TECHNICAL WORKING GROUP

OPERATIONAL SUBGROUP

ENERGY SECURITY BOARD

21 JULY 2022

AGENDA

Time	Topic
2:00	Welcome, objectives and agenda
2:05	Project plan for the operational subgroup
2:15	Operational models (refer to working papers) • Reference scenario and status quo arrangements (10 mins) • CMM and rebate allocation methods (30 mins incl Q&A) • CRM reference paper (30 mins incl Q&A) • Group discussion (25 mins)
3:50	Next steps
4:00	Thanks and close

PROJECT PLAN

Key milestones

Workshops with the technical working group (TWG) are intended to:

- Develop the design of the shortlisted model options
- Identify key issues and considerations to present for public consultation
- Provide inputs to the ESB's interim report.

Draft timetable

Date	Description
21 July 2022	Establish a shared understanding of operational models between TWG members
4 August 2022	Explore key policy questions and design choices
[11] August 2022	Review inputs and assumptions for NERA's modelling (date to be confirmed)
25 August 2022	*Agenda pending outcomes of items above*
September 2022	Review outputs of NERA modelling
September 2022	Provide inputs to inform key sections of ESB's draft interim report
[October] 2022	Release interim report (date to be confirmed)

Focus questions to resolve for detailed design

In preparation for the TWG meeting on 23 June 2022, the ESB shared a list of key questions for resolution during the detailed design phase for both investment and operational congestion models (ref. "20220623 TAR working paper Key outstanding questions for resolution.pdf").

A subset of questions has been extracted for TWG consideration in the operational timeframes during workshops scheduled July – August 2022.

1. **CRM formulation**
   - i. How do we make sure that we dispatch the cheapest available combination of resources to securely meet demand?
   - ii. What attributes must be retained as the logic is developed to solve?
2. **CMM formulation**
   - i. What allocation principles should be considered?
   - ii. What is the proposed assessment framework for them?
   - iii. If we adopt inferred economic dispatch approach, how do we infer costs?
3. **Incentives for storage and load**
   - i. How do we make sure that we dispatch the cheapest available combination of resources to securely meet demand?
   - ii. What is the scale of the potential revenue streams?
   - iii. Are rules required to ensure that storage and load do not operate in ways that worsen congestion?
4. **Winner takes all**
   - i. Should the model formulation be modified to soften the knife-edge properties of generator coefficients in access payments?
   - ii. If so, what changes are required?
5. **Out of merit generators**
   - i. Should the framework be adjusted to ensure that out-of-merit order generators (i.e. peakers) do not receive a rebate/congestion relief payment when the RRP is below the price they would be willing to generate at?
   - ii. If so, how do we identify which generators are out of merit?
6. **Constrained on generators**
   - i. How does the model treat constrained on generators?
   - ii. Can the LMP exceed the RRP?
   - iii. If a design choice is made for the LMP to be able to exceed RRP, how do we mitigate the exercise of market power?
7. **Potential for gaming**
   - i. How could the arrangements be gamed?
   - ii. Is it worse than the status quo?
8. **Contractual arrangements**
   - i. How does the model affect generator hedging arrangements?
   - ii. How does the model affect PPAs?
   - iii. Are the issues different for existing contracts vs contracts to be entering into in the future? Are transitional arrangements needed?

OPERATIONAL MODELS

OPERATIONAL MODELS

Background

The ESB shared two reference papers on the CMM and CRM

- NERA to develop its approach to model outcomes of the CMM and CRM for different market participants
- TWG (operational subgroup) to understand the fundamental elements of the CMM and CRM

The ESB/TWG will explore detailed design questions in separate working papers and future meetings.

Key topics

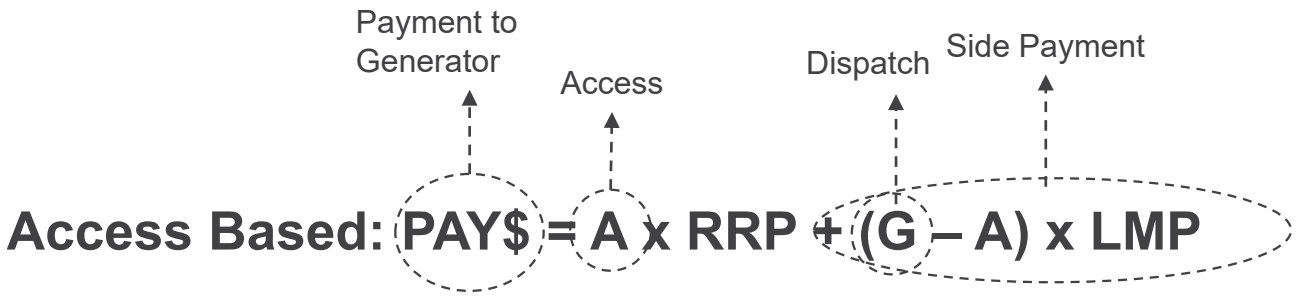
- Efficiency of dispatch achieved via the CMM and CRM
- Comparison of the model options
- Net profit outcomes for participants
- Incentives for storage and load

PRESENTATION STRUCTURE

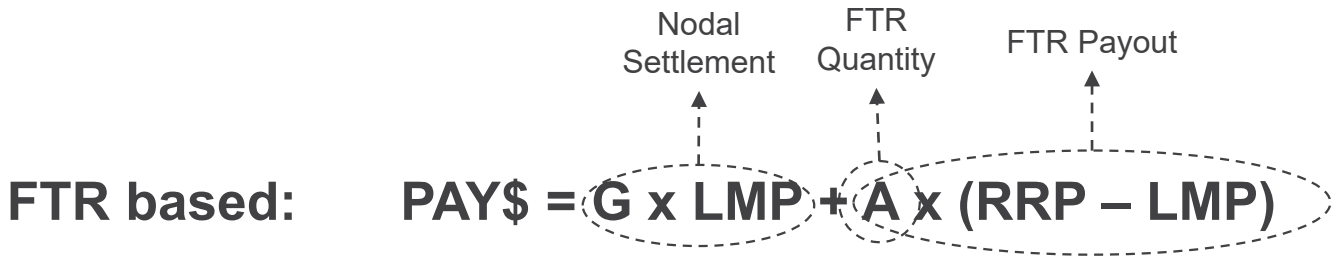
- Access Fundamentals
- Our Simple Example
- The Congestion Management Model (CMM)
- The Constraint Relief Market Model (CRM)
- Conclusions

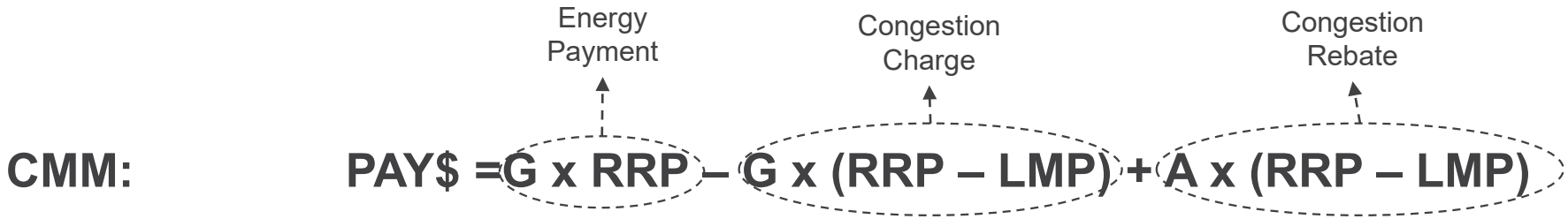
FUNDAMENTALS AND EXAMPLE

ACCESS FORMULATIONS

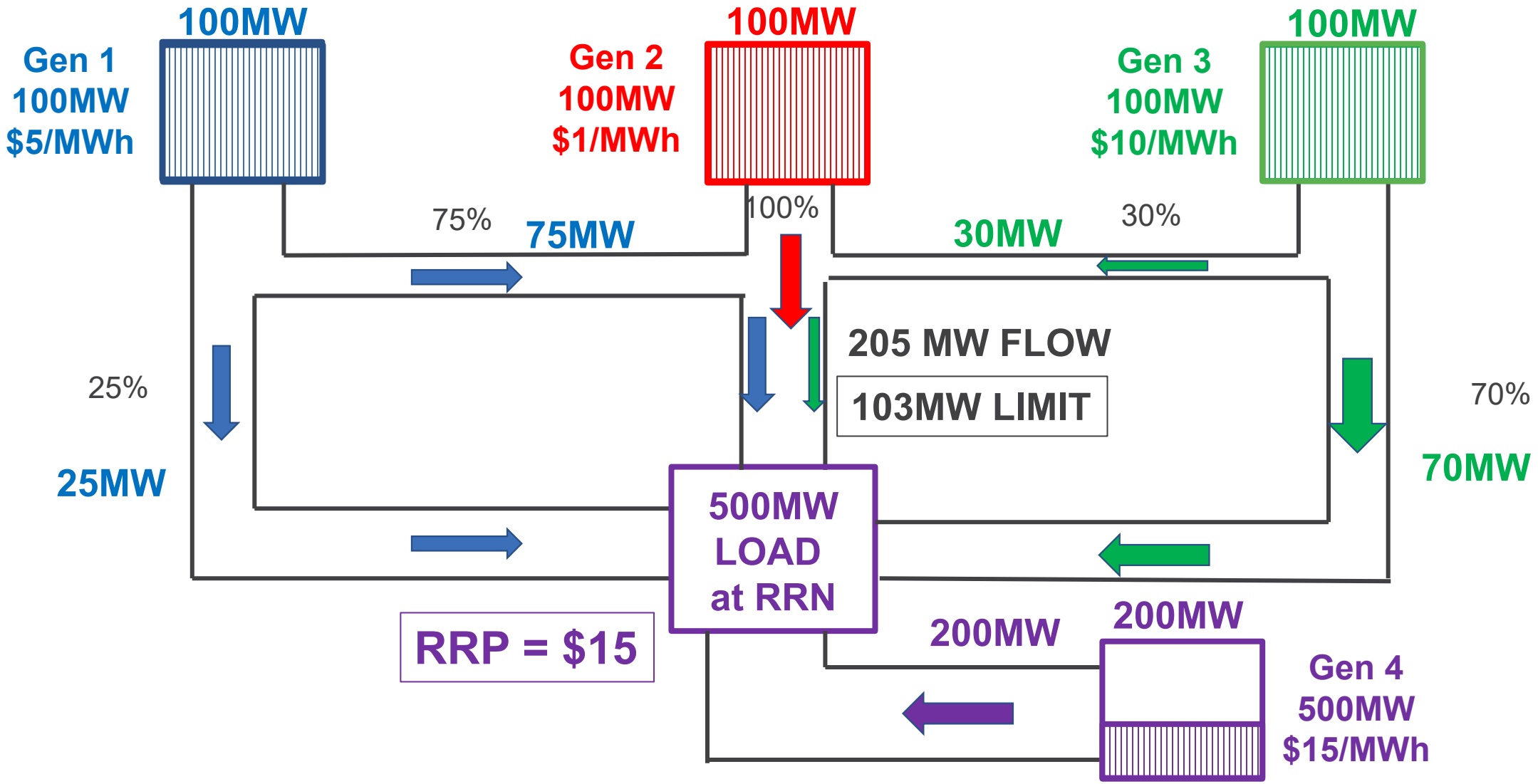


MATHEMATICALLY IDENTICAL

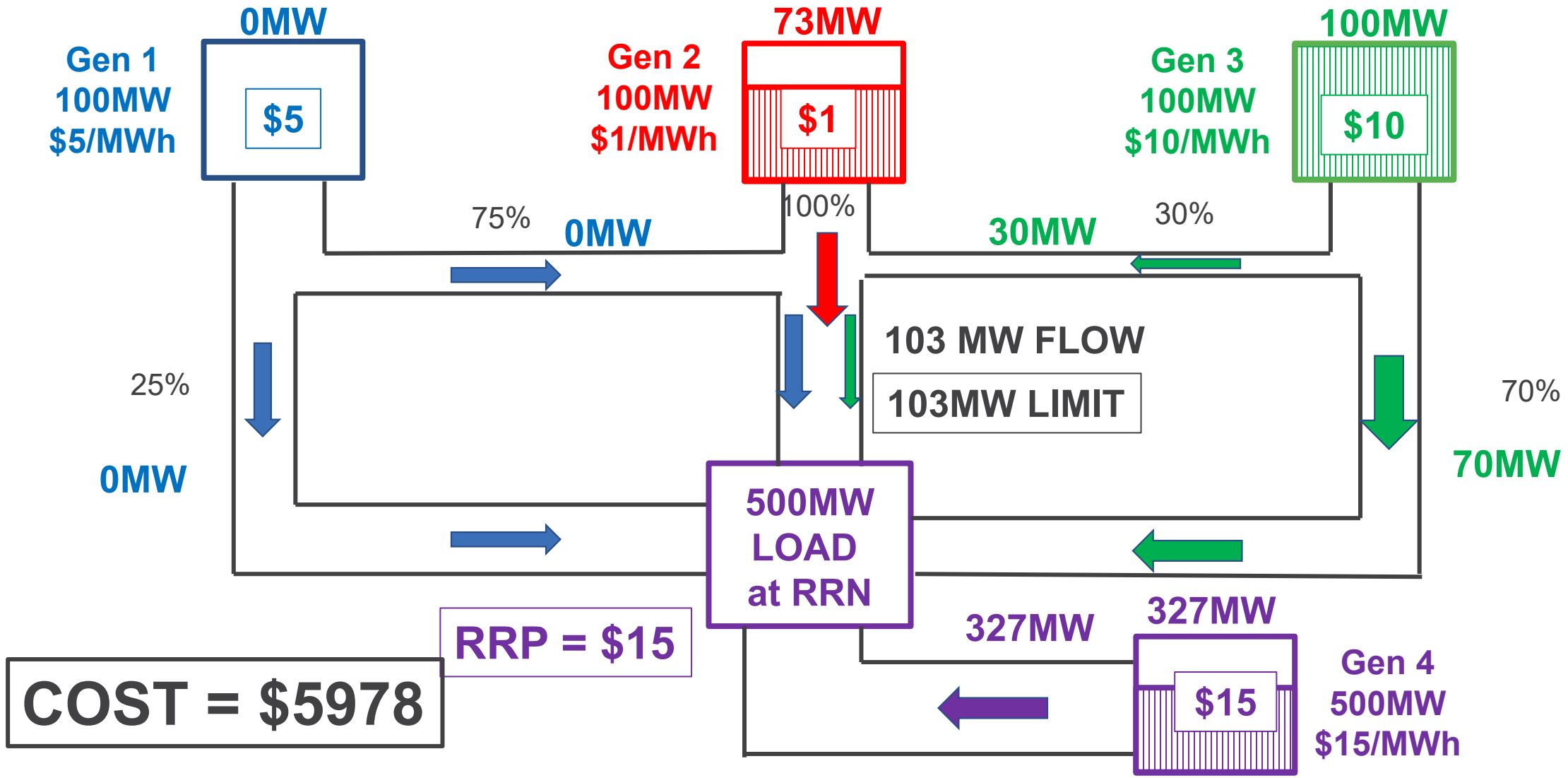




OUR EXAMPLE: SINGLE LOOP-FLOW CONSTRAINT

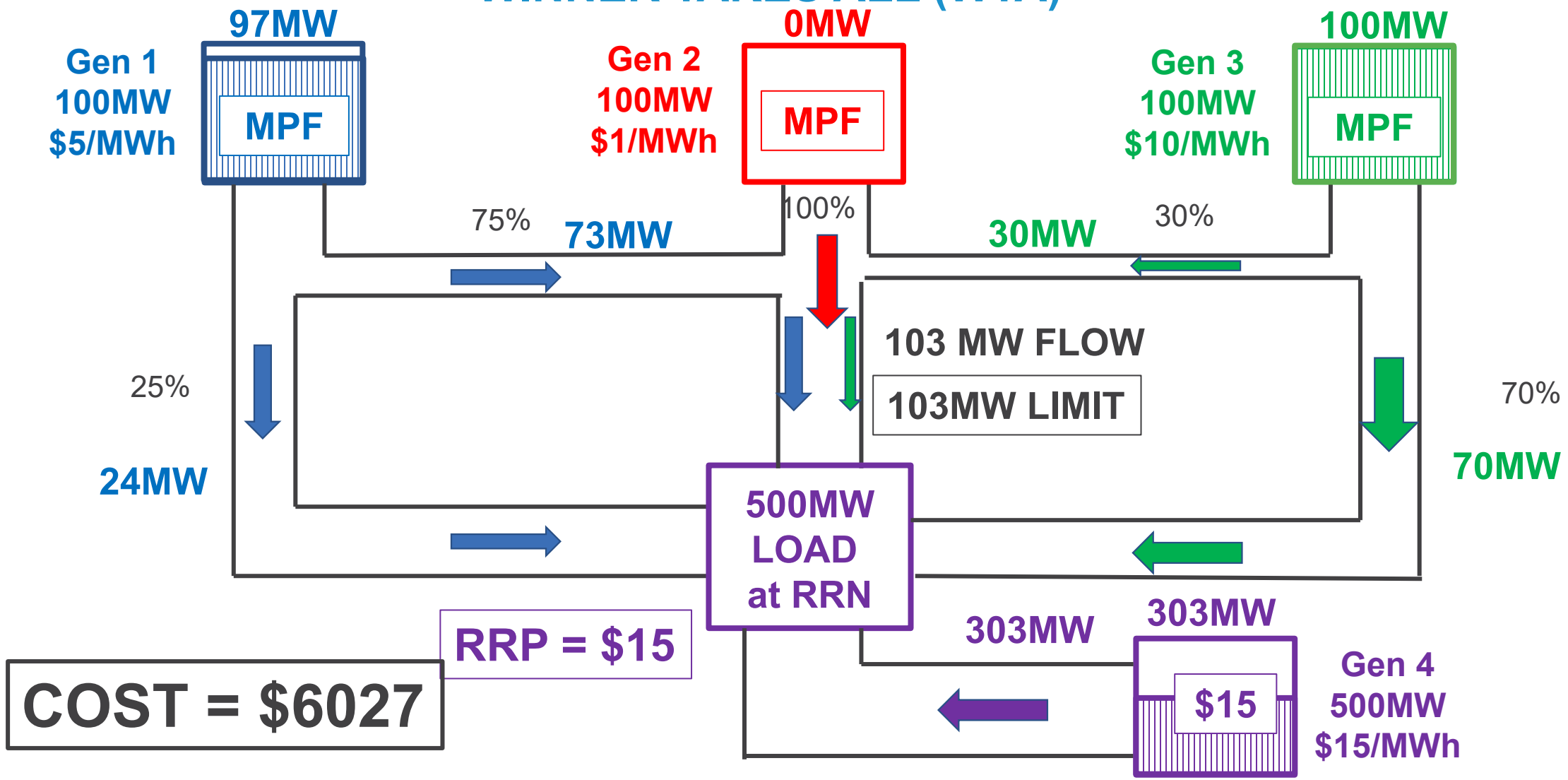


EFFICIENT DISPATCH: GENERATORS BID AT COST



TODAY'S DISPATCH: IN-MERIT, CONSTRAINED-OFF GENERATORS BID AT MPF

WINNER TAKES ALL (WTA)

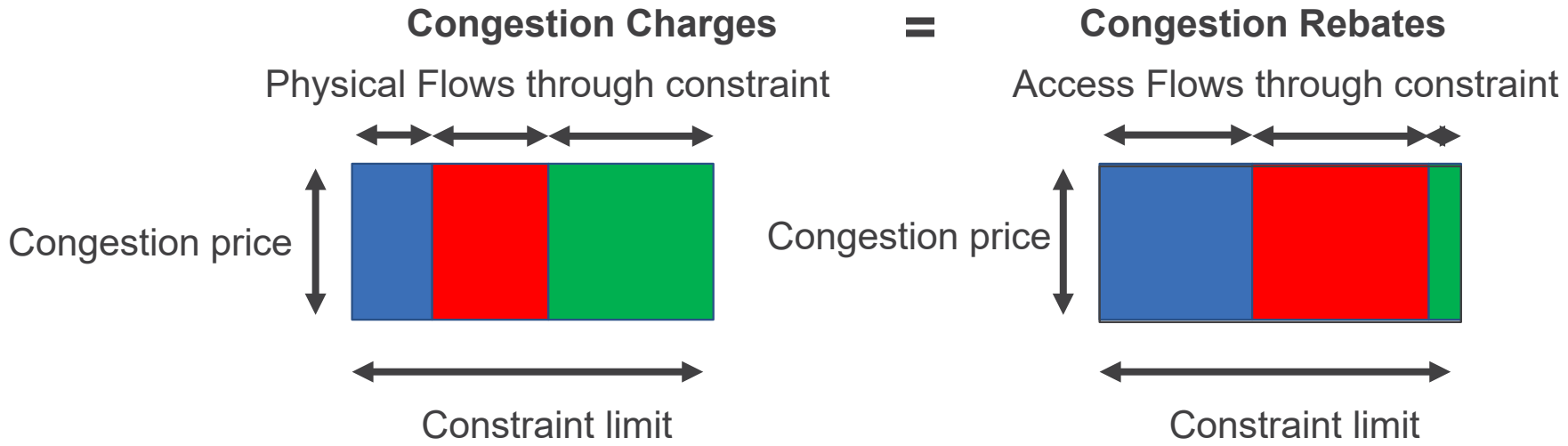


CONGESTION MANAGEMENT MODEL

CONGESTION MANAGEMENT MODEL

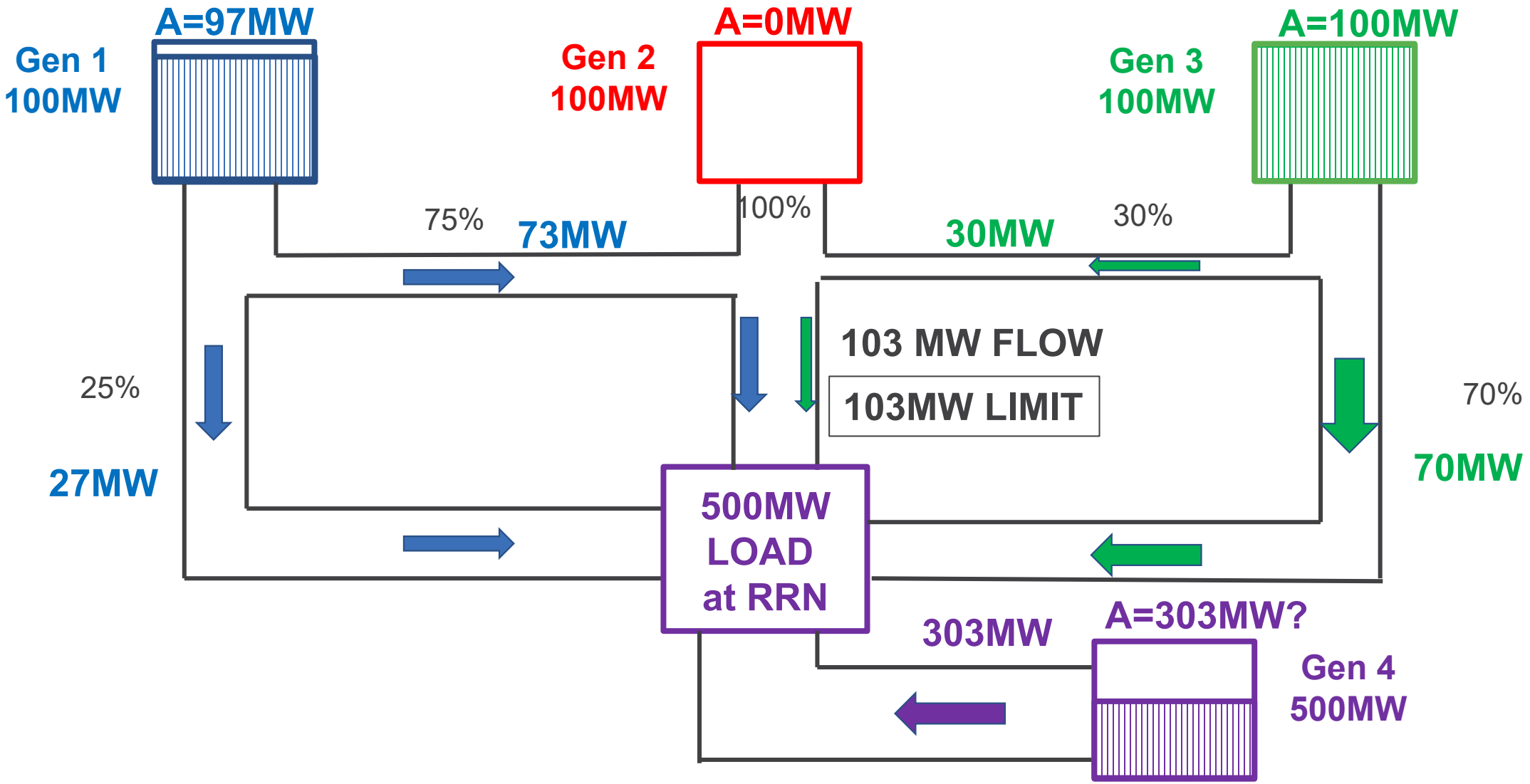
ALLOCATING ACCESS TO ENSURE SETTLEMENT ADEQUACY

CMM$ = G x RRP – congestion charge + congestion rebate
Aggregate Congestion Charge = Aggregate Congestion Rebate
Congestion charge = congestion price x flow through constraint (physical)
Congestion rebate = congestion price x flow through constraint (access)

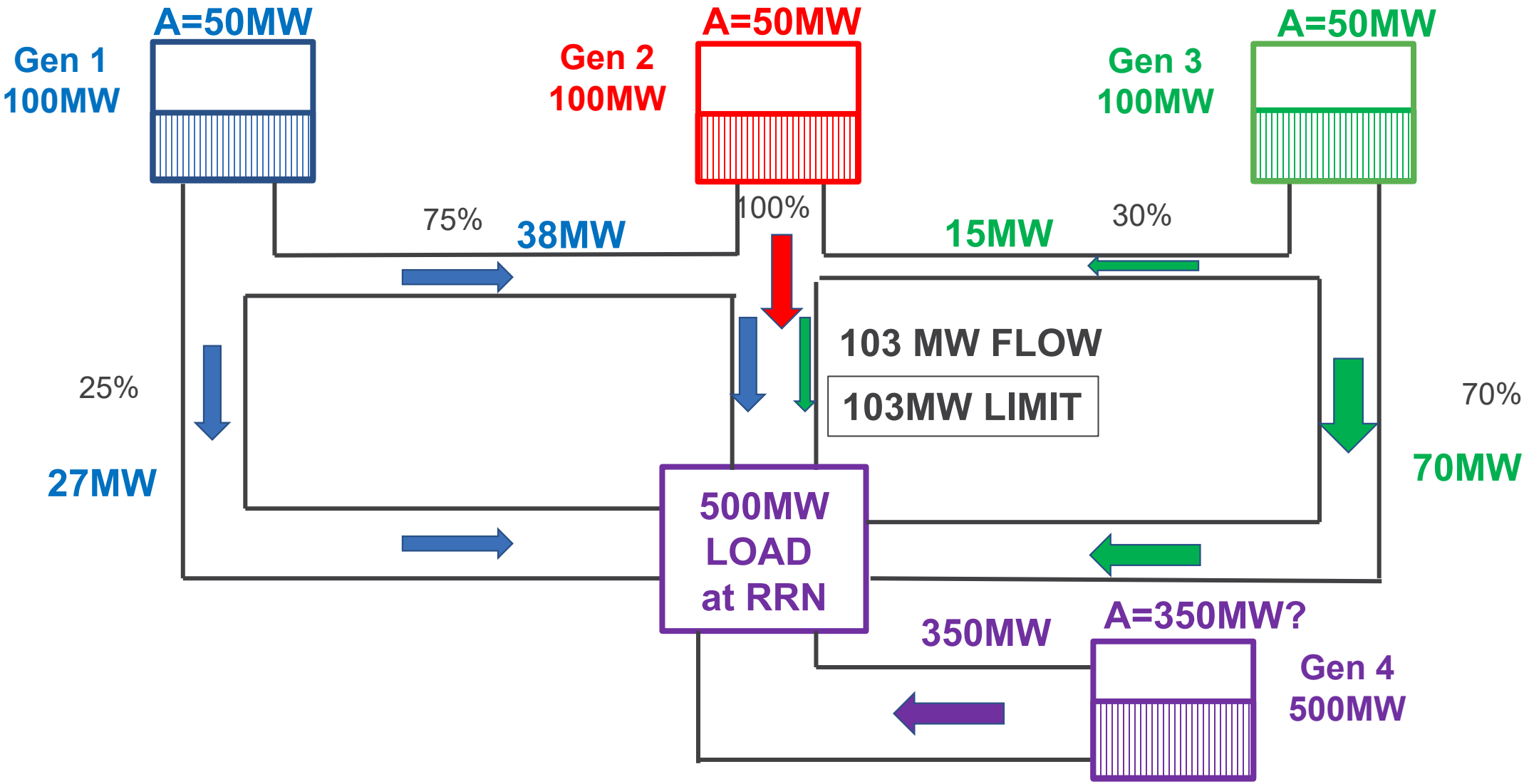


Access dispatch must be feasible

WTA ACCESS ALLOCATION



PRO RATA ACCESS ALLOCATION



CONGESTION MANAGEMENT MODEL

SETTLEMENT: EFFICIENT DISPATCH AND WTA ACCESS

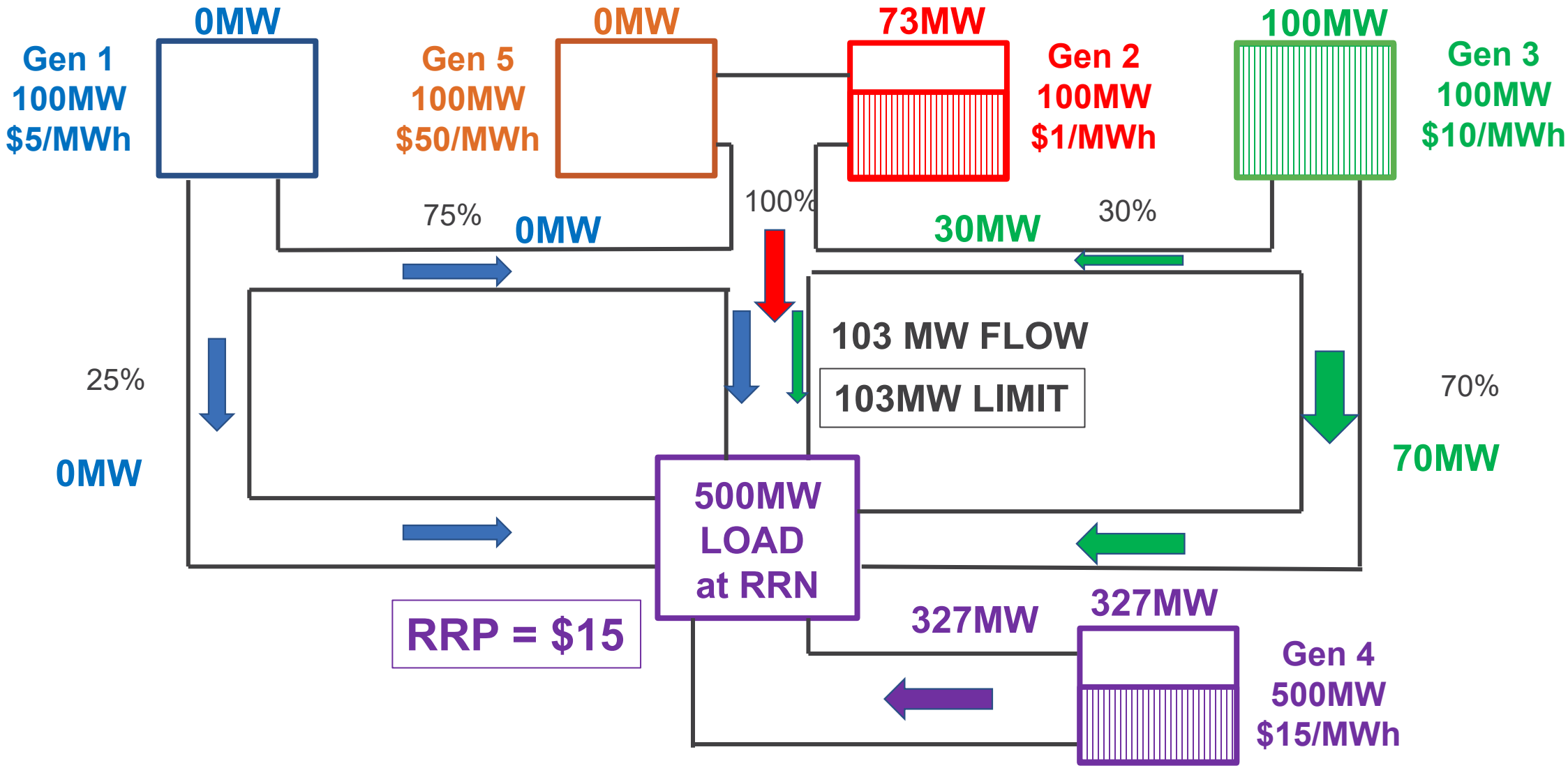
Generator	Dispatch (G) (MW)	Access (A) (MW)	Physical Flow through Constraint (MW)	Congestion Charge ($)	Access Flow through Constraint (MW)	Congestion Rebate ($)
Gen 1	0	97	0	0	73	1022
Gen 2	73	0	73	1022	0	0
Gen 3	100	100	30	420	30	420
Gen 4	327	303	0	0	0	0
Total	**500**	**500**	**103**	**1442**	**103**	**1442**

Congestion Price = $14

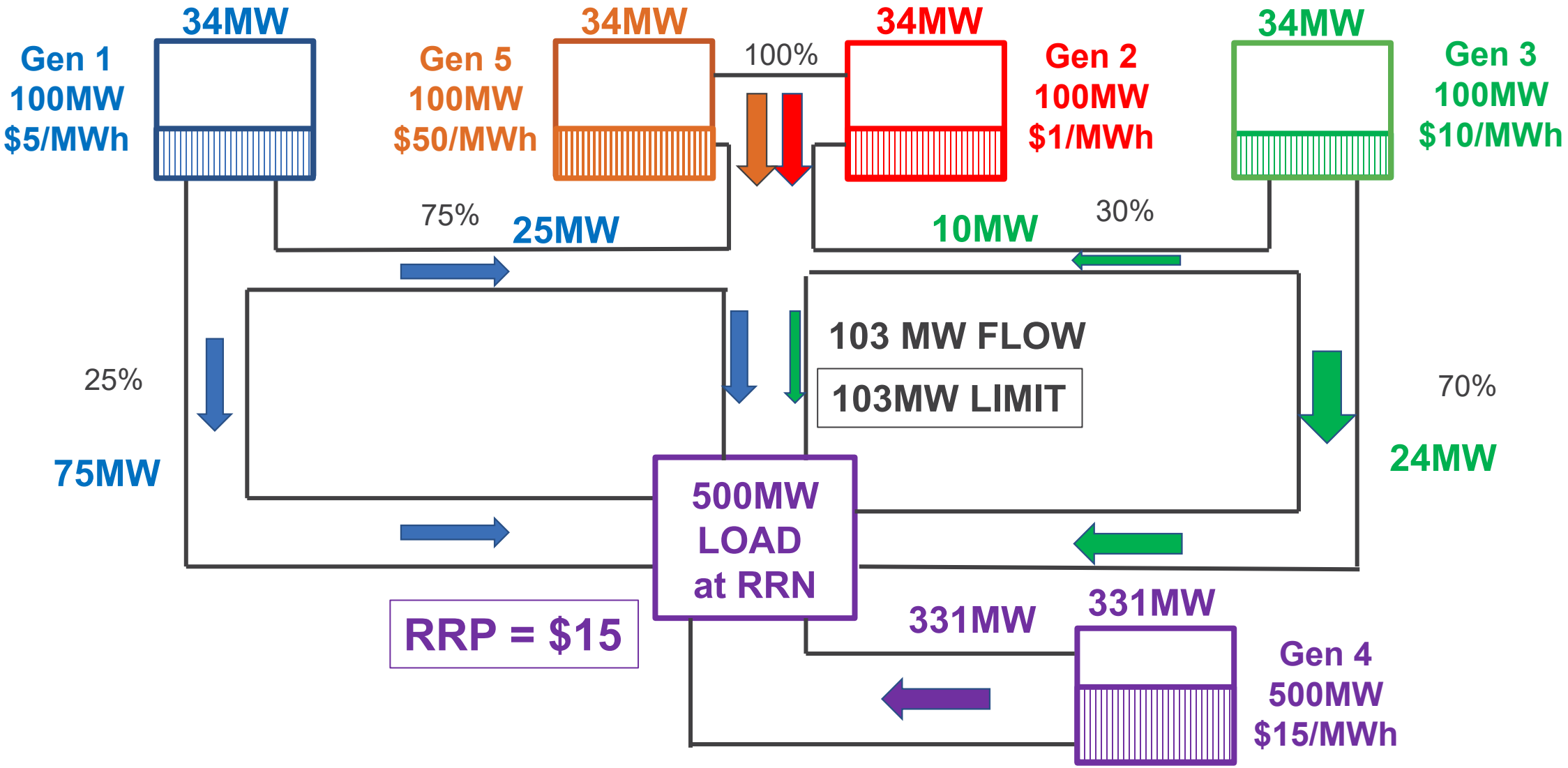
SETTLEMENT: GENERATOR REVENUES AND COSTS

Generator	STATUS QUO			CONGESTION MANGEMENT MODEL		
	Revenue	Cost	Profit	Revenue	Cost	Profit
Gen 1	1460	487	973	1022	0	1022
Gen 2	0	0	0	73	73	0
Gen 3	1500	1000	500	1500	1000	500
Gen 4	4540	4540	0	4905	4905	0
Total	**7500**	**6027**	**1473**	**7500**	**5978**	**1522**

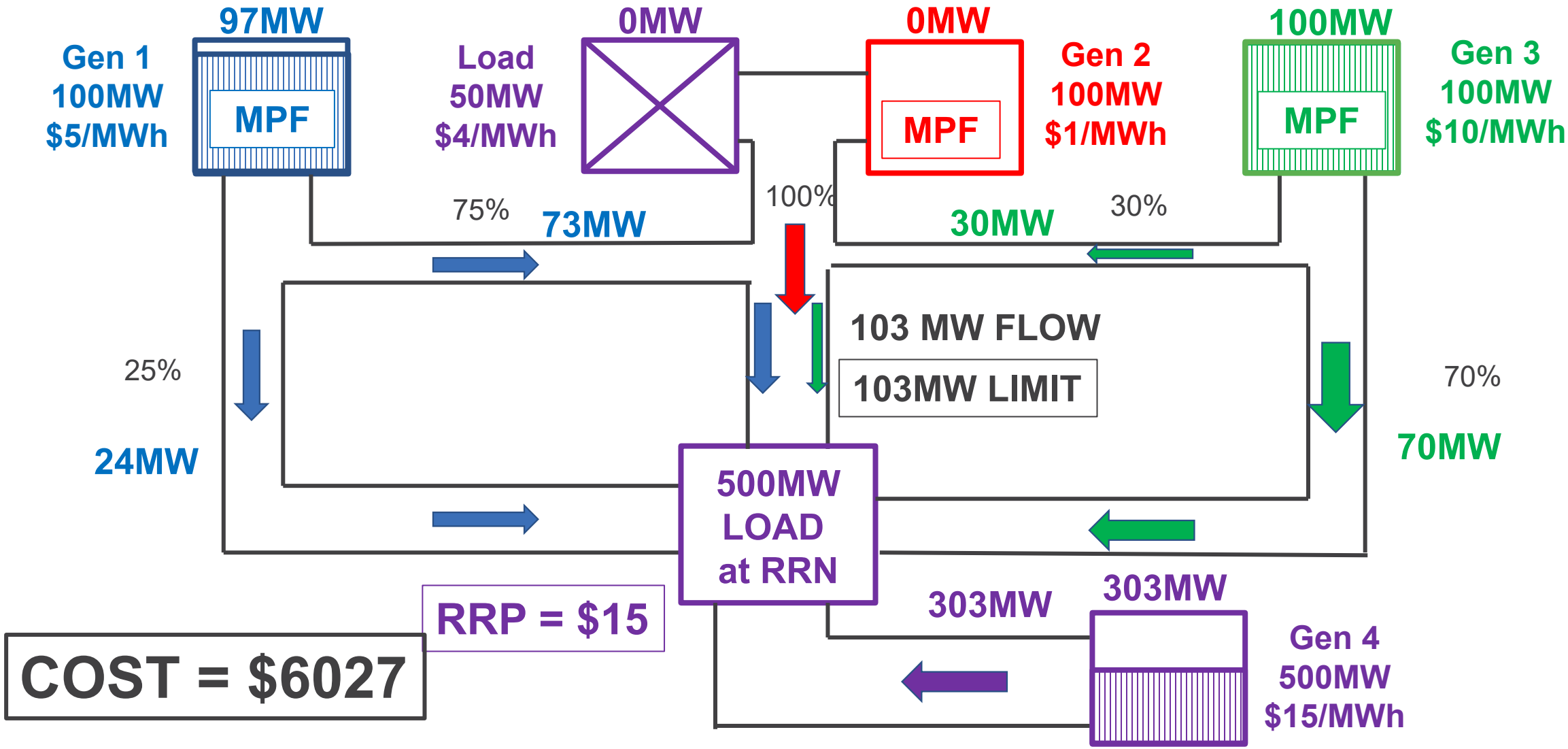
OUT-OF-MERIT GENERATOR: EFFICIENT DISPATCH



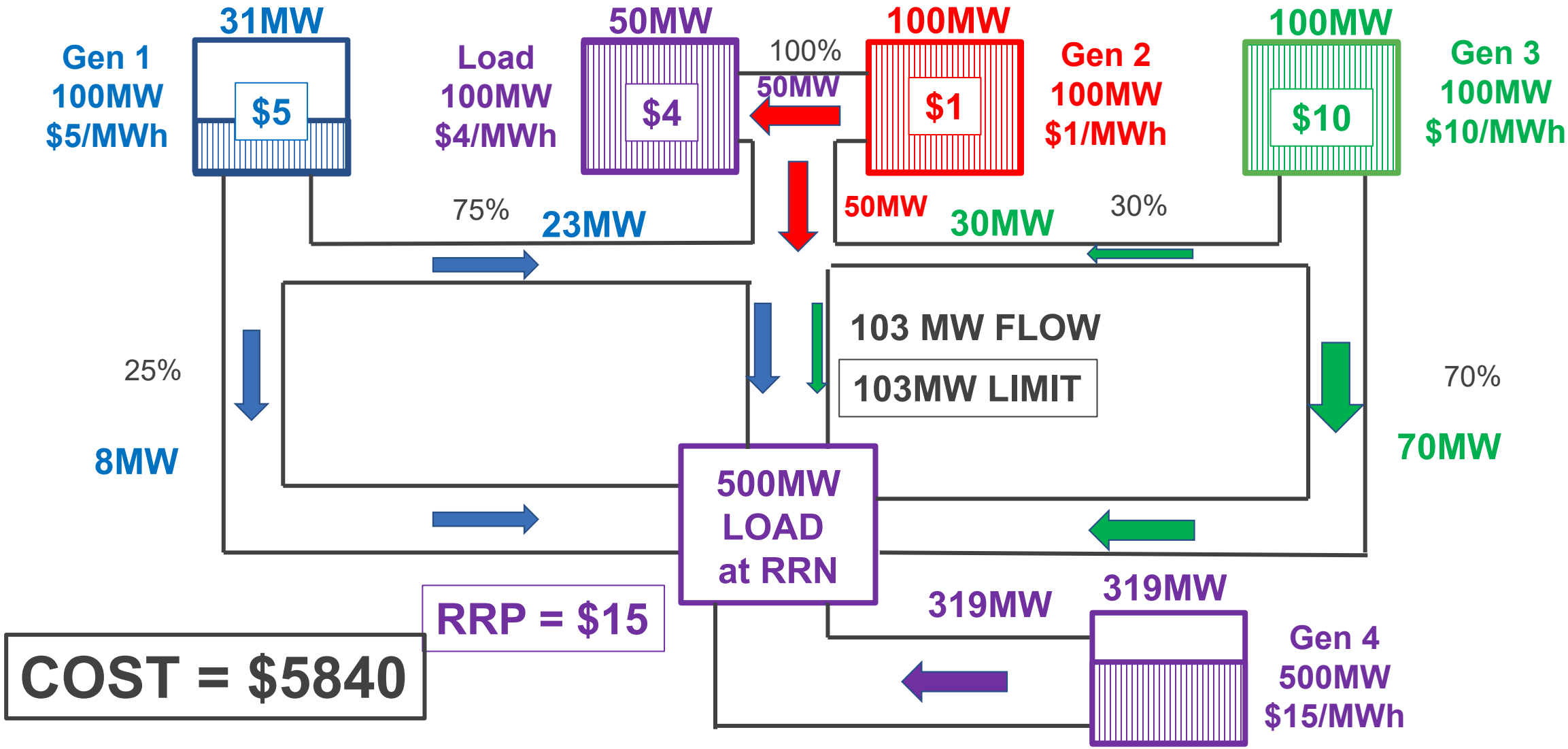
OUT-OF-MERIT GENERATOR: PRO RATA ACCESS



OUT-OF-MERIT SCHEDULED LOAD: STATUS QUO



OUT-OF-MERIT SCHEDULED LOAD: EFFICIENT DISPATCH



CMM CONCLUSIONS

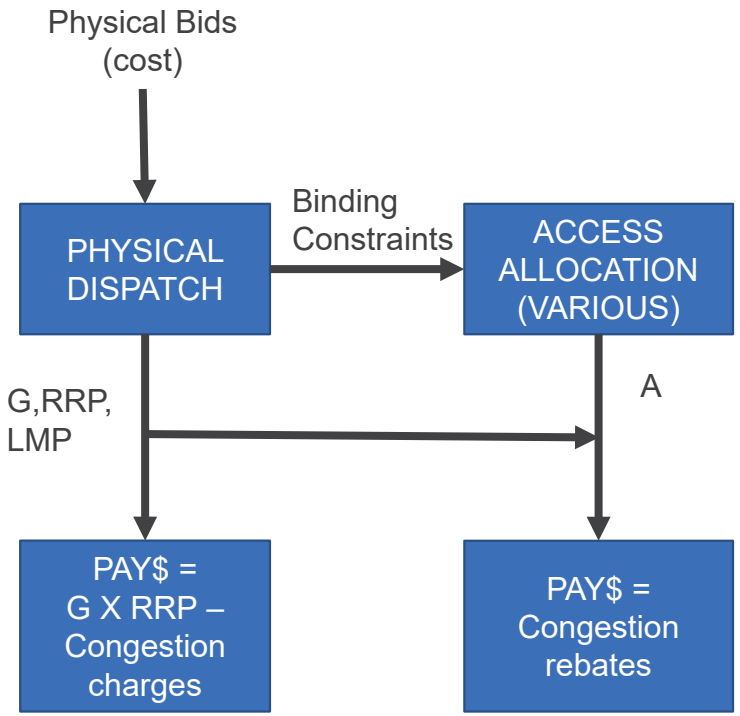
- CMM is a standard access model, although formulated with congestion charges and rebates
- Access dispatch must be feasible to ensure settlement balancing
- Several access allocation methods are possible, including WTA
- Generators obtain benefit of improved dispatch efficiency, if no change in RRP
- Out-of-merit generators could obtain windfall gain at the expense of in-merit generators
- Out-of-merit load could benefit from trading behind a constraint

CONGESTION RELIEF MARKET MODEL

DISPATCH AND SETTLEMENT ARCHITECTURES

CMM

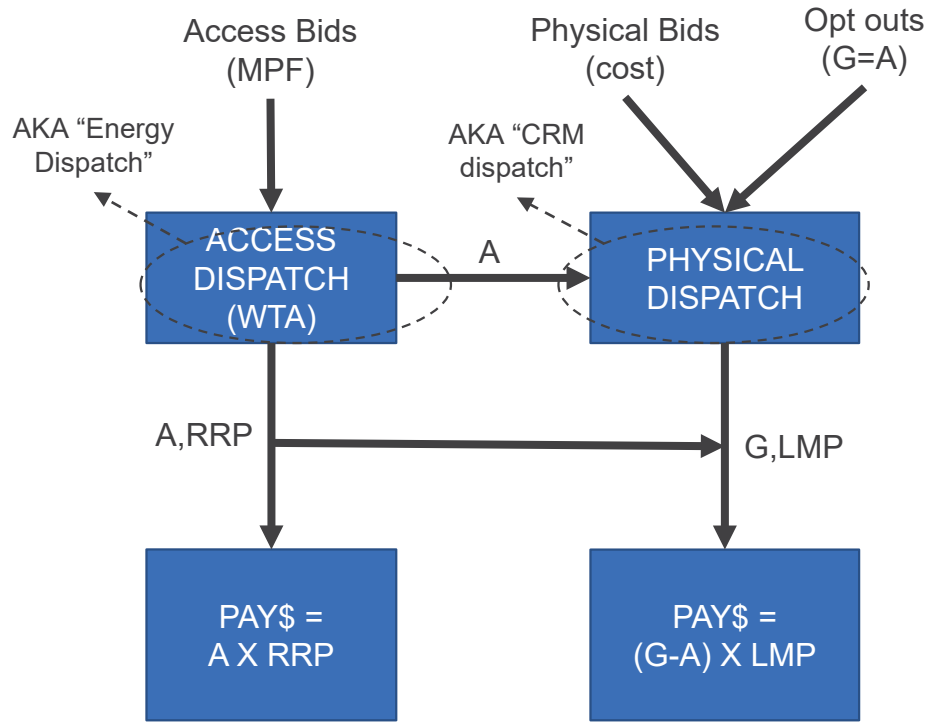
CMM$ = A x RRP + (G-A) x LMP



Access determined *after* dispatch

CRM

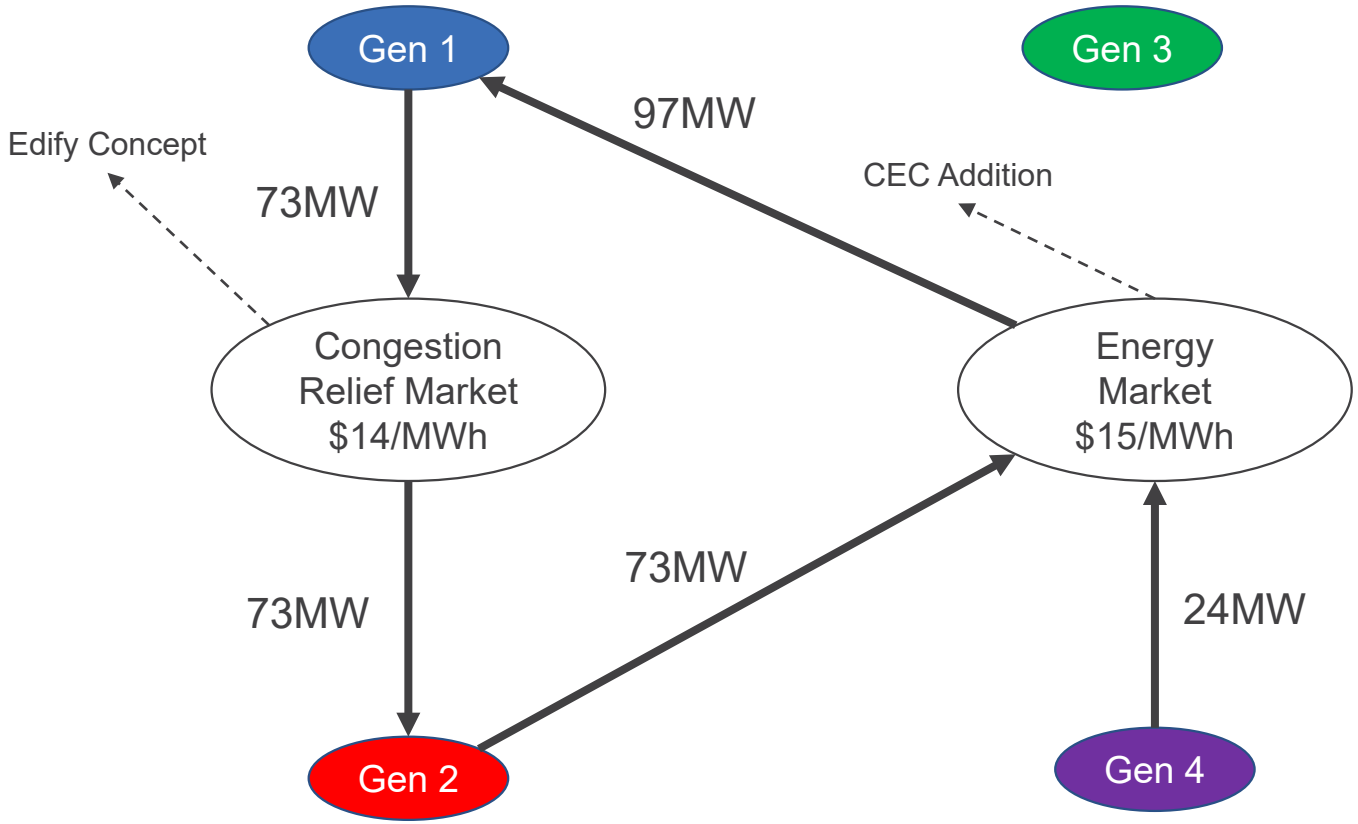
CRM$ = A x RRP + (G-A) x LMP



Access determined *before* dispatch

CONGESTION RELIEF MARKET TRADING

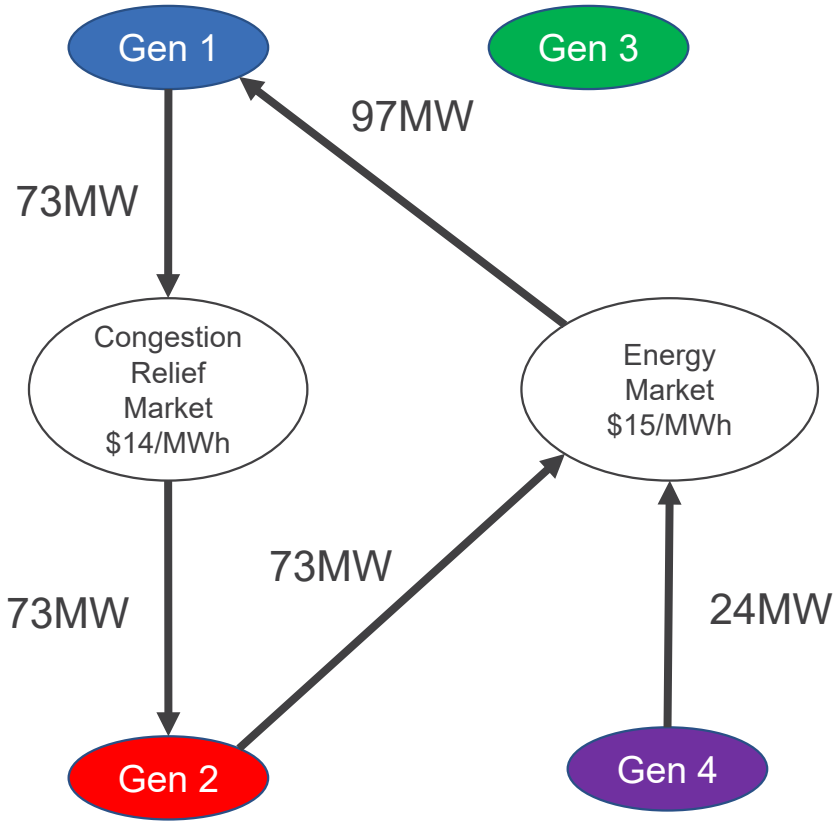
Generator	Access Dispatch (WTA)	Physical Dispatch (efficient)	Access Constraint Flow	Physical Constraint Flow
Gen 1	97	0	73	0
Gen 2	0	73	0	73
Gen 3	100	100	30	30
Gen 4	303	327	0	0
Total	**500**	**500**	**103**	**103**



CONGESTION RELIEF MARKET TRADING

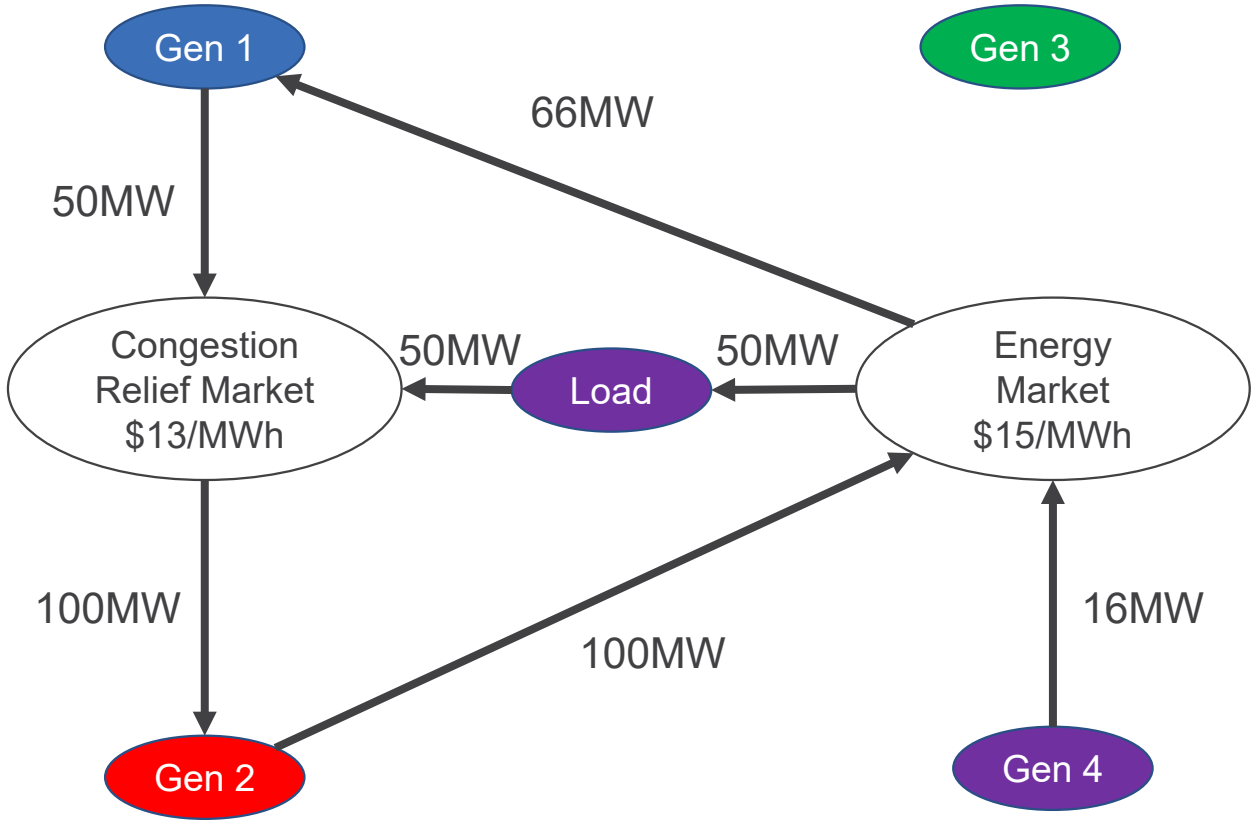
NEW SLIDE INSERTED AFTER WORKSHOP TO RESPOND TO TWG FEEDBACK

	Dispatch			Prices			Cost outcomes			Profit outcomes		
Unit	Access MW	CRM MW	Physical MW	RRP $/MWh	LMP $/MWh	Cost $/MWh	Energy $	CRM $	**Total $**	Energy $	CRM $	**Total $**
Gen 1	97.3	-97	0	15	4.50	5	487	-487	**0**	973	49	**1,022**
Gen 2	0	73	73	15	1.00	1	0	73	**73**	0	0	**0**
Gen 3	100	0	100	15	10.80	10	1,000	0	**1,000**	500	0	**500**
Gen 4	302.7	24.3	327	15	15.00	15	4,540	365	**4,905**	0	0	**0**
Total	**500**	**0**	**500**				**6,027**	**-49**	**5,978**	**1,473**	**49**	**1,522**



CONGESTION RELIEF MARKET TRADING WITH SCHEDULED LOAD

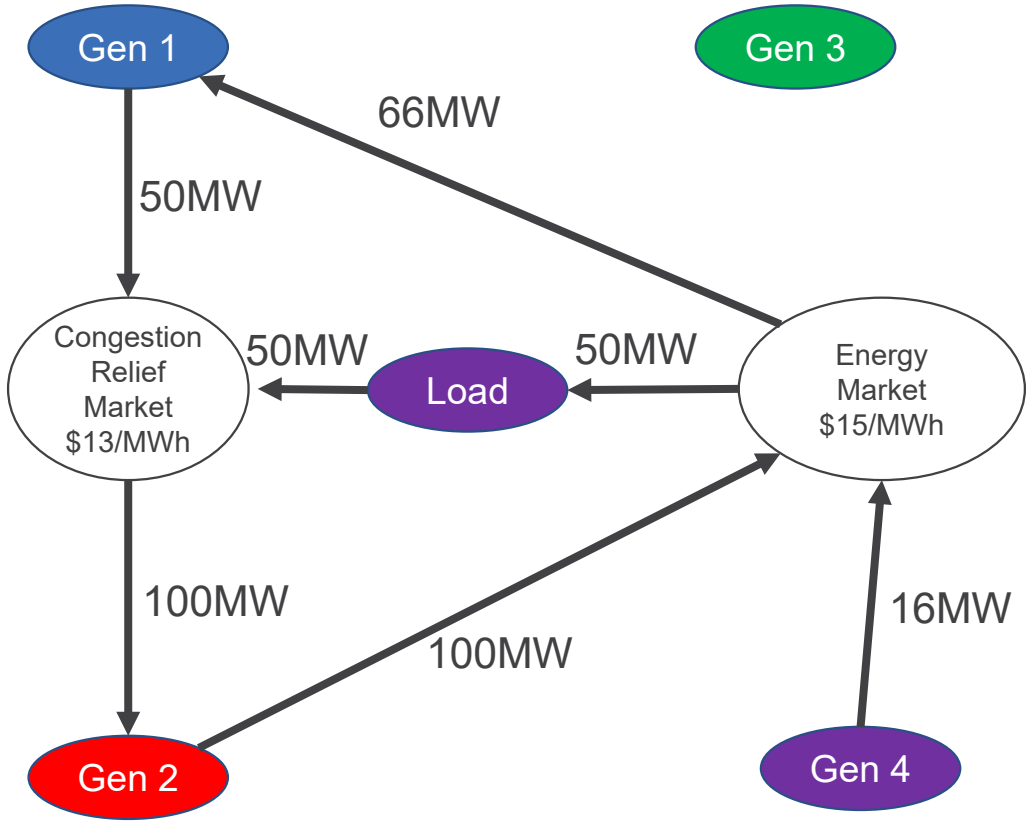
Generator	Access Dispatch (WTA)	Physical Dispatch (efficient)	Access Constraint Flow	Physical Constraint Flow
Gen 1	97	31	73	23
Gen 2	0	100	0	100
Gen 3	100	100	30	30
Gen 4	303	319	0	0
Load	0	-50	0	-50
Total	**500**	**500**	**103**	**103**



CONGESTION RELIEF MARKET TRADING WITH SCHEDULE LOAD

NEW SLIDE INSERTED AFTER WORKSHOP TO RESPOND TO TWG FEEDBACK

	Dispatch			Prices			Cost outcomes			Profit outcomes		
Unit	Access MW	CRM MW	Physical MW	RRP $/MWh	LMP $/MWh	Cost $/MWh	Energy $	CRM $	**Total $**	Energy $	CRM $	**Total $**
Gen 1	97.3	-66.7	30.7	15	5.00	5	487	-333.3	**153**	973	0	**973**
Gen 2	0	100	100	15	1.67	1	0	100	**100**	0	66.7	**67**
Gen 3	100	0	100	15	11.00	10	1,000	0	**1,000**	500	0	**500**
Gen 4	302.7	16.7	319.3	15	15.00	15	4,540	250	**4,790**	0	0	**0**
Load	0	-50	-50	15	1.67	4	0	-200	**-200**	0	116.7	**117**
Total	**500**	**0**	**500**				**6,027**	**-183**	**5,843**	**1,473**	**183**	**1,657**



CRM CONCLUSIONS

- Despite different antecedents, the CRM belongs in the same family of access models as the CMM
- The major difference is that CRM allows generators to opt out of LMP exposure
- The CEC version of the CRM builds on the original Edify version by ensuring energy balancing at the RRN
- Like the CMM, the CRM will encourage cost-reflective bidding, and efficiency gains flow to generators, if RRP is unchanged
- Like the CMM, the CRM has an issue with out-of-merit generators
- Like the CMM, the CRM gives the opportunity for out-of-merit load to trade efficiently and profitably.

OVERALL CONCLUSIONS

CONCLUSIONS

1. Many financial access models are fundamentally similar and apparent differences are primarily around how they are framed: in particular, CMM and CRM.
2. All access models that pay LMP to generation at the margin encourage cost-reflective bidding and improved dispatch efficiency
3. If RRP is unchanged, efficiency gains are shared between generators
4. These shares depend upon how access is allocated; several methods are explored for CMM, whilst CRM inherently uses the “winner takes all” allocation (also an option for CMM)
5. CMM allocates access after dispatch, whilst CRM allocates access before dispatch, allowing for opt-out
6. Out-of-merit generators could have a windfall gain under both CMM and CRM, at the expense of in-merit generators
7. Out-of-merit load is bid unavailable currently, but could trade profitably behind a constraint under CMM or CRM

GROUP DISCUSSION

NEXT STEPS

ESB to share materials to facilitate discussion of detailed design questions and modelling assumptions.
TWG to review materials with regard to the subset of design questions extracted for TWG consideration.
Treatment of storage and flexible load will be a future focus topic.

Upcoming meetings

4 August 2022	Operational TWG focused on CRM and CMM design choices
[11] August 2022	Combined TWG reviewing NERA inputs and model assumptions (invite to be sent once date confirmed)
25 August 2022	Agenda items pending outcomes of above sessions

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