

ARPA-E Energy from Wastewater

Breakout Group #4 - Translation into Practice: Metrics, outcomes, piloting, barriers and solutions

Group 2: Barriers to adoption and solutions needed for translation of technologies into practice

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What are the institutional, commercial, and legal risk barriers for adoption of new water technology (for the user, technology provider, design engineering firms)?

- Don't have a good plan for desired cost and performance metrics
 - Tough to balance risks correctly
 - Don't get a true indication of the costs
 - Lack of full cost accounting
 - Need cost and performance data at scale to lower adoption risk costs
 - GAP NEEDS TO BE CLOSED FROM LAB TO SCALE (to beat out the risk)
 - MAKE CORRECT METRICS
 - MAKE SURE THE METRICS ARE COLLECTED
- Investors need this info to evaluate opportunity and risk (although risk is OK for investors)
 - Basic research doesn't have enough thought about applicability
 - Example: cost for removal of endocrine disruptors would require regulation to force it
- Must be strategic “sweet spot testing”
 - Data must be comparable or it can be useless – can't tell why or why not it works
 - Also test must be independent or it may be suspect – this raises the risk if the vendor is the tester
- Need trusted independent evaluation that reflects industry challenges, i.e. representative plant test sites that capture variables in input conditions
 - Lot of technologies that don't have testing that truly value performance Edmonton Centre for Excellence will do the third party objective tests
 - American Water, too
 - Too often the tests are not real world or multiple situations reduces certainty of the tests

- Singapore approach offers “lessons learned”
 - Independent advisory panel vets projects
 - Funding to companies that set up locally
 - “X” prize for desal technology at 1.5 kWhrs/c3m
- Need an array of test sites that might need to be used with a system already in place
 - Take lessons from other federal approaches and create 4,5,6 places for independent assessments
 - what they need where they do it
 - work it out with EPA to help accelerate
 - Get a smart panel to identify best test facilities
 - Orange County does it, too
 - 10 wastewater firms are sharing the tests
- Consider advisory support of industry expertise to make sure that people get the right kinds of tests to help them take away risk
 - Could ARPA-e facilitate a group like that?
 - IP issues must be considered

- Is there a solution that will not require so much early proof? How to break through but let the municipals enjoy the new technologies
 - Go right at the risk
 - Private: we will take the risk? Unlimited liability? Limited liability?
 - Can the user take capped risk in exchange for some funding benefit (discount) for the cap site?
 - If ARPA e funded a project what would investors need?
 - If the value is big enough the investor will take the risk
 - If it is incremental, then perhaps the 10% advantage is not as appealing
- How do we mitigate for 10x disruptive technologies?
 - Pull in the permitting agency to be a partner in the test
 - EPA's project XL – leading providers could have a safe environment to adapt disruptive technologies, a “soft landing” was assured – what was hard was it was federal to state to local delegation and everyone had to be on board – needs to be resurrected

- Permit-based barriers
 - Even with data you can still be denied
- Company insurance policies don't allow unlimited liability for companies with new technologies
- Water is capital intensive, highly regulated, the perceived market is too small – a niche market- are there investor opportunities? Some considerations from investors...
 - Technologies with applicability for 100mgd can only do rebuilds? Not a good investment
 - Needs to fit within existing wastewater plan? Can it become a \$200 million company?
 - What is the capital payback? If there is only 10 opportunities investor wouldn't touch it. Perhaps a strategic investor would do it for link to market
 - Validate outside wastewater industry
 - Invest in technologies that scale up at lower flows, start with industrial customers and then scale up to municipal agencies – it is 8-9 years
- Barrier is that large municipal require lots of proof and technologies must start elsewhere and then move to municipal.
 - Municipals look at their liability first (and sometimes only)
 - For example, customers would like to see it operating for 5 years
 - Need at least three installations (to make a buy)
 - Must validate without violating permit limits?
 - CAN THERE BE A PERFORMANCE guarantee? To shift the risk away from the plant owner.

What actions are possible that could remove risk barriers to adoption of new water technology with minimal expense?

- Programs in Canada and Europe force researcher to find a partner in industry – if you are going to test and get benefit of prototype
- WERF looks for a proper partner for a new technology
- Methods for mitigating risk
 - Intense “defend and challenge” independent protocol/peer review before any private investment – biggest filter
 - Downstream of that filter a relatively high probability of success
 - Creates alternatives for the provider
 - If you are the first municipality to accept the installation you get 100% paid for, 2nd 80%, 3rd X%
 - Risk from user and provider:
 - User attracted to funding must cap liability for provider
 - Provider can then get insurance for the risk under the cap
- Does it beat out enough risk? Only if it solves a big enough problem?
 - Can it save or generate in North America can it save or generate \$250 million in energy/year? Or no venture money. This is go/no go decision.
 - Must articulate what technology does in specific markets

- Make information available on market size
 - WERF
 - EPA
 - EPA may have economic data
 - But the hard regulations are 30-years old
 - Much of regulation is non-technology parameters
 - Each watershed is unique
 - That data isn't available
- Private sector clients can't be bothered with grants and reporting
 - Lots of gray literature for proprietary purposes
- Prize?
 - Meet this efficiency or this percentage of performance
 - Worked in Singapore
- Is 3 years really long enough?
 - Municipalities take time to be convinced?
 - DARPA says if you can do it a some scalable size, then that's good enough
 - ARPA e identifies five key variables
 - Example reduce aeration by XX%? Each one has a prize and you would get a group of folks going after it – you could buy more expertise
 - Perhaps give them a grant to get going for phase 1 or 2 and then go to the prize – and put more money in the ones doing well
 - Perhaps small size firms could qualify for grants to help compete against big firms



- Can the scientist access groups that are already working with the utility to better tie the research to the reality
- ARPA e needs to coordinate with WEF, WERF, Water Reuse etc. to find partner municipalities?
 - Write it in a way for WEF, WERF to work together
 - Coordinated with other organizations
 - Make it a requirement
 - If we go project to project it will take years to pull off (guidance can take forever)

What role can the US and state governments play in mitigating new technology risk?

- Become customers via procurement
 - If a government entity wants to be a technology leader they need to buy the new technologies that are emergent
- Need a continual program that organizes the common goal, the programs, and projects that build upon one another
 - Look to FAA as a model
 - Lessons learned
 - Multiple universities, companies, agencies, etc. can get funded and share research
- Smart funding tied to metrics works in this space
- TARP plan for ARPA-e
 - ARPA-e puts in \$20 million, it works, we want our money back with interest
 - May not work with the current program authorization
 - Providers would probably just want the money
 - Would create a sustainable fund that keeps the investing going
- Innovation in the State Revolving Loan Fund programs?
 - Lots of money flowing already
 - 20% green infrastructure for ARRA money
 - Why not create a selection factor for innovation?
 - Some SRF don't include life cycle costs and makes it harder
 - Very disconnected state to state and case worker to case worker

- What about subsidy for full-scale demonstrations to utilities?
 - East Bay MUD would pay some portion? What portion to take that risk?
 - Would be hard to do at full scale – especially in three year turn-around
 - Could be second element – letters of intent – to get an idea of future full scale projects that could come in next phase
 - With five 10x opportunities you have...
- Do scale at small enough to afford it but large enough that it could scale up “right scale”
 - Have money set aside to do that
- ARPA-e needs broad objectives
 - Need to evaluate a broad range of performance metrics
 - Peer review process – perhaps the peer review is along the way
- Seed strategy, demo strategy
 - Set a stretch target that people can hone in on
 - Then follow on with demo

What factors must be considered for the implementation of any new wastewater treatment/energy generation technologies?

- Does it involve main stream or side stream?
- How does it fit within the local power company?
 - Are there buy requirements of local power supply?
- Would the reduction of effluent flows have downstream impacts?
 - Another kind of “unintended consequences”
- If you reduce biosolids you may have additional air emissions?
- Take the lead on coordinating the external affects of the permitting and help get permit coordination could delay permits?
 - Create a template
 - Create the linkages now?
 - Streamline permitting arm of ARPA-e?
 - Build a concerted cooperative effort for permitting?
 - Role for associations in helping, too.
- For breakthrough technologies, you will fail if you cannot figure who’s responsibility will it be help it get done?
 - Our success is less technology than
 - Limitations on implementing technology are multi-faceted
- If better bugs, better membranes that are better at generating energy, will there be permit issues?
 - Can you accelerate permitting processing if it saves more or less energy?
- Permit writer in state EPA will determine success of project
 - Must teach that permit writer show where rubber hits the road
 - Talk to the various players that starts tomorrow
 - This is different for DOE approaches



Consider systems of different form factors, sizes, etc. What would be ideal, and why? Are there any known constraints on these considerations?

What would be the advantages to having the technologies be decentralized or all together at a central plant?

- Are there additional barriers for distributed installations?
- Integrated decentralized
 - Satellite plants, optimized
- Decentralized can connect to the electrical grid at various places
- Newer systems need to be compatible with integrated decentralized