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

Mark Quan, Itron

AEIC

Load Research Annual Conference

August 9-12, 2009

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

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? (Peak or Base)
- What will that do to our system shape and load factors (Load Shape)

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.

Typical Forecast Process

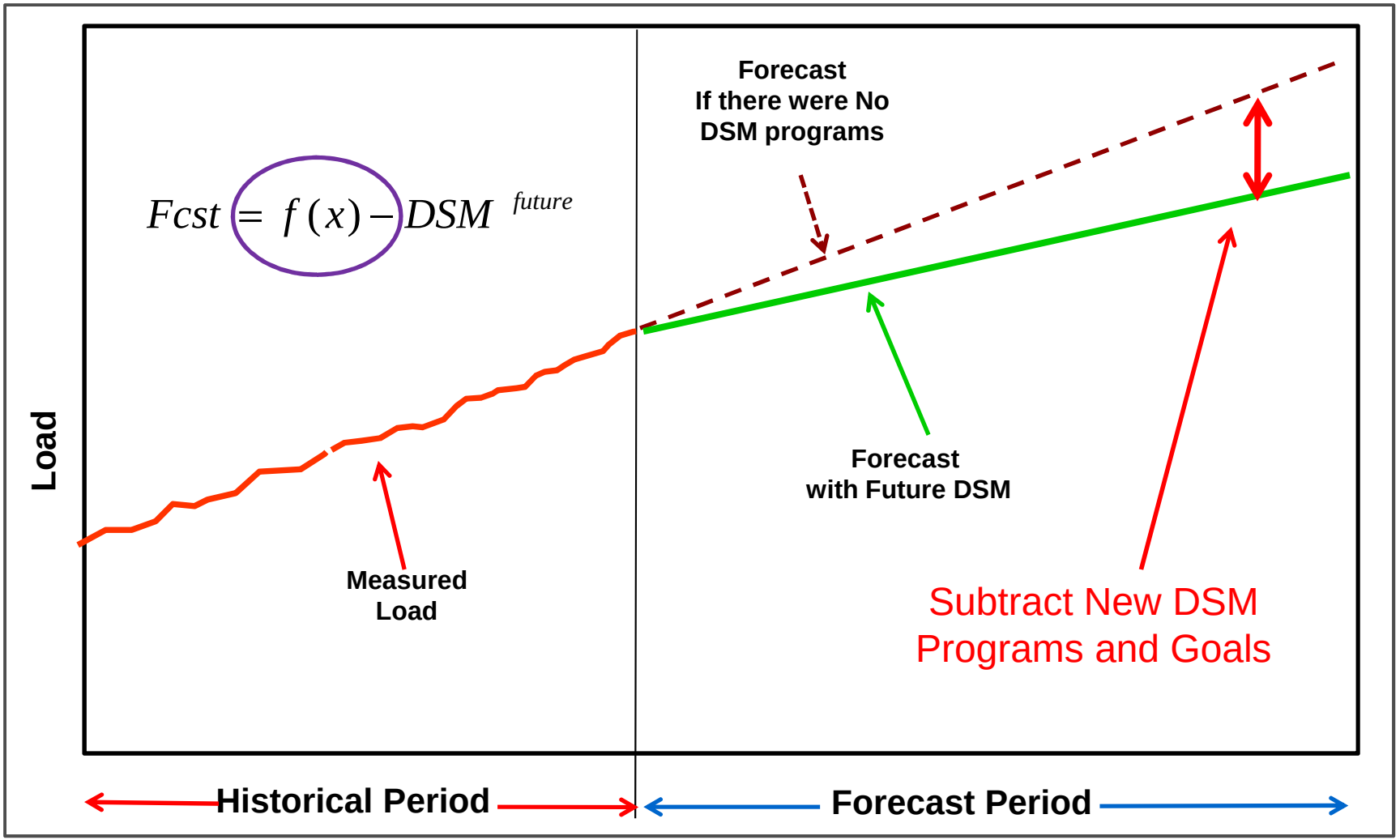
1. Monthly energy forecast by class
2. System peak forecast and hourly load forecast

Question: How do you include DSM?

Answer: *Subtract* the DSM goals from the forecast

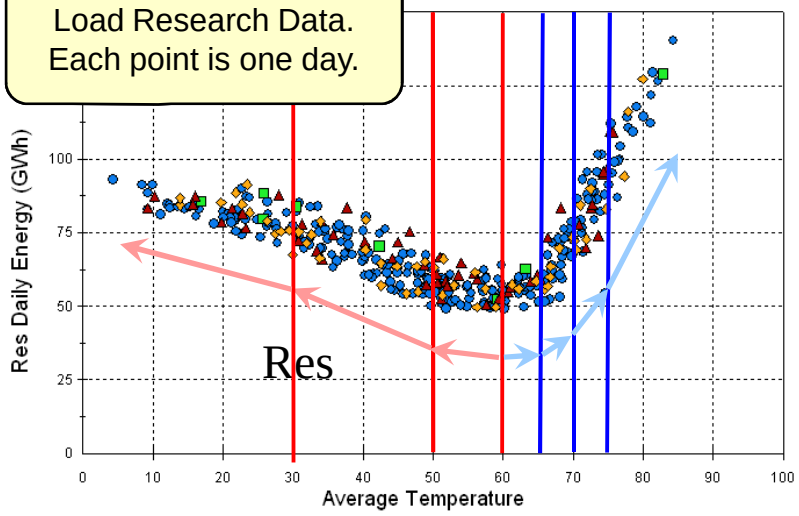
3. Subtract the DSM
   - Monthly energy
   - System peak
   - Hourly load shapes

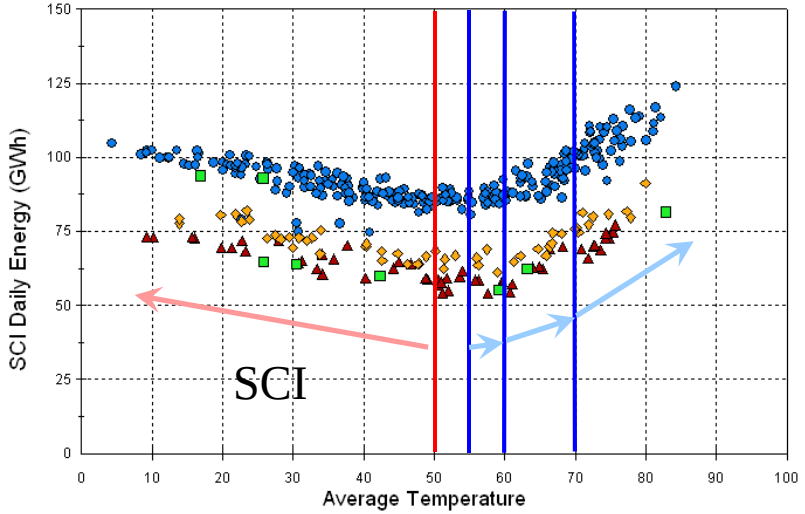
Typical Forecast Process

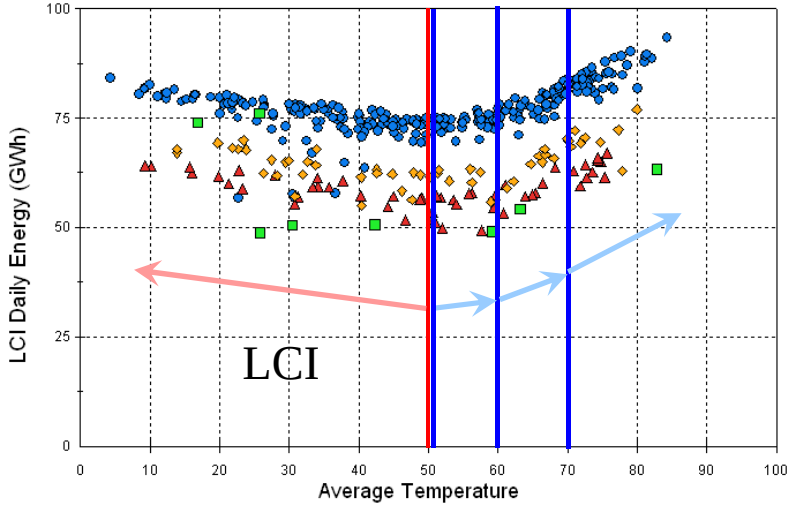


Energy Forecast - Weather Response

Load Research Data.
Each point is one day.



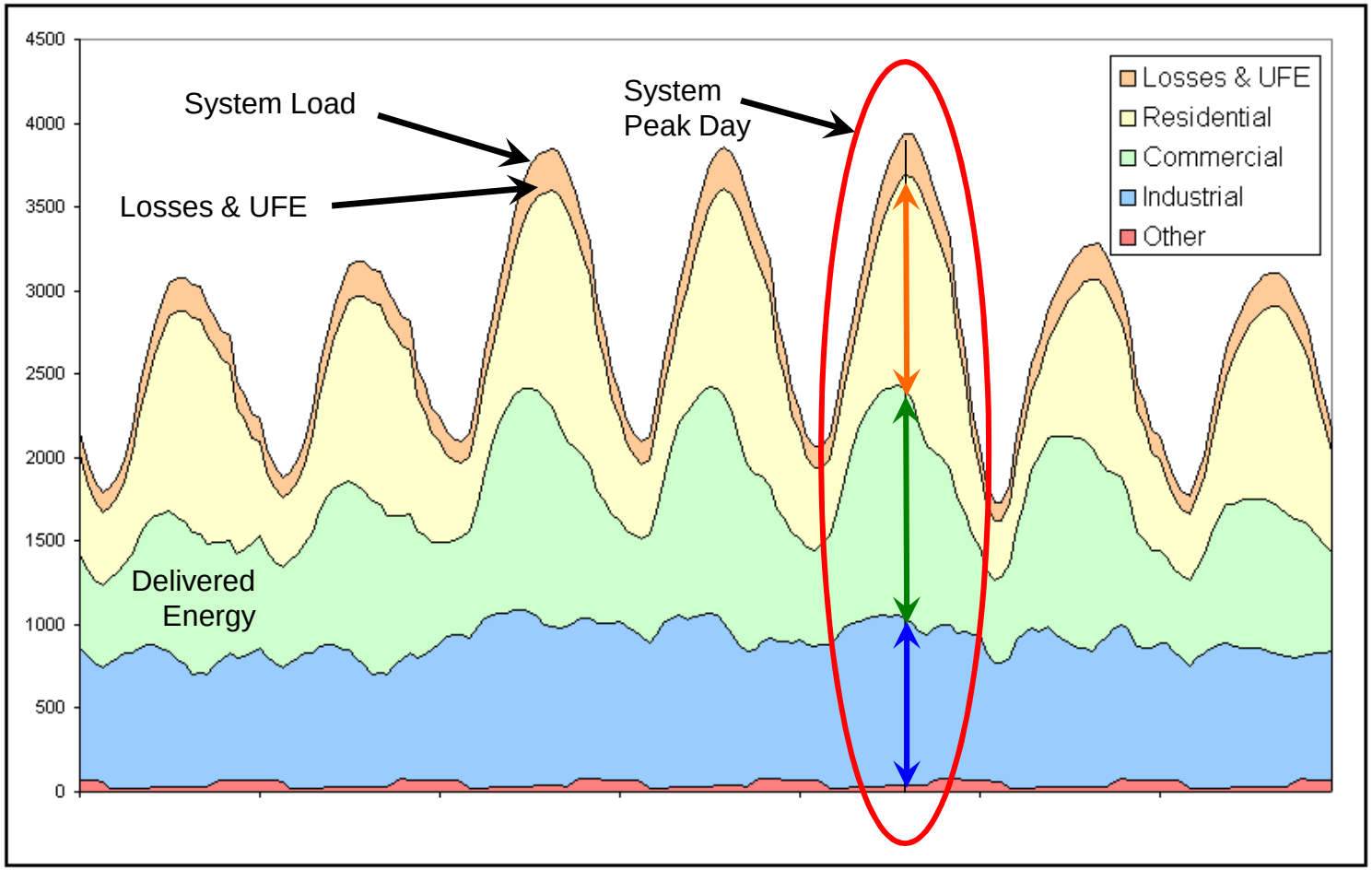




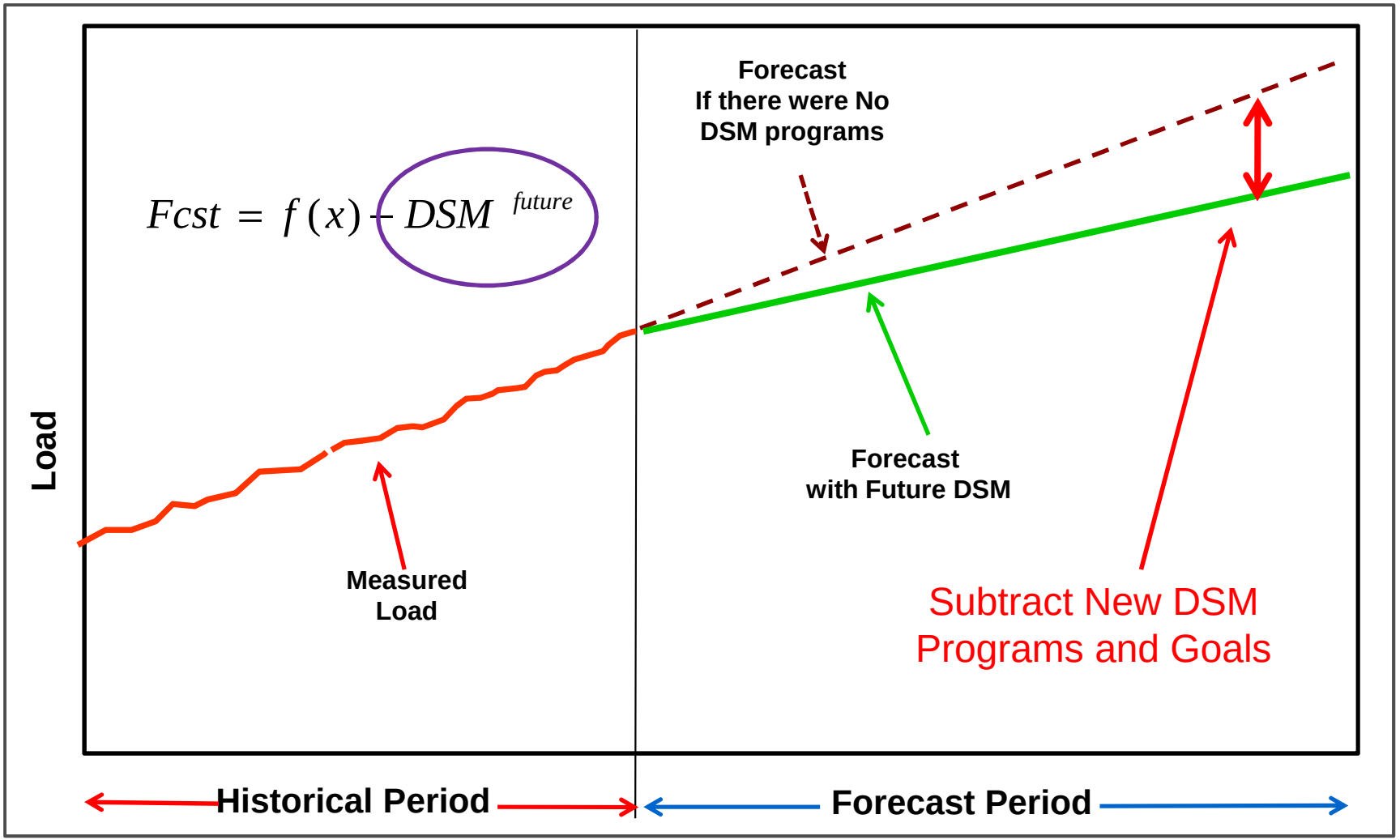
- Load Research data can help to clarify how weather effects work at the revenue class level.
- These data suggest different HDD and CDD triggers for different classes.
- The relative power of degrees in each range can be estimated from these data and used in models of monthly sales.

Peak and Shape Forecast - Composition

Class profile data allow us to estimate the composition of system loads. This is important for long-term peak forecasting.



Typical Forecast Process

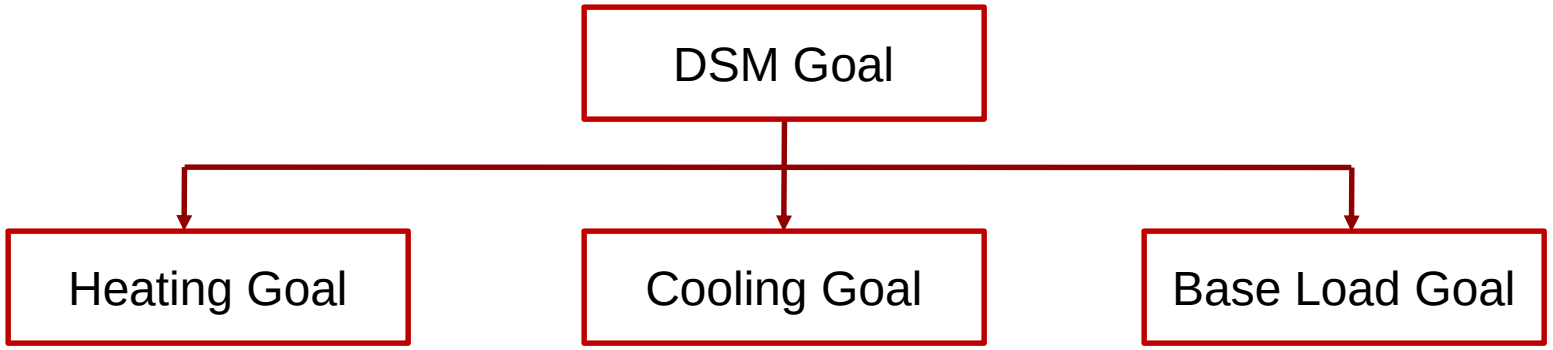


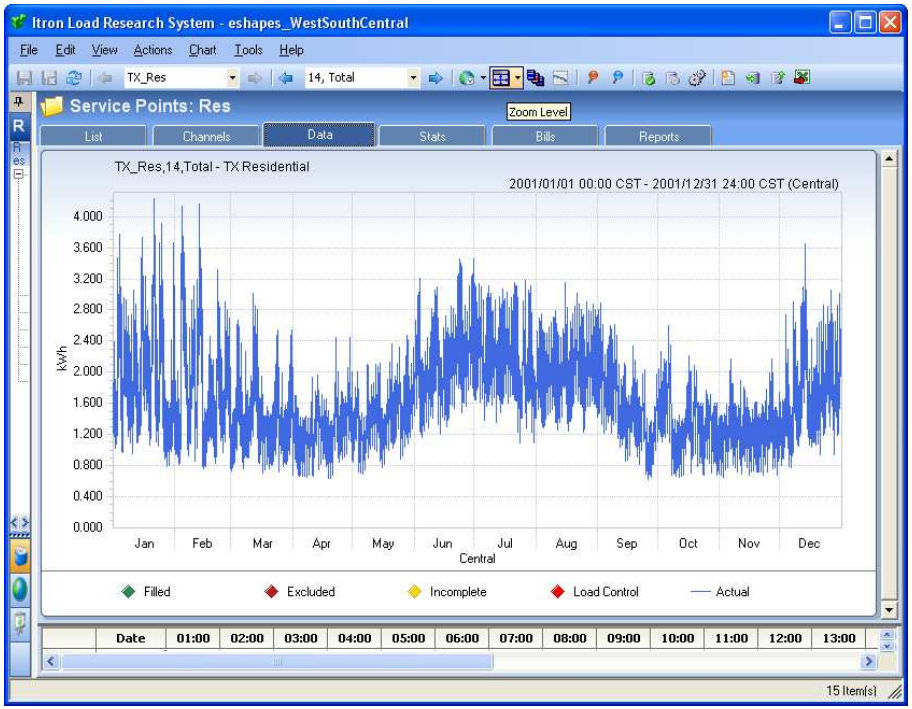
DSM Subtraction Issues

- 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

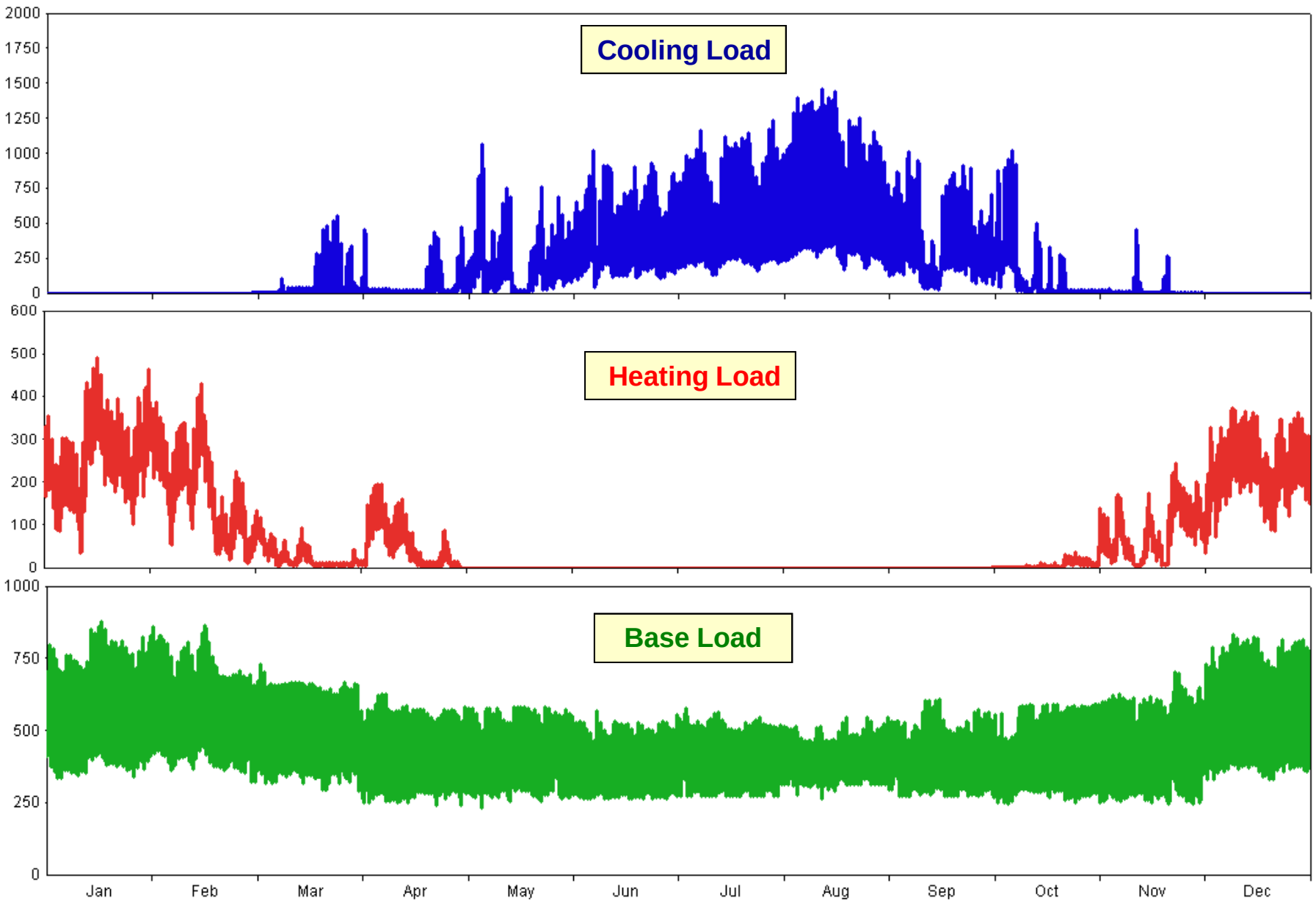
Policy Goal Data Conversion





- 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.

Generalized Shapes

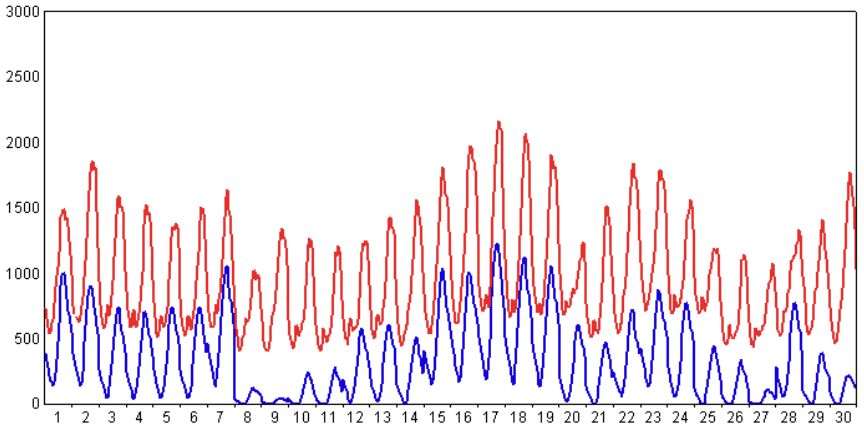


General Goal Example

Goal: 300 MW by 2015

Split:

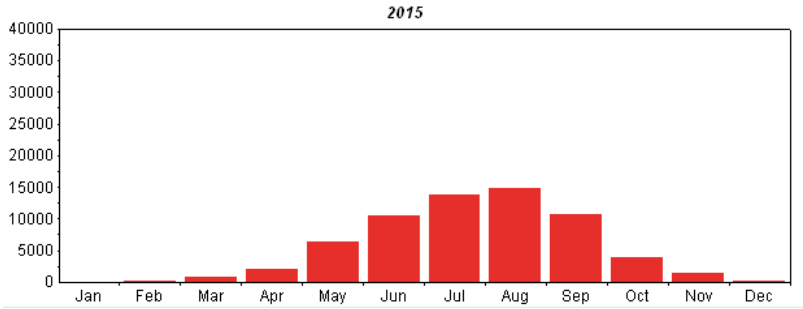
40 MW	Lighting
85 MW	Res AC
150 MW	Com HVAC
25 MW	Load Control



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.
- Cooling shapes are typically coincident with system load shapes.
- Expect to save 85 MW on the system peak

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

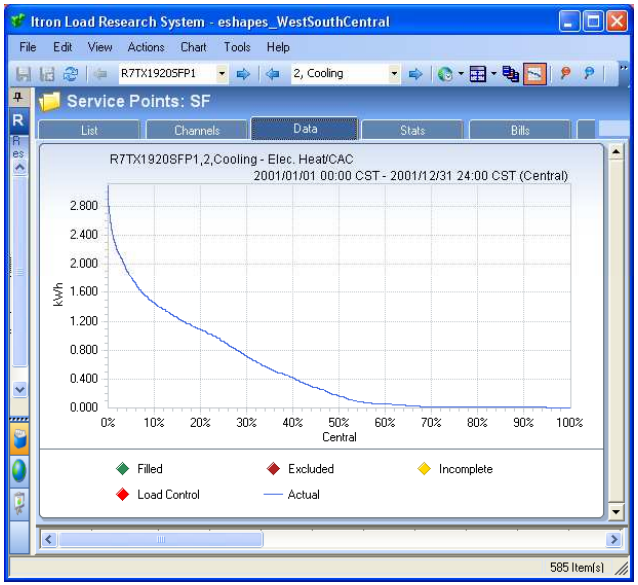
Issues

- Variety of program
- 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

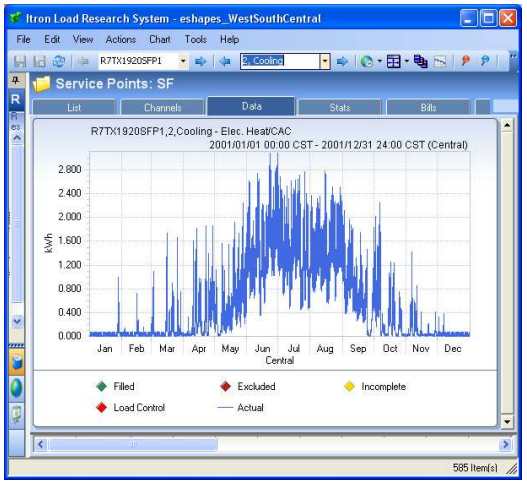
Technology Shapes

Load Research Shapes

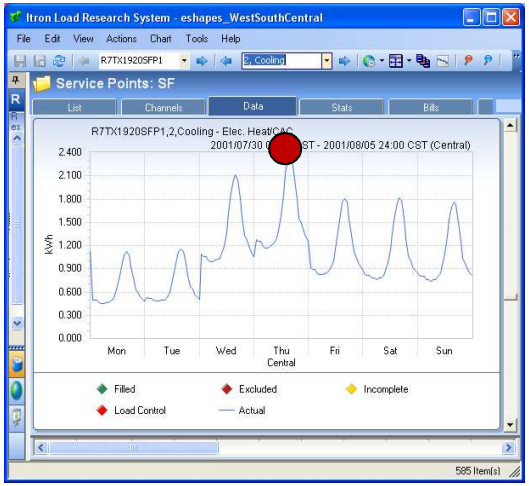


Load Duration Curve

Energy Distribution



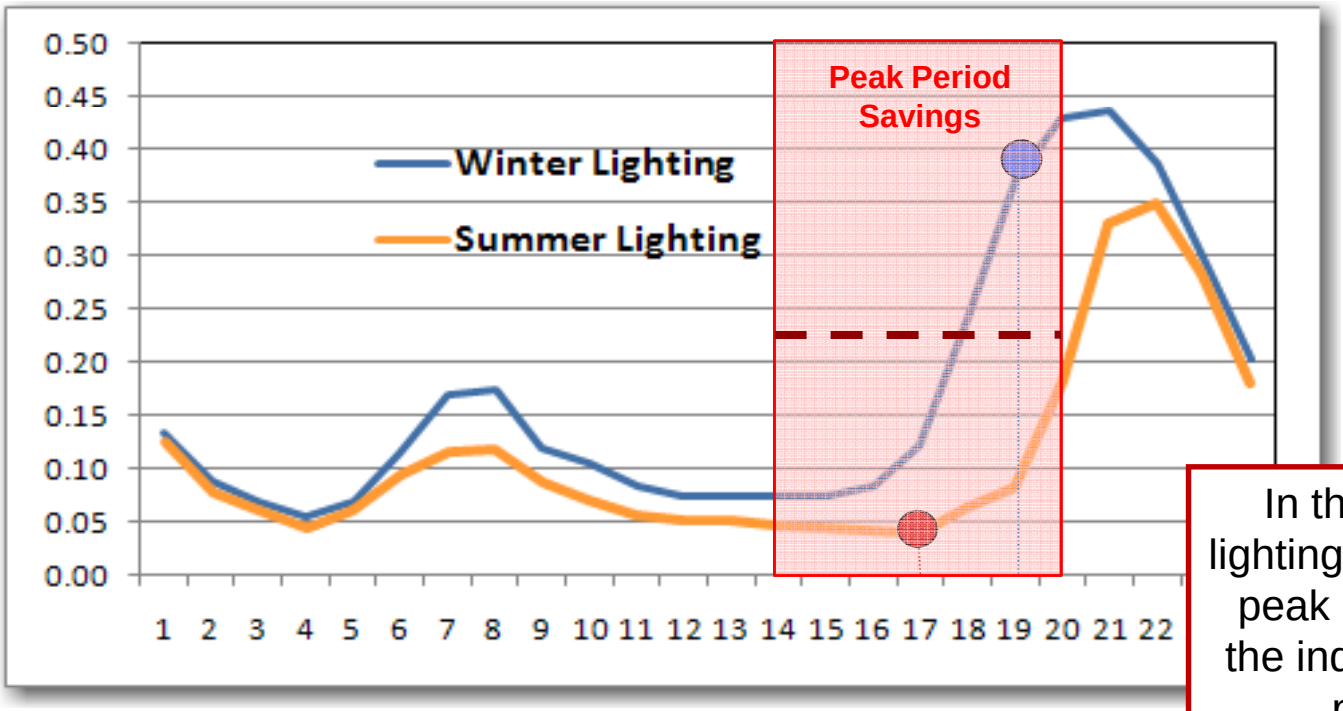
Coincident Peaks



Shapes make MWh, MW and hourly savings consistent.

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

Technology Example

Goal: 300 MW by 2015

Split:

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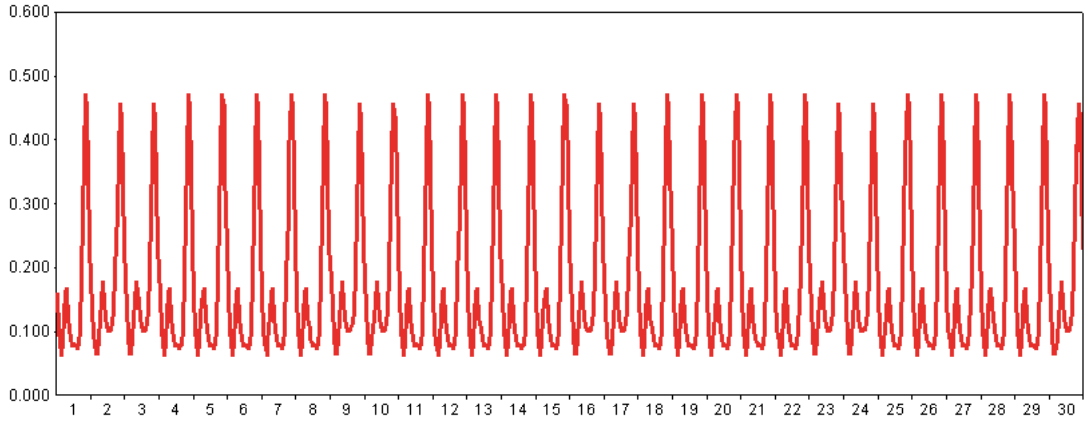
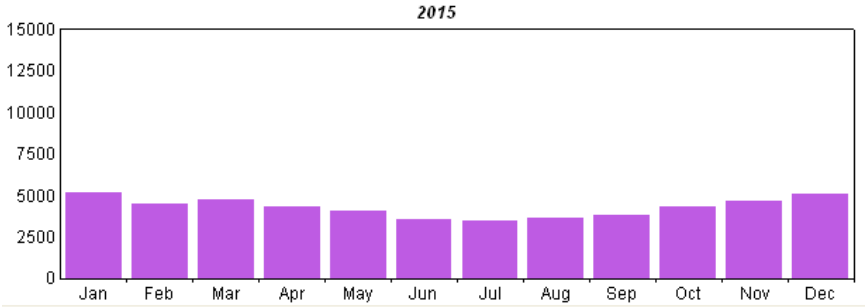


Using Load Research Data:

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



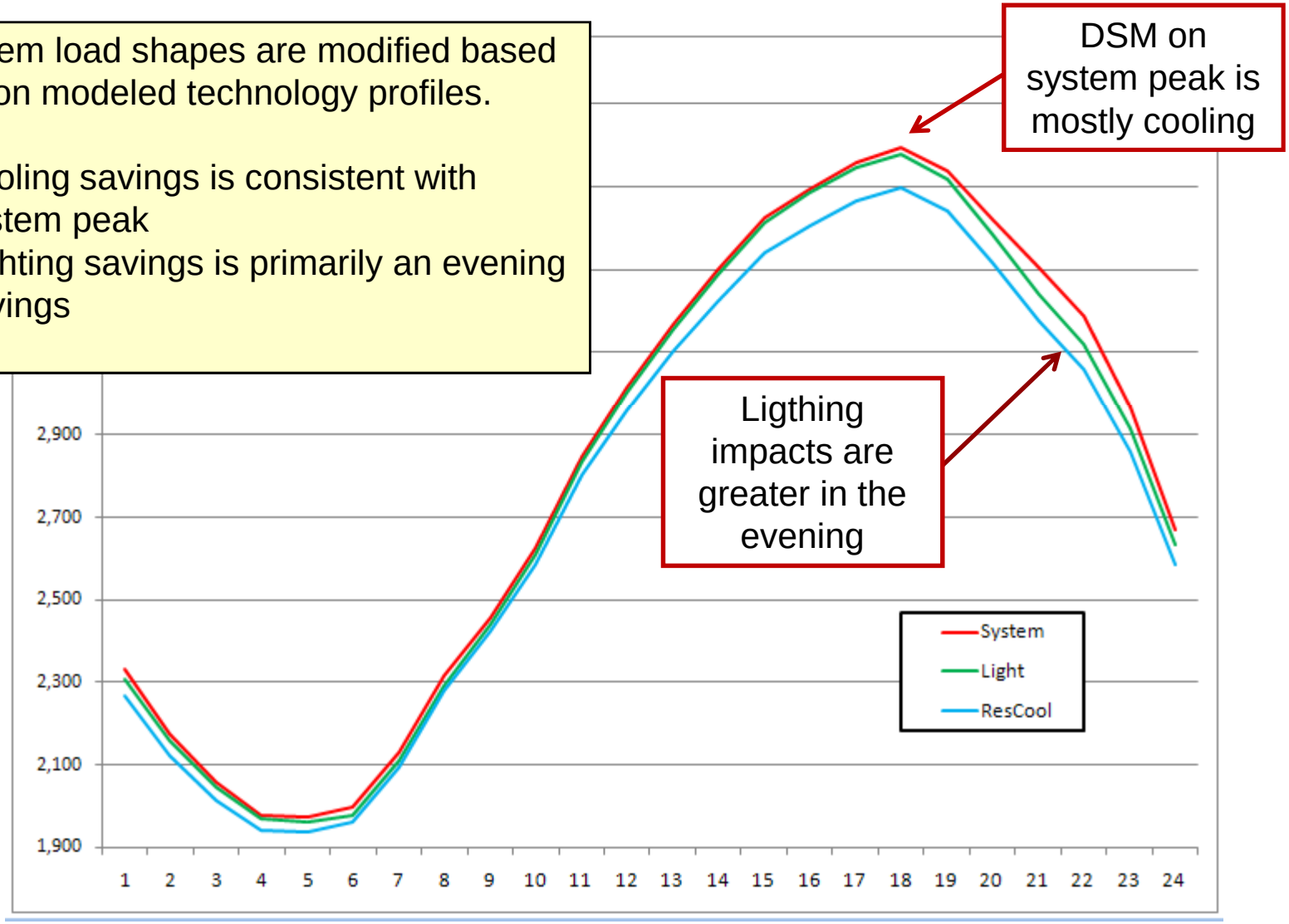
Result:

- 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)

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



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