Item 3: Committee Education on Congestion Revenue Right (CRR) Processes - Revised

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Finance & Audit Committee Meeting

ERCOT Public
August 6, 2018

Agenda

- CRR team
- CRR basics
  - Definition
  - Types
  - Auctions
- Congestion hedging example
- CRR model
- CRR funding
  - Including a discussion on recent imbalances

Congestion Revenue Rights

The primary goals of the CRR team are:

- Ensuring Market Participants have a fair and equal opportunity to participate in CRR auctions
- Providing an efficient and transparent market in regards to both process and design
- Working to ensure that the CRR auctions are as consistent as possible, both over time and with the Day-Ahead and Real-time Markets

Tasks for the team include:

- Constructing models for the Pre-assigned CRR (PCRR) allocation for Non-Opt-In Entities (NOIEs) and all of the CRR auctions, and ensuring those models are as accurate as possible
- Executing the auctions and confirming that the results are consistent and make sense
- Allocating and managing the eligibility of PCRRs
- Developing and reviewing proposed changes to the CRR market design, including changes to the ERCOT Protocols
- Designing and testing of improvements to the CRR-related software and tools

Congestion Revenue Rights

CRR auction activities for a typical month:

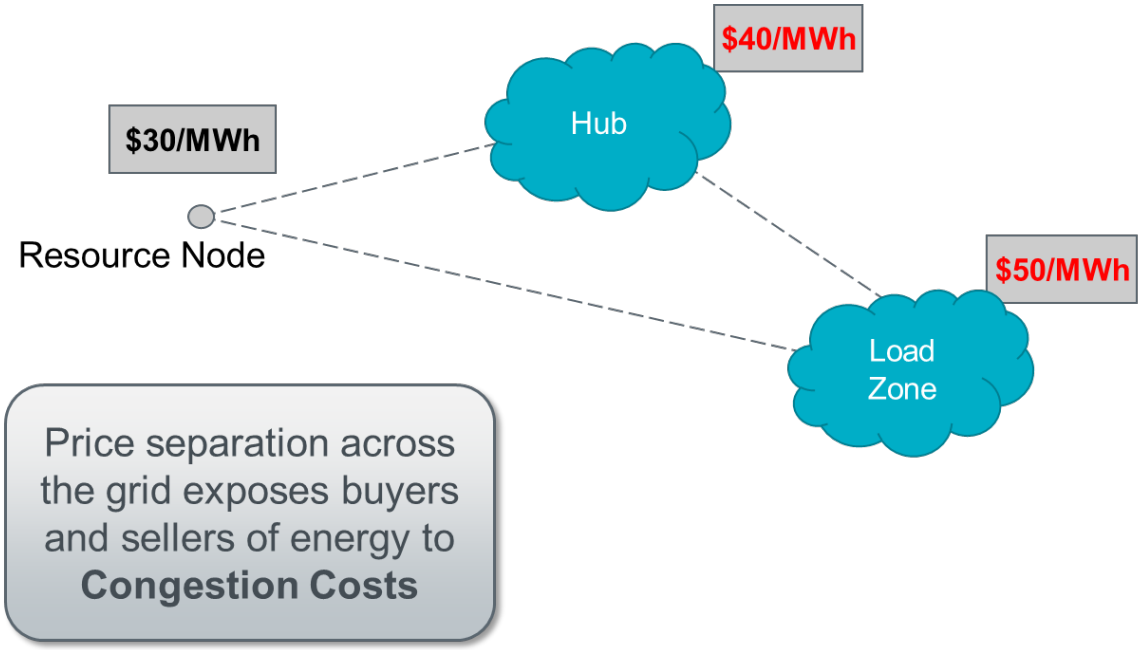
- Monthly and long-term auctions overlap
- Team completes both model build and market operator functions

CRR Auction Activities - July 2018

	Mon	Tue	Wed	Thu	Fri	Mon	Tue	Wed	Thu	Fri	Mon	Tue	Wed	Thu	Fri	Mon	Tue	Wed	Thu	Fri	Mon	Tue
	2	3	4	5	6	9	10	11	12	13	16	17	18	19	20	23	24	25	26	27	30	31
2019.2nd6.Seq3	validate results			post results					confirm ownership													
2018.AUG.Monthly				post adders report			bid window opens		bid window closes	run auction	validate results			post results					confirm ownership			
2020.1st6.Seq4									post adders report			bid window opens		bid window closes	run auction	validate results						
2018.SEP.Monthly												build and validate network model									post model	
2020.2nd6.Seq5		build and validate network model														post model						

What is a CRR?

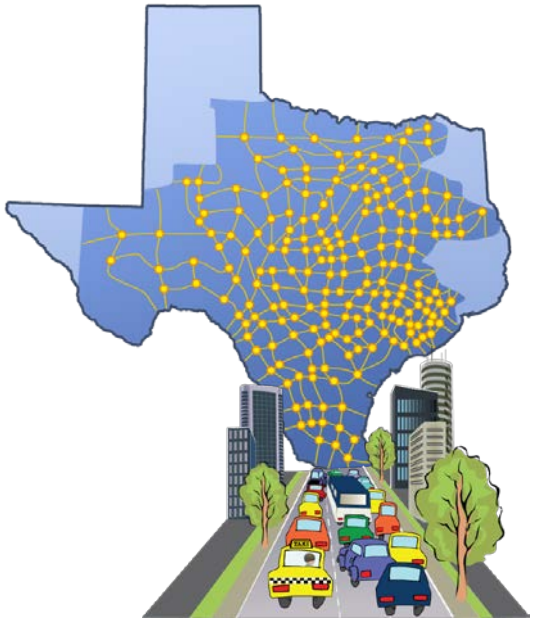
- A financial instrument that entitles the owner to be paid or charged for congestion rents that arise when the ERCOT Transmission Grid is congested in the Day-Ahead Market (DAM).
  - The price difference between any two Settlement Points: Hub → Load Zone, Resource Node → Resource Node, Load Zone → Load Zone, etc.



What is a CRR? (cont'd)

CRRs:

- Do not represent a right to receive, or obligation to deliver, physical energy.
  - Modeled as a simultaneous injection and withdrawal at two different locations
- Can be bought to hedge a physical asset or contract, locking in the cost of congestion at the cost of purchasing the CRR
- Can be bought as a financial investment, a wager that the congestion in DAM will differ from that in the CRR auction

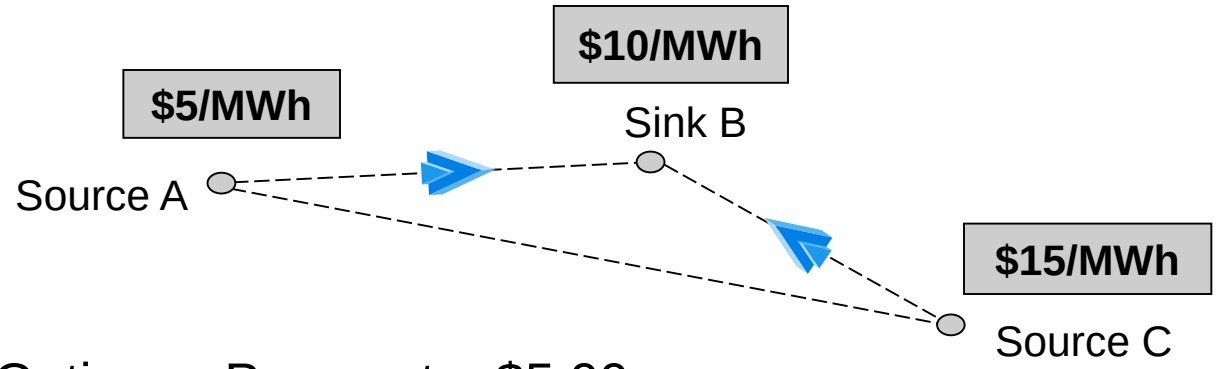


Types of CRRs

CRRs are purchased by registered CRR Account Holders (CRRAHs). There are two types of CRRs: Point-to-Point (PTP) **Options** and PTP Obligations

Point-to-Point Options

Provide a hedge that can only result in a payment



Option $_{AB}$ Payment = $5.00

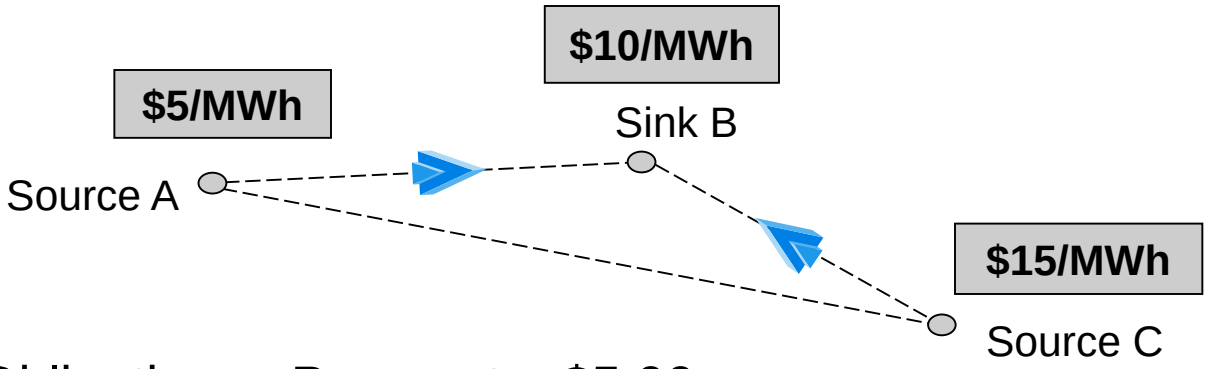
Option $_{CB}$ Payment = $0.00

Types of CRRs

CRRs are purchased by registered CRR Account Holders (CRRAHs). There are two types of CRRs: Point-to-Point (PTP) Options and PTP **Obligations**

Point-to-Point Obligations

Provide a hedge that may result in a payment or a charge



Obligation $_{AB}$ Payment = $5.00

Obligation $_{CB}$ Charge = ($5.00)

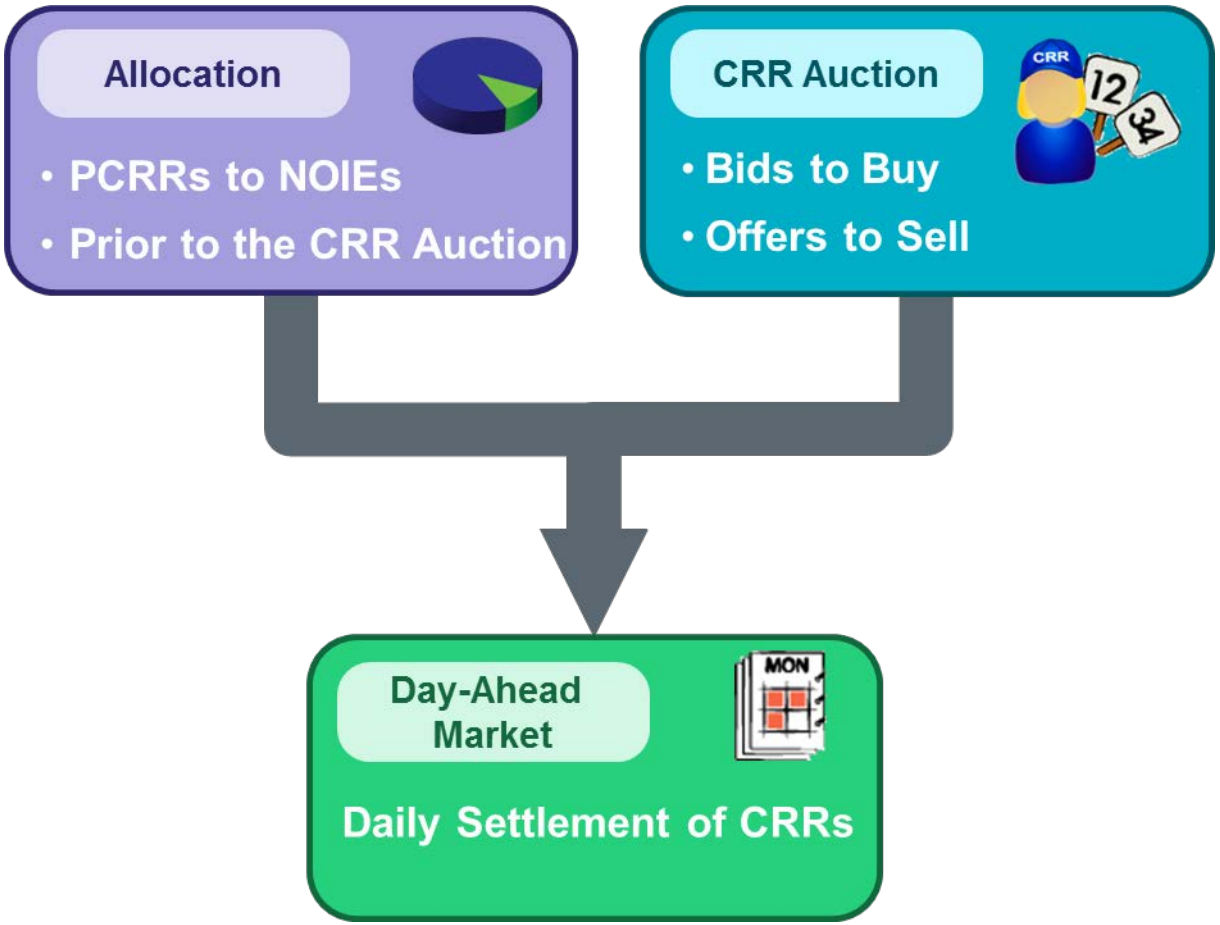
Congestion Revenue Rights

CRRs are auctioned or allocated in:

- One-month strips
  - In multi-month auctions, can link bids across contiguous months
- Time-of-use blocks
  - Definitions coincide with standard electricity contracts in ERCOT region

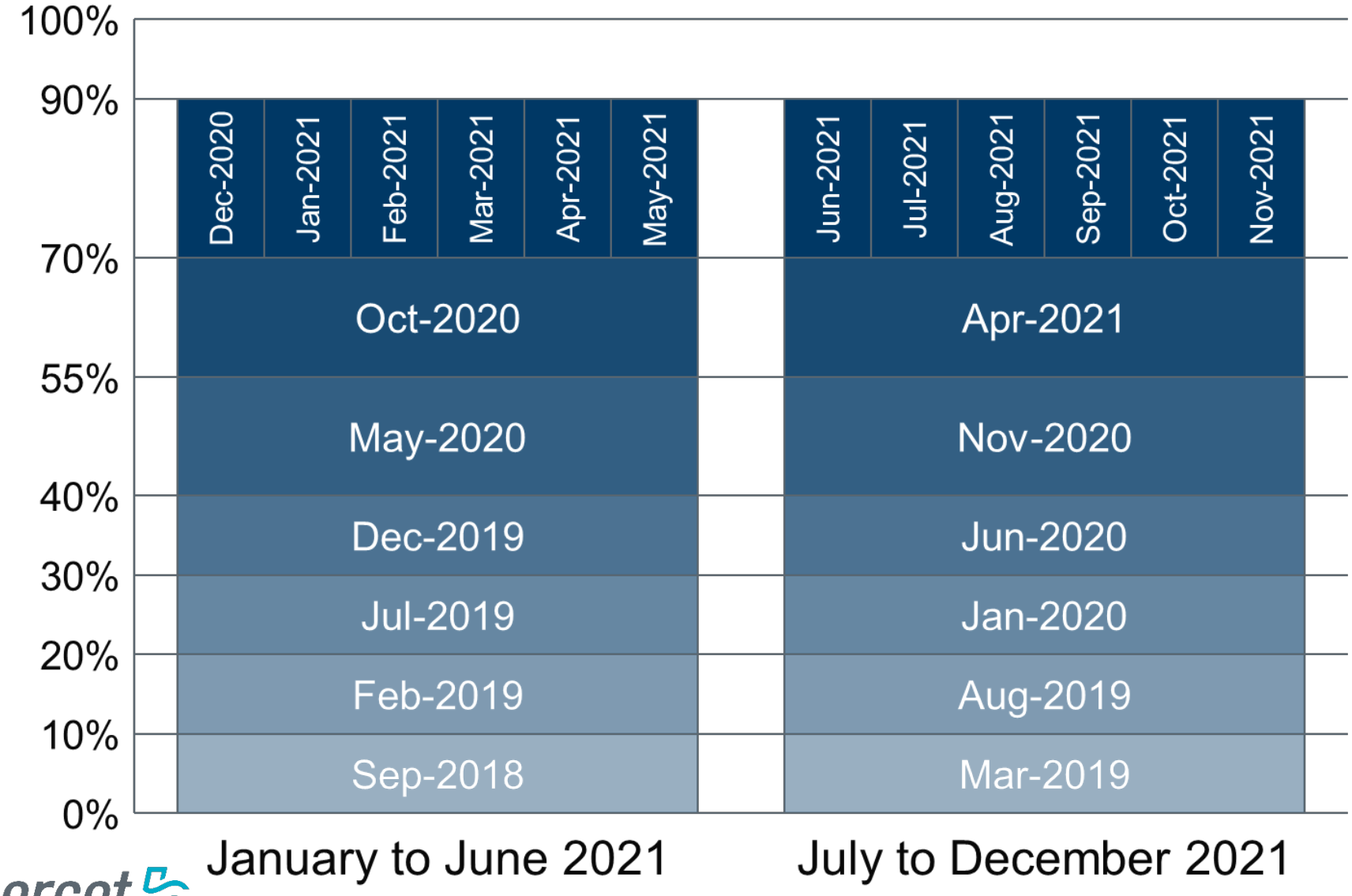
Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Off-Peak (0100 – 0600)						
Peak Weekday (0700 – 2200)					Peak Weekend (0700-2200)	
Off-Peak (2300 – 2400)						

Congestion Revenue Rights



Auctions take place twice per month (one Monthly, one Long-Term)

Availability of 2021 CRRs – network model scaling



CRR Activity Calendar

CRR Activity Calendar												
Auction Name	Auction Type	Post Network Model	Post Auction Notice and Credit Window Opens	Post Path Specific Adders Report	Auction Bid Window Opens 12:01am	Credit Lock Date and Auction Bid Window Closes 5:00pm	Post Auction Results On or Before This Date	Auction Invoice Posted and Credit Released On or Before This Date	CRR Ownership Assigned On or Before This Date 7:30pm	CRR Effective Start Date	CRR Effective End Date	Auction Capacity %
2020.1st6.AnnualAuction.Seq4	*Annual*	*6/18/2018*	*6/27/2018*	*7/12/2018*	*7/17/2018*	*7/19/2018*	*8/2/2018*	*8/3/2018*	*8/9/2018*	*1/1/2020*	*6/30/2020*	*30*
2018.SEP.Monthly.Auction	Monthly	7/31/2018	8/3/2018	8/9/2018	8/14/2018	8/16/2018	8/23/2018	8/24/2018	8/30/2018	9/1/2018	9/30/2018	90
2020.2nd6.AnnualAuction.Seq5	*Annual*	*7/24/2018*	*8/1/2018*	*8/16/2018*	*8/21/2018*	*8/23/2018*	*9/6/2018*	*9/7/2018*	*9/13/2018*	*7/1/2020*	*12/31/2020*	*20*
2018.OCT.Monthly.Auction	Monthly	8/27/2018	8/31/2018	9/6/2018	9/11/2018	9/13/2018	9/20/2018	9/21/2018	9/27/2018	10/1/2018	10/31/2018	90
2021.1st6.AnnualAuction.Seq6	*Annual*	*8/20/2018*	*8/29/2018*	*9/13/2018*	*9/18/2018*	*9/20/2018*	*10/4/2018*	*10/5/2018*	*10/12/2018*	*1/1/2021*	*6/30/2021*	*10*
2018.NOV.Monthly.Auction	Monthly	9/25/2018	9/28/2018	10/4/2018	10/9/2018	10/11/2018	10/18/2018	10/19/2018	10/25/2018	11/1/2018	11/30/2018	90
2019.1st6.AnnualAuction.Seq1	*Annual*	*9/18/2018*	*9/26/2018*	*10/11/2018*	*10/16/2018*	*10/18/2018*	*11/1/2018*	*11/2/2018*	*11/8/2018*	*1/1/2019*	*6/30/2019*	*70*
2018.DEC.Monthly.Auction	Monthly	10/23/2018	10/26/2018	11/1/2018	11/6/2018	11/8/2018	11/15/2018	11/16/2018	11/26/2018	12/1/2018	12/31/2018	90
2019.2nd6.AnnualAuction.Seq2	*Annual*	*10/16/2018*	*10/24/2018*	*11/8/2018*	*11/13/2018*	*11/15/2018*	*11/29/2018*	*11/30/2018*	*12/6/2018*	*7/1/2019*	*12/31/2019*	*55*
2019.JAN.Monthly.Auction	Monthly	11/16/2018	11/21/2018	11/29/2018	12/4/2018	12/6/2018	12/13/2018	12/14/2018	12/20/2018	1/1/2019	1/31/2019	90
2020.1st6.AnnualAuction.Seq3	*Annual*	*11/16/2018*	*11/28/2018*	*12/13/2018*	*12/18/2018*	*12/20/2018*	*1/3/2019*	*1/4/2019*	*1/10/2019*	*1/1/2020*	*6/30/2020*	*40*
2019.FEB.Monthly.Auction	Monthly	12/20/2018	12/28/2018	1/3/2019	1/8/2019	1/10/2019	1/17/2019	1/18/2019	1/25/2019	2/1/2019	2/28/2019	90
2020.2nd6.AnnualAuction.Seq4	*Annual*	*12/13/2018*	*12/26/2018*	*1/10/2019*	*1/15/2019*	*1/17/2019*	*1/31/2019*	*2/1/2019*	*2/7/2019*	*7/1/2020*	*12/31/2020*	*30*

Congestion hedging example

Market Participant has Load in LZ_NORTH and a contract for 100 MW of generation delivered in real-time to HB_WEST weekdays on peak for the month of June.

Initiate the hedge in a CRR Auction

- ✓ Purchase 100 MW CRR from HB_WEST -> LZ_NORTH Peak Weekday
- ✓ Pay $0.75/MWh

Purchase a DAM PTP Obligation

- ✓ CRR settles automatically (receive payment based on DAM prices)
- ✓ Daily purchase 100 MW PTP Obligation from HB_WEST -> LZ_NORTH (Hours 7-22)

*These two actions net out**

Delivery in Real-Time

- ✓ Receive payment for any price spread between LZ_NORTH and HB_WEST
- ✓ Incur same congestion cost

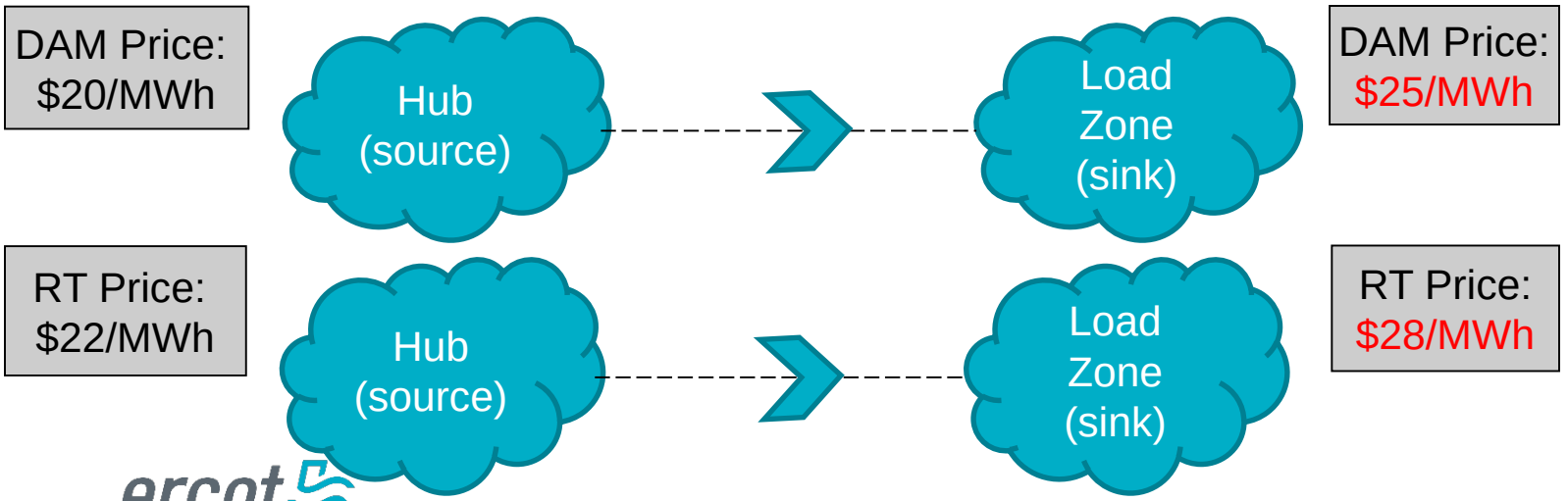
Net effect: real-time congestion hedge procured from ERCOT at a cost of $0.75/MWh

*at the Counterparty level; assumes no shortpay or deration

Congestion hedging example

Simplified example for one hour:

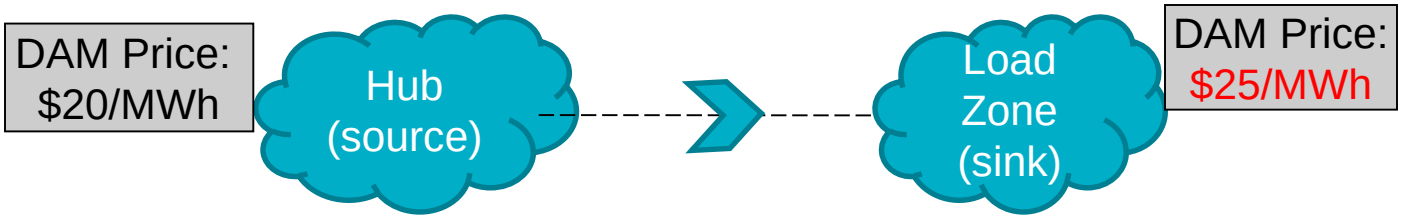
CRR **auction** purchase cost = -$0.75/MWh*100MW =	($75)
CRR payout in **DAM** = ($25/MWh - $20/MWh)*1 hr*100 MW =	$500
DAM PTP bid purchase = -($25/MWh - $20/MWh)*1 hr*100 MW =	($500)
Real-Time cost at LZ = $28/MWh *1 hr*100 MW =	($2,800)
Real-Time trade/contract at HB = $22/MWh *1 hr*100 MW =	$2,200
Real-Time payout for DAM PTP = -($28/MWh - $22/MWh)*1 hr*100 MW =	$600
	($75)



Financial investment example – Revised*

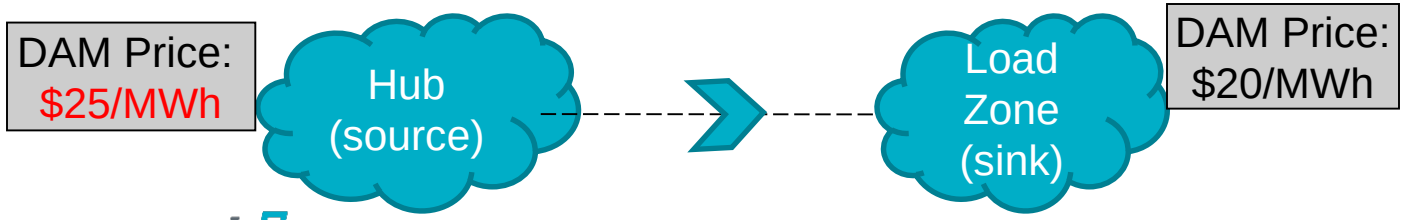
Example of a profitable investment in 100 MW of OBLs from HB_WEST to LZ_WEST:

CRR **auction** purchase cost = $0.75/MWh*100MW =	($75)
CRR settling in **DAM** = ($25/MWh - $20/MWh)*1 hr*100 MW =	$500
	$425



Example of an unprofitable investment in 100 MW of OBLs from HB_WEST to LZ_WEST:

CRR **auction** purchase cost = $0.75/MWh*100MW =	($75)
CRR settling in **DAM** = ($20/MWh - $25/MWh)*1 hr*100 MW =	($500)
	($575)



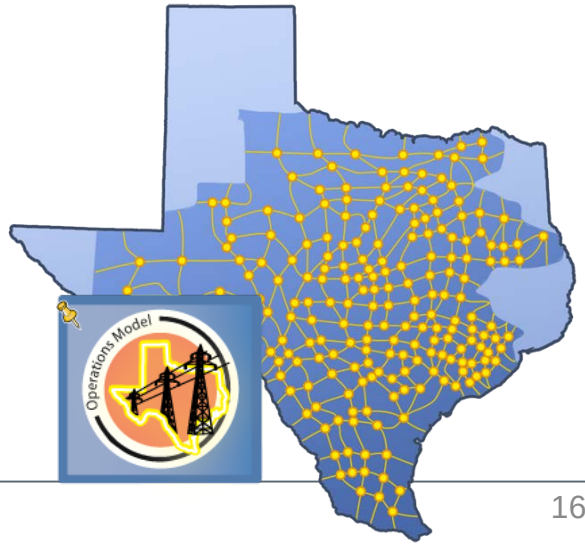
* Total in bottom example revised to correct a typographical error.

CRR Model

The amount of available system capacity that can be purchased is determined based on a future version of the Network Operations Model.

The CRR Model will reflect:

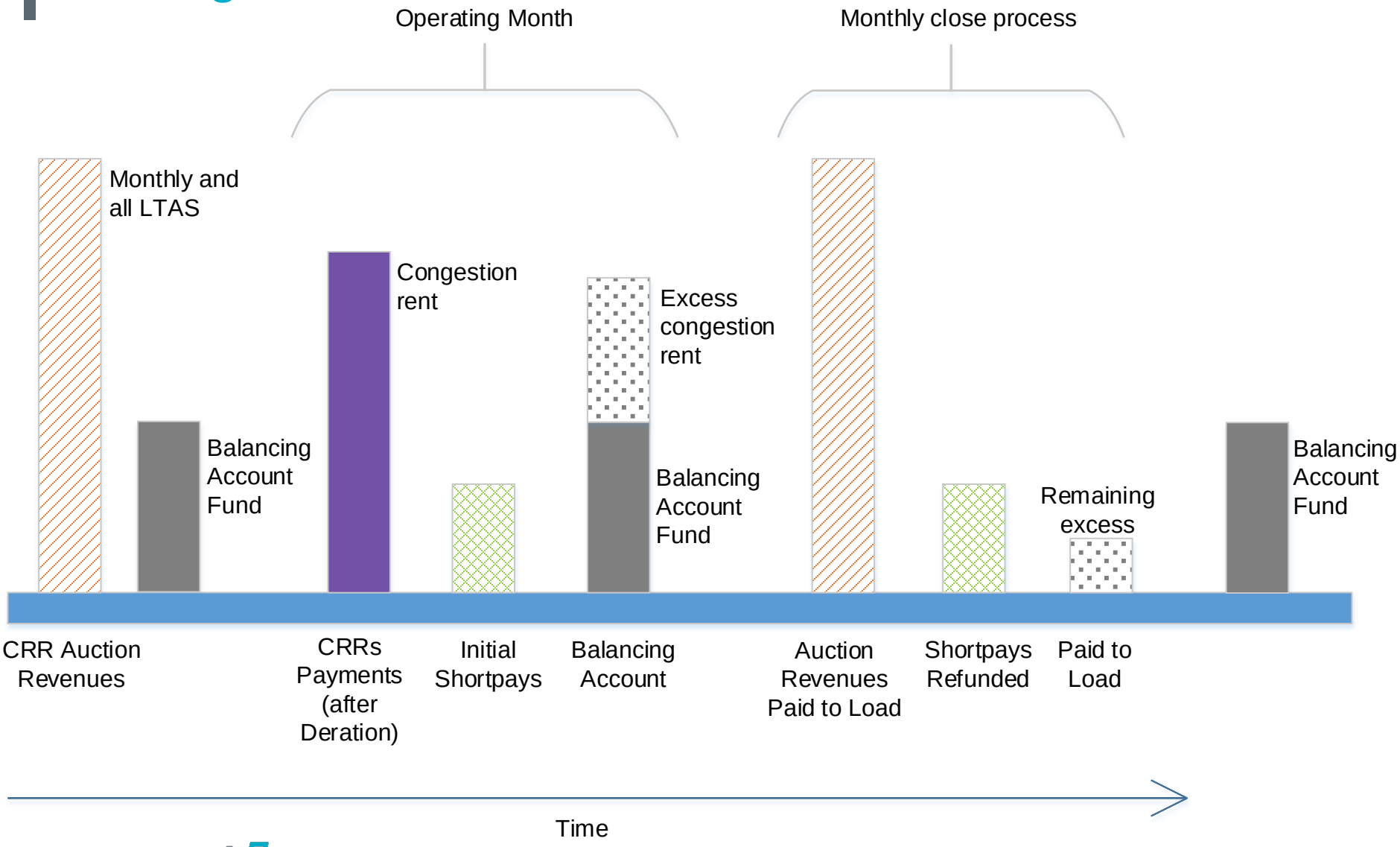
- ❑ All of the transmission facilities that are expected to be in-service on the first day of the specified month
- ❑ Outages applied based on specific criteria (see Appendix for details)
- ❑ Dynamic Ratings determined based on max forecasted or historical temperatures, depending on auction type
- ❑ List of elements that will not be subject to constraints (some limits are not enforced due to existing Congestion Management Plans, etc.)
- ❑ List of all enforced contingencies
- ❑ Biddable Settlement Points



Funding

- Congestion rent that is collected in the DAM is used to fund CRRs.
  - Congestion rent can generally be thought of as the difference between the amount that buyers pay and that sellers are paid.
- If excess congestion rent is collected in any hour, it is put into the Balancing Account.
- If an insufficient amount of congestion rent is collected in any hour, CRRAHs will be "short-paid."
  - The shortage is allocated proportionately to all CRRAHs.
- There is a separate process for reducing payments on CRRs containing Resource Nodes that impact oversold transmission elements, which is referred to as CRR derating.
  - Derations are not eligible for refunds from the Balancing Account.
  - NPRR821, implementation date 2019 TBD, removes deration for any CRR that does not sink at a Resource Node.
- At the end of each month, money in the Balancing Account will be used to refund all the shortages to the degree possible. Any remaining money after this process is set aside in the rolling CRR Balancing Account Fund with a $10M cap to help fund future shortages.
  - If the CRR Balancing Account Fund reaches the $10M cap and there is still money remaining, that money is paid to load based on a Load Ratio Share.

Funding illustration



Discussion purposes only – not to scale

Funding imbalances

When conditions diverge between markets, funding imbalances can occur. Primarily this is caused by topology differences or modeling assumptions made.

- Note that a number of elements are designed to be conservative, i.e., to tend toward underselling as opposed to overselling. For instance, a total of only 90% of transmission capacity is made available in the CRR auctions.

Generic examples:

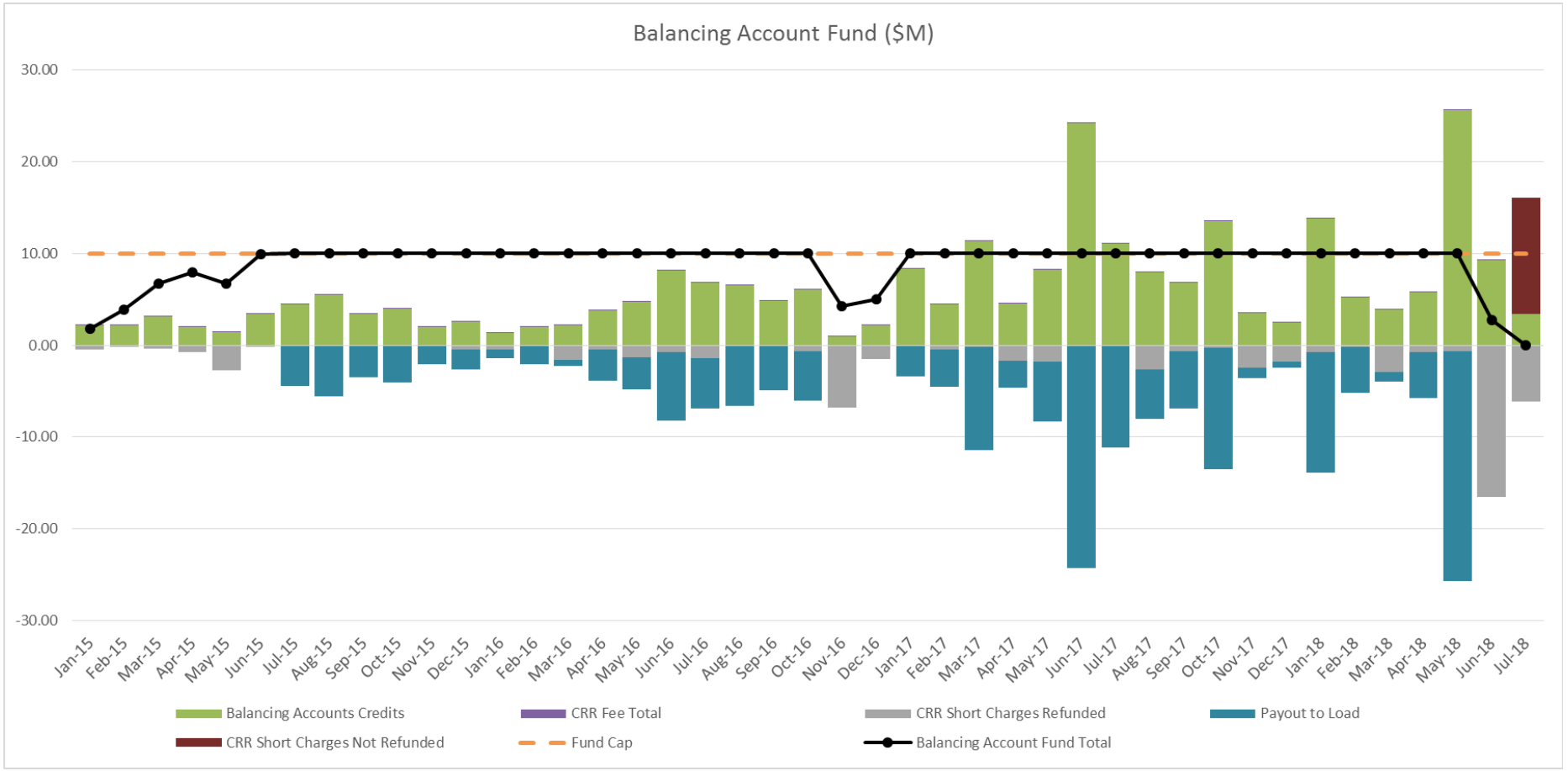
- An outage is modeled and expected for March. However, it later moves to April. This can cause CRRs to be undersold (funding surplus) in March. The rescheduled outage doesn't make the outage pull date for the April auction, so it also can cause April to be oversold (underfunded).
- February turns out to be significantly colder than expected. Because dynamically rated lines are modeled based on forecasted maximum temperature, February is undersold.
- Loads in a particular area increase quickly. CRRs sinking at Load Zones are distributed to individual loads based on distribution factors that are developed using historical information. Therefore, that Load Zone can be oversold.

Recent CRR imbalances

CRR Balancing Account ($M)	June 2018	July 2018* MTD
Monthly Day-Ahead Congestion Rent	$183.22	$127.60
Monthly Day-Ahead CRR Settlements	($190.51)	($143.08)
Monthly Day-Ahead CRR Short -Charges	$16.52	$18.85
CRR Balancing Account Credit Total	**$9.23**	**$3.38**
Beginning Fund Balance for the Month	$10.00	$2.75
CRR Balancing Account Credit Total	$9.23	$3.38
Day-Ahead CRR Short-Charges Refunded	($16.52)	($6.17)
CRR PTP Option Award Charges	$0.04	$0.04
Load-Allocated CRR Amount	$0.00	$0.00
Total Fund Amount	**$2.75**	**$0.00**
Day-Ahead CRR Short-Charges Not Refunded	**$0.00**	**$12.68**

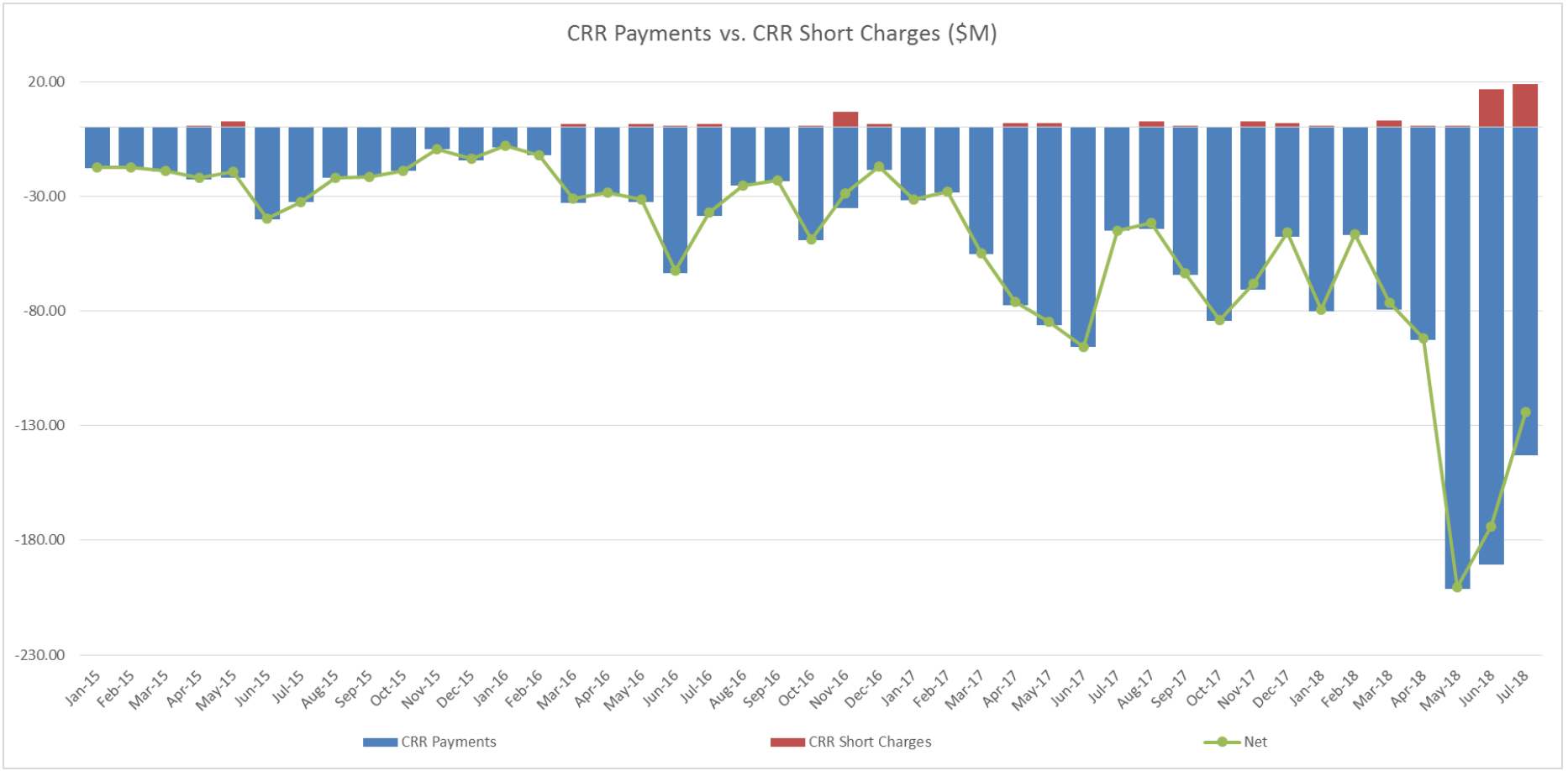
* Data for July 2018 is from July 1-23, 2018

Balancing Account Fund 2015 to date



* Data for July 2018 is from July 1-23, 2018

CRR payments 2015 to date



* Data for July 2018 is from July 1-23, 2018

Appendix

CRR Model Building

Extraction date is roughly 2 weeks prior to the posting date for monthly auctions and 3 weeks prior for each Long-Term Auction Sequence (LTAS).

- Note that the bid window opens 10 business days after the model posting for a monthly auction and 20 business days after for an LTAS
- Therefore, for monthly auctions, Outages are pulled approximately 6 weeks prior to the start of the CRR effective month

To start off the outage process, ERCOT extracts all Outages that qualify for inclusion:

- ✓ Consecutive or continuous approved Outages greater than or equal to five days;
- ✓ Approved Outages which include Transmission Elements included in the definition of a Hub;
- ✓ Approved Outages which include Transmission Elements in a 345 kV Transmission Facility;
- ✓ Approved Outages that require the use of a Block Load Transfer (BLT); and
- ✓ Any other approved Outage that has been determined by ERCOT to carry a substantial risk of causing significant congestion.

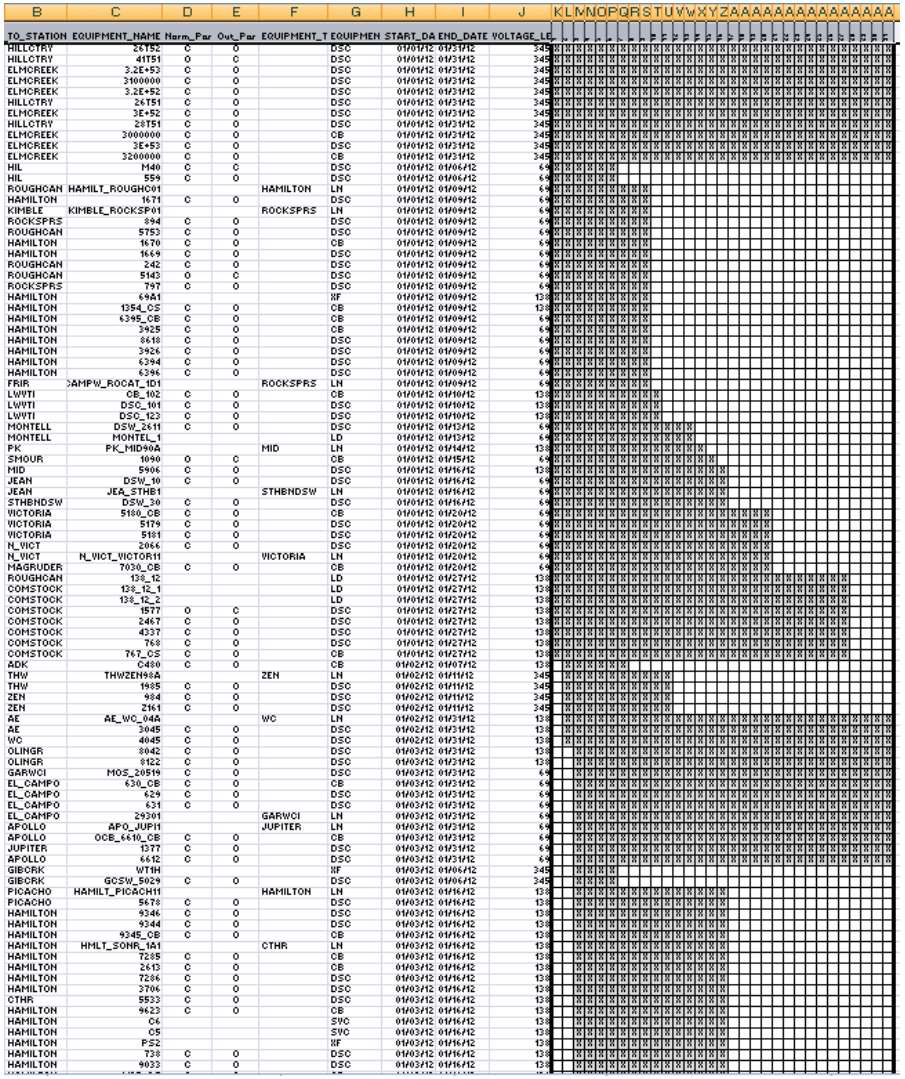
Then an analysis is performed to determine the “worst day” upon which to base the topology of our auction for that time period.

CRR Model Building

1) Gantt chart to highlight groupings of potential worst-case days, considering kV levels. Gantt chart example seen to the right.

2) Once we've narrowed it down, engineers consider historical data and knowledge about areas which may be more significantly constrained.

- Special consideration for impacts to interfaces (Generic Transmission Limits), impacts to historically significant constraints in Day-Ahead Market (DAM) and Real-Time, and consider Remedial Action Scheme equipment outages.
- MW flow impact analysis performed on subset of outage combinations.



TO_STATION	EQUIPMENT_NAME	Norm_Par	Out_Par	EQUIPMENT_T	EQUIPMEN	START_DA	END_DATE	VOLTAGE_LE
HILLCTRY	24T52	C	O		DSC	01/01/12	01/31/12	345
HILLCTRY	41T51	C	O		DSC	01/01/12	01/31/12	345
ELMCREEK	3.2E+53	C	O		DSC	01/01/12	01/31/12	345
ELMCREEK	3100000	C	O		DSC	01/01/12	01/31/12	345
ELMCREEK	3.2E+52	C	O		DSC	01/01/12	01/31/12	345
HILLCTRY	24T51	C	O		DSC	01/01/12	01/31/12	345
ELMCREEK	3E+52	C	O		DSC	01/01/12	01/31/12	345
HILLCTRY	28T51	C	O		DSC	01/01/12	01/31/12	345
ELMCREEK	3000000	C	O		CB	01/01/12	01/31/12	345
ELMCREEK	3E+53	C	O		DSC	01/01/12	01/31/12	345
ELMCREEK	3200000	C	O		CB	01/01/12	01/31/12	345
HIL	M40	C	C		DSC	01/01/12	01/06/12	69
HIL	559	C	O		DSC	01/01/12	01/06/12	69
ROUGHCAN	HAMILT_ROUGHC01			HAMILTON	LN	01/01/12	01/09/12	69
HAMILTON	1671	C	O		DSC	01/01/12	01/09/12	69
KIMBLE	KIMBLE_ROCKSP01			ROCKSPRS	LN	01/01/12	01/09/12	69
ROCKSPRS	894	C	O		DSC	01/01/12	01/09/12	69
ROUGHCAN	5753	C	O		DSC	01/01/12	01/09/12	69
HAMILTON	1670	C	O		CB	01/01/12	01/09/12	69
HAMILTON	1669	C	O		DSC	01/01/12	01/09/12	69
ROUGHCAN	242	C	O		DSC	01/01/12	01/09/12	69
ROUGHCAN	5143	O	C		DSC	01/01/12	01/09/12	69
ROCKSPRS	797	C	O		DSC	01/01/12	01/09/12	69
HAMILTON	69A1				NF	01/01/12	01/09/12	138
HAMILTON	1354_CS	C	O		CB	01/01/12	01/09/12	138
HAMILTON	6395_CB	C	O		CB	01/01/12	01/09/12	69
HAMILTON	3425	C	O		CB	01/01/12	01/09/12	69
HAMILTON	8618	C	O		DSC	01/01/12	01/09/12	69
HAMILTON	3926	C	O		DSC	01/01/12	01/09/12	69
HAMILTON	6394	C	O		DSC	01/01/12	01/09/12	69
HAMILTON	6396	C	O		DSC	01/01/12	01/09/12	69
FRIR	CAMPW_ROCAT_1D1			ROCKSPRS	LN	01/01/12	01/09/12	69
LWYTI	CB_102	C	O		CB	01/01/12	01/10/12	138
LWYTI	DSC_101	C	O		DSC	01/01/12	01/10/12	138
LWYTI	DSC_123	C	O		DSC	01/01/12	01/10/12	138
MONTELL	DSW_2611	C	O		DSC	01/01/12	01/13/12	69
MONTELL	MONTEL_1				LD	01/01/12	01/13/12	69
PK	PK_MID90A			MID	LN	01/01/12	01/14/12	138
SMOUR	1090	O	C		CB	01/01/12	01/15/12	69
MID	5906	C	O		DSC	01/01/12	01/16/12	138
JEAN	DSW_10	C	O		DSC	01/01/12	01/16/12	69
JEAN	JEA_STHB1			STHENDSW	LN	01/01/12	01/16/12	69
STHENDSW	DSW_30	C	O		DSC	01/01/12	01/16/12	69
VICTORIA	5180_CB	C	O		CB	01/01/12	01/20/12	69
VICTORIA	5179	C	O		DSC	01/01/12	01/20/12	69
VICTORIA	5181	C	O		DSC	01/01/12	01/20/12	69
N_VICT	2066	C	O		DSC	01/01/12	01/20/12	69
N_VICT	N_VICT_VICTOR11			VICTORIA	LN	01/01/12	01/20/12	69
MAGRUDER	7030_CB	C	O		CB	01/01/12	01/20/12	69
ROUGHCAN	138_12				LD	01/01/12	01/27/12	138
COMSTOCK	138_12_1				LD	01/01/12	01/27/12	138
COMSTOCK	138_12_2				LD	01/01/12	01/27/12	138
COMSTOCK	1577	O	C		DSC	01/01/12	01/27/12	138
COMSTOCK	2467	C	O		DSC	01/01/12	01/27/12	138
COMSTOCK	4337	C	O		DSC	01/01/12	01/27/12	138
COMSTOCK	768	C	O		DSC	01/01/12	01/27/12	138
COMSTOCK	767_CS	C	O		CB	01/01/12	01/27/12	138
ADK	C480	C	O		CB	01/02/12	01/07/12	138
THW	THWZEN90A			ZEN	LN	01/02/12	01/11/12	345
THW	1985	C	O		DSC	01/02/12	01/11/12	345
ZEN	984	C	O		DSC	01/02/12	01/11/12	345
ZEN	2161	C	O		DSC	01/02/12	01/11/12	345
AE	AE_WC_04A			WC	LN	01/02/12	01/31/12	138
AE	3045	C	O		DSC	01/02/12	01/31/12	138
WC	4045	C	O		DSC	01/02/12	01/31/12	138
OLINGR	8042	C	O		DSC	01/03/12	01/31/12	138
OLINGR	8122	C	O		DSC	01/03/12	01/31/12	138
GARWCI	MOS_20599	C	O		DSC	01/03/12	01/31/12	69
EL_CAMPO	630_CB	C	O		CB	01/03/12	01/31/12	69
EL_CAMPO	629	C	O		DSC	01/03/12	01/31/12	69
EL_CAMPO	631	C	O		DSC	01/03/12	01/31/12	69
EL_CAMPO	2930			GARWCI	LN	01/03/12	01/31/12	69
APOLLO	APO_JUPI1			JUPITER	LN	01/03/12	01/31/12	69
APOLLO	OCB_6610_CB	C	O		CB	01/03/12	01/31/12	69
JUPITER	1377	C	O		DSC	01/03/12	01/31/12	69
APOLLO	6612	C	O		DSC	01/03/12	01/31/12	69
GIBORK	WT1H				NF	01/03/12	01/06/12	345
GIBORK	GOSW_5029	C	O		DSC	01/03/12	01/06/12	345
PICACHO	HAMILT_PICACH11			HAMILTON	LN	01/03/12	01/16/12	138
PICACHO	5678	C	O		DSC	01/03/12	01/16/12	138
HAMILTON	9346	C	O		DSC	01/03/12	01/16/12	138
HAMILTON	9344	C	O		DSC	01/03/12	01/16/12	138
HAMILTON	9345_CB	C	O		CB	01/03/12	01/16/12	138
HAMILTON	HMLT_SONR_1A1			CTHR	LN	01/03/12	01/16/12	138
HAMILTON	7285	C	O		CB	01/03/12	01/16/12	138
HAMILTON	2613	C	O		CB	01/03/12	01/16/12	138
HAMILTON	7286	C	O		DSC	01/03/12	01/16/12	138
HAMILTON	3706	C	O		DSC	01/03/12	01/16/12	138
CTHR	5833	C	O		DSC	01/03/12	01/16/12	138
HAMILTON	9423	C	O		CB	01/03/12	01/16/12	138
HAMILTON	C6				SVC	01/03/12	01/16/12	138
HAMILTON	C5				SVC	01/03/12	01/16/12	138
HAMILTON	PS2				NF	01/03/12	01/16/12	138
HAMILTON	738	C	O		DSC	01/03/12	01/16/12	138
HAMILTON	9033	C	O		DSC	01/03/12	01/16/12	138