

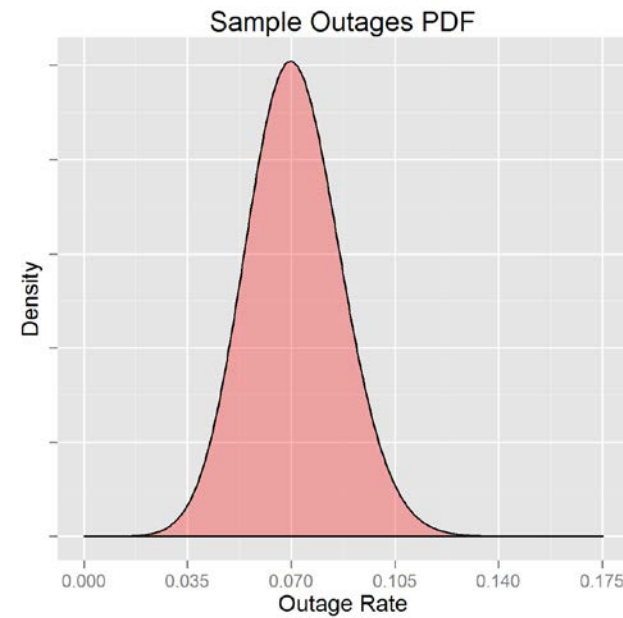
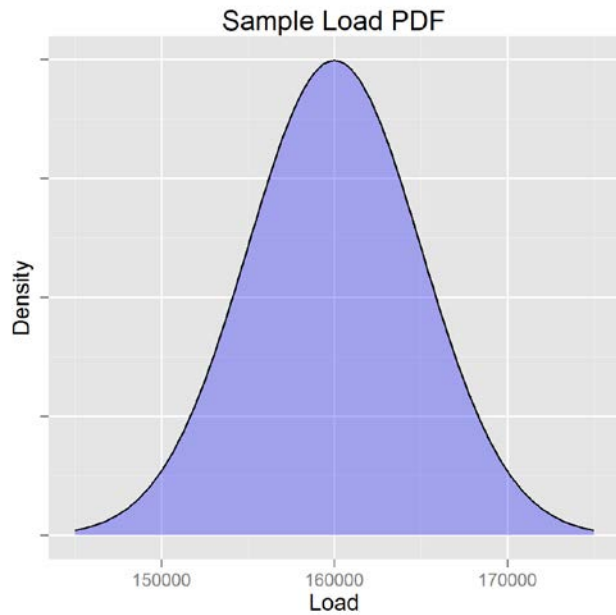


# RRS Education Session #1

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- IRM/FPR are computed for future delivery years.
  - And the future is uncertain...
- Uncertainty in:
  - Load
  - Resource Performance (Outages, Maintenance)
  - For PJM and neighboring regions
- If we have perfect foresight and know that the 50/50 peak load for a given future year is 160,000 MW, the forced outage rate of the future fleet is 7%, and the “help” we get from our neighbors is 3500 MW then
  - There will be no need for a RRS
  - The (single area) IRM is  $160,000 / (1 - 0.07) = 172,043$ , or 7.5%
  - The (two-area) IRM is  $(172,043 - 3,500) / 160,000 = 5.3\%$

- However, we know that



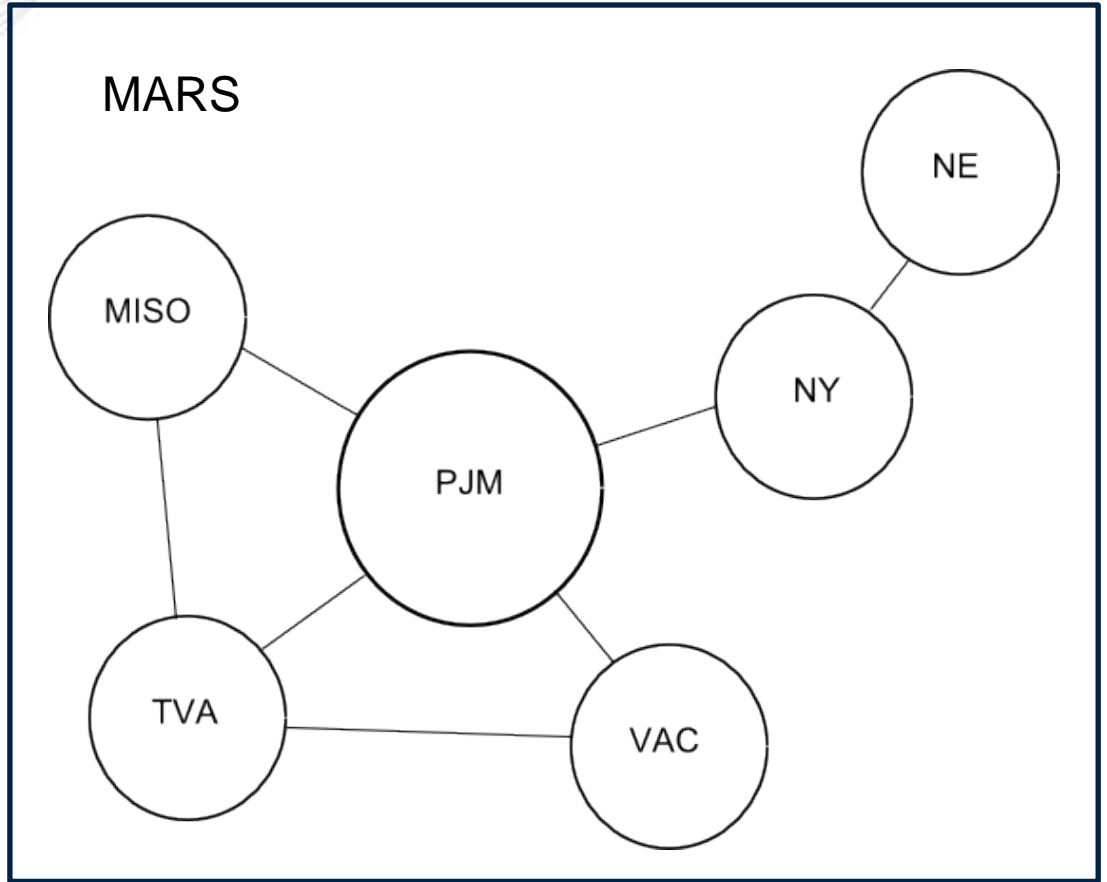
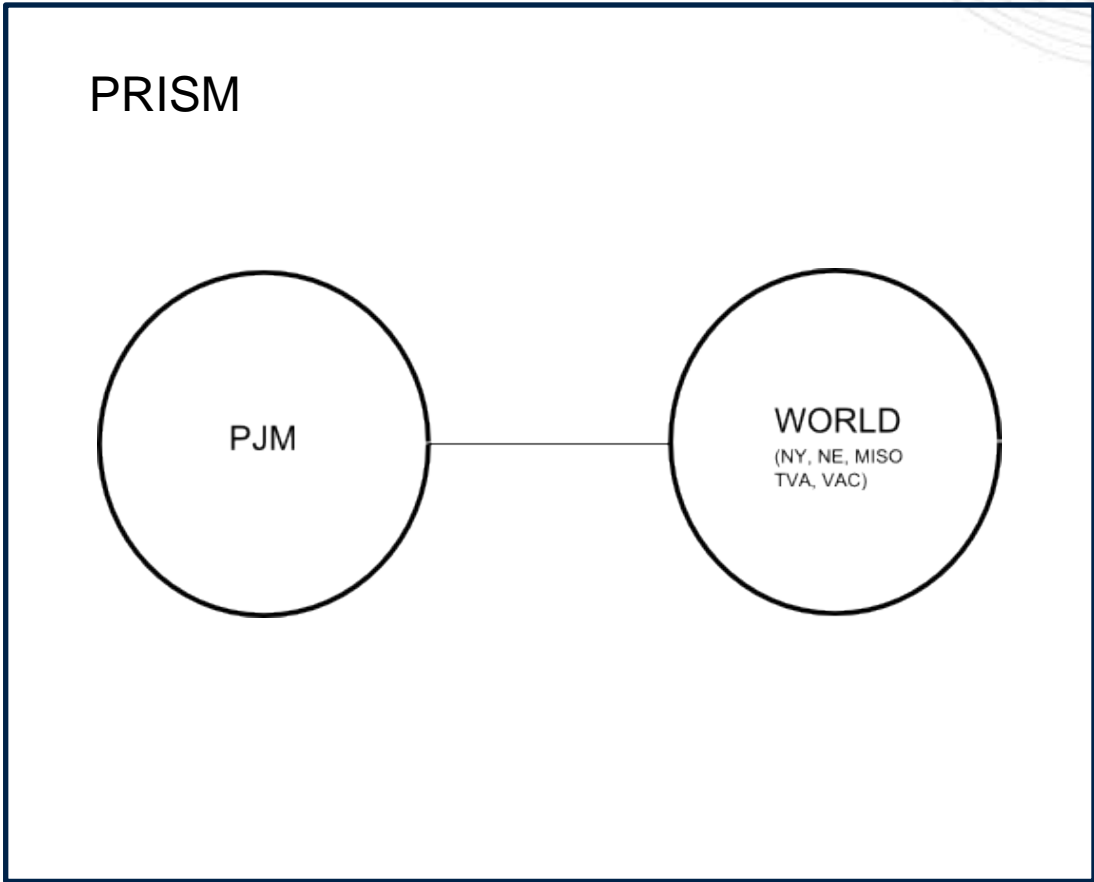
In addition, these distributions change throughout the year.  
 Also, each of the neighboring areas has its own set of load and outages distributions.

- IRM (or two-area IRM): Installed Reserve Margin computed in a PRISM case that includes PJM and the World
- Single area IRM: Installed Reserve Margin computed in a PRISM case that includes PJM only
- FPR: Forecast Pool Requirement; IRM expressed in UCAP terms.  
$$\text{FPR} = \text{IRM} \times (1 - \text{Pool Avg XEFORd})$$
- EFORd (XEFORd): Portion of time that a generating unit is in demand, but is unavailable due to a forced outage. With the elimination of Outside of Management Control (OMC) Events,  $\text{EFORd} = \text{XEFORd}$

- **CBM** : Capacity Benefit Margin. Amount of import capability reserved for emergency imports (set by the tariff at 3,500 MW)
- **CBOT**: Capacity Benefit of Ties. Expected value of the CBM in a two-area IRM run
- **LOLE**: Loss of Load Expectation. Measure of how often, on average, load exceeds available capacity. Currently, PJM (and other RTOs) use the 1 day in 10 years LOLE criterion to calculate the Installed Reserve Margin.

- Currently used by PJM: PRISM (or GEBGE)
- Most popular: GE-MARS
- How are the different RRS inputs (Load Model, Capacity Model, World) modeled in PRISM and MARS?

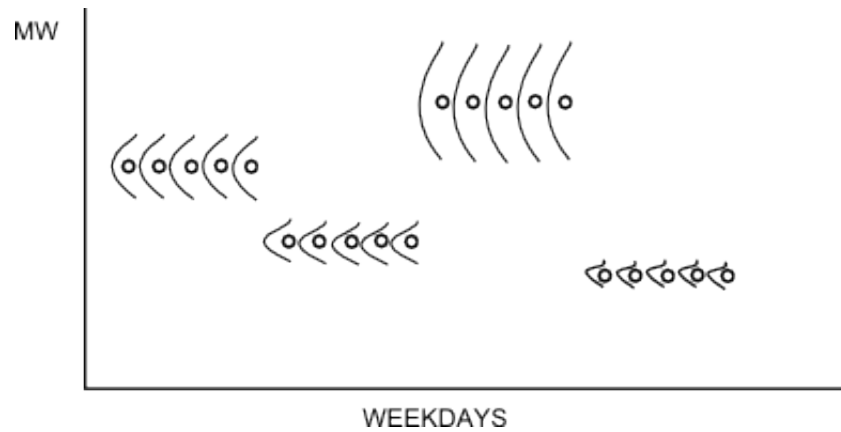
PRISM		MARS	
<i>Topology</i>		<i>Topology</i>	
two-area		multi-area	
<i>Load Model</i>		<i>Load Model</i>	
52 normal distributions; one per week		hourly load shape for entire year (per-unitized hourly loads)	
per-unitized monthly peaks		12 distributions (may or may not be normal); one per month	
forecast error factor		per-unitized monthly peaks	
daily lole computation		hourly lole computation	
<i>Capacity Model</i>		<i>Capacity Model</i>	
outage distribution developed via convolution		outage distribution developed via monte carlo simulation	
units' forced outage rates		units' forced outage rates	
units' planned outages requirement (in weeks)		units' planned outages requirement (in weeks)	
units' icap		units' icap	
		units' transition states	
		allows for more granular input data (wind/solar hourly shapes, partial outages, etc)	
<i>Solution Method</i>		<i>Solution Method</i>	
daily lole computation		hourly lole computation	
automated		trial-and-error	





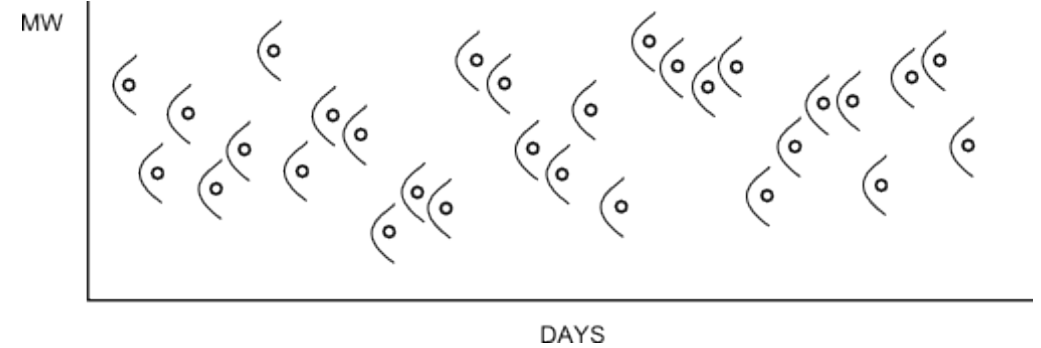
## PRISM

Daily peaks with Weekly Uncertainty for a given month



## MARS

Daily peaks with Monthly Uncertainty for a given month  
(rest of hours not shown but their uncertainty is identical)



## PRISM

For each weekday, PRISM develops a probabilistic distribution of outages by:

- Assuming that each unit has a probability equal to its forced outage rate of being offline and a probability of one minus its forced outage rate of being online
- The online/offline probabilities of units not on planned outages in the weekday considered are convoluted one by one to develop a probabilistic distribution of outages

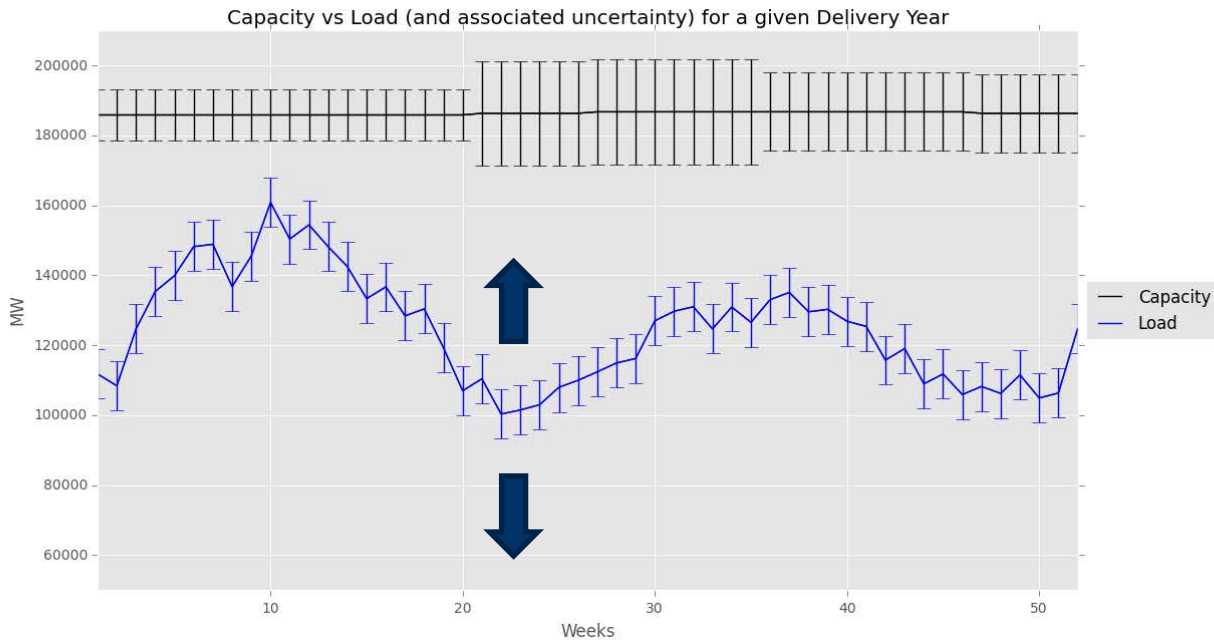
PRISM uses the convolution method to develop the capacity model

## MARS

For each hour, MARS develops a probabilistic distribution of outages by:

- Combining the forced outages and transition states of a unit to develop distributions of length of online/offline periods
- Drawing random numbers for each unit that are then used in the above distributions to determine length of online/offline periods in current replication
- Repeat the procedure above “n” times (“n” replications)
- Sum the MWs of the units offline in each replication. Each replication is assumed to have equal probability.

MARS uses Monte Carlo sampling to develop the capacity model



Starting point: forecasted 50/50 load and forecasted installed capacity

It is highly likely that the starting point will result in an LOLE above/below the 1 day in 10 years criterion

Thus, either the forecasted installed capacity or the forecasted 50/50 remains fixed while the other variable is shifted until meeting the criterion.

PJM chooses to fix the installed capacity and shift the 50/50 load.

- For a given delivery year (DY), RPM develops the reliability requirement
  - based on **DY 50/50 peak \* FPR**
  - not based on **DY 50/50 peak \* IRM**
- An increase in the IRM that is **purely** a result of an increase in the average forced outage rate of the PJM fleet **does not meaningfully increase the FPR**
  - If IRM equals 16.5, and average XEFORd = 0.066, then
    - »  **$FPR = (1+16.5)*(1-0.066) = 1.0881$  or 8.81%**
  - If average XEFORd increases to 0.076, the IRM = 17.9. Then
    - »  **$FPR = (1+17.9)*(1-0.076) = 1.0894$  or 8.94%**
  - **Impact of 1 pp increase in XEFORd:** While the IRM went up by 1.4 percentage points, the FPR went up by 0.13 percentage points

- Practical implication
  - Assuming that 50/50 peak for a given year is 160,000 MW
  - If reliability requirement is computed using IRM, then
$$160,000 \times 1.165 = 186,400 \text{ MW} \quad \text{and} \quad 160,000 \times 1.179 = 188,640$$
  - However, this is not how the reliability requirement gets computed. The reliability requirement is computed with the FPR:
$$160,000 \times 1.0881 = 174,096 \text{ MW} \quad \text{and} \quad 160,000 \times 1.0894 = 174,304$$
  - The delta in the reliability requirement is about 200 MW and is non-zero mostly due to rounding issues.

An increase/decrease in the IRM that is **purely** a result of an increase/decrease in the average forced outage rate of the PJM fleet **does not meaningfully increase/decrease the FPR nor the reliability requirement**

This is by design. When eCapacity was introduced, it was intentionally created as a unforced capacity (UCAP) market so that load does not have to pay for extra reserves needed to cover generators' forced outages.

- In summary, the RRS has 3 main inputs:
  - PJM's Load Model
  - PJM's Capacity Model (Outages)
  - World (Load Model and Capacity Model)
- IRM is impacted by all 3 inputs
- FPR is impacted by the PJM Load Model and the World

- As mentioned earlier, there is uncertainty in the forecasted load
- In fact, the PJM Load Forecast produces the following,

Weather Scenario	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10
<i>257 Additional Scenarios with CP1 value greater than CP1 value at Scenario C1983</i>										
C1983	163596	160540	160453	160318	159349	159155	156290	156019	154408	153574
E2002	163573	163060	161448	161376	160637	158294	158199	157616	157112	156261
J1981	163436	163339	157416	155687	153274	151047	150504	150054	149264	147379
A1994	163192	162646	160241	158207	157002	153207	150821	150085	149942	148557
D1993	163074	161996	161817	159583	159354	158821	155885	155831	152421	151976
G1994	162980	162610	161455	160351	157150	155240	151272	150532	150019	149143
H1994	162972	162600	161481	160379	157135	155224	151269	150597	150577	150208
D2010	162904	162760	162259	161645	159410	158621	157642	156469	155836	155519
H1977	162665	161650	159774	159250	157884	155762	154621	152005	151599	151382
<b>G1977</b>	<b>162618</b>	<b>161609</b>	<b>159737</b>	<b>159212</b>	<b>157844</b>	<b>155726</b>	<b>154593</b>	<b>151980</b>	<b>151531</b>	<b>151306</b>
I1989	162456	159807	159124	155210	154597	153615	152966	150881	150774	148911
I1986	162372	160432	157358	151683	150770	149439	148560	147918	147205	144748
F1986	162341	160404	151643	151117	150725	149384	148504	147875	147153	144707
H1986	162227	161860	157570	153617	150566	149302	149135	144776	144514	143956
G1986	162200	161820	157541	153577	150515	149247	149087	144739	143979	143907
J1986	162160	160579	157316	156936	150899	149224	148698	147845	147835	145387
L1990	162079	157592	150781	149059	147649	145235	144572	143426	141423	139775
C1990	162049	157430	151334	150731	149885	149023	147601	147492	145162	144523
I1998	162001	160091	155635	154953	152744	150403	149567	149130	148109	147133
<i>257 Additional Scenarios with CP1 value less than CP1 value at Scenario I1998</i>										

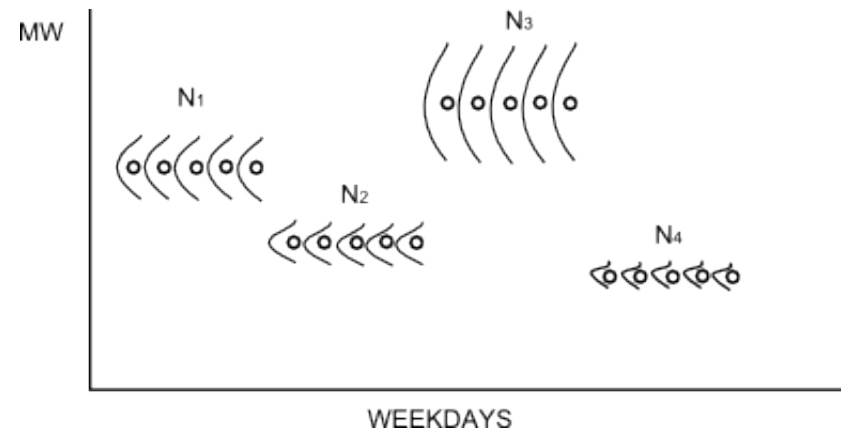
For each weather scenario, PJM determines the highest forecasted load and places the value in CP1, the second highest in CP2, and so on. Thus, the PJM Load Forecast uses a magnitude order approach (as opposed to a calendar order)

The forecasted 50/50 corresponds to the median of the CP1 values. However, there are other values, larger and smaller than the median, which altogether constitute the CP1 distribution (the 90/10 load published in the Load Forecast is derived from this distribution)

- PJM Load Forecast produces an annual peak distribution (annual peak uncertainty)
- Should this uncertainty then be used in the RRS?
  - It could be used; however
  - the PJM Load Forecast produces daily peaks whose uncertainty is modeled via discrete distributions.
  - PRISM, on the other hand, allows for uncertainty to be input via normal distributions
- Thus, we need to find a PRISM Load Model that matches the PJM Load Forecast uncertainty



- PRISM can accommodate a per-unitized daily peak load model with uncertainty introduced on a weekly basis via normal distributions (N)



- For an entire delivery year, this means inputting 52 normal distributions (N1, N2, ..., N52)

- For each of the Normal Distributions, the Most Probable Peak (MPP) of each week can be computed as

$$\text{MPP} = \text{mean} + 1.16295 \times \text{standard deviation}$$

where 1.16295 is an empirical value associated with the expected value of the maximum of a set of 5 samples drawn from a normal distribution.

Since there are 5 weekdays in a week, the MPP formula above is used to estimate the magnitude of the highest daily peak in a week.

- Currently, the Normal Distributions are obtained by looking at historical daily peak loads within a range of years
- Two options: calendar-order vs magnitude-order
- Example: PRISM Load Model for RTO from a 3 year period for 4 weeks in July

Year 1			
Week	Mean	StDev	MPP
1	121186	7579	130000
2	111958	7060	120169
3	118321	4533	123592
4	109338	7547	118115

Year 2			
Week	Mean	StDev	MPP
1	107812	4555	113110
2	108059	9544	119158
3	126411	4806	132000
4	115105	3503	119178

Year 3			
Week	Mean	StDev	MPP
1	119536	4040	124234
2	106504	2066	108907
3	113853	14744	131000
4	114156	2998	117642

- Calendar-Order

Week	Year 1		Year 2		Year 3		Final (Mixture)		Per-Unitized		MPP	Per-U MPP
	Mean	StDev	Mean	StDev	Mean	StDev	Mean	StDev	Mean	StDev		
1	121186	7579	107812	4555	119536	4040	116178	5613	0.9720	0.0483	1.0266	0.9412
2	111958	7060	108059	9544	106504	2066	108840	6957	0.9106	0.0639	0.9783	0.8969
3	118321	4533	126411	4806	113853	14744	119528	9328	1.0000	0.0780	1.0908	1.0000
4	109338	7547	115105	3503	114156	2998	112866	5106	0.9443	0.0452	0.9939	0.9112

Straightforward approach

No re-ordering of weeks is needed to compute Means and StDevs of the Final Distributions

However, final distribution indicates MPP occurs in Week 3, while it can be seen that the MPP of Year 1 occurred in Week 1

- Magnitude-Order
  - First Step: Compute Average MPPs

	Year 1	Year 2	Year 3	Avg	
Week	MPP	MPP	MPP	MPP	Rank
1	130000	113110	124234	122448	2
2	120169	119158	108907	116078	4
3	123592	132000	131000	128864	1
4	118115	119178	117642	118312	3

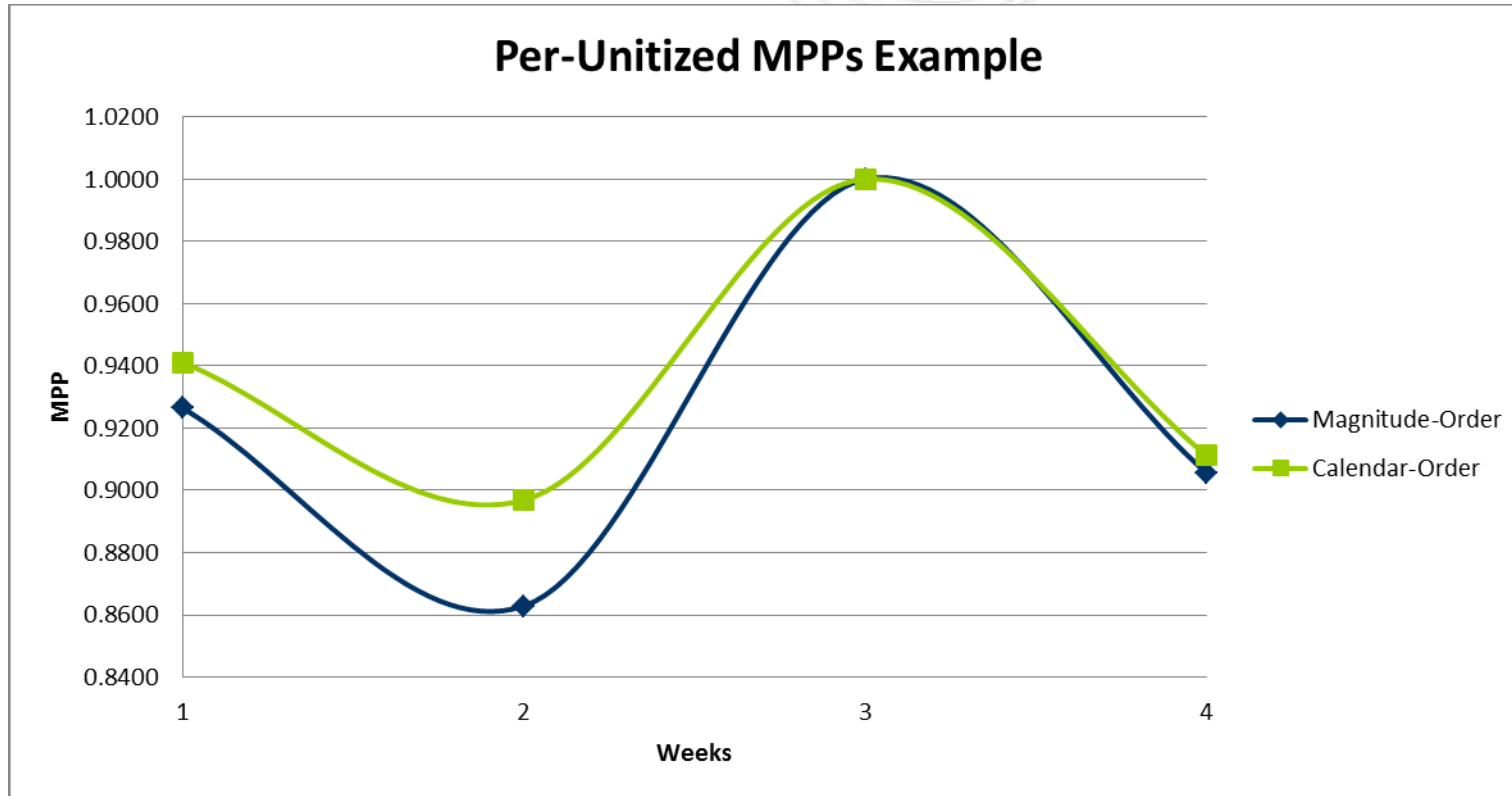
- To compute the Means and StDevs of the Final Distributions, we re-order the weeks so that the week with the highest MPP on each year is moved to week 3, the week with the second highest MPP is moved to week 1, etc

- Magnitude-Order

Week	Year 1		Year 2		Year 3		Final (Mixture)		Per-Unitized		MPP	Per-U MPP
	Mean	StDev	Mean	StDev	Mean	StDev	Mean	StDev	Mean	StDev		
1	118321	4533	115105	3503	119536	4040	117654	4047	0.9765	0.0344	1.0156	0.9265
2	109338	7547	107812	4555	106504	2066	107885	5227	0.8954	0.0485	0.9459	0.8629
3	121186	7579	126411	4806	113853	14744	120483	9965	1.0000	0.0827	1.0962	1.0000
4	111958	7060	108059	9544	114156	2998	111391	7069	0.9245	0.0635	0.9928	0.9057

Weeks on the individual years were re-ordered based on the value of the weekly Average MPP

Final distribution indicates MPP occurs in Week 3. This is also true for each of the individual years.



Calendar-Order load models tend to result in flatter load shapes

- The 52 normal distributions are used in PRISM as follows,
  - 21 Load Scenarios are considered

x	Probability
-4.2	0.000033
-3.78	0.000145
-3.36	0.000638
-2.94	0.002351
-2.52	0.007273
-2.1	0.01894
-1.68	0.0414
-1.26	0.07608
-0.84	0.11749
-0.42	0.15248
0	0.16634
0.42	0.15248
0.84	0.11749
1.26	0.07608
1.68	0.0414
2.1	0.01894
2.52	0.007273
2.94	0.002351
3.36	0.000638
3.78	0.000145
4.2	0.000033

The weekly loads examined by scenario are given by the equation:

$$\text{Load} = \text{weekly mean} + x * \text{weekly stdev}$$

with x as indicated in the table on the left. The corresponding load scenario probabilities are also in the table.



- In the Example with the 4 weeks in July using a Magnitude-Order LM.

Week	Mean	StDev	MPP
1	0.9765	0.0344	1.0156
2	0.8954	0.0485	0.9459
3	1.0000	0.0827	1.0962
4	0.9245	0.0635	0.9928

- If the Solved Load is 155,000,

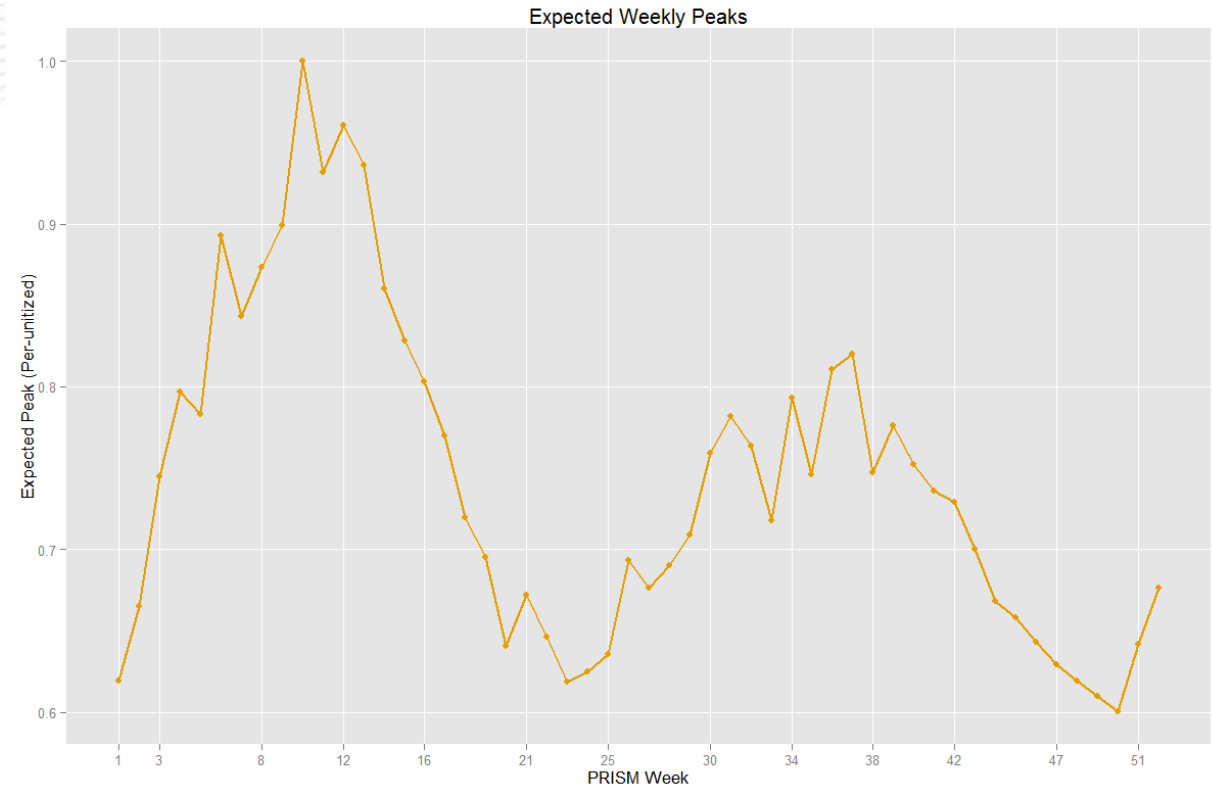
				SCEN1	SCEN2	SCEN3	SCEN4	SCEN5	SCEN6	SCEN7	SCEN8	SCEN9	SCEN10	SCEN11	SCEN12	...
				4.2	3.78	3.36	2.94	2.52	2.1	1.68	1.26	0.84	0.42	0	-0.42	...
Week	Mean	StDev	MPP	3.3E-05	0.00015	0.00064	0.00235	0.00727	0.01894	0.0414	0.07608	0.11749	0.15248	0.16634	0.15248	...
1	138078	4750	143602	158027	156032	154037	152042	150047	148053	146058	144063	142068	140073	138078	136083	...
2	126613	6135	133748	152378	149802	147225	144649	142072	139496	136919	134343	131766	129190	126613	124037	...
3	141399	11695	155000	190519	185607	180695	175783	170871	165959	161047	156135	151223	146311	141399	136487	...
4	130728	8296	140376	165572	162088	158603	155119	151635	148150	144666	141181	137697	134213	130728	127244	...

It can be seen that the peak in every scenario occurs in week 3. This is consistent with the underlying data used to construct the load model (since the load model was constructed by magnitude-ordering the MPPs)

- In addition, PRISM allows for the inclusion of
  - Forecasted monthly shape: relationship between monthly peaks in per unitized terms (from PJM's Load Forecast)
  - Forecast error factor (FEF): accounts for additional load uncertainty via increasing standard deviation in weekly normal distributions (currently at 0.01)

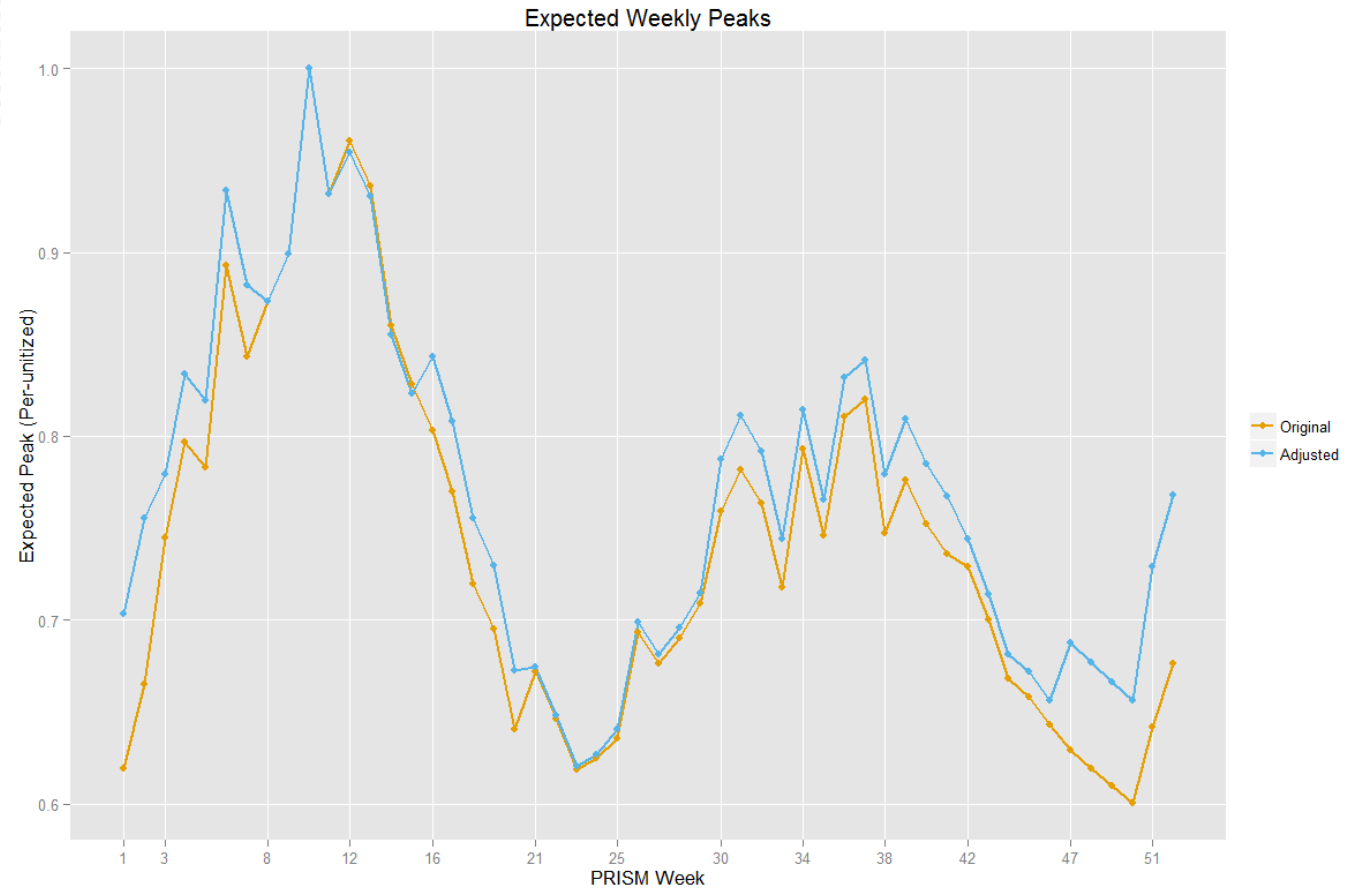
## Initial PRISM Load Model

ARC Week	Mean	StDev	Month	Expected Peak	ARC Week	Mean	StDev	Month	Expected Peak
1	0.653806	0.029374	May	0.619268	25	0.66919	0.03173	November	0.635522
2	0.689158	0.046401	May	0.665251	26	0.696	0.07558	November	0.693484
3	0.76381	0.055386	June	0.744623	27	0.70095	0.04589	November	0.676255
4	0.8093	0.064312	June	0.796665	28	0.71963	0.04051	November	0.690145
5	0.803414	0.055205	June	0.783077	29	0.74095	0.03876	November	0.709213
6	0.896342	0.075034	June	0.892585	30	0.78566	0.04732	December	0.759176
7	0.877478	0.042145	June	0.843061	31	0.80762	0.04913	December	0.781953
8	0.907979	0.043372	July	0.873553	32	0.775	0.06492	December	0.763404
9	0.917895	0.060105	July	0.899452	33	0.7493	0.03916	December	0.717534
10	1	0.078969	July	1	34	0.81002	0.05933	January	0.793068
11	0.939737	0.070929	July	0.931689	35	0.75824	0.06348	January	0.745735
12	0.976441	0.063557	August	0.960411	36	0.81943	0.06886	January	0.810616
13	0.941334	0.07372	August	0.936071	37	0.82817	0.0696	January	0.819907
14	0.880201	0.05786	August	0.86041	38	0.76145	0.06156	February	0.747333
15	0.831368	0.075286	August	0.828106	39	0.7936	0.05848	February	0.776277
16	0.818871	0.061225	September	0.803394	40	0.778	0.04822	February	0.752519
17	0.765412	0.084216	September	0.769689	41	0.76479	0.04326	February	0.7357
18	0.735947	0.058343	September	0.719778	42	0.75175	0.0507	March	0.729117
19	0.717306	0.0499	September	0.695096	43	0.72764	0.04346	March	0.700124
20	0.666088	0.042799	September	0.640427	44	0.6999	0.03605	March	0.667905
21	0.689096	0.055831	October	0.672112	45	0.68427	0.04344	March	0.658372
22	0.67393	0.040311	October	0.64618	46	0.67344	0.03684	March	0.643215
23	0.657351	0.023184	October	0.618292	47	0.65681	0.03972	April	0.629352
24	0.659539	0.02966	October	0.6249	48	0.65115	0.03294	April	0.619229
					49	0.64267	0.03083	April	0.60972
					50	0.63765	0.02424	April	0.600474
					51	0.66777	0.04235	May	0.641725
					52	0.67763	0.07675	May	0.67603



Initial PRISM Load Model adjusted for the Forecasted Monthly Shape

Month	Per-Unitized Peak
Jun	0.933919
Jul	1.000000
Aug	0.954611
Sep	0.843418
Oct	0.674150
Nov	0.714804
Dec	0.811220
Jan	0.841647
Feb	0.809492
Mar	0.743823
Apr	0.687919
May	0.767775



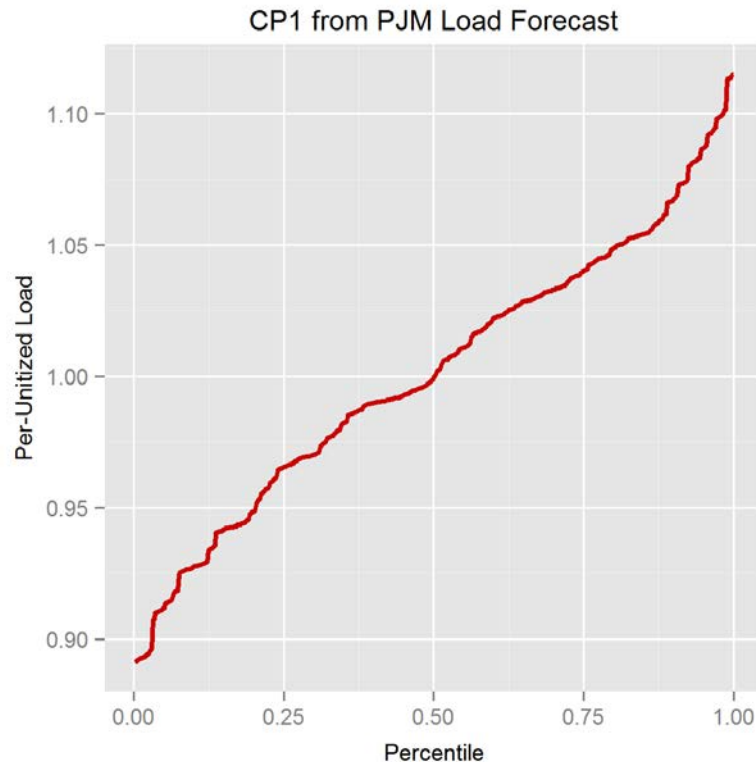
## Impact of the FEF on the load model

ARC Week	Mean	StDev	Month	Expected Peak	New StDev
34	0.81002	0.05933	January	0.793068	0.06016
35	0.75824	0.06348	January	0.745735	0.06427
36	0.81943	0.06886	January	0.810616	0.06959
37	0.82817	0.0696	January	0.819907	0.07032
38	0.76145	0.06156	February	0.747333	0.06237
39	0.7936	0.05848	February	0.776277	0.05933
40	0.778	0.04822	February	0.752519	0.04925
41	0.76479	0.04326	February	0.7357	0.04440
42	0.75175	0.0507	March	0.729117	0.05168
43	0.72764	0.04346	March	0.700124	0.04460
44	0.6999	0.03605	March	0.667905	0.03741
45	0.68427	0.04344	March	0.658372	0.04457
46	0.67344	0.03684	March	0.643215	0.03817

FEF increases the Standard Deviation of each week.  
 FEF does not increase the expected peaks, only the uncertainty around them

- To determine the load model that will be used in the RRS, a series of load model candidates (time-periods) are considered,
  - Time-periods must be at least 7 years long
  - Each LM undergoes the monthly shape and FEF adjustments
- In the 2009 July PC meeting, a criteria to select a LM for the RRS was approved. Its main tenets
  - LM must match uncertainty of CP1 distribution in PJM Load Forecast
  - PJM-World load diversity must be evaluated

- CP1 Distribution



Cumulative Distribution Function of PJM's Annual Peak

Captures weather uncertainty only

Distribution is discrete and in 2015 has 533 points (weather scenarios)

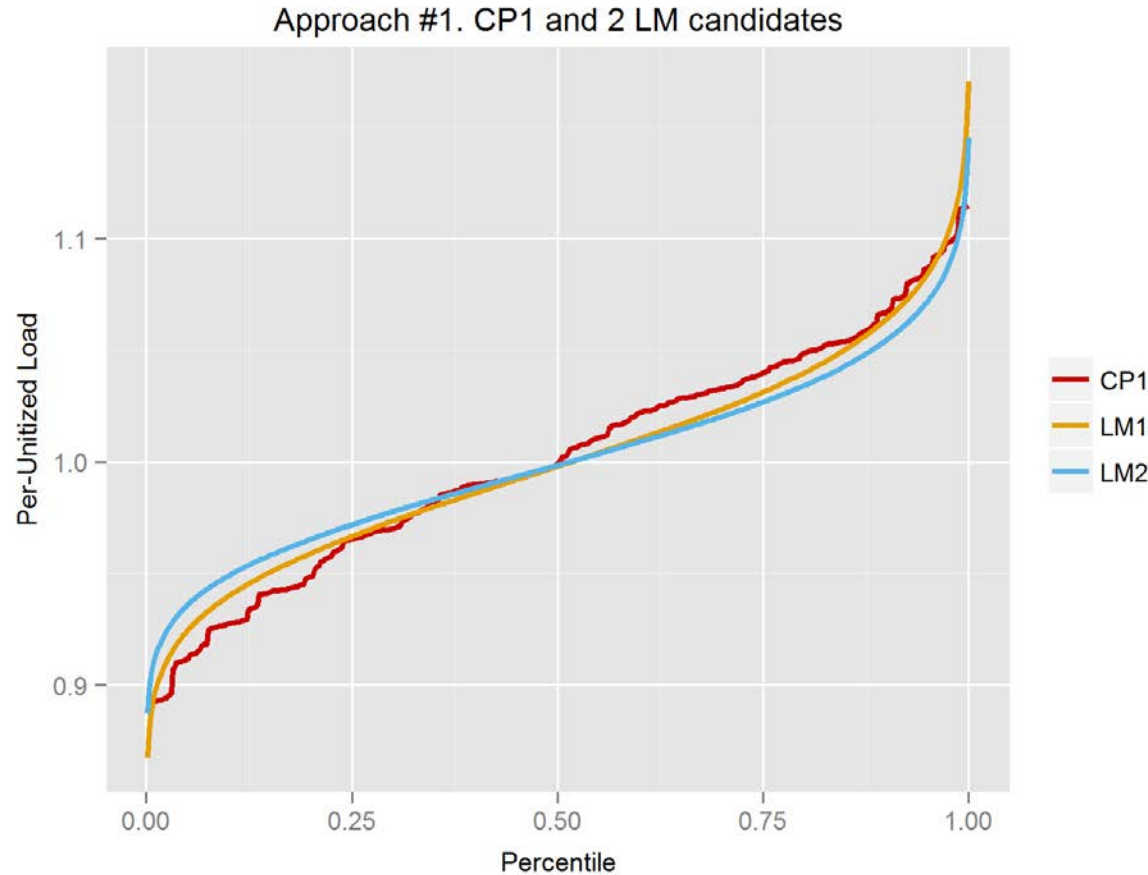
- We want to find a LM that best matches the CP1
- Since LM candidates do not provide a probabilistic distribution of daily peaks (they have daily distributions by week), we need to recreate the CP1 distribution with each of the LM candidates
- In calendar-order LMs, CP1 can occur in weeks other than the LM's peak week
- In magnitude-order LMs, CP1 can occur only in the LM's peak week
- PJM currently uses magnitude-order LMs



- We consider two approaches to recreate the CP1 distribution with LM candidates.
- Approach #1:
  - In a magnitude-order LM, we sample 5 times from the normal distribution with the highest MPP and write down the maximum value. We then repeat this 533 times (or the number of scenarios in the CP1 distribution)
  - We sort the 533 values from smallest to highest
  - The above steps are replicated 500 times.
  - We then average the 500 smallest values, then the 500 second-smallest values, and so on. We will end up with 533 values.
  - In a calendar-order LM, we sample from the 52 weeks 5 times (not only from the week with the highest MPP) writing down the highest value. We then repeat this 533 times. The rest of the steps are the same.

- Approach 1

Scenario	CP1	LM1	LM2
1	0.891345	0.867464	0.887474
2	0.891498	0.879606	0.897804
3	0.891993	0.886200	0.903414
4	0.892403	0.890848	0.907369
5	0.892594	0.894480	0.910459
6	0.892860	0.897437	0.912975
7	0.892949	0.899936	0.915100
8	0.893093	0.902212	0.917037
9	0.893340	0.904258	0.918778
10	0.893433	0.906061	0.920312
...	...	...	...
267	1.000000	0.998372	0.998850
...	...	...	...
524	1.099924	1.111693	1.095263
525	1.101255	1.114470	1.097625
526	1.101519	1.117447	1.100158
527	1.113085	1.120820	1.103028
528	1.113343	1.124303	1.105991
529	1.113343	1.128578	1.109628
530	1.113574	1.134486	1.114655
531	1.114008	1.141970	1.121022
532	1.114646	1.153369	1.130719
533	1.114879	1.170412	1.145220



We focus on the top 30 percentile (above 0.70).

We measure the absolute error point by point in the percentile between CP1 and each LM candidate.

We sum the absolute errors.

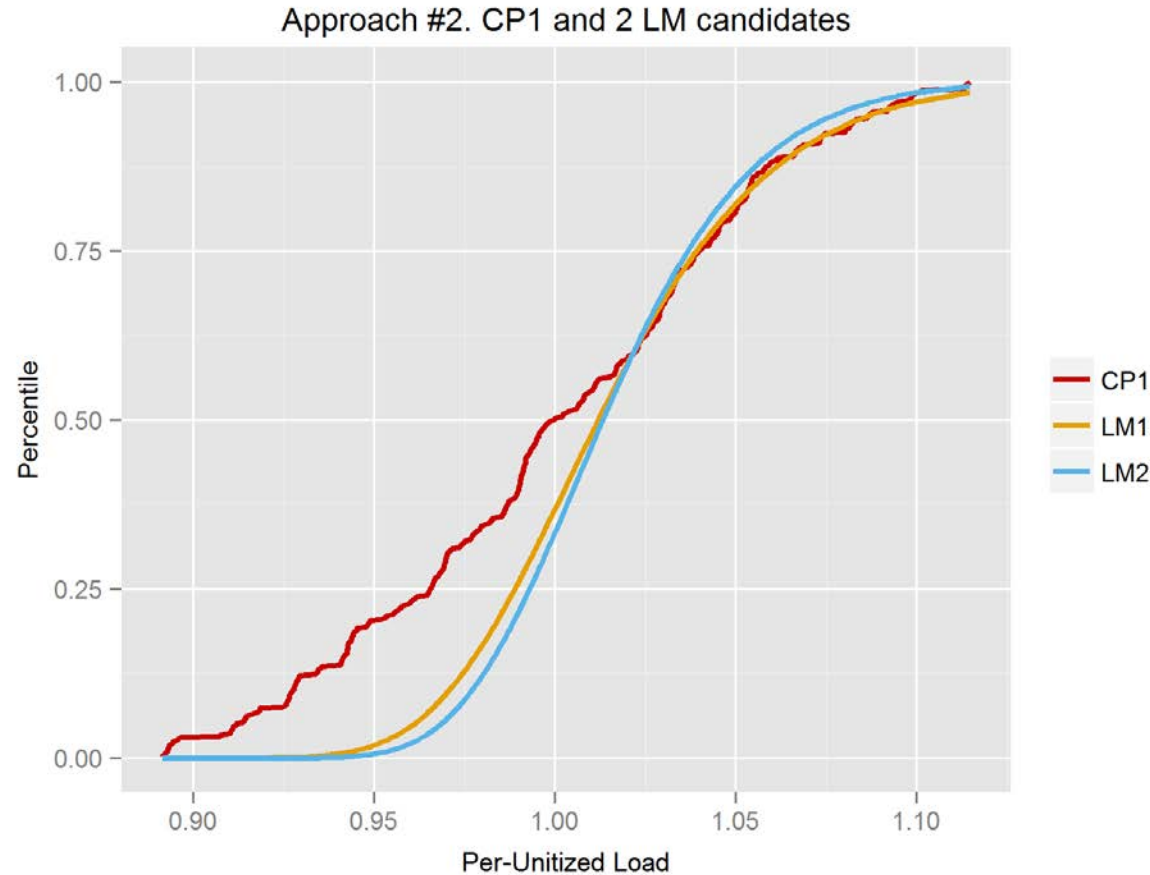
Best LM is the one with the smallest total error.

- Approach #2:

- In the CP1 distribution, it is assumed that each scenario is equally likely (i.e., each of the 533 values has the same probability).
- In a magnitude-order LM, we compute the probability of not exceeding each of the 533 CP1 values in the week with the highest MPP. We do not need to compute this probability for the remaining 51 weeks, since we know that if load is not exceeded in the peak week, it cannot be exceeded in the rest of the weeks.
- This can be done by using the following Excel formula
  - $\text{NORMDIST}(\text{CP1 value}, \text{mean}, \text{stdev}, \text{TRUE})^5$
- In a calendar-order LM, we compute the probability of not exceeding each of the 533 CP1 values in each of the weeks. We then multiply these 52 probabilities to compute the probability of not exceeding each of the values in the entire year

- Approach 2

Scenario	CDF CP1	CDF LM1	CDF LM2
1	0.001876	0.000000	0.000000
2	0.003752	0.000000	0.000000
3	0.005629	0.000000	0.000000
4	0.007505	0.000000	0.000000
5	0.009381	0.000000	0.000000
6	0.011257	0.000000	0.000000
7	0.013133	0.000000	0.000000
8	0.015009	0.000000	0.000000
9	0.016886	0.000000	0.000000
10	0.018762	0.000000	0.000000
...	...	...	...
267	0.500938	0.368294	0.333667
...	...	...	...
524	0.983114	0.969701	0.983498
525	0.984991	0.971275	0.984583
526	0.986867	0.971577	0.984790
527	0.988743	0.982333	0.991722
528	0.990619	0.982524	0.991836
529	0.992495	0.982524	0.991836
530	0.994371	0.982693	0.991937
531	0.996248	0.983007	0.992125
532	0.998124	0.983459	0.992392
533	1.000000	0.983621	0.992488



We focus on the top 30 percentile (above 0.70).

We measure the absolute error point by point in the percentile between the CP1 CDF and each LM candidate's CDF.

We sum the absolute errors.

Best LM is the one with the smallest total error.

- PJM-World Load Diversity
  - PRISM requires a LM as input for the World region
  - After running Approaches #1 and #2, we make a shortlist of PJM LMs (and associated time-periods) that have low absolute errors
  - Using the time-periods above, we compute World LMs. These World LMs undergo the monthly shape and FEF adjustments.
  - The World monthly shape is computed based on World peak load data since 1998.
  - We then compare PJM and World MPP's for the time-periods shortlisted to make sure that the regions do not peak on the same week.
  - This check is performed since historical load data so far shows that PJM and World are not likely to peak on the same week.

- PJM-World Load Diversity

Month	PRISM Week	PJM MPP	World MPP
June	5	0.8345	0.8736
June	6	0.9005	0.9185
June	7	0.9339	0.9590
July	8	0.8736	0.9267
July	9	0.9338	0.9651
July	10	1.0000	0.9965
July	11	0.9614	0.9852
August	12	0.9546	1.0000
August	13	0.8892	0.9763
August	14	0.8357	0.8959
August	15	0.7920	0.8714



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- In general, if a LM has the smallest absolute error in both Approaches #1 and #2 and passes the PJM-World Load Diversity test, then that LM will be selected to run the RRS.
- If two or more LMs have very close absolute errors in both Approaches and they all pass the PJM-World Load Diversity test, then LM vintage serves as tie-breaker
  - More recent LMs are favored
- We tend to assign more weight to the results from Approach 2 since it does not rely on random number generation