Public – Private Finance
Roles for Engineering & Environmental Firms
Building leverage amidst a divided policy landscape

Pittsburgh, PA
Aug. 13, 2018

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Partisan, ideological divide on environmental regulations

<table>
<thead>
<tr>
<th>Cost to many jobs and hurt economy</th>
<th>Are worth the cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>34</td>
</tr>
<tr>
<td>15-29</td>
<td>25</td>
</tr>
<tr>
<td>30-49</td>
<td>29</td>
</tr>
<tr>
<td>50-64</td>
<td>41</td>
</tr>
<tr>
<td>65+</td>
<td>43</td>
</tr>
<tr>
<td>Postgrad</td>
<td>21</td>
</tr>
<tr>
<td>College grad</td>
<td>28</td>
</tr>
<tr>
<td>Some college</td>
<td>37</td>
</tr>
<tr>
<td>HS or less</td>
<td>38</td>
</tr>
<tr>
<td>Rep/Lean Rep</td>
<td>58</td>
</tr>
<tr>
<td>Conserv</td>
<td>65</td>
</tr>
<tr>
<td>Mod/Liberal</td>
<td>48</td>
</tr>
<tr>
<td>Dem/Lean Dem</td>
<td>17</td>
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<tr>
<td>Cons/Cen/Mod</td>
<td>21</td>
</tr>
<tr>
<td>Liberal</td>
<td>19</td>
</tr>
</tbody>
</table>

http://environmentalbusinessjournal.com/environmental-industry-segments

2016: www.pewresearch.org/fact-tank/2016/12/14/most-americans-favor-stricter-environmental-laws-and-regulations/
Millennials are fastest growing consumer segment

<table>
<thead>
<tr>
<th>Generation</th>
<th>2016</th>
<th>2019</th>
<th>2028</th>
<th>2036</th>
<th>2050</th>
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</thead>
<tbody>
<tr>
<td>Millennial</td>
<td>71</td>
<td>74</td>
<td>73</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Gen X</td>
<td>66</td>
<td>65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boomer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>Silent</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: Millennials refer to the population ages 20 to 35 as of 2016.

PEW RESEARCH CENTER
Over-arching Drivers; Environmental Mkts, Finance

**Market & Demographics: Aging of Advanced Economies**
- Flat Energy demand in N.America + Europe ➔ “Restoration Spending”
- **Energy Supply build out in N.America** (Fracking, LNG exports, Fed Lands)
- Technology integration in **Cities** and Advanced Economies
- More Storm Damage, Climate Adaptation, Resilience planning
- Urban growth in Asia ➔ Power, Energy, Transit, Telecomm

**Politics & Policy: Reversion to “Dynamic Federalism” (N.Am + EU)**
- Shift from Compliance to Development, more Privatization, “PPPs”
- Increasing Fragmentation among States on Energy & Enviro Policy
- EPA weakened ➔ more decision making at State & City level
- Paying for Climate: “Fix on Failure” (Variety of financing approaches)
- Infrastructure Upgrades: a 20-30 year task: Grids, Transit, Pipelines, Ports
- **Private-Public Funding**: States & Industry must lead funding models
Where are we?

Conference Board: Consumer Confidence, July 2018

Conference Board Consumer Confidence Index
Recessions Highlighted in Gray, Real GDP Shown Below

Index Value: 1985 = 100

Clinton

GWBush

Obama

Trump

Regression

GDP
Market & Policy DRIVERS for 2019…

ECONOMY / MARKETS
➢ Healthy growth to continue; Commercial Development up
➢ A few more Fed rate hikes; no disruptions; QE done in USA
➢ Demand for infrastructure to remain high (Financing?) ✓ ✓ ✓

POLICY & POLITICS
➢ Democrats reclaim House, +25 to +40 seats (205Rs vs 230Ds) ✓
➢ GOP holds Senate narrowly ➔ 52-54Rs vs 48-46Ds ✓
➢ Republican dominance among Govs/States continues(30R) ✓
➢ Budget deal prevents shutdown in 2018 ✓ ✓ ✓
➢ Defense budget avoids cuts; solid spending ✓ ✓ ✓
➢ EPA cutbacks curbed a bit; but still under siege X ✓ ✓
➢ Corp of Engineers remains steady ➔ upside? DOI ? ✓ ✓ ✓
➢ WILDCARDS?: Disaster recovery? Drought/Flood stress? ✓ ✓ ✓
EXAMPLE: Highway Bill passed back in 2015...

OK, Here’s your highway bill

Nov 2015

House passes $325B highway bill
But… $325B is merely a down payment on a massive upgrading.

http://www.asce.org/failuretoact/
Gateway Project ($30B)… BIG Fed - State Debate

Blue Cities want this – Red States don’t
While CAPEX is forecasted to rebound, a significant decrease in federal funding for water utilities— which has fallen to $4.3 billion in 2014 from $16 billion in 1976— passes the burden onto states, municipalities, and ultimately ratepayers. Residential and sewer bills have increased 5% and 20% annually, respectively since 2000, but their impact is expected to continue falling short of infrastructure needs.
Welcome to Massport:
“Over the past decade, Massport and our transportation partners have invested more than $5 billion to upgrade, improve and modernize our facilities. Massport is self-supporting and receives no state tax money to support its operations or facilities. A recent economic impact report estimates that Massport contributes $8.7 billion a year in economic impact. Funds raised directly from Bond Market with AA rating. [www.massport.com]

KEY PROPERTIES
Logan Int’l Airport (BOS)
Port of Boston Terminals
Multiple sites on several wharfs
Conley Container Terminal
Cruiseport Boston
Tobin Bridge (now with Mass DOT)
Worcester Regional Airport
Hanscom Field local airport
Waterfront Properties (dozens)
MRCTI: Pitch for Resilience Funding

Regions: Why wait for Congress?

Mississippi River Cities & Town Initiative
2018 Federal Policy Platform of the Mayors along the Mississippi River
Recovery, Resilience, and the Pursuit to Conserve and Restore the Nation’s most Valuable Waterway

New York, California and Massachusetts are the top 3 climate-aligned bonds issuers

Bonds were used to finance a diverse range of projects including: urban rail, renewable energy, energy efficiency projects, sewage treatment, recycling and flood defenses. Transport dominates issuance with the majority of debt issued by transit authorities. US municipalities have been raising finance for energy conservation and renewable energy through Qualified Energy Conservation Bonds (QECBs) and Clean Renewable Energy Bonds (CREBs).

Some form of Carbon Tax… a “Pay For”?  

A Carbon tax could raise $100B per year, after some refunds.

To pay for lower corporate tax rates, Republicans need policies which will “pay for” losses of revenue.

Source: Modeling completed by RTI International for CAP.
Diversifying from Basic Bid model; New Approaches

TRADITIONAL PROCUREMENT MODEL
[no revenue prospects; public goods]
Increasingly strained by fiscal deficits…

PROJECT FINANCING MODEL
[Some revenue prospects; leverage]

Congress Appropriations $1B

AGENCY Procurements $1B (of projects)

Bidders

Project Execution

Greater leverage, more projects in more states

Congress $1B

Tax policy Loans

AGENCY Priorities / Projects $1B

State Capitols

$Finance (debt / equity)

$2B-$3B $Revenues

Project Entities

Development Enterprises
Critical Project Elements – Basic

**Private Lenders** (debt capital)
- Credit rating
- Credit subsidy cost of loan (from equity)

**Gov’t Credit Support** *(DOE Loan or Guarantee)*
- Market terms, pricing history (fuels, power)

**Power Off-takers** *(Utilities, Cities, Industrial, others)*
- Off-takers for By-products

**Equity Finance** *(Project Developer)*
- Applicant
- Credit subsidy cost of loan (from equity)

**Advanced Energy Technology Project**
- Critical system suppliers
  - Panels, frames, turbines
  - Vessels, piping
  - Burners, HRSGs, Co-gen
  - Inverters, grid relays

**Engineering Contract (EPC)**
- Fuel Feedstocks
- Feedstock transport (rail, barge, truck)
- Water supply
- Other basic services

**Private Equity sources “Sponsors”**

**Fuel Feedstocks**

**Project Site Selection**
- Community support
  - (public recognition of costs, risks / benefits of GHG savings)
- National Lab or Univ Partner

**Role of Engineering / Enviro Team**

- *Enable Capital via Risk Reduction*
  - Eliminate site risk (interveners)
  - Take out tech performance risk via engineering [Integration risks]
  - Manage Budget / Constr Risks
  - Curb Ops risk via design
  - Contain backend, waste risks

**Source:** WSHowes; ADPaterson, Verdigris Capital LLC
Critical Project Elements, Key Risk Areas – with Policy Incentives

Equity Finance (Project Developer)

Private Lenders (debt capital)

Gov’t Credit Support (loans, long-term purchase agreement)

Power Off-takers (Utilities, Cities, Industrial, others)

Off-takers for any by-products, heat

Equity sources (Institutions, hedge funds, insurance funds)

Credit rating

Market competition, price volatility (fuels, power)

Credit markets (interest rates, credit supply), Insurance

Equity Finance (Project Developer)

Commercial-scale Energy Project

Fuel Feedstocks

Feedstock transport (rail, barge, truck)

Water supply

Other basic services

Fuel Feedstocks

Critical system suppliers
- Reaction vessels, turbines
- Burners, HRSGs, Co-gen
- Inverters, grid relays

State Financial Support

State utility commission for rate review, incentives and Public Benefit Funds

Federal subsidies, and policies for GHG savings and energy reliability

Federal GHG Regulations or national clean energy standards

International pressure for GHG regulations or energy security

Site & Resource Permitting (state agency)

Operating Regulations (various agencies)

Site & Resource Permitting (state agency)

Operating Regulations (various agencies)

Site & Resource Permitting (state agency)

Operating Regulations (various agencies)

Site & Resource Permitting (state agency)

Operating Regulations (various agencies)

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Site & Resource Permitting (state agency)

Operating Regulations (various agencies)

Site & Resource Permitting (state agency)

Operating Regulations (various agencies)

Site & Resource Permitting (state agency)
“Environment as an Issue”

Public Financing…

Where is our Environmental Industry in the public / voters’ mind as an issue, or Policy Priority?

-- Air, Water, Land Pollution
-- Interaction with Energy Landscape, Fracking
-- Urban spaces & Sustainability; “Millennials”
-- Disasters, Storm recovery
PRE-9/11, Jan 2001: Bitterly divisive election (Bush v. Gore), Domestic issues

Feb 2005: Bush re-elected, Iraq War festering, Terrorism > Domestic issues

Most Important Issues to US Public

Feb 2009: Financial crisis; Obama elected with STRONG mandate in Congress

Most Important Issues to US Public

Feb 2013: Obama re-elected, but lost the House. Gridlock, Dissatisfaction

Most Important Issues to US Public

Feb 2017: Dissatisfaction at fever pitch. Republicans elected with Trump

Environmental legislation in 1970s and 1980s helped drive growth, but economic recovery, manufacturing excellence in the 1990s became larger drivers as cleanup markets topped out. Exports comprise about 10% of the total market, concentrated in air, water equipment. Global growth draws on resources.
Environmental SERVICES: Testing, Consulting, Remediation, Industrial waste treatment, Solid waste gathering and disposal
Environmental EQUIPMENT: for Air, Water, Waste
Environmental RESOURCES: Materials, Water, Energy

Drinking water delivery

Recycled Materials
Some Service Sectors slowing. Water, Energy Growing

Backend treatment services – growth in remediation, hazardous waste management, analytical labs and solid waste peaked in the 1980s and will continue to ebb. Energy and water niches, process technologies look to grow with economic drivers, upgrades.

The U.S. Environmental Industry 1990-2020

<table>
<thead>
<tr>
<th>ENVIRONMENTAL INDUSTRY SEGMENT</th>
<th>1990</th>
<th>80-90 Growth</th>
<th>2000</th>
<th>90-00 Growth</th>
<th>2010</th>
<th>00-10 Growth</th>
<th>2020</th>
<th>10-20 Growth</th>
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<tbody>
<tr>
<td>SERVICES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analytical Services</td>
<td>2.1</td>
<td>523%</td>
<td>1.8</td>
<td>-14%</td>
<td>1.9</td>
<td>7%</td>
<td>2.1</td>
<td>12%</td>
</tr>
<tr>
<td>Wastewater Treatment Works</td>
<td>18.4</td>
<td>70%</td>
<td>28.7</td>
<td>56%</td>
<td>45.5</td>
<td>58%</td>
<td>72.8</td>
<td>60%</td>
</tr>
<tr>
<td>Solid Waste Management</td>
<td>26.1</td>
<td>77%</td>
<td>39.4</td>
<td>51%</td>
<td>53.4</td>
<td>35%</td>
<td>65.9</td>
<td>23%</td>
</tr>
<tr>
<td>Hazardous Waste Management</td>
<td>7.1</td>
<td>1082%</td>
<td>8.8</td>
<td>23%</td>
<td>10.0</td>
<td>14%</td>
<td>11.1</td>
<td>11%</td>
</tr>
<tr>
<td>Remediation/Industrial Services</td>
<td>9.9</td>
<td>534%</td>
<td>10.1</td>
<td>3%</td>
<td>12.7</td>
<td>26%</td>
<td>16.9</td>
<td>33%</td>
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<tr>
<td>Consulting &amp; Engineering</td>
<td>12.5</td>
<td>856%</td>
<td>17.4</td>
<td>39%</td>
<td>26.6</td>
<td>53%</td>
<td>33.6</td>
<td>26%</td>
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<tr>
<td>EQUIPMENT</td>
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<td></td>
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<tr>
<td>Water Equipment and Chemicals</td>
<td>13.4</td>
<td>93%</td>
<td>19.8</td>
<td>48%</td>
<td>26.9</td>
<td>36%</td>
<td>38.8</td>
<td>44%</td>
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<tr>
<td>Instruments &amp; Information Systems</td>
<td>2.0</td>
<td>404%</td>
<td>3.8</td>
<td>88%</td>
<td>5.4</td>
<td>44%</td>
<td>7.8</td>
<td>45%</td>
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<tr>
<td>Air Pollution Control Equipment</td>
<td>11.1</td>
<td>144%</td>
<td>19.0</td>
<td>72%</td>
<td>14.9</td>
<td>-22%</td>
<td>19.7</td>
<td>32%</td>
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<tr>
<td>Waste Management Equipment</td>
<td>8.7</td>
<td>92%</td>
<td>10.0</td>
<td>15%</td>
<td>10.8</td>
<td>8%</td>
<td>14.0</td>
<td>30%</td>
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<tr>
<td>Process &amp; Prevention Technology</td>
<td>0.4</td>
<td>418%</td>
<td>1.2</td>
<td>183%</td>
<td>1.9</td>
<td>62%</td>
<td>2.9</td>
<td>54%</td>
</tr>
<tr>
<td>RESOURCES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Utilities</td>
<td>19.8</td>
<td>61%</td>
<td>29.9</td>
<td>51%</td>
<td>45.5</td>
<td>52%</td>
<td>67.5</td>
<td>48%</td>
</tr>
<tr>
<td>Resource Recovery</td>
<td>13.1</td>
<td>114%</td>
<td>16.0</td>
<td>22%</td>
<td>28.5</td>
<td>79%</td>
<td>33.4</td>
<td>17%</td>
</tr>
<tr>
<td>Clean Energy Systems &amp; Power</td>
<td>3.0</td>
<td>-28%</td>
<td>4.0</td>
<td>35%</td>
<td>17.2</td>
<td>327%</td>
<td>57.0</td>
<td>232%</td>
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<tr>
<td>TOTALS:</td>
<td>148</td>
<td>116%</td>
<td>210</td>
<td>42%</td>
<td>301.3</td>
<td>44%</td>
<td>443.5</td>
<td>47%</td>
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</table>

## Environmental Industry Segments

<table>
<thead>
<tr>
<th>Segment</th>
<th>Description</th>
<th>Examples of Clients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental Testing &amp; Analytical Services</strong></td>
<td>Provide testing of &quot;environmental samples&quot; (soil, water, air and some biological tissues)</td>
<td>Regulated industries, Gov't, C&amp;E, Hazardous waste and remediation contractors</td>
</tr>
<tr>
<td>Wastewater Treatment Works</td>
<td>Collection and treatment of residential, commercial and industrial wastewaters.</td>
<td>Municipalities, Commercial Establishments &amp; All industries</td>
</tr>
<tr>
<td>Water Utilities</td>
<td>Selling water to end users: Municipal entities and private companies</td>
<td>Consumers, Commercial, All industries, Institutions</td>
</tr>
<tr>
<td>Solid Waste Management</td>
<td>Collection, processing and disposal of solid waste &amp; commercial collection of recyclables</td>
<td>Municipalities &amp; All industries</td>
</tr>
<tr>
<td>Hazardous Waste Management</td>
<td>Collection, processing and disposal of hazardous, medical waste, nuclear waste</td>
<td>Chemical, Petroleum, Mfgs, Government agencies</td>
</tr>
<tr>
<td>Remediation and Industrial Services</td>
<td>Cleanup of contaminated sites, buildings and environmental cleaning of operating facilities</td>
<td>Government agencies, Property owners, Developers, Industry</td>
</tr>
<tr>
<td>Environmental Consulting &amp; Engineering (C&amp;E)</td>
<td>Engineering, consulting, design, assessment, permitting, project management, O&amp;M, monitoring, etc.</td>
<td>Industry, Government, Municipalities, Waste Mgmt. companies, POTWs</td>
</tr>
</tbody>
</table>
Progress: Leaking Underground Storage Tanks

Military families exposed to contaminated housing
By USMC Life - December 11, 2017
http://usmclife.com/2017/12/military-families-exposed-contaminated-housing/
### Environmental Equipment

<table>
<thead>
<tr>
<th>Environmental Equipment</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Equipment &amp; Chemicals</td>
<td>Provide equipment, supplies and maintenance in the delivery and treatment of water and wastewater.</td>
<td>Municipalities &amp; All industries</td>
</tr>
<tr>
<td>Instruments &amp; Information Systems</td>
<td>Produce instrumentation for the analysis of environmental samples. Includes info systems and software.</td>
<td>Analytical services, Gov't Regulated companies</td>
</tr>
<tr>
<td>Air Pollution Control Equipment</td>
<td>Produce equipment and tech. to control air pollution. Includes vehicle controls.</td>
<td>Utilities, Waste-to-energy, Industries, Auto industry</td>
</tr>
<tr>
<td>Waste Management Equipment</td>
<td>Equipment for handling, storing or transporting solid, liquid or haz waste. Includes recycling/remediation equipment.</td>
<td>Municipalities, Generating industries, Solid waste companies</td>
</tr>
<tr>
<td>Process &amp; Prevention Technology</td>
<td>Technology for in-process pollution prevention and waste recovery</td>
<td>All industries</td>
</tr>
</tbody>
</table>

### Environmental Resources

<table>
<thead>
<tr>
<th>Environmental Resources</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Utilities</td>
<td>Selling water to end users</td>
<td>Consumers, Municipalities &amp; All industries</td>
</tr>
<tr>
<td>Resource Recovery</td>
<td>Selling materials recovered and converted from industrial by-products or post-consumer waste</td>
<td>Municipalities, Generating industries, Solid waste companies</td>
</tr>
<tr>
<td>Clean Energy Power &amp; Systems</td>
<td>Solar, wind, biomass, fuel cell, geothermal, and wave &amp; tidal: Systems sales and Power value</td>
<td>Utilities, All industries and consumers</td>
</tr>
</tbody>
</table>
Business Impact in Environmental / Clean Energy

POLICY LANDSCAPE

Favorable

Infrastructure
Defense spending
Commercial Development
Brownfield conversion
Resilience planning?

Urban renewal
Hydro / Bio / Geo
Base closure / BRAC
Water services (low rates)

Road Infrastructure
Energy Infrastructure
-- LNG, pipelines, grid upgrades
Fracking
Disaster Recovery

Financing

Political shift, State action

Market Growth

Wind & Solar / CleanTech
Sustainable Development (Foreign)
Wastewater treatment
Nuclear decommissioning?
WATER

Here is the link to our survey
www.surveymonkey.com/r/WaterWasteWaterMarket

The U.S. Water Industry 1993-2016 ($mil)

## The U.S. Water Industry, 2014-2016 ($bil)

<table>
<thead>
<tr>
<th>Water Industry Segments</th>
<th>2014 ($mil)</th>
<th>2015 ($mil)</th>
<th>2015 Growth</th>
<th>2016-17 Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Treatment Equipment</td>
<td>12,400</td>
<td>12,670</td>
<td>2.2%</td>
<td>3-4%</td>
</tr>
<tr>
<td>Delivery &amp; Infrastructure Equipment *</td>
<td>13,370</td>
<td>13,640</td>
<td>2.0%</td>
<td>2-3%</td>
</tr>
<tr>
<td>Chemicals (Bulk &amp; Specialty)</td>
<td>4,920</td>
<td>5,020</td>
<td>2.1%</td>
<td>0-2%</td>
</tr>
<tr>
<td><strong>Water Equipment &amp; Chemicals</strong></td>
<td><strong>30,690</strong></td>
<td><strong>31,330</strong></td>
<td><strong>2.1%</strong></td>
<td><strong>2-3%</strong></td>
</tr>
<tr>
<td>Contract Operations *</td>
<td>3,240</td>
<td>3,320</td>
<td>2.6%</td>
<td>2-4%</td>
</tr>
<tr>
<td>Consulting &amp; Design Engineering</td>
<td>10,430</td>
<td>10,790</td>
<td>3.5%</td>
<td>3-5%</td>
</tr>
<tr>
<td>Maintenance Services *</td>
<td>2,150</td>
<td>2,200</td>
<td>2.4%</td>
<td>2-3%</td>
</tr>
<tr>
<td><strong>Water/Wastewater Services</strong></td>
<td><strong>15,820</strong></td>
<td><strong>16,310</strong></td>
<td><strong>3.1%</strong></td>
<td><strong>3-4%</strong></td>
</tr>
<tr>
<td>Instruments</td>
<td>1,370</td>
<td>1,450</td>
<td>5.8%</td>
<td>5-7%</td>
</tr>
<tr>
<td>Analytical Services</td>
<td>1,000</td>
<td>1,020</td>
<td>1.5%</td>
<td>1-2%</td>
</tr>
<tr>
<td>Wastewater Treatment Works</td>
<td>55,860</td>
<td>57,590</td>
<td>3.1%</td>
<td>3-5%</td>
</tr>
<tr>
<td>Water Utilities</td>
<td>51,980</td>
<td>53,770</td>
<td>3.4%</td>
<td>2-4%</td>
</tr>
<tr>
<td><strong>Total Water Industry</strong></td>
<td><strong>156,720</strong></td>
<td><strong>161,470</strong></td>
<td><strong>3.0%</strong></td>
<td><strong>3-4%</strong></td>
</tr>
</tbody>
</table>

* *Delivery Equipment is pipes, fixtures, pumps*


Top U.S. Water Equipment & Chemicals Companies (listed by global WE&C revenues in 2015)

>$4 Billion
- EcoLab (Nalco)
- Pentair

>$2-4 Billion
- Xylem (formerly ITT)
- GE Water & Process Technologies
- Danaher

>$1-2 Billion
- Solenis (formerly Ashland water tech.)
- Watts Water Technologies
- Evoqua (AEA Investors, fm: Siemens/USF)
- Mueller Water
- Pall Corp. (acq’d by Danaher 5/2015)

>$500-1,000 Million
- Dow Water and Process Solutions
- Culligan International (Centerbridge)
- Rexnord
- Calgon Carbon

>$200-500 Million
- Roper Technologies, Inc
- Koch Membrane Systems Inc.
- Marmon Group
- Gorman-Rupp
- Axel Johnson (Parkson, Kinetico in USA)
- 3M Purification Inc. (Cuno)
- Cabot Corporation

Universe of U.S. Water Equipment & Chemicals Companies in 2015

<table>
<thead>
<tr>
<th>WE&amp;C Global Revenues</th>
<th>Firms</th>
<th>Total</th>
<th>Average</th>
<th>Export %</th>
<th>Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;$1 Billion</td>
<td>10</td>
<td>$26,470</td>
<td>2,647</td>
<td>42%</td>
<td>$11,100</td>
</tr>
<tr>
<td>$500-1,000 Million</td>
<td>6</td>
<td>4,300</td>
<td>716</td>
<td>32%</td>
<td>1,380</td>
</tr>
<tr>
<td>$200-500 Million</td>
<td>14</td>
<td>3,780</td>
<td>270</td>
<td>26%</td>
<td>980</td>
</tr>
<tr>
<td>$100-200 Million</td>
<td>20</td>
<td>2,520</td>
<td>126</td>
<td>16%</td>
<td>400</td>
</tr>
<tr>
<td>$50-100 Million</td>
<td>30</td>
<td>2,040</td>
<td>68</td>
<td>8%</td>
<td>160</td>
</tr>
<tr>
<td>$20-50 Million</td>
<td>50</td>
<td>1,400</td>
<td>28</td>
<td>6%</td>
<td>80</td>
</tr>
<tr>
<td>&lt;$20 Million</td>
<td>220+</td>
<td>730</td>
<td>3.3</td>
<td>2%</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>350</td>
<td>$41,230</td>
<td>118</td>
<td>34%</td>
<td>$14,140</td>
</tr>
</tbody>
</table>

Source: EBJ database of Water Equipment & Chemicals companies, based on surveys, interviews and compiled research on public and private companies. Errors and omissions are unintentional.
Water/Wastewater, 2000 – 2016

Water/Wastewater in the $30-Billion U.S. Environmental Consulting & Engineering Industry, 2000-2016

$30B

Source: EBI annual model of the Environmental Consulting & Engineering industry based on surveys, interviews and revenue compilations of C&E firms. Note: Water/Wastewater accounted for more than 50% of C&E revenues in the 1970s and grew in revenues but dipped to a 22% by the early 1990s and grew to 37% in 2014. C&E services in water include analysis, design, construction management, compliance and O&M.
Top Firms in Water Segments

### Top 40 Water/Wastewater C&E Firms in 2015 ($mil)

<table>
<thead>
<tr>
<th>Firm, HQ City, Revenues in $mil</th>
<th>Gross</th>
<th>Total Water</th>
<th>Water C&amp;E</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH2M, Englewood, Colo.</td>
<td>5,992</td>
<td>1,457</td>
<td>1,095</td>
</tr>
<tr>
<td>Tetra Tech, Pasadena, Calif.</td>
<td>2,280</td>
<td>1,095</td>
<td>1,095</td>
</tr>
<tr>
<td>AECOM, Los Angeles, Calif.</td>
<td>17,817</td>
<td>1,069</td>
<td>839</td>
</tr>
<tr>
<td>MWH Global, Broomfield, Colo.2</td>
<td>1,320</td>
<td>1,178</td>
<td>653</td>
</tr>
<tr>
<td>Black &amp; Veatch, Overland Park, Kan.</td>
<td>2,963</td>
<td>648</td>
<td>372</td>
</tr>
<tr>
<td>HDR, Omaha, Neb.</td>
<td>2,123</td>
<td>363</td>
<td>363</td>
</tr>
<tr>
<td>CDM Smith, Boston, Mass.</td>
<td>1,275</td>
<td>836</td>
<td>309</td>
</tr>
<tr>
<td>Arcadis NV, Amsterdam, Holland</td>
<td>3,823</td>
<td>442</td>
<td>247</td>
</tr>
<tr>
<td>Brown and Caldwell, Walnut Creek, Calif.</td>
<td>341</td>
<td>246</td>
<td>246</td>
</tr>
<tr>
<td>Carollo Engineers, Walnut Creek, Calif.</td>
<td>212</td>
<td>212</td>
<td>212</td>
</tr>
<tr>
<td>Stantec, Edmonton, Alberta, Canada</td>
<td>2,260</td>
<td>238</td>
<td>203</td>
</tr>
<tr>
<td>Hazen And Sawyer, New York, N.Y.</td>
<td>183</td>
<td>183</td>
<td>183</td>
</tr>
<tr>
<td>Ramboll Environ, Copenhagen, Denmark</td>
<td>1,617</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Michael Baker International, Pittsburgh</td>
<td>501</td>
<td>95</td>
<td>87</td>
</tr>
<tr>
<td>Burns &amp; Mcdonnell, Kansas City, Mo.</td>
<td>2,766</td>
<td>83</td>
<td>83</td>
</tr>
<tr>
<td>Woodard &amp; Curran, Portland, Maine</td>
<td>161</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Mott MacDonald, Iselin, Nj</td>
<td>520</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>Louis Berger, Morristown, N.J.</td>
<td>981</td>
<td>129</td>
<td>77</td>
</tr>
<tr>
<td>Kleinfelder, San Diego, Calif.</td>
<td>319</td>
<td>76</td>
<td>76</td>
</tr>
<tr>
<td>WSP</td>
<td>Parsons Brinckerhoff, Montreal</td>
<td>5,777</td>
<td>182</td>
</tr>
<tr>
<td>Greeley and Hansen, Chicago, Ill.</td>
<td>76</td>
<td>76</td>
<td>76</td>
</tr>
<tr>
<td>Amec Foster Wheeler, Alpharetta, Ga.</td>
<td>8,090</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Kennedy/Jenks Consultants, San Francisco</td>
<td>84</td>
<td>61</td>
<td>61</td>
</tr>
<tr>
<td>Freese and Nichols, Fort Worth, Texas</td>
<td>93</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>
Latest EBJ Survey on Major Client Sectors for 2017

<table>
<thead>
<tr>
<th>Rank</th>
<th>2017 Major Client Sector</th>
<th>Very strong</th>
<th>Strong</th>
<th>Good</th>
<th>Slow growth</th>
<th>Flat</th>
<th>Modest decline</th>
<th>Big decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil &amp; Gas Midstream (pipelines/terminals)</td>
<td>11%</td>
<td>25%</td>
<td>40%</td>
<td>18%</td>
<td>5%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>Electronics/IT mfg. &amp; service</td>
<td>7%</td>
<td>27%</td>
<td>25%</td>
<td>31%</td>
<td>9%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>Chemical Manufacturing</td>
<td>2%</td>
<td>28%</td>
<td>35%</td>
<td>24%</td>
<td>11%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>Oil &amp; Gas Upstream (E&amp;P)</td>
<td>5%</td>
<td>18%</td>
<td>42%</td>
<td>24%</td>
<td>7%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>Oil &amp; Gas Downstream (refineries)</td>
<td>4%</td>
<td>21%</td>
<td>32%</td>
<td>34%</td>
<td>7%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>Healthcare</td>
<td>4%</td>
<td>18%</td>
<td>33%</td>
<td>27%</td>
<td>13%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>7</td>
<td>Transportation mfg (auto &amp; aero)</td>
<td>4%</td>
<td>18%</td>
<td>33%</td>
<td>27%</td>
<td>13%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>8</td>
<td>Federal government: DOD</td>
<td>10%</td>
<td>23%</td>
<td>23%</td>
<td>13%</td>
<td>17%</td>
<td>10%</td>
<td>3%</td>
</tr>
<tr>
<td>9</td>
<td>Water utilities</td>
<td>0%</td>
<td>25%</td>
<td>33%</td>
<td>25%</td>
<td>15%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>10</td>
<td>Banks &amp; Law Firms</td>
<td>0%</td>
<td>22%</td>
<td>31%</td>
<td>35%</td>
<td>13%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>11</td>
<td>Power utilities</td>
<td>2%</td>
<td>16%</td>
<td>46%</td>
<td>21%</td>
<td>12%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>12</td>
<td>Port authorities</td>
<td>2%</td>
<td>18%</td>
<td>37%</td>
<td>27%</td>
<td>12%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>13</td>
<td>Transportation authorities</td>
<td>5%</td>
<td>13%</td>
<td>33%</td>
<td>33%</td>
<td>13%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>14</td>
<td>Consumer products</td>
<td>0%</td>
<td>17%</td>
<td>41%</td>
<td>30%</td>
<td>11%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>15</td>
<td>Property developers: commercial</td>
<td>3%</td>
<td>16%</td>
<td>31%</td>
<td>36%</td>
<td>7%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>16</td>
<td>Property developers: residential</td>
<td>2%</td>
<td>14%</td>
<td>28%</td>
<td>42%</td>
<td>12%</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td>17</td>
<td>Hospitality</td>
<td>0%</td>
<td>11%</td>
<td>41%</td>
<td>35%</td>
<td>13%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>18</td>
<td>Food &amp; beverage</td>
<td>0%</td>
<td>11%</td>
<td>33%</td>
<td>41%</td>
<td>13%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>19</td>
<td>Other manufacturing</td>
<td>0%</td>
<td>8%</td>
<td>43%</td>
<td>32%</td>
<td>15%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>20</td>
<td>Metals fabricating/coating</td>
<td>0%</td>
<td>7%</td>
<td>37%</td>
<td>39%</td>
<td>15%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>21</td>
<td>Mining</td>
<td>4%</td>
<td>7%</td>
<td>32%</td>
<td>35%</td>
<td>15%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>22</td>
<td>Primary metals</td>
<td>2%</td>
<td>4%</td>
<td>33%</td>
<td>30%</td>
<td>20%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>23</td>
<td>Solid waste utilities &amp; companies</td>
<td>0%</td>
<td>5%</td>
<td>25%</td>
<td>46%</td>
<td>21%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>24</td>
<td>Petroleum retail/gas stations</td>
<td>4%</td>
<td>5%</td>
<td>20%</td>
<td>27%</td>
<td>35%</td>
<td>9%</td>
<td>0%</td>
</tr>
<tr>
<td>25</td>
<td>Education</td>
<td>0%</td>
<td>9%</td>
<td>27%</td>
<td>27%</td>
<td>27%</td>
<td>11%</td>
<td>0%</td>
</tr>
<tr>
<td>26</td>
<td>State government</td>
<td>0%</td>
<td>5%</td>
<td>25%</td>
<td>34%</td>
<td>28%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>27</td>
<td>Major retailers</td>
<td>0%</td>
<td>7%</td>
<td>19%</td>
<td>44%</td>
<td>19%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>28</td>
<td>Renewable energy development</td>
<td>2%</td>
<td>7%</td>
<td>28%</td>
<td>30%</td>
<td>13%</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>29</td>
<td>Pulp &amp; paper</td>
<td>0%</td>
<td>4%</td>
<td>15%</td>
<td>37%</td>
<td>35%</td>
<td>9%</td>
<td>0%</td>
</tr>
<tr>
<td>30</td>
<td>Local government</td>
<td>0%</td>
<td>5%</td>
<td>25%</td>
<td>31%</td>
<td>27%</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>31</td>
<td>Federal government DOE</td>
<td>0%</td>
<td>5%</td>
<td>20%</td>
<td>18%</td>
<td>41%</td>
<td>10%</td>
<td>7%</td>
</tr>
<tr>
<td>32</td>
<td>Federal government Other</td>
<td>0%</td>
<td>0%</td>
<td>7%</td>
<td>17%</td>
<td>37%</td>
<td>32%</td>
<td>7%</td>
</tr>
<tr>
<td>33</td>
<td>Federal government EPA</td>
<td>0%</td>
<td>0%</td>
<td>2%</td>
<td>10%</td>
<td>17%</td>
<td>42%</td>
<td>30%</td>
</tr>
</tbody>
</table>
West Virginia, China Energy Deal Valued at $83 Billion – Nov 2017
The size of the proposed investment is larger than the state’s GDP. China Energy Investment Corp. plans to invest $83.7 billion in shale gas development and chemical manufacturing projects in the state over two decades.

EIA July 5, 2017:  www.eia.gov/naturalgas/weekly/
USA: Swing exporter in Global Gas

- November 2016: U.S. becomes net exporter of natural gas for first time in 60 years
- By 2040, LNG exports will exceed 6.7 trillion tcf

Only four countries—the United States, Canada, China, and Argentina—have commercial shale gas production. These countries (plus Mexico, Algeria) are projected to account for 70% of global shale production by 2040. Shale gas production accounted for more than half of U.S. natural gas production in 2015 and is projected to more than double from 37 Bcf/d in 2015 to 79 Bcf/d by 2040, which is 70% of total U.S. natural gas production in the AEO2016 Reference case by 2040.
Fossil Jobs in Fracking. ACC upbeat about growth

Red States want this -- Blue Cities don’t

Through 2021: Meeting Demand Critical to Job Creation, U.S. Manufacturing Growth

Units: Billion CF/day
[US consumption = 29 tcf per year]

American Chemistry Council, 2016:
USA is seen as a favorable investment location and petrochemical producers have announced significant expansions of capacity in the U.S., reversing a decade-long decline. Gains to basic olefins capacity are estimated to range from 35% to 40%. Over 260 new chemical production projects, valued at over $161 billion have been announced through late-May 2016; 61% of these are foreign direct investment.

- Natural gas demand growth to continue through 2021 and beyond
- U.S. energy security requires unlocking low-cost production

Boston importing Russian LNG!

Cheap gas in N.America = Chemical makers moving back ON-SHORE.
Growth Industry… Storm Recovery, Resilience

KATRINA ($120B, Aug 2005)

IRENE ($17B, Aug 2011)

SANDY ($75B, Nov 2012)

HARVEY ($180B, July 2017)

IRMA ($62, Aug 2017)

Andrew ($26B, 1992)

MARIA ($90, Sept 2017)

NOAA: Disaster Event Damage since 1980

1980-2017 Year-to-Date United States Billion-Dollar Disaster Event Cost (CPI-Adjusted)

- 2004
- 2008
- 2011
- 2012
- 2005
- 2017
- Average

Billions of Dollars

- 2017
  - Harvey, Irma, Maria

- 2005
  - Katrina

- 2012
  - Sandy in NY/NJ

How are we paying for Disaster? …“Fix on failure”
OUTLOOK
…Congressional Landscape for 2018-20
SENATE 2018: 10 Ds and 2 Rs most vulnerable

10 States won by Trump with a Democrat Senator
[This is the Obama 2012 class of Senators]

DEMOCRATS (10)
IN – J. Donnelly
MT – J. Tester
ND – H. Heitkamp
FL – B. Nelson
WI – T. Baldwin
PA – B. Casey
OH – S. Brown
MI – D. Stabenow
MO – C. McCaskill

REPUBLICANS (2)
NV – Heller
AZ – J. Flake

States targeted by Democrats

http://www.centerforpolitics.org/crystalball/
Possible US House 2019; Dems +30-ish

The Rise of Polarization by City, County… State

More and more counties are uncompetitive
Counties where presidential candidates won the two-party popular vote by more than 20 percentage points

Purple America Has All But Disappeared
Counties are increasingly super red or super blue, with less and less in between.
David Wasserman, 538    March 2017

1992 | 2016
---|---
Counties “Locked” | 40% | 60%
Counties “in play” | 1,090 | 300
difference <10% | 1,090 | 300

https://fivethirtyeight.com/features/purple-america-has-all-but-disappeared/
PLOS: Cooperative Modeling of Bipartisan Action / Pairing in Congress

THE UN-DECLARED DIVORCE – A “BIG SORT”

PLOS [April 2015] Advanced modeling: Networks are drawn using a linear-attraction linear-repulsion model with Barnes Hut optimization
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0123507#pone.0123507.ref033

Avoid Contamination!

www.youtube.com/watch?v=tEczkhfLwqM
Republicans will lose some Governors in 2018, but most likely in BLUE States. So, the Red State / Blue City divide will continue to Intensify. Watch FL for 2020. Then OH and PA, plus IL, MI, WI set the RustBelt battlefield for 2020.
DailyKos: States Legislatures after 2016

Trump had nothing to do with recapture of State Legislatures by GOP… building since 1990
Democrats let their dominance from 1970s slowly erode; while GOP built up ground game. “Southern Democrats” slowly vanished. The Gingrich Revolution in 1994 was a Tremor.
Climate Policy Varies a lot by State

Blue States lead on Climate Policies… now with less Federal support

http://www.environmentalbusiness.org/#!Mixed-Reactions-Across-the-Board-on-the-Final-EPA-Clean-Power-Plan/c20ud/55c3eb6a0cf2be396baa36a6
2016: 26 states sued EPA to stop CPP

… all of them, but for NJ, voted for Trump in 2016

The Clean Power Plan

Battle Lines – The States Divided

West Virginia and 23 states filed a suit vs. the EPA in the U.S. Court of Appeals for the District of Columbia Circuit. Oklahoma, North Dakota, and Mississippi each filed suits. Eighteen States support CPP

www.scottmadden.com/insight/the-clean-power-plan/
Was EPA Clean Power Plan used by New England and CA to raise electricity rates in the rest of the country – manufacturing competitiveness? The Prime Authors of Climate bills were from CA and MA; most costly states.
America First: Development & Adaptation

➢ EPA will drive less business after cutbacks
  -- But, even real estate developers need permits signed!

➢ Budget: Hitch a ride on DOD uptick

➢ Trump / GOP want DEVELOPMENT, Growth
  -- Dems taking House will force Urban Priorities up the agenda

➢ Energy policy: cheap “Fossil First” ➔ Chemicals

➢ Play into Infrastructure at State and Fed level: BOTH
  -- Fed funding will be scattered; States set priorities, options, PPP
  -- “Restoration Redux”: Grids & Pipelines + Fed Lands (privatize)
  -- More Infrastructure will be funded via Bond Market (Massport model)

➢ Climate Adaptation, “Resilience”. Technologies.

➢ Red States vs Blue Cities INTENSIFIES thru 2020
APPENDIX – Some Global Notes
Center of Economic Gravity shifting further to Asia
IEA: Change in Primary Energy Demand to 2040

WEO: Where is the growth now…? Developing Asia

Change in primary energy demand, 2016-40 (Mtoe)
World Energy Outlook 2017

No growth
-30 United States

Negative
-200 Europe
135 Eurasia

-50 Japan

Negative
790 China
480 Middle East

India
420 Southeast Asia

270 Central & South America
485 Africa

www.iea.org/weo2017/
The World has shifted -- we are not the Center…

200m people use 600 GWs (80 GWs of nuclear energy)

How much energy will be used by 4 BILLION people (20x as many) by 2050?

Electricity consumption has doubled since 1995 to 25,000 TWh
WRI: Global Water Stress – and National Security

WRI: Water stress is not just a Developing World problem. Western USA.
WHO: Impact of urbanization -- “By 2025, half of the world’s population will be living in water-stressed areas.” BIG need for fresh water supply

Projected Water Stress in 2030

Battle for Nile River Resources

200m people affected
6.5 GW Renaissance Dam [Ethiopia]

RE-framing the Value Proposition: “LIFE SUPPORT SYSTEMS”, not just power

- More than electricity
- Reliability for large cities
- Hybrid systems
  - Potable water
  - Transport sector
  - Chemical synthesis, fuels

Largest Desalination Plant in world (220m Gal/day)

Downtown Seoul, ROK
7,000 electric buses by 2025

Ras Al-Khair, KSA
$7.2B project; 2,400 MWs