

**UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C. ) Docket No. ER21-1635-000  
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)

**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,<sup>1</sup> 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 answers submitted on May 13, 2021, by PJM and by the Indicated Suppliers.<sup>23</sup>

On April 7, 2021, PJM filed revisions to Schedule 6A of the OATT providing for annual updates to the Capital Recovery Factor (“CRF”) component of a formula rate for black start units (“April 7<sup>th</sup> Filing”). On April 28, 2021, the Market Monitor filed comments supportive of the need for corrective action but critical of the unjust, unreasonable and unduly discriminatory exclusion of existing black start units from having their formula rates calculated correctly, using accurate inputs (“April 28<sup>th</sup> Comments”). On April 28, 2021, a number of parties filed comments, some supporting flawed aspects of the April 7<sup>th</sup> Filing. On May 13, 2021, PJM and Indicated Suppliers filed answers, including responses to the

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<sup>1</sup> 18 CFR §§ 385.212 & 385.213 (2020).

<sup>2</sup> The Indicated Suppliers include: LS Power Development, LLC; J-POWER USA Development Co., Ltd.; St. Joseph Energy Center, LLC; and Hazleton Generation, LLC.

<sup>3</sup> 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”).

April 28<sup>th</sup> Comments. The Market Monitor here addresses certain arguments raised that potentially create confusion.

The Market Monitor also files this answer in opposition to the request for a hearing or settlement judge procedures included in the Joint Consumer Advocates' protest filed April 28, 2021. Neither a hearing nor settlement procedures are necessary.

The Market Monitor requests that this answer be accepted in order to facilitate the decision making process.

## I. ANSWER

### A. The CRF Formula Should Be Stated in the Tariff.

PJM states (at 4) that it: "is amenable, in response to a compliance directive, to including [the CRF] formula, and the accompanying table of inputs, in Tariff, Schedule 6A, section 18." Under the Commission's rule of reason, the CRF formula, and the accompanying table of inputs, should be stated in the filed tariff rather than in the non filed manuals.<sup>4</sup> The prolonged failure to update the CRF formula rate that lead to this case demonstrates why it is important to include the formula and the input assumptions in the tariff.

The CRF formula originally included in the April 28<sup>th</sup> Comments and then copied and pasted by PJM into the May 13<sup>th</sup> PJM Answer is:<sup>5</sup>

$$\text{CRF} = \frac{r(1+r)^N \left[ 1 - \frac{sB}{\sqrt{1+r}} - s(1-B)\sqrt{1+r} \sum_{k=1}^L \frac{m_k}{(1+r)^k} \right]}{(1-s)\sqrt{1+r}[(1+r)^N - 1]}$$

As noted in the April 28<sup>th</sup> Comments, this CRF formula produces the same result as the standard financial model that has been used by the Market Monitor in a range of

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<sup>4</sup> See, e.g., *PJM Interconnection, L.L.C.*, 175 FERC ¶ 61,084 at P 66 (2021) ("The Commission's rule of reason dictates that any rules that significantly affect rates, terms, and conditions of service and are readily susceptible to specification be on file with the Commission.").

<sup>5</sup> See April 28<sup>th</sup> Comments at 4.

applications, including MOPR and the Quadrennial Review. The Market Monitor made the model public and it is available on the Market Monitor's web page.<sup>6</sup> The Market Monitor recommends use of the formula because it is clear and precise and can easily be included in the tariff. The formula is better defined than simply referring to a standard financial model in the tariff.<sup>7</sup> The formula and its inputs are completely self contained. No additional information is required in order to calculate the correct CRF rates. The Market Monitor derived the formula for all those reasons. The formula includes explicit inputs defining all the relevant parameters including all the elements of the weighted average cost of capital, asset life, taxes, and depreciation. The derivation of the formula is provided as an Attachment to this filing.

PJM states (at 4) that the Market Monitor states "without evidence" that the formula produces the same results as the model. In fact, compelling evidence was provided. This statement by the Market Monitor was with respect to the black start CRF values in Table 2 of the April 28<sup>th</sup> Comment. The April 28<sup>th</sup> Comments included a table of values (Table 2) that were the result of using the Market Monitor standard financial model and the relevant parameter values that were included as Table 5. Using the identified parameter values in the formula produces the same CRF values in Table 2 of the April 28<sup>th</sup> Comment. As for the

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<sup>6</sup> See the CONE Template on the Monitoring Analytics Tools for PJM Markets webpage <<http://www.monitoringanalytics.com/tools/tools.shtml>>.

<sup>7</sup> The Market Monitor previously described the CRF values as being calculated using a standard financial model. That is correct. The formula produces the same results but does so in a clear and unambiguous and compact form. The formula is not the referenced standard financial model. The standard financial model is a spreadsheet based model. While they produce the same result if applied correctly, the formula is a clearly preferable approach. There can be subtle differences in the application of standard financial models. There is no reason to add that uncertainty to the tariff.

CRF values included in Table 2 and Table 3 in the April 28<sup>th</sup> Comments, the Market Monitor MOPR model and the CRF formula are the same.<sup>8</sup>

**B. CRF Tables**

The correct black start CRF values for existing black start units should be calculated using the financial inputs incorporated in the current CRF values with the exception that the new federal tax laws that went into effect on January 1, 2018, should be updated. The federal tax rate should be 21.0 percent for the black start CRF calculations and bonus depreciation should be incorporated. Table 1 shows the revised financial input values. Note that the only difference between the input values in Table 1 and the input values in the current CRF table is the federal tax rate of 21.0 percent.

**Table 1 Financial assumptions for black start CRF calculations**

Financial Parameter	Parameter Value
Equity Funding Percent	50.000%
Debt Funding Percent	50.000%
Equity Rate	12.000%
Debt Interest Rate	7.000%
Federal Tax Rate	21.000%
State Tax Rate	9.000%

Table 2 shows the updated CRF values using the financial assumptions in Table 1 with 100 percent bonus depreciation in the first year. Table 3 shows the updated CRF values using the financial assumptions in Table 1 with no bonus depreciation. The CRF values were computed using the CRF formula.<sup>9 10</sup> The corresponding tables in the April 28<sup>th</sup>

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<sup>8</sup> In addition, the statement can be verified by any reader. The Market Monitor has attached a detailed derivation of the formula as an Attachment. If further explanation or evidence is desired, the Market Monitor would be happy to provide.

<sup>9</sup> The effective tax rate (parameter *s* in the formula) is equal to *State Tax Rate + Federal Tax Rate x (1 - State Tax Rate)*.

Comments incorrectly incorporated PJM’s proposed financial assumptions that were later included in PJM’s May 4<sup>th</sup> Filing in Docket No. ER21-1844, the corresponding filing about CRF rates in Attachment DD.<sup>11</sup> In that filing PJM proposed to change the CRF input assumptions including the capital structure and the cost of capital for future capacity market auctions. The rates in the tables here incorporate only the changed tax provisions. While the differences are only in the third decimal place, these are the correct numbers.

**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	0.103
6 to 10	15	0.118
11 to 15	10	0.149
16+	5	0.248

**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	0.118
6 to 10	15	0.135
11 to 15	10	0.177
16+	5	0.310

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<sup>10</sup> The weighted average cost of capital (parameter r in the CRF formula) is equal to *Equity Funding Percent x Equity Rate + Debt Funding Percent x Debt Interest Rate x (1- Effective Tax Rate)*.

<sup>11</sup> In the April 28<sup>th</sup> Filing (at 15), Table 2 and Table 3 included the CRF rates and (at 17) Table 5 included the financial inputs. In PJM’s May 4<sup>th</sup> Filing (at 6) Table 1 compares the financial inputs for the existing CRF values to PJM’s proposed financial inputs for Attachment DD.

### C. No Contracts for Black Start Service Exist, and Would Not Be Valid Unless and Until Filed and Approved.

Indicated Suppliers assert (at 3) that the letters are contracts. Indicated Suppliers make numerous arguments (at 3–6) that depend upon the false presumption that there are contracts between PJM and black start service providers that established the rates for black start service. No such contracts exist. Indicated Suppliers make no effort to explain how certain letters from PJM to which it refers (at 3–4) constitute contracts. PJM has publicly stated to its stakeholders that the letters are not contracts.<sup>12</sup> Indicated Suppliers do not show that the letters include rates.<sup>13</sup> 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 revenue requirement decisions because they differed from the preliminary estimates included in the letters. That the letters refer to the tariff language to be implemented does not create contracts and does not create rates distinct from the rates referred to. Regardless, no contracts were filed with the Commission and therefore there is no filed rate.<sup>14</sup>

Indicated Suppliers rely on the *Mobile Sierra* doctrine and the Supreme Court decision in *Morgan Stanley*.<sup>15</sup> The *Mobile Sierra* doctrine applies only to valid contracts.<sup>16</sup> The

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<sup>12</sup> PJM has not asserted any other position in this proceeding.

<sup>13</sup> The Market Monitor provided an example of these letters in Attachment A to its April 28<sup>th</sup> Comments.

<sup>14</sup> See 16 U.S.C. § 824d(c), (d).

<sup>15</sup> See Indicated Suppliers at 4, citing *Morgan Stanley Capital Group Inc. v. Public Util. Dist. Of Snohomish Cty.*, 554 U.S. 527, 548 (2008) (“*Morgan Stanley*”); *United Gas Pipe Line Co. v. Mobile Gas Services Corp.*, 350 U.S. 332 (1956), and *FPC v. Sierra Pacific Power Co.*, 350 U.S. 348 (1956) (“*Mobile Sierra*”).

<sup>16</sup> See *Morgan Stanley* at 548 (“We hold only that FERC may abrogate a *valid* contract only if it harms the public interest” [emphasis added]). *Morgan Stanley* observes that FERC has not required contracts to be filed when entered into pursuant to a sellers’ market based rates authorization. *Morgan Stanley* does not actually hold that such contracts do not have to be filed, as is the case for other contracts establishing rates and not filed pursuant to market based rates authority. *Morgan*

narrow issue addressed in *Morgan Stanley* is how the *Mobile Sierra* doctrine applies to contracts, presuming the contracts are valid, that are entered into pursuant to sellers' market based rate authority. That issue is irrelevant to this proceeding. Black start service is not provided pursuant to market based rates authorization or under valid contracts.

Contrary to the arguments of Indicated Suppliers, *Morgan Stanley* states the law that applies to valid contracts (not under a market based rate schedule): "Like tariffs, contracts must be filed with the Commission before they go into effect," citing 16 U.S.C. § 824d(c), (d).<sup>17</sup>

Indicated Suppliers raise arguments (at 6–7) that applying the formulas to existing units violates the unit owners' rights to make filings under Section 205 of the Federal Power Act. That argument presumes that affected black start service providers have exercised or attempted to exercise their filing rights under Section 205 of Federal Power Act. No such filings exist. Unexercised Section 205 filing rights are irrelevant to this proceeding.

#### **D. PJM Has the Authority to File Revisions to Its Tariff.**

Indicated Suppliers challenge (at 6–10) PJM's authority to revise the OATT to change rates for existing black start units because the owners have relied on the rates remaining unchanged. PJM has not proposed to make any change to the formula rates or how CRF values included in those rates are calculated. Reliance on CRF values that are or become inaccurate based on the use of incorrect or outdated inputs into the formula rate is

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*Stanley* does not address whether contracts filed under market based rates authority must be filed, just as it explicitly declines to address the issue of whether market based rates are valid under the Federal Power Act. *See id.* at 538 ("We have not hitherto approved, and express no opinion today, on the lawfulness of the market-based-tariff system, which is not one of the issues before us. It suffices for the present cases to recognize that when a seller files a market-based tariff, purchasers no longer have the option of buying electricity at a rate set by tariff and contracts no longer need to be filed with FERC (and subjected to its investigatory power) before going into effect.").

<sup>17</sup> *Id.* at 531.

misplaced. Reliance interests specifically do not prevent the accurate implementation of filed formula rates.<sup>18</sup>

**E. Treating Black Start Service Providers Differently Based Solely on Whether They Are New or Existing Is Arbitrary and Unduly Discriminatory.**

Indicated Suppliers argue (at 11–12) that because there are different methods of cost recovery in Schedule 6A, it is not unduly discriminatory to pay black start service providers differently. The different formula rates in Schedule 6A are designed to address the circumstances of differently situated black start service providers. New and existing black start providers paid under a formula rate designed for providers recovering investment are similarly situated. In order to be just and reasonable and not unduly discriminatory, the revised formula rates must be applied to all similarly situated black start service providers.<sup>19</sup> The CRF formulas account for differences among units, such as the applicable term of life or the tax depreciation treatment for specific units. Other components, that apply equally to all, such as tax rates, are the same.<sup>20</sup> There are no valid circumstances where accurate CRF values should be applied to new black start service providers but

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<sup>18</sup> See, e.g., *MMC Energy, Inc. v. CAISO*, 123 FERC ¶ 61,251 at PP 68, 83–84 (2008) (Commission agreed “that the filed rate doctrine prevents the enforcement of a formal contract that would contradict a filed rate and also prevents parties from incurring a contractual obligation based on detrimental reliance where doing so contradicts a filed rate”); see also *Reiter v. Cooper*, 507 U.S. 258, 266 (1993) (“The filed rate doctrine embodies the principle that a shipper cannot avoid payment of the tariff rate by invoking common-law claims and defenses such as ignorance, estoppel, or prior agreement to a different rate.”).

<sup>19</sup> See *PJM Interconnection, L.L.C.*, 175 FERC ¶ 61,084 at P 108 (2021) (“We further find that the transition mechanism is unduly discriminatory because it treats similarly situated resources differently by discounting the capacity value of newer, unfloored ELCC Resources within a given class despite the fact that existing, floored ELCC Resources and newer, unfloored ELCC Resources within the class are similarly situated. As PJM explains, resources within a class share a common set of operational characteristics and are reasonably homogenous with respect to their impact on system resource adequacy. [footnote omitted] The transition mechanism would discriminate between resources in a class based on vintage despite the fact that all resources within a class bear equal responsibility for the decrease in the capacity contribution of their ELCC Class”)

<sup>20</sup> *Id.*



inaccurate CRF values should be applied to existing black start service providers. The proposed application of different CRF formulas and input values to units based on vintage is unduly discriminatory and should be rejected. There is no right to receive the windfall that results from paying a tax rate included in the CRF that is higher than the actual tax rate paid by the unit.

**F. No Hearing or Settlement Procedures Are Needed.**

The Joint Consumers Advocates argue (at 14) that hearing or settlement procedures should be initiated in this proceeding “because PJM (1) has not explained its mechanism to calculate the CRF values and (2) has failed to establish that its proposed vintage-based compensation scheme for black start providers is just and reasonable and not unduly discriminatory.” Neither the hearing nor settlement procedures are needed and should not be instituted. The Market Monitor has explained in this answer, prior pleadings, and in the stakeholder process how CRF values are calculated. PJM should file the CRF formula in the tariff, and there is no reason to expect that it will not file the formula. The record in this proceeding is adequate for the Commission to reject the vintage-based compensation scheme.

**G. The Accurate Implementation of the CRF Formula Will Not Discourage Investment in or Termination of Black Start Service.**

A number of commenters assert that applying correct CRF values will discourage new investment and cause termination of black start service.<sup>21</sup> There is no basis for such assertions.

The CRF formula includes incentives in the form of a fixed rate of return. No change is proposed for the incentives. The only components of the formula that will change are the components for corporate income tax rates and associated depreciation. Allowing existing

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<sup>21</sup> See Comments of the PJM Power Providers Group, Docket No. ER21-1635 (April 28, 2021) at 5; Comments of Dominion Energy Services, Inc., Docket No. ER21-1635-000 (April 28, 2021) at 3–4.

black start unit owners to retain payments intended to cover taxes that were not paid and will not be paid is an unjustified windfall. Black start unit owners did not invest in black start based on expectation of a windfall. Eliminating the windfall does not affect the level of incentive payments incorporated in the CRF rates.

The CRF formula promotes investment in black start service by reducing risk. Under the CRF formula, if corporate tax rates rise, CRF rates and therefore payments will increase to reflect the increased tax obligations.

## 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.<sup>22</sup> 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.

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<sup>22</sup> 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).

### 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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Jeffrey W. Mayes

General Counsel  
Monitoring Analytics, LLC  
2621 Van Buren Avenue, Suite 160  
Eagleville, Pennsylvania 19403  
(610) 271-8053  
*jeffrey.mayes@monitoringanalytics.com*

Joseph E. Bowring  
Independent Market Monitor for PJM  
President  
Monitoring Analytics, LLC  
2621 Van Buren Avenue, Suite 160  
Eagleville, Pennsylvania 19403  
(610) 271-8051  
*joseph.bowring@monitoringanalytics.com*

Gerard F. Cerchio  
Analyst  
Monitoring Analytics, LLC  
2621 Van Buren Avenue, Suite 160  
Eagleville, Pennsylvania 19403  
(610) 271-8050  
*gerard.cerchio@monitoringanalytics.com*

John Hyatt  
Senior Economist  
Monitoring Analytics, LLC  
2621 Van Buren Avenue, Suite 160  
Eagleville, Pennsylvania 19403  
(610) 271-8050  
*john.hyatt@monitoringanalytics.com*

Dated: May 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 20<sup>th</sup> day of May, 2021.



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Jeffrey W. Mayes

General Counsel

Monitoring Analytics, LLC

2621 Van Buren Avenue, Suite 160

Eagleville, Pennsylvania 19403

(610) 271-8053

*jeffrey.mayes@monitoringanalytics.com*

**ATTACHMENT**

## A. Background

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

$$\text{CRF} = \frac{r(1+r)^N}{[(1+r)^N - 1]} \quad (1)$$

where  $r$  is an interest rate and  $N$  is the number of uniform annual payments.<sup>23</sup>

The derivation of equation (1) is straightforward.  $N$  uniform annual payments equal to  $A$  with a present value of  $P$  is stated in equation form as

$$P = \sum_{k=1}^N \frac{A}{(1+r)^k}$$

The present value formula assumes end of year payments. The CRF is defined as the ratio of the uniform payment to the principal,

$$\text{CRF} = \frac{A}{P}$$

To obtain the formula for the CRF in equation (1) first note that the sum on the right hand side of the present value equation is a geometric sum and the equation can be rewritten without the summation as<sup>24</sup>

$$P = \frac{A}{r} \left[ 1 - \left( \frac{1}{1+r} \right)^N \right]$$

Simplifying further,

$$P = \frac{A[(1+r)^N - 1]}{r(1+r)^N}$$

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<sup>23</sup> For example, see pages 21-22 in "Economic Evaluation and Investment Decision Methods," Stermole, F.J. and Stermole, J.M. (1993).

<sup>24</sup> The formula for the geometric sum,  $ax + ax^2 + \dots + ax^N = \frac{ax}{1-x}(1 - x^N)$ , is a well known result from elementary algebra. In this case,  $a=1$  and  $x = \frac{1}{1+r}$ .

Then rearranging terms in the previous equation to obtain the quotient  $A/P$  produces equation (1).

### B. CRF That Reflects Taxable Income

The revenue stream that results from a capital investment is treated as taxable income. The revenue stream of  $N$  uniform payments of amount  $A$ , obtained by multiplying the capital investment amount  $P$  by the CRF in equation (1), would be too low in cases where the revenue stream is taxable. The goal, in the presence of taxes, is to have a CRF for which the product  $CRF \cdot P$  yields a uniform annual payment  $A$  such that the present value of the after tax cash flows resulting from payment  $A$  is equal to  $P$ .

The after tax cash flow for year  $k$ ,  $CF_k$ , can be represented as the following equation

$$CF_k = A - (A - D_k)s$$

where parameter  $s$  is the effective tax rate and  $D_k$  represents the amount of depreciation in year  $k$ . This cash flow model is consistent with the Market Monitor standard financial model. The cash flows are discounted by the after tax weighted average cost of capital.

Rearranging the terms in the cash flow equation yields  $CF_k = (1 - s)A + sD_k$  and the uniform annual payment amount  $A$  is the value that solves the equation

$$P = \sum_{k=1}^N \frac{CF_k}{(1+r)^{k-0.5}},$$

or equivalently,

$$P = \sqrt{1+r} \sum_{k=1}^N \frac{(1-s)A + sD_k}{(1+r)^k},$$

where the term  $\sqrt{1+r}$  accounts for the mid year timing convention used in the Market Monitor standard financial model. Separating terms in the summation gives

$$P = \sqrt{1+r} \left\{ (1-s)A \sum_{k=1}^N \frac{1}{(1+r)^k} + s \sum_{k=1}^N \frac{D_k}{(1+r)^k} \right\}$$

and making the geometric sum replacement

$$\sum_{k=1}^N \frac{1}{(1+r)^k} = \frac{[(1+r)^N - 1]}{r(1+r)^N}$$

yields

$$P = \sqrt{1+r} \left\{ (1-s)A \frac{[(1+r)^N - 1]}{r(1+r)^N} + s \sum_{k=1}^N \frac{D_k}{(1+r)^k} \right\}$$

Solve this equation for A,

$$A = \frac{r(1+r)^N}{(1-s)\sqrt{1+r}[(1+r)^N - 1]} \left\{ P - s\sqrt{1+r} \sum_{k=1}^N \frac{D_k}{(1+r)^k} \right\}$$

and the formula for the CRF is obtained by dividing by P

$$\text{CRF} = \frac{A}{P} = \frac{r(1+r)^N}{(1-s)\sqrt{1+r}[(1+r)^N - 1]} \left\{ 1 - \frac{s\sqrt{1+r}}{P} \sum_{k=1}^N \frac{D_k}{(1+r)^k} \right\}$$

The depreciation schedule can be represented as a combination of bonus depreciation and 15 year modified accelerated cost recovery system (MACRS) rates,

$$D_1 = P[B + (1-B)m_1]$$

$$D_k = P(1-B)m_k, \quad k = 2, \dots, L$$

$$D_k = 0, \quad \text{for all } k = L+1, \dots, N$$

where B is the bonus depreciation percent applicable in year 1,  $m_k$  is the 15 year MACRS depreciation rate for year k (see Attachment Table 1) and L is the lesser of 16 and the remaining project life N. Reflecting the depreciation schedule in the CRF formula yields

$$\text{CRF} = \frac{r(1+r)^N}{(1-s)\sqrt{1+r}[(1+r)^N - 1]} \left\{ 1 - \frac{s\sqrt{1+r}}{P} \left[ \frac{PB + (1-B)Pm_1}{1+r} + \sum_{k=2}^L \frac{(1-B)Pm_k}{(1+r)^k} \right] \right\}$$

Rearranging terms gives

$$\text{CRF} = \frac{r(1+r)^N}{(1-s)\sqrt{1+r}[(1+r)^N - 1]} \left\{ 1 - \frac{s\sqrt{1+r}PB}{P(1+r)} - \frac{s\sqrt{1+r}}{P} \left[ \frac{(1-B)Pm_1}{1+r} + \sum_{k=2}^L \frac{(1-B)Pm_k}{(1+r)^k} \right] \right\}$$

and simplifying further

$$\text{CRF} = \frac{r(1+r)^N}{(1-s)\sqrt{1+r}[(1+r)^N - 1]} \left\{ 1 - \frac{sB}{\sqrt{1+r}} - s(1-B)\sqrt{1+r} \sum_{k=1}^L \frac{m_k}{(1+r)^k} \right\} \quad (2)$$



**Attachment Table 1** MACRS (15 year) with half year convention<sup>25</sup>

15 Year MACRS		
Year	Depreciation Factor	Factor Symbol
1	5.00%	m <sub>1</sub>
2	9.50%	m <sub>2</sub>
3	8.55%	m <sub>3</sub>
4	7.70%	m <sub>4</sub>
5	6.93%	m <sub>5</sub>
6	6.23%	m <sub>6</sub>
7	5.90%	m <sub>7</sub>
8	5.90%	m <sub>8</sub>
9	5.91%	m <sub>9</sub>
10	5.90%	m <sub>10</sub>
11	5.91%	m <sub>11</sub>
12	5.90%	m <sub>12</sub>
13	5.91%	m <sub>13</sub>
14	5.90%	m <sub>14</sub>
15	5.91%	m <sub>15</sub>
16	2.95%	m <sub>16</sub>

See Attachment Table 2 for a description of the variables in equation (2).

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<sup>25</sup> See 15 year MACRS with half year convention in Appendix A, Table A-1, IRS Publication 946, United States Department of Treasury (2020).

**Attachment Table 2 Variable descriptions for CRF formula in Equation (2)**

Variable	Description
r	After tax weighted average cost of capital (AT WACC)
s	Effective tax rate
B	Bonus depreciation percent
N	Cost recovery period or remaining life of the plant (years)
L	Lesser of N or 16 (years)
$m_j$	Modified Accelerated Cost Recovery System (MACRS) depreciation factor for year $j = 1, \dots, 16$