

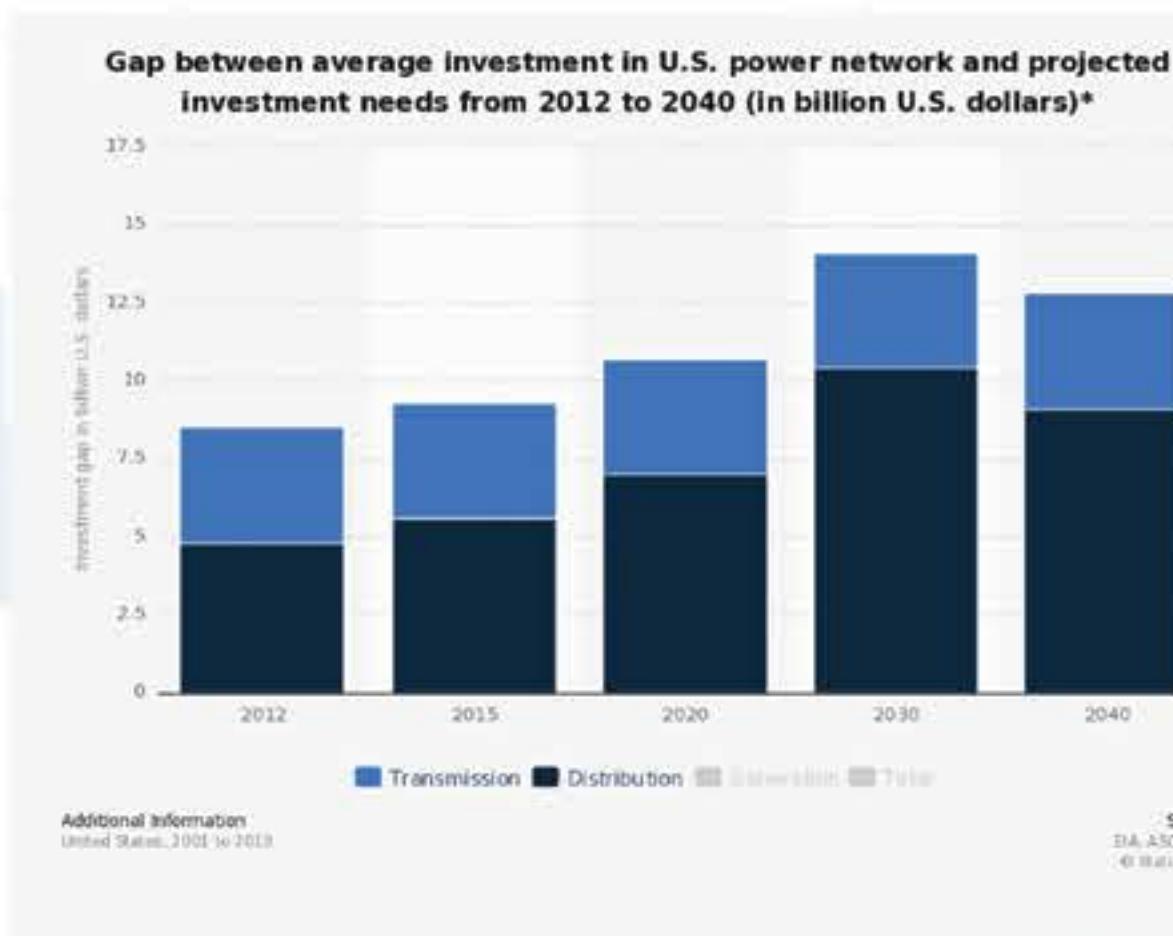
Comparative Analysis Of Capital Investments In Electric Utility Industry

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Background

- Systematic underinvestment in infrastructure by the electric utility industry in many regions.
- Deprivation of these regions of investments in other economic areas due to fragile utility infrastructure.
- Critical to the economy and everyday modern life
- Large capital investments with high uncertainty in returns
 - Decades of lag between investments and returns
 - Regulatory uncertainty
 - Rapid advancements in technology

Investment Gap



Objectives

- Identify regions with similar profiles with respect to electricity consumption and economic, demographic, and technological aspects.
- Model the relationship between capital investment amounts and electricity load on the grid over time for each profile of regions.
- Identify regions that under and over invest in infrastructure in comparison to the regions within the same profile.

Beneficiaries

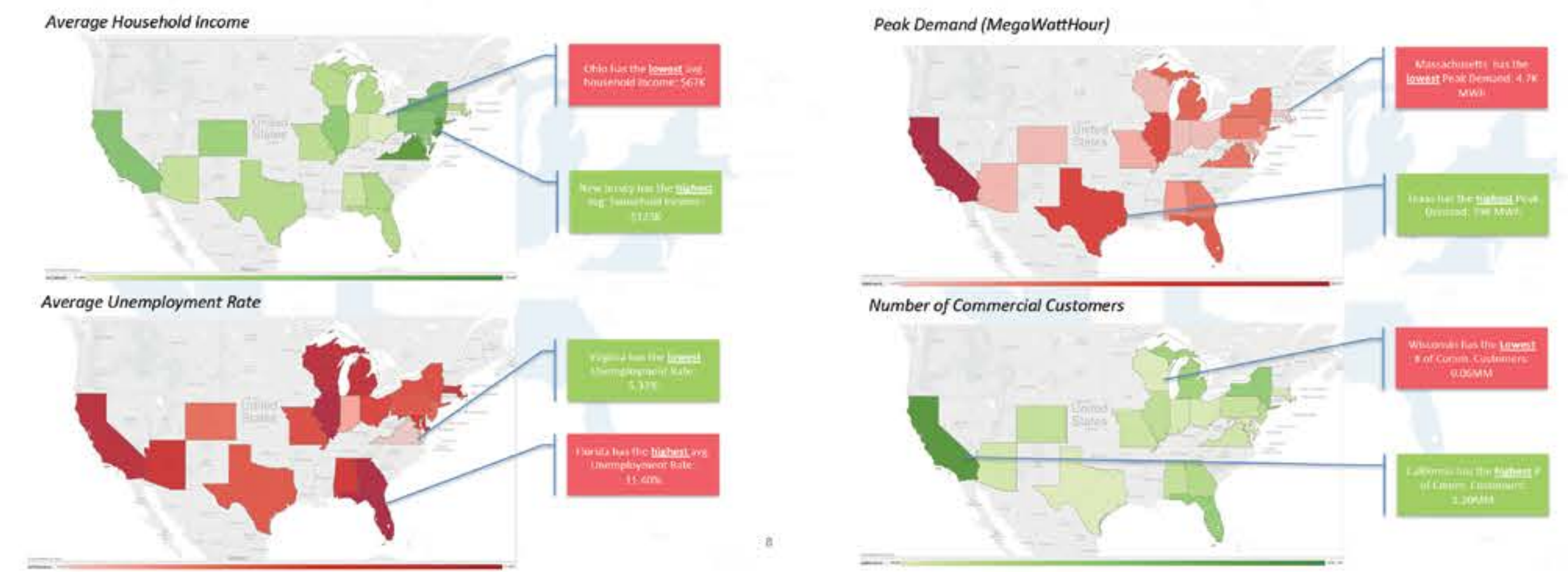
- For electric utility companies to justify rate increases to generate capital funds.
- For policy makers to evaluate legitimacy of the need for capital investments.
- For utility investors to better understand the return on their investments and the associated risk.
- For general investors of other sectors to identify regions with reliable electricity infrastructure.

Data

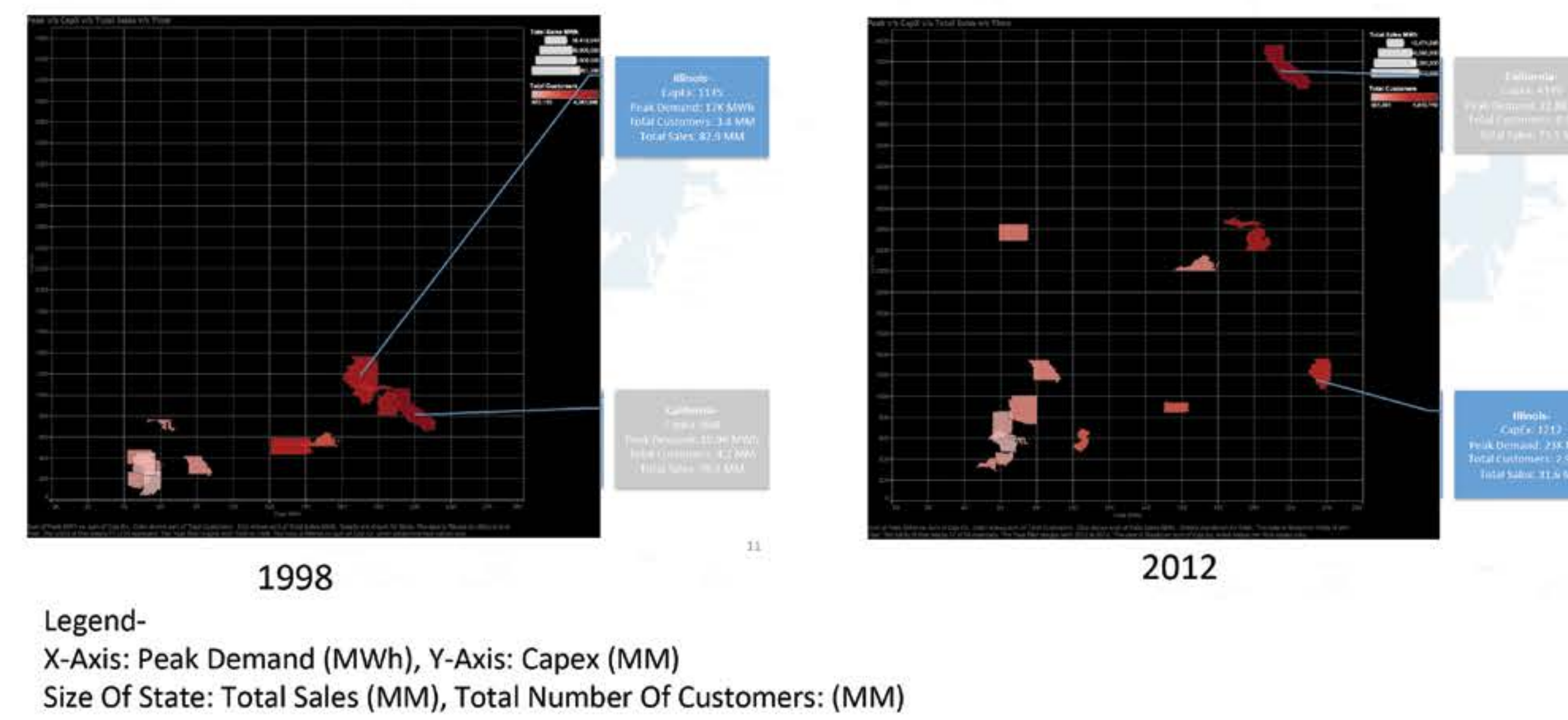
- Collected for a period of 16 years from 1997
- 23 Features such as Capital Investments, Peak Demand (for 1 hour) and Total Sales
- 516 Demographic and Economic features
- Sourced data from-
 - Capex & Revenue –mergent database
 - Sales & Peak- www.eia.gov/electricity/data.cfm
- States used for analysis-

Arizona (AZ)	Indiana (IN)	Ohio (OH)
California (CA)	Maryland (MD)	Pennsylvania (PA)
Colorado (CO)	Michigan (MI)	Virginia (VA)
Florida (FL)	New Jersey (NJ)	Wisconsin (WI)
Illinois (IL)	New York (NY)	

Brief Look At Demographic And Consumption Data



Changes YoY



Legend-
X-Axis: Peak Demand (MWh), Y-Axis: Capex (MM)
Size Of State: Total Sales (MM), Total Number Of Customers: (MM)

Analysis

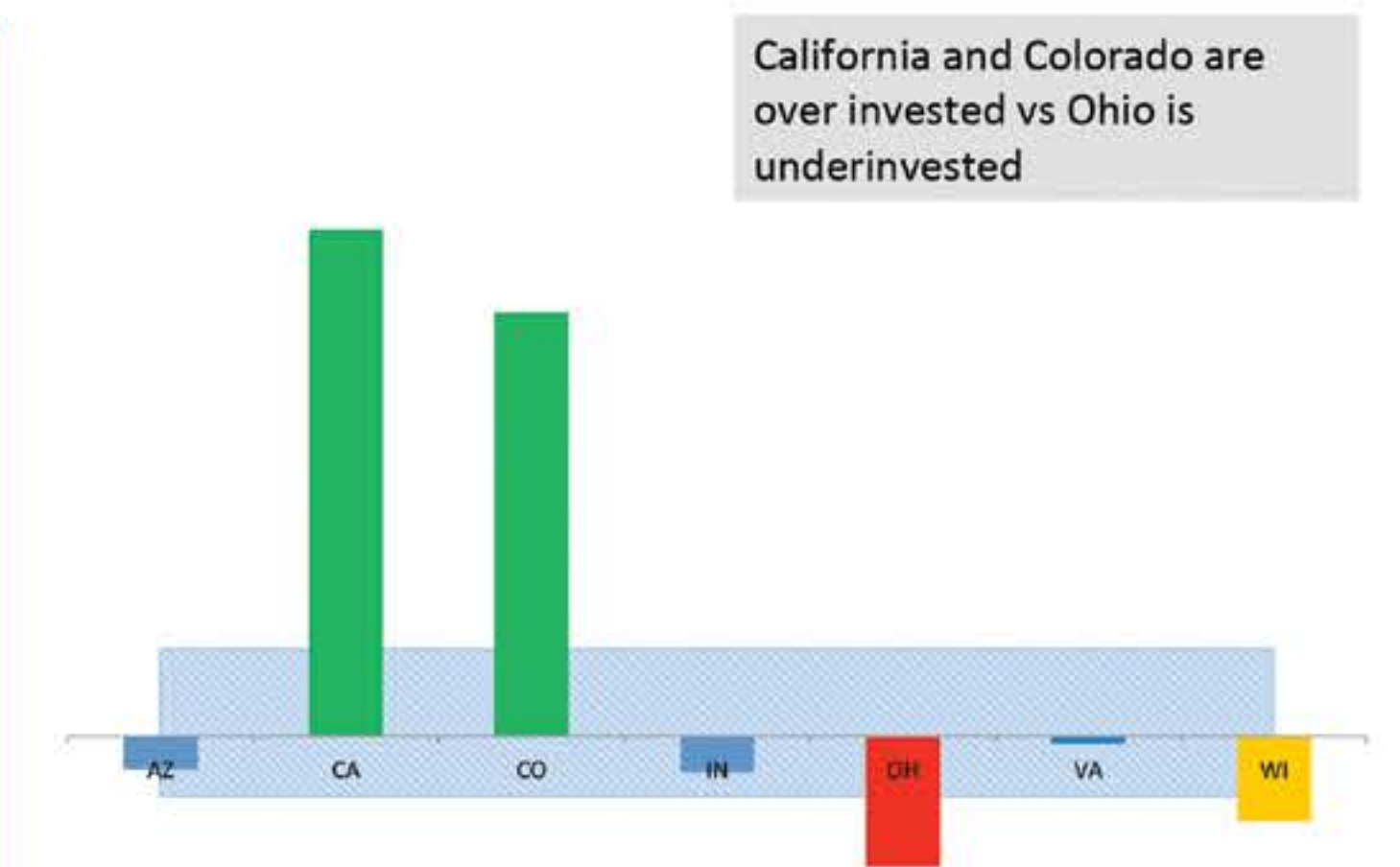
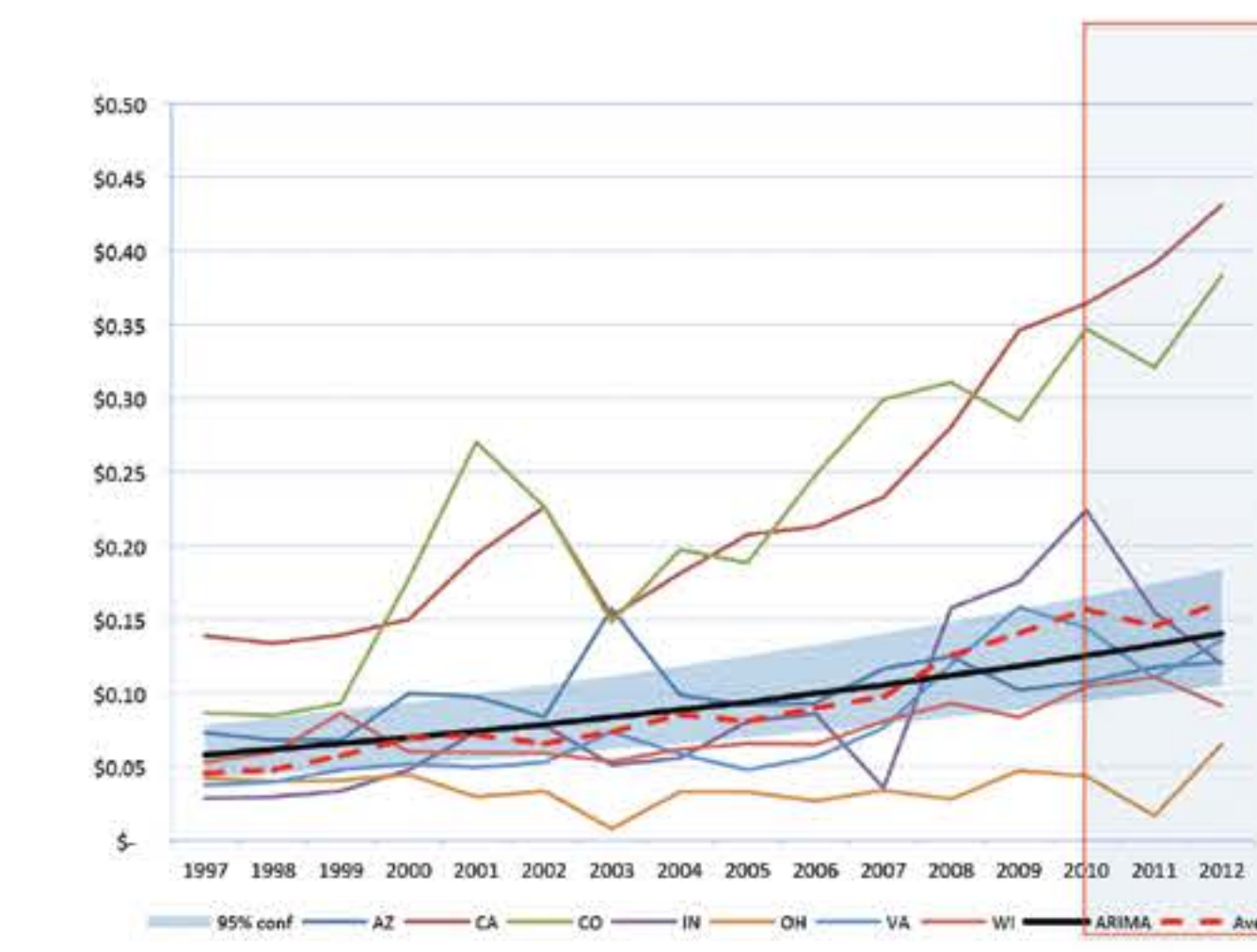
Metric

- The consumer profile of each state drives different need for electricity
- Peak demand is a good proxy for customer mix (residential, industrial and commercial) and size of customer base

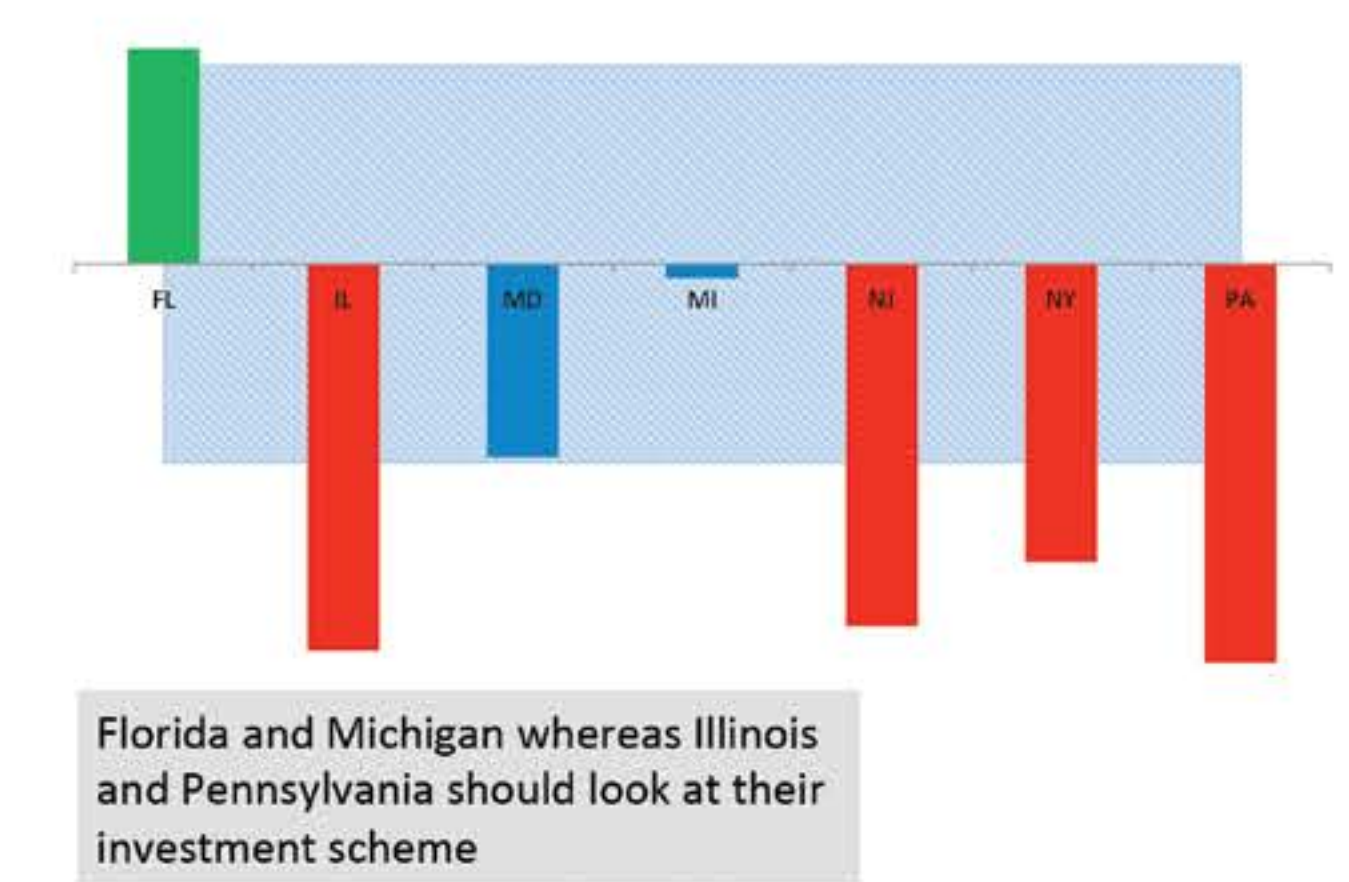
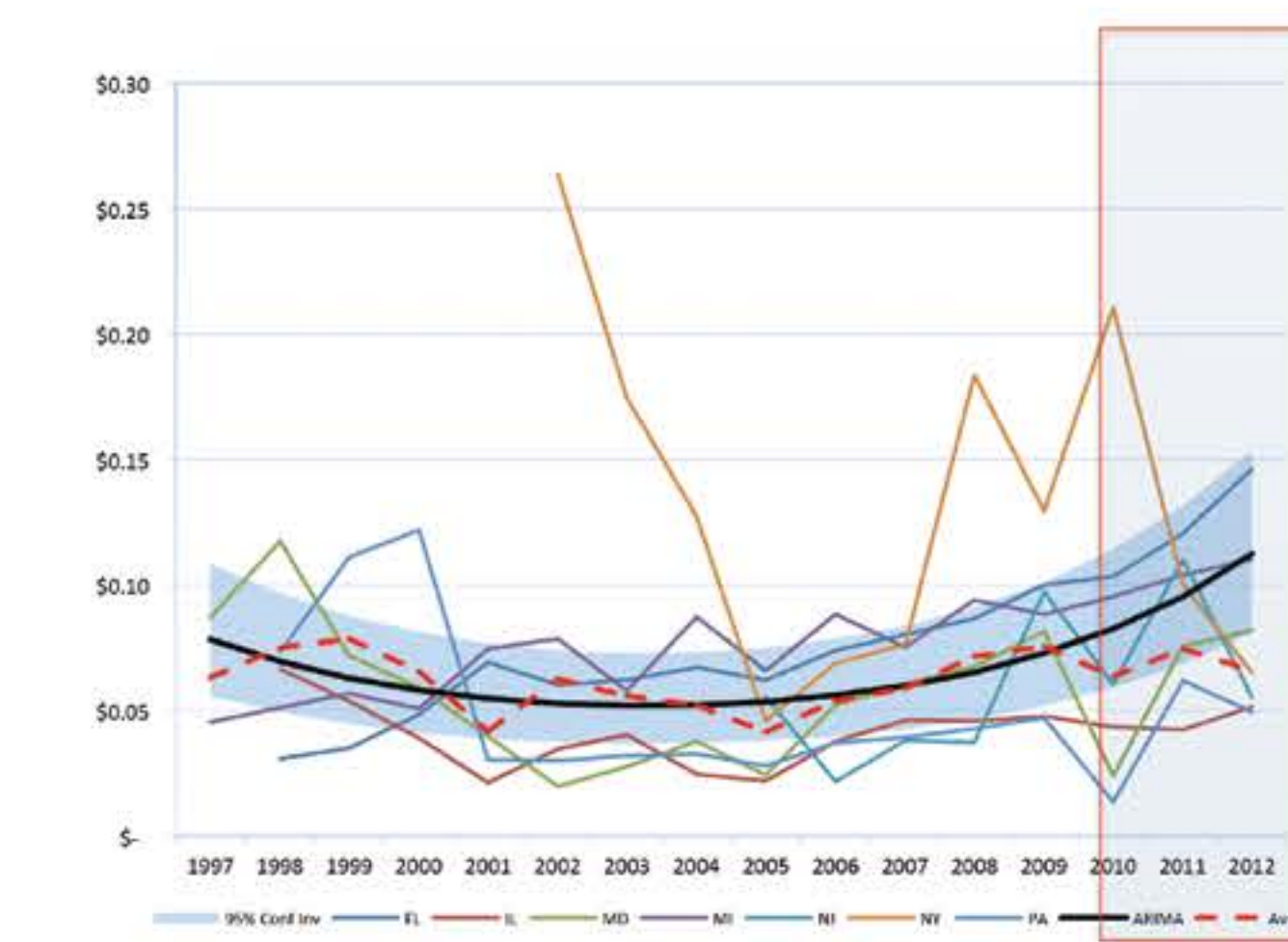
Our metric for measurement = Capital Expenditure / Peak demand



Capex/Peak Demand across States in Cluster I

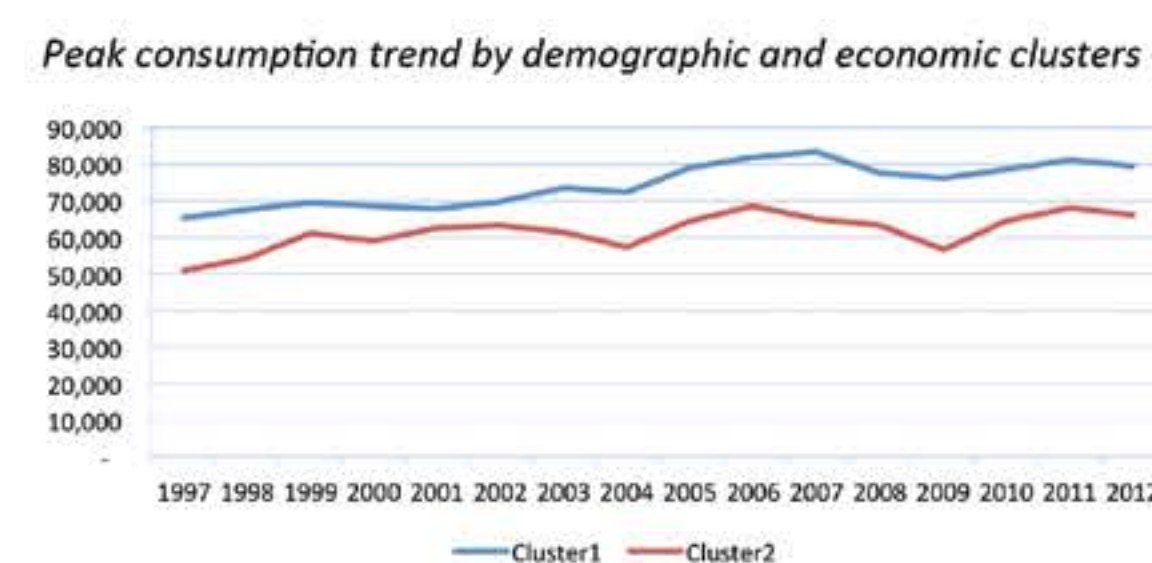


Capex/Peak Demand across States in Cluster II

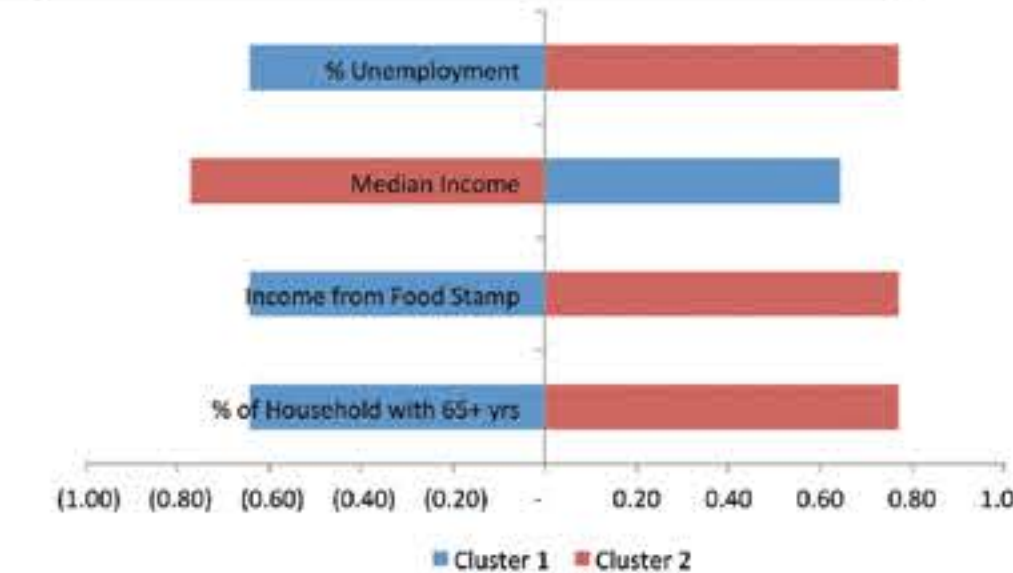


Profiling Regions With Similar Demand

Past literature in the field suggests that demographic and economic measures predicts electricity consumption
Divided the sample space into two demographically and economically homogenous clusters

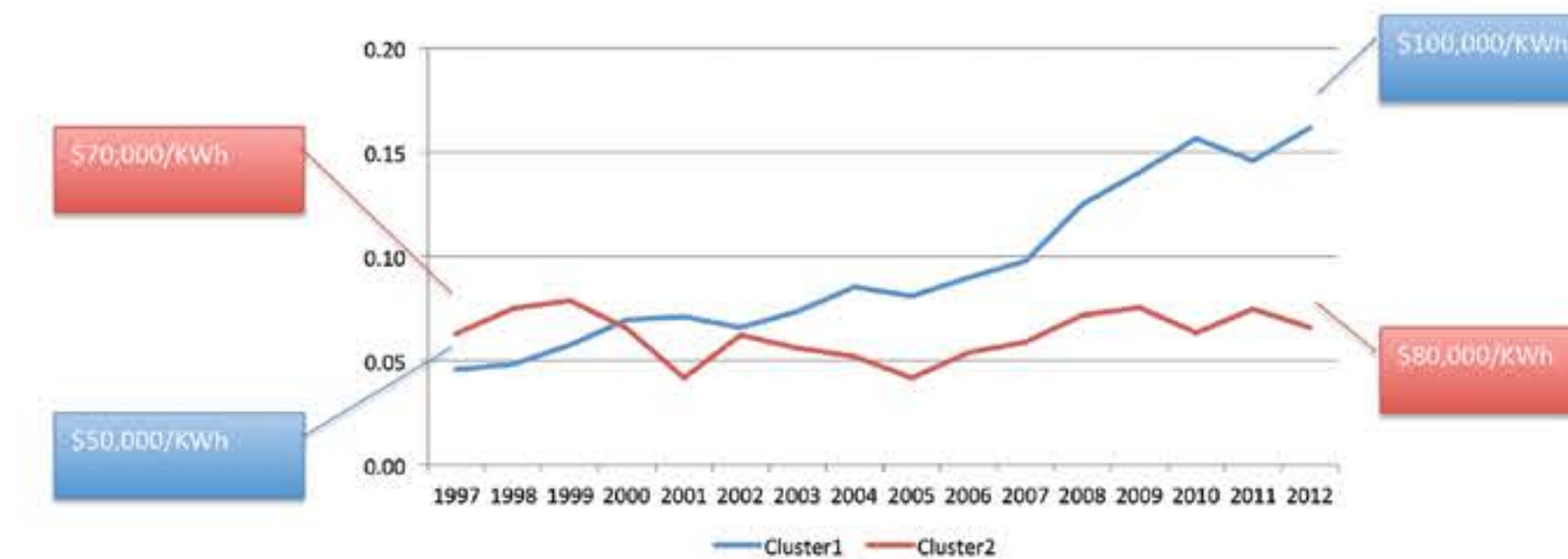


A Discriminant analysis revealed that **income, unemployment, percentage of retired personnel and income from Food Stamp** were the main drivers



Cluster 1 States:
Arizona (AZ) California (CA)
Colorado (CO) Indiana (IN)
Ohio (OH) Virginia (VA)

Cluster 2 States:
Florida (FL) Illinois (IL)
Maryland (MD) Michigan (MI)
New Jersey (NJ) New York (NY)



Cluster1 investments are more systematic and future growth oriented
Cluster2 investments pattern are less systematic but with still significant positive trend

Conclusion

- Until 2003 the difference between clusters was 1%
- Clusters started diverging from 2003 to reach a difference of 8% in 2012
- Within cluster results, mimic the between cluster results
- Altogether, it seems electric utility investment has become a rich-gets-richer type of market starting around 2003