2021-2022 Better Buildings WEBINAR SERIES

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Bri Colon
U.S. Department of Energy

John O’Neill
U.S. Department of Energy
Better Buildings, Better Plants Water Savings Network

**What is it?**
- A network of Better Buildings, Better Plants partners that participate in peer exchange activities and gain recognition for their proven solutions
- Partners can work with DOE to track a water reduction goal across all or a portion of their portfolios

**What do Organizations Commit To?**
- Participants are encouraged to set water use intensity goals for all or a part of their portfolio (e.g., in water-stressed regions), and/or contribute in one or more of the following ways:
  - Track and share water savings progress
  - Publish a case study on the Better Buildings Solution Center
  - Share best practices and lessons learned through peer exchanges
  - Document the ways water efficiency impacts other priority areas such as energy reduction, resilience, equity, and workforce development
<table>
<thead>
<tr>
<th>Water Savings Network Partners</th>
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<tbody>
<tr>
<td>• Aeon</td>
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<tr>
<td>• Alachua County Public Schools, FL</td>
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<tr>
<td>• Albuquerque Public Schools, NM</td>
</tr>
<tr>
<td>• Anthem, Inc.*</td>
</tr>
<tr>
<td>• Atlanta, GA*</td>
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<tr>
<td>• Aurora Public Schools, CO</td>
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<td>• BD</td>
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<tr>
<td>• Bentley Mills</td>
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<tr>
<td>• The Boston Land Company</td>
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<tr>
<td>• Carlisle, LLC (Wendy’s franchisee)</td>
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<tr>
<td>• CommonWealth Partners</td>
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<tr>
<td>• Corcoran Management</td>
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<tr>
<td>• Cummins, Inc.*</td>
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<td>• DWS</td>
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<td>• Electrolux</td>
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<td>• Ford Motor Company</td>
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<td>• Fort Worth, TX</td>
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<td>• Foundation Communities</td>
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<td>• Gateway Management Services, LLC</td>
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<td>• General Motors*</td>
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<td>• HARBEC</td>
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<td>• Hillsboro, OR</td>
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<td>• JBG Smith</td>
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<td>• Jonathan Rose Companies</td>
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<td>• Keene Housing*</td>
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<td>• King County Housing Authority</td>
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<td>• Kohl’s</td>
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<td>• Los Angeles Unified School District, CA</td>
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<td>• Madison City Schools, AL</td>
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<td>• Mayo Clinic</td>
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<td>• Mercy Housing</td>
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<td>• Mesa County Valley School District, CO</td>
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<td>• New Bedford Housing Authority</td>
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<td>• NHT Communities</td>
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<td>• Nissan North America</td>
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<td>• North Carolina (State of)</td>
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<td>• Nuveen</td>
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<td>• Parkway</td>
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<td>• PNC Financial Services Group</td>
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<td>• Poudre School District, CO*</td>
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<td>• Reno, NV</td>
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<tr>
<td>• Saint-Gobain Corporation</td>
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<td>• Shari’s Cafe &amp; Pies*</td>
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<td>• Shorenstein Properties LLC</td>
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<tr>
<td>• Staples*</td>
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<tr>
<td>• Tenderloin Neighborhood Development Corporation*</td>
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<td>• The Tower Companies*</td>
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<tr>
<td>• Toyota Motor Engineering &amp; Manufacturing North America</td>
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<tr>
<td>• Trinity Management</td>
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<td>• U.S. General Services Adminstration (GSA)</td>
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<td>• University of Maryland Medical Center</td>
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<td>• University of Nebraska Medical Center*</td>
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<td>• USAA Real Estate</td>
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<td>• The Wendy’s Company</td>
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<td>• Wendium of Florida (Wendy’s franchisee)</td>
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<td>• West Palm Beach, FL</td>
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Up to date list of partners can be found on the Solution Center via the Water Savings Network page [link](#)
Please go to www.slido.com
using your mobile device, or by opening a new window

Enter Event Code

#DOE
Welcome polls

We want to learn more about you!

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Today’s Presenters

Prakash Rao
Lawrence Berkeley National Laboratory

Dave Crum
Highwoods Properties

Bob Bechtold
HARBEC
Prakash Rao
Lawrence Berkeley National Laboratory
Glass Half-Full: Saving Money by Saving Water

Prakash Rao, Ph.D.

January 11, 2022
Outline

Improving the business case for water savings:

• Considering avoided risks
• Using a more comprehensive valuation of water
• Seeking low or no cost opportunities
Risks to manufacturing water supplies

Water risks overall (what the scientists are saying):
- Increase in drought risks throughout US
- Aridification and multidecadal droughts throughout Western US
- Deteriorating water quality due to climate change and human impacts
- Timing of water availability changing

Subsector | % intake in counties with WaSSI* > 1
---|---
Primary metal | 35
Fabricated metal product | 10
Transportation equipment | 10
Petroleum and coal product | 9
Plastics and rubber products | 9
Nonmetallic mineral product | 8
Machinery | 8
Food | 7
Computer and electronic product | 7
Beverage and tobacco product | 6
Paper | 6

*Water Supply Stress Index: ratio of anthropogenic water use rates to natural water replenishment rates


Source: Kenneth Streepak et al 2010 Environ. Res. Lett. 5 044012; Climate change and the aridification of North America

Appreciating the full value of water

- Dow Chemical Company quantified financial impact of water loss at a facility in TX to be $900M (30-year NPV)
- Cummins calculated true cost to be 3-5x billed water costs and 10-12x for high energy/water intensive operations

### Unilever:

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
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<tbody>
<tr>
<td>Product Category</td>
<td>Laundry products</td>
<td>Laundry products</td>
<td>Beverages</td>
<td>Hair products</td>
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<tr>
<td>Baseline water stress</td>
<td>3.61</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Days of inventory</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Purchase price of water (2016$/m³)</td>
<td>2.36</td>
<td>0</td>
<td>0.14</td>
<td>0.62</td>
</tr>
<tr>
<td>Process &amp; handling cost (2016$/m³)</td>
<td>0.62</td>
<td>0.62</td>
<td>0.62</td>
<td>0.62</td>
</tr>
<tr>
<td>Business disruption cost (2016$/m³)</td>
<td><strong>0.77</strong></td>
<td><strong>8.94</strong></td>
<td><strong>2.09</strong></td>
<td><strong>1.63</strong></td>
</tr>
<tr>
<td>True value of water (2016$/m³)</td>
<td>3.75</td>
<td>9.56</td>
<td>2.85</td>
<td>2.87</td>
</tr>
<tr>
<td>% increase from purchase price to true value of water</td>
<td>59%</td>
<td>N/A</td>
<td>1936%</td>
<td>363%</td>
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</table>

Closer examination of the true cost of water

- True cost of water = cost of water + related energy + related chemicals
- Using true cost of water can help you identify your most expensive water uses
- Case studies developed by Oak Ridge National Lab for three diverse manufacturing plants show contribution of true cost of water from each step of water flow through a plant
- In all cases, sourcing water and wastewater treatment contribute significantly to true cost

Picking the low hanging fruit

Example: water reuse

- For compliance purposes, some manufacturers already treat their wastewater before discharge
- In some cases, it may be possible to reuse these treated wastewaters without further treatment
- Other potentially low-cost reuse opportunities: increasing cycles of concentration on cooling tower, cascade rinses, recycle non-contact cooling water

## Conclusion – improving the business case for water savings

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Challenges</th>
</tr>
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<tbody>
<tr>
<td>• Operational resiliency</td>
<td>• Resources and technical assistance not widely available, though organizations like DOE are stepping up to fill this gap</td>
</tr>
<tr>
<td>• Cost savings</td>
<td>• Water efficiency and management principles are less developed and promoted than energy efficiency and management principles</td>
</tr>
<tr>
<td>• Not just water, but energy, chemicals, regulatory costs too</td>
<td>• Less financial incentive to invest and/or reduce</td>
</tr>
<tr>
<td>• Some opportunities are no cost/low cost</td>
<td>• But plenty of other drivers: regulation, business risk, community access</td>
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<tr>
<td>• Improved public image</td>
<td>• Lack of data</td>
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<tr>
<td>• Helps EE program</td>
<td></td>
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<tr>
<td>• Allows for growth and planning</td>
<td></td>
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</tbody>
</table>
Dave Crum
Highwoods Properties
Water Savings at Highwoods Properties

Dave Crum
January 11, 2022
Overview

• About Us
• Water Savings Technologies
• Irrigation Analysis and Results
Highwoods At A Glance

- Founded in 1978 in Raleigh, NC
- NYSE listed in 1994
- Portfolio
  - 8 markets across the Southeast US & Pennsylvania
  - 182 buildings
  - 28 million rentable square feet
  - Primarily Commercial Office buildings
“Highwoods Properties is firmly committed to reducing the environmental impacts of our operations and making the communities within which we operate better places to live and work.”

-Ted Klinck, President and CEO
Highwoods Sustainability - Key Facts

- Close to 90% of our utility spend is electricity
- The next largest utility is water (and getting larger over time)

**LiveMeter**
- 165 Buildings
- 15 Water Meters
- 200+ Energy Meters
- 95% Of Our Actively Managed Electricity
- $17m Controls Modernization In Process

**Sustainability Projects**
- Over 100,000 LED lamps and fixtures installed
- 72 high-efficiency chillers installed since 2009
- 9000 HP of variable frequency drives
- Hundreds of Water-efficient fixtures
- 60+ Electric Vehicle Charging Stations
- Cooling Tower Water Treatment Updates

**21 LEED Buildings Certified**

**PROUD PARTNER**
Main Water Focus in Our Buildings

Restrooms

Cooling

Landscaping
Restrooms

Primarily Using Low Flow Fixtures...and Regular Maintenance

Low Flow Fixtures aren’t new, but we’ve learned a few things about them that may get overlooked...

- **Battery operated vs hard wired fixtures**
  - Batteries need to be replaced every 3-5 years
  - Hard wired fixtures can cost much more to install
  - Need to weigh first cost vs maintenance

- **Retrofitting low flow flush valves**
  - We’ve had really mixed results with the retrofits
  - Older porcelain designed for 3.5 gal/flush can clog or require multiple flushes without enough flow

**Regular Maintenance** - our Maintenance Engineers go through each restroom at least weekly to ensure that toilets and faucets aren’t leaking
Our Cooling Tower Strategy involves

- **Automatic Water Treatment**
  - Prevents overuse of chemicals
  - Prevents corrosion and fouling of pipes, basins, hot decks, etc
  - Keeps water use low by reducing blowdown
  - Connected to our BMS for remote monitoring and alarms

- **Stainless Steel Hot Decks and Basins** to prevent premature corrosion

- **Cell Isolation** – allows for running just part of the cooling tower in cool weather or under low load. Saves water, energy, and $$$

- **Scheduling** – not running the cooling system during off-hours saves water and energy. Everybody wins!

- **Control Strategy for Tenant Loads** – where we have after hours tenant loads on our tower loop, we try to raise the loop temp (in accordance with manufacturers’ recommendations) to keep the towers from running.

- **Regular Tower Condition Assessments**
Irrigation Analysis

Every good plan starts with an analysis, this one created by Jimmy Lewis, one of our Environmental Engineering Co-op students from NC State. His novel process included

- **Find Irrigatable Area**
  - Jimmy ran Google Earth images through the MKWeb Color Summarizer
  - He used the output (% of each color) to determine how much of the image was green space and multiplied this by the amount of exposed land on the parcel

- **Normalize Building Usage** – Each building’s irrigation usage was divided by the irrigatable area to determine irrigation use intensity

- Rank order from highest to lowest and start planning

On a related note - We’re very proud of our Cooperative Education program. Check it out at

https://betterbuildingssolutioncenter.energy.gov/solutions-at-a-glance/highwoods-properties-co-op-education-program-workforce-development
Landscaping and irrigation have become a major focus for us in water management. Some of our strategies include

- **Irrigation Management**
  - We’re piloting an irrigation management system in Orlando that’s provided a 6 month ROI so far with a 80% reduction in water usage
  - Provides intelligent watering based on rainfall, weather conditions, soil types, and type of plants
  - Detects leaks in the system, which are a very common source of waste in irrigation systems

- **Native Plants** – Planting native species and keeping annuals to a minimum reduces the need for watering and annual cost of landscaping

- **Pressure Reduction** – pressure reducing valves in our Nashville market have cut water consumption by reducing damage to sprinkler heads and flow when leaks do occur.
The Future

**Metering!**

- We’ve had a very successful energy metering program for the past 10 years, resulting in over $15 million in cumulative savings
- Initial water analysis has already shown potential for detecting leaks and unnecessary usage

- We’re exploring different technologies (meters, utility pulses, etc) and looking to run pilots in 2022
- In the meantime, a few of our utilities already have interval water metering available on a web platform (Town of Cary NC, Orlando Utilities Commission, Pittsburgh Water and Sewer Authority)
At Highwoods, Sustainability is a Team Effort...

Design and Development
- LEED Certification on 100% of Office Developments since 2013
- Energy- and Water-Efficient Designs
- Environmentally Conscious Site Selection and Development
- Climate-Resilient Design and Construction

Operations and Maintenance
- Energy-Efficient Operation
- Energy Upgrade Project Implementation
- Continuous Commissioning
- Preventive Maintenance
- Climate Risk Mitigation

Highwoods Energy Command Center
- Building Monitoring
- Utility Bill Management
- Energy Procurement
- Sustainability Reporting
- Energy Star Certification
- Emerging Technology Research
- Employee Training

The Highwoods Sustainability Commitment
Bob Bechtold
HARBEC
Better Buildings Webinar
Glass Half-Full: Saving Money By Saving Water

U.S. DOE

2022 Better Building / Better Plants
Who is HARBEC?

- Founded in 1977
- Located in Ontario, NY near Rochester
- Precision plastics and metal manufacturer
  - Early adopter of advanced technology
  - Sustainable manufacturing pioneer
  - +155 team members (and growing)
- 33 electric injection molding presses;
  - 44 CNC machining centers
The American Great Lakes account for 21 percent of the Earth's surface fresh water.

Cheap water promotes a wasteful attitude.

**USC News: 9-12-18**

Two researchers crunched the numbers to determine the enormous amount of H2O withdrawn from the environment.

The researchers found that the U.S. energy system annually consumed an estimated 3.5 trillion gallons of freshwater. That's about 10 percent of total U.S. water consumption.
The US average energy consumption for potable water production was 2900 kWh per million gallons

Energy intensity of water processes (kWh/million gallons)
- Water source and conveyance 1,100 kWh
  - Treatment 1,100 kWh
  - Distribution 700 kWh
- Total 2,900 kWh

100 gallons of potable water—the amount used daily by the average person at home in the U.S.—takes about 1.1 kWh of energy to treat and distribute, according to a 2011 study by researchers at the University of South Florida. That’s a lot more energy than an efficient refrigerator uses in a day.
Potable Water Matters…
2 Events That Heightened HARBECE Water Awareness

- 9/11 = Catastrophic insurance losses
  - Many NY businesses got surprise payment increase

- B9 Plastics, Inc.
  - NFP sister company exposed us to world water dilemmas
  - 1 in 3 people globally do not have access to safe drinking water – UNICEF, WHO 18 June 2019

Better Water Maker
Sustainable Prosperity Through Technology
Alternative to Water Needs for Sprinklers

- 250k Gallon Storage Tank Requires
  - chemicals and servicing to insure safely balanced water vs.

- 900k Gallon Pond
  - Naturally balanced with cattail remediation plus aeriation
  - Rooftops and parking lot provide 1.6MM (+/-10%) gallons of rain water per year
Thermal Dump Opportunity in the Summer

- 1.2mil gallons of potable city water not evaporated
What happens to closed loop water?

- Formations of mineral scale restrict the flow of cooling water, which not only slows production, but increases maintenance expense and stresses process equipment.
- Byproducts of corrosion are difficult to control. We tried several suggested methods of improvement with little or no success.
- Bugs could grow which can make people sick. (eg.-Legionnaire's Disease)
Sustainable Energy to Sustainable Water

- Two closed loop water systems required a water management solution
- Searched for a sustainable water maintenance proposal... no hazardous chemicals

Dissimilar Metals – Water Treatment System

- 10 years of successful operation ended by DEC
Sustainable/Benign Water Treatment Solution

MONITOR, MEASURE, then MANAGE mass balance of your water system by controlling the pH of water
Pond supplied make up water needed by evaporative cooling tower requires:

- Managing the pond’s biological (bacteria) conditions through aeriation
- Use of real time sensors to measure conductivity, temperature, pH, etc.
- Using mild acid solution to control the pH that is discharged back to the pond
Future Management and Continuous Reduction Potentials of Potable Water Use in Manufacturing

- Improve the use of rain and gray water for all but drinking and hand washing

Replace standard toilets with water saver types
HARBEC ANNUAL WATER USAGE
Carbon Neutral to Water Neutral

YEAR

ANNUAL GALLONS

Baseline Established

WATER USAGE
To date we have an 82% reduction in city water consumption since our baseline year of 2013. (26% for 2018)

We will continue to invest in technologies that help us work towards our Water Neutral Goal.

In 2020 we will be focusing on technologies, equipment, and behaviors that will help reduce our normal daily water usages inside the production facility.
To date we have a 62% reduction in city water consumption since our baseline year of 2014. (30% for 2021)

- We will continue to invest in technologies that help us work towards our Water Neutral Goal.
- In 2022 we will be focusing on technologies, equipment, and behaviors that will help reduce our normal daily water usages inside the production facility.

![Facility City Water Usage- 2018-2021](chart.png)
HARBEC Alternative Water Management System

Water Neutral 2015
Calculating carbon release and water use amounts for offset purchases – purchasing from B.E.F. again

- Carbon offsets... 712 tons of carbon = $4984  
  (2020= 619 tons of carbon = $4333)
  - Big Smile Wind Farm...Dempsey Ridge in Oklahoma
- Water offsets... 977,000 gal = $1954  
  (2020= 1,178,000 gal = $2,356)
  - Middle Deschutes River...Central Oregon
- +++ 10% to STEM
  - CE Bright Futures
Carbon and Water Neutral

- Helps to support The Big Smile Wind Farm at Dempsey Ridge will deliver enough clean energy to power more than 46,000 U.S. homes.
- Projected CO2 emissions avoided: Approximately 339,000 tons annually
- Well known for its vast oil and natural gas reserves, Oklahoma will come to be recognized for its wind resources as well, currently ranking in the top 10 U.S. states for wind-energy potential

- Water Restoration Credits are used to help the Middle Deschutes River flow restoration project in Central Oregon (to restore 115 cubic feet/second flow)

- Project Benefits:
  - Enhancing Recreation & Economic Benefits
  - Water Quality Improvement
  - Wildlife & Habitat Protection
Most Recent Development – Just Imagine the possibilities...

Geothermal potential has been greatly increased in order to realize additional energy opportunities.

- Industrial Heat Pumps
- Improved thermal shedding (Process water loop)
- Increased heating and cooling possibilities (HVAC water loop)
At HARBEC we regard Eco-economic Sustainability as absolutely critical to the future of our business, and we believe that our success in the pursuit of it, will improve our competitive advantage by insuring our efficiency.

a Carbon and Water Neutral manufacturing company

ISO 50001/SEP Platinum - Nov. 2013
DOE - Better Plants – Challenge - Jan. 2014

Thank You
Q & A

Submit Questions
www.slido.com event code #DOE
2021-2022 Better Buildings
WEBINAR SERIES

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Millions of Americans work on the energy infrastructure that powers the U.S. and the buildings that power our economy. Better Buildings Workforce Accelerator partners support and grow our energy efficiency workforce by connecting to training, education, and job opportunities. Learn about the strategies and programmatic efforts they have implemented to support curricula development, job training, and career awareness to bolster future workers in the built environment.
Join the Water Savings Network!

Where can I find more information about the Water Savings Network?
- You can find program details, partnership requirements and benefits to joining the network in the [Water Savings Network Overview](#) document.
- For featured partner solutions, tools, resources and more, please visit the [Water Savings Network](#) page on the Better Buildings Solution Center.

How can my organization join?
- Reach out to your Better Buildings program contact(s) or email [betterbuildings@ee.doe.gov](mailto:betterbuildings@ee.doe.gov) stating your interest in joining.
Interested in Learning More?

Download the Additional Resources PDF from the chat box.

- Better Buildings Solution Center resources
- Speaker-chosen content
- Accessible now
Additional Questions?

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