

Balancing Load Curtailment and Customer Value

DR from a REP's Perspective

Crius Energy's Texas DR/EE Program

- Since 2014, TriEagle Energy (now part of Crius) has been offering customers free thermostats with free install to top customers to participate in Demand Response and Energy Efficiency programs in Texas
 - Currently have over 10 MW of residential capacity in Texas
 - Participating in Texas TDU, and ERCOT (Weather Sensitive ERS) Programs for DR
 - Using the capacity payment to subsidize the thermostat for customers
 - Very focused on customer comfort and value with the program

Economic Load Shifting

- Since 2015, have been using some of these houses to investigate economic load shifting to save money and reduce risk of high wholesale prices for TriEagle Energy
- If done on a large scale, accurate economic load shifting will result in lower prices for TriEagle's customers

Simple Analysis: Summer 2016 Avoided Costs

- Remove 1.8 kW/home when LMP > \$90/MWh
- Numbers Undervalue opportunity because they only value avoided energy purchases, not:
 - Avoided hedge costs,
 - Profit from hedge position in excess of physical need.

ERCOT 2016 Avoided Cost/Home: 1.8kW Curtailment When RT LMP > \$90		
Pricing Hub	Hours Above \$90	Avoided Cost Per House
Houston	141	\$ 56.24
North	89	\$ 31.20
South	114	\$ 40.65
West	95	\$ 32.79
Average	110	\$ 40.22

Demand Response Stochastic Optimization Model

- Highlights of the more elaborate analysis
- Potential profit and conditional value-at-risk (CVaR) avoidance using load shifting
- Performed using data from summers of 2011-15
- Load shifting can have positive impacts, but also negative if performed incorrectly
- Analysis performed by Steven Gabriel
 - University of Maryland Professor
 - Mechanical Engineering
 - Applied Mathematics
 - Statistics & Scientific Computing
 - +30 years academic and industry experience
 - Energy Markets
 - Optimization / Decision Sciences



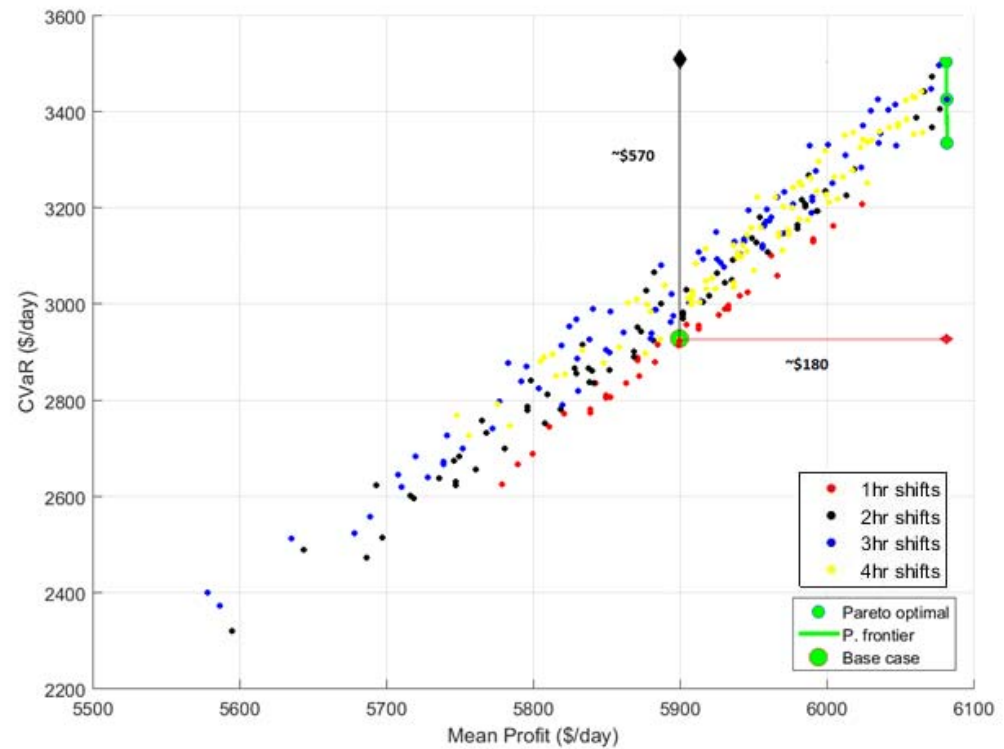
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Pareto Frontier

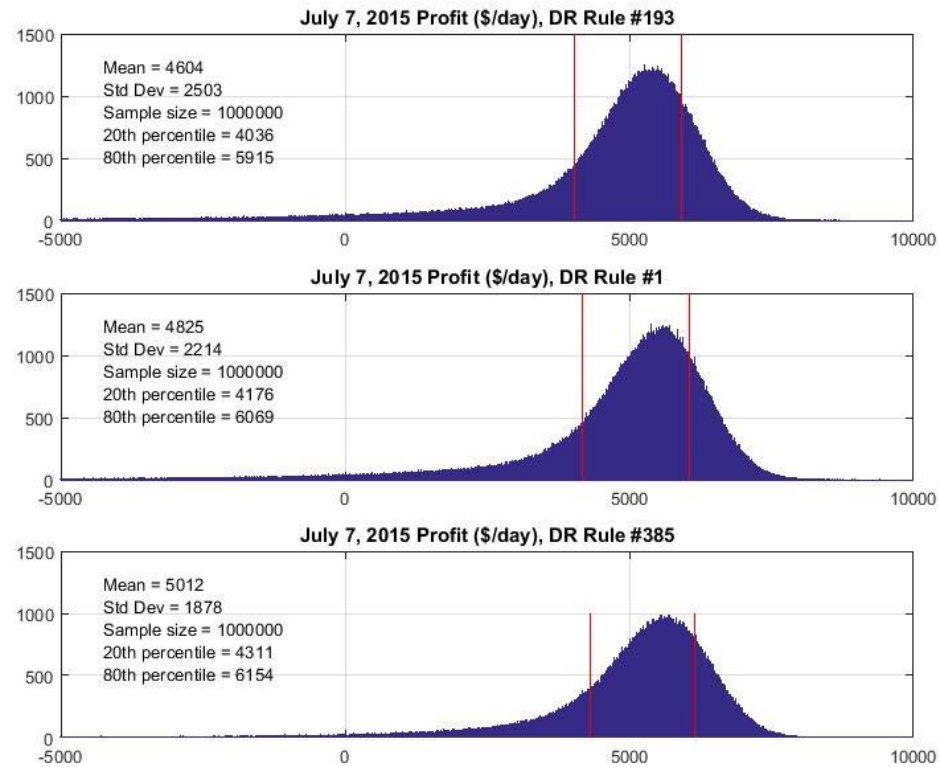
Always a tradeoff between Risk and Profit

Fraction of DR strategies better than base case in E[Profit] & CVaR

- 1-hr shifts – 39%
- 2-hr shifts – 44%
- 3-hr shifts – 57%
- 4-hr shifts – 80%



Sample Profit Distributions



Summary

- On average, limited Profit increase from Economic Load Shifting (3-4%)
- On average, significant Risk reduction with Economic Load Shifting (>20%)
- Accurate thermodynamic model of the house is assumed, without it results would be much worse
- Need to apply optimization decision-making algorithms throughout the day to optimize results
- Need to balance optimization with customer impact and opt-outs (limited resource)

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Questions/Comments?