Public

P376 'Utilising a Baselining Methodology to set Physical Notifications'

Workgroup 3

3 June 2019

ELEXON

Health & Safety

In case of an emergency

An alarm will sound to alert you. The alarm is tested for fifteen seconds every Wednesday at 9.20am

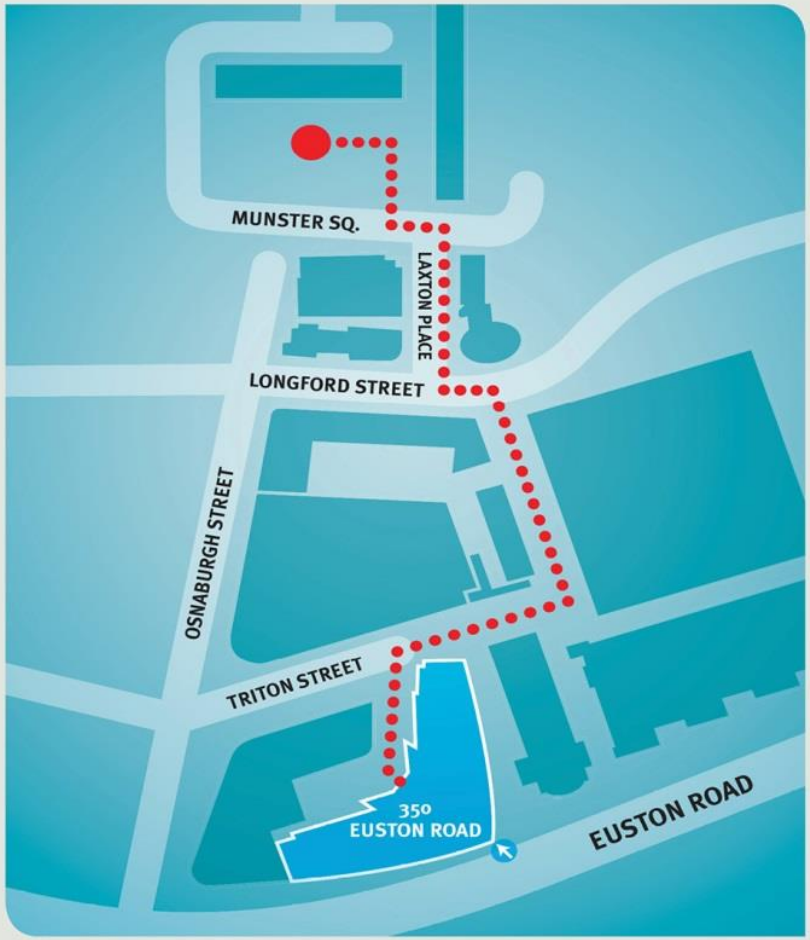
Evacuating 350 Euston Road

- If you discover a fire, operate one of the fire alarms next to the four emergency exits.
- Please do not tackle a fire yourself.
- If you hear the alarm, please leave the building immediately.
- Evacuate by the nearest signposted fire exit and walk to the assembly point.
- Please remain with a member of ELEXON staff and await further instructions from a Fire Warden.
- For visitors unable to use stairs, a Fire Warden will guide you to a refuge point and let the fire brigade know where you are.

When evacuating please remember

- Do not use the lifts.
- Do not re-enter the building until the all clear has been given by the Fire Warden or ground floor security.

Our team on reception is here to help you, if you have any questions, please do ask them.



Agenda

- Welcome and housekeeping
- Review of last meeting and actions
- Outline of potential Baseline Methodologies
- Discussion of pros and cons of options
  - Determining what baseline characteristics we want
- Consideration of how and when baselines will be calculated
  - Who will create the baseline values?
  - When will the values be created?
  - How will the administrator know to calculate a baseline value?
- Next Steps

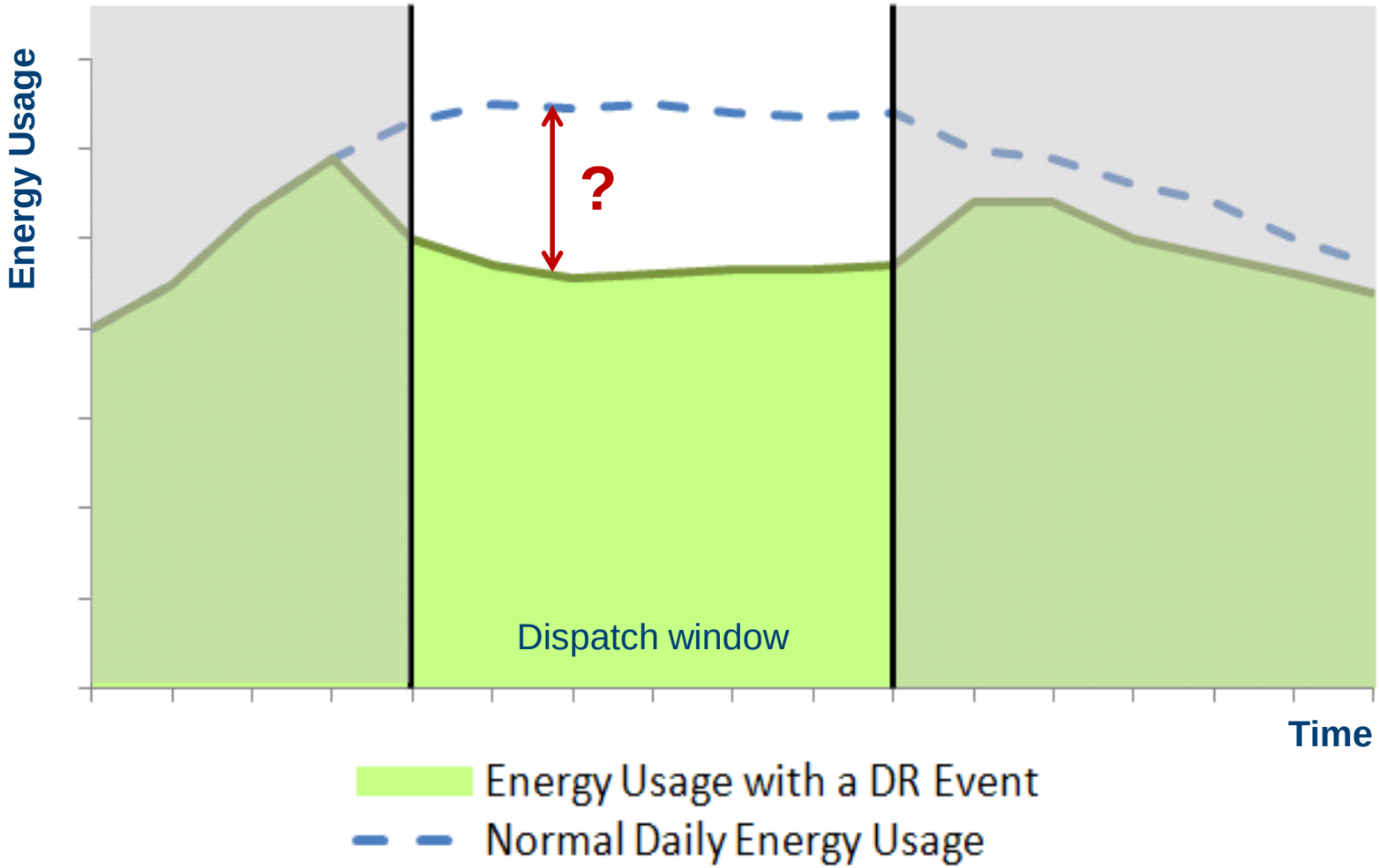
Objectives

- Review available options and determine what methods should be employed under the BSC
- Consider how and when the baseline will be created

Baseline examples

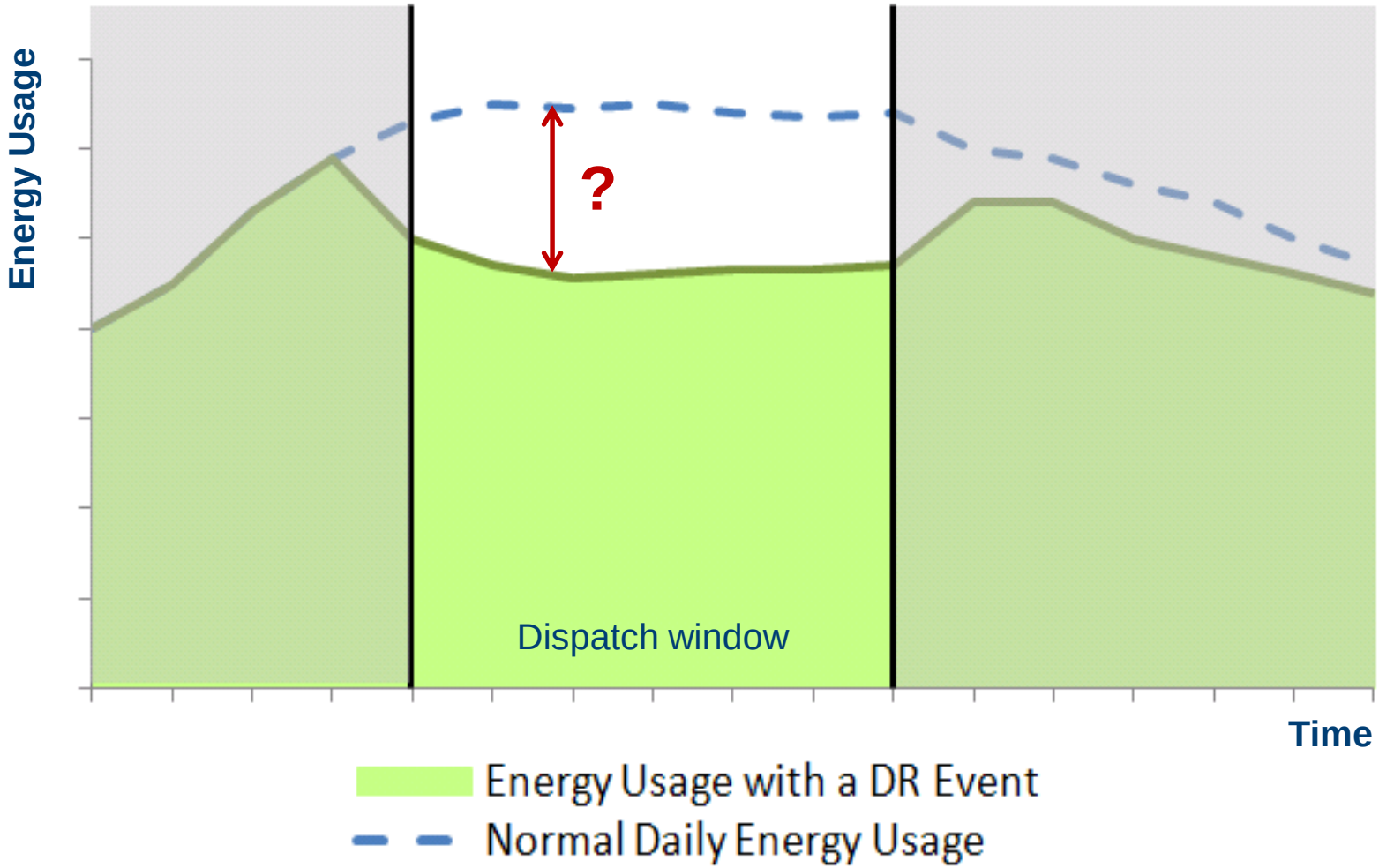
What is a baseline for?

- To assess how much demand response was delivered



What is a baseline?

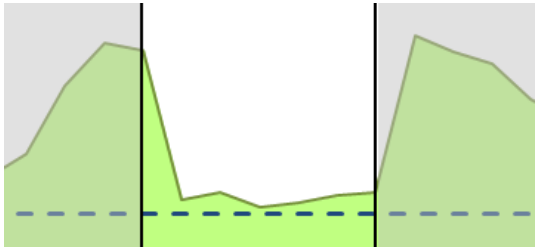
- A baseline is an estimate of the electricity that would have been consumed by a customer in the absence of a demand response event.



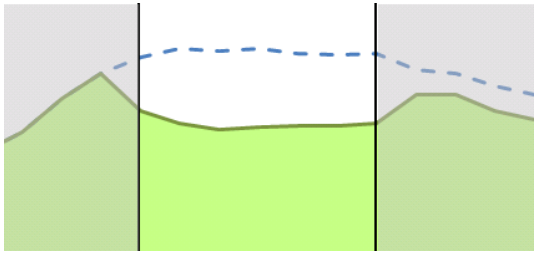
Definition from North American Energy Standards Board. Business Practices for Measurement and Verification of Wholesale Electricity Demand Response. March 16, 2009, p.9.

NAESB definitions

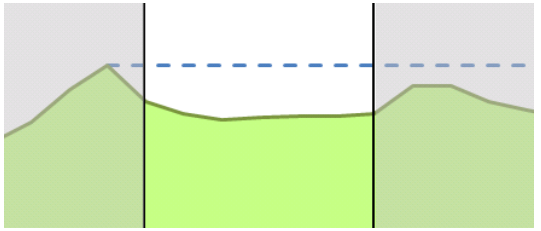
- **Maximum Base Load** (aka Firm Service Level) – uses historical meter data to generate a flat level of electricity demand that the customer must remain at or below



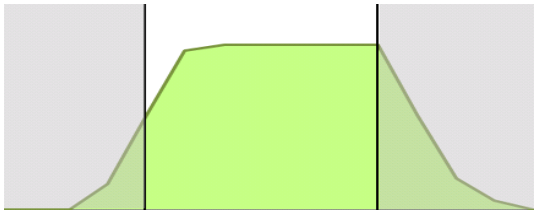
- **Baseline Type I** – uses historical interval meter data to generate a profile baseline that usually changes hour-by-hour
- **Baseline Type II** – uses statistical sampling to generate a baseline for a portfolio of customers in the instances where interval meter data for all individual sites is not available



- **Meter-Before, Meter- After** – looks at actual load data immediately preceding an event



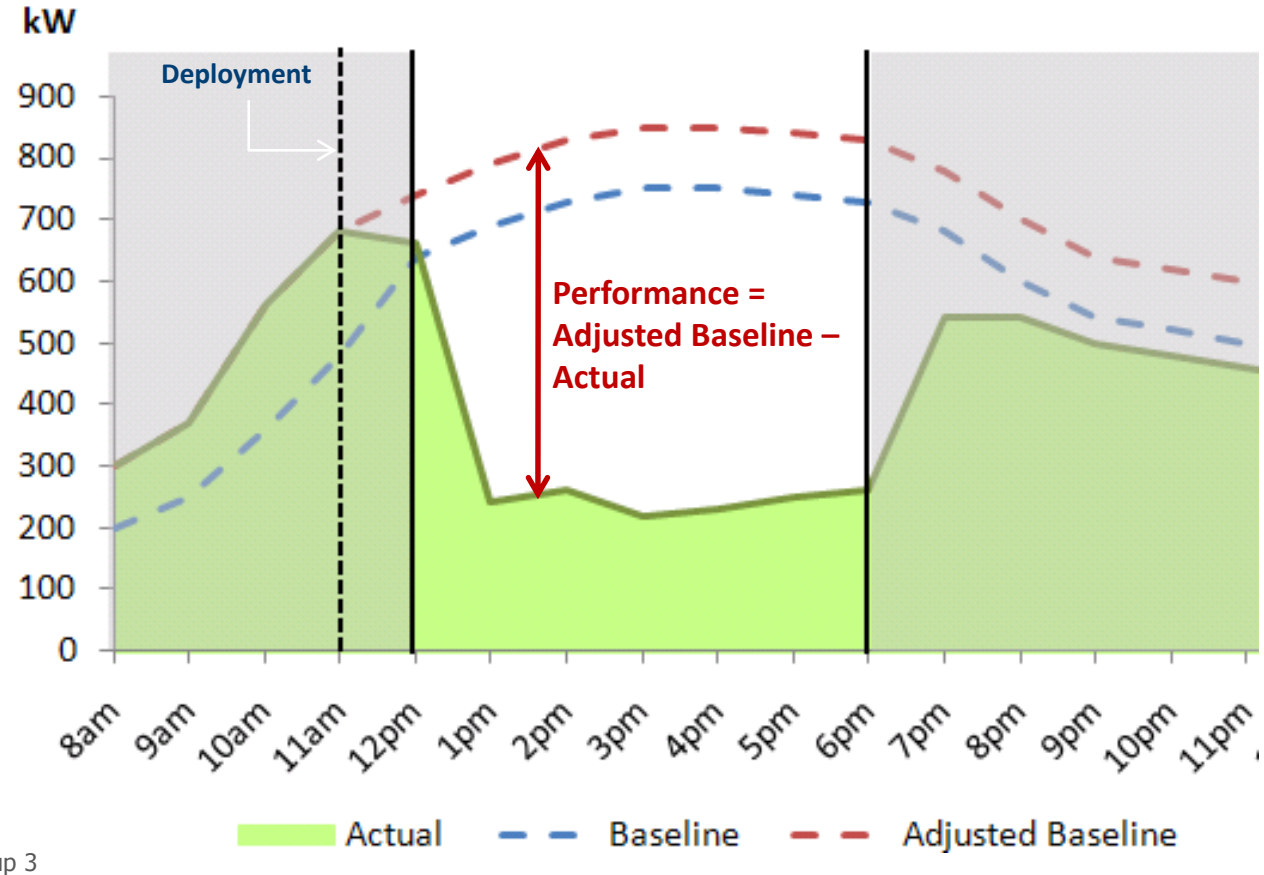
- **Generation** – baseline is set as zero and measured against usage readings from behind-the-meter generators



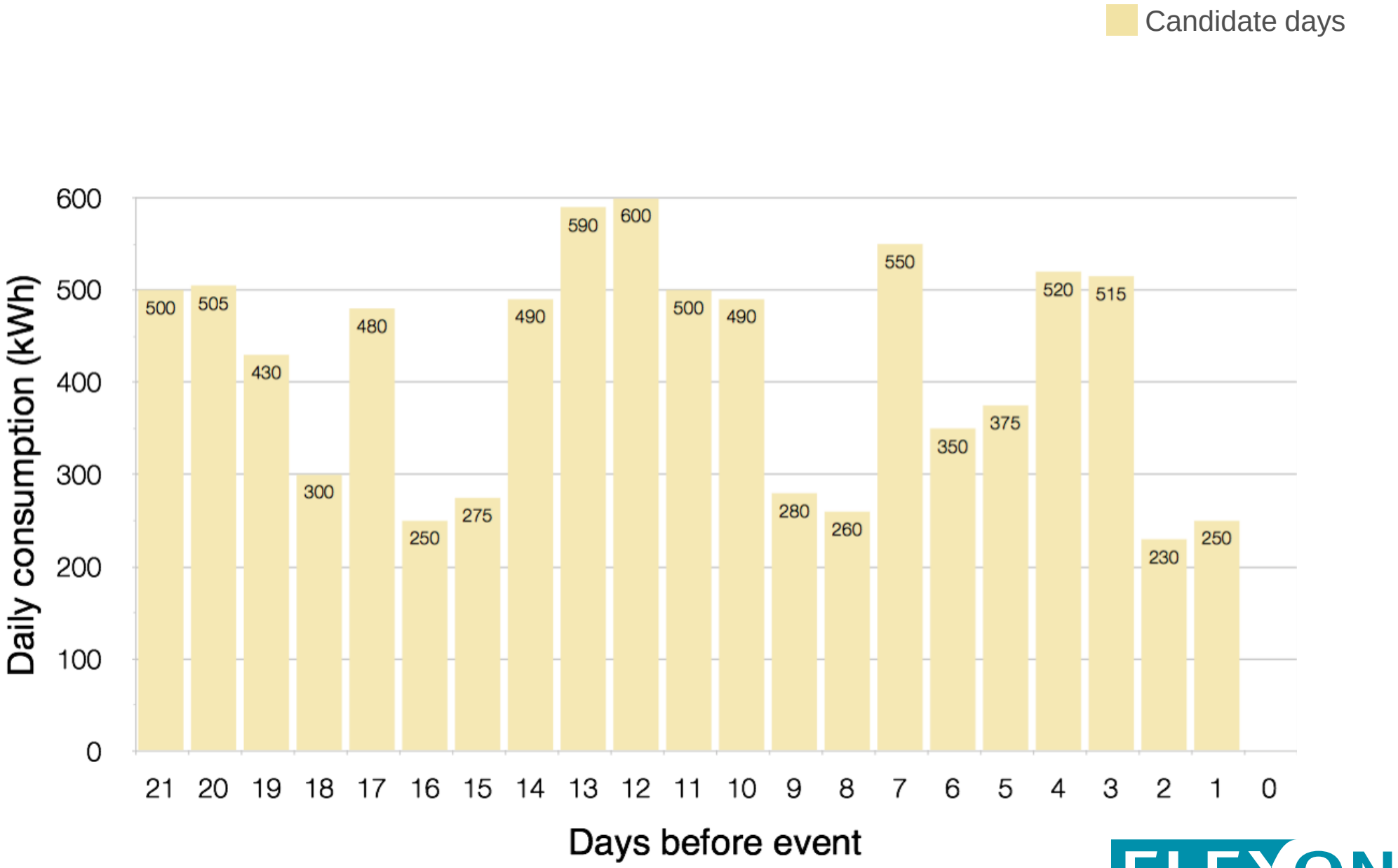
North American Energy Standards Board. Business Practices for Measurement and Verification of Wholesale Electricity Demand Response. March 16, 2009.

A closer look at NAESB Baseline Type 1

- Historical interval meter data is used to generate a **profile baseline**.
- Common profile methodologies include High X of Y, Rolling Average, Regression, and Comparable Day.
- Includes a "**Baseline Adjustment**" to more accurately reflect load conditions of the event day. Most often this adjustment is based on average load during the hours preceding deployment.



High 5-of-10 worked example



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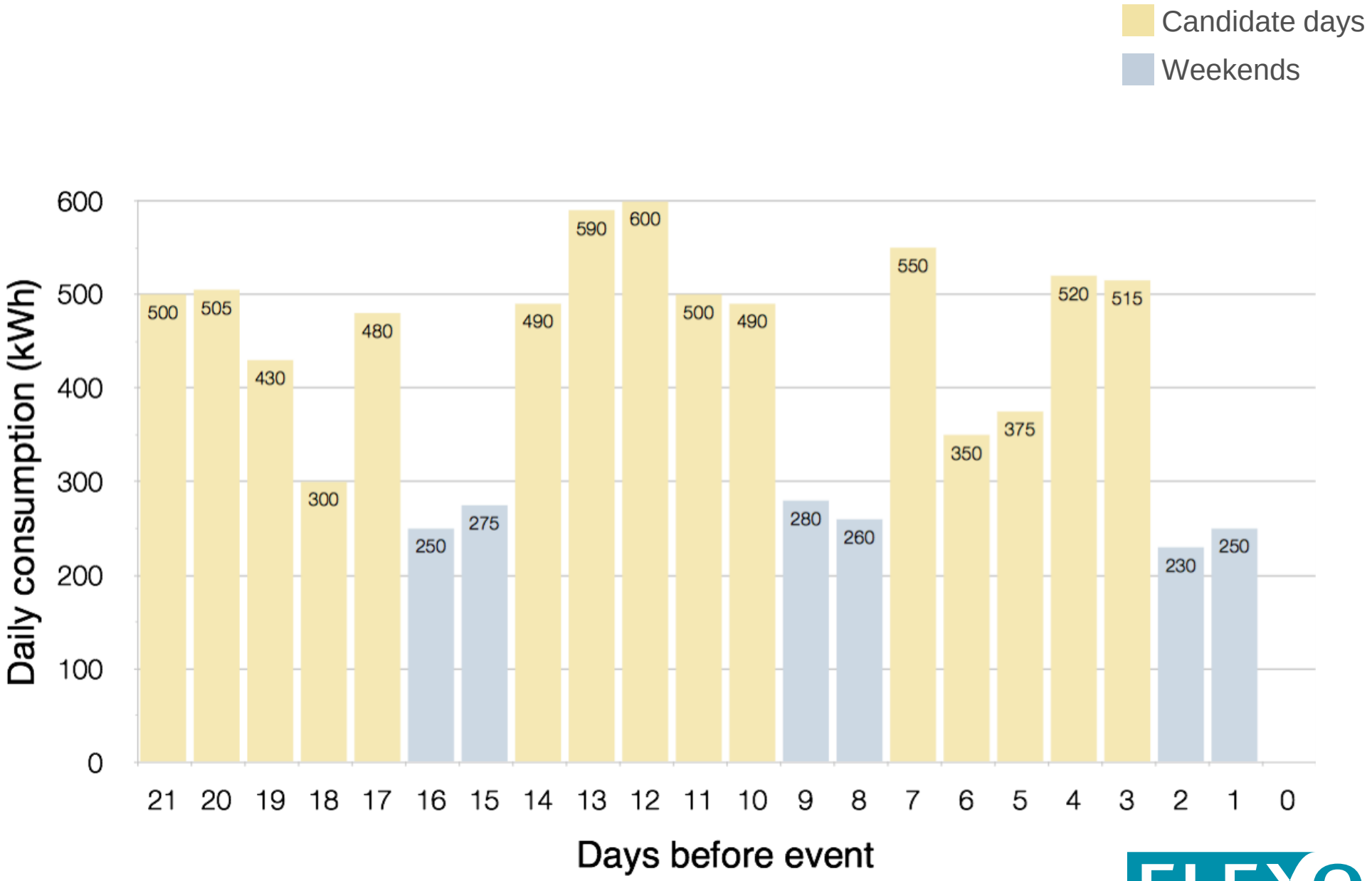

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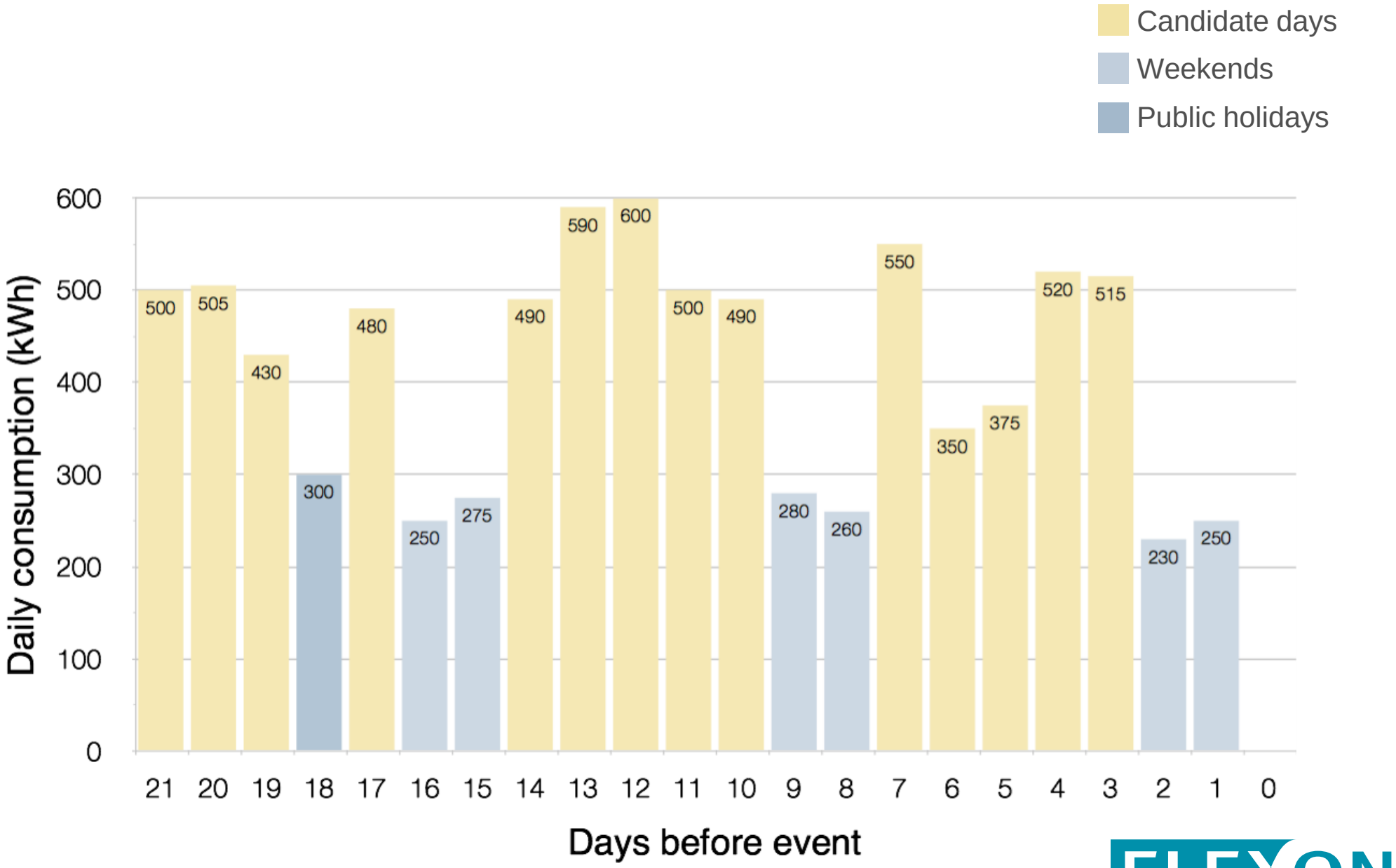

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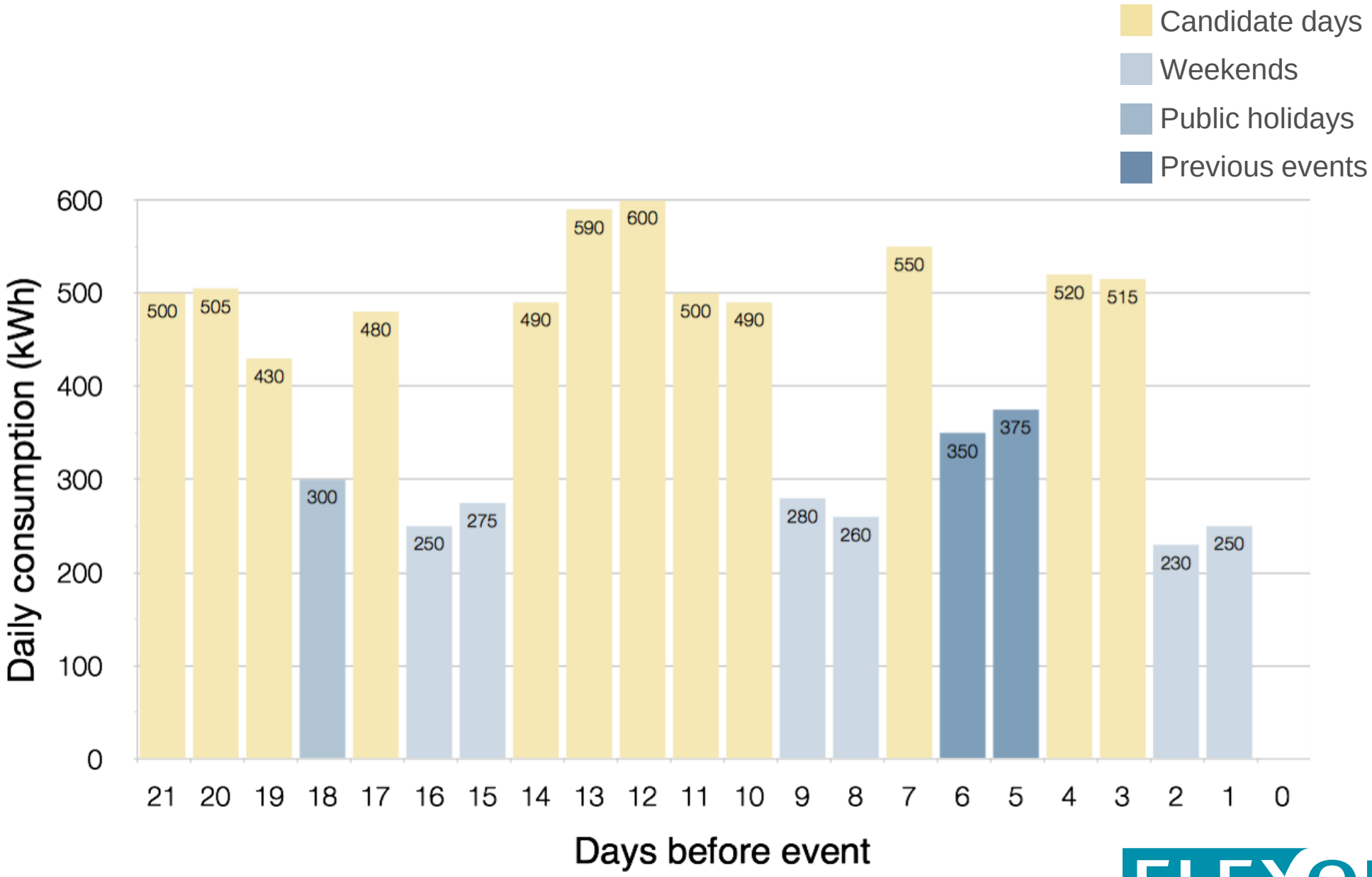

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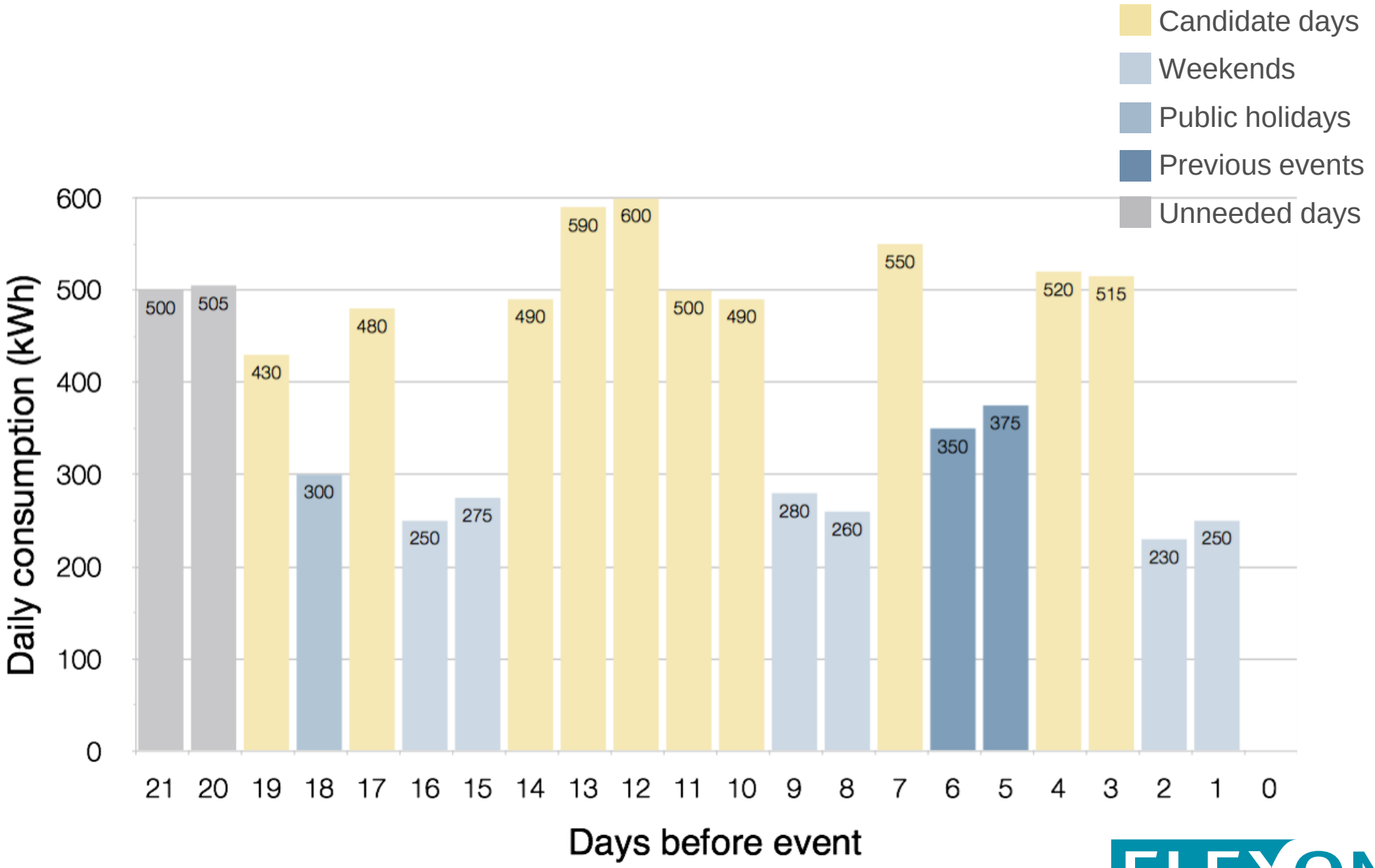
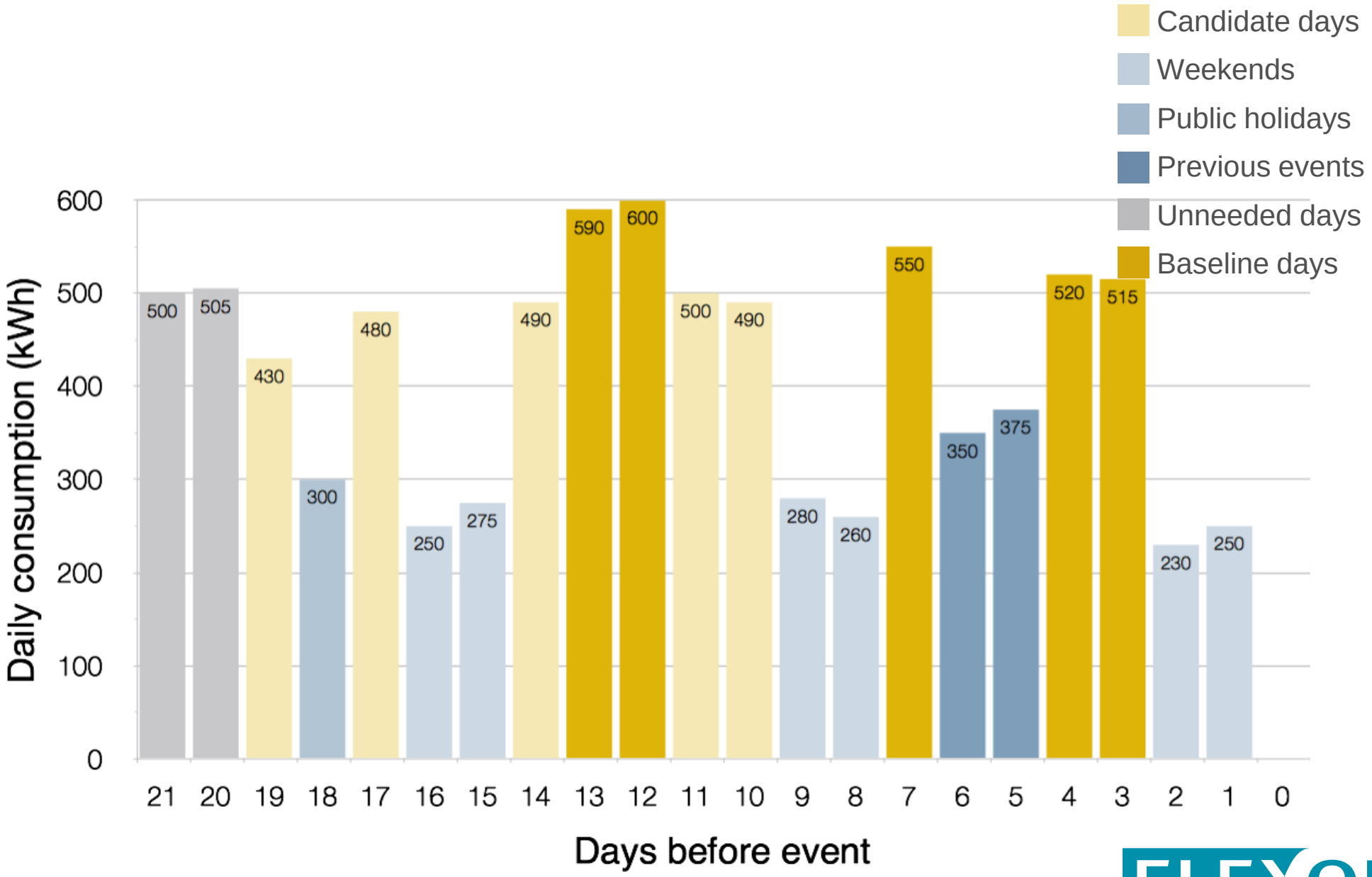
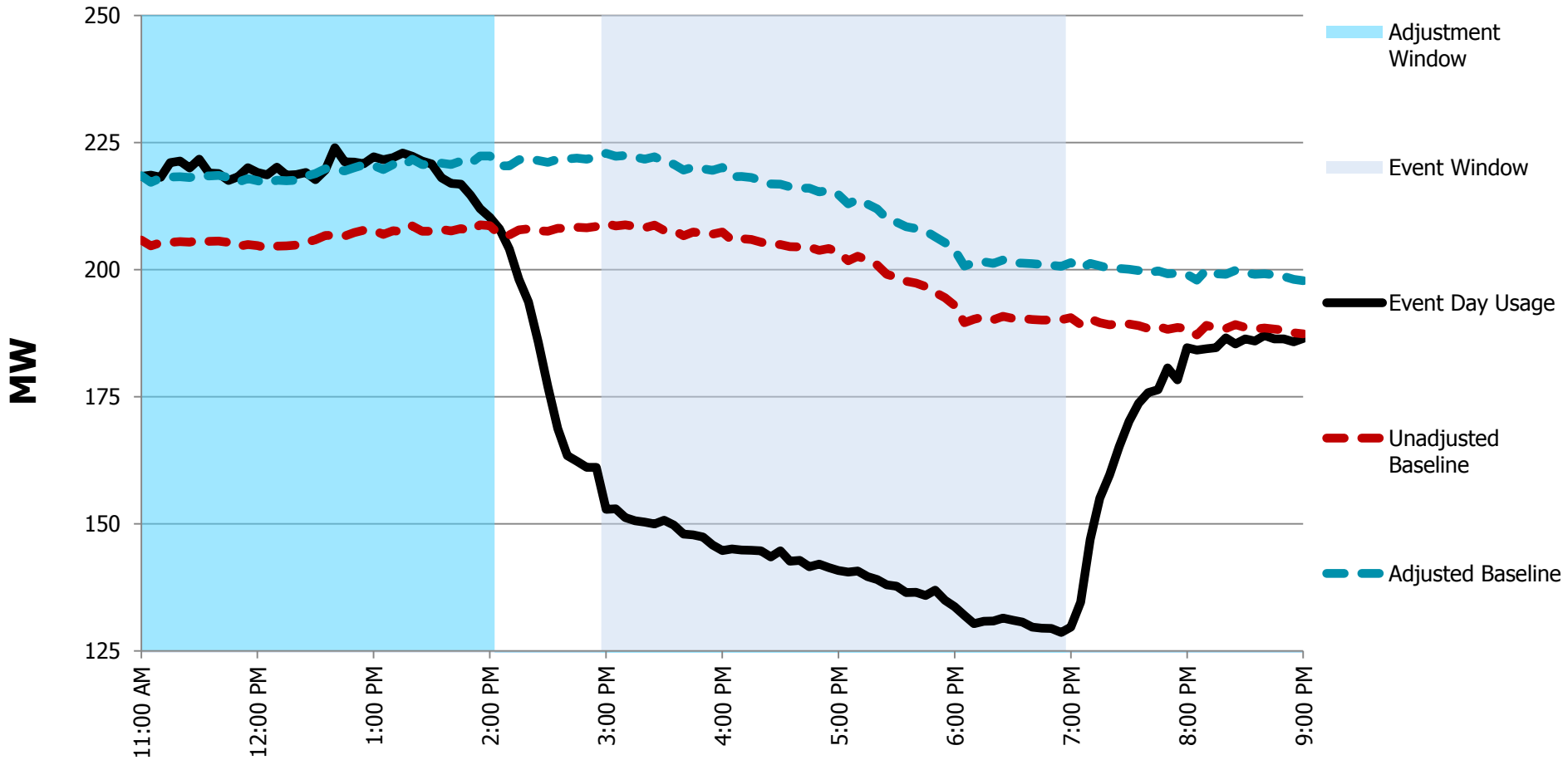


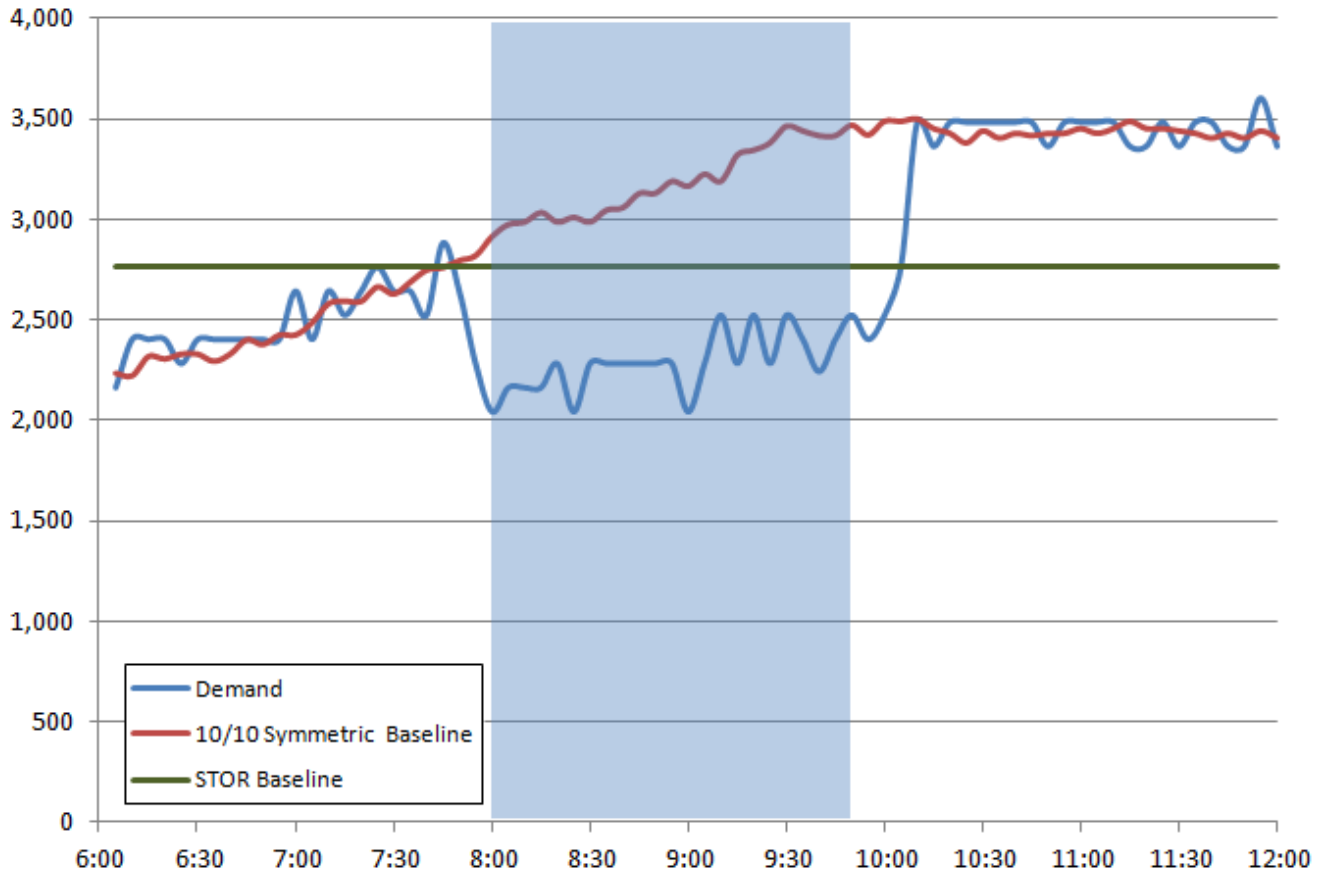
High 5-of-10 worked example



Day-of adjustment



Profile baselines increase accuracy in long dispatches



Demand: site's actual demand on the day of a real STOR event

10/10 symmetric baseline: site's average demand – in that same interval – over the 10 prior business days, adjusted symmetrically based on the day-of load conditions

STOR baseline: meter-before/meter-after type baseline, based on the average demand in the 10 minutes leading up to the dispatch instruction

Baseline characteristics

Types of baseline

Average data

- X of Y
- Weighted average
  - Selects data based on days that reflect the demand control event
  - Simple to understand, so can be replicated by customers
  - Value adjusted for conditions
- Regression
  - Uses statistical methods to create a model for energy usage
  - Can be based on individual customer characteristics or customer type
- Matching day pair
  - Finds day that matches event day most closely

Day matching

- Select baseline day that reflects DR event day
- Takes short historical time period (usually week – 2 months)
  - Averages a subset of days which align with conditions e.g. weekday

Previous days approach

- Averaging settlement period load for number of days of same type (how many days provides robustness?)

Average daily energy usage approach

- Include days with total energy usage comparable to selected day prior to event day (closed like non event day)

Proxy day approach

- Uses single day of same characteristics as proxy for load on DR day (how to select best day)

Making the data fit the day

- Baseline adjustments are used to make averaged data better suited to the event day by accounting for variations in parameters such as weather
- Considers energy usage before and after service provided to ensure that actual usage at this time is reflected in the calculated baseline
  - Compare from 4-1 hour before event and apply multiplier or addition to calculated value to match actual usage.

Pros and cons

methodology	pros	cons
Previous day	Most likely same usage pattern as event day easy method to understand	Doesn't consider effect of weather on load May need baseline adjustment to account
Average daily usage	Easy to understand Averaging removed unexpected variability in loads	Will not totally capture load pattern for event day May need baseline adjustment
Proxy day	Matches day based on defined variables to improve match	Can be hard to find day matching all variables May need baseline adjustment
regression	Concept of variable relationship easy to understand	Selecting correct variables for model Customer understanding

Assurance that baselines are accurate

- Can be validated during the registration process. Some markets require accuracy to be demonstrated before services can be provided
  - This can be done using root mean square analysis

Existing Baseline Methodologies

10 of 10

- Most recent 10 qualifying days in selection window
  - If more than 5, but less than 10 qualifying days, then choose all days
  - If less than 5 qualifying days, choose other days with highest metered value to make up 5 days
- Qualifying days are calendar weekdays that are not holiday with no demand event from a window of most recent 45 days
- Average the period data over the selected days to create a baseline value for the event period
- Adjustment: additive
  - Average of metered energy over window minus average baseline energy over window

High 4 of 5

- Most recent 5 qualifying days in selection window
  - Remove the day with the lowest metered volume to leave 4 days' of data
- Qualifying days are calendar weekdays that are not holiday with no demand event from a window of most recent 45 days
- Average the period data over the selected days to create a baseline value for the event period
- Adjustment: additive
  - Average of metered energy over window minus average baseline energy over window

Middle 2 of 4

- Often used for weekends
- Most recent 4 qualifying days in selection window
  - If not 4 qualifying days, use the highest metered days to supplement
  - Remove the day with the lowest and highest metered volume to leave 2 days' of data
- Average the period data over the selected days to create a baseline value for the event period
- Adjustment: additive
  - Average of metered energy over window minus average baseline energy over window

Weighted average method

- Used for weekday events

- On non event days:
  - Baseline = 0.9*previous day baseline + 0.1*meter load

- On event days:
  - Baseline = previous day baseline

Comparable day

- Uses data up to event to find days that have comparable energy usage
  - Assessed using mean square analysis
  - Can average data over multiple comparable days to reduce the effect of anomalies

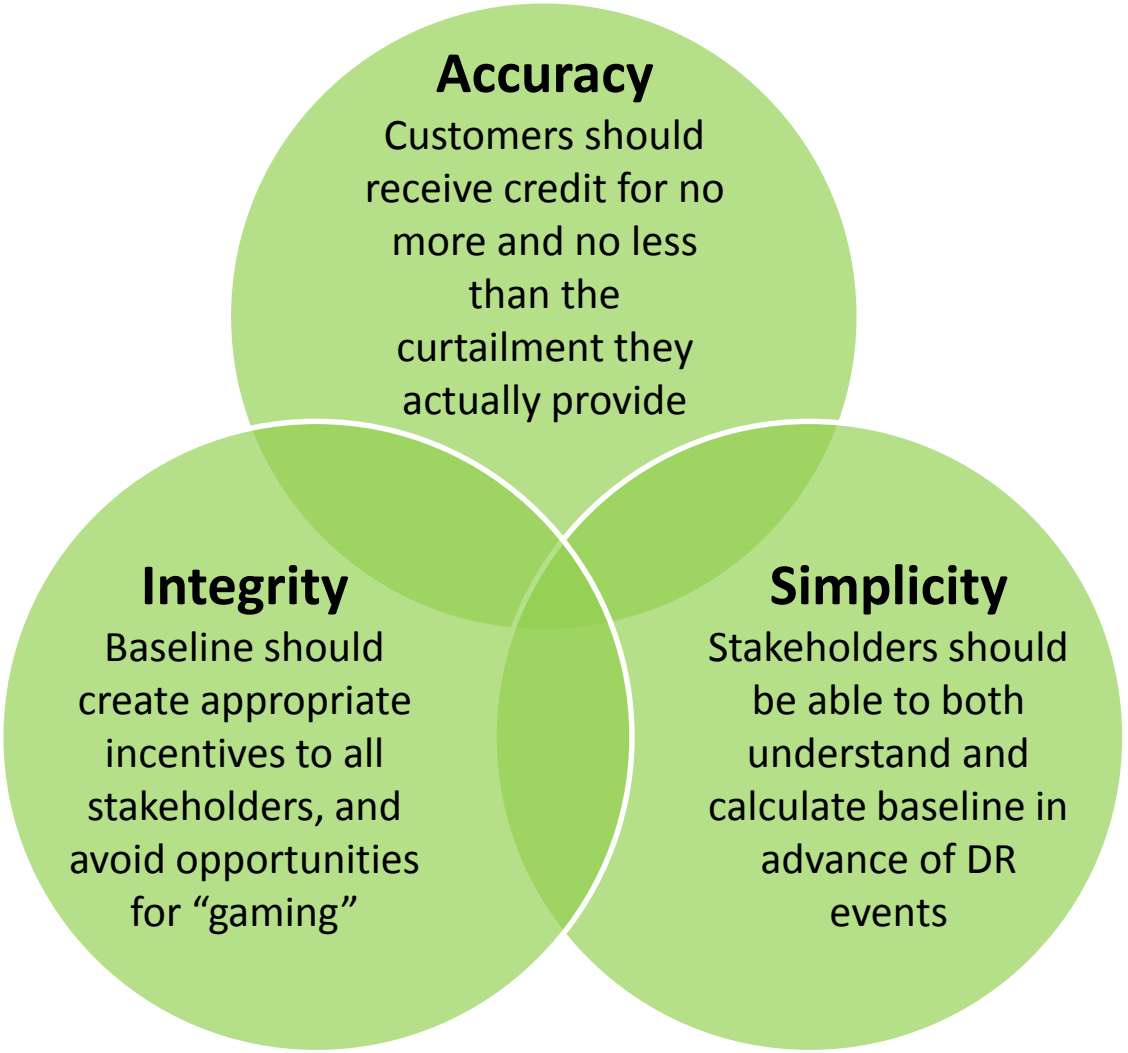
Recommendations from existing analysis

Ensuring robustness

- 10 non event days in the sample provides robustness against outliers, while still accounting for near event trends
- Recommends using at least 5 of these days to base the calculation on
- The requirement for non event days means that the baseline will cease to be reflective if services are provided repeatedly on consecutive days. It is often preferable to include recent event days over historic non event days to ensure the baseline reflects recent trends

EnerNOC's principles

- No estimate is perfect (but some are better than others!)
- M&V properties should balance Accuracy, Integrity, and Simplicity



EnerNOC recommendation

- EnerNOC recommends a baseline approach exhibiting the following attributes, ensuring that the four important qualities of a baseline are accounted for:
  - 10 day baseline window (accuracy and integrity)
  - High 5 of 10 exclusion rules among "like" days, excluding event days and holidays (accuracy and alignment)
  - Additive upward day-of adjustment (accuracy and alignment)
  - Individual baseline rather than a portfolio baseline (simplicity and alignment)
  - Average calculation method (simplicity)

Things to consider

Questions to answer

- Static or profile baseline?
- Regression or historic data
- Exclusion rules
- Additive or scalar adjustment?
- Cap?

Questions to answer

Industry or Tariff Change

- There may be significant changes to Network Charges. Historic Data may not be an accurate predictor of future usage i.e
  - If Peak Charges are made sharper this may lead to the User reducing demand which the baseline should predict
- Recent Ofgem letter indicate implementation of change 2023
  - A tariff additive could be included
  - Could this be done on a locational basis?

- Are individual baselines methodologies better suited to different site set ups and on site generation?
- Do business cycles have variability, such as seasonality?
- How to incorporate site change, i.e. factory closures etc

Next Steps

Next Steps

Next event	Approximate date
Workgroup to discuss mechanics and data routing	Early July
Review Business Requirements/legal text	Early August
Assessment Consultation	Mid-late August
Workgroup to consider consultation responses	Mid September
Assessment Report	October Panel

Appendix: Useful definitions

definitions

Profile Baseline	Incorporates frequent granular measurement across similar days, resulting in a demand estimate that mimics the dynamic nature of a customer's demand over a period
Static baseline	Generates a flat demand estimate representing the average demand during an a time interval
Measurement granularity	Refers to size of time intervals used for discrete demand measurements
Baseline window	The window of time over which demand is collected to establish a baseline
Exclusion rules	Rules governing data within a baseline window that is included or excluded from the calculation
Baseline adjustment	Changes to the calculated baseline based on actual demand or weather conditions on the event day

definitions

Additive adjustment	A fixed kW adjustment across all event time intervals to match the baseline to current usage
Scalar adjustment	Percentage multiplier across all event time intervals to match baseline to current usage
Adjustment cap	Limit on the magnitude of a baseline adjustment
Individual baseline	Concept of calculating performance or applying exclusion rules at individual site level then summing to calculate baseline for the entire portfolio
Portfolio baseline	Concept of calculating performance or applying exclusion rules at portfolio level
Average calculation	Baseline is calculated as the average demand across a number of similar intervals
Regression calculation	Baseline calculation takes a data set and determines the relationship between variables