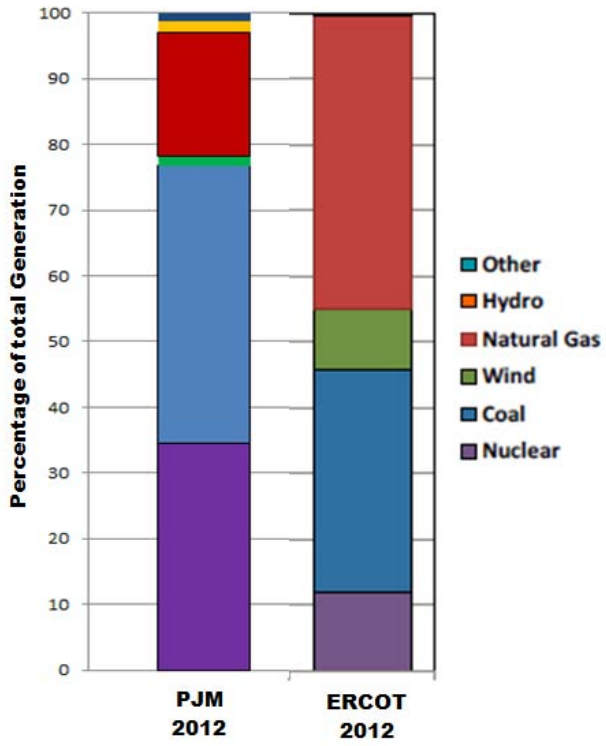
Electricity Reliability Council of Texas (ERCOT)

ERCOT vs PJM Generation make up



i

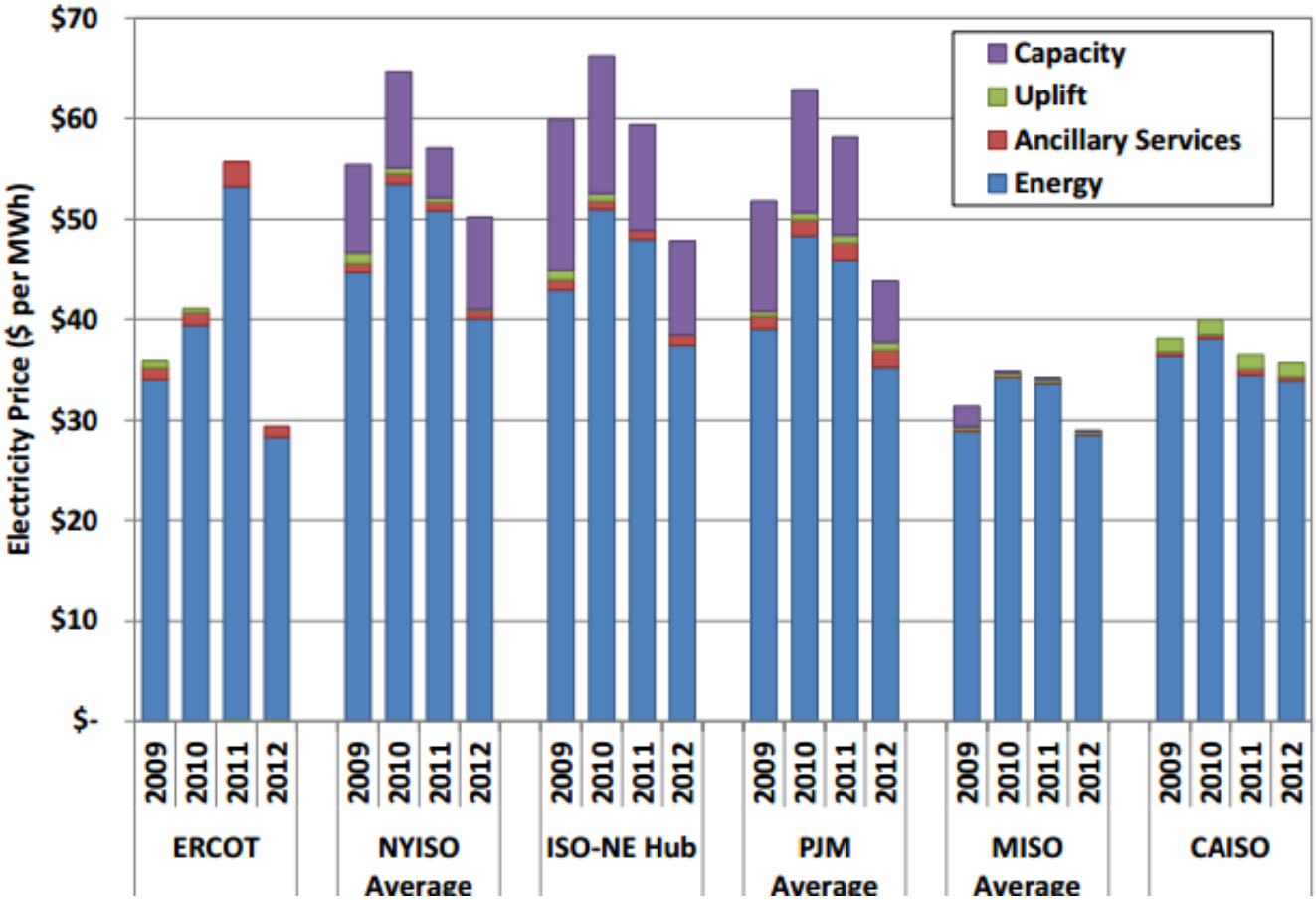
This graphic compares the generation make up in PJM and ERCOT. Not only are market rules different, footprint but generation make up are also very different between the two RTOs.

ERCOT Uplift: What is it?

In ERCOT, Generators may receive uplift payments because of specific reliability contributions they offer to the system, mandated through reliability must run or through the reliability unit commitment requirements.[ii] ERCOT does not require resources to participate in the DAM. Generators with no DA commitment and no sales and purchases are paid for their full output at the real-time price. Lost opportunity cost in the way that PJM defines it doesn't exist the same way in ERCOT. The only similar payment is made for generators operating at maximum output and lowered to provide reactive service but ERCOT has not made those payments recent history.

Virtual traders are not subject to a market administration fees Day Ahead Make Whole Charges (~$0.0037 Per Cleared MWh). There are RUC Short Capacity Charges that are very transaction dependent and only charged if a transaction is deemed to cause unit uplift. [iii]

Figure 3: Comparison of All-in Prices across Markets



Price Comparison Chart Data								
2012 SOM Figure 3			Energy		Ancillary Services		Capacity		Uplift
ERCOT	2009	$	34.03	$	1.16			$	0.69
	2010	$	39.40	$	1.26			$	0.41
	2011	$	63.23	$	2.41			$	(0.03)
	2012	$	28.33	$	1.06			$	(0.00)
NYISO Average	2009	$	44.64	$	0.97	$	8.71	$	1.06
	2010	$	63.61	$	0.98	$	9.69	$	0.61
	2011	$	60.86	$	0.84	$	4.89	$	0.47
	2012	$	40.06	$	0.78	$	9.24	$	0.14
ISO-NE Hub	2009	$	42.69	$	1.00	$	16.00	$	1.00
	2010	$	60.98	$	0.81	$	13.85	$	0.80
	2011	$	48.00	$	0.88	$	10.48		
	2012	$	37.42	$	1.04	$	9.36		
PJM Average	2009	$	39.05	$	1.26	$	11.02	$	0.48
	2010	$	48.36	$	1.66	$	12.16	$	0.79
	2011	$	46.84	$	1.69	$	9.72	$	0.79
	2012	$	36.23	$	1.70	$	6.06	$	0.79
MISO Average	2009	$	28.90	$	0.16	$	2.03	$	0.30
	2010	$	34.21	$	0.16	$	0.01	$	0.39
	2011	$	33.65	$	0.15	$	0.00	$	0.31
	2012	$	28.66	$	0.13	$	0.01	$	0.23
CAISO	2009	$	38.38	$	0.39	$	-	$	1.32
	2010	$	38.10	$	0.38			$	1.43
	2011	$	34.48	$	0.62			$	1.38
	2012	$	33.92	$	0.37			$	1.39

[iv]

ERCOT Uplift: Why does it happen?

Unit parameters and constraints cause imperfect ability to dispatch.

ERCOT Uplift: How is it allocated?

Uplift costs are assigned market-wide on a load-weighted ratio basis.[v]

ERCOT has a Reliability Unit Commitment (RUC) and hour ahead unit commitments both are trying to see if need resources online. Some units get RUC make whole payments but they aren't large amounts in aggregate. This is due in part that any revenue earned above cost is used to offset the make whole for the day. RUC charges are allocated as a capacity short charge where the ISO will look at physical schedules and trades and determine whether participants are short in RT. Much like PJM deviations, these costs are allocated to deviations in real time with caps in the calculation to ensure no participant is overburdened. If a certain participant is going to be allocated a large percentage then after a certain threshold the cost is allocated by load ratio share[vi]. Imbalance charges are the RT energy imbalance minus the DA congestion minus total purchases minus RT sales. ERCOT calculates an imbalance to RT for every settlement point.

ERCOT Uplift: Any work to reduce?

No, uplift is not a pressing concern for ERCOT as it remains at a relatively low level.

ERCOT Uplift: Q&A

1. How are start and no load compensated if the unit is on for economics the LMP doesn't cover the cost? This isn't a RUC thing, but where would the cost go? Is the unit compensated for start and no load? There is no compensation for self-commits outside of energy payments. I.e. there is no make whole

2. How concentrated is the uplift? The RUC units usually the same units?

   Of the three years analyzed 2013: two resources were also in the top 10 in 2012 and two were also in top 10 in 2011. 2012: one resource was also in the top 10 in 2011.

Summary	Annual Make Whole Uplift	Make Whole Uplift top 10 units	Percent of uplift paid to top 10 units	Total Number ERCOT Resources	Total Number RUC Resources
2011	$ (23,908,703.52)	$ (14,386,617.89)	60.17%	525	151
2012	$ (433,401.53)	$ (373,861.16)	86.26%	670	25
2013	$ (2,882,026.82)	$ (2,637,727.65)	91.52%	708	42

3. Where can I get the specific formula that tells me when one unit is deviating that keeps that unit from getting all the uplift charges?

Here's the formula from protocol section 5.7.4. And, it's not really one unit that's deviating; it's one Market Participant who is short to real time. It could be a power marketer who only Day Ahead Market Sales and no gen or trades to cover that position in real time

5.7.4.1 RUC Capacity-Short Charge

The dollar amount charged to each QSE, due to capacity shortfalls for a particular RUC, for a 15-minute Settlement Interval, is the QSE's shortfall ratio share multiplied by the total RUC Make-Whole Payments, including amounts for RMR Units, to all QSEs for that RUC, subject to a cap. The cap on the charge to each QSE is two multiplied by the total RUC Make-Whole Payments, including amounts for RMR Units, for all QSEs multiplied by that QSE's capacity shortfall for that RUC process divided by the total capacity of all RUC-committed Resources during that Settlement Interval for the RUC process. That dollar amount charged to each QSE is calculated as follows:

$$RUCCSAMT_{ruc,i,q} = (-1) * \text{Max}\left[(RUCSFRS_{ruc,i,q} * RUCMWAMTRUCTOT_{ruc,h}), (2 * RUCSF_{ruc,i,q} * RUCMWAMTRUCTOT_{ruc,h} / RUCCAPTOT_{ruc,h})\right] / 4$$

Where:

$$RUCMWAMTRUCTOT_{ruc,h} = \sum_{q} \sum_{r} RUCMWAMT_{ruc,q,r,h}$$

$$RUCCAPTOT_{ruc,h} = \sum_{r} HSL_{ruc,h,r}$$

The above variables are defined as follows:

Variable	Unit	Definition
$RUCCSAMT_{ruc,i,q}$	$	*RUC Capacity-Short Amount*—The charge to a QSE, due to capacity shortfall for a particular RUC process, for the 15-minute Settlement Interval.
$RUCMWAMTRUCTOT_{ruc,h}$	$	*RUC Make-Whole Amount Total per RUC*—The sum of RUC Make-Whole Payments for a particular RUC process, including amounts for RMR Units, for the hour that includes the 15-minute Settlement Interval.
$RUCMWAMT_{ruc,q,r,h}$	$	*RUC Make-Whole Payment*—The RUC Make-Whole Payment to the QSE for Resource *r*, for a particular RUC process, for the hour that includes the 15-minute Settlement Interval. See Section 5.7.1, RUC Make-Whole Payment. When one or more Combined Cycle Generation Resources are committed by RUC, payment is made to the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources.
$RUCSFRS_{ruc,i,q}$	none	*RUC Shortfall Ratio Share*—The ratio of the QSE's capacity shortfall to the sum of all QSEs' capacity shortfalls for a particular RUC process, for the 15-minute Settlement Interval. See Section 5.7.4.1.1, Capacity Shortfall Ratio Share.
$RUCSF_{ruc,i,q}$	MW	*RUC Shortfall*—The QSE's capacity shortfall for a particular RUC process for the 15-minute Settlement Interval. See formula in Section 5.7.4.1.1.
$RUCCAPTOT_{ruc,h}$	MW	*RUC Capacity Total*—The sum of the High Sustained Limits (HSLs) of all RUC-committed Resources for a particular RUC process, for the hour that includes the 15-minute Settlement Interval. See formula in Section 5.7.4.1.1.
$HSL_{ruc,h,r}$	MW	*High Sustained Limit*—The HSL of Generation Resource *r* as defined in Section 2, Definitions and Acronyms, for the hour that includes the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
ruc	none	The RUC process for which the RUC Capacity-Short Charge is calculated.
i	none	A 15-minute Settlement Interval.
q	none	A QSE.
h	none	The hour that includes the Settlement Interval *i*.
r	none	A Generation Resource that is RUC-committed for the hour that includes the Settlement Interval *i*, as a result of a particular RUC process.[vii]

RUCCSAMT = (-1) * Max [(RUCSFRS * RUCMWAMTRUCTOT), (2 * RUCSF * RUCMWAMTRUCTOT / RUCCAPTOT)] / 4		
$RUCSFRS_{ruc}$	This bill determinant is one MP's Short Fall Ratio Share (In this case the MP is the only one in the market that is short)	1
$RUCMWAMTRUCTOT_{ruc}$	This is the total make whole payments to RUC resources	(500,000.00)
RUCSF	This is one MP's total MW short fall	30
$RUCCAPTOT_{ruc}$	This is the sum of HSLs for RUCed resources	1000
Share of total charges from just Short Fall Ratio Share		(500,000.00)
Share of total charges from 2* total MW Short Fall Cap		(30,000.00)
The formula takes the max of the two numbers above.		
Assuming, in this case, that only one QSE is short, that QSE would be charged 30K and the remaining 470 would be uplifted to load on a load ratio share basis		

4. On page 71 of the SOM it says "There was an operational change midway through 2011 which also contributed to the reduced frequency of reliability unit commitments. During the initial months of operating the nodal market it was common for ERCOT to commit units that were providing non-spin reserves if they were needed to resolve congestion. This practice was greatly reduced starting in July 2011" What was this operational change? What did they use to resolve the congestion? Deploy Non-Spin Ancillary Services for the resource instead of committing the unit with a RUC instruction

ERCOT Additional Materials

Section 5: Transmission Security Analysis and Reliability Unit Commitment –RUC (Reliability Unit Commitment) market rules

- Section 5.7 has all of the rules for the RUC Settlement
- 5.7.1 details the make whole payments to generators
- 5.7.2 details the clawback charge to generators that made more revenue than their costs
- 5.7.4.1 details the Capacity Short Charge which is our main allocation of costs for RUC Commitments

Section 6: Adjustment Period and Real-Time Operations –Real Time Operations Market Rules

- Sections 6.6.3.1, 6.6.3.2, and 6.6.3.3 detail the payments/charge for Real Time Energy Imbalance
- Section 6.6.10 has our Real Time Revenue Neutrality Uplift: This allocates the costs of several Real Time Settlements charges to load

Section 7: Congestion Revenue Rights - CRR Market Rules

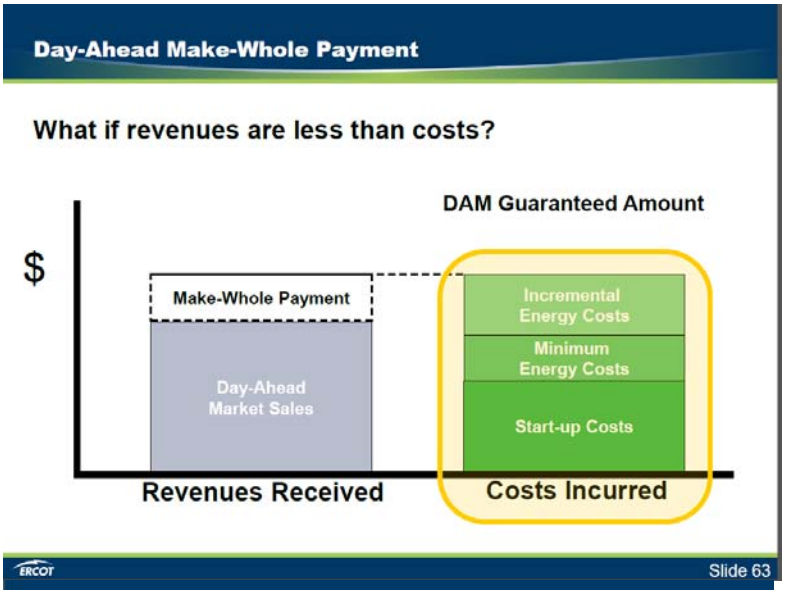
- Section 7.9 has all of the settlements calculations
- 7.9.2.1 has the payment/charge calculation for Point to Point Obligations (This are the PTP transactions that are purchased at the price difference between source and sink in the DAM and paid at the price difference between source and sink in Real Time)
    - The uplift of these costs is part of Real Time Revenue Neutrality noted above

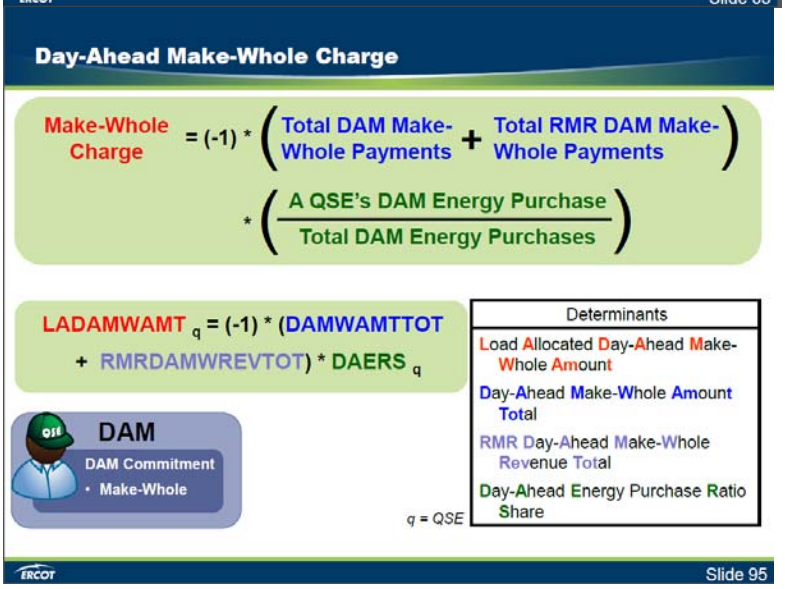
Settlements 301 Training Course: http://www.ercot.com/services/training/course/44#overview

M1 - Set301- Intro

M2 - Set301 - CRR

M3 - Set301 - DAM





M4 - Set301 - CRR Balancing Accounting

M5 - Set301 - RUC

M6 - Set301 - Real-Time Operations

M7 - Set301 - Statements & Invoices

Annual TAC Review of Markets: Impacts of RUCs --
http://www.ercot.com/content/meetings/tac/keydocs/2014/0128/15._2013_Annual_TAC_Review_of_the_Market_Impacts_of_RUCs_v5.ppt

DMS: 779323
Prepared for PJM EMUSTF 1/23/14

[i] Information from the 2012 ERCOT and PJM SOM

[ii] 2012 ERCOT State of the Market Report (link) page 2

[iii] http://www.platts.com/IM.Platts.Content/ProductsServices/ConferenceandEvents/2013/pc346/presentations/Jim_Krajecki.pdf

[iv] PJM's values for ancillary services include reactive, regulation, DASR, Synch, Black Start, Non Synch, Transmission Enhancement Cost Recovery, Administration fees, NERC/RFC charges, RTO startup and expansion, Load Response and Transmission Owner (Schedule A1). Also does not include $4.78 of other charges.

[v] 2012 ERCOT State of the Market Report (link) page 2

[vi] 2012 ERCOT State of the Market Report (link) page 71 "There was an operational change midway through 2011 which also contributed to the reduced frequency of reliability unit commitments. During the initial months of operating the nodal market it was common for ERCOT to commit units that were providing non-spin reserves if they were needed to resolve congestion. This practice was greatly reduced starting in July 2011."

[vii] Section 5: Transmission Security Analysis and Reliability Unit Commitment