many home growers there are in the market today. One lighting manufacturer noted that in 2015, they were part of a national research effort to estimate the home grower market prior to widespread legalization. They estimated that the national home grower market was comprised of approximately 500,000 households, accounting for a \$200 million lighting industry.

While uncertainty around regulation remains an issue, the majority of market actors we interviewed – both lighting manufacturers and indoor agriculture retailers – noted that they expect the number of home growers in Oregon is currently at its peak, and may start to decline as some hobbyists decide to stop, either because the novelty of growing wears off or because they can easily purchase cannabis legally at dispensaries. Three market actors directly compared the home grow market to the home brewer market within the beer industry. They believe a certain percentage of growers will continue growing at home regardless of how accessible purchasing marijuana becomes in Oregon (there are 540 licensed retail dispensaries as of 2018) because of the “craft” of their product.⁴⁹

Medical Grow Sites

A 2016 report published by the Oregon Health Authority cited that as of late 2015, there were 33,194 medical marijuana grow sites across Oregon, supplying approximately 78,000 medical marijuana users.⁵⁰ That same study found that adult usage (for those 26 and older) of recreational cannabis in Oregon had doubled from 2006, while nationally the percentage of users had increased only slightly.

Recreational Usage

The same study mentioned in the Medical Grow Sites section above, estimated 1 in 10 adult Oregonians (approximately 288,000) currently use recreational marijuana.⁵¹

⁴⁹ http://www.oregon.gov/olcc/marijuana/Documents/Approved_Retail_Licenses.pdf

⁵⁰ <http://www.oregon.gov/oha/ph/PreventionWellness/marijuana/Documents/oha-8509-marijuana-report.pdf>

⁵¹ Based on U.S. Census Bureau data analysis.

5 Summary of Findings and Recommendations

Key findings are summarized below, with additional details on the findings and analysis methods in the main body of the report. Findings are organized by the following four categories: home grower characterization, lighting market characterization, ancillary products, and market size.

5.1 Findings

Home Grower Characterization

- What are the demographics, including income range, of home growers?
- Where are home grows occurring (i.e., single-family residences, apartment buildings, manufactured homes)?

While home growers who responded to the web survey are most likely to live in single-family detached homes, **there is no significant variation in how respondents set up their grow operations in terms of location (outdoors, indoors, or in a greenhouse) or with regards to lighting usage** across different home types. Additionally, a third of the respondents who grow indoors reported being renters, suggesting it is not a significant barrier to indoor growing. This was contradicted by two of the eight interviewed indoor agricultural retailers who suggested that lack of permission from a landlord could be a barrier to renters growing cannabis.

Where growers decide to place their plants inside their homes can have implications on energy usage, as some spaces are more likely to be unconditioned than others (including unfinished basements, outside sheds, and garages) and may require additional heating or cooling of plants. **Almost half of respondents (47%) reported growing in at least one or more of the following spaces: unfinished basements, sheds, and garages.**

Reported incomes of web survey respondents mirrored that of the broader Oregon population, but higher incomes were more common among growers who use lights compared to those who do not use lights, suggesting **growers with higher incomes may be more likely to grow using lights.**

We noted differences in growing patterns and experience based on the age of the grower. **Younger growers grow in spaces that are more likely to be unconditioned more often than older growers, and also reported having more experience growing cannabis as compared to their older counterparts (55 years or older).**

Lighting Market Characterization

- What grow light features are most important to customers and how well do products from each lighting category deliver these features?
- What is the lumens per watt for each lighting product type?

The web survey prompted respondents to rate the importance of various influences on their grow lighting purchases. **Growers indicated that color spectrum, energy efficiency, wattage, heat output, expected life, and purchase price were the most important factors when deciding which lighting type to install.**

Findings from growers and specialty retailers may indicate that certain technical components of the lighting equipment that impact yield quantity and quality are not primary drivers for home growers in the same manner they would be for commercial growers.

- What is the market share for each lighting product type (e.g., LED, high-pressure sodium)?
- How important do grow light retailers and other market actors feel that the following product attributes are to their customers? (lumens, wattage, light spectrum, heat output, etc.)
- What lighting products are currently being sold for home grows and is there a distinct class of products that are appropriate for the four-plant limit and not for large scale grow operations?
- What are the specifications and retail prices of efficient and less efficient lighting products?
- How are lights configured? (e.g., number of lights, are timers used, proximity to plants)?

Home growers can choose from three categories of lighting: LEDs, fluorescent lamps (CFLs, T5s, T8s, T12s), and high intensity discharge lights (HIDs, which include high-pressure sodium [HPS], metal halide [MH] and ceramic metal halides [CMHs]), or they may opt not to use any artificial lighting at all and rely only on natural light.⁵² Specialty retailers reported that LEDs and CMHs are the most energy-efficient options for home growers who use lighting.

⁵² Survey recruitment focused on indoor growers specifically, but respondents were comprised of indoor, outdoor, and greenhouse growers. Twenty-three percent of the web survey respondents reported growing only outdoors, thus using no lighting in their cannabis grow operations.

Fifty-five percent of web survey respondents who use lighting for cannabis growing use more than one type of lamp. The most commonly reported combination of lighting was fluorescent with HIDs. The most frequently reported reason for purchasing a certain lighting type varied, with HPS and MH lamps being purchased most often for color spectrum and LEDs being purchased for lower operating costs. Our web survey results align with specialty retailer interview responses indicating that over 50 percent of growers purchase HIDs.

The remaining 45 percent of web survey respondents who use lighting use only one type to grow cannabis. **Nearly half of this group relies only on LEDs across all growth cycles.** Specialty retailers who we interviewed reported that LEDs were not very popular. This is inconsistent with the web survey findings, likely because the majority of growers who use LEDs purchase them online rather than in a specialty retail store. We found that **growers who produce cannabis for medical use are more likely to report having more than four plants in their household.** Overall, 61 percent of respondents reported having more than four plants, which means that those growers likely have more grow lights compared to those who only grow four plants or fewer.

- Are products used for home grow operations also being used for other indoor horticulture/agriculture (non-cannabis) production that would affect hours of use?

Nearly half of all web survey respondents use their LEDs and/or fluorescent lights to grow plants in addition to cannabis. The large majority of these respondents reported that despite growing other plants, cannabis growing is the main use of these lights.

- What are the channels through which lighting products are sold (e.g., specialty retailers, big box/DIY stores, online), and what is the market share for each channel?

According to web survey results, while organic gardening and hydroponic retailers were the most common lighting purchasing channel, **purchasing behavior varied across lighting types.** For example, over half of respondents who use HPS, metal halides, and T5s purchased them at specialty (hydroponic) retailers, compared to only 18 percent of respondents who purchased LEDs. Online purchasing was the most prevalent retail channel for growers purchasing LEDs, as 58 percent purchased their lights on either Amazon or an alternative online retailer.

- Are integrated ‘grow kits’ being sold that are designed for home growers in Oregon (i.e., a pre-packaged option that includes all equipment needed to grow cannabis)?
- What is the market share for kits? How does their energy use compare to a piecemeal setup or other configuration?

As reported during interviews with specialty retailers, kits are generally put together by distributors or retailers (not manufacturers) and may include lights, nutrients, small grow tents, small fans, and timers. **Twenty-seven percent of web survey respondents reported buying their lighting as part of a kit.**

What is the expected useful life of home grow lighting products (i.e., length of warranty and/or number of hours before equipment burns out or fails)?

How are these lighting products typically used by customers? Specifically:

- How many hours are these lighting products used per day throughout the grow cycle, and for what duration of time is the grow cycle in Oregon?
- What is the typical number of grow cycles per year by the average home grower?
- How long do customers typically use these types of products?
- Does seasonality impact the number of grow cycles per year?

Cannabis growing occurs in cycles (from seeds to flowering plants). The number of expected grow cycles per year by respondents differed across grow type (indoors, outdoors, and greenhouses), with the **majority of growers expecting one annual cycle outdoors, one to two cycles in greenhouses, and three or more cycles per year in indoor settings.** Market actors reported that a grow cycle generally lasts for 90 days. The 90-day grow cycle estimate aligns with the findings regarding the indoor grow cycles where 47 percent of web survey respondents reported expecting four or five grow cycles in the span of a year.

Given longer run times, **indoor grow lights typically have a lower expected useful life (EUL) than other traditional types of home lighting.** The EULs also vary between different lighting types. Web survey respondents had slightly different expectations regarding LEDs, with only **41 percent of indoor growers expecting LEDs to last more than four years** (compared to the five- to ten-year range reported by market actors), but had similar expectations with regards to HIDs (with web survey respondents reporting that **metal halides and HPS lights would last only one or two years the majority of the**

time). The different expectations for LEDs may stem from current LEDs being a newer technology that growers are less experienced with than traditional HID lighting.

One grow cycle includes three main stages: seedling, vegetative, and flowering. These stages can range from two to three weeks for the seedling stage, up to two to eight weeks for the vegetative stage, and six to eight weeks for the flowering stage.

Many web survey respondents grow across some combination of indoors, outdoors, or in a greenhouse. **Sixteen percent of respondents who grow indoors said that they grow indoors during the non-summer months only.** These respondents all have access to outdoor grow areas that they can use during the summer months, suggesting that **change in seasons may have some influence on when and where home growers decide to grow.**

Ancillary Products

- Are there ancillary products (such as cooling equipment or fans) that impact the expected energy consumption of home growing operations?
- Are lighting timers used?

The majority of indoor growers who responded to the web survey (72%) use some form of cooling because of the excess heat produced by their lighting equipment. These cooling products mostly included basic fans, although 29 percent of respondents reported using some type of air conditioner. Air conditioners were less common among growers who use LEDs, although this difference was not statistically significant. The majority of respondents who reported using a fan for cooling also reported using fans for ventilation. Overall, 73 percent of growers who responded to questions regarding HVAC requirements used a fan for either cooling or venting the space where they grow.

Heating is not as common as cooling, with only 33 percent of indoor growers who responded saying they use some form of heating for their grow operation.

Lighting timer use was very prevalent among web survey respondents, with 91 percent of survey respondents who use lighting saying that they have timers.

Market Size

- What is the size of the home grow lighting market?
- What area(s) of the state contain(s) most home growers?

We estimate the total percentage of the population in Oregon (over 18 years old) that grows their own cannabis is 0.45 percent. This includes indoor, outdoor, and greenhouse growers.

The proportion of growers who responded to our survey closely mirrored the population across all four regions. **Almost half of the growers who responded to the web survey (49%) reside in the Portland Metro region.**

5.2 Recommendations

Below, we make recommendations regarding what type of energy-efficiency program intervention may be appropriate for Oregon home growers to reduce their energy consumption, and deliver cost-effective energy savings.

At least half of the web survey respondents use at least one LED in their home grow operation, suggesting that there is some acceptance of this technology in the market. About half of these growers who use LEDs *also* use other lighting, suggesting that **any program that incentivizes LEDs needs to account for the fact that growers may be only using these for some of their plants or for only a portion of the growing cycle.** This may change as LED technology advances to allow users to change the spectrum of lighting across the grow cycle. Allowing growers to use LEDs alongside other lighting may be an important step in having growers test and trust the technology before using it exclusively in their cannabis home grow operations.

Over the course of our research, we heard from specialty retailers that ceramic metal halides (CMHs) are often offered as an energy-efficient lighting option in lieu of LEDs. While our web survey asked respondents about metal halides, we did not specifically inquire about *ceramic* metal halides. **Given the finding that these are being recommended in specialty retail shops and are rebated through some utility energy efficiency programs, we suggest further research be done to understand if ceramic metal halides are a viable energy efficiency lighting option for home growers.**

Any program design should consider that the majority of LEDs are purchased online, and not in a specialty retail store. There may also be a lack of independent quality verifications on LEDs sold online. Most non-energy-efficient lighting is purchased in retail shops. By focusing a program in the specialty retail channel, Energy Trust may have a better chance of reaching growers who are less inclined to purchase LEDs. Energy Trust could also work to increase the stocking of LEDs in specialty retail stores.

If Energy Trust decides to proceed with incentives for this sector, **we recommend that it consider the distinction between home growing for recreational use and home growing for medical use.** Oregon regulation allows medical growers to also grow cannabis for other medical patients, thus using additional energy to light additional plants. Our web survey results show that respondents who grew for medical use were more likely to report growing more than four plants (which is the legal recreational limit per household). There may be larger potential for energy savings from medical growers, and **we recommend that any program design include medical growers. Energy Trust also should be careful not to**

limit the number of incentives per household to a number that only considers the recreational four-plant limit.

Appendix A: Market Actor Interview Guides

6 Sampling Plan and Recruitment Strategy

As shown in Table 1, Evergreen will aim to complete between 4 and 8 interviews for each interview group, for a total of no less than 22 interviews.

Table 1: Market Actor Interview Targets

Interview Group	Target Completes
Lighting Manufacturers	4
Lighting Distributors	6
Home Improvement / Hardware Retailers	4
Indoor Agriculture / Cannabis-specific Retailers	8
Total	22

For retailers, Evergreen will stratify across four distinct Oregon regions to ensure that we interview a representative sample of market actors based on the population data for each region. These regions include the Portland Metro region, the Northwest Oregon region (excluding Portland Metro), the Southern Oregon region and the Eastern Oregon region. These regions have been identified based on Energy Trust of Oregon’s 2016 Annual Report in conjunction with previous research conducted by Evergreen Economics for Energy Trust.⁵³

The market actors will be assigned to a particular region based on their county. We will then sample the possible interviewees in each region by randomly assigning IDs to each of the firms within each stratified market actor interview group. We will attempt to interview market actors according to the assigned ID by contacting them a total of three times through a combination of phone calls and emails depending on the available contact

⁵³ Given the relatively small number of completed interview targets, we combined regions from Energy Trust of Oregon’s 2016 Annual Report to create more consolidated regions across the state. This included combining the North Coast and Willamette Valley regions, along with the Central and Eastern Oregon regions. We will not create a stratified sample for manufacturers or distributors.

information. If we have both phone numbers and emails, we will follow up our first phone call with an email. If we do not successfully schedule an interview after the third attempt, we will move to the next market actor.

Table 2 outlines the estimated percent of the state’s population within each designated area; this information comes from the Census.⁵⁴ Based on these population estimates, Evergreen has identified regional interview targets for both traditional hardware and home improvement retailers along with specialty indoor agriculture retailers, outlined in Table 3. The manufacturer and distributor targets are not regionally allocated because we assume that the vast majority of them operate across multiple regions. Given the relatively small amount of total interviews for each market actor group, we combined some of the targets across regions to ensure we capture an appropriate representative sample.

Table 2: Population by Region

Region	Population	Percent of Total Population
Portland Metro/Columbia River Gorge	1,813,839	44%
Northwest Oregon	1,268,293	31%
Southern Oregon	571,642	14%
Central/Eastern Oregon	439,691	11%
Total	4,093,465	100%

⁵⁴ <https://www.census.gov/quickfacts/fact/map/OR/PST045216#viewtop>

Table 3: Interview Targets by Region

Interview Group	Target Completes
Lighting Manufacturers	4
Lighting Distributors	6
Home Improvement / Hardware Retailers	4
Portland Metro/Columbia River Gorge	3
Northwest Oregon	
Southern Oregon	
Central/Eastern Oregon	1
Indoor Agriculture / Cannabis-specific Retailers	8
Portland Metro/Columbia River Gorge	4
Northwest Oregon	2
Southern Oregon	1
Central/Eastern Oregon	1
Total	22

In the event that we are unable to recruit enough interviewees to meet our targets for one of the market actor groups in a specific region, we will adjust our targets to capture an interviewee in the next most appropriate region. For example, if we are unable to recruit an indoor agriculture retailer in the Southern Oregon region (target of n=1), we will attempt to recruit an additional indoor agriculture retailer in the Central/Eastern region and vice versa.⁵⁵

To identify interviewees, we utilized Evergreen’s contacts from our prior cannabis industry research along with contacts from other previous studies conducted in the Northwest that include lighting distributors and manufacturers. Additionally, D+R leveraged their extensive industry contacts through their work with the Resource Innovation Institute and did a review of market actors in the state.

Table 4 shows the current number of interview contacts we have that fit into each category.

⁵⁵ This will be consistent with the approach for the Northwest region and the Portland Metro region

Table 4: Interview Contacts by Interview Group and Region

Interview Group	Total Contacts
Lighting Manufacturers⁵⁶	45
Lighting Distributors⁵⁶	10
Home Improvement / Hardware Retailers	111
Portland Metro/ Columbia River Gorge	67
Northwest Oregon	
Southern Oregon	44
Central/Eastern Oregon	
Indoor Agriculture / Cannabis-specific Retailers	71
Portland Metro/ Columbia River Gorge	25
Northwest Oregon	17
Southern Oregon	17
Central/Eastern Oregon	12
Total	237

Additional information on how each set of market actor contacts was created is included below.

Lighting Manufacturers

We developed the manufacturer contact list using existing contacts from D+R along with an extensive online search. The online searches began with a review of indoor agriculture/cannabis-specific Oregon retailer websites to identify what products and manufacturer lines they carried. This strategy enabled the Evergreen team to target lighting manufacturers that we know operate within the Oregon market, and that supply cannabis-specific equipment.

Lighting Distributors

The distributor contact list leverages a small number of existing contacts from D+R along with a collection of contacts derived from a list of NEEA and the Northwest Lighting Network’s distributor partners who operate in Oregon. Several of the distributors have multiple locations across Oregon and provide a wide range of lighting and other commercial and residential products.

⁵⁶ Manufacturers and distributors will not be stratified by region given the assumption that they operate across the entire state

To help supplement our current list of distributors, we will leverage our market actor interviews with manufacturers and retailers to ask about the lighting distributors with which they work. These distributors – if not already included – will be added to the distributor list.

Hardware/Home Improvement Retailers

We compiled the hardware and home improvement retailer sample using existing contacts from prior research conducted in Oregon. The sample includes a variety of both large and small retailers, including some with multiple locations across the state. We plan to limit the total number of interviews with large retailers to two, with each interview coming from a different chain of stores (i.e. Lowe’s, Ace Hardware, and The Home Depot).

Indoor Agriculture / Cannabis-specific Retailers

We developed the list of indoor agriculture and cannabis-specific retailers from multiple sources including existing D+R contacts, an extensive web search, and a review of Oregon media lists. One such list is the Willamette Week’s list of top grow shops in Oregon.

7 Market Actor Interview Guides

The objective of the market actor interviews is to collect the following information:

- Type, price, and volume of lighting equipment sold;
- Lighting equipment characteristics (watts, lumens, PAR, PPF);
- Customer perceptions and barriers to purchasing energy-efficient lighting;
- Customer priorities regarding lighting equipment relative to other costs;
- Importance placed on specific lighting features (lumens, wattage, color spectrum, heat output); and
- Market share of various lighting options.

Given the variety of experience each of the market actor groups may have in the cannabis industry, Evergreen developed unique guides for each interview group. While several questions are consistent across the various guides, each guide was created to help identify key insights based on each market actors’ role within the lighting market. The guides were modeled after the initial research questions, specifically linked to the topics that were categorized as primary or secondary data sources for the market actor interviews in the research plan. We map these questions to the research questions in Section 8.

The following subsections include each of the draft market actor interview guides including the initial recruitment text. As outlined above, we will recruit by phone or email depending on what contact information we have.

7.1 Lighting Manufacturers

Hi, this is _____ with Evergreen Economics, an energy efficiency research firm based in Portland, Oregon. We're calling on behalf of Energy Trust of Oregon, who contracted with us to conduct research on the residential cannabis industry. By residential cannabis industry, we are referring to legal home-growing in the state of Oregon.

As part of our research, we are conducting interviews with lighting manufacturers to learn more about the types of equipment used by residential growers.

Learning more about the type of equipment used by home growers will help Energy Trust evaluate the potential to create programs to promote energy-efficient products in the residential cannabis market.

Because we are studying equipment used for growing cannabis in homes, I want to assure you that all of your responses will be kept completely confidential. We will only be reporting in aggregate - no individual names or business names are shared in our reports. The purpose of our study is to inform possible development of programs that aim to promote energy-efficient products in the residential cannabis market.

[Screen for manufacturers that sell growing equipment.]

Does your firm manufacture any lighting equipment (lamps and/or fixtures) that may be used for growing cannabis in homes?[If needed: This may include high-pressure sodium lamps, metal halides, HID lamps, other types of fluorescents and other types of HID lamps, and indoor agriculture LEDs]

[If no: Thank and terminate call.]

[If yes] Are you familiar with your company's lighting products that may be used for cannabis growing?

[If not] Could you refer me to someone else at your firm that is knowledgeable about the equipment?

[When the correct person is on the phone: Repeat intro above.]

Great! Are you available to talk now for about 20-30 minutes about the residential cannabis market, or would you like to schedule a later time to talk? As a reminder,

anything you tell us will be kept confidential and will not be directly linked to you or your company in any way.

7.1.1 Background

Before we begin, to ensure we capture all the information in this interview, are you okay if we record the interview? The recordings will not be released outside of our study team and are for reference purposes only.

[IF PERMISSION GRANTED START RECORDING]: For the record, this is [NAME] with Evergreen Economics. [INTERVIEWEE], do I have your permission to record this interview for future reference?

[IF YES]: Thanks.

I'd like to start by finding out more about your company and your job in particular.

- M1. Can you tell me about your company's activity in the lighting business? [Probe on types of lighting products, primary focus, distribution region, etc.]
- M2. What is your position? [Probe on title and responsibilities.]
 - a. How long have you been in this position?
- M3. [If not specifically outlined in M1] Does your company specialize in any particular type of lighting?

[If yes] What type or types?

7.1.2 Lighting Equipment

Great! Now I have some more specific questions regarding the lighting equipment you offer that might be used for growing cannabis in homes.

- M4. What type of lighting equipment do you offer that may be used for growing cannabis? Common lighting types include high-pressure sodium lamps, metal halides, HID lamps, other types of fluorescents, and indoor agriculture LEDs. We are also interested in any fixtures you may manufacture.

[If answer is none, thank and terminate.]

- M5. Are any of these available lighting types made specifically for cannabis production?
 - a. [If yes] Which ones?
 - b. [If yes] Are any of these lighting types designed specifically for home growing versus large-scale operations? [If needed: As a reminder, we are primarily interested in residential grow equipment for this study.]

- i. [If yes] How so?
- M6. Are any of these available lighting types made specifically for other types of indoor agriculture?
 - a. [If yes] Which ones?
 - b. [If yes] What types of other applications?
 - c. [If yes] How do these other indoor agriculture markets compare to the home growing market? How do you tell the difference? [Probe on relative size of market, location, type of customer, equipment needs, etc.]
- M7. [If not mentioned in M4 or M5] Do you manufacture any pre-packaged 'grow kits' that are designed to include all of the equipment needed for home growing?
 - a. [If yes] Please describe what you include in these grow kits.
 - b. [If no] Do you know if any of your products are being packaged as part of a kit? If so, please describe.
- M8. What percentage of your overall lighting production – in terms of quantity of products – comes from lights [and grow kits if mentioned in M7] used in home grows?
 - a. What percentage of your production comes from [each response from in M4, M5 and M7]?
- M9. When did you start manufacturing the [lighting types mentioned in M4, M5, M6 and M7]? [Record for all types of grow lights mentioned.]
- M10. What were the primary factors in your company's decision to manufacture these lighting types? [Record for all types of grow lights mentioned.]
- M11. In your opinion, what lighting product features are most important to cannabis growers? *Remember, we are particularly interested in home growers.* [Probe on lumens, wattage, PAR, PPF, heat output, size, price, efficiency, light spectrum, etc.]
 - a. Why do you believe these features are most important to cannabis growers? [Probe on source of info.]
 - b. Are product spec sheets for these equipment types available online?
 - i. [If no] Can you send us product spec sheets following our call today via email? [Confirm best email address to contact.]

7.1.3 Lighting Efficiency

Now I'd like to learn a little more about the efficiency levels for the different types of products your company makes for the cannabis industry. [If needed: Please describe any differences in your experience operating in Oregon versus other states]

- M12. How do you measure the energy efficiency of the lights that you manufacture, and that are used in home cannabis production? [Probe on specific metrics such as PAR, PPFD, lumens, etc.]
- M13. Using this metric, what are the energy efficiency levels for each type of *standard* lighting equipment you offer for home cannabis growers? [Record for each type.]
- [If not mentioned] Do you know the lumens-per-watt ratio for each of these lighting types?
 - [If no] We may be able to calculate this information based on the product details of the equipment you offer. After the interview, would you be able to send the make and model number of the lighting equipment you offer so we could look up the lumens per watt?
- M14. Within each type of lighting, do you offer high-efficiency options?
- [If yes] For which lighting types do you offer high-efficiency options?
 - [If yes] Using [response from M12], what is the energy efficiency level for your high-efficiency lighting options?
 - [If yes and not mentioned in M14b] What is the lumens-per-watt ratio for these high-efficiency options?
- M15. And how do the energy efficiency levels vary across each lighting type? [Probe on types of lighting that are more or less efficient.]
- M16. What is the expected useful life (EUL) for each lighting type that you manufacture in terms of total hours? *If it is easier you could email us a spec sheet with this information.* [Record differences across lighting type. Record the units they use (years vs. hours).]
- [If M14=yes] Does the EUL vary between standard and high-efficiency options?
 - Based on the EUL, how long do you expect these lights to last (in years) in a home growing set up? [Probe on how this may translate to the number of grow cycles.]

7.1.4 Distribution and Pricing

Next I'd like to ask some questions related to how you distribute your lighting products and how you price specific lighting options for customers.

We understand it may be difficult to estimate the market share for retail sales of your lighting products. However, based on your experience, we are hoping to estimate the market share of how you distribute your products to distributors or retailers. This estimate will help us better understand how lighting products become available to customers.

- M17. For the lighting products you offer for home cannabis production, what methods of distribution do you use to sell these products to customers? [Probe on specific distributors, types of retailers (big box/DIY stores vs. specialty retailers), markets, etc.]
- a. [If multiple channels mentioned] For your lighting products, what is the approximate market share for each distribution channel? [Record for each type.]
- M18. Do your distribution methods vary from other non-cannabis lighting products you offer?
- a. [If yes] How so?
- M19. What is the suggested retail price for each type of cannabis grow light you offer? [Probe: Is this information available online or is it something you can supply via email? If so, we can capture the information after we complete the interview.]
- a. Do these prices vary for products with different efficiency levels?
 - i. [If yes] How so?

7.1.5 Customer Interaction/Conclusion

We are almost done, I just have a few more questions regarding any interactions you may have had with customers who grow cannabis at home.

- M20. Have you received any negative feedback or complaints from customers using your lighting equipment to grow cannabis at home?
- a. [If yes] Approximately how many complaints?
 - b. [If yes] What was the nature of these complaints?
 - c. [If yes] How were these complaints resolved?
- M21. Have you received any positive feedback from customers using your lighting equipment in cannabis home grows?
- a. [If yes] What was the nature of this feedback?
- M22. Over the next 3-5 years, do you think the residential grow light market in Oregon will increase in size, decrease in size, or remain about the same?

- a. Why do you say that?
- M23. Does your company have any plans moving forward to expand your product offerings for the cannabis industry? [Probe on differences between commercial and residential growing equipment.]
- a. [If yes] Please describe what type of expansion you are planning and why your company decided to pursue these options. [Probe on differences between commercial and residential growing equipment.]
 - i. Will this expansion include any new marketing efforts to sell more product offerings for the cannabis industry?
 - b. [If no] Are there any particular reasons why your company does not plan on expanding in this market?
 - c. [If no] Does your company have plans to expand marketing efforts for the current product offerings for the cannabis industry?

Thank you! Those are all of my questions. Is there anything else you think I should know about related to the lighting equipment used in cannabis home growing that I did not ask?

7.2 Lighting Distributors

Hi, this is _____ with Evergreen Economics, an energy efficiency research firm based in Portland, Oregon. We're calling on behalf of Energy Trust of Oregon, who contracted with us to conduct research on the residential cannabis industry. By residential cannabis industry, we are referring to legal home-growing in the state of Oregon.

As part of our research, we are conducting interviews with lighting distributors to learn more about the type of equipment used by residential growers.

Learning more about the type of equipment used by home growers will help Energy Trust evaluate the potential to create programs to promote energy-efficient products in the residential cannabis market.

Because we are studying equipment used for growing cannabis in homes, I want to assure you that all of your responses will be kept completely confidential. We will only be reporting in aggregate – no individual names or business names are shared in our reports. The purpose of our study is to inform possible development of programs that aim to promote energy-efficient products in the residential cannabis market.

[Screen for distributors that sell growing equipment.]

Does your company distribute any lighting equipment (lamps and/or fixtures) that may be used for growing cannabis in homes? [If needed: This may include high-pressure

sodium lamps, metal halides, HID lamps, other types of fluorescents, and indoor agriculture LEDs]

[If no: Thank and terminate call.]

[If yes] Are you familiar with your company's lighting products that may be used for cannabis growing?

[If not] Could you refer me to someone else at your company that is knowledgeable about the equipment?

[When the correct person is on the phone: Repeat Intro above.]

Great! Are you available to talk now for about 20-30 minutes about the residential cannabis market, or would you like to schedule a later time to talk? As a reminder, anything you tell us will be kept confidential and will not be linked to you or your company directly in any way.

7.2.1 Background

Before we begin, to ensure we capture all the information in this interview, are you okay if we record the interview? The recordings will not be released outside of our study team and are for reference purposes only.

[IF PERMISSION GRANTED START RECORDING]: For the record, this is [NAME] with Evergreen Economics. [INTERVIEWEE], do I have your permission to record this interview for future reference?

[IF YES]: Thanks.

I'd like to start by finding out more about your company and your job in particular. Throughout the interview, please remember that we are interested primarily on your experience within Oregon specifically.

- D1. To start, can you tell me about your company's activity in the lighting business?
[Probe on types of lighting products, primary focus, distribution region, residential vs. commercial lighting, etc.]
- D2. What is your position? [Probe on title and responsibilities.]
a. How long have you been in this position?
- D3. [If not specifically outlined in D1] Does your company specialize in any particular type of lighting?
a. [If yes] What type or types?

- D4. [If not specifically outlined in D1 or D3] And does your company serve a particular segment or segments of the residential market? [Probe on customer type and geographical region.]
- D5. [If not already mentioned] Does your company operate in other states besides Oregon? [If yes] Which states?
- D6. Over the last calendar year, approximately what percentage of your total sales came from lighting equipment specifically? As a reminder, we are interested in both lamps and fixtures.
- [If multiple states] What about the percentage of your total sales in Oregon specifically?

7.2.2 Lighting Equipment

Great! Now I have some more specific questions regarding the lighting equipment you offer that might be used for growing cannabis in homes in Oregon. [If needed: For this section, please specify whether your response is different for your experience in Oregon versus your experience operating in other states.]

- D7. What type of lighting equipment do you distribute that may be used for growing cannabis? Common lighting types include high-pressure sodium lamps, metal halides, HID lamps, other types of fluorescents, and indoor agriculture LEDs. We are also interested in any fixtures you may distribute. [If answer is none, thank and terminate.]
- Which manufacturers do you work with that make these lighting products?
- D8. Are any of the lighting equipment types you mentioned made specifically for cannabis production?
- [If yes] Which ones?
 - [If yes] Are any of these lighting/fixture types designed specifically for home growing compared to large-scale operations? [If needed: As a reminder, we are primarily interested in residential grow equipment for this study.]
 - [If yes] How so?
- D9. Are any of these lighting/fixture types made specifically for other types of indoor agriculture?
- [If yes] Which ones?
 - [If yes] What types of applications?

- c. [If yes] How do these other indoor agriculture markets compare to the home growing market? How do you tell the difference? [Probe on relative size of market, location, type of customer, equipment needs, etc.]
- D10. [If not mentioned in D7 or D8] Do you distribute any pre-packaged 'grow kits' that are designed to include all of the equipment needed for home growing?
- a. [If yes] Please describe what you include in these grow kits.
 - b. [If yes] How do your sales for grow kits compare to sales of other residential grow lights sold individually?
 - c. [If yes] Do you have any insights on the types of growers that may purchase one or the other? (e.g., new growers, growers who live in small spaces, etc.)
- D11. What percentage of your total lighting equipment sales – in terms of quantity of products – comes from lights [and grow kits if mentioned in D10] used in home grows?
- a. And what percentage of these sales comes from each type of cannabis lighting equipment that you offer?
- D12. When did you start offering the [lighting types mentioned in D7, D8, D10]? [Record for all types of grow lights mentioned.]
- D13. What were the primary factors in your company's decision to distribute these lighting types? [Record for all types of grow lights mentioned.]
- D14. In your opinion, what lighting product features are most important to cannabis growers? *Remember, we are particularly interested in home growers.* [Probe on wattage, PAR, PPF, heat output, size, price, efficiency, light spectrum, etc.]
- a. Why do you believe these features are most important to cannabis growers? [Probe on source of info.]
 - b. Are product spec sheets for these equipment types available online?
 - i. [If no] Can you send us product spec sheets following our call today via email? [Confirm best email address to contact.]

7.2.3 Lighting Efficiency

Now I'd like to learn a little more about the efficiency levels for the different types of products your firm offers for the cannabis industry. [If needed: Again, please describe any differences in your experience operating in Oregon versus other states.]

- D15. How do you measure the energy efficiency of the lights that you distribute, and that are used in home cannabis production? [Probe on specific metrics such as PAR, PPF, lumens, etc.]

- D16. Using this metric, what are the energy efficiency levels for each type of *standard* lighting equipment you offer for home cannabis growers? [Record for each type.]
- a. [If not mentioned] Do you know the lumens-per-watt ratio for each of these lighting types?
 - i. [If no] We may be able to calculate this information based on the product details of the equipment you offer. After the interview, would you be able to send the make and model number of the lighting equipment you offer so we could look up the lumens per watt?
- D17. Within each type of lighting, do you offer high-efficiency options?
- a. [If yes] For which lighting types do you offer high-efficiency options?
 - b. [If yes] Using [response from D15], what is the energy efficiency level for your high-efficiency lighting options?
 - c. [If yes and not mentioned in D17b] What is the lumens-per-watt ratio for these high-efficiency options?
- D18. And how do the energy efficiency levels vary across each lighting type? [Probe on types of lighting that are more or less efficient.]
- D19. What is the expected useful life (EUL) for each lighting type that you distribute in terms of total hours? *If it is easier you could email us a spec sheet with this information.* [Record differences across lighting type, record units used (hours vs. years).]
- a. [If D17=yes] Does the EUL vary between standard and high-efficiency options?
 - b. Based on the EUL, how long do you expect these lights to last (in years) in a home growing set up? [Probe on how this may translate to the number of grow cycles.]

7.2.4 Distribution and Pricing

Next I'd like to ask some questions related to how you distribute lighting products to retailers and customers, along with how you price specific lighting options for customers.

We understand it may be difficult to estimate the market share for retail sales of your lighting products. However, based on your experience, we are hoping to estimate the market share of how you distribute your products to other market actors such as retailers. This estimate will help us better understand how lighting products become available to end-users.

- D20. For the lighting products you offer for cannabis production, what distribution channels do you use to provide these products to customers? [Probe on specific types of retailers (big box/DIY stores vs. specialty retailers), markets, etc.]
- a. [If multiple channels mentioned] Approximately what percentage of your lighting equipment sales go through each of these channels? [Record for each type.]
- D21. Do the distribution channels vary from other non-cannabis lighting products you offer?
- a. [If yes] How so?
- D22. Are there particular regions of Oregon that have a higher demand for lighting equipment that can be used for residential cannabis production?
- a. [If yes] Which regions and why do you say that?
- D23. What is the retail price for each type of cannabis grow light you offer? [Probe: Is this information available online or is it something you can supply via email? If so, we can capture the information after we complete the interview.]
- a. Do these prices vary for products with different efficiency levels?
 - i. [If yes] How so?

7.2.5 Customer Interaction/Conclusion

We are almost done, I just have a few more questions regarding any interactions you may have had with customers who grow cannabis at home.

- D24. Have you received any negative feedback or complaints from customers using your lighting equipment to grow cannabis at home?
- a. [If yes] Approximately how many?
 - b. [If yes] What was the nature of these complaints?
 - c. [If yes] How were these complaints resolved?
- D25. Have you received any positive feedback from customers using your lighting equipment in cannabis home grows?
- a. [If yes] What was the nature of this feedback?
- D26. Over the next 3-5 years, do you think the residential grow light market in Oregon will increase in size, decrease in size, or remain about the same?
- a. Why do you say that?
 - b. [If increase or decrease] Are there any particular regions of the state that you think will [increase/decrease] more than others?

- D27. Does your company have any plans moving forward to expand your product offerings for the cannabis industry? [Probe on differences between commercial and residential growing equipment.]
- a. [If yes] Please describe what type of expansion you are planning and why your company decided to pursue these options. [Probe on differences between commercial and residential growing equipment.]
 - i. Will this expansion include any new marketing efforts to sell more product offerings for the cannabis industry?
 - b. [If no] Are there any particular reasons why your company does not plan on expanding in this market?
 - c. [If no] Does your company have plans to expand marketing efforts for the current product offerings for the cannabis industry?

Thank you! Those are all of my questions. Is there anything else you think I should know about related to the lighting equipment used in cannabis home growing that I did not ask?

7.3 Hardware Retailers

Hi, this is _____ with Evergreen Economics, an energy efficiency research firm based in Portland, Oregon. We're calling on behalf of Energy Trust of Oregon, who contracted with us to conduct research on the residential cannabis industry. By residential cannabis industry, we are referring to legal home-growing in the state of Oregon.

As part of our research, we are conducting interviews with lighting retailers to learn more about the types of equipment used by residential growers.

Learning more about the type of equipment used by home growers will help Energy Trust evaluate the potential to create programs to promote energy-efficient products in the residential cannabis market.

Because we are studying equipment used for growing cannabis in homes, I want to assure you that all of your responses will be kept completely confidential. We will only be reporting in aggregate – no individual names or business names are shared in our reports. The purpose of our study is to inform possible development of programs that aim to promote energy-efficient products in the residential cannabis market.

[Screen for retailers that sell growing equipment.]

Does your store offer any lighting equipment (lamps and/or fixtures) that may be used for growing cannabis in homes? [If needed: This may include indoor agriculture LEDs, high-pressure sodium lamps, metal halides, fluorescents and other types of HID lamps]

[If no: Thank and terminate call.]

[If yes] Are you familiar with your store's lighting products that may be used for cannabis growing?

[If not] Could you refer me to someone else at your store that is knowledgeable about the equipment?

[When the correct person is on the phone: Repeat intro above.]

Great! Are you available to talk now for about 20-30 minutes about the residential cannabis market, or would you like to schedule a later time to talk? As a reminder, anything you tell us will be kept confidential and will not be linked to you or your company directly in any way.

7.3.1 Background

Before we begin, to ensure we capture all the information in this interview, are you okay if we record the interview? The recordings will not be released outside of our study team and are for reference purposes only.

[IF PERMISSION GRANTED START RECORDING]: For the record, this is [NAME] with Evergreen Economics. [INTERVIEWEE], do I have your permission to record this interview for future reference?

[IF YES]: Thanks.

I'd like to start by finding out more about your company and your job in particular. Throughout the interview, please remember that we are interested primarily on your experience within Oregon specifically.

- H1. What is your position at your store? [Probe on title and responsibilities.]
 - a. How long have you been in this position?
- H2. [If not already mentioned] Does your store operate in other states besides Oregon?
[If yes] Which states?
- H3. Does your store specialize in any particular type of lighting?
 - a. [If yes] What type or types?

7.3.2 Available Cannabis Lighting Equipment

Great! Now I have some more specific questions regarding the lighting equipment you offer that might be used for growing cannabis in homes in Oregon.

- H4. Do you think any of the lighting equipment available in your store could be used in homes to grow cannabis? Common lighting types include high-pressure sodium

- lamps, metal halides, HID lamps, other types of fluorescents, and indoor agriculture LEDs. We are also interested in any fixtures available in your store. [If no, thank and terminate.]
- a. Which lights and fixtures that you sell do you think may be used in this way?
 - b. Of those lights and fixtures, which manufacturers do you carry?
 - c. And does your store purchase the lighting equipment directly from the manufacturers or do you work with lighting distributors?
 - i. [If lighting distributors mentioned] Which lighting distributors do you work with?
 - d. When did you start offering these lighting types?
 - e. Do you know what the primary factors were in your store deciding to sell these lighting types? [Record for all types of grow lights mentioned.]
- H5. [If LEDs not mentioned in H4] Why does your store not currently offer LED lights that may be used in cannabis home grows?
 - a. Do you anticipate this changing at all over the next year?
- H6. Are any of the lighting equipment types your store carries made specifically for cannabis production or other indoor agriculture? [If needed: As a reminder, we are primarily interested in residential grow equipment for this study.]
 - a. [If yes] Which types?
 - b. [If yes] Are any of these lighting types designed specifically for home growing compared to large-scale operations?
 - i. [If yes] How so?
- H7. [If not mentioned in H4 or H5] Do you offer any pre-packaged 'grow kits' that are designed to include all of the equipment needed for home growing?
 - a. [If yes] Please describe what is included in these grow kits.
 - b. [If yes] How do your sales for grow kits compare to sales of other residential grow lights that are sold individually?
 - c. [If yes] Do you have any insights on the types of growers who may purchase one or the other? (e.g., new growers, growers who live in small spaces, etc.)
- H8. Are the lights that can be used to home-grow cannabis located in a certain area in your store or identified in any way?
- H9. Do you have a sense for how many hours a day customers who grow cannabis at home are planning on using their lighting products? [Note that this is secondary to getting this information from growers.]
 - a. [If yes] Does this vary across lighting type? How so?

- H10. For the lights you've mentioned that can be used to grow cannabis, which of those lights are also used for other non-cannabis related activities such as other indoor agriculture or just lighting a room?
- [If yes] How do these other indoor agriculture markets compare to the indoor residential cannabis market? [Probe on relative size of market, location, type of customer, equipment needs, etc.]
 - What percentage of sales – in terms of quantity of products – for each of those lighting types we've discussed would you guess is for cannabis home grows?
- H11. What is the retail price for each lighting type we've discussed? Is this information available online? If so, we can capture the information after we complete the interview. [Record for each type of lighting.]
- H12. Over the last calendar year, approximately what percentage of your store's total sales came from lighting equipment specifically? As a reminder, we are interested in both lamps and fixtures.
- [If multiple states] What about the percentage of your total sales in Oregon specifically?
- H13. Approximately what percentage of your store's total lighting sales over the past calendar year would you estimate is from lighting that is purchased to grow cannabis indoors?
- Do you think there has been an increase in sales of lighting equipment used to grow cannabis since legalization?
 - How do you anticipate these sales will change over the next 3-5 years?
- H14. For all the lighting equipment that you offer that may be used to grow cannabis – can you rank them in terms of which ones are most popular amongst customers? [Probe on percentages for each lighting type, ask about popularity of LEDs if not mentioned.]
- Why do you think [lighting with the highest %] is the most popular choice for cannabis growers?
 - Why do you think [lighting with the lowest %] is the least popular choice for cannabis growers?
 - Has this changed at all over the last year? How so? [Probe on EE options, certain models becoming more popular, etc.]
- H15. Do you offer any equipment besides lighting that you believe is used in home grows?

- a. [If yes] Please describe what type of equipment and why you believe it is being used in cannabis production specifically. [Probe on how the equipment may increase or decrease overall energy usage.]
- H16. Based on your experience selling equipment used in home cannabis grows, what percentage of households in your sales area do you think grow cannabis? (Please specify what you think of as the sales region)
- a. How about for the entire state of Oregon?
 - b. How does this percentage of growers compare to other non-cannabis residential indoor growing markets such as salad greens, tomatoes, herbs or other fruits and vegetables? [Probe on larger or smaller market, differences in types of growers, etc.]

7.3.3 Lighting Efficiency

Now I'd like to learn a little more about the efficiency levels for the different types of products your firm offers for the cannabis industry. [If needed: Again, please describe any differences in your experience operating in Oregon versus other states]

- H17. How do you measure the energy efficiency of the lights you offer that may be used for home growing? [Probe on specific metrics such as PAR, PPF, lumens, etc.]
- H18. Using this metric, what are the energy efficiency levels for each type of *standard* lighting equipment you offer for home cannabis growers? [Record for each type.]
- a. [If not mentioned] Do you know the lumens-per-watt ratio for each of these lighting types?
 - i. [If no] We may be able to calculate this information based on the product details of the equipment you offer. After the interview, would you be able to send the make and model number of the lighting equipment you offer so we could look up the lumens per watt?
- H19. Within each type of lighting, do you offer high-efficiency options?
- a. [If yes] For which types of grow lights do you offer high-efficiency options? How do the costs compare to the standard efficiency options?
 - b. [If yes] Using [response from H17], what is the energy efficiency level for your high-efficiency lighting options?
 - c. [If yes and not mentioned in H19b] What is the lumens-per-watt ratio for these high-efficiency options?
- H20. And how do the energy efficiency levels vary across each lighting type? [Probe on types of lighting that are more or less efficient.]

- H21. What is the expected useful life (EUL) for each lighting type that you offer in terms of total hours? *If it is easier you could email us a spec sheet with this information.* [Record differences across lighting type, record units used (hours vs. years).]
- [If H19 = yes] Does the EUL vary between standard and high-efficiency options?
 - Based on the EUL, how long do you expect these lights to last (in years) in a home growing set up? [Probe on how this may translate to the number of grow cycles.]

7.3.4 Customer Interaction

Next I'd like to ask some questions regarding any interactions you may have had in your store with customers who grow cannabis at home.

- H22. In general, do customers tell you (or sales staff) about their intentions to grow cannabis when they come into your store to purchase lighting equipment?
- [If yes] How do these conversations generally go? [Probe on types of info the customers may share, types of questions they ask, etc.]
 - [If no] Are there other ways that you are able to assume they may be growing cannabis? What are they?
- H23. [If H22=yes] Do these customers provide information on their home grow such as number of plants or what part of their home they use to grow? [If needed: This may include the number of plants they are growing, the type of facility they have, their experience level, etc.]
- [If yes; "size and scale"] What differences in lighting equipment choices have you observed between smaller and larger residential cannabis growers? [Probe on definitions of smaller and larger growers, we consider this to be 1 vs. 4 or more.]
 - [If yes; "experience level"] What differences in lighting equipment choices have you observed between growers who seem to have lots of experience versus those who may have less experience?
- H24. [If H22=yes] What characteristics, if any, have you observed about the residential cannabis growers with regards to age, gender, or any other demographic details?
- Do you have any information about the types of spaces in which they are growing? (e.g. building type (single family/multifamily/mobile or manufactured home) or space inside home (closet, garage, greenhouse))
 - [If yes] What type of residence?
 - Do you have a sense of where they get information about what type of lighting they purchase?

- H25. In your opinion, what product features are most important to cannabis home growers purchasing lighting equipment? [Probe on wattage, PAR, PPF, heat output, size, price, efficiency, light spectrum, etc.]
- a. Why do you believe these features are most important to cannabis growers? [Probe on source of info.]
 - b. Are product spec sheets for these equipment types available online?
 - i. [If no] Can you send us product spec sheets following our call today via email? [Confirm best email address to contact.]
- H26. What are the main reasons why customers would choose not to buy energy-efficient lighting for their home grow?

7.3.5 Conclusion

We are almost done, I just have a few more questions.

- H27. Have you received any negative feedback or complaints from customers that purchased lighting equipment at your store that they used for residential cannabis growing?
- a. [If yes] Approximately how many?
 - b. [If yes] What was the nature of these complaints?
 - c. [If yes] How were these complaints resolved?
- H28. Have you received any positive feedback from customers using your lighting equipment in cannabis home grows?
- a. [If yes] What was the nature of this feedback?
- H29. Over the next 3-5 years, do you think the residential grow light market in Oregon will increase in size, decrease in size, or remain about the same?
- a. Why do you say that?
 - b. [If increase or decrease] Are there any particular regions of the state that you think will [increase/decrease] more than others?
- H30. Does your company have any plans moving forward to expand your product offerings for the cannabis industry? [Probe on differences between commercial and residential growing equipment.]
- a. [If yes] Please describe what type of expansion you are planning and why your company decided to pursue these options. [Probe on differences between commercial and residential growing equipment.]
 - i. Will this expansion include any new marketing efforts to sell more product offerings for the cannabis industry?

- b. [If no] Are there any particular reasons why your company does not plan on expanding in this market?
- c. [If no] Does your company have plans to expand marketing efforts for the current product offerings for the cannabis industry?

Thank you! Those are all of my questions. Is there anything else you think I should know about related to the lighting equipment used in cannabis grow operations that I did not ask?

Great! Lastly, we are asking retailers if they would be willing to share any sales data they may have for their residential cannabis lighting equipment. This sales data does not need to include any type of customer records or confidential information as it will be used solely to help estimate the market share for different types of lights used in home grows. Can you supply any type of sales data for your store? Is there another person we should ask about this type of information?

[If yes: Great! I will follow up at the end of the interview with my contact information and we can confirm the type of information we are looking for.]

[If no: That's completely understandable, we know that sales data can be confidential for stores like yours.]

7.4 Indoor Agriculture Retailers

Hi, this is _____ with Evergreen Economics, an energy efficiency research firm based in Portland, Oregon. We're calling on behalf of Energy Trust of Oregon who contracted with us to conduct market research on lighting equipment and energy use within the residential cannabis industry. By residential cannabis industry we are referring to legal home-growing in the state of Oregon.

As part of our research, we are conducting interviews with local indoor agriculture retailers to learn more about the type of equipment used by residential cannabis growers.

Learning more about the type of equipment used by home growers will help Energy Trust evaluate the potential to create programs to increase energy efficiency in the residential cannabis market.

Because we are studying energy efficiency and lighting used for residential cannabis growing, I want to assure you that all of your responses will be kept completely confidential. We will only be reporting in aggregate - no individual names or business names are shared in our reports. The purpose of our study is to inform possible development of programs that aim to improve the energy efficiency of residential growing operations.

[Screen for retailers that sell growing equipment.]

Does your store offer any lighting equipment (lamps and/or fixtures) that may be used for growing cannabis in homes? [If needed: This may include indoor-agriculture LEDs, high-pressure sodium lamps, metal halides, fluorescents and other types if HID lamps]

[If no: Thank and terminate call.]

[If yes] Are you familiar with your store's lighting products that may be used in cannabis growing?

[If not] Could you refer me to someone else at your store that is knowledgeable of the lighting products?

[When the correct person is on the phone: Repeat Intro above.]

Great! Are you available to talk now for about 20-30 minutes about the residential cannabis market, or would you like to schedule a time to talk later? As a reminder, anything you tell us will be kept confidential and will not be linked to you or your company directly in any way.

7.4.1 Background

Before we begin, to ensure we capture all the information in this interview, are you okay if we record the interview? The recordings will not be released outside of our study team and are for reference purposes only.

[IF PERMISSION GRANTED START RECORDING]: For the record, this is [NAME] with Evergreen Economics. [INTERVIEWEE], do I have your permission to record this interview for future reference?

[IF YES]: Thanks.

I'd like to start by finding out more about your store and your job in particular. Throughout the interview, please remember that we are interested primarily on your experience within Oregon specifically.

- R1. To start, can you tell me about your company's activity in the lighting business?
[Probe on types of lighting products, primary focus, residential vs. commercial lighting, etc.]
- R2. What is your position at your store? [Probe on title and responsibilities]
 - a. How long have you been in this position?
- R3. [If not already mentioned] Does your store have any additional locations?
 - a. [If yes] How many within Oregon?
 - b. [If yes] How many outside of Oregon?

- R4. [If not already mentioned] Does your company specialize in any particular type of lighting for indoor agriculture? [Probe on lighting for cannabis versus other indoor agriculture, commercial versus residential, etc.]
- [If yes] What type or types?

For this research, we are interested in residential growing equipment, not equipment that is strictly used in a commercial setting.

- R5. Over the last calendar year, approximately what percentage of your total sales came from lighting equipment that is used by cannabis home growers specifically?

7.4.2 Available Cannabis Lighting Equipment

Great! Now I have some more specific questions regarding the lighting equipment you offer that might be used for growing cannabis in homes in Oregon.

- R6. What types of lighting equipment does your store sell that may be used in homes to grow cannabis? Common lighting types include high-pressure sodium lamps, metal halides, HID lamps, other types of fluorescents, and indoor agriculture LEDs. We are also interested in any fixtures available in your store.
- Which lights and fixtures that you sell do you think may be used in this way?
 - Of those lights and fixtures, which manufacturers do you carry?
 - And does your company purchase the lighting equipment directly from the manufacturers or do you work with lighting distributors?
 - [If lighting distributors mentioned] Which lighting distributors do you work with?
 - When did you start offering these lighting types?
 - Do you know what the primary factors were in your store deciding to sell these lighting types? [Record for all types of grow lights mentioned.]
- R7. [If LEDs not mentioned in R6] Why does your store not currently offer LED lights that may be used in cannabis home grows?
- Do you anticipate this changing at all in the next year?
- R8. Are any of the available lighting types your store carries made specifically for cannabis production versus other indoor agriculture? [If needed: As a reminder, we are primarily interested in residential grow equipment for this study]
- [If yes] Which types?

- b. [If yes] Are any of these lighting types designed specifically for home growing compared to large-scale commercial operations?
 - i. [If yes] How so?
- R9. For the lights you've mentioned that can be used to grow cannabis, which of those lights are also used for other non-cannabis related activities such as other indoor agriculture or just lighting a room?
 - a. [If yes] How do these other indoor agriculture markets compare to the indoor residential cannabis market? [Probe on relative size of market, location, type of customer, equipment needs, etc.]
- R10. [If not mentioned in R6 or R7] Do you offer any pre-packaged 'grow kits' that are designed to include a set of the equipment needed for home growing?
 - a. [If yes] Please describe the products included in these grow kits.
 - b. [If yes] How do your sales for the grow kits compare to sales of other residential grow lights sold individually?
 - c. [If yes] Do you have any insights on the types of growers that may purchase one or the other? (e.g., new growers, growers who live in small spaces, etc.)
- R11. What is the retail price for each lighting type we've discussed? Is this information available online? If so, we can capture the information after we complete the interview. [Record for each type of lighting.]
- R12. For all the lighting equipment that you offer that may be used to grow cannabis – can you rank them in terms of which ones are most popular amongst customers? [Probe on percentages for each lighting type, ask about popularity of LEDs if not mentioned.]
 - a. Why do you think [lighting with the highest %] is the most popular choice for cannabis growers?
 - b. Why do you think [lighting with the lowest %] is the least popular choice for cannabis growers?
 - c. Has this changed at all over the last year? How so? [Probe on EE options, certain models becoming more popular, etc.]
 - d. [If not mentioned in a or b] How do customers view LED grow lights that you offer?
 - i. [If not addressed in a or b or d] Is there any indication that LEDs have lower production efficiencies – and consequently produce lower product yields – compared to other lighting types used in cannabis home grows?
- R13. Do you offer any equipment besides lighting that you believe is used in home grows?

- a. [If yes] Please describe what type of equipment and why you believe it is being used in cannabis production specifically.
- b. [If yes] How does the lighting choice change what is needed in terms of additional equipment?
- c. [If yes] How does this other equipment impact the energy usage of home growers? [Probe on an increase or decrease in usage, impact on lighting usage, etc.]

7.4.3 Lighting Efficiency

Now I'd like to learn a little more about the efficiency levels for the different types of products your firm offers for the cannabis industry.

- R14. How do you measure the energy efficiency of the lights you offer that may be used for home growing? [Probe on specific metrics such as PAR, PPF, lumens, etc.]
- R15. Using this metric, what are the energy efficiency levels for each type of *standard* lighting equipment you offer for cannabis growers? [Record for each type.]
- a. [If not mentioned] Do you know the lumens-per-watt ratio for each of these lighting types?
 - i. [If no] We may be able to calculate this information based on the product details of the equipment you offer. After the interview, would you be able to send the make and model number of the lighting equipment you offer so we could look up the lumens per watt?
- R16. Within each type of lighting, do you offer high-efficiency options?
- a. [If yes] For which types of grow lights do you offer high-efficiency options? How do the costs compare to the standard efficiency options?
 - b. [If yes] Using [response from R14], what is the energy efficiency level for your high-efficiency lighting options?
 - c. [If yes and not mentioned in R16b] What is the lumens-per-watt ratio for these high-efficiency options?
- R17. And how do the energy efficiency levels vary across each lighting type? [Probe on types of lighting that are more or less efficient.]
- a. [If R10=yes] In general, how does the energy usage of the grow kits compare to the other residential growing set ups that include a variety of individual components?
- R18. What is the expected useful life (EUL) for each lighting type that you offer in terms of total hours? *If it is easier you could email us a spec sheet with this information.* [Record differences across lighting type, record units used (hours vs. years).]

- a. [If R16=yes] Does the EUL vary between standard and high-efficiency options?
- b. Based on the EUL, how long do you expect these lights to last (in years) in a home growing set up? [Probe on how this may translate to the number of grow cycles.]

7.4.4 Customer Interactions

Next I'd like to ask some questions regarding any interactions you have had with cannabis home growers in your store.

- R19. Why do you think your customers choose to purchase lighting equipment at specialty retailers like your store versus other retailers such as home improvement stores or online retailers?
- a. [If a particular type of grower mentioned for specialty retailers] What percentage of the total number of home growers do you think are [type of grower mentioned in R19]?
 - b. Do you have a sense of the percentage of growers who purchase equipment at specialty retailers versus these other stores?
- R20. In general, do customers tell you (or sales staff) about their intentions to grow cannabis when they come into your store to purchase lighting equipment?
- a. [If yes] How do these conversations generally go? [Probe on types of info the customers may share, types of questions they ask, etc.]
 - b. [If no] Are there other ways that you are able to assume they may be growing cannabis in their homes? What are they?
- R21. [If R19=yes] Do these customers provide information on their home grow such as number of plants or what part of their home they use to grow? [If needed: This may include the number of plants they are growing, the type of operation they have, their experience level, etc.]
- a. [If yes; "size and scale"] What differences in lighting equipment choices have you observed between smaller and larger residential cannabis growers? [Probe on definitions of smaller and larger growers, we consider this to be 1 vs. 4 or more.]
 - b. [If yes; "experience level"] What differences in equipment choices have you observed between growers who claim they have lots of experience versus those who may have less experience?
- R22. [[If R20=yes] What characteristics, if any, have you observed about the cannabis growers with regards to age, gender, or any other demographic details?
- a. Do you have any information about the types of spaces in which they are growing? (e.g. building type (single family/multifamily/mobile or

- manufactured home) or space inside home (closet, garage, conditioned or unconditioned basement, greenhouse))
- b. [If yes] what type of residence?
 - c. Do you have a sense of where they get information about what type of lighting they purchase?
- R23. In your opinion, what product features are most important to cannabis home growers when purchasing lighting equipment? [Probe on lumens, wattage, PAR, PPF, heat output, size, price, efficiency, light spectrum, etc.]
- a. Why do you believe these features are most important to cannabis growers? [Probe on source of info.]
 - b. Based on these preferences, what lighting types best deliver on providing these features for home growers?
 - c. Are product spec sheets for these equipment types available online?
 - i. [If no] Can you send us product spec sheets following our call today via email? [Confirm best email address to contact.]
- R24. What are the main reasons why customers would choose not to buy energy-efficient lighting for their home grow?
- R25. Based on your experience selling equipment used in home cannabis grows, what percentage of households in your sales area do you think grow cannabis? (Please specify what you think of as the sales region)
- a. Does that include outdoor growers?
 - b. How about for the entire state of Oregon?
 - c. How does this percentage of growers compare to other non-cannabis indoor home growing markets such as salad greens, tomatoes, herbs or other fruits and vegetables? [Probe on larger or smaller market, differences in types of growers, etc.]

7.4.5 Customer Usage

As part of our study, we are also interested in finding out more about who is growing and how they are using equipment such as lighting in their home grow.

- R26. Based on your experience as a retailer, do you think you'd be able to answer questions about how and where home growers set up and use their growing equipment?

[If yes: Proceed with Customer Usage section.]

[If no: Skip to next section.]

Okay, great! The next set of questions deals directly with the different types of cannabis growers you've observed in your store how they use their lighting equipment. We understand you may not know exactly how growers use their equipment so you are welcome to skip any questions that you may not know.

- R27. Do you have a sense for how many hours a day customers who grow cannabis at home are planning on using their lighting products? [Note that this is secondary to getting this information from growers.]
- [If yes] Does this vary across lighting type? How so?
- R28. Are the lights that can be used to home-grow cannabis located in a certain area in your store or identified in any way?
- R29. And where in the home are home growers setting up their lighting equipment? [Probe on closets, conditioned or unconditioned basements, garages, etc.]
- R30. Do you have a sense of how long home growers typically use their lighting products to grow cannabis? Do you think it is a short period of time - 1 to 2 years - or a longer period of time? [Note that this is secondary to getting this information from growers.]
- Does this depend on the type of lighting equipment that growers purchase? [Probe on differences across lighting types.]
- R31. Do the growers you interact with change where they grow based on the climate or season? [Probe on utilizing indoor space during colder months and outdoor space during warmer months.]
- [If no] What is the typical number of grow cycles that home growers anticipate to complete per year? [Probe on differences between indoor and outdoor growers.]
 - [If yes] Does this change impact the number of grow cycles per year? How so? [Probe on number of grow cycles per year for indoor and outdoor growing seasons]

7.4.6 Conclusion

We are almost done, I just have a few more questions regarding any interactions you may have had with cannabis home growers.

- R32. Have you received any feedback or complaints from customers that purchased lighting equipment at your store?
- [If yes] Approximately how many?

- b. [If yes] What was the nature of these complaints?
 - c. [If yes] How were these complaints resolved?
- R33. Have you observed any changes in the number of customers purchasing lighting equipment for indoor home grows since legalization?
- a. [If yes] What about the types of customers that are purchasing growing equipment?
- R34. Over the next 3-5 years, do you think the residential cannabis grow light market in Oregon will increase in size, decrease in size, or remain about the same?
- a. Why do you say that?
 - b. [If increase or decrease] Are there any particular regions of the state that you think will [increase/decrease] more than others?
- R35. Does your store have any plans moving forward to expand your product offerings for the cannabis industry?
- a. [If yes] Please describe what type of expansion you are planning and why your store decided to pursue these options. [Probe on differences between commercial and residential growing equipment.]
 - i. Will this expansion include any new marketing efforts to sell more product offerings for the cannabis industry?
 - b. [If no] Are there any particular reasons why your store does not plan on expanding in this market?
 - c. [If no] Does your store have plans to expand marketing efforts for the current product offerings for the cannabis industry?

Thank you! Those are all of my questions. Is there anything else you think I should know about related to the lighting equipment used in cannabis home growing that I did not ask?

Great! Lastly, we are also asking retailers if they would be willing help our study efforts in two additional ways. Would we be able to bring flyers about our online grower survey to leave in your store? Do you have a bulletin board where we could post a flyer?

We are also asking stores to share any sales data they may have for their cannabis lighting equipment. This sales data does not need to include any type of customer records or confidential information as it will be used solely to help estimate the market share for different types of lights used in home grows. Can you supply any type of sales data for your store?

[If yes: Great! I will follow up at the end of the interview with my contact information and we can confirm the type of information we are looking for.]

[If no: That's completely understandable, we know that sales data can be confidential for stores like yours. Thank you again for participating in our research.]

8 Market Actor Research Question Mapping

Table 5 below maps the questions from Section 7 to the Research Plan questions. Each Research Plan question is identified as either being answered via the manufacturers or distributor and retailer interviews. Additionally, the table identifies whether the market actor interviews are primary or secondary sources for each of the research questions.

Table 5: Research Question Mapping

Questions from Research Plan	Retailers & Distributors	Manufacturers	Interview Questions
What lighting products are currently being sold for residential adult-use cannabis grows and is there a distinct class of products that are appropriate for the four-plant limit and not for large scale grow operations? Include both efficient and less efficient lighting options (e.g., LED, high pressure sodium, metal halide, CFL, others).	P	S	M4-M6, M14, D7-D10, H4-H7, R6-R10
What is the market share for each lighting product type (e.g., LED, high-pressure sodium, etc.)?	P	S	M4, M8, D9-D11, H14, R12 (follow up sales data request for retailers)
What are the channels through which lighting products are sold (e.g., specialty retailers, big box/DIY stores, online, etc.) and what is the market share for each channel?	P	S	M17, M18, D20, D21, R19
What are the specifications and retail price of efficient and less efficient lighting products?	P	S	M12-M16, M19, D15-D19, D23, H11, H17-H21, R11, R14-R18
What is the ratio of lumens per watt for each lighting product type?	P	S	M12-M14, D15-D17, H17-H19, R14-R16
What grow light features are most important to customers and how well do products from each lighting category deliver these features?	S	S	M11, D14, H25, R20, R23
How important do grow light retailers or other market actors feel these product attributes are to their customers? (lumens, wattage, light spectrum, heat output, etc.)	P	S	M11, D14, H22-H25, R23

Questions from Research Plan	Retailers & Distributors	Manufacturers	Interview Questions
What is the expected useful life of home grow lighting products (i.e., length of warranty and/or number of hours before equipment burns out or fails)? How are these lighting products typically used by customers? Specifically:	S	S	M16, D19, H21, R18
How many hours are these lighting products used per day throughout the grow cycle, and for what duration of time is the grow cycle in Oregon?	S		H23, R26, R27
Where in the home are grow operations located (e.g., closet, basement, etc.) and how are lights configured (e.g., number of lights, are timers used, proximity to plants, etc.)?	S		H23, H24, R29
What is the typical number of grow cycles per year by the average adult home grower?	S		M16, D19, H21, R18
How long do customers typically use these types of products - that is, do home growers use these products for only a short period of time (1-2 years), or do they use lighting products consistently over a long period of time (complete grow cycles for multiple years)?	S		R30
Does seasonality of the Oregon climate impact the number of grow cycles per year (e.g., do customers switch from indoor to outdoor growing during the summer or grow indoors all year)?	S		R31
What is the size of the residential, home grow lighting market?	P	S	M21 D22, H16, H28
What area(s) of the state contain(s) most residential adult-use growers?	P		D22, H16, R25, R34
What are the demographics, including income range, of these growers?	S		H24, R22
What are the site characteristics for home grow operations (i.e., single-family residences, apartment buildings, manufactured homes, etc.)?	S		H8, H23, R21, R22
Are integrated 'grow kits' being sold that are designed for adult home growers in Oregon (i.e., a pre-packaged option that includes all equipment needed to grow cannabis)?	P	S	M7, D10, H7, R10
What is the market share for kits? How does their energy use compare to a piecemeal setup or other configuration?	P		M7, D10, H7, R10

Questions from Research Plan	Retailers & Distributors	Manufacturers	Interview Questions
Are there ancillary products (such as cooling or fans) that impact the expected energy consumption of home growing operations?	S		H15, R13
Are products used for adult-use cannabis grow operations also being used for other indoor horticulture/agriculture (non-cannabis) production that would affect hours of use?	S		D9, H10, R9
What is the experience in the residential home grow market in other states that can help answer any of the above questions?	S		

Appendix A: Sampling Regions

The sampling regions were identified using the 2016 Energy Trust of Oregon Annual Report in conjunction with previous research Evergreen Economics completed for Energy Trust on the New Homes Process Evaluation. While Energy Trust’s Annual Report outlines six distinct regions across Oregon, we determined that four regions were more appropriate for our evaluation given the relatively small number of completed interviews we are targeting. As a result, we combined the North Coast and Willamette Valley regions into one Northwest Oregon region, and also combined the Central and Eastern Oregon regions into one region. This process was consistent with the previous sampling conducted for the New Home’s Process Evaluation, with updates included for counties on the borders between regions. Table 6 through Table 9 below outline the specific counties for each of our sampling regions.

Table 6: Portland Metro Region

Portland Metro	
Counties	County Population
Hood River County	23,232
Washington County	582,779
Multnomah County	799,766
Clackamas County	408,062
Total	1,813,839

Table 7: Northwest Oregon Region

Northwest Oregon	
Counties	County Population
Yamhill County	105,035
Clatsop County	38,632
Lincoln County	47,806
Polk County	81,823
Marion County	336,316
Columbia County	50,785
Benton County	89,385
Linn County	122,849
Lane County	369,519
Tillamook County	26,143
Total	1,268,293

Table 8: Southern Oregon Region

Southern Oregon	
Counties	County Population
Coos County	63,761
Curry County	22,713
Josephine County	85,904
Jackson County	216,527
Klamath County	66,443
Lake County	7,837
Douglas County	108,457
Total	571,642

Table 9: Central & Eastern Oregon Region

Central/Eastern Oregon	
Counties	County Population
Wasco County	26,115
Sherman County	1,710
Gilliam County	1,854
Morrow County	11,274
Umatilla County	76,456
Wallowa County	6,946
Union County	26,087
Jefferson County	23,080
Wheeler County	1,344
Baker County	16,059
Deschutes County	181,307
Crook County	22,570
Malheur County	30,439
Harney County	7,292
Grant County	7,158
Total	439,691

Appendix B: Web Survey Questions and Recruitment Material

I Recruitment Material

Below is a draft of the flyer that we will distribute to interested cannabis conference attendees. The flyer includes a link to the study's landing page, which will allow respondents to either take the survey and/or share the link with other growers.

Oregon Cannabis Home Growers Survey

We are a small energy efficiency research firm based in Portland and are **looking for people in Oregon who grow cannabis at home** to tell us a bit about how they grow (what lights they use, how often they are on, etc.) via a short, online, confidential survey.

We invite you to take the survey so we can help cannabis home growers in Oregon save energy and money.

Please **share** this link with any Oregon home growers you know!

www.OregonHomeGrowStudy.com

We want to be sure that we get feedback from as many Oregon home growers as possible, and that we represent all perspectives.

If you have questions about our research, please email or call Joe Clark:

✉ clark@evergeenecon.com ☎ (971) 888-7479

2 Web Survey

2.1 Landing Page

The survey landing page will give a short background on the study and then prompt recruits to either take the survey, or share the survey with someone else. We will use following language.

Our firm, Evergreen Economics, an energy efficiency research firm based in Portland, is gathering feedback from cannabis home growers to better understand how to help growers in Oregon save energy and money. As part of our research, we are conducting a confidential web survey for home growers in the state of Oregon. The goal of the survey is to learn more about the techniques and equipment being used by home growers in the state and to use this information to identify ways that energy efficiency programs can help growers save energy and money.

We will not share any individual information on survey participants, and we will not ask for names, contact information, or any other identifying information during any part of the survey.

This is a great opportunity to share your opinions and shape future efforts to help residential cannabis growers save energy and money.

If you have any questions or if you would prefer to complete the 10 minute survey over the phone, please email or call Joe Clark at Evergreen Economics (clark@evergreenecon.com or 971-888-7479).

To take the survey, click here.

To share the survey link with a colleague or friend who grows cannabis at home and lives in Oregon, click here.

For more information about Evergreen Economics, visit evergreenecon.com.

2.2 Grower and Facility Type

First we'd like to ask you a few questions about your experience growing cannabis at home.

1. Have you grown cannabis at your home in the last five years?
 - a. Yes, in Oregon
 - b. Yes, but not in Oregon
 - c. No experience growing at home (Skip to CLOSING TEXT)

Remember, the information provided as part of the survey will be kept strictly confidential.

If you aren't actively growing at this time, please think about your most recent grow when answering the following questions.

2. [If Q1 = b] In which state do you currently grow cannabis at your home?
 - a. [Text box for open ended response]
3. Do you currently grow cannabis for recreational use, medical use, or both?
 - a. Recreational only
 - b. Medical only
 - c. Both
4. Do you grow cannabis indoors, outdoors, or in a greenhouse? Please select all that apply.
 - a. Indoor
 - b. Outdoor
 - c. Greenhouse

[Note that Q4, 5 and 6 will all be visible on the same page]

5. [If Q4=a] How many plants do you typically grow indoors at any given time?
 - a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. 4
 - f. More than 4
6. [If Q4=b] How many plants do you typically grow outdoors at any given time?
 - a. 0
 - b. 1
 - c. 2
 - d. 3

- e. 4
 - f. More than 4
7. [If Q4=c] How many plants do you typically grow in a greenhouse at any given time?
- a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. 4
 - f. More than 4
8. [If Q3=c] Approximately how many of your total plants would you say are for medical use and how many for recreational use?
- a. _____plants are grown for medical use
 - b. _____plants are grown for recreational use
9. [If multiple grow environments are selected in Q5-7; for each environment] Which of the following reason(s) describe why you chose [indoors/outdoors/a greenhouse] for growing? Please check all that apply.
- a. Space constraints
 - b. Personal preference
 - c. Operating costs
 - d. Weather
 - e. Security
 - f. Privacy
 - g. Other (Please specify):
- [If Q4=b and Q4≠a or c skip to Q41]
10. [If Q4=c] Do you have lights in your greenhouse?
- a. Yes [continue]
 - b. No
- [If Q4=c and Q4≠a and Q10=b, skip to Q41]
11. How willing would you be to change your grow lights to a more energy-efficient option?
- a. Extremely
 - b. Very
 - c. Somewhat
 - d. Not really
 - e. Not at all

2.3 HVAC Equipment

12. Can you briefly describe how you **cool** your cannabis plants?
 - a. Type of equipment or method used: _____ or
 - b. I don't do any cooling for the plants

13. Can you briefly describe how you **heat** your cannabis plants?
 - a. Type of equipment or method used: _____ or
 - b. I don't do any heating for the plants

14. Can you briefly describe how you **ventilate** your cannabis plants?
 - a. Type of equipment or method used: _____ or
 - b. I don't do any ventilation for the plants

2.4 Lighting Equipment

Next, we'd like to find out about lighting equipment you may have purchased or installed for growing.

15. First, we'd like to know about the types of lighting you use for growing cannabis at home. Please select all that apply.
 - a. High-Pressure Sodium (HPS)
 - b. Metal Halides
 - c. Fluorescent CFLs
 - d. LEDs
 - e. T5s
 - f. T8s
 - g. T12s
 - h. Other (Please specify: _____)

16. [If multiple lighting types selected in Q15; for each lighting type] Where did you purchase your [lighting type]? Please select all that apply.
 - a. Home improvement store (e.g., The Home Depot, Lowe's)
 - b. Small hardware store (e.g., Ace Hardware, True Value, Do it Best, Orchard Supply)
 - c. Farm/agricultural supply store (e.g., Wilco, Coastal, Linnton Feed & Seed)
 - d. Organic gardening/hydroponics store (e.g., Naomi's Organic Farm Supply, American Agriculture)
 - e. Online retailer (Please specify: _____)
 - f. Other (Please specify: _____)
 - g. Don't know

17. [If multiple lighting types selected in Q15; for each lighting type] Do you use the [lighting type] lights to grow anything other than cannabis?
- Yes
 - No
18. [For each lighting type where Q17=a] Following up on the last question, what percentage of the time are the [lighting type] lights used for growing cannabis used to grow things other than cannabis?
- [dropdown percentages: 0-25%, 25-50%, 50-75%, 75%+]

For respondents of 18 add note: *For the remainder of this survey, please only think about how lighting is used for growing cannabis.*

19. [If multiple lighting types selected in Q15; for each lighting type] What stage in the cannabis growth cycle do you use [lighting type] lights? Please select all that apply.
- Seedling stage
 - Vegetative stage
 - Flowering stage
20. [If multiple lighting types selected in Q15; for each lighting type] How many years do you expect the [lighting type] lights to last?
- 1 to 2 years
 - 3 to 4 years
 - 5 to 6 years
 - 7 to 8 years
 - More than 8 years
 - Don't know
21. How many total bulbs do you use for growing cannabis? Please count each bulb within a fixture.[If multiple lighting types selected in Q15; for each lighting type] How many total [lighting type] bulbs do you use to grow cannabis?
- (select number from dropdown)
[If Q4 = a] _____ total bulbs for indoor use
[If Q4 = c] _____ total bulbs for greenhouse use
22. Are your lights on timers?
- Yes
 - No
23. [If Q22=a] When are your timers set to go on and off? Does this vary by stage (seedling, vegetative, flowering)?
- [Text box for open ended response]

24. [If multiple lighting types selected in Q15; for each lighting type] Please tell us why you chose to use the [lighting type] to grow cannabis.
- a. [Text box for open ended response]
25. When you are deciding which lighting to purchase for growing cannabis at home, please rate each of the following in terms of how important they are to you.
(Will label numbers below as the following words: *Extremely Important, Very Important, Somewhat Important, A Little Important, Not at all Important, will also randomize order of choices for each participant*)
- | | | | | | | | |
|---|---|---|---|---|---|----|--------|
| a. Purchase price | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| b. Operating costs | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| c. Availability | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| d. Energy efficiency | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| e. Past experience with product | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| f. Word of mouth | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| g. Online advice (e.g. from a forum or group) | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| h. Advertisement | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| i. Industry recommendation | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| j. In-store recommendation | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| k. Ease of installation | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| l. Wattage | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| m. PAR ⁵⁷ | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| n. PPF ⁵⁸ | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| o. Color spectrum | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| p. Heat output | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| q. Brand | 1 | 2 | 3 | 4 | 5 | NA | unsure |
| r. Expected lifespan | | | | | | | |
26. [If did not select LEDs in Q15] Do you have *any* prior experience growing cannabis with LED lights?
- a. Yes
- b. No

⁵⁷ Will have question mark that participants can scroll over to see the following definition: *photosynthetically active radiation, PAR, refers to the visible region of the lighting spectrum (wavelengths of light between 400 nm (violet, blue) and 700 nm (deep red)).*

⁵⁸ Will have question mark that participants can scroll over to see the following definition: *Photosynthetic photon flux density, PPF, is a measurement of the amount of light that reaches a plant.*

27. [If Q26=Yes] Please describe your experience growing with LEDs and why you chose to use them previously.
28. [If Q26=No] Had you heard about using LED lights to grow cannabis before taking this survey?
- Yes
 - No

[If Q26=No and Q28=No, share description of LEDs] Light Emitting Diodes, or LEDs, are designed to be more efficient and longer lasting than other types of grow lights. They produce far less heat output than traditional grow lamps with lower wattages, which means less need for cooling. Additionally, these lights are less expensive to operate overall.

29. Do you use any LEDs in your home?
- Yes
 - No
 - Don't know
30. [If Q29= b] Why don't you use LEDs in your home?
- Haven't heard of them
 - Don't like how they look
 - Too expensive
 - Other: _____
31. [Q26=a] Is there anything you don't like about using LEDs for growing cannabis in your home?
- [Text box for open ended response]
32. [If did not select LEDs in Q15 and Q26=b and Q28=a] Why didn't you choose to buy LED grow lights?
- [Text box for open ended response]

2.5 Hours of Operation

Next we have some questions about when you use your grow lights and for how long.

33. [Q4=a] Please indicate the months of the year when you grow cannabis indoors:

- a. Year-round
- b. January
- c. February
- d. March
- e. April
- f. May
- g. June
- h. July
- i. August
- j. September
- k. October
- l. November
- m. December

34. [Q4=b or c] Earlier in the survey, you mentioned that you grow outdoors or in a greenhouse. Please indicate the months of the year when you grow cannabis outdoors or in a greenhouse:

- a. Year-round
- b. January
- c. February
- d. March
- e. April
- f. May
- g. June
- h. July
- i. August
- j. September
- k. October
- l. November
- m. December

35. When you use lighting in the seedling stage of growing cannabis, about how many hours a day do you have the lights set on?

Select number of hours from the drop down menu.

____ out of 24 hours.

36. In the **seedling** stage, select the times of day that the lights are generally on. Please check all that apply:

- a. Early morning
- b. Late morning
- c. Early afternoon
- d. Evening

37. When you use lighting in the **vegetative** stage of growing cannabis, about how many hours a day do you have the lights set on?

Select number of hours from the drop down menu.

____ out of 24 hours.

38. In the **vegetative** stage, select the times of day that the lights are generally on. Please select all that apply:

- a. Early morning
- b. Late morning
- c. Early afternoon
- d. Evening

39. When you use lighting for the **flowering** stage of growing cannabis, about how many hours a day do you have the lights set on?

Select number of hours from the drop down menu.

___ out of 24 hours.

40. In the **flowering** stage, select the times of day that the lights are generally on. Please select all that apply:
- Early morning
 - Late morning
 - Early afternoon
 - Evening
41. How many full cycles of cannabis growth do you (or do you expect to) complete in a year?
- (select drop down number)
42. [If Q4= a AND Q4= b or c] How many cycles do you (or do you expect to) grow indoors in a year?
- (select drop down number)
43. [If Q4= a AND Q4= b or c] How many cycles do you (or do you expect to) grow outdoors or in a greenhouse in a year?
- (select drop down number)

[If Q4=b and Q4≠ a or c] Skip to CLOSING TEXT.

2.6 Household Characteristics

Lastly, we'd like to get some general information about your household to help us understand and identify ways that energy efficiency programs can help home growers in Oregon save energy and money.

Remember, the information provided as part of the survey will be kept strictly confidential.

44. In what type of home do you live?
- A single-family house detached from any other houses
 - A single-family house attached to one or more houses
 - Duplex, triplex, or fourplex
 - Apartment or condominium with 5 units or more
 - Manufactured or mobile home
 - Other (Please specify:) [IF PHONE SURVEY, DO NOT READ]
 - Don't know [IF PHONE SURVEY, DO NOT READ]
 - Refused [DO NOT READ OR DISPLAY]

45. How many people live in your home year-round?
a. [select number from drop down]
46. Do you own or rent your home?
a. Own
b. Rent
c. Occupy without payment of rent
47. Which category best describes your age?
a. Under 18
b. 18 - 24
c. 25 - 34
d. 35 - 44
e. 45 - 54
f. 55 - 64
g. 65 - 74
h. 75 or older
48. How knowledgeable do you feel about growing cannabis in your home?
a. Extremely
b. Very
c. Somewhat
d. A little
e. Not at all
49. [If Q4=a] In which space(s) in your home do you grow cannabis? Please select all that apply.
a. Closet
b. Garage
c. Finished basement
d. Unfinished basement
e. Bedroom
f. Other (Please specify:)

We are asking one general question about location to help us understand where different energy needs exist, and to plan possible program efforts.

50. What is your zip code?
a. [Text box for open ended response]
51. [If no response given to Q50] If you'd rather, you can enter the name of the city in which you live.

- a. [Text box for open ended response]
52. Which of the following ranges describes your 2016 total household income before taxes?
- a. Under \$15,000
 - b. \$15,000 to \$24,999
 - c. \$25,000 to \$34,999
 - d. \$35,000 to \$49,999
 - e. \$50,000 to \$74,999
 - f. \$75,000 to \$99,999
 - g. \$100,000 to \$149,999
 - h. \$150,000 to \$199,999
 - i. \$200,000 or more
53. Finally, where do you go for reliable information on growing cannabis at home?
Please select all that apply.
- a. Conferences
 - b. Public presentations
 - c. Web sites [Suggestions: _____]
 - d. Forums [Suggestions: _____]
 - e. Trade organizations [Name(s): _____]
 - f. Utility bill inserts/newsletters
 - g. Other [Please specify: _____]
54. Is there anything else you'd like to share that hasn't been covered?
- a. [Text box for open ended response]

[CLOSING TEXT] Thank you for taking the time to respond to our survey. The more responses we get, the better we can help all Oregon home growers save energy and money. Please share this survey with other Oregon home cannabis growers. [Click here to share a link to the survey.](#)

3 Web Survey Research Question Mapping

The table below maps the questions from Section 2 to the Research Plan questions raised in the web survey. Each Research Plan question is identified as either being answered via the primary source web survey or via a secondary source of information.

Questions from Research Plan	Primary or Secondary Source	Web Survey Questions from Section 2
What is the market share for each lighting product type (e.g., LED, high-pressure sodium, etc.)?	S	15, 21
What are the channels through which lighting products are sold (e.g., specialty retailers, big box/DIY stores, online, etc.) and what is the market share for each channel?	S	16
What grow light features are most important to customers and how well do products from each lighting category deliver these features?	P	24, 19, 25
What is the expected useful life of home grow lighting products (i.e., length of warranty and/or number of hours before equipment burns out or fails)? How are these lighting products typically used by customers? Specifically:	P	17, 18, 20
How many hours are these lighting products used per day throughout the grow cycle, and for what duration of time is the grow cycle in Oregon?	P	33 through 40, 20
Where in the home are grow operations located (e.g., closet, basement, etc.) and how are lights configured (e.g., number of lights, are timers used, proximity to plants, etc.)?	P	21 through 23, 53
What is the typical number of grow cycles per year by the average adult home grower?	P	41 through 43
How long do customers typically use these types of products - that is, do home growers use these products for only a short period of time (1-2 years), or do they use lighting products consistently over a long period of time (complete grow cycles for multiple years)?	P	20, 48
Does seasonality of the Oregon climate impact the number of grow cycles per year (e.g., do customers switch from indoor to outdoor growing during the	P	4, 34, 33

Questions from Research Plan	Primary or Secondary Source	Web Survey Questions from Section 2
summer or grow indoors all year)?		
What is the size of the residential, home grow lighting market?	S	See below
What area(s) of the state contain(s) most residential adult-use growers?	S	51, 50
What are the demographics, including income range, of these growers?	P	44 through 52
What are the site characteristics for home grow operations (i.e., single-family residences, apartment buildings, manufactured homes, etc.)?	P	44
Are there ancillary products (such as cooling or fans) that impact the expected energy consumption of home growing operations?	S	12 through 14
Are products used for adult-use cannabis grow operations also being used for other indoor horticulture/agriculture (non-cannabis) production that would affect hours of use?	P	17, 18

4 Call Center Script

If you receive calls asking about a study on growing cannabis at home, please read the following:

“Energy Trust of Oregon has contracted with Evergreen Economics to do research related to cannabis grown in residences. The goal of the survey is to learn more about the techniques and equipment being used by home growers in the state and to use this information to identify ways that energy efficiency programs can help home growers save energy and money.”

If needed: “The research includes both a web survey (at www.OregonHomeGrowStudy.com), which is being marketed at conferences, stores, and online, and market actor interviews with retailers, distributors, and manufacturers.”

If you have further questions about this research for Energy Trust, please contact Katie Wallace at katie.wallace@energytrust.org or 503.546.3620.

5 Frequently Asked Questions

The answers in this section will help to address any questions that are asked during recruitment.

Who is sponsoring this research?

Energy Trust of Oregon is funding this research. Energy Trust is an independent nonprofit organization dedicated to helping 1.5 million utility customers in Oregon and southwest Washington save energy and generate renewable power.. Energy Trust has contracted with Evergreen Economics to perform research on cannabis grown in residences so that Energy Trust can better understand if there is a need to encourage growers to purchase energy-efficient equipment.

I don't live in Oregon, should I still take the survey?

Yes, if you have experience growing cannabis at home, we still invite you to take the survey and would appreciate your response.

Will the survey results be shared?

We will summarize results and present them to Energy Trust without tying them to any individual respondent. The most personal information we ask for is your zip code and/or city name, and we will not ask for any identifying information such as your name or contact information. *[If needed to provide additional context for the caller: By understanding the general regions where home growers reside, we can better target any future energy efficiency program efforts in these areas.]*

Who can I call to confirm the validity of this study?

You can call Energy Trust's toll free number at 1.866.368.7878.

Who is Evergreen Economics?

Evergreen Economics is an energy efficiency research company that works to inform and improve energy efficiency programs. You can see their past cannabis-related research at calmac.org if you search "Evergreen Economics."

What do I get for taking the survey?

Whatever information you are able to give us will inform possible future incentive programs. There is no incentive associated with completing the survey; however, your insight will help us to better understand the sector, and any potential that may exist to



help growers save energy. Future efficiency programs may help you to save energy in your own home.

How long will the survey take?

We expect the survey to take no longer than 10 minutes to complete.

Will I be able to see the results of the research?

Results from this study are expected to be posted on Energy Trust's website in early 2018.

But my utility is [X], who is Energy Trust?

Energy Trust of Oregon is an independent nonprofit that serves the utility customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista with energy-saving resources and solutions, including incentives for efficiency upgrades and referrals to trade ally contractors and other energy experts

Appendix C: Additional Findings

This section includes additional findings.

Based on the product information provided by the specialty retailers, we also identified the wattage ranges for each of the lighting types. As shown in Table 1, wattage ranges were the highest for HID lighting (400-1150 watts) and the lowest for LEDs, which ranged significantly depending on the type of replacement bulb and how the product information was provided.⁵⁹ Wattage estimates for fluorescent lighting sold was unavailable based on the sales data provided by retailers.

Table 1: Typical Wattage Ranges for Lighting Types

Lighting Type	Reported Wattage Ranges	Most Common Reported Wattage	Percentage of Sales Within Most Common Reported Wattage
HID (HPS and MH)	400-1150	1000	70%
CMH	315,640	315	65%
LED panel systems	216-660	660	38%
LED replacement bulbs	5-41	41	68%
Fluorescent	-	-	-
Other (Plasma)	270	270	100%

Table 2 shows the typical lumen ranges for various lighting types.

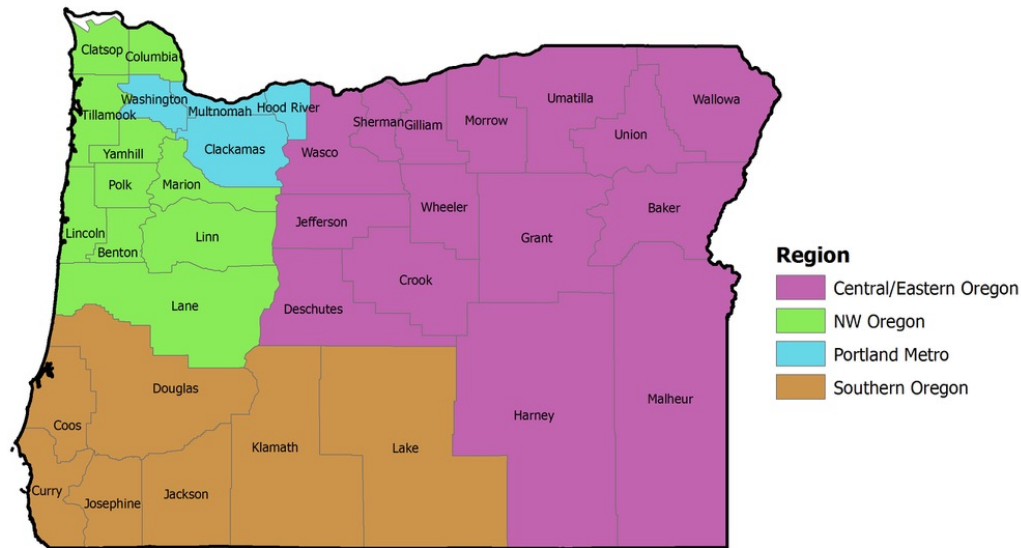
⁵⁹ For some lamps, wattages are reported for individual lamps while some are reported for the entire lighting system, which may include four or more lamps. As a result, the provided ranges account for the wattage reported by the manufacturer.

Table 2: Typical Lumens/Watt Ranges for Lighting Types⁶⁰

Lighting Type	Lumens/Watt Ranges
HPS	115-135
MH	80-120
CMH	105-110
Fluorescent	55-90
LEDs	115-135

⁶⁰ Lumens/watt estimates were calculated based on product specifications provided on manufacturer and distributor websites of the top-selling lighting products from the indoor agriculture sales data.

Appendix D: Oregon State Regions



County	Region
Hood River County	Portland Metro
Washington County	Portland Metro
Multnomah County	Portland Metro
Clackamas County	Portland Metro
Yamhill County	NW Oregon
Clatsop County	NW Oregon
Lincoln County	NW Oregon
Polk County	NW Oregon
Marion County	NW Oregon
Columbia County	NW Oregon
Benton County	NW Oregon
Linn County	NW Oregon
Lane County	NW Oregon
Tillamook County	NW Oregon
Coos County	Southern Oregon

County	Region
Curry County	Southern Oregon
Josephine County	Southern Oregon
Jackson County	Southern Oregon
Klamath County	Southern Oregon
Lake County	Southern Oregon
Douglas County	Southern Oregon
Wasco County	Central/Eastern Oregon
Sherman County	Central/Eastern Oregon
Gilliam County	Central/Eastern Oregon
Morrow County	Central/Eastern Oregon
Umatilla County	Central/Eastern Oregon
Wallowa County	Central/Eastern Oregon
Union County	Central/Eastern Oregon
Jefferson County	Central/Eastern Oregon
Wheeler County	Central/Eastern Oregon
Baker County	Central/Eastern Oregon
Deschutes County	Central/Eastern Oregon
Crook County	Central/Eastern Oregon
Malheur County	Central/Eastern Oregon
Harney County	Central/Eastern Oregon
Grant County	Central/Eastern Oregon

Appendix E: Market Actor Interview Targets and Completes By Region

Based on 2017 Census estimates of the general population across Oregon, Evergreen identified regional interview targets for both traditional hardware and home improvement retailers, along with specialty indoor agriculture retailers.⁶¹ The manufacturer and distributor targets were not regionally allocated because the vast majority of them operate across multiple regions, including the four participating lighting manufacturers and two participating distributors.

Table 1: Regional Interview Targets and Completes, by Interview Group

Interview Group	Targets	Completes
Lighting Manufacturers	4	4
Lighting Distributors	6	2
Home Improvement / Hardware Retailers	4	-
Portland Metro/Columbia River Gorge	3	-
Northwest Oregon		-
Southern Oregon	1	-
Central/Eastern Oregon		
Indoor Agriculture / Cannabis-specific Retailers	8	8
Portland Metro/Columbia River Gorge	4	4
Northwest Oregon	2	2
Southern Oregon	1	2
Central/Eastern Oregon	1	-
Total	22	14

⁶¹ <https://www.census.gov/quickfacts/OR>

Appendix F: Suggested Future Research

Energy Trust staff requested ideas for a second phase of cannabis research during the study period. This section presents ideas for a second phase of cannabis research, building on the findings from the research summarized in this report.

The goal of any future research is to provide a richer and more complete characterization of the grower lighting equipment supply chain, a segmentation of grower types, and additional recommendations for Energy Trust program interventions.

Task 1: Online and Specialty Retailer Research. Our preliminary web survey results indicate that 60 percent of growers who buy high intensity discharge lamps and metal halide lamps get them from specialty shops. For LEDs, the majority of growers (around 70%) that buy them do so online. Given this, we think it would be valuable to dive deeper on our supply side research to better understand these retailers to inform Energy Trust's decisions regarding intervention points. We see three activities being valuable in this effort:

- **Online retailer research:** We propose an investigation of online retail sales, which seems to be a popular channel for growers with LEDs, based on our initial findings. This investigation will include a cursory review of the product mix available on websites that we learned about from growers. We will also investigate the supply side chain beyond the online store to understand how it may differ from physical shops.
- **Market Characterization Report and Analysis:** The research activities above could be combined with the research done for this report into a report that characterizes growers, including where they shop and what they are likely to buy based on the purchase location, their preferences, and their demographics. This will include integration of Phase 1 and Phase 2 research in order to produce an informal, qualitative grower segmentation and supply-side market characterization to inform program intervention strategies. We will also expand upon our existing knowledge regarding utility lighting programs and include a focused review of midstream program intervention strategies. By understanding the various paths that growers may take in deciding on lighting purchases, Energy Trust will have the ability to make and justify its informed choices about market intervention.

Task 2: Medical Grower In-depth Telephone Interviews

Some responding growers reported doing some or all of their growing for medical purposes. Medical grower survey respondents were more likely to report that they grow more than four plants. We know that medical cannabis growers can legally grow more than four plants, but there is a wide range of how many plants they can grow depending on location, grandfathered status, and zoning. This means that medical cannabis growers

likely represent a significant proportion of the home cannabis grow market in the region, but that we only gained insight from our medical cannabis growing survey respondents on the smaller home medical growers (in terms of number of plants).

We propose to conduct 15 in-depth telephone interviews with registered medical growers in order to help Energy Trust understand how this group makes decisions about lighting. Because our web survey seems to only have captured smaller medical growers (but still larger than recreational only growers), talking with a larger group of medical growers would give us insight on what type of program they are better suited for (residential versus commercial) and what types of decisions they are making regarding lighting.

Task 3: Additional Summarization of Lighting Coverage

Estimates provided in this report about the cost of different lighting setups in cannabis home grows do not take into account the variety in size and number of plants that may be in a specific home grow. Evergreen recommends future research to examine manufacturer specifications and distributor price sheets to better understand the cost of purchasing different lights to suit the variety of ways a home grow may be configured.