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ABOUT WHEB

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EDITORIAL

One of the many joys of working near Manchester Square in London's West End, is that the neighbourhood benefits from one of the highest densities of electric charging stations in the UK.

While we have yet to catch a glimpse of the Tesla S-Class which has just gone on sale in the UK, we are regularly treated to the sight of Nissan Leafs, BMW i3s, Vauxhall Amperas and Mitsubish i-MiEVs vying for access to the free charging stations. Lauded and ridiculed in equal measure, Ben Goldsmith reflects on the technology beneath the bonnet (pages 2-5) and concludes that the future is likely to bright for electric vehicles.

Policy support is clearly still important in accelerating the deployment of electric vehicles, and is one of the ingredients that Jörg Sperling assesses in his review of the investment landscape in different European countries. The other two ingredients; the availability of finance and the existence of a supportive business culture, are also critical in enabling the development of environmental innovation hubs. Jörg's conclusions on the strengths of different Western European countries can be found on pages 6-9.

Finally, while electric vehicles may represent the cutting edge of desirable, sophisticated new technology that delivers superior environmental performance, more prosaic approaches used in recycling or reusing materials are proving equally attractive commercially. Seb Beloe discusses some of these technologies (pages 10-13) and the role they play in helping companies develop more cyclical business models that insulate their operations from higher and more volatile raw material prices, and extract greater value from customer relationships.

We hope you enjoy this edition of WHEB Insights.

Seb Beloe
Editor
seb.beloe@whebgroup.com

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TOGETHER IN *Electric* DREAMS?

Ben Goldsmith, Partner, considers the latest developments in electric vehicles and the outlook for the technology.

The UK government has extended its financial support for electric vehicles by a further £500m, which is likely to accelerate the steady growth in this sector. Yet investors looking for low-risk growth should also consider the broader theme of vehicle efficiency.

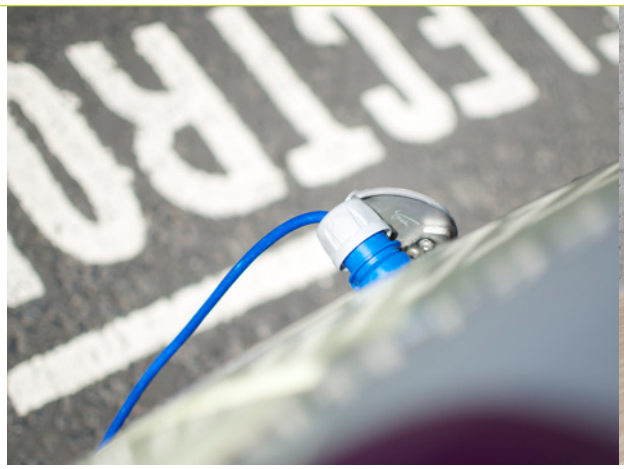
A new, futuristic-looking car has appeared on London's streets. It is the Vauxhall Ampera, called the Chevrolet Volt in the USA, an electric-powered family saloon, which uses an on-board 1.4 litre petrol engine to recharge its batteries. The result is a usable car – 0-60 in ten seconds and around a 300 mile range – which can achieve over 100 miles per gallon.

Cramming a hatchback-sized engine, an electric generator, batteries and an electric motor into one car may seem the opposite of efficient, but doing so reveals two key truths about cars and energy. First, electricity is a more efficient medium than petrol for managing power around a car. It can be generated while braking, and dispenses with the need for the heavy gearbox needed for internal combustion engines. Secondly, recharging electric cars presents challenges; hence General Motors' decision to generate electricity on board.

The Ampera is a clever piece of systems integration. It also says a great deal about where the personal transport sector stands in 2014 – so much so that it is easy to imagine it as a museum piece of the future. Its design has a fully-electric power train for efficiency but recognises petrol as the most economical and portable underlying energy source. So is the Ampera 'just another hybrid?' The answer is no. In our automotive museum of the future, the preceding exhibit would be the Toyota Prius, first released in Europe in 2001. The Prius – which became a runaway success and is still a top seller for Toyota – is essentially an internal combustion engine car which uses a battery to extend range. The Ampera is the opposite, which is a big difference; and it was awarded 8/10 by the UK's demanding Top Gear magazine, which is a bigger one.

Pure-play electric cars – those without range extenders – are also appearing. These include the Nissan Leaf with its quoted 80-mile range and the BMW i3 with a similar range, although it also comes in a range-extended model. Of these, the i3 is the more radical. It is a root and branch electric car, drawing on a BMW development programme that started with the electric Mini E of 2009. The i3 is built for lightness with a carbon-fibre body, and it is tipped for success by the UK motoring press.

"electricity is a more efficient medium than petrol for managing power around a car."



Sales of these cars are supported in the UK by a buyer subsidy of £5,000. This forms part of a broader system of support, including free recharging points in urban centres, which recently received a further £500m commitment from central government. Although this should further boost the steady growth in this market, these vehicles still represent a small (though growing) proportion of overall sales for established carmakers.

In the UK, 1,200 grant-eligible vehicles were registered in March 2014[i]; while in the US, the equivalent figure was just under 5,000[ii]. Consumer constraints include 'range anxiety' (hence the introduction of extenders), lack of charging infrastructure (although some retailers like Ikea have seen an opportunity to offer this as a perk to visiting customers) and, ultimately, cost. The Ampera and i3 are both around £30,000, which could easily buy a fast, frugal German sports saloon. And yet some markets are proving to be front-runners in the adoption of electric cars – in Norway, for example, around a fifth of new vehicles registered are electric.

So how ought investors to get exposure to this fast-moving theme? Automotive majors are not an option, given the small proportion of their business devoted to electric vehicles and the narrowing profitability many face on their traditional lines (not surprising, given that the value chain of car manufacturing and distribution has hardly changed since Henry Ford). The one large, pure-play electric car manufacturer is Tesla. It is selling over a thousand units of the Model S in the US every month, a car which has received extremely positive reviews in the petrol-loving US motoring press.

Investor demand is currently outstripping the supply of the company's shares, resulting in an eye-popping $30bn valuation or 135 times expected earnings this year. This market capitalisation may represent a broader vote of confidence in the future growth of the market, especially now that Tesla expects to produce batteries for other car manufacturers. Tesla's founder, Elon Musk, is living proof that one visionary entrepreneur can transform a market – he is nothing short of a modern-day Thomas Edison.

i http://www.smmt.co.uk/2014/04/march-2014-ev-registrations/
ii http://www.hybridcars.com/march-2014-dashboard/

"Feeling unable to overtake the West and Japan on internal combustion engines, Chinese companies are investing heavily in battery technologies."

As far as batteries go, fears over raw materials constraints – of lithium, for example – appear to have eased. New supply has come on stream and more plentiful alternatives are emerging, while institutes such as MIT regularly post new research updates. However, as is often the case with scale and cost reduction challenges, China is likely to hold the key. It has been China's vast investment in solar photovoltaic manufacturing that has given the world competitive, ever cheaper solar power. Feeling unable to overtake the West and Japan on internal combustion engines, Chinese companies are investing heavily in battery technologies. This should provide a boost to the electric vehicle market. In 2009, our private equity team at WHEB made an investment predicated in part on future price reductions in batteries, which has since proved correct. The team backed electric outboard motor manufacturer, Torqeedo, which has now benefited from battery price reductions to increase the power output of its largest unit tenfold to 80 HP – now the most powerful commercially available outboard electric boat engine.

And yet, as with any emerging sector, there is risk. Better Place, a well-backed Israeli start-up with the breakthrough idea of a network of 'battery stations' at which drivers could change one leased battery in a matter of seconds for a fully recharged replacement, went bust last year.

For those looking for thematic growth coupled with lower risk, a better mindset may be to replace the words 'electric cars' with the less catchy 'vehicle efficiency sector'. Urged on by increasing fuel-efficiency regulations (the EU's latest standard calls for companies to reduce emissions to 95g/km across the EU car fleet by 2021) and by the demands of consumers suffering from high fuel prices, car makers are competing intensely on miles per gallon. Even in the U.S, where fuel is cheaper than in Europe, over a third of motorists list fuel efficiency as a top factor in choosing a car. The result is a great stimulus to automotive supply-chain companies focusing on delivering this outcome for large carmakers. 'Stop-Start' technology, which saves fuels and cuts down on urban pollution while paying for its upfront cost in a year, is now widespread. There is also a multitude of more complex solutions, such as thermal management, 'lightweighting', and engine cooling. WHEB's listed equities team owns US-based Borg Warner, which achieved sales of $7.4bn in this market in 2013, in the portfolio of the FP WHEB Sustainability Fund.

Investors in search of an environment for accelerated take-up of pure battery electric vehicles should look, for the moment, to niche users with predictable journey patterns. These include urban car clubs, taxis and local vehicle fleets. A reminder of the suitability of electric power for such uses is provided by the humble milk float – probably the first electric vehicle seen by many of us. Although such vehicles may become obsolete through the changing face of retail, it is likely that after much refinement, similar technology will one day dominate the roads. ■

EUROPE IS *LEADING THE WORLD* IN DELIVERING ENERGY AND RESOURCE EFFICIENCY

Jörg Sperling, Partner, is responsible for the German division of WHEB's private equity team. Jörg describes the investment landscape for growth stage companies serving the markets for resource and energy efficiency across Europe.

As partner responsible for the German division of WHEB's private equity team, I spend a lot of my time on the road looking for companies developing clean industrial processes and energy-efficient solutions which will ultimately enter the product lines or production lines of Europe's leading industrial groups. Indeed, experience of the past 20 years has shown that government penalties on emissions and pollution are not simply a dead-weight cost to large industry. They can also catalyse deep-rooted improvements in efficiency and, therefore, productivity. The German chemicals sector is a case in point – environmental legislation, once feared, has helped turn it into the most efficient in the world, able to compete successfully on a global basis.

Yet large companies cannot always provide the R&D to develop a multitude of niche solutions across the supply chain, many of which also have multiple applications across different sectors. A lot of the value that we provide as growth capital investors is therefore in identifying and internationalising companies with promising technologies. In doing so, we are able to identify the various factors that make different countries into good incubators for energy and resource efficiency technologies.

What makes a country an environmental innovation hub?

Broadly speaking, this situation is determined by three main related factors – the industrial heritage of a country, its business culture and the availability of sources of finance. The ideal is a country with a well-diversified industrial base that has not had access to abundant natural resources; an open business culture focused on growth; and governmental or private-sector investors willing to provide early-stage risk capital.

The size of the domestic market is also a factor but can be a double-edged sword – a healthy domestic market allows a company to mature and generate revenue before looking overseas, but can also distract it from seeking international markets and tailoring its products accordingly. The presence of tax breaks and other incentives can have a similarly uneven effect. While they are better present than absent, too generous a regime can inflate or obscure the underlying value of a company's activities.

"experience of the past 20 years has shown that government penalties on emissions and pollution are not simply a dead-weight cost to large industry."

Heading from north to south across Europe, our experience has been as follows.

Norway's growth has historically been dominated by oil and shipping, resulting in little incentive to create technology hubs. However, there are now a number of very interesting geothermal technology companies, such as Green Energy Group ("GEG"). Headquartered in Oslo, GEG designs, manufactures and delivers modular, flexible, small scale well-head geothermal power plants, using a technology which enables developers, utilities and independent power producers to shorten significantly the time between exploration and revenue generation in geothermal projects.

Norway's neighbour, **Sweden** has, by contrast, had a different development. A lack of natural resources has created both a more diversified industrial base – extending to pharmaceuticals, automotive and high technology – as well as a focus on reducing energy intensity. The latter in turn filters down to a 'green' population who are willing to become early adopters of clean technology.

Alongside this heritage is a mature and active private equity community which seeks out international partners. That said, Sweden's openness also makes it a market where one can invest cross-border, as we successfully did with Petainer, a manufacturer of large container and refillable PET packaging that we recently sold for twice the original investment.

"Some [German companies] have even repatriated manufacturing business that was once assumed to have been lost forever to China."

It is a similar story in **Denmark**, where local investment in spin-offs, public sentiment towards both technology and the environment, and an open business culture make the country both a technology hub and a place that is a particular pleasure to do business in.

Germany – my home market – is a more complex story. On the one hand, it is a mature and diversified industrialised country with a famed bedrock of Mittelstand[i] companies. Some of these have even repatriated manufacturing business that was once assumed to have been lost forever to China, as buyers tire of extended supply chains, long lead times and variable quality. Others, meanwhile, have turned to the resource and energy efficiency markets. For example, UBC GmbH is a profitable developer and manufacturer of high-end lightweight components made of carbon fibre composite materials, and FriedolaTECH is a manufacturer of truck floorings and transport containers from recycled plastic.

i Mittelstand refers to small and medium-sized enterprises in German-speaking countries, especially in Germany, Austria and Switzerland.

Although the industrial profile of Germany is suitable, the culture and financial atmosphere provides its own set of challenges for an international partner. The owners of private, mid-size businesses are often sensitive to losing control to an international investor or much larger company.

The **UK** is uneven and is perhaps the most difficult about which to generalise. Its shift from manufacturing to services has been so great that hope of recovering industrial capacity from China, as Germany has begun to do, seems unlikely. Yet the country is still in possession of certain world class niche capabilities which can, and are, being redeployed towards industrial efficiency – even from such apparently unlikely areas as motor sport. The so-called "Anglo-Saxon" business culture encourages investment, yet the grant regime towards early stage R&D does not. With both public and private finances more precariously balanced than in other Northern European countries, as well as a more uncertain regulatory regime and greater public scepticism towards 'green' issues, the UK's role in the development of industrial efficiency technology is uncertain. The immediate manifestation of this is that those companies that do create and patent disruptive technologies tend to be sold overseas years before they reach the kind of output or market presence that they might in Germany, for example. In this respect, the UK could provide some attractive targets for corporate venture capitalists looking for mid-stage bolt-ons to their main industrial lines.

Europe offers a diverse landscape in terms of industrial heritage, business culture and available finance and, as a result, offers a varied climate for building industrial efficiency technology businesses across sectors.

I am often asked if we ever feel the need to look further afield. As described above, different European countries each have their unique characteristics. Having locals on the ground who understand these cultural and commercial nuances is key to sourcing good quality growth deals; so we focus on the geographies that we understand well; the UK/Ireland, German speaking countries and the Nordics. ■

"With a more uncertain regulatory regime and greater public scepticism towards 'green' issues, the UK's role in the development of industrial efficiency technology is uncertain."

THE CIRCULAR ECONOMY
HOW INDUSTRY IS EMULATING NATURE

Seb Beloe, Partner and Head of Research in WHEB's Listed Equities team, reports on how cyclical business models are creating value and reducing environmental impacts.

In the early 1990s I was lucky enough to have been taught by an ecology professor who maintained that industrial systems would one day come to mirror the structure of natural ecosystems. He was referring in particular to the central role and extraordinary variety of 'detritivores' - organisms that break-down and recycle nutrients - and the almost complete lack of businesses in industrial systems that play this role.

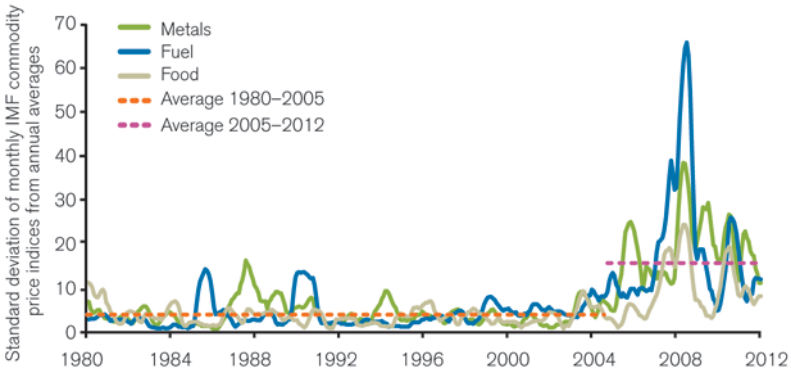
Even at that time, starry-eyed environmentalists talked about a 'circular economy' in which waste was eradicated not just from manufacturing processes, but also throughout the life cycles of products and their components. Fast-forward to 2014, and the circular economy is attracting interest and investment from sectors as diverse as chemicals to cars, and from software to business services.

Public policy, resource prices and volatility driving a step-change

Public policy has played an important role in influencing businesses and public authorities to consider how they manage waste. Taxes on landfill, such as that in the UK which at 1st April 2014 stood at £80/tonne[i], have encouraged rapid growth in alternative waste treatment technologies. However, equally important has been the rising price of raw materials, as well as the growing volatility of these prices[ii]. According to Chatham House, the sustained high level of volatility across the commodity markets since the early 2000s marks a new trend (see figure 1).

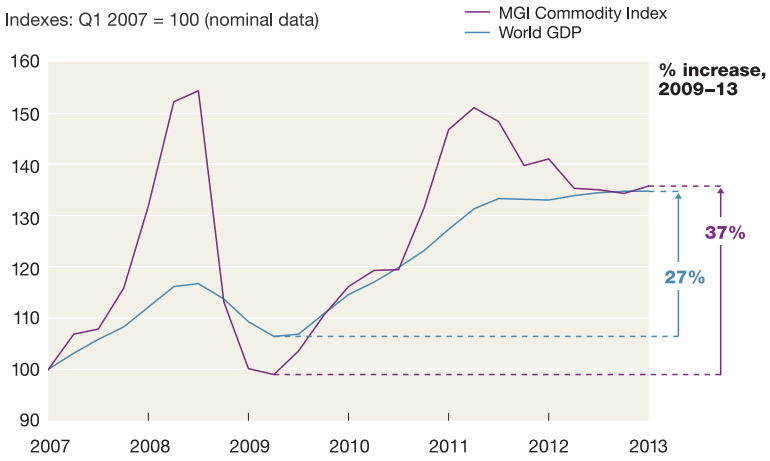
In a paper 'Remaking the industrial economy' published in 2014, McKinsey & Co. argues that the year 2000 represented an inflection point in the real prices of raw materials and that by 2008 price increases had erased almost a century's worth of real price declines. Prices fell precipitously with the onset of the global financial crisis in 2009 but, even in the few years since, resource prices have rebounded faster than global economic output. As McKinsey put it, 'the era of largely ignoring resource costs is over'[iv] (see figure 2).

Figure 1: Volatility in commodity markets 1980-2012[iii]



"According to Chatham House, the sustained high levels of volatility [in commodity markets] since the early 2000s marks a new trend."

Figure 2: Resource prices compared to World GDP[v]



Source: Food and Agriculture Organization of the United Nations (FAO); International Monetary Fund (IMF); Organisation for Economic Co-operation and Development (OECD); Oxford Economics; World Bank; UN Comtrade database; McKinsey Global Institute (MGI) analysis

While absolute scarcity is several decades away for most raw materials, more important for the economy as a whole is the growing cost of extracting useable quantities of a wide variety of raw materials from less accessible and lower quality reserves. In 1900, copper ores, for example, contained approximately 4% copper, but by 2010 the average ore grade was just over 1%[vi].

In many cases 'urban mining' (recovering valuable materials from waste streams) provides much greater opportunities for metal recovery. Umicore, for example, estimates that mining primary gold reserves yields only about 5g/tonne of ore. The same yield on a tonne of printed circuit boards is approximately 200/250g of gold[vii]. Even back in 2008, Japan's National Institute for Materials Science calculated that Japan's untapped 'urban mines' contained 1,700 tons of indium (about 61% of known natural reserves); 60,000 tons of silver (22% of world natural reserves); 6,800 tons of gold (16%), 5.6 million tons of lead (10%), 11% of the world's tin reserves and 10% of the world's tantalum[viii].

Necessity is driving invention

The old saying 'Necessity is the mother of invention,' holds true. The stipulations of policy and economics have led to an extraordinary flowering in the variety of technologies available to recover and re-use waste raw materials. Organic materials such as food waste are relatively easily dealt with through composting or anaerobic digestion. Almost all food waste from UK supermarkets is already converted into valuable biogas and fertilisers. New technologies are emerging all the time, for example, converting waste plastic into diesel, recovering phosphates from sewage to produce mineral fertilisers[ix] and even technologies for recovering the minute quantities of platinum found in street sweepings[x].

Corporate activity is heating up

These dynamics are also leading to significant corporate activity. Orix Group, a Japanese conglomerate, recently spent over US$200m on unlisted precious metal recycling company 'Net Japan', and paid approximately 51x EBITDA for the business[xi]. In Europe, Suez Environnement has teamed up with several companies including Carbios and Cynar to develop services aimed at boosting the value from plastic recycling.

Waste management businesses clearly occupy an important position in the current industry structure, but this may be changing. In the UK, 35% of businesses are looking to develop relationships with companies outside the traditional waste sector to help them manage and re-use their waste and in the process are disintermediating waste management companies[xii]. Coca-Cola for example has entered into joint ventures with plastic processors in the UK and France to capture more value from recycling PET bottles. Marks & Spencer is even trialing a joint venture with Somerset Council to source plastic waste directly from household waste streams.

In the automotive sector, Renault's Choisy-le-Roi plant, near Paris, remanufactures its automotive engines, transmissions, injection pumps and other components for resale. The operations at the plant have a radically lower environmental footprint compared with similar facilities and use 80% less energy and almost 90% less water (as well as generating approximately 70% less oil and detergent waste). The plant also delivers higher operating margins than Renault as a whole is achieving.

And changing business models

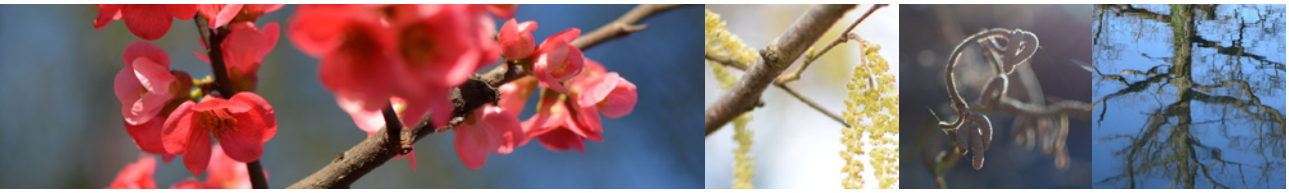
Manufacturing businesses like Renault, but also Ricoh in printers and Philips in medical technology, are finding that collecting used products and refurbishing or remanufacturing them, while utilizing existing relationships, technologies and capital can often generate higher margin opportunities than traditional manufacturing activity.

Across the economy, these impacts are likely to be very significant. McKinsey & Co. estimates that, in the European Union alone, the annual savings on material costs for durable products with moderate lifespans could reach $630 billion[xiii]. The McKinsey & Co. research also suggests that the reduced demand for raw materials (as a result of more recycled and reused materials) could significantly affect demand-driven volatility of steel prices in the automotive, machining and transport sectors.

Selling services not products

Ultimately, selling services not products may become a stepping stone to an entirely new business model. Already, companies such as Autodesk, PTC and Dassault enable their customers to monitor the performance and location of expensive capital equipment while it is in use. For example, GE is able to monitor the in-flight performance of its jet engines. If the sensors detect anomalies, replacement parts can be ordered and potentially even be available at the destination airport before the airplane arrives. In this model, GE is offering a service as much as a product.

Philips takes this approach one stage further with its business customers and now sells lighting as a service rather than just lighting products. Customers only pay for the light, and Philips takes the technology risk and the investment cost. Critically, they also usually take the equipment back at the end of its life in order to recycle the materials or upgrade them for reuse.



i http://www.letsrecycle.com/business/landfill-tax
ii Bernice Lee et al., Resource Futures – A Chatham House Report, The Royal Institute of International Affairs, December 2012 (http://www.chathamhouse.org/research/eedp/current-projects/resources-futures)
iii Ibid
iv Hanh Nguyen et al., Remaking the industrial economy, McKinsey Quarterly, February 2014 (http://www.mckinsey.com/insights/manufacturing/remaking_the_industrial_economy)
v ibid
vi 'The key drivers behind resource growth: an analysis of the copper industry over the last 100 years', Richard Schodde, MinEx Consulting, 3 March 2010
vii Umicore, Recycling of technology metals: Opportunities and limitations, Capital Markets Event on Recycling, 18-19 November 2010 (http://www.umicore.com/investorrelations/en/newsPublications/presentations/2010/show_2010CMD_Recycling.pdf)
viii Japan's 'urban mines' are comparable to the world's leading resource nations, National Institute for Materials Science, January 2008 (http://www.nims.go.jp/eng/news/press/2008/01/p200801110.html)
ix Ostara launches the UK's First Commercial Nutrient Recovery Facility at Thames Water's Slough Sewage Treatment Works, 6th November 2013 (http://www.ostara.com/sloughUK)
x Richard Gray, The streets are littered with gold, Daily Telegraph, 14 July 2013 (http://www.telegraph.co.uk/earth/environment/10177855/The-streets-are-littered-with-gold.html)
xi CLSA Research note
xii Closing the Loop: risk or reward?, Edie.net, 2013
xiii Op. Cit. iii

"in the European Union alone, the annual savings on material costs for durable products with moderate lifespans could reach $630 billion."

These examples show that during the last few years, the confluence of resource prices and volatility, policy and technology have created new opportunities for companies to develop new products and, services that can produce new revenues, generate higher margins and improve productivity, while reducing environmental impacts. Companies that are innovating in this way may still be the exception rather than the rule, but I think my old professor would be quietly pleased. ■

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WHEB

2 Fitzhardinge Street
London
W1H 6EE
United Kingdom

+44 20 3219 3441
caroline.barraclough@whebgroup.com

www.whebgroup.com