



Colorado State University

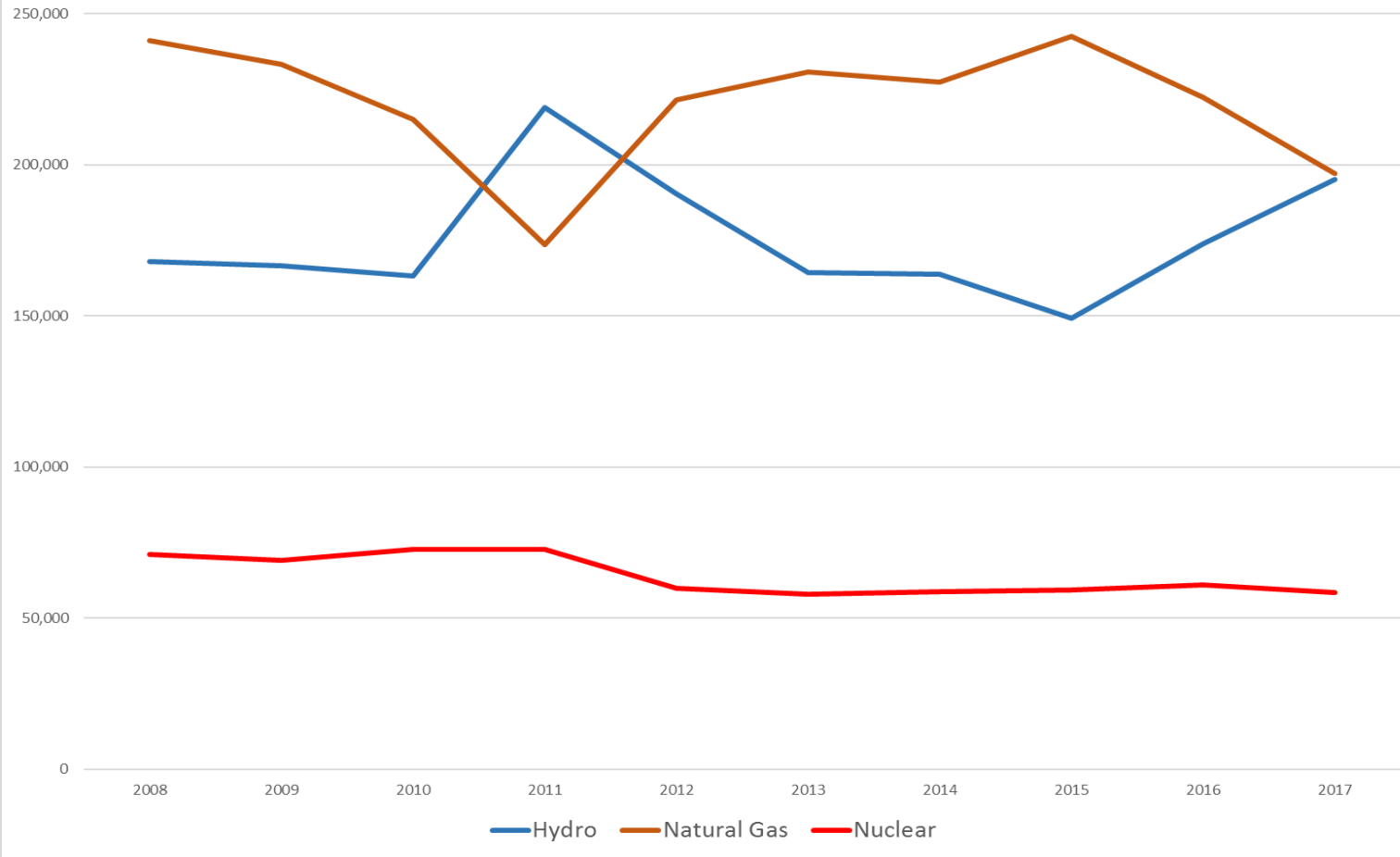
Patrick Cummins

Electricity Generation Trends on the 11-State Western Grid

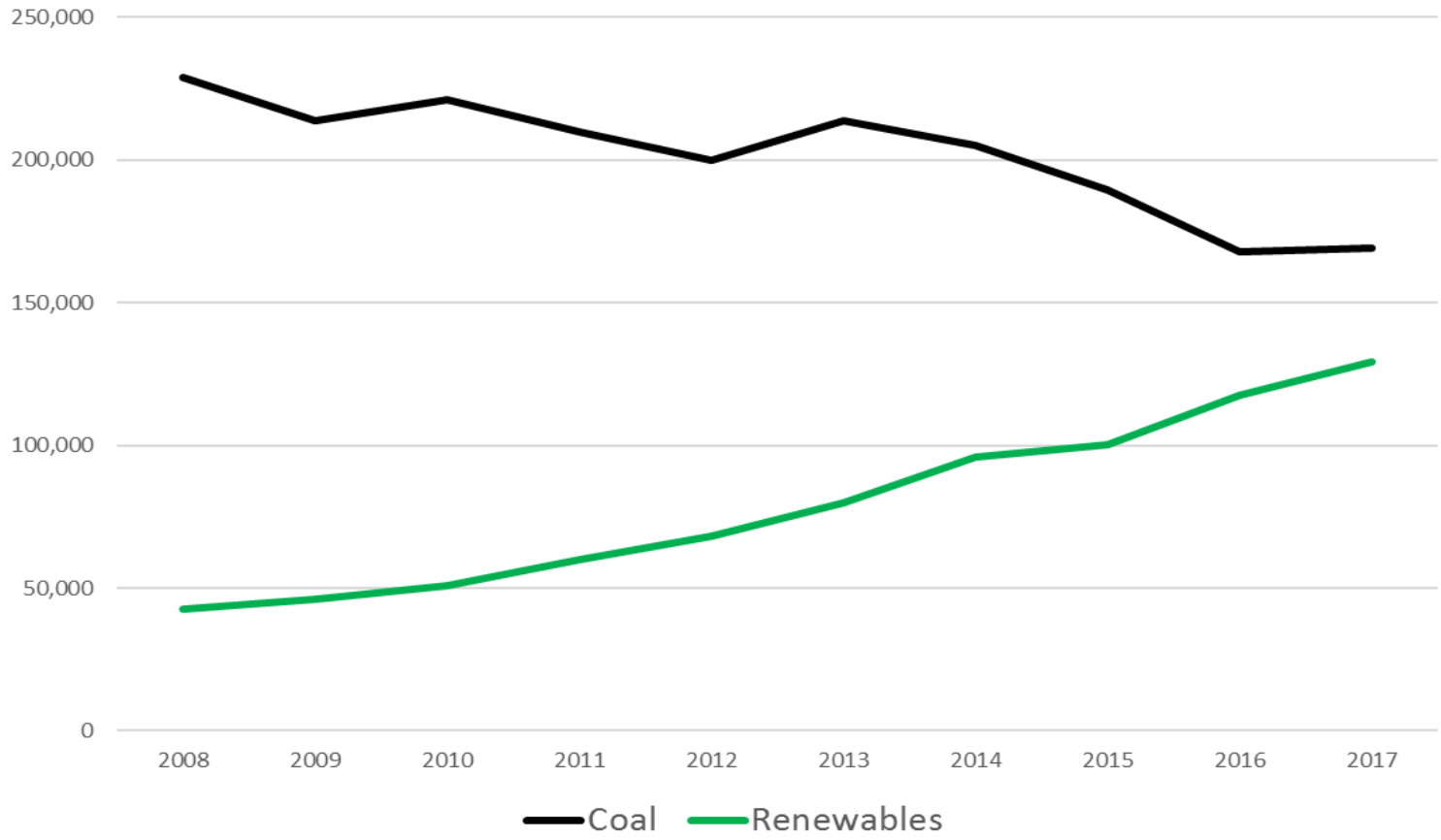
- No increase in total generation since 2008
- 2017 vs. 2008
 - Coal **-26%**
 - Nuclear **-18%**
 - Hydro + Natural Gas **-4%**
 - Renewables **+205% (3X)**

The decline in coal and nuclear generation in the West since 2008 has all been offset by growth in renewables

Western US Electricity Generation
EIA 1000 MWHrs

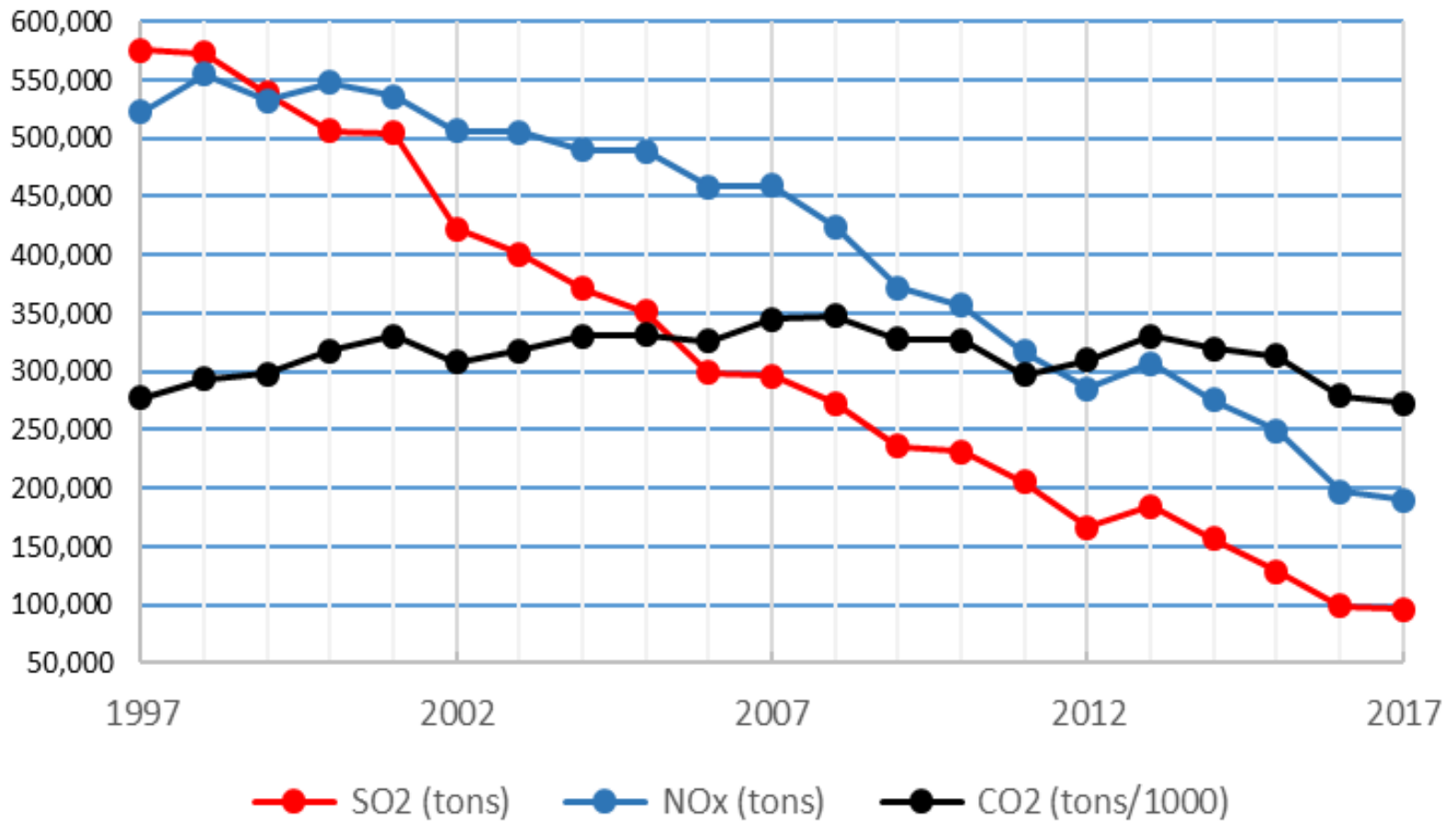


Western US Electricity Generation EIA 1000 MWHrs



Western US Power Sector Emissions 1997-2017

Source: US EPA (11 WECC states)



SO2: -83%

NOX: -64%

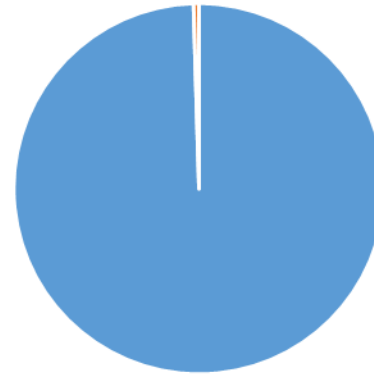
CO2: -2% (-22% since 2008)

2017 NOx Emissions from Western Power Plants



■ Coal ■ Natural Gas

2017 SO2 Emissions from Western Power Plants



■ Coal ■ Natural Gas

The Role of Coal in the West



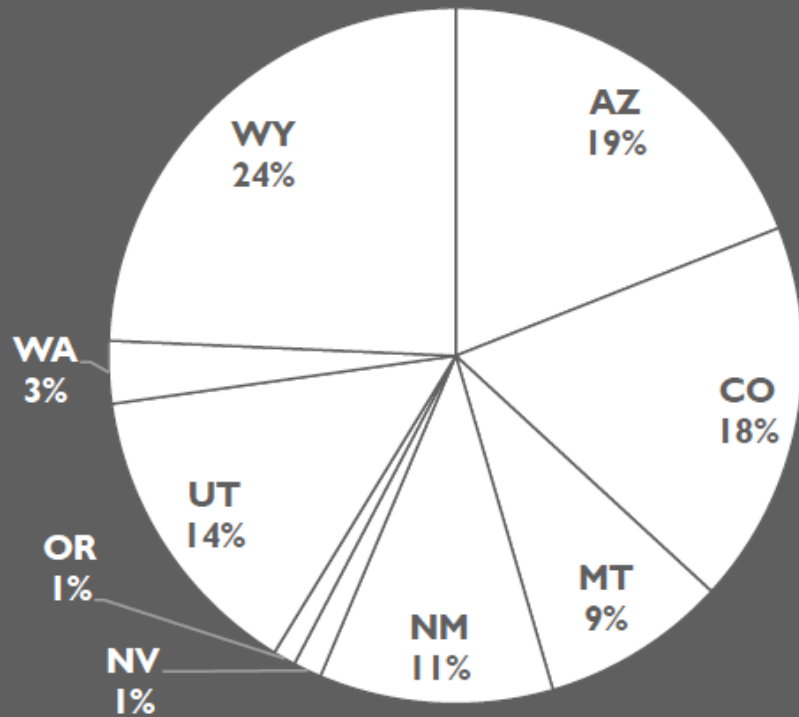
Western Interstate Energy Board

Benjamin Lim and Max Vilgalys

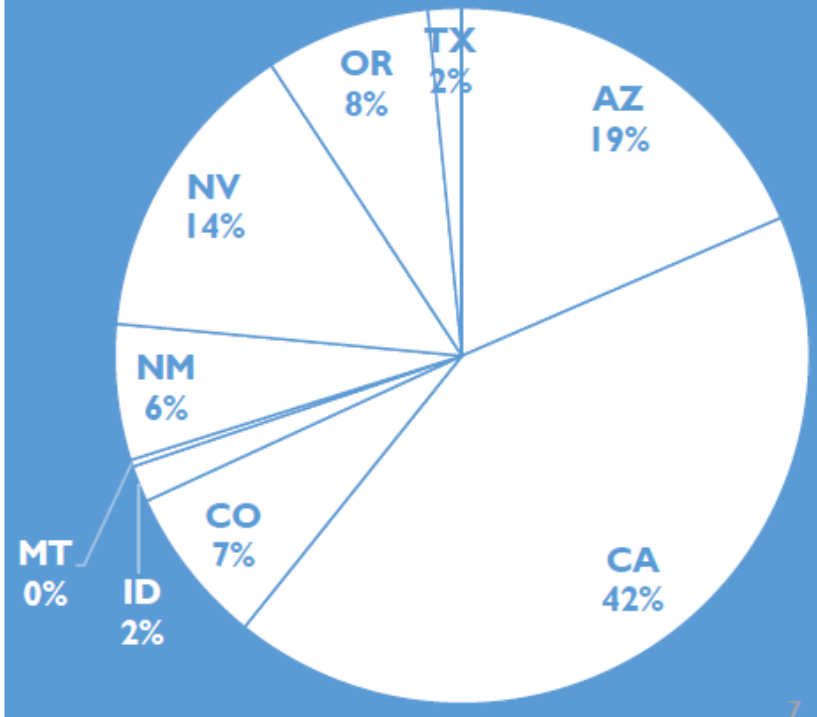


How It Breaks Up in the West

COAL HEAT INPUT DISTRIBUTION IN THE WEST

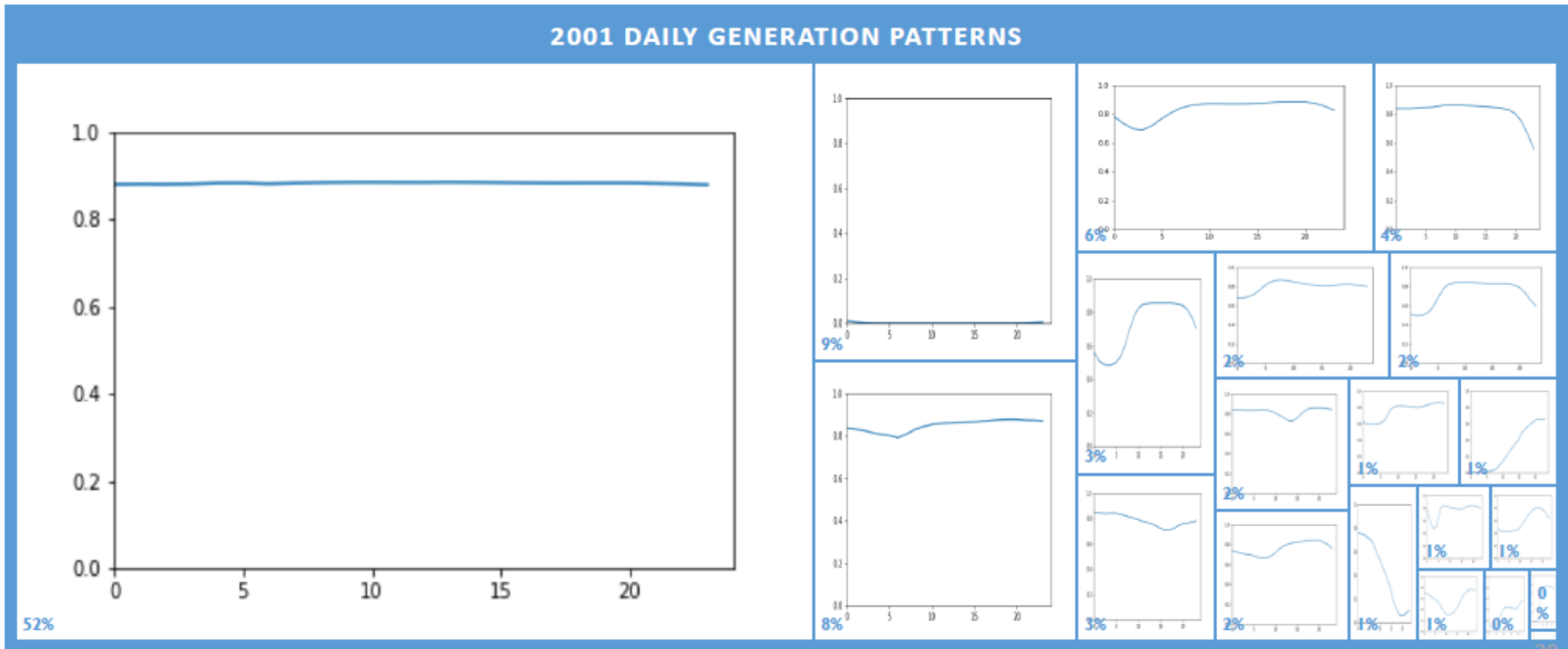


NATURAL GAS HEAT INPUT DISTRIBUTION IN THE WEST



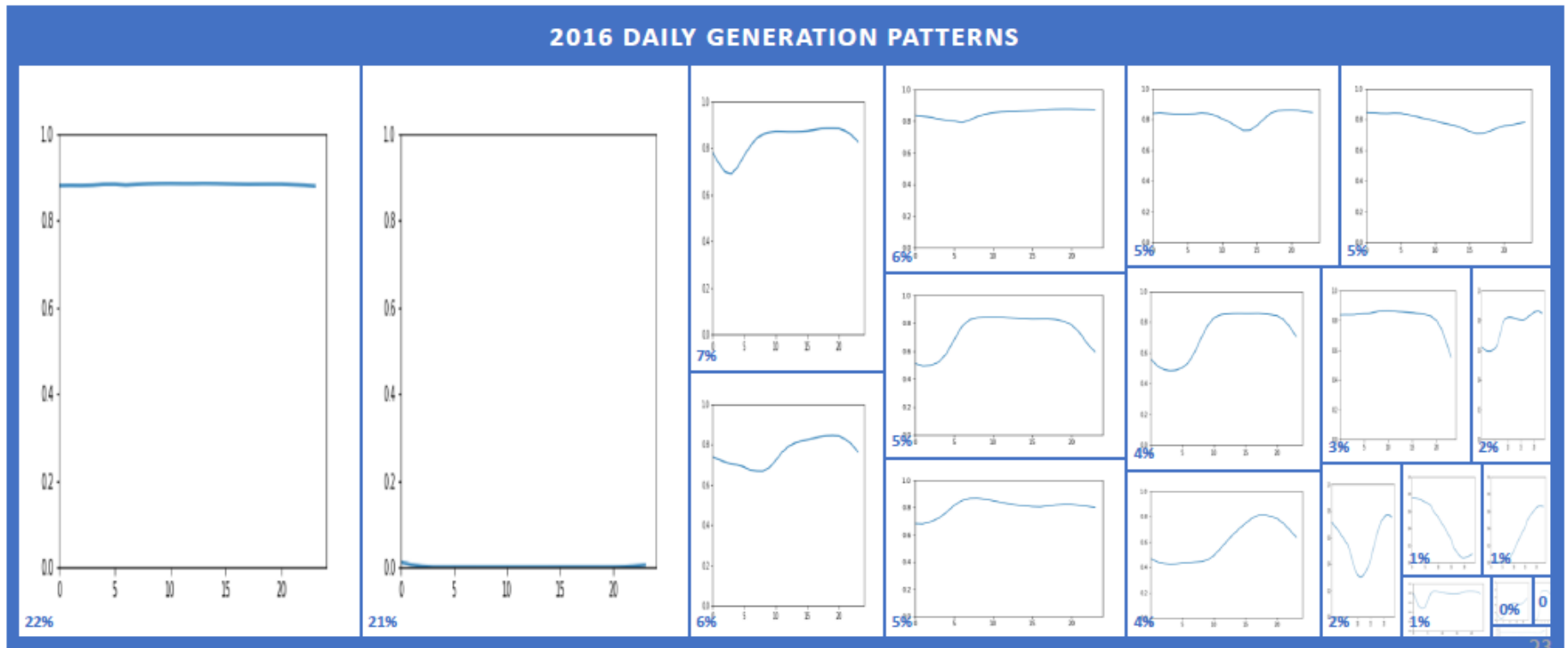
Generation Patterns of Western Coal Plants - 2001

52% of the Unit-Days were baseload generation



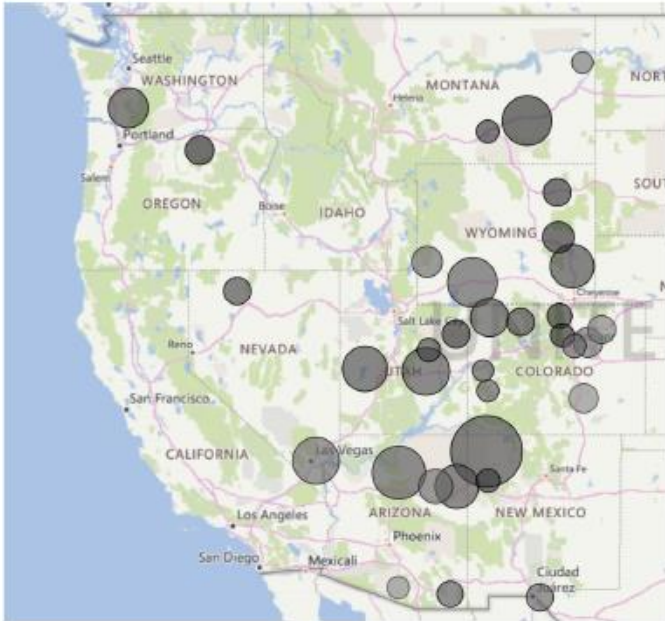
Generation Patterns of Western Coal Plants - 2016

In the last 15 years, coal unit operation has shifted dramatically

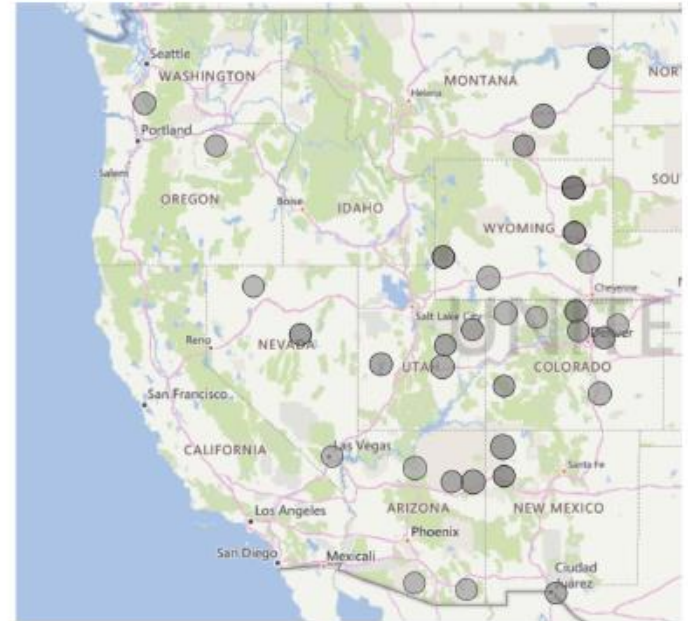


Generation and Percent Baseload Days

2001



2016



= 300 million MWh

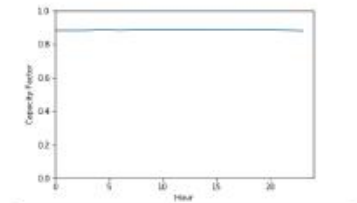
Size is Total Generation (MWh)



= 0% of the time like this:

= 100% of the time like this:

Saturation is Percent Baseload Days



11 Western States - Electricity Sector CO2 Emissions
2008 to 2016 Actual (CAMD)
2017 to 2030 = current - planned coal unit retirements

