Europe: Capital Goods:Electrical Equipment

Smart grid: A key structural growth driver in T&D; Siemens and ABB Conviction Buy

Smart grid: Crucial for energy efficiency

The development of a smart electricity grid is crucial for an energy-efficient world. The need to integrate renewable energy generation and electric vehicles into the underlying grid and future requirement to meet increasing power quality demands emphasize the ultimate importance of a smart grid.

We calculate that potential required investment to upgrade existing networks represents a US$750 bn incremental opportunity for suppliers to the T&D market over the next 30 years. On our estimates, this could drive a 33% increase in global T&D annual investment by 2019, and add 3% to annual market growth over and above base line growth in the overall T&D network.

Smart grid initiatives create global opportunities with China, the US and Europe key potential markets. We believe initial investments are likely to be concentrated in interconnection and metering. Most technologies to develop smart grid already exist, and we believe integration rather than R&D remains a key challenge, in particular for energy storage solutions.

The development of a smart grid will introduce a significant number of new players into the T&D market beyond traditional equipment providers, and we believe the emergence of Chinese competition will likely reshape the competitive landscape.

Government and regulation have a key role in making smart grid a reality, helping overcome the key challenges of technical integration, aligning incentives (given significant societal benefits) and encouraging consumer adoption.

Siemens/ABB Conviction Buy; Schneider Buy

We believe that ABB, Schneider and Siemens will be key beneficiaries of smart grid investment because they have the greatest operational and financial exposure to the segment. We believe that this opportunity justifies an additional multiple premium for these companies. We rate ABB and Siemens Conviction Buy and Schneider Buy. ABB is also on the GS SUSTAIN Focus List.

RATINGS AND 12-MONTH PRICE TARGETS

Stock	Rating	Target Price	Upside to current price
ABB	CL Buy	SFr33	60%
Alstom	Neutral	€ 50	33%
Invensys	Buy	424p	53%
Legrand	Neutral	€ 31.50	26%
Nexans	Buy	€ 85	65%
Prysmian	Neutral	€ 17	28%
Saft	Buy	€ 46	63%
Schneider	Buy	€ 137	51%
Siemens	CL Buy	€ 126	65%
Wartsila	Sell	€ 42	4%

Source: Goldman Sachs Research estimates

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Coverage view: Attractive

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Prices in the body of this note are based on the close of September 14, 2010.

Smart grid: A key structural growth driver in T&D; Siemens and ABB Conviction Buy

The development of a smart electricity grid is a key enabler for countries to meet emissions reduction targets through increased integration of renewable energy sources, electric vehicles and demand response systems, as well as meeting increased power quality and reliability demands as economies digitalize.

The current electricity grid is a passive one—electricity flows from utilities to consumers with limited real time data about power quality, network conditions and demand profiles. We define as 'smart grid' the group of automation and networking technologies that will provide the electricity network with real time two-way energy and information flows between utilities and consumers, as well as reliability controls and restoration mechanisms, required to efficiently manage supply and demand across large regions. The majority of this technology already exists, but it is used in isolation; the key technical challenge being integration and engineering, not R&D.

We believe that the smart grid represents a US$750 bn global opportunity for transmission and distribution (T&D) equipment providers over the next 30 years. This implies a c.33% increase in T&D investment by 2019E vs. current levels over and above current grid maintenance investment. We forecast the evolution to a smart grid should add 3 pp of annual average incremental growth to the T&D market over the next decade over and above base line GDP-driven market growth. This incremental opportunity should be more significant in developed markets than in emerging markets, as the former have older networks with limited automation. We believe that the smart grid opportunity creates a solid structural growth trend in the T&D market—a sector relevant to 10 out of the 33 European Capital Goods companies in our coverage (c.60% of covered market cap).

We draw the following conclusions for our Capital Goods coverage universe from this analysis:

- **We see ABB, Siemens and Schneider as the companies best positioned to benefit from this trend, given their broad portfolios.**
- **ABB and Schneider also have the highest financial exposure to smart grid-related investments in the sector: we estimate that both have more than 50% of 2010 revenues potentially exposed to it.**
- **We believe that the value of the smart grid opportunity can justify a 1x premium to target 2011E EV/EBIT for Schneider, 0.8x for ABB and 0.25x for Siemens.**

We update our price targets for these companies in our sector note, *Fixed investment recovery to the fore: Conviction Buys ABB, Cookson and Siemens*, published today. In this note, we also add Siemens to the Conviction Buy List and upgrade Schneider and Invensys to Buy from Neutral. ABB remains on the Conviction List and on the GS SUSTAIN Focus List.

We estimate that the benefits of implementing a smart grid exceed by more than 5x the related capital costs, and we therefore believe that there is a clear case for the development of a smart grid. The majority of these benefits are likely to be captured by society rather than the utilities, and we believe that governments will be the driving force behind this market, influencing which technologies will be implemented first. Current emission targets for 2020 both in Europe, the US and China as well as over US$18 bn funding committed to smart grid globally in 2010, suggest that government intervention is very likely, in our view.

Smart grid—Energy efficiency, renewable integration and power quality key drivers

We believe there are two major themes driving the need for a smarter grid:

- Focus on emissions targets in order to address climate change concerns, including two main routes of action:
  - Energy efficiency linked to energy emissions from electricity consumption. Electric vehicles and building efficiency while two key ways of meeting these targets, place increased demands on the grid.
  - Clean energy sources linked to energy generation emissions. Renewables and carbon capture remain the two primary ways of reducing emissions, but successful renewable integration requires a smarter grid able to manage more volatile supply characteristics.
- Increased requirements for power quality and reliability —the costs of an unreliable network are increasingly higher as society becomes more reliant on digital technologies.

Smart grid could represent a c.US$750 bn opportunity to utility equipment providers over the next 30 years

We define as 'smart grid' the group of technologies that will provide the electricity network with two-way information flows between utilities and consumers, self-healing mechanisms, line redundancies, and storage capabilities required to efficiently allocate and manage supply and demand of electricity. We include in smart grid all the investment over and above both current grid maintenance investment and investment required to expand the network to meet higher electricity demand.

We calculate that this opportunity could be worth c.US$750 bn globally over the next 30 years (at current pricing and interest rate conditions), equivalent to a 33% increase in annual T&D spent by 2019E. This equates to c.3 pp average incremental annual growth in the T&D market over the next decade. Allowing for time path of implementation, we calculate that the NPV of implementing smart grid globally would be US$559 bn. With many uncertainties remaining, a simple sensitivity analysis based on rates and timing of adoption gives an estimated range for the NPV of US$383-US$661 bn.

Exhibit 1: Smart grid represents a US$750 bn opportunity over 30 years globally
Base Case

						Smart grid unitary conversion costs			Smart grid conversion costs - Total			
	Grid conversion to smart by 2040 (T&D)	Transmission Lines (mn km)	Distribution Lines (mn km)	Meters conversion to smart by 2040	Non-AMI meters	Transmission $/km	Distribution $/km	Smart metering and consumer response $/meter	Transmission $bn	Distribution $bn	Smart metering and consumer response $bn	Total $bn
Europe	100%	0.73	12.2	100%	276	25,500	7,000	300	19	86	83	187
US	100%	1.17	9.8	100%	109	34,000	7,000	300	40	68	33	141
China	100%	1.04	12.5	100%	385	17,000	5,250	200	18	66	77	160
Others	50%	2.90	32.0	100%	769	17,000	5,250	200	25	84	154	262
Total		**5.84**	**66**		**1,539**				**101**	**304**	**346**	**$750**
										NPV @ 2.5% time value		**$559**

Source: Goldman Sachs Research estimates.

ABB, Siemens and Schneider—best exposed to smart grid in our coverage

Of the European Capital Goods companies in our coverage, ABB, Siemens and Schneider have the largest portfolio of products and technologies potentially exposed to smart grid development. ABB and Siemens have broad operational exposures to most smart grid product areas, while Schneider has very significant exposure in all areas apart from Transmission. ABB and Schneider are the most financially levered, with over 50% of 2010E revenues potentially exposed to smart grid. Siemens has many products across the smart grid spectrum, however because of its diversified business, it is less exposed to smart grid as a percentage of its total business (c.12% of 2010E revenues). Other companies in our coverage have exposures to particular niches of smart grid technology; for example, Saft is exposed to energy storage and batteries for automated meters.

Exhibit 2: ABB, Siemens and Schneider stand out as having the highest operational and financial exposures to smart grid
Degree of operational involvement: 2 means strong involvement across most products within category; 1 means strong involvement in a few products or low involvement in various products within category; 0 limited or no exposure; 2010E revenue exposures

			Degree of operational exposure							
Company	Region	% smart grid-related revenue	Transmission	Advanced Metering Infrastructure	Demand Response	Distribution Management Systems	Distributed Energy Sources	Energy Storage Solutions	Communication and IT	Cumulative Score
ABB	Europe	55%	2	1	2	2	2	1	2	12
Alstom	Europe	15%	2	0	0	0	1	0	0	3
Invensys	Europe	11%	0	0	1	0	0	0	2	3
Legrand	Europe	<10%	0	0	1	0	0	0	0	1
Nexans	Europe	15%	2	0	0	1	0	0	0	3
Prysmian	Europe	22%	2	0	0	1	0	0	0	3
Saft	Europe	Negligible	0	1	0	0	0	1	0	2
Schneider	Europe	59%	0	1	2	2	2	0	2	9
Siemens	Europe	12%	2	1	1	2	2	1	1	10
Wartsila	Europe	<10%	0	0	0	0	2	0	0	2

Source: Company data, Goldman Sachs Research estimates.

Smart grid opportunity justifies premium on multiple for ABB, Siemens and Schneider

We believe that the smart grid opportunity would have a material impact on earnings for ABB, Siemens and Schneider mainly post 2011. Using a DCF model to estimate the incremental impact of smart grid on target 2011E EV/EBIT multiples, we conclude the opportunity represents an additional premium of 0.8x for ABB, 0.25x for Siemens and 1x for Schneider Electric.

We have incorporated these additional premium multiples in our sector valuation framework (please refer to Appendix 1 on page 57). We reiterate our Conviction Buy on ABB (12-month price target of SFr33, 60% upside potential) and on Siemens (12-month price target of €126; 65% upside potential); Schneider remains Buy (12-month price target of €137, 51% upside potential).

Exhibit 3: Smart grid justifies additional multiple premium for ABB, Schneider and Siemens
Scenarios according to description on page 15

		Scenarios				
		Full conversion (base timing)	Early adoption (base conversion)	Base Case (timing and conversion)	Late adoption (base conversion)	Low conversion (base timing)
ABB	Incremental Value per Share (SFr)	1.63	2.11	1.84	1.45	1.45
	Incremental Upside to Current Share Price (%)	10%	10%	9%	7%	7%
	Equivalent Incremental EV/EBIT 2011E	0.85x	0.88x	0.77x	0.61x	0.61x
Schneider	Incremental Value per Share (€)	13.70	13.67	12.34	9.67	9.67
	Incremental Upside to Current Share Price (%)	15%	15%	14%	11%	11%
	Equivalent Incremental EV/EBIT 2011E	1.08x	1.08x	0.98x	0.76x	0.76x
Siemens	Incremental Value per Share (€)	2.95	2.94	2.67	2.11	2.11
	Incremental Upside to Current Share Price (%)	4%	4%	4%	3%	3%
	Equivalent Incremental EV/EBIT 2011E	0.27x	0.27x	0.24x	0.19x	0.19x

Assumptions:
- Similar contribution margin on incremental smart grid sales as 2011E T&D margin for the first 5years - progressively decreases to EBIT margin levels, since as sales increase further dedicated smart grid fixed costs need to be added
- Current marginal tax rates
- Incremental capex equivalent to 3% of incremental sales (starting after the first 5 years)
- Capex/depreciation 1.1x
- Incremental working capital requirements at same % sales as 2011E for group
- Discount rate 5% (2.5% for normalized risk free rate and 2.5% for company specific risk)

Source: Goldman Sachs Research estimates.

The benefits of developing a smart grid substantially exceed costs

Various governmental and private consulting studies estimate overall smart grid benefits ranging from 4.4x-6.7x of implementation costs. We believe economic benefits to utilities are closer to capital investment costs (1-2x benefit to cost ratio), with consumer and social benefits significantly higher, highlighting the importance of effective incentives from governments and regulators in order to encourage smart grid investments by utilities.

- We believe the main economic benefits for utilities include: (1) lower transmission and distribution losses; (2) maintenance and capital cost savings; and, (3) labor cost savings.
- The main economic benefits to consumers are: (1) fewer and shorter outage events; and, (2) reduction of electricity bill costs.
- Key social benefits include: (1) emission reductions; (2) reduced dependence on coal and oil-related energy sources; (3) job creation potential; (4) reduced hazard risks; (5) benefits from facilitating energy trading and liberalization; and, (6) higher electricity service quality.

Smart grid initiatives will be launched worldwide; not just a US and European opportunity

Current levels of smart grid funding and country targets for smart metering roll outs indicate that developed and emerging regions are likely to progress at similar paces in smart grid implementation. As an example, China and South Korea plan to have smart meters fully rolled out by 2020 vs. the EU's target of 2022 and show already higher levels of advanced metering infrastructure (AMI) demand. In 2010, China was the biggest sponsor of smart grid initiatives, with c.US$7.3 bn of committed government-backed funding, exceeding the US$7.1 bn provided in the US.

We believe the triggers for smart grid development will differ between developed and developing regions. In developed countries, underinvestment on the grid over the last decade and equipment reaching the end of their useful life will be the key triggers. While in emerging regions, fast economic growth will drive growth in energy consumption and subsequent grid investments and at the same time, pressure to adopt cleaner and more efficient energy sources and electrically powered transportation methods should also spur governments in emerging economies to look into smart grid technology investment. This could mean that these countries will make the technology leap directly to smart grid rather than developing passive networks first.

Initial investments are likely to be focused on transmission interconnection and AMI

We believe that full conversion of a typical developed country network into a smart network could take approximately a decade to complete. We do not expect development paths to be similar across regions, as the adoption of various technologies is not necessarily interdependent.

We expect regulatory environment and economic incentives will define the path taken by each region. Thus, given current announced funding initiatives, we believe in Europe the first wave of implementation will probably be associated with transmission interconnections, while in the US and China AMI will be the likely first beneficiary.

Most technology to develop smart grid already exists; integration is the challenge, not R&D

Although no full smart grid roll out has been completed so far outside of pilot projects (such, as Austin and Boulder in the US), most of the required technology exists and has been applied by utility companies in isolation. Engineering and integration, rather than technology development are the key technical challenges going forward.

Smart grid implementation comprises the following main technology areas:

- Transmission interconnection and automation
- Advanced metering infrastructure (AMI)
- Communication systems and IT infrastructure
- Demand response mechanisms
- Distribution management systems
- Distributed energy sources
- Energy storage solutions

Smart grid will only be possible with additional energy storage solutions

Generating a higher proportion of electricity through renewable sources will increase supply/demand imbalances, given the unpredictability of weather affecting the production patterns of wind and solar. Energy storage solutions help smooth those imbalances and will be a key requirement of any smart grid, in our view.

We have identified the following storage solutions as the more likely to be developed:

- Equipment to be used close to centralized generation sources to match base load demand: pumped hydro storage, compressed air energy storage, hydrogen storage.
- Equipment to be used as backup sources in case of failures and outages: thermal storage, batteries and micro compressed air storage.
- Equipment to be used as decentralized sources to ensure end-user power quality: flywheels, super-capacitors, superconducting magnetic energy storage.

Smart grid will introduce a significant number of new players into the T&D market

We have undertaken a benchmark analysis to identify possible competitors to our coverage universe in the various technological areas of smart grid implementation. Our study suggests that smart grid will open the T&D landscape to non-traditional players, such as battery and IT companies. The fact that some of the technologies are relatively recent in terms of commercialization has also attracted several start-up players. Given likely scale benefits, we believe consolidation remains a potential outcome in this area over the next decade (for example, ABB has recently acquired Ventyx, a niche player in communications and systems for smart grid).

Chinese competitors will emerge, changing the competitive landscape and increasing scale benefits

China has a clear plan for smart grid implementation, targeting a full upgrade by 2020. The State Grid has developed two plans incorporating 28 smart grid projects in seven technology areas and adopting technological standards as advanced as those being set in developed countries. Construction of a smart grid should enter the pilot phase in 2011.

Although local players benefit from significant experience in Transmission investments, we believe they are likely to gain scale and relevance in areas with fewer technological barriers initially, where cost advantages are more critical. We expect international players to retain a lead in areas such as distribution management systems, communications and IT, distributed energy resources and energy storage. Scale, low cost production and local relationships will be instrumental to international players to keep this lead.

The key challenges to make smart grid a reality are: (1) technical integration; (2) aligning incentives; and (3) consumer adoption

We identified the following three key areas of challenge to smart grid adoption:

- Technical: (1) ensuring interoperability between networks; (2) cyber security; (3) compatibility with existing networks.
- Incentives: (1) ensuring consumer benefits are shared with utilities; (2) ensuring social benefits are fully captured; (3) ensuring benefits are aligned to those who bear the cost and (4) ensuring adequate return on investment.
- Consumers: (1) overcoming current lack of awareness about what smart grid entails; (2) overcoming traditional inertia to change usage practices and legacy behaviors; (3) ensure development and adoption of smart appliance that can communicate with the network and (4) ensure dynamic billing strategies which vary the cost of electricity at different times of the day do not raise equity concerns.

Regulation and government will be key in overcoming these challenges

Because of the significant level of investment required to implement a smart grid and the fact that most of the benefits will be enjoyed by customers rather than providers, we believe government intervention by means of regulation and investment incentives, will be key in determining roll out success. In regulated electricity markets, in particular, we believe regulators will take the lead in establishing the framework for utilities to invest in the creation of a smart grid.

We identify six key areas of government intervention: (1) development of uniform standards; (2) encouraging open architecture; (3) ensuring adequate payback for investment in regulated markets; (4) appropriate incentives for investment in aligning social and utility costs to address large social benefits and public externalities arising from reducing energy consumption; (5) encouraging consumer adoption of new technology through education about the benefits from increased penetration of home automation and (6) coordinating investment across competing network players to ensure that benefits and costs are fairly shared.

Smart grid: The key to a more energy efficient world

We believe there are two major themes driving the need for a smarter grid:

- **Higher global commitment to emissions targets to address climate change concerns. There are two main streams of initiatives that will allow the world to succeed in meeting emissions targets, in our view:**
  - **Energy efficiency: to reduce energy emissions from electricity consumption. Electric vehicles and building efficiency are the primary tools in achieving these targets.**
  - **Clean energy sources: to reduce emissions related to energy generation. Renewables and carbon capture are the primary tools in achieving these targets.**
- **Stricter requirements for power quality and reliability – as the world progresses into an increasingly more digitalized economy demands in terms of power quality and reliability are higher, while costs of an unreliable network also expand significantly.**

Emissions targets and smart grid

The Kyoto Protocol on climate change adopted in 1997 has been the primary driver of the introduction of emissions targets, including CO_2, by signatories. Electricity generation and consumption is the largest and fastest source of CO_2 emissions. For example, in the European Union, heads of state have decided on a series of demanding targets to be met by 2020 (Europe's 20-20-20). These include: (1) a reduction of at least 20% in greenhouse gas emissions vs. 1990; (2) 20% of energy consumption satisfied by renewable sources by 2020; (3) a 20% reduction in primary energy use (vs. projected levels) to be achieved through improvements in energy efficiency. Separately, the US and China have also committed to emissions targets, respectively: a 17% reduction in emissions targets vs. 2005 by the US and a 40%-45% reduction in the economy's carbon intensity by 2020 in China.

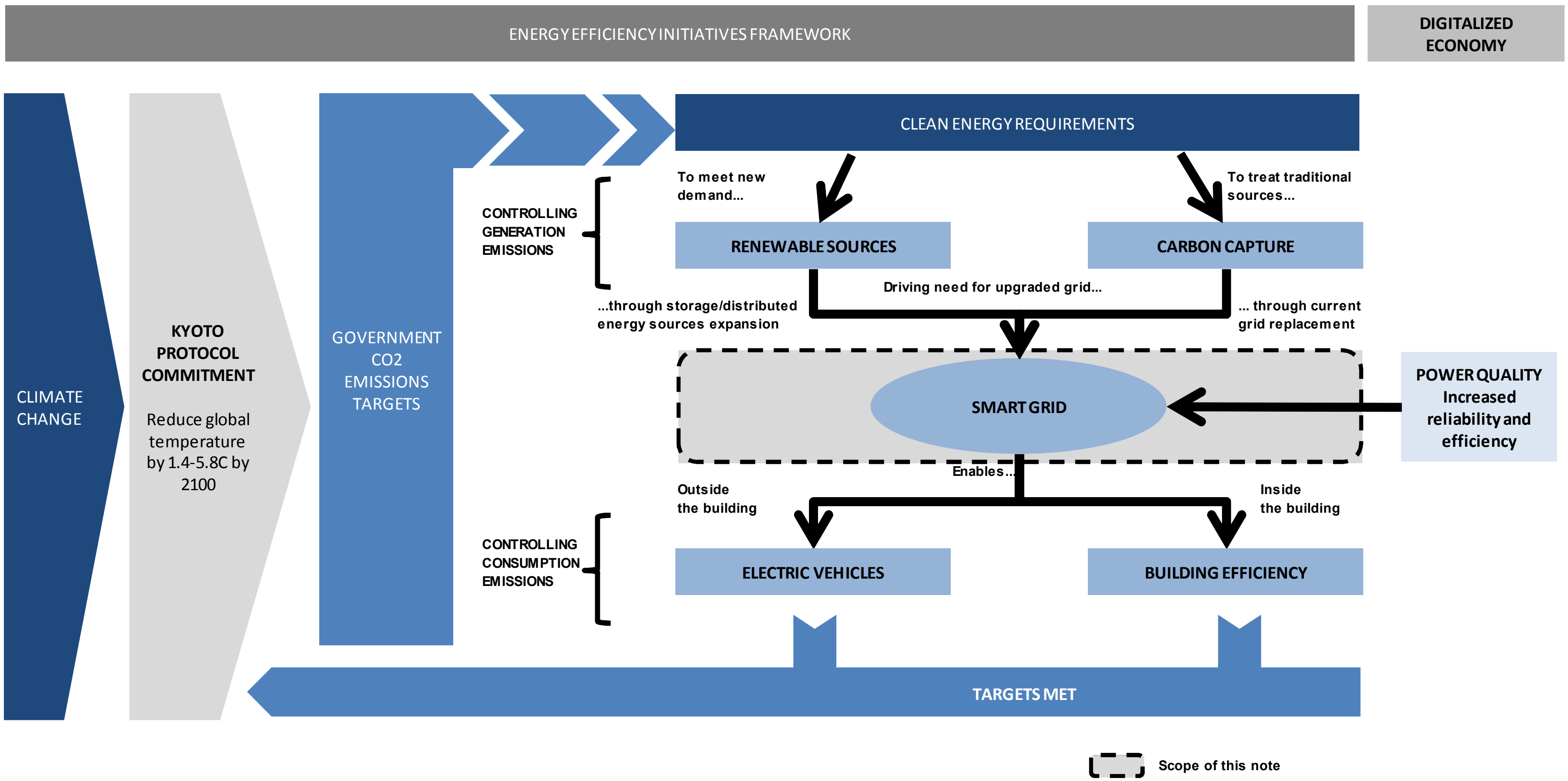
We believe that meeting these targets at a time when world electricity consumption is rising at twice the pace of energy demand, will only be possible through a clean up of the current power generation capacity basis, both by adapting existing sources (Carbon Capture) and by significantly increasing the mix of renewable sources as demand increases.

We also believe that the requirement to make renewables a viable source of electricity, on top of grid replacement needs, makes grid upgrades a matter of urgency. Smart grid implementation would allow utilities to incorporate new electricity sources into the grid (including mechanisms to automatically store, transport and control consumption of that energy) in an effective way. Smart grid would also act as a key facilitator for electric vehicles penetration and would allow for the implementation of more sophisticated electricity usage efficiency technologies in buildings—the two key levers to controlling CO_2 emissions.

Power quality and reliability and smart grid

Power quality and reliability are compromised by electrical disturbances in the grid, such as network congestion, distribution failures, voltage instability, etc.. These failures increase operational costs and curtail productivity across all sectors. For example, voltage surges and sags impede industrial equipment to achieve maximum efficiency, unless backup power generation is installed at an extra cost. As the use of digital equipment increases, the economy will become more dependent on power quality and will therefore suffer higher costs from unreliability. Smart grid technologies aim to address these unreliability problems, subsequently generating benefits for significant parts of society.

Exhibit 4: The building blocks of energy efficiency: Framework to understanding building efficiency initiatives



Source: Goldman Sachs Research.

Smart Grid: US$750 bn opportunity to utility equipment providers over the next 30 years

We believe the creation of a smart electricity grid represents an incremental $750bn opportunity for utility equipment and technology providers (at current prices and interest rates), comprising opportunities in the Transmission, Distribution and Consumer Response parts of the electricity supply/demand chain. We estimate the development of a smart grid will add an average 3 pp of incremental growth per year to the T&D market over the next decade. This implies a 33% increase in the T&D market by 2019E vs. current levels. Our estimate of US$750 bn is based on 100% adoption in all technology areas in Europe, the US and China and 50% T&D conversion in other regions. However, if we assumed 100% conversion in *all* areas and regions, the opportunity would be worth US$860 bn (a 4% upside to our base case estimate). A 20 pp lower adoption rate across all areas and regions would imply 22% downside to our base estimate (or c.US$580 bn).

Over the last century, the fundamental technology behind the electricity grid has remained broadly unchanged. The current network connects large centralized generation units to passive users within a country, with non-redundant grids and limited integration with other outside electricity systems. Energy and information flows in this network are centrally controlled and unidirectional, implying limited monitoring, fault prevention capabilities and trading potential, among others issues. Given today's economy is almost fully reliant on electricity (computers, phones, machines, service platforms, etc.), we believe it is imperative that grids are upgraded in order to overcome issues in a reliable way, particularly given the costs of a non-performing grid are getting exponentially higher as the world economy digitalizes.

Implementation of a smart grid will mean endowing the network with several new capabilities:

1. Two-way communication capabilities allowing users to take an active part in electricity usage management and facilitating the development of energy trading markets.
2. Self-healing mechanisms to minimize economic and social costs of faults in and attacks to the grid.
3. Efficient technologies that better control losses.
4. Interconnected links that prevent grid overloads by better allocating supply/demand through broader regions.
5. Transportation and storage capabilities that can support the roll out of alternative and intermittent electricity sources.

We estimate the creation of such a network will require a capital investment of c.US$750 bn over the next 30 years by utility companies globally (over and above the investment required to keep up with demand and maintenance of current grids, see Exhibit 5). This opportunity is divided into three broad areas of investment: (1) Transmission—fully automating and interconnecting current networks; (2) distribution—fully implementing the automation, information and storage systems required for a smart grid; (3) Smart Metering and Customer Response—implementing the end user devices that will facilitate an active user participation in the new energy market. To estimate this opportunity (Base Case), we assume that Europe, the US and China will see 100% grid conversion across all technology areas in the next 20 years, while for the rest of the world we assume 50% conversion of the T&D networks by 2040 (100% metering).

We assume the cost of conversion for Transmission lines will be higher in the US than Europe, because of the relatively older grid. For similar reasons, China and other developing regions should experience lower conversion costs, also supported by cheaper labor. As a base value, we assume a cost of conversion for the US of US$34k/km, estimated based on a study of the cost of upgrading the US network done by the Electric Power Research Institute (EPRI) in 2004. We then assume that conversion costs in Europe and other emerging markets are 75% and 50% of US$34,000/km, respectively, reflecting the younger age of grid equipment relative to the US. As for distribution network upgrades, we have assumed a cost of US$7,000/km both in the US and Europe (based on the same EPRI study), while we considered lower local labor costs would allow emerging regions to benefit from costs 20% lower. We estimated the cost of implementing. As for smart metering, based on various pilots done in developed countries, we estimate the full cost of installing a smart meter and related customer response tools (i.e., including equipment and software costs, labor, transportation, etc.) would be c.US$300/meter in Europe and the US, while due to the lower value-added nature of the equipment and lower labor costs in developing regions, we believe a cost of c.US$200/meter is achievable.

Exhibit 5: Smart grid represents globally a US$750 bn opportunity over the next 30 years …

						Smart grid unitary conversion costs			Smart grid conversion costs - Total			
	Grid conversion to smart by 2040 (T&D)	Transmission Lines (mn km)	Distribution Lines (mn km)	Meters conversion to smart by 2040	Non-AMI meters	Transmission $/km	Distribution $/km	Smart metering and consumer response $/meter	Transmission $bn	Distribution $bn	Smart metering and consumer response $bn	Total $bn
Europe	100%	0.73	12.2	100%	276	25,500	7,000	300	19	86	83	187
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Total		**5.84**	**66**		**1,539**				**101**	**304**	**346**	**$750**
										NPV @ 2.5% time value		**$559**

Source: Goldman Sachs Research estimates.

Our estimates suggest that by 2019 (assumed smart grid investment peak), this opportunity will be equivalent to an annual increase in T&D spent of over 30% vs. current levels (Exhibit 6). However, we expect T&D maintenance spending to decline vs. current levels as implementation progresses, because the technologies implemented as part of the smart concept imply significant efficiency improvements and requires less maintenance. This should result in lower operating costs for the grid operators.

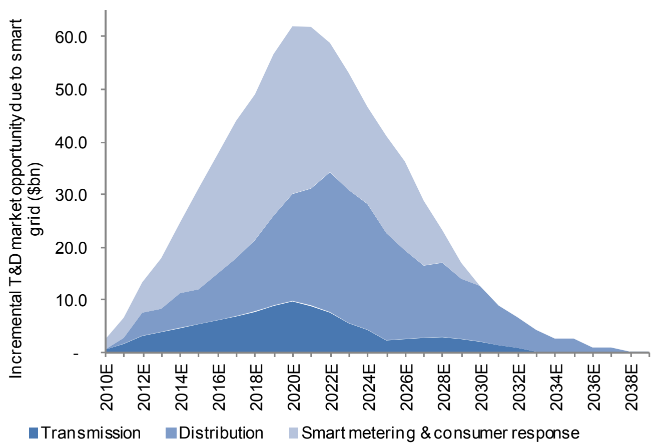
Exhibit 6: … meaning peak annual T&D investment in 2019E over 30% of current levels

	Current T&D annual ($bn)	Smart grid investment at peak 2019E (US$bn)	Smart grid at peak as % current T&D spend	Annual energy consumption (TWh)	Cost of electricity ($/kWh)	Estimated cost of consumption ($bn)	Smart grid at peak as % consumption costs
Europe	33	18	55%	3,462	0.18	610	2.9%
US	19	13	69%	3,873	0.10	387	3.4%
China	43	16	37%	3,438	0.09	303	5.2%
Others	76	10	13%	10,059	0.13	1,330	0.7%
Total	**170**	**57**	**33%**	**20,832**		**2,630**	**2.2%**

Source: Europe's Energy Portal, CIA World Fact Book, EIA, DoE.

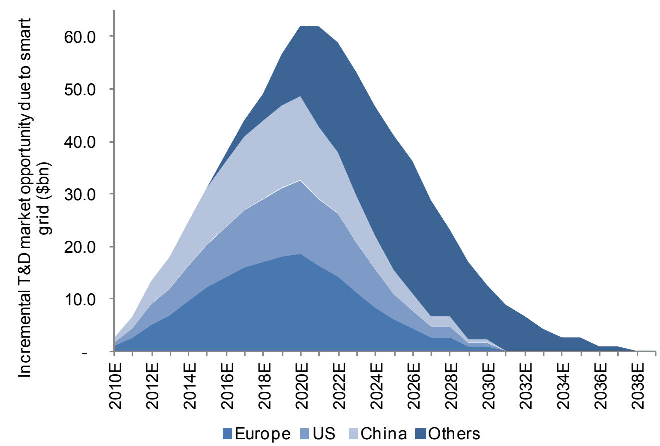
Overall, we expect smart grid investments to contribute on average 3 pp of incremental annual growth to the T&D market over the next decade.

Exhibit 7: Incremental T&D market growth by technology
US$ bn



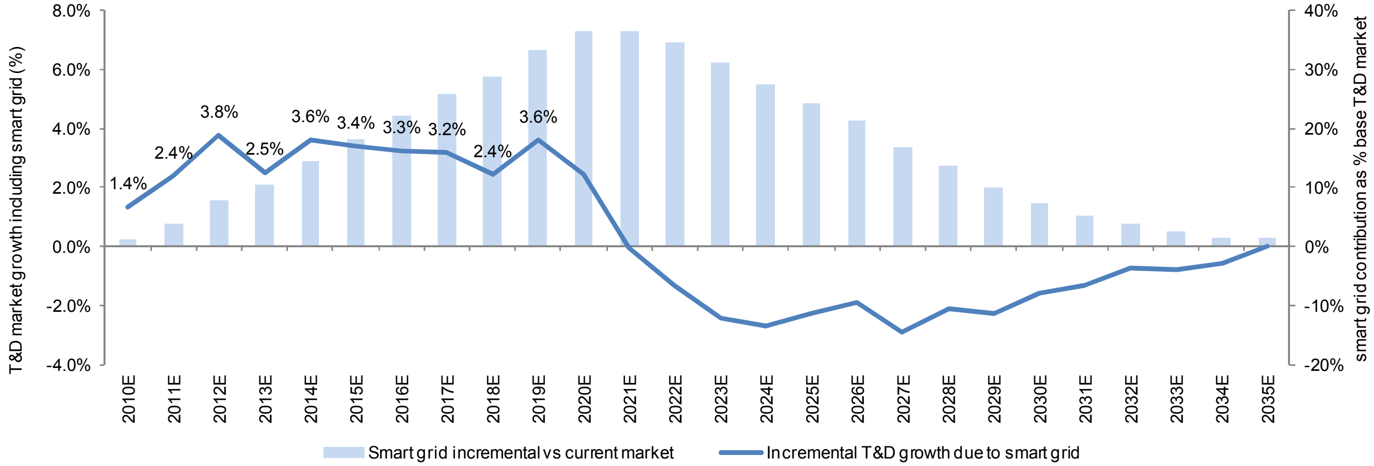
Source: Goldman Sachs Research estimates.

Exhibit 8: Incremental T&D market growth by region
US$ bn



Source: Goldman Sachs Research estimates.

Exhibit 9: Smart grid will imply significant T&D market growth over the next decade
Incremental T&D market growth due to smart grid; smart grid contribution as % of current T&D spent



Source: Goldman Sachs Research estimates.

We identify the following sensitivities to our Base Case assumptions:

- Upside risks:
  - Higher levels of adoption by region and technology (100% conversion across all regions and technologies): 12% upside assuming similar timing of adoption as Base Case (we name this scenario 'Full Conversion (base timing)').
  - Quicker adoption in Other regions (i.e., five years earlier than Base Case): 4% upside assuming similar levels of conversion as Base Case (we name this scenario "Early adoption (base conversion)").
- Downside risks:
  - Lower levels of adoption by region and technology (20 pp lower conversion across all regions and technologies): 22% downside assuming similar timing of adoption as Base Case (we name this scenario "Low conversion (base timing)").
  - Slower adoption in all regions (i.e., five-year delay): 12% downside assuming similar levels of conversion as Base Case (we name this scenario "Late adoption (base conversion)").

Exhibit 10: Sensitivities around our Base Case depending on degree of adoption (i.e., conversion) and timing of conversion
US$ bn

Real value time discounted (@2.5%)					
		Timing Case			
		5 years earlier - Others	Base Case	5 years later	Installation Real Value
Conversion Case	100%	661	628	555	**859**
	Base Case	583	559	494	**750**
	20pp lower	451	434	383	**579**

Upside/downside to Base Case (real discounted value terms)				
		Timing Case		
		5 years earlier - Others	Base Case	5 years later
Conversion Case	100%	18%	12%	-1%
	Base Case	4%	0%	-12%
	20pp lower	-19%	-22%	-31%

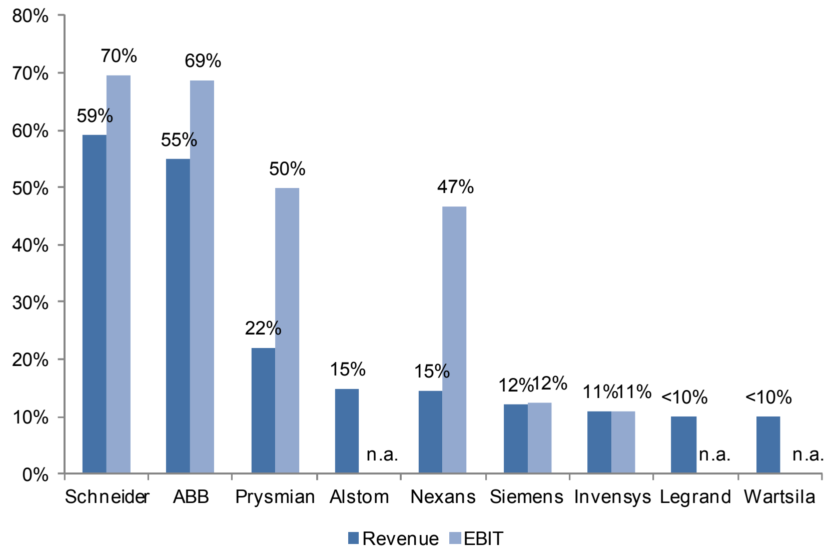
Source: Goldman Sachs Research estimates.

ABB, Siemens and Schneider best positioned to benefit from smart grid opportunity

The development of a smart grid globally offers a significant opportunity for several companies in our coverage. We believe these companies can be categorized into three groups: (1) those with significant broad exposure, which will be major beneficiaries; (2) smaller specialized players operating in particular niches that will benefit from a particular technology or application; and (3) companies with some exposure, but unlikely to be the leaders.

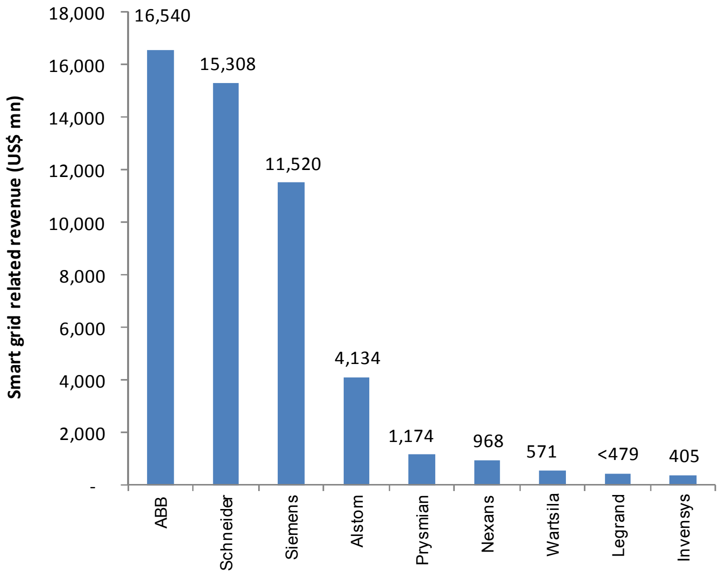
ABB, Siemens and Schneider offer the largest portfolio of smart grid technologies of our European Capital Goods coverage. Besides being two of the more operationally exposed companies, ABB and Schneider both derive more than 50% of their 2010E revenues from products directly exposed to smart grids. While having several products across the spectrum, Siemens has a more diversified business, and the overall weight of smart grid on its portfolio is lower.

Exhibit 11: ABB and Schneider are the most operationally levered to smart grid
Estimated percentage of 2010E revenues and EBIT exposed to smart grid; 2011CY estimates for Schneider and Alstom to account for full impact of Areva T&D acquisition



Source: Company data, Goldman Sachs Research estimates

Exhibit 12: On an absolute basis, we calculate that ABB and Siemens derive the largest amount of revenues from smart grid-exposed areas
US$mn; estimated revenues potentially exposed to smart-grid



Source: US Department of Energy.

Note: Exhibits 11 and 12 may include revenues from products related to T&D but not directly smart grid-related, particularly for Wartsila, Invensys and Legrand.

ABB and Siemens have a sizeable presence in most of the technology areas, while Schneider is particularly leveraged to the distribution and demand response areas (with no presence in transmission or storage).

With more than 50% of their portfolios exposed to power products directly applicable across most smart grid areas, ABB and Schneider would be the two largest beneficiaries of this growth opportunity, in our view.

We also believe Schneider will benefit indirectly via its Building and Data Centers businesses because of governments', corporations' and consumers' increased focus on energy management to be further fostered by the wave of investment in smart grids. Although not one of the more directly exposed companies to smart grid, we believe Legrand should extract similar benefits from its building efficiency portfolio.

Smart grid-related projects comprise less than 15% of revenues for Siemens, even though the company is present across the spectrum—a function of it being a large conglomerates involved in many businesses.

Prysmian and Nexans have moderate revenue exposure; however, the profitability of smart grid-exposed business is significantly superior to their other businesses, and is therefore an important earnings driver.

While large companies have the broadest exposure to smart grid and are better positioned to offer bundled products, take on integration activities and manage turnkey projects, some small companies have taken share in specific segments (examples of such companies include Itron, Landis+Gyr and SilverSpring in AMI; EnerNoc and Comverge in demand response; A123, Ener1 and EnerSys in storage).

Exhibit 13: ABB, Siemens and Schneider stand out as having the highest operational and financial exposure to smart grid (2010E)
Degree of operational involvement: 2 means strong involvement across most products within category; 1 means strong involvement in a few products or low involvement in various products within category; 0 limited or no exposure

			Degree of operational exposure							
Company	Region	% smart grid-related revenue	Transmission	Advanced Metering Infrastructure	Demand Response	Distribution Management Systems	Distributed Energy Sources	Energy Storage Solutions	Communication and IT	Cumulative Score
ABB	Europe	55%	2	1	2	2	2	1	2	12
Alstom	Europe	15%	2	0	0	0	1	0	0	3
Invensys	Europe	11%	0	0	1	0	0	0	2	3
Legrand	Europe	<10%	0	0	1	0	0	0	0	1
Nexans	Europe	15%	2	0	0	1	0	0	0	3
Prysmian	Europe	22%	2	0	0	1	0	0	0	3
Saft	Europe	Negligible	0	1	0	0	0	1	0	2
Schneider	Europe	59%	0	1	2	2	2	0	2	9
Siemens	Europe	12%	2	1	1	2	2	1	1	10
Wartsila	Europe	<10%	0	0	0	0	2	0	0	2

Source: Company data, Goldman Sachs Research estimates.

Smart grid opportunity would justify a premium to ABB, Schneider and Siemens multiple

The smart grid opportunity would have a material impact on the earnings of ABB, Siemens and Schneider mainly post 2011. Using a DCF model to estimate this incremental impact on target 2011E EV/EBIT multiples, we conclude that the opportunity represents an additional 1x to Schneider's target EV/EBIT; 0.8x to ABB's multiple and 0.25x for Siemens.

We have incorporated these premiums into our sector valuation framework (please refer to Appendix A). We reiterate our Conviction Buy on ABB (12-month price target of SFr33, 60% upside) and on Siemens (12-month price target of €126; 65% upside); Schneider remains Buy (12-month price target of €137, 51% upside). Please refer to our note, *Fixed investment recovery to the fore: Conviction Buys ABB, Cookson and Siemens*, also published today.

Exhibit 14: Smart grid justifies premium on multiple for ABB, Schneider end Siemens

		Scenarios				
		Full conversion (base timing)	Early adoption (base conversion)	Base Case (timing and conversion)	Late adoption (base conversion)	Low conversion (base timing)
ABB	Incremental Value per Share (SFr)	1.63	2.11	1.84	1.45	1.45
	Incremental Upside to Current Share Price (%)	10%	10%	9%	7%	7%
	Equivalent Incremental EV/EBIT 2011E	0.85x	0.88x	0.77x	0.61x	0.61x
Schneider	Incremental Value per Share (€)	13.70	13.67	12.34	9.67	9.67
	Incremental Upside to Current Share Price (%)	15%	15%	14%	11%	11%
	Equivalent Incremental EV/EBIT 2011E	1.08x	1.08x	0.98x	0.76x	0.76x
Siemens	Incremental Value per Share (€)	2.95	2.94	2.67	2.11	2.11
	Incremental Upside to Current Share Price (%)	4%	4%	4%	3%	3%
	Equivalent Incremental EV/EBIT 2011E	0.27x	0.27x	0.24x	0.19x	0.19x

Assumptions:

- Similar contribution margin on incremental smart grid sales as 2011E T&D margin for the first 5years - progressively decreases to EBIT margin levels, since as sales increase further dedicated smart grid fixed costs need to be added
- Current marginal tax rates
- Incremental capex equivalent to 3% of incremental sales (starting after the first 5 years)
- Capex/depreciation 1.1x
- Incremental working capital requirements at same % sales as 2011E for group
- Discount rate 5% (2.5% for normalized risk free rate and 2.5% for company specific risk)

Source: Goldman Sachs Research estimates.

The benefits of developing a smart grid substantially exceed costs

While the costs of developing a smart electricity grid are significant, detailed studies have found that benefit to cost ratios typically exceed 5x. These reflect both the economic benefits captured by utilities as well as a broad group of indirect benefits to society. We believe that the magnitude of these benefits is likely to act as a powerful catalyst for governments to implement a smart grid globally, particularly given the need to integrate renewables into the grid in order to meet wider energy efficiency commitments and fulfill continued increases in electricity demand on existing infrastructure. We expect economic benefits to utilities to be closer to capital investment costs (1-2x benefit to cost ratio) with consumer and social benefits significantly higher, highlighting the importance of effective incentives to utilities to encourage smart grid investments.

There are three key studies that have assessed the wider benefits of implementing a smart grid, calculating benefits-to-cost ratios. Estimates of the overall benefits range from 4.4 to 6.7 times the cost of implementation over the next 20 years, considering economic benefits to utilities, economic benefits to the consumer, and intangible social benefits.

These are:

- A study undertaken by the Electric Power Research Institute (EPRI) in 2004 on the costs and benefits of converting the US grid into a smart network. According to this study, the total costs of converting the US Transmission and Distribution network would be US$165 bn over the next 20 years, with benefits between US$638-US$802 bn, implying an overall benefit-to-cost ratio of c.4.4x.
- A report prepared in 2006 by the SAIC Smart Grid Team on converting San Diego's network into a smart grid, where the overall benefit-to-cost ratio was estimated at 5.7x over a 20 year period.
- A publication by National Energy Technology Laboratory (NETL) in 2009 on the implementation of a smart grid in West Virginia (mostly involving Distribution-related investments). This study concludes that the overall benefit-to-cost ratio of the solution should be c.6.7x.

We believe there are three types of economic benefits to be captured by utilities:

- Lower transmission and distribution losses.
- Maintenance and capital cost savings.
- Labor cost savings.

As for economic benefits to be captured by consumers, we consider:

- Fewer and shorter outage events.
- Reduction of electricity bill costs.

While some of the intangible social benefits are:

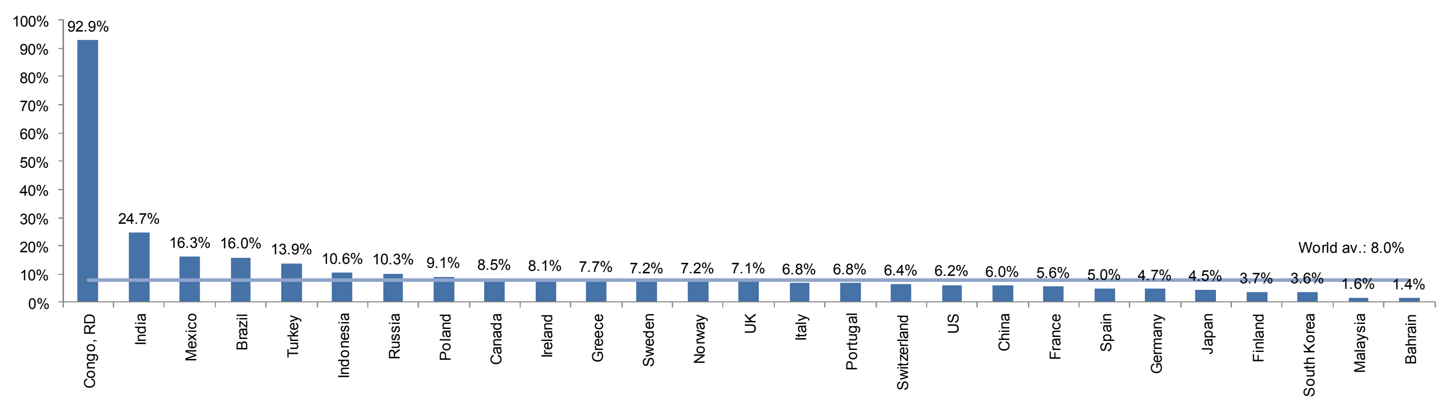
- Emissions reductions.
- Reduced dependence on coal and oil related energy sources.
- Job creation potential for equipment providers.
- Reduced hazard risks.
- Benefits from facilitating energy trading and liberalization.
- Better quality of electricity service.

Utility economic benefits

Lower transmission and distribution losses

Current network losses range from 92.9% of electricity produced in the Democratic Republic of Congo to 1.4% in Bahrain. At the highest end, these losses reflect aging infrastructure, or issues with widespread energy theft directly from the line. We estimate that average T&D losses in developed countries is c.6.1% of electricity production. According to the World Economic Forum, the use of smart grids could reduce distribution losses by up to 30%. Smart grid equipment such as high-voltage direct current (HVDC), or superconductive cables, can significantly reduce line losses, with some cables achieving losses lower than 1.5% over 1,000 km, according to Prysmian. We estimate that T&D losses represent an annual cost of c.US$150 bn for utilities globally. A 10% reduction in losses therefore (average efficiency improving from 8.0% on a consumption weighted basis to 7.2%) would yield an equivalent saving of US$15 bn, comparable to 9% of current annual global T&D investment spend. Reducing average losses from 8.2% to 1.4% (best practice—Bahrain) would imply an 82.5% reduction in absolute losses, equivalent to US$$125 bn or 73% of the current T&D spent.

Exhibit 15: Reduction of network losses will be one of the major benefits of a smart grid
Losses in T&D per country, 2007



Source: World Bank.

Exhibit 16: A 10% reduction in absolute energy losses would generate direct monetary savings equivalent to 9% of current T&D spend

Expect annual savings on T&D losses; US$ bn

	Loss rate	Electricity generation 2008 (TWh)	Loss (TWh)	Cost of loss (US$bn)	Saving benefit ($bn) 5%	10%	25%	50%
India	**24.7%**	**834**	**206**	**19**	**1**	**2**	**5**	**10**
Mexico	16.3%	257	42	4	0	0	1	2
Brazil	16.0%	455	73	7	0	1	2	3
Turkey	13.9%	199	28	3	0	0	1	1
Indonesia	10.6%	151	16	2	0	0	0	1
Russia	**10.3%**	**1,506**	**156**	**15**	**1**	**1**	**4**	**7**
Poland	9.1%	155	14	1	0	0	0	1
Canada	8.5%	599	51	5	0	0	1	2
Ireland	8.1%	30	2	0	0	0	0	0
Greece	7.7%	62	5	0	0	0	0	0
Sweden	7.2%	149	11	1	0	0	0	1
Norway	7.2%	143	10	1	0	0	0	0
UK	7.1%	390	28	3	0	0	1	1
Italy	6.8%	318	22	2	0	0	1	1
Portugal	6.8%	46	3	0	0	0	0	0
Switzerland	6.4%	69	4	0	0	0	0	0
US	**6.2%**	**4,316**	**267**	**25**	**1**	**3**	**6**	**13**
China	6.0%	3,433	205	19	1	2	5	10
France	5.6%	574	32	3	0	0	1	2
Spain	5.0%	310	15	1	0	0	0	1
Germany	4.7%	639	30	3	0	0	1	1
Japan	4.5%	1,154	52	5	0	0	1	2
Finland	3.7%	77	3	0	0	0	0	0
South Korea	3.6%	463	17	2	0	0	0	1
Malaysia	1.6%	106	2	0	0	0	0	0
Total (80% of energy generated)	**7.2%**	**16,436**	**1,190**	**112**	**6**	**11**	**28**	**56**
Others	11.3%	3,766	425	40	2	4	10	20
World	**8.0%**	**20,202**	**1,615**	**151**	**8**	**15**	**38**	**76**
as % current T&D spend				**89%**	**4%**	**9%**	**22%**	**45%**

Source: BP Statistical Yearbook, World Bank, Goldman Sachs Research estimates.

Maintenance and capital cost savings

Smart grid implementation could generate savings for utilities from low outage and blackout incidents and avoided transmission costs. While transmission lines are typically automated given the importance of a line failure, this is not the case for distribution lines, and utilities often rely on calls from customers to determine that a line fault has occurred. Furthermore, inadequate monitoring of lines, means electricity is often dispatched on lines which are already heavily loaded, increasing losses as lines operate outside of their optimal range. Better monitoring would therefore allow significant improvement in asset usage, thereby improving operational life and performance, reducing maintenance costs. According to the NETL, smart grid could contribute to a 10% reduction in network operational and maintenance costs.

Smart grid adoption also offers benefits to utilities from lower capital cost investments in generation capacity. By being able to manage peak load better, and by creating a more efficient grid, the overall generating capacity requirement is reduced.

A 5% saving in generation levelised costs (accounting for both operational, maintenance and capital costs for new plants) would equate to more than US$70 bn in savings globally, a similar magnitude to 43% of current T&D investment or two years of annual capacity growth (Exhibit 17).

Exhibit 17: Savings in annual non-renewable generation costs would be of equivalent magnitude to 43% of current annual T&D spent
Average levelised generation costs include capital, finance, owner's costs on site, fuel and operation over a unit's lifetime, with provision for decommissioning and waste disposal (new build)

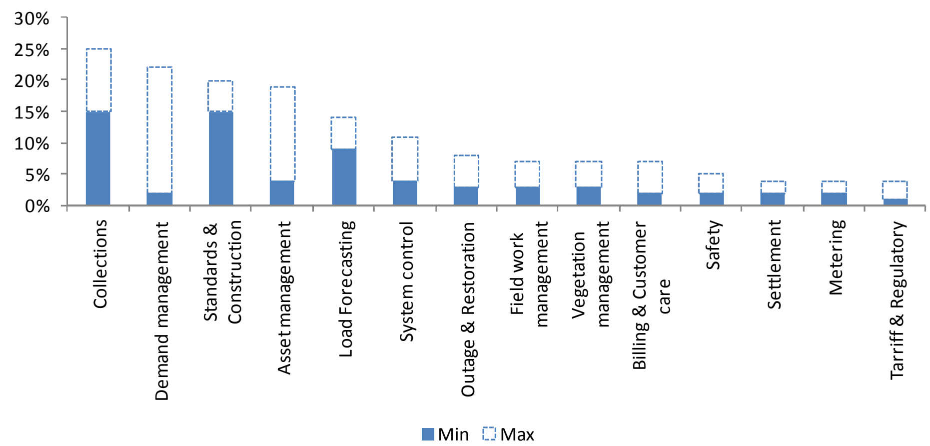
	2008 Capacity (GW)						Av. levelised	Savings per year ($bn)			Savings as % GDP 2010E		
Country	**Total**	**Non-renewable**	**of which Coal**	**Non-renewable/Total**	**Total electricity generation (TWh)**	**Non-renewable generation (TWh)**	**generation costs ($/MWh)**	**5%**	**10%**	**15%**	**5%**	**10%**	**15%**
Asia	1,408	1,113	676	79%	6,934	5,484	79	22	43	65	0.1%	0.3%	0.4%
Australia/New Zealand	65	48	30	73%	316	231	95	1	2	3	0.1%	0.2%	0.3%
Europe & CIS	1,147	824	228	72%	5,354	3,848	105	20	40	60	0.1%	0.2%	0.3%
North America	1,046	845	250	81%	4,915	3,969	85	17	34	50	0.1%	0.2%	0.3%
Africa & Middle East	385	325	55	85%	1,377	1,165	69	4	8	12	0.4%	0.8%	1.1%
Latin America	284	126	10	44%	1,306	580	69	2	4	6	0.0%	0.1%	0.1%
Brazil	104	16	1	16%	455	72	69	0	0	1	0.0%	0.0%	0.0%
Russia	179	131	29	73%	1,036	756	82	3	6	9	0.2%	0.4%	0.6%
India	162	115	85	71%	834	593	54	2	3	5	0.1%	0.2%	0.3%
China	660	528	477	80%	3,433	2,745	54	7	15	22	0.1%	0.3%	0.4%
USA	922	790	233	86%	4,316	3,700	85	16	31	47	0.1%	0.2%	0.3%
Global	**4,335**	**3,281**	**1,248**	**76%**	**20,202**	**15,294**	**95**	**73**	**146**	**219**	**0.1%**	**0.2%**	**0.4%**
as % current T&D spent								**43%**	**86%**	**129%**			
Years of generation growth saved (@2.5%pa growth)								**2**	**4**	**6**			

Source: IEA, Goldman Sachs Research estimates.

Labor cost savings

Better monitoring and communication systems can also reduce labor costs. Fewer line failures would mean lower levels of maintenance, while better information on the network would also help reduce the time required to diagnose a problem and identify the solution. Furthermore a simple grid can generate significant savings on meter readings, which currently have to be confirmed by utility staff visiting customer locations. For example, CapGemini calculates that the implementation of smart meters could generate up to 25% savings in bill collection costs, up to 7% in billing and customer care services and up to 7% in field work management (Exhibit 18)

Exhibit 18: Installing smart electricity meters could generate significant benefits to a utility operator
Cost reductions achieved two years after smart metering pilot deployment vs. two years prior to the deployment; survey of 31 utilities in North America and Europe; calculations based on assumption that smart metering is fully integrated and utilized



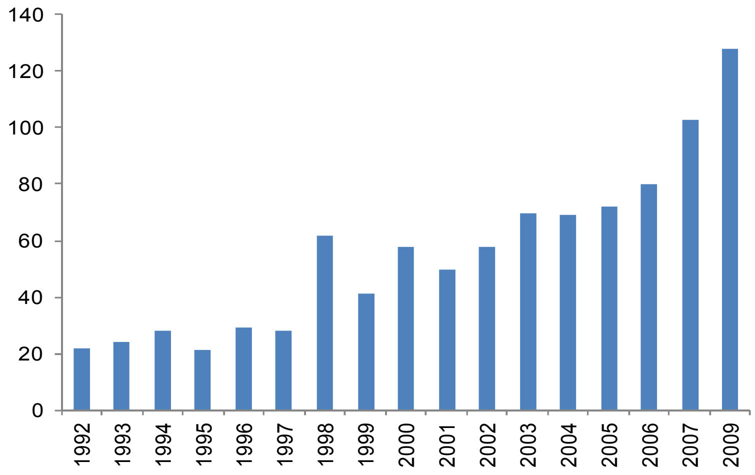
Source: Capgemini

Consumer economic benefits

Outage minimization (number and length)

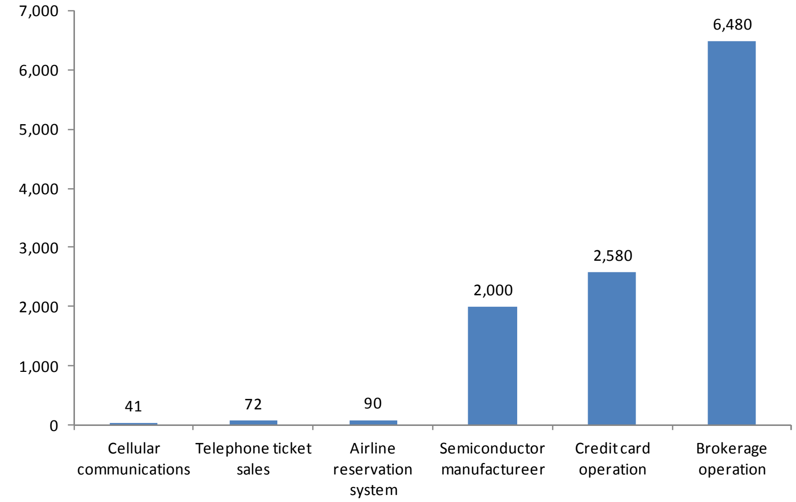
According to Areva, the nuclear and renewable energy solutions provider, outages in the US alone represent costs of at least US$150 bn annually, with an average outage affecting more than 400,000 people. Out of five largest blackouts in the last 40 years, three have occurred during the last decade. Minimizing outage would therefore reduce outage related costs for various economic activities (please refer to Exhibits 19 and 20).

Exhibit 19: Power outages have significantly increased over the last decade
Power disturbances in North America



Source: NERC.

Exhibit 20: Power outages have high community costs
US$'000 ; average cost of one hour of power interruption in the US per type of customer



Source: US Department of Energy.

Lower electricity bills for consumers

The smart grid would enable consumers to act as active energy trading parties. For example, at different points in time they can act as consumers or virtual power producers, through the use of distributed energy resources (such, as residential solar panels) and storage solutions that allow them to generate and store energy, which they can use when more convenient or they can sell back to the network.

NETL estimates that energy efficiency and effective demand response can save 10%-15% on an average consumer bill; while savings according to a Pacific Northwest study range between 7% and 12% depending on the categories of actions considered as demand response). We estimate that a 5% reduction in consumption due to demand response mechanisms would represent c.US$19bn annually saved by consumers (Exhibit 21).

Exhibit 21: A reduction of 5% in energy demand is equivalent to a saving in electricity bills of US$19bn annually

	2010 E Population (mn)	Annual energy consumption (TWh)	Cost of electricity ($/kWh)	Estimated cost of consumption ($bn)	Consumption Savings (US$bn)			Savings per capita (US$)		
					5%	10%	15%	5%	10%	15%
Europe	411	3,462	0.18	610	30	61	91	74	148	223
US	310	3,873	0.10	387	19	39	58	63	125	188
China	1,338	3,438	0.09	303	15	30	46	11	23	34
Others	4,794	10,059	0.13	1,330	66	133	199	14	28	42
Total	**6,853**	**20,832**		**2,630**	**132**	**263**	**395**	**19**	**38**	**58**

Source: EIA, Europe Energy Portal, Goldman Sachs Research estimates.

Intangible social benefits

- *Reduced emissions:* through lower energy demand and by allowing broader use of renewable resources.
- *Reduced dependence on coal and oil-related energy sources*: as transmission interconnectivity, distributed generation sources and storage solutions allow full roll out of renewable generation sources.
- *Job creation potential:* for equipment providers.
- *Reduced risk of hazard*: through safer systems (for example, through increased penetration of insulated cables and faster reaction to circuit problems due to automatic information back to source rather than relying on customers reporting faults due to weather).
- *Benefits from facilitating energy trading and liberalization*: given peak load varies by region due to industrial mix and regional climates, wholesale energy trading would allow utilities to meet peak demand through the efficient allocation of spare capacity, thereby reducing the stress on stretched generating capacity and allowing operation in a more optimal range. Moreover, wide availability of real time data on demand and further transparency on electricity pricing would put pressure on monopolies and facilitate regulatory control in a liberalized market. According to the US Department of Energy, the organized wholesale markets of PJM and ISO have already reduced wholesale electric rates between US$430 mn and US$1.3 bn a year, demonstrating the potential benefit from allowing electricity market liberalization.
- *Better quality of electricity service* as a result of utilities' ability to control and transport higher power quality. For example, some industrial machinery would not be able to reach maximum ramp up efficiency if voltage were not fully stabilized.

We believe these social benefits will represent the biggest incentive for the implementation of the smart grid concept, with the benefit-to-cost ratio from operational benefits to utilities being closer to 1x-2x. NETL's 2009 study on the West Virginia Smart Grid, for example, identified operational benefits to utilities of c.70% of the capital investment costs, even though the total benefit-to-cost ratio was 7x. According to the San Diego Smart Grid Initiative Study undertaken by SAIC Smart Grid Team in 2006, benefits to the utilities would be c.2.8x capital costs.

Smart Grid is not just a US and European opportunity

Smart grid initiatives are being launched worldwide, in both developed and developing nations, with no clear region being significantly ahead in terms of deadlines. While Europe currently has the highest AMI penetration, China and the US are allocating similar amounts of funding to smart grid initiatives. Replacement needs will trigger implementation urgency in Europe and the US, while building an efficient network to support fast economic development will act as trigger in other regions.

Smart grid development is proceeding globally, both in developed and developing regions. Although, AMI penetration is still limited in most countries (apart from Italy and Sweden), over the next ten years, most major European countries aim to have fully implemented AMI, with some developing countries such as China, South Korea and Brazil having similar objectives and South Korea and China already showing some of the highest levels of AMI demand globally (Exhibit 24).

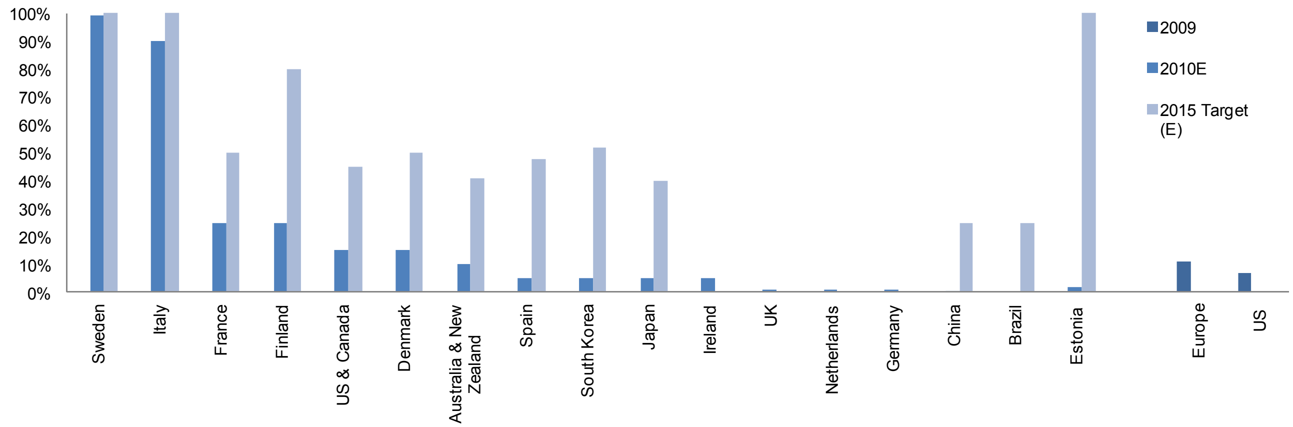
In 2010, China announced the largest smart grid annual funding program (US$7.3 bn), followed by the US (US$7.1 bn) and we expect it to dominate the global AMI market in the next two years (Exhibits 25 and 26). In addition, as mentioned in our Asia-Pacific Capital Goods research analyst's note, *China: Clean Energy:2020: New energy policy may focus on both efficiency and diversity,* July 22, 2010, the Chinese National Development and Reform Commission (NDRC) is likely to already have approved the draft Alternative Energy Development Framework, which should now be pending State Council approval. The Chinese government is increasingly focused on energy efficiency and diversity. It aims to cut carbon dioxide emissions per unit of GDP by 40%-45% by 2020E vs. 2005. We believe that the government may view the development of smart grids as a priority to help achieving this objective.

Exhibit 22: Country targets for completion of full smart metering rollout

	2010E	2011E	2013E	2014E	2016E	2017E	2018E	2020E	2021E	2022E
Countries reaching 100% smart meter penetration	Sweden	Italy	Estonia	Norway	Finland	Poland	Spain	France South Korea UK China	Brazil	Deadline for EU countries

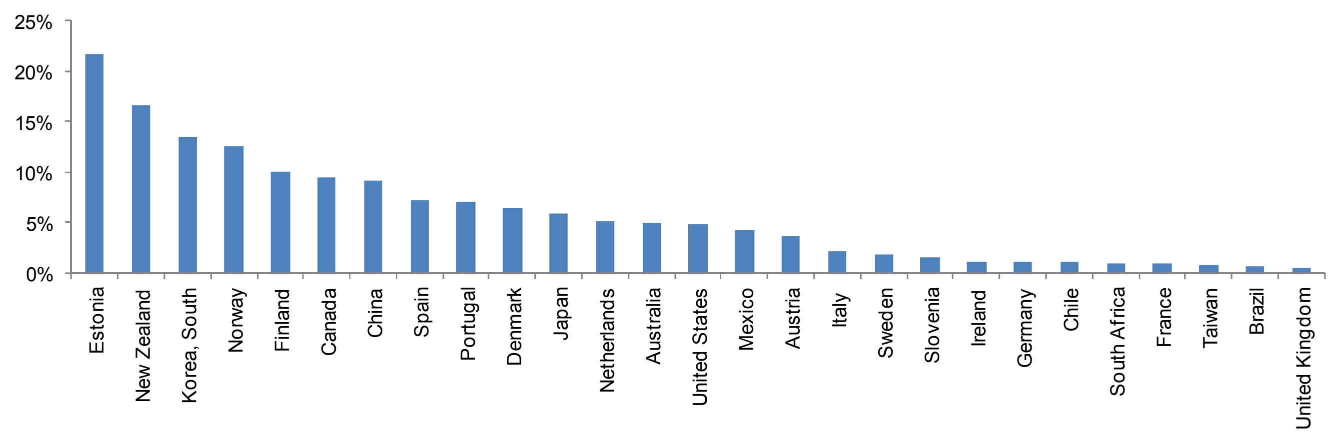
Source: Goldman Sachs Research estimates.

Exhibit 23: Smart metering penetration is still very low across all regions …
Smart metering penetration



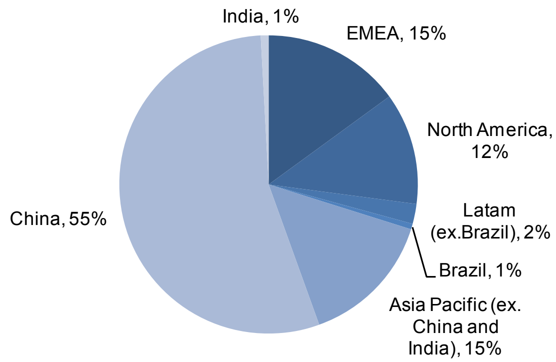
Source: ERGEG, The Brattle Group, Berg Insight, Goldman Sachs Research estimates.

Exhibit 24: … however, increased demand is not only visible in developed economies—South Korea, China and Mexico have demand levels comparable to developed nations
2010 AMI demand as % of electricity meters installed basis



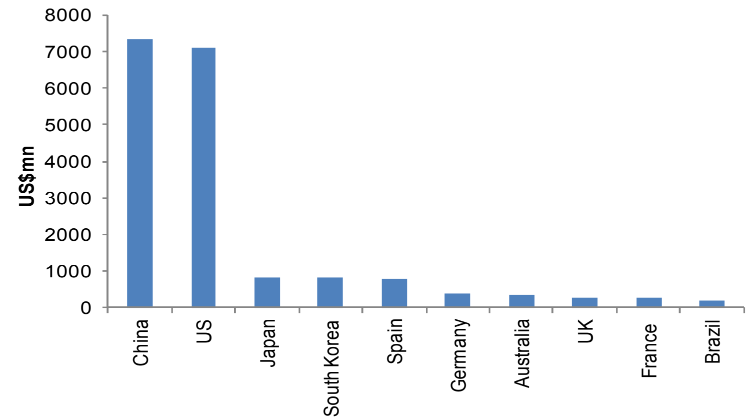
Source: ABS Research, Goldman Sachs Research estimates.

Exhibit 25: China will dominate the AMI market over the next three years
2010-2012E AMI additions by region



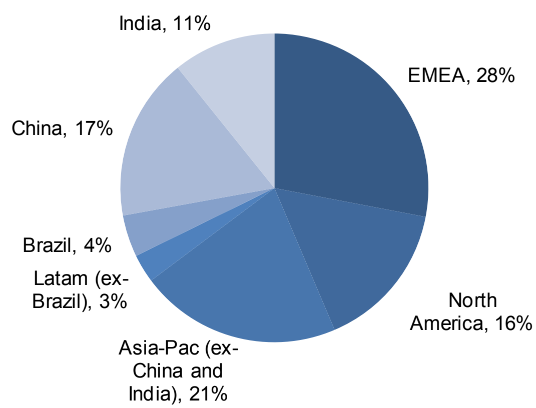
Source: ABS Research.

Exhibit 26: China is now the biggest sponsor of the smart grid initiative
Stimulus announced by country, 2010



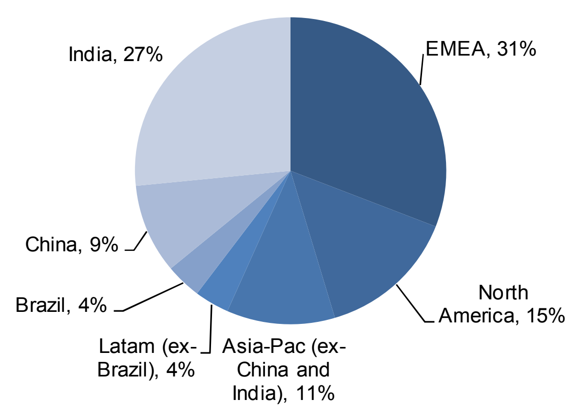
Source: Federal agencies.

Exhibit 27: China, India and US will be key drivers of investments in transmission over the next five years
2010-2015E Transmission line km additions per region



Source: ABS Research

Exhibit 28: India will drive the Distribution market over the next 5 years
2010-2015E Distribution line km additions per region



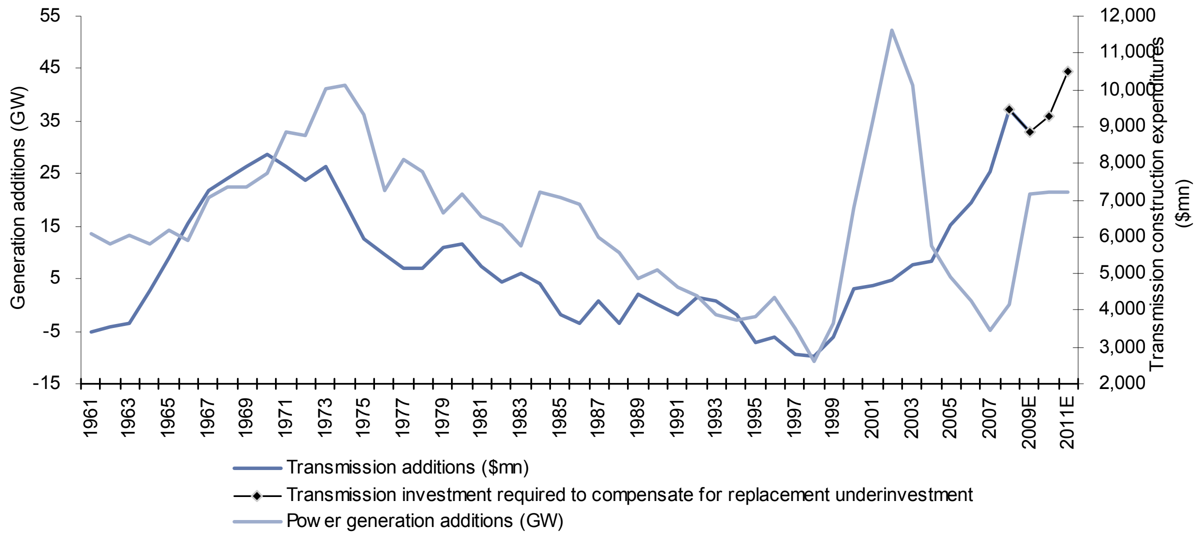
Source: ABS Research

We believe that underinvestment in developed countries in the past ten years and the fact that equipment installed in the 1960s/70s is reaching the end of its useful life (c.40 years) should provide a clear opportunity for countries to establish a smart grid agenda. For example, in the US 70% of transmission lines and transformers are more than 25 years old and 60% of circuit breakers are more than 30 years old, and we estimate that there is still some equipment in the grid that has been in operation for close to 50 years.

Fast economic development of emerging regions will trigger strong growth in energy consumption, generating the need for significant electricity investments (Exhibits 30 and 31). At the same time, governments in emerging economies will be under pressure to adopt cleaner and more efficient energy sources and transportation methods. We believe that as a result, emerging markets will make the technology leap straight to smart grid networks rather than developing passive networks first.

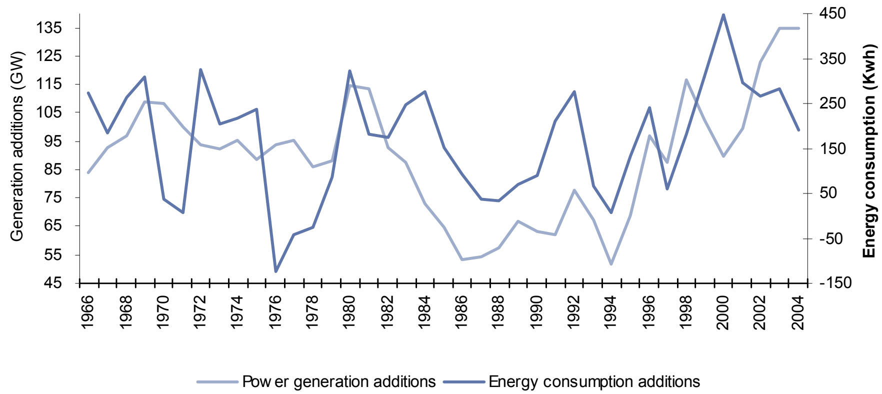
Exhibit 29: Equipment replacement in developed markets has been delayed during the last decade and as full catch-up is impossible, investment will now have to partially compensate for that

US Generation additions vs. transmission expenditures, forecast assuming progressive compensation for replacement underinvestment



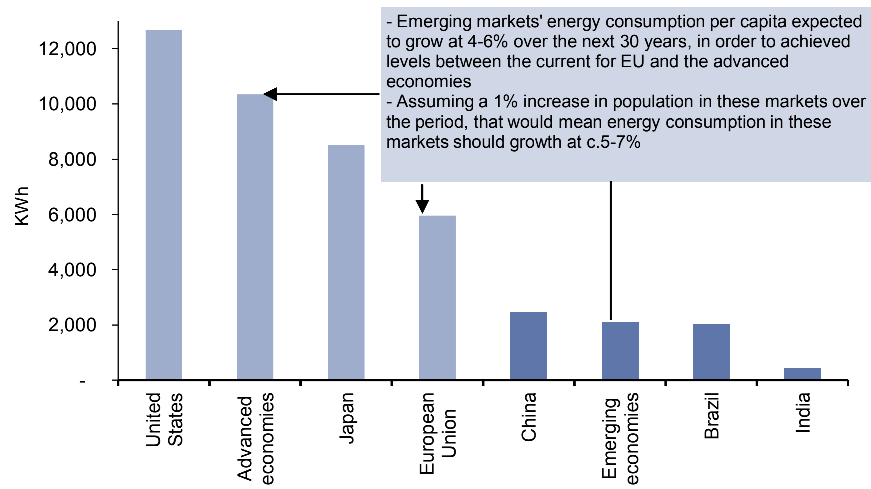
Source: IEA, EEI, Goldman Sachs Research estimates.

Exhibit 30: Energy consumption and generation additions tend to track each other
World generation additions (GW) vs. energy consumption (KWh)



Source: BP Statistical Yearbook 2009, IEA.

Exhibit 31: We expect emerging markets' energy consumption per capita to growth at 4%-6% over the next 30 years, in order to achieve levels of production in line with the EU and other advanced economies
Electricity consumption per capita, 2009



Source: World Bank, Goldman Sachs Research estimates.

Initial investments likely to be focused on transmission interconnection and metering

We believe full conversion of a developed nation's electricity network into a smart grid is likely to take about a decade to implement, although in reality this may take significantly longer. There are several different proposed paths for the implementation of a smart grid and a uniform implementation across regions or countries is unlikely. In particular, while there are clear synergies between technologies, the adoption of each technology is not fully dependent on another. We believe that regulation and clearly defined economic incentives will play an important role in determining the shape of smart grid development. However, we expect transmission interconnection in Europe and AMI in the US and China will be the key beneficiaries of smart grid development initially, given initiatives already planned on a global basis.

There is no pre-requisite for any of the smart grid phases to be implemented in sequence, and we believe timing of smart grid development is not likely to be uniform across technology categories and regions:

- In Europe, transmission and AMI will be initial areas of growth. The European Union has set target dates for transmission interconnection projects (in 2010, more than €900 mn were allocated to funding of transmission interconnections) and has announced that 2022 is the deadline for full-scale implementation of smart meters in its member countries.
- Europe is already ahead of other regions in terms of starting to implement distributed energy resources, particularly decentralized solar and wind sources, as part of its "Europe 20-20-20" plan launched in 2008. In our view, the US, China and other regions will catch up shortly given their increasing focus on complying with emissions regulations.
- We expect AMI to be the main beneficiary of the first wave of development in other regions, including the US and China, driven by regulation and funding incentives. c.25% of US smart grid stimulus last year was allocated to AMI technologies, giving utilities an incentive to start investing in this area first. Also, so far more than 30 utilities worldwide have launched pilot AMI programs.
- Implementation of demand response systems and mechanisms has already started in the US and should pick up in Europe in the coming years. We believe that demand response in developing regions will come at a later stage, given its correlation to consumer sophistication. We believe that demand response is likely to be implemented first at a commercial and industrial level, followed by residential implementation at a later stage. In our view, it is easier for governments to implement and monitor requirements at a commercial and industrial level, given the much higher energy consumption of these segments relative to residential.
- Communication and IT systems will probably start being implemented in parallel with other technologies in all regions.
- We believe that Distribution Management Systems will be a beneficiary in the second wave of development across all regions, most likely when transmission and AMI investments are mostly done. A significant expansion of distributed energy resources and storage solutions is likely to follow this phase.
- The very last phase of grid implementation is likely to cover end-user interface (i.e., demand response and on-site distributed energy resources). This will also be the phase that will take longer to implement, with commercial and industrial implementation taking priority over residential implementation.

Technology to deliver smart grid already exists

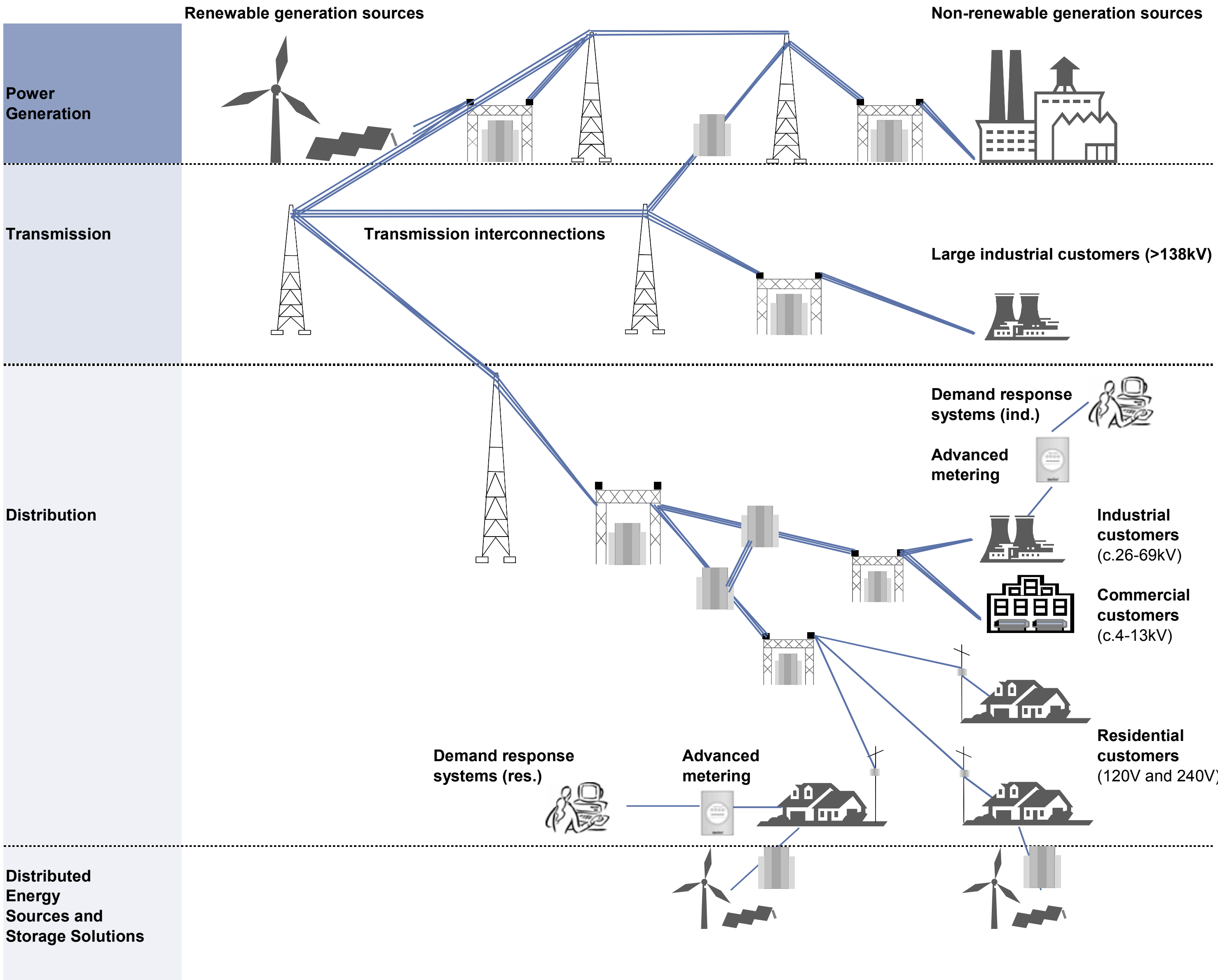
Although smart grid implementation has not been fully deployed yet in any region, our analysis of available documentation suggests that most of the required technology already exists, and that remaining challenges include engineering and integration rather than technology issues. In our view, the integration of existing technology will be a key challenge to making smart grid a reality. While individual transmission and distribution technologies are widely commercialized, smart grid areas that require further development efforts include communication and IT integration, energy storage and consumer demand response solutions, in our opinion.

Smart grid completion can be broken down into the following seven key categories:

- Transmission interconnection and automation—creation of links between existing national networks to better allocate energy supply and demand among broader regions; introduction of transmission redundancies inside existing grids to prevent large scale blackouts; and, introduction of automation mechanisms to provide real-time monitoring and communication capabilities to facilitate preemptive network management and reaction to operational conditions.
- Advanced metering infrastructure (AMI)—installation of smart meters and metering management systems allowing two-way communication between users and utilities; facilitating implementation of automatic instructions from the utility to the end point and creating the vehicle for demand response.
- Communication systems and IT integration—platforms to integrate the data collected from all grid equipment and connect it to other enterprise management systems used by utilities. Once this is implemented, utilities will have perfect real-time visibility about all the network operating areas, and will be able to estimate the effect on the whole system of actions in specific segments/regions and implement more efficient capital decisions.
- Demand response (DR)—technological platforms and related devices to allow customers to take active participation in consumption and pricing management, inclusively facilitating energy trading strategies.
- Distribution management systems (DMS)—automation technologies for managing and monitoring energy flows on the network, detecting and restoring faults (i.e., self healing mechanisms), as well as creation of links to increase network redundancy.
- Distributed energy sources (DES)—small scale decentralized generation equipment to facilitate microgrid schemes allowing continuous energy supply in cases of centralized power failures or unfavorable pricing/load conditions. Also comprises grid stabilization technologies to homogenize load profile, diminishing the impact of peak congestion.
- Energy storage solutions—devices to store energy in different points throughout the network to prevent energy waste and solve supply/demand imbalances.

Individual technologies related to transmission interconnection, automation and facilitating distribution management systems are widely developed and already in use (mostly used in isolation, however). In our view, communication systems and IT, and energy storage are less advanced areas in terms of commercialization and would benefit from more significant development efforts. Several demand response mechanisms have already been implemented by industrial consumers; however, efforts are still needed to simplify systems to facilitate their expanded use among residential consumers, in our view.

Exhibit 32: The building blocks of a smart grid
Schematics of a smart grid network



Source: Goldman Sachs Research.

Exhibit 33: The majority of smart grid technologies have already been developed

Examples of technologies enabling implementation of the smart grid concept

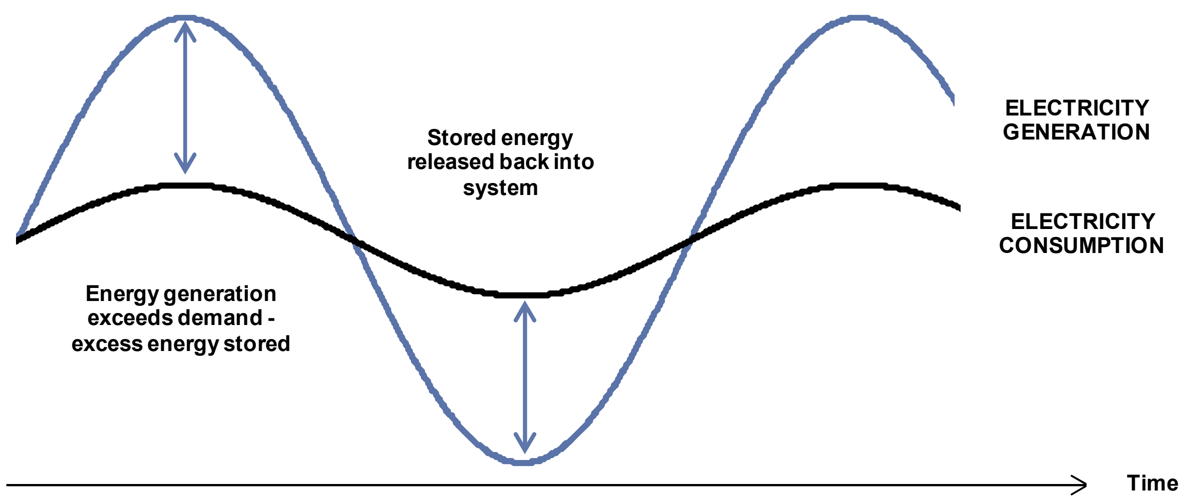
	Example of products	Summary description	Development stage
Transmission interconnections and automation			
Cables	HVDC	Ultra high and extra high voltage insulated cables for DC (>800kV) for transmission systems, allowing significant reductions in energy transportation losses	Commercialized
	Superconducting cables	Allow 3-5- times more current capacity vs. conventional cables at 10x lower losses	Under development
Equipment	FACTS	Flexible Alternative Current Transmission System - as defined by the IEEE is composed of a "power electronic based system and other static equipment that provides control of one or more AC transmission system parameters to enhance controllability and increase power transfer capability". Includes developments such as SVC (Static Var Compensator), TCSC (Thyristor Control Series Compensator), STATCOM (Static Synchronous Compensator). These systems allow to increase the transmission capacity close to the thermal limit and are a key component in the connection of intermittent energy to the grid	Commercialized
	HTSFCL	High Temperature Superconducting Fault Current Limiter - integrates detection, trigger and limiting functions, minimizing short circuit current events, thus improving network safety and reliability	Commercialized
	HTST	High Temperature Superconducting Transformers - transformers using high temperature superconducting materials, allowing efficiency improvements and lower loss levels	Developed
Software	Dispatching and monitoring systems for digital substations	Platform to allow advanced in real time visualization of network conditions (ideally 3D) through digitalized information gathering, transmission and processing of data and output	Commercialized
Advanced Meter Infrastructure			
AMI	Smart meters	Devices to allow two way communication between utilities and end users as opposed to traditional analogue or mechanical devices with no communication capabilities	Commercialized
	Meter data management systems	Platforms to allow remote management of meters comprising functions such as remote meter reading for billing on real-time, connect/disconnect capabilities, service disruption detection, load volumes and power quality monitoring; supported by communication platforms such as LAN, WAN and WiMax	Commercialized
Communication systems and IT Integration			
IT	Specialized Enterprise Control Systems	Systems to integrate all information from the various components of the grid and help to manage customers, assets, workforce, inventory, etc information in a coordinated manner in real-time	Commercialized
Demand Response Systems			
Energy management systems	For commercial and industrial users	Systems that compile detailed up-to-date information on the end user and its energy consumption patterns and the conditions of electricity traded in the network. These systems make it possible for users to smooth their daily demand profiles and should allow users to act as VPPs (virtual power plants) once all the elements of the smart grid are in place, namely appropriate storage devices	Commercialized
	For consumers		Developed
Devices	In-building displays	Equipment providing pricing, consumption, environmental and billing information	Commercialized
	Load-control devices	Tools that allow utilities to shift peak demand minimizing impact to customers	Commercialized
	Programmable communicating thermostats		Commercialized
Distribution Management Systems			
Wide area monitoring systems (WAMS)	PMU	Phasor measurement units for precise synchronization of data on a real-time basis	Commercialized
	GPS	Global positioning system to allow full visualization of network conditions	Commercialized
	LAN	Local area networks use as links between data gathering equipments and main WAMS stations	Commercialized
Volt-VAR optimization (VVO) / Conservation voltage reduction (CVR)	Tap changers	Equipment able to respond in real-time to grid and meter based systems in order to control the voltage level and the power factor throughout the grid, reducing reactive line losses and lowering the needs for total energy delivered	Commercialized
	Capacitor banks		Commercialized
Monitoring and diagnostics (M&D)	SCADA	Supervisory control and data acquisition systems performing monitoring and control functions over the elements of the distribution grid and collecting information related to energy flow parameters. These systems perform network modelling, simulate power operation, detect faults, identify risks of outages and allow participation in energy trading markets	Commercialized
Fault detection, isolation and restoration (FDIR)	Smart substation relays	Tools able to detect location and type of faults and automatically activate self-healing mechanisms or restoration process	Commercialized
	Fault sensors		Commercialized
	Mid-circuit reclosers and ties	Equipments that allow to isolate small damaged parts of the grid and redirect power to other routes allowing for continuous service	Commercialized
Distributed Energy Resources			
Alternative energy sources	Solar	On-site generation equipment allowing the concept of decentralized management and maintenance of the network, minimizing transportation losses and environmental impact and ensuring fault and outage impacts are restricted to smaller parts of the network	Commercialized
	Wind		Commercialized
	Hydro		Commercialized
Stability technologies	Decentralized gas power plants	Decentralized generation sources to optimize load in the grid, allowing higher efficiency, faster loading, lower emissions, faster electricity delivery, easier maintenance and simplifying extension potential	Commercialized
	Decentralized biopower plants		Commercialized
	Decentralized combined cycle power plants		Commercialized
Connection/Integration Systems	Electric vehicle charging systems		Developed
Energy Storage Solutions			
Storage	Pumped hydro storage	Storage systems with c.100MW capacity and appropriate to be located close to generation sources	Commercialized
	Compressed air energy storage	Storage systems with c.100MW capacity and appropriate to be located close to generation sources	Developed
	Lead-acid and NICd battery	Storage systems with <10MW capacity and appropriate to be located close in distribution networks or close to end users	Commercialized
	NaS	Sodium Sulphur batteries with capacity between c.100-1000kW appropriate to be located in distribution networks; has high charging/recharging capability, long lifetime and high energy density	Developed
	Lithium ion	Storage systems with <75MW capacity and appropriate to be located close to end users	Developed
	SMES	Super conducting magnetic energy storage with c.1-10MW capacity and appropriate to be located in distribution networks; storage under electromagnetic form allow very rapid response to network conditions	Under development
	Micro compressed air energy storage	Storage systems with c.1-10MW capacity and appropriate to be located in distribution networks	Under development
	Hydrogen energy storage	Storage systems with <10MW capacity and appropriate to be located close in distribution networks or close to end users	Developed
	FESS	Flywheel energy storage system with capacity between <1MW appropriate to be located close to end users; ideal for short term energy storage with no environmental impact and low maintenance requirements; very large energy storage density	Commercialized
	Liquid flow battery	Storage systems with <1MW capacity and appropriate to be located close to end users	Under development
	Super-capacitor	Storage systems with <100kW capacity and appropriate to be located close to end users	Under development

Source: Goldman Sachs Research estimates.

Smart grid will require additional energy storage solutions

Power demand faces peaks and troughs as consumption varies during the day. The introduction of a higher proportion of renewable energy creates additional variability given the unreliability of solar and wind generation in matching demand cycles. As a consequence, grid infrastructure will require higher capacities in order to manage fluctuation in supply and demand. While traditional solutions have dealt with variability in demand by variable supply solutions such as gas or diesel standby power; energy storage devices are becoming an increasingly viable alternative in managing energy demand fluctuations.

Exhibit 34: Energy storage solutions can help smooth out differences between electricity generation and consumption, an increasingly likely feature with an increasing share of renewable energy in overall electricity production



Source: Goldman Sachs Research estimates

According to the World Economic Forum, case studies in Belgium demonstrate that even just a 7% penetration of distributed wind turbines on the low voltage network can cause material reliability issues. This in turn emphasizes the need for appropriate energy storage solutions.

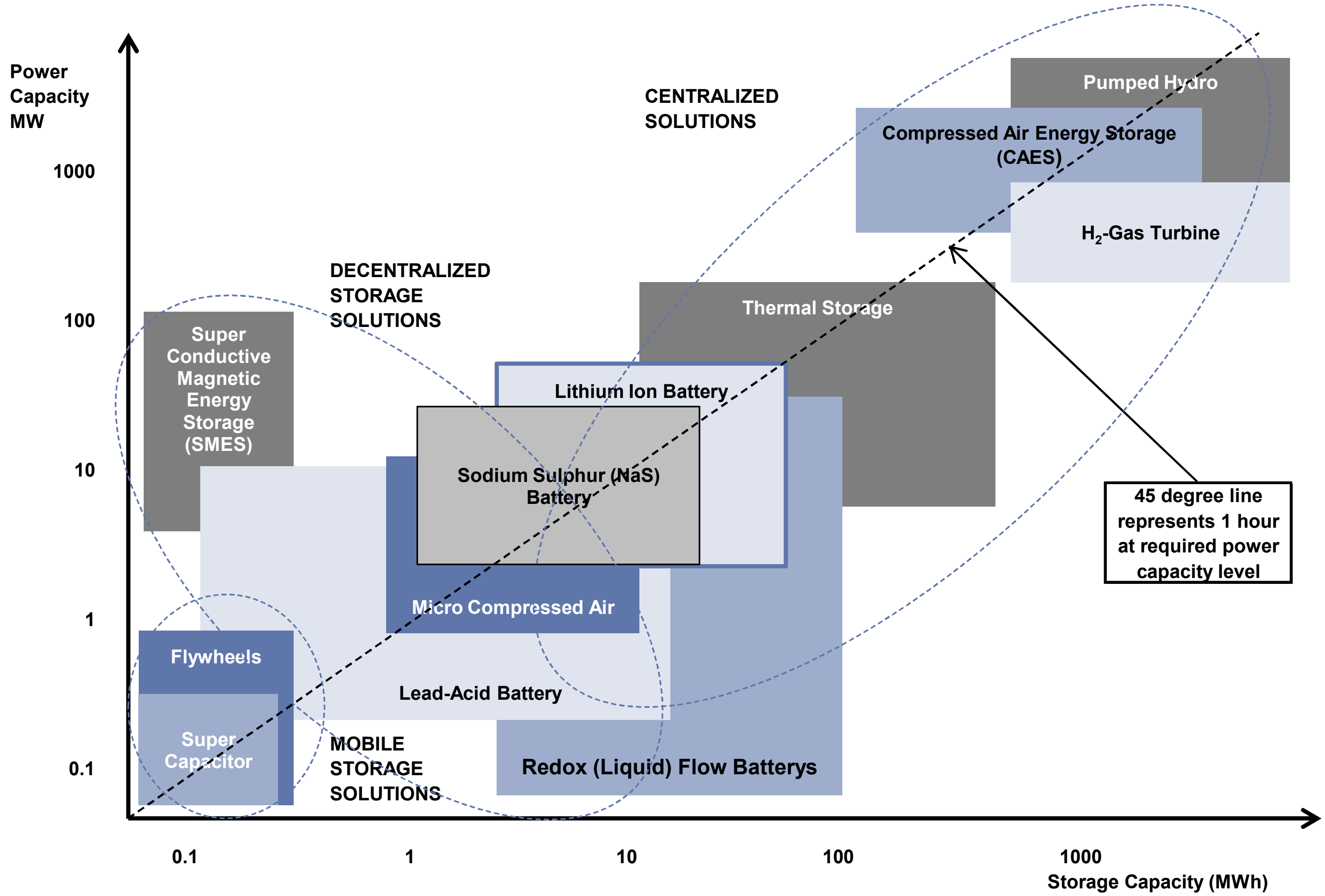
Several potential energy storage solutions exist:

- **Superconducting magnetic energy storage:** this method works by storing energy in the magnetic field generated by passing a direct current through a superconducting coil which has been cooled below its superconducting critical temperature.
- **Flywheel storage:** works by accelerating a flywheel to a very high speed and maintaining energy in the system as rotational energy. When energy is required back into the system, it is transferred from the flywheel by reducing its rotational speed.
- **Battery storage:** batteries convert chemical energy into electrical energy. A secondary battery is capable of being charged and discharged multiple times. Battery technologies vary from traditional lead-acid or nickel-cadmium to more recent technologies such as lithium ion and sodium sulphur. ABB's recent SVC Light with energy storage includes lithium ion batteries with storage potential of 5-50MW.
- **Compressed air storage:** at times of low energy demand, excess energy is used to compress air into large scale storage facilities (e.g., underground reservoirs such as salt domes, aquifers, depleted gas fields and mined caverns). When demand for electricity is high, the air is heated slightly and the expanding gas then passes through turbo-expanders to generate electricity.
- **Pumped storage:** at times of low energy demand, electricity is used to pump water to a high-storage reservoir from a low-storage reservoir. During peak demand water is then released and electricity generated through a hydro-electric generator.
- **Hydrogen:** excess energy can be used to generate hydrogen through the electrolysis of water, with the resulting hydrogen compressed or liquefied and then stored. When demand is high, energy can be converted back to electricity through a generator or through use in a fuel cell.
- **Plug-in hybrid/full electric vehicle networks:** plug-in hybrid and electric vehicles include a battery for storing electricity. A large scale network of PHEV or EV vehicles therefore produces a large scale distributed energy storage system. By allowing their vehicle to be used as a storage solution, owners have the potential to arbitrage differing power prices through the day.

Exhibit 35 illustrates each potential storage solution in terms of overall capacity and power rating that can be achieved. An average household in a developed market consumes approximately 6,900KWh per year (ranging from 4,343KWh/year in EU15 to 11,040KWh in the US), with peak demand at significantly higher levels.

Storage solutions can be divided into three main categories – mobile solutions, which can be fitted into individual devices or mobile applications; decentralized solutions which can be added to transmission and distribution grids, as well as providing large scale back up solutions for industrial customers and solutions for centralized applications which sit at site of electricity generation (such as solar or wind farms).

Exhibit 35: Storage solutions that can be placed in all areas across the grid already exist
Landscape of storage solutions by capacity of associated source vs. storage capacity



Source: Siemens, Goldman Sachs Research.

To maximize the benefits of introducing energy storage, the networking of thousands of energy storage devices is needed.

As we show in Exhibit 36, storage solutions vary depending on the role they should play on the grid:

- Pumped hydro storage, CAES and hydrogen storage are more adequate in matching base load demand close to centralized generation resources.
- Thermal storage, batteries and micro compressed air are more adequate as backup sources to be used in cases of failures and outages.
- SMES, batteries, micro compressed air, flywheels and super-capacitors are all appropriate as backup for intermittent sources such as wind or solar
- Flywheels, SMES and super-capacitors are also adequate as decentralized on site devices to ensure end-user power quality

Exhibit 36: Categorization of storage systems required for different grid functions

	Appropriate storage solutions depending on grid function			
	Storage close to base load generation equipment	**Storage for grid stabilization/backup power equipment**	**Storage to level out renewables intermittences**	**Storage to ensure user power quality**
Power Capacity	<1MW to hundreds of MW	1-200MW	20kW-10MW	1kW - 20MW
Response time	<10 min	<10 ms (prompt) <10 min (conventional)	<1 sec	<20 ms
Storage capacity	1-1,000 MWh	1-1,000 MWh	10kWh to 200MWh	50-500 kWh
Efficiency	High	Medium	High	Low
Long cycle and lifetime	High	High	High	Medium

Source: US DoE.

Exhibit 37: Comparison of costs and technical metrics for various energy storage solutions

Technology	Capital Cost indication	Storage type	Storage density	Maintenance	Lifespan	Environmental impact	Working temperature requirement	Response time	Duration of discharge at maximum power level	Cycle efficiency	Technology maturity	Comments
Pumped hydro	$700-2,000/KW	Mechanical	Low	Low	c.40 years	Medium	Normal	30ms	c.12h	c.87%	Well developed	+ Well suited for applications requiring large power levels and long discharge times and situations where fast supply of power is needed (spinning reserve), meeting sudden demand peaks, frequency regulation and voltage control - Requires large generation station and water reservoir close to power plant - Expensive to site and build - Long construction time - Large scale only
Compressed air energy storage (CAES)	$700-1,000/KW	Mechanical	Very high	n.a.	c.30 years	Low	Normal	3-15 min (large scale)	4-24h	c.80%	Relatively developed	+ Multiple units can be located on a single site + Can operate on short enough time scale to smooth out wind natural fluctuations - Geographically limited - Requires fuel input - Long construction time
Hydrogen storage	n.a.	Chemical	Very high	Very frequent	10-20 years	Medium	High	<3min	As needed	30-40%	Developing	+ Modular + System can be fully discharged at all current levels - Storage in geologic formations other than salt caverns may not be feasible - Electrolyzers and fuel cells require cooling - Large investments required to build initial infrastructure
Thermal storage	n.a.	Mechanical	Dependent on technology	n.a.	c.30 years	Low	Normal	<30min	<16h	>90%	Well developed	Performance variable depending on technology: >Low efficiency for ice, good for low temperature fluids and excellent for chilled water > Low charge/discharge capability for ice and good for others > Very low economies of scale from ice, good for low temperature fluids and excellent for chilled water - Large investments required to build initial infrastructure
Lithium Ion Battery	$1,500-3,500/KW	Chemical	Medium (80-200Wh/L)	equent (c. 6 montl	3-5 years	High	Normal	30ms	<1h	85-95%	Well developed	- High self-discharge rate; requires special charging circuit - Limited availability of cobalt - Requires sophisticated battery management - Safety issues require special handling
NaS battery	$1,000-2,500/KW	Chemical	High (145-150Wh/L)	Frequent	>15 years	Medium	Very high	30ms	1-8h	85-90%	Relatively developed	- High working temperature requirements (300-350C) and highly corrosive nature of sodium polysulfides makes it more suitable for large-scale non-mobile applications - Backup generator required
Micro compressed air	n.a.	Mechanical	Very high	n.a.	c.30 years	Low	Normal	3-15 min (large scale)	4-24h	c.80%	Developing	+ Can operate on short enough time scale to smooth out wind natural fluctuations - Geographically limited - Requires fuel input
Lead-acid battery	$300-800/KW	Chemical	Low (40-80Wh/L)	equent (c. 6 montl	3-5 years	High	Normal	30ms	1-8h	70-85%	Well developed	+ Wide availability (45-50% of battery sales) - Wear out very quickly when charge and discharged frequently - Capacity falls with decreasing temperature below 77F
Redox (liquid) flow batteries	$700-2,500/KW	Chemical	Low (15-25Wh/L)	n.a.	2-10 years	High	Normal	30ms	1-8h	70-75%	Relatively developed	+ Can be left discharged for long periods with no negative effects + Can be recharged simply by replacing the electrolyte + Suffers no permanent damage if electrolytes are mixed + Almost unlimited capacity by using storage tanks of increasing size + Scalable for large applications + Easily upgradable - Limited opportunities for standard sizes
Super conductive magnetic energy storage (SMES)	n.a.	Electromagnetic	High	Very frequent	> 20 years	Low	Very high	5ms	10s	c.95%	Relatively developed	+ Electromagnetic storage does not require transformation during application - very quick system response - Key issue is that it must run at liquid nitrogen temperatures, implying very high maintenance costs
Flywheels	High Power: $200-500/KW Long Duration: >$3,000/KW	Mechanical	High	Low (>10 years)	> 20 years	Low	Normal	5ms	Minutes to <1h	c.93%	Well developed	+ Favourable performance/price ratio + Suitable for applications where storage time and capacity ranges from short to Long term, driven by excellent cycled usage and load tracking performance + Quick recharge - Independent power and energy sizing - Large standby losses - Potentially dangerous failure modes
Super capacitor	<$700/KW	Electromechanical	Very high (100-2,000Wh/L)	Low (>10 years)	> 20 years	Low	Normal	5ms	10s	c.95%	Relatively developed	+ Suitable for short-duration applications, such as backup for brief power outages + Excellent for stabilizing voltage and frequency + Quick recharge - Sloped voltage curve requires power electronics

Source: Electricity Storage Association, IEA, NETL, Goldman Sachs Research.

Smart grid will introduce significant number of new players into the T&D market

We have undertaken a benchmark analysis to identify possible competitors to our coverage universe in the various technological areas of smart grid implementation. Our study suggests that smart grid will open the T&D landscape to non-traditional players, such as battery and IT companies. The fact that some of the technologies are relatively recent in terms of commercialization has also attracted several start-up players to the field. Given likely scale benefits, we believe consolidation remains a potential outcome in this area over the next decades (for example, ABB has recently acquired Ventyx, a niche player in communications and systems for smart grid).

Exhibit 38: Competitive landscape of smart grid equipment providers

Covered companies in bold

Transmission interconnections								
Cables	**Nexans**	**Prysmian**	**ABB**	American Superconduct	Furukawa Electric	Sumitomo Electric	Fujikura	Changyuan Group
Equipment	**ABB**	**Siemens**	**Alstom**	GE Energy	3M	American Superconductor	PowerSecure Internation	Toshiba
	Hitachi	Sieyuan Electric	Nanjing Automation	WEG	Crompton			
Software	**ABB**	**Alstom**	Ligong Online Monitoring Technology					
Advanced Meter Infrastructure								
Meters	**ABB**	GE Energy	Landis+Gyr AG	Eaton	Itron	Sensus	Elster	Echelon
	Schneider	Stark	PowerSecure International	Electro Industries	Freescale Semiconducto	Horstmann Controls	Texas Instruments	Pacific Control Systems
	Siemens	EKA Systems	Scweitzer Engineering Labs	SmartSynch	Sentec	Kinects Solutions	Kamstrup	Nuri Telecom
	Renesas	**Saft**	Linyang Electronics	Wasion Group	Ningbo Sanxing	Sunrise Technology	Hangzhou PAX	
Meter data management	**ABB**	GE Energy	SilverSpring	Honeywell	Landis+Gyr AG	Itron	SmartSynch	eMeter
	Siemens	Cooper	Kinects Solutions	Aclara	Green Energy Options	Onzo	Energy Tracking	Google
	Schneider	Triliant	Ecologic Analytics	Elster	Echelon	Aclara	EKA Systems	Wasion Group
	Integrated Electronic Systems Lab		Sunrise Technology	Hangzhou PAX				
Communication systems and IT Integration								
Integration (inc. outage management)	**Schneider**	**ABB**	IBM	Oracle	GE Energy	Elster	Telvent	Cisco
	Siemens	NARI	Redline Communications	Tropos Networks	Telus	AT&T	Sprint	Verizon
	Invensys	Current	Intelagrid	Intel	GridNet	Bridge Energy	BPL Global Limited	Osisoft
	Milsoft	Cooper	Augusta Systems	RuggedCom	ETAP	Microsoft	Intergrapah	CGI
	OATI	Fujitsu	NEC	Renesas	Nanjing Automation			
Demand Response Systems								
Energy management systems	**Invensys**	Honeywell	Eaton	EnerNoc	Comverge	Tendril	Echelon	Gridpoint
	Schneider	**ABB**	Telebright Software Corporal	Rltec	Powerit Solutions	Advanced Telemetry	Digi International	Watteco
	Open-Peak	Cpower	Bridge Energy	Sequentric	Control4	Ember	Gain Span	Greenbox
	Cooper	CGI	MicroPlanet Technology Cor	iControl Networks	Telkonet	Toshiba	Nanjing Automation	Integrated Electronic Systems Lab
Devices	**Legrand**	**Schneider**	Cooper	Aztech	AlertME.com	Blue Line Innovations	Echoflex Solutions	Energate
	3M	Infotility						
Distribution Management Systems								
Wide area monitoring systems (WAMS)	**ABB**	**Siemens**	**Schneider**	GE Energy	Hitachi	Mitsubishi Electric		
Volt-VAR optimization (VVO) / Conservation voltage reduction (CVR)	**ABB**	**Siemens**	GE Energy	Cooper	Smarter Grid Solutions	Current	Rongxin Power Electronic	
Monitoring and diagnostics (M&D)	**ABB**	**Siemens**	**Schneider**	GE Energy	Telvent	Cooper	Kinects Solutions	Current
	LIOS Technologies	LIOS Technologies	Eaton	Fujikura	Mitsubishi Electric	Toshiba	CSR Times Electric	XJ Electric
	Sieyuan Electric	Nanjing Automation	NARI	Integrated Electronic Systems Lab		Qingdao Tgood Electric	Ligong Online Monitoring Technology	
	Wuhan Zhongyuan Huadian Science & Technology							
Fault detection, isolation and restoration (FDIR)	**ABB**	**Siemens**	GE Energy	Eaton	S&C Electric Company	Schweitzer Engineering Labs	PowerSecure Internation	Current
	Fujikura	Mitsubishi Electric						
Distributed Energy Resources								
Solar	**Siemens**	**Schneider**	**ABB**	Mitsubishi Electric	Toshiba			
Wind	**Siemens**	**Alstom**	**Schneider**	**ABB**				
Hydro	Voith	Andritz	**Alstom**	**ABB**				
Stability services	**Wartsila**	**ABB**	Caterpillar	Beacon Power	Clou Electronics	Shenzhen Auto Electric Power Plant		
Connection/Integration Systems	S&C Electric Compan	Smarter Grid Solutions	PowerSecure International	**ABB**	Sieyuan Electric			
Energy Storage Solutions								
Storage	**ABB**	A123Systems	Coulomb Technologies	Beacon Power	Electrovaya	Vallence Technology	Ice Energy	AeroVironment
	Siemens	**GE Energy**	NGK Insulators	Maxwell Technologies	Enersys	Ener1	Exide/Axion	Firefly Energy
	Hitachi	Itochu	Mitsubishi Electric	NEC	**Saft**	Toshiba	Dresser-Rand	CAES Development Company
	Energy Storage and P	Ridge Energy Storage	NESS	ESMA	ELIT	PowerSystem	Active Power	AFS Trinity Power
	Piller	Delco	Urenco Power Technologies	East Penn	Teledyne	MWH	Optima Batteries	Winston Salem
	JCI Battery Group	Trojan	Crown Battery	Evionyx	AER Energy Resources	Metallic Power	Chew Tek	Power Zinc
	Electric Fuel	Alupower	Aluminium Power	Zoxy Energy Systems	Prudent Energy	ZBB Energy	Premium Power Corp.	RedFlow Technologies

Source: Goldman Sachs Research.

Chinese players likely to change competitive landscape and increase scale benefits

We believe that smart grid adoption in China is likely to be faster and more standardized than other regions. This will facilitate the emergence of strong local companies competing directly with international players in the domestic market, particularly in areas requiring less high-tech advancements.

International players should be able to sustain market leadership in high technology areas (such as DMS), as long as they have established a strong local footprint. Furthermore, we believe the size of the Chinese market will deter domestic companies from aggressively competing internationally, at least in the medium term.

China's T&D market is already the largest globally, representing c.25% of total T&D annual investment. We believe that local Chinese companies are in a privileged position to develop both technical expertise, leveling playing field vs. western firms, and gain potential scale advantage. There are two government-owned electricity grid operators in China, The State Grid (covering 88% of the territory) and Southern Grid, and there are no plans to open the market to competition. This monopoly gives China an advantage in the installation of a smart grid, as standards and compliance can be more easily implemented, since the company that operates the investment also supervises standards.

China is developing aggressive targets for its smart grid implementation and local equipment providers are already benefiting from the related growth, having been the main beneficiaries of the recent rounds of funding. Steps taken towards a smart grid so far include:

- In early 2010, China's Premier, Wen Jiabao, mentioned smart grid construction as a national priority and set the target for China to complete the upgrade by 2020 (smart-grid.tmcnet.com; May 24, 2010).The State Grid has published two smart grid development plans: the Plan for Research and Manufacturing of Smart Grid Key Equipment (including 28 projects in seven systems-related areas) and the Plan for Technological Standards Systems of Smart Grid (proposing a technological standards system as sophisticated as that being proposed in developed countries, with 92 standard series, 26 technological areas and 8 branches of general planning, smart power generation, transmission, transformation, distribution, use, dispatching, communication and information).
- Last July, the NDRC (National Development and Reform Commission) has approved the draft Alternative Energy Development Framework (pending approval by the State Council) for a c.Rmb5 tn investment from now to 2020. Our Asia-Pacific Capital Goods research analysts believe the development of smart grids will be a priority (please refer to *China: Clean Energy: 2020: New energy policy may focus on both efficiency and diversity*, July 22, 2010).
- State Grid's smart grid construction will move from pilot to construction in 2011, and is expected to have WAMS well developed by 2012 with PMU sensors in all generators of 300MV and higher and in all substations of 500kV and higher. Construction of the power consumption data collection systems has already started in 2010.
- AMI should be fully implemented by 2020.
- State Grid is actively developing a UHV (Ultra High Voltage–1,000kV AV and 800 kV DC) and is leading a project to create a unified and integrated information platform (SG186 Project–one unified IT system, 8 business application systems and 6 information support systems).

We believe domestic players will gain scale and importance first in the smart grid areas with less technological barriers to entry and where cost advantages are more important. Currently, out of the 18 Chinese names we consider preeminent in smart grid, six are highly focused on AMI (Exhibit 39). Also, several local players already have various products for transmission automation, which is comprehensive given the focus the State Grid has been putting in the last few years on developing the network.

Despite China's domestic players' potential to growth, we expect international players to retain a clear lead in areas with higher technology requirements, such as distribution management systems, communications and IT, distributed energy sources and energy storage, over the medium to longer term. We believe three factors will be key for international companies trying to compete successfully in the Chinese market:

- Scale: Gain the necessary size to be able to meet competing technology and product standards, keeping a technology edge
- Low cost production—according to McKinsey's report, *McKinsey on Smart Grid* (published in the summer of 2010), some power equipment can be 30%-50% cheaper in China than comparable products manufactured in developed markets.
- Local Chinese presence and ability to participate in Chinese market—given this market is extremely relationship and proximity dependent.

Finally, although we expect significant growth from local players and some have been exporting, the size of the internal opportunity (c.17% of the total smart grid opportunity) will make it less attractive for Chinese players to aggressively expand internationally in the medium term. In the longer term, we expect them to be more prone to expand first in other emerging markets (with similar grid expansion challenges to China) than in developed markets. Indeed, Wasion is already developing some pilot projects in South America.

Exhibit 39: Several domestic players have emerged in the Chinese smart grid landscape

Key Chinese players in smart grid

Key emerging Chinese players	Revenues 2009 (RMB mn)	Revenues 2009 ($mn)	Comments
Zhuzhou CSR Times Electric	3,325.59	489.06	Subsidiary of China South Locomotive & Rolling Stock Corp. One of the pioneers in the development of power electric components in China, focusing on electric converters and control systems. In 2009 signed a partnership agreement with Areva T&D, where Areva will bring its HVDC and FACTS expertise along with Times Electric thyristor technology and both parties will look for business opportunities in China and externally. Listed in Hong Kong since 2006.
XJ Electric	2,835.45	416.98	Primarily engaged in research, development, manufacture and distribution of automation, protection and controlling products for electric power systems. Provides power grid and power generation equipment, transformers, electrical systems, power distribution network products, direct current (DC) power distribution systems, including power supply and distribution automation equipment, power grid security and stabilization controlling devices, power management information systems, technology supporting systems for power market, relay protection and automation controlling equipment, relays, electronic measuring meters, medium-voltage switches and switch cabinets, as well as transformers and combined substations. Acquired by State Grid early this year.
Shanghai Sieyuan Electric	1,879.33	276.37	Involved in online monitoring, digital substation, flexible power transmission, electric vehicle charging cabinets and other smart grid related activities.
Guodian Nanjing Automation	1,850.13	272.08	Engaged in the technical research, product development, production, sales and engineering service in the fields of power transmission and distribution protection, power grid automation, power plant automation, water resource and electrical automation, industrial and rail transit automation, electric energy saving and environment protection, water environment protection engineering, geotechnical engineering and main dam. Key smart grid focus areas include digital substations, distribution automation, electric power information management, and electric power marketing information systems. State Grid owned.
NARI Technology Development	1,778.69	261.57	Focuses in the development, manufacture and sale of software and hardware products serving the power industry, as well as the provision of system integration services. Offers products such as: power grid dispatching automation, electricity market commercial operating systems, substation protection and composite automation products, rural power/power distribution automation products and terminals, thermal power plant and industrial controlling automation products, power usage automation products and terminals, and electrical control automation products.
Jiangsu Linyang Electronics	1,320.00	194.12	One of the largest energy meters manufacturer in China. Linyang has established branch offices in 23 provinces, and domestic market share of c.18%.
Wasion Group Limited	1,078.17	158.55	Focuses in AMR and AIM. In 2008 opened the largest manufacture base and R&D center of electricity metering in China with production capacity of 3mn 3-phase meter, 10mn of single-phase meters and 1mn of data collection terminals per year (ramped up by end of 2009). Second winner in terms of Chinese funding awarded in 2010. Investing 5% of revenues in R&D annually. It is listed since 2005 and has international offices in Europe, South East Asia, South America and North Africa. Currently doing pilot testing's in Chile, Brazil and Peru. Has a strategic partnership with Siemens since May 2010 to jointly develop smart grid projects in China and overseas.
Changyuan Group	957.33	140.78	Manufacturer of power cable accessories and heat shrink products for the power industry as well as for electronics and telecommunications. Exports 30% of group sales. According to an announcement published by Changyuan Group on Mar. 10, Shenzhen Changyuan Yingjia Investment Co., Ltd., a wholly-owned subsidiary of the group, joined hands with Shenzhen CDF-Capital Co., Ltd. and Shenzhen Pengneng Investment Holdings Co., Ltd., to set up a fund focusing on smart grid-related enterprises.
Rongxin Power Electronic	874.13	128.55	One of the largest SVC manufacturers in China, with the biggest number of local patents and producing using international using international standards. Quoted in the US Smart Grid Information Clearinghouse (sponsored by DoE) as one of the vendors of static shunt compensators (STATCOM) for voltage regulation used on alternating current electricity transmission networks.
Shenzhen Clou Electronics	430.63	63.33	Specializes in R&D, manufacturing, global marketing and customer service of Electric Power Automation Equipment and related smart units. Provides a broad range of products, covering 5 main areas: GZDW microcomputer--controlled high-frequency switching DC power supply system; special UPS for power industry and power supply inverter system; core or key components of DC power supply system; instruments used for power equipments; battery and welder.
Integrated Electronic Systems Lab	300.23	44.15	Focuses on power grid dispatching automation, substation automation, power distribution automation, power energy information collection management, automatic urban facilities and energy management systems and energy saving products.
Qingdao Tgood Electric	263.42	38.74	China's largest R&D and production base of box-type transformer substation, with annual capacity of 5,000 units.
Shenzhen Auto Electric Power Plant	140.07	20.60	Engaged in R&D, manufacture, sales and service of electric auto power supply equipment and its intellect units. Its three main products are microcomputer-controlled high-frequency DC power supply system, power dedicated UPS power supply and power dedicated inverter power supply system and power dedicated DC&AC integrated UPS equipment. The company researched and independently developed more than 870 items of core components, which apply for the electric power requirements, included in 20 main kinds, including centralized monitor equipments and microcomputer isolation monitor equipments.
Ningbo Ligong Online Monitoring Technology	124.04	18.24	Engaged in research, development, design, manufacture and distribution of high electric voltage online monitoring products. Products include transformer online monitoring systems (online multi-gas analyzers, temperature load online monitoring systems, partial discharge online monitoring systems and iron core grounding monitoring systems); gas insulated switchgear (GIS) online monitoring systems (partial discharge online monitoring systems, gas leakage online monitoring systems and GIS action features online monitoring systems); cable online monitoring systems (cable temperature online monitoring systems and cable partial discharge online monitoring systems), and other products (UV and visible light dual spectrum imaging systems, transformer switch online oil filter, etc).
Wuhan Zhongyuan Huadian Science & Technology	118.22	17.39	Leader in the Chinese electric power intellectual record analysis and time synchronization-related field. Main products include: electric power fault recording and analysis equipment, time synchronization systems, relay protection systems, measuring instruments, fault recording and analysis equipments (including transmission line recording, generator recording, transformer recording and portable recording).
Ningbo Sanxing	n.a.	n.a.	Subsidiary of AUX Group with more than 20 years experience in electricity metering. One of the largest manufacturers of meters with annual capacity for 25mn meters and 30% market share in China. Allocates 8% of sales to R&D annually. Its product line includes equipment from electric energy measurement, terminal management, main station construction, to all sorts of transformers, switch cabinets and automatic distributing devices with their accessories.
Hangzhou Sunrise Technology	n.a.	n.a.	Focuses on advanced technology in metering products and metering system solutions. As annual production capacity of 3 million metes and an installed base of 20mn. . Also offers data concentrators and communication modems for integrated AMI solutions.
Hangzhou PAX	n.a.	n.a.	Wholly-owned subsidiary company of Hi Sun Technologies (listed in Kong Kong). Leading enterprise in China's electronic measuring instruments sector. Has been focusing on developing electronic energy meter and relevant automatic systems with high technology. Also offers integrated solutions including AMI, substation data management systems, distribution data management systems, residential data management systems, etc. Established a partnership with GE in 2006. Annual production capacity of 3.6mn meters.

Source: Company data, Goldman Sachs Research estimates.

Key challenges: Technical integration, aligning incentives and consumer adoption

We believe that the development of a smart electricity grid faces challenges from three key areas: 1) technical challenges related to addressing inter-operability and standardization, particularly relevant in areas where adoption of new technologies is required; 2) ensuring adequate incentives are in place to encourage investment and that costs and benefits are appropriately aligned among the various players in the electricity chain, and 3) overcoming consumer resistance to adoption of new technology and ensuring that changes in the method by which electricity is consumed is both accepted and equitable.

Technical challenges include:

- Ensuring inter-operability between networks: Standards and requirements in electricity networks vary between countries and there is a risk that the introduction of additional IT and communication systems into the grid network may increase these differences. Furthermore, the development of distributed energy sources, and the ability of consumers to interface with the grid in a two-way manner, also raises additional challenges in ensuring consumer technology is compatible with that of utilities and generation companies. Solving inter-operability issues and moving towards harmonized standards is therefore important to ensure a unified grid can be completed.
- Cyber security: With increased information flows, the risks of cyber attacks increase. Increasingly detailed usage data on consumers introduces additional privacy and protection concerns, which will need to be addressed.
- Compatibility with existing networks: Upgrades in technology need to be able to achieve full integration with existing electricity networks without requiring wholesale replacement.

Incentive challenges include:

- Ensuring consumer benefits are shared with utilities: Utility companies' revenues are related to the amount of power they supply to customers. The development of a smart grid challenges this model by requiring investment in technologies which ultimately are likely to result in lower consumption and at lower average prices benefitting consumers, but negatively impacting utilities.
- Making sure that social benefits are fully captured: As discussed on page 26, the overall benefits of implementing a smart grid significantly outweigh the cost. However, many of these benefits are public in nature (e.g., the cost to society of black-outs in terms of lost output or the full benefits from lower CO_2 emissions), and therefore cannot be captured fully through a market system. Consequently, those parties undertaking investment are not fully rewarded for their efforts.
- Ensuring benefits are aligned with those who bear the cost. In many countries the operation of transmission and distribution grids is separate from power generation. Grid investments benefit generation companies in reducing the level of stand-by capacity required, creating a divergence in the allocation of costs and benefits from the implementation of a smart grid.
- Ensuring adequate return on investment; even in areas where costs and benefits are aligned. The regulated nature of many of the sections of the energy market means utilities are not always fully rewarded for investment, thereby reducing the incentive to invest.

Consumer challenges include:

- Consumers' current lack of awareness about what smart grid entails. According to surveys undertaken by GE, 79% of people in the US were not familiar with the term "smart grid" and of the ones that claimed to be familiar, 69% were not sure if they were already connected to one.
- Consumers' inertia to change usage practices and legacy behaviors. The outcome of electricity liberalization over the last decade is a good example highlighting how consumer demand response implementation can be a challenge: in the UK for example, even though consumers have been able to switch providers for more than ten years, less than 20% have switched suppliers over the period; for Europe as a whole, the number is even lower at 10%.
- To fully realize the benefits of home automation, appliances need to be able to communicate to energy meters and the grid in order to determine when to be turned on and off to respond to differences in electricity prices during the day. With an average lifespan for a major household appliance of 13 years, the initial penetration of "smart appliances" is likely to remain low, thereby reducing the potential benefits to consumers. However, the recent US white goods 'cash for clunkers' shows the government is focused on improving the installed base.
- Dynamic billing strategies which vary the cost of electricity at different times of the day raise equity concerns. While some households may be willing to reduce demand at peak time to save energy, others may be unable to (e.g. elderly or disabled) and as a consequence face higher energy bills, which may not be acceptable from an equity consideration, thereby resulting in regulatory limits on the extent that dynamic billing can be introduced.

Regulation and governments have a key role to play in our view

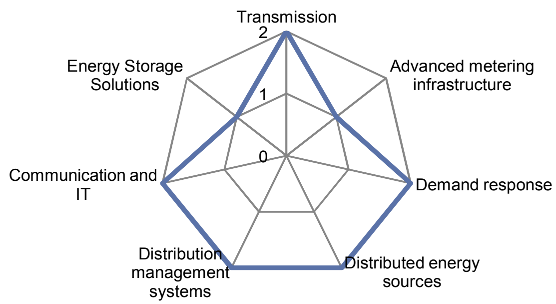
The level of investment that we estimate is required for a smart grid over the next 30 years, and the fact that the majority of associated benefits are societal rather than economic make government intervention, particularly regulation and appropriate investment incentives, a key determining factor in the roll out and success of the smart grid growth opportunity.

- **Development of uniform standards:** The Institute of Electrical and Electronics Engineers (IEEE) has 59 approved standards related to smart grid applications. A further 33 standards however remain in development, illustrating the challenges which remain in setting uniform technical standards, which we believe are key for allowing complete integration of a uniform grid.
- **Encouraging open architecture:** While having uniform standards, it is critical that those are set in a way that allow use of various competing technologies and avoid dependence on a reduced number of suppliers/solutions to be able to integrate the grid. Interoperability between IEDs (intelligent electronic devices) is a critical factor for smart grid implementation.
- **Ensuring adequate payback of utilities investment in regulated markets:** Utilities are compensated on the basis of the amount of energy sold and are subjected to maximum allowed return on capital schemes, thus have no clear incentive to invest in technologies that contribute to overall consumption reduction. Introduction of dynamic pricing schemes (reflecting current market conditions), preferential tax rebates for capital investment and allowance for accelerated depreciation are some of the ways to create an incentive for utilities to be proactive in investing in the grid.
- **Appropriate incentives for investment in aligning social and utility costs, as a way to address large social benefits and public externalities arising from reducing energy consumption:** We believe that one aspect that regulators should take into account when setting regulation mechanism for utilities is having compensation schemes linked to expected societal benefits from the capital investment, this way utilities will have a reason to introduce smart grid plans that not only maximize their economic benefits but also take into account solutions with higher societal benefits. Compensatory mechanisms linked to emissions reductions or the decrease in network congestion and outages are examples of schemes incentivizing investment in areas with higher societal benefits.
- **Encouraging consumer adoption of new technology through education about the benefits from increased home automation:** Evidence from GE's survey in the US shows that only 21% of consumers are aware of a smart grid and its entailed benefits and of these, 69% are not sure if they are already connected to a smart grid. With household appliances having an average lifespan of 13 years in developed markets, mainstream marketing of the benefits of smart grid and direct subsidies (such as recent scrappage schemes in the US) are likely to be required to speed up introduction of appliances which can be integrated into home automation systems.
- **Coordinating investment across competing network players to ensure that benefits and costs are fairly shared:** Particularly in markets where generation and T&D assets are held by separate parties, it is critical that regulators ensure an appropriate allocation of incentives among players (i.e., generation companies can satisfy the same demand with less capacity requirements due to smart grid technology, but the ones that bear the cost of increased efficiency are the grid operators that need to invest in smart technologies).

ABB (ABBN.VX, Conviction Buy, 12-month price target SFr33, 60% upside)

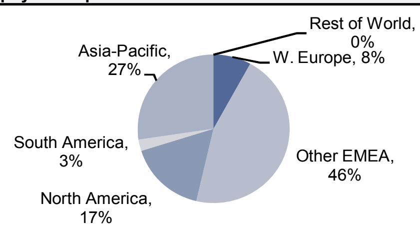
Exhibit 40: ABB's smart grid exposure and investment view
Closing price SFr20.6

Smart Grid Profile

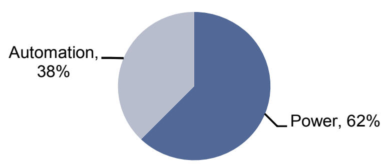


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	16,540	16540
Share of group revenues smart grid focused	55%	
Share of group profit smart grid	69%	

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure

ABB is the one company in our coverage with the broadest portfolio and exposure to the smart grid opportunity and we believe it will be one of the major winners in this competitive landscape. It is exposed to the segment mainly through its Power Products and Power Systems divisions, although part of its Low Voltage Products division can also benefit from it.

Views on drivers for smart grid: ABB sees smart grid as being driven by 3 key themes: 1) increased electricity demand (to double by 2030); 2) increased requirements for network reliability as economies digitalize; 3) electricity is the largest and fastest source of fuel emissions. ABB believes the trigger for investment will differ by region: in the US it will be reliability, in Europe energy efficiency and in developing regions it will be setting the infrastructure.

Views on technology: According to ABB, the key smart grid technology categories are: 1) Decision intelligence; 2) Communication; 3) Sensor/Actuator; 4) Power conversion/transport/storage/consumption. ABB is widely present in all these areas, which gives it an advantage when bidding for any turnkey projects or in offering bundled solutions.

ABB Positioning: In several technologies, ABB is the supplier with the longest experience in smart products (e.g., ABB has more than 10 years experience with static var compensation with more than 23 projects commissioned so far).

As a way to keep its leadership in the smart grid field, ABB has been active in investing in smaller companies with relevant positions in the field, as it did recently through the acquisition of Ventyx and the investment in Trilliant. Ventyx provides communications and IT services for utilities, with particular focus in the areas of asset management, workforce management, billings and pricing, energy trading, risk management and energy market operations. Trilliant focuses on AMI and other wireless based smart grid applications.

ABB is also involved in various smart grid pilots across the globe, such as MEREGIO (involving equipment integration, transmission and distribution automation, demand response and storage in 2 networks in Germany), Nord E.ON 1 – HVDC Light (turnkey delivery including platform, full grid code compliance, and supporting surrounding transmission grid with reactive power), Karnataka, India – Network Manager (integrated solutions for energy audit and billing using Network Manager SCADA/EMS/DMS system, with satellite and leased line communication to more than 867 locations).

Current Investment View

Investment View: We believe ABB shares offer attractive exposure to structural growth opportunities present in the T&D and automation markets in the coming cycle. We continue to see strong structural growth prospects in power, driven by increasing electricity demands, as well as structural growth opportunities in automation driven by rising industrial production in emerging markets, accelerated by increased labour to capital substitution as wages costs increase). AS emerging markets represent 46% of sales in 1H2010, BRIC countries 22% of 2009 sales, and given a strong local position in China in both power and automation (14% of sales), we believe ABB is also well-positioned to capture growth in these faster growing regions. Given its sector leading industry positioning, ESG score and top-quartile returns, ABB is already a member of the GS SUSTAIN Focus List. Historically, ABB's EV/EBIT multiple has expanded its book to bill ratio has increased. ABB's book to bill ratio was 1.09x in the first half, but as yet its multiple has yet to further expand. Therefore, we would expect improving large order intake at ABB to drive outperformance. We believe further signs of declining pricing pressure, or acceleration in savings from cost-cutting measures, could also provide for a multiple re-rating for ABB.

Group Financials

(FY; US$mn)	2008	2009	2010E	2011E	2012E
Revenues	34,912	31,795	30,442	33,504	37,031
organic sales growth	*15%*	*-5%*	*-3%*	*10%*	*11%*
GS EBIT	5,456	4,157	4,200	5,200	6,130
margin	*15.6%*	*13.1%*	*13.8%*	*15.5%*	*16.6%*
GS EPS	1.69	1.24	1.29	1.56	1.87

Valuation: Our 12-month target price of SFr33 is based on 12.8x EV/EBIT on 2011 forecast EBIT and EV adjustments. We give ABB a 1.8x premium to reflect its above-average structural growth (0.8x for smart grid related opportunities) and a 1.0x premium to reflect its top-quartile returns profile (vs. sector multiple of 10x).

Key Risks: Key risks to the downside include value-destructive M&A, weaker cash flow, increased pricing pressure, weaker US$ vs. SFr, slower recovery.

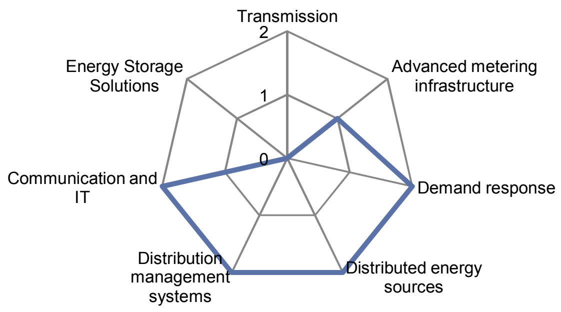
ABB Ltd:				
Primary Analyst:	Tim Rothery, CFA	tim.rothery@gs.com		
Coverage Group:	Europe-Machinery & Elec Equip		Coverage view:	Attractive
Stock Rating:	Conviction Buy	Target Price: SFr33	Duration:	12 months

Source: Company data, Goldman Sachs Research estimates.

Schneider Electric (SCHN.PA, Buy, 12-month price target €137, 51% upside)

Exhibit 41: Schneider's smart grid exposure and investment view
Closing price €90.9

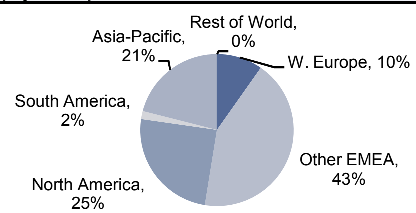
Smart Grid Profile



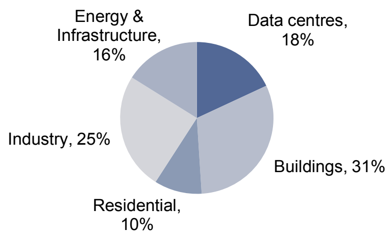
	Local FX mn	US$ mn
Revenues smart grid focused 2010E	12,150	15308
Share of group revenues smart grid focused	59%	
Share of group profit smart grid	70%	

Note: Considers Areva Distribution assets

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure and Views

We believe that Schneider is well positioned to benefit from the development of the distribution and end user-related phases of a smart grid, principally through its Power and Energy divisions, as well as parts of its Buildings division.

Views on the market: Schneider believes that the smart grid opportunity will create additional business rather than being a pure replacement trend on traditional T&D products. While it believes the US and Europe will see the first developments (with big opportunities in demand response, distributed generation and electric vehicles), growing emerging economies such as China and India should see significant developments, particularly in areas like energy efficiency, distributed generation and electric vehicles.

Schneider positioning: Schneider's long track record in serving electricity end users will give it a first mover advantage in Demand Response, in our view. Its strength in power conversion and connection technologies provides the company advantages in taking part in the Distributed Energy Sources evolution, while the assets acquired from Areva Distribution should significantly enhance its capabilities in the field of Distribution Management Systems and Communications and IT.

Schneider's focus areas within smart grid are:
(1) Distributed generation equipments - where it cooperates with US authorities on solar initiatives for federal buildings and leading utilities in Europe and China. It provides products across all medium voltage range from individual inverters to full electrical systems.
(2) Demand Response - a business where it is now starting up, but expects short term growth.
(3) Communications and IT - Schneider is already collecting some revenues in this area.
(4) Electric vehicles - Schneider is getting involved in pilots to develop charging stations for electric vehicles along with other parties and aims to be able to influence legislation in this area over the medium to long term.
(5) Energy efficiency (namely building efficiency) - already has some revenues in this area from public governmental institutions and some private customers.

Although Schneider has a wide portfolio of AMI solutions, it does not consider these a key priority (particularly in residential), as it sees better value .opportunities in other products. The company does not view storage as part of its core area of expertise, and it is therefore also not a priority.

Current Investment View

Investment View: We rate Schneider Conviction Buy within the context of our European Capital Goods coverage group. Schneider offers attractive exposure to the Transmission and Distribution market, particularly through its products related to smart grid and building efficiency, which we believe will allow the company to enjoy superior structural growth than the sector over the next cycle.
The shares have underperformed the sector by 5% YTD and we believe current levels provide an attractive entry point. Schneider currently trades on 2010E 7.1x EV/EBITDA, 8.3x EV/EBIT, 10.4x P/E, in line with the sector, which we believe fails to capture Schneider's above-average growth prospects over the next cycle.

Group Financials

(FY; €mn)	2008	2009	2010E	2011E	2012E
Revenues	18,311	15,793	18,723	20,899	22,992
organic sales growth	*7%*	*-16%*	*6%*	*7%*	*10%*
GS EBIT	2,936	2,062	2,825	3,301	4,008
margin	*16.0%*	*13.1%*	*15.1%*	*15.8%*	*17.4%*
GS EPS	8.43	5.32	7.42	8.77	10.86

Valuation: Our 12 month target price of €137 is based on a 12x EV/EBIT on 2011 EBIT and EV adjustments. We apply a 2.0x premium to the sector multiple of 10x to reflect Schneider's above average growth potential (including 1x premium for smart grid related opportunities).

Key Risks: Key risks to the downside include lower volumes, slower economic recovery, pricing pressure, adverse mix and weaker cash flow. Upside risks the converse

Schneider Electric:				
	Primary Analyst:	Daniela Costa daniela.costa@gs.com		
	Coverage Group:	Europe-Machinery & Elec Equip	Coverage view:	Attractive
	Stock Rating:	Buy Target Price: € 137	Duration:	12 months

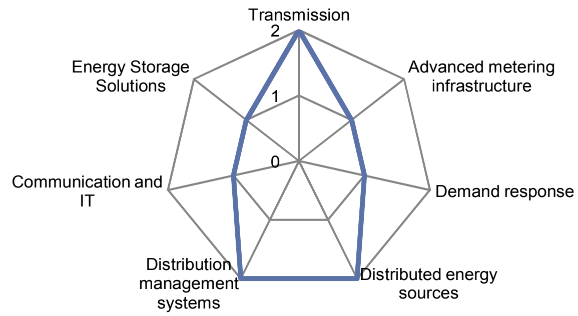
Source: Company data, Goldman Sachs Research estimates.

Siemens (SIEGn.DE, Conviction Buy, 12-month price target €126, 65% upside)

Exhibit 42: Siemens smart grid exposure and investment view

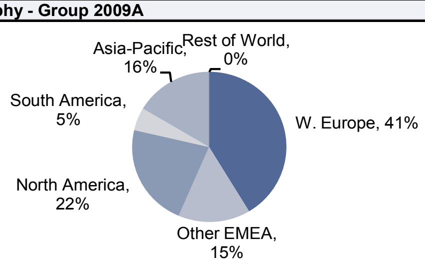
Closing price €76.2

Smart Grid Profile

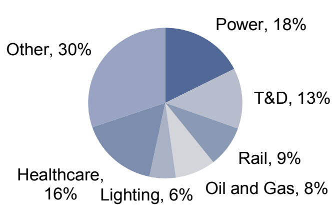


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	9,233	11633
Share of group revenues smart grid focused	12%	
Share of group profit smart grid	12%	

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure

We believe that Siemens is well positioned to benefit from the development of a smart grid principally through its Transmission and Distribution divisions within the Energy sector, and partly through some of its Building Technology division. We believe Siemens' capability to bundle products and services could benefit the company and its strong existing relationships with utility and industrial customers would also be an advantage.

Siemens expects to win smart grid orders worth more than €6 bn by 2014 (vs. c.€1 bn orders in 2009). By 2014, Siemens aims to win more than 20% market share out of the c.€30 bn market it addresses and expects 7% annual growth for its smart grid business.

The 3 key areas Siemens identified in smart grid are: 1) Smart meters; 2) Grid intelligence; 3) Utilities IT. Siemens is active in all three areas and a leader in grid intelligence. Most of the areas are addressed through its Power Transmission and Power Distribution offer, however demand response related offer is overseen by Building Technologies (focusing mostly in commercial building products, not very interested in home automation markets). Another area where Siemens is also doing some startup investment is Electric Vehicles, through its eCar team.

In particular, in the area of grid intelligence Siemens focuses on: controls for Supergrid HVDC & FACTs, power flow control, protection, energy and congestion management, SCADA and grid monitoring, condition monitoring based asset management.
Recently (October 2009), Siemens strengthened its smart grid portfolio in power data management when it took over a 60% stake in Energy4U, expanding the company's portfolio for power utilities in the area of consumption data acquisition and billing.

Current Investment View

Investment View: We rate Siemens Conviction Buy. We expect Siemens to be a major beneficiary of a continued recovery in fixed investment spending, and believe the company is well posiitoned to deliver strucutrally higher returns over the next cycle. At the current share price Siemens discounts a 7.1% EBIT margin into perpetuity, a 50bp discount to the trailling 5 year average and 380bp below our 2010 forecast. We believe Siemens trade at an unwarranted discount to the rest of the sector.

Group Financials

(FY; €mn)	2008	2009	2010E	2011E	2012E
Revenues	77,327	76,651	75,440	79,530	83,930
organic sales growth	*10%*	*0%*	*-2%*	*5%*	*6%*
GS EBIT	7,403	7,138	8,241	9,280	10,643
margin	*9.6%*	*9.3%*	*10.9%*	*11.7%*	*12.7%*
GS EPS	5.94	4.78	6.54	7.74	8.90

Valuation: Our 12 month target price of €126 is based on a 11.25x EV/EBIT on 2011 EBIT and EV adjustments. We apply a 1.25x premium to the sector multiple of 10x to reflect Siemens above average growth potential (including 0.25x for smart grid related opportunities).
Key Risks: Key risks to the downside include lower volumes, weaker US$ vs. €, weaker cash flow, disappointing targets at 4Q results, and significant contract charges.

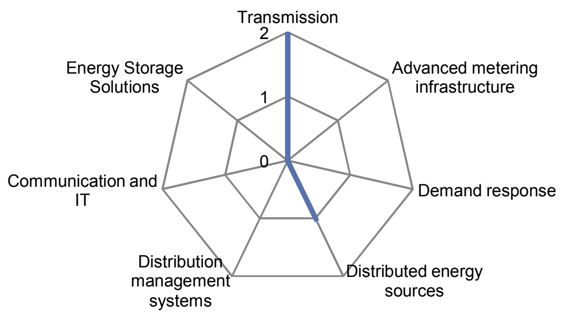
Siemens AG:	Primary Analyst:	Tim Rothery, CFA	tim.rothery@gs.com		
	Coverage Group:	Europe-Machinery & Elec Equip		Coverage view:	Attractive
	Stock Rating:	Conviction Buy	Target Price: € 126	Duration:	12 months

Source: Company data, Goldman Sachs Research estimates.

Alstom (ALSO.PA, Neutral, 12-month price target €50, 33% upside)

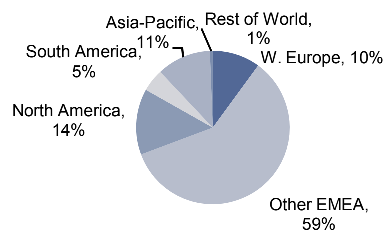
Exhibit 43: Alstom's smart grid exposure and investment view
Closing price €37.7

Smart Grid Profile

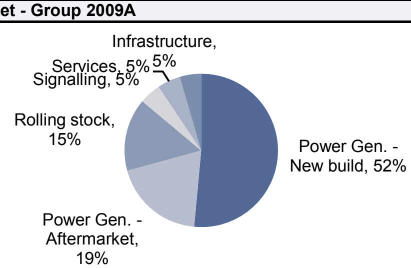


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	3,281	4134
Share of group revenues smart grid focused	15%	
Share of group profit smart grid	n.a.	
Note: Considers Areva Transmission assets		

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure and Views

We believe Alstom will benefit from the wave of transmission interconnections, creation of new lines to connect renewable energy sources and replacement of networks that will be triggered by the smart grid initiatives. Its exposure to these trends will come mostly from the assets recently acquired from Areva Transmission.
On its original business, Alstom will see also indirect structural growth related to distributed energy resources, namely renewables (solar and wind), however these still represent a very small part of Alstom's portfolio.

The assets acquired from Areva Transmission serve the following grid automation areas of smart grid:
a) Air and gas insulated automated substations (core reactors, circuit breakers, transformers, connectors, disconnectors, line traps, protection relays, surge arresters, measuring and recording products, telecommunications)
b) HVDC equipment (high voltage direct current)
c) FACTS (Flexible Alternative Current Transmission Systems)

One of the leading products acquired by Alstom is the *eterra* vision, a platform to facilitate advanced visualization functions such as monitoring of voltage conditions, steady state security parameters, transient stability and wide-area security.

Current Investment View

Investment View: We believe concerns over the outlook for demand for power generation, particularly coal, and uncertainty over the potential ability of Alstom to drive Areva Transmission assets to group margin, will keep affecting stock performance over the next quarter. Our €50 target price has 33% potential upside vs. the sector and we maintain our Neutral recommendation.

Group Financials

(FY; €mn)	2008/9	2009/10	2010/1E	2011/2E	2012/3E
Revenues	18,739	19,650	21,879	22,173	23,731
organic sales growth	*10%*	*5%*	*-5%*	*-2%*	*7%*
GS EBIT	1,536	1,779	1,624	1,643	1,889
margin	*8.2%*	*9.1%*	*7.4%*	*7.4%*	*8.0%*
GS EPS	4.19	4.73	3.98	4.11	4.87

Valuation: Our 12 month target price of €50 is based on a 10.0x EV/EBIT on 2011 EBIT and EV adjustments. We apply a 1.0x discount to the sector multiple of 10x to reflect Alstom below average growth opportunities (very late cycle fossil power generation market and defensive rail market) and a 1.0x premium given Alstom's above average returns profile.
Key Risks: Key risks to the downside include sharper volume downturn, weaker pricing, rising raw material costs; upside the converse.

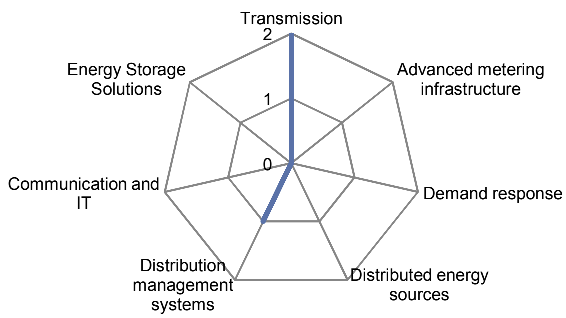
Alstom:	Primary Analyst:	Tim Rothery, CFA tim.rothery@gs.com		
	Coverage Group:	Europe-Machinery & Elec Equip	Coverage view:	Attractive
	Stock Rating:	Neutral Target Price: € 50	Duration:	12 months

Source: Company data, Goldman Sachs Research estimates.

Prysmian (PRY.MI, Neutral, 12-month price target €17, 28% upside)

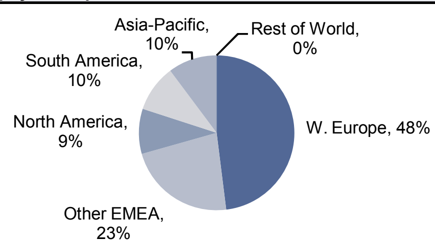
Exhibit 44: Prysmian's smart grid exposure and investment view
Closing price €13.3

Smart Grid Profile

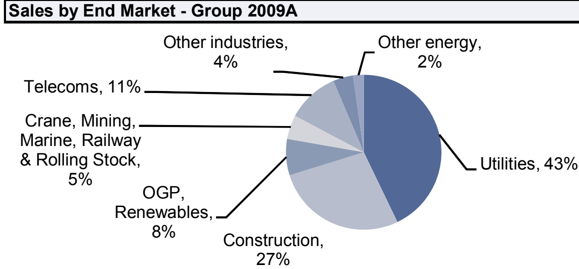


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	932	1174
Share of group revenues smart grid focused	22%	
Share of group profit smart grid	50%	

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure and Views

We believe that Prysmian will benefit from an increase in transmission interconnections, the creation of new lines to connect renewable energy sources and network replacement that will be triggered by smart grid initiatives.

Although Prysmian (similarly to Nexans) does not believe that the cable T&D market will change materially due to smart grid, it believes strong volume growth will happen in the initial phases of implementation as a result of interconnections and upgrades .
The company also believes the cable products currently in existence (such, as for example HVDC) have the required technologies to satisfy this demand. Smart grid will also drive growth in some product categories for which customers are not willing to pay yet. Increase penetration of underground cables and submarine cables for renewable connections will also have positive margin effect in cable companies.

In developed countries, apart from the increase in transmission investment due to interconnections and upgrades of lines (for replacement, increased safety and weather resistance), Prysmian will also indirectly benefit from increased investment in new distribution lines built to make the network more redundant.
In developing countries, Prysmian will benefit strongly from the creation of new lines both in transmission and distribution.

Current Investment View

Investment View: We rate Prysmian Neutral in our European Capital Goods coverage group. While we believe Prysmian is exposed to structural and cyclical growth opportunities in its end-markets (particularly T&D) and is able to sustain higher margins than its peers (2010E underlying EBIT of 7.7% vs. 4.7% for Nexans on a comparable basis), we believe the stock price already incorporates most of these considerations. Our 12-month price target of €17 implies 28% upside potential vs average 32% upside in our coverage universe.

Group Financials

(FY; €mn)	2008	2009	2010E	2011E	2012E
Revenues	5,144	3,731	4,237	4,611	5,068
organic sales growth	*4%*	*-17%*	*2%*	*8%*	*10%*
GS EBIT	477	334	327	399	490
margin	*9.3%*	*9.0%*	*7.7%*	*8.7%*	*9.7%*
GS EPS	1.50	1.05	0.99	1.31	1.67

Valuation: Our 12 month target price of €17 is based on a 9.0x EV/EBIT on 2011 EBIT and EV adjustments. We apply a 1.0x discount to the sector multiple of 10x to reflect that Prysmian in on the bottom quartile of emerging markets exposure of our stocks.

Key Risks: Key risks to the downside include weaker volume recovery, further pricing/mix deterioration, and lower cash generation. Upside risks include the converse.

Prysmian:				
Primary Analyst:	Daniela Costa	daniela.costa@gs.com		
Coverage Group:	Europe-Machinery & Elec Equip		Coverage view:	Attractive
Stock Rating:	Neutral	Target Price: € 17	Duration:	12 months

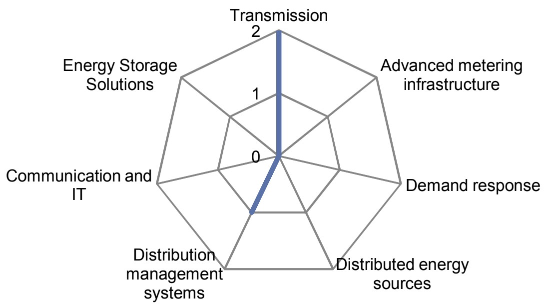
Source: Company data, Goldman Sachs Research estimates.

Nexans (NEXS.PA, Buy, 12-month price target €85, 65% upside)

Exhibit 45: Nexans's smart grid exposure and investment view

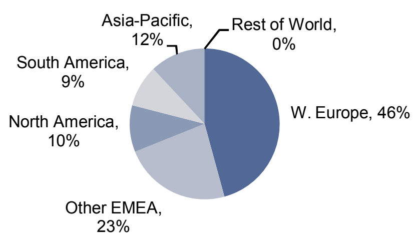
Closing price €51.5

Smart Grid Profile

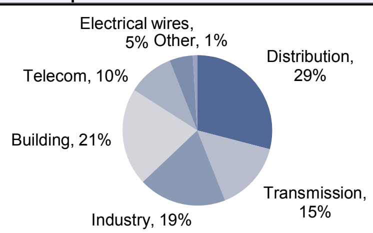


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	769	968
Share of group revenues smart grid focused	15%	
Share of group profit smart grid	47%	

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure and Views

We believe Nexans will benefit from an increase in transmission interconnections, the creation of new lines to connect renewable energy sources and network replacement that will be triggered by smart grid initiatives.

Although a more moderate contributor to smart grid technology than other players, several of its products should facilitate the implementation of smart grid technologies. These include:

a) HVDC (high voltage direct current interconnection cables) allowing significant reduction of power losses vs. traditional AC links. Growth in sales from this segment will be triggered also by the fact that it is an enabler of other smart grid technologies such as VSC (voltage storage converters). Nexans expects c.20-25% of new T&D lines in 5 years to be DC lines vs 10-15% today. HVDC technology is also essential for large scale roll-out of renewable sources

b) High voltage underground cables reducing power losses, improving reliability and safety

c) ACCC (Aluminum carbon core composite cables) allowing lower power losses at less than one quarter the weight, also minimizing thermal expansion and "line sag" two reasons behind blackouts

d) CAT-1 real time transmission line monitoring systems allowing accurate real time rating of transmission lines

e) Superconducting fault current limiters to protect power generation facilities

In developed countries, apart from the increase in transmission investment due to interconnections and upgrades of lines (for replacement, increased safety and weather resistance), Nexans will also indirectly benefit from increased investment in new distribution lines built to make the network more redundant.

In developing countries, Nexans will benefit strongly from the creation of new lines both in transmission and distribution.

Current Investment View

Investment View: We rate Nexans Buy in the context of our European Capital Goods coverage group. While we believe Nexans' share price is discounting c.5% margin in perpetuity, in line with the lower end of management guidance for 2H2010, the market seems to underestimate the structural and cyclical growth opportunities in Nexans' end markets (particularly T&D) and restructuring savings for 2010E-2012E (which are materializing as expected). We forecast a 4.7% margin for 2010 driven by one-off issues in high voltage, lower than expected volumes and worse price/mix effects, but expect the margin to recover to 7.6% in 2011. Our 12-month price target of €85 implies 65% upside potential.

Group Financials

(FY; €mn)	2008	2009	2010E	2011E	2012E
Revenues	4,776	4,026	4,226	4,542	4,947
organic sales growth	*2%*	*-19%*	*0%*	*7%*	*9%*
GS EBIT	423	241	198	343	500
margin	*8.9%*	*6.0%*	*4.7%*	*7.6%*	*10.1%*
GS EPS	11.40	3.47	2.96	6.42	10.33

Valuation: Our 12-month target price of €85 is based on a 9.0x EV/EBIT on 2011E EBIT and EV adjustments. We apply a 1.0x discount to the sector multiple of 10x to reflect Nexans below average historical returns.

Key Risks: Key risks to the downside include weaker volume recovery, further pricing/mix deterioration, further charges due to High Voltage contract delays, lack of new orders and delivery on restructuring.

Nexans:					
Primary Analyst:	Daniela Costa	daniela.costa@gs.com			
Coverage Group:	Europe-Machinery & Elec Equip		Coverage view:	Attractive	
Stock Rating:	Buy	Target Price: € 85	Duration:	12 months	

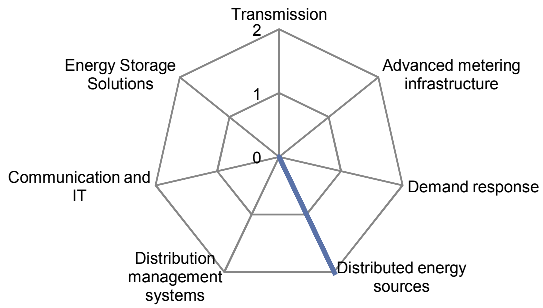
Source: Company data, Goldman Sachs Research estimates.

Wartsila (WRT1V.HE, Sell, 12-month price target €42, 4% downside)

Exhibit 46: Wartsila's smart grid exposure and investment view

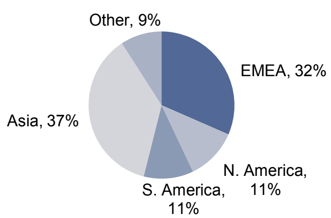
Closing price €43.6

Smart Grid Profile

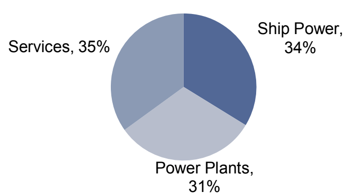


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	453	571
Share of group revenues smart grid focused	<10%	
Share of group profit smart grid	n.a.	

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure

We believe Wartsila has moderate exposure to the smart grid opportunity through is Power Plants division, mainly through products used for grid stabilization and back-up power solutions.

Although the company does not have products specifically created to address the smart grid, it believes it can see growth driven by the trend particularly in developed markets (US, Europe and Japan).

Increasing use of renewable energy, particularly small-scale localized distributed generation, will trigger significant need for equipment such as that supplied by Wartsila that cover temporary electricity production shortages through fast-reacting backup capacity close to the grid. Wartsila's flexible power plants are able to provide 25% of full power in two minutes and can achieve full output in just eight minutes being able to fulfil stabilization requirements very efficiently.

Current Investment View

Investment View: Wartsila has seen the trough in order intake in both its segments and while some recent increase in Ship Power orders has been registered, we have limited visibility to believe this is part of a sound underlying rebound trend before 2011. Given the very late cycle nature of Wartsila's business relative to other stocks within our coverage universe, we see a relatively unattractive combination of fourth quartile sector-relative earnings development over the next two years, and among the lowest upgrade risks relative to consensus forecasts.
Our target price implies 4% potential downside vs. 32% for the sector, the lowest in the sector and we therefore reiterate our Sell rating.

Group Financials

(FY; €mn)	2008	2009	2010E	2011E	2012E
Revenues	4,612	5,260	4,665	4,453	4,898
organic sales growth	*22%*	*13%*	*-13%*	*-5%*	*10%*
GS EBIT	525	638	463	402	486
margin	*11.4%*	*12.1%*	*9.9%*	*9.0%*	*9.9%*
GS EPS	3.88	4.41	3.57	2.84	3.45

Valuation: Our 12-month target price of €42 is based on a 11.0x EV/EBIT on 2011E EBIT and EV adjustments. We apply a 1.0x premium to the sector multiple of 10x to reflect Wartsila's above average structural growth opportunities both due to emerging markets presence as well as attractive exposure to the power market.
Key Risks: Key risks to the upside are stronger volume recovery and cash generation.

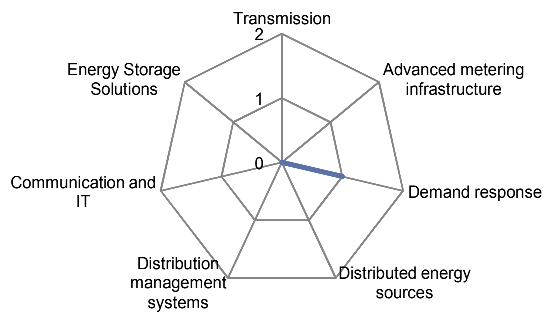
Wartsila (B):				
Primary Analyst:	Daniela Costa	daniela.costa@gs.com		
Coverage Group:	Europe-Machinery & Elec Equip		Coverage view:	Attractive
Stock Rating:	Sell	Target Price: €42	Duration:	12 months

Source: Company data, Goldman Sachs Research estimates.

Legrand (LEGD.PA, Neutral, 12-month price target €31.5, 26% upside)

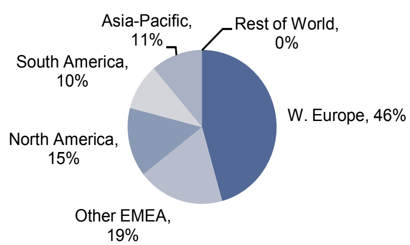
Exhibit 47: Legrand's smart grid exposure and investment view
Closing price €25.0

Smart Grid Profile

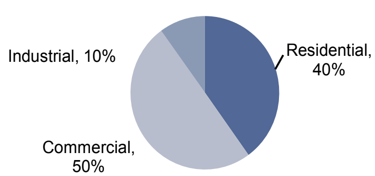


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	<380	<478.8
Share of group revenues smart grid focused	<10%	
Share of group profit smart grid	n.a.	

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure and Views

We believe Legrand will have limited exposure to the first phases of smart grid development and will see higher benefits from the related trend of building efficiency.

Energy efficiency-related products represented c.6.4% of Legrand's 2009 sales. The majority of these products relate to energy consumption reduction or improvements in energy quality.
Some of Legrand's products mostly related to smart grid allow for Demand Response, given Legrand's focus on energy distribution from the building point-of-entrance (ie, post-meter) to the inside. These include gear, such as: low consumption transformers, compensation reactive energy (batteries of capacitor to normalize electricity load), green sockets (that link to the energy distribution panel and can control switch on/switch off of appliances depending on usage and electricity pricing conditions), solutions to communicate demand patterns to external providers, etc.

So far, most of these developments have been focused on the non-residential consumer segment; however, residential use is now starting. Legrand believes there are strong grounds for regulators to start focusing on energy efficiency; the US has started implementing the Energy Code two years ago as a result of serious power shortages and France is setting the pace on building efficiency by introducing energy saving targets for public buildings in 2012. Legrand also believes the timeline for China and other fast-growing developing nations will not lag significantly developed markets.

Legrand does not seem to be interested in the network side of a smart grid and organic or inorganic growth should be expected in complementary products under the same areas it currently operates on. Priority focus is on emerging countries and fast growing applications.

Current Investment View

Investment View: We rate Legrand Neutral within our European Capital Goods coverage group. We continue to view it as a high quality, high return company with acquisition growth potential partially offset by lower structural growth expectations in its end markets (ultimately, more related to construction than T&D).

Group Financials

(FY; €mn)	2008	2009	2010E	2011E	2012E
Revenues	4,202	3,578	3,788	4,100	4,387
organic sales growth	*0%*	*-14%*	*4%*	*7%*	*7%*
GS EBIT	746	630	770	857	943
margin	*17.7%*	*17.6%*	*20.3%*	*20.9%*	*21.5%*
GS EPS	1.77	1.52	1.78	2.00	2.21

Valuation: Our 12 month target price of €31.5 is based on a 11.0x EV/EBIT on 2011 EBIT and EV adjustments. We apply a 1x premium vs. sector at 10x to account for acquisition potential, 1x premium for above average returns and 1x discount for below average structural growth opportunities.
Key Risks: Key risks to the downside include weaker volume recovery and lower cash generation. Upside risks include the converse and better cost cutting.

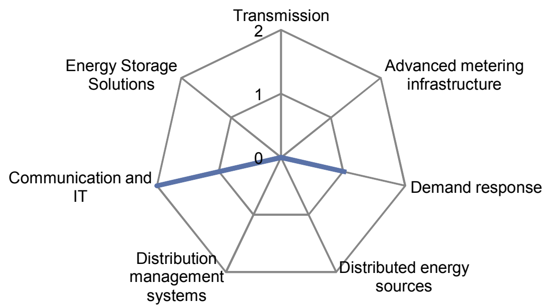
Legrand:	Primary Analyst:	Daniela Costa	daniela.costa@gs.com		
	Coverage Group:	Europe-Machinery & Elec Equip		Coverage view:	Attractive
	Stock Rating:	Neutral	Target Price: € 31.5	Duration:	12 months

Source: Company data, Goldman Sachs Research estimates.

Invensys (ISYS.L, Buy, 12-month price target 424p, 53% upside)

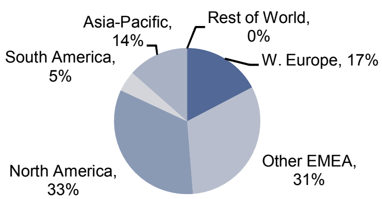
Exhibit 48: Invensys's smart grid exposure and investment view
Closing price 277p

Smart Grid Profile

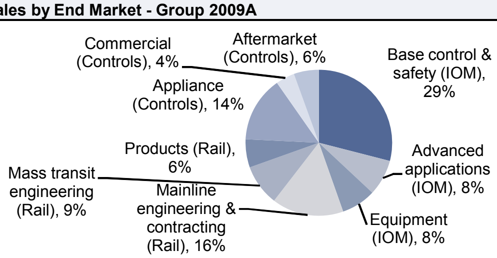


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	261	402
Share of group revenues smart grid focused	11%	
Share of group profit smart grid	11%	

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure

We believe Invensys has moderate exposure to the smart grid opportunity. Its is exposed to the Communications and IT area through its IOM (Invensys Operations Management) offer to the Utilities sector and to the Demand Response area through its Controls business.

Wonderware is its main product in terms of Communications and IT, while Invensys GoodWatts is its main product for demand response.

Invensys has active partnerships with Echelon and ConneXsoft to work on the inerrability of its Wonderware solution and other smart grid technologies. Its IOM division is also particularly strong in substation automation software solutions and instrumentation and real time control, including SCADA software.

Goodwatts is an energy management system that allows utilities to remotely control high load appliances over a managed and secure IP network, as well as allowing end users to view their electricity consumption and access their system over the internet. Application of this solution to a pilot for the Pacific Northwest grid has been mentioned as a success by the US Department of Energy.

Invensys has been working with the Open Access Same-Time Information System (OASIS), the National Institute of Standards and Technology (NIST), and other organizations to help guide development of a standards-based smart grid.

Current Investment View

Investment View: We rate Invensys Buy. The stock offers attractive exposure to the structural growth opportunities in the automation and power end markets through its IOM business. Unburdened by balance sheet concerns, we believe the company should be able to deliver better growth relative to the market in this cycle relative to the last one. We believe that the rail signalling business should continue to benefit from structural growth in rail end market, and expect a lower impact from fiscal austerity measures in this part of the rail market than compared to rolling stock.
YTD, Invensys has been the fifth worst performer in our coverage universe, underperforming the sector by 27% driven by concerns about the outlook for its rail signalling business in the face of government austerity measures, as well as its above-average NA exposure (33% of sales vs. 20% sector average). However, with the shares currently trading at 5.6x 2011E EV/EBIT, and 9.3x 2011E P/E, a 16% and 17% discount to the capital goods sector, respectively, we believe many of these concerns are already more than fully priced in.

Group Financials

(FY; €mn)	2008/9	2009/1	2010/1	2011/2	2012/3
Revenues	2,284	2,243	2,243	2,438	2,658
organic sales growth	*-4%*	*-8%*	*6%*	*9%*	*7%*
GS EBIT	244	248	248	271	362
margin	*10.7%*	*11.1%*	*11.1%*	*11.1%*	*13.6%*
GS EPS	22.4	21.6	21.6	23.7	31.9

Valuation: Our 12-month target price of 424p is based on a 10x EV/EBIT on 2011E EBIT and EV adjustments.

Key Risks: Key risks to the upside include stronger recovery in orders and volumes, better cash flow, greater savings from restructuring measures, value creative M&A. Downside risks include the converse.

Invensys:

Primary Analyst:	Tim Rothery, CFA	tim.rothery@gs.com		
Coverage Group:	Europe-Machinery & Elec Equip		Coverage view:	Attractive
Stock Rating:	Buy	Target Price: 424p	Duration:	12 months

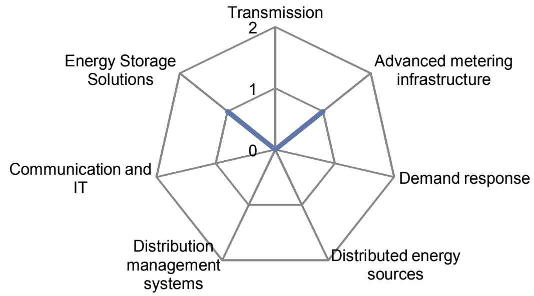
Source: Company data, Goldman Sachs Research estimates.

Saft (S1A.PA, Buy, 12-month price target €46, 63% upside)

Exhibit 49: Saft's smart grid exposure and investment view

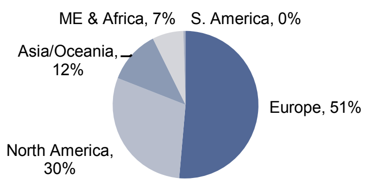
Closing price €28.2

Smart Grid Profile

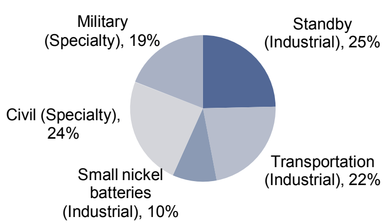


	Local FX mn	US$ mn
Revenues smart grid focused 2010E	Negligible	n.a.
Share of group revenues smart grid focused	n.a.	
Share of group profit smart grid	n.a.	

Sales by Geography - Group 2009A



Sales by End Market - Group 2009A



Smart Grid Exposure

Saft currently has limited revenue exposure to the smart grid opportunity; however, we expect it to gain an increasing position in the Electric Vehicle battery market and to become an important supplier to the AMI and DMS markets, and thus be a beneficiary of smart grid.

Saft provides batteries for the following areas of smart grid:
a) Energy storage solutions
b) Electric vehicles
c) Smart metering
d) T&D substation switching and transmission equipment

Saft is planning to address the Electric Vehicles market through its JV with Johnson Controls. The JV already has a first mover advantage on Li-ion applications and won several recent US subsidies grants. High volume manufacturing facilities will be available in 2011. Saft expects the JV to break-even by 2012-2013 with total sales of c.$175mn.

In the meantime, Saft is also participating in several smart grid pilots, including notably a project with ABB for EDF Energy UK to integrate the Li-ion into SVC Light pilot from ABB and a smart grid inverter project in partnership with Apollo Solar and funded by the US DoE to supply c.10kwh batteries to provide energy storage enabling solar energy to be effectively time shifted to match peak energy demand consumption.

Current Investment View

Investment View: In our view, Saft provides attractive exposure to the significant long-term growth potential of the electrification of the automotive powertrain. At the current price of €28.2 we believe the market discounts only Saft's high-quality core business, attaching zero value to its JCS battery joint venture with US supplier JCI. In contrast, and based on our 2015 estimates for JCS, we value the joint venture at €11/share. In its core business, Saft provides exposure to the increasingly important renewable energy market and we believe this will be a core driver of growth in the medium term.
There is 63% potential upside to our 12-month price target of €46. We maintain our Buy rating.

Group Financials

(FY; €mn)	2008	2009	2010E	2011E	2012E
Revenues	609	559	582	616	651
organic sales growth	*5%*	*-10%*	*3%*	*6%*	*6%*
GS EBIT	85	73	80	88	96
margin	*13.9%*	*13.0%*	*13.8%*	*14.3%*	*14.7%*
GS EPS	1.89	1.41	1.93	2.17	2.54

Valuation: Our 12-month target price of €46 is based on 10x EV/EBIT (in line with the sector) on 2011 forecast EBIT and EV adjustments.

Key Risks: **K**ey downside risk is FX given Saft's sensitivity to the US dollar.

Saft:	Primary Analyst:	Daniela Costa	daniela.costa@gs.com		
	Coverage Group:	Europe-Machinery & Elec Equip		Coverage view:	Attractive
	Stock Rating:	Buy	Target Price: €46	Duration:	12 months

Source: Company data, Goldman Sachs Research estimates.

Appendix 1: Capital Goods valuation framework and target multiples

Exhibit 50: Target EV/EBIT multiple framework

EV/EBIT ~ (1- g/ROIC)*(1-tax)/(WACC-g)

Historical multiple of c. 10x EV/EBIT over last cycle **Multiple implies 3% growth, 12.5% ROIC, 8% WACC**	→	10x EV/EBIT multiple
Growth		
Top quartile growth prospects post 2011? (geographic or end market) Significant acquisition value creation potential and track record?	If Yes →	+1 premium
Bottom quartile growth prospects? Significant strategic uncertainty over growth?	If Yes →	-1 discount
Returns		
Top quartile CROCI returns and equivalent EBIT margin?	If Yes →	+1 premium
Bottom quartile CROCI returns and equivalent EBIT margins?	If Yes →	-1 discount
Other		
Potential M&A target, timing of cyclical earnings recovery, etc	→	Appropriate discount/premium

Source: Goldman Sachs Research estimates

Exhibit 51: Target EV/EBIT multiple methodology by company
Base EV/EBIT multiple of 10x for the sector

	BASE MULTIPLE	GROWTH ADJUSTMENT						RETURNS ADJUSTMEN	M&A/ Other	TARGET MULTIPL	Memo: 2004-8 avg multiple	Difference vs target
		Geography	End Market	Acquisition	Growth	Smart Grid	Total Growth	Returns	Other			
ABB	10.0x	1.0	1.0	0.0	1.0x	0.80	1.8x	1.0x	0.0x	**12.8x**	11.0x	1.8x
Alfa Laval	10.0x	1.0	-1.0	0.0	0.0x		0.0x	1.0x	0.0x	**11.0x**	9.0x	2.0x
Alstom	10.0x	-1.0	-1.0	0.0	-1.0x		-1.0x	1.0x	0.0x	**10.0x**	13.5x	-3.5x
Ansaldo	10.0x	0.0	-1.0	0.0	-1.0x		-1.0x	1.0x	0.0x	**10.0x**	8.0x	2.0x
Assa Abloy	10.0x	-1.0	-1.0	1.0	0.0x		0.0x	1.0x	0.0x	**11.0x**	12.0x	-1.0x
Atlas Copco	10.0x	1.0	1.0	0.0	1.0x		1.0x	1.0x	0.0x	**12.0x**	11.0x	1.0x
Bodycote	10.0x	-1.0	-1.0	0.0	-1.0x		-1.0x	-1.0x	1.0x	**9.0x**	12.0x	-3.0x
Cookson	10.0x	1.0	-1.0	0.0	0.0x		0.0x	-1.0x	0.0x	**9.0x**	9.5x	-0.5x
Demag	10.0x	0.0	-1.0	0.0	-1.0x		-1.0x	0.0x	0.0x	**9.0x**	10.0x	-1.0x
Electrolux	10.0x	0.0	-1.0	1.0	0.0x		0.0x	-1.0x	0.0x	**9.0x**	10.5x	-1.5x
FLSmidth	10.0x	1.0	1.0	0.0	1.0x		1.0x	1.0x	0.0x	**12.0x**	12.0x	0.0x
GEA	10.0x	0.0	0.0	0.0	0.0x		0.0x	0.0x	0.0x	**10.0x**	10.5x	-0.5x
Halma	10.0x	-1.0	1.0	0.0	0.0x		0.0x	1.0x	0.0x	**11.0x**	11.0x	0.0x
Husqvarna	10.0x	0.0	0.0	0.0	0.0x		0.0x	0.0x	0.0x	**10.0x**	12.0x	-2.0x
IMI	10.0x	0.0	-1.0	0.0	-1.0x		-1.0x	1.0x	0.0x	**10.0x**	10.0x	0.0x
Invensys	10.0x	-1.0	1.0	0.0	0.0x		0.0x	0.0x	0.0x	**10.0x**	10.5x	-0.5x
Laird Group	10.0x	0.0	0.0	0.0	0.0x		0.0x	-1.0x	0.0x	**9.0x**	11.5x	-2.5x
Legrand	10.0x	0.0	-1.0	1.0	0.0x		0.0x	1.0x	0.0x	**11.0x**	11.5x	-0.5x
Metso	10.0x	0.0	0.0	0.0	0.0x		0.0x	0.0x	0.0x	**10.0x**	9.0x	1.0x
Morgan Crucible	10.0x	-1.0	-1.0	0.0	-1.0x		-1.0x	-1.0x	0.0x	**8.0x**	10.5x	-2.5x
Nexans	10.0x	0.0	0.0	0.0	0.0x		0.0x	-1.0x	0.0x	**9.0x**	9.0x	0.0x
Outotec	10.0x	1.0	1.0	0.0	1.0x		1.0x	1.0x	0.0x	**12.0x**	11.0x	1.0x
Prysmain	10.0x	-1.0	0.0	0.0	-1.0x		-1.0x	0.0x	0.0x	**9.0x**	8.5x	0.5x
SAFT	10.0x	-1.0	1.0	0.0	0.0x		0.0x	0.0x	0.0x	**10.0x**	9.5x	0.5x
Sandvik	10.0x	1.0	1.0	0.0	1.0x		1.0x	0.0x	0.0x	**11.0x**	10.5x	0.5x
Schneider Electric	10.0x	0.0	1.0	0.0	1.0x	1.00	2.0x	0.0x	0.0x	**12.0x**	10.0x	2.0x
SGL Carbon	10.0x	0.0	0.0	0.0	0.0x		0.0x	-1.0x	2.0x	**11.0x**	9.0x	2.0x
Siemens	10.0x	0.0	1.0	0.0	1.0x	0.25	1.3x	0.0x	0.0x	**11.3x**	12.5x	-1.3x
SKF	10.0x	0.0	0.0	0.0	0.0x		0.0x	0.0x	0.0x	**10.0x**	8.5x	1.5x
Spirax-Sarco	10.0x	0.0	0.0	0.0	0.0x		0.0x	1.0x	0.0x	**11.0x**	10.5x	0.5x
Tomkins					0.0x					**n.a.**	9.5x	
Wartsila	10.0x	1.0	1.0	0.0	1.0x		1.0x	0.0x	0.0x	**11.0x**	10.5x	0.5x
Weir	10.0x	1.0	1.0	0.0	1.0x		1.0x	1.0x	0.0x	**12.0x**	12.0x	0.0x

Source: Goldman Sachs Research estimates

Appendix 2: Electric vehicles make smart grid an imperative

We believe that emissions targets for the automotive industry will trigger the expansion of electric vehicles (EVs); our Autos research team estimates a required average reduction in new car emissions of c.49%, through 2020. Increasing use of electric vehicles will in turn put several stresses on the electric grid that we believe will further encourage the introduction of smart grids, such as: (1) increased demand for electricity driving a need for stronger network capacity; (2) increase in absolute load levels at peak hours creating a material need for storage throughout the chain and increased line redundancies; (3) ensuring that electric vehicles contribute towards the reduction of emissions rather than increasing these would mean satisfying additional demand with clean energy sources.

On a global basis, transportation accounts for approximately 20% of global CO_2 emissions, with road traffic accounting for approximately half this figure. Policy makers have focused their attention on the automotive industry with CO_2 emissions targets, or their equivalent fuel-efficiency standards, set over the next decade in Europe, the US, Japan, South Korea, Australia and China covering over 70% of the current global automotive market. Auto makers are already actively implementing responses to meet the requirements (Exhibit 52) (please also refer to *Global: Autos: Identifying global long-term winners,* November 27, 2009).

Exhibit 52: There are various high-profile plug-in vehicle launches planned for the next years
HEV – hybrid electric vehicle; PHEV – plug-in hybrid electric vehicle; BEV – pure plug-in electric vehicle

User tests have revealed that actual vehicle ranges are often significantly lower than the published ranges shown in this exhibit, particularly in cold weather, at high speeds, or in tough terrain.

Source: Greentech Media, company data, compiled by Goldman Sachs Research.

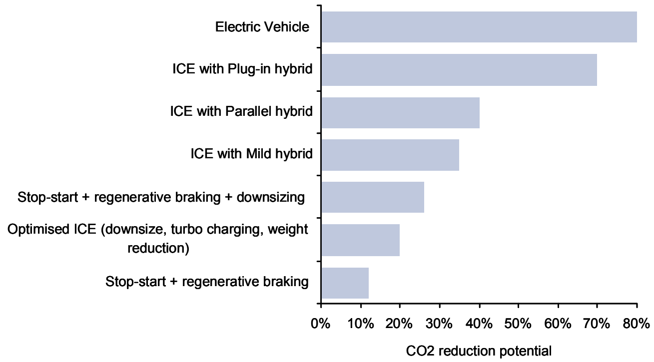
Our Autos analysts estimate the total number of light vehicles will increase by over 50% between 2010 and 2020. The International Energy Agency (IEA) estimates that the current vehicle park delivers average emission levels of c.190g CO_2/km. This suggests that in order to maintain a constant level of CO_2 emissions over the next decade on a global basis, average CO_2 emissions per vehicle will need to decline by 36% from current levels (to c.122g/km), in our estimates. Allowing for not all of the fleet being renewed in this period, our Autos team estimates that this would require an average reduction in new car emissions of c.49%, through 2020 (i.e., to c.97g/km). Electric vehicles are one of the technologies that will allow countries to reach these targets (Exhibit 53).

The expansion of electric vehicles will impose several stresses on the electric grid, which should act as a catalyst for the introduction of smart grids:

- *Demand increase driving the need for stronger capacity from the network*—being a new direct source of energy consumption, electric vehicles will significantly increase demand (according to ABB, if 20% of all new vehicles were electric recharging them could represent up to 2% of total electricity demand). The T&D network will need to support higher load, thus driving investment on extension and capacity increases, particularly of distribution lines.
- *Higher absolute load levels at peak hours create a material need for storage throughout the chain and for increased lines redundancies*—both consumer vehicles and business fleets are likely to be recharged during the evenings; to prevent outages and avoid service quality deterioration, the network will have to be complemented with material decentralized storage capacity. Additionally, to prevent the extension of any faults to reach large scale, it is also critical to increase the number of redundant lines allowing for quick isolation of some areas, if needed.
- *Ensuring electric vehicles contribute to emissions reduction rather than increase means satisfying additional demand with clean energy sources* —fulfilling new electricity demand for electric vehicles through coal-generated energy is not an alternative as in some cases the level of emissions at the generation source can be even higher than those emitted by a car (Exhibit 54). Thus, the additional demand will need to be met by the introduction of clean sources of energy, such as renewables (which will trigger smart grid investments).

Exhibit 53: Electric Vehicles is a key enabler to meet emissions reduction targets

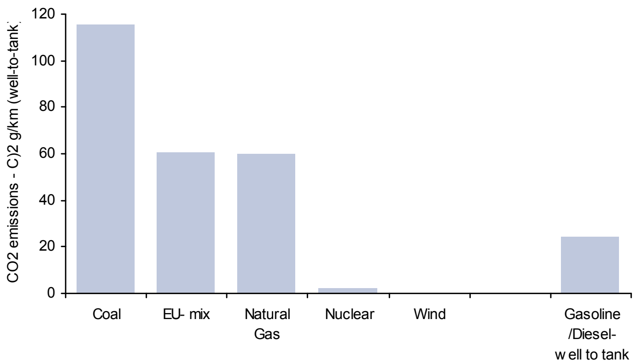
CO_2 reduction potential by technology ("tank-to-wheel")



Source: McKinsey, EPA, Transport and Environment, Goldman Sachs Research estimates.

Exhibit 54: Electric vehicles' overall CO_2 emissions depend on electricity-generation method

CO_2 emission gram per kilometer for principal energy generation methods



Source: CONCAW, EUCar, Goldman Sachs Research estimates.

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