PUBLIC VERSION

IMMEDIATE REPORT

Volume 1 - FINAL

Brazil Water/Wastewater Energy Efficiency Reverse Trade Mission (RTM)

As part of the

Brazil: Clean Energy Exchange Program RTM Series

(USTDA Activity No. 2014-51006A)

For the

U.S. Trade and Development Agency (USTDA)

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Acronyms	
ABCON	Associação Brasileira das Concessionárias – Brazilian Association of Concessionaires
ABES	Associação Brasileira de Engenharia Sanitária E Ambiental – Brazilian Association of Sanitation and Environmental Engineers
ABNT	Associação Brasileira de Normas Técnicas – Brazilian Association of Technical Norms
AEAI	Advanced Engineering Associates International, Inc.
AMI	Advanced Metering Infrastructure
ANAMOX	Anaerobic Ammonium Oxidation
ANSI	American National Standards Institute
AWWA	American Water Works Association
BOT	Build–operate–transfer
BTU	British thermal unit
CAB*	CAB Ambiental
CAESB*	Companhia de Saneamento Ambiental do Distrito Federal
CAGECE*	Companhia de Água e Esgoto do Ceará
CAPEX	Capital Expenditure
CEC	California Energy Commission
CEDAE*	Companhia Estadual de Águas e Esgotos
CETESB	Companhia de Tecnologia de Saneamento Ambiental (became Companhia Ambiental do Estado de São Paulo) – Sao Paulo Environmental Sanitation Company
COMPESA*	Companhia Pernambucana de Saneamento
CPUC	California Public Utilities Commission
CWA	Clean Water Act
DBO	Design-Build-Operate
DBO/O	Design-Build-Operate/Operate
DC	District of Columbia
DCU	Data Collection Unit
DOC	U.S. Department of Commerce
EBMUD	East Bay Municipal Utility District
EE	Energy Efficiency
EMBASA*	Empresa Baiana de Águas e Saneamento S.A.
EPA	U.S. Environmental Protection Agency
EPC	Engineering, procurement and construction
Ex-Im Bank	Export-Import Bank of the United States
GCC	Global Climate Change
GDP	Gross Domestic Product
GE	General Electric

Acronyms	
GMI	Global Methane Initiative
hp	Horsepower
HVAC	Heating, Ventilation, and Air Conditioning
IAPMO	International Association of Plumbing & Mechanical Officials
IDB	Inter-American Development Bank
IE	International Efficiency Class
IIC	Inter-American Investment Corporation
INMETRO	Instituto Nacional de Metrologia, Qualidade e Tecnologia
ITA	International Trade Administration
IWA	International Water Association
JCI	Johnson Controls Inc.
kWh	Kilowatt-hour
LAC	Latin America and Caribbean
M	Manual / Million
MGD	Million Gallons Per Day
MTU	Meter Transmission Unit
MW	Megawatt
NCC	Network Command Center
NEI	National Export Initiative
NEMA	National Electrical Manufacturers Association
NIST	National Institute of Standards & Technology
NTU	Nephelometric Turbidity Units
O&M	Operation and Maintenance
OAS*	OAS Soluções Ambientais
OPEX	Operational Expenditure
OPIC	Overseas Private Investment Corporation
PLANSAB	National Sanitation Plan for Brazil
PLC	Programmable Logic Controllers
PPP	Public–private Partnership
PRV	Pressure reducing valves
PVC	Polyvinyl chloride
Q&A	Questions and Answers
RE	Renewable Energy
REC	Renewable Energy Credit
RO	Reverse Osmosis
rpm	Revolutions per minute
RTM	Reverse Trade Mission

Acronyms	
S.A.	Sociedade Anônima (corporation)
SABESP	Companhia de Saneamento Básico do Estado de São Paulo
SANEAGO*	Saneamento de Goiás S.A.
SANEPAR	Companhia de Saneamento do Paraná
SCL	Seattle City Light
SEL	Schweitzer Engineering Laboratories
SINDCON	Sindication Nacional das Concessionárias
Solvi*	Solvi Saneamento - Sanitation/Water Division
SDWA	Safe Drinking Water Act
TWh	Terawatt-hour
TX	Texas
U.S.	United States
UFW	Unaccounted For Water
USG	U.S. Government
USGS	U.S. Geological Survey
USTDA	U.S. Trade and Development Agency
UV	Ultraviolet
VA	Virginia
VFD	Variable Frequency Drives
VOC	volatile organic compound
W and WWT	Water and Wastewater Treatment
W/WW	Water/Wastewater
WAPA	Western Area Power Administration
WEF	Water Environment Federation
WEFTEC	Water Environment Federation's Annual Technical Exhibition and Conference
WERF	Water Environment Research Foundation
WTF	Water Treatment Facility
WTP	Water Treatment Plant
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

*Brazilian company participating in delegation.

Acknowledgments

This report was prepared by Advanced Engineering Associates International, Inc. (AEAI), an Indefinite Quantity Contract (IQC) holder of the U.S. Trade and Development Agency under USTDA-10-Q-91-888, Indefinite Quantity Contract for Reverse Trade Missions, Conferences, Workshops, Training, and Outreach Activities. This report was written for the Task Order under the referenced USTDA IQC contracted to AEAI under USTDA Activity Number: 2014-51006A, "Brazil Clean Energy Exchange Program RTM Series," of which the "Water/Wastewater Energy Efficiency RTM" was the first activity and subject of this report. The Water/Wastewater (W/WW) Energy Efficiency (EE) RTM took place in and around Washington, DC; Seattle, Washington; and San Francisco, California from May 11 to May 21, 2014.

The principal authors of this report are: Suzanne B. Maia, AEAI RTM Coordinator and Vice President; Dr. Ranjan Ravaliya, Travel and Logistics Coordinator (evaluation section); and subcontractor staff Charles W. Peterson, as Technical Specialist for the assignment.

The authors gratefully acknowledge the guidance and support of USTDA Country Manager Isabel Sepulveda, as well as USTDA Country Representative in Brazil Rodrigo Mota and USTDA Regional Director Nathan Younge, for the implementation of this Activity.

I. EXECUTIVE SUMMARY

Advanced Engineering Associates International, Inc. (AEAI or Contractor) implemented the *Brazil Water/Wastewater Energy Efficiency Reverse Trade Mission (RTM)* for the U.S. Trade and Development Agency (USTDA) from May 11-May 21, 2014. USTDA sponsored 10 delegates, and an additional self-paying delegate from one of the participating Brazilian utilities was included in the delegation, for a total of 11 delegates. The activities under the RTM took place in and around the cities of Washington, DC; Seattle, WA; and San Francisco, CA. There were seven site visits, five meetings held with U.S. companies with export potential, and three thematic roundtables, in addition to a one-day Industry Roundtable encompassing delegate presentations and one-on-one meetings with 18 attending U.S. company representatives. In total, for all RTM activities, there were 75 U.S. participants. The RTM benefitted from five different corporate sponsorships.

The agenda and actual implementation of the RTM appear to have fully met USTDA and delegate expectations and objectives. The agenda provided numerous opportunities for delegates to meet with U.S. providers of products and services that the delegates consider relevant to their projects; to see installations where the technologies and systems of interest are operating; to hear from plant technical and other staff how the systems perform, plans for expansion, additional energy improvements to be done, best practices, physical and regulatory constraints, commercial issues, and customer and political viewpoints; and to learn about industry-wide initiatives and policy/regulatory perspectives from industry associations and government officials.

The Contractor is optimistic on future export sales derived from this RTM based on the post-RTM interactions already pursued by many of the participating U.S. companies, in addition to the delegates' positive observations during the tour and in their evaluations about the concrete areas of interest to them and specific equipment, technologies, services and/or companies they are directly pursuing in the aftermath of the RTM. This observation is also based on delegates' actions to prepare requests to undertake feasiblity studies with USTDA support after the conclusion of the RTM. A rough estimate of the value of potential sales by U.S. companies to the Brazilian delegation's companies, based on evaluation responses for the May 20th Industry Roundtable by U.S. company participants, are summarized in Table 1:

Table 1. Summary of Estimated Sales to Brazil Reported in the Next Three Years[1] (Brazil: Clean Energy Exchange Program – Water/Wastewater EE RTM)

U.S. Company Export Estimates	2014 U.S. Company Evaluation Responses		2015 Evaluation Responses (placeholder for future comparison)	
	# Companies Responding	Value of sales US$MM (range)	# Companies Responding	Value of sales $ MM
Expected Sales	7	US$ 345-693 million		

[1] No specific term for expected sales was referenced in the survey, but the delegates presented opportunities that ranged from about six months from the time of the RTM to three years for their project needs.

II. FINAL ITINERARY

Advanced Engineering Associates International, Inc. (AEAI or Contractor) prepared a preliminary RTM itinerary and subsequent revisions of it in coordination with USTDA, resulting in the final RTM itinerary presented on the following pages. There were also four roundtable agendas prepared for RTM activities, also presented on the pages following the RTM itinerary in the order they occurred. These include the:

- Government Roundtable, held at USTDA on May 12th to launch the RTM;
- Industry Association Roundtable, held at USTDA on May 14th;
- Finance Roundtable, held at USTDA and concluding the Washington, DC segment of the itinerary; and the
- Industry Roundtable, in San Ramon, CA near San Francisco, conducted as a traditional Business Briefing style event.

A description of the roundtables and other RTM activities is provided in Section III.

Presentations from the DC Roundtables and from Site Hosts, as made available, are provided in Attachment 3.

The Brazilian delegates with USTDA and AEAI staff at the May 20th Industry Roundtable in San Ramon, CA
(L to R): R.Ravaliya (AEAI), R. Barretto (COMPESA), L. Fabbriani (Grupo Águas do Brasil), W. Medeiros (SANEAGO), R. Gondim (CAGECE), E. Fernandes (CEDAE), C. Peterson (AEAI), O. Silveira (CAB Ambiental), G. Tannure (CEDAE), H. Bellini (CAESB), C. Silva (EMBASA), G. Dragone (OAS Solucoes), S. Maia (AEAI), H. Yamagishi (Solvi Saneamento), I. Sepulveda (USTDA).

DELEGATE ITINERARY: Brazil Water/Wastewater Energy Efficiency (W/WW EE) RTM May 11-21, 2014					
Day	**Location**	**Morning**	**Lunch**	**Afternoon**	**PM Activity**
May 11, Sunday	Wash., DC (DC)	Arrival of Delegates Hotel Check-in	Lunch	Rest and Relaxation 5:30 p.m. - Meet in lobby to go to dinner	6:00 p.m. - Orientation Dinner
May 12, Monday	DC	**8:00 a.m. - Bus to USTDA** **9:00 a.m. - Government & Regulatory Roundtable** **Host:** USTDA (Business Center) **Participants:** U.S. Environmental Protection Agency, U.S. Department of Commerce, U.S. Trade & Development Agency, Maryland Public Service Commission, District of Columbia Water and Sewer Authority. **Topics:** Regulatory standards; best practices for W/WW utilities in reducing pollution & energy use; waste-to-energy.	12:00 p.m. – Welcome by USTDA Director Zak 12:30 p.m. - Lunch	**2:00 p.m. - Bus to Site** **2:30 p.m. - Site Visit**/Host: Alexandria Renew Enterprise Wastewater Treatment Plant (WWTP). **Topics:** Discuss green energy, EE pumps, drives, SCADA, anaerobic digester gas for energy; & efforts to reduce energy & bio-solids management costs.	Dinner
May 13, Tuesday	DC	**7:30 a.m. - Bus leaves to Baltimore** **9:30 a.m. - Site Visit**/Host: Baltimore City Dept. of Public Works - Back River Wastewater Treatment Plant (WWTP). **Topics:** Energy management practices at the (large) 400 million gallons per day (MGD) WWTP; reduction of energy use in activated sludge; energy savings terms/ outcomes of EE performance contract performance contract with Johnson Controls; anaerobic digesters for sludge reduction & methane gas production; biogas-fired cogeneration plant.	12:00 p.m. - Lunch at site	**2:00 p.m. - Continue** site visit at Back River WWTP Discussions with representative from Johnson Controls (invited) on energy efficiency controls, and/or other technology vendors. **4:00 p.m. - Board bus** for return.	Dinner

DELEGATE ITINERARY: Brazil Water/Wastewater Energy Efficiency (W/WW EE) RTM May 11-21, 2014					
Day	**Location**	**Morning**	**Lunch**	**Afternoon**	**PM Activity**
May 14, Wednesday	DC	**8:00 a.m. - Bus to USTDA** **9:00 a.m. - Industry Association Roundtable at USTDA** **Participants:** American Society of Heating, Refrigerating & Air Conditioning Engineers (ASHRAE), American Water Works Association, National Electrical Manufacturers' Assn., WEF, Water Environment Research Foundation **Topics:** Effective EE & conservation practices in energy &industrial processes at U.S. water/wastewater utilities; power generation; best technologies/practices (controls, pumps, motors, drives, digesters) for energy management.	12:00 p.m. - Lunch at USTDA	**2:00 p.m. - Finance Roundtable at USTDA** **Participants:** U.S. Ex-Im Bank, OPIC, IFC, IDB. **Topics:** Best approaches & financing models available for Brazilian projects utilizing U.S. exported components.	4:00 p.m. – Board bus to airport Travel to Seattle, WA
May 15, Thursday	Seattle	**8:30 a.m. - Bus to Site** **9:30 a.m. - Site Visit**/Host: City of Seattle's Cedar Water Treatment Plant **Topics/Participants:** Discussions with facility staff and Design-Build-Operate (DBO) contractor CH2M Hill on energy efficiency equipment, practices, & results at plant.	12:00 p.m. - Lunch with CH2M Hill (sponsor)	**2:00 p.m. - Vendor One-on-One Meetings** **Participants:** CH2M Hill, GE; HSi Blowers; Praxair; Schweitzer Environmental Engineering; Siemens; Smith & Loveless, Xylem, URS (invited). **Topics:** DBO's experience (CH2M Hill) at Cedar Pt.; Effective Energy Conservation, EE Technologies (energy & process side) & Best Practices in Seattle & other U.S. WTP/WWTP.	7:00 p.m. - Dinner
May 16, Friday	Seattle	**8:30 a.m. - Bus to site** **9:30 a.m. - Site Visit**/Host: King County Wastewater Treatment Division (WTD) West Point WWTP, with a 90 MGD average throughput (dry season). **Participants:** Energy Manager, Dept. of Natural Resources & Parks, WTD.	12:00 p.m. - Lunch	**2:00 p.m. - Vendor One-on-one Meetings**, cont. **Participants:** Aclara, Beaver Equipment, WEDECO, others (invited).	

DELEGATE ITINERARY: Brazil Water/Wastewater Energy Efficiency (W/WW EE) RTM May 11-21, 2014					
Day	**Location**	**Morning**	**Lunch**	**Afternoon**	**PM Activity**
		Topics: King County's management & approach for EE & energy conservation savings & production at its multi-facility system in the Seattle area; bio-solids, reclaimed water, & biogas. Discuss key energy-savings & energy efficient equipment/technologies applied (pumps, blowers, controls/SCADA, motors, etc.) for WTD's three regional & two satellite plants, collectively treating an average 175 MGD of wastewater.			
May 17, Saturday	Seattle/SF	Rest and Relaxation; check out of hotel	12:00 p.m. - Lunch	Bus to airport Flight to San Francisco	7:00 p.m. - Dinner
May 18, Sunday	SF	Rest and Relaxation	12:00 p.m. - Lunch	Rest and Relaxation	Dinner
May 19, Monday	SF/Sacra-mento	**7:45 a.m. - Bus to site** **9:30 a.m. - Site Visit:** Sacramento E.A. Fairbairn WTP. **Topics:** Tour site; discuss with plant operator & municipality planned & implemented EE & conservation efforts, equipment performance & energy savings from variable frequency drives (pumps), energy efficient motors, etc.	12:00 p.m. - Lunch	**1:15 p.m. - Bus to Meeting** **2:00 p.m. - Meeting**/Host: California Energy Commission (Sacramento). **Topics:** California's policy & numerous initiatives & projects for conserving energy at water & wastewater treatment facilities; best practices experienced in CA; future incentives or policies under consideration.	5:00 p.m. - Return to SF via scenic route; dinner en route
May 20, Tuesday	SF	**INDUSTRY ROUNDTABLE** w/25 U.S. company representing manufacturers, developers or vendors of energy efficient process systems, EE or energy/gas conversion technologies, equipment, systems, controls, services.	12:30 p.m. - Lunch with participants	**2:00 – 5:30 p.m. - One-on-one meetings** with Roundtable participants	7:00 p.m. - Dinner sponsored by OSIsoft

DELEGATE ITINERARY: Brazil Water/Wastewater Energy Efficiency (W/WW EE) RTM May 11-21, 2014					
Day	**Location**	**Morning**	**Lunch**	**Afternoon**	**PM Activity**
		8:00 a.m. - Registration **9:00 a.m. - Opening presentations** **9:30 a.m. - Presentations** by Delegates			
May 21, Wednesday	SF	**8:00 a.m. - Bus to site** **9:30 a.m. - Site Visit**/Host: East Bay Municipal Utility District's Main Wastewater Treatment Plant (Oakland, CA) with average throughput of 63 MGD. **Topics:** Process energy use/efficiency, sludge digestion, water conservation & use of digester gas for power generation.	12:00 p.m. - Lunch	**12:30 p.m. – (during lunch) Technology Seminar** by Expert: Overview of RTM & Summary of U.S. Utility Management re: bio-solid digestion, effective EE & conservation approaches, energy project development, & technologies. **2:00 p.m. - RTM Debriefing/Closure** **2:30 p.m. - Bus to airport for departure flights**	Delegates return to Brazil (most flights leave around 7:50 p.m. – only delegate from EMBASA departs earlier)

Brazil: Water and Wastewater Energy Efficiency Reverse Trade Mission

GOVERNMENT ROUNDTABLE: AGENDA

Monday, May 12, 2014 / 9:00 a.m. - 12:00 p.m.

Venue: USTDA Business Center, 1000 Wilson Boulevard, Rm. 1600 - Arlington, VA 22309

9:00 a.m.
Welcome – USTDA
- **USTDA Overview and RTM Background and Objectives (10 minutes)**
- **Self-Introduction of Participants (3-5 sentences of experience relevant to theme)**

9:20 a.m.
Overview of Brazilian Projects in Pipeline and under Consideration: Relevant Project Issues, Interests, Needs, and Estimated U.S. Component for Equipment & Services – Charles W. Peterson, Technical Specialist (AEAI)

9:40 a.m.
Presentations by Government Participants (maximum 10 minutes each)

Topics
The participating institutions for this roundtable should present information on:
- Current supporting programs
- Studies and findings
- Policies
- Regulation and incentives
- Research
- Pilot projects relevant to energy efficiency, energy and water conservation, and power generation from bio-gas at water and wastewater treatment facilities.

10:45 a.m.
Refreshment Break

11:00 a.m.
Open discussion, moderated by AEAI Technical Specialist, Charles W. Peterson.

Invited Roundtable Institutions:

- U.S. Environmental Protection Agency: Phil Zahreddine, Senior Technical Advisor, and Jim Horne, Sustainability Program Manager, Office of Water/Office of Wastewater Management
- U.S. Department of Commerce/International Trade Administration: Adam O'Malley, Director, Office of Energy and Environmental Industries
- District of Columbia Water and Sewer Authority: Chris Peot, Director, Resource Recovery

For information regarding this event, please contact: Dr. Ranjan Ravaliya (Ranjan@aeai.net) or Suzanne B. Maia (smaia@aeai.net). Advanced Engineering Associates International, Inc. (AEAI) is organizing the event for USTDA.

Brazil: Water and Wastewater Energy Efficiency Reverse Trade Mission

INDUSTRY ASSOCIATION ROUNDTABLE: AGENDA

Wednesday, May 14, 2014 | 9:00 a.m. - 12:00 p.m.

Venue: USTDA Business Center 1000 Wilson Boulevard, Rm. 1600 - Arlington, VA 22309

9:00 a.m.
Welcome – USTDA

- **USTDA Overview and RTM Background and Objectives (10 minutes)**
- **Self-Introduction of Participants (3-5 sentences of experience relevant to theme)**

9:20 a.m.
Overview of Brazilian Projects in Pipeline and under Consideration: Relevant Project Issues, Interests, Needs, and Estimated U.S. Component for Equipment & Services – Charles W. Peterson, Technical Specialist (AEAI)

9:40 a.m.
Presentations/Overview by U.S. Association Participants (maximum 10 minutes each)

Topics
Association participants will give 10 minute presentations/overviews of U.S. Industry Background, Achievements and Goals, and topics such as:

- Current Sector Status and Goals for Clean Energy Initiatives at Facilities
- Industry Perspectives on Policy and Regulatory Issues and Performance, Pollution and Applicable Environmental Standards under Consideration in U.S.
- Estimated Potential for Capital and Resource Savings through Energy Efficiency, Conservation and Clean Energy Production Measures at U.S. Water/Wastewater Facilities
- Leading Technologies, Equipment, and Integrated Systems Manufactured in the U.S
- Ongoing R&D Initiatives to Promote Development of Clean Energy/Energy Efficiency and Conservation in the U.S. Water/Wastewater Sectors
- Joint Public-Private Initiatives

10:45 a.m.
Refreshment Break

11:00 a.m.
Open discussion, moderated by AEAI Technical Specialist, Charles W. Peterson.

U.S. Industry Associations and Representatives:

- **ASHRAE,** Doug Read, Director of Government Affairs
- **American Water Works Association,** Adam T. Carpenter, Regulatory Analyst
- **International Association of Plumbing and Mechanical Officials,** Christopher Lindsay, Manager, Government Relations
- **National Electrical Manufacturing Association,** Gene Eckhart, Senior Director for International Trade, and William Hoyt, Industry Director
- **Water Environment Federation,** Claudio Ternieden, Director of Regulatory Affairs
- **Water Environment Research Foundation,** Lauren Fillmore, Senior Program Director

Brazil: Water and Wastewater Energy Efficiency Reverse Trade Mission

FINANCE ROUNDTABLE: AGENDA

Wednesday, May 14, 2014 / 2:00 - 4:30 p.m.

Venue: USTDA Business Center, 1000 Wilson Boulevard, Rm. 1600 - Arlington, VA 22309

2:00 p.m.
Welcome – USTDA

- **USTDA Overview and RTM Background and Objectives** (10 minutes)
- **Self-Introduction of Participants (3-5 sentences of experience relevant to theme)**

2:20 p.m.
Overview of Brazilian Projects in Pipeline and under Consideration: Relevant Project Issues, Interests, Needs, and Estimated U.S. Component for Equipment & Services – Charles W. Peterson, Technical Specialist (AEAI)

2:35 p.m.
Presentations/Overview by Financial Institutions (10 minutes each)

***Note**: All of the participating institutions for this roundtable should present information on current financing programs and mechanisms, and examples of best practices on financial structuring of projects similar to those under development in Brazil, as per the following suggested themes:*

- **Financing Mechanisms and Role of [Institution]**
- **Guarantees and Financial Risk Issues for Clean Energy Projects**
- **Recommended Approaches and Financing Options for Clean Energy Projects in the Water/Wastewater Sector**
- **Best Practices for Project Development and Carbon Financing in Water/Wastewater Industry**
- **Lessons Learned, Loan Programs and Opportunities for Brazilian Water/Wastewater Energy Efficiency Improvement Projects**
- **Available CDM/Carbon and Conventional Financing for Brazilian Projects**

3:30 p.m.
Refreshment Break

3:45 p.m.
Open discussion, moderated by AEAI Technical Specialist, Charles W. Peterson.

Invited Financial Institutions:

- Overseas Private Investment Corporation (OPIC), Justin Elswit, Manager, Political & Sovereign Risk
- Inter-American Development Bank Representative, Fernando Soares Bretas, Infrastructure and Environment Sector Office
- U.S. Export-Import Bank, Craig O'Connor, Director, Office of Renewable Energy & Environmental Exports

For information regarding this event, please contact: Dr. Ranjan Ravaliya (Ranjan@aeai.net) or Suzanne B. Maia (smaia@aeai.net). Advanced Engineering Associates International, Inc. (AEAI) is organizing the event for USTDA.

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– USTDA: BRAZIL CLEAN ENERGY EXCHANGE PROGRAM –

INDUSTRY ROUNDTABLE AGENDA

Water and Wastewater Energy Efficiency RTM

Tuesday, May 20, 2014

Venue: San Ramon Marriott, San Ramon, CA

8:00 a.m.	Registration – Continental Breakfast – Networking
9:00 a.m.	Welcome and Introductions – Suzanne B. Maia, Vice President, Advanced Engineering Associates International, Inc. (AEAI)
9:05 a.m.	Opening Remarks – Thomas R. Hardy, USTDA Director for Congressional Affairs and Public Relations
9:15 a.m.	USTDA Program in Brazil and Latin America – Isabel Sepulveda, USTDA Country Manager, Latin America and the Caribbean
9:25 p.m.	Export Opportunities for U.S. Companies – Charles W. Peterson, Technical Specialist, AEAI
9:30 a.m.	Overview of Sector and Industry's Strategic Priorities and Projects – Presentations by Brazilian Delegates

- CAB Ambiental:
  Mr. Otavio Silveira, Operations Director;
- Companhia de Água e Esgoto do Ceará (CAGECE):
  Eng. Ronner Braga Gondim, Manager
- Companhia de Saneamento Ambiental do Distrito Federal (CAESB):
  Eng. Humberto Belina Adamatti, Coordinator, Energy Management
- Companhia Estadual de Águas e Esgotos (CEDAE): Eng. Edes Fernandes de Oliveira, General Manager, Production; and Eng. Gustavo Tannure, Manager, Energy
- Companhia Pernambucana de Saneamento (COMPESA):
  Dr. Ricardo Barretto, Director, Business Development

10:45 a.m.	Networking Break
11:15 a.m.	Delegate Project Presentations, cont.

- Empresa Baiana de Águas e Saneamento S.A. (EMBASA):
  Eng. César Silva Ramos, Technical and Sustainability Director

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- OAS Soluções Ambientais;
  Eng. Giuliano Dragone, Director of Operations

Delegate Project Presentations, cont.

- Saneamento Ambiental Águas do Brasil (SAAB)/Grupo Aguas do Brasil:
  Mr. Luiz Fabbriani, Director, Business Development
- Saneamento de Goiás S.A. (SANEAGO):
  Sr. Wanir José de Medeiros Júnior or Eng. Alberto Sjobom
- Solvi Saneamento:
  Eng. Hanokh Camilo Vilela Yamagishi, Project Coordinator, Sanitation, Water Div.

12:30 p.m.	Concluding Remarks: Thomas R. Hardy, USTDA Director for Congressional Affairs and Public Relations and Suzanne B. Maia, Vice President, AEAI
12:40 p.m.	Lunch
2:00 p.m.	Delegate One-on-One Meetings with Participating U.S. Firms
5:30 p.m.	Adjournment

III. OVERVIEW OF RTM ACTIVITIES

A. RTM Participant Profile

Foreign Participants: USTDA sponsored 10 of the 11 Brazilian delegates visiting the U.S. for the Water/Wastewater Energy Efficiency RTM. The Brazilian publicly-owned utility CEDAE sponsored an extra delegate. Four of the delegates were from privately-owned water/wastewater companies; seven of them were from publicly-owned utilities. There was one representative from the Government of Brazil (Consulate in San Francisco) who participated in the RTM.

U.S. Participants: AEAI contacted by electronic mail (e-mail) and by phone more than 172 persons in the U.S. to invite their involvement in the RTM as an activity host (including site visits), roundtable or meeting participant, or sponsor. Of these contacts, 124 different companies were represented, and 11 industry associations, with the remainder primarily government officials. As a result, 75 U.S. participants were present in one or more of the RTM activities, excluding 10 AEAI and USTDA staff, as shown in Table 2. Of these 75 U.S. participants, 31 represented Private Business Professionals; 32 were Government Representatives, of which 7 were U.S. Government (USG) officials, 7 were from the California Energy Commission, and the others were from publicly owned utility hosts visited during the RTM; 10 were Non-governmental Organization Professionals (mainly industry associations); one was an International Organization representative; and one was a Researcher/Faculty affiliated with an academic institution.

Of the 20 Industry Roundtable participants for the event held in San Ramon, CA, there were actually 18 U.S. participants representing 12 companies. A total of 23 U.S. company participants from 17 companies had confirmed registrations prior to the May 20th event.[2] In addition, one USG representative (not including two USTDA representatives) and one representative of the Brazilian Government (Consulate in San Francisco) attended. The Industry Roundtable sponsor was Schweitzer Engineering Laboratories (SEL). Johnson Controls, CH2M Hill, Aclara, and OSIsoft sponsored meals for other RTM activities.

Regarding the types of organizations that participated in the RTM (any activity), Table 2 gives the breakdown of U.S. participants by number and type of organization, as well as the number of individuals from these organizations by employment designation. The numbers in Table 2 do not include the 10 USTDA or Contractor staff.

[2] Of the five absent companies, two registered representatives indicated just prior to the event that sickness or conflict of schedule would prevent their participation; the other three were simply no-shows.

Table 2: U.S. Participant Profile
75 U.S. Participants by Type of Organization and Number by Employment Category

# Participants/Organization Type				
	# Entities/Organization Type		#	Participants/ Employment Designation
24	8	Entities with State/Local Gov.	32	Government Representatives
7	4	Federal Gov. Participant		
2	2	Multilateral Dev. Bank/Export-Import bank	1	International Organization Representatives
10	7	Non-Gov. Organization	10	Non-governmental Organization Professionals
31	15	U.S. Based Company	31	Private Business Professionals
1	1	University/Educational Entities	1	Researchers/Faculty (affiliated with academic institutions)
75	**37**	Total	**75**	Total

The U.S. and Foreign (Brazilian) participant lists are provided in Attachment 1.

B. Review of Activities

The actual RTM itinerary, as presented in Section II, provided site visits to seven water or wastewater treatment facilities on the East and West Coasts; three thematic roundtables in Washington, DC (Government, Industry Association, and Finance); bilateral meetings with five private sector companies; a meeting with the state policymaking authority in California (California Energy Commission); and an Industry Roundtable organized as a full day Business Briefing with delegate project presentations and one-on-one meetings with U.S. participants.

Above: Government Roundtable session at USTDA on May 12, 2014: USTDA-sponsored Brazil Water/Wastewater Energy Efficiency RTM. (Photo courtesy of Hanokh Yamagishi, Delegate)

Following is a summary of the exchanges for each main activity of the RTM itinerary.

May 12, 2014

1. Government Roundtable: USTDA opened this session, with Brazil Country Manager Isabel Sepulveda greeting the delegates and government participants, and everyone introduced themselves. Ms. Sepulveda then reviewed USTDA's mandate, the Agency's program tools to support projects in developing countries, and the background, objectives and scheduled activities of this particular RTM. She noted that USTDA has a related project and study on water loss reduction in progress in Brazil, for *Manaus Ambiental*, in which CH2M Hill is USTDA's contractor; and another study is just starting up with CAGECE, which has a delegate participating in the RTM. Following this introduction, a synopsis of the presentations for this roundtable is as follows.

Charles W. Peterson. AEAI's Technical Specialist for the RTM gave a synopsis of the Brazilian water/wastewater sector and a profile of the four private and six public utility companies and the projects represented by the delegates. He highlighted some of the major issues facing the delegates and gave estimated values for U.S. export potential in Brazil's water/wastewater sector relevant to clean energy technologies, equipment and services. This synopsis was given for the benefit of U.S. hosts/participants at virtually every RTM activity, though it is presented here in this report only once.

a. *Water:* Potable water treatment and distribution and wastewater collection and treatment in Brazil are largely the responsibility of the 27 state utilities (77%), with the balance of the services provided about equally by municipalities and private companies (the latter with a growing share, especially in the wastewater business). The amount of drinking water produced in Brazil amounts to about 8.6 billion cubic meters per year (2,270,000 million gallons), giving a reported 83% of the population nationwide access to treated drinking water, although the percentage that receives piped water varies considerably between Brazilian states. Five Brazilian states provide water services under the 60% treatment threshold, with this poorer performance reflected in the investment allocated to water services and infrastructure. Historically, these states – mainly in the North and the Northeast regions – have found it difficult to obtain significant government funding or attract private sector investment. However, the Government of Brazil has taken action to ensure that all piped water is treated as required by health regulations, and the National Sanitation Plan for Brazil (PLANSAB) approved in 2013 has established that 100% potable water supply service should be achieved by 2023.

   Water losses in Brazilian water treatment plants (WTP) are about 37%, or 3.2 billion cubic meters, of treated water. The federal government plans to cut this figure in half over the next 10 years. Reducing water losses would improve the energy efficiency (EE) of the water sector, as well as reduce high energy costs at WTP.

   The supply of piped water to rural areas poses a different set of problems. Much of Brazil's land area features sparsely populated villages and small towns with water supply based on inhabitants having access to untreated surface water from lakes and rivers as well as ground water boreholes. Some rural and low income areas have access to shared piped water via stand pipes. Many of the concessionaires represented by the delegates

are in the process of providing new water supply service to such areas, but are looking for cost-effective and loss reduction approaches and technologies to ensure economic viability.

b. *Wastewater:* Provision of water and sanitation services is the responsibility of the country's 5,560 municipalities, under the terms of the Brazilian constitution. However, state-owned water and wastewater companies in 25 of Brazil's 27 states are actually in charge of such services. Some of the state-owned companies have joint ventures with private companies, in particular for specific towns or groups of towns.

   Current federal legislation in Brazil prohibits combined sewer collection of sanitary wastewater and storm water. Sewage and storm water are mandated to be collected in separate pipe networks. Only sewage, however, is required to be treated. However, only about 39% of Brazil's wastewater is treated. PLANSAB requires that this coverage be improved, with universal access to wastewater collection in urban areas and 93% coverage in terms of wastewater treatment achieved by 2033. In addition, sewage sludge (bio solids) is and will continue to be a problem in terms of disposal and environmental concerns, as growing levels of wastewater are collected for primary and secondary treatment. Bio solids management often involves disposal without prior digestion, although digestion – and the capture and use of the biogas as an energy resource – is increasingly interesting due to high energy costs and power supply reliability in Brazil. Currently, biogas (65% methane, average level) produced during anaerobic digestion is typically flared.

c. *Estimated U.S. Component for Goods and Services in Brazilian Water/Wastewater Projects:* An estimated capital expenditure (CAPEX) of about US$140 billion is needed to provide for modernization and other improvements to the overall Brazilian water and wastewater sectors. This CAPEX includes technologies and equipment, as well as engineering and construction services. Of the overall $140 billion of investment expected for the sector, about 30% (or $42 billion) is expected to be provided from other countries, of which total U.S. companies could reasonably be expected to capture between 20% to 40%, or around US$8.4 to $16.8 billion. Of the total procurements of equipment and services projected just by the 10 Brazilian companies represented by the RTM delegates, there is a realistic potential of about $320 million (conservatively estimated based on information provided by the delegates) that could come from competitive U.S. suppliers in terms of technologies, equipment and services. U.S. companies will face competition for this market from prospective European (such as Germany and France), Canadian and Asian (such as Japan) suppliers.

   Potential sales by U.S. companies in Brazilian water treatment facilities would focus on goods that improve water collection, treatment and distribution systems, including leak/loss detection technologies, improved hydrometers with advanced metering infrastructure (AMI), including meter reading systems; pressure reducing valves (PRVs); energy efficient pumps and motors; variable frequency drives (VFD) for pumping stations; improved automation controls (i.e., SCADA systems) and instrumentation; and

renewable energy systems – such solar power systems seen at the E.A. Fairbairn or wind power – to help reduce the high cost and provide greater reliability (security) of electricity supply.

In wastewater treatment facilities, U.S. goods expected to be competitive for the Brazilian market include: energy recovery from sludge biogas (activated sludge technology), including blowers and dryers; cogeneration; mechanization/process automation; modernized controls and instrumentation (SCADA, meter systems); programmable logic controllers (PLCs); frequency inverters; telemetric systems; PRVs; energy efficient motors and pumps; and aerators.

Engineering costs normally amount to about 15% of expenditures for equipment and construction. Engineering, procurement and construction (EPC) areas in which international companies, including those from the U.S., seem best suited to participate in the Brazilian market are:

- Engineering / design services related primarily to imported systems;
- Automation / telemetry systems such as SCADA;
- Leak detection and related water loss technologies (for WTPs); and
- Systems/equipment for clean-up (pre-treatment) of biogas and turbine/engine generators (for WWTPs).

Jim Horne, U.S. Environmental Protection Agency (EPA). Mr. Horne of the Office of Water/Office of Wastewater Management explained that the agency is involved to bridge a gap that arises from the practitioners – i.e., individual water and wastewater utilities that are very local in nature and respond to different local municipal and state laws and politics as well as different management cultures – not being able to see "the big picture" for more sustainable management of natural resources and pollution control or mitigation measures that would benefit all of these utilities. The individualism of the plant operators is further emphasized because, in the U.S., most water treatment facilities (WTFs) are privately owned, and most wastewater treatment facilities (WWTFs) are owned by municipalities or districts. EPA is thus working to collect and provide information and studies that help all utilities see a longer term perspective of their business and become "sustainably managed utilities." This would involve a concerted effort to orient management, operational staff and consumers to conserve water and thus help reduce electricity consumption – which at wastewater treatment plants (WWTPs) accounts for 25% to 30% of operational expenditures. As rising energy costs are tied to rising water consumption and increasing pollutants, it is important to address efficiency in the energy-water nexus. Mr. Horne recommended the delegates to, at the very least, download the energy audit manual available online and make their energy team at the water/wastewater treatment facilities follow the systematic process for considering best practices. He also identified several other resources for the delegates and recommended attending the WEFTEC and other industry conferences for more information on best practices. Chris Godlove, also representing EPA, noted that the agency has expanded its Global Methane Initiative (GMI) to include wastewater organics management, as methane emissions from the sanitation sector directly relates to – and is far more potent than carbon dioxide emissions on – global climate change (GCC), which is under EPA's mandate. EPA has some funding for pre-feasibility studies and capacity building at all

levels. The EPA speakers provoked several comments by delegates on the importance of energy efficiency and biogas utilization strategies in Brazil related to energy costs and supply, and the effort to reduce greenhouse gas (GHG) emissions by five sectors in Brazil, including the wastewater sector.

Adam O'Malley, International Trade Administration, U.S. Department of Commerce (ITA/ DOC). Mr. O'Malley explained how Brazilian entities could work through the DOC when U.S. goods are being purchased. DOC may help with information needed to promote the "deal" or to create an enabling policy environment – e.g., in the case of this delegation, via support on renewable energy and energy efficient policies, smart grid initiatives, and other related practices or policy actions fostered by the U.S. Government to promote clean energy technology use. He also described the multi-agency "National Export Initiative" (NEI) created by the U.S. Government, which offers a portal with a focus on environmental technologies and identifying appropriate markets for these (including Brazil), as well as an export market plan. The portal offers support to both buyers and U.S. companies selling the relevant technologies. There is an "Environmental Solutions" toolkit which identifies expertise in the U.S., including both government and private sector knowledge bases.

Chris Peot, District of Columbia Water and Sewer Authority (DC Water). Mr. Peot briefed delegates on how DC Water had evolved to an autonomous public utility governed by a Board in an "enterprise" model, providing water supply and wastewater treatment services. DC Water discharges into the Potomac River which empties into the Chesapeake Bay. This is an issue of importance for DC Water and virtually all water/wastewater utilities near the coast in the mid-Atlantic region: there are major environmental protection regulations and costs because of the proximity of the Chesapeake Bay freshwater estuary, and various protections in place. This fact plus the high cost of energy – which represents 88% of its carbon footprint – and the additional sensitivities from being located in the nation's capital, where powerful politicians and other individuals demand high quality service and a clean environment for their home and work environments, pose a lot of challenges for DC Water and other local utilities. It has adopted the term "Resource Recovery Plant" instead of WWTF to stress the focus on efforts to recover, treat and re-use bio solids. For all of these reasons, DC Water has aggressively pursued EE (expecting to decrease consumption by 20%) and RE options to lower its significant energy costs, reduce pollutants and the cost of waste treatment/disposal options, and satisfy its customers. Its sludge management program is forecast to cost US$470 million with a payback period of 13 years and a 65-year operating life. Its capital investment program will also reduce its consumption/demand for chemicals. As the biggest single-site energy consumer in the area, with a demand of 25 MW at its Blue Plains WWTF alone, it has embarked on a strategic plan encompassing various investments in EE and RE to eventually achieve energy self-sufficiency, as well as in water conservation (which also reduces energy costs) and a $2.5 billion rainwater capture project. It is implementing a 13-MW project incorporating biogas digesters for its WWTP and produce electricity, with seeding of the bio digesters in August 2014. Additional onsite electrical generation will be provided by an 11.5-MW solar energy plant to be built on a Build-Own-Operate basis by a third party that is projected to have a CAPEX investment of US$38 million, selling power at a beneficial rate under a 20-year power purchase agreement to DC Water without the utility needing to put up capital for this plant. DC Water expects it may

be able to sell excess energy to the local power utility after implementing these EE and RE projects.

This session as a whole was very dynamic and information-packed. The Q&A session at the end witnessed a lot of questions and comments by the delegates on federal and local regulations, utility ownership structure, digesters, water losses, food trash, various cost items, public perceptions, corporate responsibility issues, and the role of industry associations in the U.S. versus in Brazil (where there is less common effort to examine problems or promote positive policies and incentives for industry), among other issues of interest. The delegates were enthusiastic in their comments after the conclusion of the session, and also used the break period to talk further with the USG participants.

2. Meet and Greet Interval with USTDA Director Leocadia Zak: After the Government Roundtable, the Brazilian delegates met Director Zak in her office, where she noted important USTDA predecessor activities to this RTM and potential support that USTDA could provide as the delegates continued to develop key W/WW projects utilizing clean energy technologies that could be supplied by U.S. companies. She presented the individual delegates with a gift.

Left: USTDA Director Zak greets delegates from Brazil on May 12, 2014 after the conclusion of the Government Roundtable session of USTDA Water/Wastewater Energy Efficiency RTM. (Photo courtesy of Hanokh Yamagishi, Delegate)

3. Site Visit to Alexandria Renew Enterprises (AlexRenew): David Brewster, the Director of Operations at AlexRenew, welcomed the delegation upon its arrival and gave a history and overview of the WWTP and the processes (preliminary, secondary, tertiary water treatments and the sludge process) in a training center room. AlexRenew is an autonomous utility governed by a five-member Board which includes representative members from the City of Alexandria and Fairfax County. The WWTP receives wastewater from the City of Alexandria and from the adjacent Fairfax County, which accounts for 60% of the total flow. Its rates are based on water usage, with the consumption data provided by the water utility (e.g., Virginia-American Water Company or other) but now billed separately by AlexRenew.

Mr. Brewster and three other technical staff (Mr. Jim Sizemore, Dr. Yanjin Liu, and an engineer intern, Ms. Hong Yin) provided the tour of the facility, including a pass through its onsite laboratory and discussion with the chemist at work there. The WWTP is located on a 33-acre site that confines operation and requires innovation for expansion projects: basically creating a more vertical system due to limited space, with more pumps needed to treat the wastewater flow in this configuration. The flow of wastewater to the plant currently averages 34 million gallons

per day (MGD), with 54 MGD as the maximum capacity. With spring rains, the flow is higher (around 50 MGD). The two primary products of the treatment process are bio solids and high quality reclaimed water for re-use (i.e., "second use water). The bio solids (sludge) are digested and the resultant biogas is used for process and building heating or cooling (using absorption chillers in summer), or it is flared depending on the demand for energy. Previously, a natural gas boiler was used for heating needs, but it was changed in 2011 to two biogas boilers with dual-fuel capability. There is a long-range plan (under study) to increase production of gas and use in a cogeneration system to virtually achieve energy self-sufficiency in 10-15 years. For this project, AlexRenew is looking at new technologies, especially in the digester pre-treatment area to optimize digester performance, and improvements in efficiency. The plant uses 155,000 kilowatt-hours (kWh) per day of electricity, which the proposed cogeneration plant could provide.

Reclaimed water is discharged to Hunting Creek after receiving tertiary treatment, which is required under strict regulations to reduce nutrient discharges flowing to the Chesapeake Bay. Treated sludge is hauled away by a third party, paid by AlexRenew, for application as fertilizer on small local farms.

The equipment used at the plant included tertiary plate settlers for tanks (made by Waterlink/Parkson, a U.S. company); automation systems including PLCs (programmable logic controllers) and SCADA (supervisory control and data acquisition) systems) provided by Allen-Bradley (a U.S. company). Alfa Laval is an American company which supplied centrifuges. Xylem-Sanitaire provided more efficient centrifugal blowers. There are still some multi-stage blowers which are high electricity consumers, to be replaced soon with more efficient ones. Other equipment replacement to occur before or along with a major plant overhaul (in next 10 years) will include: flow isolation/diversion gates (manufactured by Rodney-Hunt); dissolved oxygen meters (Hach); fluid components air flow meters; and animox systems (from Europe) which offer reduced energy and oxygen use.

Delegates were pro-actively involved in the discussions, asking many questions of the hosts and providing their own contexts to illustrate various issues, both in the initial overview of the plant and during the tour. There were several discussions about water and sludge treatment requirements; treated sludge disposal options; billing (having two bills for water and sanitation services, instead of one; and the periodicity being every quarter instead of every month); rate issues; raising capital for improvements through rates increases, especially with customers in two administrative jurisdictions (City of Alexandria and Fairfax County); and utility governance/ownership (60% of assets are owned by Fairfax County). These questions were similarly posed by delegates at most other site visits, so they could better understand the context in the U.S., differences in the Brazilian context, and how Brazilian requirements could change.

May 13, 2014

1. Site Visit to Baltimore County's Back River Wastewater Treatment Plant (WWTP): Designed to treat 180 MGD, with an average flow of 140 MGD, this publicly-owned plant is located on a 466-acre site in Baltimore County, and serves customers in the City of Baltimore

and in Baltimore County. The large land tract of the plant site – unlike the AlexRenew facility seen the day before – allows a horizontal flow within the plant and therefore requires less pumping. Considered already a cutting edge facility of its type, the plant is in the process of a US$500 million upgrade to the treatment processes, including tertiary treatment for nitrogen and phosphorus removal to reduce nutrients prior to discharge to the Chesapeake Bay, per the previously mentioned stringent environmental requirements. It is undertaking several major projects to reduce energy, chemical, personnel and other operating costs. It currently has about 100 operators and 200 maintenance staff, working 8 hours shifts every day around the clock.

Nick Frankos, the plant manager, described the plant's history and biological treatment processes for the delegates in a meeting room before going on a plant tour. The plant's operation and maintenance (O&M) costs run about $80 million/year. Of these costs, personnel has the largest share; with chemicals costing about $10-15 million/year; energy at around $6 million/year; and bio solid disposal at about $12 million. To reduce the waste disposal costs and reduce its electricity requirement of about 13 MW, bio solids have been increasingly turned to the production of biogas for use in energy production systems for the plant.

Mr. Frankos discussed hurricane weather issues – with peak flow rising to 400 MGD and storage tanks to control some of the flow – on the plant, as well as security issues. Storm/rain water must now be collected in separate pipes, after the old systems with bad flows and too many leaks caused problems with overflows. A new major project is improving the headworks and further reducing nitrates in the effluent, which will improve Chesapeake Bay water quality. He noted that the attack of 9/11/2001 caused changes to be made for industrial plants, including Back River WWTP, in terms of the amount and type of dangerous chemicals that may be stored onsite. For example, the bleach used by the plant these days is safer, with less chlorine levels than before, which is also beneficial to the environment and impacts the treatment processes. Food waste issues were discussed. Following tertiary treatment, the water can be discharged directly to the Bay. After the secondary treatment, the water may be sold for process water at a nearby steel mill. Dewatered sludge is managed through two processes, both of which produce a Class A (pathogen reduction) product. Half is heat dried; while the other half is composted. Agricultural use of either product is quite restricted. As a result, 95% of the heat-dried sludge is sold to cement kilns as a supplemental fuel.

For energy production, sludge from the treatment stages is pumped to digesters. The resultant biogas is used for process energy (with heat exchangers, especially in the winter) and to generate electricity in a 3-MW onsite generation plant. This project was done through a performance contract concluded with Johnson Controls Inc. (JCI) to reduce energy costs through energy efficiency measures and onsite renewable energy production. JCI is paid through the energy savings for the plant. On average, biogas used in gas turbines supplies 16% of the WWTP's energy needs. About 1 MW of additional energy is obtained from solar panels installed onsite. The remaining electricity requirement is purchased from the grid. There is no onsite energy storage capability. Back River is looking at better management practices and equipment replacement for it biggest energy consuming equipment, such as its pumping stations and five 1500 horsepower (hp) blowers, and use of SCADA (computerized control systems) to optimize system performance, lower energy use, reduce chemical use, and replace personnel.

2. Industry Presentations by Johnson Controls, Synagro, and ASTM at the Baltimore Back River Wastewater Treatment Plant: Following the initial presentation reviewing the Back River WWTP, presentations were made by two companies involved with the Back River WWTP and a research organization unrelated to the plant activities, as summarized below.

Johnson Controls, Inc. (JCI). Before touring the energy facility, JCI's representative, Richard Barrett – accompanied by other JCI staff including Vipin Goel, Arvind Srihari, and Mark Whitlock (who stays onsite to manage the energy plant) – made a basic presentation on JCI's energy savings work through performance contracts, and the project undertaken at Back River. He also indicated how the company has an active presence in Brazil and would be glad to work with delegates there. The delegates were very interested in similar types of arrangements for saving energy at their facilities.

At Back River, JCI operates a system that recovers energy from the biogas produced by the sludge digesters at the facility. As part of the energy recovery process, JCI conditions, cleans, and dries the biogas prior to energy generation. The overall system components include gas cleaning equipment (from Pioneer Energy System), engines (Waukesha), and absorption chillers (York, a JCI company), and controls (JCI). The engines provide heat that pre-heat boiler water and pre-heat digesters. Other energy savings improvements undertaken at the plant included efficiency measures for the pumps, heating, ventilation, and air conditioning (HVAC), steam recovery through Heat Recovery Steam Generators (HRSG), and Direct Digital Control Optimization (JCI). Though its plant's energy efficiency is pretty much optimized, other minor improvements could be made in lighting, controls, and HVAC areas.

Back River did not invest capital in this project: JCI has invested US$14.1 million in this project and achieves annual energy savings valued at about US$1.8 million, reflected through reduced energy purchases from the local power utility (BG&E/Constellation Energy). About $1.4 million of the annual savings is directly attributed to the energy from biodigester gas. JCI also installed the 1 MW solar project that it operates on the site. JCI receives about half of the energy savings value as its payment. It is now in the 6th year of the contract, and has saved more than $10 million in reduced energy costs so far. In addition to monetary savings, the project has avoided the emission of 12.9 million tons of carbon equivalents and saved about 1.7 million gallons of gas (valued at $1.5 million/year). The savings in O&M costs each year total another $130,000 (from reduced lighting, water and pump requirements). The payback period is 10 years or less. JCI's project financing took advantage of available renewable energy credits (RECs) and solar energy tax credits. Mark Whitlock guided the tour through the biodigester area and biogas-to-energy plant.

Synagro. Following lunch at the tour of JCI's energy plant at Back River, Mr. Bob Pepperman of Synagro, the largest U.S. bio solids management company, gave a presentation and tour of

The Baltimore Back River Pelletech℠ Facility is an indirect vertical drying system that runs continuously all year. The versatile design allows for the facility to receive and process liquid and semi-liquid forms of bio solids. Additionally, a state-of-the-art, five-stage air quality control process removes particulate matter and eliminates volatile organic compounds (VOCs) and odor components of the exhaust stream from the dryer. Once in operation, the Back River Facility became home to the world's largest indirect dryer at that time and paved the way for this technology to become widely adopted. *Source: Synagro.com*

Back River's sludge drying and pelletization plant. Although this company was not on the agenda, it was a relevant presentation for the delegates. The City of Baltimore awarded Synagro a design-build-own/operate (DBO/O) contract for its then innovative indirect heat drying and pelletization process to convert anaerobically digested sludge into an odorless fertilizer product. The Back River heat dryer increases the solids content of the sludge to about 95% through evaporation of moisture, producing 110 tons of bio solids/day. Synagro financed and set up this plant at Back River, and continues to operate it under a 20-year contract, with two 10-year options for extension. Fertilizers for food crops must now meet even more stringent EPA requirements (changing from Class B to Class A), and crops are seasonal, so Synagro also sells pellets as an energy fuel, including to a local cement plant and (30,000 tons) to a coal power plant, which may obtain carbon credits and reduce overall emissions. A U.S. company, bought by EQT (a private equity firm in Northern Europe) in 2013, Synagro operates in 37 U.S. states and in Canada. Synagro's presentation is included in Attachment 3.

ASTM International. This organization develops voluntary standards in a broad range of industrial and technical sectors, including various topics related to water. Jim Olshefsky, Director of External Relations, provided basic information about how the organization could work with industry in Brazil to develop water/wastewater standards as well as practices on safety, reliability and commercial aspects. He noted that, globally, water standards have become an increasingly prominent source of interest due to critical water access issues. Water quality testing and maintenance have become ASTM's biggest area of work, with over 300 standards promulgated internationally. It interfaces with the National Institute of Standards and Technology (NIST), U.S. Geological Survey (USGS), and EPA on water standards and testing methodologies. The advantage to utilities participating in ASTM's standards-making committees and technical meetings is that they can contribute their knowledge and experience and influence the resulting standards to be adopted (voluntarily). ASTM's relevant committee on water (D19) is open to new members (e.g., delegates) if they wanted to be involved in the emerging issues and collegial/expert exchanges on issues of interest. ASTM has been working in Brazil with ABNT and INMETRO, and through these has reached a network of Brazilian universities, government agencies, public and private companies, and other organizations.

May 14, 2014

1. Industry Association Roundtable: Six industry associations that promote water and wastewater efforts to reduce energy costs through energy conservation, efficiency and alternative energy options provided a wide range of information and references to other sources of information on the related topics. Several of them referenced cited key legislation – e.g., Safe Drinking Water Act (SDWA), Clean Water Act (CWA) – as well as major industry events that the delegates should know about, such as the International Water Conference (San Antonio, TX in November 2014), and WEFTEC (New Orleans, in December 2014). These are venues where many of the U.S. vendors and service providers will have exhibits on their energy-related technologies, systems and services in addition to offering various panels or other sessions on related energy topics of interest to the delegates. Each organization's main remarks are summarized below:

Doug Read, ASHRAE. Mr. Read, Director of Government Affairs, gave an overview of the engineering association, which works in 130 countries and has 53,644 volunteer members (including students) around the world. The Brazil chapter of ASHRAE was formed in 2002. ASHRAE serves as a pipeline for information on technology; helps create technical standards and norms ready to be adopted as codes, via the ANSI process of collaboration and consensus; has its own research program with a budget of $2.5 million/year; certifies professionals (17 have been certified in Brazil); and promotes conferences. Its 189.1 "green standard" (which includes water conservation and efficiency in HVAC systems for commercial/office buildings) and energy standard 90.1 are holistic standards relevant to the delegation (he later provided a link to a downloadable form of these standards for the delegates.) The association also works on policy initiatives via its members, and does training in standards. The delegates are welcome to join ASHRAE and participate in several of its relevant activities or committees.

Adam Carpenter, American Water Works Association (AWWA). Mr. Carpenter, Regulatory Analyst, noted AWWA was established in 1881, has 50,000 global members, and of these 4,000 pertain to water and wastewater utilities. The association promotes training/education for professionals; organizes conferences – including one in Boston in June 2014 and a "Sustainable Water Management Conference" every other year in the spring; publishes an industry journal; interacts with federal regulatory and legislative bodies; and promotes standards and best practices manuals. He clarified that neither the SWDA – which was driven by public health considerations – or the CWA – which was environmentally driven – have considered energy conservation or efficiency. However, the association feels that both energy and water are valuable resources that need to be properly stewarded. He recommended a report, "Buried No Longer," to the delegates, which is applicable to other countries and basically presents the urgent need to invest heavily to maintain (safe) drinking water availability, with a modeling tool for replacing pipelines in the ground and to create a financial plan for pipeline replacement. On AWWA's website there are various manuals (M) for purchase on: cost recovery via rates, fees, and charges; M52-water conservation and efficiency; M29-utility capital financing; M36-water audits and loss control; and free useful information for the delegates via the "Water Resource Community" portal. AWWA is a member of the International Water Association (IWA).

May 14, 2014 Industry Association Roundtable guests (L to R): A. Carpenter, AWWA; W. Hoyt & G. Eckart, NEMA; L. Sukkariyyah & C. Ternieden, WEF; L. Fillmore, WERF; D. Read, ASHRAE. (Photo by R. Ravaliya, AEAI.)

Chris Lindsay, International Association of Plumbing & Mechanical Officials (IAPMO). As Manager, Government Relations for the association that works with plumbing professionals at all levels, Mr. Lindsay deals mainly with legislative and regulatory issues. As such, he is very concerned about the "One Water" concept, which assumes that impact on any element of the water supply chain affects all of it. The California-based association has been very involved with water efficiency studies and codes/standard-making activities, and much of the leadership on these issues has occurred in California where water supply is a critical issue, being dry in the southern part of the state where most of the population is located. He said 90% of the State of California's energy consumption is related to water supply/consumption, with the following breakdown of the water sector's share of different energy sources consumed in California (presumed to be annually): 19% of the electricity, 30% of natural gas, and 88 billion gallons of diesel. Meanwhile, 70% of the State's carbon emissions are from the heating process at water/wastewater treatment plants. This highlights the need for energy efficiency in heating as well as electricity areas for WTPs and WWTPs. In the EE area, IAPMO has contributed to plumbing codes in the water sector that save energy and water; helped developed even more stringent codes than required by law for regions/areas that wanted to go "green"; takes a holistic approach to buildings when working with architects and engineers; provides professional training and educational initiatives; and has a testing and certification lab in China and Indonesia. IAPMO's work has impacted about 90% of the U.S. market, especially in pipe areas such as flow rates, lead content, plastic vs. other materials used in pipe fabrication, backflows, etc. It trains professionals to do home water audits which help homeowners to make investment decisions about saving water (and therefore energy). He identified EPA's "Water Sense" program to encourage voluntary higher standards for water and energy conservation as a point of interconnection with IAPMO's efforts in plumbing and irrigation systems.

William Hoyt, National Electrical Manufacturers Association (NEMA). Mr. Hoyt, Industry Director, gave the presentation for NEMA. He was accompanied by Mr. Gene Eckhart, Senior Director for International Trade. He mainly addressed the efficiency of electrical motors and related drives as being the key area where NEMA contributes to greater EE in the global water/wastewater sector. Motors account for 46% of worldwide energy consumption. Where international electrical motor efficiency standards are categorized as IE 1, 2, 3 and 4, with 4 as the most efficient, only the U.S. and Canada – currently at level 3 – are likely to be able to attain premium motor efficiency in the near future, with Europe expected to attain IE 3 levels in 2017. Brazil is currently at 1, but expects to attain level 2 with domestic manufacturing changes. The U.S. Department of Energy has a regulation on the energy efficiency of motors, to become effective in 2016, which will exempt five classes of motors. There is a Motor Coalition working on how to increase energy efficiency without changing the size of motors, and what it would recommend to do (replace or repair) to old motors if the "footprint" changes. It is costly to replace (especially large) motors, even if this would be the preferred option, so it is likely that some kind of extended maintenance plan would be promoted. In the U.S., premium motors are 75% of the whole market, but this percentage is less in other countries. NEMA did a joint study on the carbon footprint of motors with MIT's Materials Laboratory. This showed that 99.8% of the motor's life-time (i.e., operating 5000 hours/year for 20 years) cost is attributed to electricity. Variable frequency drives may be included if the right inverter is used, and if installed, operated and maintained properly, this would increase the EE of the motor without harming it. The next

major industry issue to deal with will be "total system efficiency," on which NEMA will work with DOE and other associations. The Hydraulic Institute works with NEMA and DOE on hydraulic pump standards.

Claudio Ternieden, Water Environment Federation (WEF). Accompanied by Laila Sukkariyyah, Director of Global Programs/Development for WEF, Mr. Ternieden, Director of Regulatory Affairs, introduced WEF as "The Water Quality People" with over 36,000 members worldwide. He characterized WEF as pushing innovation in both technologies and regulations, working with various other organizations and government agencies. A recent publication, "The Future of Cities and Water," shows that less money is available for investment in water projects than before, partly because of the grants program used to finance so many projects in the 1970s, particularly in the mid-Atlantic region, still has various antiquated requirements that affect the design and configuration of the projects. This has become a barrier for private sector partnership in these projects today. Currently, global climate change (GCC) is a driver for water issues in many places, such as Singapore, Australia, New Zealand, and the issue includes how to plan resiliency (adaptation) in water/wastewater utilities that will be affected by GCC. WEF will have an "Innovation Pavilion" at the WEFTEC forum (New Orleans, December 2014) where innovative approaches and leadership, as well as technologies, will be featured to help understand how to address different technology options for these and other issues. For example, industries which feed off of each other's products and services could be promoted in "clusters" to help spark innovation in specific areas. He noted that "resource recovery" has become the popular way to identify water/wastewater facilities, with emphasis that water (and other) resources are valued and their collection and usage need to be more sustainably optimized. There is an "Energy Roadmap" available to help guide the way to more sustainable energy management at water utilities. Soon there will be a "Nutrients Roadmap" available through WEF, which will provide guidance on removing increasing levels of nutrients from treated wastewater, and on trying to reduce the higher energy requirements this would normally entail. The U.S. military has adopted a "zero footprint" policy in water/wastewater, which is significant given its large real estate holdings globally. It is using performance contracts to achieve its goals. Other related topics Mr. Ternieden addressed included stricter storm-water collection requirements (to collect it separately and use it as a resource) and financing, utility integration, as well as data and cost-sharing, co-funding, utility clusters and vendor clusters. Finally, WEF will attend an industry event in Sao Paulo in August, and then have some meetings in Rio de Janeiro. He offered to meet with the delegates at this event or while he was in Brazil.

Lauren Fillmore, Water Environment Research Foundation (WERF). Ms. Fillmore, Program Director, directed the delegates to the many downloadable documents and studies of interest on WERF's website, including many for best practices in energy. She provided data on the energy consumption in the W/WW sector (in the U.S.): the sector consumes about 22.3 terawatt-hours (TWh) per year in electricity, and is the fourth largest electricity consuming industry nationwide; the wastewater sector uses 270 trillion BTUs in the heating and heat recovery processes at WWTPs; and the industry is working hard to find ways to reduce its energy consumption and energy costs, as well as consumption of chemicals and water, primarily through energy management and then through anaerobic digestion to produce biogas for onsite energy generation. She noted that California has led the way in a lot of areas related to the energy-water

efficiency nexus, and the best utilities seeking energy self-sufficiency and renewable energy technologies include the East Bay Municipal Utility District (EBMUD, one of the visits scheduled for the delegation) and DC Water. She said it is estimated that about 50% of the utilities in this sector could become energy self-sufficient, and it is very economic for the 100 largest utilities to do so (representing about 50% of the total). Since it is less economic (cost-effective) for smaller utilities, a policy action to support energy self-sufficiency could capture enormous energy benefits. Ms. Fillmore emphasized that "transformative" thinking is needed for good leadership in this conservative industry to evaluate a comprehensive set of issues in a holistic manner, and incorporate innovative technologies. For example, genomics and microbiology currently offer tremendous potential for advances in energy and resource management areas. WERF estimates that best practices in energy could result in 40% energy neutrality and allow carbon management (related to GCC emissions) to convert carbon to reusable energy products. Likewise, energy-intensive chemical removal processes (e.g., for nitrogen) are being reconsidered in light of energy and carbon management needs. The industry's LIFT program focuses on energy recovery/reuse/reduction through energy efficiency, especially for large Water Resource Recovery Facilities (i.e., WWTPs).

Discussions between the delegates and speakers for this panel revolved around the differences in the level of environmental regulations in Brazil vs. the U.S.; how energy efficiency measures can pay for themselves; what the return could be for different efficiency improvement measures; how solar thermal systems can help conserve energy in water treatment processes; different ways for utilities to meet standards; and the different cost structures for utilities in the U.S. and Brazil. Other topics discussed in the open session included how associations could be leveraged more in Brazil; how Brazilian delegates could join as individual or company members the U.S. industry associations represented on the panel; the importance of attending various major industry conferences, such as WEFTEC; the importance of asset management; the commonality of aging infrastructure and competing investment resources across all infrastructure sectors in both the U.S. and in Brazil; and the requirements in both countries, if not globally, to become more adaptable or resilient to natural and manmade disasters, although these are generally less emphasized in Brazil.[3] It was noted again that USTDA could fund feasibility studies for projects.

2. Finance Roundtable: This roundtable featured speakers from three organizations, with highlights from their respective remarks presented in the following paragraphs.

Justin Elswit, Overseas Private Investment Corporation (OPIC). As Manager, Political and Sovereign Risk, Mr. Elswit explained how OPIC can assist in the finance of equipment from U.S. suppliers through its investment finance and political risk management programs. In evaluating a project for risk insurance, OPIC looks at the political risk, development impacts (i.e., economic impact on GDP, jobs), and export potential for the U.S. It currently has a major focus on renewable resources including water/wastewater, renewable energy, clean technology and agricultural projects. It has supported large, medium and small U.S. companies in 103 countries, with a total of $18 billion allocated to date. Political risk insurance is based on equity for a 20-year term at competitive, locked-in rates. In the water/wastewater sector, OPIC recently

[3] Brazil contends with flooding and aridity in different regions, but not so much terrorism or hurricanes, snow/ice storms, or other climatic events common in the U.S.

was involved in Ghana for a $150 million WWTF refurbishment that would increase efficiency at the facility. In 2012, about 18% of its total commitments were for water sector projects, but there were no new projects in this sector in 2013. Its maximum finance amount is $250 million, which cannot represent more than 75% of the total investment. It is open for business in Brazil, where it would apply the highest international standards on environment, labor and human rights issues in evaluating investment risks. As financial lender of record for loans, it would look carefully at the commercial viability of private sector projects, and state ownership of the project company's equity must be less than 50% to meet OPIC's criteria. Since 6 of the 10 delegate companies are majority owned by the public sector, it would have to find other forms to support the projects: for example as a political risk investor for a U.S. bank or investor which provides 75% of the project's equity; or with multiple equity providers and a minimum of 25% equity held by U.S. companies; or if a U.S. company had a long-term O&M contract for the project that was equivalent to 20% of the equity, etc. OPIC does not cover currency risk.

Fernando Soares Bretas, Inter-American Development Bank (IDB). The IDB primarily provides assistance for public development projects. The Bank's Inter-American Investment Corporation (IIC) serves as IDB's private sector finance affiliate similar to the World Bank Group's International Finance Corporation (IFC). Mr. Bretas, of IDB's Infrastructure and Environment Sector Office, noted that IDB's strategy changed in 2007, to focus more on 100 smaller cities in the Latin America and Caribbean (LAC) region, rather than on national scale projects. This change meant that water and wastewater sector projects, under the authority of the municipalities, gained greater prominence in IDB's lending program. In Brazil, IDB has recently made a loan to Brazil for a $171 million loan to CAESB to improve the quality, reliability and service of its water supply system, as well as expand its service to residential and wholesale customers. The loan also covers upgrades to and expansion of CAESB's sanitation services. The loan includes various other clean energy and environmental (GCC) initiatives, with a 25-year term and grace period of 66 months. Mr. Bretas is very open to supporting new projects to be developed by the delegates in this sector.

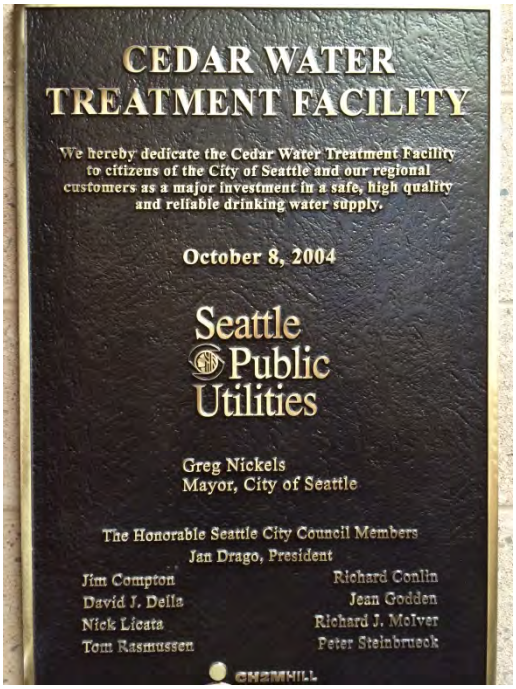
Craig O'Connor, Export-Import Bank of the United States (Ex-Im Bank). Mr. O'Connor summarized how Ex-Im Bank can provide financing for sales of U.S. goods with a loan term of up to 18 years. Ex-Im Bank's loans can be structured to cover local costs up to 30% of the value of the U.S. export contract. The repayment period starts after the project begins operations. The loan rate is locked-in at the time of the first repayment. The current loan rate is 3.92%.

May 15, 2014

1. Site Visit to City of Seattle's Cedar Water Treatment Facility (WTF): The plant's history – dating back to original facilities built in 1894 – brief description and site visit was provided by a City of Seattle/Seattle Public Utilities' water quality engineer, Ms. Lynn Kirby, accompanied and supported by the City's contractor representative from CH2M Hill, John Wesely, who is responsible for daily operations at the 10-year old plant. The treatment plant was procured through a Design-Build-Operate (DBO) contract awarded to CH2M Hill, which designed and operates the facility. CH2M Hill is in the 10th year of a 15-year operations contract. The City may extend the contract for two 5-year periods. The Cedar watershed (a lake serving as a

reservoir and a river of the same name) which serves this WTF provides between 60-70% of the City's potable water supply, to about 600,000 customers directly and to wholesale customers (other water districts which redistribute the water to the end consumers). It is located on 90,000 acres of land where no recreational or other human uses are allowed, and the water originates mainly from (and depends on) snowmelt from nearby mountains. Through another WTF, the Tolt River supplies about 30% of the City of Seattle's water. Cedar Lake is a natural water body, with a storage volume of 11 billion gallons. It has naturally occurring algae, so sometimes it is bypassed when the algae count gets too high. The Cedar River runs by and feeds the lake, with both the lake and river water part of this facility's resource base. The Cedar facility is all gravity fed, with no pumping. The City has stricter regulatory requirements for water than does the State of Washington. The plant's capacity is 180 MGD: it gets close to this capacity in the summer, but only processes 40 MGD during the winter. Ultimately, the plant could be expanded to a 280 MGD capacity. Currently, future investments are seen in adding submersible (to keep noise level down) pumps – five 40 MGD capacity pumps and two 20 MGD pumps for a total of 369 hp of new capacity. Fluoridation systems may be required, depending on whether public referenda on the issue changes the fluoride level desired.

Water is taken from the river until the turbidity level reaches 5.0 NTU (Nephelometric Turbidity Units); then water is taken from the reservoir (lake). The turbidity level for the reservoir averages 0.4 NTU. The low turbidity level for incoming water eliminates the need for initial treatment processes such as filtration and coagulation. The WTF has a three-stage disinfection process. The first step involves the addition of ozone to the water. Wedeco, a unit of Xylem, supplied the ozone system. There are 13 ozone reactors that operate at a range of power levels, depending on need. An ultraviolet (UV) light system provides the second stage disinfection, followed by chlorination as the third and final disinfection stage. The SCADA system includes I-fix software provided by GE and sends all data to the downtown (City) office, but there are monitors in all of the buildings at the site. There is a three-day diesel generator for back-up power. Delegates were interested in the systems and had questions about the electricity costs, chemical costs, and staffing levels required at the plant. Ms. Kirby forwarded via e-mail answers to questions posed by the delegates following the visit. She commented that requirements to collect storm water separately from wastewater are recent. Though the delegates were very engaged in the discussions and enjoyed the setting of the facility (very rural, with wildlife around, even though it serves the urban and peri-urban communities of Seattle), they concluded that there would be few facilities comparable to the Cedar WTF in Brazil, as there are few such lakes in Brazil and none that would be protected from human activity. Furthermore, the water used in the WTF is derived mainly from snowmelt, which doesn't exist in Brazil. Therefore, the quality of the water, contaminants and treatment processes



are quite different. Only in some drilled systems in isolated areas (stand-alone systems) might there be similarities.

2. Industry Onsite Presentation/Meeting with CH2M Hill at Cedar WTF: Ms. Kim Erwin, a design engineer with CH2M Hill, joined John Wesely to give a presentation to the delegates on the company's capabilities and highlights of its global project experience in the W/WW sector. CH2M Hill has recently been working on a study for a project in this area in Manaus, State of Amazonas in Brazil for USTDA. Ms. Erwin noted that there is expected to be a 40% shortfall of water supply by 2030, which affects food security and climate change, among other issues, and which will require total water cycle planning and optimal asset management to mitigate. Currently, the sector is affected by aging infrastructure, including 40% of the U.S. municipal market infrastructure, which is in need of upgrades and modernization. The company works in other infrastructure sectors, and provides full service solutions to its clients.

3. Industry Onsite Presentation/Meeting with Schweitzer Engineering Laboratories (SEL) at Cedar WTF: Mr. Eddie Schweitzer, Business Development Director, came to Cedar WTF to meet the delegates and make a presentation on SEL's relevant products and services. SEL was the corporate sponsor for the Industry Roundtable held in San Ramon, CA on May 20th, but the company's headquarters were not far from the Cedar WTF site. Mr. Schweitzer traced SEL's history, from making critical digital protective relays as a small family-owned business to a global business owned by its 3600 employees offering 500 products. SEL works with customers to provide safe, reliable and economic electric power. The company offers manufacturing, technical support, instruction, installation and testing services for a range of needs from generator and transmission protection to distribution automation and control systems, demand-side management programs, reservoir controls, and so forth as well as protocols to quickly react to circuits, harmonics, etc. SEL offers a 10-year reliability guarantee for its third-party certified products (with perhaps 1 of every 500 products experiencing some kind of failure per year), and has never charged for any repair or replacement in its 30 years of business. Mr. Schweitzer said that SEL has a customer satisfaction rating of 82% versus GE's rating of 6%. It offers complete services for water utilities on the energy side. It has four offices in Brazil: in Campinas, Sao Paulo, Salvador and Rio de Janeiro. Several of the delegates were interested in SEL's product and service line, including cyber protection. There were good discussions with the delegates on contextual issues related to power supply and reliability and

Above: SEL representative Eddie Schweiter (2nd from left) and CH2M Hill's John Wesely (5th from left) with Brazilian delegates at the Cedar WTF, 5/15/14. (Photograph by R. Ravaliya, AEAI.)

costs for the Brazilian utilities; requirements; PowerMax (power management system for generation); demand management; motor protection and control; and metering. SEL concluded with the reassurance that doing a project as small as just metering, to a project as comprehensive and providing the whole energy system's management and interface at the WTF/WWTFs in Brazil, would all be in its interest and capabilities.

May 16, 2014

1. Site Visit to King County's West Point WWTP: The West Point WWTP assembled three engineers in addition to the plant manager, Dan Grenet, to give an overall summary of the plant's history, operations, and energy management and production systems, as well as tour the plant (the control room featuring SCADA technology, and the collection, pumping, biogas and sludge treatment, centrifuge, drying and power generation areas). West Point serves about 720,000 residential and other customers, out of a total population of about 1.5 million in King County. Two other WWTFs also serve King County and the City of Seattle. The West Point facility is located on 32 acres: i.e., its confined area requires vertically stacked areas (there are 3 miles of tunnels) and careful planning for expansion needs. Gravity bypass (using tidal flows) is used optimally to pump the effluent 600 feet to Puget Sound. It receives an average wastewater flow of 100 MGD with a peak flow during the rainy winter months of 440 MGD. Electricity consumption averages about 8 MW, and it can produce about 2.3 MW of electricity. Initially (to 1983), gas was flared at the plant, but now biogas is produced as well as 120 wet tons (28% solids) of bio solids. The biogas derived from digestion provides 30% to 50% of the plant's energy needs (heat and electricity), with a 160 degree Fahrenheit heat loop of hot water circulating around plant. High-efficiency centrifuges are being built, and the plant already has high-efficiency blowers. Flash mixers keep the sludge aerated. The equipment consuming the most energy are the (38) pumps and an oxygen generator (based on 4 x 720 hp engines) for secondary treatment, which account for 45% of the electrical demand. There is a capital investment project to replace the swing absorption oxygen systems – plant management is looking at different options. The two large Caterpillar generators installed in April are rated at 2.3 MW each, but because of fuel constraints (biogas), only one can be used at any given time. This system allows West Point to sell power to the power utility, Seattle City Light (SCL), which pays the WWTP for the power although it is used internally and SCL does not transport the

The delegates show interest in SCADA and controls & instrumentation at West Point WWTP, 5/16/14. (Photograph by R. Ravaliya, AEAI.)

electricity. The Siemens software used at the plant became obsolete and doesn't read the newer meters, so Power Monitor software was installed to work with the new equipment and will read all of the meters. Three older 1.2 MW (each) combustion engines using biogas for cogeneration were manufactured by Waukesha (based in Wisconsin, bought by GE Energy in 2010). The heat is used for heating the digesters. All gas produced is used immediately (there is no storage). Water reclaimed after tertiary treatment through a sand filter is used at the plant, with considerable associated water and energy savings. Plant automation through PCLs and SCADA was supplied by Allen-Bradley, a U.S. company. West Point is hoping to attain a 25% improvement in energy efficiency.

2. Industry Onsite Presentation/Meeting with Aclara at West Point WWTP: Steve Meissel, Vice President of International Business Development for Aclara, came to the West Point facility to make a presentation on the company's leak detection equipment and other systems and applications it has for water, gas and electric utilities – all three of which are relevant to the Brazilian delegates. Its biggest installations are gas utilities. Aclara's StarNetwork with ZoneScan Leak Detection System provides an integrated platform including a meter transmission unit (MTU), data collection unit (DCU) and a network command center (NCC) to provide a powerful leak detection system with time stamps, geophysical data, transmission and control capabilities. This proven technology has helped many water utilities to save energy as it reduces water losses. Since the drinking water produced in Brazil has an average of about 37% in system losses, this is of interest to the delegates from the WTFs. Aclara offers remote meter reading technology, and is a leader in Advanced Metering Infrastructure (AMI). Solar-powered lithium battery back-up energy systems support Aclara's equipment: during Hurricane Sandy, it continued to provide read-outs. Aclara's technology can withstand harsh environments; be adapted to various host systems; combine water and gas utilities together, with synchronized meter reading; reduce commercial thefts; help consumers to understand their bills; and many other features. Aclara has worked in Brazil (in the State of Parana) and has a company representative there.

<u>May 19, 2014</u>

1. Site Visit to City of Sacramento's E.A. Fairbairn WTF: About nine staff from the City of Sacramento met the delegation at this plant. Ms. Amy Kral gave the overall tour and description of the facility, with other staff contributing based on their relevant area of responsibility (SCADA, plant O&M, business planning and customer services, water engineer, etc.). At the Fairbairn WTF, nine pumps have been installed to draw water from the American River. The river has a low turbidity level (range 2 to 4 NTU). The grit and other solids removed from the feed water are thickened on drying beds to about 50% solids. Total solids amount to about 2,000 wet tons per year. The City of Sacramento, which operates the plant, uses a system-wide audio detection system to identify leaks. Sacramento uses equipment provided by Fluid Conservation Systems Inc., a U.S. company. An average of 25 leaks is identified on a monthly basis, out of 590 investigations. The primary cause of water leaks for residences is a dripping toilet. Losses represent about 490 gallons/day on these properties. The City uses information and education campaigns to help orient its (residential) customers about leaks and how to stop them, and also offers rebates to encourage use of water conserving products/appliances. The area is

experiencing a drought, so water conservation and loss reduction programs are important. The City serves about 450,000 people, or about 146,000 customer accounts. The City collects for 70,000 accounts for third party suppliers. Another WTP on another river can help supply the service area. Individual meters have been installed since 1992; only 50% of the mains have meters. The pipe material in the system includes cast iron (100 years old), steel, PVC, and asbestos. The delegates asked many questions about the staff and its training, rates, and river quality issues.

2. Meeting with the California Energy Commission (CEC): The CEC's Executive Director, Robert Oglesby, led the meeting on behalf of the host agency, with seven other CEC staff in attendance. Mr. Oglesby noted how the energy situation and the energy-water nexus has evolved over the 40-year life of the CEC. In its early years, the CEC faced 8% annual energy growth and was looking at nuclear power stations to meet the rapid increase in demand. Today, with its population of 38 million and a $2 trillion GDP, the energy demand growth is basically flat at 1%. However, today the biggest consumer of energy is the water sector. In the northern part of the state, there is generally enough water, though there has been drought for several years, but the southern part of the state is water poor. Therefore, there are water transport systems from the north to the south, and from the east to the west, that add considerable energy costs to the water sector beyond those normally found. So water has been added to CEC's energy mandate (which was oil, gas and electricity policy, and building standards). The State of California has a target to obtain 30% of its energy from renewable sources by 2030. It currently derives 20% of its energy from renewable sources, so it is on track to reach the 2030 goal. There are many incentive programs supporting RE development in the state.

California has very stringent water standards, and has been pro-active (experimental) in finding ways to reduce water and energy consumption through low-flow or efficient showerheads, faucets, toilets, sprinklers, as well as energy efficiency standards. In fact, water utilities in the state had to adjust their revenue models, as water conservation was so successful it put the water utilities using consumption as their basis for tariffs financially unviable.

The CEC funds research on biogas and digester efficiency, biogas-to-energy, water recycling, and may subsidize new energy efficient technologies. Information on these projects and others supported by the CEC are available through the Public Interest Energy Research Program, found on the Commission's website. CEC and the California Public Utilities Commission (CPUC) have looked at time-of-use rates for conservation, and meters were added to support this objective. SCADA and energy management systems for water utilities help to reduce water losses (and energy). The public agencies have to consider costs-benefits to citizens for new pipelines, reservoirs, and other delivery systems. CEC noted that the EBMUD and Dublin San Ramon Services District have respectively done innovative applications of renewable energy and energy efficiency options.

May 20, 2014

1. Industry Roundtable Presentations: USTDA's Director of Public Affairs Tom Hardy made opening remarks, followed by USTDA Country Manager Isabel Sepulveda, who made a presentation on USTDA's work in the LAC region, and in the clean energy and water sectors, and reviewed relevant project activities as well as the purpose of the RTM. The first delegate to give the morning presentation provided, beyond his company's and project information, an overall industry perspective and summary of its context in terms of the increasingly high costs of energy and its lack of reliable supply for WTFs/WWTFs in Brazil; the need to modernize infrastructure; recent changes in the legal and regulatory frameworks; emerging competition in the industry; and some areas of particular technological interest. The other delegates all provided information on what specific technologies and services they would require for ongoing and upcoming projects which U.S. companies could provide, and when. Many commented to the U.S. participants that they should come to visit their facilities and discuss their projects in Brazil. After the first speaker, questions were held until the period before the upcoming (coffee or lunch) break. There were numerous exchanges during the Question and Answer (Q&A) period which were thoughtfully responded to by the delegates, with virtually all of them contributing their perspectives and recommendations. During the coffee break, there were lively discussions among the participants. Also during the break, the Activity Coordinator sought out participants not already on the schedule to sign them up for one-on-one meetings with the delegates. The onsite luncheon found a mixture of delegates and company representatives at most tables, enabling further strengthening of relationships.

2. One-on-one meetings: AEAI's Industry Specialist and Activity Coordinator sat at different delegate tables during the one-on-one meetings to help guide discussions – as the concept was quite different for the Brazilian delegates and even for many of the U.S. companies – and to observe, evaluate and/or promote potential opportunities for future commercial transactions.

Above, top-to-bottom: Delegate one-on-one meetings at the May 20th Industry Roundtable in San Ramon, CA.

CAB Ambiental with CleanBlu representatives;

Solvi with Xylem representatives;

CEDAE with Oswald Green Technologies representatives. (Photographs by R. Ravaliya, AEAI.)

May 21, 2014

1. Site Visit to Dublin San Ramon Services District WWTP: This quick plant tour demonstrated biogas energy recovery and UV treatment for pathogen reduction. The average flow of wastewater into the plant is 11.0 MGD. Two aspects of the plant of interest are digestion and use of the resultant biogas for energy and recycling of inflow water for irrigation (landscaping) after tertiary treatment. Biogas is treated prior to combustion. The equipment used includes Applied Filter Technology, which has been acquired by the Robinson Group LLC (a U.S. company). Three Waukesha engines are used to combust the treated biogas. The gas produced provides 50% of the WWTP's power needs. The tertiary treatment uses sand filters or membrane equipment that was supplied by U.S. Filter (which was acquired by Siemens). After initial treatment, the water is treated by UV light (system supplied by WEDECO, a Xylem company). Non-recycled water is pumped 16 miles to San Francisco Bay. Water recycling saves the electrical energy required to pump this water to the Bay. There is also a solar system in place on the site.

2. Site Visit to the East Bay Municipal Utility District (EBMUD) Oakland WWTP: The delegation's final activity was a description and tour of the large Oakland water and wastewater facility of the East Bay Municipal Utility District (EBMUD). This facility receives an average flow of 60 MGD of wastewater. The collection system – which is done by each city in the district, but then fed to the Oakland "interceptor" facility – has separate pipes for sanitary and storm water flows. Nonetheless, during storms (primarily in the winter) wastewater flow to the plant is increased due to significant in-flow and infiltration, so investments are being made to upgrade the lateral pipes to address this problem. One point of interest, as at most of the WTPs and WWTPs visited, was the ownership and the customer billing system. The City of Oakland bills customers for collection and EBMUD bills for treatment services. The water services cover 1.3 million customers; the sanitation services cover about 700,000 customers. The facility also treats industrial waste (which was not encountered before on the RTM). This large plant applies energy efficiency measures, systems to recover energy from digested sludge, and produces 30% more energy than it consumes. The combined biogas from sludge and outside waste streams provides 80% of the WWTP's power needs. The facility also benefits from an arrangement from the Western Area Power Administration (WAPA) which runs hydropower plants in the western region of the U.S. under DOE, and sells electricity at a cheap price to EBMUD. Electricity is purchased from the grid due to short-term differences in biogas supply and plant electrical requirements. The plant has 11 MW of generating capacity onsite, though it generates between 8-9 MW and only requires 4-5 MW for its own consumption. (It doesn't produce enough gas to generate at full capacity.) Excess electricity is sold to the Port of Oakland, which is adjacent to the WWTP, at $71/MW. No wheeling by the local power utility is needed as the transmission line was built by the Port. The plant's SCADA system was provided by Westinghouse. This product line was acquired by Emerson (a U.S. company). The entire plant is highly automated, which John Hake, who gave the delegates information about the plant and the tour of the facility, estimated improved its energy efficiency by about 5%.

The biogas is used to power three Enterprise engines (acquired in 1986 and rebuilt many times since then) with a capacity of 2.2 MW each (Enterprise was a San Francisco-based company,

then the engine and related divisions of the company were sold to DeLaval.) This equipment is still in use. A General Electric turbine generator is used to convert the engine power to electricity. To supplement the existing conversion system, EBMUD recently installed five Solar (a Caterpillar company) turbine generators, adding another 4.5 MW of generating capacity. Hot water is also circulated from the engines to heat the biodigestors.

Dewatered digested bio solids (25-28% solids) are used as daily cover at a landfill. A small portion of the plants flow (0.5 MGD) is recycled for landscaping use. The facility's recycling capacity is 2.0 MGD. In addition to sludge from wastewater treatment, the plant accepts high strength waste organics. These are primarily food processing discards from generators located up to 100 miles away. The digestion capacity for organic waste was formerly used to digest food processing waste from plants that are now closed. Effluent water is fully treated, disinfected and dechlorinated, but no tertiary treatment process for nutrient removal is yet required.

IV. CONTRACTOR EVALUATION OF RTM AND RECOMMENDATIONS

A. Overall Analysis of the RTM

Overall, and throughout the tour, delegates expressed their satisfaction with the all meetings and activities of the tour. The delegates were very inter-active and interested in all aspects of the business, from billing to recycled products, staffing requirements, transportation, environmental standards and O&M costs. They asked a lot of questions, and also contributed their knowledge on the subject matter as well as of new technologies with hosts and meeting participants.

For delegates from water utilities/companies, a primary theme of interest was reduction in systems losses due primarily to leaks during distribution. Countrywide, about 39% of treated water is lost in the distribution losses, representing both unacceptably high non-revenue water and energy inefficiency. The water utility delegates expressed their sense of limited transferability to the Brazilian context of the two water treatment facilities toured, mainly because the in-feed water turbidity of both facilities were much lower than water supplies in Brazil. However, they were interested in the use of non-chlorine disinfection equipment, SCADA systems, solar power and other energy systems and management practices.

For delegates from wastewater utilities, there was a high level of interest in digestion, conditioning (aeration, drying) and use of biogas for energy. The level of treatment on the East Coast (Alex Renew and Back River WWTP) before discharging into local water bodies which eventually lead into the protected Chesapeake Bay estuary amazed the delegates. On the West Coast, they were interested in the distance and manner of discharges, as well as various by-products obtained, use of gravity flow, and high efficiency pumps, blowers, motors, etc. All delegates were interested in plant automation systems, such as SCADA, as well as control and instrumention; and alternatives to chlorine disinfection such as ultraviolet light and ozonation equipment. (The delegates anticipate that chlorine residual standards may cause a shift to non-chlorine disinfection in the future.)

The delegates seemed to appreciate the presentations given by well established companies during the site visits, such as at Back River and King County West Point WWTP, and Cedar WTF. About one-half of the delegates were interested in and open to exploring further possibilities with some of the companies with newer or less known technologies that came to the Industry Roundtable.

The delegates did an excellent job in their presentations at the Industry Roundtable, specifically identifying project and procurement needs for these relevant to U.S. companies in their presentations, including an estimated value for each category or item. Although the one-on-one meeting format was a bit strange to them, after the meetings virtually all of the delegates expressed satisfaction with this opportunity and format for brief meetings with U.S. companies. There were some gaps in schedules for some of the delegates, but this was mainly caused by some of the U.S. companies thinking they were not relevant to their products, or by another meeting running overtime. Below is one comment received by the Industry Specialist from a delegate after the mission was completed, typical of other delegate comments:

> *"Really, it was a very productive mission. All facility visits and roundtable provided us many good information and we learn a lot with Americans successful cases. I am very hopeful in working with some technologies we have known during our stay in US. As well, I would like to thank you for the support and knowledge you lend to us along those days."*

B. Evaluation of U.S. Potential Exports/Commercial Outcomes

The Contractor believes there is a very pro-active interest being pursued in concrete terms by both delegates and U.S. companies to develop commercial relationships and export U.S. technologies and services for the projects that the delegates' companies are undertaking. The overall potential of such sales, just for projects promoted by the delegates, is estimated to be from about $345 million to US$693 million for competitive U.S. suppliers in terms of technologies, equipment and services, based on the value of potential sales indicated by 11 U.S. companies in their evaluation responses for the May 20th Industry Roundtable, as shown in Table 1.

Of the overall $140 billion of investment expected for all of the anticipated or ongoing water and wastewater sectors' projects in Brazil, about 30% (or $42 billion) is expected to be provided from other countries, of which total U.S. companies could reasonably be expected to capture between 20% to 40%, or around US$8.4 to $16.8 billion, according to AEAI's Industry Specialist accompanying the RTM.

The U.S. companies which met with the Brazilian delegates should be able to successfully expand their business to other W/WW utilities in Brazil if they pursue business with the delegates, as the delegates provided a lot of useful information to help approach this sector as a whole during discussions and in their presentations. The Contractor is optimistic on future export sales derived from this RTM based on the post-RTM interactions already pursued by many of the participating U.S. companies, in addition to the delegates' positive observations during the tour and in their evaluations about the concrete areas of interest to them and specific equipment, technologies, services and/or companies they are directly pursuing in the aftermath of the RTM. This observation is also based on delegates' actions to prepare requests to undertake feasibility studies with USTDA (Grupo Águas do Brasil, CEDAE, EMBASA, CAGECE) support after the conclusion of the RTM.

U.S. companies efforts to enter the market for clean energy production/energy efficient products and services in Brazilian water treatment facilities should focus on competitive areas, such as:

- goods that improve water collection, treatment and distribution systems, including leak/loss detection technologies;
- improved hydrometers with advanced metering infrastructure (AMI), including meter reading systems;
- pressure reducing valves;
- energy efficient pumps and motors;
- VFD for pumping stations;

- SCADA and other improved automation controls and instrumentation; and
- RE systems that help to reduce the cost of energy and provide supply security to the utilities.

For Brazilian wastewater treatment facilities, competitive U.S. goods would include:

- energy recovery systems from sludge (activated sludge technology);
- energy efficient blowers and dryers;
- energy efficient motors and pumps;
- cogeneration systems based on biogas;
- mechanization/process automation systems;
- modern controls and instrumentation (SCADA, meter systems);
- programmable logic controllers;
- frequency inverters;
- telemetric systems;
- PRVs; and
- aerators.

U.S. companies would also be competitive in the Brazilian market for both water and wastewater sectors in engineering and design services, especially for integrating the information, data collection, automation and management platforms.

C. Recommendations

Generally, it is important for USTDA or DOC to encourage the U.S. industry participants with a real interest in the Brazilian market to directly visit the delegates and other utilities in Brazil, to show their interest, to better understand what the most promising niches and opportunities would be for them in the near- and mid-term, and to cement a positive business relationship that could help them establish contacts with other utilities and/or local partnerships with respected companies in Brazil already involved in this market. The delegates stated this and invited the U.S. companies to come and see their projects in Brazil. Companies like SEL, Aclara, OSIsoft and JCI have representatives or offices in Brazil: the delegates will expect to make contact or be contacted by them in the near future. Other participating U.S. companies have already scheduled or undertaken visits to Brazil or meetings at an upcoming industry event in Brazil or in the U.S.

The delegates presented U.S. companies with several bid opportunities for this year, as well as others coming up in the next couple of years. U.S. companies should position themselves to meet these opportunities by ensuring they have a presence in Brazil, and having high-level company representatives travel there to meet with delegates with staff from their locally-established offices and/or representative partners. The delegates will notify the U.S. companies (potential equipment/service suppliers) they have met with of pending equipment procurements or specific project requirements they may bid on. The four privately-owned companies participating in the delegation may sometimes be able make deals without a public solicitation (easier), but need to have verified the prospective equipment's operation and costs, so U.S. companies should provide the necessary level of information and access to pilot projects or commercial applications. For the less proven or known technologies presented by U.S.

companies, it would be useful to bring the delegates of interest to a manufacturer or project site following the RTM. Some delegates are interested in pilot projects for these.
To secure significant U.S. exports based on the contacts and information emanating from this RTM, the Contractor also recommends the following:

- Pro-active follow-up in the next few months by USTDA representatives with the delegates and with the participating U.S. companies who have actively pursued follow-up actions with the delegates, to see what progress has been made, if the company is considering additional USTDA support via a feasibility study or other option, and what else (if anything) is needed to support further developments.
- One barrier frequently mentioned by U.S. companies is duties on imports into Brazil. USTDA or the DOC should work with the potential U.S. vendors to determine what the import taxes or and other obstacles for U.S. products would be.
- Reminders or notices to be sent by USTDA, the Contractor, or WEF that the delegates attend WEFTEC in New Orleans in December 2014, and use the event to meet with U.S. companies in the relevant areas of interest, as well as with U.S. industry organizations and agencies that participated in the thematic roundtables of the RTM, particularly AWWA, WEF, WERF, EPA and DOC. It might be useful to send Brazilian delegates a list of contacts for the involved or relevant U.S. companies and industry associations.
- Contact other U.S. companies which did not attend RTM activities – especially those who had registered for the Industry Roundtable but ultimately didn't make it – by USTDA or the relevant Export Assistance Center or DOC office, or Contractor – to see if these companies would like to approach the delegates to discuss the potential interest in their technologies or services, as originally planned. This initial contact could be guided by USTDA/other promoting party.
- Post, if permitted, information about the areas of interest indicated by the delegates on USTDA – or, alternatively, DOC – websites/portals designed for such purposes, to let U.S. companies know more about these opportunities.
- Consideration by USTDA of means – such as technical assistance, or support via another USG agency with a mandate or interest in this area – to help strengthen the domestic Brazilian industry associations to work more cohesively on joint studies looking at technologies and opportunities to reduce energy consumption or produce it at their facilities, as well as industry, policy and regulatory initiatives or positions to support. The industry associations in Brazil are weak and lack a mission and leadership, unlike the very strong industry associations that exist in the U.S. and were very dominant at the Industry Association Roundtable. The lack of integrated action by the sector in Brazil impedes information on useful technologies and approaches that would naturally bring a focus on what U.S. companies have to offer, as well as give a single entry point for U.S. companies seeking to enter the huge market represented by these Brazilian utilities. This issues was discussed with the delegates several times during the tour, and many of them were interested in promoting greater joint actions to share costs and information for studies, pilot projects, and advisory services which might easily incorporate U.S. company participation. It is noted that the private utility delegates were somewhat cautious on sharing information that they

would consider critical to their competitiveness with each other and even with the public utilities, but there should be areas in which they would participate and benefit, as well as contribute. As a first step, the delegates should be surveyed on this issue to derive their specific level of interest and possible areas that could be supported towards strengthening the industry associations or alternative means of achieving the same end goals.

- Although the preparation time for the RTM was very short for reasons explained to and accepted by the Contractor, in general it is important to emphasize that any RTM will be better if there is more lead time than this one had. Despite this, the RTM seems to have been quite successful, especially in securing the itinerary items almost as proposed, even adding on an extra site visit. To improve the quality of the RTM overall, for the industry expert's ability to confirm site visits, provide timely information to delegates and U.S. companies, and even to lead or guide discussions and shape the Industry Roundtable activity, it would have been better to have more specific information sooner on the interests and near and intermediate term project development plans of the delegates. The short lead time of this RTM impacted the ability to obtain as many participants at the Industry Roundtable as desired, though alternatively there were several company meetings outside of this event. Also, many of the delegates were under a lot of pressure to prepare themselves or provide their presentations in a timely way, or other information early enough to clarify their interests in certain types of technologies or equipment and engage targeted vendors in a more compelling manner. For example, some small companies were unsure if their products were of interest to the delegation, and didn't know whether or not to come. The Contractor was only able to clarify some of these specific areas of potential interest after the RTM started.

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ATTACHMENTS

1. **Participant Lists**
    - **A. Foreign (Brazilian) Participants**
    - **B. U.S. Participants**
2. **Evaluation Questionnaire Forms**
    - **A. Delegates**
    - **B. U.S. Company Industry Roundtable Participants**
3. **Presentations from DC Roundtables and Site Hosts**

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ATTACHMENT 1. Participant Lists

A. Foreign (Brazilian) Participants

B. U.S. Participants

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A. Foreign (Brazilian) Participants

BRAZIL, USTDA 2014-51006A, USTDA: BRAZIL CLEAN ENERGY EXCHANGE PROGRAM - WATER AND WASTEWATER ENERGY EFFICIENCY RTM, 05/11/14 - 05/21/14

																	Business Briefing Location Information:		
Firm/Organization Name	**Are you a Small Business?**	**Organization Type**	**Employment Designation**	**Are You a Delegate?**	**Receive USTDA's news & events e-mails?**	**First Name**	**Last Name**	**Title**	**(W) City**	**(W) State**	**(W) ZIP/ Postal Code**	**(W) Country**	**Office Phone Number** (xxx-xxx-xxxx OR +xx.xx.xxx.xxxx format)	**(W) Mobile Phone Number** (xxx-xxx-xxxx OR +xx.xx.xxx.xxxx format)	**Work E-Mail Address**	**How Did You Learn of this Event?**	**If "Other" in previous column, explain**	**Business Briefing or Other RTM Activity Date(s)**	**Venue Name**	**City**	**State**
CAB Ambiental	No	Foreign Private Sector	Private Business Professionals	Yes	No	Otavio	Silveira	Chief Operational Officer (COO)	São Paulo	SP	04547-005	BRAZIL	55-11-2199-0478		osilveira@cabambiental.com.br	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Companhia de Água e Esgoto do Ceará (CAGECE)	No	Foreign Gov. Official	Government Representatives	Yes	No	Ronner	Braga Gondim	Research, Development and Innovation Coordinator	Fortaleza	CE	60510-430	BRAZIL	55-85-3101-1949	55-85-8898-5509	rbgondim@yahoo.com.br	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Companhia de Saneamento Ambiental do Distrito Federal (CAESB)	No	Foreign Gov. Official	Government Representatives	Yes	No	Humberto	Belina Adamatti	Energy Management and Energy Efficiency Manager	Brasília	DF	71928-720	BRAZIL	55-61-3213-7425	55-61-8401-80	humbertobelina@caesb.df.gov	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Companhia Estadual de Águas e Esgotos (CEDAE)	No	Foreign Gov. Official	Government Representatives	Yes	No	Edes	Fernandes de Oliveira	Superintendent Manager, Guandu Water Complex	Rio de Janeiro	RJ	26298-566	BRAZIL	55-21-3759-1014	55-21-99911-5615	edes@cedae.com.br	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Companhia Estadual de Águas e Esgotos (CEDAE)	No	Foreign Gov. Official	Government Representatives	Yes	No	Gustavo	Tannure	Advisor to the CEO	Rio de Janeiro	RJ	20210-030	BRAZIL	55-21-2332-3228	55-21-99156-7474	briard@cedae.com.br	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Companhia Pernambucana de Saneamento (COMPESA)	No	Foreign Gov. Official	Government Representatives	Yes	No	Ricardo	Barretto	Director of Business Development	Recife	PE	50040-905	BRAZIL	55-81-3412-9268	55-81-9488-50	ricardobarretto@compesa.com.br	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Empresa Baiana de Águas e Saneamento S.A. (EMBASA)	No	Foreign Gov. Official	Government Representatives	Yes	No	César	Silva Ramos	Technical and Sustainability Director	Salvador	BA	41701-015	BRAZIL	55-71-3360-2208	55-71-9686-7714	cesar.ramos@embasa.ba.gov.br	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Grupo Aguas do Brasil	No	Foreign Private Sector	Private Business Professionals	Yes	No	Luiz	Fabbriani	Business Development Director	Nitteroi (Rio de Janeiro)	RJ	24030-211	BRAZIL	55-21-2729-9200	55-21-99871-9222	luiz.fabbriani@grupoaguasdobrasil.com.br	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
OAS Soluções Ambientais	No	Foreign Private Sector	Private Business Professionals	Yes	No	Giuliano	Dragone	Operations Director	São Paulo	SP	01228-200	BRAZIL	55-11-2124-6723	55-11-98465-6102	giuliano.dragone@oas.com	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Saneamento de Goiás S.A. (SANEAGO)	No	Foreign Gov. Official	Government Representatives	Yes	No	Wanir	J. de Medeiros Jr.	Manager, Development & Operational Improvement	Goiânia	GO	74805-100	BRAZIL	55-62-3243-3300		wanir@saneago.com.br	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Solvi Saneamento - Sanitation/Water Division	No	Foreign Private Sector	Private Business Professionals	Yes	No	Eng. Hanokh Camilo	Vilela Yamagishi	Project Coordinator, Sanitation / Water Division	São Paulo	SP	01415-000	BRAZIL	55-11-3124-3500	55-11-97488-9339	hyamagishi@solvi.com	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Non-Delegate Participant																					
Consulate General of Brazil in San Francisco	No	Foreign Embassy in U.S.	Government Representatives	No	No	Vivian	Parker	Trade & Investments Specialist	San Francisco	CA	94104	UNITED STATES OF AMERICA	415-820-5284		vivian.parker@itamaraty.gov.br	Other	Invited by U.S. Commercial Service	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA

B. U.S. Participants

The following RTM participants are presented in order by type of organization, then by organization name:

BRAZIL, USTDA 2014-51006A, USTDA: BRAZIL CLEAN ENERGY EXCHANGE PROGRAM - WATER AND WASTEWATER ENERGY EFFICIENCY RTM, 05/11/14 - 05/21/14

Full U.S. Participant List for All RTM Activities

5/20/2014 Business Briefing or Other RTM Activity Location Info:

Firm/Organization Name	Are you a Small Business?	Organization Type	Employment Designation	Are You a Delegate?	Receive USTDA's news & events e-mails?	First Name	Last Name	Title	(W) City	(W) State	(W) ZIP/ Postal Code	(W) Country	Office Phone Number (xxx-xxx-xxxx OR +xx.xx.xxx.xxxx format)	(W) Mobile Phone Number (xxx-xxx-xxxx OR +xx.xx.xxx.xxxx format)	Work E-Mail Address	How Did You Learn of this Event?	If "Other" in previous column, explain	Business Briefing or Other RTM Activity Date(s)	Venue Name	City	State
California Energy Commission (CEC)	No	Entities with State/Local Gov.	Government Representatives	No	No	Heather	Bird	Energy Commission Specialist I	Sacramento	CA	95814	UNITED STATES OF AMERICA	916-327-1473		hbird@energy.ca.gov	Other	Invited by AEAI	5/19/2014	CEC	Sacramento	CA
California Energy Commission (CEC)	No	Entities with State/Local Gov.	Government Representatives	No	No	Albert	Lundeen	Information Officer	Sacramento	CA	95814	UNITED STATES OF AMERICA	916-654-5027		albert@lundeen@energy.ca.gov	Other	Invited by AEAI	5/19/2014	CEC	Sacramento	CA
California Energy Commission (CEC)	No	Entities with State/Local Gov.	Government Representatives	No	No	Grant	Mack	Advisor to Chair Weisenmiller	Sacramento	CA	95814	UNITED STATES OF AMERICA	916-654-5166		Grant.Mack@energy.ca.gov	Other	Invited by AEAI	5/19/2014	CEC	Sacramento	CA
California Energy Commission (CEC)	No	Entities with State/Local Gov.	Government Representatives	No	No	Tuan	Ngo	Engineer, Applicances and Existing Buildings	Sacramento	CA	95814	UNITED STATES OF AMERICA	916-651-2908		Tuan.Ngo@energy.ca.gov	Other	Invited by AEAI	5/19/2014	CEC	Sacramento	CA
California Energy Commission (CEC)	No	Entities with State/Local Gov.	Government Representatives	No	No	Robert	Oglesby	Executive Director	Sacramento	CA	95814	UNITED STATES OF AMERICA	916-654-4996	916-799-9702	roglesby@energy.ca.gov	Other	Invited by AEAI	5/19/2014	CEC	Sacramento	CA
California Energy Commission (CEC)	No	Entities with State/Local Gov.	Government Representatives	No	No	Paul	Roggensack	Mechanical Engineer	Sacramento	CA	95814	UNITED STATES OF AMERICA	916-327-2224		proggens@energy.state.ca.us	Other	Invited by AEAI	5/19/2014	CEC	Sacramento	CA
California Energy Commission (CEC)	No	Entities with State/Local Gov.	Government Representatives	No	No	Brenda	Sturdivant	Associate Energy Specialist	Sacramento	CA	95814	UNITED STATES OF AMERICA	916-654-4708		Brenda.Sturdivant@energy.ca.gov	Other	Invited by AEAI	5/19/2014	CEC	Sacramento	CA
City of Baltimore, Back River WWTP	No	Entities with State/Local Gov.	Government Representatives	No	No	Nick	Frankos	Acting Division Chief, Wastewater Facilities	Baltimore	MD	21224	UNITED STATES OF AMERICA	410-396-9814	410-409-4285	nick.frankos@baltimorecity.gov	Other	Invited by AEAI	5/13/2014	Back River WWTP	Baltimore	MD
City of Sacramento, E.A. Fairbairn Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Craig	Chalmers	Plant Engineer	Sacramento	CA	95822	UNITED STATES OF AMERICA	916-808-1418	916-826-0513	cchalmers@cityofsacramento.org	Other	Invited by AEAI	5/19/2014	E.A. Fairbairn WTP	Sacramento	CA
City of Sacramento, E.A. Fairbairn Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Lisa	Deklinski	Security / Emergency Preparedness Program Mgr.	Sacramento	CA	95822	UNITED STATES OF AMERICA	916-808-1309	916-628-1244	ldeklinski@cityofsacramento.org	Other	Invited by AEAI	5/19/2014	E.A. Fairbairn WTP	Sacramento	CA
City of Sacramento, E.A. Fairbairn Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Amy	Kral	Supervisor of Plant Operations	Sacramento	CA	95822	UNITED STATES OF AMERICA	916-808-5651		akral@cityofsacramento.org	Other	Invited by AEAI	5/19/2014	E.A. Fairbairn WTP	Sacramento	CA
City of Sacramento, E.A. Fairbairn Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Howard	Moreland	Sr. Plant Operator	Sacramento	CA	95822	UNITED STATES OF AMERICA			HMoreland@cityofsacramento.org	Other	Invited by AEAI	5/19/2014	E.A. Fairbairn WTP	Sacramento	CA
City of Sacramento, E.A. Fairbairn Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Michael	Malone	Operations Manager	Sacramento	CA	95822	UNITED STATES OF AMERICA	916-808-6226		mmalone@cityofsacramento.org	Other	Invited by AEAI	5/19/2014	E.A. Fairbairn WTP	Sacramento	CA
City of Sacramento, E.A. Fairbairn Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Jamille	Moens	Business Services Manager	Sacramento	CA	95822	UNITED STATES OF AMERICA	916-808-5988		jmoens@cityofsacramento.org	Other	Invited by AEAI	5/19/2014	E.A. Fairbairn WTP	Sacramento	CA
City of Sacramento, E.A. Fairbairn Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Tedd	Vallance	Information Technology Supervisor, SCADA	Sacramento	CA	95822	UNITED STATES OF AMERICA	916-808-5633		tvallance@cityofsacramento.org	Other	Invited by AEAI	5/19/2014	E.A. Fairbairn WTP	Sacramento	CA
City of Sacramento, E.A. Fairbairn Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Larry	Valim	Sr. Plant Operator	Sacramento	CA	95822	UNITED STATES OF AMERICA			lvalim@cityofsacramento.org	Other	Invited by AEAI	5/19/2014	E.A. Fairbairn WTP	Sacramento	CA
City of Seattle, Cedar Water Treatment Plant	No	Entities with State/Local Gov.	Government Representatives	No	No	Lynn	Kirby	Water Quality Engineer, Seattle Public Utilities	Seattle	WA	98134	UNITED STATES OF AMERICA	206-684-0216		Lynn.Kirby@seattle.gov	Other	Invited by AEAI	5/15/2014	Cedar WTP	Seattle	WA
District of Columbia Water and Sewer Authority	No	Entities with State/Local Gov.	Government Representatives	No	No	Chris	Peot	Director, Resource Recovery	Washington	DC	20032	UNITED STATES OF AMERICA	202-787-4329	202-812-5281	cpeot@dcwater.com	Other	Invited by AEAI	5/12/2014	USTDA	Arlington	VA
Dublin San Ramon Services District (DSRSD) WWTP	No	Entities with State/Local Gov.	Government Representatives	No	No	Levi	Fuller	Plant Operations Supervisor	Dublin	CA	94568	UNITED STATES OF AMERICA	925-846-4565		fuller@dsrsd.com	Other	Invited by AEAI	5/21/2014	Dublin San Ramon Services District WWTP	Dublin	CA

BRAZIL, USTDA 2014-51006A, USTDA: BRAZIL CLEAN ENERGY EXCHANGE PROGRAM - WATER AND WASTEWATER ENERGY EFFICIENCY RTM, 05/11/14 - 05/21/14

Full U.S. Particpant List for All RTM Activities

5/20/2014 Business Briefing or Other RTM Activity Location Info:

Firm/Organization Name	Are you a Small Business?	Organization Type	Employment Designation	Are You a Delegate?	Receive USTDA's news & events e-mails?	First Name	Last Name	Title	(W) City	(W) State	(W) ZIP/ Postal Code	(W) Country	Office Phone Number (xxx-xxx-xxxx OR +xx.xx.xxx.xxxx format)	(W) Mobile Phone Number (xxx-xxx-xxxx OR +xx.xx.xxx.xxxx format)	Work E-Mail Address	How Did You Learn of this Event?	If "Other" in previous column, explain	Business Briefing or Other RTM Activity Date(s)	Venue Name	City	State
East Bay Municipal District (EBMUD), Oakland WWTP	No	Entities with State/Local Gov.	Government Representatives	No	No	John	Hake	Operations Engineer	Oakland	CA	94606	UNITED STATES OF AMERICA	510-287-1279		jhake@ebmud.com	Other	Invited by AEAI	5/21/2014	EBMUD Oakland WWTP	Oakland	CA
King County Wastewater Treatment Division (WTD), West Point	No	Entities with State/Local Gov.	Government Representatives	No	No	James	Belcher	Plant Engineer	Seattle	WA	98104	UNITED STATES OF AMERICA	206-263-3843		james.belcher@kingcounty.gov	Other	Invited by AEAI	5/16/2014	West Point WWTP	Seattle	WA
King County Wastewater Treatment Division (WTD), West Point	No	Entities with State/Local Gov.	Government Representatives	No	No	Dan	Grenet	Treatment Plant Manager	Seattle	WA	98199	UNITED STATES OF AMERICA	206-263-3825	206-555-7501	Dan.Grenet@kingcounty.gov	Other	Invited by AEAI	5/16/2014	West Point WWTP	Seattle	WA
King County Wastewater Treatment Division (WTD), West Point	No	Entities with State/Local Gov.	Government Representatives	No	No	Alan	Williamson	Treatment Plant Assistant Manager	Seattle	WA	98199	UNITED STATES OF AMERICA	206-263-3227		Al.Williamson@kingcounty.gov	Other	Invited by AEAI	5/16/2014	West Point WWTP	Seattle	WA
Oakland Export Assistance Center, U.S. Dept of Commerce	No	Federal Gov. Participant	Government Representatives	No	No	Rod	Hirsch	Director	Oakland	CA	94612	UNITED STATES OF AMERICA	510-273-7350	510-604-4187	Rod.Hirsch@trade.gov	Other	Invited by SBA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Overseas Private Investment Corporation (OPIC)	No	Federal Gov. Participant	Government Representatives	No	No	Justin	Elswit	Manager, Political & Sovereign Risk Dept.	Washington	DC	20257	UNITED STATES OF AMERICA	202-336-8461		justin.elswit@opic.gov	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
U.S. Department of Commerce/ITA	No	Federal Gov. Participant	Government Representatives	No	No	Adam	O'Malley	Director, Office of Energy & Environmental Industries, ITA	Washington	DC	20230	UNITED STATES OF AMERICA	202-482-4850		Adam.OMalley@trade.gov	Other	Invited by AEAI	5/12/2014	USTDA	Arlington	VA
U.S. Environmental Protection Agency (EPA)	No	Federal Gov. Participant	Government Representatives	No	No	Chris	Godlove	Program Manager - Water and Wastewater	Washington	DC	20460	UNITED STATES OF AMERICA	202-343-9795		godlove.chris@epa.gov	Other	Invited by AEAI	5/12/2014	USTDA	Arlington	VA
U.S. Environmental Protection Agency (EPA)	No	Federal Gov. Participant	Government Representatives	No	No	Cam	Hill-Macon	Sr. Advisor, Latin America & Caribbean Program, Office of International & Tribal Affairs	Washington	DC	20460	UNITED STATES OF AMERICA	202-564-6408		Hill-Macon.Cam@epa.gov	Other	Invited by AEAI	5/12/2014	USTDA	Arlington	VA
U.S. Environmental Protection Agency (EPA)	No	Federal Gov. Participant	Government Representatives	No	No	Jim	Horne	Sustainability Program Mgr, EPA/Office of Water/Office of Wastewater Management	Washington	DC	20460	UNITED STATES OF AMERICA	202-564-0571		horne.james@epa.gov	Other	Invited by AEAI	5/12/2014	USTDA	Arlington	VA
U.S. Environmental Protection Agency (EPA)	No	Federal Gov. Participant	Government Representatives	No	No	Phil	Zahreddine	Sr. Technical Advisor, Municipal Support Division, Office of Wastewater Management	Washington	DC	20460	UNITED STATES OF AMERICA	202-564-0587		zahreddine.phil@epa.gov	Other	Invited by AEAI	5/12/2014	USTDA	Arlington	VA
Inter-American Development Bank (IADB)	No	Multilateral Dev. Bank/Export-Import bank	International Organization Representatives	No	No	Fernando	Bretas	Principal Water & Sanitation Specialist, Water & Sanitation Div.	Washington	DC	20577	UNITED STATES OF AMERICA	202-623-1910		fernandob@iadb.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
U.S. Export-Import Bank	No	Multilateral Dev. Bank/Export-Import bank	Government Representatives	No	No	Craig	O'Connor	Director, Office of Renewable Energy & Enviromental Exports	Washington	DC	20571	UNITED STATES OF AMERICA	202-565-3556		craig.oconnor@exim.gov	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
American Water Works Association (AWWA)	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Adam	Carpenter	Regulatory Analyst	Washington	DC	20005	UNITED STATES OF AMERICA	202-326-6126	703-957-8823	acarpenter@awwa.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA

BRAZIL, USTDA 2014-51006A, USTDA: BRAZIL CLEAN ENERGY EXCHANGE PROGRAM - WATER AND WASTEWATER ENERGY EFFICIENCY RTM, 05/11/14 - 05/21/14

Full U.S. Participant List for All RTM Activities

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ASHRAE	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Douglas	Read	Director of Government Affairs	Washington	DC	20036	UNITED STATES OF AMERICA	202-833-1830		dread@ashrae.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
ASHRAE	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Jim	Scarborough	Manager of Grassroots Government Affairs	Washington	DC	20036	UNITED STATES OF AMERICA	202-833-1830		jScarborough@ashrae.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
ASTM International	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Jim	Olshefsky	Director of External Relations	West Conshohocken	PA	19428	UNITED STATES OF AMERICA	610-832-9714	610-203-4957	jolshefs@astm.org	Other	Invited by AEAI	5/13/2014	Back River WWTP	Baltimore	MD
International Association of Plumbing and Mechanical Officials (IAPMO)	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Chris	Lindsay	Manager, Govt Relations	Washington	DC	20001	UNITED STATES OF AMERICA	202-414-6176	202-445-1198	Christopher.Lindsay@iapmo.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
National Electrical Manufacturers Association (NEMA)	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Gene	Eckhart	Senior Director for International Trade	Arlington	VA	22209	UNITED STATES OF AMERICA	703-841-3204	703-888-6677	Gen_Eckhart@nema.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
National Electrical Manufacturers Association (NEMA)	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	William	Hoyt	Industry Director	Arlington	VA	22209	UNITED STATES OF AMERICA	703-841-3211	703-678-9565	Bill.hoyt@nema.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
Water Environment Federation (WEF)	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Laila	Sukkariyyah	Director, Global Programs / Development	Alexandria	VA	22314	UNITED STATES OF AMERICA	703-684-2458	703-650-8516	lsukkariyyah@wef.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
Water Environment Federation (WEF)	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Claudio	Ternieden	Director of Regulatory Affairs	Alexandria	VA	22314	UNITED STATES OF AMERICA	703-684-2416		cternieden@wef.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
Water Environment Research Foundation (WERF)	No	Non-Gov. Organization	Non-governmental Organization Professionals	No	No	Lauren	Fillmore	Sr. Program Director	Alexandria	VA	22314	UNITED STATES OF AMERICA	571-384-2107		lfillmore@werf.org	Other	Invited by AEAI	5/14/2014	USTDA	Arlington	VA
Aclara Technologies, LLC	No	U.S. Based Company	Private Business Professionals	No	No	Steve	Meissel	VP International Business Development	Hazelwood	MO	63042	UNITED STATES OF AMERICA	314-895-7362	314-749-2014	SMeissel@aclara.com	Other	Invited by AEAI	5/16/2014	West Point WWTP	Seattle	WA
Aclara Technologies, LLC	No	U.S. Based Company	Private Business Professionals	No	No	Andy	Zetlan	Vice President, Business Development and Regulatory	Hazelwood	MO	63042	UNITED STATES OF AMERICA	781-694-3332	408-391-3851	azetlan@aclara.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Alexandria Renew Enterprises (AlexRenew)	No	U.S. Based Company	Private Business Professionals	No	No	David	Brewster	Director of Operations	Alexandria	VA	22314	UNITED STATES OF AMERICA	703-549-3381 ext. 2295	703-424-1033	David.Brewster@alexrenew.com	Other	Invited by AEAI	5/12/2014	AlexRenew WWTP	Alexandria	VA
Alexandria Renew Enterprises (AlexRenew)	No	U.S. Based Company	Private Business Professionals	No	No	Yanjin	Liu	Process Manager	Alexandria	VA	22314	UNITED STATES OF AMERICA	703-549-3381		Yanjin.liu@alexrenew.com	Other	Invited by AEAI	5/12/2014	AlexRenew WWTP	Alexandria	VA
Alexandria Renew Enterprises (AlexRenew)	No	U.S. Based Company	Private Business Professionals	No	No	Jim	Sizemore	Process Manager	Alexandria	VA	22314	UNITED STATES OF AMERICA	703-549-3381 ext. 2275		jim.sizemore@alexrenew.com	Other	Invited by AEAI	5/12/2014	AlexRenew WWTP	Alexandria	VA
Alexandria Renew Enterprises (AlexRenew)	No	U.S. Based Company	Private Business Professionals	No	No	Hong	Yin	Engineer	Alexandria	VA	22314	UNITED STATES OF AMERICA	703-549-3381		hong.yin@alexrenew.com	Other	Invited by AEAI	5/12/2014	AlexRenew WWTP	Alexandria	VA
All Power Labs	Yes	U.S. Based Company	Private Business Professionals	No	No	Brian	Ballek	Sales, Americas Region	Berkeley	CA	94710	UNITED STATES OF AMERICA	510-845-1500 ext. 714		b.ballek@allpowerlabs.org	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
CH2M Hill	No	U.S. Based Company	Private Business Professionals	No	No	Daniela	Brandao	Project Manager, Water Group	San Francisco	CA	94105	UNITED STATES OF AMERICA	703-980-9304		dbrandao@ch2m.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
CH2M Hill	No	U.S. Based Company	Private Business Professionals	No	No	Kim	Ervin		Bellevue	WA	98004	UNITED STATES OF AMERICA	425-233-3536	425-495-2556	Kim.Ervin@ch2m.com	Other	Invited by AEAI	5/15/2014	Cedar WTP	Seattle	WA
CH2M Hill	No	U.S. Based Company	Private Business Professionals	No	No	John	Wesely	Project Manager II	Renton	WA	98058	UNITED STATES OF AMERICA	425-255-7238	425-941-1799	John.Wesely@ch2m.com	Other	Invited by AEAI	5/15/2014	Cedar WTP	Seattle	WA
CleanBlu Inc.	Yes	U.S. Based Company	Private Business Professionals	No	No	Erich	Fock	Chief Counsel	Capistrano Beach	CA	92624	UNITED STATES OF AMERICA	949-200-6226	805-403-2119	erichfock@cleanblu.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
CleanBlu Inc.	Yes	U.S. Based Company	Private Business Professionals	No	No	Gina	Grant	CFO	Capistrano Beach	CA	92624	UNITED STATES OF AMERICA	949-200-6226	949-212-2862	ginagrant@cleanblu.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
CleanBlu Inc.	Yes	U.S. Based Company	Private Business Professionals	No	No	Markus	Lenger	CEO	Capistrano Beach	CA	92624	UNITED STATES OF AMERICA	949-200-6226	949-412-2600	markuslenger@cleanblu.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA

BRAZIL, USTDA 2014-51006A, USTDA: BRAZIL CLEAN ENERGY EXCHANGE PROGRAM - WATER AND WASTEWATER ENERGY EFFICIENCY RTM, 05/11/14 - 05/21/14

Full U.S. Participant List for All RTM Activities

5/20/2014 Business Briefing or Other RTM Activity Location Info:

Firm/Organization Name	Are you a Small Business?	Organization Type	Employment Designation	Are You a Delegate?	Receive USTDA's news & events e-mails?	First Name	Last Name	Title	(W) City	(W) State	(W) ZIP/ Postal Code	(W) Country	Office Phone Number (xxx-xxx-xxxx OR +xx.xx.xxx.xxxx format)	(W) Mobile Phone Number (xxx-xxx-xxxx OR +xx.xx.xxx.xxxx format)	Work E-Mail Address	How Did You Learn of this Event?	If "Other" in previous column, explain	Business Briefing or Other RTM Activity Date(s)	Venue Name	City	State
Johnson Controls	No	U.S. Based Company	Private Business Professionals	No	No	Richard	Barrett	Account Executive, Building Efficiency	Sparks	MD	21152	UNITED STATES OF AMERICA		410-978-6925	richard.t.barrett@jci.com	Other	Invited by AEAI	5/13/2014	Back River WWTP	Baltimore	MD
Johnson Controls	No	U.S. Based Company	Private Business Professionals	No	No	Vipin	Goel, CEM, LEED GA	Engineering Manager - State Government & Higher Ed	New Cumberland	PA	17070	UNITED STATES OF AMERICA	717-712-1813	717-856-7579	Vipin.K.Goel@jci.com	Other	Invited by AEAI	5/13/2014	Back River WWTP	Baltimore	MD
Johnson Controls	No	U.S. Based Company	Private Business Professionals	No	No	Arvind	Srihari	Performance Assurance Engineer, Building Efficiency	Sparks	MD	21152	UNITED STATES OF AMERICA	410-527-2665	410-487-5977	arvind.srihari@jci.com	Other	Invited by AEAI	5/13/2014	Back River WWTP	Baltimore	MD
Johnson Controls	No	U.S. Based Company	Private Business Professionals	No	No	Mark	Whitlock	Energy Manager	Baltimore	MD		UNITED STATES OF AMERICA			mark.l.whitlock@jci.com	Other	Invited by AEAI	5/13/2014	Back River WWTP	Baltimore	MD
Mazzei Injector Company, LLC	Yes	U.S. Based Company	Private Business Professionals	No	No	Peter	Decker	Regional Sales Manager	Bakersfield	CA	93307	UNITED STATES OF AMERICA	661-363-6500	661-316-8864	pdecker@mazzei.net	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
New Logic Research, Inc.	Yes	U.S. Based Company	Private Business Professionals	No	No	Josh	Miller	Regional Sales Manager	Emeryville	CA	94608	UNITED STATES OF AMERICA	510-655-7305 ext. 210	510-882-9392	jmiller@vsep.com	Other	Invited by EAC	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
New Logic Research, Inc.	Yes	U.S. Based Company	Private Business Professionals	No	No	Katrin	Torres	Sales Manager	Emeryville	CA	94608	UNITED STATES OF AMERICA	510-655-7305 ext. 212		katrin@vsep.com	Other	Invited by EAC	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
OSIsoft LLC	No	U.S. Based Company	Private Business Professionals	No	No	Nand	Ramchandani	Head of Governmental Affairs	San Leandro	CA	94577	UNITED STATES OF AMERICA	415-867-3018		NRamchandani@osisoft.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
OSIsoft LLC	No	U.S. Based Company	Private Business Professionals	No	No	Paula	Reichert	Account Manager	São Paulo	SP		BRAZIL	55-11-3053-5045	55-11-99279-3406	preichert@osisoft.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
OSIsoft LLC	No	U.S. Based Company	Private Business Professionals	No	No	Jose	Rosales	Inside Account Manager	Mexico City	DF		MEXICO	52-55-5374-7654		jrosales@osisoft.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Oswald Green Technologies	Yes	U.S. Based Company	Private Business Professionals	No	No	Robert	Dawyot	Representative	San Ramon	CA	94583	UNITED STATES OF AMERICA	336-893-7552	510-333-7298	rdawyot@att.net	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Rexel	No	U.S. Based Company	Private Business Professionals	No	No	Jeffery	Ballard	Automation Specialist	Sacramento	CA	95834	UNITED STATES OF AMERICA	916-928-9700	916-765-8244	jeffery.ballard@rexelusa.com	Other	Invited by USTDA	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Schweitzer Engineering Laboratories, Inc. (SEL)	No	U.S. Based Company	Private Business Professionals	No	No	Alejandro	Avendano	Associate Field Application Engineer	San Ramon	CA	95834	UNITED STATES OF AMERICA	509-336-7136		alejandro_avendano@selinc.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Schweitzer Engineering Laboratories, Inc. (SEL)	No	U.S. Based Company	Private Business Professionals	No	No	Eddie	Schweitzer	Business Development Director, Sales and Customer Service	Pullman	WA	99163	UNITED STATES OF AMERICA	509-334-8740		eddie_schweitzer@selinc.com	Other	Invited by AEAI	5/15/2014	Cedar WTP	Seattle	WA
Synagro	No	U.S. Based Company	Private Business Professionals	No	No	Bob	Pepperman	Project Development	Baltimore	MD	21224	UNITED STATES OF AMERICA	410-284-4120	443-510-5695	rpepperman@synagro.com	Other	Invited by AEAI	5/13/2014	Back River WWTP	Baltimore	MD
Tekpea, Inc.	Yes	U.S. Based Company	Private Business Professionals	No	No	Sanjeev	Thakkar	Vice President, Business Development	Palo Alto	CA	94303	UNITED STATES OF AMERICA	650-320-1622	310-925-9999	sanjeev@tekpea.com	Other	Invited by EAC	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Xylem	No	U.S. Based Company	Private Business Professionals	No	No	Payal	Shah	Senior Application Engineer	Brown Deer	WI	53223	UNITED STATES OF AMERICA	414-365-2231	715-551-0908	Payal.shah@xyleminc.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
Xylem	No	U.S. Based Company	Private Business Professionals	No	No	Serdar	Umur	Global Product Manager, Aeration	Brown Deer	WI	53223	UNITED STATES OF AMERICA	414-458-0071	414-458-0071	Serdar.umur@xyleminc.com	Other	Invited by AEAI	5/20/2014	Industry Roundtable at San Ramon Marriott	San Ramon	CA
University of Maryland Center for Environmental Science	No	University/Educational Entities	Researchers/Faculty (affiliated with academic institutions)	No	No	Dave	Nemazie	Associate VP for External Affairs	Cambridge	MD	21613	UNITED STATES OF AMERICA	443-496-0187		nemazie@umces.edu	Other	Invited by AEAI	5/12/2014	USTDA	Arlington	VA

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ATTACHMENT 2. Evaluation Questionnaire Forms

A. Delegates

B. U.S. Company Industry Roundtable Participants

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A. Industry Roundtable and Overall RTM Evaluation Form for Delegates

USTDA would appreciate having your feedback in order to track commercial outcomes of this activity and its benefits for you. Please leave this completed form with Suzanne or Ranjan before you leave, or e-mail it to: ranjan@aeai.net or smaia@aeai.net no later than May 26, 2014. **The information you provide will be kept confidential and is for USTDA's internal use only, after collection and analysis by AEAI.[4] Thank you for your participation and support! It was a pleasure working with you.**

Delegate Name: _____

E-mail: _____ Phone: _____

1. Please indicate which meetings and site visits of the RTM were most interesting to you and any key aspects which in what areas they offered a potential opportunity for your company's eventual procurement.

Date (dd/mm/yy)	**Plant/Event/ or Organization**	**Relevance/Level of Interest** (rank 1-5, with 5 as most relevant/ interesting)	**Technologies, Services or Information of greatest interest** (List; for Vendors, also please give estimated value of component for your projects)
12/05/14	Government Roundtable: EPA		
	Dept. of Commerce/ITA		
	DC Water & Sewer Authority		
	Alexandria Renew Enterprises		
13/5/14	Baltimore County Back River WWTP		

[4] Note: On behalf of USTDA, the organizer (AEAI) will conduct a follow-up survey on results and outcomes for you in terms of sales, contracts and other business developments relevant to this delegation and its activities, including the Industry Roundtable. Your cooperation for that survey is also appreciated!

Date (dd/mm/yy)	**Plant/Event/ or Organization**	**Relevance/Level of Interest** (rank 1-5, with 5 as most relevant/ interesting)	**Technologies, Services or Information of greatest interest** (List; for Vendors, also please give estimated value of component for your projects)
	Johnson Controls Inc.		
	ASTM		
14/05/14	Industry Association Roundtable: ASHRAE		
	AWWA		
	IAPMO		
	NEMA		
	WEF		
	WERF		
	Finance Roundtable: OPIC		
	US Ex-Im Bank		
	IDB		
15/5/14	City of Seattle Cedar WTF		

Date (dd/mm/yy)	**Plant/Event/ or Organization**	**Relevance/Level of Interest** (rank 1-5, with 5 as most relevant/ interesting)	**Technologies, Services or Information of greatest interest** (List; for Vendors, also please give estimated value of component for your projects)
	CH2M Hill		
	SEL Inc.		
16/5/14	King County West Point WWTF		
	Aclara		
19/5/14	E.A. Fairbairn WTP		
	CEC		
20/5/14	San Ramon District		
21/5/14	East Bay Municipal Utility District		

2. For the one-on-one meetings with U.S. companies at the Industry Roundtable, for each company please indicate which technology, equipment or service was most interesting to you, by priority (on a scale of 1-5, with 5 for the highest priority and 1 for the least useful), and if you made initial plans to follow up this meeting with further exchanges via e-mail? A visit to Brazil? A visit or meeting at some non-Brazil venue? Other? Please indicate this in the table below.

Company	**Technologies/Equipment/ Service by priority (1-5)**		**Planned Next Step:**			
	Equipment	Priority #	E-mail	Visit to Brazil	Meeting Elsewhere	Other
All Power Labs						
CH2M Hill						
CleanBlu Inc.						
Mazzei Injector Company						
New Logic Research, Inc.						
OSIsoft LLC						
Oswald Green Technologies						
Rexel						
SEL Inc.						
Tekpea, Inc.						
Xylem – Sanitaire						

3. Were the facilities for the Industry Roundtable appropriate? (Please circle the answer that best responds.)

For presentations:	Excellent	Good	Satisfactory	Poor
For one-on-one meetings:	Excellent	Good	Satisfactory	Poor
Re: hotel accommodations:	Excellent	Good	Satisfactory	Poor

4. Were the arrangements made for your travel needs satisfactory? (Y /N)
5. Was the organizer responsive? Informative? (Y /N) Friendly? (Y /N) Helpful? (Y /N)
6. Was the information in the Delegate Handbook useful and appropriate? (Y /N)
7. What suggestions would you make to improve this type of activity and, especially, to achieve your objectives in identifying and concluding contracts or partnerships with U.S. companies to support your projects?

_____
_____
_____
_____

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B. U.S. Company Industry Roundtable Participants

INDUSTRY ROUNDTABLE: EVALUATION FOR U.S. PARTICIPANTS

USTDA would appreciate having your feedback in order to track commercial outcomes of this activity and its benefits for you. Please leave this completed form with the person at the registration desk or with one of the organizers from AEAI (Suzanne or Ranjan) before you leave, or e-mail it to: smaia@aeai.net. **Thank you for your participation and support! The information you provide will be kept confidential and is for USTDA's internal use only.**[1]

Name: _____

Organization: _____

E-mail: _____ **Phone:** _____

1. Please indicate which delegate presentations were most interesting to you and in what areas they offered a potential opportunity for your company's sale of products or services.

Delegate Company/Name	**Relevance/Level of Interest** (1-5, with 5 as most relevant/interesting)	**Technologies or Services you offer this delegate** (List) and their Estimated potential value (range in US$)
CAB Ambiental **Otavio F. da Silveira**		$
CAGECE **Ronner B. Gondim**		$
CAESB **Humberto Belina Adamatti**		$
CEDAE **Edes Fernandes de Oliveira** **Gustavo Alves Tannure**		$
COMPESA **Ricardo Barretto**		$
EMBASA **César Silva Ramos**		$
Grupo Águas do Brasil **Luiz Fernando Fabbriani**		$
OAS Soluções Ambientais **Giuliano V. Dragone**		$
SANEAGO **Wanir J. de Medeiros Jr.**		$
Solvi Saneamento **Hanokh V. Yamagishi**		$

[1] Note: On behalf of USTDA, the organizer (AEAI) will conduct a follow-up survey on results and outcomes for you in terms of sales, contracts and other business developments relevant to this delegation and its activities, including the Industry Roundtable. Your cooperation for that survey is also appreciated!

Brazil: Water/Wastewater Energy Efficiency Reverse Trade Mission (RTM) / May 20, 2014

2. Did you participate in the one-on-one meetings with the delegates? If yes, did you make initial plans to follow up this meeting with further exchanges via e-mail? A visit to Brazil? A visit or meeting with the delegate at some non-Brazil venue? Other? Please indicate this in the table below.

Delegate Company/Name	Held one-on-one meeting?		Planned Next Step:			
	Yes	No	E-mail	Visit to Brazil	Meeting Elsewhere	Other
CAB Ambiental **Otavio F. da Silveira**						
CAGECE **Ronner B. Gondim**						
CAESB **Humberto Belina Adamatti**						
CEDAE **Edes Fernandes de Oliveira** **Gustavo Alves Tannure**						
COMPESA **Ricardo Barretto**						
EMBASA **César Silva Ramos**						
Grupo Águas do Brasil **Luiz Fernando Fabbriani**						
OAS Soluções Ambientais **Giuliano V. Dragone**						
SANEAGO **Wanir J. de Medeiros Jr.**						
Solvi Saneamento **Hanokh V. Yamagishi**						

3. Were the facilities for the Industry Roundtable appropriate? (Please circle the answer that best responds.)

For presentations:	Excellent	Good	Satisfactory	Poor
For one-on-one meetings:	Excellent	Good	Satisfactory	Poor
Re: hotel accommodations:	Excellent	Good	Satisfactory	Poor

4. Were the notices you received about this activity timely? (Y /N) Useful? (Y /N)
5. Was the organizer responsive? Informative? (Y /N) Friendly? (Y /N) Helpful? (Y /N)
6. Was the information in the Briefing Book useful and appropriate? (Y /N)
7. What suggestions would you make to improve this type of activity and, especially, to improve your effectiveness in making initial contact with delegates for eventual sales?

_____

_____

_____

ATTACHMENT 3. Presentations from DC Roundtables and Site Hosts

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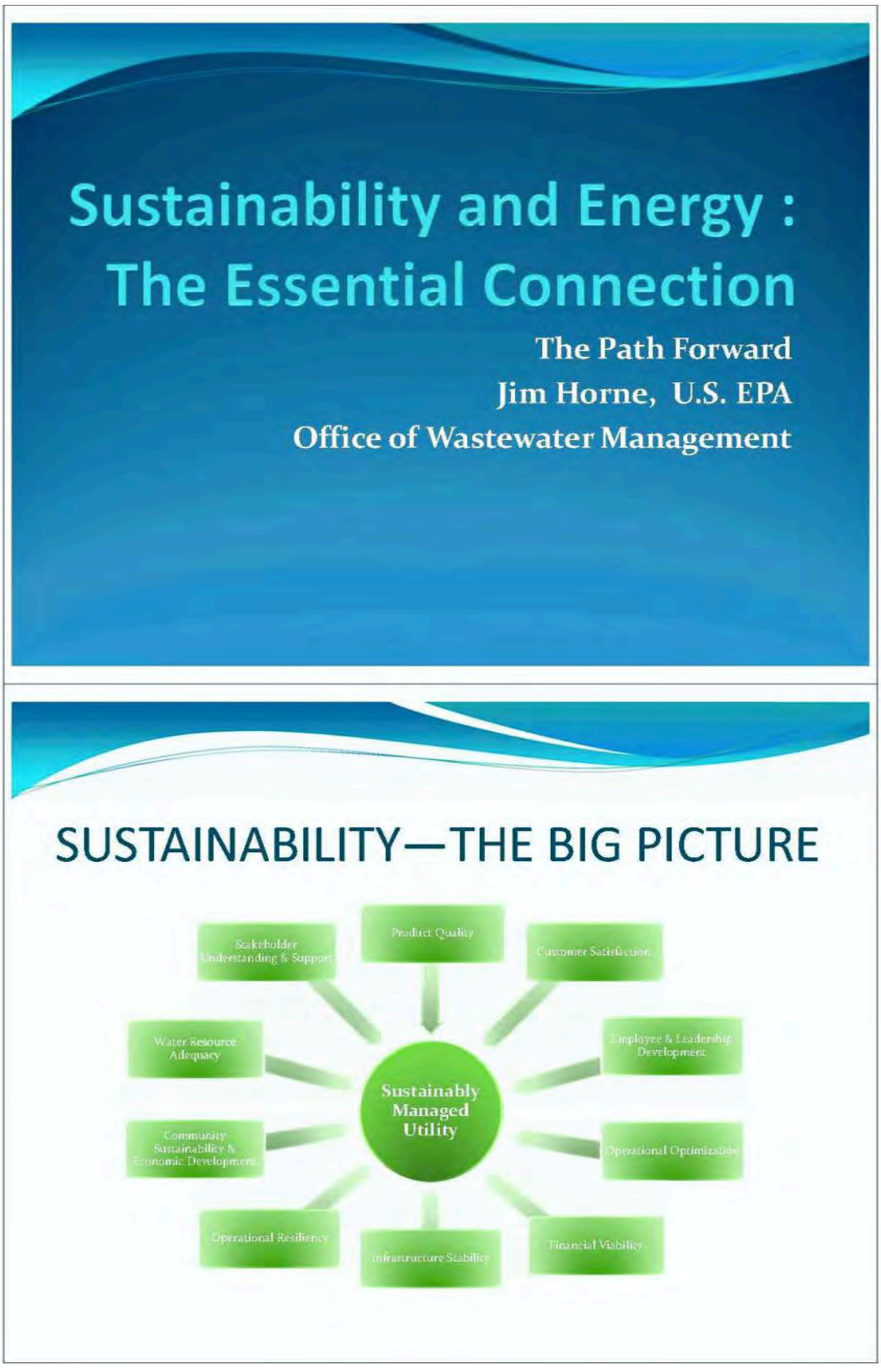

Sustainability and Energy : The Essential Connection
The Path Forward
Jim Horne, U.S. EPA
Office of Wastewater Management
SUSTAINABILITY—THE BIG PICTURE
Sustainably Managed Utility
Product Quality
Customer Satisfaction
Employee & Leadership Development
Operational Optimization
Financial Viability
Infrastructure Stability
Operational Resiliency
Community Sustainability & Economic Development
Water Resource Adequacy
Stakeholder Understanding & Support

A Few Basic Facts

- Approximately 16,000 WWTPs in the U.S.—90% treated less than 1 mgd
- Electric use for moving and treating water and wastewater in the US
  - 25-30% of total plant O&M Cost
  - Consumption and costs expected to continue to rise
- Current use of energy for wastewater treatment results in significant GHG emissions.
- Basic improvements in energy efficiency can show significant results (equipment, lighting, pumps)
- A few plants in the U.S. are becoming/approaching energy self sufficiency (net zero energy use)—progress is slow!
  - (Sheboygan, WI; East Bay MUD, CA, several others)
  - Internationally (Many plants - WERF Study: Strass WWTP, Austria)

3 3

Elements of Energy Efficiency and Self-Sufficiency

- Management motivation to implement energy efficiency initiatives—efficiency first!
- Integrated into utility's overall vision and plan
- Empowerment of staff
- Buy in from local officials (Communicate!)
- Tolerance for risk
- Audit & energy management plan
- Process optimization & operator education
- Measurable goals (linked to vision and plan)
- High level of automation and process analysis tools
- Flexible and efficient designs
- ECMs
- Anaerobic digestion &:
  - Combined Heat & Power
  - pre-treatment
  - Co-digestion
- Enhanced primary sedimentation
- Nutrient recovery and side stream flow equalization or treatment
- Thermal biosolids processes
- Solar
- Wind

4 4

Barriers to Energy Efficiency and Self-Sufficiency

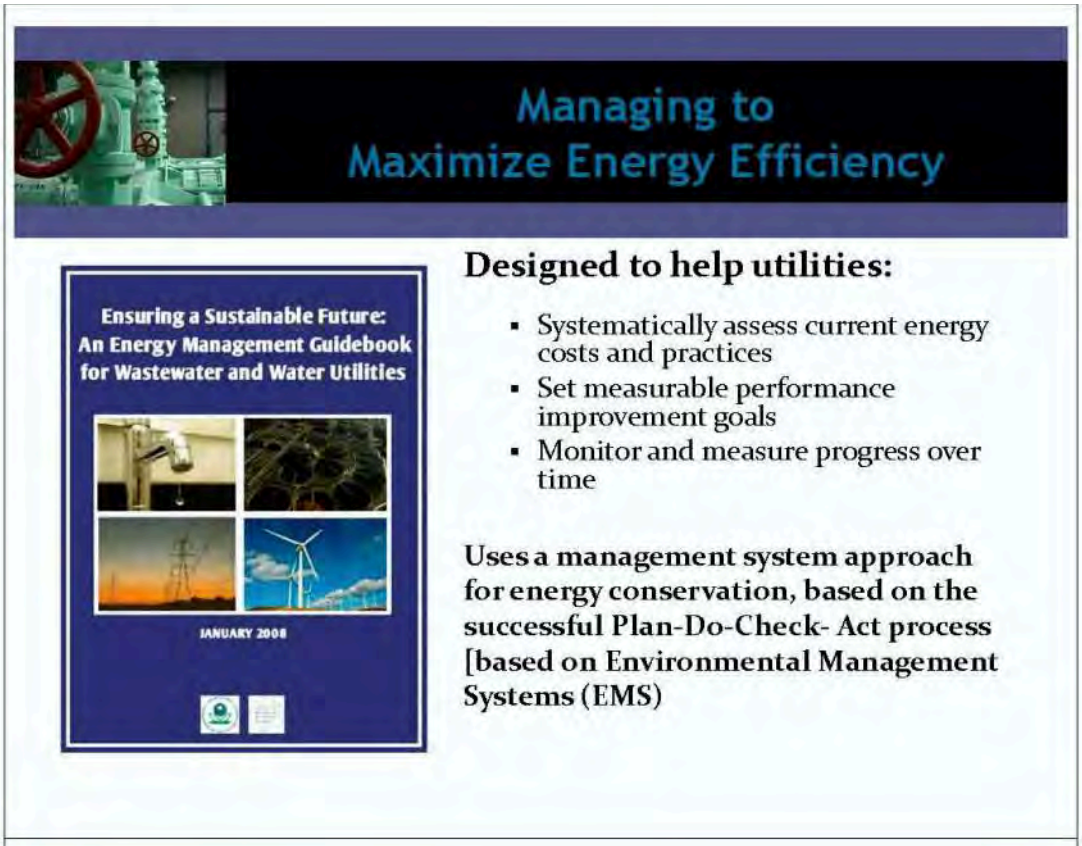
- Barriers vary depending on existing facility processes, local electric rates, stringency of local air regulations, water quality requirements, and other factors.
- Main wastewater utility barriers include:
  - Lack of knowledge
  - Financial concerns (costs, payback periods)
  - Management focus on meeting permit requirements (air and water) as the core business, perceived conflict
  - Lack of utility management plans
  - Low local energy costs
  - Limited staff at many small plants
  - No anaerobic digestion.

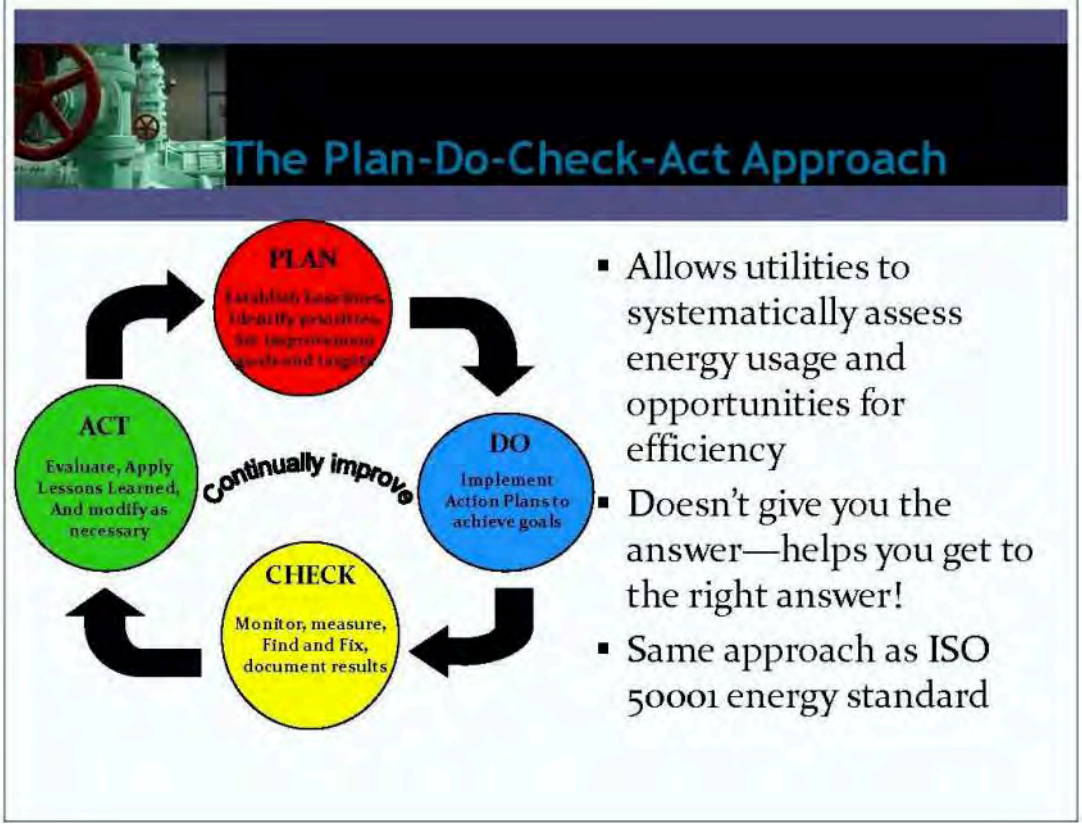
5

Where to Start

1. **Create energy team and assess energy consumption**
   - Examine and analyze bills
   - Plot energy consumption and demand for each process (recommend meters for each unit process)
   - Develop consumption baselines and compare to similar facilities, where feasible
2. **Assess energy savings opportunities (DO AN AUDIT!)**
   - Evaluate process energy consumption and operational procedures
   - Evaluate operation of each significant piece of equipment
     - Can it be turned off or run efficiently at lower capacity?
     - Are new pieces of equipment much more efficient?
3. **Develop and implement energy conservation plan starting with "low hanging fruit" projects**
4. **Contract specifications for energy efficient equipment**
5. **Measure progress, get some success under your belt, and keep moving!**

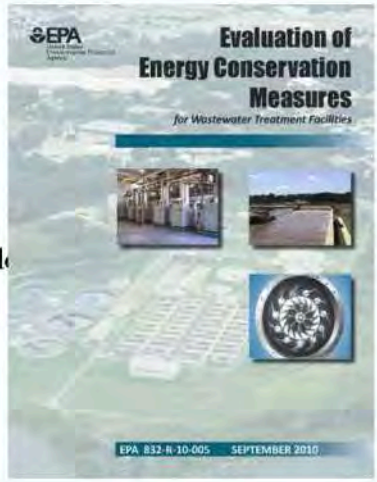
6 6


Managing to
Maximize Energy Efficiency
Ensuring a Sustainable Future:
An Energy Management Guidebook
for Wastewater and Water Utilities
JANUARY 2008
Designed to help utilities:
Systematically assess current energy costs and practices
Set measurable performance improvement goals
Monitor and measure progress over time
Uses a management system approach for energy conservation, based on the successful Plan-Do-Check- Act process [based on Environmental Management Systems (EMS)

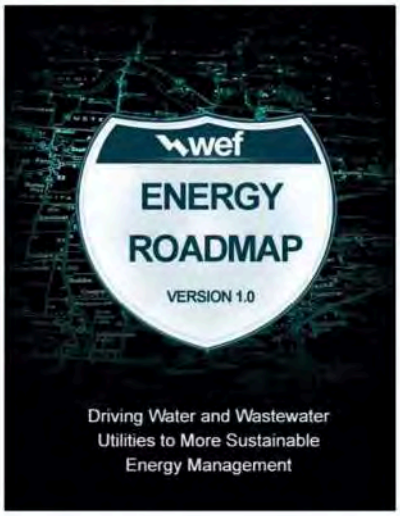

The Plan-Do-Check-Act Approach
PLAN
DO
Implement Action Plans to achieve goals
CHECK
Monitor, measure, Find and Fix, document results
ACT
Evaluate, Apply Lessons Learned, And modify as necessary
Continually improve
Allows utilities to systematically assess energy usage and opportunities for efficiency
Doesn't give you the answer—helps you get to the right answer!
Same approach as ISO 50001 energy standard

Energy Conservation Measures at Wastewater Facilities

- Main audience: Utility managers and POTW owners and operators.
- Targeted performance, cost, and savings/benefits information .
- Focus on innovative energy efficient *equipment replacements* and *operational modification* projects that result in energy savings with reasonable pay back periods.
- Nine detailed case studies.
- References info.



The Path Forward?



WEF/WERF LIFT Program

Leaders Innovation for Technology Forum

PURPOSE

A WEF/WERF Initiative Accelerating Innovation Into Practice

APPROACH

- Technology evaluations and sharing the costs of conducting new technology demonstrations (WERF Lead).
- A benchmarking study of how (resources, policies) utilities accomplish R&D (WEF Lead).
- Training, education, and outreach (WEF Lead).
- Informal forum for industry to share experiences, activities and interests (Utility, industry lead).

n

WATER RESOURCES UTILITY OF THE FUTURE

Treatment plants become energy self-sufficient or a net energy producer...


THANK YOU
MORE INFORMATION IS AVAILABLE AT
http://water.epa.gov/infrastructure/sustain/energyefficiency.cfm
horne.james@epa.gov
(202) 564-0571

Resource Recovery at Blue Plains

USTDA
Government Roundtable

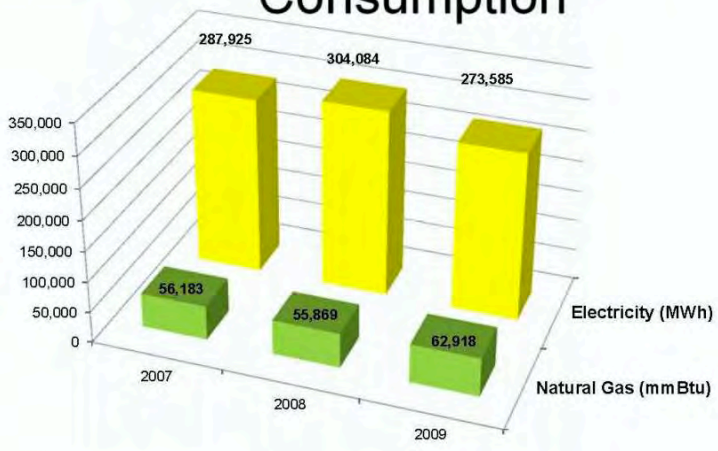
May 12th, 2014

Chris Peot, PE, BCEE
Director of Resource Recovery

dc water is life

dc water is life

Total DC WATER Energy Consumption



Based on invoices
2009 electricity based on PEPCO metering data

2

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DC Water Carbon Footprint

Table 1. Summary of Annual Emission Estimates, Calendar Year: 2008

Emission Source	Annual Emissions Estimate Metric Tons CO2e	Scope 1 and 2 Percent Contribution
Scope 2		
Electricity	146,920	88%
DSS	11,053	7%
DWS	9,163	5%
DWT	126,704	76%
Scope 1		
Natural Gas	2,967	2%
CS	197	0.1%
DSS	371	0.2%
DWS	441	0.3%
DWT	1,924	1%
FLEET	34	0.02%
Vehicle (fuel usage)	2,586	2%
Compressed Natural Gas (CNG)	0.064	0.00004%
Diesel Fuel No. 1 and 2	1041	0.6%
Motor Gasoline	1545	0.9%
Refrigerants	142	0.08%
Nitrification/Denitrification (process emissions)		
CO2 from Addition of Methanol	12,007	7%
N2O from Denitrification	443	0.3%
Effluent Discharge (process emissions)	2,009	1%
Total with Scope 1 and 2	**167,074**	
Scope 3		
Biosolids Hauling (fuel usage/distance travelled)	4,107	
Chemical Hauling (distance travelled)	1,450	
Lime Production	14,883	
Methanol Production	6,747	
N2O Emissions from Land Application of Biosolids	52,548	
Methane Emissions from Landfilling Biosolids	7	
Total with Scope 3	**246,815**	
Carbon Credits		
Carbon Sequestration Land Application	28,844	
Carbon Sequestration Land Application with Composting	13,576	
Carbon Sequestration Landfill	2	
Avoided N2O Emissions from Replacement of Inorganic Fertilizers	52,548	
Fertilizer Credits Direct Applied Biosolids (N and P)	9,006	
Fertilizer Credits Composted Biosolids (N and P)	1,692	
Total	**103,668**	
GRAND TOTAL	**143,147**	

3

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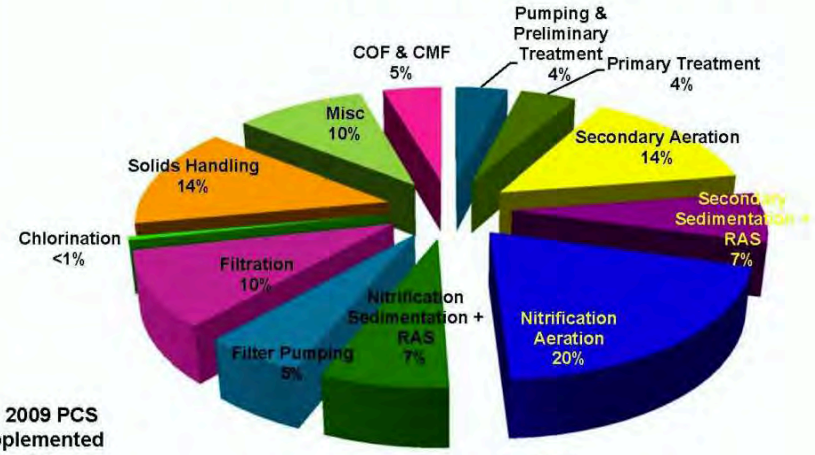
Breakdown of Electricity Consumption Blue Plains



Source: 2009 PCS data supplemented with estimates

Fast Fact:
Over 1MW of installed lighting capacity at Blue Plains alone!

4

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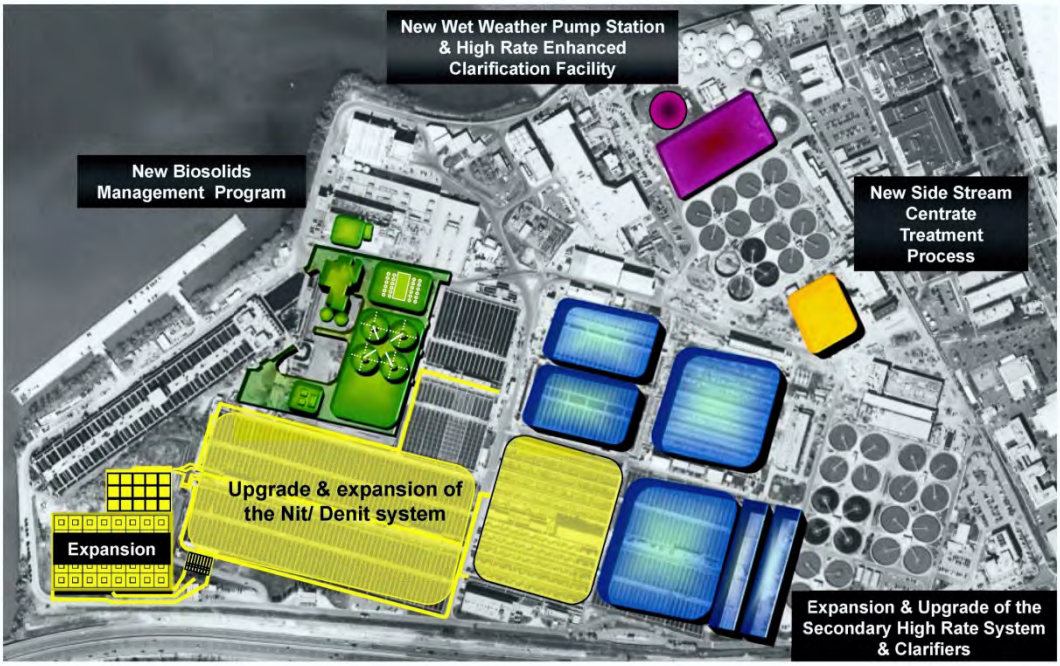
NUTRIENTS and CARBON RECYCLING
FARMING
SILVICULTURE
RECLAMATION
URBAN RESTORATION
dc water is life
BLUE PLAINS ADVANCED WASTEWATER TREATMENT PLANT:
A RESOURCE RECOVERY FACILITY
water • nutrients • carbon • energy
BLUE PLAINS
ENERGY
CLEAN WATER
CARBON NUTRIENTS
dcwater.com/biosolids
GREEN ENERGY BIORENEWABLES
POWER FROM THE PEOPLE
THERMAL HYDROLYSIS PROCESS (THP) AND DIGESTION FACILITY
GREEN BENEFITS:
• Produce combined heat and power, generating 13 MW of electricity
• Save DC Water $10 million annually cutting grid demand by a third (DC Water is the largest consumer of electricity in the District)
• Reduce carbon emissions by approximately 50,000 metric tons of CO2e per year
• Reduce trucking by 1.7 million miles per year
• Save $10 million in biosolids trucking costs
• Produce Class A biosolids to grow trees, sequester carbon and reduce runo
5


dc water is life
New Wet Weather Pump Station & High Rate Enhanced Clarification Facility
New Biosolids Management Program
New Side Stream Centrate Treatment Process
Upgrade & expansion of the Nit/ Denit system
Expansion
Expansion & Upgrade of the Secondary High Rate System & Clarifiers

water is life

Anammox Bacteria for Nitrogen Removal

- Replaces very energy intensive process
- Potential for 20% drop in energy use across the plant
- Slow growing, sensitive bacteria
- Requires some capitol improvements

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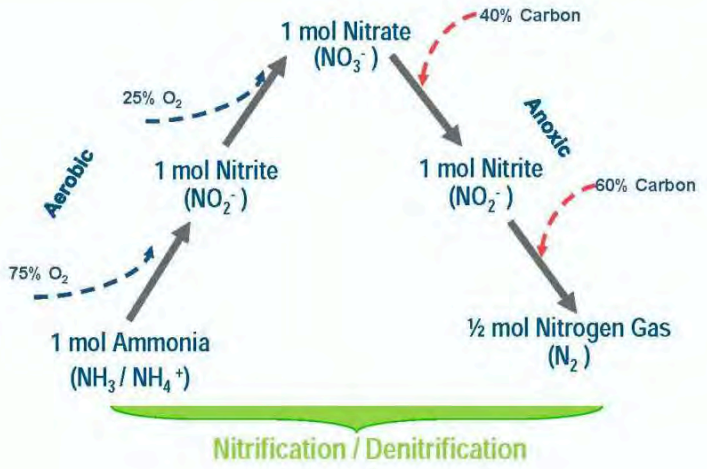
Nitrification/ Denitrification



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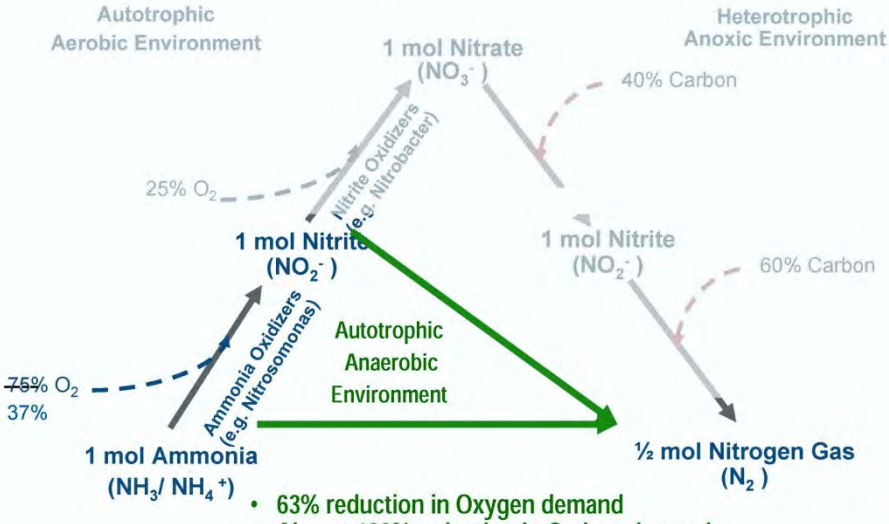
Deammonification (simplified)

water is life



- 63% reduction in Oxygen demand
- Almost 100% reduction in Carbon demand
- Much reduced in Biomass production
- Reduced CO_2 emissions (4.7 - 0.7 ton CO_2/ton N)

9

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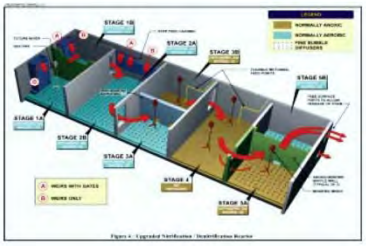
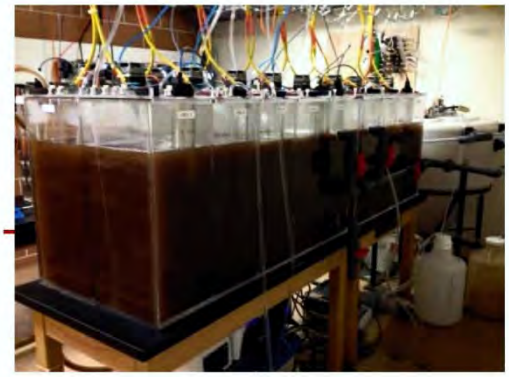
Anammox pilot (DC Water)

water is life

- Mixer
- Aerobic (Diffusers)
- Anoxic (Mixer)
- Swing (Mixer & Diffusers)





Sequential Oxic/Anoxic Operation

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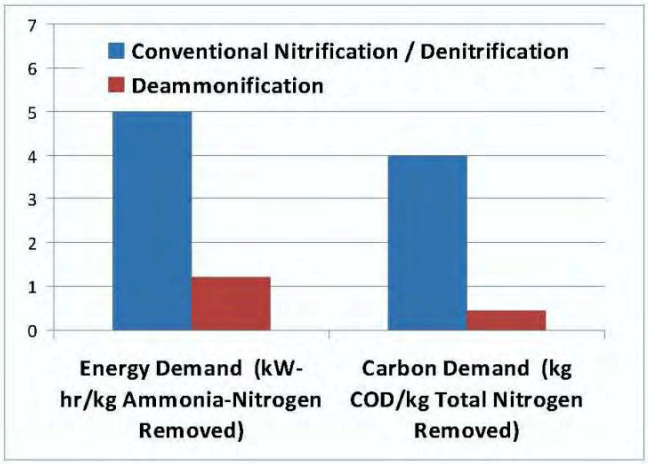
Deammonification Benefits



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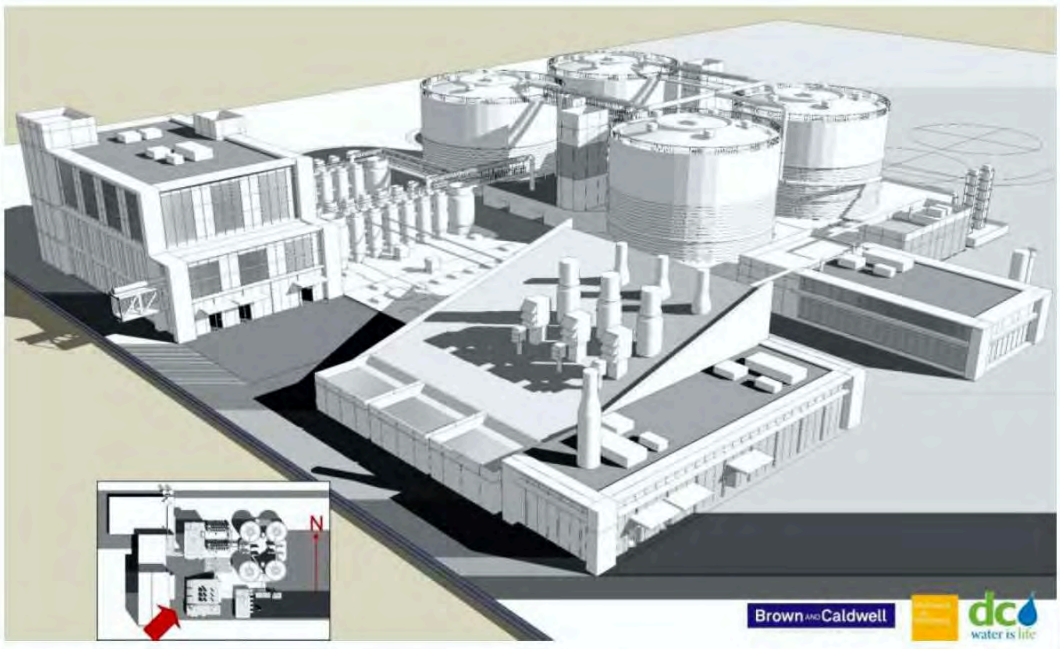

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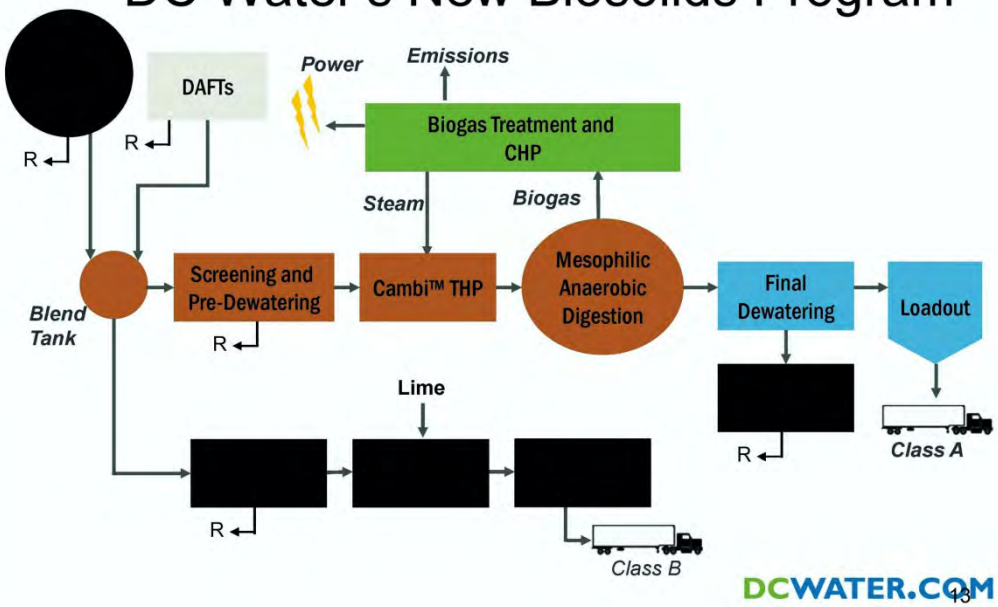
DC Water's New Biosolids Program



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Moving Research into Practice

Students

- David Inman, MS 2004;
- Sangeetha Subramanian, MS 2005
- Jared Webb, MS 2006
- Nitin Kumar, MS 2006
- Christopher Wilson, MS 2006
- Sarita Banjade, MS 2008
- Charan Tanneru, MS, 2009
- Christopher Wilson, PhD, 2009

Resulted in 25 publications and 1 patent

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Pulper	Reactors	Flash Tank
• Influent solids 15 to 18.5 %TS • Preheated to 140-210°F with recycle steam • Mixing pumps	• Batch process • Heated to 302-356°F • 54-138 psi • 22-30 minute detention time	• Depressurization • Cools down to 158-239°F • 8-12 %TS to digesters

dc water is life

Program Benefits

- **Reduce biosolids** quantities by more than 50%
- **Improve product quality** (Class A and more)
- **Generate 13 MW** of clean, renewable power
- **Cut GHG emissions** dramatically
- **Save millions of dollars** annually when the facility begins operating in 2014

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Solar Power

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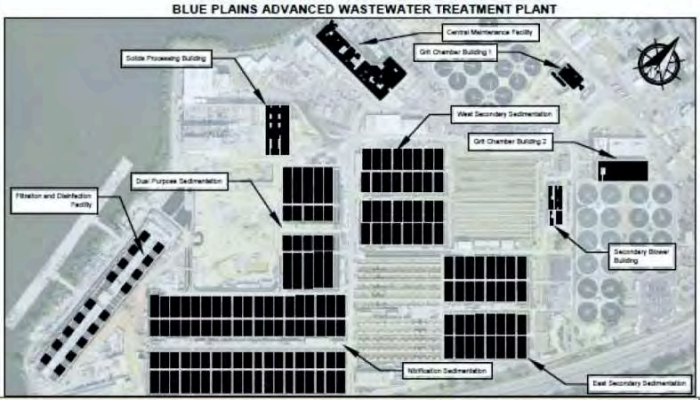
SOLAR PHOTOVOLTAIC FEASIBILITY PROJECT
DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY
BLUE PLAINS ADVANCED WASTEWATER TREATMENT PLANT



	PV SOLAR ARRAY SYSTEM DATA TABLE :									
Location	Sheet No.	Total Module	Module Nameplate (W)	MW Capacity (DC)	Azimuth (Degrees)	Tilt (degrees)	Inverter Mfg. or Approved Equivalent	Inverter Capacity in MW (AC)	Inverter Qty.	Annual Energy Output (MWh)
East Secondary Sedimentation	PV-1.1	8,832	270	2.38	217	10	ADVANCED ENERGY	2	2	2,976
West Secondary Sedimentation	PV-1.2	8,576	270	2.32	217	10	ADVANCED ENERGY	2	2	2,888
Dual Purpose Sedimentation	PV-1.3	6,720	270	1.81	217	10	ADVANCED ENERGY	1.5	2	2,264
Nitrification Sedimentation	PV-1.4	18,544	270	5.01	217	10	ADVANCED ENERGY	4.5	5	6,245
Filtration and Disinfection Facility	PV-1.5	1,944	270	0.52	166	10	ADVANCED ENERGY	0.5	1	661
Solids Processing Building	PV-1.6	1,001	270	0.27	217	10	ADVANCED ENERGY	0.250	1	323
Grit Chamber Building 1	PV-1.7	396	270	0.11	171	10	ADVANCED ENERGY	0.100	1	128
Grit Chamber Building 2	PV-1.8	915	270	0.25	217	10	ADVANCED ENERGY	0.200	2	292
Central Maintenance Facility	PV-1.9	1,915	270	0.52	171	10	ADVANCED ENERGY	0.500	1	663
Secondary Blower Building	PV-1.10	292	270	0.08	217	10	ADVANCED ENERGY	0.075	1	94
Totals		49,134		13.27				11.625	18	16,524

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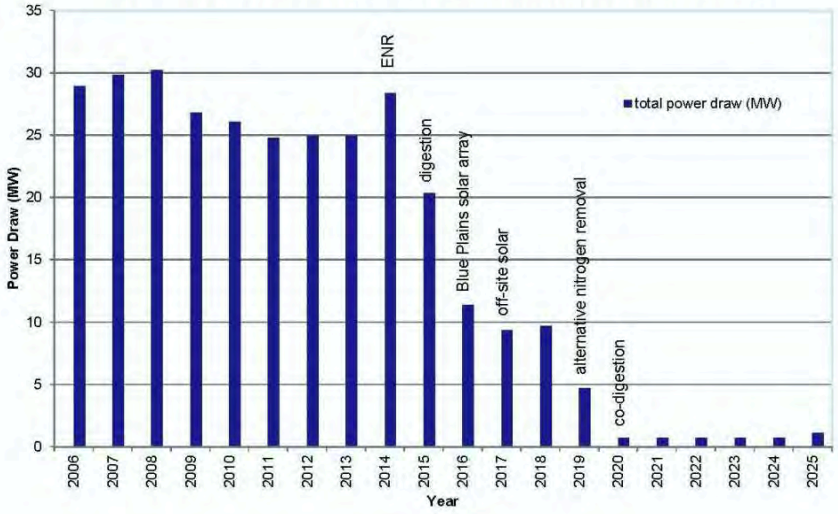
Blue Plains Grid Power Draw During Sunlight Hours



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There is no such thing as waste, only wasted resources.

Chris Peot
cpeot@dcwater.com


USTDA - sponsored Brazil:
Water/Wastewater Energy
Efficiency Reverse Trade Mission
May 11-21, 2014
ALEXANDRIA
renew
ENTERPRISES


Alexandria Renew Enterprises
One of the most advanced water reclamation facilities in the US, located in an urban landscape
ALEXANDRIA
renew
ENTERPRISES

Alexandria Renew Enterprises

- Created in 1952 as an independent Authority
- Led by an appointed 5 member citizen board
- Provides water reclamation services for Alexandria customers and wholesale service to Fairfax County

ALEXANDRIA renew ENTERPRISES

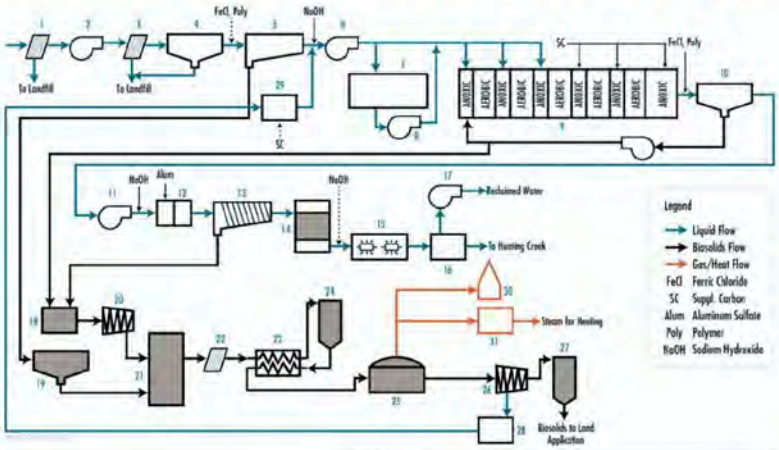
Alexandria Renew Enterprises

Small site

- National cemetery
- Major highway
- Stream
- Electrical substation
- Only 33 usable acres

ALEXANDRIA renew ENTERPRISES

AlexRenew WRRF Process Flow Diagram



Unit Processes

1 Course Screens	9 Biological Reactor Basins	17 Reclaimed Water Pumps	25 Anaerobic Digesters
2 Raw Sewage Pumps	10 Secondary Settling Tanks	18 Raw Sludge Blending Tanks	26 Dewatering Centrifuges
3 Fine Screens	11 Intermediate Pumps	19 Gravity Thickeners	27 Biosolids Silos
4 Vortex Grit Chambers	12 Rapid Mix/Floc. Tanks	20 Thickening Centrifuges	28 Centrate Storage Tanks
5 Primary Settling Tanks	13 Tertiary Settling Tanks	21 Thickened Sludge Eq. Tanks	29 Centrate Pre-Treat. Reactors
6 Primary Effluent Pumps	14 Gravity Filters	22 Sludge Screenings Presses	30 Gas Flares
7 Nutrient Mgmt. Facility	15 UV Disinfection	23 Heat Exchangers	31 Biogas Boilers
8 Nutrient Mgmt. Pumps	16 Post-Aeration Channels	24 Pasteurization Tanks	

AlexRenew WRRF Permit Limits

Monthly Average Limits:

Parameter	Limit
$cBOD_5$	5.0 mg/L
TSS	6.0 mg/L
Ammonia (Apr-Oct)	1.0 mg/L
Ammonia (Nov-Jan)	8.4 mg/L
Ammonia (Feb-Mar)	6.9 mg/L
Total Phosphorus	0.18 mg/L

In addition, AlexRenew has an annual average Total Nitrogen limit of 3 mg/L based on the waste-load allocation at design flows and loads (54 Million Gallons per Day Annual Average Daily Flow)

ALEXANDRIA renew ENTERPRISES

Non-Clog Dry-Pit Centrifugal Pumps

Flowserve Pumps

- Raw Sewage Pump Station
  6 pumps, 300 HP Motors
- Primary Effluent Pump Station
  6 pumps, 250 HP Motors
- Intermediate Pumps
  6 pumps, 400 HP Motors
- Nutrient Management Facility Pumps (future)
  4 pumps, 150 HP Motors
  4 pumps, 40 HP Motors

Fine Screening System

Parkson AquaGuard® system consists of:

- Belt-type climber screen, 6-mm openings (4 units)
- Screenings washer (4 units)
- Screenings compactor/press (4 units)

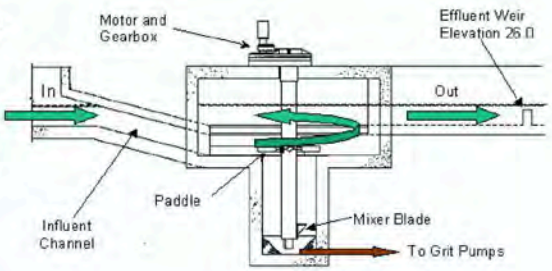
Fine screening system removes solids from the flow stream in order to protect downstream equipment.

Grit Removal System

Smith & Loveless PistaGrit® vortex grit chambers remove sand, gravel and other heavy solids from the plant influent stream to protect downstream equipment and keep material out of biosolids.

System Consists of:

- 20-ft diameter circul chambers (4 units)
- Grit mixer (4 units)
- Grit pumps (4 units)

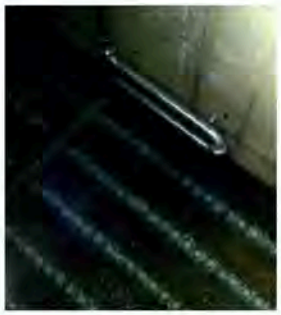


Fine Bubble Diffusers

Sanitaire membrane-type disc diffusers, 9-inch diameter

- > 20,000 diffusers in 5 basins

Fine bubble diffusers are used to introduce air to the biological reactor basins. Fine bubble diffusers offer good oxygen transfer efficiency and thus reduce operating costs.



ALEXANDRIA renew ENTERPRISES

Multi-Stage Centrifugal Blowers

Hoffman-Lamson Blowers

- 5 units
- 16,600 scfm per unit
- 1,250 HP motors

The blowers provide low-pressure air (13 psi) to aerate the biological reactor basins.

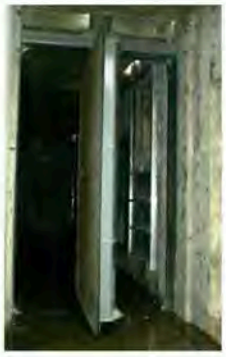
ALEXANDRIA renew ENTERPRISES

Flow Isolation and Diversion Gates

Rodney-Hunt gates are used in the biological reactor basins

- 18 cast iron gates, 10 ft x 10 ft in size
- 20 weir gates, 8 ft x 8 ft in size
- 5 butterfly gates 8.5 ft x 13.5 ft in size

Cast iron, aluminum, and stainless steel gates are used throughout the plant to isolate channels or tanks and divert flow. They are also used as adjustable weirs.



ALEXANDRIA renew ENTERPRISES

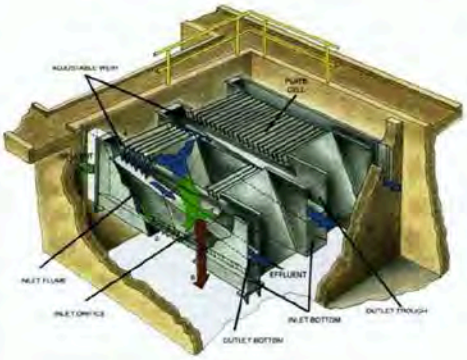
Tertiary Plate Settlers

Waterlink (now Parkson) plate settlers used:

- 8 tertiary settling tanks
- > 1,400 plates per tank

Tertiary settling removes solids and total phosphorus prior to filtration

Inclined-plate settlers were used to increase the performance of the tanks and reduce the footprint



Filter Underdrains

Tetra® U-Block used:

- 22 filter units
- 6.4 MGD per filter

Dual media filters (sand and gravel) are used to polish the final effluent

Filter underdrains are used to provide optimal backwash flow distribution and also for the ability to add air scour to the process.

ALEXANDRIA renew ENTERPRISES

Instrumentation

Instruments used at AlexRenew:

- **Hach** Dissolved Oxygen Meters
- **Fluid Components** Air Flow Meters

ALEXANDRIA renew ENTERPRISES

Controls – Allen-Bradley

AlexRenew uses a Supervisor Control and Data Acquisition System (SCADA) system to monitor and control the processes. The system consists of:

- Programmable Logic Controllers (PLC) PLC-5s, SLC-500s, & ControlLogix) by **Allen-Bradley**
- Operator Interface Terminals (OIT), PanelView by **Allen-Bradley**

Current Project Under Construction

Construction Manager at Risk (CMAR) Delivery Approach

- Provides best-value approach and flexibility to integrate with neighboring commercial/residential development
- Equipment procurement to deliver/match existing plant (Pumps, Gates, PLCs, instruments)

ASTM International Standards for the Water Treatment Industry

Presentation to
Brazilian Delegation: Water/Wastewater Energy Efficiency RTM

Jim Olshefsky, Director, External Relations

May 13, 2014
Back River Wastewater Treatment Plant – Baltimore, MD

What is ASTM?

- Global platform for the development of international consensus standards and related services
- Private sector, not-for-profit organization
- Founded in 1898
- Headquartered outside of Philadelphia
- Other offices: Beijing, Brussels, Mexico City, Ottawa and Washington, DC

- 30,000 technical expert members from 150 countries
- Participating Members work within 143 technical committees— often in multiple committees
- 12,000+ total ASTM standards
- 90 industry areas covered

2

ASTM International Relationships in Brazil

ABNT

- General Director, Ricardo Fragoso, ASTM Int'l Board of Directors (2008-2010)

University Consortia

- Partner with CAPES Consortia in Brazil to provide ASTM Information to Universities and Institutes

ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS

CAPES

ASTM INTERNATIONAL Standards Worldwide

3

Academic Outreach

Campus Visit, August 2010

Pontifícia Universidade Católica do Rio de Janeiro

- Fundamentals of Industrial Technology Course
  - Module on Standardization

Prof. José T. Araruna, PhD
Departamento de Engenharia Civil

Prof. Mauricio N. Frota, PhD
Head of the Posgraduate Metrology Programme

4

The ASTM International Mission

- Promote public health, safety, and the overall quality of life
- Contribute to the reliability of materials, products, systems and services
- Facilitate national, regional and international commerce

ASTM INTERNATIONAL Standards Worldwide

5

Starting the Process

- Members identify the need; or
- Outside representatives approach ASTM
- ASTM brings stakeholders together
- ASTM provides the forum and the process

ASTM INTERNATIONAL Standards Worldwide

6

ASTM Membership from Brazil

- Over 50 technical experts from Brazil participate in numerous ASTM International technical committees
  - Conexões e Tubos Inoxidáveis – A01 (iron and steel)
  - Cientec – D18 (soil and rock)
  - Desek Engineering – C01, C09 (cement and concrete)
  - Bass Equipmentos – G01 (corrosion of metals)
- Multi-national companies with significant operations in Brazil such as Volkswagen, Shell, BASF, Cargill, and GM

ASTM INTERNATIONAL Standards Worldwide

7

Uses of ASTM Water Standards

ASTM INTERNATIONAL Standards Worldwide

8

ASTM Water Portal Collaboration and Coordination

Water: Standardization for an Essential Resource and Precious Commodity

Water is becoming a prominent topic in global settings as drought and population pressures increase the need for abundant sources of water. Water is considered to be one of the biggest resources and most important commodities in the 21st Century. Population pressures and rising demand combined with declining fresh water supplies is creating a tension and stress on communities and businesses worldwide. As the effects of climate change become clearer the changes in water rainfall patterns are exacerbating this increasingly challenging situation.

As defined by ASTM Committee D19 on Water: the term "water" includes, but is not limited to: surface waters (rivers, lakes, artificial impoundments, runoff, etc.); groundwaters and springwaters; wastewaters (mine drainage, landfill leachate, brines, waters resulting from atmospheric precipitation and condensation (with the exception of acid deposition)); process waters; potable waters; glacial melt waters; steam; water for subsurface injection and water discharges including waterborne materials and water-formed deposits.

In an effort to continue to meet the expanding need for standardized practices and methods for water testing, transport, recycling, and safety, ASTM has compiled a listing of its current portfolio of standards related to Water.

Within the topic of Water as a Resource and Commodity, ASTM has identified five areas of interest.

ASTM INTERNATIONAL
Standards Worldwide

9

To visit the ASTM Water Portal relevant to your interests, click on the links below.


Environmental Preservation, Stewardship and Sustainable Use of Water Source


Testing and Maintenance of Water Quality


Extraction, Transportation, and Infrastructure for Water


Water Recapture, Efficiency, Reuse, Recycling, and Sustainability


Consumer and Industry Usage of Water

Water Portal Topics of Relevance

www.astm.org/waterportals.htm

ASTM INTERNATIONAL
Standards Worldwide

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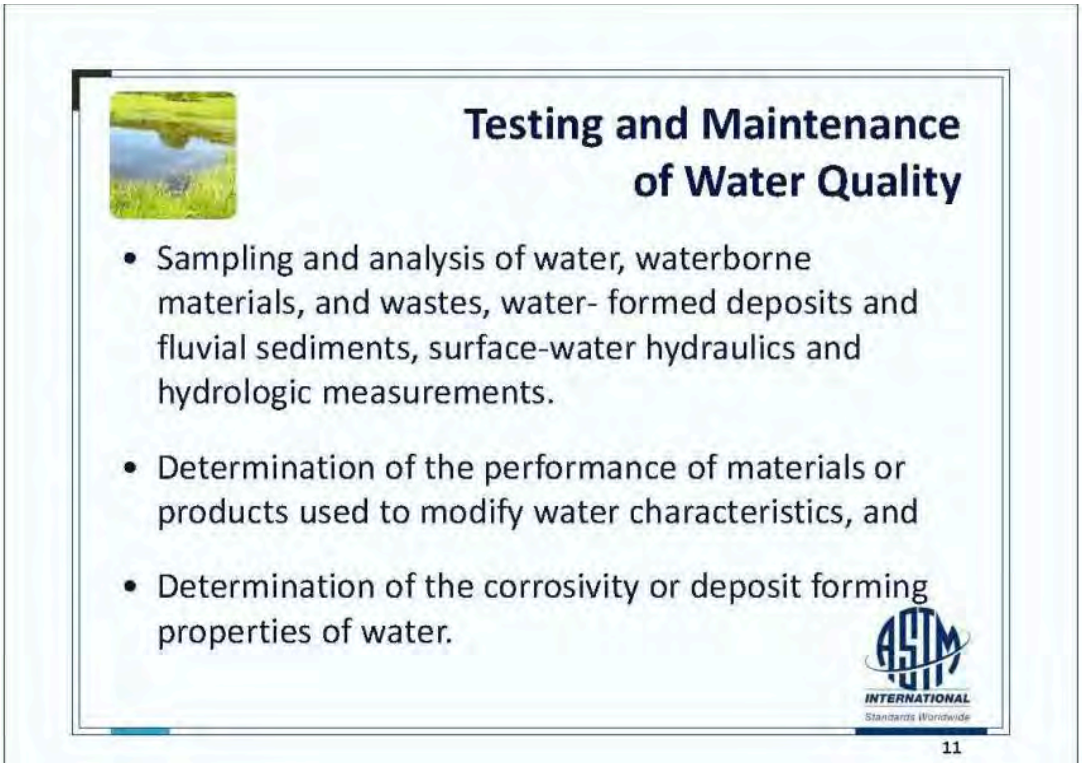
Testing and Maintenance of Water Quality
• Sampling and analysis of water, waterborne materials, and wastes, water- formed deposits and fluvial sediments, surface-water hydraulics and hydrologic measurements.
• Determination of the performance of materials or products used to modify water characteristics, and
• Determination of the corrosivity or deposit forming properties of water.
ASTM INTERNATIONAL
Standards Worldwide
11


ASTM International Committee D19 on Water
ASTM Committee D19
Quality Systems, Specification, and Statistics
Inorganic Constituents in Water
Hydraulic Fracturing Fluids
Sampling, Analysis and Surveillance of Water
Methods of Radiochemical Analysis
Water Microbiology
Membranes and Ion Exchange Materials
Methods for Analysis for Organic Substances in Water
Sediments, Geomorphology, and Open-Channel Flow
ASTM INTERNATIONAL
Standards Worldwide
12

Examples of Committee Participants

Arab Republic of Egypt:
Holding Company for
Water and Waste ***Water***

USGS
science for a changing world

Metrohm

Terracon
Consulting Engineers and Scientists

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

NIST
National Institute of
Standards and Technology
U.S. Department of Commerce

ASTM INTERNATIONAL
Standards Worldwide

13

Key Standards Referenced in Regulation

Code of U.S. Federal Regulations

- Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Analysis and Sampling Procedures
- AGENCY: Environmental Protection Agency (EPA)
  - Effective June 18, 2012

ASTM INTERNATIONAL
Standards Worldwide

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Use of ASTM Standards Worldwide

More than 6300 ASTM standards are cited (consulted, referenced, used as the basis of a national standard, or adopted) in over 75 countries

Examples:

- China: 1000
- Colombia: 989
- Ecuador: 234
- Panama: 139
- Philippines: 328
- Saudi Arabia: 923
- South Africa: 501
- Trinidad and Tobago: 231
- Turkey: 492
- Vietnam: 161

15

ASTM International Committee D34 on Waste Management

Related Standard

ASTM D6538 Standard Guide for Sampling Wastewater With Automatic Samplers

This guide covers the selection and use of automatic wastewater samplers including procedures for their use in obtaining representative samples.

16


Questions?
Contact
Jim Olshefsky
Director, External Relations
jolshefs@astm.org / 610-832-9714
ASTM INTERNATIONAL
Standards Worldwide
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CORPORATE OVERVIEW

SYNAGRO

SYNAGRO

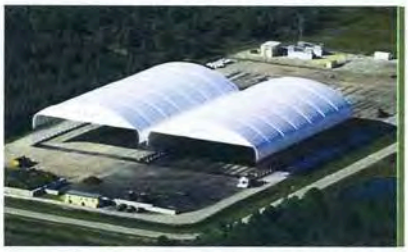
REPRESENTATIVE PROJECTS

Synagro manages organic non-hazardous residuals generated by municipal and industrial water and wastewater facilities.

Honolulu – egg-shaped digester and dryer, 2014 building 2nd digester.

Woonsocket – regional fluid-bed incinerator, 2013 installed waste heat to energy.

MD/VA land application – working as industry voice on regulation changes.



Charlotte County, FL – regional composting facility, open 1st quarter 2014.

2

SYNAGRO

INDUSTRY LEADER

Synagro is the nation's largest and most experienced Biosolids Management Company

Synagro Experience and Breadth

- Over 600 municipal and industrial clients in 34 states
- Manage over 11 million tons of biosolids annually
- 9 Class A drying/pelletizing single-customer facilities
- 3 Regional Merchant Thermal Reduction Facilities
- 4 Class A Compost Facilities
- Over **70** permanent and mobile dewatering locations
- Permitted land base of over 1,0**00,000** acres
- Over **$350** million in annual revenues
- $3 billion contract backlog
- Acquired by EQT Infrastructure II Fund August 2013

3

SYNAGRO

EQT INFRASTRUCTURE BACKGROUND

- EQT is a leading private equity firm in Northern Europe which has raised approximately ~€20 billion in committed capital across multiple investment strategies and has invested over €11 billion in more than 100 companies worldwide
- In 2007, EQT recognized an opportunity to apply its current investment model to infrastructure companies:
  - EQT Infrastructure I closed on approximately €1.2 billion of committed capital in November 2010
    - 10 portfolio companies, 3 portfolio company add-on investments and 1 exit
    - Power generation, midstream oil and gas, outsourced energy servicers, storage, waste management, infrastructure services and parking sector investments in Northern Europe, Continental Europe and North America
  - EQT Infrastructure II closed at its hard cap of €1.925 billion in January 2013
    - 3 completed acquisitions
    - Communication, energy-from-waste and storage sector investments
- Currently, EQT Infrastructure I and II have three particularly relevant portfolio companies including:
  - NORD – A leading hazardous waste management company in Northern Europe
  - EEW – A market leading private energy-from-waste company in Germany
  - RTI – A leading provider of waste services to the foodservice industry in the United States

4

SYNAGRO

SYNAGRO BROAD SERVICE OFFERINGS

Synagro offers a full suite of all commercially viable biosolids management options

- Heat Drying and Pelletization
- Composting
- Product Marketing
- Thermal Reduction
- Land Application
- Mobile and Stationery Dewatering
- Lagoon and Digester Clean-outs
- Stabilization Services
- Transportation and Disposal Services
- Gas Shale Services
- Carbon and Renewable Energy Markets
- Hypex Centrifuge Repair Services
- Design Build Operate and Capital Funding

5

SYNAGRO

HEAT DRYING AND PELLITIZATION

- Depth of Operating Experience
  - 60+ years cumulative dryer operating experience
  - Currently operate 9 facilities
    - Philadelphia, PA
    - Baltimore, MD (2)
    - Sacramento, CA
    - Honolulu, HI
    - Pinellas County, FL
    - Stamford, CT
    - Hagerstown, MD
    - Camden, NJ
- Technology Diversity
  - Experience operating 6 different drying technologies
    - Andritz
    - Swiss Combi
    - ESP
    - Seghers
    - Stord
    - Komline

Product Marketing Capabilities

- Annual Production 127,000 tons per year
- Contract Marketing 7,000 tons per year
  - Upper Occoquan, VA
  - Ocean County, NJ
- Successfully marketing 134,000 tons annually
  - Fertilizer
  - Soil Amendments
  - Renewable Energy

6

SYNAGRO

COMPOSTING

Depth of Operating Experience

- More than 45 years cumulative compost operating experience
- Currently operate 4 regional compost facilities:
  - South Kern, CA
  - Central Valley, CA
  - Arizona Soils, AZ
  - Charlotte County, FL
- Processed > 2.5 million tons of residuals; facilities range in size from 100 to 530 wet tons per day

Technology Diversity

- Experience operating 3 different composting technologies:
  - ASP
  - Windrow
  - IPS (in-vessel)

Product Marketing Strength

- Effectively marketing 220,000 tons annually

Regional Facility Development Experts

- Siting
- Permitting
- Political Interface & Community Relations

7

SYNAGRO

PRODUCT MARKETING

Nationwide Program

- Market 45% of all biosolids pellets distributed in the U.S.
  - 130,000 tons per year
- Market 30% of biosolids compost distributed in the U.S.
  - More than 220,000 tons per year

Existing Market Distribution Channels

- Pellets
  - Fertilizer: agriculture, consumer, specialty, forestry
  - Renewable energy: cement kiln, cogeneration plants
- Compost
  - Landscape, horticulture, agriculture, erosion control, specialty

All Natural Organic Granulite FERTILIZER

Full-service Dedicated Sales Experts

- Full-time professional sales staff
- Technical services staff
  - Permits, approvals, registration
  - Use guidance, Certified Crop Advisors
  - Monitoring & regulatory compliance with record keeping
- Product Quality Enhancement & Improvement Program

All Gro

8

SYNAGRO

THERMAL REDUCTION

Depth of Operating Experience

- Over 40 years cumulative facility operating experience
- 3 Regional Facilities
  - Woonsocket, RI
  - Waterbury, CT
  - New Haven, CT
- Processed more than 3 million tons through these facilities, ranging from 40 dry tons per day to 105 dry tons per day

Technology Upgrade Expertise

- Fluid bed upgrades
- MHF refurbishment
- Energy recovery
- Emission improvements

Regional Facility Development Experts

- Design, build, operate and financing expertise
- Facility upgrades and expansion
- Host community revenue generation

9

SYNAGRO

LAND APPLICATION

Comprehensive Service Package

- Land base acquisition and permitting
- Consultation services with Certified Crop Advisors
- Community outreach & education
- Transportation and application
- Regulatory monitoring and record keeping

Depth of Experience

- Over 30 years experience operating hundreds of land application projects
- Over 600 customers including:
  - Charlotte, NC
  - Houston, TX
  - Washington, DC
  - Chicago, IL
- Most experienced staff in industry
- National presence, local knowledge & expertise

Strong Industry Advocacy

- Political
- Regulatory
- Legal
- Public
- Academic Community

Large Permitted Land base

- Over 1,000,000 acres permitted in 33 states

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SYNAGRO

MOBILE AND STATIONARY DEWATERING

Depth of Resources
- Over 45 mobile centrifuge and belt press units
- Over 35 permanent installations

Combined with Beneficial Use Options
- Stabilization
- Land Application
- Soil Blending
- Composting

Nationwide Coverage
- 600 locations permit rapid response
- Emergency, periodic, seasonal, long-term options

11

SYNAGRO

LAGOON AND DIGESTER CLEAN-OUTS

Depth of Experience
- Over 30 years experience cleaning and refurbishing hundreds of digesters and lagoons
- Fleet of mobile dredges, pumps, high flotation dozers and hydraulic track hoes

Combined with Beneficial End Use Sites
- Ability to offer land application for costs savings
- Combine with mobile dewatering capability to minimize truck traffic

National Coverage
- 600 Locations permit rapid response
- Convenient incremental service offering

Comprehensive Safety Procedures
- Confined space protocols
- On-site safety professionals

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SYNAGRO

STABILIZATION SERVICES

Technology Diversity
- Class A and B Alkaline Stabilization
  - Bio*Fix
  - RDP
- Digestion
  - Egg shaped
  - Conventional

End Use Focus
- Production of usable products
- Location of end use sites

Process and End Product Odor Control Experts
- Scrubbers
- Biofilters
- Thermal Oxidizers
- Site Management

13

SYNAGRO

TRANSPORTATION AND DISPOSAL SERVICES

Rail Capabilities for Biosolids Movement
- Move over 4 million tons of material by rail annually
- Fleet of rail equipment:
  - Rail cars
  - Intermodal containers
  - Loading and unloading equipment
- Operate Northeast truck to rail transfer station
- Rail agreements with CSX, Burlington Northern Santa Fe, Norfolk Southern and Union Pacific Railroads

Nationwide Disposal Network
- Network of landfill agreements with national providers

Substantial Truck Transportation Network
- Company-owned fleet of trucks
- National truck lease agreements
- Strong subcontract trucking relationships

14

SYNAGRO

OIL SERVICES

Oil Field Support – Servicing:

- Texas
- North Dakota
- Louisiana

Closed Loop Service Advantage

- Excess fluids such as contaminated mud, wash water, rain water and any other fluids are dewatered and reused in the drilling operation
- Dewatering reduces the overall drilling costs by reducing trucking and disposal costs
- Lower disposal volumes minimize liability

Transportation

- Truck
- Rail

Dewatering

- BDP
- Centrifuge

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SYNAGRO

CARBON AND RENEWABLE ENERGY MARKETS

Diverse Technology Options

- Greenhouse gas emissions reduction
  - Recovery/beneficial use of landfill gas
  - Biosolids carbon sequestration
- Renewable energy programs
  - Dried biosolids to fuel
  - Biosolids digestion to methane
- Energy efficiency programs
  - Incinerator heat recovery and power generation
  - Cogeneration

Established Partnerships

- Cement industry
- Power industry

16

SYNAGRO

CENTRIFUGE REPAIR AND MAINTENANCE BY HYPEX

- Synagro was one of Hypex centrifuge group's customer
- Benefits to customers include:
  - Reduced downtime during repairs
  - Faster response time to emergency situations
  - Upgraded installation services
  - Preventative maintenance
  - Improved overall operating efficiency
- Centrifuge group has repaired decanters made by:
  - Sharples/Alfa Laval
  - Tomoe
  - Bird and Humboldt
  - Siemens (authorized repair shop)
  - Andritz
  - Flottweg
  - Westfalia
  - Centriquip
  - Centrisys
  - Brandt
  - Hutchinson Hayes
  - IHI
  - and others

page 17

SYNAGRO

DESIGN-BUILD-OPERATE AND CAPITAL FUNDING

Ability to Provide Single Point of Responsibility for Successful Project Delivery and Operation

- Custom Solutions – Technology Neutral
- Reduced design and construction risk
  - Decreased design and construction error
  - Decreased change orders/litigation
- Guaranteed costs
  - Firm pricing for design, construction and operation
  - Provides budget predictability
- Guaranteed end product disposition
  - Synagro responsible for end use
  - Built-in product quality incentive
- Compressed schedule
  - One procurement process
  - Collaboration on DBO parameters
- Cost savings
  - Promotes efficient design

Ability to Provide Capital Funding

- Incorporate debt and O&M cost in annual fee

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THANK YOU
People → Planet → Synchronization

Who We Are

- 53,644 volunteer members in over 130 countries
  - 4,017 student members
    - 232 members in Brasil
  - 175 chapters
    - One chapter in Brasil, established in 2002
  - 312 student branches
    - Consulting engineers, contractors, manufacturers, manufacturing representatives, architects and students
- Founded in 1894

What We Do

- Provide essential membership benefits
- Serve as pipeline for technical information
- Create standards and technical guidelines to serve the built environment
  - Offer continuing education for industry professionals
- Serve as a networking tool for industry professionals

How We Do It

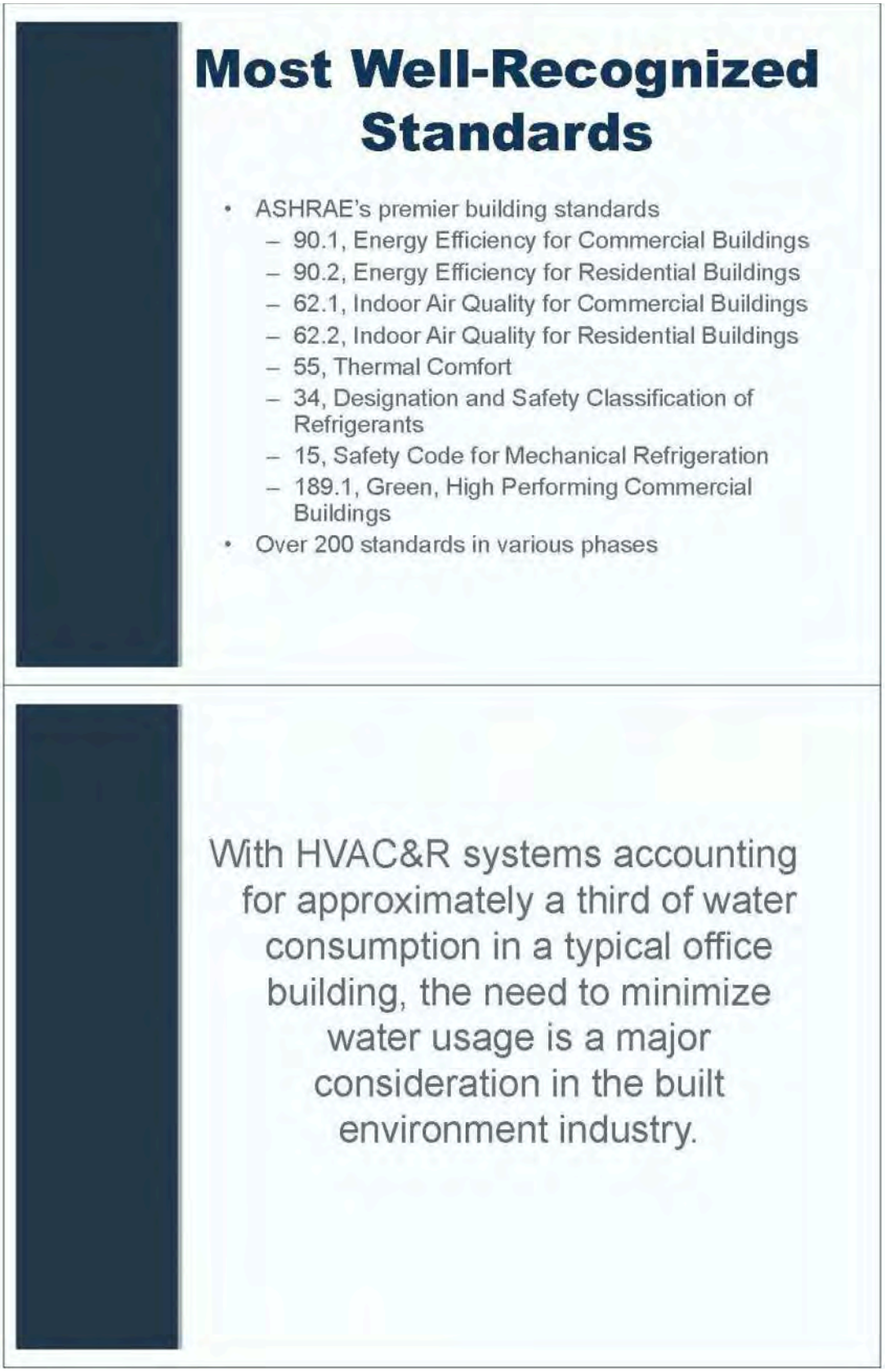
- 28 standing committees
- 112 standards and guidelines committees
- 110 technical committees
- 300+ publications
- Six certification programs
- Chapters provide leadership at the local level
- 100+ educational courses
- Research:
  - 60+ active projects
  - Over 700 projects completed over last 50 years
- Advocacy nationally and locally

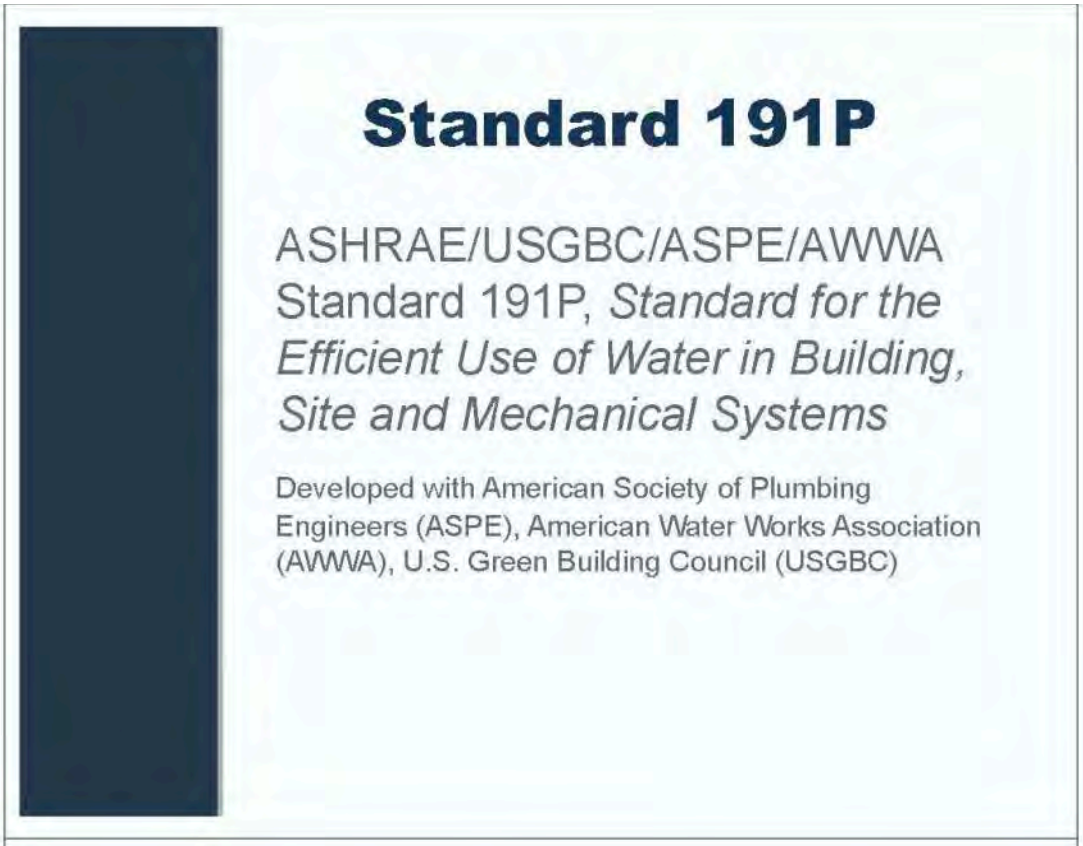
What Makes Us Different

- A global membership
- A leader in the built environment for technical advancements
- One of few HVAC&R organizations in world with own research program

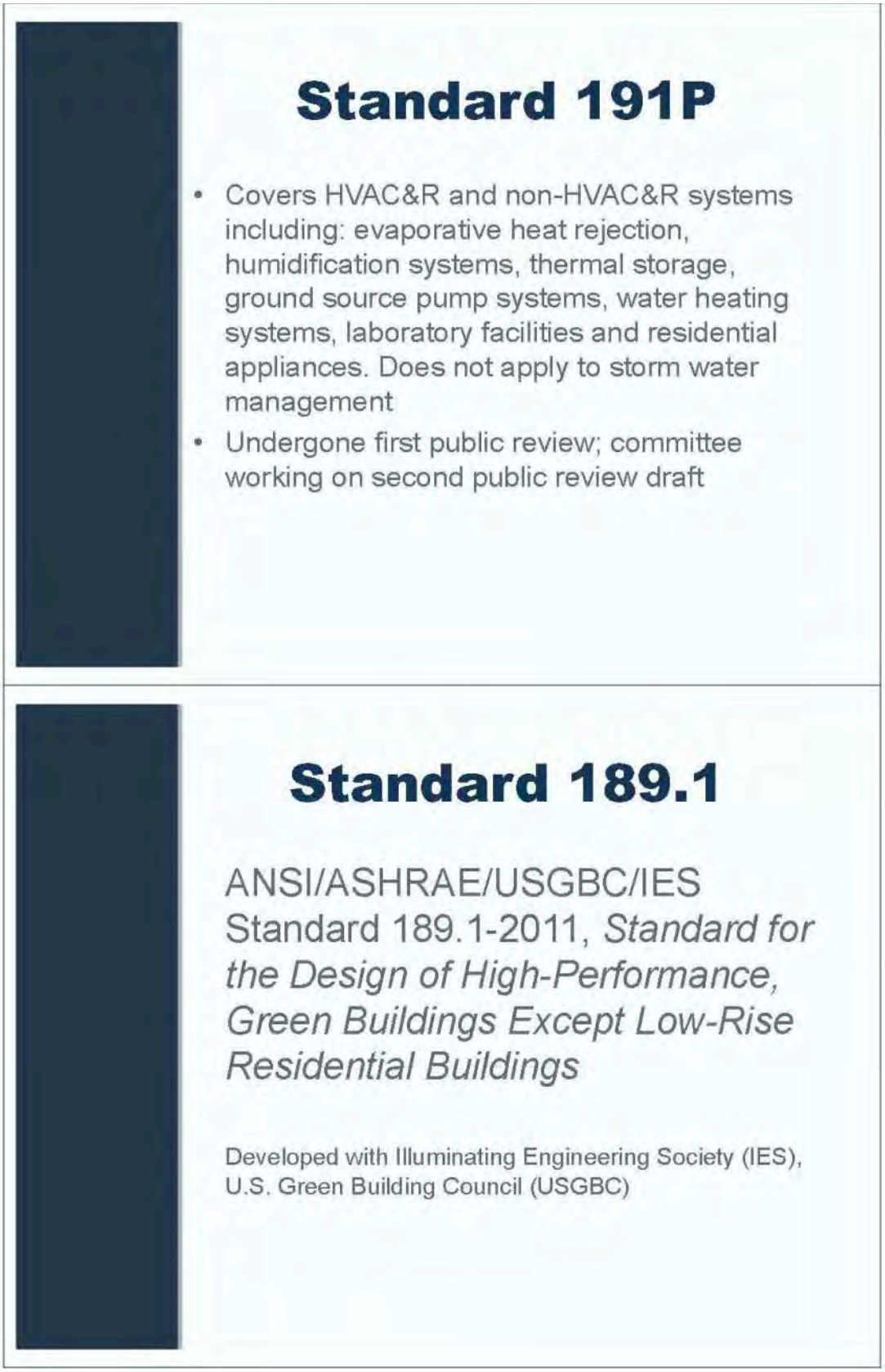
Standards Development

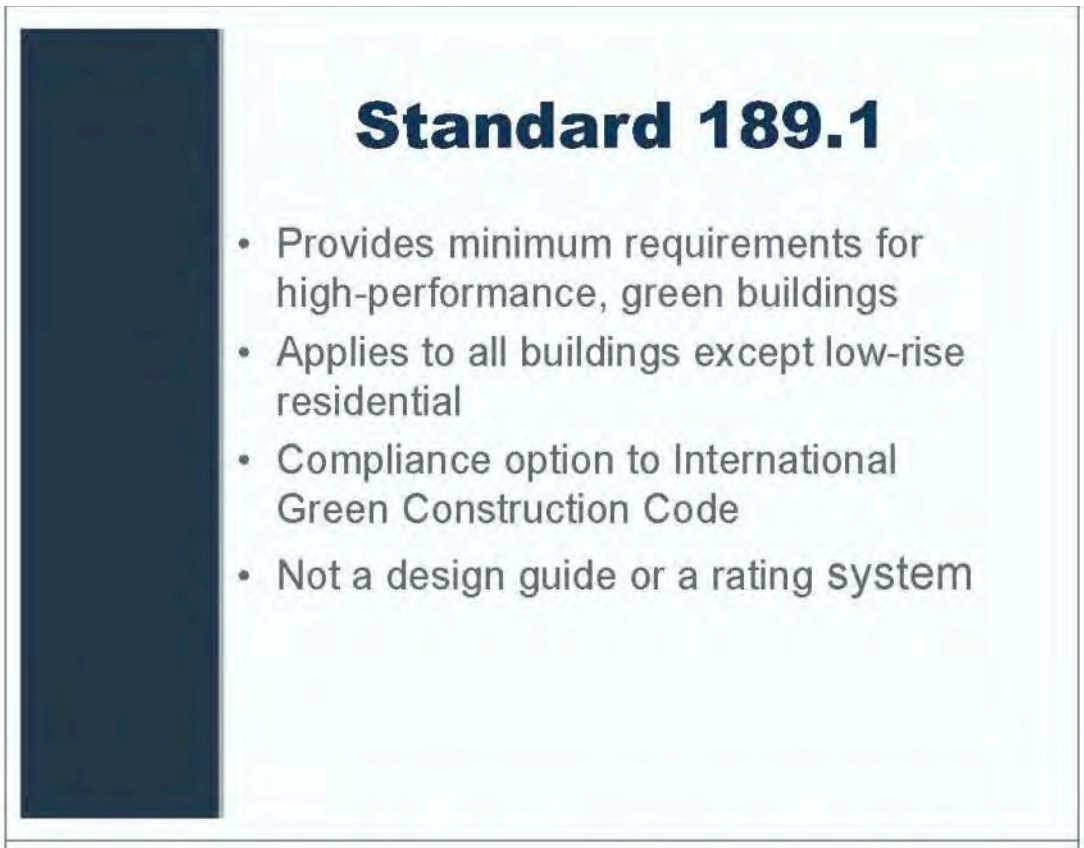
- One of only six standards-writing organizations accredited by the American National Standards Institute (ANSI) as an Audited Designator
- Consensus process ensures standards are developed independent of special interests
- Volunteer committees bring together balanced group of technical experts, professionals, government officials and business representatives

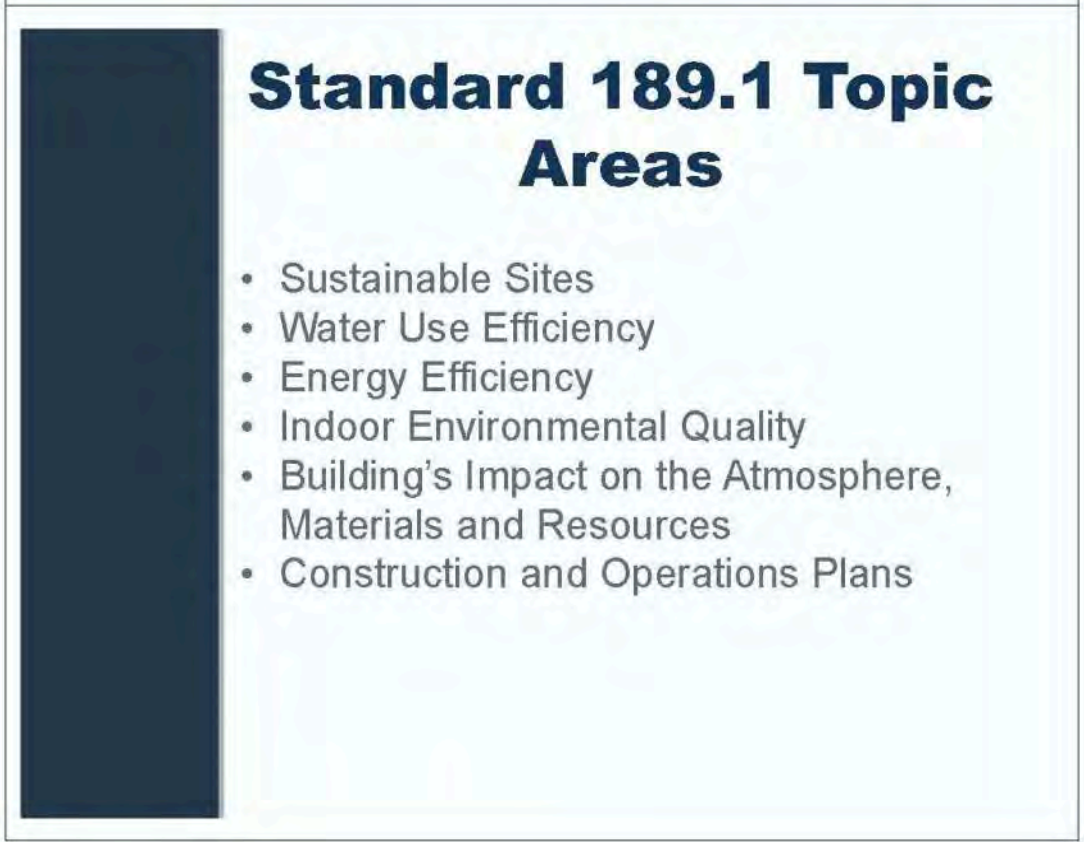

Most Well-Recognized Standards
• ASHRAE's premier building standards
– 90.1, Energy Efficiency for Commercial Buildings
– 90.2, Energy Efficiency for Residential Buildings
– 62.1, Indoor Air Quality for Commercial Buildings
– 62.2, Indoor Air Quality for Residential Buildings
– 55, Thermal Comfort
– 34, Designation and Safety Classification of Refrigerants
– 15, Safety Code for Mechanical Refrigeration
– 189.1, Green, High Performing Commercial Buildings
• Over 200 standards in various phases
With HVAC&R systems accounting for approximately a third of water consumption in a typical office building, the need to minimize water usage is a major consideration in the built environment industry.


Standard 191P
ASHRAE/USGBC/ASPE/AWWA Standard 191P, Standard for the Efficient Use of Water in Building, Site and Mechanical Systems
Developed with American Society of Plumbing Engineers (ASPE), American Water Works Association (AWWA), U.S. Green Building Council (USGBC)


Standard 191P
• Will provide baseline requirements for the design of buildings, site and mechanical systems
• Will optimize volume of water required to operate HVAC systems, plumbing systems and irrigation systems
• Currently no standard document that adequately and comprehensively addresses issue of how to efficiently use water in design, construction and operation of buildings


Standard 191P
• Covers HVAC&R and non-HVAC&R systems including: evaporative heat rejection, humidification systems, thermal storage, ground source pump systems, water heating systems, laboratory facilities and residential appliances. Does not apply to storm water management
• Undergone first public review; committee working on second public review draft
Standard 189.1
ANSI/ASHRAE/USGBC/IES Standard 189.1-2011, Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings
Developed with Illuminating Engineering Society (IES), U.S. Green Building Council (USGBC)


Standard 189.1
• Provides minimum requirements for high-performance, green buildings
• Applies to all buildings except low-rise residential
• Compliance option to International Green Construction Code
• Not a design guide or a rating system


Standard 189.1 Topic Areas
• Sustainable Sites
• Water Use Efficiency
• Energy Efficiency
• Indoor Environmental Quality
• Building's Impact on the Atmosphere, Materials and Resources
• Construction and Operations Plans

Water Use Efficiency

Mandatory Provisions

- Site water use
- Building water use
- HVAC Systems, equipment
- Water consumption management

Recent Addenda

- Addendum *v*
  - limits full-flush volume for all toilets
  - limits kitchen faucet flow rates
  - sets efficiency requirements for clothes washers and dishwashers
  - sets limits on use of reclaimed water for roof cooling and roof vegetation irrigation.
  - approved for publication
- Proposed addendum *bg*
  - reinforces limitation of turf grass, while promoting use of native plants
  - proposed to encourage improvement of native wild life and insects while conserving water

ASHRAE Research

- Since 1919, research has been core of ASHRAE
- ASHRAE Research is largest program of fundamental and applied research supported by a technical society
  - Currently 60+ active research projects, 40+ projects approved for further development
  - 55 percent conducted by universities; 45 percent by private research or engineering firms
  - Payments to active projects range between $2.5-3 million per year
  - 845 research projects valued at $67.5 million conducted since 1960

Importance of ASHRAE Research

- Improves way building systems work and way they are applied
- Allows development of technical information to create standards and guidelines, which serve as basis for testing and design practices around world
- Funds projects addressing topics such as sound, duct design, effect of oil in refrigerants, load calculations, thermal conductivity, simplified energy analysis procedures, weather data, refrigerant property data, fire and smoke control and solar design.
- Brasil Chapter raised $2,215 for Research Promotion campaign – a new "all time high" the chapter

Research

- Research Project 1544, "Establishing Benchmark Levels and Patterns of Commercial Building Hot Water Use"
- Existing information with which designers size and lay-out hot water systems in commercial sector is antiquated; industry needs better understanding of how people use water in commercial and institutional buildings
- Project objective: obtain measured hot water use in a sampling of significant building types to update Service Water Heating chapter of ASHRAE Handbook
- Scheduled for completion in August

ASHRAE Education and Training

- In-depth training on fundamentals and new technologies
- Over 250 peer-reviewed courses free of commercial bias
- Training delivered to over 4,500 professionals annually worldwide through various formats
- Courses developed and taught by industry experts
- More than 900 PDHs available

ASHRAE Training Formats

- Instructor-Led Courses
- Web-based Courses
- Self-Study Courses
- Career Enhancement Curriculum

Certification

- Six certifications validate knowledge, skills and abilities in the building industry
  - Building Energy Assessment
  - Building Energy Modeling
  - Commissioning Process Management
  - Healthcare Facility Design
  - High-Performance Building Design
  - Operations and Performance Management
- Two special administrations of all exams held in Brasil in 2013 and 2011; 17 professional certifications awarded – another planned in 2014

Periodicals

- ASHRAE Journal
- HPB Magazine
- Industry and Society newsletters

Join Us in 2014

- June 28-July 2: **2014 ASHRAE Annual Conference**
  - Seattle, Wash.
- Sept. 10-12: **ASHRAE/IBPSA-USA Building Simulation Conference**
  - Atlanta, Ga.
- Oct. 2-3: **International Conference on Efficient Building Design – Materials and HVAC Equipment Technologies**
  - Beirut, Lebanon
- Oct. 19-22: endorsing **Roomvent 2014**
  - Sao Paulo

American Water Works Association

Dedicated to the World's Most Important Resource™

Water and Energy Issues

USTDA Roundtable, May 14, 2014
Adam Carpenter
Regulatory Analyst
American Water Works Association
acarpenter@awwa.org

About AWWA

Who we are

Established in 1881, the American Water Works Association is the largest nonprofit, scientific and educational association dedicated to managing and treating water, the world's most important resource. With approximately 50,000 members, AWWA provides solutions to improve public health, protect the environment, strengthen the economy and enhance our quality of life.

What we do

- Offer education to water professionals
- Advocate for safe and sustainable water
- Collect and share knowledge
- Create volunteering opportunities

Regulatory Framework

Safe Drinking Water Act (SDWA)

- 55,000+ Community Water Systems
- Drinking water in the U.S. is very high quality, primary driver is public health
- Maintaining existing infrastructure and making improvements is increasingly important.
- SDWA does not address supply, only quality. States address supply.

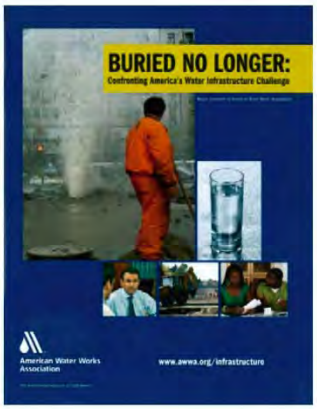
Clean Water Act (CWA)

- Also thousands of systems.
- Risk to the environment is equal or larger driver than public health protection
- Clean Water Act does not handle all pollutant sources equally
  - Point sources heavily regulated
  - Non-point sources often minimally or not at all regulated
- Includes wastewater, pre-treatment, storm water, and others

Regulatory Limitations

- SDWA and CWA are focused almost entirely on water quality (with some exceptions)
- Mostly ignore externalities like energy use / efficiency
- Most anticipated regulations for drinking water will likely *increase* energy use
- Many non-regulatory opportunities for efficiency and conservation exist, I will touch on only a sample of them

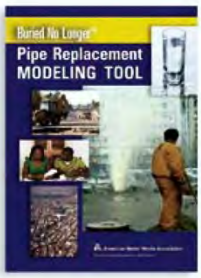
Water Infrastructure



- Vital component of efficiency is having adequate infrastructure in good condition
- Est. need of $1 Trillion USD in the next 25 years for just drinking water

http://www.awwa.org/infrastructure/

Pipe Replacement Modeling



Infrastructure replacement modeling (whether done with this tool or other tools) can help devise a plan to overcome this infrastructure challenge

http://www.awwa.org/store/productdetail.aspx?productid=34655293
or search for "pipe replacement" at awwa.org

Rates, fees, and charges

- Financing infrastructure is expensive and setting appropriate rates challenging, hence M1 as a resource
- Ultimately, much of the cost recovery comes through rates, fees, and charges
- M29 (Utility capital financing) is another resource, but some of the financing tools are U.S. specific

http://www.awwa.org/store/productdetail.aspx?productid=28731
or search for "M1" at awwa.org

Water Audits / Loss Control

- Large amounts of lost water undercut efficiency, conservation, and sustainability initiatives
- Lost water includes, but is not only leaks. Can also be illegal connections, faulty or broken meters, and other issues

http://www.awwa.org/store/productdetail.aspx?productid=6725
or search for "M36" at awwa.org

Water Conservation Programs

- Numerous conservation / efficiency program types exist (rebates, pricing structures, restrictions, and many others)
- M52 covers many of these

http://www.awwa.org/store/productdetail.aspx?productid=6740
or search for "M52" at awwa.org

Free Resource Community

Water Conservation
RESOURCE COMMUNITY

AWWA also has a Water Conservation resource community available free of charge with the latest information, reports, and other resources

http://www.awwa.org/resources-tools/water-knowledge/water-conservation.aspx
or search for "Water Conservation" at awwa.org

QUESTIONS?

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Regulatory Analyst
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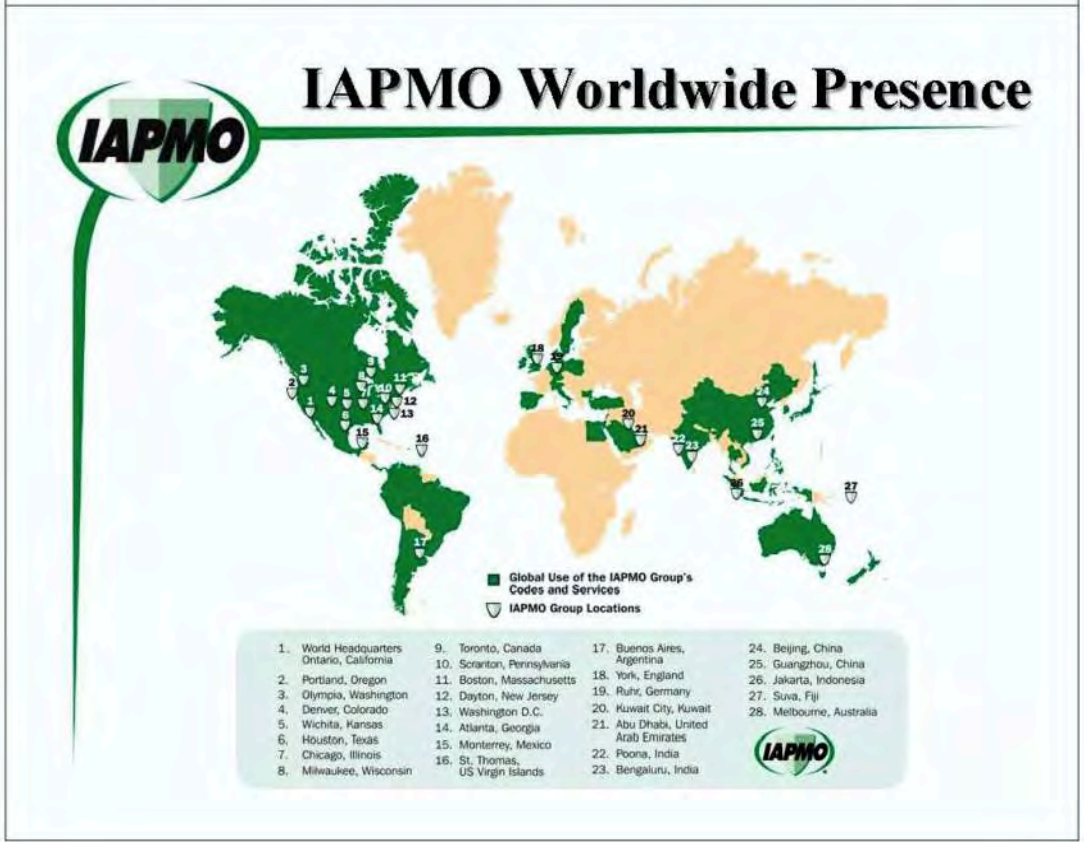
Direct: (202) 326-6126

American Water Works Association
Government Affairs Office
1300 Eye Street, NW, Suite 701W
Washington DC 20005
Gen. Office: (202) 628-8303


IAPMO
The IAPMO Group
WWW.IAPMO.ORG
Established in 1926


IAPMO
IAPMO Worldwide Presence
Global Use of the IAPMO Group's Codes and Services
IAPMO Group Locations
1. World Headquarters Ontario, California
2. Portland, Oregon
3. Olympia, Washington
4. Denver, Colorado
5. Wichita, Kansas
6. Houston, Texas
7. Chicago, Illinois
8. Milwaukee, Wisconsin
9. Toronto, Canada
10. Scranton, Pennsylvania
11. Boston, Massachusetts
12. Dayton, New Jersey
13. Washington D.C.
14. Atlanta, Georgia
15. Monterrey, Mexico
16. St. Thomas, US Virgin Islands
17. Buenos Aires, Argentina
18. York, England
19. Ruhr, Germany
20. Kuwait City, Kuwait
21. Abu Dhabi, United Arab Emirates
22. Poona, India
23. Bengaluru, India
24. Beijing, China
25. Guangzhou, China
26. Jakarta, Indonesia
27. Suva, Fiji
28. Melbourne, Australia
IAPMO

Water/Energy Nexus

IAPMO

2005 study, California Energy Commission

"water-related energy use consumes, 19% of the state's electricity, 30% of its natural gas, and 88 billion gallons of diesel fuel every year – and this demand is growing."

2009 report, River Network

Water heating was responsible for 70% of the water-related carbon emissions, wastewater treatment = 18%, water supply = 6%

The IAPMO Group

IAPMO

CODES & STANDARDS

- UPC, UMC, USPC and USEC
- Standards Development
- Backflow Prevention
- Government Relations

EDUCATION & TRAINING

- Inspectors and Plumbers Certification
- Green Plumbers
- Management System Certification
- Research and Study

CERTIFICATIO N & TESTING

- Product Testing
- Product Certification
- Quality Assurance
- Laboratories Recognition

Code Development

ANSI Approved Consensus Process

- USA
  - UPC, UMC, USPC, USEC (American National Standards)
- India
- Philippines
- Vietnam
- Kuwait
- Abu Dhabi
- Indonesia
- Jordan

International Presence

- **IAPMO R&T Oceana** - a JAS-ANZ accredited product certification body
  - *WaterMark*
  - *GasMark*
  - *OceanaMark*
- **IAPMO India**
  - Uniform Plumbing Code of India
  - Plumbing education in India
  - Product Certification

IAPMO Green

- First Green construction code published in the USA
- Original date of publication, February, 2010
- Revised in 2012, next revision scheduled for early 2014
- Turnkey document:
  - -IAPMO philosophy
  - -Covers all aspects of sustainability pertaining to water efficiency, plumbing and mechanical applications
  - -Scope includes both Commercial and Residential Buildings
- Water and energy efficiency
- Alternate water source use
  - -Recognizes alternate water as a valuable resource
- Landscape irrigation
- HVACR
- Swimming pool provisions
- Indoor environmental quality
- Installer qualifications

Testing Laboratories

Testing and Other Services:

- In compliance with ISO/IEC 17025
- Product Testing for Certification
- Pre-Purchase Testing
- Pre-evaluation
- Material Testing (NSF61 and others)
- Specialty Product Testing
- Witness Testing and Field Testing
- Failure Analysis
- Quality Control Program
- Consultation
- Training

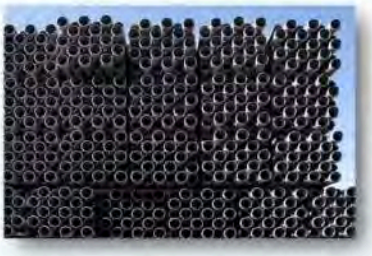
USA Facility

China Facility

Plumbing

FIRST IN FAST, TRUSTED CERTIFICATION

- Plastic Pipe and Fittings, Toxicity, Fixtures, Backflow Prevention Devices, Septic Tanks, Water Heaters, Low Lead Plumbing, GREEN & WaterSense



Lead Law

FIRST IN FAST, TRUSTED CERTIFICATION

- Section 116875 of the CA Health & Safety Code/ Low Lead Plumbing Law (AB 1953); effective January 2011
- SB 1334 – ANSI accredited 3rd Party Certification
- S. 3874 – Federal Reduction of Lead in Drinking Water Act; effective January 2014
  - Already enforced in MD, VT, LA

EPA WaterSense®

FIRST IN FAST, TRUSTED CERTIFICATION

- Voluntary partnership and labeling program launched by U.S. EPA in 2006 designed to reduce municipal water use across the country
- Simple way for consumers to identify products that use 20% less water and perform well
- A label with integrity - third-party certified, not only for efficiency, but for performance too
- Current Specifications:
  - High Efficiency Toilet
  - High Efficiency Lavatory Faucets
  - High Efficiency Urinals
  - Showerhead
  - Weather-based Irrigation Controllers

ENERGY STAR®

FIRST IN FAST, TRUSTED CERTIFICATION

- Certification Body required, no longer self-administered
- Recognized scopes under this program include:
  - ❑ Appliances: Clothes washers, dishwashers, refrigerators, freezers, water coolers
  - ❑ HVAC: Boilers, air conditioners, central air, water heaters, furnaces, ceiling and ventilation fans
  - ❑ Commercial Food Equipment: Fryers, griddles, dishwashers, ovens, ice machines, freezers, steam cookers, hot food holding cabinets
  - ❑ Battery Charging Stations
  - ❑ Luminaries
  - ❑ Roof Products

IAPMO Education and Training

- Plumbing education and training are one of the core principles that IAPMO was founded upon 80 years ago.

- IAPMO has conducted training all over the world and education initiatives continue to grow in size and scope of work.

IAPMO Education and Training

IAPMO creates and implements code-based Training Programs for:

- The Uniform Plumbing/Mechanical Codes and their derivatives.
- The International Plumbing/Mechanical Codes
- Customized Technical and Professional Development topics of your choosing


THANK YOU
Dain Hansen
Director,
Government Affairs
Christopher Lindsay
Manager,
Government Affairs
THE
IAPMO
GROUP
World Headquarters
West
4755

NEMA The Association of Electrical and Medical Imaging Equipment Manufacturers

USTDA

Brazil Water/Wastewater Energy Efficiency Reverse Trade Mission

Motor Efficiency Regulation

May 14, 2014

NEMA The Association of Electrical and Medical Imaging Equipment Manufacturers

Global Motor Efficiency Regulations

Efficiency Levels	Efficiency Classes IEC 60034-30	Testing Standard IEC 60034-2-1	Country MEPS (Minimum Energy Performance Standard)
Premium Efficiency	IE3	Low Uncertainty	USA Europe-2015* (>7.5kW); 2017* (>0.75kW) Canada Korea 2015
High Efficiency	IE2		USA Mexico Canada Australia New Zealand Brazil Korea China Europe Switzerland
Standard Efficiency	IE1	Medium Uncertainty	China Brazil Costa Rica Israel Taiwan Switzerland

* IE3 or IE2 + VSD

May 14, 2014 USTDA

NEMA The Association of Electrical and Medical Imaging Equipment Manufacturers

Efficiency Matters

- International Energy Agency estimates motors account for 46% of global energy consumption
- US Department of Energy (DOE) published its final rule for Electric Motors Energy Conservation Standards based on NEMA and **Motor Coalition (MC)** petition on May 8, 2014
- New rule largest energy savings by DOE to date
- Estimated savings to consumers: 5.4 TW, $16B, 96 million metric tons of CO2 prevented through 2030

May 14, 2014 USTDA

NEMA The Association of Electrical and Medical Imaging Equipment Manufacturers

MC's Proposed Expansion of Product Scope

- Partial motors
  - ¾ motors
- Gear motors
  - Integral shafts
- Definite purpose
  - Special shafts
  - Special flanges
- Special purpose
  - Vertical
  - Close Couple Pump
- 56 or 90 Frame motors
- TENV
- NEMA or IEC

More effectively capture motors imported as a component or finished good for both general purpose and the new categories.

¾ motor & driven equipment

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NEMA The Association of Electrical and Medical Imaging Equipment Manufacturers

Options Explored by Motor Coalition

- 1- Increase nominal efficiency level for the existing scope of covered motors.
  - Super Premium
- 2- Expand scope of covered motors using existing efficiency 12-12 levels.
  - More than triples the number of units covered by current DOE regulations

May 14, 2014 USTDA

NEMA The Association of Electrical and Medical Imaging Equipment Manufacturers

Why not increase efficiency and expand product scope? Motor User/OEM perspective

Negative utility impact creates a market barrier

1. Transition from no efficiency requirement to 12-12 plus for additional products
   1. Significant changes to physical motor size in diameter and length required
   2. Changes to performance
      1. Acceleration & stall times
      2. Higher Operating Speeds
      3. Starting Torque
      4. Power factor- service factor

2. Customer options = redesign or repair

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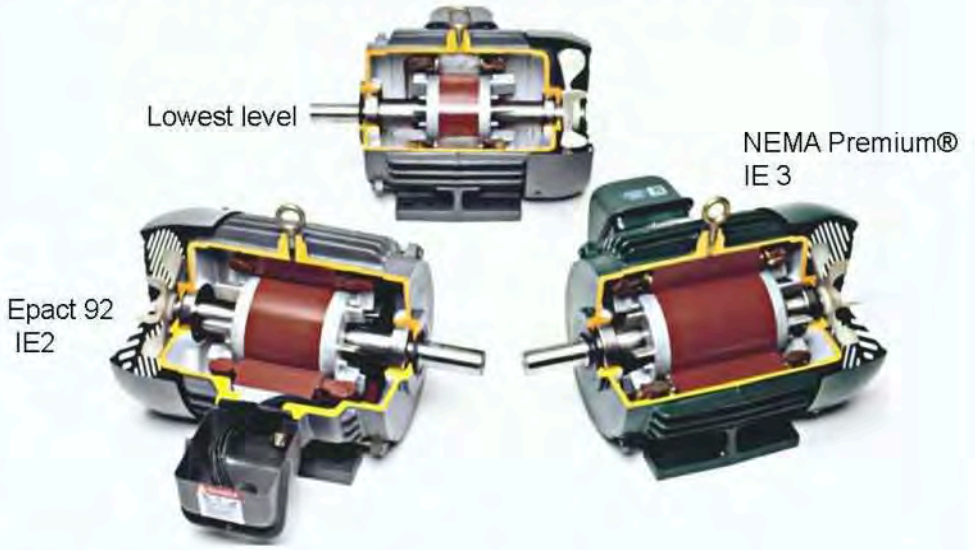
Progression of Active Material Requirements



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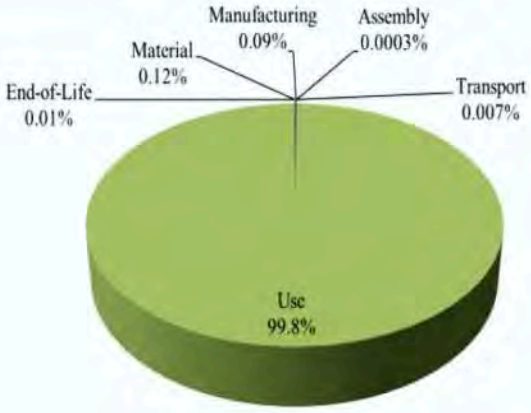
NEMA The Association of Electrical and Medical Imaging Equipment Manufacturers

NEMA Carbon Footprint Findings

Percentage impact of a typical 25 hp NEMA Premium electric motor, operated for 5,000 hours/year over 20-year lifetime powered by an average US electricity grid mix:



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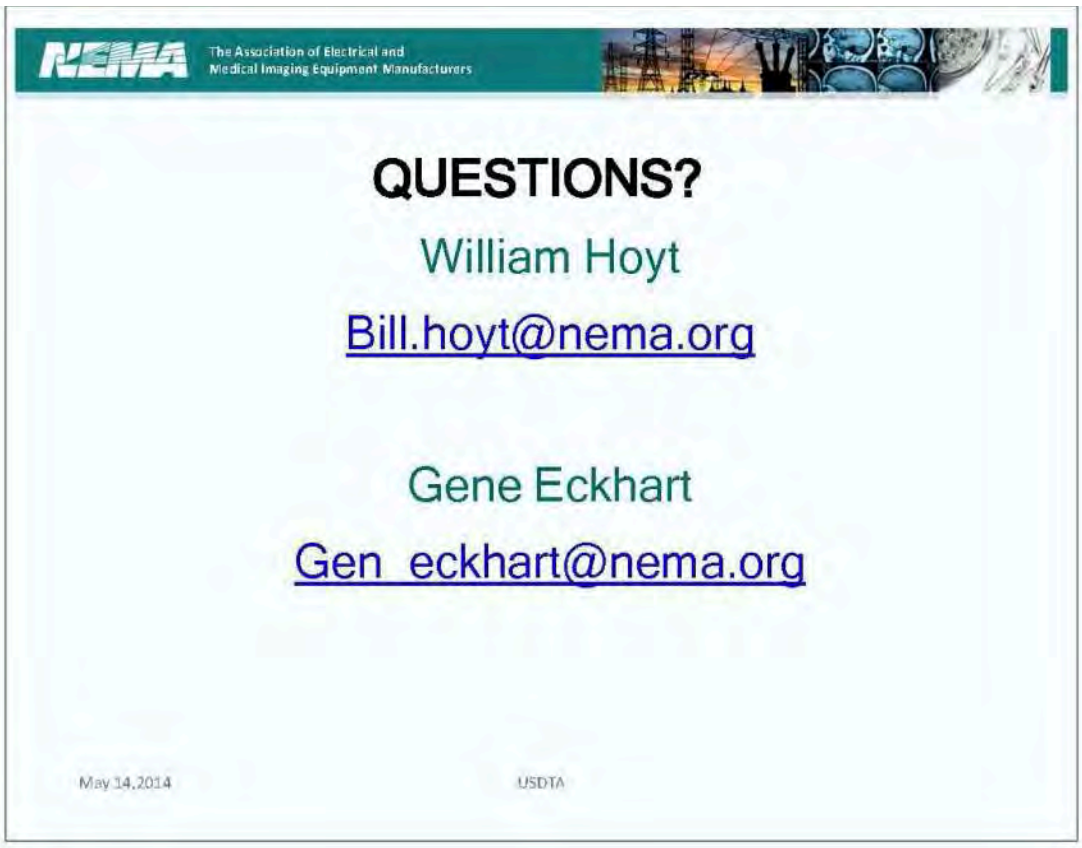
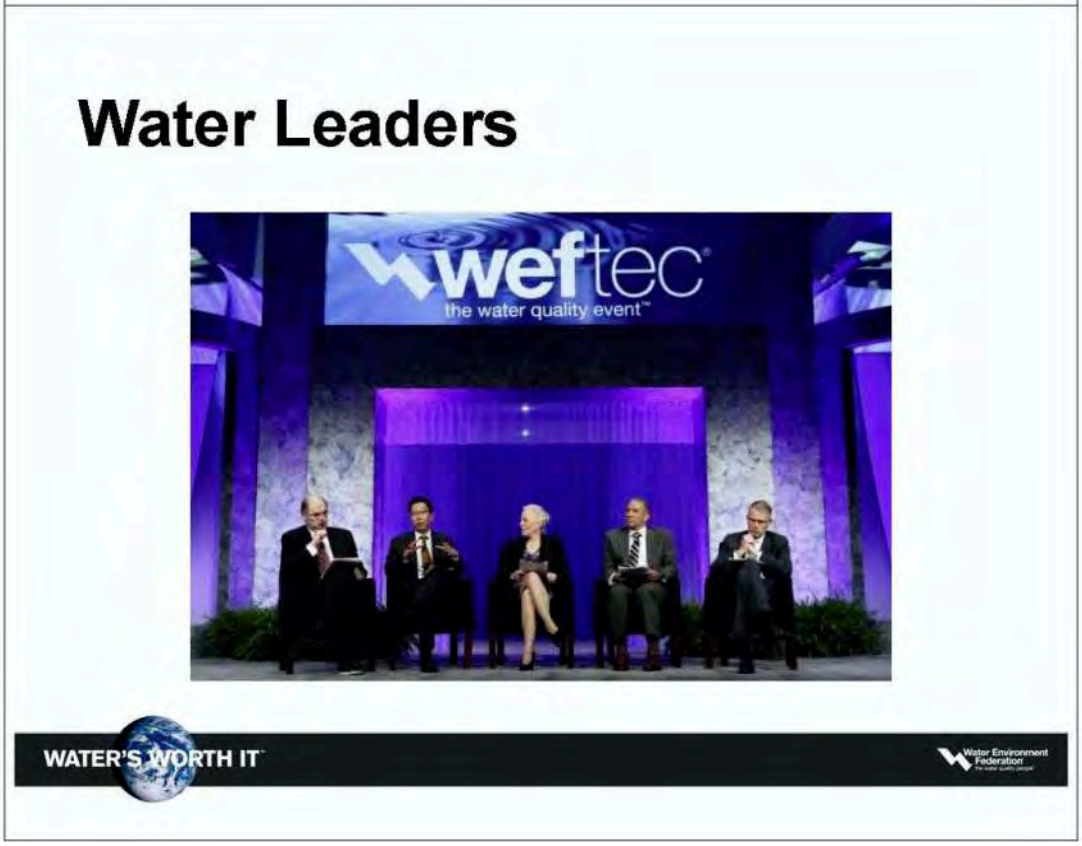

NEMA
The Association of Electrical and Medical Imaging Equipment Manufacturers
QUESTIONS?
William Hoyt
Bill.hoyt@nema.org
Gene Eckhart
Gen_eckhart@nema.org
May 14,2014
USDTA

Who Are We?

- "The Water Quality People"
- Over 36,000 members worldwide
- Hosts of the largest wastewater conference in the world – WEFTEC
- Partners for water
- Leaders in innovation

WATER'S WORTH IT


weftec 2013
SPECIAL WATER LEADERS SESSION
THE FUTURE OF CITIES AND WATER:
INSIGHTS FROM GREAT WATER CITIES
McCormick Place, Room S100
Monday, October 7 | 10:30 am - 12:00 pm
WATER'S WORTH IT
Water Environment Federation

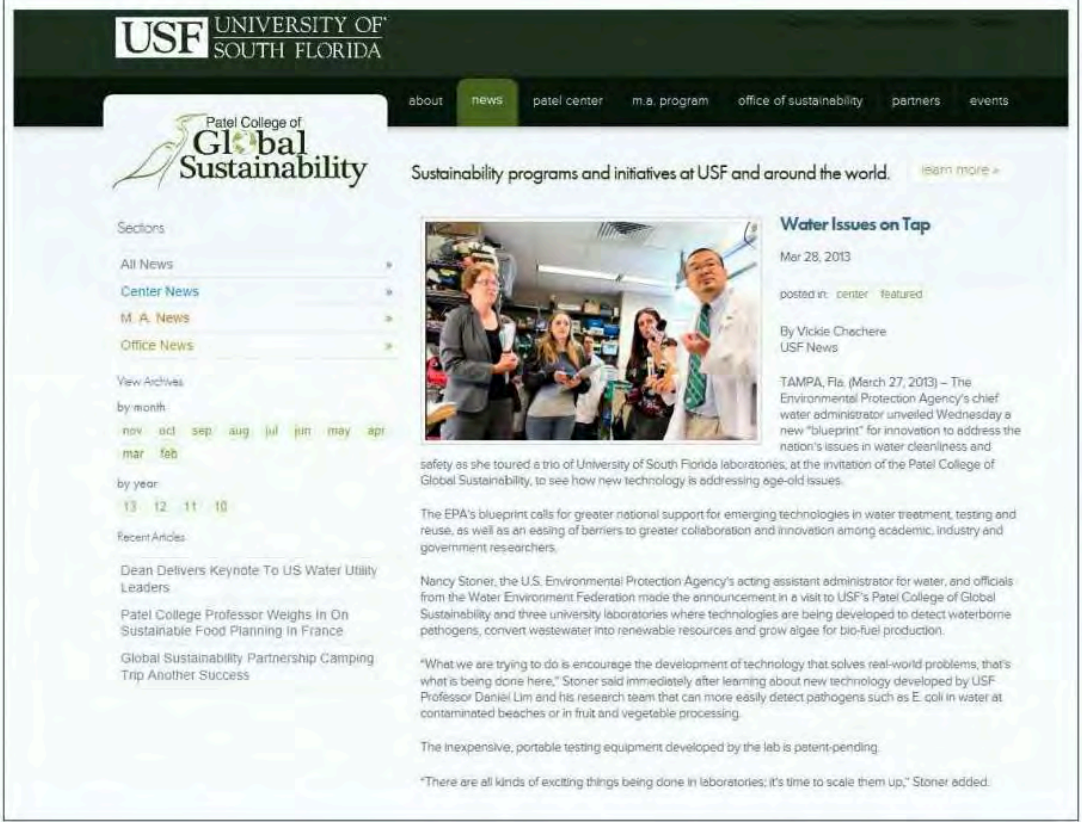

Water Leaders
weftec
the water quality event
WATER'S WORTH IT
Water Environment Federation

Adaptation from Extreme Events

The Virginian Pilot, December 5, 2010

WATER'S WORTH IT


innovation showcase PAVILION
BlueTech
BlueTech Research
innovation showcase
The 2nd Annual Innovation Pavilion
WATER'S WORTH IT
Water Environment Federation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Sustainability programs and initiatives at USF and around the world.
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Global Sustainability Partnership Camping Trip Another Success
Water Issues on Tap
Mar 28, 2013
posted in: center featured
By Vickie Chachere
USF News
TAMPA, Fla. (March 27, 2013) – The Environmental Protection Agency's chief water administrator unveiled Wednesday a new "blueprint" for innovation to address the nation's issues in water cleanliness and safety as she toured a trio of University of South Florida laboratories, at the invitation of the Patel College of Global Sustainability, to see how new technology is addressing age-old issues.
The EPA's blueprint calls for greater national support for emerging technologies in water treatment, testing and reuse, as well as an easing of barriers to greater collaboration and innovation among academic, industry and government researchers.
Nancy Stoner, the U.S. Environmental Protection Agency's acting assistant administrator for water, and officials from the Water Environment Federation made the announcement in a visit to USF's Patel College of Global Sustainability and three university laboratories where technologies are being developed to detect waterborne pathogens, convert wastewater into renewable resources and grow algae for bio-fuel production.
"What we are trying to do is encourage the development of technology that solves real-world problems, that's what is being done here," Stoner said immediately after learning about new technology developed by USF Professor Daniel Lim and his research team that can more easily detect pathogens such as E. coli in water at contaminated beaches or in fruit and vegetable processing.
The inexpensive, portable testing equipment developed by the lab is patent-pending.
"There are all kinds of exciting things being done in laboratories; it's time to scale them up," Stoner added.


THE WATER COUNCIL
WaterTAP
Technology Acceleration Project
CONFLUENCE
BLUETECH VALLEY
BlueTech RESEARCH
AN O2 ENVIRONMENTAL COMPANY
IMAGINE H2O
WATER'S WORTH IT
Water Environment Federation


Innovation – Leadership Innovation Forum for Technology (LIFT)
LIFT
Leaders Innovation Forum for Technology
Leaders Innovation Forum for Technology (LIFT)
The LIFT program includes four main components:
Technology Evaluation Program (TEP)
People & Policy
Communication
Informal Forum for R&D Managers
WERF leads the TEP program. Through this program all WERF subscribers gain:
WERF
Water Environment Federation
WATER'S WORTH IT
Water Environment Federation

COLLABORATION. INNOVATION. RESULTS.

Water Environment Federation the water quality people

WERF Water Environment Research Foundation

LIFT Focus Areas

1. Shortcut Nitrogen Removal
2. P-Recovery
3. Energy from Wastewater
4. Digestion Enhancements
5. Biosolids to Energy
6. Collection Systems (New)
7. Green Infrastructure

WATER'S WORTH IT

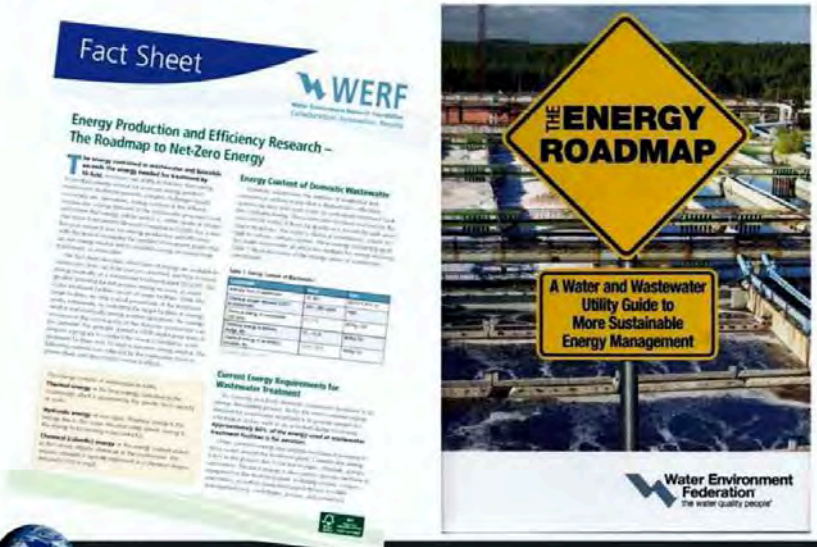
Creating the Space

- Continuous dialogue on the regulatory path forward for technologies
- Broad stakeholders collaboration
- Coordination with other groups
- EPA participation is essential
- Nutrients technologies may be first

WATER'S WORTH IT

Water Environment Federation

Water Resource Recovery Facility



Nutrients Roadmapping


Stormwater at WEFTEC
weftec
STORMWATER
CONGRESS
Conference: Oct. 5–9 | Exhibition: Oct. 7–9
Hyatt Regency McCormick Place
Chicago, Illinois, USA
Water Environment Federation
WATER'S WORTH IT
October 29, 2013 | 0 Comments
Illinois and Chicago Make Investments in Green Infrastructure
On Oct. 7 at WEFTEC® 2013, Chicago Mayor Rahm Emanuel announced the city's Green Stormwater Infrastructure Strategy initiative. Over the next 5 years, Chicago will invest $50 million in green infrastructure — one of the largest voluntary investments by an American city. The goal to reduce 946,250 m³ of polluted runoff to the Chicago River and Lake Michigan will be accomplished through proven projects, such as permeable pavement and plantings. These projects are expected to create an additional 37,650 m³ of natural storage.
The plan contains two major elements: building green infrastructure capital projects and planning for the future. Studies will help the city determine future effects of climate change and how large-scale implementation of green infrastructure can benefit Chicago and play into a citywide stormwater management plan. The Green Stormwater Infrastructure Strategy Initiative is in line with goals formed under both Sustainable Chicago 2015 and Building a New Chicago. Traditional infrastructure projects are also under way to control flooding and combined sewer overflows in Chicago. Check out the 2013 progress update on the Metropolitan Water Reclamation District of Greater Chicago's Tunnel and Reservoir Plan.
Hear from Mayor Rahm Emanuel as he addresses WEFTEC 2013 attendees during the 2013 Water Leaders session.
PLAYLIST WEFTEC 2013
PLAY ALL
Stormwater Congress Reception
AISLE 5400
weftec
STORMWATER
PAVILION
TIANFLOC CANADA
Hydro International
Water Environment Federation

Stormwater Testing and Evaluation for Products and Practices (STEPP)

DRAFT

Investigation into the Feasibility of a National Testing and Evaluation Program for Stormwater Products and Practices

A White Paper by the National Stormwater Testing and Evaluation of Products and Practices (STEPP) Workgroup Steering Committee

9/13/2013
STEPP Workgroup – Steering Committee

Water Environment Federation

WATER'S WORTH IT

Stormwater Financing

STORMWATER CONGRESS

weftec the water quality event

WEF Innovative Stormwater Infrastructure Finance Forum
In conjunction with WEFTEC 2013 and the WEF Stormwater Congress
Hyatt Regency McCormick Place | Chicago, Illinois
Conference Center, 2rd floor, Adler Room (CC24) | Session 624
Wednesday, October 9 | 1:15-5:30pm

WATER'S WORTH IT

WEFTEC 2014

New Orleans, Louisiana
September 27-October 1 – 2014
http://www.weftec.org/

WATER'S WORTH IT

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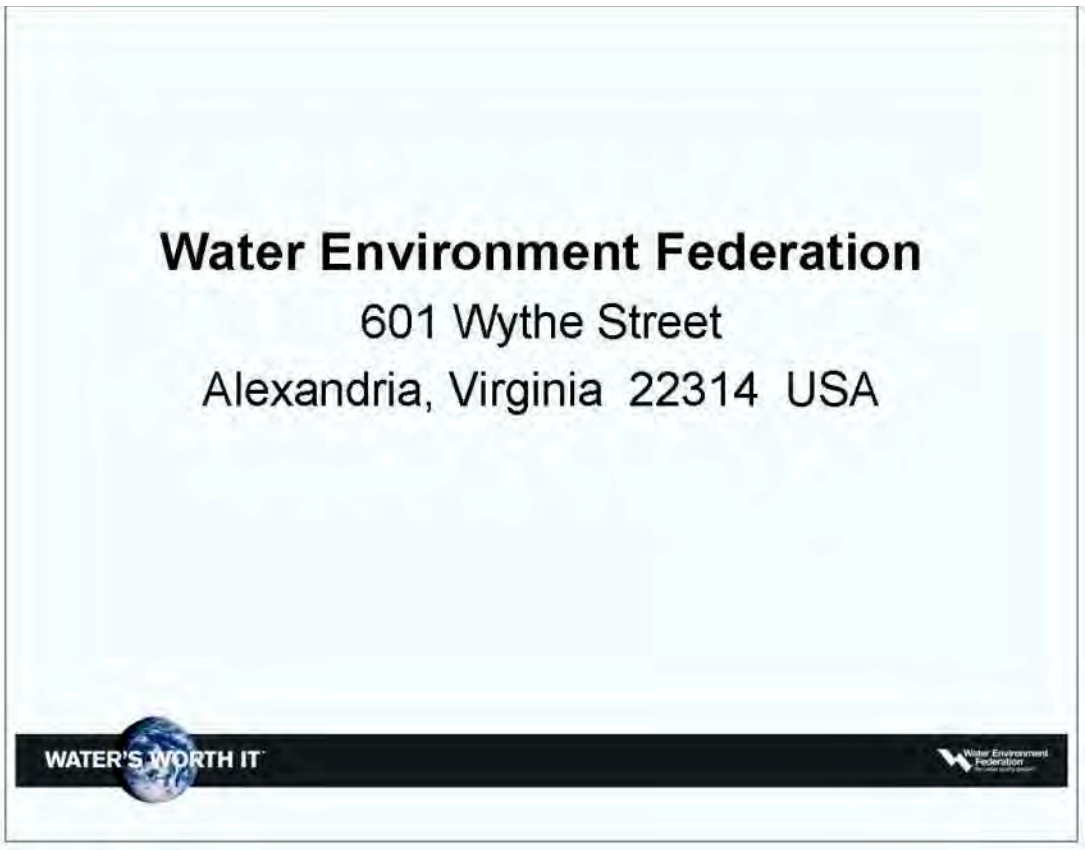
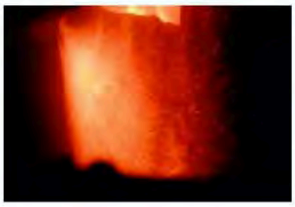
WATER'S WORTH IT


Water Environment Federation
601 Wythe Street
Alexandria, Virginia 22314 USA
WATER'S WORTH IT
Water Environment Federation

WERF


Energy and Innovation

Presentation
May 14, 2014

LIFT
Leaders Innovation Forum for Technology

WERF
Water Environment Research Foundation
Collaboration. Innovation. Results.

COLLABORATION. INNOVATION. RESULTS.

WERF
Water Environment Research Foundation

Water Environment Research Foundation

Deliver Balanced Research

- Manage peer-reviewed research lifecycle to deliver timely, actionable results.

Disseminate Results

- 35-40 reports published annually that are housed in a online, searchable database.

Create Collaborations

- Serve as a research hub for the water quality community; utilities, policy makers, consultants, universities and industry.

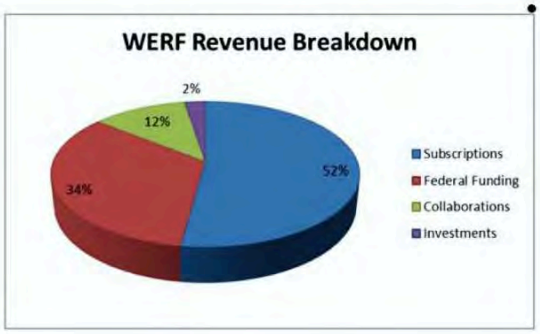
WERF

WERF Research

COLLABORATION. INNOVATION. RESULTS.

WERF
Water Environment Research Foundation

Research Funding Sources



- WERF's 300+ Subscribers:
  - Public Utilities
  - Industry
  - Engineering & Consulting Firms
  - Equipment Manufacturers
  - State Regulators
- Partnerships and collaborations
- Federal Grant Funding

*For every dollar invested, WERF creates **four dollars** by leveraging matching and in-kind support.*

WERF

How much electricity is used annually by the US wastewater sector? Primary energy?

- 22.3 TWh/year electric power used
- 270 trillion BTU/year primary energy

0.6% from wastewater

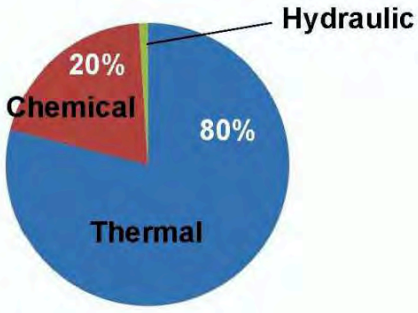
Top Electric Power Using Sectors	Percentage
Chemicals	5.21
Forest products	3.74
Food and beverage	2.26
Water and Wastewater combined	**2.0**
Iron and Steel	1.66
Transportation equipment	1.50
Petroleum refining	1.47
Plastics	1.40

5

WERF

What is the potential to recover energy from the wastewater sector?

- There is more energy in wastewater than is needed for treatment – **about 5X more**
- Total primary energy potential is 851 trillion BTU/year.



6

WERF

How close is the U.S. domestic wastewater sector to 'energy neutral or net-zero'?

- Out of the 1027 WRRFs over 5 mgd in the USA (80% of the flow treated) 492 could become energy neutral with proven, available upgrades.
- Electricity savings estimated to be 6.1 TWh annually.
- Primary Energy savings to be 73 trillion BTU annually.
- Reduction in energy demand for the sector 26.7%.
- Focus on the 100 largest WRRFs (over 50 mgd treating half of the domestic WW nationwide) for cost-effective renewable energy saving and recovery.

7

WERF

The Water Resources Utility of the Future: *A Blueprint for Action*

NACWA Water Environment Federation the water quality people

- Creating the Environment for Innovation
- Financial and Risk Management – a new business case, pooled risk and real markets for water
- Integrated Water Resource Decision-making and Management
- Transition to Resource Recovery –
  - N – nutrients
  - E – energy
  - W – water
- Transformative thinking –in leadership and staffing

WERF

WERF Energy Baseline Study

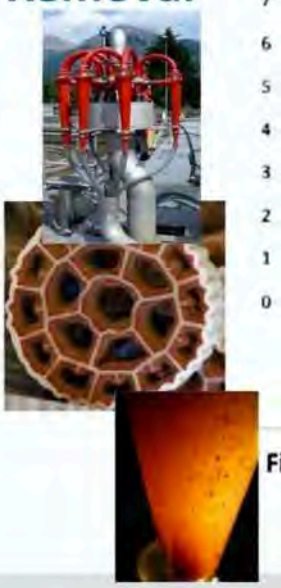
Key Findings

- Energy saving best practices contribute significantly (40%) toward energy neutrality
- Maximize carbon management for energy recovery or reuse
- Mainstream short-cut nitrogen removal process for N removal is a *MUST* for energy neutrality
- Innovation is key, need to move innovation into practice

9

WERF

Potential Energy Savings and Nutrient Removal



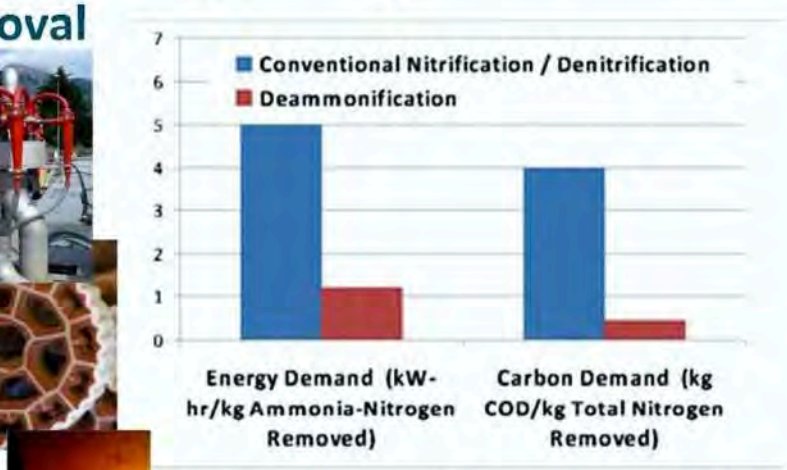


Figure 1: Energy and carbon demand comparison for nitrogen removal using deammonification and conventional nitrification/denitrification

COLLABORATION. INNOVATION. RESULTS.

Water Environment Federation the water quality people

WERF Water Environment Research Foundation

What Is LIFT?

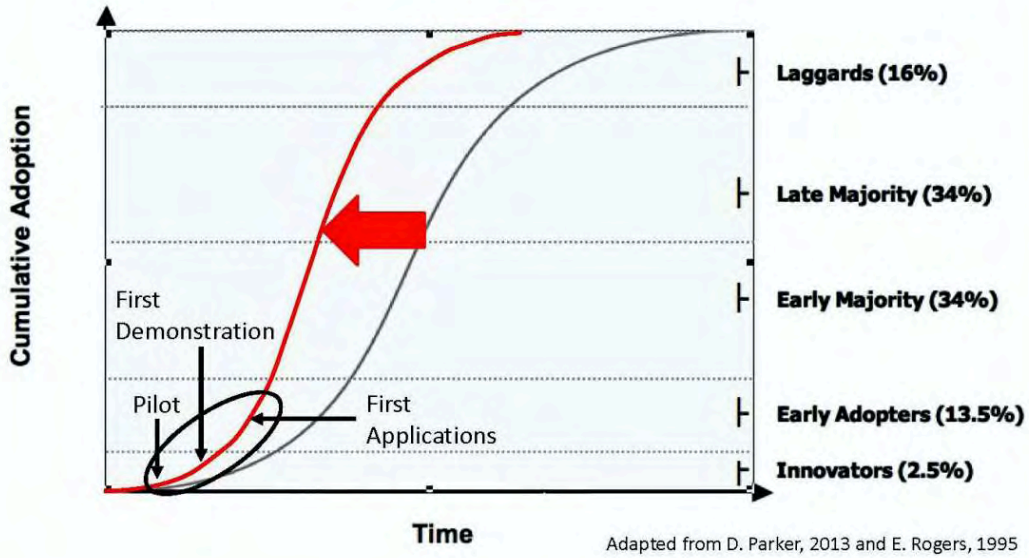
A WEF/WERF Initiative
Accelerating Innovation
Into Practice

COLLABORATION. INNOVATION. RESULTS.

Water Environment Federation the water quality people

WERF Water Environment Research Foundation

Focuses on New Technologies



Adapted from D. Parker, 2013 and E. Rogers, 1995

COLLABORATION. INNOVATION. RESULTS.

Water Environment Federation
the water quality people

WERF
Water Environment Research Foundation

LIFT Focus Areas

1. Shortcut Nitrogen Removal
2. P-Recovery
3. Digestion Enhancements
4. Biosolids to Energy
5. Energy from Wastewater
6. Collection Systems ← New
7. Green Infrastructure ←

WERF

Promote investment into energy recovery and energy efficient treatment processes at large Water Resource Recovery Facilities

Questions?

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www.werf.org/energy

WERF
Water Environment Research Foundation
Collaboration. Innovation. Results.

OPIC

Overseas Private Investment Corporation

Brazil Water/Wastewater Energy Efficiency Reverse Trade Mission

May 14, 2014

Our Organization

As the U.S. Government's development finance institution, OPIC mobilizes U. S. private capital to help solve critical development challenges and in doing so, advances U.S. foreign policy.

OPIC currently manages an $18.1 billion portfolio of projects in 103 countries and operates on a self-sustaining basis at no net cost to the American taxpayer.

The U.S. Government's Development Finance Institution 2

Administration Development Priorities

OPIC is uniquely positioned to support the administration's development strategy.

OPIC's Unique Position

Administration Priorities

"We're changing how we define development…we need to harness all the tools at our disposal—from our diplomacy to our trade and investment policies."
~President Obama, 9/22/10

- **Support broad-based, sustainable economic growth**
- **Proactively target specific countries, regions, sectors, and technologies**
- **Mobilize private sector investment**
- **Elevate development as a central pillar of national security policy**

Our Solutions

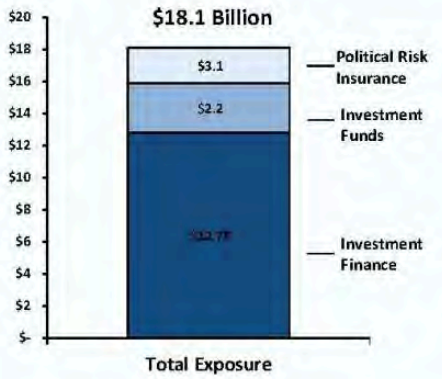
OPIC offers innovative financial solutions to support private investors including debt financing, insurance, and support for private equity investment funds.

Products

- **Investment Finance**
  - Limited recourse, long-term finance for private sector, commercial projects
  - Loan amounts up to $250M per project
  - Specific programs for providing finance to small-and-medium-sized enterprises
- **Political Risk Insurance**
  - Protection against currency inconvertibility, expropriation and political violence, including terrorism, as well as other specialized coverage
  - Policy coverage up to $250M per project, up to 20 year term
  - Fixed premium, cancellable only by insured
- **Investment Funds**
  - Senior debt for private equity funds selected by competitive process
  - Investment decisions made independently by selected fund managers
  - Provide up to $250M with bullet repayment, zero coupon structure

Current Portfolio*

Based on a $29B Statutory Capacity



*As of September 30, 2013

Our Clients and Alliances

OPIC coordinates with other U.S. government agencies and international partners to provide financing and risk mitigation products to a wide range of clients.

Current Clients

Multinationals and Small/Medium Businesses

citi, GE, PNC, PALADIN REALTY, The Coca-Cola Company, EDISON, WELLS FARGO

Nonprofits and Impact Investors

Global Communities Partners for Good, CHF International, The Asia Foundation, rootcapital, ACCION, CHEMONICS, RESCUE, Calvert

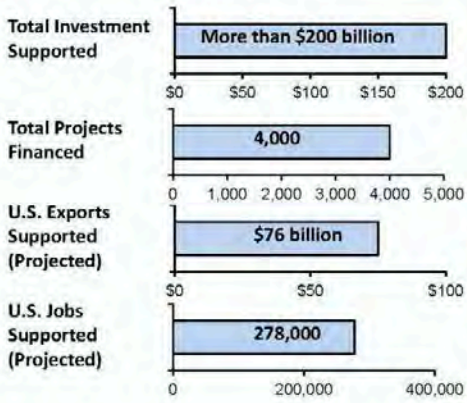
Strategic Alliances

U.S. Government	• Departments of State, Commerce, and Treasury • USAID & USTDA • Ex-Im Bank and SBA • Millennium Challenge
Development Finance Institutions	• IFC and MIGA • Regional Development Banks (IDB, ADB, AfDB, EBRD) • Other Bilaterals (CDC, FMO, DEG)
Other Partners	• Chambers of Commerce • AmChams • NGOs • Financial Institutions

Our Impact

Over the past 41 years OPIC has supported over $200 billion of investment in developing markets that is projected to support over 277,000 U.S. jobs.

OPIC By the Numbers*



*Since 1971

Success Stories

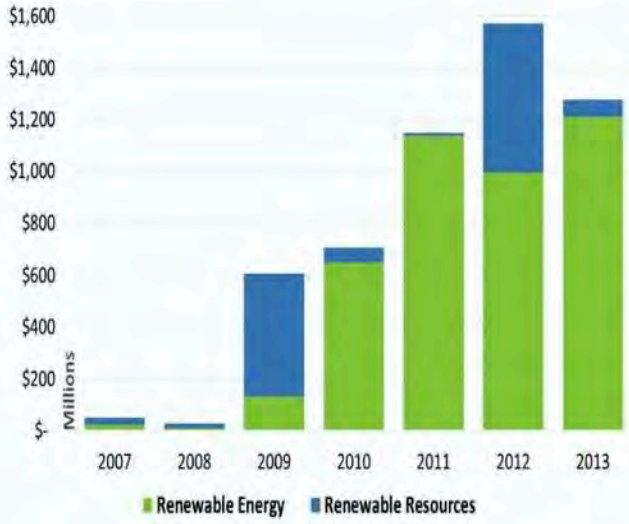
- **Haiti:** $6 million loan to Haiti 360 to produce high-quality concrete to rebuild homes and other infrastructure destroyed in 2010 earthquake.

- **India:** $3.5M loan to Healthpoint for water treatment facilities serving 400 communities to help prevent disease. *[photo: Soma Vatsa/for NPR]*

- **Iraq:** $26M in financing to Claremont Erbil for affordable housing for hundreds of families in need.

- **Ghana:** $150 million in political risk insurance to Belstar for a project that will increase clean water access and make the country's water treatment plants more efficient.

OPIC's Commitment to Renewable Resources is Growing

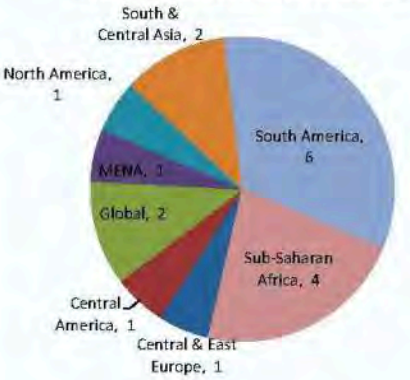


OPIC's commitments in renewable resources increased 50-fold between 2008 and 2012. In 2013, OPIC committed **$1.28 billion** to renewable resources projects.

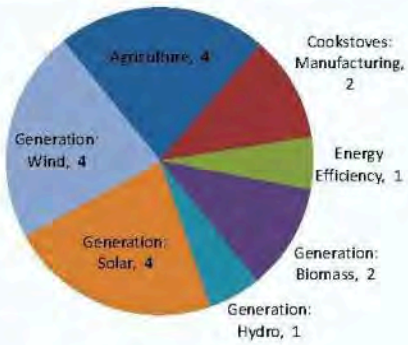
The U.S. Government's Development Finance Institution 7

Renewables in FY13

Number of Projects by Region



Number of Projects by Sector



The U.S. Government's Development Finance Institution 8

Our Policy Standards & Investment Eligibility

Investors and projects must satisfy certain policy criteria to receive OPIC financing and insurance.

Policy Standards for Projects	Eligibility Criteria & U.S. Connections
OPIC supported projects must:	✓ **Insurance**
✓ Contribute to **sustainable development** goals	➢ U.S. Citizens or U.S. Corporations more than 50% owned by U.S. Citizens
✓ Be located in one of our **~160 eligible countries**	➢ U.S. not-for-profits
✓ Comply with international **environmental standards**	➢ Entities established outside the U.S. and more than 95% owned by U.S. citizens or corporations
✓ Comply with international **human rights** and **worker rights** regulations	✓ **Finance**
✓ Cause **no loss of U.S. jobs** or adverse impact on the U.S. economy	➢ Commercially **viable business plan** and successful track record
	➢ **U.S. Private Sector Involvement** equivalent to 25 % of project company's equity
	➢ **Private sector control** (<50% government ownership)

The U.S. Government's Development Finance Institution 9

OPIC Contact

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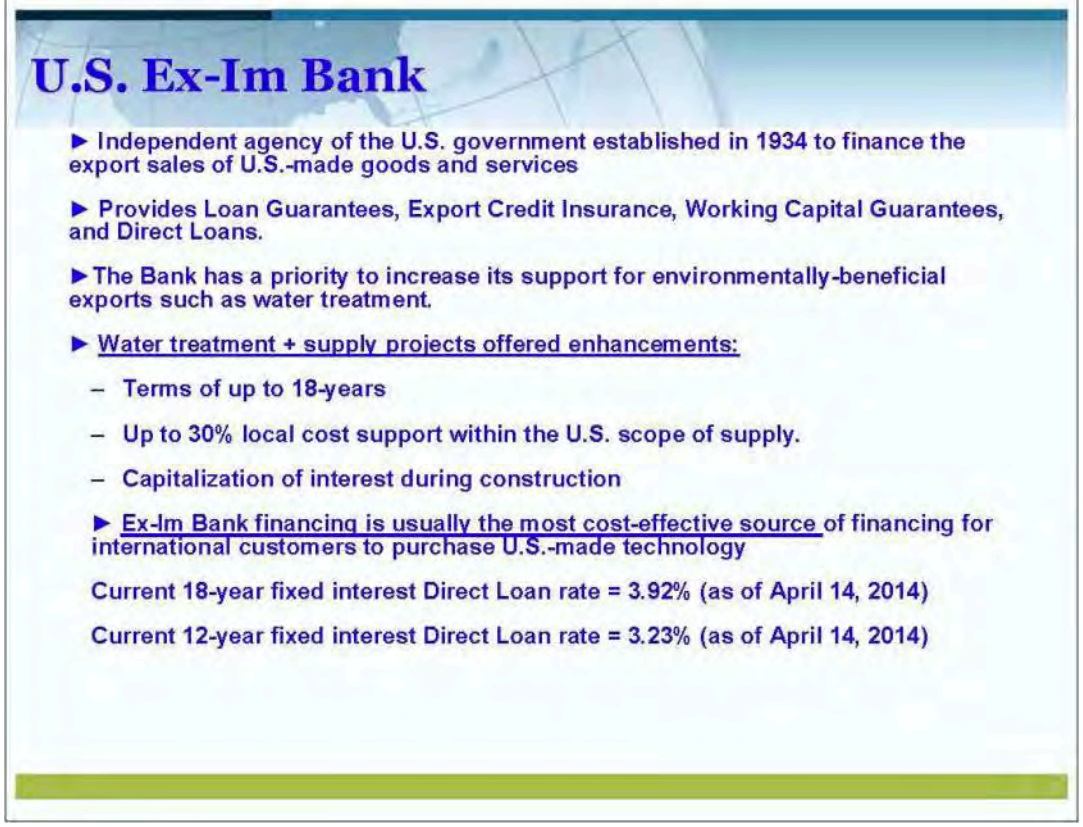
Financing Water Treatment Exports:
The Role of Ex-Im Bank
Craig O'Connor, Director
Office of Renewable Energy & Environmental Exports
WWEMA Washington Forum 2014


U.S. Ex-Im Bank
► Independent agency of the U.S. government established in 1934 to finance the export sales of U.S.-made goods and services
► Provides Loan Guarantees, Export Credit Insurance, Working Capital Guarantees, and Direct Loans.
►The Bank has a priority to increase its support for environmentally-beneficial exports such as water treatment.
► Water treatment + supply projects offered enhancements:
– Terms of up to 18-years
– Up to 30% local cost support within the U.S. scope of supply.
– Capitalization of interest during construction
► Ex-Im Bank financing is usually the most cost-effective source of financing for international customers to purchase U.S.-made technology
Current 18-year fixed interest Direct Loan rate = 3.92% (as of April 14, 2014)
Current 12-year fixed interest Direct Loan rate = 3.23% (as of April 14, 2014)

Direct Loan

- *Direct Loans* made by Ex-Im Bank to a foreign buyer
- Fixed interest rates based on a 1% spread over Treasury notes
- The international borrower submits the Direct Loan application.
- Ex-Im Bank requires the buyer to make a cash payment to the exporter equal to at least 15% of the U.S. supply contract.
  - 15% cash payment can either be borrowed from a lender or the exporter, or be from the buyer's own funds.
- Exporter paid with disbursement L/C or buyer is reimbursed
- A negotiated credit agreement required for a Direct Loan
- Shipping must be made on U.S.-flag vessel (except air shipments)

Case Study: Sri Lanka Water Treatment

- Ex-Im Bank provided $64.9 million, 12-year Direct Loan in July 2012 to finance the design and construction of the Badulla, Haliela and Ella Integrated Water Supply System
- System provided by Tetra Tech of Pasadena, CA, and other U.S. suppliers.
- The water-supply project will integrate new and rehabilitated treatment plants, storage tanks, pumping stations, a new dam and impoundment reservoir, with 50km of transmission pipeline + 100km of distribution pipeline.
- In addition to financing $53.8 million in U.S.-made goods and services

  Ex-Im Bank provided financing for local costs of up to 30% of the U.S. export contract = $16.9 million.
- Ex-Im Bank's financed the export of Tetra Tech's engineering services

  + water treatment equipment from Siemens Water Technologies (Ames, Iowa)

  + ductile iron pipe from American Cast Iron Pipe, of North Birmingham, AL.
- The loan was made to Sri Lanka's Ministry of Finance and Planning.

Case Study: Gas Verde, S.A. - Brazil

- Ex-Im Bank approved a 12-year $48.5 million Direct Loan in May 2012 to finance the export of equipment and services for a biogas treatment facility in Rio de Janeiro.
- Ex-Im Bank's current 12-year fixed-interest Direct Loan in U.S.$ = 2.43%
- Gas Verde S.A. will install U.S. biogas technology to process raw landfill gas into high-grade methane to be sold to a Petrobras refinery under a 15-year sales contract..
- The exporter is FirmGreen®, of Newport Beach, CA who along with its subcontracted companies supplied proprietary biogas-cleaning equipment run by FirmGreen's patented VerdeControls™ operating software and other related services.
- Repayment for the loan is based on the creditworthiness of the main shareholders of Gas Verde S.A. who will provide the repayment guarantee for the loan.
- The new biogas plant will capture and treat 20,000 normal cubic meters per hour (nM^3/hr) of raw landfill gas to produce 9,000 nM^3/hr of fuel-grade biomethane gas.
- Reclamation of the biogas at the site will significantly reduce passive landfill emissions to the atmosphere.
- Biogas from the Novo Gramacho plant will directly replace an estimated 10% of the natural gas derived from fossil-fuel sources that is consumed at the Petrobras refinery.
- One of the world's largest solid-waste landfills, Jardim Gramacho was the subject of "Waste Land," an acclaimed documentary nominated for an Academy Award in 2011.

Loan Guarantee

- *Guaranteed Loans* made by commercial banks (U.S. or foreign) to a foreign buyer with a 100% *unconditional* repayment guarantee from Ex-Im Bank
- Loans terms ranging from 2- 18 years
- Guarantee covers 85% of the U.S. content of the transaction.
- *Negotiated* interest rates, usually a floating rate based on spread over 6-month U.S. dollar LIBOR rate
- Banks often finance the 15% required cash payment
- Guarantee available in major foreign currencies

Case Study: Mexico Water Treatment

- Bio-Microbics, Inc., of Shawnee Mission, KS exported 10 market FAST® wastewater treatment systems to Acuapro S.A., of Monterrey, Mexico, under a 10-year, $824,000 Loan Guarantee.
- Acuapro S.A., a leading Mexican environmental consulting company that provides services in health, recycling, and waste treatment.
- Acuapro will use the financing to build, install, and operate 10 wastewater treatment plants for a major retailer in Mexico.
- Funding provided by the Private Export Financing Corporation.
- PEFCO provided 10 year fixed-rate funding for this loan under its Discount Note Facility.

Export Credit Insurance

- Enables U.S. exporters to offer short-term OPEN ACCOUNT credit *directly to their customers.*
- Export credit is an attractive substitute to cash-in-advance, letters of credit and costly local bank financing.
- Supports repayment terms up to 180 days beginning from date of importation of the goods; capital goods terms of 360 days.
- Financing is often THE critical factor in winning an export sale in emerging markets, Open account has advantages.
  - Interest rates very high in many international markets
  - Increase order quantities to existing customers/distributors
  - Enter new "risky" markets, attract new customers/distributors
- *80% of sales in Europe done on open account basis*

Case Study: Environmental Dynamics

- Environmental Dynamics, Inc. ("EDI") - Columbia, MO uses Ex-Im Bank's Multi-buyer Insurance to offer 60-day "open account" credit to customers in Brazil, Mexico, Finland, Poland, Philippines, etc.
- Replaces costly local bank financing, enables customers to offer credit to *their* customers.
  - Premium rate for 60-day credit is 0.65%
- Since EDI began using Ex-Im Bank's export credit insurance in 1997, EDI has expanded into new markets, increased its international sales, and its U.S. work force.
- EDI has established sales and distribution networks in more than 30 countries and has installed equipment in more than 3,000 industrial and municipal wastewater treatment systems worldwide.
- "Ex-Im Bank insurance enables EDI to offer competitive credit terms to a larger customer base while minimizing foreign risk," said EDI President Charles E. Tharp

Conclusion

- Ex-Im Bank: top priority to support renewable energy & environmental exports such as water treatment
- Ex-Im Bank supports short, medium, and long-term financing to creditworthy international customers, and working capital guarantees to U.S. exporters
- Ex-Im Bank financing is usually the most cost-effective source of financing for international customers to purchase U.S.-made technology & services.
- Ex-Im Bank is interested in any size project
- We will work with you to create "bankable" projects

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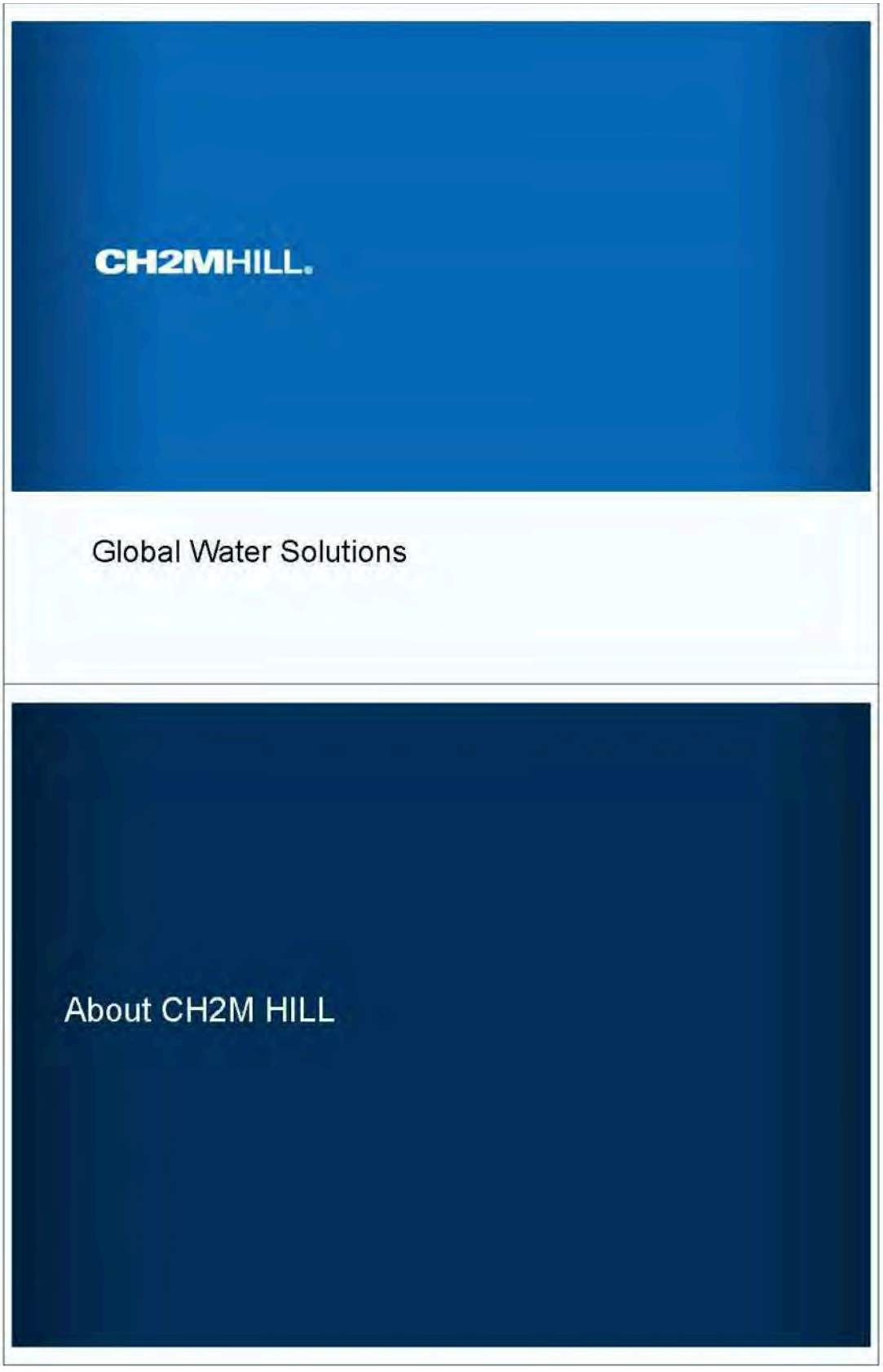

CH2MHILL.
Global Water Solutions
About CH2M HILL

About CH2M HILL

Employee-owned CH2M HILL is a global leader in full-service engineering, procurement, construction, and operations for public and private clients

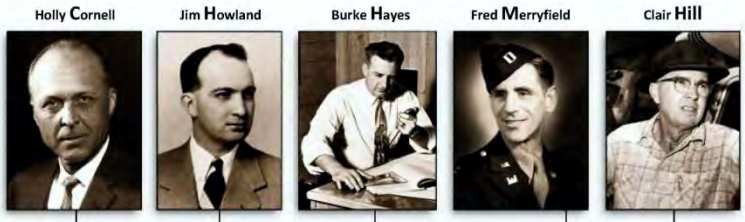
- 28,000 employees in offices worldwide
- $7 billion in revenue (2012)
- Broadly diversified across public and private sectors in water, energy, environment, infrastructure
- Recognized as a most-admired company and leading employer
- Ranked by *Engineering News-Record* as an industry-leading program management, construction management, and design firm

CH2MHILL.

Atljp201206 056 CompanyOverview

CH2M HILL's Founding

CH2M HILL was established in 1946 by three engineers and a professor from Oregon State University



CH2MHILL

CH2MHILL.

Values established 60+ years ago are still strong today

Many of these values are captured in The Little Yellow Book, a guide for business conduct written by Jim Howland and distributed to all employees around the world, in multiple languages.

- Honesty, integrity, and trust
- Focus on our clients and our people
- Employee ownership
- Innovation and technological leadership
- Collaborative and enjoyable work environment
- Challenging work
- Opportunities for individual growth

CH2MHILL.

CH2M HILL today:

We deliver extraordinary projects to solve tough challenges, around the world

- London 2012 Olympic and Paralympic Games
- Panama Canal Expansion Program
- Masdar Sustainable City, UAE
- London Tideway Improvements, Thames Water, UK
- Darling Downs Power Station, Queensland, Australia

ENR ranks #1 CH2M HILL
- Wastewater Treatment
- Sewerage / Solid Waste
- Program Management
- Construction Management

CH2MHILL.

CH2M HILL today:

FORTUNE Magazine

- "America's Most Admired Companies" — last 6 years
- "100 Best Companies to Work For" — named 5 times

Global Water Awards

- 2012 Water Company of the Year

Ethisphere

- World's Most Ethical Companies – named 5 times

Verdantix

- Top Sustainability Consulting Firm

Woman Engineer Magazine

- Top 50 Companies to Work For

2013 WORLD'S MOST ETHICAL COMPANIES
WWW.ETHISPHERE.COM

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Industry rankings:

CH2M HILL ranks among* Engineering News Record's *top 10 in water and wastewater categories across the board

- Top 500 Design Firms (July 2013)
  - #1 – Top 20 in Sewer/Wastewater
  - #4 – Top 20 in Water Treatment/Desalination
- Top 200 Environmental Firms (August 2013)
  - #1 – Top 200 Environmental Firms
  - #1 – Top 10 in Engineering/Design
  - #1 – Top 10 Firms in Consulting/Studies
  - #2 – Top 20 in Water Supply/Treatment
- Top 400 Contractors Sourcebook (May 2013)
  - Top 20 – Power, Petroleum, Haz Waste
- Global Sourcebook (Dec 2012)
  - #1 – International Design Firms in Pipelines
  - #3 – International Design Firms in Wastewater Treatment

ENR ranks #1 CH2M HILL

- Wastewater Treatment
- Sewerage / Solid Waste
- Program Management
- Construction Management

CH2MHILL.

We are committed to health, safety, and environmental stewardship

Our goal is **Target Zero**:

- Zero injuries and illnesses (world-class health and safety)
- Zero adverse impacts (environmental stewardship)
- In our culture, *every employee* takes responsibility and continually strives to achieve these goals

HSE
Target Zero
Protecting People and the Environment

CH2MHILL.

Addressing today's water challenges

Increasing awareness of water scarcity is creating a sense of urgency

WATER SCARCITY: By 2030, the world will face a 40% shortfall between human freshwater demand and available freshwater supply.

FOOD SECURITY: By 2030, to feed the world's population, global food production will need to *double*.

CLIMATE CHANGE: The Copenhagen Accord calls for developed nations to fund $100B *per year* for climate change in developing nations, starting in 2020.

AGING INFRASTRUCTURE: Water and sewer pipeline rehabilitation accounts for up to 40% of the municipal water market in developed nations.

WATER / ENERGY: 49% of all fresh water withdrawn in the U.S. is used to generate electrical power.

Source: Water Security, World Economic Forum Water Initiative, 2011

"Without water, nothing is sustainable."
—Charles Holliday, Former Chairman and CEO, DuPont; CH2M HILL Board of Directors

11

Our integrated solutions address the total water cycle to mitigate risk

- Water resources management
- Water treatment and distribution
- Wastewater collection and treatment
- Reuse
- Stormwater and flood control
- Conveyance and tunneling
- Ecosystem management
- Climate resilience
- Greenhouse gas mitigation
- Asset management

CH2MHILL.

12

We manage water challenges for clients across the public and private sectors

Public Sector

- Municipalities
- State, provincial and national governments
- Irrigation agencies
- International funding institutions
- Non-government organizations

Private Sector

- Downstream oil and gas
- Upstream oil and gas
- Power
- Mining
- Chemicals
- Industrial

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13

We provide full-service delivery solutions – under one roof

- Planning
- Design
- Program management
- Construction management
- Design-build / EPC
- Operations and maintenance

CH2MHILL.

14

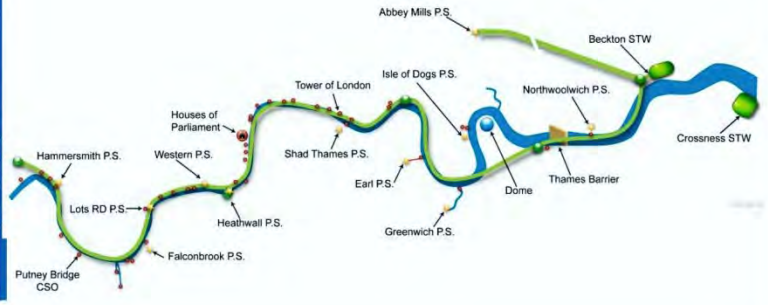
Global project highlights

London Tideway Improvements – ***Sewer overflow management program***

Client: Thames Water, U.K.

Project Features:

System to reduce CSO discharges
Two major tunnels, >75m diameter
Deepest-ever tunnel under River Thames, 32km long, capturing 34 overflows
£3.6B INVESTMENT



Deep Tunnel Sewage System (DTSS) and Changi WRP

Client: PUB Singapore

Project Scope

- World's largest, most sophisticated wastewater system
- DTSS: $2.4B program included more than 50 km of 3.5- to 6.0-meter-diameter deep tunnels across the island, and a 60m-deep influent pump station
- Changi WRP: US $1.25B, 800,000 m^3/day
- Decommissioned 6 treatment plants and 139 lift stations

Our Role

- Program management, design, construction management and commissioning services for both DTSS and Changi WRP

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Active, Beautiful, Clean Waters (ABC Waters)

Client: PUB Singapore

Project Scope

- Transforming the island nation's waterways into sustainable community assets, using a watershed approach
- Series of major projects are restoring waterways, creating new community spaces, and enhancing quality of life all across the island

Our Role

- Master planning, design, tender evaluation, and construction management

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Gippsland Water Factory

Client: Gippsland Water, Victoria, Australia

Project Scope

- 35 ML/day membrane bioreactor wastewater treatment plant to treat effluent from Australian Paper and other industrial/municipal effluent
- 8 ML/day reverse osmosis (RO) system to provide high-quality reclaimed water, enabling Australian Paper to expand operations
- 90 km of pipelines, other facility upgrades, interpretive centre

Our Role

- Design, build, commission, and operate (for 2 yrs) facilities as part of an Alliance contract

CH2MHILL. 19

Strategic Tunnel Enhancement Program (STEP)

Client: Abu Dhabi Sewerage Services Company (ADSSC)

Project Scope

- US $1.5 billion program to address growing sewer needs –Abu Dhabi's population will double in 10 years
- Main components:
  - Deep sewer tunnel—45 km long, 20-85 meters deep
  - 50 km of micro-tunneled link sewers
  - Massive deep pumping station

Our Role

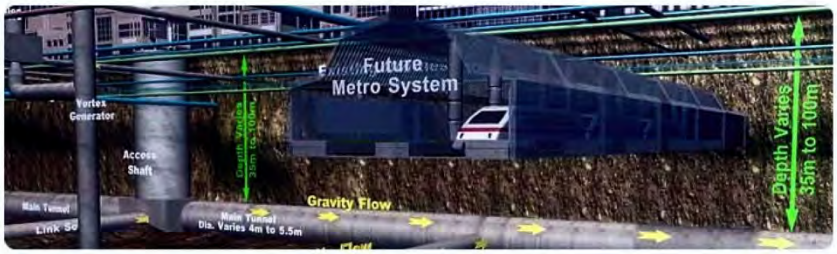
- Program Manager for all phases—planning consents, concept design, DB administration & supervision, stakeholder communication, commissioning & start-up

When completed in 2014, STEP will be one of the largest tunneled sewerage systems in the world

CH2MHILL. 20

Strategic Tunnel Enhancement Program (STEP)

Client: Abu Dhabi Sewerage Services Company (ADSSC)



CH2MHILL. 21

Regional Water Reclamation Facility DBO

Client: Spokane County, Washington, U.S.

Project Scope

- 8 mgd facility, expandable to 24 mgd
- Membrane bioreactors and nutrient removal will achieve effluent phosphorus levels among lowest in North America (50 ppb)
- LEED® Silver certification will be met for three non-process buildings
- Sludge will be anaerobically digested to produce Class B biosolids
- Digester gas will be reused to generate power, recover heat

Our Role

- DBO delivery—US $132M capital, $6M/year operations over 20 years

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Oil Sands Production Facility

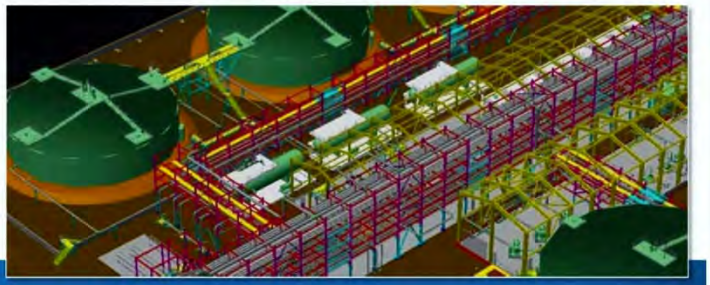
Confidential Client, Alberta, Canada

Project Scope

- Part of a 100,000 bpd Canadian oil sands production facility (steam-assisted gravity drainage – SAGD), total cost CDN $3.6B
- Being completed by CPC in a Joint Venture with Total

Our Role

- Completed FEL3 of water block (CDN $700M constructed cost)
- Now performing EP of water block (CDN $50M labor) via DBO delivery
- Next steps: Field engineering, construction



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Bioenergy Facility Development

Confidential Clients – Brazil and Texas

Brazil Bioenergy Development:

- US $750M greenfield development for bioenergy and food (ethanol/sugar/tomato paste) production
- Scope: Programmatic development of all facilities and infrastructure
- 75,000 acres (30,300 ha); three more farms planned

Texas Biofuels Development:

- 4,000-acre (1,600 ha) greenfield biofuel farm development
- Scope: Development of facilities and infrastructure
- Ultimate program: 50,000 acres (20,200 ha) to feed a 72-mg/y (273 ML/y) cellulosic ethanol plant

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Integrated Seawater Agricultural System

Client: Masdar Institute, UAE

Project Scope

- Two km^2 ISAS system will serve as a research and development facility for Masdar Institute
- Salt-tolerant *Salicornia* will be used for biofuel production, and aquaculture (shrimp, fish) for food and biofuel production, with mangroves for effluent filtration and carbon sequestration
- Minimizes demands on scarce freshwater and arable land

Our Role

- Currently negotiating contract for planning, design and construction services

CH2MHILL.

Masdar City

Client: Abu Dhabi Future Energy Company

Project Scope

- World's first carbon-neutral, zero-waste city
- Government programme to address sustainable energy sources and environmental practices
- Focus on developing and commercialising advanced, innovative technologies in renewable, alternative, and sustainable energies

Rendering courtesy of the Abu Dhabi Future Energy Company

Our Role

- Delivery partner for Masdar City development
- Quantify environmental impacts through Masdar's life cycle – carbon, energy, water, waste

CH2MHILL.

Colorado River Basin Water Supply Study

Client: U.S. Bureau of Reclamation

Project Scope

- 7-state study on water supply and demand in the Colorado River Basin
- Will result in climate adaptation and mitigation strategies to meet water needs over the next 50 years
- Addresses all water users: agricultural, municipal, industrial, energy, ecosystems

Our Role

- Leading consultant team for supply and demand assessment; stakeholder coordination; and evaluation of future water management actions

CH2MHILL.

Atotonilco WWTP

Client: CONAGUA, Mexico City

Project Scope

- Largest WWTP in the world to date
- Biological treatment capacity of 1.99 million cubic metres per day (m^3/d)
- Treated effluent will provide irrigation water for alfalfa crops in Hidalgo

Our Role

- External project manager for Conagua
- Contractor selection, engineering design review, support during construction

CH2MHILL.

London 2012 Olympic and Paralympic Games

Client: Olympic Delivery Authority

Project Scope

- 7-year program
- 500-acre Olympic Park with 9 new venues, including modifications to historic locations
- Sustainable legacy plan
- Transport program integrating London's air, road, and rail networks
- Strong program for coordinating safety and security

Our Role

- One of three firms in the program management consortium, CLM Delivery Partner
- Providing global engineering, construction, and program management expertise`

CH2MHILL.

CH2MHILL.

Global Water Solutions

SEL

SEL Worldwide: Focusing on Innovation, Quality, and Customer Service

Eddie Schweitzer
Business Development Director

May 16th, 2014

Making Electric Power Safer, More Reliable, and More Economical

Our Purpose

Making Critical Infrastructure, Safer

More Reliable, and More Economical


We Invent, Design, Manufacture, Support, Teach, Install, Test …
Secure Digital Communications
Revenue & Power Quality Metering
Engineering Services
Control Houses & Panel Solutions
Integration & Automation
Capacitor, Breaker, Bus, & Transformer Protection
Rugged Computing & Software Solutions
Generator & Motor Protection
Fiber-Optic Communications
Government & Industrial Solutions
Precise Time & Synchrophasors
Faulted Circuit Indicators


SEL Serves Multiple Industries Worldwide
Utility
Oil & Gas
Metals & Mining
Water & Waste
Pulp & Paper
Transportation
Government
Renewable Energy


You are Our Priority
Thanks to 100% Employee Ownership
3,600 Worldwide Employees


Product Reliability Enables
Ten-Year Warranty
• Get to root cause of every problem
• Inform customers with Service Bulletins
• New product if we can't repeat problem
SEL
Service Bulletin
SEL-321-1 Relays
Trip Coil Monitor Alarm
December 13, 2001
Number 2001.25
Classification
Recommended: Specified Applications
Background
Specified Application
Application Impact
Solution
SCHWEITZER ENGINEERING LABORATORIES
WORLDWIDE 10 years WARRANTY


Third-Party Certifications
Substantiate Product Performance
SEL Inc. Certifications
SEL
ISO 9001:2008
ABS Quality Evaluations
TÜV
Certificate
Certificate
ABS - Marine Type Approval
ABS
Design Assessment
Technical Certifications
- IEC 61850: KEMA, CEPEL
- Mirrored Bits: IEC 60834-1
- Computers: IEEE 1613-2003, ANSI C37.90
• CE
• IEC
• ISO
• TUV
• ABS
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Pullman, WA
SEL Lewiston Plant
Lewiston, ID
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Sensor Division
Lake Zurich, IL
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Metering
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PowerMax Keeps the Process Running

- Generation Control
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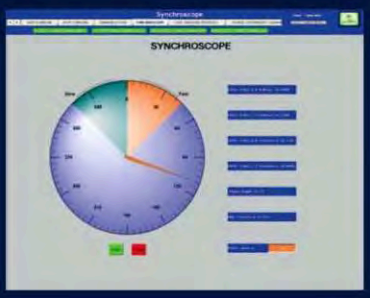

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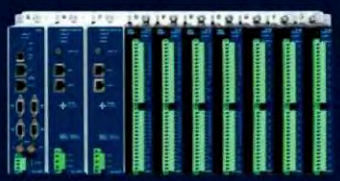
Automation Improves Reliability and Efficiency

Lift Stations

Wells

Booster Pumps



- Protection
- kWh
- Run Status
- Motor Temp.
- Runtime

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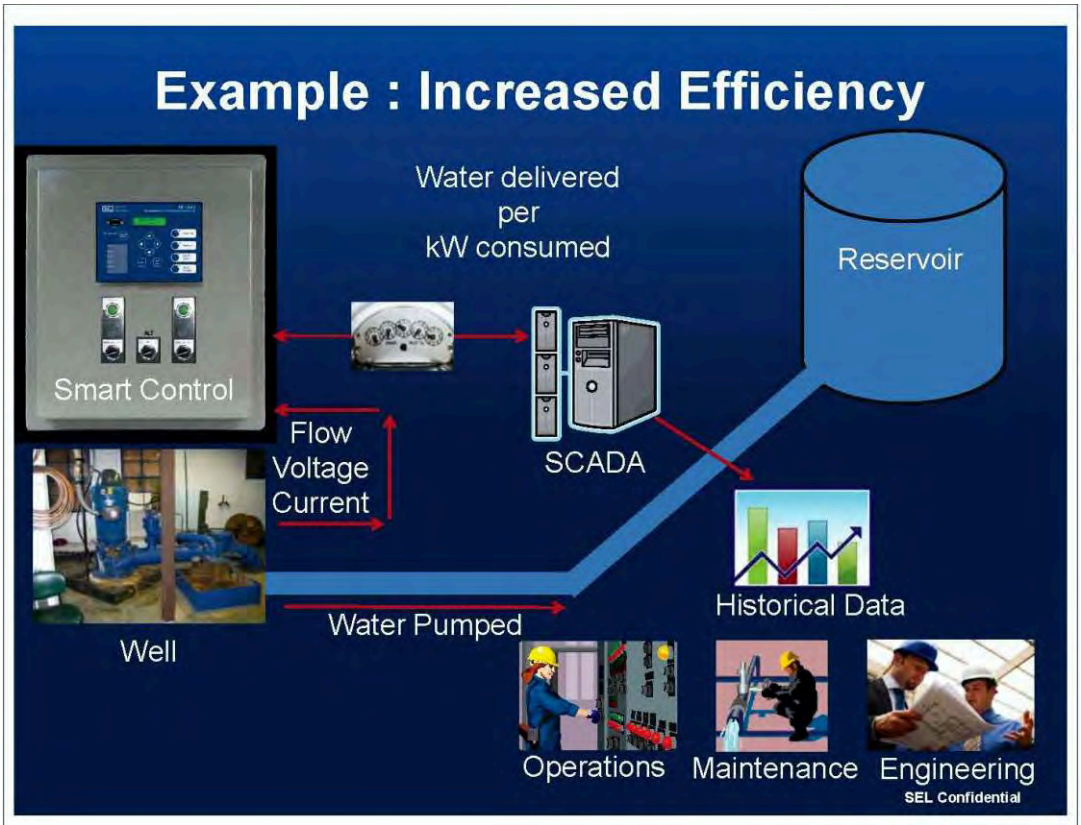
Example : Increased Efficiency
Water delivered per kW consumed
Reservoir
Smart Control
Flow
Voltage
Current
SCADA
Historical Data
Water Pumped
Well
Operations
Maintenance
Engineering
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Brazilian Water Customer References
CAESB, Brasilia
caesb
EMBASA, Salvador
embasa
Presente na vida dos baianos
SANEPAR, Curitiba
SANEPAR
SABESP, Sao Paulo
sabesp
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Please Share Your Experiences with Us


Questions?
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SEL... From Source to Use
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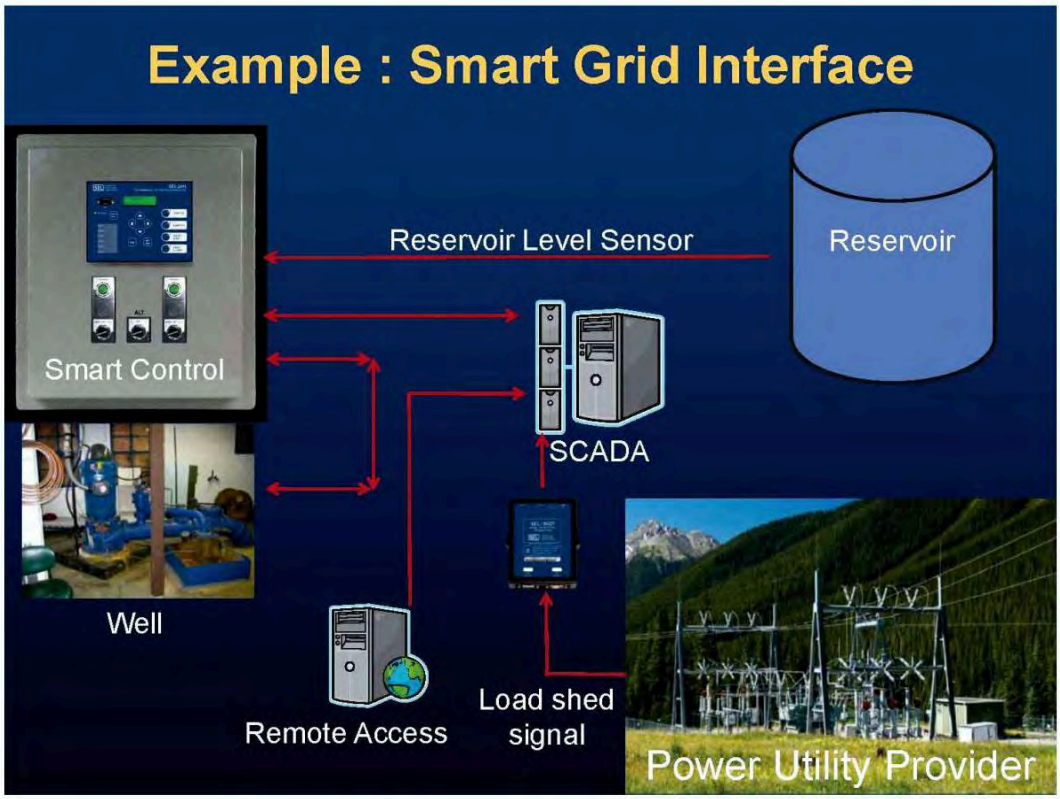
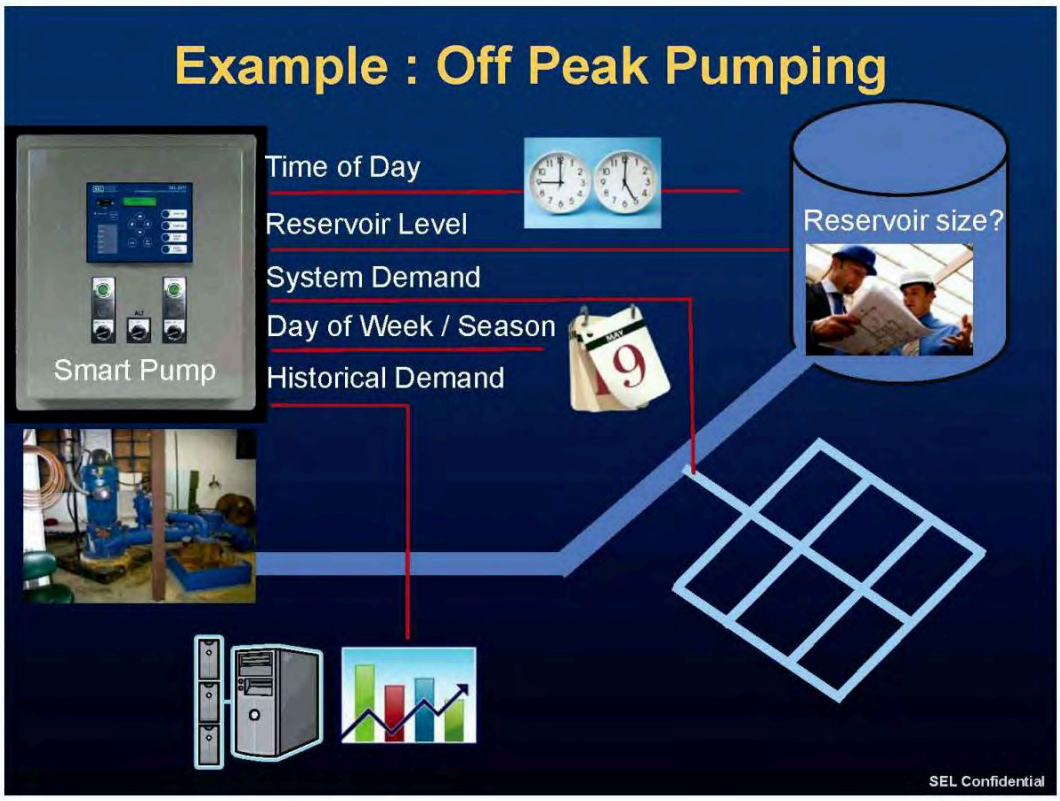

Example : Smart Grid Interface
Reservoir Level Sensor
Reservoir
Smart Control
SCADA
Well
Remote Access
Load shed signal
Power Utility Provider


Example : Off Peak Pumping
Smart Pump
Time of Day
Reservoir Level
System Demand
Day of Week / Season
Historical Demand
Reservoir size?
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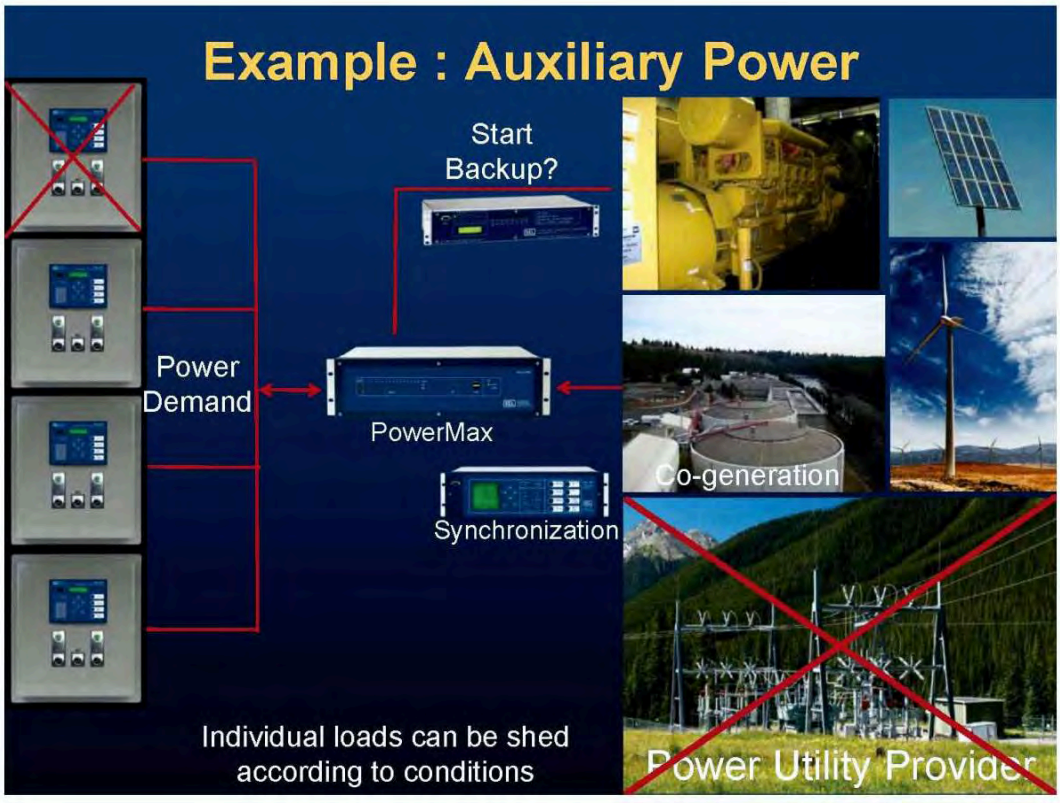
Example : Auxiliary Power
Start
Backup?
Power
Demand
PowerMax
Synchronization
Co-generation
Individual loads can be shed
according to conditions
Power Utility Provider


Water Flow Control System
SEL-3031
RF Signal
SEL-3354 RTAC Web HMI
RTAC
▪ IEC 61131
▪ DNP3 protocols
▪ Protocol convertor
SEL-2411
▪ Flexible I/O
▪ DNP3
▪ LCD display
▪ Pushbutton keypad operator interface
Other Protocols – RTAC Acts as Protocol Gateway
MIRRORED BITS®, SEL Fast Message, Modbus®, IEC 61850,
and other manufacturer serial protocols.
HMI Remote Control
SEL
SCHWEITZER
ENGINEERING
LABORATORIES
PumPAC
Main
LIFT STATION CONTROL
HOME
ALARMS
PUMP 1 Detail
PUMP 2 Detail
Normal Mode
Auto Mode
Float 4
Float 3
Float 2
Float 1
System Status
Comm Status
Healthy
Site Status
Online
System Control
Locally
System Temperature 79.3 F
Energy Metering
System_Frequency 60.0 Hz
Real Power Output 0.1 MWH
Real Power Input 0.2 MWH
Pump 1
Pump Operation
Lag Pump
Pump Status
Stopped
System Control
SITE_ON/OFF
MANUAL MODE
AUTO MODE
Pump 2
Pump Operation
Lead Pump
Pump Status
Running

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STAR AMI Network with ZoneScan Leak Detection System

Steve Meissel
International Business Development
Aclara, St. Louis, MO
2014

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Create Your Intelligent Infrastructure™

www.Aclara.com

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Who Is Aclara?

Top Smart Grid Vendors

Aclara Ranked As One Of Top 10 Smart Grid Vendors & Top 10 Stand-Out Technologies from ACE12 by Water Online

GTM TOP TEN Vendors in Smart Grid

"Aclara continues to be one of the most trusted companies in the smart grid space, offering a product portfolio to rival any company competing in the smart grid submarkets of networking/communications (including AMI), data management and hosting (including MDM) and customer energy information (including both CIS/utility billing and HAN portals)."

"In a recent independent study conducted by E Source, it was found that Aclara's consumer-engagement solutions power 15 of the top 25 utility websites; the study also stated that Aclara's solutions are used by 45 of the 100 utilities that were analyzed."

Aclara's STAR® ZoneScan leak-detection system was named one of the 10 Stand-Out Technologies from ACE12 by Water Online, a leading publication covering the water industry. Editor Kevin Westerling identified STAR ZoneScan as particularly relevant to reducing the operational costs of a utility by helping them effectively find leaks in the water distribution system.

3 Proprietary and Confidential Information

Aclara Experience

We deliver comprehensive AMI solutions

- Selected by more than 130 municipalities and water authorities
- Over 15+ years experience deploying AMI fixed-network systems
- We manage some of the largest AMI installations in North America

- SAN FRANCISCO, CA
- NEW YORK CITY, NY
- BOSTON WATER & SEWER, MA
- DES MOINES, IA
- HOLLYWOOD, FL
- TORONTO WATER, ONT
- DC WATER, DC
- BEND, OR
- WARREN, MI
- HUNTINGTON BEACH, CA
- KANSAS CITY, MO
- BEVERLY HILLS, CA
- ANN ARBOR, MI
- ATLANTIC CITY, NJ
- TOHO WATER, FL
- CORPUS CHRISTI, TX
- GREEN BAY WATER, WI
- LEESBURG, VA
- LACEY, WA
- SO CAL GAS COMPANY

4 Proprietary and Confidential Information

Largest Installations: Aclara Customers

Utility	Endpoints	Commodity	Aclara's Roles	Key Highlights
Southern California Gas	6,200,000	Gas		
Pacific Gas & Electric	4,600,000	Gas		
New York City Water	875,000	Water		
Toronto, ON Water	450,000	Water		
Wisconsin Public Service	200,000	Gas		
San Francisco Water	180,000	Water		
Kansas City Water	175,000	Water		
Corpus Christi Utilities	135,000	Gas & Water		
Washington, DC Water	123,000	Water		
TOHO Water Authority	120,000	Water		
Boston, MA Water	90,000	Water		
TOTAL, top 10 deployments	13,148,000			

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How Effective Is Fixed-Network AMI?

As part of their distribution management strategy, one large East coast utility, using the Aclara STAR Network, achieved an **83%** reduction in **non-revenue water loss** and credits AMI data as a key element in this success.

6

The Aclara Advantage

Aclara Advantage	Proof Point
Proven AMI Leader	✓ Over 16 million STAR endpoints deployed or under contract ✓ First installed U.S Fixed Network – still in operation (Canton, OH - 1996) ✓ Only company with 15+ years experience deploying AMI Fixed-Base Network Solutions ✓ Managing some of the largest U.S. water installations - San Francisco, New York City, Kansas City, DC Water, Boston
Robust Architecture	✓ Built-in redundancy • Tower-based systems do not provide redundancy ✓ Single layer architecture - no hidden network costs • Competitors require additional equipment (Repeaters) ✓ Licensed frequency • Some competitors operate on unlicensed frequency ✓ Highly-dependable read reception rate ✓ Proven battery life • Designed to last 20 years, installed systems operating at greater than 15 years
Flexible/Scalable	✓ Compatible with many Meter Manufacturers ✓ End-to-end two-way system ✓ Unique endpoint solution to match application need
Ease of Use/Support	✓ Meter agnostic ✓ AC/Solar network options ✓ Well known and experienced local partner will ensure successful project deployment and support

7 Proprietary and Confidential Information

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The Aclara STAR RF Network

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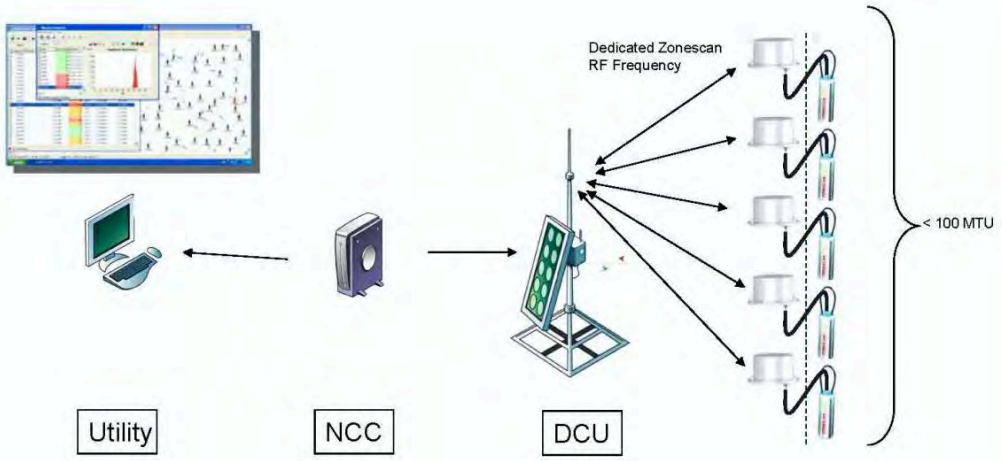
The AMI Fixed Network System

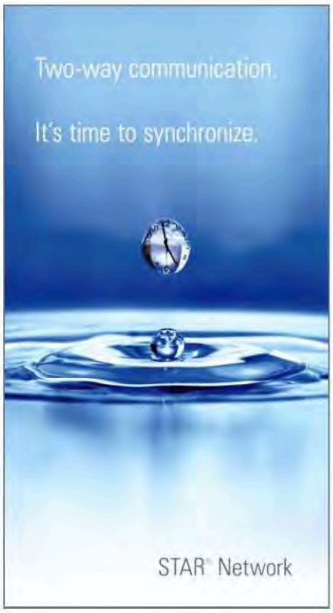


9

Two-Way Solutions -The Balanced Approach

A High Performance 2-way Network To Support Many Different 2-way Applications:

- ✓ **Series 3000 endpoints are 2-way units:**
  - Time- synchronization
  - Over-the-Air Reconfiguration
  - Installation Confirmation of MTU
  - Proven 20-year Battery Life
- ✓ **ZoneScan leak detection uses 2-way differently**
  - Simultaneous acoustic data collection
- ✓ **Future Applications supported by the Network**
  - ✓ Water shutoff will have "On-demand" to perform a live shut off in real time.
  - ✓ Will support pressure monitoring and water quality monitoring



Series 3000: Two-Way Communication MTU

Connects to all major meter brands/models including:

- Badger
- Elster AMCO
- Hersey
- Itron
- Neptune
- Sensus
- Sappel
- Actaris
- Kamstrup

Single- and dual-port models

Reports up to 8 digits from the register

Captures hourly meter data and transmits four times per day (default)

Time-synchronizes readings to within one second

Time-stamps all meter reads

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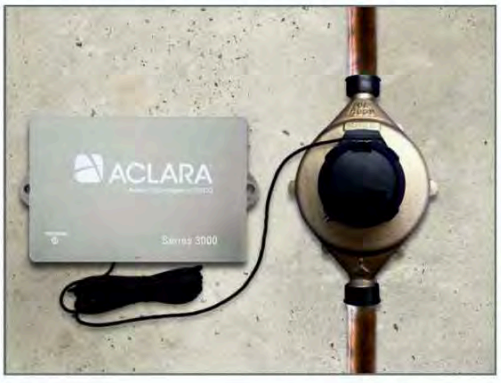
Meter Transmission Unit

STAR Series 3000 MTU is uniquely capable:

- ✓ ***Private*** licensed frequency
- ✓ 450 MHz and higher power ensure ***communication in all environments***
- ✓ Tested ***20 year battery*** life
- ✓ ***Time synchronized*** reads
- ✓ No single point of failure network
- ✓ Operates when power is out
- ✓ ***Top of the hour*** meter reading

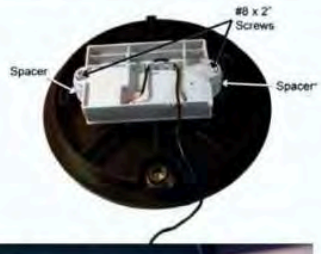


12

Aclara's Pit / Vault Experience

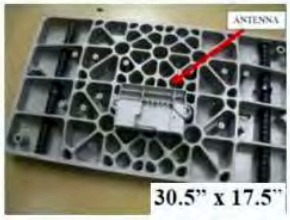
Aclara's Pit Solution – The Best In The Industry

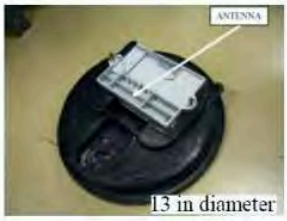
- ✓ Aclara ***technology*** allows for reliable operation
- ✓ Vast number of MTUs installed in Pits – ***more than 500,000***
- ✓ Flexible ***Below the Lid*** installation
  - Antenna does not penetrate the lid
- ✓ ***Small pit lids*** should be replaced with new Concrete, Plastic or Composite lids
- ✓ ***Large vault lids*** can be modified with RF friendly doors
- ✓ Star MTU housing is a ***permanently sealed*** waterproof housing for reliable operation in harsh environment

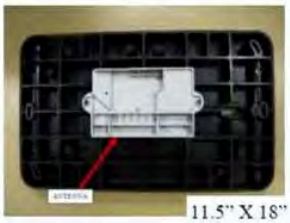


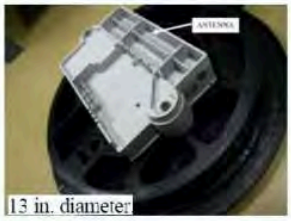
13

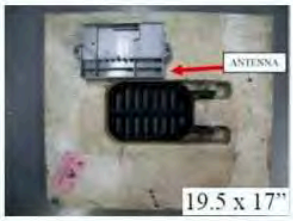
Examples of Aclara's Pit Lid Installation





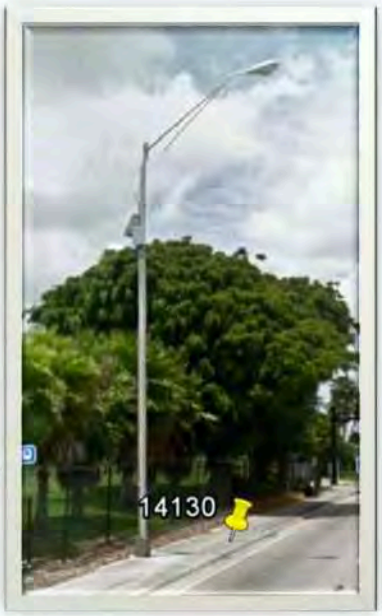






Data Collection Network

- ✓ **Battery Operated with AC or Solar Power charging options**
- ✓ **Simple Installation Effort**
  - Low antenna height at ~25 ft
  - No complex engineering at each site
  - Location is flexible
- ✓ **No hidden network cost to achieve desired Network Performance**
  - Repeaters are never required
- ✓ **DCU Infrastructure is distributed for high redundancy**



15

DCU - Data Collection Unit

Rooftop Mount

What Does the Aclara STAR NCC Do?

- ✓ The NCC is the overall command center for your AMI system
- ✓ Communicates with and manages data collection from MTUs and DCUs
- ✓ Provides web-based user interfaces for CSR and network management operations
- ✓ First line for endpoint alerts/alarms collection and notification
- ✓ Repository for readings and consumption data, allowing for exchange with back-office systems
  - Aclara Meter Data Management System (MDMS)
  - Aclara Consumer Engagement (CE)
  - Third-party CIS, Work Order Management, Billing, MDM systems, etc.

17

Benefits of Hourly Meter Data

- More consumption data to keep customers informed of their water usage and conservation efforts
- Help identify anomalies, such as constant or high usage, which can link back to a leak within the home
- Time synchronized reads provide the basis for water balance calculations

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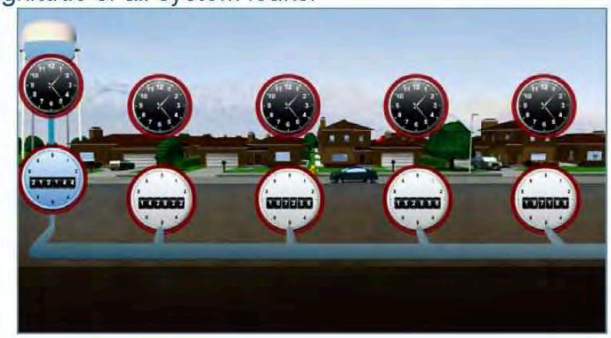
Time Synchronization

- All network endpoints are synchronized to within 1 sec of each other
- A fixed, two-way water AMI system uses a time-synchronized approach that allows a utility to take a network-wide reading at the same time.
- The singular, network reading reconciles the system data and provides information on the magnitude of all system leaks.



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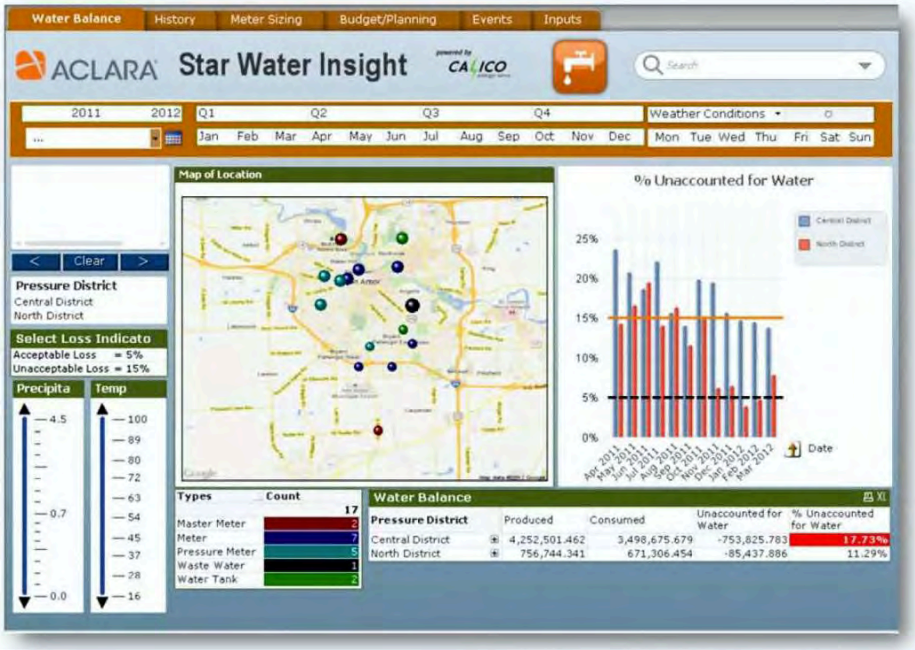
Manage Water Balance



20

STAR Network Frequency Advantage

- ✓ **Licensed 450 MHz – 470 MHz**
  - No competition for airwaves
  - Lower noise on channel
- ✓ **Lower Free Space Path Loss**
  - Increasing the frequency would require an increase in power
  - Yields battery life in excess of 20 years
- ✓ **RF Penetration**
  - 450 MHz penetrates foliage and standard construction materials effectively
    - 900 MHz signal loses almost twice the power penetrating standard building materials

Benefits of Aclara's STAR Network

Aclara's STAR Network is Designed Around Redundancy

- The majority of MTUs are covered by 2-3 DCUs
- If one DCU fails, the redundant DCUs are able to hear the message
- Should there be an "RF Collision" between two different MTUs at the same DCU, then there are multiple DCUs in the network that have the opportunity to hear the message
- Similarly, if there is a localized source of interference by a DCU, other DCUs in the network are capable of collecting the MTU messages and forwarding them to the NCC
- Multipath reflections increase the opportunity to hear a "blocked" MTU.
- The Star Network utilizes licensed frequencies that are readily available from Subtel and can be selected on an installation-by-installation basis to minimize any sources of local interference
  - Unlicensed devices are almost guaranteed to have other devices operating on the same frequency as their AMI network increasing likelihood of data loss
- The DCU can store up to 30 days of hourly profile date for all meters in the event that the backhaul communications network is not available
- Solar power option eliminates the need for ac power

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STAR Advantages

- Private licensed frequency not subject to interference
- Higher power level ensures communications through tough environments and maximizes the number of endpoints per concentrator, minimizing data backhaul costs
- Mid 400Mhz. Frequency range is optimal for signal range and propagation
- Battery usage algorithm allows 20 year operating life, minimizing field replacements
- Fixed network leak detection with Gutermann is unparalleled state-of-the-art acoustic correlation fixed network system

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STAR Zonescan Acoustic Leak Detection

Leakage Problems and Costs

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- Water loss of 10-20% is considered normal, but can be as high as 50% in areas with aging infrastructure
- Many leaks are not visible, but continue below the surface for long periods of time and remain undetected
- Leakage from water distribution systems costs the US $1-2 billion annually in wasted treatment and pumping costs; property damage and replacement costs are additional*

* Source: EPA/600/F/09-019; October 2009

25

Value of Leak Detection

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- **What is the Value of Solving the Problem?**
  - For Utility
    - Reduce non-revenue water (get paid for water produced)
    - Identifying and repairing small leaks before catastrophic pipe failure reduces emergency repair/replace costs
    - More efficient delivery to consumers extends service life and reduces life cycle costs (power, chemicals, expansion) of treatment plants; also reduces draw from water sources (water conservation)
  - For Consumer
    - More efficient delivery helps moderate rate increases
    - Fewer/less extensive emergency repairs reduce inconvenience (service outage, traffic disruption)
    - Reduces the probability of contaminated water

26

Revenue Lost from System Leaks

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A ⅛" diameter opening translates to roughly 1.4 million gallons of water lost per year. At a rate of $3.00 per 100 CF, this represents $5,600 of lost revenue per year.

A ½" diameter opening translates to nearly 22 million gallons of water lost per year. At a rate of $3.00 per 100 CF, this represents over $88,000 of lost revenue per year.

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Acoustic Leak Detection Basics

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Leak noise is mechanical vibration that occurs when a rupture or break in the main causes a pressure differential between the water in the pipe and the area outside.

Acoustic Leak Detection Basics

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Factors that affect leak noise

- Obstructions
- Consumption
- Background noise (pressure reducing or partially throttled valves)
- Pipe diameter and material
- Backfill
- Electrical hum
- Size and location of the break

Acoustic Leak Detection Basics

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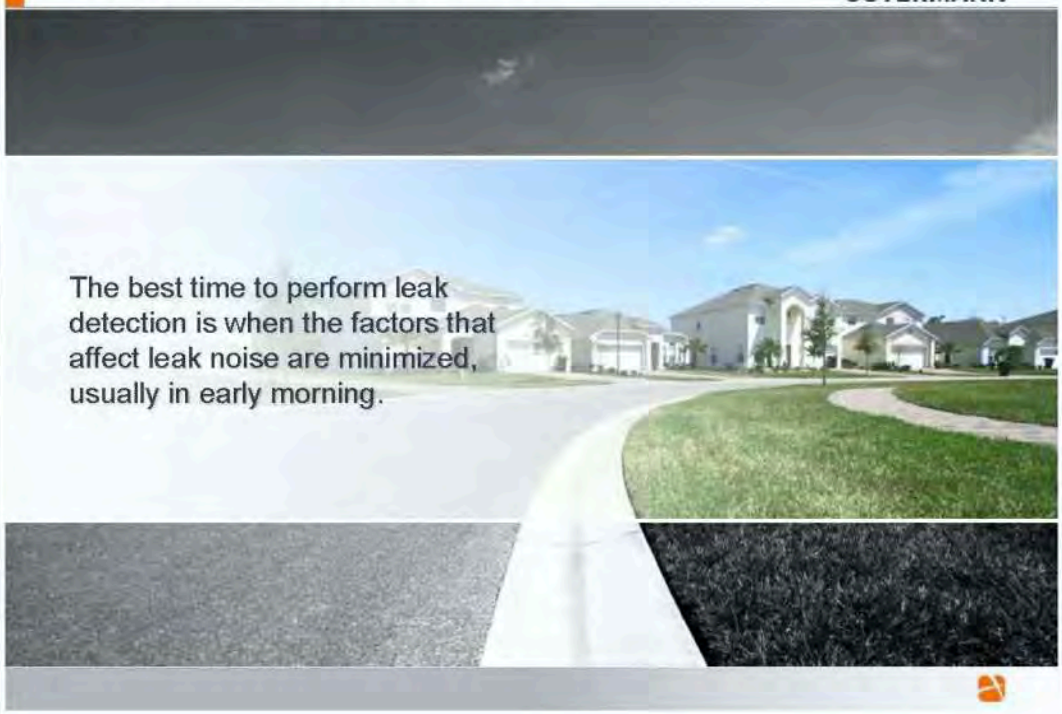

Acoustic Leak Detection Basics

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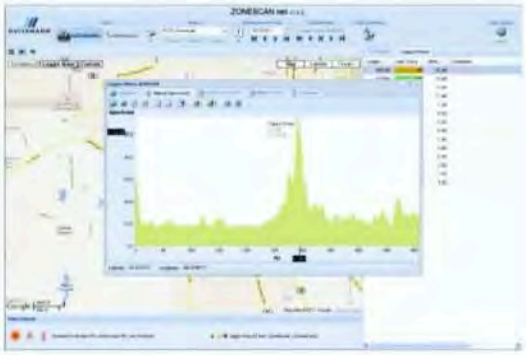
Data loggers are placed along the water distribution system to record sound, generally between the hours of 2 and 4 a.m.



Acoustic Leak Detection Basics

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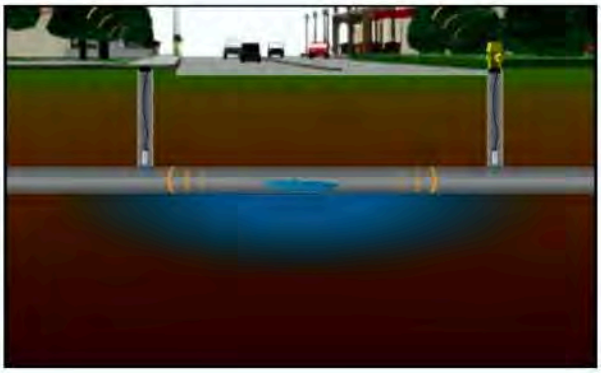
Key to successful leak detection is software that can take into account the factors affecting leak noise, correlate the data, and pinpoint any leaks.

Acoustic leak detection – How it works

- The loggers identify the minimum sound in short intervals
- The acoustic data points identify low, medium, and high frequencies
- The logger reports on the differential between the lowest and highest noises
- The software interprets changes and magnitude of sounds to rate the probability of a leak



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Acoustic Leak Detection Basics

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The correlation software for the STAR ZoneScan solution is proven accurate to within a few feet.

STAR ZoneScan Application

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- Loggers are generally placed on 2" to 20" distribution mains
- All pipe materials are suitable
- Deploy loggers in valve chambers every 500 - 600 feet, although PVC pipe will require closer spacing
- Loggers connect magnetically to valve stem
- Can be added to an existing STAR Network AMI infrastructure or implemented as a stand-alone system

Typical Deployment in Valve Chamber

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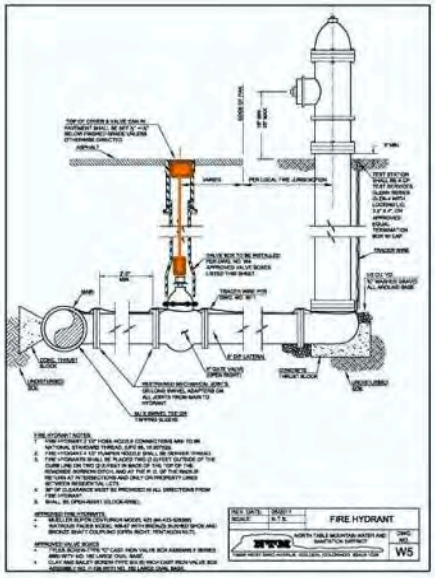

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STAR ZoneScan System Components

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- Gutermann model 820 correlating logger with watertight connector cable
- Leak detection MTU (450Mhz. Radio)
- 7-1/4" diameter non-metallic valve cover
- STAR ZoneScan software module and Gutermann application software

Mounting the Zonescan MTU (Meter Transmission Unit)

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Connecting STAR ZoneScan MTU to 21" diameter composite cover at DC Water

Operating Features

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Operating Features

- The ZoneScan loggers record 2 hours of pipe "noise" every night (amplitude study)
- "Trigger DCU" sends message to loggers within communication range to also perform a 12-second correlation recording
- The STAR Network automatically transmits all recording data back to the head end; data is available for viewing by 10 AM local time
- The ZoneScan software analyzes the recording data and visually identifies no/possible/probable leaks

STAR ZoneScan Project Page

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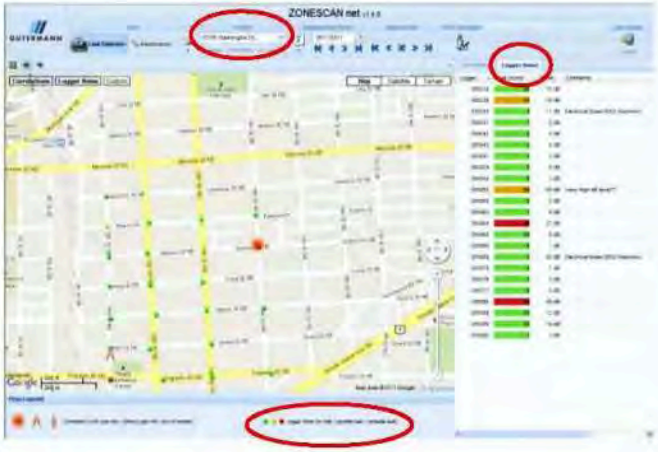

Project page shows map of deployed loggers; Logger Noise tab shows color-coded individual logger results

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Logger Histogram Shows Amount of Noise

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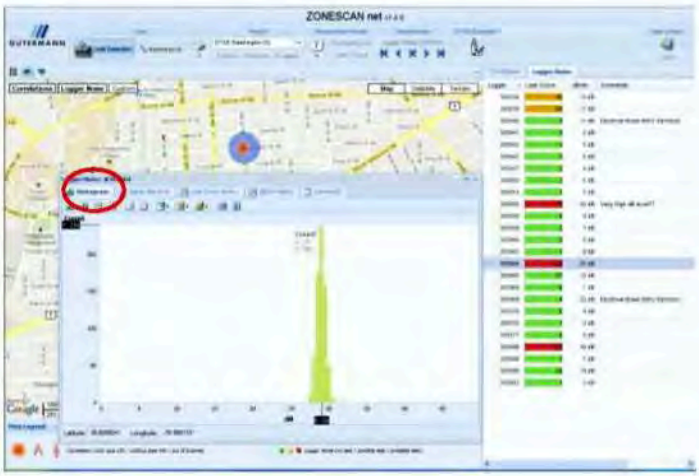

Select logger, right click, and select Histogram. Logger 305064 histogram shows noise cluster between 27 and 31 dB. No counts below 5 dB indicate constant noise (i.e. pipe is never quiet).

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Is Leak Score Changing?

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Upward trend of leak score history for logger 305099 is an indication that the leak is getting worse.

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Cross-Correlations Pinpoint Leak Location

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Select Correlations tab, select logger, right-click and select Correlation Graph. Well-defined peak places the probable leak between logger 305064 and logger 305065 (using default distance of 2,000 feet between loggers)

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Field Verification and Repair

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- Using the results from STAR ZoneScan, a ground microphone can be used to verify the leak prior to initiating repairs
- Gutermann offers ground microphone equipment if needed

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Functional Advantage of STAR ZoneScan

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- Competitive offerings only provide a histogram indicating the presence of noise
- STAR ZoneScan also offers:
  - Frequency analysis of the noise spectrum to identify false positives like electrical noise
  - Daily remote correlations between loggers identify probable leak locations at your desktop
  - Leak noise, no matter how small, will be present every night, so daily correlations aggregated over time will identify leaks that may not have been identified in initial correlation

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Key Benefits of STAR ZoneScan

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Key benefits of STAR ZoneScan

- Loggers are deployed on distribution mains, closer to leaks and further from building noise, yielding a higher confidence level that leak noise from the main is being heard
- Fixed network communication eliminates the time and expense of slow-moving (5-10 mph) patrol cars and personnel to gather data
- Automatic correlation eliminates need for manual correlation in the field; reduces life cycle costs
- Correlated recordings pinpoint leak locations within a few feet
- Immediate identification and correction of leaks results in a fast payback period

Deployment Recommendations

The STAR ZoneScan system can be deployed:

- ✓ Permanently in older, leak-prone service areas
  - Takes full advantage of your STAR AMI fixed network
  - Never miss a leak
  - Eliminates costs associated with moving MTUs/loggers
- ✓ "Lift and shift" in newer service areas

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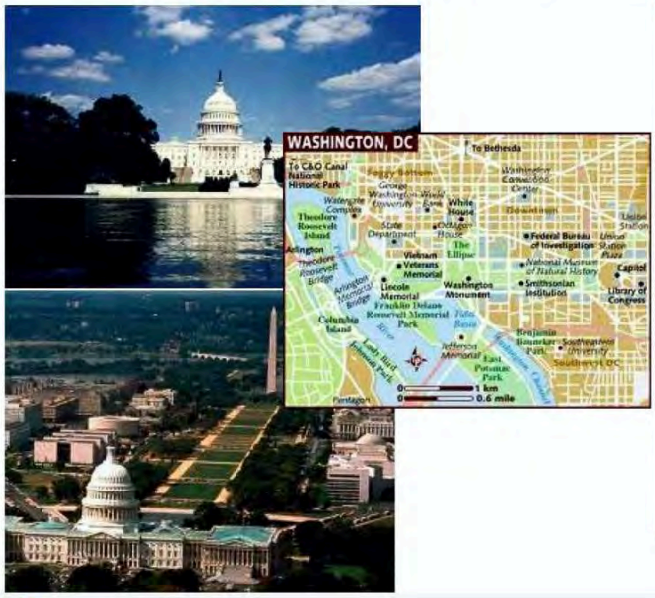
Customer Testimonial
DC Water & Sewer Authority



"One of the more significant successes that DC Water experienced through AMI was in its arrears management process. We used to bill quarterly in 2002 and back then we estimated over 23% of our bills. Once we moved to monthly billing based on actual reads, bill disputes were much less frequent and call volume sharply decreased allowing us to refocus our attention on accounts receivable." **Charles Kiely, Assistant General Manager DC Water**

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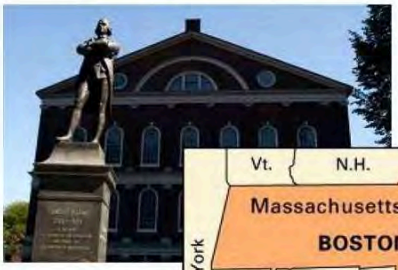
Customer Testimonial
Boston Water & Sewer Commission (BWSC)



"We have more outgoing calls on the customer service side than we have incoming calls and billing errors have been cut by 75-80%." **Jay Porter, BWSC**

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Customer Testimonial
Town of Leesburg, VA

"These three initiatives—the hydrant-metering program, the new service-line site inspections, and the system wide leak detection - were responsible for reducing our unaccounted-for water from more than 23% to 12% between 1997 and 1999. Although we had reduced our unaccounted-for water by nearly 50%, we still felt the remaining 12% was excessive, even though a lot of jurisdictions operate with a greater loss factor. That's the primary reason we began looking at our water meters. We suspected we were losing revenue due to metering inaccuracies, because many were more than 20 years old and thought to be under-registering either due to misapplication or malfunction. Several multi-family units were being served by turbine meters that were much larger than needed." **Randy Shoemaker,** Utility Director

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Customer Testimonial
City of Ann Arbor, MI

"Ann Arbor has clearly demonstrated how small municipal utilities can successfully deploy advanced metering infrastructure to capture the data necessary for extraordinary customer-service applications usage profiling and tracking, online access to daily consumption information, and unique billing options," **said Sue F. McCormick**, Public Service Administrator for the City of Ann Arbor. As home to the University of Michigan, Ann Arbor has a large number of transient students. As a result, the people responsible for charges to various water meters change often. Having daily reads allows the city to switch meters over to new occupants without physically disconnecting and then reconnecting the meter, saving time and money.**

Taken from *"City of Ann Arbor Wins Metering International Award With Implementation of the Aclara STAR Network System"* by Amy Fischbach , March 25th, 2009 – The Briefing Room.com

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Customer Testimonial
New York City

The web tracking tools for customers will provide information on the dollar value of the water they have used, in addition to past usage, billing, and payment information. The data is transmitted four times per day from households, and hourly for larger buildings. This high frequency of monitoring will help users to evaluate what time of day they use most water, strategize ways to conserve water, and will also help detect leaks if there is high fluctuation in the usage.

Mayor Bloomberg says that *"by providing homeowners and business with real-time access to their water bills, we've giving New Yorkers access to information they've never had before, so they can analyze their water consumption and target savings."***

Taken from *"NYC Rolls Out Real-Time Water Metering"* by Lea Bogdan, July 16, 2010 – Inhabitat.com

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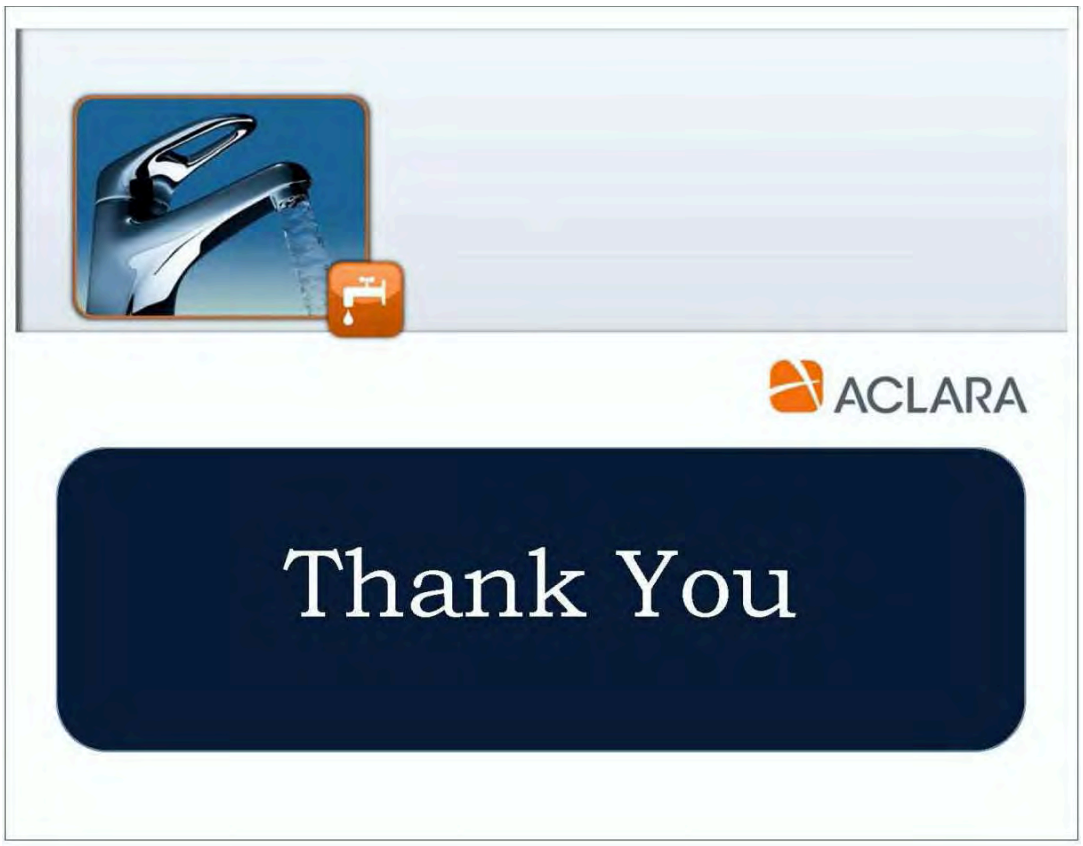
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Thank You