Convergence bidding

Congestion revenue rights (CRR) settlement rule

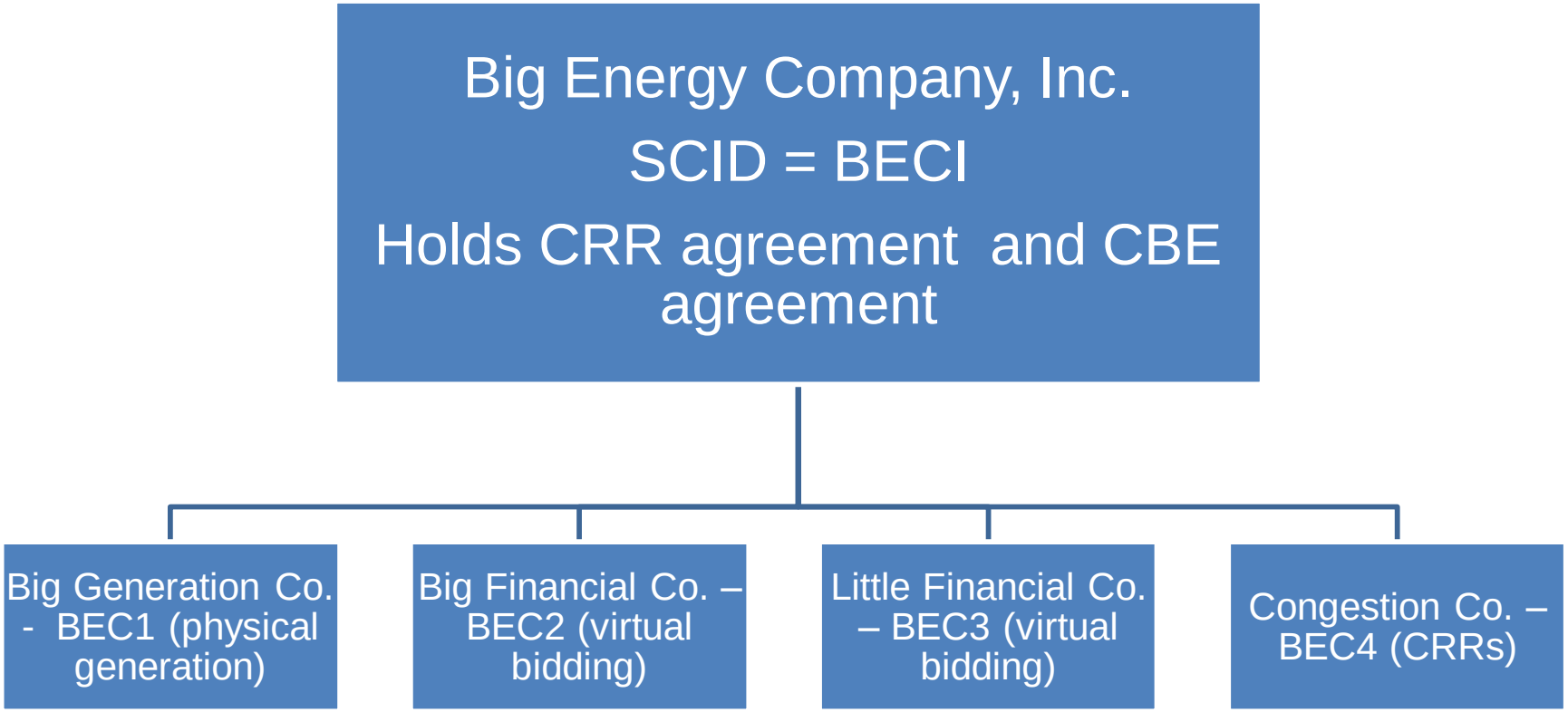
Module objective

- By the end of this module, student will be able to describe how the use of congestion revenue rights may be impacted by convergence bidding.

Defining congestion revenue rights (CRRs)

- CRRs are financial instruments that give the Holder the right to receive or the obligation to pay a share of the total congestion revenue associated with a given Trading Hour of the Day-Ahead Market.

Participant relationships – CRR settlement rule



- Both physical and virtual bids impact congestion
- If virtual bids are determined to impact CRR revenue (subject to specific criteria), the CRR settlement rule will be triggered

Overview of CRR settlement rule

- Entities can use convergence bids to enhance value of CRR portfolios
  - Virtual Bids can affect congestion on a particular constraint
  - Increased (or decreased) congestion on the constraint could enhance entity's CRRs
- CRR Settlement Rule:
  - Identifies constraints affected by entity's convergence bids
  - Change in congestion revenue is charged back to CRR Holder if DMM determines that the amount the constraint's change in congestion enhanced BECI's CRR portfolio

Defining the CRR settlement rule

CRR settlement rule is put in place to recapture - *where warranted* – the increase in CRR revenues to CRR Holders that are attributable to that Company's Convergence Bidding

CRR settlement rule criteria

The following criteria will determine if the CRR Settlement Rule should be applied:

1. Did a Virtual Bid have an impact on the constraint and is the Convergence Bidding Entity also a CRR holder? If yes, proceed to #2. If no, then the CRR Settlement will not apply.

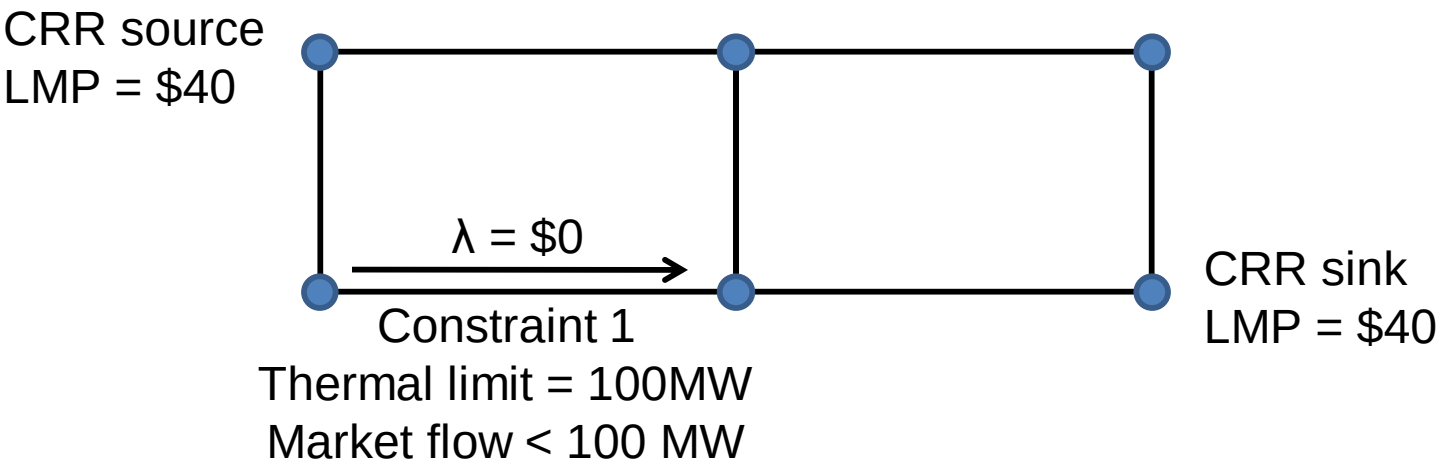
2. Was the directional flow impact greater than 10% of the thermal limit of the line? If yes, proceed to #3. If no, then the CRR Settlement will not apply.

CRR settlement rule criteria

3. Each convergence bid that impacted the constraint will be analyzed for an adjustment payment amount by each hour.

4. If it is determined the CRR portfolio profited from the impact in flow caused by that company's convergence bid, the collective amount will be charged back to the SCID that holds those CRR's.

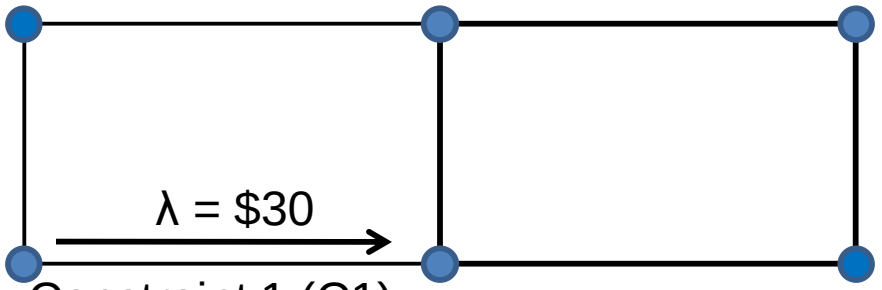
What determines CRR value? Part 1



- Congestion Co. (BEC4) owns 50 MW of CRR from CRR source to CRR sink
- CRR revenue received (ignoring losses):
  - *Day-Ahead* LMP of sink – *Day-Ahead* LMP of source
- If no congestion in system, CRR revenue = $0

What determines CRR value? Part 2

LMP = $22
C1 contributes -$18 to source LMP

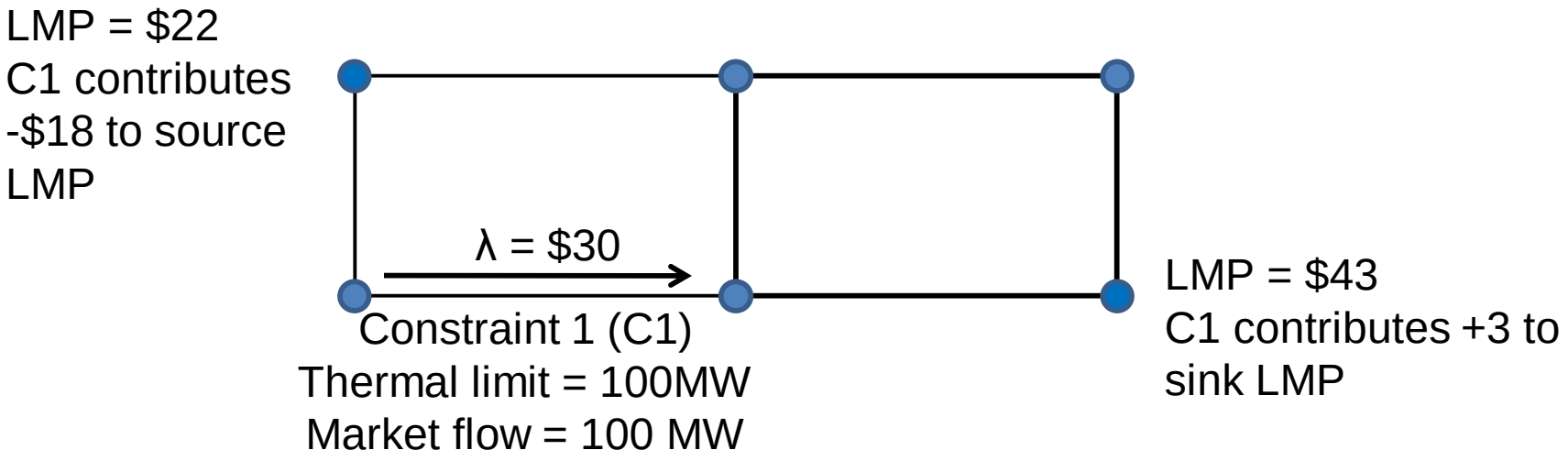


Constraint 1 (C1)
Thermal limit = 100MW
Market flow = 100 MW

LMP = $43
C1 contributes +3 to sink LMP

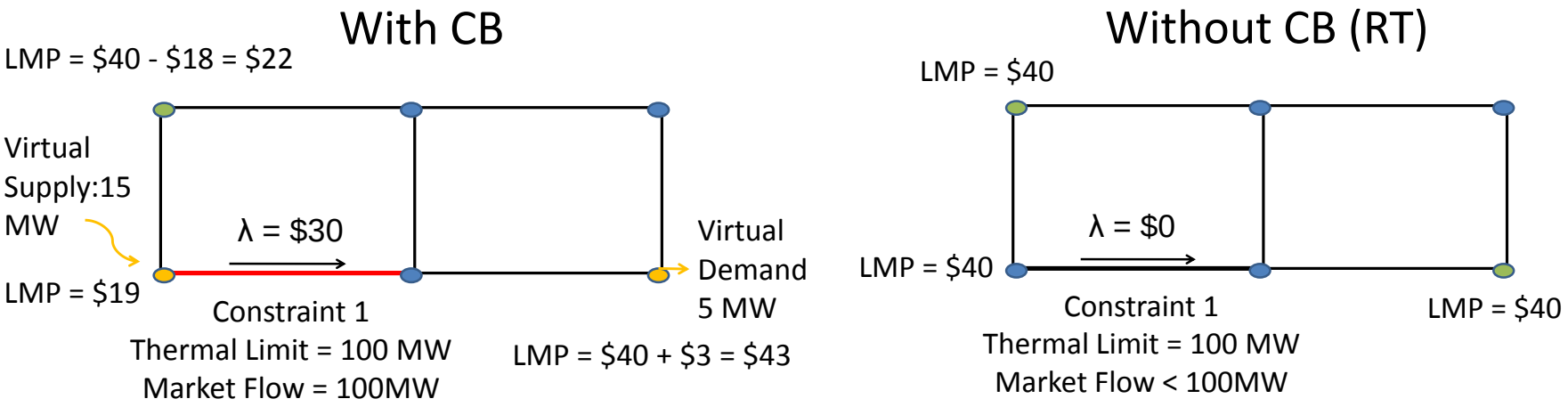
- Binding constraints cause price differences between nodes
- Each constraint's contribution to each node's LMP can be calculated
  - Positive or negative fraction of constraint's congestion cost

What determines CRR value? Part 2 (continued)



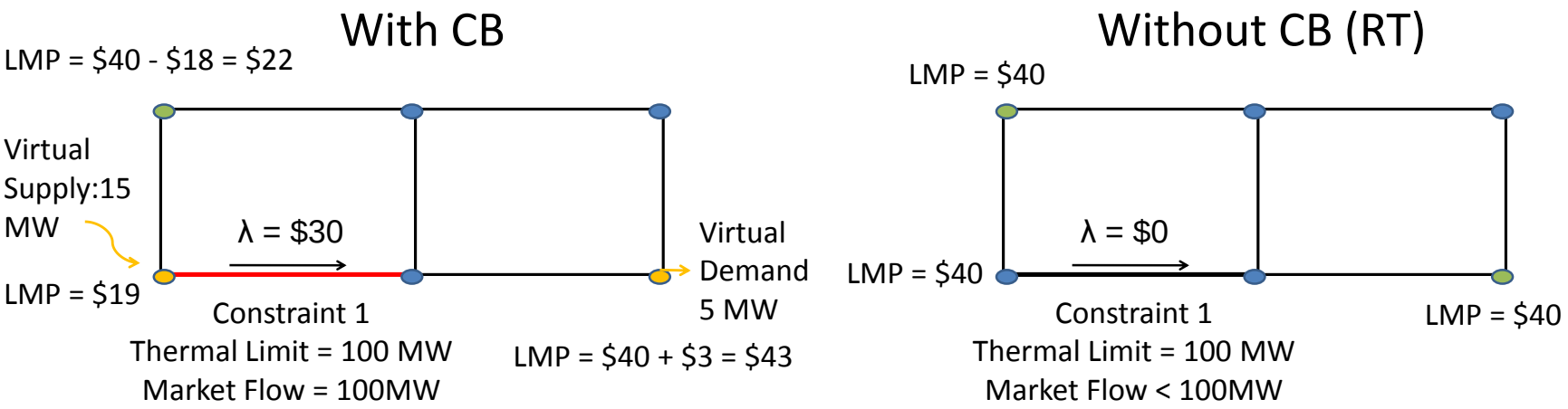
- Constraint 1 contributes:
  - +$3 to sink LMP and -$18 to source LMP
  - (CRR revenue = DA LMP@ sink – DA LMP @ source)
  - +$3 – (-$18) = $21.00 increase to value of CRR
- More congestion on constraint → Higher constraint congestion cost → Higher CRR value

How virtual bids enhance CRR portfolio



- Virtual Bids increase (or decrease) congestion on a constraint
  - Higher congestion cost on constraint 1 enhances Congestion Co. CRR value
  - Little Financial Co. (BEC3) can increase congestion on constraint via “upstream” virtual supply and/or “downstream” virtual demand

Evaluating portfolio when enhanced CRR value > CB losses



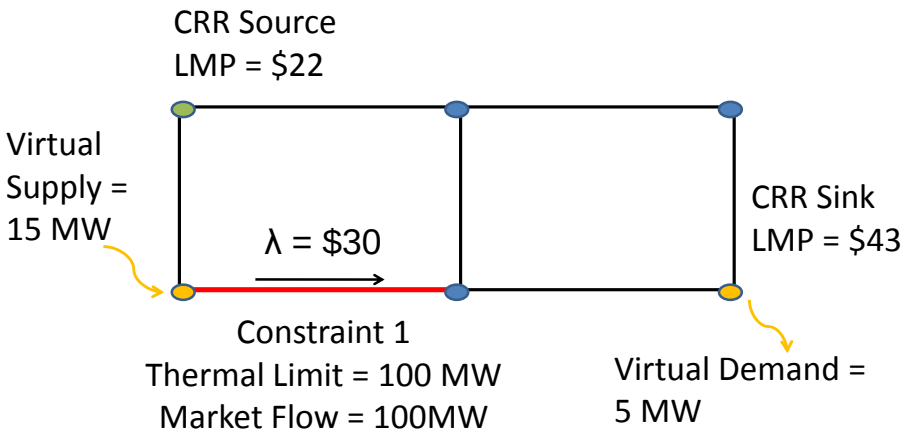
- CRR value: (LMP Sink – LMP Source)*CRR Quantity
  - CRR value with CB= $43 – $22 = $21*50MW = $1050
  - CRR value without CB: $40 – $40 = $0*50MW = $0
  - Enhanced CRR value = $1050 – $0 = $1050

  > $1,050 payment

- Convergence bidding revenues: (DA LMP – RT LMP)*CB quantity
  - Virtual supply: ($19 – $40)*15MW = -$315
  - Virtual demand: ($43 - $40)*(-5) = -$15

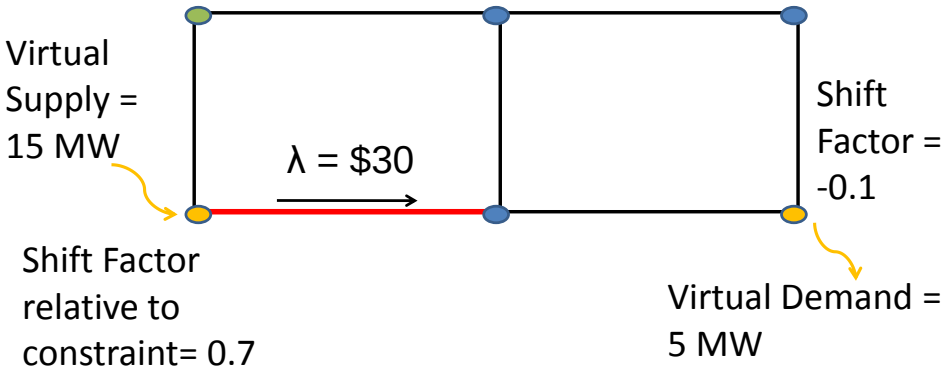
  > $330 charge

CRR settlement rule identifies constraints that were significantly impacted by entity's CB



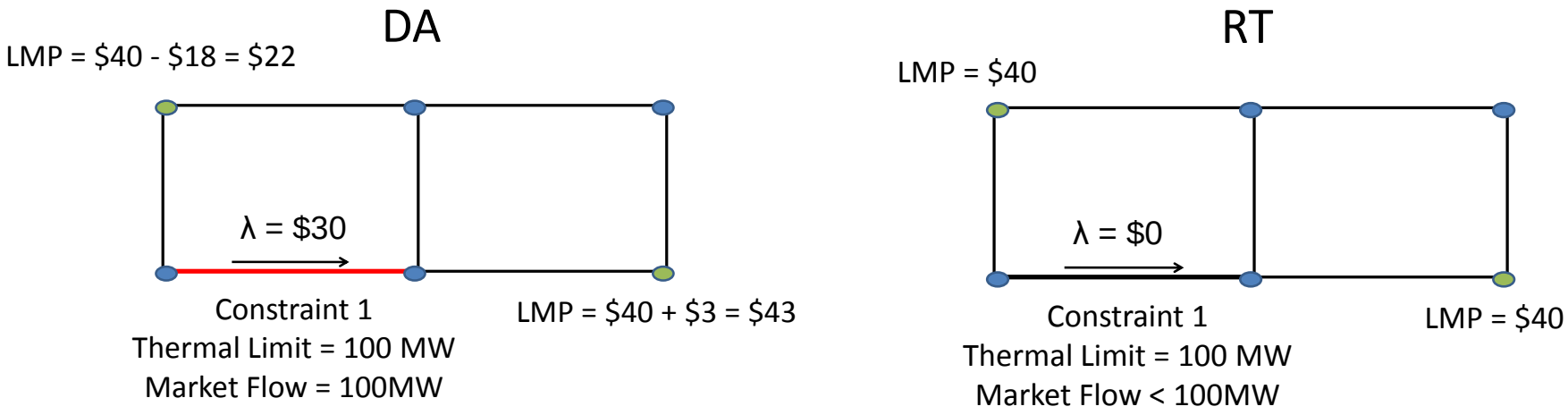
- Cannot re-run IFM for each entity, removing its virtual bids
- Instead, calculate *flow impact* of entity's virtual bids
  - If virtual bid flow impact > threshold (10% of Limit)→ conclude entity's CB *significantly impacted* constraint's congestion
  - Direction matters: Flow impact must be in direction that *could* increase value of CRR portfolio

Example: entity's virtual bids "significantly impact" constraint



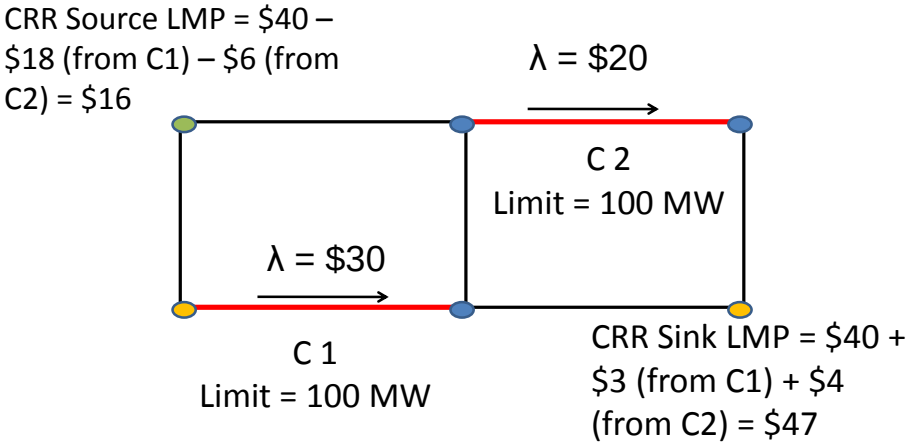
- Shift factors determine flow impact
  - Definition: Percentage of marginal injection at node that flows on constraint
  - ~70% of 15 MW virtual supply flows on constraint 1
  - ~10% of 5 MW virtual demand flows on constraint 1
- Magnitude:
  - 11 MW flow impact > 10% of 100 MW thermal limit
- Direction:
  - In direction to increase CRR value (increasing congestion)

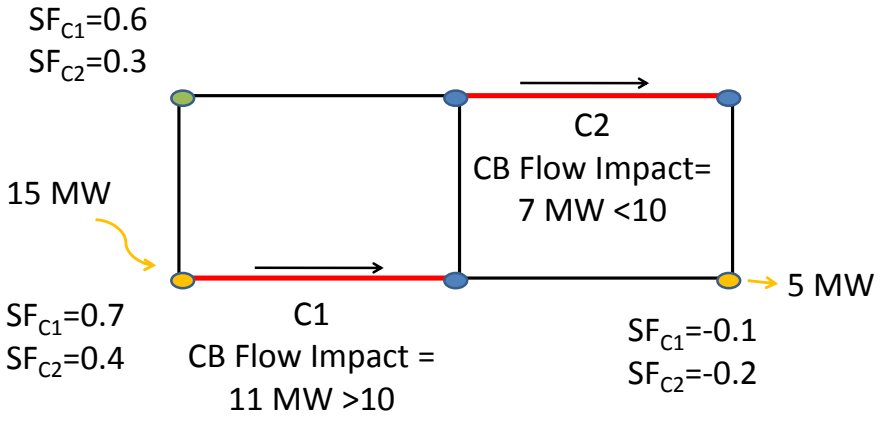
CRR settlement rule charge



- Charge to entity = amount that constraint's change in congestion (DA vs RT) enhanced entity's CRR portfolio
  - DA: constraint contributes:
    - +$3 to sink LMP
    - -$18 to source LMP
    - =$21 to CRR * 50 CRR MW = $1050 to CRR portfolio
  - RT (counterfactual): Constraint contributes $0
  - → CRR settlement rule charge = $1050 (DA) – $0 (RT)

Example: two binding constraints





- CRR worth $47 – $16 = $31 in DA, $0 in RT
  - CRR value due to both constraint 1 and constraint 2
- Entity's CB only significantly impacts constraint 1
  - CRR settlement rule charge is **only** constraint 1's contribution to enhanced CRR value
    - Constraint 1's $21/ CRR-MW charged back
    - Constraint 2's $10/CRR-MW **not** charged back
    - →CRR pays $1,550. CRR settlement rule charge = $1,050

CRR settlement rule netting

- Net constraint's impact (positive or negative) over all entity's *CRRs*
  - Eg: If Crested owns another CRR whose value is hurt by the extra congestion on C1, then the loss is credited against $1050 charge
- Net constraint's impact on CRR portfolio over all peak or off-peak *hours* of day
  - Eg: If next hour, RT congestion > DA congestion, credit against $1050 charge
  - Flow Impact magnitude and direction calculated each hour—only hours passing flow impact test included in netting
- CRR Settlement Rule always a net *charge*
  - Net "credit" converted to $0
- No netting across different constraints

CRR Settlement Rule – payment adjustment example

- An LSE engaged in virtual bidding at the nodal level for HE07 thru HE09.
- Let's walk through what happens when the virtual bids impact a constraint for all three hours.

CRR Settlement Rule – payment adjustment example

CRR Holder

Step 1

	HE7	HE8	HE9
Calculate virtual bid impact to the flow of the constraint			
Awarded virtual bid	150 MW	90 MW	300 MW

Step 2

Was the directional flow impact enough to increase the value of the CRR portfolio

Line Constraint Max MW	1,000 MW	1,000 MW	1,000 MW
Constraint threshold percentage	.10	.10	.10
Flow impact threshold	100 MW	100 MW	100 MW
Did virtual award significantly impact	Yes	No	Yes

CRR Settlement Rule – payment adjustment example cont..

Step 3	**HE7**	**HE8**	**HE9**
DA "Price" - Constraints impact on the DA value of CRR	$5.0	$4.0	$8.0
RT "Price" - Constraints impact on the RT value of CRR	$1.0	$2.0	$1.0
	$4.0	$2.0	$7.0
MW quantity of CRR owned by the participant by hour	300	300	300
Payment Adjustment if "Yes" in ***Step 2***	$1,200	$600	$2,100
CRR Settlement Rule payment adjustment for HE7 thru HE9	**$3,300**		

Module summary

- CRRs are financial instruments that give the Holder the right to receive or the obligation to pay a share of the total congestion revenue associated with a given Trading Hour of the Day-Ahead Market.
- CRR Settlement Rule applies only to CRR holders that participate in Convergence Bidding.
  - Convergence bid must impact a constraint and directional flow of the impact must be greater than 10% of the thermal limit of the line.

Module summary

- ISO cannot apply CRR Settlement Rule to affiliates
- CRR Settlement Rule will apply to affiliates for monitoring purposes
  - Lower flow impact thresholds
  - Referrals to FERC
- General monitoring of contributing to LMP divergence at nodes that would benefit affiliate's portfolio
  - Referrals to FERC if deemed market violations