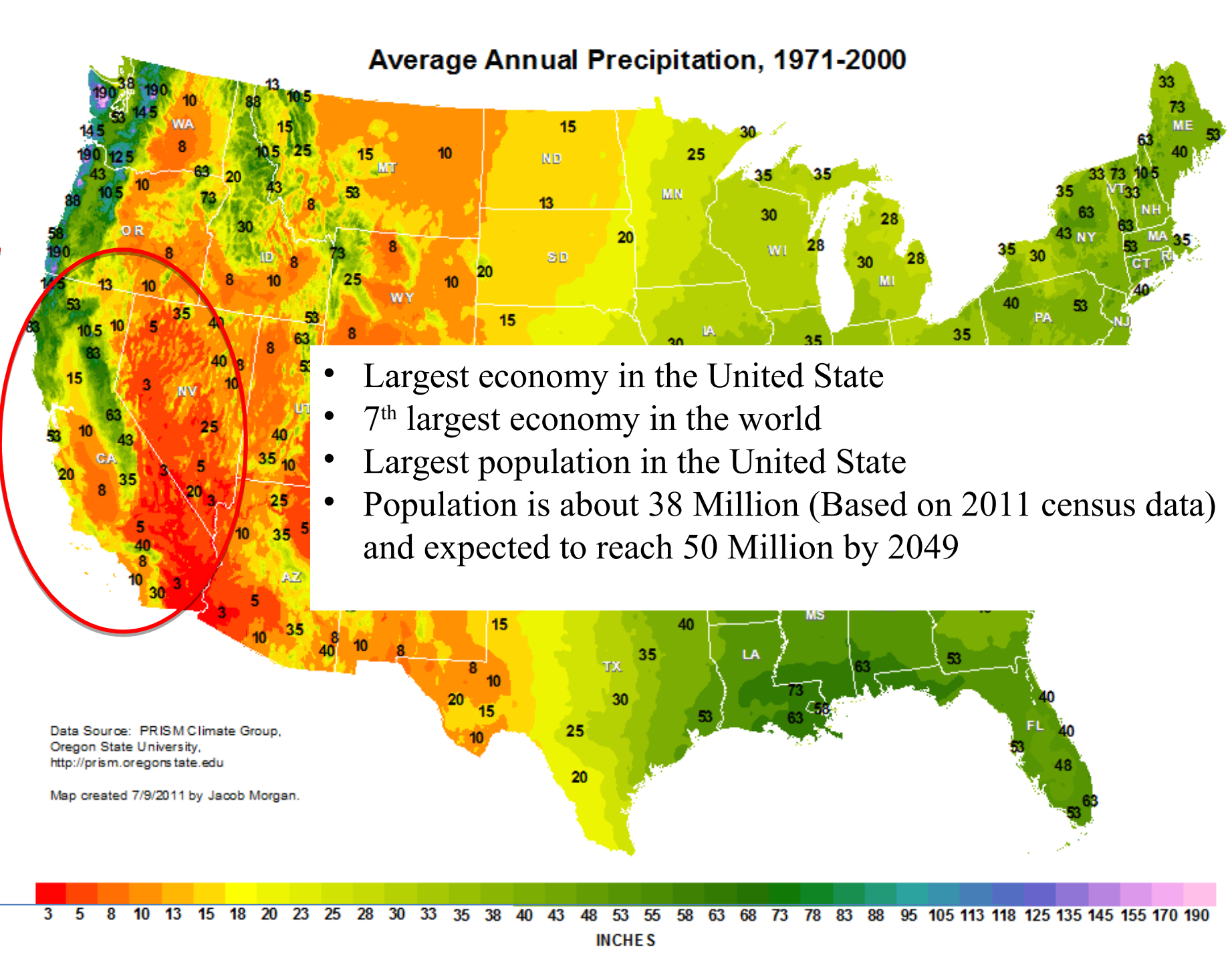
# Economic and Environmental Correlation Between the Water and Energy Sector: The Water Sector's Path to Innovation

**Newsha K. Ajami, PhD**
Director of Urban Water Policy,
Woods Institute for the Environment
Stanford University




- Largest economy in the United State
- 7th largest economy in the world
- Largest population in the United State
- Population is about 38 Million (Based on 2011 census data) and expected to reach 50 Million by 2049

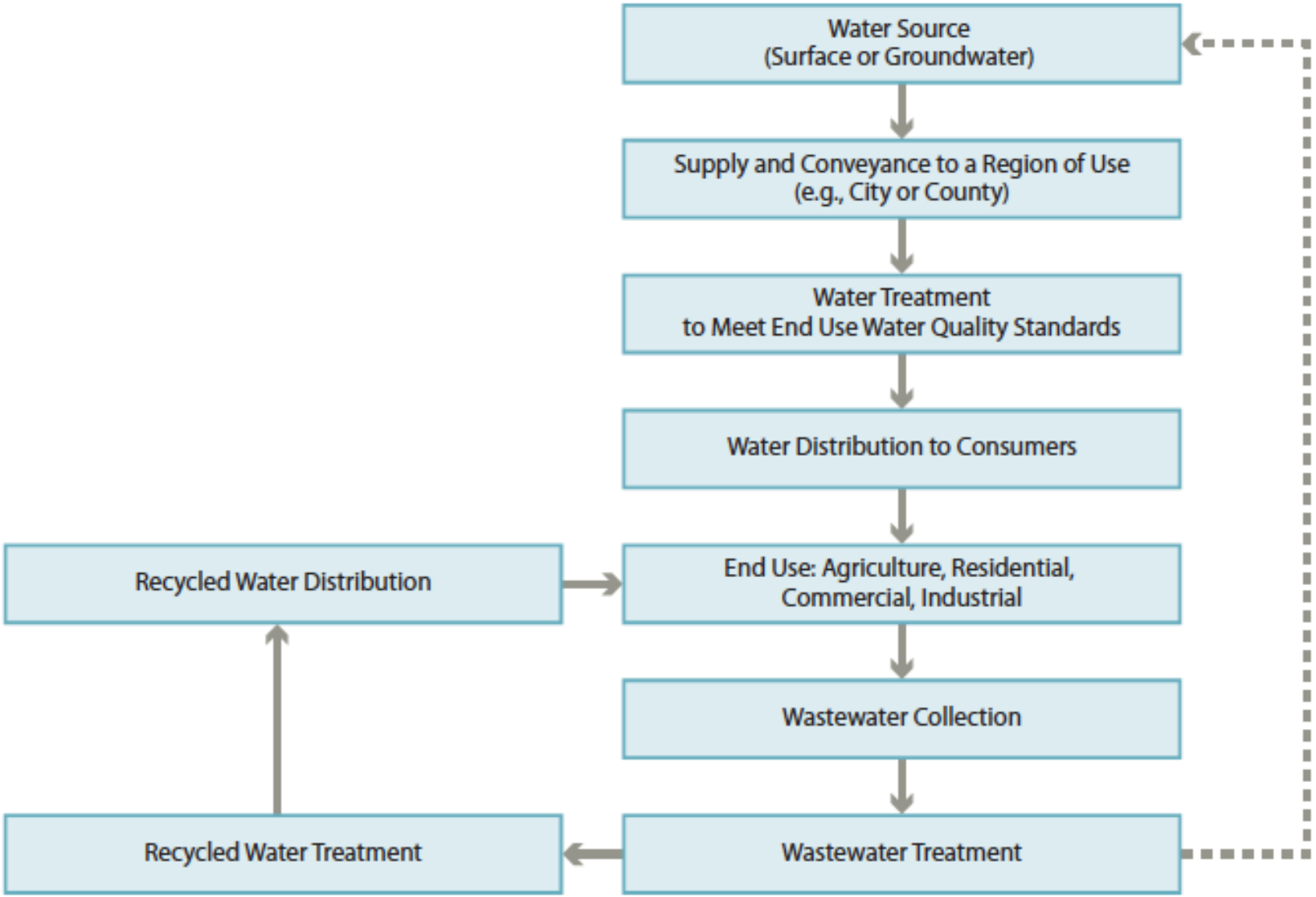
California is dealing with
Population growth
Water quality regulations and environmental requirements
Climate Change
California
Neighboring states (Arizona-Nevada)
Shrinking snow pack
Growing Water Demand
Shrinking Water Resources
Time shift in water supply
Aging Infrastructure
California's water Challenges
Rethinking our portfolio of solutions

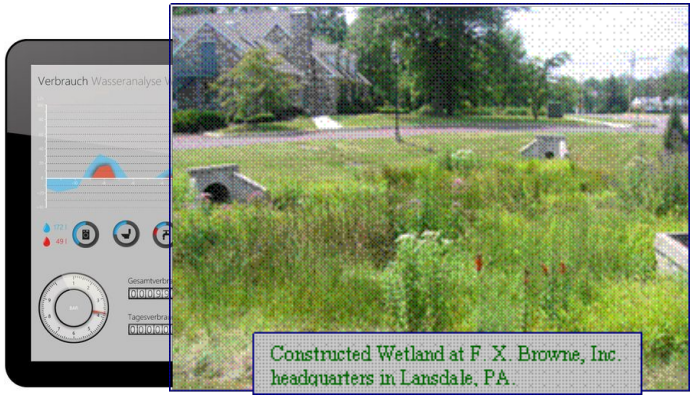
# New Thinking about Solutions

- Rethink “demand”
  - Reduce waste and increase efficiency, rethink economic priorities and choices, education
- Rethink “supply”
  - Conjunctive use, treated wastewater, innovative coordination and transfers, desalination, rainwater harvesting, storm water capture
- Rethink “management”
  - New institutions, improve existing institutions, cross-sector resource management, better water monitoring, integrated management

FIGURE 1.

## Water Distribution and Use Cycle





# Innovative Solutions

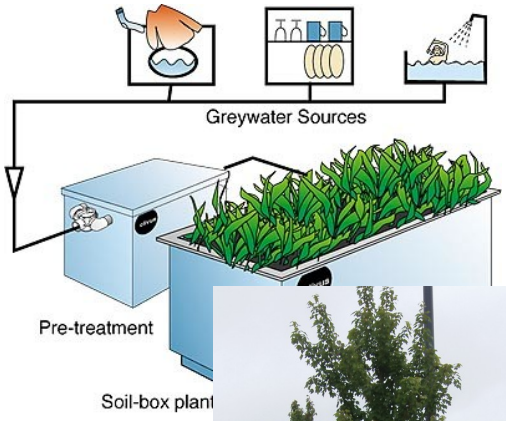
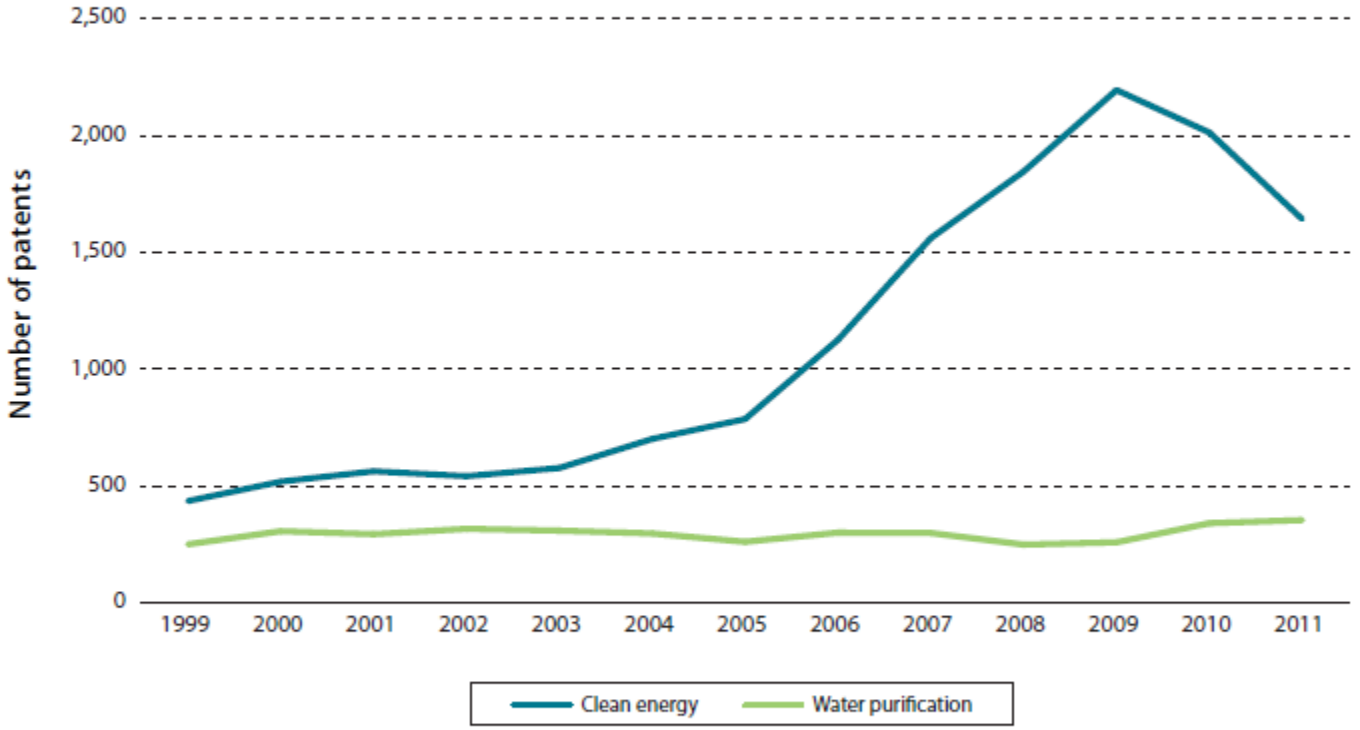


FIGURE 2.

## Comparison of U.S. Patents Filed under the Patent Cooperation Treaty for Clean Energy and Water Purification, 1999–2011

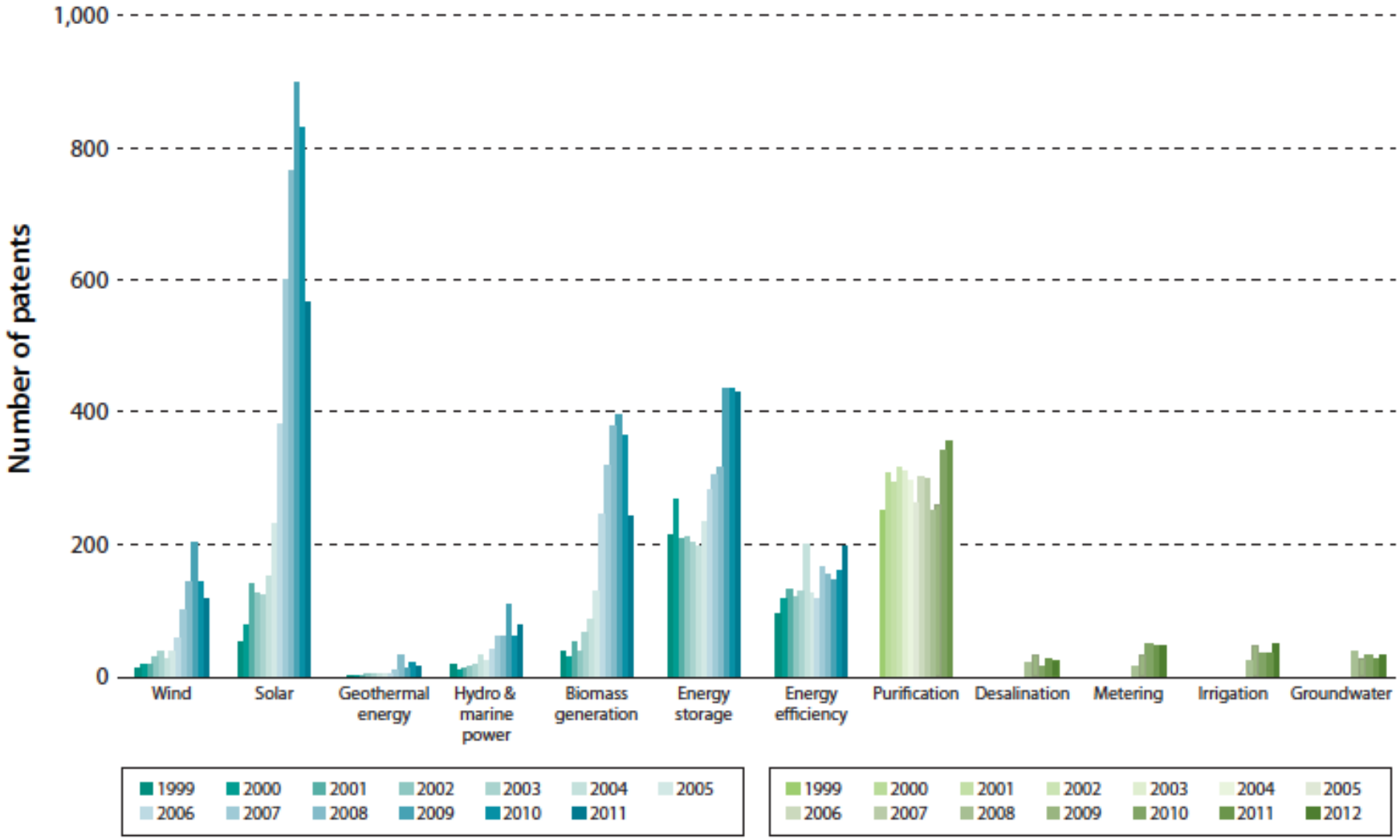



Source: Organisation for Economic Co-operation and Development (OECD) 2014.

Note: Clean energy = biomass generation + energy efficiency + energy storage + geothermal + hydro & marine power + solar + wind; and water purification is the primary contributor to patent filings in the water sector.

FIGURE 9.

## Number of U.S. Patents Filed in the Clean Energy and Water Subsectors, 1999–2012



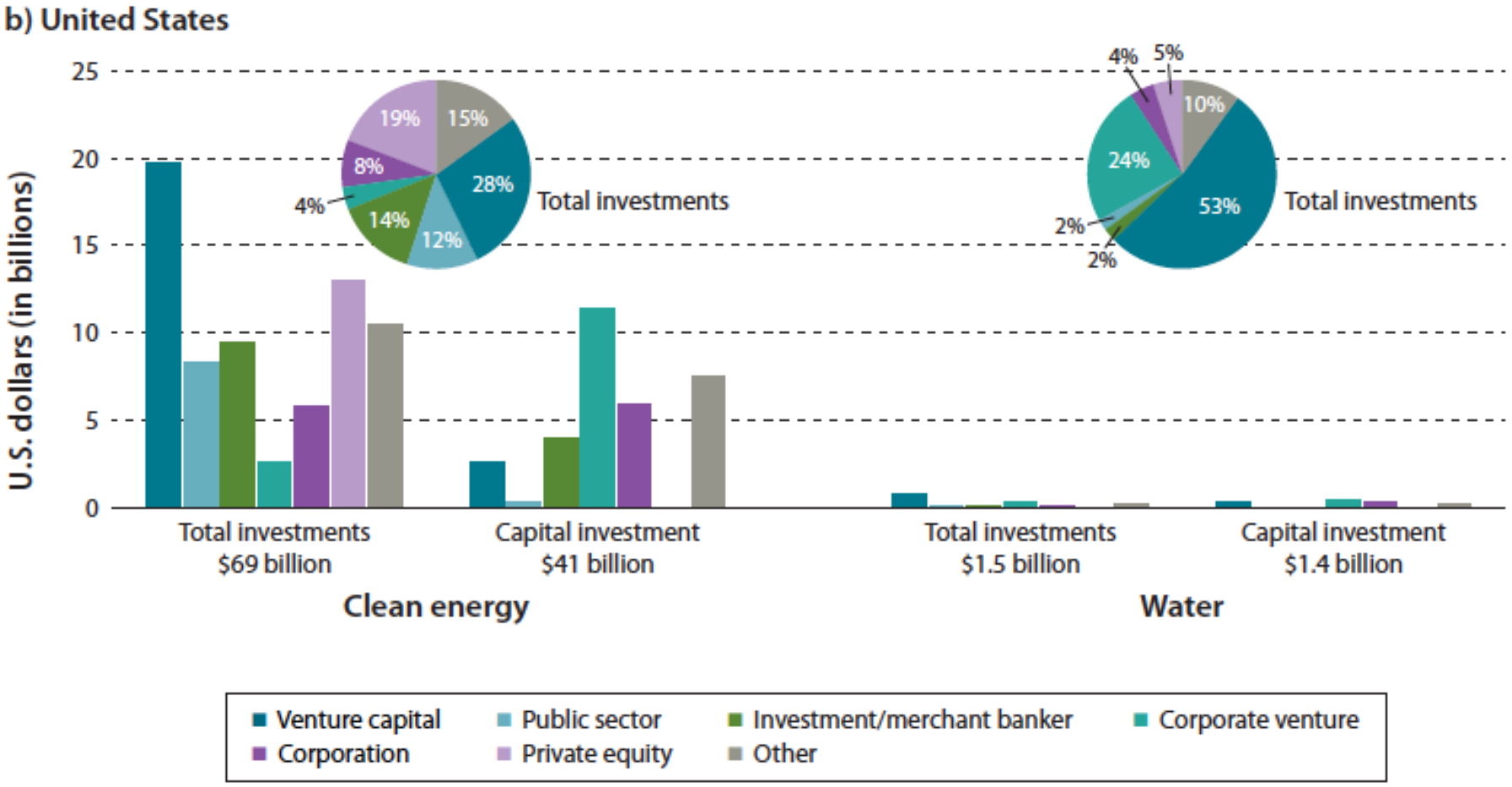
# Objectives

- Evaluate the state of innovation in the water sector
- Compare innovation rates in the water sector to those in similar sectors such as the clean energy/electricity sector
- Examines barriers to and drivers of innovation in both sectors
- Recommend policy actions that can increase the rate of effective innovation in the water sector

# Why Electric Power Sector

- Similarities:
  - The distribution and use cycles for both sectors depend on large-scale and capital-intensive infrastructures and complex governance models.
  - Prone to natural monopoly and low levels of competition due to high barriers to entry.
  - Highly politicized due to direct interface with consumers, providing services that are vital to individual, social and economic wellbeing.
  - Highly regulated and risk averse, since any system failure could have immense social and economic impacts.

# Source of Investment Dollars for Innovation Water vs. Clean Energy



# Explaining Patterns of Innovation

- Scarcity, Risk and Jurisdictional Priority
- Industry conservatism
- System life expectancy, size and complexity
- Pricing
- Access to financing
- Regulation
- System fragmentation

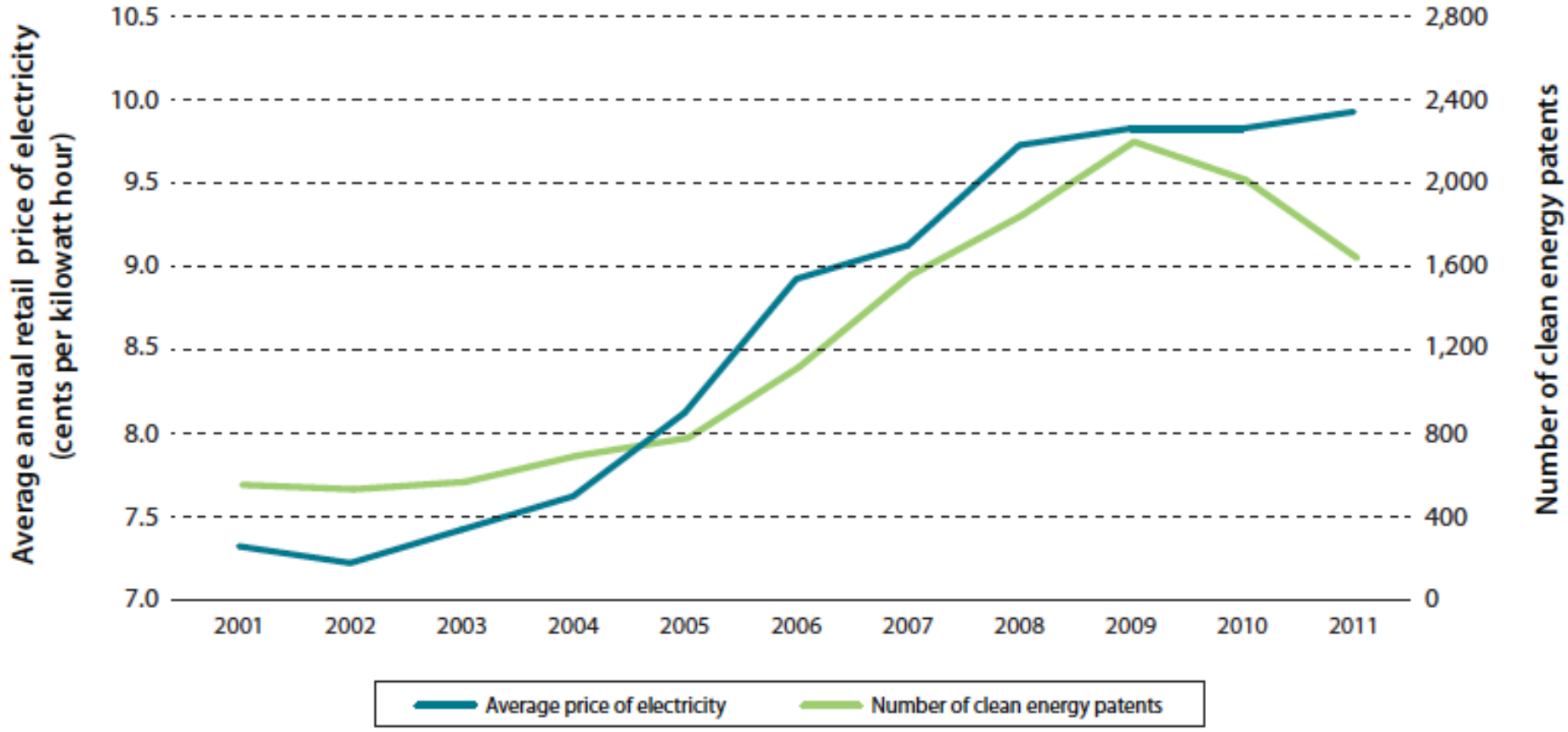
Price

Sources: California Energy Commission 2013 and Energy Information Administration

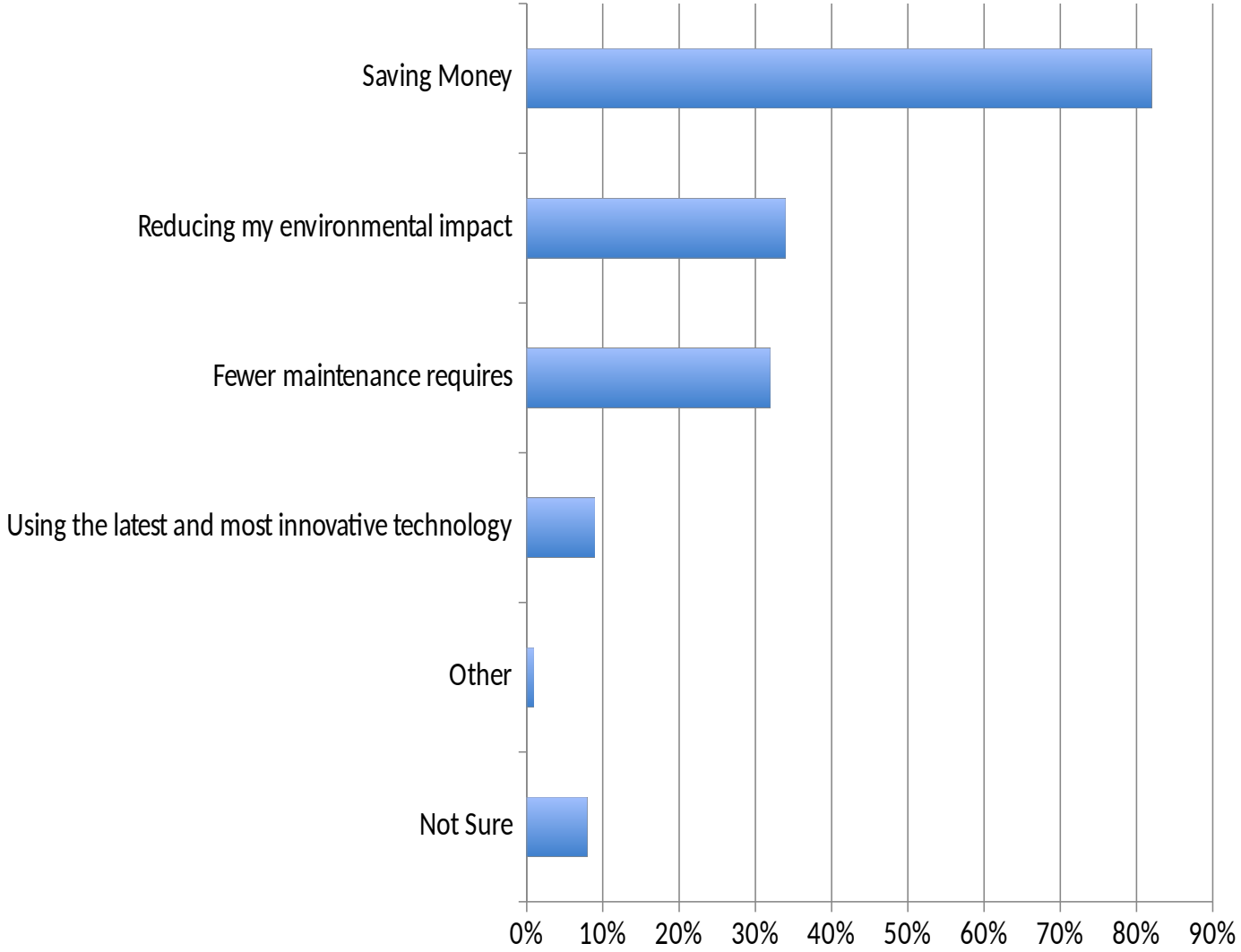
# Price and Number of Patents

FIGURE 13.

Number of Clean Energy Patents and Price of Electricity, 2001–11



# Reasons that Consumers Purchase Clean Energy Devices and Appliances



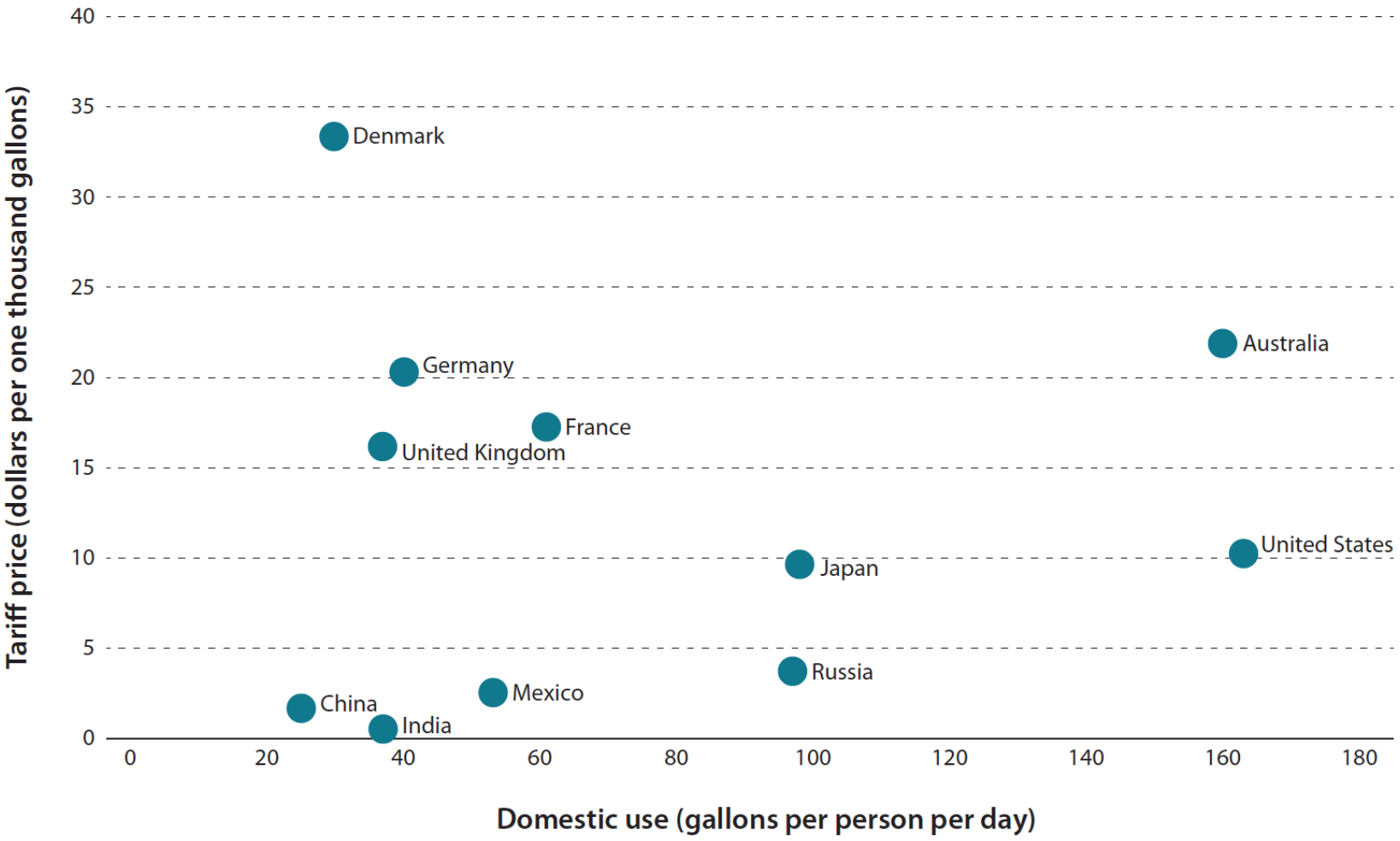

Survey respondents were asked the following question: "When making decisions around purchasing clean-energy products and services, which of the following are your primary motivators? (Choose up to two)"

Source: U.S. Homeowners on Clean Energy: A National Survey. 2015 Poll Results and Clean Energy Growth Trends. Solar City and Clean Edge

# Water Use vs. Price

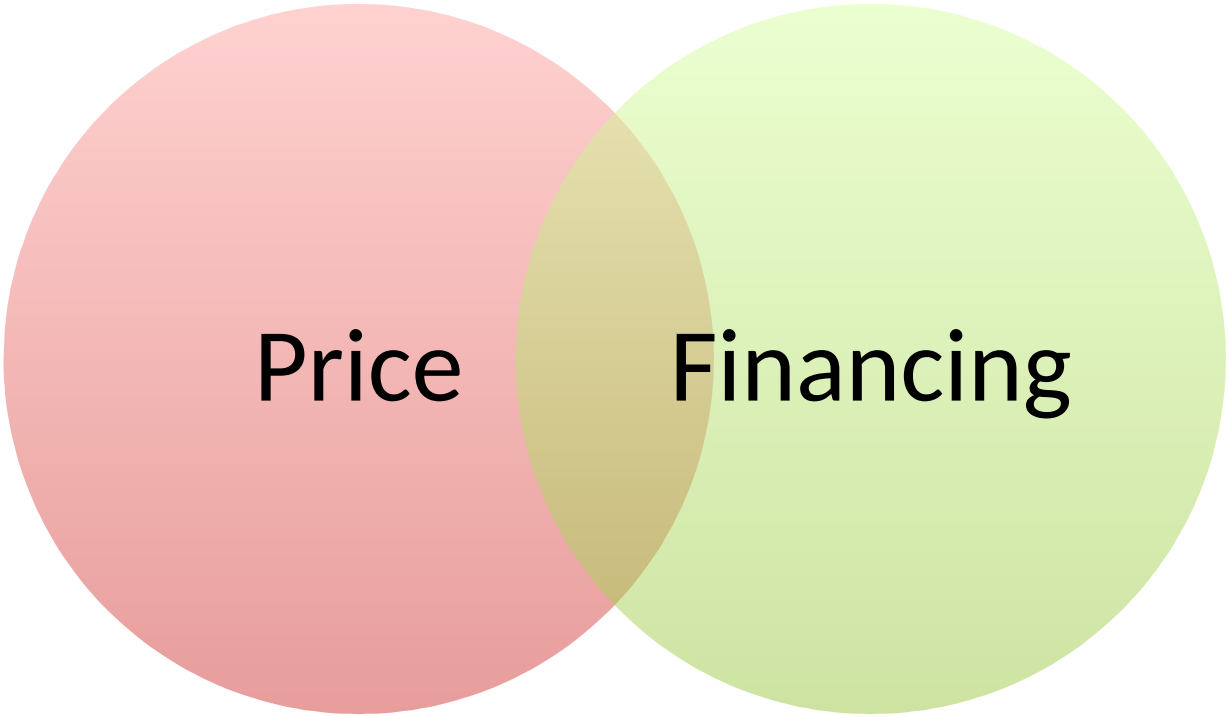
FIGURE 10.

## Tariff Price and Domestic Use per Capita, 2012



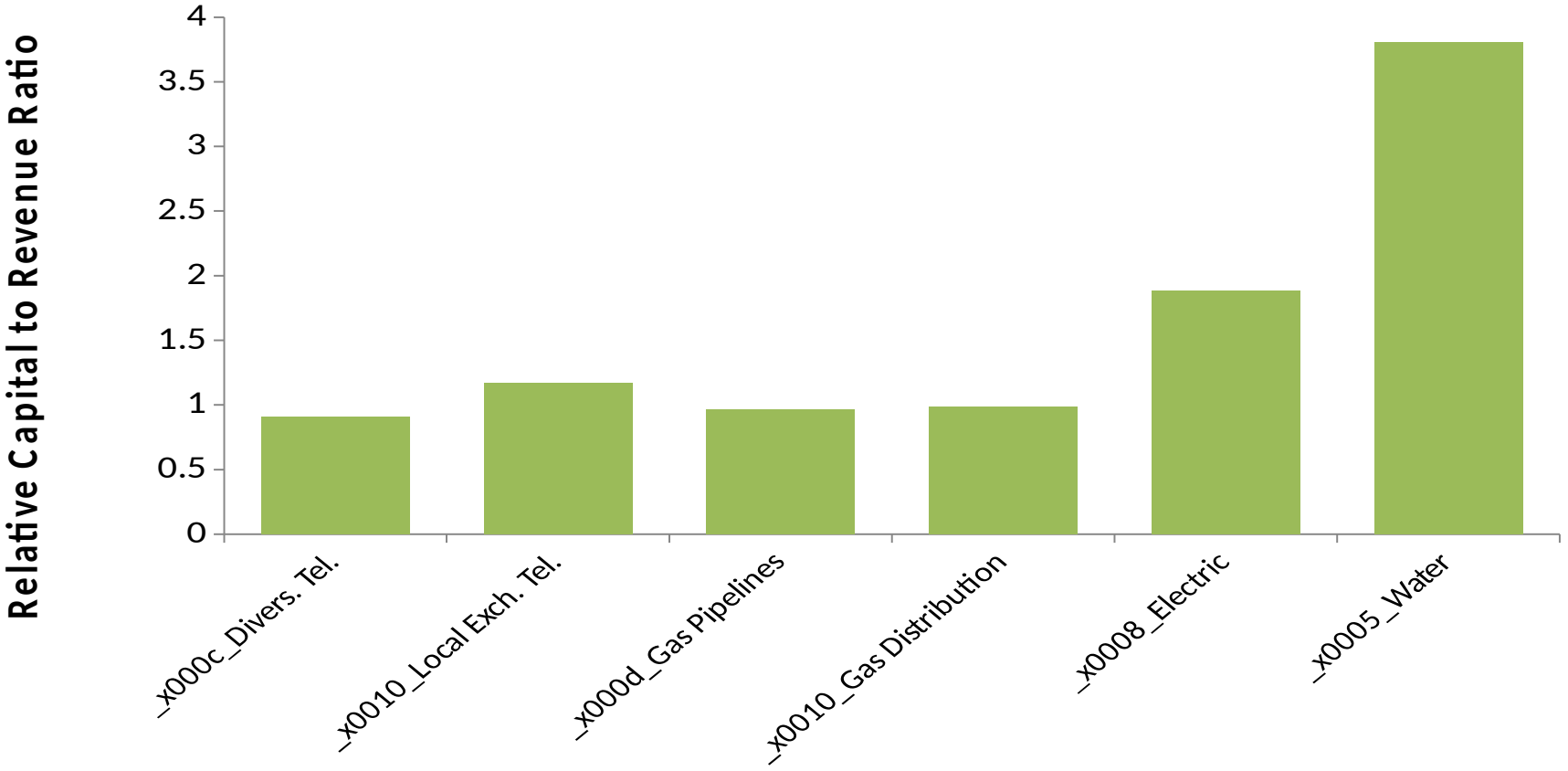

Source: Standard & Poor's 2012.

Note: The tariff price includes water and wastewater tariffs and it is the average price among cities in that country.


Price
Financing

# A Hidden System

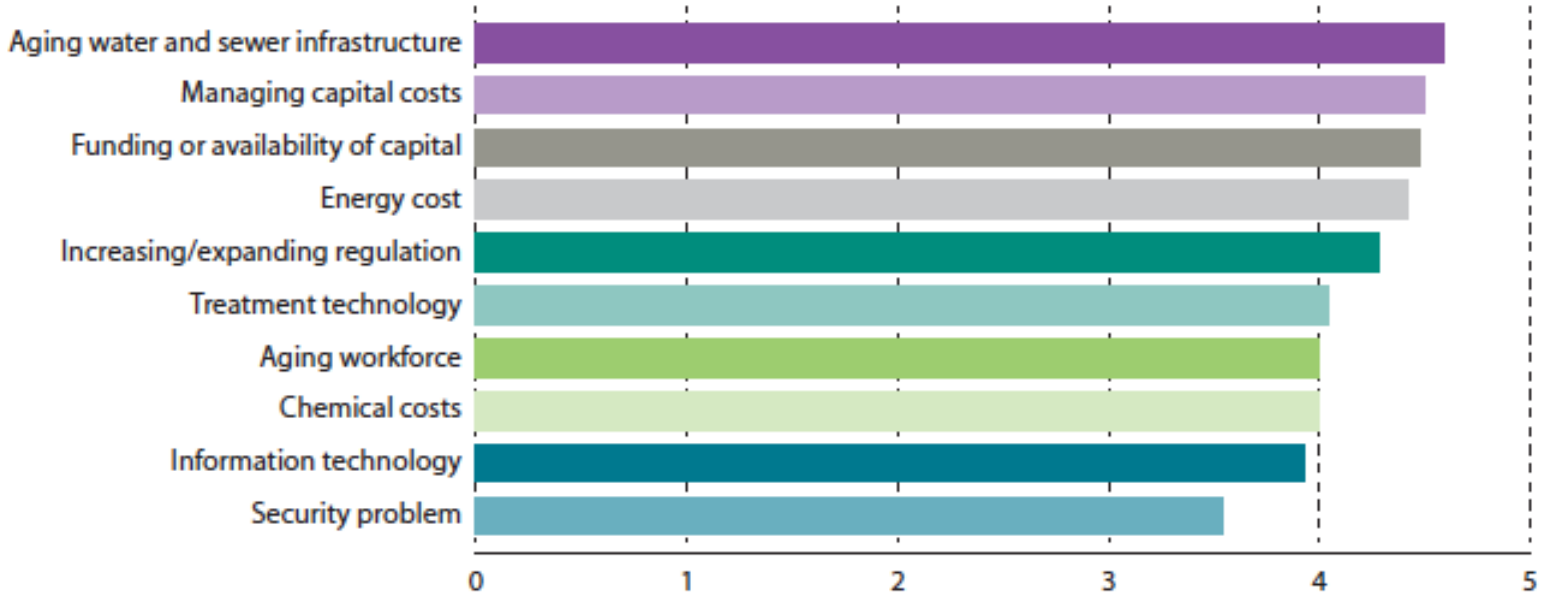
Relative capital investment to revenue for several utility services in the US




Source: Global Water Intelligence, 2010

FIGURE 12.

## Importance of Industry Issues, 2012




Source: Black and Veatch Corporation 2012.

Note: Survey participants were asked to rate the importance of each of the above referenced issues to the water industry based on a scale of 1 to 5, where 1 indicates "very unimportant" and 5 indicates "very important." The results above show the average response for each issue.

# Electricity Sector
# Public Goods Charge Era

- Created during deregulation of the state's electricity market in the 1990s to ensure that research and development did not stop

- A per-usage fee on customer utility bill, usually 1-2% of the bill ($1/$2 dollars)

- Raised money for three program areas to transform the state's electricity sector:
  - Energy Efficiency
  - Renewables
  - Research and Development

- In place from 1998-2012

Image Source: http://www.zeiss.co

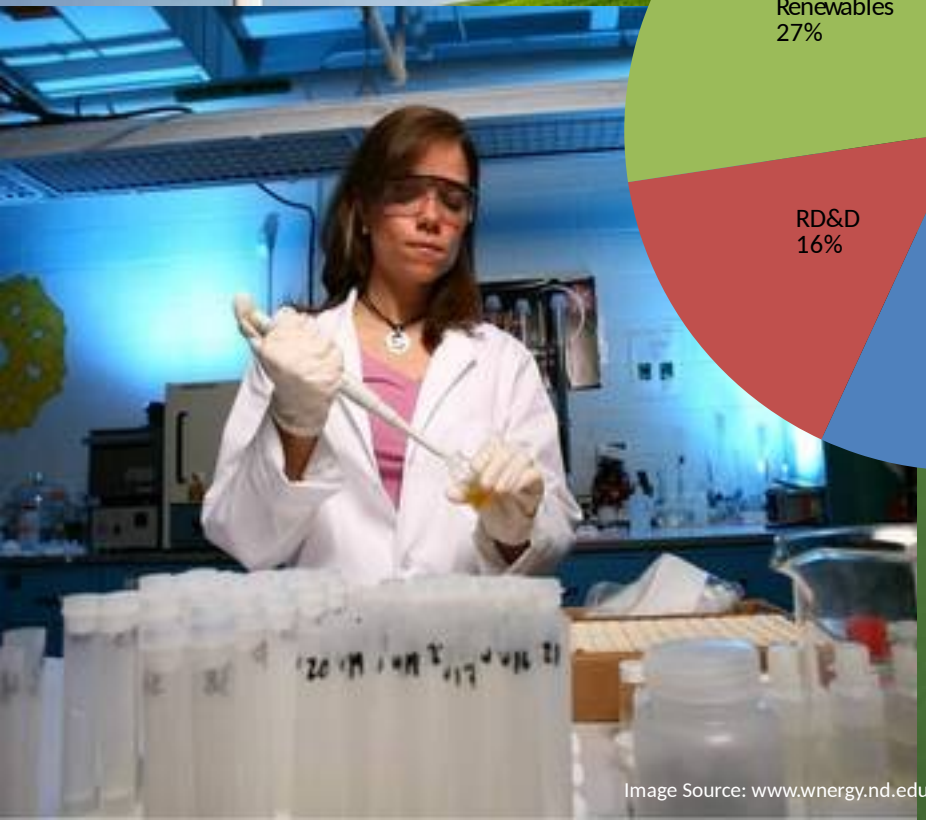


Image Source: www.wnergy.nd.edu

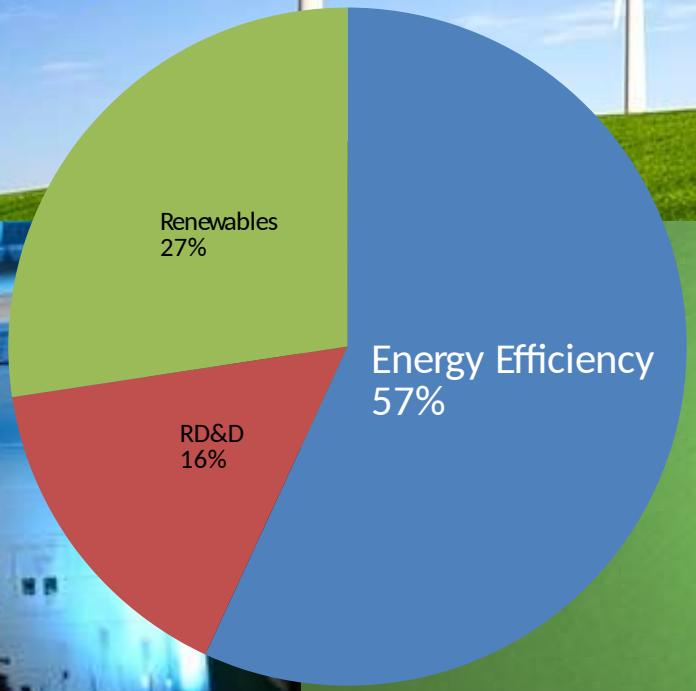
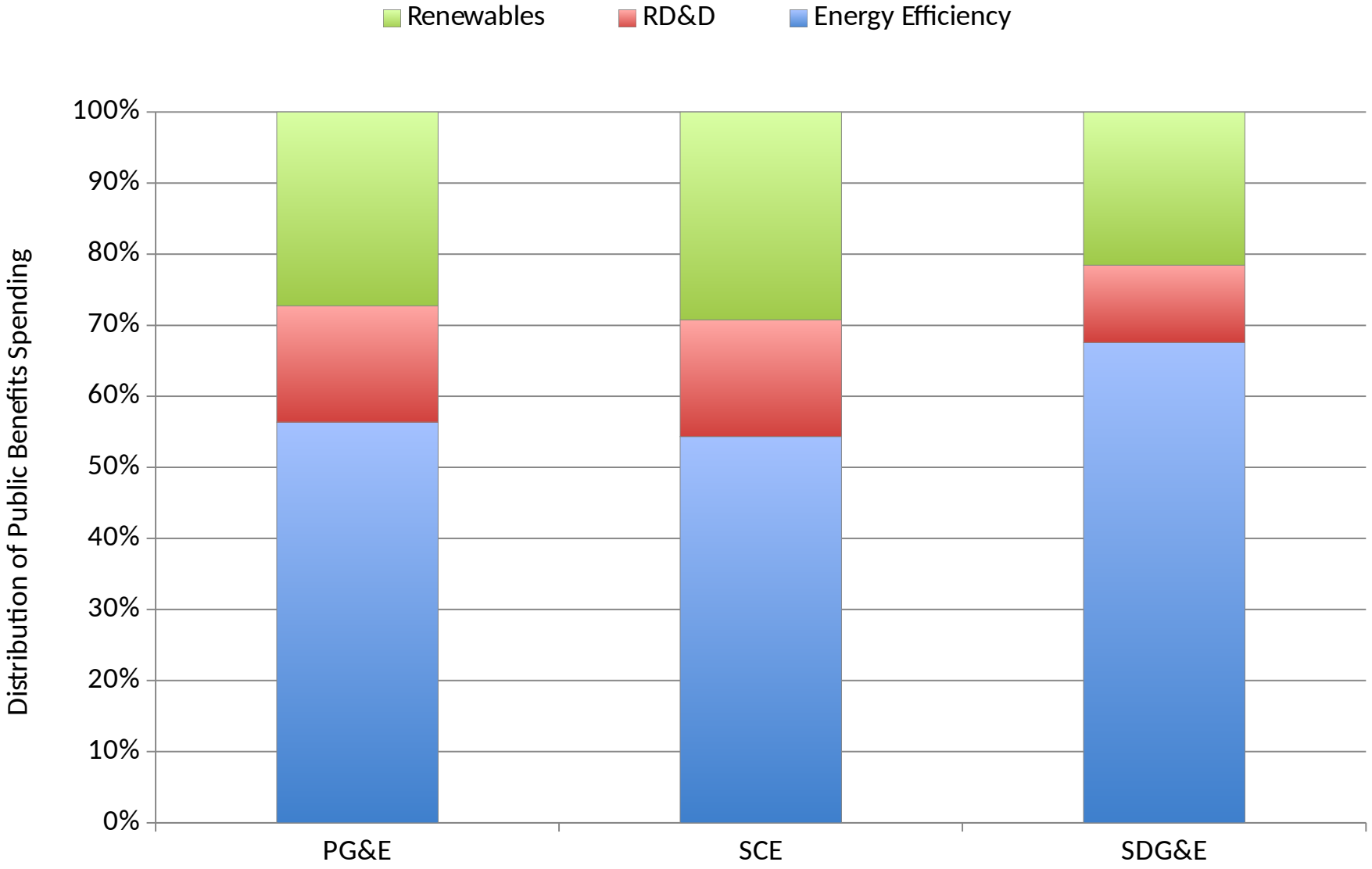

Renewables
27%
RD&D
16%
Energy Efficiency
57%

Image Source: Getty Creativ

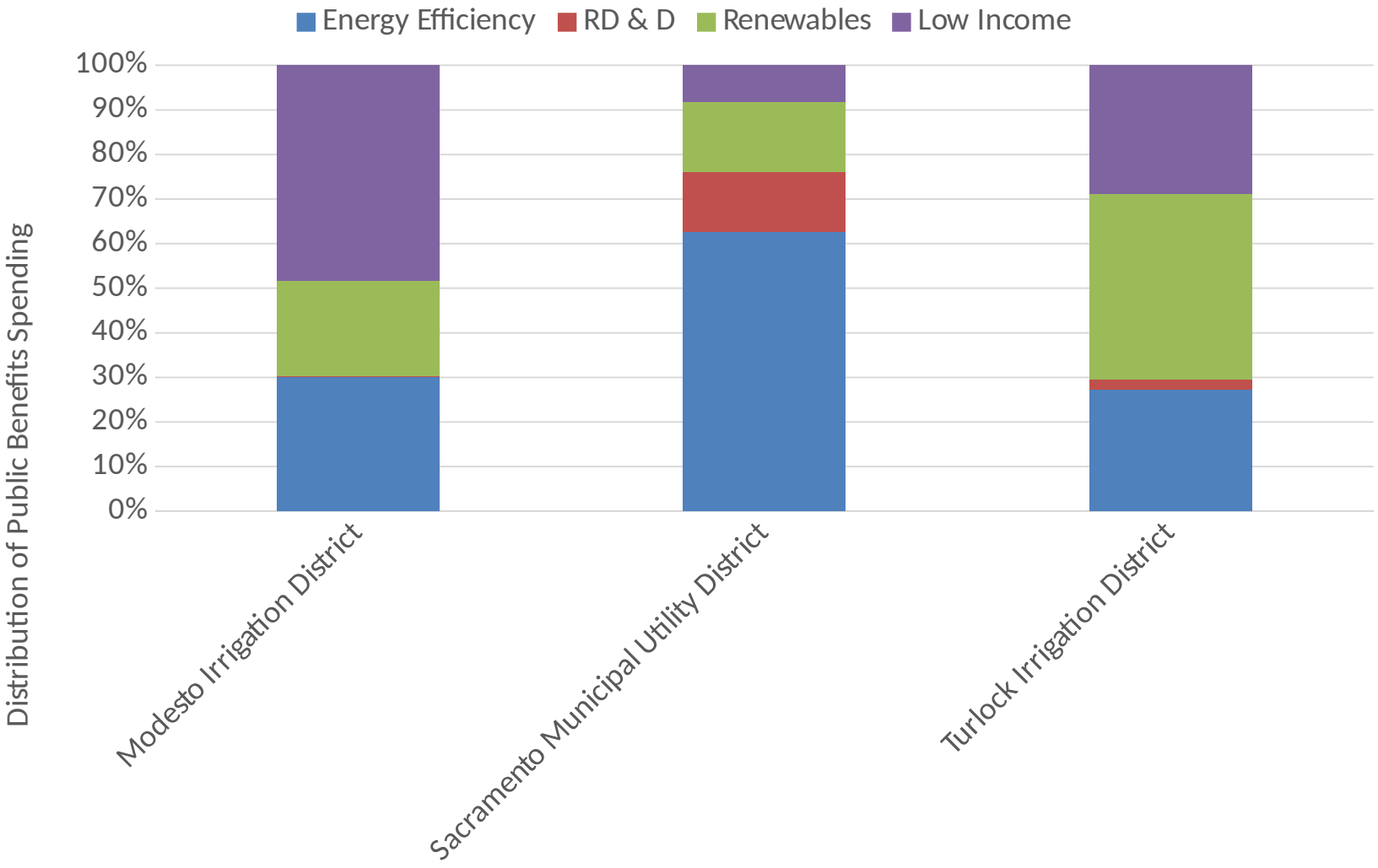
# IOU PGC Contributions 1998-2011




Note: Low Income spending is part of the IOU public purpose surcharge, but accounted for separately than the public goods charge
Energy efficiency was also funded by a procurement charge added in 2006

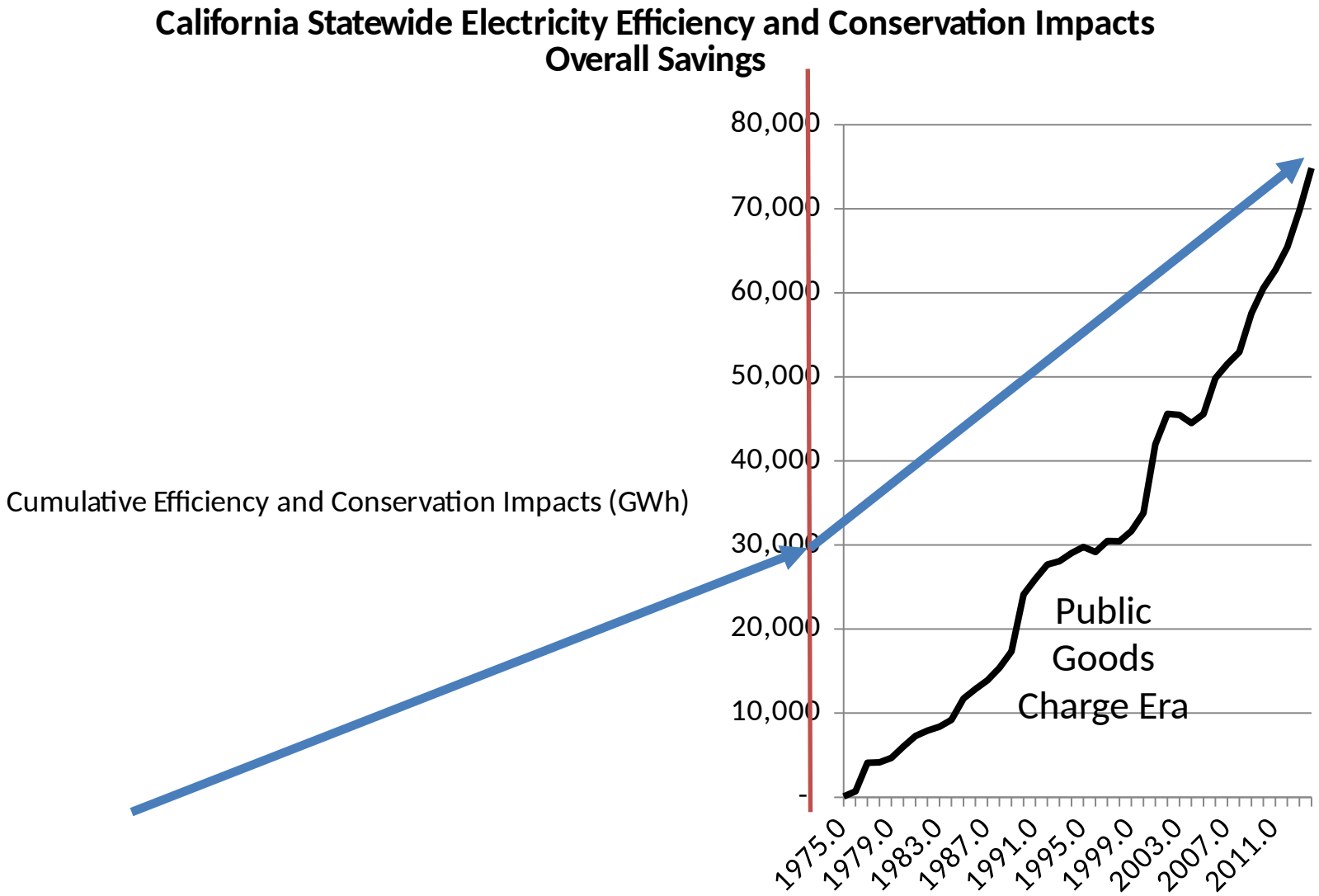
Source: California Public Utilities Commission 2011

# Examples of POU PGC Spending 2000-2011




Note: Modesto Irrigation District did not begin collecting PGC money until 2001

Source: Correspondence with POUs

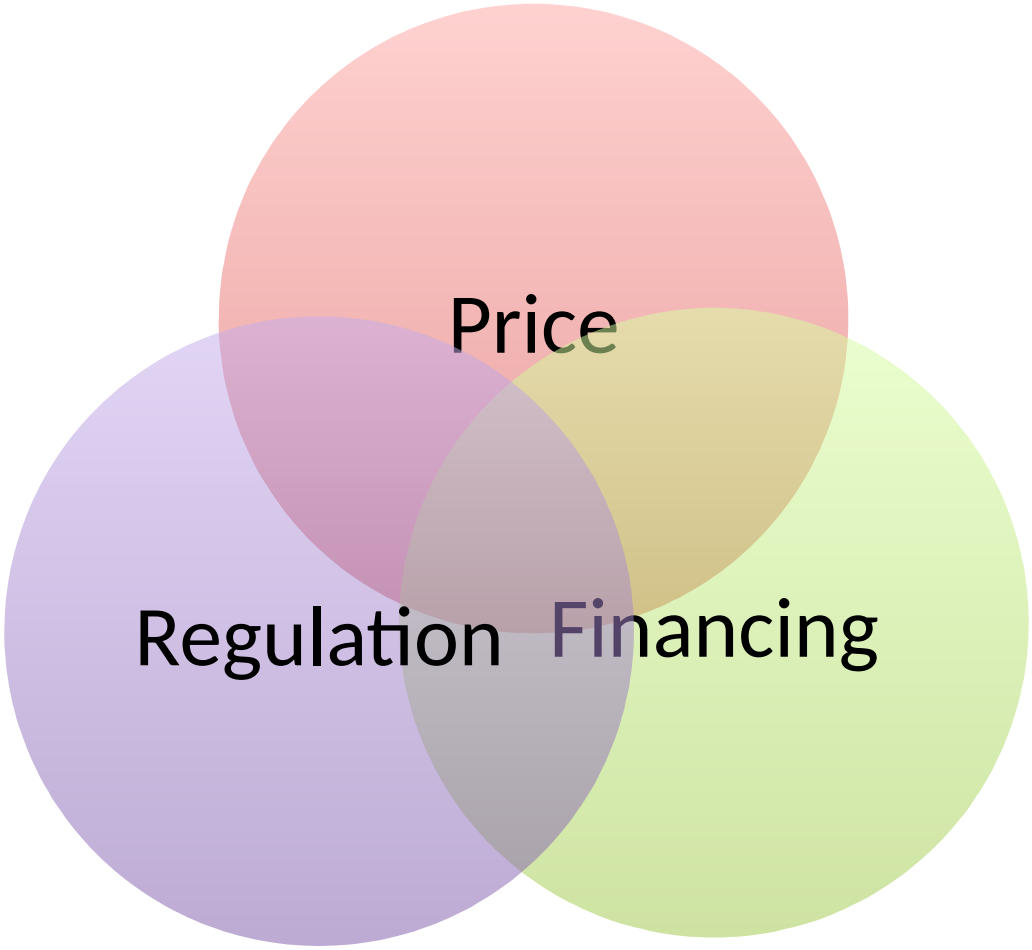


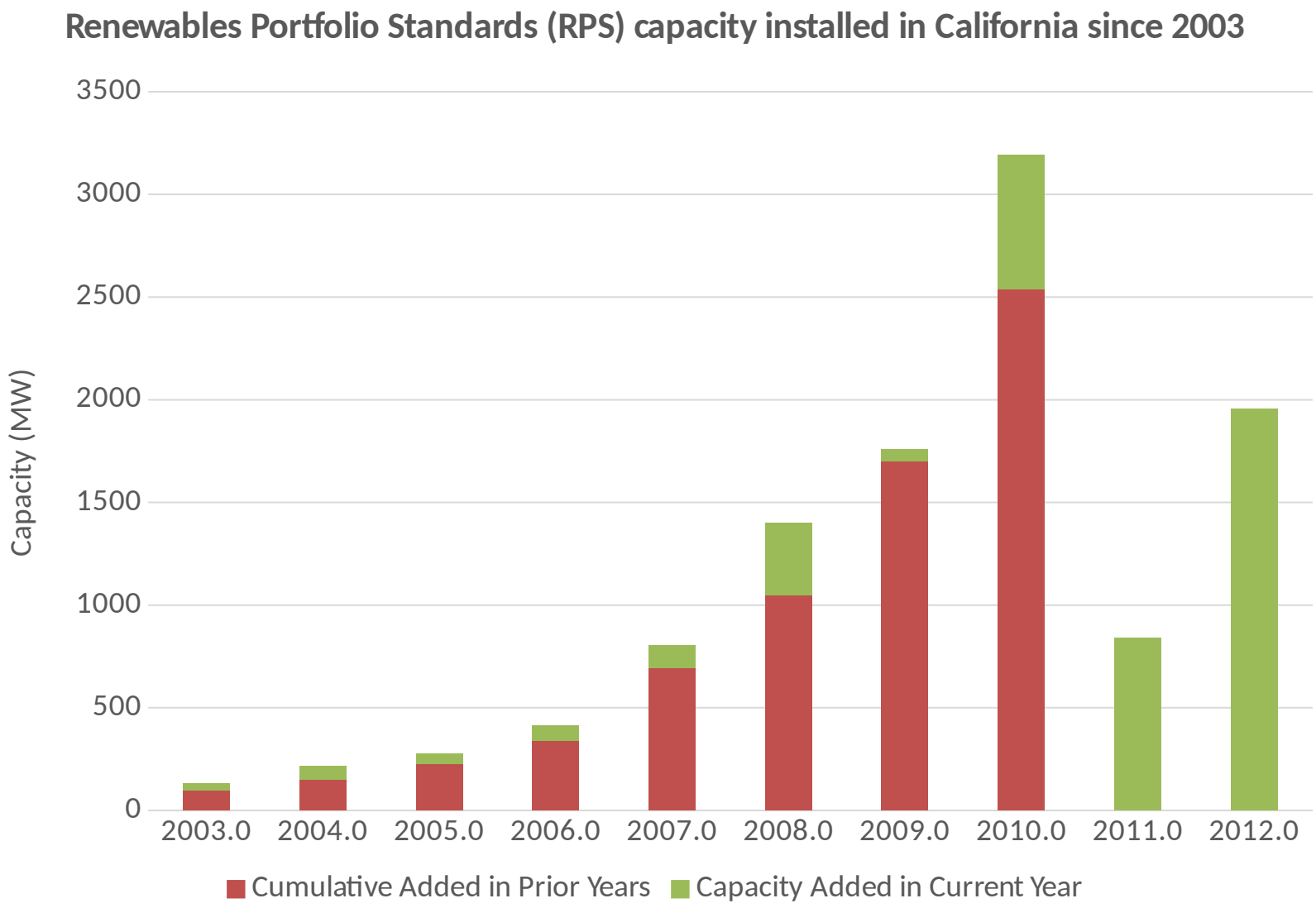

Source: California Energy Commission 2013

Note: Impacts increased 1.8 times faster in PGC era than from 1975 to 1998

# California Residential and Commercial PV System Median Installed Price

Source: Lawrence Berkeley National Lab 2014

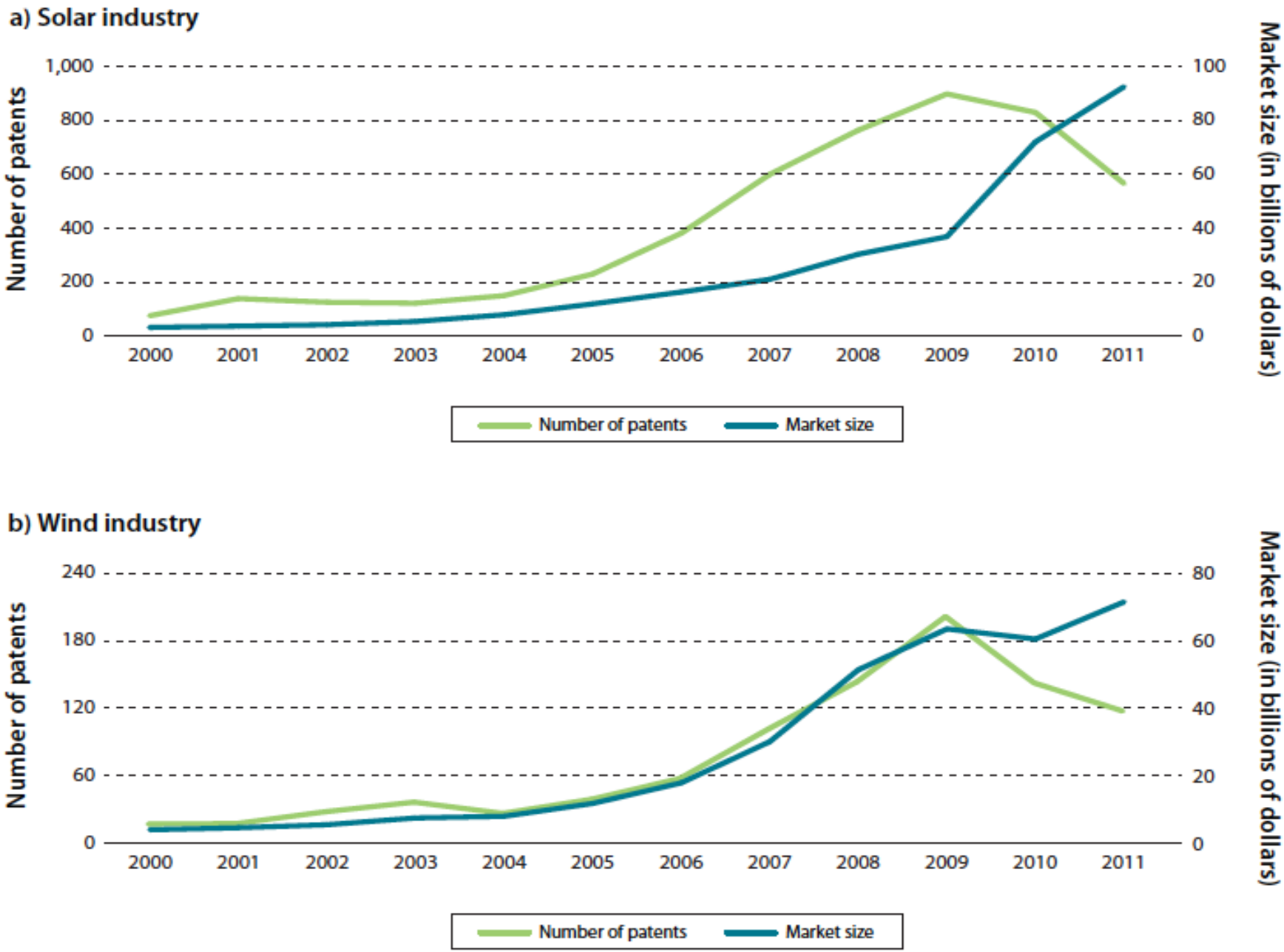

Price
Regulation
Financing

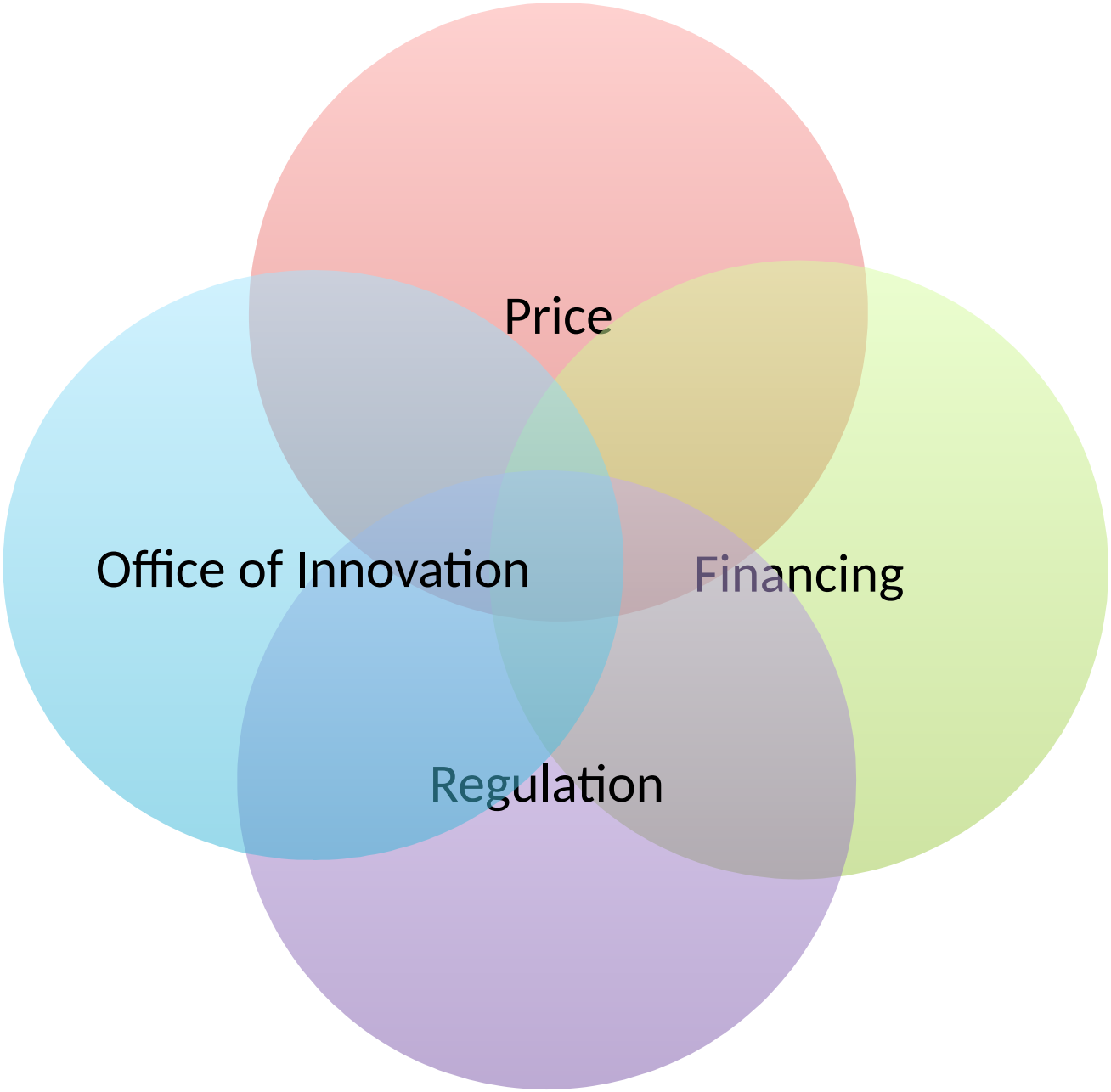



Source: California Public Utilities Commission 2015

FIGURE 7.

## Number of Patents Relative to Market Size for Solar and Wind Power Industry, 2000–11



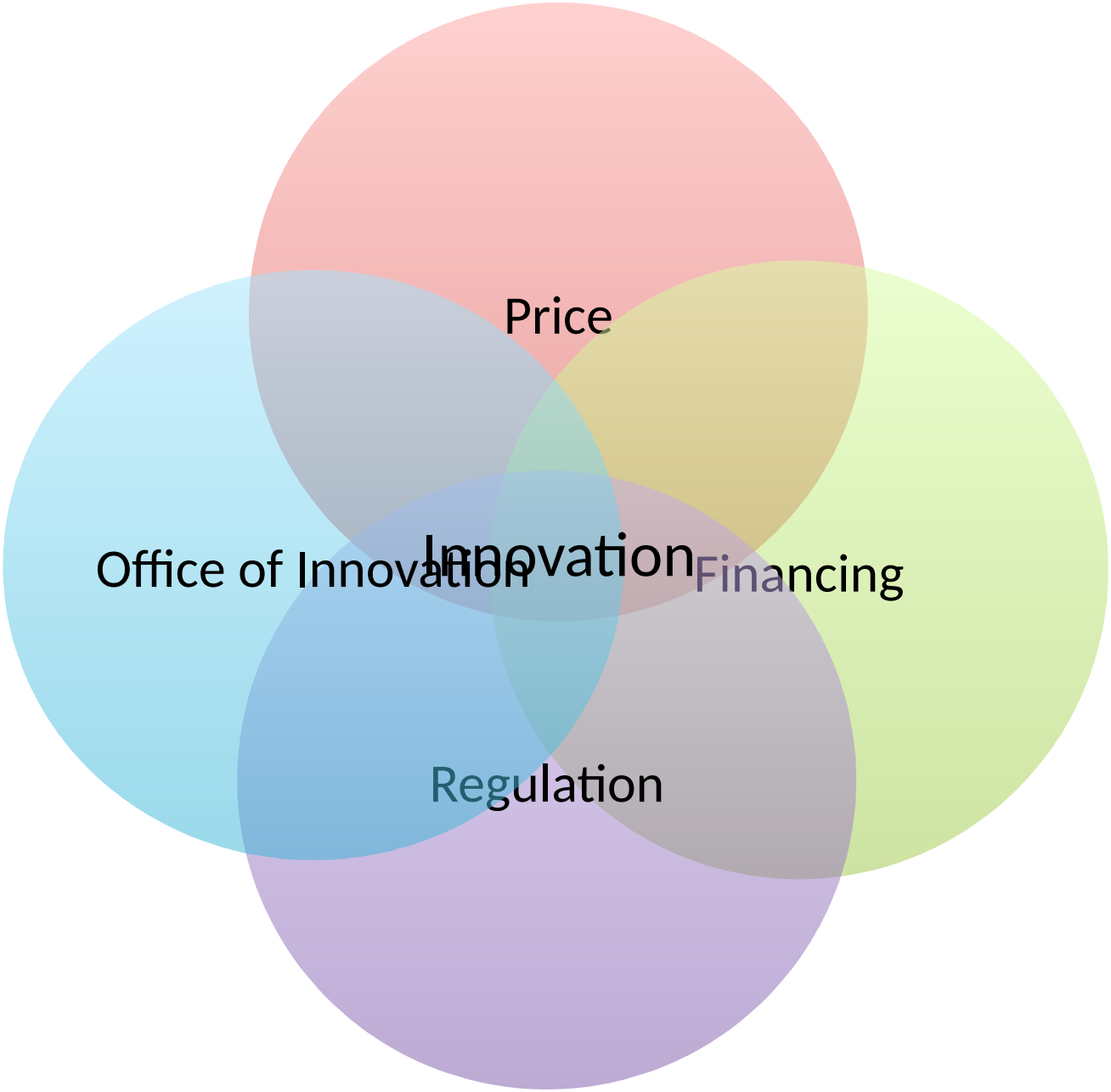

Price
Office of Innovation
Financing
Regulation

# Infusing Innovation into the Water Sector

- Draft a strategic and visionary short-term and long-term water-planning framework for the State
- Promote coordination among and within water sectors, as well as across all relevant jurisdictional levels
- Promote innovation along various water frontiers through R&D spending and the facilitation of financing and funding opportunities
- Collect and publish relevant water resources data;

# Infusing Innovation into the Water Sector

- Three top priorities for the office would be to help the States in establishing:
  - Improved water pricing policies;
  - Innovation-friendly regulation by coordinating and streamlining laws and regulatory frameworks;
  - A clearing house for all funding sources to identify and enable access to non-governmental funding sources, and promote new and innovative financing mechanisms and investment strategies .


Price
Office of Innovation
Innovation
Financing
Regulation

*Questions!*

newsha@stanford.edu