



WatchDog

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21 ABC**

**The Future isn't
a technology revolution...**

**...It's a business revolution,
enabled by technology**

and powered by batteries

MOBILE ELECTRICITY



Why batteries fail...

Improper operation

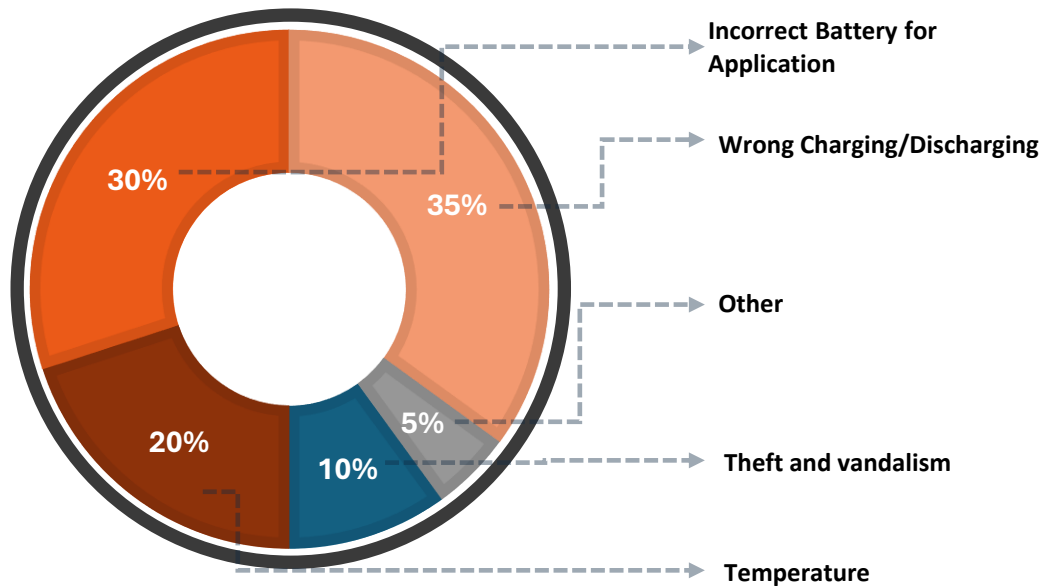
Main cause in over 50% of cases

Incorrect application

Accounts for 30% of battery failures

Theft and vandalism

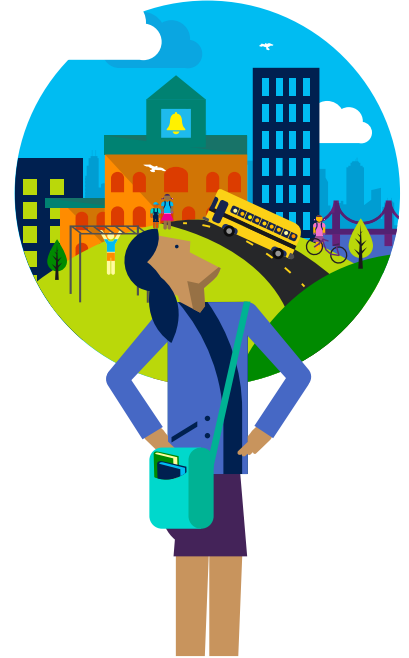
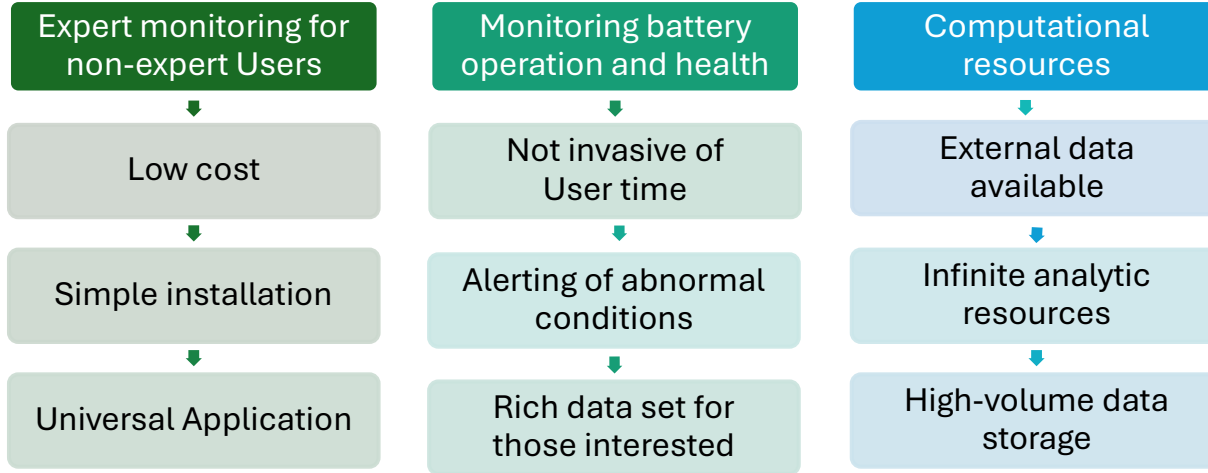
Accounts for around 10% of losses



USER IGNORANCE



The Solution – Expert Monitoring



The Solution – Battery Expert In A Box

Size

- Length 5 1/2 inches (140mm)
- Width 2 3/4 inches (70mm)
- Height 2 inches (50mm)
- Weight 0.40lbs (177grams)

Power

- Simple 2-wire connection
- <3W power consumption
- Standard operating voltage range 120V
- Withstand voltage 250V
- Reverse polarity protected

Mounting

- Fastener
- Magnetic

Environment

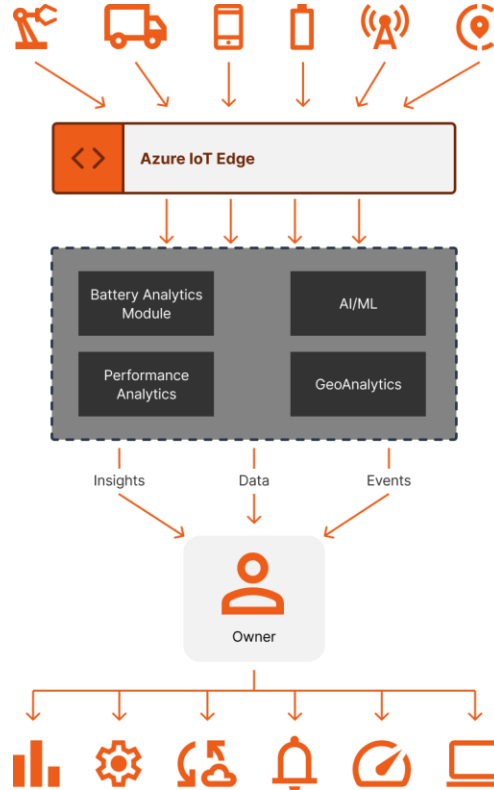
- Storage Temperature
-40 to 176 °F (-40 to 80 °C)
- Operating Temperature
-4 to 140 °F (-20 to 60 °C)

Data

- 6 month data storage in WatchDog
- Raw data data download from Web site
- 2.1 mV resolution
- 1% voltage accuracy
- $\pm 0.5^{\circ}\text{C}$ temperature resolution



The Solution – Expert Analytics



The Solution – Cloud Based Analytics

Streaming Analytics on Operational Data

Hi/Low Volts

Hi/Low Temp.

Geo Fence

Theft Detection

Machine Learning-based Performance Analytics

Bat. Health

Run/Reserve Time

Life Remaining

Under/Over
Charging

Thermal Runaway

Extensive User and owner Information

Bat. Metrics

System
Operation


Product
Performance

Warranty
Conformance

Predictive
Maintenance








The Solution – User Tools

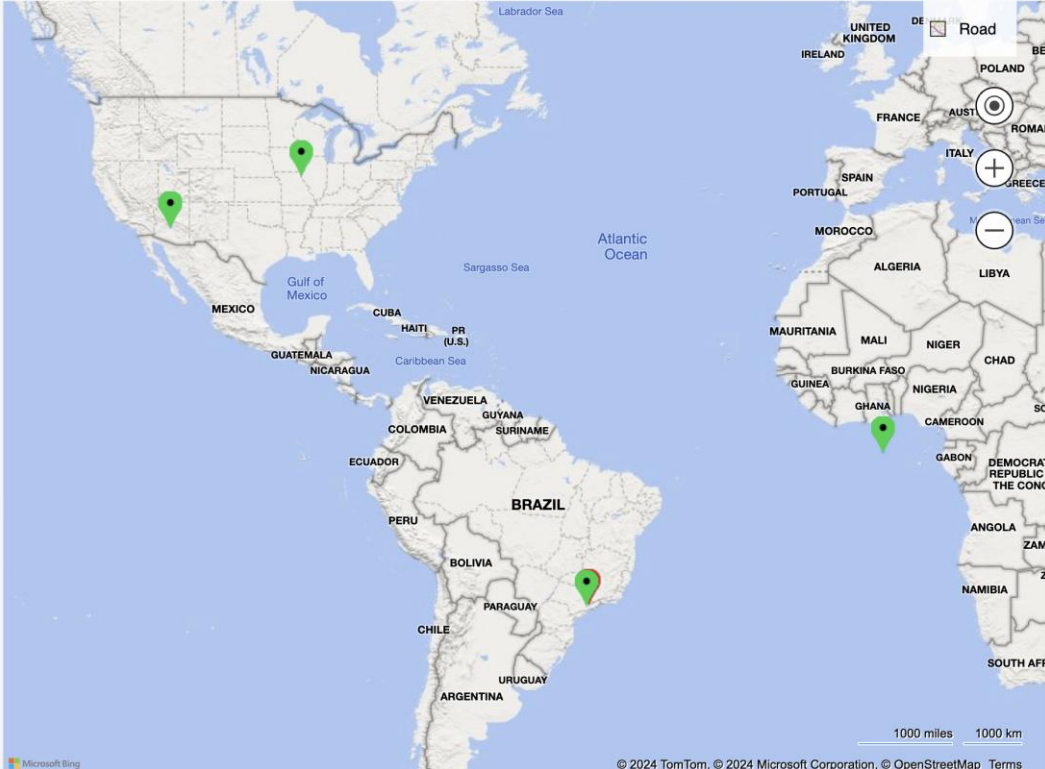
**WatchDog**

Welcome

Donald Karner dkarner@electric-applications.com

-  Devices
-  Alerts
-  **Map**
-  Administration
-  Sign Out

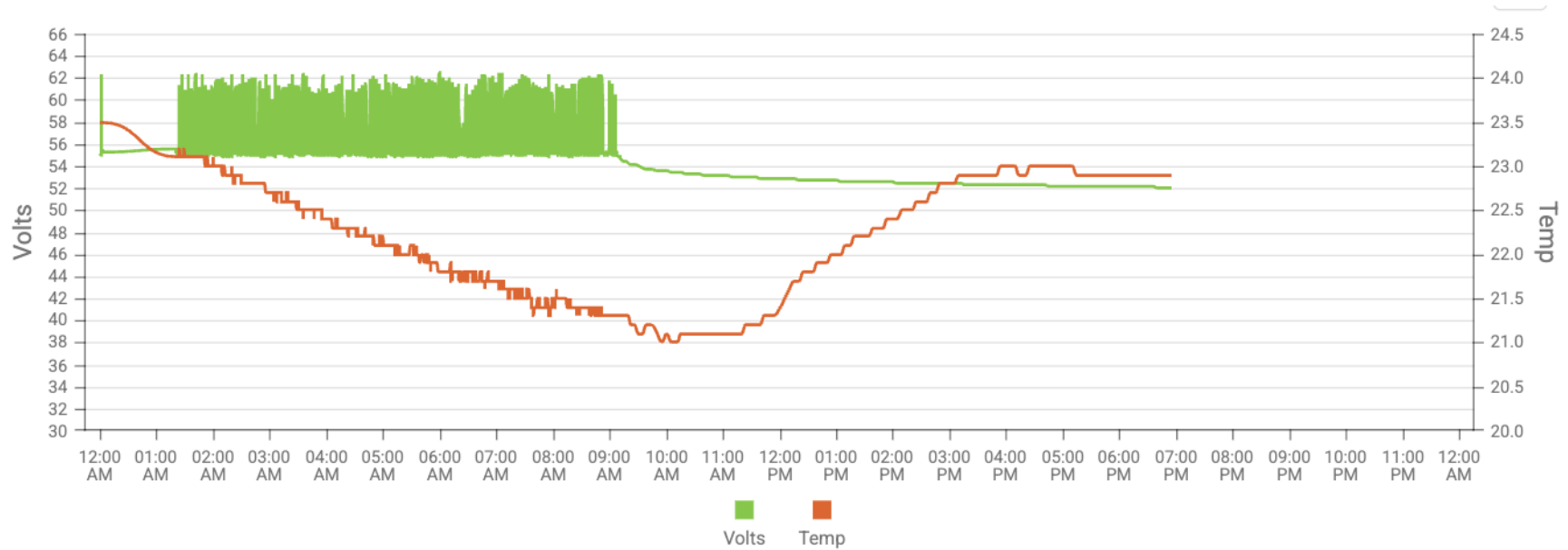
Map

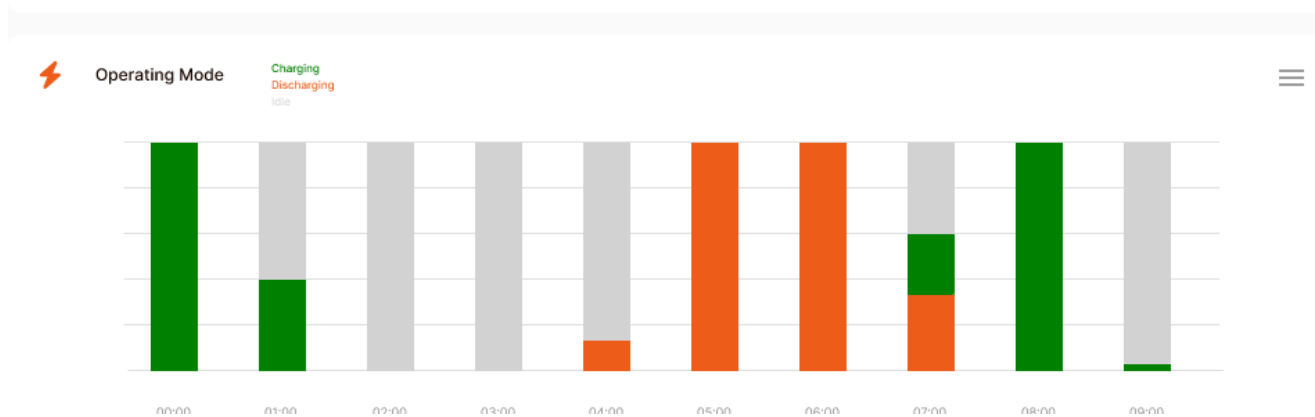
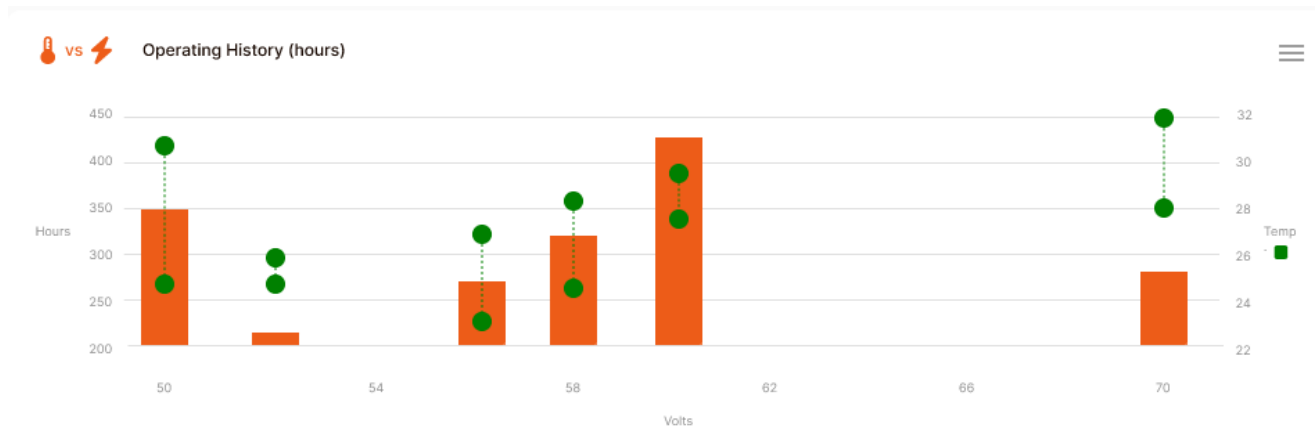


Microsoft Bing

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Graphical Data















Our Analytics – Conditional Alerts

Alert	Description
High Temperature	Battery has experienced an abnormally high temperature that may shorten its operating life
Low Temperature	Battery has experienced an abnormally low temperature that may reduce its performance
Charge Battery	Battery has remained discharged for an extended period and requires charging
Infrequent Charging	Battery is not charged frequently enough to prevent capacity loss
Low on Load Voltage	Battery has operated at a voltage too low to provide optimum equipment performance
Over Discharge	Battery has been operated at a very low state-of-charge that may reduce performance/life



Our Analytics – User Notifications

 Sustained Low State of Charge	WDSA13.93395024392	9/20/2019, 1:00 AM
 Sustained Low State of Charge	WDSA13.93395024399	2/13/2020, 1:00 PM
 Sustained Low State of Charge	WDSA13.93395024857	7/11/2019, 12:00 AM
 No Full Charge	WDSA13.93395024867	12/19/2019, 10:00 PM
 Sustained Low State of Charge	WDSA13.93395024871	5/9/2020, 9:00 AM
 Sustained Low State of Charge	WDSA13.93395024875	8/18/2019, 6:00 PM
 Sustained Low State of Charge	WDSA13.93395024881	1/25/2020, 9:00 PM
 Very High Sustained Battery Temperature	powerbox truck # 3	7/10/2021, 9:00 PM
 Sustained Low Temperature	photo room batts	2/15/2021, 6:45 AM
 No Full Charge	photo room batts	12/9/2020, 11:00 PM



WatchDog

Advisory Notification for Watchdog Unit:
WDSA13.93395024392

Alert Details:

Time Initiated: 2019-06-21 00:00:00.000
Low Operating State-of-Charge

Description:

Battery is operating for long periods at a low state-of-charge reducing its operating duration and life.

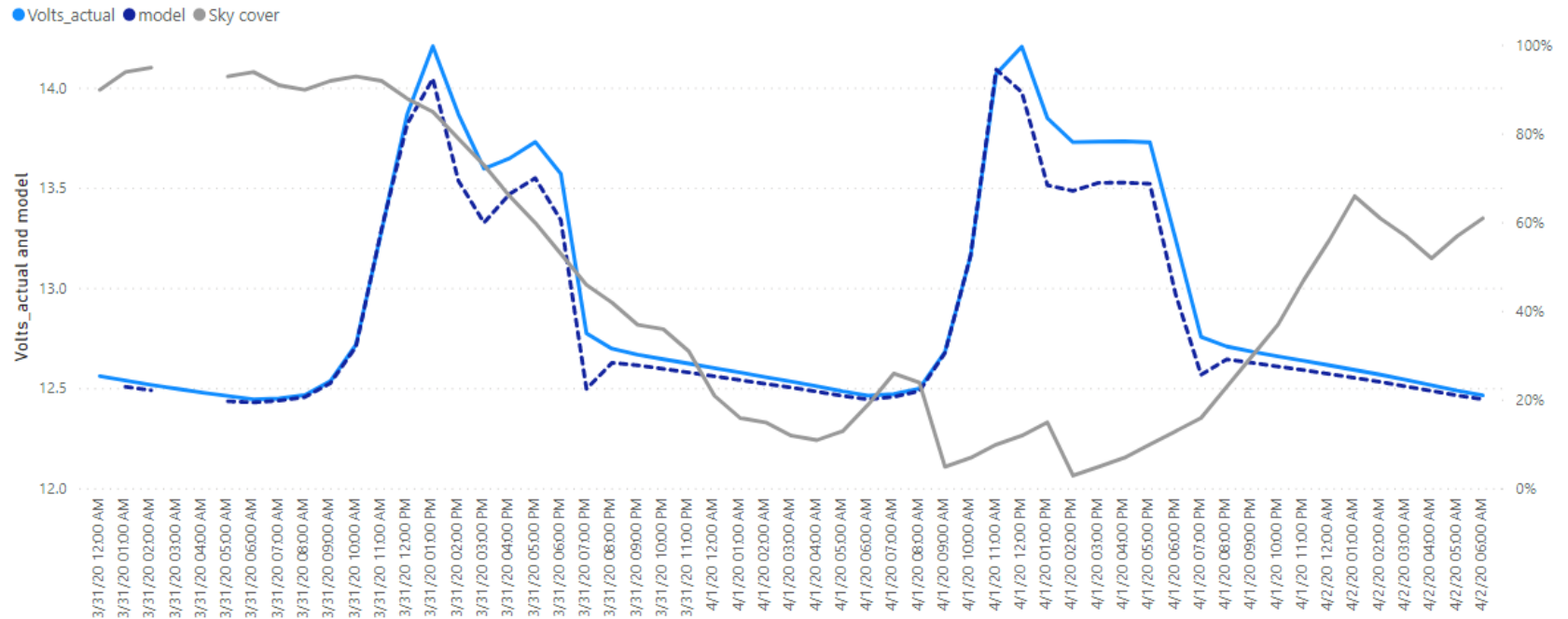
Recommended Action:

Evaluate magnitude of load and charging capability to determine why charging is not capable of returning the battery to a high



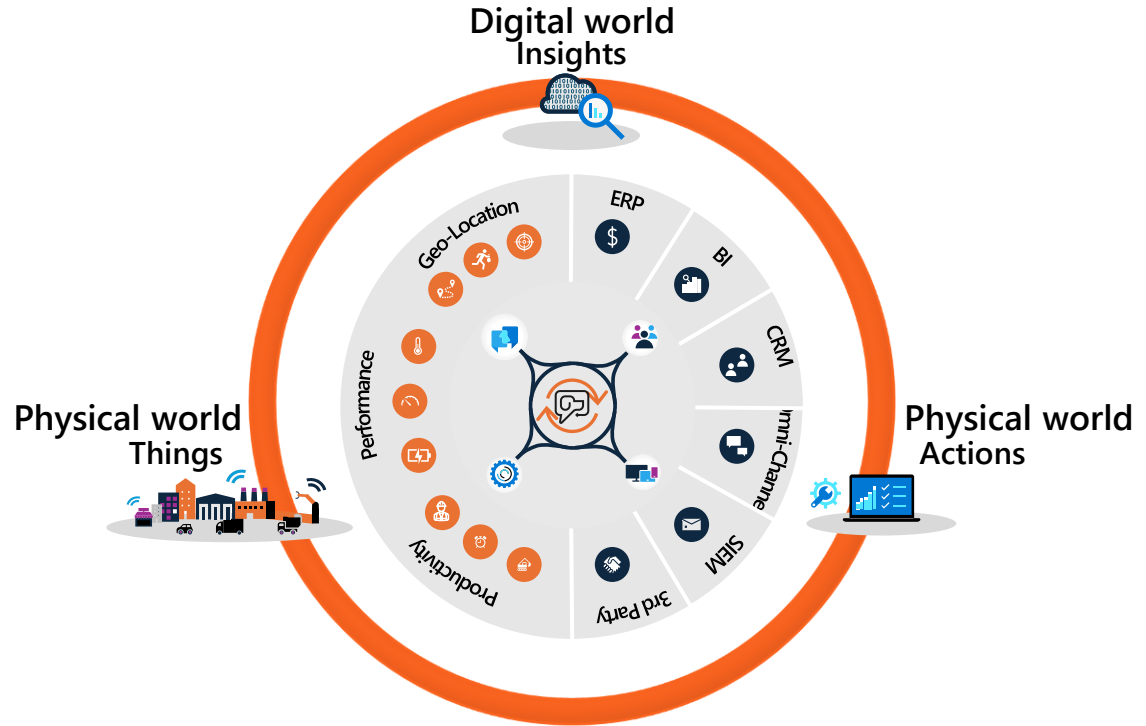
Our Analytics – Predictive Modeling

Volts_actual, model and Sky cover by Date and Hour



Our Analytics – Company Focused

- 1 Data: Capture data across business
- 2 Insight: Connect and synthesize data
- 3 Action: Improve business outcomes



Our Monitoring – Beta Partners



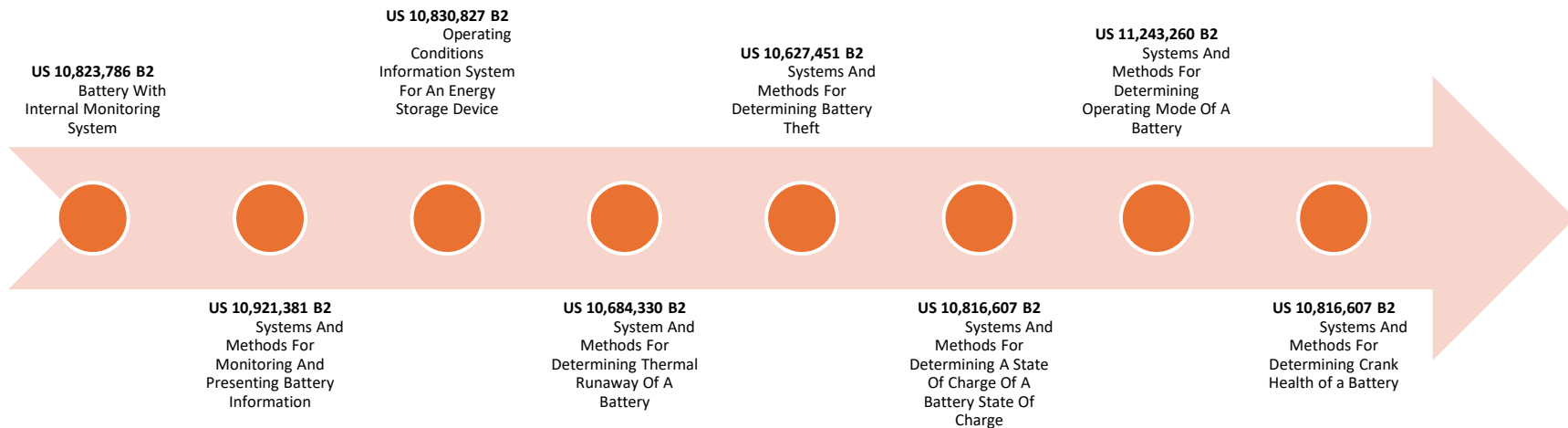
Our Monitoring – Experience

- 200 devices have participated in Watchdog beta testing
- We have captured 55,000 days of operating data
- We have demonstrated data collection on multiple continents
- We have captured data for various operating protocols
 - Reserve power
 - Motive power
 - Telecommunications
 - Mobile power
 - Off grid



Our Protection – Patents

Issued US Patents



Our Future – Data Focused





WatchDog

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