

# California's Demand Response Load Impact Protocols

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# California's DR load impact protocols are a work in progress

- Under OIR-07-01-041, the three IOUs were ordered to produce a “comprehensive set of protocols for estimating the load impacts of DR resources”
- The IOUs submitted a straw proposal and a revised straw proposal based on stakeholder input
  - *Joint IOU Revised Straw Proposal on Load Impact Estimation and Demand Response, 9/10/07*
- The CPUC/CEC issues a Joint Staff Report suggesting some relatively minor additions/changes to the IOU Straw Proposal
  - *Staff Report Addressing Load Impact Estimation Protocols, 10/12/07*
- A final decision will be issued around late February
- Today's presentation summarizes the revised SP

# There are many potential uses for DR LI estimates

- Forecasting for long term resource planning
- Ex post impact evaluation
- Monthly reporting of results toward DR goals
- Forecasting impacts for resource adequacy determination
- Forecasting impacts for operational dispatch by the CAISO
- Estimation for customer settlement in conjunction with DR resource deployment

***As directed by the CPUC, these protocols focus on load impact estimation for long term resource planning. The protocols also cover ex post evaluation as it is the precursor to ex ante estimation.***

# The protocols focus on what should be done, not on how to do the job

- Establish minimum requirements for LI estimation for DR resources
  - What must be considered prior to conducting the evaluation?
  - What must be calculated, including uncertainty adjusted, hourly load impacts for selected day types?
  - What must be reported, including selected statistics that allow reviewers to assess the validity of the analysis that underlies the estimates?
- The protocol document also provides guidance concerning issues that must be addressed and methods that can be used

# DR resources can be categorized by whether or not they are tied to a callable event

<b>Event Based Pricing</b>	Prices that customers can respond to based on an event. Includes critical peak pricing, peak time rebates, demand bidding.
<b>Direct Load Control</b>	Load is controlled at a customer's site for a called event period through a signal sent by an operator. Options include air conditioning cycling and auto-DR.
<b>Callable DR</b>	Notification is sent to a customer who then initiates actions to reduce loads, often by an amount agreed to in a contract.
<b>Non-Event Based Pricing</b>	Prices that vary by time of day but are not based on a called event. Options include TOU and RTP.
<b>Scheduled DR</b>	Loads that can be scheduled to be reduced at a regular time (e.g., each Monday between noon and 5 pm).
<b>Permanent Load Shifting</b>	Examples of load shifting technologies include ice storage air conditioning, timers and energy management systems.

# Impact estimates are to be reported for the following day types

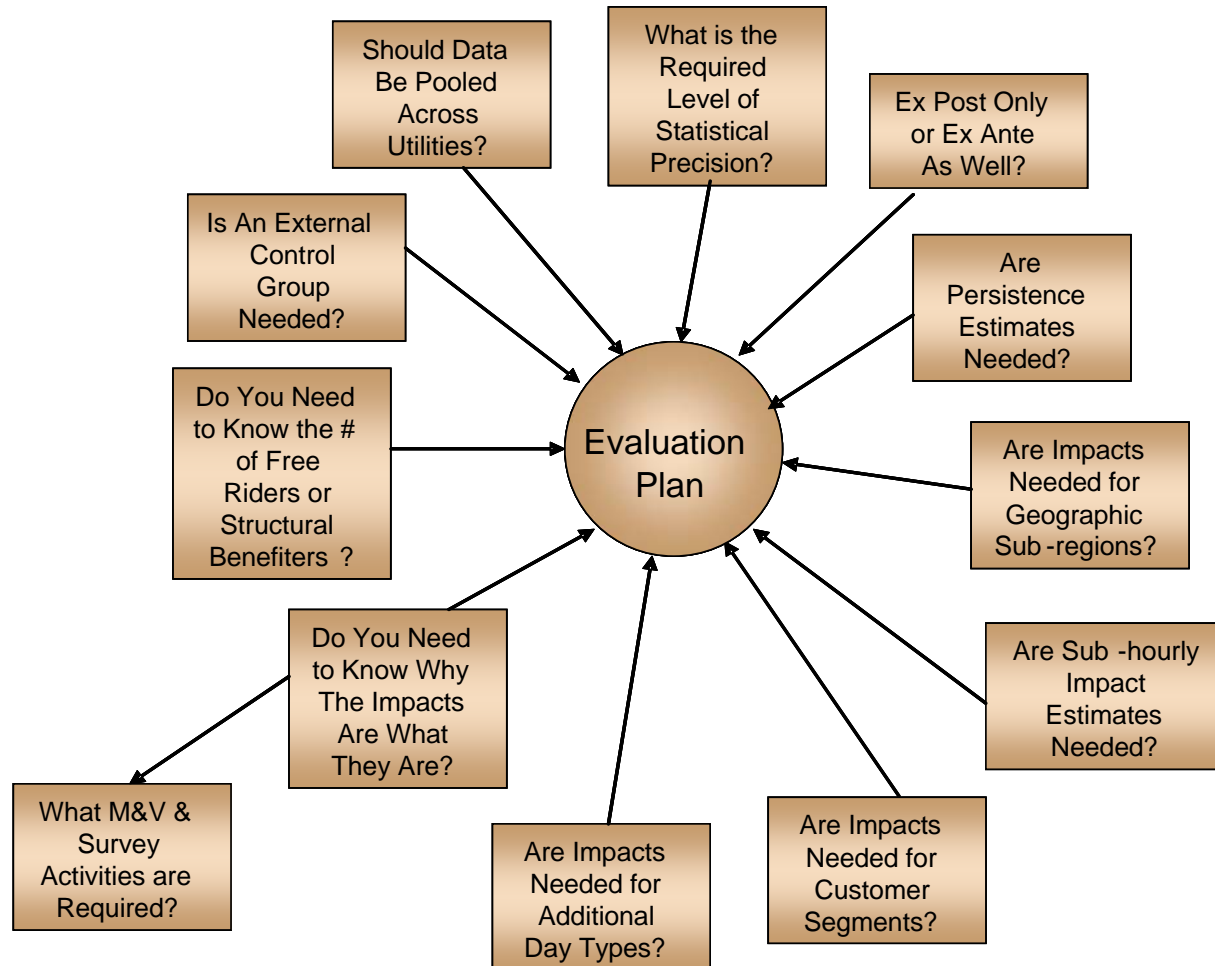
Day Types	Event Based Resources			Non-Event Based Resources		
	Event Driven Pricing	Direct Load Control	Callable DR	Non-event Driven Pricing	Scheduled DR	Permanent Load Reductions
Ex Post Day Types						
Each Event Day	X	X	X			
Average Event Day	X	X	X			
Average Weekday Each Month				X	X	X
Monthly System Peak Day				X	X	X
Ex Ante Day Types						
Typical Event Day	X	X	X			
Average Weekday Each Month (1-in-2 Weather Year)				X	X	X
Monthly System Peak Day (1-in-2 Weather Year)				X	X	X

The Staff Report recommended including estimates for a 1-in-10 weather year and for the top 100 LOLE hours and top 100 wholesale price hours.

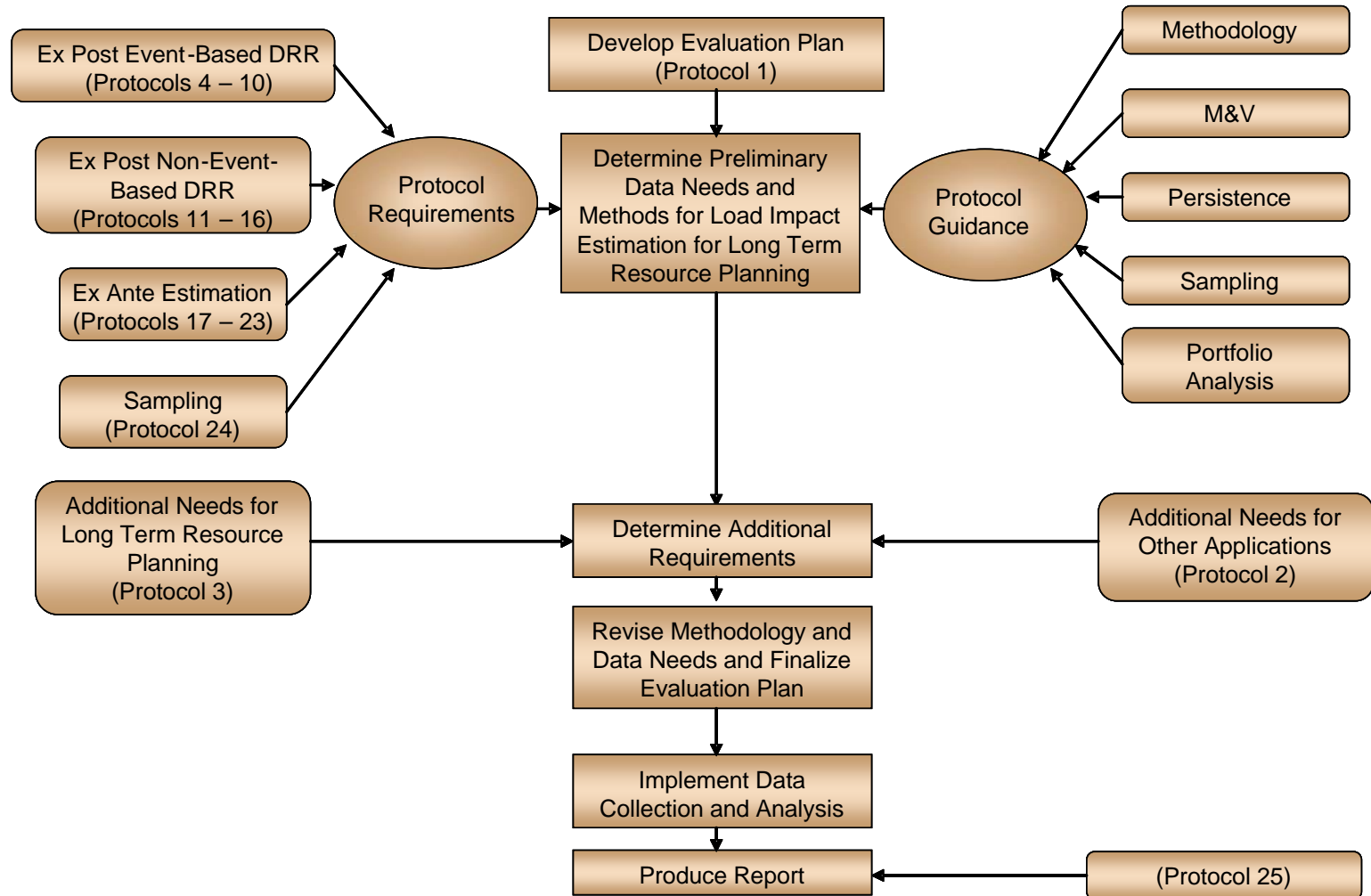
# The first 3 protocols focus on evaluation planning

- *Protocol 1:* A plan must be developed consistent with the requirements of protocols 2 and 3 and must include a budget and schedule
- *Protocol 2:* The plan must delineate whether the evaluation will also address needs beyond the minimum requirements and, if so, describe what requirements will be met
- *Protocol 3:* The plan must also delineate which of the issues depicted in the next slide are intended to be addressed

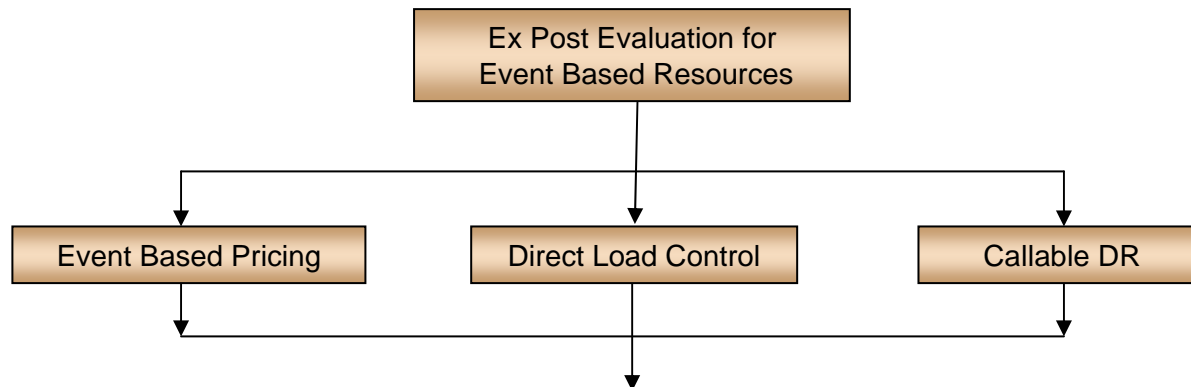
# Planning Protocol 3 requires delineating which of the following issues will be addressed



# The 25 protocols and accompanying guidance can help guide evaluation planning



# Protocols 4 through 10 concern ex post evaluation for event based resource options



## Protocols for Ex Post Evaluation of Event Based DRR

Protocol 4: Impact estimates must be provided for each hour for each of the day types identified in Protocol 8

Protocol 5: The change in energy use for the year must also be estimated

Protocol 6: Uncertainty adjusted impacts must be provided for at least the 10<sup>th</sup>, 50<sup>th</sup> and 90<sup>th</sup> percentiles

Protocol 7: The impact estimates must be reported in specific tabular form delineated in this protocol for each day type

Protocol 8: Impact estimates must be provided for each event day and for an average event day

Protocol 9: Lists the statistical tests and measures that must be reported if day matching methods are used for impact estimation

Protocol 10: Lists the statistical tests and measures that must be reported if regression methods are used for impact estimation

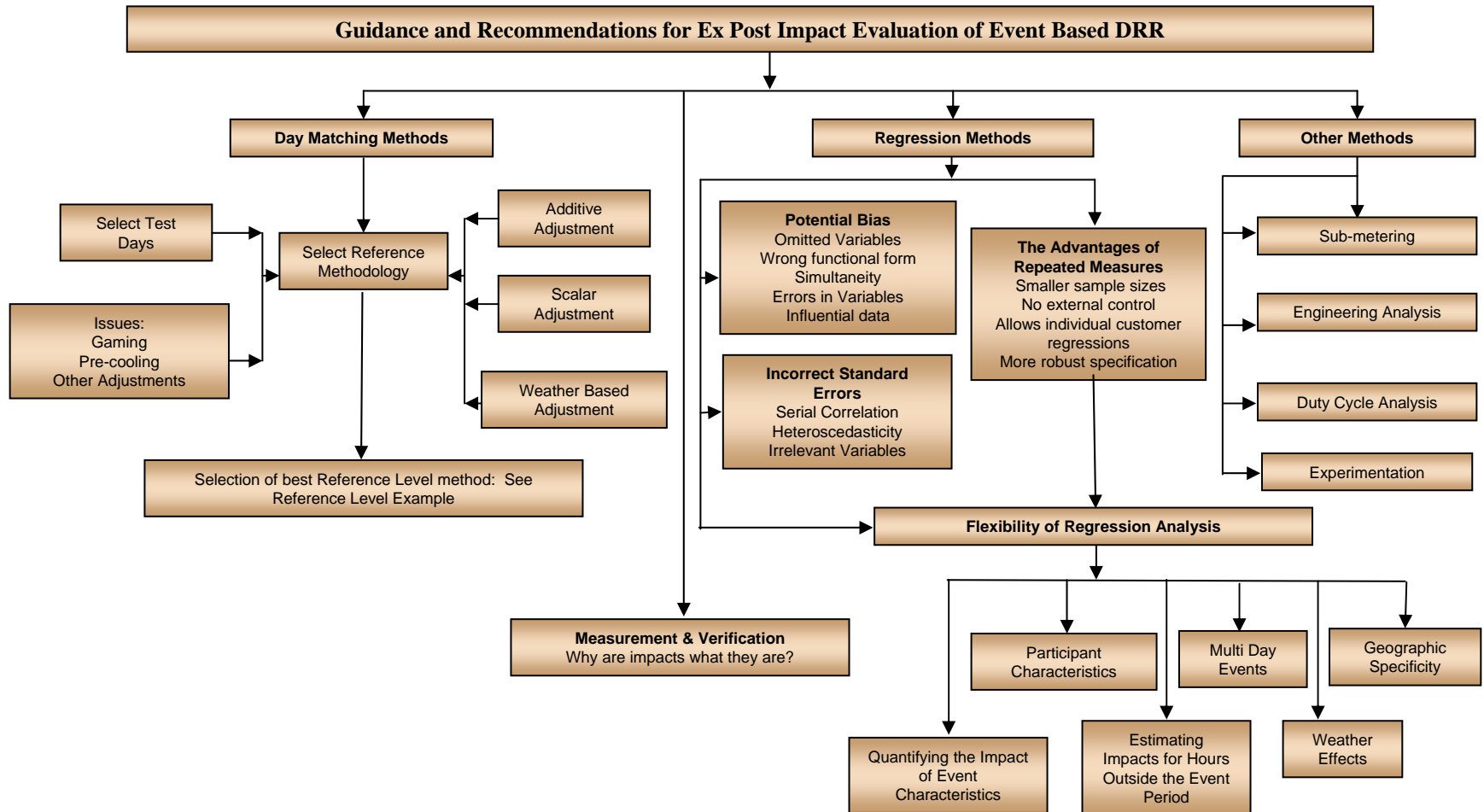
## Guidance and Recommendations for Ex Post Impact Evaluation of Event Based DRR

# The template from Protocol 7 delineates the minimum output that is required for each day type

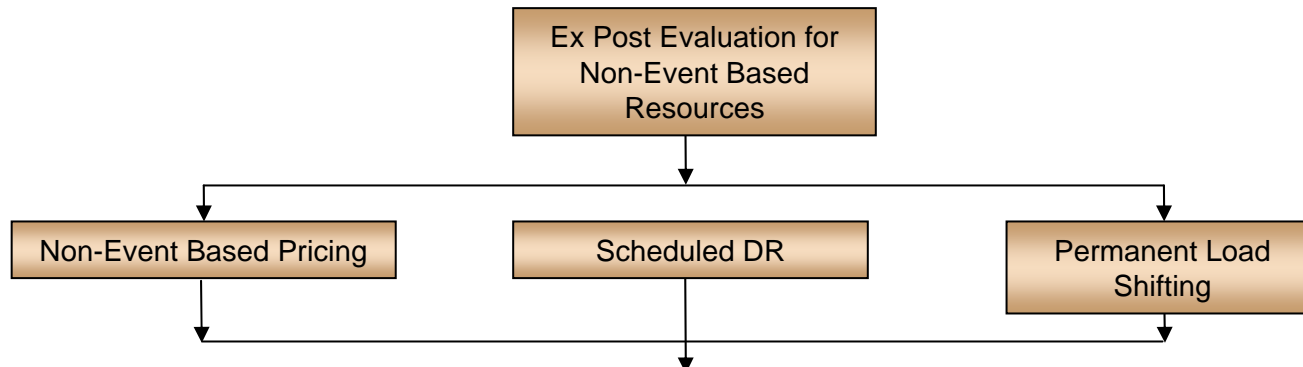
Hour Ending	Reference Load (kWh/hr)	Observed Load (kWh/hr)	Load Impact (kWh/hr)	Temperature (degrees F)	Uncertainty Adjusted Impacts		
					10th Percentile (kWh/hr)	50th Percentile (kWh/hr)	90th Percentile (kWh/hr)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
					Uncertainty Adjusted Impacts		
Day	Reference Energy Use (kWh)	Observed Energy Use (kWh)	Change in Energy Use (kWh)	Degree Hours (Base 75)	10th Percentile (kWh)	50th Percentile (kWh)	90th Percentile (kWh)

Staff Report recommended including estimates for the 30<sup>th</sup> and 70<sup>th</sup> percentiles as well.

# The protocol document provides guidance and recommendations on a variety of methods and issues for ex post evaluation of event based DR options



# Protocols 11 through 15 pertain to ex post evaluation of non-event based resource options



## Protocols for Ex Post Evaluation of Event Based Demand Response Resources

Protocol 11: Impact estimates must be provided for each hour for each of the day types identified in Protocol 15

Protocol 12: The change in energy use for each month and for the year must also be estimated

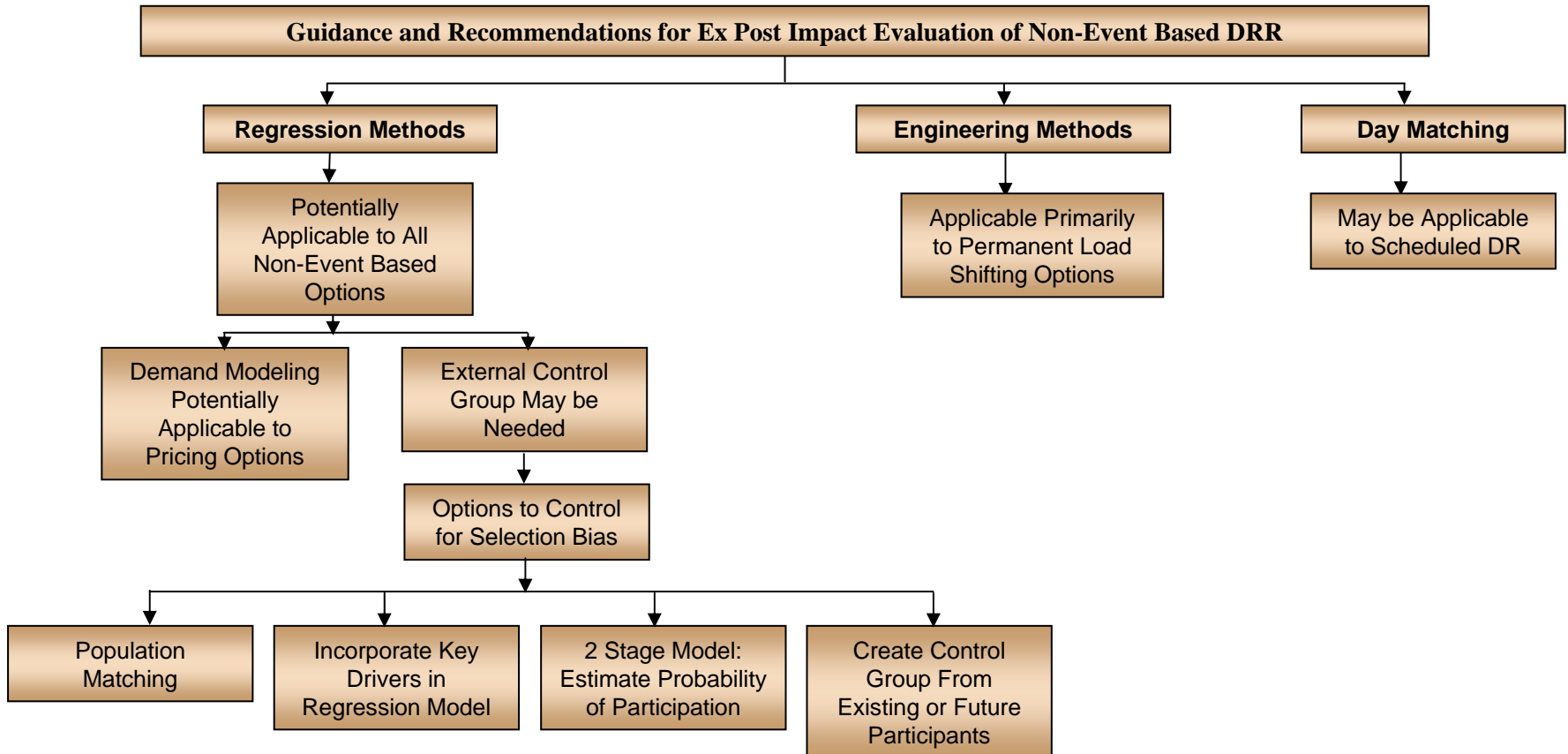
Protocol 13: Uncertainty adjusted impacts must be provided for at least the 10<sup>th</sup>, 50<sup>th</sup> and 90<sup>th</sup> percentiles

Protocol 14: The impact estimates must be reported in a specific tabular form delineated in this protocol for each day type specified in Protocol 15

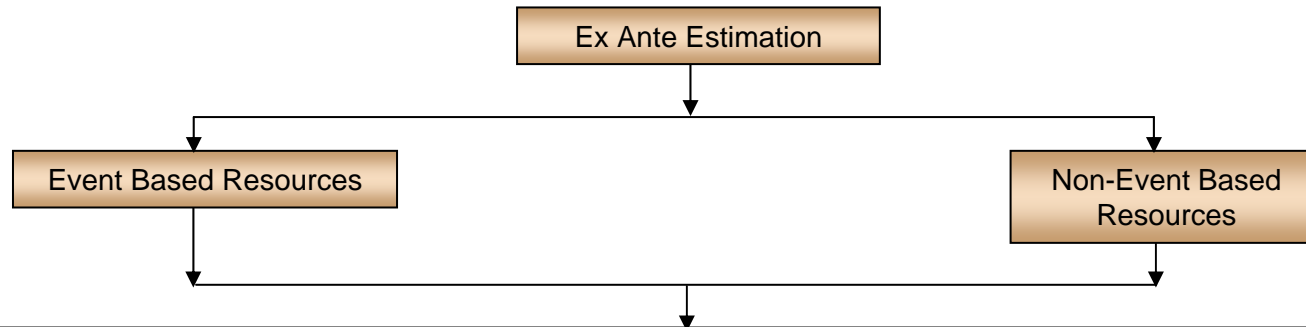
Protocol 15: Impact estimates must be provided for an average weekday and for the monthly system peak day for each month in which the DRR option is in effect

Protocol 16: Lists the statistical tests and measures that must be reported if regression methods are used for impact estimation

# Guidance for non-event based DR options focuses on the important role of control groups



# Ex ante estimation must be based on ex post evaluation



## Protocols for Ex Ante Estimation for All Demand Response Resources

Protocol 17: Base ex ante estimates on ex post evaluations (including analysis of resources from other utilities if necessary)

Protocol 18: Impact estimates must be provided for each hour for each of the day types identified in Protocol 22

Protocol 19: The change in energy use for each month and for the year must also be estimated

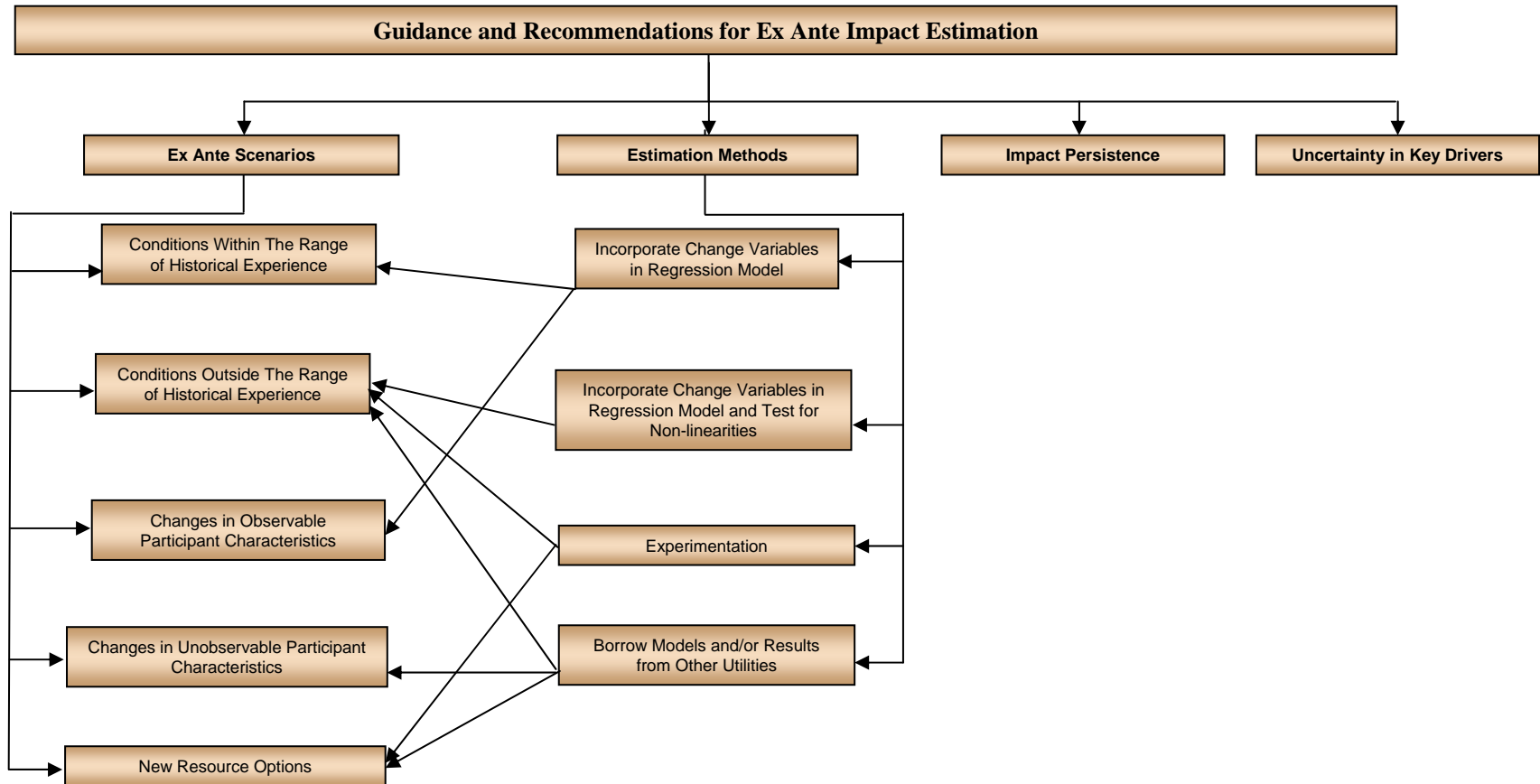
Protocol 20: Uncertainty adjusted impacts must be provided for at least the 10<sup>th</sup>, 50<sup>th</sup> and 90<sup>th</sup> percentiles

Protocol 21: The impact estimates must be reported in a specific tabular form delineated in this protocol for each day type specified in Protocol 22

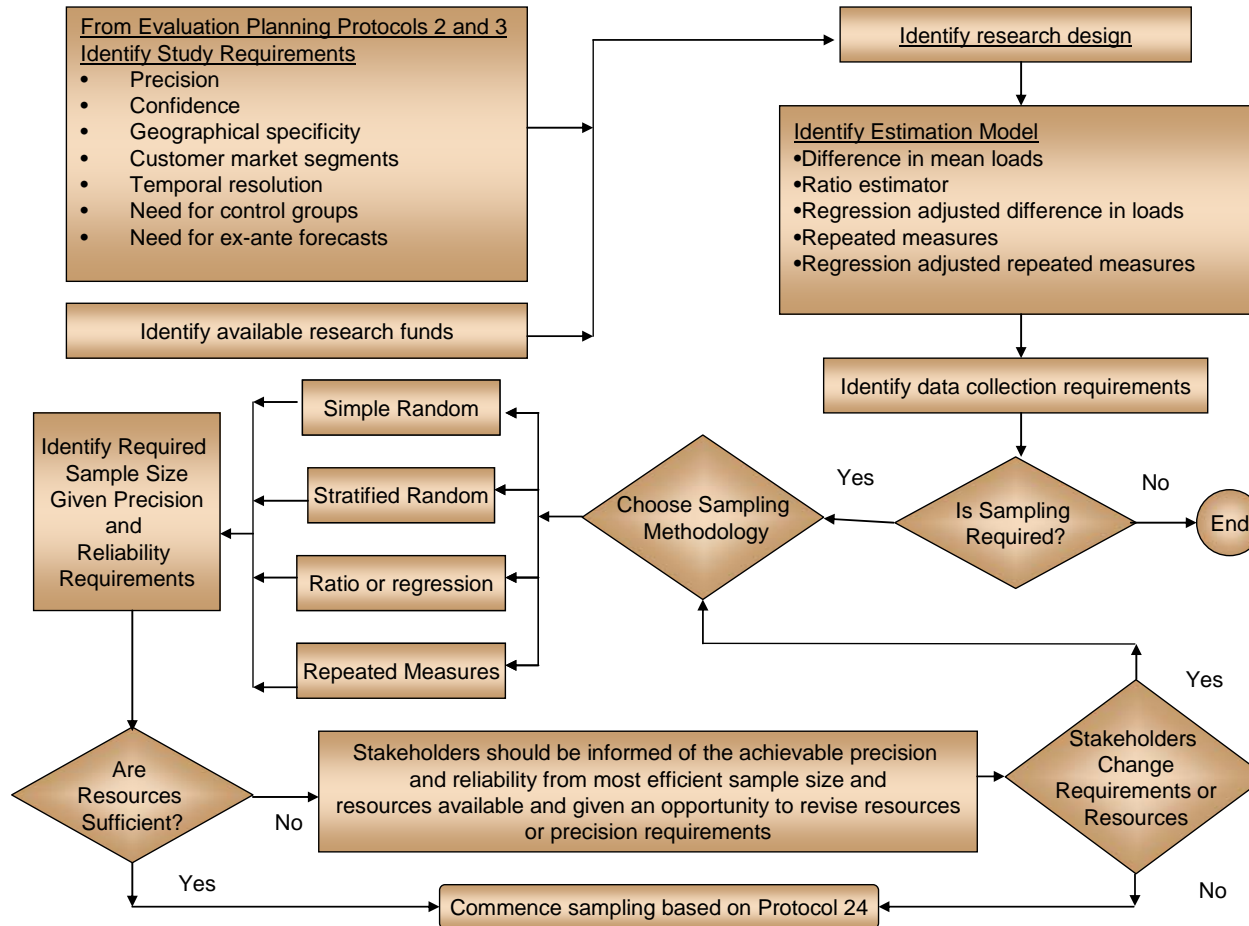
Protocol 22: Impact estimates must be provided for a typical event day for event based resources and for an average weekday and the monthly system peak day for non-event based resources for each month in which the resource is in effect

Protocol 23: Lists the statistical tests and measures that must be reported if regression methods are used for impact estimation

# Methods for ex ante estimation will vary across ex ante scenarios



# Sampling is an important aspect of most impact evaluations



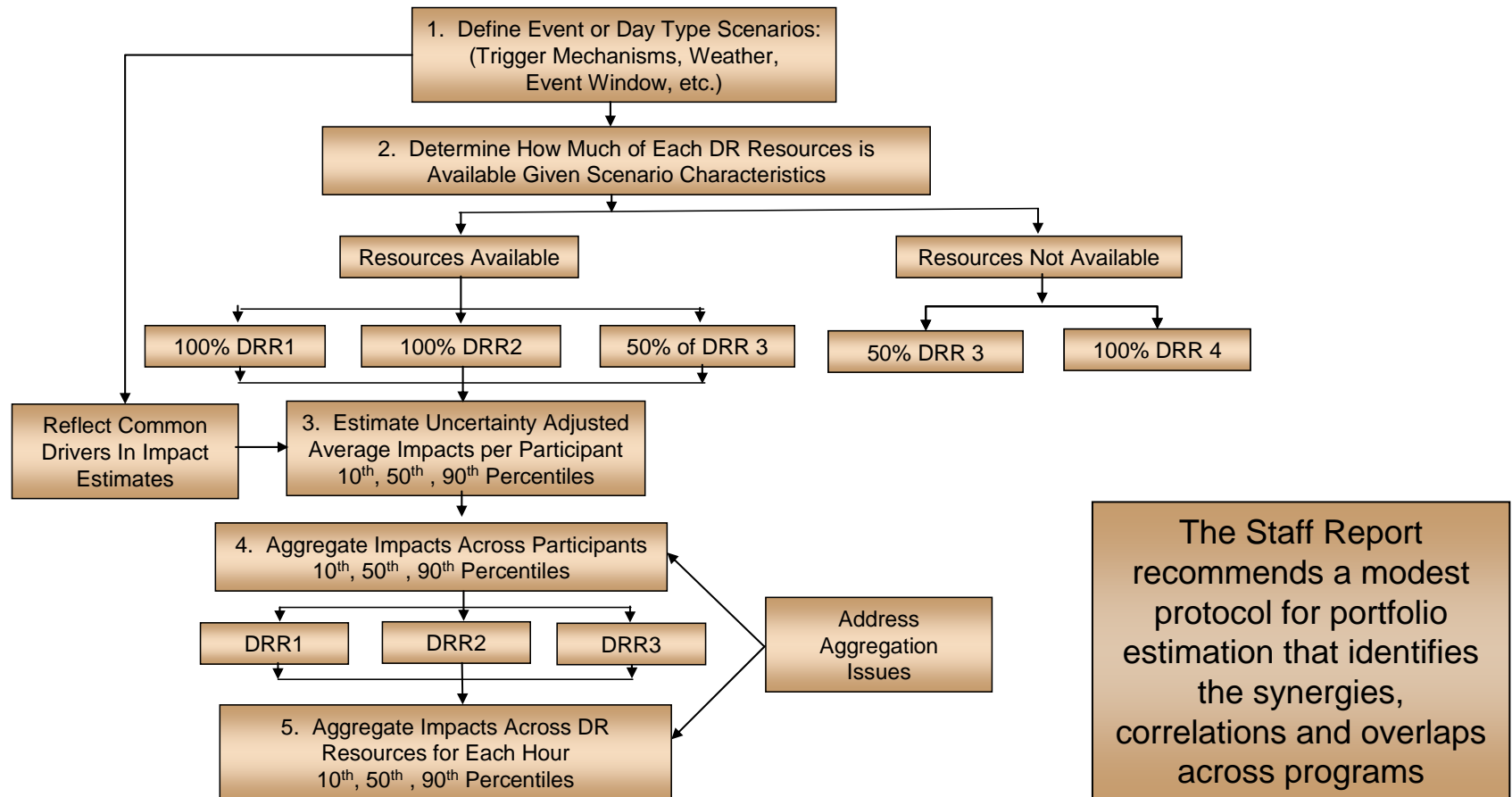
# **The sampling protocol is designed to minimize bias in any samples that are used while not being overly prescriptive**

- **The population(s) under study must be clearly identified and described**
- **The sample frame(s) used to sample the population(s) under study must be carefully and accurately described along with any measures used to correct for differences between population and sample frame**
- **A digital snapshot of the population and initial sample from the sample frame must be preserved**
- **The sample design must be described in detail, including the distributions of population and sample points across sampling strata (if any)**
- **The “fate” of all sampled observations must be tracked and documented throughout the data collection process**
- **If significant sample attrition is found to exist at any stage of the research process (i.e., recruitment, installation, operation), a study of its impact must be undertaken**
- **If selection bias is suspected, the evaluator must describe it as well as any efforts made to control for it**

# The reporting protocol sets the minimum requirements for documenting the analysis and reporting the results

- Evaluation reporting has a variety of objectives
  - Describing the evaluation objectives and plan
  - Presenting the detailed impact estimates developed as part of the evaluation
  - Comparing these findings with resource goals and the impacts that have been used to report progress toward goals, and explain any differences
  - Thoroughly documenting the methodologies used in sufficient detail so that, given access to the same data and information, a trained evaluator would be able to reproduce the impact estimates that are reported
  - Reporting any deviations from the requirements of these protocols and the reasons why it was not possible to meet them
  - Providing recommendations regarding resource modifications and modifications to the impact estimates used for resource progress reports
  - Providing recommendations concerning future evaluation activities.

# The protocol document also contains guidance for estimating impacts for DR portfolios



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