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September 3, 2014

MEMORANDUM

TO: Power Committee

FROM: Massoud Jourabchi

SUBJECT: Electrical load impacts of indoor commercial cannabis production

BACKGROUND:

Presenter: Massoud Jourabchi and Maggie Lahet

Summary: Under state of Washington initiative I-502 legal production of cannabis started in 2013-2014. Council analysis estimated the demand for electricity for the growers of cannabis represent about 80-163 Mwa of new load to the regional system.

Relevance: Producing a long-term Load forecast is a requirement of the Act. In responding to this requirement, Council's load forecast keeps track of all forms of electricity consumptions, in particular new and emerging loads. Three such emerging loads are data centers, electric vehicles and in-door cannabis production. In this presentation we will present results of preliminary analysis on load impact from cannabis production.

Workplan: 1.D. Update long-term load forecast. In preparation of the Seventh Power Plan, forecast of loads from cannabis producers will be incorporated into the long-term demand forecast.

Background: The State of Washington, through its initiative process, enacted a law allowing for recreational use of cannabis. Hundreds of producers have now been licensed to grow and process cannabis. Those producers using indoor growing facilities place a significant load on the electrical system to provide lighting, HVAC and other required services for the plants. Staff conducted interviews with a number of these producers in order to develop estimates of existing and forecast of electrical loads from these operations.

More Info: NA

IMPACT OF CANNABIS PRODUCTION IN THE PACIFIC NORTHWEST ON REGIONAL ELECTRICITY LOADS

September 9, 2014

Acknowledgement

**THIS PRESENTATION BENEFITED FROM INDUSTRY BACKGROUND
WORK DONE BY CLEARRESULT COMPANY.**

Why are we doing this study

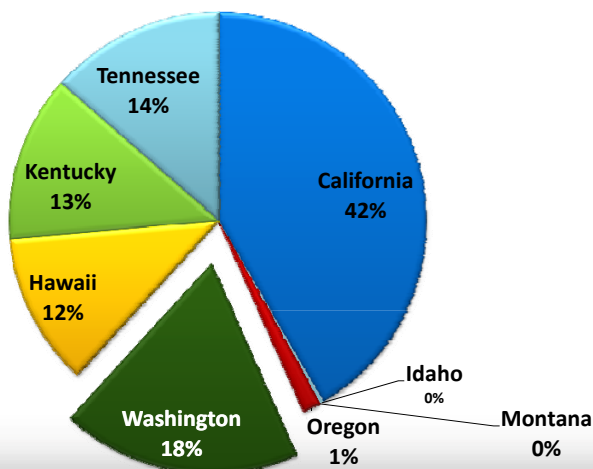
- Better understanding of impact of I-502 on electric loads in state of Washington.
- Indoor cannabis production can be a very electricity intensive.
- Provide information on energy efficiency potential for Seventh Plan development

Presentation Overview

- Growing Cycle – Why Growing Has Moved Indoors
 - Stages and pace of plant development in nature
 - Stages and pace of plant development in modern indoor growing facilities
- Results from Council's survey of I-502 producers
- Load Forecast Range
- Identify Potential Energy Efficiency Options

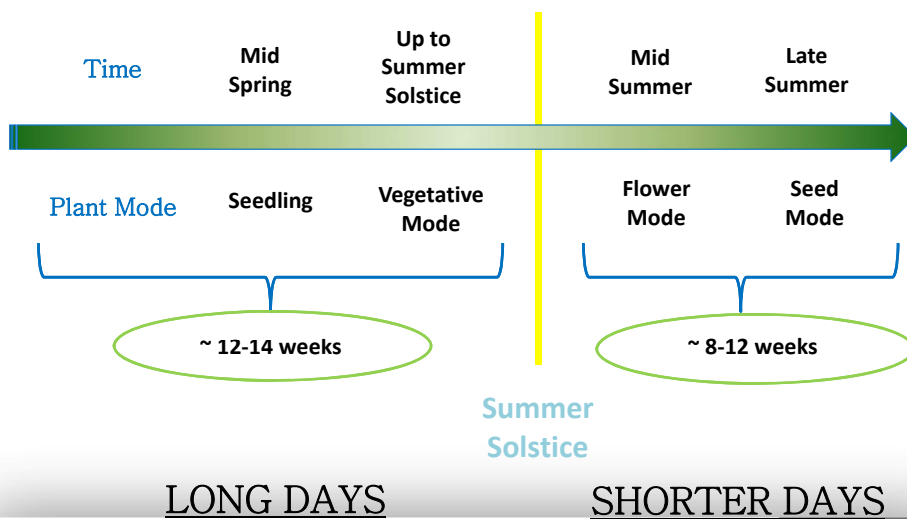


Estimated State Shares of National Cannabis Production (2006)*

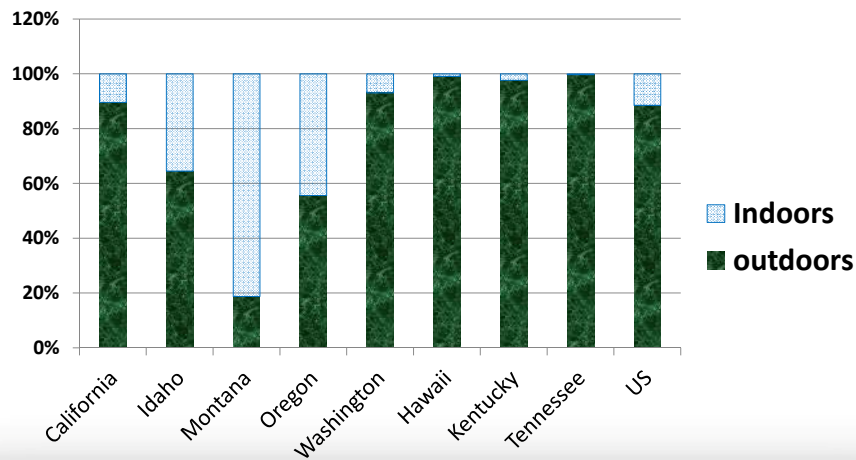


*As estimated by
Federal Government

Natures Growing Cycle



Method of Production

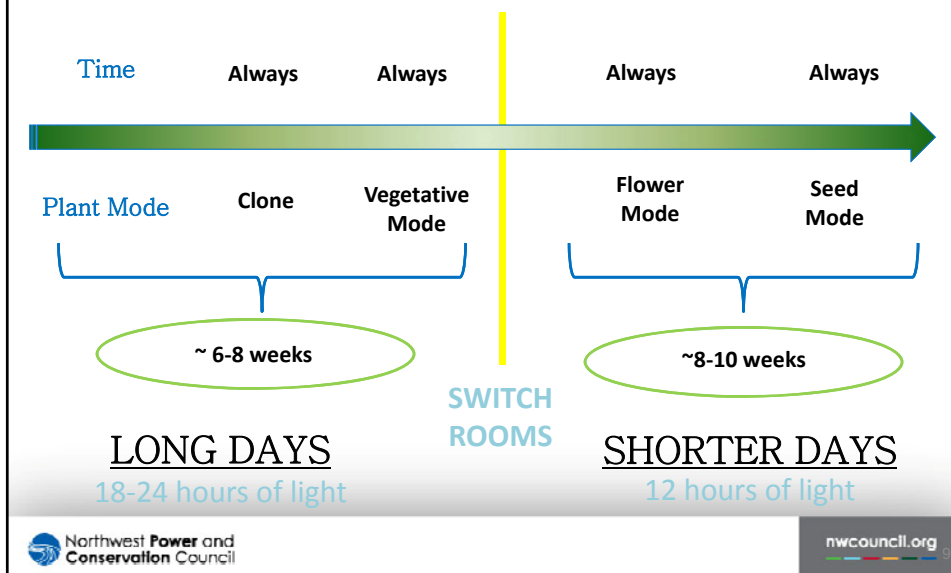


Why producers go indoors?

Indoor operations seek to:

- Reduce cycle time
- Replicate and standardize ideal outdoor conditions:
 - Temperature
 - Lighting
 - Atmosphere
 - Watering
 - Nutrients / plant food
- Increased security

Modern Indoor Growing Cycle



An indoor grow module accommodating **4 plants** sucks as much electricity as **29 refrigerators**.

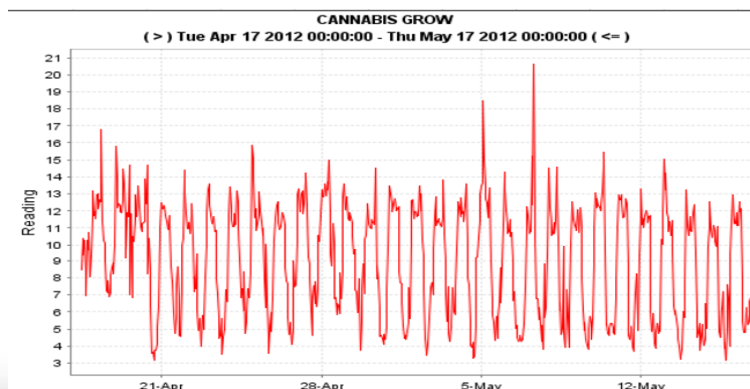
The infographic shows four small potted plants at the top. Below them is a grid of 29 refrigerator icons arranged in three rows (10 in the first row, 10 in the second, and 9 in the third). The source "Mother Jones" is cited at the bottom right. The Northwest Power and Conservation Council logo and the website "nwcouncil.org" are at the bottom.

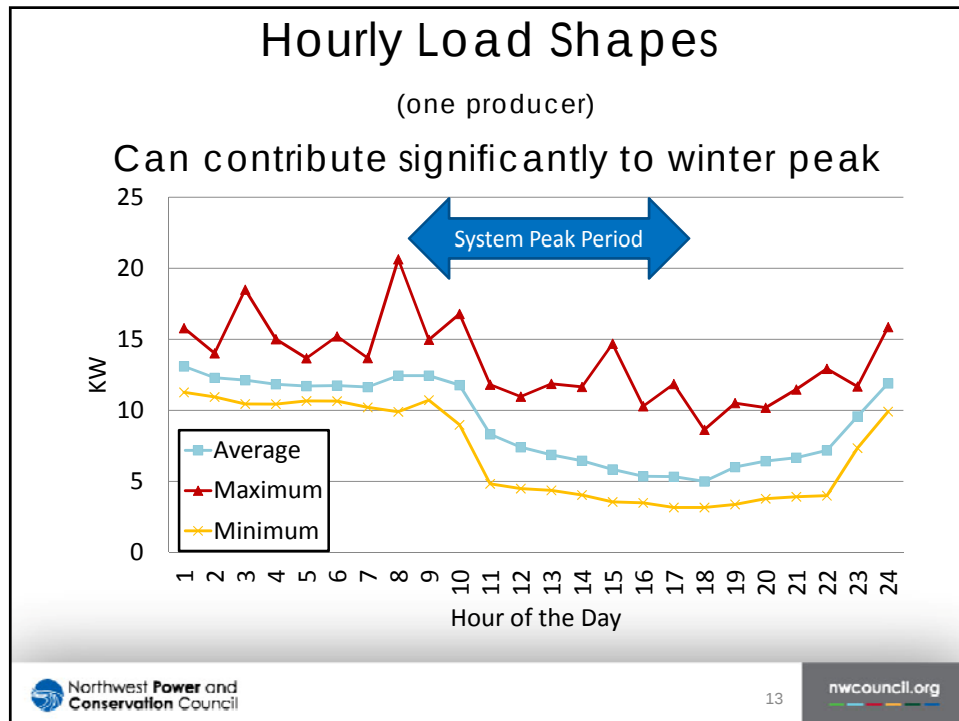
Electricity Use in Indoor Production



Hourly Load profile of one indoor producer

Producers do not have a flat profile





Findings from Council's Survey of I-502 Producers

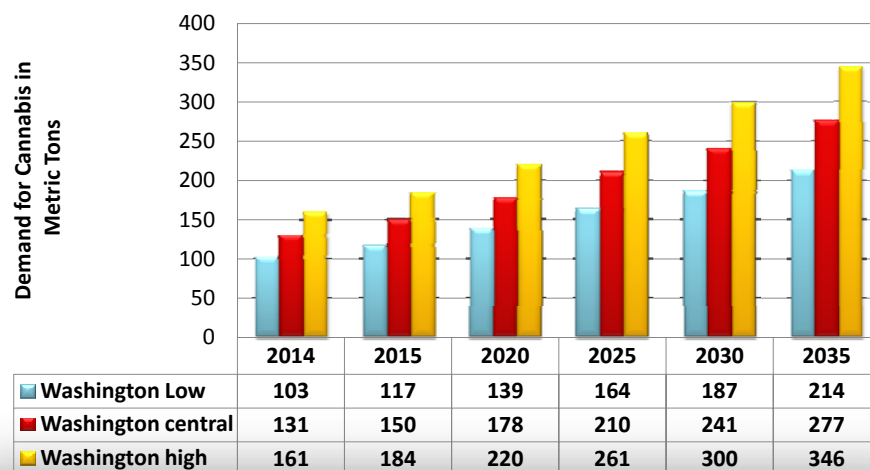
- 121 out 2626 Producers approved in July
- 1,913 Processor applications
- 2,167 Retail applications
- 13 Indoor producers were surveyed
 - Square footage, facility layout, plant strain and number of plants etc. vary by producer
 - Lighting, directly or indirectly, accounts for 80% of electricity use

Survey Results (continued)

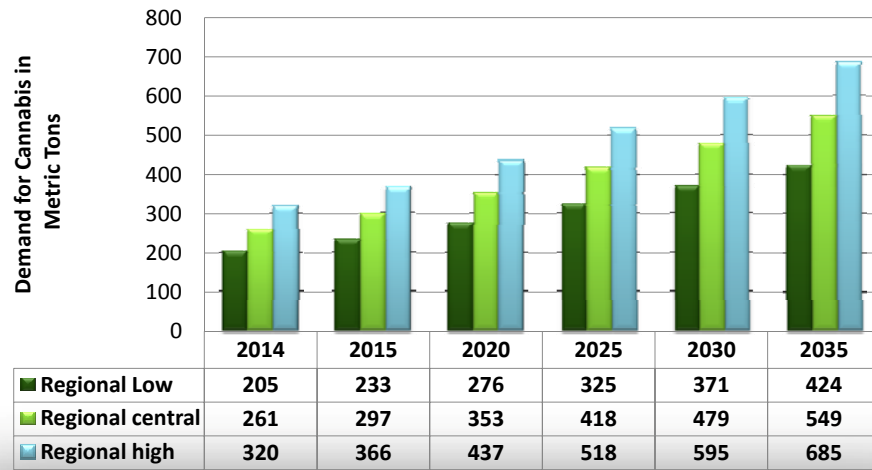
Baseline for indoor production:

- **Vegetation Room**
 - 1,000W Metal Halide , plus other lights
 - 2-8 plants per lamp
 - Operated 24 hours on, 18 hours on/6 hours off
- **Flowering room**
 - 1000W High Pressure Sodium w/adjustable ballast 600W-1150W
 - 2-3 plants per lamp
 - Operates 12 hours on/12 hours off
- **HVAC**
 - Rooms have separate HVAC and lighting
 - Mini split for every 1,000 sq. ft. with additional large unit
 - Temperature and Humidity set points

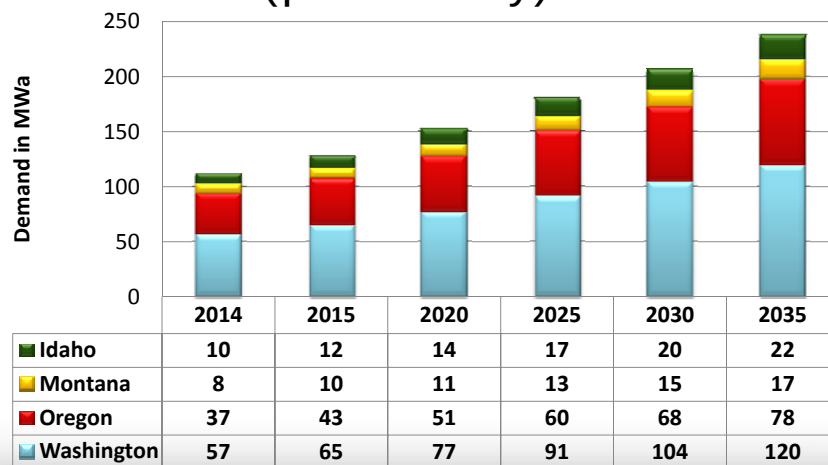
Preliminary Estimate of Demand for Cannabis 2014-2035



Preliminary Estimate of Demand for Cannabis 2014-2035



Forecast of Demand from Producers* 2014-2035 (preliminary)



Range of Forecast of Demand for Electricity

- **60 MWa** calculated using estimated demand for cannabis in Washington and borrowed metric of kWh/kg
- **80 MWa** calculated using % of total sq. ft. that each tier occupies and primary source metric of .04 kW/sq. ft.
- **160 MWa** calculated using total allowable square footage for Washington cannabis production and using borrowed metric of kWh/sq.ft./cycle

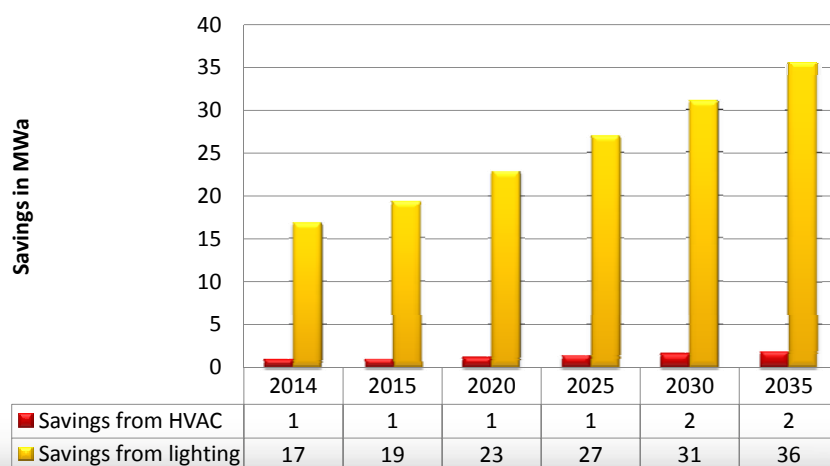
Forecasted range of 60-160 MWa

Efficiency Potential

- Surveyed Washington producers expressed interest in switching to energy efficient lighting (concerned about cost of LED lamps)
- LED Lighting Being Tested
 - Test 1- Cannabis Strain: *Bio-Diesel***
 - HPS:
 - 1.68 lbs total yield, 1,000W, 4'x4' area, 1.53lb/kW, 27.95% THC
 - LED:
 - 1.9lbs total yield, 780W, 4'x4' area, 2.44lb/kW, 26.07 %THC
 - Test 2- Cannabis Strain: *Durban Poison***
 - HPS:
 - 1.75 lbs total yield, 1100W, 4'x4' area, 1.6lb/kW, 14.39% THC
 - LED:
 - 1.85 lbs total yield, 780W, 4'x4' area, 2.37lb/kW, 22.28% THC

Findings : LED provided 6% increase in yield, 48% increase in conversion efficiency in lb/kW

Savings Potential Washington 2014-2035



Summary

- Indoor cannabis production is very energy intensive.
- There are significant efficiency gains possible by:
 - Using better lighting and HVAC
 - Moving to greenhouses
- More research needed to establish the current and future baseline.