Industry Overview

Equity | Pan-Euro | Renewable Energy
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Geothermal – smoke on the water

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Geothermal is expensive and unreliable, like all renewables

Geothermal is a cheap, reliable, low maintenance, long lifetime energy source, or at least that's the theory. In reality, geothermal costs much more than US natural gas and recent history has been littered with technical problems. A well functioning geothermal plant can produce base load power with an 85% load factor at a cost around $85/MWh. This is expensive relative to US natural gas, but reasonably competitive with diesel generators used in some emerging markets. Wind has a similar generation cost to geothermal but this does not reflect the extra backup capacity needed due to manage wind intermittency.

A niche technology suited to specific sites

There is currently only 11GW of geothermal capacity installed, providing about 0.4% of global electricity production. This compares to 220GW of wind capacity and 40GW of solar, although load factors are radically different. Geothermal needs to be sited in very specific geological conditions, which tend to coincide with tectonic plate boundaries. The biggest global opportunities appear to be in Indonesia, Chile, Philippines, Kenya, Turkey and the US. We estimate around 500MW of geothermal capacity will be added annually through 2015.

EGS could be a game changer but a decade away

Enhanced Geothermal Systems (EGS) could significantly widen the number of suitable sites. EGS artificially engineers a reservoir in a process similar to shale gas fracking. The technology is 5-10 years from commercial rollout but there are now feed in tariffs around €200/MWh in Germany and France to facilitate pilot projects. Although technical progress so far has been slow, the International Energy Agency thinks 100GW of EGS could be installed by 2050.

European company exposure – EGP the main player

Enel Green Power (XENLF,€1.74, C-1-7) has a long history in geothermal as Italy was a pioneer in the technology. EGP currently has 775MW of installed geothermal capacity and expects to add 150MW more by 2015, representing 13% of the company's capex spend during this period. The recent decision to acquire control of its LaGeo subsidiary in El Salvador could accelerate the pipeline development in our opinion. We have a Buy rating and €1.95 PO. Elsewhere, International Power recently announced a 35% stake in a 220MW project in Indonesia which we believe is the company's first foray into geothermal.

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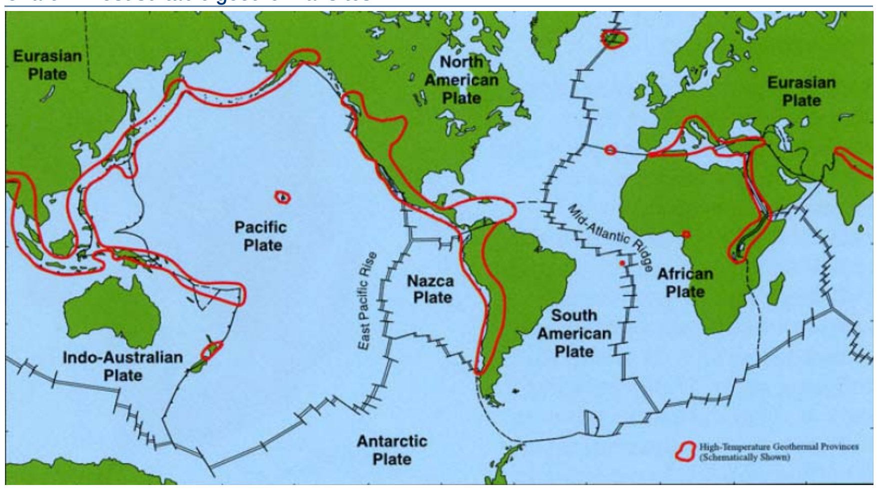
Geothermal 101

The word geothermal comes from the Greek words geo (earth) and therme (heat). Geothermal activity occurs when a fluid trapped in an underground reservoir is heated by the earth and reaches the surface through fractures or man-made wells. The first geothermal power plant was built in Lardellero, Italy in 1904 but remains a rather niche technology. Today, there is only 11GW of installed capacity, contributing 0.4% to global electricity production. The IEA believe this could rise to 200GW in 2050 through technological improvements and broader subsidy support.

Location, location, location

The most active geothermal resources are usually found along major plate boundaries such as the 'ring of fire' in the Pacific Ocean as the attrition between continents generates heat. Most magma does not reach the earth's surface but heats large regions of underground rock. Rainwater can seep down fractured rocks and after being heated, can return to the surface as steam in the form of a geyser or hot spring as seen in Iceland and Yellowstone National Park.

Chart 1: Most suitable geothermal sites

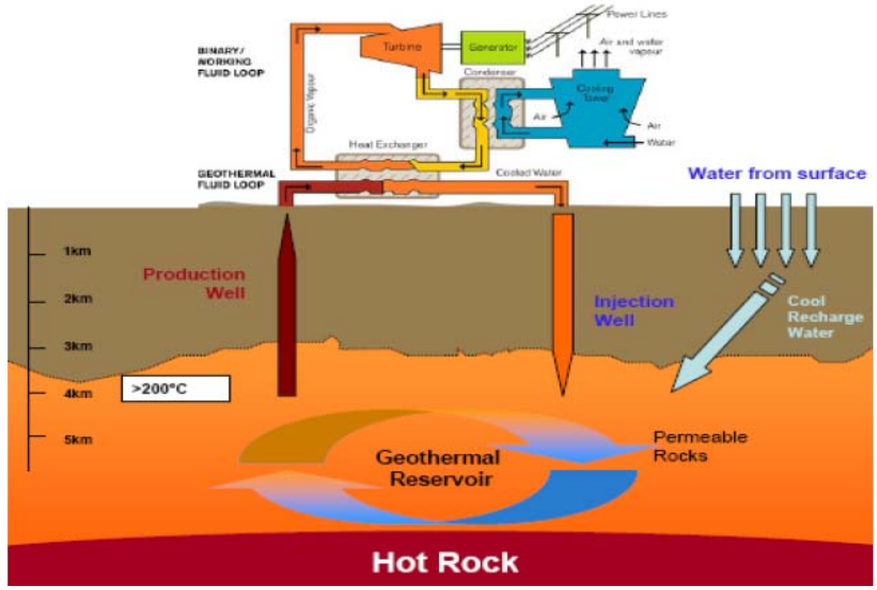


Source: University of Utah

A 'well' engineered idea

Alternatively, the hot water can be trapped under a layer of impermeable (cap) rock and a geothermal reservoir can form. Water trapped within reservoirs can reach temperatures of 700F/370c. Wells are drilled into the geothermal reservoir to bring the very hot water (brine) to the surface. Within the power plant (see Chart 2), the steam is condensed by evaporation in the cooling tower. Like all steam turbines, the force of steam spins the turbine blades which in turn spin the generator, producing electricity. The cooled water is then re-injected into the well to prevent resource depletion. The diagram below is rather simplistic as a geothermal plant will have multiple wells, with about 5MW of capacity per well. Average plant size ranges from 20MW to 300MW depending on the quality of the resource and land constraints.

Chart 2: Geothermal reservoir and binary power plant



Source: Ormat

A journey to the centre of the earth

The geothermal gradient is the rate at which the temperature of the soil increases with depth. In certain parts of the world, especially in rift valleys or volcanic regions, this gradient may be higher due to magma flowing deep within the fractures. Geothermal wells can vary substantially in depth but are commonly 2-4,000m. More recently, the development of binary technology has allowed economical extraction of wells just 500m deep.

Development time line

The development time for geothermal power is about 5 years. The construction time is 2-3 years but the preliminary resource assessment can take a similar length of time before construction starts or even longer if there are unforeseen issues in the permitting process.

The expenditure and time spent to evaluate a geothermal site before full construction is greater than compared to wind or solar. The preliminary work in geothermal is to drill 2-3 wells to check the quality and stability of the resource. The first well is drilled only about 200 feet deep using a truck mounted rig to determine the temperature and its volatility. The initial well will also provide feedback on the underground rock types and how challenging it will be to drill much deeper for the full well.

Geothermal projects are difficult to finance because of large up front capital costs and high risk as many test wells prove unsuccessful and each well costs several million dollars to drill. This initial phase tends to be financed with equity because banks want (1) proof of resource and/or (2) a signed offtake contract (power purchase agreement) before lending debt to the project. After the credit crisis of 2008, lending standards have tightened and many small geothermal developers have struggled to develop their prospective projects.

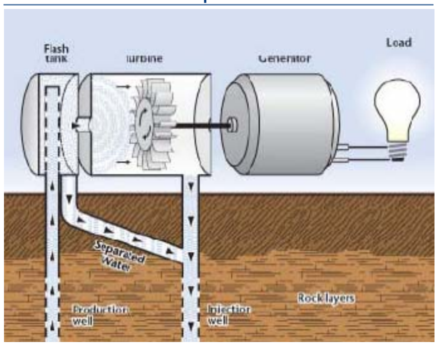
Technology depends on resource quality

There are three main types of geothermal plant technology and the decision on which to use is primarily driven by the characteristics of the available resource such as depth and reservoir temperature. The most common technology uses high temperature to power flash type plants but some markets are moving into new binary technologies that can perform at lower temperatures.

Flash steam – most common technology and tends to be used in reservoirs of water with very high temperatures. The hot water flows up through wells in the ground under its own pressure. As it flows upward, the pressure decreases and some of the hot water boils (flash) into steam.

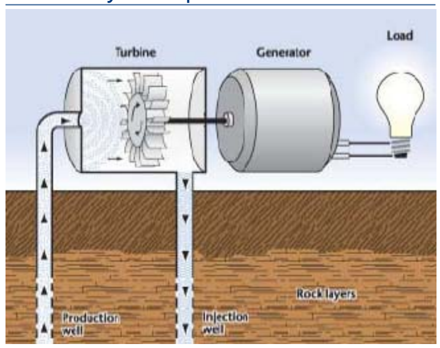
Dry steam – is the simplest plant design and usually the cheapest. Directly utilises steam drawn from an underground resource such as a geyser. Is the least flexible technology in terms of location.

Chart 3: Flash steam plant



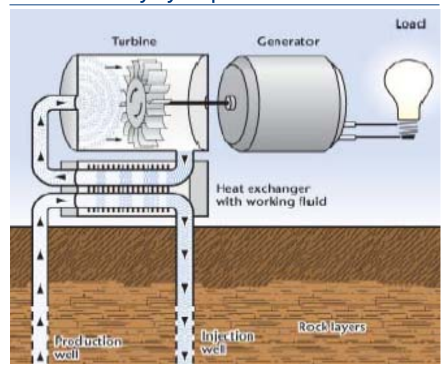
Source: NREL

Chart 4: Dry steam plant



Source: NREL

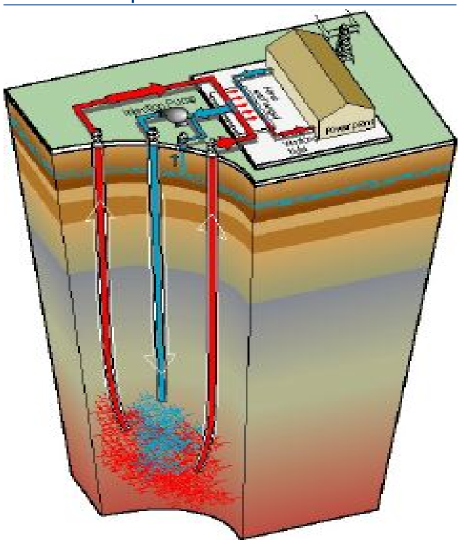
Chart 5: Binary cycle plant



Source: NREL

Binary steam – A relatively new form of technology designed for lower temperatures (<200c). Binary cycle plants use the heat from hot water to boil a working fluid with a lower boiling point within a heat exchanger. Binary plants tend to be more 10-20% expensive to construct and operate than Flash or Dry Steam.

Chart 6: EGS plant



Source: US Department of Energy

EGS – a potential game changer but a decade away

Enhanced Geothermal Systems (EGS) - involves artificially creating permeability in ‘hot rock’ and inducing water to extract the heat. The water is injected at sufficient pressure to ensure fracking, much the same way as hydraulic fracking used in the extraction of shale gas. The simplest models have one injection well and two production wells (see Chart 6) which will circulate the heated water back above surface to the turbine. While there are some small (<10MW) pilot plants, the technology is still a decade away from being commercially rolled out. A significant hurdle appears to be monitoring where the reinjected water is going.

Should EGS prove successful then the potential number of suitable sites for geothermal energy would increase exponentially. A US Department of Energy study concluded that there was 100GW of domestic geothermal resource, if EGS could be commercialised. Countries with no previous development of geothermal energy such as France and Germany have pilot EGS projects underway. It is too early to assess the cost of EGS given the limited installed capacity but the €150-200/MWh feed in tariffs that have been introduced give a good guide in our view.

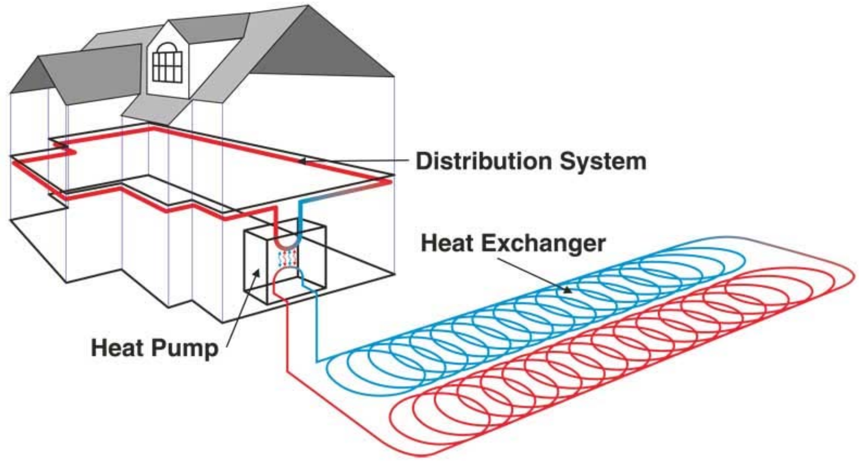
Questions remain over the risk that EGS could trigger small earthquakes because removing water may result in land subsidence. The basis for this concern comes from a pilot project in Basel which in 2006 created a 3.4 tremor and a recently delayed project for GeoDynamics in Australia. However, it’s worth remembering that geothermal development tends to take place in more seismic areas anyway.

Heat pumps – geothermal on a smaller scale

Geothermal heat pumps use the Earth's constant temperatures to heat and cool buildings. Temperatures 10 feet below the Earth's surface hold nearly constant between 50° and 60°F. For most areas, this means that soil temperatures are usually warmer than the air in winter and cooler than the air in summer. Heat pumps circulate water or other liquids through pipes buried in a continuous loop. This transfers heat from the ground into buildings in winter and reverses the process in the summer.

The heat pump market is impeded by high upfront costs and a lack of consumer awareness about the economics or payback period. Water Furnace Inc estimates that US heat pump installations will rise form 100,000 in 2009 to 1mn in 2017, a 40% CAGR, helped by the 30% tax credit and a variety of state level incentives. Penetration rates for heat pumps in Switzerland and Sweden are amongst the highest in the world and Nibe in Sweden is one of the leading heat pump manufacturers in Europe.

Chart 7: Heat pump



Source: North Dakota State University

High growth from a small base

There is just 11GW of installed geothermal capacity, which we estimate accounts for only 0.4% of global electricity generation. However, some countries such as El Salvador, Kenya, Philippines and Iceland generate over 15% of electricity production from geothermal. By 2020, Bloomberg New Energy Finance estimates that another 5GW of capacity will be added but this implies geothermal is still a very niche technology in our view compared to the annual 40GW of wind and 20GW of solar added respectively (albeit load factors are radically different).

Table 1: Current installed capacity (MW)

	Installed base (2010)
Chile	0
China	24
Costa Rica	166
El Salvador	204
Ethiopia	7
France	1
Germany	7
Guadeloupe	15
Guatemala	52
Iceland	575
Indonesia	1189
Italy	863
Japan	502
Kenya	167
Mexico	958
New Zealand	769
Nicaragua	88
Papa New Guinea	56
Philippines	1966
Portugal	29
Russia	82
Turkey	82
US	3102
Others	2
Total	10906

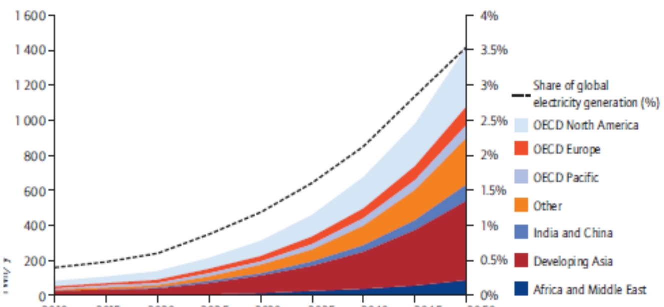
Source: IEA

Exponential growth but historical forecasts scaled back

The IEA (International Energy Agency) forecast that geothermal may supply 1.6TWh of electricity or 3.5% of global demand in 2050. In capacity terms this implies going from 11GW in 2010 to 200GW in 2050.

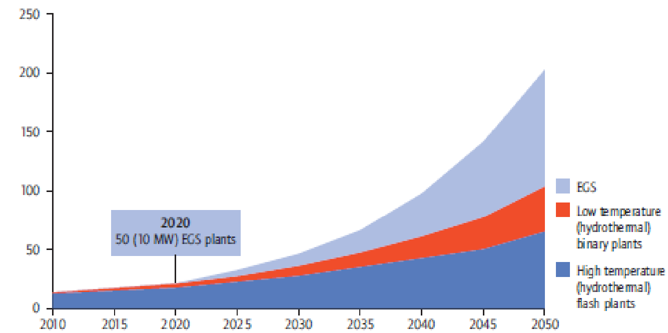
In 2010 just 300MW of geothermal capacity was added but we believe there are several GW of projects in the pipeline. Several countries particularly in Latin America, have recently introduced subsidies to encourage geothermal development in response to growing electricity demand and the high cost of running diesel generators.

Chart 8: Evolution of geothermal to world electricity production



Source: IEA

Chart 9: Evolution of installed capacity by technology



Source: IEA

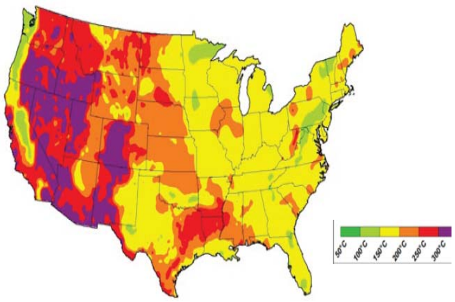
While the economics of geothermal are not dissimilar to wind (which has 220GW installed), geothermal is constrained by the limited number of suitable locations. New technology such as EGS may open up geothermal to new regions and accelerate the capacity growth. The IEA believe EGS should be commercially viable by 2030 and may account for 50% of the 200GW installed based in 2050 (see Chart 9).

As a note of caution, installation forecasts by respective industry bodies appear to have been downgraded several times over the last few years which we principally ascribe to developers having difficulty raising finance during the credit crunch and the collapse in US natural gas which has hurt the relative economics of geothermal.

Europe

While Europe has been a pioneer of wind and solar installations, geothermal has received limited attention because of the lack of natural resource in the region. The exception is in Italy which has over 800MW of installed capacity and Turkey which has an ambition to reach 550MW of capacity by 2013. There is minimal new build underway in Italy but some repowering activity. Technological developments such as EGS could open up the European market to broader development. Feed in tariffs around €150-200/MWh have been recently introduced in a number of countries including Germany and France. However, EGS project sizes are likely to be small and geothermal will remain a niche contributor to the electricity mix in our view.

Chart 10: Temperature 10km below surface



Source: NREL

North America

The US has over 3GW of installed geothermal capacity, making it the biggest market in the world. Practically all of the installed capacity is in California and Nevada, which has the best geological resource, as Chart 10 shows. According to the US Geothermal Energy Association, there is around 4GW under various stages of development, of which 1.4GW is at an advanced stage.

Geothermal incentives in the US are similar to other renewables with a 30% ITC to reduce the initial capex or a $21/MWh PTC which lasts 10 years. There are also some federal loan guarantees which reduce the cost of capital, particularly relevant for smaller developers who may struggle to raise capital in the public markets. Demand is also driven by the various State RPS's (renewable portfolio standards). Some of the Western States like California and Nevada with good natural geothermal resource happen to have amongst the most ambitious RPS targets. Regulators are therefore willing to allow utilities in these States to pass on the relatively high cost of geothermal to the rate base (customers).

Central & South America

Central America has an excellent geothermal resource and also high electricity prices because of the wide use of diesel generators which are very expensive with the rise in the oil price. Costa Rica, El Salvador, Guatemala, Mexico and Nicaragua have existing geothermal capacity and there are numerous projects under development.

So far, Chile does not have any installed capacity but has huge geothermal potential and the government recently awarded 70 exploration licenses. Chile depends on natural gas imports from surrounding countries which has made power prices very volatile when reserve margins are tight like today. Bolivia is also an interesting market with an estimated 400MW of potential projects.

Mexico has very high industrial electricity prices because agriculture and low income households receive subsidised power, which essentially forces industrials to compensate by paying high prices. In response, some industrials are now signing bilateral contracts for wind and geothermal power in order to have cost savings or more visibility on energy costs.

Asia & Oceania

There are a number of Asian countries around the Pacific 'ring of fire' such as Philippines (#2 globally), Indonesia (#3), New Zealand and Japan with geothermal power already making a meaningful contribution to the energy supply. Indonesia alone expects to add 4GW of geothermal capacity over the next decade and the national utility negotiates PPA prices with a ceiling of $97/MWh. The Philippines is targeting 1.2GW of new capacity by 2020 and recently privatised the state owed utility company to accelerate investment.

In the post Fukushima energy plan, Japan is said to be considering a geothermal FIT of $180/MWh from 2012. However, the problem for large scale deployment in Japan will be land availability. New Zealand continues to add capacity with US developer Ormat recently announcing a large equipment order. In contrast, we understand there is limited development activity in the big energy markets of China and India.

Africa

Africa has potential for geothermal power due to the East Africa Rift. The main country where development is taking place is Kenya whose government is targeting 1.25GW of new capacity by 2018 and offers an $85/MWh tariff from the national utility. There is also some development activity in Ethiopia. Financing is a constraint to development in Africa with a dependence on foreign loans from institutions such as the World Bank and Japan/French export banks which are often usually tied to equipment sales.

Table 2: Annual capacity installed (MW) and forecast

	2007	2008	2009	2010	2011E	2012E	2013E	2014E
Indonesia	100	50	150			108	191	167
US	10	50	120	50	52	95	124	127
New Zealand	20	150		163	0	0	83	166
Kenya	0	40		35	2	0	123	140
Mexico	0	0		0	25	25	0	0
Philippines	30	20	0	0	0	50	15	93
Iceland				0	90	50		
Chile								32
Nicaragua					39	39		
El Salvador								50
Costa Rica					28			4
Others	221	117	67	62	3	2	12	0
Total	381	427	337	310	239	369	548	779
y/y	-46%	12%	-21%	-8%	-23%	54%	49%	42%

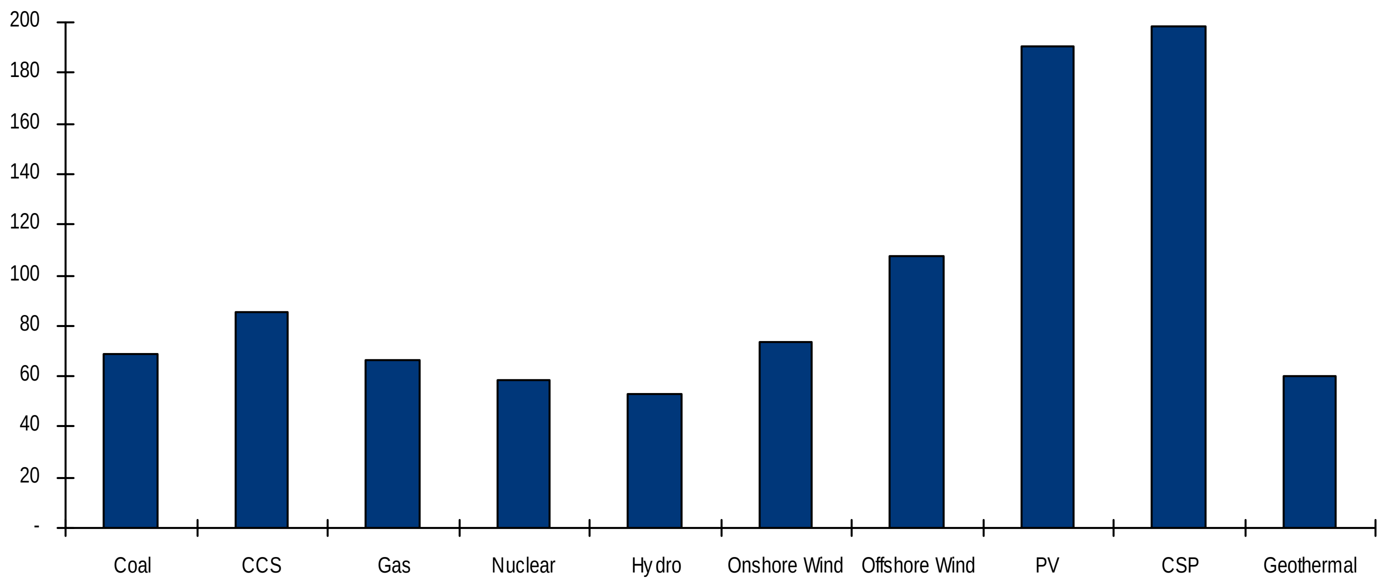
Source: Bloomberg New Energy Finance

Cost comparison

Geothermal costs can vary significantly depending on the quality of resource - namely, reservoir depth, temperature, flow rates, permeability and type of technology. As a rough approximation, we estimate the cost of geothermal electricity to be around €60/MWh ($85/MWh). This is based on €3.5mn/MW capex, 85% load factor, 30 year life and 10% WACC.

We can sense check this cost estimate in relation to the PPA's being signed at around $100/MWh (€70/MWh) on average in countries like the US, Indonesia, Kenya and Turkey. Geothermal is reasonably competitive with conventional power sources such as gas and coal in Europe, especially if we consider new entrant spreads, but less so in the US. Power prices in the US are currently around $55/MWh due to a low prevailing natural gas price that has decoupled from oil and no carbon price in place currently. European power prices are higher at around €55-75/MWh depending on the country. Geothermal looks attractive compared to other renewables like onshore wind (c.€75/MWh) and solar PV (c.€200/MWh).

Chart 11: Estimated new build cost for different technologies (€/MWh) using spot commodity prices in Europe



Source: BofA Merrill Lynch Global Research

Baseload power (if it works)

Geothermal supporters point to a 90% load factor as evidence for its suitability in providing stable baseload power. It is commonly understood that utilities would be willing to pay a premium for baseload power because of its reliability and ease of system planning. Unfortunately, in recent years we have seen widespread technical issues in geothermal plants that have resulted in lower than expected load factors and dented its credibility as a baseload power source.

A spate of high profile problems

Like deep-water drilling for oil, there can be bouts of pressure release that cause problems for the geothermal equipment. Also, sediment can mix with the brine (especially if the water reservoir becomes depleted) which causes clogging and restricts output. Ormat has suffered from a number of technical issues over the past year at its North Brawley plant where excessive sand has got into the fluid. The company ultimately had to drill new injection wells, which is an expensive solution.

To give another example, Nevada Geothermal has experienced poor load factors at its Blue Mountain plant due to the production and injection wells being drilled too close together (the cooler reinjected water reduced the temperature of the hot brine flowing out of the production well). The lower revenue has meant that it has struggled to meet the terms of its project debt. The small developer Ram, suffered substantial cost overruns at a project in Nicaragua, resulting in a rights issue and management change.

Less stress on grid management than other renewables

Utilities seem willing to enter into higher PPA prices (c.$100/MWh) for geothermal than they would be for wind (c.$60/MWh). Assuming, geothermal works as planned, the reliable output means we do not have to consider the need for back up capacity, which we do for wind and solar. Geothermal load factors are also independent of weather conditions which make it easier for the system operator to manage the grid. There is some minor seasonality to the geothermal load factor with production slightly lower in the summer due to less temperature differential above and below ground.

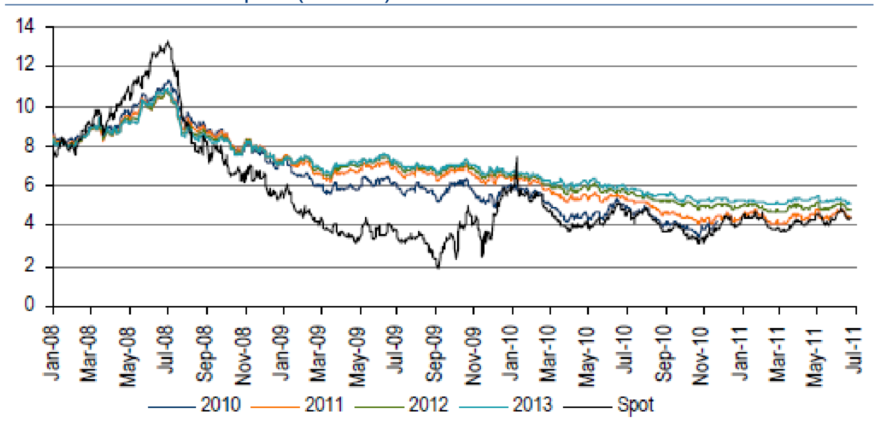
Greater capital risk compared to other renewables

While geology has no doubt been the main obstacle to greater geothermal penetration, the technology is also impeded by the higher up front capital risk (c.$500k/mw) than wind (c.$100k/mw) as the site is evaluated. In the cost comparison analysis (Chart 11) we assumed an equal 10% WACC which possibly flatters geothermal. We understand that project finance for geothermal has historically cost 50-100bp more than onshore wind because of operational risks and track record given the limited number of projects that are undertaken each year. Offshore wind faces a similar financing problem today. We believe that developers target equity returns of 15% for geothermal compared to 12% for wind given the greater execution risk in both the development and operational stages.

Low natural gas price pushes geothermal backwards

If we are correct in saying the cost of geothermal power is around $85/MWh (unsubsidised), then its relative competitiveness has changed substantially since 2008. Three years ago, natural gas prices in the US were above $10/mmbtu (see Chart 12), or expressed another way, power prices were around $80/MWh. With the proliferation of shale sources, gas prices have fallen to around $5/mmbtu today and power prices in turn have fallen to around $55/MWh.

Chart 12: US Natural Gas price ($/mmbtu)



Source: Bloomberg

This casts geothermal in a very different light and explains in part why a number of projects have been pushed back. The same delays have struck wind and solar thermal projects. With the abundance of shale gas, the forward curve for the gas price is relatively flat so this challenge will remain for some time to come and puts pressure on geothermal to reduce its costs in order to be more competitive with conventional energy.

Table 3: Typical capex breakdown

	$mn/MW
Resource Evaluation	0.3
Test Well Drilling	0.2
Production Well Drilling	1.4
Plant Construction	1.8
Total	3.7

Source: NREL

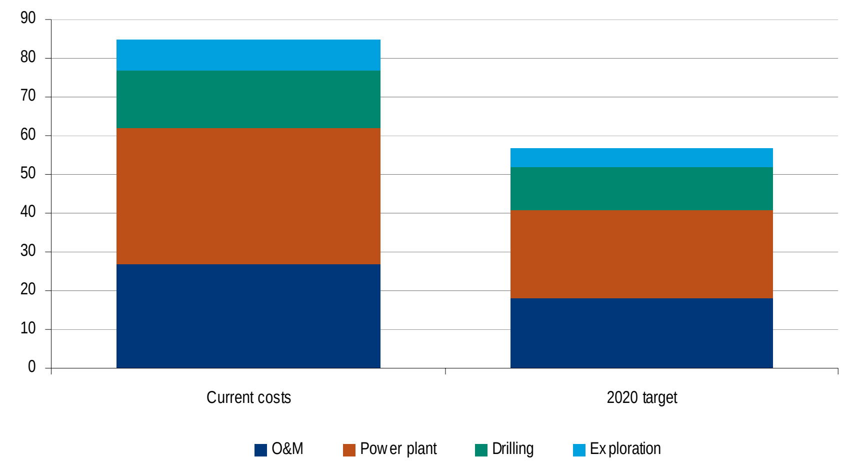
Capex breakdown

Expressed in $/watt, geothermal costs $3.5-4mn/MW according to the National Renewable Energy Labatory (NREL). However, it seems that US projects are generally cheaper to develop because of the larger project size and greater availability of drilling equipment. NREL state that roughly 15% of the cost is incurred during the planning/testing stage but this can be significantly higher depending on how many test wells have to be drilled to confirm the resource is appropriate for further development. Roughly 35% of the cost is for the production wells and 50% is for the plant, of which the turbine is the main cost component.

Cost curve of 1.0-3.5% pa

The US Department of Energy (DOE) has estimated the cost of geothermal power to be $85/MWh, similar to our own analysis. The DOE forecast in 2020 the cost can be reduced to $55/MWh, a reduction of 35%. This looks ambitious in our opinion given the limited historical progress of the industry. Using the DOE's own data, the cost of geothermal power has come down by about 25% since 1990, implying only a little over 1% per annum.

Chart 13: LCOE for geothermal ($/MWh)



Source: US Department of Energy

Costs have actually been increasing over the last 12 months due to changes in commodity costs such as steel, cement. Also, the higher oil price and rising drill count for shale gas/oil is creating greater competition for drilling equipment like rigs pushing up day rates. Ormat are one of the few developers who are vertically integrated in this respect so that they are less exposed to a shortage of rigs and wild swings in the cost of hiring rigs.

Reducing development expense

More so than wind or solar, an important cost contributor to geothermal is the development expense. The key is to better assess the quality of the reservoir, productivity of the well and permeability of the rock before too much capital is sunk. Test wells are also needed to assess the ease of reinjecting surplus water back into the reservoir. Each test well can cost $5mn to drill. This could be improved by better geological assessment techniques to avoid dry wells. The geothermal industry is making greater use of techniques from the oil and gas industry such as seismic scanning and 3D geological models.

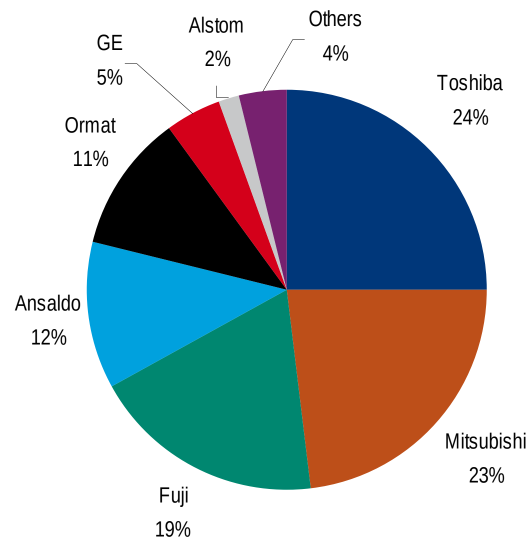
Technological innovation

The DOE has estimated flash technology cost at $75/MWh and Binary at $100/MWh. The cost difference reflects both the lower capex cost for flash, higher load factors and lower operating expenses. Binary systems are more expensive because they include additional equipment such as a heat exchanger. There are also fewer suppliers of the technology which presumably means less pricing pressure on the equipment. The binary concept is newer and therefore may have more potential for cost reduction in our opinion than the flash process. A different type of working fluid in the binary process may prove to be more efficient and cheaper.

Equipment suppliers

The geothermal equipment market is dominated by Japanese suppliers, namely Toshiba, Mitsubishi and Fuji who collectively have supplied two thirds of the installed base according to Bloomberg New Energy Finance. However, given the relatively small size of the market and the lumpiness of projects/orders, the market share could be easily distorted from year to year. Enel has tended to historically use the Italian supplier Ansaldo.

Chart 14: Geothermal turbine market share (installed cumulative capacity)



Source: Bloomberg New Energy Finance

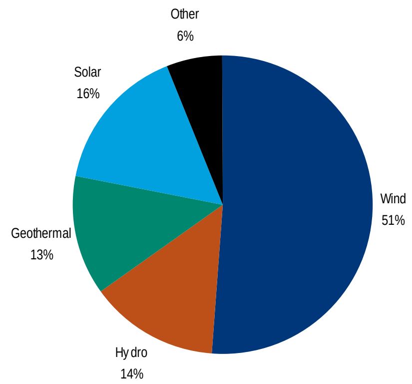
An important distinction between the equipment suppliers is what type of turbine technology they specialise in. The installed capacity can be broken down into 6.7GW flash, 2.6WG dry steam and 1.4GW binary. The Japanese suppliers appear to dominate the conventional flash/dry technology, while Ormat are the leading providers of Binary plants with roughly 90% share of that segment. Pratt & Whitney (United Technologies) and Siemens are trying to break into the binary market. As stated earlier, binary technology is used for low temperature sites (under 200c) and the average plant size tends to be only 5-10MW compared to flash technology which is 30-50MW.

European companies

Enel Green Power

EGP currently has 775MW of installed geothermal capacity, of which 728MW is in Italy and 47MW is in the US. Geothermal can have a very painful learning curve, as many of the newer, smaller developers are finding out the hard way. In contrast, EGP has been operating geothermal capacity for around 100 years, which has given the company extensive technical expertise in our opinion. EGP is also developing some proprietary innovative technologies around reinjecting water to prevent resource depletion which is often the cause of productivity problems. EGP's strong balance sheet also gives an advantage over less well capitalised smaller players in our view, given the inherent risks of developing geothermal projects.

Chart 15: EGP 2011-15 capex split



Source: Enel Green Power

EGP's business plan suggests that the company will develop c.150MW of geothermal assets through 2015, although this is only 3% of the total new MW for the company. Given the high capex/MW, EGP state that geothermal will represent 13% of capex (see Chart 15) over the period (this also includes some repowering for the existing capacity).

The last published data show EGP has over 500MW of advanced pipeline of which ~50MW is in Greece/Turkey, 50MW in North America and over 400MW in Latin America (Chile, Nicaragua and El Salvador). The pipeline covers 23 projects of which 16 are set to use flash technology and 6 binary. There is currently no capacity under construction but 17MW in the US is expected to start soon and there is 80MW of exploratory drilling under way in Chile.

Table 4: EGP advanced geothermal pipeline

Europe	Latam	US	Total
50	410	50	510

Source: Enel Green Power

EGP has a number of JVs which help broaden its geographic footprint. In early July, EGP received a favourable arbitration court ruling which gives it the right to increase its 36% stake in LaGeo, its geothermal joint venture in El Salvador. We expect EGP to increase capital in the entity to take it to a 51% controlling stake and this may enable an accelerated pipeline development in Central and South America. EGP also has a partner in Turkey called Meteor and in 2007 entered the US geothermal market with the $90mn acquisition of Amp resources. We believe EGP might contemplate further acquisitions of smaller developers to facilitate pipeline development.

Other European utility exposure

International Power announced its first foray into geothermal this past June with a 35% stake in a 220MW project in Indonesia. The project is understood to have a PPA with the national utility.

EDF owns a 30% stake in a 15MW geothermal plant in Guadeloupe that generates 10% of the country's electricity. There is no pipeline development that we are aware off.

In 2009, RWE set up a JV with Daldrup & Sohne to explore geothermal opportunities across Europe. RWE has some permits for drilling in Bavaria and the JV is also evaluating a field close to Frankfurt airport on the Upper Rhine Rift, with Fraport taking a 25% stake in the project.

Appendix

Table 5: Incentives for geothermal power

Country	Policy
Argentina	FIT of $60/MWh
Chile	Government grants exploration concessions. Chile aiming for 10% renewables in 2024 (5% in 2014 then rises 0.5% pa). Penalties for non compliance
Croatia	12 year FIT of €174/MWh
Czech Rep.	15 year FIT of €158/MWh
Equador	FIT of $130/MWh for 15 years
El Salvador	10 year tax exemption for projects under 10MW capacity
France	15 year FIT of €200/MWh for plants under 12MW capacity. Overseas territories get €130/MWh
Germany	Has a 20 year FIT of €157/MWh for projects <10mw and €103/MWh for >10MW. Also a €39/MWh bonus if installed before 2016. Is also a 30% subsidy for exploration cost. Debating a increase to €250/MWh stimulate more development and removing the size banding. Tariff falls by 1% per annum. Targeting installed capacity of 625MW in 2020.
Greece	20 year FIT of €80/MWh on the mainland and €92/MWh on the islands
Guadeloupe	Negotiated tariff of $71/MWh
Indonesia	Targeting installed capacity of 4GW in 2014 and 12.3GW by 2025. PPAs awarded through an auction with the national utility (PLN). Ceiling price set of $97 and recent PPAs around $70-95/MWh. Until 2014 there are no import duties on equipment. $39mn fund to reimburse failed drilling.
Italy	Currently get pool electricity price plus 0.9GCs for 15 years totaling around €170/MWh. Moving to FIT but havent decided price yet
Japan	Set to introduce a FIT of $120/MWh in 2012
Kenya	Ormat signed a PPA with national utility. Price ceiling for negotiations set at $85/MWh. Government targeting 4GW by 2030
Nicaragua	FIT of $80/MWh
Peru	Auction process determines 20 year FIT
Phlippines	Average PPA price of $100-110/MWh. Targeting 3.1GW of capacity in 2020
Spain	20 year Tariff of €70/MWh for capacity <50mw
Switzerland	20 year Tariff of €300/MWh for <5mw, €280 <10mw, €217 <20mw and €176 for >20mw.
Taiwan	FIT of $174/MWh
Turkey	Tariff of $105/MWh (is paid in USD) for 10 years. Targeting 550MW by 2013.
US	Can apply for the 30% ITC grant but wont include exploration drilling expense. Eligible for the $21/MWh PTC for the first 10 years of production. Can use 5 year accelerated depreciation (MACRS). Also loan guarantees available from the DOE. PPAs driven by state RPS requirements and view of long term natural gas price. Recent PPAs signed at around $100/MWh

Source: BofA Merrill Lynch Global Research

Price objective basis & risk

Enel Green Power (XENLF)

Our Price Objective of EUR1.95 is based on a country-by-country DCF analysis. We base our valuation on the installed capacity at the end of 2010 and the pipeline of projects we expect the company to complete by 2020. Our discount rate of 8-8.5% varies between countries due to sovereign and regulatory risk. Our base case assumes EUR70/MWh power price in Italy or USD90 oil.

The two key risks to our price objective would be an erosion of Italy's higher electricity prices relative to the rest of Europe and deeper than expected cuts to the currently very generous renewable subsidies in Italy. Other risks are changes in power prices, regulation, exchange rates and the cost of debt.

Link to Definitions

Energy

Click here for definitions of commonly used terms.

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EMEA - Utilities Coverage Cluster

Investment rating	Company	BofA Merrill Lynch ticker	Bloomberg symbol	Analyst
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	EDP	EDPFY	EDPFY US	Pablo Cuadrado
	EDP	ELCPF	EDP PL	Pablo Cuadrado
	EDP Renovaveis	EDRVF	EDPR PL	Matthew Yates
	Enagas	ENGGF	ENG SM	Pablo Cuadrado
	Enel	ESOCF	ENEL IM	Pablo Cuadrado
	Enel Green Power	XENLF	EGPW IM	Matthew Yates
	Fortum	FOJCF	FUM1V FH	Christopher Kuplent
	Gas Natural	GASNF	GAS SM	Pablo Cuadrado
	GDF SUEZ	GDSZF	GSZ FP	Eric Lopez
	Internat'l Power	IPR	IPRPY US	Fraser McLaren
	Internat'l Power	IPRWF	IPR LN	Fraser McLaren
	National Grid	NGGTF	NG/ LN	Fraser McLaren
	National Grid	NGG	NGG US	Fraser McLaren
	Red Electrica	RDEIF	REE SM	Pablo Cuadrado
	Scottish & Sthrn	SSEZF	SSE LN	Fraser McLaren
	Scottish & Sthrn	SSEZY	SSEZY US	Fraser McLaren
	Severn Trent	SVTRF	SVT LN	Pinaki Das
	Suez Environnement	SZEVF	SEV FP	Eric Lopez
	United Utilities	UUGWF	UU/ LN	Pinaki Das
NEUTRAL				
	Acciona	ACXIF	ANA SM	Matthew Yates
	Centrica	CPYYF	CNA LN	Fraser McLaren
	Centrica	CPYYY	CPYYY US	Fraser McLaren
	E.ON	EONGY	EONGY US	Christopher Kuplent
	E.ON	ENAKF	EOAN GR	Christopher Kuplent
	EDF	ECIFF	EDF FP	Eric Lopez
	Endesa	ELEZF	ELE SM	Pablo Cuadrado
	Hansen Transmissions	HSNTF	HSN LN	Matthew Yates
	Iberdrola	IBDSF	IBE SM	Pablo Cuadrado
	Pennon	PEGRF	PNN LN	Pinaki Das
	Veolia Environnement	VEOEF	VIE FP	Eric Lopez
	Veolia Environnement	VE	VE US	Eric Lopez
UNDERPERFORM				
	Drax Group Ltd	DRXGF	DRX LN	Fraser McLaren
	Gamesa	GCTAF	GAM SM	Matthew Yates
	Q-Cells SE	QCLSF	QCE GR	Matthew Yates
	Renewable Energy	RNWEF	REC NO	Matthew Yates
	RWE	RWEOY	RWEOY US	Christopher Kuplent
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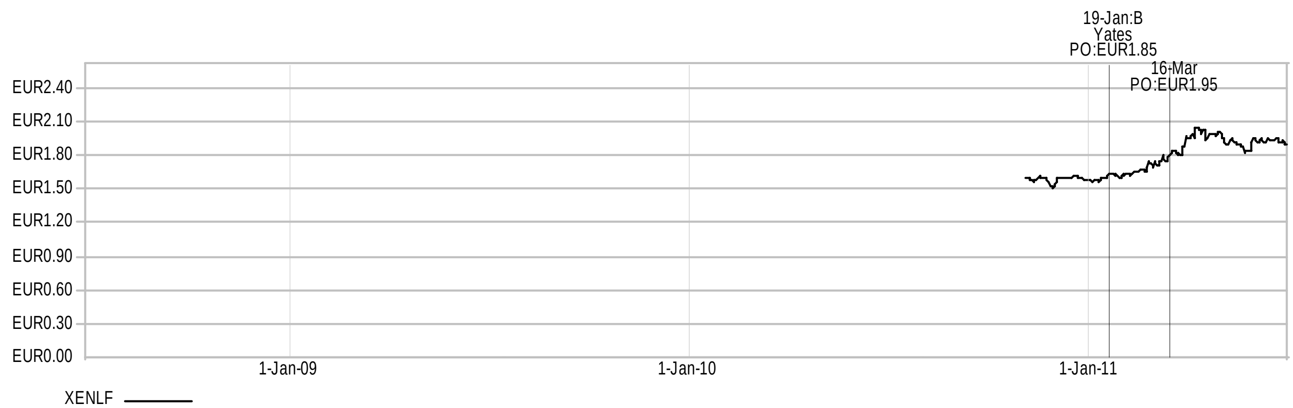
XENLF Price Chart



B : Buy, N : Neutral, U : Underperform, PO : Price objective, NA : No longer valid, NR: No Rating

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Buy	76	42.22%	Buy	35	51.47%
Neutral	48	26.67%	Neutral	30	69.77%
Sell	56	31.11%	Sell	20	40.00%

Investment Rating Distribution: Global Group (as of 01 Jul 2011)

Coverage Universe	Count	Percent	Inv. Banking Relationships*	Count	Percent
Buy	2024	53.94%	Buy	935	50.68%
Neutral	944	25.16%	Neutral	442	51.64%
Sell	784	20.90%	Sell	273	37.24%

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