Growing Green

Building your company's value by reducing its environmental impact

Buckman

Commitment makes the best chemistry.

Good for the planet. Good for business.

Dear Valued Customer,

The idea of sustainability has taken hold all over the world. You'll find it in just about every company annual report. It takes a prominent position in marketing and advertising. And for forward-thinking companies, it is having a profound effect on business strategy. After all, the future will be one of carbon taxes and credits, water shortages, and increasingly stringent regulations. Greenhouse gas management, alone, is predicted to account for four percent of global economic output. It will pay to be prepared.

Buckman has had a long-standing commitment to sustainable practices. You see it in our intimate customer approach and our steadfast adherence to proven business and ethical fundamentals. We believe being green is the key to being economically viable in the decades to come. So it only stands to reason that we would want to help our customers become sustainable, too.

There's no better place to start than water. How we use it, heat it, treat it and, ultimately, discard it affects not only your operations but also the water, soil, and air around you. That's why our water technologies division is working to bring new levels of sustainability to our clients, finding ways to improve not only each of their environmental profiles but also their social and economic vitalities. We would like nothing better than to do the same for you.

Steve Buckman
CEO & President

Going green and growing your company

are not mutually exclusive. You can do both. In fact, growing green is really the only way forward. That's because these days, a strong commitment to a sustainable future is also a commitment to saving money, to increasing productivity, to attracting customers, and to enhancing the quality of life for your employees and your community.

Buckman Green, Buckman's global sustainability initiative, is a comprehensive approach to environmental stewardship, social leadership, and financial responsibility. Our goal is finding the sustainable path, not only for ourselves, but also for our customers. Through Buckman Green we are committed to helping your company make the most of greener technologies and solutions.

This guide will show you how our trained sales associates can use specialized processes and tools to strengthen your sustainability efforts and reduce your environmental footprint in the areas of water, energy, emissions, and waste discharge.

Together, we can assess:

- **Where you are.**
- **Where you would like to be.**
- **How we will get there together.**
- **How we will know we have reached our goals.**

Not only will Buckman assist you in achieving your water and energy reduction goals, but we will also strive to do it in such a way that you reap the maximum benefit.

Why Buckman?

We practice what we preach. We've invested in new equipment, new technologies, and quantitative metrics to measure and significantly reduce our own environmental footprint. In 2010, we set ambitious five-year goals, and by 2012 we had already met many of them, including a 15% reduction in direct energy consumption, water usage and CFC emissions. We are continuing to make reductions in these areas while improving our emissions to the air, land and water. Buckman has particularly focused on eliminating emissions to landfills, with special emphasis on hazardous waste.

Of course, for Buckman, one of the best ways to minimize our impact on the planet—and to reduce your company's carbon footprint—is to improve the chemistries we create. We have dedicated ourselves to developing biodegradable, nontoxic and naturally derived products to replace less sustainable options.

For example, we have successfully replaced traditional hydrocarbon-based products with those made from renewable resources such as trees, citrus, corn and soya. We also have developed oil-free defoamers, organic coagulants and phosphate-free scale and corrosion control products.

Recent breakthroughs

Buckman is committed to providing customers with highly effective products that offer the lowest possible environmental impact. We do not accept that being green means sacrificing performance, and this thinking is what drives our researchers. Here are a few areas where Buckman is leading the way.

Enzyme Technology

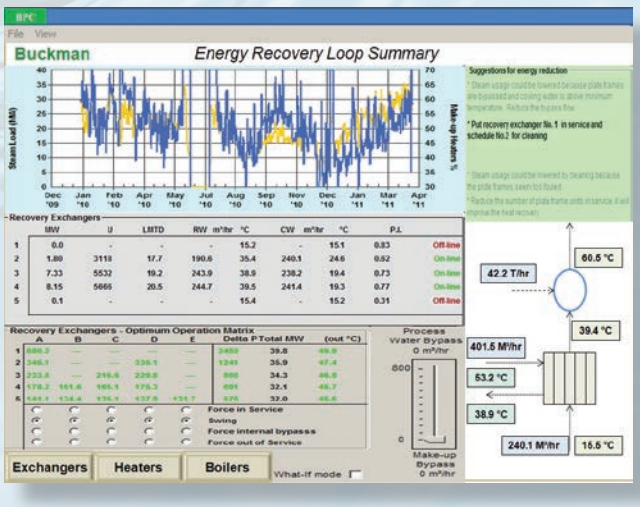
While Buckman's roots are in traditional chemistries such as biocides and scale inhibitors, we also have looked for innovative new ways to achieve similar results with less environmental impact.

For example, breakthroughs in fundamental enzyme design and in how enzymes are stabilized have resulted in novel technology that is seeing widespread application in the paper industry. Rather than relying on petrochemical-based chemicals – with varying levels of toxicity – to maintain machine cleanliness, we are now able to use enzymes. These natural products are specific in their activity, biodegradable, and nontoxic – all characteristics that embody the idea of "green."

As our portfolio of enzyme products expands, we are finding applications in other areas and industries. It is our expectation that within the next decade, enzymes will be the cornerstone of virtually all of our deposit control products.

Artificial Intelligence

Innovation is not just about the chemicals in a drum or the expertise a Buckman representative brings to a plant. It is also about developing software that draws on AI (artificial intelligence) algorithms to predict system performance and recommend corrective actions. This type of learning software provides a real-time assessment of whether critical equipment is in control and provides a de facto representative onsite at all times. These predictive tools go beyond chemical dosing, taking into account all the system variables that affect performance.



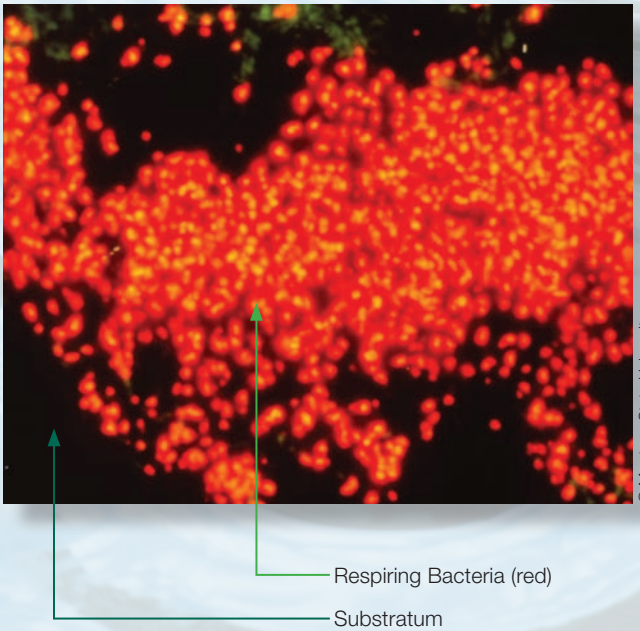
For our innovative enzymatic technologies, Buckman has been awarded two Presidential Green Chemistry Challenge Awards from the U.S. Environmental Protection Agency—one for Optimyze® in 2004 and the other for Maximyze® in 2012. Our research and development continues.

Just as important as the chemicals themselves is the search for ways to improve the sustainable credentials of the existing processes within our customers' facilities. Improving yield of forest resources. Using scale and deposit inhibitors to save energy. Reusing effluent waters. Recycling and identifying alternative water sources. We do all of this and more for our customers every day, providing not only a Return On Investment (ROI), but a measurable Return On Environment (ROE) too.

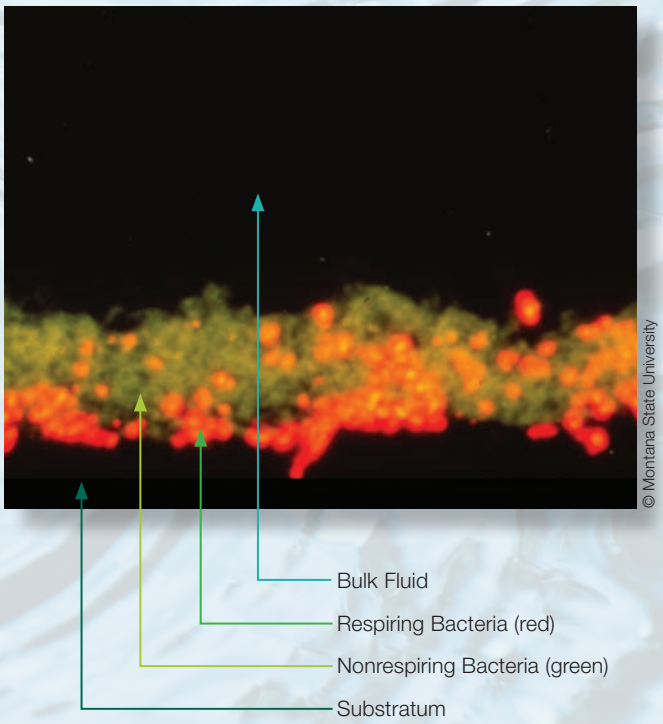
Proprietary Oxamine® Technology

Oxidizing biocides offer excellent microbial control but come with inherent limitations. Their effectiveness is compromised by high organic demand, and they lead to the formation of chlorinated organic compounds. Oxamine provides the benefits of halogen biocides but does so without these drawbacks. When you use Oxamine for biological control, you can be confident that you are protecting your water supply effectively and efficiently. And, perhaps best of all, it degrades into nontoxic minerals that won't harm the environment.

Before treatment

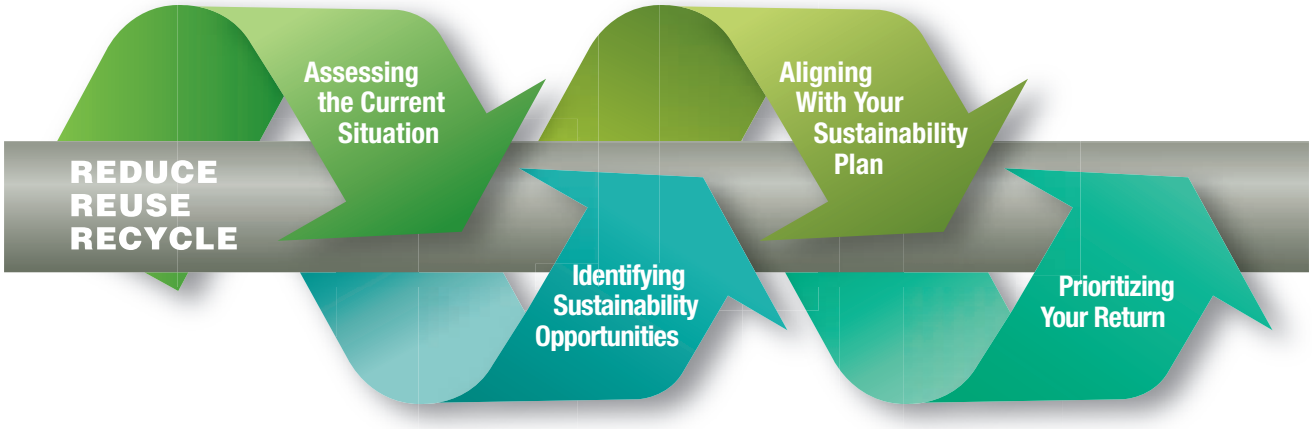


After treatment



The water & energy reduction process.

Buckman has established a way to assess your process and water systems and implement improvements that will help make your operation greener. The process consists of four distinct steps that revolve around the concepts of Reduce, Reuse, and Recycle.



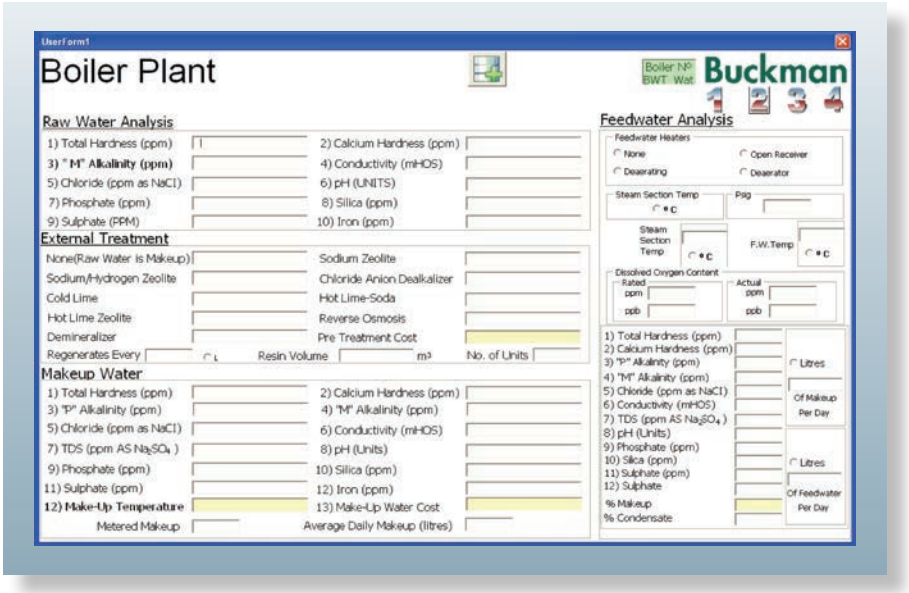
Step 1 Assessing the Current Situation

In Step 1, we assess where we are as a team—Buckman's current role in your facility, the knowledge we have regarding your systems, and what drives your sustainability program. During this step, the Buckman representative will ask a number of "now" questions to better understand:

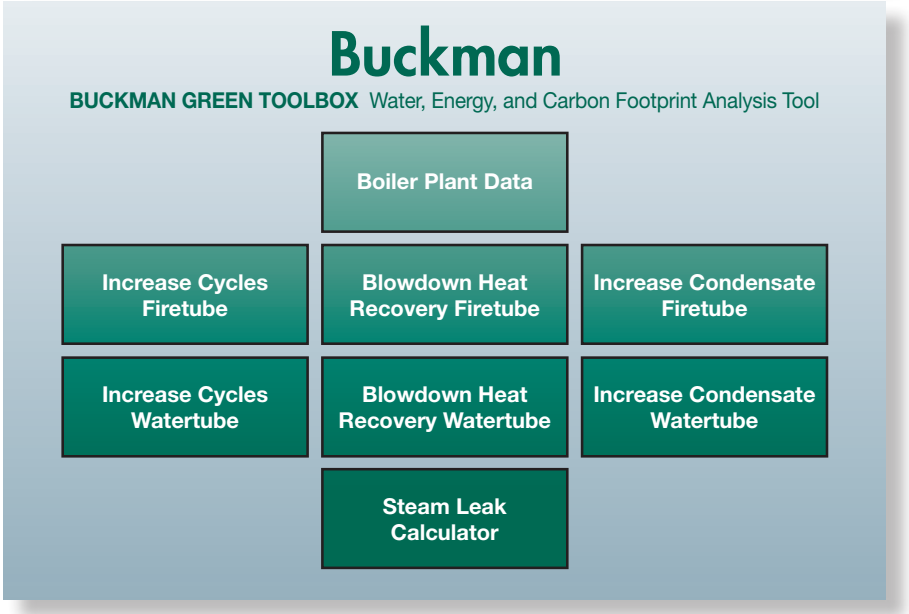
- Your current levels of water and energy consumption, discharges, and emissions.
- What drives your company's sustainability and reuse program.
- What you consider to be the ideal situation for your company.
- What the cost is of current practices within your facility.

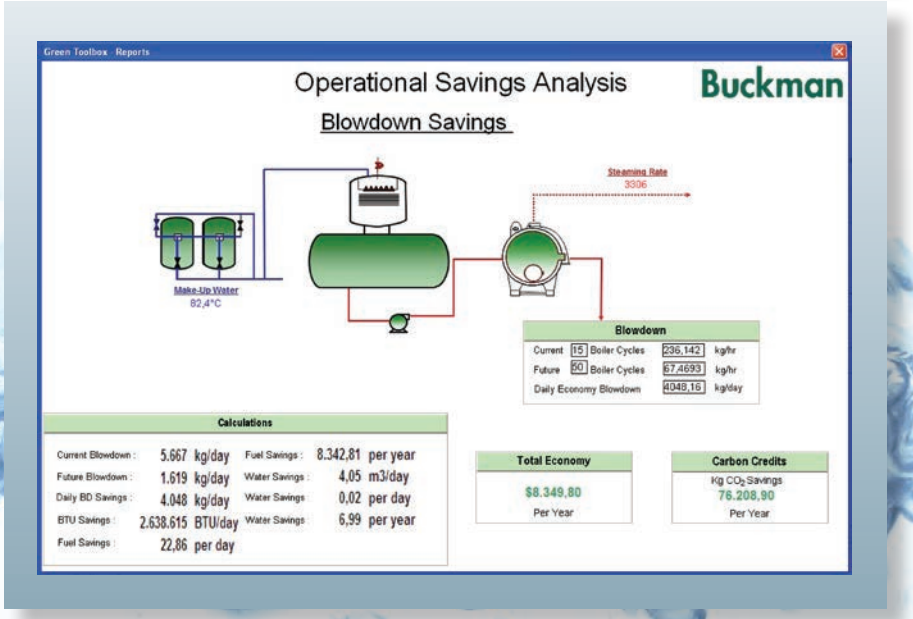
This will help establish a baseline for your facility and provide insight regarding:

- Environmental pressures under which your company operates.
- Current limitations on your company to increase capacity and sustain current practices.
- The costs of maintaining current practices and protocols.
- The roles and responsibilities of specific facility positions and personnel.
- The drivers of your green and sustainability initiatives.
- Your short, middle, and long-term strategic sustainability plans.
- Reuse initiatives you currently have in place.



Your Buckman representative will conduct a number of system surveys and use special tools and calculators to understand the water flow and usage levels in specific plants.





A Close Look at Costs

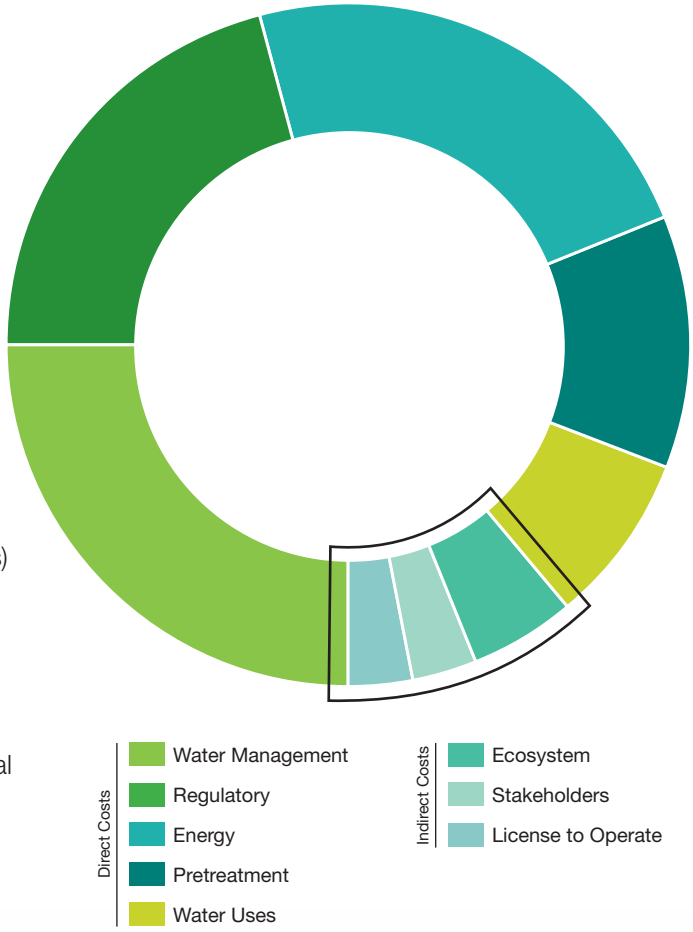
In addition to assessing flow capacities, the Buckman representative will work with your team to collect all related cost information. Your cost basis can be viewed as follows:

Direct Costs

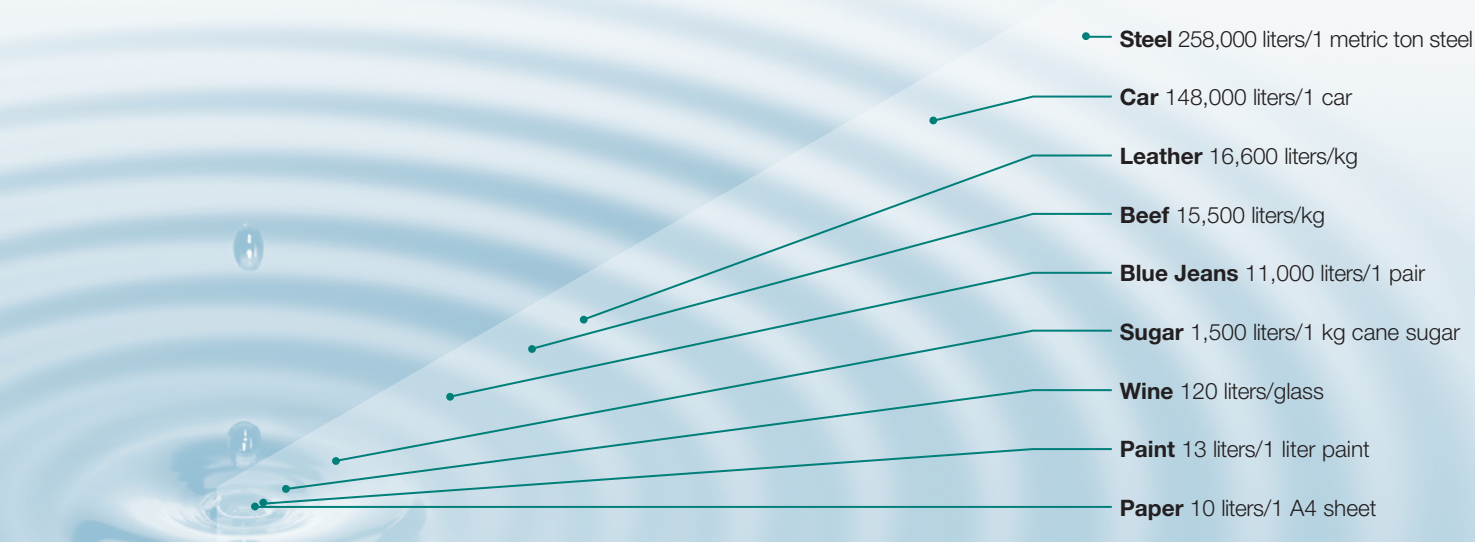
- Water use expressed as $/volume x volume per period (minute/day/year); volume units are typically gallons or m^3
- Wastewater and solid waste discharge fees
- Costs of reuse practices and treatment technologies in use
- Energy costs at current utilization rate
- Regulatory costs (permits, compliance assessment, fines, etc.)
- Costs for water management measures (staff time and resources, technology, equipment and materials)

Indirect Costs

- License to operate or grow (marginal cost for capacity expansion)
- Relationships with stakeholders (suppliers, financial institutions, employees, regulators, customers, shareholders, neighbors and local communities)
- Environmental impact (loss or damage to the environment)



How Much Water Does It Take?



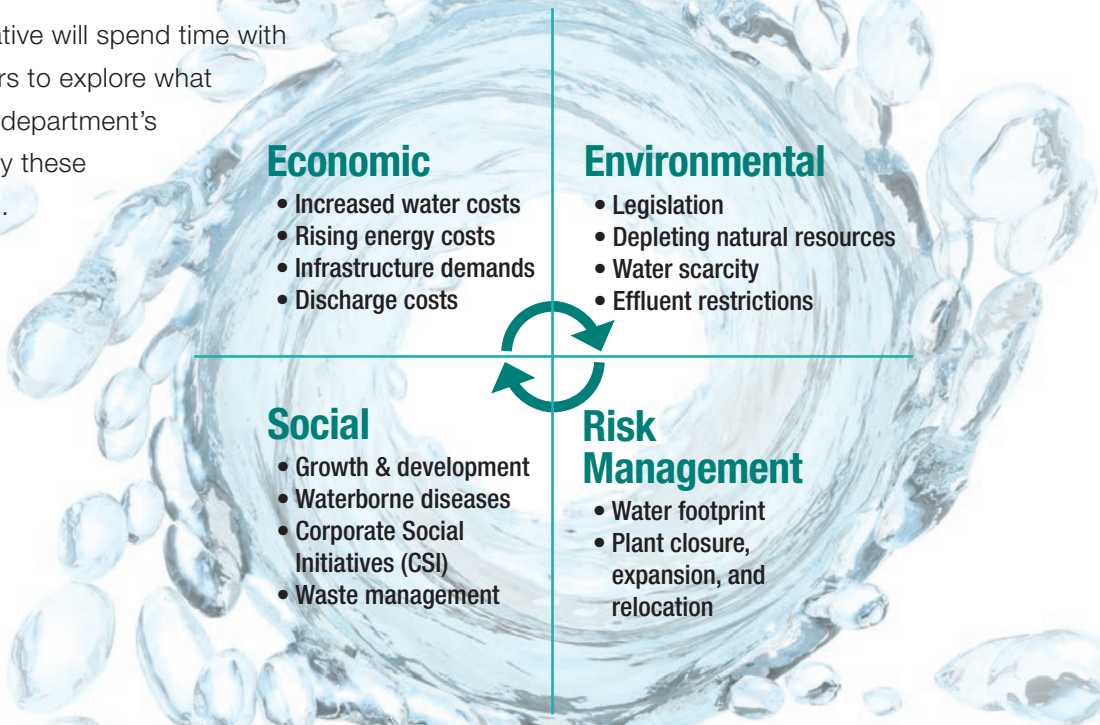
Step 2 Identifying Sustainability Opportunities

Armed with the knowledge gained in the first step, we can now see the gap between where you are and where you would like to be. In Step 2 of the process we will begin to identify opportunities to grow green.

Your Buckman representative will spend time with you and other stakeholders to explore what drives your company's or department's sustainability plan and why these drivers are of value to you.

Categories of Sustainability Drivers

Now we can look for ways to Reduce, Reuse, and Recycle and generate a list of possible opportunities to grow greener.



Reduce	• Identifying improvements with good returns that are relatively easy and quick to implement • Reducing leakage and waste • Making minor operational or process changes that do not require large capital expenditures, such as reducing makeup water use
Reuse	• Recommending different sources of influent • Reusing condensate, reclaimed sewage or domestic effluent • Harvesting rainwater
Recycle	• Introducing different or new technologies • Using reverse osmosis or an evaporator to reclaim water from salty waste • Chemically treating waste streams for suitable alternate uses

Getting Your Workforce Involved

With all of the debates and discussion in the media over global warming and emissions, conservation and energy, awareness of sustainability issues among your workforce is high. You can demonstrate your company's or department's commitment to sustainability and, at the same time, elicit innovative ideas on how everyone can contribute.

A Buckman initiative in Latin America involving a "sustainability tree" proved this point. Employees hung "suggestion leaves," each of which contained numerous innovative ideas, and came with a high level of pride and willingness to contribute.

After initiatives are implemented, feedback and progress reports are important to keep staff involved and committed.

Step 3 Aligning With Your Sustainability Plan

After generating a list of potential opportunities for improving sustainability, we are now in a position to evaluate each one.

Projects will be drafted based on their return on environment (ROE), cost, risk involved, and external influences such as regulation. Although ROE includes a monetary value associated with water or energy cost reduction, it goes beyond that.

The return from a sustainability project also takes into account risk and the positive net effect that a reduction in risk can have on your company's reputation and brand. High profile environmental incidents which have found their way into mainstream media illustrate the negative impact an environmental incident may have on the reputation of a company.

Your company may also see other gains from the successful implementation of green projects. These may include a reduction in your carbon and water footprint, and the social benefit of reduced emissions.

Step 4 Prioritizing Your Return

Finally, proposed sustainability projects are prioritized based on the ROE criteria for your plant. By determining the value of each project beforehand, we can decide which will bring your organization most efficiently toward its goals.

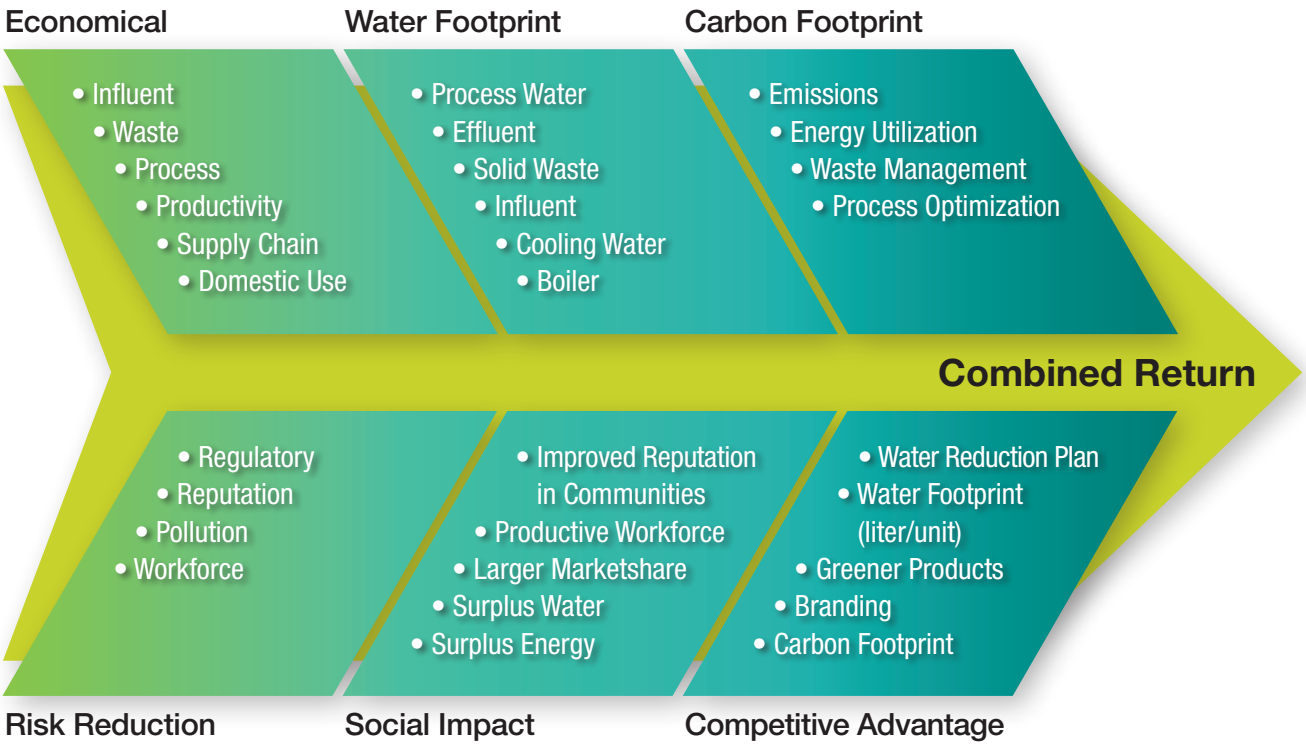
For cooling systems, the balance between cycles of concentration and increased treatment costs may render the project viable or not.

Evaluation of system and other downstream risk factors associated with the changes.

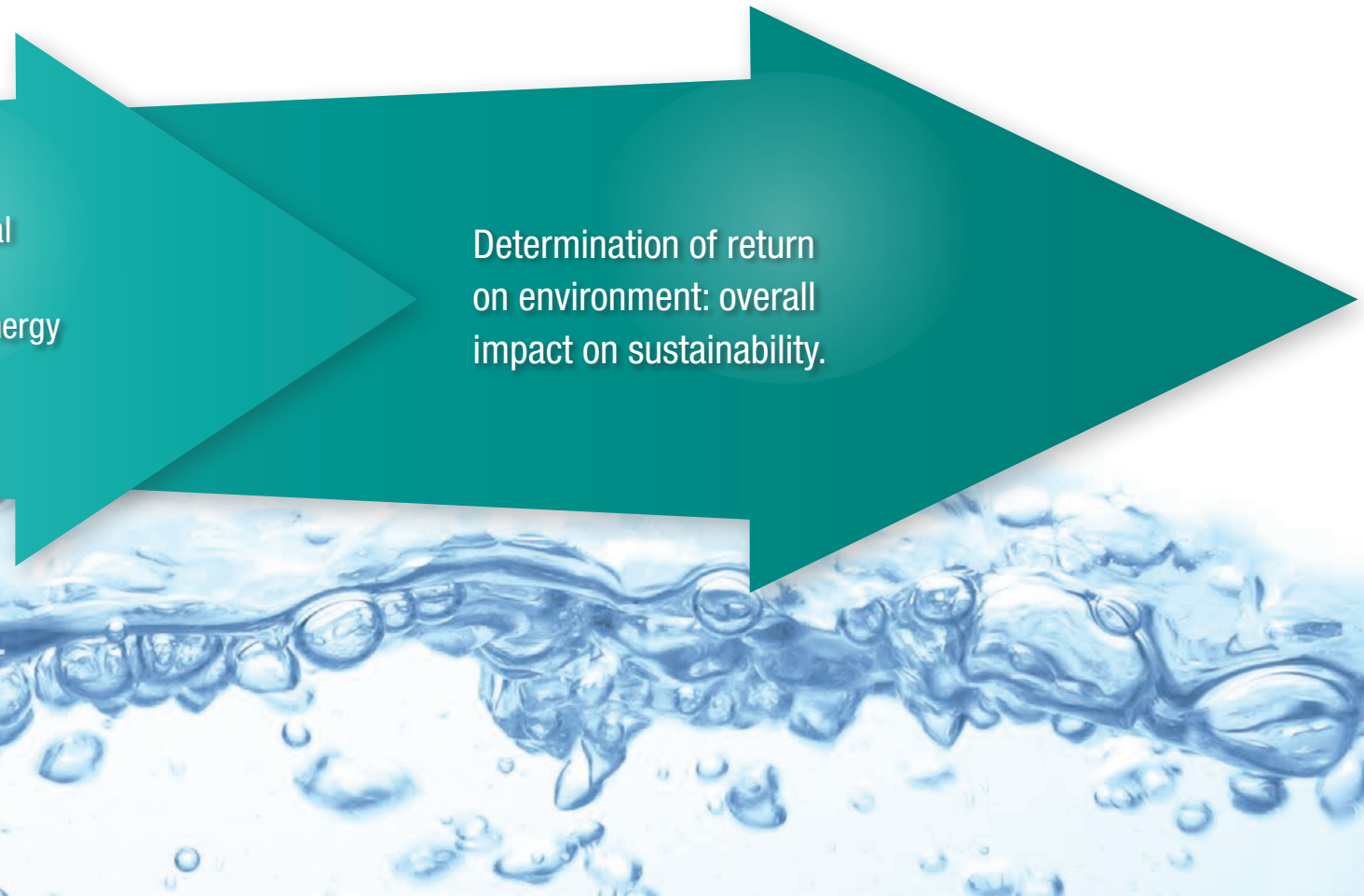
Consideration of externa factors and options (e.g., selling water or en into the community).

Return on Environment (ROE)

Factors that can be measured to determine the value being generated by a project include:



Once the recommended plan is implemented, Buckman works to measure the results and ensure success.



How it works.

Here are some case studies that document sustainable solutions we have provided for our clients and the benefits realized. Buckman can bring similar success to your company or department.

Case Study Water

Keeping an evaporator from evaporating profits

A steel plant in South Africa had an underperforming MVR evaporator due to chronic scaling. The antiscalant it used allowed seeding of scale and intense calcium sulphate formation in the condenser tubes.

Buckman began ongoing monitoring of the evaporator's efficiency, recovery, and availability, noting the nature of the scale and the frequency of shutdowns. Next, we implemented a program based on a crystal modifier scale inhibitor, which quickly softened residual scale and reduced new scale formation. Evaporator efficiency improved dramatically. After 11 months of treatment, the time between shutdowns improved from 3 months to 9 months, decreasing labor and cost.

Return on Environment (ROE) Savings

- **A 75 percent savings in water and energy costs.** By minimizing the need for shutdown and cleaning, Buckman's solution saved water and energy, reducing high-pressure cleaning costs from US$ 0.04/m^3 to US$ 0.01/m^3—a 75 percent savings.
- **A 30 percent savings in natural gas costs.** By raising the efficiency of the boiler, Buckman reduced natural gas consumption from US$ 0.21/m^3 to US$ 0.15/m^3—a 30 percent savings.
- **A 4.4 tons/year reduction in CO_2 production.**

Return on Investment (ROI)

- The return on investment (assuming a constant chemical and production expenditure) equals 22.62 percent, based on a comparison of product produced for the period pre-Buckman treatment and that currently produced.
- Based on an average efficiency of 90 percent for the design feed, the amount of effluent treated is 82.8 m^3/h, equal to 2,000,000 m^3/day. This provided a world-class solution for an intensive calcium sulphate scaling problem.
- Measurable cost-effective incentives were realized.

Case Study Air

Scrubbing away a stinky problem

A steel mill in Brazil had a stinky problem—aggressive odors caused by reduction process scrubbing gas. Workers complained because the odor presented an uncomfortable working environment. The mill called on Buckman. We applied a water-soluble masking agent, Bulab® 8108, for odor control. The state-of-the-art biotechnology can be applied directly to the water system or for misting in the air. Shock dosages were made, followed by a lower dosage for ongoing maintenance.

No more complaints were registered after application.

Return on Environment (ROE) Savings

- Working conditions improved for 40 workers

Case Study Soil

Extending the life of a sludge land-farm operation

A refinery effluent plant in Canada land-farmed DAF sludge on its property. After years of using inorganic, metal-based coagulants, the soil was nearing the allowable limits for metal content. Moving the operation offsite would cost hundreds of thousands of dollars per year. Buckman was called in to provide a green, organic solution.

By using leading-edge organic coagulants, Buckman quickly reduced oil and grease levels, soil-metal concentration, and the total amount of sludge, greatly extending the lifespan of the land-farm operation. What's more, the need for dredging was reduced.

Return on Environment (ROE) Savings

- 22 percent reduction in oil and grease
- 68 percent reduction in soil-metal concentration
- 41 percent decrease in the total amount of sludge produced
- Reduced CO_2 production by 196.6 kg/year

Return on Investment (ROI)

Buckman saved the plant:

- $300,000 in sludge removal costs per year
- $60,000 in pond dredging per year
- $250,000 — the estimated cost of a new land-farm site and approval

Case Study

Water

Reducing the load for utilities

A large power generation facility was plagued by high organic content in its high pressure boiler feedwater, resulting in higher organic loading in the pretreatment system and shortened resin run lengths and resin life. Buckman implemented a program to remove suspended solids and reduce total organic content, elevating the plant's TOC removal efficiency from 25 percent to as high as 62 percent.

Return on Environment (ROE) Savings

- Reduced effluent chemical loading by 251 tons per year
- Reduced regeneration frequency, reducing the amount of chemical used and saving about $290,000 per year
- Reduced use of regeneration water, conserving natural river resources
- Reduced blowdown levels on the boiler, saving $2,000 per year

Case Study

Energy

Preventing acid from eating away profits

An ethanol plant found that using sulfuric acid to lower pH in their thin stillage was becoming too costly. Buckman went to work feeding a specialized Bulab chemistry ahead of the first evaporator. The result was a reduction in acid use of almost 45 percent. In addition, the need for evaporator cleaning was reduced significantly, saving both energy and money.

Return on Environment (ROE) Savings

- Reduced steam usage—Cleanings between shut-downs were eliminated on Evaporator One, avoiding the reprocessing of 1,800–3,800 liters of 200-proof alcohol usually necessary for switching evaporators. The reduction in steam usage equates to a reduction in energy generated and a reduction in the plant's emissions.
- Higher syrup solids—Solids run through the evaporator increased from 31 percent to 37 percent.
- Reduced discharge—Acid wash frequency was reduced, avoiding the discharge of 6,800 kilograms of sulfamic acid into the environment.
- Improved heat transfer performance—Plant had additional flexibility to optimize water balance and backset usage. This in conjunction with the elimination of cleaning water on the evaporators resulted in a reduction in the plant's water footprint.

Return on Investment (ROI)

Reduced materials cost

- Target pH was maintained using significantly less acid

Lower process costs

The plant:

- Avoided alcohol reprocessing
- Eliminated 10 CIP's per year
- Reduced acid wash frequency
- Cleaned easier and faster with fewer plugged tubes

Want to know more?

Just tell your Buckman representative you want to grow green. He or she can provide additional examples and case studies pertinent to your industry and answer any questions. With Buckman you'll have a real partner in sustainability.

When you look to the future, look to us.

Buckman

Commitment makes the best chemistry.

Buckman Laboratories International, Inc.
1256 North McLean Blvd.
Memphis, Tennessee 38108-1241 U.S.A.

buckman.com

NORTH AMERICA
United States
+1 (901) 278-0330
Canada
+1 (450) 424-4404

EUROPE/MIDDLE EAST
Belgium
+32 9 257 92 11

LATIN AMERICA
Brazil
+55 (19) 3864-5000
Argentina
+54 11 4701-6415
Chile
+(56-2) 2946-1000
Mexico
+52 (777) 329 3740

AFRICA
South Africa
+27 (31) 736 8800

PACIFIC RIM
Australia
+61 (2) 6923 5888
Singapore
+(65) 6891-9200
China
+(86-21) 6921-0188
India
+(91) 44 2648 0220
Japan
+81 (3) 3808-1199

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