



SmartGrid Pilots Review (2008/2009) Technology and Non Price Influences

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In Home Solutions With End Use Controls

(Preferences / Portals)

Two Pilot Regions: 32 Homes/ 5 Solar PV & 98 Homes/ End Uses Only

“I know what I use and might save, but now I can also set schedules.”



Use Of Modes, Not Price Directly With EE and DR As Implicit Options

The screenshot shows a 'Modes' widget interface. At the top, there's a 'Modes' title and a 'Change Widget' button. Below the title are three tabs: 'Overview', 'Week Schedule', and 'Manage Modes'. The main content area is titled 'Your Modes Scheduled for the week' and includes a sub-instruction 'Click on any day to change the modes'. A checkbox labeled 'Starts on next day' is present. The interface displays a grid of modes for each day of the week (Sun through Sat). Each day's column contains an 'Add Mode' button and three mode entries, each with an icon and a time range. The modes are: Morning (gift icon), Away (clock icon), and Sleep (moon icon). The times vary by day: Sun (Morning 7 am, Sleep 10 pm), Mon (Morning 5 am, Away 7 am, Sleep 10 pm), Tue (Morning 5 am, Away 7 am, Sleep 10 pm), Wed (Morning 5 am, Away 7 am, Sleep 10 pm), Thu (Morning 5 am, Away 7 am, Sleep 10 pm), Fri (Morning 5 am, Away 7 am, Sleep 10 pm), and Sat (Morning 7 am, Sleep 10 pm). At the bottom right of the widget, it says 'Source: Lixar'.

Day	Modes
Sun	Morning 7 am, Sleep 10 pm
Mon	Morning 5 am, Away 7 am, Sleep 10 pm
Tue	Morning 5 am, Away 7 am, Sleep 10 pm
Wed	Morning 5 am, Away 7 am, Sleep 10 pm
Thu	Morning 5 am, Away 7 am, Sleep 10 pm
Fri	Morning 5 am, Away 7 am, Sleep 10 pm
Sat	Morning 7 am, Sleep 10 pm

“We can set our home and appliances based on when we are there or not”.

Advances Load Management Ability

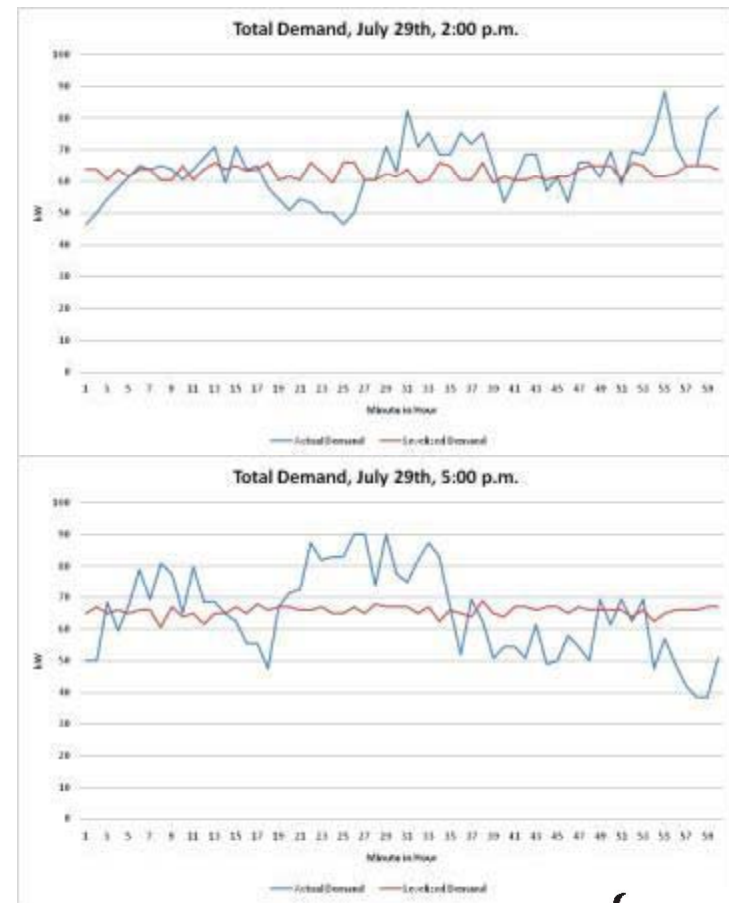
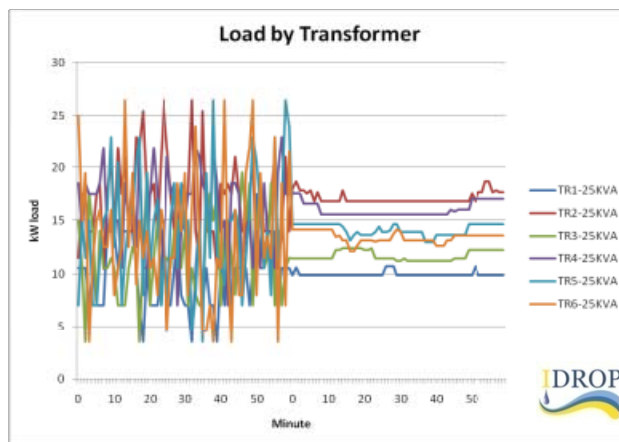
Dynamic Dispatching Results

Dispatch end uses real time to mitigate solar risk, levelize peak load

- Test 1: Opt in to “help grid efficiency” (42%)
 - Test 2: Opt out of auto-checked box (6%, nets 94%)
 - Test 3: CRM phone call, then opt in (42% to 52%).
- No price signal or price credits.

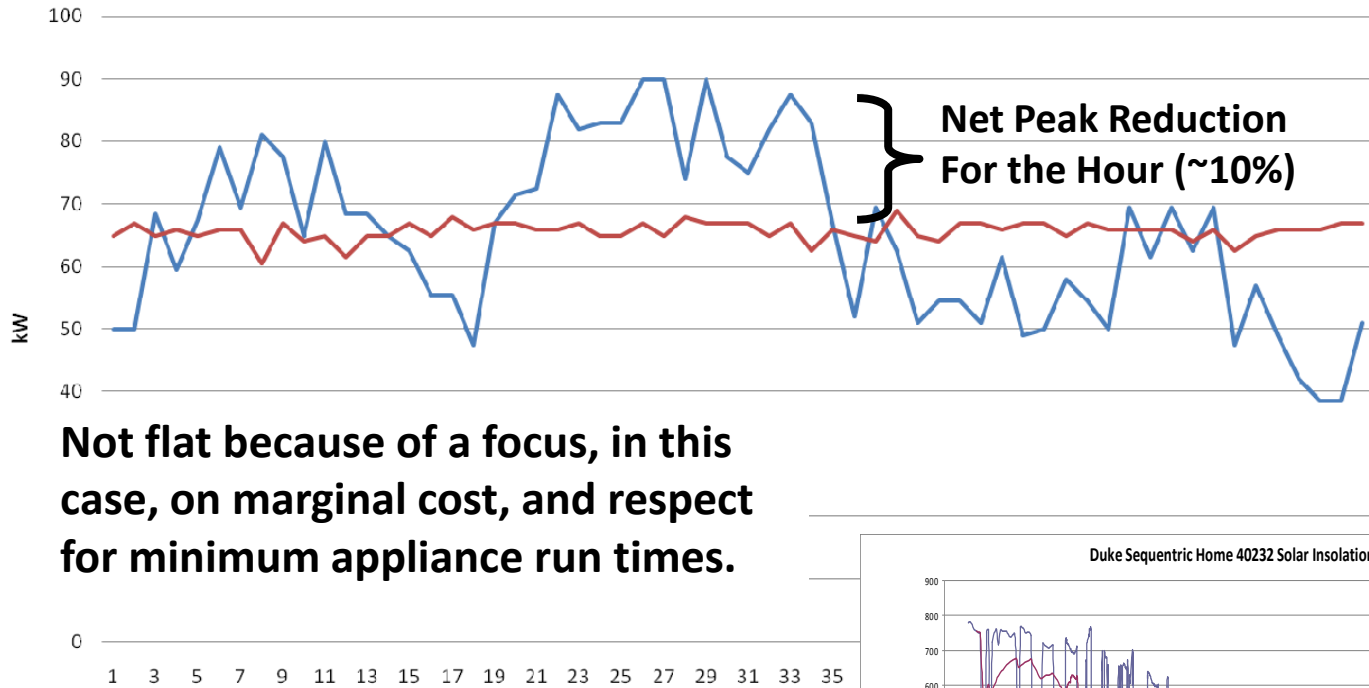
No one noticed real time dispatching, yet pilot results were 9% to 20% demand savings.

Dynamic Dispatching on Transformers



Dynamic Dispatching Results

Total Demand, July 29th, 5:00 p.m.

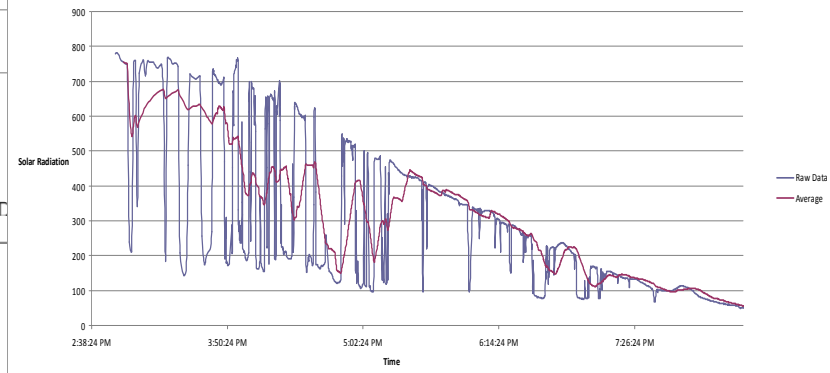


Not flat because of a focus, in this case, on marginal cost, and respect for minimum appliance run times.



— Forecasted Demand — Levelized Demand

Duke Sequentric Home 40232 Solar Insolation Data 8/7/08

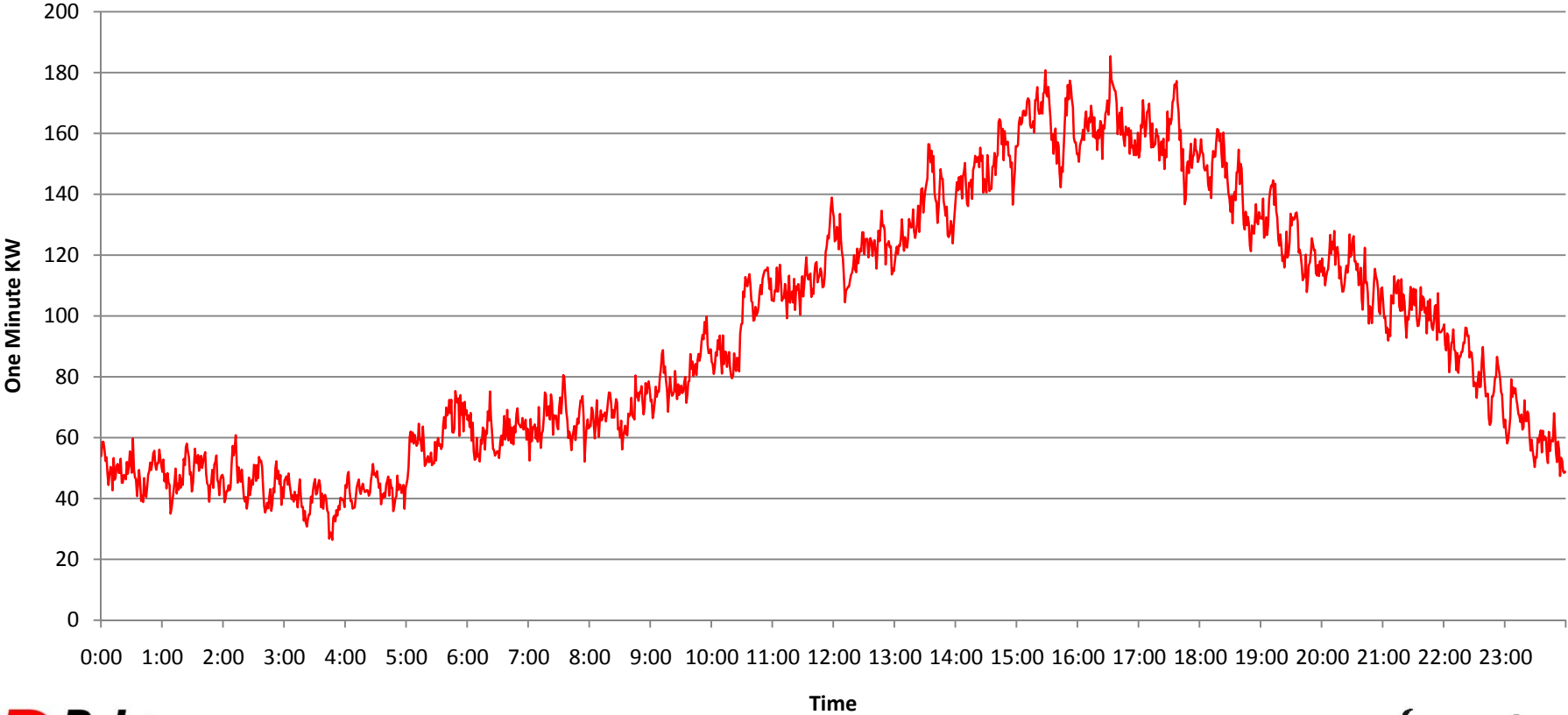


Afternoon Solar Volatility

Extending Dynamic Dispatch To Simulation Peak Day Scenario in July for a Circuit

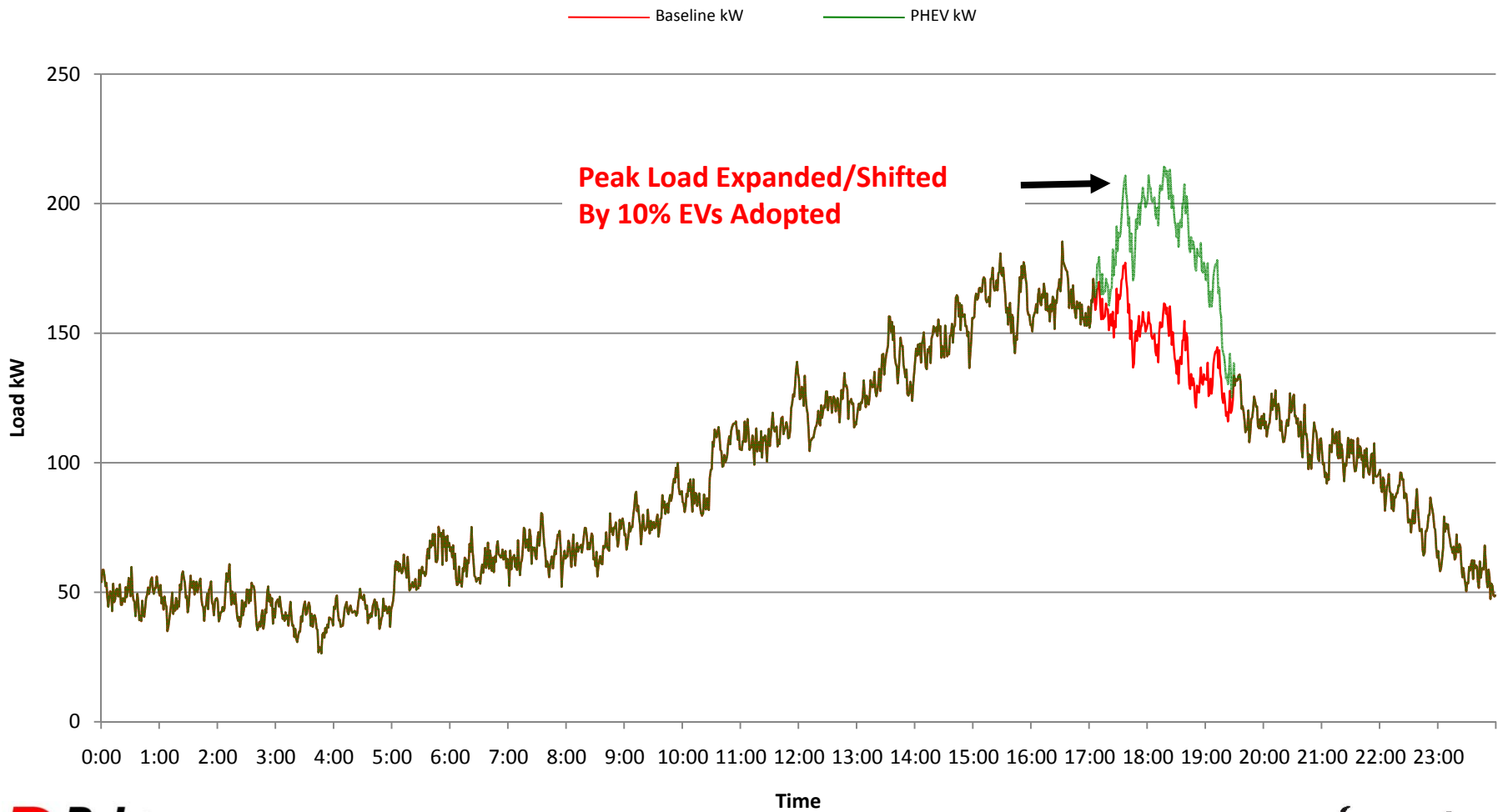
— Baseline kW

Baseline kW (per minute) for Simulated Circuit (~10 MVA)

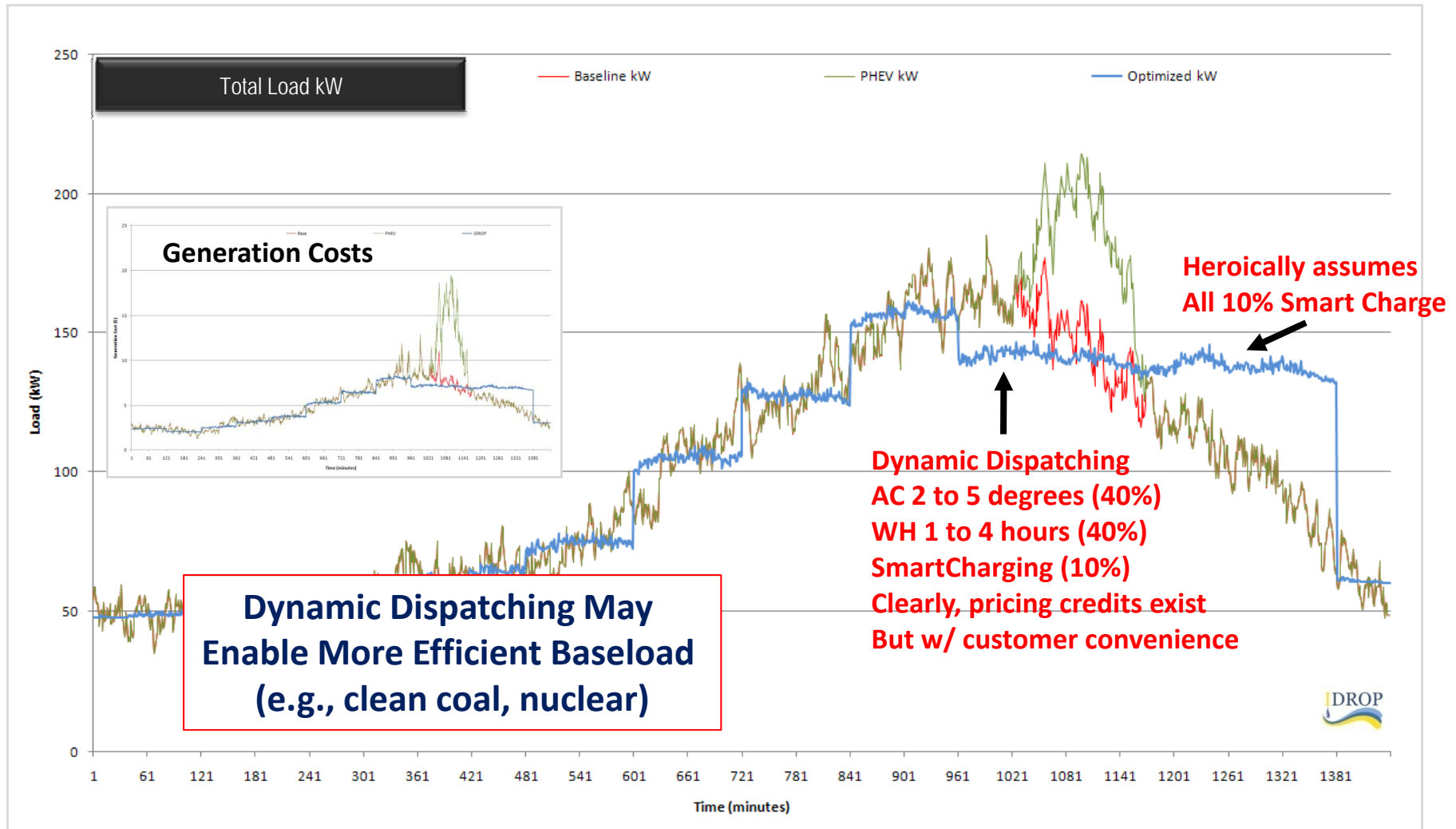


Peak Day Simulation

Dynamic Dispatching With 10% Share of EVs



Stylized Peak Day Dispatching Operation With EV, AC and WH.....Just To Show What's Possible



Pilot Evidence On Price (in)Elasticity?

Duke Energy CPP Pilot Results Mirror Others

National results similar to Duke Energy.
 (~500% ratio, ~10% reduced) **2% elasticity !!**

What makes demand so inelastic ?
(comfort, convenience, control, certainty.....nonprice)

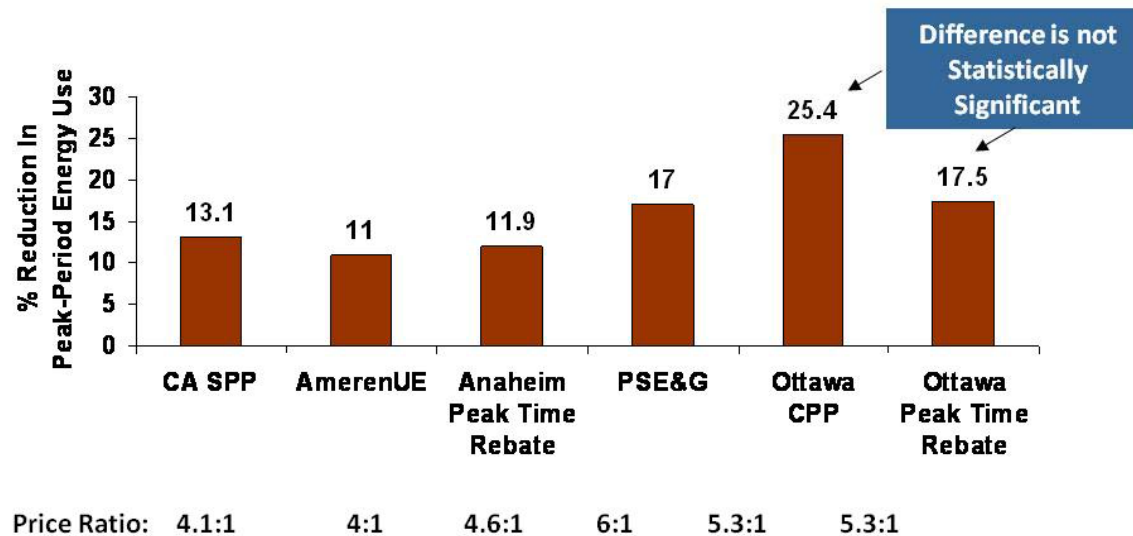
Typical Price Elasticities

Residential 8760 ~ 10% (8760)

Commercial ~ 10% to 50%

Industrial ~ 50% to 100%

Yes, some sectors are price sensitive, but not residential, and clearly not for the Top Peak Hours when we need it the most



Better To Spend on Marketing Acquisition vs. Price Credits?

In Duke Energy pilots:
 Got 13 % more participants for 50% more price credit on AC, and 1 % fewer participants with 35% price decrease.

Source: Freeman, Sullivan & Co.

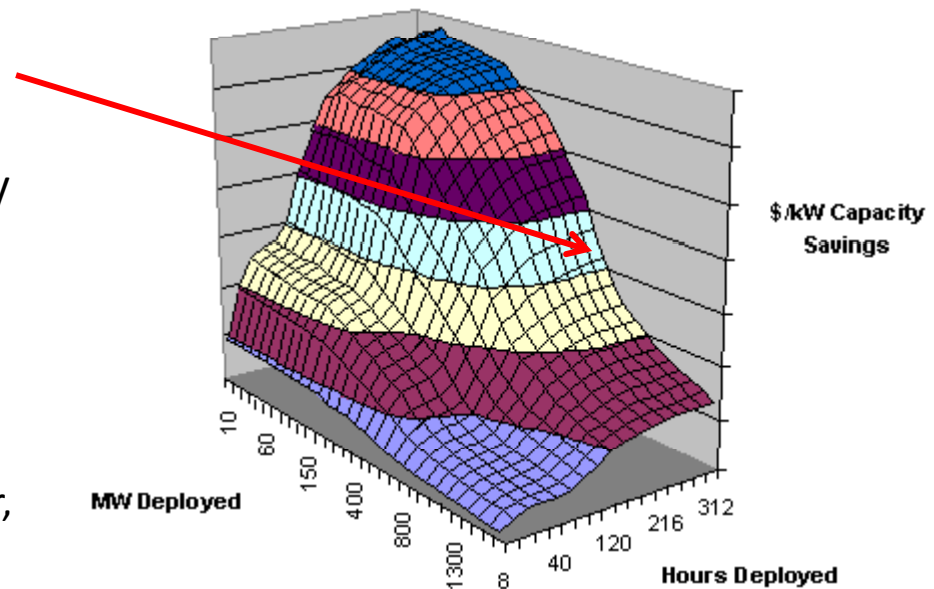


Even Where Price Does Matter, Its Influence May Narrow With Increasing SG Options

With enough MW and hours,
SmartGrid customers might be price
setters more than supply side.

Price based solutions will be increasingly
less influential, as SmartGrid succeeds.

Policy Concern: Where non-regulated, home
solutions succeed, aggregations of end uses
may “game” the ISO real time price signal.
Utilities may be eager to go behind the meter,
then, to mitigate risk via “end-use hedging”.



**Non price factors may be the
cheapest way BELOW \$75/KW**

IRP runs for range of forward market prices and hourly weather conditions. Value is delta revenue requirements in KW value, for the hours deployed.

What SG Behaviors Has Duke Energy Seen ?

Increased Customer Knowledge and Control Does Not Guarantee Conservation

Energy increases were just as common as energy reductions. Perhaps we see now why some vendors claim savings *up to 40%*. Sure, that is the max, but there is a bigger story underneath this.

Why the INCREASED use ?

Were inefficient homes

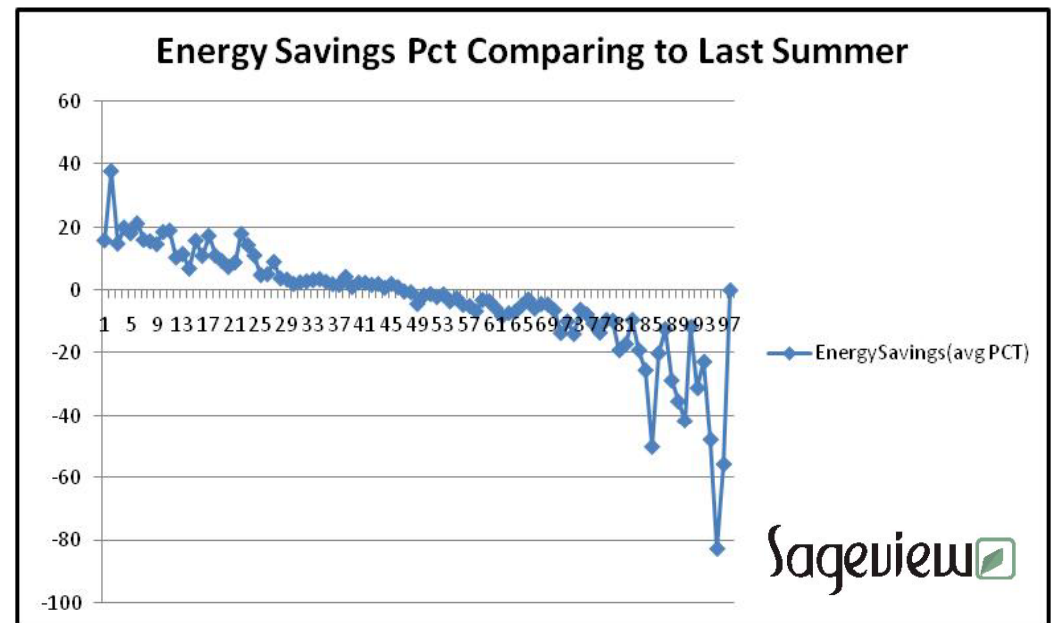
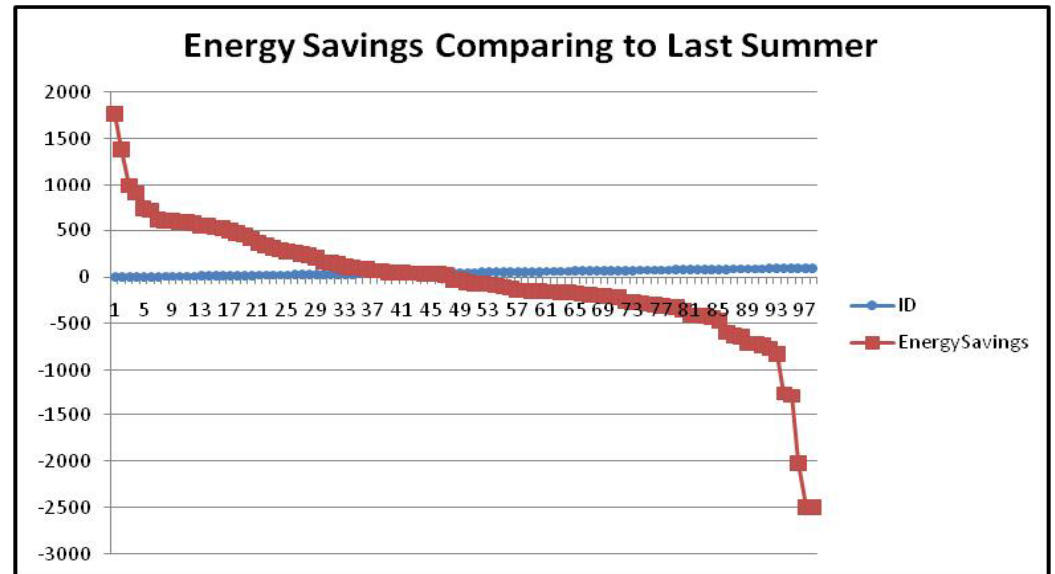
High bill volatility

Older home > 25 yrs.

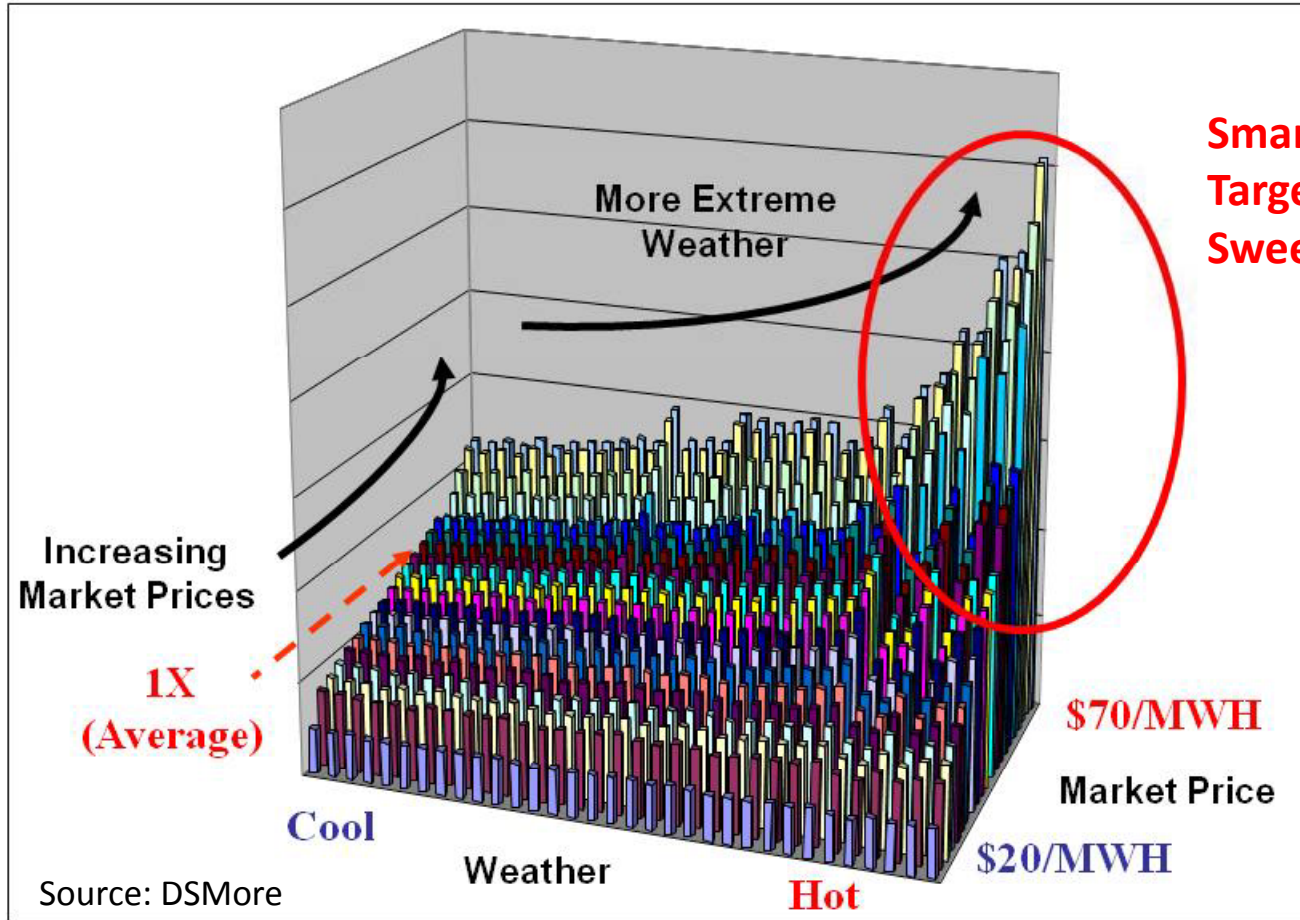
Income > \$75K

Clearly, customers differ.

Need to target different solutions to different customer segments.



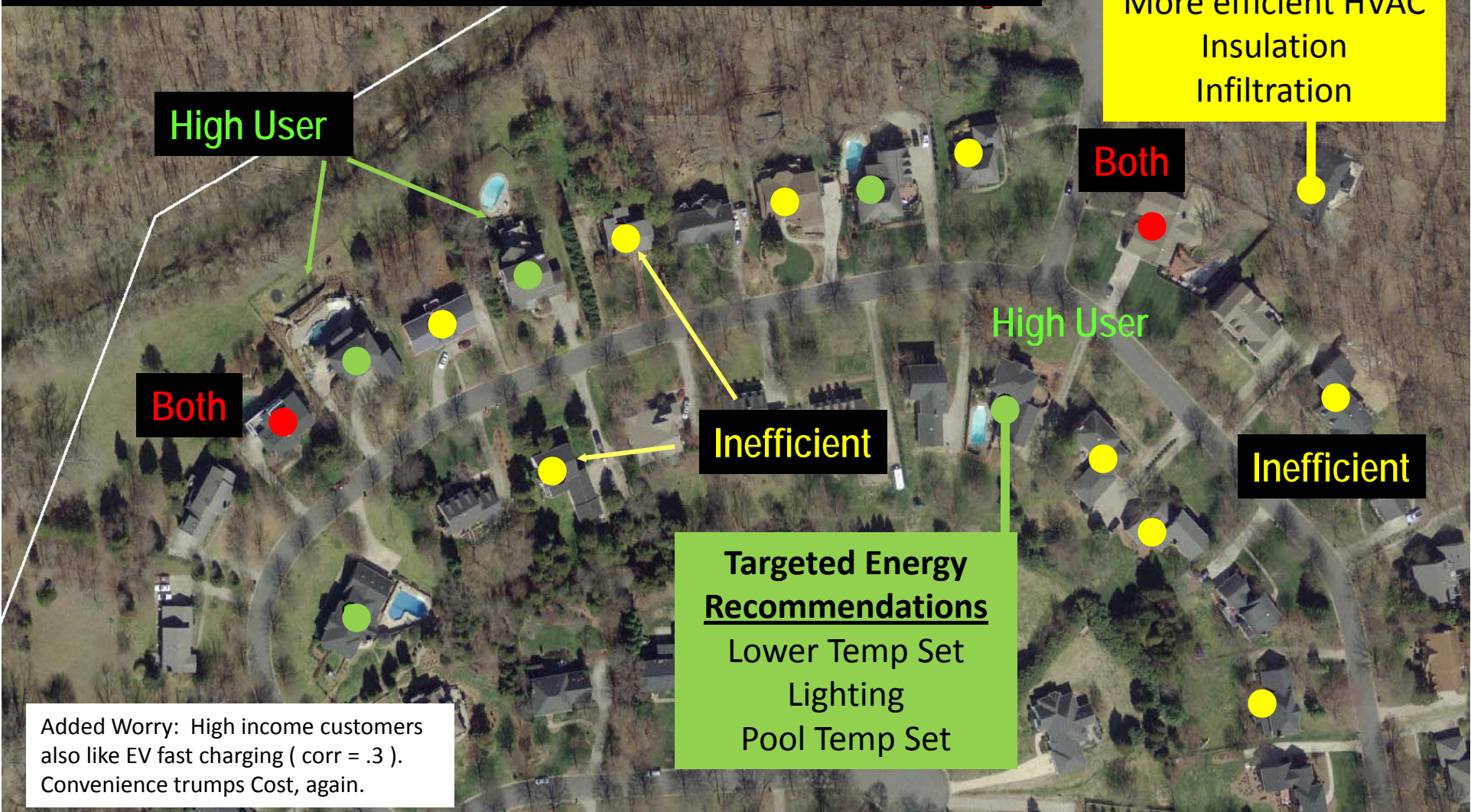
Inefficient Customers Are “Worth” More, Higher Avoided Costs
To Accurately Value DSM, We Need To Value Weather & Markets



...how can we target better ?...to get higher value...

High Users = Green (uses a lot, but may have efficient building)
Energy Losers = Yellow (inefficient, with higher kwh/degree)
Red = Both

Targeted Energy Recommendations
More efficient HVAC
Insulation
Infiltration



High User

Both

Inefficient

Both

High User

Inefficient

Targeted Energy Recommendations
Lower Temp Set
Lighting
Pool Temp Set

Added Worry: High income customers also like EV fast charging (corr = .3). Convenience trumps Cost, again.

In Sum, Non Price and Price Both Matter

Some search for rational price solutions



Implies: Real Time System Price May Be “Half of the Solution”

Single system average price, sent by utility, always subsidizes half the customers. And at least some (half?) of customers are inelastic, responding mostly to nonprice factors. Including these customers in our energy markets might just lower the ISO price BELOW the cost of “iron in the ground”, and be more reliable.

Others look to anything BUT price?

Product, Place, Promotion
Person, Positioning, Process
People (sales), Packaging, & Price
Reinforcement (ads), social modeling,
Norm, shame, experts, friends, kids
Operant conditioning, signage,
“Set it, Forget it”, Occupancy Sensors

