



California ISO

# NETWORK UPGRADES AND COST RESPONSIBILITY IMPLEMENTATION

Result of the 2018 Interconnection Process  
Enhancements Stakeholder Initiative

October 23, 2019

## Network Upgrades

- **Individual network upgrade**
  - **Interconnection Reliability Network Upgrades (IRNU)** – Reliability Network Upgrades at the Point of Interconnection to accomplish the physical interconnection of the Generating Facility to the CAISO Controlled Grid. IRNUs are treated as Reliability Network Upgrades unless otherwise noted.
  - **General Reliability Network Upgrades (GRNU)** – RNUs that are not IRNUs.
  - **Local delivery Network Upgrades (LDNU)** – shall mean a transmission upgrade or addition identified by the CAISO in the GIDAP interconnection study process to relieve a Local Reliability Constraint.
  - **Area Delivery Network Upgrade (ADNU)** – network upgrades to increase Transmission Plan Deliverability to relieve an Area Deliverability Constraint.
- **Network upgrade groups**
  - **Assigned Network Upgrade (ANU)** - Reliability Network Upgrades and Local Delivery Network Upgrades currently assigned to the Interconnection Customer. Assigned Network Upgrades exclude (1) Conditionally Assigned Network Upgrades unless they become Assigned Network Upgrades, and (2) Precursor Network Upgrades.
  - **Conditionally Assigned Network Upgrade (CANU)** - Reliability Network Upgrades and Local Delivery Network Upgrades currently assigned to an earlier Interconnection Customer, but which may be assigned to the Interconnection Customer.
  - **Precursor Network Upgrade (PNU)** - Network Upgrades required for an Interconnection Customer that consist of (1) Network Upgrades whose cost responsibility is assigned to an earlier Interconnection Customer that has executed its GIA; and (2) Network Upgrades in the approved CAISO Transmission Plan.
- **Cost responsibilities**
  - **Current Cost Responsibility (CCR)** - The Interconnection Customer's current allocated costs for Assigned Network Upgrades, not to exceed the Maximum Cost Responsibility. This cost is used to calculate the Interconnection Customer's Interconnection Financial Security requirement.
  - **Maximum Cost Responsibility (MCR)** - The lower sum of the Interconnection Customer's (1) full cost of assigned Interconnection Reliability Network Upgrades and (2) allocated costs for all other Assigned Network Upgrades, from its Phase I or Phase II Interconnection Studies, not to exceed the Maximum Cost Exposure.
  - **Maximum Cost Exposure (MCE)** - Pursuant to Appendix DD, the sum of (1) the Interconnection Customer's Maximum Cost Responsibility and (2) the Conditionally Assigned Network Upgrades from its Phase I or Phase II Interconnection Study.
- **Network Upgrade cost types**
  - **IRNU-A:** allocated portion of IRNUs
  - **IRNU-NA:** non-allocated portion of IRNUs to be included in maximum cost responsibility
  - **GRNU:** RNUs except IRNU
  - **LDNU:** LDNUs in ANU category
  - **ADNU**
  - **CANU-IR:** IRNUs in CANU category
  - **CANU-GR:** other RNUs in CANU category
  - **CANU-D:** LDNUs in CANU category

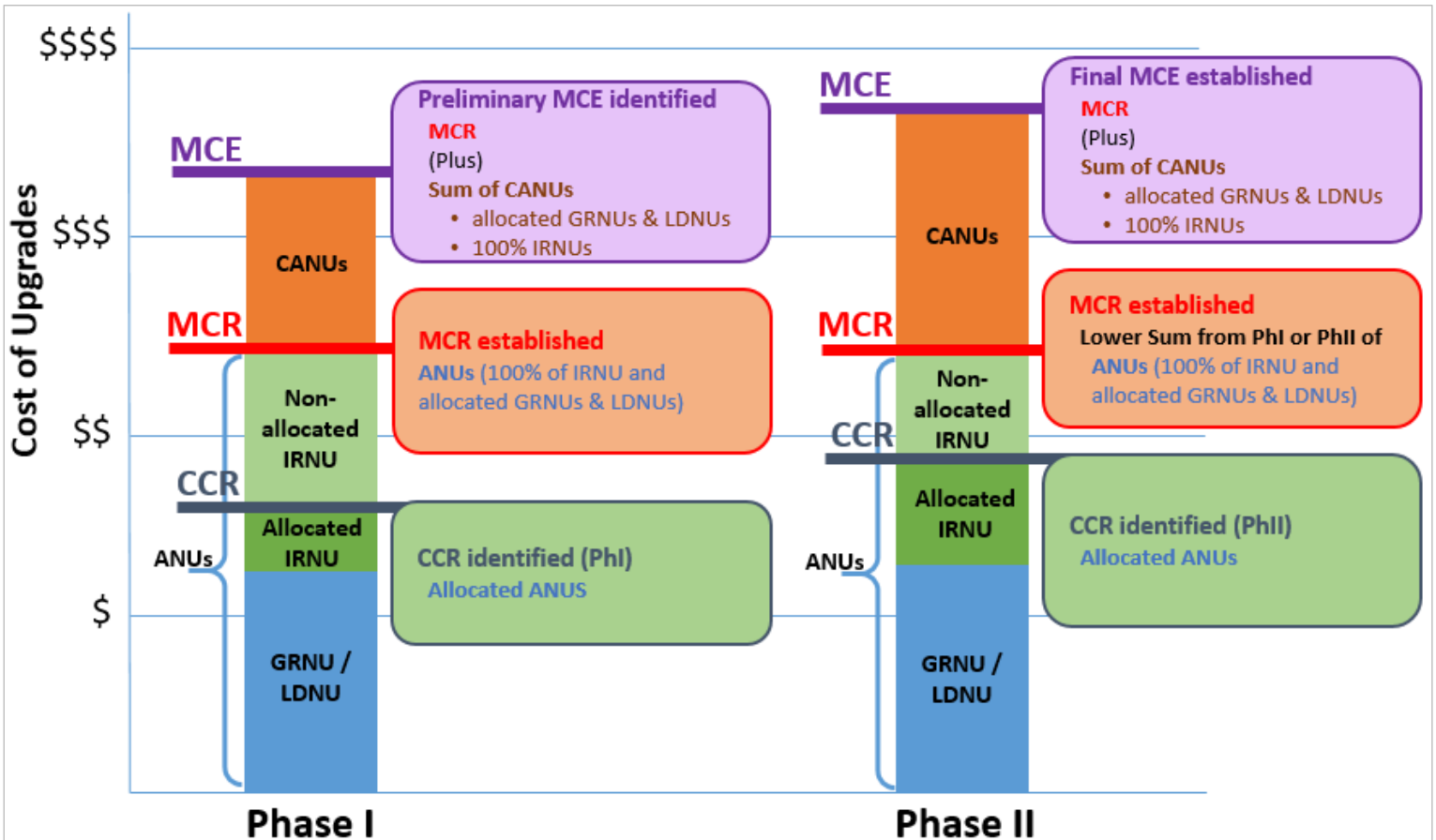
### Therefore, ANUs and CANUs are:

- **ANU** = RNU + LDNU = IRNU + GRNU + LDNU
- **CANU** = CANU-IR + CANU-GR + CANU-D

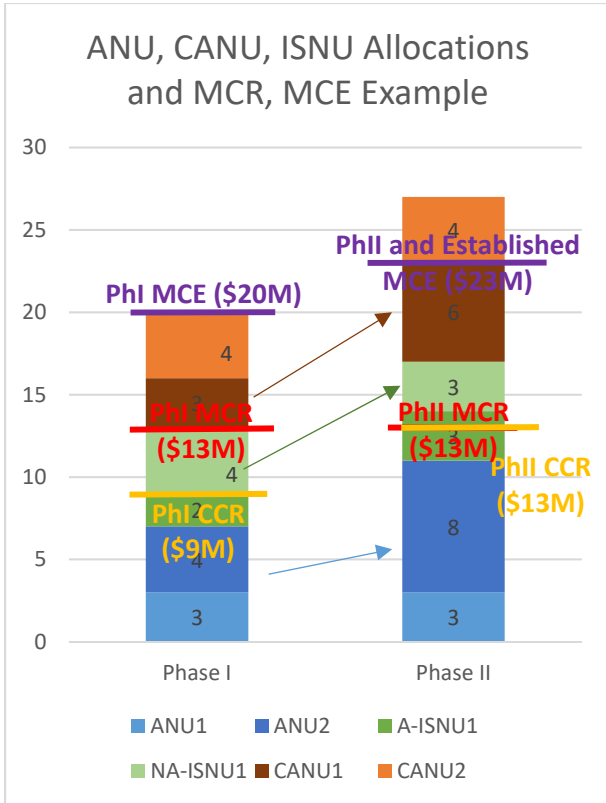
**Note on the use of 'assigned' vs. 'allocated':** assigned is upgrade specific and allocated is cost specific

- An upgrade is assigned to an IC at the allocated cost/amount

**Network Upgrade and Cost Responsibility Examples**



**Simplified example of a Phase I and Phase II Network Upgrade assignment and cost responsibility allocation**



	ANU1	ANU2	A-ISNU1	NA-ISNU1	CANU1	CANU2	CCR	MCR	MCE
Phase I	3	4	2	4	3	4	9	13	20
Phase II	3	8	3	3	6	4	13	13	23

## Cost Allocations

### Summary of how costs are allocated by upgrade

Assigned Network Upgrades			Conditionally Assigned	
Cost Allocation	for CCR		for MCR	for MCE
<b>RNU</b>				
IRNU	Full cost / # projects		Full Cost	Full Cost
<b>GRNU</b>				
SCD	by SCD Impact		by SCD Impact	by SCD Impact
Other	by MW @ POI		by MW @ POI	by MW @ POI
<b>DNU</b>				
LDNU	by Flow Impact		by Flow Impact	by Flow Impact
ADNU*	PhI: \$/MW * MW@POI PhII: Flow Impact			

\* Not part of CCR/MCR calculations

## In Phase I

### Assigned Network Upgrades

CCR = assigned GRNUs and LDNUs + allocated IRNUs

MCR = assigned GRNUs and LDNUs + 100% IRNUs

### Conditionally Assigned Network Upgrades

MCE = MCR + assigned CANUs (Final MCE established in Phase II)

## Example of Phase I Cost Responsibility Breakdown

<b>A. Current Cost Responsibility (CCR) for ANU</b>	
A.1 GRNU (\$k)	\$ -
A.2 IRNU (\$k)	\$ 6,783.00
A.3 LDNU (\$k)	\$ -
<b>Current Cost Responsibility (\$k) (A = A.1 + A.2 + A.3)</b>	<b>\$ 6,783.00</b>
<b>B. Maximum Cost Responsibility (MCR) for ANU</b>	
B.1 GRNU (\$k)	\$ -
B.2 IRNU (\$k)	\$ 6,783.00
B.3 LDNU (\$k)	\$ -
<b>Maximum Cost Responsibility (\$k) (B = B.1 + B.2 + B.3)</b>	<b>\$ 6,783.00</b>
<b>C. Maximum Cost Exposure (MCE) with CANU</b>	
C.1 CANU - GRNU (\$k)	\$ -
C.2 CANU - IRNU (\$k)	\$ -
C.3 CANU - LDNU (\$k)	\$ -
<b>Maximum Cost Exposure (\$k) (C = B + C.1 + C.2 + C.3)</b>	<b>\$ 6,783.00</b>

## In Phase II

**Maximum Cost Responsibility (MCR)** - The lower sum of an Interconnection Customer's (1) ANU costs, plus (2) 100% of IRNUs costs, from its Phase I or Phase II Interconnection Studies, which may be adjusted if a subsequent reassessment converts CANUs to ANUs.

$MCR = \min(\text{Phase I ANU} + \text{Phase I CANU converting to ANU in Phase II}, \text{Phase II ANU})$  where the full cost of IRNU, if ANU, is used in the calculation

### **Current Cost Responsibility (CCR)** -

The Interconnection Customer's current allocated costs for Assigned Network Upgrades (GRNU, LDNU, and IRNU-A), not to exceed the Maximum Cost Responsibility.

$CCR = \min(MCR, \text{current Phase II ANU allocation})$

**Maximum Cost Exposure (MCE)** - The sum of (1) the Interconnection Customer's MCR and (2) the sum of the Interconnection Customer's CANUs from its Phase II Interconnection Studies. This may be adjusted in the subsequent reassessment if a CANU is no longer needed or changes to PNU.

$MCE = MCR + \text{Phase II CANU allocation}$

### Scenarios that could occur between Phase I and Phase II:

#### Potential changes to cost responsibility include:

**MCE up** – only between Phase I and II due to increase of CANU. MCE established in Phase II.

**MCE down** – when CANU is removed (no-longer-needed or becomes PNU).

**MCR is lower of Phase I/II, however could increase in Phase II if:**

1. CANU in Phase I becomes ANU in Phase II

**CCR up** – if IRNU allocation changes (due to project withdrawal)

**CCR down** – Phase I ANU is no longer needed

#### Headroom:

When an already-assigned-GRNU decreases and CANU becomes ANU and increases in cost allocation. MCR/CCR is adjusted based on Phase I cost, but the upgrades are assigned the appropriate cost responsibility for the upgrade. The increased allocated cost of the CANU conversion to ANU will fill the gap of the headroom created from reduction in the already-assigned GRNU.

1. In the following four scenarios, cost responsibilities are generally based on the calculations above:
  - a. When GRNU and IRNU allocations increase
  - b. When GRNU and IRNU allocations decrease
  - c. When GRNU increase and IRNU decrease
  - d. When GRNU decrease and IRNU increase
2. When CANU removed: no specific adjustment
  - a. Remaining CANUs are assigned allocated costs using Phase II cost estimates (which then establishes the MCE – see above)
3. When CANU is converted to ANU:

The Phase I MCR is adjusted upward at an amount equal to the Phase I cost (protection for ICs). Then the Phase I MCR is compared to the Phase II cost allocation and the lower is the Phase II MCR.

Converted as GRNU:

When GRNU allocations increase and CANU Converted to ANU: protected by sum of Phase I costs.

When GRNU allocations decrease and CANU-G allocation increases after conversion:

CANU (now as GRNU) is now assigned its appropriate cost for that upgrade. Total costs for GRNUs may sum to more than MCR and PTO will cover that amount.

Converted as IRNU:

MCR will increase by the full cost of IRNU when converted.

CCR will increase by allocated cost in reassessment based on # or projects

**Example of Phase II Cost Responsibility Breakdown**

Deliverability Option		A
<b>A. Phase II ANU Cost Allocation for Current Cost Responsibility (CCR)</b>		
A.1 GRNU Cost (\$k)	\$	-
A.2 LDNU Cost (\$k)	\$	-
A.3 IRNU Cost (\$k)	\$	6,636
Phase II ANU Cost Allocation for CCR (\$k) ( $A = A.1 + A.2 + A.3$ )	\$	6,636
<b>B. Phase II ANU Cost Allocation for Maximum Cost Responsibility (MCR)</b>		
B.1 GRNU Cost (\$k)	\$	-
B.2 LDNU Cost (\$k)	\$	-
B.3 IRNU Cost (\$k)	\$	6,636
Phase II ANU Cost Allocation for MCR (\$k) ( $B = B.1 + B.2 + B.3$ )	\$	6,636
<b>C. Phase II CANU Cost Allocation</b>		
C.1 CANU - GRNU (\$k)	\$	-
C.2 CANU - LDNU (\$k)	\$	-
C.3 CANU - IRNU (\$k)	\$	-
Phase II CANU Cost Allocation (\$k) ( $C = C.1 + C.2 + C.3$ )	\$	-
<b>D. MCR from Phase I</b>		
D.1 Phase I CCR for ANU (\$k)	\$	3,131
D.2 Phase I CANU Cost for Upgrades Becoming ANU in Phase II (\$k)	\$	-
Phase I MCR (\$k) ( $D = D.1 + D.2$ )	\$	3,131
E. Maximum Cost Responsibility (\$k) ( $E = \min\{B, D\}$ )	\$	3,131
F. Current Cost Responsibility (\$k) ( $F = \min\{A, E\}$ )	\$	3,131
G. Maximum Cost Exposure (\$k) ( $G = C + E$ )	\$	3,131
H. Project ADNU Cost Responsibility (\$k)	\$	-

## In Reassessment

**Maximum Cost Responsibility (MCR)** - The lower sum of an Interconnection Customer's (1) LDNUs and GRNUs costs, plus (2) 100% of IRNUs costs, from its Phase I or Phase II Interconnection Studies, which may be adjusted if a subsequent reassessment converts CANUs to ANUs.

$MCR = \text{Previous MCR} + \text{Phase II cost of CANU converting to ANU in Reassessment}^{**}$  -- where the full cost of IRNU, if ANU, is used in the calculation.

**\*\***reduction can occur when costs meet tariff criteria 7.4.3 (\$1M/20%, then, min(MCR above, 100% NU allocations))

**Current Cost Responsibility (CCR)** - The Interconnection Customer's current allocated costs for Assigned Network Upgrades (GRNU, LDNU, and IRNU-A), not to exceed the Maximum Cost Responsibility.

$CCR = \min(MCR, \text{ANU reallocation})$

**Maximum Cost Exposure (MCE)** - The sum of (1) the Interconnection Customer's MCR and (2) the sum of the Interconnection Customer's CANUs from its Phase II Interconnection Studies.

$MCE = MCR + \text{Phase II CANU allocation}$

### Scenarios that could occur between Phase II and Reassessment:

#### Potential changes to cost responsibility include:

**MCE down** – when CANU is removed.

**MCR up** – when CANU becomes ANU

**MCR down** – based on 7.4.3, or Policy item above.

**CCR up** – IRNU allocation increases (other project(s) withdrawal) (up to MCR)

#### Headroom Issues:

When an already-assigned-GRNU decreases and CANU becomes ANU and increases in cost allocation. MCR/CCR is adjusted based on Phase II cost, but the upgrades are assigned the appropriate cost responsibility for the upgrade. The increased allocated cost of the CANU conversion to ANU will fill the gap of the headroom created from reduction in the already-assigned GRNU will allow for.

In this scenario, the MCR could be reduced if it meets the 7.4.3 tariff requirements.

#### IRNU-NA in MCR provide headroom for GRNU in CCR (up to MCR).

1. In the following four scenarios, cost responsibilities are generally based on the calculations above:
  - a. When GRNU and IRNU allocations increase
  - b. When GRNU and IRNU allocations decrease
  - c. When GRNU increase and IRNU decrease
  - d. When GRNU decrease and IRNU increase
2. CANU conversion to ANU

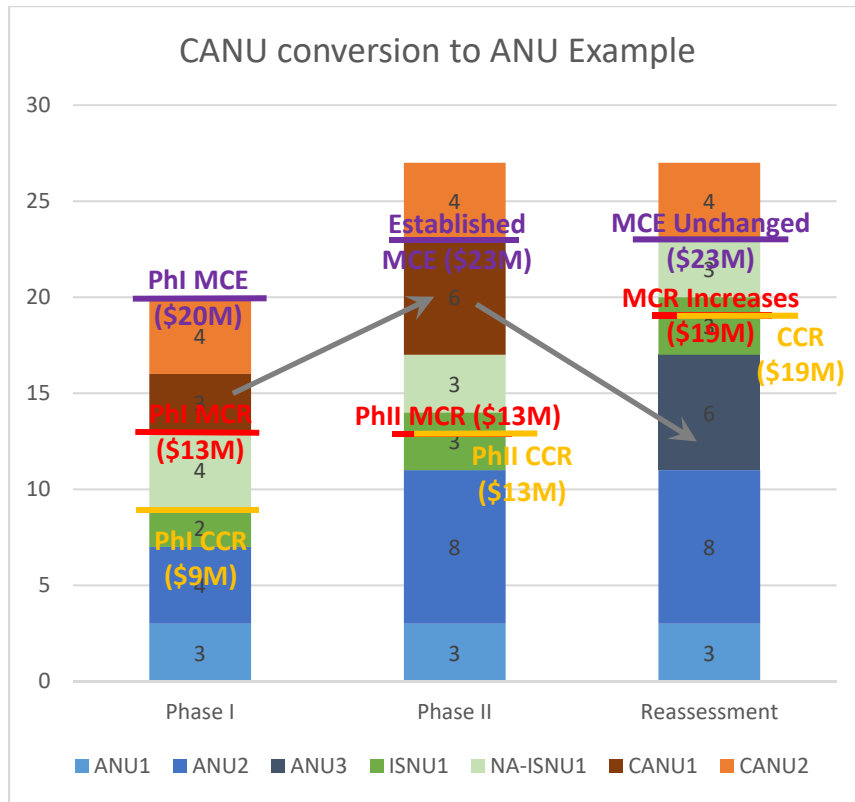
The previous MCR is adjusted upward at an amount equal to the Phase II cost assigned in the project's Phase II study. The cost in the most recent and future studies will include the appropriate allocated cost for that upgrade.

  - a. Impact on MCR – increase by full cost of IRNU assigned in Phase II study
    - o When GRNU allocations increase and CANU Converted to ANU: protected by updated MCR as calculated above.
    - o When GRNU allocations decrease and CANU-G allocation increases after conversion:



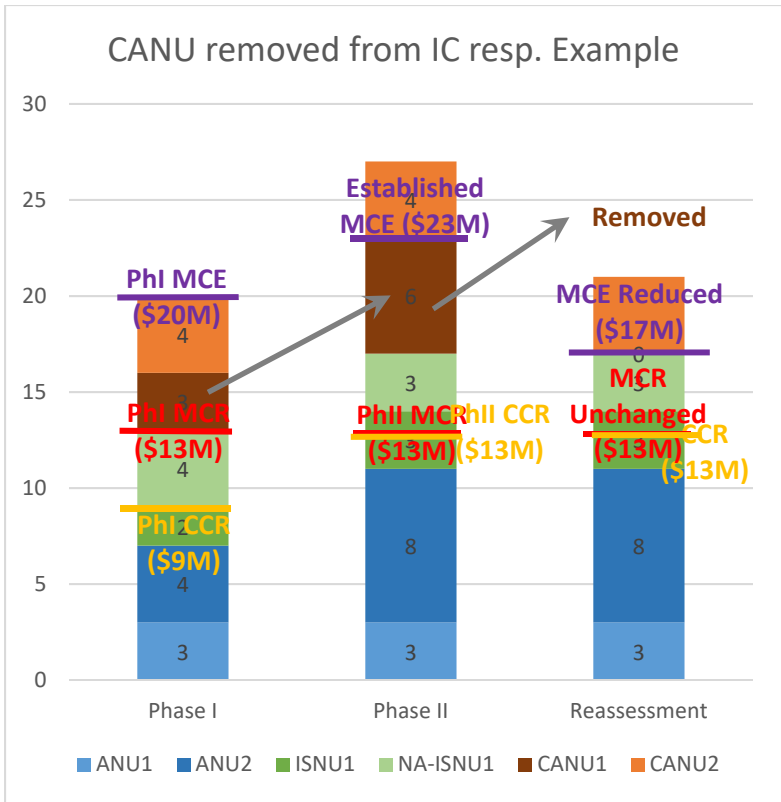
- CANU (now as GRNU) is now assigned its appropriate cost for that upgrade. Total costs for GRNUs may sum to more than MCR and PTO will cover that amount.
  - b. Impact on CCR – increase by cost allocation cost in reassessment netted with other CCR cost allocation changes (not to exceed MCR)
  - c. Impact on MCE – None.
3. CANU removed
- a. Impact on MCR – None
  - b. Impact on CCR – None
  - c. Impact on MCE – decrease by Phase II CANU allocation.
4. Shared IRNU as ANU with 3rd posting made
- a. Impact on MCR – reduced by the posted amount; see policy above
  - b. Impact on CCR – None
  - c. Impact on MCE – None

**Examples:**



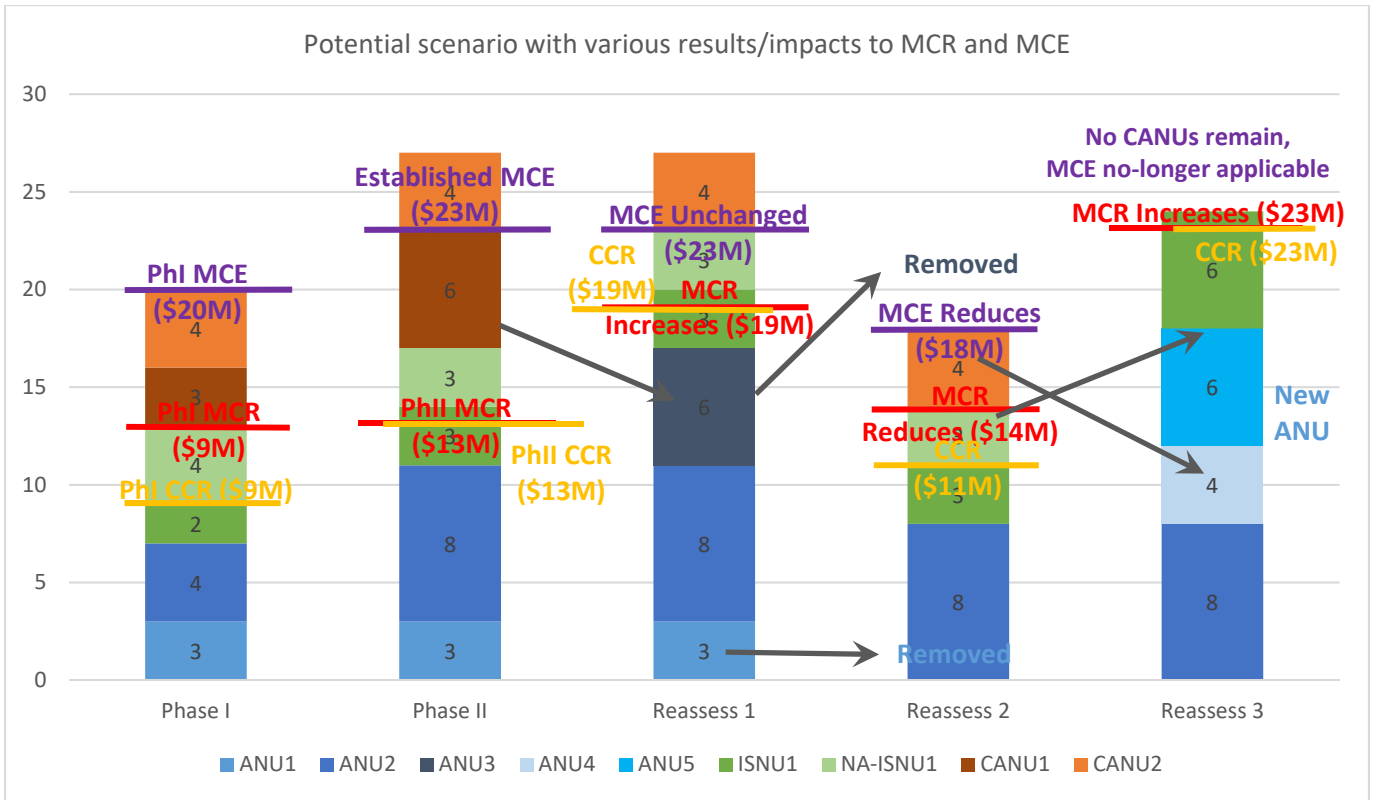
	ANU1	ANU2	ANU3	ISNU1	NA-ISNU1	CANU1	CANU2	CA* for CCR	CCR	MCR	MCE
Phase I	3	4	---	2	4	3	4	9	9	13	20
Phase II	3	8	---	3	3	6	4	14	13	13	23
Reassessment	3	8	6	3	3	---	4	20	19	19	23

\*CA = current "Cost Allocation"



	ANU1	ANU2	ISNU1	NA-ISNU1	CANU1	CANU2	CCR	MCR	MCE
Phase I	3	4	2	4	3	4	9	13	20
Phase II	3	8	3	3	6	4	13	13	23
Reassessment	3	8	3	3	0	4	13	13	17

Potential scenario with various results/impacts to MCR and MCE



	ANU1	ANU2	ANU3	ANU4	ANU5	A-ISNU1	NA-ISNU1	CANU1	CANU2	CA* for CCR	CCR	MCR	MCE
Phase I	3	4	---	---	---	2	4	3	4	9	9	13	20
Phase II	3	8	---	---	---	3	3	6	4	14	13	13	23
Reassess 1	3	8	6	---	---	3	3	---	4	20	19	19	23
Reassess 2	0	8	0	---	---	3	3	---	4	11	11	14	18
Reassess 3	0	8	0	4	6	6	---	---	---	24	23	23	23

\*CA = current "Cost Allocation"