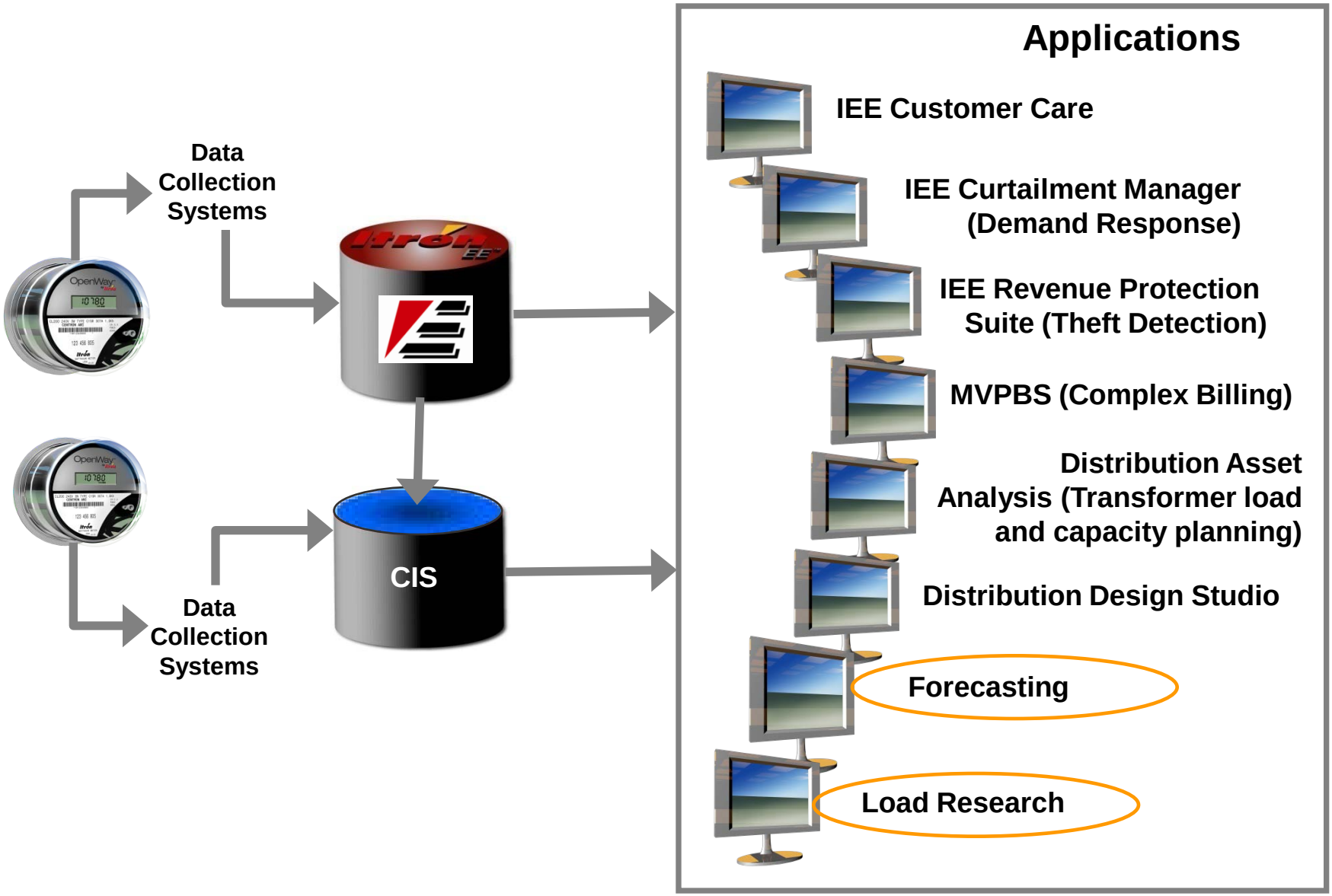
# Using Load Research Data to Incorporate Energy Efficiency Impacts in the Load Forecast

*Mark Quan, Itron*
*(mark.quan@itron.com)*

Western Load Research Conference
September 23-25, 2009

# Itron Applications for Utilities




© 2006, Itron Inc.

# Recent Policy Actions

- **California**: The California Public Utilities Commission adopted the Energy Efficiency Strategic Plan, which considers energy efficiency to be the highest priority resource and is the state's first integrated framework of energy efficiency goals and strategies that covers government, utility and private sector initiatives.
- **Maryland**: The EmPOWER **Maryland** Energy Efficiency Act of 2008 established a statewide goal of achieving a 15 percent reduction in per capita electricity use, relative to 2007 levels, by the end of 2015
- **Massachusetts**: Governor Patrick signed into law the Green Communities Act which establishes long-term plans for the reduction of energy consumption, focusing on energy efficiency as a first step in meeting future energy demand before traditional supply-side options are pursued.
- **Michigan**: The Clean, Renewable, and Efficient Energy Act of 2008 established annual electricity savings targets for the state, requiring electricity providers energy savings to rise from 0.3 percent of retail sales in 2009 to 1.0 percent of retail sales in 2012 and each year thereafter.
- **New Jersey**: The **New Jersey** Energy Master Plan has been finalized to advance the Governor's directive to achieve a 20 percent reduction in electricity usage by 2020.
- **New Mexico**: The Efficient Use of Energy Act requires electric utilities to achieve at least 5 percent energy efficiency savings from 2005 electricity sales by 2014 and 10 percent by 2020.
- **New York**: In the Energy Efficiency Portfolio Standard proceeding, the New York State Public Service Commission increased its energy efficiency funding and goals.
- **Ohio**: Investor-owned utilities are now directed to achieve energy savings of 22.5 percent through energy efficiency programs by the end of 2025 as part of legislation that also authorizes the Public Utilities Commission of Ohio (PUCO) to develop rules for electric utility decoupling.
- **Wisconsin**: Proposed energy savings goals include an annual 2.0 percent reduction in electric load and an annual 1.0 percent reduction to the natural gas load by 2015 after a ramp-up period.

*http://www.epa.gov/RDEE/energy-programs/napee/resources/e-newsletter.html*

© 2006, Itron Inc.

# Typical Scenario

DSM Group says that the forecast should include 300 MW of DSM savings by 2015.

Initial Questions:

- How are we going to do that? (Programs)
- When will we save 300 MW? (Year to Year time frame)
- What will that do to our system shape and load factors? (Load Shape and seasonality issues)

Issue:

- Most DSM groups and studies do not provide all the information needed for inclusion into a forecast.

***Load Research Data can help fill the gaps in the missing data.***

© 2006, Itron Inc.

# Typical Forecast Process

1. Monthly energy forecast by class
2. System peak forecast and hourly load forecast

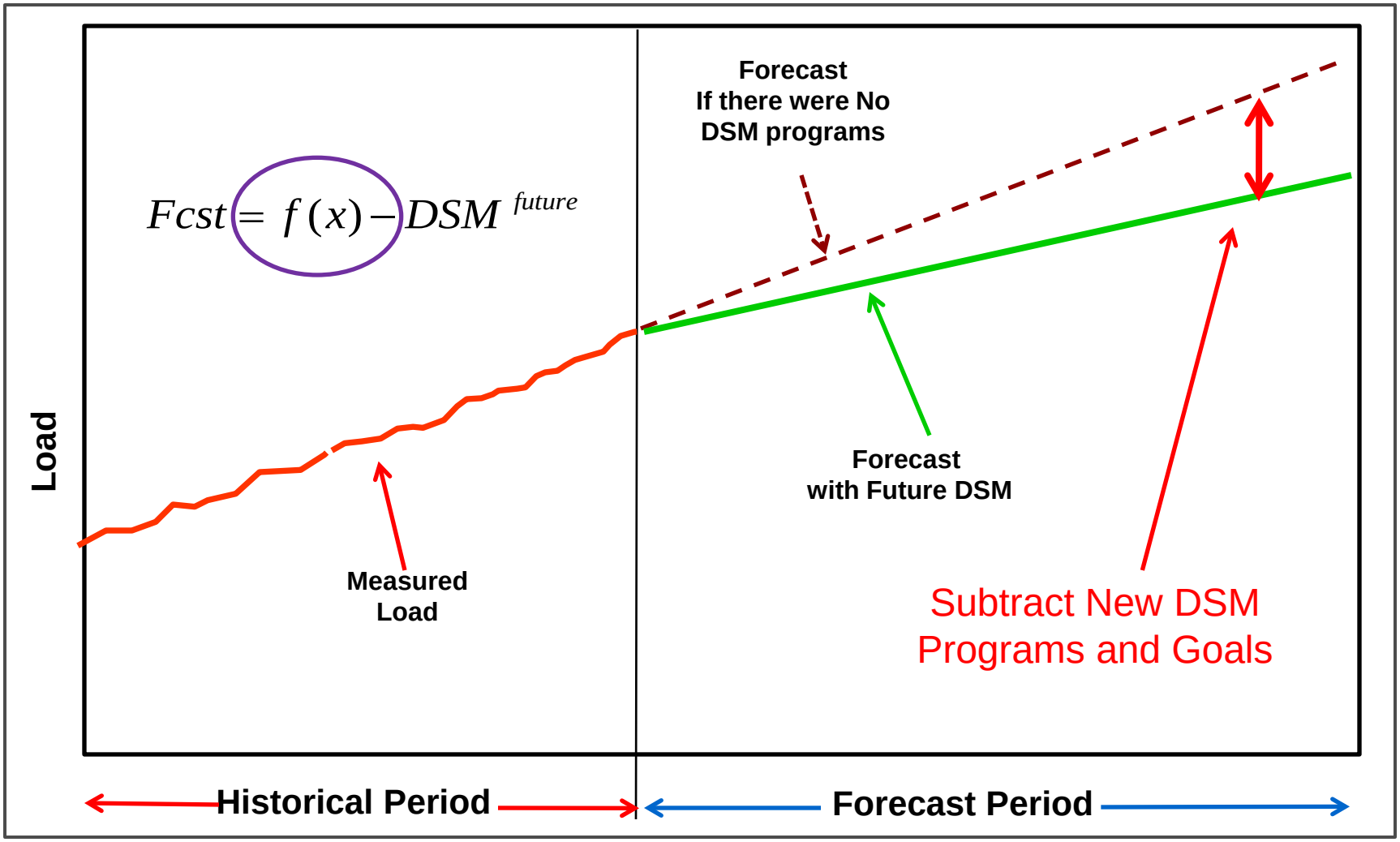
**Question: How do you include DSM?**

**Answer: *Subtract* the DSM goals from the forecast**

3. Subtract the DSM
   - Monthly energy
   - System peak
   - Hourly load shapes

© 2006, Itron Inc.

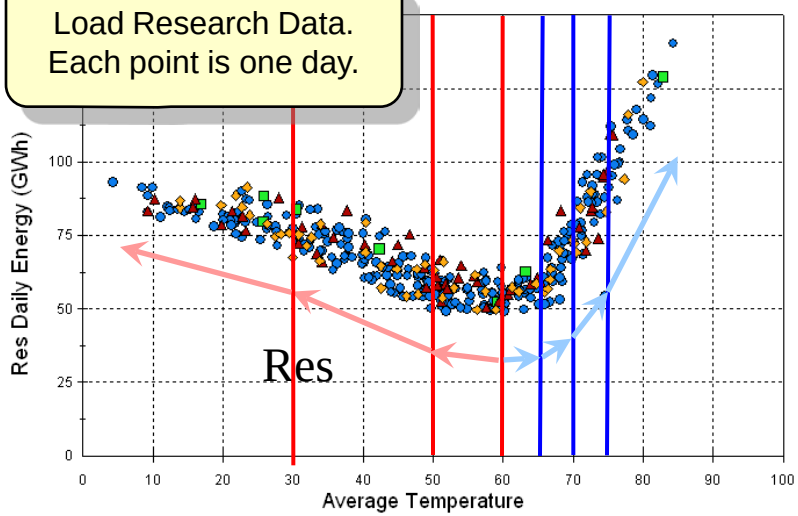
# Typical Forecast Process

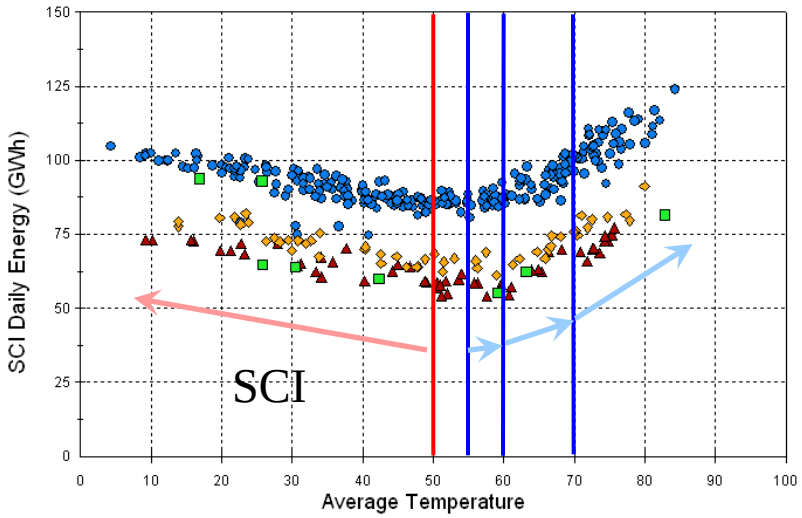


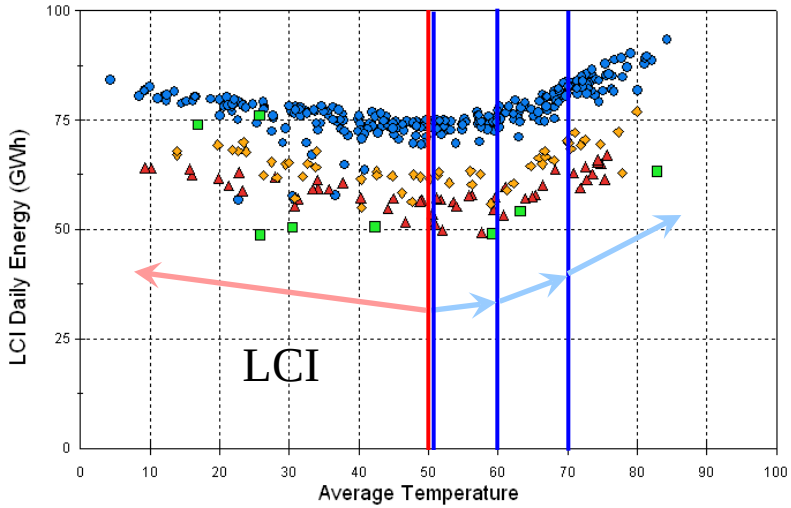

© 2006, Itron Inc.

# Energy Forecast - Weather Response

Load Research Data.
Each point is one day.



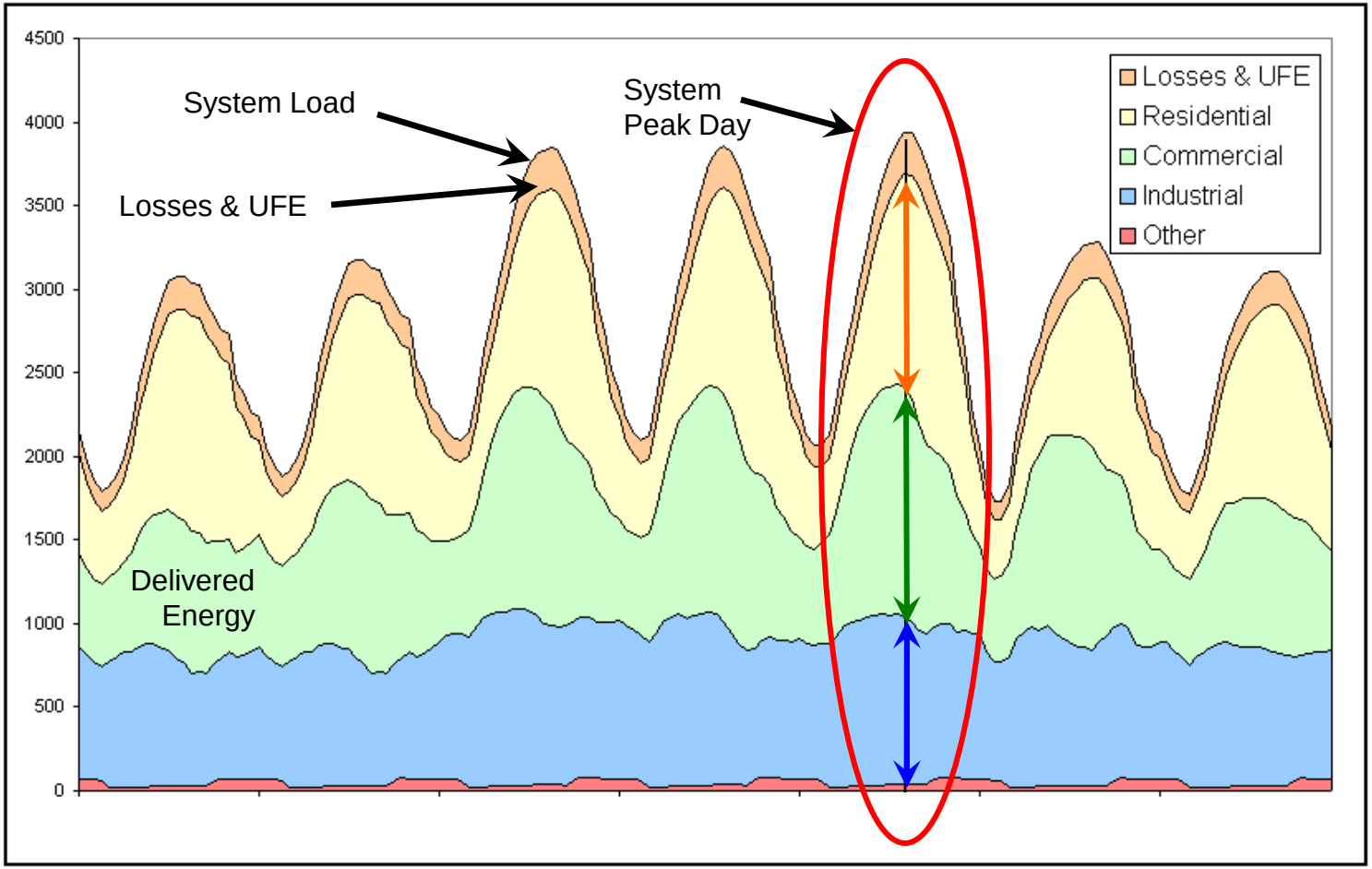




- Load Research data can help to clarify how weather effects work at the revenue class level.
- These data suggest different HDD and CDD triggers for different classes.
- The relative power of degrees in each range can be estimated from these data and used in models of monthly sales.

© 2006, Itron Inc.

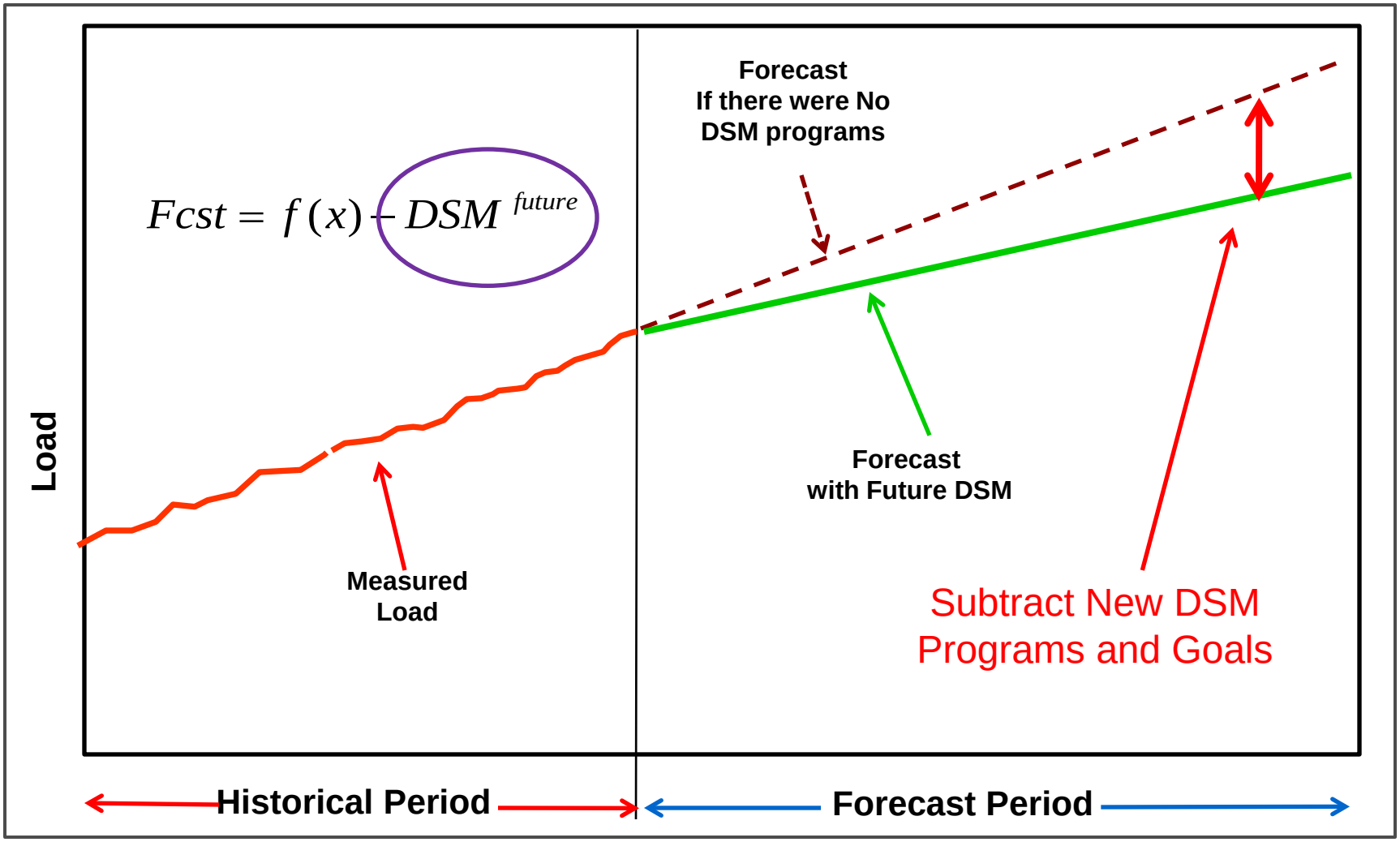
# Peak and Shape Forecast - Composition

Load Research data allow us to estimate the composition of system loads. This is important for long-term peak and system shape forecasting.




© 2006, Itron Inc.

# Typical Forecast Process




© 2006, Itron Inc.

# DSM Subtraction Issues

- Forecaster's Need
  - Monthly Savings
  - Coincident Peak impacts
  - Load Shapes

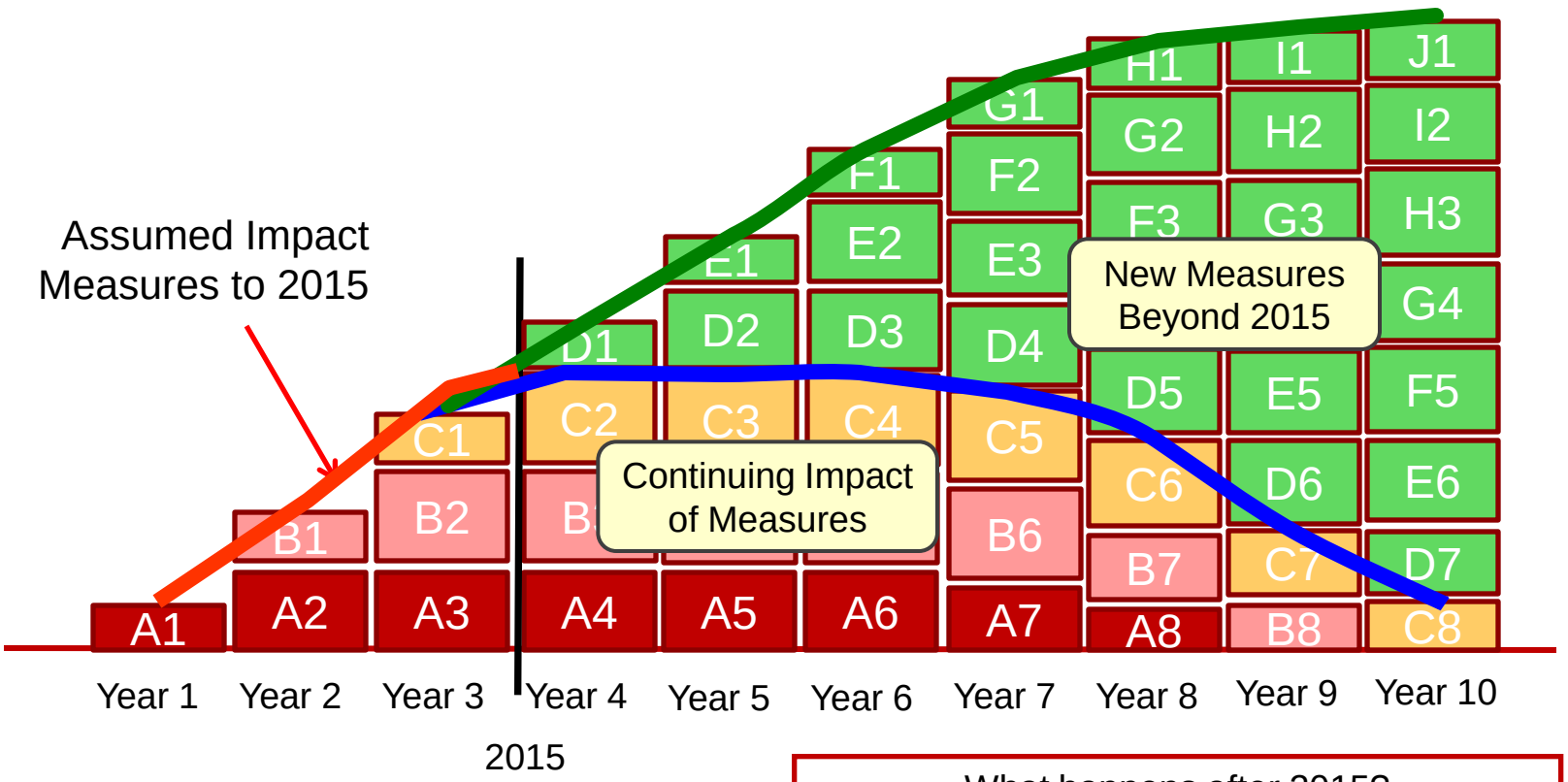
- Available Data
  - General Policy Goals
    - Characterized in MWh or MW with no associated programs.
    - Focused on an "end" result, but do not provide a year to year path for achieving the result.
    - Lacks detail on types of savings (Summer, Winter, Baseload)

  - DSM Potential Study
    - Large Variety of program
    - Provide Annual Savings and Load Factors
    - Time of Day impacts

© 2006, Itron Inc.

# Monthly Forecast Savings

DSM Group says that the forecast should include 300 MW of DSM savings by 2015

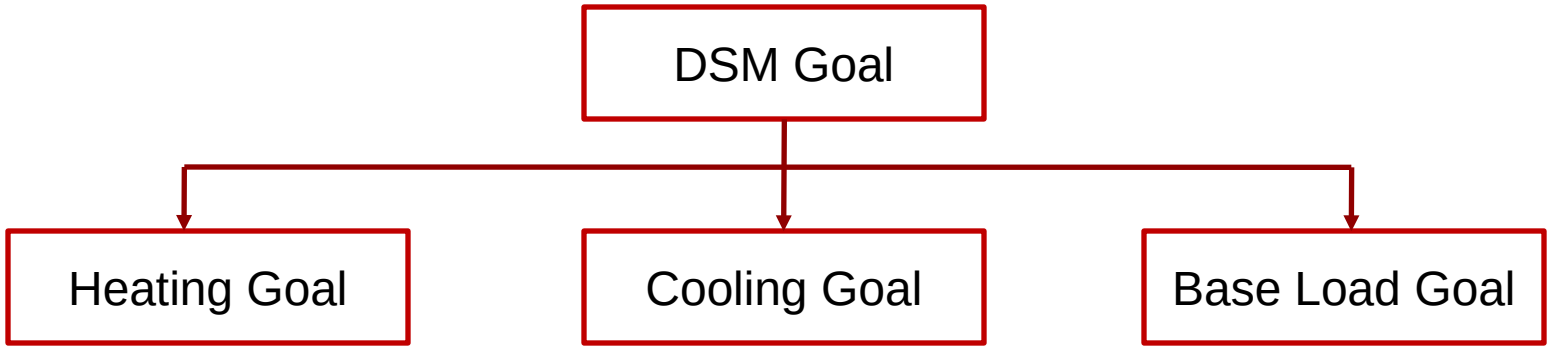


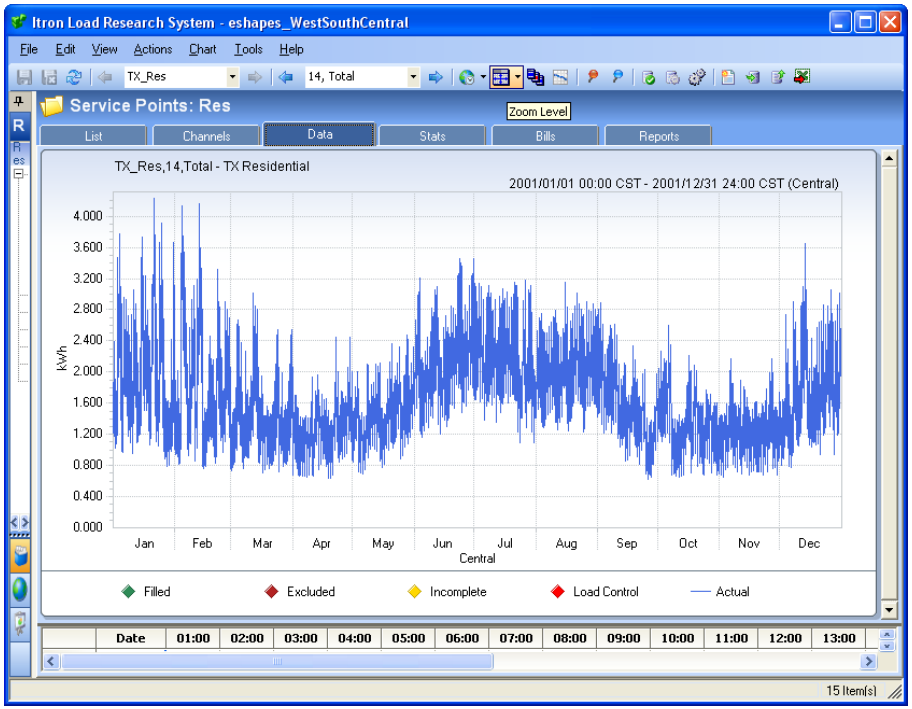

What happens after 2015?

- Measure Life of DSM programs may end
- Markets are transformed.
- Additional investments are made.

© 2006, Itron Inc.

# Policy Goal Data Conversion

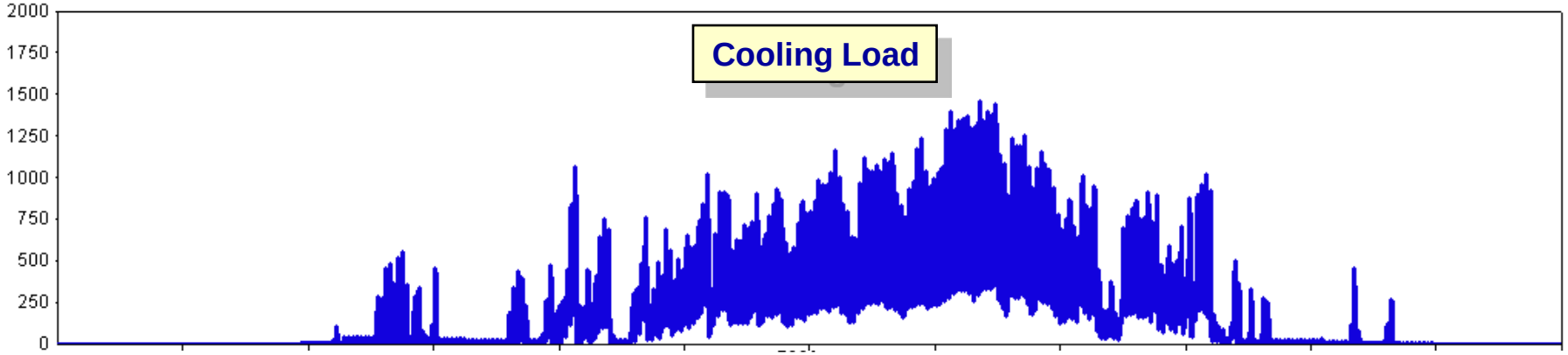


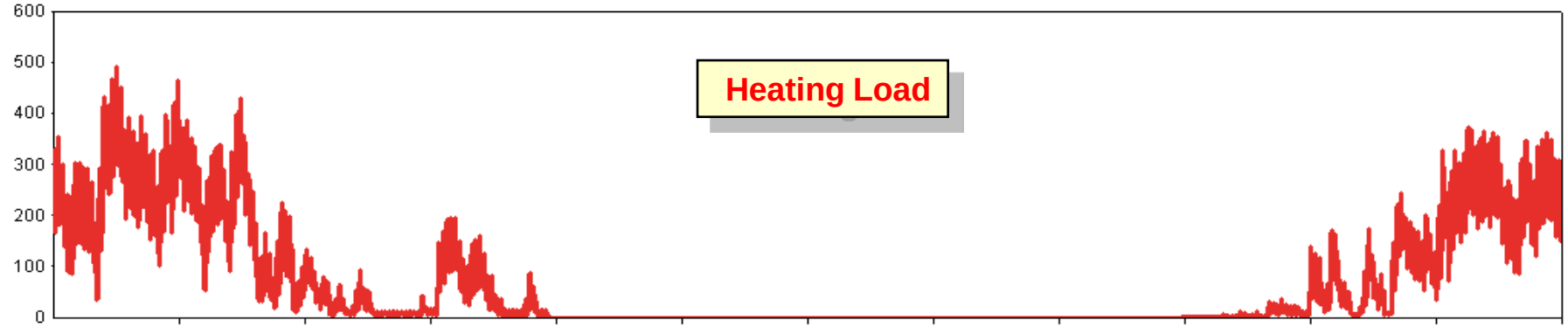



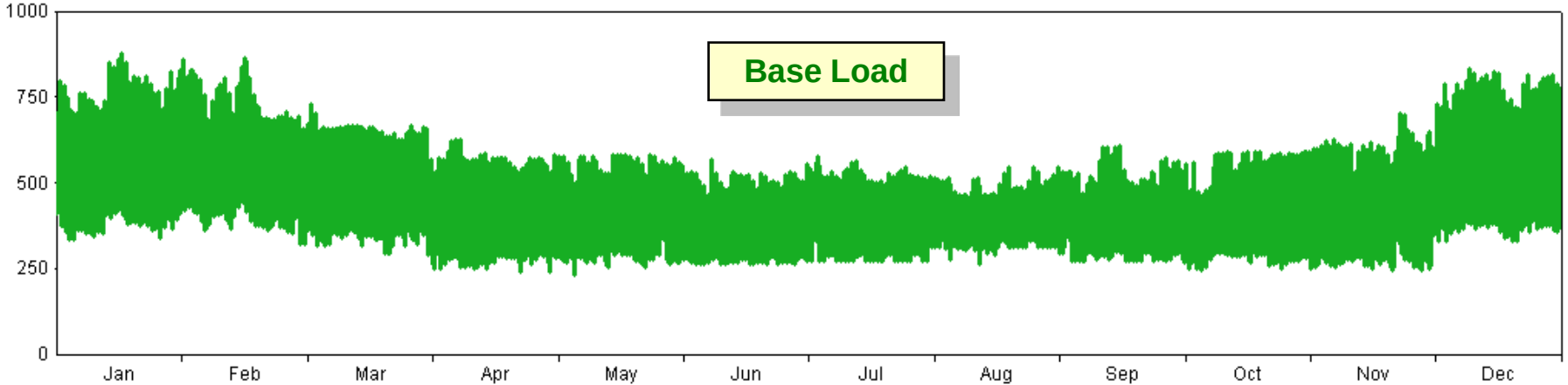

- Category splits must be assumed.
- Load Research provides heating, cooling, and baseload by class.
- Shapes provide annual load factors that are used to convert MW to MWh.
- Shape provide monthly splits for energy savings.

© 2006, Itron Inc.

# Generalized Shapes



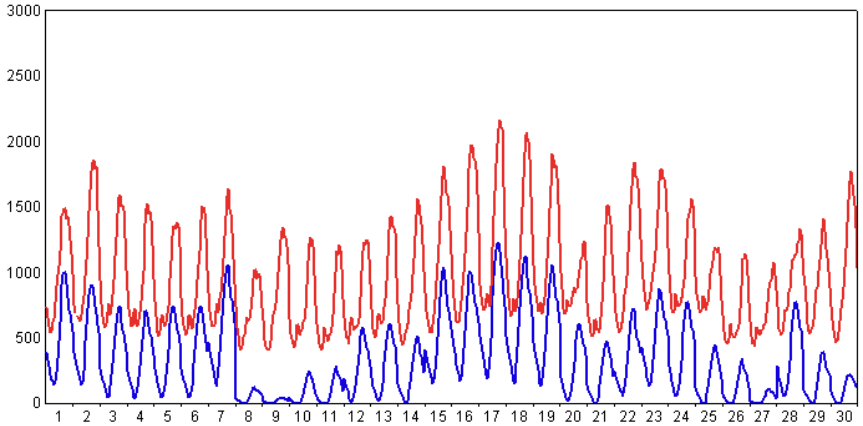



# General Goal Example

Goal: 300 MW by 2015

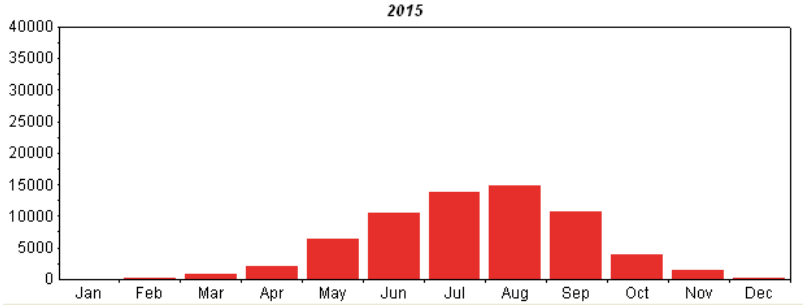
***Split:***

40 MW Lighting
85 MW Res AC
150 MW Com HVAC
25 MW Load Control




***Using Load Research Data:***

ResLoad = f($CDD_d$, $HDD_d$, $Base_d$)
ResAC = Based on $CDD_d$ coefficient(s)




***Result:***

- Monthly Profile and Hourly shape
- Shapes are calibrated to obtain 85 MW on the independent peak day.
- Hourly shape is aggregated to monthly energy to subtract from energy forecast.
- Expect to save 85 MW on the system peak

© 2006, Itron Inc.

# Potential Study Data

| Measure | Incremental Cost ($) | Lifetime (yrs) | kWh Savings | Peak kW Reduction | TRC |
|---|---|---|---|---|---|
| ENERGY STAR CAC | 93 | 12 | 2201 | 0.41 | 12.26 |
| Geothermal Heat Pump upgrade from CAC | 5297 | 30 | 1948 | 0.24 | 0.24 |
| Geothermal Heat Pump upgrade from ASHP | 5297 | 30 | 3939 | 0.49 | 0.48 |
| ENERGY STAR Room AC | 30 | 9 | 283 | 0.04 | 3.88 |
| CAC servicing | 125 | 3 | 216 | 0.03 | 0.25 |
| Radiant Barrier | 3167 | 10 | 388 | 0.05 | 0.05 |
| ENERGY STAR Reflective Roof Products | 1874 | 13 | 300 | 0.04 | 0.08 |
| Ridge Vent | 250 | 30 | 50 | 0.01 | 0.22 |
| ENERGY STAR Air Source Heat pump (upgrade from std eff) | 800 | 12 | 3260 | 0.41 | 1.18 |
| Duct Sealing FAF | 490 | 20 | 97 | 0.26 | 0.05 |
| Duct Sealing CAC | 490 | 20 | 647 | 0.09 | 1.01 |
| ECM furnace fan motor | 211 | 16 | 71 | 0.00 | 0.08 |
| Duct Sealing w/Heat pump | 490 | 20 | 744 | 0.09 | 1.16 |
| Infiltration control w/ CAC | 300 | 20 | 432 | 0.06 | 1.10 |
| Infiltration control w/ HP | 300 | 20 | 690 | 0.17 | 1.00 |
| Attic Insulation CAC | 1406 | 45 | 434 | 0.09 | 0.59 |
| Walls Insulation CAC | 374 | 45 | 430 | 0.15 | 2.19 |
| Attic Insulation HP | 1406 | 45 | 775 | 0.08 | 0.63 |
| Walls Insulation HP | 374 | 45 | 769 | 0.06 | 2.34 |
| Programmable thermostat | 235 | 15 | 1172 | 0.23 | 1.74 |
| ENERGY STAR Door replacement | 200 | 45 | 76 | 0.01 | 0.43 |
| ENERGY STAR Windows replacement | 3558 | 45 | 1282 | 0.75 | 0.41 |

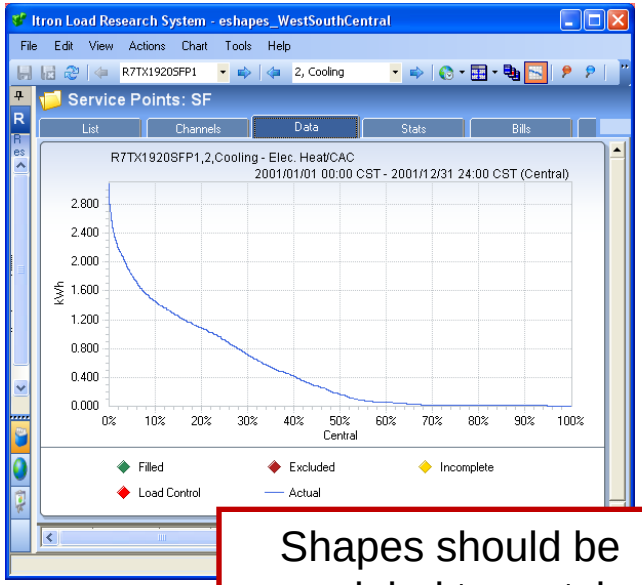
- Potential Types
  - Technological
  - Economic
  - Achievable
- Program Lists
- Summarized at the annual kW and kWh savings level

- DSM by technology or program
  - > Wall insulation
  - > Duct sealing → Heating/Cooling
  - > Attic fan
  - > Programmable thermostats
  - > Water heater insulation → Water Heater Shape
  - > CFLs → Indoor Light Shape

© 2006, Itron Inc.

# Technology Shapes

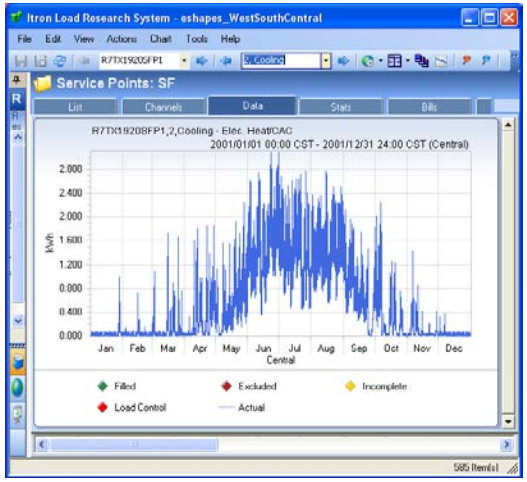
## End Use Shapes



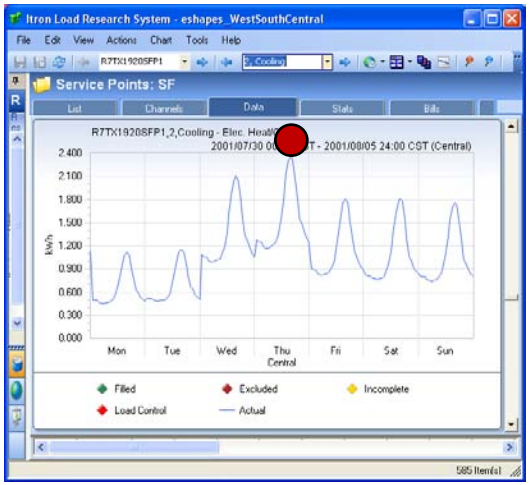

Shapes should be modeled to match forecast assumptions

**Load Duration Curve**

## Energy Distribution




## Coincident Peaks

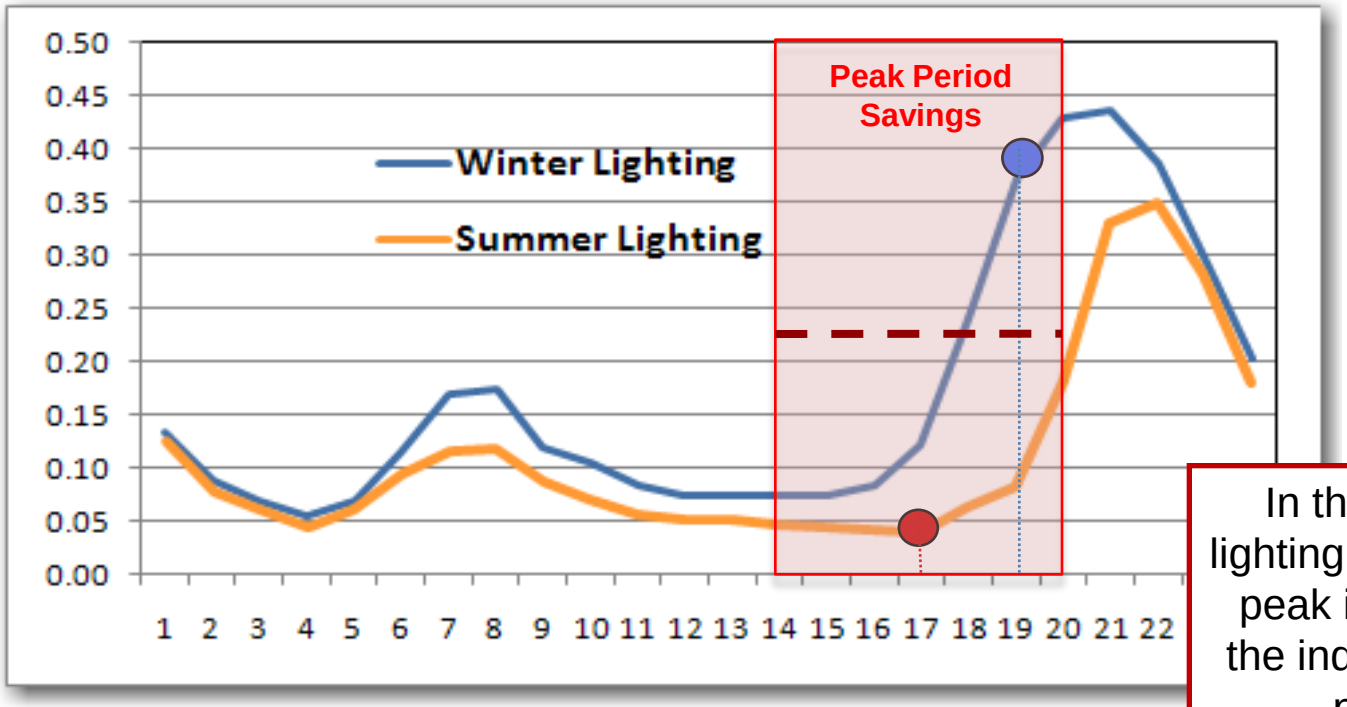



Shapes make MWh, MW and hourly savings consistent.

© 2006, Itron Inc.

# Peak Reporting Issue

- kW savings reported in the Potential Study are not necessarily coincident with system peaks.
- Savings assumptions do not use the same weather assumptions.




In this case, lighting coincident peak is 20% of the independent peak

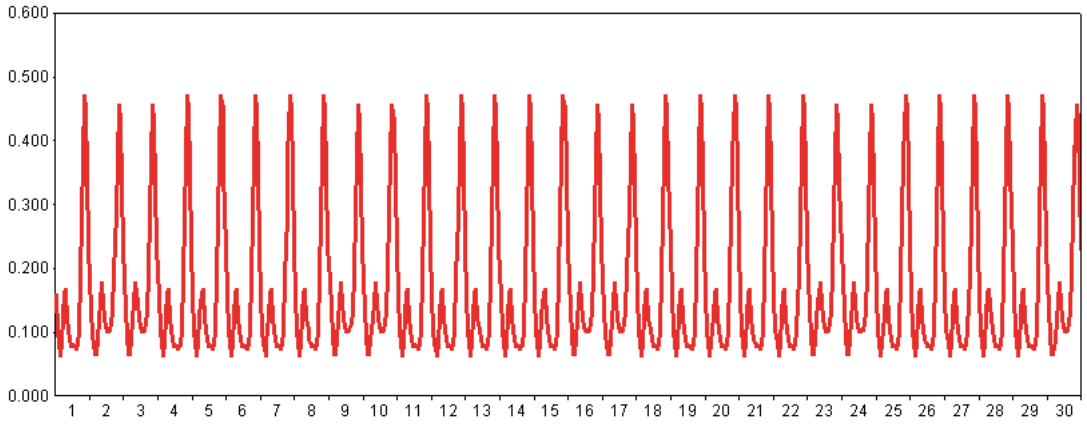
© 2006, Itron Inc.

# Technology Example

Goal: 300 MW by 2015

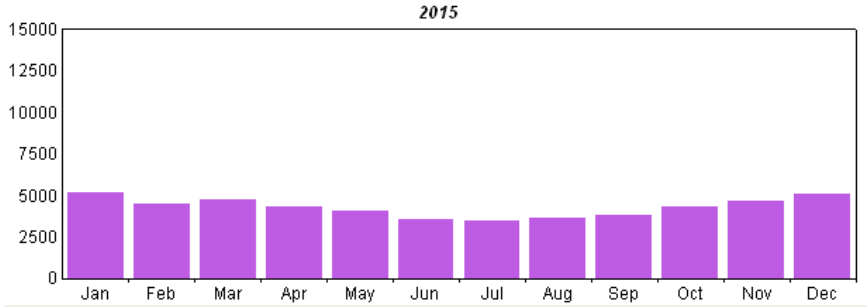
***Split:***

| | |
|---|---|
| 40 MW | Lighting |
| 85 MW | Res AC |
| 150 MW | Com HVAC |
| 25 MW | Load Control |




***Using Load Research Data:***

$ResLight_h = f(Hours\ of\ Light_h, Seasons)$




***Result:***

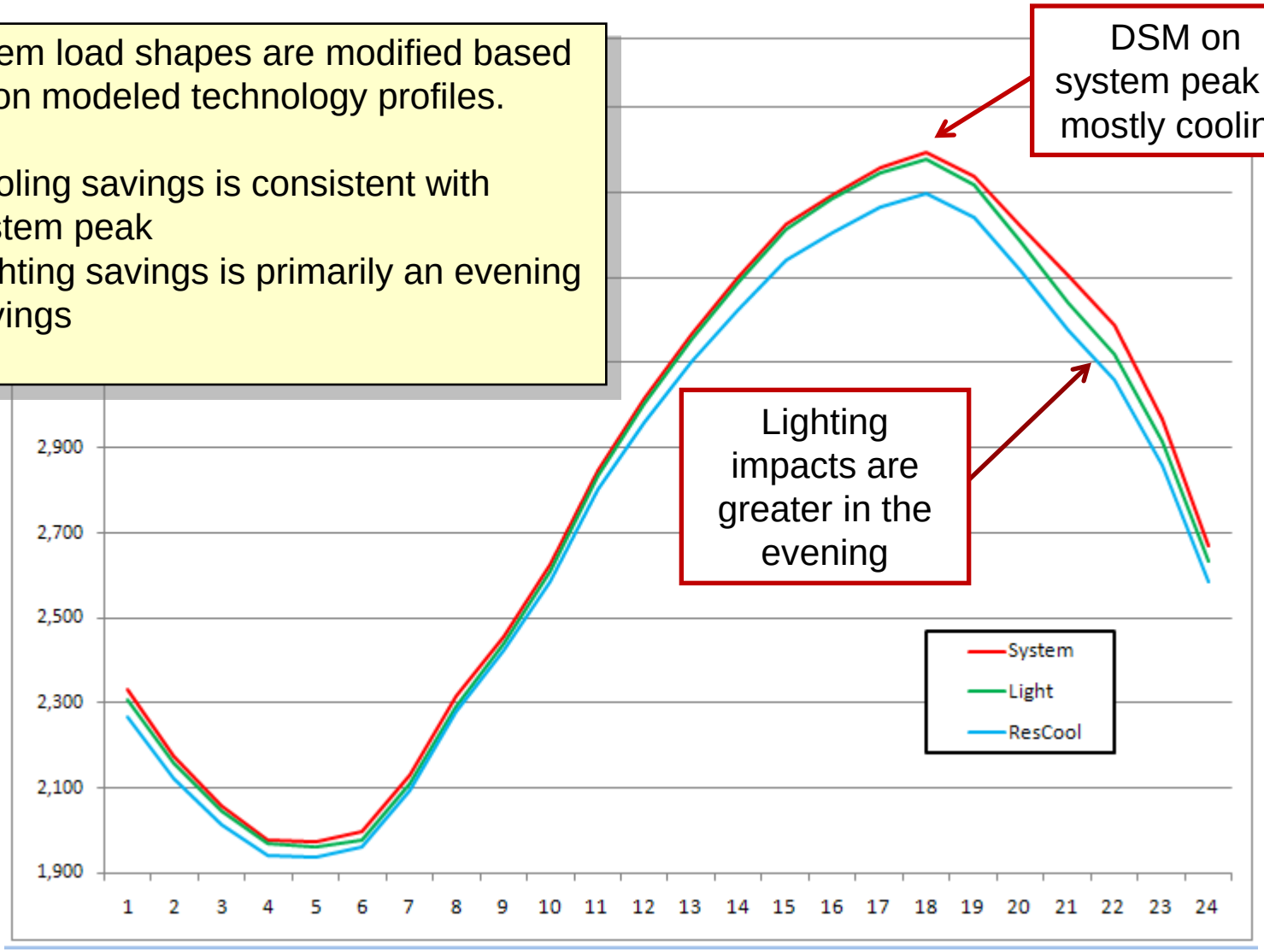
- Monthly Profile and Hourly shape
- Shapes are calibrated to obtain 40 MW during peak lighting hours
- Lighting coincident peak is 20% of independent peak.
- Only 8 MW contributes to coincident peak savings (only 268 MW total savings on peak)

© 2006, Itron Inc.

# Summer Peak Day

System load shapes are modified based on modeled technology profiles.

- Cooling savings is consistent with system peak
- Lighting savings is primarily an evening savings




© 2006, Itron Inc.

# Load Research Data Benefits

1. Monthly energy forecast by class
   - Identify weather response
2. System peak forecast and hourly load forecast
   - Identify peak composition
   - Identify load shapes
3. Subtract the DSM
   - Match programs with load shapes
   - Shapes identify coincident peaks
   - Scaled shapes modify final forecast

© 2006, Itron Inc.

# Thank You.

*To know more, start here: www.itron.com*

> Knowledge to Shape Your Future

Itron