

3 July 2009 (No. of pages: 100)

Green Industrial Revolution Gaining Momentum

Promising industries and players in next-gen eco, energy technologies

Japanese report: 16 Jun 09

Environmental Research Group

Hanako Mizuguchi**Yoko Monoe**

Summary

- The financial crisis could trigger a greater emphasis on sustainability in social and industrial structures across the globe. This report focuses on that possibility and the industries and companies (65 in Japan, 32 overseas) that are poised to lead the way. As shown in the chart below, the domestic names we have picked out in this context show favorable performance vs. TOPIX.
- The first chapter of this report discusses the above-mentioned possibility, the climate and energy policies of various countries, and changing investment opportunities.
- The second chapter verifies the technologies and necessary funds for addressing global warming. It also sheds light on the inflow of money into green funds, potential premiums for players in clean technology, and short-, medium-, and long-term strategies in Japan.
- In the third chapter, we summarize Green New Deal strategies in Japan, the US, Europe, China, and South Korea.
- In the final chapter, we identify separate categories for the various green technology industries, providing overviews and market forecasts for each and introducing the major players.

Performance vs. TOPIX for 65 Domestic Clean-tech Players (market-cap weighted avg.)

(Dec 2004 = 100)



Source: Compiled by DIR.

Contents

Summary	3
I. Toward a Green Industrial Structure	4
<i>Factors calling for green industrial revolution</i>	
1.1 Chance for Change to Sustainable Growth	4
<i>Sustainable growth model explained</i>	
1.2 Moves Aimed at Global Climate, Energy Security	7
<i>Overviews of national climate and energy policies</i>	
1.3 From Global Green New Deal to Green Economy?	12
<i>From Green New Deal to green economy?</i>	
1.4 Possible Medium- to Long-term Impact of Structural Shift	15
<i>Possible investment opportunities with green industrial revolution</i>	
II. Stock Market Response to Clean-tech Revolution	22
2.1 Focus of Clean-tech Investment Funds	22
(1) Clean-tech Investment Fund Performance	22
<i>Clean-tech funds on the rise with crude oil</i>	
(2) Potential Beneficiaries of Foreign Investment	25
<i>Foreign investor trends, performance of clean-tech names</i>	
(3) Sensitivity to Environmental Trends Yardstick for Clean-tech Stock Premium	27
<i>Sensitivity to carbon credits, coal prices</i>	
(4) Clean-tech Players on Our Radar	29
<i>Names on our radar performing well</i>	
2.2 Clean-tech Businesses that Could See Inflow of Investment over Medium to Long Term ...	39
(1) Technologies in the Spotlight	39
<i>Clean energy and transportation</i>	
(2) Focus Areas in Japan's Global Warming Policy	41
<i>Significant potential for emissions cuts in photovoltaics</i>	
(3) Efforts to Launch Full-fledged Emissions Trading	45
<i>Possible source of government revenue</i>	
III. Green New Deal Initiatives by Country	48
<i>Green support and focus areas in economic stimulus packages</i>	
3.1 Environmental Projects a Pillar of Economic Packages	48
<i>Responses to financial crisis, energy problems, and climate change</i>	
3.2 Overview of Green New Deal Initiatives	49
<i>Big spenders are China, US; focus on rail, power grids, construction</i>	
3.3 Initiatives by Country	50
<i>Overview of policies in China, US, Europe, Japan, South Korea</i>	
IV. Clean-tech Industries and Companies	58
<i>Overview of clean-tech industries and firms on our radar</i>	
4.1 Clean-tech Industries	58
<i>Overviews of clean-tech industries, including energy, transportation and water tech</i>	
4.2 Clean-tech Players on Our Radar	70
<i>65 domestic, 32 overseas firms on our radar</i>	
4.3 One-page Overviews for Major Clean-tech Players	80
<i>One-page comments on 16 domestic, two overseas firms</i>	

Summary

Green industry strategies picking up speed

This report covers the possibility of the financial crisis triggering an increased emphasis on sustainability in social and industrial structures, as well as the industries and companies (65 domestic, 32 overseas) that are poised to lead the way.

First chapter: Toward a green industrial structure

The first chapter starts off with a look into this possibility. We follow that up with the medium- to long-term climate and energy policies of various countries since before the financial crisis, with a focus on the major producers of CO₂—the US, China and Europe. Finally, we discuss how the financial crisis has altered stances on environmental investments and how such might change going forward.

Second chapter: Stock market response to clean-tech revolution

In the second chapter, we try to decipher the stock market's stance by looking at clean-tech funds and their changing portfolios. The focus then shifts to the medium- to long-term outlook and promising stories in view of domestic and overseas policies to address global warming. Specifically, we confirm technologies and necessary funds for combating global warming, and explore the inflow of money into green funds, potential premiums for clean-tech players, and Japan's short-, medium-, and long-term strategies. Wrapping up our discussion in this chapter is a look at the possibility of a full-fledged launch of an emissions trading scheme in Japan.

Third chapter: Green New Deal initiatives by country

The third chapter explores environmental projects in economic stimulus packages announced in China, the US, Europe, Japan, and South Korea between September 2008 and May 2009. All together, we estimate the Green New Deal policies total roughly Y51 trillion, with China accounting for more than half of that amount, and the US making up a fourth. Though both are major producers of greenhouse gases, neither is subject to mandatory emission cuts under the current Kyoto Protocol. As such, there is immense potential for emission reductions, and hence significant growth potential in clean-tech industries. Our research concludes that railway, power grids and construction are the three largest focus areas in Green New Deal policies, in terms of the amount earmarked for investment.

Fourth chapter: Clean-tech industries and companies

Finally, we provide overviews of industries poised to benefit from Green New Deal strategies and introduce companies we see as important in this context. In the first part of this chapter, we review a wide range of industries, including energy, transportation, and water technologies. We follow this up with short comments on the green-tech businesses of 65 Japanese and 32 overseas firms. The report ends with one-page overviews for 18 of these companies (16 Japanese, two overseas).

I. Toward a Green Industrial Structure

Hanako Mizuguchi

Financial turmoil and the credit crunch, which started with problems in the US subprime mortgage market, and triggered the collapse of Lehman Brothers, have spread and intensified into a global crisis. Amid these conditions, Barack Obama became the first black president of the United States under the slogan of “Change.” This event likely partly represents a loss of faith in the status quo and hope for change generated by the intensifying financial crisis and spillover into the real economy. Recently, fiscal and monetary measures, including some involving departures from the previous status quo, have started to arrest the slide in economic conditions. What lies beyond this change? Sustainability will probably be a key concept.

1.1 Chance for Change to Sustainable Growth

Governments around the world have rolled out monetary and fiscal stimuli in response to the sharp deterioration in the global economy following the collapse of Lehman Brothers, and currently recessionary forces seem to be weakening. We think the main reasons for this are expectations for a recovery in demand fueled by the Chinese government’s massive stimulus package, and the US government’s rapid response to the serious financial crisis and economic slowdown. Another factor to consider is ongoing expectations regarding the Obama administration’s shift of emphasis to international cooperation and the environment.

Is Continuous Economic Growth Possible?

Current economic growth models assume rising consumption

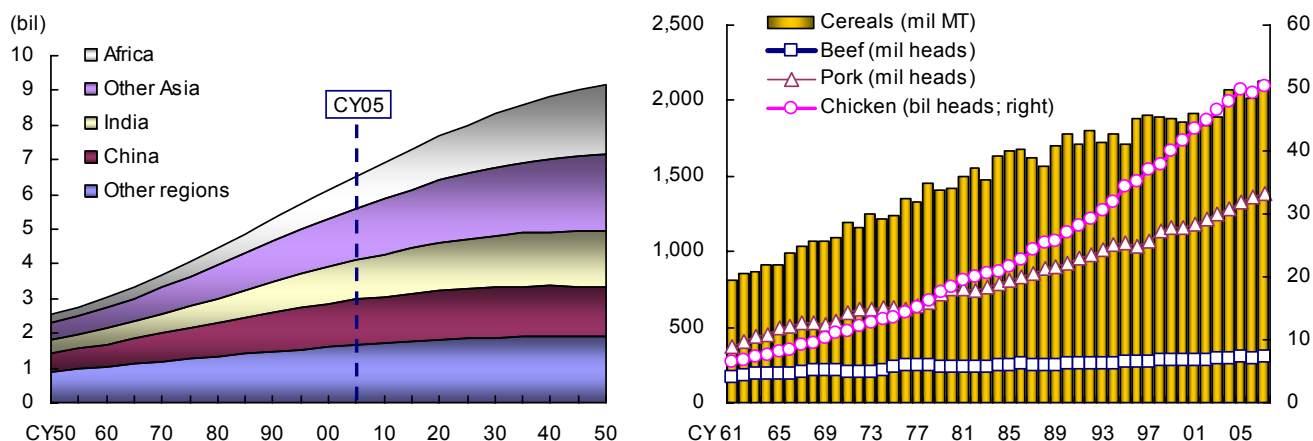
Much of the blame for the recent US housing bubble goes to rapid economic growth, fueled by increased production capacity in emerging nations and higher demand driven by excess US consumption. What we mean here by economic growth is expansion in the gross domestic product (GDP), which, as the name suggests, essentially equals increased production (consumption), though it does also take into account changes in added value. Production growth requires inputs of capital, labor, resources, and energy. Thus, economic growth is limited by the availability of these inputs.

Consumption grows as population grows

Meanwhile, with regards to consumption, the global population has grown by 4 billion people (2.6-fold) in the past 55 years from 2.5 billion in 1950 to 6.5 billion in 2005. Water and food are the minimum requirements for sustaining human life. The supply of cereals has grown, but given the marked expansion in demand (from humans, livestock, alternative energy), there is still not enough food to go round. Furthermore, the global distribution of drinking water and agricultural land is unbalanced, just like crude oil and other energy sources. Energy and resources are becoming increasingly vital for the efficient production, processing, transportation, and distribution of cereals. The United Nations forecasts the global population to expand a further 2.5 billion to over 9 billion people in 2050, with developing nations in Africa and Asia likely accounting for most of the increase. In other words, in 40 years time, capacity sufficient to provide food and energy for an additional 2.5 billion people, roughly equivalent to two Chinas (current population of 1.3 billion), will be needed.

Global Population Growth Forecasts and Cereals/livestock Production Volumes

Chart 1.1



Source: Materials from various international organizations; compiled by DIR.

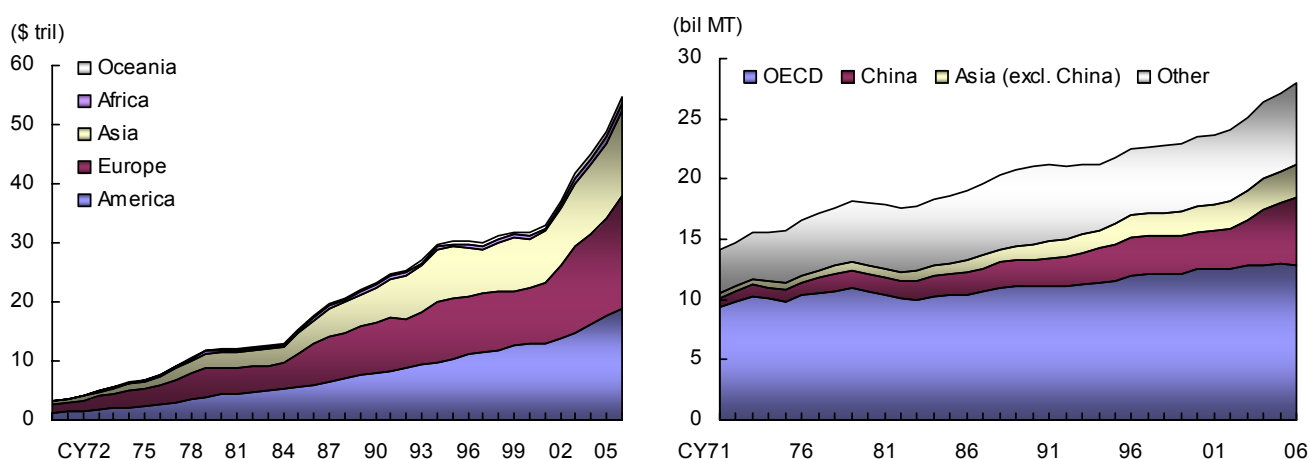
Can such a demand surge be accommodated?

Is it possible to raise supply capacity to accommodate demand for an additional two Chinas in the next 40 years? The recent surge in food and energy prices, which peaked in 2008, suggests that this is doubtful. Resources/energy (iron ore, crude oil) and food (wheat) prices skyrocketed in line with robust economic (GDP) growth in China and other emerging economies from the turn of the millennium.

Under the current economic growth model driven by expanding production and consumption, population growth without corresponding additions to food and energy supply capacities should result in considerable food/energy cost increases. Measures to secure food/energy supplies (food/energy security) amid such marked food/energy price uptrends are becoming increasingly important, even during brief corrections within such trends.

GDP by Continent and CO₂ Emissions from Energy Consumption

Chart 1.2



Source: United Nations materials; compiled by DIR.

Initiatives aiming for sustainable growth

This line of thinking has already been outlined in a book called *The Limits to Growth*, compiled by the Club of Rome and released at the United Nations Conference on the Human Environment in 1972. This work concluded that given the environmental pollution and depletion of natural resources caused by sustained global population expansion, the limits of economic growth on earth would be reached within 100 years. In 1992, the joint declaration of the Rio Earth Summit included a definition of sustainable development as incorporating environmental protection within economic

activities while keeping use of natural resources to a minimum and reducing pollution. The Kyoto Protocol, which aims to combat global warming, is based on the United Nations Framework Convention on Climate Change (UNFCCC), one of the international treaties enacted to implement the Rio Declaration.

Attempts at Sustainable Growth Models

Limits of current economic growth model apparent

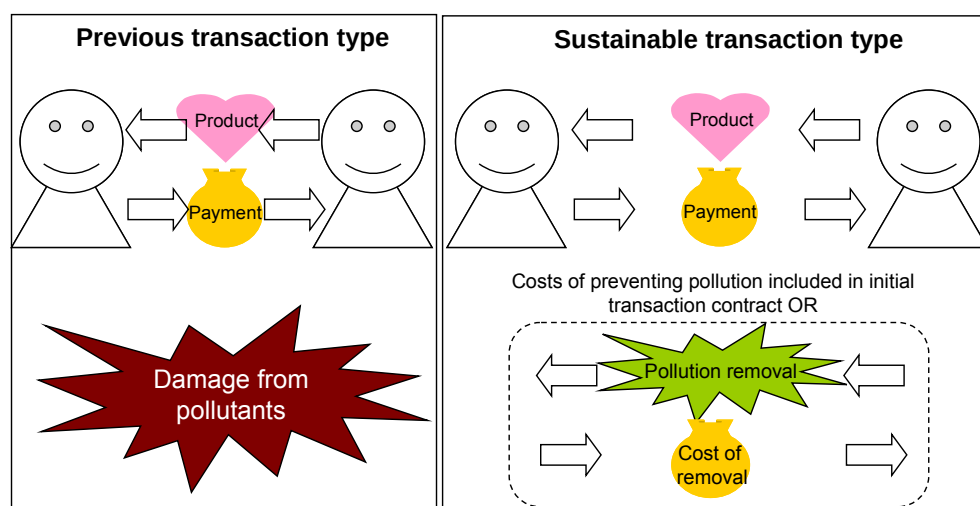
As we have already mentioned, we think the US housing bubble sparked by excess consumption illustrates the limits of the current economic growth model based on expanding consumption and production. Excessive consumption means consuming in excess of one's current income by postponing payment until the future—for example, taking out a loan to purchase something that one cannot afford on one's present income. The more such future payments pile up, the larger the damage if income falls short of expectations. In the current crisis, financial institutions extended credit (loans) to people whose current incomes suggested they would have difficulty making the required payments, based on the assumption that asset values would increase. When repayments stalled and expectations for asset price gains receded, the institutions were unable to recover these loans. They have rightly been much criticized for this behavior. However, if we view the bubble as the result of the current economic growth model that encourages excess consumption, then the focus going forward should be on developing a “sustainable” economic model, which does not induce excess consumption.

Utilizing economics to tackle environmental issues

Various sustainable growth models have been suggested. For instance, environmental economics (branch of economics handling environmental issues) researches economic methods for resolving environmental problems. Specifically, environmental economists are looking at ways to optimize transaction contracts by pricing in the costs of cleaning up or preventing pollution and other negative environmental impacts arising from the transactions. In other words, they are seeking ways to avoid greater-than-expected future damage (costs) by budgeting for environmental risks in transaction contracts, rather than ignoring them until later.

Sustainable Transactions

Chart 1.3



Source: Compiled by DIR.

Kyoto Protocol is one example

The Kyoto Protocol represents one such attempt. It is an international agreement aimed at preventing global warming (considered a threat to human life) by reducing the greenhouse gas (GHG) emissions (85% CO₂, so debates often focus on CO₂ only) which are thought to cause it. The agreement includes the introduction of emissions trading as an economic method of reducing greenhouse

gas emissions. Emissions trading works by setting a price for carbon, the main component of GHGs (pollution). Firms either try to cut emissions or buy emissions credits depending on their relative costs, so the price of emissions credits act as an indicator of the cost of cutting emissions.

Europe leads way in implementing economic measures

The leading scheme for emissions trading, accounting for 80% of trading in both volume and value terms, is the European Union Emission Trading Scheme (EU-ETS), not the mechanism included in the Kyoto Protocol. Trading activity is doubling annually, and the success of the scheme is prompting various countries and regions to develop their own systems. Some countries/regions are now discussing linking their schemes to the EU's.

Consciousness of environmental issues has been strong in Europe for some time, helping political parties with eco-friendly agendas to gain influence in government, even in developed European nations. Scandinavian nations initiated meaningful green measures in 1990, with Germany and the UK following suit in 1998. Furthermore, eight European nations, mainly in Scandinavia, have introduced environment taxes as an additional economic measure alongside emissions trading.

Looking ahead, there are calls for an import tariff or global environment tax in Europe, and even the US senate is currently debating whether such taxes would fall foul of WTO regulations. The proposed import tariffs involve EU-based corporations having to purchase emissions credits for imported products, or a carbon tax (tax based on quantity of carbon used) on imported products.

Simply put, under these measures, higher quantities of oil and other fossil fuel-based energy consumed mean higher tax charges. A carbon tax on imports could mean that carbon emissions during transportation (air, marine, land) are taxed as well. On the other hand, the combination of these regulations/taxes and rising crude oil prices would likely spur the spread of and investment in biofuels, photovoltaics, and other alternative energy sources, by enhancing their relative cost competitiveness.

Will attitudes to risk change?

President Obama, who led the call for change, has repeatedly blamed greed for the financial crisis, and has called for the replacement of the 20th century financial system that condoned such greed with a 21st century one based on different rules. He announced five core elements to his 21st century rebuilding plan, including financial reform and investment in renewable energy and technology. On the financial front, an agreement to step up supervision of hedge funds and other financial institutions was reached at the April G20 summit.

Currently, only the financial system, which gave rise to excessive focus on returns relative to risks, is in the dock. However, there may also be moves to reassess the sustainability of the pursuit of corporate profits and social utility from the point of view of environmental risks. Negotiations on the post-Kyoto framework, which are approaching the end-2009 deadline for agreement, could represent one such opportunity. The chastening experience of the recent unprecedented financial crisis could be an opportunity to create a sustainable system for the next century.

1.2 Moves Aimed at Global Climate, Energy Security

In the first section, we posited that the financial crisis could provide an opportunity for a greater emphasis on sustainability in social and industrial structures. In this section, we will summarize the current policies/strategies of major GHG emitters (chiefly US, China, Europe).

Energy—driver of economic growth—and its side effects

GHG Emissions, Energy, and Economic Growth

One reason that global warming has become a major issue is the need to maintain an environment that can sustain human life. However, another major reason, as illustrated in major nations' climate and energy policies, is that around 80% of CO₂ emissions are from energy sources. In other words, cutting GHG emissions essentially means reducing consumption of oil and coal, the drivers of 20th century economic growth. Energy consumption has typically been closely correlated with economic growth, a link that has generally strengthened as industrialization progresses. Data from the April G20 summit shows that the US and China accounted for 18% and 19% of global GHG emissions and 21% and 15% of world energy consumption, respectively. In other words, they make up half of the G20 total in both these areas. In terms of GDP, the US is the largest economy, accounting for 23% of the global total, while China currently ranks third with a 7% share (Chart 1.4). Incidentally, Japan ranks second by GDP (8% share), and third in GHG emissions and energy consumption. Going forward, industrialization in emerging and developing nations should swell energy demand, while industrialization in the Middle East and other oil-producing nations will likely lead to greater domestic energy consumption, restricting supply to the rest of the world. Amid these conditions, it will probably be difficult for countries/regions lacking oil resources to maintain their oil/coal-driven 20th-century industrial structures.

GDP, Energy Consumption, GHG Emissions of Major Nations Chart 1.4							
	GDP		Y/y %	Energy consumption		GHG emissions	
	2008 (\$ bil)	Share (%)	09 forecast	2005 PJ/a	Share (%)	Mil MT CO ₂ equivalent	Share (%)
Japan	4,844	7.8	-2.6	22,405	4.8	1,383	3.6
China	4,222	6.8	6.7	72,183	15.4	7,253	18.7
South Korea	953	1.5	-4	9,166	2	588	1.5
Australia	1,069	1.7	-0.2	513	1.1	559	1.4
US	14,334	23.1	-1.6	96,523	20.6	7,098	18.3
UK	2,787	4.5	-2.8	9,512	2	683	2.7
Germany	3,818	6.1	-2.5	14,367	3.1	1,006	2.7
France	2,978	4.8	-1.9	11,882	2.5	576	1.5
Italy	2,399	3.9	-2.1	739	1.6	588	1.5
G20	47,258	76		349,188	74.4	28,132	74.6
Other (non-G20)	14,884	24		120,271	25.6	10,594	26.4

Source: G20 materials; compiled by DIR.

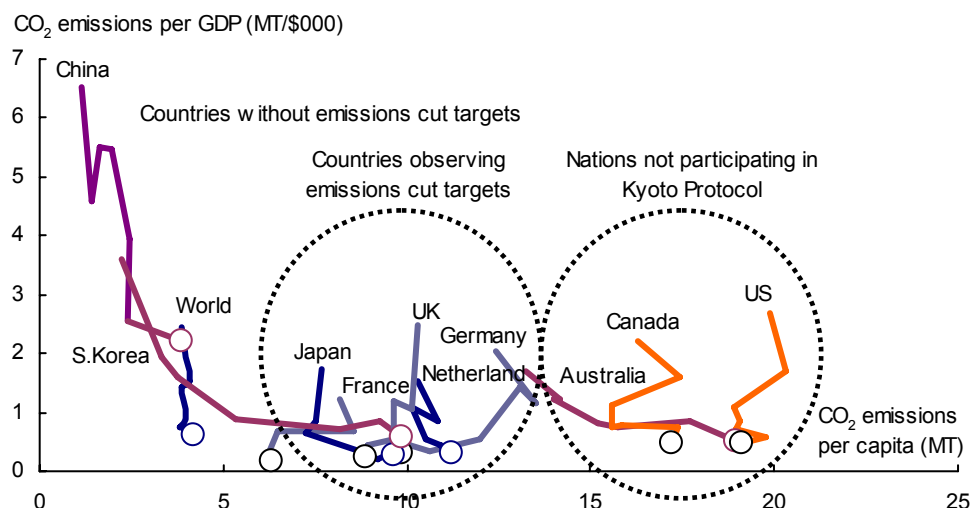
Do measures to cut GHG emissions effectively apportion energy consumption?

If one considers emissions caps under the Kyoto Protocol and other global warming policies as equivalent to putting a ceiling on energy consumption, the wariness about mandatory emissions cuts among industrializing emerging nations is understandable.

For instance, disagreement remains even on the issue of the appropriate metrics for setting emissions limits. Chart 1.5 plots emissions per GDP (vertical axis) against per capita emissions (horizontal axis) for various countries from 1975-2005 (white circles represent 2005 figures). Emissions per GDP have reached largely similar levels among developed nations, especially Japan and European nations. On the other hand, significant differences remain in per capita emissions. Among countries required to cut emissions under the Kyoto Protocol, per capita emissions have trended down in all except Holland and Japan, which planned to purchase emissions permits from the beginning. Conversely, there has been a marked uptrend in per capita emissions in South Korea, Japan, Australia and other Asia-Pacific nations.

GHG Emissions (per GDP/per capita)

Chart 1.5



Source: United Nations materials; compiled by DIR.
Note: White circles represent most recent (2005) figures.

Negotiations likely difficult

Negotiations over the post-2013 emissions framework will likely be tumultuous. Significant impetus has built up since the Kyoto Protocol came into effect in 2005, with countries setting out policy approaches and announcing/implementing subsidies and regulations in connection with (1) medium-term goals for GHG emissions cuts, (2) renewable energy targets, and (3) energy efficiency targets. 2009 is the deadline for an agreement on the post-2013 framework. Proposals from all the main emitters had emerged by May, and full negotiations based on these proposals started in June. The main points of contention are (1) the scope of mandatory cuts, (2) methods for establishing emissions cut targets, and (3) funding for such cuts. A key issue is whether the US and China join this next framework. Given the distances between the proposals of various developed and developing nations, we think reaching an international accord will be challenging. On the other hand, initiatives to reform national and regional regulations are proceeding steadily.

Emissions Targets of Various Nations and Proposals for Post-Kyoto Framework

Chart 1.6

	CY20		50		90→06		For developed nations	For emerging nations	Other
	Base year	Emissions cuts (%)	Base year	Emissions cuts (%)	Chg (%)				
Japan	2005	15	Current	60-80	5.3	Japan	Set emissions cut targets	Set energy efficiency targets by industry	Compile plans to curb emissions
EU (27 nation total)	1990	20	1990	Considering 60-80	NA	US	Set emissions cut targets for 2020, 2050	Countries with high emissions to set mitigation targets by 2020	All nations to compile plans for curbing emissions thru 2050
UK	1990	26	1990	80	-15.1				
Germany	1990	40	-	-	-18.2	EU	Emissions from developed nations to be cut 30% vs. 1990 levels	Urge to cut emissions 15-30% from expected levels assuming no measures taken	Support from developed nations to help emerging nations achieve targets
France	1990	20	1990	75	-3.5				
US	2005	14	2005	83	14.4				
Canada	2006	20	2006	60-70	21.7				
Australia	2000	5	2000	60	28.8	China	Reduce emissions more than 40% vs. 1990 levels by 2020	Cut emissions while continuing economic growth, fight against poverty	Support from developed nations to help emerging nations achieve targets
Source: Various materials; compiled by DIR.									

Source: Various materials; compiled by DIR.

Source: Media reports; compiled by DIR.

Major emitters pressing forward with own measures

Europe, where initiatives are most advanced, has already progressed from a focus on renewable energy to include energy efficiency and biodiversity. In addition, European nations are beginning to reconsider nuclear power as a means to achieve drastic emissions cuts. Meanwhile, in the US, which pursued measures in isolation during the previous Bush administration, the Obama administration has switched tack, placing greater emphasis on international cooperation and the environment. The administration has outlined its vision, including spreading renewable energy, beefing up promotion of energy efficiency, and introducing emissions trading. Japan, meanwhile, will likely introduce a feed-in tariff scheme for solar power and emissions trading from 2010. China, where there is likely significant leeway to cut emissions, has positioned strengthened energy efficiency and anti-pollution initiatives as major policy areas for combating global warming while continuing economic growth.

Broadening global warming policies

US: New Administration Moving to Introduce Mandatory Emissions Cuts

The budget announced by the Obama administration in February 2009 set targets of cutting GHG emissions by 14% relative to 2005 levels by 2020 (flat relative to 1990 levels) and by 83% by 2050 (down 80% vs. 1990). In addition, it set a goal of lifting the proportion of electricity generated from renewable sources to 10% by 2012 and 25% by 2025.

Though we have called this a shift in focus to the environment, the policies represent a continuation and expansion of Bush administration measures in some respects. For instance, reducing dependence on imported oil and coal and creating a smart grid were already incorporated in the *Energy Independence and Security Act of 2007*, enacted at end-2007. However, the Obama administration has vastly increased the scale of such measures, for instance increasing support for introducing clean technologies from \$2 billion a year over five years (total of \$10 billion) under the Bush administration's initiatives to \$15 billion per year over ten years (total of \$150 billion), a 7.5-fold increase in annual investment. The current administration announced the withdrawal from Iraq and measures to promote domestic clean energy industries such as wind power using tax deductions. Given that the US government has spent between \$50-180 billion annually on military operations in Iraq, this direction change makes sense both economically and in terms of energy security. Of course, the measures should also be effective in stimulating demand and creating jobs.

Shift to green capitalism?

How far might this change in direction go? President Obama has clearly stated that the 21st century financial system should be based on different principles from the 20th century one. In addition, he has called for a 21st century rebuilding consisting of five core elements, including investment in renewable energy/technology as well as reform of financial institutions. One example of the bold measures incorporated in this program is the inclusion in Obama's budget of earnings from selling emissions permits as a funding source for measures to cut GHG emissions. Income from emissions permit sales would be poured back into supporting clean energy, creating employment by promoting industries involved in cutting emissions. This initiative could be seen as an attempt to build a framework for altering the social structure to a form of "green capitalism." Bear in mind though, that the several laws on emissions trading that have been submitted to Congress in the past were all defeated.

Currently, a climate and energy law (*Waxman-Markey Bill*) including an emissions trading scheme is under deliberation in Congress. It includes stricter targets for emissions cuts than the budget (20% cut relative to 2005 levels in 2020 vs. 14% cut). However, the bill proposes auctioning off only 15% of emissions permits until 2025 (rest available by allocation), whereas the budget assumes that all permits will be sold. The budget incorporates \$77 billion in annual income from emissions permit auctions for several years from 2012, 20% (\$15 billion) of which would be used to support clean energy and the remainder for employee salaries. Regarding the impact of the disparity between the budget and the bill on the government's income plans, the stricter emissions targets would likely push up emissions permit prices, while larger auction volumes could increase downward pressure on permit prices, so the smaller auction framework is not necessarily a negative. Furthermore, the emissions trading scheme, if enacted, will demonstrate a sustained commitment to combating GHG emissions by the US, thereby likely accelerating the growth of green industries, as well as being an important source of government revenue.

Europe: Leader in Building Emissions Framework

Blazing trail on climate, energy policies

Europe, with its pioneering global warming policies, is trying to spearhead global efforts to tackle climate change. The EU has set the following goals for 2020: (1) cut GHG emissions by 20%; (2) supply 20% of final energy consumption (FEC)

from renewable sources; (3) make 10% of vehicle fuel from biofuel components. Furthermore, it has proposed the most radical goals for the post-Kyoto agreement among developed nations (20% cut in GHG emissions vs. 1990 levels by 2020). The EU-ETS will be expanded to include aviation from 2012, and the proportion of permits sold at auction will increase from 2013. EU leadership would naturally lead to EU measures becoming standard, which would favor European nations/firms that have experience with such regulations.

Incidentally, economic stimulus packages by the EU and various member states have generally lacked notable measures to support energy-related industries, though some initiatives for next-gen automobiles and energy-efficiency investments were included. This may be because European nations are pursuing climate and energy policies on a medium- to long-term horizon rather than as a short-term economic fix. Furthermore, the EU sets strict fiscal rules for member states, capping annual budget deficits at 3% of GDP, so members cannot make stimulus outlays that would endanger fiscal stability no matter how far economic conditions deteriorate. As such, investment to curb GHG emissions likely has weaker appeal as a tool to stimulate the economy (demand) and create employment given the progress already made in next-gen energy and infrastructure. Still, it could be argued that economic stimuli likely to increase GHG emissions hardly demonstrate a meaningful commitment to reducing emissions.

Germany

Since Alliance '90/The Greens joined the coalition of ruling parties in 1998, Germany has been shifting to renewable energy, passing the *Renewable Energy Law*, which established a feed-in tariff for electricity from renewable sources. Revisions to the law in 2009 call for renewables to account for 18-19% of FEC, 25-30% of power generation, and 14% of heating by 2020. In addition, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety envisages renewables accounting for 80% of power generation, 48% of heating, and 42% of fuels in order to meet the national target of an 80% cut in GHG emissions vs. 1990 levels by 2050.

UK

Tony Blair became prime minister in 1997, and his Labour Party election manifesto set a target of cutting CO₂ emissions by 20% vs. 1990 levels by 2020. The Chancellor of the Exchequer Gordon Brown (current prime minister) established a taskforce, which submitted a report entitled *Economic Instruments and the Business Use of Energy* (a.k.a. *The Marshall Report*) in 1998. Based on the report, an energy tax (*Climate Change Levy*) to be introduced from April 2001 was announced in the March 1999 budget. Emissions trading was initiated in April 2002. In 2006, the government said it plans to lift the share of renewables in power generation to 20% by 2020. Meanwhile a feed-in tariff for small-scale renewable power generation will start in 2010. In addition, it is vigorously pursuing cutting-edge initiatives such as carbon budgets, carbon banks, and carbon money as well as research.

Asia: Japan Stalling, China Looking to Avoid Mandatory Cuts

Japan

Japan aims to pare GHG emissions by 60-80% by 2050. On 10 June 2009, it set a medium-term goal for 2020 of a 15% cut vs. 2005 levels. Other goals for 2020 include lifting the proportion of power generation using renewables and nuclear power above 50% and increasing solar power output roughly 20-fold from current levels. The Agency for Natural Resources and Energy announced the following goals for 2020: (1) 8.2% of primary energy from renewable sources, (2) wind power output up fivefold from current levels, and (3) 50% share in new car sales for next-gen cars.

Japan has been implementing global warming policies in line with the *Kyoto Protocol Target Attainment Plan* since 2004. The core of its response has been

Nippon Keidanren's *Voluntary Action Plan on the Environment*, initiated in 1997. In addition, the revised *Act on the Rational Use of Energy* comes into force from April 2010 with a greater scope than previously, and there are plans for a feed-in tariff for solar power in 2011 and a full emissions trading scheme from 2013. We think Japan, with its low level of energy self-sufficiency, has a rich array of initiatives that could contribute to achieving climate and energy security.

Japan boasts leading efficient energy technologies, so global warming measures should be a prime business opportunity. However, the country has been unable to take a leading role in international negotiations on the emissions framework. Chiefly, there seems to be little appetite for substantial emissions cuts domestically, partly because many parties believe scope for further domestic cuts is limited. The government stance is that the high cost of relatively small cuts in domestic emissions means that cutting emissions in developing nations to optimize global emissions would be more effective. Based on national interest, we think this is a wise stance.

China

In the *11th Five-year Plan for National Economy and Social Development* promulgated in 2005, China set targets for a 20% improvement in energy consumption per GDP and a 10% reduction in emissions of major pollutants over five years. In addition, it is taking measures to improve energy efficiency and promote renewables based on the *Climate Change Action Plan*. In 2008, it announced the *Renewable Energy Development Plan for the 11th Five-year Period*, which calls for renewables to supply 10% of primary energy in 2010 and 15% in 2020. Also, media reports in February 2009 claimed the government has lifted its target for 2020 nuclear power generation capacity from 40 GW to 70 GW. The government is strongly opposed to mandatory emissions cuts for emerging and developing economies as it views the global warming problem as stemming from the accumulated GHG emissions from developed nations. It is also requesting that developed nations provide technology and funding for emissions cuts.

India

India announced the *National Action Plan on Climate Change* in 2008, incorporating eight fields of focus such as raising energy efficiency and renewable energy. It aims to lift the share of renewables in power generation from 8.5% in 2008 to 12.5% in 2012. As with China, it is opposed to mandatory emissions cuts.

South Korea

As the home of the UN chairman, South Korea is positively acting on the global Green New Deal advocated by the UN. The *First Basic Plan of National Energy* released in 2008 sets a target of 11% of primary energy from renewables and 28% from nuclear power in 2030. In addition, the economic stimulus package announced in 2009 will invest 50 trillion won in solar power, storage cells, next-gen cars, and river restoration by 2012.

1.3 From Global Green New Deal to Green Economy?

We outlined countries' medium- to long-term policies and strategies in the second section. Now we will look at what changes the financial crisis has sparked in attitudes toward green investment and further likely changes down the line.

Green New Deal: Moves to Build Next-gen Infrastructure

Global Green New Deal

The phrase "Green New Deal" became topical as the financial crisis intensified from autumn 2008. It refers to the inclusion of medium- to long-term green investments as well as measures to boost short-term demand in various nations' responses to the crisis. The United Nations is advocating such measures to all nations under the auspices of a global Green New Deal.

In Japan, Green New Deal often refers to the Obama administration's policies, but the origin of the term was likely a report released in July 2008 by a British think-tank. This report posited a Green New Deal as the solution to three problems—the credit crunch, global energy problems, and the global food crisis. It called for (1) massive investment in greening the industrial structure (industries that rely as little as possible on energy from GHG-emitting sources such as oil, coal), (2) creation of green-collar jobs, and (3) increasing funding available for investments that will generate green-collar employment.

This movement was also a subject of discussion at the London G20 summit in April 2009, when materials outlining the weight of green investments in participating countries' economic stimulus packages were presented. This data showed that funding for green investments was significantly higher in China and the US, both in absolute terms and relative to GDP. On the other hand, based on green investments as a proportion of economic stimulus packages, South Korea was top, followed by China, France, Germany, and the US. This could be taken as a reflection of various governments' enthusiasm for the Green New Deal.

	Total stimulus funding	% of GDP	Total green investment	% of total stimulus funding	% of GDP	Renewable energy	CCS, other	Energy-efficient buildings	EVs	Railways	Electricity infrastructure	Water/waste treatment	Period (yr)
Japan	485.9	10	12.4	2.6	0.3	-	-	12.4	-	-	-	-	2009 onwards
China	586.1	13.9	200.8	34.3	4.8	-	-	-	1.5	98.7	70	30.7	2009-2010
South Korea	38.1	4	30.7	80.5	3.2	1.8	-	6.2	1.8	7	-	13.9	2009-2012
Australia	26.7	2.5	2.5	9.3	0.2	-	-	2.5	-	-	-	-	2009-2012
US	972	6.8	112.2	11.5	0.8	32.8	6.6	30.7	4.8	9.9	11.9	15.6	10 years
UK	30.4	1.1	2.1	6.9	0.1	-	-	0.3	1.4	0.4	-	-	2009-2012
Germany	104.8	2.7	13.8	13.2	0.4	-	-	10.4	0.7	2.8	-	-	2009-2010
France	33.7	1.1	7.1	21.2	0.2	0.9	-	0.8	-	1.3	4.1	-	2009-2010
Italy	103.5	4.3	1.3	1.3	0.1	-	-	-	-	1.3	-	-	2009 onwards
EU	38.8	0.2	22.8	58.7	0.1	0.6	12.5	2.8	1.9	-	4.9	-	2009-2010
G20 (excl. EU)	2,609.6	5.5	396	15.2	0.8	35.5	7.6	64.3	10.1	121.8	86.8	69.8	

Source: G20 materials; compiled by DIR.

Investment in next-gen infrastructure as economic stimulus

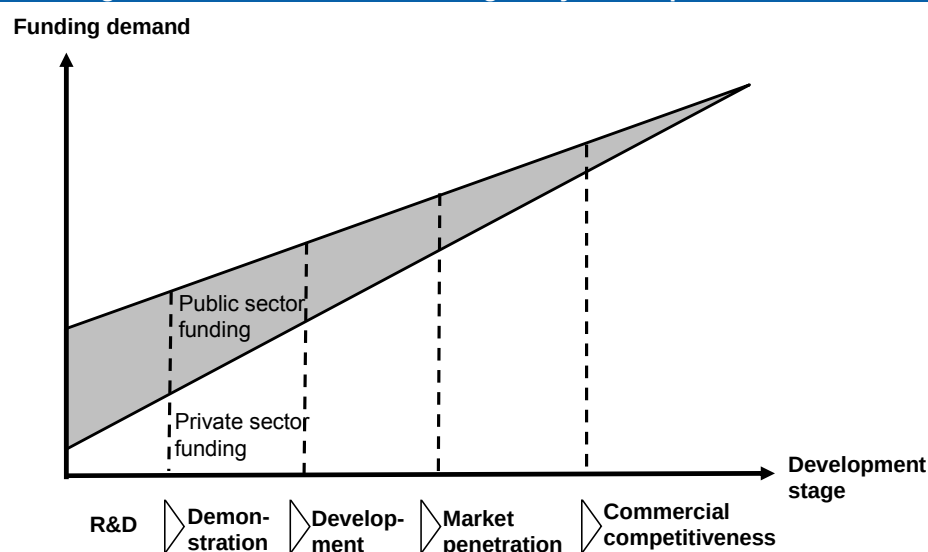
Though many nations have embarked on their own versions of the Green New Deal, the measures being taken vary considerably. Economic stimulus packages are meant to create jobs, and new demand is thought to boost job creation and the economy more than replacement purchases. As such, the US is investing roughly equally in renewable energy and energy efficiency, whereas Germany, where the renewable energy industry is already blooming, has allocated a larger portion of funds to energy efficiency investments, which it only began in 2005. China, on the other hand, is prioritizing social infrastructure investment.

Naturally, given that countries are using their own tax funds, they are prioritizing supporting their own industries and employment. For instance, the US stimulus package incorporates production of a domestically produced electric vehicle (EV) and a requirement for firms receiving support to prioritize employing US citizens. In other words, firms looking to benefit from the US package must (1) be able to contribute to higher employment in the US, or (2) boast key proprietary technologies for measures in the package, such as for core components for EVs. More specifically, measures that can be combined with public sector investment, the bread and butter of previous stimulus packages, are popular. Examples include: EVs, which require infrastructure improvements; energy-efficient construction, including renovation of public sector facilities; solar cells, which can be combined with initiatives to boost housing demand. In order for these industries to survive independently once government support measures (e.g., stimulus packages) are withdrawn, they must become profitable (through shift to mass production, other cost improvements) while such support is still available. This much is clear from the correlation between photovoltaics growth and policy support in Japan. The secretariat of the UNFCCC, which convenes climate change summits including

those that produced the Kyoto Protocol, also believes that most initial investment in developing new technology must come from the public sector, with private sector investment increasingly taking the lead as progress towards commercialization is made.

In our view, the growing international shift to developing next-gen infrastructures not reliant on oil and coal cannot be ignored. This trend of increasing funding for green investments should continue as long as the view that energy prices will keep rising remains dominant. Businesses able to adapt to this shift should achieve sustained growth.

Funding Sources for Green Technologies by Development Phase Chart 1.8



Source: United Nations Framework Convention on Climate Change (UNFCCC) materials; compiled by DIR.

Will Green New Deal Lead to Green Economy?

UN advocates industrial shift to green economy

The UN established the Green Economy Initiative in October 2008, aiming to use the impetus from the global Green New Deal movement to jump start a shift to a global sustainable “green economy” that appropriately values environmental resources. The initiative has three pillars (valuing nature’s services and incorporating this value in national, international accounts; employment generation through green jobs and laying out policies for this; instruments/market signals to accelerate transition to green economy) and six priority sectors (clean energy/technology; development of regional energy sources; sustainable agriculture; ecosystem infrastructure; reduction of emissions from deforestation/forest degradation; sustainable cities). The *Green Economy Report* currently being compiled is investigating the potential roles of four areas of government policy—subsidies, new incentives, loans, entry barriers—in aiding the transition to a green economy. As yet, there have been no notable moves by national governments to participate in the initiative. However, it could be a strong candidate to form the basis of a new economic order, given a consensus on the need for a break from the pre-financial crisis status quo.

Britain’s carbon budget, carbon bank

Among developed nations, Britain is pioneering measures to reflect environmental value in economic transactions, the key facet of the green economy. The UK passed a bill making GHG emissions cut targets legally binding this year, and included a carbon budget (cap on total carbon emissions over given period of time) in the 2009 budget. The government appears to be trying to incorporate into the

economy the aforementioned concept of valuing carbon (major component of greenhouse gases) to effectively monetize GHG emissions as a measure to combat global warming. The British government investigated extending the concept to the individual level, for instance by allocating emissions permits in credit card form to allow emissions trading between individuals.

Potential course to sustainable society

Such measures are unlikely to immediately spread globally. For example, the British government eventually decided it was too early to introduce individual emissions trading after concluding that the costs outweighed the potential benefits.

However, these measures could be an attractive option if governments choose sustainable growth over ongoing economic growth, as mentioned above. This is because current profit-based tax systems require higher profits (i.e., growth) for higher tax revenues, so they are well suited to the current status quo, but not to economies focused on sustainability. On the other hand, tax systems based on GHG (carbon) emissions would allow governments to lift tax revenues by tightening emissions regulations. In other words, boosting tax revenues would be commensurate with improving our living environment.

In the past, the UK made green investment a G8 topic for the first time at the Glen Eagles summit, and has also released a report analyzing anti-global warming measures from an economic standpoint (*The Stern Review*). The original Green New Deal report was also published by a British think-tank. Meanwhile, the UK has accumulated more emissions permits than Japan under the Kyoto Protocol scheme, despite being able to meet its own emissions reduction targets.

The US budget also factored in income from emissions trading, which could be taken as a sign of a meaningful effort to move toward a sustainable economy. If the US, the world's largest economy and GHG emitter, changes direction, the Green New Deal could blossom into a green economy.

1.4 Possible Medium- to Long-term Impact of Structural Shift

In the first three sections of this chapter, we looked at the possibility of a shift to a sustainable growth model and the potential drivers of such a transition—climate/energy policies of various countries and the UN's blueprint. This section outlines changes in investment opportunities likely to arise from this.

How Will Investment Opportunities Change under Sustainable Growth Model?

Next-gen infrastructure investment for sustainable growth

As previously mentioned, we view efforts to combat global warming as an attempt to continue economic and population growth in the face of limitations on resources (coal/oil, food). Current investments in next-gen infrastructures mark the first stage of this challenge. In our view, we are now entering an era when companies must shoulder the costs of environmental risks and provide services fitting such an eco-conscious environment, or else fall by the wayside. The same idea applies to lifestyles. On the other hand, new industries are emerging, led by renewable energy. This likely represents a business opportunity for Japanese firms, which have built up a wealth of energy efficiency expertise through past efforts.

However, as our discussion so far has shown, much of the effort to curb global warming is government-led. Therefore, we will consider the probable evolution of investment opportunities under a shift to sustainable growth by first reviewing the conclusions of *The Stern Review* (first government-commissioned report on economic impacts of global warming), and then outlining the fields likely to gain

support as drivers for cutting GHG emissions and the extent of expected growth in these fields based on Japanese government data.

The Stern Review

Official government findings on economic benefits of fighting global warming

The Gleneagles Summit held by Britain in 2005 marked a major milestone for the global warming debate as it was brought up as a discussion topic among the G8 leaders for the first time. Following the summit, *The Stern Review*, a report analyzing the economic impacts of global warming, was compiled by the former World Bank chief Dr. Nicholas Stern at the request of the then chancellor, Gordon Brown (current prime minister), and published by the British government in 2006. There had previously been several reports on the economics of anti-global warming measures, but *The Stern Review* was the first such document officially published by a national government. Specifically, it estimated the potential costs from flooding/drought if measures to curb global warming are not taken at 5-20% of GDP. On the other hand, it argued that the cost of anti-global warming measures could be capped at around 1% of GDP if implemented early, concretely illustrating the merits of prompt action.

Potential scale of market for global warming countermeasures

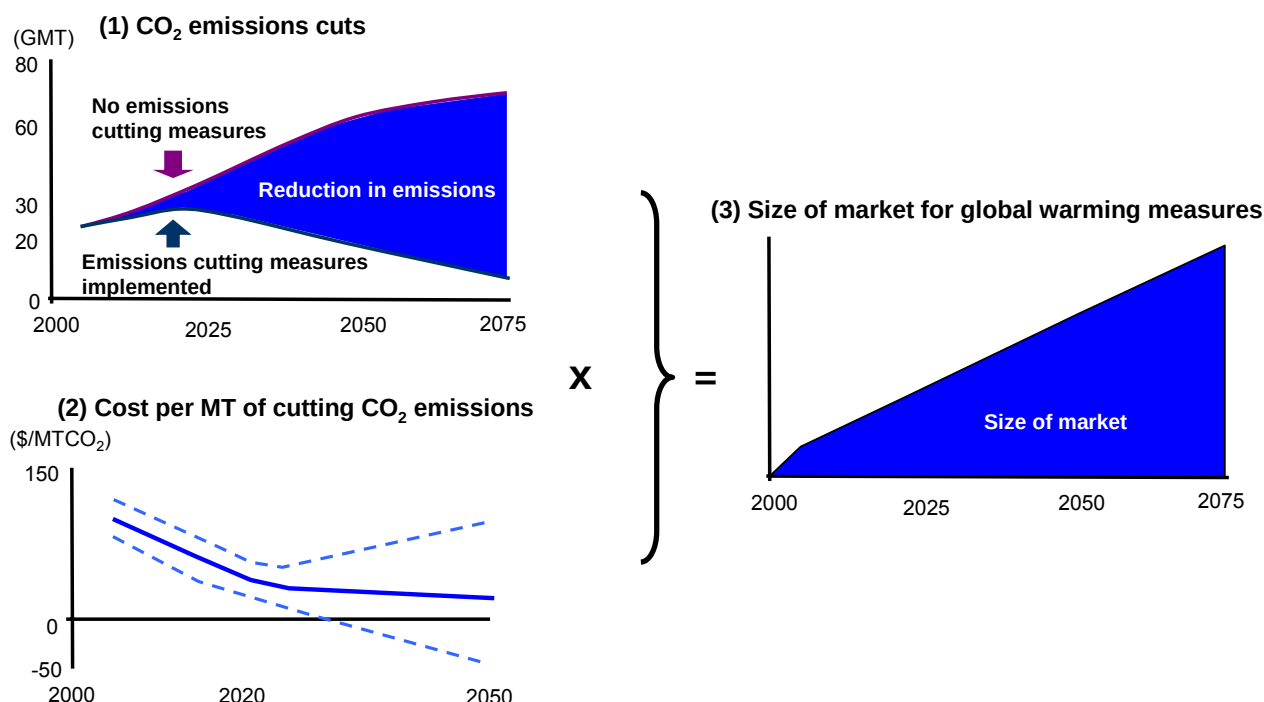
What business opportunities might measures to curb global warming create? It is possible to calculate the potential market scale for anti-global warming measures based on (a) the two scenarios for CO₂ emissions (maintaining present trend/cutting emissions) and (b) the estimate of the cost of a 1 MT cut in CO₂ emissions included in the *Stern Review*:

- (1) Estimated annual decline in CO₂ emissions in a given year:
emissions in specified year assuming no cuts (MT) – emissions assuming cuts (MT)
- (2) Estimated cost of reducing CO₂ emissions by 1 MT in specified year (\$/MT)
- (3) (1) × (2)
= cost of cutting CO₂ emissions in specified year (\$)
= remuneration for provision of emissions-cutting technology in specified year

Note, however, that these figures do not factor in duplications such as the use of intermediate materials in multiple applications. Therefore, they are best used in comparison with GDP.

Expected Market for Global Warming Measures

Chart 1.9



Source: Stern Review, other; compiled by DIR.

Possible Change in Industrial Structure Assuming Costs of 1% of GDP

**1% of GDP equivalent
to electricity supply
sector in Japan 2007**

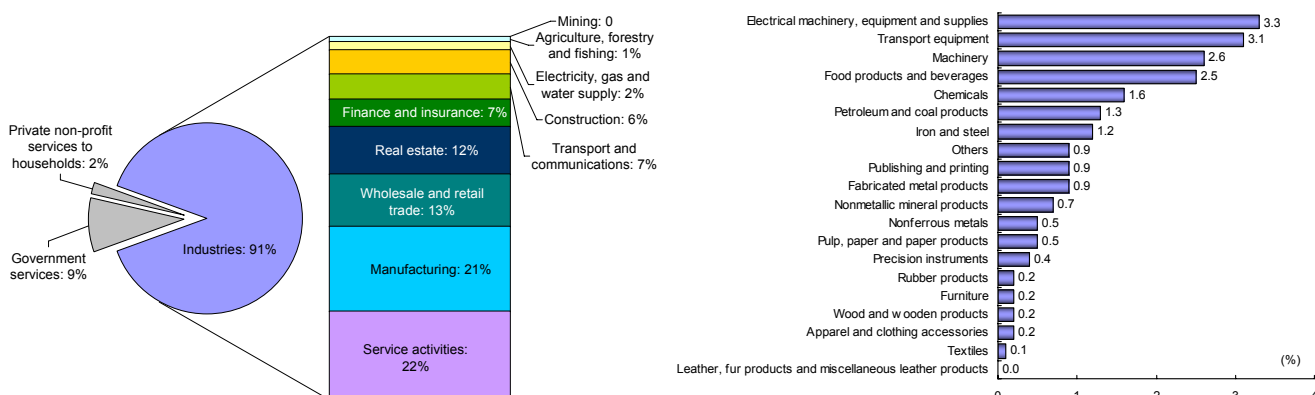
Assuming 1% of GDP is used to combat global warming as *The Stern Review* proposes, the green industrial sector (firms receiving orders/carrying out projects to curb global warming) should account for at least an equivalent portion of GDP. How big would such a sector be? The electricity supply sector accounted for exactly 1% of Japan's GDP in 2007, so therefore a green industrial sector should be at least the size of the electricity supply sector. For reference, among manufacturing sectors, the fabricated metal products and publishing & printing sectors accounted for close to 1% of GDP.

However, a "green industrial sector" does not exist in the current taxonomy. What impact would 1% of GDP being used in combating global warming have on Japan's industrial structure under the current sector breakdown? Based on the by-industry estimates of the impact included in reference materials for the Japanese government's medium-term emissions reduction targets, a significant contraction looks likely in production value for petroleum & coal products, various basic materials sectors, and electricity, gas & water supply. On the other hand, a positive impact is expected for machinery makers, who will likely receive orders for energy efficient facilities and other projects (Chart 1.11).

Prime Minister Taro Aso announced Japan's medium-term emissions reduction targets on 10 June—the government aims to boost energy efficiency by 33%, more than the 30% improvement achieved in the aftermath of the 1970s oil shocks. As a point of reference, following the first oil shock (1973), another significant energy crisis, the share of industries in 1974 GDP fell 1.6 percentage points y/y, while the shares of government services and private non-profit services to households gained 0.8 points and 0.1 points, respectively. Restrictions on oil/electricity use were initially set at 80-90% of previous levels, and remained at 87% for general applications even when eased. Transport and working hours were also restricted (Chart 1.11). Among industries, the largest drop in GDP share was for petroleum &

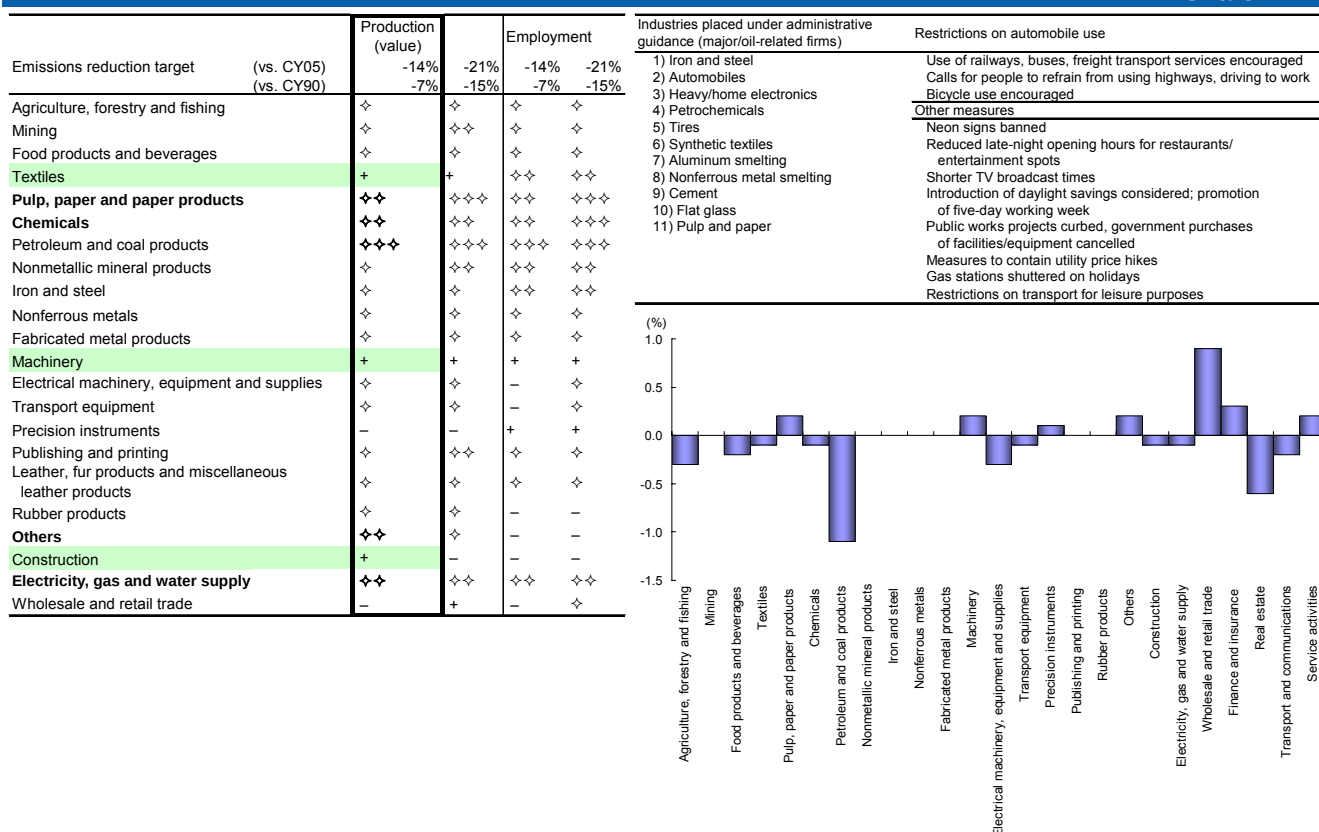
coal products (down 1.1 percentage points). On the other hand, machinery gained 0.2 points, while the impact on basic materials sectors and electricity, gas & water supply varied by industry.

Breakdown of 2007 GDP by Economic Activity (left), Breakdown of Manufacturing (right) Chart 1.10



Source: Government materials; compiled by DIR.

Expected Impact of Global Warming Measures by Industry (left), Impact of Oil Shock on GDP Shares (right) Chart 1.11



Source: Government materials; compiled by DIR.

Note: Base scenario assumes continuation of current efforts to cut emissions.

Impact on employment: +, flat/increase; -, up to 5% decrease; ◇, 5~15% decrease; ◇◇, 15~25% decrease; ◇◇◇, over 25% decrease.

Impact on production (value): +, flat/increase; -, up to 5% decrease; ◇, 5~10% decrease; ◇◇, 10~15% decrease; ◇◇◇, over 15% decrease.

Simulations Used in Setting Japan's Medium-term Targets

Current targets should translate into higher capex but lower domestic demand

As Japan moves toward a green industrial structure, society as a whole will bear the costs of switching energy sources and promoting energy efficiency. Meanwhile, which “green industries” are set to benefit financially from this transition?

Mr. Aso announced Japan's medium-term target of cutting GHG emissions by 15% vs. 2005 levels on 10 June. When deciding this target, the Japanese government carried out economic simulations assuming various levels of emissions cuts in the manner of *The Stern Review*. These simulations looked at impacts on the economy and society, the specific means for achieving emissions cuts, and comparisons with other nations. First we will outline the results of simulations of the impact on society and the economy carried out by the Japan Center for Economic Research (JCER), the National Institute for Environmental Studies (NIES), and the Keio Economic Observatory (KEO), which are summarized in Chart 1.12.

The base case scenario assumes that current measures are continued, which would yield a 4% decrease in GHG emissions in 2020 vs. 2005 levels (4% rise vs. 1990 levels). This target received strong support as a medium-term goal from industry, including Nippon Keidanren. Meanwhile, opinion polls carried out by the Cabinet Office in FY09 found high levels of support for a 14% cut in emissions vs. 2005 levels (7% cut vs. 1990). The outline of the government's strategies for achieving the target indicates that it mainly intends to continue and enhance measures incorporated in the current economic stimulus packages. In this case, the scenarios forecast a 0.2-2.2% boost to private sector capex, but a 0.5-1% drag on GDP and a Y40,000-150,000 contraction in annual disposable income in 2020 (roughly ten years ahead). In other words, capex should gain as firms are forced to cut emissions, but domestic demand will likely shrink due to higher unemployment and lower incomes.

At a gathering of business and NGO leaders, the government summarized how it analyzes the economic impacts as follows:

$\text{CO}_2 \text{ emissions [1]} = \text{GDP [2]} \times (\text{energy supply} / \text{GDP}) [3] \times (\text{CO}_2 \text{ emissions} / \text{energy supply}) [4]$

In other words, to combat global warming (reduce [1]) while continuing economic (GDP) growth (increase [2]), it is necessary to either improve energy efficiency (shrink [3]) or clean energy sources (shrink [4]). The application of specific technologies for achieving [3] or [4] are covered in simulations looking at specific means for reducing emissions and international comparisons carried out by the Institute of Energy Economics, Japan (IEEJ), NIES, and the Research Institute of Innovative Technology for the Earth (RITE).

Chief Estimates of Economic Impacts of Medium-term Emissions Cut Targets					Chart 1.12
Medium-term target	Vs. CY2005 (vs. CY1990)	-4% +4%	-14% -7%	-21% -15%	-30% -25%
Policy outline		Achievable with current measures	Feed-in tariff for solar power, support for purchasing eco-friendly vehicles, beefed-up energy-efficient housing rules	Fiscal outlay-driven: Y3.6 tril/yr Taxation/subsidies to reduce investment recovery periods to 3-10 yrs	Regulation-driven All new equipment must be most efficient possible Limit use of existing equipment, force firms to replace/make improvements
JCER (equilibrium model)					
Real GDP	2020		-0.6%	-1.4%	-3.2%
Unemployment rate			+0.2%	+0.5%	+1.4%
Marginal cost of cutting emissions			Y15,000/MT of CO ₂	Y34,000/MT of CO ₂	Y82,000/MT of CO ₂
Gasoline equivalent			Y30 increase	Y70 increase	Y170 increase
Private sector capex			+0.1%	±0%	-0.4%
Disposable income	Household/yr		-Y40,000	-Y90,000	-Y220,000
Utilities costs	Household/yr		+Y30,000	+Y70,000	+Y140,000
KEO					
Real GDP	2020		-0.5%	-2.1%	-5.6%
Unemployment rate			+0.3%	+0.8%	+1.9%
Marginal cost			Y18,300/MT of CO ₂	Y46,800/MT of CO ₂	Y87,700/MT of CO ₂
Disposable income	Household/yr		-Y150,000	-Y400,000	-Y770,000
Utilities costs	Household/yr		+Y34,000	+Y77,000	+Y132,000
JCER (macro model)					
Real GDP	2020		-0.9%	-2.6%	-6.6%
Unemployment rate			+0.2%	+0.6%	+1.4%
Marginal cost			Y18,000/MT of CO ₂	Y44,000/MT of CO ₂	Y100,000/MT of CO ₂
Private sector capex			+2.2%	+5.3%	+12.5%
Disposable income			-0.7%	-2.1%	-5.6%

Source: Government materials; compiled by DIR.

Likely Changes in Domestic Investment Opportunities

Next-gen cars, high-efficiency water heaters among technologies under consideration

From the perspective of leeway for further emissions cuts, Japan is not a particularly attractive market. Even so, Japan is introducing an emissions trading scheme to back up the *Voluntary Action Plan* and is putting in place incentives for firms to cut emissions. Specific examples included measures in the economic stimulus packages, such as (1) support for installing solar cells, (2) support for purchasing more eco-friendly vehicles, and (3) promotion of energy efficiency improvements at SMEs within the trial emissions trading scheme.

In compiling the medium-term goals, the government utilized simulations which totaled up the expected emissions reductions from specific technologies. The government is looking at solar power, next-gen cars, energy-efficient housing, and high-efficiency water heaters as the core technologies for cutting emissions, and has established subsidies and/or incentive schemes for them (Chart 1.13). In order to achieve the target of a 14% cut in GHG emissions vs. 2005 (7% cut vs. 1990), the simulations call for a significant increase in the use of next-gen vehicles. Stricter emissions standards (using industry leaders as benchmarks) could result in a roughly twentyfold increase (12.1 million vehicles vs. 600,000) in the use of next-gen vehicles relative to the scenario assuming the continuation of current measures (4% cut vs. 2005 levels). High-efficiency water heaters are also expected to benefit significantly (9 million units under current measures vs. 28 million under stricter target).

Solar cells likely core means for major emissions cuts; reducing costs an issue

Notably, solar cells would be the main technology for achieving the stricter target of cutting emissions by 21% vs. 2005 levels (15% cut vs. 1990). Assuming a 14% emissions cut target vs. 2005, the simulations call for solar power generation capacity of 14 GW in 2020 vs. 6 GW assuming current measures only. Even factoring in subsidies and other policy measures, the period required to recover the initial investment in the solar cells is estimated at a lengthy 15 years. Based on current technologies and costs, the payback period is apparently shorter for Chinese-made solar panels. Therefore, private sector demand for Japanese-made panels may not receive much of a boost unless next-gen solar cells yield significant cost reductions and efficiency gains. In other words, from the standpoint of supporting Japanese industry, subsidizing next-gen cars and high-efficiency water heaters will likely be more beneficial.

Concrete Measures for Achieving Medium-term Emissions Cut Targets						Chart 1.13	
Medium-term target		Vs. CY2005 (vs. CY1990)	-4% +4%	-14% -7%	-15%	-21% -15%	-30% -25%
Real GDP		2020	Base scenario	-0.6%		-1.4%	-3.2%
Unemployment rate			Base scenario	+0.2%		+0.5%	+1.4%
Marginal cost of emissions cut		Gasoline equivalent	\$35-62/MT of CO ₂	Y15,000/MT of CO ₂ Y30 increase		Y34,000/MT of CO ₂ Y70 increase	Y82,000/MT of CO ₂ Y170 increase
Specific policies							
Energy	Increase in solar power generation vs. current output Other	4X	10X	20X	25X	40X	55X
					Significant increase in micro-hydro power Focus on natural gas	Lift nuclear plant capacity utilization from 80% to 90%	
Policies		Purchase of renewable energy based on RPS (Renewable Portfolio Standard) system	Feed-in tariff for solar power Subsidies for home photovoltaics		Lift feed-in tariff	Compulsory installation of solar panels on new houses, large existing houses	Compulsory installation of solar panels on new houses, large existing houses
Next-gen cars	% of new car sales % of all vehicles	10%	50% 20%	50%	53% 24%	100% 40%	90% 40%
Policies		Top Runner program Subsidies, preferential tax measures	Support for purchasing eco-friendly vehicles		Strengthen subsidies, preferential tax measures Beef up Top Runner program standards	Ban sale/automobile inspections of old-type vehicles	Ban sale/automobile inspections of old-type vehicles
Housing insulation	Installation in new homes Installation in all homes	70%	80%		100% 60%	100% 100%	100%
Policies		Energy efficiency standards in Act on Rational Use of Energy Preferential tax measures	Strengthen, widen application of energy efficiency standards for homes Support for purchasing green home appliances		Strengthen subsidies, preferential tax measures	Enforce energy efficiency standards for all existing, new homes	Enforce energy efficiency standards for all existing, new homes
Notes		Efficiency improvements based on current technologies	Purchase most efficient equipment wherever realistically possible	Lift proportion of hydro and other renewable energy to world leading 20% of all power output	All new equipment to be most efficient possible Replace/improve fixed proportion of existing equipment before standard replacement period Y3.6 tril in fiscal outlays needed annually		Virtually all new/existing equipment must be most efficient possible Decrease in economic activity (production volume) Introduce carbon taxes, emissions trading

Source: Government materials (Apr 2009); compiled by DIR.

Full emissions trading scheme on horizon; recommend firms with potential to cut emissions

Firms involved in the clean tech mentioned above will likely be the main players in the green industrial sector. At the same time, the full emissions trading scheme currently under consideration could benefit industries with high levels of technological expertise and significant leeway to cut emissions. We expect gaps between firms to widen in the machinery sector, where some firms possess energy-efficient facilities and technologies, and in the basic materials and electricity supply sectors. In Europe, which leads the way in global warming policy, around 10% of firms include GHG emissions outlooks in their annual reports—they disclose estimated emissions and emissions cuts as one element of risk management. The inclusion of such indicators in financial disclosures is being considered in Japan as well, so emissions-related risk metrics may increasingly influence investors' evaluations of stocks going forward.

Likely Changes in Overseas Investment Opportunities

Hopeful for clean coal technology in emerging nations

As we have already mentioned, we only see limited potential for further emissions cuts in Japan. The two largest potential markets are the US and China, which account for roughly 20% of GHG emissions each. Japan is focusing on projects to reduce GHG emissions overseas as a way to combat global warming at lower cost than cutting domestic emissions. In order to meet the target of a 50% cut in global emissions by 2050, significant Japanese contributions to cutting emissions in Asia, which are expected to skyrocket, will likely be indispensable. Asian nations have high hopes for funding and technological support from Japan. The Japanese government's simulations also call for the acquisition of emissions credits through overseas energy efficiency projects, mainly in China, if markedly larger emissions cuts become necessary. Many countries other than Japan and oil-producing nations use coal as the main fuel for electricity generation, with China and India each producing a particularly lofty 70% (approx.) of electricity using coal. Consequently, expectations for clean coal technology are high.

Main renewable energy sources to be wind power, biofuels for a while

Furthermore, two fields, biofuels and wind power, have a much lower profile in Japan than the rest of the world. Other nations have set targets for converting transportation equipment (automobiles, planes, etc.) from gasoline and other crude oil-based fuels to biofuels. The EU aims to have 10% of vehicles powered by biofuels and other renewable sources by 2020, and the US has set a target of consuming 60 billion gallons of next-gen biofuels annually by 2030. Meanwhile, wind power is the most widely used form of renewable energy globally, and private sector investment is vigorous as the time required to recoup initial investments is shorter than for other renewables. These fields will likely continue growth even after government measures to cultivate them phase out as economic conditions recover. Japanese firms supplying major components for these industries, such as bearings and turbine blades, should garner investor attention.

II. Stock Market Response to Clean-tech Revolution

Hanako Mizuguchi

The first chapter of this report discussed the ongoing acceleration in the societal and industrial shift to resource- and energy-efficient technologies. In this section, we analyze clean-tech investment funds and performance at constituent companies in such funds in a bid to seek out potential investment opportunities resulting from the clean-tech movement. Later, we attempt to map out favorable investment strategies for the medium to long term based on both domestic and global efforts to reduce GHG emissions.

2.1 Focus of Clean-tech Investment Funds

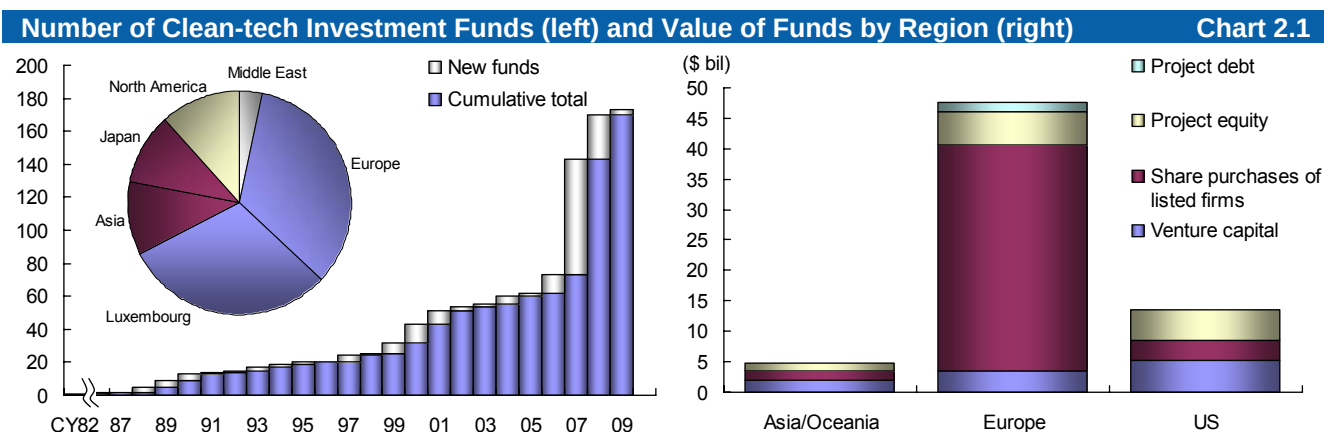
This section begins with an update to our analysis of clean-tech investment funds (in Jul 2008 report *Environmental Technologies and Japanese Companies*). By reviewing subsequent changes in the macroenvironment (drop in crude prices, economic downturn) and earnings at constituent firms, we aim to identify investments likely to outperform when the economy is in recovery and crude prices are on the rise. Specifically, we focused on those firms exhibiting correlation with broader trends in foreign investor trading, as well as stocks displaying sensitivity to changes in indexes tied to energy prices, emission trading schemes, or other topics relevant to global warming and environmental initiatives.

(1) Clean-tech Investment Fund Performance

Global focus on Japanese names

Our July 2008 review of environmentally friendly global investment funds* revealed (1) a doubling of such funds in 2007, (2) that Europe, including Luxembourg, accounted for more than 60% of such funds, and (3) that Japan was No. 2 in terms of total representation with just over 300 companies vs. just under 400 for the US (for 60 funds disclosing portfolio).

The economic climate changed significantly after our report given the drop in crude prices and the collapse of Lehman Brothers. While the total number of environmentally friendly investment funds newly established in 2008 tumbled 60% (27 funds) from the 2007 peak, it was still the second highest number to date. Europe still accounts for over 60% of total funds for this group.



Source: Bloomberg; compiled by DIR.

Source: Davos World Economic Forum; compiled by DIR.

* As classified by Bloomberg.

Active investment in Europe, growth potential in US, and large untapped market in Asia

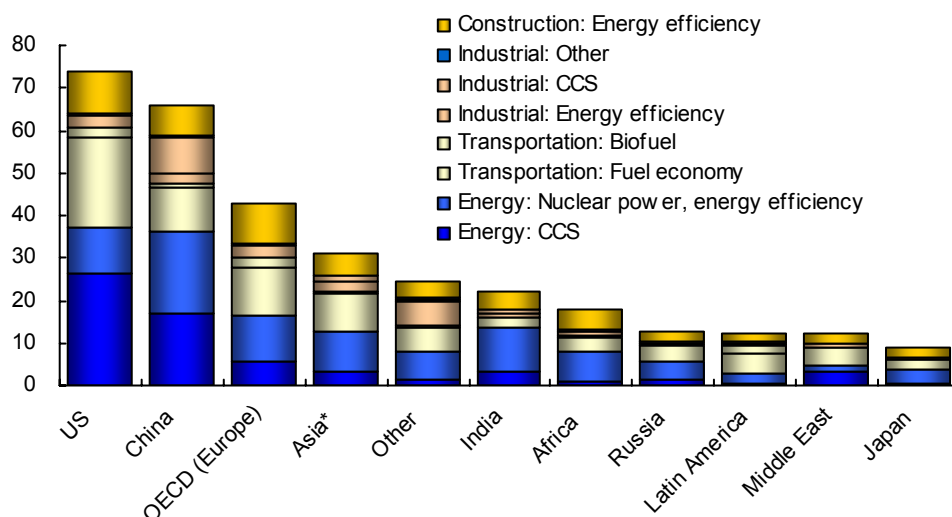
How much money is actually being invested in global warming initiatives (including investment funds and other forms of investment)? According to materials from the World Economic Forum in Davos (Feb 2009), Europe has invested over \$45 billion, giving it a commanding lead over other regions. Still, although the US has invested only one-third that of Europe, it is the leader in terms of venture capital, suggesting the clean-tech industry is beginning to attract business capital given its positioning as a growth industry. While Asia's investments amount to a mere \$5 billion (one-third of US), the region is expected to produce more GHG emissions than any other region given growth in areas such as India and China. This puts Asia on similar footing with Africa, another region boasting substantial potential for clean-tech initiatives.

What does the future hold for clean-tech investment? As of 2007, a study by the United Nations Framework Convention on Climate Change suggested that additional investments of \$200 billion per year will be needed to prevent an increase in GHG emissions from 2030. Adjusting for a rise in energy prices, the follow-up study conducted in 2008 puts the required amount somewhere between \$200-500 billion, and identified alternative energy, primarily renewable energy, nuclear power and CCS as most in need of funding.

New energies, increased efficiency could drastically reduce emissions in US, China

Still, the survey reveals some regional differences. China and the US, two of the heaviest GHG emitters, are expected to focus funding on alternative energy; over \$35 billion according to the UNFCCC estimates. The US will likely invest \$21.1 billion in improving fuel economy for autos and other vehicles, a unique trend considering the next largest investor China is expected to commit just \$10.6 billion. Meanwhile, China will likely be a leader in CCS investment as the UNFCCC expects it to spend \$8.6 billion on technologies for industrial applications (at factories, for example). The study estimates additional spending will be far lower in Japan. Although calling for \$74 billion in additional investment in the US, the study projects additional spending of under \$9 billion in Japan (\$3 billion for clean energy, \$2.5 billion for improving fuel economy and \$2 billion for lifting energy efficiency), a mere 10% of the US estimate.

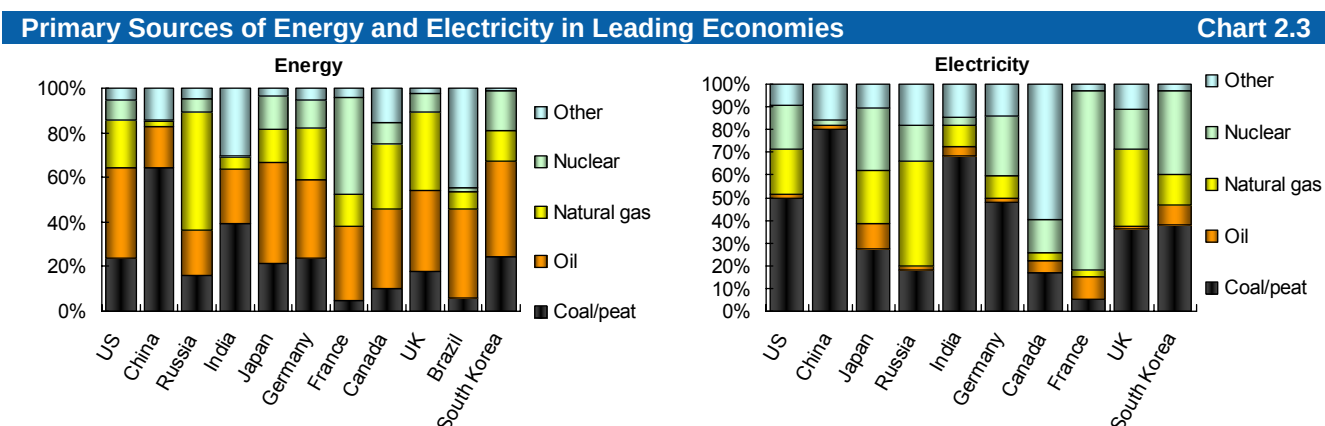
New Annual Green Investment Averages by Major Industry (\$ bil) Chart 2.2



Source: United Nations Framework Convention on Climate Change (UNFCCC) data; compiled by DIR.
 * Excludes China and Japan.
 Note: Based on 2007 study.

Each nation has own energy needs

Variations in available energy supplies and the industrial landscape would seem to account for such regional differences. For example, major energy consumers tend to rely on locally available resources, as evidenced by US dependence on oil, China on coal and Russia on natural gas. Oil is apparently used primarily for transportation purposes (powering autos, aircraft), as few nations seem to be using oil to generate electricity. The reduction of GHG emissions demands not only more efficient energy use, but also a shift away from thermal power (coal) to cleaner technologies using natural gas, renewable energy or nuclear power. Another likely scenario is the manufacture of automobiles, ships and airplanes that run not on gasoline, but other materials such as natural gas or biofuel. Electricity use will likely rise going forward, particularly as some nations grow more industrialized. Industrialization is also likely to increase transportation needs, particularly as auto ownership often climbs alongside rising incomes.



Source: IEA and OECD data; compiled by DIR.

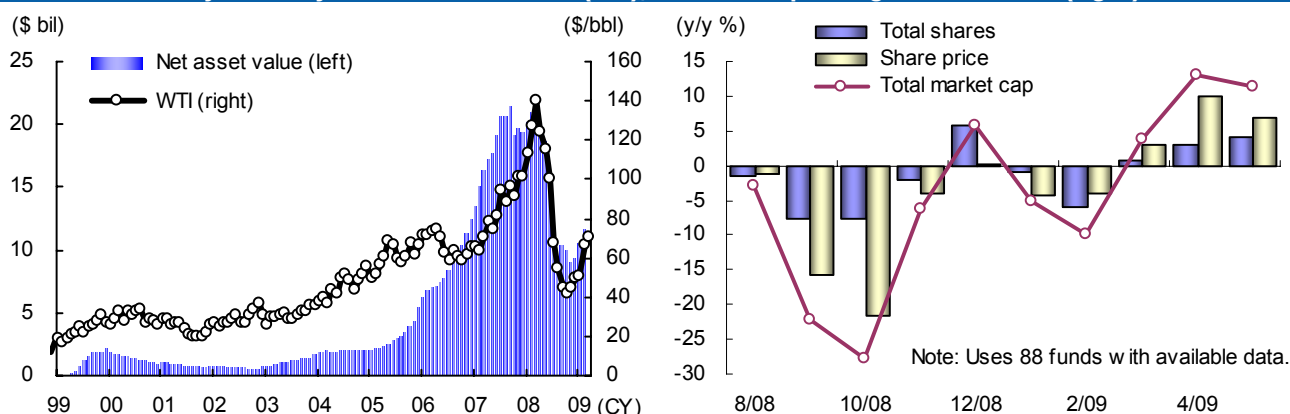
Note: DIR estimates based on available materials for China and other nations not currently OECD members.

Next-gen energy infrastructure to have personal touch

The consumer is likely to play a more active role in the next generation of energy infrastructure. Electric cars will be able to store and run on electric power. Home power systems (think solar installations) should enable individuals to easily store, transmit and access electricity. For reference, consider the impact mobile phones had over the past decade—public pay phones are disappearing and many households no longer install fixed lines. Similar to the revolution brought about by innovations in telecommunications, the new energy infrastructure is likely to usher in investment and growth amid changing lifestyles and services.

Clean-tech funds to continue uptrend after Feb 2009 bottom

As of this writing, clean-tech investment funds have failed to regain momentum in terms of a total fund number. However, on a value basis, green funds reversed course in February 2009 after crude prices turned up, and gained 26% from end-February through end-May. Granted, there was a global stock market rally during this period, but still, an analysis of the 88 funds for which we could access data from end-July 2008 on (Chart 2.4) revealed that while investors pulled investments from clean-tech funds in September and October after the Lehman Brothers bankruptcy, there was a steady inflow in March, April and May. This suggests that green investments are back on the rise.

Environmentally Friendly Fund Market Value (left), Factors Impacting Market Value (right) Chart 2.4

Source: Bloomberg; compiled by DIR.

(2) Potential Beneficiaries of Foreign Investment

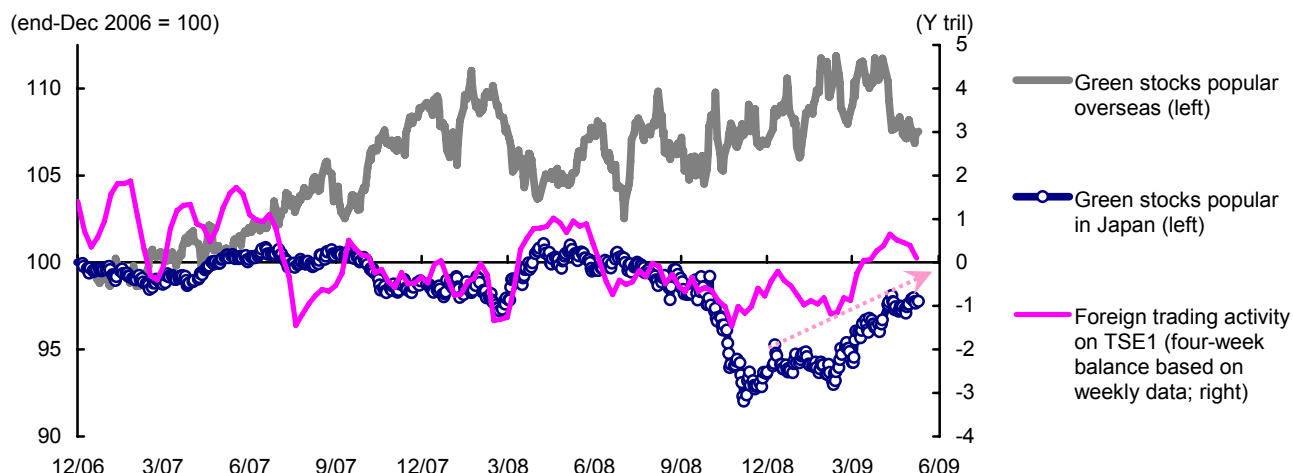
Active foreign investment could launch certain stocks

While foreign investors were long net purchasers of Japanese stocks, they have been net sellers since July 2007 following the rating downgrade on subprime MBS. While the temporary funding shortage and erosion in earnings forced many institutions to sell off shareholdings, a renewed inflow of funds might encourage some firms to repurchase investments.

Chart 2.5 maps the relative performance for two groups of green stocks: those popular overseas and those popular in Japan (based on where representation in clean-tech funds is greatest). The same chart also tracks foreign trading activity (net purchases) on the first section of the TSE. Foreign trading activity and popular green stocks in Japan have been exhibiting similar trends since October 2007. Some of the top firms in terms of representation in the domestic group were Rohm, Mitsubishi, Nitto Denko, and Panasonic. In the overseas group, top-ranking firms included Kurita Water Industries, Tokuyama, Sharp and Kyocera. Compared with counterparts popular in Japan, green stocks from the overseas group leaned toward firms with business portfolios heavily geared toward clean technologies, as well as stocks easily recognized as environmental plays based on a commanding share of the global eco market. The data suggests that stocks more popular in Japan are likely to track overall foreign trading activity, possibly because their status as a green stock is not as conspicuous as those in the overseas group. If so, further upside may be in store for this group considering foreign selling pressure has been weakening since 9 March 2009. We have compiled a list of the thirty stocks showing the highest correlation to foreign trading activity since October 2007 in Chart 2.6.

Backtracking to Chart 2.5, we can see that foreign investors were net purchasers from end-March 2008 through the beginning of May 2008. During this period, the domestic stock group rallied amid a pullback in the overseas group. From June into July, however, the latter logged an impressive performance. We have outlined the best performers from these periods in Chart 2.7 in case a similar trend reemerges. Stocks present on both this list and the aforementioned one are Daiichi Kigenso Kagaku Kogyo, Takuma, Sanki Engineering, T-Rad, Matsuda Sangyo, and GS Yuasa.

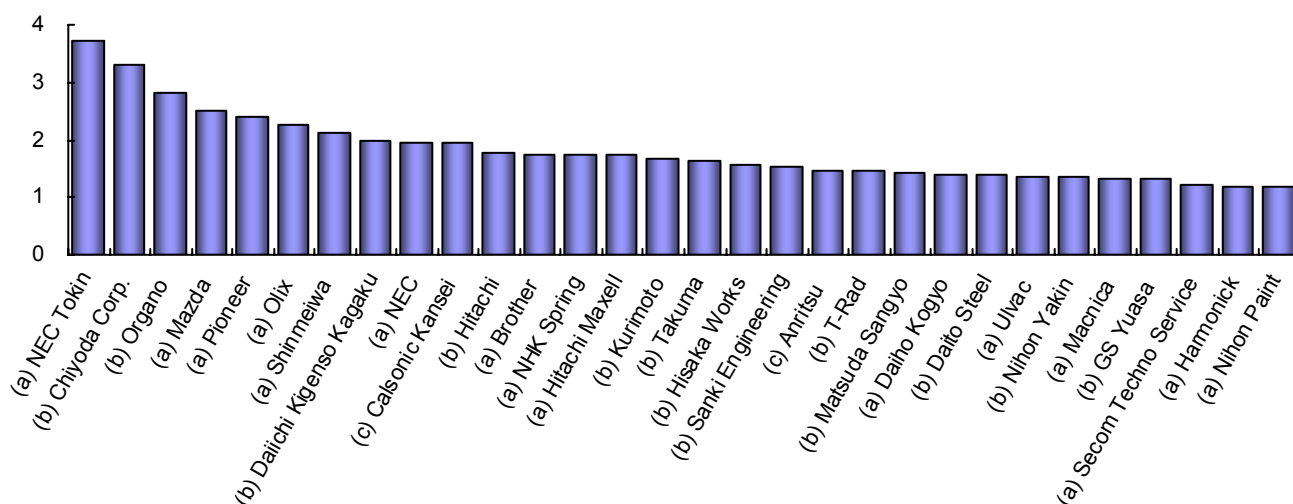
Relative Performance of Clean-tech Fund Constituents, TSE1 Foreign Trading Activity Chart 2.5



Source: TSE; compiled by DIR.

Note: Uses weekly data. Popularity determined by where representation in clean-tech investment funds is greater.

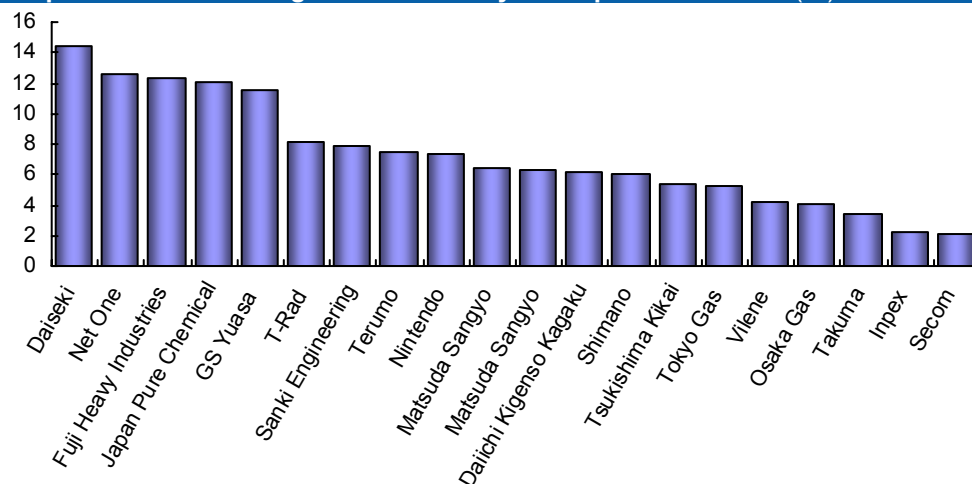
Thirty Clean-tech Stocks Showing Most Correlation with Foreign Trading Activity Chart 2.6



Source: TSE; compiled by DIR.

Note: (a) = stocks popular in Japan, (b) = stocks popular overseas, and (c) = stocks popular in both areas. Company names as listed by Nikkei. Based on regression analysis: Weekly change in share price – weekly change in TOPIX = sensitivity × foreign trading balance (Y tril) + constants. Uses data from 87-week period (5 Oct 2007 through 29 May 2009).

Top Performers among Clean-tech Players Popular Overseas (%) Chart 2.7



Source: Compiled by DIR.

Note: Data from 2 Jun through 3 Jul (2008) based on changes in share price. Company names as listed by Nikkei.

(3) Sensitivity to Environmental Trends Yardstick for Clean-tech Stock Premium

Potential winners based on different macroeconomic scenarios

Green New Deal strategies are accelerating the shift to next-gen infrastructure, and we believe expectations surrounding such initiatives underpinned the surge in the stock market from March through May. In our opinion, the clean-tech sector could be heading for an uptrend, should an economic recovery push up crude oil and energy prices and lead to increased energy usage in emerging economies. Even if the market pulls back after its sharp rise from March, medium- to long-term energy strategies and further economic initiatives are likely to provide support for the group.

Despite the hype for green stocks, some argue that diverse business portfolios at many firms make it difficult to assess whether Japanese names are being afforded a premium for clean-tech prospects. On that note, we decided to measure the sensitivity of major stocks in green funds to energy prices (as based on coal prices) and the cost of governmental climate initiatives (as based on price of emission credits) in the hopes of providing potential investment strategies. Chart 2.8 outlines our results.

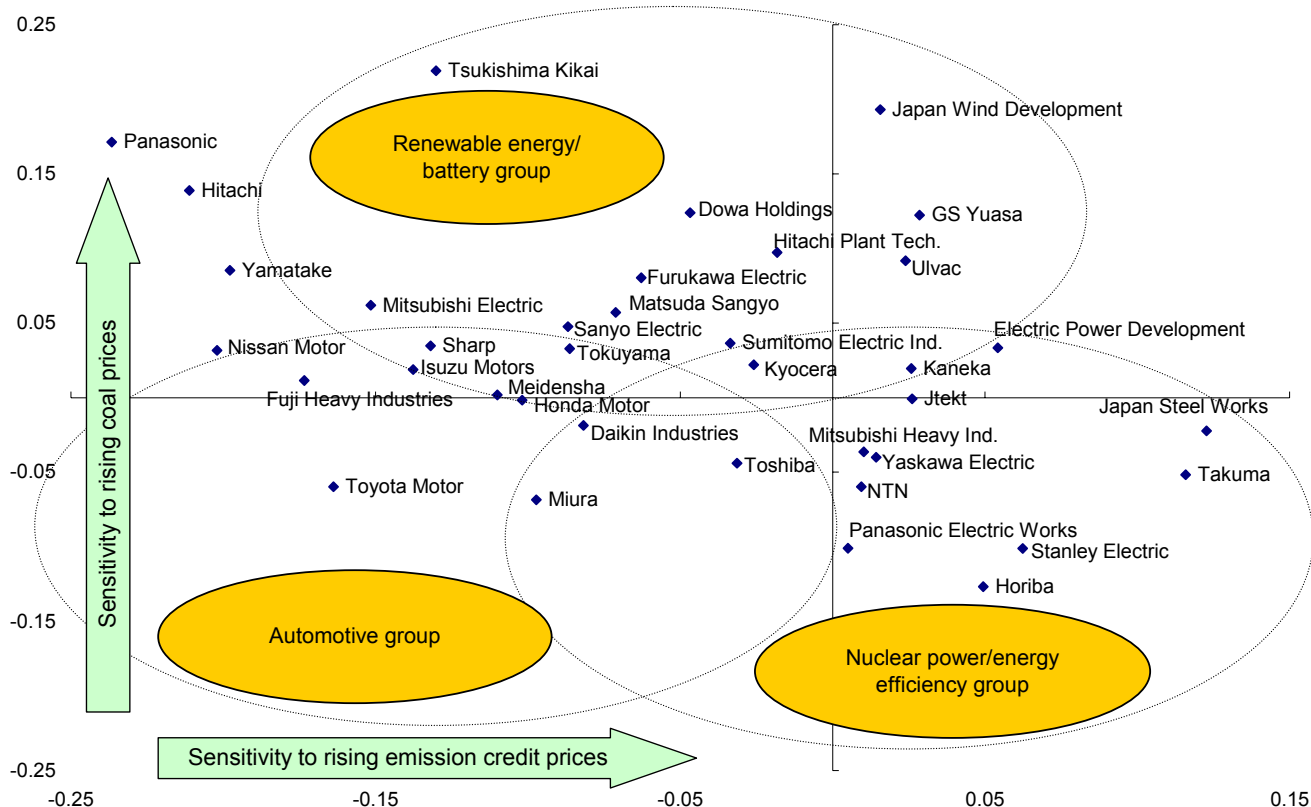
Battery makers, including GS Yuasa and Sanyo Electric, and renewable energy names, represented by the likes of Kyocera, Sharp and Japan Wind Development, showed strong sensitivity to coal prices. This makes sense as higher prices for coal, currently the cheapest input for producing electrical power, drive up costs on both ends of the supply chain, making alternative forms of energy look increasingly attractive. The same can be argued of fuel cell technologies.

Meanwhile, firms exhibiting higher sensitivity to movements in emission credit prices included nuclear power players such as Toshiba, Mitsubishi Heavy Industries and Japan Steel Works, as well as companies producing clean tech for the auto industry, names such as Yaskawa Electric, Stanley Electric, and Horiba. If, for example, rising carbon credit prices reflect increased difficulty in reaching government emission targets, a joint rise in nuclear power stocks may suggest the market is bracing for some decisive change in government policy (i.e., shift to nuclear power). The same applies to auto players, insofar that higher emission prices may herald tighter regulations benefitting providers of clean technologies.

Note that several automotive names displayed little sensitivity to either coal or emission credits. Automakers such as Toyota and Honda are trying to reduce GHG emissions with lighter compact vehicles (improving fuel economy), as well as vehicles running on bioethanol or natural gas. Therefore, when it comes to transportation plays, movements in crude oil, bioethanol and natural gas are more likely to have an impact than fluctuations in the price of coal or emission credits.

Sensitivity of Major Players to Coal and Carbon Credit Prices

Chart 2.8



Source: Bloomberg; compiled by DIR.

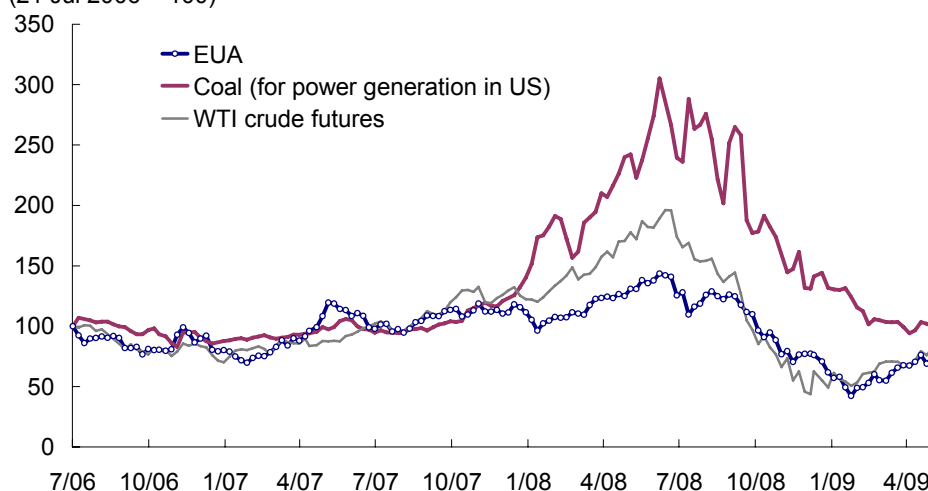
Note: Based on regression analysis: Weekly change in share price = sensitivity × weekly change in price factor + constants. Uses data from 110-week period (28 Jul 2006 through 29 Aug 2008).

Chart 2.9 graphs the prices of EU emission allowances, coal and oil. The reason we base our analysis on coal is because most major nations, excluding Japan, rely heavily on coal to generate electricity. Granted, the US is a large consumer of oil, but primarily to power its transportation sector. Overall, we believe the price of coal will have a larger impact on the shift to clean energy technology. Meanwhile, emission credits seem to be a good indicator for the market beat on climate and energy initiatives, with price increases generally heralding an acceleration of the shift to green technologies.

Emission Credit, Coal and Crude Oil Prices (%)

Chart 2.9

(21 Jul 2006 = 100)



Source: Bloomberg; compiled by DIR.

(4) Clean-tech Players on Our Radar

Charts 2.12 and 2.13 provide short comments on the clean-tech operations of 65 Japanese and 32 overseas firms on our radar.

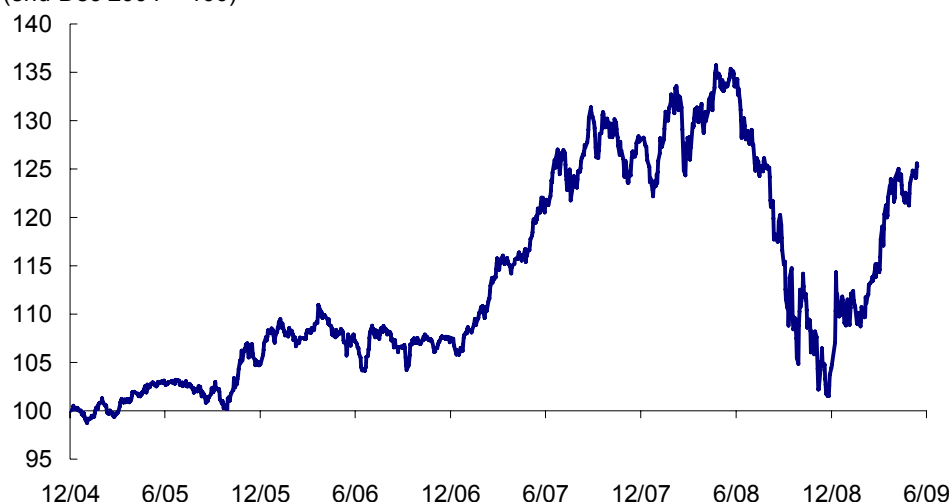
As shown in Chart 2.10, the domestic clean-tech players have fared well relative to TOPIX recently. Furthermore, they have typically outperformed TOPIX when the index has rallied (Chart 2.11). This suggests strong performance ahead as TOPIX rises moving into the next economic upcycle.

From page 80, we provide one-page overviews for the 16 Japanese and two overseas firms marked with asterisks in the charts.

Performance of Clean-tech Players vs. TOPIX

Chart 2.10

(end-Dec 2004 = 100)



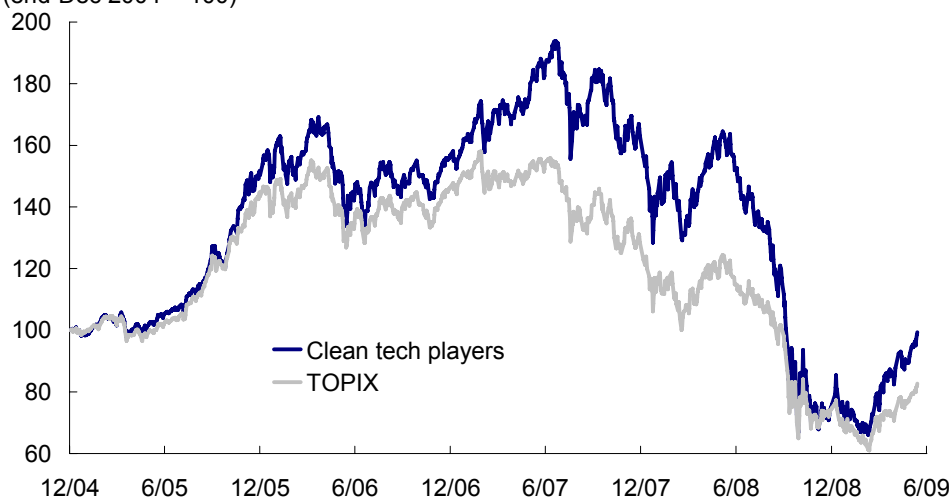
Source: Compiled by DIR.

Note: Weighted average, based on 65 domestic clean-tech players on our radar.

Performance of Clean-tech Players and TOPIX

Chart 2.11

(end-Dec 2004 = 100)



Source: Compiled by DIR.

Note: Weighted average, based on 65 domestic clean-tech players on our radar.

Japanese Clean-tech Players on Our Radar—1

Chart 2.12

Japanese Clean Tech Players On Our Radar - 1																	Chart 2-11E	
Code	Company	Market cap (Y bil) 12 Jun	Field														Notes	
			Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	Water	Energy-efficient buildings	Energy-efficient equipment	Clean coal technology	CCS	Emissions trading		Methane hydrates
1662	Japan Petroleum Exploration	321															C	Has first refusal on extraction rights for Nankai Trough (believed to be rich in resources). Became first Japanese firm to succeed in extraction from methane hydrate layer in 2000. Was operator for extraction campaign by methane hydrate resource development research consortium (government, private sector, academic participation) which dug 30 wells in Nankai Trough in 2004. (Satoshi Abe)
1963	JGC*	421											A					Track record building IGCC system power plants for Nippon Petroleum Refining. Still demonstration plants, so microscopic weight in sales. Profit contribution also likely limited. (Hirosuke Tai)
													A			Built world's second CCS plant (captures, stores CO2 emitted from natural gas plants) in Algeria in 2001. Negligible contribution to earnings at present. (Hirosuke Tai)		
														A		Already expanded CDM ops, offering alternative energy to Chinese cement plants. Minimal earnings contribution, but in black. (Hirosuke Tai)		
1969	Takasago Thermal Engineering	70									C							Takasago and other facility engineers offering energy-saving consultancy services as extension of existing businesses. Expect renewal projects to reduce CO2 emissions from office buildings to increase due to revisions to energy-saving laws, Tokyo City energy-saving by-laws. (Hirosuke Tai)
1970	Hitachi Plant Technologies	96						A										Hitachi-affiliated plant engineering firm. Estimate nuclear power plant projects account for nearly 10% of sales. Expect firm to enhance overseas project capabilities while retaining strength in domestic projects, domestic inspection business (stable income source). (Hirosuke Tai)
											C					In addition to own membrane bioreactor system, has purchased reverse osmosis system manufacturer, so can supply integrated plant systems handling seawater desalination, wastewater treatment, recycled water supply. Firm is HQ for Global Water Recycle System Association, made up of 14 firms including Hitachi, Kajima, Toray Engineering, Mitsubishi. (Hirosuke Tai)		
1983	Toshiba Plant Systems & Services	102						A										Toshiba-affiliated plant engineering firm. Nuclear power plant projects account for 25% of total sales. Expect firm to enhance overseas project capabilities while retaining strength in domestic projects, domestic inspection business (stable income source). (Hirosuke Tai)
2502	Asahi Breweries	645				C												Researching production of ethanol from high biomass yield crops and testing its use as fuel since 2006 in Okinawa. Firm apparently successful at raising biomass recovery volume through selective breeding of sugar cane. However, tax incentives and large quantity of cultivable land required remain issues probably needing to be resolved before project can become commercially viable. (Tokushi Yamasaki)
2766	Japan Wind Development	51		A														Third largest player in domestic market, with 11% share of wind power generation capacity at end-FY07. All eyes on Futamata plant in Aomori Prefecture (started operations in Jun 2008), world's first large-scale commercial wind power facility with storage batteries installed. (Satoshi Abe)
3402	Toray Industries	705								C								Orders for water treatment membranes for sea water desalination etc. likely to grow in medium term. Membranes must be replaced, so expect earnings growth as number of desalination plants increases. (Yusuke Ando)
3407	Asahi Kasei*	655																Hipore separator tops global market with roughly 50% share. FY08 sales reached more than Y20 billion. Given high technical entry barrier & importance of separators in Li-ion batteries, Hipore likely enjoys strong profitability, benefiting from growing market. Has strong edge in promising automotive field given track record in consumer electronic applications. Stepping up capacity additions recently in bid to tap robust demand. (Shinobu Takeuchi)
3436	SUMCO	366	B															Produces solar-grade wafers with FY08 (ended Jan 2009) sales reaching Y20 billion. Plans to phase in capacity additions, with new Imari plant on stream in Feb 2009. Unique electromagnetic casting technology offers cost advantages, providing potential for gains in global market share (currently few percent) over medium term. (Shinobu Takeuchi)
4047	Kanto Denka Kogyo	28							B									2nd highest market share (40%) for electrolyte materials for Li-ion batteries after Stella Chemifa. Li-ion battery-related sales checked in at Y2.1 billion in FY08 (5% of total). Stella Chemifa has upper hand for automotive batteries based on likely supply chains. (Hidemitsu Umebayashi)

Source: Compiled by DIR.

*One-page summary of clean-tech operations provided at end of period.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—2

Chart 2.12

Japanese Clean Tech Players on Our Radar																	Chart 2.11E	
Code	Company	Market cap (Y bil) 12 Jun	Field														Notes	
			Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	Water	Energy-efficient buildings	Energy-efficient equipment	Clean coal technology	CCS	Emissions trading		Methane hydrates
4080	Tanaka Chemical	19						B										Specializes in positive electrodes for Li-ion, NiMH batteries. Focusing on ternary alloy positive electrodes for consumer electronics Li-ion batteries. In automotive space, sales of positive electrodes for HEV NiMH batteries expanding, but meaningful contributions from Li-ion automotive battery business unlikely until around 2012-14. (Hidemitsu Umebayashi)
4109	Stella Chemifa*	45						A										Has 45% market share for electrolyte materials (lithium hexafluorophosphate) for Li-ion batteries. Electrolyte material sales at Y2.8 billion in FY08 (11% of total); forecast Y3.6 billion for FY09 (17%). Electrolyte material sales could hit Y10 billion in medium to long term thanks to demand for automotive Li-ion batteries. (Hidemitsu Umebayashi)
4118	Kaneka	233	C															Pioneer in thin-film solar cells. FY08 ended with sales of Y11.5 billion and slight operating loss, given weak euro and higher fixed costs on aggressive capacity hikes. Determined to boost capacity by 80 MW to 150 MW by summer 2010, likely reaching 1 GW by 2015. (Shinobu Takeuchi)
4188	Mitsubishi Chemical Holdings	657						C										Battery material sales (chiefly electrolytes) more than Y9 billion in FY08, providing little boost to profits due to heavy upfront costs. Produces all four major materials (separators, electrolytes, positive/negative electrodes), offering huge growth potential. However, lack of track record in consumer applications is hurting uptake of separators in automotive space; short-term growth potential to hinge on adoption in consumer electronics over next few years. (Shinobu Takeuchi)
4208	Ube Industries	242						A										Produces electrolytes and separators, with FY08 sales of Y12.5 billion. Strong ties with Sanyo have helped place firm among frontrunners in global electrolyte market with 25% share. It is easy for chemical firms to enjoy added value in electrolytes and separators, so margins are likely high. (Shinobu Takeuchi)
5002	Showa Shell Sekiyu	370	A															Miyazaki No. 1 solar cell plant (annual capacity 20 MW) likely yielding sales of Y5 billion, several hundred million yen in profit. Miyazaki No. 2 plant (60 MW), completed in Apr 2009, slated to start commercial production in Jul. Medium-term business plan (FY10-14), announced in May 2009, targets capacity of 1,000 MW with start up of No. 3 plant, and segment recurring profit of Y50 billion. (Satoshi Abe)
5012	TonenGeneral Sekiyu	571						A										Wholly consolidated subsidiary Tonen Chemical estimated to have second highest global market share for separators used in Li-ion batteries. Nasu plant currently has six operational production lines. Constructing two lines in South Korea (Gumi in Gyeongsangbuk Province), so production should rise to eight lines from start 2010. (Satoshi Abe)
5018	Matsumura Oil Research	3						B										Leading market share for liquid paraffin used in wet separator manufacturing. Estimate that Li-ion battery-related sales were Y900 million (7% of total) in FY08. (Hidemitsu Umebayashi)
5201	Asahi Glass	911	B															Expect medium- to long-term growth for glass substrates for solar cells. 2 main types of solar cell glass: cover glass for crystalline cells, TCO glass for thin-film cells. Technological entry barriers particularly high for TCO glass; Asahi Glass dominates supply with Nippon Sheet Glass. (Yusuke Ando)
5202	Nippon Sheet Glass	206	B															Expect medium- to long-term growth for glass substrates for solar cells. 2 main types of solar cell glass: cover glass for crystalline cells, TCO glass for thin-film cells. Technological entry barriers particularly high for TCO glass; Nippon Sheet Glass dominates supply with Asahi Glass. (Yusuke Ando)
5310	Toyo Tanso*	87	A															Makes crucibles for use in production of silicon, wafers for solar cells. Expect demand growth in medium to long term. Estimate firm's share of global market for crucibles, heaters for solar cell production at over 50%. Aggressively adding to production facilities in anticipation of future demand growth. (Yusuke Ando)
5333	NGK Insulators	607	C															Expect demand growth for NaS storage batteries for wind power generation in long term. NaS batteries are only large storage battery produced on commercial basis in world, so need to smooth output from wind power, solar power generation systems should drive demand growth. (Yusuke Ando)
5563	Nippon Denko	76						B										Bolstering production capacity of lithium manganese spinels (Li-ion battery positive electrode material). Current annual production capacity of 700 MT, but green light given for additional 2000 MT line within Takaoka plant premises. Aiming to begin shipments in 2010 (total investment: Y2-3 billion). Considering boosting capacity to around 13,000 MT from FY10, depending on demand and user needs. (Takashi Murata)

Source: Compiled by DIR.

*One-page summary of clean-tech operations provided at end of period.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—3

Chart 2.12

Japanese Clean Tech Players on Our Radar																			Chart Title
Code	Company	Market cap (¥ bil) 12 Jun	Field															Notes	
			Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	Water	Energy-efficient buildings	Energy-efficient equipment	Clean coal technology	CCS	Emissions trading	Methane hydrates		Other
5706	Mitsui Mining & Smelting	146					C											Okuaizu-based subsidiary provides steam to Tohoku Electric Power's Yanaizu Nishiyama Geothermal Power Station. Capable of maximum production of 65,000 KW—largest amount in Japan for single geothermal unit. Geothermal power does not require additional energy to drive turbines, and generates only 1/50-1/100 the CO2 emissions from coal and 1/3 of those from solar power. Upfront costs, however, are high. (Takashi Murata)	
5909	Corona	34									A							Major maker of EcoCute water heaters. Major oil heater player, but has carved out share in EcoCute market based on hot water tank technology amid shift to all-electric housing. (Hiroki Kawashima)	
5947	Rinnai*	232									A							Instant water heaters (heat-efficient) selling well in North America, with roughly 50% share. North American ops posted FY08 op profit of ¥1.1 billion on sales of ¥15.2 billion. Expect sales volume to rise 10% in FY09. Replacement purchases account for 80% of sales, so limited effects from housing start slump. (Maoki Matsuno)	
6005	Miura	84									B							Top domestic maker of small once-through boilers. Demand for eco-friendly gas-fired boilers (emit 30% less CO2 than fuel-oil fired boilers) should grow ahead. Domestic sales of such boilers have been sluggish in last two years due to supply shortage for natural gas, but shortage is being corrected, thanks in part to start of LNG imports from Sakhalin II plant. This should accelerate shift from fuel-oil fired to gas-fired boilers. (Hideaki Teraoka)	
6245	Hirano Tecseed*	16							B									Manufactures equipment for coating Li-ion battery electrodes (accounted for 17% of FY08 sales). Coating machinings for automotive Li-ion batteries look promising. Only major competitors in automotive area are Inoue Kinzoku Kogyo (6246) and Toray Engineering. Flooded with test requests from makers from Japan, Korea, Taiwan, and Europe. Meaningful growth in orders likely from FY09. (Hideaki Teraoka)	
			A														Started receiving orders for thin-film CIGS solar cell sputtering equipment in FY08; only one client: overseas maker. Estimate such equipment brought in roughly ¥1.8 billion of ¥13.5 billion in consolidated FY08 orders. Working to boost production capacity to ¥6-7 billion. Meaningful earnings contributions likely from FY10. (Hideaki Teraoka)		
6255	NPC*	46	A															Top maker of solar module production equipment with more than 40% global market share. 95% of sales from solar module production equipment; offerings work with both crystalline and thin-film solar cells. Has delivered equipment to more than 160 of roughly 180 solar module makers in world. (Hideaki Teraoka)	
6268	Nabtesco	131		A														Supplies reduction gears used in nacelle. Mitsubishi Heavy Industries is main customer, but also has track record of sales to foreign firms. Account for less than 10% of total sales. (Hirosuke Tai)	
6367	Daikin Industries*	953									A							Diversified air conditioning maker. Stands out, particularly from Asian peers, thanks to launch of highly energy efficient products based on firm's inverter and internalized refrigerant technologies. Currently ranked third globally by sales, aiming to seize second spot. (Hirosuke Tai)	
												A					Started expansion into heating equipment 3 years ago, beginning in Europe. FY08 sales were around ¥25 billion, but expect growth to over ¥50 billion in FY09. Slated to begin sales in Australia in spring 2009, China in summer 2009. (Hirosuke Tai)		
6370	Kurita Water Industries	364								A								Sells ultrapure water supply equipment to public sector, but over half of sales to industry, mainly semiconductor, LCD makers. Started supplying ultrapure water itself several years ago, but this is also mostly aimed at hi-tech industries. Yet to show interest in entering market for drinking water in China, other nations. (Hirosuke Tai)	
6471	NSK	273		A														Supplies large bearings to foreign wind turbine makers, based on long-term contracts in some cases. Business makes up roughly 10% of total sales. Profit margins likely not bad despite small sales volume as products are large, must be highly durable. (Hirosuke Tai)	
6472	NTN	181		A														Supplies large bearings to foreign wind turbine makers, based on long-term contracts in some cases. Business makes up roughly 10% of total sales. Profit margins likely not bad despite small sales volume as products are large, must be highly durable. (Hirosuke Tai)	
6473	Jtekt	315		A														Supplies large bearings to foreign wind turbine makers, based on long-term contracts in some cases. Business accounts for roughly 10% of total sales. Profit margins likely not bad despite small sales volume as products are large, must be highly durable. (Hirosuke Tai)	
6501	Hitachi	1,111						B										Estimate nuclear power project-related sales at ¥150 billion in FY07. Overseas operations basically undertaken by joint venture with GE (equity-method affiliate). Overseas operations unlikely to contribute to earnings for a while yet, but firm has new domestic projects in meantime. Hitachi, GE collaboration targets BWR systems. (Masaharu Sato)	

Source: Compiled by DIR.

*One-page summary of clean-tech operations provided at end of period.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—4

Chart 2.12

Japanese Clean-Tech Players on Our Radar — 4														Chart 2.12				
Code	Company	Market cap (Y bil) 12 Jun	Field														Notes	
			Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	Water	Energy-efficient buildings	Energy-efficient equipment	Clean coal technology	CCS	Emissions trading		Methane hydrates
6502	Toshiba*	1,567						A										Involved with both pressurized (PWR), boiling (BWR) water reactors. Overseas orders solid for PWRs, chiefly at acquisition Westinghouse Electric. Estimate FY07 Westinghouse sales at Y200 billion. Toshiba itself has long handled BWRs. BWR-related sales were around Y200 billion in FY07, mainly for maintenance services. Has received orders for two BWR reactors in North America. Firm anticipates orders for 39 reactors worldwide by 2015. (Masaharu Sato)
6503	Mitsubishi Electric	1,351	C															Has achieved world-record 18.9% conversion efficiency for polycrystalline silicon solar cells. Management plans to widen technological lead over rivals with further efficiency improvements etc. and then go on offensive rather than immediately aggressively building production capacity. Estimate sales from solar cell ops of Y45-46 billion in FY07, Y53 billion in FY08. Firm is targeting Y60 billion for FY09 and plans to boost production capacity from 220 MW in Oct 2008 to 600 MW in 2011. (Masaharu Sato)
6594	Nidec	891								C								Makes automotive motors that replace hydraulic systems. Mostly used in power steering so far. Significant growth possible going forward. (Takumi Sado)
6674	GS Yuasa	378									C							Supplying batteries for Mitsubishi Motors' i-MiEV (set for launch in summer 2009); batteries for 2,000 vehicles in 2009, 10,000 vehicles in 2011; should break even at operating line in FY11 on Y16 billion in sales. Y7.5 billion in capex planned in next two years. HEV battery plant for Honda slated to go on stream in autumn 2010 (planned investment: Y25 billion). Expect revenue early on, but likely to remain at breakeven level for a while. Production volume has yet to be decided. (Hideaki Ayabe)
6728	Ulvac	110	A															Provides turnkey systems that include amorphous silicon thin-film solar cell manufacturing equipment, which firm produces. Competitors include Applied Materials and Oerlikon. Solar cell-related product sales expected to account for 30% of total FY08 (FY-end Jun 2009) sales. (Yoshiki Yuge)
6752	Panasonic*	3,294									B							Fourth largest share of global market for mobile Li-ion batteries (about 10%); aiming for top spot after integration of Sanyo Electric. Mass-producing HEV Ni-MH through Panasonic EV Energy (JV with Toyota: Toyota, 60%; Panasonic, 40%). Will probably also eventually mass-produce HEV/EV Li-ion batteries for Toyota. (Kazuharu Miura)
6753	Sharp*	1,228	B															Solar cell ops posted FY08 sales of Y157.1 billion but operating loss of Y16.1 billion (estimates). Red ink mainly reflects failure to procure adequate supplies of key material polysilicon and increase in fixed costs from new thin-film cell plant. Solar cell ops still in red, but fourth largest share of global market in FY08 suggests excellent growth prospects. (Kazuharu Miura)
6764	Sanyo Electric	487									B							Global leader in Li-ion batteries for mobiles (25%). Supplying Honda and Ford with HEV Ni-MH. Slated to provide HEV/EV Li-ion batteries to Volkswagen and Audi. Could eventually supply cells to other assemblers. (Kazuharu Miura)
			A														FY08 solar cell sales: Y81.2 billion. Operating profit not disclosed, but margin probably again in double digits. Mass produces HIT solar cells with high energy conversion efficiency, well-suited for residential use. Announced JV with Nippon Oil to mass produce thin-film cells. (Kazuharu Miura)	
6882	Sansha Electric Manufacturing	8	A														Produces solar cell power conditioners and power supplies used in polycrystalline silicon production equipment. Sansha presently ships power conditioners—used to convert electricity produced by solar cells from DC into AC—to large power stations. Solar cell-related products make up less than 10% of total sales. (Yoshiki Yuge)	
																Produces power supplies used in battery aging process (where cells are repeatedly charged and discharged to stabilize battery quality). Product line accounts for just below 5% of total sales. (Yoshiki Yuge)		
6890	Ferrotec*	25	A															Makes, sells monocrystalline silicon ingot growing furnaces in China. Jumped to No. 1 in China by market share in 2008. Branching out to other regions, as evidenced by large new order from North America. Polycrystalline silicon ingot growing furnaces (new market entered in FY08) also faring well. Uptake of quartz crucibles (consumed in production process) gaining momentum since 2H FY08. (Hidemitsu Umebayashi)
6902	Denso	2,184									C							Manufactures power control units, with edge in medium-sized and larger vehicles. Should see meaningful contributions once Toyota hybrid sales reach 1 million vehicles annually. (Eiji Hakomori)
6934	Shin-Kobe Electric Machinery	50									C							Makes Li-ion batteries for industrial applications. Plans to start mass production of batteries for IT systems in FY10. Anticipate business breaking even at operating level in FY10 on sales of Y1 billion. (Hideaki Ayabe)

Source: Compiled by DIR.

*One-page summary of clean-tech operations provided at end of period.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—5

Chart 2.12

Japanese Clean Tech Players on Our Radar																			Chart 2.12
Code	Company	Market cap (Y bil) 12 Jun	Field															Notes	
			Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	Water	Energy-efficient buildings	Energy-efficient equipment	Clean coal technology	CCS	Emissions trading	Methane hydrates		Other
6957	Shibaura Electronics	9								A								Supplies thermistors (monitors temperature near motors and inverters) for Toyota's hybrid vehicles. Firm has high share of thermistor shipments to Toyota (more than 50%), but hybrid-related sales account for only 2% of total sales. (Mitsuharu Watanabe)	
6971	Kyocera*	1,450	A															Integrated solar cell production from wafers to generation systems. Extremely high conversion efficiency for polycrystalline silicon cells. Solar cell sales were just over Y90 billion in FY08, yielding op profit of roughly Y24 billion. Marked profit decline likely in FY09 due to weak euro, slowdown in Europe. (Takumi Sado)	
6988	Nitto Denko*	517								A								FY08 operating profit from water treatment membranes at Y1.5 billion on sales of Y20.7 billion in FY08. One of market leaders with around 30% share. Expect 11% annual market growth. However, water treatment membranes only have small weight in total company earnings. (Takumi Sado)	
6991	Panasonic Electric Works	609										A						Leading domestic EcoCute (heat pump-based hot water system) maker (units made by Panasonic, sold by PEW). FY08 sales of housing equipment for all-electric homes (IH cooking appliances, heated flooring, solar power systems) grew in double digits y/y to slightly under Y100 billion. (Kazuharu Miura)	
7003	Mitsui Engineering & Shipbuilding	202			C												C	Building demonstration plant in Abu Dhabi. Poor visibility on profit contribution, but likely to take time given strong R&D nature of operations at present. (Hirosuke Tai) Developing ships for methane hydrate transport. Currently facing significant cost issues, in addition to which, technological hurdles very high. Poor visibility on whether it will get out of development stage. (Hirosuke Tai)	
7011	Mitsubishi Heavy Industries*	1,380	C															Developing thin-film solar cells. Sales currently merely a few billion yen, so loss-making business. Firm plans to continue with R&D, but likely to be several years before profit contribution. (Hirosuke Tai)	
			A														Estimate annual sales of around Y100 billion with operating profit margin in high single digits. Expanding, mainly in North America. 2000 kW turbines are mainstay. (Hirosuke Tai)		
						A											Track record of deliveries to 12 countries. Main roles are plant construction, steam turbine supply. Minimal contribution to earnings, as earnings from each project small. (Hirosuke Tai)		
							A										Major PWR player. Also developing mid-size reactors together with Areva (France). Sales around Y200 billion, operating profit margin roughly 10%. Construction of Tomari No. 3 reactor reaching peak. Focusing on US in overseas ops; not that interested in China. (Hirosuke Tai)		
										A							Expanded into car air conditioning in addition to household, commercial-use. Roughly 5% weight in total sales. Business posting operating losses, partly due to recent massive slump in sales volume. Has considered merging business with Hitachi in past. (Hirosuke Tai)		
													C				Delivered IGCC system demonstration plant to Clean Coal Power R&D. Notable for air-blown IGCC technology. Demand likely to grow in medium term on environmental issues, but should take several years before contributing to earnings. (Hirosuke Tai)		
														A			Has built five plants so far, though all for emissions from urea plants. Plans to expand to CCS for coal-fired power plants. However, only intends to supply equipment; will not build facilities. Minimal contribution to earnings. (Hirosuke Tai)		
																C	Entered CDM field by concluding CDM contract with Chinese electric utility firm in 2007. Plans to purchase only 330,000 MT of emission credits over five years (2008-12), so profit contributions to take several years. (Hirosuke Tai)		

Source: Compiled by DIR.

*One-page summary of clean-tech operations provided at end of period.

Note: A: Already providing earnings contributions; B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—6

Chart 2.12

Japanese Clean Tech Players on Our Radar																	Chart 2.11	
Code	Company	Market cap (Y bil) 12 Jun	Field															Notes
			Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	water	Energy-efficient buildings	Energy-efficient equipment	Clean coal technology	CCS	Emissions trading	Methane hydrates	
7013	IHI	260						A										Supplying various equipment for BWRs as major Toshiba partner. Also developing pressurizers, steam generators for PWRs to supply to Westinghouse, but commercialization likely to take several years. Just over 10% of total sales. (Hirosuke Tai)
7966	Lintec*	124	A															Expect strong growth for highly profitable solar cell backsheets. Firm should expand global market share from current 20% going forward, as (1) material costs, selling prices are likely lower than standard backsheet models, (2) US subsidiary makes, sells back sheets, so should benefit from surge in US solar investment, "Buy American" initiatives. (4%). (Hidemitsu Umebayashi)
8001	Itochu	1,173	C															Has made wave of investments in solar system integrators/solar park operators in Norway, Italy, Greece, US west coast etc. Established solar business department in Apr 2009. (Jiro Iokibe)
8002	Marubeni	845														A		Early entrant into emissions trading. Sales of emissions credits obtained in China to Japanese firms, government already contributing to earnings. Only Japanese member of ECX (European Climate Exchange). (Jiro Iokibe)
8031	Mitsui & Co.	2,387					C											Bio-ethanol joint venture with Brazilian state oil firm Petrobras started operations in 2008. Joint venture plans to produce bio-ethanol from sugar cane cultivated on 30,000 hectares in inland Brazil, export it for sale on Japanese, European, US markets as transport/power generation fuel. No contribution to earnings yet. Mitsui & Co. invested Y6 billion for 20% stake. (Jiro Iokibe)
8053	Sumitomo	1,357	C															Large solar power generation operation in Canary Islands (Spain) started in May 2008. 25-year contract to sell electricity to leading Spanish electric utility Endesa from 2H CY08. Output: 9000 kW. (Jiro Iokibe)
8058	Mitsubishi	3,426	C															Acquired 34% of shares in solar power producer Amper Central Solar (Portugal), subsidiary of world's largest new-energy firm, Acciona (Spain), in Mar 2009. Current generation facilities have output of 45,800 kW. (Jiro Iokibe)
																B		Domestic leader in emissions trading in terms of trading volume, applications. Also focusing on CDM (clean development mechanisms) and JI (joint implementation). Developing one-stop services (inspection, recommendations, facility construction, financing, application services) for emissions trading. (Jiro Iokibe)
8473	SBI Holdings	317															C	Established venture capital funds investing in green technologies. Established alternative energy fund (\$20 million) in partnership with UAE government-sponsored financial institution in Jan 2009. Earnings contributions not likely for few years at earliest, but does represent new investment opportunity. (Jiro Kojima)
8518	Japan Asia Investment	10															C	Established venture capital funds investing in green technologies. Set up venture fund (\$10 million) making energy/eco-related investments in Asia in Oct 2008. Earnings contributions not likely for few years at earliest, but does represent new investment opportunity. (Jiro Kojima)
9513	Electric Power Development	440		A														Second largest player in domestic market with 13% share of wind power generation capacity at end-FY07. Had 12 operational domestic wind power facilities with total output of 256,000 kW as of Mar 2009. Overseas, has 45% stake in Zajaczkowo wind power facility (Poland; 48,000 kW). (Satoshi Abe)
												C						Carrying out trials of coal gasification technology (EAGLE project) in conjunction with NEDO. Also aiming to build demonstration IGCC system (integrated gasification combined cycle; 170,000 kW output) jointly with Chugoku Electric Power. (Satoshi Abe)

Source: Compiled by DIR.

*One-page summary of clean-tech operations provided at end of period.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Overseas Clean-tech Players on Our Radar—1

Chart 2.13

Overseas Clean Tech Leaders on Our Radar			Chart 2-10															
Country	Code	Company	Field													Notes		
			Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	Water	Energy-efficient buildings	Energy-efficient equipment	Clean coal technology	CCS	Emissions trading	Methane hydrates	Other
Asia	1211 HK	BYD						A										BYD is one of major Li-ion battery producers for mobile phones. Our estimate is that 4 billion yuan of revenue came from this business in FY08 (around 14% of total revenue). In 2007, it took roughly 9% of global consumer Li-ion battery market. BYD developed LiFeO4 battery by itself and used it in its F3DM EV model. <i>(Ricon Xia, DIR Shanghai)</i>
								C										BYD introduced the world's first dual-mode electric car model, namely F3DM in December 2008. Management expects that there will be no solid earnings contribution from this business at least in next two years, due to high production cost and limited sales volume. <i>(Ricon Xia, DIR Shanghai)</i>
Asia	1868 HK	Neo-Neon									A							51% of revenue from LED lighting in 2008. Revenue up strong 41.8% y/y in 1H08, but down 15.5% in 2H08 due to slowdown in demand. Positioned to be strong beneficiary should China see large-scale adoption of LED streetlights/exhibition panels over medium to long term. <i>(Bo Bo Wong, DIR Hong Kong)</i>
Asia	STP US	Suntech Power*	A															Largest solar cell/module maker in China with global footprint. Annual production capacity is 1 GW and aims to ship 600-700 MW in 2009, up from 497 MW in 2008. Due to fall in demand, price declines, and inventory write-downs company recorded losses in 4Q CY08, but should become profitable from 2009. <i>(Pranab Sarmah, DIR Hong Kong)</i>
Asia	6244 TT	Motech	A															Largest solar cell maker in Taiwan. Aims to expand annual production capacity by end of 2009 to 600 MW from 450 MW at the end of 2008 and plans to ship 400 MW in 2009, up 47% y/y. Motech is only large Taiwanese PV-cell maker who was profitable in 1Q CY09 thanks to its low exposure to long-term polysilicon prices. <i>(Pranab Sarmah, DIR Hong Kong)</i>
Asia	757 HK	Solargiga	A															Second largest China-based mono-wafer maker in 2008 with strong Japanese connections. Company aims to lift double ingot production capacity to 400MW this year and triple wafer processing capacity. After a huge loss in 4Q CY08 (inventory write-off) company is likely to record losses in 1H CY09. <i>(Pranab Sarmah, DIR Hong Kong)</i>
Asia	2448 TT	Epistar									A							Taiwan's largest LED chip maker, mainly supplies to China handset market, decorative lamps and also OEM chip makers for notebooks. There has been talk that Epistar may either collaborate with or acquire Toyoda Gosei's LED business for future expansion. After recording losses since 4Q CY08, we believe company became profitable from Mar-09. <i>(Andrew Chang, DIR Taipei)</i>
Asia	2393 TT	Everlight									A							Taiwan's largest LED packager with balanced product portfolio. It assembles LEDs for consumer electronics, handsets, notebook back-light, general light, street light, etc. <i>(Andrew Chang, DIR Taipei)</i>
Asia	2308 TT	Delta Electronics	A															DelSolar is expanding its annualized PV cell production capacity to 720 MW in 2009 and decided to stop investment in thin-film solar cell project. In Taiwan, it has received 100 MW system order for Kaohsiung's new Stadium and another 150 MW order at Taichung. <i>(Andrew Chang, DIR Taipei)</i>
												A						Delta is leveraging its solutions in LED ballast, power supply and heat sinks for LED street lighting projects. It has invested in high-power LED packagers, thermal module suppliers, and has formed a close supply relationship with Epistar for high-power LED chips. We estimate LED sales account for low single-digit percentage of Delta's 2009 revenue. <i>(Andrew Chang, DIR Taipei)</i>
													A					
Asia	658 HK	China High Speed Transmission Equipment Group		A														Top maker of wind turbine gear boxes in China. Roughly half of 2008 sales from wind power related ops. Plans to increase production volume in wind power related ops from 3.5 GW in 2008 to 6 GW in 2009 and 9 GW in 2010. <i>(Taiki Kaji, DIR Hong Kong)</i>
Asia	1072 HK	Dongfang Electric		B														One of China's three major wind turbine makers, vaulting to No. 3 spot in domestic market in 2008 with 17% share, up from 7%. In 2008, wind power related operations accounted for 10% of total sales (up from 2%) and 15% of orders. However, thermal power generation equipment still makes up more than 80% of total sales. <i>(Taiki Kaji, DIR Hong Kong)</i>
							B											One of China's three major heavy electric machinery makers. Revenue from nuclear power projects was booked as only part of "other" operations (6% of total sales), but related orders made up 24% of company-wide total. In addition to major equipment for generation II reactors, it has also landed orders for EPR (steam turbines, generators) and AP-1000 (pressurizers) projects. <i>(Taiki Kaji, DIR Hong Kong)</i>

Source: Compiled by DIR.

*One-page summary of clean-tech operations provided at end of period.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Overseas Clean-tech Players on Our Radar—2

Chart 2.13

Overseas Clean Tech Players on Our Radar			Field													Notes		
Country	Code	Company	Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	water	Energy-efficient buildings	Energy-efficient	Clean coal technology	CCS	Emissions trading	Methane hydrates	Other
Asia	HOLI US	HLS Systems						B										Entered nuclear power sector by establishing plant control system joint venture with China Guangdong Nuclear Power Holding (CGNPC), major Chinese nuclear power operator. Expect business to contribute more to earnings as CGNPC increases plant construction. (Taiki Kaji, DIR Hong Kong)
Asia	034020 KS	Doosan Heavy Industries & Construction						A										Sees more than 10% of total sales from nuclear power plant equipment and boasts strong position in said market. Sole producer of major nuclear power plant equipment in Korea and also has orders as major supplier for latest Toshiba/Westinghouse AP-1000 reactors. Should benefit from increased nuclear power plant construction at home and abroad. (Taiki Kaji, DIR Hong Kong)
Asia	SUEL IN	Suzlon Energy		A														Top producer of wind turbines in India with market share of over 50% and No. 5 maker globally (8.1% share based on parent). Group companies include gear box major Hansen Transmission and turbine maker Repower. Struggled in 2008 in US due to faulty blades, but should benefit from market expansion over medium to long term. (Taiki Kaji, DIR Hong Kong)
Europe	RWEGY	RWE*		B														While RWE is likely to be involved in development of new build nuclear, smart grids, CCS and cogen projects, the biggest near term growth driver for group is its renewable division which is principally focused on European onshore and offshore wind projects. RWE Innogy made small profit last year but we forecast €0.7 billion in EBIT by 2013. (Ashley Thomas, DIR Europe)
Europe	EOANGY	E.ON		B														While E.ON is likely to be involved in development of new build nuclear, smart grids, CCS and cogen projects, the biggest near term growth driver for group is its renewable division which is principally focused on European onshore wind projects. Climate & Renewables division made a small profit last year but we forecast €0.8 billion in EBIT by 2013. (Ashley Thomas, DIR Europe)
Europe	RDSALN	Royal Dutch Shell				C												Alternative Energy is not expected to be profitable until 2nd generation biofuels are commercialized. Shell is focused on cellulosic biofuels working with Iogen and Choren. Believes commercial production of 2nd generation biofuels will occur within next 10 years and biofuels could account for 7-10% of global transport fuels within 20 to 30 years. (David Stedman, DIR Europe)
Europe	BP LN	BP		B														Total of \$2.8 billion has been invested in Alternative Energy. Focuses on Wind, Solar, biofuels and CCS. BP has decided to cut capital spending on Alternative Energy in 2009 by 40%. BP has 1,000 MW of wind capacity in US plus 40 MW of capacity in India, all of which is onshore. Key partnerships are with Clipper Windpower, NRG and Dominion in US. (David Stedman, DIR Europe)
Europe	VWSDC	Vestas		A														Market is profitable but mature and global wind turbine demand in 2009 is likely to be flat or below that of 2008. Asia remains high growth region (domestics are main beneficiaries) but US and European demand is likely to fall by over 20%. With fewer framework agreements than Gamesa, Vestas may be the first to experience pricing pressure and increased competition. (Ashley Thomas, DIR Europe)
Europe	GAMSM	Gamesa		A														Market is profitable but mature and global wind turbine demand in 2009 is likely to be flat or below that of 2008. Asia remains high growth region (domestics are main beneficiaries) but US and European demand is likely to fall by over 20%. With committed order book extending to 2011 Gamesa is better protected than Vestas from pricing pressure and competition. (Ashley Thomas, DIR Europe)
Europe	ABBSS	ABB																A Leader in power and automation technologies while lowering environmental impact. Global power capex is expected to be down more than 30% in 2009 impacting their power system order intake. However, infrastructure and power line demand in Middle East and China remains relatively strong. Various government stimulus programs should also have a positive impact. (Ashley Thomas, DIR Europe)
Europe	ALOFP	Alstom												A				Leader in clean coal technology although future growth is set against tough y/y comparison given large number of European FGD installations in 2008. Increased investment in power grid in China and US should be of benefit to Power Systems division although Power Products division may suffer from lower new plant investments by utilities globally. (Ashley Thomas, DIR Europe)
Europe	SIEGY	Siemens																A Increased power grid investment will benefit both Siemens' Power Transmission and Distribution activities. Renewable division faces reduced market demand and increased competition, but 2009 results should be boosted by two large European offshore wind deals (E.ON/SSE). Siemens is also market leader in railway and energy efficiency/lighting systems. (Ashley Thomas, DIR Europe)
Europe	CEIFP	Areva						A										New nuclear build has long lead time but would benefit from US carbon cap or classification of nuclear as renewable energy. Transmission & Distribution division to benefit from grid investment. (Ashley Thomas, DIR Europe)

Source: Compiled by DIR.

*One-page summary of clean-tech operations provided at end of period.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Overseas Clean-tech Players on Our Radar—3

Chart 2.13

			Field															Notes
Country	Code	Company	Photovoltaics	Wind power	Solar thermal	Biofuel	Geothermal power	Nuclear power	Li-ion battery	Next-gen cars	Water	Energy-efficient buildings	Energy-efficient equipment	Clean coal technology	CCS	Emissions trading	Methane hydrates	Other
Europe	QCEGY	Q-Cells	A															Major solar cell maker (Germany). Aggressively investing in ventures with solar cell-related technology. Sales of 224 million euros, operating profit of 14.7 million euros in Jan-Mar 2008. High exposure to various countries' subsidy/compulsory electricity purchase schemes. (Yoko Yamada, DIR America)
US	FSLR	First Solar	A															Top thin-film cell maker. Over half of sales to large-scale generation projects. High exposure to various countries' subsidy/compulsory electricity purchase schemes. Has penned long-term supply contracts with 10 clients. Large contracts with each client, so significant fallout if dissolved. (Yoko Yamada, DIR America)
US	SPWRA	Sunpower	A															Has achieved world record conversion efficiency (20-25%) using single-face electrode structure. Involved in wide range of activities from making solar cells to installing solar panel systems. Households, large-scale generation projects, corporations each account for roughly one third of sales. High exposure to various countries' subsidy/compulsory electricity purchase schemes. (Yoko Yamada, DIR America)
US	CREE	Cree										A						Major white LED maker. Highly competitive in high-output (high luminous efficiency) LEDs, aggressively developing lighting applications. Likely to enjoy benefits of increased public investment, for instance use of LEDs by US government institutions. (Yoko Yamada, DIR America)
US	DE	Deere				A												Maker of agricultural, construction machinery. Top global market share for agricultural machinery. Agricultural machinery accounted for 65% of FY08 operating profit, followed by construction machinery (14%), financial services, lawn mowers etc. Conflict of demand for agricultural products between foods, biofuels, likely to continue until development, spread of cellulose ethanol. Firm likely to benefit, as spread of biofuels should push up agricultural product prices, feeding farmers' appetites for capex. (Shiro Sakamaki, DIR America)
US	CNH	CNH Global				A												Maker of agricultural, construction machinery. Second largest agricultural machinery maker in world. Subsidiary of Italian car maker Fiat. Conflict of demand for agricultural products between foods, biofuels, likely to continue until development, spread of cellulose ethanol. Firm likely to benefit, as spread of biofuels should push up agricultural product prices, feeding farmers' appetites for capex. (Shiro Sakamaki, DIRA)
US	AGCO	AGCO				A												Specialist agricultural machinery maker. 3rd highest global market share. High weight of sales in Europe, South America relative to top 2 firms. Conflict of demand for agricultural products between foods, biofuels, likely to continue until development, spread of cellulose ethanol. Firm likely to benefit, as spread of biofuels should push up agricultural product prices, feeding farmers' appetites for capex. (Shiro Sakamaki, DIR America)
US	GE	General Electric												A				Commercialized IGCC 7FB gas turbine in 2004. GE energy, which makes gas turbines, wind power generation equipment, had sales of \$29.3 billion, operating profit of \$4.9 billion in FY08, accounting for just under 20% of whole-company earnings. (Shiro Sakamaki, DIR America)
US	ITT	ITT									A							Involved in water treatment facilities, manufacturing water pumps. 33% of sales, 34% of operating profit from water-related operations in FY08. Wide range of sales channels—public works projects, industrial applications, housing, commercial facilities, agriculture. (Shiro Sakamaki, DIR America)

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

2.2 Clean-tech Businesses that Could See Inflow of Investment over Medium to Long Term

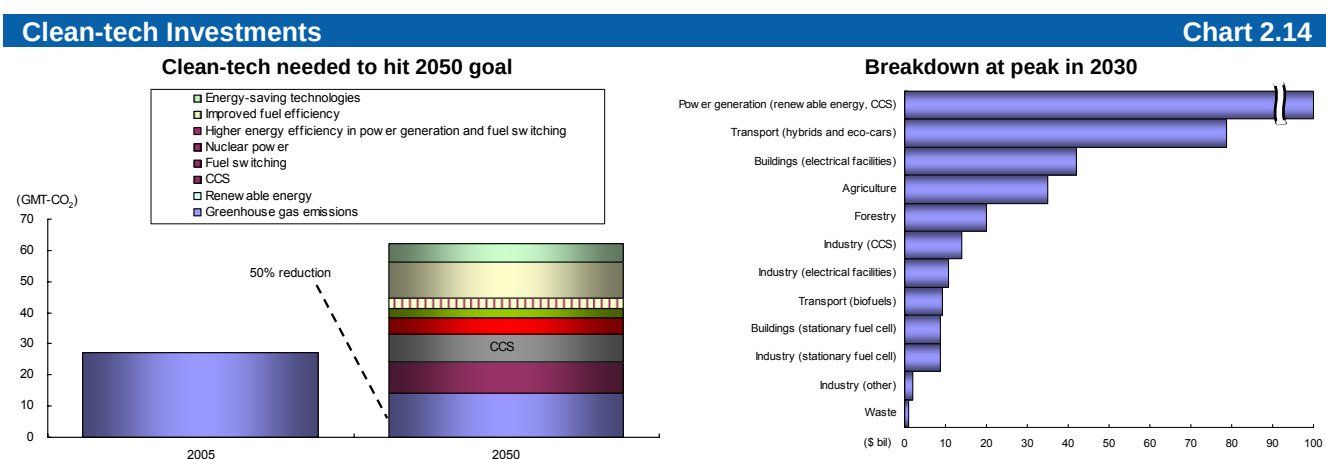
In this section, we will consider possible medium- to long-term implications of the public-and private-sector shift to clean technologies. First, we compare current levels of clean-tech investment by various countries and estimate the amount of additional funding needed to reduce greenhouse gases (GHG) to 50% of 1990 levels by 2050. We then look at what Japan is doing to reduce CO₂ emissions—including its strategies over the short-term (various incentives as part of broader economic stimulus package), medium-term (reducing 2020 emissions by 15% from 2005 level), and long-term (e.g., *Action Plan for Achieving a Low-Carbon Society*)—in order to identify those industries that might benefit over the medium to long term. Finally, we examine the results of efforts to reduce emissions over the last two years and explore possible developments once full-fledged emissions trading begins.

(1) Technologies in the Spotlight

Emissions reductions to center on clean energy sources, energy-efficient transport

Carbon dioxide (CO₂), one by-product of energy consumption, accounts for a large portion of GHG emissions. The International Energy Agency (IEA) believes attempts to reduce GHG emissions to 50% of the 1990 level by 2050 will mainly involve increased use of clean energy and energy-efficient cars or public transport. It estimates that about 50% of the necessary reductions would result from implementation of the former and 25% from the latter (Chart 2.14, left).

In 2007, the United Nations Framework Convention on Climate Change (UNFCCC), which has overseen the Kyoto Protocol and other attempts to address global warming, released a report discussing present and expected future investment in clean technologies. The paper focuses on (1) mitigation measures (aiming to stem or even reverse global warming by reducing GHG emissions) and (2) adaption measures (efforts to address impacts from the expected change in global climate). The amount of additional investment needed to keep GHG emissions in 2030 at 2004 levels is displayed in Chart 2.14 (right).



Source: IEA, United Nations; compiled by DIR.
Note: As of Jun 2008.

According to the UNFCCC report, the lion's share of spending on mitigation measures would be directed at renewable energy, nuclear power, or Carbon Capture and Storage (CCS) technologies—as much as \$150 billion in additional investment. Encouraging greater use of hybrid vehicles and other energy-efficient

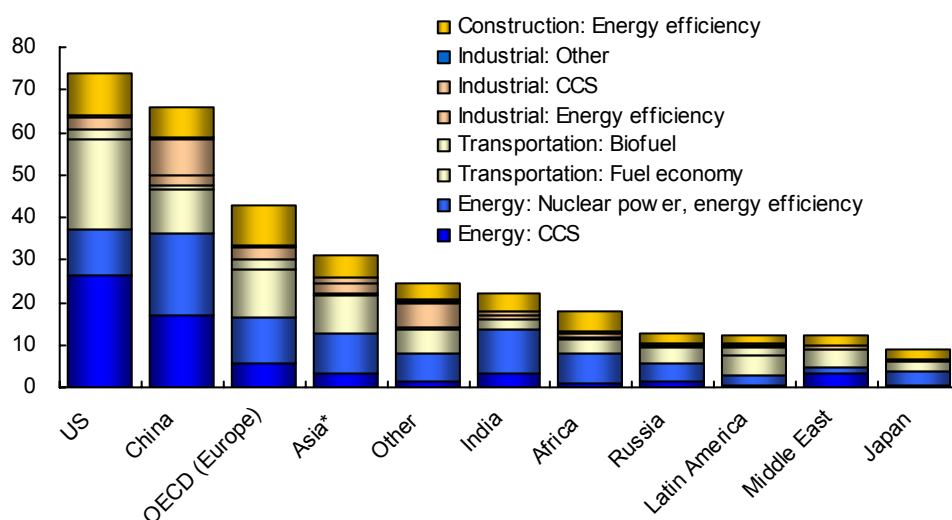
modes of transport would require an additional \$80 billion in funding, while building or retrofitting structures with more energy-efficient technologies would call for an extra \$40 billion.

Focus on efforts in US, China, and Europe

Demand for clean energy is expected to grow in the US, China and India (Chart 2.15). Elsewhere, Europe, one of the first regions to address global warming, ranks just behind the US and China in terms of its capacity to cut CO₂ emissions. It may seem odd at first that Europe's clean-tech spending centers on energy-efficient transportation and green buildings, rather than clean energy. Closer inspection, however, reveals that Europe had already introduced stiffer laws favoring clean energy from around 2000, and has only started seriously tackling energy-efficient transport and buildings from around 2004. Viewed as having very little room for further cuts in its emissions, Japan is expected to spend about \$3.7 billion on clean energy, \$2.5 billion on eco-friendly transport, and \$2 billion on energy-efficient buildings.

Additional Green-tech Investment b (UNFCCC; \$ bil)

Chart 2.15



Source: UNFCCC; compiled by DIR.

* Excludes China and Japan.

Note: Based on 2007 study.

Feasibility of renewable energy hinges on market prices for oil and coal

Potential investment in clean energy was one topic of discussion at this year's annual Davos meeting of world political and economic leaders (Feb 2009). Materials from the meeting estimate the cost of producing energy from conventional as well as renewable energy sources (Chart 2.16). However, the chart also measures changes in cost competitiveness once higher interest rates or coal/natural gas prices and additional costs from emissions trading are factored into the cost of energy production.

On an unadjusted basis (base-case scenario), cost competitiveness of each energy source ranks as follows, from highest to lowest: coal, geothermal power, biomass, natural gas, wind power, solar thermal energy (STE), and photovoltaics. However, under a more pessimistic scenario of higher interest rates and fuel costs, geothermal power becomes the most cost competitive option, followed by biomass, coal, wind power, natural gas, STE, and photovoltaics.

As noted elsewhere in this report, producing energy through photovoltaics remains relatively expensive, so government incentives will probably dictate the pace at which the technology spreads, as well as potential profits for related companies. Expectations for government support of solar power continue to rise. However,

clean coal technology (reduced CO₂ emissions in coal-fired power plants) or alternatives with lower breakeven points (geothermal, biomass, wind power) could look increasingly attractive if such expectations recede or if the economic recovery is driven by the private sector.

Sensitivity of Power Costs to Changes in Inputs (Results of Davos 2009 Meeting)						Chart 2.16	
	Power generation cost		Change in cost under following changes in assumptions (%)			Power generation cost under following scenario	
	Base case (\$/MWh)	Ranking	(1) Interest rate (-300bp)	(2) Fuel price (+20%)	(3) Carbon price (+20%)	Low interest rate and high carbon & fuel costs	Revised ranking
Coal-fired	40.6	1	-7.10	6%	45%	58.1	4
Natural gas CCGT	82	5	-1.30	16%	14%	104.8	6
Geothermal (flash)	44.3	2	-4.60	-	-	42.3	1
Geothermal (binary)	58	3	-5.10	-	-	55	3
Wind (onshore)	108.2	6	-10.40	-	-	88.8	5
Wind (offshore)	181.8	7	-5.50	-	-	171.8	7
Biomass	67.5	4	-12.10	-	-	54.8	2
Solar thermal	270.9	8	-7.70	-	-	249.9	8
Solar photovoltaic	445.7	9	-8.10	-	-	409.5	9

Source: Davos meeting materials; compiled by DIR.

Notes: 1) Base case assumptions: interest rate, 2.5%; coal, \$115.29/MT (2009); natural gas, \$1.49/MMBtu; carbon, \$28.11/MT (2009).

2) CCGT refers to combined cycle gas turbine technology, which burns natural gas mixed with air to turn turbines and reuses residual heat from the process to turn other steam turbines.

(2) Focus Areas in Japan's Global Warming Policy

Long-term Strategy: Cut Current Emissions by 60-80% by 2050

Action Plan for Achieving a Low-Carbon Society

The Japanese government released its *Action Plan for Achieving a Low-Carbon Society* in July 2008, outlining detailed steps for reducing GHG emissions in 2050 to 20-40% of current levels. Based on the *Cool Earth Energy Innovative Technology Plan*, the action plan proposes a technology roadmap that would require about \$30 billion (or about Y3 trillion) in clean-technology investment over the next five years. Projects include: (1) development of clean coal technologies and CCS; (2) expansion of solar power use; (3) greater acceptance of next-gen hybrid and electric vehicles; (4) accelerating the spread of energy-efficient technologies in buildings; and (5) advocacy of nuclear power (Chart 2.17).

Government materials indicate a Y100 billion y/y increase in the FY09 budget for energy-related projects, with around Y40 billion of that amount earmarked for advanced energy-saving technologies. This is only a fraction of the \$6 billion a year called for in the above-noted action plan (i.e., \$30 billion divided evenly over five years). Incidentally, the government increased spending on existing technologies that have already been commercialized (such as solar power or hybrid vehicles) by Y50 billion, including Y24 billion in subsidies for residential solar power systems and Y10 billion to encourage firms to equip their buildings with energy-efficient technologies.

Japan's Long-term Environmental Strategy and FY21 Budget Requests

Chart 2.17

Overview of Low Carbon Society Action Plan

Promoting Spread of Existing Technologies

- Increased use of emission-free energy sources to at least 50% of power generation by around 2020
- Use of photovoltaics increased ten-fold by 2020, forty-fold by 2030. Solar power system cost reduced by half within next 3-5 years.
- Encouraging sales of hybrid vehicles so that one of every two new cars sold is an eco-friendly version (presently one of every fifty is eco-car)
- Further promotion of nuclear power

Development of New Technologies

- Investment of around \$30 bil over next 5 years
- Large-scale testing of CCS early in FY09, aiming for commercialization before 2020
- Raising energy efficiency of IGCC power generation by 48% before 2015 and combining its use with CCS to achieve near-zero emissions
- Development of new photovoltaic technology (raise energy efficiency to over 40% by 2030 and reduce cost of producing electricity to Y7/kw)
- Reducing cost of power for fuel cell batteries from Y4-5 million/kw to Y400,000/kw by 2020-30, and raising battery life from present 40,000 hours to 90,000
- Reducing cost of super-efficient heat pumps by 25% before 2030 (50% before 2050) and also raising energy efficiency by 50% (100%) over same period

Energy-Related Items in FY09 Budget

Promoting Spread of Existing Technologies

FY09 budget request (total)	Y328.5 bil (Y278.7 bil)
(a) Renewable energy initiatives	
• Housing solar power systems	Y23.75 bil (none)
• Fuel cell batteries	Y7.5 bil (none)
• Programs to accelerate adoption of renewable energy by public and private sectors	Y40.02 bil (Y37.83 bil)
• Eco-friendly vehicles	Y4.89 bil (Y1.89 bil)
(b) Energy-saving/energy-efficient materials & facilities	
• Support for businesses	Y40.52 bil (Y29.65 bil)
(c) Nuclear power	
• Development of cutting-edge nuclear power technology (including next-gen light water reactors)	Y9.1 bil (Y6.4 bil) etc.

Development of New Technologies

FY09 budget request (total)	Y104.7 bil (Y62.9 bil)
• New photovoltaic technology	Y3.5 bil (Y2.0 bil)
• Stationary fuel cells	Y7.68 bil (Y55.8 bil)
• Cutting-edge nuclear power technology	Y9.44 bil (Y6.62 bil) etc.

Source: Government data; compiled by DIR.

The action plan also indicated that during FY08 the government would examine emissions trading, environmental taxes, and ways to encourage individuals and firms to reduce their carbon footprint. It even proposed introducing daylight savings time as a way to encourage people to change their lifestyles. However, the economic deterioration following the Lehman Brothers failure apparently forced the government to include some elements of its action plan earlier than it had expected, as part of a broader economic stimulus package.

Short-term Strategy: Encourage Green-tech Investment via Economic Stimulus Plan

Only modest outlays on green technology in economic stimulus plan

Japan's Lower House approved the supplementary budget for FY09 on 29 May, buttressing earlier stimulus measures (so-called "three-stage rocket" initiatives) initiated by the Aso administration (Chart 2.18). Development of clean technologies amounts to roughly Y1.7 trillion, or about 3% of the anticipated Y52 trillion in economic stimulus measures. According to the Stern Review on the Economics of Climate Change, countries should ideally set aside funds equal to 1% of their GDP to promote clean technologies. Given that Japan's GDP is around Y500 trillion or so, such spending should thus total around Y5 trillion. This means that one-tenth of the proposed economic stimulus measures should be devoted to such projects. On that basis, the Japanese government's proposed investment in clean technologies (only Y1.7 trillion) seems a bit modest.

The government's promotion of clean technologies centers on energy-saving devices, solar power, and eco-friendly vehicles. Although these measures aim to revive the economy, the government is probably also throwing its weight behind such existing technologies to stir up demand over the long term. Among economic stimulus measures, proposed spending on clean technologies has increased the most in terms of value in the period up to end-May 2009, when the most recent initiatives were approved. Provisions to promote clean technology totaled only around Y3 billion at end-October 2008, but now include approximately Y100 billion worth of tax credits at end-March 2009 and Y370 billion in subsidies at end-May 2009. Set-asides to promote residential solar electric systems initially totaled

only around Y14 billion but have grown to nearly Y50 billion recently. Incidentally, the Democratic Party of Japan's (DPJ) proposed economic stimulus package announced in April 2009 includes measures similar to the ruling party's (Chart 2.19). Although few details are available, the plan apparently calls for more ambitious investment in clean technologies than the government has proposed (approximately 7-10% of economic stimulus measures).

Government Stimulus Measures Backing Clean-tech Investments (from FY08)				Chart 2.18
	Program	Clean-tech proposals	Overview	Budget
Underway	Emergency measures submitted in first FY08 supplementary budget (Y11.5 tril)	Accelerated installation of energy-efficient and clean-energy infrastructure	Household, business and public installation of solar power and other clean-energy systems. Regional support for utility-scale projects (solar farms, etc.). Incentives for SMEs to expand installation of next-gen energy systems. Support for use of green buildings, equipment and appliances in private/household sectors.	Approx. Y14 bil
		Clean public transportation, modal shift	Expanded use of green transportation (passenger vehicles, ships, and aircraft). Support for modal shift, improvements in transportation networks.	Approx. Y3 bil
		Backing for local initiatives	Comprehensive program for tree biomass projects. Forest sinks.	Y6.6 bil
		R&D support	More aggressive research into groundbreaking technologies, including high-efficiency next-gen solar energy systems and CCS technologies.	Approx. 17.5 bil
		Resource development	Offshore resource exploration, increased focus on rare metal acquisition	Approx. Y1.6 bil
	Assistance measures submitted in second FY08 supplementary budget (Y26.9 tril)	Regional wastewater policies	Support for installation of large-scale wastewater treatment facilities utilizing energy-efficient purification technologies	Approx. Y27.3 bil
In pipeline	Growth initiatives under consideration for FY09 budget (Y37 tril)	Tax breaks for green buildings	Tax incentives such as making full value of facilities meeting clean-energy/energy-efficient standards deductible in year of acquisition	National: approx. Y130 bil Regional: approx. Y60 bil
		Lower taxes for clean cars	Tax cuts for qualifying green vehicles (sales/vehicle weight taxes)	National: approx. Y100 bil Regional: approx. Y110 bil
	Economic stimulus measures under consideration for FY09 supplementary budget (Y14.7 tril)	"School New Deal"	Solar installations (Y264.1 bil) and seismic improvements for public schools	Y489.2 bil
		Backing for home/office solar installations	Mandates requiring power companies to purchase privately generated solar power at twice current rate (for initial period)	Y47 bil
		Green auto purchase incentives	Scrappage incentives, subsidies for new car purchases	Y370.2 bil
		Eco-points	Incentive plan for purchase of energy-efficient appliances, including TVs, air conditioners and refrigerators	Y2,94.6 bil
		Revamped transportation network	Reduced carbon footprint for buses, trains and ships. Highly efficient public transportation network.	Y29.8 bil
		Transformation into resource powerhouse	Construction of recycling platform to reclaim resources, including rare metals. Entrance into water technologies market.	Y73.1 bil

Source: Government data; compiled by DIR.

Democratic Party of Japan Economic Stimulus Proposals (outline; as of 8 Apr 2009)			Chart 2.19
Policy	Objective	Description	Proposed Budget
Emergency economic stimulus measures to maintain quality of life, protect environment, and build a better future. (Y21 trillion over two years)	Support move to eco-friendly lifestyle and value system	50% subsidy for residential photovoltaic system installation Up to Y300,000 subsidy for upgrading to high fuel-efficiency or eco-friendly vehicles (target of around 2 mil cars) Home renovations involving energy-saving design (details under discussion)	Around Y1.6 tril
	Increase consumption, encourage development of new industries, and create/maintain stable employment	Subsidies for purchases of energy-saving consumer electronics or digital TVs (details under discussion) Establishment of Green Innovation organization to deal with agricultural, environmental, and energy-related issues (main focus on increasing agriculture-related employment) Development of eco-friendly and renewable energy technologies (such as hydrogen fuel cells, IGCC, desalination)	Around Y1.0 tril Note: Includes budget for non-environment-related items, such as agriculture and employment.

Source: Democratic Party of Japan website; compiled by DIR.

Medium-term Strategy: Reduce 2020 GHG Emissions to 85% of 2005 Level

Target calls for use of solar electrical systems to increase twenty-fold

Increasing portions of government economic stimulus measures are being devoted to clean technologies. In fact, projects not previously considered investments in clean technologies are now being labeled as such. With spending on photovoltaics and eco-friendly cars rising and unlikely to decline going forward, we are curious to see what sort of activities might be reclassified as clean tech investments and what sort of government support could be provided for such projects. For this

purpose, we have looked at various medium-term scenarios discussed in the government's Council on Global Warming Issue (hereafter, CGWI) report.

The Aso administration recently indicated that Japan would try to reduce CO₂ emissions by 15% from the 2005 level. This target is closest to the CGWI's simulation resulting in a 14% cut in emissions (Chart 2.20). Prime Minister Taro Aso announced on 10 June that the government would aim to (1) increase the use of solar power twenty-fold; (2) boost use of alternative energy sources, including hydroelectric power, such that they provide 20% of all energy consumed; (3) provide incentives so that one out of every two new cars purchased is a hybrid; and (4) raise energy efficiency by 33%, an amount even larger than the efficiency gains during the oil crises of the 1970s. Prime Minister Aso proposed achieving all of these objectives without purchases of emission credits from overseas. As Chart 2.20 suggests, execution of the plan will probably involve tax incentives and higher feed-in tariffs.

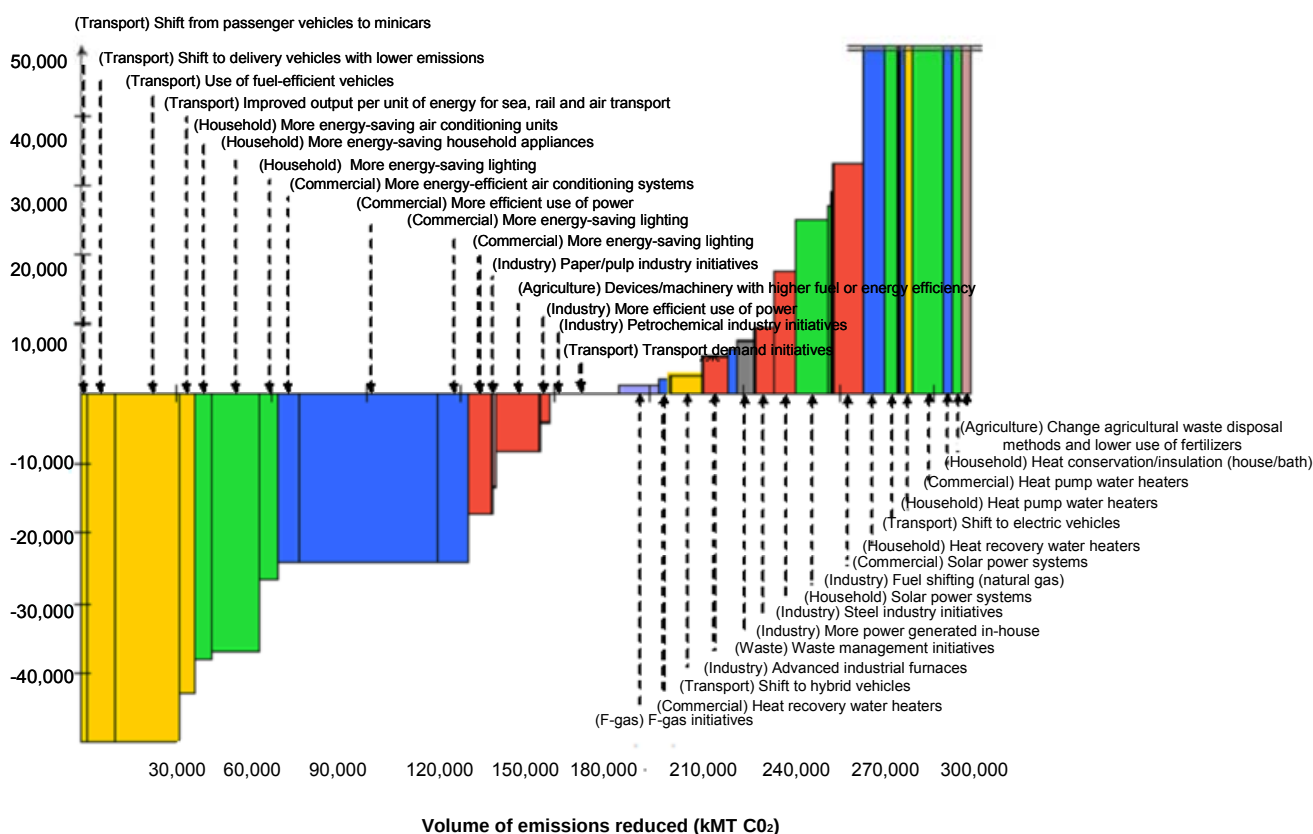
Concrete Measures for Achieving Medium-term Emissions Cut Targets						Chart 2.20	
Medium-term target	Vs. CY2005 (vs. CY1990)	-4% +4%	-14% -7%	-15%	-21% -15%	-30% -25%	
Real GDP	2020	Base scenario	-0.6%		-1.4%	-3.2%	
Unemployment rate		Base scenario	+0.2%		+0.5%	+1.4%	
Marginal cost of emissions cut		\$35-62/MT of CO ₂	Y15,000/MT of CO ₂		Y34,000/MT of CO ₂	Y82,000/MT of CO ₂	
	Gasoline equivalent	Base scenario	Y30 increase		Y70 increase	Y170 increase	
Specific policies							
Energy	Increase in solar power generation vs. current output Other	4X	10X	20X	25X	40X	55X
					Significant increase in micro-hydro power Focus on natural gas	Lift nuclear plant capacity utilization from 80% to 90%	
Policies		Purchase of renewable energy based on RPS (Renewable Portfolio Standard) system	Feed-in tariff for solar power Subsidies for home photovoltaics		Lift feed-in tariff	Compulsory installation of solar panels on new houses, large existing houses	Compulsory installation of solar panels on new houses, large existing houses
Next-gen cars	% of new car sales % of all vehicles	10%	50% 20%	50%	53% 24%	100% 40%	90% 40%
Policies		Top Runner program Subsidies, preferential tax measures	Support for purchasing eco-friendly vehicles		Strengthen subsidies, preferential tax measures Beef up Top Runner program standards	Ban sale/automobile inspections of old-type vehicles	Ban sale/automobile inspections of old-type vehicles
Housing insulation	Installation in new homes Installation in all homes	70%	80%		100% 60%	100% 100%	100%
Policies		Energy efficiency standards in Act on Rational Use of Energy Preferential tax measures	Strengthen, widen application of energy efficiency standards for homes Support for purchasing green home appliances		Strengthen subsidies, preferential tax measures	Enforce energy efficiency standards for all existing, new homes	Enforce energy efficiency standards for all existing, new homes
Notes		Efficiency improvements based on current technologies	Purchase most efficient equipment wherever realistically possible	Lift proportion of hydro and other renewable energy to world leading 20% of all power output	All new equipment to be most efficient possible Replace/improve fixed proportion of existing equipment before standard replacement period Y3.6 tril in fiscal outlays needed annually		Virtually all new/existing equipment must be most efficient possible Decrease in economic activity (production volume) Introduce carbon taxes, emissions trading

Source: Government materials (Apr 2009); compiled by DIR.

Chart 2.21 shows the various approaches to trimming CO₂ emissions that the CGWI examined. The vertical axis lists the cost of reducing emissions either through conservation or introduction of new technology, with negative values indicating lower operating costs for industries and households (i.e., positive factor). The horizontal axis, meanwhile, depicts the amount by which CO₂ emissions would be reduced. As noted before, government assistance focuses on the more costly technologies that require support to gain traction, the options on the right side of the chart. Those initiatives represented by wider bands (such as promoting spread of heat pump hot water heaters or solar power systems, encouraging greater use of natural gas by manufacturers, or raising energy efficiency of home solar power systems) will probably be the main targets of government policies. Meanwhile, those options on the left side of the chart (which mainly involve boosting energy efficiency or reducing waste) become increasingly attractive if prices for oil or other energy resources rise. Higher fuel prices will probably prompt greater investment in such technology, just as the rise in gas prices in the first half of 2008 drove increased interest in smaller cars.

Cost of Developing CO₂-Reducing Technologies

Cost of reducing emissions (Y/MT CO₂)



Source: Government data: compiled by DIR.

(3) Efforts to Launch Full-fledged Emissions Trading

*Emissions credits
potential source of
government revenue*

Japan's budget typically amounts to about two-tenths of its GDP, so spending 1% of GDP on developing clean technologies would mean devoting 5% of its annual budget to such projects. With the government already saddled with problems funding its pension system and facing double hits from a graying society and shrinking younger population, allocating 5% of the budget each year to combat global warming could be a challenge.

In his February 2009 budget overview speech, US President Obama proposed using funds from emissions credit auctions to fund investments in clean technologies—an economic approach that could be adopted in Japan, as well. Such auctions have gained traction in Europe, one of the first areas to introduce emissions trading. Trading has become a source of revenue for both the UK and Germany, with the former auctioning off credits and the latter selling them. The Regional Greenhouse Gas Initiative (RGGI), made up of 10 northeastern and mid-Atlantic US states, has conducted three auctions so far, with clearing prices settling above reserve prices in all three cases (Chart 2.22).

Companies likely to participate in emissions trading belong mainly to the energy and materials sectors, known for producing substantial amounts of CO₂. Although countries set emissions limits for firms with an eye to keeping them competitive globally, they sometimes provide additional relief for such companies. Incidentally, the Waxman-Markey bill, currently under discussion in the US Congress, will require importers in 2025 to produce emissions credits with their transactions if they are from countries that have made fewer efforts than the US to combat global warming. Countries not wanting to be shut out of the global marketplace will probably have to submit to similarly strict programs regulating CO₂ emissions.

In Japan, manufacturing industries have voiced their opposition to emissions trading, so such programs remain in a testing stage. However, sometime in the near future, even Japan will probably have to implement a full-fledged emissions-trading program in line with other industrialized countries. Such programs will most certainly place a burden on companies with large emissions, potentially raising concerns about companies with less-than-stellar finances. In Chart 2.23 below, we list the 20 companies in the TOPIX 500 whose emissions grew the most y/y, as well as the 20 with the largest reductions in CO₂. Basic materials firms are found in both lists, since emissions vary dramatically from year-to-year. However, judging from figures for individual years, operating profit and emissions do not seem to be highly correlated. Emissions and energy use are closely intertwined, so it will probably become increasingly important for materials industries to use energy efficiently in production. Japan's domestic CDM (Clean Development Mechanism) program allows large companies to acquire emissions credits by providing funds or technology to SMEs to help them cut GHG emissions. So even if a company has little room for further cuts in CO₂ emissions, possession of clean technologies could prove to be an important source of revenue.

Around 10 percent of the companies in Europe list their projected CO₂ emissions in annual reports to shareholders. As part of risk management, such firms have estimated how much CO₂ they are emitting and indicate if they expect to reduce such emissions. Given that Japan will also probably implement full-fledged emissions trading sometime in the future, such disclosures could become yet another basis on which investors make their investment decisions.

Emissions Trading Programs and Auctions Around the World				Chart 2.22
	Launch	Sale/auction proceeds	Amount of emissions sold	Price
Worldwide				
EU-ETS (Europe)	2005	UK (2008): £54 mil Germany (2008): €0.93 bil	4 mil MT of CO ₂ 40 mil MT of CO ₂	£13.6/MT of CO ₂ €23.3/MT of CO ₂
RGGI (US; ten northeastern and mid-Atlantic states)	2009	First (2008): \$39 mil Second (2008): \$110 mil Third (2009): \$120 mil	75.60 mil tons of CO ₂ (short tons)	\$3-3.5/ton of CO ₂ (short tons)
Canada	FY10 plan			
Metropolitan Tokyo (Japan)	FY10 plan			
Australia	2011 plan	If objective is to cut emissions by 25% from 2000 level, government may use auction proceeds to purchase emissions credits for industry.		
US (Waxman-Markey bill)	FY12 (currently under debate)		Aims to auction off 1% of CO ₂ emission allowances by 2019	Reserve price for emissions double that of previous year
Japan	2013			

Source: Japanese government materials; compiled by DIR.

TOPIX 500 Companies with Largest Increase/Decrease in Emissions

Chart 2.23

TOPIX 500 Companies with Largest Increase/Decrease in Emissions							Chart 2-23	
Code	Company	Sector	Market cap (Y bil)	Operating profit			Emissions (MT CO ₂)	Y/y change (MT CO ₂)
				FY07	08	09 E		
Firms with largest decrease in emissions								
5108	Bridgestone	Rubber products	1,127.0	250.0	131.6	23.2	263	-735
5233	Taiheiyō Cement	Glass & ceramics	166.3	51.6	11.2	20.0	8,045	-681
6702	Fujitsu	Electrical machinery	1,099.2	205.0	68.8	72.0	281	-568
7011	Mitsubishi Heavy Industries	Machinery	1,379.8	136.0	105.9	65.0	658	-430
5110	Sumitomo Rubber Industries	Rubber products	182.6	45.1	25.7	14.0	3	-339
5101	Yokohama Rubber	Rubber products	146.3	33.1	12.8	17.0	69	-264
7261	Mazda Motor	Transport equipment	404.3	162.1	-28.4	-50.0	738	-241
5019	Idemitsu Kosan	Oil & coal products	359.6	55.9	102.4	62.5	6,981	-226
5541	Pacific Metals	Steel products	167.0	52.3	16.2	2.6	589	-165
5232	Sumitomo Osaka Cement	Glass & ceramics	89.3	11.9	6.0	8.5	3,814	-162
7912	Dai Nippon Printing	Other products	883.3	87.1	46.2	40.0	492	-148
3861	Oji Paper	Pulp & paper	435.3	42.1	32.8	50.0	3,380	-144
5202	Nippon Sheet Glass	Glass & ceramics	205.6	46.5	1.9	-30.0	682	-105
4208	Ube Industries	Chemicals	242.2	55.9	31.2	20.0	4,407	-71
4063	Shin-Etsu Chemical	Chemicals	2,056.8	287.1	232.9	149.0	587	-62
4061	Denki Kagaku Kogyo	Chemicals	134.0	29.9	10.3	7.0	1,702	-62
9509	Hokkaido Electric Power	Electric power & gas	386.0	44.8	-17.2	26.0	892	-59
3402	Toray Industries	Textiles & apparel	704.9	103.4	36.0	15.0	2,047	-49
5901	Toyo Seikan	Metal products	425.0	21.4	9.2	14.5	1,389	-47
4185	JSR	Chemicals	401.0	60.0	30.3	15.0	602	-46
Firms with largest increase in emissions								
4183	Mitsui Chemicals	Chemicals	263.0	77.2	-45.5	-46.0	5,042	2,853
5401	Nippon Steel	Steel products	2,688.8	545.6	342.9	0.0	62,717	2,654
4005	Sumitomo Chemical	Chemicals	740.0	102.4	2.1	15.0	4,077	1,734
9501	Tokyo Electric Power	Electric power & gas	3,226.6	136.4	66.9	280.0	3,434	640
5406	Kobe Steel	Steel products	616.8	202.4	116.9	5.0	18,122	615
9513	Electric Power Development	Electric power & gas	439.7	50.7	57.1	55.0	2,800	497
9505	Hokuriku Electric Power	Electric power & gas	479.2	27.7	26.2	49.0	1,256	378
3880	Daio Paper	Pulp & paper	108.1	21.8	18.3	19.0	3,398	285
5407	Nisshin Steel	Steel products	255.6	58.5	-7.3	-43.5	8,069	220
9503	Kansai Electric Power	Electric power & gas	1,957.1	187.1	31.0	230.0	1,261	214
4043	Tokuyama	Chemicals	204.0	35.3	22.7	20.0	5,130	168
5214	Nippon Electric Glass	Glass & ceramics	526.5	100.9	76.4	40.0	2,009	109
5007	Cosmo Oil	Oil & coal products	288.2	83.8	-107.0	82.9	3,615	105
9502	Chubu Electric Power	Electric power & gas	1,682.7	167.9	182.2	205.0	2,653	102
8801	Mitsui Fudosan	Real estate	1,501.1	179.3	171.5	145.0	314	90
5713	Sumitomo Metal Mining	Nonferrous metals	917.2	155.4	10.5	14.0	1,606	90
5423	Tokyo Steel Mfg.	Steel products	198.3	15.2	53.4	6.0	1,624	84
6502	Toshiba	Electrical machinery	1,567.0	238.1	-250.2	0.0	1,279	84
5471	Daido Steel	Steel products	194.2	38.4	9.1	-9.5	1,635	81
9504	Chugoku Electric Power	Electric power & gas	722.8	84.4	15.5	85.0	1,600	71

Source: Government materials; compiled by DIR.

Notes: Y/y change in emissions from FY06 to FY07.

III. Green New Deal Initiatives by Country

Yoko Monoe

Environmental issues central to economic policies

Green New Deal stems from three crises

3.1 Environmental Projects Pillar of Economic Packages

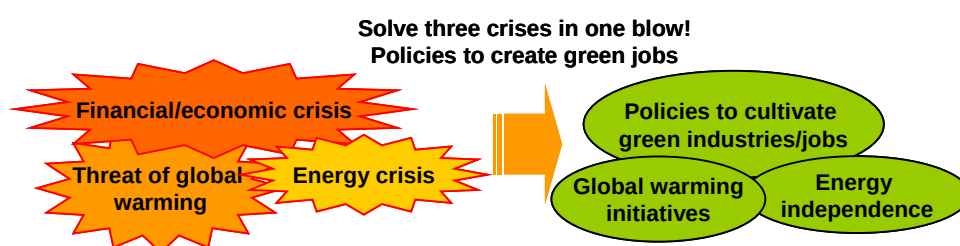
Environmental projects constitute a pillar of the economic stimulus packages hammered out across the globe following the Lehman Brothers' collapse in September 2008. President Obama's agenda likewise places high priority on green jobs and industries. Such government-lead initiatives to reinvigorate the economy and create new jobs by supporting clean-tech businesses have been dubbed the Green New Deal, after Roosevelt's New Deal following the Great Depression. In this report, we categorize all environmental measures contained in fiscal stimulus packages as "Green New Deal" initiatives, although the term has not been officially adopted by all countries, including the US.

Green New Deal initiatives stem from three crises: the financial crisis, the energy crisis, and the threat of climate change (Chart 3.1). The term first arose in a 2008 proposal by a UK NPO calling itself the Green New Deal Group. Since around 2005, though, groups have been developing more political initiatives using economic incentives to solve environmental problems (Chart 3.2). These include the Kyoto Protocol and the European Union Emissions Trading System (EU-ETS), under which higher CO₂ emissions increase costs, and lower emissions boost profit. Parallel movements, especially in Europe, have been supporting industries where businesses work on directly addressing environmental problems such as climate change. We view the Green New Deal initiatives as an extension of such activities.

This report looks at initiatives in each country to start gauging their potential impact on environment- and energy-related markets. We are also watching for which technologies could expand in which regions.

Background to Green New Deal Initiatives

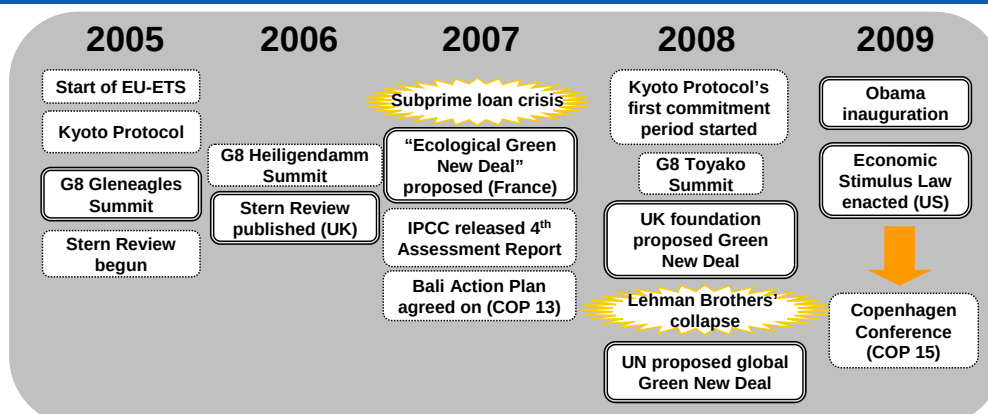
Chart 3.1



Source: Compiled by DIR.

Run-up to Green New Deal Initiatives

Chart 3.2



Source: Compiled by DIR.

3.2 Overview of Green New Deal Initiatives

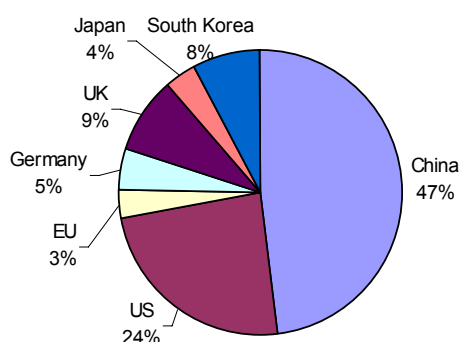
Outline of study

We started by examining economic packages announced by China, the US, Europe (the European Union, Germany, and the UK), Japan, and South Korea between September 2008 and May 2009. The term “Green New Deal initiatives” broadly refers to each government’s environmental policies and related infrastructure development, including on railroads and power grids. The latter two are considered environmental projects, since mass transit reduces the environmental burden, and smart grids should allow more efficient use of energy.

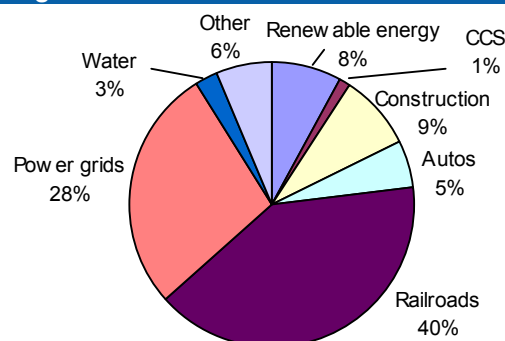
Highest outlays in China and US

Charts 3.3 and 3.4 depict the scale and major themes of the Green New Deal initiatives. Total outlays come to an estimated Y51 trillion, with roughly 50% of spending by China and 25% by the US (Chart 3.3). The two countries account for around 75% of Green New Deal spending, partly due to the size of their economies, but also reflecting intentions to significantly increasing their investment in green projects. Both countries are developing policies to support renewable energy and energy conservation, viewing global warming and the spike in crude oil prices as societal problems. Together, China and the US emit around 40% of the world’s greenhouse gases, but neither have adopted the commitments under the Kyoto Protocol (China approved the Protocol but was not included in its numerical emissions limitations, and the US chose not to ratify the Protocol). Either way, their lack of progress in establishing global warming policies suggests immense potential for emissions reductions. We see great growth potential for clean-tech businesses in both countries, given the major support under the current economic packages and prospects for global CO₂ emissions regulations in the future.

Size of Green New Deal Initiatives (Y tril) Chart 3.3



Funding Allocation Chart 3.4



Source: Government materials; compiled by DIR.

Green New Deal Initiatives in Yen Terms (Y tril) Chart 3.5

	Total	Renewable energy	CCS	Construction	Autos	Railroads	Power grids	Water	Other	Overview
China	24.51	O		O	O	20.07	14.34	O		4 tril yuan economic stimulus package: announced Nov 2008, revised Mar 2009, to be implemented from Apr 2008-Dec 2010
US	12.08	3.41	0.49	2.07	0.79	1.58	1.19	1.35	1.19	EESA: announced Oct 2008, to be implemented from 2008-18 ARRA: announced Feb 2009; investments in 2009-10, tax breaks in 2009-18
EU	1.66	0.07	0.17	0.14	0.14		0.10		1.04	European Economic Recovery Plan: announced Nov 2008, to be implemented in 2009-10
Germany	2.44			0.89	1.00	0.55				First package: announced Nov 2008, implemented from 2008. Second package: announced Jan 2009, implemented from 2009
UK	4.41	0.64		0.03	0.41	1.50	1.29	0.02	0.51	Pre-budget Report 2008: announced Nov 2008 2009 budget: announced Apr 2009, to be implemented in 2009-2011
Japan	1.84	0.62		0.04	0.62			0.02	0.53	First stimulus package: decided Oct 2008, implemented in FY08 Second package: decided Dec 2008, implemented in FY08-09 Financial crisis measures: decided Apr 2009, implemented in FY09
South Korea	3.92	0.09		2.20	0.09	0.87		0.13	0.54	Green New Deal: announced Jan 2009, implemented in 2008-12
Total	50.86	4.83	0.66	5.39	3.05	24.57	16.91	1.52	3.81	

Source: Government materials; compiled by DIR.

Notes: 1) Assuming Y98/\$, Y138/€, Y161/£, Y14/yuan, Y0.08/won (as of 12 Jun 2009).

2) CCS is carbon capture and storage.

3) Circles indicate undisclosed figures.

**Top strategic area:
Railroads**

The highest prospective outlays are for railroads, power grids, and construction projects, in that order (Chart 3.4). China, the US, and the UK plan to pump a significant amount of money into railroads; but China comes out on top, with total estimated outlays of 1.4 trillion yuan in 2009-10. The US earmarks roughly \$15.8 billion for railroad construction work, as the government hopes that expanding the mass transit system will limit crude oil consumption and increase energy security. UNIFE (a professional association for the European railway industry) expects the global railway market to expand from the current €120 billion (2005-07) to €154 billion by 2016.

Second strategic area: Power grids

China, the US, and the UK also intend to invest heavily in power grids. China's investment basically reflects higher demand for electricity, but the scheme probably also encompasses creating renewable energy sources. The US expects to spend around \$11 billion on developing a smart grid, an ambitious plan which involves updating decrepit distribution facilities while introducing cutting-edge facilities allowing two-way communication between electric utilities and consumers. This should help conserve energy and promote renewable energy sources. The Obama administration's smart grid framework calls for 3,000 miles of transmission wires. This, combined with plans in Europe and Asia, points to growth in the global market.

**Third strategic area:
Construction**

The third major area of funding is construction projects. Priorities include improving heat insulation and energy efficiency and developing eco-friendly infrastructure for major rivers. South Korea, the US, and Germany have earmarked large-scale funds in this area. In "Towards a Global Green Recovery," former World Bank Chief Economist Sir Nicholas Stern and Professor Ottmar Edenhofer from the Potsdam Institute for Climate Impact Research state that construction projects have the greatest multiplier effect among the Green New Deal initiatives. Likewise, the Fourth Assessment Report of the UN Intergovernmental Panel on Climate Change (IPCC) recommends placing a priority on measures to improve energy efficiency and combat global warming, as they apparently have greater potential to reduce energy consumption at lower costs than measures in other strategic areas. We expect tighter CO₂ regulations to create business opportunities in energy conservation. The main focal areas should be insulation materials and other construction materials and more efficient air-conditioning and lighting.

3.3 Initiatives by Country

China

Over 1.7 trillion yuan in estimated spending

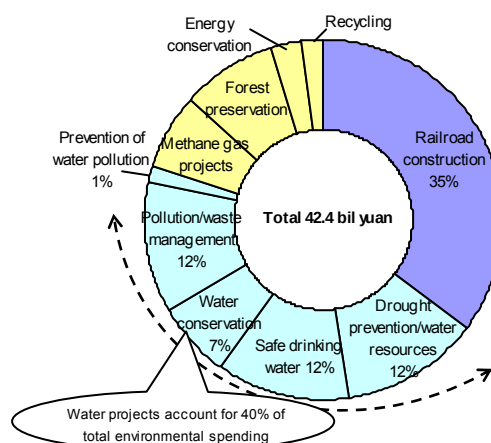
China has earmarked the largest amount for environmental projects. In November 2008, the government announced a 4 trillion yuan economic stimulus package running through 2010. In March 2009, the National People's Congress announced plans to invest 1.5 trillion yuan in improving railroad and power grid infrastructure and 210 billion yuan in energy conservation and environmental protection projects. Goals for the latter include improving waterways and reducing pollution. The government did not release detailed allocation plans but has stated that investments in infrastructure and environmental protection will total around 1.7 trillion yuan. The 1.5 trillion spending on infrastructure includes non-environmental projects such as improving airports and waterways. However, China probably will spend roughly 1.4 trillion yuan on railroads and 1 trillion on the power grid in 2009-2010.⁴ All told, China's Green New Deal initiatives will likely exceed 1.7 trillion yuan.

Top priority areas

China prioritizes railroads first, followed by the power grid and water resources. Of the 4 trillion yuan stimulus package, so far the government has only disclosed a breakdown of the 100 billion yuan spent in 2008. Water resources accounted for about 40% of environmental spending (Chart 3.6).

⁴ Railroad figure released in Nov 2008. Power grid figure based on announcements by the State Power Company and the Southern Power Grid.

Environmental Support in China's Economic Package (100 bil yuan) Chart 3.6



Source: National Development and Reform Commission materials; compiled by DIR.

Note: Roughly 12 billion yuan of total earmarked for energy conservation & environmental protection has been allocated to railroad construction and methane gas projects.

Consumption-boosting measures also support clean technologies

In 2008, the Chinese government also started announcing environmental measures aimed at bolstering consumer spending. In November 2008, for example, China announced plans to encourage people to buy hybrid cars and other new clean-energy vehicles. Currently, the government is hammering out incentives to support the purchase of 1,000 energy-efficient cars per year in ten major cities by 2012 or 2013. Meanwhile, the “electronics to the countryside” program that kicked off in February 2009 subsidizes purchases of home electronics, including solar water heaters. In March, the government announced a subsidy system for solar PV installations.

Current package provides limited support for renewable energy

China has not disclosed plans to allocate any of the 4 trillion yuan economic stimulus package to renewable energy, so we expect limited support in that area. Two years ago, though, the government set a goal of boosting the percentage of renewable energy in total energy consumed from the 7.5% recorded in 2005 to 10% in 2010 and 15% in 2020. Thus, the renewable energy market could grow to about 2 trillion yuan in 2020, with the government contributing investments of several hundred billion yuan. We see upside to the government figures, despite limited support from the current economic stimulus package, as renewable energy seems to be an area of strategic focus for the Chinese government.

US

About \$120 billion in spending

The US ranks second in terms of outlays for clean technologies. Environmental spending under the Emergency Economic Stimulus Act (EESA; took effect in Oct 2008) and the American Recovery and Reinvestment Act (ARRA; Feb 2009) comes to around \$120 billion (Chart 3.7). Green projects represent 10% of the economic stimulus package outlined in the ARRA.

Obama calls for \$150 bil in investments over next decade

The Obama administration hopes to spend \$150 billion on clean energy over the next ten years to reduce dependence on Middle Eastern crude oil and prevent global warming (Chart 3.8). The ARRA is the first pillar of this Green New Deal initiative.

Support for Green Projects in US Economic Stimulus Package (\$ bil)									Chart 3.7
	Renewable energy	CCS	Construction	Autos	Railroads	Power grids	Water	Other	Total
EESA (tax credits)	9.4	1.5	1.8	2.6	0.0	0.9	0.0	0.8	16.9
ARRA (public spending)	9.0	3.4	16.1	3.3	15.8	11.0	13.5	10.1	82.2
ARRA (tax credits)	15.7	0.0	2.8	2.1	0.0	0.0	0.0	1.0	21.6
Total	34.1	4.9	20.7	7.9	15.8	11.9	13.5	11.9	120.8

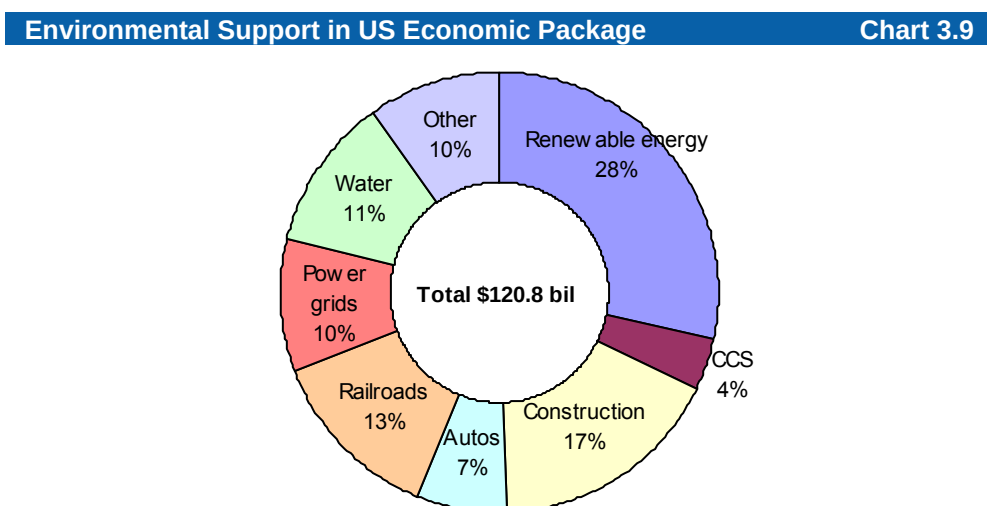
Source: US Joint Committee on Taxation; compiled by DIR.

Obama Administration's Energy & Environmental Policies		Chart 3.8
Combat spiking crude oil prices	Crack down on excessive crude oil speculation Swap oil from strategic petroleum reserves	
Improve energy independence	Save more crude oil within 10 years than it currently imports from the Middle East and Venezuela combined Promote responsible domestic production of crude oil and natural gas. Establish a process for early identification of physical obstacles or delays in the federal permission process to oil drilling Prioritize construction of natural gas pipeline in Alaska	
Reduce greenhouse gas emissions	Reduce greenhouse gas emissions by 80% vs. 1990 level by 2050 Implement an economy-wide cap-and-trade program Re-engage with the UN Framework Convention on Climate Change	
Promote clean energy	Invest \$150 in clean energy over next 10 years, creating 5 million new jobs Ensure that 10% of electricity comes from renewable sources by 2012, 25% by 2025 Promote development of clean coal technologies Ensure energy-efficient housing (improved thermal insulation) at million low-income households annually	
Transportation policies	Increase fuel economy standards Put 1 million plug-in hybrid cars, which can get up to 150 MPG, on the road by 2015 Establish a low carbon fuel standard Create \$7,000 tax credit for purchase of advanced vehicles	

Source: White House website; compiled by DIR.

Three priority areas

As shown on Chart 3.9, US Green New Deal initiatives prioritize (1) renewable energy (\$34 billion), (2) construction (\$20 billion), and (3) railroads (\$15.8 billion). Preferential tax treatment has supported rapid expansion in the renewable energy market over the past several years. For instance, installed wind capacity (i.e., how much power is produced by installed wind projects) increased 6.5-fold from 2000 to 2007. The financial crisis has made fundraising more difficult, but tax credits and support for fundraising efforts under the economic stimulus package should underpin market growth. Probable beneficiaries include wind farms, solar power plants, and geothermal plants.



Source: US Joint Committee on Taxation; compiled by DIR.

Next up: Climate and energy bill

Congress currently is deliberating a clean energy and climate bill (the American Clean Energy & Security Act of 2009). In May, the House Energy and Commerce Committee passed the Waxman-Markey climate and energy bill, raising expectations that President Obama could sign it into law. Democratic leaders will take the bill to the full House for a vote by August. The bill offers comprehensive support for a clean energy economy, based on (1) carbon emissions trading and (2) an RPS provision (renewable portfolio standards; requires higher production of renewable energy sources). The bill requires electricity suppliers to meet 6% of their load with electricity from renewable sources in 2012 and 20% in 2020. If the bill becomes law, it would provide tailwind to the renewable energy industry. The Republican Party is strongly opposed to the bill and will likely ask for revisions in the House of Representatives. However, strong support by the president and the majority party suggest that the bill could become the second pillar of the Green New Deal initiatives.

Europe

About Y8.5 trillion in spending

Green New Deal initiatives in the European Union, Germany, and the UK total around Y8.5 trillion. We believe the figure is well below the level in China and the US partly because countries decided to make huge environmental investments before the financial crisis hit. Main strategic areas are railroads, automobiles, and power grids. The UK foresees the largest outlays.

(1) European Union

Priority areas: CCS, autos, and energy-efficient buildings

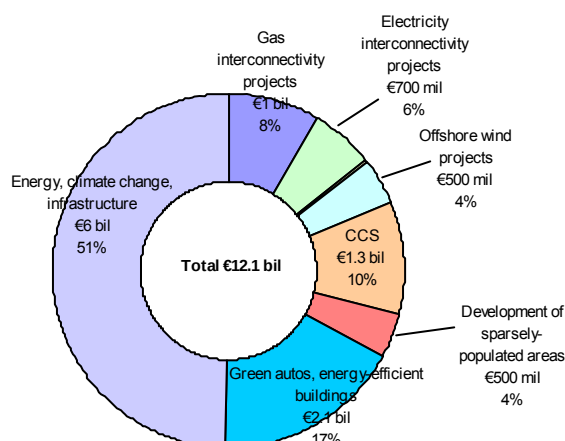
In November 2008, the European Commission announced the European Economic Recovery Plan, which includes a fiscal stimulus of €200 billion, roughly 1.5% of the European Union's GDP. The plan was approved at an EU summit meeting in December. The EU expects to supply €30 billion from its own budget, with about 12 billion of that amount allocated to environmental projects (Chart 3.10). The Commission has not disclosed a breakdown for projects combating climate change, but the highest priorities aside from that are CCS, eco-friendly cars, and construction to improve energy efficiency.

Implementing comprehensive energy-climate package

The economic stimulus package itself offers limited support for environmental projects, but the European Parliament passed a comprehensive "energy-climate package" in December 2008. This package targets reducing greenhouse gas emissions by 20% from 1990 levels and lifting the percentage of renewable energy to 20% of total energy consumed by 2020. The plan also set directives for the EU-ETS (European Union Emissions Trading System) from 2013 and included decisions on each country's renewable energy targets, financial support for CCS projects, and revised automobile emission standards. Countries probably will set their own legislation in accordance with the comprehensive package. The European Commission plans to invest revenue from emissions trading in green technologies, which will help support an estimated 410,000 new jobs as the EU achieves the targets under the package. We see high growth potential for environmental and energy-related industries in Europe.

Environmental Support in EU's Economic Package

Chart 3.10



Source: European Commission and European Investment Bank materials; compiled by DIR.

Note: The €200 billion fiscal stimulus package also includes investments of €500 million in environmental projects by the European Bank for Reconstruction and Development. Our chart does not reflect this, as detailed figures have not been disclosed.

(2) Germany

Priority areas: autos, energy-efficient buildings, railroads

Germany announced its first fiscal stimulus package in November 2008 and a second in January 2009. The government allocates €17.8 billion of the €80 billion total to environmental projects. As shown on Charts 3.11 and 3.12, the highest priorities are automobiles, energy-efficient buildings, and railroads, in that order. Germany plans to grant €5 billion in subsidies to car owners who trade in older models for more energy-efficient ones and to pump €3 billion into making buildings more energy-efficient.

Environmental Support in Germany's Economic Package (€ bil)

Chart 3.11

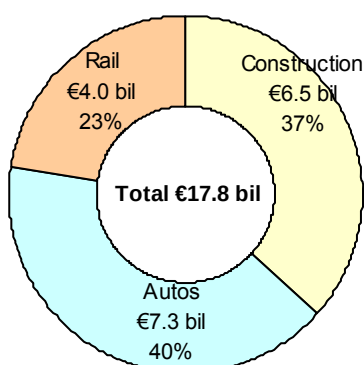
	First package (Nov 2008)	Second package (Jan 2009)	Total
Total	30.0	50.0	80.0
Environmental projects	6.5	11.26	17.76
% of total	21.7	22.5	22.2
Policies	Reduced auto tax for cars with low emissions (1.5) Energy-efficient buildings (3.0) Infrastructure investment in railroads, highways, and waterways (2.0)	Subsidies to trade in autos (5.0) Reduced auto tax for cars with low emissions (0.26) Support for auto industry R&D (0.5) Infrastructure investment by federal government (2.0) Infrastructure investment by local governments (3.5)	-

Source: German government; compiled by DIR.

Note: Infrastructure investments also include non-environmental projects such as hospitals. Chart reflects full investment amount, as breakdown not disclosed.

Environmental Spending in German Stimulus Packages

Chart 3.12



Source: German government materials; compiled by DIR.

(3) United Kingdom

Environmental stimulus reaches £27.4 billion

The United Kingdom announced its stimulus measures as part of its November 2008 *Pre-Budget Report 2008* for the 2009-2011 budget years, while the 2009 budget (announced in Apr) also includes stimulus policies. While these two plans are primarily focused on propping up the economy, the measures do include some £27.4 billion in environment-related spending (see Chart 3.13)¹.

Priority areas: Power grids, railways, renewable energy

The United Kingdom's plans place a priority on three areas: power grids, railways, and renewable energy (see Chart 3.14). The stimulus package extended the Renewable Portfolio Standard program by another ten years, and also indicated support for the inclusion of aviation activities in the EU Emissions Trading Scheme from 2012. The government expects to create some 350,000 jobs from these proposals.

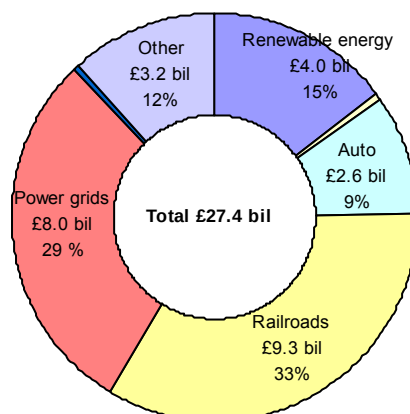
Environmental spending to boost job creation

Before September 2008, the British government had already pledged some £50 billion in environment-related spending, totaling around £80 billion when added to the most recent package. In 2008, the UK established a Department of Energy and Climate Change, and was one of the first countries in the world to encode its greenhouse gas emission reduction targets into law with the Climate Change Act of 2008. We think the British government is ramping up environment-related investment to promote business opportunities aimed at reducing global warming.

Environmental Spending in UK Stimulus Package (£ bil)		Chart 3.13
Category		Amount
Railroads		9.0
Power grids		8.0
Auto industry support		2.3
Renewable energy (through EIB)		4.0
Energy-saving initiatives		1.1
Cogeneration support		1.0
Low-carbon auto support		0.3
Waste-related		0.1
FY08 Pre-Budget Package	Home energy savings	0.2
	Public housing energy savings	0.1
	Railway expansion	0.3
	Waterways	0.0
	Flood prevention	0.0
Other		1.1
Total		27.4

Source: Her Majesty's Treasury; compiled by DIR.

Environmental Spending in UK Stimulus Packages Chart 3.14



Source: Her Majesty's Treasury; compiled by DIR.

¹ Note that environmental initiatives as defined by the British government totaled £10.4 billion, but we added railways and power grids to this total.

Environmental spending reaches Y1.8 trillion

Japan

Since last year and through April 2009, the Japanese government has announced three major economic stimulus measures: the first package in October 2008, the second in December 2008 (both aimed at shoring up citizen's daily lives), and a third in April 2009 (focused on measures to fight the financial crisis). Some Y1.8 trillion in environment-related investment is included in these packages (see Chart 3.15). The centerpiece of these plans is Prime Minister Taro Aso's new "three eco must-haves:" solar power generation, fuel efficient automobiles, and energy-saving appliances.

For solar energy initiatives (photovoltaics), the government has set aside Y490 billion in subsidies to install solar panels in schools, some Y30 billion for public facilities, and some Y27 billion for private homes. Tax rebates (which began in Apr 2009) will be offered for the purchase of new vehicles which meet government standards for fuel efficiency. Finally, a new system offering consumers "eco-points" (which can then be exchanged for other services) worth 5-10% of the selling price for energy-saving appliances was started in May 2009.

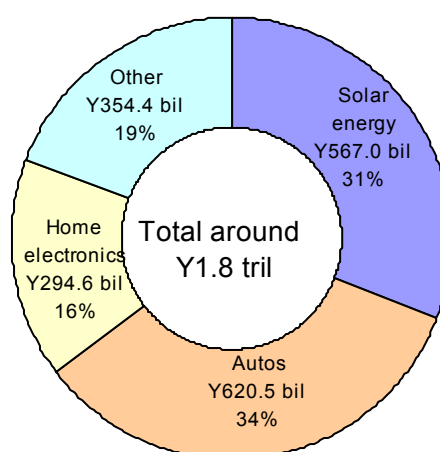
Other measures include subsidies for energy-efficient construction (around Y23.5 billion), promoting wider use of fuel cells and heat pumps (Y8.2 billion), support for water technologies (Y5.7 billion), and nuclear power-related initiatives (Y4.2 billion).

Solar energy largest component of plan

As the "Green New Deal" breakdown indicates, Japan's policies place a particular weight on photovoltaics. In June 2008, former Prime Minister Yasuo Fukuda announced the *Fukuda Vision* to cut Japan's CO₂ emissions by 60-80% by 2050, and to elevate Japan's solar power generation 10-fold by 2020 and 40-fold by 2030. This vision, later adopted by the Cabinet as an *Action Plan for Achieving a Low-Carbon Society* in July 2008, has been carried over by the current Aso administration. Subsidies for home solar panel installation were revived in January 2009, and the government is currently considering feed-in tariffs. We expect the domestic market for solar cells to grow as a result of these policies.

Breakdown of Japan's "Green New Deal" Spending

Chart 3.15



Source: Ministry of Finance, compiled by DIR.

Environment-related stimulus reaches 50 trillion won

South Korea

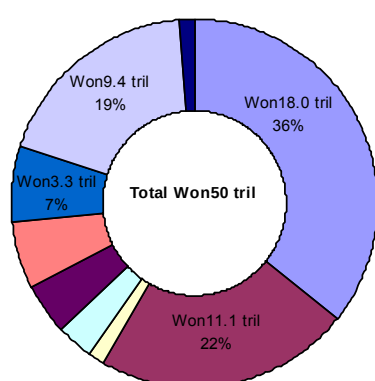
South Korea has placed environment-related measures at the center of its industrial policy since last year. In January 2009, the South Korean government announced public/private sector investment of around 50 trillion won by 2012, which is slated to create some 956,000 jobs (see Chart 3.16). South Korea aims to have its companies achieve a 10% or higher share of the global market for green industries. Funds from the central government (37.5411 trillion won) and private-sector capital (7.2357 trillion won) will pay for the measures.

The major aspect of the plan is a large-scale river project (see Charts 3.17, 3.18), where some 18 trillion won will be devoted to water resources, including flood prevention and other measures (creating 276,000 jobs). Transportation-related improvements (including high-speed rail links) and energy-efficient construction are two other priority areas. Efforts to promote wider use of smart power grids using IT resources are also planned.

Major Projects in South Korea's Green New Deal (Jan 2009)		Chart 3.16
	Investment (Won bil)	Employment
Redevelopment of four major rivers, surrounding areas	17,991.7	275,973
Eco-friendly transport network	11,143.8	162,121
National green information (GIS) infrastructure	745.6	20,077
Water resource facilities (small/mid-size dams)	1,630.2	30,985
Green cars, clean energy	2,276.5	15,179
Recycling resources	2,862.8	54,722
Promote forest biomass use	3,323.2	227,330
Promote energy-saving homes, offices, and schools	9,411.6	154,992
Environmentally-friendly living spaces	663.8	15,041
Total	50,049.2	956,420

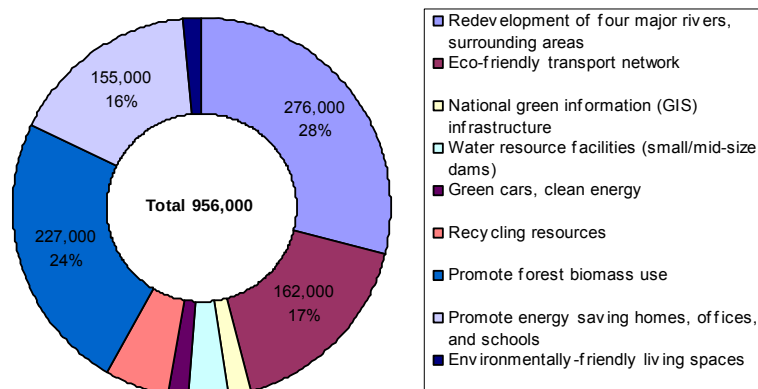
Source: JETRO; compiled by DIR.

Breakdown of South Korea's Stimulus Plan Targets
Chart 3.17



Source: JETRO; compiled by DIR.

Breakdown of Job Creation from South Korean Stimulus Package
Chart 3.18



IV. Clean-tech Industries and Companies

Yoko Monoe

Industries associated with the Green New Deal cover a wide range of areas, including energy, transportation and water technologies. This section provides a broad overview of related industries, a quick list of clean-tech players on our radar (page 70), short comments on 97 (65 Japanese, 32 overseas; pages 71-79), and one-page comments on 18 (16 Japanese, two overseas; pages 80-98).

4.1 Clean-tech Industries

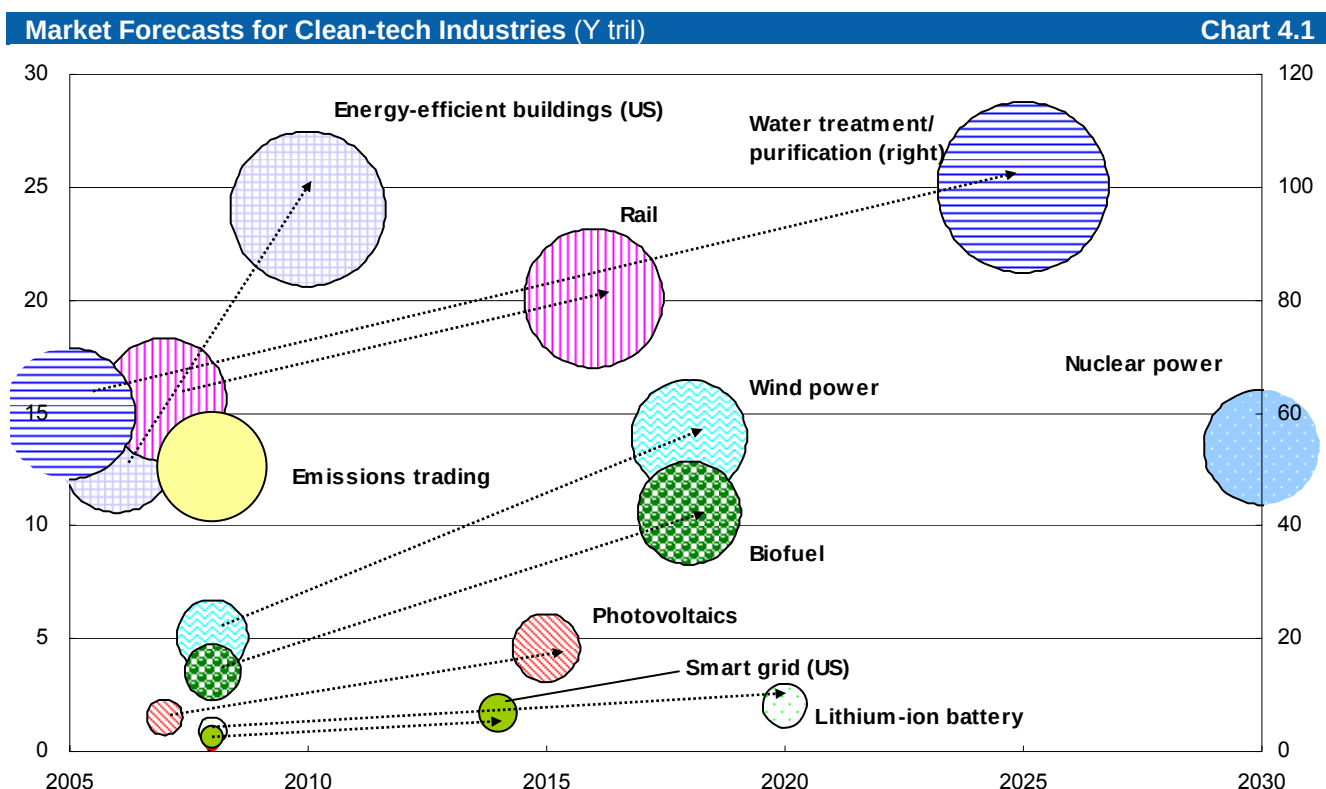
Categories

We have separated the clean-tech industries into the following broad categories: renewable energy, CCS (carbon capture and storage), green buildings, automobiles, railway, power grids, water technologies, and other. Renewable energy is broken down further into photovoltaics, wind power, biofuel, solar thermal energy, and geothermal power. We also have subcategories for automobiles—hybrid vehicles (HEV), electric vehicles (EV), and plug-in hybrids (PHEV). The “other” category includes methane hydrates, clean coal technology, heat pumps, nuclear power, and emissions trading.

Market size

Chart 4.1 shows current and projected market sizes for these categories. The absence of statistics on many clean-tech industries means limited information is available, but we forecast strong growth in water technologies, railways, green buildings, wind power, and biofuel.

In the following sections, we provide overviews of the various industries and related sub-categories.



Source: Photovoltaics, Solar Buzz and others for current market, DIR for forecasts; Wind power, CleanEdge; Biofuel, CleanEdge; Energy-efficient buildings, McGraw-Hill Construction (cited from USGBC); water tech, Japan's Council on Competitiveness (cited from METI publication); Rail, UNIFE; Lithium-ion battery, DIR; emissions trading, World Bank; nuclear power, NEA.; compiled by DIR.

Renewable Energy

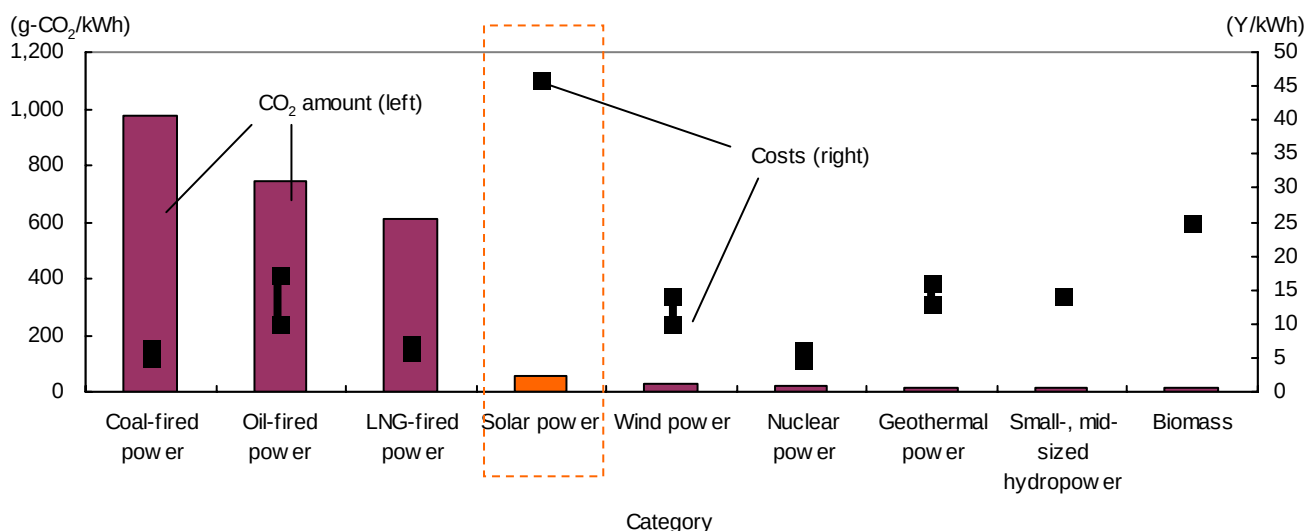
Photovoltaics

Likely to hit \$45.5 billion in 2015

This technology uses semiconductors to convert solar energy to electricity. Currently, polycrystalline silicon solar cells dominate, but thin-film silicon, non-silicon chemical, and organic solar cells are gaining attention as next-generation technologies. Japan spearheaded the development of solar cells after the oil crises, and the technology started to gain traction in the late 1990s, led by developed countries as they tried to combat global warming and ensure safe sources of energy. At current levels (roughly ¥46/kWh; Chart 4.2), the energy cost of solar cells is significant, so demand hinges greatly on government policy. As of 2008, Germany, Japan and the US had the largest cumulative installed capacities, in that order. Although Japanese businesses have excelled in the technology from the outset, German, Chinese and Taiwanese firms are catching up. We estimate the solar system market was worth some \$26.2 billion in 2008, and see it growing to roughly \$45.5 billion in 2015. The downturn in Spain, where there was a market boom from 2007, is sapping demand recently, but we expect economic stimulus packages to fuel an upturn in orders from autumn.

CO₂ Emissions and Power Generation Costs by Power Source

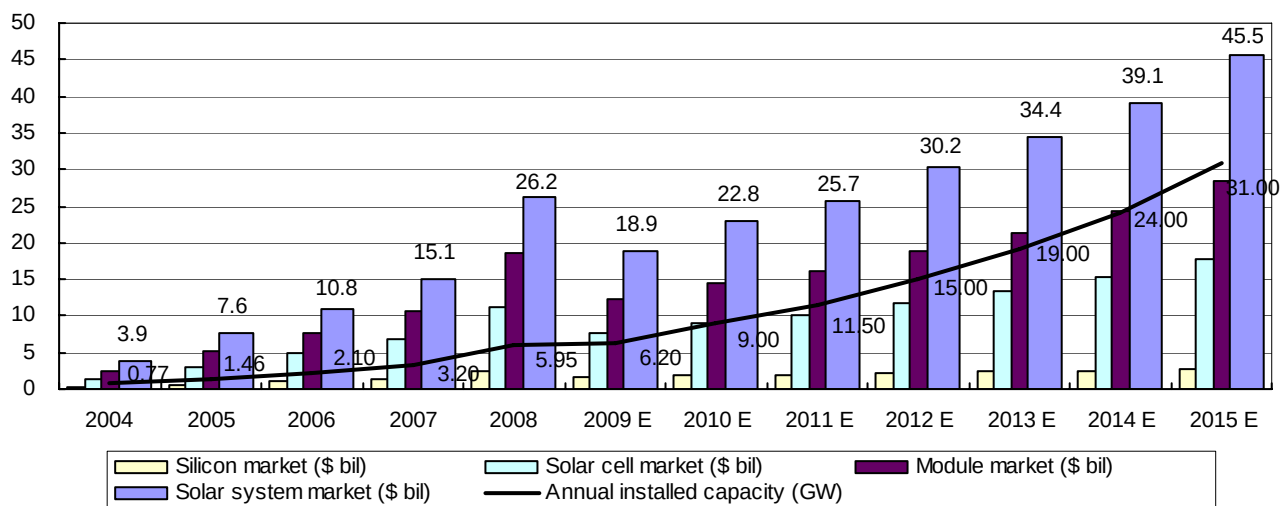
Chart 4.2



Source: Central Research Institute of Electric Power Industry (CRIEPI), Ministry of Economy, Trade and Industry (METI); compiled by DIR.

Photovoltaic Markets

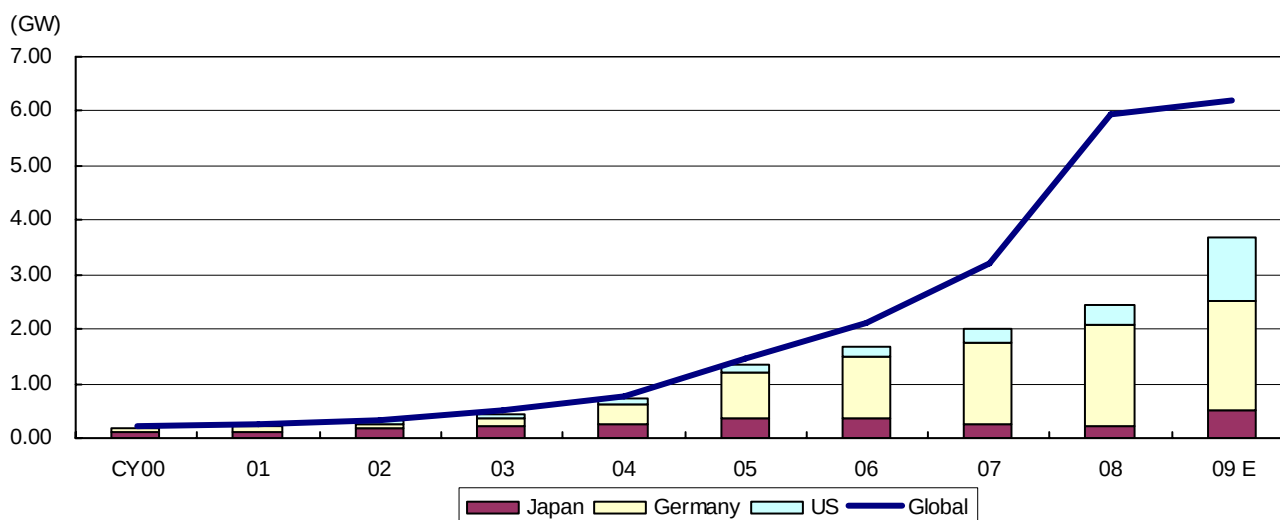
Chart 4.3



Source: Solarbuzz, Photon International; compiled by DIR.
E: DIR estimates.

Photovoltaic Annual Installed Capacity

Chart 4.4



Source: Solarbuzz, Photon International; compiled by DIR.
E: DIR estimates.

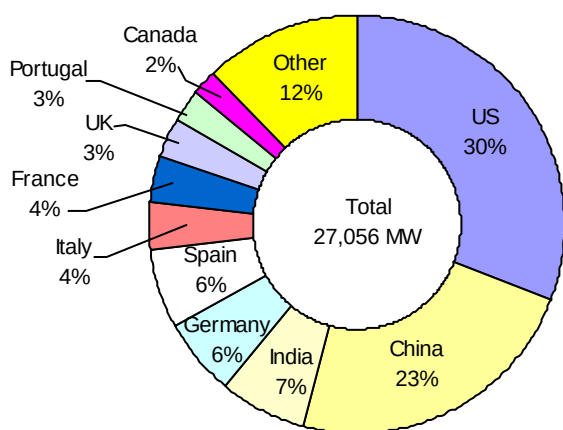
Wind Power

Market may hit \$139.1 billion in 2018

Wind power uses wind to turn the blades of a wind turbine, creating electricity. It has gained traction as a fossil fuel-free energy source as governments combat global warming and try to become more energy self-sufficient. Compared to other forms of renewable energy, wind power is given relatively strong weight in government policy in Europe and the US because of its relatively low energy cost (Chart 4.2). However, location requirements and an inconsistency in output pose restrictions. As of 2008, the US now boasts the largest cumulative installation capacity in the world, followed by Germany and then Spain. In terms of new installed capacity, the US ranks first ahead of China and India (Chart 4.5). This is in stark contrast to the first half of this decade when European countries accounted for most wind power installations. Since 2005, the technology has gained ground in the US and Asia (Chart 4.7). European firms have strong positions in this market and entry by Japanese companies has been limited (Chart 4.6). US research firm Clean Edge estimates the global market hit roughly \$51.4 billion in 2008 and expects it to reach around \$139.1 billion in 2018.

Wind Power: New Installed Capacity (2008)

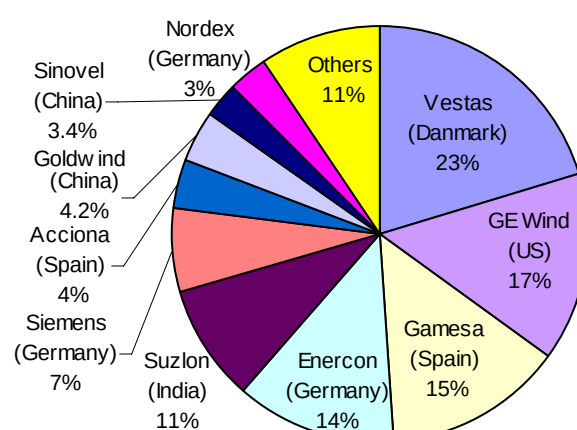
Chart 4.5



Source: Global Wind Energy Council (GWEC); compiled by DIR.

Wind Power: Production Volume by Maker (2007)

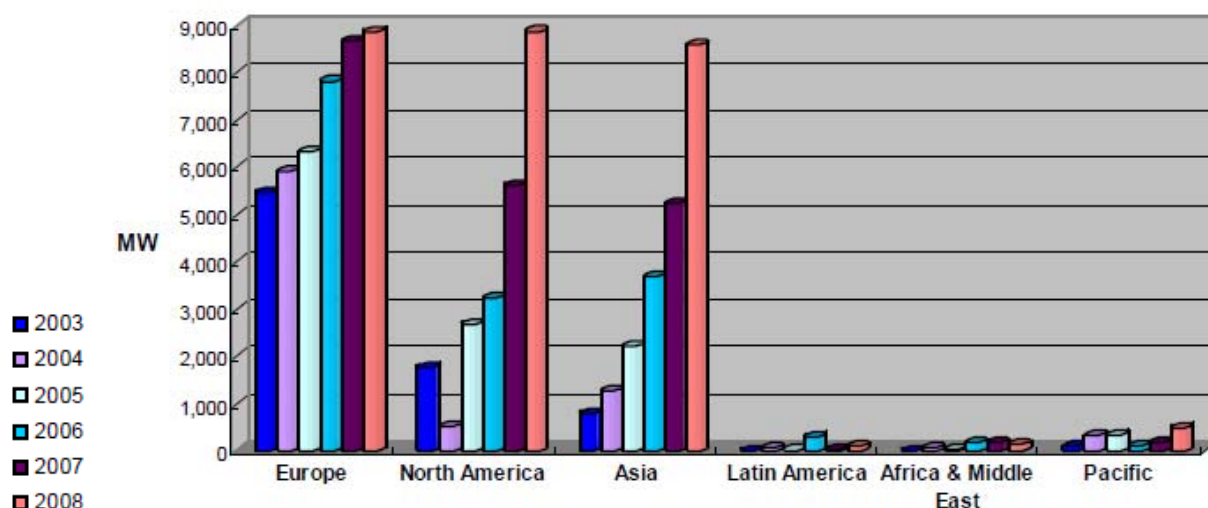
Chart 4.6



Source: BMT Consult; compiled by DIR.

Wind Power: Annual Installed Capacity by Region

Chart 4.7



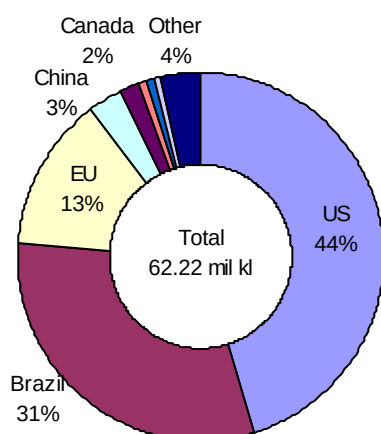
Source: GWEC (2009) Global Wind 2008 Report.

Biofuel

**Market may reach
\$105.4 billion by 2018**

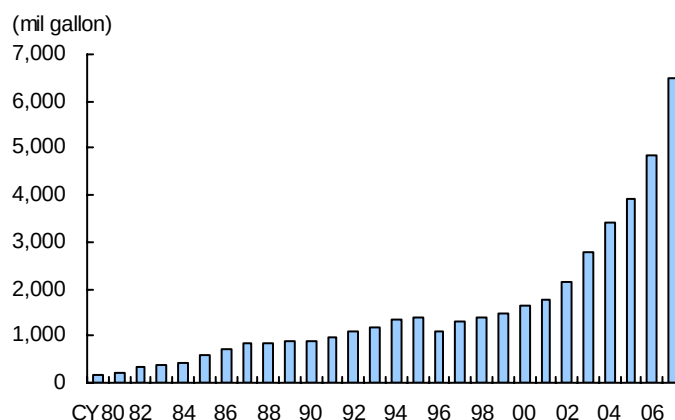
Biofuel is fuel obtained from plants such as corn or sugarcane. The CO₂ produced by burning biofuel is offset by the amount absorbed when the crops were grown, making biofuel a cleaner alternative to fossil fuels. Biofuels are already used to power automobiles and research is underway to develop commercial applications for aircraft. However, it is not without its critics, as the fact that it is derived from corn and other food commodities has been a major factor behind surging food prices. This food vs. fuel debate has sparked research into second-generation production processes using non-food crops. The US and Brazil account for roughly 70% of the global biofuel production volume. Clean Edge estimates the global market reached \$34.8 billion in 2008 and sees it rising to \$105.4 billion in 2018.

Global Biofuel Production (2007) Chart 4.8



Source: Nikkei (Organisation for Economic Cooperation and Development) ; compiled by DIR.

US Ethanol Production Chart 4.9



Source: Renewable Fuels Association (RFA); compiled by DIR.

Solar Thermal Energy

Focus on concentrating solar power systems

Solar thermal energy refers to harnessing solar energy for heating and electricity. A typical example of the technology is solar water heaters, but a more promising area recently has been concentrating solar power systems (CSP). Solar water heaters, an established technology used chiefly for home water heating, were popular in Japan in the 1980s, but demand has been slack for quite a while now, due in part to some association with aggressive door-to-door salesmen. However, sales could pick up again, as the Tokyo metropolitan government has introduced measures to support the installation of solar water heaters from FY09 and other local government units are making similar moves. Development of solar thermal energy is underway in Nevada and California in the US, and Europe has set up large-scale plants in North Africa. Construction is also being planned in the Middle East and China. Although solar thermal energy costs less than solar cells, the collectors require considerable land space, presenting site restrictions. Euro Observer estimates the market for solar thermal energy topped €2 billion in 2007.

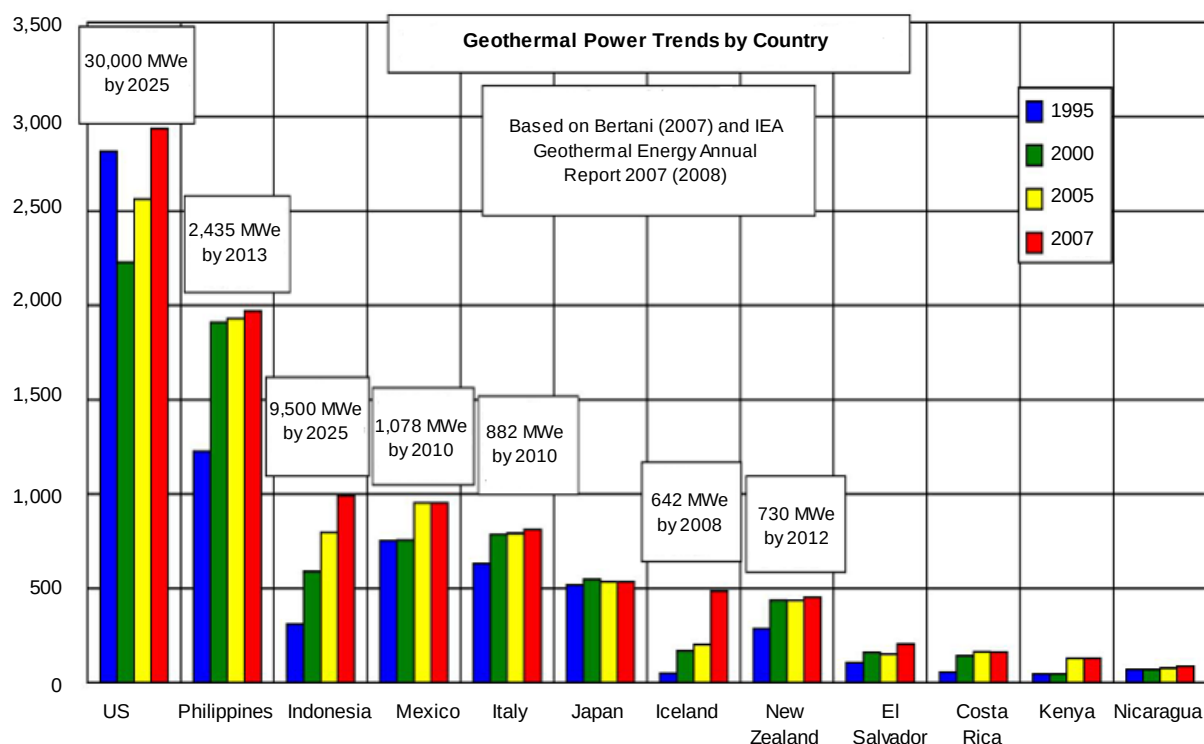
Geothermal Power

Support increasing in Japan

Geothermal power uses heat stored in the earth to turn turbines and generate power. Since it does not use fossil fuels, it generates less carbon emissions, and offers a more stable supply of power than other types of alternative energy, giving it an edge on the operating rate front. Globally, installations are rising in volcanic zones, with the US topping the 2007 installed capacity rankings, followed by Philippines and Indonesia (Chart 4.10). These countries are pushing forward with R&D with the set goals shown in the chart. In terms of resource volume, Japan is third in development potential, but it ranks only sixth in actual installed capacity, with no new installations since 1999 due to the high initial costs and the risk of prolonged development periods and objections from hot spring operators. Geothermal power is not covered by the Renewable Portfolio Standard and has little government support. That said, there are moves to promote the technology more, as suggested by a May 2009 METI report calling for stronger support for geothermal development.

Geothermal Power Trends by Country (MWe)

Chart 4.10



Source: METI, Geothermal Research (2008).

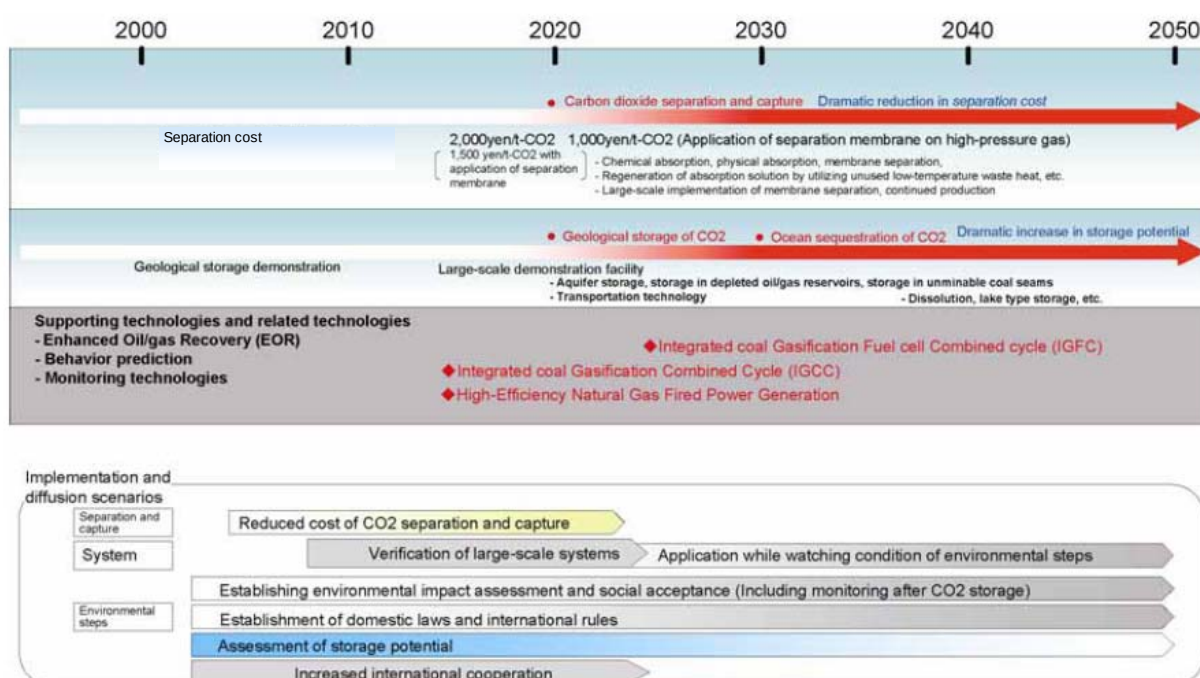
Carbon Capture and Storage (CCS)

Practical applications possible by 2020

Carbon Capture and Storage (CCS) refers to capturing CO₂ from sources such as power plants and storing it underground or underwater. Currently there are only three CCS plants in operation in Canada, Norway, and Algeria. Though still in the testing stage, CCS looks to be the most promising greenhouse gas reduction technology over the long term. The International Energy Agency (IEA) envisions 10,000 CCS projects to meet 20% of the cuts needed to halve CO₂ emissions by 2050. To ensure widespread use, the challenge ahead is reducing the ¥4,200 per metric ton it currently costs to sequester and capture CO₂. The EU has plans to build 12 trial CCS plants by 2015 and the Obama administration in the US is targeting five plants. The Japanese government also aims for a practical application of CCS by 2020 and plans to kick off a large-scale trial from FY09. Also, an international organization promoting CCS was founded in April 2009, with 15 member nations. It has hammered out goals to start 20 trial projects globally by 2010 and achieve practical application of the technology by 2020.

Japan's CCS Development Roadmap (Cool Earth Plan)

Chart 4.11



Source: METI, CCS Research (2008).

Green Buildings (energy-efficient buildings)

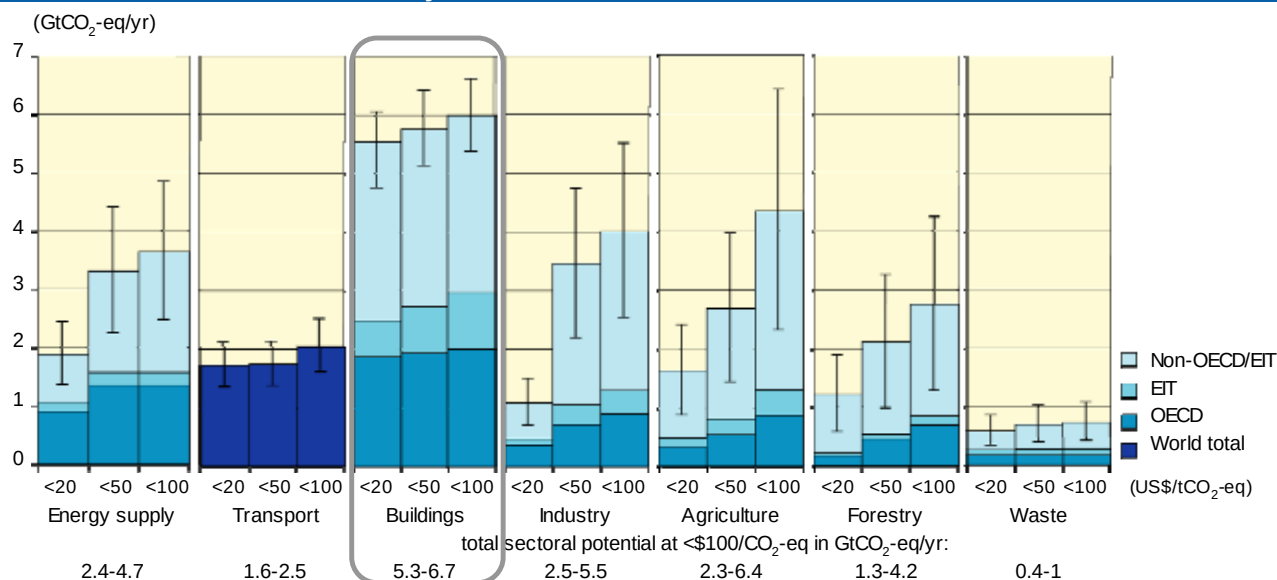
Revised energy-saving laws, Tokyo regulations providing tailwind in Japan

Green buildings can be achieved by introducing energy-saving equipment and heat insulation material. Global warming policies pin a lot of hope on energy saving in the construction industry given the potential for significant, low-cost emission cuts. The Intergovernmental Panel on Climate Change (IPCC) also sees construction as the area with the most potential for low-cost reductions (Chart 4.12). The US Green Building Council estimates that the US energy-saving construction and refurbishment market reached \$130 billion in 2006 and it expects it to grow to \$240 billion in 2010. Related products and materials include heat insulation for windows, high-efficiency air conditioning, and fluorescent and LED lighting. The Clinton Foundation, established by former US president Bill Clinton, is pushing for significant energy-saving renovations in an alliance with 40 cities throughout the world, including Tokyo and Yokohama. Japan also plans to step up measures for

the business sector from 2010 with amendments to energy-saving legislation. In the same year, Tokyo plans to require large office buildings to cut greenhouse gasses, with an annual average reduction of 8% from 2010 to 2015 for the business sector in particular. The stepped-up regulatory requirements should spur growth in this area.

Emissions Reduction Potential by Sector

Chart 4.12



Source: Intergovernmental Panel on Climate Change (IPCC) (2007) Fourth Assessment Report. Summary for Policymakers.

Automobiles

Hybrid Electric Vehicles (HEV)

Best bet among eco-oriented vehicles

HEVs combine an engine and electric motor to achieve better fuel efficiency and lower CO₂ emissions than gasoline cars. As such, they have become popular amid soaring gasoline prices, tighter mileage standards, and government subsidies. HEVs are viewed as the odds-on favorite among the handful of green car technologies, including plug-in hybrids and electric vehicles. We estimate global sales reached roughly 500,000 vehicles in 2008 and we see the market expanding to 5.13 million in 2020 (Chart 4.13). Global sales come mostly from developed countries, with the US accounting for 70%, Japan 17% and Europe 12%. Tighter regulations are likely to drive demand growth over the medium to long term, with the US, Europe and Japan requiring mileage improvements of 30-40% by 2020.

Plug-in Hybrid Vehicles (PHEV)

Global market to hit 220,000 vehicles by 2020

PHEVs are HEVs with batteries that can be charged through home electrical outlets. They have larger battery capacities than HEVs and can drive longer on the electric motor alone. US President Barack Obama pegs PHEVs as a policy target, aiming for one million domestically manufactured plug-ins on the road by 2015. However, the need for high-capacity batteries and the cost of the backup internal combustion engine are severely limiting sales volume. We expect the global market to be around 220,000 vehicles in 2020 (Chart 4.13).

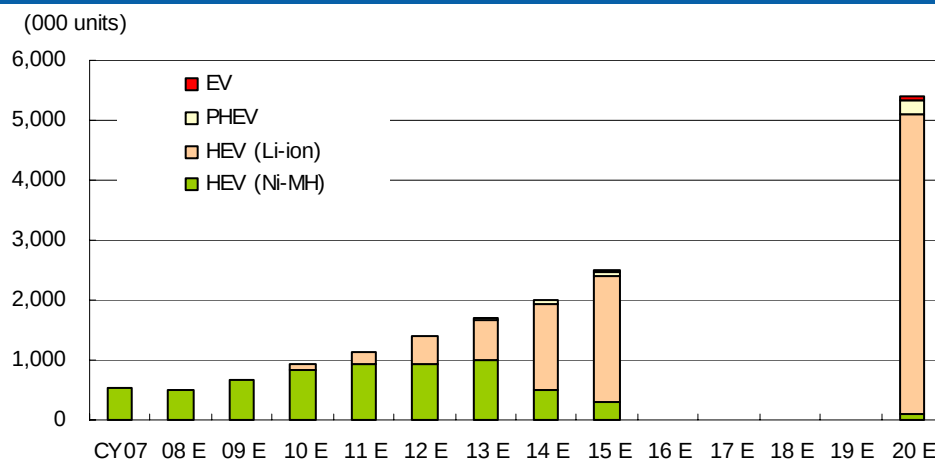
Challenge ahead: Reducing costs

Electric Vehicles (EV)

EVs run on batteries and motors only, with no gas-powered engines. Currently, sales have been limited to some eco-conscious regional governmental entities and corporations, given (1) the short range between charges, sapping passenger car and commuter demand, (2) hefty battery costs due to the significant capacity required, and (3) infrastructure limitations (charging stations). We expect the global market to reach 50,000 vehicles in 2020 (Chart 4-13).

HEV/PHEV/EV Sales Volume

Chart 4.13



Source: Compiled by DIR.

Notes: 1) PHEV: Plug-in hybrid electric vehicles

2) Ni-MH: Nickel metal hydride

E: DIR estimates.

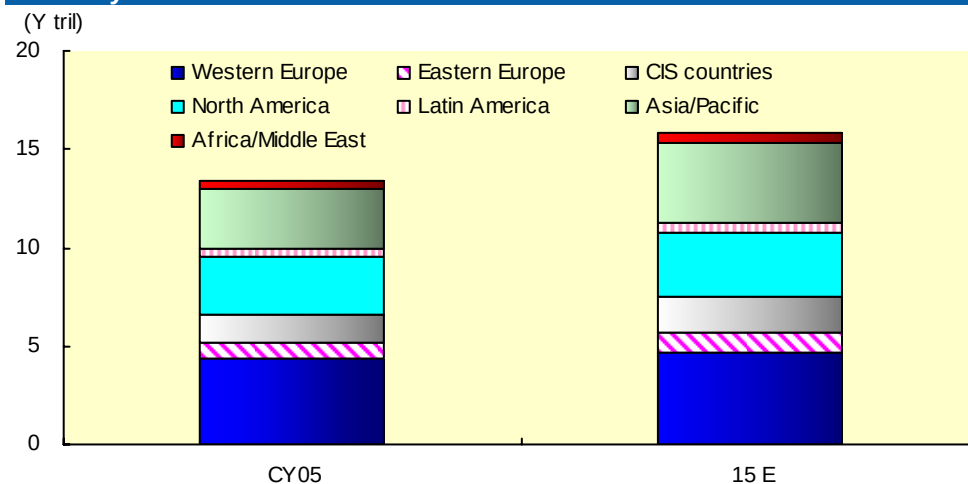
Railway

Global demand expanding

Rolling stock is more energy efficient than aircraft and automobiles and emits less CO₂ and nitrogen oxides. Some are encouraging a modal shift to railway as a means to combat global warming and energy problems. Global demand for railway is rising and the Union of European Railway Industries estimates the worldwide market was worth Y13 trillion in 2005. It sees demand reaching roughly Y16 trillion in 2015 (Chart 4.14). In his economic stimulus package, President Obama has earmarked around \$15.8 billion for high-speed railway. Also, the Chinese government announced plans to invest 600 billion yuan in rail projects. Such government measures are likely to fuel growth in the market ahead.

Railway Market

Chart 4.14



Source: The Union of European Railway Industries (UNIFE); compiled by DIR.

Note: Based on Y130/€.

E: DIR estimates.

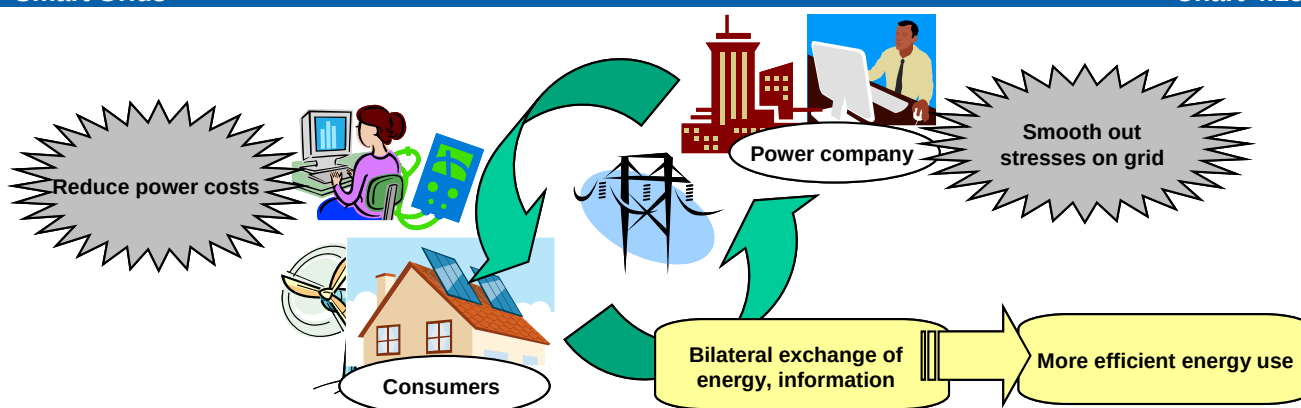
Power Grids (smart grids, etc.)

Focus on smart grids

Replacements of outdated equipment in industrialized countries and increased power demand in China, India and other emerging markets are driving investments in power grids. We have pegged this area as a Green New Deal industry given its association with energy-saving and renewable energy. The US economic stimulus package includes roughly \$11 billion in outlays for next generation “smart grid” projects. Unlike the conventional grid, where electricity is sent one way from the electric companies, smart grids allow the exchange of power and information between suppliers and consumers. Consumers are able to use special power meters called smart meters to confirm energy usage and fees on a real-time basis. They can also sell power generated from owned solar and wind systems to the power companies. Meanwhile, electric companies can smooth out stress on the grid by keeping better track of peaks in energy use and reduce operating costs by efficiently managing customer information. This cost-effective approach to energy saving has prompted several large-scale projects in Europe. Indeed, the UK, Italy, Sweden and the Netherlands all have plans to install smart meters in all households. Japan’s measures to address the economic crisis also budget some money for this field, financing a trial project on outlying islands. US research firm SBI estimates the current smart grid market reaches roughly \$6 billion in the US. It sees the market growing at a CAGR of 20% going forward, reaching \$17 billion in 2014.

Smart Grids

Chart 4.15



Source: Compiled by DIR.

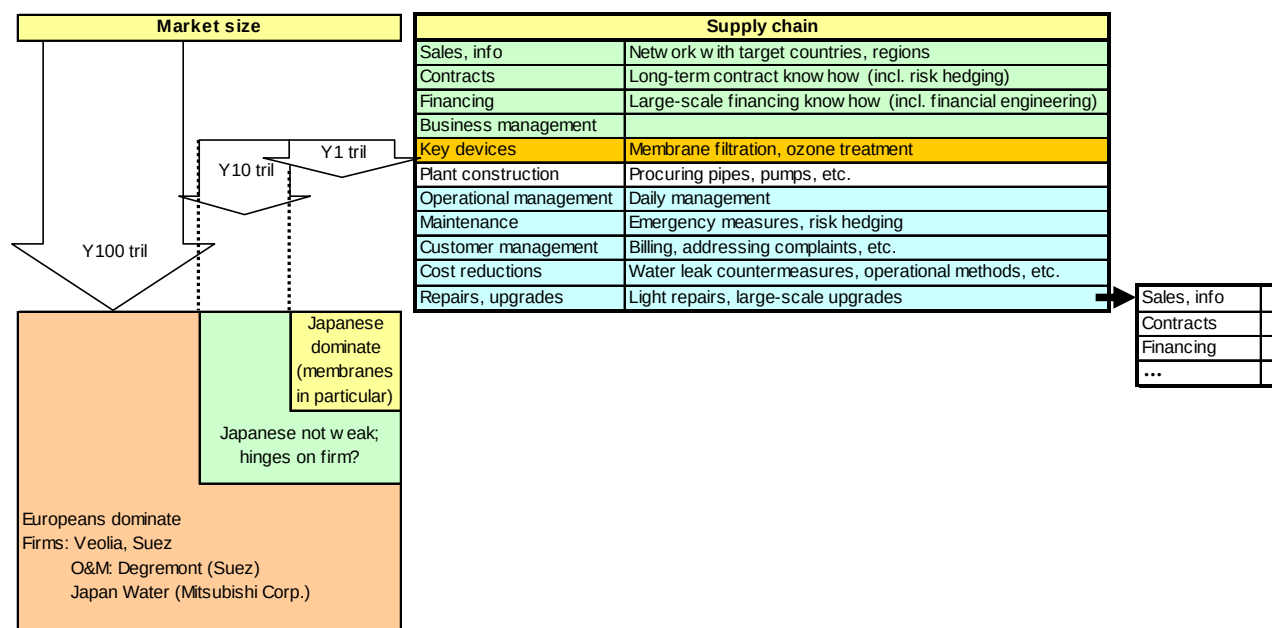
Water Technologies

Drinking, waste water businesses to grow

This covers a wide range of business areas, including drinking and wastewater systems, water treatment, and environmental protection for watershed and aquatic regions. We see the market here expanding as water demand rises and the water environment worsens. Japan’s Council on Competitiveness estimates the current global water business market at Y60 trillion and expects it to grow to roughly Y100 trillion in 2025. Japanese firms command roughly 70% of the global market in one water treatment technology—reverse osmosis membranes. However, membrane technology accounts only for around 5% of the entire water technology market. It is the operations section, such as supply water and wastewater businesses, that chiefly drives the overall water market and this area is dominated by European firms. To support forays by Japanese firms into water technology, 28 companies, including Hitachi and Toray Industries, established the Global Water Recycle System Association in January 2009 with the support of METI.

Global Water Technology Market (2025 Forecast)

Chart 4.16



Source: METI, 2008 report; compiled by DIR.

Other

Methane Hydrates

Practical extraction technology remains hurdle

Methane hydrate is methane trapped in solid form within the crystal structure of water ice, found on the ocean floor or in deep ice cores. Known as burning ice, it has been in the spotlight as a possible alternative energy. It is estimated that the ocean around Japan could have enough natural gas to support energy use for some 96 years, but such gas exists thousands of meters under the sea, making extraction a challenge. In 2008, based on ocean policy legislation enacted in 2007, the Japanese government formulated a basic ocean strategy that centers on the extraction of natural resources in Japanese waters. It aims to start commercial production of methane hydrate in 2018.

Clean Coal Technology

Challenge: Improving efficiency to match investment costs

Coal has garnered considerable attention due to (1) soaring oil prices, (2) the geographic distribution of coal reserves, and (3) the long-term availability of coal (Chart 4.17). A large portion of coal is used to produce energy and steel, emitting significant greenhouse gases (Chart 4.2). The need to reduce these emissions has prompted the development of a broad range of clean coal technologies, including IGCC (Integrated Gasification Combined Cycle), coal liquefaction, and thermal cracking. IGCC, which has been under development since the 1980s, is around 8% more efficient than ordinary oil-fired thermal power plants, and emits some 30% less CO₂. However, it is not yet efficient enough to warrant the higher investment costs, and remains in the trial stages. Oil liquefaction has seen practical application in South Africa as well as development projects in China and the US.

Available Supply, Distribution of Major Energy Resources				Chart 4.17
	Oil	Natural gas	Coal	Nuclear power
Available supply (years)	41	67	164	85
Geographic distribution	Six OPEC nations: roughly two-thirds of global volume	Eastern Europe/Russia, Middle East, and other regions: one-third each	More diverse than oil, natural gas	Widespread throughout globe

Source: Agency for Natural Resources and Energy (ANREI); compiled by DIR.

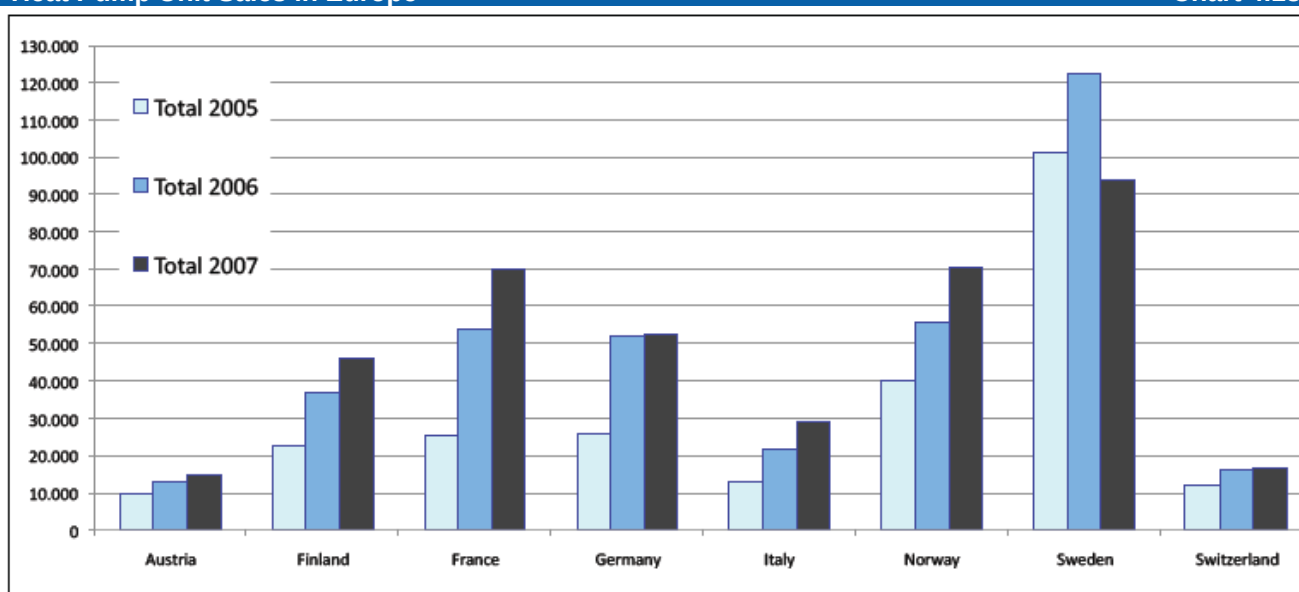
Heat Pumps

Heating needs spurring demand in Europe

Heat pumps, which provide cooling or heating through the transfer of heat in water or air, are used in air conditioners, water heaters, refrigerators, and freezers. Since they obtain heat without burning fuel, they are 35-50% more energy efficient than boilers and emit 30-50% less greenhouse gases. The IEA (International Energy Agency) estimates that heat pumps, which it views as a promising energy-saving technology, could cut global CO₂ emissions by 6%. As such, it identifies them as one of 17 promising technologies for combating global warming in a 2008 report. The technology has caught on in Europe, where there is strong demand for heating (Chart 4.18). The EU categorizes heat pumps as a type of renewable energy, positioning them as a means of meeting renewable energy targets.

Heat Pump Unit Sales in Europe

Chart 4.18



Source: European Heat Pump Association (EHPA)

Nuclear Power

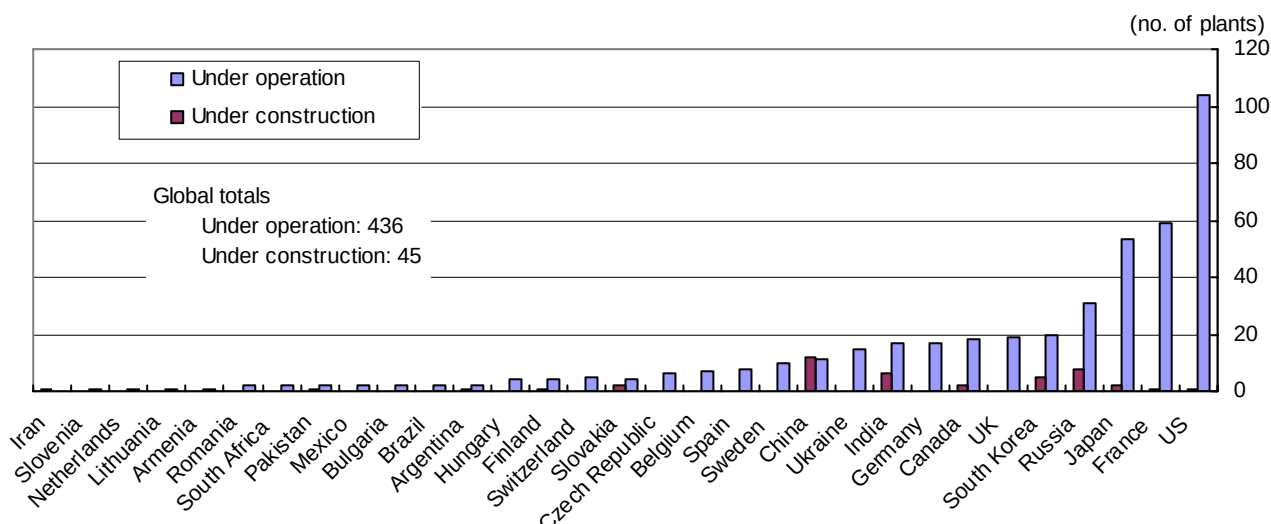
Fight against global warming fueling demand

Nuclear power is the generation of electricity using energy created by nuclear fission. The Chernobyl accident in 1986 soured demand for new plants, but the technology seems to be regaining traction, helped by the fact that it does not produce carbon-based greenhouse gasses (Chart 4.19). As of 2006, there were more than 400 plants in operation throughout the world, with the highest number in the US, followed by France and then Japan. The US has built no new plants since the Three Mile Island incident in 1979. However, drawing on comprehensive energy legislation enacted in 2005, the government established a support framework for the construction of new nuclear reactors under the Bush Administration, aiming to have nuclear power supply half of the energy needs by 2025 (equivalent to roughly 200 new reactors). Meanwhile, President Obama views nuclear power as a technology essential to combating global warming, but he does not seem as aggressive on the subject as his predecessor, clouding the policy outlook. Large-scale projects are in the planning stages in Russia, India, and China (Chart 4.19).

The OECD Nuclear Energy Agency forecasts a 2050 global nuclear power capacity of 580 million kW (increase of 50% from current level) under its low-end scenario and 1,400 million kW (four-fold increase; equivalent to 1,400 reactors) under its high-end scenario. Based on these scenarios, an average of 23 to 54 new reactors would be needed each year between 2030 and 2050. Assuming one reactor costs around Y350 billion to build, the market could reach Y8 to Y19 trillion between 2030 and 2050.

Global Nuclear Power Plants

Chart 4.19



Source: World Nuclear Association (WNA); compiled by DIR.

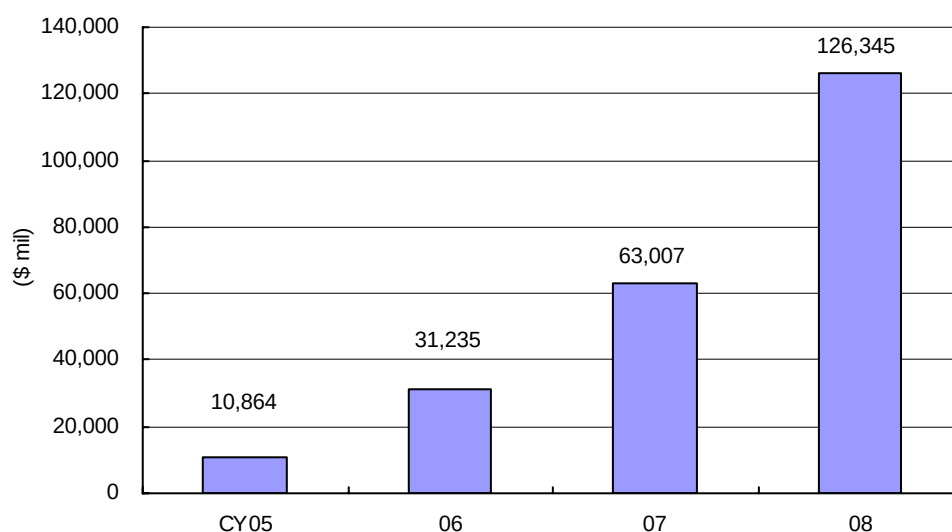
Market could grow from Y100 trillion to Y300 trillion

Emissions Trading

Emissions trading business includes emissions trading and brokering services as well as the creation of emission credits through greenhouse gas reduction projects. According to the World Bank, the global market for emissions trading doubled in 2008 to \$126 billion, of which 73% represents European emission allowances. The birth of the emissions trading market stems from several factors. First, the Kyoto Protocol, which came into force in 2005, set limits on emissions (emissions allowances) for developed countries and allowed emissions trading to be used to achieve targets. Second, in 2005, Europe launched the European Union Emission Trading Scheme, which sets caps for carbon-intensive firms and permits participants to trade allowances to meet targets. In the US, the Obama Administration has plans to introduce an emissions trading scheme similar to Europe's. Though largely a function of government policy, it is estimated the market could grow from roughly Y100 trillion to around Y300 trillion by 2020. In Japan, trading houses are spearheading forays into emissions trading. The World Bank forecasts global demand for emissions credits through 2012 at 1.6 billion MT, with Japan accounting for roughly 400 million MT of that amount. This suggests significant potential in the Japanese market.

Global Market for Emissions Trading

Chart 4.20



Source: World Bank; compiled by DIR.

4.2 Clean-tech Players on Our Radar

The following charts provide short comments and an earnings potential assessment for the clean tech businesses of 65 Japanese firms and 32 overseas companies. One-page overviews for 16 of the Japanese players and two of the overseas companies are provided from page 80.

Global Clean-tech Short List			Chart 4.21
Category	Subcategory	Japan	Overseas
Renewable energy	Photovoltaics	SUMCO, B Showa Shell Sekiyu, A Nippon Sheet Glass, B Hirano Tecseed, A Mitsubishi Electric, C Sharp, B Sansha Electric Mfg., A Kyocera, A Lintec, A Sumitomo, C	Asia: Delta Electronics, A; Solargiga, A Suntech Power, A; Motech, A; Europe: Q-Cells, A US: First Solar, A; Sunpower, A
	Wind power	Japan Wind Development, A Nabtesco, A NTN, A Mitsubishi Heavy Industries, A Electric Power Development, A	Asia: China High Speed Transmission Equipment Group, A; Dongfang Electric, B; Suzlon Energy, A Europe: BP, B; E.ON, B; Gamesa, A RWE, B; Vestas, A;
	Biofuel	Asahi Breweries, C; Mitsui & Co., C	Europe: Royal Dutch Shell, C US: AGCO, A; CNH Global, A; Deere, A;
	Solar thermal	Mitsui Engineering & Shipbuilding, C	
	Geothermal power	Mitsui Mining & Smelting, C	Mitsubishi Heavy Industries, A
Carbon Capture and Storage (CCS)		JGC, A	Mitsubishi Heavy Industries, A
Energy-efficient buildings, equipment		Takasago Thermal Engineering, C Corona (heat pump), A Rinnai (tankless hot water heater), A Miura (small once-through boiler), B Daikin Industries, A Panasonic Electric Works (heat pump); A Mitsubishi Heavy Industries, A	Asia: Epistar (LED), A; Everlight (LED), A Delta Electronics (energy saving PSU = power supply), A Delta Electronics (LED), A; Neo-Neon (LED), A US: Cree, A
Automobiles	HEV	Nidec, C; Denso, C; Shibaura Electronics, A	Asia: BYD, C
	EV		
	PHEV		
Power grids (smart grids)			Europe: ABB, A; Siemens, A
Water technologies		Hitachi Plant Technologies, C Toray Industries, C Kurita Water Industries, A Nitto Denko, A	US: ITT, A
Other	Li-ion battery	Asahi Kasei, A Tanaka Chemical, B Mitsubishi Chemical Holdings, C TonenGeneral Sekiyu, A Nippon Denko, B GS Yuasa Corporation, C Sanyo Electric, B Shin-Kobe Electric Machinery, C	Kanto Denka Kogyo, B Stella Chemifa, A Ube Industries, A Moresco, B Hirano Tecseed, B Panasonic, B Sansha Electric Mfg., A
	Methane hydrates	Japan Petroleum Exploration, C Mitsui Engineering & Shipbuilding, C	
	Clean coal technology	JGC, A Mitsubishi Heavy Industries, C Electric Power Development, C	Europe: Alstom, A US: General Electric, A
	Nuclear power	Hitachi Plant Technologies, A Toshiba Plant Systems & Services, A Hitachi, B Toshiba, A Mitsubishi Heavy Industries, A IHI, A	Asia: Dongfang Electric, B Doosan Heavy Industries & Construction, A HLS Systems, B; Europe: Areva, A
	Emissions trading	JGC, A Mitsubishi Heavy Industries, C Marubeni, A; Mitsubishi, B	
	Other	SBI Holdings (greentech fund), C Japan Asia Investment (greentech fund); C	

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—1

Chart 4.22

Field	Code	Company	Earnings potential	Notes
Photovoltaics	3436	SUMCO	B	Produces solar-grade wafers with FY08 (ended Jan 2009) sales reaching ¥20 billion. Plans to phase in capacity additions, with new Imari plant on stream in Feb 2009. Unique electromagnetic casting technology offers cost advantages, providing potential for gains in global market share (currently few percent) over medium term. (Shinobu Takeuchi)
	4118	Kaneka	C	Pioneer in thin-film solar cells. FY08 ended with sales of ¥11.5 billion and slight operating loss, given weak euro and higher fixed costs on aggressive capacity hikes. Determined to boost capacity by 80 MW to 150 MW by summer 2010, likely reaching 1 GW by 2015. (Shinobu Takeuchi)
	5002	Showa Shell Sekiyu	A	Miyazaki No. 1 solar cell plant (annual capacity 20 MW) likely yielding sales of ¥5 billion, several hundred million yen in profit. Miyazaki No. 2 plant (60 MW), completed in Apr 2009, slated to start commercial production in Jul. Medium-term business plan (FY10-14), announced in May 2009, targets capacity of 1,000 MW with start up of No. 3 plant, and segment recurring profit of ¥50 billion. (Satoshi Abe)
	5201	Asahi Glass	B	Expect medium- to long-term growth for glass substrates for solar cells. 2 main types of solar cell glass: cover glass for crystalline cells, TCO glass for thin-film cells. Technological entry barriers particularly high for TCO glass; Asahi Glass dominates supply with Nippon Sheet Glass. (Yusuke Ando)
	5202	Nippon Sheet Glass	B	Expect medium- to long-term growth for glass substrates for solar cells. 2 main types of solar cell glass: cover glass for crystalline cells, TCO glass for thin-film cells. Technological entry barriers particularly high for TCO glass; Nippon Sheet Glass dominates supply with Asahi Glass. (Yusuke Ando)
	5310	Toyo Tanso	A	Makes crucibles for use in production of silicon, wafers for solar cells. Expect demand growth in medium to long term. Estimate firm's share of global market for crucibles, heaters for solar cell production at over 50%. Aggressively adding to production facilities in anticipation of future demand growth. (Yusuke Ando)
	6245	Hirano Tecseed	A	Started receiving orders for thin-film CIGS solar cell sputtering equipment in FY08; only one client: overseas maker. Estimate such equipment brought in roughly ¥1.8 billion of ¥13.5 billion in consolidated FY08 orders. Working to boost production capacity to ¥6-7 billion. Meaningful earnings contributions likely from FY10. (Hideaki Teraoka)
	6255	NPC	A	Top maker of solar module production equipment with more than 40% global market share. 95% of sales from solar module production equipment; offerings work with both crystalline and thin-film solar cells. Has delivered equipment to more than 160 of roughly 180 solar module makers in world. (Hideaki Teraoka)
	6503	Mitsubishi Electric	C	Has achieved world-record 18.9% conversion efficiency for polycrystalline silicon solar cells. Management plans to widen technological lead over rivals with further efficiency improvements etc. and then go on offensive rather than immediately aggressively building production capacity. Estimate sales from solar cell ops of ¥45-46 billion in FY07, ¥53 billion in FY08. Firm is targeting ¥60 billion for FY09 and plans to boost production capacity from 220 MW in Oct 2008 to 600 MW in 2011. (Masaharu Sato)
	6728	Ulvac	A	Provides turnkey systems that include amorphous silicon thin-film solar cell manufacturing equipment, which firm produces. Competitors include Applied Materials and Oerlikon. Solar cell-related product sales expected to account for 30% of total FY08 (FY-end Jun 2009) sales. (Yoshiki Yuge)
	6753	Sharp	B	Solar cell ops posted FY08 sales of ¥157.1 billion but operating loss of ¥16.1 billion (estimates). Red ink mainly reflects failure to procure adequate supplies of key material polysilicon and increase in fixed costs from new thin-film cell plant. Solar cell ops still in red, but fourth largest share of global market in FY08 suggests excellent growth prospects. (Kazuharu Miura)
	6764	Sanyo Electric	A	FY08 solar cell sales: ¥81.2 billion. Operating profit not disclosed, but margin probably again in double digits. Mass produces HIT solar cells with high energy conversion efficiency, well-suited for residential use. Announced JV with Nippon Oil to mass produce thin-film cells. (Kazuharu Miura)
	6882	Sansha Electric Manufacturing	A	Produces solar cell power conditioners and power supplies used in polycrystalline silicon production equipment. Sansha presently ships power conditioners—used to convert electricity produced by solar cells from DC into AC—to large power stations. Solar cell-related products make up less than 10% of total sales. (Yoshiki Yuge)
	6890	Ferrotec	A	Makes, sells monocrystalline silicon ingot growing furnaces in China. Jumped to No. 1 in China by market share in 2008. Branching out to other regions, as evidenced by large new order from North America. Polycrystalline silicon ingot growing furnaces (new market entered in FY08) also faring well. Uptake of quartz crucibles (consumed in production process) gaining momentum since 2H FY08. (Hidemitsu Umebayashi)
	6971	Kyocera	A	Integrated solar cell production from wafers to generation systems. Extremely high conversion efficiency for polycrystalline silicon cells. Solar cell sales were just over ¥90 billion in FY08, yielding op profit of roughly ¥24 billion. Marked profit decline likely in FY09 due to weak euro, slowdown in Europe. (Takumi Sado)

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—2

Chart 4.22

Field	Code	Company	Earnings potential	Notes
Photovoltaics	7011	Mitsubishi Heavy Industries	C	Developing thin-film solar cells. Sales currently merely a few billion yen, so loss-making business. Firm plans to continue with R&D, but likely to be several years before profit contribution. <i>(Hirosuke Tai)</i>
	7966	Lintec	A	Expect strong growth for highly profitable solar cell backsheets. Firm should expand global market share from current 20% going forward, as (1) material costs, selling prices are likely lower than standard backsheet models, (2) US subsidiary makes, sells back sheets, so should benefit from surge in US solar investment, "Buy American" initiatives. (4%). <i>(Hidemitsu Umebayashi)</i>
	8001	Itochu	C	Has made wave of investments in solar system integrators/solar park operators in Norway, Italy, Greece, US west coast etc. Established solar business department in Apr 2009. <i>(Jiro Iokibe)</i>
	8053	Sumitomo	C	Large solar power generation operation in Canary Islands (Spain) started in May 2008. 25-year contract to sell electricity to leading Spanish electric utility Endesa from 2H CY08. Output: 9000 kW. <i>(Jiro Iokibe)</i>
	8058	Mitsubishi	C	Acquired 34% of shares in solar power producer Amper Central Solar (Portugal), subsidiary of world's largest new-energy firm, Acciona (Spain), in Mar 2009. Current generation facilities have output of 45,800 kW. <i>(Jiro Iokibe)</i>
Wind power	2766	Japan Wind Development	A	Third largest player in domestic market, with 11% share of wind power generation capacity at end-FY07. All eyes on Futamata plant in Aomori Prefecture (started operations in Jun 2008), world's first large-scale commercial wind power facility with storage batteries installed. <i>(Satoshi Abe)</i>
	5333	NGK Insulators	C	Expect demand growth for NaS storage batteries for wind power generation in long term. NaS batteries are only large storage battery produced on commercial basis in world, so need to smooth output from wind power, solar power generation systems should drive demand growth. <i>(Yusuke Ando)</i>
	6268	Nabtesco	A	Supplies reduction gears used in nacelle. Mitsubishi Heavy Industries is main customer, but also has track record of sales to foreign firms. Account for less than 10% of total sales. <i>(Hirosuke Tai)</i>
	6471	NSK	A	Supplies large bearings to foreign wind turbine makers, based on long-term contracts in some cases. Business makes up roughly 10% of total sales. Profit margins likely not bad despite small sales volume as products are large, must be highly durable. <i>(Hirosuke Tai)</i>
	6472	NTN	A	Supplies large bearings to foreign wind turbine makers, based on long-term contracts in some cases. Business makes up roughly 10% of total sales. Profit margins likely not bad despite small sales volume as products are large, must be highly durable. <i>(Hirosuke Tai)</i>
	6473	Jtekt	A	Supplies large bearings to foreign wind turbine makers, based on long-term contracts in some cases. Business accounts for roughly 10% of total sales. Profit margins likely not bad despite small sales volume as products are large, must be highly durable. <i>(Hirosuke Tai)</i>
	7011	Mitsubishi Heavy Industries	A	Estimate annual sales of around ¥100 billion with operating profit margin in high single digits. Expanding, mainly in North America. 2000 kW turbines are mainstay. <i>(Hirosuke Tai)</i>
	9513	Electric Power Development	A	Second largest player in domestic market with 13% share of wind power generation capacity at end-FY07. Had 12 operational domestic wind power facilities with total output of 256,000 kW as of Mar 2009. Overseas, has 45% stake in Zajaczkowo wind power facility (Poland; 48,000 kW). <i>(Satoshi Abe)</i>
Biofuel	2502	Asahi Breweries	C	Researching production of ethanol from high biomass yield crops and testing its use as fuel since 2006 in Okinawa. Firm apparently successful at raising biomass recovery volume through selective breeding of sugar cane. However, tax incentives and large quantity of cultivable land required remain issues probably needing to be resolved before project can become commercially viable. <i>(Tokushi Yamasaki)</i>
	8031	Mitsui & Co.	C	Bio-ethanol joint venture with Brazilian state oil firm Petrobras started operations in 2008. Joint venture plans to produce bio-ethanol from sugar cane cultivated on 30,000 hectares in inland Brazil, export it for sale on Japanese, European, US markets as transport/power generation fuel. No contribution to earnings yet. Mitsui & Co. invested ¥6 billion for 20% stake. <i>(Jiro Iokibe)</i>

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—3

Chart 4.22

Field	Code	Company	Earnings potential	Notes
Solar thermal	7003	Mitsui Engineering & Shipbuilding	C	Building demonstration plant in Abu Dhabi. Poor visibility on profit contribution, but likely to take time given strong R&D nature of operations at present. <i>(Hirosuke Tai)</i>
Geothermal power	5706	Mitsui Mining & Smelting	C	Okuaizu-based subsidiary provides steam to Tohoku Electric Power's Yanaizu Nishiyama Geothermal Power Station. Capable of maximum production of 65,000 KW—largest amount in Japan for single geothermal unit. Geothermal power does not require additional energy to drive turbines, and generates only 1/50-1/100 the CO2 emissions from coal and 1/3 of those from solar power. Upfront costs, however, are high. <i>(Takashi Murata)</i>
	7011	Mitsubishi Heavy Industries	A	Track record of deliveries to 12 countries. Main roles are plant construction, steam turbine supply. Minimal contribution to earnings, as earnings from each project small. <i>(Hirosuke Tai)</i>
Carbon Capture and Storage (CCS)	1963	JGC	A	Built world's second CCS plant (captures, stores CO2 emitted from natural gas plants) in Algeria in 2001. Negligible contribution to earnings at present. <i>(Hirosuke Tai)</i>
	7011	Mitsubishi Heavy Industries	A	Has built five plants so far, though all for emissions from urea plants. Plans to expand to CCS for coal-fired power plants. However, only intends to supply equipment; will not build facilities. Minimal contribution to earnings. <i>(Hirosuke Tai)</i>
Energy-efficient buildings, equipment	1969	Takasago Thermal Engineering	C	Takasago and other facility engineers offering energy-saving consultancy services as extension of existing businesses. Expect renewal projects to reduce CO2 emissions from office buildings to increase due to revisions to energy-saving laws, Tokyo City energy-saving by-laws. <i>(Hiroki Kawashima)</i>
	5909	Corona	A	Major maker of <i>EcoCute</i> water heaters. Major oil heater player, but has carved out share in <i>EcoCute</i> market based on hot water tank technology amid shift to all-electric housing. <i>(Hiroki Kawashima)</i>
	5947	Rinnai	A	Instant water heaters (heat-efficient) selling well in North America, with roughly 50% share. North American ops posted FY08 op profit of ¥1.1 billion on sales of ¥15.2 billion. Expect sales volume to rise 10% in FY09. Replacement purchases account for 80% of sales, so limited effects from housing start slump. <i>(Maoki Matsuno)</i>
	6005	Miura	B	Top domestic maker of small once-through boilers. Demand for eco-friendly gas-fired boilers (emit 30% less CO2 than fuel-oil fired boilers) should grow ahead. Domestic sales of such boilers have been sluggish in last two years due to supply shortage for natural gas, but shortage is being corrected, thanks in part to start of LNG imports from Sakhalin II plant. This should accelerate shift from fuel-oil fired to gas-fired boilers. <i>(Hideaki Teraoka)</i>
	6367	Daikin Industries	A	Diversified air conditioning maker. Stands out, particularly from Asian peers, thanks to launch of highly energy efficient products based on firm's inverter and internalized refrigerant technologies. Currently ranked third globally by sales, aiming to seize second spot. <i>(Hirosuke Tai)</i>
	6367	Daikin Industries	A	Started expansion into heating equipment 3 years ago, beginning in Europe. FY08 sales were around ¥25 billion, but expect growth to over ¥50 billion in FY09. Slated to begin sales in Australia in spring 2009, China in summer 2009. <i>(Hirosuke Tai)</i>
	6991	Panasonic Electric Works	A	Leading domestic <i>EcoCute</i> (heat pump-based hot water system) maker (units made by Panasonic, sold by PEW). FY08 sales of housing equipment for all-electric homes (IH cooking appliances, heated flooring, solar power systems) grew in double digits y/y to slightly under ¥100 billion. <i>(Kazuharu Miura)</i>
	7011	Mitsubishi Heavy Industries	A	Expanded into car air conditioning in addition to household, commercial-use. Roughly 5% weight in total sales. Business posting operating losses, partly due to recent massive slump in sales volume. Has considered merging business with Hitachi in past. <i>(Hirosuke Tai)</i>
HEV	6902	Denso	C	Manufactures power control units, with edge in medium-sized and larger vehicles. Should see meaningful contributions once Toyota hybrid sales reach 1 million vehicles annually. <i>(Eiji Hakomori)</i>
	6957	Shibaura Electronics	A	Supplies thermistors (monitors temperature near motors and inverters) for Toyota's hybrid vehicles. Firm has high share of thermistor shipments to Toyota (more than 50%), but hybrid-related sales account for only 2% of total sales. <i>(Mitsuharu Watanabe)</i>

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—4

Chart 4.22

Field	Code	Company	Earnings potential	Notes
EV	6594	NIDEC	C	Makes automotive motors that replace hydraulic systems. Mostly used in power steering so far. Significant growth possible going forward. (Takumi Sado)
Water technologies	1970	Hitachi Plant Technologies	C	In addition to own membrane bioreactor system, has purchased reverse osmosis system manufacturer, so can supply integrated plant systems handling seawater desalination, wastewater treatment, recycled water supply. Firm is HQ for Global Water Recycle System Association, made up of 14 firms including Hitachi, Kajima, Toray Engineering, Mitsubishi. (Hiroki Kawashima)
	3402	Toray Industries	C	Orders for water treatment membranes for sea water desalination etc. likely to grow in medium term. Membranes must be replaced, so expect earnings growth as number of desalination plants increases. (Yusuke Ando)
	6370	Kurita Water Industries	A	Sells ultrapure water supply equipment to public sector, but over half of sales to industry, mainly semiconductor, LCD makers. Started supplying ultrapure water itself several years ago, but this is also mostly aimed at hi-tech industries. Yet to show interest in entering market for drinking water in China, other nations. (Hirosuke Tai)
	6988	Nitto Denko	A	FY08 operating profit from water treatment membranes at ¥1.5 billion on sales of ¥20.7 billion in FY08. One of market leaders with around 30% share. Expect 11% annual market growth. However, water treatment membranes only have small weight in total company earnings. (Takumi Sado)
Li-ion battery	3407	Asahi Kasei	A	Hipore separator tops global market with roughly 50% share. FY08 sales reached more than ¥20 billion. Given high technical entry barrier & importance of separators in Li-ion batteries, Hipore likely enjoys strong profitability, benefiting from growing market. Has strong edge in promising automotive field given track record in consumer electronic applications. Stepping up capacity additions recently in bid to tap robust demand. (Shinobu Takeuchi)
	4047	Kanto Denka Kogyo	B	2nd highest market share (40%) for electrolyte materials for Li-ion batteries after Stella Chemifa. Li-ion battery-related sales checked in at ¥2.1 billion in FY08 (5% of total). Stella Chemifa has upper hand for automotive batteries based on likely supply chains. (Hidemitsu Umebayashi)
	4080	Tanaka Chemical	B	Specializes in positive electrodes for Li-ion, NiMH batteries. Focusing on ternary alloy positive electrodes for consumer electronics Li-ion batteries. In automotive space, sales of positive electrodes for HEV NiMH batteries expanding, but meaningful contributions from Li-ion automotive battery business unlikely until around 2012-14. (Hidemitsu Umebayashi)
	4109	Stella Chemifa	A	Has 45% market share for electrolyte materials (lithium hexafluorophosphate) for Li-ion batteries. Electrolyte material sales at ¥2.8 billion in FY08 (11% of total); forecast ¥3.6 billion for FY09 (17%). Electrolyte material sales could hit ¥10 billion in medium to long term thanks to demand for automotive Li-ion batteries. (Hidemitsu Umebayashi)
	4188	Mitsubishi Chemical Holdings	C	Battery material sales (chiefly electrolytes) more than ¥9 billion in FY08, providing little boost to profits due to heavy upfront costs. Produces all four major materials (separators, electrolytes, positive/negative electrodes), offering huge growth potential. However, lack of track record in consumer applications is hurting uptake of separators in automotive space; short-term growth potential to hinge on adoption in consumer electronics over next few years. (Shinobu Takeuchi)
	4208	Ube Industries	A	Produces electrolytes and separators, with FY08 sales of ¥12.5 billion. Strong ties with Sanyo have helped place firm among frontrunners in global electrolyte market with 25% share. It is easy for chemical firms to enjoy added value in electrolytes and separators, so margins are likely high. (Shinobu Takeuchi)
	5012	TonenGeneral Sekiyu	A	Wholly consolidated subsidiary Tonen Chemical estimated to have second highest global market share for separators used in Li-ion batteries. Nasu plant currently has six operational production lines. Constructing two lines in South Korea (Gumi in Gyeongsangbuk Province), so production should rise to eight lines from start 2010. (Satoshi Abe)
	5018	Matsumura Oil Research	B	Leading market share for liquid paraffin used in wet separator manufacturing. Estimate that Li-ion battery-related sales were ¥900 million (7% of total) in FY08. (Hidemitsu Umebayashi)
	5563	Nippon Denko	B	Bolstering production capacity of lithium manganese spinels (Li-ion battery positive electrode material). Current annual production capacity of 700 MT, but green light given for additional 2000 MT line within Takaoka plant premises. Aiming to begin shipments in 2010 (total investment: ¥2-3 billion). Considering boosting capacity to around 13,000 MT from FY10, depending on demand and user needs. (Takashi Murata)
	6245	Hirano Tecseed	B	Manufactures equipment for coating Li-ion battery electrodes (accounted for 17% of FY08 sales). Coating machines for automotive Li-ion batteries look promising. Only major competitors in automotive area are Inoue Kinzoku Kogyo (6246) and Toray Engineering. Flooded with test requests from makers from Japan, Korea, Taiwan, and Europe. Meaningful growth in orders likely from FY09. (Hideaki Teraoka)

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—5

Chart 4.22

Field	Code	Company	Earnings potential	Notes
Li-ion battery	6674	GS Yuasa	C	Supplying batteries for Mitsubishi Motors' <i>i-MiEV</i> (set for launch in summer 2009): batteries for 2,000 vehicles in 2009, 10,000 vehicles in 2011; should break even at operating line in FY11 on Y16 billion in sales. Y7.5 billion in capex planned in next two years. HEV battery plant for Honda slated to go on stream in autumn 2010 (planned investment: Y25 billion). Expect revenue early on, but likely to remain at breakeven level for a while. Production volume has yet to be decided. (Hideaki Ayabe)
	6752	Panasonic	B	Fourth largest share of global market for mobile Li-ion batteries (about 10%); aiming for top spot after integration of Sanyo Electric. Mass-producing HEV Ni-MH through Panasonic EV Energy (JV with Toyota: Toyota, 60%; Panasonic, 40%). Will probably also eventually mass-produce HEV/EV Li-ion batteries for Toyota. (Kazuharu Miura)
	6764	Sanyo Electric	B	Global leader in Li-ion batteries for mobiles (25%). Supplying Honda and Ford with HEV Ni-MH. Slated to provide HEV/EV Li-ion batteries to Volkswagen and Audi. Could eventually supply cells to other assemblers. (Kazuharu Miura)
	6882	Sansha Electric Manufacturing	A	Produces power supplies used in battery aging process (where cells are repeatedly charged and discharged to stabilize battery quality). Product line accounts for just below 5% of total sales. (Yoshiki Yuge)
	6934	Shin-Kobe Electric Machinery	C	Makes Li-ion batteries for industrial applications. Plans to start mass production of batteries for IT systems in FY10. Anticipate business breaking even at operating level in FY10 on sales of Y1 billion. (Hideaki Ayabe)
Methane hydrates	1662	Japan Petroleum Exploration	C	Has first refusal on extraction rights for Nankai Trough (believed to be rich in resources). Became first Japanese firm to succeed in extraction from methane hydrate layer in 2000. Was operator for extraction campaign by methane hydrate resource development research consortium (government, private sector, academic participation) which dug 30 wells in Nankai Trough in 2004. (Satoshi Abe)
	7003	Mitsui Engineering & Shipbuilding	C	Developing ships for methane hydrate transport. Currently facing significant cost issues, in addition to which, technological hurdles very high. Poor visibility on whether it will get out of development stage (Hirosuke Tai)
Clean coal technology	1963	JGC	A	Track record building IGCC system power plants for Nippon Petroleum Refining. Still demonstration plants, so microscopic weight in sales. Profit contribution also likely limited. (Hirosuke Tai)
	7011	Mitsubishi Heavy Industries	C	Delivered IGCC system demonstration plant to Clean Coal Power R&D. Notable for air-blown IGCC technology. Demand likely to grow in medium term on environmental issues, but should take several years before contributing to earnings. (Hirosuke Tai)
	9513	Electric Power Development	C	Carrying out trials of coal gasification technology (EAGLE project) in conjunction with NEDO. Also aiming to build demonstration IGCC system (integrated gasification combined cycle; 170,000 kW output) jointly with Chugoku Electric Power. (Satoshi Abe)
Nuclear power	1970	Hitachi Plant Technologies	A	Hitachi-affiliated plant engineering firm. Estimate nuclear power plant projects account for nearly 10% of sales. Expect firm to enhance overseas project capabilities while retaining strength in domestic projects, domestic inspection business (stable income source). (Hiroki Kawashima)
	1983	Toshiba Plant Systems & Services	A	Toshiba-affiliated plant engineering firm. Nuclear power plant projects account for 25% of total sales. Expect firm to enhance overseas project capabilities while retaining strength in domestic projects, domestic inspection business (stable income source). (Hiroki Kawashima)
	6501	Hitachi	B	Estimate nuclear power project-related sales at Y150 billion in FY07. Overseas operations basically undertaken by joint venture with GE (equity-method affiliate). Overseas operations unlikely to contribute to earnings for a while yet, but firm has new domestic projects in meantime. Hitachi, GE collaboration targets BWR systems. (Masaharu Sato)
	6502	Toshiba	A	Involved with both pressurized (PWR), boiling (BWR) water reactors. Overseas orders solid for PWRs, chiefly at acquisition Westinghouse Electric. Estimate FY07 Westinghouse sales at Y200 billion. Toshiba itself has long handled BWRs. BWR-related sales were around Y200 billion in FY07, mainly for maintenance services. Has received orders for two BWR reactors in North America. Firm anticipates orders for 39 reactors worldwide by 2015. (Masaharu Sato)
	7011	Mitsubishi Heavy Industries	A	Major PWR player. Also developing mid-size reactors together with Areva (France). Sales around Y200 billion, operating profit margin roughly 10%. Construction of Tomari No. 3 reactor reaching peak. Focusing on US in overseas ops; not that interested in China. (Hirosuke Tai)

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Japanese Clean-tech Players on Our Radar—6

Chart 4.22

Field	Code	Company	Earnings potential	Notes
Nuclear power	7013	IHI	A	Supplying various equipment for BWRs as major Toshiba partner. Also developing pressurizers, steam generators for PWRs to supply to Westinghouse, but commercialization likely to take several years. Just over 10% of total sales. (Hirosuke Tai)
Emissions trading	1963	JGC	A	Already expanded CDM ops, offering alternative energy to Chinese cement plants. Minimal earnings contribution, but in black. (Hirosuke Tai)
	7011	Mitsubishi Heavy Industries	C	Entered CDM field by concluding CDM contract with Chinese electric utility firm in 2007. Plans to purchase only 330,000 MT of emission credits over five years (2008-12), so profit contributions to take several years. (Hirosuke Tai)
	8002	Marubeni	A	Early entrant into emissions trading. Sales of emissions credits obtained in China to Japanese firms, government already contributing to earnings. Only Japanese member of ECX (European Climate Exchange). (Jiro Iokibe)
	8058	Mitsubishi	B	Domestic leader in emissions trading in terms of trading volume, applications. Also focusing on CDM (clean development mechanisms) and JI (joint implementation). Developing one-stop services (inspection, recommendations, facility construction, financing, application services) for emissions trading. (Jiro Iokibe)
Other	8473	SBI Holdings	C	Established venture capital funds investing in green technologies. Established alternative energy fund (\$20 million) in partnership with UAE government-sponsored financial institution in Jan 2009. Earnings contributions not likely for few years at earliest, but does represent new investment opportunity. (Jiro Kojima)
	8518	Japan Asia Investment	C	Established venture capital funds investing in green technologies. Set up venture fund (\$10 million) making energy/eco-related investments in Asia in Oct 2008. Earnings contributions not likely for few years at earliest, but does represent new investment opportunity. (Jiro Kojima)

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Overseas Clean-tech Players on Our Radar (Asia)

Chart 4.23

Field	Code	Company	Earnings potential	Notes
Photovoltaics	2308 TT	Delta Electronics	A	DeSolar is expanding its annualized PV cell production capacity to 720 MW in 2009 and decided to stop investment in thin-film solar cell project. In Taiwan, it has received 100 MW system order for Kaohsiung's new Stadium and another 150 MW order at Taichung. <i>(Andrew Chang, DIR Taipei)</i>
	6244 TT	Motech	A	Largest solar cell maker in Taiwan. Aims to expand annual production capacity by end of 2009 to 600 MW from 450 MW at the end of 2008 and plans to ship 400 MW in 2009, up 47% y/y. Motech is only large Taiwanese PV-cell maker who was profitable in 1Q CY09 thanks to its low exposure to long-term polysilicon prices. <i>(Pranab Sarmah, DIR Hong Kong)</i>
	757HK	Solargiga	A	Second largest China-based mono-wafer maker in 2008 with strong Japanese connections. Company aims to lift double ingot production capacity to 400MW this year and triple wafer processing capacity. After a huge loss in 4Q CY08 (inventory write-off) company is likely to record losses in 1H CY09. <i>(Pranab Sarmah, DIR Hong Kong)</i>
	STP US	Suntech Power	A	Largest solar cell/module maker in China with global footprint. Annual production capacity is 1 GW and aims to ship 600-700 MW in 2009, up from 497 MW in 2008. Due to fall in demand, price declines, and inventory write-downs company recorded losses in 4Q CY08, but should become profitable from 2009. <i>(Pranab Sarmah, DIR Hong Kong)</i>
Wind power	1072 HK	Dongfang Electric	B	One of China's three major wind turbine makers, vaulting to No. 3 spot in domestic market in 2008 with 17% share, up from 7%. In 2008, wind power related operations accounted for 10% of total sales (up from 2%) and 15% of orders. However, thermal power generation equipment still makes up more than 80% of total sales. <i>(Taiki Kaji, DIR Hong Kong)</i>
	658 HK	China High Speed Transmission Equipment Group	A	Top maker of wind turbine gear boxes in China. Roughly half of 2008 sales from wind power related ops. Plans to increase production volume in wind power related ops from 3.5 GW in 2008 to 6 GW in 2009 and 9 GW in 2010. <i>(Taiki Kaji, DIR Hong Kong)</i>
	SUEL IN	Suzlon Energy	A	Top producer of wind turbines in India with market share of over 50% and No. 5 maker globally (8.1% share based on parent). Group companies include gear box major Hansen Transmission and turbine maker Repower. Struggled in 2008 in US due to faulty blades, but should benefit from market expansion over medium to long term. <i>(Taiki Kaji, DIR Hong Kong)</i>
Energy-efficient buildings, equipment	1868 HK	Neo-Neon	A	51% of revenue from LED lighting in 2008. Revenue up strong 41.8% y/y in 1H08, but down 15.5% in 2H08 due to slowdown in demand. Positioned to be strong beneficiary should China see large-scale adoption of LED streetlights/exhibition panels over medium to long term. <i>(Bo Bo Wong, DIR Hong Kong)</i>
	2308 TT	Delta Electronics	A	Delta is leveraging its solutions in LED ballast, power supply and heat sinks for LED street lighting projects. It has invested in high-power LED packagers, thermal module suppliers, and has formed a close supply relationship with Epistar for high-power LED chips. We estimate LED sales account for low single-digit percentage of Delta's 2009 revenue. <i>(Andrew Chang, DIR Taipei)</i>
	2308 TT	Delta Electronics	A	Delta Electronics have acquired 80 Plus Gold certificate and achieved over 90% energy efficiency. Delta Electronics is expanding its presence on automotive power, server power and 3G base station power supply projects in emerging markets. <i>(Andrew Chang, DIR Taipei)</i>
	2393 TT	Everlight	A	Taiwan's largest LED packager with balanced product portfolio. It assembles LEDs for consumer electronics, handsets, notebook back-light, general light, street light, etc. <i>(Andrew Chang, DIR Taipei)</i>
	2448 TT	Epistar	A	Taiwan's largest LED chip maker, mainly supplies to China handset market, decorative lamps and also OEM chip makers for notebooks. There has been talk that Epistar may either collaborate with or acquire Toyoda Gosei's LED business for future expansion. After recording losses since 4Q CY08, we believe company became profitable from Mar-09. <i>(Andrew Chang, DIR Taipei)</i>
EV	1211 HK	BYD	C	BYD introduced the world's first dual-mode electric car model, namely F3DM in December 2008. Management expects that there will be no solid earnings contribution from this business at least in next two years, due to high production cost and limited sales volume. <i>(Ricon Xia, DIR Shanghai)</i>
Li-ion battery	1211 HK	BYD	A	BYD is one of the major Li-ion battery producers for mobile phones. Our estimate is that 4 billion yuan of revenue came from this business in FY08 (around 14% of total revenue). In 2007, it took roughly 9% of global consumer Li-ion battery market. BYD developed LiFeO4 battery by itself and used it in its F3DM EV model. <i>(Ricon Xia, DIR Shanghai)</i>
Nuclear power	034020 KS	Doosan Heavy Industries & Construction	A	Sees more than 10% of total sales from nuclear power plant equipment and boasts strong position in said market. Sole producer of major nuclear power plant equipment in Korea and also has orders as major supplier for latest Toshiba/Westinghouse AP-1000 reactors. Should benefit from increased nuclear power plant construction at home and abroad. <i>(Taiki Kaji, DIR Hong Kong)</i>
	1072 HK	Dongfang Electric	B	One of China's three major heavy electric machinery makers. Revenue from nuclear power projects was booked as only part of "other" operations (6% of total sales), but related orders made up 24% of company-wide total. In addition to major equipment for generation II reactors, it has also landed orders for EPR (steam turbines, generators) and AP-1000 (pressurizers) projects. <i>(Taiki Kaji, DIR Hong Kong)</i>
	HOLI US	HLS Systems	B	Entered nuclear power sector by establishing plant control system joint venture with China Guangdong Nuclear Power Holding (CGNPC), major Chinese nuclear power operator. Expect business to contribute more to earnings as CGNPC increases plant construction. <i>(Taiki Kaji, DIR Hong Kong)</i>

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Overseas Clean-tech Players on Our Radar (Europe)

Chart 4.24

Field	Code	Company	Earnings potential	Notes
Photovoltaics	QCE GY	Q-Cells	A	Major solar cell maker (Germany). Aggressively investing in ventures with solar cell-related technology. Sales of 224 million euros, operating profit of 14.7 million euros in Jan-Mar 2008. High exposure to various countries' subsidy/compulsory electricity purchase schemes. (Yoko Yamada, DIR America)
Wind power	BP LN	BP	B	Total of \$2.8 billion has been invested in Alternative Energy. Focuses on Wind, Solar, biofuels and CCS. BP has decided to cut capital spending on Alternative Energy in 2009 by 40%. BP has 1,000 MW of wind capacity in US plus 40 MW of capacity in India, all of which is onshore. Key partnerships are with Clipper Windpower, NRG and Dominion in US. (David Stedman, DIR Europe)
	EOAN GY	E.ON	B	While E.ON is likely to be involved in development of new build nuclear, smart grids, CCS and cogen projects, the biggest near term growth driver for group is its renewable division which is principally focused on European onshore wind projects. Climate & Renewables division made a small profit last year but we forecast €0.8 billion in EBIT by 2013. (Ashley Thomas, DIR Europe)
	GAM SM	Gamesa	A	Market is profitable but mature and global wind turbine demand in 2009 is likely to be flat or below that of 2008. Asia remains a high growth region (domestics are main beneficiaries) but US and European demand is likely to fall by over 20%. With committed order book extending to 2011 Gamesa is better protected than Vestas from pricing pressure and competition. (Ashley Thomas, DIR Europe)
	RWE GY	RWE	B	While RWE is likely to be involved in development of new build nuclear, smart grids, CCS and cogen projects, the biggest near term growth driver for group is its renewable division which is principally focused on European onshore and offshore wind projects. RWE Innogy made small profit last year but we forecast €0.7 billion in EBIT by 2013. (Ashley Thomas, DIR Europe)
	VWS DC	Vestas	A	Market is profitable but mature and global wind turbine demand in 2009 is likely to be flat or below that of 2008. Asia remains a high growth region (domestics are main beneficiaries) but US and European demand is likely to fall by over 20%. With fewer framework agreements than Gamesa, Vestas may be the first to experience pricing pressure and increased competition. (Ashley Thomas, DIR Europe)
Biofuel	RDSA LN	Royal Dutch Shell	C	Alternative Energy is not expected to be profitable until 2nd generation biofuels are commercialized. Shell is focused on cellulosic biofuels working with Iogen and Choren. Believes commercial production of 2nd generation biofuels will occur within next 10 years and biofuels could account for 7-10% of global transport fuels within 20 to 30 years. (David Stedman, DIR Europe)
Power grids (smart grids)	ABB SS	ABB	A	Leader in power and automation technologies while lowering environmental impact. Global power capex is expected to be down more than 30% in 2009 impacting their power system order intake. However, infrastructure and power line demand in Middle East and China remains relatively strong. Various government stimulus programs should also have a positive impact. (Ashley Thomas, DIR Europe)
	SIE GY	Siemens	A	Increased power grid investment will benefit both Siemens' Power Transmission and Distribution activities. Renewable division faces reduced market demand and increased competition, but 2009 results should be boosted by two large European offshore wind deals (E.ON/SSE). Siemens is also market leader in railway and energy efficiency/lighting systems. (Ashley Thomas, DIR Europe)
Clean coal technology	ALO FP	Alstom	A	Leader in clean coal technology although future growth is set against tough y/y comparison given large number of European FGD installations in 2008. Increased investment in power grid in China and US should be of benefit to Power Systems division although Power Products division may suffer from lower new plant investments by utilities globally. (Ashley Thomas, DIR Europe)
Nuclear power	CIE FP	Areva	A	New nuclear build has long lead time but would benefit from US carbon cap or classification of nuclear as renewable energy. Transmission & Distribution division to benefit from grid investment. (Ashley Thomas, DIR Europe)

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

Overseas Clean-tech Players on Our Radar (US)

Chart 4.25

Field	Code	Company	Earnings potential	Notes
Photovoltaics	FSLR	First Solar	A	Top thin-film cell maker. Over half of sales to large-scale generation projects. High exposure to various countries' subsidy/compulsory electricity purchase schemes. Has penned long-term supply contracts with 10 clients. Large contracts with each client, so significant fallout if dissolved. (Yoko Yamada, DIR America)
	SPWRA	Sunpower	A	Has achieved world record conversion efficiency (20-25%) using single-face electrode structure. Involved in wide range of activities from making solar cells to installing solar panel systems. Households, large-scale generation projects, corporations each account for roughly one third of sales. High exposure to various countries' subsidy/compulsory electricity purchase schemes. (Yoko Yamada, DIR America)
Biofuel	AGCO	AGCO	A	Specialist agricultural machinery maker. 3rd highest global market share. High weight of sales in Europe, South America relative to top 2 firms. Conflict of demand for agricultural products between foods, biofuels, likely to continue until development, spread of cellulose ethanol. Firm likely to benefit, as spread of biofuels should push up agricultural product prices, feeding farmers' appetites for capex. (Shiro Sakamaki, DIR America)
	CNH	CNH Global	A	Maker of agricultural, construction machinery. Second largest agricultural machinery maker in world. Subsidiary of Italian car maker Fiat. Conflict of demand for agricultural products between foods, biofuels, likely to continue until development, spread of cellulose ethanol. Firm likely to benefit, as spread of biofuels should push up agricultural product prices, feeding farmers' appetites for capex. (Shiro Sakamaki, DIRA)
	DE	Deere	A	Maker of agricultural, construction machinery. Top global market share for agricultural machinery. Agricultural machinery accounted for 65% of FY08 operating profit, followed by construction machinery (14%), financial services, lawn mowers etc. Conflict of demand for agricultural products between foods, biofuels, likely to continue until development, spread of cellulose ethanol. Firm likely to benefit, as spread of biofuels should push up agricultural product prices, feeding farmers' appetites for capex (Shiro Sakamaki, DIR America)
Energy-efficient buildings, equipment	CREE	Cree	A	Major white LED maker. Highly competitive in high-output (high luminous efficiency) LEDs, aggressively developing lighting applications. Likely to enjoy benefits of increased public investment, for instance use of LEDs by US government institutions. (Yoko Yamada, DIR America)
Water technologies	ITT	ITT	A	Involved in water treatment facilities, manufacturing water pumps. 33% of sales, 34% of operating profit from water-related operations in FY08. Wide range of sales channels--public works projects, industrial applications, housing, commercial facilities, agriculture. (Shiro Sakamaki, DIR America)
Clean coal technology	GE	General Electric	A	Commercialized IGCC 7FB gas turbine in 2004. GE energy, which makes gas turbines, wind power generation equipment, had sales of \$29.3 billion, operating profit of \$4.9 billion in FY08, accounting for just under 20% of whole-company earnings. (Shiro Sakamaki, DIR America)

Source: Compiled by DIR.

Note: A: Already providing earnings contributions, B: Likely to provide earnings contributions in next few years, C: Several years likely needed before earnings contributions; based on DIR analyst opinions.

4.3 One-page Overviews for Major Clean-tech Players

Of the 97 companies (65 domestic, 32 overseas) on our radar, we provide one-page overviews of the clean-tech operations for 18 listed below (16 domestic, 2 overseas) on the following pages.

JGC (1963)
Asahi Kasei (3407)
Stella Chemifa (4109)
Toyo Tanso (5310)
Rinnai (5947)
Hirano Tecseed (6245)
NPC (6255)
Daikin Industries (6367)
Toshiba (6502)
Panasonic (6752)
Sharp (6753)
Ferrotec (6890)
Kyocera (6971)
Nitto Denko (6988)
Mitsubishi Heavy Industries (7011)
Lintec (7966)
Suntech Power (STP US)
RWE (RWE GY)

JGC (1963)

Hirosuke Tai

Frontrunner in Plant Engineering for Efficient Energy Use

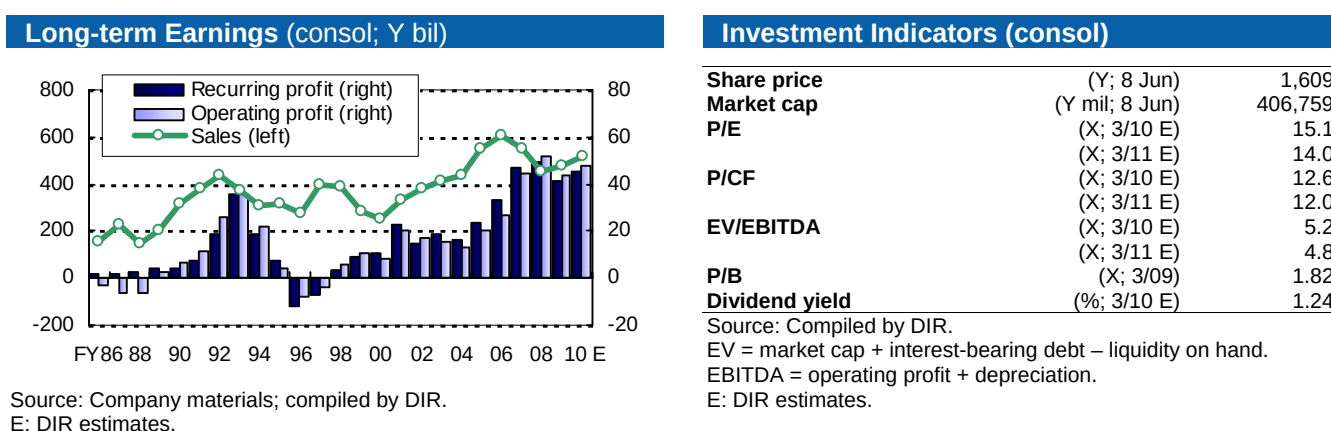
JGC is an engineering firm specializing in the construction and design of energy infrastructure, including petroleum and natural gas facilities. It has been channeling its efforts into green technologies since the 1960s in response to a growing awareness of global environmental issues, developing innovative approaches to the efficient use of natural gas, eco-friendly fossil fuels, energy-efficient power plants, and the safe disposal of environmental waste. In this report, we focus on its clean development mechanisms (CDM), carbon capture and storage (CCS), and integrated gasification combined cycled (IGCC) technologies.

Conditions in Eco-related Businesses, Outlook

IGCC technology has considerable potential as it enables power plants to fire gas turbines after gasifying petroleum coke (heavy residues), the highly sulfuric and primarily carbon byproduct produced during petroleum processing. JGC completed the first IGCC power plant (342,000 kW) in Japan in 2003 for the Nippon Oil Corporation. ICGG plants have yet to drive the top line, as the technology is still in a trial phase.

CCS technologies seek to sequester carbon by trapping CO₂ generated by large emitters of greenhouse gases and depositing it deep underground or far beneath the sea. Oil exporters seem keen on the technology, as the subterranean injection of CO₂ could help boost production (sequestration facilitates drilling by compressing remaining oil reserves). JGC was part of the natural gas project completed in Algeria in 2001, marking the second CCS plant ever built. However, this technology has yet to contribute meaningfully to earnings.

JGC's CDM track record includes an alternative energy project for a cement plant in China. It is currently working on coalbed methane technologies and greener alternatives for cement inputs. The portfolio currently accounts for a small fraction of earnings.



Income Summary (¥ mil; y/y %)												
	Year to	Sales		Op profit		Rec profit		Net income		EPS (¥)	CFPS (¥)	DPS (¥)
Consol	3/08	551,062	(-9)	44,896	(70)	46,837	(42)	30,019	(49)	118.3	142.3	21.00
	3/09	450,911	(-18)	52,003	(16)	49,388	(5)	31,543	(5)	124.8	152.4	30.00
	3/10 E	480,000	(6)	44,000	(-15)	41,500	(-16)	27,000	(-14)	106.8	127.8	20.00
	3/11 E	520,000	(8)	48,000	(9)	45,500	(10)	29,000	(7)	114.7	134.5	20.00

E: DIR estimates.

Asahi Kasei (3407)

Shinobu Takeuchi

Material Maker Poised to Benefit from Growth in Li-ion Battery Market

Asahi Kasei manufactures and sells its *Hipore* brand of Li-ion rechargeable battery separators, boasting a 50% share of the global market. We estimate FY08 *Hipore* sales at slightly more than ¥20 billion. The firm announced that in spring 2010 its existing Moriyama plant and the planned Hyuga plant (under construction) would together boost annual production capacity to 200 million m², doubling current output.

Conditions in Eco-related Businesses, Outlook

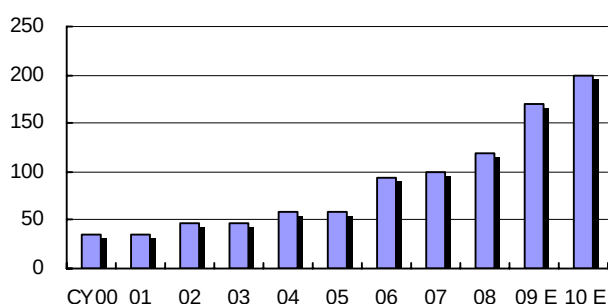
Hipore is a microporous film placed between the positive and negative electrodes of Li-ion rechargeable batteries, preventing contact between them. At the same time, it allows lithium ions to pass between the electrodes, permitting battery charge/discharge. Comprised of ultra-high molecular weight polyethylene and wet-manufactured, *Hipore* is a high molecular weight resin, giving it outstanding durability and mechanical strength. These attributes, together with the firm's first-mover advantage, have given Asahi Kasei a commanding 50% share of the global market.

Currently, it appears sales have been geared mostly for batteries for consumer electronics. Asahi Kasei manufactures and sells two types of membranes—large-pore diameter and small-pore diameter—that are tailor-made to battery makers' requirements. Both membranes deliver top-notch performance as the former is easy to process and conforms well with the characteristics needed for flat-type Li-ion batteries, while the latter's high durability and uniform membrane thickness/permeability meet the demands of cylindrical batteries. With demand for electronic devices such as laptops and mobile phones weakening from end-2008 to early spring 2009, orders for *Hipore* have also fallen sharply. That said, we believe orders will return to early 2008 peak levels after they bottom as production cutbacks run their course.

With an eye on medium-term growth, Asahi Kasei intends to step up its production for automotive batteries. The firm plans to set up R&D facilities in early spring and begin a mass production test run based on the assumption that cars powered by Li-ion batteries with *Hipore* separators will hit the market by end-2009. Separators are a critical component for battery safety. As such, automakers are likely to favor products with proven records in consumer electronics batteries in the early stages of Li-ion battery-powered vehicles. To meet quality requirements that differ from consumer applications, Asahi Kasei is likely to be thorough, looking into dry manufacturing in addition to wet processes. As such, we expect it to capture substantial market share for automotive batteries as well.

As noted above, separators are vital to battery safety, and the market has formidable entry barriers, so they are likely highly profitable. Given that the company is well positioned to translate demand growth into profit, anticipated Li-ion battery market expansion should act not only as a positive catalyst for the shares, but also as a profit growth driver.

Hipore Production Capacity (mil m²/year)



Source: Various materials; compiled by DIR.
E: DIR estimates.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	460
Market cap	(Y mil; 8 Jun)	643,331
P/E	(X; 3/10 E)	58.5
	(X; 3/11 E)	25.7
P/CF	(X; 3/10 E)	6.8
	(X; 3/11 E)	6.2
EV/EBITDA	(X; 3/10 E)	7.3
	(X; 3/11 E)	6.6
P/B	(X; 3/09)	1.07
Dividend yield	(%; 3/10 E)	1.96

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (Y mil; y/y %)

	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	1,696,789	(4)	127,656	(-0)	120,456	(-5)	69,945	(2)	50.0	102.9	13.00
	3/09	1,553,108	(-8)	34,959	(-73)	32,500	(-73)	4,745	(-93)	3.4	60.2	10.00
	3/10 E	1,350,000	(-13)	35,000	(0)	34,000	(5)	11,000	(132)	7.9	67.2	9.00
	3/11 E	1,380,000	(2)	53,000	(51)	52,000	(53)	25,000	(127)	17.9	73.6	10.00

E: DIR estimates.

Stella Chemifa (4109)

Hidemitsu Umebayashi

Top Maker of Li-ion Battery Electrolytes; Share Gains in Automotive Applications Likely

Stella commands just under half of the global share for the electrolyte lithium hexafluorophosphate (LiPF₆), a key input in the production of electrolytic solution used in Li-ion batteries. The medium- to long-term outlook has the electrolytic solution market expanding at an annual average of 10%, but we see prospects for higher growth at Stella, should it succeed in boosting its share of the automotive battery application market.

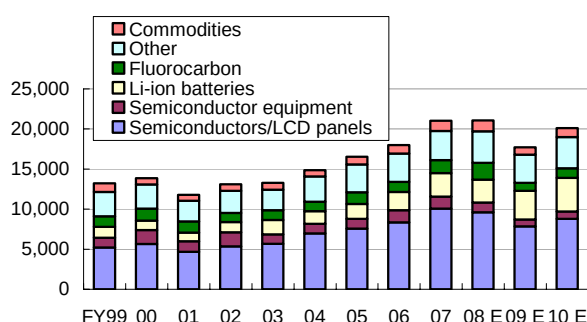
Conditions in Eco-related Businesses, Outlook

Demand for Li-ion batteries has expanded to include notebook PCs, mobile phones and other portable devices. Future growth, however, will likely favor large automotive batteries for use in HEV and EVs.

The LiPF₆ market is split roughly between Stella and Kanto Denka Kogyo (4047), which controls a 40% share. While both offer similar products, they boast different clients and employ unique production methods. Stella's major clients include Mitsubishi Chemical Holdings, Cheil Industries (South Korea), Tomiyama Pure Chemical Industries (unlisted), Mitsui Chemicals, Shanshan (China), all chemical firms producing electrolytes that apparently end up in Li-ion batteries manufactured by names such as Panasonic, Samsung SDI (South Korea), Sony and BYD (China). Meanwhile, Kanto Denka seems to do substantial business with Ube Industries, which supplies a large proportion of the electrolytic solution used by Sanyo Electric. We think Stella is better positioned to benefit from future growth in automotive battery demand, judging from its customer base. It also seems to enjoy a valuable cost advantage since its production process enables it to cut out the gasification process (of fluoride) used at Kanto Denka.

Stella's current LiPF₆ production capacity is 900 MT/year. It has launched construction to lift capacity by 200 MT to 1,100 MT/year by summer 2009, and plans to raise that figure to 1,300 MT/year during 2010. While Stella is adjusting its construction timeline to reflect the somewhat poor visibility on demand for consumer electronics applications recently, it apparently remains upbeat about future capacity additions given the emerging market for automotive applications.

High-purity Chemical Sales by Application (¥ mil)



Source: Company materials, interviews; compiled by DIR.
E: DIR estimates.

Investment Indicators (consol)

Share price	(¥; 8 Jun)	3,720
Market cap	(¥ mil; 8 Jun)	45,755
P/E	(X; 3/10 E)	NA
	(X; 3/11 E)	91.5
P/CF	(X; 3/10 E)	19.5
	(X; 3/11 E)	15.3
EV/EBITDA	(X; 3/10 E)	23.5
	(X; 3/11 E)	17.1
P/B	(X; 3/09)	2.99
Dividend yield	(%; 3/10 E)	0.81

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (¥ mil; y/y %)

	Year to	Sales		Op profit		Rec profit		Net income		EPS (¥)	CFPS (¥)	DPS (¥)
Consol	3/08	25,496	(16)	2,822	(-13)	2,722	(-17)	1,757	(-3)	142.9	355.6	33.00
	3/09	25,561	(0)	1,244	(-56)	1,270	(-53)	359	(-80)	29.2	238.6	33.00
	3/10 E	21,400	(-16)	-200	(loss)	-200	(loss)	-250	(loss)	-20.3	191.1	30.00
	3/11 E	24,100	(13)	800	(profit)	800	(profit)	500	(profit)	40.7	243.9	30.00

E: DIR estimates.

Toyo Tanso (5310)

Yusuke Ando

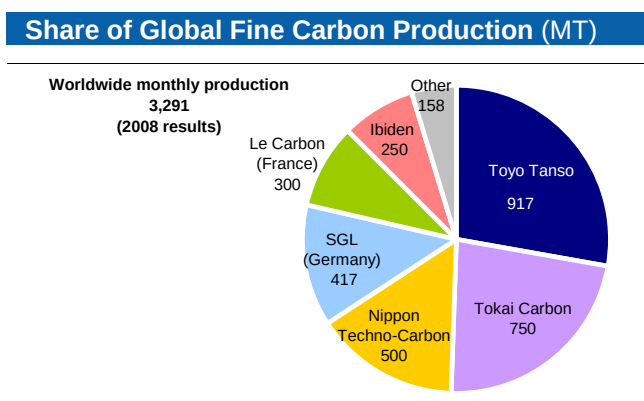
Isotropic Graphite for Solar Cells to Grow in Medium to Long Term

Toyo Tanso manufactures and sells isotropic graphite materials for use in equipment for manufacturing silicon and solar cell wafers. The firm boasts the leading market share for isotropic graphite, as well as a dominant share for graphite products for solar cells. It also received an order for materials for high-temperature gas reactors, the next generation of nuclear reactors, in December 2008.

Conditions in Eco-related Businesses, Outlook

The firm produces crucibles and heaters made of isotropic graphite for use in equipment for making silicon and wafers for solar cells. We estimate its share of the global market is over 50%. The market has grown more than 50% annually over the past two years, but expansion slowed to around 10% after the onset of the financial crisis in 2008. The firm's dependence on Chinese demand (China accounted for roughly 50% of solar cell materials sales through 2Q FY08) is significantly blunting its growth. That said, we think the market should return to its growth trend (30-50% per year) in 2H CY09 given the medium- to long-term growth potential of the solar cell market.

Isotropic graphite products are highly profitable in general, and we estimate that operating profit margins on solar cell materials are 25-30%. The long six- to eight-month manufacturing period for isotropic graphite and high technological entry barriers means the market is dominated by a few major players, chiefly Toyo Tanso, Tokai Carbon (5301), and SGL (Germany). We believe this is one factor supporting wide margins. Aside from graphite solar cell materials, we also have high expectations in the medium to long term for shipments of isotropic graphite materials for high-temperature gas reactors. The firm received an order from the Chinese government for isotropic graphite materials for its high-temperature gas reactor project in December 2008, and full shipments are likely to start from mid-2010. We anticipate strong growth potential and high profitability given that high-temperature gas reactors require large quantities of graphite materials for which the technological entry barriers are extremely high—we think only Toyo Tanso and SGL are capable of manufacturing such materials at present.



Source: Various materials; compiled by DIR.

Investment Indicators (consol)		
Share price	(Y; 8 Jun)	4,160
Market cap	(Y mil; 8 Jun)	86,256
P/E	(X; 5/10 E)	45.4
	(X; 5/11 E)	22.7
P/CF	(X; 5/10 E)	15.1
	(X; 5/11 E)	8.0
EV/EBITDA	(X; 5/10 E)	9.8
	(X; 5/11 E)	5.5
P/B	(X; 2/09)	1.85
Dividend yield	(%; 5/10 E)	0.48

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (Y mil; y/y %)											
	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	DPS (Y)
Consol	5/08	34,531	(10)	8,031	(16)	7,795	(9)	5,143	(16)	247.3	15.00
	5/09 E	29,600	(-14)	4,200	(-48)	3,900	(-50)	2,100	(-59)	101.3	20.00
	5/10 E	27,300	(-8)	3,700	(-12)	3,700	(-5)	1,900	(-10)	91.6	20.00
	5/11 E	36,500	(34)	6,400	(73)	6,400	(73)	3,800	(100)	183.3	20.00

E: DIR estimates.

Rinnai (5947)

Maoki Matsuno/Hiroki Kawashima

Increased Demand for Tankless Water Heaters in US Anticipated

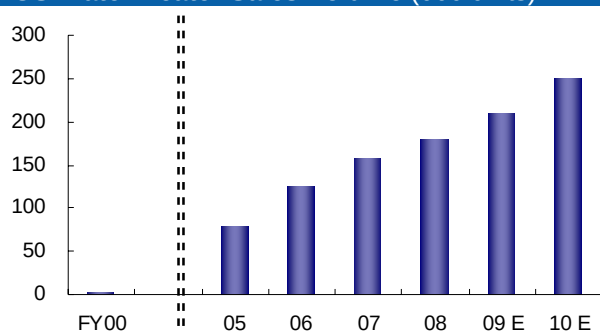
The Energy Policy Act of 2005 ushered in a changeover in demand from storage water heaters to tankless water heaters in the US, and the resumption of a \$300 tax incentive on tankless water heaters in January 2009 supported this trend. In addition, the administration of Barack Obama expanded subsidies in February 2009 to furnish 30% (up to \$1,500) of installment fees (around \$2,000) and the purchase price of tankless water heaters (over \$1,000) meeting government standards for energy savings. Buttressed by these environmental policies, we expect demand for these water heaters to increase in the medium to long term, since they are energy efficient (energy efficiency of over 82% vs. roughly 65% for storage water heaters) and do not run out of hot water.

Conditions of Eco-related Businesses, Outlook

Rinnai America posted FY08 sales of ¥15.2 billion (down 3% y/y; up 11% on local currency basis) and operating profit of ¥1.1 billion (down 9%). With changeover from storage to tankless water heaters underway in the US, sales topped 180,000 units in FY08 (up 14% y/y).

Monthly sales have been on a sharp downtrend since October 2008 as local vendors reduced inventories. However, the firm apparently saw a return to y/y gains in April, thanks to the aforementioned government policies. As a proportion of the entire water heater market (roughly 9 million units), tankless water heaters are projected to increase from 4% in CY08 to 8% in CY11, and are likely to grow even higher over the long term, given the 30% weighting they reached in Australia over nearly a decade.

US Water Heater Sales Volume (000 units)



Source: Company materials; compiled by DIR.
E: DIR estimates.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	4,150
Market cap	(Y mil; 8 Jun)	224,786
P/E	(X; 3/10 E)	20.6
	(X; 3/11 E)	19.4
P/CF	(X; 3/10 E)	11.5
	(X; 3/11 E)	11.1
EV/EBITDA	(X; 3/10 E)	6.9
	(X; 3/11 E)	6.6
P/B	(X; 3/09)	1.65
Dividend yield	(%; 3/10 E)	0.96

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (Y mil; y/y %)

	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	248,761	(6)	15,124	(19)	15,398	(14)	8,269	(32)	152.6	306.9	36.00
	3/09	236,741	(-5)	15,069	(-0)	12,958	(-16)	3,847	(-53)	71.0	240.6	40.00
	3/10 E	229,500	(-3)	17,800	(18)	18,800	(45)	10,900	(183)	201.2	360.0	40.00
	3/11 E	235,100	(2)	18,900	(6)	19,900	(6)	11,600	(6)	214.2	374.8	40.00

E: DIR estimates.

Hirano Tecseed (6245)

Hideaki Teraoka

Seeking New Growth with Li-ion Batteries, Solar Cells

Hirano Tecseed's mainstays are coating and chemical engineering (film deposition) equipment. Looking ahead, we recommend keeping an eye on (1) coating equipment for automotive Li-ion batteries, and (2) sputtering equipment used in CIGS solar cell production as potential growth fields.

Conditions in Eco-related Businesses, Outlook

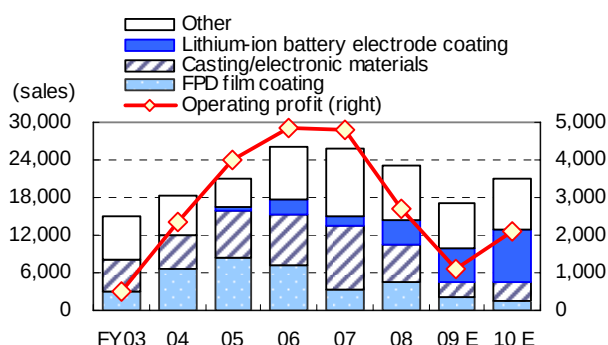
We anticipate meaningful growth in demand for large Li-ion batteries used in electric and next-generation hybrid cars. Hirano Tecseed's coating equipment, used in the production of battery electrodes, coats thin layers of aluminum (positive electrode) and copper (negative electrode) with a variety of solvents. Since the process requires highly precise coating technology, there are few competitors in the field, namely only Inoue Kinzoku Kogyo (6246) and Toray Engineering (unlisted).

Since the end of 2007, Hirano Tecseed has been flooded with requests from dozens of battery makers around the world for trial runs of coating equipment for automotive Li-ion batteries. The firm received an estimated ¥1.4-1.5 billion in orders for such equipment in FY08, and we think these numbers could expand to more than ¥4 billion in FY09, when demand is expected to come fully on stream. Profitability will likely be low at first when engineering costs are high, but should improve with repeat orders.

Solar cell production equipment is developed and manufactured at subsidiary Hirano Koh-On, which began taking orders in earnest in 2008. The subsidiary makes sputtering equipment specialized for the production of CIGS solar cells with plastic film substrates. Its one client placed approximately ¥1.8 billion worth of orders in FY08. While we foresee broader demand going forward, production capacity expansion will be essential for further growth in orders. Hirano Tecseed is training engineers to allow for production at the parent itself, which currently lacks sputtering technology. This should help production capacity double or even triple in FY09.

Earnings look set to erode significantly in FY09 due to a y/y dive in orders for FPD film coating equipment, as well as for ceramic capacitors and other electronic component equipment. However, earnings should recover from FY10, helped by order gains in the two growth areas mentioned above.

Consolidated Sales and Operating Profit (¥ mil)



Source: Company materials, interviews; compiled by DIR.
Note: Breakdown by application based on DIR estimates.
E: DIR estimates.

Investment Indicators (consol)

Share price	(¥; 8 Jun)	970
Market cap	(¥ mil; 8 Jun)	14,603
P/E	(X; 3/10 E)	21.8
	(X; 3/11 E)	11.5
P/CF	(X; 3/10 E)	13.3
	(X; 3/11 E)	8.6
EV/EBITDA	(X; 3/10 E)	4.3
	(X; 3/11 E)	2.6
P/B	(X; 3/09)	0.95
Dividend yield	(%; 3/10 E)	1.24

Source: Compiled by DIR.
EV = market cap + interest-bearing debt – liquidity on hand.
EBITDA = operating profit + depreciation.
E: DIR estimates.

Income Summary (¥ mil; y/y %)

	Year to	Sales		Op profit		Rec profit		Net income		EPS (¥)	CFPS (¥)	DPS (¥)
Consol	3/08	25,732	(-1)	4,797	(-1)	4,824	(-1)	2,935	(2)	192.3	214.0	23.00
	3/09	21,905	(-15)	2,686	(-44)	2,741	(-43)	1,665	(-43)	110.6	139.1	20.00
	3/10 E	17,000	(-22)	1,100	(-59)	1,120	(-59)	670	(-60)	44.5	73.1	12.00
	3/11 E	21,000	(24)	2,100	(91)	2,120	(89)	1,270	(90)	84.4	112.9	15.00

E: DIR estimates.

NPC (6255)

Hideaki Teraoka

Production Equipment Supports Wide Range of Solar Modules

Solar module manufacturing systems accounted for 94% of total FY08 (year ended Aug 2008) sales at NPC. The company's equipment is used in the wiring, lamination and production of crystalline and thin-film solar modules.

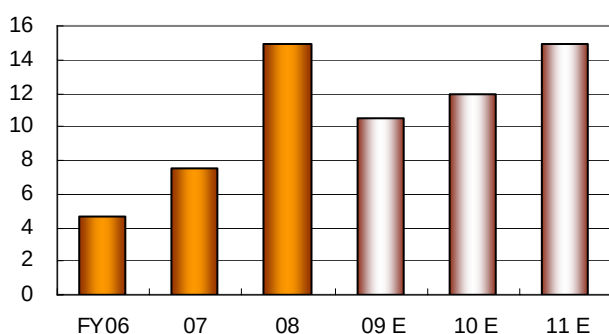
Conditions in Eco-related Businesses, Outlook

With a global share of more than 40%, NPC is the frontrunner in the solar module manufacturing equipment market. It entered the market very early in 1994, pioneering the development of automated module production equipment. To date, it has supplied equipment to over 160 of the roughly 180 solar module makers in the world. In our view, it has three major strengths: (1) it develops, manufactures and sells all of its major equipment for crystalline and thin-film solar cells in house; (2) it draws on its broad customer base to quickly ascertain cutting-edge requirements and reflect them in its offerings; and (3) it offers 24-hour global customer support. Major competitors include Nisshinbo Industries (3105), Swiss firm 3S, German maker Berger, and US company Spire Solar.

Orders for solar module manufacturing equipment grew at a rapid clip through FY08, but declined 27% y/y to ¥5.46 billion in 1H FY09. We attribute this pullback chiefly to the financial crisis and lowered subsidies in Spain and other countries. These negatives are increasingly polarizing the company's client base into two camps—makers that maintain aggressive capex plans and those that are reining in spending due to falling orders or financial difficulties. Since we see no signs of NPC losing market share due to price or quality issues, we believe its competitive edge remains unscathed.

Orders should start edging back up from autumn on benefits from government programs. As we estimate lead times at three to four months for single pieces of equipment and five to seven months for full production lines, we see earnings leveling in FY10 before a recovery kicks in from FY11. While the company does appear to be facing increasing pricing pressure, the consolidated operating profit margin should improve from 17.3% in FY10 (up 0.7 points y/y) to 18.2% in FY11 (up 0.9 points), helped by reduced overhead and other cost reductions as the firm moves production of components in house.

Solar Module Production Equipment Orders (¥ bil)



Source: Company interviews; compiled by DIR.
E: DIR estimates.

Investment Indicators (consol)

Share price	(¥; 8 Jun)	5,170
Market cap	(¥ mil; 8 Jun)	45,302
P/E	(X; 8/10 E)	33.6
	(X; 8/11 E)	28.3
P/CF	(X; 8/10 E)	30.2
	(X; 8/11 E)	25.9
EV/EBITDA	(X; 8/10 E)	16.2
	(X; 8/11 E)	13.7
P/B	(X; 2/09)	6.29
Dividend yield	(%; 8/09 E)	0.10

Source: Compiled by DIR.
EV = market cap + interest-bearing debt – liquidity on hand.
EBITDA = operating profit + depreciation.
E: DIR estimates.

Income Summary (¥ mil; y/y %)

	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	8/09	9,373	(43)	1,386	(68)	1,431	(81)	834	(79)	101.1	112.0	4.0
	8/09 E	14,500	(55)	2,400	(73)	2,370	(66)	1,400	(68)	159.8	173.5	5.0
	8/10 E	13,300	(-8)	2,300	(-4)	2,280	(-4)	1,350	(-4)	154.1	171.2	5.0
	8/11 E	15,100	(14)	2,750	(20)	2,730	(20)	1,600	(19)	182.6	199.7	6.0

E: DIR estimates.

Daikin Industries (6367)

Hirosuke Tai

Edge in Inverter and Heat Pump Technology

Daikin Industries is the third largest air conditioner maker in the world, specializing in ductless air conditioners that are easy on the utility bill. Water chillers, produced in-house, and the home-grown inverters used in its air conditioners mark additional strengths. The firm began selling heating units equipped with its heat pump technology three years ago.

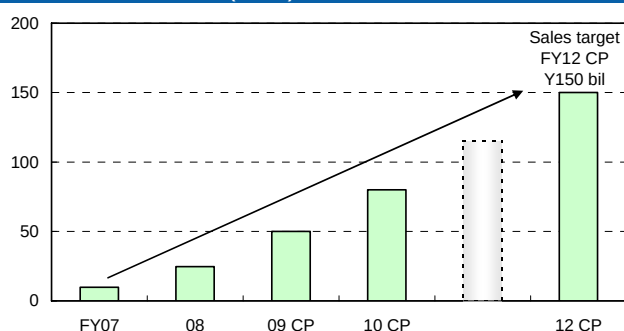
Conditions in Eco-related Businesses, Outlook

Daikin's heating unit business is rapidly expanding. Its heaters are capable of nearly tripling energy input by siphoning heat from lower temperature heat sources such as air or water. Its global market is roughly Y2 trillion, or around Y3 trillion including water heaters. Future growth markets include gas furnaces in North America, hot-water boilers in Europe, and radiant floor heating in China.

Daikin typically markets its heating units as a package system, yielding high margins that benefit the overall product mix. The firm aims to expand its heat pump business by developing heaters and water heaters that are tailored to the specific needs of various regions. Heating unit sales more than doubled from FY07 to FY08 from around Y10 billion to Y24.6 billion, and Daikin is projecting Y50 billion in FY09. Its target for FY12 is Y150 billion.

The firm is also looking to expand its inverter line. Air conditioners equipped with the technology can cut energy needs by 30%, and the firm is looking to double its FY07 sales volume to 5 million units by FY12. It apparently aims to capture a larger share of the home air conditioner market by introducing a low-cost inverter model. It has penned an agreement with Gree Electric Appliances for the joint development of a discount model it can leverage to boost market share in China. Its ambitions extend to the commercial market, where it hopes the development of a highly efficient industrial inverter unit will enable it to enlarge its share.

Altherma* Sales (Y bil)



Source: Company materials; compiled by DIR.

*Heat pump based home heating & hot water system.

CP: Company projections.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	3,190
Market cap	(Y mil; 8 Jun)	931,126
P/E	(X; 3/10 E)	77.6
	(X; 3/11 E)	27.4
P/CF	(X; 3/10 E)	17.6
	(X; 3/11 E)	12.8
EV/EBITDA	(X; 3/10 E)	15.3
	(X; 3/11 E)	11.4
P/B	(X; 3/09)	1.97
Dividend yield	(%; 3/10 E)	1.19

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (Y mil; y/y %)

	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	1,291,081	(42)	128,098	(59)	121,708	(55)	74,822	(65)	262.2	399.0	38.00
	3/09	1,202,419	(-7)	61,394	(-52)	52,007	(-57)	21,755	(-71)	74.5	228.0	38.00
	3/10 E	1,060,000	(-12)	40,000	(-35)	34,000	(-35)	12,000	(-45)	41.1	181.6	38.00
	3/11 E	1,120,000	(6)	70,000	(75)	64,000	(88)	34,000	(183)	116.5	250.1	38.00

E: DIR estimates.

Toshiba (6502)

Masaharu Sato

Nuclear Reactor Operations in Spotlight

In eco-related operations, our focus is on Toshiba's nuclear reactor operations in particular. Other interest areas include LED lighting, and the development and production of SCiB batteries, a new type of rechargeable battery. Given its more significant earnings contribution, the nuclear power business is the focus below.

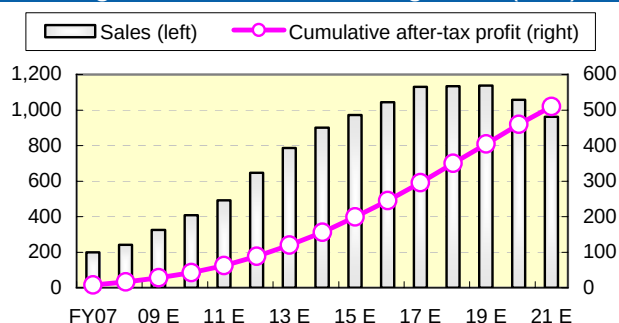
Conditions in Eco-related Businesses, Outlook

In October 2006, Toshiba wrapped up its acquisitions of BNFL USA and UK corporation Westinghouse Electric, both group companies of UK firm British Nuclear Fuels Limited (both referred to collectively as Westinghouse hereafter). The acquisition was valued at \$5.4 billion in total, with Toshiba acquiring a stake of 67% (77% initially) for \$3.8 billion (roughly ¥360 billion). This gave it control over Westinghouse, putting it in the spotlight as a top player in the global nuclear power market. Light water reactors can generally be divided into two types: boiling water reactors (BWR) and pressurized water reactors (PWR). Prior to the acquisition, Toshiba had a track record in BWRs, chiefly in Japan. The addition of Westinghouse makes it one of the few global players offering both PWR and BWR systems.

Prompted by environmental and energy concerns, a slew of new construction projects is under way on the global stage, offering a wide range of business opportunities. In the US, over 32 new plants are in the pipeline, with COL (construction and operation license) applications submitted for 26 of them. China plans to build 50 new plants (one million kW class) by 2020 and several projects are in the planning stages in the UK, Finland, India and other parts of the globe. In this environment, Toshiba is faring well—it has received orders for ten PWR AP1000 reactors (next-generation pressurized water reactors) in the US and China, and it is slated to participate in the South Texas Project for two ABWR reactors (advanced boiler water reactors). It currently anticipates orders for 39 plants worldwide by 2015.

When Toshiba finished acquiring Westinghouse, the two firms each had annual sales of around ¥200 billion. We estimate the operating profit margin at 10%, thanks in part to the current heavy weighting of maintenance services in total sales. An earnings simulation we ran for Westinghouse's nuclear reactor business estimates 2014 sales and operating profit of ¥900 billion and ¥80 billion, respectively, with the latter excluding amortization of fixed intangible assets. That would make the nuclear power business a core operation underpinning Toshiba over the long term. Given the poor visibility on construction starts for new plants and other uncertainties, the earnings model assumed multiple new plant projects every year from 2008 through 2021, for a total of 28 plants. Because of their length, nuclear power plant projects are exposed to a wide range of political risks and other threats, making comprehensive, high-level risk management all the more important.

Earnings Simulation for Westinghouse (¥ bil)



Source: Company interviews; compiled by DIR.
E: DIR estimates.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	359
Market cap	(Y mil; 8 Jun)	1,483,636
P/E	(X; 3/10 E)	NA
	(X; 3/11 E)	21.9
P/CF	(X; 3/10 E)	7.1
	(X; 3/11 E)	3.9
EV/EBITDA	(X; 3/10 E)	8.5
	(X; 3/11 E)	6.7
P/B	(X; 3/09)	2.60
Dividend yield	(%; 3/10 E)	Nil

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (¥ mil; y/y %)

	Year to	Sales		Op profit		Pretax income		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	7,668,076	(8)	238,099	(-8)	255,558	(-14)	127,413	(-7)	39.5	157.2	12.00
(SEC)	3/09	6,654,518	(-13)	-250,186	(loss)	-279,252	(loss)	-343,559	(loss)	-106.2	1.9	5.00
	3/10 E	6,740,000	(1)	23,000	(profit)	-77,000	(loss)	-117,000	(loss)	-28.3	50.3	0.00
	3/11 E	6,985,000	(4)	133,000	(478)	113,000	(profit)	67,800	(profit)	16.4	91.4	6.00

E: DIR estimates.

Note: Net income for FY09 and beyond is that attributable to shareholders of the parent.

Panasonic (6752)

Kazuharu Miura

Focus on All-electric Housing, Including Solar Cells; Strong Share in HEV Batteries

Panasonic's strategy has been to offer eco-friendly solutions for a comprehensive range of home-related needs, selling audio/visual products and white goods through its namesake brand and housing equipment through Panasonic Electric Works (PEW; 6991). Its plans to make Sanyo Electric (6764) into a subsidiary will add solar cell operations to the mix, making for an even greener home strategy. On the hybrid vehicle front, the firm established joint venture Panasonic EV Energy (PEVE) with Toyota in 1996 to provide rechargeable batteries for the *Prius* and the automaker's other major hybrids.

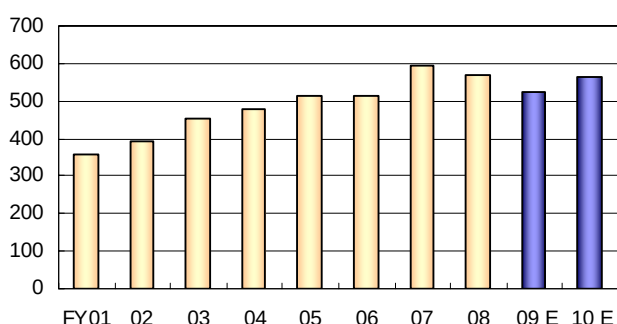
Conditions in Eco-related Businesses, Outlook

The company's all-electric housing line includes *EcoCute* products, which are manufactured by Panasonic and sold through PEW. With a share of roughly 30%, the firm is a frontrunner in the domestic market for these naturally cooled heat pump water heaters. It also leads the domestic IH cooking heater market, commanding a share of slightly more than 50%. The addition of the No. 2 solar cell producer in Japan, Sanyo Electric, will give the Panasonic group a green, comprehensive home business mix. The group's all-electric housing operations likely generated nearly Y100 billion in sales in FY08, a double-digit advance y/y. Adding the Y80 billion top-line showing of Sanyo's solar cell ops raises the total to roughly Y180 billion, representing a sizeable business with strong medium-term growth potential.

Given the resumption of government subsidies for solar power installations from January 2009, we expect the domestic solar cell market to expand 1.7-fold y/y in FY09. Home-use solar systems are likely to be packaged into all-electric housing plans. The Panasonic group boasts a variety of sales channels beyond electronics retailers, including electronic material suppliers and contractor offices, giving it an edge on the sales front.

PEVE (60% owned by Toyota, 40% by Panasonic) supplies rechargeable batteries, chiefly for Toyota's HEV models. Sanyo is a battery supplier for Ford's and Honda's HEVs and the two firms together boast a market share of nearly 100% in HEV NiMH batteries. We estimate FY07 sales at roughly Y90 billion for PEVE and some Y30 billion for Sanyo's automotive battery business, with both businesses in the black. Uptake of Li-ion batteries should take off in the first half of the 2010 decade. Given the strong technological edge both firms have with such batteries, we think Panasonic is poised to become a major player in the automotive Li-ion battery market over the medium term.

Solar Cell & Rechargeable Battery Sales (Y bil)



Source: Compiled by DIR.

Note: Sum total of Panasonic and Sanyo Electric figures.

E: DIR estimates.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	1,331
Market cap	(Y mil; 8 Jun)	2,756,024
P/E	(X; 3/10 E)	NA
	(X; 3/11 E)	55.1
P/CF	(X; 3/10 E)	137.8
	(X; 3/11 E)	8.9
EV/EBITDA	(X; 3/10 E)	9.5
	(X; 3/11 E)	6.1
P/B	(X; 3/09)	0.99
Dividend yield	(%; 3/10 E)	0.75

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (Y mil; y/y %)

	Year to	Sales		Op profit		Pretax income		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	9,068,928	(-0)	519,481	(13)	434,993	(-1)	281,877	(30)	132.9	265.9	35.00
(SEC)	3/09	7,765,507	(-14)	72,873	(-86)	-382,634	(loss)	-378,961	(loss)	-182.3	-25.5	30.00
	3/10 E	7,080,000	(-9)	5,000	(-93)	-155,000	(loss)	-220,000	(loss)	-106.2	9.7	10.00
	3/11 E	7,170,000	(1)	120,000	(NA)	80,000	(profit)	50,000	(profit)	24.1	149.7	10.00

E: DIR estimates.

Note: Net income for FY09 and beyond is that attributable to shareholders of the parent.

Sharp (6753)

Kazuharu Miura

Extensive Solar Cell Track Record

Beginning research in 1959, Sharp has over 50 years of solar cell experience. It began supplying its cells to power lighthouses in 1966, and boasted the top share of the global solar cell market for seven straight years through 2006. A failure to secure enough polysilicon pushed it to number two in 2007, and it came in fourth in 2008. Its annual production capacity is 710 MW, and related sales reached Y157.1 billion in FY08. We think the business is likely to reemerge as a growth driver over the medium to long term.

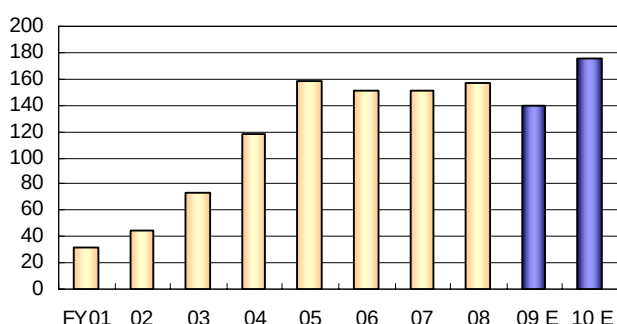
Conditions in Eco-related Businesses, Outlook

Annual solar cell installation volume jumped 52% y/y in 2007 and surged another 86% in 2008, but we expect a much smaller gain of just 4% in 2009. Substantial growth is likely in Japan and the US, but a reduction in energy eligible for feed-in tariffs (from 1,200 MW in 2008 to 500 MW in 2009) is likely to undercut demand in Spain.

Sharp's solar cell sales grew rapidly from FY98 through FY05, climbing more than 40% annually from just under Y10 billion to Y158 billion. However, a burgeoning market has strained polysilicon supply lines, causing Sharp's expansion to stall from FY06. FY08 sales grew 4% y/y to Y157.1 billion as the firm managed to get adequate polysilicon volume amid market growth. In addition, the business was profitable through 1H FY06 with an operating profit margin of around 10%, although solar cell ops swung into the red from FY07 and posted Y16.1 billion in operating losses in FY08.

Although under pressure, Sharp's solar cell business boasts an annual production capacity that ranks among the highest in the world—550 MW of crystalline solar cells, and 710 MW overall counting anticipated contributions from its new thin-film plant (brought on stream in October 2008). Sharp will apparently launch another such plant in FY09 (Sakai, Osaka) with an annual production capacity of 1,000 MW, although initial production plans are for 480 MW. A 360 MW-plant in Europe is also under consideration. With 40 years of mass production experience and products in both crystalline and thin-film lines, Sharp's solar cell operations look well-poised to reemerge as a medium- to long-term earnings driver.

Solar Cell Sales (Y bil)



Source: Compiled by DIR.
E: DIR estimates.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	1,095
Market cap	(Y mil; 8 Jun)	1,205,026
P/E	(X; 3/10 E)	NA
	(X; 3/11 E)	401.7
P/CF	(X; 3/10 E)	6.4
	(X; 3/11 E)	4.4
EV/EBITDA	(X; 3/10 E)	8.0
	(X; 3/11 E)	5.5
P/B	(X; 3/09)	1.16
Dividend yield	(%; 3/10 E)	1.28

Source: Compiled by DIR.
EV = market cap + interest-bearing debt – liquidity on hand.
EBITDA = operating profit + depreciation.
E: DIR estimates.

Income Summary (Y mil; y/y %)

	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	3,417,736	(9)	183,692	(-2)	168,399	(-1)	101,922	(0)	93.2	346.0	28.00
	3/09	2,847,227	(-17)	-55,481	(loss)	-82,431	(loss)	-125,815	(loss)	-114.3	132.4	21.00
	3/10 E	2,522,000	(-11)	-41,000	(loss)	-61,000	(loss)	-61,000	(loss)	-55.4	171.7	14.00
	3/11 E	2,523,000	(0)	35,500	(profit)	15,500	(profit)	3,000	(profit)	2.7	248.1	14.00

E: DIR estimates.

Ferrotec (6890)

Hidemitsu Umebayashi

Makes Silicon Production Equipment for Solar Cells; Plans to Expand Outside China

In FY05, Ferrotec began selling equipment used to grow monocrystalline silicon ingots used in photovoltaic cell production. It also makes quartz glass crucibles, which are used in the production process. In FY08, the company began selling polycrystalline silicon ingot furnaces. Its highly profitable photovoltaic cell businesses sported operating profit margins of 11% in FY07 (8% for entire company) and 15% in FY08 (8%).

Conditions in Eco-related Businesses, Outlook

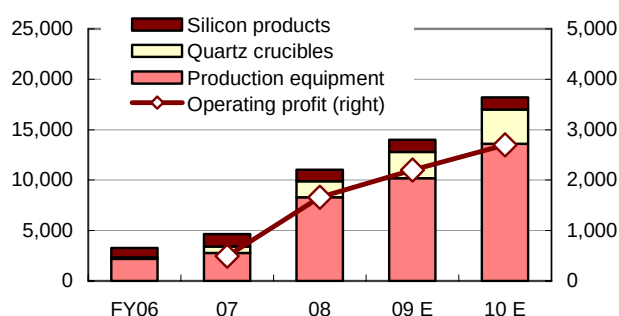
Ferrotec produces and sells practically all of its monocrystalline silicon growing equipment through its China subsidiary (Dec FY-end). Crystalline silicon photovoltaic cells are generally made with polycrystalline silicon. However, monocrystalline versions with high energy conversion efficiency are the standard in China, so the potential market is enormous. In FY08, we estimate the firm sold some 300 monocrystalline silicon furnaces (vs. 105 in FY07), helping it overtake the leading firm in the domestic market. The firm's strengths include (1) in-house production of key components, such as vacuum seals (also used in SPEs; firm has 70% share of market) and (2) its end-to-end production capabilities (it produces everything from components to end products in China).

The company is a latecomer to polycrystalline silicon ingot furnaces. Such equipment does not require vacuum seals, and with production numbers still low, margins are apparently poorer than for monocrystalline silicon equipment. Even then, the firm appears to be off to a reasonably good start, with estimated sales of more than 40 units in FY08, its first year of sales.

We spotlight the firm's quartz glass crucibles—consumables that need to be replaced each time a monocrystalline silicon ingot is produced. In our view, they will probably become a stable source of revenue for Ferrotec. The firm has ramped up mass production in FY08, steadily increasing production since 3Q. Note that Ferrotec is one of the few sector players that provides both the equipment used to grow monocrystalline silicon ingots as well as the quartz crucibles used in their production.

In FY09, Ferrotec will probably see sluggish growth in its photovoltaic cell businesses. As the firm requires a prepayment of 30% on each equipment order, few firms have cancelled existing orders. However, new orders have fallen. Over the medium to long term, crystalline silicon photovoltaic cells will almost certainly become mass-produced, and we expect investment in related equipment to pick up steam now that silicon prices are also falling. Besides China, Ferrotec is considering devoting more resources to the North American and Japanese markets. It has apparently already secured an order from a North American client for 60-70 furnaces (monocrystalline silicon) and related consumables (crucibles), with delivery set for summer 2009.

Sales in Photovoltaic Cell Businesses (Y mil)



Source: Company materials; compiled by DIR.
E: DIR estimates.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	1,149
Market cap	(Y mil; 8 Jun)	24,938
P/E	(X; 3/10 E)	31.2
	(X; 3/11 E)	16.6
P/CF	(X; 3/10 E)	7.8
	(X; 3/11 E)	6.6
EV/EBITDA	(X; 3/10 E)	9.1
	(X; 3/11 E)	7.4
P/B	(X; 3/09)	1.34
Dividend yield	(%; 3/10 E)	1.04

Source: Compiled by DIR.
EV = market cap + interest-bearing debt – liquidity on hand.
EBITDA = operating profit + depreciation.
E: DIR estimates.

Income Summary (Y mil; y/y %)

	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	36,625	(13)	3,057	(34)	2,414	(16)	1,903	(12)	99.3	211.0	12.00
	3/09	36,653	(0)	2,790	(-9)	2,097	(-13)	743	(-61)	34.4	146.4	12.00
	3/10 E	31,300	(-15)	1,500	(-46)	1,100	(-48)	800	(8)	36.9	147.4	12.00
	3/11 E	37,900	(21)	2,500	(67)	2,100	(91)	1,500	(88)	69.1	175.1	12.00

E: DIR estimates.

Kyocera (6971)

Takumi Sado

Solar cells Ops Lucrative; Products Reliable with Top-class Conversion Efficiency

Kyocera is a leading maker of solar cells. It was the first firm to start mass producing polycrystalline silicon solar cells in 1986. The firm is notable for (1) maintaining stable, strong solar cell earnings by handling production at all stages, from ingots to generation systems, (2) the reliability of its products, supported by its long track record in the field, and (3) its consistent leading position in the race to improve conversion efficiencies.

Conditions in Eco-related Businesses, Outlook

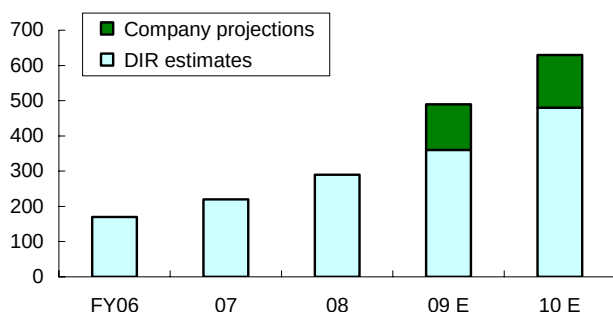
The firm commenced R&D for solar cells in 1975, the pioneer days of solar cell development. Even once the oil shocks ended and wider interest in solar cells receded, the firm beefed up development, including building a plant. In 1982, it started R&D for polycrystalline silicon solar cells, its current mainstays, and in 1984, it built the Solar Energy Center near Narita Airport to which it has invited important persons from around the world and endeavored to enlighten them about solar power. In 1986, it pioneered mass production of polycrystalline silicon solar cells. As a result of this, it was able to cut the price of solar cells from around Y20,000-30,000 per watt of output to around Y1,000/W. In 1987, it broke the contemporary record for conversion efficiency, achieving 15.1% conversion efficiency for a 10 cm² cell. Since then it has consistently set new conversion efficiency records for mass-produced cells.

In FY08, it produced solar cells with total output of 290 MW (up 45% y/y), recording sales of just over Y90 billion. Solar cell sales thus accounted for just over 8% of whole-company sales, while slackness in other businesses meant solar operations apparently made up over half of total business profit (similar to operating profit). That said, sales and profit both slumped in 4Q due to the slowdown in the European market and yen appreciation vs. the euro.

In FY09, the firm plans to produce solar cells with total output of 400 MW (up 38% y/y). Selling prices will likely drop, but the firm hopes to achieve sales growth by limiting the drop in ASPs through the launch of high-efficiency back-contact cells. In FY10, it intends to hike production a further 38% to 550 MW. However, we expect solar cell sales to drop roughly 10% y/y in FY09, mainly in Europe, as we think volume growth will fall short of the company's projections, and we assume more severe selling price declines.

Notably, Kyocera's solar cells have been adopted for the optional solar-powered interior ventilation system on Toyota Motor's (7203) new *Prius* model. The system uses fans driven by electricity generated while the car is parked using solar panels installed on the roof. This will likely have limited impact on earnings, but it warrants attention as a new application for solar cells.

Solar Cell Production Volume (MW)



Source: Compiled by DIR.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	7,660
Market cap	(Y mil; 8 Jun)	1,405,825
P/E	(X; 3/10 E)	61.1
	(X; 3/11 E)	36.8
P/CF	(X; 3/10 E)	15.4
	(X; 3/11 E)	15.1
EV/EBITDA	(X; 3/10 E)	9.9
	(X; 3/11 E)	9.3
P/B	(X; 3/09)	1.06
Dividend yield	(%; 3/10 E)	1.57

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (Y mil; y/y %)

	Year to	Sales		Op profit		Pretax income		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	1,290,436	(1)	152,420	(13)	174,842	(12)	107,244	(1)	566.6	966.1	120.00
(SEC)	3/09	1,128,586	(-13)	43,419	(-72)	55,982	(-68)	29,506	(-72)	157.3	603.7	120.00
	3/10 E	972,500	(-14)	29,000	(-33)	44,000	(-21)	23,000	(-22)	125.3	495.8	120.00
	3/11 E	1,015,000	(4)	48,000	(66)	64,000	(45)	38,200	(66)	208.1	507.8	120.00

E: DIR estimates.

Note: Net income for FY09 and beyond is that attributable to shareholders of the parent.

Nitto Denko (6988)

Takumi Sado

World Leader in Water Treatment Membranes

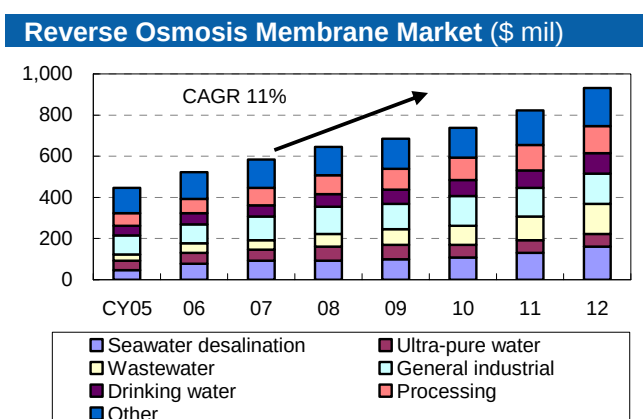
Nitto Denko is a world leader in water treatment membranes, a market we see growing around 11% annually, chiefly due to expanding demand for seawater desalination and wastewater treatment. The firm intends to expand operations beyond sales of treatment membrane elements to include pretreatment and other peripheral technologies as well as maintenance/management services for water treatment plants.

Conditions in Eco-related Businesses, Outlook

Nitto Denko produces reverse osmosis membranes used in water treatment. It has a roughly 30% share of the global market, making it the top player alongside Dow Chemical. Other rivals include Toray Industries (3402), Woongjin Chemical, Koch Membrane Systems, and Toyobo. Reverse osmosis membranes are used in treating water for boilers in power generation systems, semiconductor production, and drinking water, as well as seawater desalination and wastewater treatment. Nitto Denko has particularly large market shares in the last two areas. The global market for reverse osmosis membranes was roughly \$650 million in 2008 (up 10.5% y/y)—despite some fallout from the economic downturn, double-digit growth continued. We expect 11% annual advances going forward, with particularly high growth for seawater desalination and wastewater treatment, the company's strengths.

The firm's water treatment-related business (high-polymer separation membranes) is part of the functional products segment. FY08 high-polymer separation membrane sales were ¥20.7 billion (up 3% y/y). Sales only grew in the single digits due to fallout from the strong yen, while operating profit apparently fell y/y. Even so, the business performed strongly relative to other operations. We forecast sales of ¥22 billion in FY09 (up 6%) and ¥24.5 billion in FY10 (up 11%)—we expect steady double-digit growth excluding impact from foreign exchange rate fluctuations.

Currently, water treatment membrane elements account for almost all sales, but in the long term, the firm plans to expand the business to offer (1) pretreatment technologies, and (2) paid plant maintenance and management services based on long-term contracts. With regards to the former, the firm has established a joint venture with Mitsubishi Rayon (3404), which is strong in hollow fiber filtration technologies. It also plans to launch products for seawater desalination pretreatment. As for the latter, the firm has initiated maintenance and management services based on long-term contracts in Singapore, Spain, and Algeria. In the long term, the firm aims to achieve annual sales of ¥100 billion in the water treatment business based on (1) stronger sales growth than the wider market for reverse osmosis membranes, and (2) contributions from the pretreatment and maintenance/management businesses.



Source: Company materials; compiled by DIR.

Investment Indicators (consol)

Share price	(Y; 8 Jun)	2,835
Market cap	(Y mil; 8 Jun)	472,255
P/E	(X; 3/10 E)	37.2
	(X; 3/11 E)	26.8
P/CF	(X; 3/10 E)	8.1
	(X; 3/11 E)	8.3
EV/EBITDA	(X; 3/10 E)	6.4
	(X; 3/11 E)	6.3
P/B	(X; 3/09)	1.32
Dividend yield	(%; 3/10 E)	1.41

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (Y mil; y/y %)											
	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)
Consol	3/08	745,259	(10)	77,954	(13)	74,468	(11)	46,634	(13)	280.1	578.1
	3/09	577,922	(-22)	13,838	(-82)	14,807	(-80)	267	(-99)	1.6	305.1
	3/10 E	552,000	(-4)	22,200	(60)	21,200	(43)	12,700	(NA)	76.2	352.0
	3/11 E	557,000	(1)	28,700	(29)	27,900	(32)	17,600	(39)	105.7	342.8

E: DIR estimates.

Mitsubishi Heavy Industries (7011)

Hirosuke Tai

Capitalizing on Strong Tech Edge to Branch Out in Many Fields

Mitsubishi Heavy Industries (MHI) manufactures heavy-duty machinery for a wide range of industries, including nuclear power, power systems, aerospace, and industrial machinery. As a leader in green technology, it aims to use cutting edge solutions to enlarge its global footprint. In this report, we focus on its nuclear power, wind power, geothermal power, IGCC (Integrated Gasification Combined Cycle), CCS (Carbon Dioxide Capture and Storage) and CDM (Clean Development Mechanism) efforts.

Conditions in Eco-related Businesses, Outlook

MHI is a major player in PWR nuclear power systems and is developing mid-sized reactors with French company Areva. The firm's nuclear power business has an operating profit margin of around 10% on sales of roughly Y200 billion. Construction of the Tomari No. 3 reactor is near its peak. Overseas efforts focus on North America; the firm is not that interested in China at this juncture.

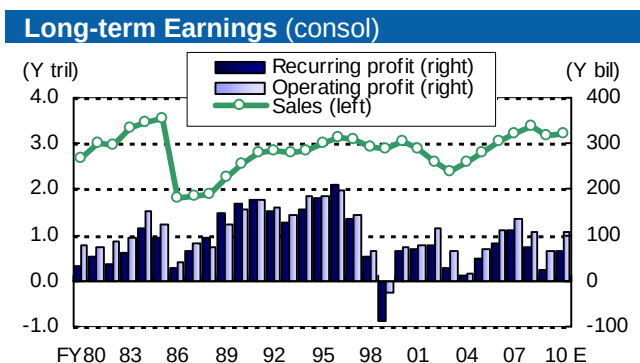
The annual wind turbine market is valued at Y4 trillion, assuming total volume of 20 GW (10,000 units). MHI is the sole manufacturer of large turbines in Japan, specializing in 2,000 kW models. Annual sales are around Y100 billion, and we estimate the operating profit margin is in the upper single digits. It is currently focused on North America. Going forward, it hopes to increase production capacity overseas and pour more resources into offshore windmill development.

MHI has constructed over 100 geothermal power facilities in 12 nations. Facilities are carbon free since they generate energy from heat trapped beneath the earth. MHI is focusing on facility construction and steam turbine supply, but contributions are modest considering the small scale of projects.

The IGCC business built a test plant for Clean Coal Power R&D. This IGCC plant is the first in the world to use highly efficient air-blown gasification technology. Still, earnings contributions have been limited.

MHI has installed five CCS facilities, all for urea producers. Its new focus is coal-fired power plants, but its chief aim is to provide the necessary equipment rather than build the facilities. The business is unlikely to provide a meaningful boost to earnings at this time.

In autumn 2007, MHI signed an agreement with the Ningxia Electric Power Group in China to purchase around 330,000 tons of emission credits over a five-year period (2008-2012).



Source: Company materials; compiled by DIR.
E: DIR estimates.

Investment Indicators (consol)		
Share price	(Y; 8 Jun)	376
Market cap	(Y mil; 8 Jun)	1,261,921
P/E	(X; 3/10 E)	87.0
	(X; 3/11 E)	33.2
P/CF	(X; 3/10 E)	7.7
	(X; 3/11 E)	6.9
EV/EBITDA	(X; 3/10 E)	11.3
	(X; 3/11 E)	9.7
P/B	(X; 3/09)	1.02
Dividend yield	(%; 3/10 E)	1.06

Source: Compiled by DIR.
EV = market cap + interest-bearing debt – liquidity on hand.
EBITDA = operating profit + depreciation.
E: DIR estimates.

Income Summary (Y mil; y/y %)											
	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)
Consol	3/08	3,203,085	(4)	136,030	(25)	109,504	(32)	61,332	(26)	18.3	56.5
	3/09	3,375,674	(5)	105,859	(-22)	75,306	(-31)	24,217	(-61)	7.2	52.8
	3/10 E	3,160,000	(-6)	66,000	(-38)	26,000	(-65)	14,500	(-40)	4.3	49.0
	3/11 E	3,200,000	(1)	105,000	(59)	65,000	(150)	38,000	(162)	11.3	54.5

E: DIR estimates.

Lintec (7966)

Hidemitsu Umebayashi

Maker of Cost Competitive Solar Cell Back Sheets; Large Potential for Market Share Gains

Our focus is on Lintec's solar cell back sheets, which are more cost-competitive than rivals and boast considerable growth potential and high profitability. The strong cost performance they offer points toward substantial upside from the current market share of 15-20%. The products, which we estimate carried an impressive operating profit margin of 20% in FY08, will likely drive profit over the medium to long term.

Conditions of Eco-related Businesses, Outlook

Back sheets are placed on the back of solar cells to protect the glass plate and inner cells. The sheets have to be highly durable (in terms of atmospheric corrosion resistance, water vapor barrier properties, and mechanical strength), able to withstand exposure to sunlight, high temperatures, wind, and rain for 20-30 years. They are used in crystalline, thin-film, and polymer solar cells, but not in dye-sensitized solar cells.

Consolidated US subsidiary Madico manufactures and sells most of Lintec's back sheets. Major clients are solar cell makers in Europe, Asia, and the US. Lintec is ranked number two in the world with an estimated market share of 15-20%. Competitors include Isovolt (Australia; global market share: 30%), Toyo Aluminum (Japan; 15%), Krempel (Germany; 12%), and Mitsubishi Plastics (Japan; 10%).

The firm's back sheets are cheap to produce. Conventional solar cells are triple-layered with expensive fluoride film (DuPont's *Tedlar* PVF film de facto standard) adhered to both sides of a PET film. To save costs, Lintec (Madico) coats the PET film with a fluoride resin, while ensuring the same level of durability. Its products are likely less expensive than rivals', making the firm better positioned to expand its market share amid the growing pricing pressure facing solar cell material makers. Furthermore, Madico is the only mass-producer of back sheets in North America. The subsidiary stands to be a strong beneficiary of US government's investments in the solar power industry and "buy American" trends.

Back sheets accounted for ¥6.1 billion (up 2.4-fold) of Lintec's FY08 sales. Although details are not disclosed, we think the business generated operating profit of ¥1.2 billion, translating to a margin of roughly 20%. Given their growth and profitability prospects, back sheets are a potential profit driver over the medium to long term.

Back Sheet Comparisons					Investment Indicators (consol)		
	Durability	Adhesion	Cost	Suitability for mass production	Share price	(Y; 8 Jun)	1,552
Conventional model (fluoride film based)	Good	Good	Fair	Fair	Market cap	(Y mil; 8 Jun)	117,323
Previous Lintec model	Good	Very good	Very good	Very good	P/E	(X; 3/10 E)	24.4
PET model	Fair	Good	Very good	Very good	P/CF	(X; 3/11 E)	19.9
						(X; 3/10 E)	7.7
						(X; 3/11 E)	7.5
					EV/EBITDA	(X; 3/10 E)	6.1
						(X; 3/11 E)	5.5
					P/B	(X; 3/09)	1.04
					Dividend yield	(%; 3/10 E)	1.29

Source: Various materials; compiled by DIR.

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (Y mil; y/y %)												
	Year to	Sales		Op profit		Rec profit		Net income		EPS (Y)	CFPS (Y)	DPS (Y)
Consol	3/08	202,296	(5)	14,894	(1)	13,279	(-10)	9,308	(-9)	123.2	242.3	24.00
	3/09	194,901	(-4)	8,498	(-43)	5,654	(-57)	3,391	(-64)	44.9	194.2	20.00
	3/10 E	182,300	(-6)	6,700	(-21)	6,100	(8)	4,800	(42)	63.5	202.4	20.00
	3/11 E	195,000	(7)	9,200	(37)	8,600	(41)	5,900	(23)	78.0	206.4	20.00

E: DIR estimates.

Suntech Power (STP US) Pranab K. Sarmah (DIR Hong Kong)

World's Third Largest Solar Cell/Module-Maker

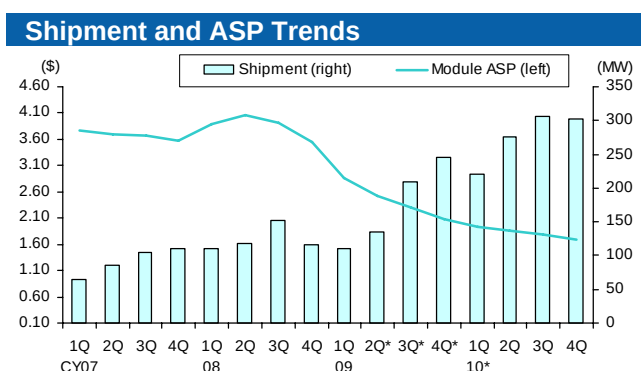
Suntech Power is the third largest solar cell/module maker in the world. Headquartered at Wuxi, China, the company started commercial production in 2002. Suntech's annualized PV-cell/module production capacity reached 1 GW at the end of 2008. It currently has plans to build a new plant in the US.

Conditions of Eco-related Businesses, Outlook

Technology/capacity. Suntech's total 2008 output was 497 MW, accounting for 6.3% of global market share. In 2008, Spain became its largest market and accounted for 37.4% of sales, followed by Germany (29.7%), the US (7.4%) and China (7.0%). In 2007, STP entered the Japanese market and BIPV (building integrated photo-voltaic) products by acquiring MSK, a Japan based BIPV specialist. It started pilot production of high conversion efficient proprietary *Pluto* technology based PV cells in 1H CY09 and plans to commence a-Si based thin-film PV-module production in 2H CY09. STP believes in virtual vertical integration for capital intensive upstream activities and has taken minority stakes in two polysilicon makers (Nitol [Russia] and Hoku [US]). It has acquired two systems companies – one each in Japan and US.

Bottoming out. Revenue and profit have been disappointing since 4Q CY08 due to a sharp decline in demand from Spain, overall demand weakness due to the credit crunch, pricing pressure, and inventory write-downs. We expect shipment and profitability to improve from 2Q CY09 backed by significant cost reductions and increased demand from Europe and China. For 2009, we expect STP's shipments to increase more than 40% y/y to 700 MW. We expect STP's ROE to recover to 15% by 2010 after dropping to below 10% in 2009 and see EPS growing at 28% CAGR between 2008 and 2011.

Investment theses for Suntech are: (1) less volatile margins than peers due to its brand and downstream activities; (2) potential for significant cost reduction from 2010 using *Pluto* cell technology; (3) beneficiary of demand from China, Japan, and the US; and (4) bottoming out of global solar industry from 2Q CY09.



Source: Company materials; compiled by DIR.
* DIR estimates.

Investment Indicators (consol)		
Share price	(\$; 8 Jun)	16.94
Market cap	(\$ mil; 8 Jun)	2,979
P/E	(X; 12/09 E)	31.2
	(X; 12/10 E)	14.7
P/CF	(X; 12/09 E)	NA
	(X; 12/10 E)	11.3
EV/EBITDA	(X; 12/09 E)	16.0
	(X; 12/10 E)	10.9
P/B	(X; 12/08)	2.69
Dividend yield	(%; 12/09 E)	Nil

Source: Compiled by DIR.
EV = market cap + interest-bearing debt – liquidity on hand.
EBITDA = operating profit + depreciation.
E: DIR estimates.

Income Summary (\$ mil; y/y %)										
	Year to	Sales		EBITDA		Net income		EPS (\$)	CFPS (\$)	DPS (\$)
Consol	12/07	1,348	(125)	195	(67)	173	(63)	1.019	0.254	0.000
	12/08	1,923	(43)	178	(-9)	111	(-36)	0.634	1.502	0.000
	12/09 E	1,654	(-14)	248	(39)	85	(-24)	0.543	-0.532	0.000
	12/10 E	2,009	(22)	363	(47)	180	(113)	1.156	1.498	0.000

E: DIR estimates.

RWE (RWE GY)

Ashley Thomas (DIR Europe)

Major Force in European Offshore Wind

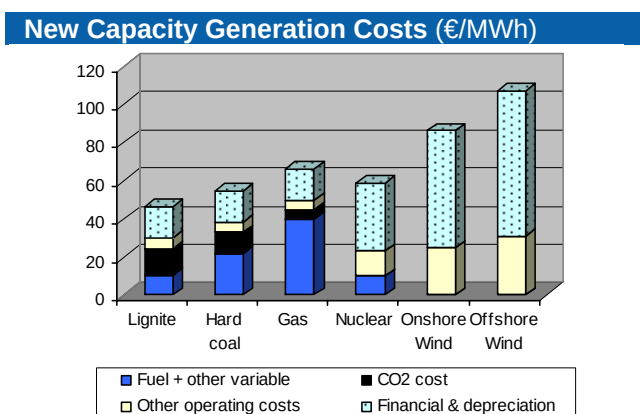
RWE Innogy encompasses the renewable activities of the RWE Group and has 1.3 GW of installed wind, hydro and biomass generation capacity (to increase to 1.8 GW post Essent). Installed capacity is targeted to increase to 4.5 GW by 2012 and over 10 GW by 2020. Management is targeting an increase in divisional EBIT to over €500 million by 2013, up from €55 million in 2008. By 2016 we forecast divisional Innogy EBIT of €1.5 billion on the basis of 6.6 GW of installed capacity.

Conditions of Eco-related Businesses, Outlook

The European onshore wind market, dominated by the Southern Europeans (Iberdrola, Acciona, EDP) is reaching maturity and in certain markets (e.g. Spain) is likely to experience a less favorable regulatory environment. The focus for renewable growth in Europe will shift to the offshore wind market (dominated by the Northern Europeans) – in which RWE is set to become a major operator.

Although offshore wind currently accounts for just 60 MW of current installed capacity, it represents the main source of RWE Innogy's future capacity growth (6.9 GW of the group's 14.6 GW capacity pipeline). The regulatory environment for offshore wind remains favorable with €565 million of EU stimulus funding and an increase in UK offshore subsidies (price and duration) recently announced.

At an estimated capital cost of €2.6 million/MW (which we expect to decline), an operator requires a power price of around €107/MWh to achieve a 7% post tax return – a €45/MWh premium to 2012 German base load prices (as of 12 May). This cost premium is provided through government subsidies – currently equivalent to a total remuneration of around €115/MWh in Germany (for 12+ years) and €150/MWh in the UK (to 2027 under old scheme), resulting in value accretive investments despite lower power prices.



Source: Company materials; compiled by DIR.

Investment Indicators (consol)		
Share price	(€; 8 Jun)	57.90
Market cap	(€ mil; 8 Jun)	30,797
P/E	(X; 12/09 E)	8.6
	(X; 12/10 E)	7.6
P/CF	(X; 12/09 E)	5.0
	(X; 12/10 E)	4.1
EV/EBITDA	(X; 12/09 E)	6.3
	(X; 12/10 E)	5.4
P/B	(X; 12/08)	2.66
Dividend yield	(%; 12/09 E)	5.79

Source: Compiled by DIR.

EV = market cap + interest-bearing debt – liquidity on hand.

EBITDA = operating profit + depreciation.

E: DIR estimates.

Income Summary (€ mil; y/y %)											
	Year to	Sales		EBITDA		EBIT		Net income		EPS (€)	CFPS (€)
Consol	12/07	42,508	(18)	7,915	(10)	6,533	(15)	2,985	(12)	5.3	10.4
	12/08	48,950	(15)	8,773	(11)	6,826	(4)	3,367	(13)	6.3	17.5
	12/09 E	43,376	(-11)	9,280	(6)	7,254	(6)	3,565	(6)	6.7	11.6
	12/10 E	40,646	(-6)	10,783	(16)	8,338	(15)	4,057	(14)	7.6	14.1

E: DIR estimates.

The data contained in this report was taken from statistical services, reports in our possession, and from other sources. The opinions and estimates expressed are our own, and we make no representations either as to the accuracy or as to the existence or non-existence of other facts or interpretations that might be significant. The information herein was gathered from responsible sources but we cannot guarantee its accuracy or completeness.

Issues are rated 1, 2, 3, 4, or 5 as follows:

- 1: Outperform TOPIX/benchmark index by more than 15% over the next six months.
- 2: Outperform TOPIX/benchmark index by 5-15% over the next six months.
- 3: Out/underperform TOPIX/benchmark index by less than 5% over the next six months.
- 4: Underperform TOPIX/benchmark index by 5-15% over the next six months.
- 5: Underperform TOPIX/benchmark index by more than 15% over the next six months.

IMPORTANT

Japan

Daiwa Institute of Research Ltd., and Daiwa Securities SMBC Co. Ltd., are members of the Daiwa Securities Group Inc., and public offerings and/or secondary offerings by the corporations listed below were lead-managed by Daiwa Securities SMBC in the last twelve months (excluding straight bond issues).

List of the Companies as of 1 Jul 2009: Linical (2183); Sobal (2186); Yashima Denki (3153); Toridoll (3397); Zappallas (3770); Tri-Wall (3957); Toshiba (6502); Sumitomo Mitsui Financial Group (8316); Orix (8591); Daiwa Securities Group (8601); T&D Holdings (8795).

Hong Kong

This publication is produced by Daiwa Institute of Research Ltd. and distributed by Daiwa Institute of Research (Hong Kong) Limited and/or its affiliates. This publication and the contents hereof are intended for information purposes only, and may be subject to change without further notice. Any use, disclosure, distribution, dissemination, copying, printing or reliance on this publication for any other purpose without our prior consent or approval is strictly prohibited. Neither Daiwa Institute of Research (Hong Kong) Limited, nor Daiwa Institute of Research Ltd., nor any of its or their respective parent, holding, subsidiaries or affiliate companies, nor any of its or their respective directors, officers, servants and employees, represent nor warrant the accuracy or completeness of the information contained herein or as to the existence of other facts which might be significant, and will not accept any responsibility or liability whatsoever for any use of or reliance upon this publication or any of the contents hereof. Neither this publication, nor any content herein, constitute, or are to be construed as, an offer or solicitation of an offer to buy or sell any of the securities or investments mentioned herein in any country or jurisdiction nor, unless expressly provided, any recommendation or investment opinion or advice. Any view, recommendation, opinion or advice expressed in this publication may not necessarily reflect those of Daiwa Institute of Research (Hong Kong) Limited, except where the publication states otherwise.

Daiwa Institute of Research (Hong Kong) Limited, its parent, holding, subsidiaries or affiliates, or its or their respective directors, officers, servants and employees may have positions in or may be materially interested in the securities in any of the markets mentioned or may have also performed investment banking and other services for the issuers of such securities.

Singapore

This research report is distributed to accredited investors, expert investors and institutional investors only. Recipients of this research report in Singapore may contact Daiwa Institute of Research (Singapore) Pte Ltd in respect of any matter arising from or in connection with this research.

United Kingdom

This material was produced by Daiwa Institute of Research Ltd., and is distributed by Daiwa Securities SMBC Europe Limited which is regulated by The Financial Services Authority and is a member of the London Stock Exchange. Daiwa Securities SMBC Europe Limited may, from time to time, to the extent permitted by applicable UK law and other applicable law or regulation, participate or invest in other financing transactions with the issuers of the Securities referred to herein (the "Securities"), perform services for or solicit business from such issuers, and/or have a position or effect transactions in the Securities or options therefore and/or may have acted as an underwriter during the past three years for the issuer of such Securities. In addition, employees of Daiwa Securities SMBC Europe Limited and its affiliate may have positions and effect transactions in such Securities or options and may serve as directors of such issuers. Daiwa Securities SMBC Europe Limited may, to the extent permitted by applicable UK law and other applicable law or regulation, effect transactions in the Securities before this material is published to recipients.

This document is intended for investors who are not Private Customers within the meaning of the Rules of The Financial Services Authority and should not, therefore, be distributed to Private Customers in the United Kingdom. This document is not to be used or considered as an offer to sell or solicitation of an offer to buy any Securities. Information and opinions contained herein have been compiled or arrived at from sources believed to be reliable, but neither Daiwa Securities SMBC Europe Limited and/or its affiliates accepts liability for any loss arising from the use hereof or makes any representation as to their accuracy or completeness. Any information to which no source has been attributed should be taken as an estimate by Daiwa Institute of Research Ltd. This document is not to be relied upon as such or used in substitution for the exercise of independent judgment. Should you enter into investment business with any Daiwa Securities SMBC Europe Limited affiliate outside the United Kingdom, we are obliged to advise that the protection afforded by the United Kingdom regulatory system may not apply; in particular, the benefits of the Financial Services Compensation Scheme may not be available.

Germany

This document has been approved by Daiwa Securities SMBC Europe Ltd and is distributed in Germany by Daiwa Securities SMBC Europe Ltd, Niederlassung Frankfurt which is regulated by BaFin (Bundesanstalt fuer Finanzdienstleistungsaufsicht) for the conduct of business in Germany.

North America

This report was prepared by Daiwa Institute of Research ("DIR"), a Japanese company. It may not be accurate or complete and should not be relied upon as such. It reflects the preparer's views at the time of its preparation, but it is provided with a time delay and does not reflect events occurring after its preparation. The preparer has no obligation to update this report or to continue to prepare research on this subject. This report is not an offer to sell or the solicitation of any offer to buy securities. Unless this report says otherwise, any recommendation it makes is risky and appropriate only for sophisticated speculative investors able to incur significant losses. Readers should consult their financial advisors to determine whether any such recommendation is consistent with their own investment objectives, financial situation, and needs.

This report does not recommend to U.S. recipients the use of Daiwa Securities SMBC or its non-U.S. affiliates to effect trades in any security and is not supplied with any understanding that U.S. recipients will direct commission business to such entities. Unless applicable law permits otherwise, non-U.S. customers wishing to effect a transaction in any securities referenced in this material should contact a Daiwa entity in their local jurisdiction. U.S. customers wishing to obtain further information or effect transactions in any securities mentioned in this report should contact Daiwa Securities America Inc. ("DSA"), Financial Square, 32 Old Slip, New York, New York 10005 (telephone 212-612-7000).

Ownership of Securities. DSA and its affiliates beneficially own one percent or more of a class of common equity securities of the following issuers: Alpha Corporation; Bel Co., Ltd.; Cabin Co. Ltd.; Daiko Denshi Tsushin Ltd.; Daiwa Seiko, Inc.; Daiwa SMBC Capital Co. Ltd.; Ehime Bank Ltd.; Fuji Television Network, Inc.; GDH KK; Imperial Hotel, Ltd.; Japan Securities Agents, Ltd.; Japan Securities Finance Co. Ltd.; Kokusai Densetu Co., Ltd.; Maruzen Company, Limited; Meisei Electric Co., Ltd.; Mitsui Mining Co. Ltd.; Nomura Co., Ltd.; Shinkin Central Bank; Sumitomo Mitsui Construction Co. Ltd.; Taito Corporation; The Blackstone Group LP.

Investment Banking Relationships. DSA or an affiliate has managed or co-managed a public offering of securities in the past 12 months, or has received compensation for investment banking services in the past 12 months, or expects to receive or intends to seek compensation for investment banking services in the next three months, for or from the following issuers: ABN Amro; Abu Dhabi Commercial Bank; ACCA NETWORKS CO. LTD.; Advance Create Co. Ltd.; Aeon Mall Co. Ltd; Air Liquide Finance; Air Water Inc.; Airgas Inc.; Ajinomoto Co. Inc.; Albany International Corp.; Albemarle Corporation; Alcoa Inc.; Alpha Credit Group, Inc.; AMB Properties Corp.; American Honda Finance Company; American International Group; Amgen Inc.; Anglo American Capital; ANX National International; ANZ National International London; Apamanshop Co. Ltd.; Aramark Services; Art Corporation; ASB Bank Ltd.; Ascot Corp.; Asian Development Bank; ASIF; Asset Investors Co. Ltd.; Australia and New Zealand Banking Group Ltd.; AutoNation; AviChina Industry and Technology Company Limited; Avis Budget Car Rental, LLC.; Azko Nobel; Balls Corp.; Banco BPI S.A.; Banco BPI SA Cayman; Banco Guipuzcoano; Bank Nederlandse Gemeenten NV; Bank of Austria Creditanstalt; Bank of Nova Scotia Ltd.; Bank of Western Australia; BAT International Finance; Bayer Holdings Japan LLC; Bayerische Landesbank; BBVA Senior Finance SA; BCP Finance Bank; Belo Corp.; Bemis Corp.; BHP Finance USA Ltd.; BHW Bausparkasse AG; Biofermin Pharmaceutical Co. Ltd.; BMW Finance BV; BNP Paribas; BNZ INTERNATIONAL FUNDING LTD; Boeing Co.; Boise Cascade Corporation; BOS International Australia Ltd.; Boston Scientific Corp; Bradford & Bingley; Brunswick Corp.; BSK; Bunadarbank Islands; Caixa D'estalvis Catunum; Caja Duero; CAM Global Finance; Canadian Imperial Bank; Canadian Oil Sands; Capmark Financial Group Inc.; Cargill Inc.; Casio Computer Co., Ltd.; CBS Corp.; CCS Inc.; Cedant Timeshare; Central Japan Railway Co.; CFF; China Automation Group Limited; China Kangda Food Co. Ltd.; China Minsheng Banking; China Resources Power Holdings Co.; China Taisan Technology Group Holdings Ltd.; China Zhongwang Holdings Ltd.; Choushinmaru Co. Ltd.; Chubu Electric Power Co. Inc.; Chuo Mitsui Trust Holdings Inc.; Cigna Corp.; Citigroup Global Markets; Clear Channel Communications; CMS Energy; Coca-Cola Amatil Limited; Commonwealth Bank of Australia; ConocoPhillips; Consumers Energy Company; Cooperative Centrale Raiffeisen-Boerenleenbank; Cox Communications Inc.; CS Group Finance; CVS

Corporation; DA Office Investment Corp.; Dah Sing Bank; Daido Steel Co., Ltd.; Daiken Medical Co. Ltd.; Daimler Chrysler; Daiwa Securities Group Inc.; Daiwa Seiko, Inc.; DANSKE BK A/S; Dekabank; Densan System Co. Ltd.; Depfa ACS Bank; Depfa Bank plc.; Depfa Deutsche Pfandbriefbank AG; Deutsche Apotheke Aerztebank; Deutsche Bahn Finance BV; Deutsche Bank AG; Deutsche Bank Aktiengesellschaft; Deutsche Bank Capital Finance Trust; Deutsche Bank Finance; Dexia Credit Local; DNB NOR BANK ASA, OSLO; Dow Chemical Company; Dydo Drinco, Inc.; E.ON International Finance BV; East Japan Railway Co.; EFG Hellas plc.; Egnatia Finance; Eksportfinans A/S; Electric Power Development Co., Ltd.; Encore Acquisition Company; Eneserve Corp.; Eurofima; Eurohypo AG.; Expedia Inc.; Export Development Canada; Fedex Corp.; Finconsumo SPA; Ford Credit Australia Limited; Ford Motor Company; Ford Motor Credit Company; FPL Group Capital Inc.; Freddie Mac; Frontier Oil Corp.; Frontier Real Estate Investment Corp.; Fuji Electric Co. Ltd.; Fuji Food System Co. Ltd.; Fujikura Kasei Co., Ltd.; Fukuoka REIT Investment Fund; Gannett Co. Inc.; General Electric Capital Corporation; General Electric Corporation; General Mills; Georgia Pacific Corp.; GM; GMAC; Goldman Sachs Group Inc.; GOME Electrical Appliances Holdings Ltd.; Gree Inc.; Hana Financial Group; Hankyu Hanshin Holdings Inc.; Harrah's Entertainment Inc.; Harrah's Inc.; Harrah's Operating Company; Hartford Financial Services Group; HBOS Treasury Service; HCA Inc.; Hellenic Bank; Hertz Corp.; Hokkaido Electric Power Co. Inc.; Hokuriku Electric Power Co.; Home Shopping Network; Hoshizaki Electric Co. Ltd.; HSH N Finance; HSH Nordbank AG; Humana Inc.; Husky Energy Inc.; Hypo Real Estate International; IDEA International Co., Ltd.; IKB Finance BV; Instituto de Credito Oficial; International Business Machine Corp; International Elite Ltd.; International Finance Corp.; International Hotel Group; Intesa Bank Ireland plc.; Ishikawajima-Harima Heavy Industries Co., Ltd.; Islandsbanki FBA; Islandsbanki FBA HF; Japan Tobacco Inc.; JFE Holdings Inc.; Jowa Holdings Co. Ltd.; J-Product Corp.; Kansai Electric Power Co.; Kaupthing Bunadarbanki HF; KBC IFIMA NV; KDDI Corp.; Keio Corp.; Keio Electric Railway Co. Ltd.; Kennedy-Wilson Japan; KFW Bankengruppe; KFW International Finance; KGaA; Kinder Morgan Energy Partners LP; Kinki Nippon Railway Co. Ltd.; Kintetsu Corp.; Komatsu Ltd.; Kommunalbanken AS; Kommunalbanken Norway; Kommuninvest I Sverige; Korea Gas Corporation; Korea National Housing Corporation; KT Corp.; Kuraudia Co. Ltd.; Kyushu Electric Power Co. Ltd.; Lakshmi Vilas Bank; Landeskreditbank BW Foerdebank; Landsbanki Islands HF; Landwirtschaftliche Rentenbank; LBHI MTNG; LG Card Co. Ltd.; LG Electronics Inc.; Li Ning Company Ltd.; Linical Co. Ltd.; Link And Motivation Inc.; Lite-On Technology Corp.; Lotte Shopping; Louis Vuitton Moet-Hennessy; Macquarie Bank Ltd.; Makino Milling Machine Co. Ltd.; Marathon Oil Corp.; Maruzen Co. Ltd.; MasterCard Incorporated; McDonalds Corp.; Meadwestvaco Corp.; MediciNova Inc.; Meisei Electric Co. Ltd.; Metlife Inc.; MGM Mirage Inc.; Millennium America; Mitsubishi Corp.; Mitsubishi Estate Co. Ltd.; Mitsubishi UFJ Financial Group Inc.; Mitsubishi UFJ Trust and Banking Corp.; Mitsui & Associates Telepark Corp.; Mitsui OSK Lines Ltd.; Mitsui-Soko Co. Ltd.; Miyachi Technos Corp.; Mizuho Corporate Bank Ltd.; Mizuho Trust & Banking Co. Ltd.; Morgan Stanley; NACF; Nankai Electric Railway Co. Ltd.; Natexis; National Australia Bank Ltd.; National Bank of Canada; National Grid Co. Plc.; National Rural Utilities Cooperation Finance Corp.; Nationwide Building Society; NEC Corp.; Nederlandse Waterschapsbank NV; Nestle Australia Limited; NIB Capital Bank; Nichirei Corp.; Nikko Citigroup; Nippon Broadcasting System, Inc.; Nippon Express Co. Ltd.; Nippon Life; Nippon Life Insurance; Nippon Restaurant Corp.; Nippon Sanso Corp.; Nippon Telegraph & Telephone Corp.; Nippon Unipac Holding; Nishi-Nippon Railroad Co. Ltd.; Nitto Denko Corp.; Noritz Corp.; Northern Rock Plc.; NRW Bank; NTT Data Corp.; NTT DoCoMo Inc.; NTT Finance Corp.; NTT Leasing; NYSE Group Inc.; Oceanus Group; Odakyu Electric Railway Co. Ltd.; Okamura Corp.; OKO Bank plc.; Okuma Holdings Inc.; Oracle Corp.; ORIX Corp.; Osaka Gas Co. Ltd.; Overnight Corporation; Peoples Insurance Company of China; Pfizer Inc.; PHH Corp.; Polar Tankers INC.; Post Properties, Inc.; Prologis; Rabo Australia Ltd.; Rabobank Nederland; Radishbo-ya Co. Ltd.; RAKIAS SUKUK Co. Ltd.; Rann International; Ras Al Khaimah Investment Authority Sukuk Inc.; Regency Centers Corp.; Reins International Inc.; Resona Bank Ltd.; Ricoh Co. Ltd.; Right On Co. Ltd.; Rinnai Corp.; Rio Tinto Finance; Royal Bank of Canada; Royal Bank of Scotland; Sabre Holdings; Sanden Corp.; Sanken Electric Co. Ltd.; Santander International; Sanyo Shinpan Finance Co. Ltd.; Sapporo Breweries Ltd.; Scientific Games Corp.; SEIGAKUSYA Co. Ltd.; Seven & I Holdings Co., Ltd.; Severn Trent Water; Sharp Corp.; Shikoku Electric Power Co. Inc.; Shinhan Financial Group Ltd.; Shinsegae Co. Ltd.; Sihuan Pharmaceutical Holdings Group Ltd.; SK Corporation; SNS Bank Nederland; Sobal Corp.; Sockets Inc.; Softbank Corp.; Sojitz Corp.; Solargiga Energy Holdings Ltd.; Sparebanken Rogaland; Spectra Energy; St George Bank Ltd.; Stanley Electric Co. Ltd.; State of North Rhine-Westphalia; Sumito Mitsui Financial Group Inc.; Sumitomo Chemical Co. Ltd.; Sumitomo Electric Industries Ltd.; Sumitomo Metal Industries Ltd.; Sumitomo Mitsui Banking Corp.; Sumitomo Mitsui Financial Group Inc.; Sumitomo Osaka Cement Co. Ltd.; Sumitomo Rubber Industries Inc.; Sun Frontier Fudousan Co. Ltd.; Suncor Energy Inc.; Suntory Ltd.; Svensk Exportkredit AB; T&D Holdings Inc.; Tac Co. Ltd.; Talisman Energy; TDK Corp.; Telefonica Emisiones; Telstra Corp. Ltd.; Terna spa; The Bank of Tokyo-Mitsubishi Ltd.; The Bank of Yokohama Ltd.; The Chiba Bank Ltd.; The Chugoku Electric Power Co., Inc.; The Eighteenth Bank Ltd.; The Kansai Electric Power Co. Inc.; The Nisshin Oillio Group Ltd.; The Norinchukin Bank; The Okinawa Electric Power Co. Inc.; The Sumitomo Trust & Banking Co. Ltd.; Ticketmaster; Time Warner Cable; Tobu Railway Co. Ltd.; Toho Gas Co Ltd.; Tohoku Electric Power Co. Inc.; Tokyo Electric Power Co.; Tokyu Store Chain; Toll Brothers; Top Engineering Co. Ltd.; Toridoll Corp.; Total Capital SA; Toyo Tire & Rubber Co. Ltd.; Toyota Credit Canada, Inc.; Toyota Finance Australia Ltd.; Toyota Finance Corp.; Toyota Industries Corp.; Toyota Motor Credit Corporation; Tri-Stage Inc.; Tri-Wall KK; Tyson Foods; UBS AG; UBS Jersey; UBS Preferred Funding Trust; Unicredito Italiano; Uni-President Enterprises Corp.; United Technologies; United Urban Investment Corp.; US Cellular Corp.; US Steel Corp.; Valor Co. Ltd.; Venture Republic Inc.; Verite Co. Ltd.; Verizon Global Funding Corp.; Viacom Inc.; Volkswagen International Finance NV; Vornado Realty Trust; Wellpoint Inc.; West Japan Railway Co.; Westpac Banking Corporation; Whirlpool Corp.; William Street Funding; Woori Finance Holdings Co. Ltd.; Wuerttembergische Versicherung; Xcel Energy, Inc.; Yashima Denki Co. Ltd.; Zappallas Inc.

The statements in the two preceding paragraphs are made as of June 1, 2009.

DSA Market Making. DSA made a market in securities or ADRs of the following issuers at the time this report was published: FUJIFILM Holdings Corp.; Internet Initiative Japan Inc.; Makita Corp.; MediciNova Inc.; Mitsui & Co. Ltd.; Nissan Motor Co. Ltd.; Wacoal Holdings Corp.

Research Analyst Conflicts. The principal research analysts who prepared this report have no financial interest in securities of the issuers covered in the report, are not aware of any material relevant conflict of interest involving them or DSA, except as noted: no exceptions.

Research Certification. The views about any and all of the subject securities and issuers expressed in this Research Report accurately reflect the personal views of the research analyst(s) primarily responsible for this report (or the views of the firm producing the report if no individual analyst[s] is named on the report); and no part of the compensation of such analyst(s) (or no part of the compensation of the firm if no individual analyst[s] is named on the report) was, is, or will be directly or indirectly related to the specific recommendations or views contained in this Research Report.