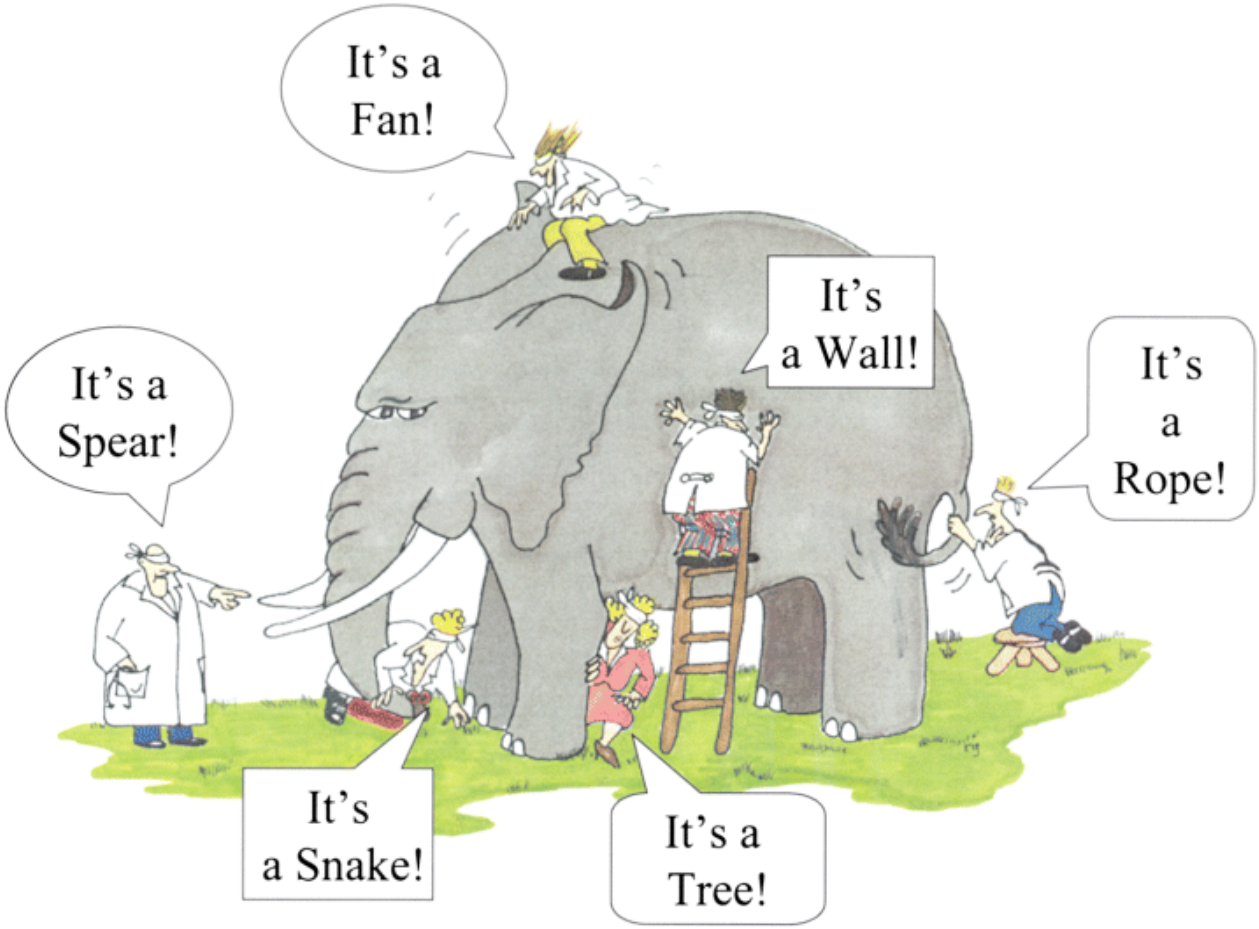
Don’t Think of an Elephant!

The Six Blind Consultants and the DR Elephant

WLRA, San Diego, September 23 2009

Consultants at Work



How is DR Evaluation Like the Six Blind Consultants story?

- You can’t see the elephant or directly measure load reduction.
- What you feel is constrained by where you (or what methods you use to) approach the animal.
- When you project your knowledge from one part of the animal (ex post) you may not do such a good job of guessing the whole animal (ex ante).

Why DR Evaluation Doesn't Need to be Like the Six Blind Consultants story?

- While we can't measure load reduction directly, we are not completely blind to it's source.
  - Targeted or likely end-uses
  - Control mechanisms
- Our knowledge of the elephant allows us to make better guesses about what it is.
- When we go to make our predictions about the whole animal we can do it with greater knowledge in mind.

Outline

- DR Evaluation Taxonomy
  - All the important permutations of DR programs from an evaluation perspective
- SDG&E's Summer Saver Program
- Specific Modeling Issues

DR Taxonomy

- DR Purpose
  - Peak Shaving
  - Ancillary Services, spinning →non-spinning
- Customer Motivation;
  - Pricing
  - Incentive
  - Emergency
- Control Mechanism
  - Active -- End-use switch, thermostat
  - Passive – Customer choice and action

DR Taxonomy, cont'd

- Kind of (sample) Data
  - Whole Premise
  - End-use
  - Comparison/Control Group
- Number, duration and Timing of Events
  - None to Too Many
  - Multiple identical events -> Highly Variable
- Ex post, ex ante or both

SDG&E's Summer Saver Program

- DR Purpose --Peak Shaving
- Motivation -- Incentive
- Control Mechanism –Active, End-use switch
- Kind of Data
  - Whole Premise
  - End-use
  - Comparison Group
- Number, duration and Timing of Events
  - Two four hour events, same time of day, (in October!?)
- Both ex post and ex ante.

Kind of Data

- Combination of all three types leaves all options on the table
- Whole Premise vs end-use
  - With AMI will there be any end-use data?
  - End-use modeling considerations – AC maximum load/load reduction.
- Comparison/Cycling Group
  - Out of favor (?)
  - How to use in the context of DR protocol focus on ex ante impact estimates.
  - Trading variation for less bias

Number, duration and Timing of Events

- Lots of events during a consistent time period, with non-event hot days is a rare ideal.
  - Can model the load reduction directly in the individual regressions.
  - Sufficient degrees of freedom to specify the event effect. Fully parallel specification avoids omitted variables bias – All but impossible.
- Can we characterize extreme weather scenarios when all hot days above some benchmark are cycled?

Both ex post and ex ante (mostly ex ante)

- Focus on ex ante is driving modeling approach.
- But ex ante is only as good as the ex post model

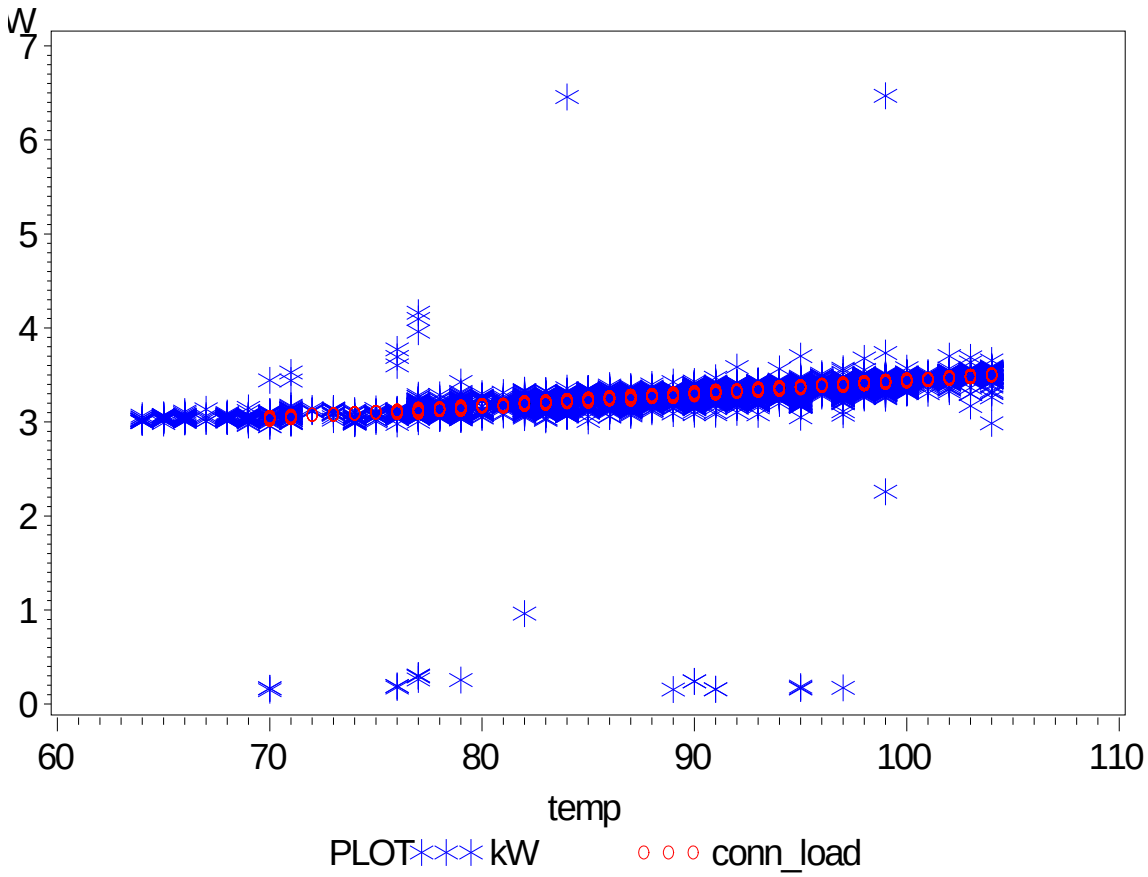
Modeling AC-related Load reduction

- We know how ACs work.
- We know how the switches work (thought the adaptive algorithms are less than transparent)

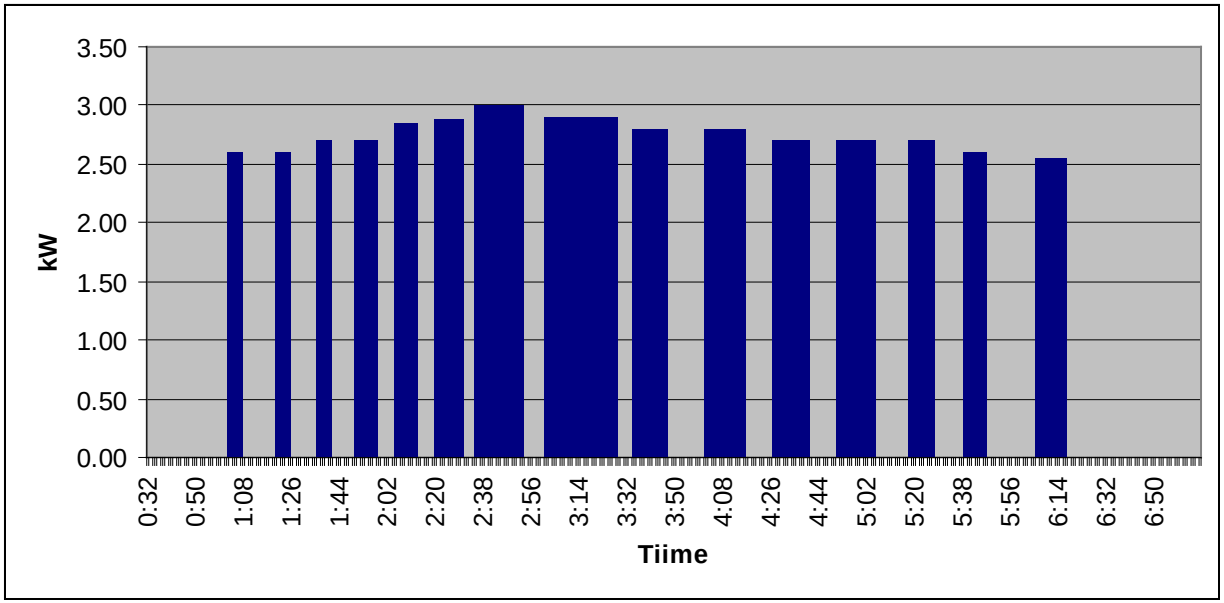
- Can we incorporate that knowledge?

What does air conditioner load look like?

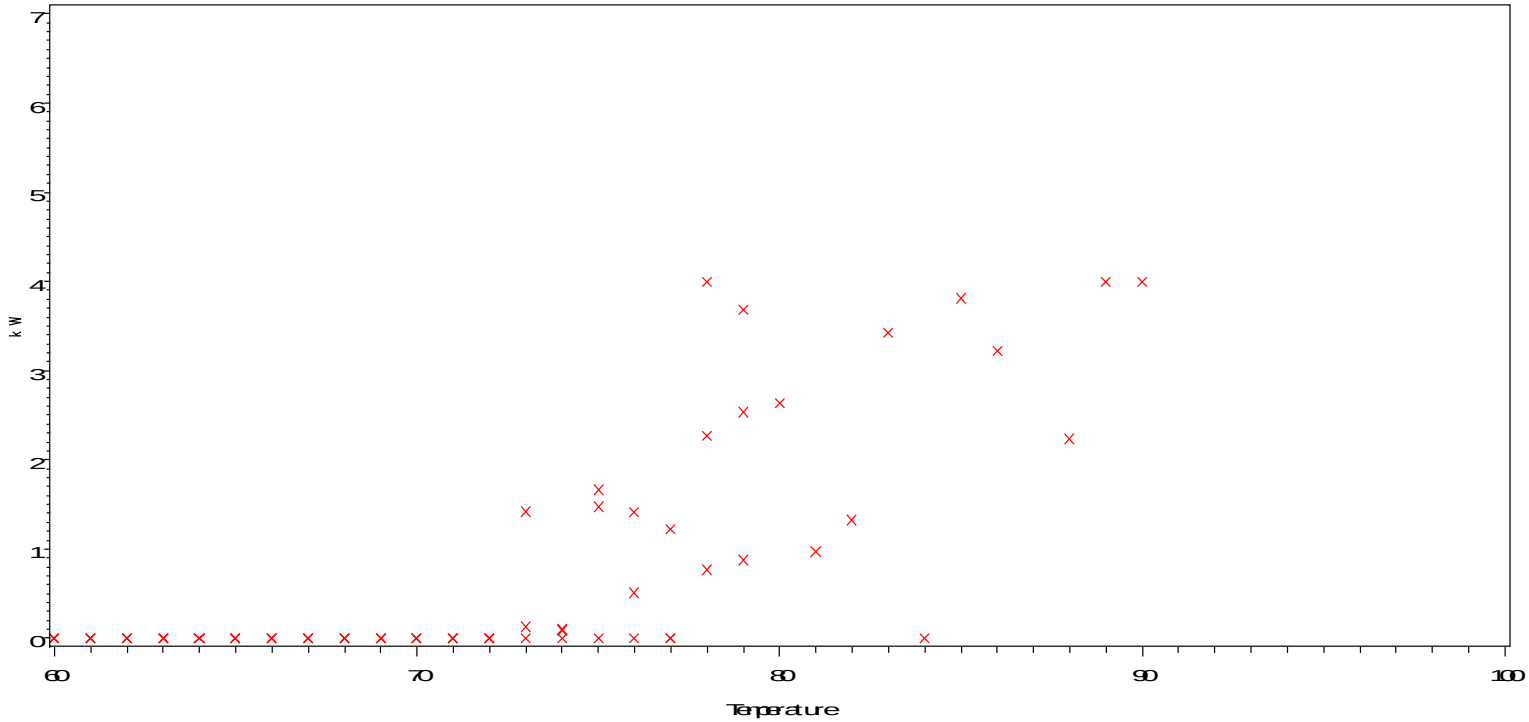
One minute instantaneous kW



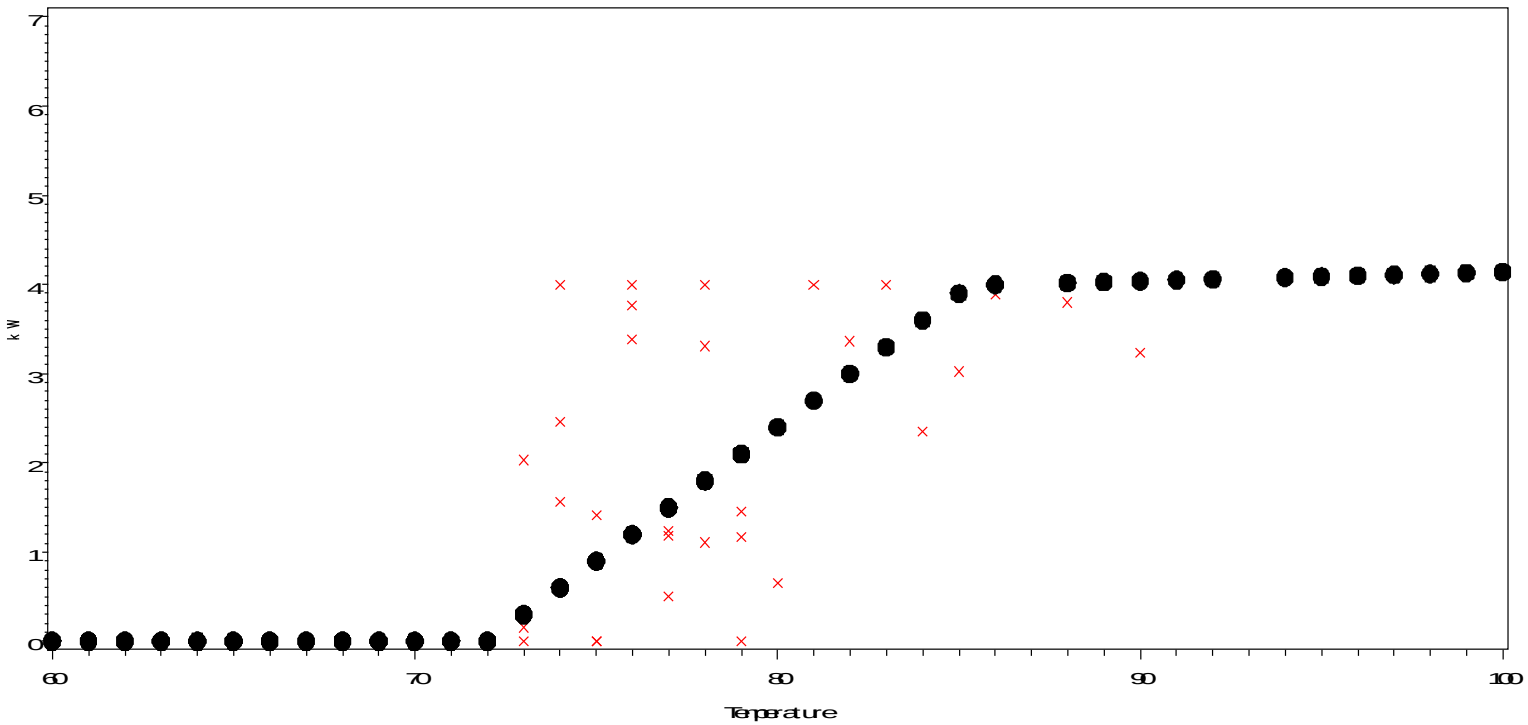
In Duty Cycle Format



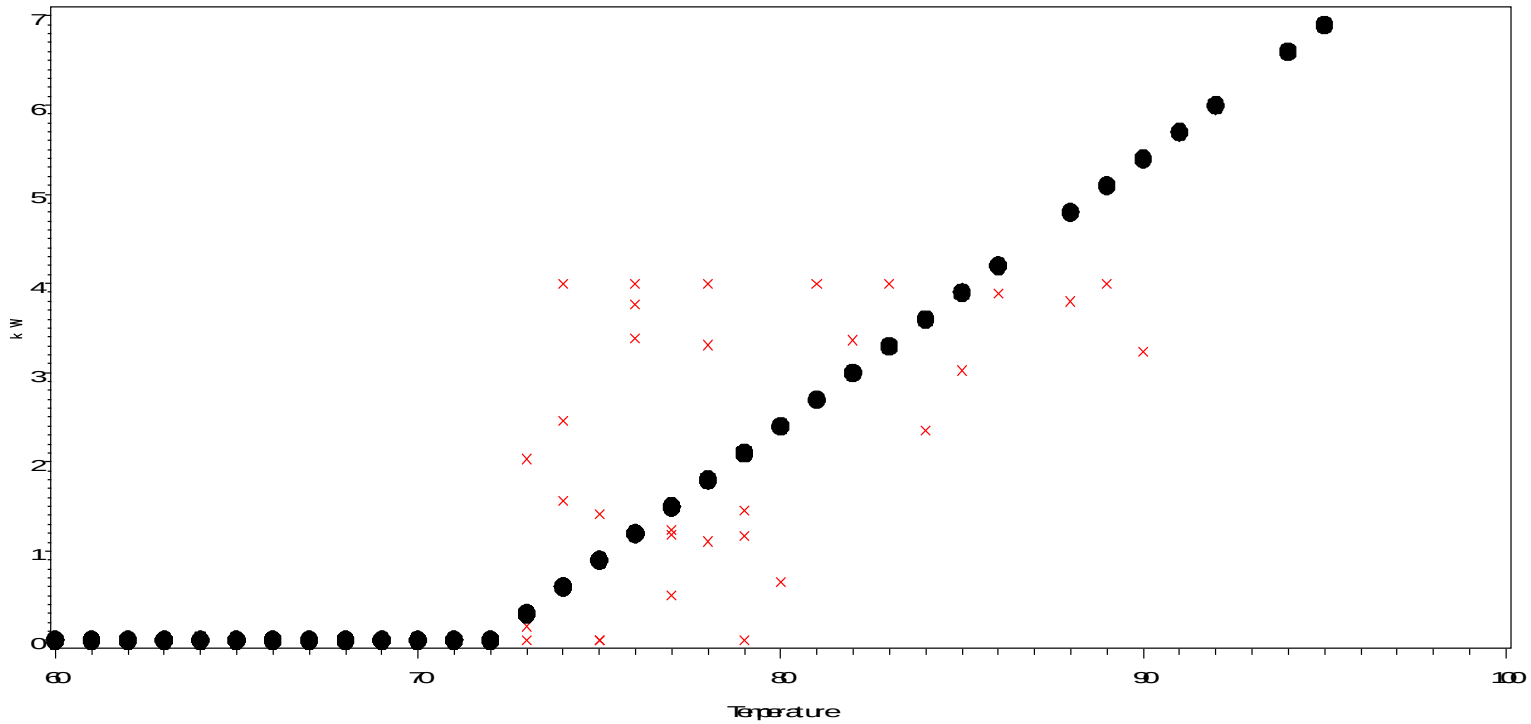
Average Hourly kW by Temperature



Average Hourly kW by Temperature w/ Duty Cycle



Hourly AC Load Modeled with a Reference Temperature of 72º



What do we do?

- End-use data
  - Fancy Tobit models are possible, but problematic.
  - Dealing with the data censoring tricky.
  - Will there be any end-use data in 5 years anyway?
- Whole premise data
  - Still an issue, just less obvious
  - Any way to know connected load?

- Switch-related load reduction is also non-linear

CDD base temp

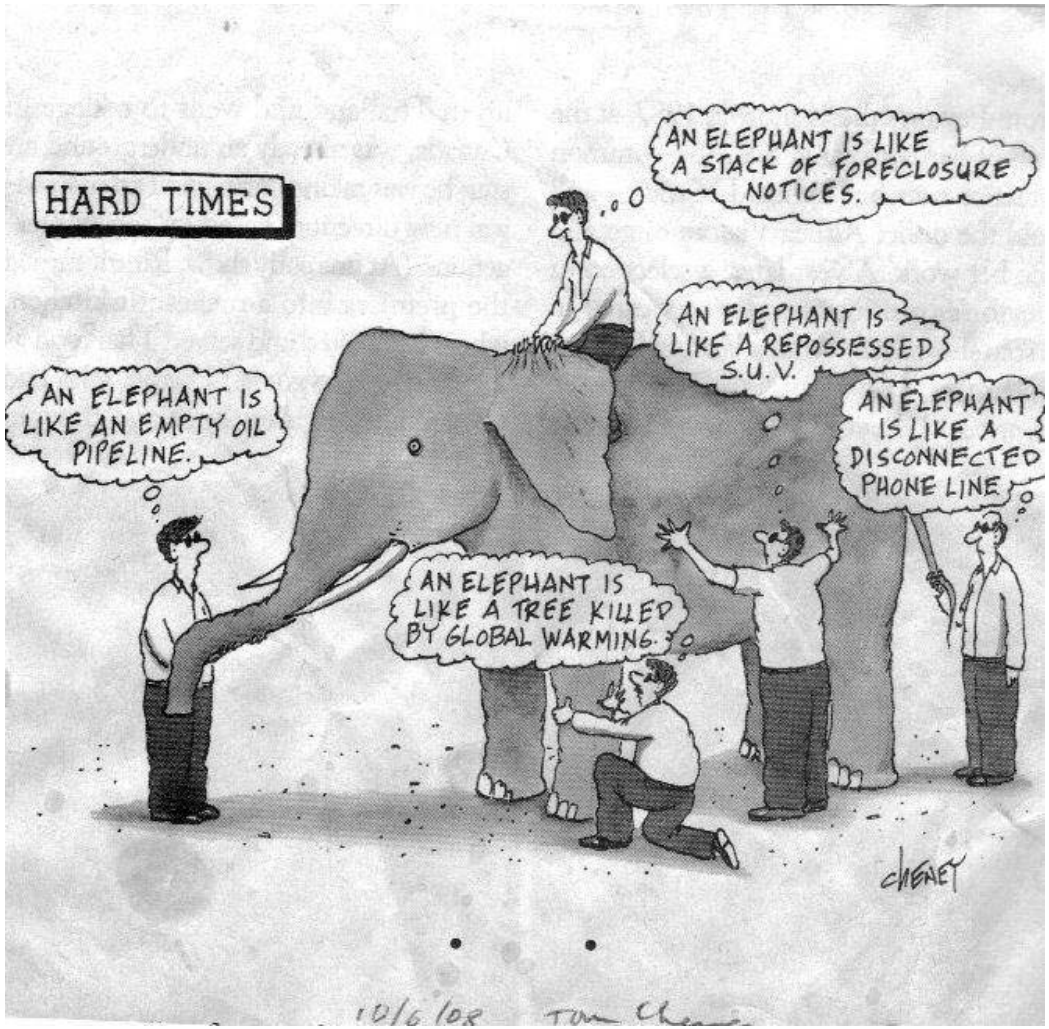
Summary -- Back to the Elephant

- The Specific Example
  - We're not blind -- Cooling load is one of the primary sources of DR load reduction. We know how it works. We need to do better at modeling it.
  - A linear estimate of a non-linear process is not a good estimate.
  - If we insist on modeling load with a large cooling component linearly we will get our ex antes wrong.

Summary -- Back to the Elephant

- Bigger Picture
  - We’re not blind – we know a lot about these programs and the characteristics that affect evaluation results.
  - Results need to be seen within this context.
  - When doing ex antes, projecting out of sample in any way, we need to be very careful.

Hard times Elephant



End sheet

Thank you for your attention.

kagnew@us.kema.com