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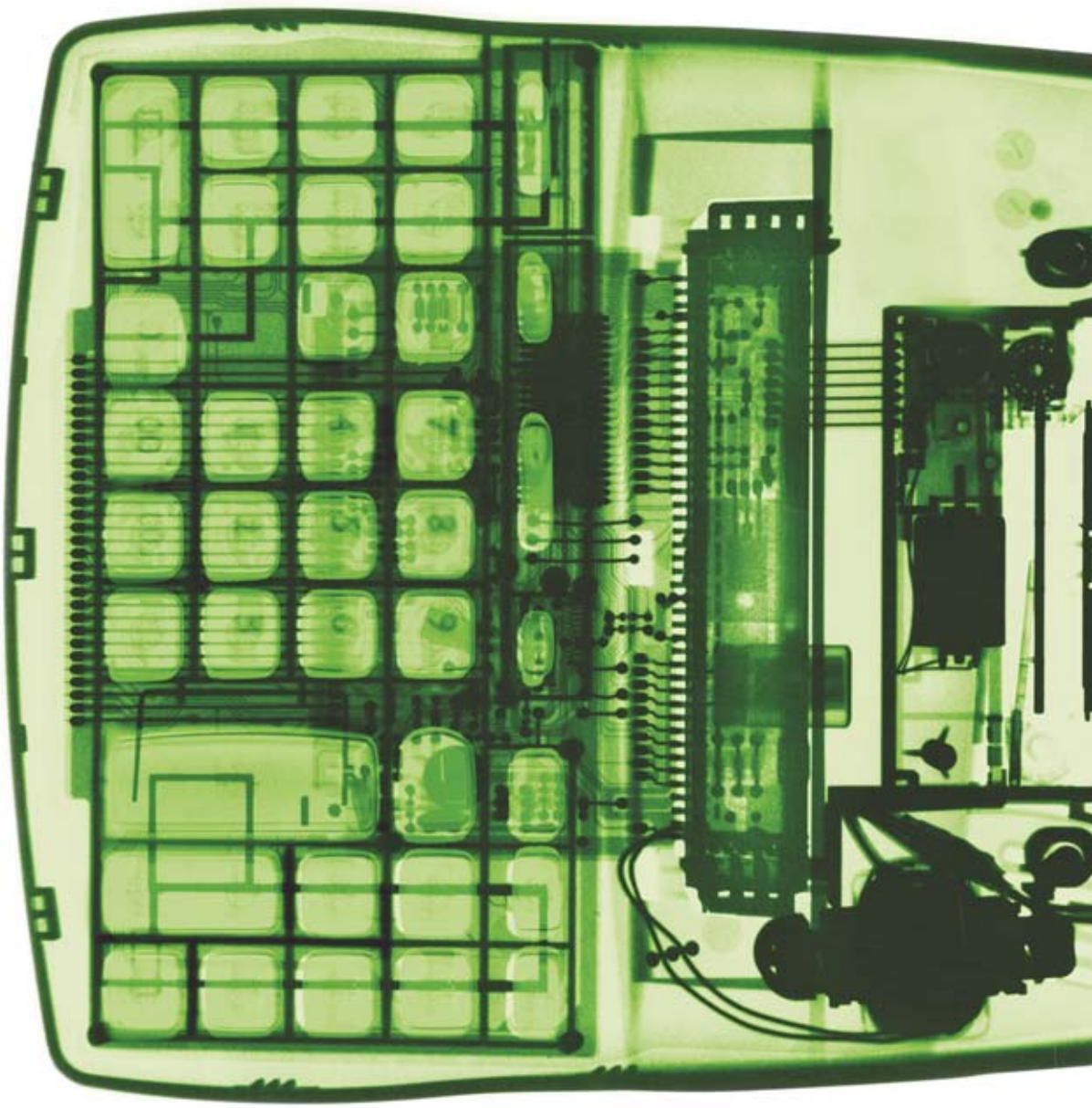
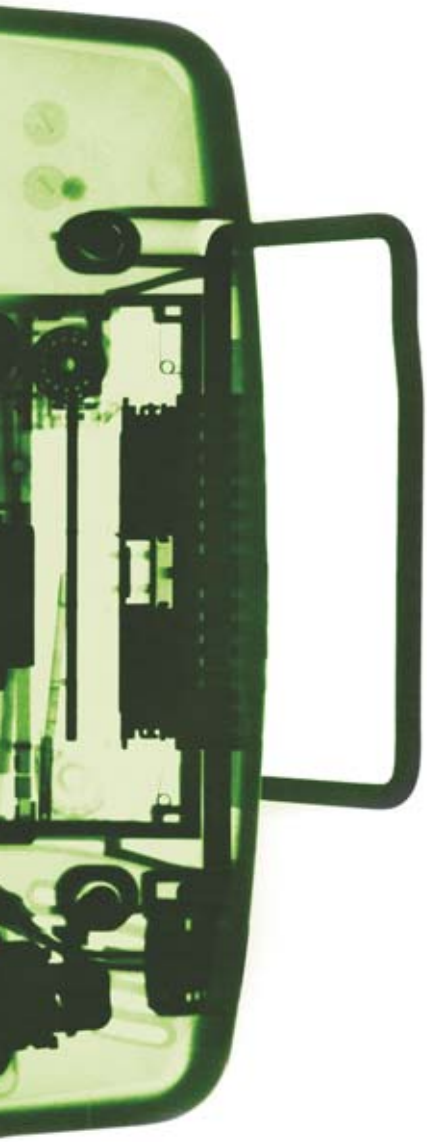
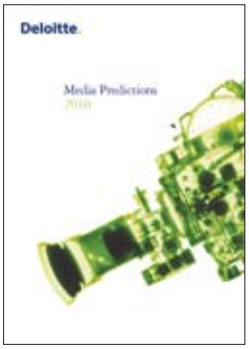
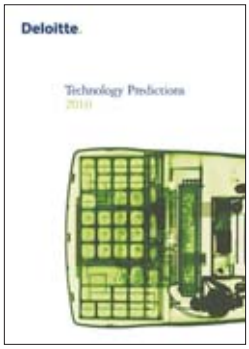
Technology Predictions 2010









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About TMT
The Deloitte Touche Tohmatsu (DTT) Global Technology, Media & Telecommunications (TMT) Industry Group consists of TMT practices organized in the various member firms of DTT. It includes more than 7,000 partners and senior professionals from around the world, dedicated to helping their clients evaluate complex issues, develop fresh approaches to problems, and implement practical solutions.

There are dedicated TMT practices in 45 countries in the Americas, EMEA, and Asia Pacific. DTT's member firms serve 92 percent of the TMT companies in the Fortune Global 500. Clients of Deloitte's member firms' TMT practices include some of the world's top software companies, computer manufacturers, semiconductor foundries, wireless operators, cable companies, advertising agencies, and publishers.

About the research
The 2010 series of Predictions has drawn on internal and external inputs including: conversations with TMT companies, contributions from DTT member firms' 7,000 partners and senior practitioners specializing in TMT, discussions with financial and industry analysts, and conversations with trade bodies.

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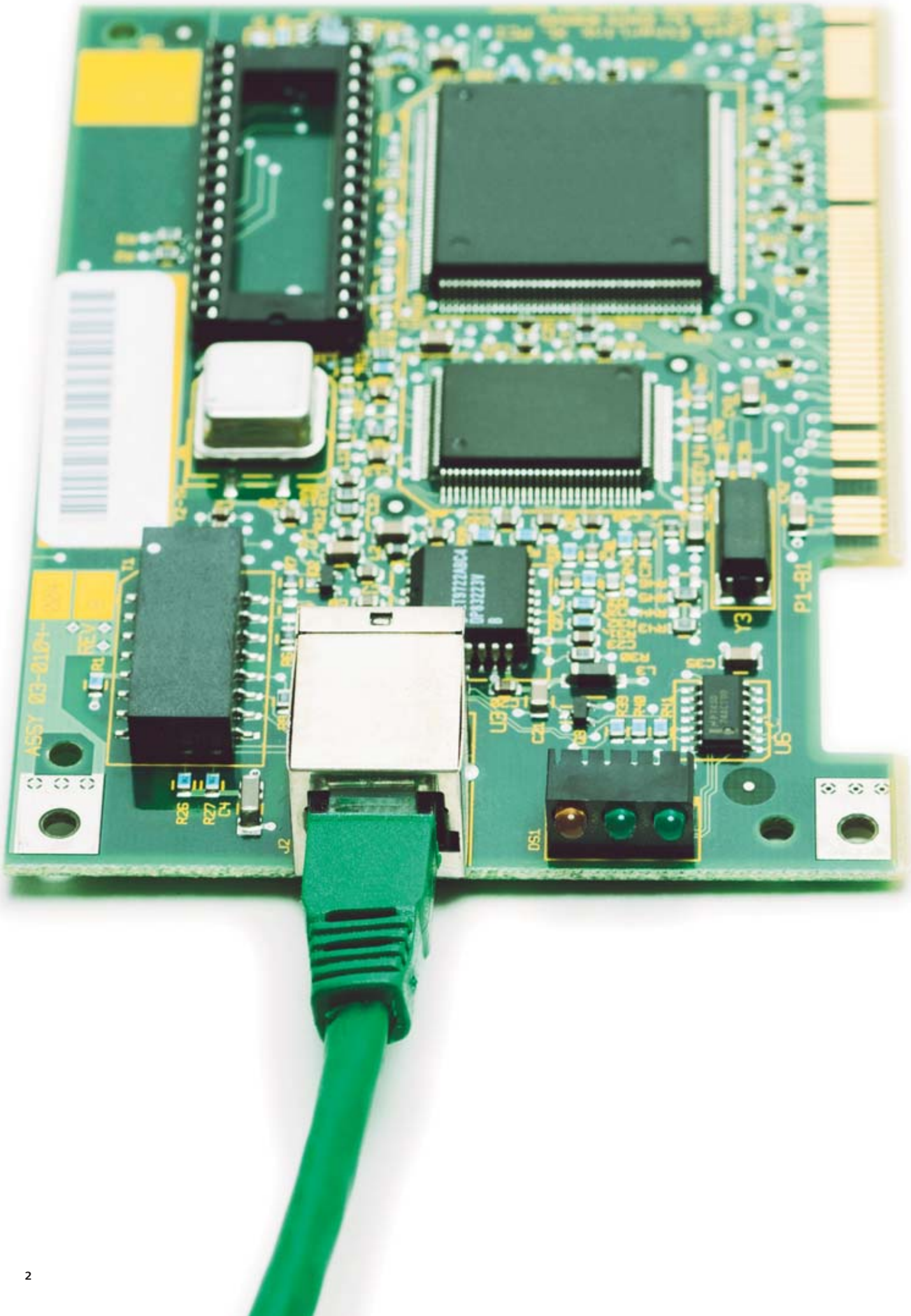
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Foreword

Welcome to the 2010 edition of Technology Predictions. This is the ninth year in which the Deloitte Touche Tohmatsu (DTT) Global Technology, Media & Telecommunications (TMT) Industry Group has published predictions on the TMT sectors.

This year's report has three principal themes: the economy, digitization, and CleanTech.

First, the global economy: if there was one advantage to making predictions for 2009, it was the consensus that most major economies were expected to fall into recession. (They did, with a few notable exceptions, such as Brazil, India, and China.) In 2010, the picture is far more mixed. While it is generally agreed that most economies should recover, there do not appear to be enough shapes or letters available to describe the possible permutations that recovery may take — will it be a U, a V, a W, or a square-root recovery? And the possibility remains of a double-dip recession, once the stimulus ends. At the time of writing, governments appeared bullish, corporations more bearish, and economists divergent.

The uncertain economic outlook is likely to keep enterprises focused on cost. This emphasis on cost is a key driver of three of our Predictions: the return of thin client computing to enterprise computing, the adoption of employee-driven technology procurement (with cost savings as a key factor), and the keen interest in, but moderate adoption of, cloud computing.

Digitization's momentum precedes the current recession by decades, but it continues to reinvent the global technology sector. This fundamentally simple transition — the conversion of analog data into digital form and its distribution via digital networks — not only changes the balance of power within the industry but can also reset the scope of other sectors. Anticipating digitization's impact is commendable, but timing is everything and preparation is paramount. Being caught off guard by the pace of digitization has been — and will continue to be — catastrophic.

Companies that have launched netTabs — devices that fit between smartphones and netbooks — over the last two decades are all too aware of this. Our view is that 2010 should, however, be a key year for the device. Moore's Law, one of the key yardsticks of digitization's progress, is expected to remain in effect in 2010, but with a focus on size, price, and cost, rather than power.

In 2010, we predict a recovery for CleanTech, following a battering by a storm of recession-induced pragmatism in 2009. But the return to growth is unlikely to be uniform. One nascent sector that may see major progress this year is carbon-negative cement. Given cement's emissions (5 percent of the global total), any advances in green cements may be significant.

I am often asked about Predictions' track record. We are never likely to be 100 percent right. However, a focus on pragmatism and an aversion to hype has meant that we are more often right than wrong. We never include a prediction only because it will come true in the next year. Rather, our focus is on identifying potential "black swans" whose impact could have major, strategic ramifications for companies in the sector.

As a result, each prediction is designed to start or stoke a further conversation — not to stop it. And we trust that the Predictions' launch, expected to take place in over 50 cities around the world in 2010, reaching over 5,000 industry executives, serves precisely this purpose.

I wish you every success for 2010 and beyond.

Jolyon Barker
Global Managing Partner
Technology, Media & Telecommunications

Smaller than a netbook and bigger than a smartphone — net tablets arrive

DTT TMT predicts that in 2010–2011, tens of millions of connected portable devices will likely be purchased by consumers with sore eyes and sore arms. Net tablets, or netTabs, will be based on a new form factor and feature significant processing capacity.[1] They will aim to offer an appealing balance of form and function. Priced between $400 and $800, they are likely to weigh less than 1.1 pounds (500 grams) and measure about 8 in by 5 in (20 cm by 12 cm by 2.5 cm). They are expected to include cellular and WiFi access, full-color touch screens, and well-populated app stores.

NetTabs are expected to meet specific consumer needs compared to smartphones on the one hand (which are still a bit small for watching videos or even Web browsing), and notebooks, netbooks, and ultra-thin PCs, on the other (which are too big, heavy, or expensive).

NetTabs, the Goldilocks of devices (not too big, not too small), may be "just right" for many users.

This is counter to consensus expectations. The segment lying between the smallest available laptop and largest phone has historically been a technological dead zone. Recent efforts from successful PC manufacturers have met with limited consumer acceptance at best.[2] As a result, many observers have concluded that there is no current consumer demand for tablet computers — nor will there ever be.[3]

While it is difficult to forecast sales of devices whose specifications are unknown, some analysts estimate 12-month sales from launch of over $1 billion.

We believe that previous attempts at the tablet form factor failed (or were less than resounding successes) for many reasons: the graphics, software, and user interface were underwhelming, not well connected to cellular or WiFi networks, and, most important, they have largely served as work-oriented data-entry devices. By contrast, an easy-to-use, consumer-focused device used primarily for media and Web browsing is much more likely to be widely accepted by the market.

The next 18 months are likely to see a proliferation of these devices from two sources: tablets that were designed to be tablets from day one and stand-alone single-purpose devices that will be repurposed as multifunction devices by adding enhanced processing and software.

Although none have been launched yet, leaked information suggests that custom-designed tablets are likely to be released by start-ups, some existing successful phone and PC makers, netbook leaders, and various smaller manufacturers using open-source phone operating systems.[4]

While it is difficult to forecast sales of devices whose specifications are unknown, some analysts estimate 12-month sales from launch of over $1 billion. This is larger than global sales of personal navigation devices (PND).[5] Some industry surveys have shown that consumers are willing to consider the new devices — even at relatively high price points. As many as 40 percent of respondents in one survey said they would be willing to pay more than $800 for one model of netTab that has been the subject of much speculation.[6]

That said, there are tens of millions of devices that have generated billions of dollars in sales that already have something close to the form factor of potential netTab units.

These are popular consumer and enterprise-friendly devices with strong brand names.[7] They include global positioning system (GPS) units, eReaders, portable entertainment devices, gaming devices, and various handheld computers in different vertical sectors. In many cases, the multifunctional smartphone and netbook, with their wide array of software applications, are finding their targets among customers who currently own one or more of the single-function devices.[8]

For example, the current PND market is roughly 40 million units and a billion dollars in annual revenues.[9] However, competition from GPS services on mobile handsets is expected to disrupt this market extensively, and analysts forecast standalone PNDs will go from 90 percent market share today to less than 30 percent by 2013.[10]

It would be difficult for PND manufacturers to respond to the netTab threat by offering more precise location functionality in the consumer space. Centimeter-level or inch level positioning accuracy is useful for the military and agriculture industries, but not for the average user. One PND manufacturer has already introduced its own smartphone,[11] and it is likely that larger multifunction devices (with larger screens for maps), such as netTabs, are sure to follow.

Other manufacturers of various tablet-sized but single-function "dumb" devices are likely to add more intelligence to their products through ARM-based or x86 processors like the Atom. These multifunction devices would offer Web browsing, support email reading, and almost certainly support widgets, applets, and the various stores for purchasing them.

Bottom line

Since netTabs are primarily networked devices and are designed to connect wirelessly over WiFi, cellular, or (less likely) WiMax technologies, wireless carriers are going to need to deal with two major issues. These devices are more expensive than all but the priciest smartphones, and consumers are likely to demand big upfront subsidies, probably in the $200 to $400 range. And if the devices are as popular as we predict, they will consume a lot of scarce bandwidth and network resources, likely degrading network performance. To make matters worse, netTabs' larger screens mean that users will want to stream bigger, higher-definition media files, exacerbating the mobile congestion issue when they are not using WiFi.

Carriers are likely to try to push users off cellular networks and onto WiFi as much as possible. NetTab manufacturers may even introduce WiFi-only tablets, although these would likely be less popular. Wireless home networks are likely to benefit; the netTab would be much more useful than a phone or PC for casual Web browsing inside the home — whether while watching TV or reading at night. More, or more powerful, wireless routers are likely to be needed.

Chipmakers are also poised to benefit. Unlike most smartphones and netbooks, netTabs are more of a premium product and are likely to require higher-end chips, generating higher, or at least incremental, margins. Similarly, touch screen and flash memory manufacturers are also likely to be beneficiaries.

In our view, existing PC and smartphone makers are unlikely to be threatened by netTabs: the netTab addresses a specific need that is currently largely unfulfilled. PC-like text or data entry would be cumbersome, and netTabs are not portable enough to replace a phone-sized device. In fact, if netTabs develop as a viable market, PC makers are more likely to be able to succeed with the tablet form factor rather than with smartphones.

The most vulnerable to netTab success may be the stand-alone eReader market. Reading eBooks on a tablet would be similar to using eReader, but the added value of a color screen and ability to display video could make the multifunction netTab the 8-inch device of choice.

Moore's Law is alive and well in 2010

DTT TMT predicts that in 2010 Moore's Law[12] will probably continue to work just fine. The traditional ability of the global semiconductor industry to double the number of transistors in a square centimeter of silicon every 18 to 24 months will not likely come to a screeching halt. In fact, it may not even slow down. But that increased density is unlikely to be used to produce larger or more computationally powerful chips. Instead, it could permit the production of "good enough" chips that use less electricity, cost less money, or are smaller.

The current consensus on Moore's Law forecasts a gloomier scenario, but historically, it has proven unwise to foretell the end of the Law. Roughly every decade since the Law's declaration in 1965, various pundits have proclaimed that "the immutable laws of physics" would force the rate of chip-manufacturing progress to slow or even stop, only to see the industry continue its advance. But the past year or two has seen an uptick in the dire predictions.[13]

Moore's Law has been misunderstood for about as long as it has been around. The popular misinterpretation is that processors become twice as powerful every two years. But the original formulation of the Law, and subsequent clarifications by Gordon Moore, never once mention speed or power.

Those anticipating the end of Moore's Law have cited various pieces of evidence. Some of the largest chip manufacturers have publicly stated that "scaling doesn't scale" the way it once did.[14] That is, the costs of doubling transistor density have certainly risen faster than in the past.[15]

Most damningly, many have noticed that the "performance" (as measured by clock speed in GHz and number of cores) of the various central processing units (CPU) and other chips has almost leveled off.[16]

The integrated circuit has permitted computing devices to become much smaller, more powerful, cheaper, and more efficient than the machines that came before them. And for years, the semiconductor industry marketed its generational advances primarily in terms of processing power, specifically clock speed. Up until 2005, the flagship CPUs found inside top-end PCs and servers ran about 10 times faster, and cost roughly the same ($500), but used more than 10 times the electricity than similar devices from a decade earlier.[17]

The increased power usage has not, until recently, slowed sales for servers or desktops.[18] But now those markets are relatively saturated, and growth rates are low. Meanwhile, the new growth markets for chips are being driven by mobile computing, smartphones, and other consumer devices. And in those markets, the primary requirements for each generation of chips are cost and power reduction. Speed, on the other hand, is generally now considered sufficient for most current user requirements.[19] In fact, the most successful recent CPU chips have been those targeted at the netbook and smartphone markets, and both are focused on price and power rather than speed.

Moore's Law has been misunderstood for about as long as it has been around. The popular misinterpretation is that processors become twice as powerful every two years. But the original formulation of the Law, and subsequent clarifications by Gordon Moore, never once mention speed or power. The Law simply refers to technology and engineering advances enabling greater transistor density. Greater density — if one is relatively indifferent to considerations of cost or electrical consumption — can translate into more computing speed. But it can also translate into lower prices or lower power usage. From the perspective of a designer, Moore's Law allows a chip to be optimized for any one of performance, price, or power — but usually not all three simultaneously.

With current growth in mobile computers coming in the form of lower-cost laptops and ultra low-cost netbooks, we predict that the next few generations of PC chips are likely going to be optimized for price, with some consideration given to power consumption and almost no focus on performance. Other strong-selling devices, such as smartphones and possibly tablets, are likely to be optimized primarily for power consumption, with some attention paid to price. Again, performance may be almost irrelevant. Although some chips will continue to be performance-driven, this segment will not likely see as much growth.[20]

Moore's Law is alive and well in 2010 and should remain so for at least the next few generations of semiconductor manufacturing technologies. But progress may well be measured by very different metrics to those used in the last two decades.[21]

Bottom line

The implications for chip manufacturers that play at the cutting edge of Moore's Law are twofold. First, although the Law is not broken, it is getting increasingly expensive to implement. Analysts forecast that the next generation of chip plants will cost roughly $7 billion, 50 percent more than they do today.[22] The equipment and design tools that go along with the new technologies will likely be much more expensive; industry consolidation is expected, resulting in as few as four surviving fabricators at the leading edge. Strategies such as joint ventures and partnerships will need to be explored for many players.

Rising costs are also likely to lead to compressed gross and net margins, so supply chain optimization is likely to become increasingly important, along with overall cost controls.

The development of cheaper chips that are also more energy efficient should allow semiconductor companies to target and penetrate new markets but will likely require new sales channels and customer service approaches.

Semiconductor equipment and packaging[23] companies will likely be as successful as ever — but they need to fine-tune their solutions to match the chipmakers. As the need for more powerful chips diminishes, the focus will move to cost reduction and better power usage: different goals require different tools and different packages.

The software industry will likely need to adjust. In the past, software code could grow or become more complex knowing that future generations of chips would be powerful enough to handle the burden. But if next-generation chips are only as powerful as current versions — or even less powerful — then software bloat could become an issue.[24]

There are significant environmental implications. Many IT applications (server farms, etc.) are large users of electrical power, so more efficient chips are a good thing. New equipment that uses less electricity and requires less cooling may allow for re-architected or larger data centers without necessitating increased refrigeration or power supplies.

Cloud computing: more than hype but less than hyper

DTT TMT predicts that in 2010 cloud computing[25] is likely to grow much faster than most other technology verticals[26] but will still fail to reach the heights its more enthusiastic supporters have suggested. We also expect to see it grow the fastest in the consumer and small and medium enterprises (SME) market, rather than in the large enterprise and government markets. Although estimates vary (usually due to definitions), in 2009 cloud services revenue was around $55 billion,[27] and we predict that it will likely grow by more than 20 percent in 2010 to roughly $70 billion, taking share away from alternative software models.

Before moving on, we may need to give some examples of cloud computing. There are personal applications (often advertising-supported) such as Gmail, Hotmail, Facebook and Twitter; consumer applications such as Google, eBay and Amazon; and business applications such as Saleforce.com and NetSuite.[28]

The consensus on cloud is polarized. One group positions cloud computing at the very apex of the hype curve, but still two to five years away from mainstream adoption.[29] The other suggests that in 2010 "cloud computing is about to explode."[30]

Our prediction is not just an average of the two extremes. We believe that there are significant advantages offered by cloud computing for some, but not all, applications and situations. There will likely be growth in those segments (non-critical file storage or customer-facing applications that see large spikes in demand), where offering dynamically scalable and virtualized resources over the Internet and as a service makes good business sense.

However, many surveys show that buyers of IT services remain hesitant about moving to the cloud. Among other things they cite concerns about security, reliability, and data portability and are sometimes skeptical about the longer-term cost benefits.[31] These are serious concerns, and whether or not a shift to cloud computing actually increases these risks compared to whatever solution is currently being used is almost beside the point. A leading software chief technology officer said in late 2009, "Perception is absolute reality, and the perception is that security is still an obstacle, and we cannot deny it."[32]

For reliability reasons, adoption of cloud is most likely to occur in markets with well-developed, secure, and reliable IT infrastructure: North America and Western Europe are currently the biggest users of cloud, and this is likely to persist for at least the short term. In the medium term, the developing world will likely catch up as cloud solutions are ideal for markets with few installed traditional hardware and software bases.[33]

Although the media tend to focus on enterprise and government adoption[34] (or non-adoption) of cloud computing (specifically, systems infrastructure delivered as a service), the reality is that 60 percent of cloud today is cloud-based advertising, while the infrastructure component is only about 6 percent.[35]

The prevalence of advertising, and other more consumer-centric applications, is consistent with the perceived benefits and risks offered by cloud computing.

When looking at the possible risks of cloud computing, enterprise and governments are legitimately obsessed with data security and maintaining near – 100 percent uptime, whereas consumers are likely to be more accepting of occasional outages, and the potential value of lost or stolen information from a single consumer is usually a great deal less than from a bank or government.

Equally, the benefits offered by cloud should benefit consumers disproportionately. Over the last decade, most enterprise and government IT departments have adopted the latest technologies, such as virtualization, to utilize their IT assets relatively efficiently. They usually have sourcing solutions that allow capacity to scale on demand, and they almost always have highly redundant storage of information. Consumers, on the other hand, tend to be inefficient, inflexible, and inadequately backed up.

Additional impediments to enterprise and governmental adoption are the issues of control and responsibility. In a traditional IT environment where the chief information officer (CIO) has followed best practices for data security and an employee loses a laptop or physical security is breached with consequent data loss, then the consequences fall on the shoulders of the employee responsible for building security. But in a cloud implementation, and even though the CIO cannot directly control security, the blame for any data loss will certainly fall on the IT department that made the decision to choose a cloud-computing approach.

Significant growth in cloud computing for consumers could change many markets. Local storage, such as DVDs, media storage devices, and USB keys, could shrink. Internet traffic could rise even more sharply. Networks could get more fully utilized (or even strained), and routers would need to do more.

Bottom line

Cloud computing solutions providers need to focus on two things: realizing that consumer applications are likely the better near-term revenue opportunity, and that their key challenge in enterprise and government adoption is addressing the security and reliability concerns. But they also need to be patient. Some enterprise reluctance may be due to the relatively limited operating history of cloud solutions. More time will produce more robust reliability and security data. In the meantime, cloud providers may need to worry about legal issues in the event of interruption of service or loss of data.[36]

Concerns over reliability and security can also be addressed with appropriate mitigation strategies: writing the appropriate service level agreements (SLAs), performing regular security audits, having third-party certification, and complying with emerging cloud standards.

The advantages of cloud for the providers of the service are well documented. Some estimates suggest that a cloud solution can provide more-or-less equivalent service, but at an 80 percent lower cost. It will likely be important for solutions providers to pass on at least some of these savings to the end customer — before new entrants do so and disrupt the industry. Some industry leaders are already offering cloud discounts, especially as volumes increase.[37]

One unanticipated effect of growth in cloud computing may be in the area of server-processing chips.[38] Historically dominated by ever more powerful multi-thread processing providers, the new processing demands of the cloud suggest the new battleground could be price and power density, possibly giving an advantage to vendors who have previously been stronger in the mass-processing market.

Significant growth in cloud computing for consumers could change many markets. Local storage, such as DVDs, media storage devices, and USB keys, could shrink. Internet traffic could rise even more sharply. Networks could get more fully utilized (or even strained), and routers would need to do more.[39] Carriers should target businesses with spiky IT needs, perhaps around seasonality or major events.[40]

Given the increasing use of energy by inefficient deployment of information technology, cloud is also being seen as a more environmentally friendly way to provide IT.[41]

Thinking thin is in again: virtual desktop infrastructures challenge the PC

DTT TMT predicts that in 2010, Virtual Desktop Infrastructure, a computing model based on "thin" or stateless clients, centralized applications, and processing power, will be taken far more seriously than in previous years, even if it does not outsell its thick client counterpart.

In 2010, over one million seats may go thin client,[42] with the largest deployments involving tens of thousands of seats.[43] A pure thin client approach centralizes processing power and data storage and replaces a user's computer with a dumb terminal whose role is limited to sending keyboard and mouse inputs and receiving screen inputs. For the users, there should be little change in experience — the same business applications that they used in their former thick client environment should all look and feel largely the same.

In 2010 an unprecedented confluence of enterprise priorities such as cost reduction, energy efficiency, security, and personal productivity are likely to make the case collectively for thin client strong enough for significant adoption.

In 2010, the majority of medium to large corporations are likely to consider the case for shifting to Virtual Desktop Infrastructure. By 2015, thin client may reach 10 percent of all enterprise client devices.[44] Cynics may note that it has been the "Year of Thin Client" for at least the last 13 years; but in each of those years, the case for thick client computing has remained more persuasive. Our view is that in 2010 an unprecedented confluence of enterprise priorities such as cost reduction, energy efficiency, security, and personal productivity is likely to make the case collectively for thin client strong enough for significant adoption.

Cost scrutiny is likely to include a continued focus on the IT budget.[45] Thin client could help deliver this via direct and indirect savings.

The principal direct cost savings is due to the ability to shrink support and maintenance and move-related costs. New recruits would not need a technician to build and install a PC for them, and human resources could simply hand out a standard thin client as part of the employee orientation. Employees could even pick up a unit from a stationery cupboard. Technical staff would not be required to undertake moves and changes. Project teams wanting to work in the same area would just need to be allocated a number of adjacent seats. Major software refreshes, such as an operating system (OS) upgrade, could be undertaken overnight, with no need to bring everyone's PC back to base. There would be less need for technical support to fix mechanical failures, as thin client units have no moving parts. Capital costs for end-user equipment may also be lower — cost per unit for devices is about a few hundred dollars.[46]

The cost per software and operating system license could also be lower in a thin client environment. Economies could be achieved through having a central pool of virtual desktops that are shared between users but only activated when in use. If 10 percent of users are not using their desktops on any given day, a commensurate reduction in software costs is possible. With a thick client environment, licenses are typically paid for on a per device basis.

Indirect cost savings could include lower real estate costs as well. Thin clients are typically smaller and lighter than PCs and can be suspended under tables, which means workers could be allocated smaller desks yet still feel they have more desk space. Moves to new office premises or major personnel relocations that accompany the adoption of thin client computing could also facilitate "hot-desking", which can lower real estate requirements.

A further key source of indirect savings could be lower power consumption. Thin client units' power consumption can be as low as 4 watts.[47] By contrast the current generation of PCs consumes about 100 watts.[48] Lower power output also means less need for air conditioning. And an increasingly important benefit of lower power is a reduced carbon footprint at a time when emissions are expected to become an increasingly prominent key performance indicator for enterprises.[49] Lower CO_2 emissions also reduce companies' spending on carbon credits or fines due to above-average emissions.[50]

Thin client would lead to some power consumption simply due to being moved from PCs to data centers. But the use of shared processing facilities should create a more energy-efficient environment overall.[51]

Security is also expected to remain a major challenge this year, particularly for enterprises with flexible workers, or with project teams now spread across continents. Thin client means that no data are stored on the device. It also enables anti-malware software to be deployed centrally, rather than in the device, which can make it nearly impossible to copy a file. Thin client should address many of enterprises' key security concerns in 2010, including the following: the impact on reputation from the loss of data; the increasingly professional approach to the creation and dissemination of malware, phishing, and other forms of digital attack; and the ubiquity and capacity of portable data storage, facilitating illicit copying of files.

The fourth key factor that may make the case for thin client is productivity. Thin client could enable workers to waste less time in booting up, shutting down, or receiving software updates. Over the course of a week, total time savings could reach a couple of hours. Working at home using a thin client could present exactly the same working experience as in an office — available in an instant.

Bottom line

The business case for thin client should be based on a holistic analysis. The key challenge here is that thin client's cost benefits may be spread across a number of a company's cost centers. Often, a business department may pick up the cost of a device; facilities may pay for air-conditioning; and the IT department may take care of software licenses. Viewed on a per-department level, the savings may look less impressive, but in aggregate, the cost benefits can be persuasive.

Another challenge for thin client, common with other deployments of new technology, is that they are most effective when integrated with process change. Thin client introduces the most value when paired with a new working approach, such as using office space more flexibly.

Those charged with deploying thin client may also need to convince workers, some of whom may resist its deployment. Some workers may begrudge the lack of a local hard disk drive, which pure forms of thin client would entail. However, employers abetted by a backdrop of recession or slow recovery may consider it a good opportunity to reshape the working environment.

A move to thin client computing would also imply that some functionality, such as touch screen access, may not work due to a lack of local processing power. Touch screen functionality may increasingly be incorporated into business operating systems and software as a means of improving the user interface.[52]

IT procurement stands on its head

"If you win the consumer, you will win the enterprise." DTT TMT predicts that 2010 will likely see many enterprise technology and telecommunications purchasing decisions based on the preferences of individual employees, rather than traditional IT department criteria.

In the past, technology and telecommunications hardware and software manufacturers targeted their latest products toward the enterprise market, and specifically the gate-keeping IT department. Enterprises tended to be early adopters, sophisticated users, and those willing to pay premium prices for premium products. A few years later, the solutions could be sold to the consumer market where typically less demanding users paid lower prices. The manufacturer made lower margins, but these were offset by larger volumes.

This traditional business model is now being reversed. Large chip companies are using their most advanced manufacturing techniques for devices aimed at the consumer, not the enterprise market.[53] What's more, new enterprise software applications for internal and external social networking were first implemented and validated by the consumer market.[54]

The first segments to experience this reversal of historic procurement processes have been computing and telecommunications devices, although traditional enterprise software applications are beginning to see some signs of employee push-back.[55]

Historically companies would support one, or perhaps two, standard desktop or laptop computers across the entire enterprise. They would almost always run a single version of a single operating system and browser across tens of thousands of workstations. The emerging pattern appears different. Some companies that used to limit their support to one type of PC or operating system are now responding to employee demands by supporting others.[56] Other IT departments are even more thoroughly disintermediating themselves from the PC-buying decision: they give employees the cash and allow them to choose the PC they want.[57]

Of course, enterprise IT departments are unlikely to do this simply because employees ask them to. Advances in various operating systems, application programming interfaces (APIs), administration tools, hardware, and virtualization mean that administering a heterogeneous corporate client environment in 2010 should not be the nightmare it might have been just a few years back.[58]

Even more of a bottom-up procurement trend is taking place in mobile telecom — especially smartphones. Total telecom costs are usually in the top three expense items in an enterprise, and the bulk of those costs are now mobile, as land line and long distance costs have fallen worldwide.[59] It has been standard practice for IT managers to control costs by standardizing on a single carrier and offering a very limited selection of devices that the firm will both support and pay for. Often these phones were not what the users would have chosen for themselves.

The traditional business model is now being reversed: Large chip companies are using their most advanced manufacturing techniques for devices aimed at the consumer, not the enterprise market.

One response to this was the rise of the "prosumer" market — enterprise employees who bought the phone themselves, but used it for both work and play. This is a large market, estimated at 14 million users in the United States alone, and growing.[60] Some leading smartphone manufacturers now get more than half of their total new subscribers from prosumer sales.[61] However, in the past, some enterprises did not allow prosumer phones to connect to the corporate IT network.

But many employees would prefer to have their smartphones better supported (and paid for) by their employers. Once again, evolutions in technology mean that devices that were formerly neither secure nor interoperable enough are now being allowed — if not always welcomed — into the enterprise IT world. Email, security, virtual private networks, and configuration management are all now likely to be supported to varying degrees.[62]

As a result, more and more enterprises are likely to allow employees to choose their own corporate phones, or at least allow prosumer-selected phones to integrate better with the enterprise networks.[63]

Of course, it isn't just PCs and smartphones. Employees are picking their own browsers,[64] insisting on the ability to use social media sites even while at work,[65] and even choosing their own voice communications solutions, including VoIP services.[66]

Bottom line

The most obvious probable effect of a more consumer-centric procurement process is to make the traditional sales approach of the enterprise hardware, software, and telecom vendors much more difficult — or different, at least. The classic enterprise sale was not without challenges, but they were known challenges, and sales techniques were designed to sell to monolithic buyers whose concerns were enterprise in scale. If consumers become the new chief procurement officers, enterprise-focused vendors will need to learn new skill sets.

It is also likely to shift the existing balance of power between incumbents and new entrants. A traditional tool has been the bundle: a vendor will agree to provide a key product at a good price, but only if the enterprise customer buys a specified number of the vendor's other products. Devices from competitors are prohibited, even if the enterprise's employees want them. This sort of tied selling may be less successful in the future, and therefore vendors will have to become more competitive and flexible.

IT departments may have to become more flexible as well. Although new technologies have made administering and provisioning heterogeneous IT environments easier, it is still more complex than a homogeneous workplace. Further, traditional IT best practices are likely to continue to be necessary. Even when the employee has picked the PC or smartphone, some of the information that resides on those devices still belongs to the enterprise and needs to be deleted if employment changes.[67]

Although being responsive to user preferences is a good thing and should make for happier employees, enterprise IT executives need to keep in mind the faddish nature of consumer sentiment. Workers may clamor for hot new devices, but there is a need for processes that reduce device and software proliferation and churn. Supporting too many choices becomes onerous to administer. Excessive churn can reduce productivity and escalate costs.

The future of many enterprise computing and telecom tools will likely be one where the line between work and personal lives is blurred. Some of that is at the request of the enterprise ("please be available 24/7") and some at the request of the employees ("OK — but please let me choose my smartphone").

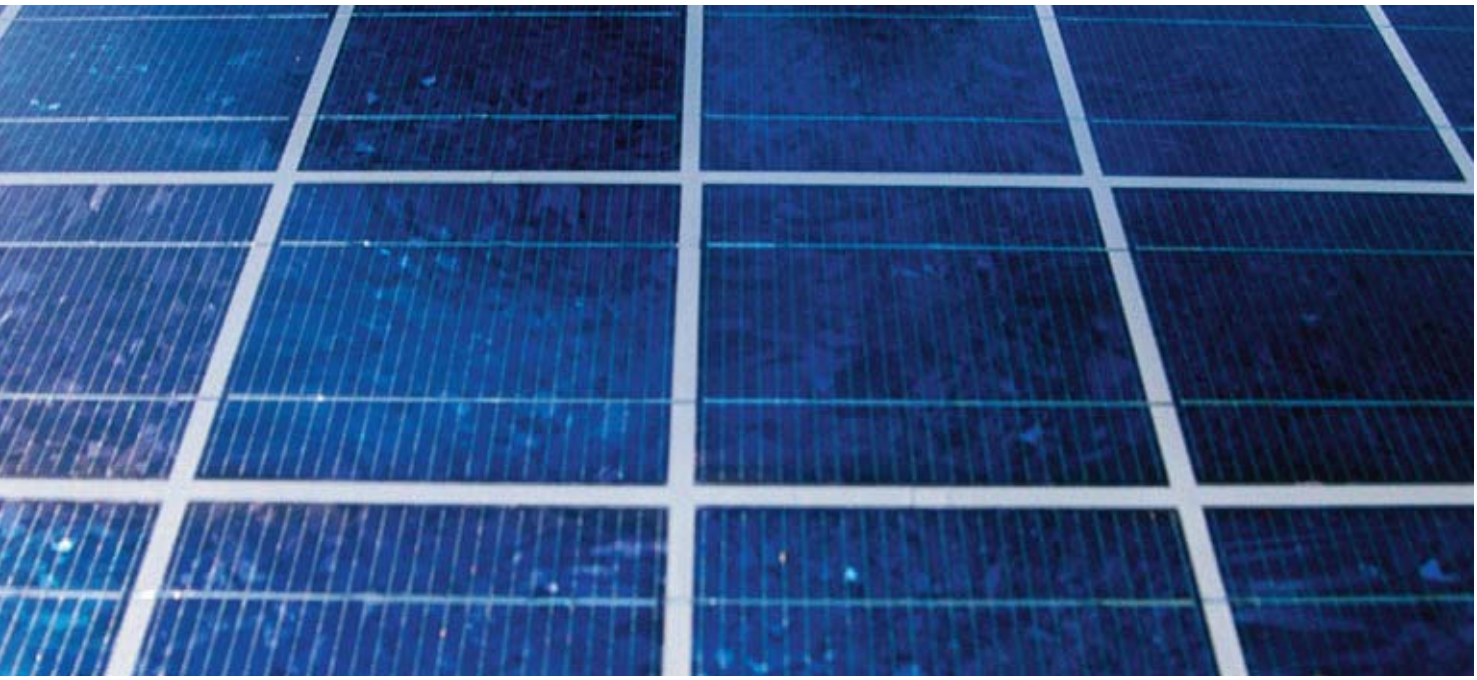
CleanTech makes a comeback. But solar stays in the shadows

DTT TMT predicts mixed performance for the CleanTech[68] sector in 2010. After a near-collapse in the stock market value of the entire industry during the recent economic crisis, government stimulus and investor interest have catalyzed a sharp recovery. However, not all areas are sharing equally in the bounty. The solar technology subsector will likely be outperformed by the broader CleanTech industry. Prices of solar equipment, tools, and raw materials will probably continue to be depressed due to global overcapacity and insufficient growth in demand.

Between its high point in June 2008 and its low in March 2009, the CleanTech Index dropped even more than broader markets, declining 61 percent versus the S&P 500's 49 percent and the NASDAQ's 46 percent dips. The recovery has shown the opposite pattern: to the end of November 2009, the S&P and NASDAQ were up 67 percent and 72 percent, respectively, and CleanTech was up 80 percent[69]. Consensus expectations are that this momentum will continue for the next year or two as tens of billions of dollars of government stimulus spending is targeted at environmental technologies that are less commoditized than more mature technology industries.[70] There are many who also anticipate an equally rapid recovery in solar stocks.[71]

We are by no means negative on the long-term prospects of solar power; however, unlike the rest of the CleanTech industry, the dominant solar technology — crystalline silicon photovoltaic (C-Si PV) — and its infrastructure currently face strong challenges that will likely limit its recovery in 2010 and 2011.

The first challenge is an unprecedented level of overcapacity in the history of silicon technology. Just prior to when the economic crisis began in late 2008, governments worldwide created a spike in demand for C-Si PV manufacturing capacity and installations. Global C-Si PV manufacturing capacity experienced material growth into 2008, with almost 12GW of annual global capacity, driving silicon and module prices up sharply. But although the economy and demand slowed (PV consumption of that capacity declined 15 percent in 2009), the capacity expansion continues unabated, largely in China and the United States. By the end of 2010, annual global capacity is expected to be 24GW, and although demand will grow, it will still only be about 6.2GW, meaning that utilization will be barely above 25 percent.[72]



Although there are significant differences between using silicon for integrated circuits and for C-Si PV, there are also enough similarities that the much longer history of the chip industry is likely to be at least partially relevant. Since data collection began in 1994, the global chip industry has never seen utilization drop below 56 percent.[73] Given the potentially unprecedented nature of the prospective 2010 PV overcapacity, three developments may be expected: low module prices, significant consolidation, and an unusually protracted recovery.

There are few signs of consolidation so far. In fact the opposite is occurring as various governments worldwide are targeting solar as a strategic industry. The result has been falling module prices (down 50 percent in 2009), rising inventories (up 64 percent to 120 days) and falling poly-silicon prices (down 72 percent year over year from $180/kg at the start of 2009).[74]

These falling prices are making C-Si PV solar more affordable, thereby stimulating demand. However, this is being partially offset by weaker energy prices, especially natural gas and electricity. Further, as governments worldwide committed to bailouts and stimulus packages aimed at job creation, their ability to provide solar subsidies decreased in some geographies.[75] A recent contentious study even argued that support for renewable energy did not create as many jobs as investing in other sectors of the economy.[76]

Although solar demand is likely to grow strongly in 2010 and 2011, some subsidy cuts and cheaper-than-expected electrical rates may prevent that growth from being as strong as some might hope. For at least the near term, the PV industry is likely to remain in overcapacity.

Bottom line

The most obvious short-term implication is that governments and industry should anticipate the looming overcapacity and slow down the construction of new PV silicon plants. Even in China — historically one of the most aggressive builders of PV capacity — recent announcements indicate that the government is restricting financing and withholding approvals of new solar plants.[77]

PV silicon and module manufacturers need to keep strong balance sheets and costs in line during the period of overcapacity. Sometimes closing entire plants may be necessary.[78] Many are experiencing negative gross margins, and those with inadequate cash balances are forced into dilutive equity and debt financings. Those further down the supply chain must also prepare for changing economics. Some of those selling raw materials to the PV industry are discovering that fixed volume contracts are being canceled or that reduced and guaranteed prices are being slashed.[79]

Competing solar technologies such as cadmium telluride (CdTe) thin film, copper indium gallium selenide (CIGS) thin film, amorphous silicon (a-Si) and solar thermal do not have the same overcapacity problems as C-Si PV. However, the entire solar industry forms a closed ecosystem, and the economic pressures that C-Si PV is experiencing are having a serious effect on competing technologies and companies, which need to worry about cost control, reducing output, and securing long-term contracts.[80]

Semiconductor equipment companies that have so far mitigated the effect of the recession by selling to the solar industry may need to brace themselves. Although sales to C-Si PV plants under construction have generated significant sales in recent months, any freeze on construction in 2010 would likely cause equipment sales to slow markedly. Semiconductor equipment has historically been a highly cyclical business, and it was expected that solar would provide a secular growth market. However, the short-term oversupply and likely freeze in new plant construction suggest that PV solar may not be as robust as hoped for several years ago.[81]

Consumers and utilities, on the other hand, are poised to benefit. Although paybacks continue to depend on geography, local electricity rates, subsidies, tax breaks, and feed-in tariffs, the significant drop in PV silicon prices (and follow-on pricing drops in competing technologies) will likely make solar more affordable than during the high-price bubble of 2007 and 2008. As a result, those with longer-term investment horizons will be able to have their day in the sun.

From gray to green: technology reinvents cement

Throughout 2010, technology's contribution to carbon dioxide (CO_2) reduction is likely to include initiatives such as electric cars, more efficient airplanes, and leaner data centers — all virtuous. Yet there is another, largely overlooked industrial segment that may deliver an equally meritorious benefit: cement.

Advances in technology may soon lead to the world's first carbon-negative cement plant[82] that could, in the medium term, deliver a significant (at least 5 percent) reduction in global CO_2 emissions.

Reinventing cement matters given the industry's status as one of the largest single contributors to CO_2 emissions. Cement represents about 5 percent of global emissions — even greater than that of the aviation sector. The culprit is calcination, the process used to manufacture most of the world's cement.
This entails baking limestone at up to 1,500°C.[83] Heating the limestone requires carbon-emitting fuel. Afterwards a further wave of CO_2 is released as the limestone burns. Roughly 900 kg of CO_2 is generated per ton of cement manufactured,[84] some of which is then reabsorbed as the cement dries.[85]

In 2010, worldwide demand for cement is expected to be at least two billion tons; China alone is expected to construct one billion square meters of new buildings.[86] Global forecast demand for cement in 2020 is three billion tons[87], that is about 2.7 trillion kg in emissions from production. Plus, by 2020, carbon trading programs are likely to have been introduced. As a result, the price of carbon credits could double the effective price of cement, which is essential to economic growth. The technology sector's challenge is to enable economic progress without a commensurate rise in carbon footprint.

There have been several attempts at engineering lower carbon cements, most commonly by combining traditional Portland cement with a variety of industrial by-products, such as power-station fly ash.[88] In some regions agricultural by-products, such as rice and sugar cane husk, have also been used.[89] Yet another approach is based on alkali activation of fly ash or other volcanic ash, creating a material that can be used as a substitute for traditional cements.

These products have most of the properties of traditional cement, but with a lower carbon footprint.[90] Emissions from production of these cements are claimed to be considerably lower than emissions associated with the manufacture of traditional cement.[91] A few of the world's recent landmark constructions have been built on low-carbon cements.[92]

In 2010, output of low-carbon cements should grow and exceed two million tons, or about 0.1 percent of total cement production in 2010.[93] But the supply of these blended cements may be limited by the availability of sufficient by-product.

Another limitation of blended cement is its CO_2 absorption capability, which is considered inferior to that of Portland cement. Traditional cement when in the form of exposed cement blocks absorbs up to 0.51 tons of CO_2 for every ton manufactured. [94] Blended cement, based on 25 percent fly ash, absorbs just 0.38 tons.[95] The delta in net emissions, adding production emissions and subtracting absorption, is about 0.13 tons.[96]

The challenge is to design a cement that generates zero CO_2 in production, emulates Portland cement's CO_2 absorption, and is available in sufficient quantities to satisfy global demand.

Cement represents about five percent of global emissions — even greater than that of the aviation sector. The culprit is calcination, the process used to manufacture most of the world's cement.

One possible solution is based on the combination of magnesium silicates and special carbonates. In 2010, a test plant for cement based on these materials will be built.[97] Supply should not be a problem as there are an estimated 10 trillion tons of reserves of magnesium silicate. The carbonate, hydrated magnesium carbonate, is a by-product from the processing of magnesium silicate. The latter is heated to create magnesium oxide (MgO). The use of magnesium silicates eliminates CO_2 emissions from raw materials processing; the special carbonates are carbon negative. The magnesium silicate needs to be heated to 650°C (rather than 1,500°C for traditional cement). This means that biomass fuel can be used whereas traditional cement requires more calorific fuels.

This new cement's ability to absorb CO_2 varies according to the ratio of carbonates to magnesium oxide (the material extracted from the magnesium silicate) used. Assuming 25 percent carbonates, final emissions are estimated at -0.06 tons of CO_2 absorbed per ton of cement created. If biomass is used, emissions drop to -0.27 tons of CO_2 per ton manufactured.

The annual emissions dividend in 2020 could be net absorption of 330 million tons of CO_2 in the manufacturing process alone, and a net reduction of over three billion tons relative to using Portland cement.

Bottom line

The potential benefits of carbon-negative cement are enormous, but they are likely to be realized over a five- to 10-year period. It may be a while before the world's skyscrapers are constructed of carbon-negative cement. Sidewalks and driveways are more likely to be the first carbon-negative constructions.

A major factor shaping the economics of carbon-negative cement is likely to be the additional benefit in the form of carbon credits. As companies start to pay for every ton of CO_2 emitted, the financial benefits of carbon-negative cement multiply.[98]

The low-carbon to carbon-negative cement sector should also consider other ways in which their products can reduce overall emissions. For example, white cements are better able to keep buildings cool by repelling heat.[99] Some varieties of low-carbon cement could even be engineered to be more durable than traditional cement.[100]

The business case for low-carbon or carbon-negative cement should not assume it will be more expensive than traditional cement.[101] In fact, the opposite may be true. A ton of raw material may generate a greater quantity of cement due to the volume of CO_2 absorbed in the production process.

The business model for reinvented cement should also consider the value of some of the manufacturing process by-products, some of which could be used in the glass, ceramic, or cement industries.[102]

A building material may seem too basic to merit inclusion in a document devoted to making predictions about technology. But advances in technology are not limited to faster lasers, smaller chips, and flying robots.[103] One of its biggest responsibilities is to address the myriad issues the world faces, which is why in previous years we have covered issues such as water scarcity, plastic, nanomaterials, and genetically modified foods. In 2010, debates over global warming are likely to continue over its scale and timing, but the technology sector will continue to be viewed as part of the solution.

Notes

The end notes consist mostly of the principal secondary sources used (published articles, press releases, vendor websites, and videos). We have provided a compact URL for all sources that are available via the Web. Some of the sources referenced may require a subscription to view. Additional sources of information referenced in the end notes include discussions with vendors, industry analysts, financial analysts, and other subject matter experts undertaken specifically as input to this report. The end notes also include further background on some of the points made in the main body of the text.

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