

Identifying LFAS sculpting opportunities

18th March 2015

Dr Joel Gilmore
Mr Ben Vanderwaal



Background and assumptions



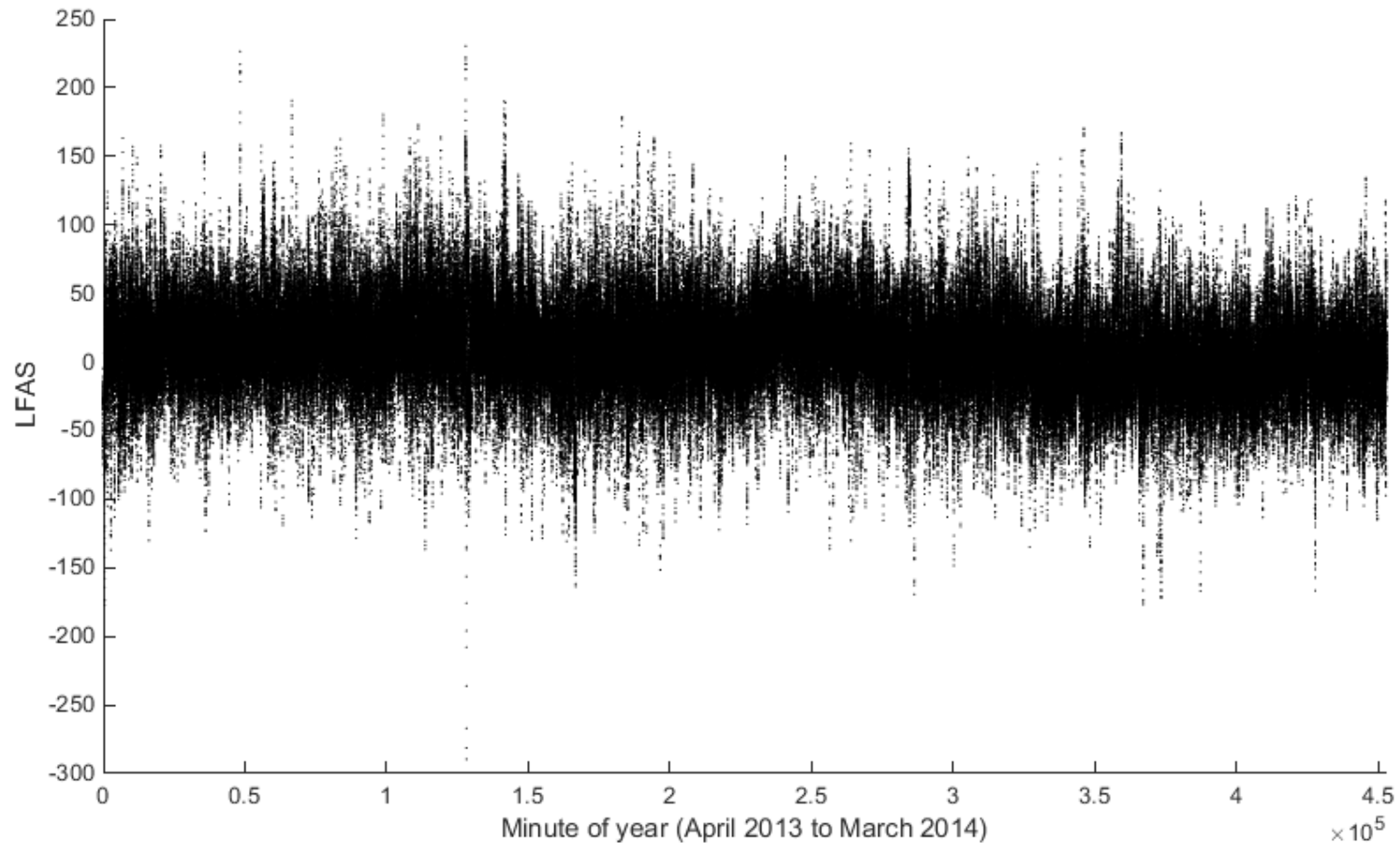
Context for the study

- ▶ EY (who acquired ROAM Consulting) undertook the 2014 Ancillary Service Standards and Requirements study for the IMO, including applying the “causes of LFAS methodology” developed by the IMO and System Management
- ▶ EY was commissioned by System Management to investigate whether opportunities exist to sculpt Load Following Service (LFAS) requirements for the WEM under various system conditions
 - ▶ Stage 1 is a scoping exercise, designed to identify trends in the underlying causes of LFAS, and whether they translate to the total LFAS needed
 - ▶ Subsequent stages will involve investigating how such trends could apply to the LFAS market, and assessing costs and benefit

Data preparation (for AS report)

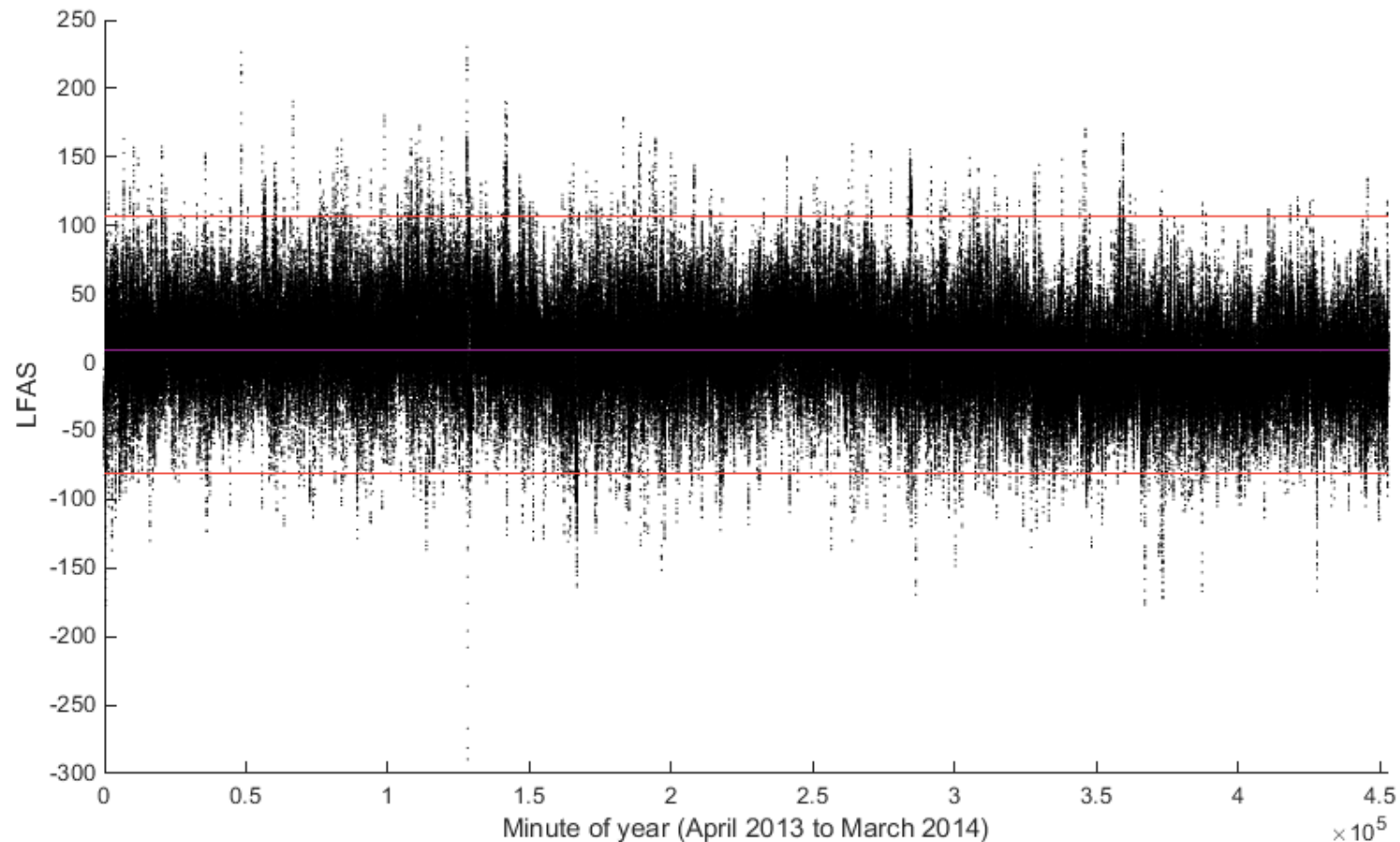
- ▶ Received April 2013 to March 2014 1-minute data, provided by System Management and the IMO
- ▶ Filtered for contingency events and other “bad data” points
- ▶ Calculated the four causes of LFAS calculated as per IMO methodology:
 - ▶ Deviation from dispatch instructions
 - ▶ BMO vs linear ramp rates
 - ▶ Load forecast error
 - ▶ NSG forecast error
- ▶ Weather and market data obtained for same period

Sum of the four causes of LFAS: “LFAS needed”



- ▶ Standard should not cover all causes:
 - ▶ 99% and 99.9% standards investigated

Sum of the four causes of LFAS: “LFAS needed”

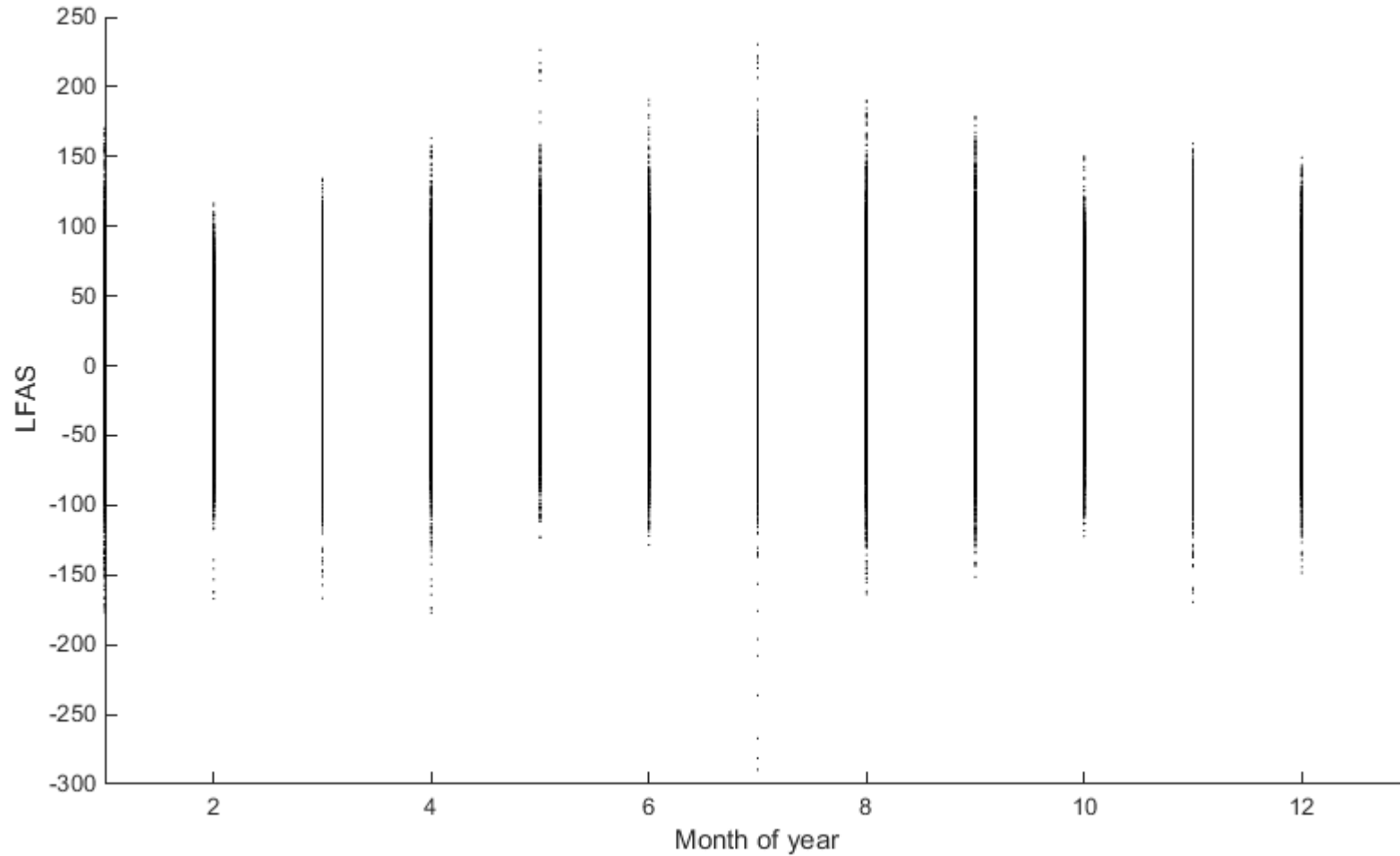


- ▶ Standard should not cover all causes:
 - ▶ 99% and 99.9% standards investigated
- ▶ **Red line** covers 99% of 1-min periods across year
 - ▶ -80 MW to +106 MW
- ▶ Does not say how LFAS needed should be met

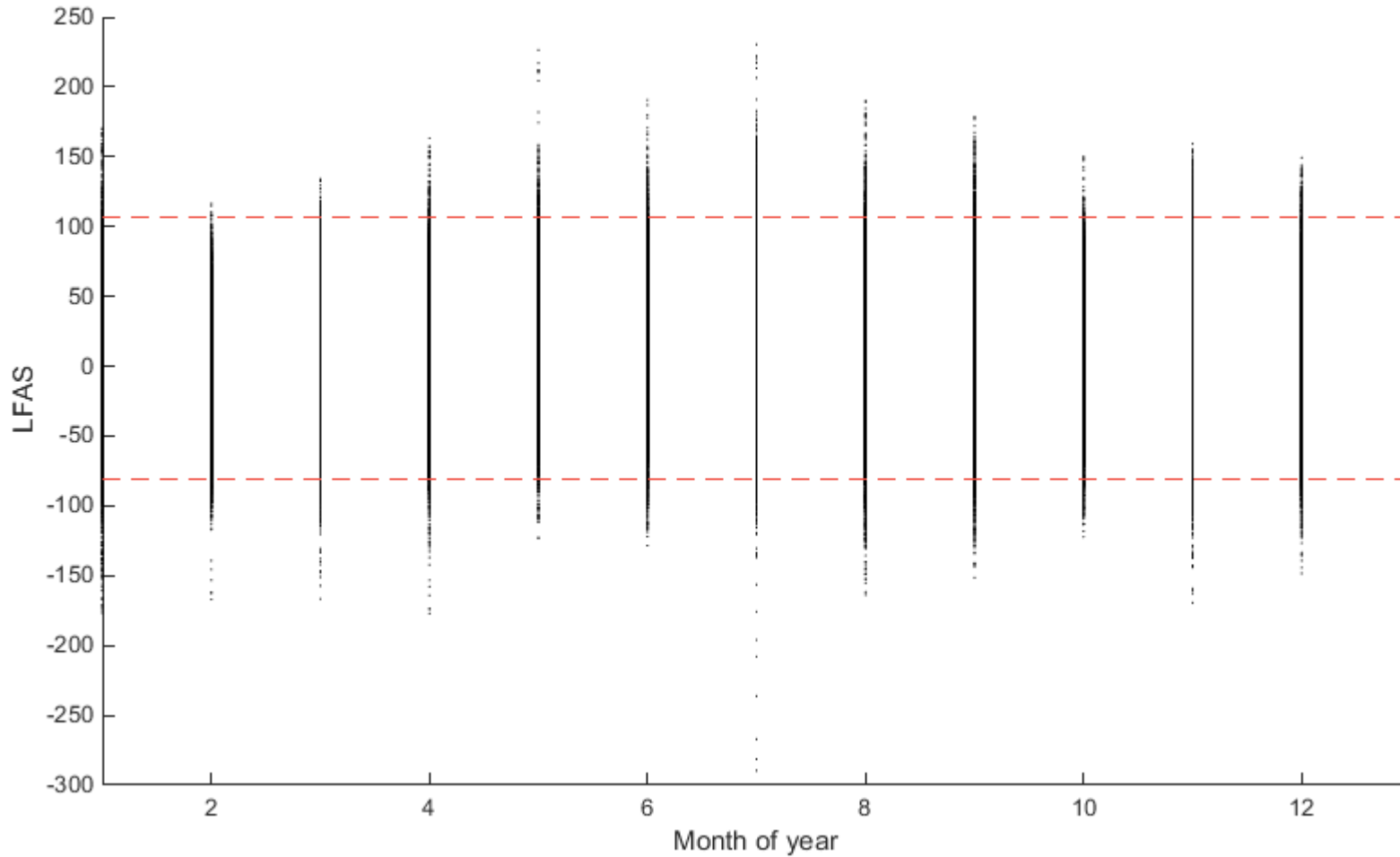
Explanatory variables

- ▶ Season or month of the year
- ▶ Time of day trends
- ▶ Demand
- ▶ Wind, solar and landfill gas production (high, low, etc.)
- ▶ Non-scheduled generation (NSG) variability and forecasting
- ▶ Weather variables (temperature, rainfall, wind speed)

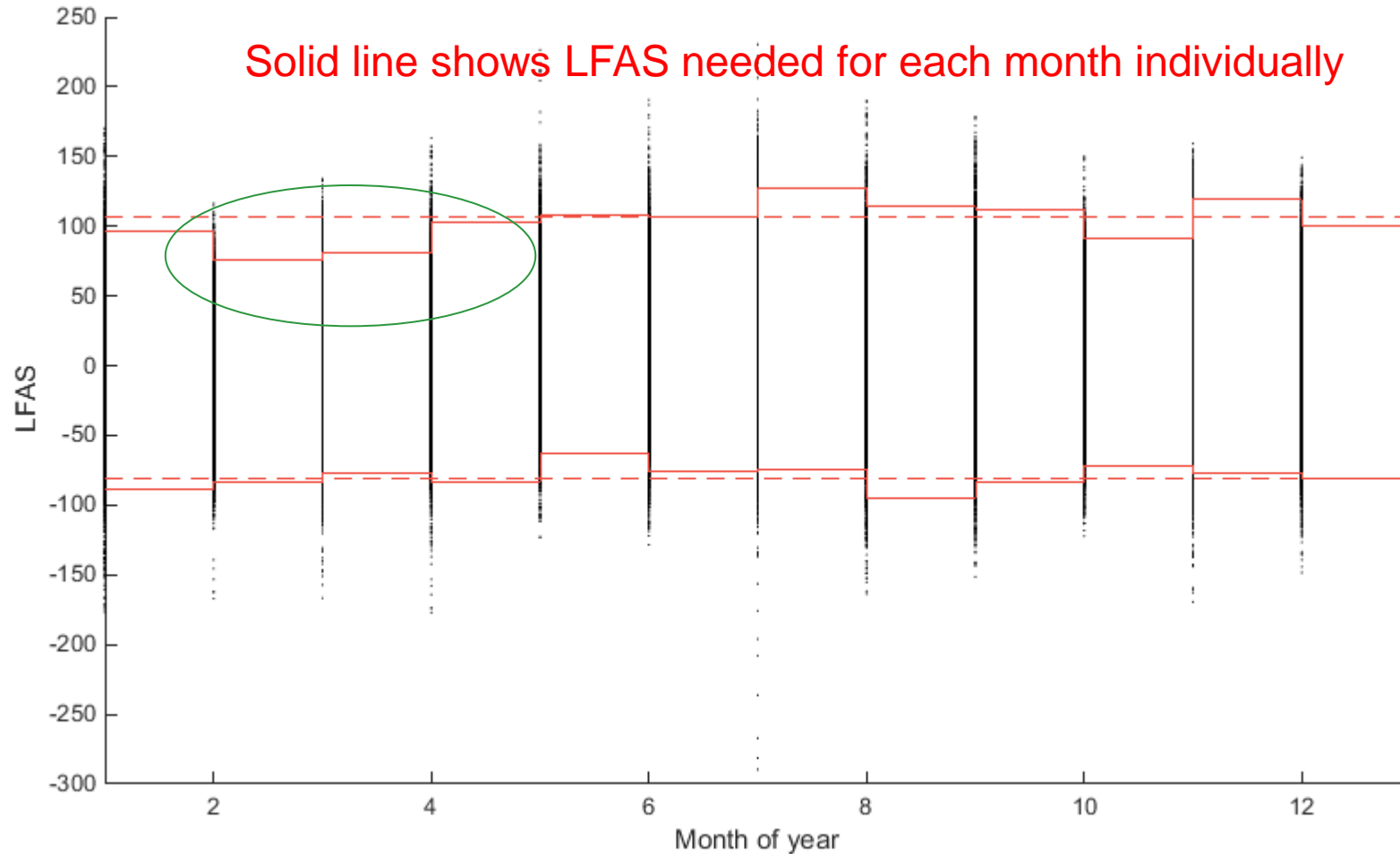
Example: Identifying trends by month of the year



Example: Identifying trends by month of the year



Example: Identifying trends by month of the year

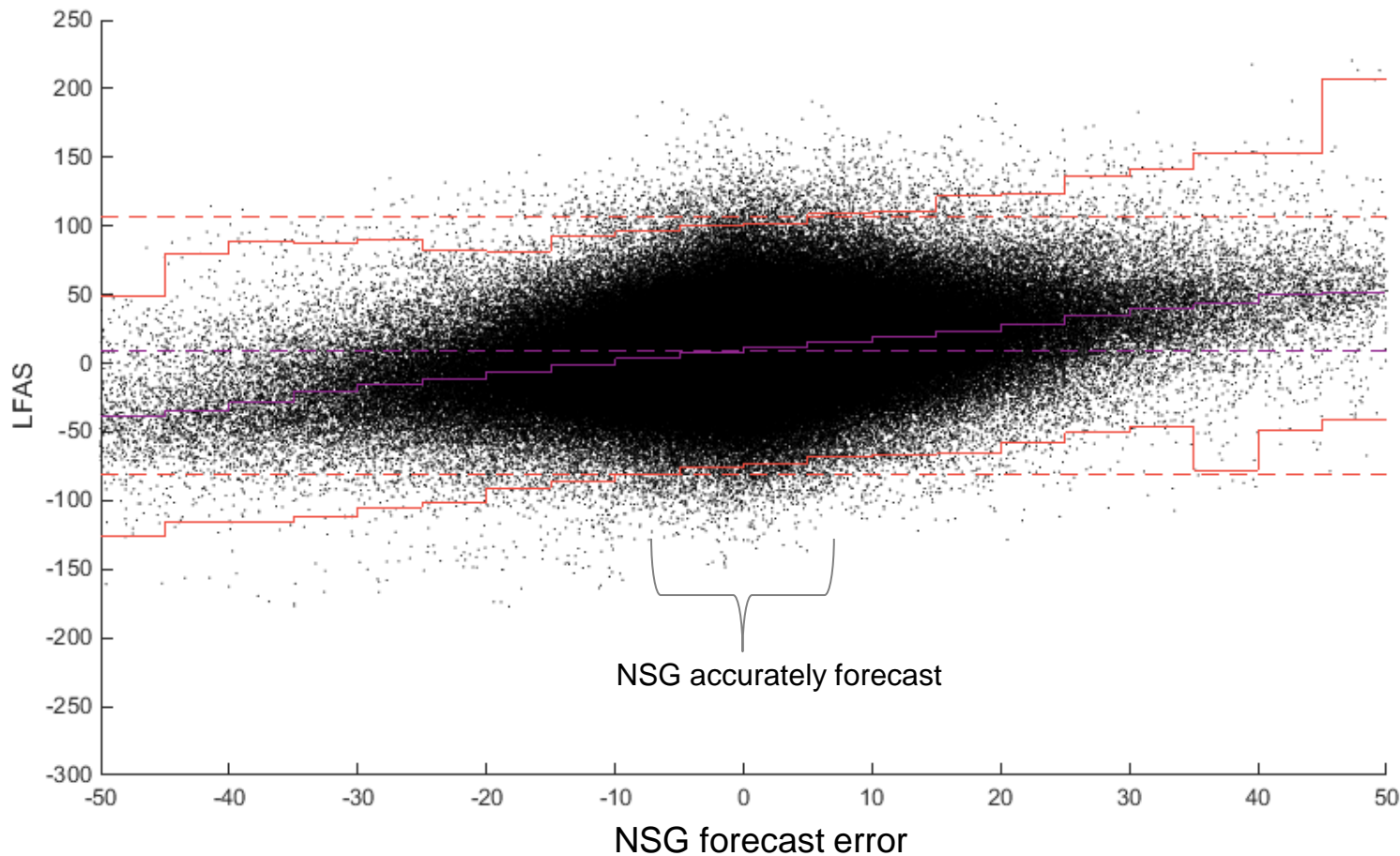


- ▶ Differences between months aren't statistically significant
 - ▶ Some months have "unusual" events
- ▶ Final two months of data (Feb & March) lower – systematic change?

Findings and results

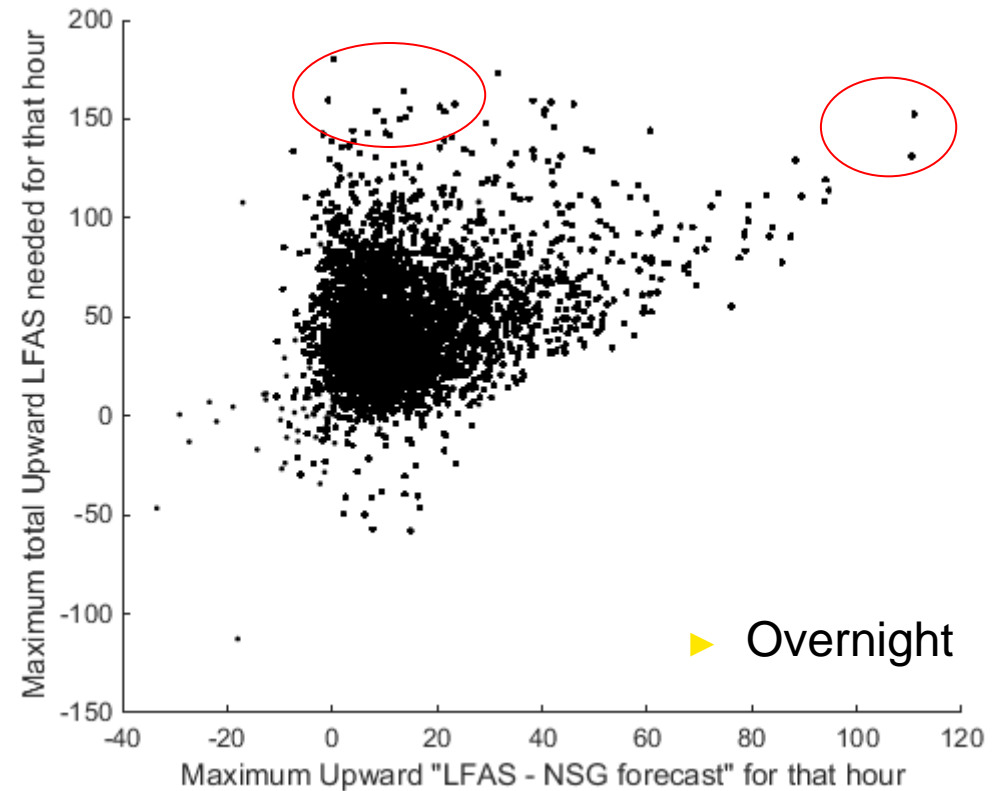
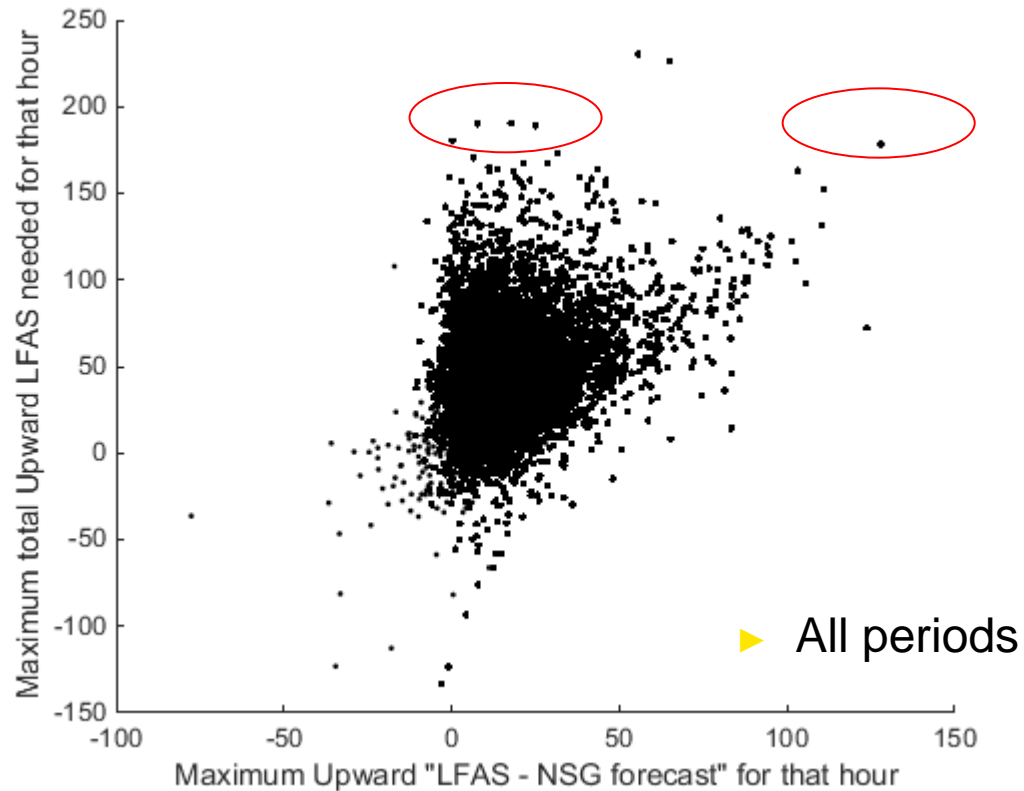


NSG forecast error contributes to LFAS



- ▶ Greater NSG forecast error is a direct cause of LFAS needed
 - ▶ Can work with or against other causes of LFAS
- ▶ However, other factors are also significant: only 5%-10% reduction in LFAS given accurate forecasts
 - ▶ Still extreme LFAS events from other causes
 - ▶ Unlikely to be able to predict *when* forecasts will be accurate?

Example: Setting Upward LFAS across an hour

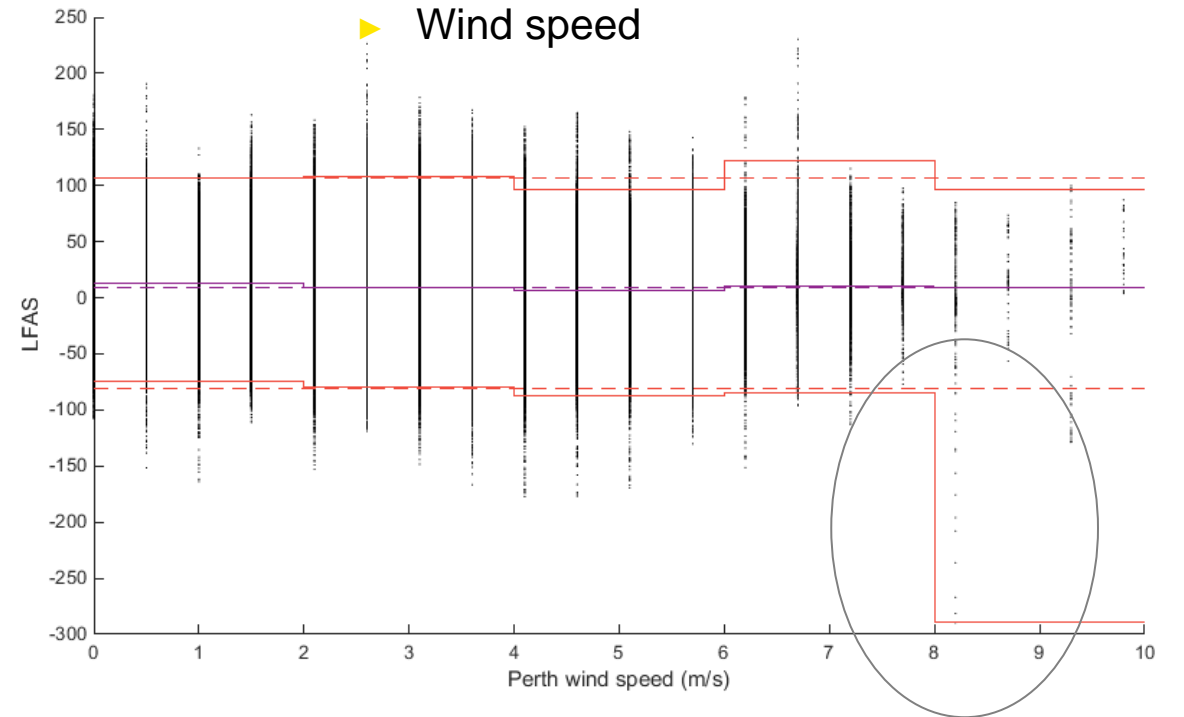
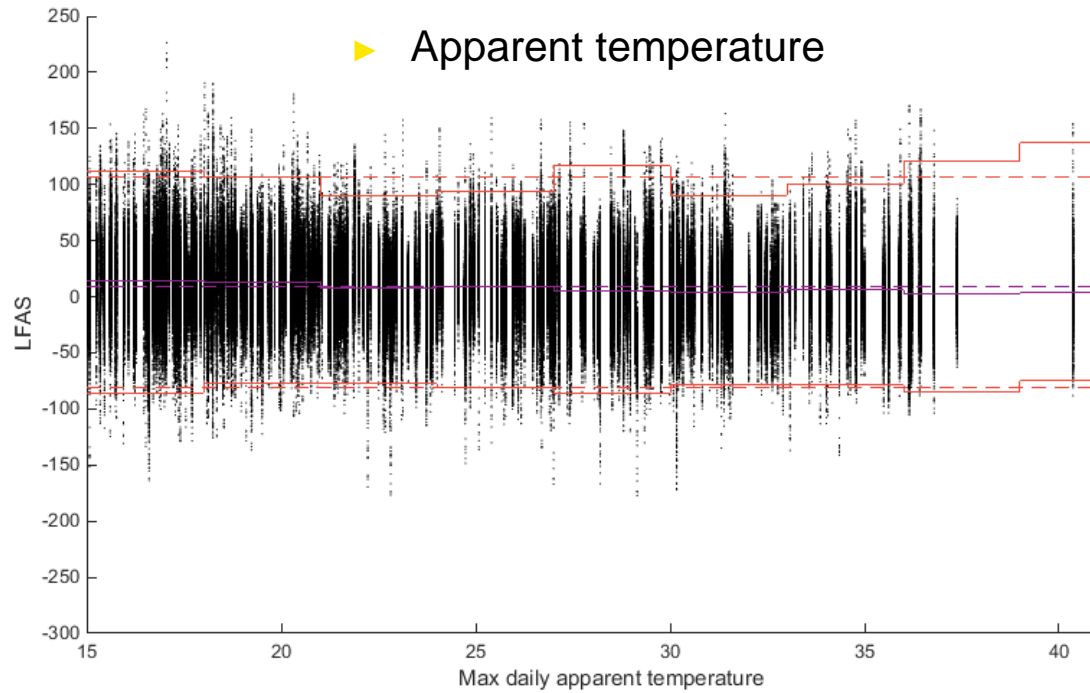


- ▶ If LFAS is set for whole hours, just as much LFAS is needed at times of low NSG forecast error as at high

Sensitivity to weather conditions

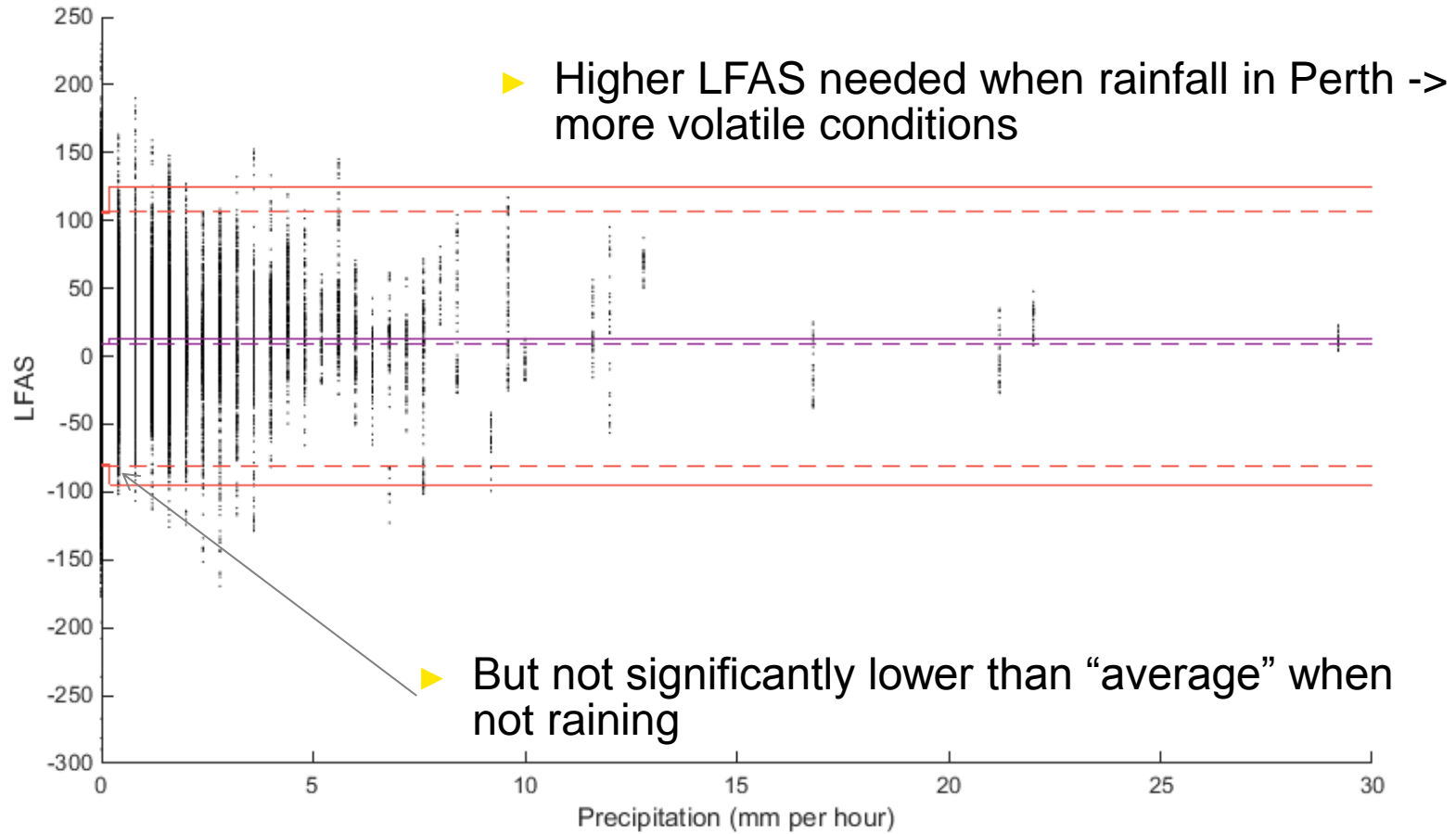
- ▶ EY has considered a number of weather variables from the Bureau of Meteorology that could be correlated with higher or lower LFAS needed:
 - ▶ Wind speed
 - ▶ Temperature, and apparent temperature (comfort factor)
 - ▶ Rainfall
- ▶ Intuitively, extreme weather conditions (rainfall, wind speed) could be associated with higher LFAS needed

Apparent temperature and wind speed (Perth)

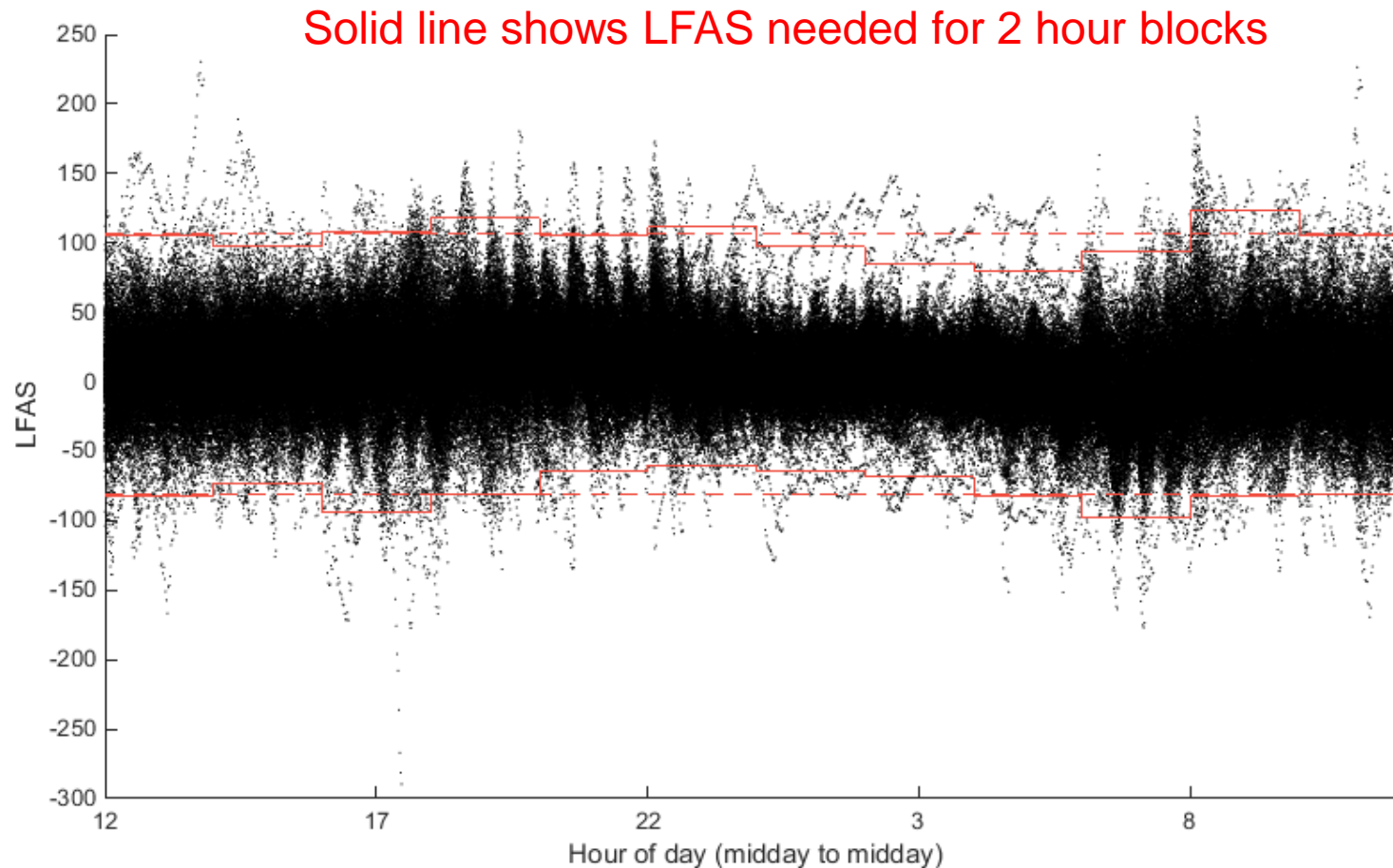


- ▶ No clear trends are identified (with statistical significance)

Rainfall in Perth

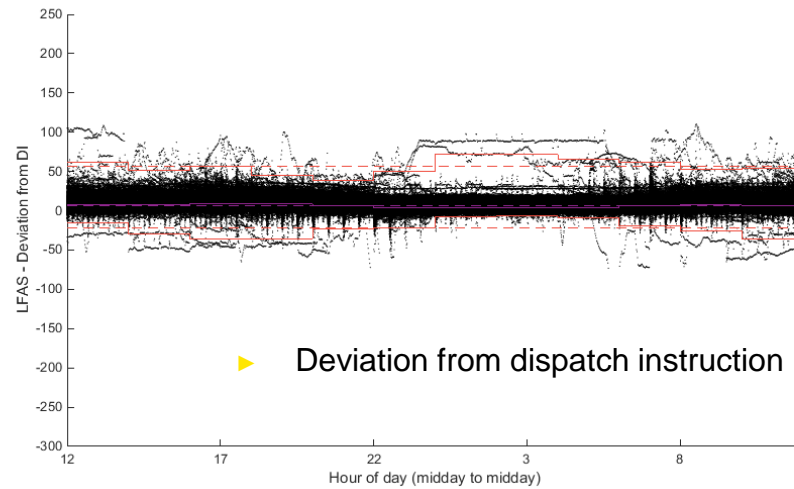
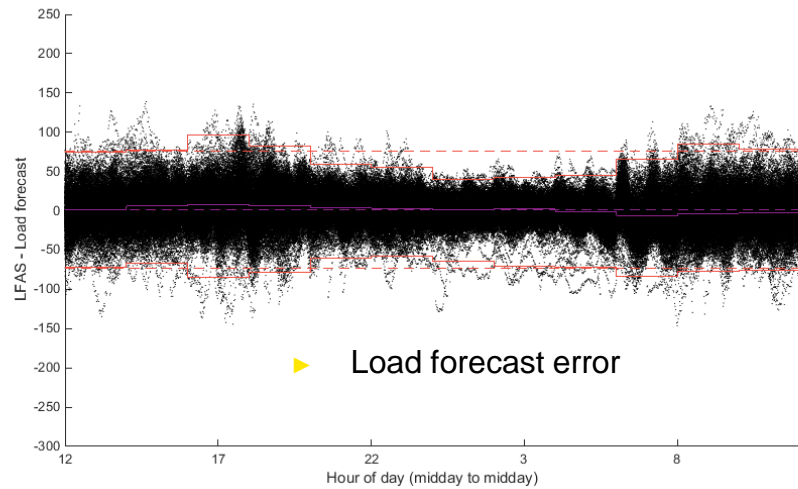
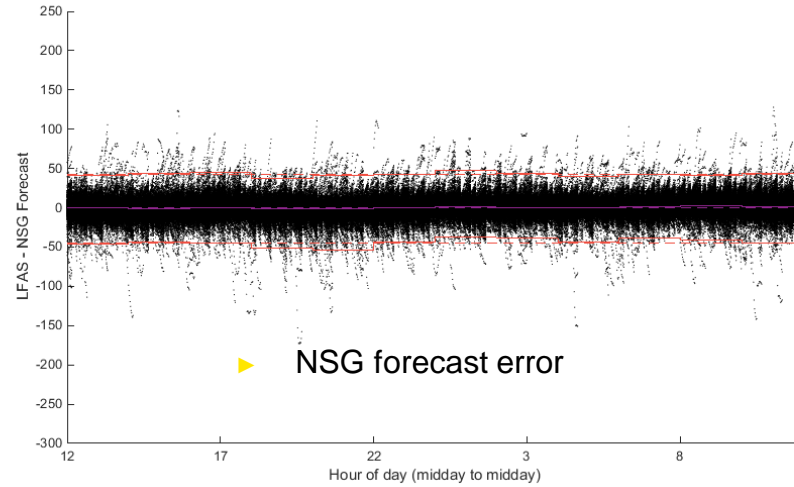
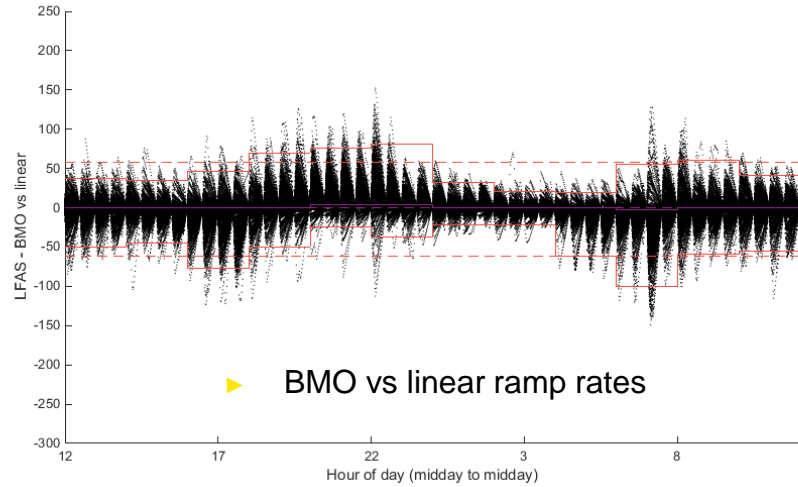


Varying LFAS by time of day



- ▶ Clear reduction in overnight LFAS needed
 - ▶ Statistically significant
- ▶ Conversely, higher than average LFAS needed during morning and evening ramp periods
 - ▶ Time of greater system stress

Time of day for individual causes of LFAS



Time of day sculpting options

	99% band			99.9% band		
	Annual requirement	Typical reduction	Overnight value	Annual requirement	Typical reduction	Overnight value
Upwards LFAS: 11pm to 7am	106 MW	10 to 30 MW	76 to 96 MW	147 MW	25 MW	122 MW
Downwards LFAS: 8pm to 4am	-80 MW	10 to 20 MW	-60 to -70 MW	-120 MW	15 to 40 MW	-80 to -105 MW

- ▶ To maintain the same standard after sculpting, some periods might require *higher* LFAS

Summary and conclusions

- ▶ LFAS is an insurance product, with most causes “unpredictable” in advance
 - ▶ Low utilisation is expected
 - ▶ Random events seem to dominate more predictable causes
 - ▶ Sculpting is new territory internationally
- ▶ The causes of LFAS are lower overnight
 - ▶ Costs, benefits and system response still need to be assessed, particularly given current LFAS providers, to translate this to a market requirement
- ▶ No weather, variability or NSG sculpting opportunities were identified
 - ▶ Even clear relationships on average LFAS can be overwhelmed by unpredictable events
- ▶ All analysis would need to be reviewed after any market changes, e.g.:
 - ▶ BMO vs linear ramp rates for generators
 - ▶ Increased amount of wind (making NSG forecast error more important)

EY

Assurance | Tax | Transactions | Advisory

About EY

EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.

About EY's Transaction Advisory Services

How you manage your capital agenda today will define your competitive position tomorrow. We work with clients to create social and economic value by helping them make better, more informed decisions about strategically managing capital and transactions in fast changing-markets. Whether you're preserving, optimizing, raising or investing capital, EY's Transaction Advisory Services combine a unique set of skills, insight and experience to deliver focused advice. We help you drive competitive advantage and increased returns through improved decisions across all aspects of your capital agenda.

In line with EY's commitment to minimize its impact on the environment, this document has been printed on paper with a high recycled content.

© 2015 EYGM Limited.
All Rights Reserved.

EYG no.

This material has been prepared for general informational purposes only and is not intended to be relied upon as accounting, tax, or other professional advice. Please refer to your advisors for specific advice.

www.ey.com