

JESSICA ALSFORD
Morgan Stanley & Co. International plc+

RICHARD FELTON
Morgan Stanley & Co. International plc+

BOBBY CHADA
Morgan Stanley & Co. International plc+

EMMANUEL TURPIN
Morgan Stanley & Co. International plc+

TIMOTHY HO
Morgan Stanley & Co. International plc+

STEPHEN BYRD
Morgan Stanley & Co. LLC

DEVIN MCDERMOTT
Morgan Stanley & Co. LLC

SIMON LEE
Morgan Stanley Asia Limited+

QIN ZHANG
Morgan Stanley Asia Limited+

MIGUEL RODRIGUES
Morgan Stanley C.T.V.M. S.A.+

FERNANDO AMARAL
Morgan Stanley C.T.V.M. S.A.+

CDP
CATE LAMB
CHARLES FRUITIERE



Power Generation Utilities

Navigating Global Water Risk



CDP is not authorised nor regulated by the FCA and as such is not providing investment advice. CDP authors are not research analysts and are neither FCA nor FINRA registered. For disclosures specifically pertaining to CDP please see the Disclosure Section located at the end of this report

Morgan Stanley does and seeks to do business with companies covered in Morgan Stanley Research. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of Morgan Stanley Research. Investors should consider Morgan Stanley Research as only a single factor in making their investment decision. **For analyst certification and other important disclosures, refer to the Disclosure Section, located at the end of this report.**

* = This Research Report has been partially prepared by analysts employed by non-U.S. affiliates of the member. Please see page 2 for the name of each non-U.S. affiliate contributing to this Research Report and the names of the analysts employed by each contributing affiliate.

+ = Analysts employed by non-U.S. affiliates are not registered with FINRA, may not be associated persons of the member and may not be subject to NASD/NYSE restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

Power Generation Utilities: Navigating Global Water Risk

The Power Generation industry is heavily reliant on water as a resource. Around 90% of global power production depends on water, either directly or via the fuel supply chain, making water a current and future strategic issue for electric utilities.

Deteriorating water security is already affecting Utility companies. 38% of respondents to CDP's 2014 survey reported water issues causing detrimental impacts to their business operations. On occasions, this has resulted in financial losses that have affected profit margins, in some cases significantly.

Looking ahead, we believe water-related risks are only going to increase. The UN estimates that water demand for global power generation is set to increase by 140% by 2050. This substantially raises the risk of water scarcity impacting the production of electricity. There are certainly ways that water risks and impacts can be mitigated, but only 55% of respondents to CDP's survey reported concrete targets or goals for their direct operations.

A changing regulatory landscape presents further challenges. Local and national governments are increasingly looking to reform and enforce legislation in order to manage water-related risks now and in the future.

Disclosure of business-critical water information is still patchy and too low: 70% of Power Generation companies requested to complete the 2014 CDP survey failed to do so. In this report, Morgan Stanley Research analysts covering electric utilities in Europe, Asia and The Americas examine the risks (and opportunities) for key stocks.

Morgan Stanley Contributors

CDP Contributors

Sustainable and Responsible

Jessica Alsford ¹	+44 20 7425-8985	Jessica.Alsford@morganstanley.com	Cate Lamb	+44 (0) 20 3818 3971	Cate.Lamb@cdp.net
Richard Felton ¹	+44 20 7425-5930	Richard.Felton@morganstanley.com	Charles Fruitiere	+44 (0) 20 3818 3960	Charles.Fruitiere@cdp.net

Europe Utilities

Bobby Chada ¹	+44 20 7425-5238	Bobby.Chada@morganstanley.com
Emmanuel Turpin ¹	+44 20 7425-6863	Emmanuel.Turpin@morganstanley.com
Timothy Ho ¹	+44 20 7425-4267	Timothy.Ho1@morganstanley.com

US Utilities

Stephen Byrd ²	+1 212 761-3865	Stephen.Byrd@morganstanley.com
Devin McDermott ²	+1 212 761-1125	Devin.McDermott@morganstanley.com

China Utilities

Simon Lee ³	+852 2848-1985	Simon.Lee@morganstanley.com
Qin Zhang ³	+852 2848-5289	Qin.Zhang@morganstanley.com

Brazil Utilities

Miguel Rodrigues ⁴	+55 11 3048-6016	Miguel.Rodrigues@morganstanley.com
Fernando Amaral ⁴	+55 11 3048-6121	Fernando.Amaral@morganstanley.com

¹ Morgan Stanley & Co. International plc+

² Morgan Stanley & Co. LLC

³ Morgan Stanley Asia Limited+

⁴ Morgan Stanley C.T.V.M. S.A.+

Table of Contents

Executive Summary	4
Water and the Electric Utilities Sector: Committing to Risk or Resilience?	10
Water Risks for Electric Utilities	13
The Changing Water Regulatory Landscape Presents Key Challenges for Electric Utilities	16
Water Management to Water Governance	19
Looking Forward	21
Case Study: Brazil – Implications of Drought for Power Supply	22
Case Study – China: Air Cooling Power Plants for Saving Water	25
Case Study – UK: Water Abstraction Licence Reform	27
Case Study – US: Entergy’s Nuclear Plant Usage of River Water	30
Water and Power Generation: a view from the suppliers of water solutions and equipment	32
Appendix – Data from the CDP survey.....	34

CDP is an international not-for-profit organisation providing the only global system for companies and cities to measure, disclose, manage and share vital environmental information. CDP works with investors, purchasing companies and governments to motivate companies to disclose their impacts on the environment and natural resources and take action to reduce them. CDP now holds the world’s largest database of primary corporate climate change, water and forest risk information. CDP puts the data and resultant insights at the heart of strategic business, investment and policy decisions. Working with CDP helps to minimise risk, identify cost savings and financial opportunities and catalyse action on critical environmental issues, including water security.

CDP’s program provides institutional investors representing \$60 trillion in assets, and purchasers leveraging a combined spend of \$126 billion, insights into corporate water risk exposure and mitigation strategies. On behalf of these stakeholders, CDP collects data from 1,064 companies that spans the granular, local context and the broader corporate strategic approaches being adopted by each company in response to water challenges. Corporate transparency on this issue provides the financial community with the necessary information to help drive investment for sustainable economies.

Executive Summary

A collaborative global report

This report was prepared jointly by Morgan Stanley Research and CDP, drawing heavily on CDP's authoritative annual survey of the global interplay between water and the utilities sector. Survey conclusions and potential investment repercussions are examined in a number of case studies by Morgan Stanley Research utilities analysts across the globe, from The Americas, Asia and Europe.

Global energy production requires an ever-increasing share of water demand

Global water demand will increase by 55% by 2050, according to UN estimates.¹ Population growth and economic development are increasing the amount of water required for irrigation, industrial and domestic purposes.

One of the key demands on water is energy production.

Today, around 16% of all water used worldwide goes into a mix of power generation, mining and pumping hydrocarbons, and this is likely to increase due to the demand for energy continuing to rise. The UN estimates that global water demand for power generation is set to increase by 140% by 2050. As such, there is a material risk of water scarcity impacting the production of energy. This is all the more relevant as the rise in energy demand is set to follow, in large part, population growth, economic activity and urbanisation in zones of existing or expected water stress.

This report focuses on the water-related risks facing the global Utilities sector. Utilities is one of the most exposed industries to water risks. In CDP's recent Global Water report, 86% of respondents in the Utilities sector identified their direct operations as exposed to water risks. This is the highest of all sectors (see Exhibit 1). Furthermore, as Exhibit 3 shows, the water intensity of the Utilities sector is very high, at 1322 megalitres of water withdrawn per \$1million of revenues.

Water is required to produce fuel used in the generation of electricity. Exhibit 2 illustrates the considerable variation in water intensity of different types of fuel production, from almost zero in the case of air-cooled conventional gas generation, to 10,000-10,000,000 litres per tonne of oil equivalent for biodiesels.

Water is also required for power generation itself. As Exhibit 4 shows, water intensity can again vary greatly, predominately driven by the type of cooling technology used. A 'dry' (air-cooled) gas plant cannot be economically operated in all geographical locations, and is less efficient than a water-cooled plant. Water-cooling is therefore the industry standard, helped by typically very attractive prices for bulk water for industrial usage.

Pricing structures often fail to send the proper economic signals for more responsible use of water. This is because most countries price water for industrial and commercial purposes below the cost of supply. The debate about the pricing of water rarely stays purely on the grounds of economic theories though, as water is still often considered a basic right and a free commodity, thereby failing to incentivise virtuous initiatives towards a better use of the resource.

There appears to be little concern that the cost of water will significantly change in the future, with only 15% of respondents to the CDP survey reporting that a "higher water price" was a specific risk factor to their operations.

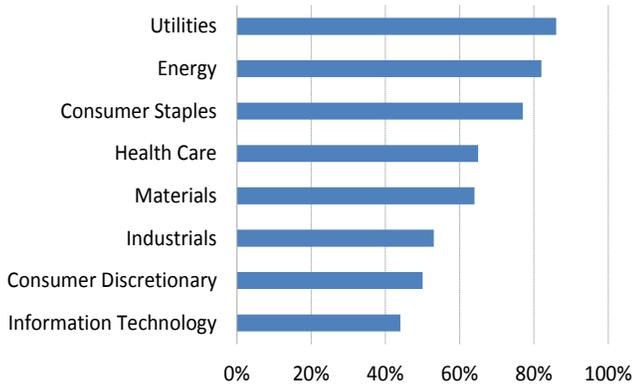
What is 'Water Security'?

Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.

UN-Water, 2013

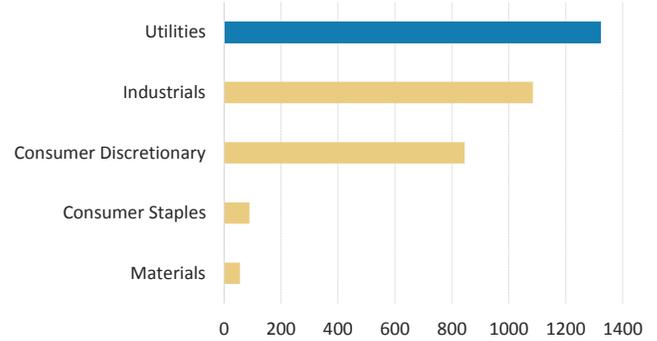
¹ unwater.org/statistics, 7 Oct 2014

Exhibit 1
Respondents exposed to water risks in direct operations



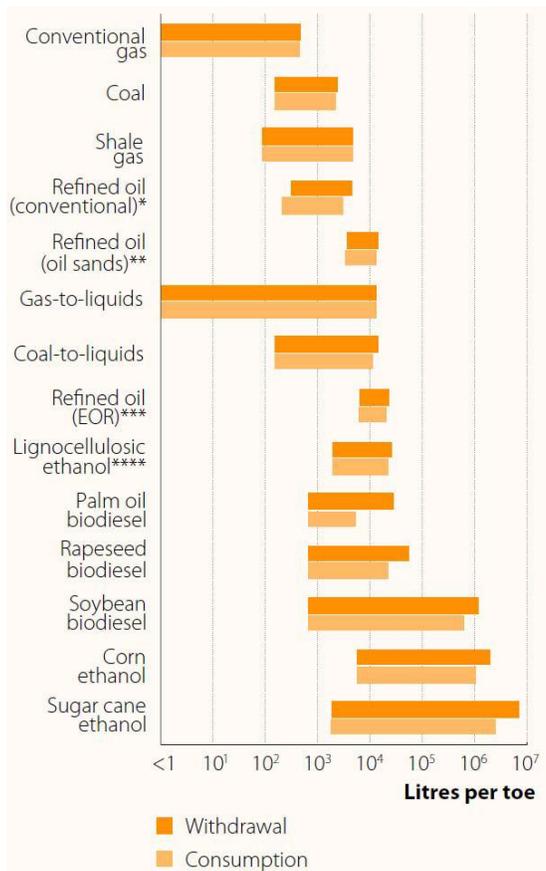
Source: CDP Global Water Report 2014

Exhibit 3
Water intensity (megalitres of water withdrawn per \$1million revenues)



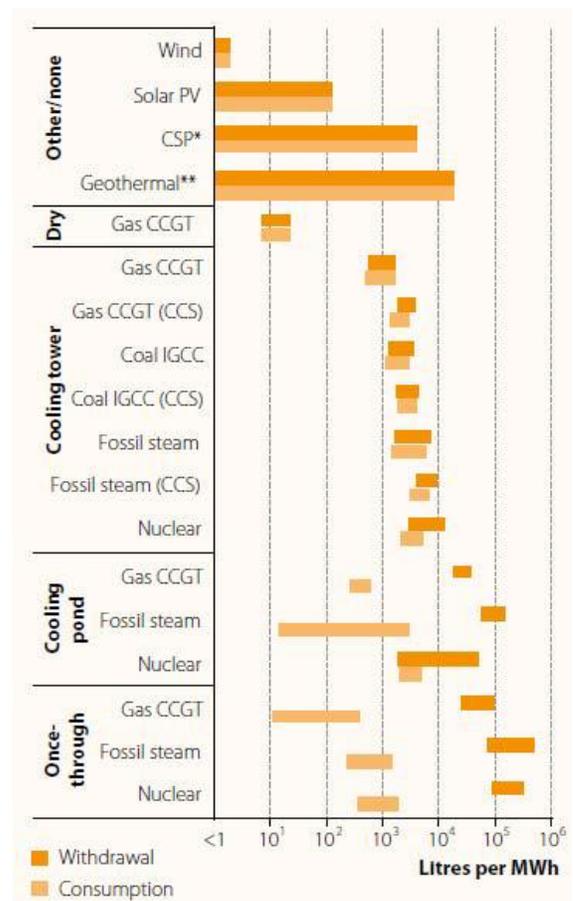
Source: CDP/ Bloomberg

Exhibit 2
Water withdrawal and consumption for fuel production (l/kWh)



Source: IEA (2012) as quoted in WWDR 2014
*Water withdrawal is water removed from any source, either permanently or temporarily (European Environmental Agency)
**Water consumption is the portion of water use that is not returned to the original water source after being withdrawn (WRI)

Exhibit 4
Water use for electricity generation by cooling technology (l/kWh)



Source: IEA (2012) as quoted in WWDR 2014
*Water use describes the total amount of water withdrawn from its source to be used (WRI)

Morgan Stanley's ESG framework identifies water as a key risk for the Utilities sector.

Our framework identifies Environmental, Social and Governance risk factors that could have a material impact on the value of a company over the short, medium or long term. We see water as one of the most pertinent ESG risks to the Utilities sector. In Exhibit 6, we demonstrate how water can impact the valuation of a Utilities company.

- (i) **Volumes** – access to water is necessary for power generation, as process water (steam generation) or cooling medium.
- (ii) **Power Price** – a shortage of power will result in higher prices for customers. In addition, should higher capital investment be required (e.g. for air-cooling plants) this may be passed on to the end customer.
- (iii) **Operating costs** – we believe the cost of water is unlikely to rise significantly. However, in the UK the cost of water abstraction licences² may increase in areas of water scarcity. Economic conditions at which water is allowed to be used, through direct water drawing rights or indirect cost of pre-discharge treatment, should be taken into consideration in some geographies.
- (iv) **Capital investment** – one way to reduce water consumption is to use air-cooling plants rather than water-based versions. However, these are much more expensive and also require more land space.
- (v) **Useful life of assets** – failure to operate within required water/ environmental legislation may result in early closure of a power plant.
- (vi) **Discount Rate** – one way to account for the water-related risk is via the discount rate.

There are a number of different ways in which water-related risks can materialise. In CDP's 2014 survey, 17 respondents (85%) reported exposure to 132 water risks across 26 categories that could cause a substantive change in their business, revenue or operations.

² A water abstraction licence details what is permitted such as how much water is allowed to be abstracted and at what times.

The risk reported by the highest proportion of respondents was “water stress and scarcity” with 40% of companies agreeing that their company does face this risk. The CEO Water Mandate³ defines water stress as comprising three core components: 1) water availability, 2) water quality, and 3) water accessibility. It refers to the ability (or lack thereof) to meet both the human and ecological demand for water.

In this report, Morgan Stanley analysts look at how water stress and scarcity are impacting the Utilities sectors in Brazil and China.

1. **Drought in Brazil.** Extreme weather patterns can make the risk of water stress immediate, as we have seen this year in Brazil. Hydropower represents 65% of the generation capacity in Brazil. Rainfall was far below its long-term average during important months of the rainy season (Jan-Apr), leading reservoir levels to deteriorate in Brazil. Demand has also reached high levels, mainly due to high temperatures during the summer, helping to speed up the reduction of reservoir levels.

One of the consequences of the drought has been a switch to more thermal power generation. This in turn has increased the cost of electricity, which is ultimately paid for by the end customers. Blackouts might also occur in future, with selective cuts in supply potentially being necessary during the summer to avoid a shortage of supply in peak hours.

2. **Water scarcity in North West China.** CDP's survey does not cover China-based Utility companies. However, water scarcity is certainly a risk in this country and having an impact on investment decisions made by Utility companies

In recent years, coal power development has shifted from East to West China, in line with China's National Air Pollution Control Plan and the country's strategy of relocating energy-intensive, polluting heavy industries and manufacturing. However, water scarcity is a serious issue here, with North China's land area accounting for 72% of China's total land area, but water resources in this region only representing 34% of the national total.

³ Launched in 2007 by the UN Secretary-General, the CEO Water Mandate is a public-private initiative designed to assist companies in the development, implementation and disclosure of water sustainability policies and practices.

As such, for coal power plants located in North West China, air-cooling power plants would be a better option than water-cooling plants. According to the National Development and Reform Commission's (NDRC) requirement on coal power plants, in North China where water resources are limited, IPPs should build large-scale air cooling power plants with water consumption rates of <math><0.18\text{cbm}/(\text{GWs})</math>. In addition, coal power plants should avoid using underground water, strictly control surface water usage, and are encouraged to use recycled water. Air cooling plants, though, require a higher investment cost, more land space and higher coal consumption, altering the economics of the power plants.

Regulatory change is also a key factor in assessing water risk. 25% of respondents highlighted "regulatory uncertainty" as a risk whilst 15% reported that "tightening regulation of withdrawal" could be an issue for their company in the future. Reviewing, revising and reforming regulation and policy is on the agenda of many national and local governments as threats to water security worsen. Worldwide, governments are formulating and implementing stringent water regulations that will likely affect many companies in the Electric Utilities sector.

In Europe, implementation of the Water Framework Directive⁴ presents a regulatory risk given the legislation has the potential to affect a wide range of electric utility operations through tightening of regulations pertaining to withdrawal and discharge.

In the US, new and existing electric utility facilities are facing the EPA once-through cooling rule for Cooling Water Intake Structures under section 136 of the Clean Water Act. The US EPA also issued a regulation in 2014 to protect wildlife from cooling water-intake operations.

In the UK, legislative reform for water abstraction is pending. Currently, water abstraction licences in the UK authorise an annual allowed quantity for abstraction and are managed by the environmental agencies of the constituent countries of the UK. However, the allowed volume is not linked to the availability of supply and this is one of the key changes under debate for future reform. The electricity generation and supply industry is easily the largest abstractor of water (outside public supply) so it would be the most affected by reforms.

⁴ The EU Water Framework Directive commits EU members to establish a framework for the protection of all ground and surface waters (rivers, lakes, transitional waters and coastal waters) in the EU.

Changes to terms and costs of licences are likely in our view, but not for another decade. Our base case is that water abstraction will become linked to availability and that costs will rise in areas with tighter supply.

Clearly, a period of extended drought would be a negative for generators if terms varied with water constraints. If generators cannot source the water to cool their systems, this will have an effect on their availability to generate, particularly given the extremely large volumes that plants require. A simple calculation comparing the annual demand in England and Wales in 2012 (c.280TWh) to the amount of water abstracted in the industry that year (13,310m cubic metres) implies that 47.5 cubic metres or 47,500 litres of water are needed for every MWh produced – these numbers are vast.

Water efficiency is likely to be part of the solution. If generators can recycle the water that they use for cooling, this would mean less abstraction, cheaper licences and less exposure to water availability. This could be performed in a number of ways, for example by using cooling towers. However, this is additional capex and would require space on site, so management would need to consider whether the spend outweighs the risk of constraints on their water supply and ultimately plant availability.

Of course, the timing of water-related risks is also vital, particularly when making investment decisions. The majority (31%) of the risks reported to CDP are anticipated to impact within a year (current), 12% in one to three years (short-term), 27% in four to six years, and 18% in more than six years' time. Worryingly, 12% are anticipated within an unknown timeframe, suggesting further analysis is needed.

Entergy, a US utility with a large deregulated nuclear power generation business, faces one of the most immediate water-related risks. Entergy has a large nuclear power plant, Indian Point, located 30 miles outside of New York City. We believe the long-term viability of Indian Point may be in question given legal/regulatory steps taken by New York State that look likely to prohibit Indian Point from using cooling water from the Hudson River. The State of New York has voiced concerns about the impacts to aquatic life (both fish and fish eggs) from Indian Point's usage of up to 2.5 billion gallons of water from the Hudson River to cool the plant.

There appears to us to be a high probability that, in 2015, the US Nuclear Regulatory Commission (NRC) will conclude that the Indian Point nuclear plant's use of cooling water from the Hudson River is inconsistent with New York's Coastal Management Program (NYCMP). We think this result would likely in turn lead to the further conclusion that a costly cooling

tower is required for the plant's operations to be consistent with the NYCMP. In our Base Case we assume Indian Point is shut down by the end of 2018, which is a major driver of our Underweight call on Entergy.

Improving the water intensity of power generation is also a business opportunity for some companies. Veolia and Suez Environnement are global leaders in water technology solutions. Historically, municipalities have dominated the companies' client bases, but there is now a significant growth opportunity from industrial clients. Specifically, it is estimated that the Power Generation market offers an attractive potential growth rate of c. 9% p.a. Examples of product and services that can be offered by Veolia and Suez to this industry include equipment sales for desalination plants, water supply contracts for nuclear power plants and turnkey engineering projects.

Finally, we think more disclosure from Utilities companies on this topic would be helpful – The exposure of the Utilities sector to water-related risks has been established, and yet 70% of companies requested to disclose information on this subject by CDP failed to do so. Disappointingly, the response rate fell in 2014 versus 2013.

However, additional companies were approached in 2014 – 67 in 2014 against 54 in 2013.

In Exhibit 5 we provide a list of companies that answered the questionnaire. Details of companies invited to participate in the survey are on pages 34-36.

Exhibit 5

Companies participating in the 2014 CDP Water questionnaire

ACCIONA S.A.	ENEL SpA
Ameren Corporation	Entergy Corporation
American Electric Power Company, Inc.	Exelon Corporation
Centrica	GDF Suez
Dominion Resources, Inc.	HK Electric Investments
DTE Energy Company	Iberdrola SA
E.ON SE	National Grid
EDF	RWE AG
EDP - Energias de Portugal S.A.	Sempra Energy
Endesa	The Southern Company

Source: CDP.

Exhibit 6

Integrating water risk into a Utility company's discounted cash flow valuation

TRADITIONAL ANALYSIS		WATER RISK ANALYSIS
Power plant capacity; Utilisation rates; Power demand	Volume of units sold	Access to sufficient water is necessary for power generation either for hydro power or for cooling thermal power.
	x	
Commodity prices; Inflation; Allowed return; RAB	Revenue per unit	In Brazil, drought led to high thermal generation which increased fuel costs. These are ultimately paid by the final consumers. Power shortages due to water scarcity would also result in higher prices.
	-	
Fuel; Operating & Maintenance costs; Employees	Operating costs	In the UK, the cost of water abstraction licences may increase in areas of water scarcity.
	-	
Maintenance and construction of facilities	Capital Investment	Rising standards regarding drawing rights or discharge volumes and quality could mean the need for more capital investment per MW (e.g. Air cooling technology), or a limitation to the ability to operate a unit to full capacity.
	-	
Current tax rate; Countries of operation	Tax	In countries with hydropower capacity, authorities have set up hydro taxes e.g. Sweden and Finland.
	-	
Interest rates; amount of debt	Interest	
	=	
	FREE CASH FLOW	
	x	
Age of power plants	Useful Life of Assets	Closure of plants that do not meet the required environmental legislation (e.g. Entergy)
	÷	
Cost of equity; Cost of debt; Equity/Debt split	Discount Rate	All risks above could impact the discount rate.
	EQUITY VALUE	

Source: Company Data, Morgan Stanley Research

Water and the Electric Utilities Sector: Committing to Risk or Resilience?

By Cate Lamb and Charles Fruitiere of CDP

Key Findings

- Worsening water security is already impacting respondents' business, with 40% experiencing detrimental impacts in the reporting year.
- Further short-term detrimental impacts are anticipated. 85% of respondents report exposure to substantive short-term water risks, some with costs as high as US\$1 billion.
- Disclosure of business-critical water information remains significantly low with 70% of companies requested to disclose failing to do so.

The world faces a water crisis

In 16 years, the planet may meet only 60% of the population's demand for water, according to a report by the 2030 Water Resources Group.⁵ Given water's economic importance, this poses an unprecedented global threat. Water insecurity, driven by poor water governance, population growth, urbanization and industrialization is restricting trade, stranding assets, threatening food security and disrupting energy supplies.

Water is an essential input for electricity generation

Water is a strategic resource for most electric utility businesses. According to the UN, 90% of power production is heavily dependent on water in both direct production and throughout the fuel supply chain⁶. However, a growing population and increasing economic activity coupled with declining water quality in many regions has resulted in increased competition for water in the public and private sectors. While the term "water scarcity" is frequently heard, we are more specifically experiencing greater competition for water and, as demands for electricity increase, so too will competition, placing greater demands on an irreplaceable natural resource.

Power plants are increasingly reliant on lakes, rivers and groundwater for cooling. This leaves companies in the sector vulnerable to a variety of physical, regulatory or reputational water risks that could impact how and when electricity is produced, where facilities can be sited, the costs of production, and the types of technologies employed for cooling. Further, the fuel sources employed at a plant can expose a company to supply chain water risks. For example, minerals unearthed during coal mining and drilling create waste with dangerous toxins such as mercury, lead, and arsenic. If these toxins contaminate groundwater they can affect drinking water and local ecosystems leading to regulatory, reputational and operational impacts for both the supplier and the purchaser.

CDP's water program provides a global, standardised framework for industry and investors alike to measure, manage, disclose and share vital water information.

CDP's corporate water data provides investors with comparable information on business risks and opportunities associated with water. In 2014, 67 electric and multi-utility companies with a total market capitalisation of \$1,126 billion were requested to disclose business critical water data through CDP. 20 companies, representing a total market capitalisation of \$559 billion, responded, for a 30% response rate, covering 50% of the requested market capitalisation.⁷ Together, these companies account for 826 million mega litres of water withdrawals per year, 28 times the capacity of Lake Powell⁸ when full and 52 times its current level.

In this section, CDP presents the results of the analysis based on the disclosures of these 20 companies. It provides insights into how these organizations are dealing with specific water risks and includes recommendations for future engagement with targeted companies. CDP's wider report forms part of a series of publications by CDP focusing on high-risk, high-impact sectors.

5

http://www.mckinsey.com/App_Media/Reports/Water/Charting_Our_Water_Future_Full_Report_001.pdf

⁶ http://www.unescap.org/sites/default/files/WWDR-2014-Volume-1_Water%20and%20Energy.pdf

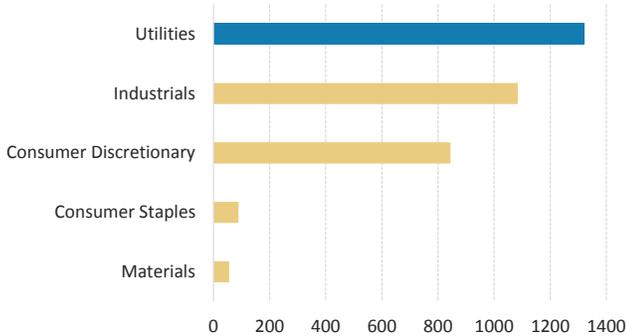
⁷ The response rate is down from 46% in 2013, a disappointing trend given that obtaining data about electric utilities' water risk exposure is essential to making sound investment choices.

⁸ Lake Powell is currently the largest reservoir in the United States in terms of capacity of water currently held, depth and surface area.

Worsening water security is a material issue for Electric Utilities given the sector’s high dependence on this irreplaceable natural resource

Exhibit 7

Water Intensity (megalitres of water withdrawn per \$1million revenues)



Source: CDP/ Bloomberg

Business impacts of the rapid depletion of water resources are already being felt. Eight out of the 20 respondents (40%) reported experiencing detrimental impacts related to water in the last reporting year. These impacts resulted in financial losses that have affected their profit margin, in some cases significantly.

Water can directly impact the value of a company and its ability to deliver a stable and successful rate of return. For example, Acciona, Endesa and E.On all reported property damage and higher operating costs due to flooding (30%), droughts (20%), regulatory uncertainty (20%) and declining water quality (20%).⁹

Exelon experienced reduced production due to a lack of surface water for cooling at one of its nuclear power plants along the Mississippi River, which cost the company approximately \$1 million.

In the US, Dominion Resources reported that new regulatory permitting requirements for the James River basin cost the company \$800,000 as it had to abandon six existing wells and install two new ones.

Further insights are provided below (Exhibit 8)

⁹ The percentage in the brackets represents the proportion of impacts (property damage and higher operating costs) reported due to this risk driver (flooding, droughts, regulatory uncertainty and declining water quality).

Exhibit 8

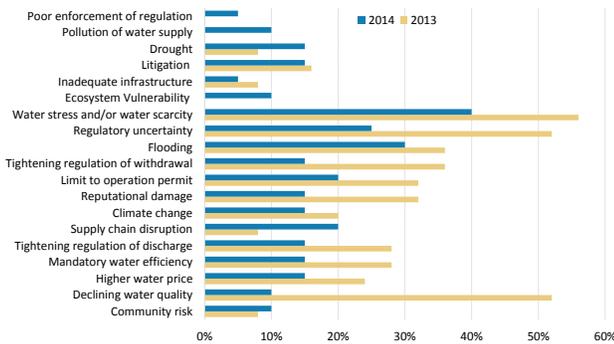
Water-related financial impact

Company	HQ Country	Impact indicator	Financial impact	EBITDA (USD mn)	Impact as % EBITDA
Consolidated Edison, Inc.	USA	Flooding- property damage, reduced production	In 2013, Consolidated Edison, Inc. reported that in the wake of hurricane Sandy, more than a million customers were without power. The total cost of the restoration and normalization efforts were in excess of \$400 m.	3,294 (FY2012)	12.10%
CLP Holdings Limited	Australia	Flooding- property damage, infrastructure reconstruction, reduced production	On 6 June 2012, water from the Morwell River Diversion entered the Yallourn mine, following the collapse of a conveyor tunnel that runs beneath the diversion. This impacted coal mine operations and reduced output from Yallourn Power Station. The reported cost in 2013 associated with the Yallourn mine flooding was \$101.9 million.	2,6975 (FY2012)	3.80%
Enel SpA	Italy	Legal compliance failure	In 2014, Enel SpA paid approximately €255,390 in fines due to pollutant quantities being above the regulatory limits for some discharge points in the Reftinskaya power plant.	21,725 (FY2013)	0.00%
Enel SpA	Italy	Flooding- property damage	Heavy rains and floods also caused overloading of the existing drainage network in the Brindisi coal thermal power plant, with resulting costs of €8,900,000.	21,725 (FY2013)	0.04%

Source: CDP 2014

Water Risks for Electric Utilities

Exhibit 9
Proportion of companies reporting specific risk drivers 2013-2014



Source: CDP Water Data 2013 and 2014

Water risks reported vary in type, scale and impact. The availability of water poses a strategic risk to a large and growing number of companies. In 2014, 17 respondents (85%) reported exposure to 132 water risks across 26 categories that could cause a substantive change in their business, revenue or operations (see Exhibit 9 for top risk categories reported by the greatest proportion of respondents).

The majority of factors driving water risk exposure within the sector remain the same year on year. However it is interesting to note that supply chain disruption has entered the top 5 risk drivers in 2014, perhaps suggesting a growing awareness of water issues that fall beyond the company fence. Further, it is surprising that declining water quality and tightening regulation of water withdrawals have both dropped out of the top 5 risk drivers given the growing regulatory scrutiny of water allocations.

Physical water risks present the most prevalent threat to the production of electricity. The two most commonly identified physical risk drivers in 2014 were flooding and water stress (see Exhibit 9). Six respondents (30%) did not report any other water risks beyond these two categories. However, all other respondents recognised risks relating to the regulation of water resources as well as reputational issues driven by real or perceived poor water management. Iberdrola, for instance, reported increasing regulation as a

substantive risk with the potential to cause disruption to operations, legal issues and reputational damage.

A decline in the quality of incoming water to production sites is also viewed as a threat. Endesa, for example, reported that a decline in water quality can lead to disruptions caused by equipment damage, higher operational costs due to the need for increased pre-water treatments and maintenance requirements, in addition to environmental problems for other water users.

Reputational damage was also cited as a risk. Although inherently difficult to quantify, a risk reported seven times across three different companies is that of reputational damage (Iberdrola, Entergy and American Electric Power). In particular, respondents anticipate that community opposition to plant construction may delay operations and result in costly litigation.

This risk is often driven by community land use rights and cultural or traditional relationships with water. In response, Iberdrola has created a general System on Stakeholder Engagement, to control reputation risks, and coordinate and monitor the reputational and corporate responsibility issues.

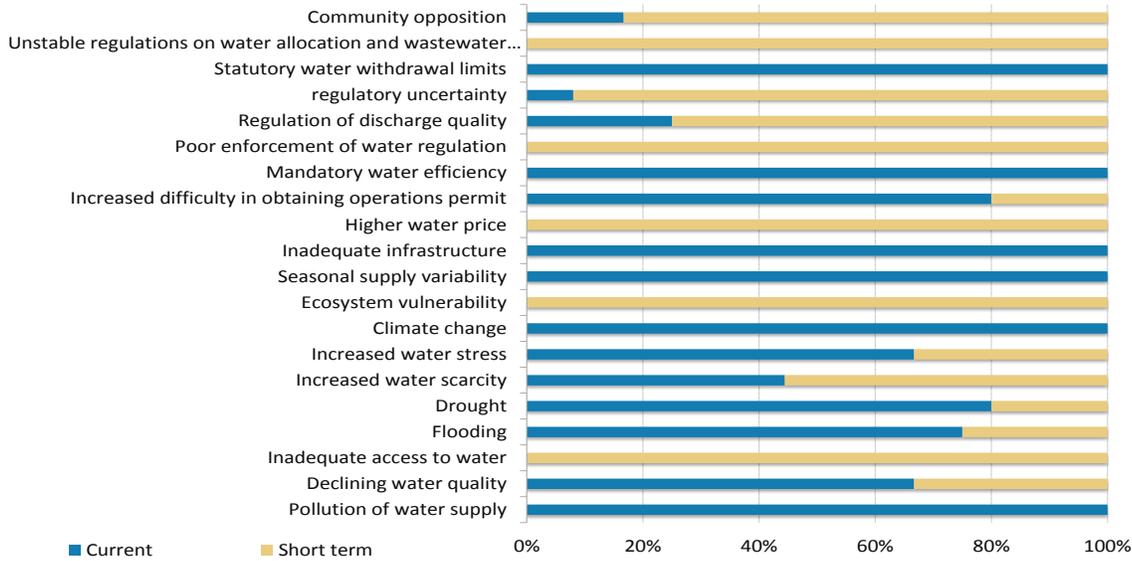
These substantive water risks are growing more immediate. The majority (31%) of the risks reported to CDP are anticipated to impact within a year (current), 12% in one to three years (short-term), 27% in four to six years, and 18% in more than six years' time. Worryingly, 12% are anticipated within an unknown timeframe, suggesting further analysis is needed.

Of the risks reported, 92% are expected to occur in the next three years (8% beyond three years). Exhibit 10 depicts the breakdown of substantive current (expected to occur within a year) and short-term risks (expected to occur in one to three years) as reported by respondents, to give an impression of the expected timing of these risks, should they occur.

Regulatory uncertainty was the most reported at 25 times, representing 27% of all current and short-term risks reported.

Exhibit 10

2014 current and short term risks



Source: CDP Water Data 2014

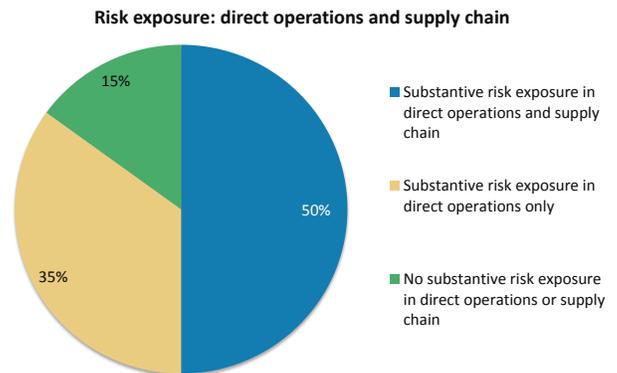
In total, 19 countries where respondents operate were reported as being vulnerable to water risks.¹⁰ There were 81 risk reports in US facilities, 17 in Spain and 6 in both the United Kingdom and Portugal. Only three companies (15%) undertake water risk assessments at a river basin level.

This is an area for improvement. Water risks are global in scale, but they manifest at a local level, and risk to business is determined by the specific local context, such as social, environmental and regulatory conditions within a river basin.

The supply chain represents an area of substantive risk for a large number of companies. 50% of respondents reported exposures. For example, Iberdrola identified the potential for brand damage associated with poor water performance by their suppliers. In addition to reputational threats, the company also anticipates that this could lead to potential reductions in capital availability.

Exhibit 11

Risk exposure to direct operations and supply chain



Source: CDP Data 2014

¹⁰ USA (81), Spain (17), UK (6), Portugal (6), Argentina (2), Australia (2), Colombia (2), France (2), Mexico (2), Morocco (2), Peru (2), Saudi Arabia (1), Sweden (1), Thailand (1), Belgium (1), Brazil (1), Chile (1), Hong Kong (1), Italy (1).

Four companies reported the following as current risks, all relating to a different fuel source:

Biomass:

Acciona is facing risks to its supply of biomass. Given the high dependency on water in the production of biomass, a reduction in rainfall will likely lead to reductions in available supply and consequentially to increases in costs.

Shale gas:

American Electric Power is facing threats to its ability to generate shale gas. According to the company, the drilling of shale gas wells requires large volumes of water, bringing with it a risk of contaminating local groundwater sources of drinking water. As a result, increasing numbers of regulators are considering restrictions, which would increase costs of an important fuel source for the company.

Coal:

EDP is facing potential restrictions in its ability to produce coal driven by restrictions in water use. The company reports that if coal becomes scarce, its price will increase and negatively impact EDP's cash flow.

Hydroelectric:

Sempra International's electric utility Chilquinta Energía relies heavily on suppliers of hydroelectric power. It reports that during periods of drought, suppliers still need to deliver on their contracts and as a result, switch from hydroelectric resources to coal, gas or diesel, which are less efficient, more expensive, and emissions intensive. While increased costs of providing the electricity are borne by the supplier, extended drought conditions will lead to higher energy costs.

Analysis suggests water risks in the supply chain may be overlooked. A total of 65% of responding companies report they include supply chain in their risk assessments, yet only 35% require key suppliers to report on water use, risk and management, and only 14% of the 132 total reported risks related to the supply chain. Companies appear to be relying on their own assessments of how their suppliers are managing water risks and opportunities, rather than requiring suppliers to report their own data and performance standards. Companies that continue in this way may miss potential opportunities and overlook serious risks.

The Changing Water Regulatory Landscape Presents Key Challenges for Electric Utilities

As water security worsens, global, national and local bodies are formulating and implementing water-related policies and regulations that may impact Electric Utilities.

Reviewing, revising and reforming regulation and policy is on the agenda of many national and local governments as threats to water security become more significant.

Worldwide, governments are formulating and implementing stringent water regulations that will likely impact many companies in the Electric Utilities sector.

A Black and Veatch survey in 2011 of more than 700 utility leaders indicated that water regulation is the issue with the greatest potential to impact the sector. CDP’s analysis indicates that 40% (53) of the total risks reported are regulatory in nature, the majority of which are anticipated to impact some 4-6 years from now. These range widely from poor enforcement and regulatory uncertainty to tighter regulation of discharge water quality and higher water prices.

For example, in Europe, EDP reported that the implementation of the Water Framework Directive presents a regulatory risk given the legislation has the potential to affect a wide range of electric utility operations through tightening of regulations of withdrawal and discharge.

The UK has pending legislative reform for water abstractions. Although the timing and impact of the legislation remains uncertain, such proposals may affect power producers significantly since a power station’s demand for cooling water cannot be changed without costly amendments to the plant.

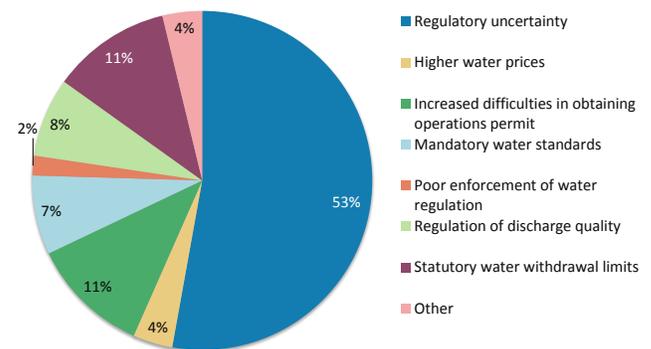
If the duration of an abstraction license expired before the expected lifetime of the power station, companies without an alternative source of water would be greatly affected. If a new license could not be secured, generating potential would be jeopardised despite the infrastructure for production and transmission already being in place. As the timing and impact of such regulations is currently unclear, pending regulations introduce an element of uncertainty that warrants further monitoring.

Impact analysis undertaken by Trucost suggests that water scarcity costs in the UK could add £1.7 million a year to the running costs of EDF Energy’s Sizewell B nuclear power station – rising to £2 million by 2025 if water stress increases

in the region¹¹. Trucost also calculated that water scarcity costs at the nine power plants operating in the east of England could add about 6 per cent to industrial power bills

In the US, new and existing electric utility facilities are facing the EPA once-through cooling rule for Cooling Water Intake Structures under section 136 of the Clean Water Act. The US EPA also issued regulation in 2014 to protect wildlife from cooling water-intake operations. These regulations were reported as a risk by both Dominion Resources and American Electric Power, in terms of the financial cost associated with installing new technologies in compliance with the new requirements. American Electric Power in 2013 reported this would have a financial effect of as much as \$1 billion for the entire fleet of coal-fired power plants, of which there could be as many as 31 power plants owned and operated by AEP. Exelon has publicly announced that it is retiring its nuclear plant in New Jersey 10 years earlier than planned due to the cost associated with having to meet more stringent water-permitting conditions.¹²

Exhibit 12
Regulatory risks reported by category



Source: CDP Data 2014

¹¹ <http://www.utilityweek.co.uk/news/utility-week-expert-view-trevor-loveday/1038082#.VFzv04dUuTp>

¹² http://www.exeloncorp.com/assets/environment/docs/Exelon_10_EP_R.pdf

Electric Utilities must move quickly, effectively and collectively if water challenges are to be addressed

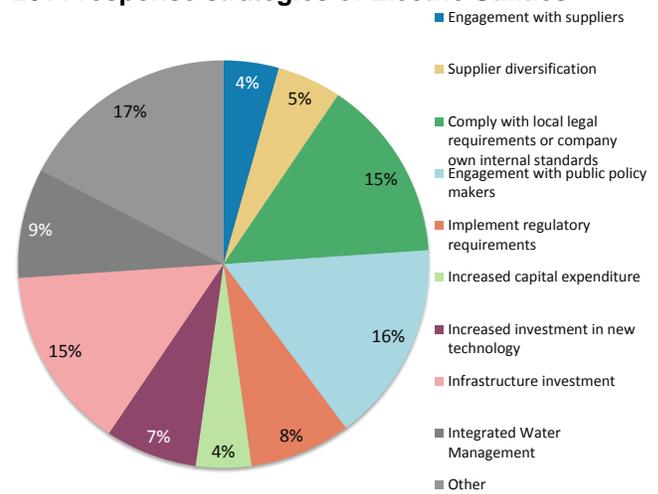
There are several ways that water risks and impacts can be mitigated. What is clear is that many cannot be dealt with by one company alone. Despite this, however, the majority of respondents are currently focusing their strategic attention on discrete activities within the fence line to reduce water dependency within their operations with little attention to other aspects of their value chain or local river basins. Just over half of respondents (55%) report concrete targets or goals for their direct operations. In general, the majority of these are focused on reducing water use or increasing water recycling/ reuse in an effort to reduce freshwater dependence. However, only 26% of these targets include an achievement date.

When considering the risks being reported – and the rapidly changing physical, regulatory and social contexts surrounding them – it is evident that many cannot be tackled solely by efficiency gains within the fence line. Companies should include actions, targets and goals for community engagement, supply chain management, river basin management, transparency and public policy. A robust strategy for minimizing risk and building long-term resilience will take each of these factors into account. However, respondents’ activities in these areas are notably lacking, potentially exposing their company and investors to risks that could be reduced. Only 40% of respondents set concrete targets or goals for community engagement, 25% for supply

chain, 25% for river basin management, 20% for transparency, and 35% set concrete targets or goals around public policy.

Given the risk exposure and water-related impacts already experienced by the sector, there is a clear and urgent need for companies to develop effective management responses in order to sustain business activities and ensure resilience in the face of water challenges.

Exhibit 13
2014 response strategies of Electric Utilities



Source: CDP Data 2014

December 9, 2014
Power Generation Utilities - Navigating Global Water Risk

Exhibit 14

Risk mitigation strategies for Electric Utilities

Type of risk	Company	Region	Risk type	Mitigation strategy
Physical risks	Endesa	Spain: Ibiza	Water stress	"Ibiza thermal plant is equipped with a cooling open cycle system that uses sea water (this system is also used for industrial purposes). In 2013, a de-mineralization plant was installed in order to reduce NOx emissions and as a result, the amount of freshwater used from the municipal system considerably increased compared to 2012."
Regulatory risks	American Electric Power	USA, Mississippi	Regulation of discharge quality	"We have invested heavily in water treatment systems to ensure we comply with our NPDES permits and we have an extensive groundwater monitoring program to help us detect adverse impacts to water quality. Our design and construction practices for new landfills typically include composite liners, leachate collection systems and groundwater monitoring wells. We proactively added an additional synthetic liner to the landfill that serves the John W. Turk, Jr., ultra-supercritical coal plant in southwest Arkansas. This will bring the design up to the level included in the EPA's proposed coal combustion residuals rule"
Regulatory risks	Exelon	USA	Increased difficulty in obtaining operations permit	"Exelon filed draft license applications for each facility in April, 2012 and filed the final license applications for each in August 2012. Exelon is using the FERC Integrated Licensing Process (ILP) to relicense the projects. In support of the development of the license applications, 47 aquatic studies designed with input from stakeholders were conducted in 2010 through 2012 and the results of the studies are included in the final license applications filed in August 2012."
Reputational risks	Iberdrola	Brazil	Inadequate access to water, sanitation and hygiene	"IBERDROLA has installed systems for capturing and storing rainwater for human consumption in the area around the Caetité windfarm in inland Bahia (Brazil). This initiative will supply water to over 3,300 homes that currently have no connection to the general water system, and no access to any type of storage resource. IBERDROLA and NEOENERGIA will work on this project with the Brazilian Ministry for Social Development and the Fight against Hunger (MDS) as part of the Water for All programme."

Source: Company Data, Morgan Stanley Research

Water Management to Water Governance

Forward planning and evaluation of how water may constrain growth is essential to the success of the sector. The companies responding to CDP indicated they expect 70% of risks to affect their businesses within the next six years. Decisions being made now on water strategy will be crucial as the sector commits to a growth trajectory that could either lead to greater exposure or enhanced resilience to water challenges. As a sector heavily reliant on water, it is essential that water governance is comprehensive and integrated into all aspects of business planning.

Approaches to assessing water risk vary greatly across the sector. 75% of respondents reported having assessed the implications of worsening water quality and quantity on the success of their organisation's growth strategy. EDF reported that the implications of worsening water quality and quantity were assessed for short-, medium- and long-term periods, and 60% of respondents undertook this evaluation over a ten-year period. Dominion also reported evaluating various risks related to water quality and quantity beyond the ten-year period. How the responding companies undertook such an assessment did vary. For example, E.ON SE went beyond legal requirements in conducting a gap analysis to determine where the company stands in relation to the UN CEO Water Management Requirements.

The Southern Company and Exelon reported assessing the effect of water quality and quantity on growth via the due diligence process for mergers and acquisitions as well as 'organic growth' for new generation capacity. Similarly, AEP and Centrica forecast water availability and quality at an individual site or project level when new generation facilities are planned. RWE AG reported that water use for thermal power stations is largely determined by the design of the plant, with water use fixed for the entire life span (40 plus years). How water assessment is factored into the growth strategy depends on the choice of cooling system and local conditions. Acciona includes risks and opportunities arising from water in its growth strategy, with such assessments used to inform the Environmental Policy of the company going forward. Endesa reported that water availability was the main indicator used to identify operational water risks that could have a substantive effect on the company's growth strategy. Quality of water discharges were also reported as impacting activities and therefore the company undertakes continuous assessment of water quality and quantity.

In 2014, 85% of respondents assessed at least one water risk in accordance with best practice, utilising accepted

methodological tools such as WRI/WBCSD. However, such tools were not used consistently in assessing risk to business units and operations at each responding company.

The management of water is becoming more strategic. 35% of companies reported that they were developing water KPIs. Acciona reported the utilization of KPI's relating to activity, country, business line and company level. KPI's included volume of water consumed by source, volume of water discharged by destination, consumption of recycled water compared to water consumption, and the company's 'positive water footprint', a calculation determined by the total of treated water, desalinated water and purified water, minus water consumed and water discharged.

In 2014, 70% of respondents reported board-level oversight of water issues. The remaining 30% need to respond to the expectation that they are aware of and actively considering the impact of water security on the company.

35% of responding companies reported that their public policy is aligned with water stewardship ambitions. Acciona reported that participation in UN Working Groups (at the Global Compact Leaders Summit) informed corporate policy. ENEL SpA reported that "we expect to have a competitive advantage when aligning our Corporate Water Management Strategy with public policy."

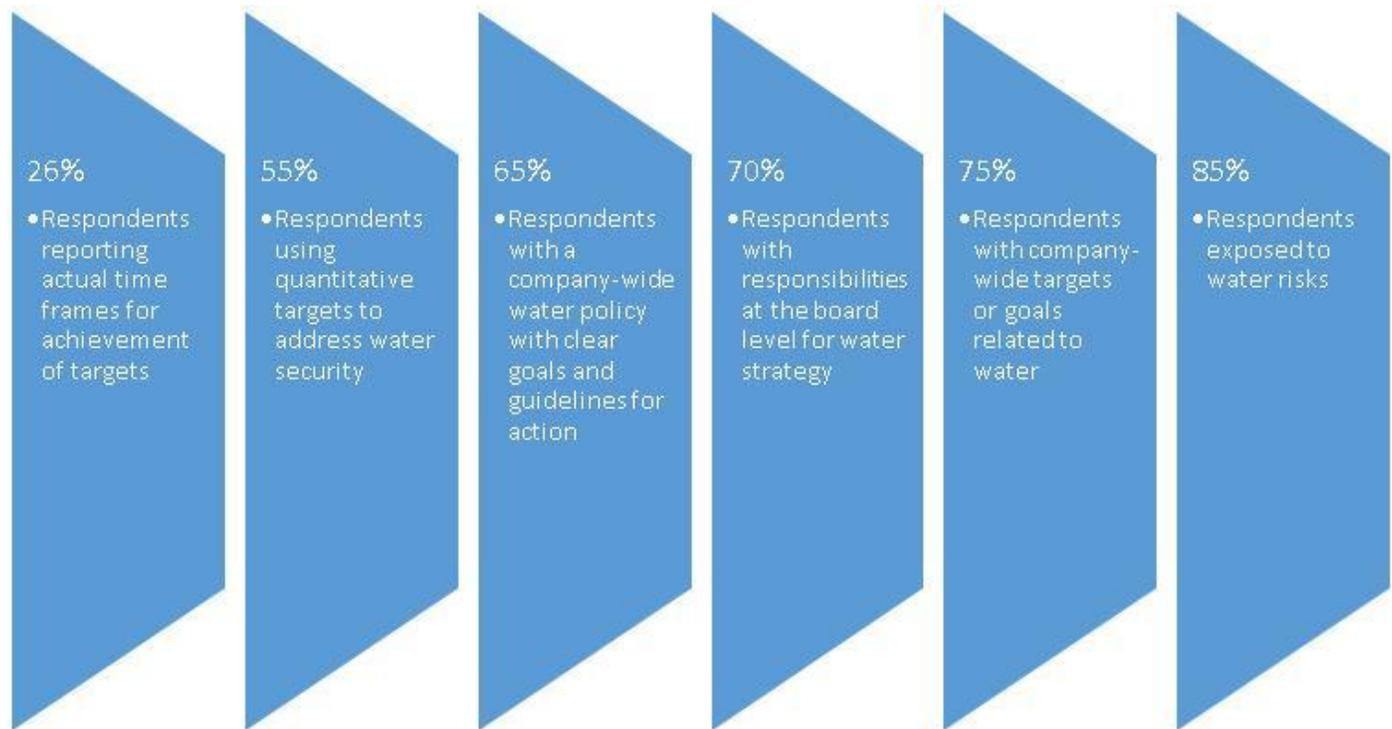
75% of respondents had a water policy that sets out clear goals and guidelines for action. However, there are very different levels of operational engagement with such policies. At one end of the scale, Exelon has implemented a Water Resources Management Policy involving company-wide evaluation of water usage and best practice. This includes hydrological evaluations and a specific focus on how climate events could impact water resources including the effect of drought on operations. Moving along the scale, HK Electric has a company-wide water policy, RWE has a water policy for select facilities only, Centrica has water-related issues incorporated into an environmental report, Sempra is in the development stages of a plan for water, and DTE Energy Company has no plan for action.

There are clear differences in approach to water management, with many companies assuming that 'business as usual' will be sufficient to deal with the challenges ahead. Too many appear not to be comprehensively addressing water risk drivers, impacts and consequences on direct operations and throughout the

supply chain. Even though a company may have a policy in place, this does not necessarily translate into meaningful action in practice.

Exhibit 15

Risk mitigation strategies for Electric Utilities



Source: CDP

Looking Forward

‘Business as usual’ is no longer appropriate given the scale, magnitude and variety of water-related risks facing the sector. It is clear that rising water demand by the sector, coupled with climate change impacts and local supply issues, has the potential for major business disruption. Against this backdrop, the 30% response rate to CDP’s information request is a cause for concern for all involved. Water stewardship will be invaluable in the coming years as these risks and challenges develop and have material repercussions. Business as usual is no longer appropriate for such a high-dependency sector, and there is a clear and compelling case to integrate rigorous water management into business practice.

Physical conditions and regulation are major water risk drivers in the electric utility sector. The major risk drivers in the electric utility sector are physical drivers that can impact direct operations and the supply chain, and regulatory drivers that encompass water quality, water pollution, cooling-water technologies and ecosystems. Monitoring the water impacts and risks of different sources of fuel for electric utilities is increasingly important as each source faces different regulations, for example the clear shift away from coal in the US. Unfortunately, there is a notable divergence between investor and responder views on regulatory and compliance risk. There is a clear need for improved attention to this area given the potential financial implications and geographical areas affected.

Water security issues need to be integrated at a strategic level and address both direct operations and the supply chain. The reporting of water-related risks is positive. However, the assessment, mitigation and integration of water security risks still needs to occur at a strategic level and address both direct operations and the supply chain. Despite recognition at board level of the strategic importance of water, this does not appear to be translating into consistent water policy adoption or measurable water-specific targets.

Investors have an important role to play in demanding information on these water-related risks and, in particular, requiring disclosure of a utility’s exposure to physical, regulatory and reputational risks. The challenge for electric utilities will be to mitigate an increasingly material risk that is prevalent throughout the direct operations and supply chain, while at the same time continuing to grow the business and provide reliable power. The essential takeaway is summarised by UNESCO: *“How can we have any hope about the future if we do not invest in what is obviously needed today?”*¹³

¹³ <http://unesdoc.unesco.org/images/0021/002151/215119E.pdf>

Case Study: Brazil - Implications of Drought for Power Supply

Miguel F Rodrigues
Fernando P Amaral

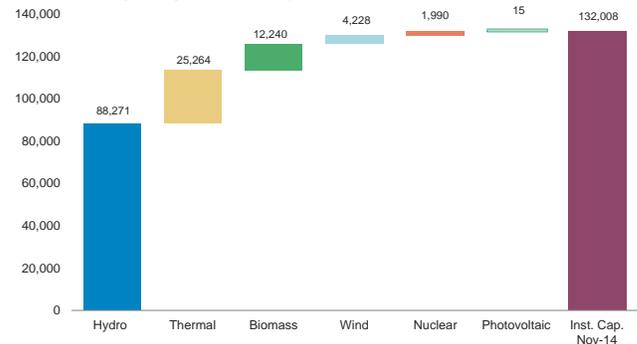
Hydropower represents 65% of the generation capacity in Brazil. This makes the Brazilian power matrix highly exposed to water risks. In the face of water scarcity, thermal generation helps the system with additional generation to meet demand. In addition, the recent hydroelectric projects are typically run-of-the-river (no reservoirs), due to environmental concerns. This increases even further the water risk, as the Grid Operator is no longer able to manage reservoir levels. 2014 was an important reference to illustrate the potential losses that the deterioration in hydrology could cause; although rationing has not been implemented, the low level of reservoirs and continued operation of thermal power brought extraordinary costs for the system. Under an extreme scenario, power rationing may be necessary, affecting companies and final consumers even further.

Reservoirs have reached concerning levels in 2014. In the Southeast/Center-West regions, which contain ~70% of the storage capacity in Brazil, reservoirs were at ~18.7% of total capacity on the last day of October, below the same period last year (45.1%). For the National System, reservoir levels reached 23.4% in October, the same as in 2001 when Brazil faced an electricity rationing.

Rainfall was far below its long-term average during important months of the rainy season (Jan-Apr), helping to deteriorate reservoir levels in Brazil. In the beginning of 2014, rainfall was materially below historical average. Demand has also reached high levels, mainly due to high temperatures during the summer, helping to speed up the reduction of reservoir levels.

Exhibit 16

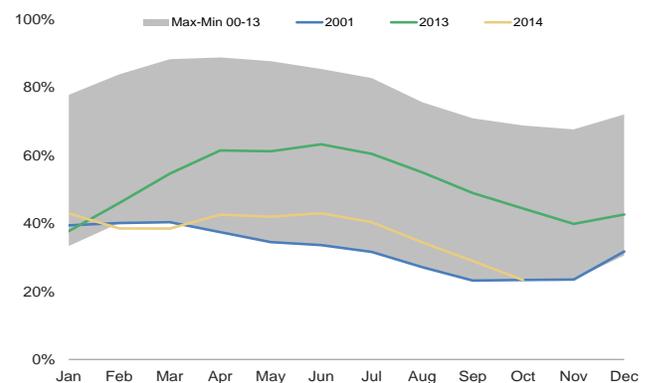
Hydro represents a relevant portion of Brazil's total installed capacity, increasing the water risk
Installed capacity in Brazil (GW, as of November 2014)



Source: ANEEL, Morgan Stanley Research

Exhibit 17

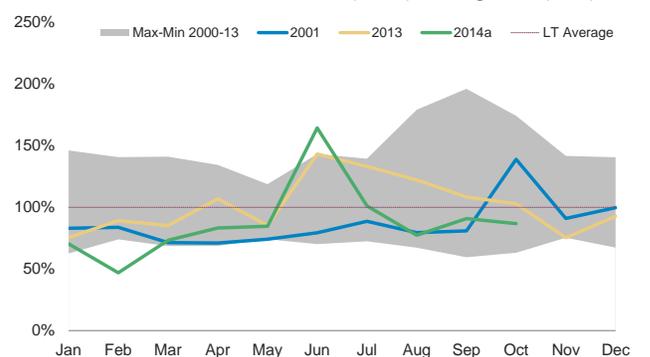
Reservoirs reached concerning levels in 2014 and the lowest since 2000 in Oct/14...
Reservoir Level (%) – National Integrated System



Source: ONS, Morgan Stanley Research

Exhibit 18

... As rainfall has been significantly below the LT avg. during the rainy season
Force of the Natural River Flow (ENA) in Avg.GW (SIN)



Source: ONS, Morgan Stanley Research. Note: ENA (Natural Energy Inflow) is the metric that shows how much electricity can be generated without changing the levels of the reservoirs, or based only on the "natural inflow."

Less rainfall significantly increases the sector's cost base. Some of these costs are passed through to final consumers and others represent actual losses for the power companies. These costs fall into two main categories:

1) Deficit in hydro generation, also known as GSF (generation scale factor). GSF is the relationship between the real hydro generation and the assured energy allocated for a specific month. Whenever this ratio is below 1.00, hydropower producers need to buy energy in the spot market. This has been a major concern in 2014, when the average deficit looks likely to reach ~9%, and we believe this could repeat next year, at ~10%, depending on factors such as hydrology, demand and operational capacity of thermal plants. The level of deficit and the uncontracted capacity in the generation portfolio of each company will define whether it is net long or short in the spot market. In other words, deficit in hydro generation has a direct negative impact for the fully contracted gencos and can reduce the gains of those with a long position in the spot market, potentially converting that into a net short position.

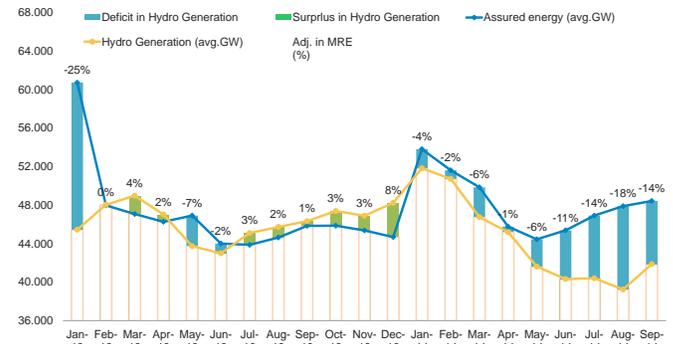
GSF resulted in a total cost of R\$16bn in the Jan-Sep 2014 period. Of this, R\$3bn was paid by the distribution companies, which are fully compensated, and R\$13bn by the generation companies, which are not compensated for this extraordinary cost. We show below an analysis quantifying the impact from the GSF in the EBITDA of the companies under our coverage. We have factored into our base case a deficit in hydro generation of ~7.7% for 2014, on average, combined with an average spot price of ~R\$680/MWh. The column "purchase in the spot market" shows the total cost related to the deficit in hydro generation. However, some companies may still have a net long position in the spot market, depending on their level of energy available for sale (e.g. CESP).

2) Fuel costs: The costs associated with the generation of thermal power are ultimately paid by the final consumers. In 2014, these costs surpassed ~R\$20bn, and we expect high thermal generation to continue during 2015, given the low starting level of reservoirs for the next year.

What's next? The latest ONS reservoir forecast for December points to 22.2%, putting the system in a vulnerable position at the rainy season. This scenario raises two concerns: blackout and rationing. The first happens when the power generation cannot meet the peak demand. Selective cuts in supply may be necessary during the summer to avoid shortages in peak-demand hours. The second risk refers to

lack of energy to meet the average demand expected for the year.

Exhibit 19
The deficit in hydro generation has been a concern for hydro generation companies during 2014
Deficit in hydro generation (GSF)



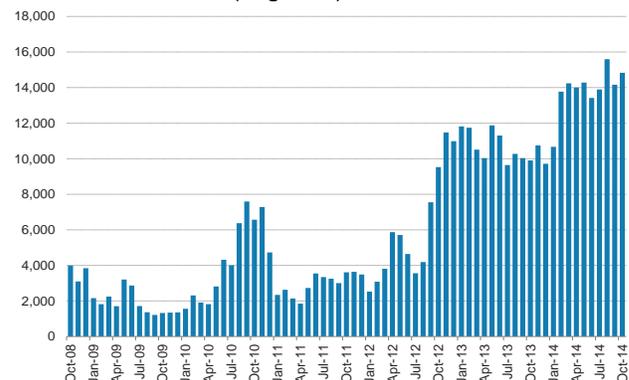
Source: CCEE, Morgan Stanley Research. Note: When the GSF (Generation Shift Factor) ratio is below 100%, hydropower producers need to buy electricity in the spot market.

Exhibit 20
Deficit in hydro generation affects negatively the fully contracted gencos and reduces the gains of those with net long positions in the spot market
7.7% Deficit in hydro generation and spot at R\$ 680/MWh

Company	Purchase in the spot R\$m	Uncontracted Energy (Avg. MW)	Gains at Spot R\$m	Net result at spot (R\$m)	2015 EBITDA (10% deficit, base case, R\$m)	2015 EBITDA (No deficit, R\$m)	Deficit drop in EBITDA %
AES Tietê	(428)	0	0	(428)	1,440	1,868	-23%
Cemig*	(582)	76	231	(351)	2,739	3,321	-18%
Cesp	(801)	400	1,214	412	2,204	3,005	-27%
Copel	(671)	205	621	(51)	2,080	2,751	-24%
CPFL Energia*	(218)	0	0	(218)	3,832	4,050	-5%
CPFL Ren.	(76)	0	0	(76)	1,044	1,120	-7%
En. do Brasil	(309)	0	0	(309)	1,387	1,696	-18%
Light	(184)	70	212	28	2,030	2,214	-8%
Tractebel ***	(961)	392	695	(266)	3,348	3,842	-13%

Source: Company Data, Morgan Stanley Research. Note: (*) Assumes that Cemig loses Jaguará and São Simão concessions. (**) Pro-forma EBITDA: CPFL's figures considers the proportional stakes in subsidiaries, excludes Serra da Mesa (per the contract with Furnas) and considers CVA adjustment in distribution. (***) TBLE's uncontracted capacity consider the energy available for sale of (75 Avg. MW), thermal generation capacity above the assured level (180 MW), and W. Arjona (136 Avg. MW). Copel's data already considers the delay of Colider HPP.

Exhibit 21
Thermal Generation is high since October 2012
Thermal Generation (Avg. MW)



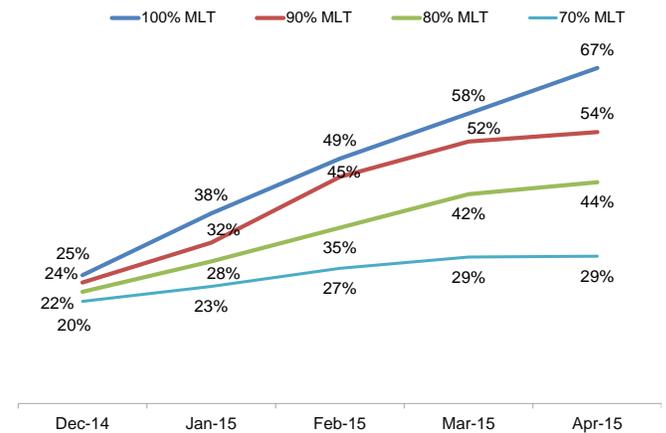
Source: ONS, Morgan Stanley Research

1) Power supply risk for 2015 (rationing): Considering current reservoir levels and rainfall forecasts, it is still early to say if the rainy season will be enough to return reservoirs to safe levels by April 2015 and thus avoid rationing. Reservoirs could surpass 40% in the SE/CW regions by April/15, roughly in-line with 2014 levels, if rainfall stays at 80% of long-term average during the rainy season. Alternatively, in order to see a recovery in reservoirs to levels above 50%, we need rainfall (ENA) of at least 90% of long-term average during the rainy season. This scenario suggests that thermal dispatch will remain close to maximum levels in 2015, driving a deficit in hydro generation, and this could be still insufficient to mitigate the rationing and blackout risk.

2) Blackout risk: The temporary lack of power is a relevant concern, given the natural increase in peak demand during the summer, coupled with low reservoir levels. In this context, selective cuts in supply may be necessary to avoid supply shortages in peak hours.

Exhibit 22

Despite low levels, reservoirs can still recover by the end of the rainy season in Brazil
Reservoir level for the National System (%)



Source: Thymos Energia, ONS, CCEE, Morgan Stanley Research. Note: Hydrology scenarios measured as a % of LT Avg. (ENA). Note: Assuming official load forecast by ONS

Case Study – China: Air Cooling Power Plants for Saving Water

Simon Lee
Qin Zhang

In recent years, coal power development in China has shifted from east to west, in line with China's National Air Pollution Control Plan and the country's strategy of relocating energy-intensive, polluting heavy industries and manufacturing. However, water scarcity is a serious issue in Northwest China. We see air-cooling power plants as a good option for Chinese IPPs to reduce water risks

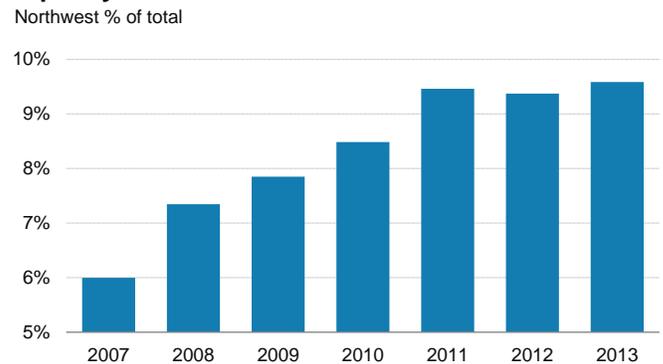
Coal power development shifting to western China. Given China's strategy of relocating energy-intensive, polluting heavy industries and manufacturing from east to west, more and more coal power plants have been built in northwest China. We note that in terms of coal power capacity, the northwest accounted for 9.6% of the total at end-2013, up from 6% at end-2007. We expect coal power plants to continue to shift to the west, as the country seeks to control coal consumption and improve air quality in the east.

According to The Opinion on 2014 Energy Work issued by the National Energy Administration (NEA), China will focus on nine large-scale coal power bases in the west of the country, including the provinces/ regions of Erdos, Ximeng, Jinbei, Jinzhong, Jindong, Shaanbei, Ningdong, Hami and Zhudong. In addition, China will build 12 power transmission lines for west-to-east power transfer.

Water scarcity in northwest China. The average water shortage within China's northwest cities is more than 50bn cubic meters (cbm) per city and two out of three cities face water shortages, according to Mr Hu Siyi, Vice Minister of Water Resources. Current per capita water resources in China are only around 2,100 cbm, around 28% of the world average. China's distribution of water resources is also uneven. North China's land area accounts for 72% of the country's total land area, but the area's water resources only account for 34% of the national total.

Exhibit 23

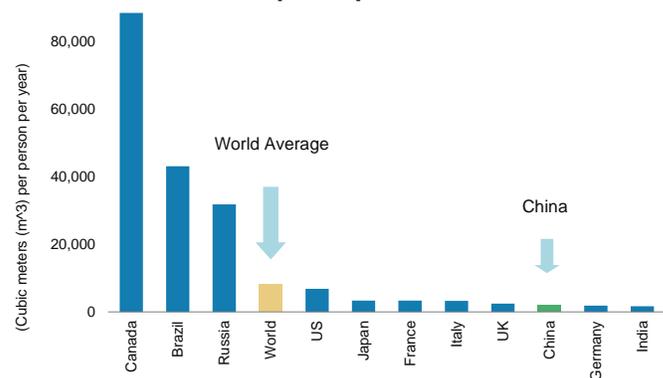
Northwest accounted for 9.6% of total coal power capacity in 2013 vs. 6% in 2007



Source: CEC, Morgan Stanley Research

Exhibit 24

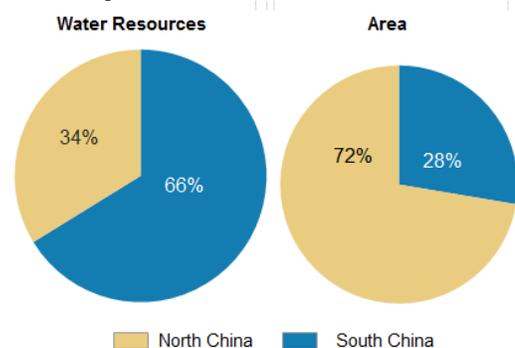
China ranks 125th in per capita water resources



Source: Water Resources Institute (2007), Morgan Stanley Research

Exhibit 25

Water scarcity is more severe in north China

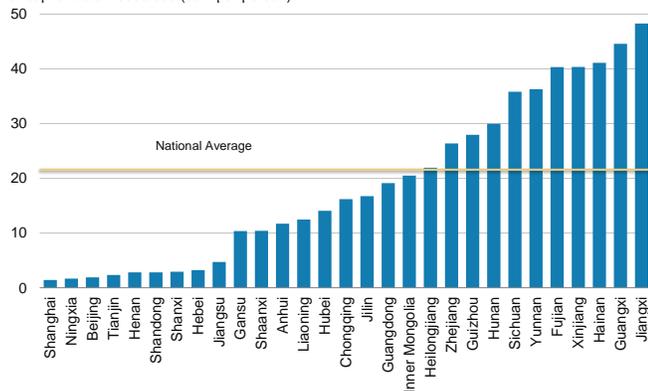


Source: NBS (2012), Morgan Stanley Research

Exhibit 26

Most provinces in the northwest are water-scarce

Per capital water resources (cbm per person)



Source: NBS (2012), Morgan Stanley Research

Air cooling power plants could be an answer to water scarcity.

Among coal power plants in China, those that employ water-cooling methods are the most common, but their large water consumption makes them unsustainable/overly costly in water saving terms. Air-cooling power plants are therefore a better option, particularly in Northwest China, where water shortage is a serious issue. According to the requirements of the National Development and Reform Commission (NDRC) on coal power plants, in north China where water resources are limited, IPPs should build large-scale air cooling power plants with water consumption rates of <0.18cbm/(GW·s). In addition, coal power plants should avoid using underground water, strictly control surface water usage, and are encouraged to use recycled water.

Air cooling power plants employ air-cooled condensers (ACC), which rely on air as the medium of heat transfer, rather than evaporation from the cooling circuit. This means that minimal water loss is achieved. Compared to water-cooling power plants, air-cooling plants can save around 66-84% of water usage. For a 1,000MW water-cooling power plant, assuming running at 8,000 hours per annum, water consumption will reach 30mt per annum. If the power plant adopts air cooling, assuming reducing 66% water usage, annual water consumption saving will amount to 20mt, implying water cost saving of Rmb20-40mn, given water tariff of Rmb1-2/t in China.

Exhibit 27

Water consumption: Air cooling vs. water cooling

Water consumption (kg/kW·h)	>600MW	300MW
Air cooling	0.44	0.33
Circulating water cooling	1.96	2.03

Source: CEC (2010), Morgan Stanley Research

However, air-cooling is more expensive...

Despite low water consumption, air-cooling power plants have these disadvantages:

- Higher investment cost:** An air-cooling heat exchanger is more expensive than water cooling equipment. In addition, air-cooling power plants' construction cost is higher. In general, a 1,000MW air-cooling power plant commands total investment of >Rmb400mn vs. Rmb350mn for water cooling plant; and a 600MW air-cooling power plant commands total investment of >Rmb250mn vs. Rmb210mn for water cooling plant;
- More land space required:** Air-cooling condenser (ACC) has huge volume and requires large land space. For example, a 600MW ACC requires 36k cbm space, 12 times the space required by the normal water-cooling condenser.
- Higher coal consumption:** Air-cooling power plants' coal consumption rate is 3-8% higher vs. water cooling plants. Take 600MW power plants as an example, air-cooling plants' coal consumption rate is 10-15g/kWh higher.

Since access to water is limited while coal and land resources are relatively affluent in northwest China, we see air-cooling power plants as a good way to solve the water scarcity issue for coal IPPs.

Case Study – UK: Water Abstraction Licence Reform

Bobby Chada
Timothy Ho

Water abstraction licences in the UK authorise an annual allowed quantity for abstraction and are managed by the environmental agencies of the constituent countries of the UK. But the allowed volume is not linked to the availability of supply and this is one of the key changes under debate for future reform.

Licence costs are driven by factors other than just volume: (1) the water source - e.g. tidal or groundwater; (2) the season - licences may be all year or Summer/Winter only; (3) the loss factor - from very low to high loss of water; (4) the region - the standard unit charge for water abstracted in Northumbria is almost triple the cost of that abstracted in Yorkshire, but the environmental improvement charge is highest in the Anglian region and zero in Yorkshire and Northumbria.

The utility industry is dependent on abstraction for cooling

The electricity generation and supply industry is easily the largest abstractor of water (outside public supply) so it would be affected the most by reforms.

Electricity generation makes up 42% of non-tidal abstraction... There were 13.7bn cubic metres of non-tidal abstractions in 2012 in England and Wales - 5.7bn were for electricity generation and supply (42%), 5.8bn were for the public water supply (42%) and the remaining 2.2bn (16%) were used in other industries such as farming and agriculture.

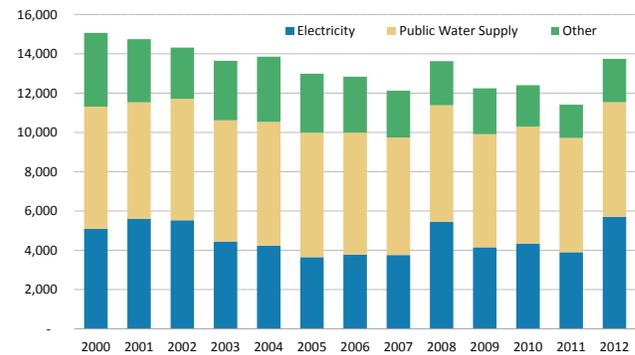
...and 60% of all abstraction. There were 22.3bn cubic metres of total abstractions in England and Wales in 2012 - 13.3bn was for electricity generation and supply (60%) and 5.8bn for public water supply (26%) and 3.1bn (14%) made up the remainder.

When taking into account tidal volumes, these numbers look larger as a lot of the big power stations use tidal abstraction for their pass-through cooling systems. High quality water is also used in steam-driven thermal generation but this volume is modest compared to that used in cooling.

Electricity abstraction of 13.3bn cubic metres in 2012 was the highest of recent times. This was due to increased volumes for use in hydropower, which requires higher volumes of water in a wet year. In 2012, hydropower abstracted 5.7bn cubic metres from non-tidal sources, which is 0.6bn higher than in 2000 and 2bn higher than Defra's 2005 estimate.

Exhibit 28

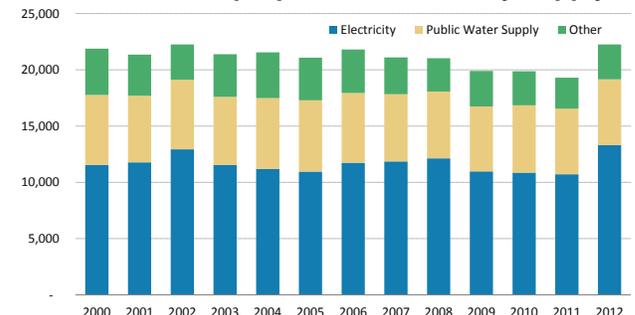
42% of water abstractions (ex-tidal) in England and Wales are for the purposes of electricity supply



Source: Defra, Morgan Stanley Research
Note: Tidal - Those parts of inland waters downstream of the normal tidal limit as marked on the 1:25,000 Ordnance Survey map and those parts of inland waters as may be specified from time to time by the Agency with the Secretary of State's approval in maps deposited at the Head Office and principal area offices of the Agency.

Exhibit 29

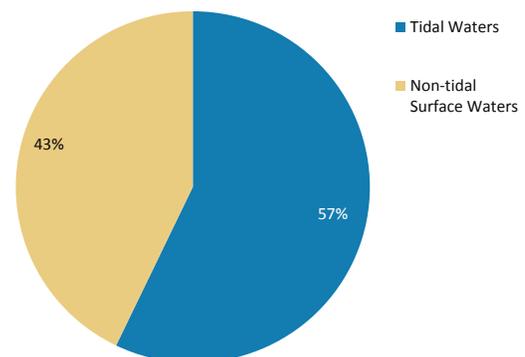
60% of water abstractions (inc. tidal) in England and Wales are for the purposes of electricity supply



Source: Defra, Morgan Stanley Research

Exhibit 30

In 2012, 57% of abstractions were from tidal waters compared to 43% from non-tidal



Source: Defra, Morgan Stanley Research

Exhibit 31

Responsibility for water abstraction by country

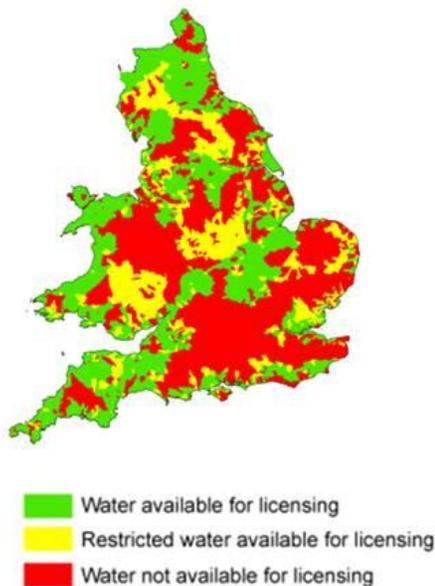
Country	Responsibility for Water Abstractions
England	The Environment Agency (EA)
Wales	Natural Resources Wales
Scotland	Scottish Environmental Protection Agency (SEPA)
Northern Ireland	Northern Ireland Environment Agency (NIEA)

Defra (Department for Environment, Food and Rural Affairs) is the government department responsible for environmental protection for the UK.

Source: EA, Natural Resources Wales, SEPA & NIEA, Morgan Stanley Research

Exhibit 32

The Environmental Agency has also prepared a regional map of where there could be future issues in abstraction licensing



Source: EA, Morgan Stanley Research

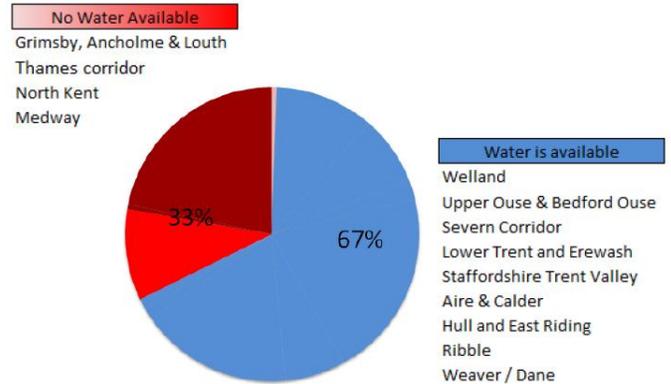
But policy makers are focusing on non-tidal freshwater catchments, which is a much smaller proportion.

We spoke to policy advisors at Defra and understand that 18% of electricity generation is dependent on freshwater abstraction (i.e. non-tidal) and this is where policy is focusing, see Exhibit 33.

Exhibit 33

Defra and the EA show that 59TWh of electricity was generated in freshwater catchments in 2010. 33% of this is in an area with water availability issues

Proportion of total gross electricity generated (59 million MWh) by freshwater catchments in 2010



Water status	Availability of water for the environment and abstraction - % range
Water available	0-100 %
No water available	100% to 124%
No water available	125% to 149%
No water available	150% to 199%
No water available	>200%

Source: The Environment Agency, Defra

Of the 59 TWh that was generated from freshwater catchments in 2010, 33% is in areas where Defra envisages a future problem with water availability. This implies that 19.5 TWh of generation is most at risk from future policy reform. Of total generation in 2010 of 348TWh, this implies that 6% of generation is at risk.

Reform is coming but not until the 2020s - shaping of policy is happening now

Defra committed to reforming the abstraction licensing system in England in its Water White Paper (Water for Life, Defra 2011) to ensure that the system is fit for the challenges of the future.

The aims of the reform are to (1) maximise water available to abstractors and provide reasonable certainty for planning; (2) facilitate trading, maximise the economic value from available water and allowing new entrants to access water; (3) protect water ecosystems in line with legal requirements and ensure the new system is able to respond to longer-term changes in availability and; (4) promote efficient use of water through

charging for actual use. The legislation to make the reform is not expected until the 2020s.

Policy proposals for changes to water abstraction went out to consultation towards the end of last year and the consultation closed on 28 March 2014. There are two main options currently in consideration for the reform of licensing: (1) Current System Plus and (2) Water Shares.

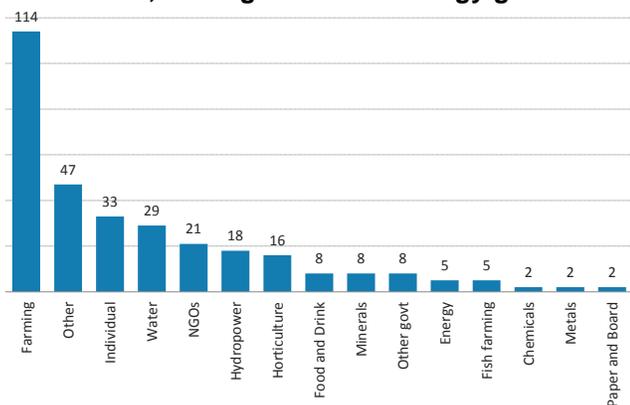
(1) Current System Plus (CSP) would link abstraction to water availability using annual and daily volumetric constraints, as in the current system. These tools would be further refined, allowing more water to be abstracted when more is available and restricting abstraction at very low flows.

(2) Water Share would give abstractors a share of the available water in a catchment, rather than an absolute amount, encouraging abstractors to take a shared responsibility for water resources in catchments.

The consultation showed a preference for CSP over Water Shares and these results will be taken into account not only by Defra but by Natural Resources Wales in the development of the Welsh final Water Strategy.

Exhibit 34

Farming gave the most individual responses to the consultation, water gave 29 and energy gave 5



Source: Defra, Morgan Stanley Research

The utility industry was represented by Energy UK in the consultation, with only companies with differing opinions offering their own response - E.ON, EDF and SSE. Hence

what seems like a small number of respondents is masked by many companies being represented by Energy UK.

We have spoken to sources in the industry and we understand that reform is on their radar but it is not something that is causing them to be unduly nervous.

There was a significant response from the water industry with 29 respondents, and we note that all the listed water companies provided a response to this first consultation.

DECC (Department of Energy and Climate Change) is of the opinion that it is still relatively early in the policy development process for water abstraction reform. Defra is modelling the impact of proposals including consideration of the impact on the energy sector. So far, DECC hasn't picked up on anything in the proposals of major concern but it continues to monitor.

Potential implications for Utilities?

Changes to terms and costs of licences are likely, in our view, but not for another decade. Our base case is that water abstraction does become linked to availability and that costs in areas with tighter supply will go up.

Clearly, a period of extended drought would be negative for generators if terms vary with water constraints. If generators cannot source the water to cool their systems this will have an effect on their availability to generate, particularly given the extremely large volumes that plants require. A simple calculation comparing the annual demand in England and Wales in 2012 (c.280TWh) to the amount of water abstracted in the industry that year (13,310m cubic metres) implies that 47.5 cubic metres or 47,500 litres of water are need for every MWh produced - these numbers are vast.

So water efficiency is likely to be part of the solution. If generators can recycle the water that they use for cooling this will mean less abstraction, cheaper licences and less exposure to water availability. This can be performed in a number of ways, for example through the use of cooling towers. However, this is additional capex and would require space on site, so management will need to consider whether the spend outweighs the risk of constraints on water supply and ultimately plant availability.

Case Study – US: Entergy’s Nuclear Plant Usage of River Water

Stephen Byrd
Devin McDermott

Entergy is a US utility with a large deregulated nuclear power generation business that is heavily driven by a single large nuclear power plant, Indian Point, located 30 miles outside of New York City. We believe the long-term viability of Indian Point may come into question given legal/regulatory steps taken by New York State that we think could prohibit Indian Point from using cooling water from the Hudson River. The State of New York has voiced concerns about the impacts to aquatic life (both fish and fish eggs) from Indian Point’s usage of up to 2.5 billion gallons of water from the Hudson River to cool the plant. We see a high probability that, in 2015, the US Nuclear Regulatory Commission (NRC) will conclude that the Indian Point nuclear plant’s use of cooling water from the Hudson River is inconsistent with New York’s Coastal Management Program (NYCMP). This result would in our view lead to the conclusion that a costly cooling tower is required for the plant’s operations to be consistent with the NYCMP. In our Base Case we assume Indian Point is shut down by the end of 2018, and is a major driver of our Underweight rating on the stock.

Background on Coastal Zone Management Act

Under the Coastal Zone Management Act (CZMA), states are given broad authority to regulate the quality of coastal waters. The CZMA encourages each state to enact its own coastal management program (CMP) and provides funding for CMP administration after it becomes federally approved. For federal approval, the development of the CMP must involve local governments and state agencies. After a CMP is approved by the federal government, federal agencies can only undertake activities or issue permits affecting the coastal zone covered by the CMP if they are deemed “consistent to the maximum extent practical” with the coastal policies contained in the state’s CMP.

Significant Habitat Designation

On July 31, 2012, New York Department of State (NYDOS) requested that The National Oceanic and Atmospheric Administration-Office of Ocean and Coastal Resource Management (NOAA-OCRM) concur with NYDOS’ changes to its Significant Coastal Fish and Wildlife Habitat designations. Included in these changes: a portion of the Hudson River (including the portion adjacent to Indian Point) was designated as a significant habitat for fish and wildlife. The

following is a description from the State of New York regarding the relevance of a “significant habitat” designation:

Once an area is designated [as a significant habitat], it is afforded special protection. Proposed actions occurring within or adjacent to the habitat must be consistent with the following policy: ‘Significant coastal fish and wildlife habitats, as identified on the coastal area map, shall be protected and preserved so as to maintain their viability as habitats’ (NYCRR - Title 19, Part 600). When an action has the potential to impair the viability of a designated habitat, that action would only be permitted when the following criteria have been met: 1. No reasonable alternative exists; 2. The action taken will minimize all adverse effects to the maximum extent practicable; 3. The action will advance one or more of the coastal policies; and 4. The action will result in an overriding regional or statewide public benefit.

Federal Gov’t Concurred With Habitat Designation

In a November 30, 2012 letter, NOAA-OCRM (the federal agency involved in regulations under the Coast Zone Management Act) **concurred** with NYDOS’ designation of a number of bodies of water as Significant Coastal Fish and Wildlife Habitats. In its concurrence, NOAA-OCRM reviewed the objections that Entergy raised to the designation of the portion of the Hudson River adjoining Indian Point. The following are key takeaways from NOAA-OCRM’s response to the objections raised to NYDOS’ designations:

1. The NYDOS designations are “routine” program changes because, among other reasons, **they have “no substantial impacts on the national interest.”**
2. **The designations do not “prohibit any existing or future uses” of the water**, because a use of water is not “prohibited on its face.” In addition, if any activity would impair a significant habitat, it could be modified to be found consistent (for example, in the case of Indian Point, by installing a cooling tower).
3. For existing uses of water (such as Indian Point), **“if an existing use must obtain a federal authorization at some time in the future, the State’s federal consistency review would be triggered and the [significant habitat] changes would apply.”**
4. Regarding Entergy’s arguments that the significant habitat designation was used “to interfere with Indian

Point,” NOAA-OCRM stated that **the designations “are not a response to any stated desire to close Indian Point...[t]he outcome of the State’s federal consistency review is unknown at this time...even if the State objects to a federal license or permit for Indian Point, Indian Point can appeal the decision to the Secretary [of Commerce], who makes the final determination of whether to approve the activity.”**

Entergy’s July 2013 letter to New York

In a July 31, 2013 letter, the law firm of Goodwin Proctor, on behalf of Entergy, wrote to NYDOS and made several points regarding a possible federal consistency review by NYDOS:

1. If NYDOS “continues to maintain that additional federal consistency review is required for the renewal of [Indian Point’s] operating licenses, Entergy requests the right to fully participate in the review process.” **Entergy has requested a hearing** with NYDOS before NYDOS were to issue a final objection (if any) to Entergy’s request for license renewal at the NRC. Entergy argues that a NYDOS negative outcome under a consistency review, without the opportunity for a hearing, would be tantamount to a “deprivation of property without due process of law.”
2. A consistency review under CZMA “was never intended by Congress to apply to existing activities and facilities such as Indian Point. **As far as Entergy is able to ascertain, New York State federal consistency review has never been used to shut down an existing operating business.**”
3. “If Entergy is ultimately prevented from using [Indian Point] for power production, [Indian Point’s] economic value and power production benefits will be squandered, along with the jobs of many.”

Our take on the “Indian Point End Game”

We believe the “end game” for Indian Point will be a negotiated shutdown of the plant by 2018. Our reasoning is as follows:

1. **We believe NRC will, in 2015, conclude that the use of cooling water from the Hudson River by the Indian Point plant is inconsistent with the State’s Coastal Management Program (CMP).** Because the CZMA in our view grants states broad authority over the regulation of water quality, and because New York was successful

in securing the concurrence of the federal government in its significant habitat designation, we believe the NRC will ultimately conclude that Indian Point’s current operations is inconsistent with the NYCMP. We believe such an outcome would be difficult to challenge given the broad language of CZMA, and would require the installation of a cooling tower, because New York has in the past described its concerns with Entergy’s proposed option, wedgewire screens (which are far less expensive). We believe this outcome is consistent with the NRC license amendment process, as evidenced by the following statement from the NRC: “Although a licensee must have a renewed license to operate a reactor beyond the term of the existing operating license, the possession of that license is just one of a number of conditions that must be met for a licensee to continue plant operation. Once an operating license is renewed, State regulatory agencies and the owners of the plant will ultimately decide whether the plant will continue to operate based on factors such as the need for power or matters within the State’s jurisdiction - including acceptability of water withdrawal, consistency with State water quality standards, and consistency with State coastal zone management plans...”

2. **A cooling tower is likely cost prohibitive to Entergy.** Entergy has stated that a cooling tower would likely cost ~\$2bn. Entergy has highlighted the potential long time frame required to obtain permits to actually construct a cooling tower. However, as many of the required permits would be granted by the State of New York, we believe the timetable could be more rapid than expected. We believe the NPV for installation of a cooling tower is negative relative to an option that we believe the State of New York might consider: an early shutdown of the plant.

A negotiated shutdown of Indian Point would represent a logical “middle ground” outcome, in our view. New York has been putting plans in place to procure replacement power when and if Indian Point were to shut down, but we believe it would require ~3 years for such replacement power plants to be procured and constructed. Allowing Indian Point to run through 2018 without cooling towers would provide additional cash flows to Entergy, avoid a very costly investment in the plant, and ensure replacement power can be procured.

Water and Power Generation: a view from the suppliers of water solutions and equipment

Emmanuel Turpin

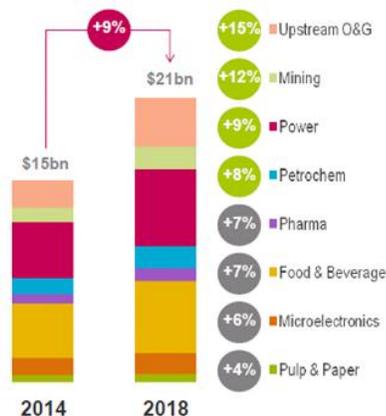
Power generation, and more generally energy production, is an area where leaders in water technology solutions such as Veolia and Suez Environnement see a lot of growth potential. This is part of the rationale for a recent focus on industrial customers by the two companies. Historically, Suez Environnement (SEV) and Veolia (VIE) have derived most of their water business from municipal contracts. They now see strong growth from industrial clients too, and typically expect double-digit annual revenue growth potential over the next few years. In this section, we discuss how these two companies interact with power utilities, and where growth could come from.

Power generation: an important segment of the growing industrial market offering

SEV and VIE both see the development of services directed at industrial clients as a key area of growth. According to studies by Global Water Intelligence (GWI), the industrial water market is worth c\$15bn currently, and should grow to \$21bn by 2018, implying a c. 9% CAGR. As shown in Exhibit 35, Power and the Food & Beverage industries are the biggest markets for industrial water today, but the highest growth rates should come from the energy sectors, chiefly the Oil & Gas and Mining sectors at +15% and +12% expected growth over the period, on GWI's estimates. Power generation offers attractive growth potential too, at c.9% – so it is not surprising that these sectors are key targets for SEV and VIE.

Exhibit 35

Growth prospects for the industrial water market (2014- 18): most growth coming from Oil/Gas, Mining and Power



Source: GWI 2014

SEV: objective of 10% CAGR in Industrial Water between 2012-16. SEV has a goal of growing its revenues from industrial clients by 10% per year until 2016. SEV made €570mn of water revenues from industrial clients in 2013, i.e. around 8% of its Water revenues globally. Equipment sales amounted to €300mn, while services revenues accounted for the remaining €270mn. The 2013 revenues were flat on 2012, but equipment sales at Degrémont (including sales to the power generation segment) grew by 11% yoy at the 9M14 stage, and the company still aims to grow its industrial water revenues by 10% per year until 2016. We would expect the company to try to strengthen its technological expertise and client portfolio in industrial water processes through acquisitions, using its solid balance sheet in the process, as part of the strategy announced at the FY13 stage. The company has indicated it already has a full product and service offering for power generators.

SEV and the power industry: SEV has been offering three levels of water service to the power industry: onsite service contracts, water treatment equipment sales, and turn-key engineering projects. Over time, the company has become more active in the service and equipment sales segments. From a technological standpoint, the company does not have any technological gap in its product offering.

From a geographical standpoint, the company has historically been very active in its core markets in Europe, including France, its single largest market, where its two largest utility clients are, unsurprisingly, EDF and GDF SUEZ. In recent years, the company has noted a slowdown of new business from the power generation segment in Europe, probably commensurate in our view with the absence of new-build projects in conventional thermal capacity due to the current overcapacity in the system. The company sees more growth outside of Europe, especially in Australia, the US, Latam and the Middle East. In the Middle East, the company notes the continued demand for its expertise in relation to desalination plants, which are energy intensive installations with a large power generation component. Interestingly, the company sees China as a market that is more difficult to address for a non-domestic supplier, due to intense local competition. The company is a large operator of municipal water and waste services.

Exhibit 36

Suez Environnement: A comprehensive product and service offering for the Power Generation segment



Source: Company Data, Morgan Stanley Research

VIE: ambitions to grow strongly in the water market for industrial customers. Veolia has identified the industrial customer segment as a key development area for its water, waste and energy services. The company has not published aggregate revenue targets the way SEV has, but has given an indication of some of the industrial segments it targets. For example, according to an article in Mining Engineering published on 8 April, Veolia said it expects its revenue from mining to double to €1.5 billion by 2020. CEO Frérot has said that mining is one of several industries being targeted by the water and waste group in an effort to secure half its revenue from industrial clients in coming years.

CEO Frérot has publicly identified Mining, Oil & Gas, Power Generation and the Agrofood businesses as the most promising industrial sectors for VIE's water business. In the Mining industry, VIE would like to recover minerals from waste water on top of the traditional water treatment operations. VIE said that 70 percent of new projects by the big six mining companies were in regions suffering water shortages. In addition, the CEO indicated that regulation around water usage and water discharge standards is toughening. The article also said that VIE estimates the global market for water, waste and environment services to the mining and metals sector will grow to more than €20 billion in 2020, from between €13-14 billion currently, and hopes to increase its share of that market from 5% to 7-8%.

Veolia and the Power Generation segment: Veolia offers the full spectrum of product and services catering for the power generation industry. From an equipment standpoint, the company offers all types of water treatment technology, the complete flow sheet, including clarification. VIE is very much involved on the service side as well. We note that Veolia manages the water supply contracts for nuclear power plants globally with key references in North America and Asia, which illustrates that its expertise is recognized by local generation companies, considering the degree of selection and scrutiny to which suppliers to the nuclear industry are exposed.

Today, Veolia is the largest of the two French companies in this segment, as it already represents roughly €300mn in annual revenues, excluding desalination processes. These contracts typically have a duration of 3-5 years. Equipment sales related to power plants linked to desalination units typically double these revenues annually.

Veolia sees further growth potential, driven by the need for new generation capacity, either greenfield in developing markets or brownfield, even in Europe where an aging fleet will need replacing. The company has also identified a trend for regulatory constraints to become more stringent. This is the case in the US for instance, with regards to the remediation of ash basins, tighter limits on water discharge and controlling air pollution. A similar trend exists for the Oil and Gas industry, as well as the mining sector, as we explained in our report [ESG Framework- Oil & Gas](#) and [ESG Framework- Metals & Mining](#). Overall, considering the renewed focus on industrial clients defined by CEO A. Frérot, the company believes it can grow its water revenues in the power generation segment towards €500mn in the next five years, implying a c.10% CAGR.

Price: Entergy \$84.04

Appendix

Exhibit 37

Companies that responded to the CDP water questionnaire (1 of 2)

Company Name	Country	Detrimental impacts related to water	Water strategy	Water targets and goals	Exposure to water risks	Facilities exposed to water risks	Type of detrimental impact experienced	Identification of water-related opportunities	Water management integrated into business strategy	Requirement of suppliers to report on water risks
ACCIONA S.A.	Spain	Yes	Yes	Yes	Yes	8	Flooding	Yes	Yes	Yes
Ameren Corporation	USA	No	Yes	Yes	Yes				Yes	No
American Electric Power Company, Inc.	USA	Yes	Yes	Yes	Yes	27	Drought, flooding	No	Yes	Yes
Centrica	United Kingdom	No	No	Yes	No			No	Yes	Yes
Dominion Resources, Inc.	USA	Yes	No	No	Yes	16	Regulatory	Yes	Yes	No
DTE Energy Company	USA	No	No	No	Yes	10		Yes	No	No
E.ON SE	Germany	Yes	No	Yes (goals only)	Yes	4	Drought, regulation, flooding	Yes	Yes	No
EDF	France	No	Yes	Yes	No				Yes	Yes
EDP - Energias de Portugal S.A.	Portugal	Yes	Yes	Yes	Yes	61	Pollution, water quality	Yes	Yes	Yes
Endesa	Spain	Yes	Yes	Yes	Yes	9	Flooding, community opposition		Yes	No
ENEL SpA	Italy	Yes	Yes	Yes	Yes				Yes	No
Entergy Corporation	USA	No	Yes	Yes (goals only)	Yes	17	Flooding, water quality, community opposition	Yes	Yes	No
Exelon Corporation	USA	Yes	Yes	Yes	Yes	15	Water scarcity	Yes	Yes	Yes
GDF Suez	France	No	Yes	Yes (goals only)	Yes	83		Yes	Yes	No
HK Electric Investments	Hong Kong	No	Yes	Yes	Yes			Yes	Yes	No
Iberdrola SA	Spain	No	Yes	Yes	Yes	33		Yes	Yes	Yes
National Grid	United Kingdom	No	No	No	Yes	13		No	Yes	No
RWE AG	Germany	No	Yes	Yes (goals only)	No			No	Yes	No
Sempra Energy	USA	No	No	No	Yes			Yes		No
The Southern Company	USA	No	No	No	Yes			Yes	Yes	No

Source: CDP

Exhibit 38

Companies that responded to the CDP water questionnaire (2 of 2)

Company Name	Engagement topics
ACCIONA S.A.	ACCIONA assesses water risks at the country level only, a suggested improvement would be to assess such risks at a lower operation level, such as facility or river basin.
Ameren Corporation	Ameren should look at requiring key suppliers to report on water use, risks and management and factor such suppliers into water risk assessments.
American Electric Power Company, Inc.	AEP should evaluate the implications of water on key commodities/raw materials and factor this into the company's water risk assessments, as AEP has reported that sufficient river water levels are needed for coal and limestone barges, in addition to gas fracking requiring significant quantities of water.
Centrica	Centrica should look at developing a company-wide water policy with clear goals and guidelines for action.
Dominion Resources, Inc.	Dominion should look at requiring key suppliers to report on water use, risk and management and utilise external methodologies to assess water risks rather than relying on internal methods. Dominion is also lacking a specific water policy and company-wide targets or goals related to water.
DTE Energy Company	DTE does not currently integrate water management into its business strategy. This means how water quality and quantity could impact the growth strategy of the company cannot be evaluated effectively. DTE also does not require key suppliers to report on water use, risk and management.
E.ON SE	E ON SE does not require key suppliers to report on water use, risk and management. In addition, the company has no quantitative targets related to water, or a specified time frame within which water risks are assessed.
EDF	EDF focuses only on the Group's coal supply chain, and a similar evaluation of other suppliers water footprint should be undertaken.
EDP - Energias de Portugal S.A.	EDP has still not addressed many water-related risks. For example, customers and suppliers are not yet included in water-risk assessments despite being viewed as relevant stakeholders in water risk assessments by the company.
Endesa	Endesa does not require key suppliers to report on water use, risk and management. Although Endesa carries out an internal water footprint analysis of suppliers, involving suppliers in the footprint calculation process would improve the calculation and provide more accurate data.
ENEL SpA	ENEL SpA does not currently require key suppliers to report on water use, risk and management. This supply chain analysis would enable the company to assess supply chain risks related to water.
Entergy Corporation	Entergy does not require key suppliers to report on water use, risk and management. The company should look at assessing water risks not only at the regional level, but at a lower operational level, such as facility or river basin level. Quantitative targets would also be an improvement on the qualitative company-wide goals Entergy currently has in place.
Exelon Corporation	Exelon should look at assessing water risks at a lower geographical scale than the country level, for example facility or river basin level.
GDF Suez	GDF Suez should look at requiring key suppliers to report on water use, risk and management. Water risks should be assessed at a lower level than the regional level. In addition, GDF should look at implementing quantitative targets related to water to supplement and improve the company-wide water-related goals.
HK Electric Investments	HK Electric Investments should look at evaluating the effects of water quality and quantity on the success of the growth strategy beyond the current 1 year period specified.
Iberdrola SA	Iberdrola has disclosed two company-wide quantitative targets related to supply chain engagement and water withdrawal reductions. Other possible areas for Iberdrola to develop water targets include reduction in consumptive volumes, reduction in water intensity and water pollution prevention targets.
National Grid	National Grid does not require key suppliers to report on water use, risk and management. Also, National Grid is lacking a water policy that sets out clear goals and guidelines for action, and no company-wide goals or targets related to water.
RWE AG	RWE does not currently require key suppliers to report on water use, risk and management. The use of external assessment for water risks would be useful rather than the reliance of internal knowledge. In addition, the development of quantitative targets in addition to goals related to water would be an area for improvement.
Sempra Energy	Sempra does not require key suppliers to report on water use, risk and management. Sempra could also look at developing a water policy or strategy at the company level.
The Southern Company	The Southern Company lacks a program which identifies the water usage or water availability of key suppliers. In addition, the Company does not have a water policy that sets out clear goals and guidelines for action.

Source: CDP

Exhibit 39

Companies that did not respond to the CDP water questionnaire

Declined to Participate	No Response
CenterPoint Energy, Inc.	AGL Energy
Chubu Electric Power Co., Inc.	Centrais Eletricas Brasileiras S/A (ELETROBRAS)
CMS Energy Corporation	CESC Ltd
Consolidated Edison, Inc.	CEZ
Duet Group	Cia Paranaense de Energia - COPEL
Edison International	CLP Holdings Limited
FirstEnergy Corporation	Duke Energy Corporation
Kyushu Electric Power Co Inc	Eskom
NiSource Inc.	Fortum Oyj
Pepco Holdings, Inc.	Hokkaido Electric Power Co., Inc.
Pinnacle West Capital Corporation	Hokuriku Electric Power Company
PPL Corporation	Integrus Energy Group, Inc.
SSE	Korea Electric Power Corporation
TECO Energy, Inc.	NextEra Energy, Inc.
The Tokyo Electric Power Company, Inc (TEPCO)	Northeast Utilities
Xcel Energy Inc.	PG&E Corporation
	Power Assets Holdings Limited
	Power Grid Corpn. of India
	Public Service Enterprise Group Inc.
	Reliance Infrastructure
	SCANA Corporation
	Shikoku Electric Power Co., Inc.
	SJVN Ltd
	SP AusNet
	Spark Infrastructure Group
	Tata Power Co
	The Chugoku Electric Power Company
	The Kansai Electric Power Co., Inc.
	Tohoku Electric Power Co., Inc.
	Torrent Power
	Wisconsin Energy Corporation

Source: CDP

Disclosure Section

Morgan Stanley & Co. International plc, authorized by the Prudential Regulatory Authority and regulated by the Financial Conduct Authority and the Prudential Regulatory Authority, disseminates in the UK research that it has prepared, and approves solely for the purposes of section 21 of the Financial Services and Markets Act 2000, research which has been prepared by any of its affiliates. As used in this disclosure section, Morgan Stanley includes RMB Morgan Stanley (Proprietary) Limited, Morgan Stanley & Co International plc and its affiliates.

For important disclosures, stock price charts and equity rating histories regarding companies that are the subject of this report, please see the Morgan Stanley Research Disclosure Website at www.morganstanley.com/researchdisclosures, or contact your investment representative or Morgan Stanley Research at 1585 Broadway, (Attention: Research Management), New York, NY, 10036 USA.

For valuation methodology and risks associated with any price targets referenced in this research report, please contact the Client Support Team as follows: US/Canada +1 800 303-2495; Hong Kong +852 2848-5999; Latin America +1 718 754-5444 (U.S.); London +44 (0)20-7425-8169; Singapore +65 6834-6860; Sydney +61 (0)2-9770-1505; Tokyo +81 (0)3-6836-9000. Alternatively you may contact your investment representative or Morgan Stanley Research at 1585 Broadway, (Attention: Research Management), New York, NY 10036 USA.

Analyst Certification

The following analysts hereby certify that their views about the companies and their securities discussed in this report are accurately expressed and that they have not received and will not receive direct or indirect compensation in exchange for expressing specific recommendations or views in this report: Jessica Alford, Miguel Rodrigues, Fernando Amaral.

Unless otherwise stated, the individuals listed on the cover page of this report are research analysts.

Global Research Conflict Management Policy

Morgan Stanley Research has been published in accordance with our conflict management policy, which is available at www.morganstanley.com/institutional/research/conflictolicies.

Important US Regulatory Disclosures on Subject Companies

Within the last 12 months, Morgan Stanley managed or co-managed a public offering (or 144A offering) of securities of Entergy Corp.

Within the last 12 months, Morgan Stanley has received compensation for investment banking services from Entergy Corp.

In the next 3 months, Morgan Stanley expects to receive or intends to seek compensation for investment banking services from Entergy Corp.

Within the last 12 months, Morgan Stanley has received compensation for products and services other than investment banking services from Entergy Corp.

Within the last 12 months, Morgan Stanley has provided or is providing investment banking services to, or has an investment banking client relationship with, the following company: Entergy Corp.

Within the last 12 months, Morgan Stanley has either provided or is providing non-investment banking, securities-related services to and/or in the past has entered into an agreement to provide services or has a client relationship with the following company: Entergy Corp.

Morgan Stanley & Co. LLC makes a market in the securities of Entergy Corp.

The equity research analysts or strategists principally responsible for the preparation of Morgan Stanley Research have received compensation based upon various factors, including quality of research, investor client feedback, stock picking, competitive factors, firm revenues and overall investment banking revenues.

Morgan Stanley and its affiliates do business that relates to companies/instruments covered in Morgan Stanley Research, including market making, providing liquidity and specialized trading, risk arbitrage and other proprietary trading, fund management, commercial banking, extension of credit, investment services and investment banking. Morgan Stanley sells to and buys from customers the securities/instruments of companies covered in Morgan Stanley Research on a principal basis. Morgan Stanley may have a position in the debt of the Company or instruments discussed in this report.

Certain disclosures listed above are also for compliance with applicable regulations in non-US jurisdictions.

STOCK RATINGS

Morgan Stanley uses a relative rating system using terms such as Overweight, Equal-weight, Not-Rated or Underweight (see definitions below). Morgan Stanley does not assign ratings of Buy, Hold or Sell to the stocks we cover. Overweight, Equal-weight, Not-Rated and Underweight are not the equivalent of buy, hold and sell. Investors should carefully read the definitions of all ratings used in Morgan Stanley Research. In addition, since Morgan Stanley Research contains more complete information concerning the analyst's views, investors should carefully read Morgan Stanley Research, in its entirety, and not infer the contents from the rating alone. In any case, ratings (or research) should not be used or relied upon as investment advice. An investor's decision to buy or sell a stock should depend on individual circumstances (such as the investor's existing holdings) and other considerations.

Global Stock Ratings Distribution

(as of November 30, 2014)

For disclosure purposes only (in accordance with NASD and NYSE requirements), we include the category headings of Buy, Hold, and Sell alongside our ratings of Overweight, Equal-weight, Not-Rated and Underweight. Morgan Stanley does not assign ratings of Buy, Hold or Sell to the stocks we cover. Overweight, Equal-weight, Not-Rated and Underweight are not the equivalent of buy, hold, and sell but represent recommended relative weightings (see definitions below). To satisfy regulatory requirements, we correspond Overweight, our most positive stock rating, with a buy recommendation; we correspond Equal-weight and Not-Rated to hold and Underweight to sell recommendations, respectively.

Stock Rating Category	Coverage Universe		Investment Banking Clients (IBC)		
	Count	% of Total	Count	% of Total IBC	% of Rating Category
Overweight/Buy	1159	35%	339	42%	29%
Equal-weight/Hold	1403	43%	355	44%	25%
Not-Rated/Hold	108	3%	20	2%	19%
Underweight/Sell	595	18%	87	11%	15%
Total	3,265		801		

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months.

Analyst Stock Ratings

Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Equal-weight (E). The stock's total return is expected to be in line with the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Not-Rated (NR). Currently the analyst does not have adequate conviction about the stock's total return relative to the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Underweight (U). The stock's total return is expected to be below the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

Analyst Industry Views

Attractive (A): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be attractive vs. the relevant broad market benchmark, as indicated below.

In-Line (I): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be in line with the relevant broad market benchmark, as indicated below.

Cautious (C): The analyst views the performance of his or her industry coverage universe over the next 12-18 months with caution vs. the relevant broad market benchmark, as indicated below.

Benchmarks for each region are as follows: North America - S&P 500; Latin America - relevant MSCI country index or MSCI Latin America Index; Europe - MSCI Europe; Japan - TOPIX; Asia - relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

Stock Price, Price Target and Rating History (See Rating Definitions)

Stock Price, Price Target and Rating History (See Rating Definitions)



Stock Rating History: 12/1/11 : NR/NR; 1/17/12 : U/I

Price Target History: 1/17/12 : 67; 3/29/12 : 64; 9/7/12 : 65; 9/12/13 : 60; 10/16/13 : 62; 1/13/14 : 59; 2/10/14 : 61; 3/6/14 : 64; 4/7/14 : 68; 5/7/14 : 70; 6/6/14 : 72; 7/7/14 : 74; 8/13/14 : 67; 9/9/14 : 70; 11/11/14 : 76

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
 Stock Price (Not Covered by Current Analyst) --- Stock Price (Covered by Current Analyst) ■
 Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
 Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
 Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

Important Disclosures for Morgan Stanley Smith Barney LLC Customers

Important disclosures regarding the relationship between the companies that are the subject of Morgan Stanley Research and Morgan Stanley Smith Barney LLC or Morgan Stanley or any of their affiliates, are available on the Morgan Stanley Wealth Management disclosure website at www.morganstanley.com/online/researchdisclosures. For Morgan Stanley specific disclosures, you may refer to www.morganstanley.com/researchdisclosures.

Each Morgan Stanley Equity Research report is reviewed and approved on behalf of Morgan Stanley Smith Barney LLC. This review and approval is conducted by the same person who reviews the Equity Research report on behalf of Morgan Stanley. This could create a conflict of interest.

Other Important Disclosures

Morgan Stanley & Co. International PLC and its affiliates have a significant financial interest in the debt securities of Entergy Corp.

Morgan Stanley is not acting as a municipal advisor and the opinions or views contained herein are not intended to be, and do not constitute, advice within the meaning of Section 975 of the Dodd-Frank Wall Street Reform and Consumer Protection Act.

Morgan Stanley produces an equity research product called a "Tactical Idea." Views contained in a "Tactical Idea" on a particular stock may be contrary to the recommendations or views expressed in research on the same stock. This may be the result of differing time horizons, methodologies, market events, or other factors. For all research available on a particular stock, please contact your sales representative or go to Matrix at <http://www.morganstanley.com/matrix>.

Morgan Stanley Research is provided to our clients through our proprietary research portal on Matrix and also distributed electronically by Morgan Stanley to clients. Certain, but not all, Morgan Stanley Research products are also made available to clients through third-party vendors or redistributed to clients through alternate electronic means as a convenience. For access to all available Morgan Stanley Research, please contact your sales representative or go to Matrix at <http://www.morganstanley.com/matrix>.

Any access and/or use of Morgan Stanley Research is subject to Morgan Stanley's Terms of Use (<http://www.morganstanley.com/terms.html>). By accessing and/or using Morgan Stanley Research, you are indicating that you have read and agree to be bound by our Terms of Use (<http://www.morganstanley.com/terms.html>). In addition you consent to Morgan Stanley processing your personal data and using cookies in accordance with our Privacy Policy and our Global Cookies Policy (http://www.morganstanley.com/privacy_pledge.html), including for the purposes of setting your preferences and to collect readership data so that we can deliver better and more personalized service and products to you. To find out more information about how Morgan Stanley processes personal data, how we use cookies and how to reject cookies see our Privacy Policy and our Global Cookies Policy (http://www.morganstanley.com/privacy_pledge.html).

If you do not agree to our Terms of Use and/or if you do not wish to provide your consent to Morgan Stanley processing your personal data or using cookies please do not access our research.

Morgan Stanley Research does not provide individually tailored investment advice. Morgan Stanley Research has been prepared without regard to the circumstances and objectives of those who receive it. Morgan Stanley recommends that investors independently evaluate particular investments and strategies, and encourages investors to seek the advice of a financial adviser. The appropriateness of an investment or strategy will depend on an investor's circumstances and objectives. The securities, instruments, or strategies discussed in Morgan Stanley Research may not be suitable for all investors, and certain investors may not be eligible to purchase or participate in some or all of them. Morgan Stanley Research is not an offer to buy or sell or the solicitation of an offer to buy or sell any security/instrument or to participate in any particular trading strategy. The value of and income from your investments may vary because of changes in interest rates, foreign exchange rates, default rates, prepayment rates, securities/instruments prices, market indexes, operational or financial conditions of companies or other factors. There may be time limitations on the exercise of options or other rights in securities/instruments transactions. Past performance is not necessarily a guide to future performance. Estimates of future performance are based on assumptions that may not be realized. If provided, and unless otherwise stated, the closing price on the cover page is that of the primary exchange for the subject company's securities/instruments.

The fixed income research analysts, strategists or economists principally responsible for the preparation of Morgan Stanley Research have received compensation based upon various factors, including quality, accuracy and value of research, firm profitability or revenues (which include fixed income trading and capital markets profitability or revenues), client feedback and competitive factors. Fixed Income Research analysts', strategists' or economists' compensation is not linked to investment banking or capital markets transactions performed by Morgan Stanley or the profitability or revenues of particular trading desks.

The "Important US Regulatory Disclosures on Subject Companies" section in Morgan Stanley Research lists all companies mentioned where Morgan Stanley owns 1% or more of a class of common equity securities of the companies. For all other companies mentioned in Morgan Stanley Research, Morgan Stanley may have an investment of less than 1% in securities/instruments or derivatives of securities/instruments of companies and may trade them in ways different from those discussed in Morgan Stanley Research. Employees of Morgan Stanley not involved in the preparation of Morgan Stanley Research may have investments in securities/instruments or derivatives of securities/instruments of companies mentioned and may trade them in ways different from those discussed in Morgan Stanley Research. Derivatives may be issued by Morgan Stanley or associated persons.

With the exception of information regarding Morgan Stanley, Morgan Stanley Research is based on public information. Morgan Stanley makes every effort to use reliable, comprehensive information, but we make no representation that it is accurate or complete. We have no obligation to tell you when opinions or information in Morgan Stanley Research change apart from when we intend to discontinue equity research coverage of a subject company. Facts and views presented in Morgan Stanley Research have not been reviewed by, and may not reflect information known to, professionals in other Morgan Stanley business areas, including investment banking personnel.

Morgan Stanley Research personnel may participate in company events such as site visits and are generally prohibited from accepting payment by the company of associated expenses unless pre-approved by authorized members of Research management.

Morgan Stanley may make investment decisions or take proprietary positions that are inconsistent with the recommendations or views in this report.

To our readers in Taiwan: Information on securities/instruments that trade in Taiwan is distributed by Morgan Stanley Taiwan Limited ("MSTL"). Such information is for your reference only. The reader should independently evaluate the investment risks and is solely responsible for their investment decisions. Morgan Stanley Research may not be distributed to the public media or quoted or used by the public media without the express written consent of Morgan Stanley. Information on securities/instruments that do not trade in Taiwan is for informational purposes only and is not to be construed as a recommendation or a solicitation to trade in such securities/instruments. MSTL may not execute transactions for clients in these securities/instruments. To our readers in Hong Kong: Information is distributed in Hong Kong by and on behalf of, and is attributable to, Morgan Stanley Asia Limited as part of its regulated activities in Hong Kong. If you have any queries concerning Morgan Stanley Research, please contact our Hong Kong sales representatives.

Morgan Stanley is not incorporated under PRC law and the research in relation to this report is conducted outside the PRC. Morgan Stanley Research does not constitute an offer to sell or the solicitation of an offer to buy any securities in the PRC. PRC investors shall have the relevant qualifications to invest in such securities and shall be responsible for obtaining all relevant approvals, licenses, verifications and/or registrations from the relevant governmental authorities themselves.

Morgan Stanley Research is disseminated in Brazil by Morgan Stanley C.T.V.M. S.A.; in Japan by Morgan Stanley MUFG Securities Co., Ltd. and, for Commodities related research reports only, Morgan Stanley Capital Group Japan Co., Ltd; in Hong Kong by Morgan Stanley Asia Limited (which accepts responsibility for its contents) and by Bank Morgan Stanley AG, Hong Kong Branch; in Singapore by Morgan Stanley Asia (Singapore) Pte. (Registration number 199206298Z) and/or Morgan Stanley Asia (Singapore) Securities Pte Ltd (Registration number 200008434H), regulated by the Monetary Authority of Singapore (which accepts legal responsibility for its contents and should be contacted with respect to any matters arising from, or in connection with, Morgan Stanley Research) and by Bank Morgan Stanley AG, Singapore Branch (Registration number T11FC0207F); in Australia to "wholesale clients" within the meaning of the Australian Corporations Act by Morgan Stanley Australia Limited A.B.N. 67 003 734 576, holder of Australian financial services license No. 233742, which accepts responsibility for its contents; in Australia to "wholesale clients" and "retail clients" within the meaning of the Australian Corporations Act by Morgan Stanley Wealth Management Australia Pty Ltd (A.B.N. 19 009 145 555, holder of Australian financial services license No. 240813, which accepts responsibility for its contents; in Korea by Morgan Stanley & Co International plc, Seoul Branch; in India by Morgan Stanley India Company Private Limited; in Indonesia by PT Morgan Stanley Asia Indonesia; in Canada by Morgan Stanley Canada Limited, which has approved of and takes responsibility for its contents in Canada; in Germany by Morgan Stanley Bank AG, Frankfurt am Main and Morgan Stanley Private Wealth Management Limited, Niederlassung Deutschland, regulated by Bundesanstalt fuer Finanzdienstleistungsaufsicht (BaFin); in Spain by Morgan Stanley, S.V., S.A., a Morgan Stanley group company, which is supervised by the Spanish Securities Markets Commission (CNMV) and states that Morgan Stanley Research has been written and distributed in accordance with the rules of conduct applicable to financial research as established under Spanish regulations; in the US by Morgan Stanley & Co. LLC, which accepts responsibility for its contents. Morgan Stanley & Co. International plc, authorized by the Prudential Regulatory Authority and regulated by the Financial Conduct Authority and the Prudential Regulatory Authority, disseminates in the UK research that it has prepared, and approves solely for the purposes of section 21 of the Financial Services and Markets Act 2000, research which has been prepared by any of its affiliates. Morgan Stanley Private Wealth Management Limited, authorized and regulated by the Financial Conduct Authority, also disseminates Morgan Stanley Research in the UK. Private UK investors should obtain the advice of their Morgan Stanley & Co. International plc or Morgan Stanley Private Wealth Management representative about the investments concerned. RMB Morgan Stanley (Proprietary) Limited is a member of the JSE Limited and regulated by the Financial Services Board in South Africa. RMB Morgan Stanley (Proprietary) Limited is a joint venture owned equally by Morgan Stanley International Holdings Inc. and RMB Investment Advisory (Proprietary) Limited, which is wholly owned by FirstRand Limited.

The information in Morgan Stanley Research is being communicated by Morgan Stanley & Co. International plc (DIFC Branch), regulated by the Dubai Financial Services Authority (the DFSA), and is directed at Professional Clients only, as defined by the DFSA. The financial products or financial services to which this research relates will only be made available to a customer who we are satisfied meets the regulatory criteria to be a Professional Client.

The information in Morgan Stanley Research is being communicated by Morgan Stanley & Co. International plc (QFC Branch), regulated by the Qatar Financial Centre Regulatory Authority (the QFCRA), and is directed at business customers and market counterparties only and is not intended for Retail Customers as defined by the QFCRA.

As required by the Capital Markets Board of Turkey, investment information, comments and recommendations stated here, are not within the scope of investment advisory activity. Investment advisory service is provided exclusively to persons based on their risk and income preferences by the authorized firms. Comments and recommendations stated here are general in nature. These opinions may not fit to your financial status, risk and return preferences. For this reason, to make an investment decision by relying solely on this information stated here may not bring about outcomes that fit your expectations.

The trademarks and service marks contained in Morgan Stanley Research are the property of their respective owners. Third-party data providers make no warranties or representations relating to the accuracy, completeness, or timeliness of the data they provide and shall not have liability for any damages relating to such data. The Global Industry Classification Standard (GICS) was developed by and is the exclusive property of MSCI and S&P. Morgan Stanley Research or portions of it may not be reprinted, sold or redistributed without the written consent of Morgan Stanley.

Morgan Stanley Research, or any portion thereof may not be reprinted, sold or redistributed without the written consent of Morgan Stanley.

The Americas
1585 Broadway
New York, NY 10036-8293
United States
Tel: +1 (1)212 761 4000

Europe
20 Bank Street, Canary Wharf
London E14 4AD
United Kingdom
Tel: +44 (0)20 7425 8000

Japan
1-9-7 Otemachi, Chiyoda-ku
Tokyo 100-8104
Japan
Tel: +81 (0)3 6836 5000

Asia/Pacific
1 Austin Road West
Kowloon
Hong Kong
Tel: +852 2848 5200



3rd Floor, Quadrant House,
4 Thomas More Square,
Thomas More Street,
London, E1W 1YW