

# A brief History of Economy and Power in the Northwest

Pacific Northwest Regional Economic Conference  
May 12-13, 2016

# History of Power in the NW is history of Columbia River



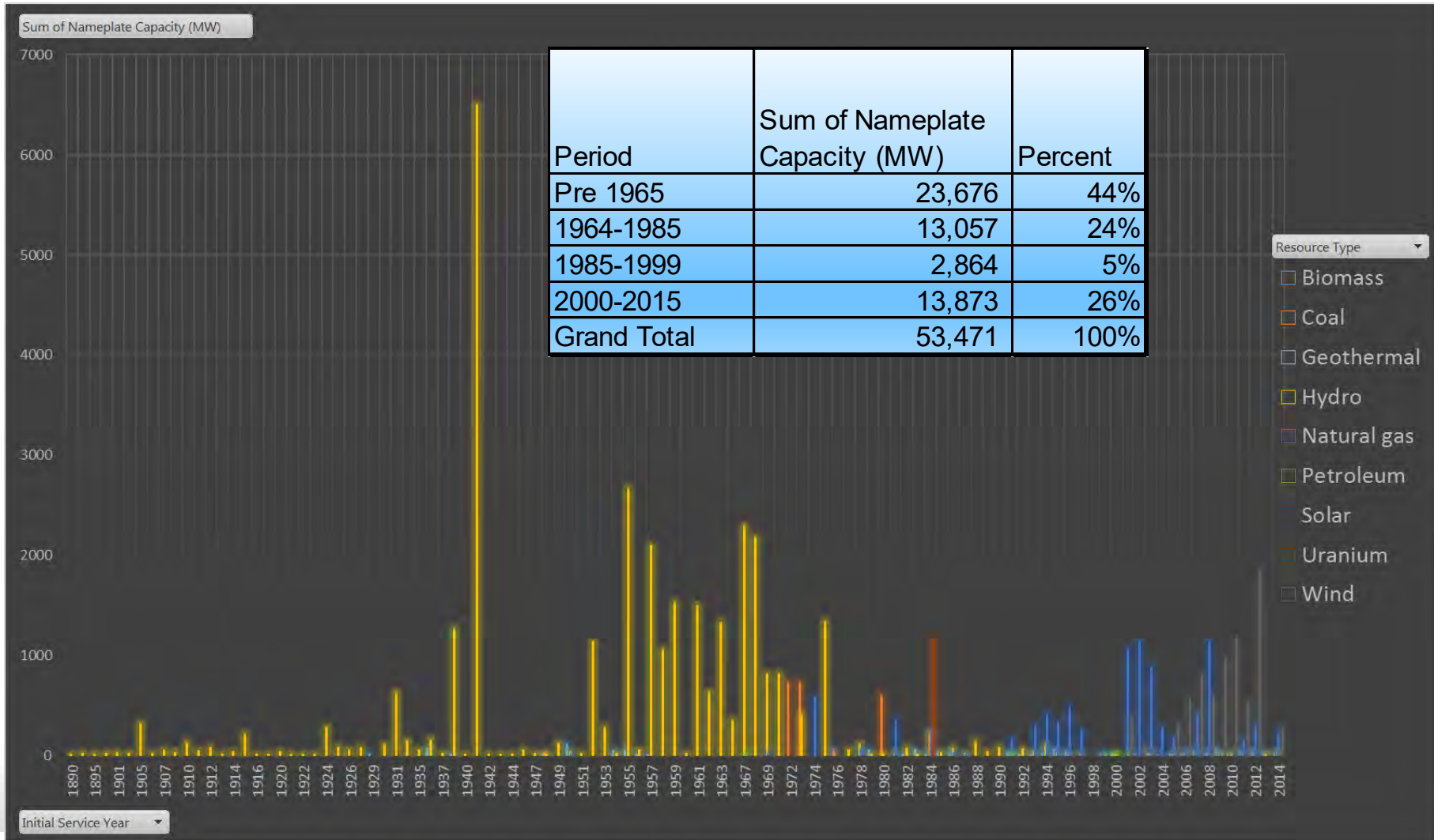
# In this presentation

- Generation Sources for Electricity
- Demand for Electricity
- Electricity Prices
- Role of Energy efficiency in the NW

# Supply Picture

- Harvesting power of Columbia river through the hydro dams has been the engine of growth in the region.
- Their addition in the NW created the ground for introduction of new high electricity intensive industries.
  - Nameplate capacity
  - Generating capacity and capacity factor
  - Capacity additions to meet peak loads

# Incremental additions to Power Plants in the NW



# CUMULATIVE NAME PLATE CAPACITY IN THE NORTHWEST (MW)

60,000

50,000

40,000

30,000

20,000

10,000

0

1890

1910

1917

1929

1940

1950

1955

1958

1967

1976

1982

1983

1984

1985

1985

1986

1987

1989

1992

1994

1996

2000

2001

2003

2006

2007

2008

2009

2010

2010

2011

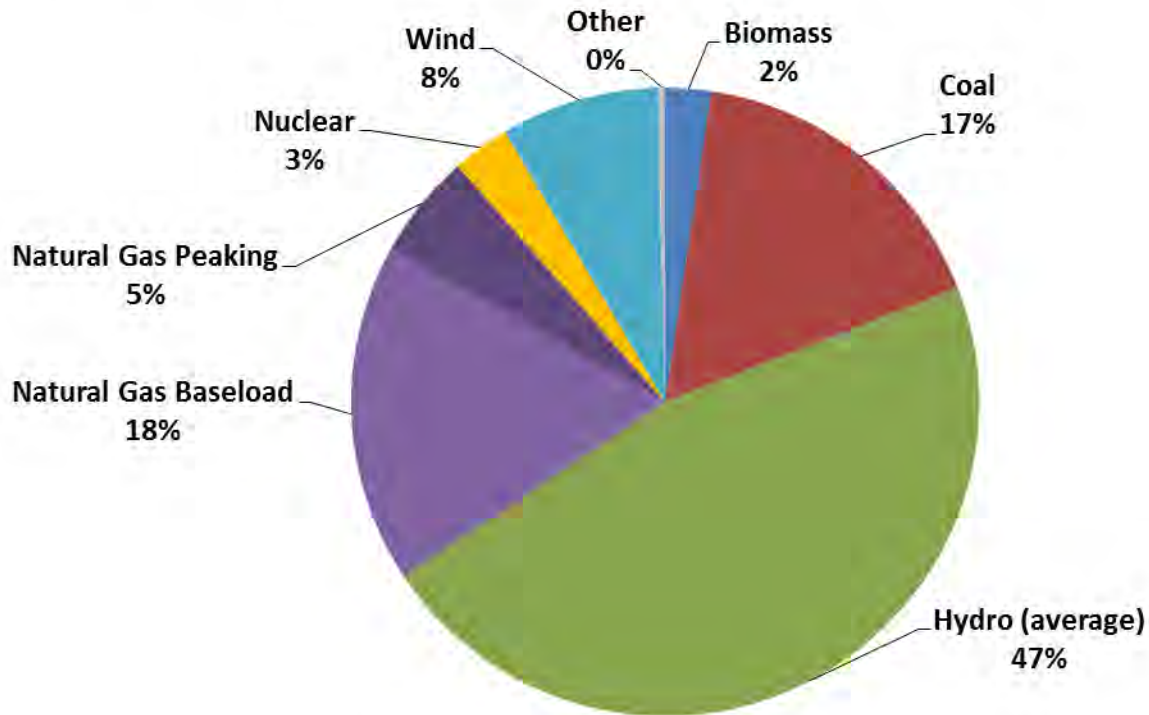
2012

2013





## Northwest Generating Capability - 34,748 MWa



Located in Power Act Region or contracted to PNW loads; WECC; In-service, under construction, standby or idle

Includes PacifiCorp WY wind plants

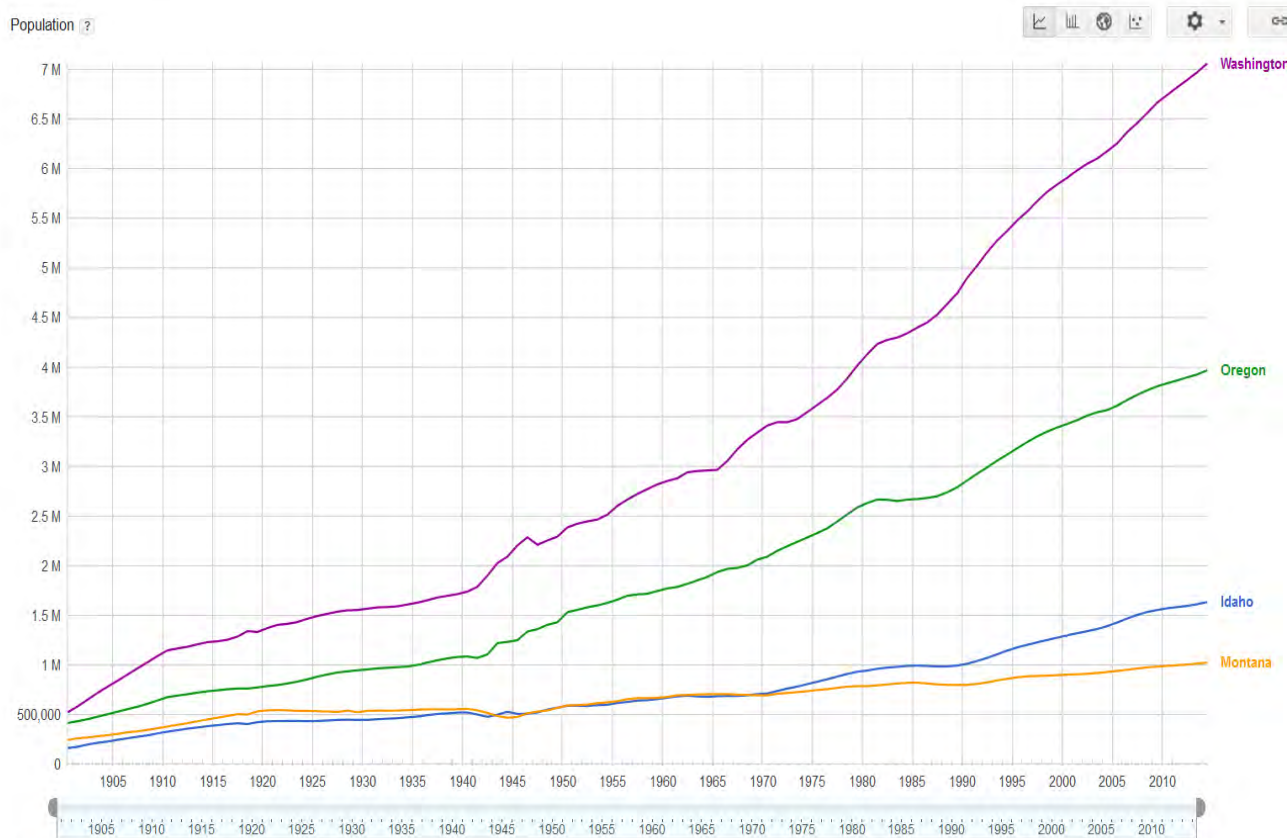
\*Other - Geothermal, Petroleum, Solar

# Demand For Electricity

- Key drivers
  - Population
  - Economic activities
  - Prices
  - Efficiency of energy using devices

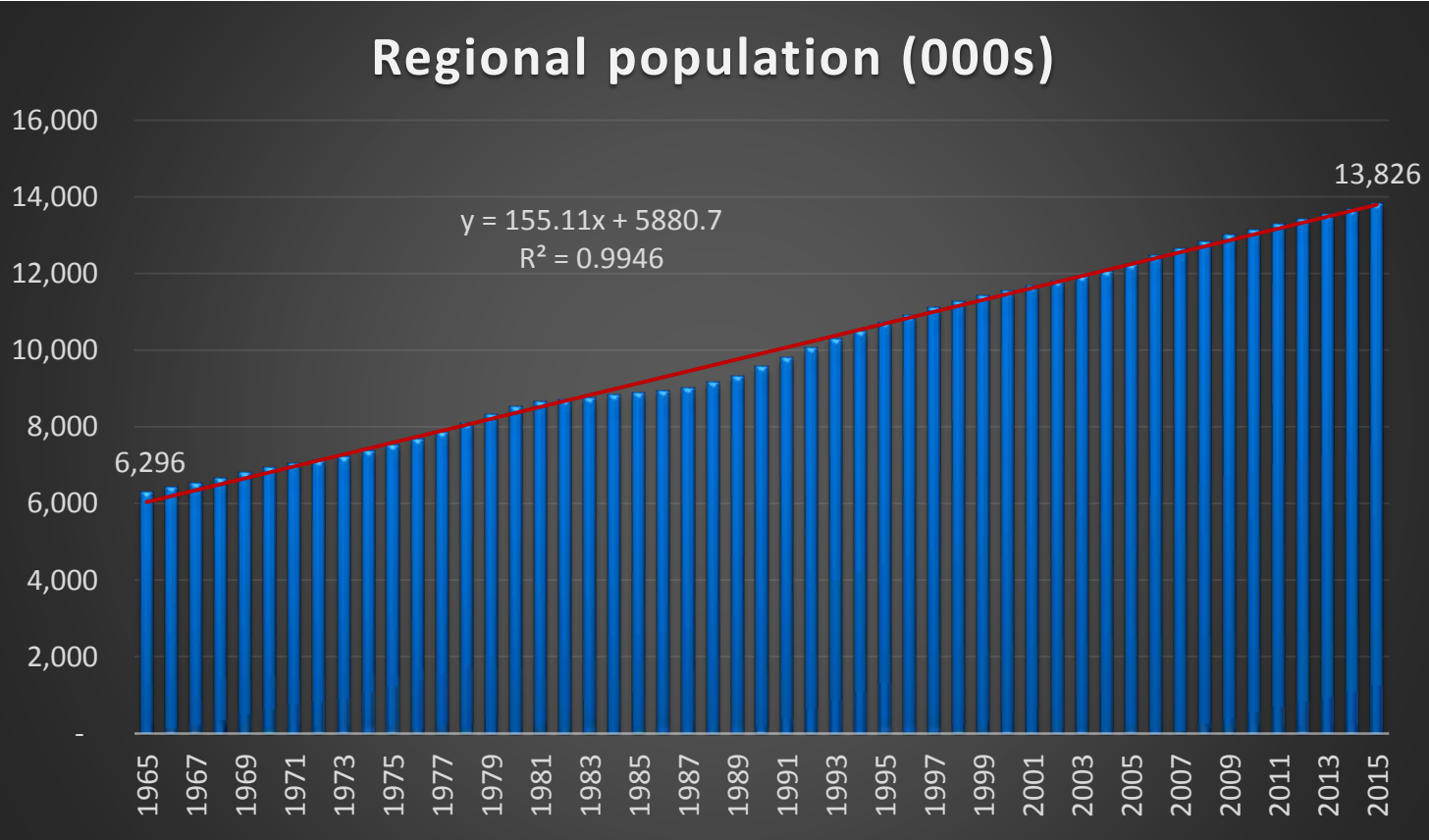


# Population in NW grown from about 1.4 in 1900 to about 14 millions in 2015

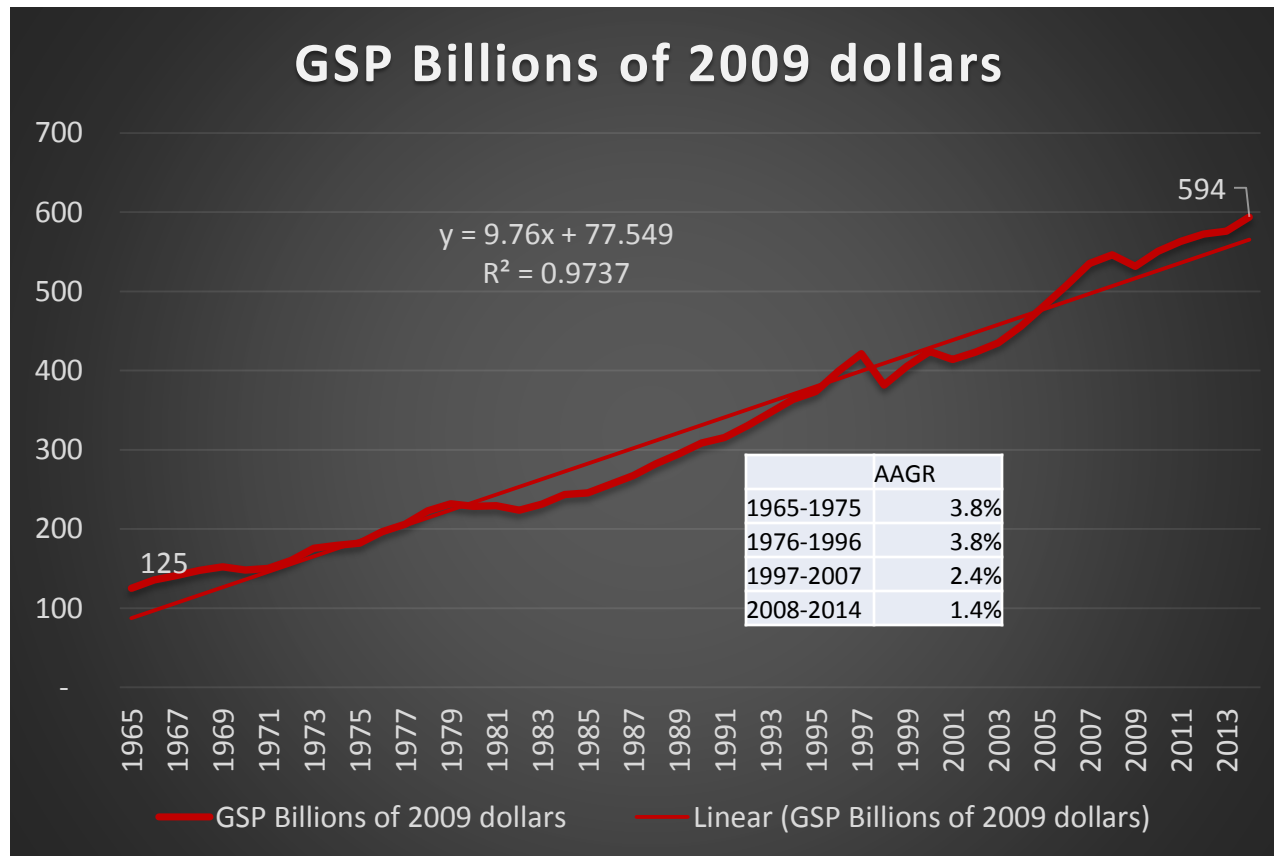


Data from U.S. Census Bureau Last updated: Jul 24, 2015  
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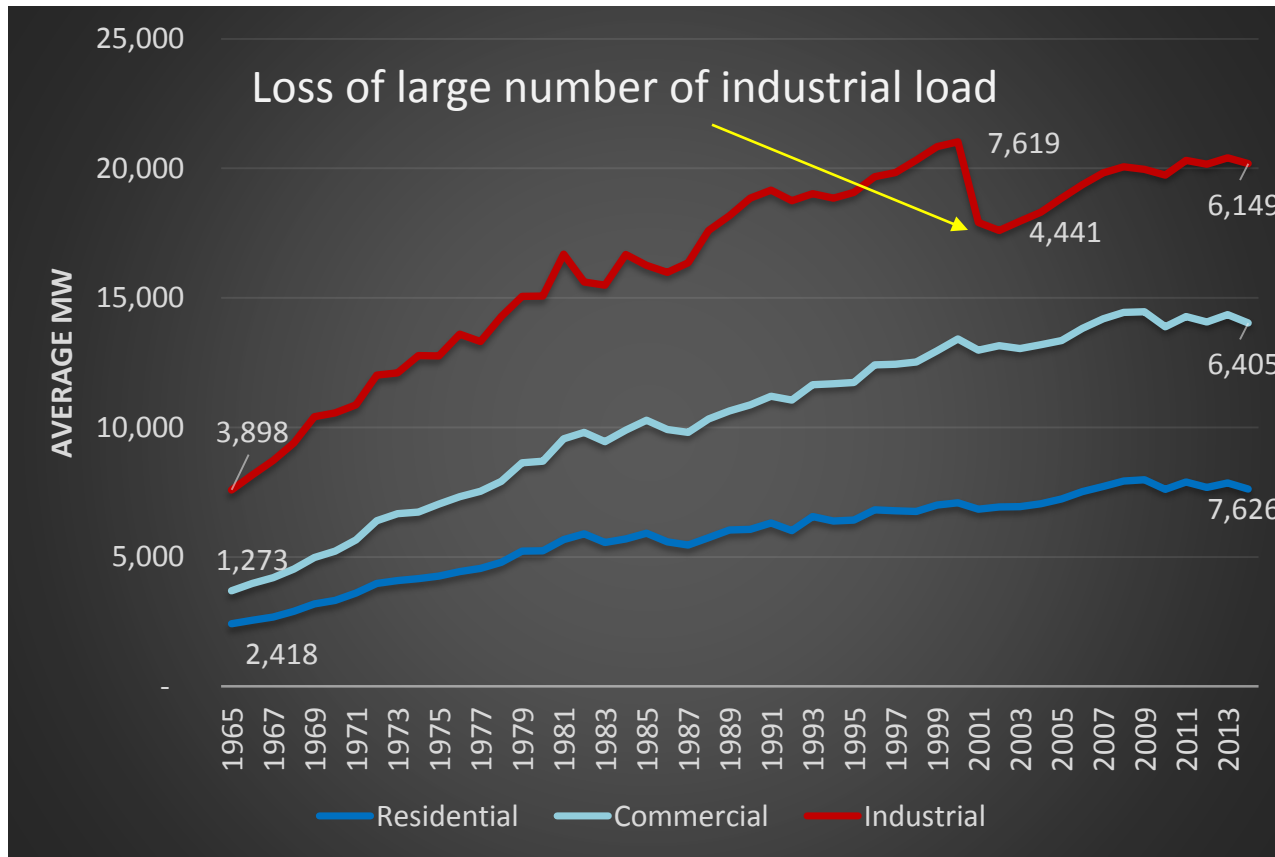
# Population more than doubled



# Economy almost quadrupled

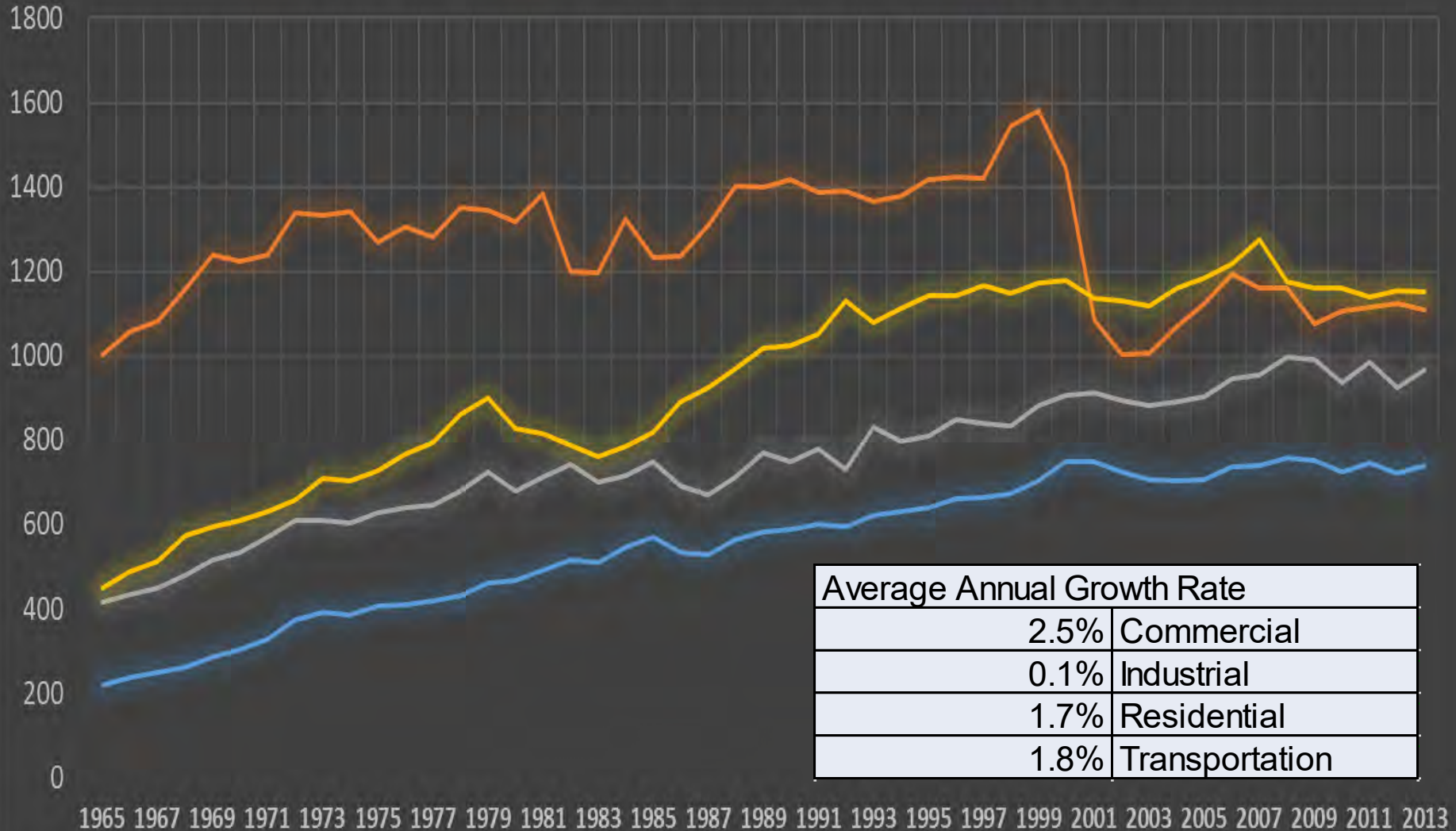


# Electric Sales Increased by 260%



# Total Energy Consumption by Sector in Trillions of BTU

— Commercial — Industrial — Residential — Transportation



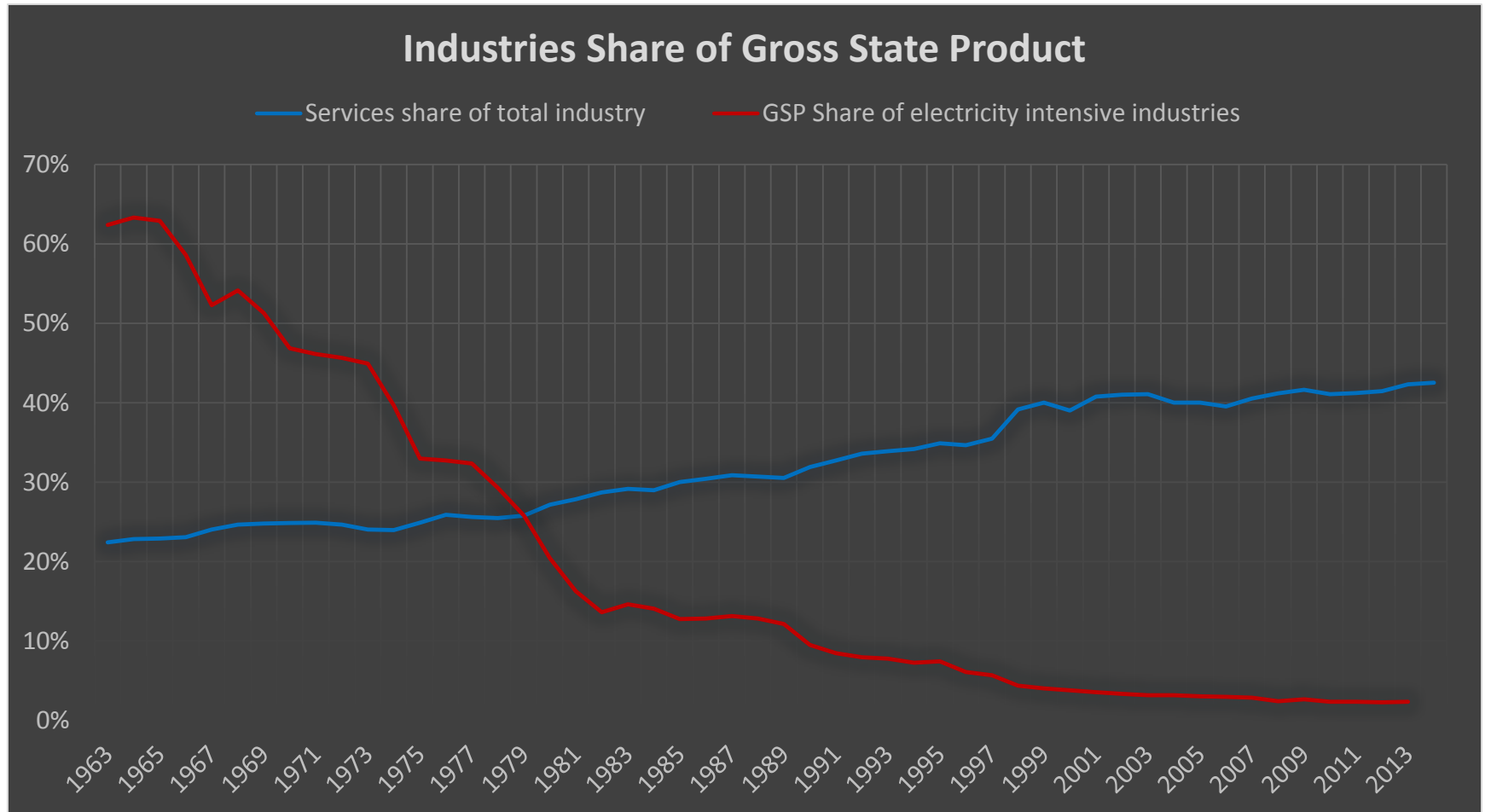
Average Annual Growth Rate	
2.5%	Commercial
0.1%	Industrial
1.7%	Residential
1.8%	Transportation

# Major Factors Contributing to Change in Demand for Energy

- Structural change in the economy
  - Moving away from resource based
  - Moving to services
  - Weather ( energy and peak loads)
- Investment in Efficiency

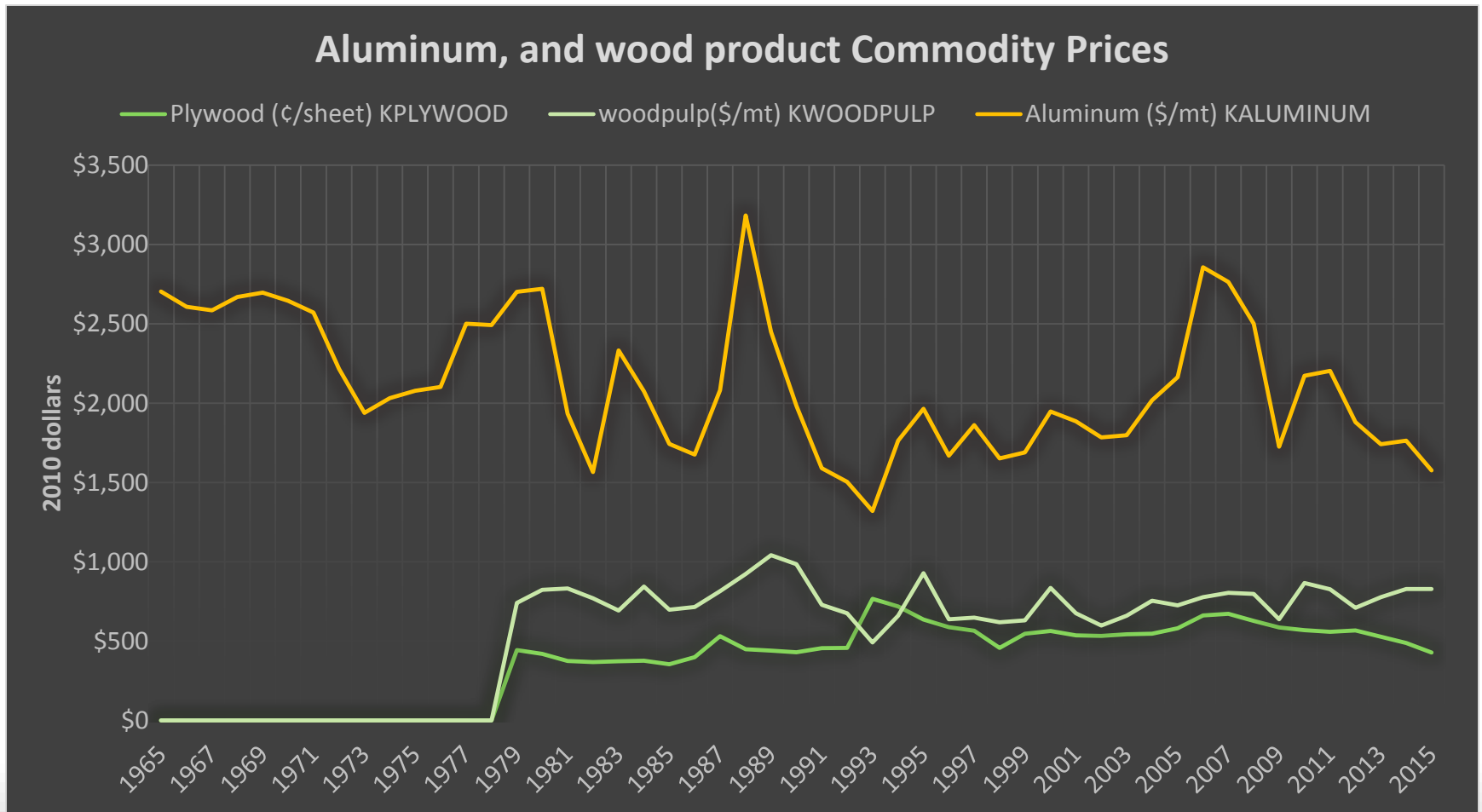


# Structural change



Lumber, Primary Metals, Food and Paper products  
Information, Educational, Financial services

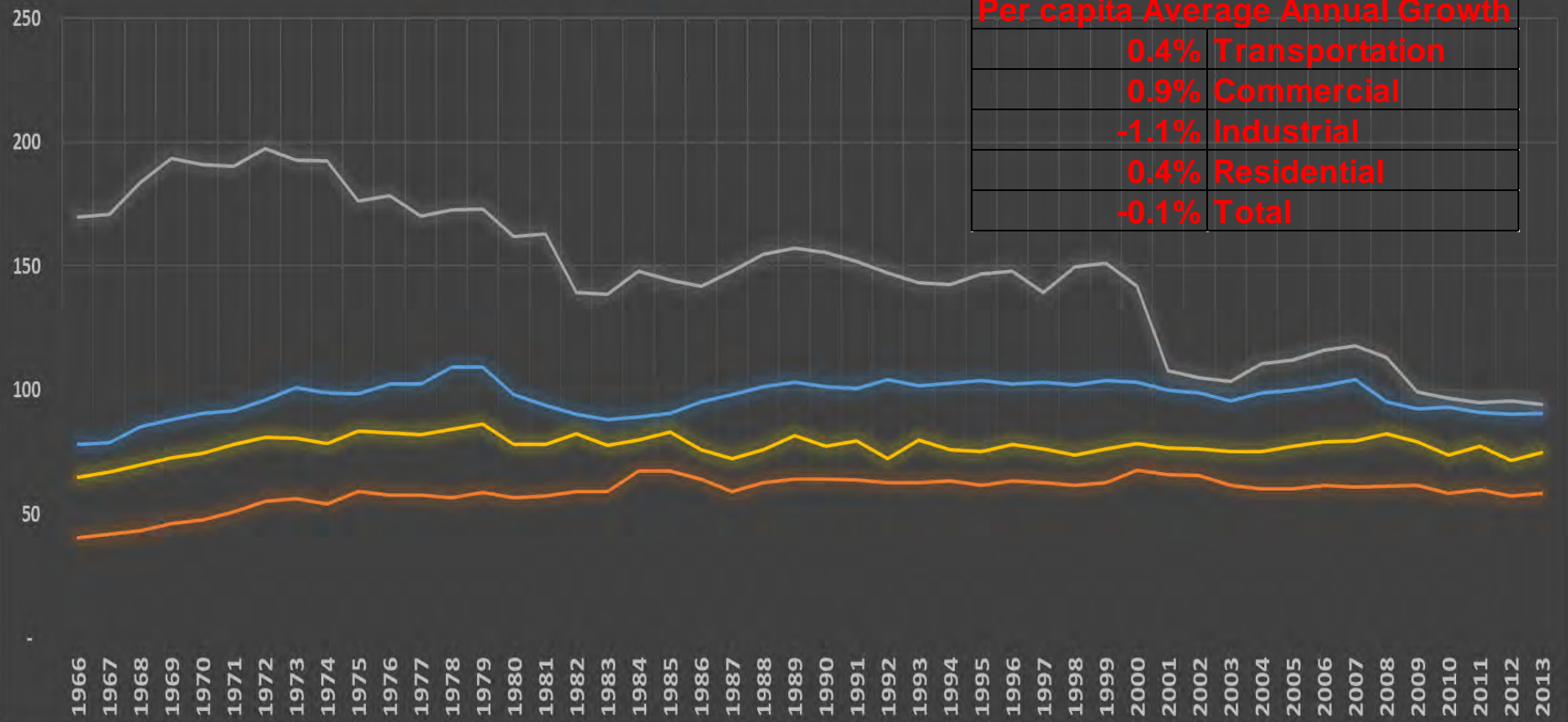
# Aluminum Commodity Prices fluctuation



# Growth in Per capita consumption has been rather

Per capita Consumption of Energy in the region by Sector

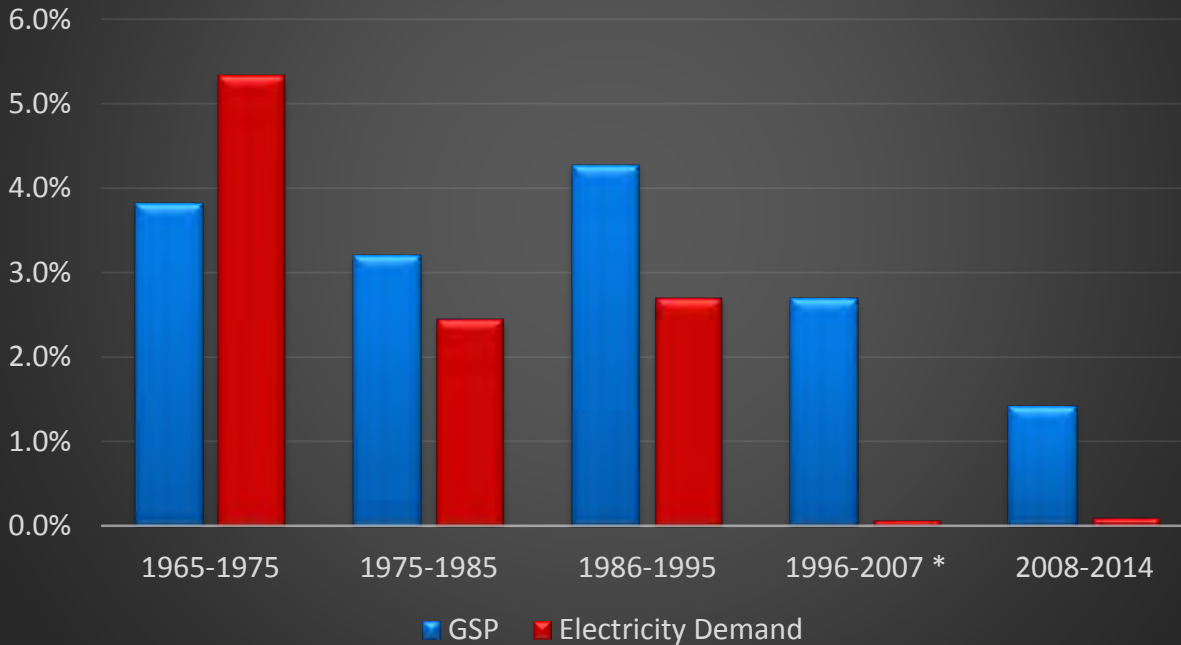
—Transportation —Commercial —Industrial —Residential



Per capita Average Annual Growth	
0.4%	Transportation
0.9%	Commercial
-1.1%	Industrial
0.4%	Residential
-0.1%	Total

# We See Five eras of growth in the Region

Average Annual Growth Rate of Economy Compared to Electricity Sales



Average Annual Growth Rate	GSP (real)	Electricity Demand
1965-1975	3.8%	5.33%
1976-1985	3.2%	2.45%
1986-1995	4.3%	2.70%
1996-2007 *	2.7%	0.07%
2008-2014	1.4%	0.10%

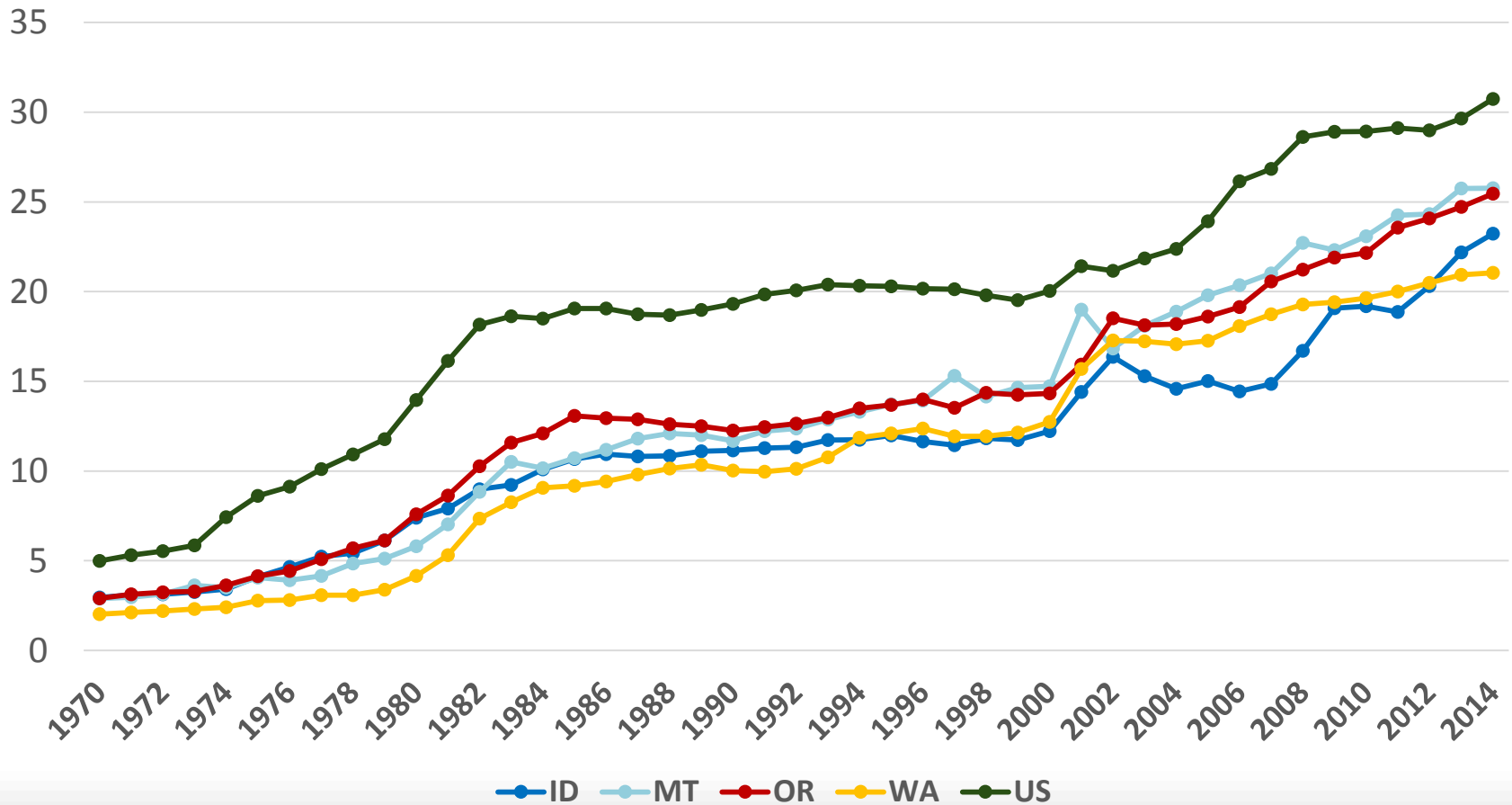
\*- lost over 3000 aMW of load in publics ( industrial recession, aluminum smelters)

# Regional Price of Electricity

- Retail price of electricity is effected by the amount of Revenue Requirement of the utilities.
- Revenue requirement is determined by capital and operating costs.
- The operating costs, include fuel cost.
- Large investments in dams with low fuel cost lead to low retail prices.

# Regional electricity prices is lower than National Average

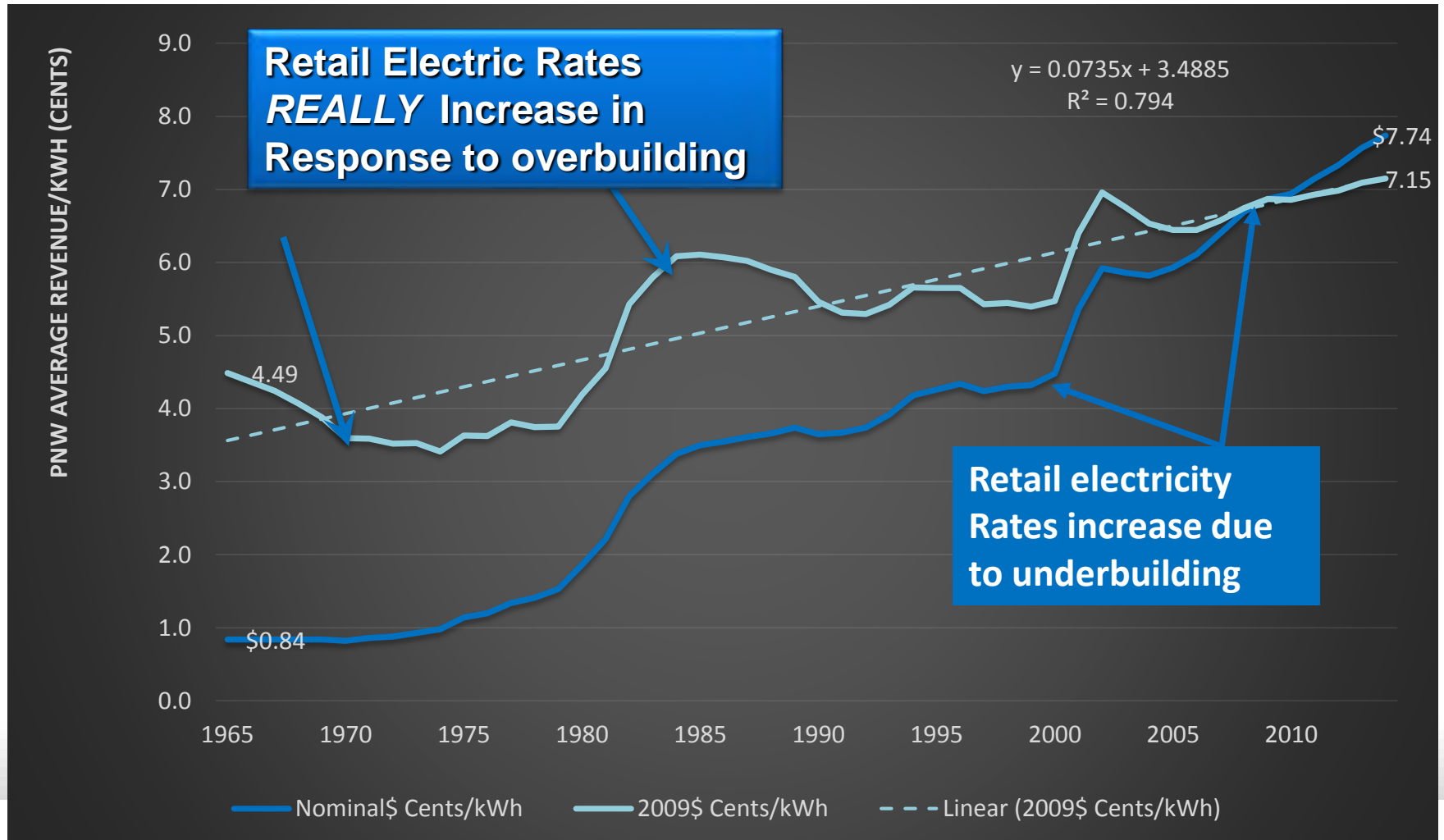
## Average Retail Electricity Rates \$/million Btu





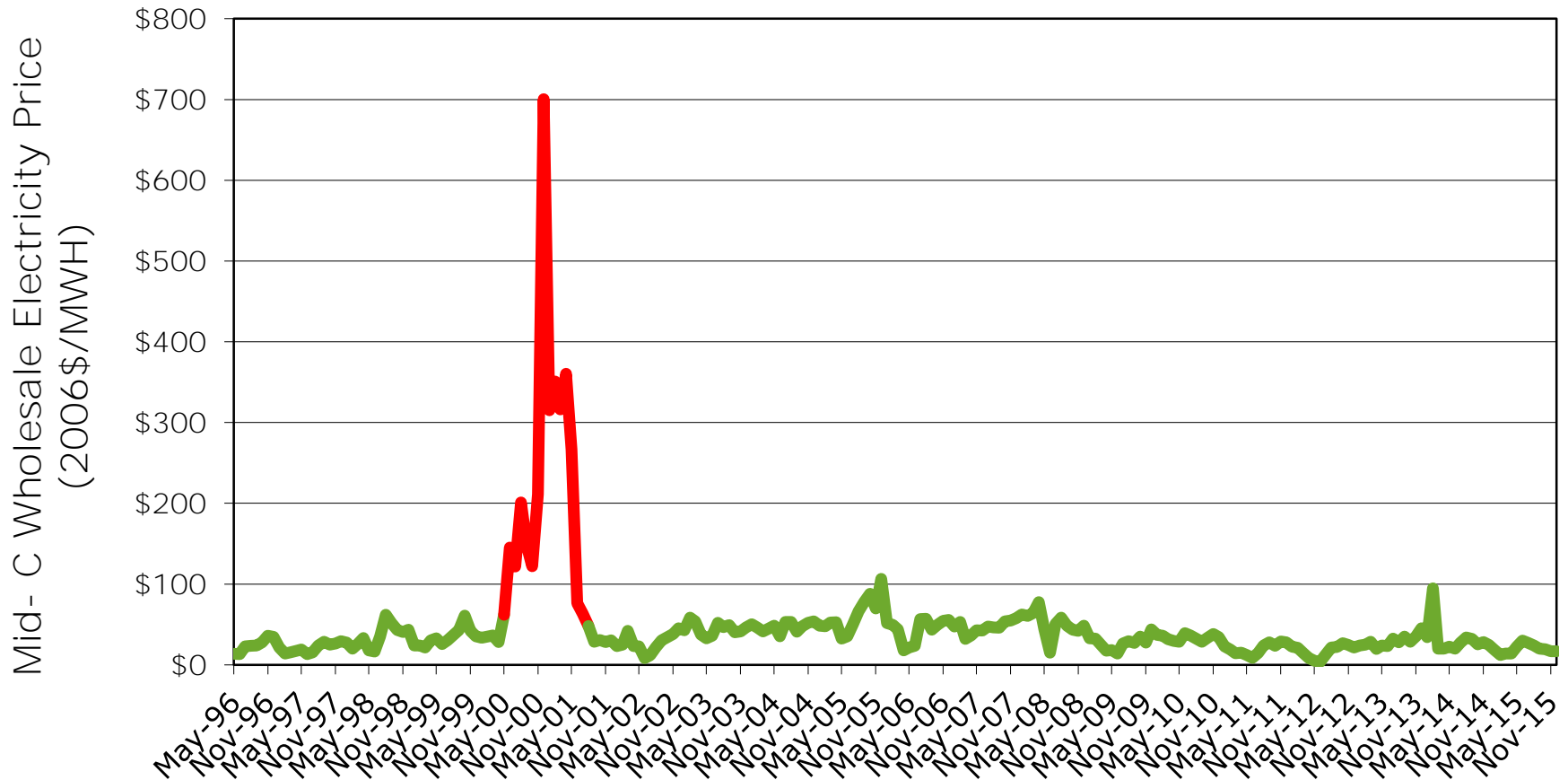
# Retail Electric Rates increased by 173 % in part due to

## Overbuilding in response to fast economic growth in the 1960s and 1970s



# Prices also increased due to 2000-2001 wholesale Electricity Price Jumps

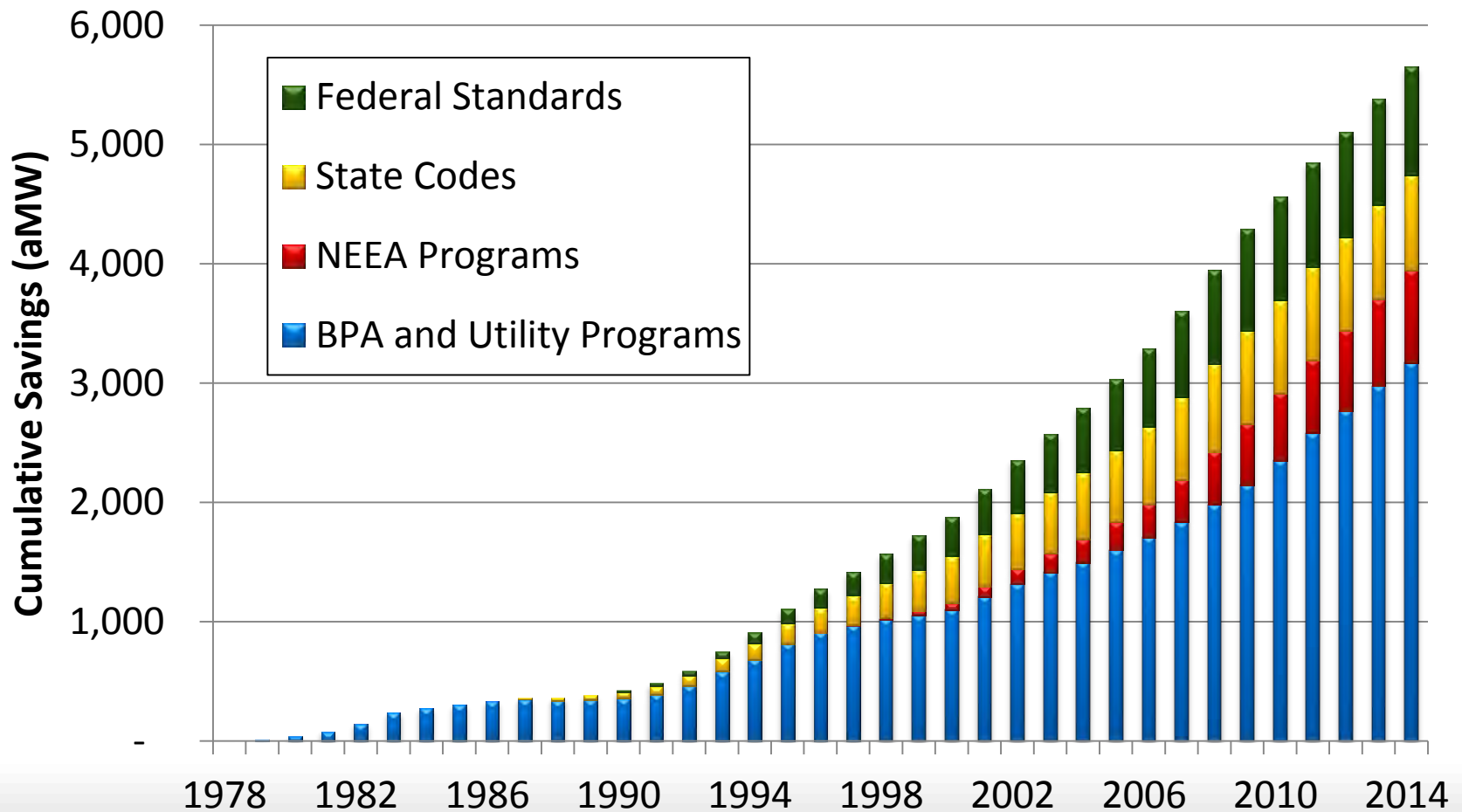
(contributed to decline of electricity intensive industries)



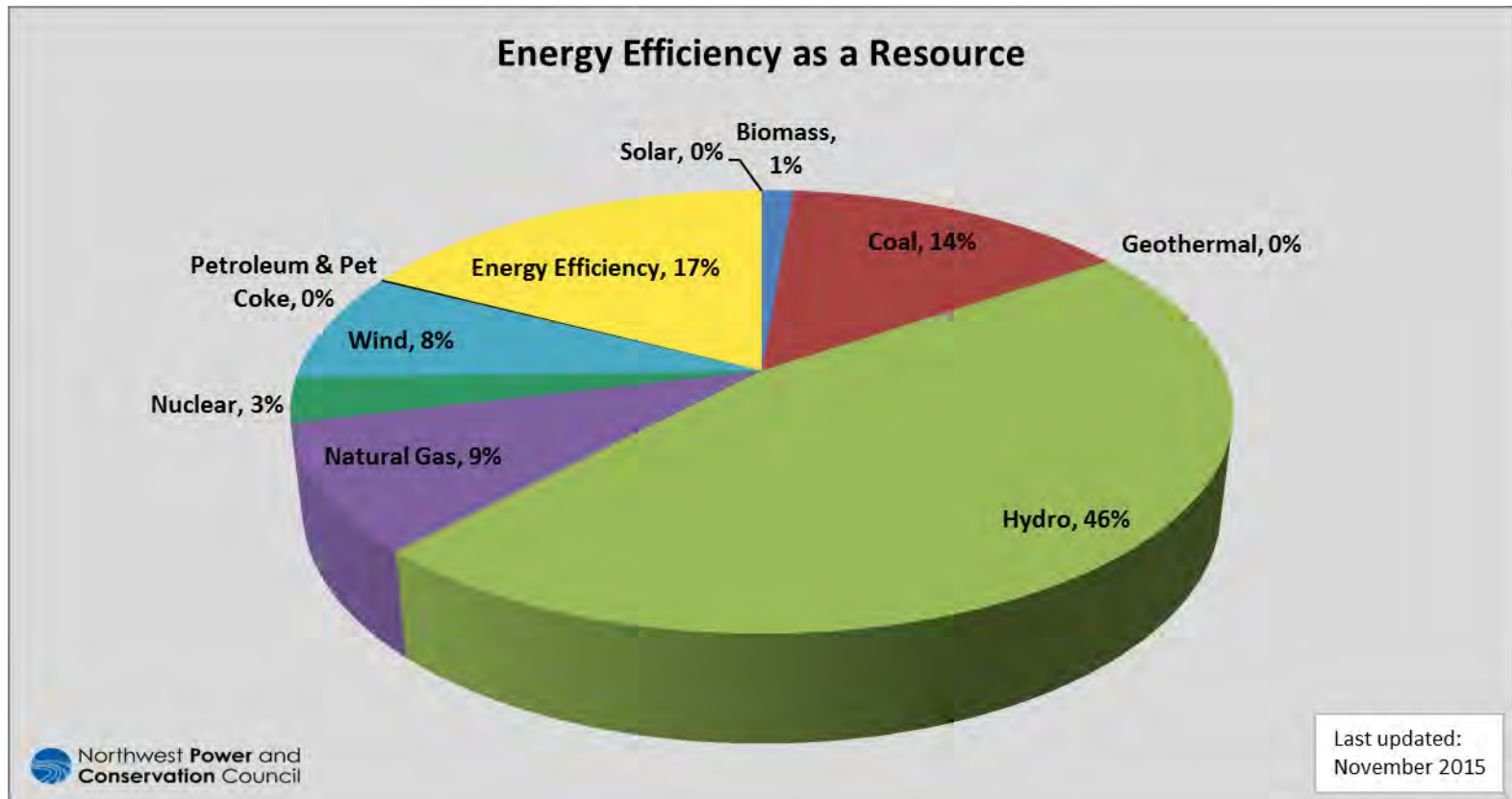
# Investing in Efficiency

- Given excess generation capacity in the region
- Given low electricity prices
- One would expect less of a incentive to do efficiency
- However, NW has been on the forefront of the efficiency.

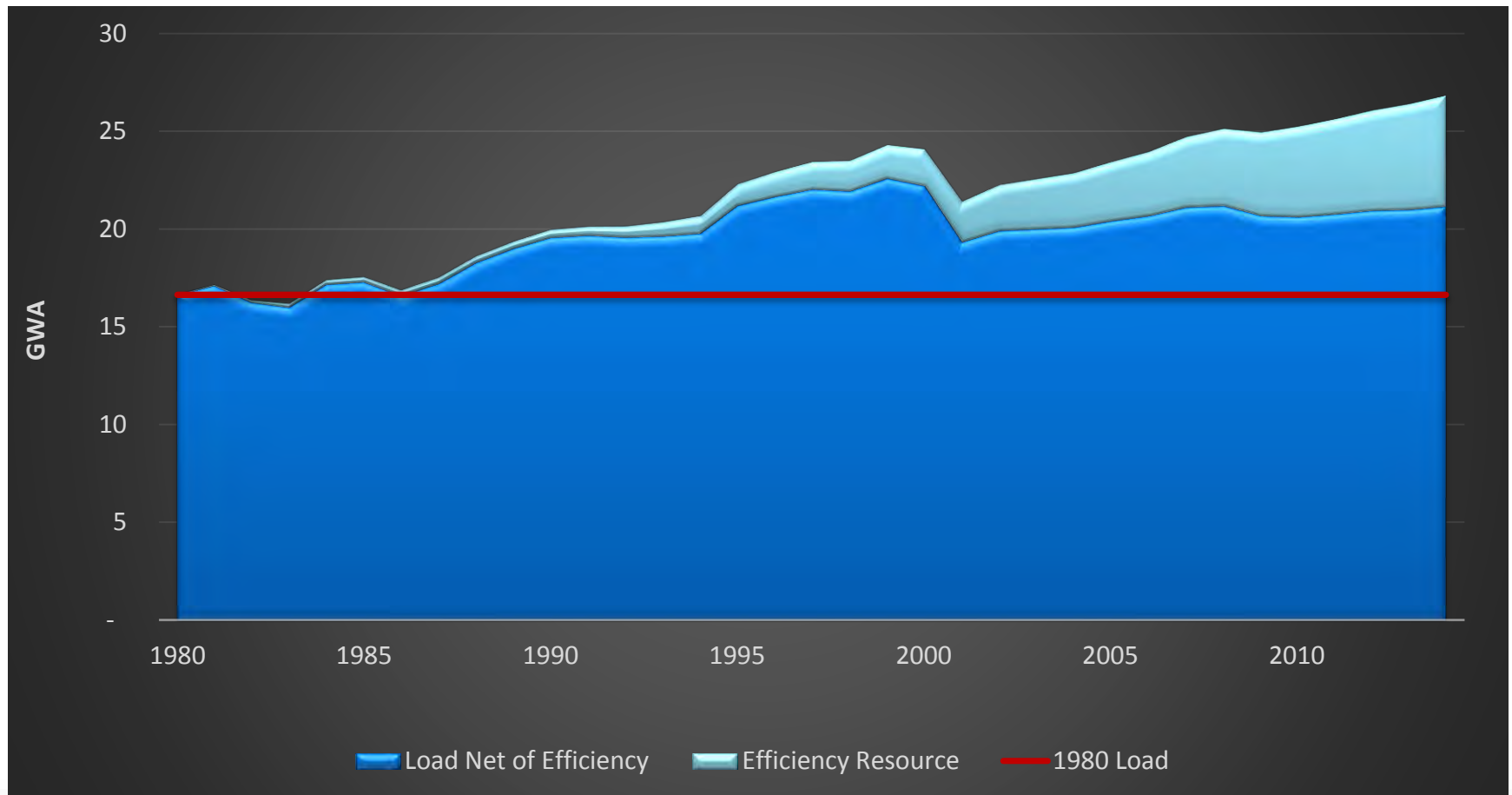
# Since 1978 Utility & BPA Programs, Energy Codes & Federal Efficiency Standards Have Produced Almost 5700 MWA of Savings



# Efficiency now generates equivalent of more than 17% of regional Mix of Generation

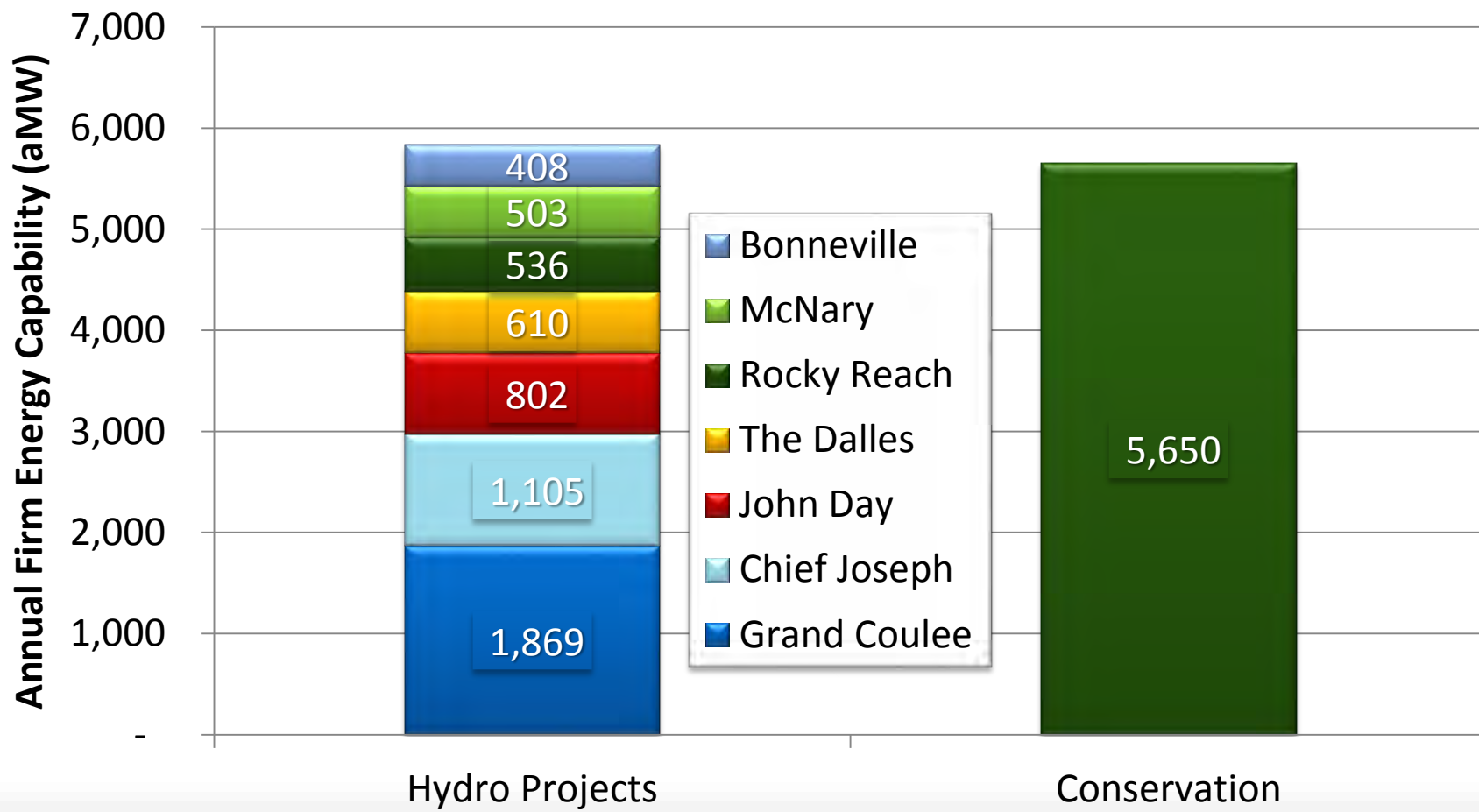


# Investment in Electricity Efficiency Has Met Nearly 55% of PNW Load Growth Since 1980





# Savings from Energy Efficiency Since 1978 Nearly Equal the Annual Firm Energy Output of the Seven Largest Hydro Projects in the Region



# So What's 5700 MWa?

- It's enough electricity to serve the *entire state of Oregon*
- It saved the region's electricity consumers nearly *\$3.51 billion* in 2014
- It lowered 2014 PNW carbon emissions by an estimated *21.9 million* MTE.
- So the region has been doing more with less.

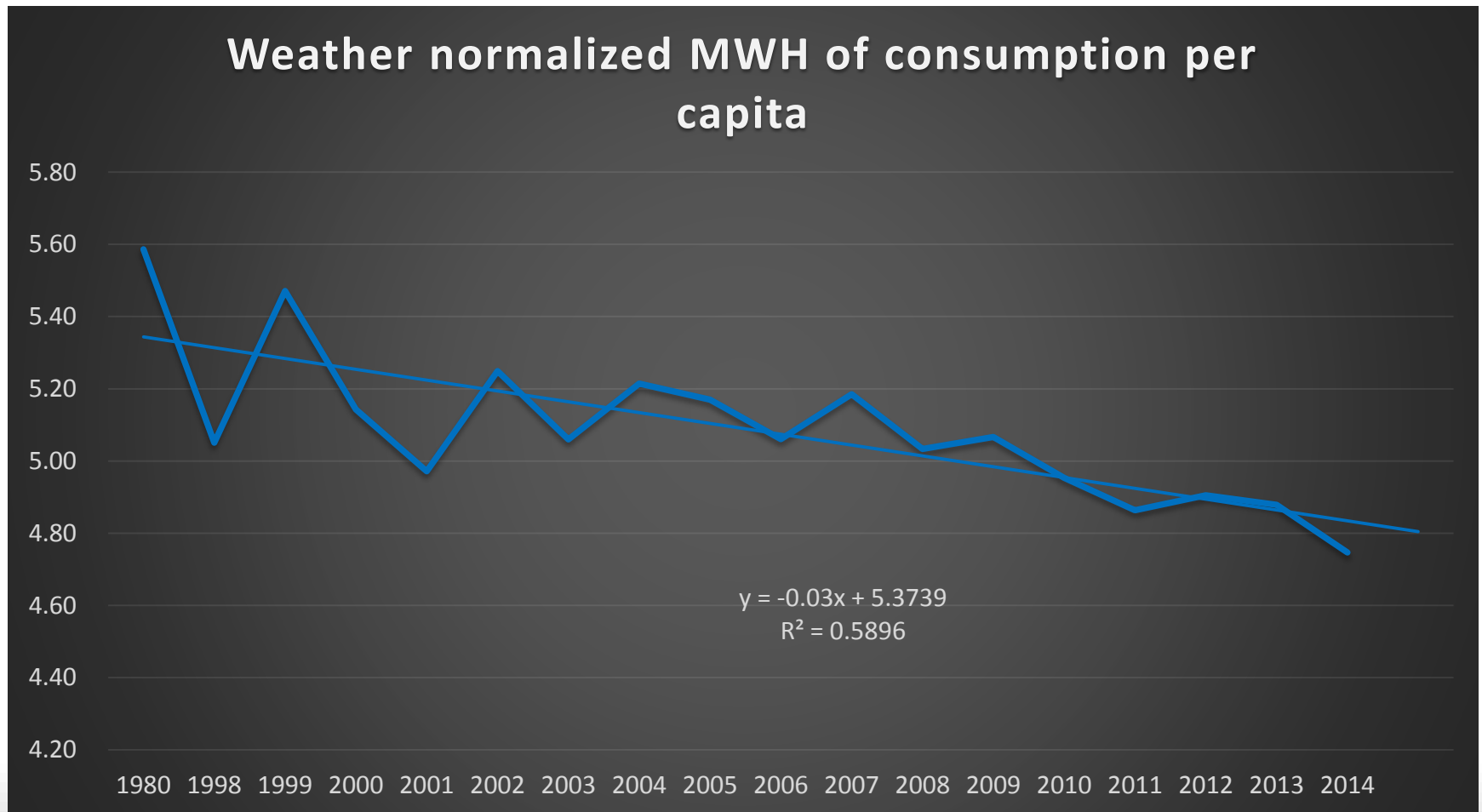
# Doing More with Less

# Doing More with Less. More people, more economic growth with less electricity usage

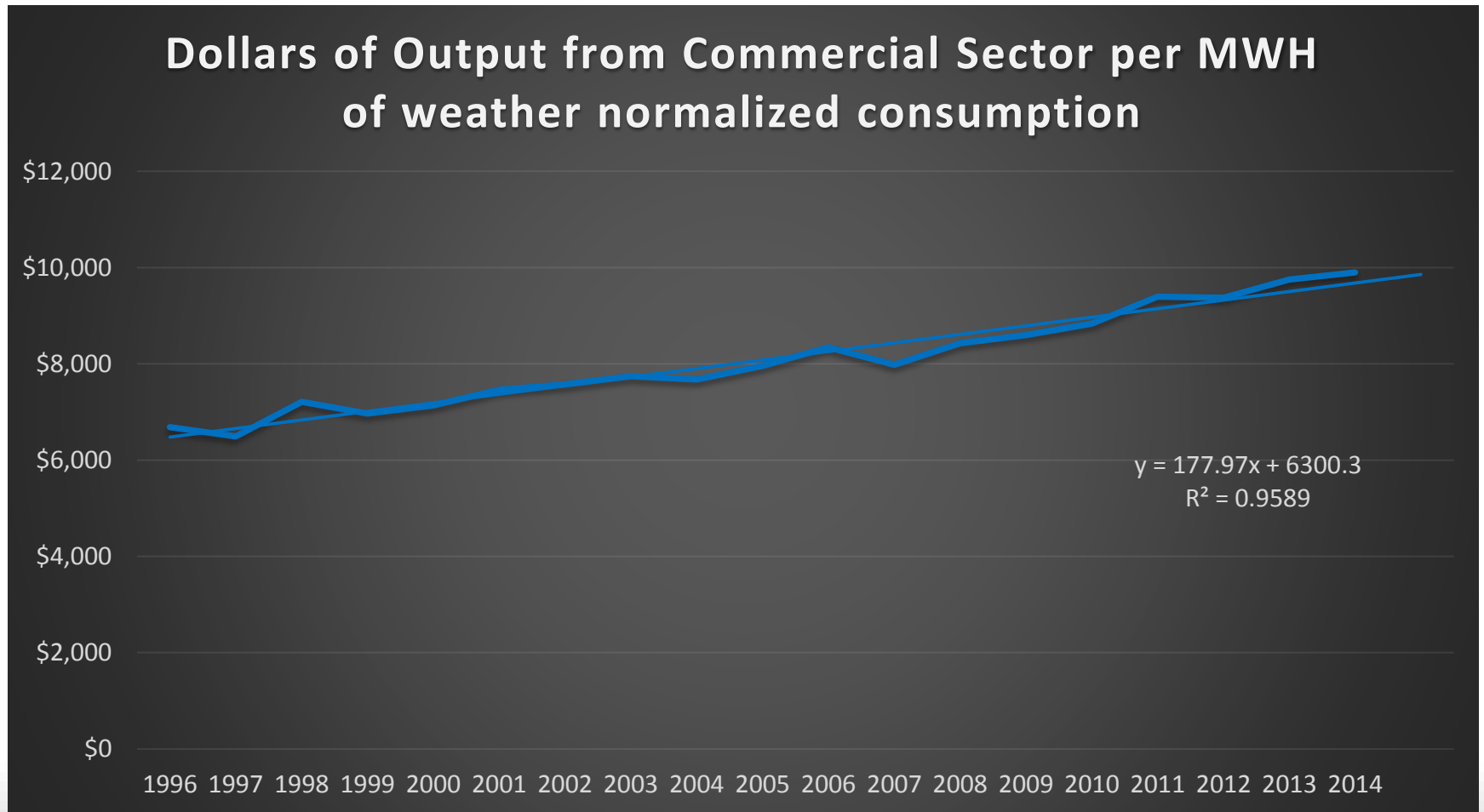
<b>AAGR</b>	<b>GSP</b>	<b>Electricity Demand</b>	<b>Population</b>
<b>1965-1975</b>	<b>3.8%</b>	<b>5.33%</b>	<b>1.81%</b>
<b>1976-1985</b>	<b>3.2%</b>	<b>2.45%</b>	<b>1.67%</b>
<b>1986-1995</b>	<b>4.3%</b>	<b>2.70%</b>	<b>2.60%</b>
<b>1996-2007 *</b>	<b>2.7%</b>	<b>0.07%</b>	<b>1.36%</b>
<b>2008-2014</b>	<b>1.4%</b>	<b>0.10%</b>	<b>1.07%</b>

\*- high electricity prices and non-competitive nature of DSI lead to about 3000 aMW of drop in demand for electricity.

# Residential Sector is doing more with less even with increase in consumer electronics usage

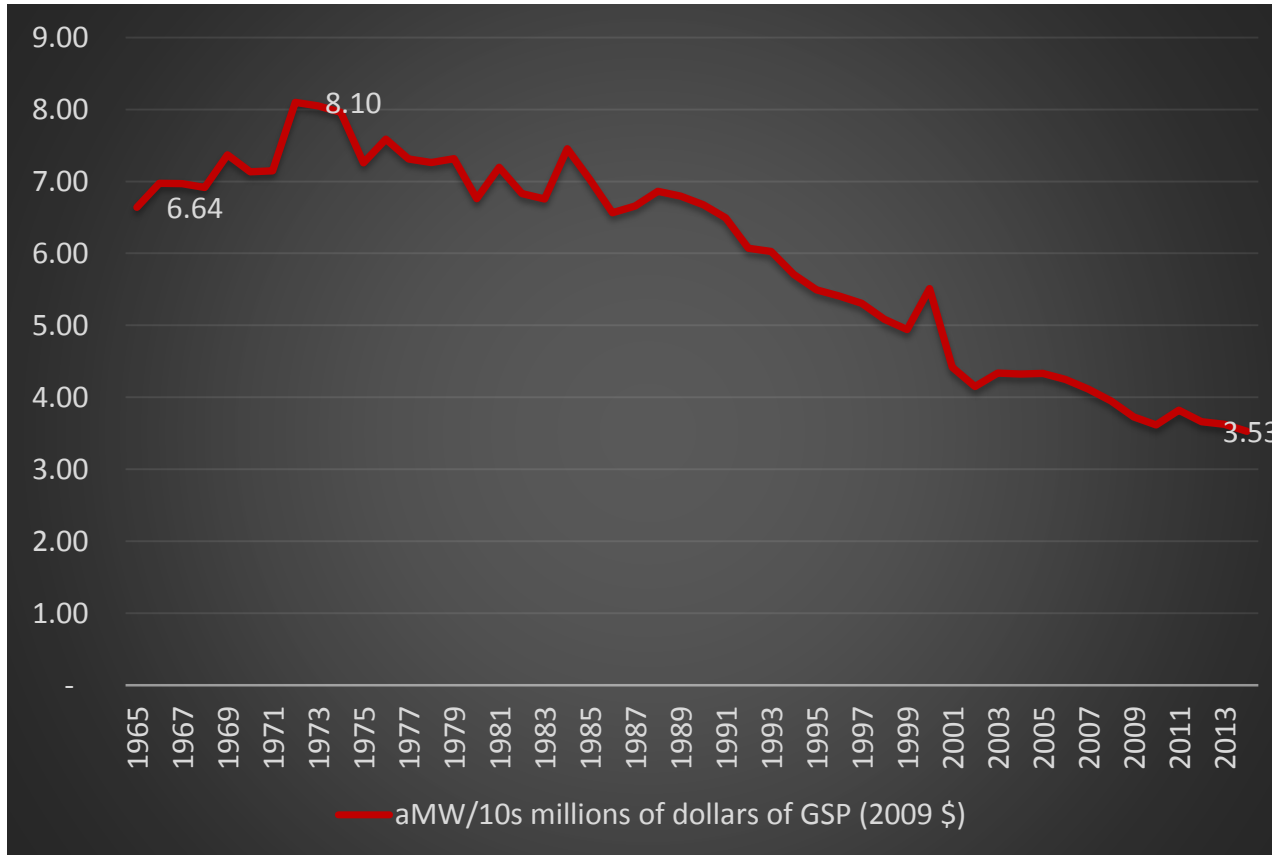


# Commercial Sector is producing more good and services with less electricity





# Change in Productivity of Electricity Use (average MW per 10 million dollar of GSP)

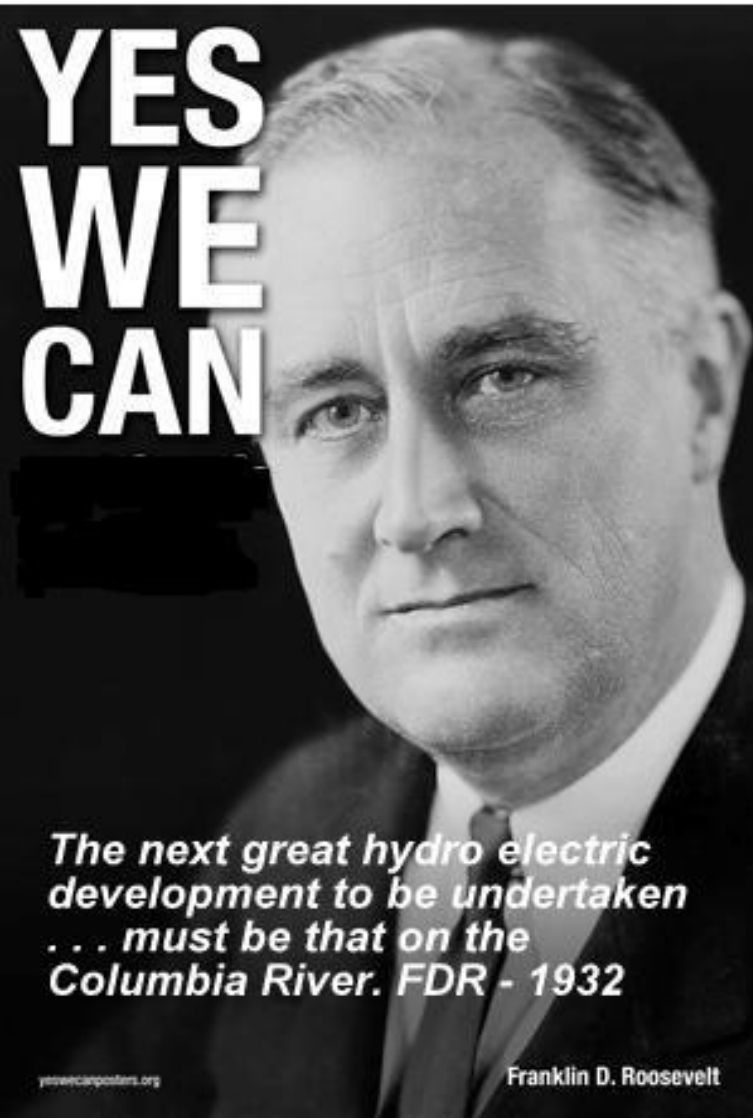


Changing economic structure of the region. Moving from High electricity intensive, low market value production to higher value production.

# So in Summary

- History of NW is history of transitional growth from resource based economy to increasingly more knowledge based economy.
- Electric Power industry was set to meet the fast growing loads of 1960s and 1970s.
- Overbuilding of supply resources, in response to rapid load growth of 1960-1970s resulted in sharp price increase.
- Demand responded by:
  - Change in industrial mix
  - Investment in efficiency
- This has led to doing more with less.
- More goods and services with less energy.
  
- Does the Next 50 years promises to be even better?
  - **In tomorrow morning's Energy II session Council presentations sheds light on the future direction of NW power system.**

# Efficiency Extends a PNW Legacy by “Stretching the River”



. . . and reduced the power systems carbon-footprint 15% below 1990 levels without further harming fisheries or native peoples