



# Green New Deal

40 ways to benefit from the €3,000bn/year green market

**SG Watchlists**

**Buildings**

- CRH
- Eaga\*
- Imerys
- Kingspan\*
- NSG\*
- Owens-Corning\*
- Rockwool\*
- Saint-Gobain
- SIG Plc\*
- Steico\*
- Uralita\*
- Wienerberger\*

**Capital goods**

- ABB
- Alstom
- Cree\*
- GE \*
- Johnson Controls\*
- Philips
- Schneider Electric \*
- Siemens
- United Technologies\*

**IT**

- Accenture
- Cisco\*
- Comverge\*
- EMC\*
- Fairchild Semi\*
- Google\*
- IBM
- International Rectifier\*
- Ittron\*
- STM
- Vmware\*
- Wipro

**Transport**

- Ansaldo
- BMW
- Bollor\*
- Borgwarner\*
- CAF
- Faiveley
- Honda
- Renault-Nissan
- Rio Tinto
- Saft Group\*
- Toyota
- Valeo

Source: SG Equity Research\* Not covered by SG: no reco., no TP. EES = SGe of approximate current sales exposure to energy efficiency theme



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- New green economy: €300-1,000bn green stimulus, 100m green jobs
- Energy efficiency: big winner of the €3,000bn/year green market
- Lowest hanging fruit: up to €3 in cost savings for every €1 invested
- Growth driver during the recession & LT growth on a 3-5 year horizon
- Global SG watchlists: Buildings, Capital Goods, IT, Transport

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## The ‘Green New Deal’

**More than ever – we need to move towards a green economy** that stimulates growth and develops new jobs and technologies while reducing GHG emissions. Governments are on board with stringent policies and targets and €300-1,000bn in green stimulus spending worldwide. We believe that the recession could bring about a paradigm shift – with a combination of far reaching policies, more benign technologies, greater energy efficiency and a reassessment of lifestyle and consumption choices. The payback is a “no brainer” – the creation of employment, savings, innovation and economic growth – both for the global economy and for companies. **However, we need to be cautious in our optimism** as depressed oil and carbon prices, longer payback periods, reluctance to make costly initial investments, and over-reliance on public policymaking and funding all threaten take the wind out of the green new deal’s wings.

**Energy efficiency should be the biggest beneficiary of the €3tm/year green market** which is expected to double in the next decade. Global energy needs are expected to grow 50% by 2030. Energy efficiency allows us to use current capacity more efficiently with up to €3 in cost savings for every €1 invested – with all of the technologies and processes available today. And far from being over-exploited, we have yet to really begin reaping the “lowest hanging fruit”. This is the Green new deal – the subject of this report and four associated reports covering the Buildings, Capital goods, IT and Transport sectors (see our four associated SG reports).

### A wide range of investment opportunities

**Green new deal and energy efficiency opportunities are arising across a wide range of sectors,** and companies involved in energy efficient products, processes, technologies and services.

1) BUILDING & CONSTRUCTION MATERIALS	2) CAPITAL GOODS
Appliances, automation, bricks, building design, distribution, electronic goods, energy management; HVAC, household appliances, insulation, lighting, retrofits, roofs, smart meters, solar PV, windows	Building automation, CCS, cogeneration, industrial automation, lighting, power generation, smart grid, T&D.
3) IT	4) TRANSPORT
HVAC, power management, software services, semiconductors, smart meters.	Aerodynamics, li-ion batteries, electric cars, fuel economy, fuel efficiency, hybrids, lightweighting, mass transit, materials, rail equipment, railways, tires.

**Company watchlists** We have identified watchlists of companies who should benefit from the Green New Deal with their energy efficiency exposure (SGEEe) acting as a growth driver during a deep recession and creating long-term growth on a 3 to 5 year investment horizon.

#### Green new deal and energy efficiency – companies that stand to benefit

Buildings	SG EEE*	Capital goods	SG EEE*	IT	SG EEE*	Transport	SG EEE*
EAGA*	100%	CREE*	100%	COMVERGE*	100%	SAFT GROUP*	100%
ROCKWOOL*	100%	ABB	35%	INT. RECTIFIER*	100%	CAF	100%
STEICO*	100%	SIEMENS	21%	ITRON*	100%	ANSALDO	100%
KINGSPAN*	75%	ALSTOM*	20%	VMWARE*	100%	FAIVELEY	84%
URALITA*	75%	SCHNEIDER ELECTRIC *	20%	EMC*	>95%	BORGWARNER*	50%
WIENERBERGER*	50%	GE *	<20%	FAIRCHILD SEMI*	75%	VALEO	50%
OWENS-CORNING*	36%	JOHNSON CONTROLS*	<20%	CISCO*	50%	BMW	25%
SIG PLC*	33%	PHILIPS	15%+	STM	25%	HONDA	25%
SAINT-GOBAIN	30%	UNITED TECH.*	<20%	IBM	<10%	RENAULT-NISSAN	25%
NSG*	<30%			WIPRO	<10%	TOYOTA	25%
CRH	10%			ACCENTURE	<10%	BOLLORE*	<5%
IMERYS	10%			GOOGLE*	<5%	RIO TINTO	<5%

Source: SG Equity Research\* Not covered by SG: no recco., no TP. \* SGEEe = SGe of approximate current sales exposure to energy efficiency theme.

## Investment summary

**More than ever – we need to move towards a “Green New Deal”,** a green recovery and new green economy that aims to stimulate growth and develop new jobs and technologies while reducing GHG emissions. We believe that the recession could bring about a paradigm shift – with a combination of far reaching policies, more benign technologies, greater efficiency for energy and raw materials usage and a reassessment of lifestyle and consumption choices. The payback is a “no brainer” – short- and long-term generation of employment, savings, innovation and economic growth – both for the global economy and for companies.

**Energy efficiency should be the biggest beneficiary of the estimated €3trillion/year low carbon market.** Conventional technologies can reduce energy use and emissions by up to two-thirds in the buildings, IT, power and transport sectors. As a rule of thumb, energy efficiency allows us to use current capacity more efficiently with up to €3 in cost savings for every €1 invested. Green stimulus funding should keep these issues on the table and bring a number of projects forward. Moreover, policymakers continue to stick to their guns and push increasingly stringent efficiency and emissions legislation providing the theme with a further boost. And far from being over-exploited, we have yet to really begin reaping this “lowest hanging fruit”.

**However we need to be extremely cautious and guarded in our optimism.** Depressed oil and carbon prices, longer payback periods, reluctance to make costly initial investments, both by companies and consumers, and over-reliance on public policymaking and funding all threaten to take the wind out of the green new deal’s wings. Worryingly, previous recessions in the 1970s and 1980s failed to bring about a fundamental change in thinking despite a flurry of energy efficiency regulations on cars, appliances and buildings.

### Green stimulus, €300 billion to €1 trillion!

**Channelling stimulus funding to a green or low carbon economy is as innovative and potentially ground-breaking as FDR’s New Deal.** We have identified €300bn in new global green stimulus funding with new spending, subsidies, loan guarantees and tax breaks and incentives for energy efficiency, with buildings, construction, power and transport and renewable energy emerging as the biggest winners. Including existing announcements – and accounting for the lack of transparency and specificity in many announcements – the figures could be as high as €1trn!

**This funding should provide a major short-term boost for economies and companies with energy efficiency exposure** while creating jobs, exerting a multiplier effect and laying solid foundations for the transition to a sustainable low carbon economy. It is estimated, for instance, that well-tailored components of a green recovery effort have the potential to save the US economy an average of \$450m/year in energy costs for every \$1bn invested, and that for every \$1bn in spending, 30,000 jobs are created while annual GHG emissions could be reduced significantly (Source: WRI).

**Given the urgency of the crisis, governments are making a major effort to have the funding hit the ground as soon as possible.** This will have multiple-enabling effects – eliminating the 1-2 year time lag that usually accompanies green funding commitments and legislation and allowing companies to benefit in 2009 and 2010e – as well as keeping green issues on the table and moving forward energy efficiency projects that might not otherwise have seen the light of day until years later.

## Green jobs, a silver lining amidst the gloom

**By going green, governments and business could play a vital role in tackling the grim global economic outlook of 200 million+ unemployed.** Green jobs are a win-win for everyone – with high employment intensity, positive long-term employment and growth effects – and key to reducing energy costs and CO2 emissions. The Green New Deal will involve large-scale investments in new technologies, equipment, buildings, and infrastructure, which will provide a major stimulus for green jobs. With the aid of robust enabling frameworks, we could see as many as 100 million green jobs by 2030.

## Energy efficiency will enable a green new deal

**We believe that the cheapest, easiest and quickest way of enabling the green new deal is energy efficiency.** Energy efficiency is almost always less expensive than developing new energy sources – tending to cost €1-3 cents/kWh saved – so companies with energy efficiency exposure can profit now, and have a large potential upside which will come with regulatory efforts to reduce CO2 emissions. Globally, it is estimated that energy efficiency has resulted in energy savings of 56% between 1973 and 2004 and that going forward it offers the greatest potential for cost and energy savings of any of the low carbon options currently on the table. Moreover, it involves minimal sacrifice for business or stakeholders and there is virtually no end in sight to the possibilities of reaping this lowest hanging fruit.

## Green buildings, the best begins at home

**Buildings have the single largest potential of any sector for greater energy efficiency** – as energy use in buildings could be easily and cheaply reduced by up to 80% by using a range of existing, conventional technologies. While the sector is being hit hard by the recession, stimulus spending and new legislation will bring forward a number of energy efficiency projects, create a rare opportunity for short-term growth and prevent a worst case scenario in the sector. In particular, we believe that companies involved in energy efficient activities such as energy services, insulation, lighting, HVAC, micro-CHP, solar PV and windows, among others, are well-positioned to benefit from the theme (See also SG's *Green Buildings* report).

## Green capital goods, T&D the big winner

**Against the backdrop of a deep recession, the pure economic incentive to invest in energy efficiency measures has diminished** as project paybacks have lengthened, typically from two years to three years and beyond. However, industries exposed to direct policy influence through regulation and legislation should benefit most in our view. From this perspective, the **T&D industry stands out with regulated tariffs and major stimulus funding on the grid.** Lighting also stands to benefit from the legislative move on incandescents. We see less support in the short-term for purely market-orientated segments such as Industrial Automation or Power Generation (See also SG's *Green Capital Goods* report).

## Green IT, the silent emitter and enabler

**The IT sector's environmental credentials – both from risk and opportunity perspectives – have long been neglected** by investors. The UN estimates that the sector's emissions could overtake the aviation sector by 2020. Data centres need to be singled out for particular scrutiny with their energy use projected to increase significantly and they could account for 50% of IT budgets for some companies. We believe that companies developing software and hardware to green data centres stand to benefit. Moreover, we believe that IT companies can play a critical role as an enabler for others sectors, notably buildings, logistics, power and transport, enabling cost savings of over €625bn by 2020e. Semiconductors will be key to

enabling energy efficiency in other sectors, while we are particularly positive on IT's role vis-à-vis the potential \$20bn/year smart grid market (See also SG's *Green IT* report).

### **Green transport, trains over automobiles and planes**

**Public transport will be key to greater efficiency** and the €86bn global rail industry should benefit from solid and sustained growth in the medium to long term because of its competitive advantages in terms of environmental concerns, transport needs and increasing urbanisation in emerging countries. For the auto sector, we do not believe that green transport will increase volumes for the OEMs – especially in the current market – but rather that **cost-and fuel efficient vehicles will minimise the downside risks of increasingly stringent 2015 and 2020 CO2 targets and ensure long-term survival**. We believe that the most advanced manufacturers here are the market leaders in hybrids and electric cars. **For airlines, efficiency will also be part of a defensive tool to counter-balance oil prices and carbon taxes**. (See also SG's *Green Transport* report).

### **Cautious and guarded optimism**

Energy efficiency is unquestionably the largest, cheapest, and cleanest wedge among the low carbon solutions available to us. However, we need to be cautious and guarded in our optimism given the range of factors that could play out against wide-scale adoption:

**Global capex recession** A deep global capital-spending recession is now underway that could easily rival the busts of previous decades. We are rapidly reaching the fall in operating rates and utilisation rates in construction, industry and transport that we saw in the early-1980s, 1990-1 and 2000-1 recessions. The threat of a sustained fall in commercial and industrial activity (c.40%) would certainly threaten energy efficiency investments. Moreover, there is nowhere for companies to hide with the capex slump global in nature and the downturn potentially set to worsen if we see a slowdown in government stimulus spending.

**Oil prices are closer to \$40 than \$140** Soaring energy prices up until mid 2008 acted as a key incentive for industry to invest in energy efficiency measures during the up cycle. However since their peak, oil and gas prices have fallen by two-thirds with a deep recession compounding the possible disincentives. Experiences in the mid-1980s showed that a fall in oil prices means that governments largely abandoned the efficiency quest. However, long-term we need to be clear that not only is energy efficiency cheaper than new supply side projects, but it will be driven by higher oil prices with the IEA estimating a moderate scenario price of \$61/bbl and a high price of 100/bbl in 2020e and some seeing a price of \$200/bbl.

**Carbon pricing's role as a driver has weakened** with EU carbon prices falling from €23/t in Q308 to €11 in Q209e, with the rapid industrial slowdown, shrinking utilities' production rates, greater use of renewables and risk aversion all playing a part. However, we need to stress that the EU is sticking to its guns on its 20% reduction target for 2020 – and that the post-2013 effect of auctioning and the US "green card" also needs to be factored in. In the medium-term, we see EUA prices climbing back towards €20/t and CER at €18-19/t – prices which should be sufficient to spur companies to push for emissions reductions in a new "less is more" economy.

**There is no free lunch and even energy efficiency costs something.** Despite the cost saving credentials of energy efficiency initiatives across the board, the level of initial required investment may act as a disincentive, both to consumers and industrial players during the recession. Many will be focused on keeping the costs down rather than taking on additional cost burdens (even if energy efficiency brings about long-term cost savings).

Equity Research

**Green Buildings – SG watchlist of companies that could benefit**

Company	Country	ISIN	Energy efficiency exposure % of sales (SGe)**	Price (€) 17/03/08	Reco. 17/03/08	Mkt cap. €m	EV/EBIT 2009e	EV/EBIT 2010e	EV/EBITDA 2009e	EV/EBITDA 2010e	P/E 2009e	P/E 2010e
<b>GREEN BUILDINGS</b>												
EAGA*	UK	GB00B1P75854	100%	1.51	NR	380.41	7.64	6.17	6.57	6.47	10.61	9.47
ROCKWOOL*	DENMARK	DK0010219153	100%	45.21	NR	402.48	10.55	8.3	4.59	8.3	19.1	13.6
STEICO*	GERMANY	DE000A0LR936	100%	1.02	NR	13.06	NA	NA	NA	NA	NA	NA
KINGSPAN*	IRELAND	IE0004927939	75%	2.8	NR	472.86	8.91	7.26	5.53	7.26	9.93	8.66
URALITA*	SPAIN	ES0182170615	75%	4.27	NR	843.32	8.48	8.61	6.37	8.61	10.98	11.86
WIENERBERGER*	AUSTRIA	AT0000831706	50%	5.24	NR	439.89	12.45	10.81	5.03	10.81	9.26	6.09
OWENS-CORNING*	US	US6907421019	36%	5.824	NR	740.38	NA	NA	NA	NA	19.03	11.8
SIG PLC*	UKI	GB0008025412	33%	1.13	NR	154.07	6.01	6.03	4.61	6.03	1.48	2.12
SAINT-GOBAIN	FRANCE	FR0000125007	30%	20.785	NR	9,589.31	6.5	6.5	NA	NA	7.8	7.9
NSG*	JAPAN	JP3686800008	<30%	1.6	NR	1,070.71	-320.36	-24.17	6.49	-24.17	NA	NA
CRH	IRELAND	IE0001827041	10%	15.6	Sell	10,307.09	8.9	8.6	NA	NA	10.6	10.9
IMERY	FRANCE	FR0000120859	10%	27.54	Sell	1,665.67	7.8	7.5	NA	NA	7.3	7.1

Source: SG Equity Research, Datastream. \* Not covered by SG (no reco, no TP), financial data based on consensus estimates from Datastream. \*\* Not listed. \*\*SGe of approximate current sales exposure to energy efficiency theme

**Green Capital Goods – SG watchlist of companies that could benefit**

Company	Country	ISIN	Energy efficiency exposure % of sales (SGe)	Price (€) 17/03/08	Reco. 17/03/08	Mkt cap. €m	EV/EBIT 2009e	EV/EBIT 2010e	EV/EBITDA 2009e	EV/EBITDA 2010e	P/E 2009e	P/E 2010e
<b>GREEN CAP GOODS</b>												
CREE*	US	US2254471012	100%	17.1921	NR	1,521.41	NA	NA	NA	NA	36.74	32.7
ABB	SWITZER.	CH0012221716	35%	10.46	Buy	24,286.09	7.1	7.4	NA	NA	11.4	12.7
ALSTOM	FRANCE	FR0010220475	21%	40.69	Hold	11,815.77	7.1	5.9	NA	NA	10.2	8.8
SCHNEIDER ELECTRIC	FRANCE	FR0000121972	20%	49.375	Hold	11,790.37	8.6	9.0	NA	NA	9.5	10.8
GE *	US	US3696041033	20%	7.7095	NR	81,415.06	4.23	4.5	2.34	4.5	8.97	9.19
JOHNSON CONTROLS*	US	US4783661071	<20%	7.5707	NR	4,498.62	37.82	10.77	8.75	10.77	35.7	8.07
PHILIPS	NETHER.	NL0000009538	<20%	12.17	Hold	10,994.63	10.2	7.6	NA	NA	13.5	10.5
SIEMENS	GERMANY	DE0007236101	15%+	44.65	Buy	37,991.77	5.1	6.2	NA	NA	8.5	8.3
UNITED TECH.*	US	US9130171096	<15%	32.1561	NR	30,341.14	6.7	6.06	5.72	6.06	9.85	9.2

Source: SG Equity Research, Datastream. \* Not covered by SG (no reco, no TP), financial data based on consensus estimates from Datastream. \*\* Not listed. \*\*SGe of approximate current sales exposure to energy efficiency theme

Equity Research

**Green IT – SG watchlist of companies that could benefit**

Company	Country	ISIN	Energy efficiency exposure % of sales (SGe)	Price (€) 17/03/08	Reco. 17/03/08	Mkt cap. €m	EV/EBIT 2009e	EV/EBIT 2010e	EV/EBITDA 2009e	EV/EBITDA 2010e	P/E 2009e	P/E 2010e
<b>GREEN IT</b>												
COMVERGE*	US	US2058591015	100%	4.4021	NR	96.52	NA	NA	NA	NA	NA	NA
INT. RECTIFIER*	US	US4602541058	100%	10.4155	NR	752.64	NA	NA	NA	NA	NA	NA
ITRON*	US	US4657411066	100%	34.361	NR	1,262.94	NA	NA	NA	NA	12.94	10.66
VMWARE*	US	US9285634021	100%	18.1712	NR	1,647.27	14.83	11.09	10.71	11.09	23.78	20.34
EMC*	US	US2686481027	>95%	8.465	NR	17,030.5	NA	NA	5.3	NA	12.16	10.82
FAIRCHILD SEMI.*	US	US3037261035	75%	2.8448	NR	352.17	NA	NA	NA	NA	NA	NA
CISCO*	US	US17275R1023	>50%	12.4431	NR	72,630.25	6.97	5.9	6.42	5.9	12.9	13.55
STM	FRANCE	NL0000226223	25%	3.44	Sell	3,131.46	NA	29.2	NA	NA	NA	24.3
IBM	US	US4592001014	<10%	71.6286	Sell	96,102.31	6.9	6.8	NA	NA	10.5	11.4
WIPRO	INDIA	INE075A01022	<10%	3.4	Sell	4,982.66	7.4	6.7	NA	NA	9.7	9.4
ACCENTURE	US	BMG1150G1116	<10%	23.4984	Buy	14,271.79	6.7	6.9	NA	NA	13.8	14.2
GOOGLE*	US	US38259P5089	<5%	258.5288	NR	62,121.57	10.05	8.38	8.17	8.38	16	13.88

Source: SG Equity Research, Datastream. \* Not covered by SG (no reco, no TP), financial data based on consensus estimates from Datastream. \*\* Not listed. \*\*SGe of approximate current sales exposure to energy efficiency theme

**Green Transport – SG watchlist of companies that could benefit**

Company	Country	ISIN	Energy efficiency exposure % of sales (SGe)	Price 17/03/08	Reco. 17/03/08	Mkt cap. €m	EV/EBIT 2009e	EV/EBIT 2010e	EV/EBITDA 2009e	EV/EBITDA 2010e	P/E 2009e	P/E 2010e
<b>GREEN TRANSPORT</b>												
SAFT GROUP	FRANCE	FR0010208165	100%	€18.39	NR	340.47	8.21	7.46	6.07	7.46	9.31	8.67
CAF	SPAIN	ES0121975017	100%	219.75	Buy	747.32	3.3	2.9	NA	NA	9.8	8.8
ANSALDO	ITALY	IT0003977540	100%	10.75	Hold	1,094.0	7.3	6.5	NA	NA	13.4	12.4
FAIVELEY	FRANCE	FR0000053142	84%	51.5	Buy	675.99	9.1	8.2	NA	NA	13.7	11.4
BORGWARNER	US	US0997241064	50%	14.4167	NR	1,665.6	34.42	12.25	8.24	12.25	44.84	12.08
VALEO	FRANCE	FR0000130338	50%	10.51	Buy	925.1	196.2	10.3	NA	NA	NA	7.4
BMW	GERMANY	DE0005190003	25%	22.85	Hold	15,266.74	4.6	3.3	NA	NA	7.3	5.5
HONDA	JAPAN	JP3854600008	25%	18.1	Buy	33,206.12	15.5	NA	NA	NA	24.6	NA
RENAULT	France	FR0000131906	25%	14.15	Hold	3,627.52	NA	NA	NA	NA	NA	28.9
NISSAN	Japan	JP3672400003	25%	JPY658.0	Hold	12,624.8	NA	NA	NA	NA	NA	NA
TOYOTA	JAPAN	JP3633400001	25%	JPY3,010.0	Hold	80,959.5	NA	NA	NA	NA	91.7	NA
BOLLORE	FRANCE	FR0000039299	<5%	78.005	NR	1,926.81	17.77	11.93	5.59	11.93	NA	91.99
RIO TINTO	UK	GB0007188757	<5%	21.42	Buy	21,389.65	4.8	3.4	NA	NA	7.5	4.9

Source: SG Equity Research, Datastream. \* Not covered by SG (no reco, no TP), financial data based on consensus estimates from Datastream. \*\* Not listed. \*\*SGe of approximate current sales exposure to energy efficiency theme

## Energy efficiency is the easiest answer

**Energy efficiency offers a powerful and cost-effective tool for achieving a sustainable energy future.** Improvements in energy efficiency can reduce the need for investment in energy infrastructure, cut costs, increase competitiveness and improve stakeholder welfare. It also provides environmental benefits via reduced emissions and lower pollution as well as increasing energy security by decreasing the reliance on imported fossil fuels. Moreover, it involves minimal sacrifice. If one compares a modern refrigerator to one from 1973, which was the year of the OPEC oil embargo, it's bigger, it's CFC refrigerant-free, its inflation-adjusted price is two-thirds less—and it uses 75% less energy.

**Energy efficiency increased energy savings by 56% from 1973-2004 (Source: IEA) and has the potential to produce further savings of close to two-thirds of energy use by 2030** with a significant positive impact in terms of CO2 emissions. Moreover, there is virtually no end in sight to its energy savings potential with the “lowest hanging fruit” having yet to be adopted on a large-scale across the buildings, capital goods, IT, power and transport sectors.

### A key beneficiary of stimulus spending

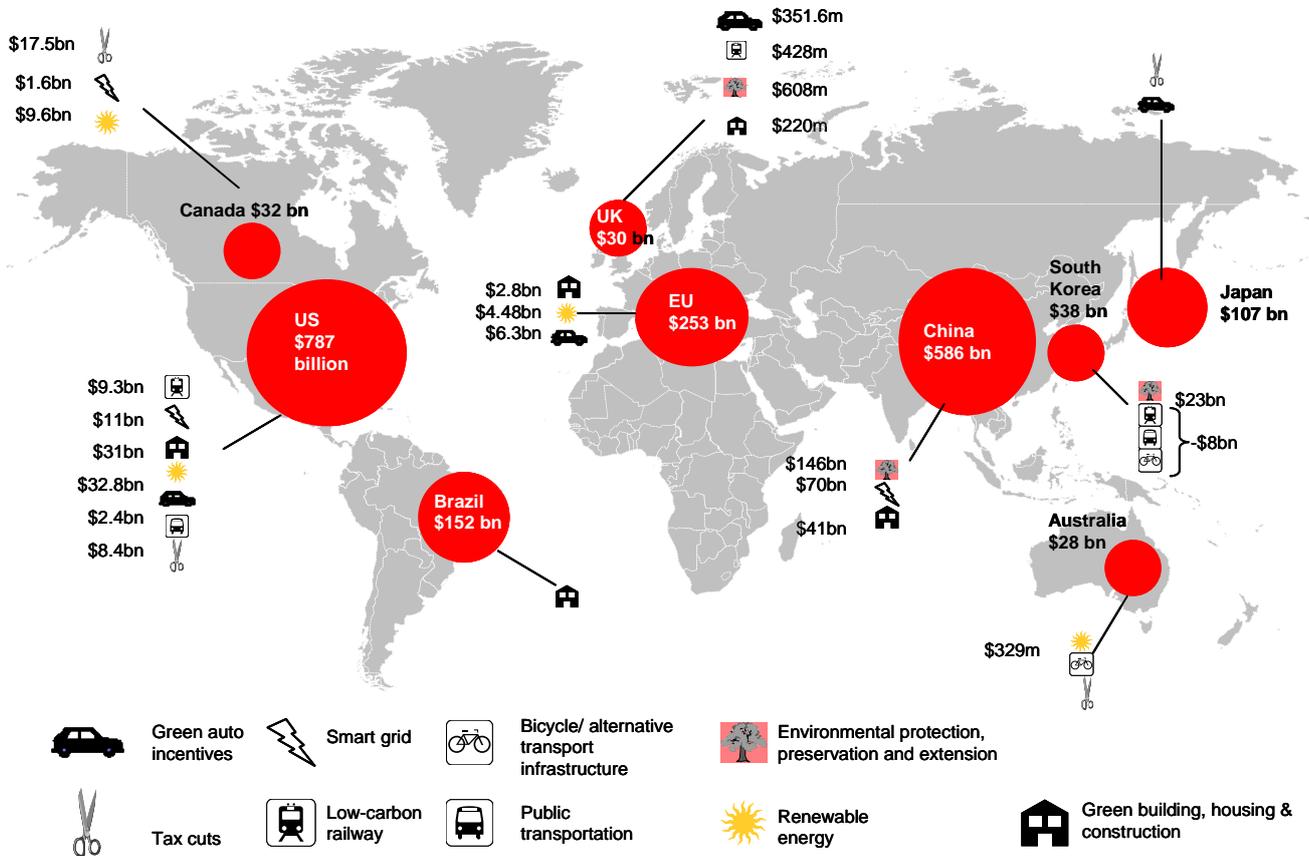
**Energy and environmental goals have risen to the top of policymakers agendas as evidenced by the wave of attention being given to the idea of green economic recovery.** Governments around the world have allocated over €300bn in new “green” spending to stave off recession and the figure could be as high as €1trn if we include existing announcements (although this is an admittedly imprecise science). We are already seeing calls for the G20 to push stimulus spending to 2% of GDP and continued economic slowdown could see levels approach the 3.5-4% of GDP seen during FDR's New Deal. The case for a green stimulus is based on the goals of generating short-term economic growth and employment, creating significant cost savings for business, consumers and government – while simultaneously addressing the long-term policy goals of climate change (see further *Appendix 1 – Green Stimulus*).

### Energy efficiency is coming out the biggest winner

**Energy efficiency-related spending, incentives and tax cuts have emerged as one of the biggest recipient of stimulus spending** as a result of its ability to build or improve infrastructure as well as reduce costs and promote savings, both vis-à-vis stakeholders and governments. We believe that the stimulus spending will bring forward a number of energy efficiency projects that would otherwise have been tabled at a later date. Big efficiency winners include:

- **Green buildings:** construction, weatherisation of public buildings and homes
- **Green power:** T&D infrastructure, smart meters/smart grid
- **Green transport:** alternative propulsion, cash for clunkers, fuel efficiency, railways, trams

**Overview of stimulus packages and green stimulus spending**



Source: SG Equity Research

**Green jobs**

In addition to the green spending keeping energy efficiency issues on the table – both for policymakers and corporates – **it should play a vital role in long-term job creation, a pressing need in the current environment.** Green jobs advantages include their high employment density and the net long-term employment and economic growth effects of reducing energy costs to the economy as a whole. Energy supply – including building, construction, renewables and transport – should all play important roles in realising the environmental, economic and employment impacts. It is estimated that as many as 100 million green jobs could be created in the coming decades (see further *Appendix 2 – Green Jobs*):

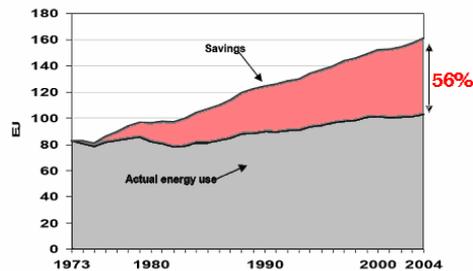
- **Buildings:** efficiency measures could create up to 3.5m jobs in the EU and US alone
- **Smart grid:** up to 280,000 direct jobs from deployment of technologies (Source: GridWise)
- **Renewables:** employs 2.3m people globally today which could grow to 30m by 2030
- **Transport:** approximately 230,000 jobs in manufacturing environmentally friendly vehicles globally and an additional 1.3m working in mass transit in the EU and US
- **UK:** 1.3m employed in the green sector by 2017e - an annual growth rate of 5%

## A solid energy savings track record

**Energy efficiency has already brought about the most tangible energy saving results of any of the solutions in the energy puzzle.** It now takes one-third less energy to produce a unit of GDP today than it did in the 1970s – the most important reason for this development being the considerable energy savings that have taken place as a result of improved energy efficiency in power generation, manufacturing, residential and commercial buildings, and for different modes of passenger and freight transportation:

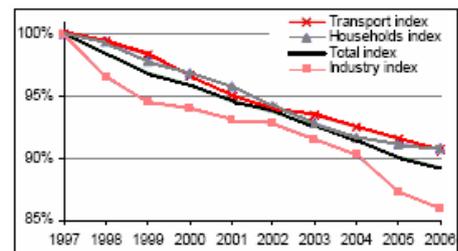
- **The IEA** estimates that energy efficiency resulted in savings of 56% of IEA-11 energy consumption levels between 1973 and 2004. These impressive results – the hypothetical equivalent of 5.5GtCO<sub>2</sub>e – were achieved despite energy demand in IAE countries increasing steadily since 1973 (interrupted only by the oil price shocks in 1973-74 and 1979). If the whole world followed the same trend, the global abatement from energy efficiency gains over 30 years would amount to around 15 Gt CO<sub>2</sub> per annum.
- **In Europe**, final energy use would have increased by 115 Mtoe, or 11% per year over the 1997-2006 period had there been no energy efficiency improvements. That is one-third of all crude oil imports into the EU-27 in 2006.

**Energy efficiency's role in energy savings: IEA11 1973-2004**



Source: IEA, SG Equity Research

**Energy efficiency trends for final consumers for EU 27 (ODEX index, 1997 = 100%)**



Source: European Commission, SG Equity Research

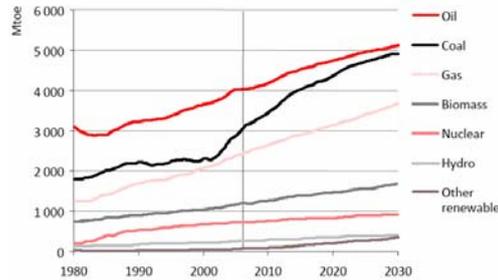
## The key to tackling growing energy use & CO<sub>2</sub> emissions

**Energy efficiency will yet again be key going forward with world energy consumption projected to expand by 50% from 2005 to 2030** – to 695 quadrillion Btu – on the back of long-term economic growth and expanding populations in the world's developing countries (Source: IEA 2008 Reference Case):

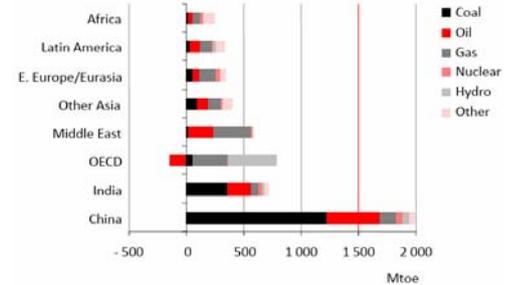
- **Energy consumption in non-OECD countries** is expected to expand by an average of 2.5% per year to 2030 (vs. 0.7% for OECD countries)
- **Net electricity generation** should grow to 33.3 trillion kWh by 2030 (vs. 17.3 trillion kWh in 2005) with the strongest growth in non-OECD countries
- **China and India** – the fastest growing non-OECD economies – could account for one-quarter of world energy consumption by 2030 (vs. 18% in 2005 and 8% in 2000)

<sup>1</sup> EA-11: Australia, Denmark, Finland, France, Germany, Japan, Italy, Norway, Sweden, UK and US

**World primary energy demand: 1980-2030e**



**Incremental primary energy demand: 2006-2030e**

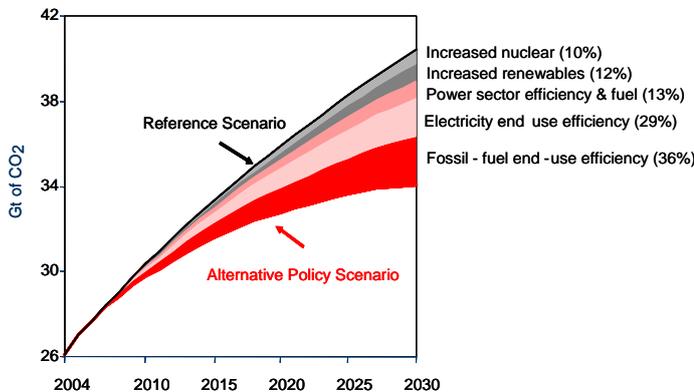


Source: IEA, World Energy Outlook, SG Equity Research

**Greatest potential for reducing CO2 emissions**

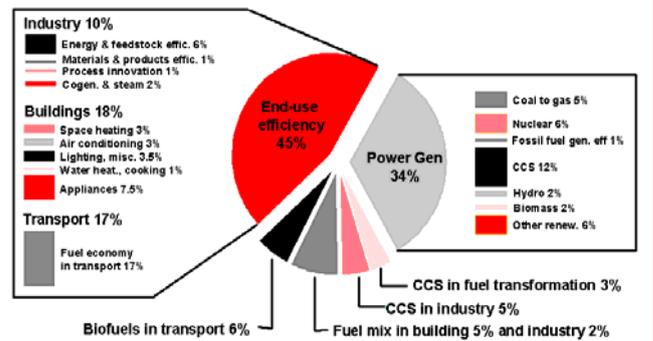
Energy efficiency presents a huge under-exploited cost-effective GHG saving opportunity and merits being the single greatest focus of GHG abatement strategies in the near and medium-term. Improved energy efficiency could halve expected growth in electricity demand and reduce the need for generation capacity by a third. In consequence, it could save 15 GtCO<sub>2</sub>e by 2050 – the equivalent of 58% of current global emissions. The greatest potential savings from end-use efficiency is in developing countries (67%) and transition economies (49%).

**Potential to reduce CO2 emissions (2030e)**



Source: IEQm SG Equity Research

**Potential to reduce CO2 emissions (2050e)**

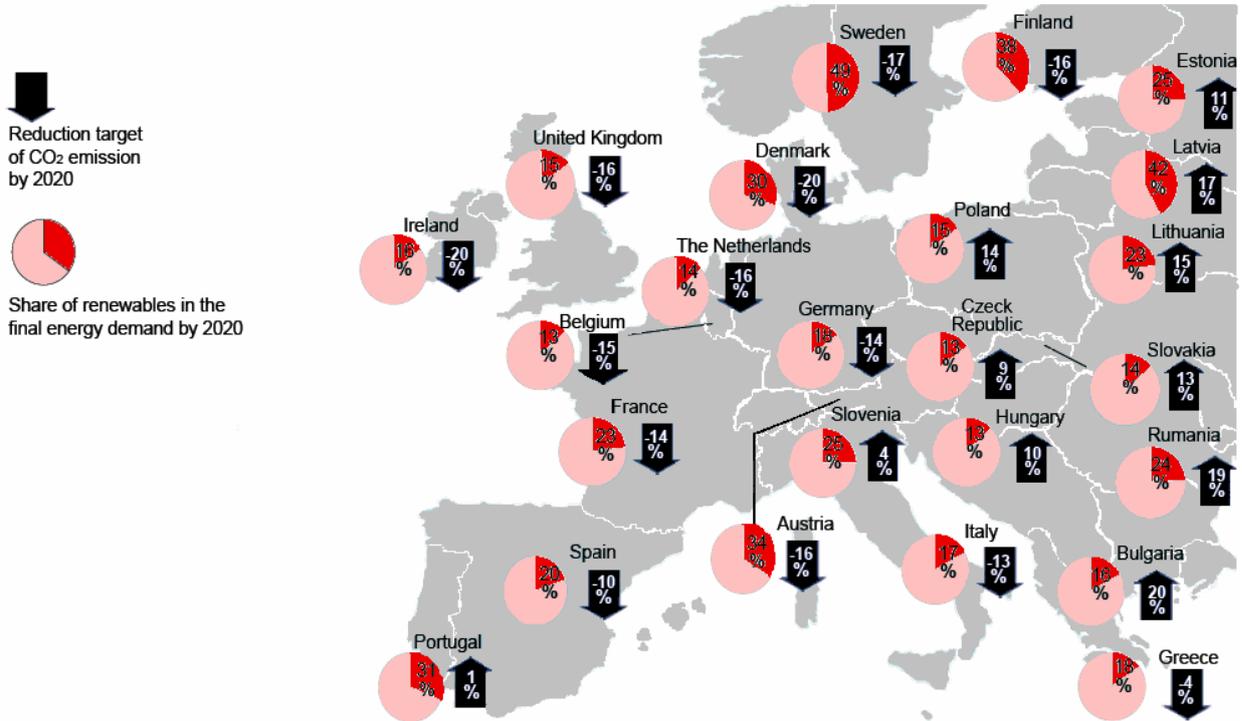


Source: IEA MAP scenario – 2050 32GtCO<sub>2</sub> reduction

**Essential to meeting regulatory targets**

Energy efficiency is both the result of policy developments and the application of concrete measures. Technology development creates the basis and environmental legislation has contributed much, especially the EU's Emission Trading Scheme (ETS) and transport emissions policies. Taxation and other fiscal measures such as state aid and recent industry policy tools also provide strong incentives for markets to realise cost effective energy savings. It is essential to continue relying on these efficient instruments, especially in the current difficult economic situation.

**National CO2 savings targets and share of renewable energy by 2020**

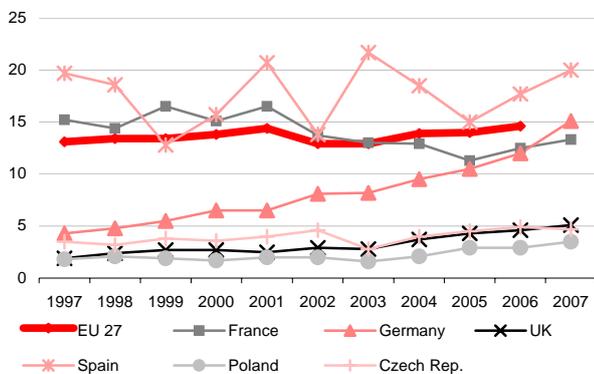


Source: EU, Rockwool, SG Equity Research

**Steady progress on EU's 20-20-20 goals**

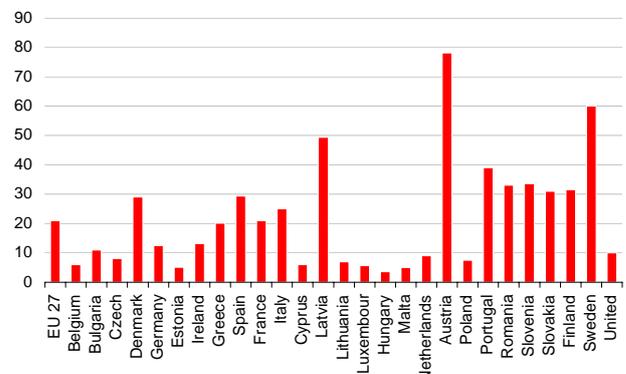
**Energy efficiency will be key to meeting ever stricter regulatory standards on reducing CO<sub>2</sub> emissions.** The EU has to date, been in the leader in this regard with the Commission stressing the need to increase energy efficiency as part of the “20-20-20” goals for 2020 – 20% energy saving, 20% reduction in greenhouse gas (GHG) emissions and 20% share of renewables in overall EU energy consumption. If the objectives are met, the EU would not only use about 400m/toe less primary energy, but it would also avoid the construction of about 1000 coal power plants, or half a million wind turbines – and reduce CO<sub>2</sub> emissions by 860Mt.

**Share of renewables in electricity production (1997-2007)**



Source: Eurostat, SG Equity Research

**Share of renewables in electricity production 2010e**



Source: Eurostat, SG Equity Research

### EU tools for achieving energy efficiency

The EU has also established a specific energy efficiency policy which includes: 1) a general policy framework and actions taken under the European Energy Efficiency Action Plan; 2) National Energy Efficiency Action Plans based on the framework Directive on Energy Services; 3) legal frameworks for the most important consumption sector - buildings and energy consuming products; (4) flanking policy instruments such as targeted financing, provision of information and networks like the Covenant of Mayors and Sustainable Energy Europe; and 5) international collaboration on energy efficiency. A comprehensive Energy Efficiency Action Plan was also developed and adopted in 2006 which proposes 85 actions and measures to be taken at EU and national level by 2012.

### *Ambitious new targets in the works*

The European Commission is in the process of proposing new legislation that will contribute to achieving the 20% energy saving objective by 2020:

- **Strengthening the EPBD** (Energy Performance of Buildings Directive): to apply to more buildings and to enhance the role of energy performance certificates and inspection reports for heating and air conditioning systems.
- **Revising the Energy Labelling Directive**: to apply to additional energy-using and energy-related products, and not to household appliances alone
- **Introducing a labelling scheme for tyres** to promote the use of fuel efficient tyres;
- **Facilitating the uptake of cogeneration** (combining heat and power generation)

### Carbon markets, US green card will change the landscape

**Carbon pricing's role as a driver has weakened** as EU carbon prices have fallen in concert with other markets and asset classes from levels close to €23/t in early October 2008 to €11 in Q209e. This rapid slowdown has played a major part with industrials selling as they cut production and with utilities fully stocked as power demand from their clients shrinks – as has greater use of low-carbon energy by utilities. Our view remains however that emissions will still be higher than the quotas distributed until at least 2012. Going forward, we need to stress that the EU is sticking to its stringent reduction targets – 20% by 2020 – and that the post-2013 effect of auctioning also needs to be factored in. In the medium-term, we see EA prices climbing back towards €20/t and CER at €18-19/t – prices which should be sufficient to spur companies to push for emissions reductions in a new “less is more” economy.

### SG EUA and CER price forecasts to 2013

		2007	Q108	Q208	Q308	Q408	2008	Q109f	Q209f	Q309f	Q409f	2009f	2010f	2011f	2012f	2013f
<b>EUA</b>	€/tCO2	<b>19.60</b>	21.50	25.70	24.40	18.70	<b>22.60</b>	9.00	11.00	12.00	15.00	<b>11.80</b>	<b>16.00</b>	<b>19.0</b>	<b>20.0</b>	<b>23.0</b>
<b>CER</b>	€/tCO2	<b>15.10</b>	15.90	17.70	20.20	16.20	<b>17.50</b>	17.50	10.00	11.00	13.50	<b>10.60</b>	<b>14.50</b>	<b>18.0</b>	<b>18.0</b>	-

Source: SG Commodities Research (estimates at March 12009)

**Steady progress by EU27 towards CO2 targets**

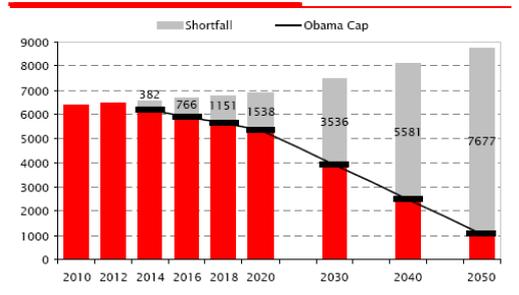
Member State	1990 UNFCCC base	1990 Kyoto Protocol base	Kyoto 2012 Target	2006 Emissions (UNFCCC)	Change in Kyoto Emissions 1990-2006
Unit	Mt	Mt	%	Mt	%
Austria	79,172	79,050	-13%	91,090	15%
Belgium	144,530	145,729	-8%	136,970	-6%
Bulgaria	132,614	132,619	-8%	71,343	-46%
Cyprus	NA	NA	NA	NA	NA
Czech Republic	194,244	194,248	-8%	148,204	-24%
Denmark	70,342	69,978	-21%	71,914	3%
Estonia	41,593	42,622	-8%	18,876	-56%
Finland	70,946	71,004	0%	80,291	13%
France	566,411	563,925	0%	546,527	-3%
Germany	1,227,688	1,232,430	-21%	1,004,794	-18%
Greece	104,603	106,987	25%	133,112	24%
Hungary	115,849	115,397	-6%	78,625	-32%
Ireland	55,526	55,608	13%	69,762	25%
Italy	516,898	516,851	-6%	567,922	10%
Latvia	26,456	25,909	-8%	11,621	-55%
Lithuania	49,370	49,414	-8%	23,222	-53%
Luxembourg	13,187	13,167	-28%	13,322	1%
Malta	NA	NA	NA	2,847	NA
Netherlands	211,651	213,034	-6%	207,477	-3%
Poland	563,443	563,443	-6%	400,459	-29%
Portugal	59,109	60,148	27%	82,739	38%
Romania	281,895	278,225	-8%	156,680	-44%
Slovakia	73,679	72,051	-8%	48,902	-32%
Slovenia	20,340	20,354	-8%	20,591	1%
Spain	287,687	289,773	15%	433,339	50%
Sweden	72,043	72,152	4%	65,749	-9%
U.K.	771,979	779,904	-13%	655,787	-16%
EU 27	5,751,254	5,764,022	-8%	5,142,166	-11%

Source: SG Commodities Research

**A \$1trn US market by 2020**

The US remains the largest economy in the world and although it has been slow to act on climate change, Barack Obama's pledge to turn to a mandatory federal cap and-trade carbon market to address global warming will transform the carbon market landscape. We suggest that U.S. legislation could be passed in 2010 and the new system could begin in 2013 with the first forward trades occurring in 2011. It would cover around 87% of the economy, setting a target of 1990 levels by 2020 and 80% below 1990 levels by 2050. An average of 50% of allowances would be auctioned at the start with a 95% auction rate by 2020. SG Commodities believes that the impact will no doubt be significant, as transactions in the **first year of the cap could exceed US\$100bn and reach US\$1trn by 2020.**

**Potential Obama cap**



Source: SG Commodities Research, Orbeo

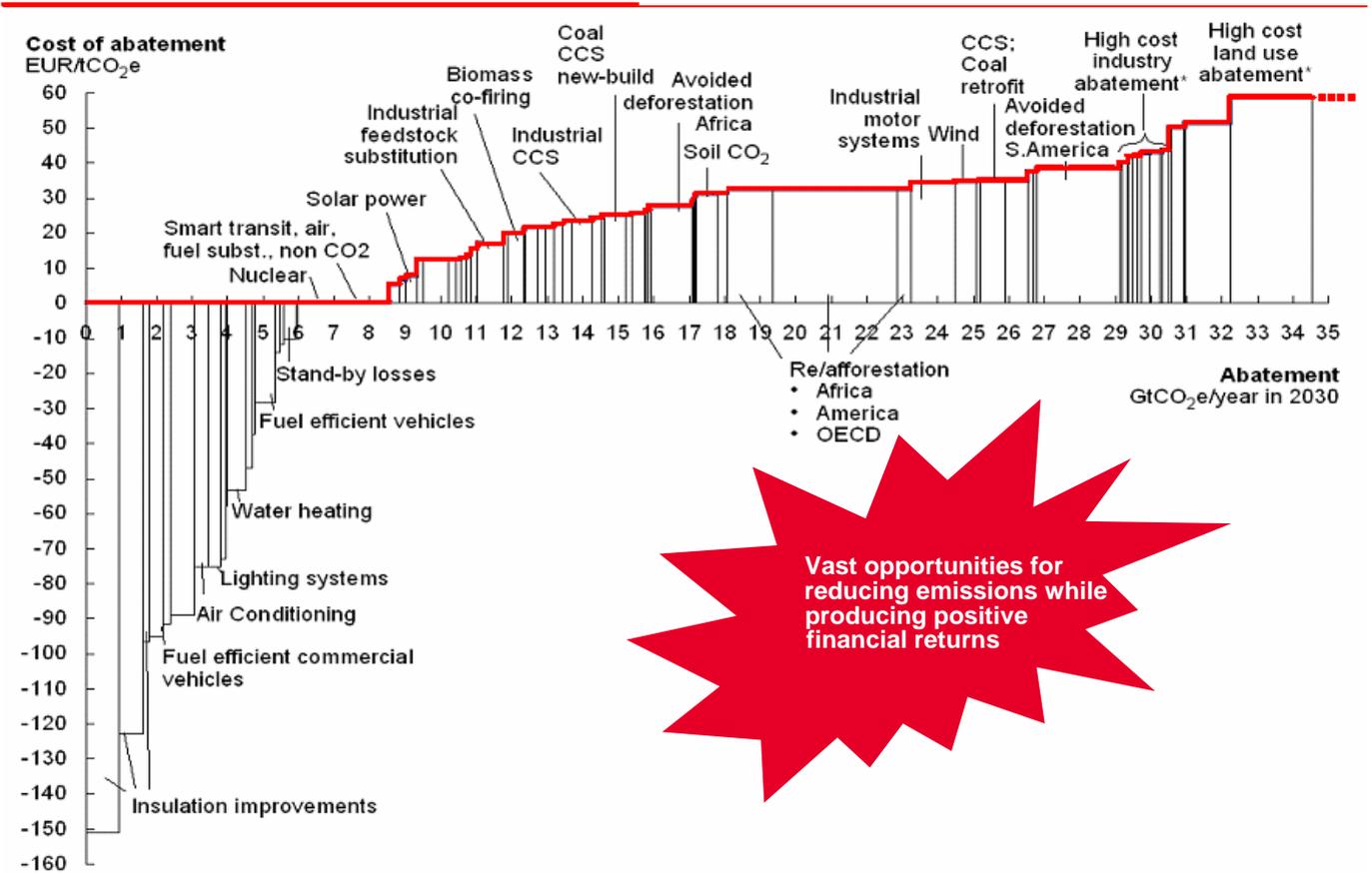
## Cheap and easy cost savings for all

Energy efficiency is highly relevant for stakeholders and economies. More people feel the effect of higher energy bills, as do businesses. Reducing energy consumption is the best sustainable long-term response. Energy saving benefits per year can easily amount to over €1,000 per household: €600 thereof due to lower energy bills and the remainder due to cost-savings elsewhere. However, upfront costs remain a challenge. Since most renovations have a long lifetime, the added cost of making such a renovation energy efficient will itself pay back much faster than the lifetime of the renovation itself.

## Huge benefits for national economies

Energy efficiency is beneficial to national economies as a whole and even more for local development. In the EU, the direct benefit of energy saving if the 20% energy reduction objective is met in 2020 is expected to be €220bn pa. The indirect economic benefits are much higher. Energy efficient products and materials, and energy services constitute a profitable market, also for export. It is an opportunity for European business to lead innovation and create new jobs, often with local small and medium-sized companies (SMEs), as investments in energy efficiency are mostly related to small-scale renovation projects.

**Global Cost Curve of Greenhouse Gas Abatement Opportunities 2030e (cost of abatement vs level of abatement)**



Source: Vattenfall, McKinsey, SG Equity Research

## Green buildings: the best begins at home

### SG Green buildings watchlist

CRH  
EAGA\*  
IMERYS  
KINGSPAN\*  
NIPPON SHEET GLASS\*  
OWENS-CORNING\*  
ROCKWOOL\*  
SAINT-GOBAIN  
SIG PLC\*  
STEICO\*  
URALITA\*  
WIENERBERGER\*

\* Not covered by SG, no reco, no TP

Globally buildings are responsible for up to 45% of primary energy use and have the single greatest potential of any sector for greater energy efficiency. Despite lacking the sexiness of renewables or hybrids, it goes without saying that the cheapest fight against global warming begins at home – as energy use in buildings could be easily reduced by up to 80% by using a range of existing, conventional technologies such as more efficient heating, cooling and lighting systems and insulation and windows. Such measures could reduce projected GHG emissions by 29% by 2030 (Source: IPCC) – at little or even negative cost, given the payback on initial investment and ensuing reinvestment as well as the positive economic and employment growth impacts. However, long lifetimes and slow replacement rates mean that action is needed sooner rather than later.

While the global buildings sector is and is likely to continue to be hit hard by the recession through 2009, reducing building-related emissions is key in the current economic crisis – to tackling a broad swathe of challenges including rising energy costs and fuel poverty, costs for business and ordinary households and long-term energy security. Moreover, we believe that stimulus spending will bring forward a number of energy efficiency projects and prevent a worst case scenario in the sector. In particular, we believe that a number of companies involved in energy efficient activities such as distribution, energy services, fuel poverty, insulation, lighting, HVAC, micro-CHP, solar PV and windows, among others, are well-positioned to benefit from the green buildings theme in the long-term.

### Energy efficiency measures for buildings



Source: SG Equity Research

### Green buildings – companies that could benefit

Theme	Impacted sub-sectors	Companies
Insulation	Glass wool	Johns-Manville* (Berkshire Hathaway), Knauf*, Owens-Corning, Saint Gobain, Superglass, Uralita
	Stone wool	Fibrex*, IIG (John Mansville*), Knauf*, Paroc*, Rockwool, Saint-Gobain
	Plastic foam	BASF, CRH, Dow, Johns-Manville*, Kingspan, Metecno*, Owens-Corning, Recticel, Thyssen
Windows	Smart glass	Asahi Glass, Deceuninck, Nippon Sheet Glass, Saint-Gobain, Superglass
Bricks	Clay bricks	Imerys, RDB, Wienerberger
Lighting	Efficient lighting	Aixtron, Cree, Emcore, Epistar, GE, Nippon Sanso, Philips, Siemens (Osram Sylvania), Taiyo, Zumtobel
HVAC	Energy management & control (temperature, lighting, consumer monitoring)	AABB, Emerson, Honeywell, Ingersoll Rand (Trane), Johnson Controls, Lime Energy, Schneider Electric, Siemens, United Technologies (Carrier), Wavin
Next Generation Heating	Geothermal heat pumps, efficient boilers, micro/residential CHP	Centrotec, Ceres Power Holdings, Ceramic Fuel Cells Ltd, Nibe
Escos	Energy services, fuel poverty	Ameresco*, APS Energy Services (Pinnacle West Capital Corporation), EAGA, Johnson Controls, Siemens
Smart Meters	Smart meters / grid	See Green IT report
Distributors	Building products	BSS, SIG
Green Buildings	High environmental standards, certification	Bouygues, Commonwealth Property Office Fund, Icade*, Klepierre, Mitsubishi Estate, Sonae Sierra, Unibail-Rodamco, Vinci
Consumer Goods	Appliances, air conditioning	Daikin, Electrolux, Emerson, Invensys, LG

Source: SG Equity Research, \* Not listed

## Buildings are the #1 source of CO2 emissions!

**Contrary to common perceptions, it is not transportation or industry which is responsible for the highest levels of energy consumption and emissions, but buildings.** Commercial and residential building stock accounts for up to 40% of global energy use. Moreover, energy consumption in the sector as well as associated CO2 emissions are set to rise by as much as 50% by 2030e. The fact that buildings have long lives means that acting on energy efficiency now for both new and existing building stock will have significant implications on energy use and CO2 emissions for the next 50-100 years. Positively, conventional and emerging technologies have the potential to significantly reduce buildings-related emissions and move us towards passive or zero-energy homes in as little as 10 to 15 years.

### CO2 profile of buildings sector

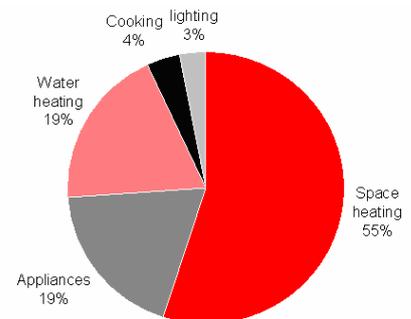
Energy consumption	CO2 emissions	Abatement opportunities	Implications
110 quadrillion BTU	8.2Gt	• 3.7GtCO2e of low-cost abatement by 2030e:	• 100% of abatement opportunities in the sector come at zero or negative cost
Residential: 76%	Residential: 63%	- 3.0Gt residential & 1.3Gt commercial	• All abatement measures maintain living standards at higher energy efficiency
Commercial; 24%	Commercial: 37%	- HVAC, windows & insulation: 2.3Gt	
BAU growth: +50% 2030e	BAU growth: +70% 2030e (14 Gt)	- Appliances & reducing standby losses: 1.1Gt	
	Developed world: 63%	- Lighting: 0.3Gt	
		• Additional potential of ~2Gt at <€40/tCO2 with more aggressive standards & programs	

Source: Vattenfall, SG Equity Research

### Heating & cooling are the biggest culprits

**The largest source of energy consumption is energy used for heating and cooling buildings,** which accounts for two-thirds of energy use in buildings. The energy use figure rises to 80-85% if other operational phase uses such as lighting, water heating and running appliances are also taken into account. The residential sub-sector accounts for well over two-thirds of energy use with 80% of energy consumption used in small buildings (< 1000 m2). In terms of who is using up all of this energy, the biggest consumers (per capita) are developed countries with the US #1 followed by Australia and Canada.

### Average household energy consumption (use)

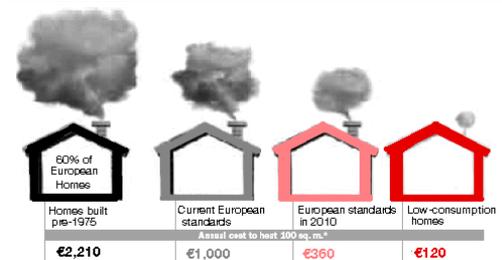


Source: IEA, SG Equity Research

### Need to focus on existing buildings (in)efficiency

**The greatest challenge lies in modernising existing buildings** of varying levels of (in)efficiency to reduce energy wastage via outdated building components and systems. Existing buildings account for 99% of the global building stock – with many having been constructed before global warming became an issue. An estimated 75% of energy efficiency savings potential lies with buildings constructed pre-1975 (Source: Ecofys). Within the EU there are roughly 150m dwellings – of these 32% were built before 1945, 40%

### Annual costs to heat 100 sq. m. home\*: home built pre-1975 to low consumption home



Source: Saint-Gobain, SG Equity Research. \* Based on oil at \$90.

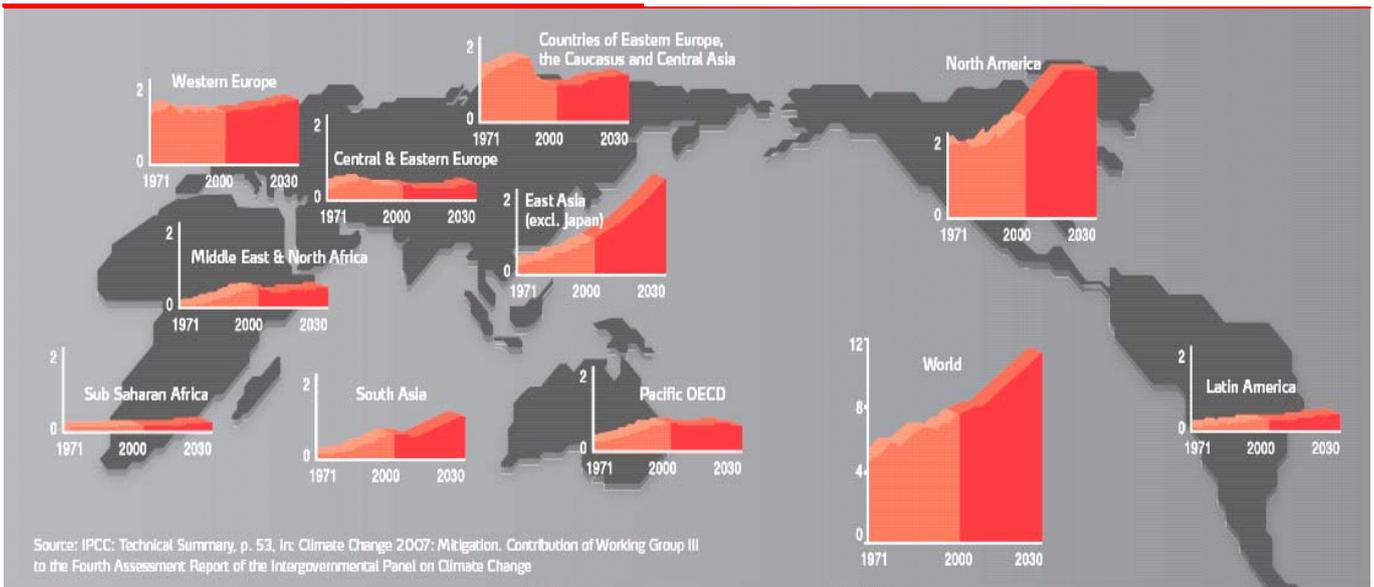
between 1945-1973 and the remaining 28% built since then. Many of the older buildings were built to less stringent energy efficiency criteria than present day building codes require. With new buildings representing on average 1% of the stock, and a renovation cycle for existing buildings being 25-50 years, there is no time to lose in implementing more stringent building regulations for both new and existing buildings of all dimensions.

**Energy consumption is set to continue to rise**

**Buildings’ energy consumption has increased steadily since the 1960s – including +29% from 1990-2004 (Source: IEA) – and looks set to continue to increase because of a range of factors:**

- Ageing housing stock in developed and developing countries
- Increasing average home size: +17% from 1990-2004 (Source: IEA)
- Additional lighting, heating, cooling, household appliances = increasing consumption
- Rising middle classes in developing countries
- Urbanisation: an additional 4bn people living in urban areas by 2050
- 2bn sq m of new construction p.a. in China to 2020 (will double): 7% annual growth

**CO2 emissions (Gt) from buildings incl. emissions from the use of electricity: 1971, 2000, 2030e**



Source: IPCC, SG Equity Research

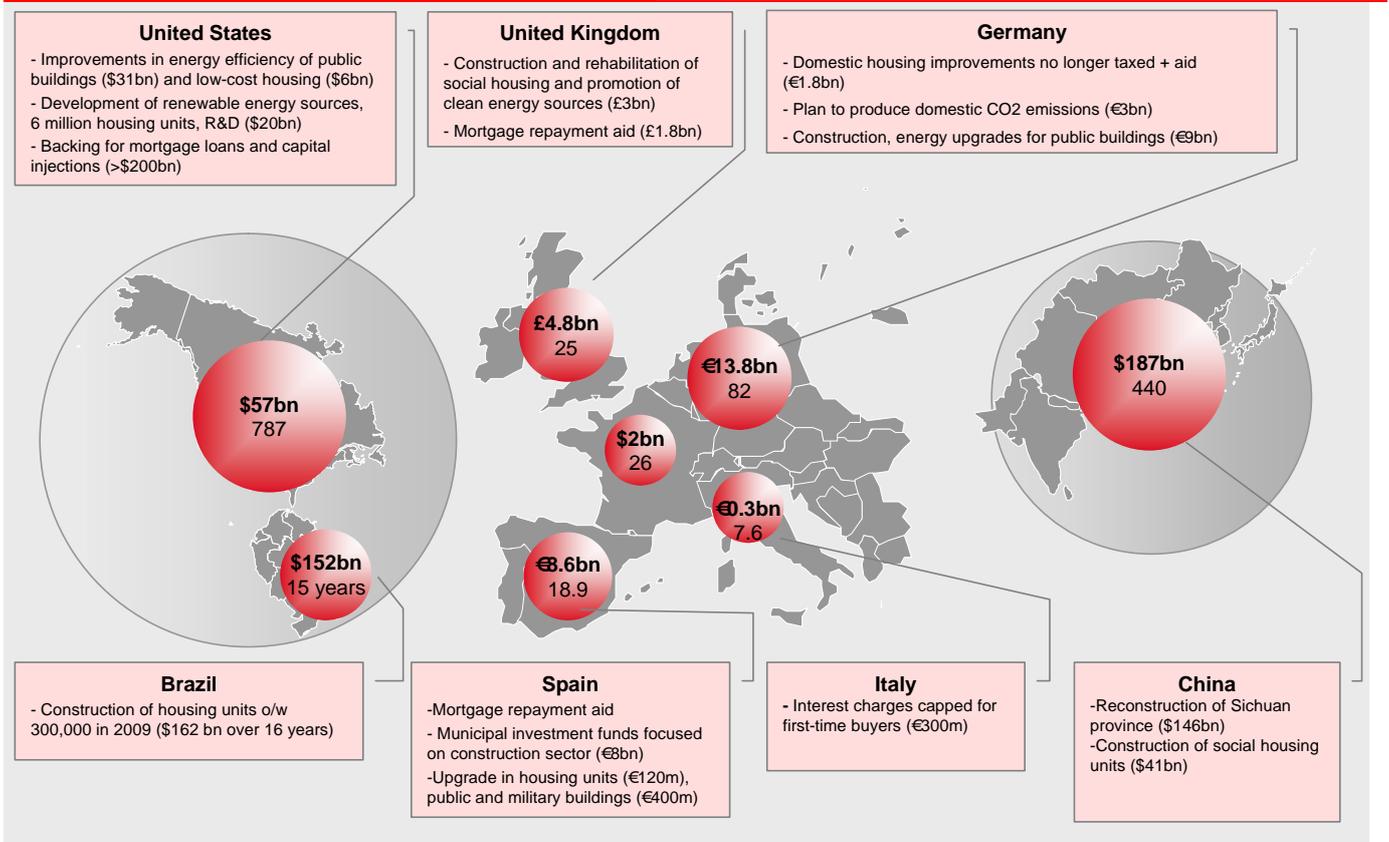
**Regulators are driving energy efficiency**

The building and construction sector employs over 110m people worldwide – between 5-10% of the total workforce in many countries – and the downturn in construction markets is thus a major source of concern. Positively, as a part of the “Green New Deal”, many governments around the world are firming their commitment to reducing buildings’ energy consumption by stepping up existing building energy codes or creating new ones where none existed before.

**Major recipient of stimulus spending, impact in 2010e**

**Buildings including energy efficiency measures are one of the biggest recipients of public stimulus funding and could play a major role on avoiding catastrophe scenarios** although we do not believe that they will completely halt the decline in construction activity. It is important to note that stimulus spending is accelerating or moving forward investments in energy efficiency projects that would otherwise have been undertaken at a later date.

**Construction stimulus packages: increased regulation on renovation & energy efficiency**



Source: Saint-Gobain 2009, SG Equity Research

With the full impact of the global crisis likely to kick in this year and the boost from recovery plans unlikely to materialize before year-end, our economists expect 2009 to be the worst year of the financial crisis. Sector companies, overall, anticipate a more rapid impact from US stimulus measures: following recent pressure from President Obama to start using funds made available within a 120-day timeframe or risk losing such funds. The impact of the Chinese stimulus package is likely to kick in even faster, perhaps with initial signs visible as early as Q2 09e. French companies expect the French recovery plan to have an impact in early 2010e.

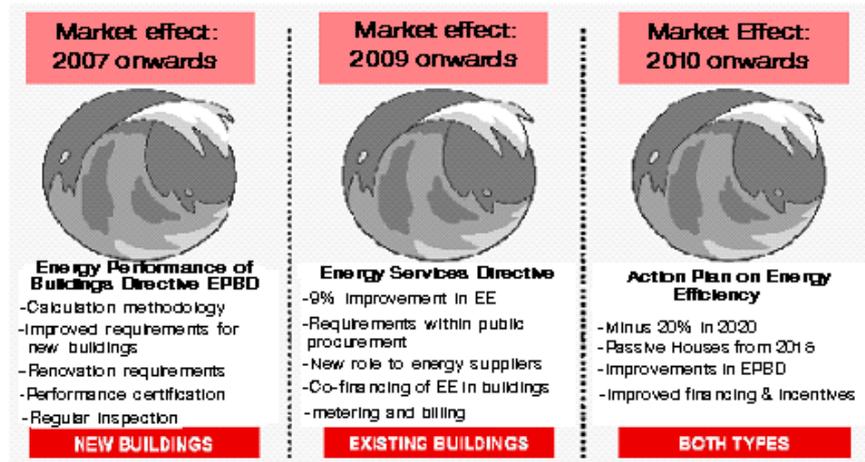
**Prominent & ambitious regulatory framework in Europe**

The combination of the EU's Energy Performance Building Directive, Energy Services Directive and Action Plan on Energy Efficiency provide the world's most prominent and ambitious framework for energy efficient buildings – with a goal that member countries reduce energy use by 20% by 2020. The EPBD, in particular applies minimum requirements for:

- **All newbuilds >50m<sup>2</sup>** concerning average insulation levels, maximum U-values for windows as well as roofs, walls, and ceilings, maximum interior temperature and maximum levels of energy consumption per square meter.
- **Renovation of all existing buildings >1000m<sup>2</sup>** including the installation of new, greener, components and appliances such as systems of lighting, heating, cooling, energy production, insulation, ventilation, and glazing of walls and windows among others.

**A 2009 recast which could remove the current 1000m<sup>2</sup> threshold for major renovations would result in up to €8bn in new capital investments according to the Commission.**

**Market effects of EU energy efficiency regulations for buildings**



Source: Rockwool, SG Equity Research

**Alarming lack of stringent standards in North America**

**Energy-efficiency standards in North America are low given the huge needs for improved energy efficiency.** In the US, efforts have been led by non-profit making organisations (NPOs) such as the Green Building Initiative in cooperation with the EPA or the Department of Energy offering guidelines and benchmarks for greener building and appliances i.e. Energy Star, LEED and the ICC. But there is huge progress to be made with US Department of State Energy Efficiency & Renewable Energy reporting in January 2009 that there are still 11 states with no statewide residential energy code and an additional four states with codes less stringent than 1998 standards. This is alarming as the US continues to lead the world with the highest CO2 emissions from buildings and close to 80% of the existing building stock reportedly under insulated.

**Voluntary standards playing an increasingly important role**

Voluntary standards are also playing an increasingly important role in promoting energy efficiency. For instance, 21 countries have established 1+ green building certification standards including: BREEAM (UK), CASBEE (Japan), Green Star (Australia, New Zealand), LEED (Canada, India, US), Passivhaus (Australia, Germany, UK), Minergie (Switzerland) and Haute Qualité Environnementale (France). We are also seeing a move in Europe to consumer appliance-like energy efficiency labels and ratings for buildings (e.g. Germany, Ireland and the UK) as a means of providing buyers with information about a building's efficiency rates.

**Ireland: energy cost based on energy ratings (250m2 bungalow, Dormer & 2-storey house)**

BER	Energy cost per m2 (approx.)	Energy cost saving (approx vs. C1)	CO2 emissions (kg/m2/yr)
A1	€2.00	80%	0
A2	€3.00	70%	9
A3	€5.00	50%	16
B1	€6.50	35%	20
B2	€7.50	25%	28
B3	€8.00	20%	31
C1	€10.00	NA	35

Source: Kingspan, SG Equity Research

### Long-term vision of zero net energy buildings

Regulators long-term vision is a world in which buildings consume zero net energy. It is ambitious, but ambition is necessary to achieve the progress needed to address climate change and energy use. The UK government, for instance, anticipates dramatic energy reductions to achieve its goal that all new homes in England will be carbon neutral by 2016.

### Cost and CO2 savings, the lowest hanging fruit

**The massive amount of energy used (and wasted...) by buildings around the world does have an upside – it offers the easiest and cheapest route to energy efficiency.** Simple improvements in windows, insulation, lighting and appliances can contribute significantly to meeting global emissions targets.

#### Cost Effectiveness and Energy Savings from Investments in Buildings' Energy Efficiency

Climate type (EU 15)	Building component	U-value before (W/m <sup>2</sup> C)	U-value after (W/m <sup>2</sup> C)	Energy saved [kWh/m <sup>2</sup> a]	Annual investment cost [€/m <sup>2</sup> a]	Cost of conserved energy [cent/kWh]	Simple payback time (years)
Warm Climate*	Package (walls, roof, floor, windows)	2.93	1.85	132.6 / 71.0%	2.61	2.0	2.7
Moderate Climate**	Package (walls, roof, floor, windows)	1.97	0.71	152.6 / 64.2%	3.70	2.4	4.8
Cold Climate***	Package (walls, roof, floor, windows)	1.33	0.46	148.3 / 65.5%	3.82	2.6	6.2

Source: IEA, SG Equity Research. \*Broadly representative of France, Greece, Italy, Portugal and Spain; \*\*Broadly representative of Belgium, Ireland, Luxembourg, the Netherlands and the United Kingdom; \*\*\*Broadly representative of Austria, Denmark, Finland, Germany and Sweden.

In making these improvements thousands of jobs will be created in the R&D of new energy efficient building components, product manufacturing, and in the construction sector. Increasing energy efficiency in buildings will create multiple benefits for the environment and the economy, not to mention energy and political security, making it a win-win-win approach.

#### Abatement opportunities in residential & commercial building sectors have negative costs!

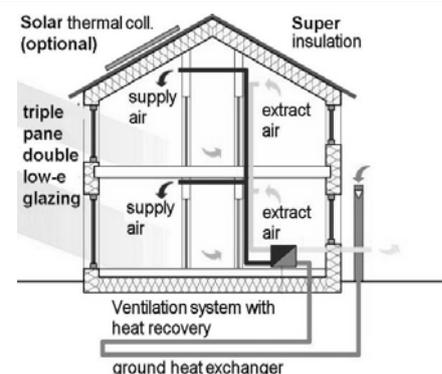
Description		Residential Abatement potential (GtCO <sub>2</sub> e)	2030e Abatement cost (€/tCO <sub>2</sub> e)	Commercial Abatement potential (GtCO <sub>2</sub> e)	2030e Abatement cost (€/tCO <sub>2</sub> e)
Lighting	Low energy bulbs, fixtures, timers, LFLs	0.2	-89	0.1	-61
Appliances	Increased unit efficiency	0.6	-49	0.3	-30
Water heating	More efficient systems	0.4	-35	0.1	-104
A/C	More efficient systems	0.1	-48	0.2	-83
Heating & ventilation	Insulation & improved heating/ventilation	1.2	-129	0.5	-123

Source: Vattenfall, EPA, SG Equity Research

### Effective thermal envelope is the key to energy efficiency in buildings

A solid thermal envelope (i.e. building shell acting as a barrier against heat transfer between the interior and exterior environments) can prevent the loss of heat from a building and reduce heat infiltration from the external environment, reducing the amount of energy needed to maintain comfortable conditions for inhabitants. An effective envelope depends on the performance of individual components including insulation of walls, ceilings and floors and the thermal properties and air-tightness of windows and doors. Improvements in the envelope can reduce

#### Creating an effective thermal envelope

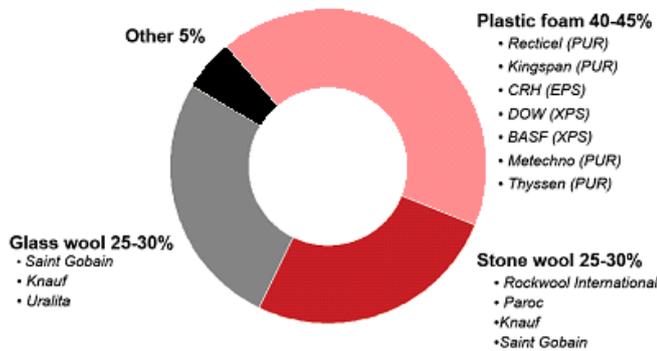


Source: IEA,

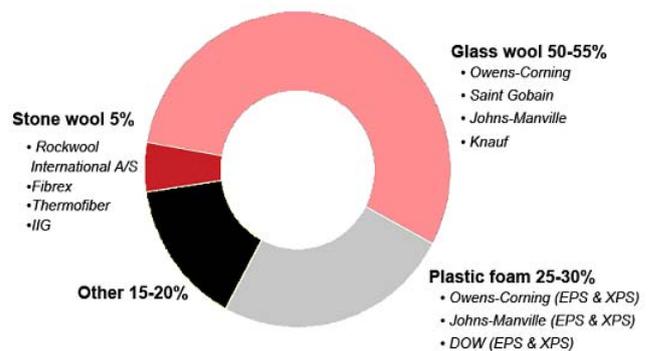


commercial buildings saves at least 30% of total commercial energy consumption. The need for insulation is immense both in developed markets such as the US where it is estimated that 80% of houses are under-insulated and only 1% of the re-insulation market is being captured (Source: Owens-Corning) – as well as in developing markets such as China and India where building stock is growing fast. In the long run, installing more efficient building insulation should be cheaper than changing to low-energy light bulbs or more fuel efficient cars and far cheaper than nuclear, wind or solar power.

**European insulation market**



**North American insulation market**



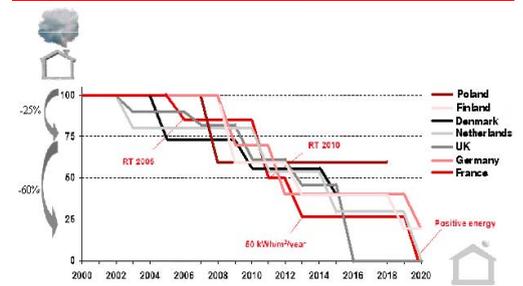
Source: Rockwool, SG Equity Research. Market data at March 2008.

**Thermal insulation materials – comprising glass wools, stone wools and renewable resource materials – should continue to see long-term growth in demand** in buildings and industrial applications because of their strong thermal insulation qualities and the fact they also provide heat resistance, acoustic insulation and fire protection. Short-term, we anticipate that the renovation market will be the best performer and the market segment which should see the most activity on energy efficiency.

**Cost concerns driving more stringent insulation regulation**

**Regulation has played a pivotal role in the drive for better insulation** – and the triple goal of cutting energy costs and emissions. Despite the recession, we anticipate that cost cutting will continue to drive the market, notably by pushing the regulators to pass more stringent u-Value standards. In Europe, the EPBD dictates minimum requirements for new buildings concerning average insulation levels, minimum U-values for roofs, walls, and ceilings, maximum interior temperature and maximum levels of energy consumption per square meter. We anticipate that the 2009 recast of the EPBD should be relatively ambitious on insulation and we are also seeing positive developments in the US, with the passage of a tax credit bill in late 2008, whereby all home improvements for increased energy efficiency – including insulation and windows – from 1 January 2009 will qualify homeowners for tax credits.

**Relative trends in thermal regulations: 2000-2020 (basis of 100 in 2000)**



Source: Saint-Gobain, SG Equity Research

**Better insulation could save 1.6Bt of CO2/y**

Better insulation in new and existing buildings could result in savings of 185Mt CO2/y in Europe alone – the equivalent of a 20% reduction of heating energy use and approximately 5% of total EU CO2 emissions (Source: Euroace). The addition of thermal insulation to existing buildings in Europe could decrease current building energy costs and CO2 by some 42% and 350Mt respectively. Simple measures such as roof and wall insulation have the potential to:

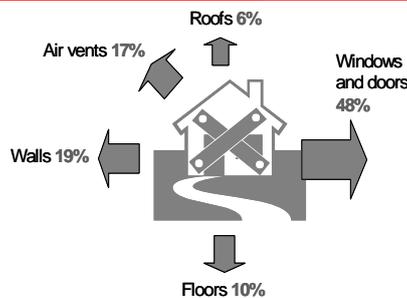
- Reduce emissions by 460Mt/y, more than Europe’s total Kyoto commitment;
- Reduce energy use by 3.3 million barrels of oil a day;
- Save Europe €270bn a year in energy costs (Source: EURIMA).

Globally, it is estimated that improved insulation could – by itself – save 1.6bn tons of GHG a year, which is more than the industrial emissions of Japan (Source: ISover).

**Glass windows, the weakest link**

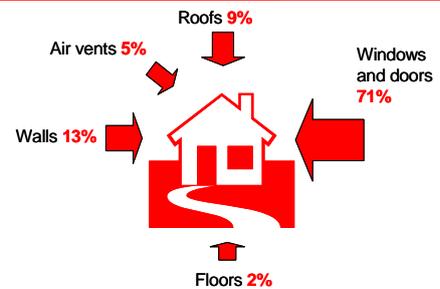
Despite comprising a relatively limited surface area, windows are a building’s weakest link – offering less resistance to heat flows than ceilings, walls or floors. Windows are the area of greatest heat loss and gain and air leakage – accounting for up to 70% of the warmth that penetrates a residential building in summer and for close to 50% of the heat that escapes in winter. Energy loss via windows accounts for approximately 11% of total losses of energy in buildings, typically because of the type of glass used in their construction. Thus despite improvements in heating and cooling systems in recent years, related energy efficiency gains are largely irrelevant if a building is not equipped with energy efficient windows which incorporate multiple glazing layers, low-conductivity gases between glazing layers, low-emissivity coatings, and the use of low conductivity framing materials.

**Windows’ role in heat escape in winter**



Source: NSG Group, SG Equity Research

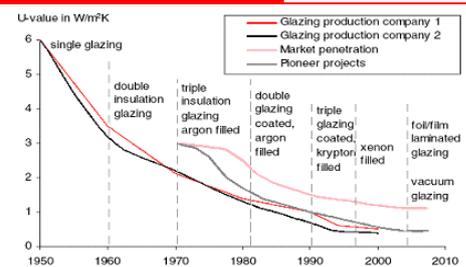
**Windows’ role in heat penetration in summer**



**Improving energy performance of windows**

The energy performance of a window is measured by its ability to resist heat flow or transfer (via conduction, convection or emissions- known as its insulating value (U-value)). The higher the U-value the poorer the energy efficiency of the window, as more heat will flow through it and vice versa. There are several methods to improve the efficiency of windows, including increasing the layers of glazing to double- or triple- glazing, coating the glass with special metals, or filling the

**Evolution of U-values for window glazing: 1950-2010e (in W/m2K)**



Source: CERE, ETH Zurich, SG Equity Research

space between glass plates with an inert gas or a vacuum to reduce heat transfer. A new generation of sophisticated, "smart windows" such as solar control and electrochromic windows – most of which are at an R&D stage vis-à-vis residential and commercial buildings – hold the promise of significantly reducing energy demand and cutting air conditioning and heating loads in the future.

### Regulation driving the move to efficient windows

As with insulation, the primary drivers for increased demand for more advanced, energy efficient windows are the increasing regulations for energy efficiency in buildings which require manufacturers and builders to uphold certain standards in production and construction – and require consumers to purchase products of a certain predefined standard. Another key driver has been rising energy prices in that consumers are more willing to invest in more advanced building materials, such as energy efficient windows, if it will save them money on heating and cooling bills in the long run. In the EU, once again the EPBD has led the way in member states tightening regulations on energy efficiency standards specific to windows.

### Energy efficiency savings of up to 11%

Since the loss of energy via windows amounts to 11% of total energy loss in buildings, installing energy efficient windows would in turn save up to 11% of current losses in energy resulting from windows with poor or inadequate energy performance. Replacing ordinary single or double glazing with low-e glass could reduce buildings' emissions (765Mt CO2 emitted/yr) by 140Mt for the EU25 alone (Source: Glass for Europe). Replacing standard windows with higher optical and thermal quality windows such as those with double glazing or low-e coating can reduce heating and cooling requirements for buildings by 20%.

### Benefits of upgrading EU15 windows to low-e glazing (static energy demand scenario)

	Energy saving MGJ	Cost saving M€ pa	CO2 Saving Mt CO2
<b>EU 15 Total</b>	<b>775</b>	<b>10,315.43</b>	<b>5.77</b>

Source: Glass for Europe

### Companies that stand to benefit

Based on their current exposure to energy efficiency and our long-term forecasts for future development, we believe the following themes and companies constitute a good way to invest in Green buildings through global equities:

**CRH** is the world's #2 building materials company and largest producer of foam thermal insulation (EPS) in Europe with #1 market positions in Ireland, the Netherlands, Nordic countries and Poland. Insulation falls under CRH's pan-European and Americas building products businesses – and the company produced 6.2 million cubic meters of insulation in 2007 (annualised volumes), saving approximately 1.2Mt of CO2 per year cumulatively. In terms of energy efficiency, CRH also benefits from clay products (insulation of brick kilns to minimise heat loss etc.), high insulation values for its concrete sandwich panels and its range of "Platinum" insulation products used in concrete housing to achieve an "A" rating (<75kWh/m2/year of energy). CRH recently raised €1.24bn from shareholders at the same time as its 2008 pre-tax profits fell 15% to €1.3bn. Although 2009 is seen as challenging, it should benefit from lower energy prices, cost reduction measures and US stimulus spending where it has significant public sector projects with fixed budgets.

**EAGA** is the UK's leading provider of residential energy efficiency solutions for utility companies under the EEC (Energy Efficiency Commitment) and CERT (Carbon Emissions Reduction Target), is the leading deliverer of UK fuel poverty programmes, a leading installer of residential insulation and is rapidly growing as a supplier in the £10bn/year UK social housing sector. eaga has helped lift several million vulnerable people out of fuel poverty by installing energy efficiency measures into 5 million UK homes. The company is well-positioned in the short to medium-term with visibility on the UK government's 'warm-front' funding programme to 2011, confirmation of 2008-11 CERT targets, a Scottish Power outsourcing contract, acquisitions in installations services, and securing the Digital Switchover Help Scheme contract. It has a 5Y pipeline to 2013 of £2.0bn and a bid pipeline of £1.1bn. Rather than being hit by the recession, it reported a 10% rise in revenues in the six months to November 30 2008. Falling energy prices should not hit the company as rising unemployment is likely to further UK fuel poverty.

**Imerys** is the #1 French player in clay roof tiles, bricks, chimney blocks and natural slates with 18% of sales exposed to new construction and 15% to renovation. The group is the world leader in the conversion of industrial minerals with strong positions for many minerals (andalusite, bauxite, alumino-silicate, diatomite, kaolin, perlite...). Imerys has a strong portfolio of energy efficiency products including Monomur bricks, Optibric insulation, PV roof tiles, hot water thermal tiles and the Labelhome clay building standard (50kWh/M2). In building materials (clay bricks and roof tiles), Imerys' business slumped significantly in the H2 2008 with a -15% decline in French housing starts. However, thanks to the resistance of roofing market linked to renovation and to further penetration by clay bricks gaining speed in tertiary buildings and small collective housing, sales volumes in France were down only -6.8% for clay roof tiles and -2% for clay bricks. We believe that the energy efficiency push on renovations will continue this relatively positive trend.

**Kingspan Group PLC** is a leader in high performance building materials (e.g. timber frames) and insulation solutions: #1 in UK and Ireland thermal insulation with a 25% market share and a market leader in core insulated panels in the CEE (c.25% market share), Belgium and Germany (c.15%), Canada (c.70%) and Australia and New Zealand (>60%). In addition to its insulated panels business (40% of sales), it also derives 16% of sales from renewables, hot water systems (including solar water systems which saw +60% sales growth in 2008), fuel storage and pollution controls. The company has been hit by a slowdown in the UK and Irish construction markets and for newbuilds, with pre-tax profits falling 70% in 2008 (although insulated panels only fell 5%). While these markets should remain depressed, the company's energy efficient products position it well for long-term growth with Kingspan also planning to develop its insulation and renewable products internationally, including North America.

**Nippon Sheet Glass** is a global glass leader with the greatest focus on flat glass of all the industry majors (trading as Pilkington following the 2006 acquisition by NSG). Pilkington has strong market positions in building products and automotive OE and automotive glass replacement sectors. In FY08, 47% of Group sales were generated by building products with the EU its largest market. The group has a strong line-up of eco-glass from double-glazing through to low-e, vacuum and solar control glass – which offer up to 8x the thermal insulation of single glazing. NSG also stands to benefit from growth in the solar PV market (company est. 40% growth for next five years in low iron rolled and AR for crystalline PV), TCO coated glass for thin film PV (>70% market share), low iron float for concentrated solar (est. 3% growth) – and with 43% of sales coming from the auto sector, NSG is also a market leader for solar control glazing for cars.

**Owens Corning** is an industry leader in glass fiber insulation and reinforcement, roofing and asphalt. In all, 36% of its sales come from insulation and it has leading positions in the North American market (89% of insulation sales) – plastic foam products for the residential, commercial and industrial segments – as well as insulated ducts for HVAC solutions. It has increased recycled content in its flagship PINK insulation to 40% and is actively looking to develop the re-insulation market – targeting the 80m under-insulated US homes. While the company does not anticipate an immediate turnaround in US construction – seeing a 2008 loss of \$839m – it hopes to see sales improvements via tax credits for energy efficiency and stimulus spending. OC is also a global leader in fiberglass composites (c. \$2.36bn in 2008 sales) which are up to 50% lighter than steel and key to lightweighting related efficiency in a number of sectors. It could also benefit via stimulus spending on renewables as it is the leading provider of glass fibre for wind blades (c.10% of composite sales) – it could be one of the least obvious but biggest beneficiaries of wind power expansion in the US.

**Rockwool International A/S** is the world's #2 in insulation and #1 in stone wool products – with insulation accounting for 85% of sales and systems 15%. It has 23 factories in 15 countries and c.8,500 employees in 35 countries – and is the process of expanding in Russia (3 plants) and investing in India (new green-field factory). The company has been hit by higher energy costs, lower sales prices and lower capacity utilisation and delay in construction projects continue in many countries. However, it should continue to benefit from higher activity in the refurbishment segment with mineral wools taking the lion's share of many regulatory (EPBD2) and government efficiency schemes, particularly for smaller buildings.

**Saint-Gobain** is the world's largest manufacturer and distributor of building materials, and a leader in high performance materials and glass containers. Energy efficiency accounts for ~30% of the Group's sales and ~40% of operating income (2008e). SGO is the world #1 on high-performance stone and rock wool insulation with high thermal resistance and in layered glass. It is also well positioned on other efficiency themes, including a) low-E glass with U-values as low as 1.0W/22K, b) solar power modules via AVANCIS (a JV with Shell using technology based on applying thin films of type CIS to a glass substrate and is developing glass and glass based substrates for other photovoltaic technologies), c) lighting, supplying sapphire substrates used in LEDs and OLEDs (new forms of "electronic lighting" offering superior energy efficiency and longer life), and d) producing particulate filters for diesel engines which capture 99.99% of emissions. It is also innovating on solid oxide fuel cells for usable electricity and heat, with installations capable of producing up to 1 kW (for domestic use) or several megawatts (power station), depending on how many basic units are combined together. Beyond the economic cycle, Saint-Gobain's positioning in materials that enable energy savings and are environmentally friendly constitutes a real growth driver and we think this is where Saint-Gobain will continue to expand in the long term.

**SIG Plc** is an international supplier of insulation, exteriors, interiors and specialist construction products. The Group operates across Europe in 15 countries. It is the #1 European supplier of insulation materials which accounts for over one-third of sales. Demand from ever-stricter building regulations on energy efficiency such as the UK's CERT and goal of zero-carbon homes – means that retrofit-driven growth should continue to outpace its sector even if there is a delayed impact at play - it typically takes at least two years for the full effects of new laws to take hold. With residential construction accounting for only 20% of sales, the effect of the slowdown should be moderated. Moreover, SIG should benefit from the fact that one-third of sales come from the public sector and increased long-term spending on schools and hospitals.

**Steico AG** is positioned as a system provider for environmentally friendly insulation materials (wood-fibre based insulation: 62% of sales) and is moving towards being a system provider for ecological construction materials, for example by using natural fiber boards (30% of sales) for I-Joists. Its product portfolio consists of insulation solutions for roof, dry walls, ceiling and floor constructions and it is the EU market leader for wood-fiber insulation materials (c. 40% market share). Its environmental credentials are further reinforced by an FSC certificate (Forest Stewardship Council) for all wood-fiber insulation materials and also the 'natureplus' seal for its key product range. Despite difficult market conditions – with the company predicting a possible loss in 2009 – Steico should continue to hold a stable niche position for ecological insulation materials.

**Uralita** is a Spanish building materials group focused on four core competencies: insulation materials (50.5% of sales), gypsum (22.9%), pipes (18%) and roofing (8.5%). It operates 39 production facilities throughout Europe, and is the market leader for insulation materials in Spain (47% of sales) and #3 European manufacturer. It stands to benefit both from energy efficiency for housing (insulation, plasterboard, roof tiles and solar panels) and efficiency in use of water pipes. The decline of the Spanish (23% of sales), UK and CEE construction sector is taking its toll. The company announced a €60m profit for 2008 on sales, which fell 8% to €1bn. It is majority owned by Nefinsa SA.

**Wienerberger** is the world's #1 player in hollow bricks and European #2 for roof tiles. Hollow bricks accounted for 38% of 2007 revenues, facing bricks (façade) for 33% and roof tiles for 21%. The company has a history of high margins for its hollow bricks resulting from its strong gains of market share in Western Europe, rollout and growing presence in CEE countries and limited competition – with Wienerberger the only major multinational player in the field (ex-CRH and Hanson for facing bricks in some markets). WIE saw 2008 revenues fall 2% to €2.4bn and anticipates a difficult market environment for 2009, particularly for its emerging Europe business. It estimates a 10% fall in revenues for 2009 and plans to continually adjust capacity to reflect market conditions.

## Green capital goods - T&D the big winner

### SG Green Capital Goods Watchlist

ABB  
ALSTOM  
AREVA  
CREE\*  
GENERAL ELECTRIC\*  
JOHNSON CONTROLS\*  
PHILIPS  
SCHNEIDER ELECTRIC  
SIEMENS  
UNITED TECHNOLOGIES\*

\* Not covered by SG, no reco, no TP

**2009 is a crossroads for energy efficiency:** Soaring energy prices up until mid 2008 acted as a key incentive for the industry to invest in energy efficiency measures during the upcycle. However since the peak, Oil and Gas prices have fallen 69% and 64% respectively. Against the backdrop of a deep recession, the pure economic incentive to invest in energy efficiency measures has diminished as project paybacks have lengthened, typically from 2 years to 3 and beyond for building projects, for example. But, energy efficiency has not disappeared. Political targets such as the EU's goal to cut CO2 emissions by 20% by 2020 – and stimulus spending – will focus the economy's attention to be more efficient in its energy usage.

**Examining the entire electrical chain from light bulb to power plant,** we believe that industries exposed to direct policy influence through regulation and legislation should benefit most in our view. From this perspective, the T&D industry stands out. The main investment driver is a regulated tariff used to ensure guaranteed returns. More importantly, stimulus packages in the US, Europe and China have all highlighted the power grid as being a key area where energy efficiency investments will be implemented. We see little support in 2009 for purely market orientated segments such as Industrial Automation or Power Generation. Despite the attraction of long-term savings, the collapse in energy prices combined with the economic recession is likely to see discretionary capex projects delayed or cancelled.

### Green Capital Goods – companies with energy efficiency exposure

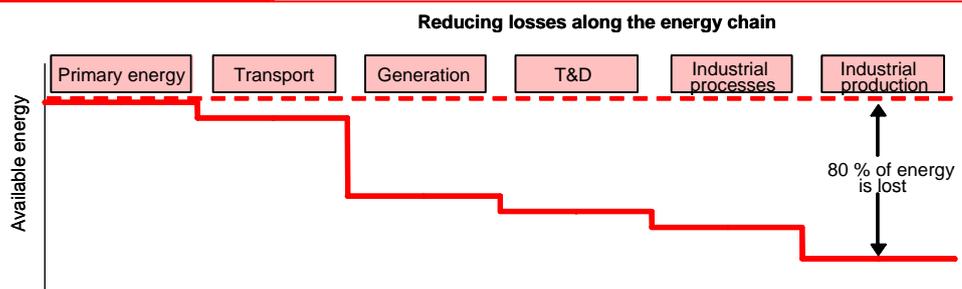
Theme	Products, technologies, services	Companies
Lighting	Eco-bulbs, CFLs, LEDs, electronic ballasts, luminaries	Cree, Epistar, Philips, Siemens, Zumtobel
Building Automation	Dimmers, timers, presence detectors, thermostats, floor heating, Variable speed drives (HVAC, pumps, fan, motors) Building management systems, power monitoring& analysis Building services	GE, Honeywell, Johnson Controls, Schneider Electric, Siemens, Tyco, UTC
Industrial Automation	Applications (pumps, fans, compressors), High efficiency motors, variable speed drives	ABB, Emerson, Invensys, Mitsubishi, Omron, Rockwell, Schneider Electric, Siemens, Yokogawa
T&D	HVDC, efficient transformers, automation tools, subsea links	ABB, Areva, Siemens
Power Generation	Power plant technology	Alstom, GE, Siemens

Source: SG Equity Research

### Long-term drivers for energy efficiency are striking

High energy prices, rising environmental concerns and more stringent regulations about more energy-efficient buildings and industrial processes have been fuelling demand for energy efficiency solutions. Growth has also driven by the need for quality and reliable power supply due to rising concerns regarding power grid efficiency. At present 80% of energy is lost by the time the end user actually consumes it, so the scope for savings is huge.

### Energy lost throughout the whole chain



Source: ABB, SG Equity Research

- **Energy demand is set to double over the next 50 years**, while CO2 emissions need to half to avoid dramatic climate changes. 20% energy savings would represent 1,150TWh of electricity, i.e. the electricity generated by 1,300 1,000MW power plants or 575Mt CO2 in one year.
- **Electricity production is expected to double by 2030** with coal remaining the most widely used fuel, accounting for up to 90% of new power generation in China (Source: IEA). Even with the increasing use of renewables and low-carbon energy, there's a huge need to improve generation and transmission efficiency of coal and oil-fired power plants which have average transformation efficiency of 30-35% (vs. 60% for new generation capacity).
- **Regulators are sticking to their guns on CO2 & renewables targets** Despite a fall in carbon prices, the EU is sticking to its stringent emissions reduction targets – 20% by 2020 – and the post-2013 effect of auctioning also needs to be factored in. In the medium-term, we see EA prices climbing back towards €20/t and €23/t by 2013 – prices which should be sufficient to spur companies to push for emissions reductions in a new “less is more” economy. Moreover, U.S. legislation could be passed in 2010 and we estimate transactions in the first year of the cap could exceed US\$100bn and reach US\$1trn by 2020.
- **Stimulus spending on electricity infrastructure** The T&D, renewables and building markets are set to be clear beneficiaries of government stimulus packages. In Europe, France has already indicated for example that as part of its stimulus package, RTE (the grid operator) will increase spending by 20% to €1bn in 2009. In the US, President Obama's stimulus package looks to attribute \$11bn in funding for the electricity grid including a concerted move towards a “smart grid”. A second element of the plan is to provide \$8bn in loan support for renewable energy and transmission loan guarantees, which if successful is expected to support more than \$80bn in loans. China is also looking to spend up to €56bn on refurbishing and expanding its electricity grid.
- **Energy efficiency is a better solution than new capacity** Energy efficiency is also a much better way than adding new power capacity to satisfy growing demand. Energy efficiency is cleaner and cheaper than adding capacity since 1 unit of electricity saved at home or in the workplace equals to 3 units of saved power production. The global electricity generation amounts to 17,400 TWh while the global electricity end use is just 5,742 TWh. Energy efficiency is also quicker as it is a shorter term investment with a quick payback. Technology is also readily available. Finally, it reduces dependence on energy imports as it does not require other countries' electricity generation.
- **Existing technologies could easily save up to 30% in energy consumption** Up to 30% savings are possible through a combination of more efficient devices, better usage of installation and devices and monitoring program. Counting on people behaviour to turn off devices when not needed is hopeless in the long term. Automation technologies to monitor and regulate motors, heating and lighting are necessary. This is where capital goods companies come in.

**Up to 30% energy savings are possible**

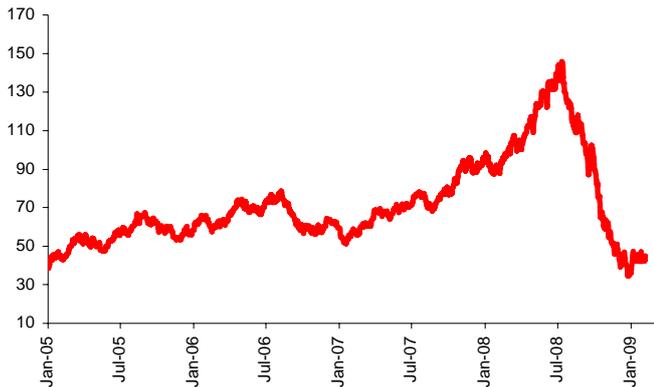
	Potential energy savings	Comments
Efficient devices and installation	10 to 15%	Low consumption devices. Insulated buildings
Optimised usage of installation and devices	5 to 15%	Turn off devices when not needed, regulate motors or heating at the optimised level
Permanent monitoring and improvement program	2 to 8%	Maintenance program to measure and react in case of deviation

Source: Schneider, SG Equity Research

## 2009 will be a crossroads

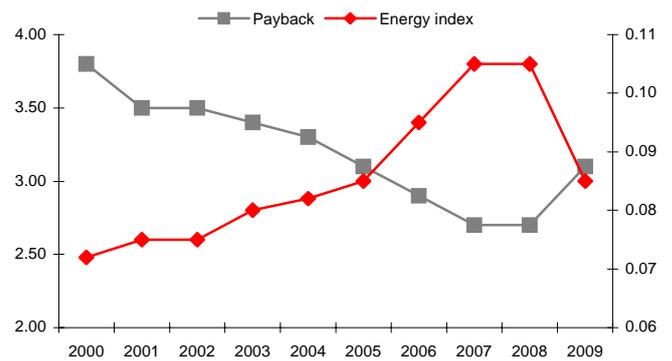
While the long-term arguments in favour of energy efficiency are clear and the technology already existing, we believe the current recession is likely to significantly dampen demand for such solutions. Energy prices have fallen by over 60% since their peak last summer, meaning that potential savings have diminished and payback periods have stretched out.

### Energy prices have fallen from their peak



Source: Datastream, SG Equity Research

### ... leading to longer payback periods



Source: SG Research and Schneider

More precisely, we believe that the theme of energy efficiency has reached a crossroads. On the one hand, we expect legislative steps and public spending to support certain industries, most noticeably the T&D industry. The T&D industry remains a largely regulated market and as such policymakers can have a greater influence on investment decisions. Higher tariffs for specific regions or projects can be used to stimulate investment. Moreover, stimulus plans in the EU, Europe and China are all targeting this industry. In the US, the federal fiscal stimulus program will spend \$11bn on smart grid related technologies for the T&D market. In Europe, France will increase spending by 20% on the power grid in 2009 as part of its stimulus package, while China has indicated that it will accelerate an already ambitious investment programme. Companies are also responding to the challenge, with RWE announcing on 24 February that it will create a special Energy Efficiency division

On the other hand we expect this theme to diminish in importance for end market such as Industrial Automation, Power Generation and the Building Industry. These largely liberalised industries, with predominantly market-orientated investment decisions are likely to focus on the growing payback period such projects achieve against the face of falling energy prices and as such cancel and delay investments.

### Sales by end market for select Capital Goods companies

Sales by end market	Siemens	Schneider	Legrand	ABB	Phillips	Alstom
Power Generation	17%	0%	0%	0%	0%	67%
Transmission & Distribution	11%	10%	0%	49%	0%	0%
Industry	20%	29%	0%	46%	0%	0%
Building	7%	40%	100%	5%	0%	0%
Transportation	7%	0%	0%	0%	0%	33%
Lighting	5%	0%	0%	0%	27%	0%
Critical power	0%	13%	0%	0%	0%	0%
Other	33%	8%	0%	0%	73%	0%
<b>As a % of group sales</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Source: SG Equity Research

## Lighting, legislative support will be a driver

**Lighting accounts for 19% of electricity use worldwide**, out of which 31% is for residential lighting and 69% for commercial, industrial and outdoor lighting. According to Philips, up to 75% of all lighting currently installed is old and inefficient. In Europe approximately 2.1 billion energy inefficient bulbs are sold every year mainly for homes, and other commercial uses while there are 3.6 billion such inefficient bulbs in use. According to CELMA, 75% of office and industrial lighting systems are inefficient while 30% of all road lighting is over 20 years old, based on technology dating from the 1960s. Potential energy savings are thus huge - up to 40% could be realised with available technology, corresponding to a reduction of around €106bn in electricity costs per year (40% savings @ €10cts/KWh) and 555 million tonnes of CO2 emissions per annum worldwide.

### Toward environmentally friendly and energy-saving products

Many countries have now established energy conservation programmes, including China, one of the largest markets for energy-saving bulbs. The industry’s product offering to reduce energy consumption is also impressive with compact fluorescent bulbs, eco-classic bulbs (energy saving halogen), solid state lighting solutions (LEDs), electronic ballasts and energy efficient luminaires all offering huge potential to reduce energy use by lighting.

#### Examples of energy saving improvement over the past 15 years (worldwide)

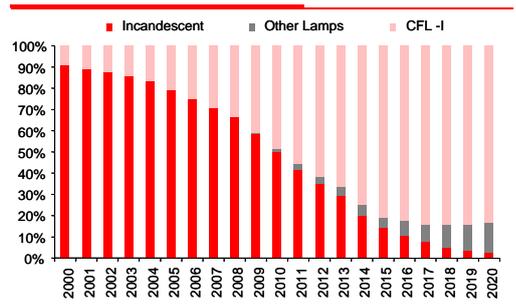
Area of lighting	Energy improvement over the last 15 years	CO2 savings per bulb per year
Road lighting	225%	110 kg
Shop lighting	400%	166 kg
Office & Industrial lighting	300%	140 kg
Home lighting	500%	100 kg

Source: SG Equity Research

### Legislation could phase out incandescents by 2020

Philips is currently lobbying the European commission to underline the cost and CO2 savings of using new lighting sources. This comes on the back of increasing regulatory moves to ban incandescent lights. A number of major markets are currently in the process of phasing them out (Australia, Brazil, China etc.) while others have set in place timelines for effective bans (EU: 2009-11, Japan: 2012, US: 2014). However, falling energy prices could delay this switch over. Current market renovation rates are however too slow (3% a year in street lighting, 7% a year in office lighting). Rising energy prices acted as a clear catalyst to accelerate investments. However, as electricity prices fall, pay-back times for green products are lengthen, which could lead to a delay of renewal rates.

#### Phase out of incandescents

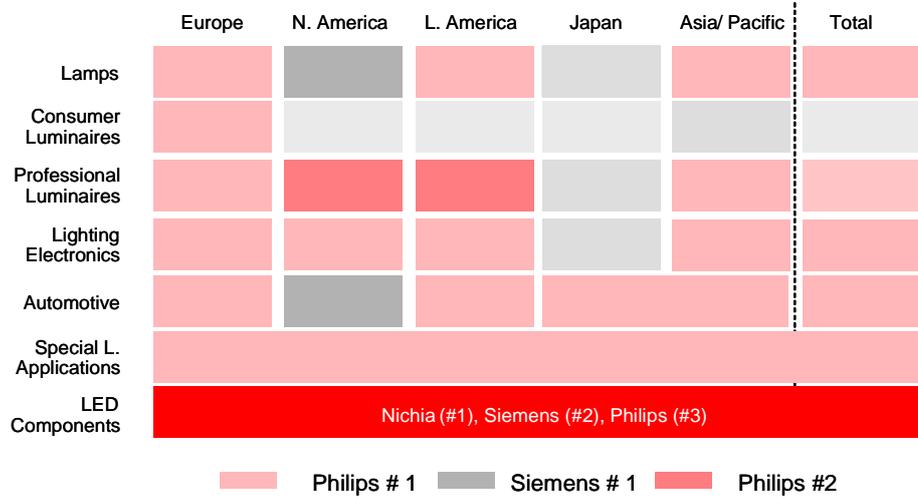


Source: SG Equity Research

### Philips and Siemens control 39% of the traditional bulb market

With the exception of luminaires, the lighting industry is highly consolidated with the three largest companies Philips (20% market share), Siemens (19% market share) and GE (12% market share) controlling around half of the world market – and a few niche players such as Cree and Epistar playing important roles in energy efficient LEDs.

**Lighting - market positioning per business per region**



Source: Philips, SG Equity Research

**Building Automation may profit in 2010**

The Buildings sector is one of the biggest energy consumers (39% of total energy consumed worldwide, of which 21% related to residential and 18% related to tertiary, industrial and infrastructure buildings). This segment consists of products to measure, control, detect faults and report information (sensors, actuators, controllers, etc.), combined with software to analyse and help operators to manage building functionalities and costs. This includes HVAC control (Heating, Ventilation, Air Conditioning), lighting control, fire and security systems. Siemens estimate that the Building Automation market is worth around €85bn. Renovation and the use of more efficient HVAC, lighting and integrated building systems can yield up to 30% of energy savings.

**Available energy efficiency products and solutions**

Energy efficiency products	Management systems	Services
Dimmers, timers, presence detectors Thermostat, floor heating control Variable speed drives for HVAC, pumps, fans, motors	Building management systems and analysis Power monitoring	Site audits Data collection and analysis Financial analysis and ROI validation Planning of improvement plan Remote monitoring and optimisation

Source: SG Equity Research

**Stimulus spending should offset negative factors**

- **Falling energy prices lengthen payback periods:** As energy prices fall, the commercial payback period for many construction projects is likely to be extended from 2 years towards 3 years and beyond. We fear that in the current liquidity constraint environment this will lead to many projects being cancelled or delayed, as companies look to scale back investments and preserve their cash reserves.
- **IT investments could fall from demanding levels** Energy solutions for data centres has been an area of booming investment in recent years, against the backdrop of growing demand for data services and rising energy prices. While previous studies, such as that of the IDC forecast the cost to power and cool servers in a data center would increase by 54% in the next 4 years, we are concerned that these forecasts are no longer valid. As energy prices

decline, we are concerned that such discretionary investments could be delayed despite the long term savings.

■ **Benefits from the stimulus plan to come in 2010:** As described earlier, stimulus packaged in China, Europe (Germany, Italy, Spain, UK) and the US are likely to provide a clear boost to the industry. Obama's plan for example in the US is looking to spend \$31bn on building energy efficiency investments. We consider that the majority of this investment will be materialised in 2009 and bring forward a number of planned energy efficiency initiatives.

### Siemens and Schneider are best placed in Europe

At a global level, this market remains highly fragmented. Local presence is a key competitive factor and from this perspective Europe is dominated by Siemens and Schneider, while Honeywell and Johnson Controls are the main players in the US.

#### Competitive landscape for building automation

	Building controls	Sensing	Security	Fire systems	Building solutions
Siemens	☑	☑		☑	☑
Honeywell	☑	☑	☑	☑	☑
GE		☑	☑	☑	
Johnson Controls	☑				☑
Schneider	☑	☑	☑		☑
Tyco			☑	☑	
UTC	☑		☑	☑	☑

Source: Honeywell, SG Equity Research

### Industrial Automation likely to see delayed investments

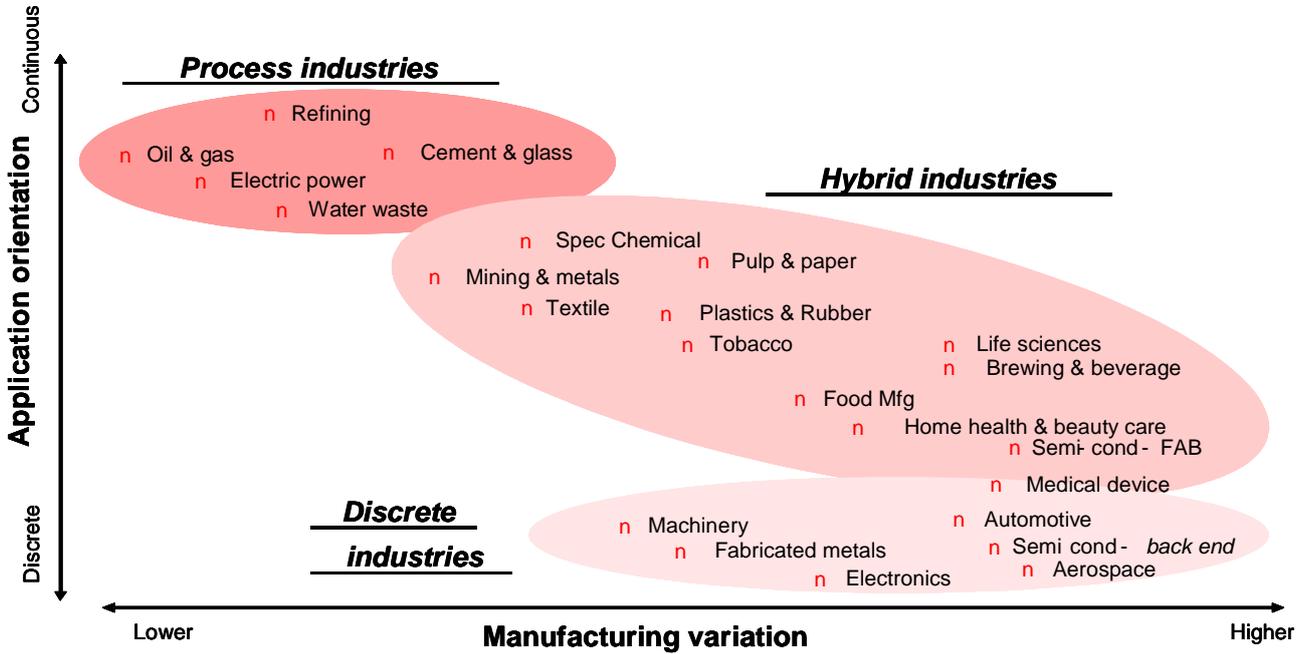
**Industry accounts for 39% of the world's energy consumption** and the underlying objective of the Automation market has always been to make industrial processes more efficient and profitable. Against the background of scarce and expensive resources, energy efficiency is becoming an important growth driver for the automation industry. The potential for energy savings is extremely significant, especially around motors. Energy costs represent 25% to 50% of production costs on average and motors account for over 60% of the electricity usage. Schneider estimates that the average facility can reduce its energy consumption by 10 to 20%. Switching to energy efficient motor systems throughout the EU could produce savings amounting to 2020 billion kWh in electricity consumption, which is equivalent to a reduction of €10bn in annual operating costs for industry.

#### Potential electricity savings from switching to energy efficient motor systems

	EU-15	EU-25	France	Germany	Italy	UK
High efficiency motors	24	27	4	6	4	3
Variable speed drives	45	50	8	10	7	6
Applications (pumps, fan, compressors)	112	125	19	26	17	15
Total	181	202	31	42	28	24

Source: ABB, SG Equity Research

**Overview of automation sector and breakdown between processes**

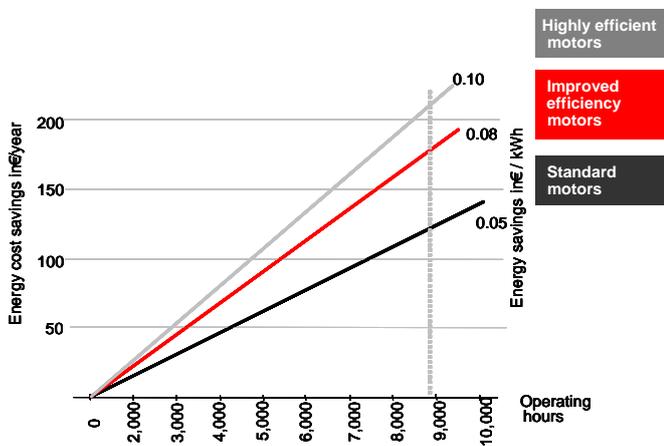


Source: Rockwell, SG Equity Research

**Lengthening payback likely to delay investments**

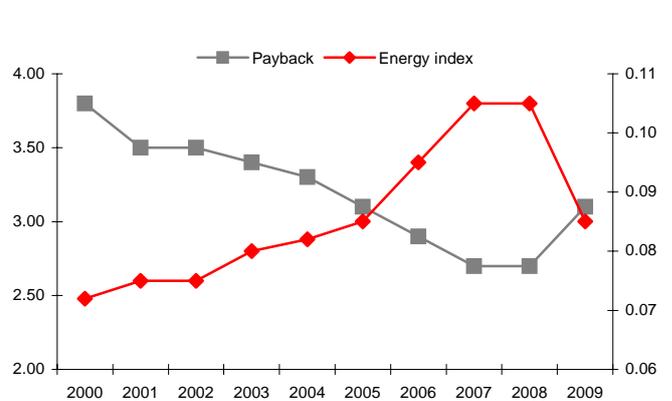
In the current environment, we are particularly concerned that the Automation market will suffer from its exposure to general industrial capex trends. Industrial investments, which receive no state funding or legislative constraints are most sensitive the payback of a project. As shown in the chart below on the left-hand side, the higher the cost of energy, the greater savings a typical variable speed drive can achieve. The opposite of course is true. While rising energy prices shortened payback periods and stimulated energy efficiency investment up until 2008, falling energy prices are likely to work in the opposite sense during 2009, as shown in the chart below.

**Energy savings from a variable speed drive**



Source: Siemens

**Payback period as energy prices fall**

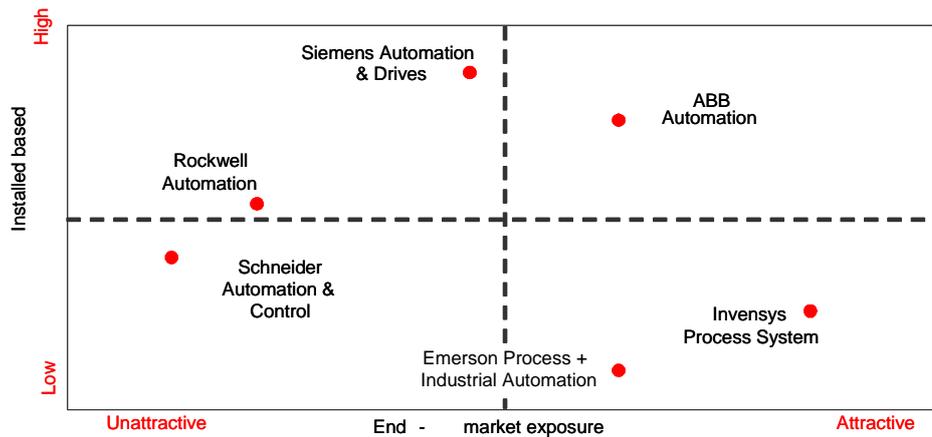


Source: Schneider

**Siemens is the No 1 automation company**

There are numerous players in the automation business, with only Siemens controlling more than 15% of the total market (27% of company sales). However, historically most companies have competed within specific sub-segments (discrete, process, etc.) of the overall automation market and with the help of closed systems, barriers to competition remained high, supporting profitability. Other major actors include ABB (12% of market, 51% of sales), Emerson (6%, 43%), Schneider (4%, 29%), Rockwell (4%, 100%), and Invensys (2%, 29%).

**Competitive landscape for industrial automation**

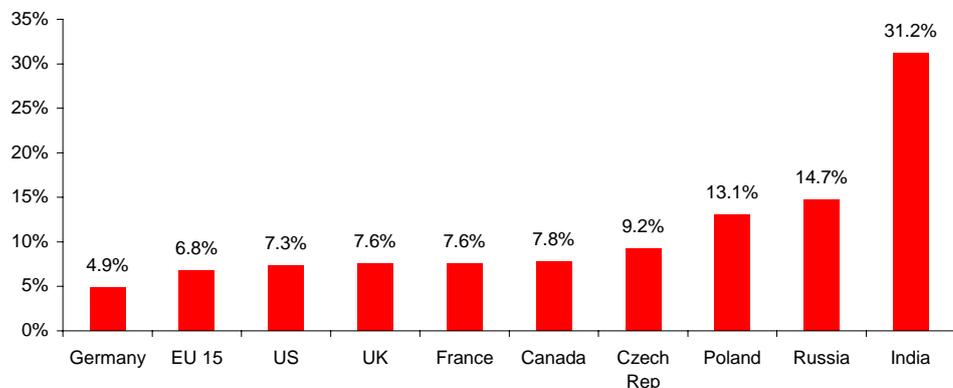


Source: SG Equity Research

**T&D a clear winner from stimulus packages**

Energy efficiency can be considered as a smart way to satisfy growing electricity demand, rather than adding new power capacity. It is cleaner and cheaper since one unit of electricity saved at home or in the workplace equals three units of saved power production. However, at present, about 7% of the electricity transported over the grid is even lost in mature regions such as the US and EU. In emerging markets it can be as high as 31%.

**Energy losses in the grid**



Source: Areva

### T&D cuts down energy losses

The Transmission & Distribution (T&D) industry – which supplies equipment, systems and services to medium and high voltage energy markets – is particularly well placed to deliver energy efficiency gains in our view.

#### Overview of T&D technology and energy savings

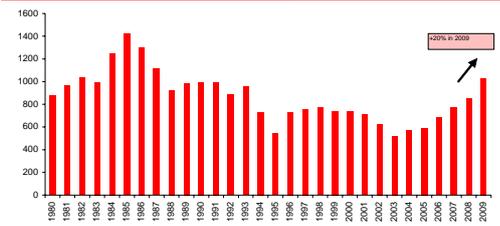
T&D technology	Energy savings
HVDC	High voltage direct current lines used to transport electricity over long distance can reduce electricity losses by threefold
Transformers	More efficient transformers
Automation tools	ABB's Flexible Alternating Current Technology (FACTS) can increase transmission capacity by 20%-40% through existing lines
Subsea links	Can enable offshore Oil & gas platforms to be connected to the national grid & thus avoid expensive & polluting on site power sources (oil fuelled generator). Typical savings by connecting an oil platform to the grid would be about 130,000t CO2/y

Source: SG Equity Research

### Stimulus packages to act as real support

The T&D market is also set to be a clear beneficiary of government stimulus packages. In Europe, France has already indicated for example that as part of its stimulus package, RTE the grid operator will increase spending by 20% to €1bn in 2009. In the US, President Obama's stimulus package looks to attribute \$11bn in funding for the electricity grid. A second element of the plan is to provide \$8bn in loan support for renewable energy and transmission loan guarantees, which if successful is expected to support more than \$80bn in loans.

Annual investment in French power grid: 1980-2009e



Source: SG Equity Research

### Cross border initiatives provide an additional support

As Europe seeks to put in place a more efficient single electricity market, a key requirement is to have the necessary infrastructure that will facilitate cross-border electricity flows, i.e. interconnections. The EU considers that a minimum of 10% interconnection level is sufficient to introduce effective competition across borders. At present, France, Spain, Portugal, the UK, Ireland, Italy and Poland are all below this level. This political goal should support T&D in the coming years and we have seen recent promises of European Investment bank (€18bn/y from 2009) and European Commission (€5bn) funding. In the US, federal authorities have also tried to put in place legislation to boost T&D investment such as the priority corridors to improve the interstate grid (National Interest Electric Transmission Corridors).

### Connecting renewables will also boost T&D demand

In both Europe and the US there is a significant change in the energy mix that is being installed. In particular, the growing amount of wind energy will require additional and more sophisticated transmission requirements. In 2007 wind power in the US made up 20% of new capacity announcements. While in Europe 43% of new capacity additions in 2008 were for wind farms. Distributed energy resources often require more T&D investment with the Edison Electric Institute estimating, for example, that for every 10 miles of additional wind transmission requirements (assuming the cost is \$3m for one mile of 345-kV link) an additional

investment of \$30m is needed (i.e. changing frequency needs to be adjusted with the help of hardware such as a frequency converter, switching to other energy sources etc).

**T&D looks better placed than power generation**

To highlight the importance of energy efficiency, the Edison Electric Institute recently indicated that, through the implementation of "realistically achievable" energy efficient and demand response programmes, the US would require 81 GW less power capacity compared (vs. reference scenario of 214 GW to 2030). In such a scenario, spending on power generation would be nearly \$200bn less than in its reference scenario, while spending on T&D would remain steady at \$880bn and additional spending on advanced metering and energy efficiency as well as demand reduction programmes would amount to \$85bn (10% of the T&D budget).

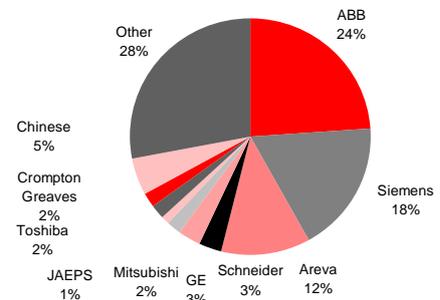
**Power outlook to 2030 with energy efficiency scenario**

	Reference scenario	Reasonably achievable efficiency base case scenario
Total new capacity (GW)	214	133
Generation (\$bn)	697	505
Transmission (\$bn)	298	298
Energy efficiency and demand reduction investments (\$bn)	0	85
Distribution (\$bn)	582	582
<b>Total capital investment (\$bn)</b>	<b>1,577</b>	<b>1,470</b>

Source: EEI, SG Equity Research

Overall, we consider that the trend towards energy efficiency is extremely positive for T&D players that can offer smart grid technologies, more efficient transformers to reduce transmission losses and metering services to reduce final electricity demand (See further SG's *Green IT* report). On the other hand, the trend represents a significant threat for the Power Generation industry as the more energy that is saved by the final consumer, the less necessity there is to build new capacity.

**T&D market share 2007**



Source: SG Equity Research

On a company basis, we expect the three major T&D players – ABB (clear leader), Siemens, best in class) and Areva (catching up) – will benefit from these investments given that they all have a complete product offering and engineering expertise. They have been taking market share in the recent past and we expect this trend to continue.

**T&D – key industry differences**

	ABB	Siemens	Areva
Installed base	+++	++	+
Technology	+++	+++	++
Global presence	+++	+++	+++
Solutions provider	+	+++	++
Product range	+++	+++	++
<b>Key differentiating factor</b>	<b>Higher exposure to high margin products business</b>	<b>Higher exposure to low margin systems business</b>	<b>Fast improving player but still behind top 2</b>

Source: SG Equity Research. Range: from + to +++ with + being the weakest and +++ the strongest

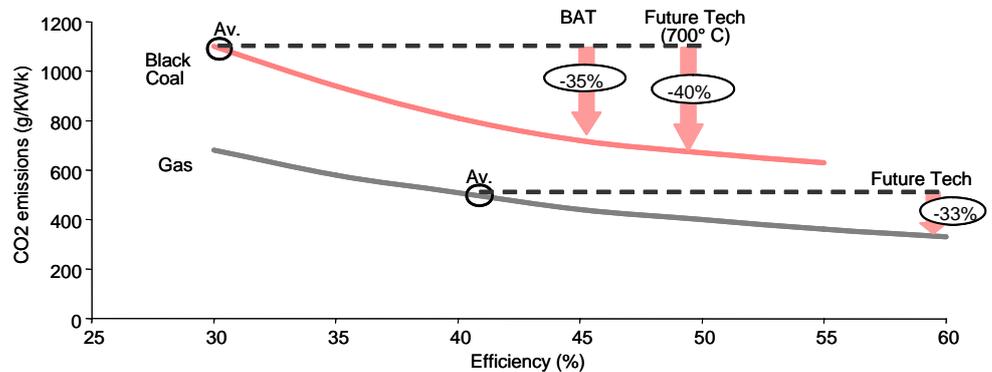
## Power Generation to face the brunt of capex cuts

The power generation market provides a full range of equipment necessary for the conversion of energy into electricity. It offers a broad array of power plant technology, including the development and manufacture of equipment, the planning, engineering and construction of new power plants, as well as services.

### Efficiency is key for a power plant

The more efficient a power plant is the less fuel it requires to produce an equivalent amount of power and thus the more profitable and less polluting it is. The leading power generation companies are all looking to increase the efficiency, with each percentage point reducing CO2 emissions and delivering a competitive advantage. Compared to the traditional installed based, the Power Generation industry is targeting a 40% in CO2 emissions for Coal power plants and a 30% reduction for Gas power plants. **Alstom is the company most exposed to this trend in our universe.**

### CO2 reductions through efficiency gains

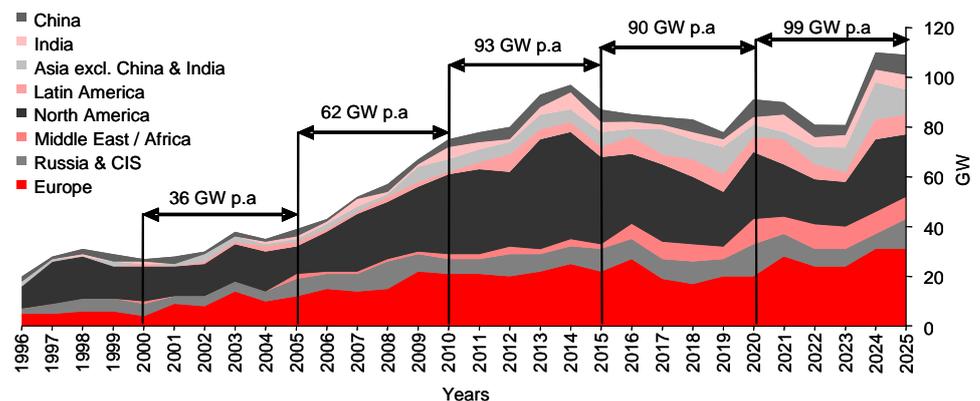


Source: Alstom

### Strong needs for retrofit and environment systems

The volume of plants reaching over 40 years of age in the world is growing very quickly, creating significant growth potential for the retrofit market. It is often a captive market for the original supplier. Besides, risks are much lower than for large installation contracts and market volatility is also much lower. Based on the installed base, North America has the largest volume of power plants reaching over 30 years of age. This is mainly due to the several installations throughout the post-war period.

### Evolution of installed base reaching 40 years old age (GW)

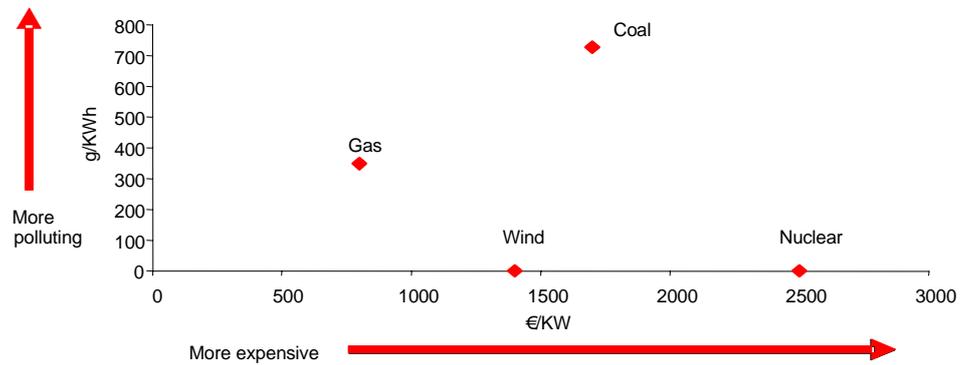


Source: Alstom

**Power generation priorities**

Within the power generation market we believe that Utilities in the short term are likely to focus on the most essential projects, namely those projects that ensure the lights don't go out. As base load power plants require a large upfront investment (roughly €4bn for Nuclear, €1.7bn for Coal compared to c. €640m for Gas), in our view, most are likely to be delayed. Longer-term, we expect CO2-free technologies to continue to gain ground within the energy mix – with coal power plants likely to fall out of favour (ex clean coal and CCS), while a mixture of wind energy and gas solutions should grow in popularity.

**Attractiveness of Power Generation technologies**



Source: SG Equity Research, EDF and Eurelectric

**The Big Three PG players**

GE Energy (13% of group sales and reporting a margin of 17.5% in 2007) is the clear market leader holding the No. 1 position in the lucrative gas market and expanding heavily in wind (22% of divisional sales). GE Energy's business model is to focus purely on selling products and then servicing the aftermarket. It chooses to avoid high-risk low-margin turnkey projects. Siemens (17% of group sales) is active in all major technologies, holding the no 2 spot in Gas and Coal. Siemens' strategy is to build and expand capacities (Wind, Gas turbines, T&D), reduce its exposure to turnkey projects, while growing its service and product businesses to reduce the risk profile. In essence, it is looking to follow the GE business model. Alstom's strategy is to have a well diversified portfolio of products to take account of shifts in demand. The company believes that no single energy source will prove to be the dominant source, but rather the world will rely on a blend of technologies. While Alstom missed out on the US gas bubble at the beginning of the decade, the current balanced demand make-up is more favourable for the company as it exploits its leading position in Steam, Hydro and renewed presence in Gas.

**Power generation – key industry differences**

	Alstom	Siemens	GE
Installed base	+++	+	++
Technology	++	++	+++
Global presence	+++	+++	+++
Solutions provider	+++	++	+
Product range	++	+++	+++
Presence in emerging markets	+++	+++	+
<b>Key differentiating factor</b>	<b>Core competence is project management</b>	<b>Moving to the GE business model</b>	<b>Pure component supplier &amp; service provider</b>

Source: SG Equity Research. Range: from + to +++ with + being the weakest and +++ the strongest

## Green capital goods – companies that stand to benefit

HVAC and controls companies - Companies that are involved in control systems to automate energy use in buildings and HVAC (design, construction, maintenance, and repair of heating, ventilating, and air conditioning systems) – See SG's Green Capital Goods report.

**ABB** has a three-fold business model of increasing energy efficiency, securing reliable power and improving industrial productivity. Its power-transmission equipment and services business (49% of sales, world #1) helps reduce energy losses between power plant and end-user. Its Power Products arm (world #1) manufactures and sells a broad range of power products such as high and medium voltage switchgear, circuit breakers, and power and distribution transformers, while Power Systems (world #2) is an engineering business for grid systems, power generation systems, network management solutions and substations. Despite the downturn, we believe that ABB will continue to benefit from its T&D exposure, with rich product content biased towards high EBIT margin products, many markets showing good growth for upgrades and replacement services and the market likely to be a major beneficiary of regulation and stimulus funding. ABB is also the world #1 on industrial-automation equipment (27% of sales) as well as process automation services (20% of sales, market leader) – which can drive up to 50% energy savings.

**Alstom** is a global leader in equipment and services for power generation and rail transport. We see it as the leader of the pack on energy efficient power generation with world #1 market positions on hydro, conventional islands for nuclear power plants and environmental control systems. Alstom's PG strategy is to have a well diversified portfolio of products to take account of shifts in demand. The company believes that no single energy source will prove to be the dominant source, but rather the world will rely on a blend of technologies. While Alstom missed out on the US gas bubble at the beginning of the decade, the current balanced demand make-up is more favourable for the company as it exploits its leading position in Steam, Hydro and renewed presence in Gas. We also regard it as one of the clear market leaders on CCS with a strong position on post-combustion technology. Alstom also stands to be a beneficiary of green transport trends with world #1 positions in very high speed trains and high speed trains, #2 in the urban transport market and leading positions on regional trains, signalling, infrastructure equipment and all associated services. Alstom Transport can therefore offer its clients end-to-end solutions on many contracts, as a service provider or a contract manager. We remain concerned that as utilities cut capex, the PG market looks vulnerable and for FY 2009/10 we expect group orders to decline by 25%.

**Cree** is the US market leader for the semiconductors used in LED solid-state lighting, wireless and power applications with a leadership position in DiC and GaN LEDs. Its LEDs cuts costs and energy consumption in lighting for everything from buildings and street lighting to video displays, laptops, digital cameras, traffic signals. Technological advances have helped its bright white LEDs to achieve 100 lumens per watt and its LR6 product uses 6w and can operate for 50,000 hours for only \$60 at current US rates (vs 100w and \$325 for the average incandescent). It also stands to benefit from solar growth with SiC transistors for inverters designed for solar PV generators. The company recorded record profits for Q209 (+24% yoy) despite challenging market conditions with commercial lighting applications growth counterbalancing a fall in other sectors. The company believes that it will benefit from stimulus funding in new installations like the Federal Reserve and planned Pentagon renovations.

**General Electric** is positioned as an energy efficiency leader across the board and its “ecoimagination” business line accounted for \$17bn in 2008 revenues which could rise to \$25bn by 2010 according to company estimates. It has 72 relevant products available and significant pipeline in the works. It is a world leader across energy (IGCC, solar, wind, biogas, gas turbines, clean coal, CCS, nuclear), industry (lighting, motors), transport (auto, aviation, rail) and water (cooling, reuse, desalination). GE Energy (21% sales) is the world leader on power generation, holding the No. 1 position in the lucrative Gas market and expanding heavily into Wind (22% of divisional sales). GE Energy’s business model is to focus purely on selling products and then servicing the aftermarket; it chooses to avoid high-risk low-margin turnkey projects. While PG could be hit in 2009, given its wide portfolio, GE stands to be one of the biggest beneficiaries of stimulus spending including the smart grid where it is a market leader in manufacturing hardware and software for smart meters. GE could also emerge as a major data centre player – potentially offering clients up to 40% energy savings through its digital energy, lighting systems, water and automation lines of business. While the company announced a 45% fall in Q408 earnings, dragged down by GE’s financial divisions, its industrial divisions continued to perform well.

**Johnson Controls** is the largest provider of energy efficient solutions for commercial, industrial and residential markets. Its products are focused on automation and controls that monitor, automate, and integrate building operating equipment and conditions – i.e. the next generation of efficient buildings. It manages over 1bn square feet of customers' facilities and delivers services to 20bn/sqft as an increasing number of companies outsource heating/cooling, security and information systems. JCI is also the #1 supplier of automotive battery management systems and power systems, with a focus on energy savings. Its JV with France's Saft has made headlines with contracts with major OEMs for li-ion batteries for hybrids (See also Saft). Its auto interiors division (50% of sales) is a competitive advantage for its batteries and power systems and also produces energy saving innovations like its EcoClimate seats (higher heat absorption and moisture absorption than conventional seats) and the use of new bio-based materials. While the company announced its first quarterly loss in 16 years – following downturns in the auto and constructions sectors – its efficiency focus should be a major plus as seen with its recent inclusion in US government efficiency programs and the li-ion battery pack deal with Ford.

**Philips** is a world leader in healthcare, lifestyle products and energy efficient lighting solutions – three themes well-positioned for long-term growth. Philips has overtaken GE and Siemens as the world’s leading light manufacturer and is a serious major player on LEDs and CFLs. Following Color Kinetics and Genlyte, the company may continue acquisitions to cement its global leadership position. The company continues to innovate, for example working on a total solution lighting system that will react to people’s movements and the amount of natural sunlight. Energy efficient lighting should benefit from stimulus spending and provide some support in recessionary times. While it still has some progress to make, Philips is also rolling out an increasing number of energy efficient commercial products including a water purifier with PowerSave, the Lux TV range, the Azure Precision iron, the Cineos Soundbar with Ambisound and healthcare equipment.

**Schneider Electric** is a global specialist in energy management with solutions to cope with 72% of worldwide end user energy consumption (basically in all buildings and industries except for transportation) and claims that its existing technologies can save up to 30% of energy with the use of low consumption devices, energy meters, lighting control systems, variable speed drives, energy management software, etc. It is a European market leader on

building automation with its energy efficiency offering now represents around 15-20% of group sales and growing at around 20%. Critical Power represents another 15% of Schneider's turnover and serves end markets such as data centres – an area where it is making a major push. It is also the European #2 in industrial automation with its energy efficiency offering representing around 20% of sales and growing at 20-25%. While Schneider's energy efficiency growth could be hit by a slowdown in the building sector and longer paybacks may delay industrial automation investments, it continues to show strong management and strategy and an ambitious "one company" programme which could tackle productivity gains and SG&A cost concerns.

**Siemens AG** is a global leader in electronics and electrical engineering, operating in the industry, energy and healthcare sectors – and will in our view be one of the biggest energy efficiency beneficiaries across themes. In lighting, Siemens' Osram is the world No. 2 with green lighting an important growth driver (+15% in 2008) and LEDs now accounting for 14% of Lighting sales. In building automation (7% of sales) it shares a joint #1 position in Europe, having worked on more than 1,500 energy projects and 7,500 updates since 2004 – and hoping to double energy efficiency sales over the next four years (a goal which may be aided by stimulus funding). It is the world #1 on industrial automation with 15% of the global market, a full range of applications from drive controls to motors and gears and a service offer which can reduce energy consumption by 12-15%. It is the No. 2 player in the T&D market (11% of sales) with a #1 position in the utilities market and in Europe and the technology leader within the industry, such as in the HVDC market. In power generation (17% of sales), Siemens is changing its business model to build and expand capacities (Wind, Gas turbines, T&D), reduce its exposure to turnkey projects, while growing its service and product businesses to reduce the risk profile. Finally on transport, Siemens is the world #3 active in all the main domains of the market with a particularly strong position in signalling. We see the company's cost cutting potential and improving execution as other attractive qualities.

**United Technologies Corp.** provides a range of high-tech products and support services to the aerospace and building industries – and its key products include Carrier heating and air conditioning (14.6% of sales, global #1), Pratt & Whitney aircraft engines (12.1%), fire and security systems (5.7%) and UTC Power fuel cells (#1 on-site, transport and space). While it might not be an obvious energy efficiency choice, it has a growing portfolio of relevant products and services and a huge R&D machine (\$3.6bn in customer-focused R&D and top-10 for clean energy patents in 2007), which has created innovations such as the PureCycle geothermal power system facilitating volume production and its molten salt storage technology should speed up the development of concentrating solar power. Carrier has some of the highest energy efficiency ratings in the industry. UTC Power has a large portfolio of products which will help modernise energy infrastructure (power systems with 1.7-3.0x average grid efficiency, microturbines). It has also made significant inroads with elevators (Gen3: >75% lower power consumption than traditional elevators), its Pratt & Whitney engines (fuel efficiency) and as a contributor to the Boeing 787 (Hamilton Sundstrand).

## Green IT, Silent efficiency killer and enabler

### SG Green IT watchlist

ACCENTURE  
CISCO\*  
COMVERGE\*  
EMC\*  
FAIRCHILD SEMICONDUCTOR\*  
GOOGLE\*  
IBM  
INTERNATIONAL RECTIFIER\*  
ITRON\*  
STMICROELECTRONICS  
VMWARE\*  
WIPRO

\* Not covered by SG, no reco, no TP

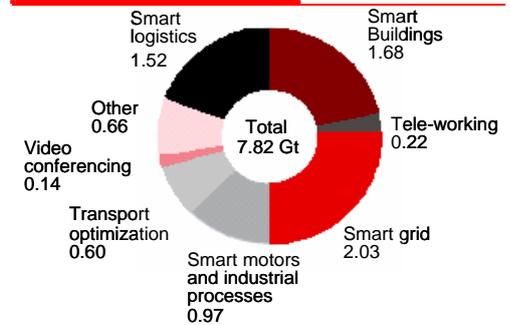
The IT sector has consistently delivered innovative products and services that have systematically increased productivity and supported economic growth across the world. However, the sector's environmental credentials – both from risk and opportunity perspectives – have long been neglected by investors. The UN estimates over 2% of total worldwide CO2 emissions are currently generated by ICT – and that the sector could overtake the aviation sector by 2020. Data centres need to be singled out for particular scrutiny with their energy use projected to increase significantly as the number of centres is expected to grow to over 120m by 2020. As IT emissions concerns rise, the energy efficiency of the sector is being targeted by stakeholders and both EU and US regulators. Additionally, energy price increases and availability constraints are also on the agenda – with data centres expected to account for up to 50% of IT budgets for some companies – meaning that companies are starting to feel the pressure and the industry is waking up.

**We believe that Green IT initiatives are a significant answer to these issues and will help companies to both reduce their energy use and CO2 emissions simultaneously.**

Green IT makes good business sense both in terms of tens of billions in potential cost savings for data centre-reliant companies with every €1 in energy savings driving up to €3-€8 in operational savings (Source: IBM). The biggest beneficiaries will be the companies developing software and hardware to green data centres – including companies involved in consolidation, data centre design, data de-duplication, infrastructure management, thin provisioning, virtualisation, as well as heating, cooling and power management.

**We also believe that IT companies can play a critical role as an enabler for other sectors, notably buildings, logistics, power and transport** with the GeSI estimating that it could “enable” cost savings of over €625bn by 2020. We are particularly positive on IT's long-term role vis-à-vis semiconductors on a range of industries and the potential \$20bn/year smart grid – which we believe will be a key area for stimulus funding and energy efficiency in the coming years – and believe that a number of companies are positioned to benefit.

### IT-enabled savings 2020e, GtCO2e



Source: GeSI, SG Equity Research

### Green IT – companies that could benefit

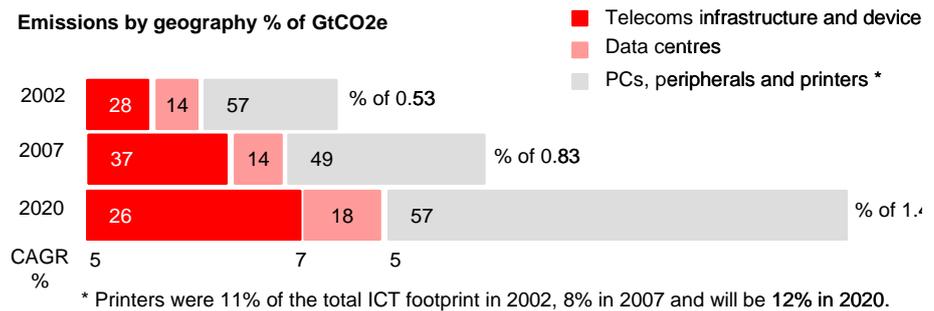
Theme	Impacted sub-sectors	Companies
Green Data Centres	Cooling, data-deduplication, design & architecture, power supply, powering down, thin provisioning, virtualisation	Business software & services, data storage devices, diversified computer systems, hardware, internet providers, IT Services, technical & system software
Consulting	Carbon footprint, data centres, environmental efficiency, smart grid, teleworking	Business software & services, Management services
Semiconductors	Power semiconductors (power conversion, motor control)	Semiconductors
Smart Grid	Smart meters, Intelligent electricity networks	Business services, internet information providers, scientific & technical instruments, technology, utilities

Source: SG Equity Research

## ICT emissions are set to outpace the airline sector!

Despite common stereotypes of CO2 emissions being a non-issue for ICT companies, the ICT sector was responsible for 1.3% of global primary energy use and 1.4% of CO2 emissions in 2006. These figures increase to close to 2% of global totals if telecoms-related emissions are also taken into account (c.830 MtCO2e). Materials and manufacture account for about one quarter of the sector's footprint with the bulk of CO2 emissions impacts coming from usage.

### Global ICT footprint by sub-sector



Source: GeSI, SG Equity Research

### ICT emissions are set to grow at around 6% p.a. to 2020

Global ICT emissions are set to rise at a rate of 6% p.a. and could reach 1.43Gt CO2e by 2020 (Source: GeSI): Among the factors driving the increase in emissions are booming demand for ICT in developing countries: rising incomes and increasing affordability will mean that by 2020, one-third of the global population will own a PC (vs. 1/50 today), 50% will own a mobile phone and 1 in 20 will have broadband connection – with the bulk of the growth coming from China and India.

### Data centre's power consumption becoming a major concern

The number of data centres is increasing as business demands increase and each facility is housing more powerful IT equipment. From 18m servers today, the market could grow to 120m+ servers by 2020 with the average data centre consuming as much energy as 25,000 households (i.e. 259 MTCO2e). In addition to the electricity needed to run IT devices at data centres (i.e. load associated with all of the IT equipment, such as compute, storage, and network

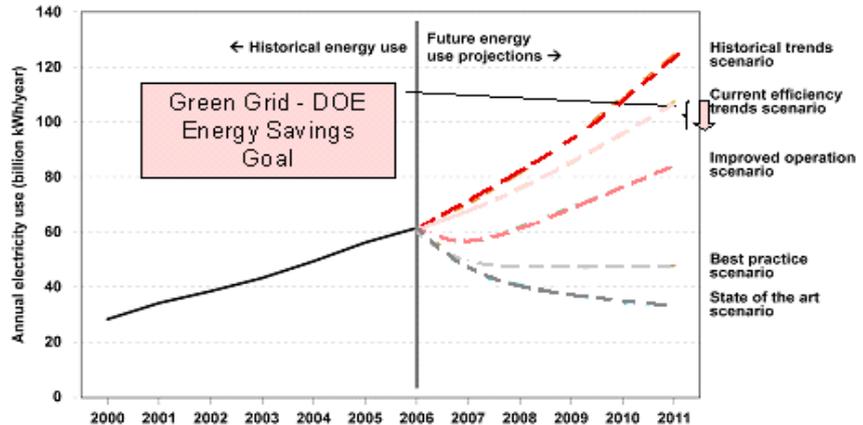
#### Average data centre power consumption

Equipment	Power consumption
Chiller	33%
IT Equipment	30%
Uninterruptible power supply (UPS)	18%
Computer room air conditioner (CRAC)	9%
Power distribution units (PDUs)	5%
Humidifiers	3%
Switch / generator	1%
Lighting	1%

Source: The Green Grid, SG Equity Research

equipment, along with supplemental equipment such as KVM switches, monitors, and workstations/ laptops used to monitor or otherwise control the data centre) – the largest source of power consumption lies with Total Facility Power, which includes everything that supports the IT equipment load such as power delivery and cooling systems.

**World's data centers projected to surpass airline industry as a greenhouse gas polluter by 2020**



Source: Report to Congress on Server and Data Center Energy Efficiency Public Law 109-431" US EPA, August 2, 2007, SG Equity Research

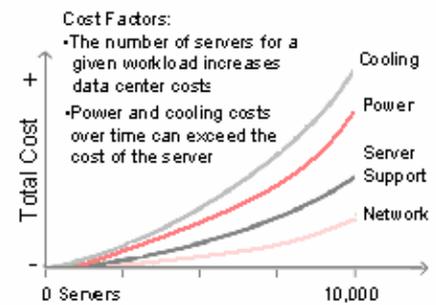
**Cost is forcing companies to act**

The increase in computing demand, IT equipment power density, energy costs – and their subsequent importance as a significant part of the total cost of ownership is forcing companies to act on Green IT. Data centre costs have risen to account for 25% of IT budgets and data centres are growing 2x faster than the IT revenues.

By 2015, the costs to operate servers are expected to exceed the cost to purchase server hardware, while energy bills traditionally have accounted for less than 10% of an overall IT budget, they could soon account for more than half:

- 100 KWatt in IT power = up to \$1m in infrastructure costs
- \$1 in equipment = up to \$1 in energy costs
- \$1 in energy = up to \$1 for energy for HVAC

**Data centre cost factors**



Source: Intel, SG Equity Research

Energy budgets are swelling as companies use more energy to keep their systems running. In a worst case scenario, without radical changes in operations, the world's data centres could run out of power and many companies with large data centres could face significantly reduced profitability. The slowing economy will not derail efforts to make IT operations more energy efficient for the simple reason that green IT saves companies money. According to the latest Forrester report surveying 1,500 IT practitioners from 1,022 companies in October 2008, 67% cite energy-related cost savings as the main driver for corporate IT decisions.

**Growing regulatory pressure**

Regulators are becoming increasingly vocal on IT energy use and in the EU the European Commission is taking a lead role in ensuring that the IT sector leads efforts to attain climate change targets. To date, the focus has bene on voluntary mecahnisms but stronger action may be on the agenda with the EC's Information Society Commissioner hinting at the possible introduction of mandatory public-procurement standards to improve energy-efficiency standards for ICT – and the EC set to publish shortly policies and proposals to boost the use

of smart technologies to combat climate change. In the U.S. a number of standards are in place or being developed on energy efficiency, power supply, power measurement and virtualisation capability and EPA power/performance benchmarks should be in place by 2010.

## Greening data centres

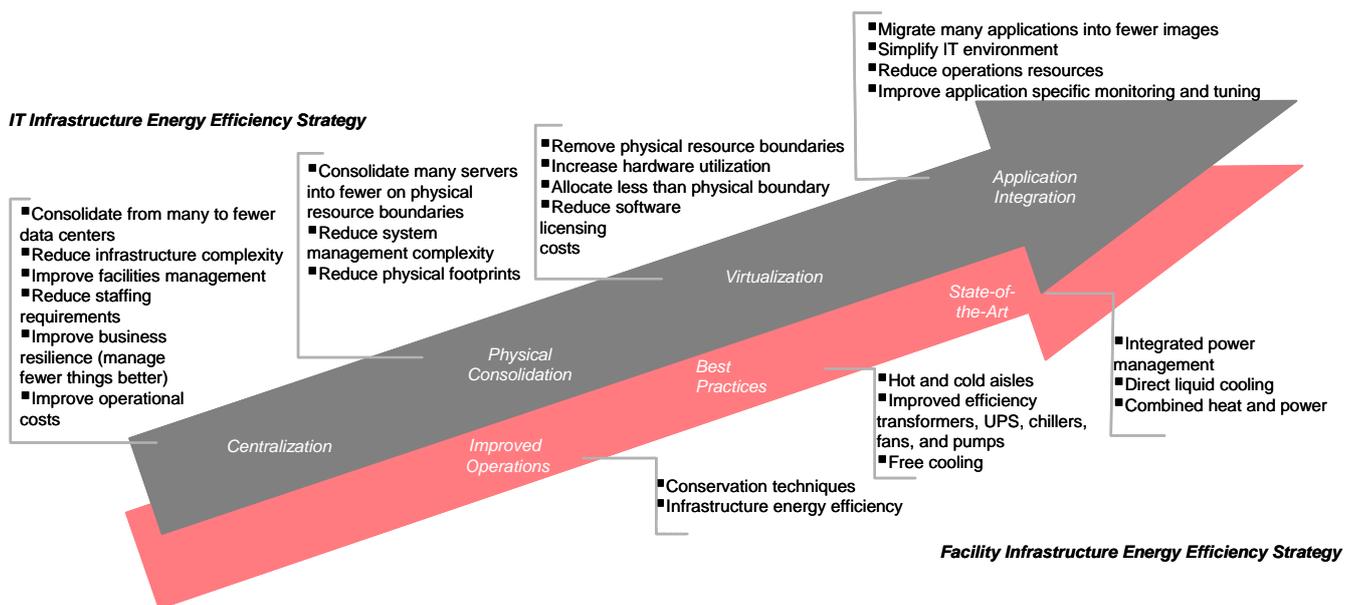
Green data centres enact more energy efficient software and technology to better manage increased computing, network, and storage demands on a large scale – while operating more efficiently in terms of energy usage, power consumption space utilisation and reduction of polluting energy sources.

### Greening the data centre

Greening technique	Overview
Data compression	Most established energy savings technology and has long helped to save disk space, speeds up data recovery using fewer backup sources, and saves on storage system and media purchases
Virtualisation	<40% energy savings by applications and servers working in a non-dedicated manner, pooling assets where utilisation is low, making it possible to run multiple operating systems and multiple applications on the same computer simultaneously
Data de-duplication	reduces storage needs and boosts efficiency by optimising storage systems to eliminate the inherent data redundancies that exist in many traditional storage and data protection processes, such as backup (>25x reduction in backup data)
Thin provisioning	Deals with the problem of over-provisioning by allowing IT systems to allocate a larger virtual amount of capacity than the actual physical amount available. As capacity requirements grow, thin provisioning can automatically release physical storage
Adopting cooling technologies	<30% savings via modular, scalable power and cooling architecture (e.g. detect when temperatures are running high & providing direct cooling to those areas)
Air conditioning	<30% savings via more efficient AC architecture (row-oriented cooling, shorter air paths) and economizer modes of AC
Power use	Best in class UPS systems have <70% less losses than legacy UPS. ~10% energy savings by directing low voltage DC into the data centre (eliminating the need for mechanical back up, uninterruptible power supply units)
Floor layout	<12% savings via hot/cold aisle arrangements with suitable AC arrangements
Distributed generation	Use of renewables or locally generated energy: solar, wind, hydro, geothermal, fuel cells etc.
Better datacenter metrics	Fair comparisons for datacenter energy efficiency (and the components that comprise it) will require a standardised set of performance and energy efficiency metrics (a la miles-per-gallon for cars)

Source: SG Equity Research

### Energy efficiency for IT infrastructure and facility infrastructure



Source: IBM, SG Equity Research

## IT's enabling effect - hundreds of billions in savings

The IT sector has an increasingly important role to play in creating a low carbon society. In particular, it will be a key actor in enabling other sectors such as buildings, power, transport and industry to become more energy efficient. IT will help to radically transform the way these sectors operate and the IT sector's "enabling effect" role could help to deliver up to a 15% reduction in global BAU emissions by 2020 (7.8 GtCO<sub>2</sub>e out of 51.9 GtCO<sub>2</sub>e). Savings could reach well over €600bn (\$946.5bn) including up to €553bn (\$872.3bn) in energy and fuel saved and an additional €91bn (\$143.5bn) in carbon saved (Source GeSI). These assumptions are based on SG Commodities BAU forecast of a CO<sub>2</sub> cost of €20/t for 2012.

### IT's enabling effect: up to 7.8 GtCO<sub>2</sub>e abatements by 2020

GtCO<sub>2</sub>e

7.8 GtCO<sub>2</sub>e of ICT-enabled abatements are possible out of the total BAU emissions in 2020 (51.9 GtCO<sub>2</sub>e)

The SMART opportunities including dematerialisation were analysed in depth

- Industry
  - Smart motors
  - Industrial process automation
  - Dematerialisation\* (reduce production of DVDs, paper)
- Transport
  - Smart logistics
  - Private transport optimisation
  - Dematerialisation (e-commerce, videoconferencing, teleworking)
  - Efficient vehicles (plug-ins and smart cars)
  - Traffic flow monitoring, planning and simulation
- Buildings
  - Smart logistics†
  - Smart buildings
  - Dematerialisation (teleworking)
  - Smart grid‡
- Power
  - Smart grid
  - Efficient generation of power, combined heat and power (CHP)



\*Dematerialisation breaks down into all sectors except power. See detailed assumptions in Appendix 3.  
 †Reduces warehousing space needed through reduction in inventory. See Appendix 3.  
 ‡Reduces energy used in the home through behaviour change. See Appendix 3.

Source: GeSI, SG Equity Research

## Smart grid, a \$20B/year market

Smart grids are intelligent electricity networks that connect energy suppliers and consumers through the use of sophisticated technologies. They use advanced two-way ICT technologies and sophisticated sensing and monitoring technologies which can monitor and control the flow of power between utilities and their customers to avoid blackouts, incorporate distributed power generation and even use plug-in electric vehicles as grid storage batteries. The smart grid has huge potential to improve industrial efficiency, promote the use of cleaner energy resources, ensure the security of infrastructure and improve stakeholders' everyday lives. However, significant progress needs to be made on a number of fronts including introducing AMI (advanced metering infrastructure or "smart meters") as an enabler.

For companies competing for a piece of the emerging smart grid market it is something of a Wild West story with a variety of competing technologies and communication standards at play. However, the prospect of lucrative utility contracts and growing governmental support

means that there is significant room in an industry that's still in its infancy. But as utilities start installing smart meters and demand response systems, as well as Home Area Networks, we anticipate short to medium-term opportunities for a number of small, pure play smart networks and smart meter companies such as current market leader Itron as well as Comverge, Echelon and EnerNoc. Longer-term, we believe that global players such as Accenture, Cap Gemini, Cisco, General Electric, Google or IBM are likely to buy out many of the smaller players as risk-averse utilities prefer to buy equipment and services from large companies.

**Drivers for updating the electricity grid**

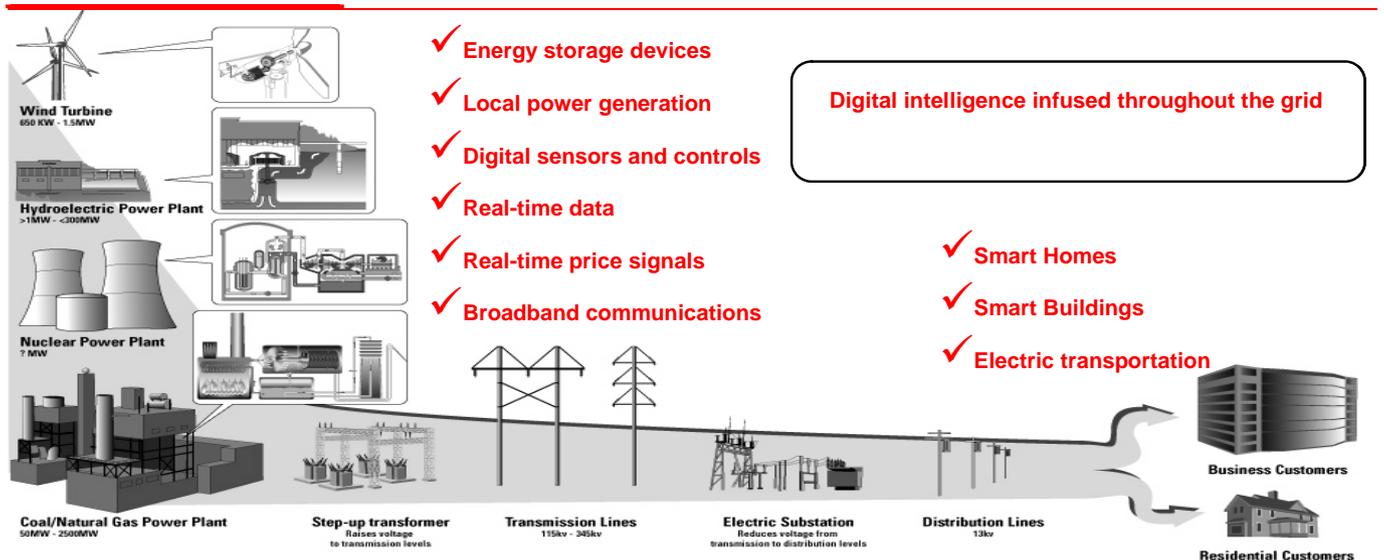
Expected change	Impact
Shift in centralised power structure from coal and petrol to natural gas	Power plants will be constructed close to harbours and pipelines rather than demand sites in order to reduce costs
Extension of renewable energy systems	Reduced regional flexibility. Intermittent production is a challenge to match supply and demand in real-time
Maximum integration of decentralised energy resources	e.g. renewables - because of their efficiency potential and quick response potential to fluctuating demand
Use of dynamic pricing models with ICT functionality	High levels of automation and device-specific automation to ensure user awareness and capacity building
Countries are looking to isolate energy grid disturbances	Changing climate patterns / uncertainty

Source: SG Equity Research

**Traditional grid is not positioned for new reality of decentralised power**

The traditional model of electric power generation and delivery is based on the construction of large, centrally located power plants – i.e. hubs surrounded by major electrical load centres. The electricity grid brings power from the plant to users and consists of two infrastructures: high-voltage and low voltage transmission systems. Beyond distributed generation pilot projects, there have been no major changes in the electricity grid in many years. The current grid is antiquated, non-ICT compatible and not positioned to deal with the biggest challenge going forward: the transition away from today's demand side management to dynamic demand scenarios. It is in major need of a revamp – new transmission lines and a massive upgrade of the analogue grid that directs the energy from place to place, with new computers, sensors, and communication gear to manage the network.

**Smart grid**



Source: Xcel Energy, SG Equity Research

### Smart grids save energy and costs

Smart grids save energy and reduce carbon emissions by developing an interactive network that links multiple energy providers with numerous energy users using advanced technologies such as advanced metering infrastructure (AMI) and services (smart meters). Unlike traditional systems in which energy flows from utility to consumer, AMI/smart grid systems allow both information and energy to flow in either direction. Data on energy production, energy costs, energy sources, and energy consumption is made available to producers and consumers. The data can then be used as inputs into automated or managed decision-making processes to manage energy demand, choose energy providers, or schedule energy use for off-peak periods. Under an optimistic scenario – the implementation of a smart-grid enabled supply and demand management system could reduce power sector emissions by 2.03 GTCO<sub>2e</sub> and save up to €79bn by 2020.

### Smart grid's cost savings potential

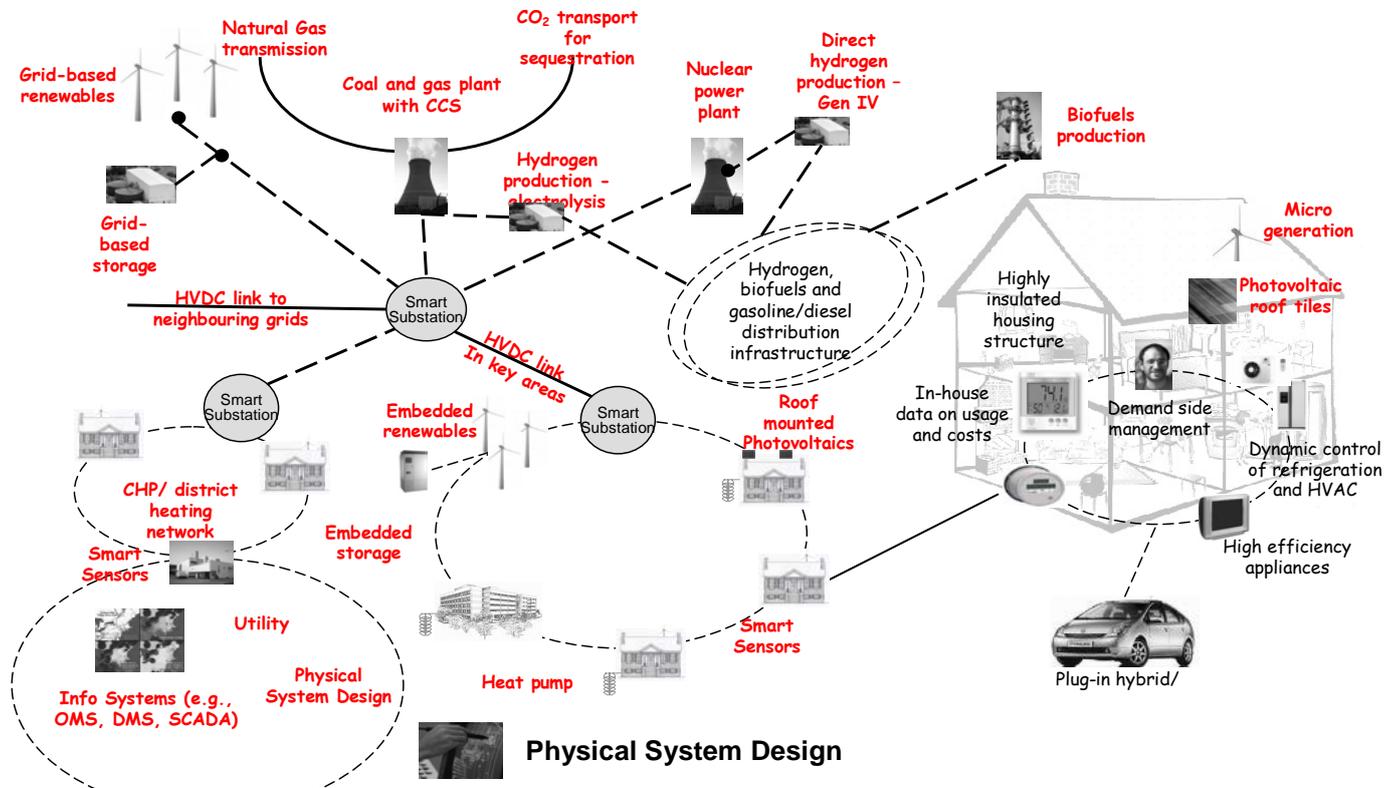
Functions / benefits	Cost savings	Cost savings potential
Automated and remote meter reading	Collections	15-25%
Remote connection and disconnection	Standards & constructions	15-20%
Monitoring of power quality	Demand management	2-22%
Consumer information about utilities (i.e. current & historic consumption, costs, GHGs, current tariff & demand)	Asset management	4-19%
Misc. safety; field work management, settlement, system control, billing & customer care, tariff & regulatory, outage & restoration	Load forecasting	9-14%

Source: Cap Gemini, European Commission, SG Equity Research

### Major beneficiary of regulation and stimulus spending

There are several examples of utilities having pioneered smart grid projects with Enel in Italy undertaking the largest project to date – the €2.1bn Telegestore system which involved 27m smart meters – and which delivers annual savings of €500m/year. As part of the Green New Deal, many countries are setting aside funds to invest in smart grids including Canada and China, as well as \$11bn under the US economic stimulus to modernise the grid including \$4.5bn to convert the low-voltage part of the system into a so-called smart-grid, introducing digital-age efficiencies into the system, reducing waste and negating the need for expensive and polluting new power plants. According to a US DOE report power outages and interruptions cost Americans at least \$150bn every year, despite the current system being rated as more than 99% reliable. That means that initial investments in a smart grid could ultimately save \$150bn per year in the US alone with significant savings to be had in other developed and developing economies as well as increased reliability and access to electricity in a more environmentally friendly framework.

**Smart grid: a collection of transformational technologies that reduce costs while improving outcomes**



Source: Accenture, SG Equity Research

**A \$20bn a year market!!!**

The global market for smart grid components and software is estimated at US\$20bn a year – with changes in behaviour associated with smarter metering reducing energy consumption by between 3% and 15%. There are currently close to 1.5bn installed meters in the world but over 90% are based on 1970s designs and their replacement will see utilities spending hundreds of billions in the coming years on new smart meters, infrastructure improvements, including computers, sensors, and networking systems. The installed base of smart electricity meters in Europe is projected to grow by over 15% CAGR between 2008 and 2013e – and the market is expected to reach 81.2M by 2013 (Source: Berg Insight). Italy and the Nordic countries have already seen rapid roll-out – and France, Spain and the Netherlands are all in the processing of adopting smart meters (with an expected 11M units p.a. by 2013). The US is also seeing significant take-up particularly in California.

**Key obstacles to smart metre roll-out**

- Lack of consumer demand on AMI & limited engagement in innovation
- No EU-wide mass implementation of AMI
- No real-time efficiency-oriented pricing
- Lack of harmonized standards
- Unbalanced power (influence) structure of energy market actors
- Global unified standard production of end devices
- Broadband internet connection
- Infrastructure owners are not supporting rapid implementation
- Lack of ICT experts in the energy sector
- Lack of investment support incl. for SMEs
- Need for regulatory support to harmonise the EU energy market

Source: SG Equity Research

## Green IT - companies that stand to benefit

Based on their current exposure to energy efficiency and our long-term forecasts for future development, we believe the following themes and companies constitute a good way to invest in Green IT through global equities:

**Accenture** has a range of Green IT solutions including data centre technology and operations (DCT&O). In 2008, it launched its Green Technology Suite – IT-based assessment and monitoring tools to reduce carbon footprint – to capture a larger part of the estimated \$4.8bn Green IT consulting services industry (2013e). The suite complements the product focused strategies launched by big IT vendors by centring on power use, quantifying the benefits of changes, analysing side effects, and looking at greener product procurement and disposal strategies. Its offer covers the key user issues: a datacentre estimator recommends energy reduction strategies based on power use, performance and expected changes in demand; a workplace estimator helps companies look at how green IT strategies – such as thin clients and telepresence – can affect the organisation in other ways; and a green maturity model assesses the overall environmental efficiency of IT across the entire organisation. The company's Q109 results as well as our contacts would suggest that management is confident in its capacity to outperform peers and continue to increase profitability in the downturn.

**Cisco Systems Inc.** is the world leader in networking for the Internet and a major Green IT infrastructure actor, catering to customers focused on network platforms (i.e. supporting business applications while decreasing the total cost of ownership). Its Green IT strategy focusing on: 1) efficiency of network infrastructure (improved switching, routing, collaboration solutions, 2009 launch of EnergyWise power management software that will run on top of its network to help businesses reduce energy use for phones, computers, HVAC, lighting systems); 2) energy efficient data centres (virtualisation); 3) efficient work practices (secure networking, IP telephony, virtual meetings: Unified Communications, TelePresence, WebEx); and 4) smart buildings and work spaces (intelligent power management, IT infrastructure). Ongoing speculation in the WSJ that Cisco – with \$29.5bn cash – may be interested in acquiring EMC or VMWare, would add to its efficiency credentials, as could its move into the smart grid via Energywise. Cisco has continued to post good top and bottom line numbers, topping consensus Q209 estimates after embarking on \$1bn cost cutting plan.

**Comverge** is the largest provider of demand response services to utilities and has over 500 utility clients and 5m devices delivered or installed (>2200 MW of energy). Its bread and butter has been installing its own hardware and software in homes to help utilities curtail residential power use via the use of 1-way pager networks. These older generation devices are seen as stranded assets and in February 2009, the company launched its "Apollo Platform" 2-way communication software to get a piece of the demand-response market from utility customers (with its strong existing customer base giving it a strong positioning). The new platform will be a key element of the Progress Energy Carolina EnergyWise demand response system and will also be deployed by PEPCO Holdings – and has helped its future contracted revenues surpass the \$500m mark for the first time. We believe Comverge could be a major beneficiary of the \$4.5bn in US stimulus spending for the smart grid.

**EMC** is the #1 data storage infrastructure company and a market leader in energy efficient storage platforms including virtualisation (it is the majority shareholder of VMWare – see below), data and file mobility (efficiency tiered storage) and back-up, recovery and archiving. Major brands include Clariion, RSA, Symmetrix and VMWare and nearly every major product announcement in the last two years has included some element of energy improvement

(consolidation, disk spin-down, larger capacity/lower power disk drives, SSDs, dynamic cache partitioning), such as its announcement that it will enter the primary data de-duplication market in 2009. EMC has created a cross-functional Green Team bringing together 18 departments to develop new integrated efficiencies for hardware and software such as its "Design for Environment" program and EMC Consulting works with clients on energy efficiency. EMC posted record Q408 profits and total revenues which saw a 12% increase YoY, its sixth straight year of double-digit revenue growth. But the company, hit hard by the 2000 bubble – is bracing itself for slower growth and is engaging in major cost cutting.

**Fairchild Semiconductor** is a leading global supplier of high performance semiconductors that enable smart power management and reduced energy consumption. It is the #1 global supplier for optimising system power and generates over 70% of its annual revenues from its power business including motors (variable speed motors and inverter-controlled drives being energy savings of up to 40%), power supplies (high efficiency power supplies and reducing consumption in stand-by mode) and lighting (move to CFLs). It also stands to benefit from the consumer market with a portfolio of products that ensure maximum efficiency for a variety of consumer electronics, from cell phones to plasma screens. In 2008, it also formed a global Energy and Environmental Design Team to identify energy-conservation projects at its major manufacturing sites worldwide. Following a Q408 loss, the company has said that order rates are beginning to stabilise and FCS is now building backlog.

**Google Inc** has taken a vocal position on energy efficiency via its involvement in Renewable Energy Cleaner than Coal, RechargeIT, Climate Savers Computing Initiative, and in going Carbon Neutral. We see it as an emerging leader on the smart grid. Following investments in two leading start-ups and collaboration with GE – it is looking to transform energy infrastructure in the image of the internet: decentralized, distributed, disembodied. It recently announced plans to use its software skills to help consumers track their home energy usage to lower demand via a smart grid software tool called Google PowerMeter that will show smart-meter enabled home energy consumption almost in real time on a user's computer (which could help consumers reduce electricity bills by 5-15%). The company hopes to develop partnerships with utilities and start-ups for roll out in the next few months (e.g. a utility could create an application that runs consumer appliances when power demand is at its lowest). Google's focus on the consumer could serve as a major competitive advantage – and long-term could play a major role in the power sector and in giving ordinary households more power to control their electricity use. The company reported stronger than expected Q408 results that suggested its search-advertising business and cost-cutting efforts have enabled it to weather the recession better than rivals.

**International Business Machines** develops and manufactures IT (computer systems, software, networking systems, storage devices, microelectronics) and has been active on Green IT for 15 years. It is now one of the company's core growth drivers – with IBM spending \$1bn/year on new products and services for energy efficiency and dedicating a "Green Team" of 850 specialists. IBM pioneered data centre efficiency at its own operations, avoiding 45% of emissions from 1990 to 2007 (vs. 1990 base) and is now looking to double its centres compute capacity by 2010, without increasing power consumption, thus avoiding 5B kWh/year. This expertise has been successfully rolled over to customers and IBM has over 2,000 green IT client projects focused on data centres offering energy efficient servers and technology (System z and x), storage virtualisation (>80% energy savings) and services (storage and servers, site and facilities, integrated communications, business objectives, end users). The company is well-positioned on the smart grid – giving utilities end-to-end support

in upgrading their transmission systems, set standards, develop software, and order the right components – and says that it is one of its fastest-growing business categories. IBM's less is more approach to IT continues to pay dividends with the company performing well in a difficult environment - reporting record annual revenue and Q408 profit (+12%).

**International Rectifier** is a market leader in advanced power management technology, from analog and mixed signal ICs to advanced circuit devices, power systems, and components for consumer and industrial applications. It is a key enabler for energy efficiency across the green deal spectrum including for cars (advanced power management systems for fuel efficiency solutions), motor controls (integrated design platform for variable speed motor control), data centres (scalable multiphase architecture, dual-sided MOSFETS and real-time power monitoring ICs) and lighting (dimming and non-dimming high voltage ICs). Market demand significantly deteriorated in Q408 and the company is expecting a 13-35% industry fall in Q109e – but IRF considers itself well-positioned in terms of its balance sheet and capital and cost control discipline.

**Itron** is the global leader in smart meters with a 30% global market share in meters (#1 electric smart meters, #2 gas meters and #4 waters), 5% share in North America, automated meter reading and advanced metering infrastructure. It is battling with GE for large utility deployments and currently works with 3,000 utilities including recent deals with Southern California Edison (5.3m metre deployment) - and had 2007 revenues of US\$1.46bn. Its acquisition of European rival Actaris (ex-Schlumberger Smart Metering) for €1.7bn gave it global reach with 65% of revenues coming from outside North America and a #1 position in the EU market. ITRI saw 2008 revenues increase to \$1.9bn in 2008 (+30%). The 30-year-old Washington state-based company is also partnering with innovative startups and should be a major beneficiary of the \$4.5bn in US stimulus spending for the smart grid.

**STMicroelectronics** is the world's #5 semiconductor company and at the forefront of System-on-Chip (SoC) technology and its products play a key role in enabling convergence markets. ST has been committed to developing products and technologies that enable an increasingly efficient power-supply chain in microelectronics applications for industrial, consumer and computer markets since the early 1990s - with #1 market positions in the auto and industrial sectors and in power conversion semiconductors. Its efficiency solutions focus both on reducing energy consumption in the chip itself and contributing to energy savings in end applications, such as home appliances (ST internal analysis shows its energy-saving power electronics technologies can cut residential energy consumption by a third), low-power stand-by systems and lighting (complete solutions with smart lamp management, electronic ballasts, dimming solutions). ST is also looking to step up its activity in LED lighting where it is a market leader. At the chip level, ST has made major advances with its MDmeshpower MOSFET technology and in using alternative materials and technologies such as Silicon Carbide (SiC). Our IT analyst currently anticipate that the slowdown in end markets for STM's products is likely to last at least until Q2 and that the slowdown in handsets and automotive industries (50% of STM's turnover) could last longer.

**VMware** which is majority owned by storage giant EMC – is the global leader in virtualisation. Its advanced resource and memory management features enable consolidation ratios of 15:1 or more, which increase hardware utilisation to as much as 85%. Once virtualised, it can also monitor utilisation across the data centre and intelligently power off unneeded physical servers without impacting applications and users. Its solutions enable customers to reduce energy consumption and costs by up to 80%. Virtualisation software has

been one of the fastest-growing technologies of recent years and the company has over 30,000 customers, including 90% of the Fortune 500, in just over a decade. It has made such inroads that Dell, Fujitsu, HP, IBM, Fujitsu and Siemens servers come pre-loaded with VMware. It recently launched its first open source virtual desktop client, which will enable IT managers to host their companies' users desktops in the data centre with the ability to provision power and storage space as needed. The company beat revenue estimates with its Q408 results (+25% YoY) as did its year-end results, which increased by 42% YoY – with customers likely to continue to opt for its server and desktop consolidation cost-saving projects.

**Wipro Technologies** is the No.1 provider of integrated business, technology and process solutions on a global delivery platform. It's a strong player, helping clients go green by adopting eco-friendly product designs, green data centres, energy efficiency solutions and virtualization. It has helped clients build over 75 green data centres (APC-MGE, AMD, Hitachi) and operates a global command centre to monitor and provide real-time input on load and server utilisation. The acquisition of Infocrossing has helped further its offer. Wipro also has one of the most comprehensive green IT business offers, covering everything from consulting (Wipro Eco Energy), smart devices, green lighting solutions, industrial water treatment, renewables, carbon accounting, paperless office solutions, freight management, virtual workspaces, to green testing and green computer peripherals. Wipro is a member of the Green Grid and has gone carbon neutral. Despite Wipro's long-term fundamentals and a valuation at historic lows, we remain cautious on the shares on a short-term basis (and our IT analyst currently rates it a Sell).

## Green transport: trains, autos and planes, in that order

### SG Green Transport Watchlist

ANSALDO  
BMW  
BORGWARNER\*  
BOLLORE\*  
CAF  
FAIVELEY  
HONDA  
RENAULT-NISSAN  
RIO TINTO  
SAFT GROUP\*  
TOYOTA  
VALEO

Source: SG Equity Research, \* Not covered BY  
SG: no recco., no TP

**The transport sector is responsible for 14% of global greenhouse gas emissions** with road transport accounting for 75% of these emissions, and air transport for about 13%. Transport emissions are projected to increase with over 60% until 2030 with the boost in new road vehicles in developing countries the main driver. A combined strategy of fuel efficient technologies, fuel switching, demand reduction via public transport and strong policy frameworks could limit the growth to 10%.

**Public transport will be key to global efficiency and the €86bn rail industry should benefit** from solid and sustained growth in the medium to long term. Rail has huge competitive advantages over air transport in terms of environmental concerns, transport needs and increasing urbanisation in emerging countries – and should be benefit from economic stimulus spending on infrastructure. This should mean significant benefits for railway equipment companies, in particular, especially Ansaldo, CAF and Faiveley.

**The auto sector need to make massive efficiency improvements to met stringent CO2 targets** with a 15-49% improvement needed in the EU to meet the 2015 130gCO<sub>2</sub>/km target. Conventional, readily available technologies offered by suppliers like Valeo and lightweighting via aluminium and composites should allow OEMs to meet 2015 targets. However, we believe that we will need to see massive take-up of electric cars if there is any chance of meeting possible 2020 EU and US targets of 95g (-41%) and 50mpg (-45%) respectively. Admittedly, large scale roll-out of electric cars will be dependent on improvements in battery technology but we believe electric cars will be a form of insurance against CO<sub>2</sub> targets (1% of electric cars in the fleet means a direct 1% reduction of a fleet's fuel economy) and allow OEMs to benefit from government support and tax-incentives. Ultimately, we do not believe that green transport increase volumes for the OEMs – especially in the current market – but rather that **cost-and fuel efficient vehicles will minimise the downside risks and ensure long-term survival.** We believe that the most advanced manufacturers are the market leaders on hybrids (Toyota, Honda), and electric cars with the Renault-Nissan Alliance (which has plans for an ambitious roll-out of electric vehicles).

### Green Transport – companies that could benefit

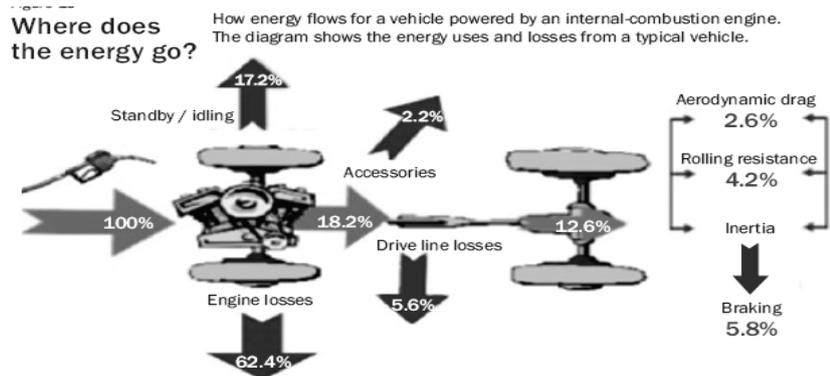
Theme	Impacted sub-sectors	Companies
OEMs	Auto manufacturers	BMW, Honda, Renault-Nissan, Toyota
Motors & drive train suppliers	Auto parts, electrical components & equipment, original parts & accessories mfrs, precious metals & minerals	Anglo Platinum, Aquarius Platinum, Beru, BorgWarner, Bosch*, Continental, Denso, Epcos, Johnson Controls, Johnson Matthey, Umicore, Valeo
Eco-tires	Rolling resistance Tires & rubber products	Bridgestone, Continental, Michelin
Li-ion batteries	Basic materials, chemical – agricultural, electrical components & equipment	3M, ActaCell, All Cell Tech., Altair Nanotechnologies, BYD Co, Ener1, Enersys, Envia Systems, FMC Lithium, LG Chem, Matsushita (Panasonic), MicroSun, Mobius Power, Recuperyl*, Saft Group, Samsung SDI, Sanyo, SiLyte, Sociedad Quimica y Minera de Chile S.A, Western Lithium Corp
Lightweighting	Aluminium, composite materials Auto parts, Basic materials	Alcoa, Gurit, Magna, Rio Tinto Alcan, Toray Inds.
Rail equipment	Equipment, fastenings, railway systems, rolling stock, services, signalling Aerospace & defense, Construction, Engineering & construction, industrial conglomerates, rails & road - passenger	Alstom, Ansaldo, Bombardier, CAF, China Railways Construction, Delachaux, Faiveley, GE, Knorr Bremsse, Siemens, Thales, Trinity Inds, Voestalpine, Vossloh, Wabtec
Railways	Rail & road - freight	Burlington Northern Santa Fe, Canadian National Railway, Canadian Pacific Railway, CSX Corp, Genesee & Wyoming, Guangshen Railway Co, Kansas City Southern, Norfolk Southern Co., Union Pacific

Source: SG Equity Research. \* Not listed

## Automobiles, huge needs for efficiency innovations

The auto sector need to make massive efficiency improvements to met stringent CO2 targets with a 15-49% improvement needed in the EU to meet the 2015 130gCO2/km target. Conventional, readily available ICE technologies offered by suppliers like Valeo and lightweighting via aluminium and composites should allow OEMs to meet 2015 targets. However, we believe that we will need to see massive take-up of electric cars if there is any chance of meeting possible 2020 EU and US targets of 95g (-41%) and 50mpg (-45%) respectively. Admittedly, large scale roll-out of electric cars will be dependent on improvements in battery technology but we believe electric cars will be a form of insurance against CO2 targets (1% of electric cars in the fleet means a direct 1% reduction of a fleet’s fuel economy) and allow OEMs to benefit from government support and tax-incentives. **Ultimately, we do not believe that green transport increase volumes for the OEMs – especially in the current market – but rather that cost and fuel efficient vehicles will minimise the downside risks and ensure long-term survival.** We believe that the most advanced manufacturers are the market leaders on hybrids (Toyota, Honda), and electric cars with the Renault-Nissan Alliance.

### Energy inefficiency in the internal combustion engine (ICE)

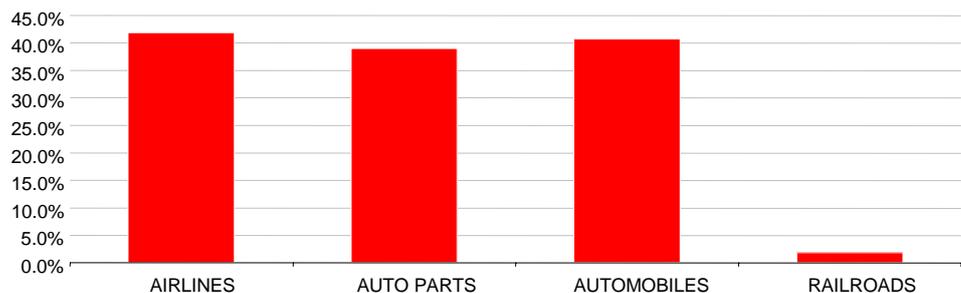


Source: www.fueleconomy.gov

### CO2, up to 40% of EBIT at risk for OEMs and suppliers

Energy inefficiency for ICEs means increased CO2 emissions. Using our proprietary CREAM (carbon risk exposure assessment) model to assess the potential CO2 impacts on EBIT margins – after having considered current level of EBIT, pricing power and “free allocation” – the issue hangs over the sector like Damocles’ sword with up to 40% of EBIT at risk.

### Potential negative impact of CO2 – energy efficiency -on EBIT



Source: SG Equity Research, CREAM model, financial data provided by Dastream (IBES current consensus estimated for EBIT margins, sales), carbon price at €8.50/ton), Centre Info, coverage: DJ Stoxx Global 1800

**Sector needs to see 15-49% improvements to meet EU targets**

With the adoption of the progressive implementation of the 130g CO2/km threshold rule from 2012-2015, European OEMs have three years to adapt their fleets to the new constraints. In all, 65% of their fleet must meet the 130 CO2/km target by 2012 and 100% by 2015.

**CO2 emissions by group in 2006 and respective targets for 2012-2015e**

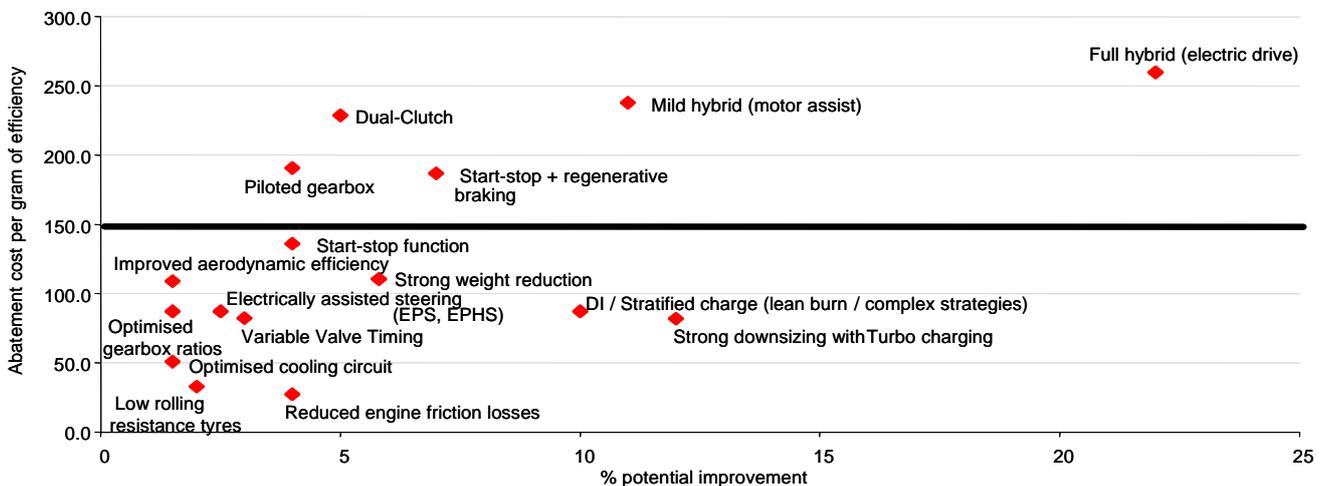
	Mass Avg in 2006 in kg	Unit sales Total (2006)	2006 CO2 Avg in g/km	TARGET 2012	Reduction in g	Reduction in %
BMW	1,453	739,993	182	137	45	-25%
Daimler	1,472	860,816	184	138	46	-25%
Fiat	1,112	1,050,885	144	122	22	-15%
Ford	1,319	1,490,276	162	132	30	-19%
GM	1,257	1,424,783	157	129	28	-18%
Porsche	1,596	39,069	282	144	138	-49%
PSA	1,201	1,882,210	142	126	16	-11%
Renault	1,234	1,232,236	147	127	20	-14%
Volkswagen	1,366	2,744,849	165	134	31	-19%
Toyota	1,214	773,329	152	127	25	-16%
Nissan	1,202	273,893	164	126	38	-23%
Mitsubishi	1,245	101,124	169	128	41	-24%
Honda	1,261	229,791	153	128	25	-16%
Mazda	1,296	229,135	173	130	43	-25%
Suzuki	1,152	178,614	164	123	41	-25%
Subaru	1,384	31,541	216	135	81	-38%
Hyundai	1,349	461,880	165	133	32	-19%
<b>Total</b>	<b>1,289</b>	<b>13,744,424</b>	<b>159</b>	<b>130</b>	<b>29</b>	<b>-18%</b>

Source: EU Commission

**Conventional technologies are very cost-efficient**

The fuel economy of conventional gasoline-powered light-duty vehicles (cars, SUVs, minivans and pickup trucks) can be increased to at least 35 miles per gallon by 2020 worldwide through improvements in internal combustion engines, transmissions, aerodynamics, and other technologies. This can be done with existing technology—meaning technology that is available today or in the pipeline—with minimal changes in the performance of current vehicles and without hybrid or diesel technology. Of course, one can expect improvements with regard to hybrid technologies thanks to economies of scale and R&D progress – but for the near term and especially given the current economic climate, OEMs will be looking to limit the amounts of increased cost being passed on to customers!

**CO2 abatement cost by technology (€/t CO2)**



Source: SG Equity Research, TNO, IEEP, LTA for European Commission

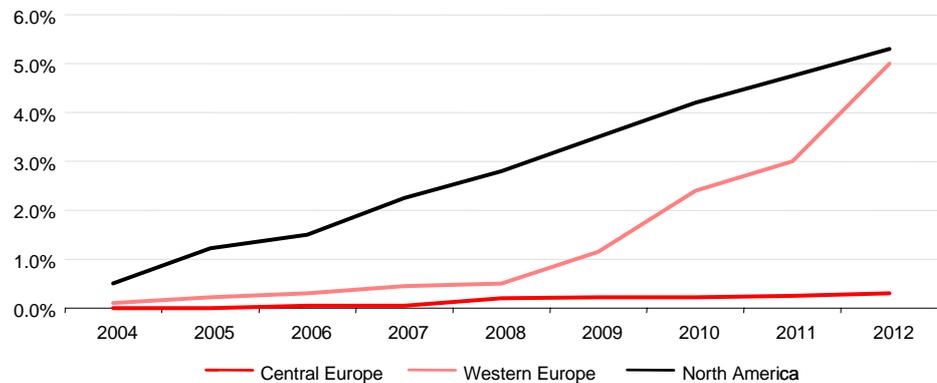
### Lightweighting, size really matters

We believe that reducing weight through greater use of high-strength steel, aluminium and composite materials will be critical to increasing fuel economy to 50 miles per gallon. Each 10% reduction in vehicle weight translates to a 6 or 7 % increase in fuel economy (Source: US National Sciences Academy). Moreover lightweighting is a more cost-effective means of improving fuel economy costing between €40-130 per ton of CO2 abated, far below the €300 attached to a current full hybrid solution. Vehicle weight reductions of 5% to 10-15% could be achieved by greater use of high-strength steel, aluminium and composite materials. This would improve fuel economy by approximately 3%-10%. A greater move to aluminium will however be likely linked to price developments as well as being focused on premium cars. This could benefit aluminium companies such as Rio Tinto Alcan and Alcoa as well as carbon fibre specialists such as Toray Industries.

### A milestone year for hybrids

We believe that 2009 will be a milestone year for hybrids which are rapidly moving to take 5% of the car market. Forecasts for future sales of hybrids are complicated by many factors including the oil price, cost of credit along with confidence in hybrids by consumers as well as the OEMs and car dealers themselves. But the sales trend is accelerating with the third generation Prius, Honda Insight and Ford's push all serving as drivers. The number of hybrid car sales in North America – where we believe hybrids will be a key segment – will double in the next three years, according to a new forecast presented by R.L. Polk & Company. While the recession is hitting short-term sales, more than one in 20 new vehicles sold in the United States and Canada will have a hybrid gas-electric powertrain by 2012. That's a growth from 2.8% in 2008 to 5.3% in 2012.

### Full-Hybrid market share forecast



Source: POLK (November 2008), hybridcars.com

### Electric cars will be the long-term technological winner

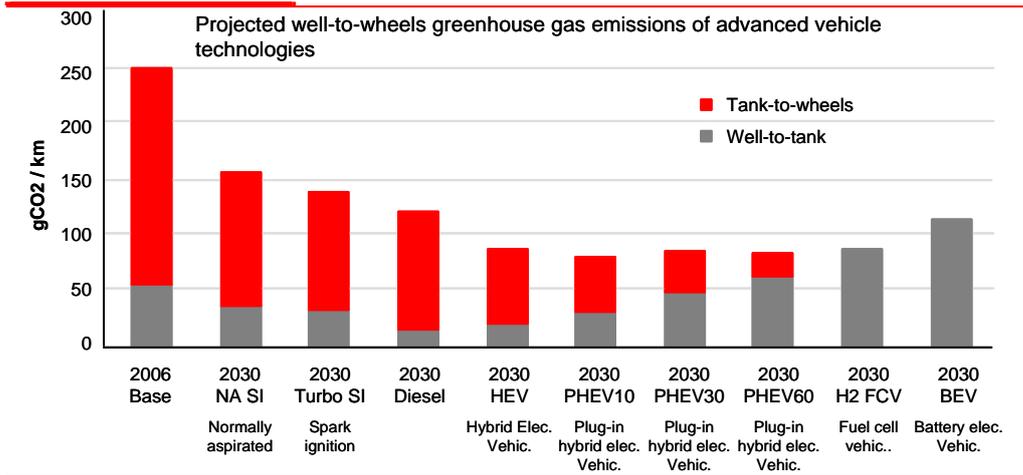
A significant percentage of this global automobile fleet of 1 billion vehicles will be electrified in the coming decade. Ultimately a significant proportion of global production, currently 60-65 million vehicles per year, will be replaced with highly electrified vehicles.

**Looking forward to the increasingly stringent CO2 constraints** – 130gCO2/km by 2015 (-19%) and 95gCO2/km by 2020 (-41 %) in the EU and the “threat” of 50mpg (-45%) in the US by 2020 as well as similar Chinese and Japanese requirements – we believe that the electric car will emerge as the big technological winner. While the 2015 targets can be achieved with conventional energy-efficient technologies, it seems impossible at this stage to reach the 2020 targets without breakthrough “zero-carbon” technologies. We envisage that an increasing part

of the OEMs fleets could be electrified at a zero-emission level, enabling OEMs to meet emissions targets.

**Fuel consumption could be reduced by 60%** The US National Sciences Academy recently advised that Plug-in Hybrid electric vehicles (PHEV) could reduce fuel consumption by around 60% if their batteries allow a 40 miles range at least.

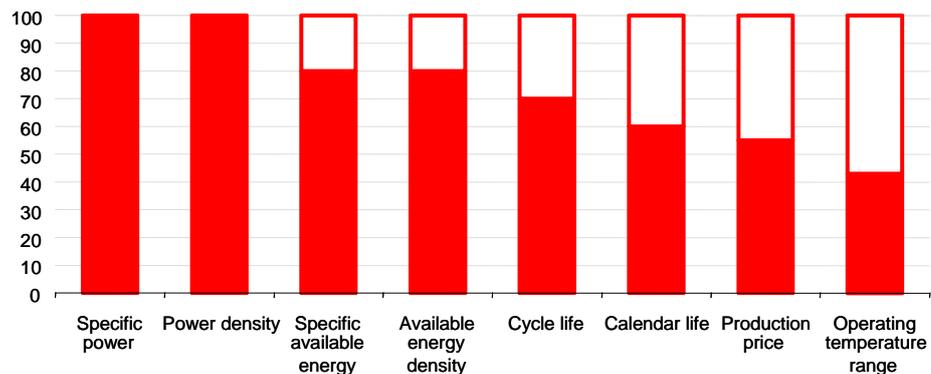
**Projected GHG emissions of alternative technologies to (2030e)**



Source: US NSA (2008)

**Battery is the key challenge, low utilisation and low range** PHEVs must have considerably larger battery in order to store significant electrical energy from the grid. A PHEV running on electricity for 40 miles will consume approximately 14 kWh (industry standard of 350 Wh/mile). The battery pack needs to be approximately 28 kWh (twice as large) to allow for the less-than-complete discharging required for a long battery life. A PHEV battery must also have a reasonable weight, size, cost and recharging time, and, to be commercially viable, must last many years. This will require significant technological progress given that the energy density of gasoline is 50 times that of a lithium-ion battery when measuring volume, and 100 times that of a lithium-ion battery when measuring weight. It will also require greater progress on cost as a battery with 28-kWh capacity costs \$20,000, meaning that they are not yet feasible for the consumer market on any large scale.

**Batteries: where we stand vs where we need to be for a commercial roll-out of EVs**



Source: SG Equity Research, US NSA (2008)

**Rapid progress on battery development** The OEMs are making significant progress with electric cars. General Motors plans to produce the Chevrolet Volt, a commercial PHEV, by 2010. The Volt, according to GM, will use a new type of lithium-ion battery, have an electric range of about 40 miles in urban driving, and utilise about 50% of the capacity of its battery. Toyota has also announced a new PHEV to appear in 2010; it is expected to have a pair of lithium-ion batteries and an electric range of about 7 miles. Things could also change rapidly with R&D developments such as a March 2009 announcement by researchers at the Massachusetts Institute of Technology (MIT) who said they have developed battery cells capable of charging in under a minute, an astonishing 100 times faster than a regular rechargeable battery.

**Lithium challenges**

With one billion cars on the road globally and 60-65 million new vehicles produced per year, the lithium needs involved in electrification will be huge with each battery needing around 2kgs of Lithium mineral! **This has raised issues as to whether we may face an eventual shortage.** An analysis of Lithium's geological resource base shows that there is insufficient economically recoverable Lithium available in the Earth's crust to sustain EV manufacture in the volumes required, based solely on Li-on batteries. However Lithium is also massively available in sea water under the format of Lithium Chloride (LiCl), at a concentration of 0.17mg/l, that would provide an everlasting reserve of Lithium if it could be exploited at an economical cost.

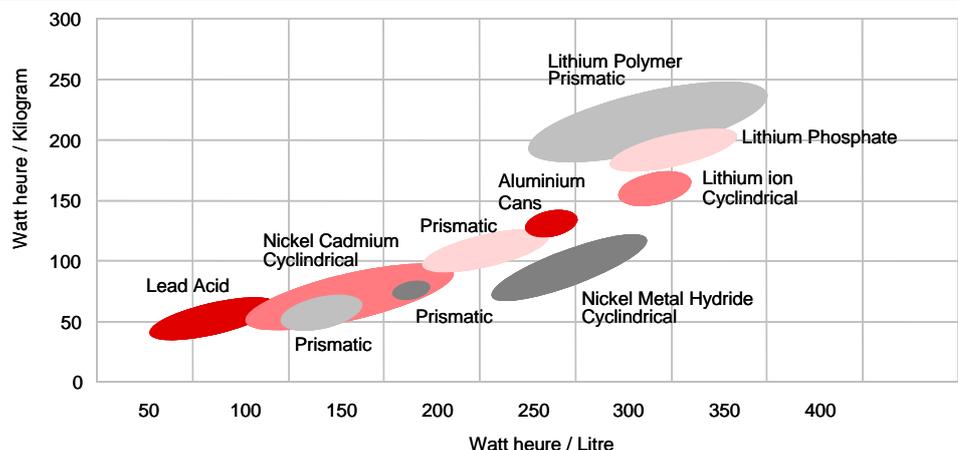
**Lithium is not a major cost concern** A kilowatt hour of bulk lithium ion batteries costs \$300 to \$500. Hence, lithium carbonate costs for the moment only 2-4% of the battery's total cost, and could easily support a 10 times price increase!

**Recycling is an opportunity rather than a risk** The capacity for massively recycling millions of new li-ion batteries is not yet there, and pollution is on the rise. However, two facts cannot be ignored: a) unlike oil, Lithium is a mineral and does not disappear during processing; and b) thanks to recycling, the risk of a possible shortage might well vanish if Lithium is well recycled. Recently for instance, the French company Recupyl was rewarded for its new process enabling a 98% recycling rate of metals in batteries. T

**Safety advantages** The good thing with Lithium batteries is that they contain no toxic metals (although there is the safety risk of fire if the metallic lithium is exposed to moisture while the cells are corroding).

**Zinc-based batteries could be an alternative** Alternative battery technologies like ZnAir, ZnSilver and NaNiCl are not resource constrained and offer potentially higher performance than Li-on.

**Efficiency rate of batteries**

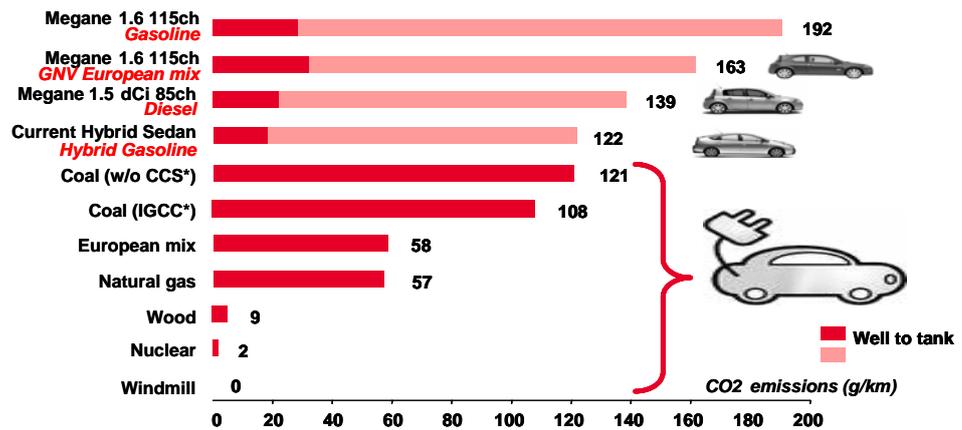


Source: SG Research, www.electron-economy.com

### From tank to wheel to well to tank

Electric cars do not mean necessarily mean that energy use is reduced or that there will be no more auto-related CO2 emissions. CO2 emissions will still be an issue, but they will be emitted “well-to-tank” rather than “tank to wheel” which is currently the case. CO2 will be emitted from power stations, which are fuelled by coal, gas, oil, hydro, wind, solar or nuclear. Positively, even a coal-fired power station has a higher level of energy efficiency than the tailpipe of a conventional ICE. But increasing use of electric cars will need to be counter-balanced by efforts, for instance, to install carbon capture for coal-fired power plants.

### Fuel efficiency through electric cars: the Renault example



Source: Renault

### Customers will have the final word: what & when will they pay

We have consistently stressed in our previous auto and efficiency reports (Feb 2008, June 2007) the importance of pricing power – understood as the capacity to pass on additional costs onto customers. With a prolonged slump sales looking a salient reality, it is very likely that customers will not accept additional “up-front” costs. Moreover, declining oil prices will probably reduce the abatement costs induced by lower fuel consumption. We believe that consumers do not consider the purchase of a car and the purchase of fuel as the same “investment decision”, but rather the former as personal capex and the latter as opex. Consumers do want green cars but on the downside, a majority of people do not want to pay more than a 5% increase for a significant improvement of fuel (Source: Cap Gemini). This latter finding is likely to be exacerbated in the current economic climate.

### OEMs looking to insuring fleets and benefit from tax incentives

Full electric cars in an OEM’s fleet will represent a kind of fleet insurance against EU-like CO2 constraints. 1% of electric cars in the fleet means a direct 1% reduction of a fleet’s fuel economy. Besides this, with incentive schemes like the bonus-malus in France or the \$1bn tax-break voted by the US Congress in Oct 2008, PHEV cars will strongly benefit from a much needed subsidy. The provision would grant all-electric vehicles or plug-in models with a 4-kwh battery pack or higher a \$4,168 credit. A vehicle like the Chevrolet Volt with a 16-kwh battery would qualify for the maximum \$7,500 credit for vehicles under 10,000 pounds weight.

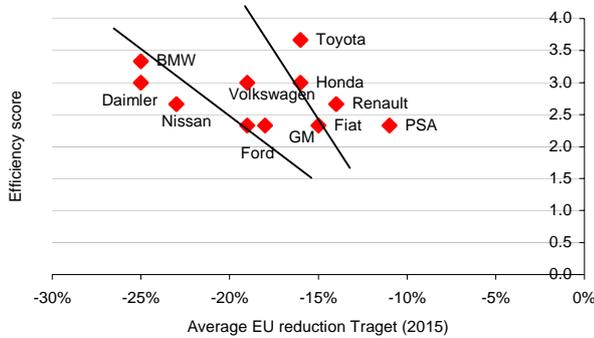
### Two groupings: defensive vs. offensive strategy

In the following chart we use the EU’s reduction target by 2012-2015 as a general proxy of the general positioning of OEMs regarding the CO2/fuel consumption constraint, coupling this quantitative, objective assessment with our own qualitative assessment of OEMs positioning regarding fuel and energy efficiency (see table further below). This allows us to split the OEMs into two categories: the ones who will need energy/fuel efficiency as a tool to match the

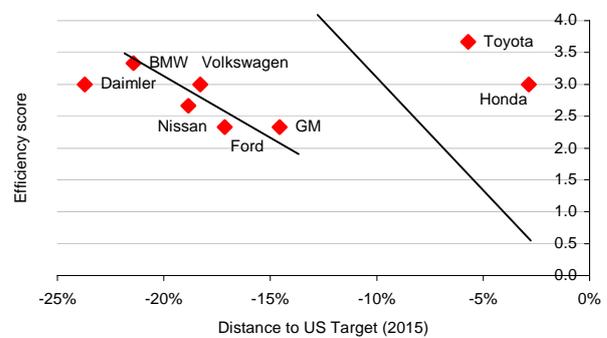
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constraint (defensive strategy), and the ones who are positioned to either meet their obligations or to seize the opportunity to develop market share.

**Efficiency – Distance to Target mapping (Europe)**



**Efficiency – Distance to Target mapping (US)**



Source: SG Equity Research; US EPA (Jan 2008), EC (Dec 2007)

We believe that the most advanced manufacturers are the market leaders on hybrids (**Toyota, Honda**), and electric cars with the **Renault-Nissan Alliance** (with their Better Place strategic partnership to be adopted by pioneer countries like Denmark and Israel after 2011). BMW should also benefit from an excellent position on micro hybrids with regenerative powers as well a leading position on ICE and Diesel.

**A scoring perspective on OEMs and efficiency (1 = weak, 3 = strong, 4= very strong)**

OEM	Micro-Hybrid	Mild Hybrid	Full Hybrid	Plug-In Hybrid	E-Flex	Electric car (Plug-in)	Total Hybrid, PHEV cars	ICE engines (downsizing, stratified, CAI, diesel)	Others (aerodynamics, transmission, weight, 5-10%)	Overall average
Improvement Rate	5-10%	10-15%	20-30%	50-95%	25-75%	25-95%		10-15%	5-10%	
Average cost	€100-500	€800-1500	€2000-4000	€2500-5000	€4500-8000e	€8000-9000e		€200-400	€100-200	
Toyota	◆◆		◆◆◆	◆			6	◆◆◆	◆◆	3.7
BMW	◆◆◆	◆					3	◆◆◆	◆◆◆	3.3
Daimler	◆◆	◆	◆				4	◆◆◆	◆◆	3.0
Honda	◆	◆◆◆	◆				4	◆◆◆	◆◆	3.0
Volkswagen	◆		◆				2	◆◆◆◆	◆◆◆	3.0
Nissan	◆		◆			◆	3	◆◆◆	◆◆	2.7
Renault	◆					◆	3	◆◆◆◆	◆◆	2.7
PSA	◆◆						2	◆◆◆	◆◆	2.3
Ford	◆	◆	◆				3	◆◆	◆◆	2.3
GM	◆		◆			◆	3	◆◆	◆◆	2.3
Fiat	◆						1	◆◆◆	◆◆	2.3
Porsche	◆		◆				◆◆	◆◆	◆	1.7

Source: SG Equity Research

**Look to the suppliers**

For suppliers, Valeo, Bosch (not listed), Johnson Control, BorgWarner, and Continental are all well positioned at least in micro and mild hybrids, and even in batteries (Johnson-Saft JV). For listed suppliers, our auto analyst believes Valeo has one of the most balanced and developed portfolios of technologies both for electric/hybrid and non-electric and conventional technologies. **For commodity suppliers**, we think the trend is generally favourable to aluminium providers (such as for example Rio Tinto Alcan and Alcoa) as well as companies involved in composite materials (such as Toray) provided that the US adopts a footprint system to calculate new fuel economy targets (CAFÉ standards) and that aluminium prices remain acceptable.

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**OEM and Supplier efforts on energy efficiency technologies**

Categories	Technol.	Functions	State of development	Advantages	Disadvantages	Suppliers	constructors
Micro hybrid	Stop&Start	Switch off the engine during a short stop and switch on when you re-accelerate.	Commercialised	-9% to -15% oil consumption & less CO2 emissions. Most affordable technology	None	Valeo / Bosch	PSA (07) / BMW (07) / Daimler
Mild Hybrid	Regeneration	Recovery of the cinematic energy during the brake. Energy is stock in a high-capacity battery.	Commercialised	Less consumption & emissions than classic Stop&Start, more power in case of strong acceleration	None	Valeo / Bosch	BMW (07), PSA (Diesel Hybrid4 -11)
Mild Hybrid	With electrical engine	Recovery of the cinematic energy during the brake + electric engine	Commercialised	Less consumptions and emissions than Regeneration System	End of life (battery) / Both engines can't work alone	Panasonic	Honda, Ford
Full Hybrid	Parallel Hybrid	Classic engine + Electric engine	Commercialised	Engines can work independently or together when more energy is needed. Combined with Mild Hybrid Regeneration.	End of life (battery)	Sanyo	Toyota + Lexus
Full Hybrid	Serial Hybrid	All electric vehicle (classic engine only used to charge the batteries)	Prototype	<b>No transmission mechanical loss / innovation : the classic engine</b>	End of life (battery); energy to transform hydrogen + capacity to stock it		GM
Full Hybrid	Connected Hybrid	Electric vehicle which can be plug on or charge by classic engine in case of total discharge	Prototype (20 vehicles under production => VW Golf)	Autonomy > than full electric vehicle (electric autonomy : 50km).	End of life (battery)		VW
Electric	Classical - Plug-In	Classic batteries => Pb / Ni / Lithium ion	Commercialised / Lithium ion (2009/2010)	Full clean power -> no emission when used	Autonomy / End of life (battery)	BASF / Bosch / Mitsubishi Motors / Sanyo	Nissan-Renault / Toyota / => Lithium ion / Honda => Ni
Electric	Fuel cell (PAC) Hydrogen	Produce energy from fuel (hydrogen) on the anode side, and an oxidant (O2) on the cathode side. ≠ from a classical battery in that Fuel cell consume reactant which must be replenished.	Prototype (2010/2012)	Full clean power -> no emission when used / Autonomy (estimation : 300km for PSA; 500km for BMW).	hydrogen storage capacity and industrialisation.	Intelligent Energy	BMW / Nissan / VOW / GM / Toyota / Ford / PSA / Daimler
Transmission	Dual Clutch	Semi-automatic transmission with separates clutches for odd and even gears. => CVT (Continuous variation Transmission).	Commercialized	Fastest transmission system; Lower emissions and consumptions.	Technically none.	Bosch	VW (DSG) -> Audi, Porsche, Seat, Skoda.
Transmission	Dual Dry Clutch	Idem dual clutch but with higher performance than hydraulically double clutch system (immersed in oil bath)	Coming soon	Emissions 4% lower than Dual Clutch	Technically none.	Valeo	Ferrari (New California in few months)
Engine	Down-sizing	Increasing engines power and torque without increasing cylinder capacity / Reducing engines' capacity at same power	Commercialised	Fuel consumption and emissions reductions.	None		Fiat / VW / BMW / PSA / Renault
Engine	Oil Direct Injection	Highly pressurised gasoline is directly injected in the combustion chamber by the Common Rail.	Commercialised on diesel engines for many years and since 2007 on gasoline engines	Less consumptions and emissions	None but still an internal combustion engine	Bosch	All recent diesel engines and almost all generalist manufacturers for gasoline engines.
Engine	Camless	Valves are independent and computer controlled (magnetics) and free => infinitely variable valve timing (possibility to shut down one or more cylinder).	Prototype	Efficiency 20% greater than a camshaft-operated engine => Consumptions and emissions 20% lower than classical engine.	None but still an internal combustion engine	Valeo	BMW / Fiat
Auxiliaries	EGR	Exhaust Gas Recirculation => get back a part of exhaust gas to reintroduce them in the admittance -> lower combustion temperature.	Commercialised	Lower NOx emissions	None	Bosch / Valeo	Range Rover / Jaguar
Auxiliaries	Cooling System	New cooling system for optimized thermal energy management => Better regulation, better temperature increasing -> better fuel combustion.	Commercialised	Lower Nox and CO2 emissions	None	Bosch / Valeo	VW
Construction	Weight reduction	Using light alloys (Aluminium...) a synthetic materials (plastic). Development of nanostructures: reduce mass of vehicles.	Alloys and synthetic materials -> commercialised / Nanostructure -> laboratory.	Mass reduction => consumption reduction => less emissions.	None / cost of nanostructure	Faurecia	All manufacturers. First was Audi with Aluminium (Audi 2 & 4).
Construction	Aerodynamic	CX/SCX coef. Improvement => friction strength reduction.	On work since the blower creation.	Friction strength reduction => consumption reduction => less emissions	Design (it depends on preferences).	Pininfarina and other car designers.	All manufacturers.
Construction	Tires	Friction strength reduction due to materials and wide tire.	Commercialised	Friction strength reduction => consumption reduction => less emissions	Low level of performances.	Michelin / Continental / Pirelli	Depends on each vehicle.

Source: SG Equity Research Companies

## Public transport is key – the rail renaissance

### Global rail market

Global market	€103bn
Length of network	4,450,000km
w/o electric	400,000km
No. locomotives	140,000
No. multiple-unit trains	55,000
No. freight wagons	3,700,000

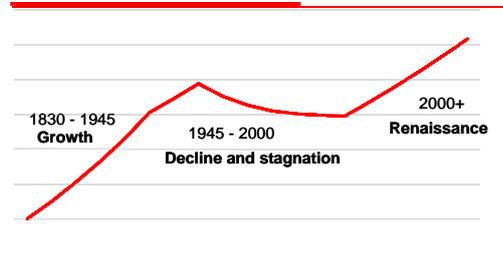
Source: Vossloh, SG Equity Research

The rail industry should benefit from solid and sustained growth in the medium to long term. Although it did not seem a priority for most governments a few years ago, rail transport appears to be an appropriate and competitive solution in terms of environmental concerns, transport needs and increasing urbanisation in emerging countries. The decision to move on to trams and rail is also politically dictated and could benefit from the current economic climate of economic stimulus spending on infrastructure. We believe that rail has a clear competitive edge over other forms of land and air transport which is only set to increase with time. This is bringing about significant benefits for railway equipment companies, in particular, especially Ansaldo, CAF and Faiveley.

### An €86bn market

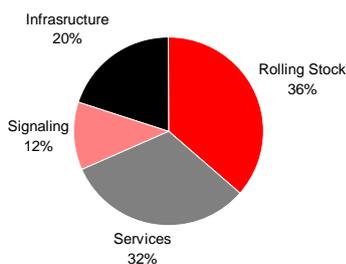
The rail market is estimated by Unife to be worth €86bn worldwide. Nearly 32% of revenues are derived from services. The North American market (24% of the global market) is essentially focused on freight. It is therefore of less value than the European market (40%). In our view, the rail market will continue to benefit from a favourable environment over the years ahead. The accelerated development of rail infrastructure in Asia, particularly in China, represents a powerful growth driver and new CO2 emission reduction targets in western countries are gradually leading rail to be favoured over road transport, a trend which could be accentuated by the sharp rise in oil prices. The railway renaissance which began a few years back, therefore looks set to continue.

### Rail: Golden age, decline & renaissance



Source: SG Equity Research

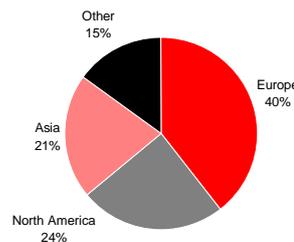
### Market size and breakdown by business\*



The market is estimated by Unife to be worth €86bn worldwide. Nearly 32% of revenues are derived from services.

Source: Union de l'industrie ferroviaire européenne (Unife) \* 05-07

### Geographic breakdown of the market\*



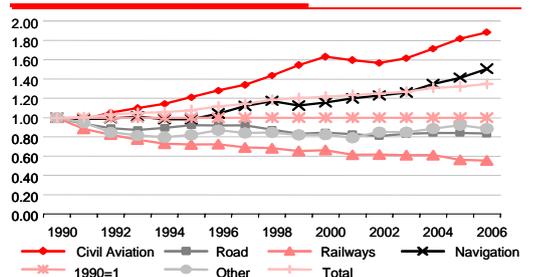
The North American market is essentially focused on freight. It is therefore of less value than the European market

Source: Union de l'industrie ferroviaire européenne (Unife) \* 05-07

## The most environmentally friendly form of transport

In our view, there can be no doubt that massive recourse to public transport is essential to achieve the main objectives of reducing fossil-fuel consumption (depletion), improving energy security, cutting back energy costs and reducing GHG emissions vis-à-vis the transport sector. Railways are the most environmentally friendly form of land transport – taking into account upstream or

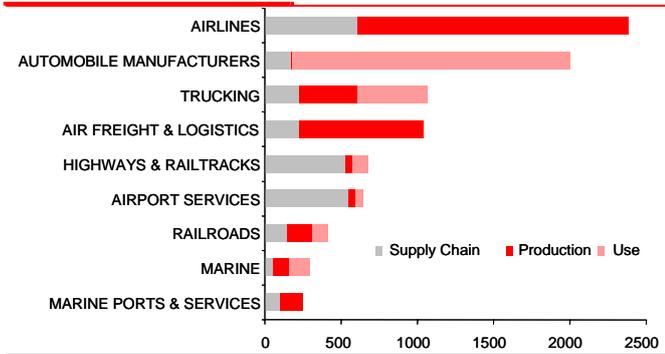
### CO2 emissions by mode EU 27: 1990-2006



Source: SG Equity Research

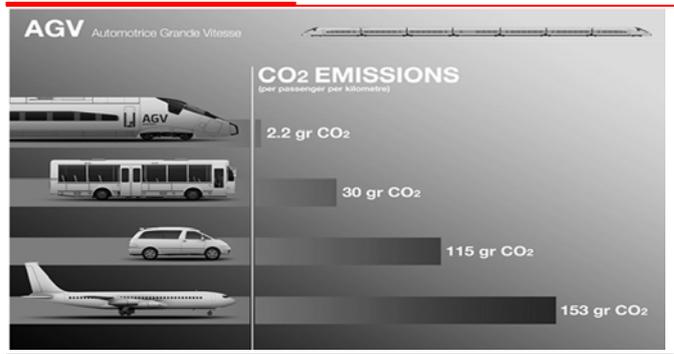
downstream emissions or on a per passenger basis. The CO2 evolutions over the last decade are extremely favourable for rail vis-à-vis other forms of transport and are likely to continue going forward.

**Carbon intensity (GCO2/\$US of revenues): MSCI World**



Source: SG Equity Research, centre Info

**CO2 emissions (per passenger and per km)**



Source: Alstom, Ademe (reference CO2 / kw.h rate on electricity production in France)

**Cautious optimism going forward**

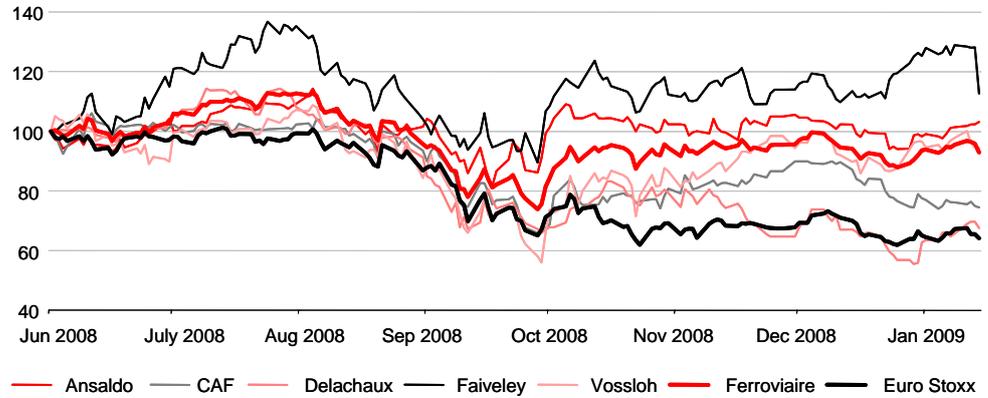
We are afraid the financial crisis will delay ongoing discussions over railway projects slated to begin after 2010. The difficulty of obtaining financing could lead some projects to be delayed or scrapped altogether, which would impact industry revenues starting in 2011. We have witnessed the emergence of conflicting signs in recent months including the postponement of invitations to tender owing to the financial crisis, uncertainty over the high-speed train project in Argentina and concerns regarding the private funds needed to finance the Tour-Bordeaux line in France. Positive signs however continue, including:

- China's 2020 plan is going forward (\$300bn and 3,000km of rail per year to 2020)
- UK railway lobby: high-speed rail lines
- French Paris-Rennes TGV line (€3bn)
- Algeria: \$30bn budgeted to modernise the railway network
- US: ambitious projects (which still need financing)
- Economic stimulus packages to encourage investment (France, Germany, Spain)

**Structural growth and strong visibility for railway equipment**

We have consistently highlighted the structural nature of growth in the rail equipment market. This growth lends considerable appeal to the groups operating in these markets (which have record order backlogs), particularly in the current, still highly uncertain, economic and stock-market context. News flow has remained favourable, strengthening our confidence in the sector. The railway equipment sector has significantly outperformed over the last months, even posting a positive performance in absolute terms. Against a difficult stock-market backdrop, investors now seem to have a better appreciation of the defensive nature of rail equipment stocks.

**Performance of railway equipment companies Q208 (base = 100)**



Source: Factset, SG Equity Research

**Airlines: there will be blood (pressure)**

**Air flights are responsible for 2% of global CO2 emissions** and 8% of global economic activity (Source: IATA). Airlines' CO2 emissions have been steadily rising since 1990, driven by growth in emerging countries where air transport is a key channel to industrial and commercial development as well as the boom in low-cost carriers. Passenger traffic has grown at roughly 9% a year since 1960 and if air travel increases as projected, aviation's emissions will more than double to between 5% and 6% of the global GHG emissions total by 2050.

**With a new, controversial CO2 scheme to be applied to all flights landing or taking off in Europe by 2011, our belief is that regulators may try to put the brakes on airlines' growth as it is the fastest growing source of CO2 and fuel consumption for all forms of transport.** We have our doubts regarding the legal status of the new EU legislation, as non-EU members might very well go to a WTO court and win their case for non-EU flights, but we believe that it is a first step in fundamental changes to come. High-speed trains have a clear edge for both fuel consumption and CO2 emissions, and there is no rapid technological way for air transport to make up its competitive disadvantages.

**Even though energy efficiency is a major challenge for airlines, it is also a defensive tool to battle oil price rises and carbon taxes rather than a way to gain market share** against other forms of transport. Innovation will be the key to change in the sector, but it will be the aerospace companies as well as long-term sectoral programmes that will hold the answers.

**Renewed fleets: key driver in the short-term**

Comparisons between airline operators are really tricky, as the best indicator (CO2/PKT – Passenger Kilometre Travelled) depends on various factors like the range of flights and the type of carrier. A direct comparison based on this indicator does not bring real added value, except for identical flights. More interesting is the use of a renewed fleet indicator as a younger fleet can strongly help to reduce fuel consumption. In that perspective, there is a clear split between low-cost carriers (EasyJet, Ryanair) and airlines operators from “emerging” airline economies (Qatar Airways, Emirates, Kingfisher) on the one hand, and historic operators on the other. For the latter, led by Iberia and Lufthansa, average fleet age is around 10 years – which is 4-5 older than for their low-cost competitors, and which will give the low-costs an edge in terms of fuel consumption.

**Average fleet age and fuel costs (% of total revenues)**

	Average fleet age	Fuel costs/revenues
EASY JET	2.3	30.0%
RYAN AIR	2.7	29.0%
QATAR AIRWAYS	4.6	NA
EMIRATES	5.6	24.9%
KINGFISHER	6.1	43.0%
IBERIA	7.8	20.9%
LUFTHANSA	8.4	17.2%
QANTAS	9.3	22.2%
CONTINENTAL AIRLINES	9.4	23.5%
AIR FRANCE/KLM	10.2	18.9%
JAPAN AIRLINES	11.0	19.1%
BRITISH AIRWAYS	11.4	23.5%
DELTA AIRLINES	12.4	38.3%

Source: SG Equity Research, companies (2008 or last data available)

**Biofuels: a partial, mid-term solution**

In January 2008, a Boeing 747 took off from Tokyo's international airport and, an hour later, landed safely on the same strip of tarmac. The Japanese plane was not propelled by fossil fuel but by a biofuel mix based on camelina and jatropha oilseed plants. The event was the first biofuel test flight in Asia. But since 2008, a number of airlines have engaged in similar tests. In February 2008, Virgin flew a Boeing 747 from Heathrow to Amsterdam with a fuel mix based on coconut extract. The same month, Airbus completed a successful experiment using a liquid fuel processed from gas to power its new A380 aircraft. Last month, Continental Airlines became the first US carrier to carry out a demonstration flight using a biofuel mix. IATA members, as a whole, are committed to using 10% alternative fuels by 2017.

**Interesting targets, but for the very long term**

British Airways announced plans to cut its carbon emissions in half by 2050. The move would see the company wipe 8m tonnes of the emissions off its net carbon balance sheet. BA says it has already improved its fuel efficiency by 28% since 1990. It has also saved 50,000 tonnes of CO2 over the past two years by flying shorter, more direct international routes. The company's list of remedies includes investment in cleaner aircraft, improvements in fuel use and more efficient flight routings. Air France is also currently swapping its eight Boeing 747-200 freighters for Boeing 777s, in order to cut fuel consumption by almost one-third.

**Much will depend on the next generation of aircraft**

Current modern aircraft consume, on average, 3.5 litres of fuel per 100 passenger kilometres – similar to a small car. The long-awaited next generation of aircraft, such as the Airbus A380 and Boeing 787, could boast fuel efficiencies of below 3 litres per 100 passenger kilometres.

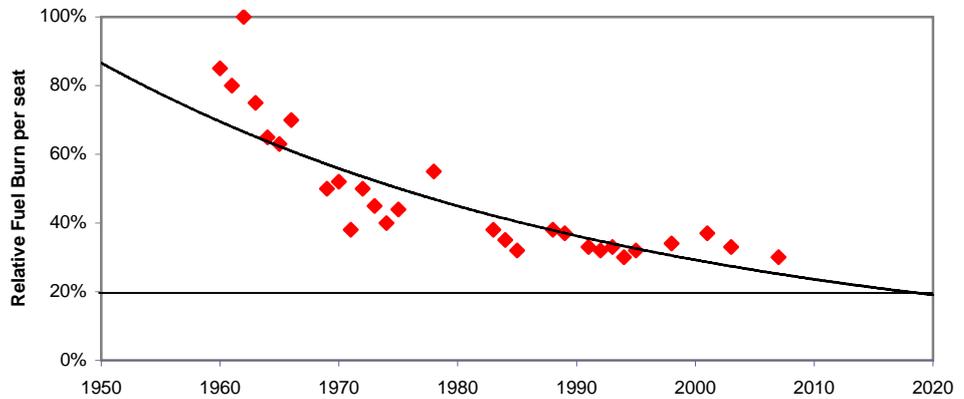
**50% improvement does not look easy**

The objectives set in 2001 by ACARE (Advisory Council for Aeronautics Research in Europe) are still confirmed by companies like manufacturers like EADS: -50% CO2 by 2020, as well as -80% of NOx and -50% of perceived noise. These objectives would be achieved by a combination of technologies in aircraft manufacturing, engine design and air and traffic management. According to company comments made at the EADS Investor Day in November 2008) improved fuel economy will come from:

- Structures: fuel burn savings up to 10%
- Aerodynamics: savings up to 10%
- Systems: savings up to 10%
- Engines: savings up to 25%.

However, these economies cannot be combined together, meaning that the potential reduction will definitely not be 55%.

**Long-term energy efficiency (Airbus)**



Source: SG Equity Research, Airbus / EADS (Investor Responsible Day 2008)

**Airlines will still have the edge for 80% of journeys**

Even with a 50% reduction by 2020, airlines could still be far behind their train competitors for journeys with a range under 1,000-1,500km. However, airlines would have an edge for the estimated 80% of airline journeys which are for over 1,500km.

**Airlines, the “new Integrated mobility firms”**

Stakeholders such as Greenpeace have pushed airlines to make a move towards becoming “transport companies” rather than airlines, by looking at how it could best transfer passengers around the country while emitting the least carbon as possible. We believe that we may see moves in this direction such as with last year’s announcement by Air France-KLM that it was in preliminary discussions with French utility Veolia to replace some of its domestic flights with high-speed rail, but not before 2011 and the liberalisation of the sector.

**Companies that could benefit - Green transport**

Based on their current exposure to energy efficiency and our long-term forecasts for future development, we believe the following themes and companies constitute a good way to invest in Green Transport through global equities:

**Ansaldo STS** is one of the world leaders in the rail signalling equipment market which offers significant medium term potential. The introduction of new regulations associated with the construction of new pan-European corridors and compatibility needs provides the signalling market with an additional growth driver. We believe Ansaldo is capable of tapping into the momentum in this market as it has acquired a lead in terms of expertise in ERTMS (European Rail Traffic Management Systems) and it has a multi-local structure that enables it to be perceived as a national player in various countries. Additionally, it manages turn-key infrastructure projects via its Transport Systems division which is able to co-ordinate all or part of a new line extension project – and which is likely to be successful in expanding outside Italy thanks to experience acquired in underground transit systems. The group continued to register a high level of new orders in the second quarter (more than €700m to date) indicating that the market remains well orientated and has not suffered any serious setbacks due to the

financial crisis. The geographical diversity of its contracts also demonstrates the group's ability to move beyond its borders. The group's FY08 results (EBIT: +17% to €118m, net profit +33% to €78m exceeded consensus and the company is on target to meet or even exceed its 2009 forecasts.

**BMW** BMW's brands include BMW, mini, and Rolls-Royce. Our auto analysts regard BMW as the best-positioned premium player on the green transport theme thanks to the combination of its fuel efficient mini line, its downsizing push and massive implementation of micro-hybrids. BMW currently has 20 models emitting no more than 140 g/km CO<sub>2</sub> and has also introduced start & stop (micro-hybrid) systems for most of its cars. It is also working on developing new mild and full hybrid solutions. The so-called dual-mode hybrid technology being developed by BMW and its consortium partners includes an onboard fuel- optimisation computer that determines when and at what speeds the two motors will be used for power and how the on-board battery will be recharged. The company is producing hybrid electric vehicles using lithium-ion battery technology, with two models in their Concept 7 series due out as early as 2009. BMW also introduced the world's first series-developed vehicle with a hydrogen combustion engine in 2006 and the company continues to research and promote hydrogen technology as part of its clean energy program.

**Bolloré** While many OEMs remained skeptical, Bolloré, the diversified holding company, has always been convinced that a market for EVs will develop and has heavily invested in its BlueCar project since 2004. Using storage technology developed in the manufacture of plastic films for capacitors, Bolloré's Batscap battery manufacturing subsidiary (95% owned by Bolloré and 5% by EDF) has developed a high performance metal lithium polymer battery to power an EV. The project is reaching realisation with Bolloré SA and Pininfarina partnering in "Véhicules Électriques Pininfarina Bolloré". Under the scheme, prospective owners can now register to lease the car under a €300-per-month (£267/\$377) deal that includes 24x7 roadside assistance. The lease scheme will initially operate in the UK, France, Italy, Germany, Spain and Switzerland, and initial deliveries of the car will begin in "about a year". In order to secure a sustainable access to lithium, Bolloré even suggested in March 2009 that it may set up a production plant in Bolivia with a capacity of 70,000 vehicles per annum. The 28kWh battery is adaptable for an EV with a range of 250km and a top speed of 130 km/h. Bolloré has undoubtedly carved a globally leading position in this area and its LMP-Bluecar package is high performance, low-cost and pollution-free. While high costs currently restrict the market to a niche client base such as public authorities like La Poste, we believe that the operation could become profitable in five years.

**BorgWarner Inc.** is a global leader in highly engineered engine and drivetrain components and systems that address fuel economy and air quality needs. Over two-thirds of its sales are derived from energy efficiency technologies and it is a key supplier for hybrids and EVs. Demand for its gas and diesel turbochargers and dual-clutch transmission technology is expected to continue to drive an above sector growth rate. In late 2008, BWA announced \$2.1bn of expected net new powertrain business for 2009 through 2011 (+8% over 2006-8). Despite the contraction in the industry, BWA is the best positioned of the suppliers to meet fuel economy needs in every region of the world with Europe accounting for 50% of new business and Asia 30%. Turbochargers for advanced diesel and gasoline direct injected (GDI) engines account for the biggest share of new business (35%) followed by dual-clutch technology (16%). Despite twice revising 2008 guidance downwards, the dual focus on fuel economy and emissions reductions should drive long-term growth.

**CAF** Despite a low profile, the group is the world's #5 train manufacturer with a comprehensive offering and a strong international presence, particularly in South America. It specialises in the passenger transport market, particularly suburban and commuter trains, but has a growing interest in the high-speed market. It operates at every level of the value chain, from the design to the production of trains. Only engines and traditional subsystems (i.e. brakes, air conditioning, doors, etc.) are purchased from outside suppliers. The group even produces part of the steel it uses in the wheel production process. We remain positive on the company supported by an excellent recent track record, a buoyant rail equipment environment and very attractive multiples. We nevertheless continue to highlight a lack of communication, with management providing very little explanation on key points relating to profitability and no indication on outlook (although this is also a factor undemanding multiples). However, the latest results (period to end-September), supported our opinion, showing continued top-line growth, high level margin consolidation and a record order book.

**Faiveley** is a major rolling stock parts manufacturer with strong global market share on air conditioning (world #1 with 30% market share), braking systems (world #2, with 35% EU market share) and electro-mechanical systems (top-3 in access doors, interior doors and pantographs). It also benefits from strong visibility thanks to a record level of orders. In addition to demand from China and environmental concerns, Faiveley offers considerable potential for external growth. Three years after the acquisition of Sab Wabco, the company has returned to a positive net cash position and returned to the acquisition trail (with five recent transactions and exclusive negotiations with Ellcon-National, a US company specialising in freight train braking systems). The simplification of the shareholder structure that has been outstanding for nearly a year now (buyout of Faiveley Transport minorities) could also be announced. The group released solid H108 results (revenues up 20% LFL and operating profit up 33%) and enjoys an orderbook representing more than 15 months of revenues and a financial situation that should allow it to pursue its external growth programme (despite the minority buyouts carried out in December).

**Honda Motor Co.** is a diversified group with three industrial activities: automobiles (80% of the business), motorcycles (13%) and power products (4%). In auto, Honda Motors is the number two Japanese car manufacturer after Toyota in terms of global market share and the sixth-largest car manufacturer worldwide. Honda has tapped the hybrid market, with the launch of hybrid versions of the Civic and the Accord in the US, the latter was abandoned however, owing to limited success. Honda is persevering with the Civic hybrid and is launching a new mid-sized hybrid on the world market ("Insight") with production at 200,000 units, of which 100,000 are to be produced in North America. The price of this vehicle makes it more affordable than the Toyota products, but it uses the less sophisticated mild-hybrid technology. It has started off with relatively strong sales in Japan, out-selling the Prius in early 2009. Although the company has been hit by a very tough environment, our auto analysts still expect a significant recovery in 2010/11 on the back of a general rebound in demand and cost cutting measures over the coming months.

**Renault-Nissan Alliance** is the world's fifth largest automaker and involves extensive collaboration on efficiency. The Alliance is not really present in hybrids (using a Toyota motor for the hybrid Altima). Instead, the group has focused on two technologies: the all electric car, and, longer-term, the fuel cell. It is the global leader on electric cars – and plans to dominate the segment in the same way Toyota did with hybrids – with electric car initiatives in Israel, Denmark, Portugal, Monaco, Japan, and with French electric utility company, EDF – and in the US, ZEV partnerships in Tennessee, California, Arizona and Oregon (including the

development of public battery recharging infrastructure). In March 2009, Renault confirmed objectives for 20,000-40,000 EV sales in 2011 and over 100,000/year 2012-2015e and Nissan estimates that the market could grow to 15m+ city cars. The group will sell four EVs – the "C" segment Fluence sedan, an EV version of the 5-seater city Kangoo by 2011-12, and a vehicle aimed at short journey customers. The group has signed a partnership agreement with NEC for the manufacture of lithium-ion batteries and is partnering with India's Bajaj for an ultra-low-cost model for emerging markets by 2010. Although Renault reported 2008 earnings below expectations and an expected €1bn loss in 2009, we remain confident in management, the group has a solid plan for preserving cash and at current levels would be a value opportunity if demand were truly to become more favourable.

**Rio Tinto** is a leading international mining group involved in aluminium, copper, diamonds, energy (coal and uranium), gold, industrial minerals (borax, titanium dioxide, salt, talc) and iron ore. It should benefit via energy efficiency via Rio Tinto Alcan (global #1 for aluminum) and its Alcan Engineered Products division, an international leader in engineered aluminum, lightweight materials and technology. It is well-positioned on lightweighting: auto parts, coating systems, large extrusions for aircraft fuselage frames; buildings: functional surface products to enhance environmental performance; and renewables: composite material applications for wind turbines and solar surface products. The group is also endeavouring to reduce the energy efficiency of its aluminum – with a 2008 target of a 6% reduction per tonne of product (vs. 2003) – and is working on step change technologies such as the Drained Cathode Cell for aluminum production. Our metals & mining analyst believes that Rio Tinto is among the cheapest companies in the sector and believes it will further re-rate as the market assesses the merits of the Chinalco transaction.

**Saft Group** is the world's leading developer of high-tech batteries for industry – the world #1 for ni-cad batteries for industrial applications and primary lithium batteries and #2 for specialised advanced technologies for the defence and space industries. Johnson Controls-Saft – the company's JV with JCI, the world's leading maker of conventional auto batteries – is one of the best positioned groups in the electric car battery war. The JV is the perfect mix, combining Saft's li-ion expertise and battery plant with JCI's extensive supply and design relationships with the world's top OEMs – resulting in major contracts with BMW, Ford, BMW and two Chinese players. The February 2009 contract with Ford for 5,000 battery packs is a particularly important move forward as the JV will supply the entire battery system and not just the li-ion cells – thus doubling content per vehicle and revenues. Saft could also benefit from the smart grid following a Q408 partnership with ABB to develop the world's first high voltage li-ion battery system designed to improve the stability of power distribution grids. Saft Group announced strong overall growth for 2008 at 4.9% YoY at constant rates, which was a good performance in the changing economic conditions.

**Toyota Motor Corp.** is the world's largest automaker and well ahead of the pack for hybrids, with the Prius, the first ever model launched in the segment and still by far the best seller. The next stage is offering "plug-in" functionalities (PHEV), i.e. recharging batteries while the vehicle is not in use instead of using the petrol engine only to charge the batteries. This new third generation Prius is to be released by 2010 and the group has signed a partnership agreement with Panasonic for the provision of li-ion batteries. The new Prius will emit just 89g CO<sub>2</sub>/km, well under the binding 130g set under EU rules - and that equates to fuel-efficiency of 3.9 litres per 100km. The aim is to sell 400,000 of the new Prius by 2010. Toyota also expects to sell 15% more hybrid vehicles in Europe. The company, which is the largest car-maker in the world, plans to offer a hybrid version of every model it produces by 2020. Toyota

also own Lexus which where three hybrid models have been developed under the more luxury affiliated brand. In 2007 Toyota started offering flexible fuel vehicles for sale in Brazil that can run on up to 100% bio-ethanol fuel as part of its energy diversification strategy. Due to its financial strength and significant positions in all markets and technologies, our auto analysts believe Toyota still has the highest mid-term potential, but short term, its strong presence in the US market and in several vehicles segments makes the company more dependent on general market trends, hence a risk on volume and margins.

**Valeo** is one of the world's top automotive suppliers with 121 plants, 61 R&D centres, 10 distribution centres and 51,200 employees in 27 countries. We believe that the company is well-positioned to benefit from major industry trends. Powertrain efficiency for OEMs is today largely driven by CO2 challenges – and Valeo's long-standing R&D efforts are paying off with a wide portfolio of "Green by nature" fuel economy solutions. These can improve fuel efficiency by up to 40% (i.e. camless system 15-20% saving [according to Valeo]; micro-hybrid 6-15%; thermal management 7-9%; cooled EGR system 5-7%; dual clutch 4-6%; power on demand 3%). Our auto analysts believe its stop-start mild hybrid system is also best positioned to capture the lion's share of the 17m hybrid vehicles by 2013e – efforts which could be aided by a February 2009 partnership with Michelin to coordinate the development of electric and rechargeable hybrid vehicle systems. Valeo is also well positioned to benefit from the drive to zero accidents (automation, visibility, driving assistance) and improved comfort (the "no stress" car). While the company experienced a dismal Q408 and is looking forward to a gloomy 2009, Valeo has been extremely reactive in cutting costs and our analysts believe its very solid balance sheet should allow it to comfortably wait out the crisis.

## Appendix 1 – Green stimulus, \$300-1,000bn for the green new deal

The idea of economic stimulus to revive national economies during times of financial hardship decreased spending or general economic decline is far from groundbreaking. However, **channelling stimulus funding to a green or low carbon economy is as innovative and potentially ground-breaking as FDR's New Deal.** Green New Deal stimulus packages are being developed and implemented by governments worldwide with major new spending, subsidies, loan guarantees and tax breaks and incentives for energy efficiency (buildings, construction, power and transport) and renewable energy. To date, we have identified close to \$300bn in new global green stimulus funding – and the figures are growing by the day. If one takes into account, pre-existing green funding commitments made globally, the figures could be as high as €1,000bn and are rapidly moving towards the UN target of 1% of GDP and stakeholder calls for green measures to account for 20% of global economic recovery plans.

**We need to be very cautious with the figures.** Governments have been less than transparent in terms of the total amounts, what is new funding rather than pre-existing funding, as well as on the timing. Moreover, we are still far from the estimated 3.5% of GDP which FDR allocated for the New Deal – which would be the equivalent to £50bn p.a. for the UK or \$500bn for the US.

**The green stimulus funding should provide a major short-term boost for economies** while creating jobs, exerting a multiplier effect and laying solid foundations for the transition to a sustainable low carbon economy. It is estimated for instance, with regard to the \$100bn US green stimulus that the plans the potential to save the US economy an average of \$450m/year for every \$1bn invested and that for every \$1bn in spending, 30,000 jobs are created while annual GHG emissions could be reduced by 592,600 tons between 2012 and 2020. Given the urgency of the economic and climate crises, it thus comes as little surprise that governments are making a major effort to have the funding hit the ground as soon as possible. This will have multiple enabling effects – eliminating the 1-2 year time lag that usually accompanies green funding commitments – as well as keeping energy efficiency issues on the table and moving forward projects that would not otherwise have seen the light of day until years later. Yet again, we reiterate our view that the cheapest, easiest and most effective funding strategies are energy efficiency measures for buildings, power and transport in particular.

### United States, \$100bn

In response to a moribund economy, growing unemployment and international pressure on GHGs, the US has been working hard to pass a stimulus package that will meet its economic and environmental needs. Entitled the “American Recovery and Reinvestment Act”, the package is worth \$787bn with the bulk coming in the form of spending and the remaining part in the form of tax cuts for homeowners and businesses. Close to 13% of the package - \$100bn - will be spent on fighting climate change with energy efficiency – buildings, power (T&D, smart grid) and transport – as well as renewable energy emerging as the biggest winners.

**Overview of US green stimulus plan (\$)**

Buildings	Conservation / retrofits	<\$24bn (S)	Federal government, residential and military buildings and low- and middle-income homes (insulation, windows etc.)  Biggest single recipient because many of the projects can be done quickly and employ unemployed construction workers
	Home conservation	\$4.3bn (T)	Homeowner tax credit for 30% of the cost of efficiency measures (windows, boilers etc): capped at \$1,500.
	Bonds	\$1.5bn (T)	Lets local and state governments raise money for conservation / retrofits and renewable projects by issuing bonds backed by the federal government
Transport	Public transport	\$17.7bn (S)	Building train lines, adding new bus routes and upgrading existing systems. Focus on commuter transit and high-speed rail such as Amtrak.
	Advanced vehicles	\$3.2bn (S)	>\$2bn in loan guarantees to companies developing batteries for electric cars
	Efficient vehicles	\$1bn (S)	Includes \$600 m for municipal, state and federal governments to buy fuel efficient vehicles and buses as well as \$400 m to install infrastructure for charging electric cars.
Power	T&D	\$6.5bn (L)	Address the shortage of power line capacity (eg. 2003 blackouts) and more lines to transport renewables to urban areas
	Smart grid	\$4.5bn (S)	Digitise the power grid, making it more efficient (cut losses) and better able to handle renewables The money would be used for matching grants to utilities and to set up pilot programs
	CCS/ clean coal	\$3.4bn (S)	R&D and investments in carbon capture & storage (CCS) technology
Renewable energy	Loans	\$10bn (S)	Effectively outright grants for renewable energy and transmission projects in the early stages of development
	Wind	\$13bn (T)	3-year extension of tax break for big wind projects: effective 30% subsidy Will provide greater stability to the market
	Large scale	\$11bn (T)	"Carry-back" - a tax credit against prior profits Will act as an important incentive for many business that invest in renewable energy
	Manufacturing	\$1.4bn (T)	Lets companies that make renewable energy components receive a tax credit of 30% of their new investments in plants or machinery
	Small-scale project tax credits	\$1bn (T)	Recoup up to 30% of the cost of a household renewable unit on your federal tax bill
	Energy research	\$1.6bn (S)	Funding of Energy Department's office of science for research on global warming, biofuels, high energy physics and nuclear physics
Water	Water/waste disposal	\$1.3bn (S), \$3.8bn (L)	Development & improvement of water & waste disposal facilities in rural areas
	Water infrastructure	\$6bn (S)	Improvements in local water infrastructure
Waste	Nuclear cleanup	\$6.4bn (S)	Cleanup at old nuclear weapons and energy facilities
	Environmental clean-up	\$1.2bn (S)	Cleanup up at old industrial sites and other areas currently monitored by EPA

Source: SG Equity Research. S = spending, T = tax break

## Europe, \$200bn and growing

The EU has been ahead of other countries such as the US in adopting legislation aimed at increasing energy efficiency and reducing emissions. It is making steady, if not always perfect, progress towards its 20-20-20 goals for 2020 and policymakers have not stepped back in their commitments despite the recession. The targets have been boosted by recent stimulus plans to provide incentives in the form of subsidies, loans and tax breaks for investments in green technology, energy efficiency measures for buildings, power, transport and renewable energy projects.

### Germany, \$70bn green stimulus

The German stimulus is overwhelmingly centred on a \$67bn subsidy – close to 20% of total stimulus spending – for the national auto industry which employs one in seven Germans directly or indirectly. The downturn has seen a collapse in sales in Germany's important high-export auto industry which has threatened thousands of jobs. The aim of the hefty cash injection is to develop the industry into a world leader in the production of low emission, highly fuel efficient green vehicles. This has been supplemented by a "cash for clunkers" programme. Funding has also been allocated to help people transition to low energy housing.

### Overview of German stimulus package

Buildings	Low carbon housing	\$1.3bn (S)	Development of low or zero carbon housing ("passiv haus"): consume 90% less heating energy than conventional buildings
Transport	Industry subsidy	\$67bn (S)	Develop the auto industry into a world leader in the production of low emission, highly fuel efficient green vehicles
	Scrapping old cars	\$1.5bn (T)	Getting older inefficient cars off the road

Source: SG Equity Research

### UK, ambitious green stimulus plan under discussion

Britain has been vocal in stating that economic recovery depends on green jobs and investment – and is currently in the process of finalising a new Low Carbon Industrial strategy which will centre on energy efficiency, energy infrastructure, low carbon vehicles and making the UK a good location for investment in low carbon business. The strategy will seek to create 400,000 new jobs by 2017 – for a total of 1.3 million. In the meantime, the government has brought forward close to three quarters of a billion pounds in green spending for 2009.

### Overview of UK stimulus package

Buildings	Renovation	£210m	Improving insulation and heating systems in low-income households: 76,000 homes
Transport	Railways	£300m	Bring forward delivery of up to 200 new carriages, expanding rail capacity
	Low-carbon vehicles	£250m	Low-carbon vehicles
Infrastructure	Flooding	£20m	Flood defences that will protect 27,000 homes
Renewables	Subsidies	NA	Extended Renewables Obligation (subsidy) by 10 years to 2037

Source: SG Equity Research

### France, push on low efficiency vehicles & renewables

The French government has created a system of tax incentives for consumers who purchase low-emission, high efficiency automobiles and a corresponding increase in taxes on inefficient vehicles. France has also declared that by 2020 it will use renewable energy sources to supply 23% of its total energy needs as well as become a global leader in the field of solar PV technology. The goal is to increase the amount of solar energy generated in the country by 400x by 2020 and it has added a new category of solar feed-in tariffs of €0.45/kWh for commercial buildings to take advantage of their large rooftops and install solar PV projects. Residential buildings, which account for 40% of rooftop solar project installations in France, also qualify for a 50% tax credit.

#### Proposed Solar Feed-In Tariffs 2009

Building category	Years	Tariff €/kWh	Tariff \$/kWh
Commercial Buildings	20	0.45	0.57
Building Integrated	20	0.55	0.7
Ground-Mounted	20	0.3	0.38
Residential	20	0.3	0.38

Source: Renewable Energy World, SG Equity Research

### Green stimulus packages in other EU countries

Country	Stimulus amount	'Green' Projects to be funded
Czech Republic	NA	Value-added tax write offs for new cars, lowering social security payments
Portugal	NA	Investments in schools, boosting technology and alternative energy
Bulgaria	NA	Investments in infrastructure and public building repairs as well as education and healthcare to create jobs.
Spain	\$14bn	\$14bn will be invested in public works and other infrastructure projects with the goal to create 300,000 jobs.
Austria	NA	Investments in energy efficiency, broad-band infrastructure, railroad advancements, public facilities, and house conservation scheme
Poland	NA	Investments in renewable energy and environmental protection

Source: SG Equity Research

## Canada, US\$9.6bn green stimulus

Canada unveiled a US\$32bn stimulus plan in January that includes tax cuts, US\$9.6bn in investments in infrastructure and renewable energy programs, and worker training programs over the next five years. Supporters of the plan say it should create about 190,000 jobs by 2011. Approximately US\$800m is expected to go specifically to sustainable energy funding and for training workers for the green job market.

### Overview of Canadian stimulus package

Green spending	Sub-segment	Amount	Overview
Infrastructure & energy	NA	US\$9.6bn	NA

Source: SG Equity Research

## China, close to \$600bn in announced & new green stimulus

China is directing up to a third of their 4 trillion yuan (€465bn, \$585bn) stimulus package over two years on spending on energy efficiency and environmental projects to boost the economy, respond to the urgent need for job creation and meet their 2010 energy intensity targets (-20% on 2005). While the specific figures are hard to pin down and there is debate as to how much of this is new stimulus funding (e.g. on water and sewage infrastructure), it is important to note that the country is going green. The Ministry of Environmental Protection has explicitly stated that the stimulus will not be spent in energy and resource-intensive industries or high-pollution industries and will benefit the renewable energy and pollution-control industries. Rail transport, power generation, particularly nuclear, as well as T&D – investment in the national electricity power grid to boost renewable energy projects with quicker and more stable connections – are the major beneficiaries.

### Overview of Chinese stimulus package

Green spending	Sub-segment	Amount	Overview
Power	Nuclear	\$95.5bn	Extension of projects
	T&D	\$70bn	Grid infrastructure
Transport	Railways	\$59-73bn (S)	3,000 km of new track per year
Water	Infrastructure	\$20bn	NA
Waste	Infrastructure	\$41bn	NA
Environment	Protection	\$146bn	NA
<b>Total</b>		<b>\$586bn</b>	-

Source: China Environmental Law, SG Equity Research

## South Korea, \$38bn green stimulus

South Korea's 50 trillion won (\$38bn) green stimulus package aims to boost the economy and create 956,000 jobs in the next four years, including 140,000 in 2009. Energy conservation, recycling, carbon reduction, flood prevention, development around the country's four main rivers and maintaining forest resources are among projects to be pursued under the plan. The plan has been hailed by the UN and stakeholders as "best practice" in the emerging area with positive factors including its funding commitments (2/3 of the stimulus, 3% of GDP, ST job creation, tangible opportunities for businesses, innovation and high-level buy in from the President.

### Overview of South Korean stimulus package

Green spending	Sub-segment	Amount	Overview
Transport	Green transport	\$8bn (S)	Low carbon railways, energy efficient public transport systems and special roads for cyclists: 160,000 new jobs
Renewables	NA	NA	Developing renewables
Waste	Recycling	NA	NA
Rivers	Revitalisation	\$13bn (S)	Revitalisation of 4 main rivers to improve water management and control flooding: 280,000 jobs
Dams	Dams	\$1.44bn (S)	Small & medium-sized dams: 30,000 jobs
Forests	Expansion	\$2.16bn (S)	expanded to conserve natural resources and reduce CO2 emissions related to deforestation
<b>TOTAL</b>	<b>NA</b>	<b>\$37.8bn</b>	956,000 jobs

Source: SG Equity Research

### Japan, \$1trn green sector by 2020e

As part of its \$111bn stimulus efforts, Japan has announced plans to grow its green business sector to \$1trn by 2020 (vs. \$745bn today). To reach this goal the Japanese government may

- set up zero interest rate loans for environmentally friendly companies
- create up to 2 million green jobs
- increase investment in the country's existing renewable energy sector
- increase investment in the energy efficient appliances sectors, products

### Australia, up to US\$18.6bn green stimulus

After significant pressure from stakeholders, Australia approved a US\$28bn stimulus package which includes US\$18.6bn in funding for schools, environmental projects and bicycle paths to be spent over 18 months (rather than over six years as was originally planned), as well as a smaller amount for renewables. Critics have been disappointed by the lack of focus on energy efficiency, electricity infrastructure and renewables R&D.

### Overview of Australian stimulus package

Green spending	Sub-segment	Amount	Overview
Environment	Projects	US\$18.6bn	Funding for schools, bicycle paths, environmental projects
Renewables	Energy Fund	US\$329m	NA

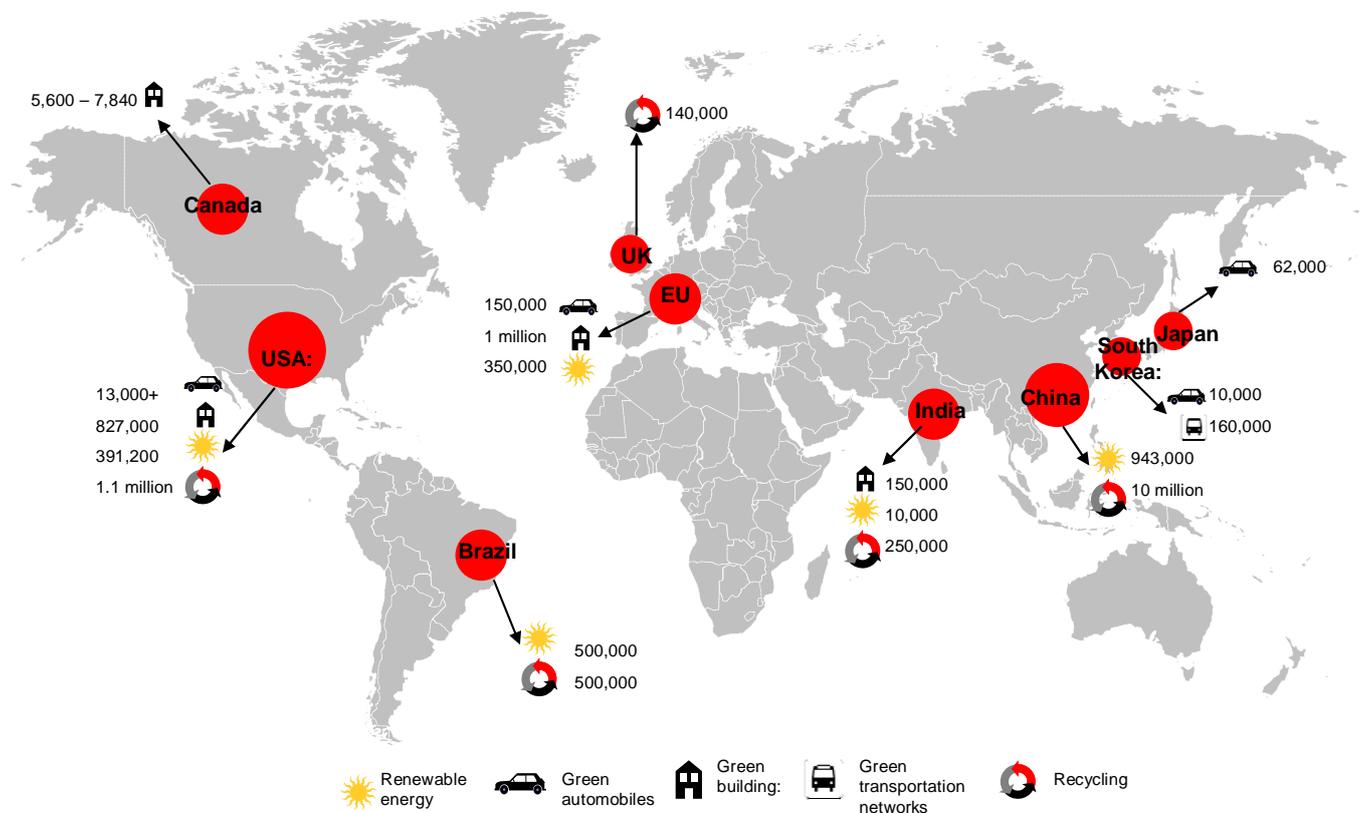
Source: SG Equity Research

## Appendix 2 – Green jobs, the silver lining

With unemployment rising fast and the economy deteriorating, the primary goal of policymakers and economic recovery plans is and will be job creation. We believe that by going green, governments and business could play a vital role in counter-balancing the economic crisis – saving jobs threatened by the global economic downturn as well as creating millions of new green jobs around the world. Green jobs’ are a win-win for everyone – with their advantages including high employment intensity and the net long-term employment and growth effects of reducing energy costs to the economy as a whole – as well as their role in moving us to a low carbon global economy. The Green New Deal will involve large-scale investments in new technologies, equipment, buildings, and infrastructure, which will provide a major stimulus for this much-needed new green employment and an opportunity for retaining and transforming existing jobs.

The total number of jobs created will depend on a wide range of variable including policy design, scale and speed of implementation as well as corporate and consumer response. However, we are talking about figures which could – with the aid of a robust enabling framework – easily rise to close to the 100 million jobs mark by 2030.

### Green jobs today and tomorrow



Source: SG Equity Research

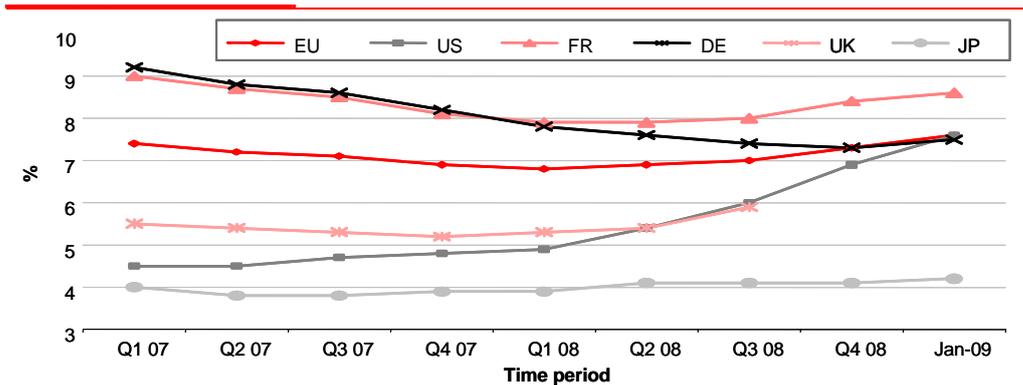
## Tackling the grim employment outlook

The global picture for jobs is grim. There are 200 million people unemployed globally as well as hundreds of millions underemployed and in vulnerable work, and 1.3 billion earning less than \$2/day. Preliminary International Labour Organization (ILO) estimates for 2009 forecast tens of millions of new unemployed people and working poor due to the global financial crisis – with a particularly worrying rise in youth joblessness. The financial crisis has rapidly evolved into an economic crisis and now a jobs one.

### Unemployment on the rise

Current levels of unemployment in the US and the EU hover between 7% and 8%, although some individual European countries are reporting unemployment rates above the EU average such as Spain whose current rate is over 13% (OECD). Governments are feeling increasing pressure from their citizens and their peers internationally to revive national economies and save and create as many jobs as possible. The main incentive for governments to create green jobs is that they could kill two birds with one stone by simultaneously helping to achieve both energy security and job security.

#### Unemployment data Q1 2007 to January 2009: EU, US, France, Germany, UK & Japan



Source: US Department of Labor Bureau of Labor Statistics (BLS), SG Equity Research

## Green jobs are an answer to the current crisis

In an ideal state of affairs, a green economy is one that does not generate pollution or waste and is hyper-efficient in its use of energy, water, and materials. Using this green utopia as a yardstick would mean that currently there are few, if any, green jobs. For that reason we have adopted the more realistic, pragmatic and process-oriented definition offered by the UNEP (United Nations Environment Program) which defines them as “work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality”. Specifically, but not exclusively, this includes jobs that: help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimise or altogether avoid generation of all forms of waste and pollution.

### Millions of green jobs already exist

Energy supply – renewable energy and energy efficiency (buildings, construction, power and transportation) as well as agriculture and forestry are particularly important in terms of their environmental, economic and employment impacts. This will only increase in the coming years with estimates that the global market for environmental products and services will grow from €1,000bn (\$1,370bn) to €2,200bn (\$2.40bn) by 2020 (Source: Roland Berger Strategy Consultants):

- **Energy efficiency technologies:** appliances, industrial processes, electrical motors, insulation, etc.): \$617bn (€450bn) at present; \$1,233bn (€900bn) by 2020
- **Sustainable transport:** more-efficient engines, hybrids, fuel cells, alternative fuels, etc.): \$247bn (€180bn); \$493bn (€360bn) by 2020.
- **Renewables:** market providing finance for clean and renewable energies could reach \$1.9trn by 2020
- **Waste management/recycling:** \$41bn (€30bn); \$63bn (€46bn) by 2020
- **Water supply/sanitation/water efficiency:** \$253bn (€185bn); \$658bn (€480bn) by 2020

**Constructing a post-carbon world will undoubtedly entail a massive undertaking** in areas like the electricity network and off-grid applications; mass transit and less-polluting cars and the building sector. Currently, much of the world's infrastructure, industrial machinery, buildings, and transportation system is highly inefficient and overly reliant on fossil fuels. There are unparalleled investment and employment opportunities in reorienting the world economy's products and services, and jobs, toward a greener future. For instance, each year, an estimated \$200bn–250bn is invested in energy-related infrastructure to replace existing capital stock and meet ever-rising demand (and another \$1.5trn is spent on energy consumption).

**Types of green jobs by sector**

Strategy		Representative jobs
Energy efficiency	Buildings	Electricians, Heating/Air Conditioning Installers, Carpenters, Construction Equipment Operators, Roofers, Insulation Workers, Carpenter Helpers, Industrial Truck Drivers, Construction Managers, Building Inspectors
	Transport	Civil Engineers, Rail Track Layers, Electricians, Welders, Metal Fabricators, Engine Assemblers, Bus Drivers, Dispatchers, Locomotive Engineers, Railroad Conductors
	Smart grid	Computer Software Engineers, Electrical Engineers, Electrical Equipment Assemblers, Electrical Equipment Technicians, Machinists, Team Assemblers, Construction Labourers, Operating Engineers, Electrical Power Line Installers and Repairer
Renewables	Wind	Environmental Engineers, Iron and Steel Workers, Millwrights, Sheet Metal Workers, Machinists, Electrical Equipment Assemblers, Construction Equipment Operators, Industrial Truck Drivers, Industrial Production Managers, First-Line Production Supervisors
	Solar	Electrical Engineers, Electricians, Industrial Machinery Mechanics, Welders, Metal Fabricators, Electrical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Labourers, Construction Managers
	Advanced biofuels	Chemical Engineers, Chemists, Chemical Equipment Operators, Chemical Technicians, Mixing and Blending Machine Operators, Agricultural Workers, Industrial Truck Drivers, Farm Product Purchasers, Agricultural and Forestry Supervisors, Agricultural Inspectors

Source: SG Equity Research

**Economic stimulus packages will promote green job creation**

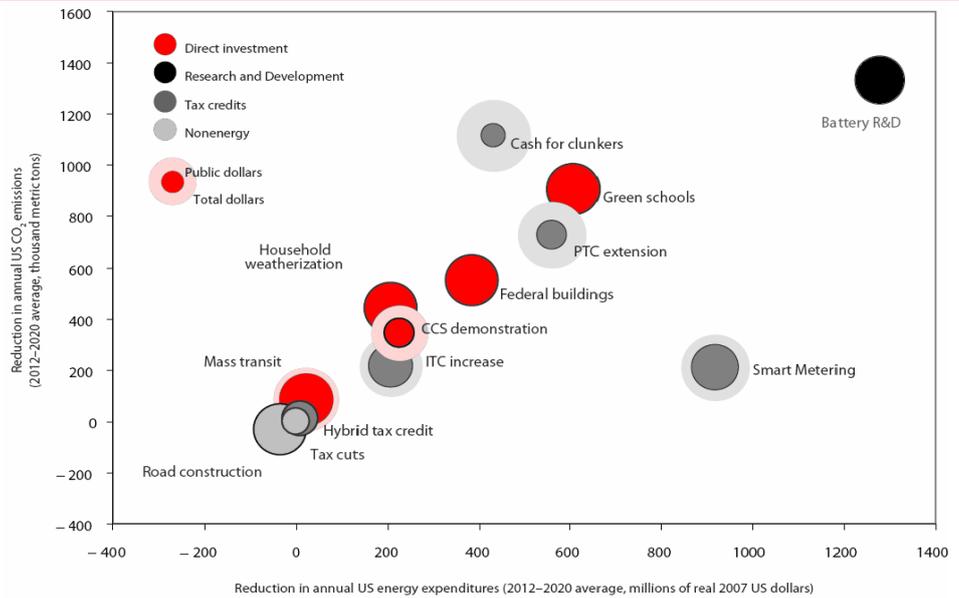
The US, Canada, the UK, Japan, Australia, China, South Korea and the EU are among those who have announced green stimulus programs that will include provisions for the direct or indirect creation of green jobs. Government assistance will be offered in the form of investments in national infrastructure and technology, subsidisation of energy efficiency improvements to buildings, renewable energy tax credits and loan guarantees, research and development across various energy efficient sectors, and other loans and tax credits to environmentally friendly projects and companies to name a few. Given the current economic environment, we believe that governments will do their utmost to ensure that funds are put to work as fast as possible – and to avoid the usual 1-2 year delayed impact which often accompanies government spending and green regulations.

**Most of these funding activities will create green jobs indirectly** by providing employers and programs with the financial support necessary for them to take on new employees and undertake new projects. Government stimulus in the form of tax credits and loan guarantees can help eliminate the perceived risks of “going green” for individual homeowners and companies when they invest in green retrofits for buildings, buy a more energy efficient

automobile, start a renewable energy or clean tech business endeavour, etc. The rationale behind this is that if people feel that they are risking less or have more to gain by making green decisions and investments then they are more likely to do so, while increased demand for green products and services will create green jobs.

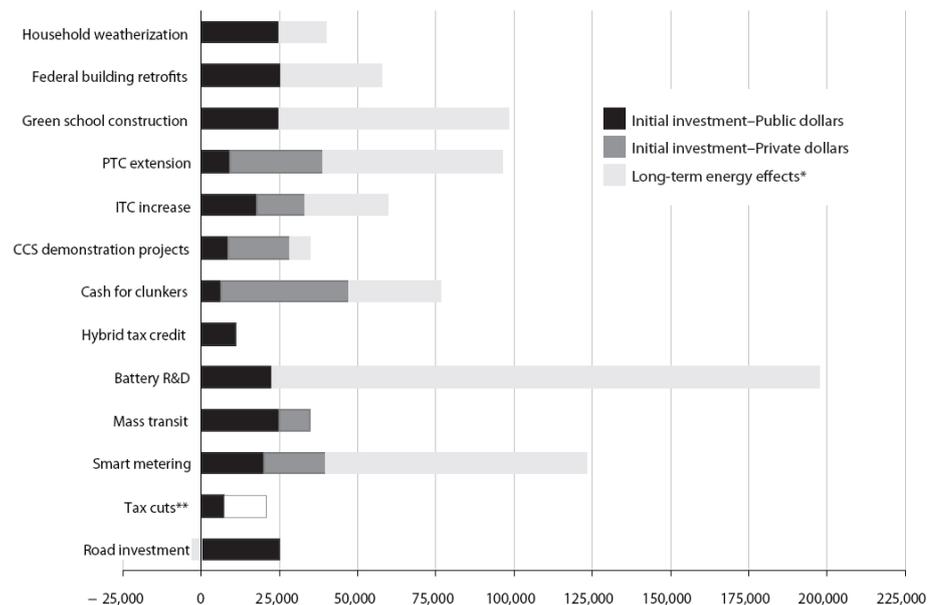
**However, some green jobs will be funded directly** by government stimulus such as construction and manufacturing jobs for mandatory energy efficiency upgrades for federal buildings. Green jobs in the retail and wholesale sectors are expected to be created in turn when workers in the construction and manufacturing sector go out and spend their money in the economy.

**Impact of green recovery policy options – reduced annual energy spend (X-axis), CO2 emissions (Y-axis), job creation (circle size) for every \$1bn spent**



Source: WRI, SG Equity Research

**Total employment effects – job-years created through \$1bn in government investment**



Source: WRI, SG Equity Research

## Green jobs markets and growth potential

### Renewable energy jobs

Segment	No. of jobs
Wind	3,000,000
Solar PV	1,700,000
Solar thermal	624,000
Biomass	11,740,000
Hydro	39,000
Geothermal	250,000

Source: UNEP SG Equity Research

### Renewable energy, 30m jobs by 2030

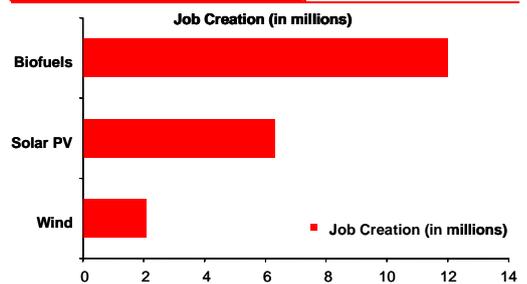
There are currently over 2.3m employed globally in the renewable energy industry, with the US, Japan, Germany, China and Brazil among the leading markets (Source: UNEP 2008). The figures are inflated by the fact that 50% of these jobs are in the biofuels sector where plantation-based jobs dominate (i.e. green jobs vs. good jobs concerns arise). The next largest segment is the solar thermal sector followed by wind, solar PV, hydro and geothermal energy.

### The potential for employment growth in the renewables sector is immense

and likely to be pushed by policymakers as renewable energy generates more jobs per unit of installed capacity than fossil fuel power plants. Renewables are likely to pick up some of the slack from falling employment in the fossil fuel industry which has seen a decline due to the mechanisation and automation of production. Biofuels are expected to take the largest share of new

jobs followed by solar PV (6.3m) and then wind (2.1m). Growth in the wind sector will create greater demand for engineers and machinists as well as increasing opportunities in the manufacturing and transportation sectors potentially translating to hundreds of thousands of "green collar" jobs. Growth in the solar PV sector will create similar employment opportunities but on a significantly larger scale since solar energy is cheaper to produce and there are generally more possible locations for solar fields than for wind farms.

### Renewable energy jobs 2030e



Source: UNEP, SG Equity Research

### Estimated employment over life of facility: jobs per MW of average capacity

		Manufacturing, construction, installation	Operations & maintenance / fuel processing	Total
<b>Renewables</b>	Solar PV	5.76-6.21	1.20-4.80	6.96-11.01
	Wind power	0.43-2.54	0.27	0.70-2.78
	Biomass	0.40	0.38-2.44	0.78-2.84
<b>Fossil fuels</b>	Coal-fired	0.27	0.74	1.01
	Natural-gas fired	0.25	0.70	0.95

Source: UNEP, SG Equity Research

### Green buildings, tens of millions of new jobs

A worldwide transition to energy-efficient buildings would create millions of jobs, as well as "greening" existing employment for many of the estimated 111 million people already working in the construction sector. We expect that the sector is likely to be a major focus for policy-makers given its economic importance – 9% of GDP and 8% of employment and €2trn in annual turnover in the EU alone – and a major beneficiary of stimulus spending. The positive economic impacts, cost savings and easy global execution (i.e. irrespective of location, climactic conditions) associated with green buildings jobs mean that tens of millions of jobs are likely to be created in the coming years.

### Increasing standards for the energy efficiency have had positive economic and employment effects.

A study conducted by the UK government in 2000 found that for every \$1.4m invested in increasing the energy efficiency of residential buildings, 11.3-13.5 full-time equivalent jobs were created. It is estimated that retrofits and renovations of existing buildings to reduce their greenhouse gas emissions received public and private funding totalling more than \$25bn between 2001 and 2006 and created employment for 145,000 people.

**Investments in energy efficiency could generate +2-3.5 million green jobs in the EU and US alone**, with the potential for tens of millions of jobs in developing countries. New legislation such as the anticipated 2009 EPBD2 in the EU - requiring greater energy efficiency from new and existing residential and non-residential buildings should jumpstart job creation in the green building and retrofitting industry as well as in the development and manufacturing of green appliances, lighting, insulation and domestic heating and cooling systems.

**Government stimulus funding should jumpstart the moribund sector** by recovering jobs currently being lost and bringing forward a number of energy efficiency investments that would otherwise have been undertaken at later dates. This funding will be key given the immense amounts of initial investment necessary for the implementation of an overhaul of the building industry. However, we expect that building improvements should more than pay for themselves in the long term through reduced energy bills and the reduction of GHGs.

**The far-reaching benefits of a green boom in the building industry** could go beyond restoring jobs to unemployed contractors, architects, construction workers and manufacturers by infusing the market with new credit and much needed investment. Another benefit would be the resulting greening of the skills set of industry professionals such as plumbers, electricians and construction workers and new opportunities in technical training programs.

**Job creation from energy-efficiency measures in the building sector**

Country / region	Study / project	Projected jobs
Canada	Retrofit municipal buildings on a national scale	5,600-7,840 FTE
EU	20% reduction in energy consumption	1,000,000
	2009 recast of the EPBD	280,000-450,000
	75% reduction of CO2 emissions in residential buildings	1,377,000 (2030e), 2,585,000 (2050e)
US	\$90bn in funding for green buildings	827,260
	Standards on water heaters, fluorescent lamp ballasts and clothes washers	120,000 (2020e)

Source: UNEP, ETUC, European Commission, Apollo Alliance, US DOE, SG Equity Research

**Smart grid, new green IT and green power jobs**

**Many countries are installing or expanding initial energy infrastructure**, giving governments a window of opportunity to overhaul energy infrastructure on a global level in a way that will increase energy efficiency and insure long term sustainability. Potential infrastructure developments include a pan-European super grid to replace the current outdated power grid and connect different regions to energy produced with various technologies such as wind, solar and hydro power which are usually generated far from the population centers that consume them. The need for an enhanced power grid is also becoming apparent in the US where the current energy infrastructure is showing strain from electricity demand which will only increase in coming years with the new wave of plug-in electric cars due out as early as 2010. The proposed government stimulus package would allocate up to \$11bn for a national smart grid. China is also planning to create electricity grid infrastructure worth approximately \$70bn which should provide employment opportunities around the country.

**This could act as a catalyst for direct jobs as well as spawn many indirect jobs from the deployment of smart grid technologies.** The US GridWise Alliance estimates that up to 280,000 new jobs can be created directly from the smart grid in the US alone. Moreover smart grid deployment should drive a substantial number of indirect jobs as it will be a key enabler of the deployment of new technologies such as plug-in hybrid electric vehicles (PHEVs), DERs such as solar and wind, smart appliances and home automation software and hardware. Replacement of energy infrastructure will create tens of thousands of domestic and international employment opportunities ranging from civil and electrical engineers to general electricians and factory workers. We can anticipate seeing new jobs being created in the

utilities, capital goods and software and IT sectors, and at equipment vendors, new technology providers and educational institutions.

### Green transport, putting employees back to work

**The green jobs market in the automobile industry is currently relatively small** when compared to the industry as a whole – with approximately 230,000 jobs in manufacturing environmentally friendly vehicles around the world – and 1.3m working in mass transit in the EU and US.

#### Motor vehicle manufacturing and green jobs

	EU	Japan	South Korea	US
Passenger car manufacturing workforce	2,000,000	952,000	247,000	1,095,000
Vehicles emitting >120gCO2/km (%)	7.5	6.3	4.3	NA
Vehicles achieving >40mpg (%)	NA	NA	NA	1.2
Green vehicle jobs	150,000	62,000	10,000	13,000

Source: UNEP, SG Equity Research

**Green jobs could return hundreds of thousands of employees back to work** in the EU, Japan and the US where automakers have been hit hard by the financial crisis and made massive cuts in employment and production. Increased vehicle fuel efficiency standards should create jobs in technology, R&D, planning, production and manufacturing, marketing, transportation, sales and distribution as OEMs rush to develop new fuel efficient models to meet consumer and government demands as well as new technologies such as lithium-ion batteries. This is especially relevant in the US where fuel efficiency standards lag far behind those in the EU and Japan. While the new administration has announced plans to change this there is a lot of catching up to do, and catching up will require an expensive overhaul of the US auto industry to remake it into a green sector with hundreds of thousands of green jobs to run it.

**Public transport should see considerable growth** as an increasing number of cities around the world install rapid transit and hi-speed trains and revamp outdated, inefficient or nonexistent rail systems. The move on efficient mass transit systems would provide a full spectrum of employment from engineers to operators, maintenance and ticket sales. Retrofitting of existing vehicles used in public transportation such as diesel buses to increase efficiency and reduce pollution are expected to lead to the substantial job creation.

### Concerns and challenges

The prospect of a wave of green employment to simultaneously revive the economy, rescue the environment from the damage we have caused and put us on a sustainable long term path is a seductive scenario. However, we need to remain realistic about the possibilities and implications of a green stimulus package creating millions of government subsidised jobs and view this as a possible partial answer to some of the global economic, social and environmental challenges we are currently faced with. In short, this Green New Deal is not an El Dorado and needs to be approached with intelligence, preparation, caution and the awareness that many aspects of the proposed transition to a greener global existence will have results that are as yet unknown.

### Timeframe, it may take months or even years

While many countries will be passing green stimulus packages in the coming months, the jobs that they aim to create will not be created overnight. Implementation of some of the measures proposed, such as green retrofitting of government buildings, can take place relatively quickly once the funds are made available. However it may take months or even years before the full effects of the indirect or induced impacts of the stimulus packages are felt in the job market.

### Funding, long-term sustainable support will be needed

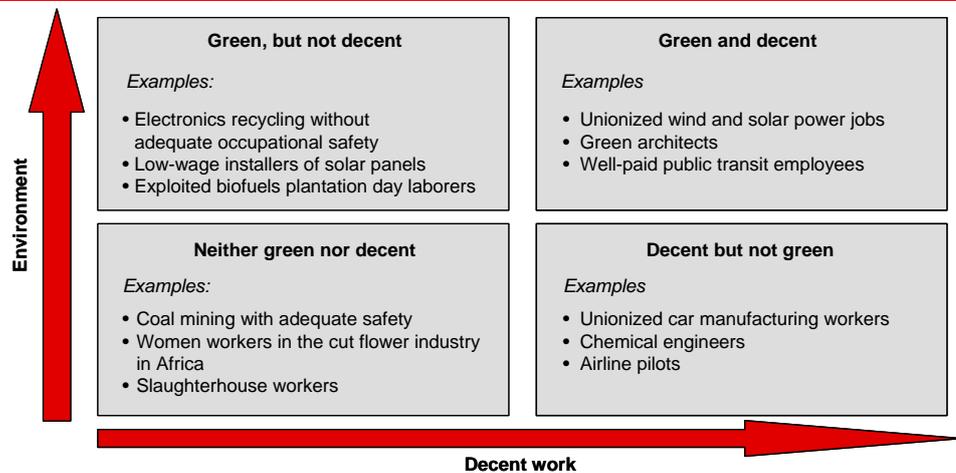
The issue of funding for green stimulus and green jobs remains a concern. In order to fund a new green job market many governments are poised to take on serious debts which are widely considered unavoidable and necessary in order to jumpstart the economy and create jobs to solve rampant unemployment. However, national debt-inducing government subsidies are not a sustainable option for the long term support of the job market. There needs to be a plan for transition from government support to independent viability if the plan is to be successful – including reducing or removing current fossil fuel subsidies, adopting carbon taxes, taxing windfall oil profits, auctioning pollution allowances, and providing assistance to developing countries so as to create a global strategy for the transition to a green economy.

### Worker training, shortages of qualifications and skills

Many jobs will require a certain level of “green literacy” or skills base that is not prevalent. While manufacturing and construction will be able to continue as before but with different more environmentally friendly materials used or higher standards applied, other jobs will require new, advanced or special education or training. Germany, the US and UK are already reporting shortages of qualified workers for new skills- or knowledge-intensive positions. We need to see adaptations in secondary and post-secondary education as well as specialised training and certification programs to fill green positions. With increased competition for new green jobs due to cautious hiring practices coupled with high unemployment rates, applicants will need more skills and experience than was perhaps necessary in the non-green job market.

### Green jobs vs. good jobs

#### Balancing environmental & social issues



Source: UNEP, SG Equity Research

To date, there seems to be little focus on the quality and sustainability of green jobs, raising the question of whether they are necessarily good jobs. Long-term, it will be the quality of employment in terms of pay, longevity, benefits and conditions which will determine whether or not a green job can be considered as good and decent jobs. Some jobs considered green, such as in the biofuels sector, can also be short term, part time, low paid, or with few worker rights and benefits depending on the region. And while industries such as renewables will generate more jobs than their non-renewable fossil fuel counterparts, the new green jobs may pay less than the non-green jobs they replace. The presence of trade unions in some sectors should increase the quality of benefits, pay and conditions of green jobs such as in the automobile industry but not all sectors have this type of assertive representation.

## Appendix 3 - Green stimulus packages

### Summary of global economic stimulus plans with green measures

	Overall economic package	% of GDP	Priorities	Green component (% of GDP)	Energy Efficiency	Auto	Renewables	Infrastructure
<b>EU</b>	€200bn (\$253bn) incl. €30bn from EU funds	1.5%	Economic stimulus, green jobs, infrastructure, energy efficiency	€12bn (\$15bn) from EU funds (0.1%)	€2.2bn (\$2.8bn) for energy efficient homes & factories; lower VAT for energy efficient products & buildings	€5bn (\$6.3bn) on green R&D	€3.5bn (\$4.48bn) for renewables & incentives to meet 2020 targets.	
France	€26bn (\$33bn)	1.3%	Automobile energy efficiency, green building / construction	€900m (\$1.1bn) (0.005%)	€200m (\$253m) fund for energy efficient homes	€200m (\$253m) to encourage people to buy new cars and scrap polluting ones		€500m (\$632m) in infrastructure projects
Germany	€84bn (\$106bn)	1.3%	Auto sector (including energy efficiency provisions), infrastructure, aid to families	NA	Funding to KfW (€15bn/\$18bn) for loans for household energy efficiency. €3bn (\$3.8bn) in 2009/10 to reduce building emissions. Tax deduction for repairs & modernisation increased to €1,200 (\$1,500) per household.	€53bn (\$67bn) subsidy for the auto industry to make it the world leader in green vehicles. 1-2 year tax exemption for "low emission" cars (Euro 5 & 6 norms)	Lending from KfW for solar PV in 2009 with attractive loan rates	€1bn (\$1.27bn) in 2009-10, expansion of rail & waterways
UK	€24bn (\$30.3bn)	1.4%	Tax cuts, energy efficiency in buildings, renewable energy	€481m (\$608m) for energy efficiency, rail transport & environmental protection	Additional €113m (\$143m) for the "Warm Front" scheme (low income insulation) and €68m (\$85m) for the "Decent Homes" program (reduce building emissions)		Extension of renewables obligation by 10 years to 2037 (incl/ offshore wind investments)	Additional €339m (\$428m) to accelerate the extension of rail network capacity
<b>US</b>	€623bn (\$787 bn)	Up to 5%	Infrastructure, healthcare and energy/energy efficiency	Up to €79bn (\$100bn) for projects to fight climate change	€28.3bn (\$26.86bn) for energy efficiency initiatives. €15.5bn - €24bn (\$20bn - \$31bn) to increase energy efficiency of homes, schools, public and military buildings.	€1.9bn (\$2.4bn) in incentives to scrap polluting cars and buy environmentally friendly models	€3.8bn (\$4.8bn) in renewable energy bonds for consumer utilities. €261m (\$329m) renewable energy fund to be dispersed over 18 months. €26bn (\$32.8bn) in funding for clean energy projects. €2.6bn (\$3.4 bn) for CCS for clean coal.	€8.5bn (\$11bn) smart grid €13.7bn (\$17.7bn) on public transport infrastructure such as commuter transport and high speed trains.
<b>Australia</b>	€22.2bn (\$28 bn)	1.3%	Payments to low and middle income families, renewable energy, investments in schools	€261m (\$329m) renewable energy fund.			€261m (\$329m) renewable energy fund to be dispersed over 18 months.	Investment in bicycle paths
<b>Canada</b>	€25.4bn (\$32bn)	2.4%	Tax cuts, worker training, infrastructure, renewable energy	€7.6bn (\$9.6bn) for infrastructure & renewables (0.7%)			€635m (\$800m) to boost sustainable energy sources.	
<b>China</b>	€445bn (\$560bn)	7%	Transport and energy infrastructure, post-disaster reconstruction, environmental protection, water & sanitation	Up to €115.9 (\$146bn) for environmental protection. (1.8%)			€75.8bn (\$95.5bn) for expansion of nuclear energy projects.	€55.6bn (\$70bn) on electricity grid. €15.9 (\$20bn) on water infrastructure & conservation projects
<b>Japan</b>	€85bn (\$107bn)	2.5%	Aid to families, tax breaks/relief for small and/or green businesses	Tax cuts & incentives for environmentally friendly businesses		Tax cuts for low-emission cars		
<b>South Korea</b>	€30bn (\$37.87bn)	3.7%	Green transport networks, 960,000 new green jobs	€18.3bn (\$23bn) on forest expansion, river improvements, green transport networks. (2.3%)				€6.35bn (\$8bn) for green transport infrastructure incl. low carbon railways, energy efficient public transport, special roads for cyclists.

Source: SG Equity Research

**Equity Research**

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