US Electric Utilities & IPPs
PJM's Ohio Conundrum

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

Our annual PJM bus tour yesterday focused on nearly a single issue: OH's fate
We hosted our latest trip to meet with PJM officials, the Independent Market Monitor (IMM), and other PJM-related executives. The key theme among all remains how to deal with the pending PPA proposals before the Public Utilities Commission of Ohio (PUCO). IPPs DYN and TLN have pledged to oppose AEP/FE at FERC if the PUCO grants a PPA. The PUCO appears poised to approve the PPAs with both settlements in place, but that would just initiate proceedings at FERC over two key issues. First—do the contracts violate 'Affiliate Rules' (Edgar/Allegheny standards) on wholesale market transactions?; and second—do the contracts require the imposition of 'Minimum Offer Price Rule' (MOPR)? We are still biased to believe a return to a cost-of-service arrangement will *not* be deemed an issue with an affiliate (ultimately contracts could yet be re-struck to address any technicalities). We also do not see the second issue around bidding at a floor price as a meaningful issue when taken in isolation.

Expect the market monitor to support EPSA claims, bolstering Affiliate claims
We look for PJM's market monitor to file in support of the latest 206 complaint at FERC, supporting the complaint to temporarily waive the Affiliate contracting rights of both AEP and FE as they pertain to the current PPA. The weight added from this seemingly impartial observer of the market would lend merit to the partisan claims of peer generators that the process is uncompetitive. We look for FERC to respond swiftly, likely prior to the ~March approval timeline for the PUCO. Bottom line, we do not think complainants will necessarily be successful. Importantly, we expect a relatively short time frame to have clarity from FERC.

Pushing the MOPR subject again – this time for all *existing* regulated assets
Should PJM and the market monitor use the opportunity of the Ohio contracts to push for a reevaluation of how all regulated and quasi-regulated/public assets are bid, this could drive capacity prices higher. That said, only the market monitor appears willing to push the subject of regulated MOPR exemptions directly via a complaint at FERC – rather than through the conventional, and slower stakeholder process. As such we see this as a more challenging proposition given preferences for substantial changes to originate through consensus across the stakeholder process.

Few major tweaks to capacity auction design make this year 'straightforward'
With no major rule changes aside from a shift in the load methodology to reflect in the current auction, we do not expect any big surprises to emerge. Moreover with even the portion of Capacity Performance remaining approximately the same at 80%, we do not expect any new dynamics to emerge on bidding strategies either. We perceive that PJM's desire is to keep the status quo if possible following years of rule changes. More broadly PJM appears keenly aware of the disparate interests of its members and does not appear to be pushing for any further meaningful changes to market design through the stakeholder process. We perceive a handful of issues to watch: PJM import rules, finalization of CP requirements on resources (eg-exemptions), and energy market reforms on gas-electric coordination (hourly bidding).

What's the timeline?
1) We look for FERC to take action on Affiliate complaint; 2) Hearings in Supreme Court case on MD power case on ~Feb 24 – with decision likely in April/May; 3) PUCO decision on FE/AEP contracts in ~March. Other uncertain events: Further FERC complaint on MOPR policies as well as subsequent appeals of decisions.

A full library of PJM reports follows:

What are the pivotal questions for PJM?

What about the new PJM parameters?

- **PJM parameters were filed last night:** *There are no major surprises.* What did we notice? All of the same regions were singled out for testing, with CETO/CETL metrics, a leading indicator on whether a region will break-out or not, all indicating 'slightly' tighter. DPL-S was noticeably lower, but overall, we expect a largely 'status quo' auction with similar regions 'breaking out' separately. We see ComEd as likely to continue to clear at a high level. EMAAC overall could well continue to clear separately, but emphasize the implementation of new Maryland NO_x regulations on January 1, 2020 could serve to constrain the smaller region of BGE-PEPCO in the next auction cycle.

What is the rallying call for IPPs? It's not PJM. We still see PJM as 'topping' out with capacity prices largely at their highest levels through the cycle. Rather, we see upside in the power markets as tied to other factors (New England, Texas) as well as any recovery of natural gas.

What is the fate of the Ohio PPAs?

- **What would the imposition of a MOPR do?** On December 29th Stu Bresler, PJM's Senior Vice President of Markets, filed testimony in the pending Ohio ESP proceedings for FirstEnergy (FE). PJM did not opine on whether it supports or opposes the pending Purchase Power Agreement (PPA) proposed partial settlement, but PJM's objective was to clarify the rules around bidding behavior for FE's impacted plants. In the absence of more detailed language PJM believes that the PPA would result in too much uncertainty regarding how the impacted assets could legally bid "reasonably." If Public Utilities Commission of Ohio (PUCO) accepts the PPA, then PJM has requested the conditioning language which broadly would require that the impacted 'PPA assets' cannot bid below their actual costs (as defined by PJM) regardless of the revenue received from regulated customers. Essentially this would create a Minimum Offer Pricing Rule (MOPR) for this existing capacity to prevent artificial capacity price suppression in accordance with FE agreeing to reasonable oversight.

PJM will need to file an amicus brief now rather than direct testimony, but the net effect of having their opinion on the record should remain.

  What would the imposition of a MOPR do? This would likely bolster prices in both the RTO portion of the market, but particularly the ATSI zone. Given how sensitive this region is to high prices, requiring units to bid at 'high' levels would likely generate pushback among FE's core customers and constituents.

  As mentioned, we do not see this testimony as impacting the probability of success for FE or AEP's pending proposed ESPs, but this does address a broader power investor concern that FE would simply bid into the auctions at zero to guarantee clearing the auctions. Please click here for the full testimony.

PJM appears to believe it can *already* impose a MOPR as needed: The RTO appears to claim that they already have the legal latitude to impose a MOPR requirement on units (such as those contracted in Ohio).

- *What does the PPA mean to FE and AEP?* For FE cash flows from the PPA arrangement remain critical to funding regulated growth and maintaining credit quality. The PPA is far more valuable for FE, in our view, but we expect both names to trade as a function of whether investors believe the PUCO will grant PPAs.

- *How to value the PPA for FE?* The emerging debate remains whether to value the PPA based on cash flows (DCF) or earnings (multiple on EPS) from the assets. FirstEnergy is valued predominately on a P/E basis, so we see expect most investors will be biased to use that approach; with the balance of the FirstEnergy Solutions subsidiary having minimal earnings in our view, we think the DCF approach has more validity. With AEP looking to divest its entire merchant fleet, we think most investors will simply gravitate towards a P/E basis for AEP as well.

  Net-net, we continue to prefer AEP over FE. In our view, FE's investment thesis is predicated on receiving the PPA whereas we view a potential PPA as more of an incremental opportunity for AEP. Further, the added ratebase opportunities for renewables are unlikely to face the same challenges as contracting for thermal (but this too could be subject to some ambiguity). Irrespective, we maintain our Buy rating on AEP and emphasize that AEP continues to *exclude* any impact from the PPA to its consolidated cash flows.

  We continue to prefer AEP over FE.

  In summary, while PPAs are positive for AEP/FE, we do not see the ongoing debate over the outlook for PJM contracting to prove a positive for the sector. Rather, the prospects for a protracted legal debate are a net headwind for merchant generators given muddying of the regulatory construct and wider implications for other regions contemplating such actions. For the competitive IPPs, we expect this to remain a rallying point rather than a point of substance for the timing being.

What qualifies as an 'appropriate' Affiliate transaction?

Under the Edgar standard at FERC, multiple parties appear to be taking the position that only a competitive solicitation is sufficient to meet this standard of wholesale market behavior between a utility and its corresponding competitive affiliates. FE and AEP are taking a different approach – arguing that the ratebase-like PPA arrangements are consistent with Affiliate transactions as they are effectively cost-of-service arrangements.

Consumer protections vs. enabling regulated cost-of-service: We see the core of any case as reaching into the issue of whether regulated cost of service is indeed the lowest cost option for consumers. FERC will be averse to challenge states on the 'regulated' model. There are clearly cost savings in short-term contracts over ensuring recovery of capital spent over the long term.

Clear effort to protect consumers: While we see FERC as increasingly more pro-consumer in recent decisions, pushing to address perceived discrepancies in bidding behaviors for instance in MISO, the question is whether FERC will see it as imperative to push back on state-level cost-of-service efforts.

Are other restructured states going to follow Ohio? We do not expect them to. We do not see any other states immediately following the example of Ohio; rather, Illinois' own efforts in PJM will be legislative and attempting to save nuclear plants, rather than a return to a cost-of-service approach. Also at the core of any argument for FERC to intervene is the precedent established on future efforts by states to *begin* to re-regulate. The industry overall appears to be heading in this direction.

We expect FERC will *not* close the door – and will leave states the latitude to move *back* to a traditional cost-of-service approach.

Can a new MOPR be imposed on *existing* assets?

- We understand the market monitor is contemplating a filing at FERC in the event the current FERC complaint on Affiliate action is not successful. Rather than attempt to address imposing Minimum Offer Price Rules (MOPR) on existing assets through the conventional stakeholder process, efforts at PJM could be 'short-circuited' and jumped straight to a complaint before FERC. This is yet another angle that existing generators could have a 'bite at the apple'.

- *Dominion and other regulated entities:* In the Ohio hearings on their actions, numerous references back to Dominion were raised – and their ability to construct assets within a ratebase paradigm and impact auctions. We think there may be growing pressure to push D and other companies into an 'FRR' construct to more explicitly push them out of the wider market (with load and resources matched in a separate process – accounted for outside of the auction).

- *Reset of net-short and net-long parameters this Fall:* A further potential pitfall for quasi-regulated entities is a review of the parameters that go into deciding to what extent a 'self-supplying' entity can continue to receive an overarching exclusion from MOPR. While PJM itself does not appear biased to push back against its regulated entities, it could yet impose more stringent requirements to receive this exemption. *This would appear likely and a near-term headwind for the likes of Dominion.*

How will the Supreme Court play in?

SCOTUS will further refine states'-federal rights on wholesale markets.

Recently, SCOTUS sided with FERC on Demand Response – over states.

We continue to look for how the Supreme Court will address the jurisdictional issues presented in the Maryland power market case it has recently taken up – and whether this will have a read-through to Ohio. While we continue to view the issues as technically different, many in the industry appear to be gravitating towards a relevant read-through arising out of this case. It seems reasonable to assume the Supreme Court will set at least a tone with which FERC can opt to address the Ohio case – whether to interfere in bilateral state power contracting efforts or reinvigorate its jurisdiction on the issue, and encourage it to take a stand.

When will we hear anything? We look towards hearings on the subject the week of February 22nd, with a corresponding decision likely no sooner than its typical later Spring timeframe (likely *around* the current capacity auction cycle) in April-May. That said, there is clearly the potential for *accelerated* resolution.

What is the latest on Capacity Performance?

What units are at risk from CP?

The focus remains on two flavors:

- **Steamers (of all flavors).** We continue to emphasize less traditional 'steaming' capacity that has historically been troubled to ramp to meet forthcoming 'nimble' CP requirements could be the most at risk – particularly for those with low capacity factors. In this instance, it's the legacy gas and oil peakers which appear the most at risk. Few datapoints have emerged to confirm this yet – but think this may become a guiding datapoint in conversations among generators in coming months as they articulate their 'CP upside' scenarios.

- **Peakers (Combustion Turbines)** *behind the gas LDC 'wall'.* With a wave of relatively 'newer' CTs located behind the gas LDCs (and hence subject to interruption when heating loads require the service for residential customers), it remains unclear to what extent units are pursuing dual permits vs. installing laterals to nearby gas pipelines where possible. We expect the TLN Sapphire portfolio will be a key to watch to this effect in NJ.

- *How many are not clearing the auction already?* With 13GW failing to clear the latest auction, the question remains just how much 'clearing' capacity could yet fail to clear the CP auction. More importantly, how much of the 13GW failing to clear and/or base will eventually be able to comply – either from taking greater risk (Demand Response) or from investments in existing assets (dual fuel capabilities/new gas access).

How will gas availability impact penalties?

- We continue to await updates from FERC on various rehearing requests around Capacity Performance, including specifics as to what counts as an exemption event for penalties – and what does not. We continue to perceive interest from a wide range of parties. *Among the most surprising elements may be what FERC ultimately 'allows' as a permissibly gas-related outage. For example, generators could not incur performance penalties if unable to perform.* We look for these clarifications prior to the next full auction to take place in May.

What will be the impact on reserve margins?

- *Reserve margins staying intact for now*. As the generators perform as intended under CP rules, the wider market EFOR will decline, with a corresponding reduction in the required region wide reserve margin. This should gradually phase in over a ~3-year period as EFORs are averaged in under new rules.

- EFORd's could well start to improve already, as units invest preemptively ahead of the implementation of the CP regulations.

- Outages and EFOR events relate directly to temperature – and most importantly to Wind Chill factors. As such, rolling *off* the last two winters (and specifically 2014) should generally *reduce* the overall EFOR across the portfolio.

- This should drive *gentle* backwardation in forward capacity auctions, likely offsetting in part any prospective demand growth.

Why was the Base so close to the CP Results?

- The simple answer is that *fewer* participants provided a coupled bid than would have thought. The simple answer appears to be that those that could provide CP simply chose to do so, while those more cautious about selling CP had much higher offers for their base bids, particularly amidst any higher spending contemplated to become 'CP' compliant.

What is the latest with transmission in PJM?

We note relatively limited action beyond the project involving the Artificial Island competitive transmission procurement effort last year. We perceive less desire to push forward on such controversial and litigious projects. We see PJM as just the latest example of the challenges in executing on FERC 1000 prospects. We continue to await any formal timeline by FERC to review FERC 1000 rules via a new technical conference this year.

<u>Focus remains on small-scale transmission:</u> We emphasize AEP's ability to ramp capex in this sector speaks to the litany of smaller projects contemplated, which are *not* subject to the same level of planning (RTEP) scrutiny that most other larger projects are subject to.

What is the impact of potential PJM import (pseudo-tie) reforms?

Limiting imports could prove quite detrimental to IPH and MISO generators more broadly.

- The issue is that generators are still subject to NERC's local Transmission Load Relief (TLR), which can restrict participation in the PJM energy market as transmission pathways become congested. While the unit *wants* to participate in the PJM market – it simply *can't* do it because of other circumstances related to the adjacent RTO transmission limitations. The question is whether this is simply a risk to the generator or something whether PJM should simply reject these structures from existing?

- <u>Hopeful that will have amicable resolution between PJM and MISO</u> without a prolonged regulatory process so that generators have visibility ahead of the PJM auction. It would appear that MISO is proposing to ensure that energy and capacity are fungible – and that it ensures capacity flow across into PJM regardless of whether tied to a specific unit as a 'backstop' to ensure that PJM meets its needs.

- Dynegy has commented that it does not anticipate a material impact to its MISO fleet that imports into PJM. While we believe a risk mitigating strategy would be appropriate on both sides of the MISO-PJM seam to ensure adequate capacity to meet commitments on both sides, we perceive PJM as keen to ensure that all capacity physically pseudo-tieing into the market be *physically* required to participate in the market (rather than replaced).

- *Focus on MISO:* We sense growing focus among MISO stakeholders that a sloped demand curve for *just* the Zone 4 region is a feasible outcome. Following the latest MISO capacity auction pushback, we wouldn't doubt this could be the case.

  <u>Please click on this link to read the full report</u>

Other takeaways from our visit to PJM:

- Winter 2016 operation and performance: The early heating season has seen some units with operational challenges but performance has generally been better; however, clearly have not experienced the same level of load as in previous winters.
  - There were *no* performance assessment hours in 2015. We continue to perceive some generators taking the attitude that actual hours incurred will be limited.
  - Units with low capacity factors where generators may not have dedicated the necessary maintenance capital could be more at risk.
- Shifting to hourly generator bids will increase flexibility, and likely apply slight downward pressure on prices: By creating a more nimble system, this should allow generators to adjust their prices closer to real-time and thereby adjust bids to more accurately reflect risk. In contrast, day-ahead bidding has to account for greater uncertainty in the form of higher prices. While PJM appears to support the proposal, the IMM initially has expressed opposition, raising concerns about market power.

Valuation Method and Risk Statement

Risks for Utilities and Independent Power Producers (IPPs), including AEP and FE, 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.

Our valuation for IPPs and competitive integrated utilities, including AEP and FE, is based on a sum-of-the-parts analysis.

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. UBS acts or may act as principal in the debt securities (or in related derivatives) that may be the subject of this report.

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%	36%
Neutral	FSR is between -6% and 6% of the MRA.	39%	28%
Sell	FSR is > 6% below the MRA.	12%	22%
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.	<1%	<1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 31 December 2015.
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 FINRA. Such analysts may not be associated persons of UBS Securities LLC and therefore are not subject to the FINRA restrictions 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

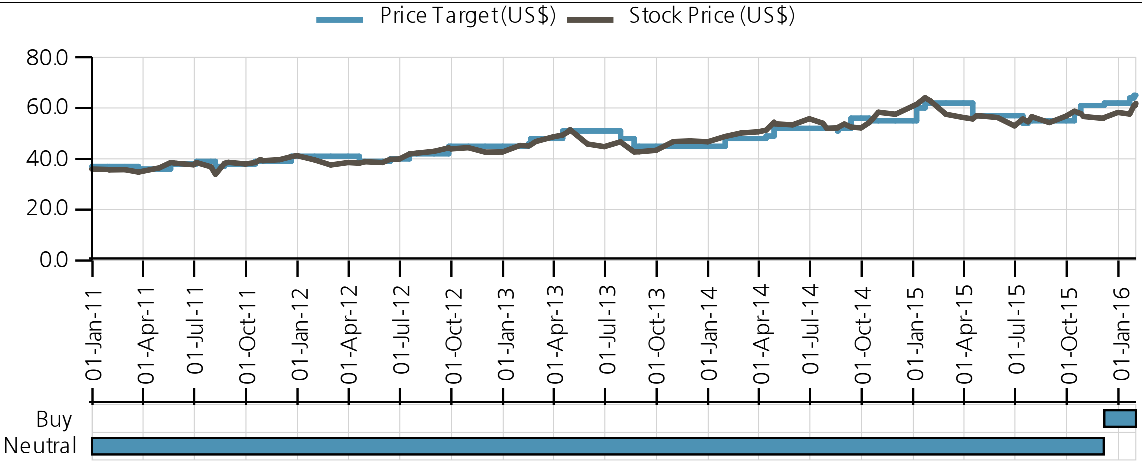
Company Name	Reuters	12-month rating	Short-term rating	Price	Price date
American Electric Power, Inc.[2, 4, 6a, 6b, 7, 16]	AEP.N	Buy	N/A	US$61.79	01 Feb 2016
FirstEnergy Corp.[7, 16]	FE.N	Neutral	N/A	US$33.05	01 Feb 2016

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.
4. Within the past 12 months, UBS AG, its affiliates or subsidiaries has received compensation for investment banking services from this company/entity or one of its affiliates.
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.
7. Within the past 12 months, UBS Securities LLC and/or its affiliates have 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.

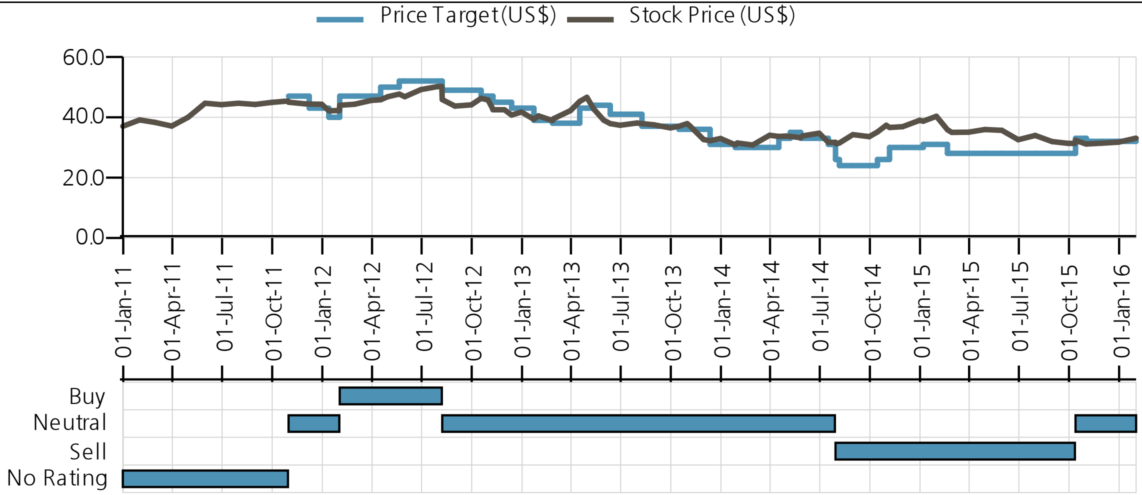
Unless otherwise indicated, please refer to the Valuation and Risk sections within the body of this report. For a complete set of disclosure statements associated with the companies discussed in this report, including information on valuation and risk, please contact UBS Securities LLC, 1285 Avenue of Americas, New York, NY 10019, USA, Attention: Investment Research.

American Electric Power, Inc. (US$)



Source: UBS; as of 01 Feb 2016

FirstEnergy Corp. (US$)



Source: UBS; as of 01 Feb 2016

Additional Prices: Dynegy, Inc., US$11.93 (01 Feb 2016); Dominion Resources, US$70.18 (01 Feb 2016); Talen Energy Corp, US$7.06 (01 Feb 2016); Source: UBS. All prices as of local market close.

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.

Global Research is provided to our clients through UBS Neo, the UBS Client Portal and UBS.com (each a "System"). It may also be made available through third party vendors and distributed by UBS and/or third parties via e-mail or alternative electronic means. The level and types of services provided by Global Research to a client may vary depending upon various factors such as a client's individual preferences as to the frequency and manner of receiving communications, a client's risk profile and investment focus and perspective (e.g. market wide, sector specific, long-term, short-term, etc.), the size and scope of the overall client relationship with UBS and legal and regulatory constraints.

When you receive Global Research through a System, your access and/or use of such Global Research is subject to this Global Research Disclaimer and to the terms of use governing the applicable System.

When you receive Global Research via a third party vendor, e-mail or other electronic means, your use shall be subject to this Global Research Disclaimer and to UBS's Terms of Use/Disclaimer (http://www.ubs.com/global/en/legalinfo2/disclaimer.html). By accessing and/or using Global Research in this manner, you are indicating that you have read and agree to be bound by our Terms of Use/Disclaimer. In addition, you consent to UBS processing your personal data and using cookies in accordance with our Privacy Statement (http://www.ubs.com/global/en/legalinfo2/privacy.html) and cookie notice (http://www.ubs.com/global/en/homepage/cookies/cookie-management.html).

If you receive Global Research, whether through a System or by any other means, you agree that you shall not copy, revise, amend, create a derivative work, transfer to any third party, or in any way commercially exploit any UBS research provided via Global Research or otherwise, and that you shall not extract data from any research or estimates provided to you via Global Research or otherwise, without the prior written consent of UBS.

For access to all available Global Research on UBS Neo and the Client Portal, please contact your UBS sales representative.

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 expressed 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 ACPR (Autorité de Contrôle Prudentiel et de Résolution) 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 regulated by the Polish Financial Supervision Authority. Where an analyst of UBS Limited (spolka z ograniczona odpowiedzialnoscia) Oddzial w Polsce has contributed to this

document, the document is also deemed to have been prepared by UBS Limited (spolka z ograniczona odpowiedzialnoscia) Oddzial w Polsce. **Russia:** Prepared and distributed by UBS Bank (OOO). **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 (Registration No. 1995/011140/07), an authorised user of the JSE and an authorised Financial Services Provider (FSP 7328). **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. **Dubai:** The information distributed by UBS AG Dubai Branch is intended for Professional Clients only and is not for further distribution within the United Arab Emirates. **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. UBS Securities LLC is not acting as a municipal advisor to any municipal entity or obligated person within the meaning of Section 15B of the Securities Exchange Act (the "Municipal Advisor Rule"), and the opinions or views contained herein are not intended to be, and do not constitute, advice within the meaning of the Municipal Advisor Rule. **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. [MCI (P) 018/09/2015 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. **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 (Capital Markets Services License No.: CMSL/A0063/2007). This material is intended for professional/institutional clients only and not for distribution to any retail clients. **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. It provides brokerage services bearing SEBI Registration Numbers: NSE (Capital Market Segment): INB230951431, NSE (F&O Segment) INF230951431, NSE (Currency Derivatives Segment) INE230951431, BSE (Capital Market Segment) INB010951437; merchant banking services bearing SEBI Registration Number: INM000010809 and Research Analyst services bearing SEBI Registration Number: INH000001204. UBS AG, its affiliates or subsidiaries may have debt holdings or positions in the subject Indian company/companies. Within the past 12 months, UBS AG, its affiliates or subsidiaries may have received compensation for non-investment banking securities-related services and/or non-securities services from the subject Indian company/companies. The subject company/companies may have been a client/clients of UBS AG, its affiliates or subsidiaries during the 12 months preceding the date of distribution of the research report with respect to investment banking and/or non-investment banking securities-related services and/or non-securities services. With regard to information on associates, please refer to the Annual Report at: http://www.ubs.com/global/en/about_ubs/investor_relations/annualreporting.html

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

UBS