
NOW-R²: Identifying Priority Research Questions for Onsite Wastewater Recycling Research

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Why Horizon Scanning?

What are the world's biggest issues?

Who is going to solve them?

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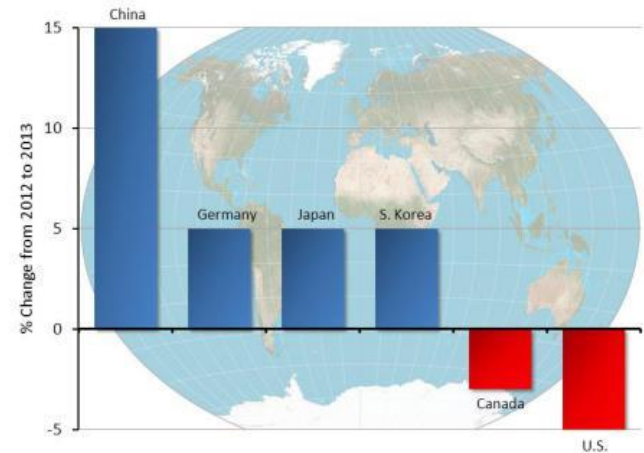
The 20 big questions in science

From the nature of the universe (that's if there is only one) to the purpose of dreams, there are lots of things we still don't know – but we might do soon. A new book seeks some answers

Hayley Birch, Colin Stuart and Mun Keat Looi
The Observer, Sunday 1 September 2013



Scientific R&D Spending



Source: Cell, 2013 Jul 3;154(1):16-9.

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NATURE | COMMENT

Policy: Set research priorities in a time of recession

Patrick Cunningham¹

23 October 2013

Rigorous analyses are needed to establish the benefits of the knowledge economy, says former

Previous Examples: Global Horizon Scanning Project

- The Global Horizon Scanning Project aims to identify important and timely environmental quality research needs
- Research questions identified, if answered, would markedly advance toward more sustainable environmental quality over the next decade
- Unique partnership with SETAC (and ACS ENVR and AGRO Divisions in NA)



Global. Transparent. Inclusive. Multidisciplinary. Multisector.

Previous Examples: Understanding Needs, Challenges, Opportunities, Vision and Emerging Roles in Environmental Health



What are the key challenges and opportunities facing environmental public health practitioners?

What are the Key Research Needs for Onsite Wastewater?



Needs for Onsite Wastewater Recycling Research

Unique Partnership with NOWRA

Steering Committee with Diverse Representation

Followed established survey and workshop synthesis methods

Phase 1: Survey

- input from hundreds in business, government, academic, NGOs

Phase 2: Synthesis workshop at 2021 Mega-Conference in San Marcos



Identifying Key Research Questions

- Address important gaps in knowledge
- Be answerable through a realistic research design
- Have a factual answer that does not depend on value judgments
- Cover a spatial and temporal scale that could realistically be addressed by a research team (e.g., \$5-10M over 5 years)
 - Not a PhD thesis. Not a “moonshot”.
- Not be answerable by “it all depends” or “yes” or “no”
- If related to impact and interventions, should contain a subject, an intervention, and a measurable outcome

We asked professionals two questions...

What technical scientific research question (e.g., innovation, design, resiliency, resource recovery), if answered, would substantially advance the science of decentralized wastewater over the next decade?

What environmental management (e.g., science-policy, implementation, enforcement) research question, if answered, would substantially advance the practice of decentralized wastewater over the next decade?

33 Priority Research Questions Identified Across Six Themes

Treatment, Performance and Resource Recovery

How can we develop onsite systems that can be implemented and interfaced within broader circular economy/food-energy-water nexus efforts, while maintaining effectiveness and reliability across different economic conditions and geographic regions?

Treatment, Performance and Resource Recovery

How can we develop effective, efficient and economically viable treatment approaches with resource recovery (e.g., nutrients, septage, water) for diverse beneficial reuse applications?

Treatment, Performance and Resource Recovery

How can we identify and develop interventions for failing systems (e.g., due to diverse reasons) that are smaller, more affordable, scalable and user friendly, particularly given current funding inequities?

Treatment, Performance and Resource Recovery

How can we adapt, develop and validate robust treatment approaches, which are effective for diverse constituents (e.g., PFAS, PPCPs, QACs, FOG), for various water reuse applications (e.g., fit for purpose)?

Treatment, Performance and Resource Recovery

How does soil characteristics and heterogeneity influence design, efficacy and reliability, particularly with influences of lot size (e.g., planning, zoning), climate, geomorphology and waste stream diversity (e.g., PFAS, QACs, PPCPs)?

Resiliency, Efficacy and Sustainability

What innovation is needed related to onsite systems to increase effluent quality and social acceptance for water reuse?

Resiliency, Efficacy and Sustainability

Can we demonstrate how to implement onsite system to enhance resiliency considering climate change, natural disasters and economic challenges?

Resiliency, Efficacy and Sustainability

Can we evaluate and innovate for the variability in performance achievable with decentralized treatment systems?

Resiliency, Efficacy and Sustainability

What innovation is needed related to onsite systems to increase effluent quality and social acceptance for water reuse?

Resiliency, Efficacy and Sustainability

How could sensors improve integration,
sustainability, affordability and management?

Environmental Quality and Public Health

What is the quantifiable role and relative contribution of decentralized waste water compared to other contaminant sources on water quality?

Environmental Quality and Public Health

What are the public health, environmental, social, and economic impacts of failing systems?

Environmental Quality and Public Health

How does climate or extreme weather impact operation and performance of decentralized wastewater management systems infrastructure?

Environmental Quality and Public Health

What water quality parameters are an appropriate risk reduction for various reuse applications?

Environmental Quality and Public Health

What is the contribution of emerging contaminants (e.g., PFAS) from onsite waste water sources to groundwater contamination in the US?

Implementation

How does maintenance, regulations and enforcement influence the effectiveness of systems?

Implementation

How can more consistent regulations be developed and implemented across the US?

Implementation

Which incentives are effective for better onsite wastewater installation and management?

Implementation

What are economical effective solutions for septage treatment?

Implementation

What data and case studies of reuse can be gathered and consolidated to aid in implementation?

Implementation

How do you develop regional asset management to decentralize to individual and cluster sustainable solutions and make responsible management economically viable?



Needs for Onsite Wastewater Recycling Research

Next steps...

Preparing manuscripts for publication

Dissemination of findings key stakeholders, funders