HSBC
Global Research

Equity Strategy/Global
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Disruptive Technologies

Winners and losers from game changing innovation

HSBC analysts worldwide highlight 18 businesses that are being revolutionised by new technology or shifts in their business models

These include fully automated driving, big data and cloud computing, electricity storage, and healthcare advances in stem cells and bio-similars

We identify likely winners and losers, and present 12 investible ideas

By Garry Evans

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Summary of investible ideas

Company name	BBG code	MCap (USD bn)	ADTV (USD mn)	CCY	Current price	HSBC target	PE 2013e	PE 2014e	Performance -3M	Performance -1Y	Performance -3Y	HSBC rating	HSBC analyst name
Celltrion	068270 KS	4.1	133.0	KRW	44300.0	76000.0	19.9	12.8	6.0%	-9.0%	71.0%	OW	Nam Park
Continental	CON GR	33.9	64.7	EUR	124.9	150.0	11.0	9.5	21.6%	63.3%	119.3%	OW	Horst Schneider
Dangdang	DANG US	0.6	27.4	USD	11.7	13.5	NA	15.1	68.6%	147.9%	NA	OW(V)	Chi Tsang
Experian Ltd	EXPN LN	19.1	28.5	GBP	11.7	15.0	22.5	19.3	2.6%	14.0%	69.3%	OW	Rajesh Kumar
Ericsson	ERICB SS	41.5	84.8	SEK	86.1	105.0	18.7	14.1	13.3%	43.8%	16.3%	OW	Richard Dineen
Gemalto	GTO NA	9.8	47.5	EUR	82.1	100.0	24.2	19.7	18.0%	19.9%	172.6%	OW	Antonin Baudry
Ingenico	ING FP	3.9	13.3	EUR	53.7	63.0	19.5	16.7	4.9%	34.3%	150.7%	OW	Christophe Quarante
LG Electronics	066570 KS	10.4	69.3	KRW	68400.0	100000.0	14.3	7.9	-6.3%	-0.9%	-27.2%	OW	Brian Sohn
Medipost Co Ltd	078160 KS	0.4	8.1	KRW	67100.0	122700.0	88.6	64.1	7.4%	-29.4%	97.6%	OW(V)	Nam Park
Pharmicell Co. Ltd	005690 KS	0.2	2.2	KRW	4325.0	7900.0	NA	37.2	8.7%	-31.1%	-25.9%	OW(V)	Nam Park
Samsung Electronics	005930 KS	194.5	320.8	KRW	1418000.0	1870000.0	6.6	5.9	5.7%	5.3%	82.5%	OW	Ricky Seo
SAP	SAP GR	91.5	201.5	EUR	54.8	74.0	17.0	14.8	-2.5%	-1.2%	51.0%	OW	Antonin Baudry

Source: HSBC, Thomson Reuters Datastream

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Disruptive technologies

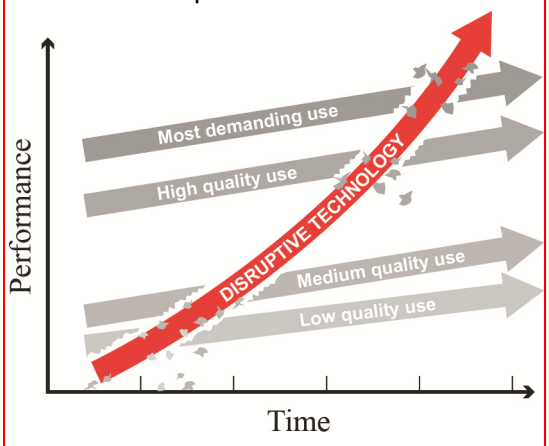
- We define disruptive technology broadly: it is any innovation that is liable to revolutionise an industry and challenge the dominance of its incumbents
- The current disruptions are driven largely by a convergence of technologies: telecoms speed, data capacity and network effects
- If history is a guide, investors are likely find it easier to spot the likely losers than the winners

What's a disruptive technology?

The concept of 'disruptive technology' (or 'disruptive innovation', since it can consist of business models too) was invented by Clayton Christensen in his 1997 book *The Innovator's Dilemma.* A disruptive technology is an innovation which creates a new market or value network and eventually goes on to disrupt an existing market or network.

Christensen focused on innovations that break the usual pattern of companies producing higher-spec products at a higher price (he called these conventional advances 'sustaining technologies'). Disruptive technologies, at least in their early years, typically offer *poorer* performance than established technologies but are cheaper and provide customer benefits not offered (or even considered) by the existing market leaders. The disruptive technology quickly improves in quality and replaces older technologies (Chart 1)

1. How low-end disruption occurs over time



Source: Wikipedia

The leading companies in the industry either miss these developments, or fail to see that the performance of the new technology will improve rapidly or, even if they understand all this, are unable to retool their business quickly enough because of institutional inertia. Christensen famously quoted the examples of hydraulic excavators replacing cable-operated excavators, mini steel mills beating vertically integrated steel mills, and the continuous process of one floppy disc technology being superseded by the next generation (14" by 8" by 5.25" by 3.5").

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But an even better recent example is digital cameras. Initially, they could take only very low resolution photos. But quality improved to an extent where today even professional photographers prefer them, and only some Hollywood movies are still shot using traditional film. Even though the leader in film photography, Eastman Kodak, understood the threat, it was unable to re-engineer its business and eventually filed for Chapter 11 in 2012.

But in this report, we have defined disruptive innovation (or 'game changers') more broadly than Christensen. The internet may have changed the dynamic he described. It is possible for a new entrant to challenge an established market with an offering that is cheaper and, from the start, miles better. Amazon, for example, sold books for the same price as conventional bookstores (or even more cheaply) but offered a better service (far wider choice, user reviews, no need to go to a store). It eventually drove most booksellers out of business, even before it moved into e-books with the Kindle. Encyclopaedias were replaced by Wikipedia (which is better and free).

In our view, even incremental improvements can sometimes be disruptive, since some market leaders will be unable to keep up with the pace of technological change (think of Nokia and Blackberry, and the extent to which they have lost out to Apple and Samsung in smartphones). Christensen would see these as 'sustaining technologies' in which it would be easier for leading established companies – used to striving for continuous technological advance in order to raise prices – to erect barriers to entry to see off smaller competitors.

What disruptive technology is not

There are some sectors, though, where pundits have been predicting disruptive change for decades but where it has never happened, despite the existence of revolutionary technology. Often this is due to the dominance of incumbents, or because the new technology affects only superficial aspects of the business not its underlying dynamics.

Our financial sector analysts, for example, when asked to contribute to this report could not identify a credible disruptive technology in the retail banking space (and not for lack of trying). This may come as a surprise to readers. After all, market commentators have been predicting the demise of the traditional retail banking model for some 20 years. But, while new entrants have come (and often gone) and new technology has been introduced (telephone banking, internet, mobile payments), it is still the incumbents that dominate.

Why has the banking sector proved so resilient? Our analysts argue that:

- 99% of banking customers treat their bank as a utility and are primarily interested in a small group of core products. Customers want banks to provide them with mortgages (which technology can't easily disrupt), savings accounts (which again technology can't disrupt, even though new entrants come and go) and current accounts (which, because they have to be linked into the clearing system, are very difficult to disrupt). Banks have a huge embedded customer base for all of these products. The vast majority of banks' profits are made in traditional retail banking: savings and loans.
- Much of the new technology in banking is associated with the payments market (although mobile phones as payment tools have been around for a while). However, in developed economies most retail customer payments are free to the customer (or close to) and hence there isn't the usual cost-saving incentive to switch to alternative technology. Second, since the banks dominate access to

the customers (in the developed markets at least), the new technology providers often want to work with the banks not against them. Finally, the banking system generates a relatively small percentage of its revenues from traditional retail payments (particularly with the EU and US clamping down on debit and credit card charges). So the potential financial impact of new payment technologies is limited.

The pace of change is accelerating

We could have written a report focussing on disruptive technology at any time in the past 200 years. All eras since the industrial revolution have had their batch of new disruptive technologies (railways, electricity, telegraph and telephone, TVs and computing – to name just a few).

But in some ways, the pace of change currently is particularly rapid, driven by developments in a few key technologies:

- cheapness of data storage
- growing speed and bandwidth of telecommunications
- data-processing ability of chips, allowing ever smaller devices
- growth of network interconnectedness
- growth of robotics and artificial intelligence
- natural resource stress (rise in commodities prices, water shortages, climate change) triggering environment regulation
- healthcare (stem cells etc.)

There are any number of new technologies at various stages of development currently, any of which could be highly disruptive to existing market participants. Many of those have been identified by our sector analysts in the sections that follow. In Table 2, we have included a selective list of the most interesting potentially disruptive technologies that are currently being discussed in the media and by tech specialists.

How can investors use the concept?

Investors need to be aware of technological change and its implications. But basing investment decisions on this awareness is far from simple. It is very hard to judge which technologies will succeed and which will fall by the wayside. Even if you get that right, spotting the companies that are able to exploit the new technology successfully is difficult. Many will be unlisted start-ups and so available only to venture capital investors. It is often easier to spot the losers (large companies whose business models will be disturbed) than the likely winners.

Think back to Christensen's examples. The developers of a disruptive technology will tend to be small companies (frequently started by managers who have left the top companies in the industry) and there will be many of them, with competing versions of the new technology. Many will fail. But, if you can successfully spot the emerging technology, it may be relatively simple to identify companies that are vulnerable to it.

Take the internet. If we had been writing this report in 1998, we could perhaps have made a good guess at which companies would lose out as their business models became obsolete (booksellers, travel agents, newspapers, music and video retailers, electronics stores, postal services). But spotting Amazon, Google and Apple as the biggest winners would have been much harder.

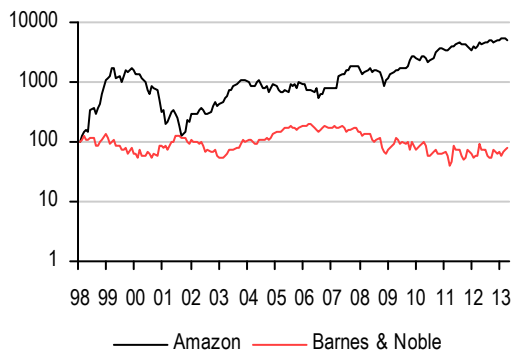
2. Potentially disruptive technologies currently

3D manufacturing	New materials (metamaterials, nanomaterials, carbon nanotubes, conductive polymers)
Batteries	Next generation semiconductors: EUV x-ray lithography
Biosimiliar drugs	Next level of mobile bandwidth
Cheap smartphones	Oil and gas fracking
Compressor-less air-con	Online education (Khan Academy etc)
Crowd-sourced financing (Kickstarter etc)	Over the top video (You Tube streaming, no cable sub needed)
Data storages/memory technologies	Payment systems
DNA as storage	Personal robots
Driverless cars	RFID (radio frequency identification) tags
Electric cars	Solar photovolatics
Flexible electronics/displays	Stem cell treatments
Grid-scale electricity storage	Unmanned aircraft (drones)
Invitro meat	Wearable computing
LED lighting	WiFi substitution
Machine translation	ZipCar
Near-field communications	

Source: HSBC

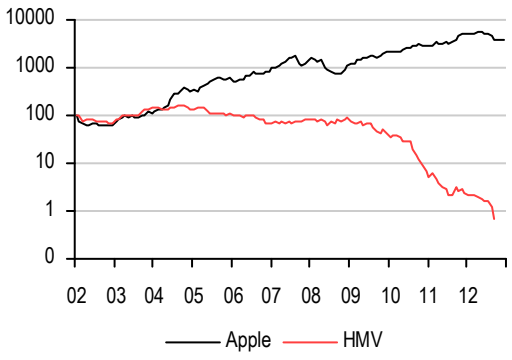
But, if you *can* successfully pick out the winners, this can of course be very remunerative. The charts below show the stock prices of Amazon versus Barnes & Noble, Apple versus HMV (the winners and losers from internet retailing), and Canon versus Kodak (photography). The comparison is stark. Amazon's stock price has risen about 50-fold since 1998, while B&N is 20% below where it was 15 years ago. Apple's stock is up 6000% over the past 10 years, while HMV has been delisted after its bankruptcy in January 2013. Canon has thrived while Kodak has entered Chapter 11.

3. Amazon stock price vs Barnes & Noble stock price (log scale)



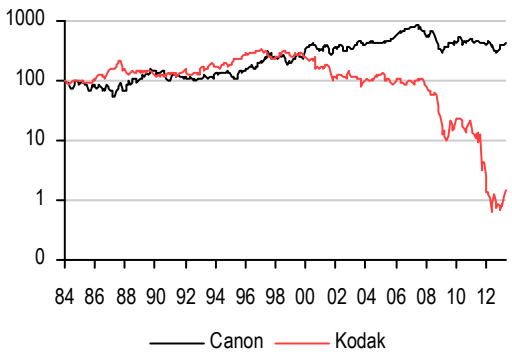
Source: HSBC, Bloomberg

4. Apple stock price vs HMV stock price (log scale)



Source: HSBC, Bloomberg

5. Canon stock price vs Eastman Kodak stock price (log scale)

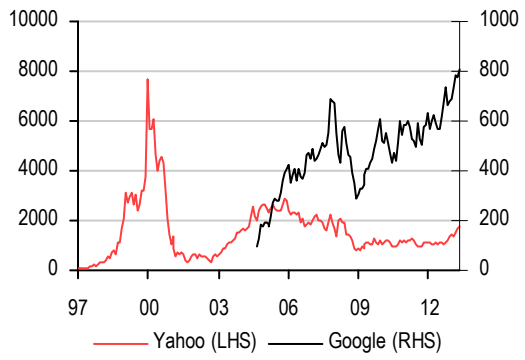


Source: HSBC, Bloomberg

Of course, we deliberately chose the most dramatically contrasting pairs. An investor in 1998 could easily have chosen Yahoo as their favourite to

win dominance of the internet. But as shown in Chart 6, after rising 60-fold from its IPO in 1997 to the peak of the TMT bubble in March 2000, Yahoo's stock collapsed and never fully recovered as the company was eclipsed by Google.

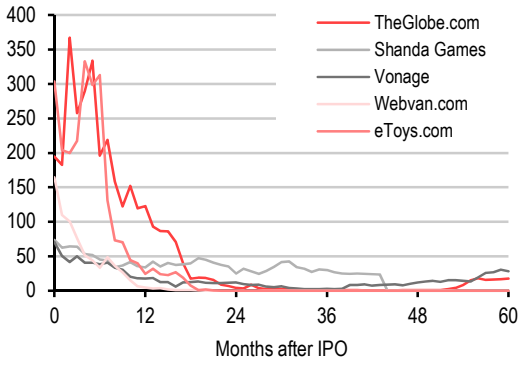
6. Yahoo stock price vs Google stock price



Source: HSBC, Bloomberg (Yahoo: Jan 1997=100; Google: Aug 2004=100)

And it could have been even worse. Investors who backed exciting-sounding internet IPOs such as Webvan.com, eToys.com or Vonage (a voice over IP telephone service) would have lost all or most of their money (Chart 7). Many of these stocks soared to a big premium over their IPO price on their first day of trading, but many had failed within 18 months of listing. Our point: picking the winners is tough.

7. Selected internet IPOs



Source: HSBC, Bloomberg (IPO price=100)

It was the same in the 1820s

This is by no means a new phenomenon. Alasdair Nairn in his definitive (and, undeservedly, little known) study of technology investing *Engines that Move Markets* (2002) looked at 10 episodes in history of disruptive technological change: canals and railways in Britain, US roadroads, the automobile, electric light, crude oil, the telegraph, wireless/radio/TV, early computers, the development of the PC, and the 1990s dot.com bubble.

He identified five stages in each of these booms:

- Initial scepticism from the incumbent technology and potential investors;
- Scepticism slowly replaced with enthusiasm, with new entrants flocking to the market and capital funding becoming available. Most companies do well, stock prices rise;
- The technology begins to mature and participants become more realistic. Some run out of cash, only the strong survive, and many investors lose money;
- Pessimism spreads and stock prices fall;
- Eventually the market stabilises, often with only a handful of leading players remaining. These companies can now make good profits.

The lesson that Nairn draws is that 'the winners take many years to emerge and…it is well-nigh impossible to identify them early….Conversely, the losers tend to be both more obvious, and more obvious at an early stage'.

What our analysts have come up with

We asked our analysts around the world to come up with examples of disruptive technologies (defined broadly, as explained above) in their sectors. Some replied that there was nothing relevant, and it is hard to disagree that food production, shipping or luxury goods are likely to continue with much the same technology and business models they have used for decades.

But many of our analysts came up with thought-provoking ideas. Some of these were in fresh, areas that have not widely discussed among technology experts (spray-on solar or biosimilars, for instance). And, for better known disruptions – such as 3D printing, automated driving or e-commerce – our analysts often had original perspectives that differed from the received wisdom.

Some of the analysts came up with classic Christensen disruptive technologies, where a lower-spec innovation is creating a new market. For example, 3D printing is still far inferior to traditional manufacturing and aimed mainly at hobbyists. But, in coming years the technology should improve rapidly and begin to eat into existing value networks (for example auto parts makers).

Other analysts focused on developments that were clearly 'sustaining technologies' in Christensen's terms. Flexible screens, for example (a technology that will allow the screens on smartphones or tablets to be bent or wrapped around) are a direct development from current technology and likely to be dominated by the current market leaders such as LG Electronics and Samsung Electronics. But they represent a threat to phone makers (perhaps Apple, HTC, Nokia) that might not be able to develop the technology.

And some innovations our analysts identified will set up entirely new categories that may produce no losers. So they may be described as revolutionary, but not disruptive. The 'internet of things' – monitoring devices attached to people or objects – might be an example of this. It is difficult at this early stage to predict accurately what business opportunities will be created, but there are unlikely to be any existing businesses that lose out.

We can also see a number of common threads running through what the analysts have written:

- **Convergence of technologies**. Many of the innovations have become possible because a bunch of technologies (telecommunications, speed of data processing, artificial intelligence) have reached a trigger level simultaneously. Examples: automated driving, insurance telematics, internet of things.
- **The plethora of new entrants**. Many new technologies have lots of start-ups competing for precedence (and capital). Examples: 3D printing and solar.
- **Competing technologies**. Connected to the previous point, in many new areas, a number of new technologies compete and the winner remains unclear. Examples: energy storage, and mobile payments.
- **Collaboration**. The growth of social networking has spawned many innovations and pushed companies to rethink their business models by encouraging teamwork. Example: cloud computing.
- **The continued development of the internet**. Though it is 20 years since the internet first went public, new applications are still being developed. E-commerce is spreading into new fields and geographies. Mobile payments are at an early stage of development.
- **Environmental regulation**. Dwindling resources (leading to structurally higher commodities prices) and climate change have led many countries to introduce regulation on emissions or energy usage. Examples of technologies triggered by this: automated driving, electric vehicles, grid storage systems, and energy storage.

We don't pretend to have all (or even many) of the answers but we think the technologies explained in the pages that follow will raise

important questions that investors need to be aware of.

How to use this report

We have divided the disruptive technologies that our analysts have identified into five broad categories to make them easier to follow:

- Implications of the internet
- New manufacturing/new products
- The energy revolution
- Healthcare
- Miscellaneous

For each technology, we have asked our analysts to identify the companies they think will be the winners or losers. This is easier to do in more established technologies, where the competitive landscape is already starting to take shape; it is fiendishly difficult in more futuristic areas, where different technologies vie for dominance, and where the pioneers may be start-up companies or small divisions of large firms. Many of the names our analysts mention here are not covered by HSBC (or not even listed). There may be other companies which we identify as winners in a technology, but which our analysts do not rate as Overweight for other reasons (for example, because their stock is too expensive).

To make this report more actionable for investors, in the section that follows, we have identified 12 companies (our 'key investible ideas'), on which our analysts have a high conviction that they will emerge as a winners from the respective disruptive technology and which they rate Overweight.

We also asked our climate change team to contribute a special chapter on how climate change and resource stress is a major factor in propelling disruption, particular in the energy sector.

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Key investible ideas

- We have identified names we think will be winners in the disruptive technologies we have discussed
- From among these we highlight 12 stocks, on which our analysts have a high-conviction Overweight call
- These represent our key investible ideas for investors wanting to buy into technological change

Implications of the internet

Analytics, internet of things

SAP (OW, target price EUR74)

SAP is the worldwide leader in enterprise application software. Following a transition period dedicated to investment and development, we now expect SAP to reap the benefits in 2014-15 of what we call the 'software virtuous cycle', with top-line growth on a fixed-cost base creating margin leverage and producing FCF to allow R&D and acquisitions.

The in-memory database HANA represents break-through innovation and is the strategic backbone for the group's growth. All products are now available on HANA (Business Suite) on a global distribution platform, and we expect another expansion in margins.

We estimate top-line growth of 10% in 2014-15 with the potential for positive surprises in the core ERP business if the economy recovers. With structural margin improvement as a result of scalability (especially in the cloud business) and a favourable product mix, we think the group is well on track to reach its target of a non-IFRS EBIT margin of 35% in 2015, implying a rise of 100bp pa and an EPS CAGR of +14% pa over 2012-15e.

High free cash flow generation and, as a result, ability to self-finance further innovation and acquisitions, should help improve the business model and boost EPS growth.

Big data

Experian (OW, target price 1,500p)

The UK company has historically been a leader in market share information for companies such as Google and Facebook. Its market database contains information on about 2.2bn global consumers, demographic data on 500m individuals in 260m households, and profiles of 1.2bn cookies.

In recent years, the company's business has shifted from the provision of mailing lists to marketers for physical mail – often known as junk mail – to internet-based marketing. More recently, there has been a further shift within internet usage to mobile. Experian is well-placed to benefit from these trends.

We think the combination of 1) the increasing shift in ad dollars to the internet, 2) Experian's

core skill of combining data from multiple sources to create information, and 3) the high level of capex in the past three years after the migration of the company's databases to new platforms could herald interesting potential for the future. We see significant upside risk to consensus growth and margin expectations. Our estimates are 8-16% ahead of consensus for the next two years.

Mobile payments

Gemalto (OW, target price EUR100) and Ingenico (OW, target price EUR63)

Gemalto is the world's leading authentication solutions provider through smartcards and related software with a 45% market share. It also provides strong secured digital IDs for a low cost per unit and trusted environment for all the mobile payment ecosystem. The group will massively benefit from the deployment of digital services globally and secured mobile payment in particular. This will make its top-line growth more dynamic with a multiplication of opportunities in each covered segment (SIM cards in mobile com, banking cards, e-government paper, access to cloud). It can transform its operating model with the 'dematerialisation' of cards/IDs (the ID directly embeded on the SIM card instead, implying lower proportion of hardware), development of software as a service, and transaction processing through exploiting of platforms. We expect top-line growth of +10% pa and EPS +20% pa for the next four years (2013-17), with strong potential for positive surprises.

At the heart of the mobile eco-system when we talk about the link with the merchant, ie in the Point of Sales Terminal market, **Ingenico** is a co-leader with a 40% market share of the world-wide installed base in 2012, just behind VeriFone-Hypercom (estimated at 42%). Thanks to its easycash acquisition in 2009, Ingenico became a PSP (Payment Service Provider) involved in the Transaction processing business (acquiring a Transaction and managed it). At that time, Ingenico also decided to take a stake in ROAM Data (fully owned now) involved in the Mobile Payment. Lastly, with its Ogone recent acquisition in the on-line transaction business, Ingenico has completed its offer in the Payment arena.

Retail

Dangdang (OW (V), target price USD13.45)

Dangdang continues to evolve its model to meet customer demand and is taking a greater share of wallet in China's fast-growing online market. From its start as an online book seller, it expanded to general merchandise (eg baby & maternity and household), then opened up its platform to some 6,000 online merchants, and in April started offering its customers flash sales (also known as deal-of-the-day sales) from its apparel merchants. Further, it is already driving 10% of orders via mobile devices. Dangdang was previously the first e-commerce company in China to generate profit and free cash flow, but has suffered two years of margin pressure as a result of intense competition. The success of its tactical moves to shift to marketplace and excellent execution have helped take margins to two-year highs, giving the company better visibility on returning to profit, which we forecast next year. We believe this will be a critical milestone and catalyst for Dangdang, triggering a further re-rating.

New manufacturing/new products

Flexi screens

LG Electronics (OW, target price KRW110,000); Samsung Electronics (OW, target price KRW1,870,000)

We think the next big thing in mobile is going to be flexible screens – phones that bend and can fold away – and these two Korean companies are the best placed to benefit. Indeed the first handsets are about to hit the market. It's a substantial opportunity for **LG Electronics**, which has seen

its smartphone market share fall to 5%. We think this could rise to 7-8% in 2014. **Samsung Electronics**, already the world leader in smartphones, can use flexible display to further strengthen its position. Both companies have a head start on their rivals because they already have a vertically integrated supply chain in place. We think flexible display will be difficult to commercialise for Apple, given the large size of its orders and a lack of capacity in the industry.

Healthcare

Biosimilars

Celltrion (OW, target price KRW76,000)

One of the most significant drug developments in the past few decades has been the emergence of 'biologics' (therapies created using biological processes), the first of which – insulin – obtained US FDA approval in 1982. The first generation of biologics consisted mainly of proteins that are almost identical to those found in humans, such as insulin and human growth hormones which supplement a particular deficiency. The second generation of biologics – monoclonal antibodies (mAb) and fusion proteins – were first launched in the mid-1990s. Since they target only cancers or other causes of disease, they tend to be highly efficacious and have fewer side effects than other treatments (such as chemotherapy which tends to be more generally cytotoxic). Given their highly desirable characteristics, mAbs and fusion proteins are the fastest-growing biologics. By 2015, we forecast that the global mAb market will be worth USD64bn, up at a CAGR of around 30% from USD39bn in 2009.

Despite the substantial medical benefits of mAbs and fusion proteins, patient access to them is limited by their high cost. Original manufacturer biologics can cost well above USD10,000 (usually around USD30,000-50,000) per patient per year. Even in developed countries, where health insurance usually pays for these drugs, biologics use is increasingly becoming a burden on national budgets. However, we are on the cusp of a major change in the biologics industry as patents on many of these complex, expensive drugs expire in the next few years. This provides opportunities for other manufacturers to produce generic versions of biologics or biosimilars, which are substantially cheaper. Initially, these biosimilars are likely to be priced at around 50-70% of the levels of the original drugs. Despite remaining expensive in absolute terms, their lower pricing will substantially broaden access for patients.

In this market, time to market is critical. We favour firms with drugs in late-stage global clinical trials, and which have manufacturing facilities in place. Our preferred mAb/fusion protein biosimilar player is Celltrion, the global front runner in this segment and a pure-play stock. Celltrion has made most progress towards global approvals. Its Remicade biosimilar is already approved in more than 10 countries, including Korea. Importantly, Celltrion is the first mAb biosimilar to have EMA approval. The firm also has a very advanced pipeline, with global filing for its Herceptin biosimilar starting in May/June 2013; a Korean filing has been submitted.

Stem cells

Medipost (OW(V), target price KRW122,700); Pharmicell (OW(V), target price KRW7,900)

For years, stem cells have promised curative treatment for severe diseases that could only be treated supportively, with few, if any, therapeutic choices. They have also promised better alternatives to existing treatments. But so far these promises have mostly remained unfulfilled. Also, linkage of some stem cell treatments with destruction of embryos has led to negative public and political perception in certain regions. Nevertheless, development of stem cell treatments using non-embryonic stem cells (somatic stem cells), and longer-term, induced pluripotent stem

cells (iPS, stem cells derived from somatic cells) continues to move ahead.

Given stem cells' huge potential, there are hundreds of trials in progress globally, but few have reached late-stage trials and only a handful has been regulator-approved. Interestingly, a number of stem cell treatments have arrived in Korea, almost unnoticed by the rest of the world. In our view, a number of Korean stem cell firms have become investible as the high drug development risks have receded following approvals by regulators. Much of the investment risk is now related to more visible commercial penetration of the treatments. We are Overweight (V) on Medipost and Pharmicell, both of which have regulator-approved stem cell treatments, good pipelines and are well funded.

Miscellaneous

Automated driving, Electric Vehicles

Continental (OW, target price EUR150)

Continental AG is divided into two parts, Rubber and Automotive. The latter currently accounts for 60% of group sales but only 40% of group EBIT (2012). We expect this share to rise to 50% by 2018. This is driven by Conti's high exposure to the most important mega-trends in the automotive industry (stiffer safety and emission regulation globally plus increasing information technology in cars) and its leading global position for some key automotive electronic applications. Conti is among the market leaders for several important products (eg gasoline direct injection, ESC, telematic solutions) and benefits from increasing penetration rates of these products globally. Conti's Rubber group meanwhile generates superior EBIT margins compared to most of its global peers (Michelin, Pirelli, Goodyear, Bridgestone), amongst others because of its focus on more profitable tire segments such as winter tires and high-performance tires. Thanks to both these strong performing parts, as a rule of thumb Conti says that if the global light vehicle market is flat, it believes it can still grow revenues by 5%.

Small cells

Ericsson (OW, target price SEK105)

We believe Ericsson is the best large-cap listed communications equipment stock with which to play the small cells theme. Global mobile network traffic is expected to grow 12.6x to 2017 (Cisco Systems forecast). We believe the traditional methods by which mobile operators have increased capacity up to now (purchasing more spectrum and by introducing new generations of more spectrally-efficient network technology) will not – in themselves – be sufficient to meet this demand. We believe this will force operators to add additional capacity by making their networks denser, by means of small cell network overlays (based mainly on 3G/4G cellular standards but also by integrating WiFi). We believe that Ericsson's leading position in traditional cellular networks (c35% overall global market share and c38% in the latest 4G equipment) provides a major incumbency advantage, which along with the company's well-established reputation for best-in-class products, implementation and maintenance, should make it the vendor-of-choice for small cell projects going forward, in our view.

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Summary of investible ideas

Company name	BBG code	MCap (USD bn)	ADTV (USD mn)	CCY	Current price	HSBC target	PE 2013e	PE 2014e	Performance -3M	Performance -1Y	Performance -3Y	HSBC rating	HSBC analyst name
Celltrion	068270 KS	4.1	133.0	KRW	44300.0	76000.0	19.9	12.8	6.0%	-9.0%	71.0%	OW	Nam Park
Continental	CON GR	33.9	64.7	EUR	124.9	150.0	11.0	9.5	21.6%	63.3%	119.3%	OW	Horst Schneider
Dangdang	DANG US	0.6	27.4	USD	11.7	13.5	NA	15.1	68.6%	147.9%	NA	OW(V)	Chi Tsang
Experian Ltd	EXPN LN	19.1	28.5	GBP	11.7	15.0	22.5	19.3	2.6%	14.0%	69.3%	OW	Rajesh Kumar
Ericsson	ERICB SS	41.5	84.8	SEK	86.1	105.0	18.7	14.1	13.3%	43.8%	16.3%	OW	Richard Dineen
Gemalto	GTO NA	9.8	47.5	EUR	82.1	100.0	24.2	19.7	18.0%	19.9%	172.6%	OW	Antonin Baudry
Ingenico	ING FP	3.9	13.3	EUR	53.7	63.0	19.5	16.7	4.9%	34.3%	150.7%	OW	Christophe Quarante
LG Electronics	066570 KS	10.4	69.3	KRW	68400.0	100000.0	14.3	7.9	-6.3%	-0.9%	-27.2%	OW	Brian Sohn
Medipost Co Ltd	078160 KS	0.4	8.1	KRW	67100.0	122700.0	88.6	64.1	7.4%	-29.4%	97.6%	OW(V)	Nam Park
Pharmicell Co. Ltd	005690 KS	0.2	2.2	KRW	4325.0	7900.0	NA	37.2	8.7%	-31.1%	-25.9%	OW(V)	Nam Park
Samsung Electronics	005930 KS	194.5	320.8	KRW	1418000.0	1870000.0	6.6	5.9	5.7%	5.3%	82.5%	OW	Ricky Seo
SAP	SAP GR	91.5	201.5	EUR	54.8	74.0	17.0	14.8	-2.5%	-1.2%	51.0%	OW	Antonin Baudry

Source: HSBC, Thomson Reuters Datastream

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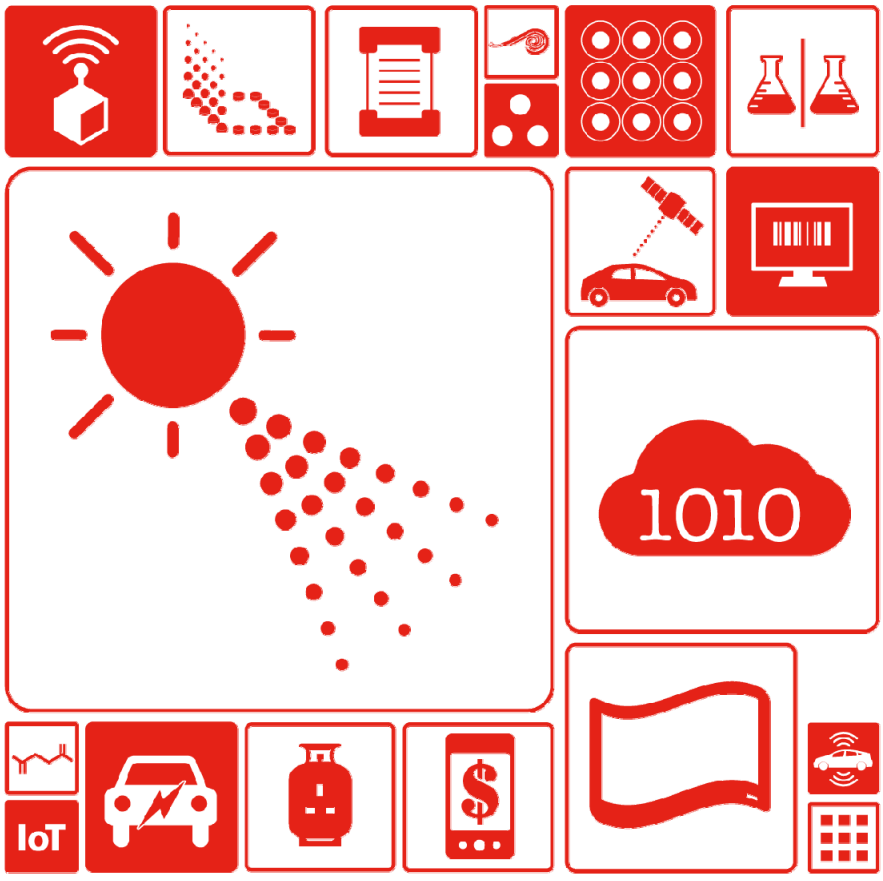
Implications of the internet



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Internet of things

- Always-connected internet of things (IoT) to enable sensors and new interfaces to digitise the analogue world. Beyond device hardware, there are profound implications for software, services, media, and data/telecom
- A forecast trillion connections from the IoT indicate an important disruptive technology
- Far-reaching implications make it hard to list winners and losers – every company must leverage IoT to be competitive in the future

The first evolution of the internet

According to Cisco, the first true evolution of the internet is the 'internet of things'. Today we see this mostly through a shift from fixed connectivity to mobile driving a proliferation of always-connected smart devices. For example, IDC estimates the smartphone market will grow nearly 50% in 2013 to approach a billion units. While that sounds like a large number, the penetration rate in emerging markets remains low with the installed base in China alone set to increase to a billion units by 2016. Extrapolating out five years, it is not difficult to image 1.5-2.0bn smartphones shipping annually. Beyond phones, the tablet market is estimated to surpass the notebook market this year and ship more than 200m units.

Adding connectivity to everything from consumer devices, business asset management, to traditional appliances and further to 'wearable' computing, we can easily see how it is estimated that about five years ago, the number of connected devices exceeded the population of the entire world.

By 2015, the number of connected devices is estimated to range from as little as three times the world's population (or roughly 25 billion) to perhaps as many as 1 trillion devices (120 times the population) – each with its own IP address always connected to the internet.

Profound implications of so many 'smart connected devices'

Robert Scoble and Shel Israel are in the process of writing a book titled *The Age of Context: How it Will Change Your Life and Work*. We agree with their thesis and see ever smarter and more connected devices providing context about how humans can interact with everything around us.

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Electronics are becoming increasingly more intelligent and intuitive (ie 'human like'). One can imagine billions of devices making use of numerous sensors to digitize the real 'analogue' world. Evidence is already being seen through basic GPS, compasses and accelerometers within mobile phones. Essentially, a human's five senses are being replicated. Cameras are our eyes; microphones our ears. Touch screens have revolutionised how to control a device, and voice, gestures, and even eye tracking, are mimicking different forms of human interaction. Beyond sensing the environment, these electronic devices are leveraging logic to log, interpret and interact, ultimately helping people accomplish tasks in the real world. So while your phone may not have a sense of taste/smell, it can leverage social media feedback to provide relationships and descriptions.

Beyond the downstream hardware that enables digitisation, the internet of things will drive cloud related themes such as broadband, storage, analytics, security, advertising and media. Further, we believe *personalised and anticipatory* services that interact with these smart objects will likely prove even more disruptive.

Hints of the IoT are evident today and range from wearable Google Glasses to individuals using data from fitness sensors enabling a movement now called 'the quantified self'. Beyond individuals, corporations and governments are making use of IoT to improve inventory control or energy management through things like smart grids.

Quantifying the impact of IoT is difficult, but the potential is enormous. As a simple example, imagine the benefits of reducing travel delays by leveraging real-time traffic flow data. Not only does this save countless man-hours, but the potential for pollution reduction is just as important.

Despite the obvious benefits this will bring to human lives, we believe there are several hurdles to overcome and one of the most important would be how regulators and government authorities monitor the amount of information now out in the cloud. In addition, the huge volume of data will also place intense stress on servers as capacity grows online. The amount of personal information available on the internet also creates risks for individuals as more and more personal details such as spending pattern, location, and chat history gets up in the cloud. Many companies like Google and Apple are now the gatekeepers of such private information and are susceptible to information leaks, which will raise concerns over whether users actually do have privacy rights over on their own information on the internet.

Winners and losers

IoT has such far-reaching implications that it is difficult to narrow down the potential winners and losers to a concise list.

- Hardware-related winners will likely provide sensors and connectivity components to the IoT. Industry leaders in wireless semiconductors like **Broadcom** and **Qualcomm** are very well positioned to benefit. The major sensor suppliers today vary widely, but **ST Microelectronics**, **Invensense** and **Texas Instruments** are all making MEMs based accelerometers. Camera sensor suppliers also vary with **Sony**, **Samsung** and **Omnivision** dominating the subsegment. Capacitive sensors for touch include companies like **Atmel**, **Elan**, **Synaptics** and **Cypress Semiconductor**.
- Other hardware for IoT includes servers, storage and datacenters. All PC makers sell servers (and many large players like **Google** and **Facebook** are now designing their own

servers). Thus the safest play on server hardware is through **Intel** which dominates the core logic chips in all servers. Other companies like **Equinix**, **Rackspace**, **Amazon Web Services**, and **Telecity** build and manage datacenters. And hard disk drive companies like Western Digital and Seagate work with storage solution providers such as **EMC**. Data and telecom equipment mostly comes from **Cisco**, **Ericsson** and **Huawei**, but there are many peripheral components required.

- The software and services side of IoT is also vast. **Google** is a clear player, as are the tens thousands of internet names, from social media to search engines and more. On the software infrastructure side, systems from companies like **IBM**, **SAP** and **Oracle** will benefit.

The biggest losers from the IoT are probably individual privacy and potentially, safety. Sensors will record and analyse all of an individual's data for easy tracking and analysis. And with so many even partially autonomous devices being connected, security is a large risk. Imagine what would happen if a terrorist organisation took down a power grid.

Beyond privacy and safety, all companies will have to employ the IoT to both manage their internal operations as well as drive customer engagement and sales. Thus any traditional business that does not adapt to the IoT will be at risk.

For example, **General Electric** suggested at a recent conference that the 'Industrial Internet' could eliminate USD150bn in waste across industries, while a 1% increase in productivity would generate savings of USD30bn in aviation, USD66bn in power generation and USD63bn in health care over 15 years. The bottom line is that every company must be involved in the IoT to be competitive in the future.

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Cloud/big data/ analytics

- Cloud computing is an all-encompassing concept used to describe a technology shift to centralized computing as a service.
- Beyond services, cloud has implications for hardware, software, infrastructure, storage, security, and 'big data' analytics.
- Thousands of companies enable the cloud and importantly, make use of its data. We focus on big data analytics, marketing services and outsourcing opportunities for IT services

Defining the cloud concept and the players

Cloud computing is a catch-all or jargon phrase that in very general terms describes a technology shift where a 'cloud' provides centralised access to computing resources such as hardware, software and application services. Examples of cloud services include everything from basic web-based email to sophisticated business software that is run remotely to cut costs and enhance flexibility.

The number of players in the cloud space is likely to be in the thousands, especially when considering that enabling cloud-based services also has far reaching implications for technology hardware, software, networking and telecom infrastructure, storage, and security. Further, with the increasing adoption of mobile computing devices and improvements in connectivity, the potential for the evolution of cloud-computing-related technologies is immense.

The cloud concept can also be extended to 'big data' analytics that leverage massive amounts of data usually gathered and stored in the cloud. The best example of how this data is then used is in marketing services for more targeted, and therefore effective, advertising and marketing campaigns.

Given such a broad concept with such far reaching implications for the entire technology food chain, the leaders in cloud vary widely with many lesser known new players, as well as tech giants from yesteryear. A well-known, yet very brief list of cloud companies would include industry leaders such as **Google**, **Amazon**, **Rackspace**, **Microsoft**, **Citrix**, **IBM**, **Cisco**, **HP**, **NetApp**, **Dell**, **Oracle**, **SAP**, **VM Ware** and **Salesforce.com**.

Rather than attempt an exhaustive look at all aspects of the cloud, we focus primarily on outsourcing opportunities for IT services (eg **TCS**, OW, target INR2,120, **Infosys**, Neutral, INR2,520, **Capgemini,** OW target EUR51, **Atos**, OW, target EUR68, look best placed to ramp up

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their cloud-based services providers), then big data analytics (we highlight **SAP**, OW, target EUR74) and marketing services (we highlight **Experian**, OW, target 1,500p).

Lowering total cost of ownership and investing in data analytics

The key motivation currently for CIOs is to perform operational run-the-business tasks at the minimum TCO (total cost of ownership) and invest more in customer-facing or 'customer-decoding' technologies. Corporates are focused on making traditional IT costs variable and investing in data analytics, which make them more nimble and agile in understanding their customer preference, and the resulting go-to-market strategies.

Increased offshoring and the adoption of cloud and Software as a Service (SaaS – platform-based business process outsourcing) address the requirement to make costs more variable, while investments in mobility and analytic solutions address the aim of servicing customers better.

There are two disparate opportunities we envisage, and we believe different IT companies would approach these areas of growth in two separate ways: supporting the IT infrastructure of SaaS providers and providing platform BPO.

Supporting the IT infrastructure of SaaS providers

Companies such as Salesforce.com, SAP or Oracle would increasingly need hosting partners to manage the infrastructure and for application upgrades, for example. The opportunity would commence with offering consulting services to its clients, which could include the cost benefit analysis of migration to cloud computing and then the migration road-map.

Some of the large organisations may choose to migrate only certain applications on to the cloud, which would then require an integration effort with the on-premises applications and databases. The security landscape would remain a key area of investments for the SaaS providers and even at the client end. In all these areas, IT companies can potentially partner with the SaaS provider.

Platform BPO (BPaaS – Business process as a service)

At the other end of the spectrum, which is platform BPO (BPaaS – Business process as a service), IT companies are hosting the applications and then providing the business process services as well. Vendors manage the entire infrastructure and charge the clients on a per-use basis. Most of the companies have already developed multiple solutions on BPaaS. Success or market adoption of these solutions is still limited, owing in part to the early stage of adoption, but more to the lack of clarity about the potential addressable market, in our view. We believe that in the long term, IT vendors that have previously been providing application support (ADM) services to their clients will be able to successfully ride the wave of SaaS and BPaaS adoption.

Penetration of cloud services in outsourcing contracts

Recent commentary from industry experts evidences the growing success of cloud philosophy. Cloud-related services are seeing a significant increase in their share of total outsourcing contracts. In nearly 27% of all contracts in 9M 2012, cloud services formed part of the scope of work, compared with just 10% in 2010. Furthermore, nearly half of the vendors are seeing that cloud services are part of the project scope in nearly one-quarter of their contract

pipelines, and expect cloud services to grow faster than the core traditional services.

Consequently, newer technology services (such as cloud, SaaS, mobility and analytics), will be the potential accelerators of growth for IT service providers. We see a potential USD60bn market opportunity from these services for Indian IT industry in FY14.

Among the top IT services companies **TCS**, **Infosys, Capgemini and Atos** are well placed to grow their cloud practices in our view. These companies have a significant customer base and volume share; giving them a greater opportunity to leverage/cross- sell new technologies and grow them faster than peers. TCS has been successfully diversifying its service portfolio, in our view, is well positioned and has the resources to ramp up its cloud offerings. Infosys has aligned its strategy with a focus on the next-generation technologies such as cloud and mobility among others. Consequently the company has also earmarked USD100m in investing in platforms and solutions.

Big data: Analytics

The amount of data is increasing at an exponential rate and extracting the nuggets of information that can benefit businesses is becoming a strategic issue for many companies.

SAP is the worldwide leader in enterprise application software. SAP High-Performance Analytic Appliance (HANA) is a data warehouse appliance for processing high volumes of operational and transactional data in real time. HANA uses in-memory analytics, an approach that queries data stored in random access memory (RAM) instead of on hard disk or flash storage.

Since its first presentation (by Sapphire in Orlando in mid-2011), HANA has been the main focus of the company in terms of technological development and communication.

We estimate that the first strategic step of deployment has been a strong success. From the end of 2011 and in 2012, SAP has focused on migrating its existing business warehouse clients onto HANA, the first HANA-based product. Revenues from HANA reached EUR392m in 2012, far above the EUR320m targeted by the group at the beginning of 2012.

But the potential of HANA is global as the number of potential uses increase with additional data in every client sector. The next step of the strategy is no less than to propose HANA everywhere, on every segment, for every client on every sector everywhere in the world in notably two directions:

- Business intelligence, social networks analytics and predictive analytics – with real time analysis, business intelligence will become the forefront of the data opportunity.
- Core Business suite now available on HANA could displace database competitors (mainly Oracle) from SAP's client base – SAP announced on 10 January that its core ERP product, Business Suite, was now available on HANA. Migration onto HANA is proposed without changing the already installed business suite thanks to a traditional enhancement package. The price will be similar to the Oracle option (15% of the bill).

We expect these initiatives to boost penetration and growth for the group. For 2013, the group is guiding for revenues of EUR650-700m from HANA, implying growth of 70%. Our estimates are at the high end of the range (EUR705m, up 80%).

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Big data: Marketing services

Marketing services manages geographical, demographic and lifestyle data on customers and businesses. Data are often collected from cookies, internet traffic, the postal department and other private data sources.

What does it do?

In simple terms, the business offers data on consumers in different areas. This allows its customers to plan, execute and follow up on advertising and marketing campaigns for consumer and financial products. Its customers are typically retail chains, credit card companies and advertising firms such as **WPP**. **Experian** has historically been a market leader in market share information for players such as **Google** and **Facebook** through its business. Its marketing data base contains information about 2.2bn global consumers, demographic data on 500m individuals in 260m households, and profiles of 1.2bn cookies.

Market trend: big data

Historically, the business was involved in the provision of mailing lists to marketers for physical mail, often classified as 'junk mail'. However, since the early 2000s, there has been a structural shift to internet-based marketing. Experian's strategy of offering marketing solutions such as Cheetahmail has allowed it maintain high market share.

Digital media ad spending grew at a CAGR of 20% from 2000 to 2009, with internet search growing at more than a 50% CAGR. Various market research estimates suggest that online media ad spend is set to grow at a significant premium to overall ad spending. Internet spend still accounts for only 20% of global advertising dollars (2012e), but as more media shift online, advertisers are likely to move more ad spend to these channels.

Recent changes: cross-channel marketing

One aspect that has made this space more interesting in the past five years is the advent of different data sources – most importantly the shift of internet usage to mobile. This requires marketers to target their ad dollars more effectively in order to generate the appropriate conversion to sales.

The combination of: 1) the increasing shift in ad dollars to the internet; 2) Experian's core skill of combining data from multiple sources to create information; and 3) the high level of capex in the past three years as the company has migrated its databases to new platforms could herald interesting potential for the future.

Competitive landscape:

The market is highly competitive and diverse, with competitors in the space including TransUnion, D&B, Equifax, Experian, Harte-Hanks and Acxiom.

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Mobile payment and NFC

- A dramatic increase in the use of mobile devices for financial transactions is creating a complex new ecosystem
- A variety of emerging technologies are being pushed by merchants, but long term we expect simplicity and security to favour Near Field Communication (NFC), pushed by issuers, MNOs and banks
- Mobile payment will revolutionise Gemalto's business model on both a 2-5 year and a 5-10 year view, and will stimulate Ingenico's sales growth on a 2-5 year view through upgrades of its installed Point of Sales base

From fixed to mobile

Just a few years ago, mobile phones had only one purpose: to ensure that end users were able to receive and send calls. But now the world is going mobile, with the use of internet services rapidly moving from PC to tablets and smartphones.

The past few years have seen a dramatic increase in the use of the mobile devices for financial transactions. Mobile payment and Mobile Financial Services (MFS) have become key to the long-term strategies of banks, financial institutions, mobile network operators (MNOs) and retailers globally.

This rapid expansion is occurring in all geographies. However, the mobile payment market is still at a relatively early stage, and it is difficult to make reliable forecasts of potential growth rates and market size.

Technology research firm Gartner published a report in May 2012 projecting the number of users of mobile payment in the world to rise from 134 million in 2011 to 413 million in 2016, implying a CAGR of 25%. It estimated the value of mobile payment transactions to rise from around USD106bn in 2011 to USD617bn by 2016, implying a CAGR of 42%.

This creates big opportunities for service and solution providers. We think the only long-term way to sustainably achieve advantages for all players in the ecosystem and support a broader penetration of mobile payments is to establish:

- one or very few broad standards, which can be used widely among merchants worldwide;
- secure solutions to ensure reliable transactions and fraud prevention.

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A variety of emerging technologies are being pushed by merchants, but in the long term we expect the need for simplicity and security to favour Near Field Communication standard (NFC). This is being pushed by issuers, MNOs and banks.

The secure element at the heart of the ecosystem

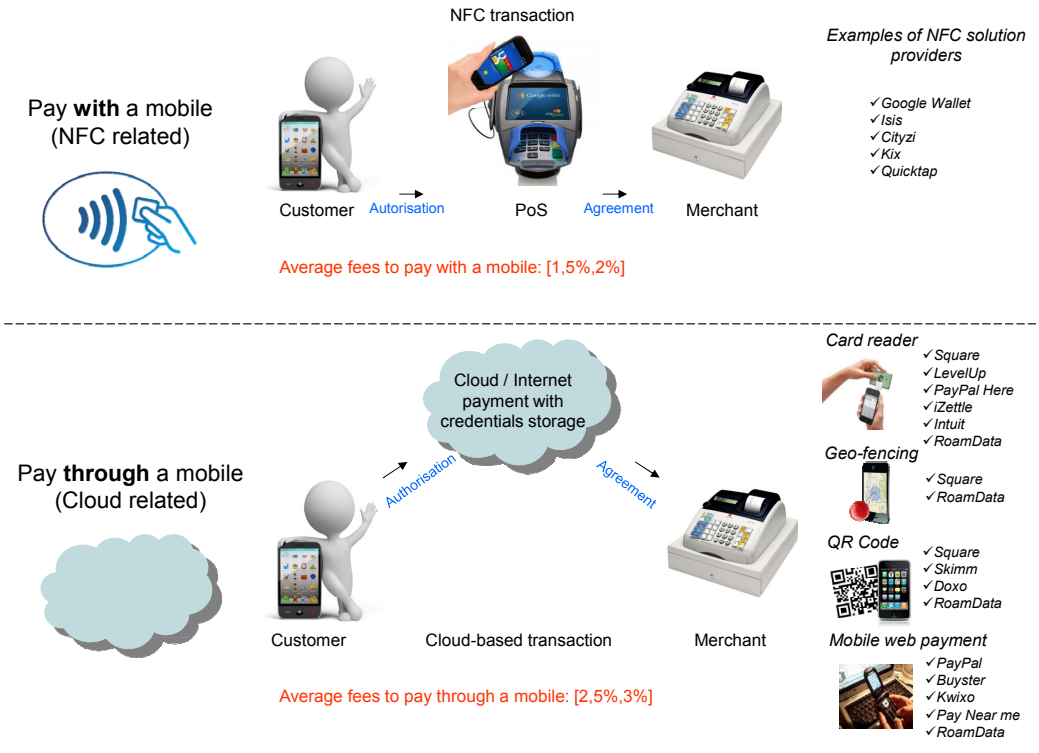
A mobile device can be used for payment in the following ways:

- **Pay with** a mobile at the point of sales (PoS) terminal. The phone can be used to pay with a virtual banking card in the SIM card.
- **Pay through** a mobile, by making a mobile web payment. The phone provides access to banking applications, e-commerce, and SMS services through the mobile network.

Secure elements are the 'vault' of the system; they are required each time a payment is offered on the phone. The secure element can be embedded in a number of ways:

- In the SIM (UICC) card: The SIM is owned by the MNO. It offers several advantages such as being almost independent of the handset, potentially offering over-the-air activation of the secure element and associated applications.
- In the handset: An embedded secure element offers handset manufacturers a way of creating their own business models and hosting secure application independent from the MNOs. The embedded secure element is integrated at the time of manufacturing the handset and is not removable.

Ways to pay with/through a mobile



Source: HSBC

- In a secure micro SD card: After the SIM, the secure SD card is currently the second-most-common form of removable secure element. Its main benefit is independence from both operators and handset manufacturers. Banks and service providers developing loyalty programmes are looking into these devices to create their own models and services.
- In a cloud-based secure element: The payments' credentials are stored in the cloud.

There is a battle among the major players in the mobile payment ecosystem over the secure element localisation concerning who will be able to receive revenues from the payment application.

Technologies being promoted by merchants

Because the implementation of the infrastructure needed to put NFC standards in place will take time, a multitude of alternative technological solutions has already been developed. This has been mainly the initiative of merchants, who have a strong interest in deploying mobile payment solutions as soon as possible.

Such initiatives include: **1) Card readers:** boxes that plug into the audio port of a mobile phone. These allow individuals, small business and retailers to take payments via credit card. **2) Geo-fencing:** this allows customers to find a merchant nearby and to benefit from special offers. **3) QR Code:** small black square dots arranged in a pattern on a white square. The QR Code is compatible with all existing mobile operating systems. **4) Mobile web payment:** The consumer uses web pages displayed or additional applications downloaded and installed on the mobile phone to make a payment, just as in a desktop environment.

Among thousands of solutions that have already emerged, some already appear to be winners, working in various areas of the world, and in some case competing directly against the traditional payment solution providers.

These include: **1) PayPal**, performing payment processing for online vendors, auction sites, and other commercial users, for which it charges a fee. **2) Square**, which facilitates mobile payments. The first version of Square used a credit card reader (a 'swiper') plugged into the audio jack of a phone. The group has also developed a system based on QR Codes and more recently, an application based on geo-fencing and a wallet. **3) iZettle** is a Swedish start-up considered to be the European equivalent of Square.

Payment at PoS through NFC will finally dominate

NFC technology involving Mobile Network Operators (MNOs), banks and service providers is more complex to put in place in terms of infrastructure and will be ready to use later (we expect from H2 2013). But NFC will emerge as a simple and cheaper solution, and the most secure.

Based on existing radio-frequency identification (RFID) standards, Near Field Communication (NFC) is a wireless communication technology enabling smartphones and similar devices to communicate when close to each other, for example to make a payment from a SIM card with contactless point of sales terminals.

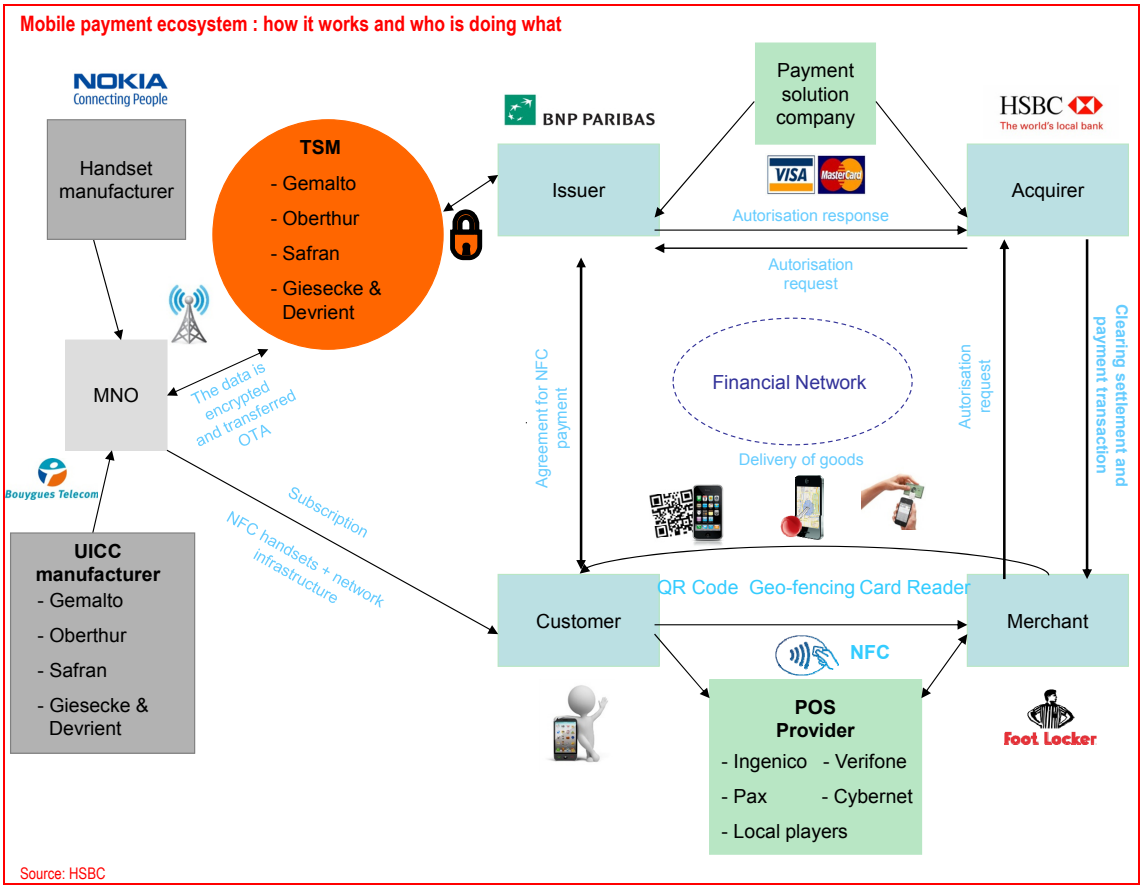
The technology is being pushed by MNOs through the European Telecommunication Standards Institute, and by banks and card issuers worldwide through the EMV contactless standard and therefore already appears to be an established standard for mobile payment worldwide.

NFC can also be used for many other purposes such as identification, transport, ticketing, and physical access, and hence carries potential benefits for different actors in the entire value chain. All these uses are likely to boost its implementation.

However, the deployment of NFC worldwide necessitates a lot of investment in infrastructure throughout the value chain, and as a consequence will require participation from a huge number of established technology providers.

We expect the use of NCF technology to rise gradually but surely. On a more long-term view (10 years), Gemalto estimates that 70% of owners of a physical banking card will also have a digital banking card embedded in their mobiles, implying a potential market of above 1.7 billion digital banking cards on top of the current 2.5 billion plastic bank cards already in place (including the US).

Mobile payment ecosystem : how it works and who is doing what



Source: HSBC

Winners and losers

Gemalto (OW, target EUR100)

Gemalto is the world's leading authentication solutions provider through smartcards and related software. Ongoing R&D investment equivalent to 6% of revenues each year (about EUR130m 2012) positions Gemalto as a leader and supplier of innovation, and positions it for global technological disruption. Use of smartcards will increase as a means of communication, authentication or security in all covered segments.

- **Telecoms** (49% of sales in 2012, with 19% from Platforms, Software and Services).
- **Machine to Machine** (M2M, 9% of sales): A continual increase in communication between machines, including automobiles, gas and electricity meters, smart grids, inventory management, etc.
- **Banking** (25% of sales): Development of EMV security standards worldwide (Europay, Mastercard and Visa), in particular in the US from the end of 2013, which will double the addressable market worldwide. Multiplication of digital banking cards thanks to NFC will nearly double again the addressable market at a gross margin close to 100% (versus 32% for physical banking cards).
- **Security** (17% of sales): For governments, with the expansion of government documents to smartcards or biometrics (passports, identity cards, healthcare cards, driving licences, etc); for companies with the development of Identity and Access Management.

Gemalto owns around 45% of the market in all covered segments. The company ranks ahead of **G&D**, a family-owned German company with a 20% market share, and France's **Oberthur** (market share of 20%).

Ingenico (OW, target EUR63)

In the PoS Terminal market, **Ingenico** is a co-leader with a world-wide installed base market share of c40% in 2012, just behind **VeriFone-Hypercom** (42%e). Ingenico has more than 17 million terminals deployed in over 125 countries. In 2011, Ingenico was the leader in terms of PoS Terminal shipments with a 27% market share, just before VeriFone with a 25% market share. The table below gives the worldwide market share of the company and the breakdown by region.

Second, thanks to its easycash acquisition in 2009, Ingenico became a PSP (Payment Service Provider) involved in the Transaction processing business (acquiring a Transaction and managed it). At that time, Ingenico also decided to take a stake in ROAM Data (fully owned now) involved in the Mobile Payment. Third, with its Ogone recent acquisition, Ingenico has completed its offer in the Payment arena.

As an investment case, at the heart of the payment process along the acquiring side, Ingenico has developed multiple and dedicated solutions to meet the demand of customers and to expand its position.

Installed base: market shares of PoS terminals by geographical region

Companies	Europe (30% of market)	North America (30%)	Asia-Pacific (20%)	South America (15%)	Middle East/Africa (5%)	World
Ingenico	55%	15%	30%	40%	65%	40%
VeriFone – Hypercom	35%	75%	35%	42%	25%	42%
Cybernet	2%	0%	20%	8%	7%	8%
Others*	11%	10%	15%	10%	3%	10%

*Others: Gores Group in North America, Pax in Asia-Pac., Bitel in Mideast/Africa.
Source: HSBC estimates.

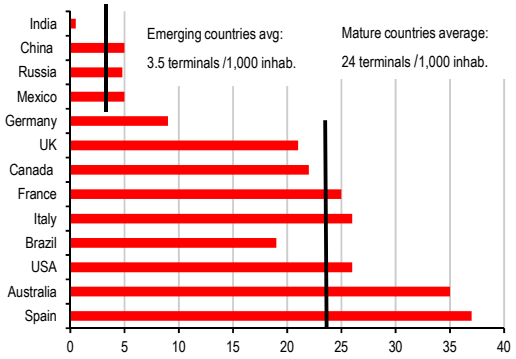
Ingenico's core strategy is the following:

- **leverage the payment platform** (Telium 3 at the end of the year) by opening payment to new ecosystems and partners;
- **accelerate PoS management services** through the reduction of the fleet administration costs; and
- **implement multi-channel gateway services** (one infrastructure for all sales' channels, reporting, fraud prevention, data analytics, business applications).

Lastly as one of the key drivers of Ingenico's future profitable growth, the graph below demonstrates the gap between developed and emerging economies in terms of the penetration rate of PoS Terminals. In developed markets, the average PoS terminal per thousand people is 24 versus 3.5 on average in emerging countries such as Russia, India, China and Mexico. Urbanization is a considerable source of growth for Ingenico as the development of the cities spurs demand for additional shops and retailers.

As a consequence, a middle class is appearing with new needs (new bank accounts), new habits of consumption (access to new merchants) while the governments in these countries have to secure tax collection and put in place rules for collecting sales taxes with the PoS Terminal as in China or in Turkey for instance. For all these reasons, as we are still in an equipment phase, the CAGR of the developing countries like Brazil, Russia, India and China will continue for several years. At the end of FY2012, emerging/developing countries represented 48% of Ingenico's sales (52% for mature ones) with Germany the group's primary market, Brazil the second, France the third and China the fourth.

PoS Terminal penetration rates by country



Source: Company data, Euromonitor, IMF

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Retail

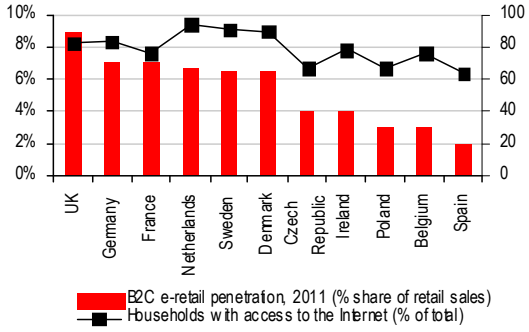
- E-commerce is changing traditional bricks-and-mortar retailing more than any other consumer technology
- The current extent of disruption varies by category and by country, with consumer electronics and apparel at greater risk than food retail, and the UK being the most advanced market
- China is now the biggest online market globally, with fast-rising internet and mobile penetration combining with rapid expansion of immature retail markets

In DM, and even more in EM

Consumers are changing their shopping habits and ordering a wider range of products online, with m-commerce (or mobile connectivity) the fastest channel of online growth, via the use of new smart devices, tablets and phones.

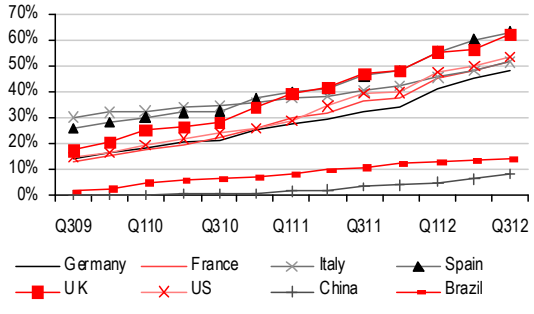
In mature markets this growth represents a channel shift reflecting use of new technology, while in emerging markets both bricks-and-mortar and online retailing are growing rapidly, with the latter driven by the fast spread of the internet. In China for example, we project internet penetration to rise from 42% at end 2012 to 55% by end 2015, with the bulk of growth coming from the less

B2C e-retail penetration vs household internet access



Source: M&S multi-channel presentation, November 2012, OECD -Households with access to the Internet, 2011 or latest available year, HSBC estimates

Smartphone penetration in key markets



Source: ComScore for Wt Europe and US; Brazil - Telecoms regulator ANATEL and ITU; for China numbers are based on discussion with IR's (by HSBC telecom team), local press & HSBC estimates.

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developed parts of the country. Rising smartphone adoption will also drive growth in mobile shopping in China, with 300m devices to be sold this year and 3G penetration reaching 26% in May (303m users of 1.17bn in total) and we estimate 46% by 2015. China's total retail sales are set to continue to grow rapidly, albeit with a slowdown from 14.3% last year to 12.5% this year and 12% in 2014 on our estimates.

Online presence increasingly an operating necessity

It is becoming essential for retailers to develop multi-channel propositions, incorporating an online platform, to maintain overall competitiveness. For some this will be an earnings enhancing experience, giving them the ability to tap into higher growth channels. We consider those companies with genuine pricing power, and/or differentiated brands as best-placed to succeed.

Online food to remain below 10% penetration …

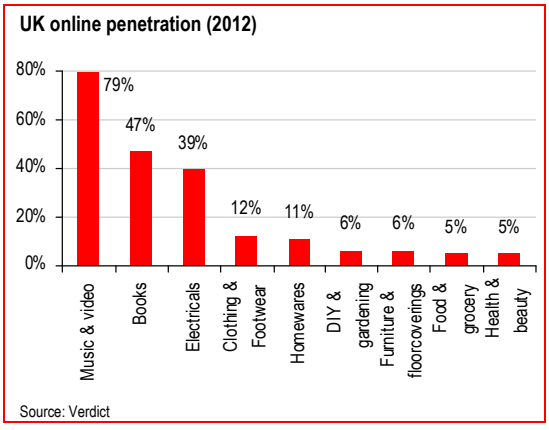
We believe online food will remain a niche market with a maximum online penetration of c10% for the foreseeable future as the costs of preparation and delivery are higher than for non-food items. This is mainly because of the number of items per basket and the difficulty of introducing more automation in the warehouses. This will eventually need to be reflected in higher prices or lower returns. None of the logistics/fulfilment technologies currently utilised within the Food Retail sector currently offer decent profitability, thus limiting the online opportunity to that of a niche market at the industry level.

… but for non-food categories to rise far more

Non-food sales categories benefit from significantly higher rates of online penetration. We expect online sales of consumer electrical and clothing & footwear to show significant growth. For example, for the UK:

- Online apparel sales are estimated to grow to GBP7bn by 2015, implying a CAGR of 7-8% (source: IMRG) versus total apparel sales growth of less than 1%. Online purchases could double to 70% of total UK retail sales by 2020.
- We expect UK online electrical sales to deliver a four-year CAGR (2012-16) of 4.8% versus a decline of 0.2% for offline.

From the retailers' point of view there is an increased emphasis on online as a channel to market that will allow them to increase, or at least maintain, sales and market share, by offering their customers more ways to shop. Accordingly we prefer stocks that have either high exposure to online, or scope to rapidly accelerate online growth, are differentiated by customer offer /brand, and have operating platforms that can be rapidly adapted to a centralised online model.



Online fuelling capacity withdrawal in DM, cannibalisation a key risk

Our analysis suggests that in the UK since 2011 a total of c40% of stores have been closed. While this has primarily been driven by economic slowdown and consolidation, we think online/multi-channel sales growth has speeded up this process. This is likely to accelerate in categories such as consumers electronics.

Cannibalisation remains a key risk for established bricks-and- mortar retailers with mature market positions. We therefore prefer those companies with high online exposure but low exposure to rental payments (we believe the best way to assess the latter is by analysing fixed cost cover).

China – the top online shopping market globally

Expected to reach USD560bn in 2015

According to iResearch, the e-commerce market in China reached USD1.3tn last year, measured by gross market value (GMV), up 32%. We expect the market to increase to USD2.5tn by 2015. GMV is a useful volume metric that reflects the total value transacted in the market. For online retailers that procure their own merchandise to sell direct to consumers, GMV is the equivalent of revenue. E-commerce market places, on the other hand, charge a commission on transactions conducted on their platform of 2-10%, and their revenue is a fraction of the merchandise value.

The e-commerce market is comprised mostly of B2B (where businesses buy from each other, such as procuring steel or manufactured products). The most exciting segment of e-commerce is online shopping, which was 16% of e-commerce in 2012, representing USD206bn, up 66%. We expect online shopping to grow 42% this year to USD300bn, the biggest in the world. By 2015, we expect the online shopping market in China to total USD560bn, 20% of the total e-commerce market. Online shopping in China represented 6% of total retail sales last year, up from 0.6% in 2007. Online shopping in the US was USD231bn last year, representing 8% of total retail sales. By 2015, we expect online shopping to be 10% of total retail sales in China.

42% internet penetration – rural driving the next leg of growth

The biggest driver of online shopping growth is the continued growth in the penetration of internet services in China. At the end of 2012, internet penetration was 42% nationwide, totalling 564m users. Importantly, while cities like Beijing and Shanghai have penetration rates of roughly 70% (compared with around 80% for the US) there are 25 provinces in China with penetration rates of less than 50%. These provinces are growing their internet populations at a mid-to-high teens rate. By 2015, we see internet penetration in China reaching 55%, with the bulk of the growth coming from the less-developed parts of the country.

E-commerce spreading due to smartphones

Rising smartphone penetration also supports growth in online shopping. At the end of 2012, 422m users accessed the internet in China using mobile devices, representing 75% of all internet users. Increasing smartphone adoption will continue to drive 3G penetration, and mobile shopping will continue to grow. Specifically, 3G penetration reached 26% in May (according to the MIIT) and we expect it to rise to 46% by 2015. China is already the world's biggest market for smartphones, with 208m in shipments last year. IDC forecasts 300m this year. iResearch estimates that the mobile e-commerce market was USD9bn last year, up nearly 4x from the previous year. By 2016, iResearch forecasts this market to top USD100bn.

Meeting untapped demand in lower tier cities – surprising spending patterns

Another growth driver for online shopping is the demand from lower tier cities. As internet penetration in these cities improves, consumers are increasingly shopping online. Data from McKinsey indicates that while online shoppers in tier 4 cities have lower average incomes, the amounts they

spend online are similar to shoppers in tier 2 and 3 cities (RMB4,500-RMB5,000 annually). As a percentage of wallet, shoppers in tier 4 cities actually spend more than their counterparts in tier 1 cities. For these consumers, online shopping provides a much better selection of goods than is available through traditional retail.

A retail market that is still immature

China's modern retail market is still fairly young, with only 20 years of history. The size of the country has limited the emergence of truly national chains. Traditional retail remains underdeveloped in many rural provinces. As a result, the market is relatively fragmented and the biggest retailers are regional companies focusing on tier 1 and 2 cities.

Online retail to continue to gain versus traditional retail

We expect online retail growth to continue to pressure traditional retail for four key reasons. First is that dominant online operators such as Taobao and Tmall have a truly nationwide footprint without the need for brick and mortar locations, a key advantage in a large country such as China. **Taobao**, the C2C arm of **Alibaba** (not listed), had a GMV of RMB900bn (USD145bn) last year, a staggering figure that represented 4% of total retail sales in China.

Second, online merchants have been able to use technology and data to make shopping online easier. Traditional retailers are only now moving online, so online incumbents have a head start here. They have also collected years of shopping data that they can mine for opportunities to improve sales and returns.

Third, online shopping still offers the best value for most products and low prices remain a key factor. Even though low pricing on its own is probably not a sustainable business model, online sellers of commodity products such as household items and apparel (particularly on Taobao), will likely continue to use price as their key value proposition.

Finally, online operators are moving aggressively to capitalise on smartphone adoption, creating the market for mobile e-commerce. According to Caixin, Taobao has 150m mobile users. Alibaba Group (not listed) recently acquired an 18% stake in Sina's Weibo microblogging platform, one of the current 'killer apps' on mobile. Alibaba also bought 28% of AutoNavi (AMAP US, NR), a leading map information supplier in China, with the potential to exploit location-based information for mobile e-commerce.

Key challenges

Fulfilment and logistics – China's fulfilment and logistics sector has failed to keep up with the pace of growth of China's online shopping sector. Retailers have had to contend with hundreds of thousands of small, regional companies that are far from efficient. Even though delivery in tier 1 and 2 cities is fairly good, fulfilment capabilities in the fast-growing lower tier cities remain a challenge. This is the biggest potential bottleneck to further growth of online shopping in China. Even delivery from Taobao, the leading C2C site, can be unreliable.

Meeting customer expectations – As the online shopping market matures, the expectations of online shoppers are also increasing. This means that online operators (both retailers and marketplaces) will need to invest more to create, develop and leverage their unique selling propositions.

For example, **Dangdang** (DANG US, OW(V), TP USD13.45) continues to evolve its model to meet customer demands and is taking a greater share of wallet. From its start as an online book seller, it expanded to general merchandise (eg, baby &

maternity, and household), then opened up its platform to some 6,000 online merchants, and in June started offering its customers flash sales (also known as deal-of-the-day sales) from its apparel merchants. Further, it is already driving 10% of orders via mobile devices.

In addition, the industry must address the critical issue of counterfeit goods (mostly on C2C platforms) in order to improve shopping confidence and consumer satisfaction. The government is already exploring the widening of consumer rights law to protect online shopping.

Competition to rise – Competitive intensity in the sector is high (price wars are common) and we expect this to continue as certain companies try to gain dominance in a particular category. In particular, as more online retailers offer third-party merchandise on their marketplaces, it will be harder to differentiate between platforms. **JD.com** (not listed), the biggest independent online retailer, is aggressively expanding, and it already contributes 25% of GMV. Further, internet giant **Tencent** (700 HK, Neutral, TP HKD320) is a new entrant into online shopping and it has lofty ambitions supported by ample financial resources. It could be the most destabilising force in online shopping over the next few years.

In addition, traditional retailers will mount a competitive response, leveraging their strong local market knowledge, customer base, merchandising know-how, supply chain expertise, physical locations and logistical networks.

Profitability remains elusive – Despite very strong market growth, most of the online shopping operators have yet to achieve profitability. Alibaba Group is the exception and the company generated USD890m in net profit last year, up 85% y-o-y, with 29% operating margins and 70% gross margins. Compared to other online operators, Alibaba Group has a dominant presence and also a unique business model. About 57% of its revenue in 2012 was from Taobao, its C2C platform, which generates the bulk of its revenue from selling advertising to its merchants. Even JD.com, with over USD10bn in GMV, has yet to become profitable. In February, JD.com company raised another USD800m in capital from investors including Saudi Arabia's Prince Al-Waleed bin Talal, valuing the company at USD8bn. Management has stated that it expects the company to turn profitable sometime in the next several quarters.

Focus on market share gains through aggressive pricing, investments in logistics, customer acquisition and product development has meant losses for most B2C players. That said, as companies shift increasingly to marketplace models where they earn a commission instead of capturing a margin on goods sold, profitability should improve. For example, Dangdang's success in its marketplace has helped take margins to two-year highs, giving the company better visibility on reaching a profit.

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Insurance telematics

- Telematics should lead to more accurate pricing as insurers rate individual risks based on detailed driving habits and could result in significant premium changes for mis-priced drivers
- Telematics' success would be demand dependent, with consumers wary about allowing scrutiny of their personal information, which would therefore restrict market size to the riskiest drivers
- Insurers expanding their existing offering but it is still too early to list winners and losers

A shift to personalised pricing

Currently, drivers with actual lower risk attributes are punished with higher premiums for belonging to a statistically more risky group based on demographic and location. For example, a safe 20-year-old driver (particularly if male in regions where discrimination by gender is allowed) typically has to pay a much higher premium on his car insurance than a middle-aged reckless driver because proficiency behind the wheel has no bearing on the premium.

Although after a ruling by European courts in December 2012 differentiating between genders in premium calculations in the EU has ceased, but insurance for young drivers remains expensive. However, helped by regulation and fledgling competition, the nascent Insurance Telematics industry, targeting mainly the young, promises dynamic pricing tailored to individual risks.

How it works

Simply put, by having a telematics device installed in a car, a driver can be sold personalised insurance based on how safe a driver he or she is. This makes it especially beneficial for inexperienced but careful young drivers or drivers with low annual mileage.

A telematics device or a 'black box' is an integrated GPS tracking system with a GSM cellular module offering functions for accident alert (eCall), theft detection and vehicle tracking. It may include other value added capabilities such as tele-diagnostics, remote control locking, traffic reports, breakdown and local-support service calls and other floating car data.

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'Black box' or a telematics unit

Source: Continental AG, ingenie.com

The device when fitted onto a car, records vital driving data, which is periodically monitored to analyse driver behaviour and thus determine drivers' risk category and thereby their insurance premiums. The device transmits data over a cellular network including acceleration, speed, braking, cornering, routes taken, mileage, time of the day, and so on. In the event of an accident, an integrated emergency eCall service is activated with the device also collecting data on time and place of the accident, force of impact, speed and direction of travel. Emergency response capability has been at the core of embedded telematics applications in cars, especially in the US and EU.

After analysing patterns in driving style, insurers charge premiums that incentivise safer driving. Typically premiums are reviewed annually or quarterly with a discount or escalation applied depending on driving style.

Technology platform already exists

Telematics and connectivity systems have been already available in many developed markets for some time with module costs having declined notably. The units already support key functions for post-crash safety and emergency assistance services (eCall), remote locking and navigation support. With the required platform already in place, and a further thrust from regulations, it shall not be too complex for insurance providers to integrate their driver profiling insurance applications on the existing telematics systems.

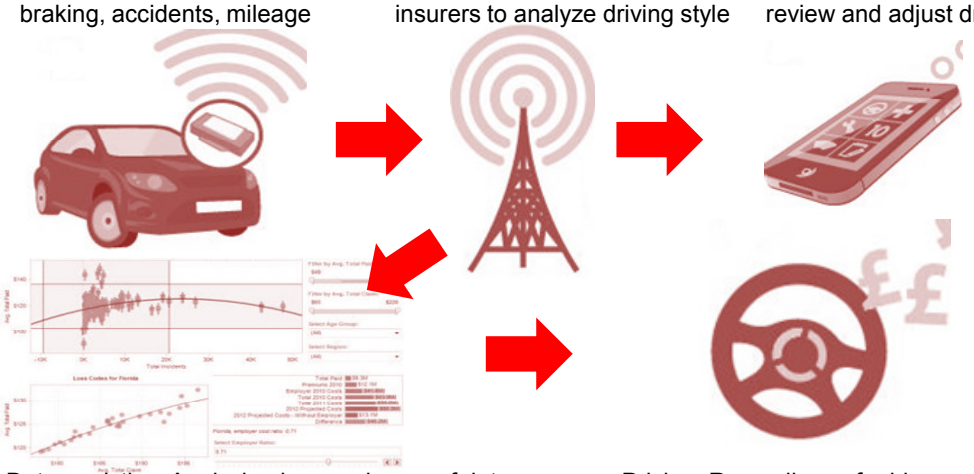
However, the concern currently is around the high installation cost of the 'black box' which restricts its application to the higher premium driver categories. Insurers are experimenting with alternative cheaper options (mobile phone applications) which could be more viable for a broader market, but these have been less successful with concerns around their accuracy and fraudulent behaviour. Insurers are concerned about the quality of data collected from mobile applications given limited scrutiny around its portability and use by third party rather than the actual drivers.

Insurance telematics : How it works

Telematics box collects real time driving data = acceleration, braking, accidents, mileage

Data transmitted over a cellular network to secure servers for insurers to analyze driving style

Feedback and reports on driving style sent to users to review and adjust driving style



Data analytics: Analyzing large volumes of data on driving behaviors and patterns. Improves pricing accuracy and insurance premiums

Pricing: Rewarding safe drivers with low premiums and higher premiums for reckless drivers

Source: HSBC

Regulation to boost penetration rates

Regulation plays a pivotal role in boosting the take-up rates for basic telematics applications, especially for enforcing emergency response and theft detection. Thus, in our opinion, layering in the telematics insurance system on an existing embedded platform will be much easier for insurers. The European Commission has already set about putting the infrastructure in place and making eCall mandatory in all cars from October 2015 across the EU. Although no such regulation exists in North America, GM (On Star), Chrysler (UConnect) and Ford (SYNC) already offer telemetry kits supporting 911 emergency services.

Regulation on related issues also enables take-up of telematics. Vehicle theft risks in some emerging markets pushes premiums very high. In Brazil, for instance, premiums run as high as 20% of car costs, implying car owners end up paying the equivalent of the entire cost of the car over five years in premiums. Thus under the new 'Contran 245' regulation, OEMs in Brazil need to build a tracking module into every vehicle as of 2013.

However, we note that regulation will only ensure the use of devices with bare minimum capabilities and low-margins for automotive suppliers; low bandwidth (only 2G) and basic value added services. Advanced telematics applications such as infotainment and live traffic information require higher bandwidth capabilities (3G/ LTE) and are thus expensive with higher margins.

…but data privacy issues a key concern

Consumer acceptance remains one of the key impediments for telematics insurance given drivers' reluctance to allow insurers to track their behaviour. Apart from concerns on whether traffic violations would be reported to authorities, other vexing issues include ownership and usage of data. Although customers may agree to share data on their driving behaviour with insurers in exchange for lower insurance premiums, they

would be wary of sharing sensitive information with third parties about vehicle diagnostics and when, where, and how they drive.

There is limited clarity on data ownership and data sharing issues in different countries. In the US, data ownership issues are being managed via through legislation. The Senate has passed a bill which makes car owners, or the lessee of the vehicle, as owners of data and not the car maker.

Benefits

1 **Risk management:** a) Insurers already use data mining to study driver behaviour, especially for fleets, to identify high risk profiles, and this would provide another source of data; b) It would provide the insured with claim validation for thefts, accidents and traffic violations; c) It would result in a decline in claim frequency and claim costs for the insured.

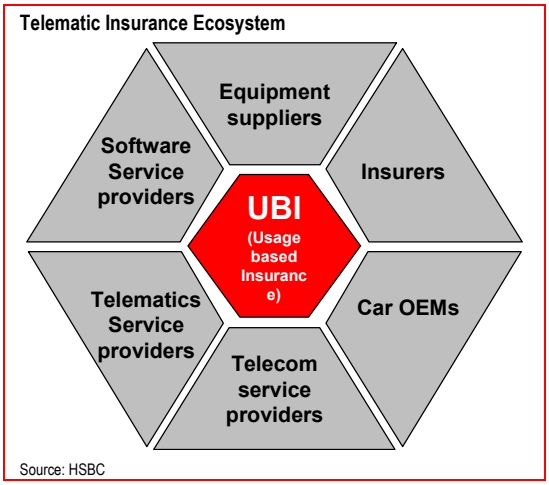
2 **Safety:** The vehicle can be located in an emergency. Active monitoring should improve driver behaviour and so result in safer driving and also help identify accident hot spots, resulting in better road safety. It assists with traffic management and enforcement by speed monitoring, congestion and charging.

3 **Scalable platform for suppliers**: With vehicle telemetry being a scalable platform, equipment suppliers will benefit from higher take-up rates as acceptance of value-added services increases.

4 **Efficiency:** Fleet operators could use it to incentivise drivers to drive safely, for route and fleet optimisation and to cut fuel consumption.

Other applications

Proprietary eCall solutions relying on SMS are already available from car makers such as GM, BMW, PSA and Volvo. With increased acceptance and harmonisation of standards, other services such as traffic information, routes are expected to grow. Other value-added services include infotainment services such as streaming video/data to vehicles, active vehicle diagnostics, dealer-to-car communication, and in-vehicle advertising leveraging on driving or route data.



Winners and losers

Telematics equipment manufacturers: **Continental AG**, **Denso**, **Bosch**, **TRW, Johnston Controls**, **Magneti Marelli**, **TomTom**.

Car manufacturers: Premium car makers have a head start since advanced infotainment and telemetry systems are already standard. Mass market brands promising better fuel efficiency could use telematics technology to move the brand upscale.

Software services: IT companies with Big Data analytics capabilities, such as Microsoft.

Telecom services: Network service providers, and remote software updating providers.

Insurers: First movers will have the advantage as they will have more data and experience of accurately rating the risks. Some early entrants include AA Insurance, Co-operative Insurance and InsuretheBox in the UK private motor market. However traditional insurers have also announced telematics offerings.

Insurers failing to adopt the technology for the riskiest drivers may lose market share or mis-price risks. Over time we would expect any pricing advantage to be competed away.

Claims lawyers may also lose out as evidence provided by the black boxes would leave less room for dispute.

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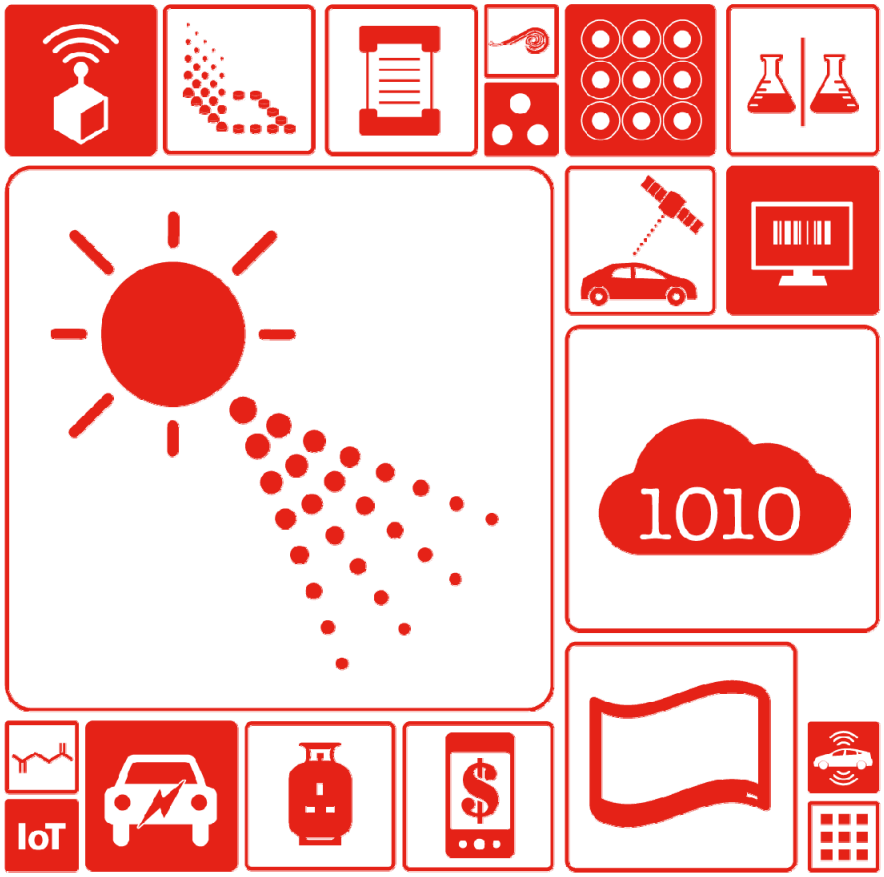
New manufacturing/ new products



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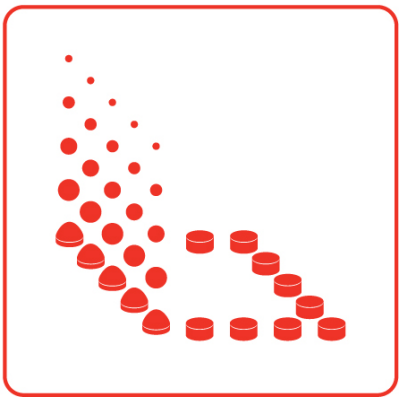
3D printing



- 3D printing has made the headlines recently, and all aspects of production technology will be impacted by the shift from traditional 'subtractive' to 'additive' techniques
- The technologies are already in use, for example for rapid prototyping
- However, they have a long way to go before they will be competitive for mass production

3D printing machines (which have actually been around for over 20 years) make 3-dimensional models of almost any shape from a set of digital blueprints using one of a number of technologies.

These machines have made headlines over the past year, with pundits speculating on the rise of 'distributed manufacturing'. Who needs a factory any more when now the factory can come to you? Who needs today's large-scale transport industry when you can simply manufacture products locally using designs downloaded from the internet? And who needs all the specialist tools (lathes, drills, integrated machine tools) of legacy 'subtractive' manufacturing once the additive manufacturing revolution is here?

However there's a catch: the pundits are getting a little ahead of themselves. First, additive manufacturing techniques may be adept at producing solid-state components, but relatively few things we buy are homogeneous solid-state artefacts. Most are assembled and most have moving parts. Even in an additive future, someone or something will still need to do that (often complex) assembly work.

Moreover 3D printers will be producing one item at a time. Even if the technology is very cool, are we sure it will always be cost competitive compared with traditional subtractive technology machines in a factory making tens of thousands of items at a time? Those machines leverage off a lot of economies of scale (not least material procurement) that a Starbucks manufacturing model (minifabs on every street corner and a skinny latte while you wait) could never hope to replicate.

Lastly there are surely legal and IP (intellectual property) issues: I own the blueprint; you'd love to download it for a licence fee and make one at home. You say you're John Doe from Columbus, Ohio – but how do I know that? How do I know you aren't, in fact, a Chinese competitor who has software capable of reverse engineering my

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'secure' digital blueprint and destroying my licence stream forever? How much am I going to have to charge you for a licence to offset that risk? And how competitive is distributed manufacturing inclusive of that cost?

We conclude that while additive manufacturing is very much a reality today, its use will, for the foreseeable future, be restricted to particular niches, including rapid prototyping where it has already made major inroads.

History of 3D printing

3D printing, also known as additive manufacturing, is the process in which a 3D solid object of any shape is made via a digital model. +Additive manufacturing is defined as a process in which many layers of materials are being laid over each other in different shapes to create an object, compared to traditional subtractive manufacturing where materials are removed from a working piece to create an object.

The most popular form of subtractive manufacturing is CNC (computer numerical control) machining. CNC manufacturing is done when a computer converts designs products by Computer Aided Design software (CAD) into numbers, which in turn be used as the coordinates of a graph to control the movement of the cutter in a CNC machine.

A number of technologies are used: stereolithography (SLA) and fused deposition modelling (FDM) for use with plastics; and selective laser sintering (SLS), direct metal laser sintering (DMLS) and electron beam freeform fabrication (EBF) for use with metals.

3D printing has been around since the late 1970s, the same time as inkjet printers, but the 3D printers of old were very large, too expensive to be economically feasible, and had limitations to what they could produce. However, in recent years, 3D printing has evolved and is now increasingly replacing or complementing traditional design-to-manufacturing alternatives.

Based on data from various market research firms, we estimate the 3D printer market to have been worth approximately USD800m in 2012, and to grow at a CAGR of 17% (from 2013-19e) to exceed USD2.5bn. We note that the global power tools market was over USD20bn in 2012, meaning the penetration of 3D printers is still relatively low.

3D printers retail at an ASP of USD1,300 (for personal use) to as much as USD1m for more complicated 3D printing systems which are for mass production purposes. According to Wholers, there are now more than 23,000 3D printers in the global market, versus just 350 or so units in 2008.

Currently, 3D printers are being employed in segments including:

- automotive & transportation
- aerospace & defence
- consumer
- education
- MCAD and architecture
- personalised medical devices

The industry is, according to 3D Systems, driven by:

- increasing global R&D spending;
- compressed design-to-manufacture timelines;
- product evolution; driving increase in component count and complexity;
- democratisation which expands opportunity to both consumers and manufacturers;

- attractiveness due to sustainability which helps to reduce inventory, waste, cost & carbon footprint.

We believe 3D printing has taken a substantial time to come into mainstream because of high prices, poor yields, inability to create a final product and unwillingness for manufacturers to embrace a revolutionary product. However, recently prices for 3D printers have come down. This, coupled with increasing awareness and the ability of 3D printers to provide the prototypes for actual products, is leading to ramp-up in their use.

Winners and losers

Losers are harder to identify given the frontier nature of the technology, and consequently the uncertain relationship between this new technology and existing technologies. Many will have heard Warren Buffett's *bon mot* that the best way for an investor to play the emergence of the automotive industry in the early 20th century would have been to short horses. But the US railroad network – another supposed victim of the rise of the automobile – in fact continued to expand for another 30 years after the emergence of mass market automobiles, if we date that from the introduction of the Model T Ford in 1908. There may well be significant further growth in subtractive manufacturing technologies, and therefore no clear losers from today's perspective.

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Flexible screens

- We expect competition to start shortly with the release of smartphones with curved screens
- Apple, Nokia and HTC may find this new technology difficult to commercialise quickly
- LG Electronics and Samsung Electronics set to be winners, near term, from market share gains through new products; LG Innotek, LG Display and Cheil Industries are the main indirect beneficiaries

The next big thing in mobile – flexible display

Imagine a screen that is bent around the side of the phone. Then go a stage further and imagine a range of bendable, rollable and foldable digital devices. Welcome to flexible display, the technology that is about to become commercial reality. Flexible displays can be bent without being damaged, making it possible to create products that are ultra-thin, almost unbreakable and flexible. The potential for this technology is substantial as the ultimate goal is to produce cheap mass-produced digital devices that can be rolled up like paper.

We believe the introduction of flexible display will change the industry landscape. Starting with another wave of innovation in H2 2013, flexible display based on new plastic materials will evolve into bendable and then transparent products.

We believe the smartphone market, which has grown at a significant rate since the second half of 2009, is starting to mature. Aggressive new players are trying to catch up with market leaders. Currently, all smartphones use rectangular touch screens, making it harder to differentiate between products. And with lower entry barriers leading to fierce price competition, sentiment has turned gloomy as fears about lower profitability grow. Flexible display should help change that.

OLED gives established players an edge

Other than larger screen size and better resolution, there is little room for improvement in flat display panels, which is based on light-emitting diode (LED) technology. Top Korean LCD makers have been trying to breathe life into the industry, but penetration levels for LCD TVs are already high. LCD can't be used in flexible display, which needs self-light emitting material, such as OLED (organic LED). Korean companies have led the

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development of OLED, which is already being used in some smartphones and TVs. OLED's faster response time and outstanding colour definition have given the early entrants an edge as its use in high-end products also generates a margin premium. OLED is the first step to making the commercialisation of flexible display a reality.

Challenges remain

Heavy investments have already been made in LCD facilities, which will have to be converted to produce flexible display. Second, a substitute for glass needs to be found: most displays use glass as it offers better resistance to heat, gas and moisture, and is more transparent than other materials. However, it is not flexible, so new plastic materials are needed. Lastly, flexible display products need to show that they can offer consumers added value. It remains to be seen how much of a premium companies will be able to charge for these products. The consumer will be the judge of that.

We think flexible display will be fully commercialised in 2014, but some products based on existing technology may be available much earlier. The first thin smartphones and tablet PCs using plastic substrates could be in stores in just a couple of months, but how much added value these prototypes will offer consumers remains to be seen.

Winners and losers

Competition to hot up shortly

We expect competition to start to hot up in shortly, with the release of smartphones with curved screens made of both plastic substrate and thin glass. **LG Electronics** and **Samsung Electronics**, which have vied with each other since the launch of OLED TV in January 2012, should also compete fiercely in the flexible display smartphone market. In H2 2013, **Samsung Electronics** is likely to start offering flexible display in its Galaxy Note 3, and LG Electronics in its Optimus G2 models, with possible volumes of 10-15m and 5-10m, respectively. This would mean that by the end of the year flexible display could represent 5% of the global smartphone market and 15% of high-end smartphones in H2 2013. These models are all high end, so the impact on earnings will be visible at an early stage. The first models will still use glass in the outer layer of the curved screen, so won't be completely flexible. However, by 2014 plastic film will be available and the new products will represent a revolutionary change in the smartphone, notebook and tablet industry.

Vertical integration essential

We believe vertical integration is essential to fully commercialise flexible display for the following reasons:

- Although individual panel and materials companies are capable of solving technological issues, the supply chain needs to be tested by the rigours of mass production.
- We think flexibility on pricing throughout the supply chain is also essential, especially in the early stages. TV makers have a '40% premium' rule for TV products, but set prices lower when they launched LED and ultra-high definition TV. They will probably have to adopt the same tactics for flexible display as customers assess these new products.
- A whole range of new components will be needed to meet the requirements of flexible display (for example, a completely new shaped battery will have to be designed).

Korean handset maker to benefit most initially

Korean handset makers stand to benefit most at first as they have an opportunity to grow their

market share on the back of these new and highly differentiated flexible display products. It's certainly a substantial opportunity for **LG Electronics**, which is experiencing a slump in its smartphone business. The company's market share is only 5%, but we believe this could rise to 7-8% in 2014.

Samsung Electronics, the leader in the smartphone handset market, can use flexible display to further strengthen its position. We believe these two companies have a head start on their global handset rivals because they already have a vertically integrated supply chain in place. For example, we think flexible display will be difficult to commercialise for **Apple**, given the large size of its orders and a lack of capacity in the industry.

Meanwhile, it may take **Nokia** and **HTC** some time to introduce flexible display products as organising the supply chain is likely to be a lengthy process.

We believe **LG Innotek** will be one the biggest indirect beneficiaries of the flexible display trend. For example, if **LG Electronics**' handset business improves, LG Innotek will supply it with most of the handset components – touch screen, PCB, and camera modules. LG Innotek also holds the key to developing the required flexible components (eg flexible PCB) when curved design is introduced. This will strengthen the relationship between LG Innotek and LG Electronics.

What's more, LG Innotek is developing a transparent electrode, essential for transparent display in the longer term. We also believe **Cheil Industries** will have the largest upside risk in the mid to long term as the company can co-operate with **Samsung Display** to develop core technologies required for flexible display. This is Cheil's differentiating factor and is expected to drive revenue growth at its electronic material division.

The proliferation of flexible display is also good news for equipment makers. Starting shortly, Samsung Display and **LG Display** are expected to expand capacity by converting existing LCD fabs to plastic OLED to maximise investment efficiency. As a result, SFA, Samsung Display's equipment maker, is expected to benefit.

HSBC

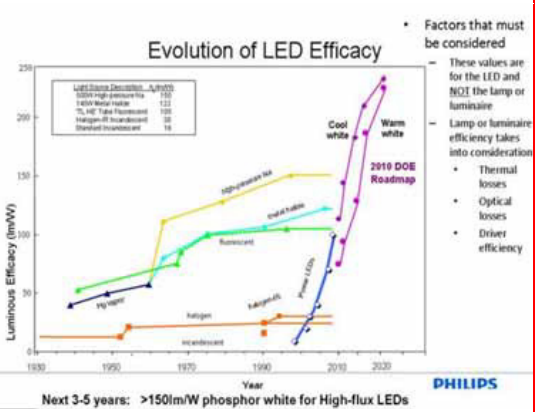
LED lighting

- A rapid fall in cost of ownership is leading to a shift from traditional lamps to LED in general illuminations
- Longer lifetime and increased complexity of lighting solutions are calling for a change in business models
- Lamp manufacturers, such as Philips, Osram, Panasonic and GE, are affected just as much as luminaire producers such as Zumtobel, Eaton, Hubbell or Acuity

Let there be LED

The lighting industry has generally been considered a slow-moving industry, where new technologies penetrate the market at snail's pace. In a sense this has not changed with the advent of LEDs, as the first LED products suitable for general lighting applications appeared in the 1990s.

Lamps and components industry



Source: Philips

However, we have now reached a point where lumen per watt exceeds other green technologies, such as compact fluorescent, and as the graph opposite shows the trajectory is steep.

The combination of falling prices, better light quality (as measured in the colour rendering index) and value-added lighting solutions is leading to wider adoption. The table overleaf illustrates the simple economics, and these show that the total cost of ownership is already on a par with compact fluorescent lamps. So no wonder that McKinsey reckons that the value-based market share for LED in general lighting applications will rise from around 10% at the beginning of the decade to 80% at the end of it.

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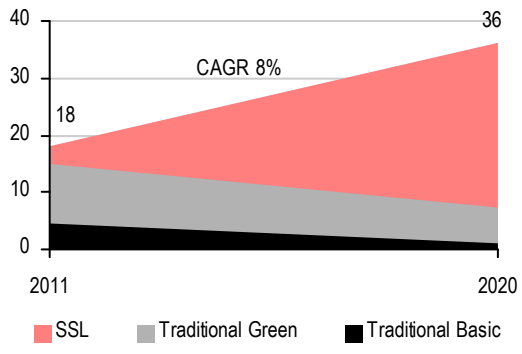
Cost Ownership of different lamp categories

	LED	CFL	Halogen	Incandescent
Watts per bulb (equiv. 60 watts)	10	13	40	60
Initial cost per bulb (USD, approx)	**20.00**	**3.00**	**5.00**	**0.75**
KWh of electricity used over 50,000 hours	500	650	2000	3000
Cost of electricity (USD, @ 0.10per KWh)	50	65	200	300
Bulbs needed for 50,000 hours of use	1	5	17	36
Light bulb projected lifespan (hours)	35,000	10,000	3,000	1,400
Equivalent 50,000 hours bulb expense (USD)	28.57	15.00	83.33	26.79
Total cost for 50,000 hours (USD)	**78.57**	**80.00**	**283.33**	**326.79**

Source: HSBC Research, Wikipedia, Osram prospectus

Lamps and components industry (EURbn)



Source: McKinsey 2012 Lighting report

The advent of LEDs is disruptive to the industry largely for two reasons.

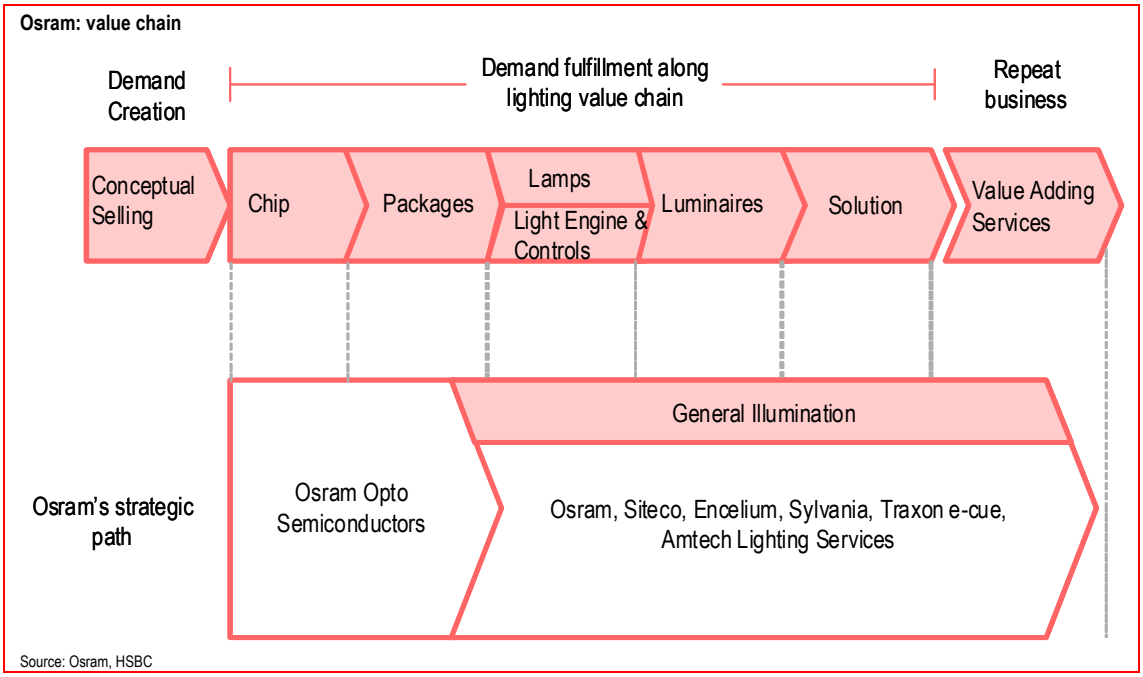
First, LEDs are meant to last for up to 35,000 hours compared to 1,000 to 2,000 for incandescent light bulbs or 10,000 to 15,000 hours for fluorescent tubes. Hence, the industry's traditional model of selling replacement lamps through a retail network is under threat.

Second, the complexity of the lighting solution is changing. Typically a lighting 'arrangement' consists of one or more light switches, one or more luminaires (fixtures) and one or more lamps; easy to understand and easy to fit. Going forward the most sophisticated solutions will consist of one or more internet-enabled control panels, sensors and several luminaires with integrated light engines. In their most advanced form these systems are so complex that they require highly skilled sales people and project managers to convince the customer of the benefits and to monitor the installation process, and trained technicians to service them after installation.

As a consequence of the superior lifespan we are seeing lower growth and rising price pressure in traditional lamps forcing the major players to raise productivity like they never had to before. They are also cutting capacity in those products that will most quickly be replaced in the mature markets, such as incandescent light bulbs.

As a consequence of the complexity of the solutions we are seeing companies expanding along the value chain. The most aggressive in this respect is Philips, a leader in traditional lighting, which has acquired companies along the entire value chain. Today Philips is the largest lighting company in the world with in-house capabilities from the LED chip to the luminaire and the control.

What the winning business model will be remains to be seen. Given the early stage of mass adoption the industry is in flux. Today we are looking at an industry with little if any standardisation. By and large, manufacturers have been developing light engines to their own liking and have sold them on to the luminaire manufacturers, forcing those to develop new luminaires. Only recently we have seen LED products designed to resemble incandescent light bulbs or halogen lamps, which fit existing luminaires (fixtures). Falling prices



have led to some adoption of these replacement products and the chances are that with further price declines, their adoption will gain momentum hampering the replacement of luminaires.

Furthermore we are seeing that the luminaire manufacturers are pushing for a standardisation of LED modules and light engines to encourage more competition among their manufacturers.

Winners and losers

Winners

In our view it is unlikely that there will be one winning businesses model. Philips (PHIA, N, TP EUR26) and Osram (OSR, OW, target price EUR40) have a presence along the entire value chain. This gives both companies a strong position to start with. As long as they keep up with technology and stay ahead of the price curve with their costs this strong presence in the channels will allow them to succeed and most likely grow faster than the market at the expense of the smaller players. If this is the case, they would be succeeding alongside companies which have a strong value proposition on a smaller stretch of the value chain such as Cree or Nichia at the front end, or Zumtobel with its strong brand in luminaires at the end.

Losers

Most difficult is the situation for the smaller mid-market players along the value chain. Unless they manage to leapfrog the majors in technology through innovation, they are unlikely to keep ahead of the price curve.

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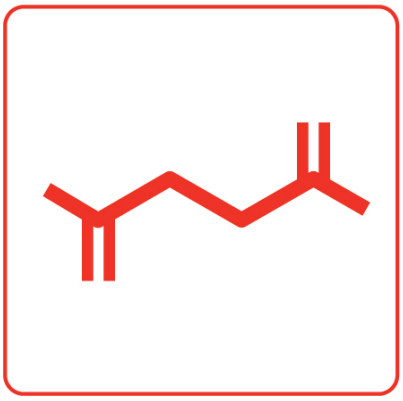
Bio cracking



- Bio-cracking offers a source of chemical building blocks that does not involve oil-based raw materials and is environmentally friendly
- The technology is still some away from full scale production, but does offer alternative routes to chemicals which could be in short supply given the uncompetitiveness of conventional naphtha-based crackers
- Potential winners from this theme include DSM and Bio Amber

What is bio cracking?

Conventional cracking takes refined oil products; predominately naphtha to produce ethylene (C_2), propylene (C_3), butadiene (C_4) and aromatics (C_6); the process has high energy requirements. Bio-cracking takes natural raw materials (crops or biomass) and using yeast or bacteria (strains of E.*coli*) to produce C_3, C_4 and C_5 building block chemicals. Currently several companies (Bio Amber, DSM, Myriant and Purac) have developed pilot or small scale commercial production of several of the building blocks – lactic acid (C_3) and succinic acid (C_4).

Using biotechnology to produce chemicals is not a new concept; for many years amino acids, ethanol and various vitamins have been commercially produced via fermentation and biotechnology routes.

Impact on the chemical industry?

Up until recently the consensus would have been that the bulk of C_3-C_5 chemical building blocks would be produced via oil-based naphtha crackers or PDH (propane dehydrogenation) units. However, bio cracking offers a low-cost production route.

In the medium term, if this technology is successfully scaled up, we could see significant low-cost supply coming into the market, which could squeeze the margins of the high-cost producers.

One potential limiting factor is that the majority of the raw materials currently come from soft commodities (such as corn). This would increase the pressure on agrochemical production, which is currently is not producing enough crops to feed the world's population. We believe that for scaling up producers will need to find alternative non-food based raw materials, like biomass or bio-waste.

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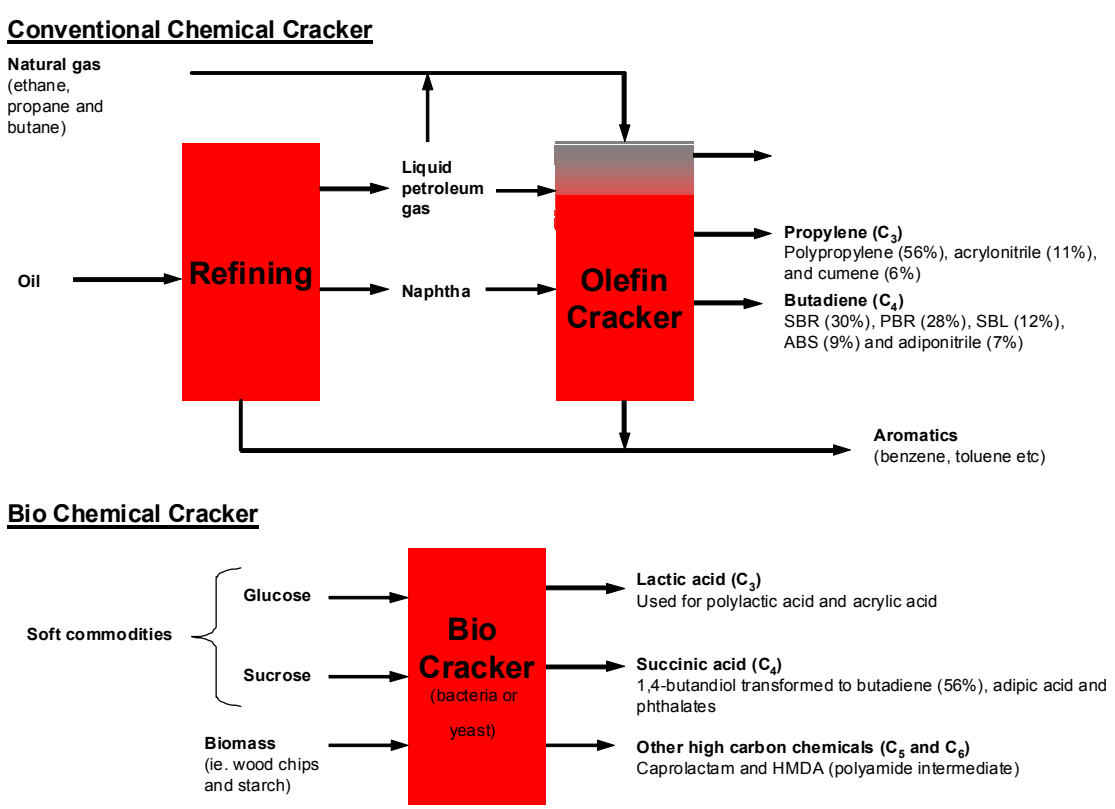
Overview of conventional and bio crackers



Source: HSBC

Why now?

We believe that there are several reasons why bio-crackers are starting to move from an academic project toward commercial reality.

Shortage of the C_3-C_6 chemical building blocks: The advent of shale gas (and potentially shale oil) has had a significant impact on the global petrochemical industry particularly in North America. The global petrochemical industry has shifted towards using more natural gas (ethane and propane) raw materials, resulting in shortage of the C_3-C_6 chemical building blocks. This can be clearly seen in the decoupling of the ethylene and butadiene/benzene prices over last four years. Looking ahead, North America petrochemical producers are adding more natural gas based petrochemical capacity, which will be all C_2 (ethylene focused). Therefore buyers of propylene, butadiene and aromatics are been forced to look for alternative sources.

Proof of concept and cost: In the last few years several companies have moved their bio-industrial toolkits from bench/small pilot scale plants to commercial sized plants. For example, Myriant now has two (in the US and Germany) producing succinic acid, and Purac is using its lactic acid technology in Spain. Bio Amber has a commercial succinic acid plant in France, which was opened in 2010. While these plants are not on the scale of conventional chemical plants, we believe that companies will look to scale up their production. The move to commercial manufacturing has allowed producers to show that their cost of manufacturing is low, the newest 1,4-butandiol process and plants are cost-competitive with

conventional methods down to approximately USD50/bbl (WTI) oil price.

Environmental considerations: The bio-cracker route is much more environmentally friendly than traditional fossil fuel production routes; in certain processes it consumes carbon dioxide and the waste products are water and heat. Moreover in certain end-markets, consumers are demanding or willing to pay price premiums for 'green' products.

Conventional chemical players placing bets

Over the last few years all of the major chemical companies have set up technology or financial alliances with the handful of companies that are in the bio-petrochemical sector. We believe that this shows that the broader chemical industry acknowledges this is a viable and commercial route of production.

Lots of chips been laid on bio petrochemical producer roulette table

	Partner	Type	Comment
Bio Amber	Mitsui	Commercialisation	Joint venture to build a new manufacturing facility in Canada
	PTT MCC Biochem	Commercialisation	Joint venture to build a new manufacturing facility in Thailand
	Solvay	Commercialisation	Collaboration to develop aliphatic and aromatic esters of bio-succinic acid
	Lanxess	Commercialisation	Jointly developing succinate-based plasticizers
	Mitsubishi Chemicals	Commercialisation	BioAmber is Mitsubishi Chemical Corporation's (MCC) exclusive global supplier of bio-based succinic acid
	Nature Works	Commercialisation	Working to produce PLA/PBS resins
	Faurecia	Commercialisation	BioAmber will be supplying the partnership will supply the partnership between Faurecia and Mitsubishi Chemicals with succinic acid .
	Cargill	Innovation	BioAmber is working with Cargill to develop a new generation of yeasts for the production of succinic acid
	Dupont	Innovation	Bio Amber has the licence to use DuPont's catalyst technology to develop and commercialize the hydrogenation of succinic acid to produce BDO and THF
	Evonik	Innovation	BioAmber is working with Evonik to develop catalysts that convert bio-based succinic acid into BDO, THF and GBL
	Celexion	Innovation	BioAmber has an exclusive, worldwide licence to develop, make, use or sell certain C_6 derivatives, including adipic acid, hexamethylene diamine and hexanediol
Genomatica	Mitsubishi Chemicals	Manufacturing	Joint venture to build an Asian-based BDO plant using Genomatica technology
	Novamont	Distribution	Joint venture to produce BDO at a site in Adria Italy using Genomatica technology
	Tate & Lyle	Raw Materials	Development agreement to jointly scale up the production of BDO from dextrose sugar feedstocks in North America
	BASF	Licence	BASF has licensed to use Genomatica BDO technology
	Toray Industries	Manufacturing JV	Producing PBT from Genomatica's BBO technology
	Versalis	Joint venture	Creation of bio-based butadiene business
	Chemtex	Partnership	Genomatica received world-wide rights to PROESA for the production of BDO from biomass
Myraint	PTT Global Chemical	Financial/Manufacturing	PTT GC invested USD60m and will jointly develop Myriant's technology in South East Asia
	Blue Star	Financial/Manufacturing	Developing succinic acid plant in Nanjing
	Bayegan	Manufacturing	Commericalise Myriant's succinic acid technology in EMEA
	Udhe	Technology	Alliance to provide turnkey succinic acid plants
	Davy Process Technology	Technology	Davy and Myriant will combine their succinic acid and BDO technology
Purac	BASF	Joint venture	BASF and CSM formed Succinity GmbH to produce succinic acid
Roquette	DSM	Joint Venture	The joint venture is using yeast to produce succinic acid, it is called Reverdia

Note: BDO = 1,.4-butanediol; THF = tetrahydrofuran; GBL = gamma-butyrolactone; PLA = polylactic acid; PBS = polybutylene succinate
Source: Company data

Competitive landscape

There are relatively few pure-play bio-petrochemical producers. These include **Bio Amber** (focusing on bio-succinic acid), **Genomatica** (bio-based BDO) and **Myriant** (bio-succinic acid). There are also significant joint ventures, **DSM** (DSMN.AS, EUR58.13, Neutral) and **Roquette Frères** using yeast to produce bio-succinic acid, and **BASF** (BASFn.DE, EUR67.9, OW), and **Purac** (bio-succinic acid)

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Winners and losers

The publicly listed players in the area of bio-petrochemicals are **BASF**, **Bio Amber** and **DSM**. The main private players are **Genomatica** and **Myriant**. From a European perspective we believe that the only way to play this theme is through DSM and BASF.

DSM – key player in Europe

Among the established European chemical players, DSM is arguably the most exposed to and biggest beneficiary of a potential 'bio-based' revolution within the industry. Thanks to its position as the globally leading producer of vitamins and as a leader within the production of yeasts, cultures, enzymes and anti-infectives (penicillin) DSM has been at the forefront of industrial bio-technology for some time based on its competencies in the fields of fermentation and biocatalysis.

The company has established a dedicated Innovation division, which has the target of achieving EUR1bn of sales by 2020 (from EUR102m in 2012). This division consists of two platforms, DSM Biomedical (which generates the vast majority of the division's current sales) as well as DSM Bio-based Products & Services. The latter includes the company's activities in the field of cellulosic (second generation) bio-ethanol as well as its bio-chemicals activities. The key product here is bio-based succinic acid, for which DSM has a joint-venture with French starch-processor Roquette, named Reverdia. The JV inaugurated a medium-scale commercial plant (10kt) in Italy in 2012.

Whereas competitors such as Bio Amber and Myriant use a bacteria-based production process, Reverdia follows a yeast-based route – given DSM's strong competency in this area – which requires fewer production steps and yields less by-products. While succinic acid for now is only a relatively small market, the targeted cost level, which is clearly below that of the petrochemical-based substitute, would open up new markets and therefore increase the market size substantially. The product has already been qualified in several applications and is likely to be used for the production of polyamides, polyesters and solvents. In our understanding, however, the current plants still lack the required scale to achieve the aspired cost levels. Accordingly, Reverdia plans to start up a second commercial, large-scale plant in 2015, which is supposed to achieve this target, in order to licence this technology out to third parties in the future. DSM also has advanced activities in renewable adipic acid, which is a building block for polyamide 6,6 used in fibres (carpets) as well as engineering plastics (autos, electronics).

In our view, the market is, for the most part, aware of DSM's activities in this area, but does not give it any credit, yet, given the lack of current sales as well as the difficulty involved in modelling these emerging activities. Therefore, we think DSM's shares would allow investors to benefit from a potential break-through of these technologies, which is likely to still be a couple of years out, without risking too much in case it is unsuccessful.

BASF – largest producer of BDO

BASF is the world's largest producer of 1,4-butanediol (BDO), other producers include Dairen Chemical, LyondellBasell, Ashland and Xinjiang Markor Chemical Industry. The major uses for BDO are in the production of tetrahydrofuran (THF – an intermediate of spandex), polybutylene terephthalate (PBT) resins for engineering plastics and in the manufacture of gamma-butyrolactone (GBL) and polyurethane elastomers. BASF's involvement in bio-petrochemicals is its joint venture with Purac (a subsidiary of Corbion) called Succinity GmbH, which will combine Purac's

biotechnology with BASF's process technology. In May of 2013 BASF entered into a global agreement with Genomatica to licence its BDO technology. Succinic acid is converted to BDO with a rhenium/ruthenium (Re/Ru) catalyst system.

Currently the bio-petrochemical business represents a very small proportion of BASF's sales and profits, but white biotechnology (industrial biotechnology) is one of BASF's key innovation areas and could provide a significant number of new products in the future.

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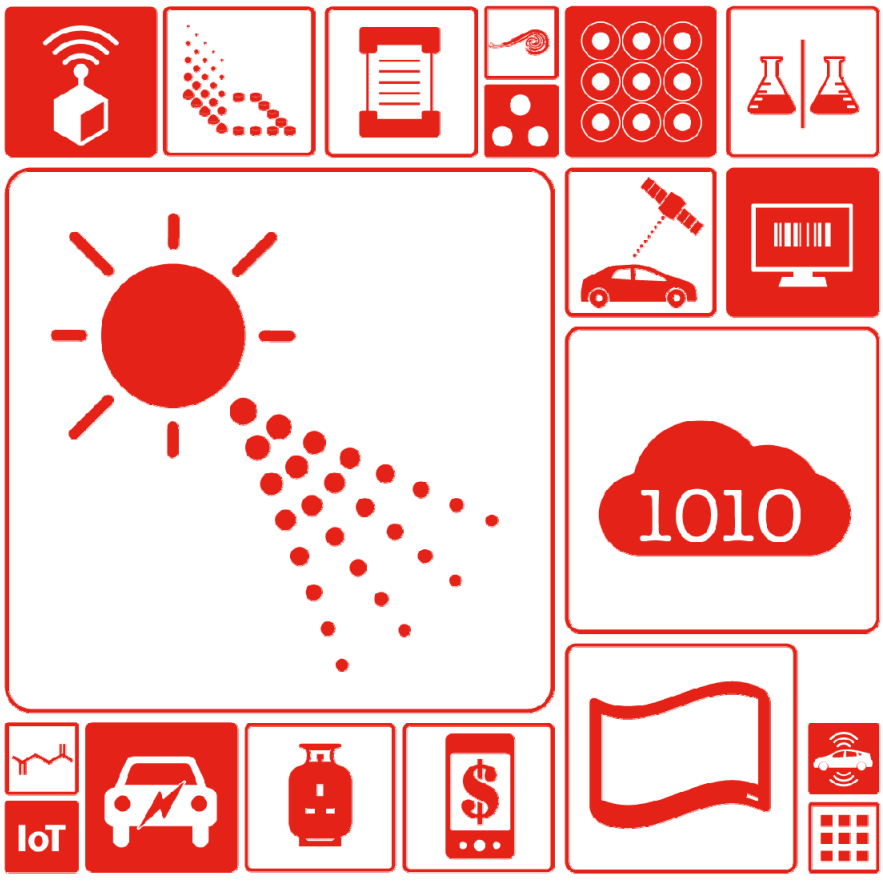
The energy revolution



HSBC

A disruptive climate

- Climate change, combined with natural resource stress, is a disruptive factor in both technology and business models
- Carbon constraints mean energy efficiency is imperative
- Downside risks to tightening policies and disruptive technologies include stranded assets and changing business models

The response to climate change is already a key force behind technological development – particularly in the energy sector – and we believe this will intensify as the drive for low-carbon growth deepens.

Climate change exacerbates stress

Climate change exacerbates underlying pressures on natural resources such as energy, water and food. The chart below highlights the interplay of this 'resource nexus' – with climate acting both as a threat multiplier and an innovation stimulator. We believe this convergence of forces will play an increasing role in disrupting existing energy technologies and business models.

Policy drivers

The growing realisation of the severity of climate impacts, combined with rising resource stress, is driving a tightening of environmental regulations.

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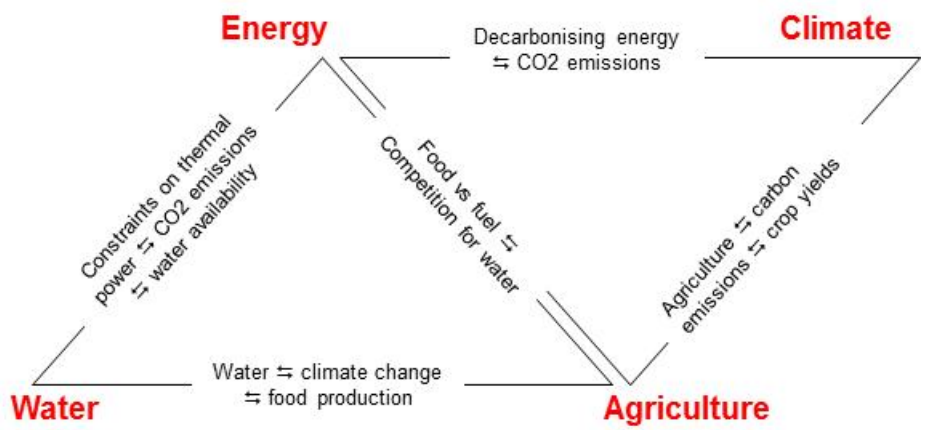
Climate factors affect water availability, energy and agriculture, as well as the policies governing these



Source: HSBC

From a climate perspective, the world's five largest emitters are China, the USA, India, the EU and Russia. A range of factors are prompting countries to choose a low-carbon growth pathway. The table on the next page shows that these factors – including changes to economic structure, energy substitution, efforts to reduce urban air pollution and water stress - are most aligned in China (see *Peak Planet*, 25 March 2013).

Factors driving low-carbon growth and technology development

	China	US	EU	India
Economic structure	√	X	X	X
Energy substitution	√	√	√	√
Air pollution	√	√	√	X
Water	√	√	X	√
Carbon	√	√	√	X

Source: HSBC estimates

Constraining emissions

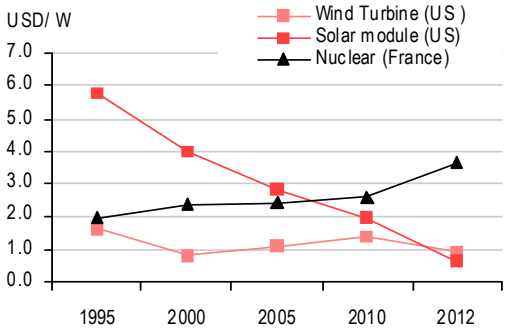
Fossil fuels account for four-fifths of global CO_2 emissions and are an obvious starting point for reducing emissions – by using less of them as well as using them more efficiently.

Power generation

Improving the efficiency of power generation and consumption is crucial to reining in emissions. Carbon constraints – through a carbon tax or emissions trading – are being imposed in many countries. Power generation will be subject to these regulations and hence could be forced to innovate and redesign existing operations models. Utilities analyst Adam Dickens explores the storage technology of 'power to gas' on page 62.

The increase in renewable energy use – through both regulatory forces such as renewable portfolio mixes and feed-in-tariffs as well as technological advancement could also erode the growth of traditional fossil-fuel-based power generation. The cost of renewable technology has been coming down, so it will soon be competitive with traditional power generation; nuclear power however has exhibited a 'negative learning curve'. We look at the potential of 'spray-on solar' on page 77.

No longer alternative: the declining costs of renewable energy technology



Source: World Nuclear Association, EWEA, ArnulfGrubler, Alan Goodrich and et al, BNEF, HSBC

A revolution in battery technology could speed up the deployment of renewable technology such as wind and solar, especially given the intermittency of generation. Grid storage systems, including batteries are covered on page 66. Electric vehicles would also benefit from improved battery technology. On the other hand, if carbon capture and storage (CCS) technology fully develops commercially then there is the risk that the development of renewables will be slower.

Vehicle emissions

In a similar vein, tightening regulation on vehicle emissions in the developed world is impacting oil demand growth. The eventual push towards electric vehicles – which have zero tailpipe emissions of both carbon dioxide and pollutants such as SOx and NOx – would be very disruptive to the traditional fossil-fuel-based automobile industry, this is discussed on page 72.

Energy efficiency

Using resources more efficiently is imperative in a resource constrained world – in terms of both energy and water. Regulations coming into force,

especially those which hasten low-carbon development, should further drive efficiency. For example, a tax on carbon is accelerating innovation in industrial efficiency, building-efficiency targets and the phase out of traditional incandescent light bulbs are driving the transition to LED lighting. This is covered from page 48.

A peak in demand?

We believe that demographic and climate factors are combining to bring about a peak in energy demand in the industrialised world. Existing technology will be replaced by much more efficient – disruptive – technology, as demand plateaus and eventually declines in the industrialised world. We think climate policy could hasten the efficiency drive as well as the timing of 'peaks' among developing countries. This is already happening in Europe as the Energy Efficiency Directive comes into play, see *European energy utilities*, 10 April 2013.

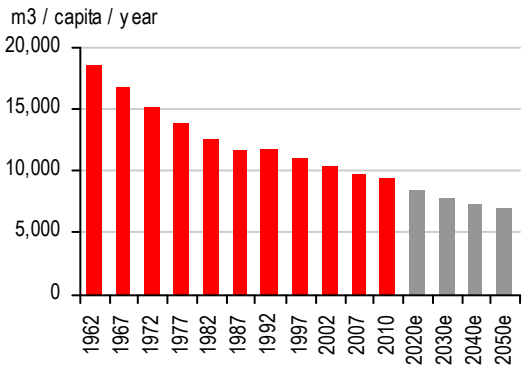
Resource stress

Existing resource stresses in certain geographic regions such as water scarcity, or natural energy price fluctuations, could be additional drivers for technological and business model change.

Water scarcity and energy prices

Water availability is a key expression of climate change – higher temperatures mean more evaporation; for every 1°C of warming, 8% more moisture is absorbed. In *Water stress* (September 2012), we estimated that per-capita water use will increase by 50% on average by 2030 for the G20. However, per-capita availability is likely to decline.

Global freshwater availability is declining



Source: FAO Aquastat, UN population forecasts

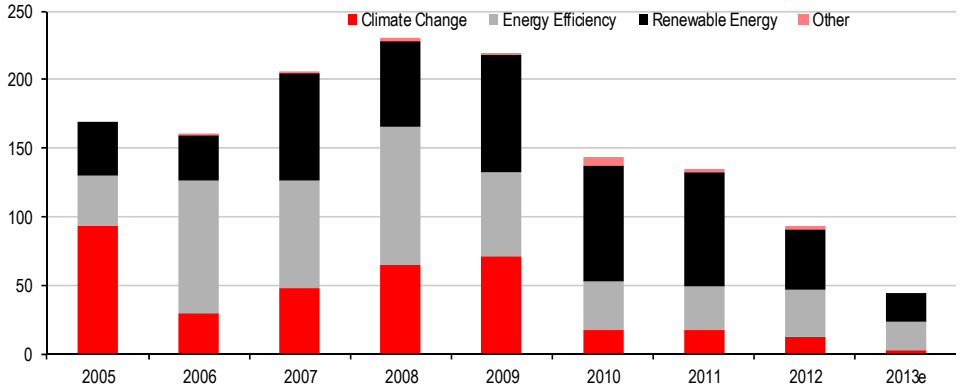
Water supply is essential for thermal power generation, whereas key renewable technologies are much more water-efficient; water constraints also highlight the need for energy efficiency. For traditional power generation, water scarcity in certain regions may drive improved efficiency and new technology such as fuel cells. Sean McLoughlin looks at fuel cells on page 70.

Riding the next wave

We believe that the climate agenda is entering a new wave of policy activism, symbolised by the recent launch of the IPCC's Fifth Assessment Report (see *IPCC: Science, Impact, Forecasts*; 27 September 2013). In the last decade, political, corporate and public support deepened on the back of the Stern report on the economics of climate change (2006) and the IPCC's Fourth Assessment Report (AR4) in 2007. The number of climate policies grew by 12% between 2007 and 2008 as nations prepared for the 2009 Copenhagen climate summit.

The combination of the global financial crisis and the failure of Copenhagen to produce a global agreement resulted in a fall off in new policies from 2009 (See the chart below, Climate Policy Momentum). We believe that 2013 will mark the low point in new policies and expect that policies

Climate policy momentum will bottom out in 2013 and grow into 2015 (# of policies)



Note: Other includes forestry (LULUCF and REDD+), waste and adaptation policies. Y axis = Number of policies introduced.
Source: Climate Change, Energy Efficiency and Renewable Energy - IEA Policies and Measures Database; Other - 3rd Globe Climate Legislation Study, 2013. The 2013 estimate annualises new policies to date

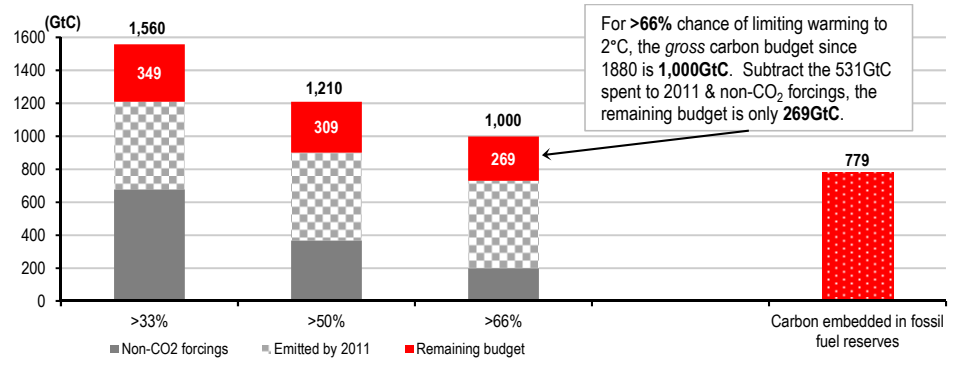
will regain momentum through to 2015 as governments get ready for the finalisation of international negotiations in December that year. This time we expect much greater focus on national strategies that deliver energy security and technological innovation, in place of aspirations for global carbon markets.

Downside risk for incumbents

One consequence of tightening climate policies is downside risk for energy incumbents. The latest IPCC report, for example, concluded that the global economy had a one trillion tonne (1,000GtC) budget for the amount of carbon that can be emitted without breaching the 2°C target. This budget gives a 66% chance of holding warming below this level. But 531GtC have already been emitted, and when allowance is made for non-carbon greenhouse gases, only 269GtC remains for the rest of the 21st century. Comparing this with the carbon embedded in existing reserves of coal, oil and gas, it is clear that most fossil fuels cannot be commercialised without the application of carbon capture and storage if the 2°C target is to be respected (see chart below).

We have previously explored the issue of 'stranded assets' in *Coal and Carbon*, (21 June 2012) and *Oil and Carbon Revisited* (25 January 2013).

The diminishing carbon budget is significantly lower than the carbon embedded in fossil fuel reserves



For reference, one tonne of carbon corresponds to 3.67tCO_2.
Source: IPCC AR5 SPM, IEA WEO 2012.

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Power to gas

- Power to gas presents an attractive way of storing electricity and limiting CO_2 emissions
- Investment is taking place: smart grids, P2G pilot projects
- It is a long-term solution which at present only addresses the power storage conundrum to a limited extent

Electricity storage

The massive build-up of intermittent renewable power generation, with Germany at the forefront, has led to widening over-capacity and reduced load-factor for conventional power plants, particularly gas-fired. These are obliged to remain online to protect against times when peak demand coincides with there being no wind or sun. Storage of electricity therefore becomes even more essential.

Economic cost is a major factor, especially given cheap power prices in the US due to the shale boom. Apart from pumped hydro storage, limited in its impact, there is as yet no economically-viable technology that could have more than a negligible effect.

The present business model of the major incumbents could well be jeopardised by any technological breakthrough in electricity storage at an acceptable economic cost, which could lower entry barriers. On the other hand, the present merit order system, through which non-regulated prices in Europe are set via the marginal cost of production, would lose its applicability, and utilisation rates of gas-fired plant could well recover.

Power-to-gas

Applying the storage technology known as 'power to gas' or P2G, excess electricity is temporarily stored as chemical energy in the form of synthetic natural gas just as in a huge accumulator. Gas is an ideal storage medium, as it can be fed into the existing gas distribution system without any difficulty, being readily available for electricity generation or for the heat market, as and when required.

The power-to-gas method works as follows:

- excess electricity is used to electrolyse water into its components, which are hydrogen and oxygen.
- the hydrogen reacts with CO_2 (emanating from flue-gas captured by the power plant's scrubber) to form methane, which is the main component of natural gas.

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- Triggers, or catalysts, are needed for hydrogen and CO_2 to react with each other. Testing is to take place to establish whether the CO_2 captured in lignite-fired power plants is suitable for natural-gas generation.
- A pilot plant could be then set up, allowing for excess electricity from renewable energy to be stored in the form of natural gas.
- A portion of the water produced in the process would be recycled back to the electrolysis stage, bringing savings in required volumes of new pure water. In the electrolysis stage, oxygen would also be stored for methane combustion, in which. CO_2 and water are produced.
- The produced CO_2 would be recycled back to boost the hydrogen to methane conversion process, and water would be recycled back to the electrolysis stage. The CO_2 produced by methane combustion would be turned back to methane, thus eliminating greenhouse gases. Methane production, storage and adjacent combustion would recycle all the reaction products, creating a low-carbon cycle.

E.ON: P2G a long-term proposition

E.ON has spent EUR5m on a pilot project at a 2MW P2G unit in Falkenhagen, eastern Germany, a region of high wind output.

E.ON's 11 November 2011 communique explained: 'wind [or solar] power is used to run electrolysis equipment that transforms water into hydrogen which is injected into the regional gas transmission system, the hydrogen becomes part of the natural gas mix. At present, up to 5% hydrogen can be added to the natural gas grid without any problems, and in the medium term experts expect up to 15%. This means that today's entire renewable power output could be stored in the German gas grid. However, demand for capacity on this scale will only arise over the next decades, when most generated power should come from renewable energies'.

On 28 August 2013, E.ON inaugurated the plant. It added that '[The project will] serve as a platform for gathering technical and regulatory experience in the construction and operation of P2G storage units. This experience will represent an important step toward making P2G technology ready for the mass market'.

Advantages

A clear advantage of this approach is that the renewable methane can be stored in the existing natural gas network, which has a huge storage capacity. Countries with developed natural gas infrastructure such as the United States or European countries would be able to store a great deal of energy. Germany, for example, could store the equivalent of the entire country's electricity demand for a period of several weeks. Pumped hydro storage, in contrast, could provide electricity only for several hours. Moreover, synthetic production of natural gas allows countries that do not have mountainous enough regions for large pumped hydro storage to build their own storage capacities domestically.

Disadvantages

One major drawback to this approach is the significant energy loss involved. The conversion of electricity into methane occurs with an efficiency of only 60% (the pilot project that is currently in operation reaches just 40%). If the methane is later used in a natural gas power plant to produce electricity, the efficiency falls to 36%. Pumped hydro storage, on the other hand, stores energy at an efficiency rate of between 70% to 80%. Existing CCGT plants have up to 56% efficiency levels.

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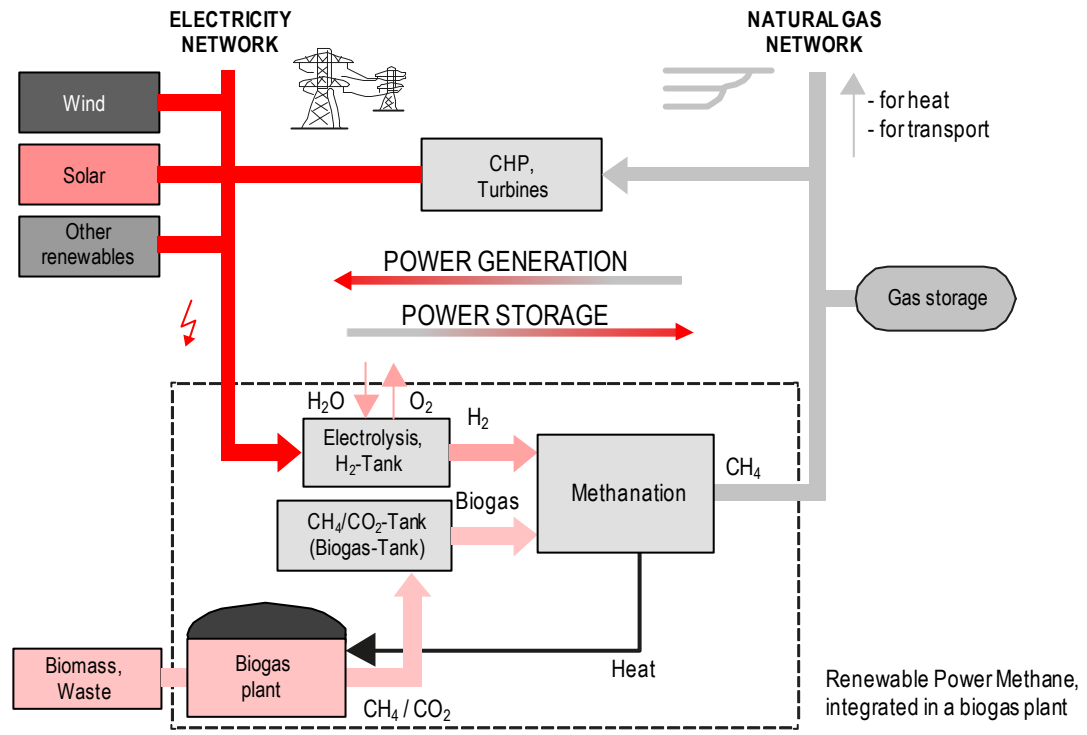
Power to gas conversion process



Source: HSBC

However, this is the only approach that allows reasonable large-scale energy storage, making the losses in efficiency less relevant.

While the low efficiency of this approach may counteract its convenience, the development of reliable large-scale electricity storage alternatives for widespread deployment of renewable energy is becoming essential. Thus, as long as no true alternatives for long-term electricity storage exist, this approach should be considered as a potential future energy storage technology by investors, the industry, and policy-makers.

Cost is too high

At present, the cost of power-to-gas is too high to make the process a viable economic alternative, at least in the near term.

The economic driving force of this energy storage process is the difference in cost between electricity during times of low demand and peak demand. At current electricity pricing, this difference is only EUR5-10/MWh, a reflection of ample supply and the ability of solar to feed demand at peak-demand times. At 40% efficiency

Comparison of energy storage technologies

	Power MW	Capacity MW	Storage period time	Efficiency %	Cost ¢/kWh delivered
Chemical					
Methane	varies	varies	indefinite	24%-42%	16-44
Hydrogen	varies	varies	indefinite	22%-50%	25-64
Mechanical					
Compressed air energy storage	2-300	14-2,050	day	40%-75%	2-35
Pumped hydro energy storage	450-2,500	8000-190,000	day - month	63%-85%	0.1-18

Source: ZAE BAYERN

(which is currently feasible) and EUR35-45/MWh base load price (in a basket of northern EU countries including Germany, France, and the Nordic region; base-load prices are EUR60-70/MWh in Italy and the UK), only the variable cost of producing power works out to be EUR70/MWh excluding fixed cost and other expenses, as against the current peak load price of EUR40-50/MWh. At this rate of efficiency, this process would be economically unfeasible. Even if we take into account the generous subsidies, the cost of producing the power would range between EUR200/MWh to EUR400/MWh.

Winners and losers

Conventional power plant and gas storage value could be enhanced

If higher load-factors from conventional plants emerge from the ability to store renewables-generated power, then the potential impact on the value of conventional plant is likely to be positive. The value of gas networks would be enhanced by their ability to store the electricity in the form of methane, and we could see the need to build more storage since existing storage facilities are filled simply in order to respond to upcoming winter demand for gas.

- Gas-fired power plants, whose load factor has been virtually destroyed by renewables, would be the major beneficiary. The major users of gas-fired power plants in Europe are GDF Suez, E.ON, and Iberdrola.
- Owners of gas networks and storage sites include GDF Suez, E.ON, Gas Natural, and RWE.

Affordability the question: the EU needs it more than the shale-fuelled US

However, the affordability of power-to-gas storage is likely to be a major obstacle when set against the impact of the US shale gas revolution, which has led to a fully flexible as well as cheaper electricity production mix, apart from which it has reduced the urgency for the US to require power storage of its own. This has made the economics of electricity storage through gas even more challenging than before. We do not believe that shale can be the game-changer in Europe that it has been in the US; extraction costs appear sharply higher, the high population density of much of Europe counts against it, and political acceptance appears harder to gain. Faced with higher power costs as storage through gas adds to growing renewables costs, EU industry would lose out in terms of competitiveness versus the US, whilst retail customers (traditional funders of the bulk of renewables cost) would face further rises in their power bills.

More regulation needed: better for earnings visibility, could restore the sector's lost defensive character

In our view, the present non-regulated marginal cost of production model would be unsustainable in the event of a major contribution from electricity storage in the form of gas. New regulation would be required for electricity storage, in any form. The power generation sector has suffered from its exposure to the volatility of non-regulated prices, and we believe would benefit, from any measures that would ultimately make companies' earnings stream more reliable.

Gas-fired power plants, whose load factor has been virtually destroyed by renewables, would be the major beneficiary. The major users of gas-fired power plants in Europe are GDF Suez, E.ON, and Iberdrola. Owners of gas networks and storage sites include GDF Suez, E.ON, Gas Natural, and RWE.

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Grid storage systems

- Progress is being made, but storage volumes are negligible
- Still looking for the major breakthrough
- This would add value to grids and hurt the large generators

Grid energy storage

Grid energy storage (also referred to as large-scale energy storage) refers to a system of storing electricity on a large scale within an electricity power grid.

The use of grid energy storage systems is particularly important for networks that are connected to large intermittent energy sources, such as solar and wind. The production of electricity from these intermittent renewable sources can vary widely during the day, and often the demand has to be balanced by the electricity stored in these systems, without relying on electricity produced from power plants.

Technologies exist, but they are massively sub-scale

In our view, electricity storage through grids could prove more affordable than other systems being studied, such as power to gas, but major breakthroughs are required to allow volumes stored to be anywhere near significant enough. On a sufficiently large scale, the system has the ability to create small, flexible, localised networks that could jeopardise the business model of the conventional generators and lower entry barriers.

On the other hand, the ability to store power would inevitably, over time, bring a return of regulation to power prices since the present non-regulated

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Qualitative comparison of various energy storage methods

Electric storage system type	First viable in year	Energy density (kW/ft3)	Power density (kW/ft³)	Electrical efficiency, % -24 hr	Smallest size kWh	Lifetime in years	Levelised annual cost (USD/kWh)
Batteries							
Lead-acid	1985	2	3	92	1	8	25
Nickel-metal hydride	2000	5	200	92	1	8	80
Lithium polymer	2005	6	6	88	5	7	120
Sodium-sulfur	2008	7	25	88	5	7	85
Mechanical storage							
SMES	1995	0	15	87	500	30	200
Super-carbon capacitor	2002	2	5,000	94	1	30	85
Low-speed flywheels	1999	8	20	90	10	30	40
High-speed flywheels	2003	12	50	89	4	30	80
Compressed Air	1975	n.a.	n.a.	82	100	30+	20
Pumped Water	1950	n.a.	n.a.	82	100,000	30+	20
Thermal (STES)	1990	5	1	82	10,000	30	15

Source: *Distributed Power Generation: Planning and Evaluation* by H. L. Willis and W. G. Scott, 2000

marginal cost model, tailored to the current situation of negligible storage would lose its applicability. This would restore the lost defensive character of the energy utilities sector, something that we believe investors would welcome.

A variety of storage technologies

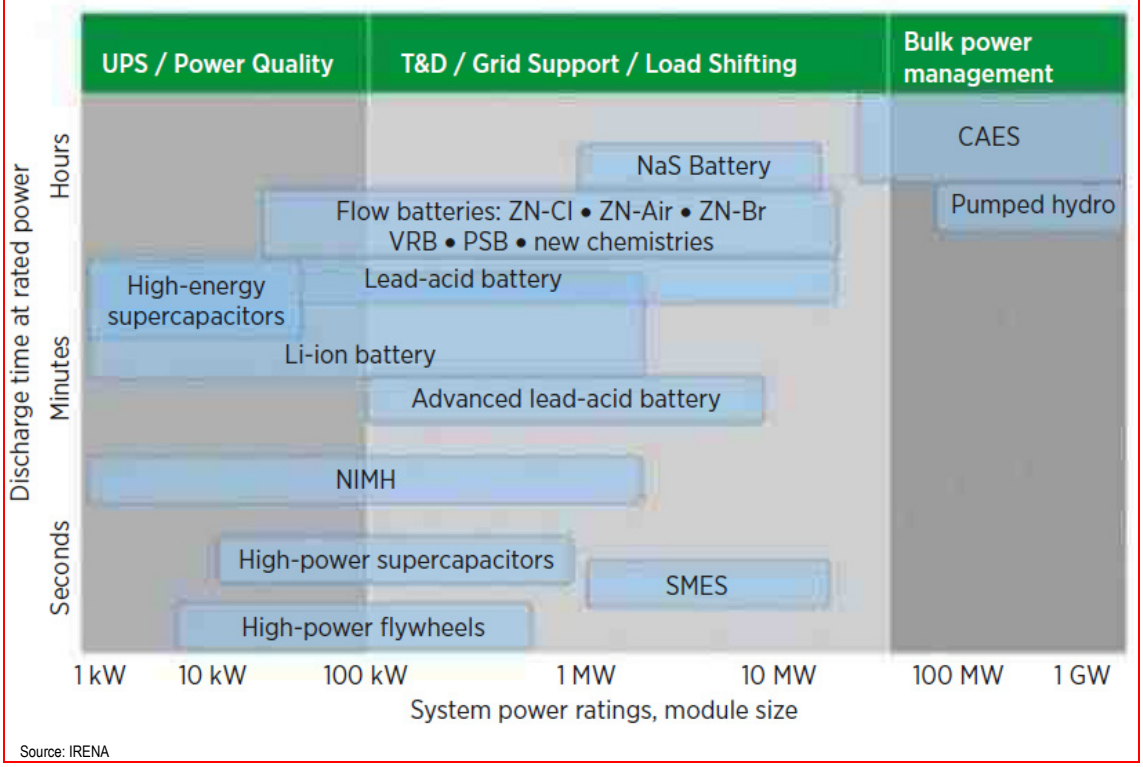
A number of very different methods exist to store electric energy, some of which are listed in the table above. Only two of those shown actually store the energy in electric form: super-capacitors and SMES (Superconducting Magnetic Energy Storage).

- **Batteries** store the energy in a chemical form, but the natural operation of the battery converts the power to direct current electric power upon being provided with a pathway for the power to flow.
- **Mechanical storage** includes several types of flywheels, compressed air, and pumped hydro systems. The last two are practical and widely used on a system (100 MW peak capacity or larger) scale.
- **Thermal storage systems** use electricity to heat a liquid to very high temperatures and then use that, via a heat exchanger, to heat steam to drive a steam turbine generator or a sterling cycle generator.
- **Pumped Water storage** is known to be the largest form of grid energy storage available. The Electric Power Research Institute reports that, as of March 2012, it constitutes more than 99% of bulk storage capacity available.

Cost considerations

Large storage units have high capital costs, and therefore have a pay-back time of many years. The conventional battery stores also have a limited number of charge cycles, after which they

Summary of major storage technologies by discharge rate for different scales of application



Source: IRENA

must be replaced, adding significantly to maintenance costs. The efficiency of these storage technologies is also between 50-80%, depending on the technology. A storage facility would therefore, have to compete against 'peak' plant technologies (such as open-cycle gas turbines – OCGTs) for contracts to provide standing reserve. OCGTs have lower capital costs and running costs dictated by the price of natural gas. A 2011 report by DECC estimated the total per-kW capital cost of an OCGT plant to be GBP500-700. A grid energy storage system is useful in reducing fuel usage and carbon dioxide emissions, but no such system has yet been able to come close to meeting the cost of an OCGT plant.

Smart grid: the most affordable way

Storage will in the future face competition from demand-side management (DSM) technologies, which have the advantage of modest capital costs. End-user loads can be actively shed by the utility during peak usage periods to enable this demand management.

The smart grid is designed to link usage of electric power with available production from intermittent power sources such as wind and solar.

Localised solutions, resulting in more efficient electricity usage, would include (as promoted by an E.ON-Deutsche Telekom JV, 2 September 2011) the linking up of solar energy systems, fuel cells or small power generators of individual homes onto a local platform, pooling the combined generating capacity. According to E.ON and Deutsche Telekom's joint communique: 'This means that the combined capacity of these systems is virtually equivalent to a larger power station. Thus the systems not only supply each home but also, by feeding electricity into the public grid, help to ensure security of supply'.

We believe that DSM is an important development for future energy networks, although there would have to be significant rollouts of smart grids (through smart metering and suitable appliances). The smart grid is designed to vary usage of electric power with available production from intermittent power sources such as wind and solar.

We expect such roll-outs to occur, initially at local levels and eventually on a wider scale.

It seems to us that this is the most logical way of balancing demand and production given the prohibitive costs of other storage technologies such as power to gas. But it will take a major change of mentality by end-users, who will have to get used to timing the use of their appliances according to power production patterns rather than their own preference.

Future of electricity storage

As variable generation on a network increases, so do reserve costs due to the need to have more reserve provision available. With rising fossil-fuel prices, the economic viability of storage may increase in the future as fossil-fuel based reserve becomes more uncompetitive. The shift to storage may also intensify with falling capital costs of storage technologies.

Winners and Losers

The large incumbent integrated power companies could suffer from the introduction of grid-based electricity storage, in our view, since the way would be open for smaller, more nimble, more localised operators to step in. We note that companies such as E.ON are setting up partnerships with large end-users (such as Metro) to optimise energy usage at their major outlets. On the other hand, the value of their (at present almost worthless) upstream gas-fired plants would benefit from higher utilisation rates and probable

regulation that we believe should result from power storage (assuming that volumes of power storage are sufficient to force an end to the present marginal-cost market model in most EU markets).

Grid companies would benefit from the ability to store power. Suppliers would benefit from rolling-out smart meters to their customer base through the potential to cut churn, amongst other things.

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High-temperature fuel cells

- Fuel cells have underdelivered on much-hyped promises of more efficient conversion of gas to electricity
- But, as shale gas provides cheap gas, and electricity costs rise due to the emphasis on clean generation, high-temperature fuel cells could begin to supplant gas and coal for baseload power generation
- Winners: FuelCell Energy, Bloom Energy, MHI. Losers: Siemens, GE

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Disruptive by its very nature (it converts hydrogen gas into water and produces electricity in the process), fuel cell technology has long been touted to revolutionise a number of end-user markets, from transport and portable devices to residential and baseload power. In reality, long and expensive development timelines have delayed market entry and, more than a decade after numerous high-profile IPOs, no pure-play manufacturer has yet to sustain profitability.

The principle behind fuel cell technology was discovered in the 19th century but the high costs of manufacturing given the need for highly expensive materials, such as platinum, has held back commercialisation and kept the focus firmly on R&D and cost reduction. Only recently has commercial-scale production of fuel cells started to gather pace.

We believe that high-temperature fuel cells have the potential to emerge as a disruptive technology in the next 2-5 years for industrial scale baseload power generation, replacing demand for conventional gas and coal related steam turbines.

How fuel cells work

Fuel cell technology is based on an electrochemical process whereby hydrogen is combined with oxygen to produce electricity. The conversion is efficient (~50%) and clean (the main by-product is water and there are no pollutants from combustion). In order to generate power, multiple fuel cells are arranged and sealed in a battery-like structure, known as a fuel cell stack, which is fed with oxygen and hydrogen. The size of the stack can be tailored to meet the power needs of individual end markets (ranging from watts for portable, to kW for commercial to MW for industrial).

Why high-temperature fuel cells?

High-temperature fuel cells are one of the two families of fuel cells, and it is important to differentiate between them as each family targets different applications and thus end markets. Low-temperature fuel cells (operating at 60-140°C) are

relatively light and flexible and are suited for applications which require many power cycles (for example vehicle engines, and mobile battery chargers). High-temperature fuel cells (operating at 400-1,000°C) on the other hand are suited for stationary applications (such as baseload power) as they cannot withstand the same degree of thermal cycling. The main benefit of high-temperature fuel cells is their ability to directly convert natural gas (and other hydrogen-rich gases) into electricity – low-temperature fuel cells only work with a pure hydrogen source and require expensive gas reforming technology to work with a natural gas feed.

What will be disrupted?

While fuel cells are widely expected to break into a number of end markets over the next decade, including transport, we think the opportunity in stationary fuel cell power generation is closer to mass market commercialisation.

This technology has graduated from R&D to the early commercialisation phase with key markets Korea and the US driving rising power generation demand. Production costs for MCFC have roughly halved since 2006, and better lifetime performance now results in a levelised cost of energy of USD140-150/MWh.

Gradual technology improvements should lead to further declines in pricing and boost the cost competitiveness of fuel cells, but the current cost range for coal and gas power generation of USD70-120/MWh remains materially lower.

We see an additional driver for a potentially disruptive demand shift. On one hand, the shale gas boom in the US (and increasingly outside the US) should ensure that gas prices remain low over the next decade. On the other hand, global policy has shifted in favour of cleaner power generation which has tended to promote higher cost renewables at the expense of cheaper coal. This we expect should help maintain upward pressure on electricity prices. As high-temperature fuel cells convert natural gas directly into electricity, the technology is a beneficiary of a rising divergence between natural gas and electricity prices, leading to accelerated uptake of fuel cell-powered baseload generation at the expense of traditional power generation. This poses a challenge for manufacturers of incumbent power generation equipment.

Winners and losers

In the longer-term, as high-temperature fuel cell technology replaces demand for conventional turbines, we expect the leading suppliers of gas and steam turbines will need to either develop or acquire this technology, otherwise face the prospect of losing market share.

As an example of in-house development, Mitsubishi Heavy Industries (MHI, n/c) announced in September 2013 it had achieved 4,000 hours of uninterrupted operation of a 200kW pressurized hybrid (combined-cycle) power generation system incorporating solid oxide fuel cells (SOFC) and a micro gas turbine (MGT). MHI has been developing this system since 2008.

The gas turbine market is dominated by Siemens (SIE GR, Neutral, TP EUR90, current price EUR90.07) and GE, followed by MHI and Alstom (ALO FP, OW, target price EUR35, current price EUR24.92). The most important steam turbine mature market players and Alstom, Siemens and Hitachi. The most important emerging market players are Dongfang, Shanghai Electric, Harbin and BHEL.

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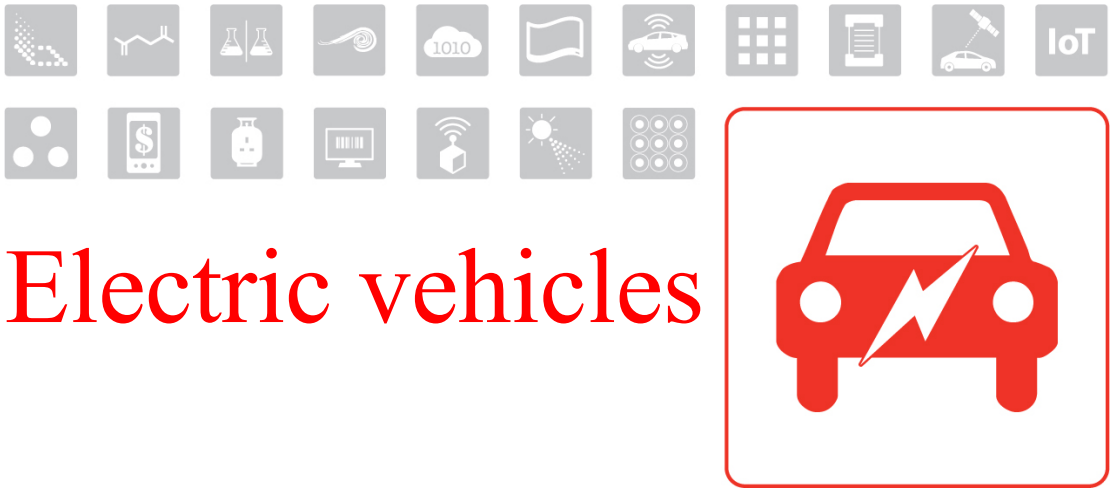

Electric vehicles

- European car makers have to reduce fuel consumption of their fleet by c50% by 2025e, requiring high capex for electric vehicles
- Sustainable segment mix changes and high R&D expenditure will be a burden for the whole auto industry
- Consumers are not (yet) willing to pay for the high R&D burden; higher prices could see lower car density, particularly in urban areas

Emission regulation the trigger

Globally, environmental issues have taken on great importance, reflecting concerns ranging from global warming (Europe) to high air pollution (China). This has led to pressure to cut carbon emissions drastically, with Europe at the forefront of this endeavour.

Emission targets in the EU

While the current standard for cars (<130g CO_2/km average fleet emission, to be achieved in full by 2015) is within reach for the OEMs, the EU has proposed much tougher norms for 2020.

Medium-term target 2020

The European Commission currently intends to limit CO_2 emissions per car maker to 95g/km for the European fleet average by 2020. According to the European Commission, this equates to approximately 4.1 l/100km of petrol or 3.6 l/100km of diesel in terms of fuel consumption. The regulation is currently undergoing amendment in order to implement the 2020 target, after Germany has intervened against the final legislation in June 2013 (source: IHS).

Potential long-term target 2025

Even though no legislation draft has yet been passed, targets of around 68-78 CO_2 g/km in 2025 have been discussed by EU politicians this year (source: IHS). In our view, these targets will determine whether it will still be possible for premium manufacturers to maintain their focus on high-performance cars. The targets currently being discussed imply that average fuel consumption for the whole car fleet in Europe needs to decline from 5-6 litres (l) petrol today to around 3l by 2025e; for premium car makers such as BMW or Audi, this would mean a cut of c50% over the next 12 years.

While 2015 targets are relatively easy to achieve, given the improvements in combustion engine technology, the advances will not be enough to meet the potential targets in 2025e, even assuming a significant shift in the mix of sold cars towards smaller cars with low emission engines. We believe

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that car makers such as Audi, Mercedes and BMW will not meet the potential emission targets for 2025e without significant sales of electric vehicles.

CO_2 targets in other parts of the world not as strict as in the EU

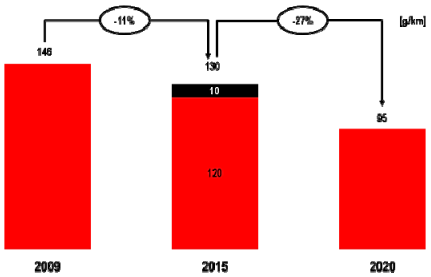
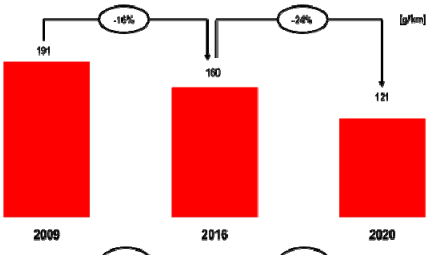
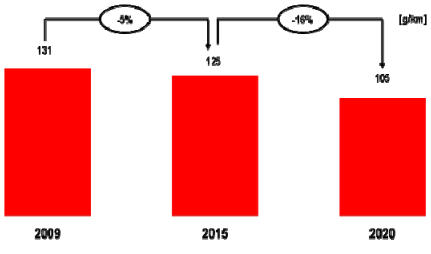
Japan and the US are taking initiatives to lower CO_2 emissions, as well as Europe. In the table below, we compare the emission targets by country, based on the New European Driving Cycle (NEDC) for measuring CO_2 emissions in cars in Europe.

The table shows that Europe has set the strictest targets until 2020, followed by Japan and the US. Recent emissions regulation trends suggest that countries such as China could also introduce targets in line with the European levels, and we expect this to spread to other global regions. Pressure to reduce emissions is here to stay. In our view, Europe will set the trend regarding CO_2 emission regulation. Hence, the themes of emission regulation and electric vehicles, which are closely related to each other, will be particularly European themes.

Electrification of the drivetrain

The idea of electric vehicles (EV) is to replace the traditional internal combustion engine (ICE) with an electric motor. This is powered by electricity saved in batteries and converts c60% of electric energy to power at the wheels, versus only 20% for an ICE.

CO_2 regulation in a global context: The EU has the toughest regulations

Region	Control variable	Structure	Sanctions	Exemptions	Measuring cycle	NEDC corresponding CO_2 emissions Roadmap
EU	CO_2 [g/km]	Fleet weight average	High, progressive depending on exceedance	Phase-in until 2015 exemptions for small manufacturers emission groups	NEDC	
US	Greenhouse gas /CO_2 [g/mi] + fuel efficiency [mpg]	Fleet average by vehicle platform	Extremely high or rather compliance is obligatory	Exemptions for small manufacturers until 2015 Credit system	CAFE (FTP + HFET)	
Japan	Fuel efficiency [km/l]	Fleet average by weight category ('top runner method')	Low	n/a	JC08	

Source: RWTH Aachen, Institut für Kraftfahrzeuge, CO_2-Reduzierungspotenziale bei PKW bis 2020; 2012

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Classification of electric vehicles depending on the degree of electrical power used

Level	Features
Hybrid electric vehicles (HEV)	Hybrids are dual fuel vehicles in which a small electric battery supplements the conventional ICE, increasing fuel efficiency by up to 25%. Depending on the degree of electric power, they can be further classified as micro/mild/full hybrids. **Example:** Toyota Prius
Micro hybrid	Provides engine stop-and-start capability that allows the vehicle to stop the engine when not moving and restart it within milliseconds
Mild hybrid	Same as micro hybrid but uses the electric motor to assist the gas engine when extra power is needed
Full hybrid	Same as mild hybrid but utilises a larger battery. At low speeds a full hybrid can be operated on electrical-only power
Plug-in hybrid electric vehicles (PHEV)	Plug-in hybrids are an advanced version of HEVs, having a larger battery pack (more electrical power) that can be charged externally, whereby they can be driven alternately on gas as well as on electrical power (for small distances of c60-70kms). **Example:** GM's Chevy Volt
Battery electric vehicle (BEV)	This is an EV in its purest form, running only on battery power (much larger than hybrids, charged externally). BEVs have a range of c120-130km when fully charged and have zero tailpipe emissions. **Example:** Nissan Leaf
Fuel cell electric vehicle (FEV)	These vehicles use hydrogen fuel cells instead of a battery and have a relative higher mileage and lower refuelling time with similar low CO_2 emissions. However, the production cost is double/triple that of BEVs and they lack refuelling infrastructure. Nevertheless, OEMs (Hyundai, Toyota, Daimler, Honda) have announced plans to develop FEVs, with Hyundai aiming to sell 1,000 such cars by 2015

Source: Johnson Controls, TVA, US DOE, HSBC

A full electric vehicle has zero CO_2 emissions (hybrids have an electric motor and a combustion engine), thus allowing carmarkers to meet their targets, while also solving the problem of limited oil reserves. The next step in the development of EVs would be full cell EVs, using hydrogen as a source of power and providing a solution to some of the problems encountered with EVs, as we discuss below.

Lacklustre initial demand…

Despite apparent early consumer enthusiasm, huge investments from OEMs and government support (in the form of purchase incentives and R&D grants), EVs have not yet made an impact on consumers' buying behaviour. In our view, there are two main reasons for this:

- **High prices:** Current EV models are still twice as expensive as conventional cars (even taking into account purchase incentives).
- **Range, safety and infrastructure:** The maximum range of only c150-170km with a full charge and lack of sufficient public charging stations are causes of concern for prospective customers, as are the fire-related issues reported with lithium-ion batteries in other applications.

…as battery technology needs to improve

The EV itself is not a complex technology; it is the battery chemistry that needs to improve to generate higher consumer demand. Currently, the Li-ion battery accounts for one-third or more of the total vehicle cost and it's not only a problem of economies of scales. An answer to this cost issue (as well as the weight and range problem) could lie in the use of lithium air battery technology. It uses atmospheric oxygen as the electrolyte, making the battery very light. Importantly, it has a very high energy density (c12kWh/kg; 10-15x that of Li-ion and comparable to gasoline), enabling it to have a high range. Among OEMs, BMW (BMW GR; N; EUR70.86) and Toyota Motor Co. (7203.T; not rated; JPY6,460) are together working on developing Li-air batteries. However, this technology is still far off commercial use (IBM cites a timeline beyond 2020) as problems including recharging and spontaneous combustion need to be addressed first.

Expected penetration rates

While the business case for EVs in the long term remains compelling, we do not see much traction in the near term. Considering the issues discussed above, we believe consumers are more likely to prefer hybrids or plug-in hybrid electric vehicles

(PHEVs) over pure EVs. Beyond 2015, we expect slightly better uptake of EVs, depending on technological developments, but see mass adoption only by 2030 at the earliest.

Premium segment may be more successful initially: We believe that in the short term it will be difficult to position electric vehicles in the price-sensitive mass markets. It is more a concept for niche segments, ie the sports/luxury car segment. Price is not a barrier in this segment and good performance characteristics (smooth operation, strong acceleration) may generate some demand. Consumers in this segment usually have a second car for city driving and EVs fit this requirement well. These customers are willing to trade the limitations of EVs for an opportunity to be seen as 'trend setters'. A study conducted by Bain Consulting (June 2010) suggests there are 350,000 potential customers globally, while GFK Automotive believes that targeting luxury car owners could quadruple EV sales in the short term. However, as these customers are likely to choose EVs for their 'coolness', car design will play an important role in the purchase. This, we believe, will be advantageous for premium car makers like BMW.

EV/PHEV/Hybrid vehicle forecasts

	2012	2020e	2025e	2030e
EV/PHEV	**77**	**3,778**	**12,931**	**22,140**
Penetration rate (%)	*0.1%*	*3.8%*	*10.0%*	*15.0%*
-- Europe	19	1,624	5,431	9,742
-- North America	35	1,209	4,267	6,199
-- APAC	23	944	3,233	6,199
Hybrids	**1,409**	**7,456**	**15,517**	**22,140**
Penetration rate (%)	*2.0%*	*7.5%*	*12.0%*	*15.0%*
Total	**1,486**	**11,233**	**28,449**	**44,280**
Penetration rate (%)	*2.1%*	*11.3%*	*22.0%*	*30.0%*

Source: HSBC estimates

In terms of regional trends, we expect Europe to be an early adopter of EVs because of tough CO_2 regulations, smaller driving distances and higher fuel prices compared with the US. We also expect EVs to generate some demand in China where the government has publicly stated its commitment to the use of EVs to reduce air pollution and has introduced purchase incentives.

Fuel cell cars not yet an option

The next step could be to replace the battery with fuel cells, using hydrogen as the fuel. Fuel-cell cars are powered by electricity generated by combining hydrogen and oxygen, so emit no greenhouse gases, just like electric vehicles (EVs). However, they are drawing more attention than EVs owing to their significantly higher mileage and lower charging times. A full supply of hydrogen can offer a range of 500 kilometres, about twice as much as a fully charged electric car, and it takes only three minutes to fill the tank of a fuel-cell car (source: IHS).

The development of fuel-cell cars is being led by three groups of Japanese, European and US automakers, which are collaborating to ease the huge development cost burden. While Honda recently announced a tie-up with General Motors (GM), Toyota has teamed up with BMW, and Nissan is in alliance with Daimler and Ford. Toyota/BMW and GM/Honda want to have a jointly developed FCV on the market by 2020, and Nissan/Daimler even aims for 2017.

Lack of hydrogen fuelling infrastructure prevents mass penetration

Originally, production costs of fuel cell were very high (cUSD1m per vehicle), but they have come down. According to *Hydrogen Fuel News*, Toyota plans to sell fuel cell electric vehicles (FCEV) for about USD51,000 per vehicle. This price would not be bad, but nevertheless, we believe it will take more than a decade before penetration rates for FCVs pick up significantly. LMC forecasts global FCEV sales of only 20,000 units in 10 years. The main problem is still hydrogen fuelling

infrastructure. Unlike electric vehicles, which can be recharged at home, hydrogen vehicles will require a network of filling stations. In Japan, the US and Europe, the problem of who will pay for the infrastructure build-up has not been solved, which we believe would cost billions of euros in a country like Germany. Only if Japan, the US and Europe announced a framework agreement regarding the build-up of hydrogen filling stations with precise targets and deadlines would we become more confident that penetration rates of FCEVs would increase globally.

Winners and losers

We believe the whole auto industry will suffer from tighter emission targets and the switch to electric vehicles. Car makers need to invest a lot of money today, but demand will remain low in the near term as price-sensitive consumers are not willing to pay a premium for this technology. In the event of a breakthrough in technology, combustion engine suppliers would also suffer from a declining market (over the very long term). In general, we think electric vehicle content (ie batteries) will result in increases in car prices over the next few years, particularly for large and heavy cars. On the back of that trend, we believe car density could decline globally over the next 12 years. Since production capacities of car makers will remain high and offer little flexibility, the result could be a shrinking auto industry stuck in cut-throat competition.

Car makers that take the theme of electric vehicles more seriously could benefit in the future from a first-mover advantage, in our view. A good example of this is Tesla (**TSLA US**; not rated). Tesla's share price has increased year to date by more than 400% and the market cap of the company is now around USD22bn. This example is for us the proof that investors are willing to reward the long-term potential of the electric vehicle technology.

Among the European car makers, we would highlight **BMW (BMWG.DE, EUR80.47, Neutral)**. BMW has been an early adopter of electric vehicles technology and has created a completely new sub-brand. Its first compact EV, the i3, was introduced at the German trade fair IAA in September and will be launched in Q4 2013. The i8 sports car (a PHEV) will be launched in 2014. The i3 will have a range of 130-160km, which can be extended to 240-300km using an optional range extender. Using carbon fibre for its entire body structure (first time in car mass production), it is 200-300kg lighter than a similar-sized electric vehicle (total weight is 1195kg without range extender).

Despite its relatively high price (i3: EUR35,000, i8 should be EUR120,000+) we expect more than 20,000 i3s and 5,000 i8s to be sold in FY 2015 (HSBCe). Due to its premium positioning with a completely new design and special marketing (such as offering a traditional car at cheaper rental rates when travelling beyond the EV range), we expect BMW's EVs to be a success from the early stages. It should enable the company to become a successful player in the EV area, in our view, while further improving its premium image. All in all, we believe BMW has a competitive advantage of 4-5 years over its German peers, as a result of its unique light-weight construction with carbon fibre and the concept of a new sub-brand.

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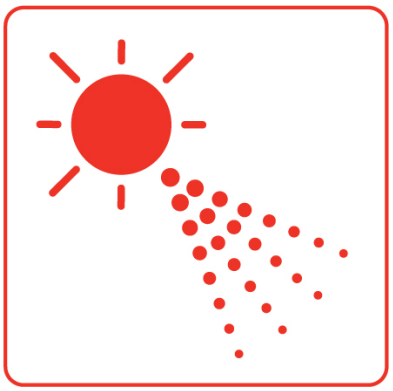
Spray-on solar



- Solar powers almost any surface, potentially widening the market for solar developers
- In the longer term, a 5-10 year perspective, we believe spray-on technology will broaden the application of solar power
- Traditional module makers' supply chain would be shaken up

Solar on any surface

Based on spray-on solar technology, solar panels can be 'installed' on any surface by spraying nano-particles of photovoltaically active material (eg semiconductor or carbon compound) mixed with a conducting polymer. The photovoltaically active nano-particles will generate electricity when exposed to light.

What makes it a disruptive technology?

Currently, solar panels are manufactured based on two main technology pathways:

- Crystalline technology – solar panels are made from crystalline silicon
- Thin-film technology – solar panels are made by applying a conductive paste, eg cadmium telluride (CdTe) or copper indium gallium selenide (CIGS) on a glass substrate.

Manufacturing crystalline solar panels is a highly energy intensive and thus relatively costly process (particularly in the polysilicon manufacturing stage). The light absorption characteristics of silicon also make the panels less sensitive to infrared light. Thin-film panel production requires very high capital investment and panel conversion efficiency is typically low.

Spray-on solar technology seems to be a solution that takes advantage of the limitations of the current technologies and with more to offer:

1 The production procedure is simple and requires minimal energy – as opposed to crystalline panels which are manufactured using complex procedures (such as vaporisation and deposition of crystalline poly, slicing, and chemical etching), spray-on solar is made simply by mixing nano-particles with polymers into a spraying paint.

2 Saves on material cost – the spray is intended to be applicable on any surface and therefore does not require a separate substrate such as glass for contemporary solar panels. According to GTM Research, substrate and processing takes up c19% of the production cost of a thin-film panel. We also estimate

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that the substrate takes up c5% of crystalline module production costs.

3 Saves on installation cost – compared to installing arrays of solar panels, this technology can be made to work by spraying on the intended surface.

4 Lighter, greater flexibility and transparency – this enables solar to have greater integration into building materials and application on surfaces that are not flat. Also transportation costs are much lower due to the lighter weight. The photovoltaically active material is expected to be better in capturing infrared light that traditional crystalline technology.

Future development path

This technology needs to undergo enhancements in order to reach the commercialisation stage:

1 Higher efficiency – the current efficiency of the product is c10.1%. Mitsubishi Chemical Holdings (4188 JP), one of the players developing this technology, envisages efficiency to be 15% by 2015 and as high as 20% in future. Norwegian spray-on solar developer solar EnSol believes it can achieve 20% by 2016.

2 Longer lifetime – the lifetime of spray-on solar is currently at around 5 years versus 25+ years for solar panels manufactured under the two current technologies. A longer lifetime would enhance the investment case for spray-on solar.

3 Increase in applicable surfaces – currently the spray can be applied on only very smooth surfaces.

4 Lower cost of production – successful commercialisation should rapidly bring down production costs

Research shows that the enhancements largely depend on the stability of the mix of organic compounds and the maturity of the technology routes producing nano-particles.

Potential impact

In the longer term, in a 5-10 year perspective, we believe spray-on technology will broaden the application of solar power. The major use will be for Building Integrated Photovoltaics (BIPV), rooftop installations and small electrical appliances.

Current solar technologies are continuously being improved in terms of efficiencies and production costs which will impact the economics for disruptive technology. But with the above listed enhancements achieved, we would expect spray-on solar to open up new market areas and compete directly with current module-based solar product demand thanks to its greater flexibility and portability. Manufacturers of traditional solar modules and related materials, such as glass substrates, may thus suffer as a result.

Solar project developers could benefit from spray-on solar because they have a better, cheaper choice of 'panel', lower installation costs and greater choice as to where they could develop their projects.

Winners and losers

Potential winners could be:

- Manufacturers of spray on solar – **Mitsubishi Chemical Holdings** (4188 JP, unrated), **DuPont Co.** (DD US), **New Energy Technologies** (NENE US, unrated**), EnSol LLC** (unlisted).
- Solar project developers.

Potential losers could be:

- Manufactures of solar polysilicon – **GCL Poly** (3800 HK, OW), **REC** (REC NO, N(V), target price NOK1.60)
- Manufacturers of glass for thin-film modules – **First Solar** (FSLR US, unrated)
- Manufacturers of crystalline modules such as **Trina Solar** (TSL US, unrated), **Yingli Solar** (YGE US, unrated), **Renesola** (SOL US, unrated), and **Jinkosolar** (JKS US).
- Manufacturers of glass substrate, such as **Xinyi Glass** (868 HK, OW(V), TP HKD6.60).

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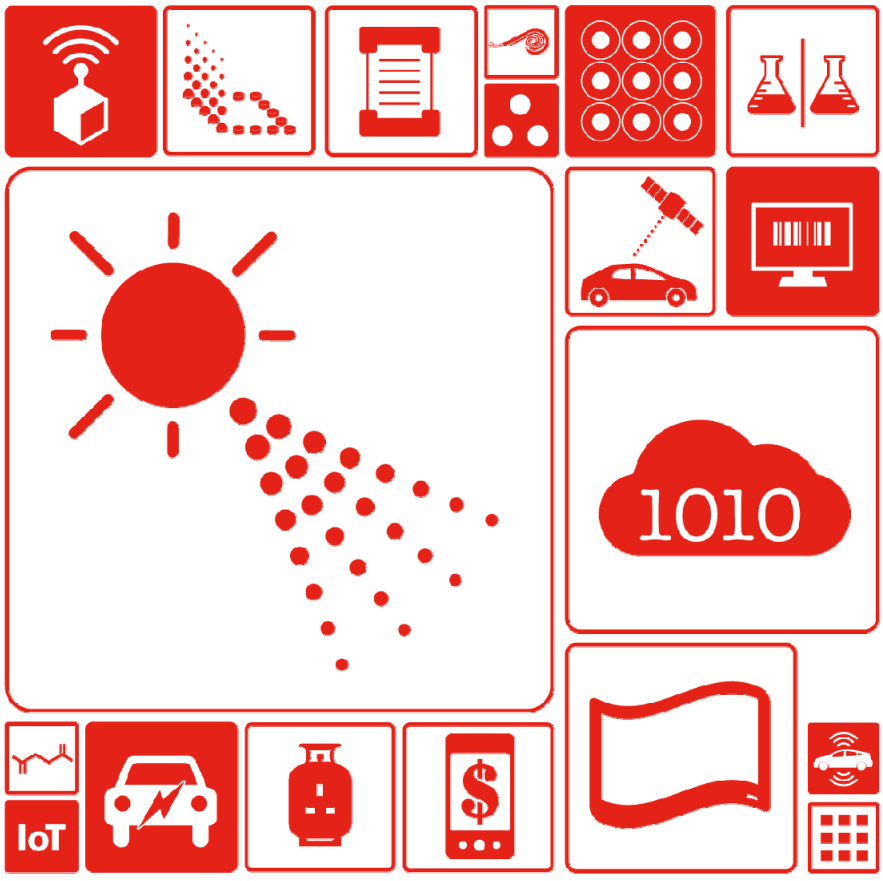
Healthcare



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Biosimilars

- Biosimilars – more affordable 'generic' versions of highly effective biologics for severe diseases – are poised for global launch; we see sales rising at a 2009-15 CAGR of some 40% to USD15bn by 2015
- Monoclonal antibodies (mAbs) account for around 39% of biologics, and many are facing patent expiry in the next six years, driving massive growth in mAb biosimilars
- Our preferred mAb/fusion protein biosimilar player is Celltrion (Overweight, target price KRW76,000)

Reaching more patients

Biologics are great – but expensive

One of the most significant drug developments in the past few decades has been the emergence of 'biologics', the first of which – insulin – obtained US FDA approval in 1982. The first generation of biologics consisted mainly of proteins that are almost identical to those found in humans, such as insulin, human growth hormones and erythropoietin, which supplement a particular deficiency. The second generation of biologics – monoclonal antibodies (mAb) and fusion proteins – were first launched in the mid-1990s. These drugs were designed to specifically target the causes of serious conditions, such as cancers and autoimmune diseases. For example, mAbs block cancer growth by interfering with the specific molecules that are required for cancer to form and for tumours to grow. mAbs are all the more important because other therapeutic options may be limited or existing therapies may be insufficient. Since they target only the cancers or other causes of disease, they tend to be highly efficacious and have fewer side effects than other treatments.

Given their highly desirable characteristics, mAbs and fusion proteins are the fastest-growing biologics. We estimate that global biologics sales reached around USD120bn in 2010 (some 14% of global pharma sales), and we forecast sales to reach roughly USD164bn by 2015. Demand for mAbs and fusion proteins is surging in developed markets, which account for 75-80% of the total market. Emerging market demand is also rising, driven by increased prosperity and expanded insurance coverage. By 2015, we forecast that the global mAb market will be worth USD64bn, up at a CAGR of around 30% from USD39bn in 2009. Demand should also benefit from new mAbs that target vulnerabilities in a range of cancers and

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immunological indications. Hundreds of mAbs are currently in clinical studies, many of them at a late stage.

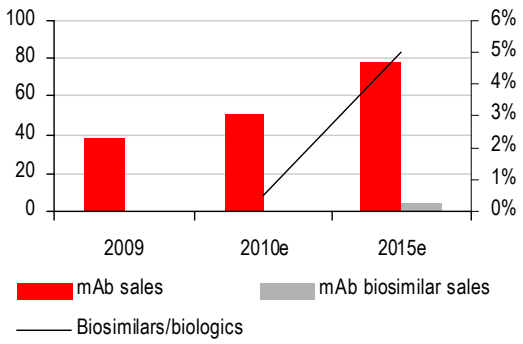
Unfortunately, despite the substantial medical benefits of mAbs and fusion proteins, patient access to them is limited by their high expense. The innovator (original manufacturer) biologics used to treat diseases such as cancers and rheumatoid arthritis cost well above USD10,000 (usually around USD30-50,000) per patient per year. It can cost as much as USD200,000 to treat Gaucher's disease, a rare hereditary condition, using biologics. Even in developed countries where health insurance usually pays for these drugs, the use of biologics is increasingly becoming a serious burden on national budgets. Furthermore, even with insurance, patients' co-pay amounts can remain high.

Biosimilars to expand access

We are on the cusp of a major change in the biologics industry as patents on many of these complex, expensive drugs will expire in the next few years. This provides opportunities for other manufacturers to produce generic versions of biologics that are substantially cheaper. Biosimilars or generics therefore tap a deep vein of pent-up demand. Initially, biosimilars are likely to be priced at around 50-70% of the levels of the original drug, depending on markets. Despite remaining expensive in absolute terms, their lower pricing will substantially broaden access for patients on national insurance and private insurance schemes, as well as those paying out of their own pocket.

By 2015 about 16 mAbs and fusion proteins are set to lose their patent protection, starting in 2014-15 in the EU with Rituxan, a drug for non-Hodgkin's lymphoma. The US Generic Pharmaceutical Association (GPhA) estimates that some USD31bn of originator biologics are set to lose their exclusivity over the next six to seven years. We forecast that sales of mAb biosimilars will soar at a CAGR of around 79% to USD4.5bn by 2015, up from negligible levels. This compares with the 40% CAGR we project for the overall biosimilars market in the same period. By 2015, we estimate that mAb biosimilars will account for some 30% of the total biologics market. The overall biosimilars market is small at present, worth up to USD2bn in 2010, and is completely dominated by 'first-generation' products such as insulin, whose patents mostly expired in the past decade.

Global mAb biologics and biosimilars market (USDbn, %)



Source: HSBC

First-generation biosimilar growth is set to remain strong as more manufacturers (mostly in India and China) invest in capacity; in the case of Indian and Korean companies, we also expect tie-ups with overseas partners. For China's biosimilar makers, substitution of dominant multinational products remains the challenge. However, as with original biologics, the real driver of global biosimilar growth will be mAbs and fusion proteins.

Very high hurdles for mAb biosimilars

The attractive potential of this market prompted strong expressions of interest among potential makers across the globe several years ago, but

things have since gone quiet. The reality is that there is a dearth of players in mAb biosimilars, illustrating the gap between intention and execution. This is because, unlike chemical drugs, which are easy and cheap to copy exactly and for which sales approval is easy to obtain, biosimilars makers (especially those making mAbs) face daunting hurdles.

The first challenge is independently producing a drug similar enough, and therefore of sufficient therapeutic and safety quality, to satisfy sceptical regulators. The drugs then require high-cost manufacturing facilities (commercial-scale plants can cost hundreds of millions of US dollars) that take years to build and certify. These facilities need to be operated with precision and strict quality control, as even minor deviations in the manufacturing process can lead to unacceptable products.

Manufacturers then face very tough regulatory hurdles. Unlike chemical generics, biosimilars must undergo expensive, multi-year clinical trials. We estimate that a global trial costs USD200-USD300m per drug. This assumes that the manufacturer satisfies the very tough approval standards laid down by the regulators. The EU implemented biosimilar approval guidelines in 2011, and the US followed suit last year, issuing (draft) guidelines that are similar to those of the European Medicines Agency (EMA). Even once approved in the developed markets, biosimilars must overcome issues related to interchangeability – ie the ability to substitute the original with a biosimilar. Regulations in many markets do not currently allow this.

It is unsurprising then, that even experienced chemical generics makers are hesitant to commit to multi-year R&D, capital expenditure and clinical trial costs for biosimilars of second-generation biologics. Based on whether they actually have trials in developed markets, the relevant global players are currently Boehringer-Ingelheim (rituximab phase 3), Sandoz (rituximab phase 3), and Celltrion (infliximab and trastuzumab completed, rituximab phase 3). Pfizer started phase 1/2 trials for rituximab last year. The Teva-Lonza joint ventures, TL Bio and Samsung Biologics, appear to have stopped their respective trials of rituximab (at least temporarily).

Winners and losers

In this market, time to market is critical. We favour firms with drugs in late-stage global clinical trials, and which have manufacturing facilities in place. Our preferred mAb/fusion protein biosimilar player is **Celltrion** (068270 KS, OW, target price KRW76,000), the global front-runner in this segment and a pure-play stock. Celltrion has made most progress towards global approvals. Its Remicade biosimilar is already approved in 10-plus countries including Korea. Importantly, Celltrion produces the first mAb biosimilar to gain EMA approval. The firm also has a very advanced pipeline: global filing for its Herceptin biosimilar started in May/June 2013, a Korean filing has also been submitted and it is about to start global P3 trials for its Rituxan biosimilar.

In China, technical hurdles in product development and process management create bottlenecks that are hindering domestic players' growth in mAbs. However, a few firms have made significant progress and, with accumulated expertise, China could become a significant player in the coming years. In the meantime, we think the investible winners are the leaders/potential leaders in first-generation biosimilars, a high-growth market in China that is dominated by multinationals. Although the technical hurdles are not as high as for mAbs, first-generation biosimilars still pose formidable challenges in terms of technical and capital investments.

India's biosimilars are mostly centred around first-generation biosimilars at present, although most Indian pharmas – including Biocon, Intas and Lupin – are targeting mAb/fusion protein products, while Dr. Reddy's is preparing significant mAb capacity.

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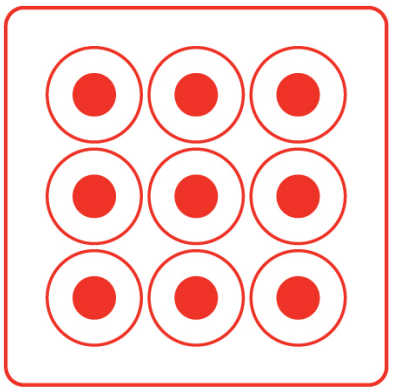
Stem cells



- Stem cells offer curative treatment for severe diseases that could previously only be treated supportively
- In Korea, heart attack, degenerative cartilage and Crohn's disease patients have access to regulator-approved stem cell treatments
- Development pipelines include treatments for stroke, spinal cord injuries and Alzheimer's disease that are in or entering late-stage trials, based on well-established platforms

Promises

Potential is there, but trials needed

For years, stem cells have promised curative treatment for severe diseases that could previously only be treated supportively, with few if any therapeutic choices. They have also held out the possibility of better alternatives to existing treatments. So far these promises have mostly remained unfulfilled, however. Moreover, the linkage of some stem cell treatments with the destruction of embryos has led to negative public and political perceptions in certain regions. Nevertheless, the development of stem cell treatments using non-embryonic stem cells (somatic stem cells) and, longer-term, induced pluripotent stem cells (iPS, stem cells derived from somatic cells) continues to move ahead.

As with any new drug, the viability of stem cells lies in clinical data and regulatory approvals, especially given the emergent nature of the treatments – the science is evolving continuously. In light of stem cells' huge potential, hundreds of trials are in progress globally, but few have reached the late stage and only a handful of treatments have gained regulatory approval. In 2011 the US FDA approved its first stem cell treatment, New York Blood Center's Hemacord, for the allogeneic transplantation of hematopoietic progenitor cells. In 2012, Health Canada approved Osiris Therapeutics' Prochymal for acute graft-versus-host disease (GvHD) in children. Currently Mesoblast and Osiris are leading trials in the US and other developed markets. Mesoblast completed US FDA P2 for congestive heart failure, and has a treatment for acute myocardial infarction in P2 trials. Similarly, Osiris has a treatment in US FDA P2 for myocardial infarction. Interestingly, a number of stem cell treatments have also arrived in Korea, almost unnoticed by the rest of the world.

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Stem cell market size

The addressable market for stem cell treatments could include a wide range of severe conditions. In the US alone, it is estimated that some 125m patients could benefit from stem cell treatments; most of the target market for cell therapy comprises conditions that are currently incurable or only partially treatable. Early estimates for the dollar value of stem cell therapy appear to have reflected the optimism that treatments could reach the market quickly. In 2004, the cell therapy market (including therapy with cells other than stem cells) and related technologies were forecast at around USD40bn by 2010 and USD81bn by 2012[1].

Potential US patient populations for stem cell-based therapies

Medical condition	Number of patients (m)
Cardiovascular disease	58.0
Autoimmune disease	30.0
Diabetes	16.0
Osteoporosis	10.0
Cancer	8.2
Alzheimer's disease	1.0
Parkinson's disease	1.5
Burns (severe)	0.3
Spinal cord injury	0.3
Birth defects	0.2
Total	**125.3**

Source: Perry, D., Science 287:1423, 2000

More recent estimates for the stem cell market vary widely, from around USD859m[2] (cancer-related only) to USD21.5bn[3] in 2010 and USD529m in 2011[4]. Some forecast the stem cell market to reach roughly USD88bn by 2014[5]. These estimates appear to include treatments, services (including cord blood banking) and development tools. We believe the extremely broad range of estimates reflects the fact that some include stem cell-related treatments (mostly bone marrow transplants) that are performed in hospitals, as well as the dearth of regulator-approved treatments on the market. We also believe that, at least until 2013, a substantial proportion of the lower-value market estimates relate to cord blood banking. However, regulator-approved stem cell treatments could start to be launched in major markets in the next two to three years.

Need for regulatory approval

Most stem cell therapies available today are offered by individual physicians and hospitals, and optimistic claims are frequently made about their ability to address severe conditions. Regulators generally do not view such surgical transplants as standardised, drug-like treatments. Consequently, these practices are unregulated or lightly regulated. The issue for patients contemplating these therapies is that little, if any, safety and efficacy data are available that would enable them to assess the risks and determine whether there would be any medical benefit.

Some national regulators, such as the Ministry of Food & Drug Safety (MFDS, previously the Korea Food & Drug Administration KFDA) have provided relevant regulatory pathways for biologics and biosimilars. In particular, Korea's MFDA has regulated stem cells as a class of drug for the past decade. The regulator treats stem cells no differently to infusion replacement therapy drugs such as EPO. The benefit to patients receiving stem cell treatments approved by such a regulator is that safety and efficacy have been stringently evaluated and found to be satisfactory.

Potential starting to be realised in Korea

Korean biotech in stem cells

The backdrop to Korean firms' development of approved stem cell treatments is that the companies have focused their limited resources on

[1] *Jain PharmaBiotech Report, 2004*
[2] *Bcc Research, 2011*
[3] *MarketResearch.com, 2011*
[4] *Kalorama Information, 2008*
[5] *MarketsandMarkets, 2009*

research and technologies that have potential high value-added. Korean pharma and biotech firms recognised the difficulty of developing new chemical entities, especially in the face of competition from multinationals. In the late 1990s some diverted their R&D focus towards biologics, where the perceived technology gap was much narrower (biologics were first approved in the developed markets in the early 1990s). As a result, many Korean biotechs were relatively early entrants in the field of cell therapy –in particular stem cells and immuno-cell therapy – and capitalised on the nation's large pool of well-educated scientists.

After decade-long R&D and trials, the first generation of stem cell treatments has arrived in Korea, almost unnoticed by the rest of the world. All of the therapies approved to date use somatic stem cells. In 2011 the MFDS approved Pharmicell's HCG-AMI to treat hearts damaged by acute cardiac infarction (heart attack). In 2012 it also approved Medipost's Cartistem for traumatic and degenerative osteoarthritis and Anterogen's Cupistem for Crohn's disease. Notably, Korea's biotechs are exploiting not only stem cells' ability to regenerate new cells in damaged areas, but also their paracrine effects (their influence on other cells near the stem cells used for treatment) for therapeutic purposes. Examples of the former are Medipost's Cartistem for traumatic and degenerative osteoarthritis and Anterogen's Cupistem for Crohn's disease, both of which have been approved. Examples of the latter include Medipost's Neurostem-AD for Alzheimer's disease and Pharmicell's Hearticellgram-AMI for heart attacks.

More treatments in company pipelines

In the next few years, patients' choice of stem cell treatments in Korea is likely to expand. Firms have other stem cell treatments in mid- to late-stage trials that address these indications, backed by data that have supported their safety and efficacy. Treatments in development address stroke, spinal cord injuries, Alzheimer's disease and severe liver cirrhosis – severe conditions where few if any treatments are available. We believe the risks of approval for pipeline drugs are lower, as each firm has a treatment approved; the pipelines are based on the same platform technology as the approved treatments.

MFDS-approved trials of stem cell treatments in Korea (bold indicates final approval received)

Company	Phase	Status	Indication	Stem cell source	Treatment type
Medipost	**3**	**Complete**	**Degenerative osteoarthritis**	**Cord blood**	**Allogeneic**
Medipost	1/2	Complete	GvHD in HSCT	Cord blood	Allogeneic
Medipost	2	Ongoing	Bronchopulmonary dysplasia	Cord blood	Allogeneic
Medipost	1	Complete	Alzheimer's disease	Cord blood	Allogeneic
Pharmicell	**2/3**	**Complete**	**Acute myocardial infarction**	**Bone marrow**	**Autologous**
Pharmicell	3	Ongoing	Acute ischemic stroke	Bone marrow	Autologous
Pharmicell	2/3	Ongoing	Chronic spinal cord injury	Bone marrow	Autologous
Pharmicell	2	Ongoing	Alcohol-induced liver cirrhosis	Bone marrow	Autologous
Anterogen	**2**	**Complete**	**Crohn's Disease (trial extension)**	**Adipose tissue**	**Autologous**
Anterogen	2	Complete	Crohn's Disease	Adipose tissue	Autologous
Anterogen	2	Ongoing	Complex anal fistula (trial extension)	Adipose tissue	Autologous
Anterogen	2	Complete	Complex anal fistula	Adipose tissue	Autologous
Anterogen	1	Ongoing	Faecal incontinence	Adipose tissue	Autologous
Homeotherapy	1	Ongoing	GvHD	Bone marrow	Allogeneic
Homeotherapy	1/2a	Complete	GvHD	Bone marrow	Allogeneic

Source: MFDS, HSBC

Winners and losers

In our view, certain Korean stem cell firms have become investible as the high drug development risks have receded following approvals by regulators. Much of the investment risk is now related to the more visible commercial penetration of the treatments. We are Overweight (V) on Medipost (078160.KS, KRW122,700) and Pharmicell (005690.KS, KRW7,900), both of which have regulator-approved stem cell treatments, good pipelines and are well funded.

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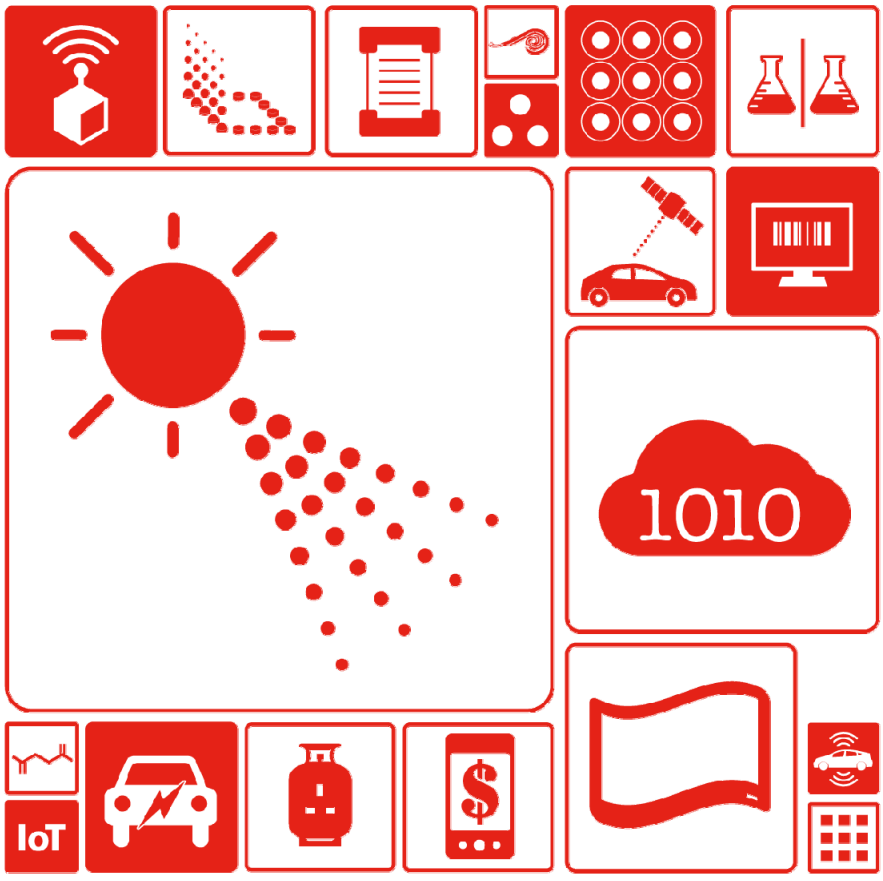
Miscellaneous



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Fully automated driving

- By 2025, driverless cars will be in widespread operation, which could revolutionise individual mobility
- This will enable people to drive until an old age; fuel efficiency will increase; and accidents will be reduced to close to zero
- Continental is a key supplier for this technology and looks poised to benefit the most

Electronics automotive supply

In recent decades, global demand for electronic systems in light vehicles has grown rapidly, and this trend is set to continue. The overall global market for automotive electronic systems is forecast to grow from USD156.7bn in 2010 to USD239.1bn in 2020 (Source: IHS). The electronics content value per car is estimated to increase by 5.7% from 2010 to 2020 (excluding infotainment, Source: IHS). Electronic automotive applications cover all areas of a car, from powertrain and safety features to infotainment applications.

In our view advanced driver assistance systems (ADAS) will be a key growth driver within safety applications. Such mechanisms can enhance car safety, a key selling point. Illustrative of its promise and potential, the ADAS electronics market is estimated to almost triple from 2010 through to 2020 (Source: IHS). Current ADAS features are limited to adaptive cruise control, lane departure warnings and emergency brake assists. In the future, however, these systems will also comprise automated driving features.

Details on automated driving technology

Autonomous driving envisages cars operating on their own, using various sensors (GPS, cameras, infrared, radar or laser) for environment detection, onboard systems to gather vehicle data, software for processing those data, actuators to control the car and a simple user interface to interact with the occupants. Communications systems are vital for data exchange over cellular networks or WiFi, since vehicles need to communicate with each other as well as with the surrounding infrastructure (eg traffic lights, emergency services).

Development stages

While complete autonomy may still be more than a decade away, the transition is envisaged to come in stages, with the level of automation growing progressively. Continental AG, one of the

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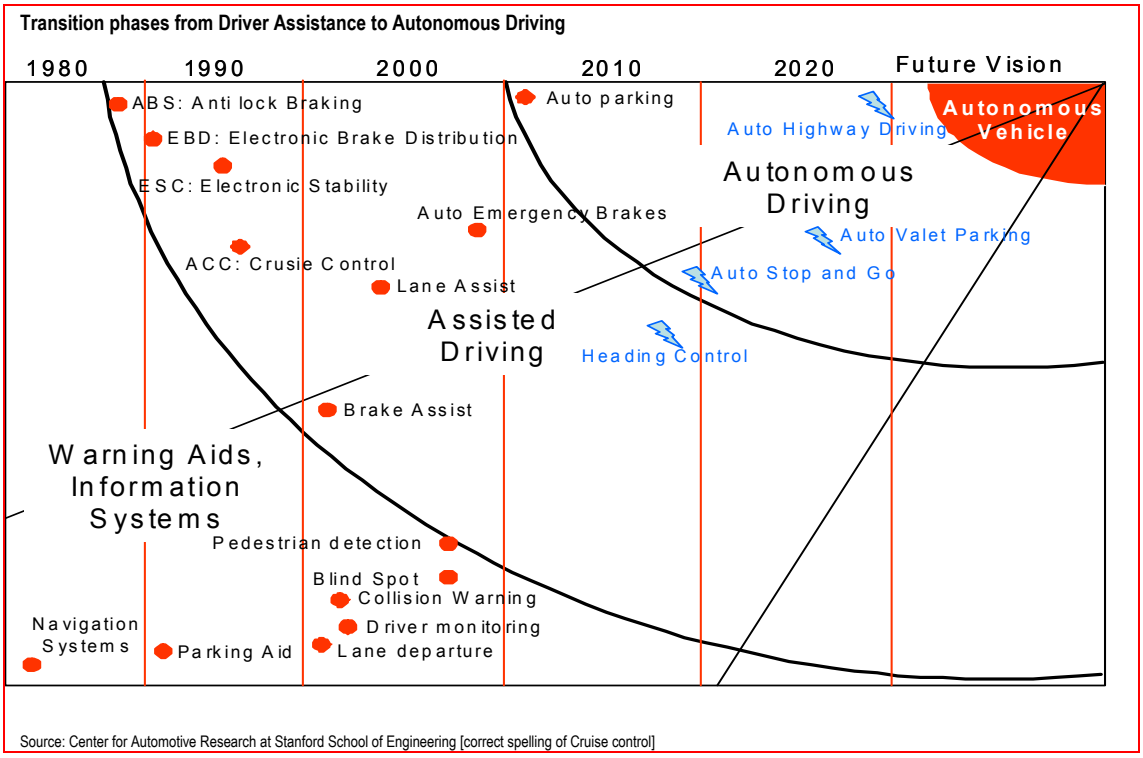


pioneers investing in autonomous driving systems, foresees the following key stages.

Stage 1

Partial automation between now and 2016**:** Monitoring required with assisting drivers at low speeds of up to 30 km/h and in stop-and-go situations. Examples of this feature can already be found in the new Mercedes S-Class and the BMW X5, which can both be ordered as of H2 2013. In the Mercedes S-Class, this automatic stop-and-go driving feature is included in a so called 'Driver-Assistance Package Plus', which costs buyers around EUR2,700 on top of the list price of the car. This example also shows that the technology is already available today.

Stage 2

Highly automated from 2020: Higher automation at faster speeds (highways). No monitoring but the driver is still required to take over control with a lead time.

Stage 3

Fully automated from 2025: driver oversight not required, complete control to the system passed over for a certain length of time.

Suppliers and car makers are optimistic on growth rates

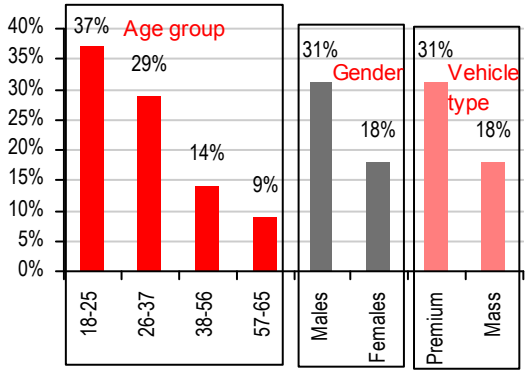
The technology trade group IEEE (www.ieee.org) expects self-driving vehicles to account for 75% of traffic by 2040, which appears striking. **Continental AG** (CON GR, OW, TP EUR150) claims that there has been a high interest in this technology; it intends to offer further solutions in assisted driving by 2015 and will be able to develop the first applications for highly autonomous driving by 2020. By 2025 Continental should be ready to provide applications for high-speed and complex driving situations for production. Ford, Volvo, Audi and BMW have developed self-driving concept cars already and Google's fleet of autonomous cars,

including the Toyota Prius, have already covered a million miles in road tests.

Higher acceptance among Premium cars

A survey on autonomous driving conducted by JD Power in the US reveals that 37% of respondents expressed interest in 'fully autonomous driving' even before learning the price and 20% of all vehicle owners said they definitely would or probably would purchase a fully autonomous car. Respondents who said that they would definitely or probably purchase an autonomous vehicle if the technology cost USD3,000 favoured the technology more in premium cars rather than non-premium, while more males (25%) preferred this than females (just 14%). Remarkably, the younger age groups exhibit a greater readiness for autonomous vehicles, although this demographic group is widely believed to place more emphasis on driver control and vehicle performance.

Survey results: percentage of respondents that would buy autonomous vehicle based on the market price of USD3,000



Source: JD Power and Associates 2012 US automotive emerging technologies Study

Our penetration and volume forecast

It is hard to estimate the market potential of automated driving features today. We assume that this feature will mainly be built into premium vehicles by 2025. The table below shows our assumptions about both the development of the global premium car market and the penetration rate for automated driving (AD) systems. We have also estimated the price per system, in order to reach our market volume forecast. We expect the price per system to increase owing to the rising complexity of these systems. Fully automated driving simply requires more sensors and cameras in the car than partially automated driving, in our view.

Our forecast shows that a huge market will emerge for automotive suppliers such as Continental. We estimate market volumes of around EUR9bn in 2025, up from zero today. We expect 25% of all premium vehicles to be equipped with an automated driving feature in 2025.

Our market forecasts for automated driving

	2013e	2016e	2020e	2025e
Global light vehicle premium market (000 units)	8,029	9,777	10,745	11,293
Growth rate pa	4.6%	7.3%	1.4%	1.0%
automated driving (AD) penetration rate (%)	0.0%	3.0%	11.0%	23.5%
AD units (000)	0	293	1,182	2,654
Price per AD system (EUR)	2,187	2,503	2,899	3,361
AD market volume (EURm)	0	734	3,427	8,919

Source: HSBC estimates

Key benefits of the technology

In our view, the primary benefits of autonomous driving are: 1) safety via the reduction in human error that leads to mishaps; 2) energy efficiency, as driving and traffic flow become more fuel-efficient; and 3) comfort, as it will eliminate the need for routine driving tasks – especially useful for travel over long distances. Furthermore, autonomous driving should lead to increased car density around the world by 2050 since people will be able to drive cars at a greater age than before, even beyond 70-80 years.

Winners and losers

As autonomous driving will give mobility to the aged and the physically challenged, we believe that the likely losers could be taxi services, which

could suffer reduced demand in some regions. Public transport, such as train and bus services, could also suffer.

A number of companies are already conducting research in the area of automated driving (eg Daimler, Audi, BMW and Google). Car makers will instead face the challenge of how to charge their end-customers for this technology.

We believe the way to invest into this theme is to buy innovative suppliers such as **Continental, Delphi** (DLPH US; not rated; USD58) and **Denso** (6902 JP; not rated, JPY4,785).

Continental is already the global market leader in advanced driver assistance systems (ahead of **Delphi**, **Denso**, **Bosch**; source: Continental Fact Book 2012) and in our view is best placed to become the pioneer of and market leader in fully automated driving. Continental has also conducted more than 24,000 km of testing with an automated car in Nevada, US. Driverless technology is therefore already available. Given its expertise as a system supplier and its proven technology, we expect car makers to view Continental as a potential preferred partner for developing autonomous driving systems.

Continental develops products for autonomous driving in its Chassis and Safety (C&S) division, which earns healthy EBIT margins close to 10-11% and accounts for one-fifth of group revenues.

We believe margins in the C&S division would be adversely affected by the higher R&D costs associated with these technologies, as volumes will remain low in the initial phases. However, as penetration levels of these systems ramp up, cost per unit should decline rapidly on higher volumes, thereby improving margins.

HSBC

Small cells

- Diminishing network efficiency gains steer focus towards small cells as a solution to the global mobile data 'capacity crunch'
- Early adopters include SK Telecom, AT&T and Vodafone
- Potential winners: Ericsson, large, diversified telcos; potential losers: small, mobile-only operators

Capacity crunch and small cells

In thematic reports such as *The Capacity Crunch* (Dec 2009) and *Honey, I Shrunk the Cells* (April 2012) the HSBC TMT team has highlighted a major barrier to the mobile industry's ability to significantly increase network capacity to handle exponential levels of traffic growth caused by spiralling mobile data usage. The problem is that mobile network technologies – the latest iterations being so-called '3G' and '4G' networks – are reaching what might be considered 'maximum efficiency'. This is happening as the quest for further efficiency gains is increasingly constrained by the laws of radio physics – what is often termed the 'Shannon Limit'. (This relates to the maximum amount of data that can be sent error-free over-the-air at a given level of interference – the latter being a varying but ever-present feature in the mobile environment.)

Although we see some marginal efficiency improvements in network as possible over the next 5-10 years (primarily via new antenna technologies such as MIMO and beam-forming, we expect), we do not believe that technological innovation itself will produce a step-change in network efficiency capable of extracting large amounts of additional capacity from what are inherently limited amounts of radio spectrum. We believe this leaves operators with one remaining (but proven and effective) option to avert a 'capacity crunch': massively increasing the density of their mobile networks. Thankfully, new 'small cell' products enable operators to do just this, and much more cost-effectively than before.

Small is the new big in mobile

Over the past couple of years a slew of new small cell products have come from equipment vendors such as Ericsson, Huawei, Nokia Siemens Networks and Alcatel-Lucent – the latter being the creator of the iconic LightRadio 'cube' (see pictures at bottom of following page).

The fundamental principle of small cells boils down to an old concept in network design, that of 'cell splitting'. Cell splitting is the process of replacing or overlaying large cells with smaller ones, in order to

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reduce contention among users for limited shared resources. Given the inherently limited amounts of spectrum that can be used for mobile (roughly 400MHz-3GHz, the latter being the upper limit for non-line-of-sight connections) and the peaking efficiency of network technologies (due to the constraints of Shannon's Law), cell splitting is effectively a means of sweating these scarce spectrum resources harder. Indeed, it may well be the only reliable way of adding significant amounts of mobile capacity in future.

Instead of having to share spectrum with a large number of users spread out over a cell area that may cover several miles, the same radio frequencies are instead confined to users falling within a radius of perhaps 100 or 200 metres (the idea being that customers further away would use an alternative cell site located closer to them). As a result, more spectrum can be allocated to a given user, while shorter ranges imply lower levels of interference (typically a function of distance), driving up the overall spectral efficiency of the system.

For example, lower interference levels permit the use of more sophisticated modulation schemes (the technique of inserting binary code into a radio wave), and also mean that less overhead must be devoted to forward error correction (FEC) coding, the duplicate code, needed to reconstruct lost or corrupted original data. A small cell with a radius of, say, up to 100m may be able to utilise the most-efficient 64QAM modulation scheme (6-bits per wave) throughout the entire cell coverage area. However, in a traditional macrocell with a radius of say 1-2km, the effective range of 64QAM would only correspond to 5-10% of the cell area. Beyond this range higher interference levels would necessitate the use of more robust, but less data-intensive modulation schemes such as 16QAM (4bits/wave) or QPSK (2bits/wave) for the most distant users. A similar efficiency step-up/-down applies to FEC coding options in 3G and 4G too: users closer to the cell antenna will experience less interference and hence have a likelihood of fewer lost/corrupted packets; consequently lighter coding, meaning less overhead, may be applied. Although estimates are necessarily rough, we believe that, in combination, this should yield a >2x spectral efficiency advantage for small cell networks versus traditional macrocellular builds covering the same geographic area. This means that, even with the same amount of spectrum, operators deploying dense small-cell networks would have a >2x capacity advantage to offer their customers faster mobile data speeds or larger data volumes or the same speeds/volumes at a cost advantage – or indeed some combination of the above.

This architectural capacity boost from small cells can be readily felt even today in the commonplace experience of using a WiFi hotspot – where the principal is the same. Users frequently complain that their typical 3G experience is slower than their usual WiFi experience. However, WiFi, like any wireless technology, is similarly constrained by Shannon's Law, and moreover is based on the very same – or similar – building blocks as 3G and 4G, so WiFi is no more (nor indeed less) spectrally efficient at the same range. The faster speeds achieved in a WiFi hotspot are instead simply the product of less contended radio spectrum. Given the inherently shorter range of WiFi (typically <100m radius), even the most crowded Starbucks will only have a handful of laptop and smartphone users accessing the hotspot, whereas today's outdoor 3G or 4G macrocells, covering considerably larger areas, may have several hundred active mobile data users at any given moment.

Small cell products are in the process of making the leap from vendor presentations to real-world test networks and commercial launches. To date there have been 46 small-cell deployments by operators worldwide, including nine of the top 10 operators measured by revenue. SK Telecom in Korea (so often an innovator) has deployed 44,000 small cells (including home, enterprise and public access or 'metro' versions). In the US AT&T has plans to deploy 40,000 small cells by 2015. SoftBank in Japan has rolled out 120,000 small cells (both residential and public access variants), and now serves around 21m subscribers. In emerging markets America Movil has a small cell trial network in Panama. Research firm *Informa Telecoms & Media*, estimates there were 6.5m small cells deployed by end-2012, and this figure is expected to reach 15m by end-2013 and 91m by 2016.

As mobile core networks become more intelligent, though, they are increasingly able to manage a range of different radio technologies, giving rise to the concept of heterogeneous networks or 'HetNets'. This will allow mobile operators to knit technologies like WiFi into the broader cellular 3G and 4G 'fabric'. We make this point only to stress that small cell innovation is not specific to any technology (not least as there is little to differentiate WiFi and 3G/4G at a fundamental level these days, as we note), but is rather an architectural innovation.

Winners and losers

We believe that **Ericsson** (ERICb.ST, SEK105, OW) stands to benefit from the trend of building

Alcatel Lucent LightRadio 'cube' small cell base station

Source: Image reproduced with permission of Alcatel Lucent

LightRadio small cell base station (on column)

Source: Image reproduced with permission of Alcatel Lucent

capacity via small cell products. Although rival **Alcatel-Lucent** (ALUA.PA, EUR2.3, UW(V)) takes the prize for popularising small cells with its innovative, eye-catching LightRadio product, we believe its presence in the mobile infrastructure market is too weak to take full advantage of the demand opportunity. Ericsson, however, has won an estimated 60% of global LTE contracts – making it by far the market leader. Steady demand to create smaller-cell architectures alongside a more heterogeneous approach to radio technologies should be positive for Ericsson's revenues and margins longer term we believe.

Large, diversified telecoms operators

For telecoms operators, we believe the new world of small cell mobile data will hand advantages to operators possessing scale and diversified fixed-mobile network assets. Capex scale should enable denser network builds, leading to a material capacity advantage over smaller rivals. Moreover, due to the short range of small cell products (typically envisaged at <100m radius) these products must be sited close to users – most typically at ground level. This makes it very difficult (if not impossible) to 'backhaul' traffic via conventional microwave relay systems, which require line-of-sight between points, forcing operators to use expensive fibre instead. In this regard it should be a major advantage for mobile operators with sister fixed-line broadband access networks as well.

Losers

Small, mobile-only operators

In contrast to the above, we see small, mobile-only operators as the losers, since lower absolute capex (somewhat independent of capex/sales) should mean less dense network builds (either macrocellular or small cells) leading to a capacity/speed disadvantage in mobile data. Mobile-only players also face a considerable challenge to backhaul traffic from the small cell sites that they do build given the expected low elevations involved.

Appendix

Valuations and risks for investible ideas

Potential return equals the percentage difference between the current share price and the target price, including the forecast dividend yield when indicated.

SAP (OW, target price EUR74): Our target price is based on DCF (WACC 9.5%, risk-free rate 3%, beta 1.1 and risk premium 6%). Under our research model, for stocks without a volatility indicator, the Neutral band is 5pp above and below the hurdle rate for eurozone stocks of 9.0%. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

Our Overweight rating is subject to the following risks: 1) Most of the equity story appears to be driven by newsflow around the fast-growing businesses HANA, Mobile and Cloud; unfavourable newsflow could put the share price under pressure; 2) higher investment in sales, marketing and distribution than we expect could lead to a lower EBIT margin; 3) acquisitions with a risk of EPS dilution (high price), margins and integration; 4) EUR appreciation against USD and JPY.

Experian (OW, target price 1,500p): We have argued that the 2009 credit crunch produced unusual cyclicality in the industry, mainly due to bank mergers. Given that we do not expect a high level of bank mergers, we look at the multiples the sector traded on excluding that period. On average, stocks such as Equifax and FICO used to trade on a 12-month forward PE multiple of 17x. We would argue that Experian deserves to trade at a premium to these multiples owing to the various structural trends in the sector – especially in its own geographic footprint. We arrive at our 12-month target price of 1,500p by applying a (calendar) 2015 PE multiple of 18x. Under our research model, for stocks without a volatility indicator, the Neutral band is 5pp above and below the hurdle rate for UK stocks of 7.5%. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

The main downside risks to our rating are: 1) weakness of the Brazilian *real*, although the Serasa option price should adjust accordingly and act as an offset; 2) any weakness in the US credit outlook could affect the multiples and we would see share price weakness led by such multiple contractions as a buying opportunity; 3) Brazilian tax increases could be significant if Experian is unable to defend its position to charge goodwill amortisation pre-tax; 4) large-scale bank/retail mergers may lead to margin pressure.

Gemalto (OW, target price EUR100): Our target price is based on a DCF (WACC 8.5%, 3.0% risk-free rate, a 6.0% risk premium, and a beta of 0.9). Under the HSBC research model, the Neutral band for non-volatile stocks is 5pp above and below the 9.0% hurdle rate for eurozone stocks. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

Our forecasts and Overweight rating are subject to the following downside risks: 1) cash flow generation could disappoint with improvement in the WCR and improvement of capex; 2) the dilutive impact of potential acquisitions on margins and, in particular, external growth operations designed to boost group market share – notably in the telecoms' software and services segments; 3) the equity story is focused on EMV migration in the US and NFC deployment around the world: postponement of or lower-than-expected growth in these technologies could lead to lower growth and leverage on margins, which could hurt the share price; 4) managing consensus

reactions and expectations: consensus is regularly surprised by releases, owing to misunderstandings about the seasonal nature of the group's business.

Ingenico (OW, target price EUR63): Our target price is based on DCF (WACC of 9.5% based, in turn, on a 3% risk-free rate, a 6% market premium, and a 1.3 beta, which factors in the risk of integration of acquisition) with standard gearing of 16% and a 3% after-tax interest rate. Under the HSBC research model, the Neutral band for non-volatile stocks is 5pp above and below the 9.0% hurdle rate for eurozone stocks. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

We have identified three main downside risks: 1) Exchange rates, which have a direct impact on the gross margin and operating margin in euros (conversion on the income levels); 2) interest rates, in view of our DCF valuation method: as the company is not so leveraged (gearing of 18% pre-deal), it is exposed to no specific risk in relation to its financial structure; 3) with respect to specific risks, Ingenico is a 'fabless' company and is dependent on EMS (electronic manufacturing services) in order to manufacture its products, which gives it little flexibility to adapt quickly to an abrupt downturn; in addition, any industrial issues related to defaults, delays or component shortages would have a negative impact on Ingenico.

E-Commerce China Dangdang (OW(V), target price USD13.45): Our DCF applies Dangdang's all-time historical mean beta of 2.5 versus the S&P 500, our standard 2% risk-free rate and 10% equity risk premium. We use a 5% perpetual growth rate as the company should only become free cash flow positive in 2014e. Our DCF model yields a target price of USD13.45. Our target price implies 0.7x 2013e sales. Given the company's high-risk nature, we believe a high WACC is appropriate. Despite our high WACC, we still see material upside potential to Dangdang's current value. Under our research model, for stocks with a volatility indicator, the Neutral band is 10pp above and below the hurdle rate of 9.5% for China stocks. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight (V).

The key risks to our rating relate to competition remaining high and also execution in this fast-moving market. In particular, the e-commerce segment is large and fast growing. A number of key players have already entrenched themselves, but new entrants are driving competition in most segments. Dangdang needs to maintain strong execution in branding, customer acquisition and retention, fulfilment and procurement in order to reach profitability and maintain a sustainable business.

LG Electronics (OW, target price KRW100,000): We use sum-of-the-parts methodology for end-2013e to reflect the different characteristics of each business unit and typical seasonality. For the TV division, we use an estimated 2013e EV/EBITDA multiple of 5.2x, which is at a 30% premium to 4.0x, the lowest average EV/EBITDA multiple for the company's Japanese peers in the past 10 years. We believe a 30% premium is reasonable, given the differences in margins and high-end product offerings. For the handset division, we apply a 10.0x EV/EBITDA multiple, the average for Motorola and HTC over the past 10 years, as we expect LGE's handset business to remain profitable, given its positive smartphone shipment outlook for 2013e. For the appliance and air-conditioner divisions, we apply EV/EBITDAs of 4.1x and 6.7x, respectively, which are the average multiples for its peers. Under our research model, for stocks without a volatility indicator, the

Neutral band is 5pp above and below the hurdle rate for Korean stocks of 10%. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

Downside risks include: the delayed launch of flagship smartphones and TVs, and a slower-than-expected recovery in demand for consumer electronics.

Samsung Electronics (OW, target price KRW 1,870,000): Our target price is based on a target 2013e PB multiple of 1.9x, which reflects our improving ROE assumption and compares with its historical 10-year average PB of 1.7x. The stock currently trades at 1.4x 2013e PB versus its historical average of 2.2x. Under our research model, for stocks without a volatility indicator, the Neutral band is 5pp above and below the hurdle rate for Korean stocks of 10%. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

Downside risks include greater KRW appreciation and a further slowdown in the global economy, which may dampen profitability, while JPY weakness may weaken competitiveness. A potential decrease in demand caused by the global economic slowdown is another risk for the company.

Celltrion (OW, target price KRW76,000): Our KRW76,000 target price is based on an average of PE and DCF, plus an estimated dividend (2013e: KRW200/share). Our PE target of 35x is based on an unchanged 2012-14e PEG of 1.0x. Our DCF is based on a 10.4% WACC assumption (RFR = 3.0%, ERP = 7%, beta = 1.2). Short-term downside risks include delays in gaining drug approvals or non-approvals. Long-term downside risks include delays in clinical trial completions, competitive responses from originators, resistance to biosimilars in developed markets, and low affordability in emerging markets.

Medipost (OW(V), target price KRW122,700): We have a DCF-based target price of KRW122,700. Domestic sales of Cartistem account for around 12% of our appraised valuation. The bulk of the valuation lies in Neurostem-AD and Cartistem in the US, both of which are at a relatively early stage. The addressable market for Neurostem-AD, a treatment for Alzheimer's disease, is much larger than for cartilage regeneration.

Valuation summary

KRWbn,	NPV	% of total	WACC
Cartistem	66	8%	10.5%
Neurostem-AD	332	38%	20.0%
Pneumostem, Promostem	16	2%	15.0%
Cartistem US	380	43%	25.0%
CBB	70	8%	10.5%
Services	16	2%	10.5%
Total	**879**	**100%**	

Source: HSBC estimates

Under our research model, for stocks without a volatility indicator, the Neutral band is 5pp above and below the hurdle rate for Korean stocks of 10%. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

Risks include: slower-than-expected take-up of Cartistem, delays in approval/non-approval of pipeline drugs, delays in US FDA trials for Cartistem, and high reliance on Cartistem (US) and Neurostem-AD for long-term growth.

Pharmicell (OW(V), target price KRW7,900): Our KRW7,900 target price is calculated with a DCF-based analysis of each pipeline drug that uses WACC of 10-20% depending on the stage of commercialisation or development. We include a DCF-based valuation of IDB and factor in the impact of a 9.3% dilution from bonds with warrants.

Valuations summary (KRWbn)	
Product	**NPV (KRWbn)**
MCI	115
IS	135
SCI	55
LC	33
IDB	21
Total	359

Source: HSBC estimates

Under our research model, for stocks without a volatility indicator, the Neutral band is 5pp above and below the hurdle rate for Korean stocks of 10%. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

Risks include slower-than-expected gains in production efficiency, slower-than-expected patient take-up of HCG-AMI, delays in approval/non-approval of pipeline, limited information on clinical trial design, and delays in US FDA IND approval for liver cirrhosis treatment.

Continental (OW, target price EUR150): We value Continental using a sum-of-the parts analysis, based on our expectations for 2014. Our valuation focuses on EV/sales, EV/EBITDA and EV/clean EBIT multiples. We take Factset consensus 2014 peer multiples, and we value the Rubber Group at a 10% premium to a peer group consisting of Michelin, Pirelli, Nokian Renkaat, Goodyear, Bridgestone, Hankook. We value the Automotive Group in line with its peer group consisting of BorgWarner, Delphi, Denso, Valeo, TRW Auto, Autoliv. In our view, the main downside risks for Conti are macro related and comprise lower global car- and replacement tyre demand.

Ericsson (OW, target price SEK105): We value Ericsson using a DCF approach based on a WACC of 8.4%, comprising a risk-free rate of 3.5% and an equity risk premium of 6%, with beta of 1.00, and a debt-to-total capital ratio of 20%.

Under our research model, for stocks without a volatility indicator, the Neutral band is 5pp above and below the hurdle rate for Swedish stocks of 9.5%. At the time we set our target price, it implied a potential return that was above the Neutral band; therefore, we rate the stock Overweight.

Downside risks to our Overweight rating, in our view, include capex reductions by European operators, price pressure from Chinese rivals Huawei and ZTE, and a trend toward network sharing among mobile operators, all of which may adversely affect Ericsson's revenue growth and profitability. Increasing competition between Ericsson and Cisco – the latter of which continues to expand in mobile – is another potential downside risk.

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Notes

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Disclosure appendix

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Our ratings are re-calibrated against these bands at the time of any 'material change' (initiation of coverage, change of volatility status or change in price target). Notwithstanding this, and although ratings are subject to ongoing management review,

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*A stock will be classified as volatile if its historical volatility has exceeded 40%, if the stock has been listed for less than 12 months (unless it is in an industry or sector where volatility is low) or if the analyst expects significant volatility. However, stocks which we do not consider volatile may in fact also behave in such a way. Historical volatility is defined as the past month's average of the daily 365-day moving average volatilities. In order to avoid misleadingly frequent changes in rating, however, volatility has to move 2.5 percentage points past the 40% benchmark in either direction for a stock's status to change.

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Company	Ticker	Recent price	Price Date	Disclosure
CONTINENTAL	CONG.IB	124.40	04-Oct-2013	1, 2, 5, 6, 7, 11
ERICSSON	ERICb.ST	85.80	04-Oct-2013	2, 5, 6, 7, 11
EXPERIAN LTD	EXPN.L	11.60	04-Oct-2013	4, 11
INGENICO	INGC.PA	54.20	04-Oct-2013	1, 4, 5
LG ELECTRONICS	066570.KS	67200.00	04-Oct-2013	6, 7, 11
SAMSUNG ELECTRONICS	005930.KS	1418000.00	04-Oct-2013	5, 6, 7
SAP	SAPG.DE	54.52	04-Oct-2013	4, 6, 7, 11

Source: HSBC

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