Extensible Energy
A Cleaner World

John Powers - Background

John Powers

CEO, Extensible Energy

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30+ years experience – Energy Consultant and Software Entrepreneur

BA Economics from Reed College
MA in Economics from UC Berkeley

Board Member at PLMA (peakload.org)

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Extensible Energy:

Load Flexibility Software for Commercial Buildings

Partnering with Solar Developers and Utilities

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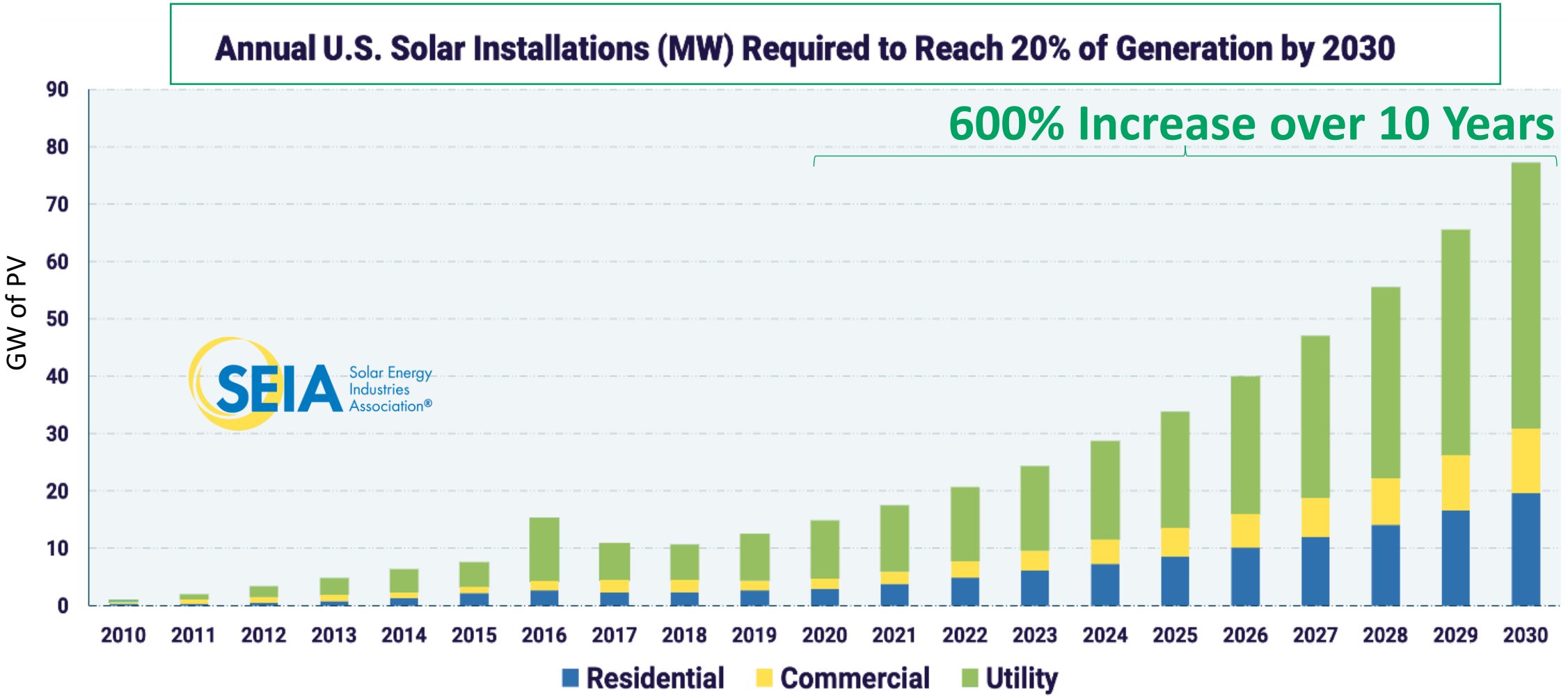
$1 Trillion Solar Opportunity. 2021-2030 (US market)



Software will be highest margin & fastest growing segment

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PROTECTION
LOCATION
NETWORK
SHOPPING
WATER
MOBILITY
ENERGY
ECOLOGY
HEALTH

Opportunity Knocks: SBIR Topic 13a

Grant applications are sought in the following subtopics:

a. Controls and Systems for the On-Site Consumption of Solar Energy

For solar energy to reach ubiquitous deployment, building owners, developers, and utilities will need improved capabilities to consume solar on-site, with as little impact on the electric grid as possible. Such an arrangement would reduce costs and technical challenges related to enabling bidirectional power flows, greatly reduce state policy risk, and maximize the value of solar systems' production.

Applications are sought for the development of innovative design tools, controls, and systems that integrate solar PV production, building load controls, electric vehicles and/or stationary storage. Applications should seek to optimize the usage, storage and deployment of solar electricity, while reducing installed costs. Areas of interest include, but are not limited to: (1) automated and predictive analytics applied to building load controls; (2) automated design tools for the development of integrated PV generation, load controls, electric vehicles and/or stationary storage, (3) intelligent controls for the charging and discharging of storage systems; (4) techniques and methods for incorporating short-term weather projections; (5) rapid, efficient, and safe installation of behind-the-meter storage, controls, and generation; and (6) techniques and methods for monetizing integrated PV, load response, and storage in electricity markets.

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Topic 13a in the Real World

Enter the Entrepreneurs…

- Building owners need to save money on their electric bill
- Solar helps them save on energy charges, but not demand charges
- ***Solar-aware control of building loads can solve that***
- That will help building owners, solar providers, and grid operators
- Oh, by the way, that will raise the percentage of on-site solar used in the building

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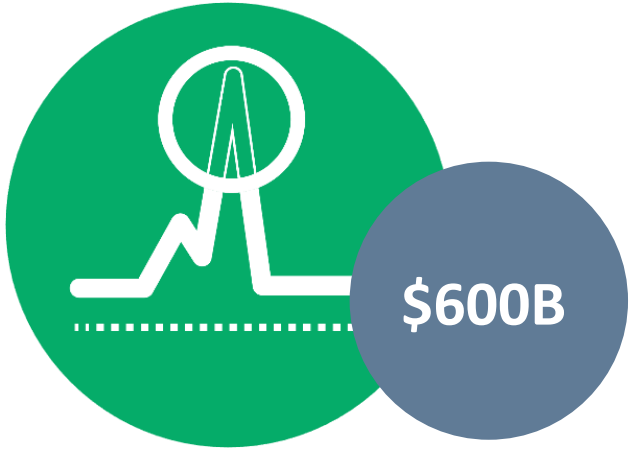
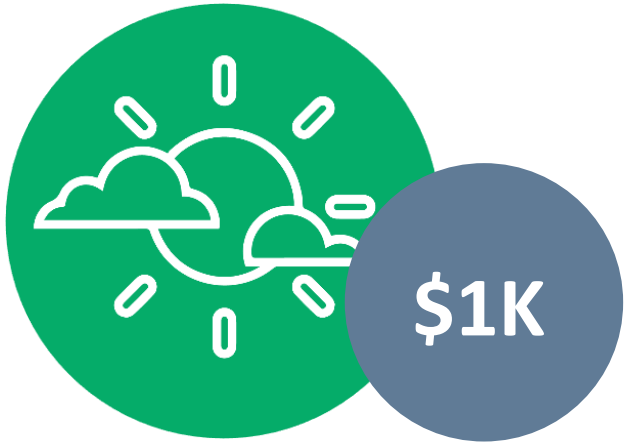
Problem

Buildings cannot dynamically participate in the grid



HIGH ELECTRICITY COST

Electricity charges increasing globally; $50B in annual US demand charges



LACK OF CONTROL

A single cloud or misstep could cost thousands for utilities and customers

UNMANAGED

< 2% of buildings are intelligently managed. Buildings cannot react to the grid

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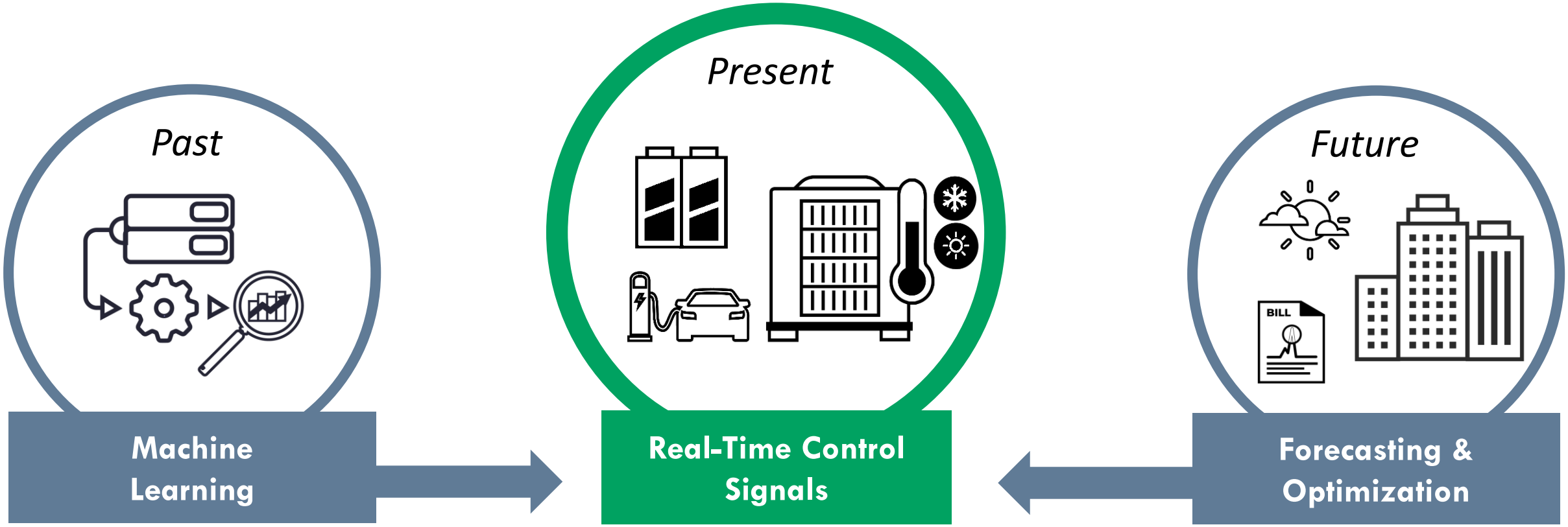
Solution: Solar Load Balancing Software (SLoBS)



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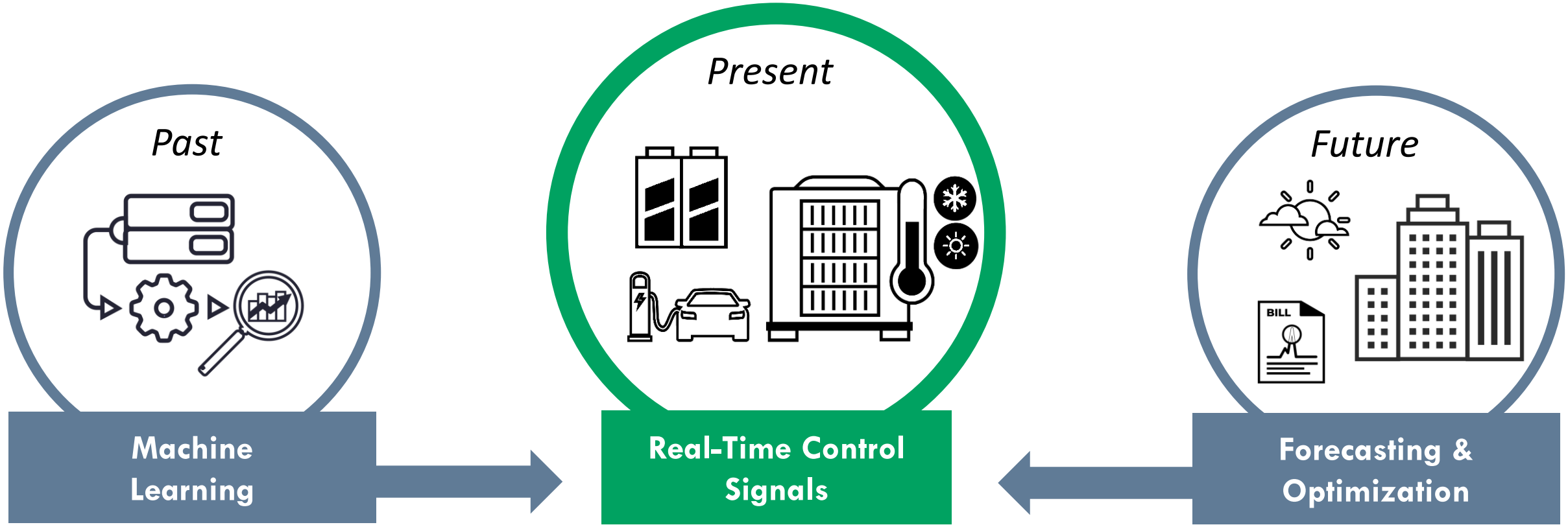
Solution: DemandEx™ Load Flexibility Software



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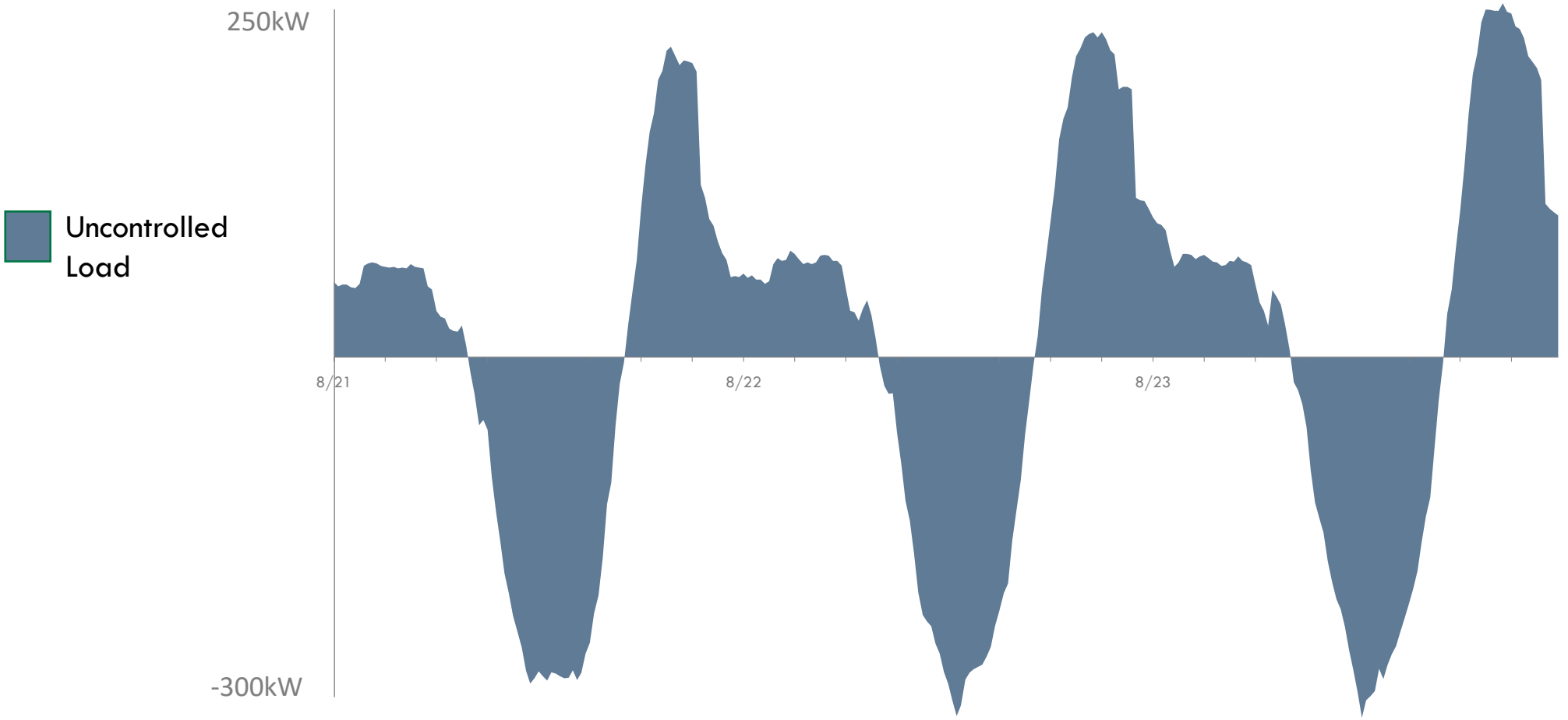
Buildings ”Live in the moment”

Even ‘well behaved’ buildings do not control demand charges or reduce peaks



Commercial Building Load Profile

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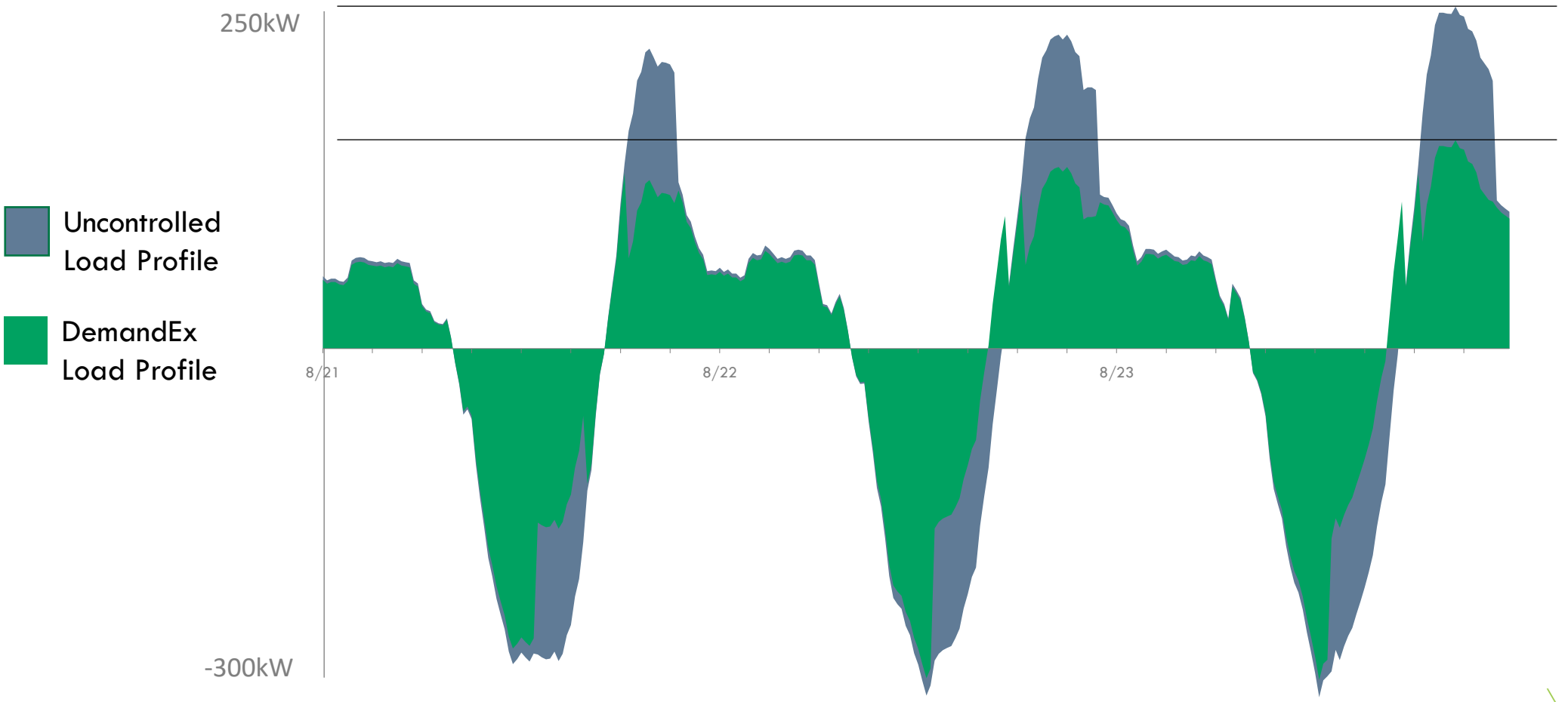
Buildings ”Live in the moment”

Load Flexibility Software Saves Demand – And Money



$5000 per month

100kW reduction
$50 per kW rate in SDGE Territory

Commercial Building Load Profile

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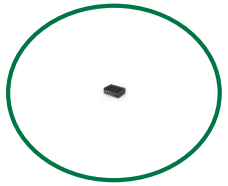
10X Improvement Over Batteries

DemandEx™

- $80 / kWh installed cost
- Practically no hardware or labor costs
- Priced on shared savings (1/3rd of savings)
- No Permitting
- 1 Day Install
- Gets better over time

Commercial Battery

- $1000 - $1200 / kWh installed cost
- High hardware costs, higher labor costs
- Complex financing, incentive to 'oversell'
- Permitting: Fire, Electrical
- 6 - 12 Month Sales Cycle and Installation
- Performance degradation and 10yr lifespan



Relative Size

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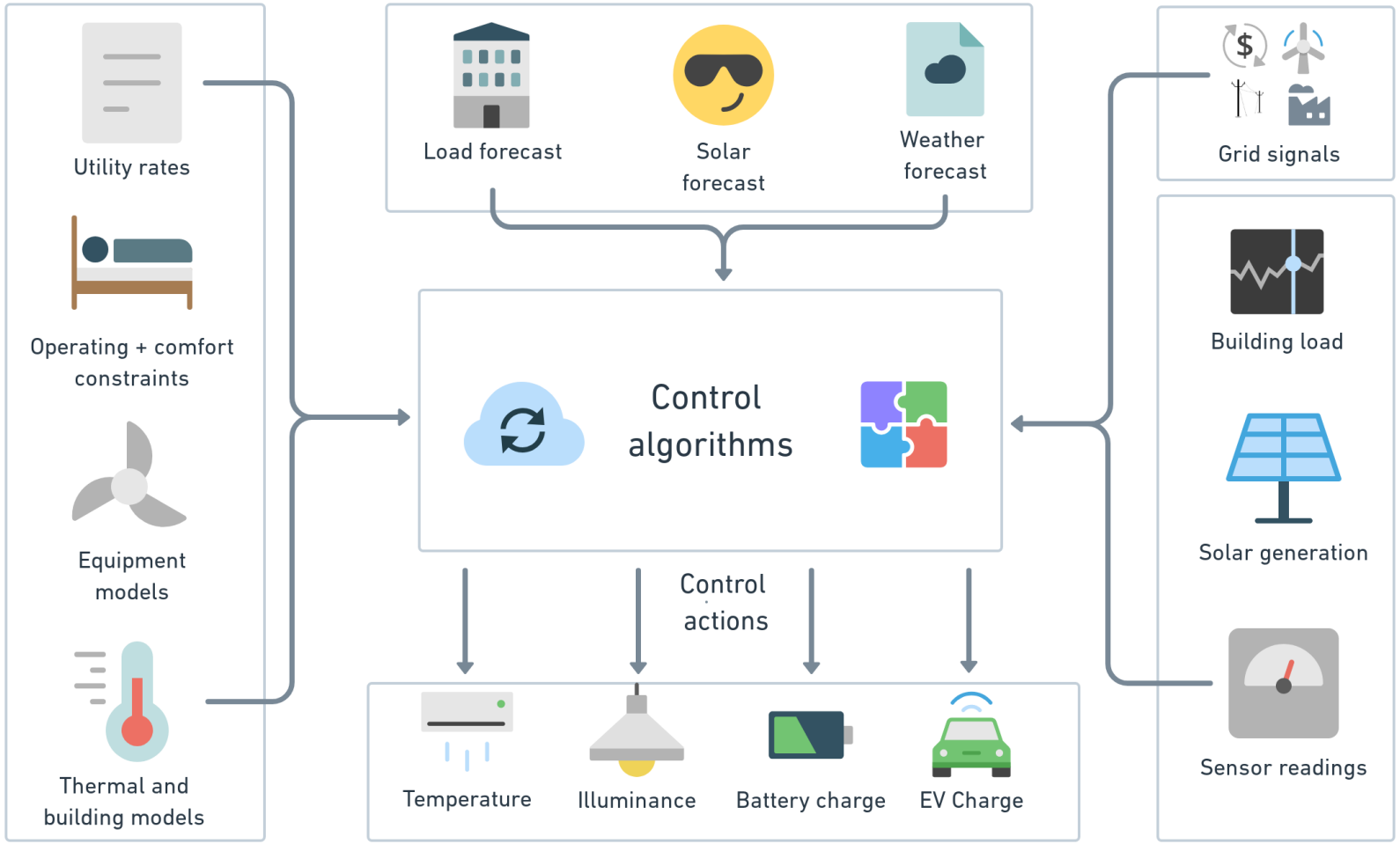
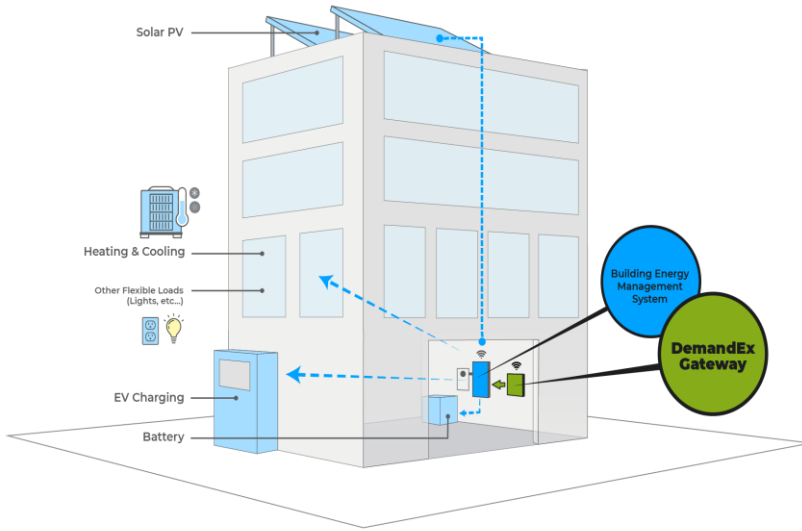
Technical Approach



DemandEx Gateway



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Optimization and Control: Fancy Math

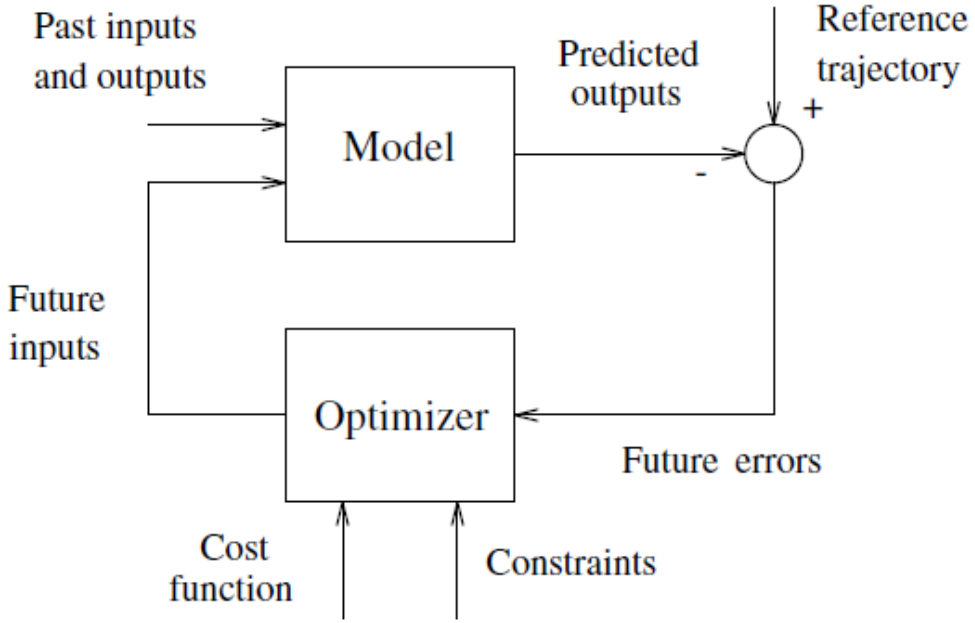

Fig. 1.2. Basic structure of MPC

Model Predictive Control (MPC)

Idea: (also called *receding horizon control*)

- at any time t, solve the problem over a prediction horizon

$$\begin{aligned} \text{minimize} \quad & J_N(x_t) = \sum_{k=0}^{N-1} \ell(x_{t+k|t}, u_{t+k|t}) \\ \text{s.t.} \quad & x_{t+k+1|t} = f(x_{t+k|t}, u_{t+k|t}), \quad k = 0, \ldots, N-1 \\ & u_{t+k|t} \in \mathcal{U}, \; x_{t+k|t} \in \mathcal{X}, \quad k = 0, \ldots, N-1 \\ & x_{t|t} = x_t, \; x_{t+N|t} = 0 \end{aligned}$$

$x_{t+k+1|t}$ and $u_{t+k|t}$, $0 \le k \le N-1$, are **planned** states and controls

- Implement only the first control $u^*_{t|t}$ at time t

$$u_t = u^*_{t|t}(x_t), \quad x_{t+1} = f(x_t, u_t)$$

- $t \to t+1$ and repeat the above procedure

"*Tutorial overview of model predictive control*", J.B. Rawlings, IEEE Control Systems, 2002.

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Ehrlich Toyota

Optimization and Control: The Real World

IPOWER Alliance
Driving Intelligent Energy

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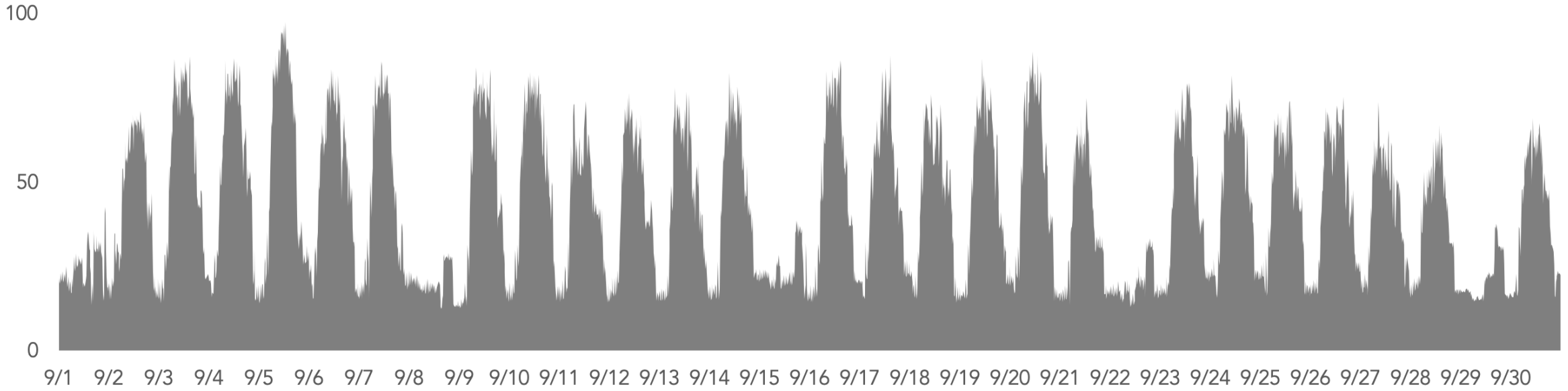
Ehrlich Toyota (Before)



- Cooling driven demand peaks in summer months
- $11,500/year demand charge; Greeley, CO; Xcel SPVTOU
- Installed a battery and DemandEx-optimized microgrid for resilience and demand charge reduction

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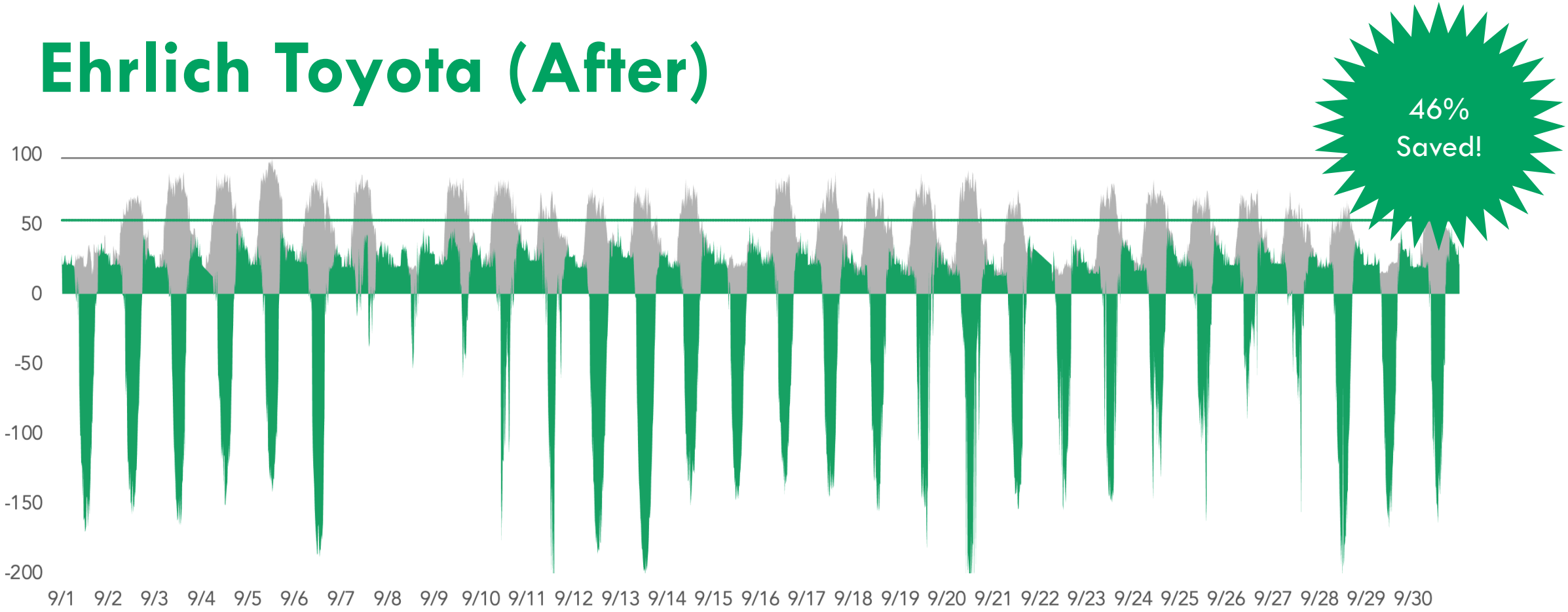
Ehrlich Toyota (After)



Savings Category	
Annual Savings	$3,900
Average Demand Reduction in Summer Months	33%
Annual Energy Reduction	N/A*

*Energy charge negative

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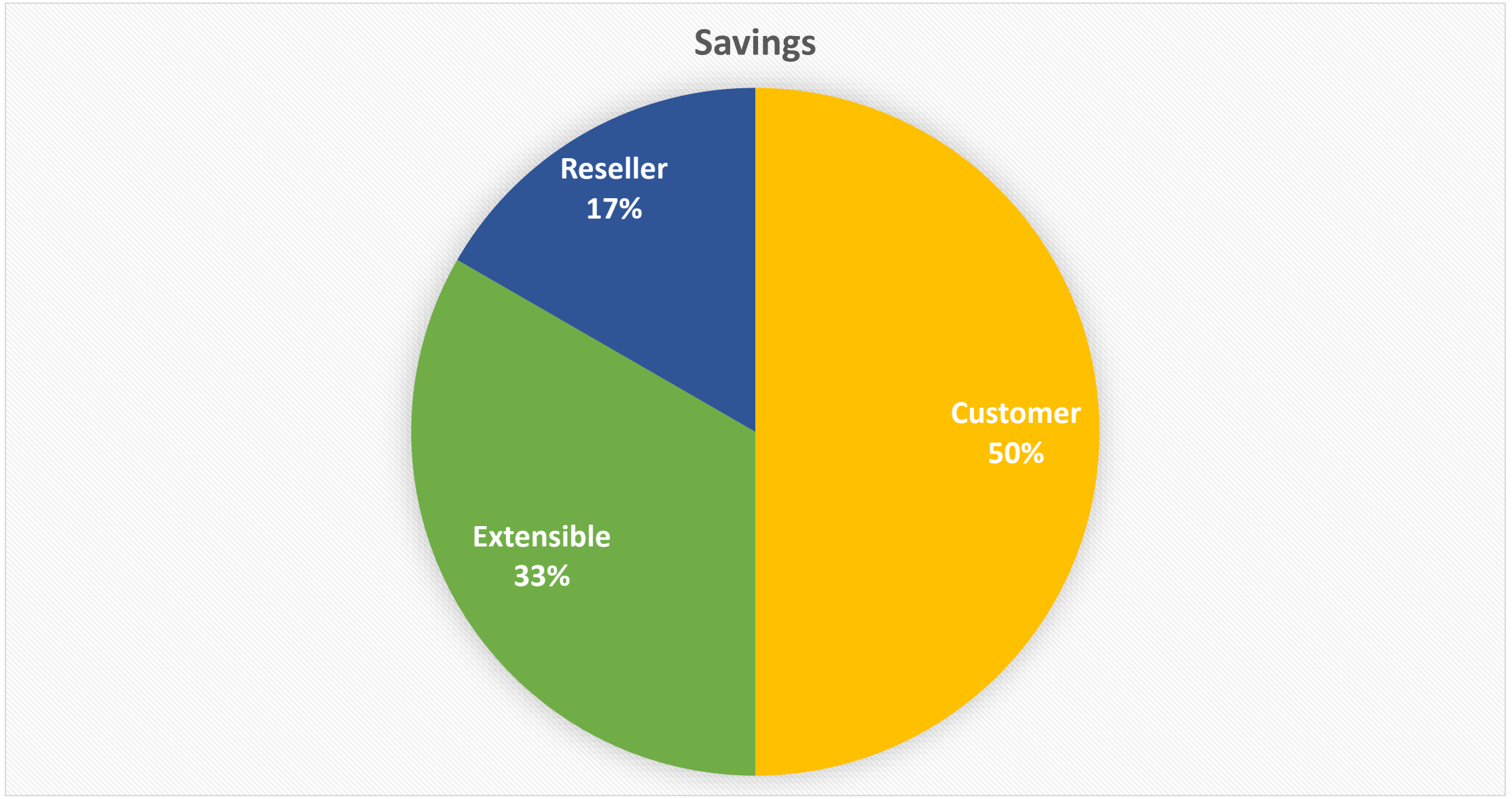
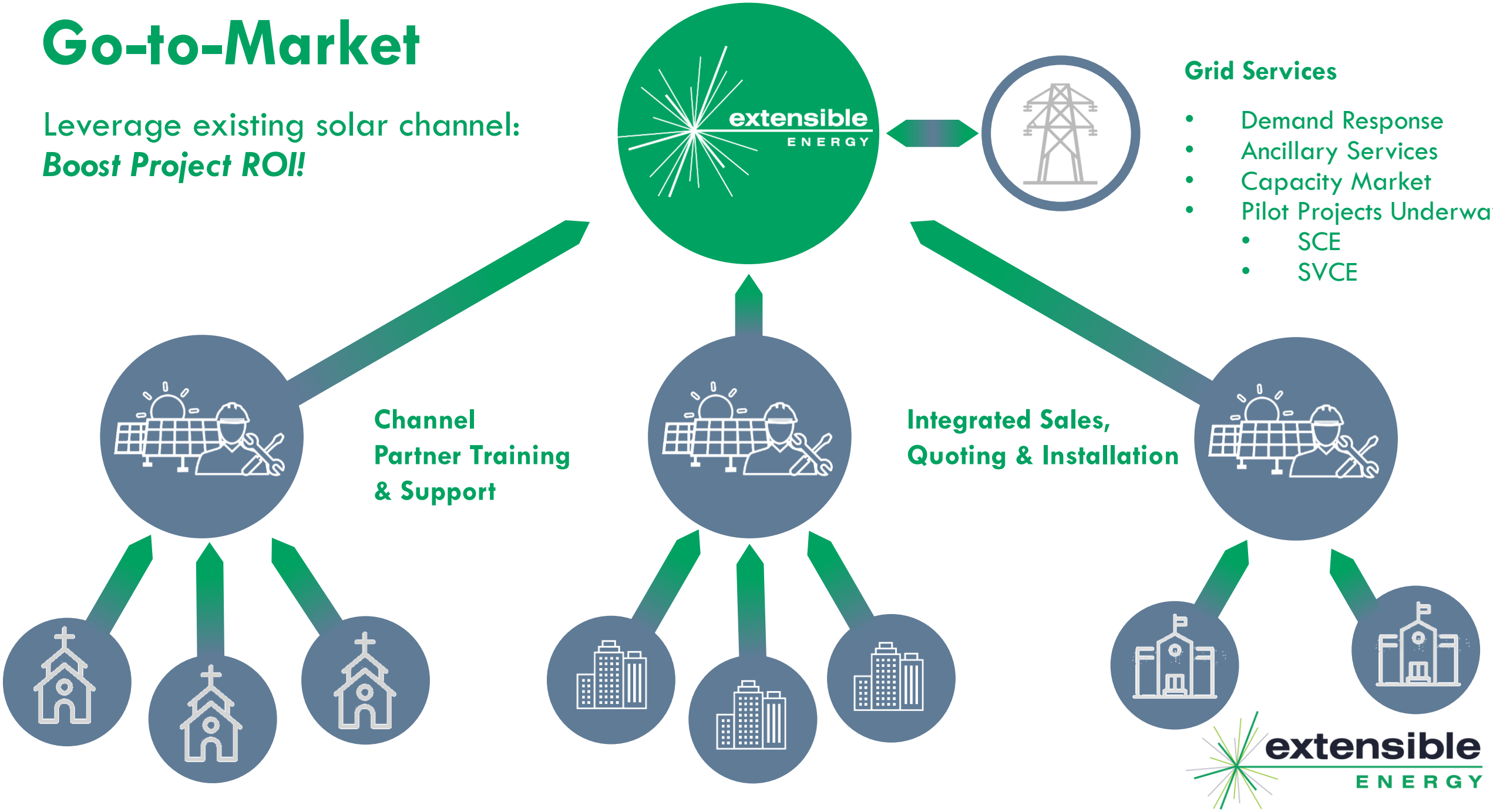

Savings
Reseller
17%
Customer
50%
Extensible
33%

Go-to-Market

Leverage existing solar channel:
Boost Project ROI!



Value Proposition

Solar Installation Partners

- Combined Solar + DemandEx Makes Proposals More Compelling
- Strong Competitive Differentiator
- Position Partner as an Energy Problem Solver, not a Solar Panel Salesman
- Earn Additional Revenue on Each Deal (through markup)

Commercial Customers

- Increased Savings Result in Higher Return on Solar Investment
- Better Comfort and Convenience
- Better Control of Energy Usage – Automation Eliminates Human Errors
- Monitoring and Alerting of Solar and Building Equipment – Preventative Maintenance

Utilities and Energy Suppliers

- Improved Grid Hosting Capacity for Solar
- "Right-Sizing" of Battery Storage
- Multiple Value Streams in Generation, Distribution
- Programs for C&I Customers

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Partnership Strategy

More than 80 solar companies sending prospective customers today.

Initial utility pilots underway.

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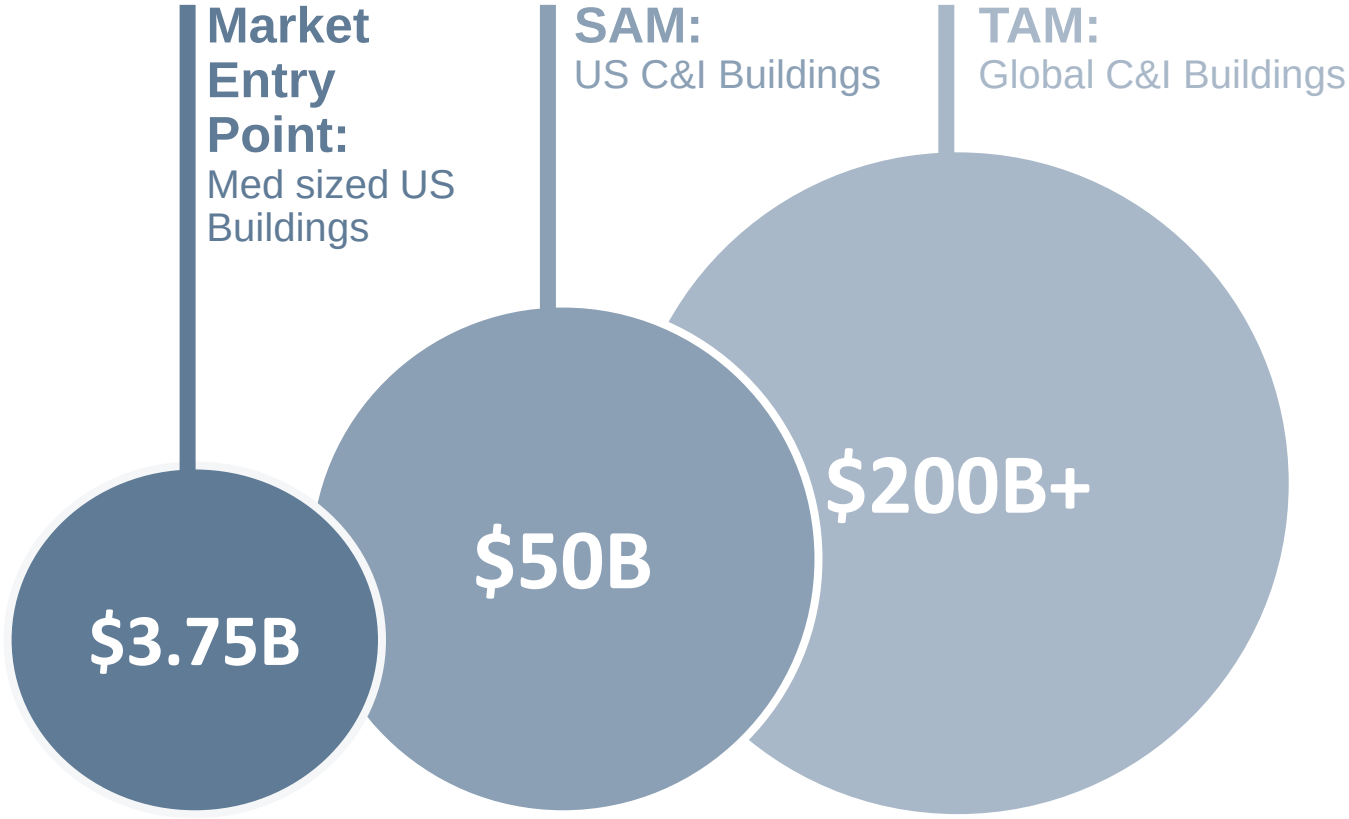
Market Size Analysis

US Demand Charges:

$50B/year

"Load flexibility is the giant issue nobody is talking about… Extensible Energy's load-flexibility software is a win-win for the solar contractor and the building owner."

- Jigar Shah, *Co-Founder at Generate Capital Inc*



Demand charge savings available by segment, US, 2020

Sources: GTM, CBECS, SEIA, Navigant

Global market expected to grow at rate similar to renewables.

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You Can Help Make This Happen

Everyone: We're Hiring!

- Please get the word out; see:
- https://www.extensibleenergy.com/careers

Utilities: We're Piloting!

- Demonstrate Load Flexibility as a Resource
- Share Benefits Between Grid and Customer
- Load Flexibility ≠ Demand Response
  - Ask me about that! john@extensibleenergy.com

Solar Installers: We're Shipping!

- Close More Commercial Solar Deals
- Join Our Partner Program:
- https://www.extensibleenergy.com/extensibleplus

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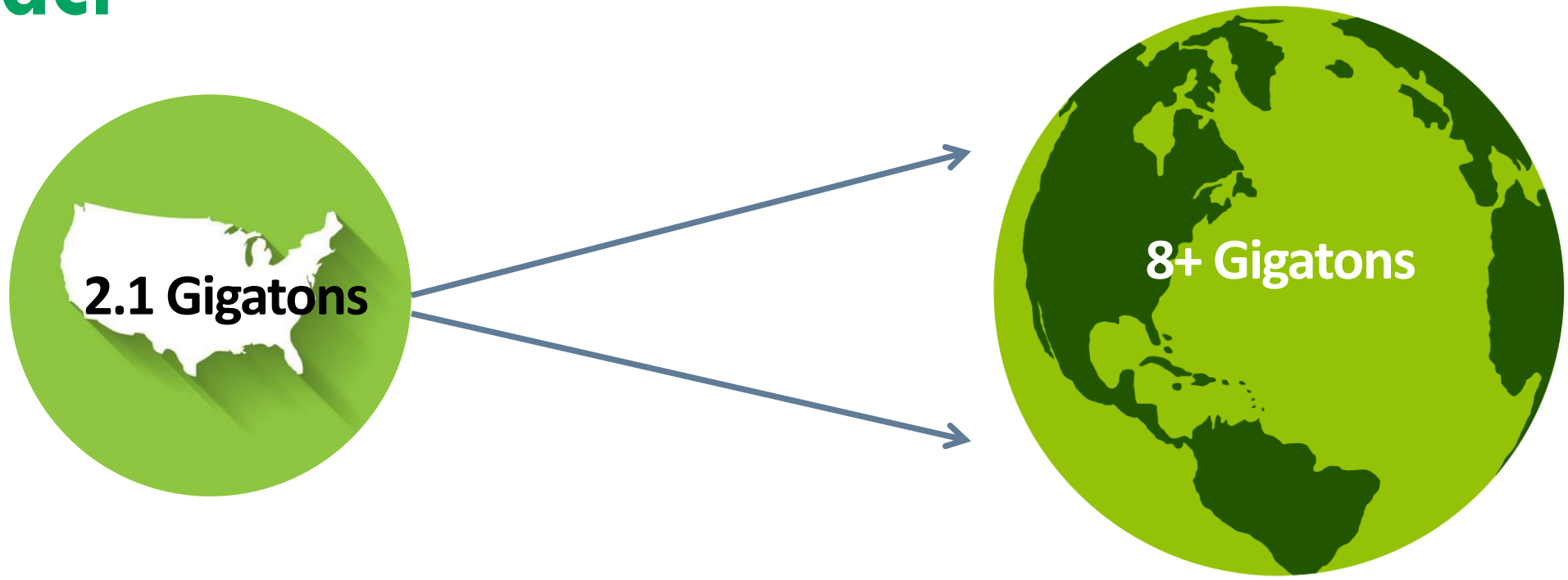
Impact



Extensible Energy reduces CO_2 emissions in two major ways:

1) We shift electricity usage from high to low emissions intensity times of day

2) We unlock previously uneconomic parts of the solar market

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THANK YOU DOE!

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