

Solar and Electric Vehicles:

What are the Opportunities



2018
SOLAR POWER
Mountain West
POWERED BY GOSEIA COLORADO SOLAR ENERGY INDUSTRIES ASSOCIATION

2018
SOLAR POWER
Mountain West
POWERED BY GOSEIA COLORADO SOLAR ENERGY INDUSTRIES ASSOCIATION

2018
SOLAR POWER
Mountain West
POWERED BY GOSEIA COLORADO SOLAR ENERGY INDUSTRIES ASSOCIATION

2018
SOLAR POWER
Mountain West
POWERED BY GOSEIA COLORADO SOLAR ENERGY INDUSTRIES ASSOCIATION

2018
SOLAR POWER
Mountain West
POWERED BY GOSEIA COLORADO SOLAR ENERGY INDUSTRIES ASSOCIATION

2018
SOLAR POWER
Mountain West
POWERED BY GOSEIA COLORADO SOLAR ENERGY INDUSTRIES ASSOCIATION



Megatrends in EV

Models:
 US today, 40 / by 2020, 80
 Price parity expected 2022, no subsidy
 GM x20, Ford x13 by 2023
 Volvo all, VW 80, Toyo all, MB all ...
 Global in five years, 127 PHEV/BEV

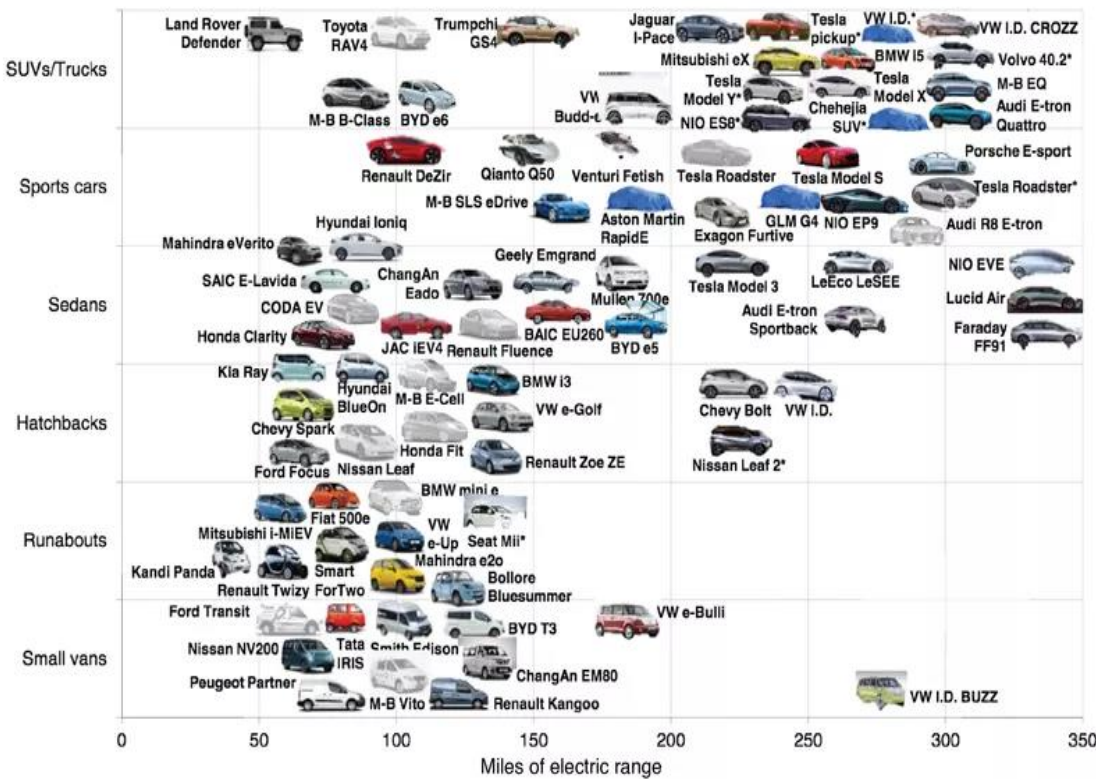
Oil:
 Exxon doubled forecast, OPEC sextupled
 Diesel:
 Banned in India, China, Norway, UK, France

Charging:
 Electrify America \$2B
 VW Mitigation Trust \$2.4B (\$360M EVSE)

Investment:
 Utilities proposing \$100M investments

Electric-Car Boom

Models by style and range available through 2020



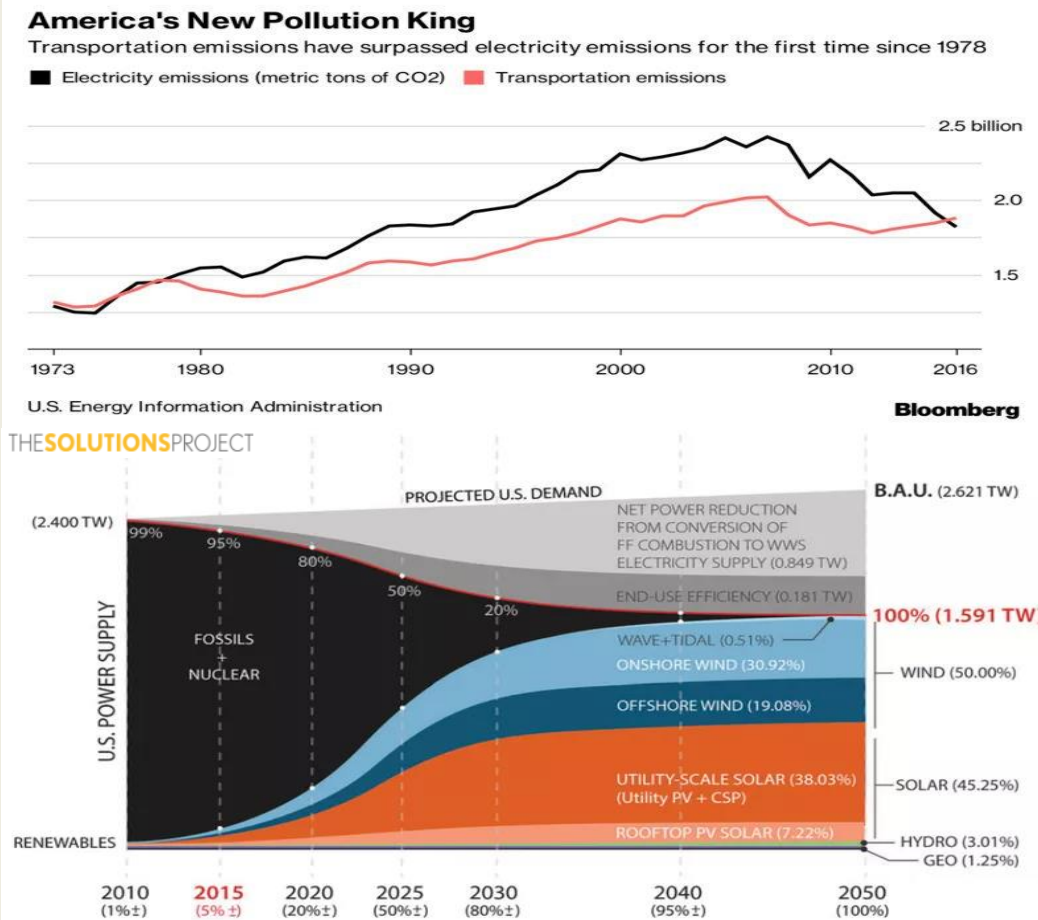
Why Is This Important

CO2:
 ICE is now largest source of emissions as wind and solar green the grid and gas shuts coal

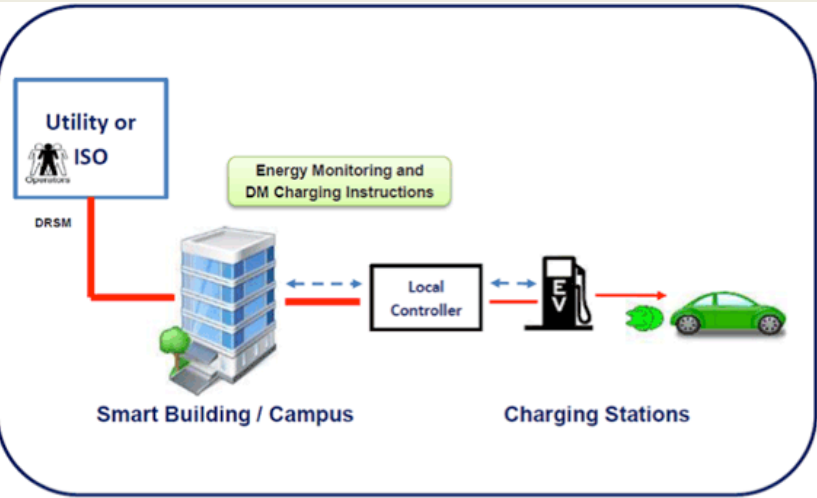
Smut:
 White House covered in coal ash, cities and states step in to clean up

RE:
 Most economic source for new power
 Requires grid flexibility

EV+PV+Wind:
 Perfect match



Takeaways



Enterprise can extend DR management to its offices using local controllers.
 Enterprise manages employee authorization for charging. Notification services to employees if they login to enterprise networks.



Why Shared Mobility?

1 TNC Vehicle=30,000+ miles/year



2.5 personal vehicles=30,000 miles/year



Project Benefits:

150 Maven Bolts Result in annual benefits of:

- 4.5 million eVMT
- 150,000 gallons of gasoline saved
- 1,000 Tons of CO₂ avoided



Advancing the Electric Vehicle Market in Colorado

Will Toor

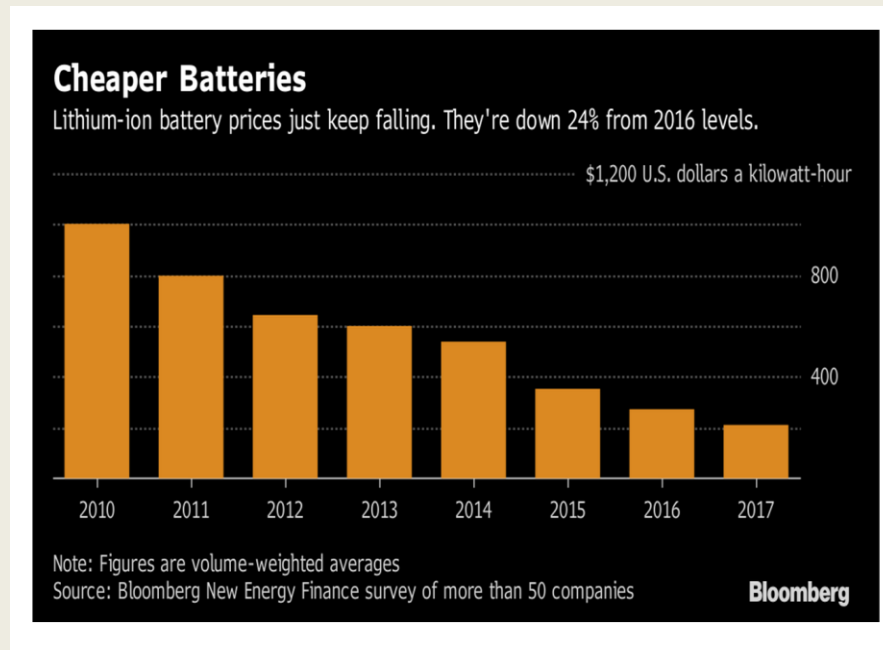
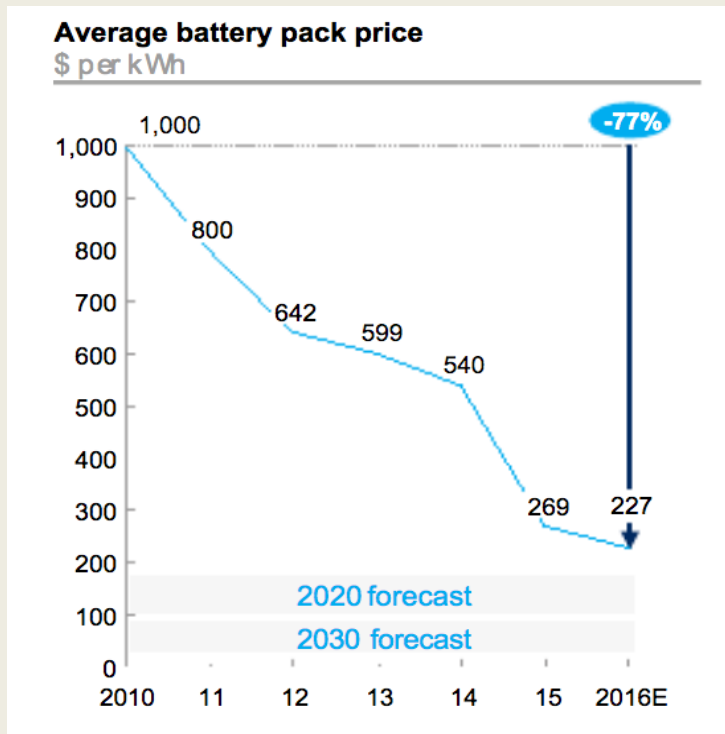
Southwest Energy Efficiency Project



Automaker Investments in Electric Vehicle Development

- **Ford** will invest \$4.5 billion in electrified vehicles by 2020: including a 300 mile range fully electric SUV and a F-150 hybrid
- **GM** recently laid out a bold vision for a “zero crashes, zero emissions, and zero congestion” future, announced plans for 20 new electric vehicles by 2023 – including two by 2019, and rolled out the acclaimed Chevy Bolt across the U.S.
- **Toyota** committed to having at least 10 new models of all-electric vehicles by the early 2020’s
- **Daimler AG** announced a billion dollar investment to build electric vehicles in the U.S. with production starting in the early 2020’s
- **BMW** reached 100,000 in global electric vehicle sales while promising a dozen new models of electric vehicles by 2025
- **Fiat-Chrysler** to electrify portfolio ([Wards Auto, July 2017](#))
- **Volvo** announced that “all the models it introduces starting in 2019 will be either hybrids or powered solely by batteries” ([New York Times, July 2017](#))

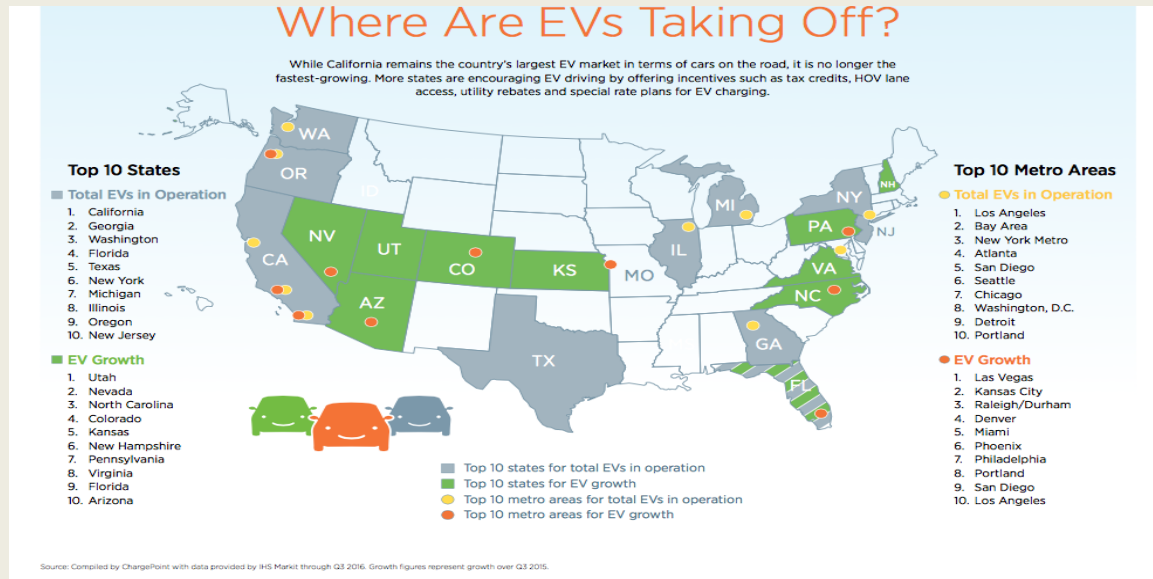
Figure 1: Lithium-Ion Batteries Costs are Falling Faster than Anticipated (From McKinsey & Co. – January 2017)



From McKinsey & Co. January 2017

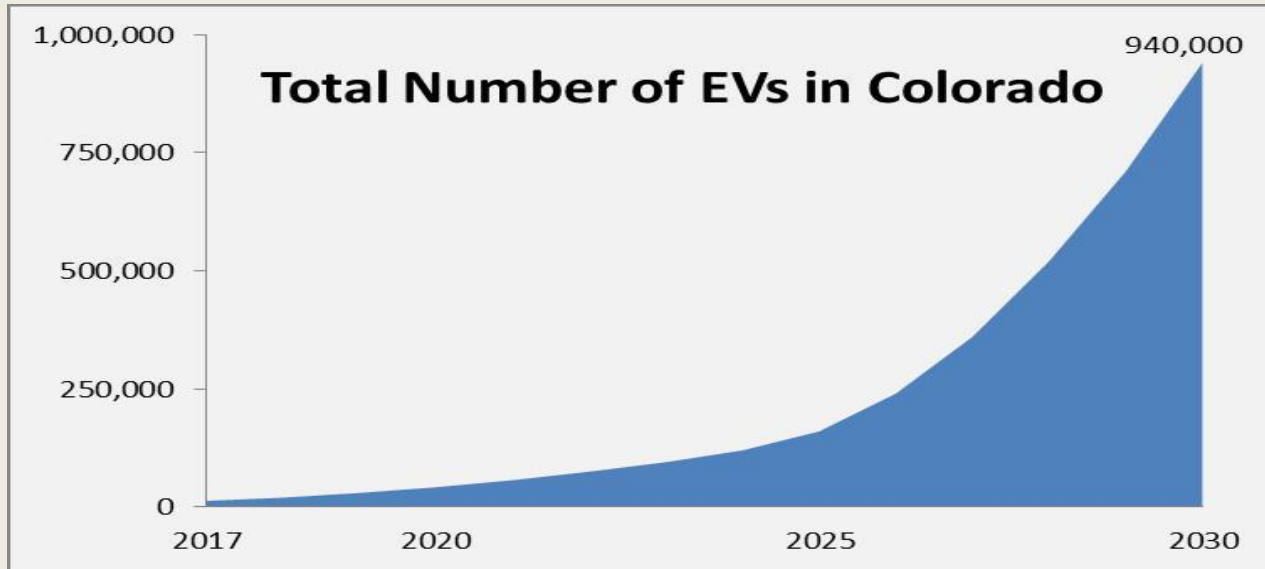
EVs growing rapidly in Colorado

- 41% annual growth rate 2012-2017
- Sales in 2017 up 53% over 2016



New state EV plan

- Approximately 1,000,000 EVs by 2030
- 200,000+ EVs by 2025



Key State policy issues

- Removing prohibition on utility investment in EV charging - encourage utility support for electrification
- Demand charge reform
- Use of VW funds, CMAQ funds
- Continue \$5,000 state tax credits for EVs
- Push back against Trump administration proposal to weaken clean car standards

Key policies and programs: local

- Investing in charging stations
- Electrifying TNCs
 - Oregon Uber- goal of 10% electric
- Discounted group purchase programs
 - Very powerful tool for selling EVs
- EV ready building/zoning codes
- Local fleet purchases
- Ambitious local EV adoption goals

Contact Info

Will Toor

Transportation Program Director,
Southwest Energy Efficiency Project

www.swenergy.org

wtoor@swenergy.org

303-447-0078 x6

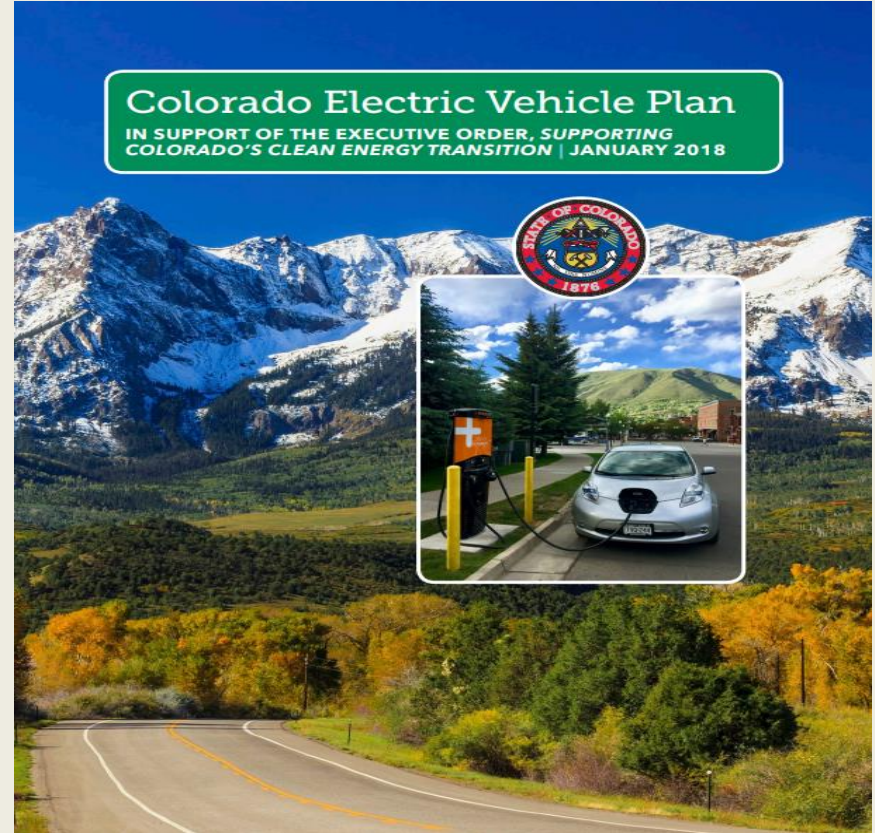


Solar and Electric Vehicles: What are the Opportunities?

**Zach Owens, Program Manager
Transportation Fuels and Technology
Colorado Energy Office
March 13, 2018**

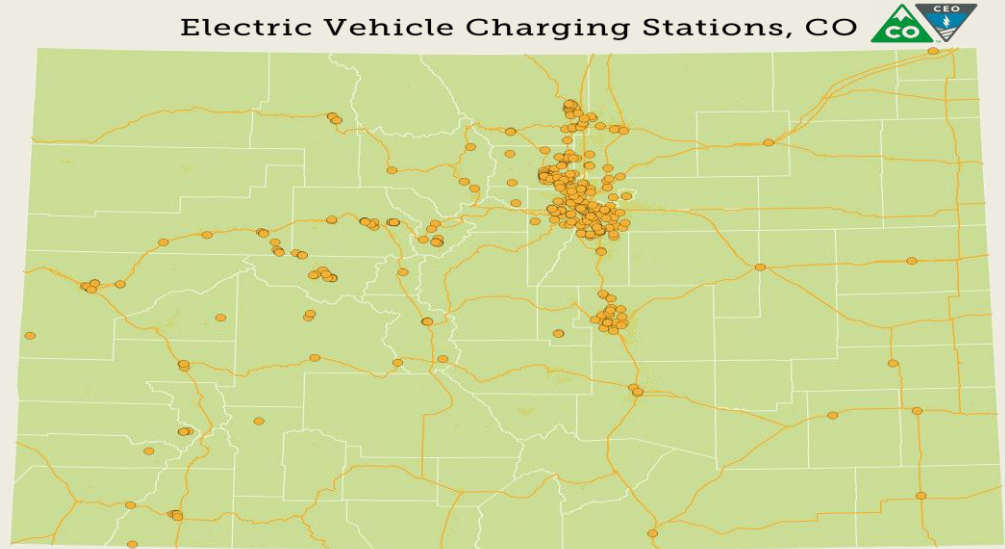
Colorado Electric Vehicle Plan

- Released January 24
- Electric Vehicle plan to build out key charging corridors that will:
 - facilitate economic development
 - boost tourism
 - reduce harmful air pollution
- Action #1: Build out Colorado's EV fast-charging infrastructure through public-private partnerships and in coordination with other programs and funding sources.



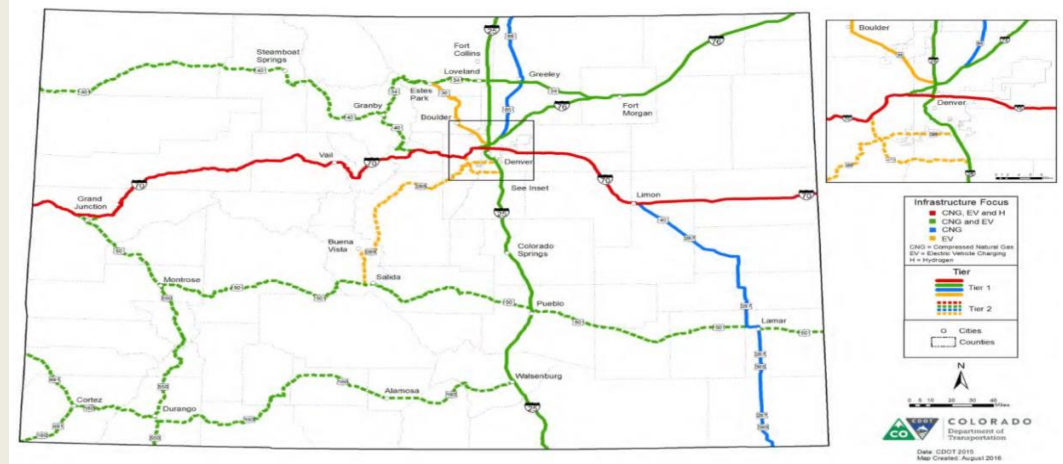
Charge Ahead Colorado - Community Charging

- Charge Ahead Colorado is a partnership between the Regional Air Quality Council (RAQC) and the Colorado Energy Office (CEO).
- Provides grants for Level II and DC fast-charging stations across the state and assists with purchase of EVs in the 7-county metro area.
- Visit <http://cleanairfleets.org/programs/charge-ahead-colorado> for more info



DCFC Corridors - Role of the State

- Stakeholder alignment
- Utility engagement
- Policy development
- Standardization
- Collaboration with local government
- Incentivize public and private investment



Source: CDOT

DCFC Corridor Considerations

- 30 – 50 miles between stations
- 1 mile or closer to highway
- 24 hour access
- Restrooms, water fountains
- Close/walking distance to restaurants, businesses, tourist destinations
- ADA Compliance
- Safety & Lighting
- 50 kW, Futureproofing to 150, 350 kW
- **Innovation with solar and storage**
- Consistent User Experience & Customer Service
- Appropriate Signage

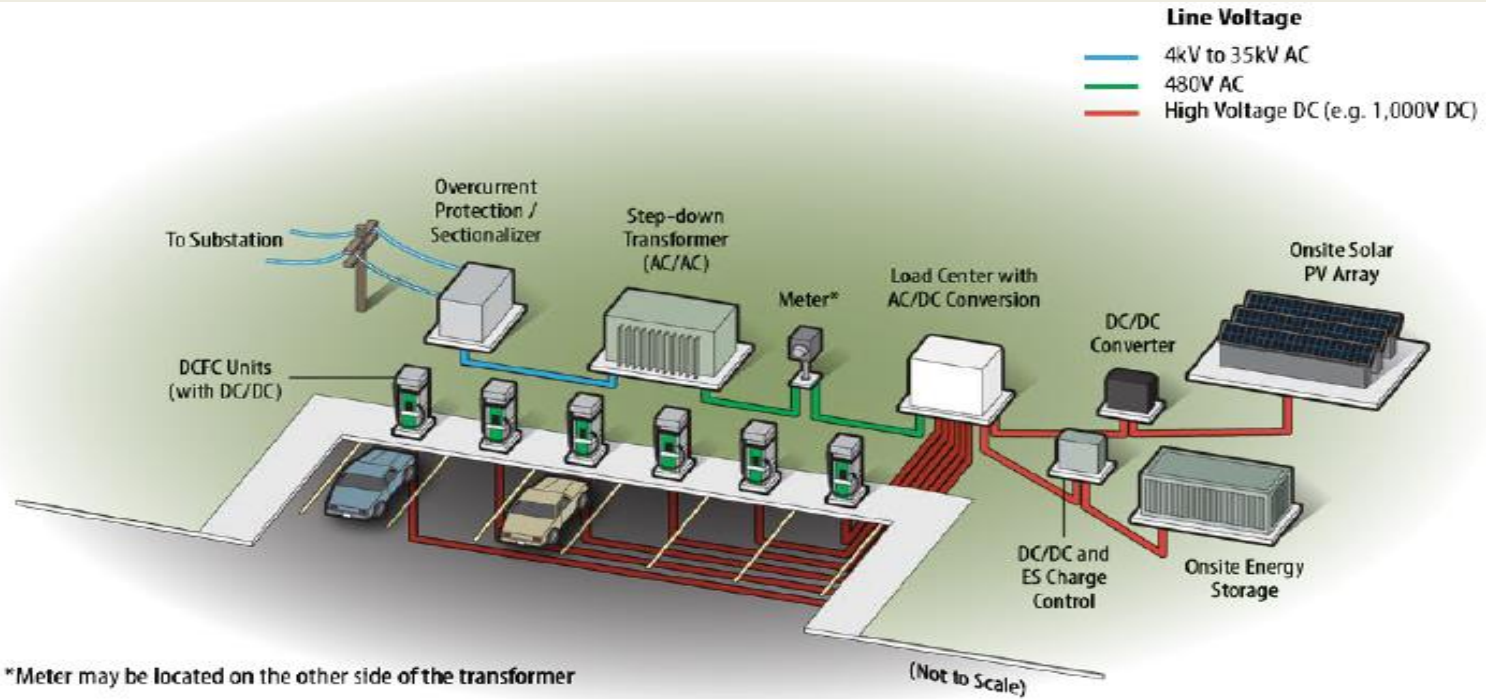
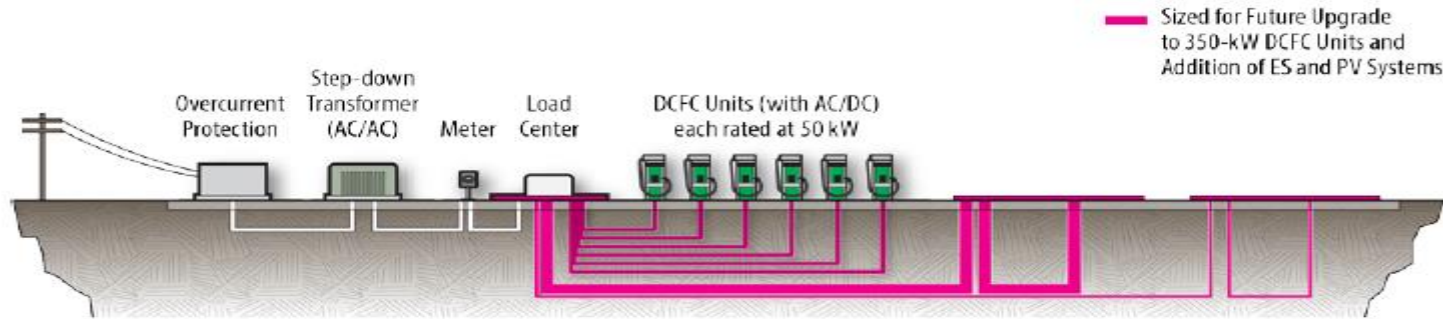
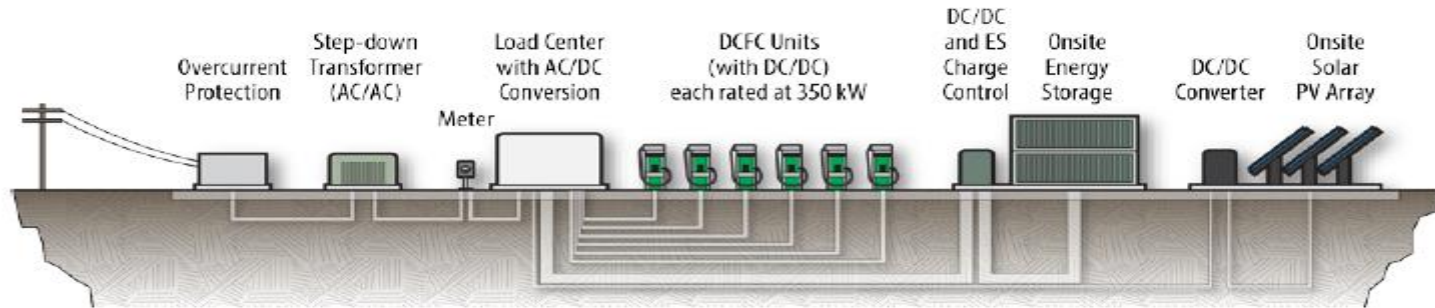


Figure ES-2. Diagram of a multi-port DCFC complex with onsite ES and solar PV systems.

INL - Continued



A) DCFC complex with 50-kW chargers and no ES and PV systems at initial installation





Zach Owens
Program Manager
Transportation Fuels and Technology



Zachary.owens@state.co.us
The Colorado Energy Office



@coenergyoffice



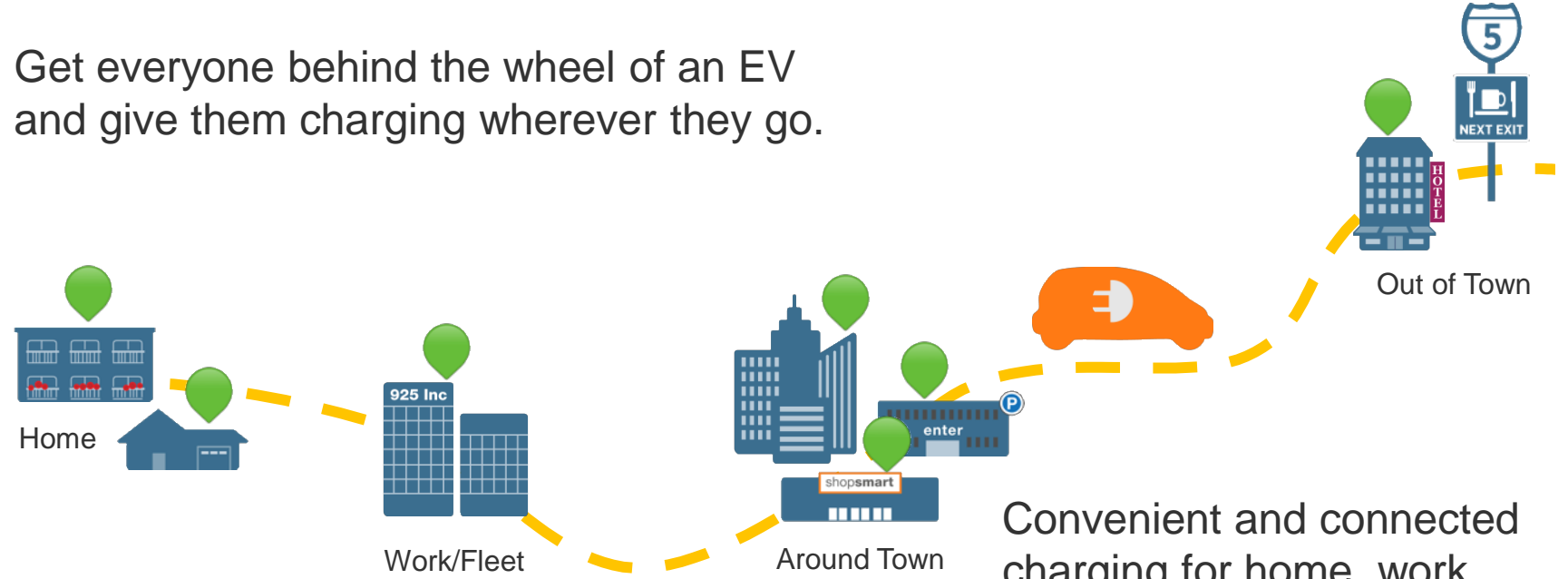
Solar and Electric Vehicles: What are the Opportunities?

Ian E Stern-Markovitz, Account Executive – Colorado & Utah

Monday, March 12, 2018

ChargePoint Mission: EV Charging, Everywhere

Get everyone behind the wheel of an EV and give them charging wherever they go.



Convenient and connected charging for home, work, around town and out of town.

Largest EV Charging Network in North America

42,500+

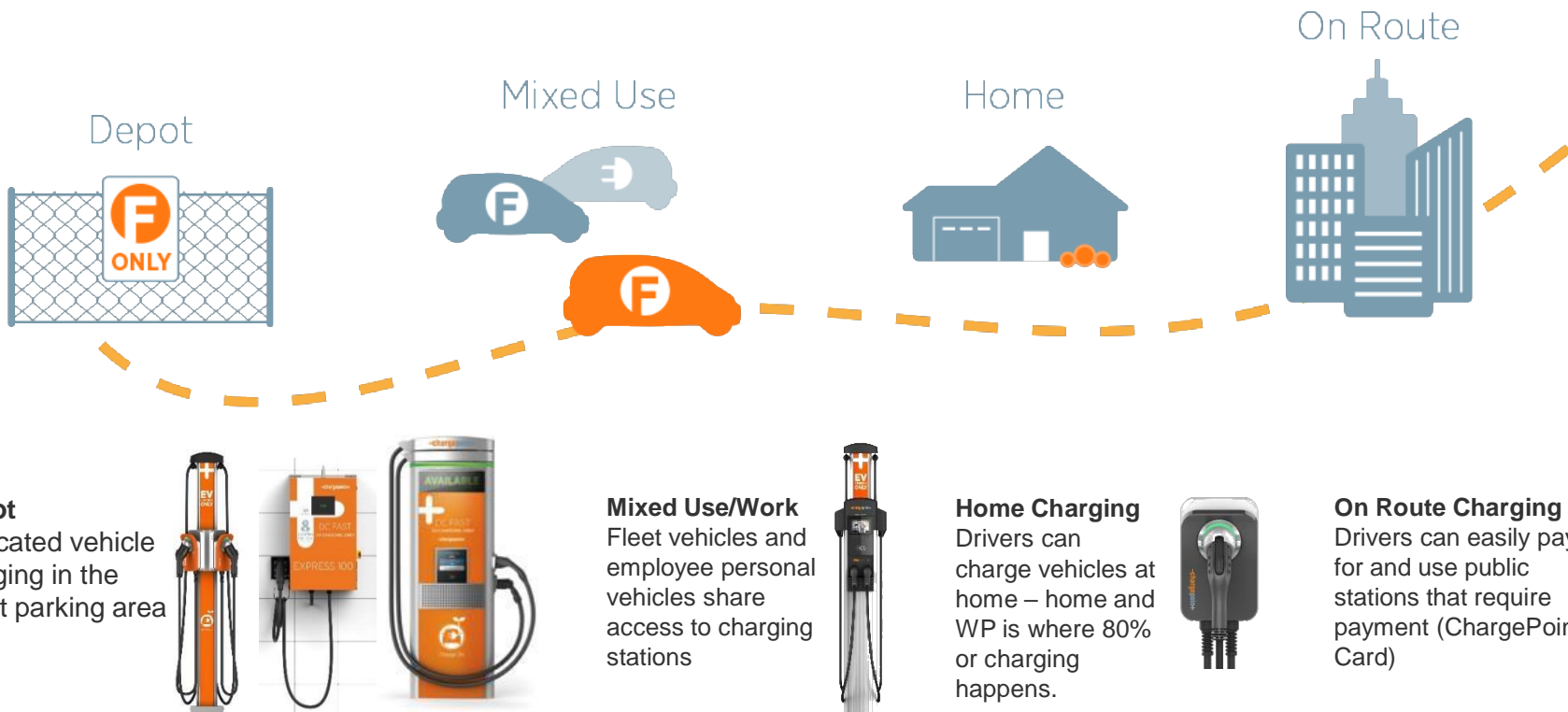
Charging Spots
(650+ DC)

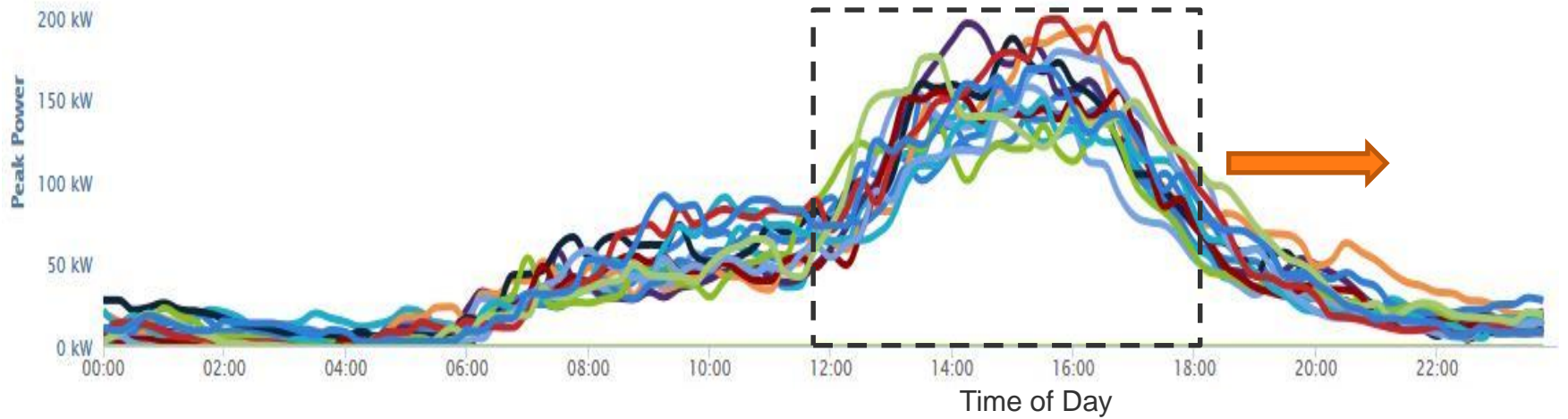
29M+

Charges Delivered

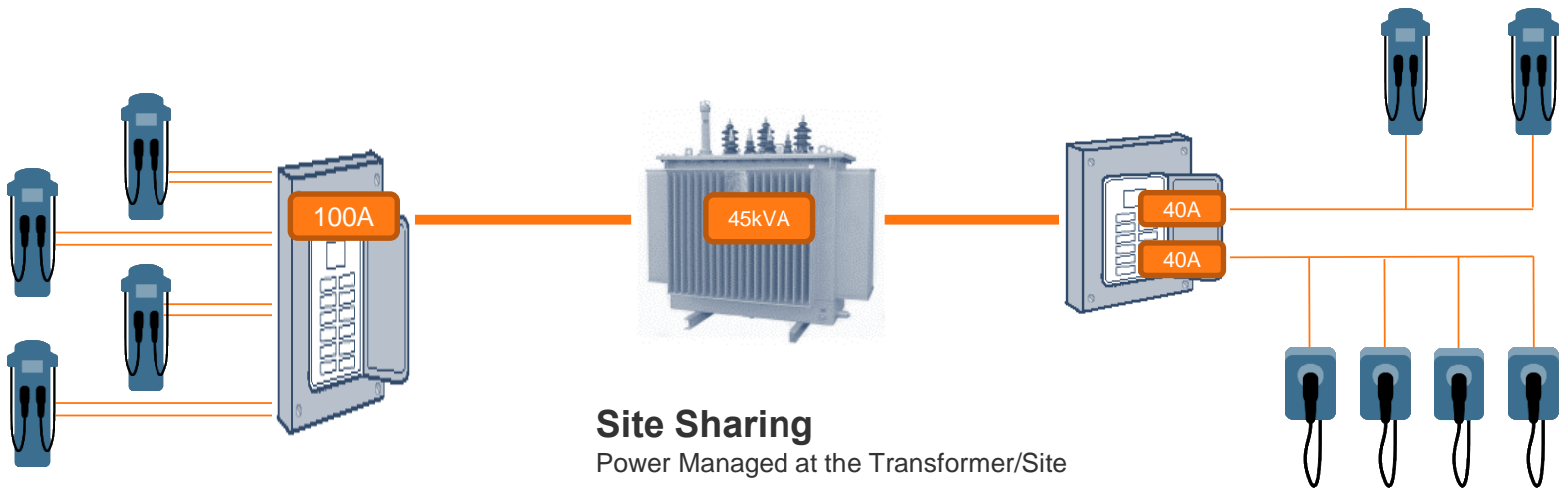


Addressing Every Vehicle Charging Need





Multi Level Power Management



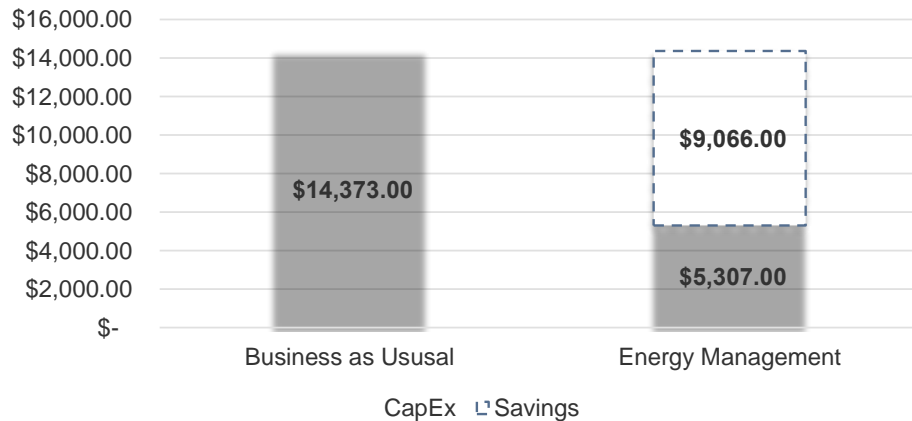
Panel Sharing
Power Managed at the Panel

Site Sharing
Power Managed at the Transformer/Site

Circuit Sharing
Power Managed at the Breaker

Example: Capital Savings with Energy Management

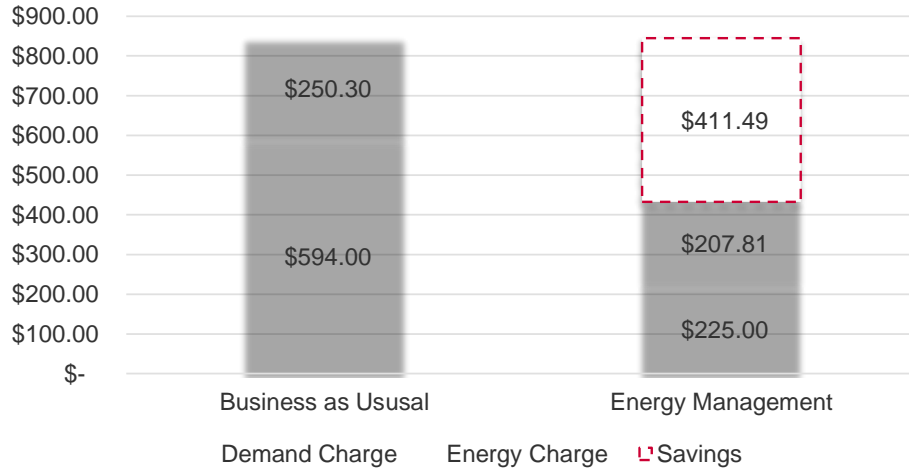
Capital Savings with Energy Management Per Site



- + **Over 60% CapEx Savings**
- + Assumes 45 EVs at a single site
- + Significant cost reduction in:
 - Electrical Panels
 - Conduit and Wiring
 - Transformer
- + Analysis excludes cost of installing stations (this is common across both scenarios)
- + Key features:
 - Scheduled Charging
 - Panel Sharing
 - Can Solar increase these savings?

Example: Fuel Savings with Energy Management

Annual Fuel Savings Per Vehicle



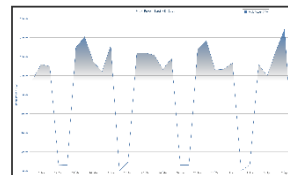
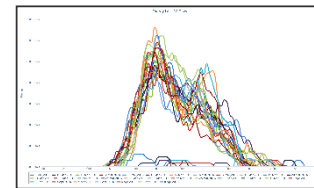
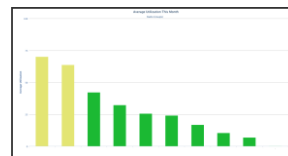
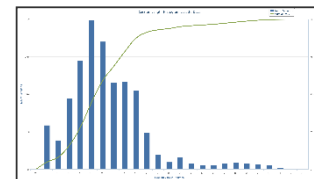
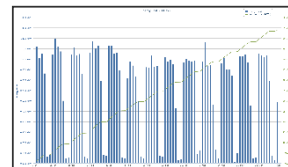
- + 57% Fuel Savings
- + Utilize utility off-peak energy rates
- + Significant demand charge reduction
- + Power allocation is flexible and will never exceed a static or dynamic power ceiling

ChargePoint Vehicle and Station Data and Reporting

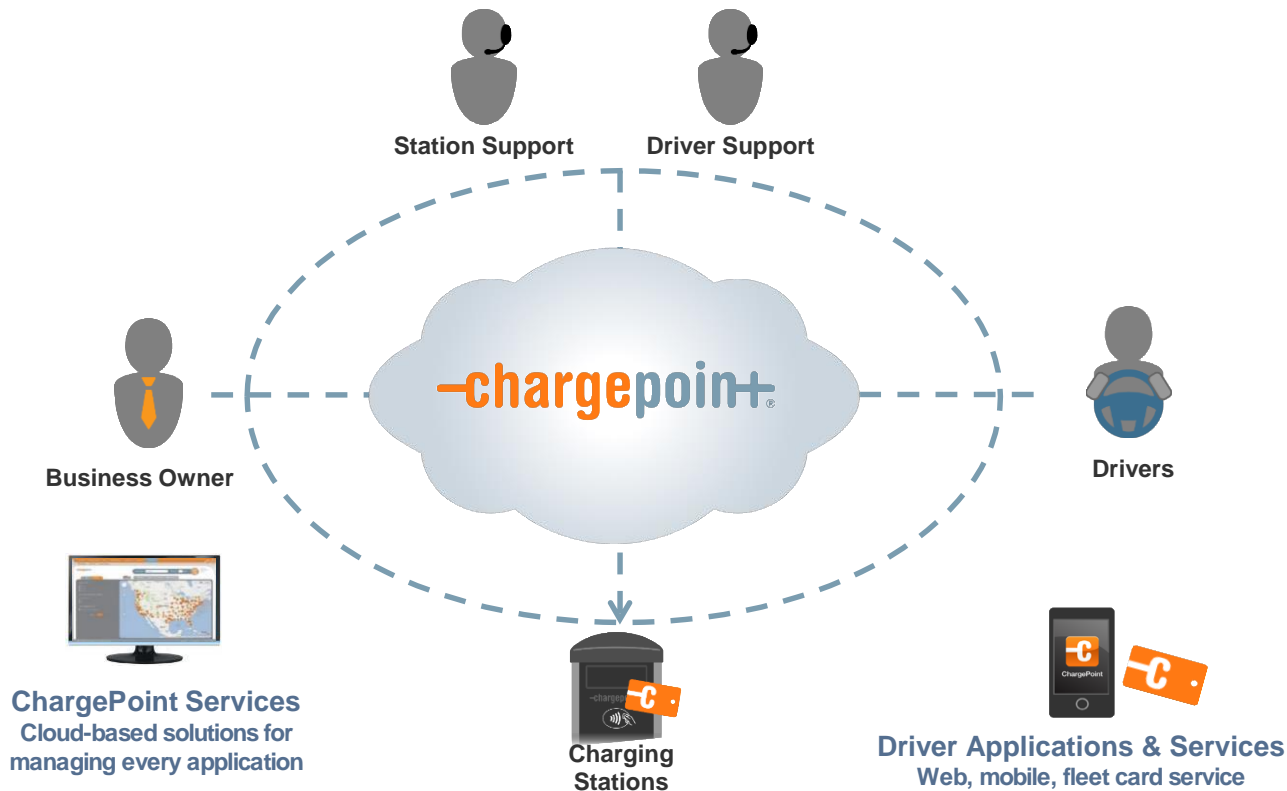
Measuring Success

- + Energy use (kWh) and cost
- + Peak Power Load, Average Power Load (kW)
- + GHG Avoidance and Gasoline Savings
- + Utilization of stations
- + Peak occupancy of stations
- + Charging session duration
- + Detailed transaction data

Integrate data into existing systems

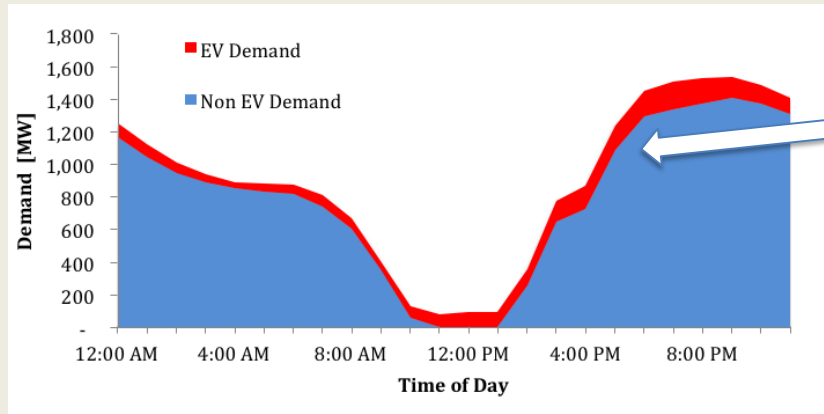


World Class Support



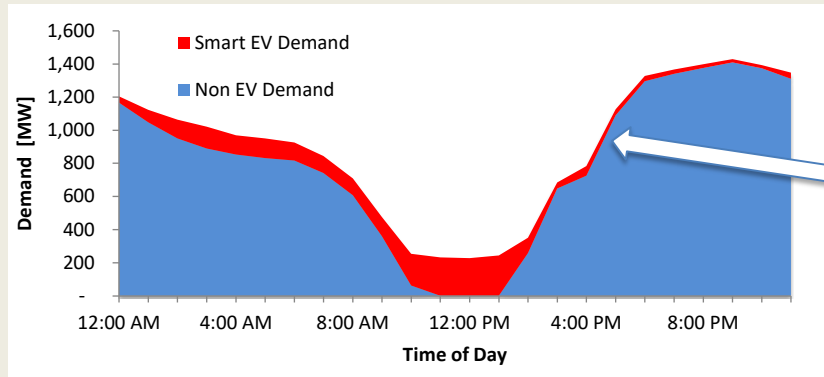
For questions:
lan.markovitz@chargepoint.com
303-902-5163

Pressed Duck



**Big
"duck
curve"**

Projected HECO demand with 23% EV penetration with uncontrolled EV charging

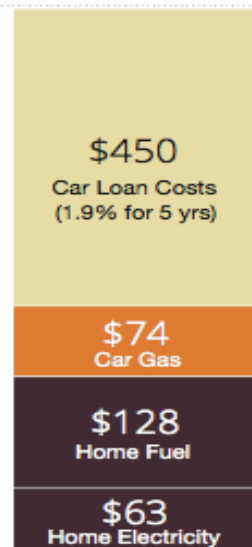


**Smaller
"duck
curve"**

Projected HECO demand with 23% EV penetration and optimized charging

Thinking of buying
a Toyota Camry?

Car + Home Energy
Monthly Expenses: \$715



Approx. Loan Costs

Car Monthly Fuel Cost

Home Monthly Energy Costs

Instead, consider
a Nissan Leaf (EV), Solar (PV),
Heat Pump, Energy Efficiency (EE)
(Net Zero Home + Transportation)

Car + PV + EE + Home energy
Monthly Expenses: \$715



Monthly total of
loan payments
\$715
(4% for 6.2 yrs)

EV + PV + EE
Paid off in
6.2 years

Savings over 10 years*
\$17,370

Savings over 25 years*
\$96,820

Yearly CO₂ reduction
18.5 t

*Minus extra loan payments
until paid in full. Includes a 3%
energy escalation rate.

Leaf: \$10,961 after rebates
Solar PV: \$18,032 after rebates
Solar PV Capacity: 8.4kW
Efficiency Upgrade: \$18,032

2400 SqFt home
10,000 car miles/yr
Camry: \$22,970

DENVER, CO



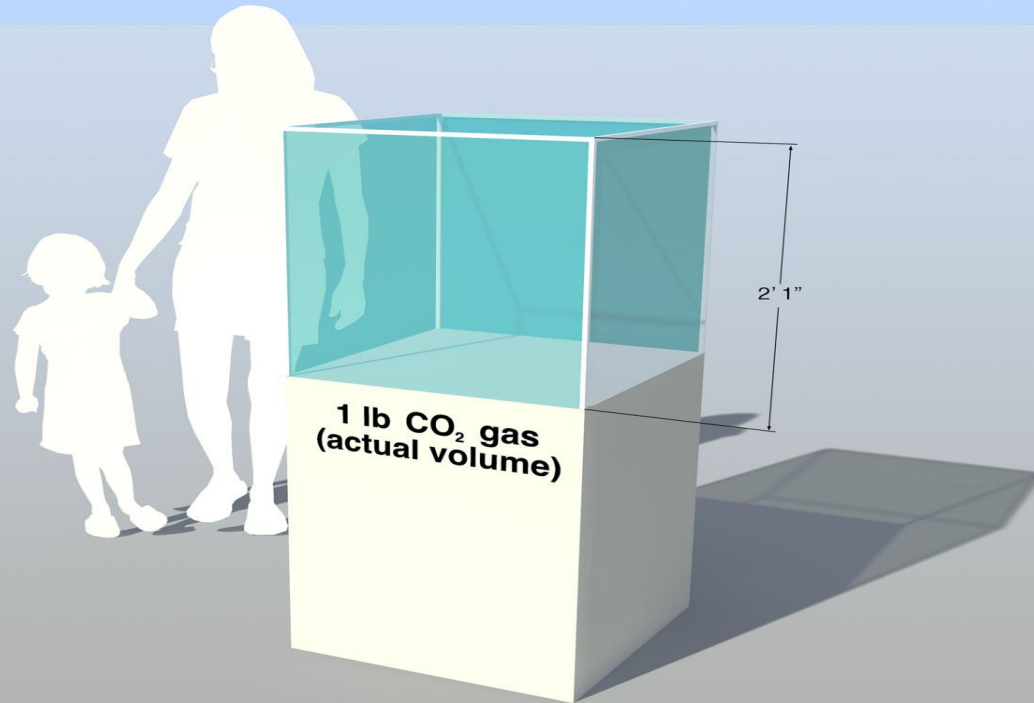
NIGEL ZEID

EV Geek



Graphics courtesy of realworldvisuals.com

One pound of CO₂



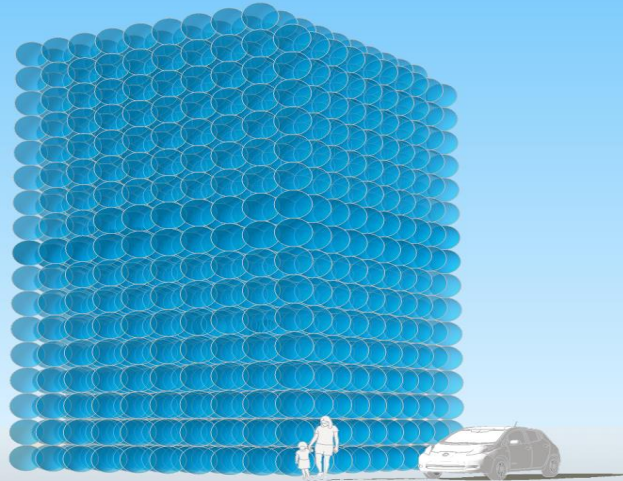
BOULDER NISSAN

DAILY CO2 EMISSIONS USING 904 kWh OF ELECTRICITY PER DAY

904 kWh creates 1,690 lbs of CO2

Each sphere is **ONE POUND** of **CO2** and is **30.5 INCHES** in diameter.

Dimensions of the stack are **25' x 25' x 43'**

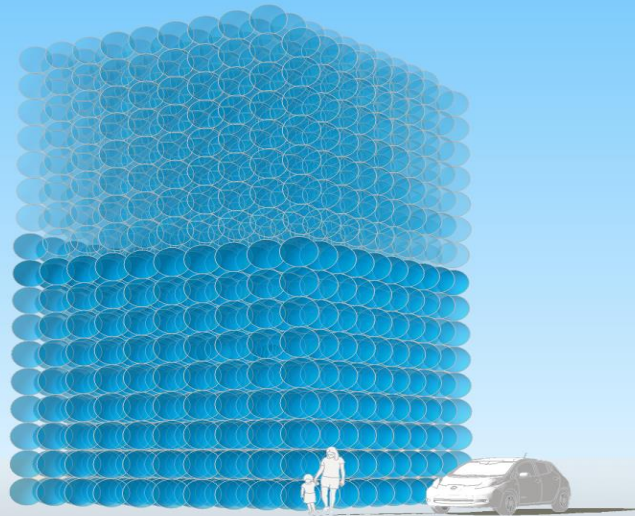


BOULDER NISSAN

AFTER INSTALLING LED LIGHTING THROUGHOUT THE STORE.

Daily saving of **773 lbs** of **CO₂**

Down from **1690 lbs** to **917 lbs**

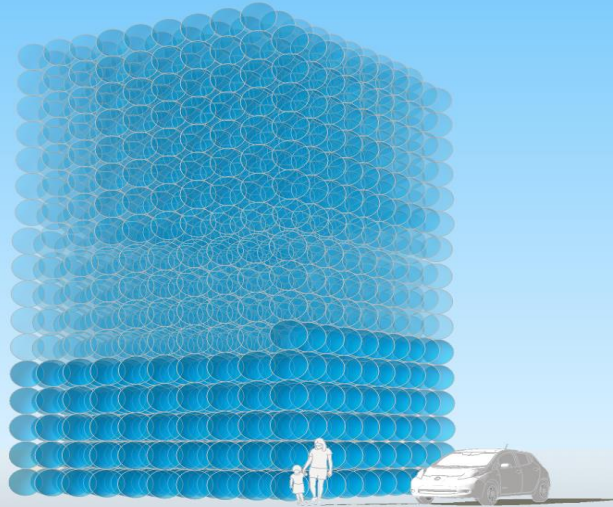


BOULDER NISSAN

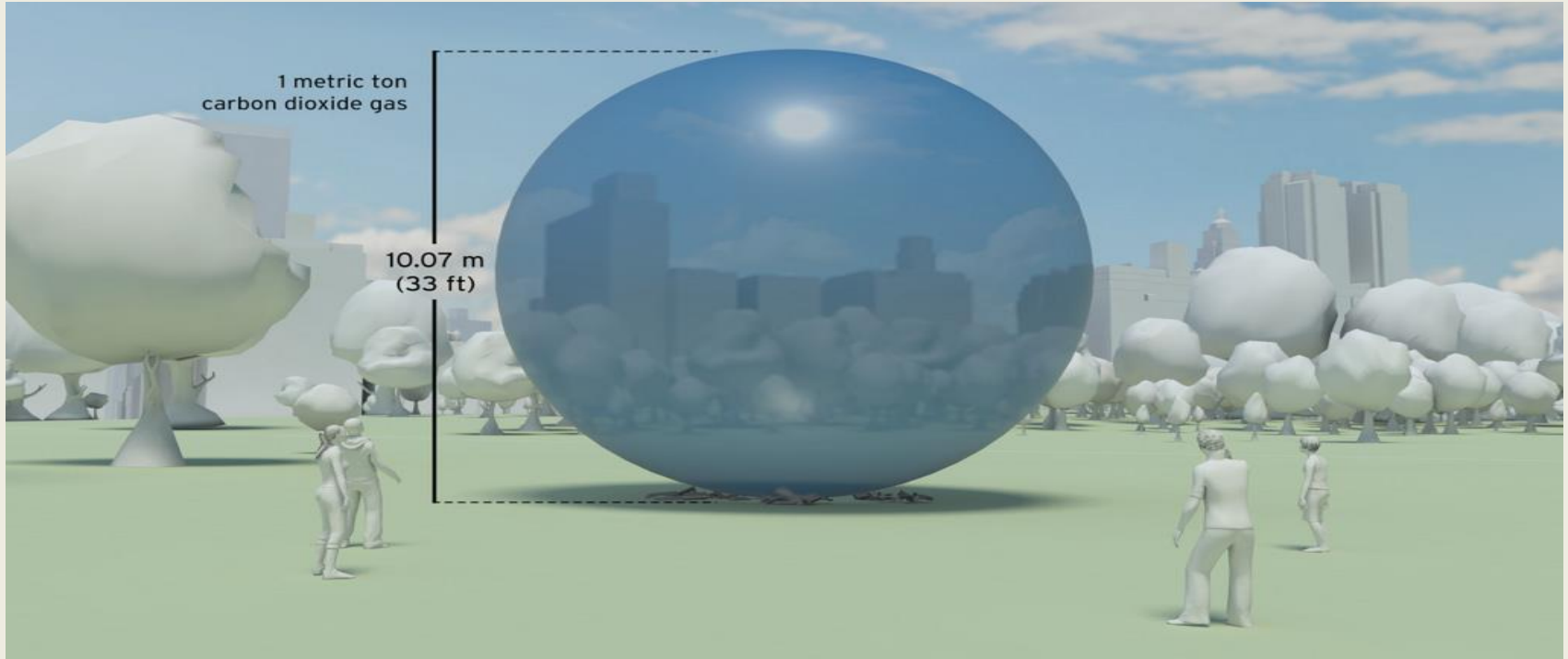
AFTER INSTALLING 50kW OF SOLAR PANELS.

Daily saving of **399 lbs** of **CO₂**

Down from **917 lbs** to **518 lbs**



In 2017 BOULDER NISSAN saved **88.7** tons of CO₂.
ONE TON OF CO₂ IS EQUIVALENT TO A 33' DIAMETER SPHERE.

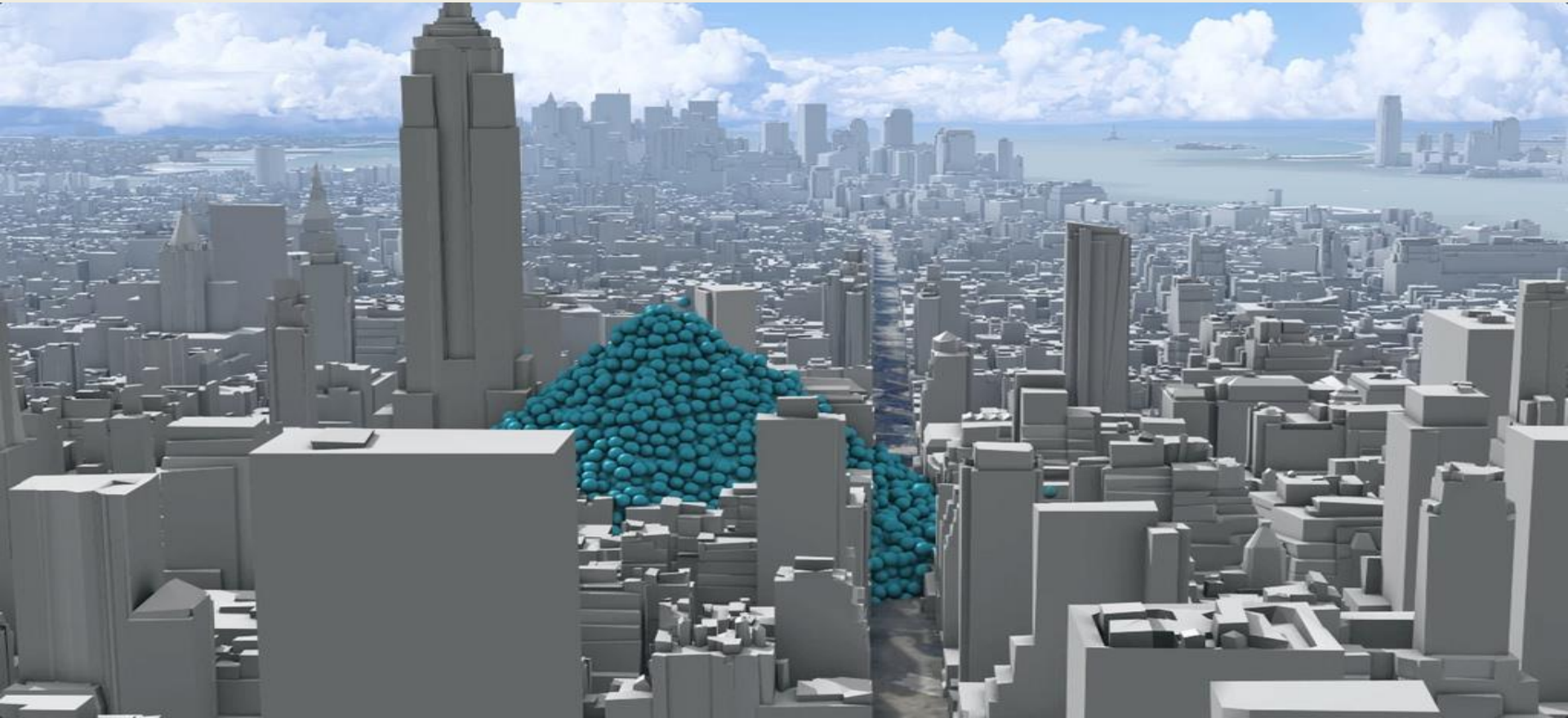


one metric ton
carbon dioxide

26' 8"

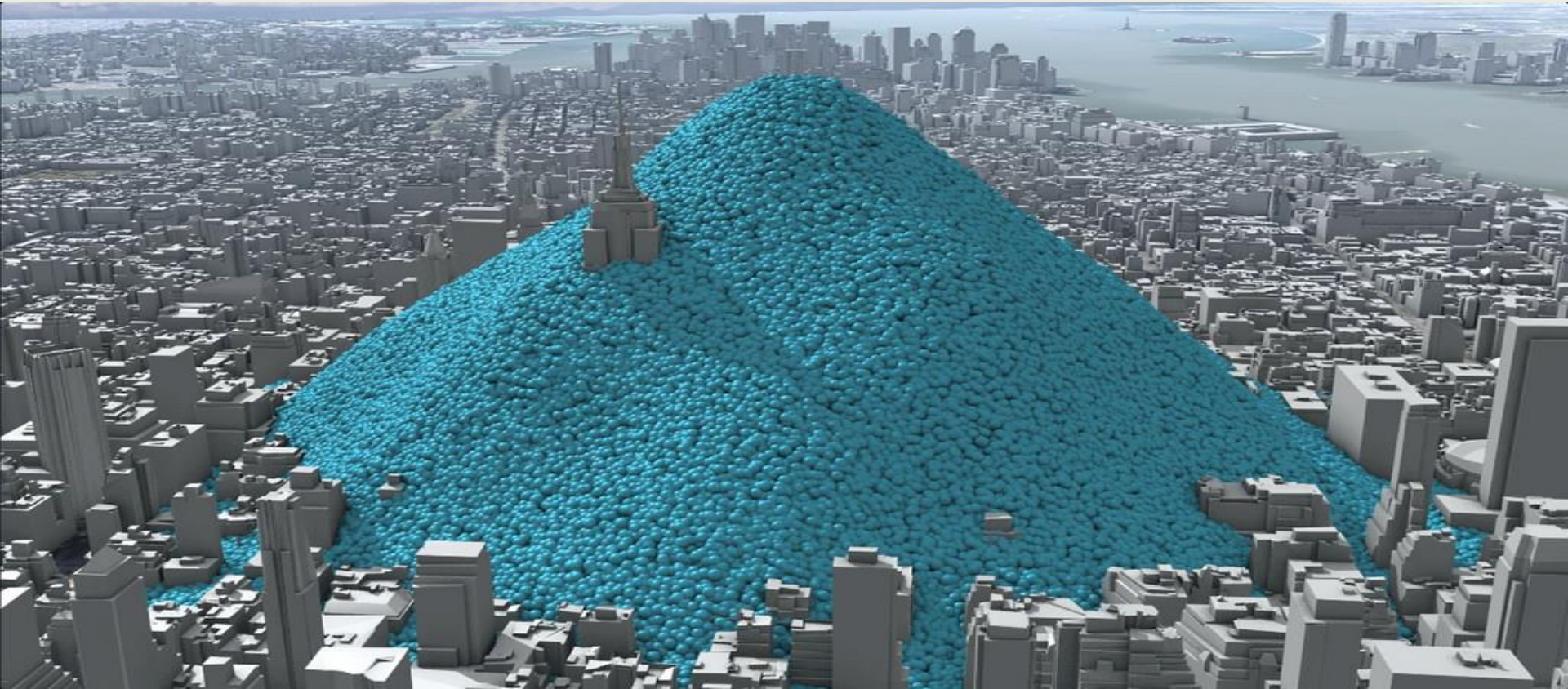


CO₂ produced in New York City in 1 hour
6,164 Tons

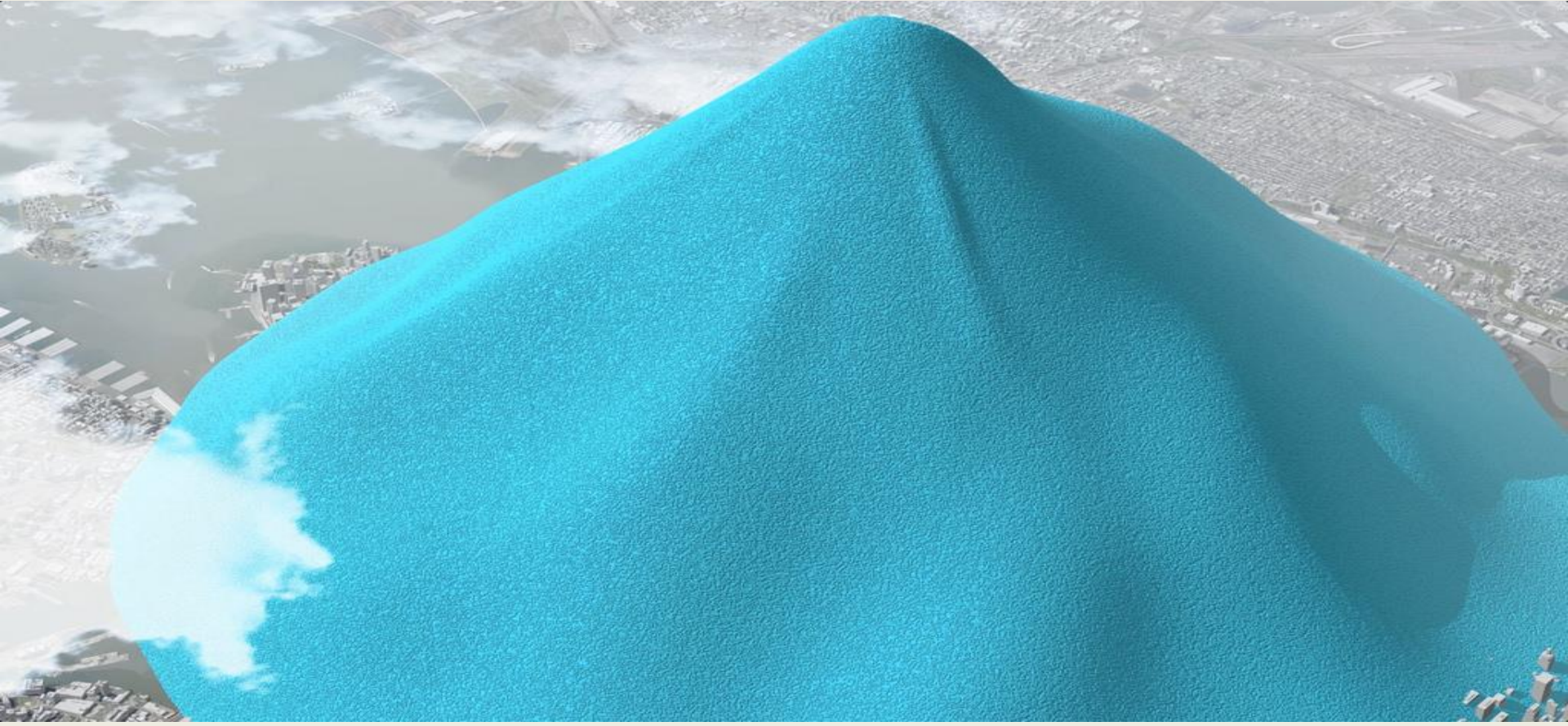


CO2 produced in New York City in 1 day

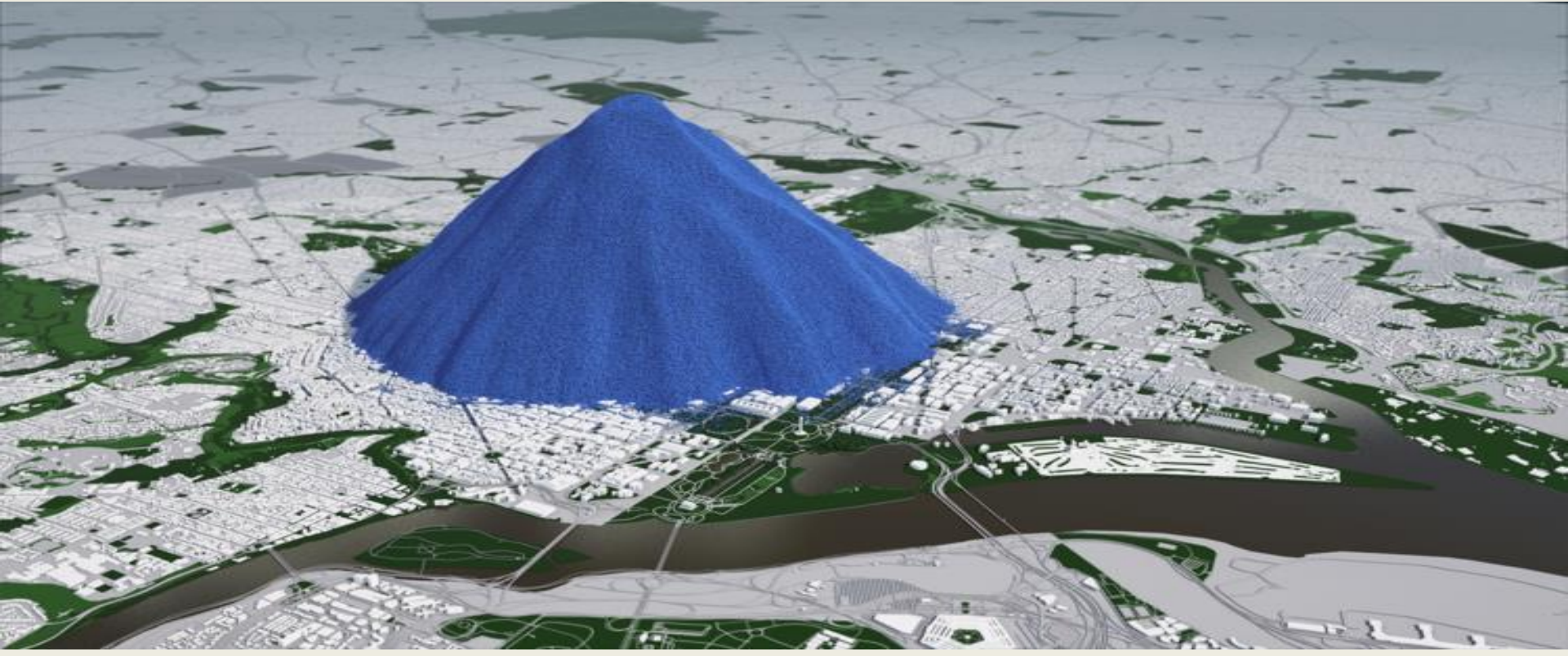
147,945 Tons



CO2 produced in New York City in 1 year
54,000,000 Tons



USA Daily CO2 Emissions
18,821,917 Tons



USA Daily CO₂ Emissions

218 tons every second

13,000 tons every minute

784,000 tons every hour



bould-r
n+ssan



n+g-l z-+d

Electric Vehicle Specialist

Mobile: 720.878.6757

Store: 303.443.8110

Fax: 303.449.5269

E: nigel@bouldernissan.com

Web: bouldernissan.com

2285 28th Street
Boulder, CO 80301