

# STATEWIDE EVALUATION TEAM

## UPDATE ON DEMAND RESPONSE STUDY

*Pennsylvania Public Utility Commission  
Demand Response Stakeholders Meeting  
02/21/2013*



GDS Associates, Inc.  
Engineers and Consultants



# INTRODUCTION FROM TUS STAFF

- The final version of the SWE study will be completed in April 2013 and made publicly available
- A summary of key findings to date are included in this presentation
- Outline of remaining tasks
- Question and answer session will follow the slide presentation

# PRESENTERS

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# OBJECTIVES OF THE DR STUDY

Overarching Objective: Provide the Commission with information that will inform their decision on whether or not to include DR programs in future phases of Act 129 by quantifying the ability of DR programs to reduce retail electric rates.

1. Examine the structure of current DR requirements and evaluate alternatives to the Top 100 hours criteria
2. Research DR structures and financial mechanisms in other jurisdictions
3. What impact do Act 129 programs have on reducing retail electric rates over and above existing PJM programs?
4. Develop a high level program design with recommendations to the Commission for future DR programs

# CURRENT STRUCTURE

- Act 129 mandates a 4.5% peak *demand reduction* over the top 100 hours of the summer of 2012
- Demand Reduction – can be achieved by DR programs or through energy efficiency programs because most EE measures reduce power consumption during periods of peak demand
- Demand Response – achieved through dispatched or price driven resources that reduce peak demand temporarily and are not designed to produce a net energy savings.
- Act 129 does not have a stand-alone demand response target

# CURRENT STRUCTURE

- Gross verified energy and demand reductions from energy efficiency programs through PY3

EDC	Energy Reduction	Demand Reduction
Duquesne	2.19%	1.35%
PECO	2.73%	2.34%
PPL	2.61%	2.16%
Met-Ed	2.04%	1.49%
Penelec	2.16%	1.58%
Penn Power	2.25%	1.31%
West Penn Power	1.89%	1.35%
<b>Average</b>	<b>2.27%</b>	<b>1.65%</b>

# CURRENT STRUCTURE

- EDCs are on pace to achieve a 2.0%-2.5% demand reduction through the coincident peak demand reduction from EE programs during Phase I of Act 129
- Effectively creates a 2.0%-2.5% *demand response* goal to be achieved in a single summer
- SWE research found this effective target to be aggressive when compared to DR goals in other jurisdictions

# SUMMARY OF GOALS IN VARIOUS STATES

- Other jurisdictions reviewed have DR goals less than 1% per year

State	Demand Reduction Goal	Demand Response Goal	Goal Amount	Goal Year	Average Annual Reduction
CA	Yes	Yes	*5%	2020	N/A
IL	No	Yes	1.10%	2018	0.10%
OH	Yes	No	7%	2018	0.75%
NY – Con Edison	No	Yes	N/A	N/A	N/A
PA	Yes	No	4.50%	2012	4.50%
WI	Yes	No	1.50%	2014	0.25%

\* California's 5% goal is for price responsive DR

- Financial penalties for non-compliance require EDCs to dispatch DR even when it may not be cost effective or needed for reliability



# TOP 100 HOURS PROTOCOL

- Basing demand reduction targets on the highest 100 hours of peak demand is unique to Pennsylvania
- There are predictive difficulties associated with EDCs determining which hours will be top 100 hours
- Weather uncertainties - Summer 2012 was very warm during June and July and then mild during August and September
- EDCs were expecting top 100 hours in August and September that never arrived.

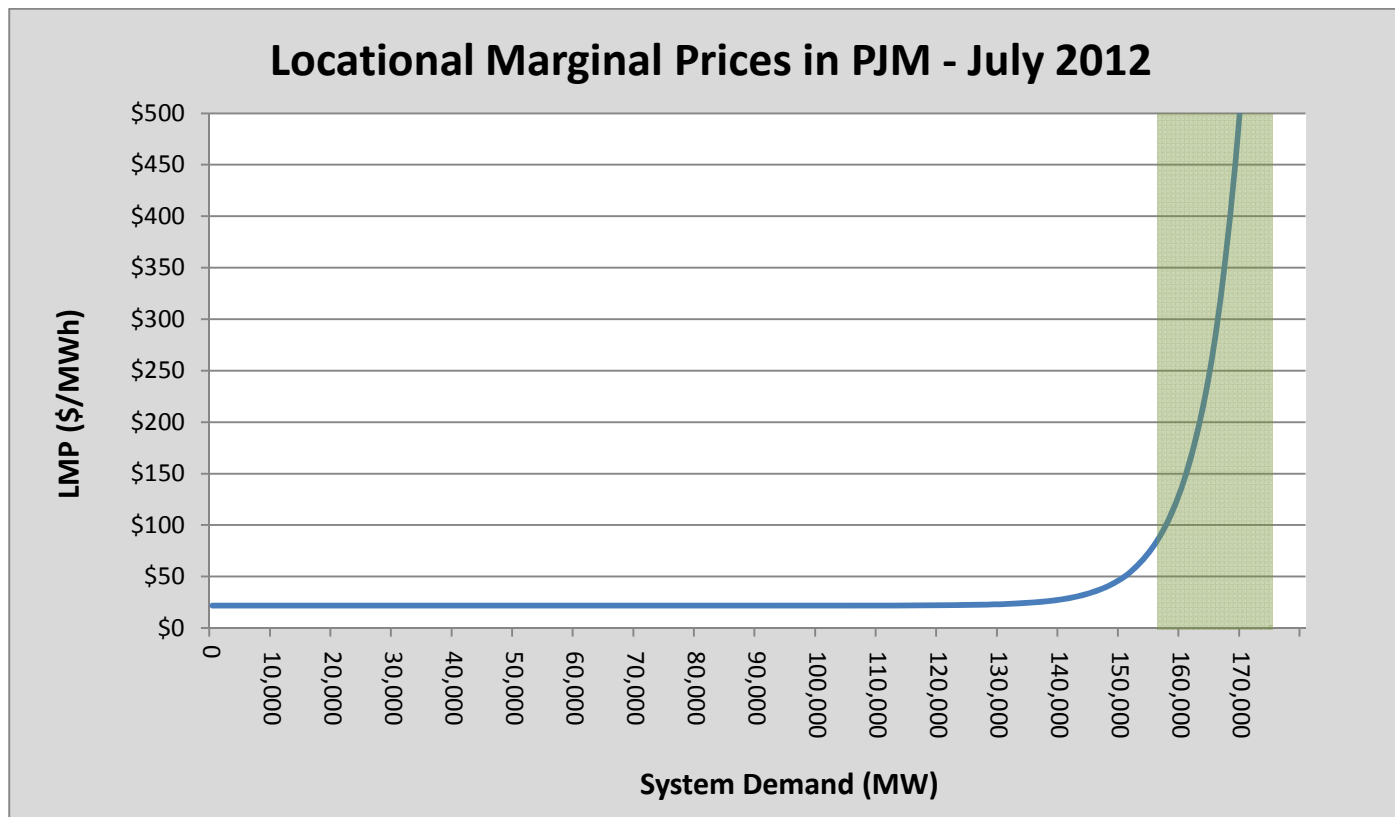
# TOP 100 HOURS PROTOCOL

- This structure does not adequately capture the complexities of the DR market and results in DR resources being dispatched when it is not cost-effective to do so because the grid is not constrained
- DR resources valued as a surrogate for capacity are typically called over a much smaller subset of hours
- SWE examined market energy prices (LMPs) in Pennsylvania from 2007 to 2012 during the top 100 hours to understand system constraints

# RELATIONSHIP BETWEEN LMP AND LOAD

- PJM calculates monthly supply curves as part of the Net Benefits Test
  - Used to determine the threshold at which DR resources will be compensated at full LMP to balance supply and demand
  - Threshold is usually very low (~ \$25).
- This threshold is not applicable to Act 129 because EDCs are forced to pay resources considerably more than LMP to ensure targets are met
- Mathematical relationship is informative for examining constraint

# RELATIONSHIP BETWEEN LMP AND LOAD



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# RELATIONSHIP BETWEEN LMP AND LOAD

- The supply curve remains flat while low-cost generation offers are available
- The “green zone” where LMPs begin to increase sharply in response to increases in system load indicates that the grid is constrained and only high-cost or distant generation resources are available
- DR resources are generally deemed necessary and cost-effective when called in this “green zone”
- Shifting system load downward during these periods of price volatility will have a positive economic effect

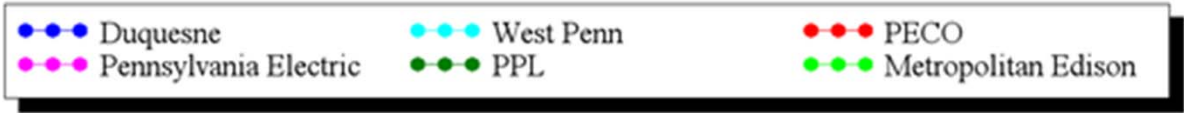
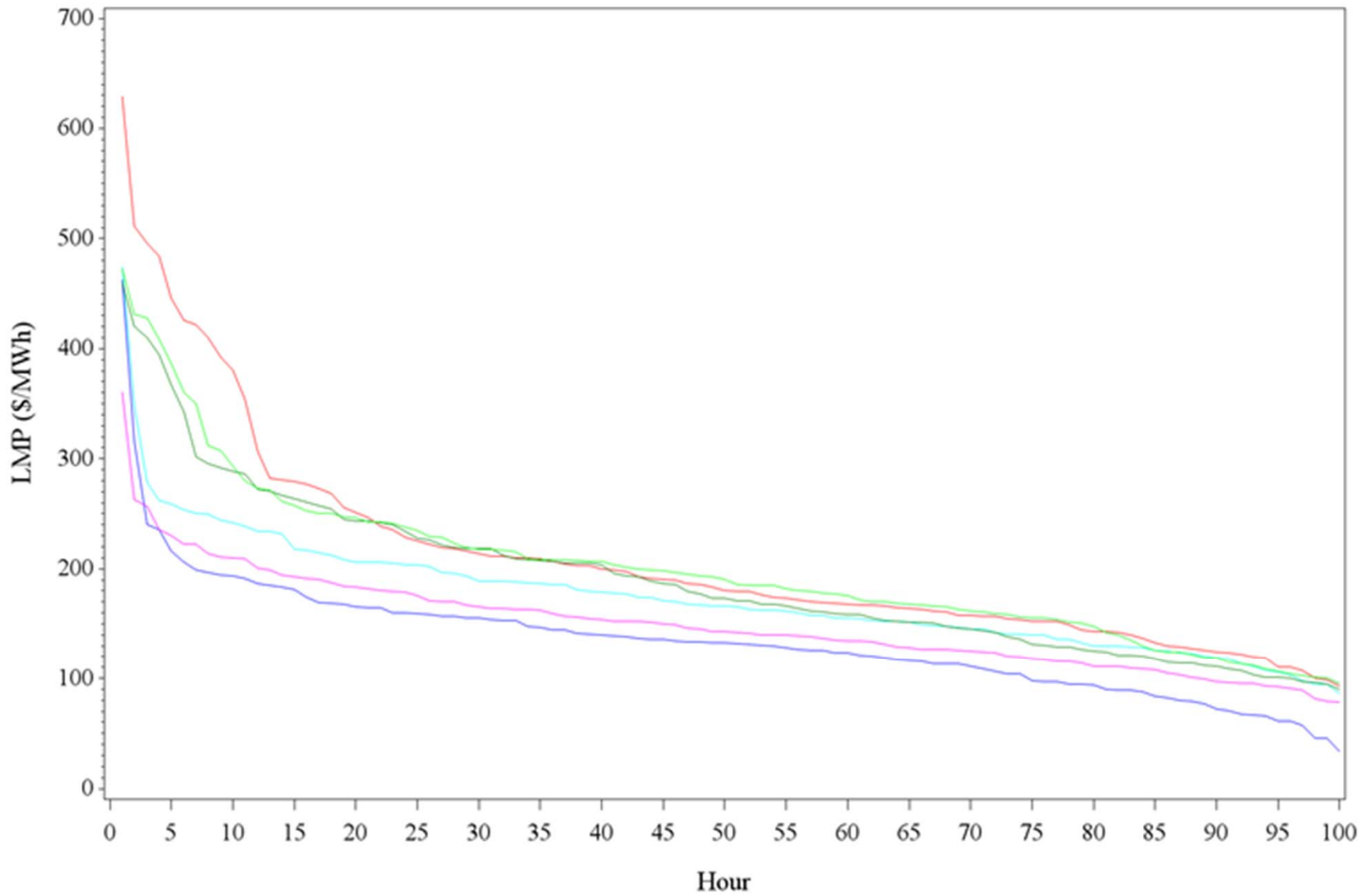
# HISTORICAL FINDINGS IN PENNSYLVANIA

- The need for DR is not consistent across the state. Energy and capacity prices in the eastern part of the state are consistently higher than those in the western part of the state.
- There is significant variation in energy prices within the top 100 hours of a summer performance period for each EDC.
- The need for DR is highly correlated with weather patterns and will be much lower in a cool summer than a hot summer for a given EDC

# GEOGRAPHIC VARIANCE

- Pennsylvania spans both the Mid-Atlantic and West market regions of PJM
- Capacity pricing is consistently higher for the EDCs in the Mid-Atlantic market region
- SWE performed a statistical test comparing the top 100 hour LMPs between EDCs for each year from 2007 to 2012
  - Findings indicate a statistically significant difference between EDCs for each year other than 2012.
  - LMPs from the eastern EDCs were significantly higher than the western EDCs
- Lack of differences between EDCs are probably an outlier. SWE expects east-west differences to continue

# LMP Comparison 2008





# GEOGRAPHIC VARIANCE

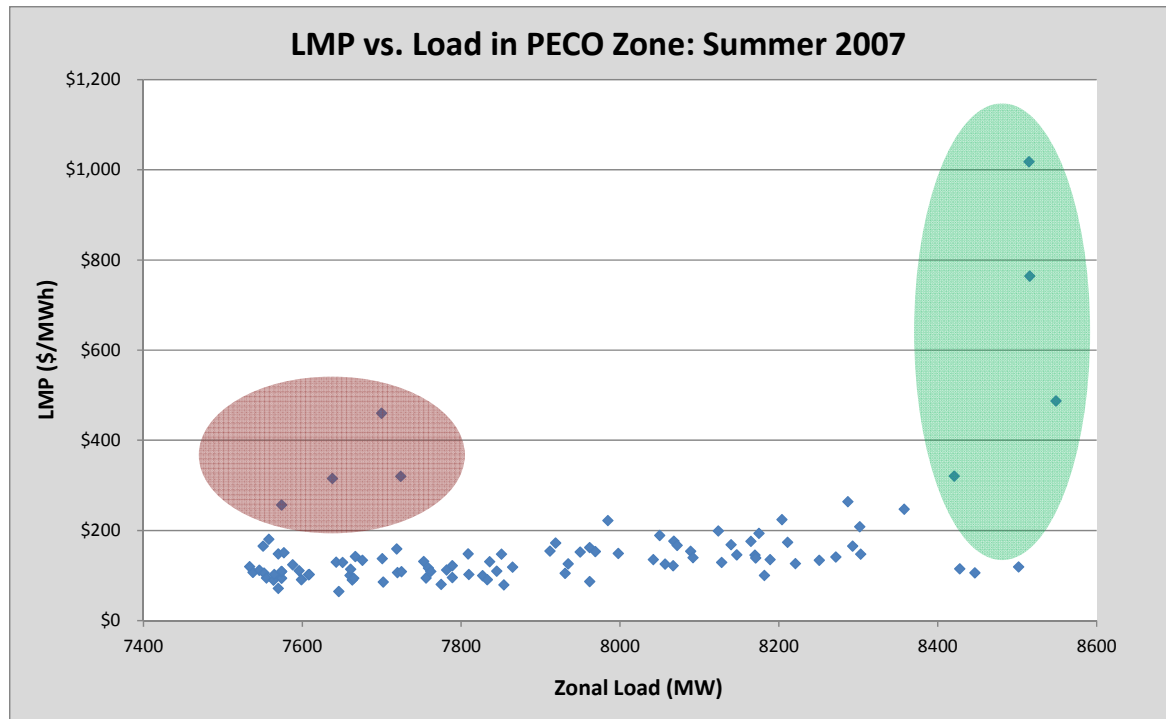
- Acquisition costs for DR resources are relatively stable between EDCs
- Market differences play a significant role in the cost effectiveness of DR programs
- Decisions to include DR targets in future phases of Act 129 should be made at the EDC level rather than on a statewide basis
  - *Example* - The NYPSC determined that DR programs are most practical and economical in the 5 NYC Boroughs and only established DR goals in the Con Edison service territory

# VARIANCE WITHIN THE TOP 100 HOURS

- Phase I TRC Order requires EDCs to average demand impacts across the top 100 hours of system demand. Average reduction is multiplied by an avoided cost of capacity (\$ per kW/year) to monetize benefits
  - Implies that reductions in each of the 100 hours are valued equally
- SWE analysis finds significant variation in LMP within the top 100 hours for any given year
- Calling events during a smaller subset of hours when pricing is elevated and volatile will increase the cost effectiveness of programs

# VARIANCE WITHIN THE TOP 100 HOURS

- The need for DR is correlated to both low supply (red zone) and high demand (green zone)



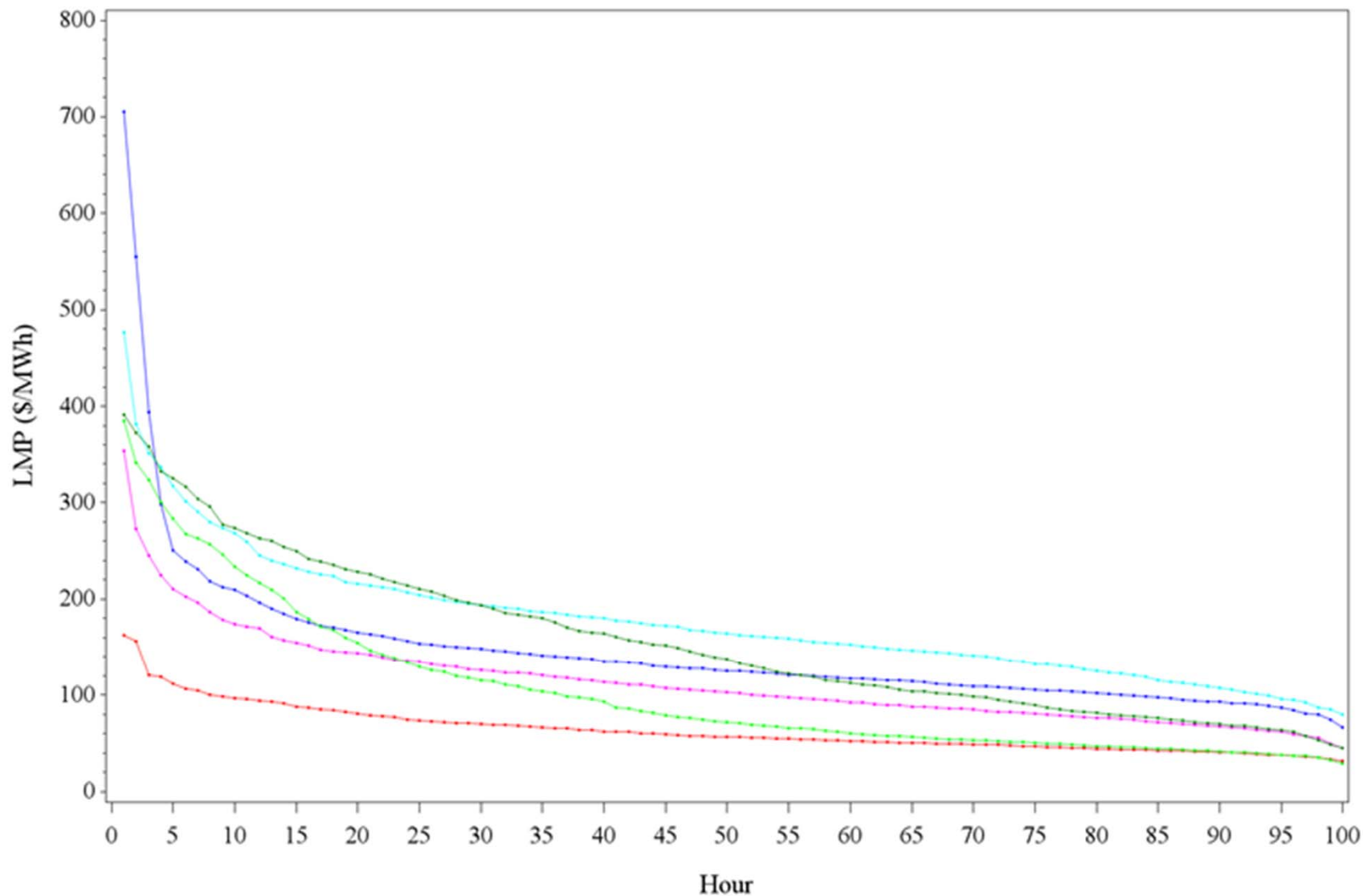
# VARIANCE WITHIN THE TOP 100 HOURS

- SWE believes there were at least 50 of the top 100 hours where the grid was not significantly constrained. Reasonably priced generation offers would have been a better option to balance supply and demand in the state
- If DR goals are established for Phase III of Act 129 it will be vital to determine how benefits will be determined
- The current approach is sound provided the number of performance hours is reduced to correspond with the “green zone” and “red zone”
- This would bring Pennsylvania more in line with how capacity is valued in other jurisdictions

# VARIANCE BETWEEN YEARS

- Estimating a fixed number of hours over which to measure DR performance is challenging because the need for DR is not consistent from year to year
- Capacity prices vary significantly by year. The 2012/2013 delivery year was particularly low which will hurt the TRC ratios of DR programs from Phase I
- Weather and economic conditions play a dramatic role in DR and are difficult to predict in advance

### Average LMPs by Year 2007-2012



# VARIANCE BETWEEN YEARS

- 2009 was an abnormally cool summer during an economic recession. DR resources will be necessary or cost effective during very few hours during this type of summer
- In a hot summer like 2008 or 2011, there may have been 20 or 30 hours when DR would have relieved grid constraint and been cost effective
- DR performance periods should be flexible and determined by load or market conditions in place that year

# INTERIM FINDINGS AND RECOMMENDATIONS

- Act 129 demand reductions are more aggressive than other states
- Act 129 does not have a true DR goal
- Penalties for non-compliance make EDCs more likely to rely on dispatchable DR programs. Lower goals and penalties may promote more pricing-based DR programs to stimulate peak demand reduction.
- All states examined treat DR incentive payments as a proxy for the participant cost in TRC modeling. California protocol only includes 75%.
- California and Illinois treat ISO payments as a benefit in their respective TRC tests. This approach would have a positive impact on the cost effectiveness of DLC programs



# INTERIM FINDINGS AND RECOMMENDATIONS

- Capacity prices play a significant role in the cost effectiveness of DR and vary from year to year. The SWE recommends the Commission pay careful attention to the results of the PJM Base Residual Auction for the 2016/2017 delivery year when considering Phase III demand reduction or demand response goals
- Any compliance metric should be the average load reduction observed over a subset of hours during which DR is likely to produce a cost effective alternative to generation rather than a fixed number of hours

# ALTERNATIVE STRUCTURES

Two possible mechanisms for determining the DR performance period

- Consider any hour during which the real-time LMP for an EDC zone is above a certain threshold to be a DR compliance hour. This structure accounts for both the “green zone” and “red zone” but has some of the same predictive difficulties associated with the top 100 hours
- Compare day-ahead forecasts with EDC peak load forecasts. If the day-ahead forecast is above a certain threshold (97%-99%) DR resources should be called for a logical subset of hours. This method has low uncertainty but does not account for the “red zone”

# REMAINING TASKS

- Scoring of attribution surveys conducted by EDC evaluators. Output is two Incremental Benefits Ratios (PJM Econ, PJM Emergency) used to discount Act 129 benefits when overlapping participation occurs between Act 129 and PJM
- Benefit Cost modeling. Based on Summer 2012 impacts, program delivery costs and avoided cost values.
- Benefit Cost sensitivity analysis. Consider alternative TRC guidelines
  - CA protocol of including 75% of incentives in costs
  - Capacity costs which may be in place during Phase III
  - Measure life > 1 year for DLC switches
  - Consider Phase I DLC equipment and installation costs “sunk”
  - Avoided T&D costs
  - “kW under control” instead of average over top 100