STUDY

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Financing the Energy Transition is a High Stakes Game for Investors

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Summary

Worldwide demand for energy is expected to rise by 43% between now and 2035, driven by growth in emerging markets. In what is called the 450 Scenario, designed to limit global warming to 2°C, the IEA (International Energy Agency) calls for growth of demand to be limited to 14%, and recommends a radical change in the energy mix that would limit fossil fuels to 64% (vs. 81% in 2011) and double renewable energy's current share to 26% by 2035.

In view of the upcoming 2015 International Climate Conference (Cop21) in Paris, we are seeing a number of new regulations emerge. The European Union's new Climate and Energy Package, for instance, aims for a 40% reduction in GHG emissions by 2030. In China, the government intends to reduce the weight of coal in energy consumption to 60% in 2020 (currently 68%). In June of this year, President Obama presented a plan to reduce by 30% the CO_2 emissions of domestic electrical plants by 2030.

In answer to the challenges of climate change and reducing greenhouse gasses, the two following sectors will be the object of substantial investment as we move forward:

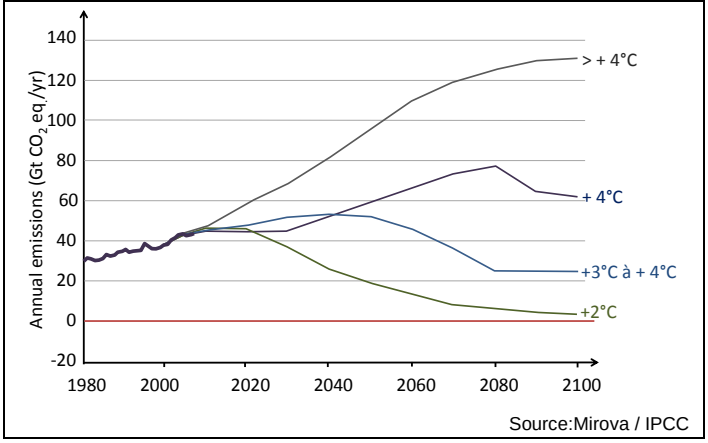
- **Low carbon energy: the most recent IPCC report estimates at $147bn the annual increase of investments in low carbon technologies, particularly renewables between now and 2035.**
- **Energy efficiency: the IPPC anticipates that investments in improving energy efficiency in building, transport and industry will grow by $336bn annually over the same period.**

In the latest reports from the IPCC (Intergovernmental Panel on Climate Change), published in 2013 and 2014, the scientific community has confirmed that it is extremely likely (>95%) that human activities have an impact on climate. We can already see some of the consequences of climate change, such as increasingly frequent heat waves and melting at the polar ice caps.

A continuation of global warming will exacerbate existing trends, producing greater frequency of droughts and coastal flooding along with diminishing agricultural yields, the extinction of species and the migration of tropical diseases toward higher latitudes.

To limit the impact of climate change and stay on track toward sustainable development objectives, it is high time we implemented stringent measures for reducing emissions. As illustrated in the various scenarios published by the IPCC, only an immediate stalling of emissions, followed by a considerable drop throughout the remainder of the decade, will keep temperatures under the 2° mark, a goal, which, however ambitious it seems today, remains the object of an international consensus.

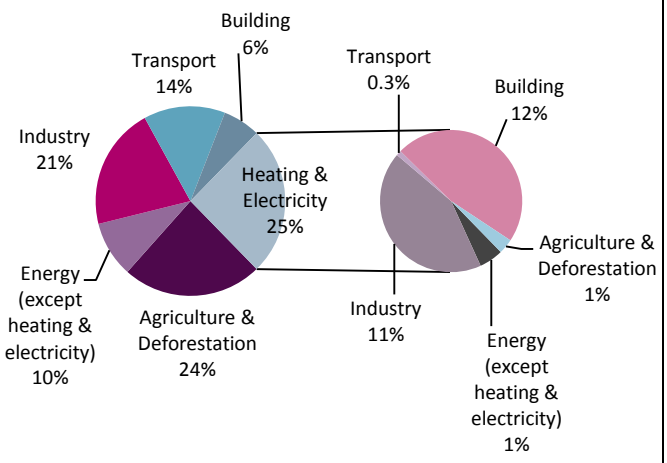
Figure 1. Climate impact of the various emissions scenarios



Source:Mirova / IPCC

Making this objective a reality will require that society undertake structural changes at all levels, particularly in the way we use energy, which is currently responsible for ~75% of GHG emissions. We remain heavily reliant on fossil fuels, which provide 80% of the energy we consume, and coal, oil and gas continue to grow. Operationalizing the energy transformation will require major evolutions in most sectors: power production, transport, building, industry.

Figure 2. GHG emissions by sector (49 Gt eq. CO_2, 2010)



Source:Mirova / IPCC

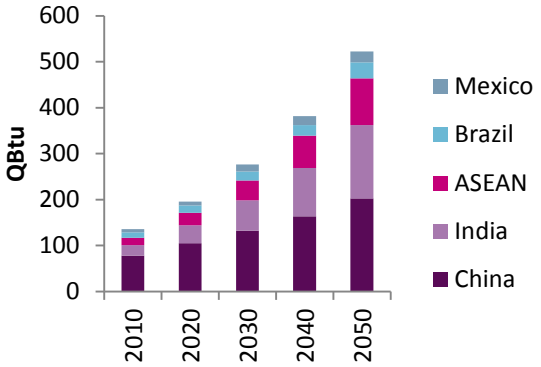
These transformations will present opportunities for companies able to offer solutions to the challenges they raise.

I. The energy transition as the new frame of reference

Population growth, increasing urbanisation, and the rise of a middle class in emerging countries have contributed to a doubling of worldwide energy consumption in the last 40 years. Between 1973 and 2011, the proportion of energy demand from OECD countries shrank from 60% to 41% in the face of rising emerging markets (EM) demand. Continued economic expansion in emerging countries is expected to go hand in hand with rising per capita energy consumption, which remains two to three times lower than levels in developed countries.

This means energy demand in emerging countries might as much as quadruple by 2050; this increase would represent 2.5 times the current consumption of the US and Europe combined.

Figure 3. Predicted growth in energy demand for select emerging countries

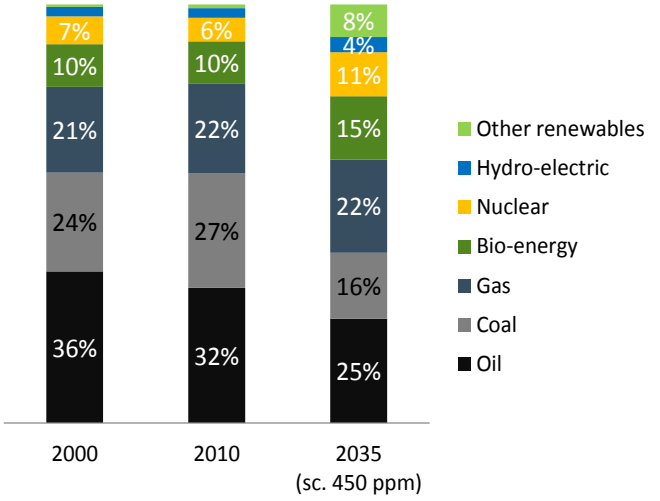


Source: Mirova / World Bank / IEA

In its latest study, the "World Energy Outlook" published in November of 2013, the IEA presents three possible scenarios describing the future behaviour of the market for energy to 2035. These are:

- **The Current Policies Scenario (CPS)**: this is a 'business as usual' scenario, expected to produce a 43% rise in energy demand by 2035 in the absence of regulation to fight climate change in the next 20 years.
- **New Policies Scenario (NPS)**: this base-case scenario predicts a 33% growth in world energy demand over the 2010-35 period, with 60% of it to come from China, India and the Middle East. Concurrently, GHG emissions would increase by more than 20%
- **450 Scenario (meets 450ppm CO_2 equivalent quota)**: 14% growth in energy demand between 2010 and 2035. This is the only scenario to permit a reduction in GHG emissions and be compatible with a global temperature rise of no more than +2°C.

Figure 4. Distribution of energy sources under the 450ppm scenario

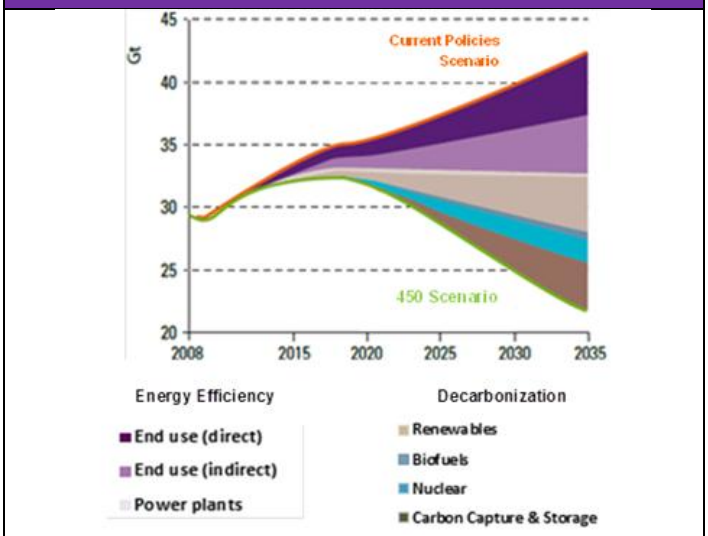


Source: Mirova / IPCC

For implementation of the 450 Scenario, the IEA focuses on two types of measures:

- **Energy efficiency:** a severe curb on increasing energy consumption in order to ensure that 2035 levels remain under the 15,000 Mtoe, as compared to the 17,000 Mtoe levels predicted by its base-case scenario, the NPS. The IPCC believes that $336bn of annual investments will be required over the 2010-35 period in the three sectors that consume the most energy: building, transport and industry).
- **Decarbonisation:** a radical transformation of the energy mix that includes a considerable reduction in the use of oil and coal, a stabilization of gas, and high growth in renewables and nuclear energy along with carbon capture technologies. The IPCC report estimates that investment in low carbon technologies will grow by $147bn annually, as compared to current annual investments of $1.2 trillion in energy today.

Figure 5. Comparison of world energy consumption under the different IEA scenarios



Source: Mirova / IEA

Legislation is taking shape

At the European Union level

It is against this background that the new Climate and Energy Package for 2030 proposes to bolster the targets of the 2020 plan on at least two fronts:

- Reduction of GHG levels. The EU shifted the -20% objective to -40% in its 2030 plan (given an effective reduction of 18% in 2012).
- The proportion of renewables in the global energy mix. This objective, which is -20% in the 2020 package has become -27% minimum for 2030 (2011 levels were 12.5%).

A 2030 target number for the reduction of energy consumption in the EU (-20% in the initial plan) is still under discussion at this time.

Beyond the question of climate change, concerns about the security of fossil energy reserves are likely to amplify the emphasis on renewables in the EU. In March 2014, following events in Ukraine, EU government leaders requested that the European Commission prepare a roadmap by June for reducing energy dependence on Russia. In 2012, 24% of the European Union's gas came from Russia (dependence varied, with highs of 37% for Germany and 29% for Italy), and 50% of these imports were piped through Ukraine.

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China

In China, combating climate change, combined with the need to reduce pollution, are forcing a reduction in the reliance on coal. China today accounts for 50% of all coal consumption and a third of CO_2 emissions worldwide. The central government has announced it will reduce the proportion of coal in the country's energy mix to 60% by 2020 (currently 68%). A long term objective that will cap carbon consumption at the national level is also expected. Instead, China wishes to develop the contribution of renewables to its energy mix. From a base of 7% in 2011, the plan has a target of 15% for 2020 and calls for 40% by 2040.

Figure 6. China's Energy Plan: main objectives

	2012	2015	2017	2020
Primary energy mix				
- from non-fossile fuel	6%	11%	13%	15%
- from natural gas	3%	>7%	>9%	NA
- from coal	68%	NA	65%	60%
Power generating capacity (GW)				
Hydropower capacity	249	290	330	400
Wind power	61	100	150	200
Solar power	3	35	70	100
- from distributed energy	0	20	35	NA
- from power stations	3	15	35	NA

Sources: Mirova / NRDC (National Development and Reform Commission)

United States

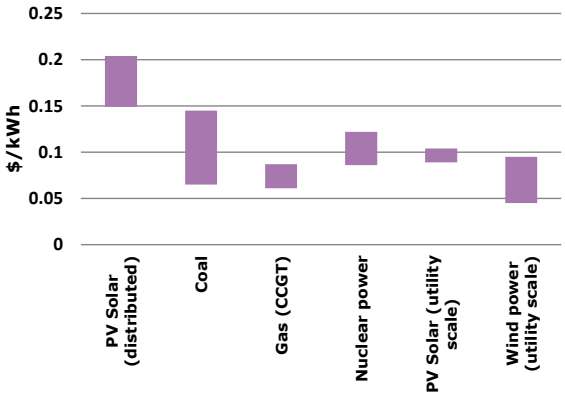
The United States continues to exhibit some of the highest CO_2 emissions worldwide at ~21t eq. of CO_2 per capita, as compared to less than 10 tonnes in Europe. The disparity can be partially explained by the substantial place of coal in the US electric energy mix (~48% of mix). While the question of climate change has long remained a side issue, a number of regulations aimed at reducing CO_2 are now taking shape.

Thus 40 states have enacted RPS (Renewable Portfolio Standard), regulations that include targets for renewable energy development. The most proactive of these are California, which is aiming for 33% renewable energy by 2020, Nevada, which is targeting 25% for 2025, and Hawaii, which hopes to achieve 40% by 2030. In order to achieve its goal of 33%, California will invest $115bn in the electricity sector between now and 2020, of which $100bn in power plants and $15bn in transmission.

At the federal level, President Obama introduced a plan in June 2014 to reduce CO_2 emissions from electrical power plants by 30% (compared to 2005 levels) before 2030. According to this plan, coal consumption would drop by 25-27% between now and 2020, replaced with renewables, whose contribution would increase by 12 GW, and natural gas.

The strong decline of production costs associated with solar energy and its increasing disparity from the price of electricity sold on the grid makes it more attractive for individuals and businesses in the US to make their own electricity from solar panels installed on roofs, in what is called *distributed generation*. In the short period between 2010 and 2013, distributed solar went from 3% to 12% of all new solar capacity installed in the United States (4.6 GW total). In the first quarter of 2014, total solar installations jumped 79%, to 1.33 GW, with a third of these coming from individual households and commercial or industrial clients.

Figure 7. Cost of electricity production in the US, by technology



Source: Mirova / Lazard

II. An array of solutions

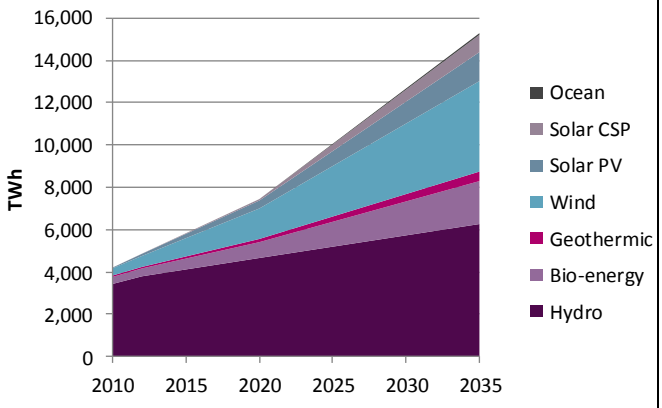
In order to best identify and take advantage of opportunities arising from these changes, we put together an investment universe focused on the various activities that contribute to the energy transition. This universe is built around the following solutions.

Low carbon energy

Renewable energy, the fuel driving the energy transition

Energy from renewable sources, which emits no CO_2 and is considered by and large acceptable in terms of other environmental concerns, is set to play a starring role in the struggle against climate change. Technologies like hydropower and biomass, biofuels and geothermic energy, which are relatively mature, will continue to increase their contribution to electrical power generation, however, the strongest levers for growth will be more recent technologies, especially solar and wind power.

Figure 8. Electricity from renewable sources in the 450ppm scenario: breakdown by technology



Source: Mirova / WEO

Solar

Solar energy made a strong comeback on the equity markets in 2013 on the basis of several fundamental drivers.

1/ Favourable regulatory changes, particularly in China and Japan;

2/ a price stabilisation of solar panels since March of 2013, thanks to a better balance of supply and demand;

3/ a continuing decline of the production costs for solar energy that have brought it close to 'grid parity' (the wholesale cost of electricity, excluding cost of grid integration) in some parts of the world. For instance, it is believed that solar energy has achieved grid parity in 10 of the 50 American states.

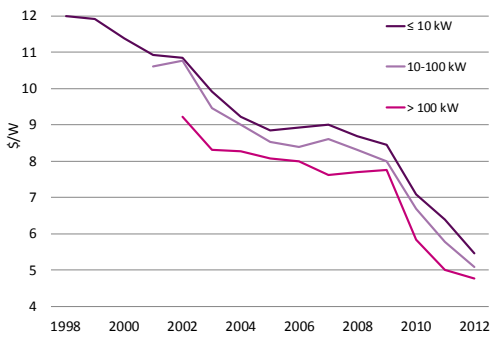
Following a 16% increase in the demand for modules in 2013, the total market is expected to show 20% growth in 2014 and 16% in 2015 (source: HSBC).

With capacities of 12 GW added in 2013, China has become the largest market for solar in the world. This number is forecast to reach 14 GW in 2014, according to China's NEA (National Energy Administration). The last reform of feed-in-tariffs, during the second half of 2013, extended their application beyond solar farms used by utility companies to residential installations, which are still relatively undeveloped in the country. The new solar targets published by the National Development and Reform Commission (NDRC) and NEA for 2017 are counting on a doubling of capacity to 70 GW from the 35 GW anticipated by 2015.

After China, Japan is the second largest market for solar energy, with 6.5 GW of installed capacity as of 2013, a number that is expected to grow to 7.5 GW in 2014. Even after the planned 11% drop in the price of solar electricity to 32 JPY/kWh came into effect in April, Japan remains one of the world's most attractive markets. Following the Fukushima catastrophe and a temporary ban on nuclear power, Japan has decided to undertake massive investments in renewables, which currently constitute 10% of the energy mix, with hydroelectric alone currently supplying 8%. Based on the proposals, which vary from one political party to another, this proportion could double or even triple by 2030.

In the US, 4.2 GW of new solar capacity was installed in 2013, representing 15% of the total market worldwide. Of this, nearly 90% involved large-scale projects; the rest consisted of residential projects. A system of Investment Tax Credits (ITC) grants developers a tax credit equal to 30% of their investment for all projects commissioned before 2016. Over the 2014-2016 period, the US market could amount to 20 GW in new installations, more than half of it from distributed solar by residential and commercial clients.

Figure 9. PV solar cost trends (1998-2012)



Source: Mirova / IEA

Wind Power

After a 20% drop in new wind turbine installations during 2013, the market is expected to bounce back in 2014 and 2015, with growth estimated at 23% for 2014 and 11% for 2015, representing 44.3 GW and 49.1 GW, respectively (source: HSBC). The bulk of this expansion is expected to come from the Americas in 2014 and the Asia-Pacific region in 2015. European installation rates are expected to remain stable for the period.

Figure 10. New wind farm capacities by region (2010-2015)

Source: Mirova / GWEC / HSBC

China will likely remain the largest wind power market (15 GW), although this market remains 'controlled' by Chinese turbine manufacturers. In the US, despite the lapse of the Production Tax Credit for wind power at the end of 2013, projects whose construction began before December 2013 will continue to receive tax credits for a 10 year production period. This provision applies to 12.5 GW of new installations in the 2014-15 period. The strongest growth in onshore wind is likely to come from emerging markets, where Brazil, in first place with 3 GW of new capacity anticipated in 2014, is on par with Germany and ahead of India (2.4 GW).

Europe's wind power equipment manufacturers made a strong recovery on the stock market in 2013 (+300% and +400%) buoyed by:

- an upturn in order intake starting in the first quarter of 2013, concurrent with a stabilization of turbine prices,
- manufacturers' implementation of restructuring plans (sales of assets, reduction of fixed costs) during the trough of their business cycle.

Given the context of double digit volume growth, manufacturers should see margins improve thanks to falling costs, economies of scale and efficiency gains.

Natural gas is an transition solution

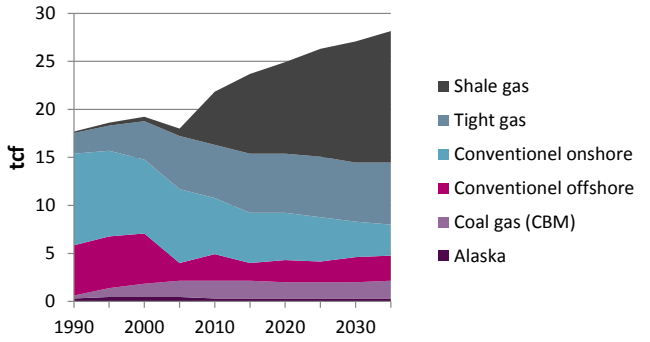
Natural gas has a carbon footprint that is half that of coal for electricity production, and can thus play a temporary role in the reduction of CO_2 emissions when combined with energy efficiency measures and the development of low-carbon energy solutions. This is especially true in countries where coal plays an important role, such as China, India and the United States. Consequently, the "natural gas as a transition solution" segment of the investment universe focuses on these countries.

In the United States, the Environmental Protection Agency's (EPA) new emission rules for coal-fired plants will take effect in 2015. According to the IEA, this will cause the equivalent of 60 GW of capacity to be shut down between now and 2020 (approximately 20% of capacity from coal-fired plants at end 2012). According to the IEA, 42% of the electricity produced today in the US still comes from coal, ahead of natural gas (25%), nuclear power (19%) and renewables (14%).

The development of shale gas production in the US, in addition to providing a substitute for other, more polluting fossil fuels, has allowed the US to reduce its dependency on imports, and allowed them to avoid gas prices in line with those of Japan, which are fixed by long term contracts pegged to the price of oil (American gas prices are a third of Japan's). Non-conventional gas currently accounts for 45% of US gas production, a number that could rise to 80% within the next quarter century.

Investments in pipelines and storage capacity (Midstream activities) related to the explosion of nonconventional resources in North America should see strong growth between now and a 2035 horizon (USD +14.1 bn/yr during 2014-2035 according to ICF International). As the US prepares to launch exports of LNG (liquefied natural gas), projects for building terminals are multiplying along the Pacific coast and the Gulf of Mexico, although none of these installations are operational as of yet. According to the energy consulting firm IHS, the United States' LNG export capacity should reach 66 bcm by 2018-2020, as compared to a total LNG market of 540 bcm by this time.

Figure 11. Natural gas production in the United States



Source: Mirova / IEA

Sluggish growth for nuclear power

Nuclear energy is often touted, particularly by the IEA, as a viable option in the fight against climate change. It is true that this technology presents the advantage of a CO_2 footprint close to that of renewable energies, because fission reactions emit no GHG. Nonetheless, it is an energy source with risks of its own:

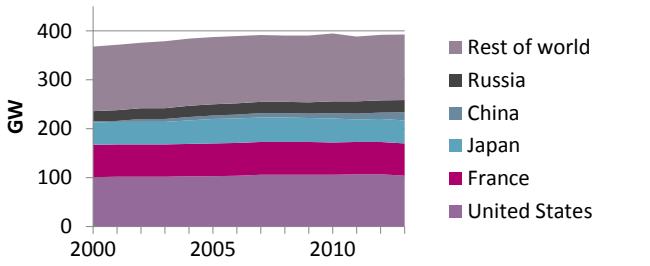
- The risk of nuclear accidents. Events like Three Mile Island, Chernobyl and Fukushima have demonstrated that nuclear accidents are a reality.
- Management of nuclear waste. Even after reprocessing of high-level nuclear waste, by-products of fission result in long-lived radioactive waste which can remain dangerous for thousands, even hundreds of thousands of years. This remains the biggest challenge facing the industry.

All of Mirova's funds share the belief that nuclear power can provide a solution for reducing CO_2 emissions. This said, the risks associated with this technology mean that it is not appropriate for every country. Political stability is essential, and a high level of technical know-how is necessary. A case by case analysis of the strategies pursued by players in the nuclear industry is thus necessary, especially for those whose contracts are in countries where a monitoring of the industry has yet to be established.

The want of a consensus has also weighed heavily on the development of the industry for several years now. This has shown up as production capacities that have flat-lined for the last decade or so.

The Fukushima accident further reinforced existing concerns, and some countries, most notably Germany, have elected to withdraw from nuclear power. Even for countries relatively favourable to this technology, like the United States, France, Russia or China, the catastrophe has meant a strengthening of safety regulations and, consequently, increased costs.

Figure 12. Installed nuclear power capacity by country



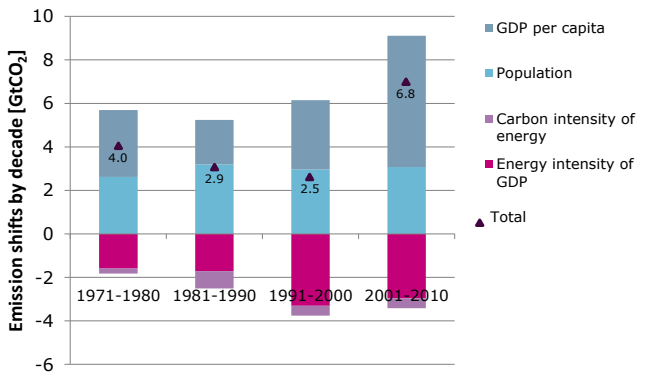
Source: Mirova / IEA

Given this context, the growth forecasts published by the IEA seem overly optimistic, and it appears more likely that we will see a relatively slow growth of nuclear power in the medium term. As of now, nuclear is not in and of itself a theme in our investment universe.

Energy efficiency

Increased pressure and volatility in energy prices have pushed improving energy efficiency to centre stage in the strategy of many businesses, especially in the transport and industry sectors. Nonetheless, as illustrated in Figure 13, efforts made in recent decades to reduce the energy intensity of GDP, as well as the carbon intensity of energy production, have not been sufficient to offset increases in emissions due to population growth and a higher standard of living worldwide.

Figure 13. Changes in carbon emissions: positive and negative contributors



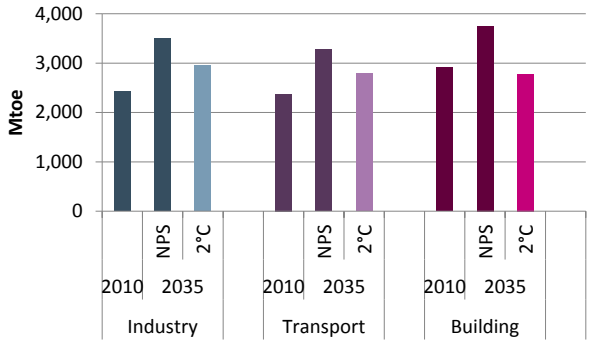
Source: Mirova / IPCC

In anticipation of the 2015 International Conference on Climate Change to be held in Paris (Cop21), new regulations are set to appear in several countries. China's 12th five-year plan (2011-15) aims for a 17% reduction in the country's energy intensity (defined as energy consumption over GDP). This goal is likely to be carried over at the same rate in the 13th five-year plan (2016-20).

Guesses as to the size of investments related to energy efficiency vary according to the source. In a study from 2011, the IEA estimated the market's size as falling in the $147-300bn range. The latest study jointly produced by Ecofys and HSBC arrived at a figure of $365bn for investments devoted to energy efficiency in 2012, or half again as much as investments in renewables ($244bn, according to the Renewable Energy Policy Network (REN21).

Improvements in energy efficiency are predominately associated with the three most energy consuming sectors of the economy: Building (35% of global consumption), Industry (31%) and Transport (30%). According to the Ecofys-HSBC study, three quarters of the investments in energy efficiency in 2012 involved the Building sector, 80% of which went to residential.

Figure 14. Efficiency scenarios for the big 3 energy consumers



Source: Mirova / IEA

'Enabling' technologies

In addition to technologies that directly reduce energy consumption or GHG emissions, the fight against climate change involves massive investments in technologies that indirectly enable CO_2 savings. Two of these look particularly promising right now, and are examined below.

Smart Grids

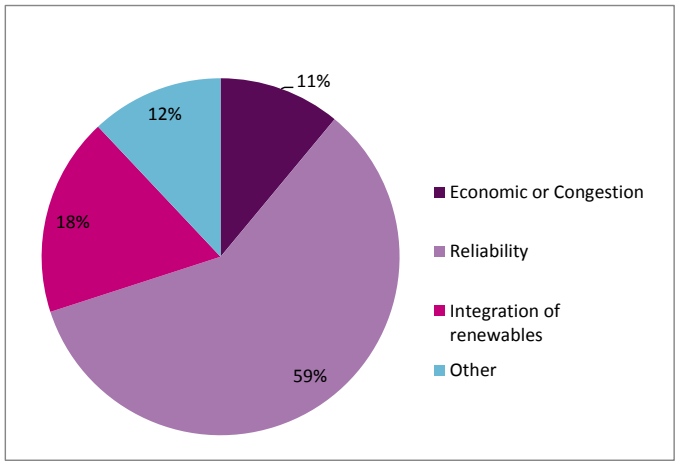
Expansion of the renewables sector entails large amounts of funding for electrical infrastructure, particularly in the area of transmission/distribution and what are called smart grids.

Firstly, the construction of new production capacity in places other than traditional power plants requires that new transmission infrastructure be built. Additionally, since electricity can basically not be stored, the incorporation of intermittent sources of energy such as solar or wind power requires an intelligent management of transmission in order to ensure load matching. The development of smart grids is thus a necessary condition of integrating renewables into the electrical grid. Furthermore, smart grids make possible additional efficiency gains through demand response systems and peak levelling.

Investments in smart grids could amount to €290bn in Europe and boost growth in the long term for European utilities (UBS, 2014). After years of underinvestment, electrical infrastructure (Transmission and Distribution) is finally taking off in the United States, and should experience high growth through the 2030 forecast horizon (estimated at $120-160bn per decade [Brattle Group,2014), based on two major drivers:

- New reliability regulations for grids that include requirements as to repair, replacement, updates and maintenance.
- Increasing need for interconnection related to changes in the energy mix (decrease of coal in favour of natural gas and renewables).

Figure 15. Primary drivers of new transmission projects in the United States



Source: Mirova / NERC 2013 Long-term Reliability Assessment

Electric vehicles

Transport accounts for half of the world's oil usage, and nearly 15% of all GHG emissions. Developing electric vehicles is beginning to look like a serious alternative to combustion engines. While electric vehicles are comparable to conventional combustion-driven ones in terms of fuel efficiency, they eliminate dependence on oil, and make it possible to envisage "green" mobility if the electricity to power vehicles can be generated from low carbon energy sources.

Hybrid electric vehicles (HEVs) represented a total of 1.7 million units, or 2.4% of all vehicles sold worldwide in 2012. Japan is the world's largest market for hybrids at one million units sold in 2012, according the International Council on Clean Transportation. The volume of hybrid vehicles purchased in the US and Europe during the same period was substantially lower, at 360,000 and 135,000 respectively. Nonetheless, annual growth in these two markets is in the 30-40% range. With the favourable momentum seen in Japan, the US and Europe, hybrid vehicles could amount to 6% of the market by 2020.

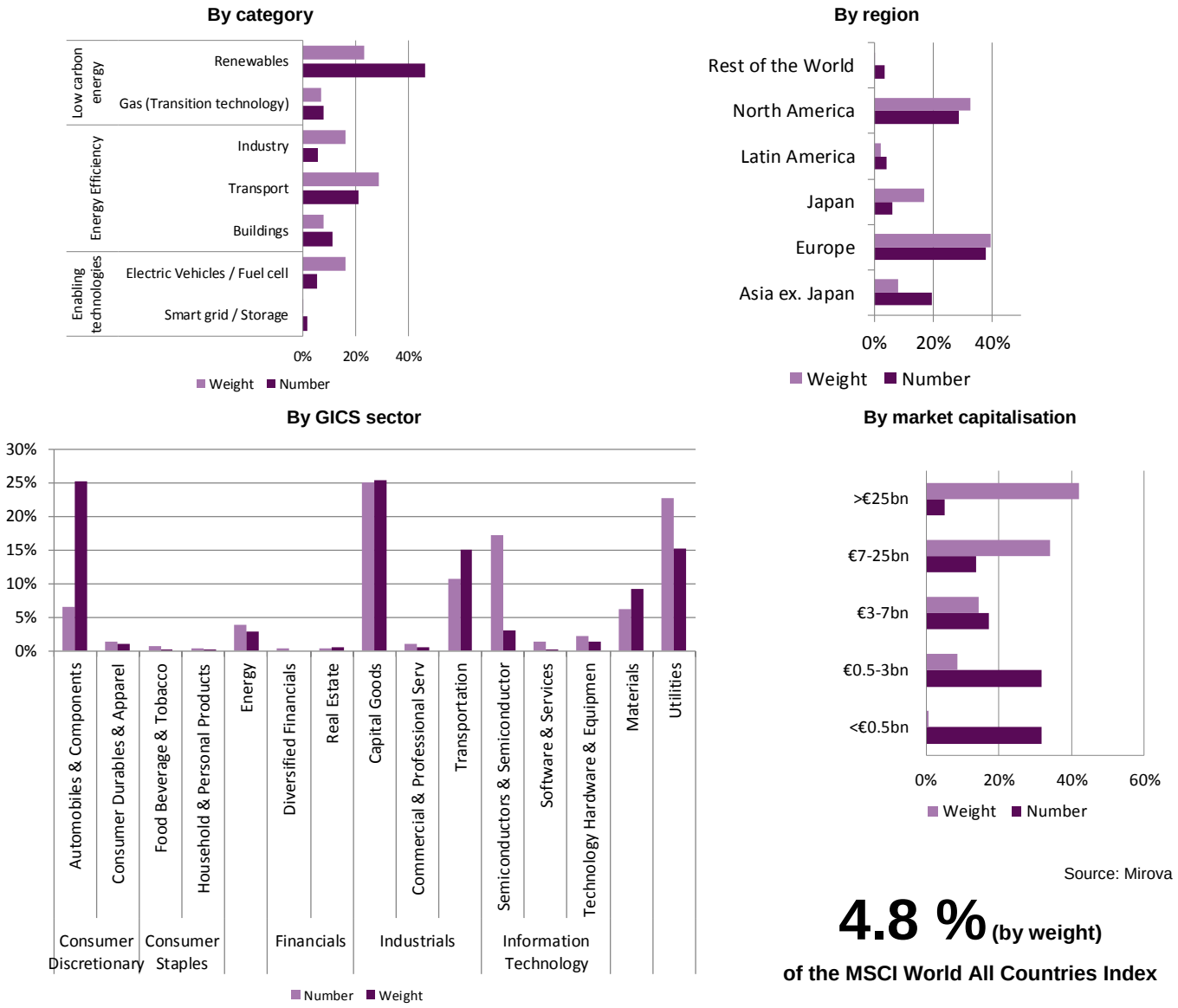
Electric vehicles are a much smaller market than hybrids, with a total of 112,000 vehicles sold in 2012 (55,000 'plug-in hybrids' and 57,000 'full electric vehicles'). Despite these quite limited sales numbers, electric vehicles are already the target of massive investment on the part of automakers and equipment manufacturers. These investments should help remove current obstacles to widespread adoption of electric vehicles: their high price tag, lack of charging infrastructure and, more generally a lack of confidence in a business model seen as somewhat short of maturity.

Driven by general regulations on CO_2 as well as those specific to automobiles, electric vehicles could snag a 3% to 4.5% share of new car sales by 2020, according to some scenarios (Rockwood, 2014).

III. Investment Universe

In order to identify the companies with exposure to these various opportunities we rely on an 'Energy Transition' investment universe comprising over 300 securities, 200 of which have market capitalisations of more than €500 million. This universe also shows a healthy diversity in terms of sectors and geographical areas (Figure 16). As of now, 55% of the total number of stocks falls into the "low carbon energy" category, followed by "energy efficiency" in second place at 38% and 'Enabling technologies at 8% in third. Given the global nature of these investment themes, 60% of the stocks in the universe are listed outside of Europe.

Figure 16. Overview of the 'Energy Transition' universe



Source: Mirova

4.8 % (by weight)

of the MSCI World All Countries Index

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