

Mieux Connaître L'Évolution Des Consommations D'Eau Pour Un Service Plus Adapté Aux Différent Usages

Nantes: 92^e congrès de l'ASTEE 2013

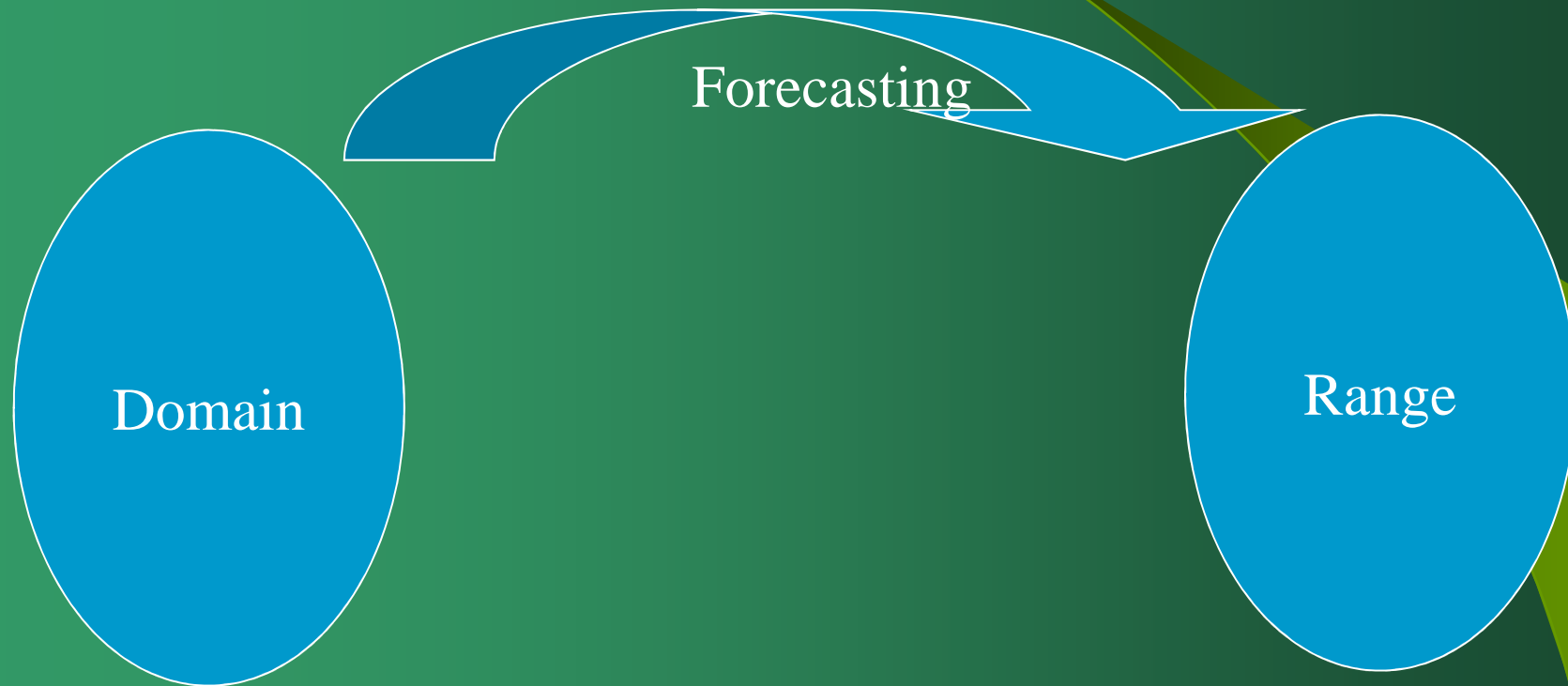
Certains thèmes

- How Water Consumption is Changing
 - Trends in urban water consumption, what explains it, what are the consequences for utilities?
 - Statistical discernment of demand drivers
 - Forecasting future water demand to better plan investment and operation of water utilities
- The future may not be like the past
 - Cost of Water and Customer choices
 - The pace and pattern of new development
 - New construction design

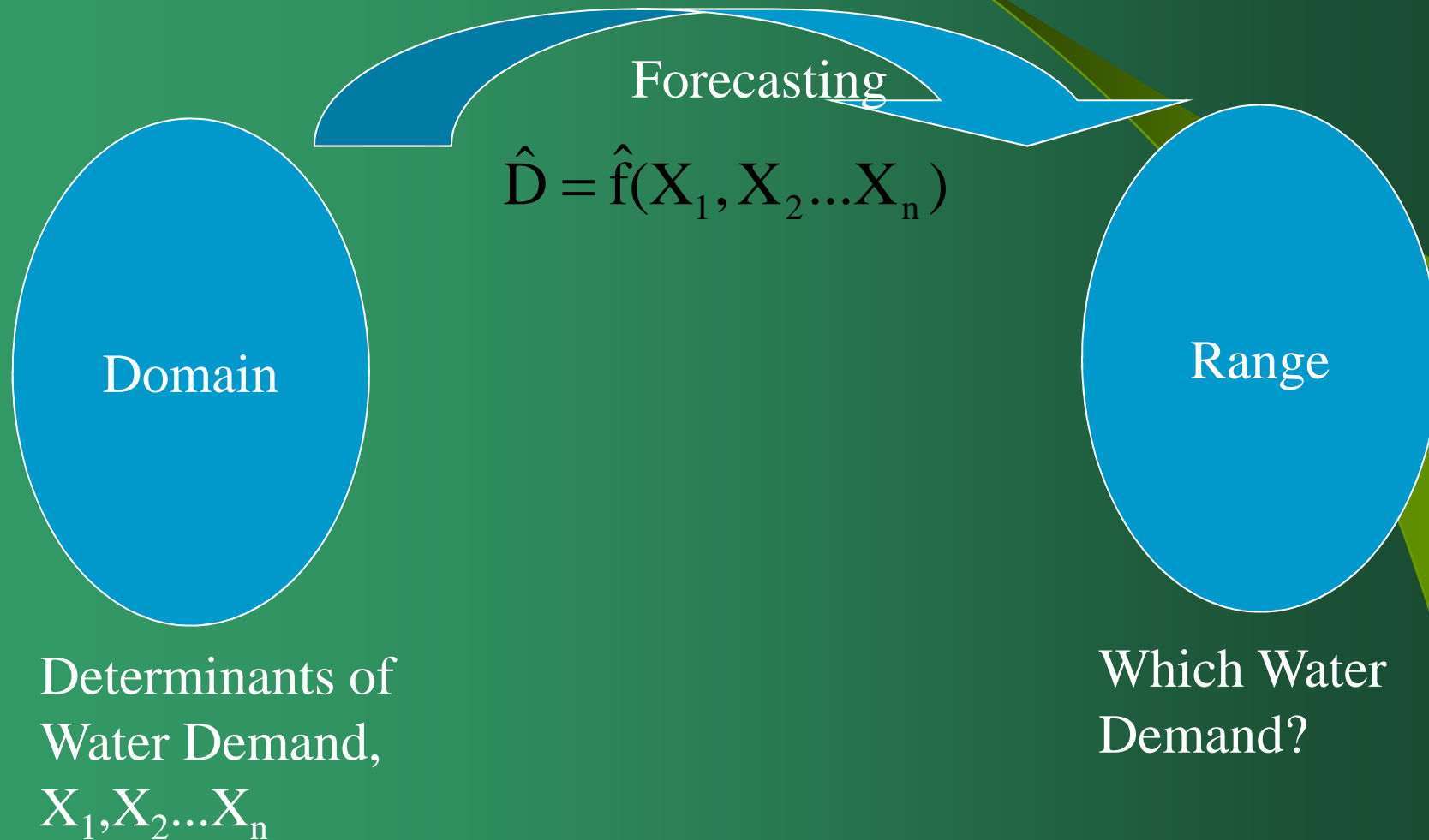
Different notions of water demand

- Engineer – may view demand in terms of “demand load” – a production requirement, need
- Water Planner – water demand as supply provided, use
- Financial Planner -- demand as revenue-producing consumption;
- Economist – demand as a choice-based relationship between quantity and price, sometimes conditional on quality and reliability

Demand Forecasting goes from here to there



Demand Forecasting goes from here to there



Reasons for Declining Demand

- Increasing Cost of Water?
- Increasing Water Use Efficiency?
- Changing Consumptive Patterns?
 - Chosen, Designed, Mandated
- Worst Recession in 2 Decades?
- Climate Change?

DECLINING WATER SALES AND UTILITY REVENUES: A FRAMEWORK FOR UNDERSTANDING AND ADAPTING

A WHITE PAPER
FOR THE NATIONAL WATER RATES SUMMIT –
RACINE, WISCONSIN

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Planning Uses of Water Demand Forecasting

Three different types of uses for demand forecasting

- Long Range Planning
 - Supply Adequacy Evaluation
- Short-Range Planning
- Financial Planning

What is the goal of water pricing?

*To shape demand
(system load)*

*To ensure a social
safety net*

**To reflect costs, improve
efficiency, and promote
sustainability**

*To internalize
externalities*

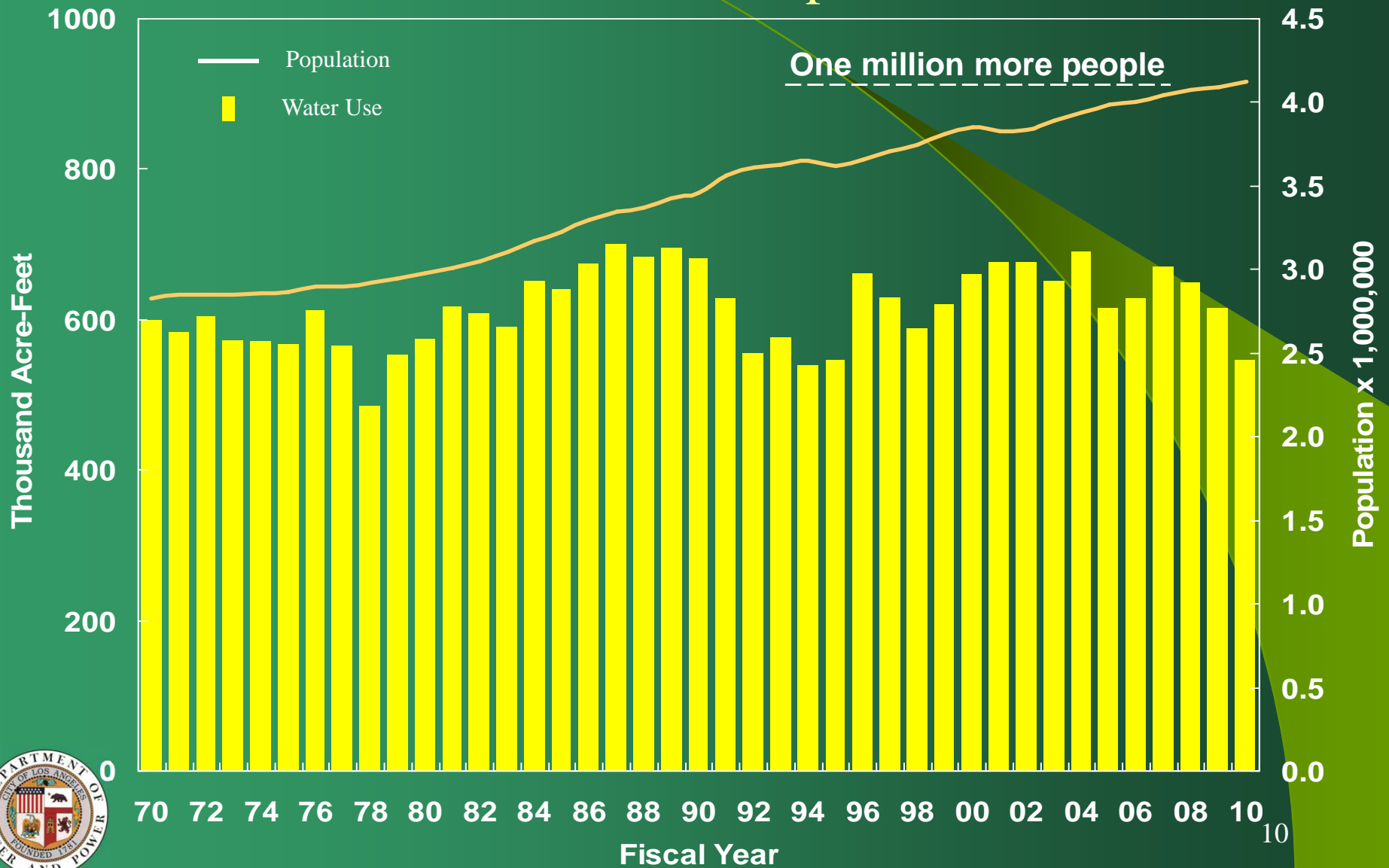
*To provide sufficient
and stable cash flow*

Vue d'ailleurs: Water Demand Forecasting in the U.S.

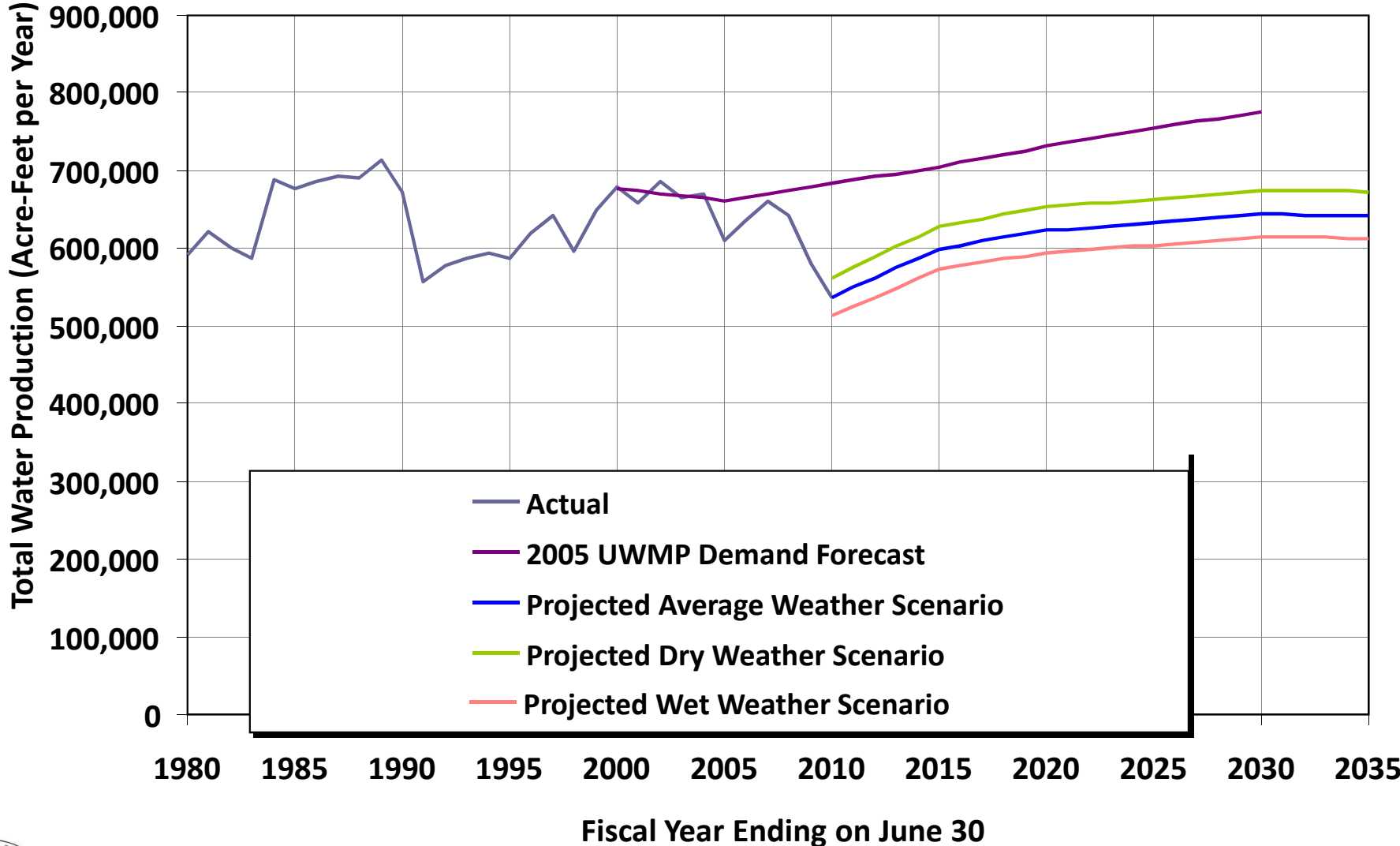
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Effect of Efficiency in Los Angeles

Water Use and Population



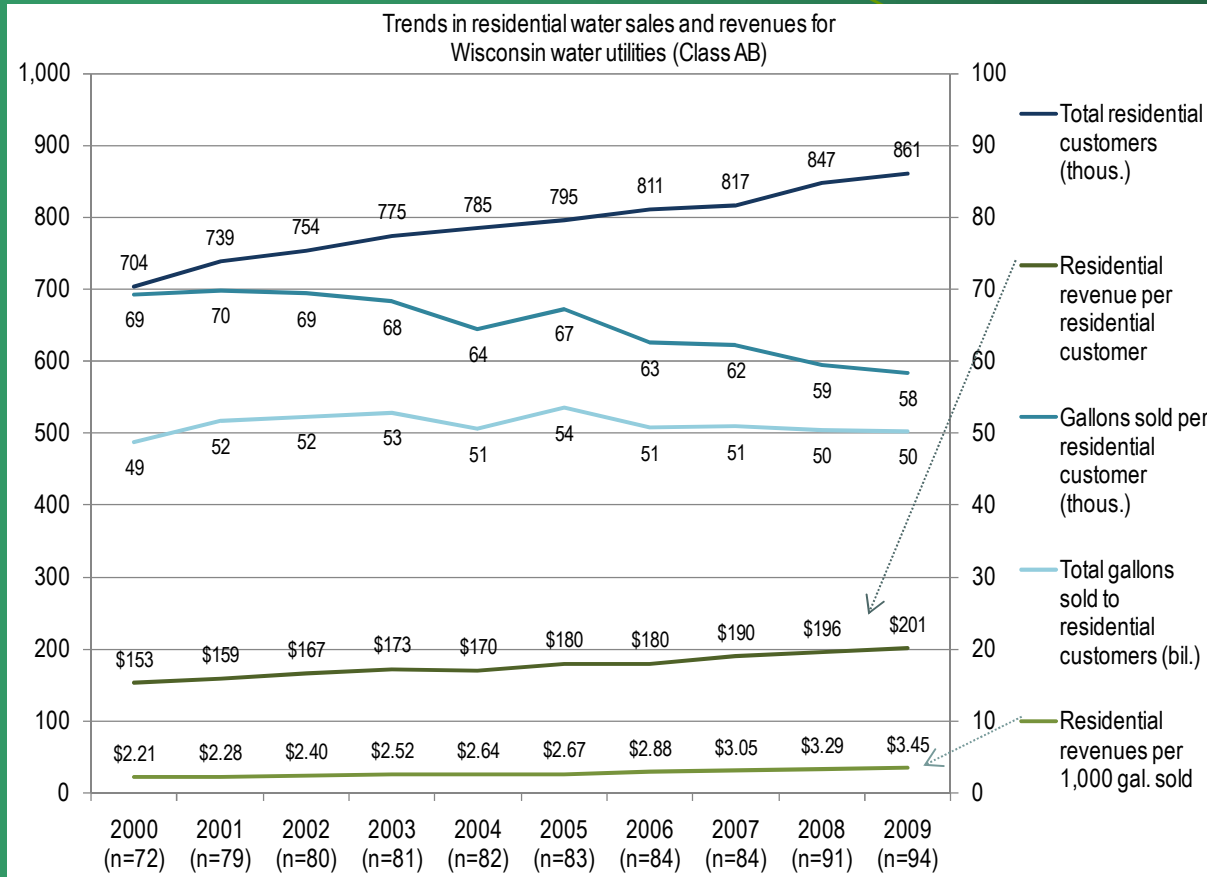
LADWP Water Demand Forecast



Note: Projected demands account for planned water conservation savings



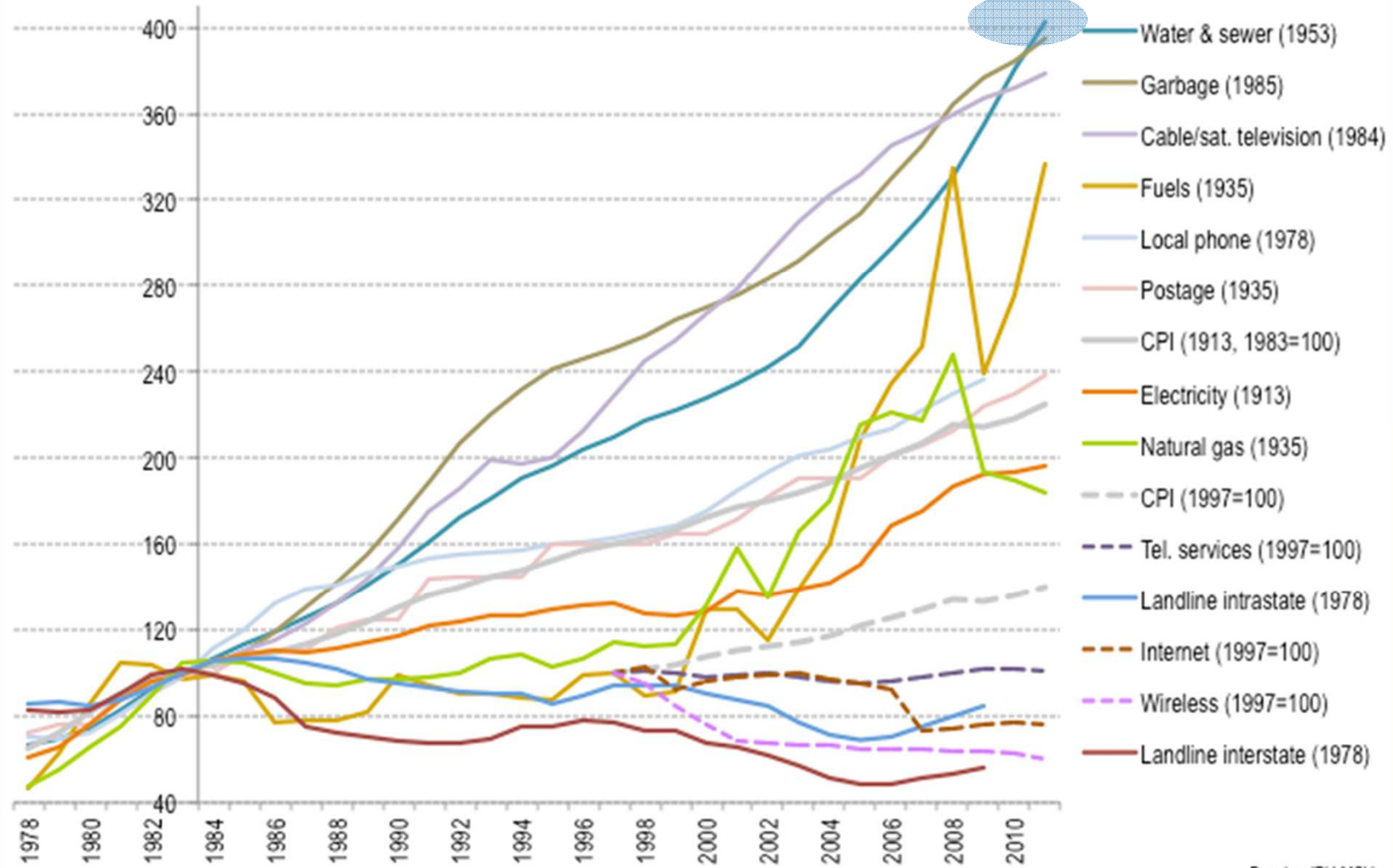
Wisconsin trends



Milwaukee

- Water sold in 2000 = $\sim 158 \times 10^6$ cu. m.
- Water sold in 2011 = $\sim 122 \times 10^6$ cu. m.
- Population: flat at 600,000

Trends in consumer prices (CPI) for utilities

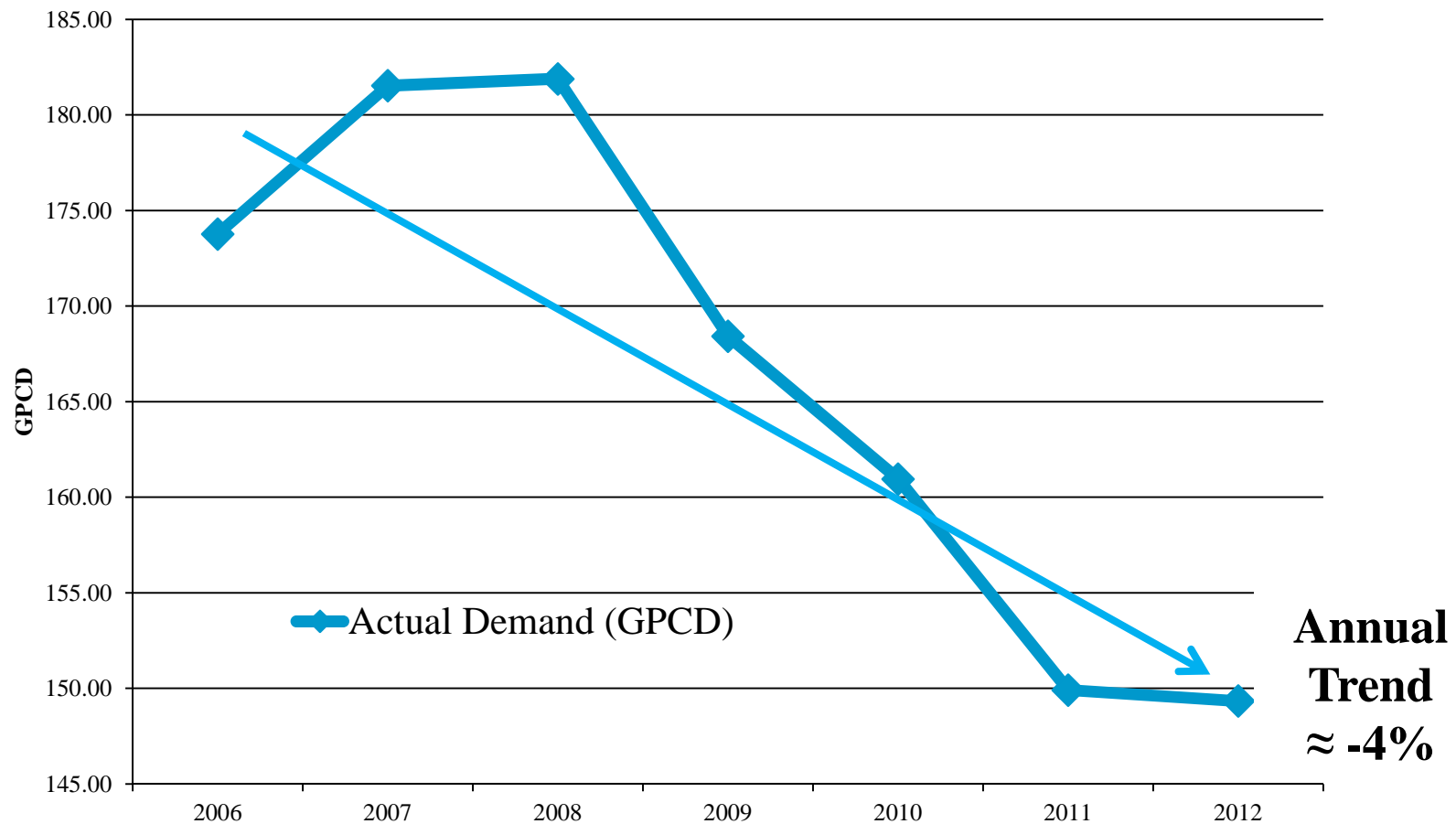


Price response (“rate shock”)

- Economic response
 - Customers use less per the law of demand (price elasticity)
 - Effect can be dramatic
- Political response
 - Customers call in and complain
 - Customers vote in a different Board or City Council
- Water ratemaking is always *political*
 - Not necessarily a bad thing

A Statistical Fable: Water Demand Falling off a Cliff

**WAWA Water Annual Per Capita Demand:
Actual versus Normalized Demand (GPCD)**



Statistical Demand Models

- 1992-2010 Data
- Model Form
 - Season, (S),
 - Weather (W),
 - Meters (M) and
 - Employment (E)
 - Price (P)

$$\text{Use} = \mathbf{f}(\mathbf{S}_t, \mathbf{W}_t, M_t, E_t, P_t) + \varepsilon$$

$$\ln \text{ Production}_t = \mu + S_t + W_t + M_t + E_t$$

$$M_t \equiv \ln \text{ Meters} - \text{mean } \ln \text{ Meters}$$

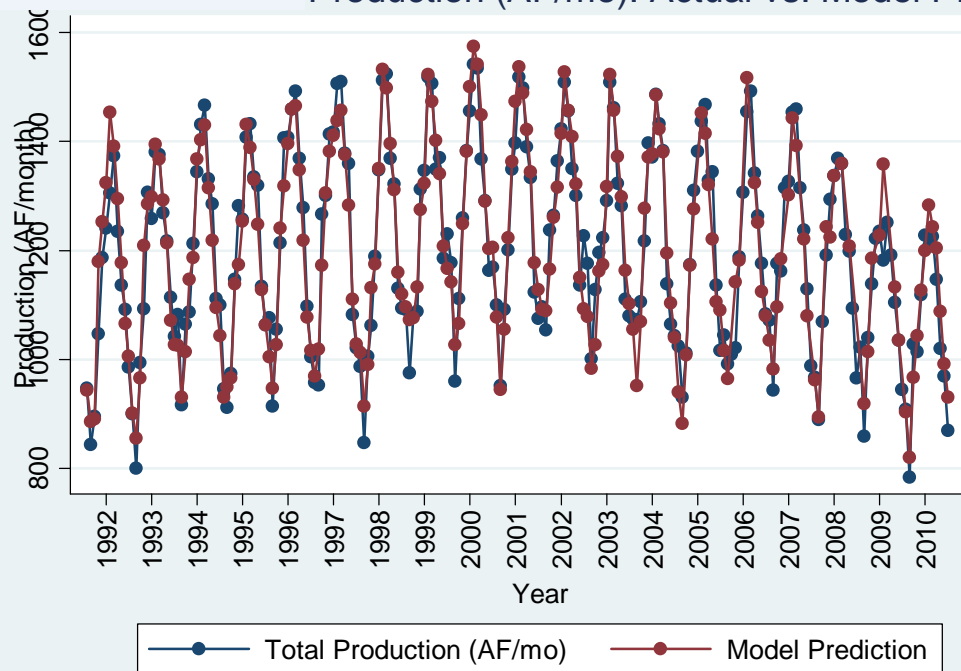
$$E_t \equiv \ln \text{ Emp} - \text{Trendin } \ln \text{ Emp}$$

- Robust Regression data quality screen

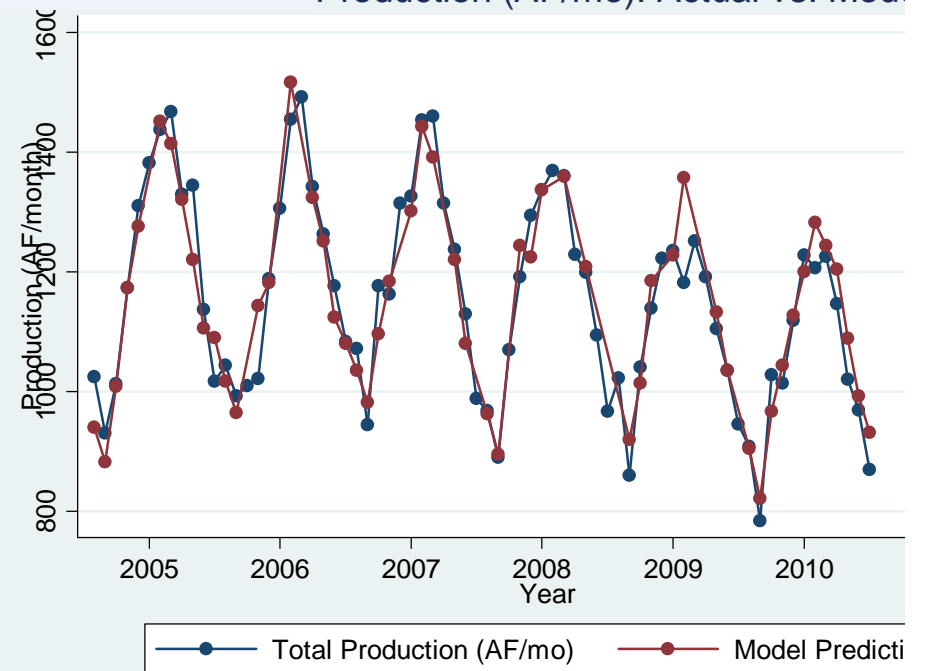
West Anywhere Water Authority: Actual vs. Model Prediction

Statistical Model with Climate and Employment: Is there a surprise here?

WAWA Production (AF/mo): Actual vs. Model Prediction

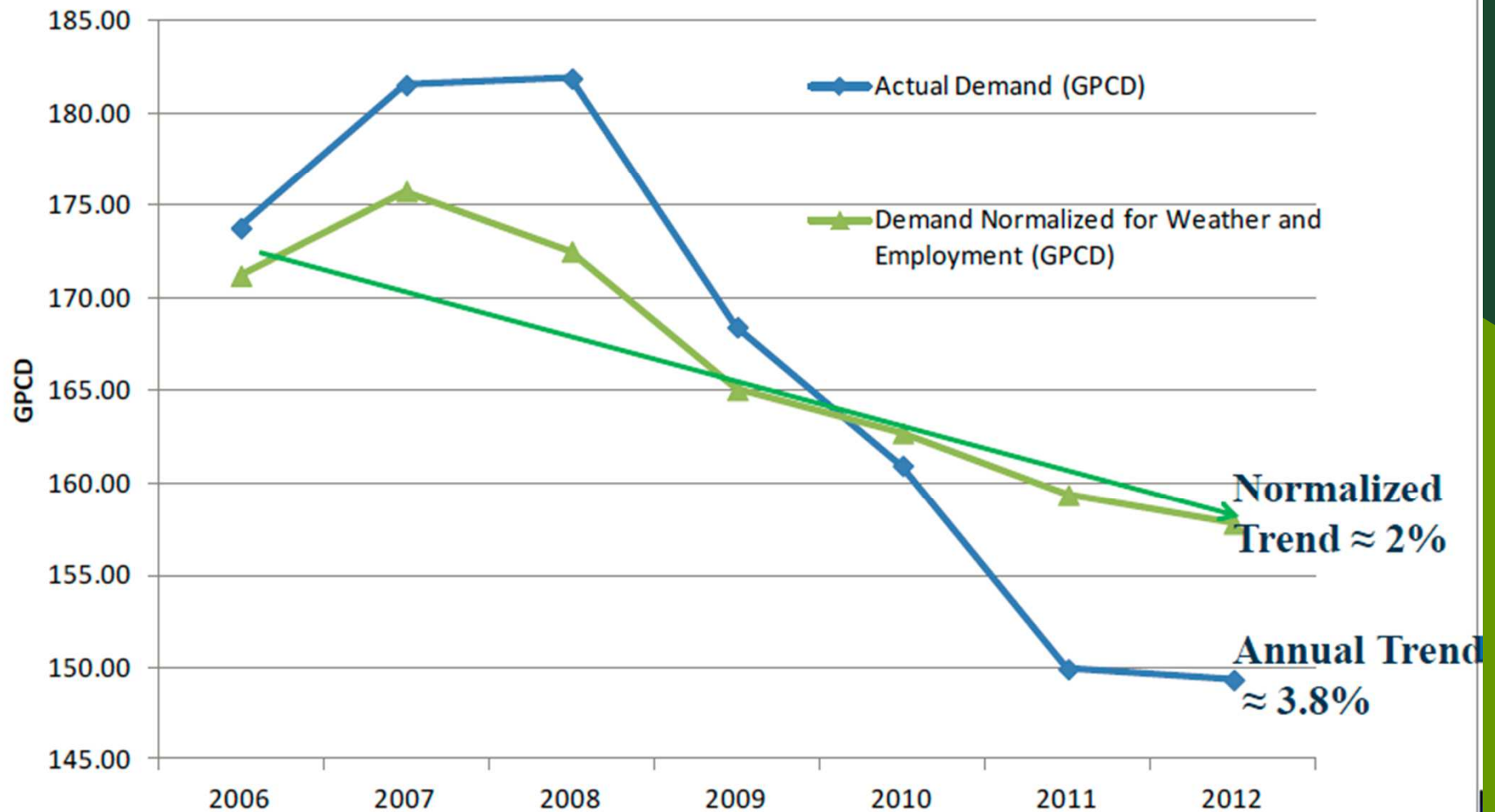


WAWA Production (AF/mo): Actual vs. Model Prediction



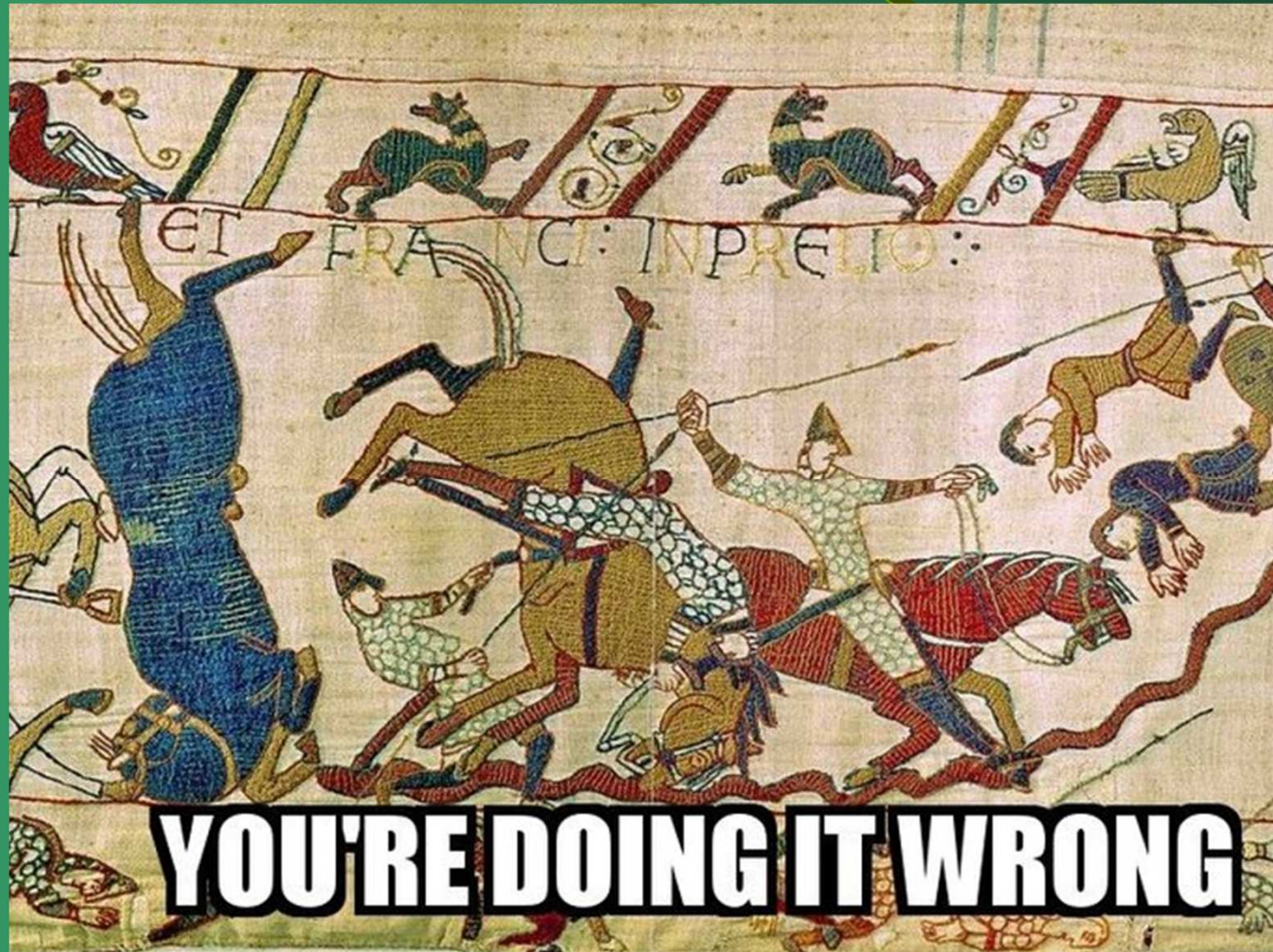
Statistically Removing the Effect of Recession and Weather: Trend Analysis

**WAWA Water Annual Per Capita Demand:
Actual versus Normalized Demand (GPCD)**



Water Use Efficiency: You're doing it wrong

- If conservation is the problem... then
- You're doing it wrong.



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