

Sustainable Water System Design and Maintenance:

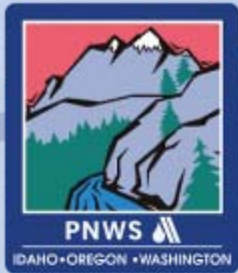
Solutions Are Closer Than They Appear

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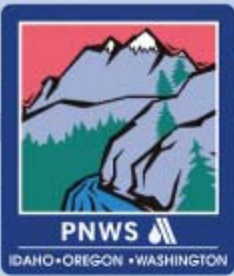




Outline

- **What is Sustainable?**
- **Drivers**
- **A Business Focus on Design and Maintenance**
- **The Fundamental Bottom Line!**



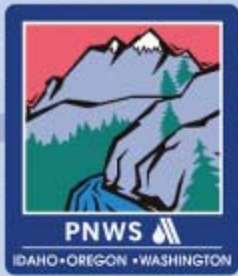


What is Sustainable?

- **Terminology**
- **Focus on Efficiency and Effectiveness**
 - Alliance to Save Energy estimates that our economy would use nearly 50% more energy today if we had not implemented the efficiency gains from the last energy crisis*
- **What About Conservation?**

* Michael Grunwald, *Wasting Our Watts*, Time, January 12, 2009.





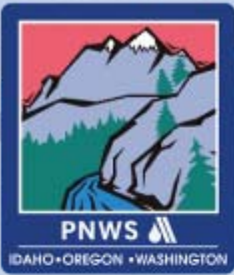
What are Sustainable Water System Concepts?

- **Energy recovery – pressure reducing valve stations**
- **Cooling facilities through heat exchangers**
- **Solar/Wind power options**
- **Life Cycle Cost Analysis**



Photo from www.ee.washington.edu





Drivers: What is Pushing Going Sustainable?

- Public interests/perception
- Regulations
- Unit energy costs are increasing
- Energy needs are increasing
- Water is a limited resource

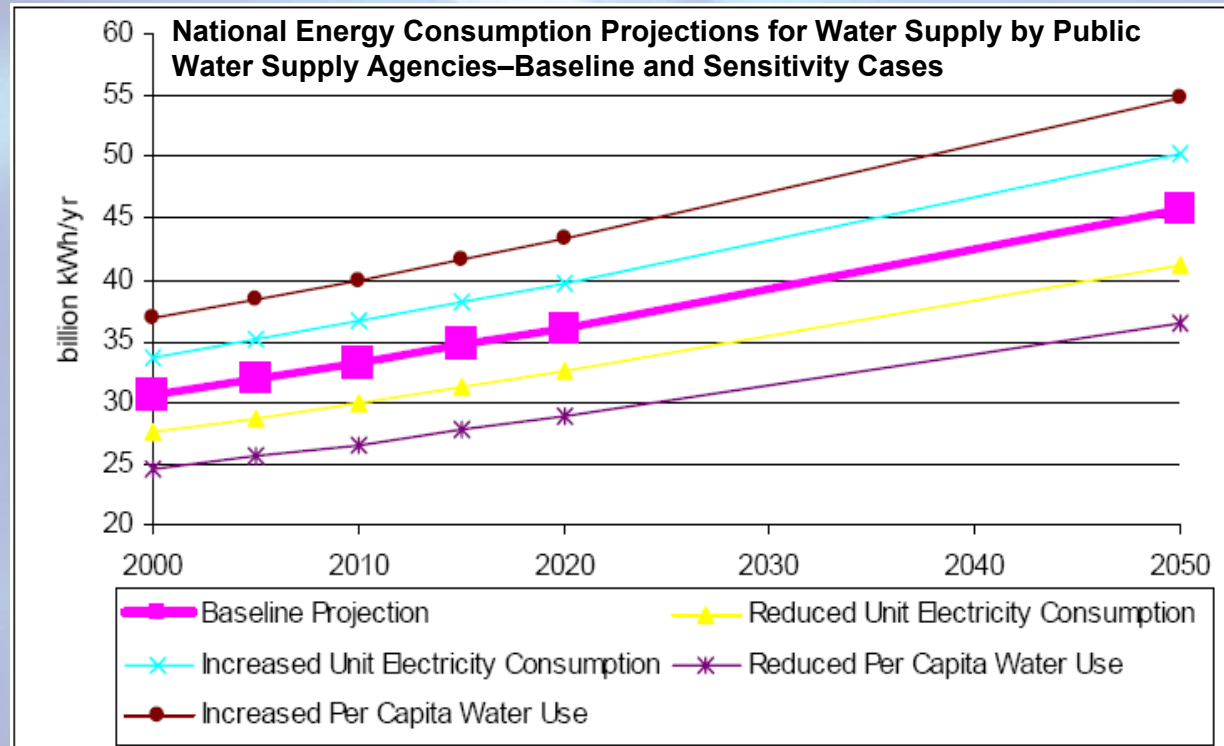
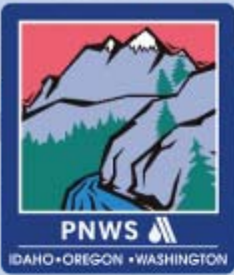


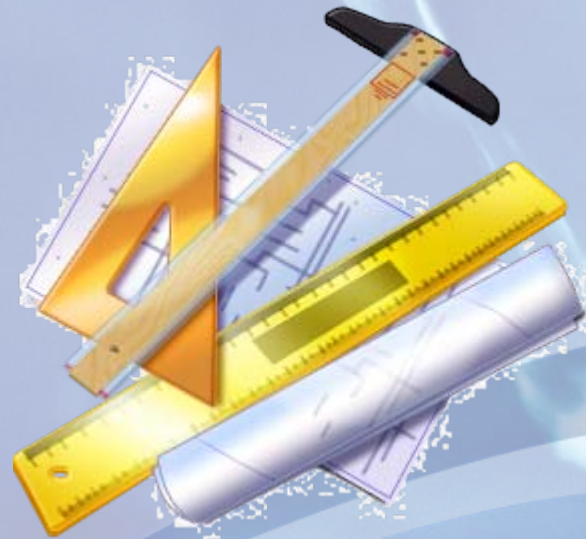
Image from *Water and Sustainability: U.S. Electricity Consumption for Water Supply & Treatment—The Next Half Century*, EPRI, Palo Alto, CA: 2000. 1006787.

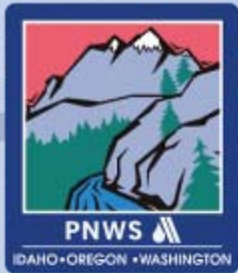




A Business Focus on Design and Maintenance

- **Water System Design Aspects**
 - Pumping and treatment facilities
“Highest direct user of energy”
 - Reservoirs
 - Piping

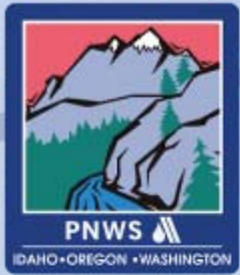




A Business Focus on Design and Maintenance (continued)

- **Operation: Where it all happens**
 - Real-time control
 - Smart grid options
- **Maintenance: Keeping it on the straight and narrow**
 - Maintain the investment
 - Make it part of the culture



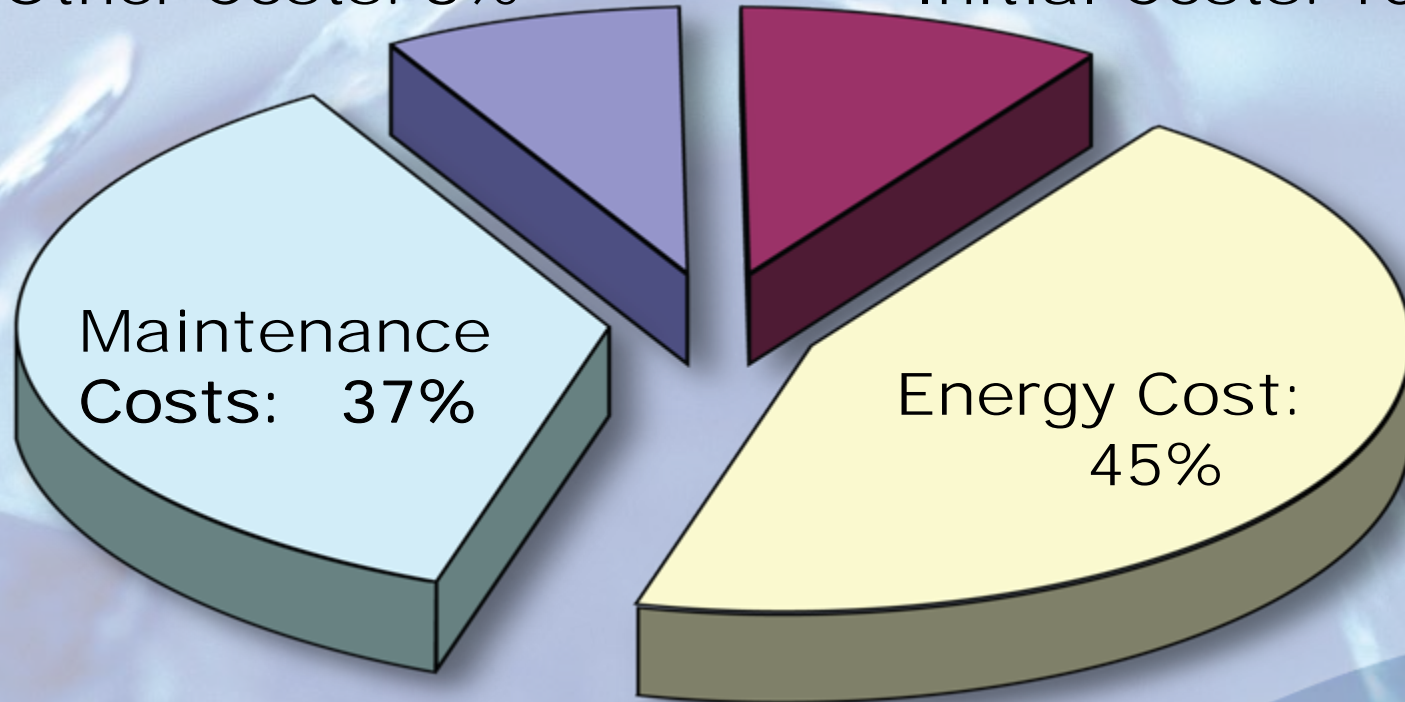


Evaluation of Design Alternatives

- **Life Cycle Cost Analysis**

Other Costs: 8%

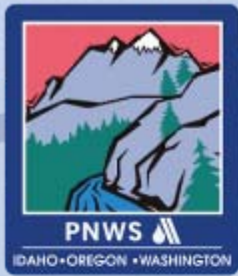
Initial Costs: 10%



Life Cycle Cost of Pump*

*From *World Pumps*, Volume 2008, Issue 496, January 2008



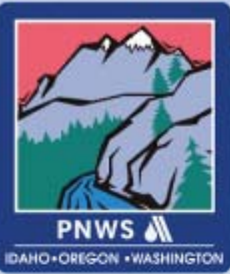


Key Aspects of Equipment Selection

- **Select equipment and an operation scheme that meets current and future supply needs at the best efficiency**
- **Improve existing pump efficiency ***
 - Match pump characteristics to duty
 - Operate pumps at their best efficiency point
 - Counter efficiency deterioration through reconditioning

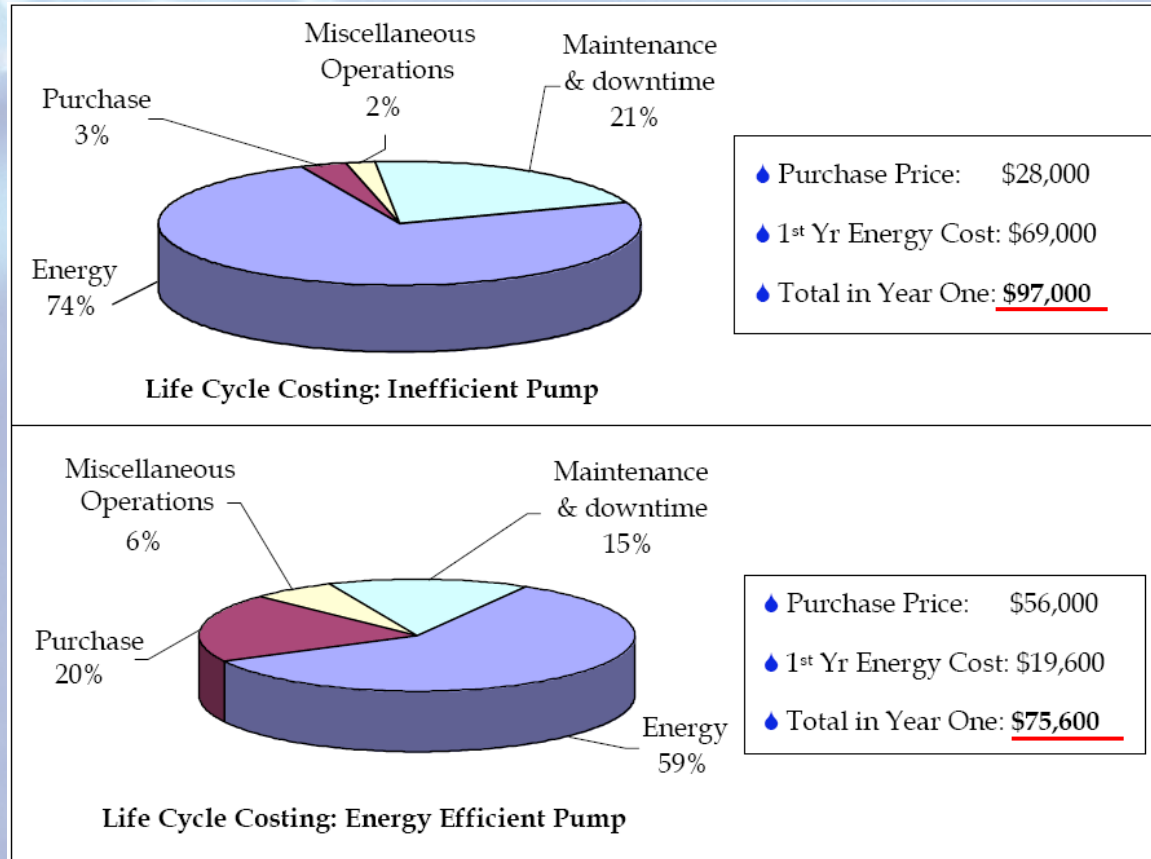
* David Reeves, *Study on improving the energy efficiency of pumps*, European Commission, 2001. AEAT-6559/ v 5.1.





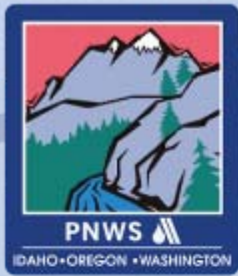
Importance of Efficiency

- **Optimizing pump systems can often result in immediate energy savings of 20%, with energy savings of 30 to 40% often possible**



From *Watery: Water and Energy Efficiency in Water Supply and Wastewater Treatment*, The Alliance to Save Energy, February 2007.





Water System Design Aspects: Reservoirs

- **Planning/Design Reservoirs**

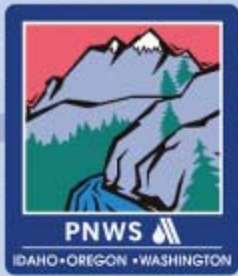
- Plan for two reservoirs per pressure zone for adequate water storage

- Allows for more flexibility in allowing water storage to shift peak energy requirements

- Allows for phasing to match future demand

- Avoid pumped storage because it increases peak electric requirements

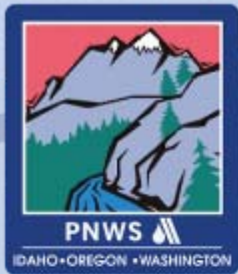




Water System Design Aspects: Piping

- **Planning/Design Piping**
 - Consider pipe size to head loss impacts, especially for transmission mains
 - Plan for future looping, which allows for expansion of the distribution system for future flow requirements

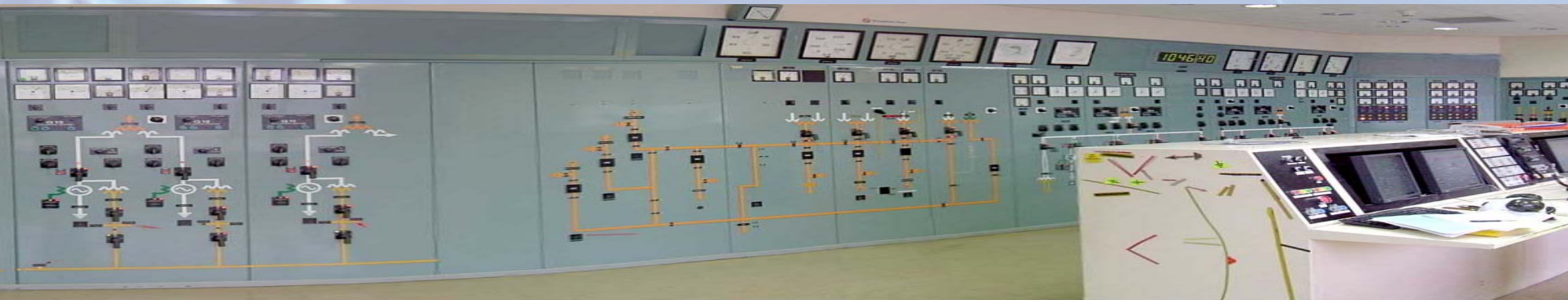


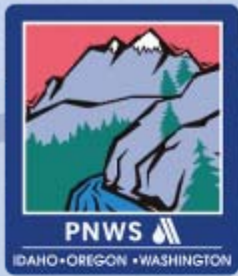


Operations

Where it all happens

- **Real Time Control (aka SCADA)**
 - Better energy management of facilities
 - Pump selection to meet system needs
 - Optimization of pumps in real time

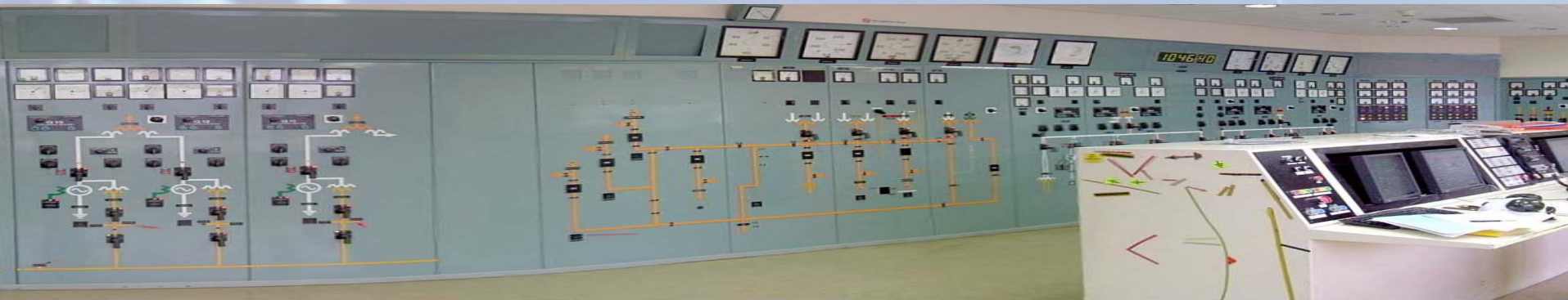


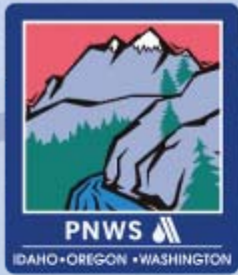


Operations

Where it all happens (continued)

- **Smart Grid – How to Utilize Energy in the Future**
 - Options for controlling pump run times to achieve lower energy cost
 - Provides real-time feedback on water/energy use





Maintenance

Keeping it on the straight and narrow

- **Maintain the Investment**

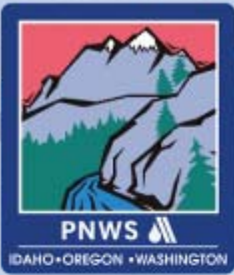
- Monitoring efficiency
- Scheduling rehab/replacement
- Computerize maintenance management system

▶ **“You Can’t Manage What You Don’t Measure”** ◀

- **Part of the Culture**

- Teaming with operations and maintenance staff to improve system efficiency

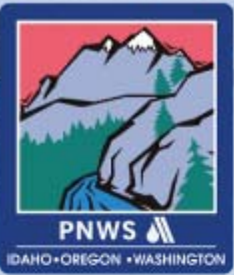




The Fundamental Bottom Line!

- **Cost savings – This is the ultimate driver**
- **Provides high quality service to customers**
- **Enhances investment opportunities for your business model**





Questions?

