# Using Financial Information to Make Engineering Decisions

**Doug Waugh**
**Clackamas County Water Environment Services (WES)**

# Who Are We?

## Generally Natural Monopolies

- Operate in the public interest
- Little to no choice by consumers
- Many municipally owned
- High fixed costs

# Water Utility Cost Structure

## Fixed

- Does not vary with sales
- Salaries, debt service, etc.

## Variable

- Varies with water sales
- Power, chemicals, etc.


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# Expectations on Levels of Costs

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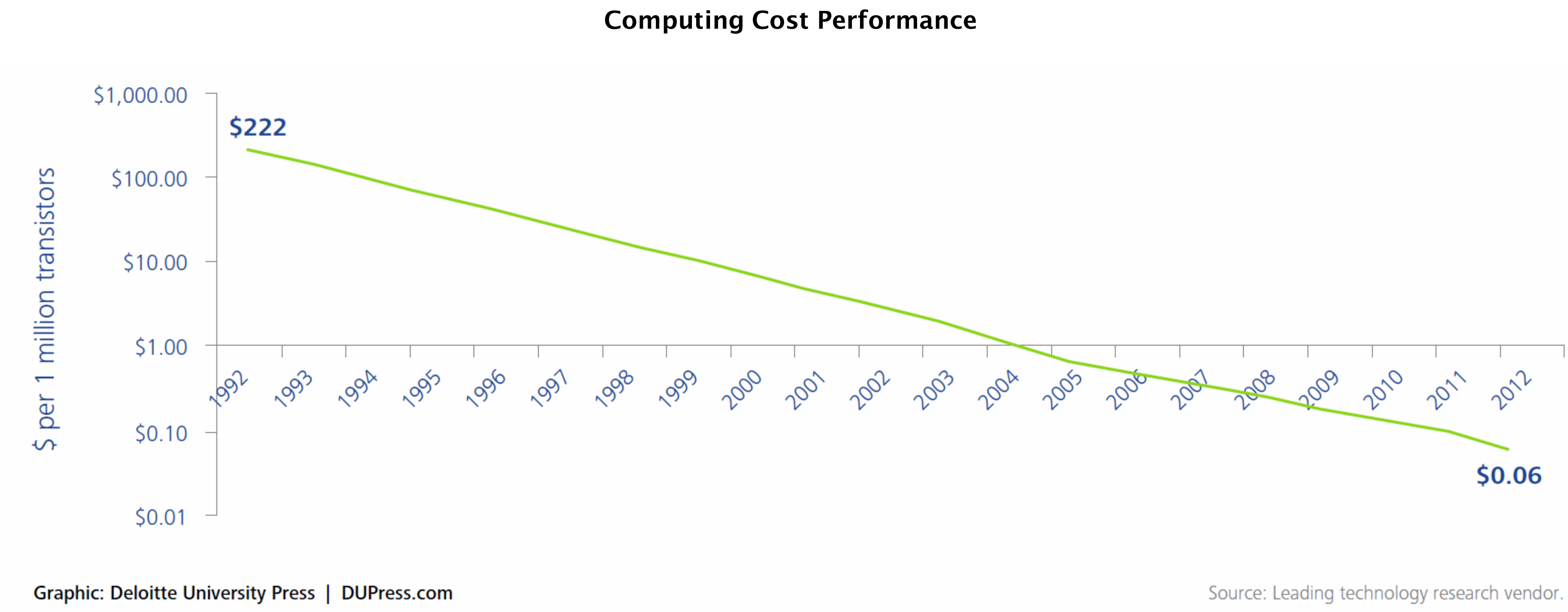
# Customers' Experience in Other Parts of the Economy

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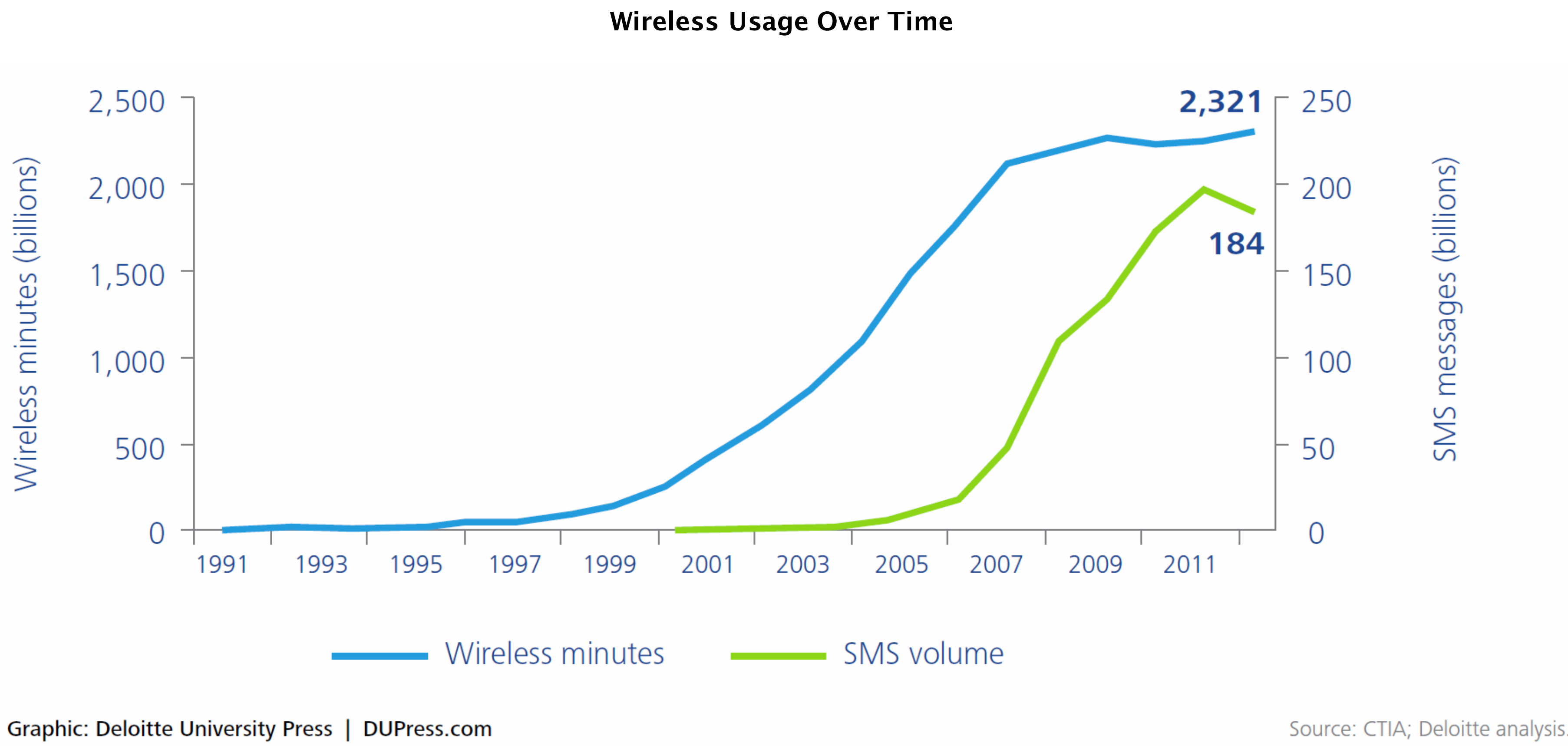
# How Others Grow Revenue

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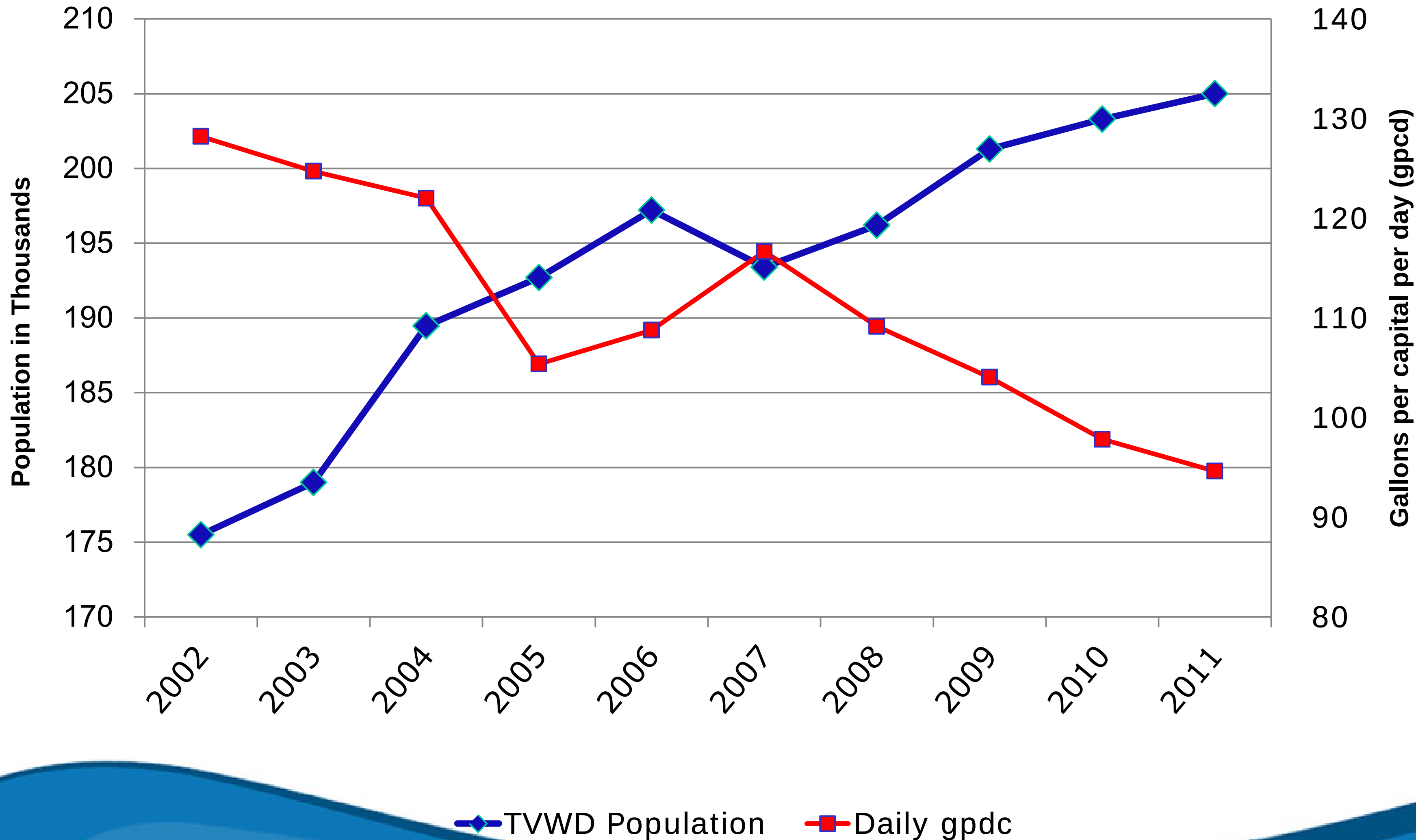
# TVWD Water Consumption Trends

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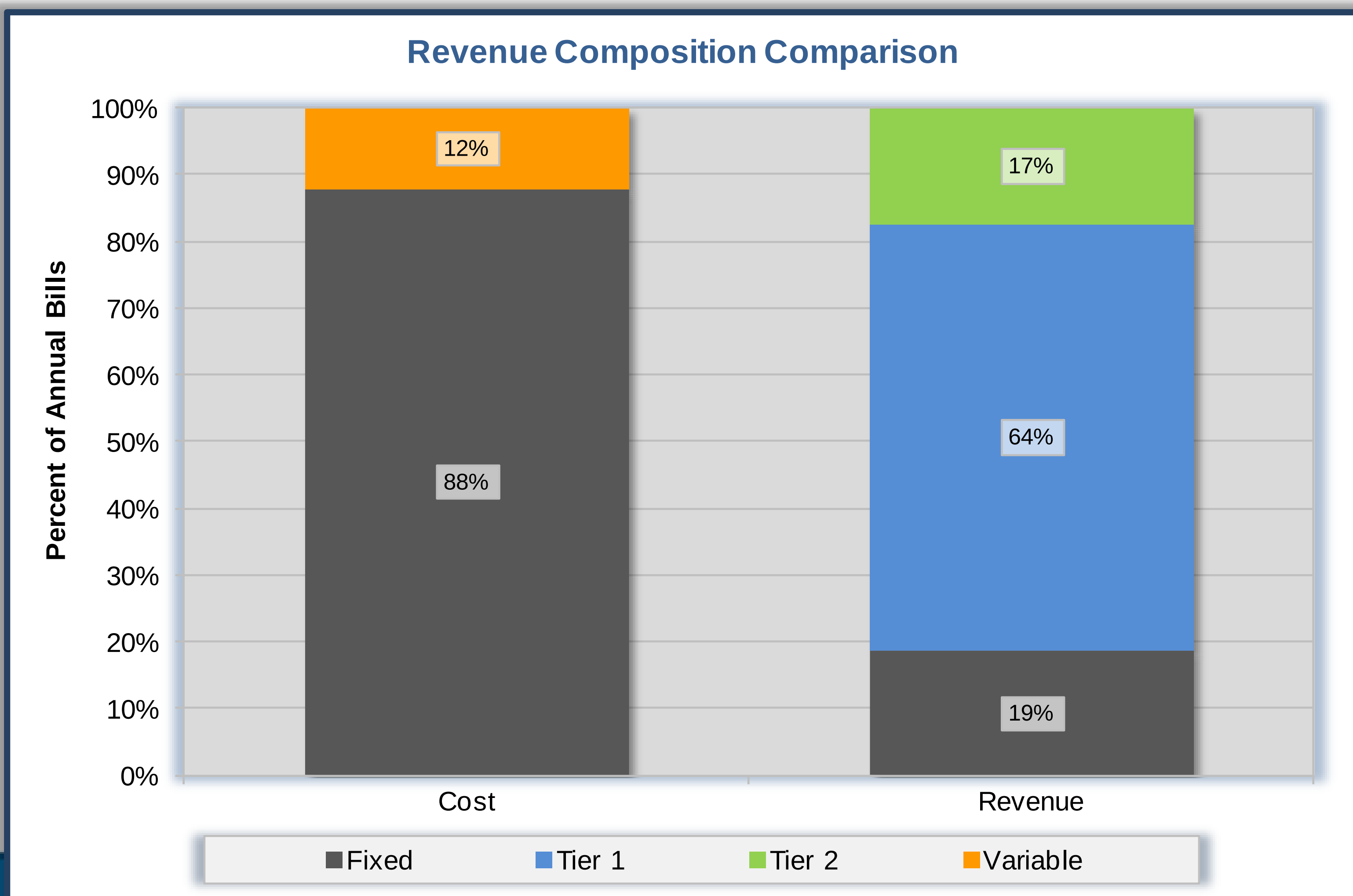
# Cost and Revenue Structures

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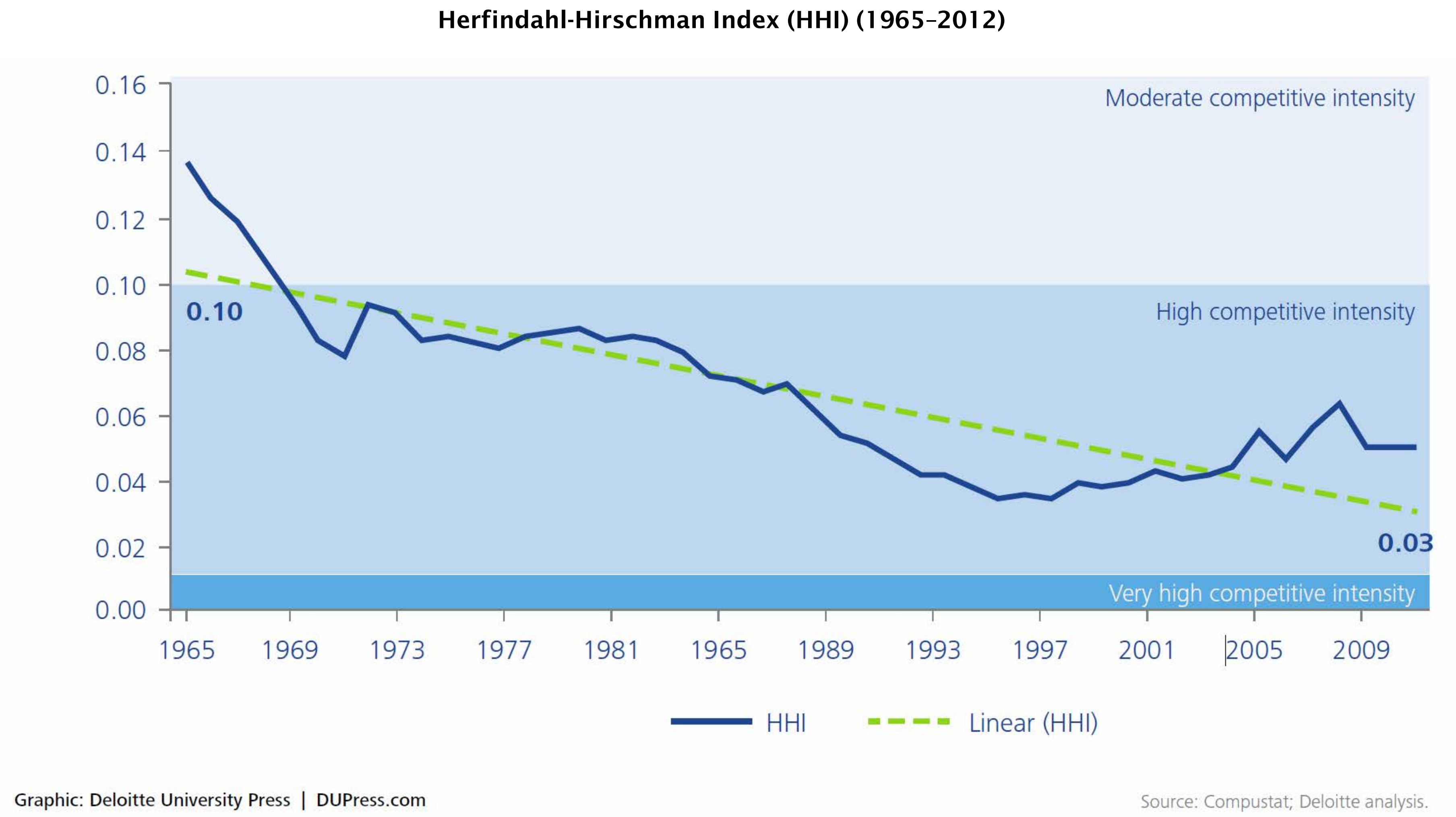
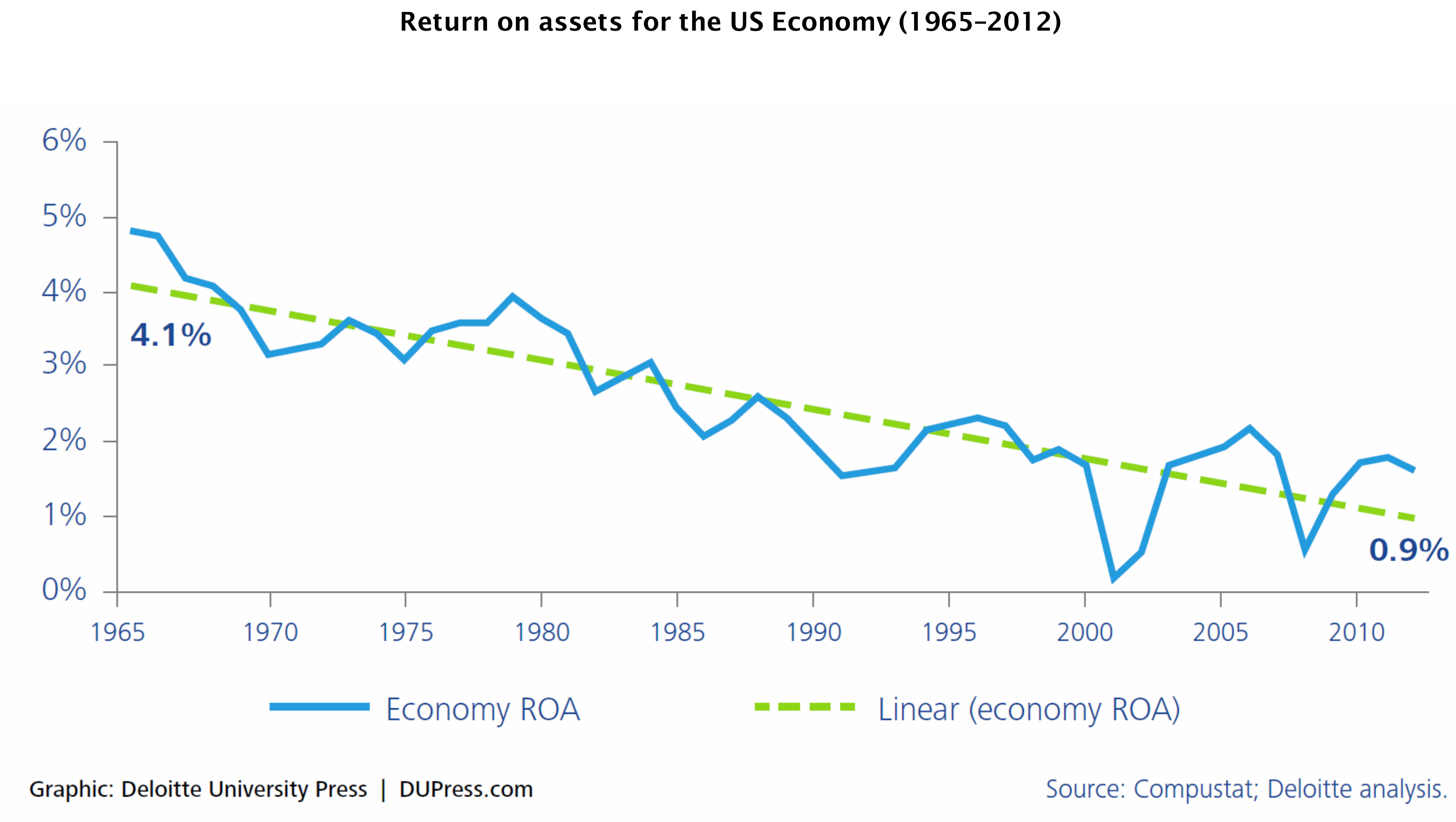
# Industries Are More Competitive

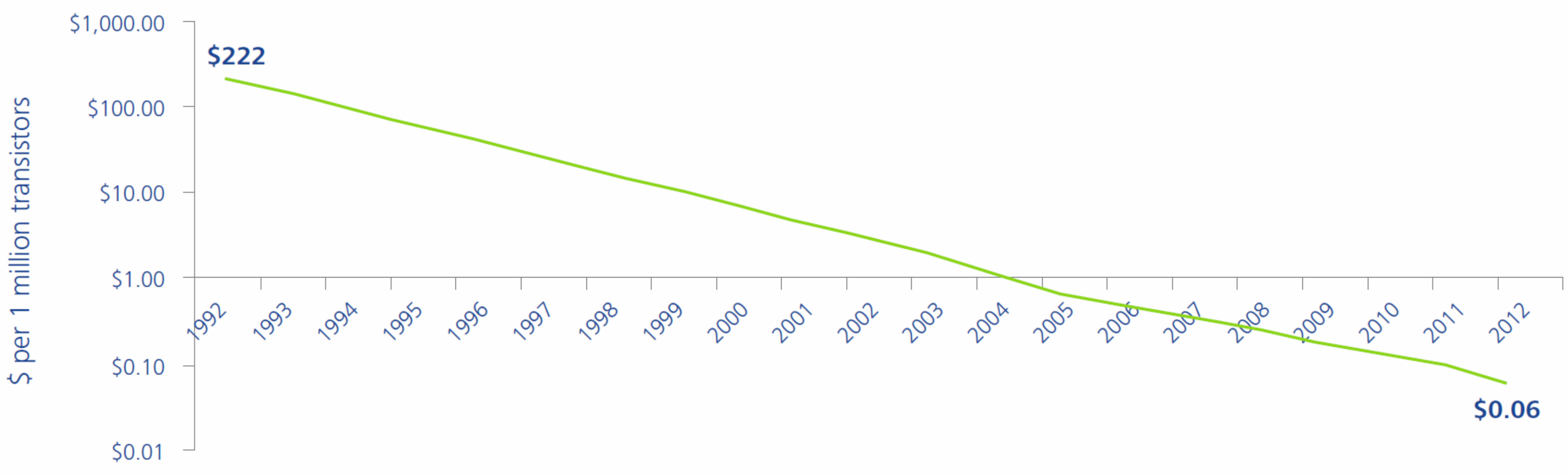


# Declining Returns on Assets



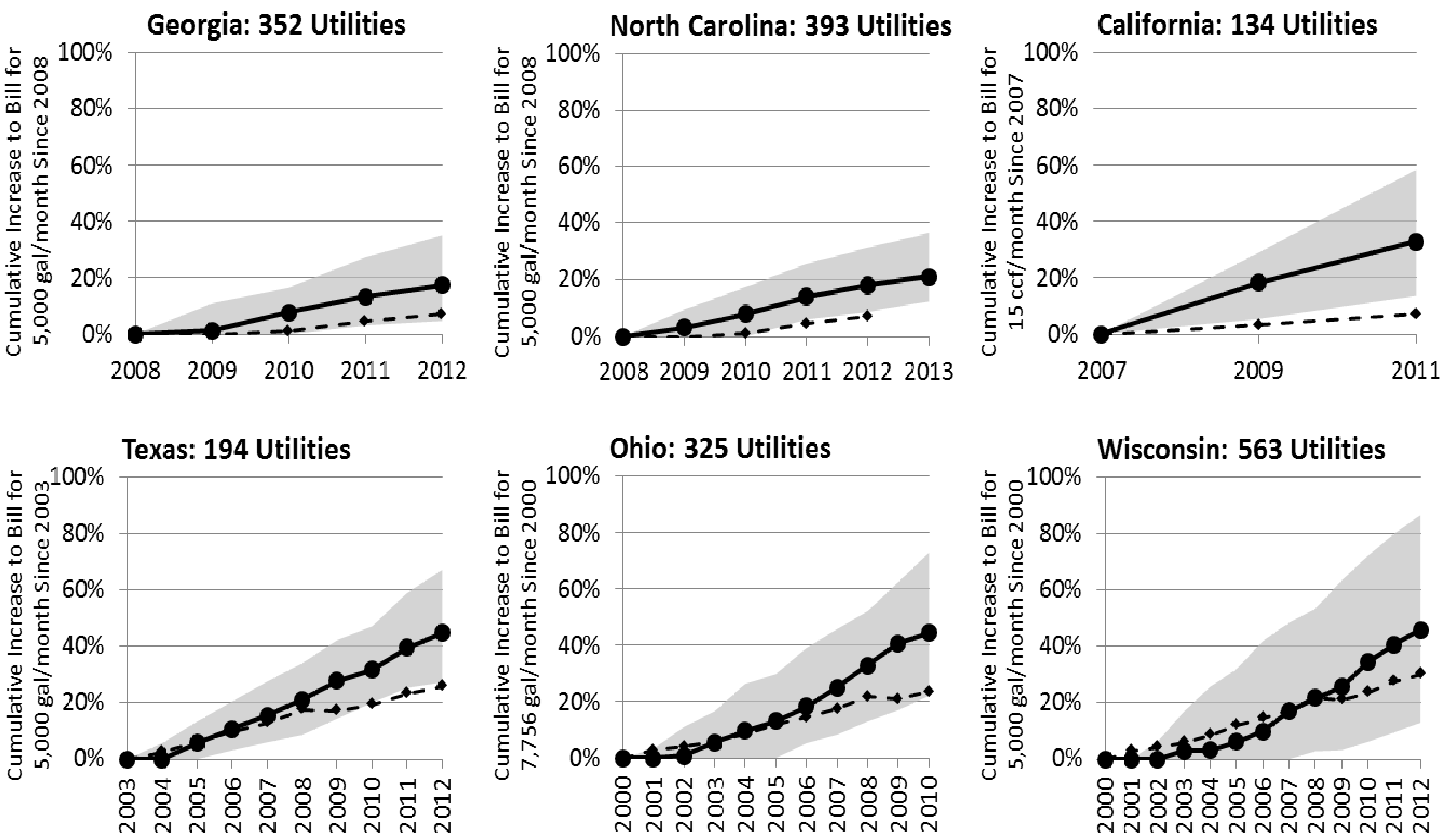
# What Do Our Customers Expect?

**Computing Cost Performance**




Graphic: Deloitte University Press | DUPress.com

Source: Leading technology research vendor.




Data analyzed by the Environmental Finance Center at the University of North Carolina, Chapel Hill and Raftelis Financial Consultants, Inc. Rates data for all utilities in this analysis were known for all consecutive years and the cohort of utilities is the same for all years. Inflation of the regional Consumer Price Index is shown for the region each state is located in: South for GA, NC, TX; West for CA; Midwest for OH, WI. Data sources: Annual and biennial statewide rates surveys conducted by Raftelis Financial Consultants (CA), Georgia Environmental Finance Authority/Environmental Finance Center, North Carolina League of Municipalities/Environmental Finance Center, Ohio EPA, Texas Municipal League, and Wisconsin Public Service Commission; Regional Consumer Price Indices by the U.S. Bureau of Labor Statistics.

# Affordability of Utility Service

## Using Financial Information to Make Engineering Decisions

# Three Concepts

## Reducing the Pie

- Reductions in service levels
- Efficiency measures
- Economies of scale
- Long-term debt
- SDCs

## Reallocating the Pie

- Low-income assistance
- Lifeline rates
- Fund external organizations like Care-to-Share

## Serving the Pie Differently

- Increase billing frequency
- Encourage voluntary contributions to Care-to-Share

# Measures of Affordability

## Affordability Measures Ability to Pay

- Most measures simply measure “community-wide” ability to pay
- Typically based % of median household income (MHI) dedicated to utility bills
- For a water typical affordability ranges from 1.5% to 2.5% of MHI

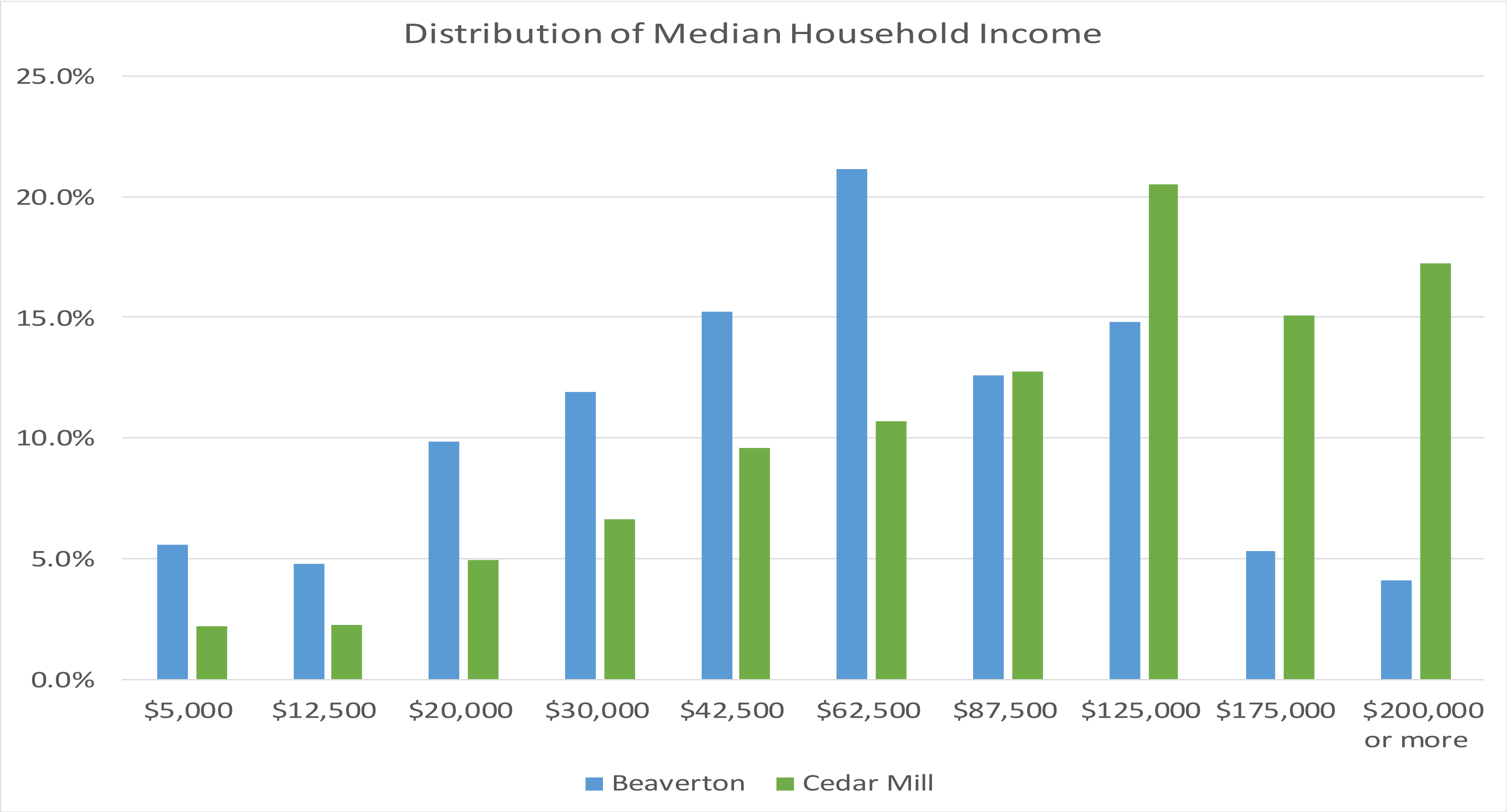
# "Affordable" Bills Under Various Measures of Median Household Income

| | | Range of Affordability | | |
|---|---|---|---|---|
| **Community** | **MHI** | **1.50%** | **2.00%** | **2.50%** |
| Beaverton | $55,115 | $68.89 | $91.86 | $114.82 |
| Aloha | $60,297 | $75.37 | $100.50 | $125.62 |
| Tigard | $62,521 | $78.15 | $104.20 | $130.25 |
| Hillsboro | $64,197 | $80.25 | $107.00 | $133.74 |
| Cedar Hills | $68,793 | $85.99 | $114.66 | $143.32 |
| Cedar Mill | $106,429 | $133.04 | $177.38 | $221.73 |
| Washington County | $63,814 | $79.77 | $106.36 | $132.95 |

Median Household Income (MHI) based on US Census Quick Facts at http://quickfacts.census.gov/qfd/states/41/41067.html

***Is it really this simple?***

# MHI Distribution Across Households – A Tale of Two Communities

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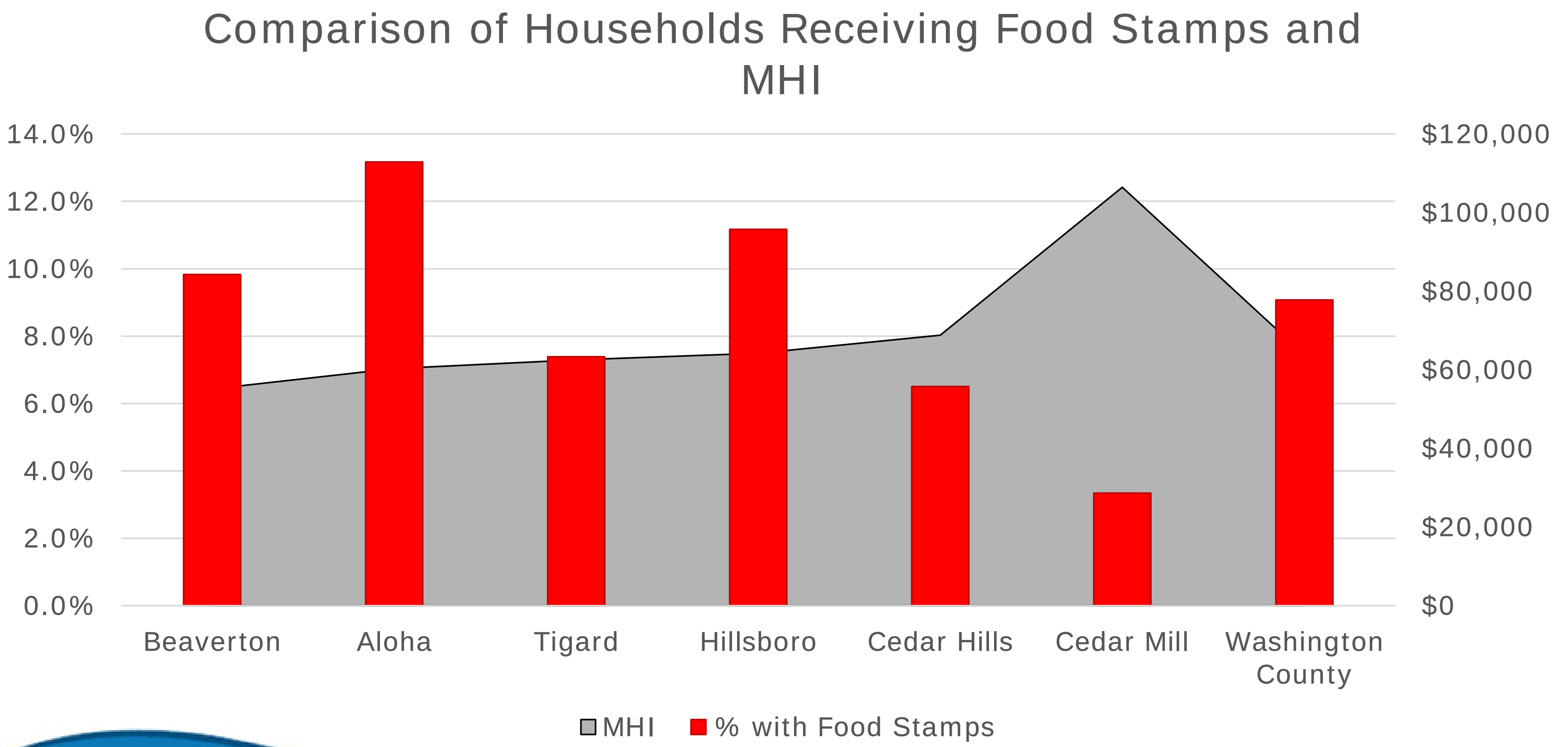
# TVWD Serves a Diverse Community

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# Challenges Facing Major Public Works Projects

## The Environment

- Higher expectations of project cost estimates
- Transparency in reporting costs and progress
- Increasing sensitivity to public investments
- Customers' expectations of future costs

# Expectations on Accuracy of Cost Estimates

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# Developing Program Cost Estimates

**Concept Screening**

- Selecting alternatives for further analyses

**Study or Feasibility**

- Higher degree of engineering analysis
- Increase in project definition

**Budget, Authorization, or Control**

- High-level of engineering certainty
- Purpose of Predesign Study

**Financing-Quality Information**

- Sufficient confidence in cost estimates to document financial feasibility

# Limitation on Cost Details

| Estimate Class | Expected Accuracy Range | Level of Project Definition | Typical Purpose |
|---|---|---|---|
| Class 5 | Low: -20% to -50%<br>High: +30% to +100% | 0% to 2% | Concept Screening |
| Class 4 | Low: -15% to -30%<br>High: +20% to +50% | 1% to 15% | Study or Feasibility |
| Class 3 | Low: -10% to -20%<br>High: +10% to +30% | 10% to 40% | Budget, Authorization, or Control |
| Class 2 | Low: -5% to -15%<br>High: +5% to +20% | 30% to 70% | Control or Bid/ Tender |
| Class 1 | Low: -3% to -10%<br>High: +3% to +15% | 50% to 100% | Check Estimate or Bid/Tender |

Source: The Association for the Advancement of Cost Engineering (AACE) International Recommended Practice No. 18R-97.

# Engineering Data May Feed Concerns

Desire to know more than we can know

- We're experts in our field

Systematic optimism

- AKA: Hope over experience

Pressure from communications and others

- Uncertainty doesn't communicate well

# Call to Action

## Challenges for Utilities

- Garner the greatest value for our customers
  - Choose investments wisely—prioritize capital projects
- Embrace transparency
- Prepare for customer reactions to future revenue increases
- Identify value in our investments

# Business Case Evaluations

## Objectives

- Provide consistent framework to evaluate alternatives
- Embrace transparency in decision-making process
- Develop a culture of economy with ratepayer dollars
- Ensure alignment with utility strategic planning
- Incorporate triple bottom-line analyses explicitly

# Key Elements of a Business Case

## Understand Utility's Cost of Capital

- Ratepayers money dedicated to utility infrastructure has a cost

## Develop Project Alternatives

- Distinctly different
- Feasible to implement

## Select an Evaluation Methodology

- Appropriate for the question at hand
- Adequately addresses risk

## Determine Project Benefits and Costs

- Monetary and Non-monetary Costs and Benefits

# Thank you!

# If you're REALLY interested…

# Cost of Capital for Utilities

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# Traditional Factors in Opportunity Cost of Capital

| | |
|---|---|
| **Time value of Money and Inflation** | • Risk-free return |
| **Comparable Risks** | • Interest rate risk<br>• Business risk<br>• Financial risk<br>• Liquidity risk |
| **Other Risks** | • Physical risk<br>• Environmental risk<br>• Legal risk |

# Develop Project Alternatives

## Using Financial Information to Make Engineering Decisions

# Project Alternatives

**Is Each Alternative Feasible?**

- Straw men don’t make for good decision making

**Do Benefits Vary Among Alternatives?**

- Differing benefits require cost-benefit analysis
- Consistent benefits allows cost-effectiveness analysis

**Are the Risks the Same Among Alternatives?**

- Risk register assists in evaluation of risks
- Scale risk analysis appropriately

**Do the Alternatives Have Long Lives?**

- Shorter lives generally reduces the effect of cost of capital
- May suggest a simpler evaluation methodology

**Are Lives the Same for Each Alternative?**

- May mean benefits differ
- Consider including terminal valuations of alternatives

# Select Evaluation Methodology

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# Typical Evaluation Methodologies

- Present Value and Net Present Value
- Internal Rate of Return
- Hurdle Rates
- Pay-Back Analysis

# Net Present Value Analysis

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# Present Value Analysis

- Classic approach to comparing alternatives
- Incorporates discount rate into analysis
- Most common tool to use for evaluation of alternatives with differing timing

# Simple Formula

$$PV_1 = \frac{F}{(1+r)^1}$$

# Practical Application

| | | Option 1--Export | | Option 3--Partial Diversion | |
|---|---|---|---|---|---|
| Year | Discount Factor | Cash Flow | Discounted Cash Flow | Cash Flow | Discounted Cash Flow |
| 2003 | 100.0% | $6,225,530 | $6,225,530 | $2,485,137 | $2,485,137 |
| 2004 | 90.7% | 3,318,335 | 3,010,920 | 5,199,129 | 4,717,475 |
| 2005 | 82.3% | 3,508,287 | 2,888,372 | 2,734,305 | 2,251,153 |
| 2006 | 74.7% | 3,528,221 | 2,635,681 | 2,599,154 | 1,941,642 |
| 2007 | 67.8% | 3,637,997 | 2,465,916 | 2,670,774 | 1,810,311 |
| 2008 | 61.5% | 3,783,417 | 2,326,908 | 2,799,405 | 1,721,713 |
| 2009 | 55.8% | 3,772,403 | 2,105,194 | 3,179,244 | 1,774,181 |
| 2016 | 28.3% | 4,222,511 | 1,193,157 | 6,408,016 | 1,810,717 |
| 2017 | 25.6% | 4,342,085 | 1,113,280 | 3,268,964 | 838,139 |
| 2018 | 23.3% | 4,539,882 | 1,056,160 | 3,499,944 | 814,228 |
| 2019 | 21.1% | 4,505,131 | 950,980 | 8,590,682 | 1,813,392 |
| 2020 | 19.2% | 4,531,348 | 867,901 | 4,531,348 | 867,901 |
| | | --------------- | --------------- | --------------- | --------------- |
| Total Cash Flow | | $73,993,705 | | $67,214,442 | |
| Net Present Value | | | $36,477,940 | | $30,579,268 |

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# Selecting a Discount Rate

- Results influenced by selection
- May require sensitivity analysis
- Theoretical issues
  - Opportunity cost
  - Similar to an interest rate
- Options
  - OMB Circular A-94

# Dealing with Inflation

| | |
|---|---|
| Typical | • Use real dollar estimates (i.e., without inflation)<br>• If necessary, use same inflation rates for benefits and costs |
| Debt Service | • Recommend using cash flows rather than debt<br>• If debt must be incorporated, remember that constant debt service actually declines in real dollars |
| Escalations Differ from Inflation | • Include real escalation rates in cash flow |

# Thoughts on Preset Value

- May imply complexity
- Undiscounted cash flow is a Present Value with a real discount rate of 0%
- Cost of capital can be complex—assumes ability to reinvest capital at discount rate
- Might not incorporate the size of the alternatives—not all alternatives will have the same financial impact on the organization

# Internal Rate of Return

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# Internal Rate of Return

## Measures Effective Return

- What discount rate would be necessary to make the alternatives have equal net present value
- Can produce multiple results
- Assumes proceeds can be reinvested at the IRR
- Example: What discount rate makes the present value of an income stream total to zero?

# Hurdle Rate

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# Hurdle Rate

## Minimum Rate of Return

- Projects with an IRR less than hurdle rate are sidelined
- Projects with IRR exceeding hurdle rate are considered

# Payback Analysis

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# Payback Analysis

## Break-Even Analysis

- Number of years a required to recover investment
- Normally ignores cost of capital
- May be modified to include present value calculations
- Suited for short-term alternatives

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Thanks Again…….!

There is more………

# Example Application of Methodologies

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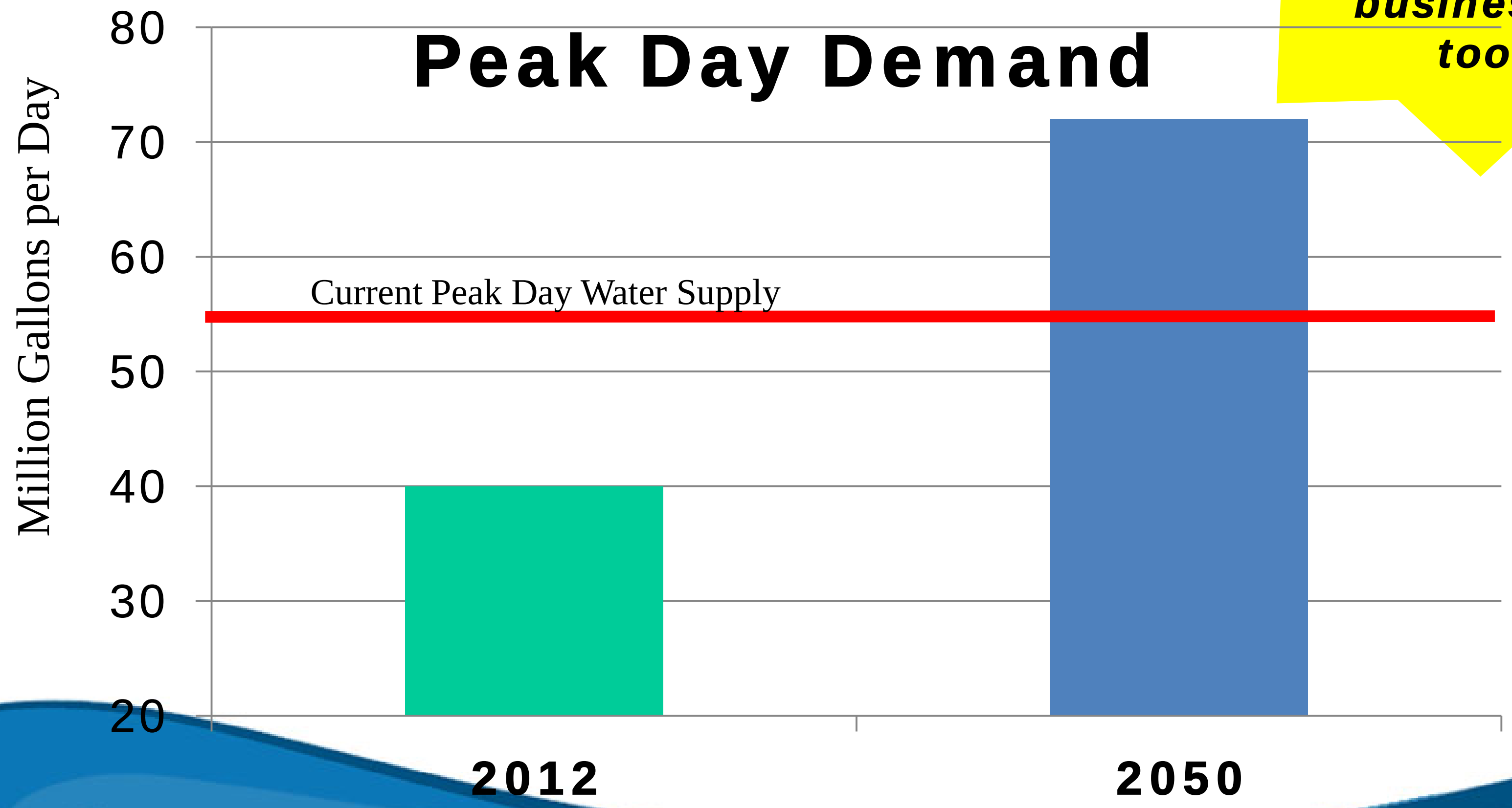
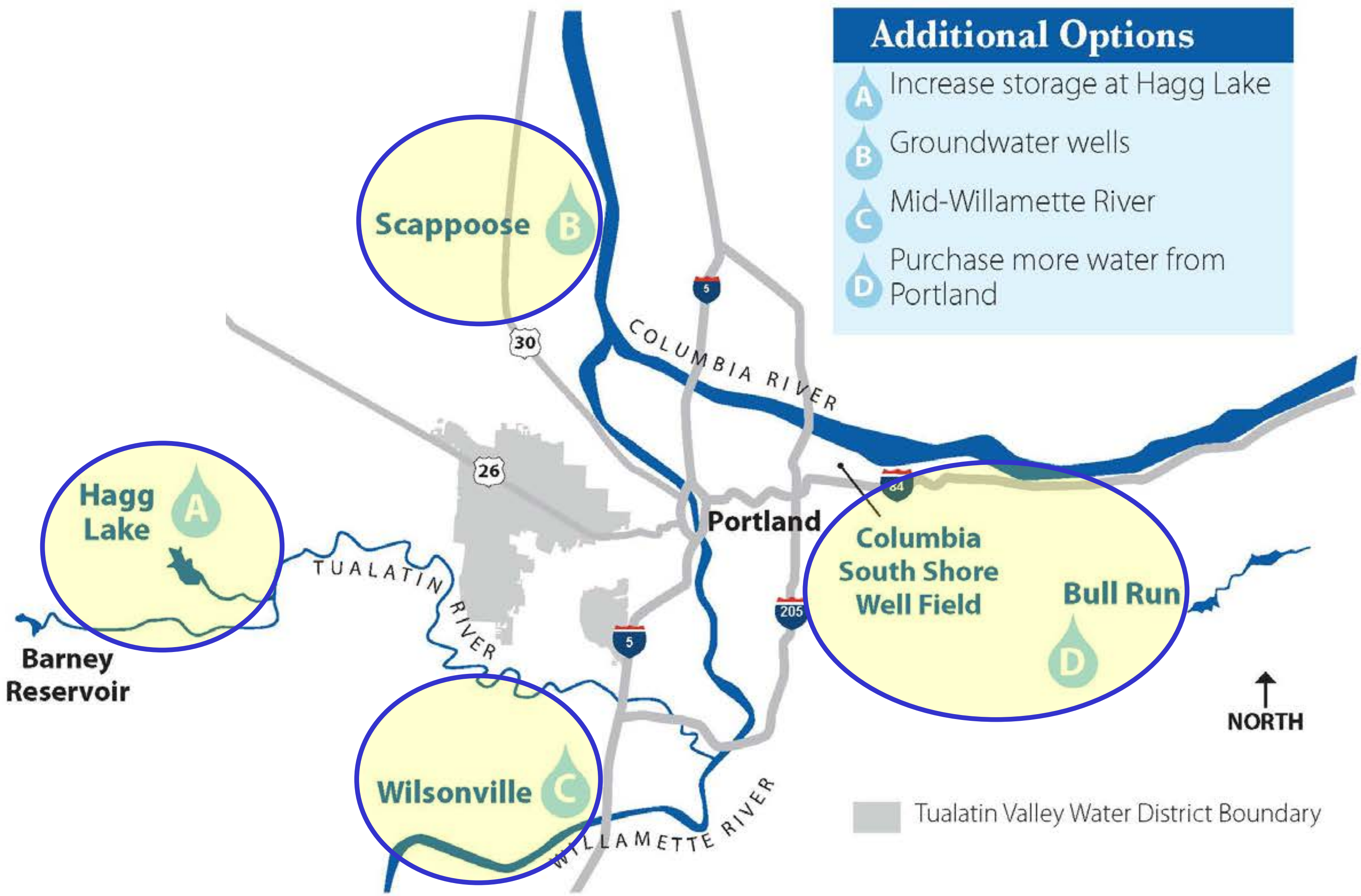
# We have enough water for today—but need to take steps to have enough water to meet future demands.

***82,000 new residents by 2042.***
***More jobs and businesses too.***



# What Was Considered?

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# Cost and Rate Impacts

## Economic Analysis

- Present Value Analysis

## Risk Analysis

- Monte Carlo

## Rate Impacts

- Long-term Financial Forecast

# Water Supply Planning Criteria

- ☑ Finished water quality
- ☑ Cost and rate impact
- ☑ Can be right-sized
- ☑ Reliability
- ☑ Redundancy
- ☑ Implementation risk
- ☑ Public and business acceptance
- ☑ Construction impacts
- ☑ Sustainability
- ☑ Ownership / control
- ☑ Non-fluoridated supply for Metzger

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# Sample Findings

| Scenario | Present Value Analysis: Net Present Value | Rank | % from Lowest | Diff. from Lowest | Undiscounted Analysis: Undiscounted Cash Flow | Rank |
|---|---|---|---|---|---|---|
| TBWSP w/Fed | $960,000,000 | 1 | 0% | $0 | $16,925,000,000 | 1 |
| Mid-Willamette | 965,000,000 | 3 | 1% | 5,000,000 | 18,705,000,000 | 3 |
| PWB w/o Part. w/ UV | 1,210,000,000 | 6 | 26% | 250,000,000 | 29,520,000,000 | 6 |
| PWB w/ Part. w/ UV | 960,000,000 | 1 | 0% | 0 | 24,465,000,000 | 5 |
| TBWSP w/o Fed | 1,200,000,000 | 5 | 25% | 240,000,000 | 17,370,000,000 | 2 |
| Northern Groundwater | 1,175,000,000 | 4 | 22% | 215,000,000 | 20,535,000,000 | 4 |

# Integrating Risk and Uncertainty

## Monte Carlo Simulation

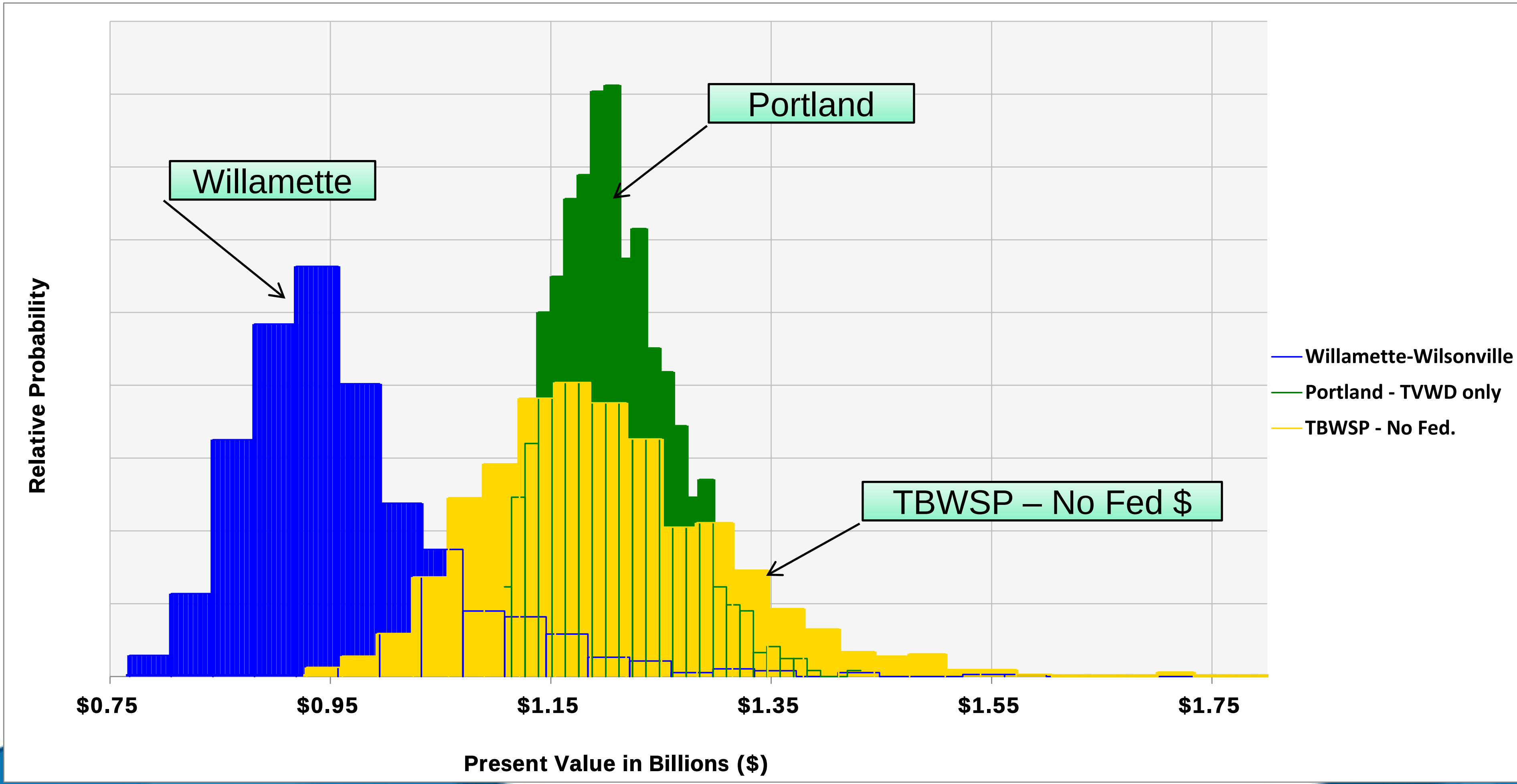
- Replaces point estimates used in assumptions with a statistical range
- Measures the affect that variations in multiple assumptions has on our results
- Statistical ranges developed using professional engineering judgment by a group of experts

# Evaluation of Risks by the Experts

| Component | TBWSP | Willamette - Wilsonville | Portland Supply | Northern Groundwater |
|---|---|---|---|---|
| Wells | N/A | N/A | N/A | Medium |
| Dam construction | High | High | High | High |
| Raw intake and pumping | High | Low | Medium | High |
| Water treatment facilities | Low | Low | N/A | High |
| Booster pump stations | Low | Low | Low | Low |
| 20 MG reservoir | Medium | Medium | Medium | Medium |
| Pipelines | Medium | Medium | High | High |

# Economic & Financial Evaluation

Comparison of Options

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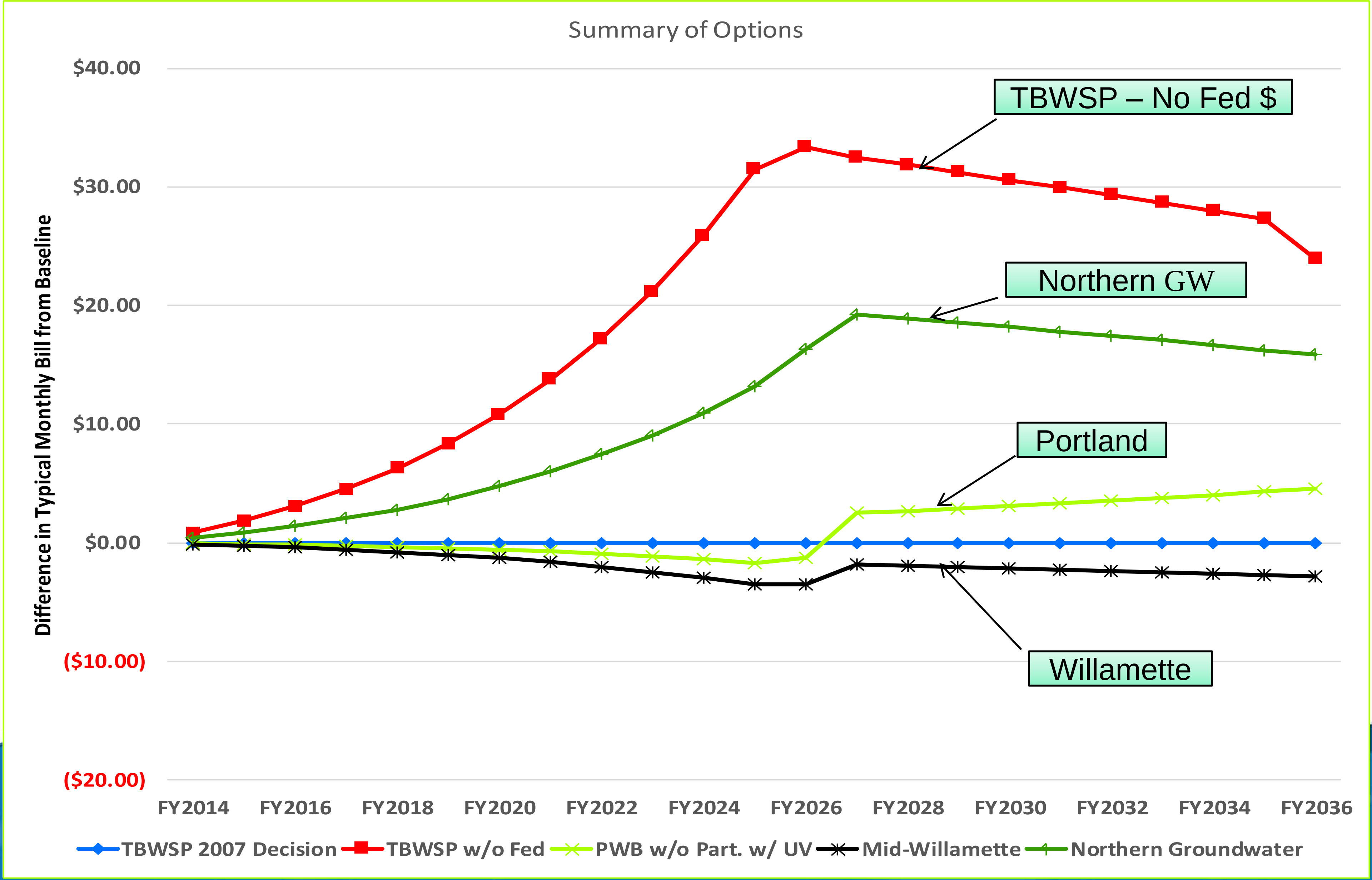
# Economic & Financial Evaluation



# Thanks!

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