memo

To: NEPOOL Participants Committee Working Session

From: Market Development

Date: April 8, 2021

Subject: The FCEM and Existing State Programs

Introduction

Stakeholders and the ISO are scoping the framework for a "Forward Clean Energy Market" (FCEM) that would procure clean attribute certificates (CECs) years in advance. We seek to clarify necessary scoping details so that the ISO and the Analysis Group (AGI) can complete the modelling framework for quantitative analysis. A key outstanding question is the extent to which the new CECs would be integrated with existing state programs, which are designed to help facilitate the development of resources with specific environmental attributes. Because this design choice will likely affect CEC and REC pricing, it may be important for modelling purposes. The ISO and stakeholders are evaluating three approaches, summarized below:[1]

Approach 1: Clean energy certificates reflect a clean attribute that is distinct from and does not overlap with other environmental attributes so that clean resources that are eligible can earn both CECs and renewable energy certificates (RECs) with each MWh of energy production during the delivery year.

Approach 2: Clean energy certificates encompass all environmental attributes, so that a resource that chooses to sells CECs in the FCEM cannot also sell a REC in the delivery year for the same MWh.[2]

Approach 3: The existing programs are discontinued, and the region uses clean energy certificates to meet its environmental objectives.

This memo considers six cases (labelled A through F) that demonstrate total payments to resources under the different approaches and with different relationships between CEC demand and REC demand. In the numerical examples, there are two renewable resources that produce both renewable and clean energy, and therefore can sell both CECs and RECs, and two clean resources that can sell only CECs. The cases assume competitive markets for both CECs and RECs, meaning that the price that is set for each of these

[1] See Section 4 of the FCEM Scoping memo, https://nepool.com/wp-content/uploads/2021/03/NPC_FG_20210318_Supplemental-1.pdf.

[2] Approach 2 would require clear rules regarding how a resource eligible to produce either a CEC or a REC would determine which type of credit it would like to generate.

certificates is based on the "break even" cost that must be recovered by the marginal resource that provides this product, outside of revenue from other markets such as the real-time energy market. The table below summarizes the cases, their assumptions, and key takeaways.

Summary of Cases and Results

	Approach	Relationship between REC and CEC Demand	Key Takeaways
Case A	Current Market Rules	Only REC Demand	Under current market rules, resources recover their costs through REC revenue. Total payment for certificates is $200,000.
Case B	Approach 1	CEC Demand > REC Demand	CEC demand is introduced and is greater than REC demand. Resources can now recover costs through REC and/or CEC revenue. Total payment for RECs and CECs is $210,000, with the increase compared to Case A due to the increased quantity of clean energy. The resources that sell CECs and RECs don't receive double payment compared to Case A.
Case C	Approach 1	CEC Demand >>> REC Demand	CEC demand is set far greater than REC demand. The REC constraint is not binding and the REC price is $0/MWh. Total payments increase to $475,000, reflecting the larger quantity of clean energy demanded. No double payment occurs.
Case D	Approach 3	Only CEC Demand	CEC demand is kept at the higher level but the state REC programs are discontinued so that there is no REC demand. This case clears the same quantity of MWhs from the same resources at the same price as Case C. When CEC demand is sufficiently large relative to REC demand, Approach 1 and Approach 3 yield equivalent results.
Case E	Approach 2	CEC Demand > REC Demand	CEC demand is set as in Case B but we assume Approach 2. The renewable resources satisfy the REC demand and the clean resources satisfy the clean energy demand. Total payments are $335,000, larger than Case B's total payments = $210,000. This increase in payments reflects the fact that more clean MWhs have to clear to meet the same clean energy demand.
Case F	Approach 2	CEC Demand < REC Demand	CEC demand is decreased to avoid purchasing excess clean energy. Total payment for RECs and CECs is $210,000, as in Case B.

The cases demonstrate three key points:

1. Stakeholders have expressed concern about the possibility of "double payments" under Approach 1, where resources that can sell both CECs and RECs will see increased payments per MWh of energy relative to Approach 2 and Current Market Rules. The examples suggest that such double payments may not materialize because CEC and REC prices adjust to ensure that marginal resources that are capable of selling both CECs and RECs will recover their costs, but no more than that amount.[3]

2. Approach 1 and Approach 3 yield equivalent outcomes when CEC demand is sufficiently large compared to REC demand, because this may lead to a quantity of renewable energy that is greater than or equal to the state requirements.

3. Approach 2 can lead to additional payments compared to Approach 1. Approaches 1 and 2 may yield equivalent results when CEC demand is reduced to account for the existing programs, but it

[3] Costs here, and throughout the memo, refer to incremental costs that the resource does not expect to recover through other wholesale markets, like the real-time energy market and capacity market.

may be difficult to make these approaches equivalent in practice, given the large number of state programs, where these each have different eligibility criteria, non-compliance rates, etc.

Given the above observations, the ISO proposes that AGI assume Approach 1 for the straw FCEM framework, as this appears to align most appropriately with the criteria the ISO identified for choosing between design options.[4] More specifically, it appears relatively simple to model, avoids the double payment concern identified by stakeholders, and allows for the continuation of the existing state programs. However, as the examples in this memo show, this approach may produce similar outcomes as Approach 2.

This memo, however, should not suggest that the ISO has finalized its thinking on the extent to which the existing programs should be integrated with the new CECs for the purposes of modelling. Indeed, the ISO welcomes stakeholder feedback on the proposed approach, particularly as it may relate to stakeholder's goals for the FCEM framework, and looks forward to further discussion.

Case A: Current Market Rules

Table 1 below summarizes the parameter values for the resources in all six cases considered in this memo. In each of the cases, there are two clean resources (Clean 1 and Clean 2) that can sell only CECs, and two renewable resources (Renewable 1 and Renewable 2) that can sell both CECs and RECs. The renewable resources are assumed to have greater costs and so need to be compensated at a higher rate to be economical.[5] For example, Renewable 2 would need to be paid at least $25/MWh for their clean energy or renewable attributes. If they are not paid at least this much, their resource will not be built. Clean 1, on the other hand, has fewer costs and so only needs to be paid $10/MWh to be built. All four resources have the same maximum certificate award of 5,000 MWh, so that no resource can sell more than 5,000 MWhs of CECs and the two renewable resources cannot sell more than 5,000 MWhs of RECs. Note that for simplicity and ease of comparison, we assume each resource submits fully rationable offers, so that there is no lumpiness in REC or CEC awards. Finally, we assume that the markets for both the RECs and the CECs are competitive, so that the marginal resource breaks even on their investment.

Table 1: Parameter Summary for Resources

		Clean 1	Clean 2	Renewable 1	Renewable 2
[1]	Unrecovered Costs/MWh	$10	$15	$20	$25
[2]	Maximum Certificate Award	5,000 MWh	5,000 MWh	5,0000 MWh	5,000 MWh
[3]	Qualified to Sell RECS?	No	No	Yes	Yes
[4]	Qualified to Sell CECs?	Yes	Yes	Yes	Yes

While all six cases assume these same resource properties, they will produce different results based upon assumptions about the demand for each environmental attribute and whether resources can receive both

[4] For further discussion of these criteria, see the ISO's memo on the straw FCEM framework, available at https://nepool.com/pathways-study-process/1a-fcem-scoping-memo_vfinal/.

[5] Because resources that qualify as renewable must have additional attributes, they generally have higher costs than resources that are only "clean." In practice, some resources that qualify as renewable may be cheaper than other resources that qualify as "clean."

clean and renewable energy certificates for each MWh produced. These cases begin with current market rules, where there are renewable energy credits, but no clean energy credits.

Under current market rules, there are no CECs so the resources can only recover their costs with REC revenue. The table below summarizes the results for Case A, where the REC demand is set at 8,000 MWh.[6]

Case A: Current Market Rules, No CEC Demand						
			Clean 1	Clean 2	Renewable 1	Renewable 2
[1]	REC Demand		8,000 MWh			
[2]	CEC Demand		-			
[3]	REC Award		0 MWh	0 MWh	5,000 MWh	3,000 MWh
[4]	CEC Award		-	-	-	-
[5]	REC Price		$25/MWh			
[6]	CEC Price		-			
[7]	Resource Revenue/MWh		$0/MWh	$0/MWh	$25/MWh	$25/MWh
[8]	Total REC Payments		$200,000			
[9]	Total CEC Payments		-			
[10]	Total Payments		$200,000			

In this case, Renewable 1 clears for its entire capability so Renewable 2 is marginal as it provides 3,000 MWh of renewable energy. Because Renewable 2 is the marginal resource for RECs, it sets their price at its "breakeven" cost of $25/MWh. In total, the resources sell 8,000 MWh of RECs and so satisfy the REC requirement. Total payments to the resources is $200,000.

Note that, without CEC demand, there is not compensation for clean energy. Thus, the clean resources that are eligible only for CECs earn no incremental revenues from the sale of environmental attributes. As a result, neither clean resource is developed and the region's energy mix doesn't include any clean energy beyond what is provided by the two renewable resources.

Case B: CEC Demand > REC Demand, Approach 1

Under Approach 1, the renewable resources can sell both CECs and RECs for the same MWhs. Assume the CEC demand is 9,000 MWh, REC demand remains unchanged from Case A at 8,000 MWh, and that the resources have the same parameter values as in Table 1. The table below summarizes the results for Case B.

[6] For simplicity, we assume the demand bids are vertical.

Case B: CEC Demand > REC Demand, Approach 1					
		Clean 1	Clean 2	Renewable 1	Renewable 2
[1]	REC Demand	8,000 MWh			
[2]	CEC Demand	9,000 MWh			
[3]	REC Award	0 MWh	0 MWh	5,000 MWh	3,000 MWh
[4]	CEC Award	1,000 MWh	0 MWh	5,000 MWh	3,000 MWh
[5]	REC Price	$15/MWh			
[6]	CEC Price	$10/MWh			
[7]	Resource Revenue/MWh	$10/MWh	$0/MWh	$25/MWh	$25/MWh
[8]	Total REC Payments	$120,000			
[9]	Total CEC Payments	$90,000			
[10]	Total Payments	$210,000			

As in Case A, the least cost way to meet the REC demand is to award Renewable 1 with 5,000 MWh of RECs and Renewable 2 with 3,000 MWh of RECs. With Approach 1, Renewable 1 and Renewable 2 can be awarded CECs in addition to RECs, and so Renewables 1 and 2 also receive 5,000 MWh and 3,000 MWh of CECs, respectively. To meet the remainder of CEC demand, Clean 1 provides the final 1,000 MWh at least cost.

While the change in awards from Case A is modest, the pricing implications are important. First, Clean 1 is now marginal for CECs and so sets the CEC price. That is, if the CEC demand was increased by 1 MWh, Clean 1 would clear for an additional MWh of CEC at a cost of $10. This increase in costs sets the CEC price at $10/MWh. Note that this price is the "break even" price for Clean 1.

Second, Renewable 2 remains marginal for RECs. However, because Renewable 2 receives $10/MWh for each CEC it is awarded, it can recover its costs while receiving a lower REC payment than in Case A. More specifically, Renewable 2 only needs to be paid $15/MWh for RECs to break even as this will result in it fully recovering its costs of $25/MWh ($15 for each REC sold, and another $10 for each CEC sold). As a result, Renewable 2 sets the REC price at $15/MWh.

Note that despite the fact that the two renewable resources are paid twice for each MWh, their total compensation per MWh is still $25. (Row [7] is the same in both of the above tables for the two renewable resources.) Thus, the double payment concern that has been highlighted with respect to Approach 1 does not appear to materialize.

Finally, note that the total payment to the resources for both CECs and RECs is $210,000. The additional $10,000 in total payments in Case B compared to Case A reflects Clean 1's cost for providing CECs.

Case C: CEC Demand >>> REC Demand, Approach 1

Continuing with Approach 1, Case C is identical to Case B except the CEC demand is increased by 10,000 MWh to 19,000 MWh. The table below summarizes the results for Case C.

Case C: CEC Demand >>> REC Demand, Approach 1					
		Clean 1	Clean 2	Renewable 1	Renewable 2
[1]	REC Demand	8,000 MWh			
[2]	CEC Demand	19,000 MWh			
[3]	REC Award	0 MWh	0 MWh	5,000 MWh	4,000 MWh
[4]	CEC Award	5,000 MWh	5,000 MWh	5,000 MWh	4,000 MWh
[5]	REC Price	$0/MWh			
[6]	CEC Price	$25/MWh			
[7]	Resource Revenue/MWh	$25/MWh	$25/MWh	$25/MWh	$25/MWh
[8]	Total REC Payments	$0			
[9]	Total CEC Payments	$475,000			
[10]	Total Payments	$475,000			

Clean 1, Clean 2, and Renewable 1 all clear for their maximum capabilities, so Renewable 2 is marginal for both RECs and CECs. Note, however, that the REC demand is no longer binding: the 9,000 MWhs of RECs awarded is greater than the 8,000 MWh demand.[7] As a result, the REC clearing price is $0/MWh. The CEC demand is still binding, however, and Renewable 2 sets the CEC price at $25/MWh. Note that this $25/MWh CEC price is necessary for Renewable 2 to break even and recover their costs because, in this case, they expect no additional revenue from RECs.

The total payment to the resources for both CECs and RECs is $475,000. The additional payments reflect the fact that substantially more CECs are awarded in Case C than in Case B. Despite the additional payments, there is still no "double payment": the two renewable resources are still paid $25/MWh, as in Case A and Case B. (Row [7] is unchanged for the renewable resources.)

Case D: Approach 3, No REC Demand

With Approach 3, the state programs are assumed to be discontinued so that there is no REC demand. CEC demand is unchanged from Case C at 19,000 MWh. The table below summarizes the results for Case D.

[7] Whether the REC demand bid binds is a function not only of the size of CEC demand, but also of supply conditions. For example, if the maximum capability of clean resources was substantially decreased, the REC demand could be rendered non-binding in Case B as well.

Case D: No REC Demand, Approach 3						
			Clean 1	Clean 2	Renewable 1	Renewable 2
[1]	REC Demand				-	
[2]	CEC Demand				19,000 MWh	
[3]	REC Award		-	-	-	-
[4]	CEC Award		5,000 MWh	5,000 MWh	5,000 MWh	4,000 MWh
[5]	REC Price				-	
[6]	CEC Price				$25/MWh	
[7]	Resource Revenue/MWh		$25/MWh	$25/MWh	$25/MWh	$25/MWh
[8]	Total REC Payments				-	
[9]	Total CEC Payments				$475,000	
[10]	Total Payments				$475,000	

Renewable 2 is still marginal for CECs, as Clean 1, Clean 2, and Renewable 1 clear for their entire capability. Without REC demand, there is no REC price, and the resources recover their costs entirely from CECs. As in Case C, the total payment to the resources is $475,000, and the renewable resources are paid $25/MWh. There is no double payment to the renewable resources.

Note that Approaches 1 and 3 will generally yield the same results when REC demand is not binding, as occurred with Case C. If, however, REC demand is binding, as in Case B, Approach 1 will yield different outcomes than Approach 3. In particular, under Approach 3 without the REC demand, fewer renewable resources and more clean (but not renewable) energy resources are likely to clear than under Approach 2 when REC demand is binding. Approach 3 will generally result in lower costs for the same quantity of clean energy but it will yield less renewable energy.

Case E: CEC Demand > REC Demand, Approach 2

With Approach 2, the renewable resources can be compensated for either CECs or RECs, but not both. More specifically, for the purposes of this memo, we assume that each MWh's attributes can only be counted for one product. In practice, we expect the resources to sell the highest value certificates, subject to their capability. In this case, where the REC price is higher than CEC price, we expect the renewable resources to sell the RECs and the clean energy resources to sell the CECs. To ease comparisons, CEC and REC demand are the same as in Case B with Approach 1, as illustrated in the table below.

Case E: CEC Demand > REC Demand, Approach 2					
		Clean 1	Clean 2	Renewable 1	Renewable 2
[1]	REC Demand	8,000 MWh			
[2]	CEC Demand	9,000 MWh			
[3]	REC Award	0 MWh	0 MWh	5,000 MWh	3,000 MWh
[4]	CEC Award	5,000 MWh	4,000 MWh	0 MWh	0 MWh
[5]	REC Price	$25/MWh			
[6]	CEC Price	$15/MWh			
[7]	Resource Revenue/MWh	$15/MWh	$15/MWh	$25/MWh	$25/MWh
[8]	Total REC Payments	$200,000			
[9]	Total CEC Payments	$135,000			
[10]	Total Payments	$335,000			

Renewable 2 is marginal for the RECs and sets the REC price at $25/MWh, while Clean 2 is marginal for the CECs and sets their price at $15/MWh. Because the renewable resources cannot sell both CECs and RECs, their total revenue per MWh is $25/MWh. Note that the total revenue to the renewable resources is the same in Case E as in all of the other cases.

Despite the fact that CEC demand is only 9,000 MWh, the resources sell 17,000 MWhs of energy that could yield CECs, where this remaining 8,000 MWh of energy instead is used to satisfy only demand for RECs. As a result, the total overall payment to the resources in Case E ($335,000) is substantially higher than in Case B ($210,000).

Case F: CEC Demand < REC Demand, Approach 2

To avoid the increased costs seen in Case E that result from procuring excess clean energy, Case F reduces CEC demand to 1,000 MWh, so that Cases F and B result in the same total payments. See the table below.

Case F: CEC Demand < REC Demand, Approach 2					
		Clean 1	Clean 2	Renewable 1	Renewable 2
[1]	REC Demand	8,000 MWh			
[2]	CEC Demand	1,000 MWh			
[3]	REC Award	0 MWh	0 MWh	5,000 MWh	3,000 MWh
[4]	CEC Award	1,000 MWh	0 MWh	0 MWh	0 MWh
[5]	REC Price	$25/MWh			
[6]	CEC Price	$10/MWh			
[7]	Resource Revenue/MWh	$10/MWh	$0/MWh	$25/MWh	$25/MWh
[8]	Total REC Payments	$200,000			
[9]	Total CEC Payments	$10,000			
[10]	Total Payments	$210,000			

Once again, Renewable 2 is marginal for RECs and sets their price at $25/MWh. Reducing CEC demand from 9,000 MWh to 1,000 MWh decreases Clean 1 and Clean 2's CEC awards, so that Clean 1 is now marginal for CECs and sets their price at $10/MWh. These prices ensure that each Clean 1 and Renewable 2 both recover their costs and break even. Note that the total resource revenue per MWh (Row [7]) and total payments to the resources (Row [10]) are the same in Cases B and F.

Case F demonstrates that it is possible to achieve the same outcomes with Approaches 1 and 2, as this outcome is effectively equivalent to Case B, where resources are permitted to sell both clean energy certificates and RECs. However, given that there are often many different RECs, where the products vary by state, technology, and location, it may not be practical to adjust clean energy demand to produce an outcome that meets both the region's clean energy targets and its many REC requirements in a cost-effective manner.

Conclusion

The six cases above show that, given competitive REC and CEC markets, we do not expect renewable resources to receive additional revenue per MWh with the introduction of clean energy certificates. However, given the same levels of demand, we do observe increased costs with Approach 2 compared to Approach 1. These increased costs from Approach 2 can be alleviated by adjusting demand, but the ISO believes that this may be difficult in practice, given the large number of overlapping state programs with different eligibility criteria, noncompliance rates, etc. Finally, Approach 1 and Approach 3 will often yield identical results, and when the two approaches yield different results, Approach 3 will generally entail lower costs.

Given these observations, the ISO proposes that, for modelling purposes, AGI assume Approach 1 so that the CECs are not integrated with the existing state programs. This approach appears to be relatively simple to model, avoids the double payment concern identified by stakeholders, and allows for the continuation of the existing state programs. The ISO has not finalized its thinking on this issue, however, and welcomes stakeholder input and feedback in the coming weeks as we move towards a decision.