

CONVERGENT

**How a 10MW Battery is Saving
an Industrial Customer on GA**



CONVERGENT

Convergent is the leading independent developer of energy storage solutions in North America.



CONVERGENT

1st

We were the first company to bring online an energy storage system for Global Adjustment reduction.

40MW

We are the largest operator-owner of energy storage systems in Ontario.

25%

Our proprietary algorithm is 25% more accurate at predicting peaks than public market forecasts.



Bolton

4.2MW/8.4MWh



Sarnia

10MW/20MWh



Windsor

4MW/8MWh



Sarnia

10MW/20MWh



Brockville

600kW/1.2MWh



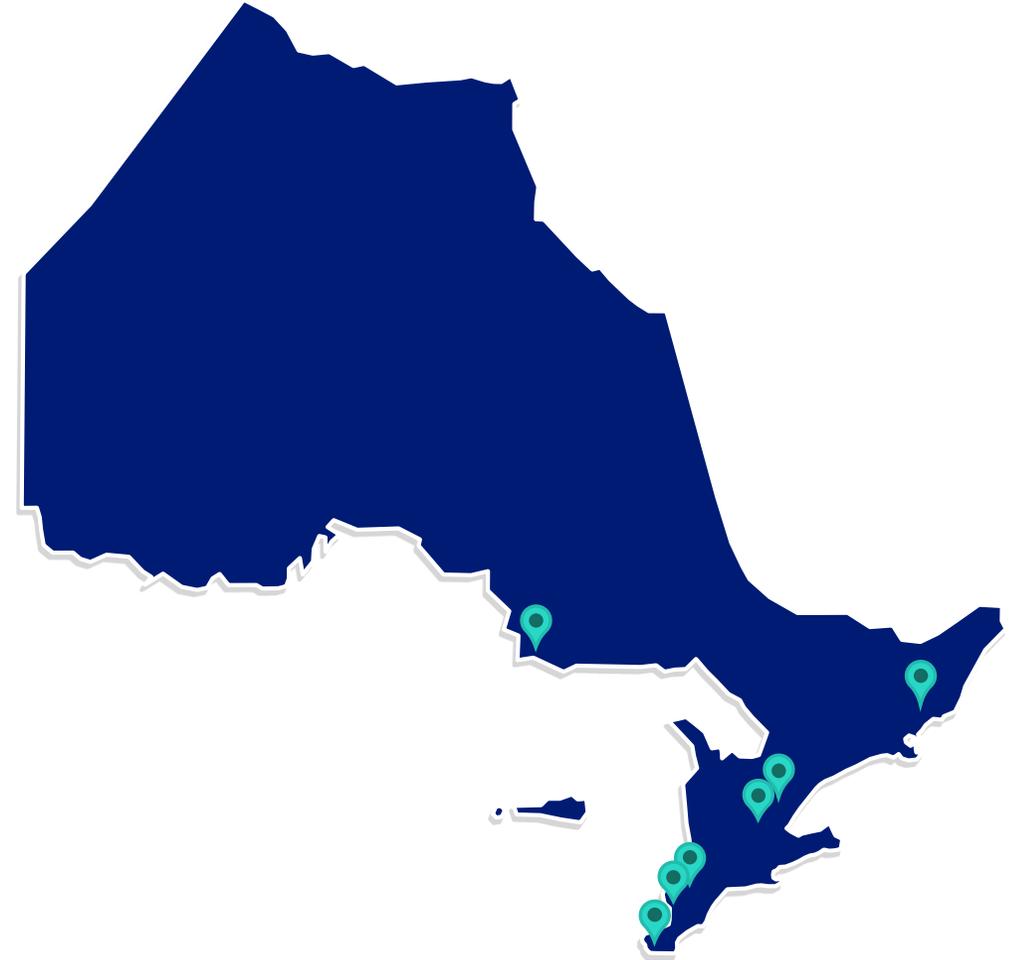
Sault Ste. Marie

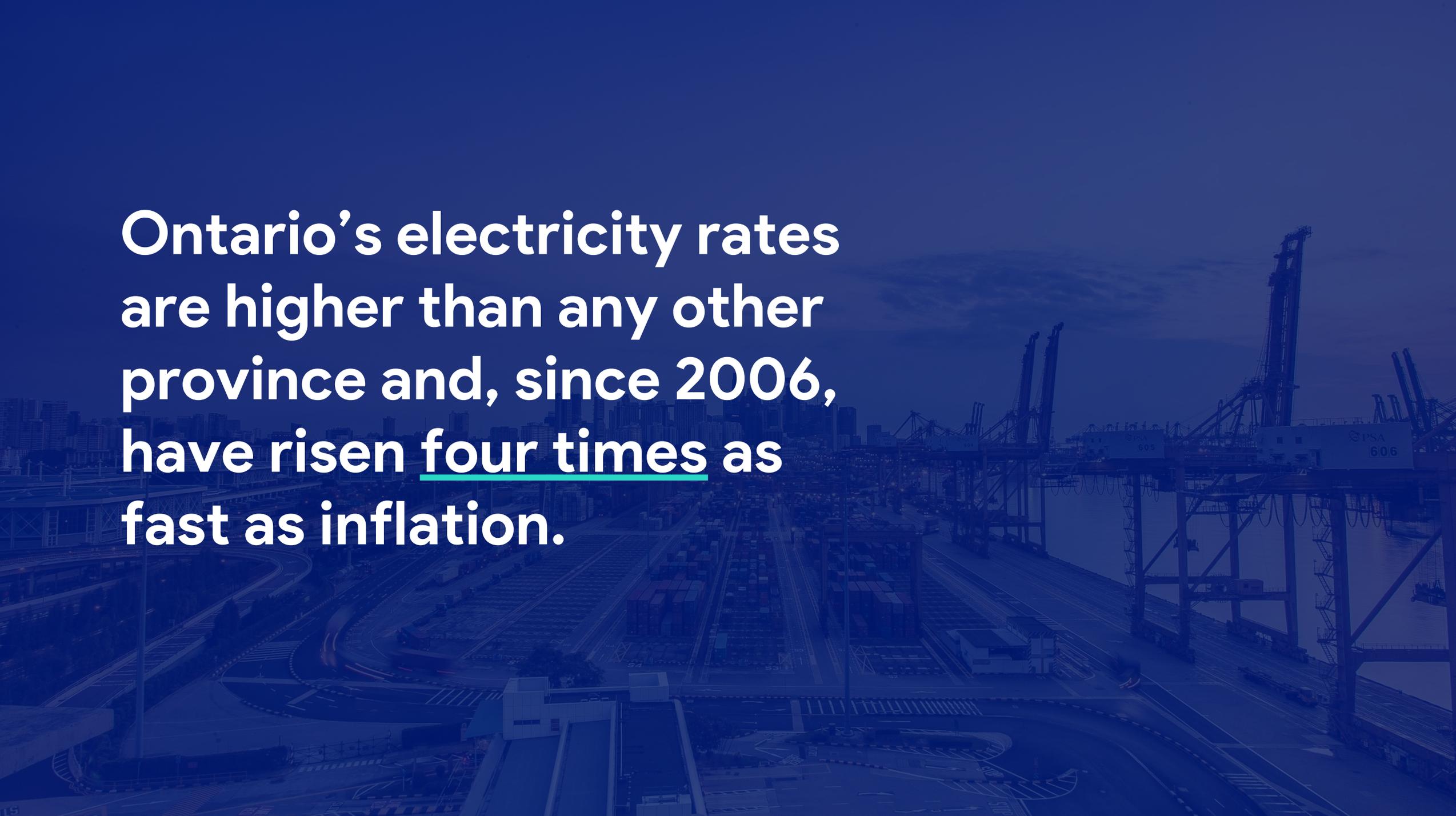
7MW/7MWh



Guelph

5MW



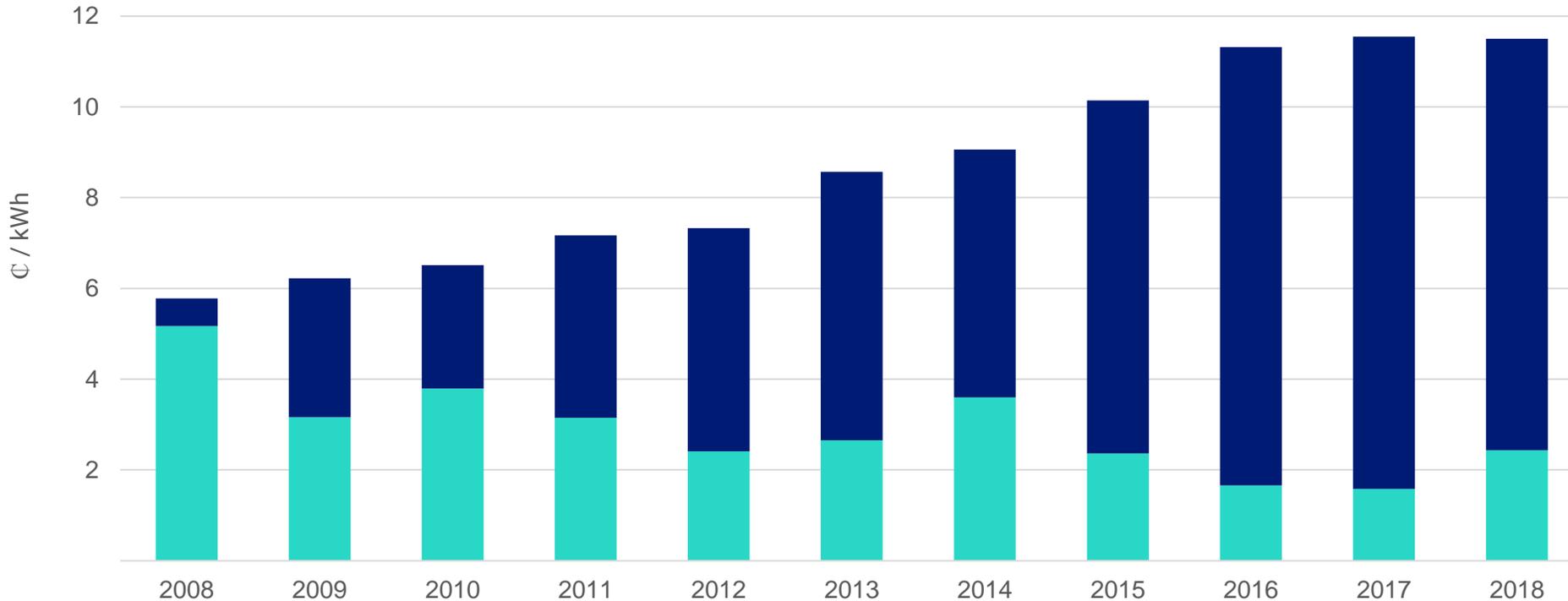
An aerial view of a port area, likely a container terminal, with numerous cranes and stacks of shipping containers. The scene is overlaid with a dark blue filter. The text is positioned on the left side of the image.

Ontario's electricity rates are higher than any other province and, since 2006, have risen four times as fast as inflation.

The Global Adjustment (GA) charge makes up **50%-70%** of an industrial customer's total energy bill.

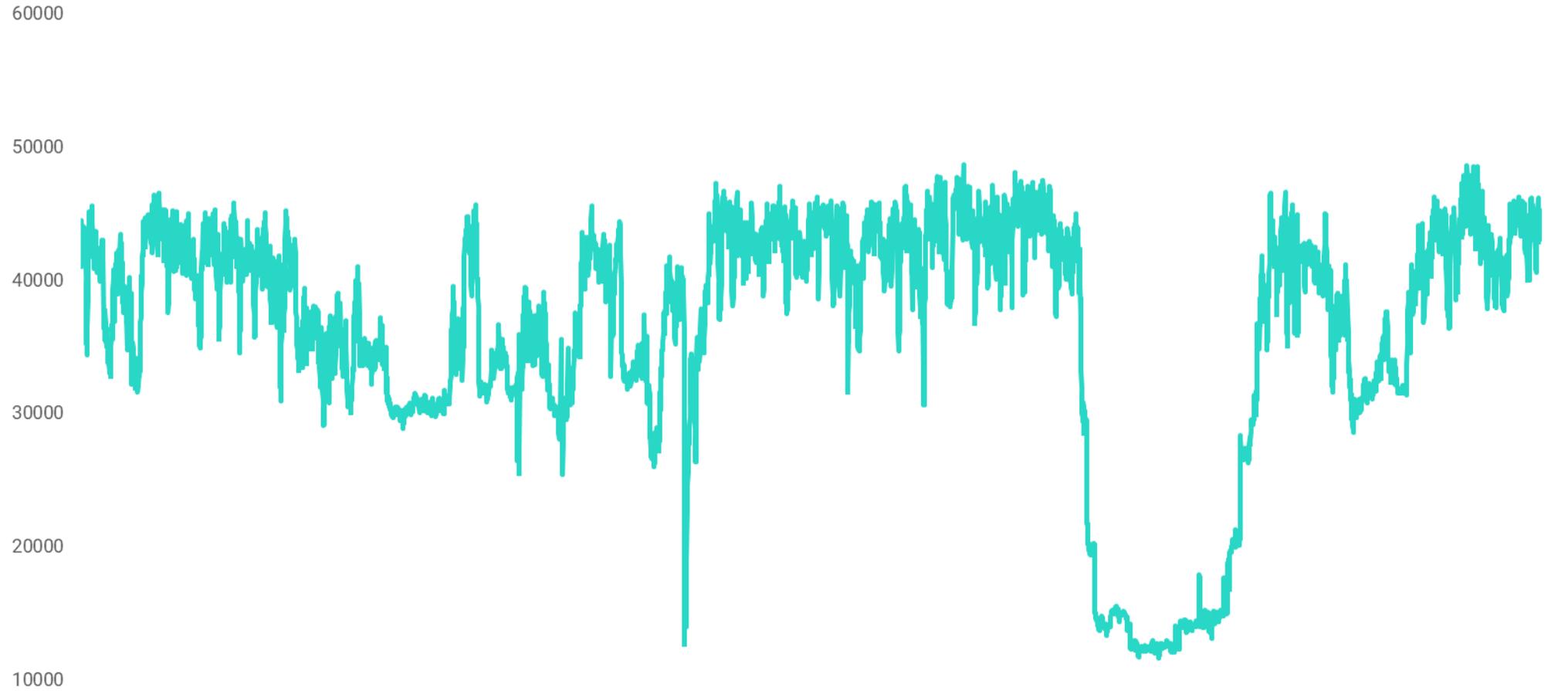
Ontario Electricity Pricing Trends

■ Average Ontario Energy Price ■ Average Global Adjustment



**In 2018 alone, GA totaled
\$11.2 billion CAD (\$8.3 billion USD)**

Facility Annual Load Profile - 2015



Understanding Global Adjustment Costs

Date of Peak	Hour End	Facility Load* (MW)	Ontario Peak (MW)
July 28, 2015	17	39.47	22,516
July 29, 2015	17	41.95	22,472
August 17, 2015	17	40.75	22,383
September 2, 2015	17	43.77	22,063
September 8, 2015	18	28.62	21,923
Average		38.91	22,271
Total		194.56	111,357
Peak Demand Factor		194.56 / 111,357 = 0.0017471	

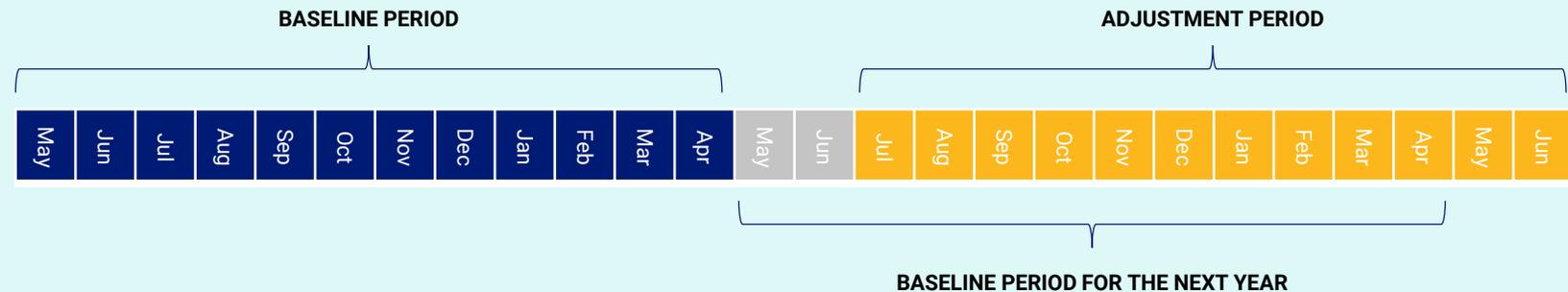
2016 / 2017 GA COST ESTIMATE:

0.0017471 × \$11.8 B =

\$ 20,615,958

- Baseline or "Peak Setting" Period:**
 Period in which the IESO tracks and records the five highest demand peaks for the province. A facility's power demand during each of the five peaks determines the facility's Peak Demand Factor.
- Adjustment or "Billing" Period:**
 Period during which the Peak Demand Factor that was set in the previous Baseline Period is used to calculate a facility's share of Global Adjustment costs.

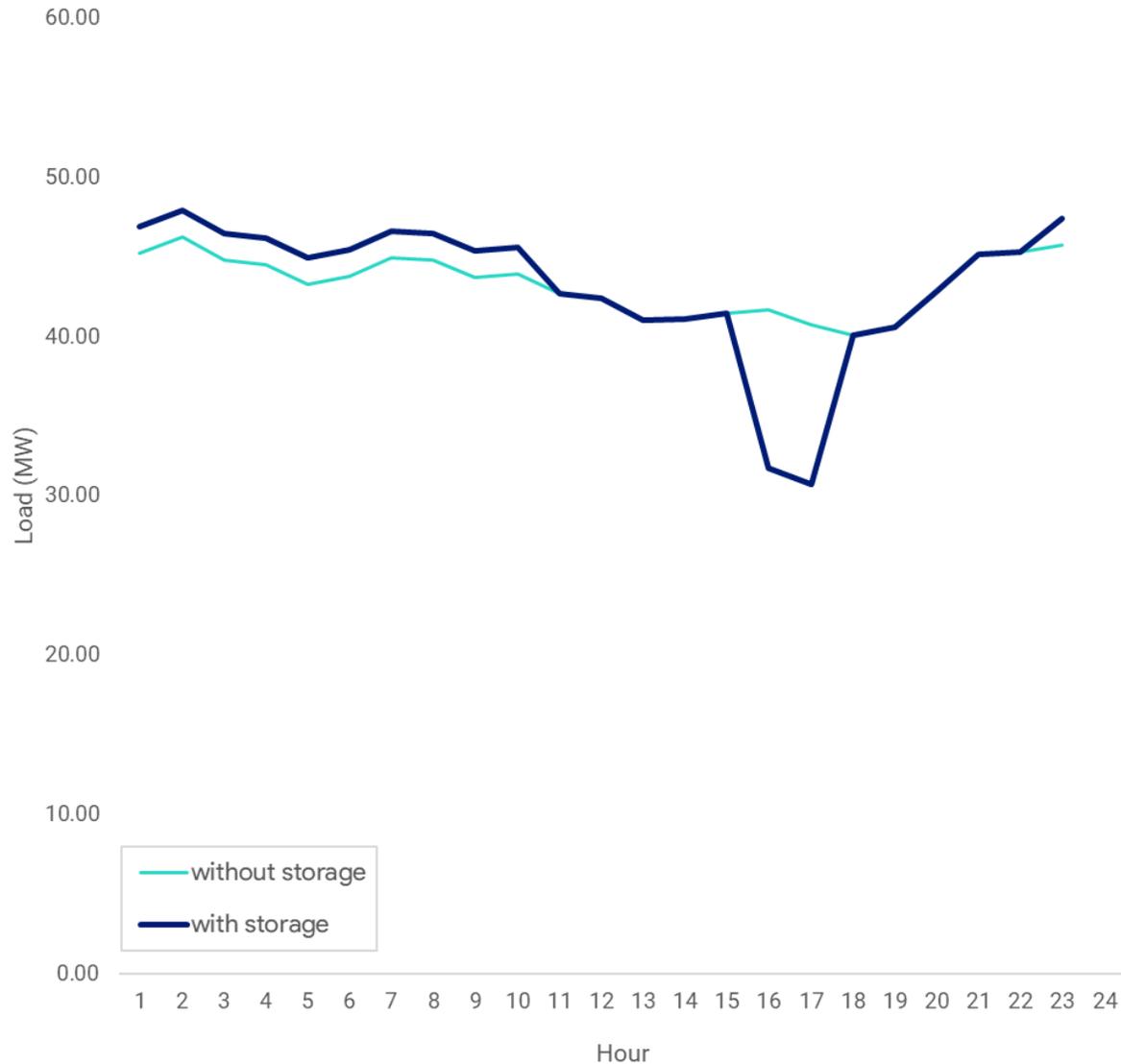
WHEN A FACILITY'S PEAK DEMAND FACTOR IS FIXED AND APPLIED







Source: Ledke Technology Co., www.ledke.com



Primary Technical Concerns

Will the energy storage system:

- Contribute harmonics?
- Disrupt VFD on our 10K HP compressor?
- Cause the lights to flicker?
- Can you control how quickly you ramp up/down?
- What if you are operating/dispatching power and it suddenly shuts down?

Will you shut us down?

Studied: Load flow, short circuit, harmonic distortion, ramp up/down . . .

TOTAL CURRENT DISTORTION										
Device Name	Bus Name From/To	Voltage From/To	I_RMS(A)	KWLoss Tot/Harm	KVARLoss Tot/Harm	IT	K	I_THD(%)	IEEE-519	
20T1	2i	2i	TOTAL VOLTAGE DISTORTION							
27T1	2	2	Bus Name	Voltage	V_RMS(V)	V_TIF	V_THD(%)	IEEE-519		
30T1	3i	3i	6434-7-A364E							
	3i	3i	6434-MCC A4							
30T2	3i	3i	6440-64F							
	3i	3i	6441-MCC B1							
	3i	3i	6442-MCC B2							
31LT3	3	3	6443-MCC B3							
	3	3	6444-MCC B4							

TOTAL SYSTEM POWER LOSSES			
Harmonic Losses		Total RMS Losses	
P/kW	Q/kVAR	P/kW	Q/kVAR

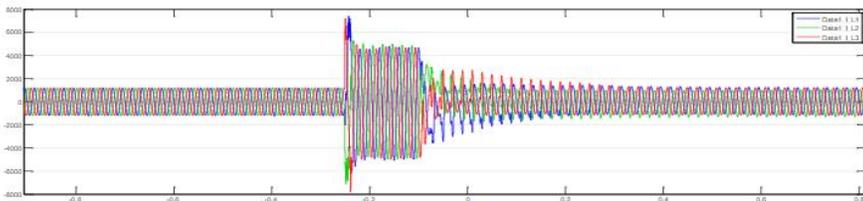
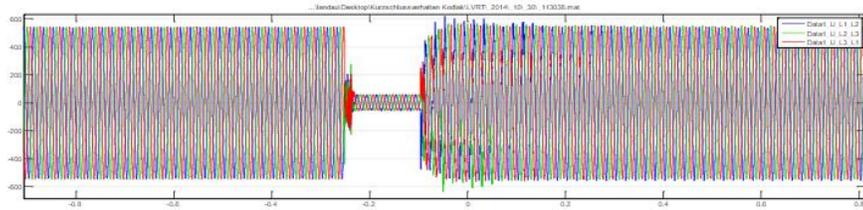
Harmonic analysis of AC grid current

Sunny Central 2200 (-US)

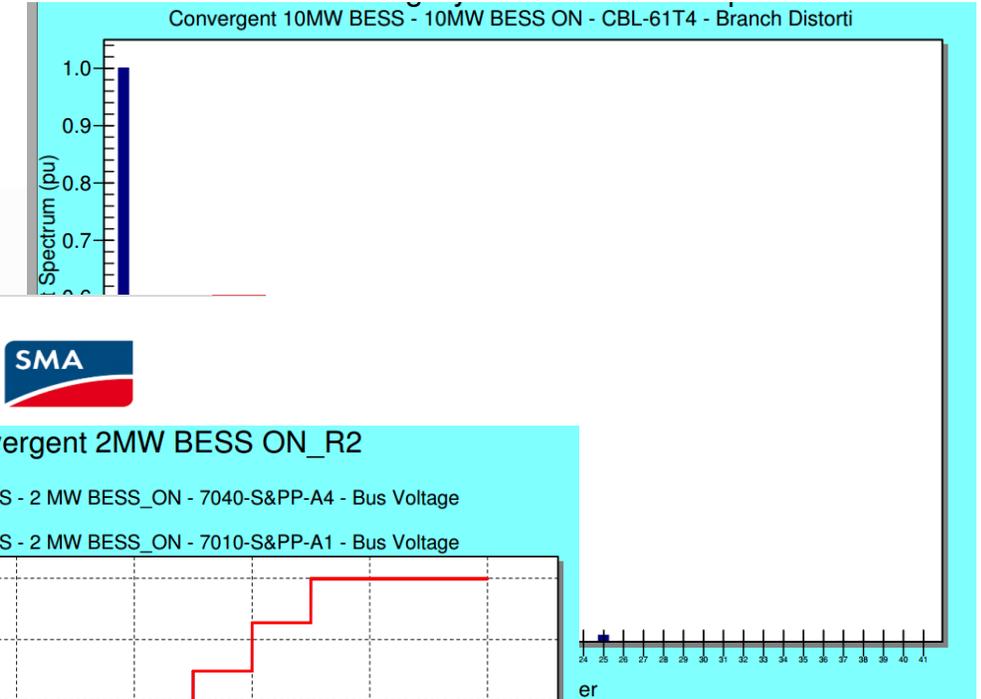
Values measured at: 385 V-AC
 at approx. rated current: 3300 A
 Values referred to: 34,5 kV
 Frequency: 60 Hz

Date of measurement: January
 Author: Greger
 Approved by: Steets

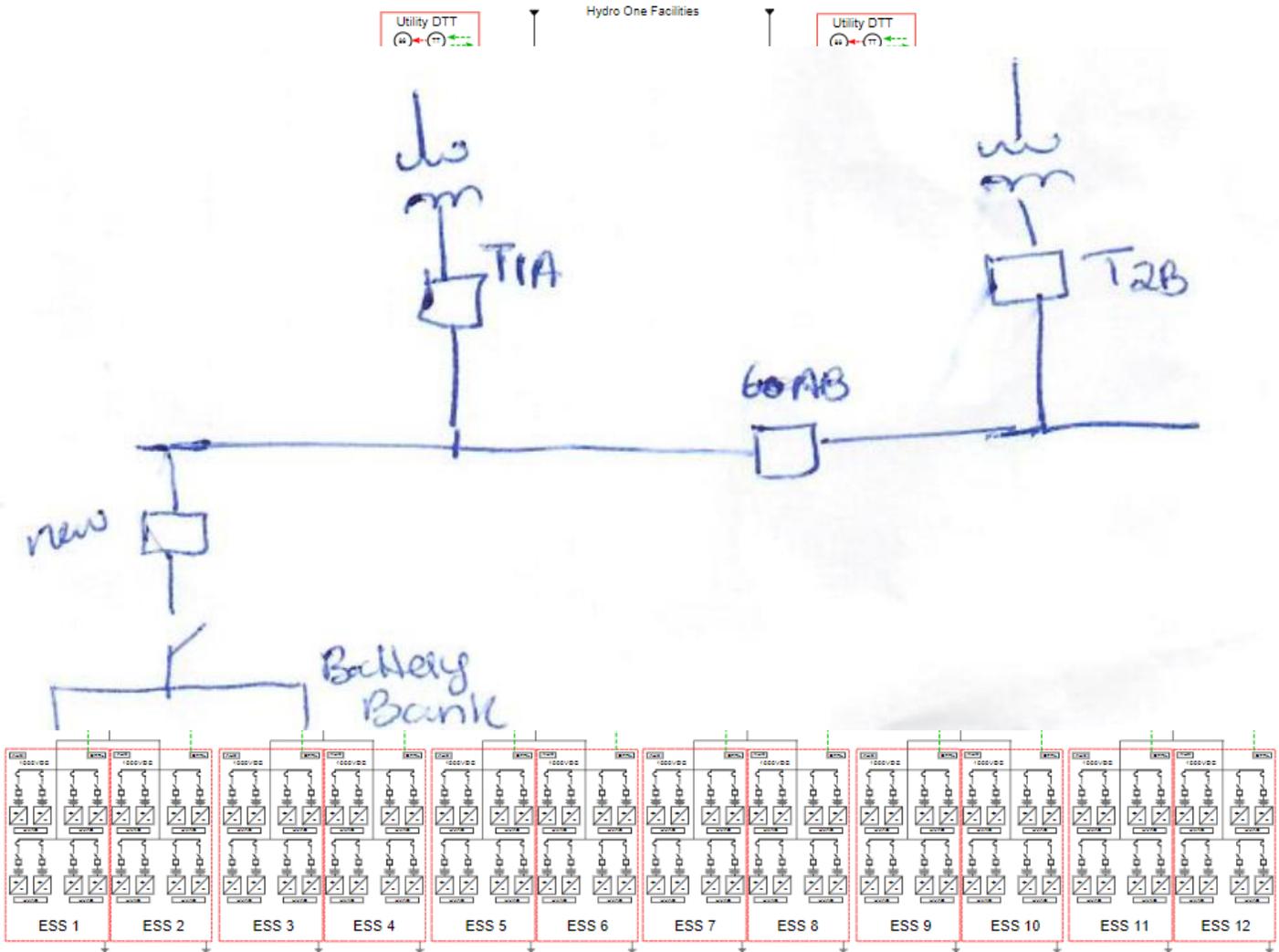
harmonic order	current [A _{peak}]	current [% I _n]
1	51,6112	99,1
2	0,0461	0,09
		28
		16
		7,5



Picture 1: Symmetrical voltage drop (5% U_n)



How we interconnect















Energy Storage North America Innovation Award Recipient, 2019

Customer	Large Petrochemical Refinery
Capacity	10 MW / 20 MWh
Status	Operational
Technology	Lithium ion
Interconnection	13.8 kV

**IESO Peak Forecasts
are routinely inaccurate.**

In 2017, the IESO Forecast missed 70% of the actual peak hours.

Peak IQ™

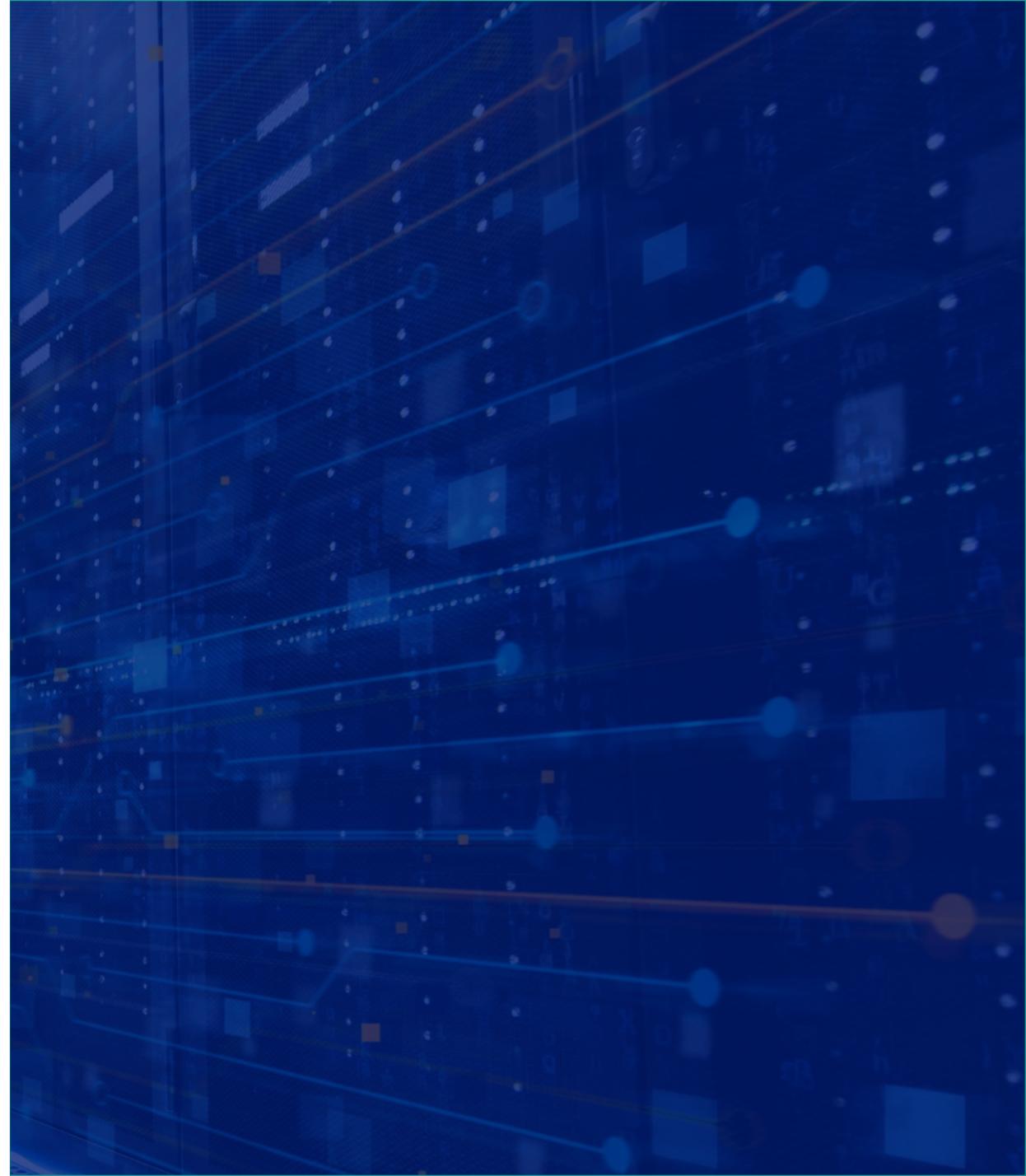
State of the Art Intelligence

Convergent has developed in-house a suite of peak prediction algorithms significantly more accurate than the IESO's forecasts.

99% uptime

>26,000 operational hours

5/5 successfully predicted every top 5 demand peak since its July 2017 release



Key Stats

- ✓ 10MW/24MWh
- ✓ 1,734 LG Chem lithium-ion modules
- ✓ Six 12' x 30' purpose built containers
- ✓ Each enclosure weighs about 130,000lbs
- ✓ Nominal 1,000 VDC
- ✓ 9 months to design, engineer & commission



Thank You

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