



A 21st Century Financing Framework to Support Water Sector Paradigm Shift

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Climate Change



Urbanization

A changing urban water cycle requires new approaches to urban water management



To reinvent our systems, we must know how much water is needed when and where

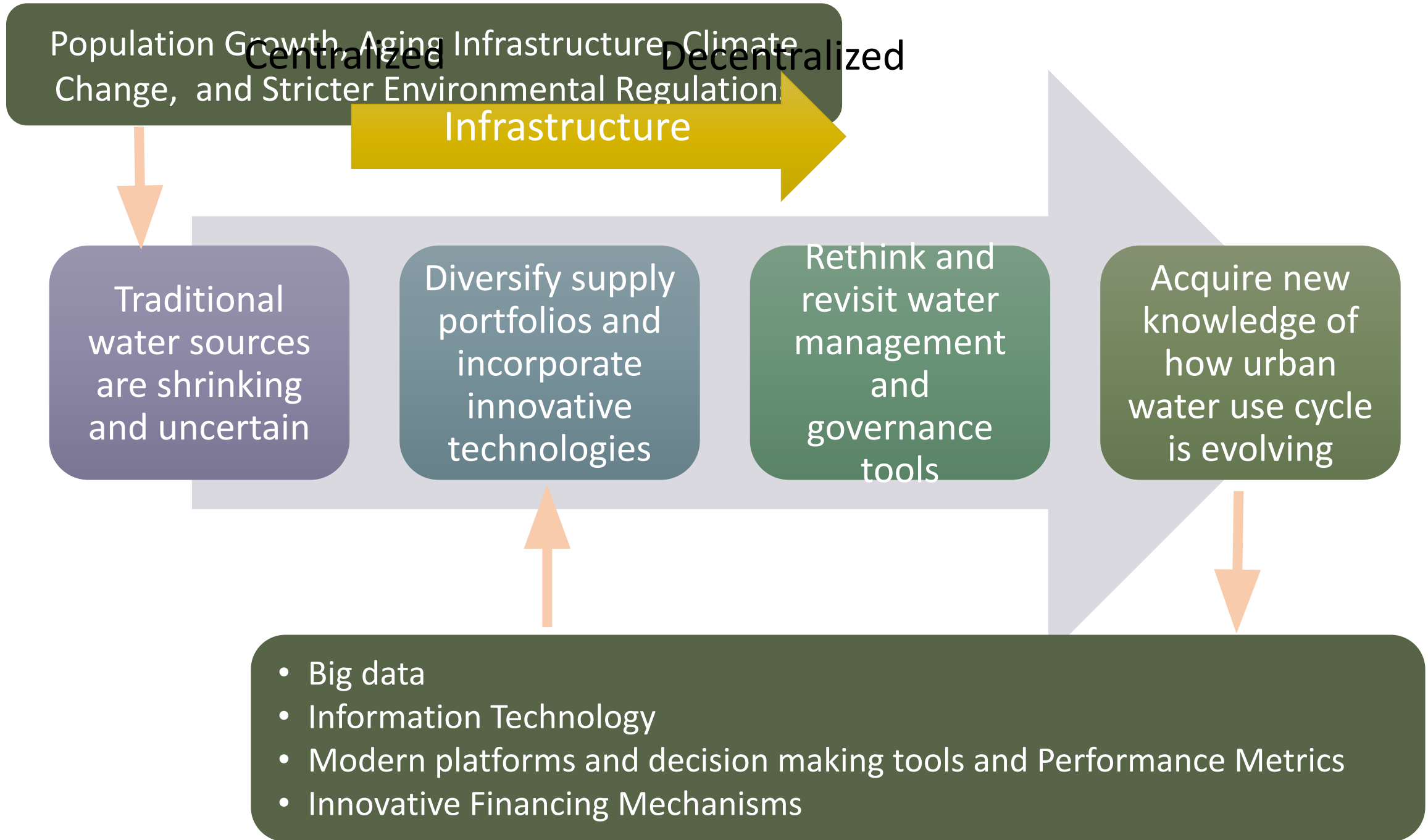


Aging Infrastructure



Environmental Externalities

Paradigm Shift in the Water Sector





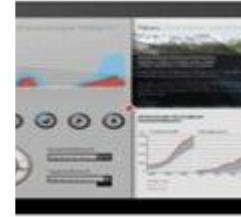
Rethinking Demand

- Reduce waste and increase efficiency,
- Rethink economic priorities
- Education and outreach strategies



Rethinking Supply

- Source protection and watershed management
- Stormwater capture
- Graywater systems
- Treated wastewater
- Conjunctive use
- Desalination

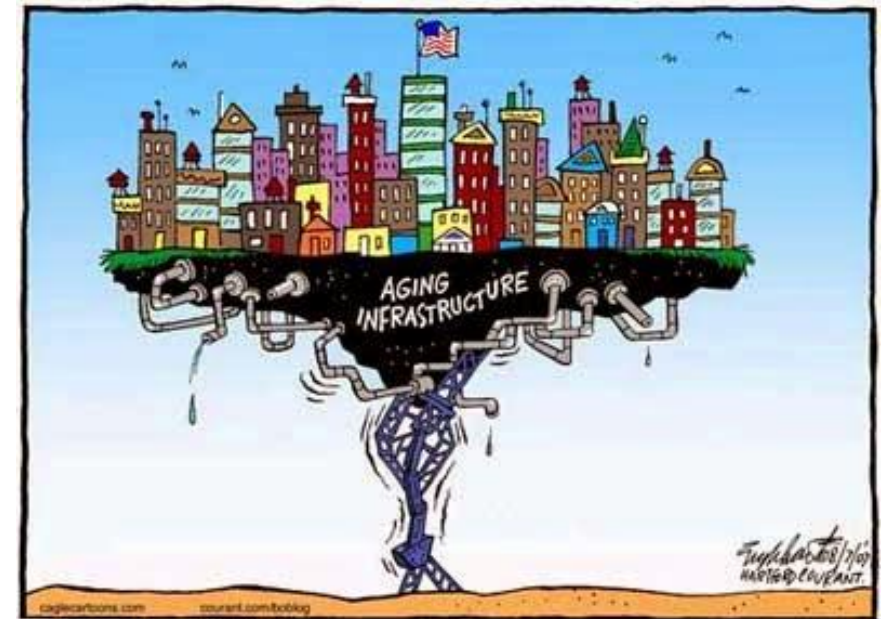


Rethinking Governance

- Water data monitoring and collection
- Cross-sector resource management
- Regional water management
- Financing

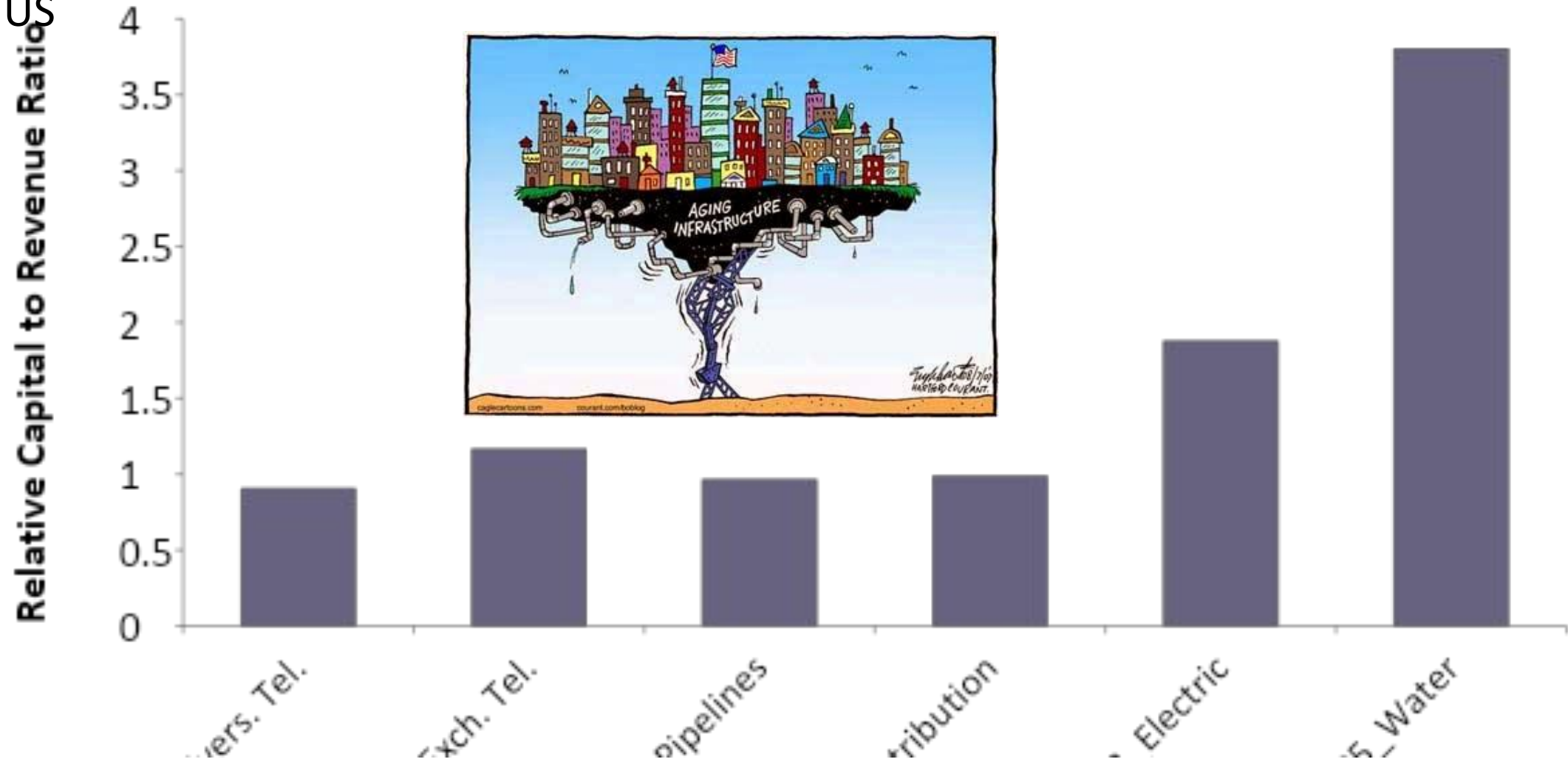
Financing Water – How?

- ❑ Limited federal and state funding: grants, subsidies, and tax exemptions for municipal bonds
- ❑ Increasing pressures require renewed investment and innovative ways to fund new solutions to aging infrastructure



A Hidden System

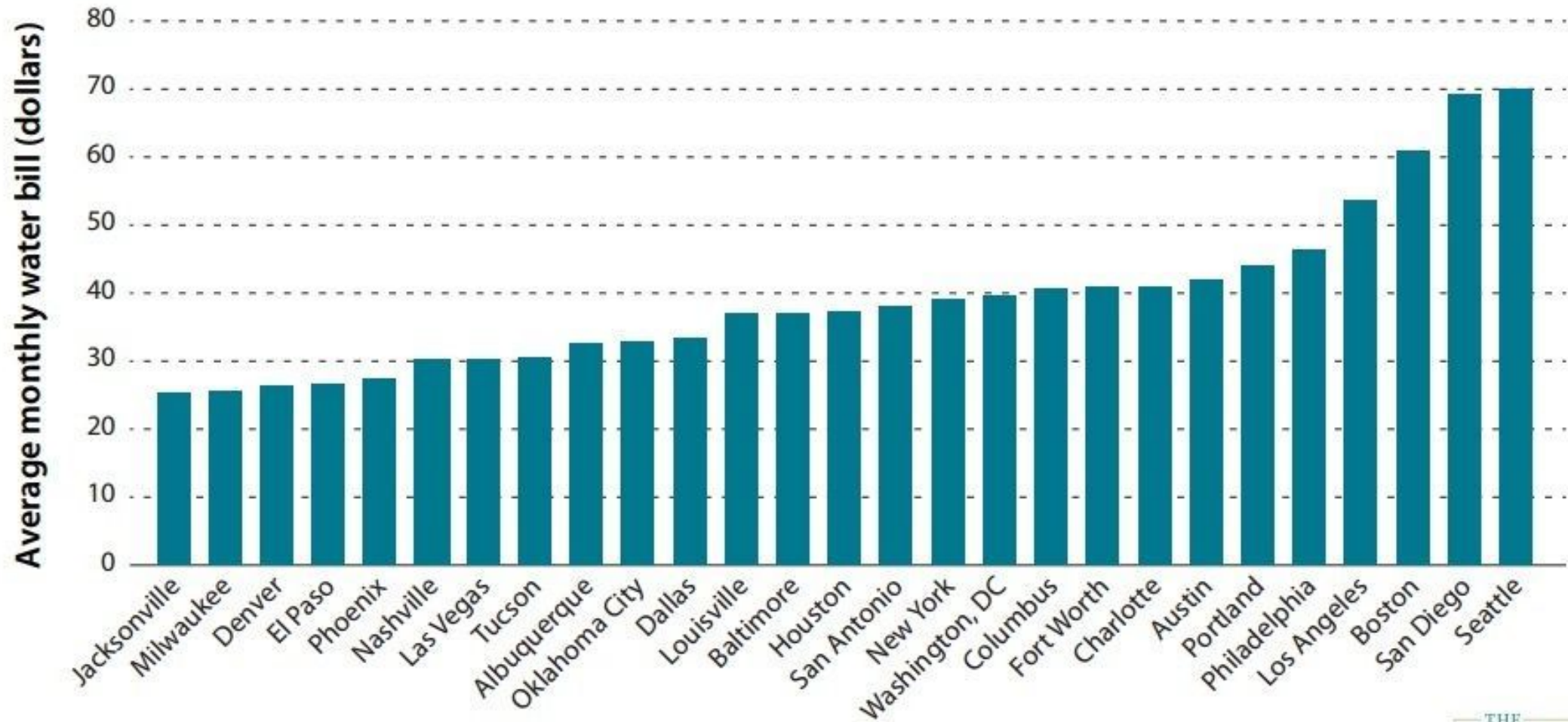
Relative capital investment to revenue for several utility services in the US



Source: Global Water Intelligence, 2010

Average Monthly Water Bill in Large U.S. Cities, 2010

Typical household water bills in large U.S. cities range widely from \$25 per month to \$70 per month.

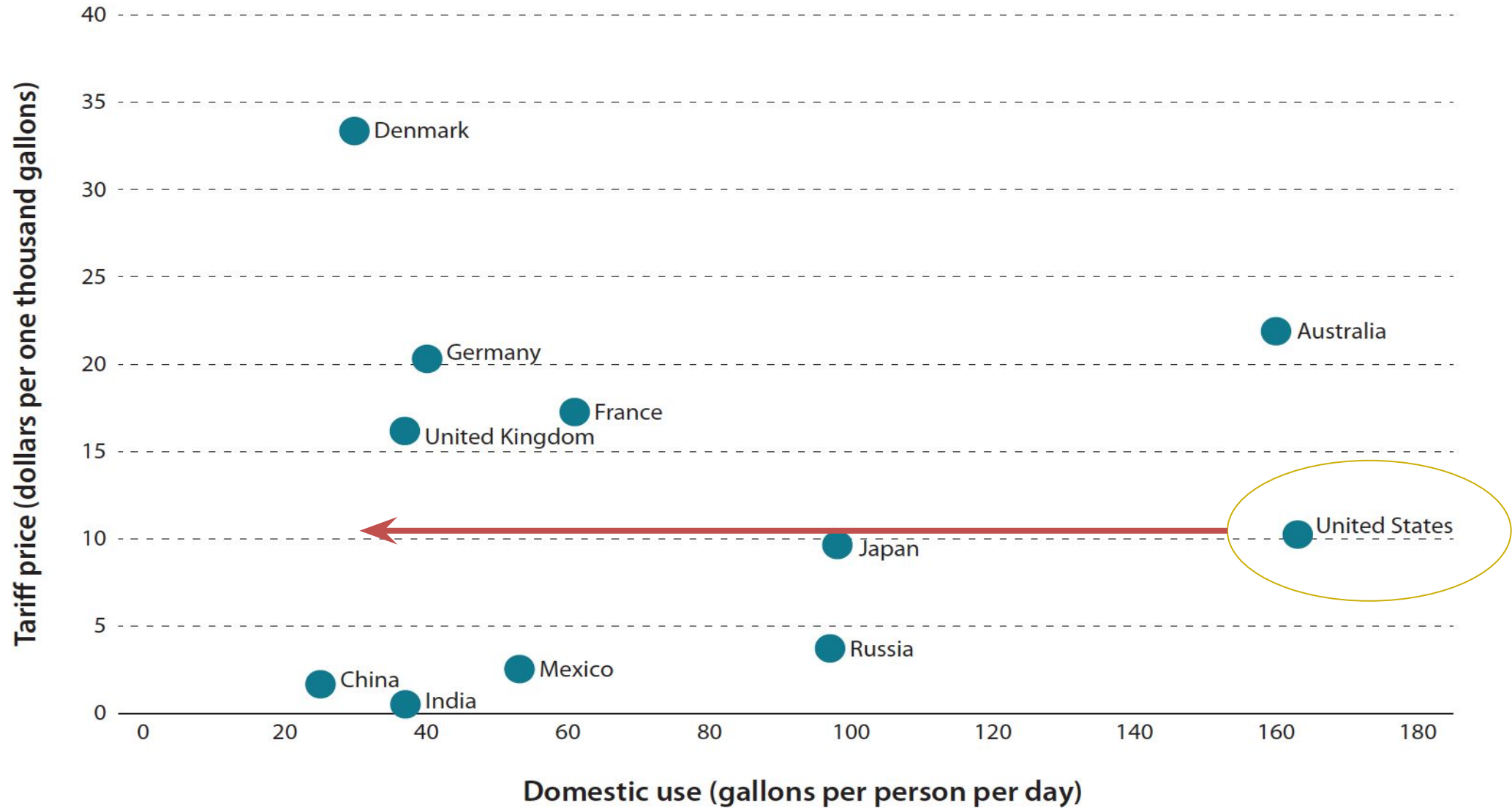


Source: American Water Works Association and Raftelis Financial Consultants 2011.

Note: "Average monthly water bill" refers to the monthly water bill charged by the municipal water systems that operate in the selected cities assuming a monthly water use of 11,200 gallons. For more details, see the technical appendix.

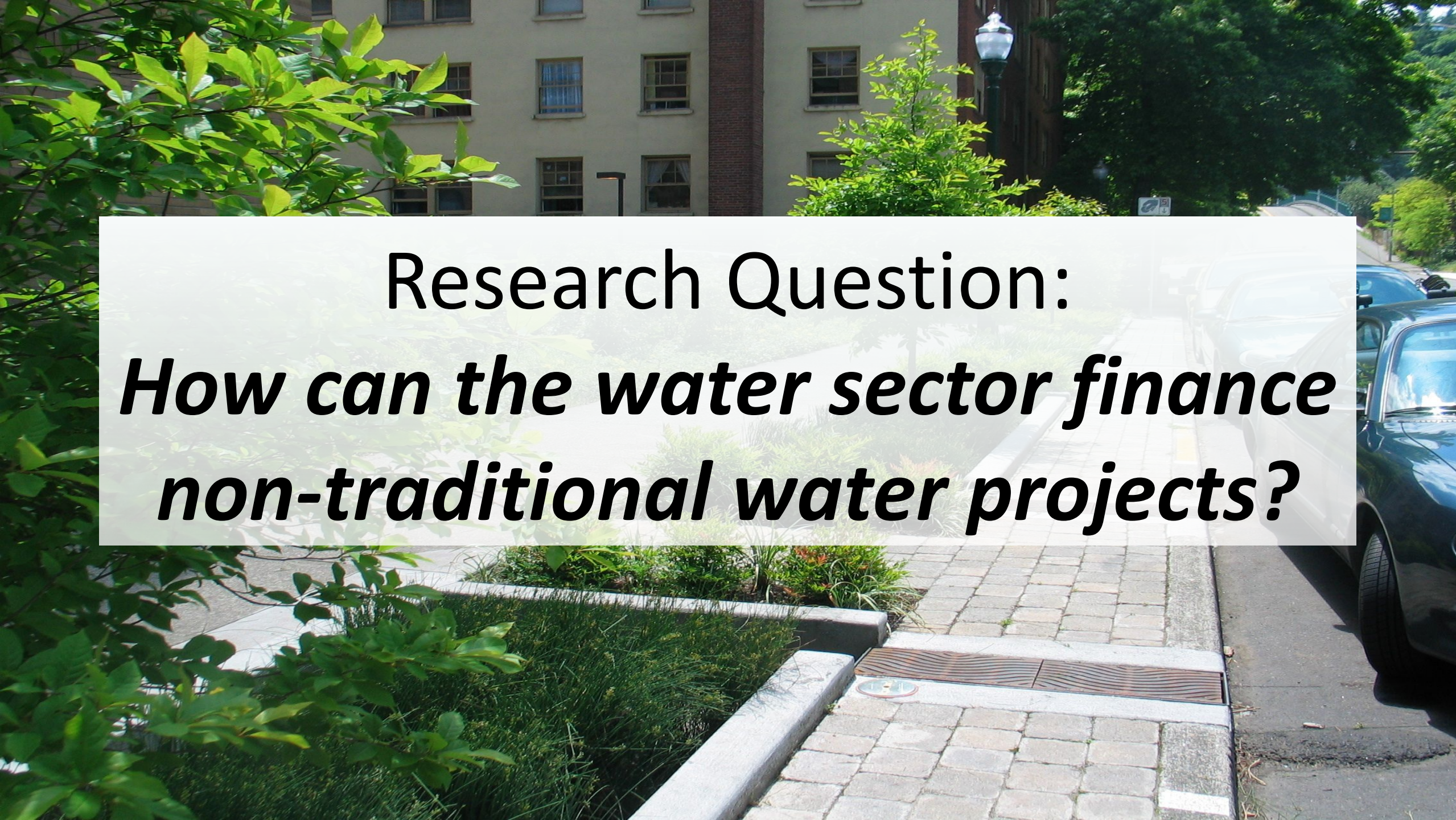
FIGURE 10.

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.



Research Question:
***How can the water sector finance
non-traditional water projects?***



Looking to the Electricity Sector

Methodology

1. Gather case studies of non-traditional (innovative, multipurpose, and small- to medium-scale) projects
2. Identify common elements among case studies
3. Create a financing framework
4. Identify funding mechanisms we believe could be **most useful to the water sector**

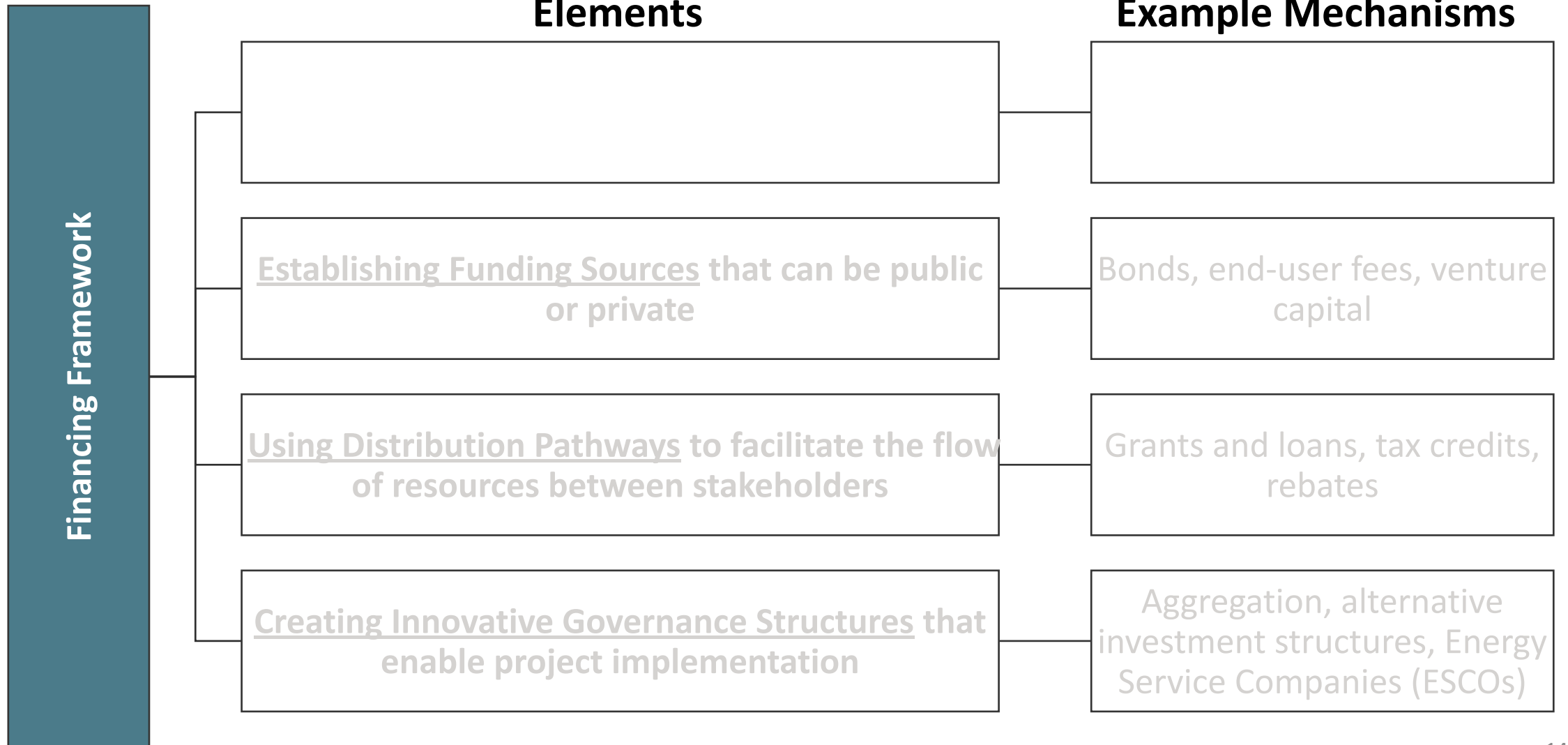
Evolution of the Electricity Sector: Overcoming Barriers

- Limited access to traditional public funding resources
- Difficult to secure private investments
- Regulatory challenges
- Perception towards change



Financing Framework

Financing Framework



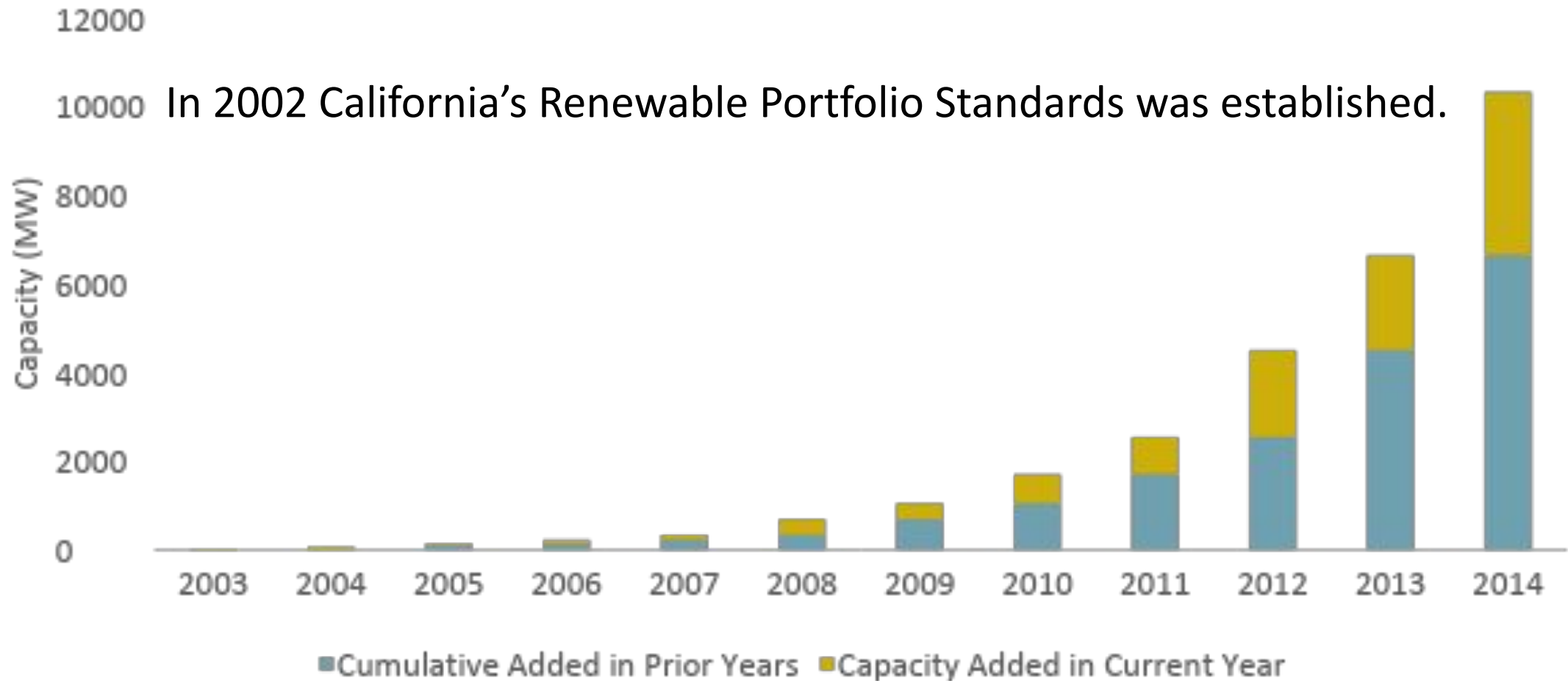
1. Catalyzing Change

- Regulations
- Market Forces
- Price Structuring and Revenue Decoupling

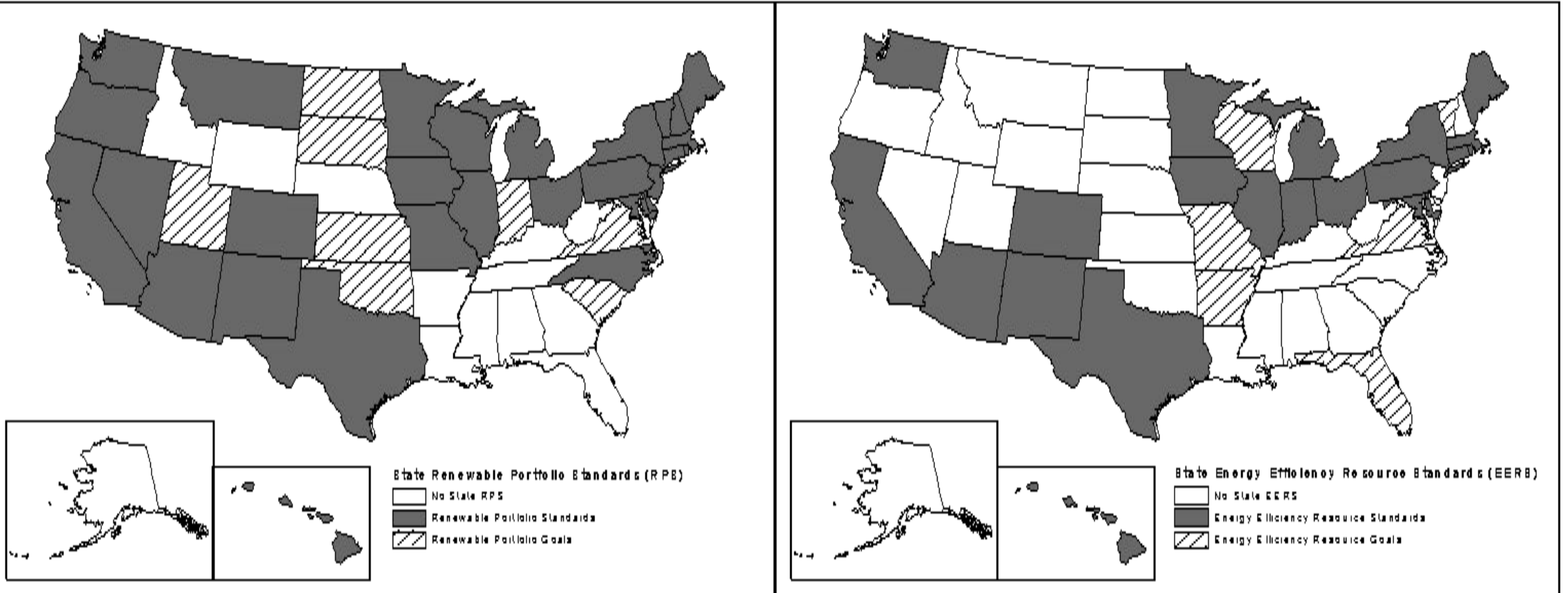
Policies and economic forces drive change

Evolution of the Electricity Sector

Renewables Portfolio Standards (RPS) capacity installed in California

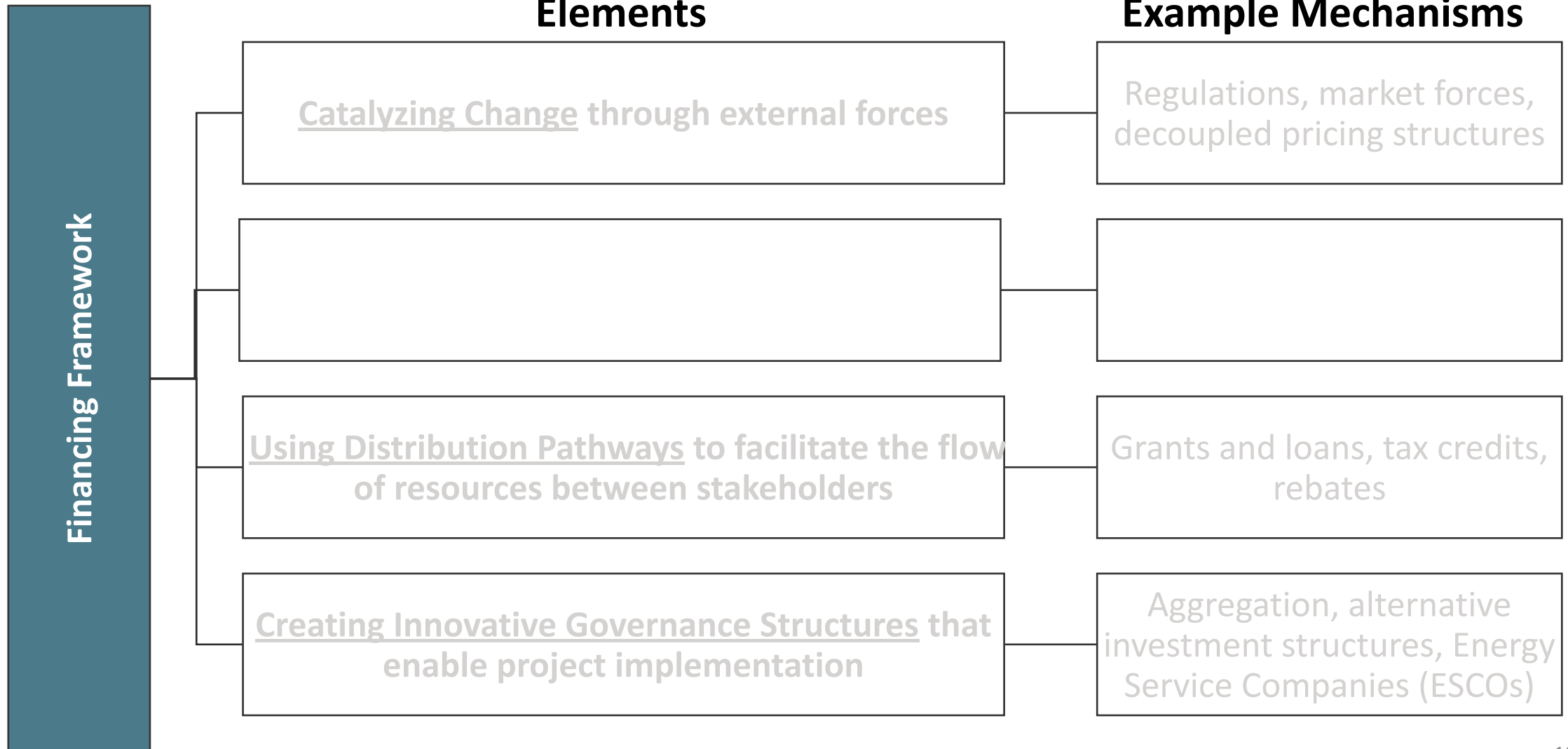


State-level renewable portfolio standards and energy efficiency resource standards in the United States



Data Source: North Carolina Solar Center 2016

Financing Framework



2. Establishing Funding Sources

- **Public Sources**

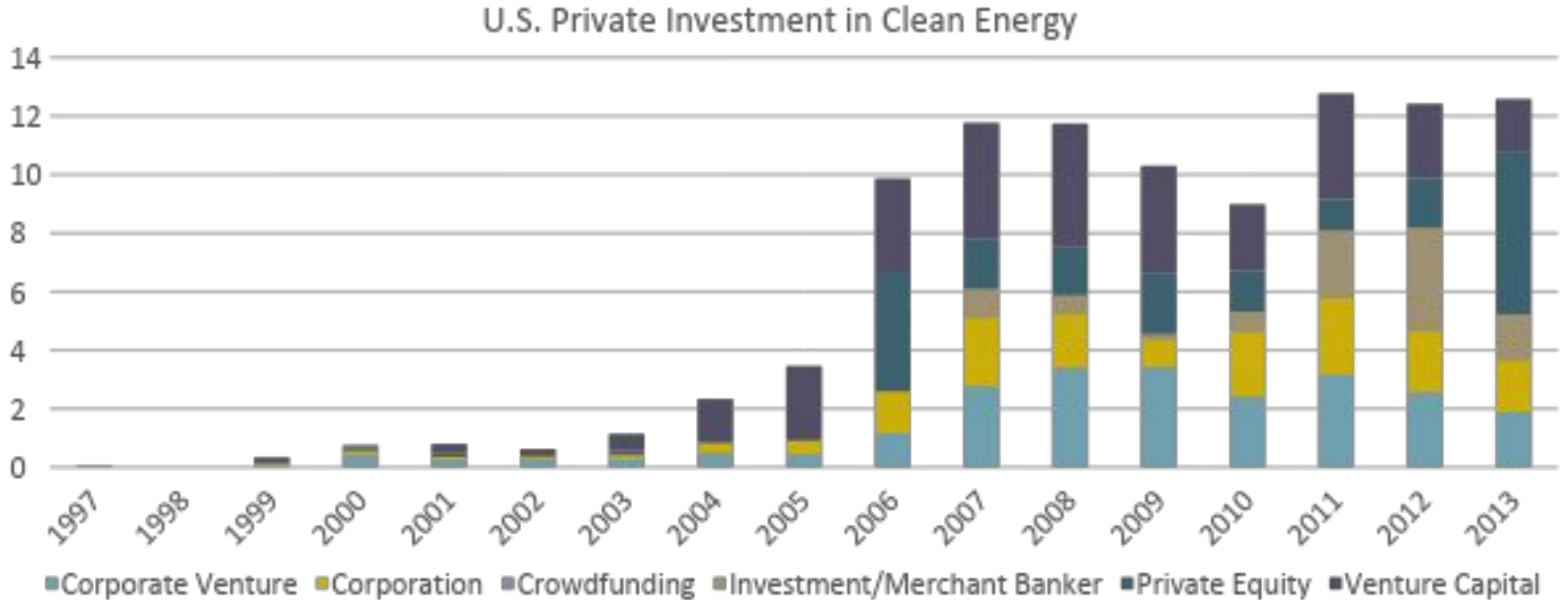
- Taxes
- Bonds
- Revolving Fund
- End-User Fees

- **Private Sources**

Look beyond traditional
funding sources

2. Establishing Funding Sources

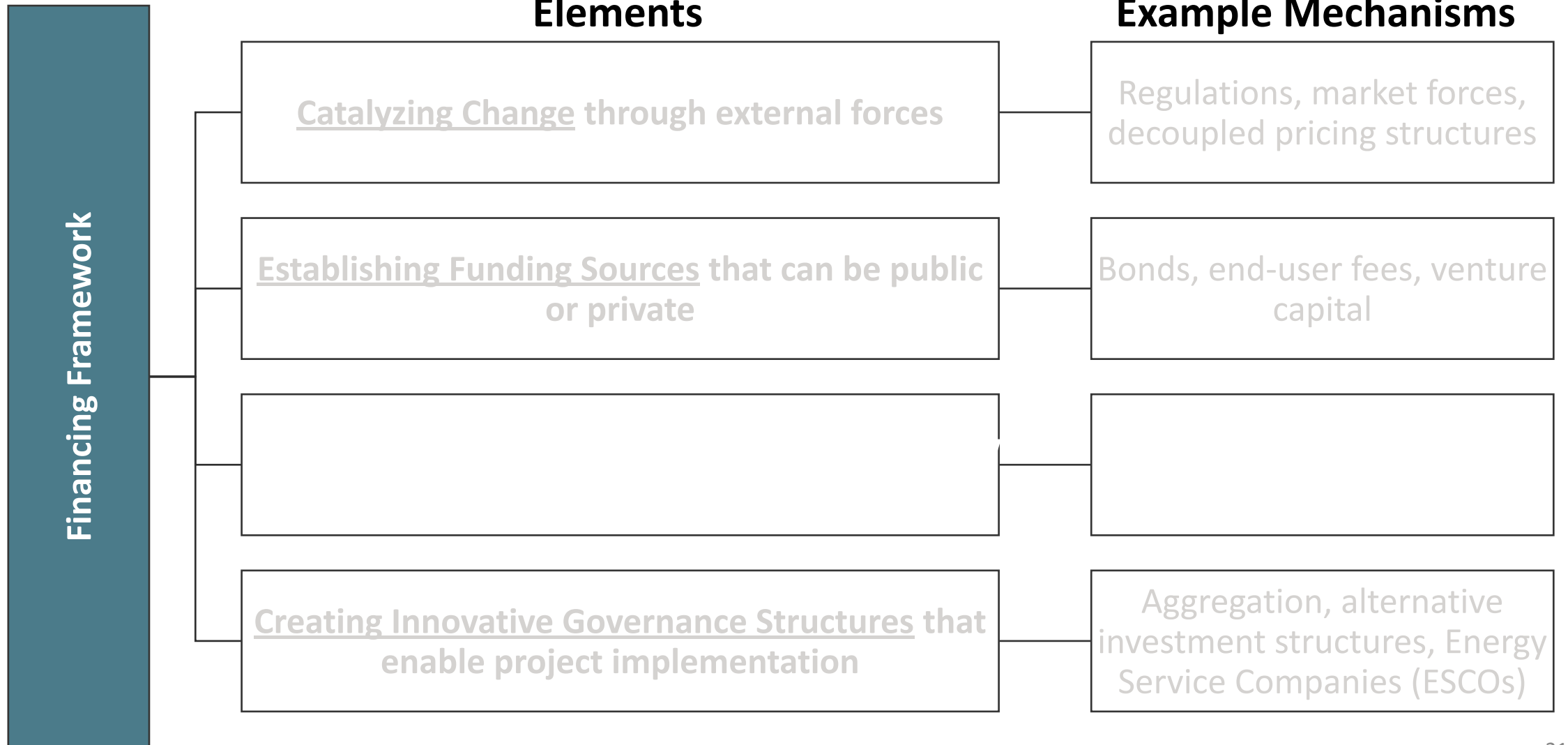
Private Capital



Source: Cleantech Group 2014

Note: Clean energy = biomass generation + energy efficiency + energy storage + solar + wind + geothermal + nuclear + hydro & marine + smart grid. Non-private categories of investment not shown here are debt funds, public sector funding, and other.

Financing Framework

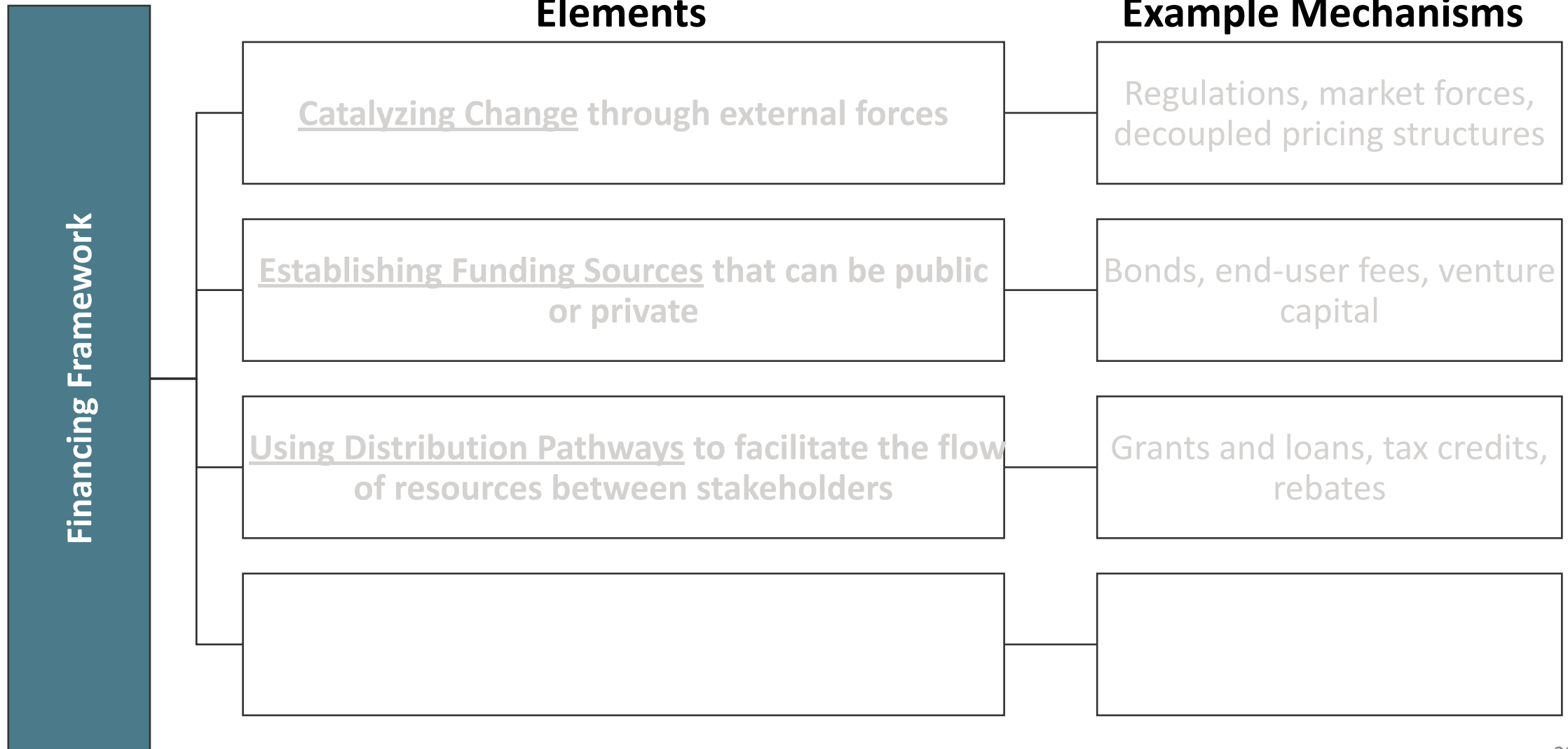


3. Using Distribution Pathways

- Government Grants and Loans
- Rebates
- Tax Credits
- **On-Bill Initiatives**

Mechanism	Financial Backer	Repayment Mechanism
On-Bill Financing (OBF)	Utility shareholders, utility ratepayers, public	Utility bills
<div style="border: 1px solid black; padding: 10px; display: inline-block;"> <p>Cost-sharing with end-users encourages participation</p> </div>		
(OBR)		Utility bills
Property Assessed Clean Energy (PACE)	Private investors through bonds	Property tax bills and assessments

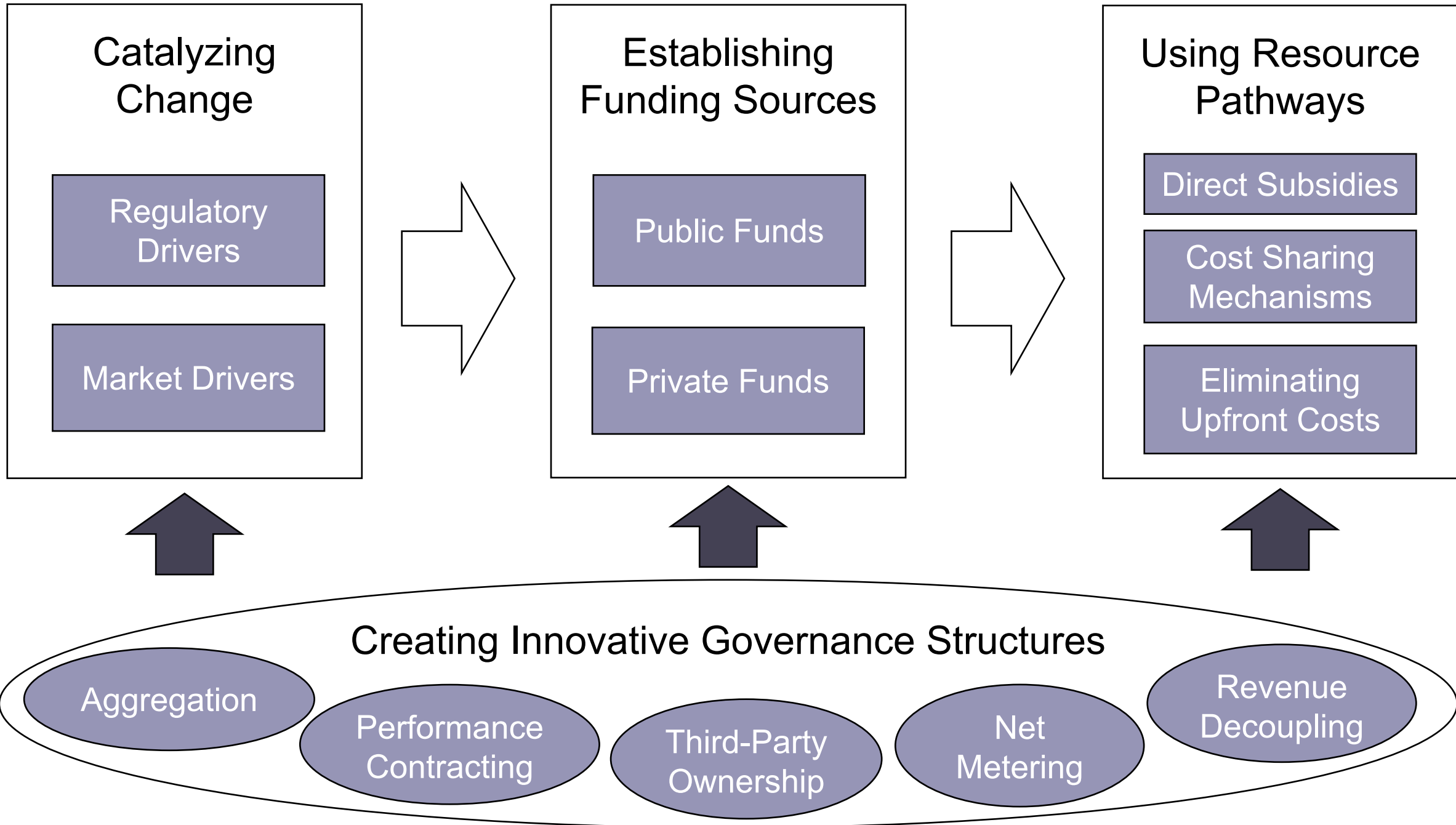
Financing Framework



4. Creating Innovative Governance Structures

- Project and Financial Aggregation
- Green Banks
- Alternative Investment Structures
- End-to-end service
- Lease and Purchase
- Net Metering
- Public Private Partnerships

Utilize a diverse financing strategy to minimize risk and increase economic potential

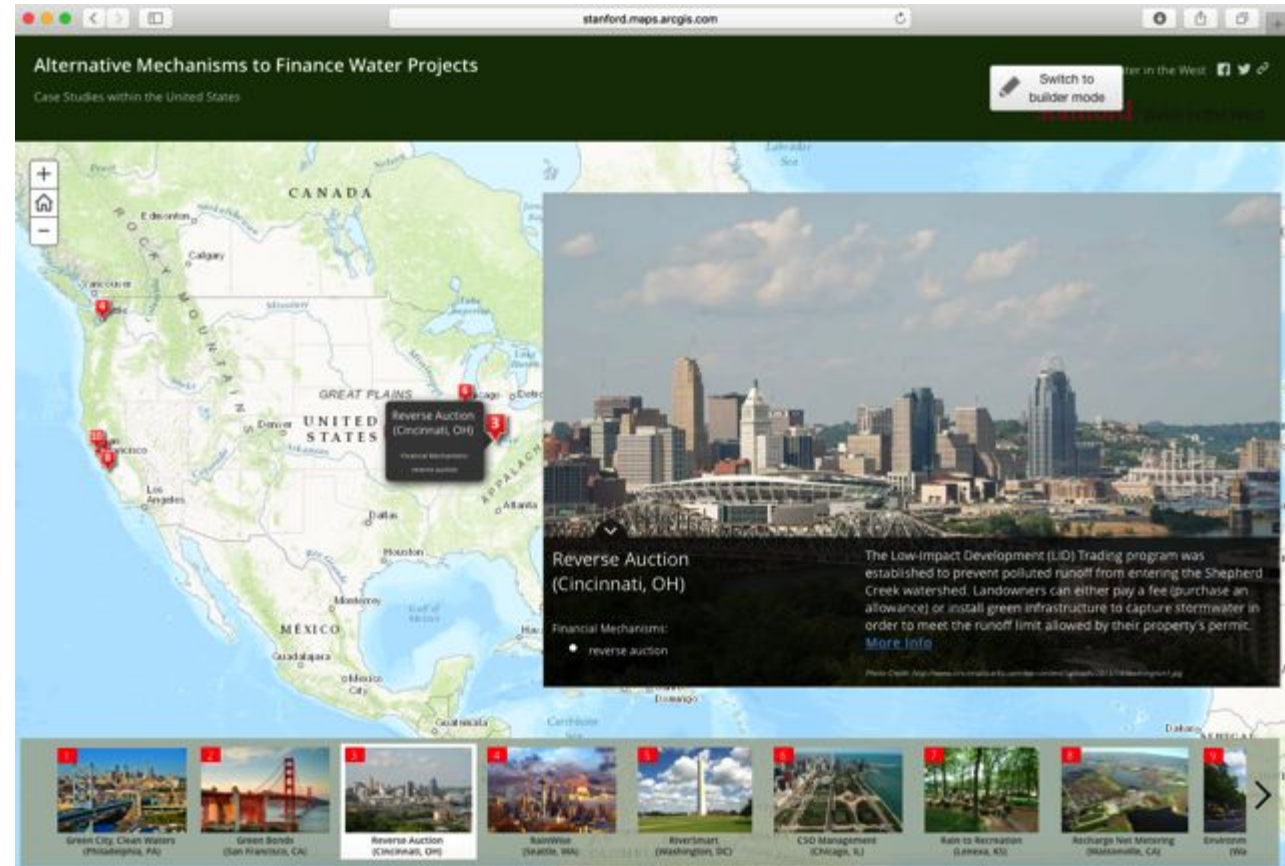


Case Studies in the Water Sector

Financing Water Projects- Living Map

Mechanisms Highlighted:

- Stormwater Fees
- Reverse Auction
- Performance-Based Rebates
- Stormwater Credit Trading Program
- Grant Programs
- Environmental Impact Bond
- Project Aggregation





D.C. Storm Water Retention Credit Trading

- Direct Regulation
- Credit Trading platform



Stormwater Retention Credits Trading Program
(Washington, D.C.)

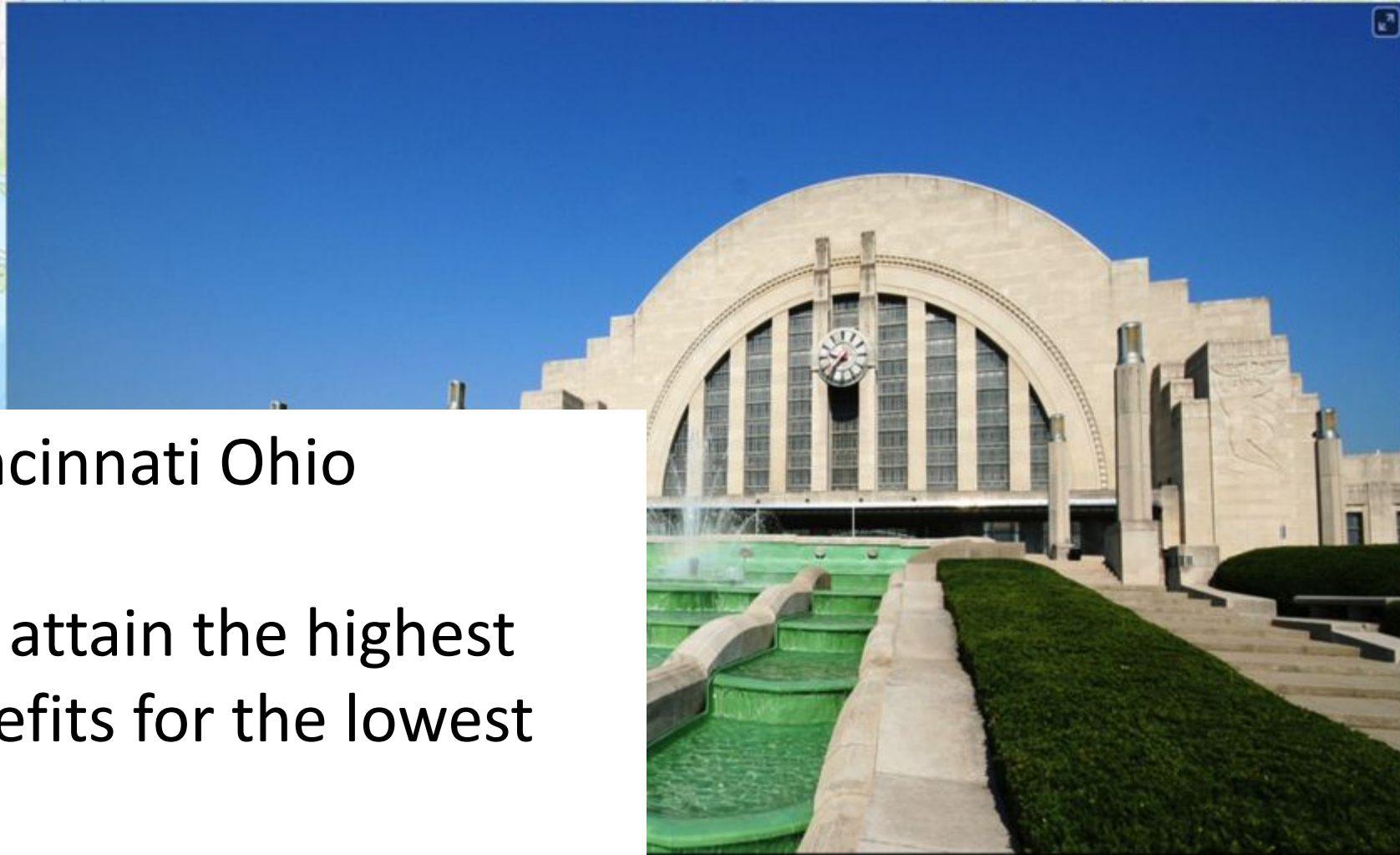
Financing Mechanisms:

- Credit Trading
- Direct Regulations

The District of Columbia Department of Energy & Environment (DOEE) recently implemented a Stormwater Retention Credit (SRC) Trading Program to encourage property owners to capture stormwater runoff and prevent pollutants from spilling into the Chesapeake Bay and the District's local waterways. The SRC Trading Program enables properties that voluntarily install green infrastructure to generate credits that can be sold in an open market and be used to meet regulatory requirements for managing stormwater runoff. [More Info](#)

Photo Credit: Wally Gobetz





Reverse Auction in Cincinnati Ohio

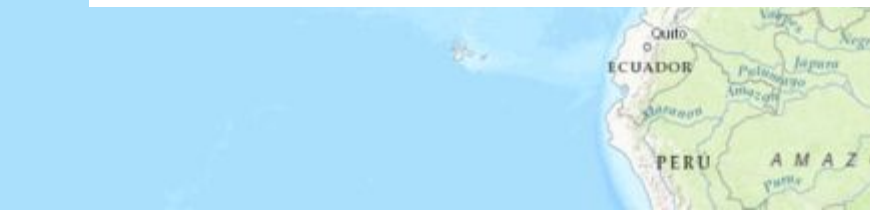
- Direct Regulation
- Reverse Auction-to attain the highest environmental benefits for the lowest price

Financing Mechanisms:

- Reverse Auction
- Direct Regulations

In an effort to develop a cost-effective stormwater management plan, a two-year reverse auction pilot program was implemented in Shepherd Creek using parcel-level runoff mitigation practices. Residents submitted sealed bids stating how much they would be willing to have free rain barrels and/or rain gardens installed on their property. Bids with the highest environmental benefits and lowest cost to the program were selected. [More info](#)

Photo Credit: OZinOH



Emerging models of Public Private Partnerships

Emergence of Community Based PPPs

Public Private Partnership (PPP)

- Transactional contract
- Performance based contractual agreement
- Goal is minimizing risk and increasing profits

Community Based PPP

- “Relational contract” based on long-term trust and confidence between partners
- Alignment of goals between public and private sectors
- Shared risks and responsibility for project management
- Transparency between partners through adaptive management of project goals
- Focused on local economic growth and Improved quality of life in urban and underserved communities

Prince George County, MD: Clean Water Partnership

- Manage stormwater runoff in a **Design-Build-Operate-Maintain (DBOM) CBP3**
- Design, installation, maintenance, and monitoring of stormwater facilities **to treat about 4,000 acres of impervious** areas over the next 30 years.

- The CWP's goals:

- to

- to In addition to reimbursement for O&M expenses, they will receive

- Base fee equal to 5 percent of the operation and maintenance costs and expenses,

- Financial

- D

- P

- C

- Incentive fee based on:

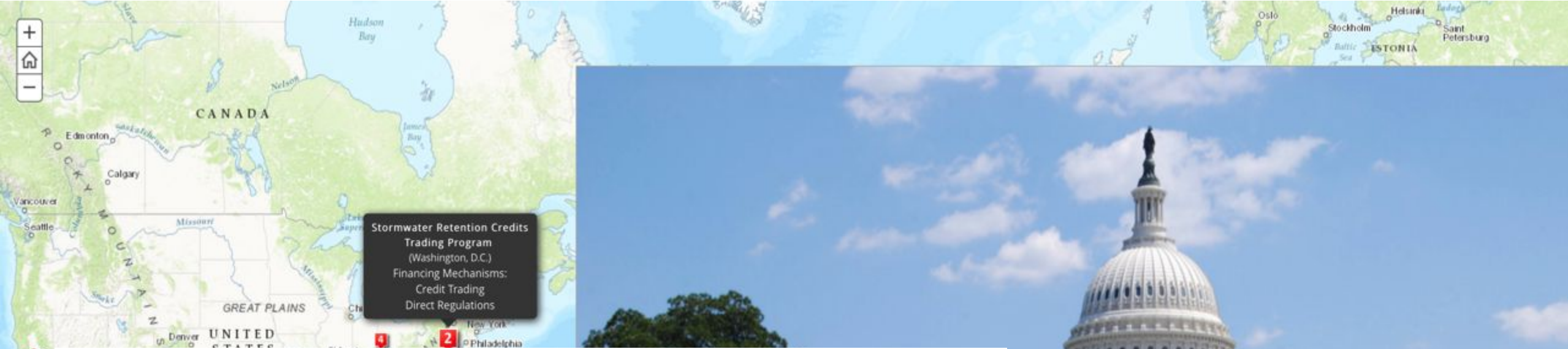
- delivering projects within the time and budgetary goals,
- promoting socioeconomic change by incorporating County-based businesses, minority/protected class businesses, and creating jobs for County residents.

- Fee credit: property owners that implement stormwater reductions

Impact Driven Bonds:

Promote positive social and/or environmental
impacts

Attract sustainability motivated investors

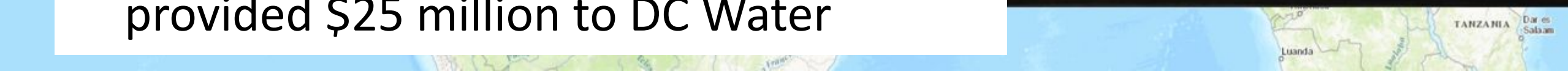


Stormwater Retention Credits Trading Program (Washington, D.C.)
Financing Mechanisms:
Credit Trading
Direct Regulations

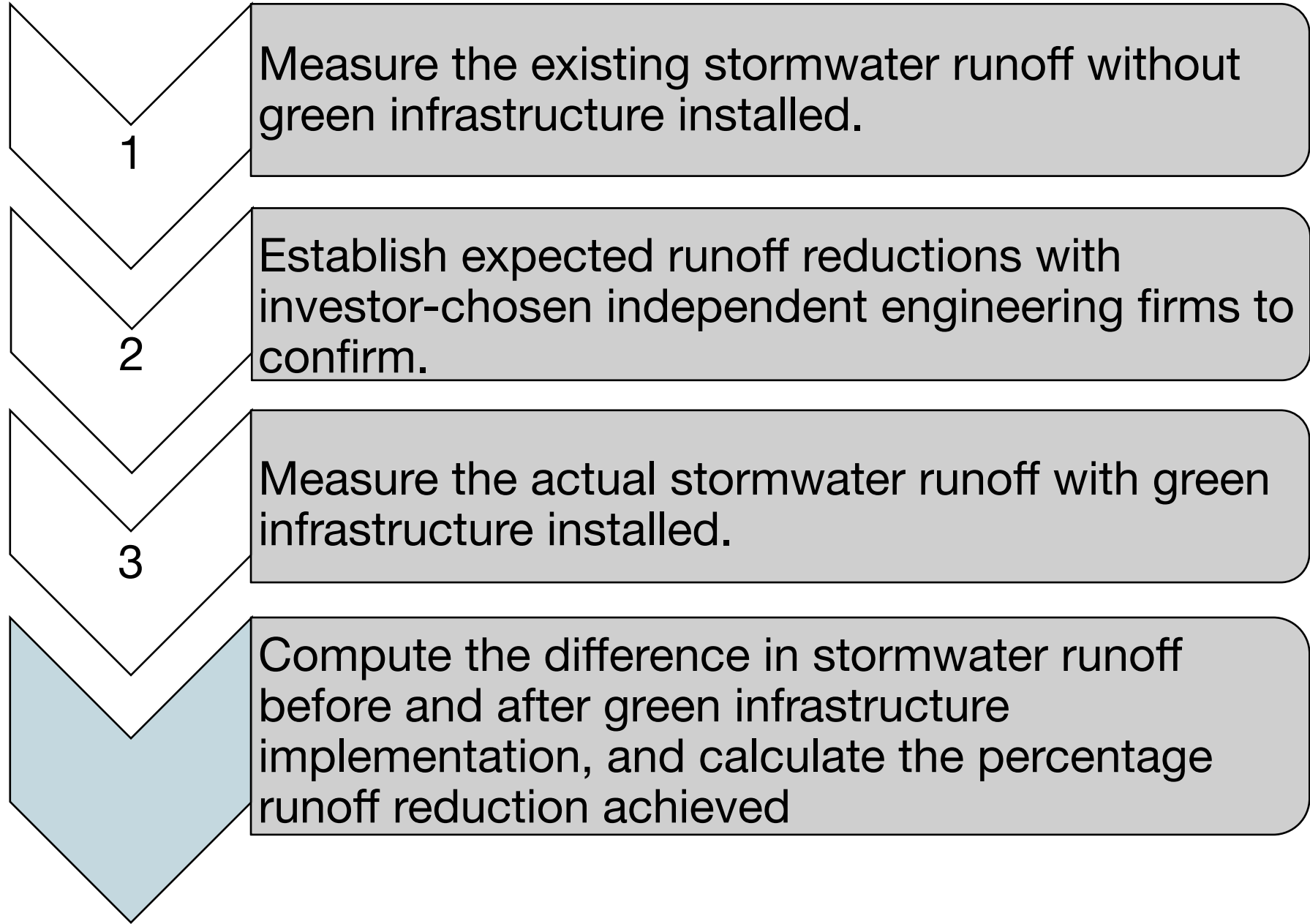
Environmental Impact Bond:

- Reduce stormwater runoff in **twenty acres** by installing **green infrastructure** such as green roofs, porous pavement, and rain gardens in two District neighborhoods.
- Goldman Sachs and Calvert Foundation, provided \$25 million to DC Water

The District of Columbia Department of Energy & Environment (DOEE) recently implemented a Stormwater Credit (SRC) Trading Program to encourage property owners to capture stormwater runoff and prevent pollutants from spilling into the Chesapeake Bay and the District's local waterways. The SRC Trading Program enables properties that voluntarily install green infrastructure to generate credits that can be sold in an open market and be used to meet regulatory requirements for managing stormwater runoff. [More Info](#)
Photo Credit: Wally Gobetz

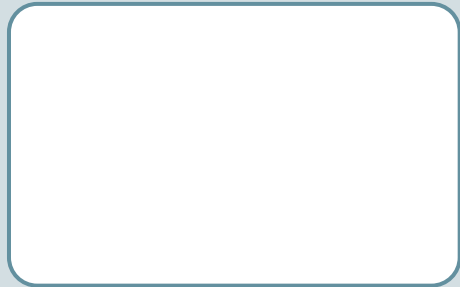
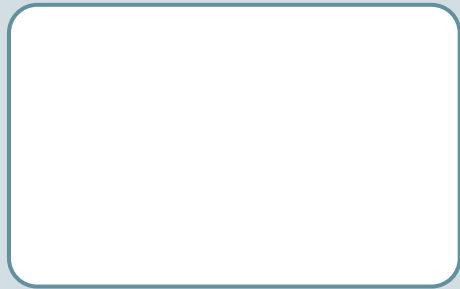


Assessing Program Performance



Performance Related Financial Risk Management

Performance Tier 1



Performance Tier 2



Performance Tier 3

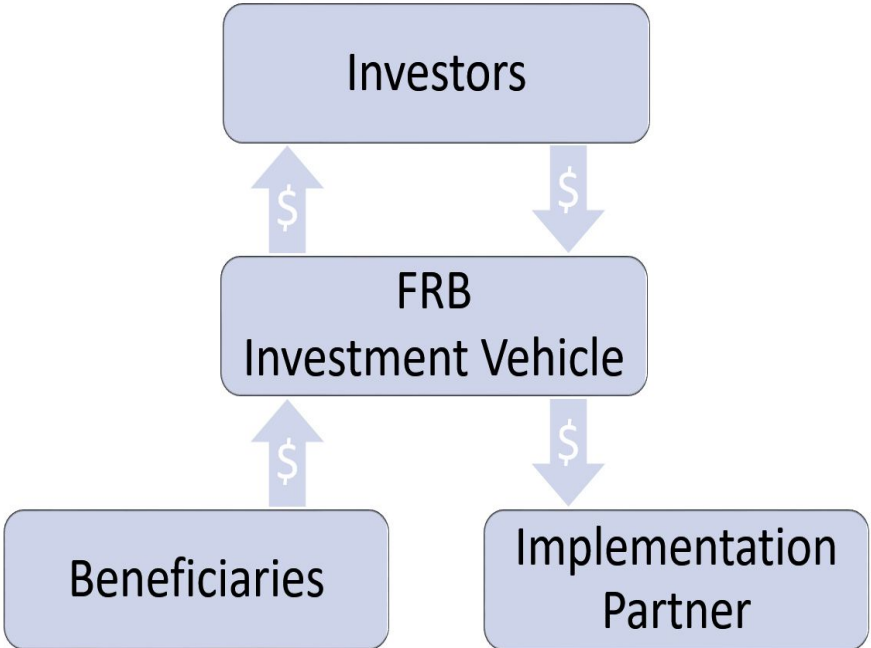


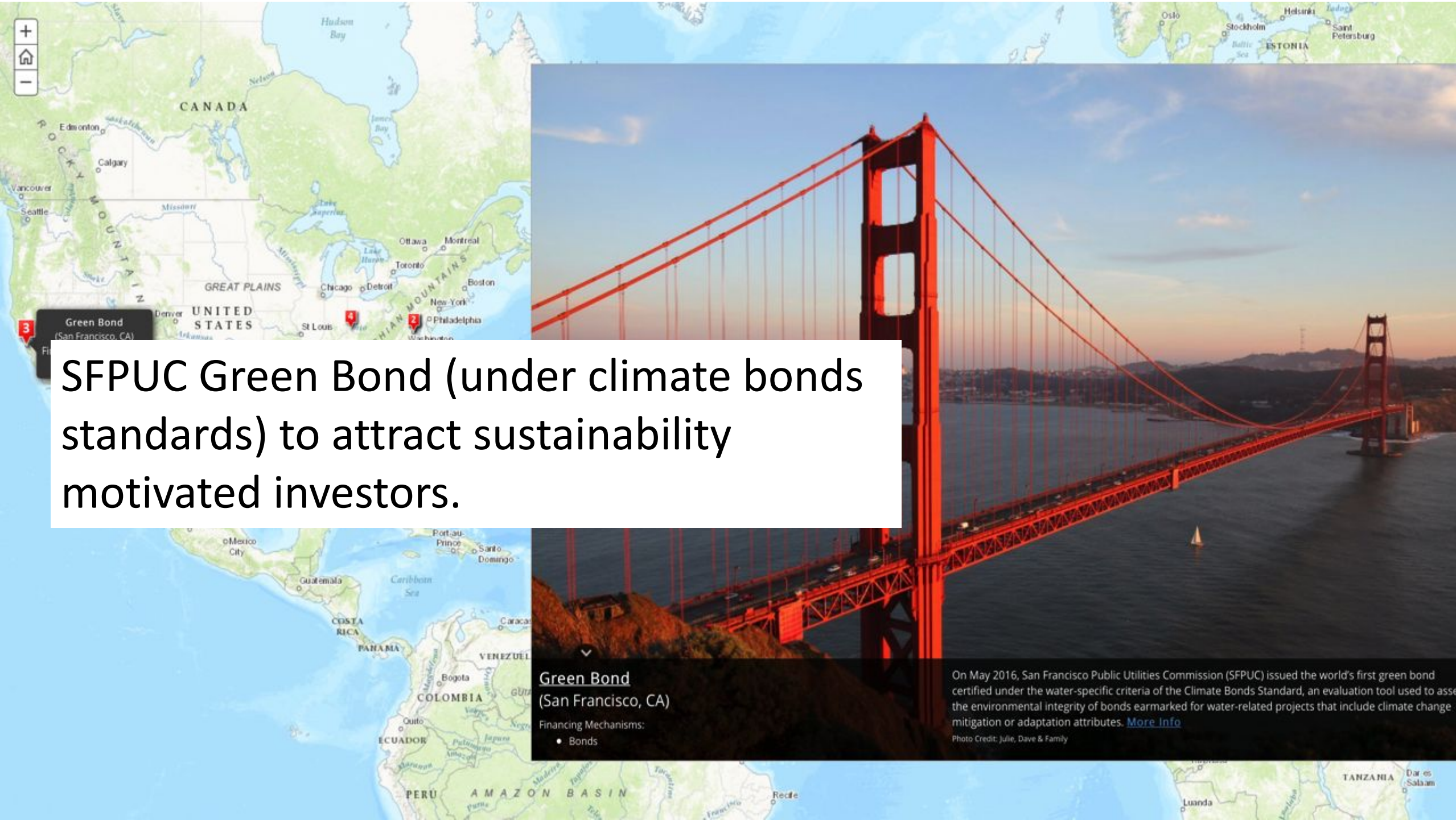
Forest Resilience Bond

- Aggregation of funds to reduce cost and risk to each investor
- Identified beneficiaries

Primary Beneficiaries and Performance Criteria

US Forest Service	Water Utilities & Dependent Companies	Electric Utilities	State Governments





SFPUC Green Bond (under climate bonds standards) to attract sustainability motivated investors.

Green Bond
(San Francisco, CA)

- Financing Mechanisms:
- Bonds

On May 2016, San Francisco Public Utilities Commission (SFPUC) issued the world's first green bond certified under the water-specific criteria of the Climate Bonds Standard, an evaluation tool used to assess the environmental integrity of bonds earmarked for water-related projects that include climate change mitigation or adaptation attributes. [More Info](#)

Photo Credit: Julie, Dave & Family

Major barrier to access alternative capital:
Lack of *multi-sector performance metrics*
for natural systems

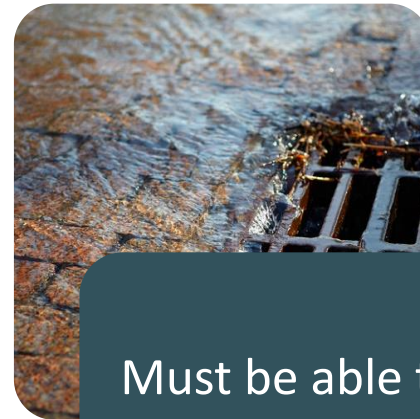
Innovative Performance Matrices for Natural System



Green infrastructure is critical for future water management



Financing is a significant barrier to implementation





Must be able to prove performance of natural systems



Develop multi-sector performance metrics for financing

Case Study Locations

Case Studies

-  International
-  Domestic



Conceptual Model Outline



Social Measures in Performance Metrics

- Reduction in urban heat island effect
- Increase in household participation and environmental awareness
- Increase in value of property/city
 - % increase in residential property values, % decrease in tenant turnover
- Increase in quality of life, including mental health benefits
 - % increase in urban neighborhood property values]
- Increase in educational value
- Improvement to Health and Safety Risk Index (HSRI) and decrease in crime rate
- Increase in recreation use [user days]
- Increase in community gathering spaces and events
- Increase in community willingness to pay
- Reduction in unemployment rate
- Increase in street tree canopy
- Increase in transportation options
- Increase in access to cleaner air/water
- Increase in food production
- Decrease in odors

Food for Thought

- Enact policies and economic forces to drive change
 - Portfolio standards, demand-side management and pricing
- Establish more innovative funding solution Green banks, impact investment, CBPPP and on-bill financing
- Mobilize non-government/private capital
- Utilize a diverse financing strategy to minimize risk and increase economic potential

Food for Thought

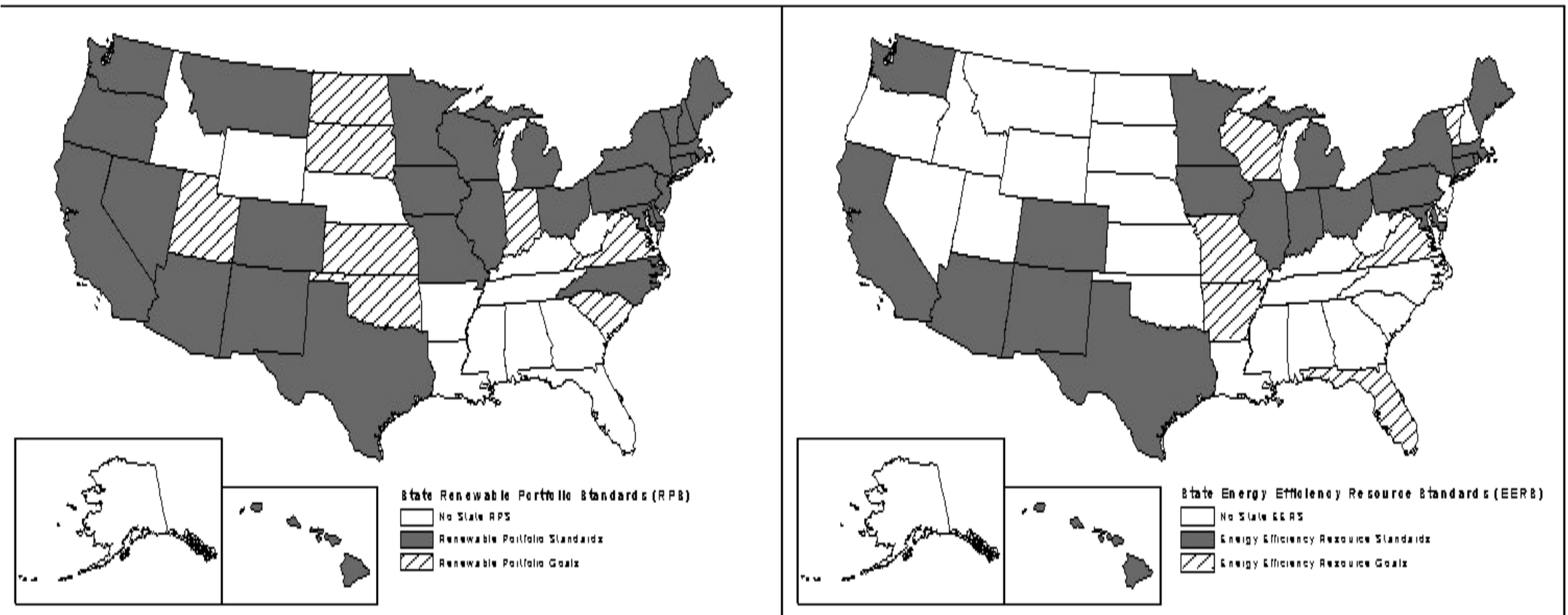
- Cost Sharing and customer-based financing can be an *enabler* at every scale
 - Developer, end-user, communities and municipalities
- Develop innovative multi-sector performance measures

Thank you

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Living Map: <http://arcg.is/2onr2Do>

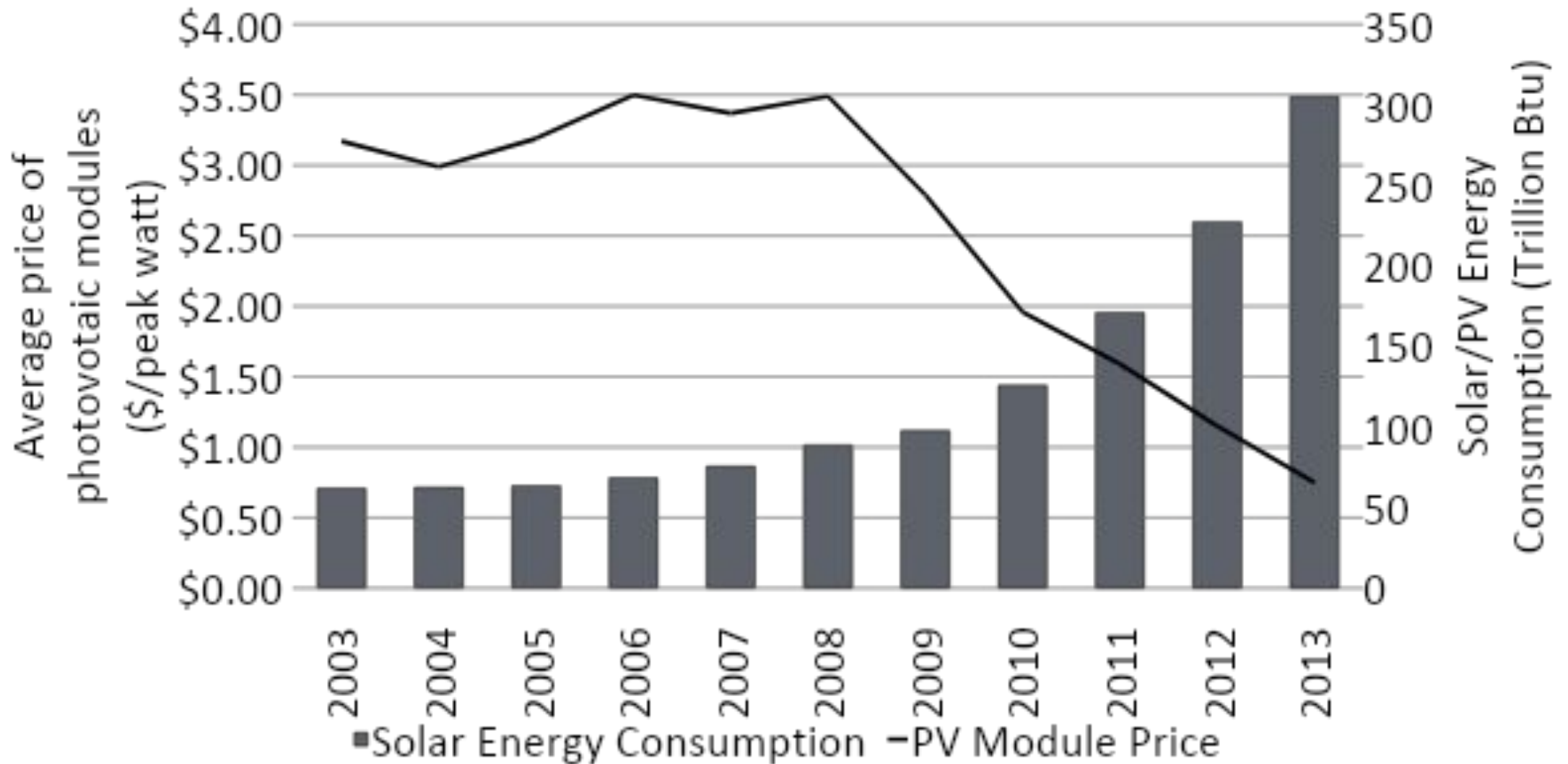




State-level renewable portfolio standards (RPS) and energy efficiency resource standards (EERS) in the United States

Data Source: North Carolina Solar Center 2016

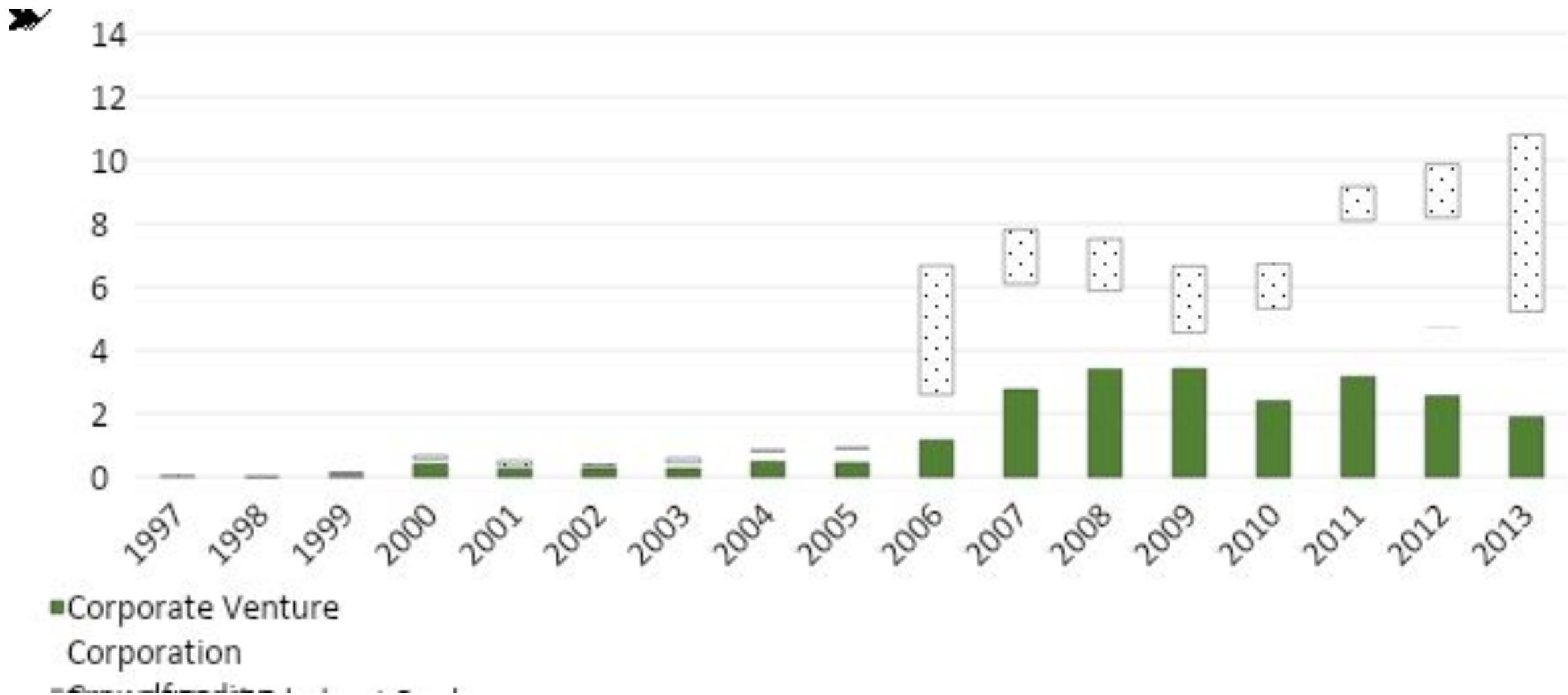
Quesnel, Ajami, and Wyss, 2017. *Env. Mgmt.*



Solar Energy Module Price and Consumption in the United States

Data Sources: U.S. Energy Information Administration 2016a; U.S. Energy Information Administration 2016b

Note: Price not adjusted for inflation



U.S. private investment in clean energy

Data source: Cleantech Group 2014

Quesnel, Ajami, and Wyss, 2017. *Env. Mgmt.*

Paradigm Shift in the Water

Sector

- Big data
- Information Technology
- Modern platforms and decision making tools
- Innovative Financing Mechanisms

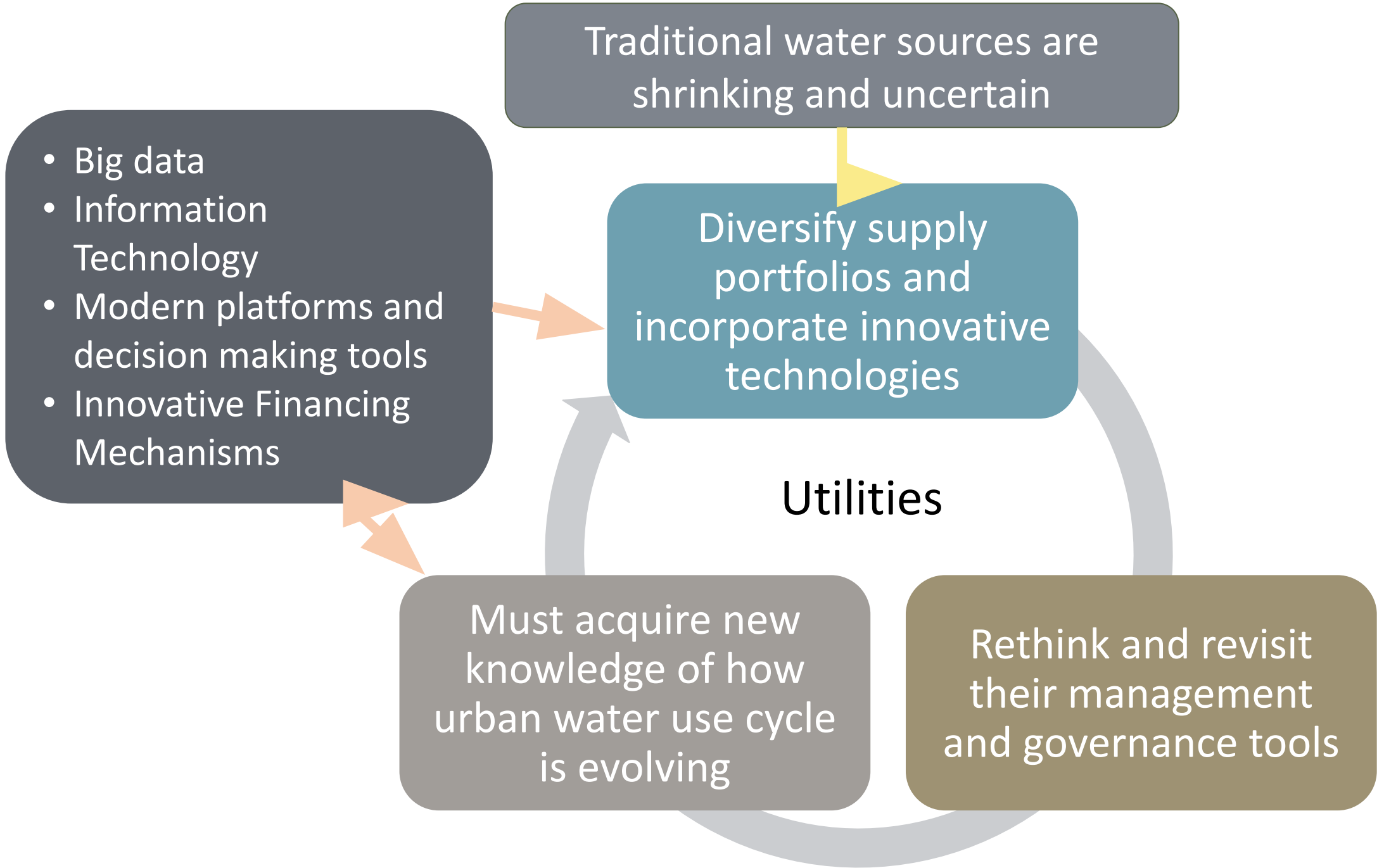
Traditional water sources are shrinking and uncertain

Diversify supply portfolios and incorporate innovative technologies

Utilities

Must acquire new knowledge of how urban water use cycle is evolving

Rethink and revisit their management and governance tools

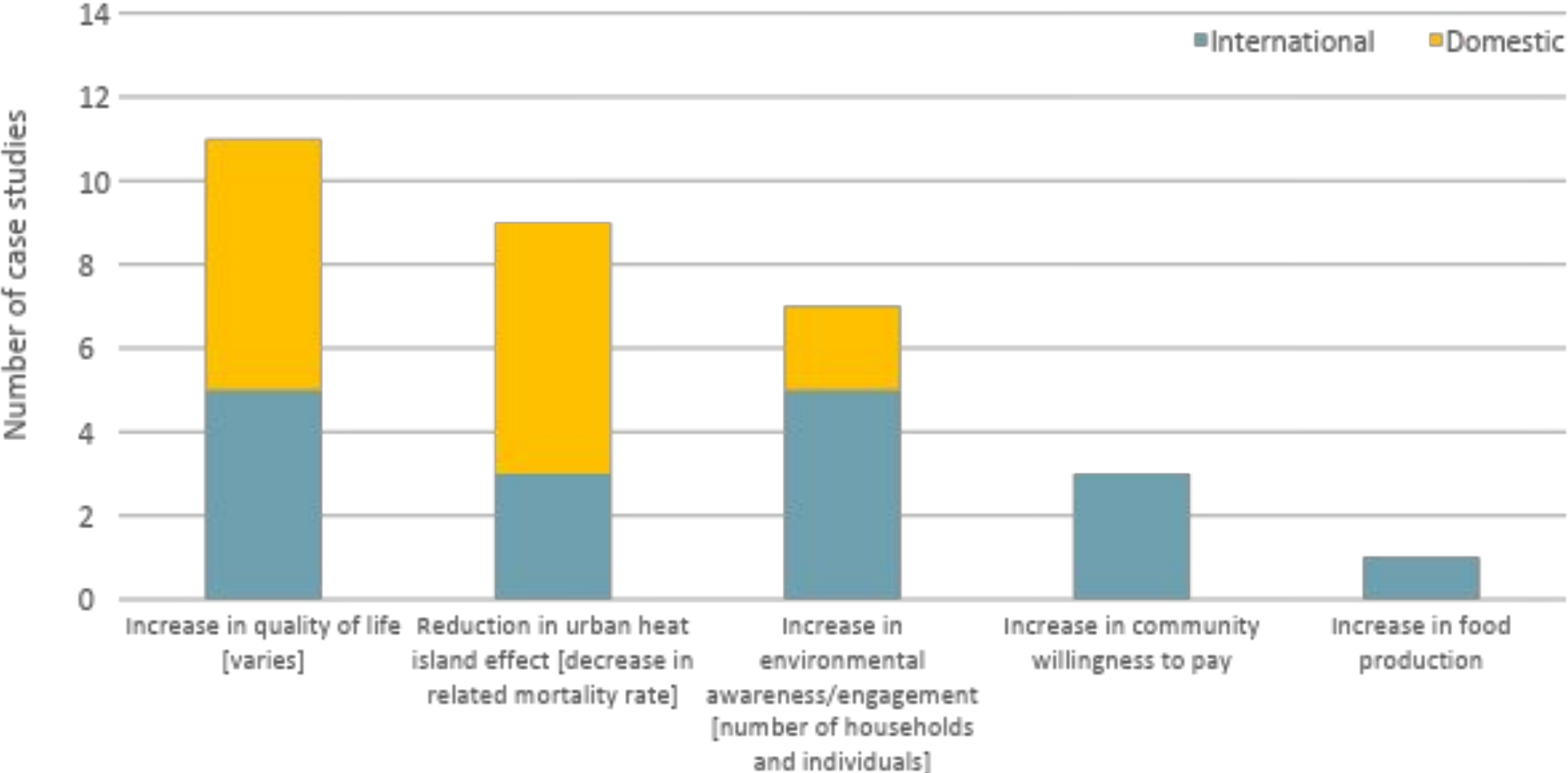


Distributed Water Systems

- Flexibility
- Resiliency
- Reliability

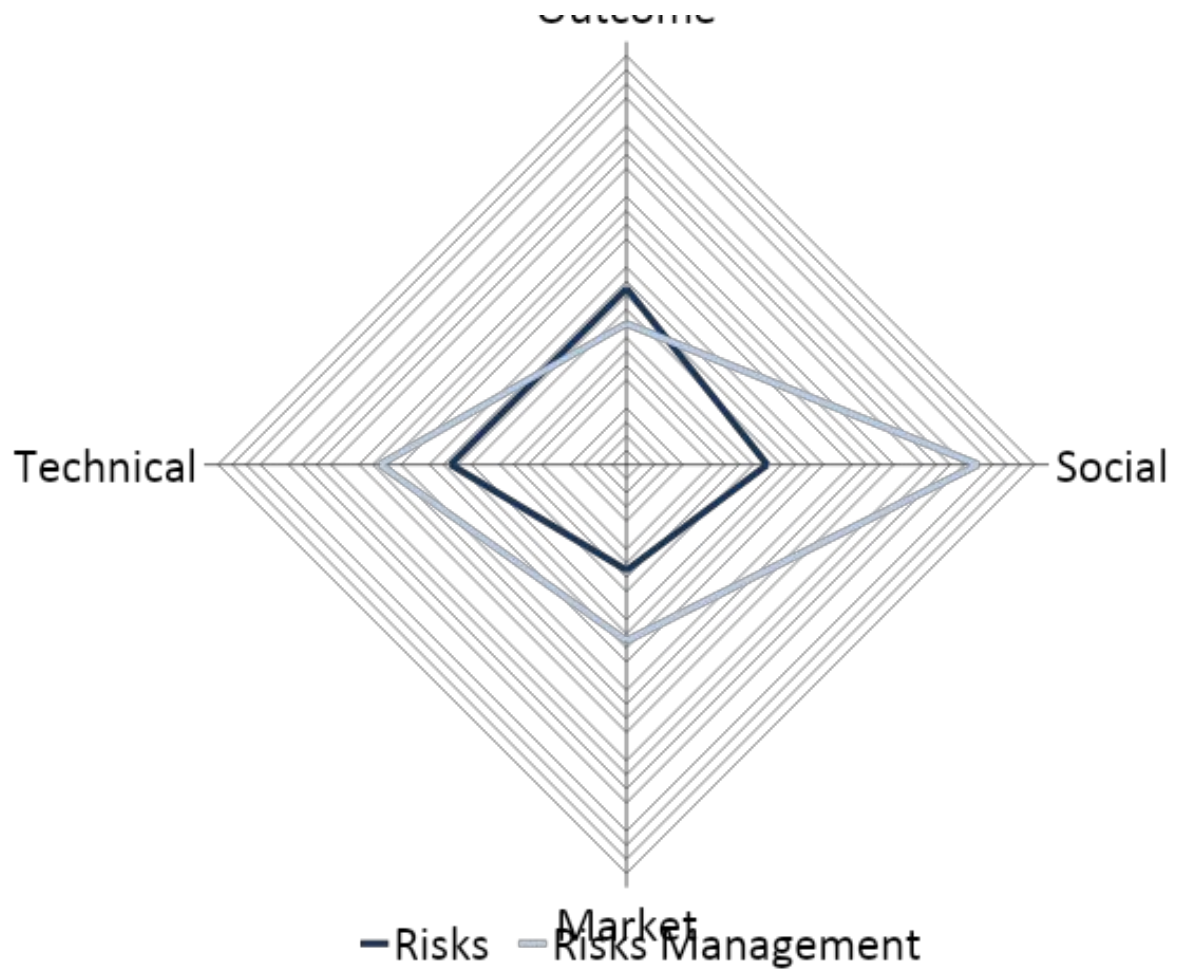


Social Element of Performance Metrics Results

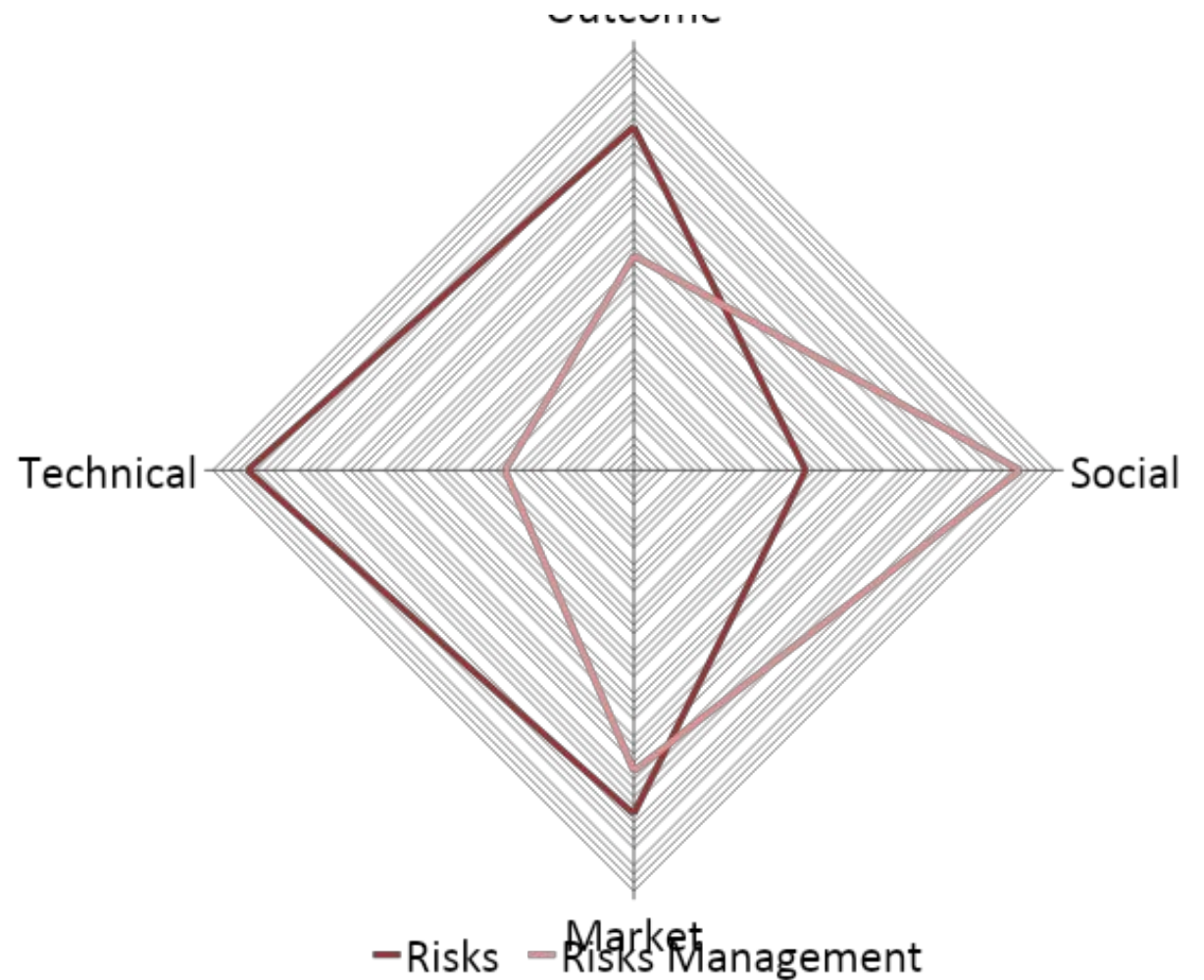


Risk and Risk Management Analysis

Domestic



International



Food for Thought

- Enact policies and economic forces to drive change
 - Portfolio standards, demand-side management and pricing
- Establish more innovative funding solution
 - Green banks, impact investment, on-bill financing and net-metering
- Utilize a diverse financing strategy to minimize risk and increase economic potential
- Cost Sharing and customer-based financing can be an *enabler* at every scale
 - Developer, end-user, communities and municipalities

Category	Category Details	Supporting Questions
Project Background	Motivation; Objectives	What catalyzed the decision undertake the project?
Project Logistics	Duration; Cost; Location; Funding Source	<p>What funding sources were used for capital costs?</p> <p>What funding sources were identified for ongoing or projected operations and maintenance costs?</p>
Evaluation Method for Performance Metrics	Type(s)	What was the rationale for selecting the given evaluation method?
Performance Metrics (Environmental, Social, Economic, Technical)	Type(s); Assessment of Actual vs. Potential Impact	<p>What was the rationale for selecting the given performance metrics?</p> <p>What data were collected with respect to the given performance metrics?</p>
Risk and Risk Management	Type(s); Identification; Assessment Method Used; Mitigation	How were financial risks identified and mitigated?

Case Study List

International

Location	Project	Abbreviation
Melbourne, Australia	Little Stringybark Creek	MEL
Brisbane, Australia	Water for Today and Tomorrow	BRI
Glasgow, Scotland	Green Management	GLA
Malmo, Sweden	Urban Stormwater Management Program	MAL
Singapore, Singapore	Active Beautiful Clean (ABC) Water Programme	SIN
Vancouver, Canada	Integrated Rainwater Management Plan	VAN
Berlin, Germany	Biotope Area Factor (BAF) Initiative	BER

Domestic

Location	Project	Abbreviation
Philadelphia, PA	Green City, Clean Waters	PHI
Washington, D.C.	Stormwater Retention Credits Trading Program	WDC
Seattle, WA	RainWise Rebate Program	SEA
Portland, OR	Clean River Rewards Program	POR
Chicago, IL	Combined Sewerage Overflow Management Programs	CHI
Lenexa, KS	Rain to Recreation	LEN
San Francisco, CA	Managing Stormwater Using Green Infrastructure	SF

