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VIA E-FILING

June 5, 2024

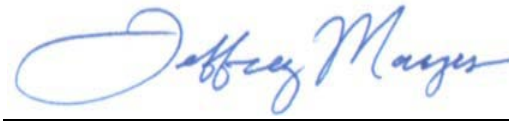
The Honorable Joel deJesus
Office of Administrative Law Judges
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426-0001

Re: *PJM Interconnection, L.L.C.*, Docket No. EL21-91-000, -003

Dear Judge deJesus:

Pursuant to Rule 507 of the Commission's Rules of Practice and Procedures, 18 CFR § 385.507 (2023), Monitoring Analytics, LLC, acting in its role as the Independent Market Monitor for PJM Interconnection, L.L.C., hereby submits for consideration in this proceeding the Direct Testimony of Joseph E. Bowring (Exhibit IMM-0001) and supporting Exhibits IMM-0002 through IMM-0020. Exhibit IMM- 0010; Exhibit IMM-0019; and Exhibit IMM-0020 are being treated as confidential at PJM's request.

Respectfully submitted,



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CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania,
this 5th day of June, 2024.

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UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. EL21-91-000, -003

DIRECT TESTIMONY OF JOSEPH E. BOWRING ON BEHALF OF THE INDEPENDENT MARKET MONITOR FOR PJM

Q 1. PLEASE STATE YOUR NAME AND POSITION.

A. My name is Joseph E. Bowring. I am the Market Monitor for PJM. I am the President of Monitoring Analytics, LLC. My business address is 2621 Van Buren Avenue, Suite 160, Eagleville, Pennsylvania. Monitoring Analytics serves as the Independent Market Monitor (IMM) for PJM, also known as the Market Monitoring Unit (MMU or Market Monitor). Since March 8, 1999, I have been responsible for all the market monitoring activities of PJM, first as the head of the internal PJM Market Monitoring Unit and, since August 1, 2008, as President of Monitoring Analytics. The market monitoring activities of PJM are defined in the PJM Market Monitoring Plan, Attachment M and Attachment M-Appendix to PJM Open Access Transmission Tariff (OATT).[1]

Q 2. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to explain: (1) the nature and purpose of the formula rate at issue in this proceeding; (2) how the existing Capital Recovery Factor (CRF) values for generating units that were selected to provide Black Start Service prior to June 6, 2021 were calculated;[2] (3) why, as a result of changes in federal income tax provisions resulting from the Tax Cuts and Jobs Act (TCJA),[3] the existing CRF values that result in a Capital Cost Recovery Rate for generating units that were

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1 *See PJM Interconnection, L.L.C.*, 86 FERC ¶ 61,247; 18 CFR § 35.34(k)(6).

2 *See* PJM OATT Schedule 6A Para. 18.

3 Tax Cuts and Jobs Act of 2017, Pub. L. No. 115-97, 131 Stat. 2054 (2017).

selected to provide Black Start Service prior to June 6, 2021, are unjust, unreasonable, and unduly discriminatory or preferential; and (4) how the inputs to the existing formula rate should be adjusted to produce a correct Capital Cost Recovery Rate for such units.

I will also address the questions raised by the Presiding Judge in the "Order Accepting Without Prejudice Preliminary Joint Statement of Issues."

Q 3. PLEASE PROVIDE A SUMMARY OF THE CENTRAL ISSUE IN THIS CASE.

A. The federal tax law inputs to the formula rate for black start capital cost recovery changed as a result of tax law changes that became effective on January 1, 2018. The result was that the correctly calculated CRF rates decreased significantly effective January 1, 2018. PJM failed to reflect those changed inputs in the CRF rates paid to black start owners. PJM failed to change the CRF rates after being notified of the issue by the Market Monitor. PJM finally changed the CRF rates in a filing approved by order issued by the Commission on August 10, 2021, but those rates failed to address the ongoing overpayments to black start resources that had been selected to provide service prior to June 6, 2021.[4] PJM's approach in this case misunderstands the fundamental purpose of the CRF provision. That purpose is to ensure the payment of 100 percent of the defined return to investors. PJM's approach would result in substantial overpayment to investors in all affected black start units. This is a factual matter.

Q 4. WHAT ISSUE(S) DID THE COMMISSION SET FOR HEARING?

A. The Commission's March 24, 2023, order set the following issue of fact for hearing:

> [W]hether, as a result of changes from the TCJA, the existing CRF values result in a Capital Cost Recovery Rate for generating units that were selected to provide Black Start Service prior to June 6, 2021 that is unjust and unreasonable. While the record does not contain conclusive evidence that the existing CRF values include a 35% tax rate, the Market Monitor has introduced sufficient evidence that those values may include a 35% tax rate, raising a disputed issue of

[4] *See PJM Interconnection, L.L.C.*, 176 FERC ¶ 61,080.

> material fact as to whether changes to the tax rate render the existing CRF values unjust and unreasonable. The import of the tax rate in the determination of the CRF value is a material fact that cannot be determined based on the existing record, which warrants setting the justness and reasonableness of the existing CRF values for hearing and settlement judge procedures.[5]

I conclude in this testimony that the CRF rate for black start resources that were selected prior to June 6, 2021, included a tax rate of 36 percent and did not include the TCJA bonus depreciation provisions. I conclude that the TCJA federal tax provisions should have been included in all CRF rates effective on January 1, 2018, and thereafter. I conclude that failure to include the correct tax provisions in CRF rates resulted in overstated rates and resulted in overpayments to black start resources that were unjust and unreasonable as a result. I explain how to provide appropriate relief to ensure, to the maximum extent consistent with Commission policy on refunds, that PJM customers do not pay overpay for black start service based on PJM's errors in implementing the impact of the TCJA on CRF rates for black start resources selected for service prior to June 6, 2021.

Q 5. HOW DO YOU RESPOND TO THE ISSUES SET FOR HEARING?

A. The Commission noted that the Market Monitor had provided sufficient evidence to raise the issue but did not find that there was conclusive evidence as to the tax rate included in the CRF calculations. This testimony and exhibits provide dispositive evidence that the existing CRF rates were based on a 36 percent tax rate, including 2005 affidavits from Market Monitor witnesses and public PJM reports.[6] [7] AMP and ODEC cited the same PJM report.[8] This testimony and exhibits provide dispositive evidence that the existing CRF rates were based on the use of Modified Accelerated Cost Recovery System (MACRS) depreciation, including public PJM reports. The question is not complicated. The straightforward CRF math demonstrates the tax

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5 *See PJM Interconnection, L.L.C.*, 182 FERC ¶ 61,194 at P 32.

6 *Comments of the Independent Market Monitor for PJM* at 6, Docket No. ER21-1635-000 (April 28, 2021). See Exhibit IMM-0013.

7 *Id*. at footnote 15.

8 *Protest of American Municipal Power, Inc. and Old Dominion Electric Cooperative* at 3, Docket No. ER21-1635-000 (April 28, 2021).

rate that is incorporated in the referenced CRF rates. As a result, this testimony demonstrates that the existing CRF rates that PJM continues to apply to black start resources selected prior to June 6, 2021, are simply wrong. The federal income tax rate was reduced to 21 percent and the MACRS depreciation was replaced with the more favorable bonus depreciation. Because the CRF rates do not include the actual tax rate and depreciation provisions that became effective on January 1, 2018, both of which significantly reduced the taxes paid by the referenced black start resources, the rates necessarily allow for over recovery of the investment that the rate is designed to recover, and are therefore unjust and unreasonable. The rate is excessive and the over recovery is substantial. The rate cannot be properly determined to be just and reasonable based on a determination that the impact is de minimis. The impact is not de minimis.

Once the factual issue is resolved, the issue of how to determine the appropriate going forward CRF rates for units selected prior to June 6, 2021, must be resolved, in order to ensure just and reasonable recovery of their discrete investment under the applicable formula rate.

Q 6. WHAT IS THE EVIDENCE FOR THE LEVEL AND DEFINITION OF THE FEDERAL TAX RATE IN THE ORIGINAL CRF VALUES?

A. PJM's required reports to stakeholders (see Exhibits IMM-0006 at 7, IMM-0007 at 8 and IMM-0008 at 8 to this testimony) all document explicitly the inputs to CRF calculations and that the level of the federal tax rate included in the CRF values is 36 percent. PJM also included the 36 percent tax rate in its report to stakeholders dated October 2019, after the tax law changes took effect. The income tax and depreciation assumptions are also validated by responses to discovery questions by the Market Monitor and PJM. In response to S-IMM-1.1, the Market Monitor provided a spreadsheet that shows the calculation of the CRF values (Exhibit IMM-0017). In response to S-PJM-1.2, PJM provided a copy of the original spreadsheet that was used to calculate the CRF values (Exhibit IMM-0020). These CRF values, including the superseded 36 percent federal tax rate, have applied and continue to apply to black start resources that were selected to provide black start service prior to June 6, 2021.

Q 7. PLEASE DESCRIBE THE NATURE AND PURPOSE OF THE RATE AT ISSUE IN THIS PROCEEDING.

A. The specific rate at issue in this proceeding is a formula rate included in Paragraph 18 of Schedule 6A of the OATT (Schedule 6A). The formula rate in Schedule 6A

compensates black start service units included in PJM's system restoration plan. PJM relies on the black start system restoration plan to restore service if there is a system wide black out event, a shutdown of the PJM transmission system.

The formula rate included in Schedule 6A is:

(Fixed BSSC) + (Variable BSSC) + (Training Costs)
+ (Fuel Storage Costs)} * (1 + Z)

Only the Fixed BSSC term of the formula is at issue in this proceeding and even more specifically only the CRF component of the Fixed BSCC as it applies to black start units selected to provide black start service prior to June 6, 2021, is at issue in this proceeding. Selected to provide service means that PJM selected the black start resource pursuant to a PJM RFP process prior to June 6, 2021, and does not refer to the date that the resource actually began providing service.

There are three options for calculating the Fixed BSSC term: the Base Formula Rate; the Capital Cost Recovery NERC-CIP Specific Recovery; and the Capital Cost Recovery Rate.

The first option is the Base Formula Rate for Fixed BSSC:

(Net CONE * Black Start Unit Capacity * X.)

The Base Formula Rate formula calculates a rate based on the net cost of new entry (Net CONE) for a new unit in the PJM Capacity Market in $/MW-day, multiplied by the Black Start Unit Capacity in MW, multiplied by an allocation factor X which is defined to be .02 for CTs (combustion turbine generators). The Net CONE value is a parameter of the PJM Capacity Market and has nothing directly to do with the cost of units providing black start service.

The Base Formula Rate for Fixed BSSC does not provide for the recovery of a specific capital investment in black start capability. The default Fixed BSSC is not based on the cost of the black start resource. The Base Formula Rate in Paragraph 18 is not a cost of service rate.

The second option is the Capital Cost Recovery NERC-CIP Specific Recovery, a special purpose Fixed BSCC that allows existing black start units to recover

incremental costs associated with compliance with NERC reliability standards.[9] The formula for Capital Cost Recovery NERC-CIP Specific Recovery is:

(Net Cone * Black Start NERC-CIP Unit Capacity * X) + (Incremental Black Start NERC-CIP Capital Costs * CRF) + (Fuel Assurance Capital Costs * CRF)

The third option, the Capital Cost Recovery Rate, is at issue in this proceeding. [10] The Fixed BSCC formula is:

(FERC-approved rate) + (Incremental Black Start Capital Costs * CRF) + (Fuel Assurance Capital Costs * CRF)

The issue in this case is the correct CRF values for black start resources that are paid under the Capital Cost Recovery Rate.

As there is no "FERC-approved rate" component of the rates for the units at issue in this proceeding, the "FERC approved rate" component is effectively zero dollars.

None of the black start resources at issue have any Fuel Assurance Capital Costs to date.

Therefore, the effective Fixed BSCC formula for purposes of this proceeding is:

(Incremental Black Start Capital Costs * CRF)

The CRF provides for the return on and of a discrete, defined investment in black start capability over a defined period at a defined rate of return, after which the payment for black start becomes the default black start charge for the remainder of the term for which the resource provides black start service.

Q 8. WHAT IS A CRF?

A. CRF means capital recovery factor. A CRF is a rate which, when multiplied by the investment in an asset, results in an equal annual revenue requirement over the

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9 *See PJM Interconnection, L.L.C.*, 127 FERC ¶ 61,197, at P 39; order on compliance filing 1, 128 FERC ¶ 61,249 (September 17, 2009); delegated order on compliance filing 2 (November 17, 2009).

10 This option was established by the Commission in 2011. *See PJM Interconnection, L.L.C.*, 138 FERC ¶ 61,020; PJM Filing, Docket No. ER11-1440 (August 30, 2011) at 9.

defined term of the CRF. That annual revenue requirement provides for full recovery of the investment costs and a return on that investment over the defined term of the CRF at a rate of return defined in the formula. CRF is a general financial concept broadly applicable across investments and industries. (See the IMM reports on the CRF calculations in Exhibits IMM-0003, IMM-0004 and IMM-0014 at 7-10).

Q 9. WHAT IS THE PURPOSE OF THE CRF RATE FOR BLACK START REVENUE REQUIREMENTS?

A. The CRF calculations in the PJM OATT were originally developed for use in defining market seller offer caps in PJM capacity market auctions.[11] The purpose of the CRF values in the capacity market was to explicitly match the return of and on capital to the expected life of the incremental investment in capacity resources, defined as APIR in the OATT, Attachment DD. [12] At the time of the establishment of the RPM capacity market rules, coal units with relatively short expected remaining lives were required to make large investments in environmental controls. As a result, it was necessary to provide for different time periods over which the opportunity for full recovery of capital costs could occur. The CRF table defined CRF levels for a range of expected asset lives with a defined set of input variables and values.

Q 10. HOW WERE THE EXISTING CRF VALUES CALCULATED FOR GENERATING UNITS THAT WERE SELECTED TO PROVIDE BLACK START SERVICE PRIOR TO JUNE 6, 2021?

A. The CRF values were included in the initial RPM filing in 2005.[13] The Market Monitor calculated the CRF values that were included in PJM's 2005 RPM filing.[14]

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11 *See PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,331 (2006); OATT Attachment DD § 6.8(a).

12 *See* OATT Attachment DD § 6.8(a).

13 PJM Filing, ER05-1410 (August 31, 2005) Tab C (Revised Original Sheet No. 590).

14 Affidavits by Joseph Bowring and Raymond Pasteris included in PJM's Filing in ER05-1410 describe the CRF calculation and the model assumptions. *Id*., Tab G (Affidavit of Joseph E. Bowring) at 23, and Tab I ("Independent Study to Determine Cost of New Entry Combustion Turbine Power Plan Revenue

The CRF values were added to Schedule 6A in 2009 to allow for the recovery of new or additional fixed black start capital costs.[15] It was explicit at the time of the filing that the CRF rate was a specifically defined formula rate and not a stated rate.[16]

Q 11. WERE THE CRF VALUES ALWAYS BASED ON EXPLICTLY STATED INPUT VALUES, INCLUDING THE APPLICABLE FEDERAL INCOME TAX RATE?

A. Yes. There are six defined inputs to the CRF formula: debt to equity ratio, rate of return on equity, interest rate on debt, federal income tax rate, state income tax rate and depreciation factors. (See the IMM reports on the CRF calculations in Exhibits IMM-0003 and IMM-0004). These inputs were stated explicitly the very first time that PJM filed the CRF rates in the capacity market filing. The Market Monitor developed the CRF method that was incorporated in the CRF tables in the PJM OATT.

Q 12. IS THE CRF CALCULATION A BLACK BOX CALCULATION?

A. No. The CRF calculation is not and has never been a black box calculation. The CRF calculation is based on a limited set of known inputs that result in the defined CRF values that were first listed in a table in Attachment DD to the PJM OATT. In addition to the fact that the Market Monitor calculated the CRF values and the details of those calculations have been provided, PJM also explicitly states the detailed assumptions of the original CRF calculation. See PJM reports that demonstrate PJM's knowledge of the detailed nature of the CRF calculations: Exhibits IMM-0006 at 7, IMM-0007 at 8, IMM-0008 at 8, IMM-0012 at 9 to this testimony.)

Requirement," Attachment to the Affidavit of Raymond M. Pasteris on Behalf of PJM Interconnection, L.L.C.) at 3–4.

[15] PJM Filing, Docket No. ER09-730 (February 19, 2009) at 7. See Exhibit IMM-0011.

[16] *Id. passim.*

Q 13. IS THE FEDERAL INCOME TAX RATE ONE OF THE INPUTS TO THE CRF CALCULATION?

A. Yes. The federal income tax rate is one of the explicitly stated inputs to the CRF calculation. The original CRF calculations explicitly included a federal income tax rate of 36 percent. This tax rate was included in the original PJM RPM filing, has been stated publicly by the Market Monitor on numerous occasions, and was included in PJM's reports to stakeholders on black start costs.[17]

Q 14. IS THE TAX DEPRECIATION METHOD ONE OF THE INPUTS TO THE CRF CALCULATION?

A. Yes. The tax laws in place prior to the TCJA provided for the use of MACRS depreciation in the calculation of federal taxes. The TCJA replaced MACRS with a bonus depreciation method that allowed for depreciation of 100 percent of the asset value in the first year of operation.[18] The impact of that change was to reduce the federal income taxes owed by the affected entity. The original CRF calculations explicitly included federal income tax payments based on MACRS depreciation rate. The MACRS depreciation method was included in the original PJM RPM filing, has been stated publicly by the Market Monitor on numerous occasions, and was included in PJM's reports to stakeholders on black start costs.[19]

Q 15. HAS THE MARKET MONITOR USED DIFFERENT APPROACHES TO DEFINING THE CRF FORMULA?

A. Yes. The Market Monitor has used different approaches but all of them are substantively identical. The Market Monitor used a multiyear financial model to

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[17] *See* Exhibits Nos. IMM-0006 at 7, IMM-0007 at 8, IMM-0008 at 8, -0012 at 9, -0020.

[18] Bonus depreciation is 100 percent for capital investments placed in service after September 27, 2017 and before January 1, 2023. Bonus depreciation is 80 percent for capital investments placed in service after December 31, 2022 and before January 1, 2024, and the bonus depreciation level is reduced by 20 percent for each subsequent year through 2026. Capital investments placed in service after December 31, 2026 are not eligible for bonus depreciation. See 26 U.S. Code §168(k)(6)(A).

[19] *See* Exhibits Nos. IMM-0006 at 7, IMM-0007 at 8, IMM-0008 at 8, IMM-0012 at 9.

calculate the CRF values that were included in Attachment DD to the PJM OATT. That financial model included repayment of debt on a fixed mortgage style schedule and recognized that all net revenue in excess of costs including debt costs and tax obligations flow to the equity owner of the asset. This approach is called the flow to equity (FTE) approach.

In 2021, the Market Monitor developed a formula that is the equivalent of the multiyear financial model for calculating CRF values.[20] However, the formula provided by the Market Monitor used the weighted average cost of capital (WACC) approach to defining returns to debt holders and equity owners rather than the FTE approach. The WACC approach maintains a constant debt to equity ratio by attributing net revenue in excess of costs to both debt holders and equity owners in proportion to the debt to equity ratio. That formula was filed by PJM and approved by the Commission and is now both in Attachment DD and Schedule 6A of the PJM OATT.

As part of the Market Monitor's responses to Commission Staff discovery in this case, the Market Monitor clarified that the FTE approach correctly reflects the ownership interests in net revenue in excess of costs.[21] The pre-June 6, 2021, CRFs were calculated using a flow to equity (FTE) financial model that incorporates a mortgage payment approach for the loan repayment. Under this approach, the debt to equity ratio is not constant during the cost recovery period. The formula for the post-June 6, 2021, CRF was derived from a weighted average cost of capital (WACC) financial model that maintains a constant debt to equity ratio. When the revenue is equal to the level required to meet all the payment obligations, without excess payments, the results of the two models are quite close.

When there are payments in excess of the level required to meet all the payment obligations, as has occurred in this case, the difference between the models is significant. In the WACC model, the revenue in excess of income taxes, required interest payments and return on equity is split between accelerated loan repayment and payment to equity according to the debt to equity ratio, and the debt to equity ratio is maintained at a constant level during the cost recovery period. In the FTE

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[20] *Comments of the Independent Market Monitor for PJM* at 16, ER21-1635-000 (April 28, 2021).

[21] *See* the Market Monitor's response to discovery question S-IMM-1.3, Exhibits IMM-0016, IMM-0018.

model, revenue in excess of income taxes and required debt payments flows to the equity investor.

In this case, payments to black start resources used CRF calculations based on taxes higher than actual required tax payments. As a result, there were payments in excess of the level required to meet all the payment obligations. In cases where there are excess payments, the FTE model accurately captures the excess returns to equity while the WACC model does not.

Rather than assuming that a part of excess earnings flow to debt holders as the WACC approach does, the FTR approach correctly recognizes that all of the excess earnings flow to equity holders. The FTE approach is the correct way to calculate CRF values because it reflects the fact that excess revenues flow to the equity holders. The FTE is also expressed as a formula with the same inputs and same input values as the Market Monitor's formula with the WACC approach.[22] The Market Monitor developed and provided the CRF formula based on the FTE approach as part of the responses to Staff discovery in this matter.[23]

Q 16. WHAT IS THE RELATIONSHIP BETWEEN THE CRF TABLE IN ATTACHMENT DD AND THE CRF TABLE IN SCHEDULE 6A?

A. The table of CRF values based on the CRF table in Attachment DD was included in Schedule 6A for black start because the issue was the same issue addressed in the capacity market. The issue was how to match the expected or intended life of the asset (black start investment) to the recovery of the capital costs using equal annual payments for a range of different recovery periods. The financial calculation is the same for any asset if the inputs are the same. The inputs were the same for the capacity market and the black start cost recovery. One important difference between the two applications of CRF is that the CRF is intended to pay black start owners the exact amount of the CRF revenue requirement while in the capacity market, the CRF/APIR calculation changes the market seller offer cap and provides the opportunity to receive the full annual revenue requirement in the capacity market.

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22 Exhibit IMM-0003 provides the FTE formula at 11. Exhibit IMM-0004 shows the WACC formula at 7.

23 See spreadsheet attached to the Market Monitor's response to discovery question S-IMM-1.3, Exhibit IMM-0018.

Q 17. DOES SCHEDULE 6A PROVIDE FOR FULL RECOVERY OF CAPACITY COSTS OVER A DEFINED PERIOD?

A. Yes. Schedule 6A provides that at the conclusion of the recovery of the specific and discrete investment cost over the defined term of the recovery period, recovery of the investment cost using the Capital Cost Recovery Rate is complete. The Capital Cost Recovery Rate is specifically designed for the recovery of a discrete fixed capital investment plus a return on the invested capital. When the Capital Cost Recovery Rate has served its purpose and provided a return of and on the investment, continued black start service is then compensated under the default rate.

Q 18. WHAT IS THE DIFFERENCE BETWEEN A STATED RATE AND A FORMULA RATE?

A. A stated rate is a fixed value approved by the Commission. A formula rate is a formula approved by the Commission with defined inputs. As input values change, the new values are used in the formula to calculate the applicable rate. The Capital Cost Recovery Rate is a formula rate. The CRF, a component of the Capital Cost Recovery Rate, is a specific formula rate with clearly defined characteristics that distinguish it from other formula rates.

Q 19. WHY DO THE EXISTING CRF VALUES RESULT IN AN OVERRECOVERY OF CAPITAL COSTS FOR BLACK START UNITS SELECTED PRIOR TO JUNE 6, 2021?

A. The CRFs, when multiplied by the capital investment amount, result in an annual revenue payment that is sufficient to provide for the return on and return of the capital investment and to provide for the income taxes associated with the annual revenue payment over the term of the CRF.

The original CRF calculation, which resulted in values calculated by the Market Monitor and proposed by PJM for inclusion in the OATT in 2005, and included in Schedule 6A of the PJM OATT in 2009, was based on a federal income tax rate of 36 percent and depreciation using the 15 year Modified Accelerated Cost Recovery System (MACRS). (See for example Exhibits IMM-0005 at 6, IMM-0006 at 7, IMM-0007 at 8, IMM-0008 at 8, IMM-0012 at 9.)

The TCJA reduced the federal income tax rate for existing and new investments, including black start investments, effective January 1, 2018. The TCJA reduced the federal corporate income tax rate to 21 percent. The TCJA also included a provision

that allows for 100 percent bonus depreciation for property placed in service after September 27, 2017, and before January 1, 2023.[24] [25]

The result was a significant reduction in the CRF for black start investments. The continued application of the CRF rates that include higher than actual tax obligations has resulted in customers paying black start owners a windfall equal to the impact of the reduction in tax obligations under the TCJA. Customers paid and are paying for the capital costs of black start resources as if those resources were obligated to pay taxes at the prior high rate when those resources were actually paying taxes at a much lower rate.[26]

PJM should have reduced CRF rates immediately, effective January 1, 2018, for all existing and new black start resources. The result would have been to ensure that all black start owners received what they reasonably expected when PJM selected them to provide black start service and to ensure that all customers paid what they could have reasonably expected. Those reasonable expectations included a return on and of the capital invested to provide black start service, over the defined recovery period.

The Market Monitor notified PJM by email of the CRF errors on October 3, 2019.[27] Eighteen months later, in April 2021, PJM filed to update the CRF and at that time argued the original CRFs were black box values that could not be updated for existing black start providers. PJM recognized in 2020 that the federal income tax rate in the CRF values needed to be corrected from 36 percent to 21 percent.[28]

Q 20. WHAT HAS BEEN THE RESULT OF THE FAILURE TO CORRECTLY CALCULATE THE CRF VALUES?

A. There are 49 black start generators that have received payments based on the outdated CRFs that reflect federal income tax rates and depreciation schedules

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24 Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2096, Stat. 2105 (2017) at Subtitle C, Part I, SEC. 13001.

25 *Id*. at Subtitle C, Part III, SEC. 13201.

26 See Exhibit IMM-0014, Attachment B, Section F at13.

27 *See* Exhibit IMM-0009.

28 *See* Exhibit IMM-0013 at 9, attached, Black Start Education, PJM Interconnection, L.L.C., PJM Operating Committee Meeting (May 14, 2020).

corresponding to the tax laws in effect prior to the passage of the TCJA. The 49 generators include 29 black start generators that began providing black start service prior to September 27, 2017, and would not have been eligible for bonus depreciation under the TCJA. Of those 29 black start generators, 11 completed their capital recovery terms between January 1, 2018, and June 2021. The excess payments to these 29 generators were due to the change in the federal income tax rate alone and were not affected by the changes to depreciation rules. Of the 49 black start generators, 20 began black start service after September 27, 2017, and before January 1, 2023, and received excess payments as a combined result of the change in the federal income tax rate and the change in depreciation rules included in the TCJA. Of the 38 black start generators, from that group of 49, that have not completed their capital recovery terms, 24 generators will complete their capital recovery terms in 2024 and 2025. An additional 8 generators will complete their capital recovery terms in 2026. The last 6 generators will complete their capital recovery terms from 2035 through 2040.

Q 21. HOW SHOULD THE EXISTING CAPITAL COST RECOVERY RATE FOR THE PRE JUNE 6, 2021 UNITS BE ADJUSTED?

A. The CRF rates going forward should be recalculated for the units selected to provide Black Start Service prior to June 6, 2021, using the formula and the correct inputs, in order to ensure that the purpose of the CRF is met, and that black start units are correctly compensated over the defined term of the CRF for each such unit. That recalculation should reflect the return of capital already received by existing black start units under the applied CRF values to date, and, as a result, eliminate the over recovery that would occur if the current CRF values remain in place.[29] The CRF values should be set at a level that pays for the full tax liability and the full return on the black start capital investment (rate of return or cost of capital) and the full return of the black start capital investment (depreciation) over the full term of the CRF. The weighted average cost of capital paid to black start owners over the full term of the CRF should be exactly as explicitly included in the original CRF values. A

[29] At this point, not all over recovery can be eliminated through adjustments to the CRF going forward.

description of this proposal and a formula for calculating the updated CRF are included in the Market Monitor's Comments in this docket.[30]

Applying the post-June 6, 2021, CRF formula to the black start units that started service prior to June 6, 2021, will not provide an equitable resolution. An equitable resolution must account for the investment that has already been returned to the equity investors.[31] The reduction in the income tax liability introduced with the Tax Cuts and Jobs Act significantly lowered the income tax payments and the resulting savings goes to the equity investors, thereby increasing the rate of investment payback. The Market Monitor proposed a resolution to the issue in November 2021. The Market Monitor's proposal is to pick a date in the near future, determine the outstanding investment principal as of that date and then calculate a revised CRF based on the original financial parameters and the state income tax rate assumption, updated federal income tax rules and a revised recovery period equal to the time remaining in the original capital recovery period. The revised CRF will result in a lower payment for black start units for the remainder of the capital recovery period but at the end of the recovery period the owner of the black start unit will have received revenue sufficient to provide for the payback of debt at 7 percent interest, federal and state income tax liabilities, a 12 percent return on equity and the return of the equity portion of the capital investment.[32]

Finally, if refunds are allowable under the applicable legal principles, then refunds should be made equal to the total overpayment of revenues based on the incorrect federal tax provisions included in the CRF values.

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30 *See* Comments of the Independent Market Monitor for PJM, Docket No. EL21-91-000 (November 11, 2021), corrected (November 18, 2021), at 19–26.

31 The Market Monitor showed in a previous filing that an equity investor would have fully recovered its capital investment in the 2nd year of capital recovery in the case that bonus depreciation was applicable. See Table 6 in Exhibit IMM-0014, Attachment B.

32 The Market Monitor described the proposed resolution in a previous filing. See Section H in Exhibit IMM-0014, Attachment B.

Q 22. HOW DOES TIMING AFFECT THE POSSIBLE OUTCOMES IN THIS MATTER?

A. The Commission has indicated that retroactive application of revised CRFs to black start resources that have completed their capital cost recovery is not a viable option in this proceeding.[33] Twenty four black start resources will complete their capital recovery terms in 2024 and 2025. Eight black start resources will complete their capital recovery terms in 2026. Six generators will complete their capital recovery terms from 2035 through 2040. In the absence of a Commission decision, these black start resources will continue to be paid based on the incorrect and overstated CRFs through the full term of their CRFs.

Q 23. HOW WOULD THE ADJUSTMENT PROPOSED BY THE MARKET MONITOR ADDRESS THE PROBLEM?

A. If the Market Monitor's proposal were implemented effective January 1, 2025, the overpayment for capital cost recovery would be reduced from $89.7 million to $23.6 million. Table 1 shows the capital recovery payments that would result if the CRFs were corrected effective January 1, 2025. The reduction would be larger if the CRFs were corrected before an effective date of January 1, 2025. Table 1 also shows the result of further delays. If the Market Monitor's proposal were implemented effective January 1, 2026, the overpayment for capital cost recovery would be reduced to $39.9 million.

Under the Market Monitor's proposal, an updated CRF is calculated for each unit. The unit specific updated CRF reflects the remaining unrecovered capital investment and the remaining years of capital recovery as of the date of implementing the updated CRF. The updated CRF values reflect the actual capital recovery to date based on the overstated CRF values and the correspondingly reduced requirement for the balance of the period. The capital recovery payment totals in Table 1 do not include separate refunds or disgorgement of previous payments to the black start generators. Twenty-two black start units have capital cost recovery periods that extend beyond January 1, 2025, but the owners will have completed the capital cost recovery by January 1, 2025. The capital cost recovery payments for these units will cease on January 1, 2025, under the Market Monitor's proposal.

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[33] 176 FERC ¶ 61,080 at P 50 ("August 10th, 2021 Order").

To reduce the overpayment below $23.6 million it would be necessary to require refunds from black start resources that have completed their CRF terms using the overstated CRFs or that have already received 100 percent or more of their full capital recovery. The Commission established a 15 month refund period that began in August 2021.[34] That 15 month refund period has expired.

Table 1 Market Monitor resolution compared to status quo

	Capital Recovery Payments 2018 - 2040 ($ millions)	Overpayment ($ millions)
Had CRFs been updated on January 1, 2018	$424.6	
Current CRFs remain in place	$514.3	$89.7
Market Monitor - Updated CRFs beginning January 1, 2025	$448.2	$23.6
Market Monitor - Updated CRFs beginning January 1, 2026	$464.5	$39.9

Q 24. IS YOUR APPROACH RETROACTIVE RATEMAKING?

A. No. The CRF is a formula rate that defines total payments over a defined term. If the CRF is overstated in the early years, regardless of the reason, it can be reduced in the later years in order to produce the intended result over the entire term. That is not retroactive ratemaking as it does not require the repayment of payments made under a stated or filed rate. The proposed going forward adjustment to the formula produces an outcome that is the only outcome consistent with the purpose of this specific formula rate for CRFs, to provide 100 percent of the defined return to both debt and equity investors over the defined term of the CRF.

Note that this is very different from standard cost of service ratemaking that sets a stated rate that remains in place until it is changed by a subsequent decision of the Commission. That is the essential difference between a stated rate and a formula rate designed to recover capital costs over a defined term.

[34] August 10, 2021 Order at 54.

Q 25. HOW IS THE FIRST ISSUE IN THE PRELIMINARY JOINT STATEMENT OF ISSUES RELEVANT TO THIS HEARING?[35]

A. The first issue is: How were the existing CRF values for generating units that were selected to provide Black Start Service prior to June 6, 2021 calculated or determined? The existing CRF values for generating units that were selected to provide Black Start Service prior to June 6, 2021, were calculated using the six defined inputs and the FTE method. The important point for this matter is that one of the inputs was the federal income tax rate of 36 percent. It is relevant to this hearing because is establishes the fact that, effective January 1, 2018, the CRF values and the associated formula rates for black start resources were no longer correct because they failed to include the reduction in the federal income tax rate defined in the TCJA and the change in the bonus depreciation treatment defined in the TCJA. The CRF values should have been reduced effective January 1, 2018. The fact that the CRF rates were not reduced resulted in a windfall for those black start resources that were paid based on the overstated CRF rates. The calculation method and the federal tax provisions are relevant because they define the windfall, they define the amount of the windfall and they define the expected returns to the black start resources. Both are needed in order to define the benchmark for defining the correct CRF values going forward for the applicable black start resources.

Q 26. HOW IS THE SECOND ISSUE IN THE PRELIMINARY JOINT STATEMENT OF ISSUES RELEVANT TO THIS HEARING?

A. The second issue is: Whether, as a result of changes from the TCJA, the existing CRF values result in a Capital Cost Recovery Rate for generating units that were selected to provide Black Start Service prior to June 6, 2021 that is unjust, unreasonable, or unduly discriminatory or preferential. The fact that the CRF values were incorrect and overstated for generating units that were selected to provide Black Start Service prior to June 6, 2021, means that the revenues that directly resulted from those overstated CRF values were in excess of a just and reasonable rate because they paid to the affected black start owners a return in excess of the return defined in the CRF calculations.

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[35] Order Accepting without Prejudice Preliminary Joint Statement of Issues, *PJM Interconnection, L.L.C.*, EL21-91-003 (November 2, 2023) at P 6.

Q 27. HOW IS THE THIRD ISSUE IN THE PRELIMINARY JOINT STATEMENT OF ISSUES RELEVANT TO THIS HEARING?

A. The third issue is: If the existing CRF values result in a Capital Cost Recovery Rate for generating units that were selected to provide Black Start Service prior to June 6, 2021 that is unjust, unreasonable, or unduly discriminatory or preferential, what adjustments should be made to the existing CRF values to produce a lawful Capital Cost Recovery Rate for such units? The existing CRF values for the relevant black start resources should be calculated to ensure that those resources receive the returns defined in the CRF over the full term of the CRF recovery period. That is not possible for some units that have reached or will have reached the end of their CRF recovery period by the time this matter is decided.

Q 28. HOW IS THE FOURTH ISSUE IN THE PRELIMINARY JOINT STATEMENT OF ISSUES RELEVANT TO THIS HEARING?

A. The fourth issue is: If the existing CRF values result in a Capital Cost Recovery Rate for generating units that were selected to provide Black Start Service prior to June 6, 2021 that is unjust, unreasonable, or unduly discriminatory or preferential, should refunds be made and, if so, how should refunds be calculated? If refunds are allowable under the applicable legal principles, then refunds should be made equal to the overpayment of revenues based on the incorrect federal tax provisions included in the CRF values. In the absence of refunds, the going forward CRF values should be calculated for each applicable black start resource so as to ensure that those resources receive the returns defined in the CRF over the full term of the CRF recovery period where possible.

Q 29. WHAT ADDITIONAL ISSUES DID THE PRESIDING JUDGE REQUEST THAT THE PARTIES ADDRESS?[36]

A. The Presiding Judge stated five additional questions. I will address each question.

Q 30. WHAT WAS THE FIRST QUESTION?

A. The first question was: What are the appropriate time periods (base/test periods) to review data to assess whether the resulting Capital Cost Recovery Rate is unjust and unreasonable?

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[36] *Id.* at P 8.

Q 31. PLEASE RESPOND TO THE PRESIDING JUDGE'S FIRST QUESTION.

A. The relevant time period to review for overpayment is the period during which the CRF values were incorrect, the period from January 1, 2018, to the present for those black start resources that continue to be paid based on CRF values that include the incorrect federal tax provisions. This is not a standard rate case where there is a test period. This case is about a formula rate that was not adjusted when a known input changed. All of the overpayment during this ongoing period constituted and constitutes unjust and unreasonable rates and should be returned to customers.

Q 32. WHAT WAS THE SECOND QUESTION?

A. The second question was: How is the Capital Cost Recovery Rate determined? What inputs other than CRF values go into that determination?

Q 33. PLEASE RESPOND TO THE PRESIDING JUDGE'S SECOND QUESTION.

A. The Capital Cost Recovery Rate is a tariff defined term that is explained on page 6 of this testimony. The Capital Cost Recovery Rate for purposes of this proceeding is Therefore, the effective Fixed BSCC formula for purposes of this proceeding is: (Incremental Black Start Capital Costs * CRF). The only relevant part of the Capital Cost Recovery Rate for purposes of this proceeding is the CRF.

The details of the CRF rate calculation are included in the IMM reports on the CRF calculations in Exhibits IMM-0003 and IMM-0004). There are six defined inputs to the CRF formula: debt to equity ratio, rate of return on equity, interest rate on debt, federal income tax rate, state income tax rate and depreciation factors. These inputs were stated explicitly the very first time that PJM filed the CRF rates in the capacity market filing. The debt to equity ratio, rate of return on equity and interest rate on debt together define the cost of capital. The cost of capital defines the rate of return that investors in the applicable black start resources expected to receive.

Q 34. WHAT WAS THE THIRD QUESTION?

A. The third question was: How should CRF values be determined? What inputs other than the federal income tax rate go into that determination?

Q 35. PLEASE RESPOND TO THE PRESIDING JUDGE'S THIRD QUESTION.

A. The six inputs were defined in the prior response. The correct CRF values applicable to generating units that were selected to provide Black Start Service prior

to June 6, 2021, should be calculated using the correct federal tax provisions in the CRF formula.

Q 36. WHAT WAS THE FOURTH QUESTION?

A. The fourth question was: For all of the relevant inputs in determining CRF values and the Capital Cost Recovery Rate, including the federal income tax rate, what has changed since 2009 that might affect whether the Capital Cost Recovery Rate is just and reasonable?

Q 37. PLEASE RESPOND TO THE PRESIDING JUDGE'S FOURTH QUESTION.

A. The only change that is known as a demonstrable fact is the change in the federal tax provisions, including the federal income tax rate and the depreciation provisions of the federal tax code. The elements of the cost of capital, which are the debt to equity ratio, rate of return on equity, and interest rate on debt, are all matters of judgment. The elements of the cost of capital are set prior to selecting a black start resource for service, and they define the expected returns to the investors in the black start resources, based on the fact that investors must pay federal income taxes at required levels. The level of state tax rates is defined in the CRF formula as an average state income tax rate. Black start owners accepted black start revenues based on all those inputs, including the assumption that the federal income tax provisions were based on actual federal tax law. Investors will receive their expected returns if the federal tax components of the CRF calculation correctly include the actual tax obligations of the resource.

Q 38. WHAT WAS THE FIFTH QUESTION?

A. The fifth question included multiple parts: Is there a zone of reasonableness applicable to the Capital Cost Recovery Rate, CRF values, or the relevant inputs to either? If so, how should such zone(s) of reasonableness be determined, and what are such zone(s) of reasonableness as of August 17, 2021? [fn omitted] Where do the existing CRF values and the resulting Capital Cost Recovery Rate lie in relation to such zone(s) of reasonableness? If not, what alternate methodology should I adopt to assess whether or not the existing CRF values result in a Capital Cost Recovery Rate that is unjust and unreasonable? Why should I adopt such an alternate methodology in lieu of an assessment of applicable zone(s) of reasonableness, like the assessment the Commission uses to determine return on equity? [fn omitted]

What does this alternate methodology say about the use of the existing CRF values and the resulting Capital Cost Recovery Rate as of August 17, 2021?

Q 39. PLEASE RESPOND TO THE PRESIDING JUDGE'S FIFTH QUESTION.

A. There is not a zone of reasonableness applicable to the CRF. The CRF is a formula rate with defined inputs. When the federal tax provisions changed, the appropriate CRF value was a single number for each identified duration. The method that should be adopted to assess whether the existing CRF values applicable to generating units that were selected to provide Black Start Service prior to June 6, 2021, were just and reasonable is simply to compare the excess revenues paid to black start resources that actually resulted from the incorrect CRF values to the revenues that were defined when the original CRF values were calculated. All of the excess revenues are unjust and unreasonable. There is no zone of reasonableness in this case of a formula rate with an objectively incorrect input. The federal tax provisions are not a matter of regulatory judgment like the cost of capital. The CRF values for post June 6, 2021, black start resources have been correctly calculated. The CRF values for those black start resources that received and continue to receive a windfall starting on January 1, 2018, are overstated.

Q 40. CAN YOU PROVIDE OF A CHRONOLOGY OF EVENTS RELEVANT TO THIS PROCEEDING?

A. Yes. Exhibit IMM-0002 to this testimony is a chronology of the key dates in the history of the CRF issue. The chronology includes: the implementation date of CRF values in the capacity market; the implementation date of the Capital Cost Recovery Rate component in Paragraph 18 of Schedule 6A for black start; the enactment and effective dates of the TCJA; the dates of the Market Monitor's efforts to correct the CRF table to reflect the changed federal tax provisions; the dates of the PJM stakeholder process relating to the CRF; the dates in this proceeding of PJM's filings with the Commission and the Commission's investigation.

Q 41. PLEASE EXPLAIN THE EXHIBITS SUPPORTING THIS TESTIMONY

A. Exhibit IMM-0001 is this testimony.

Exhibit IMM-0002 is the CRF Chronology.

Exhibit IMM-0003 is the IMM's "Capital Recovery Factors for the Flow to Equity Approach Technical Reference," dated December 10, 2021. This Technical

Reference defines CRF and includes the derivation of the CRF formula under the flow to equity (FTE) approach. The original CRF values, filed by PJM in 2005 for the capacity market and in 2009 for black start, were calculated using the FTE approach. The Technical Reference explains the role of federal tax rates and the difference between the tax depreciation provisions prior to the TCJA (MACRS) and the tax depreciation provisions included in the TJCA (bonus depreciation).

Exhibit IMM-0004 is the IMM's "Capital Recovery Factors Technical Reference," dated April 25, 2022. This Technical Reference defines CRF and includes the derivation of the CRF formula under the weighted average cost of capital (WACC) approach. The CRF formula added to the PJM OATT in October 2021 and currently applicable to black start generators that are scheduled for service after June 6, 2021, was derived by the Market Monitor using the WACC approach. The WACC CRF formula is included in Schedule 6A of the PJM OATT.

Exhibit IMM-0005 is an IMM MIC presentation, dated September 18, 2006. This IMM presentation provides a description of proposed tariff changes applicable to black start units. The presentation includes the original CRF values on slide 6. Slide 6 also makes explicit that Modified Accelerated Cost Recovery System (MACRS) depreciation was used in the calculation of taxes included in the CRF values at that time, prior to the TCJA. This demonstrates that the tax depreciation schedule used in the calculation of the CRF values was an explicit part of the calculation of the original CRF values.

Exhibit IMM-0006 is PJM's "Review of Black Start Formula and Cost Components," dated June 2011. This PJM report was required by the tariff and included "a review of the components and formulas in the current approved version of Schedule 6A: Section 18," and "report on the results of that review to stakeholders." This PJM report was the first report to the stakeholders that addressed the use of the CRF for black start resources. The report provides a complete description of the CRF model assumptions (at 7), including all six inputs and including a federal tax rate of 36 percent. The report states that the CRF values used for black start originated in the capacity market tariff. The report was included in the meeting materials for and reviewed at a meeting of the Black Start Service Task Force on June 21, 2011.

Exhibit IMM-0007 is PJM's "Review of PJM Black Start Formula and Cost Components," dated December 2014. This PJM report was the second report to stakeholders on the review of the black start formula as required by the PJM tariff.

The report provides a complete description of the CRF model assumptions (at 8), including all six inputs and including a federal tax rate of 36 percent. The report was included in the meeting materials for and reviewed at the MC Webinar on January 20, 2015.

Exhibit IMM-0008 is PJM's "Review of PJM Black Start Formula and Cost Components," dated October 2019. This PJM report was the third report to stakeholders on the review of the black start formula as required by the PJM tariff. The report provides a complete description of the CRF model assumptions (at 8), including all six inputs and including a federal tax rate of 36 percent. This report was included in the meeting materials for and reviewed at the MC Webinar on October 30, 2019. This report was presented to the stakeholders after the tax law changes in the TCJA became effective on January 1, 2018. This report was presented to stakeholders after the Market Monitor had informed PJM by email of the incorrect CRF values on October 3, 2019. The report concludes (at 10) that "PJM has received, reviewed, and approved several resources during the multiple RFPs listed above. As a result, no additional changes are needed due to the response following the above mentioned RTO Wide and Incremental RFPs." Two of the referenced RFPs were issued after the January 1, 2018, effective date of the TCJA tax provisions. The Market Monitor referenced this report (at fn 15) in *Comments of the Independent Market Monitor for PJM*, Docket No. ER21-1635-000 (April 28, 2021).

Exhibit IMM-0009 is an email from the Market Monitor to PJM, dated October 3, 2019. The email clearly documents the required changes to the CRF rates in the PJM tariff as a result of the tax law changes included in the TCJA. The email also documents the appropriate level of each of the inputs to the CRF calculation as a result of the TCJA.

Exhibit IMM-0010 is an email from PJM to the Market Monitor, dated February 7, 2020. The email shows that PJM is in agreement with the Market Monitor regarding the updates to the CRF rates in the PJM tariff as a result of the tax law changes included in the TCJA. Exhibit IMM-0010 is treated as confidential at PJM's request.

Exhibit IMM-0011 is PJM's filing in Docket ER09-730 Filing, dated February 19, 2009. This is the PJM filing that included the tariff updates with the original black start CRF values. The PJM filing letter describes the addition of the CRF values at pages 3-4, and 7.

Exhibit IMM-0012 is PJM's presentation to the PJM Operating Committee: "Black Start Education, Black Start Unit Testing, Substitution, Termination Rules, and Capital Recovery Factor (CRF)," dated May 14, 2020. This PJM presentation shows (at 9) the changes to the CRF parameter assumptions that are necessary due to the TCJA, including a reduction in the federal tax rate from 36 percent to 21 percent.

Exhibit IMM-0013 is the Market Monitor's initial response to the PJM filing to update the CRF in Docket ER21-1635. The Market Monitor addresses (at 5-7) the derivation of the CRF values, notes (at 6 and fn 15) the tariff requirement that PJM provide a periodic review of the CRF rates and assumptions, states (at fn 15) the parameter assumptions used to compute the CRF and includes (at 16) a general formula for calculating CRF values. The Market Monitor also objects (at 13) to PJM's proposal to leave in place the incorrect CRF values for units selected for black start service prior to June 6, 2021.

Exhibit IMM-0014 is the Market Monitor's response in accordance with paragraph 53 of 176 FERC ¶ 61,080. These comments were filed on November 18, 2021, in ER21-91-000 and are a revised version of the Market Monitor's comments filed on November 11, 2021. Attachment B to this filing is a clean version of the comments. The comments provide a background on CRF (at 7-10), detailed examples explaining the over recovery of capital investment costs that is occurring (at 10-18) and a proposed resolution (at 18-26) that resets the CRF values, on a prospective basis, to levels that provide capital cost recovery that aligns with the intended rates of return (12 percent return on equity, 7 percent cost of debt).

Exhibit IMM-0015 is an answer filed by the Market Monitor on December 20, 2021, in response to an answer by Vistra Corp. and Dynegy Marketing and Trade ("Vistra") in EL21-91-000. The Market Monitor's answer provides additional details and clarifications regarding its proposed resolution. The Market Monitor addresses (at 3) Vistra's contention that the Market Monitor's proposed resolution constitutes retroactive ratemaking.

Exhibit IMM-0016 is the Market Monitor's response to FERC Trial Staff's first set of data requests.

Exhibit IMM-0017 is a spreadsheet attachment to request S-IMM-1.1. The spreadsheet replicates the calculation of the original CRF values.

Exhibit IMM-0018 is a spreadsheet attachment to request S-IMM-1.3. The spreadsheet shows the differences in the FTE and WACC approaches.

Exhibit IMM-0019 is PJM's response to FERC Trial Staff's first set of data requests. Exhibit IMM-0019 is treated as confidential at PJM's request.

Exhibit IMM-0020 is a spreadsheet attachment to request S-PJM-1.2. The spreadsheet shows the financial and income tax assumptions used to calculate the original CRF values. Exhibit IMM-0020 is treated as confidential at PJM's request.

Q 42. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. EL21-91-000, -003

DECLARATION

JOSEPH E. BOWRING states that I prepared the testimony to which this declaration is attached with the assistance of the staff of Monitoring Analytics, LLC, and that the statements contained therein are true and correct to the best of my knowledge and belief. Monitoring Analytics, LLC, is acting in its capacity as the Independent Market Monitor for PJM.

Pursuant to Rule 2005(b)(3) (18 CFR § 385.2005(b)(3), citing 28 U.S.C. § 1746), I further state under penalty of perjury that the foregoing is true and correct.

Executed on June 5, 2024.

Joseph E. Bowring

CRF Chronology

Date	Event
August 31, 2005	PJM files RPM tariff revisions (ER05-1410) that include the original CRF values in PJM OATT Attachment Y, Section 6.8.
September 18, 2006	Market Monitor presents proposed revisions on black start capital cost recovery to the PJM Market Implementation Committee. The proposed revisions incorporate the CRF table previously included in the PJM RPM filing. See Exhibit IMM-0005.
December 22, 2006	Order accepting RPM settlement, including CRF table in OATT Attachment DD § 6.7 & 6.8. *PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,331.
February 19, 2009	PJM Filing, Docket No. ER09-730. The filing includes the CRF values in the provisions providing for recovery of incremental investment cost for black start units. See Exhibit IMM-0011.
April 21, 2009	Table of CRF values for APIR (Attachment DD) filed in ER09-730 becomes effective.
May 29, 2009	Order accepting table of CRF values for inclusion in the formula rates in Paragraph 18 of Schedule 6A to the OATT. *PJM Interconnection, L.L.C.*, 127 FERC ¶ 61,197, at P 39; order on compliance filing 1, 128 FERC ¶ 61,249 (September 17, 2009); delegated order on compliance filing 2 (November 17, 2009).
June 6, 2009	Table of CRF values for black start capital recovery filed in ER09-730 becomes effective.
June 21, 2011	In compliance with tariff provisions, the PJM report, *Review of Black Start Formula and Cost Components,* is included in the meeting materials and reviewed at the Black Start Task Force Meeting. The report includes a review of the CRF values and CRF model assumptions. See Exhibit IMM-0006.
January 20, 2015	In compliance with tariff provisions, the PJM report, *Review of Black Start Formula and Cost Components,* is included in the meeting materials and reviewed at the MC Webinar. The report includes a review of the CRF values and CRF model assumptions. See Exhibit IMM-0007.
December 22, 2017	Tax Cuts and Jobs Act of 2017 (TCJA) enacted. Public Law No: 115-97.
January 1, 2018	TCJA tax rate changes applicable to the CRF values become effective.
February 1, 2018	PJM initiates RTO-wide black start service RFP process. Proposed in service date of April 1, 2020.
February 1, 2019	PJM initiates BGE/PEPCO black start service RFP process. Proposed In service date April 1, 2021
October 3, 2019	Email from IMM to PJM noting the impact of the TCJA on the CRF. See Exhibit IMM-0009.
October 30, 2019	In compliance with tariff provisions, the PJM report, *Review of Black Start Formula and Cost Components,* is included in the meeting materials and reviewed at the MC Webinar. The report includes a review of the CRF values and CRF model assumptions. See Exhibit IMM-0008.
April 16, 2020	PJM Operating Committee initiates stakeholder process to update black start CRF values.
May 14, 2020	PJM presents black start education, which includes the calculation of the CRF. PJM states the original financial assumptions and the proposed updates,

	including a decrease in the assumed federal income tax rate from 36 percent to 21 percent. See Exhibit IMM-0012.
April 7, 2021	PJM files revisions to Schedule 6A in Docket No. ER21-1635, to account for the prospective effects of tax rates on CRF values, without including CRF formula in Schedule 6A. The filing expressly continued to apply the preexisting incorrect CRF values to black start units in service prior to June 6, 2021, the requested effective date. PJM states that the CRF are black box numbers and there is no process in place to update the values for existing units.
April 28, 2021	The Market Monitor files comments in Docket No. ER21-1635. The Market Monitor addresses the derivation of the CRF values, notes the tariff requirement that PJM provide a periodic review of the CRF rates and assumptions, and includes a general formula for calculating CRF values. The Market Monitor also objects to PJM's proposal to leave in place the incorrect CRF values for units selected for black start service prior to June 6, 2021. See Exhibit IMM-0013.
June 6, 2021	Revisions filed in ER21-1635 become effective.
August 10, 2021	Order accepting revisions to Schedule 6A, effective June 6, 2021, subject to minor conditions, and instituting a show cause proceeding "to determine whether the existing rates for [Black Start Units], which are based on [the TCJA], remain just and reasonable. 176 FERC ¶ 61,080.
October 12, 2021	PJM files (Docket No. EL21-91-000) a response to the show cause directive (at 48) in 176 FERC ¶ 61,080. PJM maintains the previously stated position that the CRF are black box values and that it is just and reasonable, and not unduly discriminatory or preferential to continue capital cost recovery payments based on the outdated and incorrect CRF.
November 11, 2021	In accordance with 176 FERC ¶ 61,080 (at 53), the Market Monitor files comments in Docket No. EL21-91-000. The comments provide a background on CRF, detailed examples explaining the over recovery of capital investment costs that is occurring and a proposed resolution that resets the CRF values to levels that provide capital cost recovery that aligns with the intended rates of return (12 percent return on equity, 7 percent cost of debt).
November 18, 2021	The Market Monitor files an updated version of its November 21, 2021 comments (EL21-91-000) to address errors. See Exhibit IMM-0014.
December 20, 2021	The Market Monitor files an answer to an answer by Vistra Corp. and Dynegy Marketing and Trade ("Vistra") in EL21-91-000. The Market Monitor's answer provides additional details and clarifications regarding its proposed resolution, and addresses Vistra's contention that the Market Monitor's proposed resolution constitutes retroactive rate changes. See Exhibit IMM-0015.
March 24, 2023	Order in Docket No. EL21-91-000 establishing hearing and settlement procedures "to determine whether, as a result of changes from the [TCJA], the existing CRF values result in a Capital Cost Recovery Rate for generating units that were selected to provide Black Start Service prior to June 6, 2021 that is unjust and unreasonable." 182 FERC ¶ 61,194.
August 23, 2023	Order Declaring Impasse, Docket No. EL21-91-000.
January 31, 2024	Offer of Settlement filed in EL21-91-000
February 20, 2024	Market Monitor files comments in opposition of settlement, Docket No. EL21-91-000, -003.

March 13, 2024	Order Denying Request to Certify Contested Settlement, Docket Nos. EL21-91-003, ER21-1635-005.

Capital Recovery Factors (CRF) for the Flow to Equity Approach Technical Reference

Monitoring Analytics, LLC

December 10, 2021

Table of Contents

1 The Basics of CRF

A capital recovery factor (CRF) is used to convert a principal amount of capital into an equivalent stream of uniform payments. A typical CRF formula found in engineering economics textbooks is given in equation (1.1).[1]

(1.1)

$$CRF = \frac{r(1+r)^N}{(1+r)^N - 1}$$

Variable r is an interest rate, N is the number of uniform annual payments and payments are assumed to occur at the end of year. To derive equation (1.1) the CRF is first denoted by c, allowing the annual payment to be stated as $A = cK$, where K is the capital investment. Then c is the value that solves the following present value equation,

$$\begin{aligned} K &= \sum_{j=1}^{N} \frac{cK}{(1+r)^j} \\ &= cK \sum_{j=1}^{N} \left(\frac{1}{1+r}\right)^j \end{aligned}$$

The summation in the equation above is a finite geometric series. A general formula for the sum of a finite geometric series is given by

(1.2)

$$\sum_{j=H}^{W} v^j = \frac{v^H}{1-v}(1 - v^{W-H+1}) .$$

H and W are positive integers and v is any number except one ($v \neq 1$). It is straightforward exercise to show that equation (1.2) is valid. If S is the sum on the left hand side of equation (1.2), then $S - vS = v^H - v^{W+1}$ and solving for S gives the right hand side of (1.2).

Using equation (1.2) with $H = 1$, $W = N$ and $v = 1/(1+r)$ yields

$$\sum_{j=1}^{N} \left(\frac{1}{1+r}\right)^j = \frac{(1+r)^N - 1}{r(1+r)^N}.$$

Replacing the summation in the present value equation yields

$$K = cK\left(\frac{(1+r)^N - 1}{r(1+r)^N}\right)$$

and solving for c produces equation (1.1).

[1] For example, see pages 21-22 in "Economic Evaluation and Investment Decision Methods," Stermole, F.J. and Stermole, J.M. (1993).

1.1 CRF That Reflect Taxable Income

The revenue that results from a capital investment is taxable income. The revenue payment A, obtained by multiplying the capital investment amount K by the CRF in equation (1.1), would be too low in cases where the revenue is taxable. The goal, in the presence of taxes, is to have a CRF for which the product $CRF \cdot K$ yields an annual payment A that will provide the necessary and sufficient level of revenue to cover the investors' annual tax payments, and the return on and return of the capital investment. In other words, over the life of the project, the revenue in excess of the tax payments and investment return should equal the original capital investment. The annual revenue payment can be determined by solving an equation where the present value of the after tax cash flows resulting from annual revenue payment is equal to the initial capital investment.

The composition of the after tax cash flow is dependent upon capital budgeting model. The flow to equity (FTE) model was used to develop the original CRF for PJM Black Start Service.[2] The FTE approach discounts the after tax cash flow to the equity investor at the return on equity. The CRF must satisfy the following present value equation,

$$E \cdot K = \sum_{j=1}^{N} \frac{CF_j}{(1+r_e)^j} \ .$$

$E \cdot K$ is the equity portion of the capital investment, CF_j is the after tax cash flow to the equity investor for year j, r_e is the rate of return on equity and the revenue, tax and debt payments are assumed to occur at the end of the year. The model variables are defined in Table 1. In the FTE model, the after tax cash flow is revenue net of taxes and the debt payment, and the tax calculation includes an offset for both depreciation and interest on the debt. The after tax cash flow for year j is

$$CF_j = cK - \left(cK - \delta_j K - I_j\right)s - P$$

$$= cK(1-s) + \delta_j K s + I_j s - P$$

where c is the CRF, K is the total capital investment including debt and equity, I_j is the interest portion of the debt payment P and s is the effective tax rate. Upon replacing CF_j in the present value equation

$$E \cdot K = cK(1-s)\sum_{j=1}^{N} \frac{1}{(1+r_e)^j} + Ks\sum_{j=1}^{N} \frac{\delta_j}{(1+r_e)^j} + s\sum_{j=1}^{N} \frac{I_j}{(1+r_e)^j} - P\sum_{j=1}^{N} \frac{1}{(1+r_e)^j}.$$

Equation (1.2) with $H = 1$, $W = N$ and $v = 1/(1+r_e)$ gives

[2] Additional details on the flow to equity approach can be found in Section 17.2 in "Corporate Finance," Ross, Westerfield, Jaffe, 4th Edition, 1996.

$$\sum_{j=1}^{N} \frac{1}{(1+r_e)^j} = \frac{(1+r_e)^N - 1}{r_e(1+r_e)^N}$$

and substituting into the previous equation results in

$$E \cdot K = cK(1-s)\left(\frac{(1+r_e)^N - 1}{r_e(1+r_e)^N}\right) + Ks\sum_{j=1}^{N} \frac{\delta_j}{(1+r_e)^j} + s\sum_{j=1}^{N} \frac{I_j}{(1+r_e)^j} - P\left(\frac{(1+r_e)^N - 1}{r_e(1+r_e)^N}\right).$$

Solving for c yields

(1.3)

$$c = \frac{r_e(1+r_e)^N}{(1-s)[(1+r_e)^N - 1]}\left\{E - s\sum_{j=1}^{N} \frac{\delta_j}{(1+r_e)^j} - \frac{s}{K}\sum_{j=1}^{N} \frac{I_j}{(1+r_e)^j} + \frac{P}{K}\frac{(1+r_e)^N - 1}{r_e(1+r_e)^N}\right\}.$$

Table 1 Variable descriptions for the FTE capital budgeting model

Variable	Description
K	Capital investment (included debt and equity)
E	Equity funding percent
r_e	Return on equity
r_d	Debt interest rate
P	Debt payment
I_j	Interest portion of debt payment in year j
s	Effective tax rate
N	Cost recovery period
δ_j	Depreciation factor for year j

Formulas for the debt payment and interest portion of the debt payment, for debt with a term of N years and assuming end of year debt payments, are given in equation (1.4).

(1.4)

$$P = (1-E)K\frac{r_d(1+r_d)^N}{(1+r_d)^N - 1}$$

$$I_j = (1-E)Kr_d(1+r_d)^{j-1}\left(\frac{(1+r_d)^{N-j+1} - 1}{(1+r_d)^N - 1}\right), \quad j = 1, \cdots, N$$

Using the (1.4)

$$\sum_{j=1}^{N} \frac{I_j}{(1+r_e)^j} = \sum_{j=1}^{N} (1-E)Kr_d(1+r_d)^{j-1}\left(\frac{(1+r_d)^{N-j+1} - 1}{(1+r_d)^N - 1}\right)\frac{1}{(1+r_e)^j}$$

$$= (1-E)K\left(\frac{r_d}{(1+r_d)^N-1}\right)\left[(1+r_d)^N\sum_{\mathrm{j}=1}^{\mathrm{N}}\left(\frac{1}{1+\mathrm{r_e}}\right)^j-(1+r_d)^{-1}\sum_{\mathrm{j}=1}^{\mathrm{N}}\left(\frac{1+r_d}{1+\mathrm{r_e}}\right)^j\right]$$

As previously noted

$$\sum_{j=1}^{N}\frac{1}{(1+\mathrm{r_e})^{\mathrm{j}}}=\frac{(1+\mathrm{r_e})^N-1}{r_e(1+\mathrm{r_e})^N}$$

and equation (1.2) with $H=1$, $W=N$ and $v=(1+r_d)/(1+r_e)$ gives

$$\sum_{j=1}^{N}\left(\frac{1+r_d}{1+r_e}\right)^j=\left(\frac{1+r_d}{r_e-r_d}\right)\left(\frac{(1+\mathrm{r_e})^N-(1+\mathrm{r_d})^N}{(1+\mathrm{r_e})^N}\right).$$

Upon replacing the finite geometric series with the expressions above

$$\sum_{\mathrm{j}=1}^{\mathrm{N}}\frac{\mathrm{I_j}}{(1+\mathrm{r_e})^{\mathrm{j}}}=(1-E)K\left(\frac{r_d}{(1+r_d)^N-1}\right)\left[(1+r_d)^N\left(\frac{(1+\mathrm{r_e})^N-1}{r_e(1+\mathrm{r_e})^N}\right)-\frac{(1+\mathrm{r_e})^N-(1+\mathrm{r_d})^N}{(r_e-r_d)(1+\mathrm{r_e})^N}\right].$$

Replacing the sum of discounted interest payments in equation (1.3) and using (1.4) to replace P yields the CRF formula in equation (1.5).

(1.5)

$$\begin{aligned}\mathrm{CRF}=\frac{\mathrm{r_e}(1+\mathrm{r_e})^{\mathrm{N}}}{(1-\mathrm{s})[(1+\mathrm{r_e})^{\mathrm{N}}-1]}\Bigg\{&\mathrm{E}-\mathrm{s}\sum_{\mathrm{j}=1}^{\mathrm{N}}\frac{\delta_{\mathrm{j}}}{(1+\mathrm{r_e})^{\mathrm{j}}}\\&-(1-E)s\frac{r_d}{(1+r_d)^N-1}\left[(1+r_d)^N\left(\frac{(1+\mathrm{r_e})^N-1}{r_e(1+\mathrm{r_e})^N}\right)-\left(\frac{(1+\mathrm{r_e})^N-(1+\mathrm{r_d})^N}{(r_e-r_d)(1+\mathrm{r_e})^N}\right)\right]\\&+(1-E)\left(\frac{r_d(1+r_d)^N}{(1+r_d)^N-1}\right)\left(\frac{(1+\mathrm{r_e})^{\mathrm{N}}-1}{\mathrm{r_e}(1+\mathrm{r_e})^{\mathrm{N}}}\right)\Bigg\}\end{aligned}$$

Substituting the parameter values shown in Table 2 into the CRF formula, assuming a five year capital recovery period and straight line depreciation yields a CRF of 0.275362. With a capital investment of $1 million, the annual payment is $275,362.

Table 3 provides a cash flow summary for a $1 million capital investment with a five year cost recovery period that uses straight line depreciation. The revenue for each year, equal to the product of the CRF and the capital investment amount, is $275,362. The tax payment for each year is equal to the effective tax rate times the revenue net of depreciation and the interest portion of the debt payment. The interest payment in year 1 is equal to the product of the debt interest rate

and the initial debt of $500,000, and the return on equity in year 1 is equal to the product of the rate of return on equity and the initial equity investment of $500,000.

Table 2 Financial parameter and tax assumptions[3]

Parameter	Parameter Value
Equity Funding Percent	50.0000%
Debt Funding Percent	50.0000%
Equity Rate	12.0000%
Debt Interest Rate	7.0000%
Federal Tax Rate	21.0000%
State Tax Rate	9.3000%
Effective Tax Rate	28.3470%
Depreciation (δ_i , i = 1,2,3,4,5)	20.0000%

After accounting for the tax payment, the debt payment and return on equity in year 1, $81,975 is available as payback to the equity investors. The remaining equity investment is $418,025 at the end of year 1. The year 2 interest on debt is the product of the debt interest rate and the remaining debt at the end of year 1. The year 2 return on equity is the product of the rate of return on equity and the remaining equity investment at the end of year 1. Payback to equity investors is $90,087 in year 2. The cash flows for years 3 through 5 are analogous to the year 2 cash flow.

Table 3 Cash flow summary for 5 year, $1 million investment with straight line depreciation[4]

Service Year	1	2	3	4	5
Revenue	$275,362	$275,362	$275,362	$275,362	$275,362
Depreciation	$200,000	$200,000	$200,000	$200,000	$200,000
Interest on debt	$35,000	$28,914	$22,402	$15,434	$7,978
Tax payment	$11,441	$13,167	$15,013	$16,988	$19,101
Debt payment	$121,945	$121,945	$121,945	$121,945	$121,945
Return on equity	$60,000	$50,163	$39,353	$27,466	$14,391
Payback of debt	$86,945	$93,032	$99,544	$106,512	$113,968
Payback of equity	$81,975	$90,087	$99,051	$108,962	$119,924
Remaining debt	$413,055	$320,023	$220,479	$113,968	$0.000
Remaining equity	$418,025	$327,938	$228,887	$119,924	$0.000

[3] The effective tax rate (parameter s in the formula) is equal to *State Tax Rate + Federal Tax Rate x (1-State Tax Rate).*

[4] FTE model with end of year revenue and tax payments.

After the final revenue payment in year 5, the remaining equity investment, and the remaining debt are reduced to $0. Summing horizontally across the debt payback row and the equity payback row produces $500,000 for each, reflecting the 1:1 debt to equity ratio in Table 2. This example illustrates that the revenue payment determined by the CRF provides the necessary and sufficient annual revenue to pay the taxes associated with the revenue payment as well as the required return on and return of the capital investment. This important point is established as a general result in the following proposition.

Proposition 1.1. The CRF given by equation (1.5) is the unique value, assuming a FTE model with end of year payments, for which the resulting annual revenue payment is necessary and sufficient, over the term of the investment, to provide for the annual tax liability and the return on and return of the capital investment.

1.2 Half Year Convention

The revenue and tax payments would likely be made on a monthly or quarterly basis rather than occurring at the end of the year. A better model with respect to the timing of the revenue and tax payments is obtained by assuming the revenue and tax payments occur at the midpoint of each year. To derive a CRF corresponding to midyear revenue and tax payments, the present value equation from the previous section is modified to reflect the new timing assumption. Each after tax cash flow amount is assumed to occur a half year earlier than in the previous model. The revised present value equation is

$$K = \sum_{j=1}^{N} \frac{CF_j}{(1+r)^{j-0.5}} \ ,$$

or equivalently,

$$\mathrm{K} = \sqrt{1+r_e} \sum_{\mathrm{j}=1}^{\mathrm{N}} \frac{CF_j}{(1+r_e)^{\mathrm{j}}} \ .$$

Making the substitution,

$$CF_j = cK - \big(cK - \delta_j K - I_j\big)s - P$$

and solving for c yields equation (1.6).

(1.6)

$$c = \frac{r_e(1+r_e)^N}{(1-s)[(1+r_e)^N - 1]} \left\{ \frac{E}{\sqrt{1+r_e}} - s \sum_{j=1}^{N} \frac{\delta_j}{(1+r_e)^j} - \frac{s}{K} \sum_{j=1}^{N} \frac{I_j}{(1+r_e)^j} + \frac{P}{K} \frac{(1+r_e)^N - 1}{r_e(1+r_e)^N} \right\}.$$

Formulas for the debt payment and interest portion of the debt payment, for debt with a term of N years and assuming the half year convention are given in equation (1.7).

(1.7)

$$P = (1-E)K\frac{r_d(1+r_d)^{N-1/2}}{(1+r_d)^N-1}$$

$$I_1 = (1-E)K\left(\sqrt{1+r_d}-1\right)$$

$$I_j = (1-E)Kr_d(1+r_d)^{j-3/2}\left(\frac{(1+r_d)^{N-j+1}-1}{(1+r_d)^N-1}\right), \quad j = 2,\cdots,N$$

Substituting the formulas for the interest payment into the sum of discounted interest payments from (1.6) results in

$$\sum_{j=1}^{N}\frac{I_j}{(1+r_e)^j} = (1-E)K\left(\frac{\sqrt{1+r_d}-1}{1+r_e}+\sum_{j=2}^{N}\left(r_d(1+r_d)^{j-3/2}\left(\frac{(1+r_d)^{N-j+1}-1}{(1+r_d)^N-1}\right)\frac{1}{(1+r_e)^j}\right)\right)$$

$$= (1-E)K\frac{\sqrt{1+r_d}-1}{1+r_e}$$

$$+\frac{(1-E)Kr_d}{\sqrt{1+r_d}[(1+r_d)^N-1]}\left[(1+r_d)^N\sum_{j=2}^{N}\left(\frac{1}{1+r_e}\right)^j-(1+r_d)^{-1}\sum_{j=2}^{N}\left(\frac{1+r_d}{1+r_e}\right)^j\right].$$

Both summations in the previous expression are finite geometric series that can be simplified by using equation (1.2). Taking $H = 2$, $W = N$ and $v = 1/(1+r_e)$ gives

$$\sum_{j=2}^{N}\frac{1}{(1+\mathrm{r_e})^{\mathrm{j}}} = \frac{(1+\mathrm{r_e})^{N-1}-1}{r_e(1+\mathrm{r_e})^N}$$

and with $H = 2$, $W = N$ and $v = (1+r_d)/(1+r_e)$

$$\sum_{j=2}^{N}\left(\frac{1+r_d}{1+r_e}\right)^j = (1+r_d)^2\left(\frac{(1+\mathrm{r_e})^{N-1}-(1+\mathrm{r_d})^{N-1}}{(r_e-r_d)(1+\mathrm{r_e})^N}\right).$$

Replacing the summations yields equation (1.8).

(1.8)

$$\sum_{j=1}^{N}\frac{I_j}{(1+r_e)^j} = (1-E)K\frac{\sqrt{1+r_d}-1}{1+r_e}$$

$$+\frac{(1-E)Kr_d\sqrt{1+r_d}}{(1+r_d)^N-1}\left[(1+r_d)^{N-1}\left(\frac{(1+\mathrm{r_e})^{N-1}-1}{r_e(1+\mathrm{r_e})^N}\right)\right.$$

$$\left.-\left(\frac{(1+\mathrm{r_e})^{N-1}-(1+\mathrm{r_d})^{N-1}}{(r_e-r_d)(1+\mathrm{r_e})^N}\right)\right]$$

Using (1.8) to replacing the sum of discounted interest payments in equation (1.6) and using (1.7) to replace P yields the CRF formula in equation (1.9).

(1.9)

$$CRF = \frac{r_e(1+r_e)^N}{(1-s)[(1+r_e)^N-1]}\left\{\frac{E}{\sqrt{1+r_e}} - s\sum_{j=1}^{N}\frac{\delta_j}{(1+r_e)^j} - s(1-E)\frac{\sqrt{1+r_d}-1}{1+r_e}\right.$$
$$- s(1-E)\frac{r_d\sqrt{1+r_d}}{(1+r_d)^N-1}\left[(1+r_d)^{N-1}\left(\frac{(1+\mathrm{r_e})^{N-1}-1}{r_e(1+\mathrm{r_e})^N}\right)\right.$$
$$\left.\left. - \left(\frac{(1+\mathrm{r_e})^{N-1}-(1+\mathrm{r_d})^{N-1}}{(r_e-r_d)(1+\mathrm{r_e})^N}\right)\right] + (1-E)\left(\frac{r_d(1+r_d)^{N-1/2}}{(1+r_d)^N-1}\right)\left(\frac{(1+r_e)^N-1}{r_e(1+r_e)^N}\right)\right\}$$

Using the parameter values in Table 2, with a five year capital cost recovery period and straight line depreciation, equation (1.9) yields a CRF of 0.260975. With an initial capital investment of $1 million, the annual payment is $260,975. Table 4 shows the corresponding cash flow summary.

Table 4 Cash flow summary for 5 year, $1 million investment with half year convention

Service Year	1	2	3	4	5
Revenue	$260,975	$260,975	$260,975	$260,975	$260,975
Depreciation	$200,000	$200,000	$200,000	$200,000	$200,000
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$12,408	$9,361	$11,146	$13,055	$15,098
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$47,817	$37,508	$26,176	$13,713
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$101,528	$85,909	$94,433	$103,855	$114,275
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$398,472	$312,563	$218,130	$114,275	$0

The calculation of the values in Table 4 is identical to the corresponding values in Table 3 except that the year 1 interest on the debt and the year 1 return on equity reflect a half year period. The interest on debt in year 1 is equal to the product of the initial debt and the half year interest rate $\sqrt{1+\mathrm{r}_d}-1$. The return on equity in year 1 is equal to the product of the equity investment and the half year rate of return $\sqrt{1+\mathrm{r}_e}-1$. The cash flow summary shows that the revenue payment determined by the CRF is necessary and sufficient to pay the taxes associated with the revenue payment as well as the required return on and return of the capital investment.

Changing the depreciation assumption to 3 year MACRS produces a CRF of 0.251812. The MACRS depreciation factors are shown in Table 7. The lower CRF relative to the straight line depreciation example reflects the lower tax payment under MACRS due to the accelerated depreciation schedule. In years 1 and 2, the tax payment in Table 5 is negative due to the

accelerated depreciation assumption.[5] The cash flow summary in Table 5 shows that the revenue payment determined by the CRF, using 3 year MACRS depreciation, is at the necessary and sufficient level to provide for the taxes associated with the revenue payment as well as the required return on and return of the capital investment.

Table 5 Cash flow summary for 5 year, $1 million investment with 3 year MACRS

Service Year	1	2	3	4	5
Revenue	$251,812	$251,812	$251,812	$251,812	$251,812
Depreciation	$333,300	$444,500	$148,100	$74,100	$0
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	($27,976)	($62,545)	$23,260	$46,147	$69,195
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$44,070	$25,782	$15,597	$6,935
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$132,749	$152,398	$84,880	$72,180	$57,793
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$367,251	$214,853	$129,973	$57,793	$0

Assuming 100 percent bonus depreciation results in a CRF of 0.242110. The corresponding cash flow summary is given in Table 6.

Table 6 Cash flow summary for 5 year, $1 million investment with bonus depreciation

Service Year	1	2	3	4	5
Revenue	$242,110	$242,110	$242,110	$242,110	$242,110
Depreciation	$1,000,000	$0	$0	$0	$0
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	($219,716)	$60,707	$62,492	$64,401	$66,445
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$22,226	$17,271	$11,936	$6,190
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$314,786	$41,288	$44,458	$47,883	$51,586
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$185,214	$143,926	$99,469	$51,586	$0

In each example, the annual revenue payment, equal to the product of the capital investment and the CRF obtained from equation (1.9) is the necessary and sufficient revenue amount to cover the

[5] It is assumed that the capital investor would use the negative tax liability from this project as an offset against the tax liability resulting from other revenue.

tax liability and the return on and return of the investment capital. This observation is generalized in the following proposition.

Proposition 1.2. The CRF given by equation (1.9) is the unique value, assuming a FTE model with the half year convention, for which the resulting annual revenue payment is necessary and sufficient, over the term of the investment, to pay the annual tax liability and the return on and return of the capital investment.

Table 7 Modified Accelerated Cost Recovery System (MACRS) with half year convention[6]

Year	3 year Depreciation Factors	5 year Depreciation Factors	10 year Depreciation Factors	15 year Depreciation Factors	20 year Depreciation Factors
1	33.33%	20.00%	10.00%	5.00%	3.750%
2	44.45%	32.00%	18.00%	9.50%	7.219%
3	14.81%	19.20%	14.40%	8.55%	6.677%
4	7.41%	11.52%	11.52%	7.70%	6.177%
5		11.52%	9.22%	6.93%	5.713%
6		5.76%	7.37%	6.23%	5.285%
7			6.55%	5.90%	4.888%
8			6.55%	5.90%	4.522%
9			6.56%	5.91%	4.462%
10			6.55%	5.90%	4.461%
11			3.28%	5.91%	4.462%
12				5.90%	4.461%
13				5.91%	4.462%
14				5.90%	4.461%
15				5.91%	4.462%
16				2.95%	4.461%
17					4.462%
18					4.461%
19					4.462%
20					4.461%
21					2.231%

Proposition 1.2 Proof. K_0 is the initial capital invested and, $j \geq 1$, represents the equity investment remaining at the midpoint of cost recovery year j. $K_1^{(e)}$ is the remaining equity investment at the midpoint of year 1 after using the year 1 revenue net of taxes, the debt payment and return on equity, as a payback to the equity investors. The proposition states that the CRF in equation (1.9)

[6] See Appendix A, Table A-1, IRS Publication 946, United States Department of Treasury (2020).

is the unique value that will result in $K_N^{(e)} = 0$. Representing the CRF in equation (1.9) as c, the year 1 revenue net of taxes and return is

$$cK_0(1-s) + \delta_1 K_0 s + I_1 s - P - EK_0\left(\sqrt{1+r_e} - 1\right).$$

The rate of return on equity reflects a half year of return due to the half year convention. The equity investment that remains at the midpoint of year 1 is

$$K_1^{(e)} = EK_0 - \left(cK_0(1-s) + \delta_1 K_0 s + I_1 s - P - EK_0\left(\sqrt{1+r_e} - 1\right)\right)$$

$$= EK_0\sqrt{1+r_e} - cK_0(1-s) - \delta_1 K_0 s - I_1 s + P.$$

The year 2 revenue net of taxes, the debt payment and return on equity is

$$cK_0(1-s) + \delta_2 K_0 s + I_2 s - P - r_e K_1^{(e)}$$

and the equity investment that remains at the midpoint of year 2 is

$$K_2^{(e)} = K_1^{(e)}(1+r_e) - cK_0(1-s) - \delta_2 K_0 s - I_2 s + P.$$

Substitution for $K_1^{(e)}$ yields

$$K_2^{(e)} = EK_0(1+r_e)^{3/2} - cK_0(1-s)[(1+r_e)+1] - [\delta_1(1+r_e)+\delta_2]K_0 s - [I_1(1+r_e)+I_2]s + P[(1+r_e)+1].$$

Repeating this process through the end of the capital recovery period yields

(1.10)

$$K_N^{(e)} = EK_0(1+r_e)^{N-1/2} - cK_0(1-s)\sum_{j=1}^{N}(1+r_e)^{j-1} - K_0 s\sum_{j=1}^{N}\delta_j(1+r_e)^{N-j} - s\sum_{j=1}^{N}I_j(1+r_e)^{N-j} + P\sum_{j=1}^{N}(1+r_e)^{j-1}.$$

Equation (1.2) with $H = 1$, $W = N$ and $v = 1 + r$ gives

$$\sum_{j=1}^{N}(1+r_e)^{j-1} = \frac{1}{1+r_e}\sum_{j=1}^{N}(1+r_e)^{j} = \frac{(1+r_e)^N - 1}{r_e}.$$

Using the formulas for I_j in equation (1.7) yields

$$\sum_{j=1}^{N} I_j(1+r_e)^{N-j}$$

$$= (1-E)K_0\left(\sqrt{1+r_d}-1\right)(1+r_e)^{N-1}$$
$$+\sum_{j=2}^{N}(1-E)K_0 r_d(1+r_d)^{j-3/2}\left(\frac{(1+r_d)^{N-j+1}-1}{(1+r_d)^N-1}\right)(1+r_e)^{N-j}$$
$$= (1-E)K_0\left(\sqrt{1+r_d}-1\right)(1+r_e)^{N-1}$$
$$+\frac{(1-E)K_0 r_d(1+r_e)^N}{\sqrt{1+r_d}(1+r_d)^N-1}\left[(1+r_d)^N\sum_{j=2}^{N}\left(\frac{1}{1+r_e}\right)^j-(1+r_d)^{-1}\sum_{j=2}^{N}\left(\frac{1+r_d}{1+r_e}\right)^j\right]$$

Equation (1.2) with $H=2$, $W=N$ and $v=1/(1+r_e)$ gives

$$\sum_{j=2}^{N}\left(\frac{1}{1+r_e}\right)^j=\frac{(1+r_e)^{N-1}-1}{r_e(1+r_e)^N}$$

and $H=2$, $W=N$ and $v=(1+r_d)/(1+r_e)$ gives

$$\sum_{j=2}^{N}\left(\frac{1+r_d}{1+r_e}\right)^j=(1+r_d)^2\left[\frac{(1+r_e)^{N-1}-(1+r_d)^{N-1}}{(r_e-r_d)(1+r_e)^N}\right].$$

Upon making these substitutions

$$\sum_{j=1}^{N} I_j(1+r_e)^{N-j}$$

$$= (1-E)K_0\left(\sqrt{1+r_d}-1\right)(1+r_e)^{N-1}$$
$$+\frac{(1-E)K_0 r_d(1+r_d)}{\sqrt{1+r_d}(1+r_d)^N-1}\left[(1+r_d)^{N-1}\left(\frac{(1+r_e)^{N-1}-1}{r_e}\right)\right.$$
$$\left.-\left(\frac{(1+r_e)^{N-1}-(1+r_d)^{N-1}}{(r_e-r_d)}\right)\right].$$

Replacing the summations in equation (1.10) and replacing P using (1.7) yields

$$K_N^{(e)} = EK_0(1+r_e)^{N-1/2} - cK_0(1-s)\left(\frac{(1+r_e)^N - 1}{r_e}\right) - K_0 s\sum_{j=1}^{N}\delta_j(1+r_e)^{N-j}$$
$$- s(1-E)K_0\left(\sqrt{1+r_d}-1\right)(1+r_e)^{N-1}$$
$$- s(1-E)K_0\frac{r_d(1+r_d)}{\sqrt{1+r_d}(1+r_d)^N - 1}\left[(1+r_d)^{N-1}\left(\frac{(1+r_e)^{N-1}-1}{r_e}\right)\right.$$
$$\left. - \left(\frac{(1+r_e)^{N-1} - (1+r_d)^{N-1}}{(r_e - r_d)}\right)\right] + (1-E)K_0\left(\frac{\mathrm{r_d}(1+\mathrm{r_d})^{\mathrm{N}-1/2}}{(1+\mathrm{r_d})^{\mathrm{N}} - 1}\right)\left(\frac{(1+r_e)^N - 1}{r_e}\right).$$

Replacing c with the CRF formula in (1.9) results in $K_N^{(e)} = 0$. The equation for K_N also establishes the uniqueness of the CRF. If there are two CRF values, for instance c_1 and c_2, satisfying the proposition, then each will produce $K_N = 0$ and one can quickly deduce from the equation for K_N that $c_1 = c_2$.

Capital Recovery Factors (CRF) Technical Reference

Monitoring Analytics, LLC

April 25, 2022

Table of Contents

1 The Basics of CRF

A capital recovery factor (CRF) is used to convert the principal amount of a capital investment into an equivalent stream of uniform payments. A typical CRF formula found in engineering economics textbooks is given in equation (1.1).[1]

(1.1)

$$CRF = \frac{r(1+r)^N}{(1+r)^N - 1}$$

Variable r is an interest rate, N is the number of uniform annual payments and the payments are assumed to occur at the end of year. To derive equation (1.1) the CRF is first denoted by c, allowing the annual payment to be stated as $A = cK$ where K is the capital investment. Then c is the value that solves the following present value equation,

$$\begin{aligned} K &= \sum_{j=1}^{N} \frac{cK}{(1+r)^j} \\ &= cK \sum_{j=1}^{N} \left(\frac{1}{1+r}\right)^j \end{aligned}$$

The summation in the equation above is a finite geometric series. A general formula for the sum of a finite geometric series is given by

(1.2)

$$\sum_{j=H}^{W} v^j = \frac{v^H}{1-v}(1 - v^{W-H+1}) .$$

H and W are positive integers and v is any number except one ($v \neq 1$). It is a straightforward exercise to show that equation (1.2) is valid.[2]

Using equation (1.2) with $H = 1$, $W = N$ and $v = 1/(1+r)$ yields

$$\sum_{j=1}^{N} \left(\frac{1}{1+r}\right)^j = \frac{(1+r)^N - 1}{r(1+r)^N}.$$

Replacing the summation in the present value equation yields

$$K = cK\left(\frac{(1+r)^N - 1}{r(1+r)^N}\right)$$

[1] For example, see pages 21-22 in "Economic Evaluation and Investment Decision Methods," Stermole, F.J. and Stermole, J.M. (1993).

[2] If S is the sum on the left hand side of equation (1.2), then $S - vS = v^H - v^{W+1}$ and solving for S gives the right hand side of (1.2).

and solving for c produces equation (1.1).

1.1 CRF That Reflect Taxable Income

The revenue that results from a capital investment is taxable income. The revenue payment A, obtained by multiplying the capital investment amount K by the CRF in equation (1.1), would be too low in cases where the revenue is taxable. The goal, in the presence of taxes, is to have a CRF for which the product $CRF \cdot K$ yields an annual payment A that will provide the necessary and sufficient level of revenue to cover the investors' annual tax payments, and the return on and return of the capital investment. In other words, over the life of the project, the revenue in excess of the tax payments and investment return should equal the original capital investment. The annual revenue payment can be determined by solving an equation where the present value of the after tax cash flows resulting from the annual revenue payment is equal to the initial capital investment.

The composition of the after tax cash flow is dependent upon the capital budgeting model. The weighted average cost of capital (WACC) approach was used to develop the CRF for PJM Black Start Service which was accepted by FERC in August 2021.[3] [4] The WACC approach to capital budgeting discounts the after tax cash flow at the after tax weighted average cost of capital rate and payback of the investment in each recovery year reflects the assumed debt and equity financing structure.[5] The CRF must satisfy the following present value equation,

$$K = \sum_{j=1}^{N} \frac{CF_j}{(1+r)^j} \ .$$

K is the capital investment, CF_j is the after tax cash flow for year j, r is the WACC rate, and the revenue, tax and debt payments are assumed to occur at the end of the year. The model variables are defined in Table 1-1. In the WACC model, the after tax cash flow is revenue net of taxes, and the tax calculation includes an offset for depreciation. The after tax cash flow for year j is

$$CF_j = cK - \big(cK - \delta_j K\big)s$$

$$= cK(1-s) + \delta_j Ks$$

[3] 176 FERC ¶ 61,080 (August 10, 2021) at 43-44.

[4] Additional details on the weighted average cost of capital approach to capital budgeting can be found in Section 17.3 in "Corporate Finance," Ross, Westerfield, Jaffe, 4th Edition, 1996.

[5] The after tax weighted average cost of capital rate is equal to *Equity Funding Percent* x *Equity Rate* + *Debt Funding Percent* x *Debt Interest Rate* x (*1- Effective Tax Rate*).

where c is the CRF, K is the total capital investment including debt and equity, cK is the annual revenue payment, s is the effective tax rate and δ_j is the depreciation factor for year j. Upon replacing CF_j in the present value equation

$$K = cK(1-s)\sum_{j=1}^{N}\frac{1}{(1+r)^j} + Ks\sum_{j=1}^{N}\frac{\delta_j}{(1+r)^j}.$$

Equation (1.2) with $H = 1$, $W = N$ and $v = 1/(1+r)$ gives

$$\sum_{j=1}^{N}\frac{1}{(1+r)^j} = \frac{(1+r)^N - 1}{r(1+r)^N}$$

and substituting into the previous equation results in

$$K = cK(1-s)\left(\frac{(1+r)^N - 1}{r(1+r)^N}\right) + Ks\sum_{j=1}^{N}\frac{\delta_j}{(1+r)^j}.$$

Solving for c yields the CRF formula in equation (1.3).

(1.3)

$$CRF = \frac{r(1+r)^N}{(1-s)[(1+r)^N - 1]}\left\{1 - s\sum_{j=1}^{N}\frac{\delta_j}{(1+r)^j}\right\}$$

Table 1-1 Variable descriptions for the WACC capital budgeting model

Variable	Description
r	After tax weighted average cost of capital
s	Effective tax rate
N	Cost recovery period
δ_j	Depreciation factor for recovery year *j*

Substituting the parameter values shown in Table 1-2 into the CRF formula, assuming a five year capital recovery period and straight line depreciation yields a CRF of 0.274938. With a capital investment of $1 million, the annual payment is $274,938.

Table 1-3 provides a cash flow summary for a $1 million capital investment with a five year cost recovery period that uses straight line depreciation. The revenue for each year, equal to the product of the CRF and the capital investment amount, is $274,938. The tax payment for each year is equal to the effective tax rate times the revenue net of depreciation. The return on the capital investment in year 1 is equal to the product of the WACC rate and the initial capital investment of $1,000,000.

Table 1-2 Financial parameter and tax assumptions[6]

Parameter	Parameter Value
Equity Funding Percent	50.0000%
Debt Funding Percent	50.0000%
Equity Rate	12.0000%
Debt Interest Rate	7.0000%
Federal Tax Rate	21.0000%
State Tax Rate	9.0000%
Effective Tax Rate (s)	28.1100%
After tax Weighted Average Cost of Capital (r)	8.5162%

After accounting for the tax payment and return on investment in year 1, $168,711 is available as payback to the investors. The remaining capital investment is $831,289 at the end of year 1. The year 2 return on investment is the product of the WACC rate and the remaining capital investment at the end of year 1. Payback to investors is $183,079 in year 2. The cash flows for years 3 through 5 are analogous to the year 2 cash flow.

Table 1-3 Cash flow summary for 5 year, $1 million investment with straight line depreciation[7]

Recovery Year	1	2	3	4	5
Revenue	$274,938	$274,938	$274,938	$274,938	$274,938
Depreciation	$200,000	$200,000	$200,000	$200,000	$200,000
Tax Payment	$21,065	$21,065	$21,065	$21,065	$21,065
Return on capital investment	$85,162	$70,794	$55,202	$38,283	$19,923
Capital investment payback	$168,711	$183,079	$198,670	$215,590	$233,949
Remaining capital investment	$831,289	$648,209	$449,539	$233,949	$0

After the final revenue payment in year 5, the remaining capital investment is reduced to $0. Summing horizontally across the capital investment payback row in Table 1-3 produces $1,000,000. This example illustrates that the revenue payment determined by the CRF provides the necessary and sufficient annual revenue to pay the taxes associated with the revenue payment as well as the required return on and return of the capital investment. This important point is established as a general result in the following proposition.

Proposition 1.1. The CRF given by equation (1.3) is the unique value, assuming a WACC capital budgeting model with end of year payments, for which the resulting annual revenue payment is

[6] The effective tax rate (parameter s in the formula) is equal to *State Tax Rate + Federal Tax Rate x (1-State Tax Rate).*

[7] WACC model with end of year revenue and tax payments.

necessary and sufficient, over the term of the investment, to provide for the annual tax liability and the return on and return of the capital investment.

1.2 Half Year Convention

The revenue and tax payments would likely be made on a monthly or quarterly basis rather than occurring at the end of the year. A better model with respect to the timing of the revenue and tax payments is obtained by assuming the revenue and tax payments occur at the midpoint of each year. To derive a CRF corresponding to midyear revenue and tax payments, the present value equation from the previous section is modified to reflect the new timing assumption. Each after tax cash flow amount is assumed to occur a half year earlier than in the previous model. The revised present value equation is

$$K = \sum_{j=1}^{N} \frac{CF_j}{(1+r)^{j-0.5}} ,$$

or equivalently,

$$\mathrm{K} = \sqrt{1+r} \sum_{\mathrm{j}=1}^{\mathrm{N}} \frac{CF_j}{(1+r)^{\mathrm{j}}} .$$

Making the substitution,

$$CF_j = cK(1-s) + \delta_j Ks$$

and solving for c yields equation (1.4).

(1.4)

$$CRF = \frac{r(1+r)^N}{(1-s)[(1+r)^N - 1]} \left\{ \frac{1}{\sqrt{1+r}} - s \sum_{j=1}^{N} \frac{\delta_j}{(1+r)^j} \right\}$$

Using the parameter values in Table 1-2, with a five year capital cost recovery period and straight line depreciation, equation (1.4) yields a CRF of 0.260798. With an initial capital investment of $1 million, the annual payment is $260,798. Table 1-4 shows the corresponding cash flow summary.

Table 1-4 Cash flow summary for 5 year, $1 million investment with half year convention

Service Year	1	2	3	4	5
Revenue	$260,798	$260,798	$260,798	$260,798	$260,798
Depreciation	$200,000	$200,000	$200,000	$200,000	$200,000
Tax Payment	$17,090	$17,090	$17,090	$17,090	$17,090
Return on Capital Investment	$41,711	$67,959	$52,992	$36,751	$19,126
Payback of Capital Investment	$201,997	$175,749	$190,716	$206,957	$224,582
Remaining Capital Investment	$798,003	$622,255	$431,539	$224,582	$0

The calculation of the values in Table 1-4 is identical to the corresponding values in Table 1-3 except that the year 1 return on investment reflects a half year period. The return on investment in year 1 is equal to the product of the capital investment and the half year rate of return $\sqrt{1+r}-1$. The cash flow summary shows that the revenue payment determined by the CRF is necessary and sufficient to pay the taxes associated with the revenue payment as well as the required return on and return of the capital investment.

Changing the depreciation assumption to 3 year MACRS produces a CRF of 0.254231. The MACRS depreciation factors are shown in Table 1-8. The lower CRF relative to the straight line depreciation example reflects the lower tax payment under MACRS due to the accelerated depreciation schedule. In years 1 and 2, the tax payment in Table 1-5 is negative due to the accelerated depreciation assumption.[8] The cash flow summary in Table 1-5 shows that the revenue payment determined by the CRF, using 3 year MACRS depreciation, is at the necessary and sufficient level to provide for the taxes associated with the revenue payment as well as the required return on and return of the capital investment.

Table 1-5 Cash flow summary for 5 year, $1 million investment with 3 year MACRS

Service Year	1	2	3	4	5
Revenue	$254,231	$254,231	$254,231	$254,231	$254,231
Depreciation	$333,300	$444,500	$148,100	$74,100	$0
Tax Payment	($22,226)	($53,485)	$29,833	$50,635	$71,464
Return on Capital Investment	$41,711	$65,170	$44,515	$29,195	$14,343
Payback of Capital Investment	$234,747	$242,546	$179,883	$174,401	$168,424
Remaining Capital Investment	$765,253	$522,708	$342,825	$168,424	$0

The depreciation assumption has a significant impact on the CRF level. Generally, the faster the capital is depreciated for tax purposes, the lower the CRF. The Tax Cuts and Jobs Act (TCJA), signed into law on December 22, 2017 included bonus depreciation rates applicable to capital investments placed in service after September 27, 2017.[9] [10] Capital investments placed into service after September 27, 2017 and before January 1, 2023, are eligible for 100 percent bonus depreciation.[11]

[8] It is assumed that the capital investor would use the negative tax liability from this project as an offset against the tax liability resulting from other revenue.

[9] Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2096, Stat. 2105 (2017).

[10] 26 U.S. Code §11(b)

[11] Bonus depreciation is 100 percent for capital investments placed in service after September 27, 2017 and before January 1, 2023. Bonus depreciation is 80 percent for capital investments placed in service after December 31, 2022 and before January 1, 2024, and the bonus depreciation level is reduced by 20

Assuming 100 percent bonus depreciation results in a CRF of 0.247523. The corresponding cash flow summary is given in Table 1-6. The CRF for straight line depreciation for a five year cost recovery period is 5.3 percent higher than the CRF corresponding to 100 percent bonus depreciation.

Table 1-6 Cash flow summary for 5 year, $1 million investment with bonus depreciation

Service Year	1	2	3	4	5
Revenue	$247,523	$247,523	$247,523	$247,523	$247,523
Depreciation	$1,000,000	$0	$0	$0	$0
Tax Payment	($211,521)	$69,579	$69,579	$69,579	$69,579
Return on Capital Investment	$41,711	$49,621	$38,692	$26,834	$13,965
Payback of Capital Investment	$417,334	$128,324	$139,252	$151,111	$163,980
Remaining Capital Investment	$582,666	$454,343	$315,091	$163,980	$0

The CRF for a capital investment with a 20 year recovery period is 0.103149 and the corresponding cash flow summary is given in Table 1-7 for a capital investment totaling $10,000,000.

percent for each subsequent year through 2026. Capital investments placed in service after December 31, 2026 are not eligible for bonus depreciation. See 26 U.S. Code §168(k)(6)(A).

Table 1-7 Cash flow summary for 20 year, $10 million investment with bonus depreciation

Service Year	Revenue	Depreciation	Tax Payment	Return on Capital Investment	Payback of Capital Investment	Remaining Capital Investment
1	$1,031,492	$10,000,000	($2,521,048)	$417,109	$3,135,431	$6,864,569
2	$1,031,492	$0	$289,952	$584,597	$156,943	$6,707,626
3	$1,031,492	$0	$289,952	$571,231	$170,308	$6,537,318
4	$1,031,492	$0	$289,952	$556,728	$184,812	$6,352,506
5	$1,031,492	$0	$289,952	$540,989	$200,551	$6,151,955
6	$1,031,492	$0	$289,952	$523,910	$217,630	$5,934,325
7	$1,031,492	$0	$289,952	$505,376	$236,164	$5,698,161
8	$1,031,492	$0	$289,952	$485,264	$256,276	$5,441,886
9	$1,031,492	$0	$289,952	$463,439	$278,101	$5,163,785
10	$1,031,492	$0	$289,952	$439,756	$301,784	$4,862,001
11	$1,031,492	$0	$289,952	$414,055	$327,484	$4,534,517
12	$1,031,492	$0	$289,952	$386,166	$355,373	$4,179,143
13	$1,031,492	$0	$289,952	$355,902	$385,638	$3,793,505
14	$1,031,492	$0	$289,952	$323,061	$418,479	$3,375,026
15	$1,031,492	$0	$289,952	$287,422	$454,117	$2,920,909
16	$1,031,492	$0	$289,952	$248,749	$492,791	$2,428,118
17	$1,031,492	$0	$289,952	$206,782	$534,758	$1,893,361
18	$1,031,492	$0	$289,952	$161,241	$580,298	$1,313,062
19	$1,031,492	$0	$289,952	$111,822	$629,717	$683,345
20	$1,031,492	$0	$289,952	$58,195	$683,345	$0

In each example, the annual revenue payment, equal to the product of the capital investment and the CRF obtained from equation (1.4) is the necessary and sufficient revenue amount to cover the tax liability and the return on and return of the investment capital. This observation is generalized in the following proposition.

Proposition 1.2. The CRF given by equation (1.4) is the unique value, assuming a WACC capital budgeting model with the half year convention, for which the resulting annual revenue payment is necessary and sufficient, over the term of the investment, to pay the annual tax liability and the return on and return of the capital investment.

Table 1-8 Modified Accelerated Cost Recovery System (MACRS) with half year convention[12]

Year	3 year Depreciation Factors	5 year Depreciation Factors	10 year Depreciation Factors	15 year Depreciation Factors	20 year Depreciation Factors
1	33.33%	20.00%	10.00%	5.00%	3.750%
2	44.45%	32.00%	18.00%	9.50%	7.219%
3	14.81%	19.20%	14.40%	8.55%	6.677%
4	7.41%	11.52%	11.52%	7.70%	6.177%
5		11.52%	9.22%	6.93%	5.713%
6		5.76%	7.37%	6.23%	5.285%
7			6.55%	5.90%	4.888%
8			6.55%	5.90%	4.522%
9			6.56%	5.91%	4.462%
10			6.55%	5.90%	4.461%
11			3.28%	5.91%	4.462%
12				5.90%	4.461%
13				5.91%	4.462%
14				5.90%	4.461%
15				5.91%	4.462%
16				2.95%	4.461%
17					4.462%
18					4.461%
19					4.462%
20					4.461%
21					2.231%

1.3 Proof of Proposition 1.2

Proposition 1.2. The CRF given by equation (1.4) is the unique value, assuming a WACC capital budgeting model with the half year convention, for which the resulting annual revenue payment is necessary and sufficient, over the term of the investment, to pay the annual tax liability and the return on and return of the capital investment.

Proof. K_0 is the initial capital invested and K_j, $j \geq 1$, represents the capital investment remaining at the midpoint of cost recovery year j. K_1 is the remaining capital investment at the midpoint of year 1 after using the year 1 revenue net of taxes and return on investment, as a payback to investors. The proposition states that the CRF in equation (1.4) is the unique value that will result in $K_N = 0$. Representing the CRF in equation (1.4) as c, the year 1 revenue net of taxes and return on investment is

[12] See Appendix A, Table A-1, IRS Publication 946, United States Department of Treasury (2020).

$$cK_0(1-s)+\delta_1 K_0 s - K_0\left(\sqrt{1+r}-1\right).$$

The rate of return on the investment reflects a half year of return due to the half year convention. The equity investment that remains at the midpoint of year 1 is

$$K_1 = K_0 - \left(cK_0(1-s)+\delta_1 K_0 s - K_0\left(\sqrt{1+r}-1\right)\right)$$

$$= K_0\sqrt{1+r} - cK_0(1-s) - \delta_1 K_0 s.$$

The year 2 revenue net of taxes and return on investment is

$$cK_0(1-s)+\delta_2 K_0 s - rK_1$$

and the capital investment that remains at the midpoint of year 2 is

$$K_2 = K_1(1+r) - cK_0(1-s) - \delta_2 K_0 s\,.$$

Substitution for K_1 yields

$$K_2 = K_0(1+r)^{3/2} - cK_0(1-s)[(1+r)+1] - [\delta_1(1+r)+\delta_2]K_0 s\,.$$

Repeating this process through the end of the cost recovery period yields

(1.5)

$$K_N = K_0(1+r)^{N-1/2} - cK_0(1-s)\sum_{j=1}^{N}(1+r)^{j-1} - K_0 s\sum_{j=1}^{N}\delta_j(1+r)^{N-j}\,.$$

Equation (1.2) with $H=1$, $W=N$ and $v=1+r$ gives

$$\sum_{j=1}^{N}(1+r)^{j-1} = \frac{1}{1+r}\sum_{j=1}^{N}(1+r)^{j} = \frac{(1+r)^N-1}{r}.$$

Replacing the first summation in equation (1.5) yields

(1.6)

$$K_N = K_0(1+r)^{N-1/2} - cK_0(1-s)\left(\frac{(1+r)^N-1}{r}\right) - K_0 s\sum_{j=1}^{N}\delta_j(1+r)^{N-j}\,.$$

Replacing c in (1.6) with the CRF formula in (1.4) results in $K_N = 0$. Equation (1.6) also establishes the uniqueness of the CRF. If there are two CRF values, for instance c_1 and c_2, satisfying the proposition, then each will produce $K_N = 0$ and one can quickly deduce from the equation (1.6) that $c_1 = c_2$.

Black Start Tariff Section 6.4 Proposed Changes

MIC

September 18, 2006

Market Monitoring Unit

Proposed Changes

- Ensure appropriate incentives for new black start units
- Ensure appropriate agreement term for new black start units
- Ensure appropriate cost recovery term for new black start units
- Goal is to match reasonable expected life of black start investment with cost recovery and commitment to purchase black start service

Proposed Changes

- Ensure that commitment by seller to provide black start service is consistent with life of black start investment
- Ensure that commitment by buyers to purchase black start service is consistent with life of black start investment

Proposed Changes

- New entry black start service generation revenue requirements
  - Actual fixed costs will be recovered over the remaining life of the associated generator up to a maximum of 20 years.
    - Apply CRF factors
  - Fixed costs include all fixed costs including return on and of capital.
  - Actual variable costs will be recovered on an annual basis.
  - Tariff provisions will provide for such cost recovery.
  - Owners retain option to file with the FERC.

Proposed Changes

- Owners recovering black start service generation revenue requirements for existing units under tariff rate
  - Will continue to recover costs under that structure.
- Owners recovering black start service generation revenue requirements under FERC approved agreements
  - Will continue to collect under those agreements until expiration of the contract term.
  - After the agreement expires, only variable costs will be collected.
  - After the agreement expires, there will be no additional collection of fixed costs unless new capital

Capital Recovery Methodology

- Capital Recovery Factor (CRF)
  - Capital will be recovered based on the remaining life of the associated generator.
  - Based on 15 year MACRS tax depreciation schedule.

Age of Existing Unit	Remaining Life of Plant (Years)	Levelized CRF
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16 to 20	5	0.363

- CRF Example
  - A generator owner invests $1 million to enable a seven year old unit to provide black start service.
    - Life of the black start investment is 20 years.
    - From the CRF table, the default remaining age is 15 years.
    - Therefore assumed life of black start investment is 15 years.
    - The resulting CRF is 0.146.
    - The annual levelized revenue requirement for the investment in the black start unit is:

      $1 million * 0.146 = $146,000 per year.

Review of Black Start Formula and Cost Components

Laura Walter, PJM

June 2011

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Black Start: Executive Summary

Black Start Service is the ability of generating units to start without an outside electrical supply or the demonstrated ability of a generating unit with a high operating factor (subject to Transmission Provider concurrence) to automatically remain operating at reduced levels when disconnected from the grid.

PJM's Open Access Transmission Tariff, relating to Black Start Service, requires PJM to review the formula and cost components utilized to compensate Black Start Service providers at least every two years. Specifically, Schedule 6A: Section 18 states:

> ***At least every two years, PJM shall review the formula and its costs components set forth in this section, and report on the results of that review to stakeholders.***[i]

This paper is the report required by the tariff, a review of the components and formulas in the current approved version of Schedule 6A: Section 18. **This report is not a review of the annual revenue requirements calculated by the tariff and whether the compensation black start units receive is adequate to keep the unit in black start service and maintain it reliably.**

Areas that require further consideration in this report include; possible update to the CRF table, the Fixed Black Start Service Cost (FBSSC) for units not requesting capital recovery costs under Section 5, more specific definitions to clarify and provide guidance when calculating cost for units requesting capital recovery costs under section 6 and the clarification of fuel storage cost to remove any interpretation from the tariff.

Black Start: Total Revenue Requirements

Black start service supplies electricity for system restoration in the unlikely event that the entire PJM Interconnection grid would lose power. In the event that power would be lost across the entire grid, black start service is be used to supply electricity to help restore the system. Black start service is provided by generating units that have the ability to start up and deliver power to the grid without an outside source of power – or units that can remain in operation at reduced output levels when disconnected from the grid. Such units must be able to reconnect to the grid within 90 minutes after a request from PJM. They also must be able to maintain frequency and voltage under varying loads. To be designated as a black start resource, a generating facility must pass a series of performance tests every 13 months. In a system-restoration situation, black start units can be used to reestablish the regional electric system. Once connected, they supply power to other generating units and help restore load. This must be a careful, deliberate process that keeps generation in balance with load in order to avoid the possibility of another loss of service.

The owners of black start units receive cost-based payments for providing the service to the grid. Schedule 6A section 18 outlines the formulas used to calculate the revenue requirements. The primary formula is as follows:

$$\text{Generator's Annual Black Start Service Revenue Requirement} = \{\text{Fixed BSSC} + \text{Variable BSSC} + \text{Training Costs} + \text{Fuel Storage Costs}\} * (1 + Z)$$

Where:

- Fixed BSSC = Fixed Black Start Service Cost
- Variable BSSC = Variable Black Start Service Costs
- Training Costs = $3,750 per plant per delivery year (50 staff hours per plant per year *$75 per staff hour)
- Fuel Storage Cost is the cost defined in the tariff for oil units with onsite storage (discussed below)
- Z= the incentive factor of 10%

The total revenue requirements are the amount of compensation a black start unit receives per delivery year if it fulfills all the black start requirements under the tariff. This amount is allotted monthly, and may change every delivery year (June 1 – May 31). PJM records the tests of all black start units receiving compensation through the PJM tariff and alerts PJM Settlements to stop payment if requirements are not met.

Automatic Load Rejection Units (ALR) or Units with a High Operating Factor

Automatic Load Rejection Units are generating units with a high operating factor that have demonstrated the ability (subject to Transmission Provider concurrence) to automatically remain operating at reduced levels when disconnected from the grid. These units can be considered black start where appropriate, but they do not receive the same black start payments as black start units that start without an outside electrical supply. The revenue requirements for ALR units are as follows[ii]:

$$\text{ALR Generator's Annual Black Start Service Revenue Requirement} = \text{Training Costs} * (1 + Z)$$

- Where Z is a 10% incentive factor
- Training costs are calculated as 50 staff hours per plant per year *$75 per staff hour = $3,750 per plan per delivery year

For ALR units, the total annual compensation from black start is $4,125 per plant per delivery year.

Fixed Black Start Service Cost (FBSSC)

Fixed Black Start Service Cost are calculated in two possible ways depending on whether the unit is recovering costs under section 5[iii] or Section 6[iv] of Schedule 6A with the central difference being whether the black start unit owner seeks to recover new or additional capital costs through application of the Schedule 6A formula rate. The following figure shows the 2 methods for recovery of Fixed BSSC.

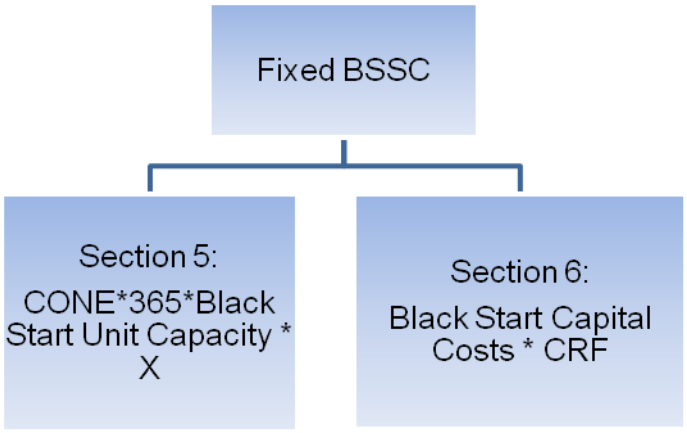

Figure 1: Two methods to recover fixed black start costs per Schedule 6A

If units recover Fixed BSSC through Schedule 6A, section 5, they are electing to forgo any recovery of black start capital costs and fall into the lower left-hand box above. If units prefer to recover through Schedule 6A, Section 6, then they do submit capital costs for recovery and fall into the lower right-hand box above.

Section 5 Fixed Black Start Service Cost for Units not requesting Capital Cost Recovery

For units recovering costs under Section 5 and not recovering black start capital costs, Fixed Black Start Service Costs are defined below:

Where CONE is equal to "then current net Cost of New Entry for the CONE Area where the Black Start Unit is located as set forth in Section 5.10 of Attachment DD". These are the CONE areas set forth in Attachment DD:

Geographic Location Within the PJM Region Encompassing These Zones	Cost of New Entry in $/MW-Year
PS, JCP&L, AE, PECO, DPL, RECO ("CONE Area 1")	122,040
BGE, PEPCO ("CONE Area 2")	112,868
AEP, Dayton, ComEd, APS, DQL ("CONE Area 3")	115,479
PPL, MetEd, Penelec ("CONE Area 4")	112,868
Dominion ("CONE Area 5")	112,868

The formula refers to a table with gross CONE in $-MW-year, but is referring only to the five CONE areas in the 2013-2014 delivery year. The use of UCAP CONE or ICAP CONE is not specified. Cost of New Entry is a Reliability Pricing Model (RPM) parameter and is related to the cost to build a GE Frame 7F in an area specified above. As CONE values used in planning parameters are calculated before Base Residual Auctions (BRA), the CONE values are three years old during the "current" delivery year in which the black start units are paid. The five CONE areas listed here are not applicable to every delivery year.

The net CONE is then multiplied by 365 so as to convert the $/MW-day net CONE value to a $/MW-year value. It is PJM staff opinion that units of measurements should be explicit in this formula to avoid confusion.

The Black start unit capacity is defined, as the installed capacity (ICAP).

The term X is:

> *the Black Start Service allocation factor unless a higher or lower value is supported by the documentation of the actual costs of providing Black Start Service. For such units qualifying as Black Start Units on the basis of demonstrated ability to operate at reduced levels when automatically disconnected from the grid, X shall be zero. For Black Start Units with a commitment established under section 5, X shall be .01 for Hydro units, .02 for Diesel or CT units.*

PJM staff would recommend changing "Hydro" to include "Storage Units".

Section 6 Fixed Black Start Service Cost for Units requesting Capital Cost Recovery

$$\text{Black Start Capital Cost Recovery} =$$

$$\text{Capital Costs for incremental equipment solely necessary for Black Start} * \text{CRF}$$

For units recovering black start capital costs under Section 6, Fixed Black Start Service Costs are defined below:

> *"Black Start Capital Costs" is the capital cost documented by the owner or accepted by the Commission for the incremental equipment solely necessary to enable a unit to provide Black Start Service in addition to whatever other product or services such unit may provide. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to Black Start Units solely on the basis of the provision of Black Start Service by such unit.*

This section (Black Start Capital Costs) should be well defined to clarify what is meant by the statement, "for the incremental equipment solely necessary to enable a unit to provide Black Start Service in addition to whatever other product or services such unit may provide".

This statement could be interpreted in different ways – for example it could refer to s to only the equipment required to allow the unit to be black start capable, such as a diesel generator, air starter, batteries, or specific control functions. This section could also imply that the entire generating unit could be replaced or repaired through Schedule 6A. This ambiguity needs to be clarified.

"CRF" or "Capital Recovery Factor" includes age and years of remaining life, but the tariff specifies that the CRF is based on "the age of the unit."

Age of Black Start Unit	Years of Remaining Life of Black Start Unit	Levelized CRF
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16+	5	0.363

The CRF table has several different assumptions such as: the Capital Recovery Factor based on a levelized proforma for a 100MW Combustion Turbine for $1M, 2.5% inflation, 36% federal tax rate, 9% state tax rate, income tax rate 41%, 50% equity and 50% debt with a 7% interest rate, and a 12% internal rate of return on equity.

This CRF table was originally taken from the capacity market, and the capacity market CRF table has since been updated to the following:

Age of Existing Units (Years)	Remaining Life of Plant (Years)	Levelized CRF
1 to 5	30	0.107
6 to 10	25	0.114
11 to 15	20	0.125
16 to 20	15	0.146
21 to 25	10	0.198
25 Plus	5	0.363
Mandatory CapEx	4	0.450
40 Plus Alternative	1	1.100

Whether this is a more appropriate fit for the CRF table for Black Start should be explored.

Variable Black Start Service Cost (VBSSC)

$$\text{Variable Black Start Service Cost} = \text{Black Start Unit O\&M} * Y$$

O&M is the Operating and Maintenance Cost that is calculated for all cost offers through following Manual 15: Cost Development Guidelines. Y is 1% of the total annual O&M.

Training Cost

$$\text{Training Costs} = 50 \text{ staff hours/year/plant} * \$75/\text{hour}$$

$75 is a fixed rate written into the tariff that does not change with inflation or other economic indicators. This currently does not seem to be an inadequate amount. This cost is independent of the number of people trained, how many do restoration drills, and the cost of training to determine the true cost for training.

Fuel Storage Cost

$$\text{Fuel Storage Costs} =$$

$$(\text{Minimum Tank Suction Level} + (\#\text{ of Run Hours Required} * \text{Fuel Burn Rate})) * (12\text{ month forward strip} + \text{basis}) * \text{Bond Rate}$$

PJM staff believes units of measure in this component should be explicit. For the 12 month forward strip and bond rate, the value from May 1 every year should be used to keep recovery consistent across resources. Determination of basis should also be defined.

Conclusion

The areas that require further consideration include; possible update to CRF table, the Fixed Black Start Service Cost (FBSSC) for units not requesting capital recovery costs under Section 5, more specific definitions to clarify and provide guidance when calculating cost for units requesting capital recovery costs under Section 6 and the clarification of fuel storage cost definitions should be clarified to remove any interpretation from the tariff.

Potential Parking Lot Items

- Fixed Black Start Service Cost (FBSSC) Formula Clarifications
- Evaluation of CRF table
- Fuel Storage Cost Clarifications

[i] http://www.pjm.com/documents/~/media/documents/agreements/tariff.ashx page 512

[ii] http://www.pjm.com/documents/~/media/documents/agreements/tariff.ashx page 509

[iii] Owners of Black Start Units selected to provide Black Start Service in accordance with section 4 and electing to forego any recovery of new or additional Black Start Capital Costs shall commit to provide Black Start Service from such Black Start Units for an initial term of no less than two years and authorize the Transmission Provider to resell Black Start Service from its Black Start Units. The term commitment shall continue to extend until the Black Start Unit owner, or the Transmission Owner, with the consent of the Transmission Provider, or the Transmission Provider, with the consent of the Transmission Owner, provides written, one-year advance notice of its intention to terminate the commitment.
[iv] Owners of Black Start Units selected to provide Black Start Service in accordance with section 4 and electing to recover new or additional Black Start Capital Costs shall commit to provide Black Start Service from such Black Start Units for a term based upon a reasonable estimate of the expected life of the Black Start Unit, as set forth in the CRF Factor Table in section 18, and authorize the Transmission Provider to resell Black Start Service from its Black Start Units. Either the Transmission Provider, with the consent of the Transmission Owner, or the Transmission Owner, with the consent of the Transmission Provider, may terminate the commitment with one year advance notice of its intention to the Black Start Unit owner, but the Transmission Owner shall reimburse the Black Start Unit owner for any amount of unrecovered Fixed Black Start Service Costs over a period not to exceed five years. A Black Start Unit owner may terminate the provision of Black Start Service with one year advance notice (or its commitment period may be involuntarily terminated pursuant to the section 15 below). Such Black Start Unit shall forego any otherwise existing entitlement to future revenues collected pursuant to this Schedule 6A and fully refund any amount of the Black Start Capital Costs recovered under a FERC-approved rate (recovered on an accelerated basis pursuant to the provisions of section 17(i)) in excess of the amount that would have been recovered pursuant to section 18 during the same period. At the conclusion of the term of commitment established under this section 6, a Black Start Unit shall commence a new term of commitment under either section 5 or 6, as applicable.
[v] http://www.pjm.com/documents/~/media/documents/agreements/tariff.ashx Page 2267

Review of Black Start Formula and Cost Components

Thomas Hauske, PJM

December 2014

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Black Start: Executive Summary

Black Start Service is used to restart the grid after a loss of electrical service and is needed because most generators require electricity to start. Traditional black start is the ability of generating units to start without an outside electrical supply. Another type of black start unit is an Automated Load Rejection (ALR) unit that is a generator with a high operating factor and the demonstrated ability [1]to automatically remain operating at reduced levels when disconnected from the grid.

The PJM Open Access Transmission Tariff (tariff) [2] requires PJM to review the formula and cost components utilized to compensate Black Start Service providers at least every two years. Specifically, Schedule 6A: Section 18 states:

> *At least every two years, PJM shall review the formula and its costs components set forth in this section, and report on the results of that review to stakeholders.*[3]

This paper describes in document form the report given on Black Start Compensation at the May 7, 2013 System Restoration Strategy Senior Task Force[4] that is required by the tariff with a review of the components and formulas for black start compensation. This report also documents the System Restoration Strategy Task Force's (SRSTF) review of black start compensation modifications that were discussed from February 2013 to September 2014, with submittals of minor compensation changes to the Federal Energy Regulatory Commission (FERC) for approval. The FERC approved the recommended compensation changes on November 14, 2014.

[1] Subject to Transmission Provider concurrence

[2] http://www.pjm.com/~/media/documents/agreements/tariff.ashx

[3] The most recent Tariff changes approved by FERC on November 14,2014 changed the review cycle to five (5) years.

[4] http://www.pjm.com/~/media/committees-groups/task-forces/srstf/20140522/20140522-item-02-bs-compensation-changes.ashx

Black Start: Current Total Revenue Requirements

Black start service supplies electricity for system restoration in the unlikely event that the entire PJM Interconnection grid would lose power. In the event that power would be lost across the entire grid, black start service is be used to supply electricity to help restore the system. Black start service is provided by generating units that have the ability to start up and deliver power to the grid without an outside source of power – or units that can remain in operation at reduced output levels when disconnected from the grid. Such units must be able to reconnect to the grid within 180 minutes after a request from PJM. They also must be able to maintain frequency and voltage under varying loads. To be designated as a black start resource, a generating facility must pass a series of performance tests every 13 months. In a system-restoration situation, black start units can be used to reestablish the regional electric system. Once connected, they supply power to other generating units and help restore load. This must be a careful, deliberate process that keeps generation in balance with load in order to avoid the possibility of another loss of service.

The owners of black start units receive cost-based payments for providing the service to the grid. A generator's Annual Black Start Service Revenue Requirement is the amount of compensation a black start unit receives per delivery year if it fulfills all the black start requirements under the tariff. The PJM tariff outlines the formulas used to calculate the revenue requirements.

Traditional Black Start Units

The primary formula to calculate a traditional black start generator's Annual Black Start Service Revenue Requirement can be found in the tariff, Section 18 of Schedule 6A is as follows:

$$\text{Generator's Annual Black Start Service Revenue Requirement} = \{\text{Fixed BSSC} + \text{Variable BSSC} + \text{Training Costs} + \text{Fuel Storage Costs}\} * (1 + \text{Z})$$

Where:

- Fixed BSSC = Fixed Black Start Service Cost
- Variable BSSC = Variable Black Start Service Costs
- Training Costs = $3,750 per plant per delivery year (50 staff hours per plant per year multiplied by $75 per staff hour)
- Fuel Storage Cost is the cost defined in the tariff for oil units with onsite storage (discussed below)
- Z= the incentive factor of 10 percent

The Annual Black Start Service Revenue Requirements is allotted monthly, and may change every delivery year (June 1 – May 31). PJM records the tests of all black start units receiving compensation through the PJM tariff and alerts PJM Settlements to stop payment if requirements are not met.

Automatic Load Rejection Units (ALR) or Units with a High Operating Factor

Automatic Load Rejection Units are generating units with a high operating factor that have demonstrated the ability (subject to Transmission Provider concurrence) to automatically remain operating at reduced levels when disconnected from the grid. These units can be considered black start where appropriate, but they do not receive the

same black start payments as black start units that start without an outside electrical supply. The revenue requirements for ALR units are as follows[5]:

$$\text{ALR Generator's Annual Black Start Service Revenue Requirement} = \text{Training Costs} * (1 + Z)$$

- Where Z is a 10 percent incentive factor
- Training costs are calculated as 50 staff hours per plant per year multiplied by $75 per staff hour = $3,750 per plan per delivery year

For ALR units, the total annual compensation from black start is $4,125 per plant per delivery year.

Fixed Black Start Service Cost (FBSSC)

Fixed Black Start Service Cost can be recovered through the PJM tariff or through a FERC approved rate. Fixed Black Start Service Costs recovered through the tariff are calculated in three possible ways depending on whether the unit is recovering costs under Paragraph 5[6] or Paragraph 6[7] of Schedule 6A with the central difference being whether the black start unit owner seeks to recover new or additional capital costs. The following figure shows the three methods for recovery of Fixed BSSC.

[5] http://www.pjm.com/documents/~/media/documents/agreements/tariff.ashx page 509

[6] Owners of Black Start Units selected to provide Black Start Service in accordance with section 4 and electing to forego any recovery of new or additional Black Start Capital Costs shall commit to provide Black Start Service from such Black Start Units for an initial term of no less than two years and authorize the Transmission Provider to resell Black Start Service from its Black Start Units. The term commitment shall continue to extend until the Black Start Unit owner, or the Transmission Owner, with the consent of the Transmission Provider, or the Transmission Provider, with the consent of the Transmission Owner, provides written, one-year advance notice of its intention to terminate the commitment.

[7] Owners of Black Start Units selected to provide Black Start Service in accordance with section 4 and electing to recover new or additional Black Start Capital Costs shall commit to provide Black Start Service from such Black Start Units for a term based upon a reasonable estimate of the expected life of the Black Start Unit, as set forth in the CRF Factor Table in section 18, and authorize the Transmission Provider to resell Black Start Service from its Black Start Units. Either the Transmission Provider, with the consent of the Transmission Owner, or the Transmission Owner, with the consent of the Transmission Provider, may terminate the commitment with one year advance notice of its intention to the Black Start Unit owner, but the Transmission Owner shall reimburse the Black Start Unit owner for any amount of unrecovered Fixed Black Start Service Costs over a period not to exceed five years. A Black Start Unit owner may terminate the provision of Black Start Service with one year advance notice (or its commitment period may be involuntarily terminated pursuant to the section 15 below). Such Black Start Unit shall forego any otherwise existing entitlement to future revenues collected pursuant to this Schedule 6A and fully refund any amount of the Black Start Capital Costs recovered under a FERC-approved rate (recovered on an accelerated basis pursuant to the provisions of section 17(i)) in excess of the amount that would have been recovered pursuant to section 18 during the same period. At the conclusion of the term of commitment established under this section 6, a Black Start Unit shall commence a new term of commitment under either section 5 or 6, as applicable.

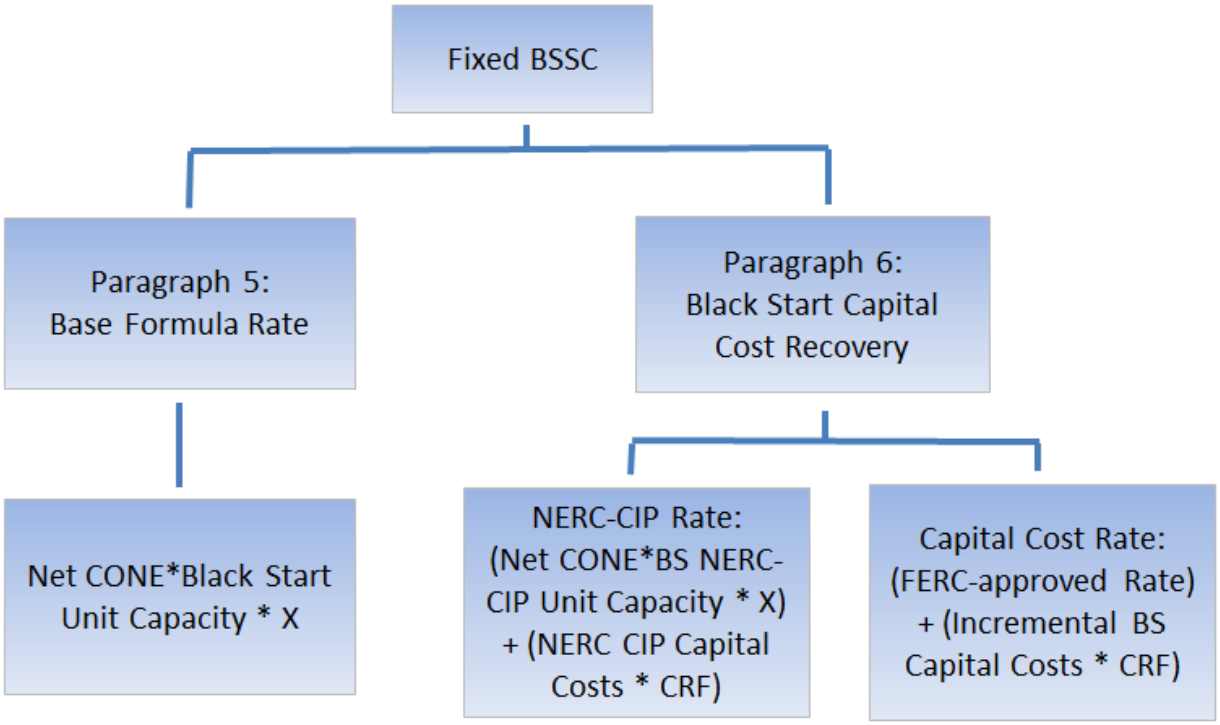

Figure 1: Three methods to recover fixed black start costs per Schedule 6A

If units recover Fixed BSSC through Paragraph 5, they are electing to forgo any recovery of black start capital costs and fall into the lower left-hand box above. If units prefer to recover through Paragraph 6, then they do submit capital costs for recovery and fall into the lower two right-hand boxes above. Units recovering costs under a FERC approved rate can also recover new or additional black start capital costs through the PJM tariff and fall into the lower right hand box.

Paragraph 5 Fixed Black Start Service Cost for Units not requesting Capital Cost Recovery

For units recovering costs under Paragraph 5, Fixed Black Start Service Costs are calculated using the Base Formula Rate below:

Fixed BSSC = Net CONE * Black Start Unit Capacity * X

Where Net CONE is "*the then current installed capacity ("ICAP") net Cost of New Entry (expressed in $/MW year) for the CONE Area where the Black Start Unit is located*". The CONE areas and values for the 2014-2015 delivery year are:

	TO Zones within Cone Area	2014-2015 Cost of New Entry in $/MW - Year
CONE Area 1	PS, JCP&L, AE. PECO, DPL, RECO	94,108
CONE Area 2	BGE, PEPCO	82,778
CONE Area 3	AEP, Dayton, ComEd, APS, DQL, ATSI, DEOK, EKPC	123,655
CONE Area 4	PPL, MetEd, Penelec	97,455
CONE Area 5	Dominion	90,487

Black Start Unit Capacity is defined, as "*the Black Start Unit's installed capacity, expressed in MW*."

The term X is defined as *"the Black Start Service allocation factor unless a higher or lower value is supported by the documentation of the actual costs of providing Black Start Service. For such units qualifying as Black Start Units on the basis of demonstrated ability to operate at reduced levels when automatically disconnected from the grid, X shall be zero. For Black Start Units with a commitment established under paragraph 5, X shall be .01 for Hydro units, .02 for Diesel or CT units."*

Paragraph 6 Fixed Black Start Service Cost for Units requesting Capital Cost Recovery

For units recovering NERC-CIP black start capital costs under Paragraph 6, Fixed Black Start Service Costs are calculated using the following equation:

Fixed BSSC = (Net CONE * Black Start NERC-CIP Unit Capacity * X)
+ (Incremental Black Start NERC-CIP Capital Costs * CRF)

Where Net CONE is "*the then current installed capacity ("ICAP") net Cost of New Entry (expressed in $/MW year) for the CONE Area where the Black Start Unit is located*".

Black Start NERC-CIP Unit Capacity is *"the Black Start Unit's installed capacity, expressed in MW, but, for the purposes of this calculation, capped at 100 MW for Hydro units, or 50 MW for CT units."*

The term X is defined as *"the Black Start Service allocation factor unless a higher or lower value is supported by the documentation of the actual costs of providing Black Start Service. For such units qualifying as Black Start Units on the basis of demonstrated ability to operate at reduced levels when automatically disconnected from the grid, X shall be zero. For Black Start Units with a commitment established under paragraph 5, X shall be .01 for Hydro units, .02 for Diesel or CT units."*

Incremental Black Start NERC-CIP Capital Costs are defined as *" those capital cost documented by the owner or accepted by the Commission for the incremental equipment solely necessary to enable a Black Start Unit to maintain*

compliance with mandatory Critical Infrastructure Protection Reliability Standards (as approved by the Commission and administered by the applicable Electric Reliability Organization ".

"CRF" or "Capital Recovery Factor" is equal to the levelized CRF as set forth in the applicable CRF Table set forth below.

For units recovering incremental black start capital costs under Paragraph 6, Fixed Black Start Service Costs are calculated using the following equation;

Fixed BSSC = (FERC-approved rate) + (Incremental Black Start Capital Costs * CRF)

"FERC-approved rate" is "*the Black Start Unit's current FERC-approved recovery of costs to provide Black Start Service, if applicable. To the extent that a Black Start unit owner is currently recovering black start costs pursuant to a FERC-approved rate, which cost recovery will be included as a formulaic component for calculating the Black Start Unit's annual revenue requirement pursuant to this paragraph 18. However, under no circumstances will PJM or the Black Start Unit owner restructure or modify that existing FERC-approved rate without FERC approval."*

Incremental Black Start Capital Costs are defined as *the new or additional capital cost documented by the owner or accepted by the Commission for the incremental equipment solely necessary to enable a unit to provide Black Start Service in addition to whatever other product or services such unit may provide. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to Black Start Units solely on the basis of the provision of Black Start Service by such unit. However, incremental Black Start Capital Costs shall not include any capital costs that the Black Start unit owner is recovering for that unit pursuant to a FERC-approved recovery rate."*

"CRF" or "Capital Recovery Factor" is "*equal to the Levelized CRF based on the age of the Black Start Unit, which is modified to provide Black Start Service, as present in the CRF Table below:"*

Age of Black Start Unit	Years of Remaining Life of Black Start Unit	Levelized CRF
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16+	5	0.363

The CRF table has several different assumptions such as: the Capital Recovery Factor based on a levelized proforma for a 100MW Combustion Turbine for $1M, 2.5 percent inflation, 36 percent federal tax rate, 9 percent state tax rate, income tax rate 41 percent, 50 percent equity and 50 percent debt with a 7 percent interest rate, and a 12percent internal rate of return on equity.

Optionally, a Black Start unit owner may elect to apply an alternative Capital Recovery Factor (CRF), in lieu of the age-based CRF table listed above, which is based upon the expected capital Improvement Lifespan of the new or additional capital improvements (as determined by the applicable depreciation period of the capital improvement, as published from time to time by the US Internal Revenue Service).The Applicable Recovery Period and the term of

Black Start Service Commitment shall be the same and determined by the expected Capital Improvement Lifespan. In the event that the Black Start unit seeks recovery of capital improvements that are included in more than one category of Capital Improvement Lifespan (as set forth below), its Applicable Recovery period and term of commitment to provide black start service for such Black Start unit shall be the longest expected life of those new or additional capital improvements.

Capital Improvement Lifespan (years)	Applicable Recovery Period/Term of Commitment (years)	Levelized CRF
16-20	20	0.125
11-15	15	0.146
6-10	10	0.198
1-5	5	0.363

In those circumstances where a Black Start Unit owner has elected to recover incremental Black Start Capital Costs, in addition to a FERC-approved recovery rate, its applicable term of commitment shall be the greater of: (i) the FERC-approved recovery period, or (ii) the applicable term of commitment as established by the CRF Tables above.

After a Black Start Unit has recovered its allowable Incremental Black Start Capital Costs or Incremental Black Start NERC-CIP Capital Costs, as provided by the applicable Capital Cost Recovery Rate, and has satisfied its applicable commitment period required under Schedule 6A: Paragraph 6, the Black Start Unit shall be committed to providing black start in accordance with Paragraph 5 of Schedule 6A and calculate its Fixed BSSC in accordance with the Base Formula rate.

Variable Black Start Service Cost (VBSSC)

$$\text{Variable Black Start Service Cost} = \text{Black Start Unit O\&M} * Y$$

Where Black Start Unit O&M is*" the operations and maintenance cost attributable to supporting Black Start Service and must equal the annual variable O&M outlined in the PJM Cost development Guidelines set forth in the PJM Manuals. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to a Black Start unit solely on the basis of the provision of Black Start Service by the unit."*

Y is "*unless a higher or lower value is supported by documentation of costs. If a value of Y is submitted for this cost, a (1-Y) factor must be applied to the Black Start unit's O&M costs on the unit's cost-based energy schedule, calculated based on the Cost Development Guidelines in the PJM Manuals"*

For unit qualifying as Black Start Units on the basis of a demonstrated ability to operate at reduced levels when automatically disconnected from the grid (ALR), there are no variable costs associated with providing Black Start Service and the value for Variable BSSC shall be zero.

Training Cost

$$\text{Training Costs} = 50 \text{ staff hours/year/plant} * \$75/\text{hour}$$

Fuel Storage Cost

Black Start Units that do not use oil as their fuel must set their Fuel Storage Costs to zero. Black Start units that can use oil for fuel shall calculate Fuel Storage Costs as:

$$\text{Fuel Storage Costs} =$$

$$(\text{Minimum Tank Suction Level} + (\#\text{ of Run Hours Required} * \text{Fuel Burn Rate})) * (12\text{ month forward strip} + \text{basis}) * \text{Bond Rate}$$

Where Minimum Tank Suction Level is *"and shall apply where no direct current pumps are available for the black Start Unit*".

Number of Run Hours are *"the actual number of hours a transmission provider requires a Black Start Unit to run. Run Hours shall be at least 16 hours or as defined by the Transmission Owner restoration plan, whichever is less".*

Fuel Burn rate is *"actual fuel burn rate for the Black Start Unit*".

12 Month Forward Strip is *"the average of forward prices for the fuel burned in the Black Start unit traded the first business day on or following May 1*".

Basis is *"the transportation costs from the location referenced in the forward price data to the Black Start unit plus any variable taxes".*

Bond rate is *"the value determined with reference to the Moody's Utility Index for bonds rated BAA1 reported the first business day on or following May 1".*

Z Factor

The Z factor shall be an incentive factor solely for Black Start Units with a commitment established under Schedule 6A Paragraph 5 and shall be ten percent. For those Black Start units that elect to recover new or additional Black Start Capital Costs under Paragraph 6, the incentive factor (Z), shall be equal to zero.

SRSTF Black Start Proposed Revenue Requirements Changes

Black Start: System Restoration Strategy Task Force (SRSTF)

The PJM System Restoration Strategy Task Force was created to analyze and evaluate PJM's System Restoration plan and utilization of Black Start generation during a System Restoration as directed by the Markets and Reliability Committee.[8]

The SRSTF reviewed the existing black start compensation methods contained in PJM's tariff on May 7, 2013[9] and considered four different black start compensation proposals:[10]

A. Modified Status Quo + Revised Incentives
B. Proxy for Formula Replacement
C. Cost Allocation
D. Minimum Incentive

The Minimum Incentive (D) became the primary and the Proxy for Formula Replacement (B) became the secondary. Both proposals were forwarded to the Markets and Reliability Committee (MRC) and proposals failed a sector weighted vote at the February 27, 2014 meeting.[11]

The SRSTF then considered several minor changes to Black Start unit compensation. These changes impact a small number of Black Start units and are seen more as "clean-up" or "equity" issues as opposed to any major changes to the method of compensation for Black Start units. The task force also looked at potential changes to cost allocation, but is not recommending any changes to the existing Black Start cost allocation methodology. The Minor Compensation Proposal was forward to the MRC and approved July 31, 2014[12] and submitted to FERC for approval

[8] The System Restoration Strategy Senior Task force (SRSTF) charge:

Due to industry developments such as new environmental regulations, NERC CIP (Critical Infrastructure Protection) standards and increasing cost of Black Start generation, PJM foresees a potential future reliability issue with the current method of System Restoration Planning. This Task Force will examine the current System Restoration Planning process to determine its viability and efficiency moving forward and recommend any changes to the System Restoration strategy and associated procurement, cost allocation, and compensation methods, inclusive of back stop options to the MRC for approval. - http://www.pjm.com/~/media/committees-groups/task-forces/srstf/postings/charter.ashx

[9] http://www.pjm.com/~/media/committees-groups/task-forces/srstf/20130507/20130507-black-start-compensation.ashx

[10] http://www.pjm.com/~/media/committees-groups/task-forces/srstf/20131122/20131122-compensation-back-stop-matrix.ashx

[11] http://www.pjm.com/~/media/committees-groups/committees/mrc/20140327/20140327-item-01-draft-20140227-meeting-minutes.ashx

[12] http://www.pjm.com/~/media/committees-groups/committees/mrc/20140821/20140821-item-01-draft-minutes-mrc-20140731.ashx

on September 15, 2014[13]. One of the changes included in the proposal extended the Schedule 6A review period from two years to five years to align with the RTO Wide Black Start RFP.

Main Proposal – Minimum Incentive Compensation Proposal

This proposal received 66 percent support from the SRSTF. The significant change in this proposal would be to change the incentive factor in the Black Start Base Formula Rate from 10 percent to the greater of 10 percent or $25,000. The existing Capital Recovery Rate and NERC CIP Capital Recovery Rates would not change. Other more minor changes included in this proposal include:

- The Black Start Capacity MW amount would be based on the offered Black Start MW for energy only units and the ICAP for capacity units
- ALR units would be permitted to recover NERC Compliance costs as documented to the Independent Market Monitor
- Would allow compensation for fuel storage to include fuels other than oil
- Would provide for a five year PJM internal review of revenue formulas

Alternate Proposal – Proxy for Formula Replacement

This proposal received 63 percent support from the SRSTF. The significant change in this proposal would be to replace the Black Start Base Formula Rate and components with a Proxy formulation. This proxy was developed based on the average of the responses received from the RTO-wide and Incremental Request for Proposal (RFP) submittals. The Proxy rate would replace the Base Formula Rate, Variable Operating and Maintenance (VOM) Costs, Fuel Storage and Training Costs. The existing Capital Recovery Rate and NERC CIP Capital Recovery Rates would not change. The Proxy rates are shown in the table below:

Black Start Resource Size	Initial Capital Payment to add Black Start (from RFP Responses)	Additional Black Start Resource Capital Payment (From RFP Responses)	Annual Black Start Capital Payment (using 0.125 CRF)	Additional Resource Annual Black Start Capital Payment	Annual Black Start O&M Payment (from RFP Responses)	Annual Black Start Fuel Storage Payment (from RFP Responses)	Unit Total Annual Black Start Payment (including Training)
MW <= 10*	$275,798	$105,871	$34,475	$13,234	$3,351	$6,280	$47,855
10 > MW <= 60	$1,930,588	$741,097	$241,323	$92,637	$23,456	$43,957	$312,486
60 > MW <= 90	$5,069,227	$1,258,927	$633,653	$157,366	$37,572	$64,152	$739,127
90 > MW <=300 Small Starting requirement	$6,861,848	$1,953,800	$857,731	$244,225	$182,896	$87,700	$1,132,077
90 > MW <=300 Medium Starting Requirement	$16,918,852	$1,953,800	$2,114,856	$244,225	$182,896	$87,700	$2,389,202
90 > MW <=300 Large Starting Requirement	$24,552,399	$1,953,800	$3,069,050	$244,225	$182,896	$87,700	$3,343,395
* No Data from RFP Responses. Assumed 5/35 of 10 > MW<= 60 MW Values							

The proposal would also provide for a five year PJM internal review of this formulation.

Comparative Summary

The objective of both proposals is to provide more incentive for the existing Black Start resources (which are currently on the Base Formula Rate) to continue to provide this service. This provides for continuity and flexibility in Restoration Planning and provides more assurance of an adequate supply of Black Start generation to meet critical load needs.

[13] http://www.pjm.com/~/media/documents/ferc/2014-filings/20140915-er14-2883-000.ashx

Neither proposal changes the Capital Recovery Factors which are used for new capital investments for Black Start units as there was general agreement on the task force that the Capital Recovery Factors provides sufficient incentive to attract new Black Start resources.

Both proposals would increase the cost of Black Start Service in the RTO. The Proxy for Formula Replacement would increase costs more significantly than the Minimum Incentive proposal. Estimated cost impact for each proposal over existing rates is shown below:

Transmission Zone	Revenue Requirement 9/1/2011	Revenue Requirement 9/1/2012	Revenue Requirement 9/1/2013	Minimum Incentive	RTO & Incremental RFP Proxy Cost
AECO	$587,375.76	$612,749.80	$659,039.18	$849,126.54	$2,210,244.00
AEP	$641,304.41	$1,065,072.31	$713,841.68	$1,100,196.98	$1,955,964.00
APS	$163,108.11	$263,640.01	$293,618.98	$391,926.34	$885,337.00
ATSI	$110,933.66	$170,352.21	$121,530.86	$160,482.60	$624,972.00
BGE	$3,258,715.57	$8,220,357.01	$5,212,388.17	$5,299,327.26	$6,894,242.76
COMED	$3,607,130.48	$5,175,988.79	$4,394,846.18	$4,558,736.61	$5,233,355.84
DAY	$166,374.93	$245,123.31	$259,735.15	$436,122.86	$1,061,523.00
DEOK		$331,699.42	$1,211,017.72	$1,216,925.45	$1,674,002.69
DOM			$1,069,397.17	$1,069,397.17	$1,069,397.17
DPL	$534,124.05	$543,207.62	$587,724.57	$1,009,295.07	$2,938,570.00
DUQ	$40,729.08	$53,404.09	$61,788.81	$61,788.81	$61,788.81
EKPC			$387,247.88	$402,043.52	$869,913.00
JCPL	$541,191.23	$328,467.96	$608,508.56	$626,403.28	$1,726,848.68
METED	$541,937.33	$478,493.70	$897,429.93	$897,617.32	$897,617.32
PECO	$1,266,963.40	$1,379,460.78	$1,548,942.76	$2,108,129.78	$7,316,155.00
PENELEC	$367,061.09	$573,457.48	$525,051.98	$535,152.14	$1,557,651.75
PEPCO	$462,700.00	$212,074.47	$325,972.27	$325,972.27	$325,972.27
PPL	$157,515.64	$152,847.12	$251,989.60	$569,078.44	$1,814,081.00
PSEG	$3,858,641.94	$2,673,261.66	$1,867,588.19	$2,806,728.73	$3,533,143.00
PJM TOTAL	**$16,305,806.68**	**$22,479,657.74**	**$20,997,659.64**	**$24,424,451.18**	**$42,650,779.31**

Note – Values in the table above applied the two proposals to the existing Black Start costs as September 1, 2013. These costs will vary in the future as some existing Black Start units retire and new Black Start units are selected through the RTO-wide Black Start RFP process.

Markets and Reliability Committee Actions

Both proposals failed a sector weighted vote at the Markets and Reliability Committee (MRC) meeting on February 27, 2014[14]. The SRSTF continued to work on abridged compensation proposal and forwarded the Minor Compensation Changes with Limited Fuel Storage to the MRC for approval. This proposal was endorsed in the July 31, 2014 MRC meeting[15].

Minor Compensation Changes with Limited Fuel Storage Proposal

The SRSTF looked at several minor changes to Black Start unit compensation. The Minor Compensation Changes with Limited Fuel Storage Proposal impacts a small number of Black Start units and are seen more as "clean-up" or "equity" issues as opposed to any major changes to the method of compensation for Black Start units. The task force also looked at potential changes to cost allocation, but did not recommend any changes to the existing Black Start cost allocation methodology.

[14] http://www.pjm.com/~/media/committees-groups/committees/mrc/20140327/20140327-item-01-draft-20140227-meeting-minutes.ashx
[15] http://www.pjm.com/~/media/committees-groups/committees/mrc/20140821/20140821-item-01-draft-minutes-mrc-20140731.ashx

The Compensation proposal described below received 58 percent support at the SRSTF. No other compensation proposal received the required 50 percent approval at the SRSTF to move it forward to the MRC for consideration.

The changes include:

- Allowing Energy Only Black Start units to be compensated using the offered Black Start MW.
  - Justification: Currently Black Start units on the base formula rate are compensated based on ICAP values. There is no mechanism to compensate Energy Only Black Start units on the base formula rate for providing this service.
- Allow Automatic Load Rejection (ALR) units to recover NERC Compliance costs as documented to the IMM.
  - Justification: This would allow ALR units to recover NERC Compliance costs and be comparable with traditional Black Start units in the ability to recover these costs.
- Allow for fuel storage compensation for liquefied natural gas (LNG), propane and oil per the existing formula for fuel storage.
  - Justification: Currently only oil storage is specified in the tariff. This would allow units that use LNG or propane to comparably recover fuel storage costs associated with providing Black Start.
- In the case where Black Start units share a common fuel tank, only one Black Start unit will be eligible for recovery of Minimum Tank Suction Level (MTSL).
  - Justification: This is to close a loophole in the current fuel storage compensation which allows for multiple Black Start units using the same fuel tank to recover the fuel storage costs related to the minimum tank suction level.
- Provide for a five year PJM internal review of compensation formula.
  - Justification: This would align the formula review with the RTO-wide RFP process and reduce PJM staff administrative burden. Currently this review is performed every 2 years. Results of the review will be reviewed with PJM Stakeholders (either MRC or MC Webinar).

Conclusion

The SRSTF performed a thorough review of the current black start compensation in Schedule 6A of the PJM Open Access Transmission Tariff starting in February 2013. Only the minor compensation changes proposal was approved by the MRC in July 2014 and forwarded to the FERC for approval on September 15, 2014[16]. The FERC approved the minor compensation proposal on November 14, 2015.

[16] http://www.pjm.com/~/media/documents/ferc/2014-filings/20140915-er14-2883-000.ashx

Review of Black Start Formula and Cost Components

PJM Operation Analysis & Compliance Department

PJM Interconnection

October 2019

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Black Start: Executive Summary

Black Start Service is used to restart the grid after a loss of electrical service and is needed because most generators require electricity to start. Traditional black start is the ability of generating units to start without an outside electrical supply. Another type of black start unit is an Automated Load Rejection (ALR) unit that is a generator with a high operating factor and the demonstrated ability[1] to automatically remain operating at reduced levels when disconnected from the grid.

The PJM Open Access Transmission Tariff (tariff) [2] requires PJM to review the formula and cost components utilized to compensate Black Start Service providers at least every five years. Specifically, Schedule 6A: Section 18 states:

Every five years, PJM shall review the formula and its costs components set forth in this section 18, and report on the results of that review to stakeholders. [3]

This paper is intended to document the review as required by Schedule 6A, and is not intended to provide information and updates regarding the current PJM Operating Committee Special Sessions for Fuel Requirements for Black Start Resources. Current and future updates of the PJM Operating Committee Special Session for Fuel Requirements for Black Start Resources may be found via PJM's website for the PJM Operating Committee.[4]

Since the 2014 prior review of Schedule 6A, Section 18, a revision to the tariff language took effect on November 16, 2017 to clearly define the initial annual black start revenue requirement review process for new black start units. The initial review process for new black start units includes an initial annual black start revenue estimate to be collected during the document and compensation review period. This change has resulted in minimizing the potential for large after the fact black start rebilling charges to network service customers and point-to-point reservations.

During the past five years, PJM has held an RTO Wide Black Start Request for Proposal and four Black Start Incremental Request for Proposals with three completed and one currently under review. Generator Owner interest and black start service bidding remains active with multiple RFP responses. As a result, PJM is not recommending modifications to the current version of Schedule 6A, Section 18.

[1] Subject to Transmission Provider concurrence
[2] https://agreements.pjm.com/oatt/3897
[3] Schedule 6A Black Start Service Section 18 Effective Date: 9/1/2018
[4] https://www.pjm.com/committees-and-groups/committees/oc.aspx

Schedule 6A Changes since 2014 Review

Initial Review for New Black Start Units

On September 22, 2017, Docket No. ER17-2332-000, the Commission issued an Order accepting revisions to PJM Tariff, Schedule 6A setting forth a process for establishing the initial revenue requirement for a new Black Start Unit entering service in PJM (effective date November 16, 2017). The new process can be found in the tariff, Section 17B which allows for the submittal of new Black Start Service revenue requirements (including supporting data and documentation) to PJM and the Market Monitoring Unit for review and analysis by no later than 90 days after entering Black Start Service. The Market Monitoring Unit has a 90-day period to review the submittals and calculate the new Black Start Unit's annual revenue requirement and submit to PJM and the Black Start Unit owner. More time is allotted in the event of more than three new Black Start owner submittals. In this case, the Marketing Monitoring Unit has an additional 90 days to review the next set of three submittals and so on until complete. The Black Start Owner has 7 days to notify PJM and the Marketing Monitoring Unit if it disagrees with the Market Monitoring Unit's determination. PJM shall determine within 30 days if the values submitted by the Black Start Unit owner meet the requirements of the Tariff and PJM Manuals. If PJM does not accept the values submitted by the Black Start Unit owner, the owner may file its proposed values with the Commission for approval. If PJM accepts the Black Start Unit owner's Black Start revenue requirements, the Market Monitoring Unit may petition the Commission for an order that would require the Black Start Unit owner to utilize the values determined by the Market Monitoring Unit or PJM or such other values determined by the Commission.

During this initial period, PJM will hold the new Black Start Unit owner's monthly credits in a non-interest bearing account. Following acceptance of the new Black Start Unit owner's annual revenue requirement (per Section 17B), the Black Start owner will begin to receive monthly credits, including any monthly credits held by PJM back to the date the unit enters Black Start Service (Section 22). Zonal rates will be based on Black Start Service capability or share of generation units designated by the Transmission Provider and allocated to network service customers and point-to-point reservations. Zonal rates will include estimated annual revenue requirements as estimated by the unit entering Black Start Service. Any estimated annual revenue requirement true up will be included in the monthly bill following the acceptance of the new Black Start unit's annual revenue requirement (Section 25)

Black Start: Current Total Revenue Requirements

Black start service supplies electricity for system restoration in the unlikely event that the entire PJM Interconnection grid would lose power. In the event that power would be lost across the entire grid, black start service is to be used to supply electricity to help restore the system. Black start service is provided by generating units that have the ability to start up and deliver power to the grid without an outside source of power – or units that can remain in operation at reduced output levels when disconnected from the grid. Such units must be able to reconnect to the grid within 180 minutes after a request from the Transmission Owner (specific to the Transmission Owner's System Restoration Plan). They also must be able to maintain frequency and voltage under varying loads. To be designated as a black start resource, a generating facility must pass a series of performance tests every 13 months. In a system-restoration situation, black start units can be used to reestablish the regional electric system. Once connected, they supply power to other generating units and help restore load. This must be a careful, deliberate process that keeps generation in balance with load in order to avoid the possibility of another loss of service.

The owners of black start units receive payments for providing the service to the grid. A generator's Annual Black Start Service Revenue Requirement is the amount of compensation a black start unit receives per delivery year if it fulfills all the black start requirements under the tariff. The PJM tariff Schedule 6A outlines the formulas used to calculate the revenue requirements.

Traditional Black Start Units

The primary formula to calculate a traditional black start generator's Annual Black Start Service Revenue Requirement can be found in the tariff, Section 18 of Schedule 6A is as follows:

$$\text{Generator's Annual Black Start Service Revenue Requirement} = \{\text{Fixed BSSC} + \text{Variable BSSC} + \text{Training Costs} + \text{Fuel Storage Costs}\} * (1 + Z)$$

Where:

- Fixed BSSC = Fixed Black Start Service Cost
- Variable BSSC = Variable Black Start Service Costs
- Training Costs = $3,750 per plant per delivery year (50 staff hours per plant per year multiplied by $75 per staff hour)
- Fuel Storage Cost is the cost defined in the tariff for oil units with onsite storage (discussed below)
- Z = the incentive factor of 10 percent

The Annual Black Start Service Revenue Requirements is allotted monthly, and may change every delivery year (June 1 – May 31). PJM records the tests of all black start units receiving compensation through the PJM tariff and alerts PJM Settlements to stop payment if requirements are not met.

Automatic Load Rejection Units (ALR) or Units with a High Operating Factor

Automatic Load Rejection Units are generating units with a high operating factor that have demonstrated the ability (subject to Transmission Provider concurrence) to automatically remain operating at reduced levels when disconnected from the grid. These units can be considered black start where appropriate, but they do not receive the same black start payments as black start units that start without an outside electrical supply. The revenue requirements for ALR units are as follows[5]:

$$\text{ALR Generator's Annual Black Start Service Revenue Requirement} = \text{Training Costs} * (1 + Z)$$

- Where Z is a 10 percent incentive factor
- Training costs are calculated as 50 staff hours per plant per year multiplied by $75 per staff hour = $3,750 per plan per delivery year

For ALR units, the total annual compensation from black start is $4,125 per plant per delivery year.

[5] https://agreements.pjm.com/oatt/3897

Fixed Black Start Service Cost (FBSSC)

Fixed Black Start Service Cost can be recovered through the PJM tariff or through a FERC approved rate. Fixed Black Start Service Costs recovered through the tariff are calculated in three possible ways depending on whether the unit is recovering costs under Paragraph 5[6] or Paragraph 6[7] of Schedule 6A with the central difference being whether the black start unit owner seeks to recover new or additional capital costs. The following figure shows the three methods for recovery of Fixed BSSC.

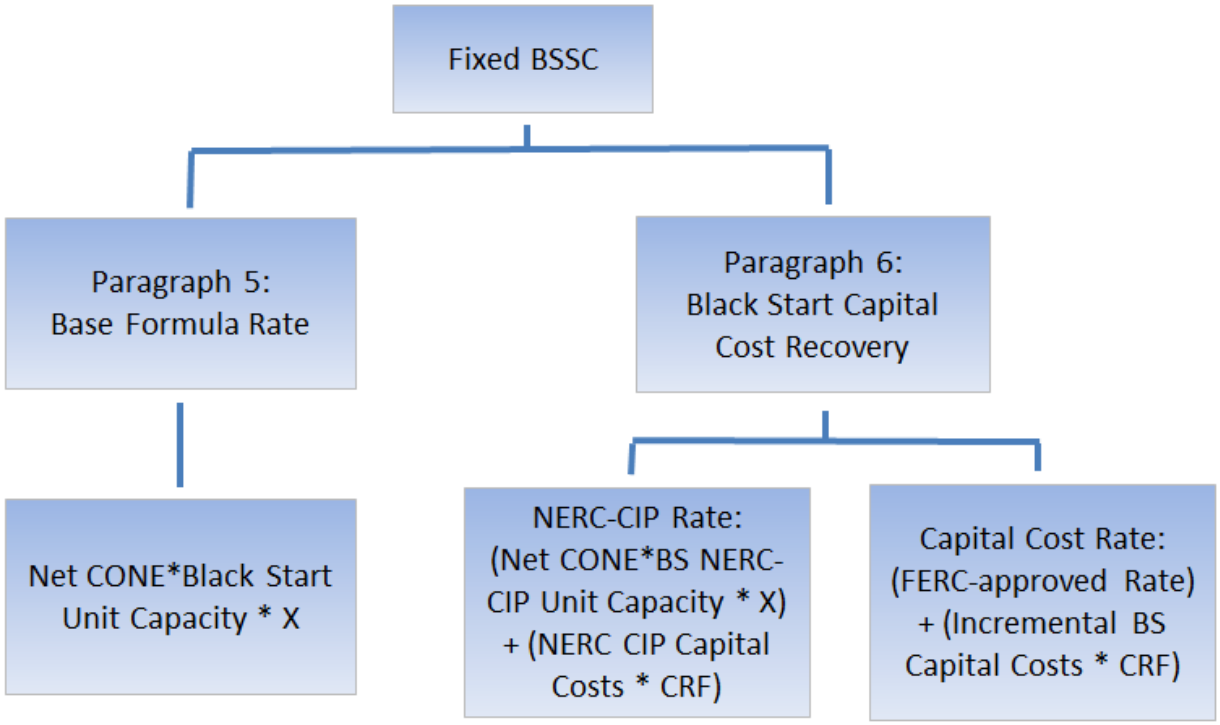

Figure 1: Three methods to recover fixed black start costs per Schedule 6A

[6] Owners of Black Start Units selected to provide Black Start Service in accordance with section 4 of this Schedule 6A and electing to forego any recovery of new or additional Black Start Capital Costs shall commit to provide Black Start Service from such Black Start Units for an initial term of no less than two years and authorize the Transmission Provider to resell Black Start Service from its Black Start Units. The term commitment shall continue to extend until the Black Start Unit owner, or the Transmission Provider provides written, one-year advance notice of its intention to terminate the commitment or the commitment is involuntarily terminated pursuant to section 15 of this Schedule 6A.

[7] Owners of Black Start Units selected to provide Black Start Service in accordance with section 4 of this Schedule 6A and electing to recover new or additional Black Start Capital Costs shall commit to provide Black Start Service from such Black Start Units for a term based upon the age of the Black Start Unit or the longest expected life of the Incremental Black Start Capital Cost, as set forth in the applicable CRF Tables in section 18 of this Schedule 6A. For those Black Start Units that elect to recover new or additional Black Start Capital Costs in addition to a prior, FERC-approved cost recovery rate, the applicable commitment period shall be the longer of the FERC-approved recovery period or the applicable term of commitment as set forth in the CRF Tables in section 18 of this Schedule 6A. The Transmission Provider may terminate the commitment with one year advance notice of its intention to the Black Start Unit owner, but the Black Start Unit owner shall be eligible to recover any amount of unrecovered Fixed Black Start Service Costs over a period not to exceed five years. A Black Start Unit owner may terminate the provision of Black Start Service with one year advance notice and consent of the Transmission Provider (or its commitment period may be involuntarily terminated pursuant to the section 15 below). Such Black Start Unit shall forego any otherwise existing entitlement to future revenues collected pursuant to this Schedule 6A and fully refund any amount of the Black Start Capital Costs recovered under a FERC-approved rate (recovered on an accelerated basis pursuant to the provisions of section 17(i) of this Schedule 6A) in excess of the amount that would have been recovered pursuant to section 18 of this Schedule 6A during the same period. At the conclusion of the term of commitment established under this section 6 of this Schedule 6A, a Black Start Unit shall commence a new term of commitment under either section 5 or 6 of this Schedule 6A, as applicable.

If units recover Fixed BSSC through Paragraph 5, they are electing to forgo any recovery of black start capital costs and fall into the lower left-hand box in Figure 1. If units prefer to recover through Paragraph 6, then they do submit capital costs for recovery and fall into the lower two right-hand boxes in Figure 1. Units recovering costs under a FERC approved rate can also recover new or additional black start capital costs through the PJM tariff and fall into the lower right hand box in Figure 1.

Paragraph 5 Fixed Black Start Service Cost for Units not requesting Capital Cost Recovery

For units recovering costs under Paragraph 5, Fixed Black Start Service Costs are calculated using the Base Formula Rate below:

Fixed BSSC = Net CONE * Black Start Unit Capacity * X

Where Net CONE is "*the then current installed capacity ("ICAP") net Cost of New Entry (expressed in $/MW year) for the CONE Area where the Black Start Unit is located*". The CONE areas are:

CONE Area 1: AE, DPL, JCPL, PECO, PS, RECO
CONE Area 2: BGE, PEPCO
CONE Area 3: AEP, APS, ATSI, ComEd, Dayton, DEOK, Dominion, Duquesne (DLCo), EKPC, OVEC
CONE Area 4: MetEd, Penelec, PPL

Net Cone Area $/MW day may be found by delivery year via PJM's website:
https://www.pjm.com/markets-and-operations/rpm.aspx
Each delivery year contains a workbook titled "Planning Period Parameters for Base Residual Auction" with the values listed in the Net CONE worksheet.

Black Start Unit Capacity is defined, as "*the Black Start Unit's installed capacity, expressed in MW*."

The term X is defined as *"the Black Start Service allocation factor unless a higher or lower value is supported by the documentation of the actual costs of providing Black Start Service. For such units qualifying as Black Start Units on the basis of demonstrated ability to operate at reduced levels when automatically disconnected from the grid, X shall be zero. For Black Start Units with a commitment established under paragraph 5, X shall be .01 for Hydro units, .02 for Diesel or CT units."*

Paragraph 6 Fixed Black Start Service Cost for Units requesting Capital Cost Recovery

For units recovering NERC-CIP black start capital costs under Paragraph 6, Fixed Black Start Service Costs are calculated using the following equation:

Fixed BSSC = (Net CONE * Black Start NERC-CIP Unit Capacity * X)
+ (Incremental Black Start NERC-CIP Capital Costs * CRF)

Where Net CONE is "*the then current installed capacity ("ICAP") net Cost of New Entry (expressed in $/MW year) for the CONE Area where the Black Start Unit is located*".

Black Start NERC-CIP Unit Capacity is *"the Black Start Unit's installed capacity, expressed in MW, but, for the purposes of this calculation, capped at 100 MW for Hydro units, or 50 MW for CT units."*

The term X is defined as *"the Black Start Service allocation factor unless a higher or lower value is supported by the documentation of the actual costs of providing Black Start Service. For such units qualifying as Black Start Units on the basis of demonstrated ability to operate at reduced levels when automatically disconnected from the grid, X shall be zero. For Black Start Units with a commitment established under paragraph 5, X shall be .01 for Hydro units, .02 for Diesel or CT units."*

Incremental Black Start NERC-CIP Capital Costs are defined as *" those capital cost documented by the owner or accepted by the Commission for the incremental equipment solely necessary to enable a Black Start Unit to maintain compliance with mandatory Critical Infrastructure Protection Reliability Standards (as approved by the Commission and administered by the applicable Electric Reliability Organization ".*

"CRF" or "Capital Recovery Factor" is equal to the levelized CRF as set forth in the applicable CRF Table set forth below.

For units recovering incremental black start capital costs under Paragraph 6, Fixed Black Start Service Costs are calculated using the following equation;

Fixed BSSC = (FERC-approved rate) + (Incremental Black Start Capital Costs * CRF)

"FERC-approved rate" is "*the Black Start Unit's current FERC-approved recovery of costs to provide Black Start Service, if applicable. To the extent that a Black Start unit owner is currently recovering black start costs pursuant to a FERC-approved rate, which cost recovery will be included as a formulaic component for calculating the Black Start Unit's annual revenue requirement pursuant to this paragraph 18. However, under no circumstances will PJM or the Black Start Unit owner restructure or modify that existing FERC-approved rate without FERC approval."*

Incremental Black Start Capital Costs are defined as *the new or additional capital cost documented by the owner or accepted by the Commission for the incremental equipment solely necessary to enable a unit to provide Black Start Service in addition to whatever other product or services such unit may provide. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to Black Start Units solely on the basis of the provision of Black Start Service by such unit. However, incremental Black Start Capital Costs shall not include any capital costs that the Black Start unit owner is recovering for that unit pursuant to a FERC-approved recovery rate."*

"CRF" or "Capital Recovery Factor" is "*equal to the Levelized CRF based on the age of the Black Start Unit, which is modified to provide Black Start Service, as present in the CRF Table below:"*

Age of Black Start Unit	Years of Remaining Life of Black Start Unit	Levelized CRF
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16+	5	0.363

The CRF table has several different assumptions such as: the Capital Recovery Factor based on a levelized proforma for a 100MW Combustion Turbine for $1M, 2.5 percent inflation, 36 percent federal tax rate, 9 percent state tax rate, income tax rate 41 percent, 50 percent equity and 50 percent debt with a 7 percent interest rate, and a 12percent internal rate of return on equity.

Optionally, a Black Start unit owner may elect to apply an alternative Capital Recovery Factor (CRF), in lieu of the age-based CRF table listed on page 7, which is based upon the expected capital Improvement Lifespan of the new or additional capital improvements (as determined by the applicable depreciation period of the capital improvement, as published from time to time by the US Internal Revenue Service).The Applicable Recovery Period and the term of Black Start Service Commitment shall be the same and determined by the expected Capital Improvement Lifespan. In the event that the Black Start unit seeks recovery of capital improvements that are included in more than one category of Capital Improvement Lifespan (as set forth below), its Applicable Recovery period and term of commitment to provide black start service for such Black Start unit shall be the longest expected life of those new or additional capital improvements.

Capital Improvement Lifespan (years)	Applicable Recovery Period/Term of Commitment (years)	Levelized CRF
16-20	20	0.125
11-15	15	0.146
6-10	10	0.198
1-5	5	0.363

In those circumstances where a Black Start Unit owner has elected to recover incremental Black Start Capital Costs, in addition to a FERC-approved recovery rate, its applicable term of commitment shall be the greater of: (i) the FERC-approved recovery period, or (ii) the applicable term of commitment as established by the CRF Tables above. After a Black Start Unit has recovered its allowable Incremental Black Start Capital Costs or Incremental Black Start NERC-CIP Capital Costs, as provided by the applicable Capital Cost Recovery Rate, and has satisfied its applicable commitment period required under Schedule 6A: Paragraph 6, the Black Start Unit shall be committed to providing black start in accordance with Paragraph 5 of Schedule 6A and calculate its Fixed BSSC in accordance with the Base Formula rate.

A. *Variable Black Start Service Cost (VBSSC)*

$$\text{Variable Black Start Service Cost} = \text{Black Start Unit O\&M} * Y$$

Where Black Start Unit O&M is *"the operations and maintenance cost attributable to supporting Black Start Service and must equal the annual variable O&M outlined in the PJM Cost development Guidelines set forth in the PJM Manuals. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to a Black Start unit solely on the basis of the provision of Black Start Service by the unit."*
Y is 0.01, "*unless a higher or lower value is supported by documentation of costs. If a value of Y is submitted for this cost, a (1-Y) factor must be applied to the Black Start unit's O&M costs on the unit's cost-based energy schedule, calculated based on the Cost Development Guidelines in the PJM Manuals"*

For unit qualifying as Black Start Units on the basis of a demonstrated ability to operate at reduced levels when automatically disconnected from the grid (ALR), there are no variable costs associated with providing Black Start Service and the value for Variable BSSC shall be zero.

B. Training Cost

$$\text{Training Costs} = 50 \text{ staff hours/year/plant} * \$75/\text{hour}$$

C. Fuel Storage Cost

Black Start Units that do not use oil as their fuel must set their Fuel Storage Costs to zero. Black Start units that can use oil for fuel shall calculate Fuel Storage Costs as:

$$\text{Fuel Storage Costs} =$$

$$(\text{Minimum Tank Suction Level} + (\#\text{ of Run Hours Required} * \text{Fuel Burn Rate})) * (12 \text{ month forward strip} + \text{basis}) * \text{Bond Rate}$$

Where Minimum Tank Suction Level is *"and shall apply where no direct current pumps are available for the black Start Unit"*.

Number of Run Hours are *"the actual number of hours a transmission provider requires a Black Start Unit to run. Run Hours shall be at least 16 hours or as defined by the Transmission Owner restoration plan, whichever is less".*
Fuel Burn rate is *"actual fuel burn rate for the Black Start Unit"*.

12 Month Forward Strip is *"the average of forward prices for the fuel burned in the Black Start unit traded the first business day on or following May 1*".

Basis is *"the transportation costs from the location referenced in the forward price data to the Black Start unit plus any variable taxes".*

Bond rate is *"the value determined with reference to the Moody's Utility Index for bonds rated BAA1 reported the first business day on or following May 1".*

D. Z Factor

The Z factor shall be an incentive factor solely for Black Start Units with a commitment established under Schedule 6A Paragraph 5 and shall be ten percent. For those Black Start units that elect to recover new or additional Black Start Capital Costs under Paragraph 6, the incentive factor (Z), shall be equal to zero.

Request for Proposal (RFP) since 2014

April 11, 2014: Black Start Incremental Request for Proposal for AEP Zone. PJM requested bids for additional black start capability within the AEP transmission zone.

November 24, 2014: Black Start Incremental Request for Proposal for Northeast Ohio and Western Pennsylvania. PJM requested additional black start capability within Northeastern Ohio and Western Pennsylvania.

July 28, 2015: Second Incremental Request for Proposal for Northeast Ohio and Western Pennsylvania. PJM determined the need for additional black start capability within Northeastern Ohio and Western Pennsylvania.

February 01, 2018: PJM 2018 RTO Wide Black Start Request for Proposal. This was the second PJM RTO-wide black start Request for Proposal process and requested bids for new black start capability in accordance with the Five-Year Black Start Selection Process as documented in PJM Manual 14D.

February 01, 2019: Black Start Incremental Request for Proposal for BGE/PEPCO Zones. PJM requested bids for additional black start capability within the BGE transmission zone.

Conclusion

PJM Manual 14D: Generator Operational Requirements; Section 10: Black Start Generation Procurement outlines the PJM black start selection process and includes the RTO wide black start RFPs, PJM incremental black start RFPs and PJM Reliability Backstop processes. Resources that are awarded black start service are compensated under Schedule 6A of the Tariff, with the associated formula and its cost components documented in this paper. PJM has received, reviewed, and approved several resources during the multiple RFPs listed above. As a result, no additional changes are needed due to the response following the above mentioned RTO Wide and Incremental RFPs.

Gerard Cerchio

From: Joseph Bowring
Sent: Thursday, October 3, 2019 6:07 PM
To: David Schweizer; Glen D. Boyle
Cc: Gerard Cerchio
Subject: Black Start CRF tables

David/Glen:
Three CRF tables:

- First is the current tariff table
- Second is the current tariff table recalculated to reflect recent changes in tax law that reduce CRF values
- Third is our proposed CRF table for black start. This table uses a 20 year CRF for all black start units. We would be ok providing for a return of a pro rata share of the payments to the generation owner if the unit failed before 20 years, and with a guarantee to continue providing black start service for the balance of the useful life of the unit at the tariff rate.

Let us know if you want to discuss.
Thanks
Joe

Black Start CRF - Current Tariff

Age of Existing Units (Years)	Remaining Life of Plant (Years)	Levelized CRF @ 12% IRR
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16 +	5	0.363

Black Start CRF - Current Tariff-New Tax Law

Age of Existing Units (Years)	Remaining Life of Plant (Years)	Levelized CRF @ 12% IRR
1 to 5	20	0.096
6 to 10	15	0.111
11 to 15	10	0.144
16 +	5	0.246

Black Start CRF - IMM Proposed New Tariff

Age of Existing Unit Where BS Located (Years)	Life of BS Unit (Years)	Levelized CRF @ 12% IRR
1 to 60 Plus	20	0.096

Financial Assumptions

	Current	2019
Percent Equity	50%	50%
Percent Debt	50%	50%
Loan Term	Remaining Plant Life	Remaining Plant Life
Loan Rate (%)	7.0%	7.0%
Federal Tax Rate (%)	35.0%	21.0%
Sate Tax Rate (%)	9.0%	9.0%
Depreciation	15 Yr. MACRS	First Year 100% Bonus (1)
Target IRR	At End of Plant Life	At End of Plant Life

(1) For property placed in service after September 27, 2017

PJM Interconnection
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955 Jefferson Avenue
Norristown, PA 19403-2497

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February 19, 2009

Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E., Room 1A
Washington, D.C. 20426-0001

ORIGINAL

Re: *PJM Interconnection, L.L.C.*, Docket No. ER09-730-000

Dear Ms. Bose:

Pursuant to Section 205 of the Federal Power Act, 16 U.S.C. § 824d and the Federal Energy Regulatory Commission's ("FERC" or "Commission") Regulations, 18 C.F.R. Part 35, PJM Interconnection, L.L.C. ("PJM") hereby submits for filing revised tariff sheets of the PJM Open Access Transmission Tariff ("PJM Tariff").[1] The purpose of these revisions is to make clarifying and other changes to PJM's Black Start Service practices and rules by amending Schedule 6A of the PJM Tariff to allow Black Start Service providers the opportunity to recover incremental costs associated with complying with North American Electric Reliability Corporation ("NERC") Reliability Standards. Additionally, the proposed revisions address the ability of Black Start Service provider to seek independent, Commission-approved capital investment recovery, in lieu of the PJM Schedule 6A formulaic revenue recovery. PJM respectfully requests that the Commission accept the proposed revisions to the Tariff for filing, allowing them to become effective April 21, 2009.

I. Background

Currently, Schedule 6A of the PJM Tariff sets forth the details necessary for identifying generators to provide Black Start Service[2] that are included in each Transmission Owner's system restoration plans and are critical for restoration of the Transmission System in the event of de-energizing event. In this regard, the owners of Black Start Units identified for inclusion in a system restoration plan commit to providing Black Start Service for a rolling two-year commitment, until terminated either by the Transmission Provider, Transmission Owner and/or Black Start Service provider.

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[1] Capitalized terms not otherwise defined herein have the meaning specified in the PJM Operating Agreement or the PJM Open Access Transmission Tariff, as appropriate.

[2] Black Start Service represents the capability of generating units to start without an external (system) electrical supply or the demonstrated ability automatically to remain operating at reduced levels when disconnected from the grid. *See PJM Tariff Schedule 6A ¶ 2.*

Importantly, the provisions of Schedule 6A also set forth the annual Black Start Service revenue requirement for the PJM Region, which is the sum of the annual Black Start Service revenue requirements for each generator that is designated as providing Black Start Service and has provided PJM with a calculation of its annual revenue requirements; calculated based upon the formula as set forth in paragraph 18 of Schedule 6A. In turn, Transmission Customers are charged for Black Start Service according to the formulas set forth in Schedule 6A.

Schedule 6A and its associated revenue requirements were grounded in the idea that they would provide an incentive for generators to produce Black Start Services by allowing them to include in their Black Start Service revenue requirements the costs associated with Black Start Service, plus an incentive factor.[3] Subsequently, more flexibility in the recovery of fixed costs associated with providing Black Start Service was adopted so as to encourage existing and new generation to provide the service.[4]

With the establishment and development of mandatory Reliability Standards in recent years, there exists a general concern that Black Start Service providers may be subjected to incremental costs associated with providing Black Start Service that they otherwise would not have incurred, particularly as those requirements related to the designation of their facilities as "critical assets" in a system restoration plan[5] and, therefore, subject to further Critical Infrastructure Protection ("CIP")[6] Reliability Standards. Thus, late in 2007, PJM's Market Implementation Committee chartered the Black Start Services Working Group ("BSSWG"). The BSSWG was directed to discuss and recommend courses of action to address additional Black Start issues. Specifically, at that time, the BSSWG was charged with: (i) investigation of the inclusion of NERC CIP Reliability Standards costs in the current Black Start cost recovery; (ii) investigation of a provision for Black Start Service providers to seek capital investment recovery related to Black Start Service independently of the formulaic rate set forth in the current Schedule 6A; (iii) investigation of a requirement for PJM to handle billing associated with any newly proposed cost recovery mechanisms, and; (iv) investigation of the need to update a cross reference in the Schedule 6A formulaic rate to Capacity Deficiency Rate ("CDR") to account for implementation of the Reliability Pricing Model ("RPM").

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3 Currently, the incentive factor is set at ten percent.

4 In 2004, a change to the "Black Start Allocation Factor" used to determine the "Fixed Black Start Service Costs" was made to allow Black Start Service providers the opportunity to recover capital investment incurred to replace retired Black Start Service resources, to install Black Start capability on new units with better control capabilities to improve existing restoration plans and to address any significant major equipment failures on existing resources. *See PJM Interconnection, L.L.C.*, Docket No. ER04-598-000 (2004).

5 NERC Reliability Standard CIP-002-1, R1 requires the Responsible Entity to identify and document a risk-based assessment methodology to use to identify its Critical Cyber Assets. Such risk-based assessment methodology shall consider, among other things, systems and facilities critical to system restoration, including black start generators. Once identified as a Critical Cyber Asset, the Responsible Entity must undertake a variety of further steps to ensure the protection of that Critical Cyber Asset, including placement of security management controls (CIP-003-1), training of personnel having authorized cyber or physical access to the Critical Cyber Asset (CIP-004-1), identification and protection of electronic security perimeters (CIP-004-1), physical security program (CIP-005-1), and so forth. As set forth in detail in those requirements, they chiefly apply to those cyber assets associated with identified critical assets.

6 Early on in the process, it was recognized that Black Start Unit owners may be subject to a variety of NERC Reliability Standards that may not relate to their provision of Black Start Service, for example, NERC CIP 003 – 009.

Over the course of the ensuing months, the BSSWG met and discussed various alternatives designed to address the assigned goals. The following proposed revisions to Schedule 6A represent the collective work of the BSSWG members and, in turn, PJM stakeholder consultation and consideration, and are designed to address the following purposes:

(1) establish a tiered level of commitment for a Black Start Unit to provide service dependent upon whether they are seeking to recover additional fixed cost capital costs or not;

(2) allow Black Start Service Providers the opportunity to recoup reasonable costs that would not otherwise be incurred but for maintaining their Black Start units in compliance with NERC standards, and;

(3) establish an alternative capital cost recovery mechanism by allowing a Black Start Service Provider to seek Commission approved cost of service recovery in lieu of the proposed Schedule 6A formulaic rate.

ii. The Proposed Revisions

As indicated above, the proposed changes tendered in this filing are primarily grounded in the recognition that Black Start Services are a key element in reliably and promptly restoring power to the PJM Region in the event of a power system restoration event (e.g., blackout). The need for adequate Black Start Service and the obligation of an ISO/RTO to compensate those entities that provide Black Start Service in order to ensure reliable operation of the transmission system has been recognized by the Commission [7] and the proposed revisions here attempt to encourage the provision of new and existing Black Start Service by ensuring that Black Start Service providers are afforded the opportunity to recover their true costs of service, plus a reasonable incentive factor. In this regard, while the concepts originally established under Schedule 6A remain intact, some revisions in the calculation of reasonable cost of service recovery have been changed.

A. Election of Applicable Commitment Period

Initially, the proposed revisions set forth two levels of commitment for a generator to provide Black Start Service dependent upon the election of the unit owner to either forego or recover any new or additional "Black Start Capital Costs"[8]. The election to forego recovery of Black Start Capital Costs requires a commitment to provide Black Start Service on a rolling, two year basis. However, those Black Start Service providers who elect to recover new or additional Black Start Capital Costs will commit to provide Black Start Service for a term based upon the

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[7] *See e.g. PJM Interconnection, L.L.C.*, 109 FERC ¶ 61,368 at P1 (2004).

[8] Newly defined further in Schedule 6A, as a sub-set of the definition of Fixed Black Start Service Costs, Black Start Capital Costs are the capital costs approved by the Commission for the incremental equipment solely necessary to enable a unit to provide Black Start Service in addition to whatever other products or services such unit may provide. These costs are proposed to include those costs incurred by the Black Start Owner to meet applicable NERC Reliability Standards.

reasonable estimate of the expected life of the Black Start Unit, as set forth in a newly proposed Cost Recovery Factor ("CRF") Table in paragraph 18 of Schedule 6A.

The allowance of this newly proposed option is grounded in the recognition that some, but not all, Black Start Service Providers may be required to invest in additional capital improvements to ensure compliance with relevant Reliability Standards that are solely related to the provision of Black Start Service, and may decide to recover those costs through Schedule 6A in return for an applicable commitment period. It was recognized by the BSSWG that while Black Start Unit owners may be subject to a variety of NERC Reliability Standards unrelated to the provision of Black Start Service, certain Reliability Standards may uniquely impact the provision of Black Start Service and require further capital investment to remain compliant. This option now permits the Black Start Service provider to recover those improvements. However, to be clear, the proposed inclusion of Fixed Black Start Capital Costs contemplates only the inclusion of further capital improvements that would otherwise not be required but for the Black Start Unit owner's provision of Black Start Service.[9]

Accordingly, proposed paragraph 6 sets forth the applicable commitment period for those owners who elect to recover new or additional Black Start Capital Costs and provides that they shall commit to provide Black Start Service for a term based upon a reasonable estimate of the expected life of the Black Start Unit, as set forth in the CRF Table in paragraph 18. Application of the proposed CRF to any newly incurred fixed Black Start Service Costs is designed to ensure that recovery of the new improvements are depreciated in a manner commensurate with the age of the Black Start Unit at the time of the improvement. Likewise, the commitment to provide Black Start Service on a forward basis is also tied to the age of the Black Start Unit to ensure that the Black Start Unit owner may reasonably recover the additional capital investment with a corresponding commitment term based upon the expected life of the Black Start Unit. Thus, the opportunity to recover fixed capital improvements through the application of Schedule 6A will require a commitment on the part of the Black Start Unit owner to provide Black Start Service for the term as set forth in the CRF table and represents a reasonable recovery of its capital investment.[10]

Further proposed language in paragraph 6 has been offered to ensure that the Black Start Unit owner, who has elected to make capital improvements and commit to providing Black Start Service for the applicable term, has the opportunity to recoup those costs in the event that its commitment period is terminated through no fault of its own. As such, where the Transmission Provider, with the consent of the Transmission Owner, or the Transmission Owner, with the consent of the Transmission Provider, decides to terminate the commitment with one-year advance notice, then the Transmission Owner shall reimburse the Black Start Unit owner for any unrecovered amount Fixed Black Start Service Costs over a period not to exceed

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[9] Perhaps the most elementary example of this would be an otherwise compliant generator who is required to install a fence around its facility as a result of the facility's designation as a "critical," and therefore subject to NERC CIP standards. In this case, the owner would elect to recover the additional fixed costs and commit to providing Black Start service based upon the reasonable estimate of the expected life of the Black Start Unit itself, as set forth in the CRF Table found in paragraph 18.

[10] As set forth further herein, the election of a Black Start Unit owner to recover its investment is not limited to Schedule 6A. Indeed, as part of these suggested changes to Schedule 6A, the Black Start Unit owner has the option to seek recovery of its Black Start costs of service through the application of a Commission approved rate in lieu of the recovery provided under Schedule 6A.

five years.[11] However, in those cases where the Black Start Unit owner decides to terminate its applicable commitment period, or is the subject of involuntary termination for failure to meet the testing requirements set forth in paragraph 15, then it shall forego any otherwise existing entitlements to revenues collected pursuant to Schedule 6A and must fully refund any amount of Black Start Capital Costs recovered under a FERC-approved rate in excess of the amount that would have been recovered pursuant to the Schedule 6A revenue requirement formula.

For those Black Start Service providers who forego recovery of new or additional Black Start Capital Costs, Paragraph 5 of Schedule 6A still sets forth a rolling, two-year term of commitment. However, the tendered revisions to paragraph 5 further clarify that the term commitment shall continue to extend until the Black Start Unit owner, or the Transmission Owner, with the consent of the Transmission Provider (or the Transmission Provider with the consent of the Transmission Owner) provides written, one-year advance notice of its intention to terminate the commitment. Aside from clarifying changes made to the calculation of the revenue requirement as discussed further herein, the requirements of Black Start Unit owners providing service under Schedule 6A pursuant to this commitment remain largely intact.

Newly proposed paragraph 6A has been carved out of the existing paragraph 5, and like existing paragraph 5, it details the consequences in the event that a Black Start Unit owner fails to meet its applicable commitment period. Except, the provisions of this paragraph have been expanded to account for the different consequences attendant to the Black Start Unit owner's election of revenue recovery under proposed paragraph 5 or 6, with similar consequences of revenue forfeiture as applicable to its election of recovery. Similarly, revisions to paragraph 15 have been proposed to clarify that if the Black Start Unit owner fails to meet its annual testing requirements and does not make the necessary corrections to pass subsequent testing, then the Black Start Unit owner will be deemed to have failed to meet its applicable commitment period and will be subject to the forfeiture of revenues as set forth in proposed paragraph 6A.

B. Revenue Requirements

Currently, paragraph 17 of Schedule 6A limits the recovery of an owner's Black Start Service expenses to the formula rate contained in paragraph 18. However, proposed revisions to paragraph 17 now contemplate that the Black Start Service provider may elect to base its applicable revenue requirements on either a FERC-approved rate for the recovery of the cost of providing such service for the entire duration of the commitment term selected in either paragraph 5 or 6, or the formula set forth in paragraph 18. By allowing the Black Start Service provider the option to elect either avenue to recover rates, PJM also will clarify further in proposed paragraph 17 that PJM will presume that any FERC-approved cost recovery plan would be the exclusive basis for the recovery of a Black Start Unit's recovery or costs during the applicable term.

Spelling out the authorization for a Black Start Unit owner to seek FERC-approved cost recovery merely reinforces that owner's unilateral right under Section 205 to file with FERC to establish or to revise its annual cost based revenue requirement for Schedule 6A. Importantly,

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[11] The choice to establish a five-year reimbursement period was largely made as a result of a compromise between two competing stakeholder views; namely reimbursing the investment over the one year period prior to the termination or allowing reimbursement over the remaining expected life of the unit as set forth in the proposed CRF table.

however, proposed paragraph 17 clarifies that an owner seeking FERC-approved recovery will be limited to that recovery method to ensure that the Black Start Unit owner will only be compensated for those costs associated with that service that are not being recovered through other rates or charges.

As noted above, the primary impetus for the proposed Tariff revisions center on allowing a Black Start Unit owner to recover its reasonable costs associated with compliance to NERC-mandated Reliability Standards that it otherwise would not have incurred but for the application of those standards. This is primarily a result of the generation owner's classification of certain units, likely black start units, as critical assets. The critical asset designation is the differentiating issue which separates black start units from other generation resources. It makes the "critical" units potentially subject to the NERC CIP standards where other generation assets are not. Thus, sweeping changes to the formula for calculating a generator's annual Black Start Service revenue requirement are set forth in paragraph 18.

Currently, Schedule 6A provisions calculate a Black Start Unit owner's revenue requirement by application of a formula which is comprised of five distinct factors: (i) Fixed Black Start Service Costs (" Fixed BSSC"); (ii) Variable Black Start Service Costs ("Variable BSSC"); (iii) Training Costs; (iv) Fuel Storage Costs and Carrying Costs; and (v) 1 + an Incentive Factor.[12] The application of these five distinct factors is not proposed to change in any substantial way, but, rather, it is the pieces that make up those factors that are slated for renovation. In this regard, the first formulaic factor – Fixed BSSC – has been substantially revised to capture two broad purposes; namely, (i) allow Black Start Service providers to recover the fixed costs of any capital improvements made solely to meet the requirements of NERC Reliability Standards that apply to Black Start Units solely on the basis of the provision of Black Start Service by that unit; and (ii) replace a reference in the formula to the retired PJM Capacity Deficiency Rate concept with the net CONE concept currently used in PJM's Reliability Pricing Model ("Cost Of New Entry").

With respect to the first purpose, the Fixed BSSC formulaic factor had to be broken down further to be applicable to, both, a generator that elects to forego any new or additional Black Start Capital Costs and those that seek to recover additional Black Start Capital Costs. Thus, the applicable Fixed BSSC formulaic factor for Black Start Units with a commitment established under proposed paragraph 5 (i.e., electing to forego capital costs recovery) is **CONE *365 * Black Start Unit Capacity * X**, where CONE is the newly defined Cost of New entry, Black Start Unit Capacity is the capacity of the unit expressed in MW, and X is the Black Start Service Allocation Factor.[13]

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[12] For units that operate at reduced levels when automatically disconnected from the grid, the formula is revised to remove Fixed Black Start Service Costs, Variable Black Start Service Costs and Fuel Storage and Carrying Costs since these components are not necessary as these units do not have qualifying incremental expense associated with providing Black Start Service and do not keep an inventory of fuel specifically for Black Start Service. This revised formula exists in the current Schedule 6A and will be applicable in the proposed Schedule 6A, with proposed clarifications to the formulaic component definitions, where applicable.

[13] The Black Start Service Allocation Factors is a defined term which was incorporated into Schedule 6A in February 2004 to provide an incentive to encourage existing and new generators to provide black start service. The inclusion of the allocation factor created more flexibility in the recovery of the fixed costs incurred to provide the black start service since the then current formula did not permit black start service providers the opportunity to recover capital expenditures to replace existing resources or make major improvements in the resources to continue or

Where a generator has elected to recover new or additional fixed Black Start Capital Costs pursuant to a commitment established under proposed paragraph 6, the proposed Fixed BSSC formulaic factor shall be **Black Start Capital Cost * CRF**. Black Start Capital Costs are defined as the capital costs approved by the Commission for the incremental equipment solely necessary to enable a unit to provide Black Start Service and those fixed costs incurred by the generator in order to meet NERC Reliability Standards that apply to Black Start Units solely on the basis of the provision of Black Start Service by that unit. Importantly, in this calculation, Black Start Capital Costs are defined and limited to only those incremental costs incurred by the generator to provide the Black Start Service. All other costs, including those relating to compliance with NERC Reliability Standards which would have been incurred by the Black Start Unit Owner notwithstanding its provision of Black Start Service, may not be recovered pursuant to this Schedule 6A.

The proposed CRF table is a vital component of this proposed formula as it provides the calculation of the levelized CRF which is then multiplied by the Black Start Unit owner's Black Start Capital Costs to derive the appropriate Fixed Black Start Service Costs. Also, the CRF table provides the appropriate level of commitment for those Black Start Unit owners electing to provide service pursuant to proposed paragraph 6, which is a term based upon a reasonable estimate of the expected life of the Black Start Unit.

Conversely, the opportunity to recover variable costs attributable to supporting Black Start Service is not tied to the election of one commitment period over another. But, instead, all Back Start Service providers are given the opportunity to include those operating and maintenance expenses attributable to supporting Black Start Service, including costs incurred to meet NERC Reliability Standards that apply to the Black Start Unit solely on the basis of the provision of Black Start Service. The universal inclusion of variable operating and maintenance costs in the formulaic calculation of revenue requirements recognizes the inherent differences associated with making actual capital improvements to a Black Start Unit to provide Black Start Service as opposed to recovery of ongoing operation and maintenance expense.

In this regard, the Variable BSSC component of the formula has been slightly revised to clarify that all Black Start Units, regardless of commitment level, shall calculate Variable BSSC using this formula and to include a definition of "Black Start Unit O&M." Similar to the definition of Black Start Capital Costs used in the calculation of Fixed BSSC above, Black Start Unit O&M are the operations and maintenance costs attributable to supporting Black Start Service and shall include those costs incurred by the owner in order to meet NERC Reliability Standards that apply to the Black Start Unit. Importantly, like the definition of Black Start Capital Costs, Black Start Unit O&M is explicit in limiting the recovery of those costs incurred to comply with NERC Reliability Standards that apply to the Black Start Unit solely on the basis of the provision of Black Start Service by the unit.

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increase a generator's ability to provide black start service. The allocation factors permitted generators to recover capital investment incurred which might have been above the then current caps used as allocation factors under the PJM Tariff. *See PJM Interconnection, L.L.C.* Letter Order, Docket No. ER04-598-000 (April 27, 2004). The Allocation Factors set forth in this filing are not proposed to change, other than to clarify that units qualifying as Black Start Units on the basis of demonstrated ability to operate at reduced levels when automatically disconnected from the grid, the Allocation Factor shall be zero. PJM stakeholders have agreed that the listed amounts are the minimum percentages of a generator's fixed costs that appropriately should be attributed to Black Start Service.

Additional revisions are proposed to the remaining components of the paragraph 18 revenue requirements formula which do not change the disposition of the formulaic calculation, but provide further clarification as to the structure of those components. For example, the definition of Fuel Storage Costs has been changed to clarify that Black Start Units that cannot use oil for fuel shall calculate Fuel Storage Costs as zero. Moreover, the definition has been arranged to provide clarity by separating out key components of the Fuel Storage Costs and ordering them into line-item definitions. Also, words and appropriate punctuation have been added where applicable.

The existing incentive factor has been re-termed "Z," and further clarified thet it will be an incentive factor for Black Start Units that have elected to forego recovery of new or additional fixed Black Start Capital Costs in accordance with the commitment pursuant to proposed paragraph 5, and shall be ten percent. The incentive factor, as it exists currently, was contemplated to provide compensation for Black Start Service providers which includes reimbursement for the actual out of pocket costs of providing Black Start Service plus and adequate, but not excessive, incentive payment to encourage generators to provide such service. Its application in the proposed revisions is limited those owners electing to forego recovery of new or additional fixed Black Start Service Costs because those owners who seek to recover new or additional fixed costs will fully recover all costs of service under the proposed formula without the application of Z. Conversely, those unit owners electing to provide Black Start Service pursuant to a commitment period established under proposed Paragraph 5 may actually incur costs that otherwise would not be recovered through application of the revenue requirements formula, and application of the Z factor is designed to compensate them for those difficult to quantify costs. Thus, the PJM stakeholders determined that it was appropriate to limit application of Z to those specific Black Start Unit owners.

Finally, to ensure that Black Start Unit owners are adequately compensated for providing Black Start Service, and that proper incentives exist to ensure continued provision of Black Start Services, PJM has proposed to require that it review the revenue requirement formula and its cots components every two years and report on the results of that review to the PJM stakeholders.

III. Stakeholder Support

On January 15, 2009, the PJM Members Committee met and endorsed by acclamation these proposed revisions, with no member opposed or abstaining.

IV. Effective Date

Consistent with the Commission's notice requirements, PJM requests an effective date of April 21, 2009, which is at least 60 days after the date of this filing.

V. Documents Enclosed

This submittal includes an original and six copies of the following:

- This letter of transmittal;
- The proposed PJM Tariff revisions in non-redlined format (Attachment A);

- The proposed PJM Tariff revisions red-lined against the currently effective tariff sheets (Attachment B)

VI. Correspondence and Communication

The following individuals are designated for inclusion on the official service list in this proceeding and for receipt of any communications regarding this filing:

Robert V. Eckenrod
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Norristown, Pennsylvania 19403-2497
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Craig Glazer
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VII. Service

PJM has served a copy of this filing on all PJM Members and on all state utility regulatory commissions in the PJM Region by posting this filing electronically. Electronic service is permitted as of November 3, 2008, under the Commission's regulations[14] pursuant to Order No. 714[15] and the Commission's Notice of Effectiveness of Regulations, issued on October 28, 2008, in Docket No. RM01-5-000. In compliance with these regulations, PJM will post a copy of this filing to the FERC filings section of its internet site, located at the following link: *http://www.pjm.com/documents.ferc.html* with a specific link to the newly filed document, and will send an e-mail on the same date as this filing to all PJM Members and all state utility regulatory commissions in the PJM Region alerting them that this filing has been made by PJM today and is available by following such link. [16]

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[14] See 18 C.F.R. §§ 35.2, 154.2, 154.208 and 341.2.

[15] *Electronic Tariff Filings*, 124 FERC ¶ 61,270 (2008) (Order No. 714).

[16] PJM already maintains updates and regularly used e-mail lists for all PJM Members and affected Commissions.

Respectfully submitted,

Robert V. Eckenrod
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Attachment A

Tariff Changes

Clean Version

K:\pjm\TARREVS\Schedule 6a tariff changes 2-13-09 (clean).DOC

PJM Interconnection, L.L.C.
FERC Electric Tariff
Sixth Revised Volume No. 1

First Revised Sheet No. 238
Superseding Original Sheet No. 238

SCHEDULE 6A

Black Start Service

To ensure the reliable restoration following a shut down of the PJM transmission system, Black Start Service is necessary to facilitate the goal of complete system restoration. Black Start Service enables Transmission Provider and Transmission Owners to designate specific generators called Black Start Units whose location and capabilities are required to re-energize the transmission system following a system-wide blackout.

TRANSMISSION CUSTOMERS

1. All Transmission Customers and Network Customers must obtain Black Start Service from the Transmission Provider pursuant to this Schedule 6A.

PROVISION OF BLACK START SERVICE

2. A Black Start Unit is a generating unit that has equipment enabling it to start without an outside electrical supply or a generating unit with a high operating factor (subject to Transmission Provider concurrence) with the demonstrated ability to automatically remain operating, at reduced levels, when disconnected from the grid. A Black Start Unit shall be considered capable of providing Black Start Service only when it meets the criteria set forth in the PJM manuals. For the purposes of this Schedule 6A, the expected life of the Black Start Unit shall take into consideration expectations regarding both the enabling equipment and the generation unit itself.

3. A Black Start Plant is a generating plant that includes one or more Black Start Units. A generating plant with Black Start Units electrically separated at different voltage levels will be considered multiple Black Start Plants.

4. The Transmission Provider, in conjunction with the Transmission Owners, are responsible for developing a coordinated and efficient system restoration plan that identifies all of the locations where Black Start Units are needed. The PJM Manuals shall set forth the criteria and process for selecting or identifying the Black Start Units necessary to commit to providing Black Start Service at the identified locations.. No more than three Black Start Units at a Black Start Plant will be eligible for compensation under this Schedule 6A, unless specifically approved by the Transmission Provider as an exception. No Black Start Unit shall be eligible to recover the costs of providing Black Start Service in PJM unless it agrees to provide such service for a term of commitment established under Paragraph 5 or 6 below.

5. Black Start Units selected to provide Black Start Service in accordance with paragraph 4 and electing to forego any recovery of new or additional Black Start Capital Costs shall commit to provide Black Start Service for an initial term of no less than two years. The term commitment shall continue to extend until the Black Start Unit owner, or the Transmission Owner, with the consent of the Transmission Provider, or the Transmission Provider, with the consent of the Transmission Owner, provides written, one-year advance notice of its intention to terminate the commitment.

6. Black Start Units selected to provide Black Start Service in accordance with paragraph 4 and electing to recover new or additional Black Start Capital Costs shall commit to provide Black Start Service for a term based upon a reasonable estimate of the expected life of the Black Start Unit, as set forth in the CRF Factor Table in paragraph 18. Either the Transmission Provider, with the consent of the Transmission Owner, or the Transmission Owner, with the consent of the Transmission Provider, may terminate the commitment with one year advance notice of its intention to the Black Start Unit owner, but the Transmission Owner shall reimburse the Black Start Unit owner for any amount of unrecovered Fixed Black Start Service Costs over a period not to exceed five years. A Black Start Unit owner may terminate the provision of Black Start Service with one year advance notice (or its commitment period may be involuntarily terminated pursuant to the paragraph 15 below), provided that it foregoes any otherwise existing entitlement to revenues collected pursuant to this Schedule 6A and fully refunds any amount of the Black Start Capital Costs recovered under a FERC-approved rate in excess of the amount that would have been recovered pursuant to paragraph 18 during the same period. At the conclusion of the term of commitment established under this paragraph 6, a Black Start Unit shall commence a new term of commitment under either paragraph 5 or 6, as applicable.

6A. In the event that a Black Start Unit fails to fulfill its commitment established under Paragraph 5 to provide Black Start Service, receipt of any Black Start Service revenues associated with the non-performing Black Start Unit shall cease and, for the period of the unit's non-performance, the Black Start Unit owner shall forfeit the Black Start Service revenues associated with the non-performing Black Start Unit that it received or would have received had the Black Start Unit performed, not to exceed revenues for a maximum of one year.

In the event that a Black Start Unit fails to fulfill its commitment established under Paragraph 6 above, such unit shall forego any otherwise existing entitlement to revenues collected pursuant to this Schedule 6A and fully refund any amount of the Black Start Capital Costs recovered under a FERC-approved rate in excess of the amount that would have been recovered pursuant to paragraph 18 during the same period, but such unit remains eligible to establish a new commitment under paragraph 5 or 6.

Performance Standards and Outage Restrictions

7. Black Start Units must have the capabilities listed below. These capabilities must be demonstrated in accordance with the criteria set forth in the PJM manuals and will remain in effect for the duration of the commitment to provide Black Start Service.

   a. A Black Start Unit must be able to close its output circuit breaker to a dead (de-energized) bus within 90 minutes of a request from the Transmission Owner or the Transmission Provider.

   b. A Black Start Unit must be capable of maintaining frequency and voltage under varying load.

   c. A Black Start Unit must be able to maintain rated output for a period of time identified by each Transmission Owner's system restoration requirements, in conjunction with the Transmission Provider.

8. Each owner of Black Start Units or Black Start Plants must maintain procedures for the start-up of the Black Start Units.

9. If a Black Start Unit is a generating unit with a high operating factor (subject to Transmission Provider concurrence) with the ability to automatically remain operating at reduced levels when disconnected from the grid, this ability must be demonstrated in accordance with the criteria set forth in the PJM manuals.

10. No more than one Black Start Unit at a Black Start Plant may be subject to planned maintenance at any one time. This restriction excludes outages on common plant equipment that may make all units unavailable. A Black Start Unit not currently designated as critical and on the same voltage level may be

substituted for a Black Start Unit that is subject to a planned outage to permit a concurrent planned outage of another critical Black Start Unit at the Black Start Plant to begin. The Black Start Unit used as a substitute must have had a valid annual test within the previous 12 months.

11. Concurrent planned outages at multiple Black Start Plants within a zone may be restricted based on Transmission Owner requirements for Black Start Service availability. Such restrictions must be predefined and approved by Transmission Provider in accordance with the PJM manuals.

Testing

12. To verify that they can be started and operated without being connected to the Transmission System, Black Start Units designated as critical shall be tested annually in accordance with the PJM manuals. The Black Start Unit owner shall determine the time of the annual test.

13. Compensation for energy output delivered to the Transmission System during the annual test shall be provided for the Black Start Unit's minimum run time at the higher of the unit's cost-capped offer or real-time Locational Marginal Price plus start-up and no-load costs for up to two start attempts, if necessary. For Black Start Units that are generating units with a high operating factor (subject to Transmission Provider's concurrence) with the ability to automatically remain operating at reduced levels when disconnected from the grid, an opportunity cost will be provided to compensate the unit for lost revenues during testing.

14. To receive Black Start Service revenues, a Black Start Unit must have a successful annual test on record with the Transmission Provider within the preceding 13 months.

15. If a Black Start Unit fails the annual test, the unit may be re-tested within a ten-day period without financial penalty. If the Black Start Unit does not successfully re-test within that ten-day period, monthly Black Start Service revenues will be forfeited by that unit from the time of the first unsuccessful test until such time as the unit passes an annual test. If the Black Start Unit owner determines not to make the necessary repairs to enable the Black Start Unit to pass the annual test, the Black Start Unit owner will have failed to fulfill its commitment pursuant to paragraph 5 of this Schedule 6A and will be subject to the additional forfeiture of revenues set forth in paragraph 6A

Revenue Requirements

16. The annual Black Start Service revenue requirement shall be the sum of the annual Black Start Service revenue requirements for each generator that is designated as providing Black Start Service and has provided the Transmission Provider with a calculation of its annual Black Start Service revenue requirements. A separate line item shall appear on the participants' Transmission Provider bill for Black Start Service charges and credits.

17. Black Start Service revenue requirements for each Black Start Unit shall be based , at the election of the owner, on either (i) a FERC-approved rate for the recovery of the cost of providing such service for the entire duration of the commitment term set forth in either paragraph 5 or 6, as applicable, or (ii) the formulas set forth in paragraph 18 of this Schedule 6A for the commitment term set forth in paragraph 5 or 6 as applicable. Each generator's Black Start Service revenue requirements shall be an annual calculation. No change to a Black Start Service revenue requirement shall become effective until the existing revenue requirement has been effective for at least twelve months. PJM will presume that any FERC-approved cost recovery plan would be the exclusive basis for the recovery of a Black Start Unit's recovery of its costs during the applicable term.

18. The formula for calculating a generator's annual Black Start Service revenue requirement is:

{(Fixed BSSC) + (Variable BSSC) + (Training Costs) + (Fuel Storage Costs)} * (1 + Z)

For units that have the demonstrated ability to operate at reduced levels when automatically disconnected from the grid, the formula is revised to:

(Training Costs) * (1+ Z)

where:

Fixed BSSC

Black Start Units with commitment established under paragraph 5 shall calculate Fixed BSSC or "Fixed Black Start Service Costs" in accordance the following formula:

CONE * 365 * Black Start Unit capacity * X

Where:

"CONE" is the then current net Cost of New Entry for the CONE Area where the Black Start Unit is located as set forth in Section 5.10 of Attachment DD.

"Black Start Unit Capacity is the Black Start Unit's installed capacity, expressed in MW.

X is the Black Start Service allocation factor unless a higher or lower value is supported by the documentation of the actual costs of providing Black Start Service. For such units qualifying as Black Start Units on the basis of demonstrated ability to operate at reduced levels when automatically disconnected from the grid, X shall be zero. For Black Start Units with a commitment established under paragraph 5, X shall be .01 for Hydro units, 02 for Diesel or CT units. For Black Start Units having recovered new or additional Fixed Black Start Service Costs on an accelerated basis prior to April 21, 2009, X shall instead be .005 for Hydro units and .01 Diesel or CT units.

Black Start Units with commitments established under paragraph 6 above shall calculate Fixed BSSC or "Fixed Black Start Service Costs" in accordance with the following formula:

Black Start Capital Cost * CRF

Where:

"Black Start Capital Costs" is the capital cost approved by the Commission for the incremental equipment solely necessary to enable a unit to provide Black Start Service in addition to whatever other product or services such unit may provide. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to Black Start Units solely on the basis of the provision of Black Start Service by such unit.

"CRF" or "Capital Recovery Factor " is equal to the levelized CRF based on the age of the Black Start Unit, which is modified to provide Black Start Service, as present in the CRF Table:

Age of Black Start Unit	Years of Remaining Life of Black Start Unit	Levelized CRF
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16+	5	0.363

Variable BSSC

All Black Start Units shall calculate Variable BSSC or "Variable Black Start Service Costs" in accordance with the following formula:

Black Start Unit O&M * Y

Where:

"Black Start Unit O&M" are the operations and maintenance costs attributable to supporting Black Start Service and must equal the annual variable O&M outlined in the PJM Cost Development Task Force Manual. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to the Black Start Unit solely on the basis of the provision of Black Start Service by unit.

"Y" is 0.01, unless a higher or lower value is supported by the documentation of costs. If a value of Y is submitted for this cost, a (1-Y) factor must be applied to the Black Start Unit's O&M costs on the unit's cost-based energy schedule, calculated based on the Cost of Element Guidelines in the PJM Manauls.

For units qualifying as Black Start Units on the basis of a demonstrated ability to operate at reduced levels when automatically disconnected from the grid, there are no variable costs associated with providing Black Start Service and the value for Variable BSSC shall be zero.

Training Costs:

All Black Start Units shall calculate Training Costs in accordance with the following formula:

50 staff hours/year/plant*75/hour

Fuel Storage Costs:

Black Start Units that cannot use oil for fuel shall cacluate Fuel Storage Costs or "FSC" as zero. Black Start Units that can use oil for fuel shall calculate Fuel Storage Costs in accordance with the following formula:

{MTSL + [(# Run Hours) * (Fuel Burn Rate)]} *
(12 Month Forward Strip + Basis) * (Bond Rate)Where:

Run Hours are the actual number of hours a Transmission Provider requires a Black Start Unit to run. Run Hours shall be at least 16 hours or as defined by the Transmission Owner restoration plan, whichever is less.

"Fuel Burn Rate" is actual fuel burn rate for the Black Start Unit.

"12-Month Forward Strip" is the average of forward prices for the fuel burned in the Black Start Unit.
"Basis" is the transportation costs from the location referenced in the forward price data to the Black Start Unit plus any variable taxes.
"Bond rate" is the value determined with reference to the Moody's Utility Index for bonds rated Baa1.
"MTSL" is the "minimum tank suction level" and shall apply where no direct current pumps are available for the Black Start Unit.

For units qualifying as Black Start Units on the basis of a demonstrated ability to operate at reduced levels when automatically disconnected from the grid, there are no associated fuel storage costs and the value for FSC shall be zero.

Z

Z shall be an incentive factor for Black Start Units with a commitment established under paragraph 5 above and shall be ten percent.

At least every two years, PJM shall review the formula and its costs components set forth in this paragraph, and report on the results of that review to stakeholders.

19. Transmission Provider or its agent shall have the right to independently audit the accounts and records of each Black Start Unit that is receiving payments for providing Black Start Service.

Credits

20. Monthly credits are provided to generators that submit to the Transmission Provider their annual revenue requirements established pursuant to paragraph 17 of this Schedule 6A. The generator's monthly credit is equal to 1/12 of its annual Black Start Service revenue requirement for eligible critical Black Start Units.

21. Revenue requirements for jointly owned Black Start Units will be allocated to the owners based on ownership percentage.

Attachment B

Tariff Changes

Redline Version

K:\pjm\TARREVS\Schedule 6a tariff changes 2-13-09 (redline).DOC

PJM Interconnection, L.L.C.
FERC Electric Tariff
Sixth Revised Volume No. 1

First Revised Sheet No. 238
Superseding Original Sheet No. 238

SCHEDULE 6A

Black Start Service

To ensure the reliable restoration following a shut down of the PJM transmission system, Black Start Service is necessary to facilitate the goal of complete system restoration. Black Start Service enables Transmission Provider and —Transmission Owners to designate specific generators called Black Start Units whose location and capabilities are required to re-energize the transmission system following a system-wide blackout.

TRANSMISSION CUSTOMERS

1. All Transmission Customers and Network Customers must obtain Black Start Service from the Transmission Provider pursuant to this Schedule 6A.

PROVISION OF BLACK START SERVICE

2. A Black Start Unit is a generating unit that ~~is able~~ has equipment enabling it to start without an outside electrical supply or a generating unit with a high operating factor (subject to Transmission Provider concurrence) with the demonstrated ability to automatically remain operating, at reduced levels, when disconnected from the grid. A Black Start Unit shall be considered capable of providing Black Start Service only when it meets the criteria set forth in the PJM manuals. For the purposes of this Schedule 6A, the expected life of the Black Start Unit shall take into consideration expectations regarding both the enabling equipment and the generation unit itself.

3. A Black Start Plant is a generating plant that includes one or more Black Start Units. A generating plant with Black Start Units electrically separated at different voltage levels will be considered multiple Black Start Plants.

4. The Transmission ~~Owners~~Provider, in conjunction with the Transmission ~~Provider~~Owners, are responsible for developing a coordinated and efficient system restoration plan that identifies all of the locations where Black Start Units are needed. The PJM Manuals shall set forth the criteria and process for selecting or identifying the Black Start Units ~~that are included in each Transmission Owner's system restoration plans and are critical for restoration of the Transmission System. Black Start Units will be identified as critical pursuant to criteria set forth in the PJM manuals~~ necessary to commit to providing Black Start Service at the identified locations.. No more than three Black Start Units at a Black Start Plant will be ~~considered critical and~~ eligible for compensation under this Schedule 6A, unless specifically approved by the Transmission Provider as an exception. ~~The Transmission Provider shall consider such exceptions on a case-by-case basis~~No Black Start Unit shall be eligible to recover the costs of providing Black Start Service in PJM unless it agrees to provide such service for a term of commitment established under Paragraph 5 or 6 below.

Issued By: Craig Glazer
Vice President, Governmental Policy
Issued On: February 19, 2009

Effective: April 21, 2009

5. ~~Owners of Black Start Units initially shall commit to providing Black Start Service for a two year period. Black Start Unit owners and Transmission Owners that identify the Black Start Unit as critical may terminate this two year commitment upon notice given one year before the date the commitment period ends~~ Black Start Units selected to provide Black Start Service in accordance with paragraph 4 and electing to forego any recovery of new or additional Black Start Capital Costs shall commit to provide Black Start Service for an initial term of no less than two years. The term commitment shall continue to extend until the Black Start Unit owner, or the Transmission Owner, with the consent of the Transmission Provider, or the Transmission Provider, with the consent of the Transmission Owner, provides written, one-year advance notice of its intention to terminate the commitment.

6. Black Start Units selected to provide Black Start Service in accordance with paragraph 4 and electing to recover new or additional Black Start Capital Costs shall commit to provide Black Start Service for a term based upon a reasonable estimate of the expected life of the Black Start Unit, as set forth in the CRF Factor Table in paragraph 18. Either the Transmission Provider, with the consent of the Transmission Owner, or the Transmission Owner, with the consent of the Transmission Provider, may terminate the commitment with one year advance notice of its intention to the Black Start Unit owner, but the Transmission Owner shall reimburse the Black Start Unit owner for any amount of unrecovered Fixed Black Start Service Costs over a period not to exceed five years. A Black Start Unit owner may terminate the provision of Black Start Service with one year advance notice (or its commitment period may be involuntarily terminated pursuant to the paragraph 15 below), provided that it foregoes any otherwise existing entitlement to revenues collected pursuant to this Schedule 6A and fully refunds any amount of the Black Start Capital Costs recovered under a FERC-approved rate in excess of the amount that would have been recovered pursuant to paragraph 18 during the same period. At the conclusion of the term of commitment established under this paragraph 6, a Black Start Unit shall commence a new term of commitment under either paragraph 5 or 6, as applicable.

6A. ~~In the event that neither the Black Start Unit owner nor the Transmission Owner exercises its right to terminate by providing a one-year notice of termination, the commitment to provide Black Start Service automatically will be extended for an additional year to maintain a rolling two-year commitment.~~ In the event that a Black Start Unit fails to fulfill its ~~two-year rolling~~ commitment established under Paragraph 5 to provide Black Start Service, receipt of any Black Start Service revenues associated with the non-performing Black Start Unit shall cease and, for the period of the unit's non-performance, the Black Start Unit owner shall forfeit the Black Start Service revenues associated with the non-performing Black Start Unit that it received or would have received had the Black Start Unit performed, not to exceed revenues for a maximum of one year.

In the event that a Black Start Unit fails to fulfill its commitment established under Paragraph 6 above, such unit shall forego any otherwise existing entitlement to revenues collected pursuant to this Schedule 6A and fully refund any amount of the Black Start Capital Costs recovered under a FERC-approved rate in excess of the amount that would have been recovered pursuant to paragraph 18 during the same period, but such unit remains eligible to establish a new commitment under paragraph 5 or 6.

~~6. Transmission Provider may terminate a Black Start Unit's designation as critical by providing two years prior notice of such termination.~~

Performance Standards and Outage Restrictions

7. Black Start Units must have the capabilities listed below. These capabilities must be demonstrated in accordance with the criteria set forth in the PJM manuals and will remain in effect for the duration of the commitment to provide Black Start Service.

   a. A Black Start Unit must be able to close its output circuit breaker to a dead (de-energized) bus within 90 minutes of a request from the Transmission Owner or the Transmission Provider.

   b. A Black Start Unit must be capable of maintaining frequency and voltage under varying load.

   c. A Black Start Unit must be able to maintain rated output for a period of time identified by each Transmission Owner's system restoration requirements, in conjunction with the Transmission Provider.

8. Each owner of Black Start Units or Black Start Plants must maintain procedures for the start-up of the Black Start Units.

9. If a Black Start Unit is a generating unit with a high operating factor (subject to Transmission Provider concurrence) with the ability to automatically remain operating at reduced levels when disconnected from the grid, this ability must be demonstrated in accordance with the criteria set forth in the PJM manuals.

10. No more than one Black Start Unit at a Black Start Plant may be subject to planned maintenance at any one time. This restriction excludes outages on common plant equipment that may make all units unavailable. A Black Start Unit not currently designated as critical and on the same voltage level may be

substituted for a Black Start Unit that is subject to a planned outage to permit a concurrent planned outage of another critical Black Start Unit at the Black Start Plant to begin. The Black Start Unit used as a substitute must have had a valid annual test within the previous 12 months.

11. Concurrent planned outages at multiple Black Start Plants within a zone may be restricted based on Transmission Owner requirements for Black Start Service availability. Such restrictions must be predefined and approved by Transmission Provider in accordance with the PJM manuals.

Testing

12. To verify that they can be started and operated without being connected to the Transmission System, Black Start Units designated as critical shall be tested annually in accordance with the PJM manuals. The Black Start Unit owner shall determine the time of the annual test.

13. Compensation for energy output delivered to the Transmission System during the annual test shall be provided for the Black Start Unit's minimum run time at the higher of the unit's cost-capped offer or real-time Locational Marginal Price plus start-up and no-load costs for up to two start attempts, if necessary. For Black Start Units that are generating units with a high operating factor (subject to Transmission Provider's concurrence) with the ability to automatically remain operating at reduced levels when disconnected from the grid, an opportunity cost will be provided to compensate the unit for lost revenues during testing.

14. To receive Black Start Service revenues, a Black Start Unit must have a successful annual test on record with the Transmission Provider within the preceding 13 months. ~~To receive initial Black Start Service revenues, within six months after the effective date of this Schedule 6A, each critical Black Start Unit must have had a successful annual test within the previous 13 months. In the event a Black Start Unit does not have a successful test at the end of the six month period, the initial six months of revenues from Black Start Service will be forfeited and the unit will be ineligible to receive such revenue until the successful completion of an annual test.~~

15. If a Black Start Unit fails the annual test, the unit may be re-tested within a ten-day period without financial penalty. If the Black Start Unit does not successfully re-test within that ten-day period, monthly Black Start Service revenues will be forfeited by that unit from the time of the first unsuccessful test until such time as the unit passes an annual test. If the Black Start Unit owner determines not to make the necessary repairs to enable the Black Start Unit to pass the annual test, the Black Start Unit owner will have failed to fulfill its ~~two-year~~ commitment pursuant to paragraph 5 of this Schedule 6A and will be subject to the ~~penalties~~ additional forfeiture of revenues set forth in ~~that~~ paragraph ~~5~~6A.

Revenue Requirements

16. The annual Black Start Service revenue requirement shall be the sum of the annual Black Start Service revenue requirements for each generator that is designated as providing Black Start Service and has provided the Transmission Provider with a calculation of its annual Black Start Service revenue requirements. A separate line item shall appear on the participants' Transmission Provider bill for Black Start Service charges and credits.

17. Black Start Service revenue requirements for each Black Start Unit shall be based ~~on the formula~~, at the election of the owner, on either (i) a FERC-approved rate for the recovery of the cost of providing such service for the entire duration of the commitment term set forth in either paragraph 5 or 6, as applicable, or (ii) the formulas set forth in paragraph 18 of this Schedule 6A for the commitment term set forth in paragraph 5 or 6 as applicable. Each generator's Black Start Service revenue requirements shall be an annual calculation. No Cchanges to athe Black Start Service revenue requirements ~~may be made annually, but will become effective in the second year of the generator's commitment to provide Black Start Service~~ shall become effective until the existing revenue requirement has been effective for at least twelve months. PJM will presume that any FERC-approved cost recovery plan would be the exclusive basis for the recovery of a Black Start Unit's recovery of its costs during the applicable term.

18. The formula for calculating a generator's annual Black Start Service revenue requirement is:

~~{(Fixed BSSCBlack Start Service Costs) + (Variable BSSCBlack Start Service Costs) + (Training Costs) + (Fuel Storage Costs & Carrying Costs)} * (1 + Incentive FactorZ)~~

For units that have the demonstrated ability to operate at reduced levels when automatically disconnected from the grid, the formula is revised to:

~~(Training Costs) * (1+ Incentive FactorZ)~~

where:

~~Fixed Black Start Service Costs~~BSSC

Black Start Units with commitment established under paragraph 5 shall calculate Fixed BSSC or "Fixed Black Start Service Costs" in accordance the following formula:

CONE ~~= CDR~~ * 365 * Black Start Unit capacity * X

Where:

"CONE" is the then current net Cost of New Entry for the CONE Area where the Black Start Unit is located as set forth in Section 5.10 of Attachment DD.

~~CDR = PJM Capacity Deficiency Rate on an installed capacity basis~~

"Black Start Unit Capacity =is the Black Start Unit's installed capacity, expressed in MW.

X =is the Black Start Service allocation factor ~~(Hydro = 0.01, Diesel = 0.02, CT = 0.02)~~ unless a higher or lower ~~another~~ value is supported by the documentation of the actual costs of providing Black Start Service. For such units qualifying as Black Start Units on the basis of demonstrated ability to operate at reduced levels when automatically disconnected from the grid, X shall be zero. For Black Start Units with a commitment established under paragraph 5, X shall be .01 for Hydro units, 02 for Diesel or CT units. For Black Start Units having recovered new or additional Fixed Black Start Service Costs on an accelerated basis prior to April 21, 2009, X shall instead be .005 for Hydro units and .01 Diesel or CT units.

Black Start Units with commitments established under paragraph 6 above shall calculate Fixed BSSC or "Fixed Black Start Service Costs" in accordance with the following formula:

Black Start Capital Cost * CRF

Where:

"Black Start Capital Costs" is the capital cost approved by the Commission for the incremental equipment solely necessary to enable a unit to provide Black Start Service in addition to whatever other product or services such unit may provide. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to Black Start Units solely on the basis of the provision of Black Start Service by such unit.

"CRF" or "Capital Recovery Factor " is equal to the levelized CRF based on the age of the Black Start Unit, which is modified to provide Black Start Service, as present in the CRF Table:

Age of Black Start Unit	Years of Remaining Life of Black Start Unit	Levelized CRF
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16+	5	0.363

Variable BSSC ~~lack Start Service Costs = Black Start Unit O&M * Y~~

All Black Start Units shall calculate Variable BSSC or "Variable Black Start Service Costs" in accordance with the following formula:

Black Start Unit O&M * Y

Where:

"Black Start Unit O&M" are the operations and maintenance costs attributable to supporting Black Start Service and must equal the annual variable O&M outlined in the PJM Cost Development Task Force Manual. Such costs shall include those incurred by a Black Start Owner in order to meet NERC Reliability Standards that apply to the Black Start Unit solely on the basis of the provision of Black Start Service by unit.

"Y" is 0.01, unless a higher or lower value is supported by the documentation of costs. If a value of Y is submitted for this cost, a (1-Y) factor must be applied to the Black Start Unit's O&M costs on the unit's cost-based energy schedule, calculated based on the Cost of Element Guidelines in the PJM Manauls.

~~Variable Black Start Service Costs are the variable O & M costs that can be attributed to supporting Black Start Service, to be calculated as follows:~~

~~where: Y = 0.01 unless another value is supported by the documentation of costs~~

~~Note: If a value of Y is submitted for this cost, (1-Y) factor must be applied to the Black Start Unit's O&M costs on the unit's cost-based energy schedule.~~

~~Variable O&M~~ For units qualifying as Black Start Units on the basis of a demonstrated ability to operate at reduced levels when automatically disconnected from the grid, there are no variable costs associated with providing Black Start Service ~~are equal to annual variable O&M as outlined in the Cost Development Task Force PJM manual~~and the value for Variable BSSC shall be zero.

Training Costs: ~~= 50 staff hours/year/plant * $75/hour~~

All Black Start Units shall calculate Training Costs in accordance with the following formula:

50 staff hours/year/plant*75/hour

Fuel Storage Costs:

Black Start Units that cannot use oil for fuel shall cacluate Fuel Storage Costs or "FSC" as zero. Black Start Units that can use oil for fuel shall calculate Fuel Storage Costs in accordance with the following formula: ~~Fuel Storage & Carrying Costs (applicable only to oil-fired units) = (# Run Hours) * (Fuel Burn Rate) * (12 Month Forward Strip + Basis) * (Bond Rate)~~

{MTSL + [(# Run Hours) * (Fuel Burn Rate)]} *
(12 Month Forward Strip + Basis) * (Bond Rate)Where:

Run Hours are the actual number of hours a Transmission Provider requires a Black Start Unit to run. Run Hours shall be at least 16 hours or as defined by the Transmission Owner restoration plan, whichever is less.

~~Note: If no direct current pumps are available for the Black Start Unit, the fuel storage and carrying costs may include a tank minimum suction level.~~

"Fuel ~~b~~Burn ~~r~~Rate" is actual fuel burn rate for the Black Start Unit.

"12-Month Forward Strip" is the average of forward prices for the fuel burned in the Black Start Unit.
~~Black Start Unit.~~

"Basis" is the transportation costs from the location referenced in the forward price data to the Black Start Unit plus any variable taxes
~~data to the Black Start Unit plus any variable taxes.~~
"Bond rate" is the value determined with reference to ~~will be~~ the Moody's Utility Index for bonds rated Baa1.

"MTSL" is the "minimum tank suction level" and shall apply where no direct current pumps are available for the Black Start Unit.

For units qualifying as Black Start Units on the basis of a demonstrated ability to operate at reduced levels when automatically disconnected from the grid, there are no associated fuel storage costs and the value for FSC shall be zero.

~~**Incentive Factor = Z = 10%**~~

~~Where Z~~ shall be ~~is~~ an incentive factor for Black Start Units with a commitment established under paragraph 5 above and shall be ten percent.

At least every two years, PJM shall review the formula and its costs components set forth in this paragraph, and report on the results of that review to stakeholders. ~~initially set to the above level and will be periodically reviewed by Transmission Provider.~~

19. Transmission Provider or its agent shall have the right to independently audit the accounts and records of each Black Start Unit that is receiving payments for providing Black Start Service.

Credits

20. Monthly credits are provided to generators that submit to the Transmission Provider their annual revenue requirements ~~based on the formula in~~ established pursuant to paragraph 187 of this Schedule 6A. The generator's monthly credit is equal to 1/12 of ~~their~~ its annual Black Start Service revenue requirement for eligible critical Black Start Units.

21. Revenue requirements for jointly owned Black Start Units will be allocated to the owners based on ownership percentage.

Document Content(s)

Black Start Education

Black Start Unit Testing, Substitution, Termination Rules, and Capital Recovery Factor (CRF)

Becky Davis

PJM Performance Compliance

PJM Operating Committee Meeting
May 14, 2020

Black Start Definitions

Black Start Unit

A single generator that is able to start without an outside electrical supply, or the demonstrated ability of a base load unit to remain operating, at reduced levels, when automatically disconnected from the grid.

Black Start Plant

A plant that includes a unit that can black start.
A Black Start Plant with Black Start Units at different voltage levels (electrically separated) will be considered multiple Black Start Plants.

Black Start Units

PJM, in collaboration with the Transmission Owners, identify the generating units that are critical for system restoration.

- Transmission Owners develop and review the restoration plan annually.

  Black Start Units Listed in TO Restoration Plans

Black Start Units								
Unit Name	Unit Type	ICAP	Emergency Minimum (Unit Min Stable Load)	Prim.Fuel	Sec. Fuel	Hot Start Time (Hours)	Cold Start Time (Hours)	Ramp Rate (MWs/Minute)

- Black Start Units receiving compensation under Schedule 6A have agreed that the unit should be designated as black start.

Black Start Testing Requirements

Every generating unit that is providing black start capability shall be tested to verify that it can be started and operated without being connected to the PJM power system.

- Scheduled at the discretion of the generator owner; however, prescheduled with PJM prior to testing.
- Completed and submitted black start test report for all testing performed (pass or fail, and requested 14 days following test).
- A successful test is required, on a 13-month rolling basis, for the Black Start Unit to continue receiving black start compensation under Schedule 6A.

Identify all Black Start Units for annual testing.

Black Start Testing Requirements

- Start when requested from "blackout" state
- Close to a dead bus within 3 hours
- Operate at reduced levels when disconnected from the grid
- Maintain frequency and voltage under varying load

SECTION 2 : TEST PERFORMANCE

TEST PERFORMED ON DATE

BLACK START TEST BEGINS TIME

Please notify PJM Dispatch on the day of the actual test, prior to test start.

TIME OF OUTPUT BREAKER CLOSE TIME

The generating unit must have the ability to close the output breaker to a dead bus within 180 minutes.

THE BLACK START TEST DISPLAYED THE ABILITY TO ...	ACTUAL EQUIPMENT TEST SUCCESS	SIMULATED EQUIPMENT TEST SUCCESS	ITEM NOT TESTED	TESTING FAILED
... START WITHOUT POWER				
... CLOSE INTO A DE-ENERGIZED BUS				
... OPERATE AT REDUCED LEVELS WHEN DISCONNECTED FROM THE GRID				
... MAINTAIN FREQUENCY UNDER VARYING LOAD (FOR A PERIOD OF AT LEAST THIRTY MINUTES)				
... MAINTAIN VOLTAGE UNDER VARYING LOAD (FOR A PERIOD OF AT LEAST THIRTY MINUTES)				
... MAINTAIN BLACKSTART RATED OUTPUT FOR DURATION MATCHING LCC RESTORATION REQ				

Please check the appropriate box above for each testing item.

BLACK START TEST ENDED TIME

TEST SUPERVISED BY NAME

Black Start Unit Substitutions

Schedule 6A Black Start Service – Section 10

10. No more than one Black Start Unit at a Black Start Plant may be subject to planned maintenance at any one time. This restriction excludes outages on common plant equipment that may make all units unavailable. A Black Start Unit not currently designated as critical and on the same voltage level may be substituted for a Black Start Unit that is subject to a planned outage to permit a concurrent planned outage of another critical Black Start Unit at the Black Start Plant to begin. The Black Start Unit used as a substitute must have had a valid annual test within the previous 12 months.

Provide additional clarification and guidance for Black Start Unit substitution.

Schedule 6A Black Start Service – Unit Terminations

Initial commitment of at least two years from black start service implementation date.

May terminate with one year's advanced notice if:

- **Black Start Unit owner initiated termination**

  Forego any existing entitlement to revenues collected under Schedule 6A (refund FERC-approved rates)

- **PJM initiated termination**

  Black Start Unit owner eligible to recover any amount of unrecovered fixed black start service costs over a period < 5 years

Additional termination rules to address potential delays for units without a black start test on file for an extended period.

Schedule 6A Black Start Service – Capital Recovery Factor

Black Start Units may recover new or additional black start capital costs for a term based on the age of the Black Start Unit.

Capital Recovery Factor (CRF) Table

Age of Black Start Unit	Term of Black Start Commitment	Levelized CRF
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16+	5	0.363

Capital recovery factor (CRF) based on a levelized pro forma for a 100 MW combustion turbine for $1 M.

Capital Recovery Factor Components

9%
State tax rate

50%
Equity

and

50%
Debt

12%
Internal rate of return on equity

Federal tax rate

36%
Current

~21%
Proposed

Current federal corporate tax rate 21%

Income tax rate

41%
Current

~28%
Proposed

Based on current federal corporate and state tax rates

Interest Rate

7%
Current

~3.5%
Proposed

Based on current bond rate

New/Revised Tax Laws

Bonus depreciation

Appendix

Appendix

References:

- PJM OATT Schedule 6A Black Start Service
- PJM M-12 Balancing Operation; Section 4
- PJM M-10 Pre-Scheduling Operations; Section 2
- PJM M-14D Generation Operational Requirements; Section 10
- PJM M-27 Open Access Transmission Tariff Accounting; S-7
- PJM M-36 System Restoration; Sections 6 & 8

Appendix

Black Start Testing Form:

https://www.pjm.com/-/media/markets-ops/ancillary/black-start-test-report-forms.ashx?la=en

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. ER21-1635-000

COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 211 of the Commission's Rules and Regulations,[1] Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor ("Market Monitor") for PJM Interconnection, L.L.C. ("PJM"),[2] submits these comments responding to the filing submitted by PJM Interconnection, L.L.C. ("PJM") on April 7, 2021 ("April 7th Filing"). The revisions proposed to Schedule 6A of the OATT are the most significant feature of the April 7th Filing. The proposed revisions provide for annual updates to the Capital Recovery Factor ("CRF") component of black start payments for new black start units that require new or additional capital investment. The April 7th Filing proposed revisions would apply correct CRF values to new black start units and would apply incorrect CRF values to existing black start units. Existing black start units would continue to be paid under the CRF values currently included in the tariff, even though those values are known to be incorrect. Nothing justifies the resultant continuing windfall to existing black start units. No basis exists for creating a discriminatory preference for existing units.

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1 18 CFR § 385.211 (2020).

2 Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff ("OATT"), the PJM Operating Agreement ("OA") or the PJM Reliability Assurance Agreement ("RAA").

Schedule 6A should be revised to replace the inaccurate CRF values now included in Schedule 6A and the proposed formula for calculating CRF values should be added to the tariff.

The April 7th Filing removes the inaccurate CRF values and replaces the values with a description of the components of the CRF calculation. The April 7th Filing does not correct the flawed implementation of the CRF formula to existing black start units. The April 7th Filing instead requests validation of the incorrect implementation to date and extend that incorrect implementation for all existing black start units for each unit's entire recovery period.

The CRF values became inaccurate effective January 1, 2018, when amendments to the U.S. Internal Revenue Code became effective, reducing the federal corporate income tax rate from a maximum 35 percent to 21 percent and changing the tax depreciation provisions.[3] The federal tax rate and depreciation provisions are inputs to the CRF formula and the combination significantly reduced tax obligations and therefore significantly reduced the CRF values.

The result was that, after that date, the revenue requirements paid to black start units included payments for taxes that the unit owners did not actually pay.

Commission precedent related to the failure to correct tariff rates when tax laws change is clear. In addition, there is no reason to allow a discriminatory preference to existing units relative to new units providing the same service under formula rates. The April 7th Filing should not be accepted without requiring changes to expand the scope to apply to all black start units. The correct CRF values should be applied to all black start units effective with the change in the tax rates on January 21, 2018. The CRF equation should be included in Schedule 6A and not in the PJM manuals. The correct value of each input to the formula should be included in the PJM manuals.

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[3] Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2054 (2017).

The April 7th Filing includes a number of other changes that the Market Monitor supports as just and reasonable, including a change to use the life of black start equipment as the basis for the commitment period, and a change to the calculation of the Minimum Tank Suction Level ("MTSL") to include only the volume of fuel used to provide black start service. The changes are improvements to the existing rules. A commitment period based on the life of the black start equipment should be applied to new or additional investments going forward, without unjustified and discriminatory consideration of whether the unit entered service before or after June 6, 2021.

I. COMMENTS

A. Background

1. Black Start Service Is Compensated Under a Formula Rate

Black Start Units are paid under a formula rate set forth in Paragraph 18 of Schedule 6 to the OATT. Black Start Unit owners have the option to receive compensation for black start service under one of the formula rates included in Paragraph 18 or owners can file a cost of service rate with the Commission.[4] A "formula rate," the Commission has explained, is "the formula itself, the algebraic equation used to calculate the rates."[5] In approving a formula, the Commission has explained, "It does not approve the inputs into the formula or the charges resulting from the application of the inputs to the algebraic equation."[6] The formula rate is the filed rate, and should be established and revised in a Section 205 filing.[7]

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4 *See PJM Interconnection, L.L.C.*, 127 FERC ¶ 61,197 at PP 4, 9 (2009).

5 *See PJM Interconnection, L.L.C.*, 166 FERC ¶ 61,216 at P 49 (2019).

6 *Id*.

7 *See PJM Interconnection, L.L.C.*, 110 FERC ¶ 61,053 at P 120 (2005) ("[T]he formula alone constitutes the filed rate. The Commission's acceptance of a formula rate authorizes the utility to use the formula rate on an ongoing basis. Further, section 205 filings are unnecessary as long as the utility continues to apply the formula that was accepted").

The input values and the values resulting from the application of the formula are not the filed rate, and are not established or revised by filing.[8] The input values must be determined and applied in accordance with the formula. If the input values are subsequently determined to be inaccurately determined or applied, then the calculation must be performed correctly and the billing must be corrected.[9] Retroactive billing is not prohibited. On the contrary, retroactive billing is required under the filed rate doctrine.[10] The correct result of the formula must be applied.[11]

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8 *See, e.g., id.* at P 120 n.105 (2005) ("[T]he costs used in applying the formula rate are not part of the rate and have not been reviewed. These costs may be challenged by customers and other entities. (*Appalachian Power Company*, 23 FERC ¶ 61,032 at 61,088 (1983) (Commission not precluded from examining the reasonableness of fuel costs automatically collected under a formula rate). If the costs are shown to be unjust and unreasonable, the Commission may require retroactive relief. (*Golden Spread Electric Cooperative, Inc. v. Southwestern Public Service Company*, 72 FERC P 61,142 at 61,727 n.9; *Public Service Company of New Hampshire*, 6 FERC ¶ 61,299 at 61,710 (1979) (fuel adjustment costs challenged and refunds required of the extra costs of spot coal).")

9 *See, e.g., Ameren Ill. Co.*, 162 FERC ¶ 61,025 at P 26 (2018) ("The Commission's acceptance of a formula rate constitutes acceptance of the formula, but not the inputs to the formula. Parties can challenge the inputs to the formula rate in the same way as they can challenge costs in a stated rate case, including by raising prudence issues. In order for formula rates to work properly, they must allow for after-the-fact corrections and updates. While parties should use due diligence to ensure that correct data is used, should an error be discovered, the inputs to the formula rate must be corrected and the formula rate re-calculated to prevent parties from being overcharged or undercharged."); *Kan. Elec. Power Coop. v. Evergy Kan. Cent.*, 175 FERC ¶ 61,044 (2021) ("longstanding precedent allows participants to challenge formula rate inputs or implementation errors whenever the participants discover them," citing , *e.g., Delmarva*, 145 FERC ¶ 61,055 at P 23; *Entergy Services*, 145 FERC ¶ 61,049 at P 10; *Pioneer Transmission*, 126 FERC ¶ 61,281 at nn.100–101; *PSEG*, 124 FERC ¶ 61,303 at nn.17-18 (citations omitted); *Quest Energy, L.L.C. v. Detroit Edison Co.*, 106 FERC ¶ 61,227, at ¶ 21 (2004); *Yankee Atomic Elec. Co.*, 60 FERC ¶ 61,316 at 62,094, 62,096–97 (1992) (noting the Commission's authority to order refunds of imprudent costs charged to customers through formula rates in prior periods).

10 *See, e.g.*, 110 FERC ¶ 61,053 at P 120.

11 *Id*.

In contrast, a traditional cost of service rate, or stated rate, specifies the value and does not necessarily indicate the supporting rationale.[12] The stated rate must be applied.

a. Capital Recovery Factor (CRF) Values

The capital recovery factor (CRF) is a key component used in the formulas for determining the annual black start service revenue requirements for owners recovering capital investment.[13] The CRF is a rate, multiplied by the relevant investment, which defines the annual payment needed to provide a return on and of capital for the investment over a defined time period. CRFs include as inputs the weighted average cost of capital and its components, including the rate of return on equity and the interest rate on debt and the capital structure, in addition to depreciation and taxes. For example, a five year CRF will allow the recovery of the relevant depreciation plus a return over five years. The revenue requirement defined by the CRF is only part of the total annual revenue requirement which may also include O&M costs and other costs.

The April 7th Filing mispresents the values in the CRF table as "'black box' numbers."[14] The basis for the CRF was clear when the CRF values were calculated in 2007 and the basis has been explained repeatedly in the PJM stakeholder process. Paragraph 18 of Schedule 6A requires PJM to review the black start service formula and its costs components every five years and to report on the results of that review to stakeholders. PJM presented its report to the PJM Members Committee on October 10, 2019, but that report failed to address the change in federal tax rates.[15] The Market Monitor explained the

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[12] Stated rates are routinely established under black box settlement agreements that explicitly lack any cost based rationale and are accepted only because they are agreed to.

[13] The CRF is also used in the OATT to calculate the avoidable cost rate (ACR) used in the calculation of cost offers in the PJM Reliability Pricing Model (RPM).

[14] *See* April 7th Filing at 12.

[15] *See* PJM Operation Analysis & Compliance Department, Review of Black Start Formula and Cost Components (October, 2019) at 8 ("The CRF table has several different assumptions such as: the Capital Recovery Factor based on a levelized proforma for a 100MW Combustion Turbine for $1M,

basis for CRF values to the PJM Operating Committee on August 6 and September 3, 2020.[16] The values in the CRF table in Paragraph 18 are not black box values. The Commission uses the term black box to describe settlements that do not resolve issues on principle or approve specific calculation methods.[17] The values in the CRF table were calculated by the Market Monitor including exactly the components of CRF identified in the revisions to Paragraph 18 in the April 7th Filing.[18] The proposed revised language for Paragraph 18 in the April 7th Filing makes reference to a standard formula to be included in the PJM manuals.[19] The CRF

2.5 percent inflation, 36 percent federal tax rate, 9 percent state tax rate, income tax rate 41 percent, 50 percent equity and 50 percent debt with a 7 percent interest rate, and a 12percent internal rate of return on equity."), which can be accessed at: <*https://www.pjm.com/-/media/committees-groups/committees/mc/20191030-webinar/20191030-item-05-review-of-black-start-formula-and-cost-components.ashx*> ("PJM 2019 Black Start Formula Review").

16 *See* "Black Start Issues," presented by Market Monitor at the August 6 and September 3, 2020, PJM Operating Committee Meetings, and revised on September 9, 2020. The presentations can be found at:< *https://www.monitoringanalytics.com/reports/Presentations/2020.shtml*> .

17 *See, e.g., Texas Gas Transmission Corporation*, 53 FERC ¶ 61,022 at 61088 (1990) ("Article V of the settlement, as stated above, recognizes that neither Texas Gas, its customers, the Commission, the Commission's staff, nor any other person shall be deemed to have approved, accepted, agreed, or consented to any ratemaking principle or any method of cost-of-service determination, cost allocation or rate design underlying or supposed to underlie any of the rates or refunds provided for in the settlement. This is the essence of a so-called 'black box' settlement. The Commission recognizes that there is no underlying agreement as to the appropriate level of any individual cost categories and there are no 'working papers' showing any agreed upon allocation of costs among the various cost-of-service components, as Western Kentucky seeks to clarify.").

18 *See* April 7th Filing, Attachment C (Marked), provided OATT Schedule 6A para 18:

> The CRF shall consist of the following components: (i) capital structure and cost of capital; (ii) federal income tax and depreciation rates as utilized by the U.S. Internal Revenue Service; (iii) average state tax rate, and (iv) debt interest rates, all as determined in accordance with Manual 15. The CRF shall be updated annually in accordance with the procedures in Manual 15 for (i) federal income tax rates as utilized by the U.S. Internal Revenue Service in effect at the time of the annual CRF update; (ii) average state tax rate; and (iii) debt interest rates. The CRF capital structure and cost of capital include the following rate components: [i] A capital structure debt/equity ratio of 50 percent debt and 50 percent equity; and [ii] An after-tax internal rate of return on equity of 12 percent.

19 *See* April 7th Filing, Attachment C (Marked), provided OATT Schedule 6A para 18.

calculation has been explained in the PJM stakeholder process, and additional information was and is available to any participant inquiring about it, including during the annual review of black start formula rates. Neither the CRF calculation nor the values in the CRF table were disputed.

Contrary to the position PJM now adopts, PJM's report in 2019 specified the inputs, and the value of the inputs, to the CRF calculation. This further demonstrates that the values included in the CRF table reflect the underlying CRF calculation based on specific inputs and do not themselves constitute the filed rate that PJM is required to apply. PJM also explained in its 2019 report that it would accept values different from the CRF values included in the tables if black start service unit owners could justify a different CRF value based on the CRF formula components.[20] This also demonstrates that the CRF values are calculated based on specific inputs and are not a black box. PJM could not have taken the position that it was acceptable to using alternative CRF values if the CRF values in the table constituted black box or stated values.

Table 1 shows the CRF values for black start units currently included in Paragraph 18 of Schedule 6A to the OATT.

Table 1 Existing CRF table for black start units

Age of Black Start Unit (Years)	Term of Black Start Unit Commitment (Years)	Levelized CRF
1 to 5	20	0.125
6 to 10	15	0.146
11 to 15	10	0.198
16+	5	0.363

[20] PJM 2019 Black Start Formula Review at 8 ("Optionally, a Black Start unit owner may elect to apply an alternative Capital Recovery Factor (CRF), in lieu of the age-based CRF table listed on page 7, which is based upon the expected capital Improvement Lifespan of the new or additional capital improvements (as determined by the applicable depreciation period of the capital improvement, as published from time to time by the US Internal Revenue Service).").

b. Changes Affecting CRF Values

The existing CRF values in Table 1 were made obsolete as of January 1, 2018, when amendments to the federal tax code became effective, reducing the federal corporate income tax rates from 35 percent to 21 percent and making the depreciation provisions more beneficial.[21] PJM failed to update the CRF values at that time.

The Commission recognized and addressed the same issue in another context. In 2018, the Commission issued an Order to Show Cause concerning the impacts of federal tax laws on transmission rates.[22]

The Commission explained:

> 2. On December 22, 2017, the Tax Cuts and Jobs Act of 2017 (Tax Cuts and Jobs Act)[n3: Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2054 (2017).] was signed into law. The Tax Cuts and Jobs Act, among other things, lowered the federal corporate income tax rate from a maximum 35 percent to a flat 21 percent rate, effective January 1, 2018. This means that, beginning January 1, 2018, companies, including those subject to the Commission's jurisdiction, will compute income taxes owed to the Internal Revenue Service based on a 21 percent tax rate. This tax rate reduction will result in lower income tax expense going forward and a reduction in accumulated deferred income taxes on the books of rate-regulated companies.[footnote omitted]
>
> 3. The recovery of federal corporate income taxes is reflected in transmission rates. When tax expense decreases, so does the cost of service. The Commission must ensure that the rates, terms, and conditions of jurisdictional services under the FPA are just, reasonable, and not unduly discriminatory or preferential.[n5: 16 U.S.C. §§ 824d-e (2012).] It has been the Commission's policy to allow transmission rates to be established through, among other things, formulas. Regarding formula rates, the Commission has stated that "the formula itself is the rate, not the particular components of the formula."[footnote omitted] Thus, periodic adjustments, which are typically performed on an annual basis,

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21 Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2054 (2017).

22 Alcoa Power Generating Inc.—Long Sault Division, et al., 162 FERC ¶ 61,224 (2018) (*Alcoa Power*).

> "made in accordance with the Commission-approved formula do not constitute changes to the rate itself and accordingly do not require section 205 [of the FPA][footnote omitted] filings."[footnote omitted]
>
> 4. Formula rates include the federal income tax rate as either a fixed line item or an input that is adjusted annually. For formula rates with inputs that are adjusted annually, the current 21 percent federal corporate income tax rate will be reflected in a transmission revenue requirement without requiring a revision to the formula rate. However, for those formula rates where the federal corporate income tax rate is a fixed line item, absent a revision to the formula rate, the current 21 percent federal corporate income tax rate would, to the detriment of customers, not be reflected in a transmission revenue requirement.

The same tax law changes identified by the Commission in this 2018 case affect the correct calculation of CRF values and the Commission's reasoning applies directly to the CRF issue.

c. PJM's Letters to New Service Providers Are Not Contracts and Do Not Change the Formula Rate.

Paragraph 18 in Schedule 6A include several variants of a formula rate for compensation for black start service. The formula rates apply to multiple scenarios. None of the formula rates included in Paragraph 18 apply to the recovery of investment in new equipment to enable the provision of black start service.

PJM determined that it needed black start service in locations where new investment in existing units would be required so that the unit could provide black start service. PJM did not file to revise Paragraph 18 to provide a formula rate specifically applicable to this scenario. Instead, PJM drafted letters to black start service providers making new investments in units that PJM represented as how PJM intended to interpret and apply the formulas in Paragraph 18 to investment in new black start service capability.

The Market Monitor includes the text of one such recent letter as Attachment A, with identifying information removed.[23] The letter states: "the purpose of this correspondence is to memorialize the terms associated with providing [COMPANY] the opportunity to recover new or additional Black Start Capital Costs as set forth in paragraph 6 of Schedule 6A of the Tariff." The letter is substantively similar to other letters from PJM to new black start service unit owners.

The letters constitute unilateral communications by PJM. These letters are not contracts, and PJM is not bound to interpret and apply the tariff as indicated in the letters. PJM did not and could not agree to make any payment not provided for under Schedule 6A, which included the filed formula rate and the review process for the components included in the formula rate. PJM is required to apply the filed rate, in this case, a formula rate.

The letters are not contracts. PJM's signing the letter is not the equivalent to its executing a contract. The letters contain no terms or conditions that typically would be included in contracts. The letters were not filed with the Commission, as would be required for contracts for jurisdictional service.[24] The letters make explicit reference to "paragraph 6 of Schedule 6A of the Tariff," the paragraph allowing for recovery under formula rates, and do not purport to be self standing.

The letters refer to the CRF, stating:

> As [COMPANY] is electing to recover Black Start Capital Costs in a manner consistent with the approach specified in Paragraph 6 of Schedule 6A of the Tariff, the Fixed Black Start Service Costs for each Black Start Unit shall be the product of (i) the Incremental Black Start Capital Cost for such Black Start Unit and (ii) the

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[23] The Market Monitor has taken this approach, out an abundance of caution, in order to protect confidential Member information and to efficiently address what are essentially form letters to multiple unit owners. The Market Monitor can provide copies of the letters to the Commission upon request.

[24] *See* 16 U.S.C § 824d(c).

> applicable Capital Recovery Factor ("CRF") as set forth in the Capital Recovery Factor table in Schedule 6A of the Tariff (the "CRF Table"). For the purposes of [] CT2 and [] CT4, PJM has determined that the appropriate CRF and recovery period will be five (5) years, and that the applicable CRF for the purposes of the Project will be 0.363.[25]

PJM was not authorized to make a final determination on rates at the time it sent the letters. PJM's letters preceded, by as much as two years, the Market Monitor's review of the cost inputs for new black start units under Paragraph 17B of Schedule 6A. Under that process, the Market Monitor reviews the actual capital costs once incurred, based on invoices, attempts to come to an agreement with the black start service unit owner about the appropriate level of capital costs. After receiving notice of the Market Monitor's position, PJM makes its determination on the total revenue requirement.

The Market Monitor raised the issue of incorrect CRF values with PJM as part of the review of specific black start units in 2020. PJM approved three owners' revenue requirement calculations despite the Market Monitor's explicit objection to the CRF rate used. PJM is authorized to make a determination after the Market Monitor's review is complete.[26] PJM was not bound by the level of payments estimated in its letters and there is no evidence that PJM agreed to the level of payment in the letters. There is no evidence that any unit owner disputed PJM's final revenue requirement decisions because they differed from the preliminary estimates included in the letters.

Black start service unit owners cannot claim reasonable reliance on estimates included in the letters. PJM could not and did not predetermine the results of the review process under Section 17B of Schedule 6A.

In addition, the argument for reliance ignores the nature of the specific component of the CRF formula affected by the tax law changes. The CRF formula includes an incentive

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25 *See* Attachment A.

26 *See* OATT Schedule 6A para. 17B.

component accounting for a just and reasonable rate of return. The changes to the tax laws had no effect on the incentive component. The tax law changes affected only the cost-based tax component of the CRF formula. The adjustment recommended by the Market Monitor would ensure that customers are not required to compensate black start resources for costs that are not actually paid by black start resources. An adjustment to the level of CRF values is required for the same reason that the Commission required an adjustment to transmission rates in *Alcoa Power*.

2. The Inaccurate Values in the CRF Table Have Had and Will Continue to Have Significant Impacts.

Since as early as October 2019, the Market Monitor has raised the issue of incorrect CRF values included in the tariff with PJM. PJM has sole authority to implement the tariff and should implement the filed rate, including formula rates, without delay.[27] The Market Monitor urged PJM to correctly implement the black start formula rate and to apply corrected CRF values based on the changes to corporate tax rates effective January 1, 2018, and the Commission's determination in *Alcoa Power*. Because such changes involve the correct application of the formula rate, PJM had and has the authority to implement the changes immediately and was not required to initiate any stakeholder process or to submit a Section 205 filing. The Market Monitor encouraged PJM to take action to correct the CRF as quickly as possible.

PJM took no action to correct the inaccurate payments and charges that resulted from and continue to result from the use of inaccurate CRF values. PJM instead took up the matter in the stakeholder process. Even though the need to correct the CRF values was clear in fact and law, the PJM Members Committee produced no affirmative recommendation.[28]

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[27] *See* OATT § 12A; 18 CFR § 35.28(g)(3)(iii)(A).

[28] April 7th Filing at 2.

The April 7th Filing includes proposed revisions developed by PJM and filed under Section 205 of the Federal Power Act (at 1–2). The April 7th Filing clarifies and makes explicit the CRF component of the formula rate for future black start service units. The April 7th Filing makes no corrective actions concerning the inaccurate implementation of the formula rate since January 1, 2018. The April 7th Filing instead proposes to exclude existing black start service units from corrective action. Accepting the April 7th Filing without condition would make PJM's failure to take corrective action permanent and would extend that failure into the future indefinitely for all existing black start units with revenues based on CRF values.

Without further delay, PJM should correct, or be directed to correct, its implementation of the Schedule 6A formula rate and inaccurate billing since January 1, 2018, regardless of when or whether the revisions proposed in the April 7th Filing become effective.

B. The Formula Rate Should Apply Accurate CRF Values for All Black Start Units.

The April 7th Filing eliminates the table of CRF values that are subject to change when the inputs change. The April 7th Filing identifies the components of the formula in Paragraph 18, but does not include the formula.[29]

The April 7th Filing is prospective only. The April 7th Filing does not change PJM's obligation to apply the correct filed formula rate since January 1, 2018. The April 7th Filing proposes to continue paying owners of existing black start units for the entire remaining CRF payment period for each unit based on known incorrect CRF values.

It is unjust and unreasonable to apply the black start service formula rate using the CRF values known to be inaccurate. PJM has not supported this approach. There is no justification for providing owners of existing black start service units a windfall at the

[29] *See* April 7th Filing, Attachment C (Marked), provided OATT Schedule 6A para 18.

expense of PJM customers. Applying inaccurate values contradicts the precedent set in *Alcoa Power*.[30] The same corrected formula should apply to owners of both new and existing owner units.

C. The Commitment Period Based on the Life of the Black Start Equipment Should Apply to All Units.

The April 7th Filing states (at 8–9):

> PJM proposes to revise Schedule 6A, section 6 to streamline the commitment period and termination provisions for the Black Start Service commitment by Black Start Units electing to recover new or additional Black Start Capital Costs. The commitment period for these units will now be the life of the Black Start equipment.

The Market Monitor supports the revisions changing the commitment period based on the life of the black start equipment. The proposed revisions, however, do not apply the new commitment period rules to all new investments in black start resources. The proposed revisions continue to apply the current commitment period to new investments at units that existed prior to June 6, 2021.

The proposed revisions state:

> Owners of Black Start Units selected to provide Black Start Service prior to June 6, 2021, in accordance with section 4 of this Schedule 6A and electing to recover new or additional Black Start Capital Costs shall commit to provide Black Start Service from such Black Start Units for a term based upon the age of the Black Start Unit or the longest expected life of the Incremental Black Start Capital Cost, as set forth in the applicable CRF Table.[31]

The commitment rules governing new investments should be the same regardless of whether the black start unit was selected before or after June 6, 2021. Nothing justifies applying different commitment periods to new investments at black start units based on an

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30 162 FERC ¶ 61,224.

31 *See* April 7th Filing, Attachment C (Marked Sheet), proposed revised OATT Schedule 6A para. 6.

arbitrary date of June 6, 2021. This unduly discriminatory feature of the proposed revisions in the April 7th Filing should be rejected.

D. Recommended Approach

The Market Monitor has calculated the correct CRF values for existing and new black start units. The Market Monitor also provides the formula that can be used in the tariff to calculate correct CRF values as the various input values change.

PJM should be directed to include the formula, with input definitions, in the tariff.

Correctly calculated CRF values are different for black start resources added under the prior tax provisions and black start resources added under the new tax provisions. Black start resources added after January 1, 2018, pay taxes based on both the identified 21 percent corporate tax rate and the depreciation provisions that apply to new investment. Table 2 includes the CRF values reflecting those inputs.

Table 2 Updated CRF table for black start units: Tax rate and depreciation changes

Age of Black Start Unit (Years)	Black Start Cost Recovery Period (Years)	Updated Levelized CRF
1 to 5	20	0.101
6 to 10	15	0.116
11 to 15	10	0.147
16+	5	0.246

Black start resources added prior to January 1, 2018, pay taxes based on the identified 21 percent corporate tax rate and on the depreciation provisions in effect at the time of that investment. Table 3 includes the CRF values reflecting those inputs.

Table 3 Updated CRF table for black start units: Tax rate changes only

Age of Black Start Unit (Years)	Black Start Cost Recovery Period (Years)	Updated Levelized CRF
1 to 5	20	0.115
6 to 10	15	0.132
11 to 15	10	0.175
16+	5	0.308

While the CRF values can be calculated using a standard financial model, that model can also be reduced to a formula which produces exactly the same results. The formula uses identified inputs to calculate the correct CRF values based on those input values.

A general formula for calculating CRF values is:[32] [33]

$$\mathrm{CRF} = \frac{r(1+r)^N \left[1 - \frac{sB}{\sqrt{1+r}} - s(1-B)\sqrt{1+r}\sum_{j=1}^{L}\frac{m_j}{(1+r)^j}\right]}{(1-s)\sqrt{1+r}\,[(1+r)^N - 1]}$$

The inputs are listed in Table 4.

Table 4 Variable descriptions for the CRF formula

Formula Symbol	Description
r	After tax Weighted Average Cost of Capital (ATWACC)
s	Effective Tax Rate
B	Bonus Depreciation Percent
N	Cost Recovery Period (years)
L	Lesser of N or 16 (years)
m_j	Modified Accelerated Cost Recovery System (MACRS) depreciation factor for year j = 1, …, 16

The CRF values in Table 2 can be replicated using the formula with the input values in Table 5 and 100 percent bonus depreciation (B = 100 percent). Bonus depreciation at 100 percent is applicable for 2022 but for each year after 2022, the applicable bonus depreciation is reduced by 20.0 percent. In 2023 and after the 15 year MACRS depreciation factors will be applicable.[34]

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[32] The formula is derived from a CRF formula typically found in engineering economics textbooks. For example, "Economic Evaluation and Investment Decision Methods," Stermole, F.J. and Stermole, J.M. (1993).

[33] The CRF formula is based on the MMU MOPR valuation model and assumes mid year levelized payments.

[34] See 15 year MACRS with half year convention in Appendix A, Table A-1, IRS Publication 946, United States Department of Treasury (2020).

Table 5 Parameter values[35] [36]

Model Parameter	Parameter Value
Equity Funding Percent	45.000%
Debt Funding Percent	55.000%
Equity Rate	13.000%
Debt Interest Rate	6.000%
Federal Tax Rate	21.000%
State Tax Rate	9.300%
After tax Weighted Average Cost of Capital (ATWACC)	8.215%
Effective Tax Rate	28.347%

The CRF values previously provided by the Market Monitor have been revised slightly based on lessons learned during the MOPR review process. The prior CRF values incorporated a mortgage style term loan structure. The proposed CRF values are fully consistent with the financial model used by the Market Monitor and PJM to calculate MOPR Gross CONE values.[37]

Continued use of the incorrect CRF values for existing black start resources will cause customers to overpay by more than $96 million over the full CRF life of these resources.

The overpayment was calculated separately for each unit, applying the correct CRF for units with investments made prior to the new tax laws and for units with investments made after the new tax laws.

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35 Effective Tax Rate $= 9.3\% + 21.0\% \cdot (1 - 9.3\%)$. State tax rate plus federal tax rate.

36 $\text{ATWACC} = 45.0\% \cdot 21.0\% + 55.0\% \cdot 6.0\% \cdot (1 - 28.347\%)$.

37 The MOPR model is publicly available at <https://www.monitoringanalytics.com/tools/docs/IMM_MOPR_Gross_CONE_Template_v1.xlsx>.

Table 6 Lifetime difference in payments to black start units with updated CRF

Years	Existing Annual Revenue Requirement Total	Updated Annual Revenue Requirement Total	Difference Per Year Total	Updated Lifetime Difference Total
Pre 2017 units	$53,402,977	$46,637,692	$6,765,285	$38,078,930
Post 2017 Units	$28,217,475	$19,902,490	$8,314,985	$58,811,154
Total	$81,620,451	$66,540,182	$15,080,269	$96,890,084

E. Other Changes are Just and Reasonable

PJM proposes a number of other revisions to Schedule 6A, including:

- Allowing for the termination the service commitment for specified reasons;
- Coordinating planned outages and substitutions in (Schedule 6A §§ 7–11);
- Conditioning payment on testing within the preceding 13 months (Schedule 6A §§ 12–14);
- Terminating service and forfeiting revenues for black start units failing to obtain a successful test for an extended period of time (Schedule 6A § 15);
- Clarifying that the Minimum Tank Suction Level ("MTSL") calculation must reflect only the incremental volume of fuel necessary to provide black start service by calculating the Black Start Energy Tank Ratio of MTSL (Schedule 6A § 18).

These proposed revisions should be accepted as just and reasonable because they operate either to ensure PJM and its customers receives the black start service for which they pay and on which they rely to ensure appropriate allocation of incremental black start service costs.

II. CONCLUSION

The Market Monitor respectfully requests that the Commission afford due consideration to these comments as it resolves the issues raised in this proceeding.

Respectfully submitted,

Jeffrey W. Mayes

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Dated: April 28, 2021

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania,
this 28th day of April, 2021.

Jeffrey W. Mayes
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Attachment A

Re: [COMPANY]–[UNIT] Black Start RFP Proposal Acceptance

Mr. [CONTACT]:

This letter supersedes the [DATE] Black Start RFP Proposal Acceptance letter to [COMPANY] for [UNIT] Facility's General Electric 7-FA Combustion Turbines located in [LOCATION] ("[] CTs"), [] CT2 and [] CT4 to add [] CT1 and [] CT3 as Black Start capable. This letter also contains the response to [COMPANY] Black Start Proposal submittal to PJM Interconnection, L.L.C. ("PJM") dated [DATE], regarding the PJM RTO Wide Five Year Selection Process Request for Proposal dated [DATE] ("RFP") seeking submissions for replacement black start capability in all PJM transmission zones. [COMPANY] proposed black start project capital expenditures estimated in the amount of $[INVESTMENT] at the [UNITS] ("[]Costs"), which were deemed necessary by [COMPANY] to enable []CT2 and []CT4 to be upgraded to Black Start Units[38] and for []CT1 and []CT3 to be made Black Start capable.

PJM is hereby providing notification that [COMPANY]'s proposal has been accepted for [] CT2 and [] CT4 at the [] Facility to provide black start service. Moreover, [] CT1 and [] CT3 are accepted to be Black Start capable. The proposed [] Project Costs have been reviewed and the purpose of this correspondence is to memorialize the terms associated with providing [COMPANY] the opportunity to recover new or additional Black Start Capital Costs as set forth in paragraph 6 of Schedule 6A of the Tariff.[39] At this time, PJM expects [] CT2 and [] CT4 to provide Black Start Service as of [DATE].

Recovery of [] Project Costs will occur in accordance with the Black Start Service revenue requirement formula set forth in Paragraph 18 of Schedule 6A of the Tariff. As [COMPANY] is electing to recover Black Start Capital Costs in a manner consistent with the approach specified in Paragraph 6 of Schedule 6A of the Tariff, the Fixed Black Start Service Costs for each Black Start Unit shall be the product of (i) the Incremental Black Start Capital Cost for such Black Start Unit and (ii) the applicable Capital Recovery Factor ("CRF") as set forth in the Capital Recovery Factor table in Schedule 6A of the Tariff (the "CRF Table"). For the purposes of [] CT2 and [] CT4, PJM has determined that the appropriate CRF and

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[38] Capitalized terms not otherwise defined herein shall have the meaning ascribed to them as set forth in PJM's Open Access Transmission Tariff, the Amended and Restated Operating Agreement of PJM Interconnection, L.L.C. and/or PJM Manuals, as appropriate and applicable.

[39] Importantly, this correspondence makes reference to and incorporates certain provisions of Schedule 6A of the Tariff, and where helpful to resolve ambiguity, the terms set forth herein should be construed in a manner consistent with the Tariff and/or Schedule 6A thereto.

recovery period will be five (5) years, and that the applicable CRF for the purposes of the Project will be 0.363.

Similarly, based upon the reasonable expected life of the [] CTs upon completion of the project, [COMPANY] is committing to provide Black Start Service from [] CT2 and [] CT4 for five (5) years. For its part, by submitting the [] Project Costs for recovery, [COMPANY] acknowledges that consistent with Schedule 6A of the Tariff, [] CT2 and [] CT4, shall not be eligible to recover any incentive rate for providing Black Start Service, including provisions for Fixed BSSC calculated under Paragraph 18 in accordance with Paragraph 5 of Schedule 6A, the "Z" incentive factor, or any similar successor provisions. However, consistent with the allowance for revenue recovery provided in Schedule 6A the [] [C]Ts may recover Variable BSSC, Training Costs and Fuel Storage Costs if applicable.

The five (5) year cost recovery period for the [] CTs shall commence on the first day of the first month following (i) completion of upgrading the [] CT2 and [] CT4 to a Black Start Unit, (ii) successful completion of a Black Start test in accordance with PJM's manual requirements, and (iii) the addition of [] CT2 and [] CT4 as Black Start resources in the [COMPANY] Restoration Plan. Prior to this date [COMPANY] will provide PJM with a best estimate of each unit's annual revenue requirement. Initially, upon entering Black Start Service, [COMPANY]'s Black Start credits will be held by PJM in a non-interesting bearing account until approval of [] CT2's and [] CT4's annual revenue requirement has been approved in accordance with Paragraph 17B of Schedule 6A to the Tariff. However, for each month during the applicable five (5) year cost recovery period, including the months when revenues were withheld by PJM during the revenue approval process, that the [] CTs has successfully complied with all applicable Black Start testing requirements, [COMPANY] will be paid, for the [] CTs: (a) Black Start Service Revenue Requirements for the applicable unit for such year calculated in accordance with the Black Start Service Revenue Requirement set forth in Paragraph 18 of Schedule 6A to the Tariff divided by (b) twelve (12) (the amount calculated by dividing (a) by (b) shall be the "Monthly Black Start Service Revenue Requirement"). For the months when revenues were withheld by PJM during the revenue approval process, PJM will reconcile the estimated annual revenue requirement with the final approved annual revenue requirement pursuant to Paragraph 17B of Schedule 6A to the Tariff and issue credits or charges based on the final approved annual revenue requirement.

Importantly, [COMPANY] shall not include in its RPM avoided costs rates (ACR or APIR – Section 6.8 of Attachment DD to the Tariff) any Black Start Capital Costs or any avoidable costs associated with black start service during this five (5) year term of commitment.

Finally, in the event that during the five (5) year cost recovery period [COMPANY] maintains that an additional amount of capital investment is required in order for the [] CT2 and [] CT4 to provide Black Start Service, the period for recovery of any such additional

capital investment (assuming approval) shall be determined in accordance with Paragraph 18 of Schedule 6A. [COMPANY] acknowledges that the period of recovery of such additional capital investment may run concurrently with the recovery of the costs contemplated in this correspondence. All [] CTs project costs will be recovered by [COMPANY] in [] CT2 and [] CT4 annual revenue requirement unless [] CT1 and [] CT3 is used by [COMPANY] as a substitute in the future in accordance with paragraph 10 of Schedule 6A.

If you should have any questions or concerns, please do not hesitate to contact me at 610-666- 8839.

Sincerely, Stanley H. Williams

Director, Settlements and Operation Analysis & Compliance

CC: Michael Bryson, Vice President – Operations
Joseph Bowring, President, Monitoring Analytics
Glen Boyle, Manager, Operation Analysis & Compliance
David Schweizer, Manager, Generation

November 18, 2021

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

Re: *PJM Interconnection, L.L.C* Docket No. EL21-91

Dear Ms. Bose:

On November 11, 2021, Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM ("Market Monitor"), submitted comments in this proceeding. Errors in that pleading were identified subsequently and are corrected here.

The corrections include table references, typos, a clarification, and deletion of a sentence that was inadvertently included, with a corresponding footnote.

Attached please find a marked version (Attachment A) and a clean version (Attachment B).

If you have any questions regarding this filing, please contact me at (610) 271-8053.

Sincerely,

Jeffrey W. Mayes, General Counsel

Attachment A

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. EL21-91-000

COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 211 of the Commission's Rules and Regulations,[1] and the order to show cause issued in this proceeding on August 10, 2021,[2] Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor ("Market Monitor") for PJM Interconnection, L.L.C. ("PJM"),[3] submits these comments responding to the response submitted by PJM on October 12, 2021 ("October 12th Filing").

PJM attempts, but fails, to support the position that it is reasonable to require customers to overpay approximately $126 million to black start units because black start is a critical service, because the provision of black start service requires investors to take on risk, because CRF is a black box and because the units receiving a windfall can be distinguished from those not receiving a windfall.

It is not reasonable to require customers to overpay for black start service. None of PJM's assertions, even if correct, would justify charging customers what are clearly not just and reasonable rates. Black start is a critical service. Black start investors are compensated for their risks through a combination of a defined rate of return and a guarantee of revenue for

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1 18 CFR § 385.211 (2021).

2 PJM Interconnection, L.L.C., 176 FERC ¶ 61,080.

3 Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff ("OATT"), the PJM Operating Agreement ("OA") or the PJM Reliability Assurance Agreement ("RAA").

the term of the commitment under cost of service rates that ensures that return. It is not reasonable to provide a random, large overpayment to a group of black start owners based on PJM's failure to update rates to reflect changes to the tax code and to assert that the goal of such overpayment is to address risk. PJM has never stated that the rate of return included in the CRF rates is not compensatory. If PJM believes that the rate of return included in the CRF is not correct, PJM should file to change it. CRF is not and has never been a black box. The basics of financial mathematics are well known. PJM's definition of acceptable discrimination is that one set of investors has already received a windfall. Under PJM's proposal, one set of units would receive a windfall and one set of units would not receive a windfall. It is irrelevant to assert that one group had a "different understanding" and that because PJM appears to believe that one group may have expected a windfall, that it is just and reasonable to provide that windfall.

The Market Monitor explains the basic math of the CRF rates, shows the impacts of continuing to pay for black start service under the PJM proposal and derives an updated CRF. The essential point is the explanation of how the CRF rates, for the black start units that have been paid for taxes not incurred, can be adjusted on a going forward basis so that the CRF rates reflect the level of recovery of capital costs that has already occurred. The new, lower CRF rates for these units will compensate black start owners using the existing rate of return for their remaining investment in existing black start units and ensure that black start owners receive full compensation, but no more, as required by the tariff.

I. COMMENTS

A. Background

The October 12th Filing responds to the directive in the Commission's August 10, 2021 order ("August 10th Order") for PJM "(1) to show cause as to why its Tariff remains just and reasonable and not unduly discriminatory or preferential; or (2) to explain what changes to its Tariff it believes would remedy the identified concerns if the Commission were to determine that the Tariff has in fact become unjust and unreasonable or unduly

discriminatory or preferential and, therefore, proceeds to establish a replacement Tariff."[4] PJM chose option (1) but offered no new arguments or ideas to support its assertion. PJM reminds the reader of the critical importance of black start service (at 3). PJM attempts to revive the black box argument (at 2) stating that "the evidence shows that the CRF percentages for Existing Black Start Investments were presented in the Tariff as black box stated rates, disconnected from any analyses of the development of the rates and providing no indication of how the CRF rate may be changed during the life of a project, nor under what circumstances."

The Market Monitor agrees with PJM's self evident assertions that black start service is a vitally important service and that black start units should be fairly compensated. But neither point supports paying specific black start units a windfall. Continuing to pay black start service providers at current rates that do not reflect the significantly reduced costs that resulted from the Tax Cuts and Job Act (TCJA) of 2017, unambiguously results in a windfall to specific black start units.[5] [6] The TCJA lowered the corporate tax rate to 21 percent and introduced bonus depreciation for capital investments placed in service after September 27, 2017.[7] PJM provides no support for paying this windfall that results from charging customers for taxes that are not actually paid. PJM does not deny that this windfall has been paid, continues to be paid and would be guaranteed to be paid under the PJM proposal.

B. Continuing to Pay Black Start Units Existing as of June 6, 2021, at the Current CRF Rates Is Unduly Discriminatory.

PJM's primary argument (at 5) for continuing to pay the existing black start units as of June 6, 2021, at the current CRF rates is that "different rates among non-similarly situated

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4 176 FERC ¶ 61,080 at 48.

5 Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2096, Stat. 2105 (2017).

6 26 U.S. Code §11(b).

7 See 26 U.S. Code §168(k)(6)(A).

customers are not unduly discriminatory." PJM misapplies the unduly discriminatory standard. PJM misstates the facts, and has not shown that its cited precedents are relevant here.

PJM explains (at 2), "owners of Black Start Units that made the Existing Black Start Investments … are not similarly situated to new Black Start Unit investors in the timing of investment in Black Start capability and the filed rate at the time of their investment decisions." PJM relies (at 5–8) on various cases where the Commission took into account information available to investors at the time of investment decisions and treated them differently as a consequence. These cases are not on point because the cited cases concern subjective matters like investors' evaluations of the costs and benefits of RTO membership or the impact of certain rule changes on the terms of financing.[8] The issue in this case is the level of tax rates and taxes paid. The issue in this case concerns objective facts and does not concern subjective investor expectations. It is unduly discriminatory, and unjustifiable, to provide a windfall to a class of black start service providers based on the use of demonstrably incorrect tax payments.

PJM's formula rate has not changed. PJM has now filed and made explicit in the tariff the formula that has always applied. The result is enhanced transparency, but not a change to the formula rate. PJM mischaracterizes its formula rates under OATT Schedule 6A as "stated rates," and, based on that mischaracterization, attempts (at 8–9) to distinguish its formula rates from a straightforward application of the principles in *Alcoa Power Generating Inc.—Long Sault Division*, 162 FERC ¶ 61,224 (2018) ("*Alcoa*"), and *Public Utility Transmission*

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[8] *See, e.g.*, PJM at 6 n.15 , citing Mo. River Energy Servs. v. FERC, 918 F.3d 954, 958–60 (D.C. Cir. 2019) ("The court affirmed the Commission's reasoning that there was no undue discrimination between new and existing members because the new members had the opportunity to consider the costs and benefits of joining SPP."); PJM at 6–7 n.19, citing *ISO New England Inc.*, 170 FERC ¶ 61,011, at PP 14–15 (2020) ("The Commission found that new non-commercial capacity was not similarly situated with existing non-commercial capacity that cleared before the upcoming auction policy because 'existing capacity would have secured financing and/or made arrangements in anticipation of, and contingent upon, the incumbent financial assurance requirements.'").

Rate Changes to Address Accumulated Deferred Income Taxes, Order No. 864, 169 FERC ¶ 61,139 (2019) ("Order No. 864").

PJM asserts (at 8–9) that "not all utilities with stated transmission rates that were subjects of the show cause order in *Alcoa* filed to reduce their stated transmission rates to reflect the lower federal corporate income tax rate." This case concerns PJM's formula rate, and under the principles explained in *Alcoa*, PJM should be required to apply its formula rates accurately. PJM provides no valid reason for continuing to pay black start units for taxes that are not paid based on an arbitrary in service date. PJM does not explain how the circumstances justify any exception, or how the circumstances match those of any entity asserted to have received an exception. The only example of a reason why the Commission might not require accurate treatment of tax rates in a show cause proceeding is where the "the reduced tax rate is being addressed in another proceeding pending before the Commission."[9] PJM has not indicated another proceeding addressing this issue. There is no other proceeding.

PJM also argues that it should be treated like "utilities with stated transmission rates" that, under Order No. 864, were allowed "to address TCJA's impact on ADIT in their next rate case." OATT Schedule 6A refers explicitly to formula rates, not stated rates.[10] The case concerns the application of PJM's formula rates. Unlike stated rates, formula rates are meant to accommodate changed inputs without the need for additional filings. PJM provides no reason not to implement just, reasonable and not unduly discriminatory formula rates in this proceeding.

The Market Monitor's proposed values reflect the actual tax rates and taxable depreciation rates that actually apply to each unit. If the taxable depreciation rate for a unit

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9 *See* 162 FERC ¶ 61,224 at P 4 n.7.

10 *See* OATT Schedule 6A para. 17 ("Black Start Service revenue requirements for each Black Start Unit shall be based, at the election of the owner, on either (i) a FERC-approved rate … or (ii) the formula rates set forth in section 18 of this Schedule 6A").

built in 2016 differs from that for a unit built in 2019, different taxable depreciation rates apply to each unit. That result is not discriminatory because it reflects the actual taxes paid by each unit.

The Market Monitor's proposal is consistent with the case law upon which PJM relies with respect to both taxes paid and the treatment of depreciation. Investor expectations are not relevant to the amount of taxes paid. If a reduction in tax rates is not accounted for, the result is an unjust and unreasonable and unduly discriminatory windfall.[11] To avoid undue discrimination, PJM should uniformly calculate and apply the formula rate based on the effective tax rates.

PJM never addresses, in any of its filings, the fact that customers are being unjustly overcharged for black start service. PJM focuses on the expectations of investors rather than the expectations of customers who could reasonably expect that the regulatory process would result in correctly calculated payments for black start service.

The windfall issue resulted from a loophole created by PJM's failure to update the PJM tariff. PJM failed to update its tariff for months after the flaw had been identified. PJM states (at 7) that "at the time existing Black Start Unit owners made the tailored Existing Black Start Investments addressed by a CRF, they did not have notice of the new formulaic, annually updated CRF, or the opportunity to consider this new approach's costs and

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[11] *See Alcoa Power Generating Inc.—Long Sault Division*, 162 FERC ¶ 61,224 (2018) (Given the reduction in the federal corporate income tax rate, we have undertaken a review of Commission-jurisdictional stated transmission rates under open access transmission tariffs or transmission owner tariffs, and we have identified Respondents as having such arrangements in effect. Because the federal corporate income tax rate has been reduced to 21 percent, absent a change to the stated rates, Respondents' stated rates may not accurately reflect their cost of service. Accordingly, we find that Respondents' stated rates on file with the Commission appear to be unjust, unreasonable, and unduly discriminatory or preferential, or otherwise unlawful.); Order No. 864 at P 8 ("As a result of the Tax Cuts and Jobs Act reducing the federal corporate income tax rate from 35 percent to 21 percent, a portion of an ADIT liability that was collected from customers will no longer be due from public utilities to the IRS and is considered excess ADIT, which must be returned to customers in a cost of service ratemaking context.[footnote omitted] Public utilities are required to adjust their ADIT assets and ADIT liabilities to reflect the effect of the change in tax rates in the period that the change is enacted.[footnote omitted]").

benefits." While PJM failed to update the tariff, the owners of black start units with service terms beginning, during, or after 2018 knew the results of being paid a revenue amount determined by a CRF calculated under the outdated tax rates and depreciation schedules. While the question of expectations is not at issue, black start owners could not reasonably have expected PJM to fail to update the CRF rate for the lower taxes or have expected the Commission to approve charging excessive cost-based rates not based on costs.

CRF means capital recovery factor. The CRF is calculated to ensure that investors are paid for the return on capital and the return of capital. The basic and well understood financial math of the CRF rate includes taxes. PJM has not supported its implicit claim that investors legitimately expected a windfall based on a reduction in the tax rate and has not supported its implicit claim that, even if true, investors' expectations of a windfall should be ratified by a regulatory decision.

The issue now is to determine a new CRF rate for payments going forward.

C. Capital Recovery Factor: the Basics

The PJM tariff states that owners of black start units may elect "to recover new or additional Black Start Capital Costs" and defines Incremental Black Start Capital Costs as "new or additional capital costs … for the incremental equipment solely necessary to enable a unit to provide Black Start Service."[12] The tariff clearly states that black start owners are entitled to recover black start capital costs, no more and no less.[13] The black start capital cost recovery consists of a return on the capital investment, a return of the capital investment, and the associated income taxes incurred. The correctly calculated capital recovery factor (CRF), when multiplied by the initial capital investment, provides the necessary and sufficient revenue level to provide for the return on and return of the capital investment and to pay the associated income taxes.

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[12] OATT Schedule 6A Paras. 6 and 18.

[13] *Id*.

Table 1 makes clear what is meant by the phrase "necessary and sufficient revenue to pay the tax liabilities and provide for the return on and the return of the capital investment." But Table 1 does reflect a rounding error in the existing CRF. The correctly calculated CRF results in exactly the outcome required by the tariff.

Table 1 shows the cash flows for a black start unit with a five year service term and a $1 million capital investment using the financial parameter and tax rate assumptions for black start service beginning prior to June 6, 2021. The parameter and tax rate assumptions are in Table 2.

Table 1 Cash flow summary for 5 year service term, $1 million capital investment[14] [15] [16] [17]

Service Year	1	2	3	4	5
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$123,524	$100,244	$106,840	$113,203	$119,428
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$48,908	$37,393	$25,287	$12,493
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$92,436	$95,959	$100,878	$106,621	$113,190
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$407,564	$311,604	$210,726	$104,105	($9,085)

[14] The model uses 15 year MACRS depreciation factors with the half year convention and the tax payment is calculated as the product of the effective tax rate in Table 2 and the revenue net of depreciation and interest on debt.

[15] The model assumes the half year convention for revenue and tax payments. The interest on the debt in year 1 is equal to the product of the debt investment and the half year interest rate, $\sqrt{1.07} - 1$. The year 1 return on equity is equal to the product of the equity investment and the half year rate of return, $\sqrt{1.12} - 1$. Interest on the debt in other years is 7.0% of the previous year's remaining debt. Return on equity beginning in year 2 is 12.0% of the previous year's remaining equity.

[16] The debt payment is calculated using a standard formula given by $\$500{,}000 \cdot \frac{(.07)(1.07)^5}{\sqrt{1.07}[(1.07)^5-1]}$, or Microsoft Excel PMT function can be used, $-\sqrt{1.07} \cdot \text{PMT}(.07,5,500000,0,1)$.

[17] Payback of the debt investment is equal to the debt payment net of interest on the debt. Payback of the equity investment is equal to revenue net of taxes, the debt payment and return on equity.

Table 2 Financial parameter and tax rate assumptions[18]

Financial Parameter	Parameter Value
Equity Funding Percent	50.0000%
Debt Funding Percent	50.0000%
Equity Rate	12.0000%
Debt Interest Rate	7.0000%
Federal Tax Rate	36.0000%
State Tax Rate	9.0000%
Effective Tax Rate	41.7600%

The CRF defined in the tariff for black start service beginning prior to June 6, 2021, is 0.363 for a five year service term. This CRF was based on the assumption that tax rates were at levels prior to the TCJA. The cash flow summary in Table 1 is based on the financial model, called a flow to equity (FTE) model, that was used to develop the CRF stated in the tariff.[19] The FTE model treats the return and payback of equity and debt separately. The payback to equity investors in the FTE model is calculated as the revenue net of taxes, the debt payment and return on equity. The weighted average cost of capital (WACC) model which was used to calculate the CRF for black start service after June 6, 2021, averages the equity and debt in the calculation of investment return and investment payback. The cash flow summary in Table 1 shows that in each year after accounting for the tax payment, return on equity and the debt payment, there is additional revenue for payback to the equity investor. The equity investment remaining at the end of the service term should be exactly $0, but the tariff defined CRF values have rounding errors that cause a small overpayment in this example.

Table 3 shows the cash flow summary for the same example with the rounding errors corrected. The CRF is 0.360545 and the annual revenue payment is $360,545.[20] Table 3 makes

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[18] The effective tax rate is equal to State Tax Rate + Federal Tax Rate x (1-State Tax Rate).

[19] Additional details on the flow to equity approach can be found in Section 17.2 in "Corporate Finance," Ross, Westerfield, Jaffe, 4th Edition, 1996.

[20] The CRF value of 0.360545 was calculated using a CRF formula for the FTE model that is similar to the CRF formula used for WACC model CRF.

clear exactly what is meant by the phrase "necessary and sufficient revenue to pay the tax liabilities and provide for the return on and the return of the capital investment." Table 3 eliminates the small rounding error that is shown in Table 1, but both tables illustrate the essential point. The correctly calculated CRF results in the outcome required by the tariff. Each year the revenue that results from the CRF covers the interest on the debt and the payback of the debt principal, covers the defined return on the equity investment, covers the taxes, and the remaining funds go towards payback of the equity investment. At the end of the service term, the remaining debt investment and the remaining equity investment are both $0. The entries in the debt payback row sum to $500,000 as do the entries of the equity payback row, reflecting the 1:1 debt to equity ratio in Table 2.

Table 3 Cash flow summary for 5 year service term, $1 million capital investment with rounding errors corrected

Service Year	1	2	3	4	5
Revenue	$360,545	$360,545	$360,545	$360,545	$360,545
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$122,499	$99,219	$105,815	$112,178	$118,403
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$49,079	$37,756	$25,866	$13,313
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$91,006	$94,358	$99,084	$104,612	$110,940
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$408,994	$314,636	$215,552	$110,940	$0

D. How the CRF Creates a Windfall Based Only on the Tax Rate

The creation of the windfall under PJM's proposal can be illustrated using the same basic example. The windfall is a result of both the reduction in the tax rate and the change in the depreciation provisions. This illustration is only about the windfall resulting from the change in the tax rate. Consider a black start unit that began service on January 1, 2016. The unit would not have been eligible for bonus depreciation, but the federal tax rate dropped to 21.0 percent on January 1, 2018.

Table 4 shows the resulting cash flow summaries. The first cash flow summary in Table 4 shows the cash flow that was assumed when the CRF determination was made. It

was assumed for the five year service term that the black start owner would pay federal taxes at 36.0 percent and there is a small overpayment by customers due to the rounding errors.

The second cash flow summary in Table 4 reflects the change of federal tax rate to 21.0 percent on January 1, 2018, which in this example is at the beginning of service year 3.[21] No other parameters were changed. The tax liability in service year 3 dropped by $34,923 and the extra funds were an additional payback to the equity investors. The lower tax liability has a compounding effect with the result that the rate of equity payback increases each year. At the end of the five year service term the payback to equity investors exceeds the equity investment by $133,372 or 26.7 percent. The payback in excess of the total capital investment of $1 million has been exceeded by 13.3 percent. This excess payment, the windfall, is the result of the fact that the actual tax rate decreased but that the CRF was not decreased to reflect that change.

[21] The new effective tax rate after changing the federal tax rate to 21.0% is 28.11%. This assumes the state tax rate remains at 9.0%.

Table 4 Cash flow summary for 5 year service term, $1 million capital investment, service term starting January 1, 2016

Service Year	1	2	3	4	5
	Cash flow assumed in annual revenue determination				
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$123,524	$100,244	$106,840	$113,203	$119,428
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$48,908	$37,393	$25,287	$12,493
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$92,436	$95,959	$100,878	$106,621	$113,190
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$407,564	$311,604	$210,726	$104,105	($9,085)
	Cash flow reflecting actual tax liabilities, return and payback				
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$123,524	$100,244	$71,918	$76,201	$80,391
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$48,908	$37,393	$21,096	$3,359
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$92,436	$95,959	$135,801	$147,814	$161,361
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$407,564	$311,604	$175,804	$27,989	($133,372)

The resultant internal rate of return (IRR) also shows the overpayment by customers for black start service. The IRR is the discount rate for which the net present value of the after tax cash flow is $0. For example, the after tax cash flow, or revenue net of taxes and the debt payment, for each of the examples is in Table 5. The IRR under the original CRF determination, with no change in tax rates, is 12.5 percent where the rounding error in the CRF has caused the IRR to deviate from the assumed return on equity value of 12.0 percent.[22] [23] The IRR is 12.0 percent for the second row of Table 5. The only difference in the second row

[22] The IRR was calculated using the Solver application in Microsoft Excel.

[23] Each annual cash flow amount is assumed to occur at the midpoint of the service year.

is that the rounding error is eliminated in the second row. The IRR is 19.2 percent for the row 3 after tax cash flow which reflects the reduction in actual tax payments compared to the tax payments included in the CRF. The failure to update the CRF to reflect the reduced tax rate increased the black start owner's return on equity from 12.0 percent to 19.2 percent in this example.

Table 5 After cash flow for 5 year service term, $1 million capital investment

Service Year	1	2	3	4	5
After tax cash flow - Original CRF determination	$121,587	$144,867	$138,271	$131,908	$125,683
After tax cash flow - Rounding errors corrected	$120,157	$143,437	$136,841	$130,478	$124,253
After tax cash flow - Actual tax liabilities, return & payback	$121,587	$144,867	$173,193	$168,910	$164,720

E. Actual Calculated Windfall Paid by PJM Customers for Units that Have Completed Service

As a result of the reduction in tax payments and the failure to reduce the CRF to reflect that reduction, payback in excess of the capital investment has already occurred for PJM black start service. The Market Monitor calculated the payback of capital investments for seven black start units that completed their service terms between August 2018 and June 2021, and found that the payback exceeded the capital investment amounts by $4.3 million or 10.2 percent. This means customers paid the black start owners sufficient revenue to cover the tax liabilities associated with the black start revenue and investment return payments at 7.0 percent for the debt portion of the capital investment and 12.0 percent for the equity portion, and the customers paid back the capital investment plus an additional $4.3 million or 10.2 percent of the capital investment.

In this filing, the Market Monitor is not proposing any adjustment to the payments already made to units that completed their service terms prior to June 2021.

F. How the CRF Creates a Windfall Based on the Tax Rate and Depreciation

The creation of the windfall under PJM's proposal can be illustrated using the same basic example. The windfall is a result of both the reduction in the tax rate and the change in the depreciation provisions. This illustration is about the windfall resulting from both the

change in the tax rate and the change in depreciation rules. Consider a black start unit that began service on January 1, 2019. This black start unit would have paid federal income tax at 21.0 percent from the start of the service term and would have been eligible for 100 percent bonus depreciation.

Table 6 shows the resulting cash flow summaries. The first cash flow summary in Table 6 shows the cash flow that was assumed when the CRF determination was made. It was assumed for the five year service term that the black start owner would pay federal taxes at 36.0 percent and there is a small overpayment by customers due to the rounding errors. Even though the service term begins after the effective date of the TCJA, the revenue payment is exactly the same as in first example because it is based on the CRF in the tariff that continued to incorporate the incorrect tax rates and depreciation.

The second cash flow summary in Table 6 reflects the actual tax liabilities and expected return on and return of the capital investment. The federal tax rate of 21.0 percent beginning with service year 1, and 100 percent bonus depreciation, are reflected in the second cash flow summary. No other changes were made.

Table 6 Cash flow summary for 5 year service term, $1 million capital investment, service term starting January 1, 2019[24] [25]

Service Year	1	2	3	4	5
	Cash flow assumed in annual revenue determination				
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$123,524	$100,244	$106,840	$113,203	$119,428
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$48,908	$37,393	$25,287	$12,493
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$92,436	$95,959	$100,878	$106,621	$113,190
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$407,564	$311,604	$210,726	$104,105	($9,085)
	Cash flow reflecting actual tax liabilities, return and payback				
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$1,000,000	$0	$0	$0	$0
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	($183,897)	$94,182	$95,952	$97,845	$99,871
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$12,017	($4,652)	($23,110)	($43,555)
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$399,857	$138,912	$153,812	$170,375	$188,794
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$100,143	($38,769)	($192,581)	($362,956)	($551,751)

As a result of the CRF including revenues for taxes that are not paid, the equity portion of the capital investment was fully paid back in service year 2, rather than at the end of the five year period. An assumption in the FTE model, is that the equity investor invests the excess payback at the same rate of return on equity included in the CRF, 12 percent. This is reflected in the cash flow summary as a negative return on equity in Table 6, which is then

[24] It is assumed that the capital investor would use the negative tax liability in service year 1 as an offset against the tax liabilities resulting from other revenue.

[25] The effective tax rate is 28.11% after changing the federal tax rate to 21.0%.

included in the payback to equity as a positive number.[26] The cash flow summary shows that payback in excess of the equity investment is $551,751 or 110.4 percent. The payback in excess of the total capital investment of $1 million is 55.2 percent. The IRR is 61.6 percent for the after tax cash flow reflecting the actual tax liabilities. This excess payment, the windfall, is the result of the fact that the actual tax rate decreased and the depreciation rules changed but that the CRF was not decreased to reflect those two changes.

A row by row comparison between the two cash flow summaries in Table 6 shows that the payback in excess of the capital investment can be separated into three distinct categories, payment of taxes that were not incurred, return on capital investments that have already been paid back and return on reinvestment of the excess payback. (See Table 7.) The difference between the service year 1 tax payment assumed in the outdated CRF and the actual tax payment is $307,421. The difference between the investment return numbers for service year 2 is $36,891. This reflects the accelerated payback of the equity investment. In service year 3 through service year 5, the equity investment has been paid back in full yet the revenue payment of $363,000 assumes a return on equity for each year. In fact, the equity investor, having been paid back in full in service year 2, is earning returns on the excess payback in service year 3 through service year 5 as shown in the third row of Table 7. The Table 7 total of $542,666 and the excess payback due to rounding errors, $9,085, sum to the total payback in excess of the capital investment given in Table 6.

Table 7 Payback in excess of the capital investment by category

Service Year	1	2	3	4	5
Payments for taxes not incurred	$307,421	$6,062	$10,889	$15,358	$19,557
Return on capital that has already been paid back	$0	$36,891	$37,393	$25,287	$12,493
Return on reinvestment of payback in excess of the capital investment	$0	$0	$4,652	$23,110	$43,555
Total for Year	$307,421	$42,953	$52,933	$63,755	$75,604
Total for All Years					$542,666

[26] Payback to equity in the FTE model is (Revenue – Taxes – Debt Payment – Return on Equity).

G. Actual Calculated Windfall Paid by PJM Customers for Black Start Units Still in Service

If black start units continue to receive the annual revenue payments determined by the incorrect CRF, as PJM recommends, customers will overpay black start units that started service ~~during or after 2018 and~~ prior to June 6, 2021, by $126.0 million. The overpayment will go to the existing black start service fleet and $126 million does not include the $4.3 million in excess payback that has already been paid to black start units that completed their service terms between August 2018 and June 2021. The Market Monitor uses the FTE model to calculate the overpayment because that was the model used to calculate the CRFs that created the overpayment.

For black start units that started service during or after 2018 and prior to June 6, 2021, the percent payback in excess of the capital investment and the IRR in excess of the required level will be the same for units with the same term of service. All five year black start units will have the same percent overpayment. All ten year black start units will have the same percent overpayment. The same is true for all service lives. All such black start units were eligible for 100 percent bonus depreciation and the new federal tax of 21.0 percent was effective from the start of the service terms.

Table 8~~Table 9~~ summarizes the actual percent payback in excess of the capital investment and the IRR that will result under the PJM proposal. Under the PJM proposal with the financial assumptions in Table 2, all black start units beginning a ten year service term during or after 2018 and before June 6, 2021 will receive payback in excess of their capital investment totaling 70.5 percent of the capital investment. For every $1 million invested the black start owner will receive $~~70,500~~700,500 in addition to being paid back the $1 million capital investment and receiving annual revenue payments to cover the tax liabilities and return on the investment. A unit with a 20 year service term will receive payback in excess of their capital investment totaling 155.2 percent of the capital investment.

Table 89 Payback in excess of capital investment and IRR for service terms beginning on or after January 1, 2018 and before June 6, 2021

Service Term	Excess Payback as Percent of Investment	Internal Rate of Return (IRR)
5	55.2%	61.6%
10	70.5%	34.0%
15	96.2%	25.6%
20	155.2%	22.8%

Table 9Table 10 shows the actual expected payback in excess of the capital investment, by service term start date, for the black start units in PJM. The majority of the excess payback, 71.4 percent, is attributable to black start units that began services terms after January 1, 2019.

Table 910 Expected payback in excess of capital investments for existing black start units

	Excess Payback ($ million)	Percent
Service Terms Beginning Prior to January 1, 2017	$36.05	28.6%
Service Terms Beginning After January 1, 2019	$89.93	71.4%
Total	$126.0	100.0%

H. Closing the Loophole

The Commission invited interested entities to respond with "what changes to PJM's Tariff should be implemented as a replacement rate."[27]

The Market Monitor proposes to update the CRF applicable to existing units going forward to a rate that will reflect the return of capital already received by existing black start units and eliminate the payback in excess of the capital investment for existing black start units. The Market Monitor's proposal is consistent with the "capital cost recovery" language in Schedule 6A of the PJM tariff and can be implemented without any retroactive resettlement

[27] August 10th Order at 53.

or disgorgement. The updated CRF can be set at the level that covers the tax liabilities going forward, pays a return at the required rates on any remaining capital investment, pays back the full investment and therefore results in the required return on and of capital over the CRF term.

Using the formula for the CRF, a different CRF will need to be calculated for each existing black start unit based on the exact in service date and the duration of the service period. The Market Monitor is providing the formula in this filing. The Market Monitor has calculated the resulting CRF for each existing black start unit and will provide to the Commission and PJM if that would be helpful.

Table 10~~Table 11~~ shows updated CRF values for several combinations of service start dates and service terms. The updated CRF values were calculated using equation (1) below and the financial parameter and tax rate values in Table 12~~Table 14~~.

Table 10~~11~~ Updated CRF for selected dates and service terms

Service Start	Service Term	Current CRF	Updated CRF
7/1/2019	5	0.363	0.083443
7/1/2020	5	0.363	0.174620
7/1/2021	5	0.363	0.225022
7/1/2019	10	0.198	0.110218
7/1/2020	10	0.198	0.127560
7/1/2021	10	0.198	0.137200
7/1/2019	20	0.125	0.083515
7/1/2020	20	0.125	0.088581
7/1/2021	20	0.125	0.092963

The procedure for establishing a formula for the updated CRF is a two step process: (1) the remaining capital investment is determined as of the effective date of the updated CRF and (2) an updated CRF formula is derived based on the remaining service term and the remaining capital investment amount.

1. Model for Updated CRF Reflecting a Change in the Tax Law

The updated model incorporates a change in the tax rate and a change in the CRF to permit the calculation of the impact of over collection under the initial tax rate and associated

CRF, the new tax rate, and the updated CRF. The timing of these two changes is treated independently in order to reflect the delayed implementation of the revised CRF.[28] To account for these factors, variable m represents the service year during which the tax change occurs, and variable q represents the first service year during which the updated CRF is effective. Variable γ represents the fractional portion of service year m for which the old tax rate is applicable. Variable μ is defined to be the fractional portion of service year q for which the old CRF is applicable.

The formula for the updated CRF is given in equation (1).

$$c_2 = \frac{r_e(1+r_e)^{N-q}}{(1-s_2)[(1+r_e)^{N-q+1} - 1 - \mu r_e(1+r_e)^{N-q}]} \Bigg\{ F_{q-1}(1+r_e) - \mu c_1(1-s_2)$$

$$- s_2 \sum_{j=q}^{N} \delta_j \left(\frac{1}{1+r_e}\right)^{j-q}$$

$$- (1-E)s_2 \frac{r_d(1+r_d)^{q-3/2}}{[(1+r_d)^N - 1]} \left[\frac{(1+r_d)^{N-q+1}[(1+r_e)^{N-q+1} - 1]}{r_e(1+r_e)^{N-q}} \right.$$

$$\left. - \frac{(1+r_e)^{N-q+1} - (1+r_d)^{N-q+1}}{(r_e - r_d)(1+r_e)^{N-q}} \right]$$

$$+ (1-E)\left(\frac{r_d(1+r_d)^{N-1/2}}{(1+r_d)^N - 1}\right)\left(\frac{(1+r_e)^{N-q+1} - 1}{r_e(1+r_e)^{N-q}}\right) \Bigg\}. \qquad (1)$$

The factor F_{q-1} which when multiplied by the initial capital investment K_0 gives the remaining equity investment prior to the effective date of the updated CRF,

[28] At this point the implementation of a revised CRF will take place at least three year and ten months after the effective date of the TCJA.

$$F_{q-1} = F_{m-1}(1+r_e)^{\alpha} - c_1(1-s_2)\frac{(1+r_e)^{q-m}-1}{r_e} + \gamma c_1(s_1-s_2)(1+r_e)^{q-m-1}$$

$$-\gamma\delta_m(s_1-s_2)(1+r_e)^{q-m-1} - s_2X - (1-E)[\gamma s_1 + (1-\gamma)s_2]Z(1+r_e)^{q-m-1}$$

$$+(1-E)\frac{r_d(1+r_d)^{N-1/2}}{(1+r_d)^N-1}\frac{(1+r_e)^{q-m}-1}{r_e}$$

$$-(1-E)s_2\frac{r_d(1+r_d)^{m-1/2}}{[(1+r_d)^N-1]}\left\{\frac{(1+r_d)^{N-m}[(1+r_e)^{q-m-1}-1]}{r_e}\right.$$

$$\left.-\frac{(1+r_e)^{q-m-1}-(1+r_d)^{q-m-1}}{r_e-r_d}\right\}$$

where

$$\alpha = \begin{cases} q-m-1/2, & m=1 \\ q-m, & m>1 \end{cases}$$

$$X = \begin{cases} 0, & m=q \\ \sum_{j=m}^{q-1}\delta_j(1+r_e)^{q-j-1}, & m<q \end{cases}$$

$$Z = \begin{cases} \sqrt{1+r_d}-1, & m=1 \\ \frac{r_d(1+r_d)^{m-1}}{\sqrt{1+r_d}}\left(\frac{(1+r_d)^{N-m+1}-1}{(1+r_d)^N-1}\right), & m>1\,. \end{cases}$$

Factor F_{m-1} which when multiplied by the initial capital investment K_0 gives the remaining equity investment prior to the change in the tax law. In the case that the tax law change occurs in the first service year ($m = 1$), the value of the equity investment prior to the tax change is equal to the equity funding percent, or $F_0 = E$. In the case the $m > 1$

$$F_{m-1} = E\sqrt{1+r_e}(1+r_e)^{m-2} - c_1(1-s_1)\left[\frac{(1+r_e)^{m-1}-1}{r_e}\right] - s_1\sum_{j=1}^{m-1}\delta_j(1+r_e)^{m-1-j}$$
$$-(1-E)s_1\left(\sqrt{1+r_d}-1\right)(1+r_e)^{m-2}$$
$$+\frac{(1-E)r_d(1+r_d)^{N-1/2}}{(1+r_d)^N-1}\left[\frac{(1+r_e)^{m-1}-1}{r_e}\right]$$
$$-(1-E)s_1\frac{r_d\sqrt{1+r_d}}{(1+r_d)^N-1}\left\{\frac{(1+r_d)^{N-1}[(1+r_e)^{m-2}-1]}{r_e}\right.$$
$$\left.-\frac{(1+r_e)^{m-2}-(1+r_d)^{m-2}}{r_e-r_d}\right\}.$$

As an example, consider a black start unit that began service on December 1, 2018, and assume the updated CRF will be effective on January 1, 2022. In this case the new tax law was effective prior to the service start date so that m is 1 and γ is 0. The updated CRF becomes effective one months into service year 4, so that q is 4 and μ is 0. 0833.

Table 1113 Variable descriptions for updated CRF

Variable	Description
E	Equity funding percent
r_e	Return on equity
r_d	Debt interest rate
s_1	Effective tax rate prior to tax rate change
s_2	Effective tax rate after tax rate change
c_1	Initial CRF
c_2	Updated CRF
N	Cost recovery period
m	Service year in which tax rate change occurs
γ	Partial year in service year m for which tax rate s_1 applies
q	Service year in which updated tax rate is incorporated into CRF
μ	Partial year in service year q for which CRF c_1 applies
δ_i	Depreciation factor for service year i

The Market Monitor recommends that the financial parameters for black start units that began service prior to June 6, 2021, remain unchanged. This directly addresses the expectation question. The risk and return expectations are unchanged. The only updates are to include the actual federal and state tax rates and bonus depreciation where applicable. The financial parameter and tax rate assumptions, the current assumptions for existing black start

units that began service prior to June 6, 2021, along with the proposed updates, are presented in Table 12.

Table 12~~14~~ Financial parameter and tax rate assumptions

Parameter	Black start service beginning prior to June 6, 2021	Market Monitor's Replacement Rate
Equity Funding Percent	50.0000%	50.0000%
Debt Funding Percent	50.0000%	50.0000%
Equity Rate	12.0000%	12.0000%
Debt Interest Rate	7.0000%	7.0000%
Federal Tax Rate	36.0000%	21.0000%
State Tax Rate	9.0000%	9.3000%
Effective Tax Rate	41.7600%	28.3470%
After tax Weighted Average Cost of Capital	8.0384%	8.5079%

Consider again the example of a black start unit with a five year service term and a $1 million capital investment that began service on July 1, 2020.[29] ~~The cash flow summary in Table 8 shows the payback in excess of the capital investment equal to $492,060.[30]~~

Using the formula in equation (1) and the parameter assumptions under the Market Monitor's replacement rate in Table 12, gives an updated CRF value of 0.174620, where the updated CRF is effective on January 1, 2022.[31] The updated annual revenue requirement is $174,620.

Table 13 shows the corresponding update to the cash flow summary. The updated revenue requirement is effective beginning in service year 2. The year 2 revenue reflects six

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[29] The black start unit service start date is after the TCJA effective date so that parameter m = 1 and parameter $\gamma = 0$.

~~[30] In this section the state tax rate has been updated to 9.3 percent whereas the previous calculation that produced the excess payback of $492,060 assumed a 9.0 state tax rate. Updating both the federal and state tax rate gives would give an excess payback of $490,369 under the PJM proposal to not change the CRF.~~

[31] The updated CRF effective date is at the start of service year 2 so that parameter q = 2 and parameter $\mu = 0.5$.

months at the old CRF rate and six months at the updated CRF. The remaining capital investment is $0 at the end of the service term and summing the capital investment payback row produces a total investment payback of $1 million. The loophole has been closed and the result is fully consistent with the goal of the formula rate in the tariff. The black start owner would receive the necessary and sufficient revenue to cover the target return on the investment, the full recovery of the capital investment, and all the tax liabilities associated with the annual revenue payment. The internal rate of return (IRR) for the after tax cash flow resulting from the updated CRF is 12.0 percent which matches the return on equity in Table 12.

Table 1315 Updated cash flow summary reflecting updated CRF

Service Year	1	2	3	4	5
Revenue	$363,000	$268,810	$174,620	$174,620	$174,620
Depreciation	$1,000,000	$0	$0	$0	$0
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	($185,447)	$68,276	$43,361	$45,270	$47,313
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$11,831	$3,333	$2,129	$1,009
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$401,408	$70,814	$10,037	$9,332	$8,409
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$98,592	$27,778	$17,741	$8,409	$0

Next consider a black start unit with a ten year service term and a $10 million capital investment. Assume the service term begins on March 1, 2020 and the updated CRF is effective on January 1, 2022.[32] The current CRF for black start units with at 10 year service term and a service start date prior to June 6, 2021 is 0.198. Using equation (1) and the parameters in Table 12 results in an updated CRF of 0.120700. The new annual revenue requirement is $1,207,002.Table 14 shows the cash flow summary corresponding to the updated CRF.

[32] The service start date is after the TCJA effective date so that parameter $m = 1$ and parameter $\gamma = 0$. The effective date for the updated CRF is ten months into service year 2 so that $q = 2$ and $\mu = 0.8333$.

Table 1416 Ten year black start service term, $10 million investment ($ 000)

Service Year	1	2	3	4	5	6	7	8	9	10
Revenue	$1,980.0	$1,851.2	$1,207.0	$1,207.0	$1,207.0	$1,207.0	$1,207.0	$1,207.0	$1,207.0	$1,207.0
Depreciation	$10,000.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Interest on debt	$172.0	$313.9	$287.7	$259.6	$229.6	$197.5	$163.2	$126.4	$87.1	$45.0
Tax payment	-$2,322.2	$435.8	$260.6	$268.6	$277.1	$286.2	$295.9	$306.3	$317.5	$329.4
Debt payment	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2
Return on equity	$291.5	$201.3	$138.2	$123.8	$108.6	$92.6	$75.9	$58.2	$39.7	$20.3
Payback of debt	$516.2	$374.3	$400.5	$428.6	$458.6	$490.7	$525.0	$561.8	$601.1	$643.2
Payback of equity	$3,322.5	$525.9	$120.0	$126.4	$133.1	$140.0	$147.1	$154.3	$161.6	$169.1
Remaining debt	$4,483.8	$4,109.5	$3,709.0	$3,280.4	$2,821.8	$2,331.1	$1,806.1	$1,244.3	$643.2	$0.0
Remaining equity	$1,677.5	$1,151.6	$1,031.6	$905.2	$772.1	$632.1	$485.0	$330.8	$169.1	$0.0

The revenue in service year 2 reflects 10 months at the old CRF and 2 months at the updated CRF. The remaining capital investment at the end of the service term is $0 indicating that the revenue determined by the updated CRF provides the necessary and sufficient level of revenue to cover the tax liabilities and provide for the return on and return of the capital investment. The IRR for the after tax cash flow resulting from the updated CRF is 12.0 percent which matches the return on equity in Table 12.

Under the PJM proposal, this black start unit would continue to receive the annual revenue amount of $1,980,000 and the payback in excess of the capital investment~~, calculated using a WACC model,~~ would total $7,041,067 for a total of 170.4 percent of the $10 million capital investment, or a total return of capital of $17,041,067.[33]

I. Additional recommendations

In order to address any concerns regarding impacts on risk and expectations, the Market Monitor recommends that the financial parameters used to calculate the CRF for a black start unit be fixed at the parameters in place as of the service start date.[34] For example,

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33 The excess payback value, 70.4 percent, differs from the corresponding excess payback value in Table 8~~Table 9~~ because of the state tax rate assumption. The Market Monitor's replacement rate assumes a state tax rate of 9.3 percent. The values in Table 8~~Table 9~~ were calculated assuming a 9.0 percent state tax rate.

34 Financial parameters to be fixed at the start of the service term consist of the debt to equity funding ratio, interest rate on debt and the return on equity.

the CRF for a black start unit beginning service on December 1, 2021, would be calculated using the CRF formula in Schedule 6A of the PJM tariff, the financial parameters in Table 15 and the current tax rates and applicable level of bonus depreciation.[35] The CRF value determined at the start of the service term would only be updated in the event of a change in the tax rate or applicable depreciation schedule. PJM included language in a recent compliance filing that specifies the values for the debt to equity ratio and the rate of return on equity given in Table 15.[36] The new tariff language also describes the source of the debt interest rate and describes a process for updating the debt interest rate going forward. In the case that PJM does update one of the financial parameters listed in Table 15, the Market Monitor recommends that the new financial parameters only apply to black start service terms that begin on or after the effective date of the new financial parameters. A change to one of the parameters in Table 15 would not require a change to the CRF of an existing black start unit under the Market Monitor's proposed approach.

Table 15~~17~~ Financial parameters for black start units with service starting after June 6, 2021[37]

Financial Parameter	Parameter Value
Equity Funding Percent	50.0000%
Debt Funding Percent	50.0000%
Equity Rate	12.0000%
Debt Interest Rate	6.0000%

35 The Commission directed PJM to include a formula for calculating CRF for black start service beginning after June 6, 2021 in 176 FERC ¶ 61,080 at 43.

36 See *Attachment A (Redlines) to the Compliance Filing re: Tariff, Schedule 6A, Black Start Revision* (at Schedule 6A, Section 18), PJM Interconnection L.L.C., Docket ER21-1635 (September 9, 2021).

37 Section 18 of Schedule 6A of the PJM tariff says the "debt interest rate is based on the most recent Net CONE quadrennial review after-tax weighted average cost of capital (ATWACC)". The most recent quadrennial review used a debt interest rate of 6.0 percent and this value is used here for illustrative purposes.

II. CONCLUSION

The Market Monitor respectfully requests that the Commission afford due consideration to these comments as it resolves the issues raised in this proceeding.

Respectfully submitted,

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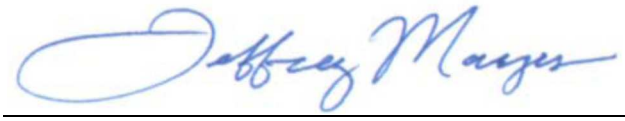
Dated: November 11, 2021

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania,
this 11th day of November, 2021.



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Attachment B

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. EL21-91-000

COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 211 of the Commission's Rules and Regulations,[1] and the order to show cause issued in this proceeding on August 10, 2021,[2] Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor ("Market Monitor") for PJM Interconnection, L.L.C. ("PJM"),[3] submits these comments responding to the response submitted by PJM on October 12, 2021 ("October 12th Filing").

PJM attempts, but fails, to support the position that it is reasonable to require customers to overpay approximately $126 million to black start units because black start is a critical service, because the provision of black start service requires investors to take on risk, because CRF is a black box and because the units receiving a windfall can be distinguished from those not receiving a windfall.

It is not reasonable to require customers to overpay for black start service. None of PJM's assertions, even if correct, would justify charging customers what are clearly not just and reasonable rates. Black start is a critical service. Black start investors are compensated for their risks through a combination of a defined rate of return and a guarantee of revenue for

1 18 CFR § 385.211 (2021).

2 PJM Interconnection, L.L.C., 176 FERC ¶ 61,080.

3 Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff ("OATT"), the PJM Operating Agreement ("OA") or the PJM Reliability Assurance Agreement ("RAA").

the term of the commitment under cost of service rates that ensures that return. It is not reasonable to provide a random, large overpayment to a group of black start owners based on PJM's failure to update rates to reflect changes to the tax code and to assert that the goal of such overpayment is to address risk. PJM has never stated that the rate of return included in the CRF rates is not compensatory. If PJM believes that the rate of return included in the CRF is not correct, PJM should file to change it. CRF is not and has never been a black box. The basics of financial mathematics are well known. PJM's definition of acceptable discrimination is that one set of investors has already received a windfall. Under PJM's proposal, one set of units would receive a windfall and one set of units would not receive a windfall. It is irrelevant to assert that one group had a "different understanding" and that because PJM appears to believe that one group may have expected a windfall, that it is just and reasonable to provide that windfall.

The Market Monitor explains the basic math of the CRF rates, shows the impacts of continuing to pay for black start service under the PJM proposal and derives an updated CRF. The essential point is the explanation of how the CRF rates, for the black start units that have been paid for taxes not incurred, can be adjusted on a going forward basis so that the CRF rates reflect the level of recovery of capital costs that has already occurred. The new, lower CRF rates for these units will compensate black start owners using the existing rate of return for their remaining investment in existing black start units and ensure that black start owners receive full compensation, but no more, as required by the tariff.

I. COMMENTS

A. Background

The October 12th Filing responds to the directive in the Commission's August 10, 2021 order ("August 10th Order") for PJM "(1) to show cause as to why its Tariff remains just and reasonable and not unduly discriminatory or preferential; or (2) to explain what changes to its Tariff it believes would remedy the identified concerns if the Commission were to determine that the Tariff has in fact become unjust and unreasonable or unduly

discriminatory or preferential and, therefore, proceeds to establish a replacement Tariff."[4] PJM chose option (1) but offered no new arguments or ideas to support its assertion. PJM reminds the reader of the critical importance of black start service (at 3). PJM attempts to revive the black box argument (at 2) stating that "the evidence shows that the CRF percentages for Existing Black Start Investments were presented in the Tariff as black box stated rates, disconnected from any analyses of the development of the rates and providing no indication of how the CRF rate may be changed during the life of a project, nor under what circumstances."

The Market Monitor agrees with PJM's self evident assertions that black start service is a vitally important service and that black start units should be fairly compensated. But neither point supports paying specific black start units a windfall. Continuing to pay black start service providers at current rates that do not reflect the significantly reduced costs that resulted from the Tax Cuts and Job Act (TCJA) of 2017, unambiguously results in a windfall to specific black start units.[5] [6] The TCJA lowered the corporate tax rate to 21 percent and introduced bonus depreciation for capital investments placed in service after September 27, 2017.[7] PJM provides no support for paying this windfall that results from charging customers for taxes that are not actually paid. PJM does not deny that this windfall has been paid, continues to be paid and would be guaranteed to be paid under the PJM proposal.

B. Continuing to Pay Black Start Units Existing as of June 6, 2021, at the Current CRF Rates Is Unduly Discriminatory.

PJM's primary argument (at 5) for continuing to pay the existing black start units as of June 6, 2021, at the current CRF rates is that "different rates among non-similarly situated

[4] 176 FERC ¶ 61,080 at 48.

[5] Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2096, Stat. 2105 (2017).

[6] 26 U.S. Code §11(b).

[7] See 26 U.S. Code §168(k)(6)(A).

customers are not unduly discriminatory." PJM misapplies the unduly discriminatory standard. PJM misstates the facts, and has not shown that its cited precedents are relevant here.

PJM explains (at 2), "owners of Black Start Units that made the Existing Black Start Investments … are not similarly situated to new Black Start Unit investors in the timing of investment in Black Start capability and the filed rate at the time of their investment decisions." PJM relies (at 5–8) on various cases where the Commission took into account information available to investors at the time of investment decisions and treated them differently as a consequence. These cases are not on point because the cited cases concern subjective matters like investors' evaluations of the costs and benefits of RTO membership or the impact of certain rule changes on the terms of financing.[8] The issue in this case is the level of tax rates and taxes paid. The issue in this case concerns objective facts and does not concern subjective investor expectations. It is unduly discriminatory, and unjustifiable, to provide a windfall to a class of black start service providers based on the use of demonstrably incorrect tax payments.

PJM's formula rate has not changed. PJM has now filed and made explicit in the tariff the formula that has always applied. The result is enhanced transparency, but not a change to the formula rate. PJM mischaracterizes its formula rates under OATT Schedule 6A as "stated rates," and, based on that mischaracterization, attempts (at 8–9) to distinguish its formula rates from a straightforward application of the principles in *Alcoa Power Generating Inc.—Long Sault Division*, 162 FERC ¶ 61,224 (2018) ("*Alcoa*"), and *Public Utility Transmission*

[8] *See, e.g.*, PJM at 6 n.15 , citing Mo. River Energy Servs. v. FERC, 918 F.3d 954, 958–60 (D.C. Cir. 2019) ("The court affirmed the Commission's reasoning that there was no undue discrimination between new and existing members because the new members had the opportunity to consider the costs and benefits of joining SPP."); PJM at 6–7 n.19, citing *ISO New England Inc.*, 170 FERC ¶ 61,011, at PP 14–15 (2020) ("The Commission found that new non-commercial capacity was not similarly situated with existing non-commercial capacity that cleared before the upcoming auction policy because 'existing capacity would have secured financing and/or made arrangements in anticipation of, and contingent upon, the incumbent financial assurance requirements.'").

Rate Changes to Address Accumulated Deferred Income Taxes, Order No. 864, 169 FERC ¶ 61,139 (2019) ("Order No. 864").

PJM asserts (at 8–9) that "not all utilities with stated transmission rates that were subjects of the show cause order in *Alcoa* filed to reduce their stated transmission rates to reflect the lower federal corporate income tax rate." This case concerns PJM's formula rate, and under the principles explained in *Alcoa*, PJM should be required to apply its formula rates accurately. PJM provides no valid reason for continuing to pay black start units for taxes that are not paid based on an arbitrary in service date. PJM does not explain how the circumstances justify any exception, or how the circumstances match those of any entity asserted to have received an exception. The only example of a reason why the Commission might not require accurate treatment of tax rates in a show cause proceeding is where the "the reduced tax rate is being addressed in another proceeding pending before the Commission."[9] PJM has not indicated another proceeding addressing this issue. There is no other proceeding.

PJM also argues that it should be treated like "utilities with stated transmission rates" that, under Order No. 864, were allowed "to address TCJA's impact on ADIT in their next rate case." OATT Schedule 6A refers explicitly to formula rates, not stated rates.[10] The case concerns the application of PJM's formula rates. Unlike stated rates, formula rates are meant to accommodate changed inputs without the need for additional filings. PJM provides no reason not to implement just, reasonable and not unduly discriminatory formula rates in this proceeding.

The Market Monitor's proposed values reflect the actual tax rates and taxable depreciation rates that actually apply to each unit. If the taxable depreciation rate for a unit

9 *See* 162 FERC ¶ 61,224 at P 4 n.7.

10 *See* OATT Schedule 6A para. 17 ("Black Start Service revenue requirements for each Black Start Unit shall be based, at the election of the owner, on either (i) a FERC-approved rate … or (ii) the formula rates set forth in section 18 of this Schedule 6A").

built in 2016 differs from that for a unit built in 2019, different taxable depreciation rates apply to each unit. That result is not discriminatory because it reflects the actual taxes paid by each unit.

The Market Monitor's proposal is consistent with the case law upon which PJM relies with respect to both taxes paid and the treatment of depreciation. Investor expectations are not relevant to the amount of taxes paid. If a reduction in tax rates is not accounted for, the result is an unjust and unreasonable and unduly discriminatory windfall.[11] To avoid undue discrimination, PJM should uniformly calculate and apply the formula rate based on the effective tax rates.

PJM never addresses, in any of its filings, the fact that customers are being unjustly overcharged for black start service. PJM focuses on the expectations of investors rather than the expectations of customers who could reasonably expect that the regulatory process would result in correctly calculated payments for black start service.

The windfall issue resulted from a loophole created by PJM's failure to update the PJM tariff. PJM failed to update its tariff for months after the flaw had been identified. PJM states (at 7) that "at the time existing Black Start Unit owners made the tailored Existing Black Start Investments addressed by a CRF, they did not have notice of the new formulaic, annually updated CRF, or the opportunity to consider this new approach's costs and

[11] *See Alcoa Power Generating Inc.—Long Sault Division*, 162 FERC ¶ 61,224 (2018) (Given the reduction in the federal corporate income tax rate, we have undertaken a review of Commission-jurisdictional stated transmission rates under open access transmission tariffs or transmission owner tariffs, and we have identified Respondents as having such arrangements in effect. Because the federal corporate income tax rate has been reduced to 21 percent, absent a change to the stated rates, Respondents' stated rates may not accurately reflect their cost of service. Accordingly, we find that Respondents' stated rates on file with the Commission appear to be unjust, unreasonable, and unduly discriminatory or preferential, or otherwise unlawful.); Order No. 864 at P 8 ("As a result of the Tax Cuts and Jobs Act reducing the federal corporate income tax rate from 35 percent to 21 percent, a portion of an ADIT liability that was collected from customers will no longer be due from public utilities to the IRS and is considered excess ADIT, which must be returned to customers in a cost of service ratemaking context.[footnote omitted] Public utilities are required to adjust their ADIT assets and ADIT liabilities to reflect the effect of the change in tax rates in the period that the change is enacted.[footnote omitted]").

benefits." While PJM failed to update the tariff, the owners of black start units with service terms beginning, during, or after 2018 knew the results of being paid a revenue amount determined by a CRF calculated under the outdated tax rates and depreciation schedules. While the question of expectations is not at issue, black start owners could not reasonably have expected PJM to fail to update the CRF rate for the lower taxes or have expected the Commission to approve charging excessive cost-based rates not based on costs.

CRF means capital recovery factor. The CRF is calculated to ensure that investors are paid for the return on capital and the return of capital. The basic and well understood financial math of the CRF rate includes taxes. PJM has not supported its implicit claim that investors legitimately expected a windfall based on a reduction in the tax rate and has not supported its implicit claim that, even if true, investors' expectations of a windfall should be ratified by a regulatory decision.

The issue now is to determine a new CRF rate for payments going forward.

C. Capital Recovery Factor: the Basics

The PJM tariff states that owners of black start units may elect "to recover new or additional Black Start Capital Costs" and defines Incremental Black Start Capital Costs as "new or additional capital costs … for the incremental equipment solely necessary to enable a unit to provide Black Start Service."[12] The tariff clearly states that black start owners are entitled to recover black start capital costs, no more and no less.[13] The black start capital cost recovery consists of a return on the capital investment, a return of the capital investment, and the associated income taxes incurred. The correctly calculated capital recovery factor (CRF), when multiplied by the initial capital investment, provides the necessary and sufficient revenue level to provide for the return on and return of the capital investment and to pay the associated income taxes.

12 OATT Schedule 6A Paras. 6 and 18.

13 *Id*.

Table 1 makes clear what is meant by the phrase "necessary and sufficient revenue to pay the tax liabilities and provide for the return on and the return of the capital investment." But Table 1 does reflect a rounding error in the existing CRF. The correctly calculated CRF results in exactly the outcome required by the tariff.

Table 1 shows the cash flows for a black start unit with a five year service term and a $1 million capital investment using the financial parameter and tax rate assumptions for black start service beginning prior to June 6, 2021. The parameter and tax rate assumptions are in Table 2.

Table 1 Cash flow summary for 5 year service term, $1 million capital investment[14] [15] [16] [17]

Service Year	1	2	3	4	5
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$123,524	$100,244	$106,840	$113,203	$119,428
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$48,908	$37,393	$25,287	$12,493
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$92,436	$95,959	$100,878	$106,621	$113,190
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$407,564	$311,604	$210,726	$104,105	($9,085)

[14] The model uses 15 year MACRS depreciation factors with the half year convention and the tax payment is calculated as the product of the effective tax rate in Table 2 and the revenue net of depreciation and interest on debt.

[15] The model assumes the half year convention for revenue and tax payments. The interest on the debt in year 1 is equal to the product of the debt investment and the half year interest rate, $\sqrt{1.07} - 1$. The year 1 return on equity is equal to the product of the equity investment and the half year rate of return, $\sqrt{1.12} - 1$. Interest on the debt in other years is 7.0% of the previous year's remaining debt. Return on equity beginning in year 2 is 12.0% of the previous year's remaining equity.

[16] The debt payment is calculated using a standard formula given by $\$500{,}000 \cdot \frac{(.07)(1.07)^5}{\sqrt{1.07}[(1.07)^5-1]}$, or Microsoft Excel PMT function can be used, $-\sqrt{1.07} \cdot \text{PMT}(.07,5,500000,0,1)$.

[17] Payback of the debt investment is equal to the debt payment net of interest on the debt. Payback of the equity investment is equal to revenue net of taxes, the debt payment and return on equity.

Table 2 Financial parameter and tax rate assumptions[18]

Financial Parameter	Parameter Value
Equity Funding Percent	50.0000%
Debt Funding Percent	50.0000%
Equity Rate	12.0000%
Debt Interest Rate	7.0000%
Federal Tax Rate	36.0000%
State Tax Rate	9.0000%
Effective Tax Rate	41.7600%

The CRF defined in the tariff for black start service beginning prior to June 6, 2021, is 0.363 for a five year service term. This CRF was based on the assumption that tax rates were at levels prior to the TCJA. The cash flow summary in Table 1 is based on the financial model, called a flow to equity (FTE) model, that was used to develop the CRF stated in the tariff.[19] The FTE model treats the return and payback of equity and debt separately. The payback to equity investors in the FTE model is calculated as the revenue net of taxes, the debt payment and return on equity. The weighted average cost of capital (WACC) model which was used to calculate the CRF for black start service after June 6, 2021, averages the equity and debt in the calculation of investment return and investment payback. The cash flow summary in Table 1 shows that in each year after accounting for the tax payment, return on equity and the debt payment, there is additional revenue for payback to the equity investor. The equity investment remaining at the end of the service term should be exactly $0, but the tariff defined CRF values have rounding errors that cause a small overpayment in this example.

Table 3 shows the cash flow summary for the same example with the rounding errors corrected. The CRF is 0.360545 and the annual revenue payment is $360,545.[20] Table 3 makes

[18] The effective tax rate is equal to State Tax Rate + Federal Tax Rate x (1-State Tax Rate).

[19] Additional details on the flow to equity approach can be found in Section 17.2 in "Corporate Finance," Ross, Westerfield, Jaffe, 4th Edition, 1996.

[20] The CRF value of 0.360545 was calculated using a CRF formula for the FTE model that is similar to the CRF formula used for WACC model CRF.

clear exactly what is meant by the phrase "necessary and sufficient revenue to pay the tax liabilities and provide for the return on and the return of the capital investment." Table 3 eliminates the small rounding error that is shown in Table 1, but both tables illustrate the essential point. The correctly calculated CRF results in the outcome required by the tariff. Each year the revenue that results from the CRF covers the interest on the debt and the payback of the debt principal, covers the defined return on the equity investment, covers the taxes, and the remaining funds go towards payback of the equity investment. At the end of the service term, the remaining debt investment and the remaining equity investment are both $0. The entries in the debt payback row sum to $500,000 as do the entries of the equity payback row, reflecting the 1:1 debt to equity ratio in Table 2.

Table 3 Cash flow summary for 5 year service term, $1 million capital investment with rounding errors corrected

Service Year	1	2	3	4	5
Revenue	$360,545	$360,545	$360,545	$360,545	$360,545
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$122,499	$99,219	$105,815	$112,178	$118,403
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$49,079	$37,756	$25,866	$13,313
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$91,006	$94,358	$99,084	$104,612	$110,940
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$408,994	$314,636	$215,552	$110,940	$0

D. How the CRF Creates a Windfall Based Only on the Tax Rate

The creation of the windfall under PJM's proposal can be illustrated using the same basic example. The windfall is a result of both the reduction in the tax rate and the change in the depreciation provisions. This illustration is only about the windfall resulting from the change in the tax rate. Consider a black start unit that began service on January 1, 2016. The unit would not have been eligible for bonus depreciation, but the federal tax rate dropped to 21.0 percent on January 1, 2018.

Table 4 shows the resulting cash flow summaries. The first cash flow summary in Table 4 shows the cash flow that was assumed when the CRF determination was made. It

was assumed for the five year service term that the black start owner would pay federal taxes at 36.0 percent and there is a small overpayment by customers due to the rounding errors.

The second cash flow summary in Table 4 reflects the change of federal tax rate to 21.0 percent on January 1, 2018, which in this example is at the beginning of service year 3.[21] No other parameters were changed. The tax liability in service year 3 dropped by $34,923 and the extra funds were an additional payback to the equity investors. The lower tax liability has a compounding effect with the result that the rate of equity payback increases each year. At the end of the five year service term the payback to equity investors exceeds the equity investment by $133,372 or 26.7 percent. The payback in excess of the total capital investment of $1 million has been exceeded by 13.3 percent. This excess payment, the windfall, is the result of the fact that the actual tax rate decreased but that the CRF was not decreased to reflect that change.

[21] The new effective tax rate after changing the federal tax rate to 21.0% is 28.11%. This assumes the state tax rate remains at 9.0%.

Table 4 Cash flow summary for 5 year service term, $1 million capital investment, service term starting January 1, 2016

Service Year	1	2	3	4	5
	Cash flow assumed in annual revenue determination				
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$123,524	$100,244	$106,840	$113,203	$119,428
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$48,908	$37,393	$25,287	$12,493
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$92,436	$95,959	$100,878	$106,621	$113,190
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$407,564	$311,604	$210,726	$104,105	($9,085)
	Cash flow reflecting actual tax liabilities, return and payback				
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$123,524	$100,244	$71,918	$76,201	$80,391
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$48,908	$37,393	$21,096	$3,359
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$92,436	$95,959	$135,801	$147,814	$161,361
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$407,564	$311,604	$175,804	$27,989	($133,372)

The resultant internal rate of return (IRR) also shows the overpayment by customers for black start service. The IRR is the discount rate for which the net present value of the after tax cash flow is $0. For example, the after tax cash flow, or revenue net of taxes and the debt payment, for each of the examples is in Table 5. The IRR under the original CRF determination, with no change in tax rates, is 12.5 percent where the rounding error in the CRF has caused the IRR to deviate from the assumed return on equity value of 12.0 percent.[22] [23] The IRR is 12.0 percent for the second row of Table 5. The only difference in the second row

[22] The IRR was calculated using the Solver application in Microsoft Excel.

[23] Each annual cash flow amount is assumed to occur at the midpoint of the service year.

is that the rounding error is eliminated in the second row. The IRR is 19.2 percent for the row 3 after tax cash flow which reflects the reduction in actual tax payments compared to the tax payments included in the CRF. The failure to update the CRF to reflect the reduced tax rate increased the black start owner's return on equity from 12.0 percent to 19.2 percent in this example.

Table 5 After cash flow for 5 year service term, $1 million capital investment

Service Year	1	2	3	4	5
After tax cash flow - Original CRF determination	$121,587	$144,867	$138,271	$131,908	$125,683
After tax cash flow - Rounding errors corrected	$120,157	$143,437	$136,841	$130,478	$124,253
After tax cash flow - Actual tax liabilities, return & payback	$121,587	$144,867	$173,193	$168,910	$164,720

E. Actual Calculated Windfall Paid by PJM Customers for Units that Have Completed Service

As a result of the reduction in tax payments and the failure to reduce the CRF to reflect that reduction, payback in excess of the capital investment has already occurred for PJM black start service. The Market Monitor calculated the payback of capital investments for seven black start units that completed their service terms between August 2018 and June 2021, and found that the payback exceeded the capital investment amounts by $4.3 million or 10.2 percent. This means customers paid the black start owners sufficient revenue to cover the tax liabilities associated with the black start revenue and investment return payments at 7.0 percent for the debt portion of the capital investment and 12.0 percent for the equity portion, and the customers paid back the capital investment plus an additional $4.3 million or 10.2 percent of the capital investment.

In this filing, the Market Monitor is not proposing any adjustment to the payments already made to units that completed their service terms prior to June 2021.

F. How the CRF Creates a Windfall Based on the Tax Rate and Depreciation

The creation of the windfall under PJM's proposal can be illustrated using the same basic example. The windfall is a result of both the reduction in the tax rate and the change in the depreciation provisions. This illustration is about the windfall resulting from both the

change in the tax rate and the change in depreciation rules. Consider a black start unit that began service on January 1, 2019. This black start unit would have paid federal income tax at 21.0 percent from the start of the service term and would have been eligible for 100 percent bonus depreciation.

Table 6 shows the resulting cash flow summaries. The first cash flow summary in Table 6 shows the cash flow that was assumed when the CRF determination was made. It was assumed for the five year service term that the black start owner would pay federal taxes at 36.0 percent and there is a small overpayment by customers due to the rounding errors. Even though the service term begins after the effective date of the TCJA, the revenue payment is exactly the same as in first example because it is based on the CRF in the tariff that continued to incorporate the incorrect tax rates and depreciation.

The second cash flow summary in Table 6 reflects the actual tax liabilities and expected return on and return of the capital investment. The federal tax rate of 21.0 percent beginning with service year 1, and 100 percent bonus depreciation, are reflected in the second cash flow summary. No other changes were made.

Table 6 Cash flow summary for 5 year service term, $1 million capital investment, service term starting January 1, 2019[24] [25]

Service Year	1	2	3	4	5
	Cash flow assumed in annual revenue determination				
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$50,000	$95,000	$85,500	$77,000	$69,300
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	$123,524	$100,244	$106,840	$113,203	$119,428
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$48,908	$37,393	$25,287	$12,493
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$92,436	$95,959	$100,878	$106,621	$113,190
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$407,564	$311,604	$210,726	$104,105	($9,085)
	Cash flow reflecting actual tax liabilities, return and payback				
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$1,000,000	$0	$0	$0	$0
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	($183,897)	$94,182	$95,952	$97,845	$99,871
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$12,017	($4,652)	($23,110)	($43,555)
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$399,857	$138,912	$153,812	$170,375	$188,794
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$100,143	($38,769)	($192,581)	($362,956)	($551,751)

As a result of the CRF including revenues for taxes that are not paid, the equity portion of the capital investment was fully paid back in service year 2, rather than at the end of the five year period. An assumption in the FTE model, is that the equity investor invests the excess payback at the same rate of return on equity included in the CRF, 12 percent. This is reflected in the cash flow summary as a negative return on equity in Table 6, which is then

[24] It is assumed that the capital investor would use the negative tax liability in service year 1 as an offset against the tax liabilities resulting from other revenue.

[25] The effective tax rate is 28.11% after changing the federal tax rate to 21.0%.

included in the payback to equity as a positive number.[26] The cash flow summary shows that payback in excess of the equity investment is $551,751 or 110.4 percent. The payback in excess of the total capital investment of $1 million is 55.2 percent. The IRR is 61.6 percent for the after tax cash flow reflecting the actual tax liabilities. This excess payment, the windfall, is the result of the fact that the actual tax rate decreased and the depreciation rules changed but that the CRF was not decreased to reflect those two changes.

A row by row comparison between the two cash flow summaries in Table 6 shows that the payback in excess of the capital investment can be separated into three distinct categories, payment of taxes that were not incurred, return on capital investments that have already been paid back and return on reinvestment of the excess payback. (See Table 7.) The difference between the service year 1 tax payment assumed in the outdated CRF and the actual tax payment is $307,421. The difference between the investment return numbers for service year 2 is $36,891. This reflects the accelerated payback of the equity investment. In service year 3 through service year 5, the equity investment has been paid back in full yet the revenue payment of $363,000 assumes a return on equity for each year. In fact, the equity investor, having been paid back in full in service year 2, is earning returns on the excess payback in service year 3 through service year 5 as shown in the third row of Table 7. The Table 7 total of $542,666 and the excess payback due to rounding errors, $9,085, sum to the total payback in excess of the capital investment given in Table 6.

Table 7 Payback in excess of the capital investment by category

Service Year	1	2	3	4	5
Payments for taxes not incurred	$307,421	$6,062	$10,889	$15,358	$19,557
Return on capital that has already been paid back	$0	$36,891	$37,393	$25,287	$12,493
Return on reinvestment of payback in excess of the capital investment	$0	$0	$4,652	$23,110	$43,555
Total for Year	$307,421	$42,953	$52,933	$63,755	$75,604
Total for All Years					$542,666

[26] Payback to equity in the FTE model is (Revenue – Taxes – Debt Payment – Return on Equity).

G. Actual Calculated Windfall Paid by PJM Customers for Black Start Units Still in Service

If black start units continue to receive the annual revenue payments determined by the incorrect CRF, as PJM recommends, customers will overpay black start units that started service prior to June 6, 2021, by $126.0 million. The overpayment will go to the existing black start service fleet and $126 million does not include the $4.3 million in excess payback that has already been paid to black start units that completed their service terms between August 2018 and June 2021. The Market Monitor uses the FTE model to calculate the overpayment because that was the model used to calculate the CRFs that created the overpayment.

For black start units that started service during or after 2018 and prior to June 6, 2021, the percent payback in excess of the capital investment and the IRR in excess of the required level will be the same for units with the same term of service. All five year black start units will have the same percent overpayment. All ten year black start units will have the same percent overpayment. The same is true for all service lives. All such black start units were eligible for 100 percent bonus depreciation and the new federal tax of 21.0 percent was effective from the start of the service terms.

Table 8 summarizes the actual percent payback in excess of the capital investment and the IRR that will result under the PJM proposal. Under the PJM proposal with the financial assumptions in Table 2, all black start units beginning a ten year service term during or after 2018 and before June 6, 2021 will receive payback in excess of their capital investment totaling 70.5 percent of the capital investment. For every $1 million invested the black start owner will receive $700,500 in addition to being paid back the $1 million capital investment and receiving annual revenue payments to cover the tax liabilities and return on the investment. A unit with a 20 year service term will receive payback in excess of their capital investment totaling 155.2 percent of the capital investment.

Table 8 Payback in excess of capital investment and IRR for service terms beginning on or after January 1, 2018 and before June 6, 2021

Service Term	Excess Payback as Percent of Investment	Internal Rate of Return (IRR)
5	55.2%	61.6%
10	70.5%	34.0%
15	96.2%	25.6%
20	155.2%	22.8%

Table 9 shows the actual expected payback in excess of the capital investment, by service term start date, for the black start units in PJM. The majority of the excess payback, 71.4 percent, is attributable to black start units that began services terms after January 1, 2019.

Table 9 Expected payback in excess of capital investments for existing black start units

	Excess Payback ($ million)	Percent
Service Terms Beginning Prior to January 1, 2017	$36.05	28.6%
Service Terms Beginning After January 1, 2019	$89.93	71.4%
Total	$126.0	100.0%

H. Closing the Loophole

The Commission invited interested entities to respond with "what changes to PJM's Tariff should be implemented as a replacement rate."[27]

The Market Monitor proposes to update the CRF applicable to existing units going forward to a rate that will reflect the return of capital already received by existing black start units and eliminate the payback in excess of the capital investment for existing black start units. The Market Monitor's proposal is consistent with the "capital cost recovery" language in Schedule 6A of the PJM tariff and can be implemented without any retroactive resettlement

[27] August 10th Order at 53.

or disgorgement. The updated CRF can be set at the level that covers the tax liabilities going forward, pays a return at the required rates on any remaining capital investment, pays back the full investment and therefore results in the required return on and of capital over the CRF term.

Using the formula for the CRF, a different CRF will need to be calculated for each existing black start unit based on the exact in service date and the duration of the service period. The Market Monitor is providing the formula in this filing. The Market Monitor has calculated the resulting CRF for each existing black start unit and will provide to the Commission and PJM if that would be helpful.

Table 10 shows updated CRF values for several combinations of service start dates and service terms. The updated CRF values were calculated using equation (1) below and the financial parameter and tax rate values in Table 12.

Table 10 Updated CRF for selected dates and service terms

Service Start	Service Term	Current CRF	Updated CRF
7/1/2019	5	0.363	0.083443
7/1/2020	5	0.363	0.174620
7/1/2021	5	0.363	0.225022
7/1/2019	10	0.198	0.110218
7/1/2020	10	0.198	0.127560
7/1/2021	10	0.198	0.137200
7/1/2019	20	0.125	0.083515
7/1/2020	20	0.125	0.088581
7/1/2021	20	0.125	0.092963

The procedure for establishing a formula for the updated CRF is a two step process: (1) the remaining capital investment is determined as of the effective date of the updated CRF and (2) an updated CRF formula is derived based on the remaining service term and the remaining capital investment amount.

1. Model for Updated CRF Reflecting a Change in the Tax Law

The updated model incorporates a change in the tax rate and a change in the CRF to permit the calculation of the impact of over collection under the initial tax rate and associated

CRF, the new tax rate, and the updated CRF. The timing of these two changes is treated independently in order to reflect the delayed implementation of the revised CRF.[28] To account for these factors, variable m represents the service year during which the tax change occurs, and variable q represents the first service year during which the updated CRF is effective. Variable γ represents the fractional portion of service year m for which the old tax rate is applicable. Variable μ is defined to be the fractional portion of service year q for which the old CRF is applicable.

The formula for the updated CRF is given in equation (1).

$$c_2 = \frac{r_e(1+r_e)^{N-q}}{(1-s_2)[(1+r_e)^{N-q+1} - 1 - \mu r_e(1+r_e)^{N-q}]} \Bigg\{ F_{q-1}(1+r_e) - \mu c_1(1-s_2)$$

$$- s_2 \sum_{j=q}^{N} \delta_j \left(\frac{1}{1+r_e}\right)^{j-q}$$

$$- (1-E)s_2 \frac{r_d(1+r_d)^{q-3/2}}{[(1+r_d)^N - 1]} \left[\frac{(1+r_d)^{N-q+1}[(1+r_e)^{N-q+1} - 1]}{r_e(1+r_e)^{N-q}} \right.$$

$$\left. - \frac{(1+r_e)^{N-q+1} - (1+r_d)^{N-q+1}}{(r_e - r_d)(1+r_e)^{N-q}} \right]$$

$$+ (1-E)\left(\frac{r_d(1+r_d)^{N-1/2}}{(1+r_d)^N - 1}\right)\left(\frac{(1+r_e)^{N-q+1} - 1}{r_e(1+r_e)^{N-q}}\right) \Bigg\}. \qquad (1)$$

The factor F_{q-1} which when multiplied by the initial capital investment K_0 gives the remaining equity investment prior to the effective date of the updated CRF,

[28] At this point the implementation of a revised CRF will take place at least three year and ten months after the effective date of the TCJA.

$$F_{q-1} = F_{m-1}(1+r_e)^{\alpha} - c_1(1-s_2)\frac{(1+r_e)^{q-m}-1}{r_e} + \gamma c_1(s_1-s_2)(1+r_e)^{q-m-1}$$

$$-\gamma\delta_m(s_1-s_2)(1+r_e)^{q-m-1} - s_2X - (1-E)[\gamma s_1 + (1-\gamma)s_2]Z(1+r_e)^{q-m-1}$$

$$+(1-E)\frac{r_d(1+r_d)^{N-1/2}}{(1+r_d)^N-1}\frac{(1+r_e)^{q-m}-1}{r_e}$$

$$-(1-E)s_2\frac{r_d(1+r_d)^{m-1/2}}{[(1+r_d)^N-1]}\left\{\frac{(1+r_d)^{N-m}[(1+r_e)^{q-m-1}-1]}{r_e}\right.$$

$$\left.-\frac{(1+r_e)^{q-m-1}-(1+r_d)^{q-m-1}}{r_e-r_d}\right\}$$

where

$$\alpha = \begin{cases} q-m-1/2, & m=1 \\ q-m, & m>1 \end{cases}$$

$$X = \begin{cases} 0, & m=q \\ \sum_{j=m}^{q-1}\delta_j(1+r_e)^{q-j-1}, & m<q \end{cases}$$

$$Z = \begin{cases} \sqrt{1+r_d}-1, & m=1 \\ \frac{r_d(1+r_d)^{m-1}}{\sqrt{1+r_d}}\left(\frac{(1+r_d)^{N-m+1}-1}{(1+r_d)^N-1}\right), & m>1\,. \end{cases}$$

Factor F_{m-1} which when multiplied by the initial capital investment K_0 gives the remaining equity investment prior to the change in the tax law. In the case that the tax law change occurs in the first service year ($m = 1$), the value of the equity investment prior to the tax change is equal to the equity funding percent, or $F_0 = E$. In the case the $m > 1$

$$F_{m-1} = E\sqrt{1+r_e}(1+r_e)^{m-2} - c_1(1-s_1)\left[\frac{(1+r_e)^{m-1}-1}{r_e}\right] - s_1\sum_{j=1}^{m-1}\delta_j(1+r_e)^{m-1-j}$$
$$-(1-E)s_1\left(\sqrt{1+r_d}-1\right)(1+r_e)^{m-2}$$
$$+\frac{(1-E)r_d(1+r_d)^{N-1/2}}{(1+r_d)^N-1}\left[\frac{(1+r_e)^{m-1}-1}{r_e}\right]$$
$$-(1-E)s_1\frac{r_d\sqrt{1+r_d}}{(1+r_d)^N-1}\left\{\frac{(1+r_d)^{N-1}[(1+r_e)^{m-2}-1]}{r_e}\right.$$
$$\left.-\frac{(1+r_e)^{m-2}-(1+r_d)^{m-2}}{r_e-r_d}\right\}.$$

As an example, consider a black start unit that began service on December 1, 2018, and assume the updated CRF will be effective on January 1, 2022. In this case the new tax law was effective prior to the service start date so that m is 1 and γ is 0. The updated CRF becomes effective one months into service year 4, so that q is 4 and μ is 0. 0833.

Table 11 Variable descriptions for updated CRF

Variable	Description
E	Equity funding percent
r_e	Return on equity
r_d	Debt interest rate
s_1	Effective tax rate prior to tax rate change
s_2	Effective tax rate after tax rate change
c_1	Initial CRF
c_2	Updated CRF
N	Cost recovery period
m	Service year in which tax rate change occurs
γ	Partial year in service year m for which tax rate s_1 applies
q	Service year in which updated tax rate is incorporated into CRF
μ	Partial year in service year q for which CRF c_1 applies
δ_i	Depreciation factor for service year i

The Market Monitor recommends that the financial parameters for black start units that began service prior to June 6, 2021, remain unchanged. This directly addresses the expectation question. The risk and return expectations are unchanged. The only updates are to include the actual federal and state tax rates and bonus depreciation where applicable. The financial parameter and tax rate assumptions, the current assumptions for existing black start

units that began service prior to June 6, 2021, along with the proposed updates, are presented in Table 12.

Table 12 Financial parameter and tax rate assumptions

Parameter	Black start service beginning prior to June 6, 2021	Market Monitor's Replacement Rate
Equity Funding Percent	50.0000%	50.0000%
Debt Funding Percent	50.0000%	50.0000%
Equity Rate	12.0000%	12.0000%
Debt Interest Rate	7.0000%	7.0000%
Federal Tax Rate	36.0000%	21.0000%
State Tax Rate	9.0000%	9.3000%
Effective Tax Rate	41.7600%	28.3470%
After tax Weighted Average Cost of Capital	8.0384%	8.5079%

Consider again the example of a black start unit with a five year service term and a $1 million capital investment that began service on July 1, 2020.[29]

Using the formula in equation (1) and the parameter assumptions under the Market Monitor's replacement rate in Table 12, gives an updated CRF value of 0.174620, where the updated CRF is effective on January 1, 2022.[30] The updated annual revenue requirement is $174,620.

Table 13 shows the corresponding update to the cash flow summary. The updated revenue requirement is effective beginning in service year 2. The year 2 revenue reflects six months at the old CRF rate and six months at the updated CRF. The remaining capital investment is $0 at the end of the service term and summing the capital investment payback row produces a total investment payback of $1 million. The loophole has been closed and the result is fully consistent with the goal of the formula rate in the tariff. The black start owner

[29] The black start unit service start date is after the TCJA effective date so that parameter $m = 1$ and parameter $\gamma = 0$.

[30] The updated CRF effective date is at the start of service year 2 so that parameter $q = 2$ and parameter $\mu = 0.5$.

would receive the necessary and sufficient revenue to cover the target return on the investment, the full recovery of the capital investment, and all the tax liabilities associated with the annual revenue payment. The internal rate of return (IRR) for the after tax cash flow resulting from the updated CRF is 12.0 percent which matches the return on equity in Table 12.

Table 13 Updated cash flow summary reflecting updated CRF

Service Year	1	2	3	4	5
Revenue	$363,000	$268,810	$174,620	$174,620	$174,620
Depreciation	$1,000,000	$0	$0	$0	$0
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Tax payment	($185,447)	$68,276	$43,361	$45,270	$47,313
Debt payment	$117,889	$117,889	$117,889	$117,889	$117,889
Return on equity	$29,150	$11,831	$3,333	$2,129	$1,009
Payback of debt	$100,685	$89,937	$96,233	$102,969	$110,177
Payback of equity	$401,408	$70,814	$10,037	$9,332	$8,409
Remaining debt	$399,315	$309,378	$213,145	$110,177	$0
Remaining equity	$98,592	$27,778	$17,741	$8,409	$0

Next consider a black start unit with a ten year service term and a $10 million capital investment. Assume the service term begins on March 1, 2020 and the updated CRF is effective on January 1, 2022.[31] The current CRF for black start units with at 10 year service term and a service start date prior to June 6, 2021 is 0.198. Using equation (1) and the parameters in Table 12 results in an updated CRF of 0.120700. The new annual revenue requirement is $1,207,002.Table 14 shows the cash flow summary corresponding to the updated CRF.

[31] The service start date is after the TCJA effective date so that parameter $m = 1$ and parameter $\gamma = 0$. The effective date for the updated CRF is ten months into service year 2 so that $q = 2$ and $\mu = 0.8333$.

Table 14 Ten year black start service term, $10 million investment ($ 000)

Service Year	1	2	3	4	5	6	7	8	9	10
Revenue	$1,980.0	$1,851.2	$1,207.0	$1,207.0	$1,207.0	$1,207.0	$1,207.0	$1,207.0	$1,207.0	$1,207.0
Depreciation	$10,000.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Interest on debt	$172.0	$313.9	$287.7	$259.6	$229.6	$197.5	$163.2	$126.4	$87.1	$45.0
Tax payment	-$2,322.2	$435.8	$260.6	$268.6	$277.1	$286.2	$295.9	$306.3	$317.5	$329.4
Debt payment	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2	$688.2
Return on equity	$291.5	$201.3	$138.2	$123.8	$108.6	$92.6	$75.9	$58.2	$39.7	$20.3
Payback of debt	$516.2	$374.3	$400.5	$428.6	$458.6	$490.7	$525.0	$561.8	$601.1	$643.2
Payback of equity	$3,322.5	$525.9	$120.0	$126.4	$133.1	$140.0	$147.1	$154.3	$161.6	$169.1
Remaining debt	$4,483.8	$4,109.5	$3,709.0	$3,280.4	$2,821.8	$2,331.1	$1,806.1	$1,244.3	$643.2	$0.0
Remaining equity	$1,677.5	$1,151.6	$1,031.6	$905.2	$772.1	$632.1	$485.0	$330.8	$169.1	$0.0

The revenue in service year 2 reflects 10 months at the old CRF and 2 months at the updated CRF. The remaining capital investment at the end of the service term is $0 indicating that the revenue determined by the updated CRF provides the necessary and sufficient level of revenue to cover the tax liabilities and provide for the return on and return of the capital investment. The IRR for the after tax cash flow resulting from the updated CRF is 12.0 percent which matches the return on equity in Table 12.

Under the PJM proposal, this black start unit would continue to receive the annual revenue amount of $1,980,000 and the payback in excess of the capital investment would total $7,041,067 for a total of 170.4 percent of the $10 million capital investment, or a total return of capital of $17,041,067.[32]

I. Additional recommendations

In order to address any concerns regarding impacts on risk and expectations, the Market Monitor recommends that the financial parameters used to calculate the CRF for a black start unit be fixed at the parameters in place as of the service start date.[33] For example, the CRF for a black start unit beginning service on December 1, 2021, would be calculated

[32] The excess payback value, 70.4 percent, differs from the corresponding excess payback value in Table 9 because of the state tax rate assumption. The Market Monitor's replacement rate assumes a state tax rate of 9.3 percent. The values in Table 9 were calculated assuming a 9.0 percent state tax rate.

[33] Financial parameters to be fixed at the start of the service term consist of the debt to equity funding ratio, interest rate on debt and the return on equity.

using the CRF formula in Schedule 6A of the PJM tariff, the financial parameters in Table 15 and the current tax rates and applicable level of bonus depreciation.[34] The CRF value determined at the start of the service term would only be updated in the event of a change in the tax rate or applicable depreciation schedule. PJM included language in a recent compliance filing that specifies the values for the debt to equity ratio and the rate of return on equity given in Table 15.[35] The new tariff language also describes the source of the debt interest rate and describes a process for updating the debt interest rate going forward. In the case that PJM does update one of the financial parameters listed in Table 15, the Market Monitor recommends that the new financial parameters only apply to black start service terms that begin on or after the effective date of the new financial parameters. A change to one of the parameters in Table 15 would not require a change to the CRF of an existing black start unit under the Market Monitor's proposed approach.

Table 15 Financial parameters for black start units with service starting after June 6, 2021[36]

Financial Parameter	Parameter Value
Equity Funding Percent	50.0000%
Debt Funding Percent	50.0000%
Equity Rate	12.0000%
Debt Interest Rate	6.0000%

34 The Commission directed PJM to include a formula for calculating CRF for black start service beginning after June 6, 2021 in 176 FERC ¶ 61,080 at 43.

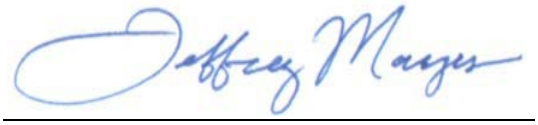
35 See *Attachment A (Redlines) to the Compliance Filing re: Tariff, Schedule 6A, Black Start Revision* (at Schedule 6A, Section 18), PJM Interconnection L.L.C., Docket ER21-1635 (September 9, 2021).

36 Section 18 of Schedule 6A of the PJM tariff says the "debt interest rate is based on the most recent Net CONE quadrennial review after-tax weighted average cost of capital (ATWACC)". The most recent quadrennial review used a debt interest rate of 6.0 percent and this value is used here for illustrative purposes.

II. CONCLUSION

The Market Monitor respectfully requests that the Commission afford due consideration to these comments as it resolves the issues raised in this proceeding.

Respectfully submitted,



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Dated: November 11, 2021

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania,
this 11th day of November, 2021.

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UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. EL21-91-000

ANSWER AND MOTION FOR LEAVE TO ANSWER
OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rules 212 and 213 of the Commission's Rules and Regulations,[1] Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor ("Market Monitor") for PJM Interconnection, L.L.C. ("PJM"), submits this answer to the answer submitted on December 10, 2021, by PJM and by Vistra Corp. and Dynegy Marketing and Trade, LLC (together "Vistra").[2]

On September 9, 2021, PJM filed revisions in this proceeding to Schedule 6A of the OATT to make explicit the formula for calculating the Capital Recovery Factors ("CRF") used as a component in the formula rates for black start service include in Paragraph 18 ("September 9th Filing").[3]

This case is about a mistake and how best to correct the mistake. PJM failed to update the CRF in the tariff to account for the Tax Cuts and Jobs Act of 2017 (TCJA). Black start units that were in service on January 1, 2018, faced a different tax liability going forward than the one assumed in the calculation of the CRF. The mistake was then

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1 18 CFR §§ 385.212 & 385.213 (2021).

2 Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff ("OATT"), the PJM Operating Agreement ("OA") or the PJM Reliability Assurance Agreement ("RAA").

3 PJM Compliance Filing, ER21-1635-002 (September 9, 2021) ("September 9th Filing").

compounded by PJM awarding new black start service terms in 2019, 2020, and 2021, using the incorrect and outdated CRF. In their August 10th order, the Commission stated that the "CRF values currently on file with the Commission appear to be unjust, unreasonable, unduly discriminatory or preferential, or otherwise unlawful."[4] The Market Monitor provided analysis that shows how the failure to update the CRF for seven black start units with completed service terms resulted in $4.3 million of payments to black start unit owners in excess of the capital investment.[5] The Market Monitor's analysis also shows that a failure to update the CRF will result in $126 million of payments to black start unit owners in excess of the capital investment for existing black start service units.[6]

The Market Monitor's proposal to fix the mistake will update the CRF for existing resources to a level that covers the tax liability associated with the capital recovery revenue payments, pays a 12 percent return on equity and the return of the equity investment and repays the debt investment at 7 percent. These financial terms are identical to the financial assumptions used to calculate the pre TCJA CRF. The Market Monitor's proposal is not retroactive. The Market Monitor's approach first establishes the remaining capital investment for a black start unit on the effective date of the updated CRF, and then calculates a new CRF using the remaining capital investment and the black start unit's remaining term of service.

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4 *PJM Interconnection, L.L.C.*, 176 FERC ¶ 61,080 at P 47 (2021) ("August 10th Order").

5 *See* Comments of the Independent Market Monitor (Corrected), Docket EL21-91-000 (November 18, 2021) at 10–13.

6 *Id*. at 13–18.

I. ANSWER

A. The Market Monitor's Proposal Is Not Retroactive.

The Commission stated in the August 10th Order (at P 50) that retroactive settlement would not be considered. The Market Monitor's proposal is consistent with the Commission's determination. At this point there is no active black start unit with a fully recovered black start capital investment, and therefore no over recovery or excess payback has occurred.[7] But over recovery will occur if the CRF values are not updated. Vistra points to the Market Monitor's statement that the updated CRF "will reflect the return of capital already received by the existing black start units and eliminate the payback in excess of the capital investment" as evidence that the Market Monitor's proposal will "claw-back alleged prior over-recoveries."[8] Vistra appears to interpret "eliminate the payback" as a disgorgement or retroactive resettlement which is a misunderstanding. The full amount of the capital investment plus return and taxes will be paid to black start unit owners. The payment will not be less than full compensatory. The payment will not be more than full compensatory. The Market Monitor's proposal does not claw back or disgorge payments. The Market Monitor's proposal simply and accurately prevents the excess payback from occurring.

The Market Monitor's proposal is similar to restructuring a loan. For example when a mortgage is refinanced, the outstanding principal is determined and a new interest rate is used to calculate a new monthly payment. The present value of the newly determined monthly mortgage payments is equal to the outstanding principal.

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[7] Capital recovery in excess of the taxes, and the return on and return of the capital investment has occurred for black start units that have completed their service terms. *See* Comments of the Independent Market Monitor for PJM, Docket No. EL21-91-000 (November 11, 2021) at 13.

[8] Vistra at 5.

The Market Monitor applies the same logic to update the CRF to account for the tax impacts of the TCJA. The outstanding capital investment is determined as of a specified date. Then an updated CRF and associated revenue requirement are calculated so that the present value of the after tax cash flow associated with the newly determined revenue payments is equal to the outstanding capital investment.

B. Criticisms of the Market Monitor's Analysis Are Misplaced.

Vistra stated that the Market Monitor's analysis and estimate of the $126 million payback in excess of the capital investment "should be viewed as an exercise in false precision and afforded no weight."[9] Vistra contends that the Market Monitor's "cash flow summaries would be instructive if - and only if - the cash flows associated with every single Black Start investment made by a variety of companies across the PJM footprint over the course of their cost-recovery periods were identical and remained static but for the" federal tax rate.[10] Vistra misunderstands the cash flow summaries. The Market Monitor's cash flow summaries that illustrate the payback in excess of the capital investment are from the perspective of the PJM customer and represent the costs that PJM customers are required to pay. The Market Monitor's analysis shows that payments by PJM customers will exceed the amount required by the tariff. It is not relevant to the PJM customer whether Vistra's effective federal tax rate for 2018, due in part to a deferred tax credit of $54 million, may have been 44.6 percent (see Table 1). The PJM tariff requires that the black start customer pay the black start owner's tax liability associated with the capital recovery revenue, and the return on and return of the capital investment. The terms of the capital investment from the PJM customer's perspective is a 1:1 debt to equity ratio, 12.0 percent return on equity and 7.0 percent debt interest rate. Knowledge of whether or not the black start owner is

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9 *Id*. at 7.

10 *Id*. at 6.

deferring taxes or knowledge of the actual financial terms for each black start owner is not necessary. The customers pay this amount regardless of the other aspects of the unit owners' financial situation.

Vistra's income tax table actually illustrates the Market Monitor's point (see Table 1). Vistra's black start service revenue for 2017 and 2018 would have been included in the first line of Table 1 (income before income taxes), and lines 2 and 3 clearly show the impact of the TCJA. Vistra's black service revenue from 2017 was taxed at 35 percent and Vistra's black start service revenue from 2018 was taxed at 21 percent.

Table 1 Income Tax Expense (Benefit) Table from Vistra Energy Corp. Form 10-K[11]

	Year Ended December 31,	
	2018	2017
Income (loss) before income taxes	$ (101)	$ 250
US federal statutory rate	21%	35%
Income taxes at the U.S. federal statutory rate	(20)	88
Nondeductible TRA accretion	8	(80)
State tax, net of federal benefit	22	13
Impacts of tax reform legislation on deferred taxes	—	451
Return to provision adjustment	(12)	19
Remeasurement of historical Vistra Energy deferred taxes for expanded state footprint	(54)	—
Effect of refundable minimum tax credits no longer subject to sequestration	(15)	—
Nondeductible compensation	8	—
Nondeductible transaction costs	3	—
Equity awards	(3)	—
Nondeductible debt restructuring costs	—	—
Nondeductible interest expense	—	—
Nontaxable gain on extinguishment of LSTC	—	—
Valuation allowance on state NOLs	20	—
Other	(2)	13
Income tax expense (benefit)	$ (45)	$ 504
Effective tax rate	44.6%	201.6%

The material below line 3 in Table 1 has absolutely no relevance to the PJM black start service customer and should be given zero consideration in any analysis of PJM black start capital cost recovery.

C. Vistra's Arguments For Not Changing the CRF Are Self Serving and Disingenuous.

Vistra (at 7) accuses the IMM of ignoring "the steep public consequences of disregarding the compensation established" for black start investments. Had the corporate

[11] *Form 10-K for the Fiscal Year Ended December 31, 2018, Vistra Energy Corp.*, Note 9, p 119 <https://filecache.investorroom.com/mr5ir_vistracorp_ir/130/vistra-q42018-10K.pdf>.

tax rate increased most assuredly Vistra would be seeking a change to the CRF.[12] Vistra seeks to maintain the current black start revenue payments that assume a 36 percent federal tax rate. Vistra ignores the "steep public consequences" of forcing PJM customers to reimburse black start providers for taxes that are not being levied and eventually under the PJM proposal, to pay returns for investments that have already been paid back.

Vistra argues (at 8) that "Black Start service presents providers with unique risks" and that these "risks are not reflected in the IMM's calculations." PJM made a similar argument in its response to the show cause order.[13] Arguments concerning risk and return should be framed in terms of rate of return. Equity investors and lenders would require higher rates of return if the risks of providing black start service have increased. If Vistra or any other entity genuinely believes the 12 percent return on equity and 7 percent interest on debt are not adequate, then they should make an argument for these rates to be increased. PJM undercuts their contentions regarding risk and return by filing for exactly the same return on equity (12 percent) in their April 7th filing and again in their September 9th Filing.[14] The Market Monitor is not aware of any filings in the black start CRF docket (ER21-1635-000) that sought a higher return on equity than 12.0 percent. Vistra's arguments are also undercut by the fact their black start investments were made prior to the TCJA. Following Vistra's logic (at 7), Vistra (or their predecessor) undertook "complex risk assessments" prior "to committing to make the Black Start investments" and concluded that 12 percent return on equity and debt at 7 percent adequately reflected the risk of providing black start

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12 Media reports in recent months indicate that Congress was just one or two votes shy of increasing the corporate federal income tax rate.

13 PJM, Response to Commission's Show Cause Order at 3, Docket EL21-91 (October 12, 2021).

14 *Cf*. PJM Filing, ER21-1635-000 (April 7, 2021), Attachment C (Redlines); September 9th Filing, Attachment C (Redlines).

service. Now Vistra argues that it is necessary to the keep the current CRF in place in order for Vistra to capture returns in excess of the 12 percent return on equity.

D. The CRF is Not a Stated Rate.

Vistra continues to argue (at 2–5) that CRF values calculated under the formula that is now explicit in the tariff cannot be applied retroactively. Vistra apparently means to suggest that the CRF values included in the tables in Paragraph 18 of OATT Schedule 6A prior to PJM's September 9th Filing ("CRF Tables") are stated rates. Vistra never actually claims that the CRF Tables are stated rates. Vistra stops at the legally meaningless observation that the CRF Tables are "stated."

The CRF Tables standing alone are not rates at all, stated or formula. The CRF Tables are components of the formula rate set forth in Paragraph 18. Paragraph 18 explicitly describes the rates set forth in that paragraph as "formula rates." The CRF values are components of formula rates.

That Paragraph 18 included the CRF Tables in Paragraph 18 does not change their fundamental nature as components of formula rates. The September 9th Filing explicitly includes a formula, and the previous approach of including the CRF Tables did not explicitly include a formula. Vistra suggests (at 3) that that the CRF Tables have no basis because PJM failed to fully explain their basis when it filed them. Information on the basis of the calculated values represented in the CRF Tables has always been available.

Vistra concedes the critical point about formula rate components at issue here when it states: "Retroactive rate changes are only permissible in two narrow circumstances, as the D.C. Circuit recently underscored: (1) when a filed rate takes the form of a formula that varies as the incorporated factors change over time and (2) "when a court invalidates a filed rate as unlawful."[15] Vistra is wrong to characterize such circumstances as "retroactive rate

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[15] *See* Vistra at 4 & n.9, citing Okla. Gas & Elec. Co. v. FERC, 11 F.4th 821, 830–31 (D.C. Cir. 2021) (citing Old Dominion Elec. Coop. v. FERC, 892 F.3d 1223, 1227 (D.C. Cir. 2018)).

changes." The correct characterization is that use of accurate components is necessary to implement the filed formula rate.

The Market Monitor's proposal corrects the overpayment issue and does not require rebilling.

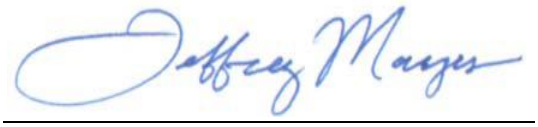
II. MOTION FOR LEAVE TO ANSWER

The Commission's Rules of Practice and Procedure, 18 CFR § 385.213(a)(2), do not permit answers to answers or protests unless otherwise ordered by the decisional authority. The Commission has made exceptions, however, where an answer clarifies the issues or assists in creating a complete record.[16] In this answer, the Market Monitor provides the Commission with information useful to the Commission's decision making process and which provides a more complete record. Accordingly, the Market Monitor respectfully requests that this answer be permitted.

III. CONCLUSION

The Market Monitor respectfully requests that the Commission afford due consideration to this answer as the Commission resolves the issues raised in this proceeding.

Respectfully submitted,



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[16] *See, e.g., PJM Interconnection, L.L.C., 119 FERC ¶61,318 at P 36 (2007)* (accepted answer to answer that "provided information that assisted … decision-making process"*); California Independent System Operator Corporation*, 110 FERC ¶ 61,007 (2005) (answer to answer permitted to assist Commission in decision-making process); *New Power Company v. PJM Interconnection, L.L.C.*, 98 FERC ¶ 61,208 (2002) (answer accepted to provide new factual and legal material to assist the Commission in decision-making process); *N.Y. Independent System Operator, Inc.*, 121 FERC ¶61,112 at P 4 (2007) (answer to protest accepted because it provided information that assisted the Commission in its decision-making process).

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Dated: December 20, 2021

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania,
this 20th day of December, 2021.

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UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. EL21-91-003

RESPONSE OF THE INDEPENDENT MARKET MONITOR FOR PJM
TO FERC TRIAL STAFF'S
FIRST SET OF DATA REQUESTS

S-IMM-1.1. Please provide all available workpapers and/or formulas used to derive the Levelized Capital Recovery Factor (CRF) for Black Start facilities selected to provide service prior to June 6, 2021 (pre-June 6, 2021 CRFs). Define all terms and where applicable provide as live excel spreadsheets.

RESPONSE

Documents responsive to this request are attached. The attached spreadsheet contains a simulation model that was used to calculate the pre-June 6, 2021, CRF values.[1] There is a separate tab for calculating the CRFs corresponding to the four capital recovery periods (5 years, 10 years, 15 years and 20 years). The annual revenue payment is equal to the product of the CRF and capital investment amount. The after tax cash flow to the equity investor is equal to the revenue net of income tax payments and debt payments.[2] The model uses the solver function to iterate through possible values for the CRF, stopping when the internal rate of return (IRR) corresponding to the after tax cash flow is equal to the required return on equity (12.0 percent).

There is an assumption in the simulation model that has an effect on the calculated CRF value, increasing the CRF value slightly. In the simulation model, the debt payments are treated as occurring at mid year. The mid year convention can be used to better align the

[1] 2023-09-15 S-IMM DR 1-1 Response-Attachment.

[2] Generally the fixed O&M expense would also be subtracted from the revenue but the fixed O&M is set to $0 for the capital recovery calculation.

timing of the revenue, income tax and debt payments which would likely be made on a monthly or quarterly basis.[3]

Three presentations from 2006 on the CRF approach are attached to the response to Data Request S-IMM-1.2.

Sponsor: Prepared under the supervision of Dr. Joseph E. Bowring.

Dated: September 15, 2023

[3] The Market Monitor noted this issue in a previous filing but described it as a rounding error. See pages 8-9 and footnote 20 in *Errata Filing of the Independent Market Monitor for PJM*, Attachment B, EL21-91 (November 18, 2021).

S-IMM-1.2. Please provide any Market Monitor records of the stakeholder process in which these CRF factors were developed.

RESPONSE

Please see the following attached documents:

- Attachment A: Black Start Tariff Section 6.4 Proposed Changes, MIC (September 18, 2006).
- Attachment B: Black Start Tariff Section 6.4 Issues, MRC (October 25, 2006).
- Attachment C: Black Start Tariff Section 6.4 Proposed Changes, MIC (October 31, 2006).

Sponsor: Prepared under the supervision of Dr. Joseph E. Bowring.

Dated: September 15, 2023

S-IMM-1.3. Was the formula used to derive the pre-June 6, 2021 CRFs equivalent to the formula for the CRF for facilities selected to provide service after June 6, 2021 (post-June 6, 2021 CRFs)? If not, please explain your understanding of the differences between the two formulas.

RESPONSE

No. The pre-June 6, 2021, CRFs were calculated using a flow to equity (FTE) financial model that incorporates a mortgage payment approach for the loan repayment. Under this approach, the debt to equity ratio is not constant during the cost recovery period. The formula for the post-June 6, 2021, CRF was derived from a weighted average cost of capital (WACC) financial model. When the revenue is equal to the level required to meet all the payment obligations, without excess payments, the results of the two models are quite close.

But when there are payments in excess of the level required to meet all the payment obligations, as has occurred in this case, the difference between the models is significant. In the WACC model, the revenue in excess of income taxes, required interest payments and return on equity is split between accelerated loan repayment and payment to equity according to the debt to equity ratio, and the debt to equity ratio is maintained at a constant level during the cost recovery period. In the FTE model, revenue in excess of income taxes, required debt payments and return on equity flows to the equity investor.

In this case, payments to black start resources used CRF calculations based on taxes higher than actual required tax payments. As a result, there were payments in excess of the level required to meet all the payment obligations. In cases where there are excess payments, the FTE model accurately captures the excess returns to equity while the WACC model does not.

The attached spreadsheet includes a side by side comparison of the approaches.[4] Model A is an FTE model and Model B is a WACC model. Both models use the mid year convention where revenue, tax and debt payments are assumed to occur at the midpoint of the year rather than at the end of the year. Model A uses a mortgage type loan repayment and model B splits the return of the investment between repayments of loan principal and payments to equity according to the debt to equity ratio. Model A results in a debt to equity ratio based on repaying the debt principal following the mortgage payment structure and all excess revenues flowing to equity. Model B maintains a constant debt to equity ratio throughout the cost recovery period. Model A is the model

[4] 2023-09-15 S-IMM DR 1-3 Response-Attachment.

used to determine the pre-June 6, 2021 CRFs. Model B is the model used to determine the post-June 6, 2021 CRFs.

The spreadsheet illustrates how each model reflects the impacts of using the incorrect federal income tax law to calculate the CRF.[5] Table 1 shows the revenue and payment streams associated with the FTE model that uses a mortgage style loan repayment (Model A in the attached spreadsheet). The revenue payment reflects the five year CRF value, 0.363, used to determine the revenue payments to pre-June 6, 2021, black start units based on tax laws in place prior to the Tax Cuts and Jobs Act of 2017 (TCJA).[6] The income tax payment in the model reflects the 100 percent bonus depreciation and 21 percent federal income tax rate included in the current tax laws. The interest on the debt and the repayment of the debt principal are not affected by the excess revenue which results from the incorrect income tax assumptions. All of the excess is paid to equity investors. In year 1, revenue in excess of income taxes, interest payments and return on equity is $500,542 of which $100,685 goes toward repayment of the debt principal and the remaining $399,857 goes to the equity investors. In year 2, the remaining equity investment is paid off and there is an additional $38,769 paid to the equity investors. Over the five year recovery period the repayment of the debt principal totals $500,000 as does the repayment of the equity investment. The excess revenue to equity investors in the table is the money left over in each year after meeting all other obligations. The after tax cash flow to equity investors is the sum of the ROE, repayment of the equity investment and the excess revenue to equity investors. The internal rate of return corresponding to the after tax cash flow is 61.7 percent. This 61.7 percent rate of return is more than five times higher than the target return. The intent of the CRF payment is to provide the equity investors with a 12 percent return on investment.

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[5] On the Parameters Assumptions tab of the spreadsheet, set the federal income tax rate to 21 percent, the depreciation type to 100 percent bonus deprecation (by inputting 'B100') and set the CRF override flag to 1 (this forces the model to use a CRF value of 0.363 which is the original five year CRF).

[6] Public Law 115-97.

Table 1 FTE model with five year cost recovery period and $1 million investment

Flow to Equity Approach - Non Constant D/E with Mid Year Payments					
Capital Recovery Year	1	2	3	4	5
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$1,000,000	$0	$0	$0	$0
Interest on debt	$17,204	$27,952	$21,656	$14,920	$7,712
Income Tax	($183,897)	$94,182	$95,952	$97,845	$99,871
Return on equity (ROE)	$29,150	$12,017	$0	$0	$0
Revenue in excess of taxes, interest and ROE	$500,542	$228,849	$245,392	$250,235	$255,416
Repayment of debt principal	$100,685	$89,937	$96,233	$102,969	$110,177
Repayment of equity investment	$399,857	$100,143	$0	$0	$0
Debt Remaining	$399,315	$309,378	$213,145	$110,177	$0
Equity Remaining	$100,143	$0	$0	$0	$0
Excess Revenue to equity investors	$0	$38,769	$149,159	$147,266	$145,240
After tax cash flow to equity investors	$429,008	$150,929	$149,159	$147,266	$145,240
Internal Rate of Return (IRR) to equity investors	61.7%				

Table 2 shows the revenue and payment streams for the WACC model with a constant debt to equity ratio (Model B in the attached spreadsheet). Revenue in excess of income taxes, interest payments and return on equity is split between repayments of loan principal and repayments of equity investment according to the debt to equity ratio which is 50/50 in this case. In year 1, revenue in excess of income taxes, interest payments and return on equity is $500,350 with $250,175 going to accelerated debt repayment and $250,175 going to the equity investors.[7] Under this approach, the debt and equity are repaid in year 4. The excess revenue to equity investors in years 4 and 5 is the money left over in each year after meeting all other obligations. The after tax cash flow to equity investors is the sum of the ROE, repayment of the equity investment and the excess revenue to equity investors. The internal rate of return corresponding to the after tax

[7] The year 1 revenue net income taxes, interest and ROE is slightly lower (by $192) under the WACC approach. This results from the return on investment calculation when using the mid year convention. In the WACC model (Model B), the year 1 investment return net the income tax shield is equal to $\left(\sqrt{1+E\cdot r_e+D\cdot(1-s)\cdot r_d}-1\right)\cdot K$ where E is the equity funding percent, D is the debt funding percent, r_e is the return on equity, r_d is the interest rate on debt, s is the effective income tax rate and K is the capital investment. Under the FTE approach with the mid year convention (Model A), the year 1 return on equity is $\left(\sqrt{1+r_e}-1\right)\cdot E\cdot K$, the year 1 interest on the debt is $\left(\sqrt{1+r_d}-1\right)\cdot D\cdot K$ and the tax shield can be explicitly stated as $s\cdot\left(\sqrt{1+r_d}-1\right)\cdot D\cdot K$. Since $\left(\sqrt{1+E\cdot r_e+D\cdot(1-s)\cdot r_d}-1\right)\neq\left(\sqrt{1+r_e}-1\right)\cdot E+(1-s)\cdot\left(\sqrt{1+r_d}-1\right)\cdot D$, models A and B give different values for revenue net of income taxes, interest and ROE.[8] For a few resources, a portion of the payments received during the 15 month refund period will have to be returned in order to achieve a 12 percent return on investment.

cash flow is 41.5 percent. This 41.5 percent rate of return is more than three times higher than the target return. The intent of the CRF payment is to provide the equity investors with a 12 percent return on investment. The internal rate of return to equity investors in the WACC model is lower than in the FTE Model A because Model B is based on the incorrect assumption that equity holders would repay debt holders early despite the fact that it reduces the return to equity holders.

Table 2 WACC model with a five year cost recovery period and $1 million investment

WACC Approach - Constant D/E with Mid Year Payments					
Capital Recovery Year	1	2	3	4	5
Revenue	$363,000	$363,000	$363,000	$363,000	$363,000
Depreciation	$1,000,000	$0	$0	$0	$0
Gross Income Tax	($179,061)	$102,039	$102,039	$102,039	$102,039
Income Tax Shield[1 2]	$4,643	$4,916	$2,767	$435	$0
Interest on debt[1 2]	$17,204	$17,488	$9,843	$1,548	$0
Return on Equity (ROE)[1 2]	$29,150	$29,979.01	$16,874.42	$2,653.83	$0.00
Revenue in excess of taxes, interest and ROE	$500,350	$218,410	$237,010	$257,194	$260,961
Repayment of debt principal	$250,175	$109,205	$118,505	$22,115	$0
Repayment of equity investment	$250,175	$109,205	$118,505	$22,115	$0
Debt Remaining	$249,825	$140,620	$22,115	$0	$0
Equity Remaining	$249,825	$140,620	$22,115	$0	$0
Excess Revenue to equity investors	$0	$0	$0	$212,963	$260,961
After tax cash flow to equity investors	$279,325	$139,184	$135,379	$237,733	$260,961
Internal Rate of Return (IRR) to equity investors	41.5%				

The reduction in the income tax liability introduced with the TCJA significantly reduced the income tax payments and the windfall savings that resulted from continuing to pay black start resources under the outdated tax laws went to the equity investors. The FTE model correctly reflects the accelerated repayment of the equity investment and the flow of excess revenues to the equity investor. The WACC model with a constant debt to equity ratio understates the cash flow to the equity investor. The Market Monitor's proposal to calculate a revised CRF is based on the FTE model that reflects the windfall income tax savings accruing to the equity investors. Under the Market Monitor's proposal, a date is selected, for example January 1, 2024, and a revised CRF that accounts for the repayment of the investment as of January 1, 2024, is calculated. Under this approach, the revised revenue will be set at a level for which the return on investment for equity investors, over the entire black start service period, is 12 percent, as originally

intended.[8] The revised CRF will result in a lower payment for black start units for the remainder of the capital recovery period but at the end of the recovery period the owner of the black start units will have received revenue sufficient to provide for the repayment of debt at 7 percent interest, federal and state income tax liabilities, a 12 percent return on equity and the return of the equity portion of the capital investment, all as intended in the CRF calculations.[9]

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[8] For a few resources, a portion of the payments received during the 15 month refund period will have to be returned in order to achieve a 12 percent return on investment.

[9] The Market Monitor described the proposed resolution in a previous filing. See Section H in *Errata Filing of the Independent Market Monitor for PJM*, Attachment B, EL21-91 (November 18, 2021).

S-IMM-1.4. Does the CRF increase with the age of the Black Start Unit under the pre-June 6, 2021 CRFs, as well as the post-June 6, 2021 CRFs? If there is a difference in how age affects CRF between the two, please explain that difference and why that difference exists.

RESPONSE

The CRF value, holding the other parameters constant, is a function of the recovery period. The longer the recovery period, the lower the CRF. The logic is that the recovery of the investment is over a longer period and that the longer the recovery period, the smaller the required annual recovery. In Attachment DD, the recovery period is an inverse function of the life of the underlying capacity resource. The older the underlying capacity resource, the shorter the recovery period. In Attachment DD, the CRF is applied to incremental capital investment in existing capacity resources, termed APIR. The logic was that older units had a shorter remaining life and therefore needed a shorter recovery period for incremental investment.

In the case of black start resources, the same logic applied only if an existing resource added black start capability. If an older resource with a shorter remaining life added black start capability, the recovery period for the black start investment would be shorter. For a new resource with black start capability, the recovery period should be 20 years and include a commitment to provide black start for the entire life of the resource.

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Dated: September 15, 2023

S-IMM-1.5. Please provide any materials in your control relating to engagement between the Market Monitor and PJM relating to the use of tax rates in the development of existing or past CRFs, to include presentations, emails and other communications between PJM and the Market Monitor.

RESPONSE

The Market Monitor continues to review its files, and it expects that it can provide the requested materials on or before Friday, September 22, 2023.

Sponsor: Prepared under the supervision of Dr. Joseph E. Bowring.

Dated: September 15, 2023

S-IMM-1.6. Please provide any materials in your control relating to engagement between the Market Monitor and stakeholders, to include customers, Black Start Service providers and any other participants, relating to the use of tax rates in the development of existing or past CRFs, to include presentations, emails and other communications. Please note which if any of these are or were available to Black Start Service providers and/or to the public.

RESPONSE

The Market Monitor continues to review its files, and it expects that it can provide the requested materials on or before Friday, September 22, 2023.

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Dated: September 15, 2023

S-IMM-1.7. Did the Market Monitor prepare the initial workpapers used to develop pre-June 6, 2021 CRF rates, including the use of a 36% corporate federal income tax rate in those calculations? If yes:

a. Please explain in detail any changes made to these calculations between the preparation of any initial workpapers and the final setting of the CRF rates at issue.
b. Please identify who at the Market Monitor would have the most knowledge of such calculations and any subsequent changes.

RESPONSE

Yes, the Market Monitor prepared the initial workpapers.

a. NA

b. Any questions about the calculations and any subsequent changes should be directed to Dr. Joseph E. Bowring.

Sponsor: Prepared under the supervision of Dr. Joseph E. Bowring.

Dated: September 15, 2023