**Annotated Bibliography- Bulb Brigade**

**“Energy Independence and Security Act of 2007 (EISA) US EPA Backgrounder.”**

**2007. *United States Environmental Protection Agency*. Spring 2007.https://**

**www.energystar.gov/ia/ products/lighting/cfls/downloads/EISA\_Backgrounder\_**

**FINAL\_4-11\_EPA.pdf?6bd2-3775**

This resource translates the Energy Independence and Security Act for consumers, explaining how it will affect their buying habits as well as which lighting technologies are directly affected. This resource highlights how changing focuses on a technology create changes in production and consumer behavior.

**“GrowBright 600 Watt HPS Bulb.” 2016. HTG Supply. 2016.**

 **https://www.htgsupply.com/products/growbright-600-watt-hps-bulb.**

This webpage, designed to market and sell the 600W HPS bulb to indoor growers, focuses on describing the bulb’s light output and how its light positively affects plant growth. The site also describes the lifespan of a 600W HPS bulb, demonstrating how it lasts roughly three times as long as other kinds of high intensity discharge bulbs. Since the page’s aim is to convince the viewer to purchase the bulb, it lays out all of its advantages over other types and provides a helpful FAQ. Overall, this source is useful for understanding why indoor growers have come to favor the HPS bulb.

**Haze, Nebula. 2018. “5 Barriers to LED Grow Light Domination – HPS vs LED**

**Grow Lights.” Grow Weed Easy. 2018. http://www.growweedeasy.com/led-vs-hps.**

In this blog post, one grower weighs in on the ongoing debate over whether LED or HPS bulbs are better for plant growth. He argues that LED bulbs seem to be superior because of their efficiency, built-in cooling system, and customizable light spectrum capabilities; however, in his opinion, they also have five faults that allow the HPS bulb to maintain its position as the best growing bulb. These faults of LED bulbs are: their intensity of light often burns plants, they are expensive, they yield inconsistent results, when the bulb malfunctions, you must buy an entire new bulb instead of just a new part, and when purchasing an LED bulb, it is often hard to tell exactly how much electricity it uses. Since this post was written by a professional grower who has used both LED and HPS bulbs, it provides a first-hand account of why HPS bulbs are still very relevant to the indoor growing industry despite the development of LED bulbs.

**“HPS Servicing Guide.” 2004. http://www.americanelectriclighting.com/Library/
 Literature/PDFs/HPS%20Servicing%20Guide.pdf.**

This servicing guide provides a deep dive into the setup, inner workings, and functions of HID HPS bulbs. Additionally, it describes the function and set up of other equipment needed to make the bulb function, such as the hood and ballast. This resource is valuable for understanding the setup process of the HPS bulb, as well as how the parts fit together to form a working light source.

**“Inventing Six Modern Electric Lamps.” n.d. http://americanhistory.si.edu/ lighting/**

**20thcent/invent20. htm.**

This webpage lays out the process of invention of six types of modern lighting: Tungsten Halogen, Metal Halide, High Pressure Sodium, Compact Fluorescent, Silicon Carbide, and Sulfur. These types of recent lighting devices are also compared to Edison’s original lamp, which shows the specific developments that lighting technologies have undergone in the past century and a half or so. There is a specific section detailing the HPS bulb’s invention and how scientists developed the ceramic Lucalox that serves as the bulb’s outer shell. Overall, this site is helpful for understanding the progression of lighting technology and why the HPS bulb was such a breakthrough in the industry.

**“IPower 600 Watt HPS MH Digital Dimmable Grow Light System Kits Air Cooled**

**Reflector Hood Set.” 2018. Zenhydro.2018.  https://www.zenhydro.com/ipower-**

**grow-light-600w-hps-mh-dimmable-air-cool-hood-set.html?gclid=EAIaIQobCh**

**MI3L-I96Ge2QIVRUOGCh1xAQhZEAQYAiABEgJmVfD\_BwE.**

This webpage sells a starter kit for the 600W HPS bulb grow system. In addition to the bulb, the kit includes a dimmable ballast, a reflective hood, a ratchet clip hanger rope, and a timer. This resource provides helpful information on and photos of all of the various parts needed to make the HPS bulb function properly.

**Kane, Raymond and Daniel Larson. 2001. “The High Pressure Sodium Lamp.”**

**In *Revolution in Lamps: A Chronicle of 50 Years of Progress*. Edited by Raymond**

**Kane and Heinz Sell. Lilburn, GA: The Fairmont Press, Inc. p. 239-276.**

This chapter gives a review of the history of the HPS lamp’s invention as well as a technical guide to how the components work together to produce light. It describes the chemical reaction of the components of the arc tube, and why these elements were selected over other combinations.

**“LED vs HPS – Which Grow Lights Are Better?” 2016. HTG Supply. 2016.**

**https://www.htgsupply.com/informationcenter/resources/Led-vs-hps-which-grow-**

**lights-are-better.**

This webpage features a comparison of HPS and LED growing bulbs, with the intention of determining which is superior. A list of pros and cons for each bulb helps the reader determine which bulb is best for them and their growing location. The article concludes by saying that both bulbs have advantages and disadvantages over the other, and it is difficult to say overall which is superior to the other. The author suggests that each grower make the decision of which bulb to buy based on their individual setup.

**Ottenstein, Sidney A. United States Patent: 4999547 – Ballast for high pressure sodium**

**lamps having constant line and lamp wattage. 4999547, issued March 12, 1991.
http://www.freepatentsonline.com/4999547.pdf**

This patent for the HPS bulb system’s ballast outlines the inner workings of the power source for the bulb. It explains its wattage output and how the technology was invented, as well as featuring several algorithmic diagrams for how the ballast works. Since the ballast is crucial to the proper functioning of the HPS bulb, this resource aids in the understanding of how the HPS bulb’s overall system works together to produce light.

**Smith, Arthur. “HID Lights for Beginners – High Intensity Discharge Lamps**

**Explained.” LEDwatcher, 13 June 2016, http://www.ledwatcher.com/high-intensity-**

**discharge-lamps-explained/**.

The author of this webpage explains in detail high intensity discharge lamps, the category under which the HPS bulb falls. He also specifically outlines the process of how the the lamp turns on, from the electricity surging through the ballast to the chemical reactions happening inside the arc tube that produce the bulb’s light spectrum output. Additionally, the page provides a labeled diagram of the bulb, as well as an explanation of its various uses, efficiency, maintenance, advantages, and disadvantages. This is a thorough and complete resource for learning about the HPS bulb, as it explains both its technical and socio-technical systems.

**Stouch, Justin. 2017. “LED Versus High Pressure Sodium (HPS) and Low Pressure Sodium (LPS).” Stouch Lighting. http://www.stouchlighting.com/blog/**

 **led-vs-hps-lps-high-and-low-pressure-sodium.**

This page, featured on the website of an LED lighting company, provides a comparison chart of LED versus low and high pressure sodium bulbs. The chart discusses multiple topics, such as “Correlated color temperature,” “Cycling,” “Dimming,” “Efficiency,” and “Heat emissions,” and determines which bulb is superior in each topic. Unsurprisingly, they have chosen LED as the winner of each category. When researching the HPS bulb, arguments both for and against its usefulness allow for one to develop a well-rounded sense of the strengths and weaknesses of the bulb.

**Whelan, M, and Rick DeLair. 2013. “Sodium Lamp.” Edison Tech Center. 2013.
 http://www.edisontechcenter.org/SodiumLamps.html.**

Both the history and the function of the HPS bulb are explained in a detailed manner in this resource. After outlining the inventions and development of the materials used to create the bulb, the author discusses some of its advantages and disadvantages and provides a detailed diagram of how the chemicals interact with each other inside the arc tube to produce light. This webpage also features several videos demonstrating how the HPS bulb turns on, as well as a slow-motion sequence of the different light spectrum outputs of the bulb according to the chemical reactions taking place inside the arc tube.

**"What Is Voltage?" Fluke Corporation. Accessed April 19, 2018. http://en- us.fluke.com/training/training-library/measurements/electricity/what-is-**

**voltage.html.**

This webpage explains how electrons travel through a conductor to create voltage. It also highlights the differences between direct and alternating current. This resource is helpful in understanding how the HPS bulb system starts; the ballast sends voltage through the base of the bulb to start the flow of electrons in the bulb’s arc tube.