

Market Research & Momentum Savings Team

Quarterly Call | May 6, 2020

Bonneville
POWER ADMINISTRATION



Agenda

- Welcome/introductions
- Outdoor lighting stock assessment



Outdoor Lighting Stock Assessment

Momentum Savings Quarterly Call
May 6, 2020



Agenda

- About the Study
 - What's OLSA?
 - Sampling
 - Status
- Cataloging Results
- Streetlighting Findings
- Questions & Discussion

About OLSA

Why OLSA?

Outdoor lighting has a significant role in programs and regional load



*Relatively large
end-use – regionally
and nationally*



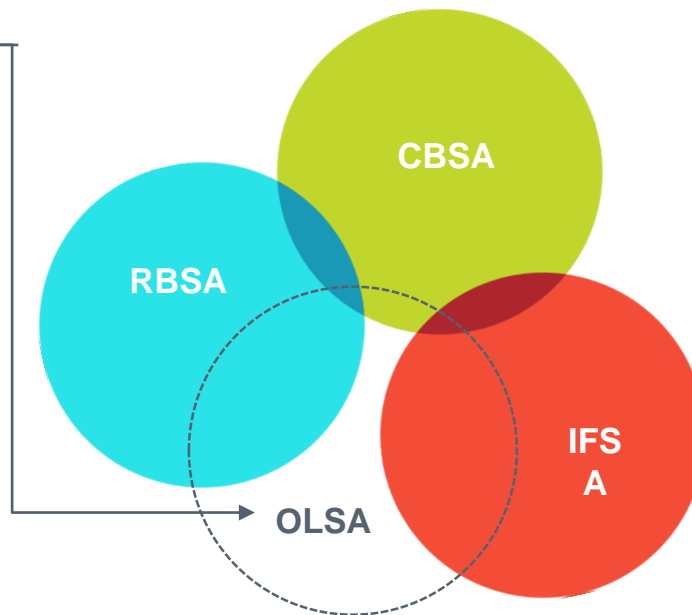
*Outdoor is 46% of BPA's
non-residential lighting
program activity*



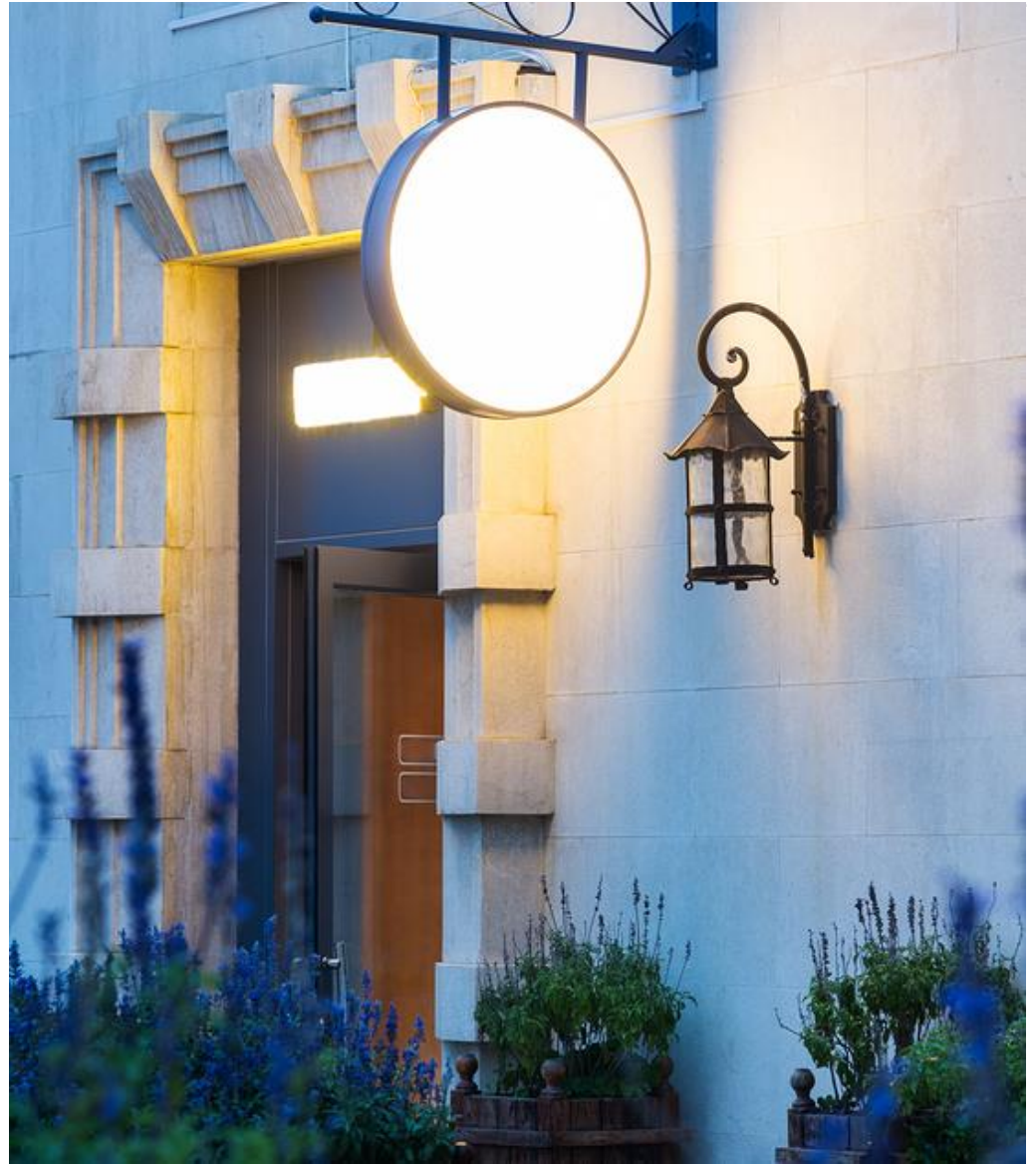
*Inconsistent market
size estimates for
key segments*

Previous Regional Stock Assessments Have Not Prioritized Outdoor Lighting

OLSA would complement other stock studies by filling in key gaps.



So, what exactly
is “in” OLSA?



Included in OLSA

**Street and
Roadway Lighting**



**Industrial &
Agricultural
Exterior**



**Standalone
Parking Garages
& Lots**



**Public
Spaces/Parks**



Commercial Building Exterior



Not in OLSA

Residential Landscape



Traffic Lights & Billboards



Sampling

Creating a Sample Frame

No single list of outdoor fixtures exists, just as one does not exist for commercial buildings

In absence, team used a geographic sample design to generate the sample frame

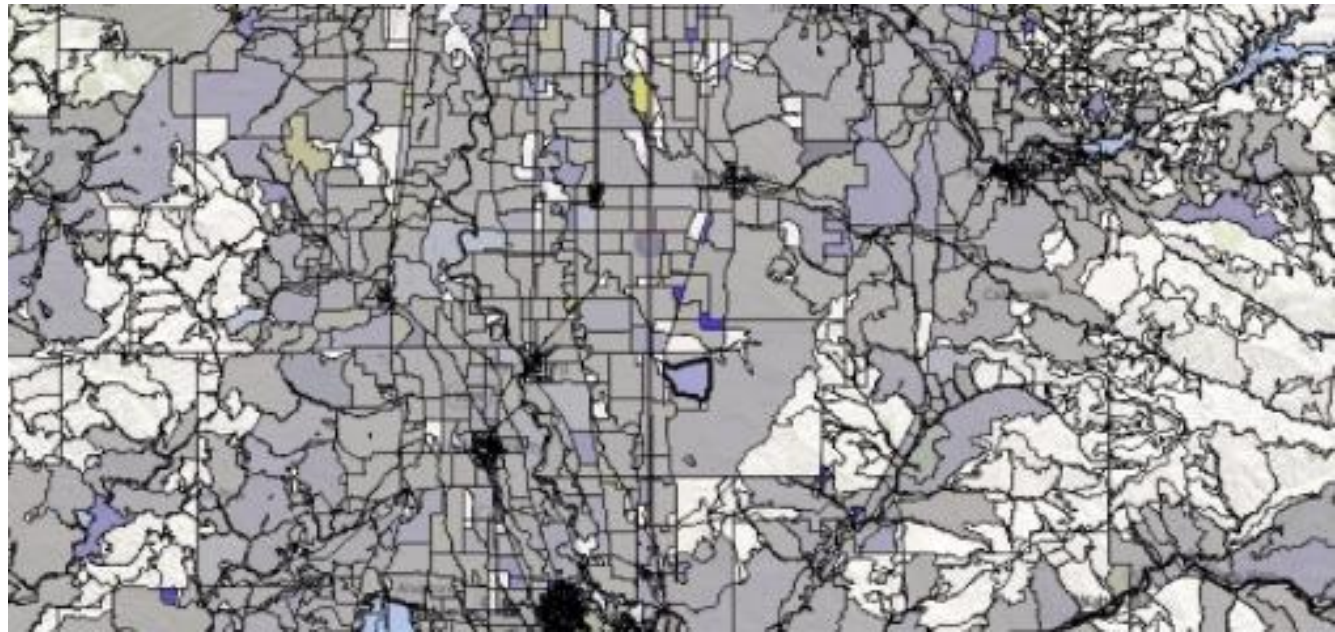


Sampling Unit: Census Blocks

Why? Be consistent with CBSA

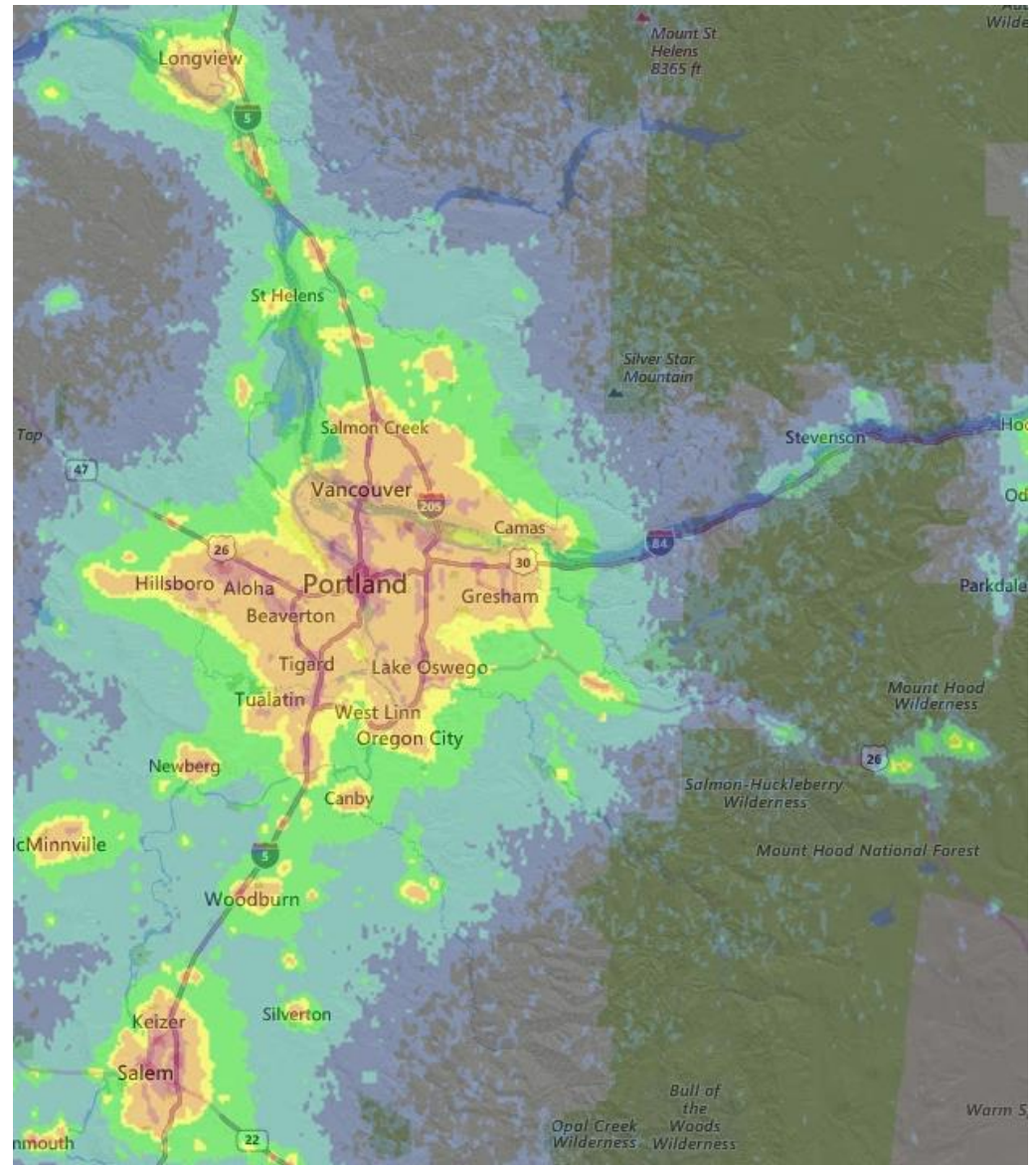
Also:

- Mutually exclusive
- Comprehensive and exhaustive
- Reasonably sized



Satellite Luminosity Data

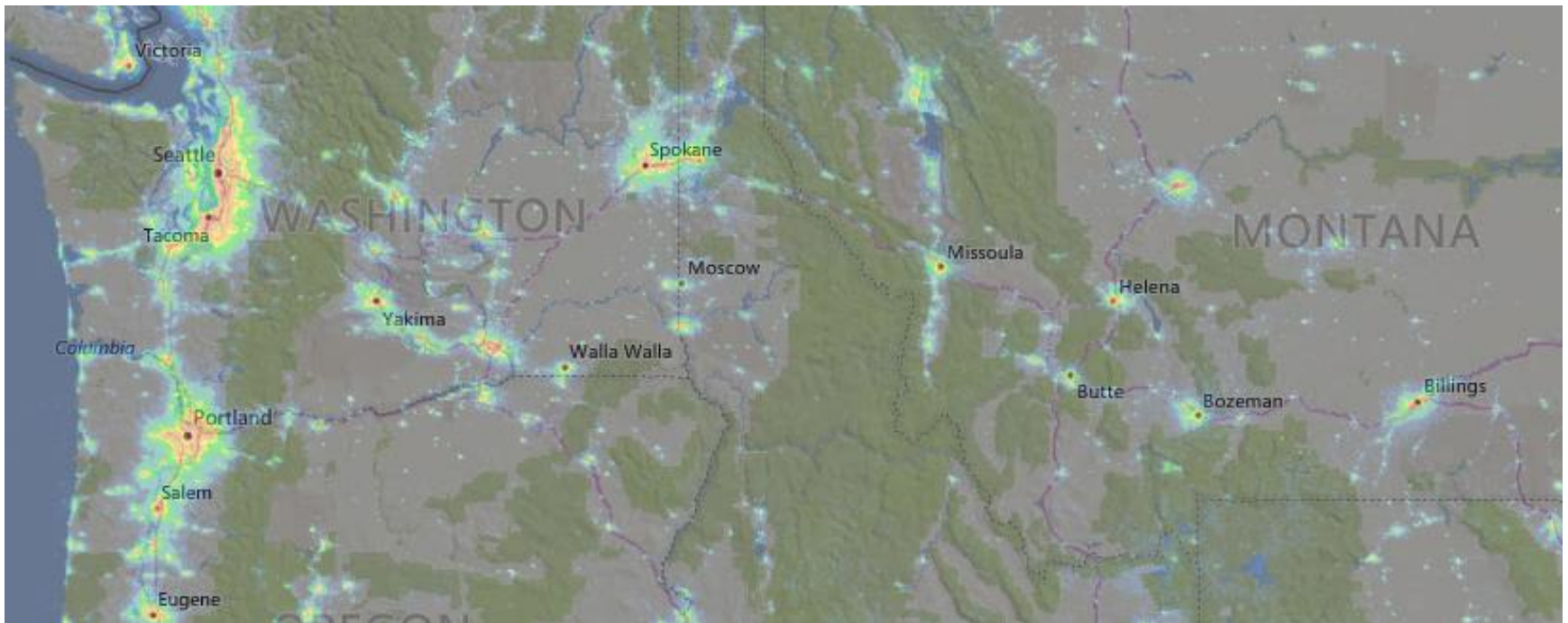
- Used **luminous flux** (average luminosity in an area multiplied by the size of the area) to identify “brighter” areas in region
- These areas are likely to contain OLSA outdoor lighting segments



Combining Luminosity Data and Census Blocks

Used GIS to merge satellite luminosity and Census block datasets, resulting in luminous flux values for every Census block in the four-state region.

The resulting data set offers regionally comprehensive sampling frame for OLSA from which the team can draw a sample of blocks in which we emphasize those that have the greatest flux, and thus most likely to contain OLSA lighting.



Regional Sample Frame

- 2,000 total blocks
- Stratified random sample with heavier sampling of “brighter” blocks

Strata	Total Regional Census Blocks	Sampled Census Blocks
1	337,846	54
2	34,999	34
3	49,976	87
4	43,601	137
5	23,274	113
6	20,012	143
7	13,819	146
8	9,920	153
9	7,083	159
10	4,848	158
11	3,385	160
12	2,270	155
13	1,366	141
14	738	122
15	347	238
Total	553,484	2,000

1. Web-based Data Collection

Used custom tool, based on Google Maps/Streetview to remotely (and cost-effectively) identify OLSA lighting and count streetlights



2. On-Site Data Collection

On-site data collection is only relevant for blocks with OLSA lighting other than street lights.



Study Phases

OLSA – Phased Rollout

PHASE 1 (JUNE 2017-MARCH 2018)

- Determined scope and sampling approach (2,300 blocks, stratified using satellite luminosity data), developed utility outreach materials, and created data collection protocol

PHASE 2 (MAY 2018-JULY 2019)

- Built cataloging tool, cataloged 600 blocks in greater Seattle area, piloted utility outreach, completed 16 site visits, and refined cataloging and onsite data collection protocol

PHASE 3 (OCT 2019-JAN 2020)

- Finished cataloging, created “shovel ready” site visit sample, and estimated regional streetlighting consumption

Cataloging Results



Blocks Types

Relatively even split between block types

Block Type	Count	Percent
Other OLSA (i.e., have at least one OLSA site)	803	34%
Streetlights Only (but no OLSA sites)	917	38%
No OLSA (no OLSA sites or streetlights)	673	28%
Overall	2,393	100%

Site Types (Sample)

Site Type	Sites identified	% of Sites
Manufacturing	419	28%
Park/open space	294	20%
Residential <= 3 stories with Common	235	16%
Power generation, water supply, waste and water treatment	135	9%
Ports (air and water)	98	7%
Agriculture and fisheries	94	6%
Bulk storage (tanks and silos)	65	4%
Residential > 3 Stories	36	2%
Cemetery	25	2%
Mixed	20	1%
Jail, prison, asylum	17	1%
Mining, gas/oil extraction	17	1%
Military bases	16	1%
Parking	11	1%
Stadiums	10	1%
Courthouse	4	<1%
Rail/bus stations	4	<1%
Data center	3	<1%
Total	1,503	100%

What do these results suggest at a regional level?

Site Type	In Sample	“Extrapolated”
Manufacturing	419	6,596
Park/open space	294	9,807
Residential <= 3 stories with Common	235	5,090
Power generation, water supply, waste and water treatment	135	2,026
Ports (air and water)	98	1,245
Agriculture and fisheries	94	3,794
Bulk storage (tanks and silos)	65	7,351
Residential > 3 Stories	36	4,859
Cemetery	25	1,523
Mixed	20	605
Jail, prison, asylum	17	363
Mining, gas/oil extraction	17	227
Military bases	16	229
Parking	11	239
Stadiums	10	49
Courthouse	4	487
Rail/bus stations	4	240
Data center	3	26
Grand Total	1,503	44,755

OLSA Sites by Block

1,503 total
OLSA sites
means:

- 1.9 sites per “Other OLSA” block
- 0.63 sites per sampled block (regardless of type)

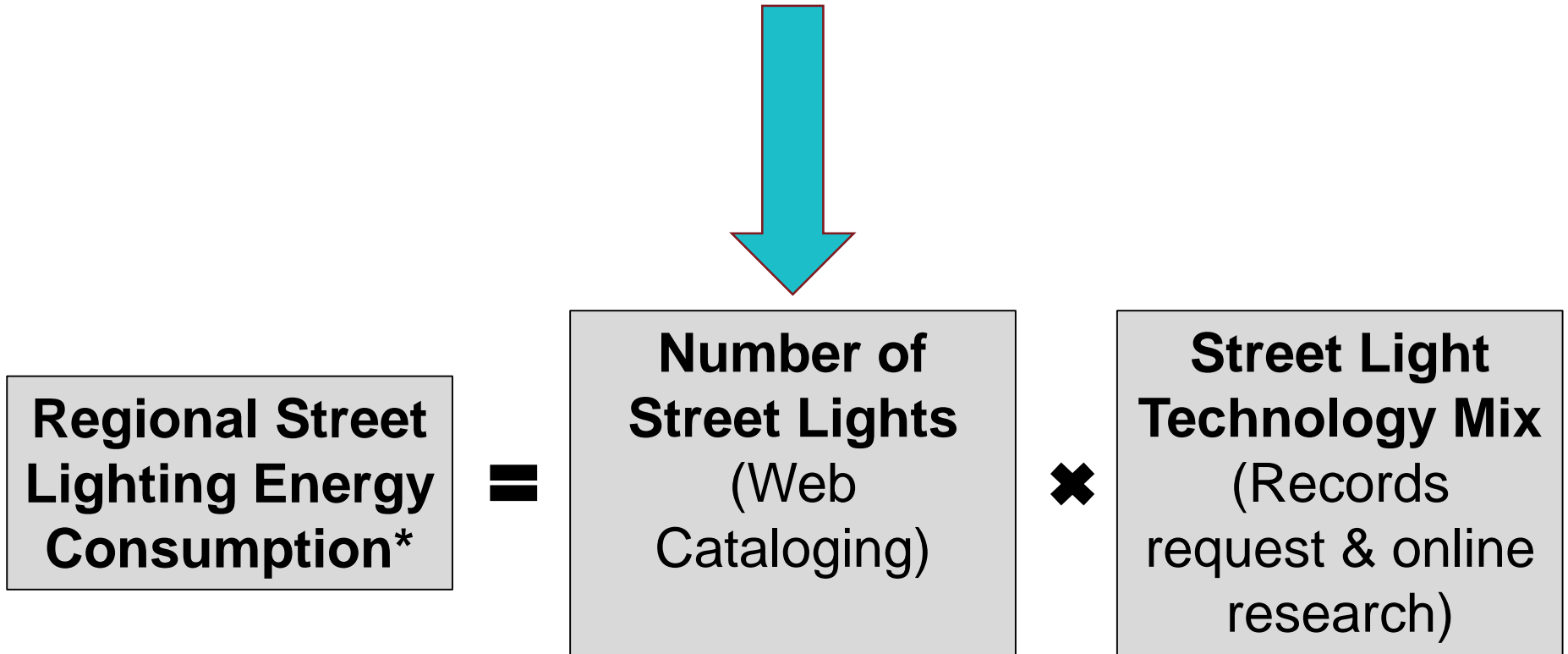


This one had 18!

Bonus: Streetview Hall of Fame



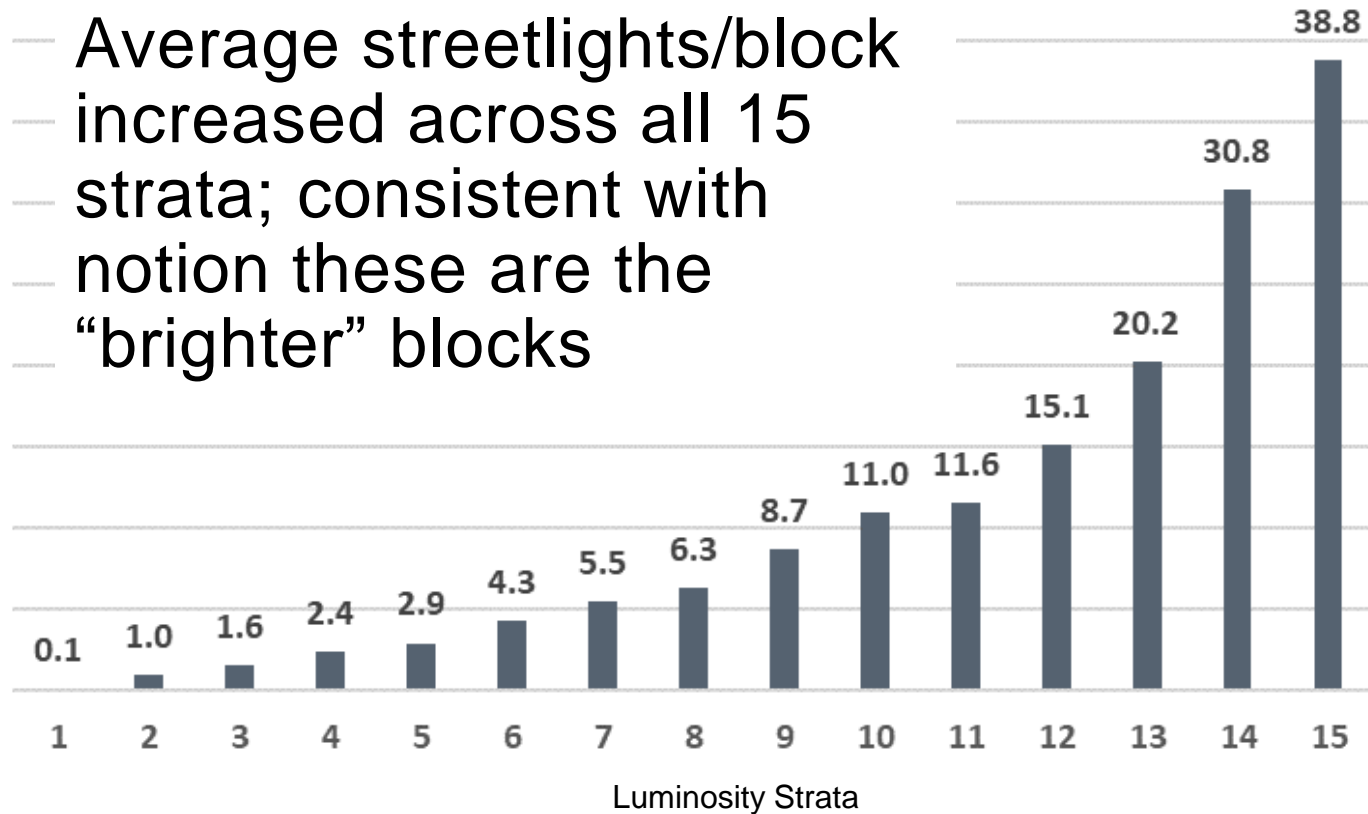
Streetlighting



*And HOU assumption

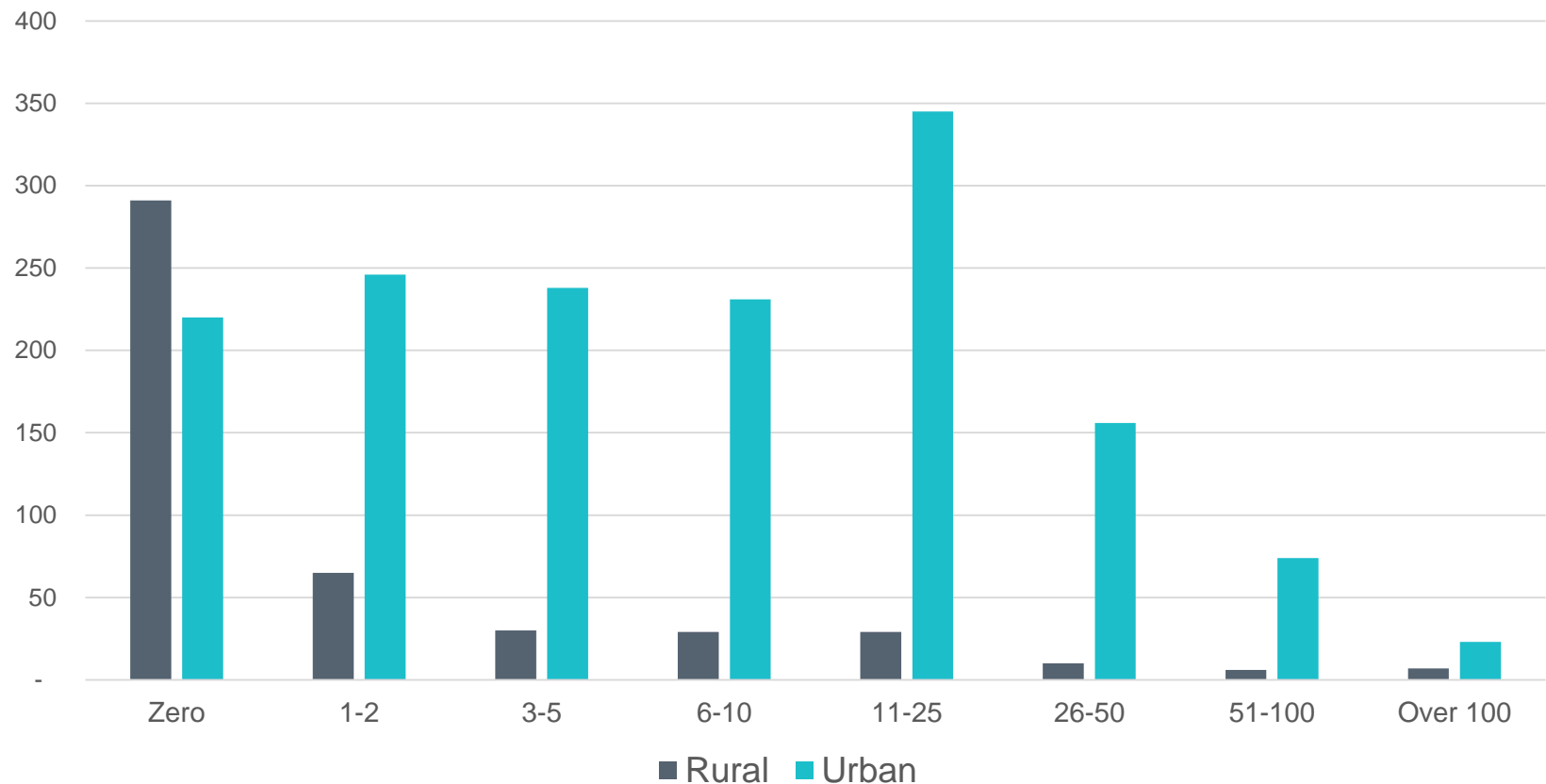
Streetlight Counts by Stratum

- Average streetlights/block increased across all 15 strata; consistent with notion these are the “brighter” blocks



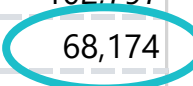
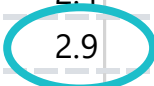
Streetlighting Counts by Urban/Rural

Unsurprisingly, catalogers found few streetlights in rural blocks (~3k of ~26k):



Regional Estimate: 786k

Strata	Total Regional Census Blocks	Sampled Census Blocks	Observed Streetlights	Observed Streetlights /Block	Extrapolated Regional Streetlights
1	337,846	54	4	0.1	25,026
2	34,999	34	33	1.0	33,970
3	49,976	87	138	1.6	79,272
4	43,601	137	323	2.4	102,797
5	23,274	113	331	2.9	68,174
6	20,012	143	619	4.3	86,625
7	13,819	146	797	5.5	75,437
8	9,920	153	966	6.3	62,632
9	7,083	159	1,379	8.7	61,431
10	4,848	158	1,736	11.0	53,267
11	3,385	160	1,849	11.6	39,118
12	2,270	155	2,337	15.1	34,226
13	1,366	141	2,851	20.2	27,620
14	738	122	3,753	30.8	22,703
15	347	238	9,232	38.8	13,460
Total	553,484	2,000	26,348	13.2	785,756



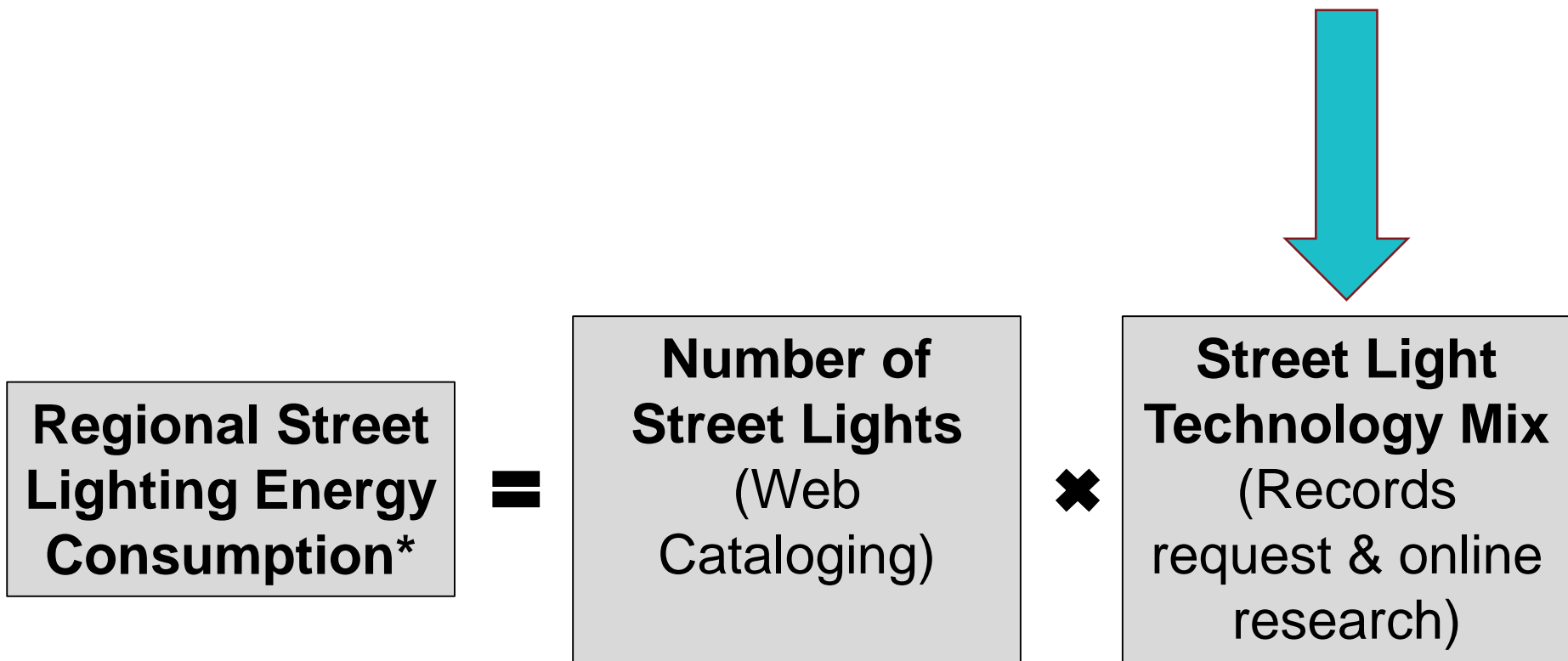
Statistical Precision

Strata	Total Regional Census Blocks	Sampled Census Blocks	Extrapolated Regional Streetlights	Precision at 90% Confidence	Min Estimate	Max Estimate
1	337,846	54	25,026	115%	-	53,857
2	34,999	34	33,970	40%	20,337	47,602
3	49,976	87	79,272	18%	64,836	93,708
4	43,601	137	102,797	17%	85,720	19,873
5	23,274	113	68,174	18%	56,117	80,232
6	20,012	143	86,625	16%	73,102	100,149
7	13,819	146	75,437	16%	63,459	87,414
8	9,920	153	62,632	18%	51,291	73,973
9	7,083	159	61,431	20%	49,409	73,453
10	4,848	158	53,267	17%	44,321	62,212
11	3,385	160	39,118	14%	33,617	44,619
12	2,270	155	34,226	15%	29,183	39,268
13	1,366	141	27,620	16%	23,172	32,069
14	738	122	22,703	14%	19,511	25,894
15	347	238	13,460	10%	12,129	14,791
Total	553,484	2,000	785,756	6%	736,467	835,046

Previous Estimates

We're aware of two - both higher:

- 1M (Seventh Power Plan)
- 1.7M (NEEA)



*And HOU assumption

Analysis Goal

Develop street lighting technology mixes by both **state** and **urban/rural** census designation

Why?

- Previous research indicated cities were earlier/faster adopters of LEDs
- Lighting in urban and rural areas tend to be owned/managed by different entities

Two Data Sources

1. Records Requests (RR)

- Sent 130 requests; 70 responded with information representing 342,000 streetlights

2. Press Releases (PR)

- Acquired through online articles and information on government websites

Online Research Examples

Olympia, WA

Doing Things Better Effective and Efficient

- **All streetlights converted to energy saving LED Lights.** About 30% of the City's streetlights are owned by Puget Sound Energy. After completing the conversion of all City-owned streetlights to LED in 2013, this project completed the conversion of the remaining lights, those owned by PSE. Now all streetlights and traffic signals in the City are LED, saving the City over \$200,000 on electric energy consumption.



Streetlight Conversion



Eugene, OR

Eugene's switch to LED street lights draws some heat

by [blognews](#) · [3 YEARS AGO](#) · LESS THAN A MINUTE READ



Workers are finishing changing out nearly 5,000 streetlights with fixtures that are more energy efficient, but the whiter light is drawing criticism from some residents. Portland-based contractor Christenson Electric is scheduled to wrap up within the next month the work of swapping out fixtures employing high-pressure sodium bulbs with ones using light-emitting diodes, also called LEDs.

Portland, OR

How big is the City's street light program?

The City owns about 55,000 street lights. 50,200 of these street lights are cobra-head fixtures. These overhead fixtures are found on most roadways, especially arterials and residential areas. The remaining 4,800 are ornamental street lights. Many downtown streets and other special lighting districts are lit by ornamental street lights. All of the City's street lights work to brighten our streets to help make travel safer and reduce crime by increasing visibility.

Why did we switch to LEDs?

Cities around the world are switching to LED lights as a way to save both money and energy while simultaneously increasing safety and visibility. These cities include our neighbors to the north in Seattle and nearby in Gresham, Lake Oswego, Hillsboro, Beaverton, Clackamas County and Milwaukie, to name a few.

Bellevue, WA

LED Conversion

A joint project between the City of Bellevue and Puget Sound Energy to replace 4,242 old low-pressure sodium streetlights with new, energy-efficient LED (light-emitting diode) fixtures was completed in May 2016.

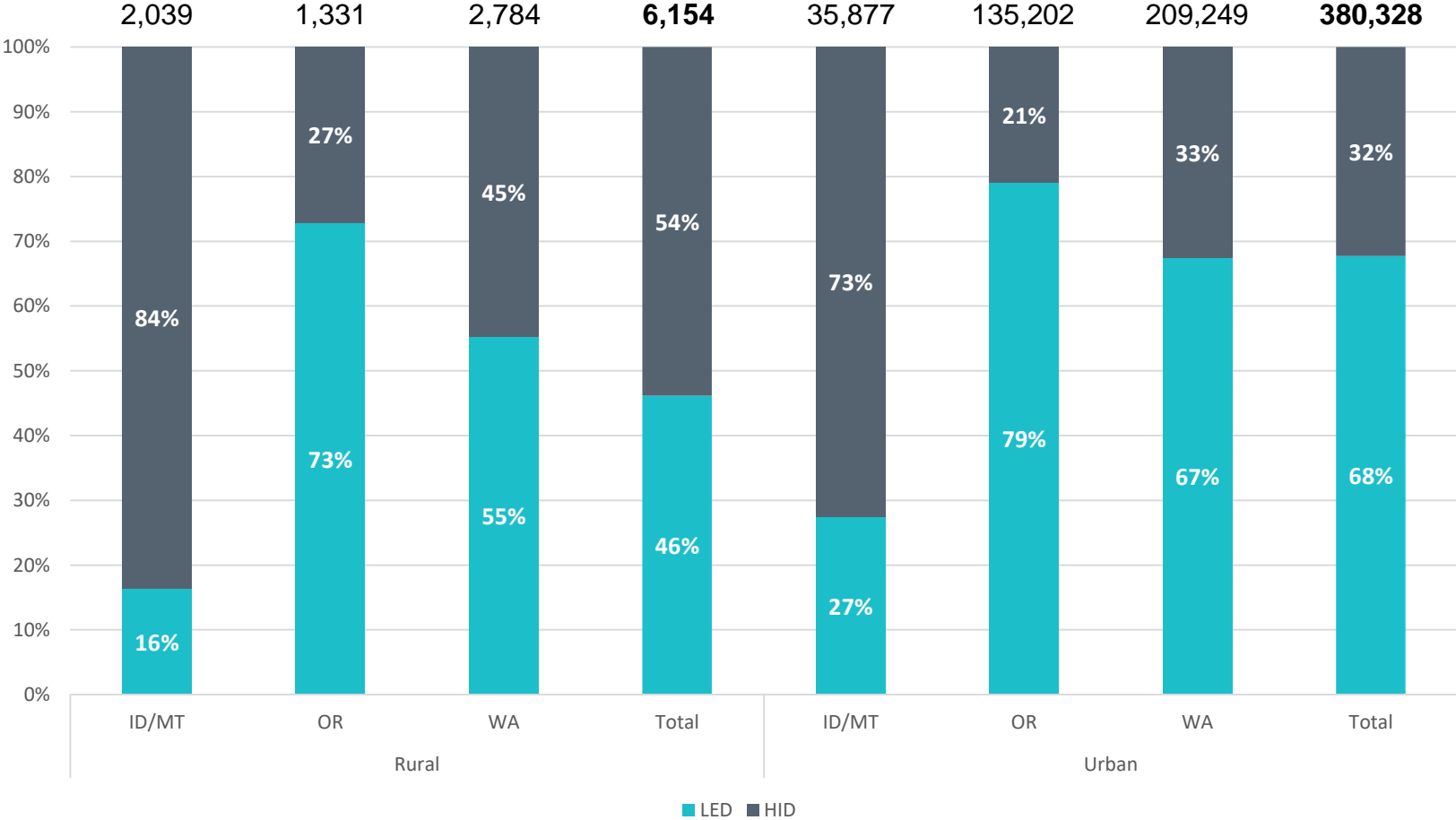
Background

The City of Bellevue received a state grant to replace half of the city's streetlights with the longer-lasting LEDs. Puget Sound Energy owns and maintains approximately 5,600 streetlights in Bellevue; the city owns and maintains about 3,100 lights. Implementing the new lighting technology is an important component of the city's Environmental Stewardship Initiative Strategic Plan 2013-2018, which encourages energy retrofits and operational improvements for municipal facilities.



Estimated Technology Mix (by State and CB Type)

Number of Streetlights



Threats to Validity

- 1. Limited Rural Data.** We have a lot more tech mix information about urban areas (380k) than rural areas (6k)
- 2. LED Press Release Bias.** Most available press releases are announcing LED conversions (i.e., no one publishes stories about sticking with HIDs). As a result, using press releases bias tech mix toward greater efficiency

Regional Summary

(Count and Mix by State and CB Type)

3. Meaningful differences by state

State	Urban		Rural		Regionwide	
	Streetlights	% LED	Streetlights	% LED	Streetlights	% LED
ID/MT	96,839	27%	18,367	16%	115,206	27%
OR	269,042	79%	8,327	73%	277,369	79%
WA	369,709	68%	23,472	55%	393,180	67%
Total	735,590	68%	50,166	46%	785,756	67%

1. Most lights are in urban blocks

2. Higher LED penetration in urban areas

A close-up photograph of several yellow tulips in bloom, with some petals showing a slight orange tint. The background is softly blurred, showing more flowers and green foliage. A bright yellow horizontal band is overlaid across the middle of the image, containing white text.

Contact: bfwatson@bpa.gov

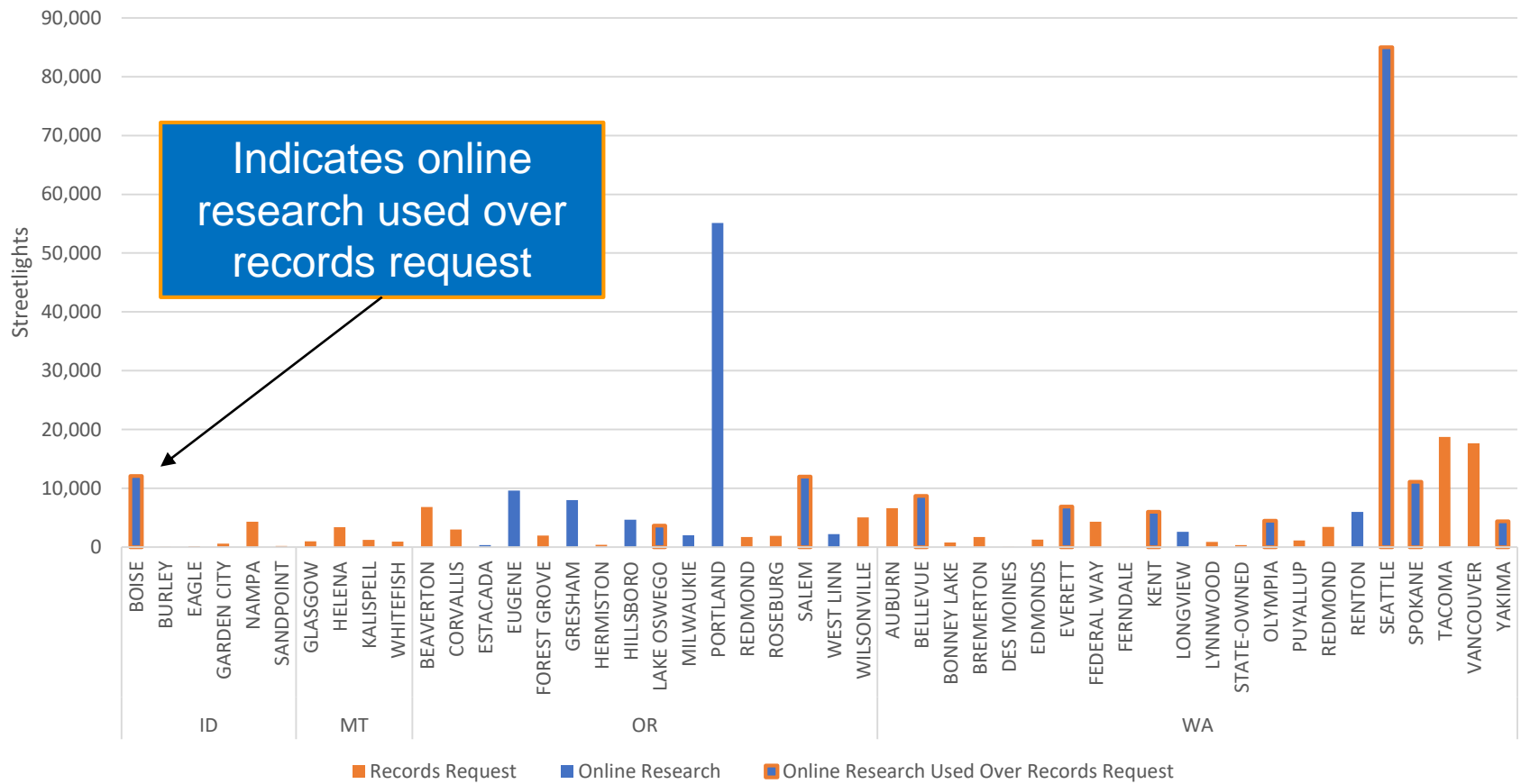
See you August 5th!

****New WebEx Info Coming****

Appendix

What if we had both?

- We typically relied on **online research**.
- Why?
 - Usually more recent
 - Ex: Olympia, WA's records request indicated that all of their streetlights were high pressure sodium lamps, but online research showed they had recently converted to LED
- Tradeoff: Location vs. Technology Accuracy



Quality Check

