

# Life-Cycle Based Decision-Making—The Foundation for Sustainable Materials Management

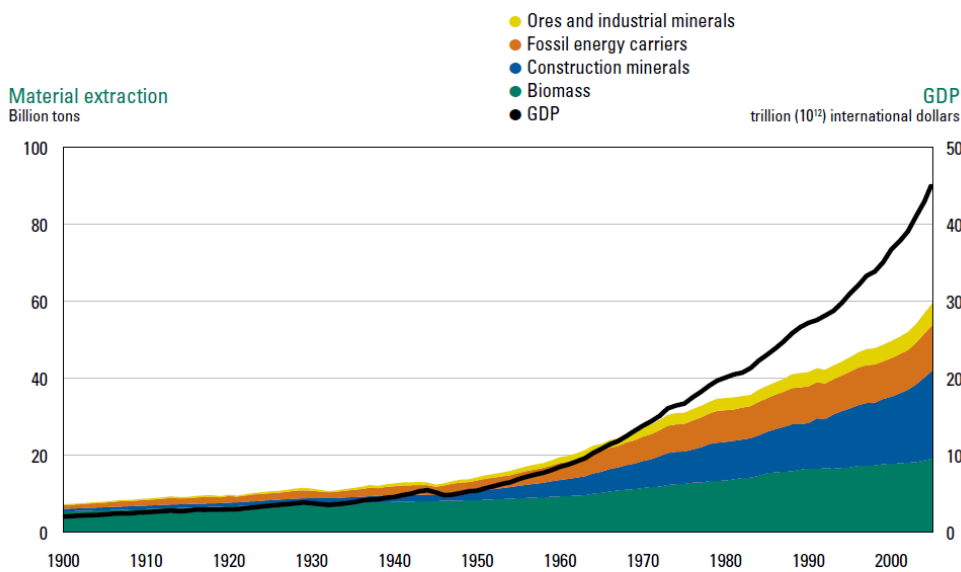
A Business Case for Consideration by the U.S. Chamber of Commerce  
 Prepared by US EPA Office of Resource Conservation and Recovery  
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## Background:

In an era of limitless business ingenuity but limited resources, the sustainable management of natural capital is increasingly at the forefront of international dialogue about how to achieve economic growth without compromising human health and the environment upon which that growth depends. By looking across the life cycle, businesses can find opportunities that enhance and sustain their value proposition and reduce risk through sustainably managing materials.

According to the UN Environment Programme (UNEP), “Humans are consuming resources and producing waste at a greater scale than ever before and per capita consumption levels are projected to increase

Figure 2. Global material extraction in billion tons, 1900–2005



Source: Krausmann *et al.*, 2009

with continued development.” For every 1% increase in GDP, resource use has risen 0.4%<sup>1</sup>. Data indicate that global material resource use during the 20<sup>th</sup> century rose at about twice the rate of population. The growth rate in materials use was still lower than the pace of growth of the world economy. Despite some decoupling of economic

growth and materials use, questions remain about the extent to which economic and environmental policies have impacted this decoupling<sup>2</sup>. Nevertheless, resource use is still on a steep rise and this decoupling is insufficient to overcome the even higher demands we face in the future given projections

<sup>1</sup> Circular Advantage: Innovative Business Models and Technologies to Create Value in a World without Limits to Growth <http://www.accenture.com/us-en/Pages/insight-circular-advantage-innovative-business-models-value-growth.aspx>

<sup>2</sup> Decoupling Natural Resource Use and Environmental Impacts from Economic Growth UNep 2011 decoupling natural resource use and environmental impacts from economic growth

around future world population growth, economic growth and energy and material consumption<sup>3</sup>. The United States consumed 57% more materials in the year 2000 than in 1975 (see Figure 1)<sup>4</sup>. In the global context, the total volume of material resources extracted or harvested worldwide reached nearly 60 billion metric tons (Gt) per year in 2007, with nonrenewable resource extraction accounting for 60% of global extraction<sup>5</sup>. According to the World Resources Institute, “one half to three quarters of annual resource inputs to industrial economies is returned to the environment as wastes within just one year.”<sup>6</sup>

Unsustainable consumption of natural resources and concomitant environmental degradation translates into increasing business risks through higher material costs, and supply uncertainties or disruptions. This can also translate into potential opportunities for innovation.

In March 2015, delegates of all G7 members met in Berlin to consider natural resource efficiency and to affirm the importance of the protection and efficient use of finite natural resources, as well as the positive impact of the three dimensions of sustainability—economy, ecology and social aspects. Through the March 2015 meetings that were focused on resource efficiency<sup>7</sup>, as well as follow-up efforts, the G7 seeks to strengthen the competitiveness of industries, safeguard jobs and enhance environmental protection. The G7 focus on Resource Efficiency or Sustainable Materials Management (SMM), is an opportunity to address much-needed action around the economic implications of resource scarcity and to leverage ongoing international initiatives in the OECD and the 10 Year Framework of Programmes on Sustainable Consumption and Production (10YFP).

Life-cycle based decision-making is critical for addressing the complex challenges we face to sustainably manage our natural resources while experiencing healthy economic growth. The focus on Sustainable Materials Management is truly a paradigm shift from an historic end-of-life, waste management perspective on materials to a full life cycle perspective and understanding of how we should source, use and manage materials in order to promote growth, conserve natural capital and minimize negative human health and environmental impacts. By understanding dependencies on natural capital across the life cycle, we can take the most effective action to optimize their use while ensuring the health of humans and the environment. And those effective actions can be business opportunities.

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<sup>3</sup> UNEP (2011) Decoupling natural resource use and environmental impacts from economic growth, A Report of the Working Group on Decoupling to the International Resource Panel. Fischer-Kowalski, M., Swilling, M., von Weizsäcker, E.U., Ren, Y., Moriguchi, Y., Crane, W., Krausmann, F., Eisenmenger, N., Giljum, S., Henricke, P., Romero Lankao, P., Siriban Manalang, A., Sewerin, S.

<sup>4</sup> Sustainable Materials Management: the Road Ahead <http://www.epa.gov/smm/pdf/vision2.pdf>

<sup>5</sup> Resource Productivity in the G8 and the OECD <http://www.oecd.org/env/waste/47944428.pdf>

<sup>6</sup> Matthews, Emily, et al. Weight of Nations: Material Outflows from Industrial Economies. World Resource Institute. Washington, DC, 2000.

<sup>7</sup> Both in national programs and policies and in contributions to multilateral efforts, the United States strongly supports the concept of Sustainable Materials Management (SMM). SMM is a concept endorsed by the OECD (<http://www.oecd.org/env/waste/smm.htm>) and strongly affiliated with the concepts of resource efficiency and the Circular Economy.

## Life-cycle Based Decision-Making & Business Opportunities:

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*“The costs of pollution, ecosystem depletion and health impacts have grown steadily over the past five years and now exceed \$1 trillion per year for U.S. companies—equal to 6.2 percent of national GDP—and almost \$3 trillion for global companies.” Dr. Richard Mattison, CEO, Trucost PLC for the State of Green Business 2015*

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There are numerous business opportunities associated with the implementation of sustainable materials management approaches that investigate opportunities across the entire life cycle of materials, products and services. From differentiating greener products from their competitors to increasing efficiency by engaging in information sharing top global brands are engaged in the pursuit of sound business practices that are grounded in

sustainable choices. A 2009 study from consultancy A.T. Kearney found that during the economic slowdown, companies that were recognized as being “sustainability-focused” outperformed others in their industries by an average of 15% over six months<sup>8</sup>.

### *Public Sector Engagement Opportunities*

Governments are big purchasers. The Federal government alone spends over \$500 billion on products and services. Governments are seeking to increase efficiencies, improve environmental performance and enhance sustainability in their operations and supply chains. The Federal government recently released *Executive Order 13693: Planning for Federal Sustainability in the Next Decade*. This Executive Order offers opportunities for businesses to generate innovative materials, products and services that simultaneously meet the government demand for sustainability and expose the business to less risk.

Additionally, in some instances, business opportunity walks hand-in-hand with local government solid waste management policy and programs. According to the Southeast Recycling Development Council, in Tennessee, local governments pay \$42 million annually to bury commodities with a raw value of \$180 million. Alabamians pay \$25 million to bury \$193 million worth of materials. The Georgia Department of Community Affairs determined that their state pays right at \$100 million to bury \$300 million. Recycling could be a potent economic generator in a time where our country desperately needs jobs and economic development.

While EPA is currently updating the *U.S. Recycling Economic Information (REI) Study* which is due out later this year, our 2001 study showed we have domestic capacity to process 2 billion pounds of soda bottles, yet currently we only collect 1.4 billion/annually. And there is growing demand for more recycled plastic. The aluminum industry is eager for more aluminum cans – yet in the U.S. we bury nearly half of our cans in landfills, which by the way are valued at over \$1 billion. Glass recycling capacity exceeds supply by 65%. Paper recycling is available to 87% of Americans. The structure is in place for steel can recycling. Both seek to increase their consumption. All of the materials collected are used in recycling, and the forecast is for this demand to increase.

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<sup>8</sup> Green Winners, A.T.Kearney

### *Risk Reduction Opportunities*

In addition to business opportunities, companies may find risk reduction to be a compelling reason to embed sustainable managerial management in their products, programs and policies. According to the *State of Green Business 2015*, “The costs of pollution, ecosystem depletion and health impacts have grown steadily over the past five years and now exceed \$1 trillion per year for U.S. companies—equal to 6.2 percent of national GDP—and almost \$3 trillion for global companies. Preserving natural capital (the stock of resources and ecosystem services available to humans and corporations) reduces risk to critical supply chains and prepares companies to respond to a shifting regulatory and market environment<sup>9</sup>.”

In some instances, a focus on sustainable materials management may result in a reduction in the cost of compliance associated with hazardous waste regulations. Further, sustainable materials management can also lower the cost of waste removal as companies produce less waste and byproducts, and reduce transportation costs through lower product weight and more efficient transportation<sup>10</sup>. For example, General Motors (GM) switched from purchasing chemicals to purchasing chemical management services (a product-service system business model which uses a life-cycle approach for making improvements). As of 2008, GM went from 14,000 chemical suppliers/200,000 chemicals to six Chemical Management Service providers/72,000 chemicals world-wide. These six providers help GM green their supply chain through screening of all suppliers. It also allows for faster compliance with regulations and identification of and ability to switch to less and nontoxic alternative chemicals. GM realized a 30% reduction in chemical use and 30% reduction in costs<sup>11</sup>. At the same time, GM’s efforts to transform waste into valued by-products created \$6 million in sales<sup>12</sup>.

### *Process Improvement Opportunities*

In addition to increasing efficiency and reducing risk, life cycle-based decision-making and sustainable materials management can provide the following benefits to businesses<sup>13</sup>:

- Optimizing industrial systems by identifying operations within a market chain that have the greatest material impacts and opportunity for improvement, often referred to as “hotspots,” potentially offering strong return on investment. For example:
  - Replacing bottles with square cartons, saving space on shelves and in trucks; and
  - FedEx uses large plastic bags to handle small packages and envelopes going from one distribution center to another. The bags are collected and sent to a company that shreds, pelletizes and blows them into new bags for delivery back to FedEx<sup>14</sup>.

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<sup>9</sup> State of Green Business 2015, downloadable at: <http://www.greenbiz.com/report/state-green-business-report-2015>

<sup>10</sup> “The Sustainability Advantage” Bob Willard

<sup>11</sup> GM Presentation at US EPA 2008 Resource Conservation Challenge Workshop.

<sup>12</sup> WBCSD (2008). Sustainable Consumption Facts and Trends – From a Business Perspective. Geneva: WBCSD.

<sup>13</sup> How to Know If and When it’s Time to Commission a Life Cycle Assessment [http://www.icca-chem.org/iccadocs/acc\\_icc\\_lifecycle\\_2013.08.pdf](http://www.icca-chem.org/iccadocs/acc_icc_lifecycle_2013.08.pdf)

<sup>14</sup> April 2015 conversation with Will Sager of the Southeast Recycling Development Council

- Helping decision makers understand the environmental trade-offs of a decision such as implementing a particular technology to reduce GHG emissions that may result in increased water usage, allowing full disclosure and transparency.
- Hedge price volatility exposure and enhance resiliency through better and adaptive supply chain and end-of-life management.

### *Case Studies*

Companies seeking opportunities to capitalize on business opportunities and reduce risk must imbue their corporate social and environmental responsibility programs with innovative thinking that's grounded in sound science and transparent results. The following case studies, featured on the US EPA's Sustainable Manufacturing website, offer insight into how some corporations are aiming to engage in meaningful life-cycle based decision-making:

- **Advanced Composite Structures:** Using the Value Mapping Process, New Mexico Manufacturing Extension Partnership analyzed and reviewed the production process and the layout of the company's production area. ACS was able to eliminate excess movement, materials, and tooling to help create a more streamlined product flow. The company reduced costs by 65%, increased production from 20 units per shift to 45 units per shift, reduced its production facility size by 73%, and reduced scrap rates from 24% to 1.8%.
- **Custom Print:** An examination of the company's inventory and purchasing records demonstrated over 80 different chemicals on-site. A team of press operators, purchasing staff and maintenance personnel investigated the causes and suggested ways for reducing the chemical inventory. Other suggestions included modifying ventilation to improve worker health and reducing wasted ink. As a result, the company's chemical inventory was reduced by 70% with estimated saving of \$5,000 per year. The company also reduced its air conditioning needs, which cut electricity costs by \$2,000/month (40%) and reduced its wasted ink by training employees to mix specialty colors from existing ink stocks
- **Canyon Creek Cabinet Company:** Canyon Creek implemented a series of process improvements to reduce hazardous and solid wastes, reduce wastewater discharges, and energy consumption. Production improvements included reduced lead time, defects, and material loss and damage. Total cost savings for the company are approximately \$1,189,550 per year, with increased production from about 900 cabinets per day on average to about 1,000 cabinets per day.

**For More Information:** <http://www.epa.gov/sustainablemanufacturing/case-studies.htm>

Increasingly, manufacturers have enhanced value proposition, product differentiation and innovation as a result of life-cycle based decision-making:

- **Unilever Sustainable Living Plan:** Unilever is working to decouple growth from environmental impact in order to double the size of its business and increase the positive social benefits of its products. The Unilever Sustainable Living Plan sets out about 60 time-bound, publicly-reported targets designed to reduce costs, support customers and grow its brands, opening up new markets in a sustainable way. Targets include halving the environmental footprint of Unilever's products and sourcing 100 per cent of agricultural raw materials sustainably by 2020. Measures

include investments in R&D and development of sustainable products and resource efficient factories. In 2011, 100 percent of the electricity purchased for Unilever sites in Europe and Canada came from renewable sources.

**Environmental/Social Value:** The value of the plan lies in its potential to reduce Unilever's environmental impact across the whole value chain (i.e. from sourcing of raw materials to product distribution and disposal of waste). Socio-economic benefits include engaging at least 500,000 smallholder farmers and 75,000 small-scale distributors in Unilever's supply network by 2020, thereby building economic resilience along the supply chain and enabling Small and Medium Enterprise to benefit from the growth of the business.

**Financial Value Drivers: Sales Growth and Duration.** According to Unilever, the business case for this strategy is compelling. Integrating sustainability into its brands will encourage innovation, drive cost efficiencies, and create a competitive advantage as retailers and consumers increasingly demand sustainable options. Through the action areas, Unilever will ultimately reduce its operational expenditure through effective management of supply-side risks and efficient use of resources. Reductions have already been made through a range of initiatives, including the introduction, between 2008 and 2011, of combined heat and power (CHP) systems in many of its European factories which has led to savings of more than € 10 million a year (by the end of 2011). Unilever has noted that reformulating products or creating innovative new products adapted to a world of more constrained resources has translated into commercial gains. For example, a fabric conditioner was developed for handwashing laundry, 'One Rinse,' which reduced the amount of water required to rinse detergent from clothes by two-thirds. This saves an average of 30 litres of water per wash. In 2011 they launched Surf One Rinse in the Philippines and expanded the Comfort One Rinse range in Indonesia, Thailand and Vietnam. Unilever's One Rinse products are now used in 12.5 million households worldwide, a 60 per cent increase on 2010. Adapting its product portfolio to fit a future of limited resources will drive growth in new markets<sup>15</sup>.

- **PUMA:** PUMA collaborated with PricewaterhouseCoopers and Trucost to conduct the first Environmental Profit and Loss Account (EP&L) for 2010, published in 2011. The EP&L serves as a strategic, risk management and transparency tool. The account quantifies the value of ecosystem services and the negative impacts, focusing on GHG emissions, water use, land conversion, other air pollution and waste resulting from core operations and along its entire supply chain. Environmental impacts were valued at € 145 million for 2010. Only € 8 million of this total derived from PUMA's core operations, and the remaining € 137 million from PUMA's external suppliers. PUMA apparel is heavily reliant on the use of water for the production of raw materials and their processing. Sustainable sourcing of raw materials and resource efficiency across the tiers will build a more resilient supply chain and translate into a stronger business model to succeed over time. This significantly improves the company's risk profile.

**Environmental/Social Value:** By recognizing the extent of economic risk derived from negative environmental impact PUMA is able to quantify the benefits of integrating sustainability into its

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<sup>15</sup> UNEP, 2012, The Business Case for the Green Economy. Sustainable Return on Investment

global supply chain. With resource limitations clearly in its sights, PUMA is sourcing more sustainable materials in order to mitigate and manage this risk.

Financial Value Drivers: Reduced Capital Expenditure & Increased Profit Margin. The main output from the EP&L is the quantification of the value of the environmental impacts (€ 145 million for 2010), which present an economic risk from environmental factors such as water availability, rising raw material costs and further constraints in production carrying significant strategic implications. In practical terms this amount would translate as a negative financial impact on business. Using the tool allows PUMA to reduce this financial loss thus strengthening its operating margin through an early view of emerging risks, enabling the company to respond strategically to protect long-term shareholder value. PUMA has publicly committed itself to having 50% of the international collections made of more sustainable materials by 2015 and is currently well positioned to do so<sup>16</sup>.

- **Monsanto and Natura:** While companies have been tracking agricultural commodities and forest products for years.....new technologies such as sensors, data analytics and the so-called Internet of Things are enabling companies to more easily and affordably account for the environmental and social impacts of their materials and products – all the way upstream to farms, forests, mines and individual factories. Monsanto and Natura compared monocultural soy and palm oil production techniques with ones that conserve local ecosystems. The study proved that methods that protect natural capital have much greater value for the companies, their suppliers and the environment than more intensive production methods<sup>17</sup>. **For More Information:** <http://www.greenbiz.com/blog/2014/03/19/natural-capital-analysis-puts-value-agroforestry-context>
- **Interface:** Interface is using natural capital valuation expertise to enhance life cycle assessment data. Putting monetary value on different impacts allows the company to be clearly differentiated and compared with other companies, and its environmental programs to be prioritized and communicated<sup>18</sup>. **For More Information:** <http://lcacenter.org/lcaxiii/final-presentations/875.pdf>

#### **Actionable Items Associated with the May 20<sup>th</sup> G7 Resource Efficiency Meeting:**

There are a number of actions that the U.S. Chamber of Commerce and their member companies could consider in connection with the May 20<sup>th</sup> G7 Resource Efficiency Meeting. In order to leverage existing efforts and expertise, EPA recommends consideration of the following action areas:

- **Advocacy and Information Sharing:** On May 6-7, 2015, the U.S. Chamber of Commerce Foundation is hosting a forum on “The Circular Economy: Unleashing New Business Value.” The U.S. Chamber might consider highlighting this in demonstrating interest in the resource efficiency/SMM/Circular Economy agenda. EPA would also welcome engaging this forum and

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<sup>16</sup> UNEP, 2012, The Business Case for the Green Economy. Sustainable Return on Investment

<sup>17</sup> State of Green Business 2015 <http://www.greenbiz.com/report/state-green-business-report-2015>

<sup>18</sup> This example is drawn from the State of Green Business 2015 <http://www.greenbiz.com/report/state-green-business-report-2015>

other stakeholders on the business case for life-cycle based decision-making, which is central to sustainable materials management.

- **Policy Priorities:** Each year, the U.S. Chamber of Commerce advances a list of policy priorities. Given strong international interest and a strong business case for implementing life cycle-based decision-making, consider making sustainable materials management one of the U.S. Chamber of Commerce's 2016 Policy Priorities.
- **Join Ongoing EPA Initiatives:**

- **Wasted Food:** 40% of U.S. food goes to waste, costing Americans approximately \$165 billion annually. Reducing the amount of food wasted has significant economic, social and environmental benefits. The U.S. Chamber, its associated businesses and organizations can join EPA's SMM Food Recovery Challenge (FRC), which seeks to prevent and reduce wasted food. Challenge endorsers and participants can save money, help communities and protect the environment by purchasing less, donating extra food and composting. **For More Information:** <http://www.epa.gov/foodrecoverychallenge/>

Internationally, the U.S. Chamber of Commerce and/or its members could help advance a focused international food waste reduction and recovery initiative being proposed as part of a soon-to-launched Sustainable Food Systems Programme under the 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP) that was adopted at Rio+20, for which EPA serves as the US government National Focal Point.

EPA is also working with USDA around the UN Sustainable Development Goals to reduce food loss and food waste by 2030. Consider joining EPA and other stakeholders to develop a strategy to address this critical issue that affects the economic, environmental and social well-being of the U.S.

- **Electronics:** EPA works closely with leaders across the electronics community to ensure the safe and sustainable management of electronics throughout products lifecycles and encourages Chamber members to consider working with EPA on this issue. According to a 2013 Sprint press release, Sprint's priority for e-waste is reuse, which provides significant financial benefits: cost savings for Sprint and its suppliers was \$217 million in 2012 and \$59 million in the first quarter of 2013.

EPA encourages qualifying electronics manufacturers and retailers to join the SMM Electronics Challenge. **For more information:**  
<http://www.epa.gov/epawaste/consERVE/smm/electronics/index.htm>