US Electric Utilities & IPPs
PJM Attacks the Polar Vortex

Equities

Americas
Electric Utilities

Julien Dumoulin-Smith
Analyst
julien.dumoulin-smith@ubs.com
+1-212-713 9848

Michael Weinstein
Associate Analyst
michael.weinstein@ubs.com
+1-212-713 3182

Paul Zimbardo
Associate Analyst
paul.zimbardo@ubs.com
+1-212-713 1033

PJM Staff proposal would ramp up reliability requirements and capacity prices

In response to the high levels of forced outages experienced this past winter during the Polar Vortex, PJM released a white paper on 8/20 to propose the creation of a new capacity product called Capacity Performance (CP) that would encompass a new range of reliability requirements. All plants seeking CP qualification would be expected to upgrade systems to operate in extreme weather with short start-up times (specific to type). Stiffer penalties that could wipe out a year's worth of capacity revenue in days ensure compliance. All remaining non-qualifying capacity would be categorized in three buckets: Base Annual Capacity (including Annual Demand Response), Extended Summer DR, and Limited DR. Preliminary loss of load expectation studies show that the PJM should limit the amount of non-CP capacity to only 10%-15% of total, or ~20-30 GW (precise figures are forthcoming in a corresponding reliability study to be released shortly); the lower the figure, the better for capacity prices. Should the proposal be implemented, we expect a significant bifurcation of capacity pricing to occur, with much higher pricing for CP, with the new 'base' capacity receiving a discounted price, potentially just ~half of the CP level, akin to the prices paid to Limited DR in recent auctions.

Yes, quite positive- but too early in the process to get too excited

While we agree with the Street's initial reaction it could prove positive for some generators (namely EXC, NRG, PEG, and even in some cases FE), we expect the stakeholder process to only now kick-off, with significant further revisions both before it gets filed at FERC in the ~November timeframe, as well as potentially through that process as well. Despite scrutiny of gas generators, we suspect CPN is a net beneficiary as well. Among the most exposed to potential penalties under the new structure is PPL's Talen portfolio given operational issues at its largest assets, along with smaller portfolios given the concentrated (and exacerbated) outage risk. DYN is also likely a beneficiary given its existing portfolio of CCGTs. We appreciate the proposal is a step towards higher pricing, but don't expect a structural re-rating higher of the group until clarity early next year (once through the FERC process) around final new rules. Ultimately, we caution that higher capacity prices will continue to incentivize meaningful new gas generation (particularly in the MAAC region), as it prices continue to appear sufficient to incentivize new generation. Net-net, this would be a positive for pricing for generators to the tune of at least ~$10/MW-day (assuming the bulk of DR shifts away from annual products), with a greater uplift to potentially constrained zones.

What's the upside case? We see three key decisively positive aspects.

We see the ability for generators to choose to bifurcate their capacity between the new CP bucket, and the residual 'base' capacity as a key benefit for generators with a large footprint, namely EXC. We suspect those with meaningful size could yet opt to clear their capacity with high EFOR rates in the base capacity bucket, pushing up prices for CP. This appears to be the most significant potential upside, with potential units like EXC's Calvert Cliffs (following this year's costly forced outage), a clear candidate to remain 'base'. Second, the rules around Demand Response (DR) would tighten significantly, requiring annual products to not just deliver consistently over a three-day period, but also setting the requirement to clear in the day-ahead auction. We suspect this could meaningfully reduce annual DR products, but is also likely to prove a contentious issue before FERC too (unclear if it will remain a requirement in our view). Lastly, while the Street continues to focus on the impacts on gas availability, we think the real target here is ineffective coal capacity (the bulk of the winter outages were coal units this winter, not gas.) We suspect this could yet knock marginal coal 'over the edge'. Gas appears largely insulated, with abundant options to add oil storage if truly pressed.

www.ubs.com/investmentresearch

It's not a panacea either, as penalties could impose real costs

We caution also the penalty structure is likely to drive real pain to generators unable to meet peak load conditions. The proposed penalty structure would be equal to the LMP price during undeliverable periods * undeliverable MWs. While this penalty appears less than what has been adopted in New England, we suspect this could yet evolve. We believe the penalty is not too punitive, suggesting the generators are likely to view this level as palatable (rather, we could see an argument the penalties are not sufficiently punitive). Overall, the added risk of penalties adds risk to plant incapable of delivering on commitments consistently. Among the most exposed portfolios in our view is PPL's Talen portfolio given consistent operational issues at its Susquehanna nuclear plant, coupled with a meaningful coal and legacy peaker portfolio in PJM (although we suspect some of these assets may not have fully cleared the auction regardless).

Proposal likely aimed at forcing older coal plants to retire or upgrade

With coal units responsible for 34% of the forced outages occurring on Jan 7 (the peak of the vortex), the result of the proposed rules would be to force out older (unreliable) units to make a decision to either upgrade (mostly with equipment to ensure their continued operations during extreme cold events) or retire and make room for newer more reliable plants. We suspect that the requirements will require investors to increasingly discern which are legacy plants, with real reliability issues. We suspect this will force a re-evaluation upwards in the maintenance capex for legacy portfolios, such as FE's (although the quantity of which is unclear).

What about regional reliability needs? Could exacerbate constraints.

Little discussed in the proposal will be how this requirement for Capacity Performance will be allocated by region. This is likely to prove especially contentious as requirements by locality potentially exacerbate capacity deficiencies in specific zones, like ATSI and PSEG. We read the proposal as generally favourable to both companies, pending a more full appreciation of their respective breakdown of capacity between the two buckets.

What about gas plants? It's really about dual fuel and short-term deals

Additionally, the most likely result among gas generators will be the creation of oil-tank backup at most sites. We continue to believe that firm gas transportation across the deregulated power market is simply unfeasible in any reasonable timeframe; rather we suspect more manageable oil-storage tanks will be expanded (pending emission permits) or short-term asset management arrangements pursue (this would include effectively 'hedging' away the gas deliverability risk to an independent marketer, effectively securing gas during peak conditions only, a costly but effective option). We believe NJ is the most acutely impacted by gas deliverability issues. While gas supply issues have plagued New England – and proven the driving factor in pushing for such performance penalties – the example in PJM is quite the opposite.

Nuclear should come out ahead, but adds to operational risk profile

Nuclear risk profile increased, but potential net beneficiary

Given nuclear unit's typically baseload dispatch profile, it would appear this asset class is largely a winner under the new rules, however, we view the risk on operating troubled assets as particularly acute. In particular, we perceive long-duration outages as placing some nuclear generators in a position to payback to PJM a net penalty (rather than receive capacity revenues) if down for any protracted period during summer months. We flag that Exelon overwhelming endorsed the construct on its latest 2Q call. We believe its enthusiasm for the

program is partially rooted in its larger market position within PJM, enabling it to choose whether to commit its portfolio (between CP and Base auctions). We believe an element of marketing monitoring will be a crucial and corresponding element to program implementation.

This is about winter reliability, not so much summer, right?

Focus remains on winter availability of units, following polar vortex

Notably investors should focus on winter operational attributes of plants, rather than Summer, given the outages that occurred during the polar vortex last winter. Technically the highest penalties – and greatest risk period due to higher pricing remains the summer.

Understanding the parties' positions? Look to the New England docket.

For a greater understanding of a breakdown of issues, we suggest investors turn to the FERC Docket approving New England's performance enhancements (which were *more* punitive in penalty, but substantially *less* so in placing greater capacity requirements, namely on Demand Response). This docket is ER14-1050. What we believe investors should bear in mind is the ambivalent attitude of generators towards these reforms, as many were quite cautious on significant operational and deliverability risk (specifically arising from transmission outages, which could prevent generators from meeting requirements).

New requirement to bid Day-Ahead for Demand Response is major burden

Annual DR may qualify for the new CP product but in order to do so, it must meet all the same requirements as physical generation, including 24*365 availability and the mandate to bid energy into the day-ahead markets every day they have committed to be available. We believe the bidding requirement is going to prove particularly onerous for most DR providers, potentially knocking out capacity from the CP auction and driving prices higher. Conversely, much of this DR will head into the non-CP market as Base, Extended Summer, or Limited DR, which is going to be subject to 10%-15% caps, driving prices for these products lower.

Seeking to tighten the requirements on delivery, but it's up to generators

We read rules as largely a suggestion- and likely to evolve. Generators will decide whether to take risk on CP commitments

Among the most important: on-site fuel or dual-fuel backup for 3 days, with gas-fired plants ensuring fuel availability through some combination of firm transportation, firm commodity purchases, storage, balancing agreements, park & loan, either directly or through a third party asset management agreement. We read these requirements as more suggestive, with gas plants opting whether or not to take the associated deliverability risk of meeting added performance penalties.

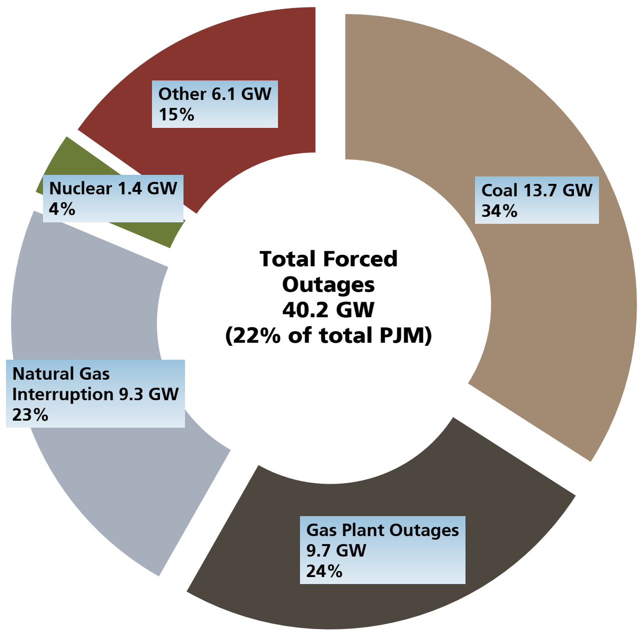
Point by point:

Who didn't perform last January during the Vortex?

During the Polar Vortex this winter, PJM has often noted that on the all-time peak winter load day (Jan 7), approximately 22% (40 GWs) of capacity was unavailable for various reasons. Of this amount, the largest chunk was due to 13.7 GW (34%) of coal unit outages, followed by 9.7 GW (24%) of gas outages, with another 9.3 GW (23%) of gas shut down for lack of available gas transportation. While the unavailability of firm gas transportation for power generation has received much attention, it is our understanding that PJM considers the high forced outage rate of the older coal fleet to be as big (if not more) of a problem.

While the unavailability of firm gas transportation for power generation has received much attention, it is our understanding that PJM considers the high forced outage rate of the older coal fleet to be as big (if not more) of a problem.

Figure 1: Jan 7 Evening Peak Forced Outage in PJM



Source: PJM Interconnection

Key Impacts from Rules:

In our opinion, there are at least **three primary drivers** of these capacity reforms:

first, to force the retrofit or retirement of the remaining coal fleet (that isn't already retiring in 2015 for MATS);

second, to increase capacity payments to nuclear generators that have been rendered uneconomic under the current construct;

and third, to encourage gas-fired units to acquire oil-tank backup systems wherever possible.

New capacity product is akin to bifurcation already in DR products

Most capacity will be deemed/sell into Capacity Performance bucket

Only unreliable assets will commit to 'base' capacity bucket

So this proposal adds a new capacity product – Capacity Performance (CP) – to boost reliability during the current "rapid transition" of fleet composition currently underway as a result of EPA-driven coal fleet retirements toward increased reliance on natural gas. Since fewer resources will meet the requirements for CP, the clearing price for it is likely to be materially higher than the other capacity products: Base Capacity, Limited DR and Extended Summer DR. Furthermore, PJM is proposing to extend the limitations on max quantity for Base Capacity, thus capping the amount of non-CP resources allowed to clear the RPM auctions (without decrements).

How much of the new 20-30GW limit will be filled by Limited and Extended Summer DR? Not too much. With total DR clearing in the last auction of ~12GW, we suspect the bulk of the capacity that will be applied towards the lower-reliability threshold will be conventional capacity. Of the cleared capacity, 1.4 GW from last year was designated as 'Annual' – and therefore would *not* be included towards the 20-30GW cap. We suspect a meaningful shift towards more limited products for Demand Response in the subsequent auction given the more onerous conditions attached (although this appears to us the most tenuous part of the DR proposal as part of its FERC application).

The real question [driving the upside on capacity prices] remains how much of the existing conventional capacity will opt to commit only to the base product? This remains particularly opaque at this point in time.

Timeline from here is still several months out – lots could change.

Consistent with past years of PJM reform, the proposal will now go through the stakeholder process in order to arrive at a formal 205 FERC filing to adjust PJM's tariffs in the November timeframe. This would in turn establish a timeframe for FERC to respond to PJM by early next year (say ~January timeframe) in order to be in effect for next year's May auction for 2018/19 delivery period. While PJM had promised an expedited stakeholder process to arrive at – and implement these rules – we suspect substantial comment and consternation over the proposal could yet bog down the timeline in coming weeks. We remind investors that New England's proposed Performance Initiative (PI) provided particularly prickly through the stakeholder process, with substantial doubts as to whether PJM would even approve the reforms (we suspect these could yet evolve too).

Preliminary studies show that the aggregate limit for all three non-CP products is likely in the 10%-15% range of total IRM required capacity. This limitation could be expected to push resulting clearing prices for these segments down significantly should more than 18-28 GW of capacity not qualifying as CP attempt to bid for a space in the auction.

Figure 2: Summary of Proposed Capacity Products

Category	Availability Expectations	Limitation	Penalties	Penalty Window
Capacity Performance	All hours of the year	None	Real-time LMP	Year-round - Hot/Cold weather alert & Max Emergency alert
Base Capacity	All hours of the year	None	Real-time LMP for generators / Current DR penalties for DR	For generators - Max Emergency Generation Loaded in summer or winter / Current rules for DR
Summer Extended DR	May through October	10 hours/day	Current DR penalties	Summer - DR activations
Limited DR	June through September	10x6	Current DR penalties	Summer - DR activations

Source: PJM Interconnection

Steeper penalties for non-performance are probably the toughest new burden for existing older coal units and Annual DR with reliability problems.

To qualify as a Capacity Performance (CP) product, the following conditions would apply:

- All generators must have on-site fuel (or dual-fuel backup capability) for at least 16 hours of continuous operation per day for three consecutive days. Gas-fired plants must also ensure fuel availability through some combination of firm transportation, firm commodity purchases, storage, balancing agreements, park & loan, either directly or through a third party asset management agreement.

- All generators must make appropriate investments in O&M and weatherization to ensure that the unit can operate as required through extreme hot or cold weather conditions

- <u>Steeper penalties for non-performance;</u> CP penalties are equal to MW commitment X non-compliance hours X real-time LMP. Note that "regular" non-CP DR that qualifies as Base Capacity, Limited, or Extended Summer is still subject to the existing DR penalties. To illustrate the effectiveness of the new penalty system, they cite examples of typical ComEd and PSEG generators that would have lost nearly 30% of their annual capacity revenue for a single day of non-performance on Jan 7, 2014 (the all-time winter peak load at the height of the polar vortex). Penalties are capped at 2.5x annual capacity revenue for Capacity Performance product and 1.5x for regular Base capacity product.

- All generators must be flexible with relatively short start times as specified

- Annual DR is treated identically to other generators and must be available 24x365 and capable of reducing demand as committed for the 16 peak hours of three consecutive days.

- Energy efficiency resources must demonstrate that they are effective year-round and not just during the summer (e.g., air conditioning controls are not eligible).

- CT's and other plants that run limited hours/year under emissions constraints must be able to perform at a minimum 10% annual capacity

factor (876 hours). This also applies to DR that may be limited by environmental limitations on backup generators.

- All resources must deliver energy when PJM declares a Hot or Cold Weather Alert or a Maximum Emergency Generation Alert.
- External resources must be exempt from capacity import limits, intertied and dispatched by PJM with firm transmission; essentially equivalent to an internal resource.
- All CP resources must bid into day-ahead markets every day they are available – **including DR**. This new requirement is likely to have a strong negative impact on DR capacity revenues.
- All Qualifying Transmission Upgrades (QTUs) will bid in to RPM as a CP product since they increase CETL and reduce the requirement for Base Capacity and more limited DR.
- Annual capacity that doesn't meet these requirements is now called "Base Capacity"

All CP resources must bid into day-ahead markets every day they are available – including DR. This new requirement is likely to have a strong negative impact on DR capacity revenues.

Demand Resource Coupling now extended to include CP

DR currently has the right to bid into multiple product categories (Annual, Ext Summer, and Limited), with PJM clearing bids based on lowest cost to the system. This concept now extends to bidding into both Capacity Performance as well as Base Capacity as well.

New limitations on non-CP resources

New maximum clearing quantities for the non-CP resource categories (Base Annual, Ext Summer DR and Limited DR) are proposed, with the maximum based on the total for all three categories such that the displacement of Capacity Performance resources results in a 10 percent increase in the Loss of Load Expectation (LOLE) to 1.1 events every 10 years (instead of the standard 1 event). These limitations would ensure maximum reliability at least cost.

Preliminary studies show that the aggregate limit for all three non-CP products is likely in the 10%-15% range of total IRM required capacity. This limitation could be expected to push resulting clearing prices down significantly.

Initial proposal can be found here:

http://www.pjm.com/documents/reports.aspx

Statement of Risk

Risks for Utilities and Independent Power Producers (IPPs) primarily relate to volatile commodity prices for power, natural gas, and coal. Risks to IPPs also stem from load variability, and operational risk in running these facilities. Rising coal and, to a certain extent, uranium prices could pressure margins as the fuel hedges roll off Competitive Integrateds. Further, IPPs face declining revenues as in the money power and gas hedges roll off. Other non-regulated risks include weather and for some, foreign currency risk, which again must be diligently accounted in the company's risk management operations. Major external factors, which affect our valuation, are environmental risks. Environmental capex could escalate if stricter emission standards are implemented. We believe a nuclear accident or a change in the Nuclear Regulatory Commission/Environment Protection Agency regulations could have a negative impact on our estimates. Risks for regulated utilities include the uncertainty around the composition of state regulatory Commissions, adverse regulatory changes, unfavorable weather conditions, variance from normal population growth, and changes in customer mix. Changes in macroeconomic factors will affect customer additions/subtractions and usage patterns.

Required Disclosures

This report has been prepared by UBS Securities LLC, an affiliate of UBS AG. UBS AG, its subsidiaries, branches and affiliates are referred to herein as UBS.

For information on the ways in which UBS manages conflicts and maintains independence of its research product; historical performance information; and certain additional disclosures concerning UBS research recommendations, please visit www.ubs.com/disclosures. The figures contained in performance charts refer to the past; past performance is not a reliable indicator of future results. Additional information will be made available upon request. UBS Securities Co. Limited is licensed to conduct securities investment consultancy businesses by the China Securities Regulatory Commission.

Analyst Certification: Each research analyst primarily responsible for the content of this research report, in whole or in part, certifies that with respect to each security or issuer that the analyst covered in this report: (1) all of the views expressed accurately reflect his or her personal views about those securities or issuers and were prepared in an independent manner, including with respect to UBS, and (2) no part of his or her compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by that research analyst in the research report.

UBS Investment Research: Global Equity Rating Definitions

12-Month Rating	Definition	Coverage[1]	IB Services[2]
Buy	FSR is > 6% above the MRA.	48%	33%
Neutral	FSR is between -6% and 6% of the MRA.	41%	30%
Sell	FSR is > 6% below the MRA.	11%	23%
Short-Term Rating	**Definition**	**Coverage[3]**	**IB Services[4]**
Buy	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	less than 1%	less than 1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	less than 1%	less than 1%

Source: UBS. Rating allocations are as of 30 June 2014.
1:Percentage of companies under coverage globally within the 12-month rating category. 2:Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.
3:Percentage of companies under coverage globally within the Short-Term rating category. 4:Percentage of companies within the Short-Term rating category for which investment banking (IB) services were provided within the past 12 months.

KEY DEFINITIONS: Forecast Stock Return (FSR) is defined as expected percentage price appreciation plus gross dividend yield over the next 12 months. **Market Return Assumption (MRA)** is defined as the one-year local market interest rate plus 5% (a proxy for, and not a forecast of, the equity risk premium). **Under Review (UR)** Stocks may be flagged as UR by the analyst, indicating that the stock's price target and/or rating are subject to possible change in the near term, usually in response to an event that may affect the investment case or valuation. **Short-Term Ratings** reflect the expected near-term (up to three months) performance of the stock and do not reflect any change in the fundamental view or investment case. **Equity Price Targets** have an investment horizon of 12 months.

EXCEPTIONS AND SPECIAL CASES: UK and European Investment Fund ratings and definitions are: Buy: Positive on factors such as structure, management, performance record, discount; **Neutral:** Neutral on factors such as structure, management, performance record, discount; **Sell:** Negative on factors such as structure, management, performance record, discount. **Core Banding Exceptions (CBE):** Exceptions to the standard +/-6% bands may be granted by the Investment Review Committee (IRC). Factors considered by the IRC include the stock's volatility and the credit spread of the respective company's debt. As a result, stocks deemed to be very high or low risk may be subject to higher or lower bands as they relate to the rating. When such exceptions apply, they will be identified in the Company Disclosures table in the relevant research piece.

Research analysts contributing to this report who are employed by any non-US affiliate of UBS Securities LLC are not registered/qualified as research analysts with the NASD and NYSE and therefore are not subject to the restrictions contained in the NASD and NYSE rules on communications with a subject company, public appearances, and trading securities held by a research analyst account. The name of each affiliate and analyst employed by that affiliate contributing to this report, if any, follows.

UBS Securities LLC: Julien Dumoulin-Smith; Michael Weinstein; Paul Zimbardo.

Company Disclosures

Company Name	Reuters	12-month rating	Short-term rating	Price	Price date
Calpine Corporation[2, 4, 5, 6a, 16]	CPN.N	Neutral	N/A	US$22.64	21 Aug 2014
Dynegy, Inc.[5, 16]	DYN.N	Buy	N/A	US$29.72	21 Aug 2014
Exelon Corp.[4, 5, 6a, 6c, 7, 16, 22]	EXC.N	Neutral	N/A	US$32.25	21 Aug 2014
FirstEnergy Corp.[16]	FE.N	Sell	N/A	US$33.46	21 Aug 2014
NRG Energy Inc.[16]	NRG.N	Buy	N/A	US$30.01	21 Aug 2014
PPL Corporation[2, 3, 4, 5, 6a, 6c, 7, 16]	PPL.N	Neutral	N/A	US$34.29	21 Aug 2014
Public Service Enterprise Group[6b, 7, 16]	PEG.N	Neutral	N/A	US$36.45	21 Aug 2014

Source: UBS. All prices as of local market close.
Ratings in this table are the most current published ratings prior to this report. They may be more recent than the stock pricing date

2. UBS AG, its affiliates or subsidiaries has acted as manager/co-manager in the underwriting or placement of securities of this company/entity or one of its affiliates within the past 12 months.
3. UBS Securities LLC is acting as advisor to PPL Corp on its announced agreement to sell its hydroelectric facilities to Northwestern Energy.
4. Within the past 12 months, UBS AG, its affiliates or subsidiaries has received compensation for investment banking services from this company/entity.
5. UBS AG, its affiliates or subsidiaries expect to receive or intend to seek compensation for investment banking services from this company/entity within the next three months.

6a. This company/entity is, or within the past 12 months has been, a client of UBS Securities LLC, and investment banking services are being, or have been, provided.

6b. This company/entity is, or within the past 12 months has been, a client of UBS Securities LLC, and non-investment banking securities-related services are being, or have been, provided.

6c. This company/entity is, or within the past 12 months has been, a client of UBS Securities LLC, and non-securities services are being, or have been, provided.

7. Within the past 12 months, UBS Securities LLC has received compensation for products and services other than investment banking services from this company/entity.
16. UBS Securities LLC makes a market in the securities and/or ADRs of this company.
22. UBS AG, its affiliates or subsidiaries held other significant financial interests in this company/entity as of last month`s end (or the prior month`s end if this report is dated less than 10 working days after the most recent month`s end).

For a complete set of disclosure statements associated with the companies discussed in this report, including information on valuation and risk, please contact UBS Securities LLC, 1285 Avenue of Americas, New York, NY 10019, USA, Attention: Publishing Administration.

Unless otherwise indicated, please refer to the Valuation and Risk sections within the body of this report.

Global Disclaimer

This document has been prepared by UBS Securities LLC, an affiliate of UBS AG. UBS AG, its subsidiaries, branches and affiliates are referred to herein as UBS.

This document is for distribution only as may be permitted by law. It is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or would subject UBS to any registration or licensing requirement within such jurisdiction. It is published solely for information purposes; it is not an advertisement nor is it a solicitation or an offer to buy or sell any financial instruments or to participate in any particular trading strategy. No representation or warranty, either express or implied, is provided in relation to the accuracy, completeness or reliability of the information contained in this document ('the Information'), except with respect to Information concerning UBS. The Information is not intended to be a complete statement or summary of the securities, markets or developments referred to in the document. UBS does not undertake to update or keep current the Information. Any opinions expressed in this document may change without notice and may differ or be contrary to opinions expressed by other business areas or groups of UBS. Any statements contained in this report attributed to a third party represent UBS's interpretation of the data, information and/or opinions provided by that third party either publicly or through a subscription service, and such use and interpretation have not been reviewed by the third party.

Nothing in this document constitutes a representation that any investment strategy or recommendation is suitable or appropriate to an investor's individual circumstances or otherwise constitutes a personal recommendation. Investments involve risks, and investors should exercise prudence and their own judgement in making their investment decisions. The financial instruments described in the document may not be eligible for sale in all jurisdictions or to certain categories of investors. Options, derivative products and futures are not suitable for all investors, and trading in these instruments is considered risky. Mortgage and asset-backed securities may involve a high degree of risk and may be highly volatile in response to fluctuations in interest rates or other market conditions. Foreign currency rates of exchange may adversely affect the value, price or income of any security or related instrument referred to in the document. For investment advice, trade execution or other enquiries, clients should contact their local sales representative.

The value of any investment or income may go down as well as up, and investors may not get back the full (or any) amount invested. Past performance is not necessarily a guide to future performance. Neither UBS nor any of its directors, employees or agents accepts any liability for any loss (including investment loss) or damage arising out of the use of all or any of the Information.

Any prices stated in this document are for information purposes only and do not represent valuations for individual securities or other financial instruments. There is no representation that any transaction can or could have been effected at those prices, and any prices do not necessarily reflect UBS's internal books and records or theoretical model-based valuations and may be based on certain assumptions. Different assumptions by UBS or any other source may yield substantially different results.

This document and the Information are produced by UBS as part of its research function and are provided to you solely for general background information. UBS has no regard to the specific investment objectives, financial situation or particular needs of any specific recipient. In no circumstances may this document or any of the Information be used for any of the following purposes:

(i) valuation or accounting purposes;

(ii) to determine the amounts due or payable, the price or the value of any financial instrument or financial contract; or

(iii) to measure the performance of any financial instrument.

By receiving this document and the Information you will be deemed to represent and warrant to UBS that you will not use this document or any of the Information for any of the above purposes or otherwise rely upon this document or any of the Information.

Research will initiate, update and cease coverage solely at the discretion of UBS Investment Bank Research Management. The analysis contained in this document is based on numerous assumptions. Different assumptions could result in materially different results. The analyst(s) responsible for the preparation of this document may interact with trading desk personnel, sales personnel and other parties for the purpose of gathering, applying and interpreting market information. UBS relies on information barriers to control the flow of information contained in one or more areas within UBS into other areas, units, groups or affiliates of UBS. The compensation of the analyst who prepared this document is determined exclusively by research management and senior management (not including investment banking). Analyst compensation is not based on investment banking revenues; however, compensation may relate to the revenues of UBS Investment Bank as a whole, of which investment banking, sales and trading are a part.

For financial instruments admitted to trading on an EU regulated market: UBS AG, its affiliates or subsidiaries (excluding UBS Securities LLC) acts as a market maker or liquidity provider (in accordance with the interpretation of these terms in the UK) in the financial instruments of the issuer save that where the activity of liquidity provider is carried out in accordance with the definition given to it by the laws and regulations of any other EU jurisdictions, such information is separately disclosed in this document. For financial instruments admitted to trading on a non-EU regulated market: UBS may act as a market maker save that where this activity is carried out in the US in accordance with the definition given to it by the relevant laws and regulations, such activity will be specifically disclosed in this document. UBS may have issued a warrant the value of which is based on one or more of the financial instruments referred to in the document. UBS and its affiliates and employees may have long or short positions, trade as principal and buy and sell in instruments or derivatives identified herein; such transactions or positions may be inconsistent with the opinions expressed in this document.

United Kingdom and the rest of Europe: Except as otherwise specified herein, this material is distributed by UBS Limited to persons who are eligible counterparties or professional clients. UBS Limited is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. **France:** Prepared by UBS Limited and distributed by UBS Limited and UBS Securities France S.A. UBS Securities France S.A. is regulated by the ACP (Autorité de Contrôle Prudentiel) and the Autorité des Marchés Financiers (AMF). Where an analyst of UBS Securities France S.A. has contributed to this document, the document is also deemed to have been prepared by UBS Securities France S.A. **Germany:** Prepared by UBS Limited and distributed by UBS Limited and UBS Deutschland AG. UBS Deutschland AG is regulated by the Bundesanstalt fur Finanzdienstleistungsaufsicht (BaFin). **Spain:** Prepared by UBS Limited and distributed by UBS Limited and UBS Securities España SV, SA. UBS Securities España SV, SA is regulated by the Comisión Nacional del Mercado de Valores (CNMV). **Turkey:** Distributed by UBS Limited. No information in this document is provided for the purpose of offering, marketing and sale by any means of any capital market instruments and services in the Republic of Turkey. Therefore, this document may not be considered as an offer made or to be made to residents of the Republic of Turkey. UBS AG is not licensed by the Turkish Capital Market Board under the provisions of the Capital Market Law (Law No. 6362). Accordingly, neither this document nor any other offering material related to the instruments/services may be utilized in connection with providing any capital market services to persons within the Republic of Turkey without the prior approval of the Capital Market Board. However, according to article 15 (d) (ii) of the Decree No. 32, there is no restriction on the purchase or sale of the securities abroad by residents of the Republic of Turkey. **Poland:** Distributed by UBS Limited (spolka z ograniczona odpowiedzialnoscia) Oddzial w Polsce. **Russia:** Prepared and distributed by UBS Securities CJSC. **Switzerland:** Distributed by UBS AG to persons who are institutional investors only. UBS AG is regulated by the Swiss Financial Market Supervisory Authority (FINMA). **Italy:** Prepared by UBS Limited and distributed by UBS Limited and UBS Italia Sim S.p.A. UBS Italia Sim S.p.A. is regulated by the Bank of Italy and by the Commissione Nazionale per le Società e la Borsa (CONSOB). Where an analyst of UBS Italia Sim S.p.A. has contributed to this document, the document is also deemed to have been prepared by UBS Italia Sim S.p.A. **South Africa:** Distributed by UBS South Africa (Pty) Limited, an authorised user of the JSE and an authorised Financial Services Provider. **Israel:** This material is distributed by UBS Limited. UBS Limited is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. UBS Securities Israel Ltd is a licensed Investment Marketer that is supervised by the Israel Securities Authority (ISA). UBS Limited and its affiliates incorporated outside Israel are not licensed under the Israeli Advisory Law. UBS Limited is not covered by insurance as required from a licensee under the Israeli Advisory Law. UBS may engage among others in issuance of Financial Assets or in distribution of Financial Assets of other issuers for fees or other benefits. UBS Limited and its affiliates may prefer various Financial Assets to which they have or may have Affiliation (as such term is defined under the Israeli Advisory Law). Nothing in this Material should be considered as investment advice under the Israeli Advisory Law. This Material is being issued only to and/or is directed only at persons who are Eligible Clients within the meaning of the Israeli Advisory Law, and this material must not be relied on or acted upon by any other persons. **Saudi Arabia:** This document has been issued by UBS AG (and/or any of its subsidiaries, branches or affiliates), a public company limited by shares, incorporated in Switzerland with its registered offices at Aeschenvorstadt 1, CH-4051 Basel and Bahnhofstrasse 45, CH-8001 Zurich. This publication has been approved by UBS Saudi Arabia (a subsidiary of UBS AG), a Saudi closed joint stock company incorporated in the Kingdom of Saudi Arabia under commercial register number 1010257812 having its registered office at Tatweer Towers, P.O. Box 75724, Riyadh 11588, Kingdom of Saudi Arabia. UBS Saudi Arabia is authorized and regulated by the Capital Market Authority to conduct securities business under license number 08113-37. **United States:** Distributed to US persons by either UBS Securities LLC or by UBS Financial Services Inc., subsidiaries of UBS AG; or by a group, subsidiary or affiliate of UBS AG that is not registered as a US broker-dealer (a **'non-US affiliate'**) to major US institutional investors only. UBS Securities LLC or UBS Financial Services Inc. accepts responsibility for the content of a document prepared by another non-US affiliate when distributed to US persons by UBS Securities LLC or UBS Financial Services Inc. All transactions by a US person in the securities mentioned in this document must be effected through UBS Securities LLC or UBS Financial Services Inc., and not through a non-US affiliate. **Canada:** Distributed by UBS Securities Canada Inc., a registered investment dealer in Canada and a Member-Canadian Investor Protection Fund, or by another affiliate of UBS AG that is registered to conduct business in Canada or is otherwise exempt from registration. **Brazil:** Except as otherwise specified herein, this material is prepared by UBS Brasil CCTVM S.A. to persons who are eligible investors residing in Brazil, which are considered to be: (i) financial institutions, (ii) insurance firms and investment capital companies, (iii) supplementary pension entities, (iv) entities that hold financial investments higher than R$300,000.00 and that confirm the status of qualified investors in written, (v) investment funds, (vi) securities portfolio managers and securities consultants duly authorized by Comissão de Valores Mobiliários (CVM), regarding their own investments, and (vii) social security systems created by the Federal Government, States, and Municipalities. **Hong Kong:** Distributed by UBS Securities Asia Limited and/or UBS AG, Hong Kong Branch. **Singapore:** Distributed by UBS Securities Pte. Ltd. [mica (p) 107/09/2013 and Co. Reg. No.: 198500648C] or UBS AG, Singapore Branch. Please contact UBS Securities Pte. Ltd., an exempt financial adviser under the Singapore Financial Advisers Act (Cap. 110); or UBS AG, Singapore Branch, an exempt financial adviser under the Singapore Financial Advisers Act (Cap. 110) and a wholesale bank licensed under the Singapore Banking Act (Cap. 19) regulated by the Monetary Authority of Singapore, in respect of any matters arising from, or in connection with, the analysis or document. The recipients of this document represent and warrant that they are accredited and institutional investors as defined in the Securities and Futures Act (Cap. 289). **Japan:** Distributed by UBS Securities Japan Co., Ltd. to professional investors (except as otherwise permitted). Where this document has been prepared by UBS Securities Japan Co., Ltd., UBS Securities Japan Co., Ltd. is the author, publisher and distributor of the document. Distributed by UBS AG, Tokyo Branch to Professional Investors (except as otherwise permitted) in relation to foreign exchange and other banking businesses when relevant. **Australia:** Clients of UBS AG: Distributed by UBS AG (Holder of Australian Financial Services License No. 231087). Clients of UBS Securities Australia Ltd: Distributed by UBS Securities Australia Ltd (Holder of Australian Financial Services License No. 231098). Clients of UBS Wealth Management Australia Ltd: Distributed by UBS Wealth Management Australia Ltd (Holder of Australian Financial Services Licence No. 231127). This Document contains general information and/or general advice only and does not constitute personal financial product advice. As such, the Information in this document has been prepared without taking into account any investor's objectives, financial situation or needs, and investors should, before acting on the Information, consider the appropriateness of the Information, having regard to their objectives, financial situation and needs. If the Information contained in this document relates to the acquisition, or potential acquisition of a particular financial product by a 'Retail' client as defined by section 761G of the Corporations Act 2001 where a Product Disclosure Statement would be required, the retail client should obtain and consider the Product Disclosure Statement relating to the product before making any decision about whether to acquire the product. The UBS Securities Australia Limited Financial Services Guide is available at: www.ubs.com/ecs-research-fsg. **New Zealand:** Distributed by UBS New Zealand Ltd. The information and recommendations in this publication are provided for general information purposes only. To the extent that any such information or recommendations constitute financial advice, they do not take into account any person's particular financial situation or goals. We recommend that recipients seek advice specific to their circumstances from their financial advisor. **Dubai:** The research distributed by UBS AG Dubai Branch is intended for Professional Clients only and is not for further distribution within the United Arab Emirates. **Korea:** Distributed in Korea by UBS Securities Pte. Ltd., Seoul Branch. This document may have been edited or contributed to from time to time by affiliates of UBS Securities Pte. Ltd., Seoul Branch. **Malaysia:** This material is authorized to be distributed in Malaysia by UBS Securities Malaysia Sdn. Bhd (253825-x). **India:** Prepared by UBS Securities India Private Ltd. (Corporate Identity Number U67120MH1996PTC097299) 2/F, 2 North Avenue, Maker Maxity, Bandra Kurla Complex, Bandra (East), Mumbai (India) 400051. Phone: +912261556000 SEBI Registration Numbers: NSE (Capital Market Segment): INB230951431, NSE (F&O Segment) INF230951431, BSE (Capital Market Segment) INB010951437.

The disclosures contained in research documents produced by UBS Limited shall be governed by and construed in accordance with English law.

UBS