Chapter 17

The economics of sustainable industrial water use, reuse, and the value of water

Thomas Chesnutt

A&N Technical Services, Encinitas, CA, USA

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17.1 INTRODUCTION

This article describes some of the economic aspects of sustainable industrial water use often overlooked by water professionals and the general public alike. Most industrial plant managers understand the importance of water as an input to their industrial processes. Most utility managers – and elected officials – understand the importance of industrial plants to the local economy – tax receipts, jobs, and incomes. What does an understanding of economics add to this picture?

Economics has been described as the science of scarcity. In the ideal market (the one that only exists between the covers of an economics textbook) the price of a good mediates the relationship between the seller and the buyer; this is enshrined in the popular concept of 'supply and demand.' Going back a step further, the cost of production acts as a floor, determining the lowest price the supplier can charge for goods, while the value to the buyer dictates the highest price they will pay. Between these two poles, the market will set the actual price, which determines how many units are offered for sale and how many are bought and consumed (Renzetti, 2002).

But industrial water as a product is different from most other goods, including other commodities. The difference has a significant impact on how companies make decisions about water, and how they understand the value of sustainable industrial water to their enterprise. This article will explore the nature of this difference, and the economic forces that even now are inspiring some companies to use water more sustainably to ensure their future profitability.

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17.2 A UNIQUE MARKET

As a result of monopoly, subsidies, and externalities, industrial water is bought and sold quite differently than the goods in the ideal market. Where textbook transactions are mediated by the rational voice of price, in reality the industrial water use market is more likely to be a shouting match between the holders of 19th century water rights and the voters in the last election. Each of these factions alters the function of the market; together they make buying and selling water a unique departure from the classical pattern.

17.2.1 Monopoly

Water is the prototype of 'the naturally-occurring monopoly.' The reason for this is simple: It does not make sense for competing water utilities to build and maintain parallel pipelines in every street. Without competition, though, what is to prevent the monopolistic supplier from charging exorbitant fees for its product – especially a product as vital to human survival as water? As the economics textbook will further explain, monopolistic suppliers must be constrained by regulation, either formal or informal, to prevent predatory pricing (i.e., 'price-gouging'). So instead of allowing the market to determine prices, prices are set through negotiation in the public arena between the utility monopoly and the government authority responsible for approving rates. This regulatory process is often imperfect which results in water bills that don't reflect the actual cost of water or its value to the customer. As we'll discuss in more detail below, this causes a multitude of problems, especially when future water supplies are threatened by droughts or unknown viruses, water pollution, and over-allocation of resources. In the face of such future uncertainties, and without accurate price signals to guide us, it is no longer enough to merely do as we have always done before.

17.2.2 Social subsidies

The rates a private utility charges for water are commonly regulated by an independent board, while a public utility's rates may be set by an elected board or city council. In both cases, the regulatory board and governing body are subject to political pressures, either directly or indirectly. The utility may lobby the board to raise rates to cover operating and maintenance expenses and capital costs (and in the case of private utilities, to turn a profit). Ratepayers on the other hand (i.e., the public) may reward elected officials who keep rates low. One way to avoid rate increases – at least in the short run – is to put off maintenance and defer equipment replacement and other infrastructure investments. While customers may appreciate the lower rates, they don't see the corresponding reduction in water quality and reliability resulting from these deferred investments in water infrastructure. Another way to keep rates low is to attempt to find state or federal grants to pay for water improvement projects. These 'social subsidies' are common, complicating the determination of the full costs of water. The discrepancy between the price of water and its true economic value can be even further widened when utilities use historical cost accounting to determine water rate since future costs can differ from the past. Forward-looking cost accounting provides better cost signals for customers about the cost consequences of their consumption decisions. There are dangers to driving through life while staring in the rearview mirror (AWE, 2014).

17.2.3 Externalities

The market price for water rarely includes all its environmental and social costs. In economic terms, an 'externality' occurs whenever, during the normal course of its manufacture, distribution, and use, a product impacts a third party who was not part of the transaction between buyer and seller (Papandreou, 1998). Water pollution is the classic example cited in economics textbooks to illustrate the meaning of

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externality: when one town's water consumption results in wastewater that pollutes the water supply of downstream towns. The need to prevent such impacts (or pay to mitigate them) is one of the reasons economists point to in order to justify government regulation of the market. 'Life cycle' cost accounting is the attempt to account for all costs throughout a product's lifecycle – costs of production, consumption, and disposal.

17.3 EFFECT OF AN IMPERFECT WATER MARKET ON INDUSTRY

In short, the water market is imperfectly regulated. The utilities that supply water to industrial customers do so within the context of a variety of outside pressures – economic, political, and social – that determine how much they can charge for water, limiting their ability to control the quality and reliability of the product they sell. In the past industry was not seriously inconvenienced by these limitations, since in general water was plentiful and the waste discharge requirements were easy to meet. Over time, however, as the mandatory environmental flows were added to growing municipal and agricultural water demand and wastewater regulations ratcheted downward, water and wastewater services began to struggle to meet industry requirements, and companies sometimes found themselves needing higher quality and more reliable water than utilities could provide.

At that point, it is often economically advantageous for a company to invest in the treatment and reuse of its own wastewater. This is the overall context in which a business case for onsite industrial water reuse can be created. Economically speaking, the forces that drive a consumer to become a self-producer of the needed service breaks the presumed market monopoly of the networked utility. Using jargon from the utility perspective, this is termed 'system-bypass' and is viewed negatively by utility planners desiring a simpler planning problem. From the customer or market perspective, self-provision can be a rational lower cost approach to achieving desired service levels.

17.4 MAKING A BUSINESS CASE FOR SUSTAINABLE WATER USE

Company managers looking to improve the quality and reliability of their industrial water supply must typically develop a business case to invest in water reuse. A business case compares the investment costs with expected benefits, and projects are favored when benefits exceed costs. By creating a business case, facility managers can increase their understanding of the challenges, costs, and advantages of projects. It creates a transparent, common ground from which the company can reach a 'go/no go' decision by placing a value on benefits that are hard to quantify, including avoided cost of service interruptions, reputational risk, internal capacity building, and other factors.

Construction of a business case for industrial water reuse can be hampered, however, by the fact that the 'true cost of water' – that is inclusive of all lifecycle costs and exclusive of subsidies and externalities – is rarely reflected in its price. As discussed above, the price of water is depressed by embedded subsidies and deferred maintenance, and the 'market value' of water reuse does not include the external benefit of reducing wastewater discharge. Many managers mistakenly assume that non-monetary factors should not enter into the decision ('If you cannot count it, it does not count'). As a result, most business cases tend to weigh financial impacts more heavily than equally important considerations such as influence on the local economy, society, and environment; public health effects; shareholder value; guaranteeing worker safety; reputational risk; and supply chain reliability.

Two strategies that often help tip the decision in favor of reuse are 1) to include the value of avoiding a water supply interruption and 2) consideration of the social and environmental benefits of reuse by internalizing or monetizing these externalities.

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17.4.1 Best practices for making a business case

Since many of the benefits related to water reuse are diffuse (spread out), the best practice is to start with identification of costs and benefits. All costs and benefits can be named and qualitatively discussed, even before any attempt is made to assign a dollar value to them (Hein *et al.*, 2020). Since business decision-makers, in general, are very averse to any threat to existing production processes, some important benefits are related to reducing the risk posed by unpredictable, hard-to-control costs. For example, interesting, successful business cases have been made for reuse projects on the basis of reduced risk of supply disruption.

It has also been noted that recently water and sewer rates in the United States have been increasing at more than twice the general rate of inflation (customer expenditure data from the Bureau of Labor Statistics, 2019). To reflect the full benefit of water reuse, then, a business plan can also include the avoided cost of future rate hikes, as well as energy costs, staff time, and service provider fees (e.g., cooling towers operation) resulting from reduced water use. It can also address the additional avoided costs of damage to existing assets, reputational degradation, and the benefit of improved operational insights.

17.4.2 Sustainable profits

Another major development in economic practice is to include in the business case factors related to reputation degradation and operational insights. We note that evolutionary economics research explicitly ties sustainability and survivability to organizational culture and leadership (Sonntag, 2018). While most competitive industries are appropriately 'cost-phobic,' even within a purist's understanding of profit as 'the only valid objective for an ethical business decision-maker' (Friedman, 1970), an economic case can still be made for industrial reuse based on the current trend among customers demanding 'green' products. Sustainability initiatives can be an important 'signal,' to use a term from information economics (Spence, 2002), to both investors and buyers. Recognizing this, many public agencies have developed programs to recognize sustainability achievements by companies in their service areas to provide further incentive to invest in water and energy conservation projects (Figure 17.1). The market success of 'sustainability' exchange traded funds demonstrates this point, as investment giant Blackrock wrote recently to its investors: 'Our investment conviction is that sustainability- and climate-integrated portfolios can provide better risk-adjusted returns to investors' (Gilbert, 2020). Within this understanding, implementation of industrial reuse can be both rational and ethical for profit-maximizers.

Furthermore, a recent survey by the Environmental Defense Fund (EDF) shows that emerging technologies now allow companies to implement on-site treatment and reuse to raise the bar on sustainability performance, and reports that in the last five years 72% of business leaders see a greater alignment between business and environmental goals (EDF, 2019). In short, competition now embraces sustainability, and agile business leaders are leading the way.

17.5 THE INDUSTRIAL DECISION-MAKERS' PERSPECTIVE

Decision-makers for industry today frequently embrace the 'triple bottom line approach' to accounting, which includes a metric for social and environmental benefits. Introduced in 1994 by John Elkington, triple bottom line accounting was applied to the issue of measuring three types of factors: financial, societal, and environmental (Elkington, 2018). Standards for the triple bottom lines have been developed by the Global Reporting Initiative (GRI) and can be found at their website: www.globalreporting.org (GRI, 2019). A comparable approach expands the non-economic elements into Environmental, Social, and Governance factors (ESG), where 'governance' relates to corporate ethics, board diversity and

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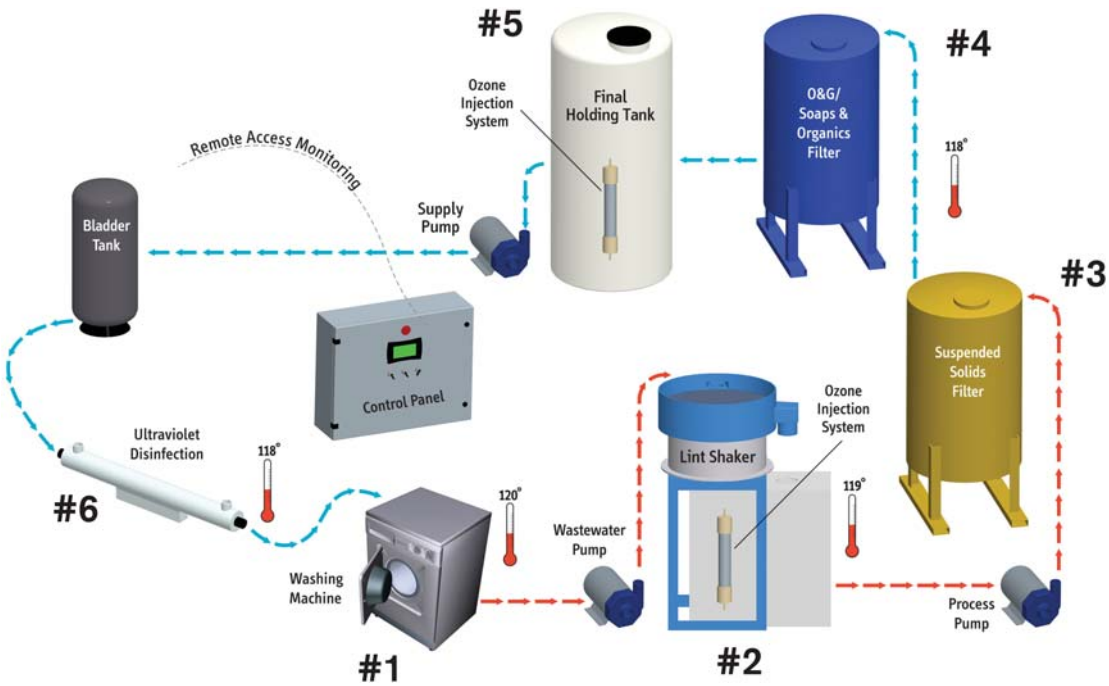

Figure 17.1 A treatment system to reuse laundry water at the 1000-room Westin Bonaventure Hotel & Suites was part of an energy and water recovery project recognized as 'Water Efficiency Project of the Year' by the Los Angeles 'Better Buildings Challenge,' co-sponsored by the LA Department of Water and Power. (*Source: AquaRecycle*)

composition, shareholder rights, supply chain engagement, and transparency. For public companies, there are sustainability disclosures that feed the Dow Jones Sustainability Indices (Robeco, 2020) and a recent application by the US WateReuse Foundation supports 'triple bottom line' analysis of alternative water supply projects (Stanford, 2016).

Company-generated social benefits can include community employment/income, effects on human health, labor relations, and drought resilience (USEPA, 2020). Company generated environmental benefits can include reductions in the pollution of ecosystems (measured by reduced eutrophication potential or ecotoxicity potential) or to the carbon footprint (avoided greenhouse gas emissions), and preservation of a natural resource (USEPA, 2014). Meanwhile, industrial firms that ignore sustainability can make themselves less competitive by missing strategic opportunities and overlooking risks material to their company's ongoing performance and enterprise value (AWE, 2015).

17.6 CONCLUSION

Effective business cases need to qualitatively identify effects of a water reuse project across the triple bottom lines (the company, the community/society, and the environment). The heart of the issue for many potential industrial reuse projects will be that the project investment costs are direct, upfront, and obvious. As noted, the reuse project's benefits may be diffuse, difficult to quantify, and spread over time (Chesnutt and

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Pekelney, 2006). Value-adding firms have realized that their firm's competencies provide a competitive advantage in creating a sustainable supply-chain that also adds value to their community and their (operating) environment. Recent events of unpredictable uncertainties, such as pandemic-induced disruptions, point to the values that firms can add by means of sustainable industrial water use.

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Alliance for Water Efficiency. (2015). Net Blue: Water Offset Policies for Water-Neutral Community Growth. https://www.allianceforwaterefficiency.org/resources/topic/net-blue-supporting-water-neutral-growth.One innovation being tested in multiple water-scarce North American communities is implementation of 'Water Neutral' developments where industrial expansion in water-scarce areas is allowed if the new development 'offsets' its incremental demand load by purchasing water savings in the community or off-site water reuse (including load-reducing stormwater capture)

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Most recently, Elkington asserts that TBL has been turned into an accounting exercise that narrows the economic bottom line to a financial analysis and omits the rethinking necessary for a healthier capitalist economy. 'But the TBL wasn't designed to be just an accounting tool. It was supposed to provoke deeper thinking about capitalism and its future …'

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