United States Environmental Protection Agency

EPA Office of Research and Development

Safe & Sustainable Water Resources Program

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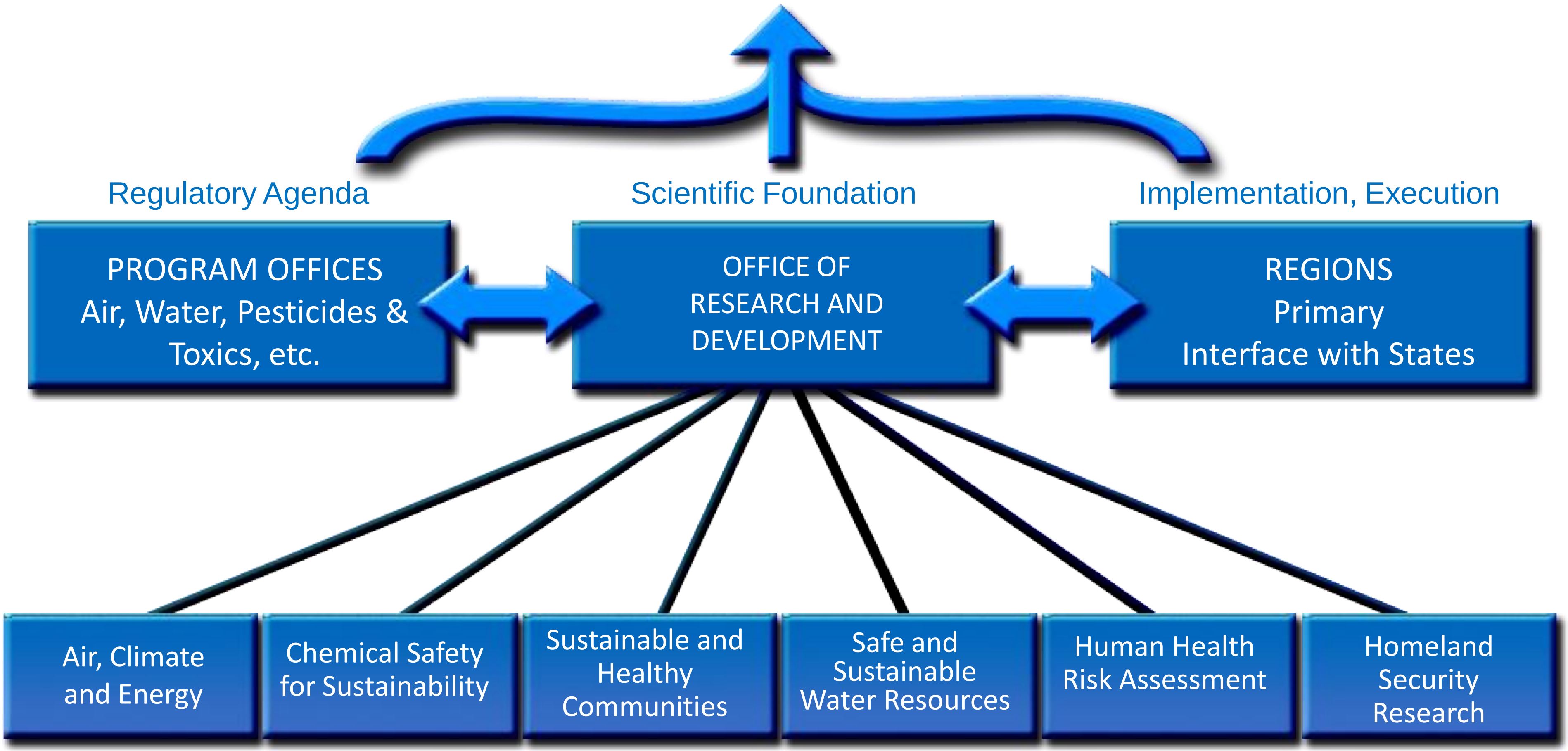
EPA MISSION

Protect human health and safeguard the natural environment – air, water, land – upon which life depends



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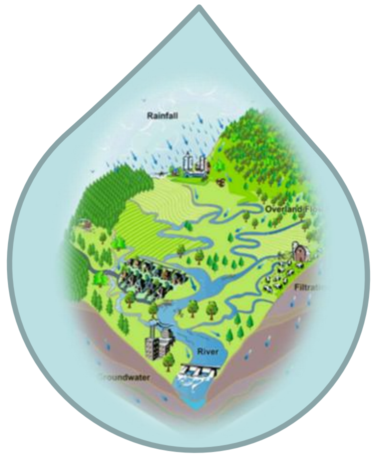
SSWR Goals



SSWR's Goals stem from the realization that water resources are not sustainable using 20th century approaches to address 21st century problems

3 main goals of the research program:

1. Protect public health and the environment
2. Provide safe and sustainable water to meet societal, economic and environmental needs
3. Manage water resources in a sustainable manner, specifically to
    - Integrate wastewater, storm water, drinking water and reclaimed water,
    - Maximize energy production, nutrient & materials mgmt, and water recovery, and
    - Incorporate comprehensive water planning and optimum combinations of built, green and natural infrastructure

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ORIGINS OF THE PROBLEMS

Urbanization
Including:
•Land use management
•Industrial Processes

Population demographics
• aging drinking water and wastewater infrastructure

Non-point source pollution
• Agriculture

MANIFESTIONS OF THE PROBLEM IN THE WATER ENVIRONMENT

Poor Water Quality
•Physical processes (e.g., flow; degraded habitat)

•Loadings: Nutrients, Pathogens, Chemicals, Sediments

Additional stressors:

•Insufficient Water Quantity

•Climate change and variability

NEW FOCUS - Pro-active, Integrated, Sustainable Solutions

SYSTEMS APPROACH TO SOLUTIONS

Theme 1 Sustainable Water Resources

Ensure safe and sustainable water quality and availability to protect human and ecosystem health. Determine the condition of water resources for protection and restoration. Improve management by using a whole watershed perspective.

Theme 2 Sustainable Water Infrastructure Systems

Ensure the sustainability of critical water infrastructure to produce, store and deliver safe and high-quality drinking water, and to provide transport and use-specific treatment of wastewater and stormwater.

SSWR addresses 7 Program Questions Across these 2 Themes

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Q1: What factors are most significant and effective in ensuring the sustainability and integrity of water resources?

Q2: What approaches are most effective in minimizing the environmental impacts of naturally-occurring and anthropogenic contaminants and land-use practices leading to the sustainability of surface and subsurface water resources? (e.g., energy production, mineral extraction and injection activities, agriculture, urbanization)

Q3: What are the impacts of climate variability and changing human demographics on water quality and availability in freshwater, estuarine and coastal aquatic ecosystems?

Q4: What are the most effective and sustainable approaches for maintaining and improving the natural and engineered water system to effectively protects water quantity and quality?

Q5: **How can EPA effectively manage water infrastructure to produce safe and sustainable water resources from source to drinking water tap to receiving waters?**

Q6: What effective systems-based approaches can be used to identify and manage causes of degraded water resources to promote protection and recovery?

Q7: What technical and highly-targeted research activities are needed to support Program and Region Offices?

Expanded two-generational bioassay of an environmentally realistic highly complex mixture of DBPs resulting from chlorination

In vivo reproductive toxicity data evaluating 9 regulated tri-halomethanes (THMs) and haloacetic acids (HAAs) as a mixture and dose-response data were collected for both male and female reproductive/developmental endpoints.

Data can be used by OW to:

- understand dose-response relationships
- establish LOELs and NOELS
- extrapolate from experimental animals to humans
- margin of exposure assessments.

Investigation into techniques to specifically detect viable organisms

Evaluate the use of propidium monoazide as a novel way to distinguish viable from non-viable microbial pathogens in water.

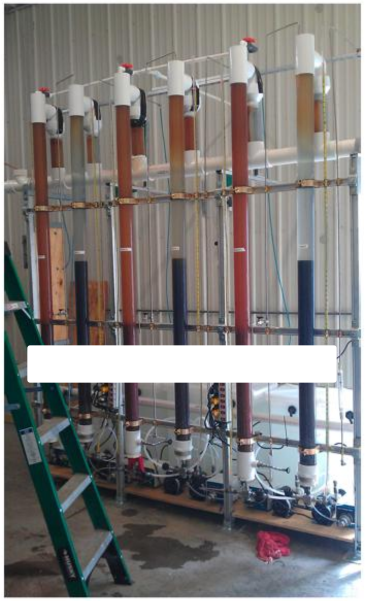
Improved occurrence methods are expected to provide more relevant data for risk assessments and greater certainty and efficiency in interpreting monitoring information from Drinking Water and Recreational Waters, and likely be incorporated into methods used in treatment efficacy studies.

Guidance on the design, operation, and cost of biological treatment systems for removal of chemicals of emerging concern

- ✓ Pilot study that evaluated the effectiveness of biological water treatment for ammonia removal from water to reduce ammonia in water, and the formation of nitrites/nitrates in the distribution system

- ➢ Full-scale demonstration in Palo, Iowa

- ➢ Aerobic and anaerobic pilot systems currently evaluating removal of multiple contaminants (perchlorate, nitrate, bromate, pesticides, DBP precursors, CECs)



Water Infrastructure Research in Progress

- Decision support tools to compare status quo and novel/alternative water service approaches (i.e., for drinking water, wastewater/storm water, water reuse, and conveyance systems) that include economic considerations and allow scaling from small communities to river basins

- Determine under what conditions soil contaminant intrusion from back-siphonage through pipe cracks during low pressure events might occur and identify how sediment re-mobilization in storage tanks is affected by tank design and operation

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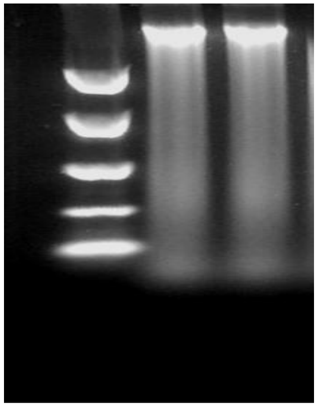
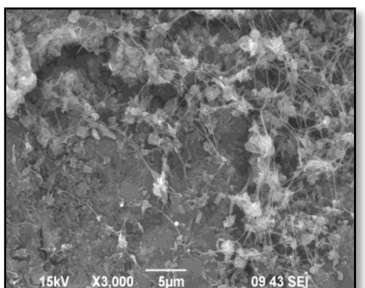
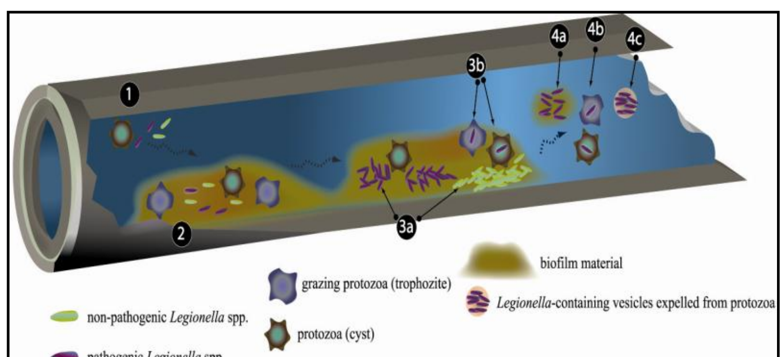
Water Infrastructure Research in Progress





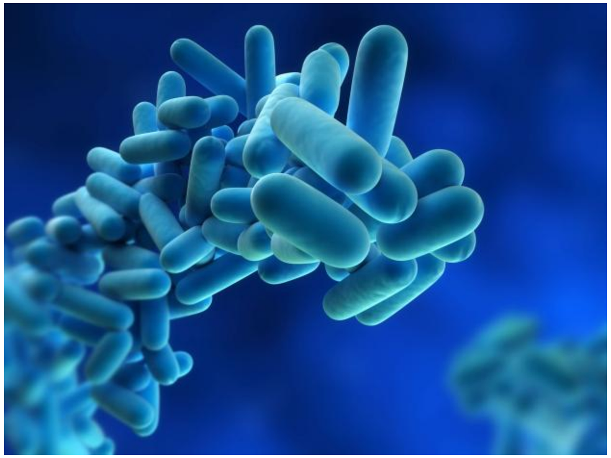
- Impacts of pH, DIC and orthophosphate on lead corrosion
- Impacts of water quality on copper release from plumbing and associated chlorine consumption
- Changes in the microbiology of distributed water treated with free chlorine versus monochloramine using a metagenomic approach in small and disadvantaged systems
- Changes in pipe biofilm community structure with conversion from free chlorine to monochloramine



Water Infrastructure Research in Progress

- Develop methods to evaluate human health risk to groups of contaminants, such as those encountered during extreme weather events and combined sewer overflows and risks associated with urban water infrastructure.

- Develop a small scale adenovirus method for use as an indicator and/or a Legionella method optimized for storage tank studies.



Water Infrastructure Research in Progress

- National database structure for life-cycle performance assessment of water and wastewater rehabilitation technologies (Retrospective)
  - ➢ Water utility managers – are these technologies better based on performance and cost than the traditional approaches?
  - ➢ Track performance variations that may occur due to climate, effluent chemistry, etc.

- A new pipe leak detection platform based on networking of economic acoustic and pressure sensors coupled with robust signal processing and data mining technologies

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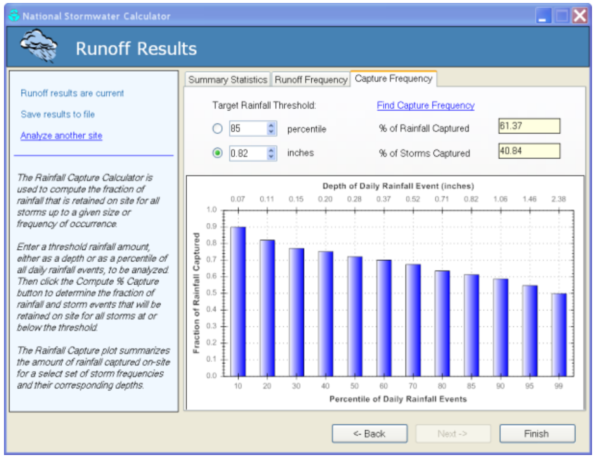
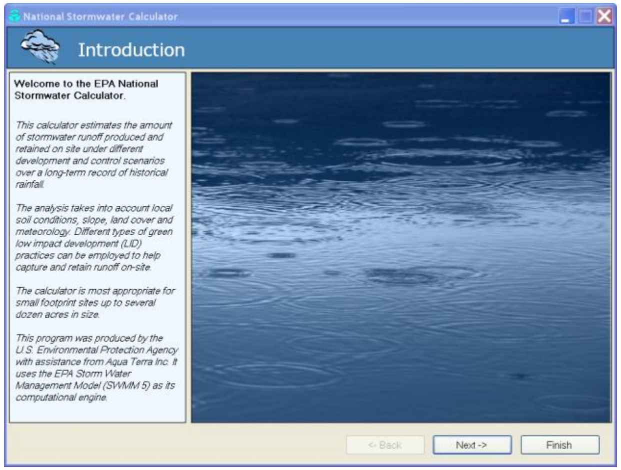
Site-Based Stormwater Calculator

based on SWMM

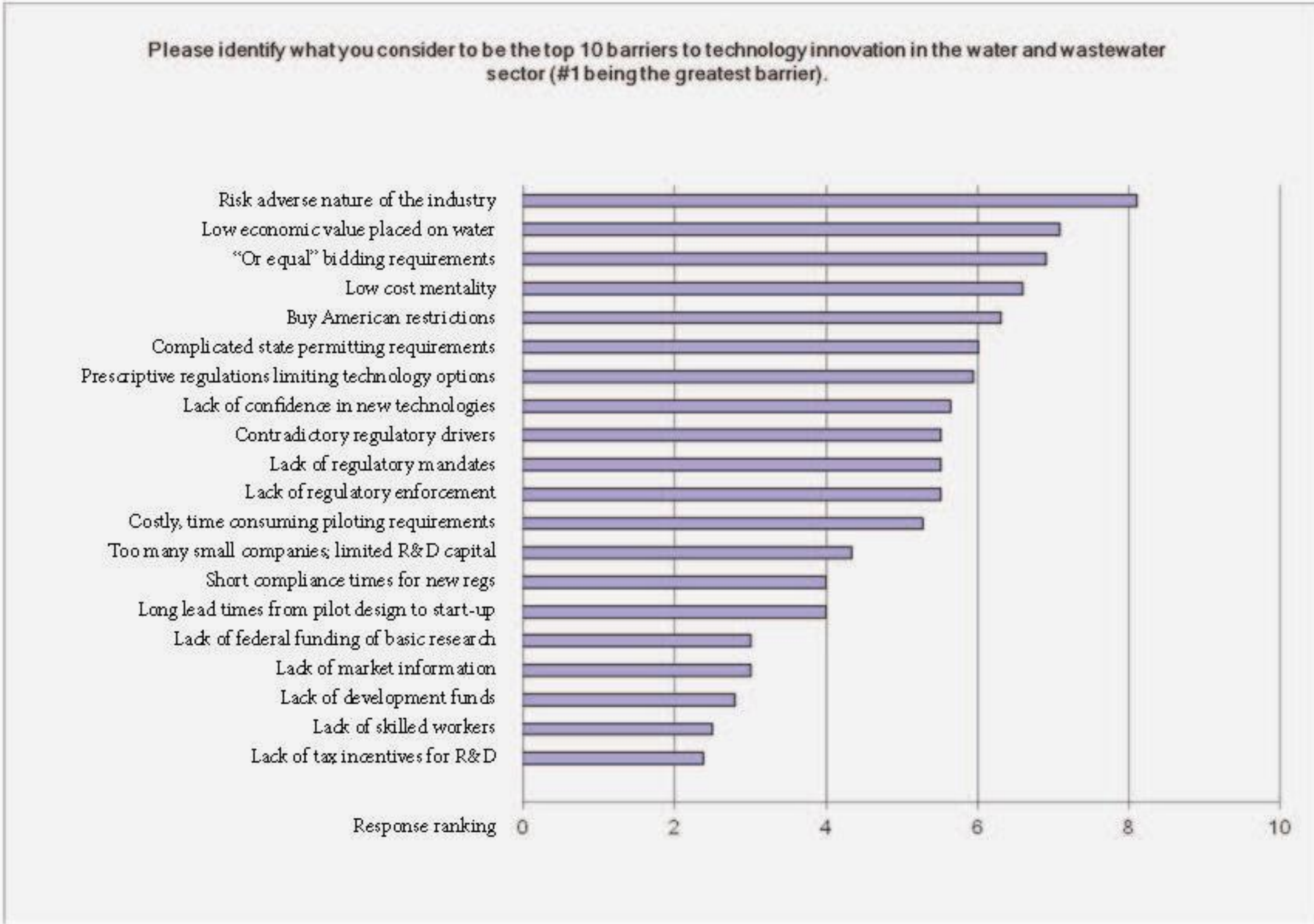
- Stormwater calculator relies on SWMM model in background, easy to use.
- Developers and local planners estimate how much stormwater will run off their property (under development) with various green infrastructure/low impact development plans.
- Focus on stormwater runoff before it gets into sewer systems, unlike the larger scope and spatial scale of SWMM.
- The stormwater calculator is undergoing external peer review, and will publicly available soon.





Green Infrastructure
Best Management Practices (BMP) Performance Monitoring

- Monitoring of GI BMPs such as permeable parking lots and rain gardens (O&M, long term performance) and stream restoration (storm water and nutrients)
- Edison, NJ EPA facility: permeable parking lots, rain gardens
- Data from GI BMPs are used to inform the development and evaluation of stormwater modeling tools (e.g., SWMM)


Please identify what you consider to be the top 10 barriers to technology innovation in the water and wastewater sector (#1 being the greatest barrier).
Risk adverse nature of the industry
Low economic value placed on water
"Or equal" bidding requirements
Low cost mentality
Buy American restrictions
Complicated state permitting requirements
Prescriptive regulations limiting technology options
Lack of confidence in new technologies
Contradictory regulatory drivers
Lack of regulatory mandates
Lack of regulatory enforcement
Costly, time consuming piloting requirements
Too many small companies; limited R&D capital
Short compliance times for new regs
Long lead times from pilot design to start-up
Lack of federal funding of basic research
Lack of market information
Lack of development funds
Lack of skilled workers
Lack of tax incentives for R&D
Response ranking
0
2
4
6
8
10