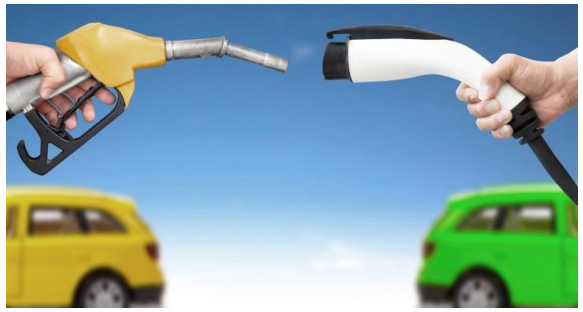
Charging Ahead: Enevate's Silicon Li-ion EV Battery Breakthroughs

2020 GLOBAL CLEANTECH 100

Addressing Consumer & Key Industry Pain Points

Pain Points for EV Adoption	Enevate Delivers
Carbon footprint	**Up to 20% smaller carbon footprint**
Long inconvenient charging time	**10X faster**, 5-minute Extreme Fast Charge
Price premium over ICE	**20% lower cost anode**, affordable EVs
Driving distance	**30% more EV range**, higher energy density
Low-temp performance	**>100% better** low temperature performance
Safety	**Safer Battery**, no lithium plating
Efficiency	**Higher efficiencies** in regenerative braking and charger utilization



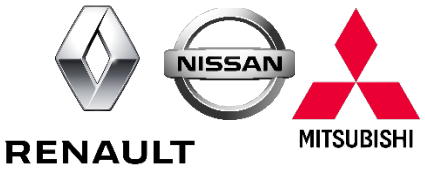
Competitive advantage for EVs when they can charge as fast as refueling a gas vehicle

Enevate Fast Charge Demo Video https://youtu.be/4-IWs4Ibq0c

Click on graphic below or link above to play

Fast Facts

- **Enevate develops Next-Generation Li-ion battery technology for Electric Vehicles**
  - Founded 2005 in Southern California, USA
  - Latest investments by:

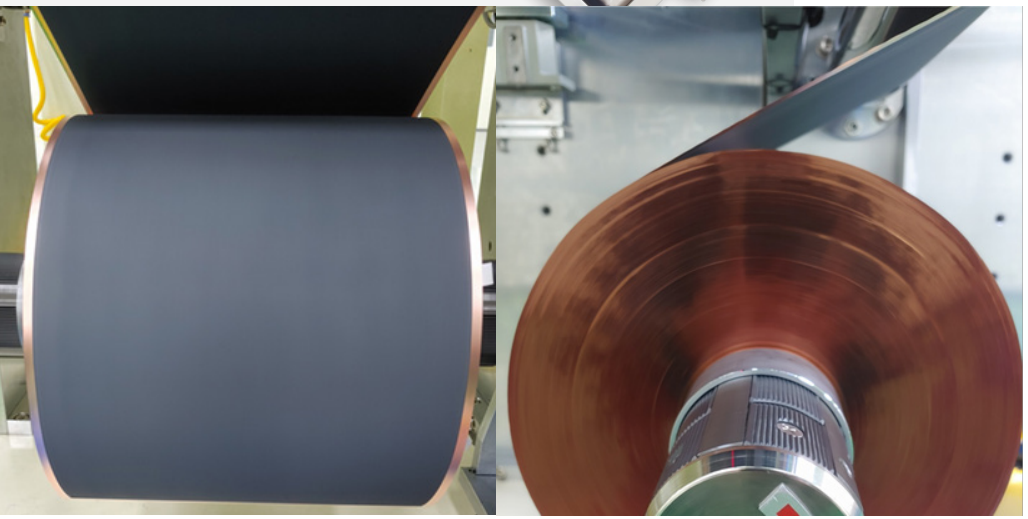


- **Our Vision: A cleaner and sustainable environment through a variety of battery powered applications and products that are accessible and affordable to everyone**
- **Our Mission: Develop innovative battery technologies to accelerate adoption of electrified mobility**
- **Our Business Model: Battery technology licensing & transfer**
  - Non-capital intensive, leverages experienced high volume & quality battery makers to supply the EV industry
- **Our Technology: Developed over 10+ years with 350+ patents issued and in-process**
  - Tested by 20+ battery and automotive manufacturers in Asia, US, and Europe
  - Licensing new 4th Generation XFC-Energy® technology with eXtreme Fast Charge for high volume commercialization

Enevate 4th Generation XFC-Energy® Technology

XFC-Energy Technology provides a comprehensive cell solution to the automotive industry, developed for gigafactory-scale manufacturing and lower cost than conventional Li-ion cells

- **Processes designed for high volume continuous roll-to-roll processes of over 80 meters per minute**
- **Flexible anodes that can be stacked or wound**
- **Compatible with existing factories and most cathodes**



- **Capable of over 1000 cycles**
- **Operation at -20˚C and below temperatures**
- **Currently designing for 2024-2025 model year EVs**
  - 2022-2023 for other applications

Highly Experienced in Li-ion Battery Cell Development

ENEVATE

10+ years
LI-ION CELL DEVELOPMENT

4 generations
SILICON-DOMINANT LI-ION CELL TECHNOLOGY

1 million meters
ELECTRODES PRODUCED

2500 channels
AVAILABLE FOR BATTERY TESTS

50k electrical tests
PERFORMED

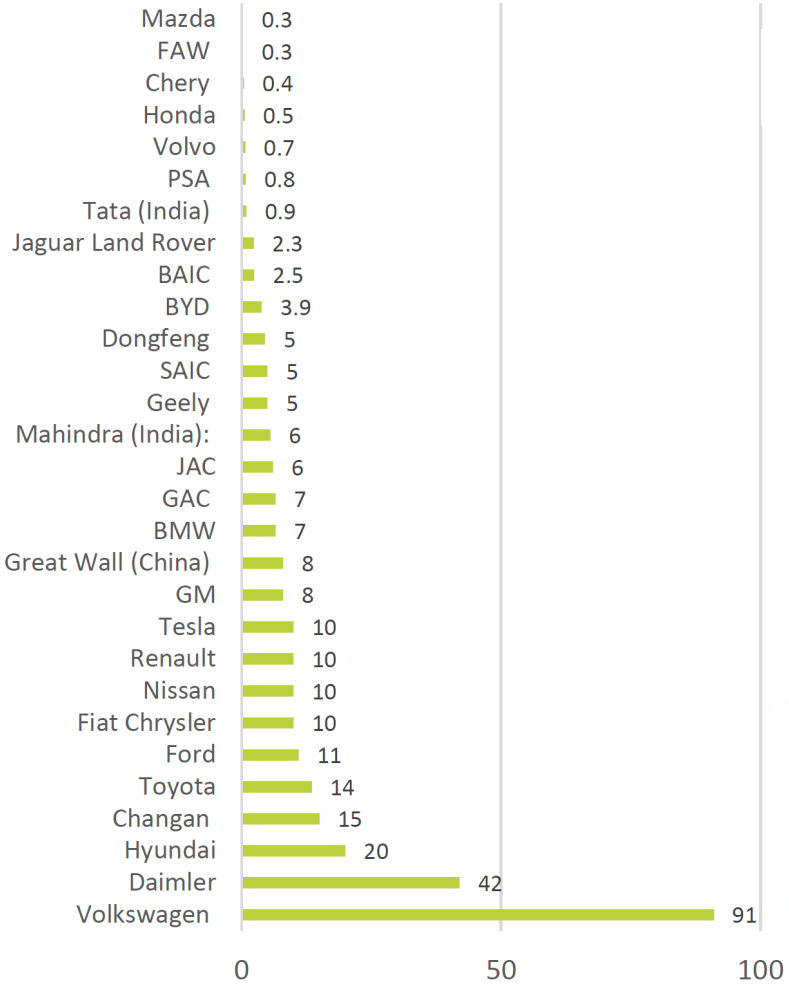
50k Li-ion cells
ASSEMBLED AND FINISHED

74 million hrs, 8400 yrs
CUMULATIVE CELL TESTING

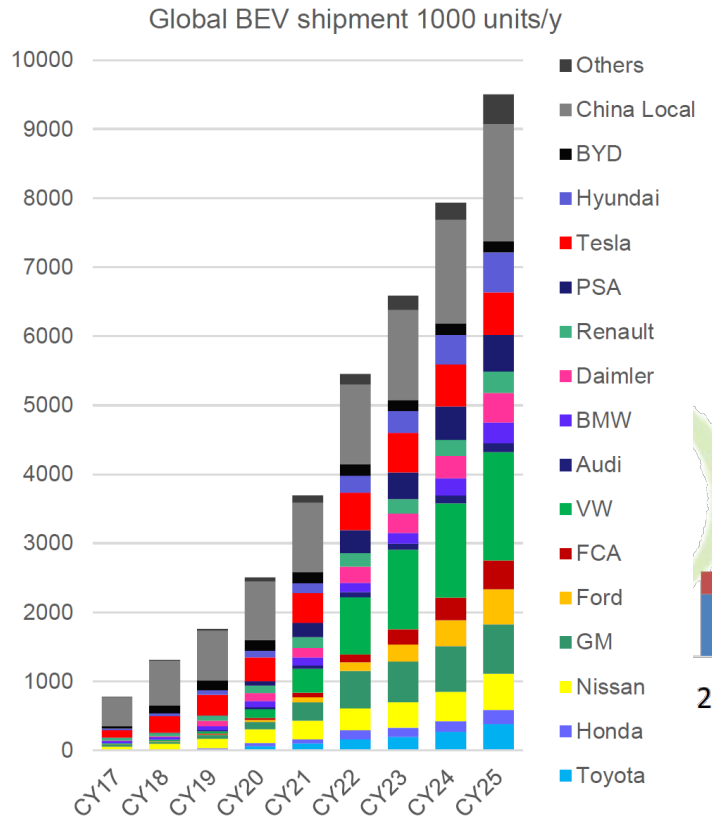
2 billion datapoints, 400GB data
COLLECTED & ANALYZED

Electric Vehicle & Battery Opportunity is Massive

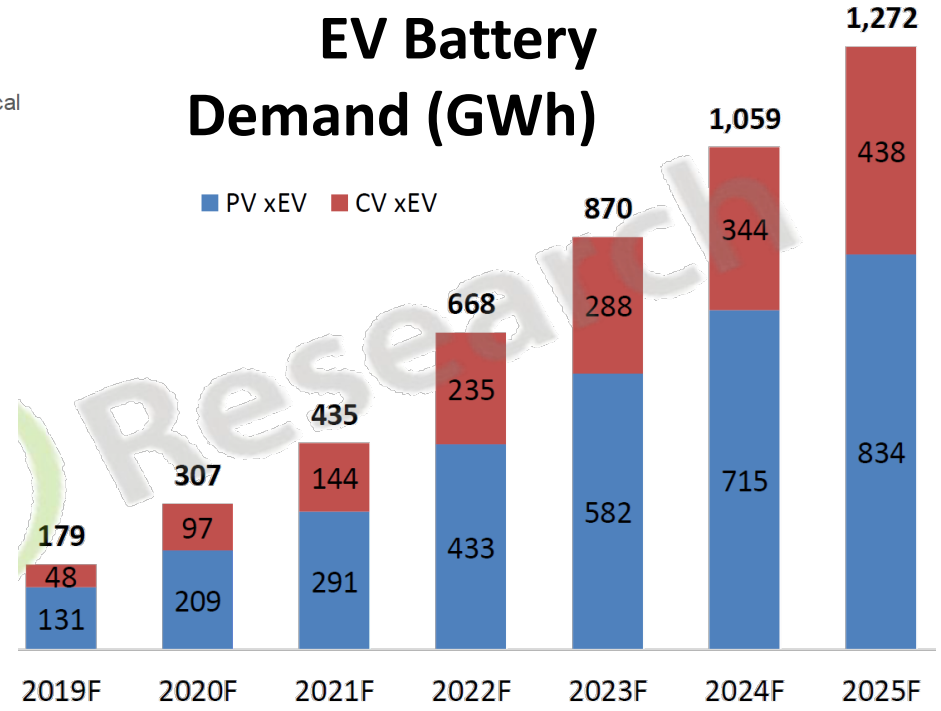
Carmakers to Invest More Than $300B in EV



source: Avicenne, Jan 2020



source: B3, AABC-Asia Oct 2019



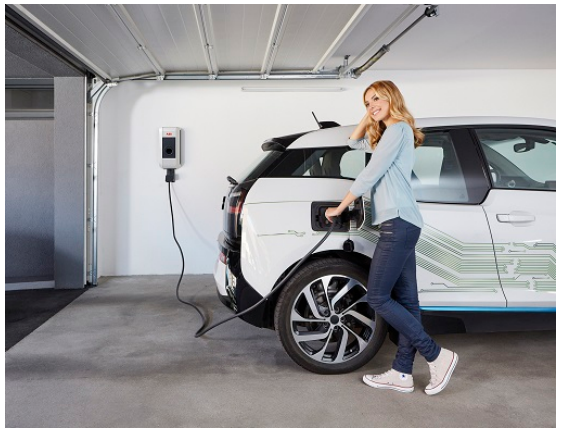
PV: Passenger Vehicle
CV: Commercial Vehicle
source: SNE Research Report:
Global EV & Battery Market Forecast, Sept 2019

By 2030, Tesla believes the global demand is for 10 TWh per year of EV batteries

source: Tesla Battery Day, 22 Sept 2020

Making EVs More Convenient Than Gas Cars

Home
(8-10 hours)



Work or Destination
(45-90 min)

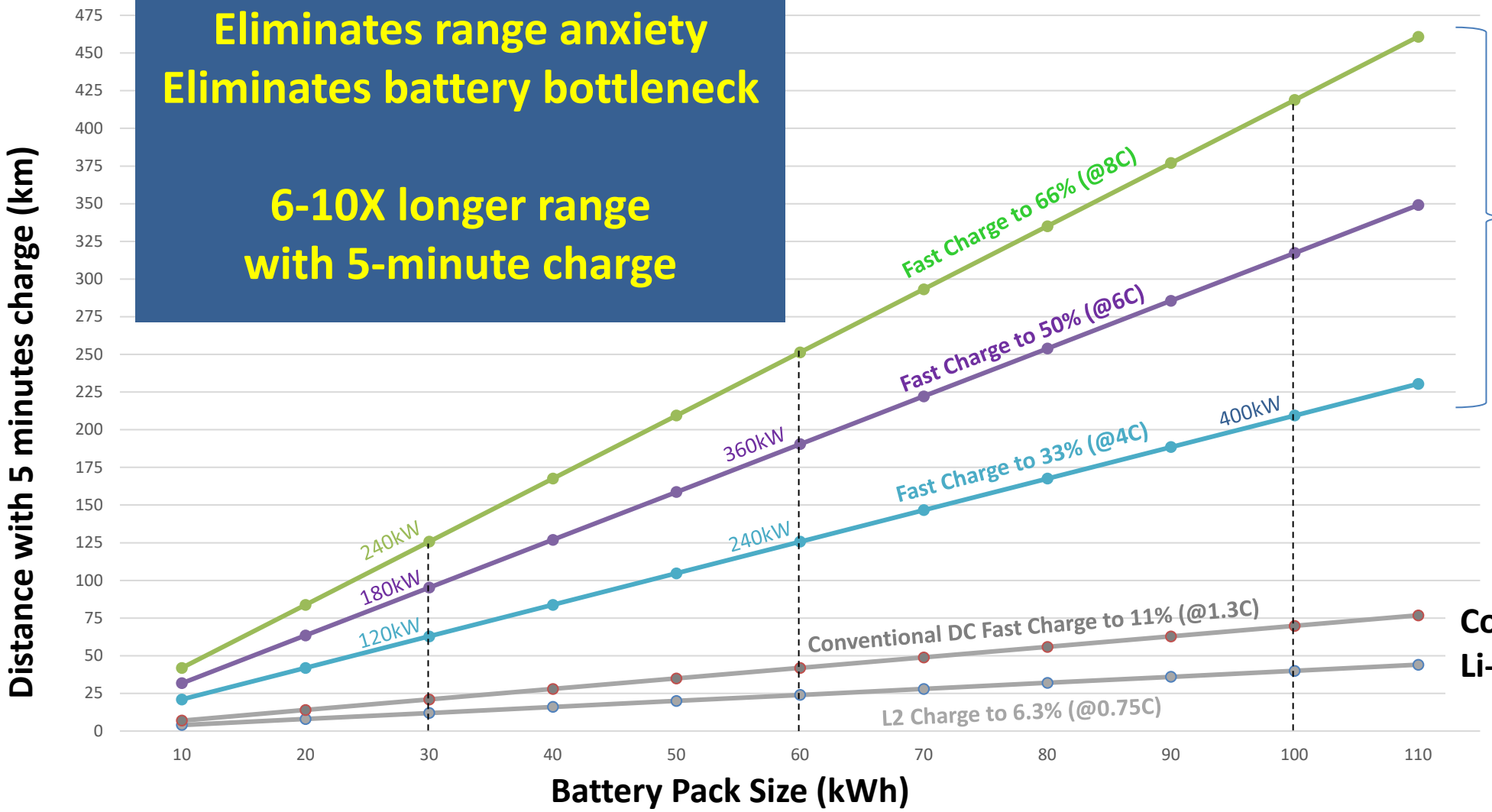
Fast Charge on the Road:
Drive-through Charging Station
(5-10 min, highway or street corner)

Extreme Fast Charging changes people's perception of EV charging convenience

5-Minute Charge: Paradigm Shift in EV "Refueling"

Eliminates range anxiety
Eliminates battery bottleneck

6-10X longer range with 5-minute charge



Enevate XFC-Energy® Li-ion battery

Today's existing Level 3 DC Fast Charge standards being deployed

CCS 2.0

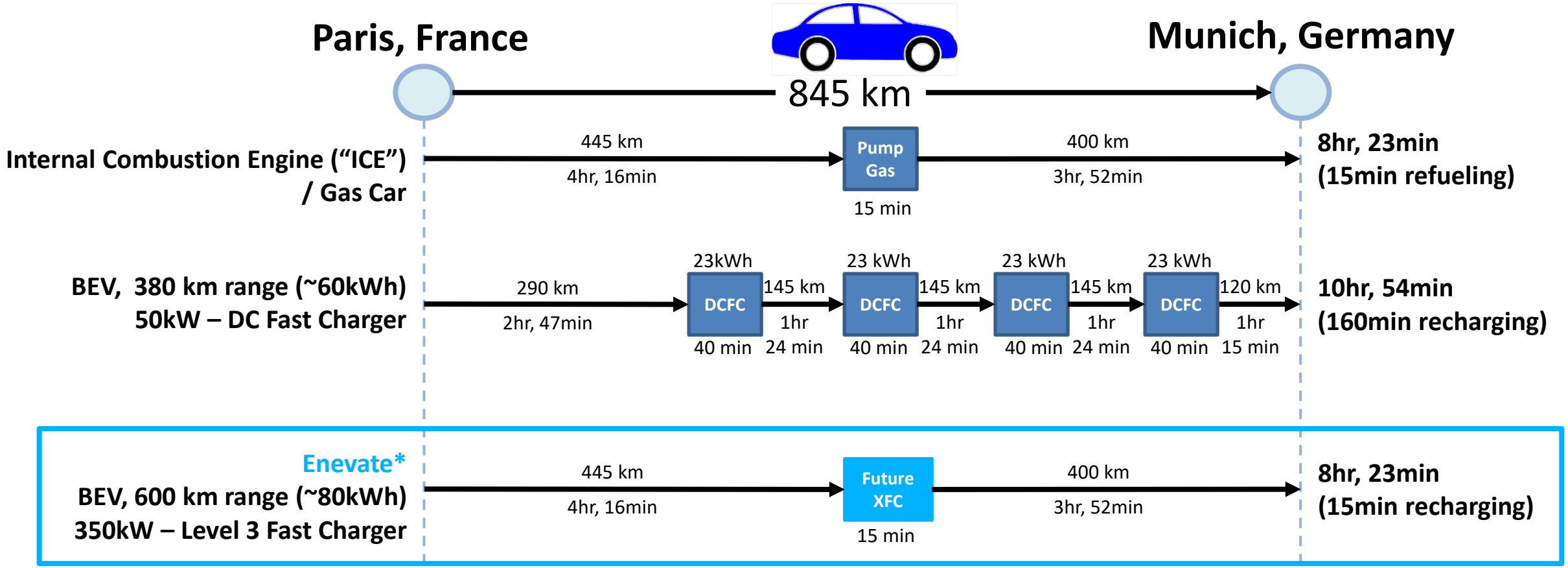
Up to 350kW

CHAdeMO 3.0 Released

Up to 500kW

Conventional Li-ion battery

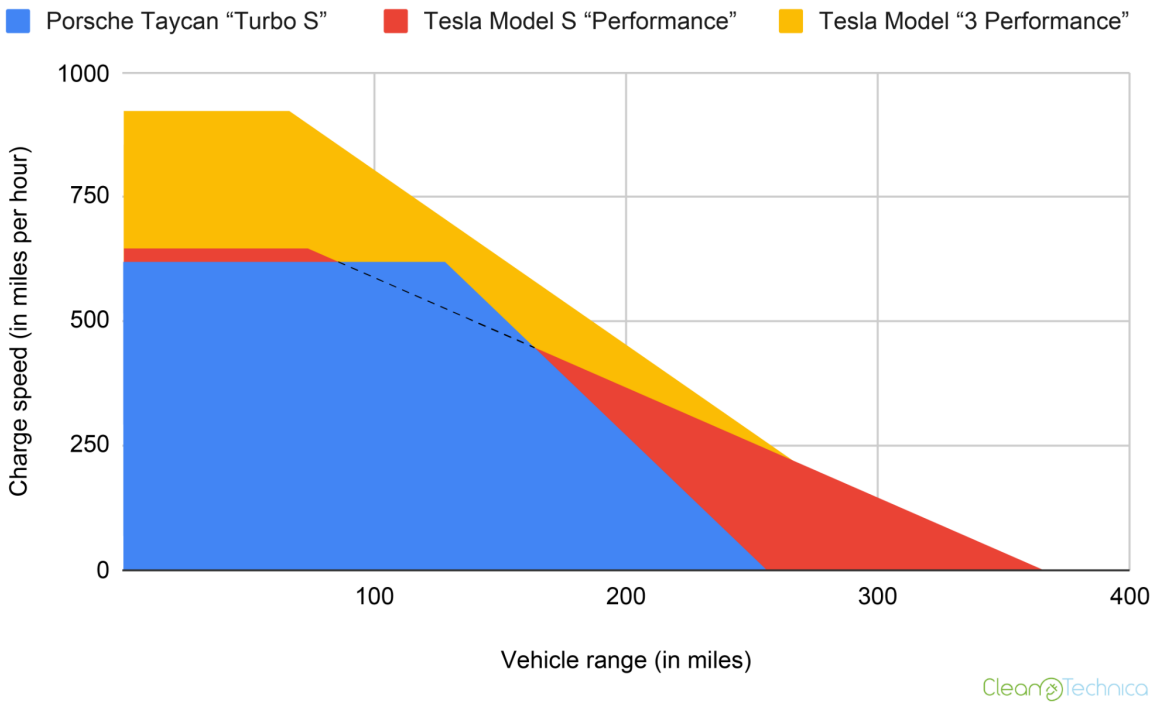
Example: Charge & Trip Time Experience



*Enevate estimate

Source: 2017, DOE – Enabling Fast Charging – A Technology Gap Assessment

Utilizing the Charging Infrastructure Efficiently



- **McKinsey & Co**
  - $50B to ensure public charging station access similar to gas stations in just US, Europe, China
  - $11B just for the US
- **Enevate's charging technology can save $Billions in infrastructure investment**

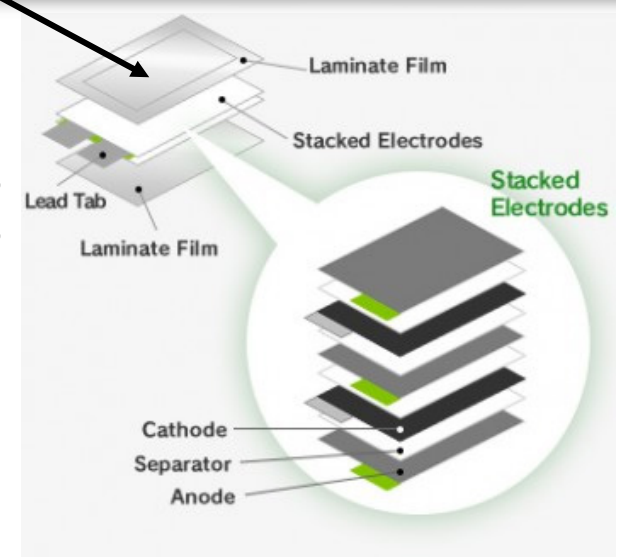
- **Charging current drops quickly in most scenarios**
- **Battery will be damaged if a certain rate is exceeded at each SOC (State Of Charge)**
- **Enevate's battery could charge at full rate for almost the entire time reducing charge time for chargers at almost all rates**

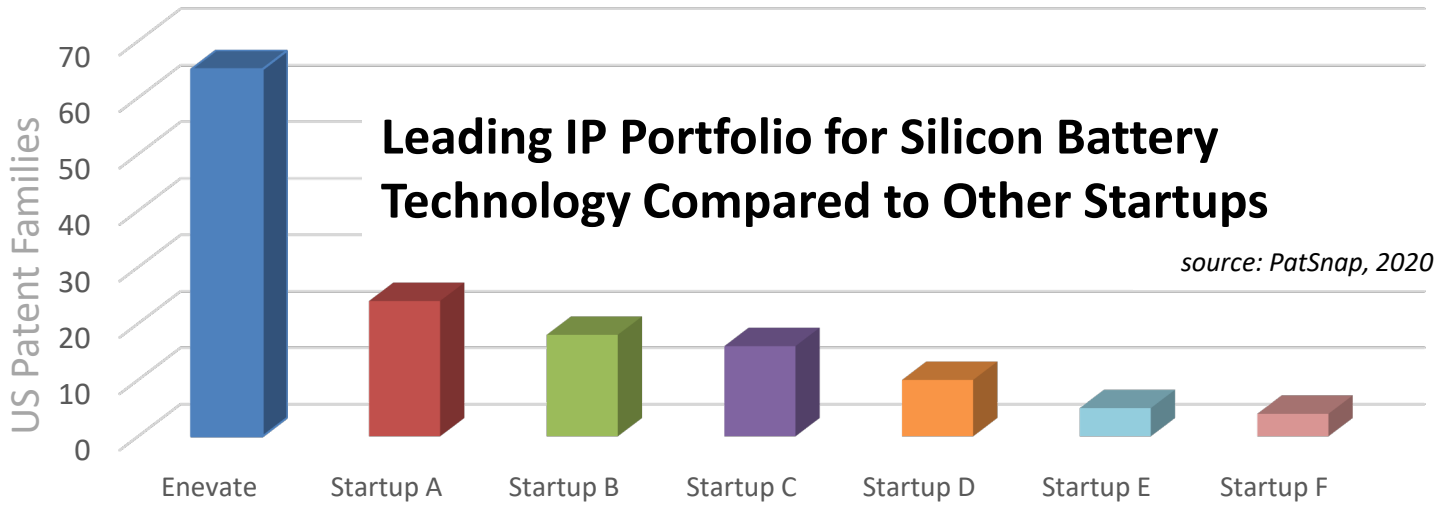
Enevate's Technology: XFC-Energy® Li-ion Battery Cell

ENEVATE

EV Battery Pack has many cells

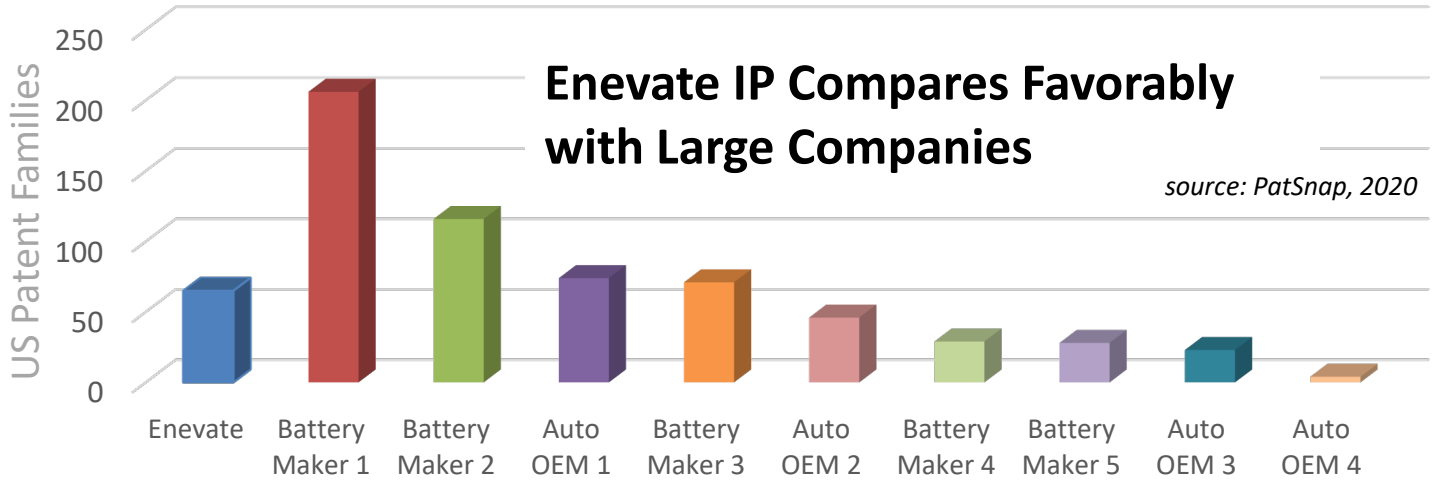
EV Cell has many electrodes (negative anodes, positive cathodes)





Leading IP Portfolio for Silicon Battery Technology Compared to Other Startups

source: PatSnap, 2020

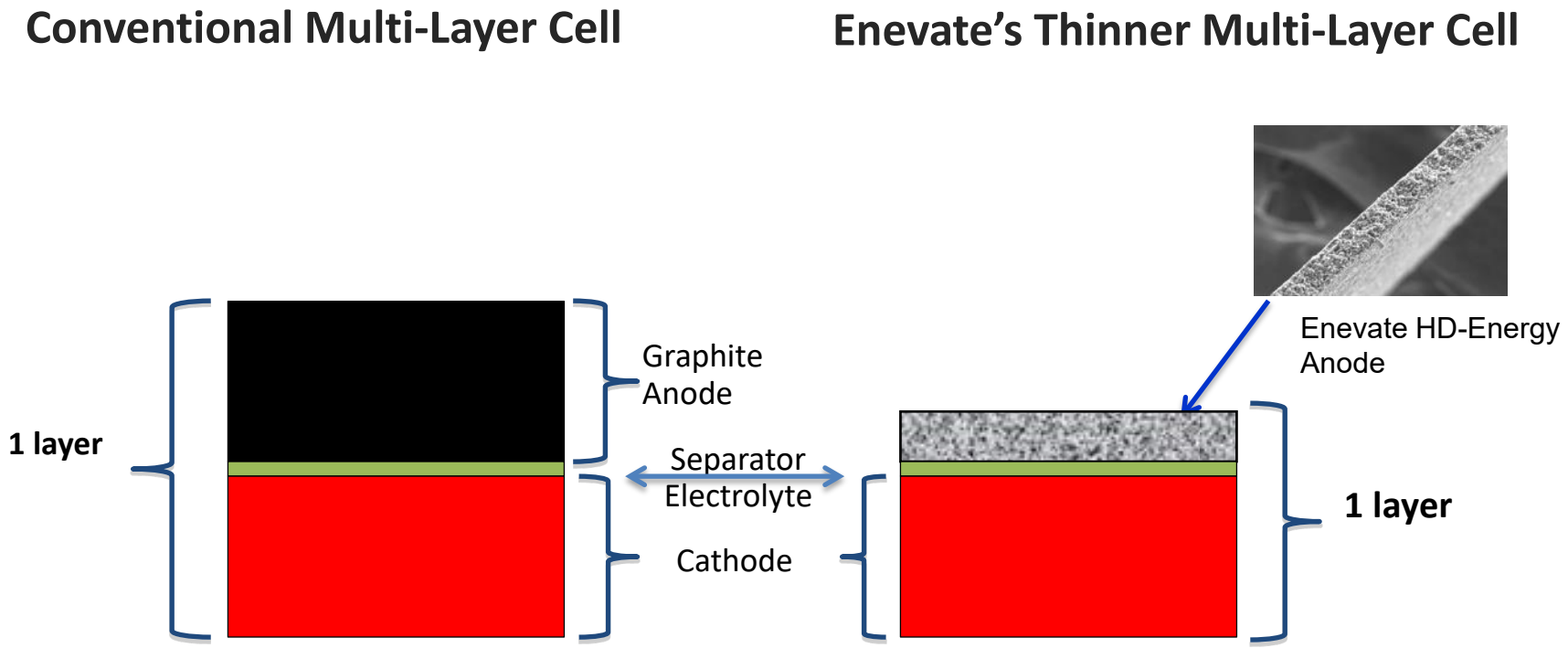


Enevate IP Compares Favorably with Large Companies

source: PatSnap, 2020

Enevate holds the largest portfolio of silicon battery patents compared to other startups and most established EV automotive and battery companies

Enevate vs Conventional



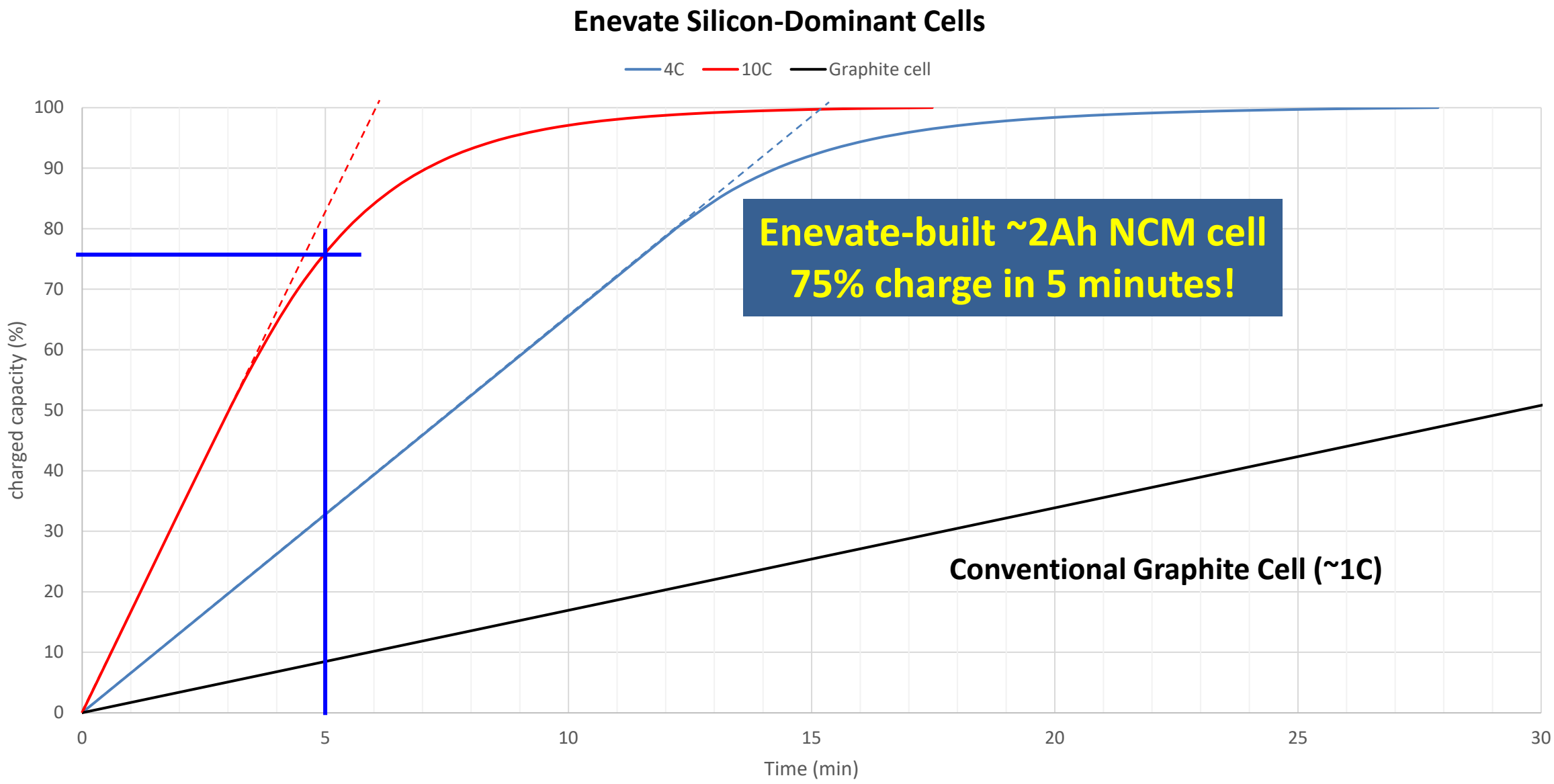
More Energy, Smaller Size

Technical Fast Facts

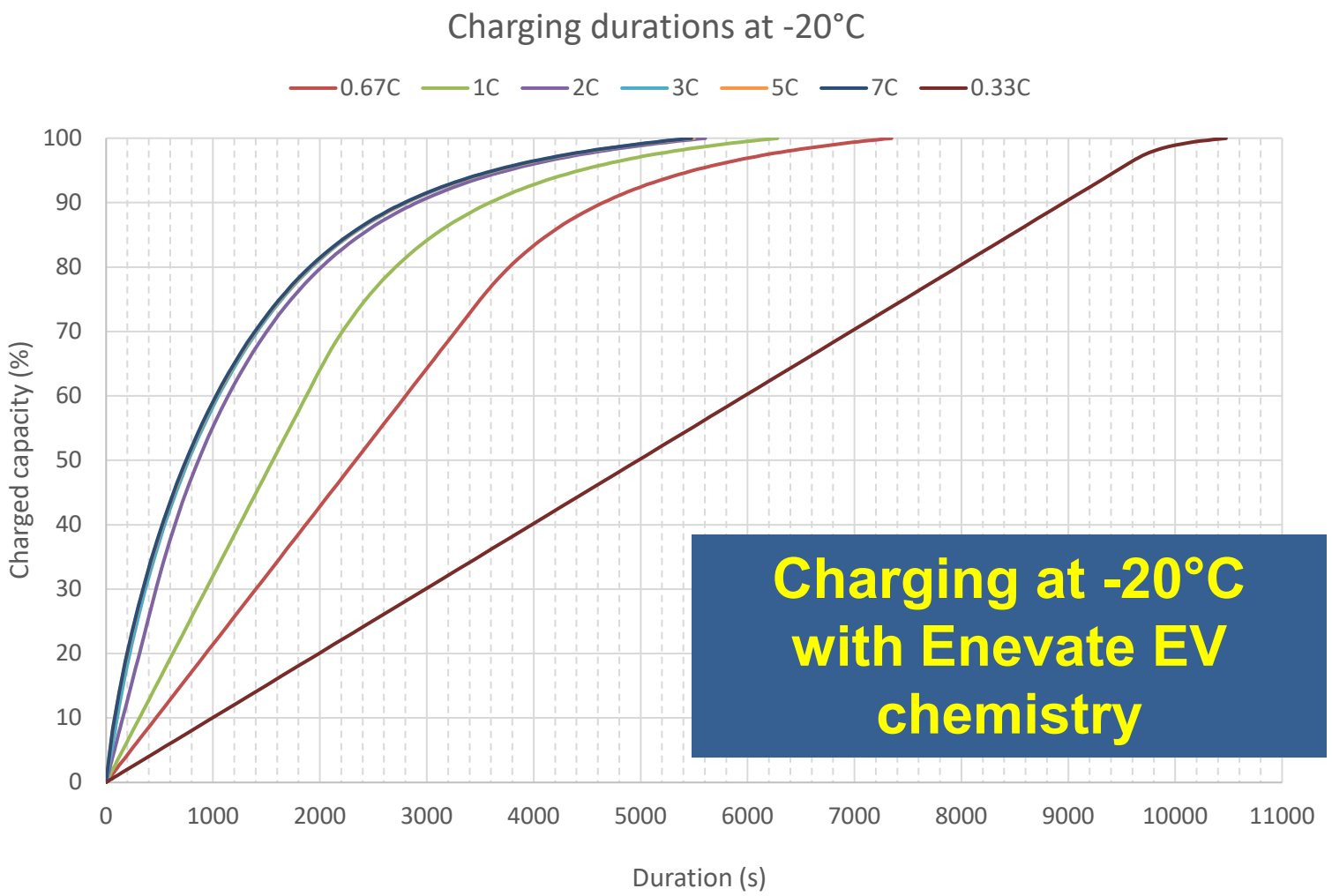
- **XFC-Energy® Anode Film: Pure Silicon-Dominant Micro-Matrix**
  - Inexpensive silicon, low carbon footprint
  - Scalable processes
  - Scalable for use in pouch, prismatic, and cylindrical formats
  - Can be paired with NCA, NCM811, NCMA, low-cobalt and other advanced cathodes

- **Anode is >>70% Silicon**
  - ~3000 mAh/g specific capacity available (compared to graphite, 372 mAh/g max)
  - 1000-2000 mAh/g utilized in cell designs
  - Achieving energy densities of up to 1000 Wh/L, ~350 Wh/kg in large format cells
  - High Initial Coulombic Efficiency: 93% for anode, ~90% for full cells (similar to graphite cells)

Extreme Fast Charge for Electric Vehicles



Low Temperature Charge with High Nickel Chemistry



Dangerous to charge graphite cells below 0°C

"Many battery users are unaware that consumer-grade lithium-ion batteries cannot be charged below 0°C (32°F). Although the pack appears to be charging normally, plating of metallic lithium can occur on the anode during a sub-freezing charge. This is permanent and cannot be removed with cycling. Batteries with lithium plating are more vulnerable to failure if exposed to vibration or other stressful conditions. Advanced chargers (Cadex) prevent charging Li-ion below freezing." – Battery University

Additional Benefits

Regenerative braking key to electric vehicle efficiency and range

- **Problem: Regenerative braking, and thus EV range suffers at lower temperatures**
  - Existing cell technology is challenged at absorbing energy at low temperatures
- **Solution at room temp: Enevate technology can deliver longer range**
- **Solution in cold temp: Enevate technology can deliver even longer range**
  - Regenerative braking is power limited in cold weather because battery can only accept limited charging
  - With less or no battery heating, even more improvements can be realized

Smaller & Lighter Battery Allows for More Efficient & More Affordable EVs

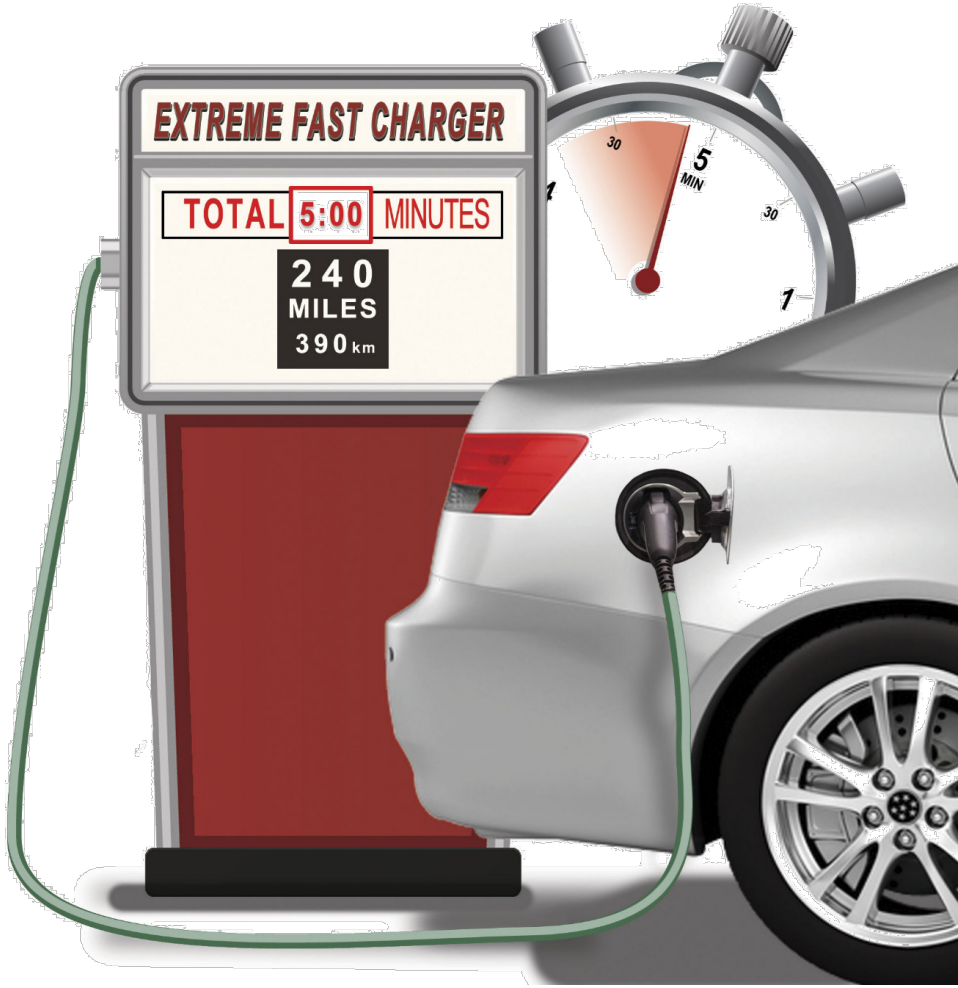
Example EV with Enevate XFC-Energy® Technology

- **Future EV with Enevate XFC-Energy battery technology**
  - **5-minute Extreme Fast Charging:** same time as gas car
  - Capable of cold-climate fast charging
  - 75kWh battery for 600km WLTP + 50km reserve range (eBoost® mode)

- **Smaller carbon footprint for CO2 emissions**
  - One EV is equivalent to planting two thousand evergreen trees over 10 years
- **More affordable: 20% lower anode cost**
- **Most convenient: Charge @home, @work, AND @highway charge stations**
- **More efficient: Better regenerative braking efficiency and low temperature performance**
  - Longer range for the same battery size
- **Save money on charging infrastructure and utilize existing infrastructure more efficiently**

Thank you!

www.enevate.com



BACKUP

Management Team

Robert A. Rango, President & CEO

- 35+ years: Mobile, Wireless, Semiconductors, Optical, Communications; drove $4B component business at Broadcom to be #1 globally in Wi-Fi, Bluetooth, GPS
- EVP/GM Broadcom, VP/GM Lucent Micro, AT&T Bell Labs
- MSEE Cornell, BSEE SUNY-Stony Brook

Sameer Rao, CFO

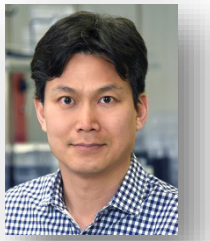
- 21+ years: Semiconductors, Optical, Communications
- Senior Director Finance Max Linear
- MBA USC, MSEE UNCC,
  BSEE Manipal Institute of Technology

Jarvis Tou, EVP Marketing & Products

- 30+ years: Li-ion Batteries, Automotive, Wireless, Mobile, PC, M2M Consumer Electronics, Semiconductors
- VP/GM CalAmp, VP Staccato, VP Silicon Wave, Intel, Motorola
- University of Pennsylvania Wharton EDP, MBA Arizona State, MSEE Purdue, BSEE University of Michigan

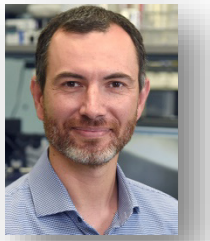
Noel Whitley, General Counsel

- 23+ years: Netlist, Broadcom, Cooley LLP
- JD University of Texas School of Law, MSEE Georgia Tech, BSEE Texas A&M



Dr. Ben Park, Founder & CTO

- 20 years: Surface and Bulk Chemistries, Battery Materials Screening and Development, Battery Chemistry
- 240+ patents issued or filed, authored 45+ talks and publications
- PhD ME UC-Irvine, MSEE Purdue, BSEE Seoul National University

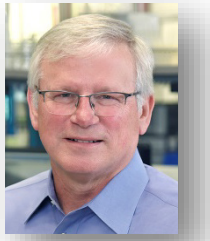


Dr. Frederic Bonhomme, VP Research & Engineering

- 20+ years: Li-ion Batteries, Supercapacitors for Automotive, Industrial, Space and Defense applications
- Johnson Controls, Saft
- PhD and MS Physical Chemistry Bordeaux University

Todd Tatar, VP Operations & Quality

- 35+ years: Li-Ion Batteries; VP PowerGenix, Sanyo, GE, Gould, Martin Marietta
- BSChemE, BS Chemistry USF



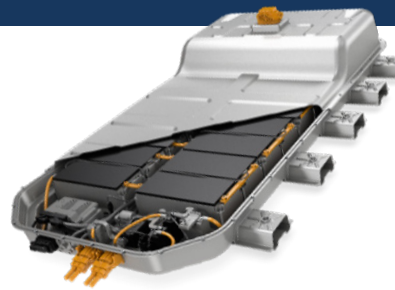
Kirk Shockley, VP Manufacturing Projects

- 30+ years: Li-ion Batteries, Solar Energy, Electronic Components; COO Global Solar Energy; VP KEMET Electronics; Fuji Film, Union Carbide
- BS Industrial Management Purdue

New EV Battery Technology Development

Maturity

Product Engineering & Manufacturing Commercialization



EV Large Pouch Cells (modules & EV pack)

Automotive B & C-samples

Start Production

EV Large Pouch Cell (full EV product size)

Typically 30-40 layers

50-150Ah

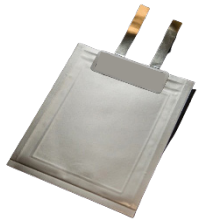
Automotive A-samples

Development & Process Engineering

Small Pouch Cell (many-layers)

Typically 10+ layers

~1Ah+



Small Pouch Cell (few-layers)

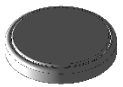
Typically 3-7 layers,

~0.5Ah

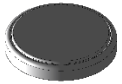
Small Pouch Cell (single-layer)

Typically ~0.1Ah

Materials & Electrochemistry Research



Half-Cells (research coin cell)



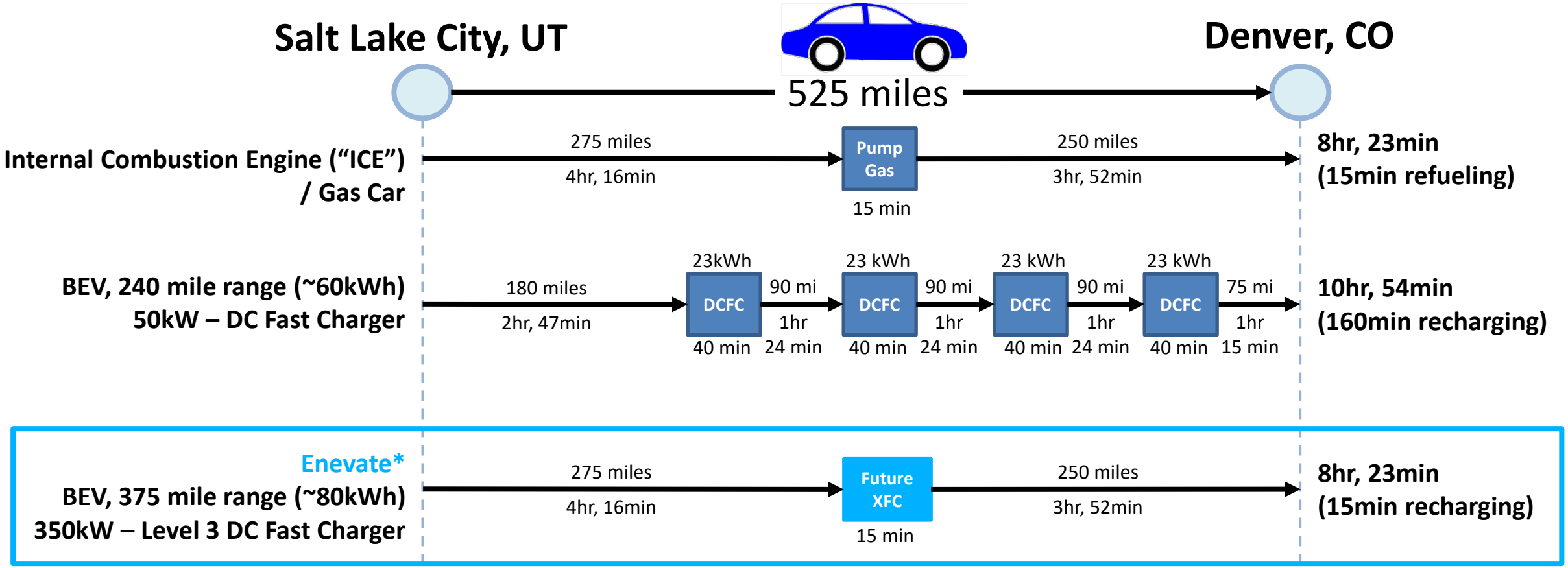
Full-Cells (research coin cell)

Materials Research & Characterization

Typical Time for Any New Breakthrough Battery Technology

10-15 years

Charge & Trip Time Experience: Salt Lake City to Denver



*Enevate estimate

Source: 2017, DOE – Enabling Fast Charging – A Technology Gap Assessment

Technology Licensing & Transfer Package

- **Patent Portfolio - Covers Key Advantages of Technology**
  - Silicon-dominant anode
  - Separator
  - Cell design
  - Formation
  - Conductive films
  - Silicon raw materials
  - Nanocoatings
- **Technology**
  - Cell Design
  - Anode Design
  - Electrolyte Package
  - Materials
- **Production Experience**
  - Testing Methods and Results
  - Quality systems
  - Control plan
  - Documentation
- **Certification from Key Standards Organizations**
  - Certification results and data
  - ISO-certified quality system data
  - Know-how regarding achieved/passed certifications
- **Data**
  - Cost reduction plan
  - Yield Information
  - Test data
  - Product cost analysis
- **Supply Chain Relationships**
  - Material suppliers
  - Service providers (including contract manufacturers)

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