

# Global Leadership & Technology Exchange



**11–12 November 2010**  
**Shanghai, China**



“On behalf of the GLTE Low-Carbon Leadership Board, I would like to thank Siemens – and Wolfgang Dehen especially – for serving as the host for this milestone of an exchange. The Shanghai GLTE marked GLTE’s first visit to this remarkable country, and Siemens’s long experience here, coupled with its leadership in low-carbon innovation, made them the ideal host”

Dr Osvald Bjelland, Chairman, Xyntéo

International advisory firm Xyntéo founded GLTE in 2007. Xyntéo runs the exchange programme and facilitates low-carbon collaborations among the partners. Xyntéo alone is responsible for this document and any errors it contains.

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## About the Global Leadership & Technology Exchange

The Global Leadership & Technology Exchange (GLTE), founded by international strategic advisory firm Xyntéo, aims to provide senior business leaders with knowledge, networks and tools they need to exploit the opportunities generated by the shift to a low-carbon economy.

At the heart of GLTE is a belief in the unique power of collaboration – across value chains, across borders – to equip business leaders to achieve low-carbon growth. For many companies, carbon is “elsewhere” – that is, it originates not from within their own four walls but from somewhere else along the value chain. Only collaboration can root out these inefficiencies to capture value.

Also, carbon is so tightly wound into economic and commercial activity that extricating it is a titanic challenge calling for the pooling of resources and ingenuity on a massive scale. Our partners work together practically to develop innovative collaborative solutions that are beyond the scope, scale or capabilities of any one organisation.

GLTE partners span three continents and a range of sectors and industries, from oil and gas, energy and utilities to transportation, finance, risk management, consumer goods and information technology. Current GLTE partners are: Det Norske Veritas, Deutsche Bank, Electric Power Research Institute, Gazprom, Hess Corporation, PG&E Corporation, Siemens, Shell, Statoil, Subsea 7, Tata Consultancy Services, Tata Sons, Unilever and Wilh. Wilhelmsen.

## About the Shanghai exchange

Twice a year the companies that make up the Global Leadership & Technology Exchange meet to share knowledge of low-carbon innovation and explore collaborative opportunities to pursue low-carbon growth. On 11-12 November 2010 senior representatives of the partners convened in Shanghai, China. The meeting was hosted by Siemens.

At the Shanghai GLTE, we focused on China’s role in shaping the low-carbon world through both its geopolitical engagement and its growing contribution to driving low-carbon innovation. Drawing on Siemens’s widespread experience and expertise along the entire energy conversion chain, we devoted a substantial part of the programme to the “new electricity age” and to the role of electricity from alternative sources in building a secure and sustainable energy system. We also looked at how we need to change the way we plan and arrange our cities in order to meet the challenges of urbanisation and climate change.

After kicking off with an edited version of the speech by Victor Gao, one of the exchange’s stand-out speakers, this document goes on to take stock of China’s growing leadership in low-carbon innovation and then considers electricity’s potential to unlock a low-carbon world. The text is embedded with photos and memorable quotes from participants and speakers.



# Understanding China

## Eight ways to see the world's most talked about country in a clearer light

*In the 1980s Victor Gao served as English interpreter to Deng Xiaoping, China's late paramount leader. Today he is a Director of the China National Association of International Studies and Executive Director and Chairman of the International Committee of the Beijing Private Equity Association.*

*Dr Gao was an opening guest speaker at the Siemens-hosted Global Leadership & Technology Exchange in Shanghai on 11-12 November 2010. This is his speech, edited slightly for print.*

“There’s a real concern as to whether China and the US will have the wisdom, vision and courage to break the curse of history”



Over the past five or six years, China's economy has overtaken those of Italy, France, the UK, Germany and Japan; today it is the world's second-largest. The speed and magnitude of this transformation have absolutely no precedent in modern history. But there are no fanfares or street celebrations going on here in China. This is because China is intently focused on clearing the next hurdle – the likelihood that its economy will overtake that of the US at some point over the next two decades.

What will be China's biggest challenge over the coming two decades? I predict that it will not be an economic challenge; nor will it be financial. I predict it will be geopolitical. I believe the US has yet to come to terms with China's rise and its

eventual supersession of the US. There's a real concern as to whether China and the US will have the wisdom, vision and courage to break the curse of history – namely the disruption that has traditionally accompanied the transfer of global hegemony from one country to another. Managing this transition peacefully will require extreme care and a heightened understanding of the US on the one hand and China on the other.

But understanding China – this is a very difficult task. How can one begin to break down and absorb such a complex country? Here are eight points I often use to stimulate thought and dialogue on this issue.

- 1** First, understanding China is an interactive exercise. It is not one-way traffic, but a give-and-take of understanding and being understood, an exchange in which you gain an understanding of China while China gains an understanding of you.
- 2** Second, understanding China is really a matter of “seeing is believing”. From Western media reports one cannot possibly form an accurate picture of reality here in China. Come here yourself! See China, touch it, hold it in your hand, smell it, taste it, embrace it, try it – then you will draw your own conclusions as to what exactly China is.
- 3** Third, understanding China requires an appreciation of history. I find it amazing that I feel bound to remind you that Marxism is not a Chinese invention, but rather a German one. Socialism is not a Chinese invention; it's decidedly European in provenance. China's modern-day political party system is not a Chinese invention: the Chinese Communist Party adopted its model from abroad. Many of the things that you think characterise China are actually imported from elsewhere – a feature of China's rollercoaster ride of learning from Europe and America since the first Opium War.
- 4** Fourth, in trying to understand China, we should remind ourselves that beauty, or the lack thereof, is in the eyes of the beholder. If you see something you think you like in China or something you think you don't like in China, this may actually have nothing to do with China – sometimes this is a product of the values that you bring to the table. Because China is so different from the rest of the world and because it will remain very, very different for centuries to come, “getting China” requires an emancipation of the mind.
- 5** Fifth, understanding China is a process and not an end – a continuous film rather than a static snapshot. The latter will always feature flaws and thus merit criticism. But if you view modern China as a motion picture rolling from 32 years ago up to today and beyond into the future, then I think you will like what you see. The progress will become visible over time. You will see imperfections too, of course, but give us some time, give us some patience, and we will be able to sort these out too.
- 6** Sixth, understanding China means avoiding the folly of thinking that there is only one China. In terms of sovereignty and territorial integrity, of course, there is only one China. But compare rural China to urban China and modern China to historical China; observe the differences between coastal China versus the central and border regions of China; consider the Han-Chinese-China versus the minority-Chinese-China. From this diversity and complexity it is obvious that there are in fact multiple Chinas.

“Many of the things that you think characterise China are actually imported from elsewhere – a feature of China's rollercoaster ride of learning from Europe and America since the first Opium War”

“If you view modern China as a motion picture rolling from 32 years ago up to today and beyond into the future, then I think you will like what you see”

Did you know that China's population is greater than the total population of all the OECD countries combined? Can you believe that? China as a land mass is about three times bigger than India. If you think there is only one China, and you treat it simplistically, your quest to understand the country will most likely fail.

- 7 Seventh, understanding China calls for a mental accommodation of the scale and pace of change it is undergoing. It is very rare for any country – going right back to the beginning of the Industrial Revolution – to experience industrialisation, modernisation, urbanisation and globalisation at virtually the same time. The transformations we are witnessing in China are happening so fast that they are happening almost simultaneously. And we have not seen the end of these changes.



8 Eighth, understanding China can be highly rewarding. Recent Chinese-French relations provide a telling illustration. French President Nicholas Sarkozy and Chinese President Hu Jintao just signed a \$20 billion trade deal, highlighting the wisdom of leaders who think outside the box and focus on the things that matter – creating jobs, for example. Western leaders who act on a true understanding of China will reap benefits – in turn so will China.

Don't forget that "China" has another meaning – porcelain, which was of course pioneered by the Chinese. Elegant and delicate, it is also remarkably hard and strong. It can exist forever for you to admire and adore. However, china is also fragile and brittle. If you do not handle it with care, it could shatter; you could get cut.

The same could be said of the country. In trying to gain an understanding of China, remember to handle China with care. If you don't, it could become burdensome to carry around. But if you do, China will be there for you to admire and benefit from, spiritually as well as materially, for decades to come.

Indeed I believe that the world will benefit from China in at least two ways in coming years. The first is that China will, I believe, become increasingly important as a champion of free trade. With total imports and exports making up 60-65% of GDP, China cannot afford to allow protectionism to rear its ugly head. The second way I predict China will benefit the world will be by spearheading green development and green technology. A more sustainable, inclusive development, underpinned by a more harmonious relationship between man and nature, is a necessity for China. There is no other choice; there is no other way.

I had the great honour of working as Deng Xiaoping's English interpreter in the 1980s. In my briefing for this speech, I was asked what the great leader would have said to us if he could have been here. He once told us to forget about political arguments and to recognise that "development is the hard truth". I think that, now, he would have told us that "*green* development is the hard truth" – the smart truth.

The original development model in China may no longer be sustainable: we are too reliant on resources and our energy efficiency is relatively low. Without being pushed, China needs to come up with a new growth model based on much higher energy efficiency and much lower levels of carbon emissions. The reasons for making this leap are many and compelling. We need to build a new paradigm for change.

A recent conversation I had with BYD Chairman Wang Chuanfu suggests that China is moving in the right direction. When I asked him how his K9 all-electric e-bus was doing, he replied that everything was going very well. The Chinese government – both the central government and around two dozen municipal governments – had bought around a thousand buses for each of about 24 cities. However, Chairman Wang also pointed out the bus would not yet make a profit – it is not yet economical. That is why government backing is so crucial. If you cannot line up a tremendous amount of government support, it's not going to pan out. This is a major stumbling block around the world. But in China we will most likely find the magic to make it work.

The Chinese may not be very eloquent in saying what they think, but they can be extremely effective in doing what they want to do. The e-bus is just one of many testaments to China's determination and ability to go greener in the coming decades. They can help you gain a better understanding of what this country really is about.

"A more sustainable, inclusive development, underpinned by a more harmonious relationship between man and nature, is a necessity for China. There is no other choice; there is no other way"

"The Chinese may not be very eloquent in saying what they think, but they can be extremely effective in doing what they want to do"



# From Copenhagen and Cancún to Beijing

## In the bid to create a low-carbon economy, actions speak louder than words

“If Copenhagen was the Great Dane that whimpered, Cancún was the Chihuahua that roared” – an inventive analogy, from the BBC’s environment correspondent, to compare how the two latest UN climate conferences measured up against pre-meeting hopes.<sup>1</sup> While Copenhagen fell short of its promises, the before and after pictures of Cancún show the reverse pattern. Expectations in the run-up to the Mexican summit, dragged nearly to rock bottom by the anticlimax of Copenhagen, were surprisingly overshot, and Cancún was pronounced a success – of sorts.

And the Cancún meeting did make some laudable progress. A Green Climate Fund was established, tasked with raising and disbursing \$100 billion per year by 2020 to help poor countries adapt to climate impacts and pursue low-carbon development. The bid to halt deforestation (the source of nearly 20% of global emissions<sup>2</sup>) was also given a boost: delegates agreed the conditions under which countries would



“We don’t necessarily need a global agreement; we need action”

Dr Fan Gang, Director, China National Economic Research Institute

<sup>1</sup> “Cancún: the chihuahua that roared”, blog by BBC environment correspondent Richard Black, 11 December 2010: [www.bbc.co.uk/blogs/thereporters/richardblack/2010/12/cancun\\_the\\_chihuahua\\_that\\_roar.html](http://www.bbc.co.uk/blogs/thereporters/richardblack/2010/12/cancun_the_chihuahua_that_roar.html)

<sup>2</sup> Estimate by UN-REDD: [www.un-redd.org](http://www.un-redd.org)

“Much can be done without a global agreement, but the free rider dilemma means that an international pact is still very important”

Dr Michael von Saldern, Head of Strategy, Siemens Energy Sector

be rewarded for preventing damage to their forests. With these outcomes, Cancún yanked the UN-led negotiations back on track just in time, avoiding the plunge to irrelevance many had feared.<sup>3</sup>

Significant though the above measures are, they deliver more bark than bite. Pledges do not equal action. Ultimately, Cancún will not achieve the cuts in emissions that scientists agree are necessary to stave off dangerous warming. The underlying market failure remains uncorrected: emitting greenhouse gases remains either too cheap or free. The crux of the problem – our prevailing economic model’s carbon habit – remains in place.

Fortunately, removing gigatonnes from the atmosphere is not entirely dependent on global summiteering. Countries are already acting on their own, wielding a range of fiscal and policy instruments to improve the carbon performance of their economies. In turn, their businesses are moving, prompted not just by taxes and obligatory standards but also by an appreciation of the commercial opportunities of the low-carbon economy.



Michael von Saldern,  
Siemens Energy Sector



Wolfgang Dehen,  
Siemens Energy Sector

“In order to fight the devil you have to give him a name. We need a carbon price”

Dr Michael von Saldern, Head of Strategy, Siemens Energy Sector

## Getting on with the job

From Brazil’s announcement that it has slowed deforestation over the last decade by more than 70%<sup>4</sup> to India’s levy on coal producers to create a fund for clean energy projects,<sup>5</sup> we see that some of the world’s most vigorous economies are confronting the carbon challenge in highly practical ways – proving that global agreement is not a make-or-break precondition of progress and suggesting that the link between economic growth and greenhouse gas emissions can be loosened.

China, too, has shown a striking eagerness to take aggressive measures against its carbon emissions. This attitude is being driven from the top. In October 2007, President Hu Jintao exhorted the Communist party to “adopt an enlightened approach to development that results in expanded production, a better life and sound ecological and environmental conditions, and build a resource-conserving and environment-friendly society that coordinates growth rate with economic structure, quality and efficiency”.<sup>6</sup>

<sup>3</sup> “A sort of progress”, *The Economist*, 18 December 2010

<sup>4</sup> Statement of the Brazilian Environment Minister, Izabella Teixeira, to the General Debate of COP 16, website of the Republic of Brazil, 9 December 2010: [www.brasil.gov.br/news/history/2010/12/09/statement-of-ms-izabella-teixeira-minister-of-environment-of-brazil-to-the-general-debate-of-cop-16/newsitem\\_view?set\\_language=en](http://www.brasil.gov.br/news/history/2010/12/09/statement-of-ms-izabella-teixeira-minister-of-environment-of-brazil-to-the-general-debate-of-cop-16/newsitem_view?set_language=en)

<sup>5</sup> “India may raise \$535 million from coal tax meant to encourage alternatives”, Bloomberg, 1 July 2010: [www.bloomberg.com/news/2010-07-01/india-to-raise-535-million-from-tax-on-coal-output-this-year-ramesh-says.html](http://www.bloomberg.com/news/2010-07-01/india-to-raise-535-million-from-tax-on-coal-output-this-year-ramesh-says.html)

<sup>6</sup> President Hu Jintao’s report to the 17<sup>th</sup> National Congress of the Communist Party of China: [www.china.org.cn/english/congress/229611.htm](http://www.china.org.cn/english/congress/229611.htm)

China's leadership recognised early on that its economic model needed a course adjustment. The 11<sup>th</sup> Five-Year Plan – formulated in 2004, three years before the IPCC issued its landmark report on human-induced climate change – sought to redirect China's development towards a more resource-lean, energy-efficient model.

The plan – which covers the period 2006-10 – announced that China would cut its energy intensity by 20%.<sup>7</sup> During the first three years of the plan, as GDP soared by over 10% per year,<sup>8</sup> the amount of energy used per unit of GDP was reduced by more than 10%, saving 290 million tonnes of coal-equivalent and 750 million tonnes of CO<sub>2</sub>-equivalent.<sup>9</sup>



Gao Jifan (left) and Lord Oxburgh of Liverpool (right)

According to the Worldwatch Institute, “This pace of energy conservation has rarely been achieved by the rest of the world”.<sup>10</sup> This trend is set to continue: in December 2009 China announced it would, by 2020, reduce its carbon intensity by 40-45% relative to 2005 levels.<sup>11</sup> The 12<sup>th</sup> Five-Year Plan, to be approved in March, is expected to continue the Chinese push to build a lower-carbon growth model.

## Widening cleaner energy options

In 2000 China's energy demand was half that of the US; today it is likely the world's biggest energy consumer.<sup>12</sup> Demand continues to surge, propelled by the government's energetic infrastructural investment. By 2035, predicts the International Energy Agency (IEA), Chinese energy demand will increase by 75% over 2008 levels.<sup>13</sup>

China has limited attractive supply options with which to quench this thirst. Coal accounts for 70% of total energy use.<sup>14</sup> Next up in the Chinese energy mix is oil, more than half of which is imported.<sup>15</sup> Finding ways of heightening energy security while building a cleaner energy supply has become a strategic priority for the government. Hence the country's remarkable sprint to develop renewable energy technology, its increasing use of natural gas and its concerted efforts to wean its energy-hungry transportation sector off fossil fuels.

## A pace-setter in renewables

By 2020, 15% of China's final energy consumption will come from non-fossil sources. This is the target – and given past performance it is hard to doubt that it will be met. In 2008, the share of renewables in China's primary energy mix reached 10% – two years before the 2010 deadline.<sup>16</sup>

“Even if you forget about climate change and pollution for a minute, improved efficiency remains essential for China's development. China cannot reach the next round of growth without radically scaling up efficiency”

Dr Fan Gang, Director, China National Economic Research Institute

<sup>7</sup> “Energy consumption growth may slow down in H2”, China Daily, 15 July 2010: [www.chinadaily.com.cn/business/2010-07/15/content\\_10110303.htm](http://www.chinadaily.com.cn/business/2010-07/15/content_10110303.htm)

<sup>8</sup> Compiled from the following Chinese news agency reports: [http://news.xinhuanet.com/english/2009-01/22/content\\_10700833.htm](http://news.xinhuanet.com/english/2009-01/22/content_10700833.htm); [http://news.xinhuanet.com/english/2008-01/24/content\\_7485388.htm](http://news.xinhuanet.com/english/2008-01/24/content_7485388.htm); and [www.chinadaily.com.cn/china/2007-01/26/content\\_793128.htm](http://www.chinadaily.com.cn/china/2007-01/26/content_793128.htm)

<sup>9</sup> Compared to business-as-usual emissions. Xie Zhenhua, “To Implement the Scientific Concept of Development and Accelerate the Building of Resource-Saving and Environment-Friendly Society,” *Macroeconomic Management*, No. 5 (2009), cited in “Renewable Energy and Energy Efficiency in China: Current Status and Prospects for 2020”, Worldwatch Institute, October 2010, p.15

<sup>10</sup> “Renewable Energy and Energy Efficiency in China: Current Status and Prospects for 2020”, Worldwatch Institute, October 2010, p.5

<sup>11</sup> “Analysts' View: China announces CO<sub>2</sub> intensity target for 2020”, Reuters, 26 November 2009: [www.reuters.com/article/2009/11/26/us-climate-china-view-idUSTRE5AP14D20091126](http://www.reuters.com/article/2009/11/26/us-climate-china-view-idUSTRE5AP14D20091126)

<sup>12</sup> *World Energy Outlook 2010*, International Energy Agency, Paris: OECD/ IEA, 2010, p.77

<sup>13</sup> *World Energy Outlook 2010*, IEA, p.85

<sup>14</sup> Profile on China, US Energy Information Administration website: [www.eia.doe.gov/emeu/cabs/China/Background.html](http://www.eia.doe.gov/emeu/cabs/China/Background.html)

<sup>15</sup> Cui, Minxuan et al., *Annual Report on China's Energy Development 2009*, Beijing: Social Science Academic Press, May 2009, cited in “Renewable Energy and Energy Efficiency in China: Current Status and Prospects for 2020”, Worldwatch Institute, October 2010, p.8

<sup>16</sup> All facts and figures in this paragraph are taken from *Renewables 2010 Global Status Report*, REN21, 2010, p. 35: [www.ren21.net/Portals/97/documents/GSR/REN21\\_GSR\\_2010\\_full\\_revised%20Sept2010.pdf](http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sept2010.pdf)

“The renewables business model today is based on incentives. Success will mean that renewables become cost-competitive with coal and independent from incentives”

Jean-Christoph Heyne, Head of Business Development, Renewable Energy Division, Siemens Energy Sector



China’s energy ambitions are being followed up vigorously, producing dramatic results:<sup>17</sup>

- In 2009, China added more renewable energy capacity than any other country, accounting for 37 of the 80 gigawatts added worldwide.
- In 2004, China accounted for just 2% of the new wind power capacity added in the world that year. This share has since risen to nearly half,<sup>18</sup> and the country is now the leading market for wind.
- Between 2004 and 2009, China nearly doubled its hydropower capacity to 197 gigawatts.
- By the end of 2008, China was home to more than 70% of the world’s 149 gigawatts-thermal of installed solar hot water/heating capacity.

While other countries have been struggling to pay the bills, China has been ploughing money into development of renewable energy. In 2009, China, together with Germany, led the world in investment in “new renewables” (small hydro,

<sup>17</sup> Unless otherwise indicated the figures in the following four-point list are taken from: *Renewables 2010 Global Status Report*, REN21, pp.10, 21, 21, 56

<sup>18</sup> *Global Wind Statistics 2010*, Global Wind Energy Council, 2 February 2011, p.2: [www.gwec.net/fileadmin/documents/Publications/GWEC\\_PRstats\\_02-02-2011\\_final.pdf](http://www.gwec.net/fileadmin/documents/Publications/GWEC_PRstats_02-02-2011_final.pdf)



Xu Jianguo, Chairman and CEO, Shanghai Electric Group

modern biomass, wind, solar, geothermal and biofuels).<sup>19</sup> With this kind of backing, Chinese companies are capturing more and more of the world's clean energy technology markets, and China has become a global leader in the production of compact fluorescent light bulbs, solar water heaters, solar PV cells and wind turbines.<sup>20</sup>

The growing strength of Chinese producers has raised hackles in competitor countries, where some judge Beijing's robust backing to be unfair.<sup>21</sup> But the reality is that as China's efforts in renewables race along, the country will do the world a notable service by driving volumes up and prices down, making renewables more competitive and widening cleaner energy options for all.

China's race to develop renewable energy technology may, however, be outpacing its ability to make use of it. At the end of 2010 China's total installed wind capacity edged past that of the US to become the world's highest – at 41.8 gigawatts. Yet, reportedly, only a little over half was connected to the grid by the close of August. Many turbines are consequently standing idle, and some wind farms are working far below capacity because local grids are struggling to cope with the rising number of intermittent energy sources.<sup>22</sup>

### **Higher hopes for natural gas**

Representing just 1.3% of global conventional reserves, China's domestic natural gas supply is relatively low.<sup>23</sup> Demand, too, is comparatively modest: 89 billion cubic metres are consumed each year,<sup>24</sup> accounting for just 4% of China's primary energy supply.<sup>25</sup>

“Each renewable energy source has its advantages and disadvantages. We need to match up the right technology to the right place, and we need to draw on integrated energy solutions to use the strength of one technology to offset the weakness of another”

Jean-Christoph Heyne, Head of Business Development, Renewable Energy Division, Siemens Energy Sector

<sup>19</sup> As above, p.27

<sup>20</sup> “Renewable Energy and Energy Efficiency in China: Current Status and Prospects for 2020”, Worldwatch Institute, October 2010, p.7

<sup>21</sup> See, for example, “United Steelworkers challenge China over renewable energy jobs”, 14 September 2010: [www.energyboom.com/emerging/united-steelworkers-challenge-china-over-renewable-energy-jobs](http://www.energyboom.com/emerging/united-steelworkers-challenge-china-over-renewable-energy-jobs)

<sup>22</sup> “China has highest wind power capacity: report”, Reuters, 13 January 2011:

[www.reuters.com/article/2011/01/13/us-china-power-wind-idUSTRE70C1FA20110113?feedType=RSS&feedName=environmentNews](http://www.reuters.com/article/2011/01/13/us-china-power-wind-idUSTRE70C1FA20110113?feedType=RSS&feedName=environmentNews)

<sup>23</sup> BP Statistical Review of World Energy, June 2010, p. 22: <http://bp.com/statisticalreview>

<sup>24</sup> As above, p.27

<sup>25</sup> 89 billion cubic metres is the equivalent of 80.1 million tonnes of oil equivalent (Mtoe). This represents 4% of China's total primary energy supply in 2007: 1,994 Mtoe. Primary energy supply figures taken from *Energy Technology Perspectives*, International Energy Agency, Paris: OECD/IEA, 2010, p.382



“There are enormous shale deposits in China and the government has set ambitious targets. By 2020, 8-12% of China’s natural gas supply will come from shale”

Jens-Petter Kvarstein, Vice President, Technology, Statoil China

This is all about to change. By 2020 the Chinese government aims to increase to 10% natural gas’s share of primary energy demand<sup>26</sup>; to get there, the country is reportedly aiming to more than double natural gas consumption by 2015.<sup>27</sup>

The shale-induced natural gas renaissance that has rewritten the energy landscape in the US has yet to hit China. Since exploration is still in the early stages, it is difficult to land on any number with certainty, but according to some estimates, unconventional reserves could give China as much as a hundred years of supply based on 2020 demand.<sup>28</sup> So further drilling could reveal a completely new energy picture in China.

Indeed, foreign companies are already venturing into Chinese shales and tight gas. And as China’s national oil companies step up their unconventional gas activities, they are likely to seek out more partnerships. In November 2009, for instance, the White House announced a US-China shale gas initiative, which exchanges American knowledge for investment opportunities.<sup>29</sup>

### **Greener mobility**

China is home to the world’s biggest market for new auto sales. As of August 2009, China’s vehicles numbered 180 million; each month this enormous fleet adds another million to its ranks.<sup>30</sup> Energised by a scarcity of secure oil and a billowing

<sup>26</sup> Higashi, N., “Natural Gas in China – market evolution and strategy”, International Energy Agency, Paris: OECD/IEA, 2009, p. 4: [www.iea.org/publications/free\\_new\\_Desc.asp?PUBS\\_ID=2106](http://www.iea.org/publications/free_new_Desc.asp?PUBS_ID=2106)

<sup>27</sup> “China aiming to more than double natural gas use, Securities News reports”, Bloomberg, 21 January 2011: [www.bloomberg.com/news/2011-01-21/china-aiming-to-more-than-double-natural-gas-use-securities-news-reports.html](http://www.bloomberg.com/news/2011-01-21/china-aiming-to-more-than-double-natural-gas-use-securities-news-reports.html)

<sup>28</sup> “Unconventional gas may supply China for decades”, Bloomberg, 25 November 2009: [www.bloomberg.com/apps/news?pid=newsarchive&sid=aHG7Kj0YsqFY](http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aHG7Kj0YsqFY)

<sup>29</sup> See “Statement on US-China Shale Gas Resource Initiative”, US government website, 17 November 2009: [www.america.gov/st/texttrans-english/2009/November/20091117145333xjsnommis0.4233515.html](http://www.america.gov/st/texttrans-english/2009/November/20091117145333xjsnommis0.4233515.html)

<sup>30</sup> “Renewable Energy and Energy Efficiency in China: Current Status and Prospects for 2020”, Worldwatch Institute, October 2010, p.9

pollution problem, Beijing is forcefully reshaping the Chinese auto landscape, trimming it of carbon emissions.

Here are some illustrations of the changes underway:

- The government has proclaimed that 5 million electric-powered cars will be on the road by 2020 – up from virtually none today. This will represent 35% of the global market.<sup>31</sup>
- According to a survey by Ernst & Young, 60% of Chinese show a strong interest in purchasing an electrical vehicle – nearly five times the number in the US, the UK, Germany and Japan.<sup>32</sup> This would curb use of both conventionally-powered cars and airplanes.
- The government hopes to make a world leader of its electric vehicle industry. One Chinese pioneer – BYD – recently launched an all-electric bus. The K9, which also features a roof-top solar system, runs emissions-free. BYD says the e-bus can reach speeds of 43 miles per hour and can travel 190 miles on a single electric charge without a solar contribution.<sup>33</sup>
- China claims it has achieved 40 years of high-speed railway development in just five years. There are now plans for further lines to connect all Chinese cities with 500,000 plus residents, with a view to providing high-speed rail access to 90% of the Chinese population.<sup>34</sup>
- A ban on gasoline-powered motorbikes in several urban areas of China lifted the sales of electric bicycles from just 40,000 in 1998 to 21 million in 2008.<sup>35</sup>

“If business could simply set payback periods of eight rather than five years, it would open up so many amazing new opportunities”

Thomas Bergmark, Senior Advisor, Xyntéo



<sup>31</sup> “China charges into electric cars”, Fortune website, 19 October 2010: <http://tech.fortune.cnn.com/2010/10/19/china-charges-into-electric-cars/>

<sup>32</sup> As above

<sup>33</sup> “BYD introduces all-electric bus and signs agreement with Hunan Province for 1000 K9 e-buses”, BYD website, 30 September 2010: [www.byd.com/buzz/company-news/byd-introduces-allelectric-bus-and-signs-agreement-with-hunan-province-for-1000-k9-ebuses](http://www.byd.com/buzz/company-news/byd-introduces-allelectric-bus-and-signs-agreement-with-hunan-province-for-1000-k9-ebuses)

<sup>34</sup> “Just How ‘Invincible’ is China’s High-Speed Rail? It’s Hurting Air Travel”, The Infrastructurist, 10 February 2010, [www.infrastructurist.com/2010/02/10/just-how-invincible-is-chinas-high-speed-rail-its-hurting-air-travel](http://www.infrastructurist.com/2010/02/10/just-how-invincible-is-chinas-high-speed-rail-its-hurting-air-travel)

<sup>35</sup> “Green cities for blue skies in China”, Ajay Chhibber writing for China Daily, 12 January 2011: [www.chinadaily.com.cn/opinion/2011-01/12/content\\_11831879.htm](http://www.chinadaily.com.cn/opinion/2011-01/12/content_11831879.htm)

“Until the 1990s, few people in China had a telephone. Today over 800 million are mobile phone subscribers. Soon the Chinese will buy more mobile phones than the rest of the world put together. Over 420 million Chinese are online. Everywhere around the world, people know more and more about the good life and are trying to grab a piece of it”

Dr Osvald M. Bjelland,  
Chairman, Xyntéo

“On the one hand, we have a lot of consumers saying that they want to buy sustainable products but that everything they see on TV is junk. On the other hand you have producers saying that they want to produce and sell sustainable products but wondering whether people will buy them. We need to connect these two parties together and build a self-sustaining ‘virtuous cycle’ between them. This can be done without a large degree of government influence”

Professor Mohan Munasinghe,  
former Vice Chair,  
Intergovernmental Panel on  
Climate Change

## “Greening the dragon”: big challenges on the road ahead

The challenges facing the Chinese project to create an “ecological civilisation”<sup>36</sup> are formidable. Looming large is the sheer pace of growth in energy demand – over 10% per year.<sup>37</sup> This is undercutting efforts to tackle energy intensity, which though greatly improved remains relatively very high: four times that of the US; seven times that of Japan, France, Germany, the UK and Italy; and 1.5 times that of India.<sup>38</sup>

The other corollary of energy demand is of course China’s contribution to global greenhouse gas emissions. Though the Chinese, for now, emit relatively little per head – 4.6 tonnes of CO<sub>2</sub> a year versus the average American’s 19 tonnes – the country itself is the world’s biggest emitter: in 2006, its economy spewed 6 billion tonnes of climate-altering gas into the atmosphere – up from 4 billion in 1994.<sup>39</sup> Whether or not the country’s energy mix can be recalibrated away from traditional coal power towards cleaner sources will have a decisive say in China’s ability to rein in its aggregate emissions as well as the emissions and energy intensity of its economy.



China will also need to continue to foster parity between domestic energy prices and the world market. Reforms in this area have played a major role in reducing energy intensity since 1980. But energy prices still do not reflect the cost of externalities. The IEA estimates that China’s fossil-fuel subsidies amounted to \$19 billion in 2009.<sup>40</sup>

The 12<sup>th</sup> Five-Year Plan will have a significant bearing on China’s progress towards lower-carbon development. As China’s leaders seek to correct some of the economy’s structural imbalances – for instance its heavy dependence on exports and infrastructural investment along with timid domestic consumption – they will be influencing not only their own country’s development pathway but also the growth trajectory pursued by the entire world.

At the heart of this challenge is the following question: can China carve out a new path to greater prosperity, one which uses resources judiciously and which does not mirror the short-sighted, wasteful practices deployed by those countries that

<sup>36</sup> The phrase “ecological civilisation” was deployed by President Hu Jintao at the 17th National Congress of the Communist Party of China in October 2007. See “China’s efforts to make globalization green”, China Daily, 2 November 2007: [www.china.org.cn/english/environment/230594.htm](http://www.china.org.cn/english/environment/230594.htm)

<sup>37</sup> “Renewable Energy and Energy Efficiency in China: Current Status and Prospects for 2020”, Worldwatch Institute, October 2010, p.34

<sup>38</sup> Cui, M. et al., *Annual Report on China’s Energy Development 2009*, Beijing: Social Science Academic Press, May 2009, cited in “Renewable Energy and Energy Efficiency in China: Current Status and Prospects for 2020”, Worldwatch Institute, October 2010, p.11

<sup>39</sup> “Renewable Energy and Energy Efficiency in China: Current Status and Prospects for 2020”, Worldwatch Institute, October 2010, p.9

<sup>40</sup> *World Energy Outlook 2010*, IEA, p.593



“A Tale of Two Cities’ – a comparison of Hong Kong and Vancouver – illustrates how city management shapes the urban footprint. In Hong Kong, developers are forced to pony up to secure rezoning permission, prompting them in turn to squeeze as much as possible out of the space available without investing in low-carbon features. In Vancouver, on the other hand, authorities draw on the city’s inherent natural endowment to entice developers to incorporate eco-friendly perks. They are given more height in exchange for, say, a rental car pool for the building instead of a deep basement with one-to-one parking spots”

Anson Chan, Chairman and CEO,  
The Bonds Group

industrialised earlier? The answer will depend on a range of variables, but one factor is certain – the values underpinning Chinese behaviour at all levels of society, from the policymaker to the consumer. As China’s middle-income consumer class explodes to 220 million by 2025,<sup>41</sup> their behaviours and choices will wield enormous sway over both national and international emissions performance.

### **Urbanisation – a battle that must be won**

The world’s cities represent a key strategic battlefield in the fight against climate change. Responsible for two-thirds of global emissions of greenhouse gases,<sup>42</sup> they are part of the problem; yet as clusters of innovation and investment, they are also a core part of the solution. Policymakers’ ability to deal with urbanisation will be a weighty factor in determining whether or not cities will help or hinder the development of lower-carbon growth models around the world.

Urbanisation is a global reality, but in China the numbers involved are especially staggering. City-dwellers are projected to increase from 600 million in 2008 to more than 1 billion in 2030.<sup>43</sup> The influx is already prompting pretty radical action by the government. In December 2010, the Chinese authorities introduced a lottery system for issuing car licence plates in Beijing, restricting new registrations to those who have paid tax and social insurance in the city for more than five years. The initiative will allow just 240,000 additional vehicles in 2011, one-third the annual level in 2010. “At one stroke”, writes *The Economist*, “this has taken 10 million potential buyers out of the market.”<sup>44</sup>

According to a recent McKinsey study,<sup>45</sup> two factors increase the chances that Chinese cities will be able to cope with the projected influx. First off, their high population densities make investment in, for example, public transportation attractive to policymakers. Second, China’s leadership seems willing to back stated commitments to improved urban sustainability with cash – between 2005 and 2008, three-quarters of the cities in McKinsey’s sample increased funding for

<sup>41</sup> “Sustainable Consumption: facts and trends from a business perspective”, World Business Council Sustainable Development, 2008, p.8: [www.wbcsd.org/DocRoot/19Xwhv7X5V8cDIHbHC3G/WBCSD\\_Sustainable\\_Consumption\\_web.pdf](http://www.wbcsd.org/DocRoot/19Xwhv7X5V8cDIHbHC3G/WBCSD_Sustainable_Consumption_web.pdf)

<sup>42</sup> “Fighting Carbon Emissions: Cities Take the Lead”, Bloomberg BusinessWeek, 3 June 2010: [www.businessweek.com/technology/content/jun2010/tc2010063\\_575685.htm](http://www.businessweek.com/technology/content/jun2010/tc2010063_575685.htm)

<sup>43</sup> “How green are China’s cities?”, Jonathan Woetzel, *McKinsey Quarterly*, January 2011. Accessible via: [www.mckinseyquarterly.com/How\\_green\\_are\\_Chinas\\_cities\\_2734](http://www.mckinseyquarterly.com/How_green_are_Chinas_cities_2734)

<sup>44</sup> “Hitting the Brakes”, *The Economist*, 1-7 January 2011

<sup>45</sup> “How green are China’s cities?”, Jonathan Woetzel, *McKinsey Quarterly*, January 2011. The study presents an “urban sustainability index”. Information on this, as well as the source of the information contained in this paragraph, can be found at: [www.mckinseyquarterly.com/How\\_green\\_are\\_Chinas\\_cities\\_2734](http://www.mckinseyquarterly.com/How_green_are_Chinas_cities_2734)

“Shanghai is already a global knowledge hub in several industries – in trade, maritime, financial and manufacturing services – and it is carving out a lead in other sectors, among them transportation, energy, information technology and pharmaceuticals. For China to assume a global position as a technology provider, it will need to recalibrate its education system and create stronger ties between universities and business. Also the SOEs get too much support; they are not driven by innovation, leaving the bulk of the technological leadership to MNEs”

Torger Reve, Visiting Professor, Fudan University and Wilh. Wilhelmsen Professor of Strategy & Industrial Competitiveness, Norwegian School of Management



environmental protection. Interestingly, almost a third were able to expand their economies while improving environmental performance.

### ***From made in China to created in China***

China’s spirited efforts to stake out a leading position in renewable energy technologies is one important thread in the government’s overall plan to move the country up the value chain – to upgrade the country from the world’s low-cost factory to its high-value innovation hub. But according to Yu Yongding, a former member of the People’s Bank of China’s Monetary Policy Committee, it is precisely a shortage of home-grown innovative capacity that is serving as China’s “Achilles’ heel”.<sup>46</sup>

The unusual level of cooperation between government and business, which has been such a boon to China’s growing strength in clean energy, can also have a dark side, dampening that innovative impulse that makes the private sector such a core driver in any nascent industry. Innovation in China cannot be left exclusively to government-backed academies; private businesses also need to get involved.

How innovative an economy is depends ultimately on human brainpower. This lesson has not been lost on China. Since 1998 its government has tripled the proportion of GDP spent on education; and in just a decade, China’s higher-education sector has become the largest in the world.<sup>47</sup> However, though Chinese institutions are churning out graduates in ever more impressive numbers, it is vital that the education system is geared to teach them the business of innovation.

That said, China’s rise as a world innovator seems assured. A glance at trends in intellectual property tells the story. In 2010 China led global growth in patent applications, increasing its contribution by 56%. (The US, by comparison, suffered its third annual decrease since 2008.<sup>48</sup>)

This development should not be surprising. China is in fact home to some of the history’s most life-altering inventions, from printing to gunpowder. And as Angus Maddison pointed out in his authoritative work on the Chinese economy, Asia has accounted for more than half of world output for 18 of the last 20 centuries.<sup>49</sup>

<sup>46</sup> “China’s growth model ‘unsustainable’”, FT.com, 23 December 2010: [www.ft.com/cms/s/0/f38e08ce-0e84-11e0-b9f1-00144feabdc0.html#axzz1DRncJtgA](http://www.ft.com/cms/s/0/f38e08ce-0e84-11e0-b9f1-00144feabdc0.html#axzz1DRncJtgA)

<sup>47</sup> “The New Challenge from China”, Fareed Zakaria, *TIME*, 18 October 2010

<sup>48</sup> “China’s international patent filings on 56.2-pct jump last year: WIPO”, Xinhua, 9 February 2011: [http://news.xinhuanet.com/english2010/china/2011-02/10/c\\_13724928.htm](http://news.xinhuanet.com/english2010/china/2011-02/10/c_13724928.htm)

<sup>49</sup> “Maddison counting”, *The Economist*, 29 April 2010: [www.economist.com/node/16004937](http://www.economist.com/node/16004937)



“We are entering a ‘golden age’ of Chinese manufacturing. The low-cost, labour-intensive days are over; a shift to high-value added activity is in the making”

Ben Story, Head of Industrials, EMEA and Asia Pacific, Deutsche Bank

## Wise words

In a recent interview in TIME magazine, Chinese premier Wen Jiabao was asked about change in China. In his response he drew on the Yangtze River. He said, “Those who go along with the trend will thrive, and those who go against the trend will fail.”<sup>50</sup>

For the moment, many political leaders are not moving with the current – distracted by the fall-out from the downturn, obstructed by legislative logjams or bereft of electoral mandates, they have been unable to sustain the momentum of global negotiations. They need to find the will to get going again. In the meantime, it is encouraging that individual countries and businesses all around the world are heeding the sentiment expressed by Wen Jiabao and getting on with the business of low-carbon growth.

<sup>50</sup> “The New Challenge from China”, Fareed Zakaria, *TIME*, 18 October 2010



# The Promise of Electrification

## Wider use of electricity from clean energy sources could accelerate progress to the low-carbon economy

The steep and steady rise of the world's population, the intensifying migration of these numbers to our cities, the precipitous, industrialisation-driven increase in emissions of climate-warming gases – today's biggest challenges are also in many ways proof of our success in generating and spreading wealth.

Sustaining this progress will take energy and lots of it. The International Energy Agency (IEA) predicts that between 2008 and 2035 global energy demand will increase by 36%,<sup>1</sup> driven primarily by emerging and developing economies. As powerhouses like China and India continue their surge forward, and newly nascent regions like sub-Saharan Africa pick up speed,<sup>2</sup> they will require more energy to power their factories and trucks, to heat and cool their homes and to meet growing personal demand for cars, air conditioners and iPads.

How can this hunger be sated? How do we give everybody the energy they need without overloading the climate and making our cities unlivable? Electrification could provide an answer.

“Coal in China, coal in India, coal in the US – these are the three ‘Cs’. Replacing them in power generation, using combined-cycle turbines, would bring us down to 400 grams of CO<sub>2</sub>/kilowatt-hour”

Dr Michael von Saldern, Head of Strategy, Siemens Energy Sector



Michael von Saldern (left) and Wolfgang Dehen (centre), Siemens Energy Sector

An interview with Siemens Energy Sector CEO Wolfgang Dehen, filmed on location in Shanghai, is posted at [www.xynteo.com](http://www.xynteo.com)

<sup>1</sup> *World Energy Outlook 2010*, Paris: OECD/ International Energy Agency, 2010, p. 77

<sup>2</sup> Six of the ten fastest-growing economies are in sub-Saharan Africa. Over the next five years, Africa is likely to overtake Asia as the world's fastest-growing region. See: [www.economist.com/blogs/dailychart/2011/01/daily\\_chart](http://www.economist.com/blogs/dailychart/2011/01/daily_chart)



## On the road to a new electricity age

Electrification has the potential to unlock the low-carbon growth that an energy-hungry world needs. Not only can electricity be used in all modern energy-related services, including transportation, heating and cooling and mechanical processes; it can also be generated from a diversity of low-carbon energy sources – from renewables to fossil-based energies deployed in tandem with CCS technology. Electricity is also, of course, emissions-free at the point of use.

The electrification of transportation holds particular promise. According to the IEA, the transport sector today accounts for 19% of global energy consumption and emits 23% of the world's energy-related CO<sub>2</sub> emissions.<sup>3</sup> Personal transportation is the worst offender: more than 50% of the sector's energy consumption is attributable to cars, with road freight traffic accounting for 30%.<sup>4</sup>

The voracity of personal transport has led to a boom in the development of electrical vehicles, which boast double the energy efficiency of today's combustion engine vehicles.<sup>5</sup> The US and Chinese governments, eager to reduce their reliance on oil imports, have committed major funds to support this emerging industry. In 2009, the US government announced \$2.4 billion in federal grants to accelerate the development of electric cars and batteries.<sup>6</sup> In 2010, China revealed its own plans for an electric car industry, including state funding amounting to \$15 billion.<sup>7</sup>

These efforts are likely to generate enormous commercial opportunities. Just before 2020, China is set to become the world's largest electric vehicle market; by 2035, it will account for 40% of global sales.<sup>8</sup> Carlos Ghosn, Nissan's CEO, has predicted that, by 2020, electric cars will make up 10% of the global car market.<sup>9</sup> The IEA goes further, projecting that by 2035 about 70% of all cars sold worldwide will be advanced vehicles (ie, electric cars, plug-in hybrids and hybrids).<sup>10</sup>

<sup>3</sup> Executive Summary of "Transport, Energy and CO<sub>2</sub>: Moving Toward Sustainability", Paris: OECD/IEA, 2009, p.29: [www.iea.org/Textbase/npsum/transport2009SUM.pdf](http://www.iea.org/Textbase/npsum/transport2009SUM.pdf)

<sup>4</sup> "Pictures of the Future", Siemens, 2010, p.11:

[www.siemens.com/innovation/pool/en/publikationen/publications\\_pof/pof\\_fall\\_2010/pof-2-2010-e-doppel.pdf](http://www.siemens.com/innovation/pool/en/publikationen/publications_pof/pof_fall_2010/pof-2-2010-e-doppel.pdf)

<sup>5</sup> "105 years of electromobility in Berlin", Siemens, 2010: [www.siemens.com/press/en/events/corporate/2010-04-emobility.php](http://www.siemens.com/press/en/events/corporate/2010-04-emobility.php)

<sup>6</sup> "President Obama Announces \$2.4 Billion in Grants to Accelerate the Manufacturing and Deployment of the Next Generation of U.S. Batteries and Electric Vehicles", White House press release, 5 August 2009: [www.whitehouse.gov/the\\_press\\_office/24-Billion-in-Grants-to-Accelerate-the-Manufacturing-and-Deployment-of-the-Next-Generation-of-US-Batteries-and-Electric-Vehicles/](http://www.whitehouse.gov/the_press_office/24-Billion-in-Grants-to-Accelerate-the-Manufacturing-and-Deployment-of-the-Next-Generation-of-US-Batteries-and-Electric-Vehicles/)

<sup>7</sup> "China to invest in Electric and Hybrid Vehicles", *New York Times*, 19 August 2010: [www.nytimes.com/2010/08/20/business/energy-environment/20car.html?\\_r=2](http://www.nytimes.com/2010/08/20/business/energy-environment/20car.html?_r=2)

<sup>8</sup> *World Energy Outlook 2010*, IEA, p.417

<sup>9</sup> "Ghosn's faith in electric cars vindicated", *Financial Times*, 21 November 2010:

<http://cache.ft.com/cms/s/0/7230c8d4-f59d-11df-99d6-00144feab49a.html#axzz1Cn0J98AM>

<sup>10</sup> *World Energy Outlook 2010*, IEA, p.431



## Planes, trains and automobiles – and more

Electric cars are of course only part of the story. The electrification of buses, trucks and even bicycles will also play a starring role in the creation of a low-carbon future. “E-bikes” could provide an affordable and clean means of individual mobility, giving crucial respite where problems with local pollution and congestion are pressing. Electric bikes are already particularly popular in China, partly due to the ban on gasoline-fuelled scooters in several big cities, including Beijing and Shanghai.<sup>11</sup>

High-speed trains are gaining more and more attention as a powerful lever to lower-carbon transport. While Japan, the US and Europe are all seeking to expand their networks, the locus of growth is in China. Beijing has announced that it will increase its passenger network to 16,000 kilometres by 2020 – an increase of a third.<sup>12</sup>

The natural competitor of high-speed rail is the airplane. Where these trains are able to capture passengers away from planes – according to a Siemens study, most likely for journeys lasting less than 3.7 hours<sup>13</sup> – they could help save substantial amounts of CO<sub>2</sub>. As urbanisation clusters more and more of the world’s population into cities, high-speed rail can provide a convenient, carbon-efficient bridge between urban centres – a necessity in a globalised world.

“In Europe we are still talking about electromobility. In China it’s older news: this morning I was almost run over by an electrical bike, as it moves so fast and silently”

Wilfried Breuer, CEO, Power Transmission Solutions, Siemens Energy Sector

<sup>11</sup> *World Energy Outlook 2010*, IEA, p.433

<sup>12</sup> “Is China’s Economy Speeding Off the Rails?”, *New York Times*, 22 December 2009: [www.nytimes.com/2009/12/23/world/asia/23iht-letter.html](http://www.nytimes.com/2009/12/23/world/asia/23iht-letter.html)

<sup>13</sup> “Moving with energy into a mobile future”, Siemens, 2010:

[www.siemens.com/press/pool/de/events/corporate/2010-10-ecartec/WS\\_Electromobility\\_US.pdf](http://www.siemens.com/press/pool/de/events/corporate/2010-10-ecartec/WS_Electromobility_US.pdf)

Electric mobility promises more than just reduced CO<sub>2</sub> emissions. Fine particle emissions from the exhaust of combustion engine vehicles not only contribute to city smog, but also exacerbate health hazards such as heart disease, altered lung function and lung cancer. Given that electric vehicles produce significantly less noise, tomorrow's cities could also be much quieter. It is hard to believe that cities could become more pleasant places to live, but electrification can make this possible.



“The high-speed train has some impressive records to point to. Over a hundred years ago a Siemens train hit 200 kilometres per hour; in 2007 we reached 404 kilometres per hour with a series train. But, to me, records are not that important. They prove merely that something is technically feasible. The real test is whether a technology can be brought into commercial service and deliver benefits to the community”

Juergen Model, Vice President, High Speed Trains Rolling Stock, Siemens Industry Sector

“Trains, planes or automobiles – high-speed rail is without question the most environmentally friendly way to travel. Take the 500-kilometre route between Frankfurt and Paris. Each air passenger emits 83 kilograms of CO<sub>2</sub>, while the average rail passenger is responsible for just 10. Now scale these proportions up to Chinese dimensions. High-speed trains transported 70 million people *just* to the Shanghai World Expo in 2010. The savings potential only in China is enormous – and a saving here is a saving for the world”

Juergen Model, Vice President, High Speed Trains Rolling Stock, Siemens Industry Sector



Dr Richard Hausmann, Siemens Energy Sector

## Challenges: building the intelligent infrastructure

Making use of electrification's advantages hinges on massive infrastructural change, demanding a concerted collaborative effort by government and the private sector. Charging stations, for example, will need to become a familiar sight in our cities, making it possible to charge vehicles wherever they are parked – at home, at supermarkets, in front of restaurants or in parking garages. Drivers will need to be assured that they can easily recharge their vehicles anywhere, with easy methods of payment.

Until now, power grids have worked in only one direction, carting electricity from the producer to the consumer. Tomorrow's grids will need to be much more dexterous and much more intelligent. They will need to ensure an uninterrupted supply of power despite a higher degree of decentralisation among suppliers. They will need to be able to manage fluctuations in the feed from renewable energy sources. They will need to empower consumers to participate in the market, allowing them to sell energy back to the grid. This will require sophisticated ICT systems to give producers and consumers alike real-time information on how much energy is being generated and consumed.<sup>14</sup>

Transmission and distribution systems will also require rethinking to cope with the world's changing energy needs: we need to move substantially more power to substantially more people. High-voltage direct current (HVDC) technology is proving to be a highly efficient way of transporting bulk power over long distances. This widens energy options. In China, for example, HVDC lines can allow inland centres to replace coal-fired generation with hydropower from coastal regions.<sup>15</sup> The same principle stands behind the Desertec project, which aims to use HVDC technology to feed solar power from North Africa into the European grid.<sup>16</sup>

The challenges for electrification are steep. Firstly, the degree to which electrification can help reduce emissions levels depends fundamentally on the energy mix from

“Over 224 gigawatts of HVDC capacity are to be installed in China over the next ten years. Over the last 30 years, the world installed roughly 100 gigawatts. This means that China will over the next decade install over double what the world installed over the last three”

Wilfried Breuer, CEO, Power Transmission Solutions, Siemens Energy Sector

<sup>14</sup> “Siemens commences operations of 800kV HVDC link in China”, Energy Business Review, 22 June 2010: [http://utilitiesnetwork.energy-business-review.com/news/siemens\\_commences\\_operations\\_of\\_800kv\\_hvdc\\_link\\_in\\_china\\_100622](http://utilitiesnetwork.energy-business-review.com/news/siemens_commences_operations_of_800kv_hvdc_link_in_china_100622)

<sup>15</sup> “HVDC transmission for lower investment cost”, ABB, 2011: [www.abb.com/industries/db0003db004333/678bb83d3421169dc1257481004a4284.aspx](http://www.abb.com/industries/db0003db004333/678bb83d3421169dc1257481004a4284.aspx)

<sup>16</sup> “Key Technologies”, DESERTEC Foundation, undated, [www.desertec.org/en/concept/technologies](http://www.desertec.org/en/concept/technologies)

“Storage is the Holy Grail for renewables power generation”

Dr Michael von Saldern, Head of Strategy, Siemens Energy Sector

“Business is well-placed to effect change. You have influence with government and you have influence with the consumer. And your decision-making is concentrated. I have been impressed by the number of CEOs I have met who have said, ‘Yes, we see there is a problem, and, yes, we are going to do something about it’”

Professor Mohan Munasinghe, Chairman, Munasinghe Institute for Development and former Vice Chair, Intergovernmental Panel on Climate Change

which the electricity is generated. And the infrastructural challenges, including associated costs, are formidable. HVDC lines can have negative impacts on the territory through which they pass; cables are less intrusive but five-to-six times more expensive.<sup>17</sup> The smart grid represents an enormous change, entailing the wholesale overhaul of our current electricity networks as well as our behaviours.

Electric cars, too, have a potential drawback – they will in fact increase the load on an already beleaguered electricity system. However, by serving effectively as a means of storing energy, they can also help balance out the inherent intermittency of a more renewables-heavy electricity mix. The car batteries could store the energy generated by renewable energy sources when it is not needed, such as at night; when electricity demand increases and the price rises, this electricity could be fed back into the grid.<sup>18</sup>



Mohan Munasinghe,  
Munasinghe Institute for Development

## The right road

We’ve come to a fork in the road on the journey to growth. One of the branches looks clear and straight, but is a dead-end. The other starts in tougher terrain, to be sure, yet leads to a new kind of growth, capable of delivering long-term progress to a larger, more urban world population. Electrification is not a silver bullet, and scaling it up along the lines discussed in this paper faces titanic challenges. But its potential is undeniable. It could help take more of us farther down the right road.

<sup>17</sup> “105 years of electromobility in Berlin”, Siemens, 2010: [www.siemens.com/press/en/events/corporate/2010-04-emobility.php](http://www.siemens.com/press/en/events/corporate/2010-04-emobility.php)

<sup>18</sup> As above

## Couldn't join us in Shanghai?

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