



Distributed Resources

Felix Aguayo
EDF Renewables, Distributed Solutions

September 23, 2019

A Global Leader in Low-Carbon Energy

EDF Group

70+
years experience

\$17.3 B
EBITDA

152,033
employees

31.5 M
clients worldwide

EDF Renewables

\$964 M
EBITDA

22
operating countries

3,800
employees

22.5 TWh
green electricity

EDF Renewables North America

16 GW
developed

10 GW
O&M contract

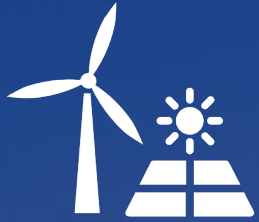
24 GW
pipeline

30+
years experience

1,112
employees

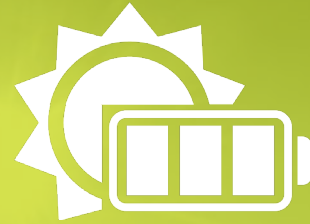
as of 12/31/18

EDF Renewables North America



Grid-Scale Power

Grid-Scale Power provides origination, development, transaction and construction services for large-scale wind (offshore and onshore), solar photovoltaic, and storage projects.



Distributed Solutions

Distributed Solutions originates, develops, builds, and operates customer-focused renewable energy projects that incorporate solar, storage, electric vehicle charging, and energy management.



Asset Optimization

Asset Optimization offers a full range of services for all phases of renewable energy projects – operations, management, procurement, routine and emergency maintenance, retrofits and upgrades.

Three Themes to Watch + LCOE Implications

- Storage
- Electrification
- Integration of PV+BESS+EV

- CEPs vs CCGT

Storage Market Still Small and Concentrated...

Wood Mackenzie Power & Renewables / ESA U.S. Energy Storage Monitor Q3 2019

woodmac.com 

Top energy storage states, Q2 2019

California leads BTM; Texas is the leading FTM state

Top three markets by segment in Q2 2019 (energy capacity)

Rank	Residential	Deployments (MWh)	Non-residential	Deployments (MWh)	Front-of-the-meter	Deployments (MWh)
1 	California	39.2	California	47.9	Texas	10.0
2 	Hawaii	10.7	Massachusetts	4.8	Maine	10.0
3 	PJM (excl. NJ)	3.7	New York	2.6	New York	3.8

Source: Wood Mackenzie Power & Renewables

...But, Growth Projections are Substantial

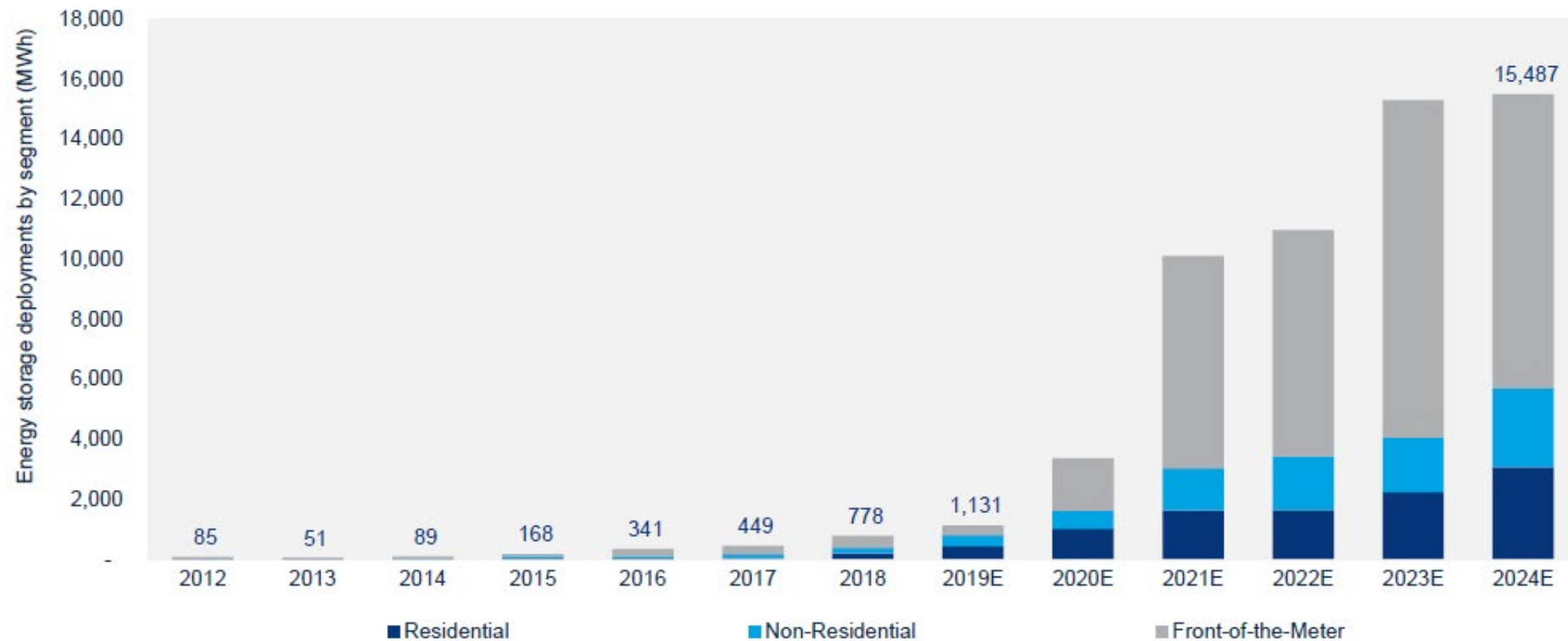
Wood Mackenzie Power & Renewables / ESA U.S. Energy Storage Monitor Q3
2019

woodmac.com 

U.S. market will reach 15.5 GWh in annual deployments by 2024

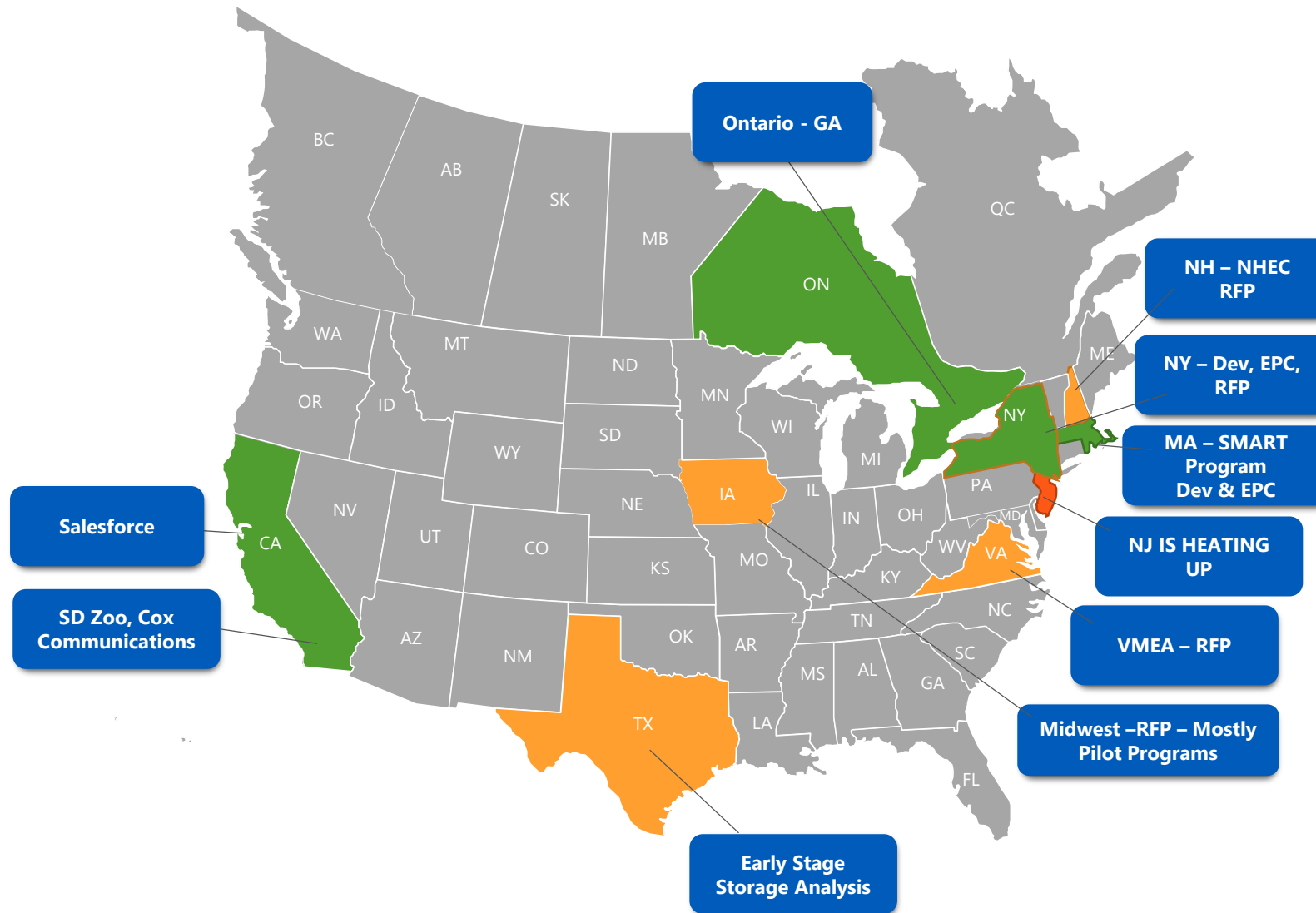
4-hour systems becoming the norm for front-of-the-meter systems; average BTM durations inch toward 3 hours

U.S. energy storage annual deployment forecast, 2012-2024E (MWh)



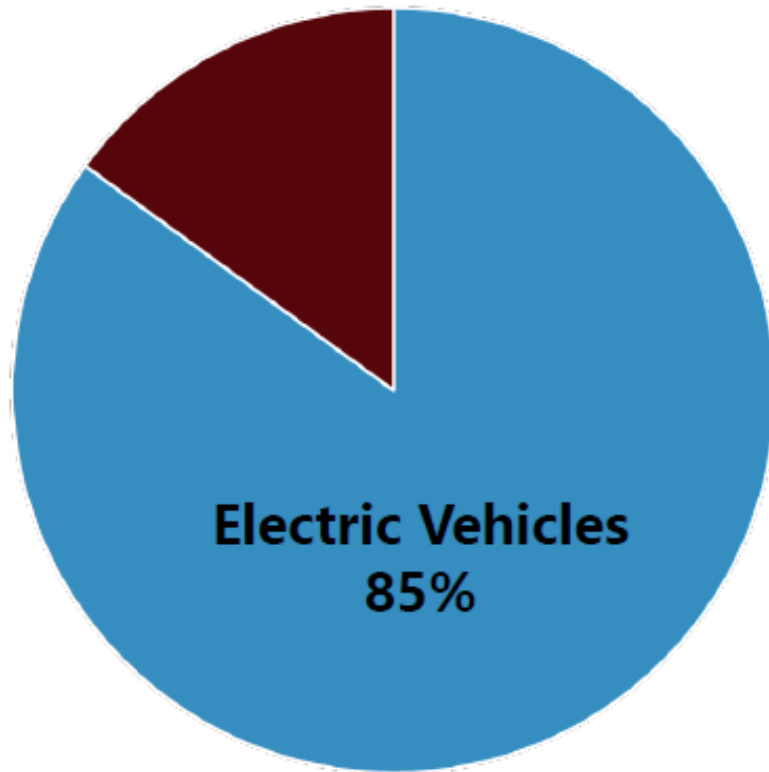
EDF Storage Activity U.S. and Canada

235 MWH in development or construction



Transportation Electrification

End-Uses for Lithium Ion Batteries



Data Source: Benchmark Minerals

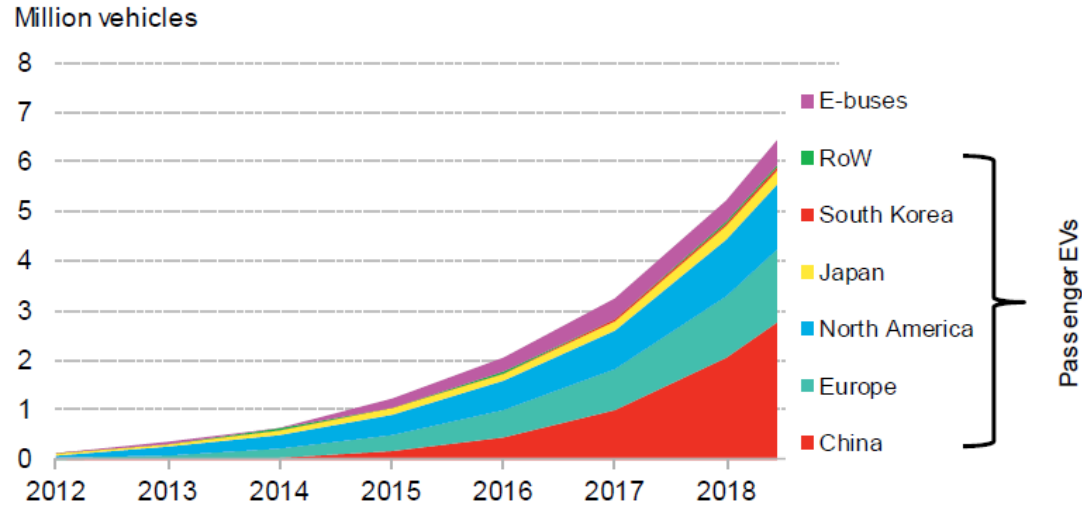
> **1,234.8 GWh** of global lithium ion battery manufacturing capacity planned for 2023



= enough for approx. 20% of 2018 global sales

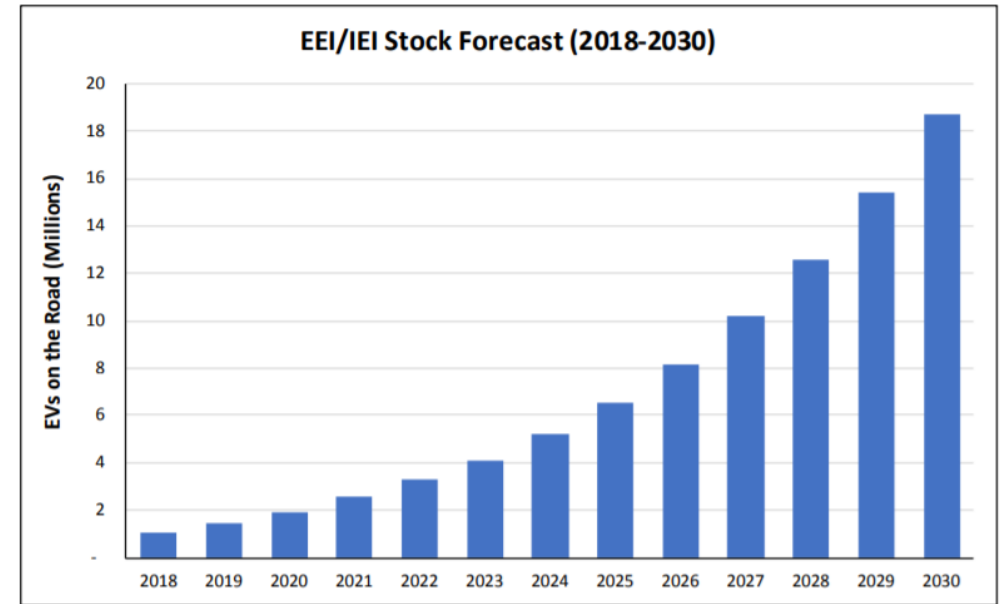
EVs Driving Battery Costs Lower

Cumulative global EV sales by region

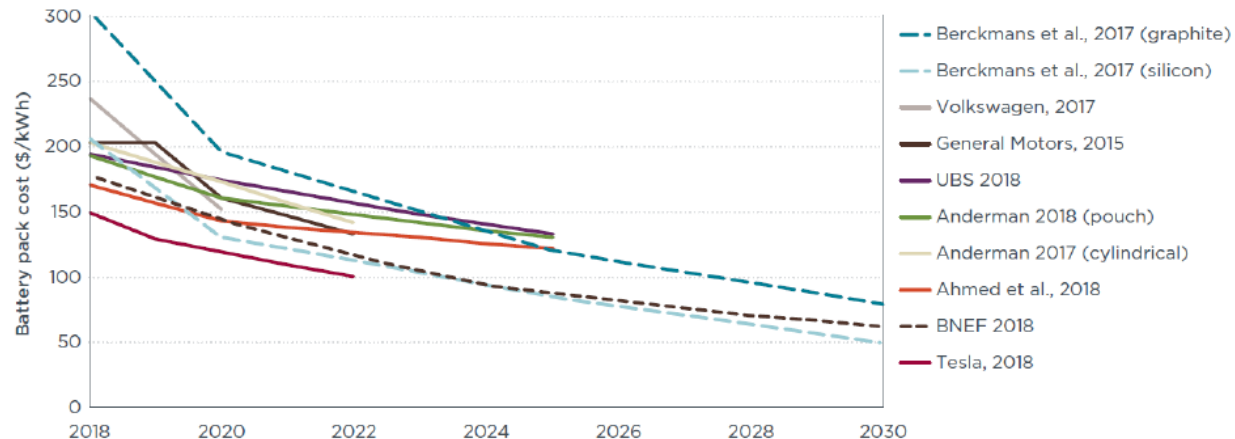


Source: BloombergNEF, CV World, Bloomberg Terminal. Note: Total includes BEVs and PHEVs.

Figure 1. EEI/IEI Forecast of EV Stock in 2030



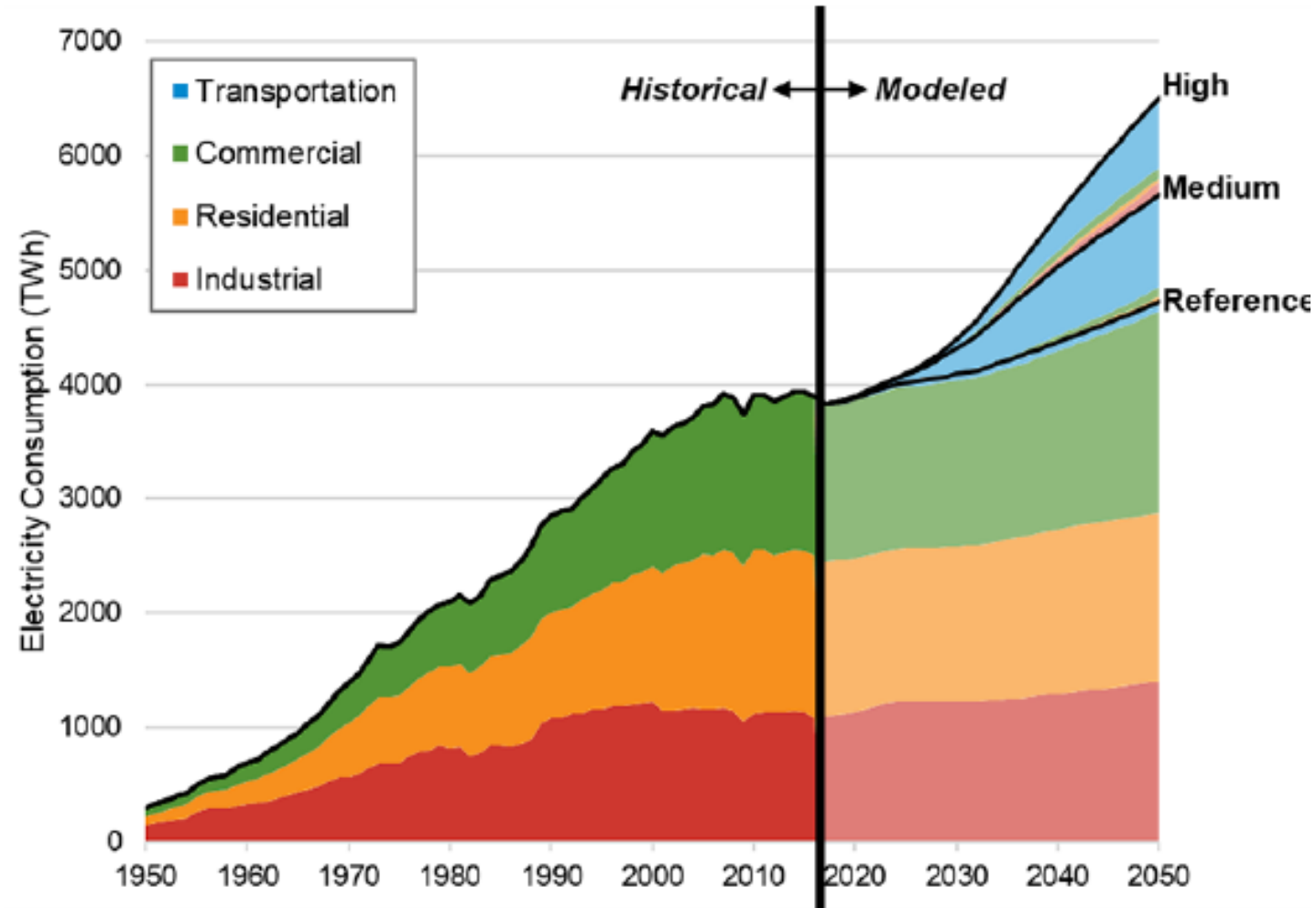
Electric Vehicle Battery Pack Costs & Estimates, by technical report or study



Source: International Council on Clean Transportation, *Update on EV costs in the United States*, Working Paper, June 2019. Distributed Solutions * Confidential*

EV Impact on Electric Grid

NREL estimates a 20-38% increase in electricity consumption, primarily driven by electric transportation



Source: NREL. "Electrification Futures Study". Aug 2018. <https://www.nrel.gov/analysis/electrification-futures.html>

PowerFlex Systems - We Know EV Charging!

1,500+
EV CHARGING
STATIONS DEPLOYED

6,000,000+
ELECTRIC MILES
DELIVERED SAFELY

#1
UL-LISTED LOAD
MANAGEMENT SYSTEM



PROJECT
DEVELOPMENT

FINANCING

TURN KEY EPC

PROJECT
COMMISSIONING

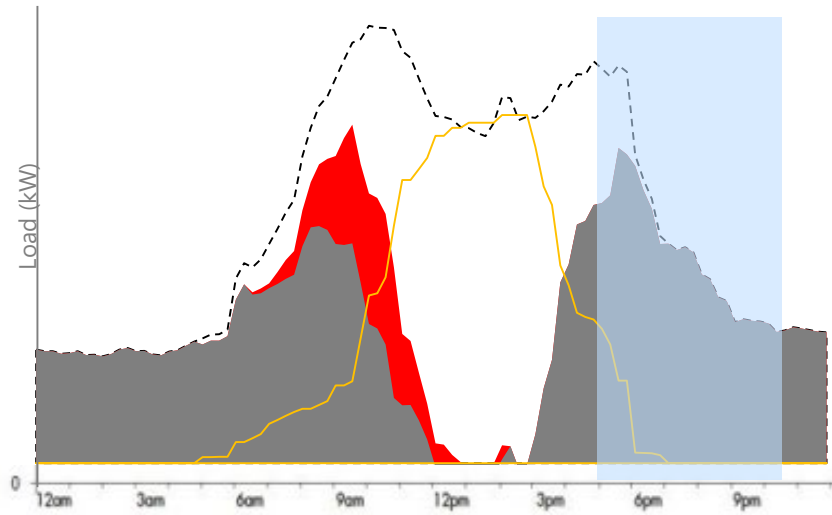
ASSET
MANAGEMENT/OM



Advanced Controls: solar, storage and EVs

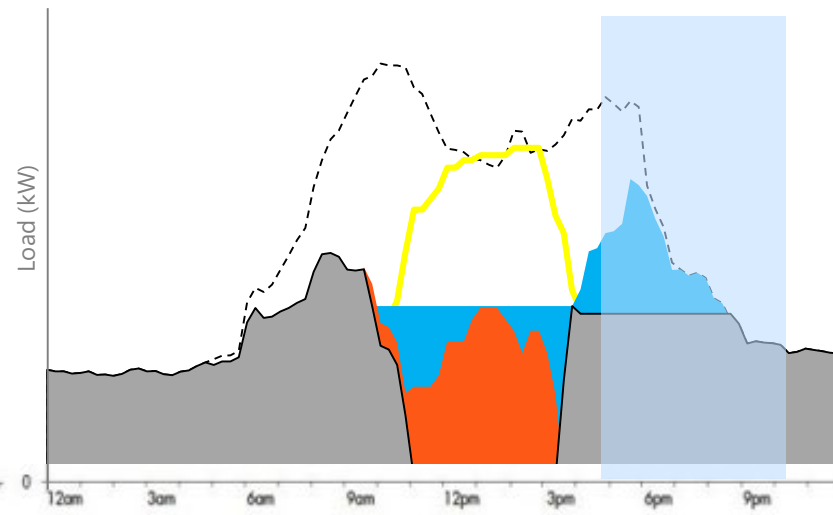
Dumb Charging + Solar

☐ Dumb EV Load ■ Dumb EV + PV ■ Facility Load □ PV



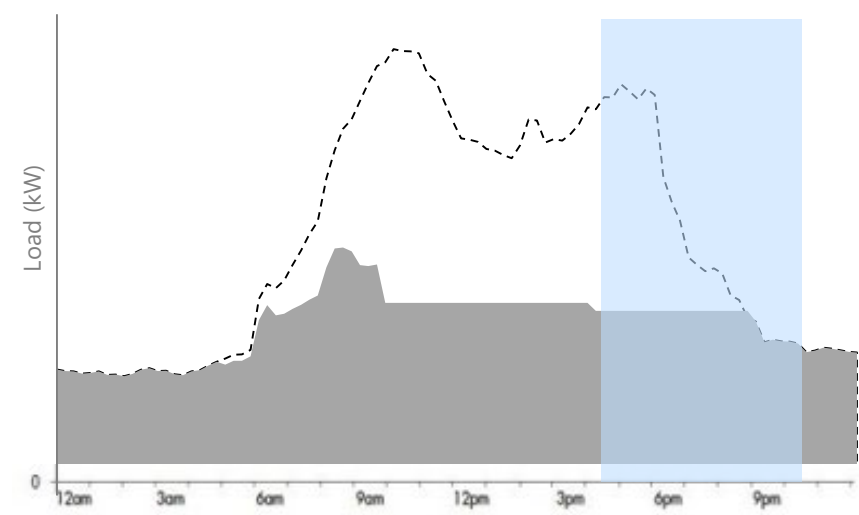
Smart Charge + Solar + Storage Solution

☐ Dumb Charging Facility Load ■ PV
■ Storage ■ Smart EV Charging
■ New Facility Load ■ Storage Charging



Dumb Load Profile Vs Integrated Solution

☐ Dumb Charging Facility Load ■ New Facility Load

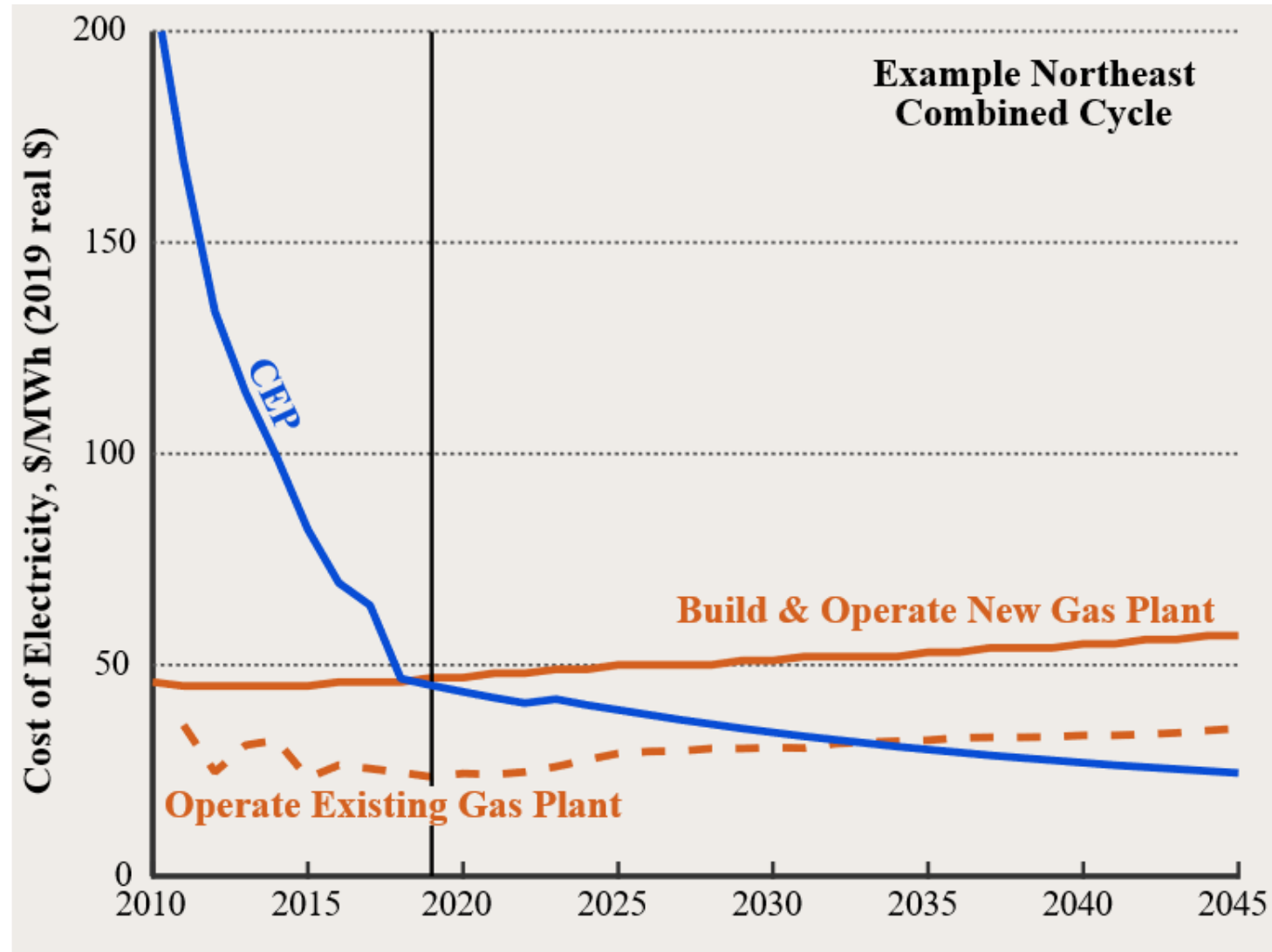


Uncontrolled EV charging: Solar helps reduce Demand Charges, steep ramp impact on utility

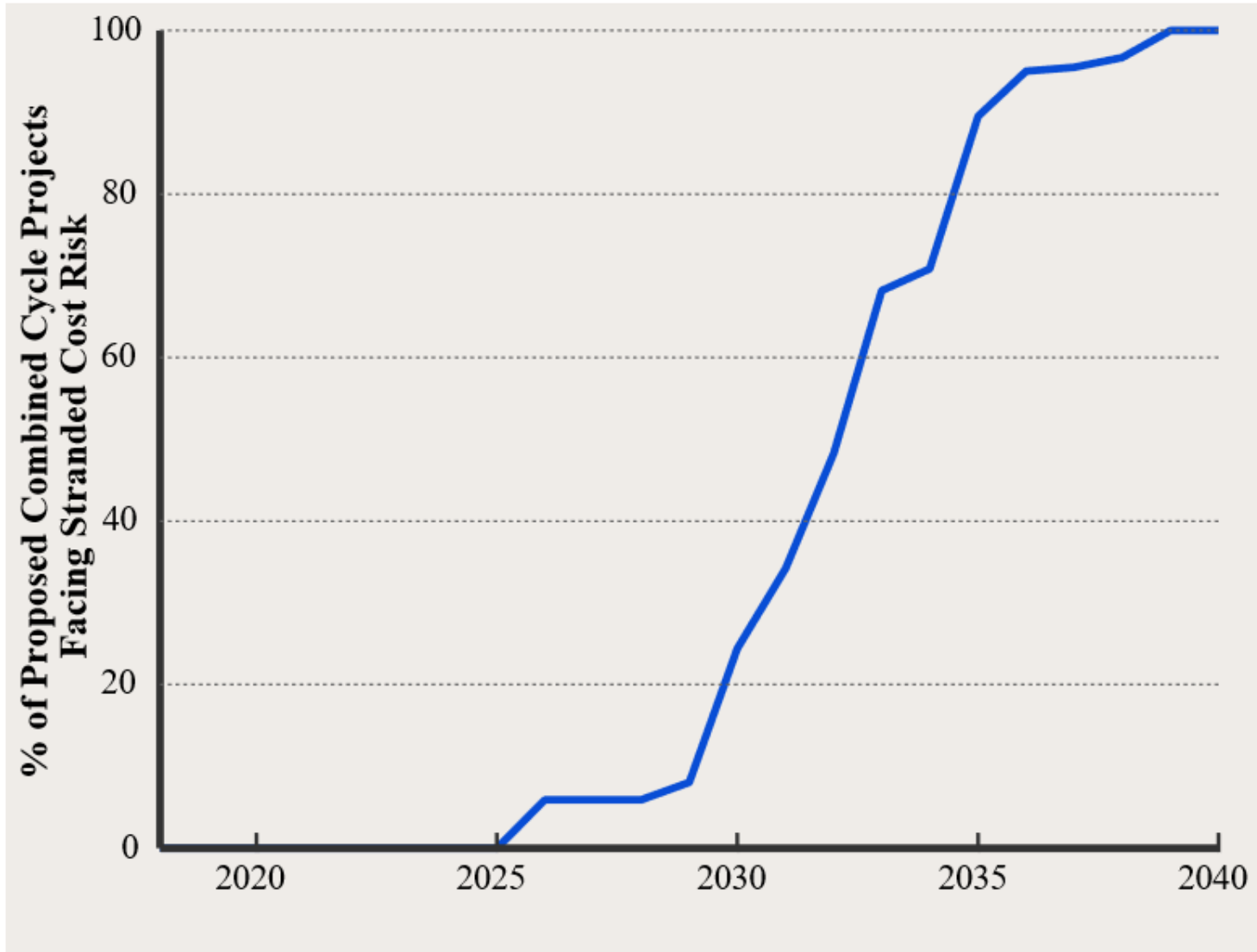
Smart EV charging: Solar with storage managed for TOU costs
Lower Customer Costs

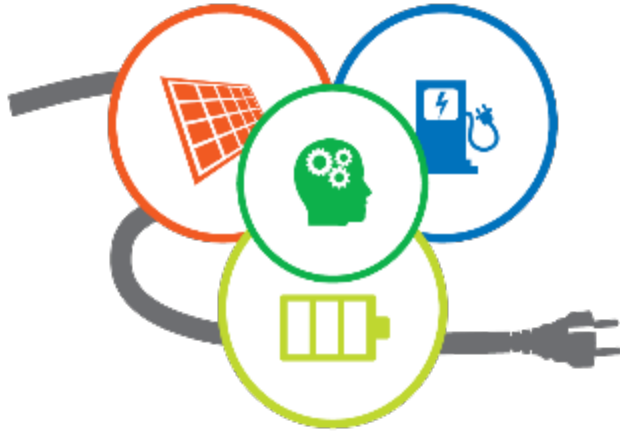
Customer load shape improved for enhanced system efficiency
Lower Utility costs/risks

RMI White Paper: CEPs competitive with New Build



Projected Competitive Implications





Thank You.

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