

Dynamic, Configurable, and Proven Technology

Confidential Information Presentation

Saturday, March 23, 2024

Premergy, Inc.



Premergy, Inc. is a U.S. Technology Development Company Focused on Global Battery Power Management and Energy Optimization



OPPORTUNITY

Premergy's patent-protected electric vehicle battery management design and control system addresses two key issues in the electric vehicle marketplace: Vehicle Range and Battery Thermal Stress



Dynamic

- Seamlessly manages battery bank output through every mode of vehicle operation (acceleration, deceleration)
- Optimizes power while moderating battery stress and heat
- Captures more regenerative power at slower speeds



Configurable

- Battery technology and vehicle type agnostic
- Adaptable software algorithms
- Easy to design-in and connect subsystems
- Minimal associated weight gain or space requirement
- Applications across the entire battery electric vehicle marketplace
- Intellectual property portfolio provides flexibility and protection around technology application
- Cost-effective to mass produce and design-in to existing and future vehicles
- Measurable and meaningful benefits to end-user



Proven

- ✓ **Prototype tested and performance validated**
- ✓ **Increases vehicle range or efficiency in excess of 20%**
- ✓ **Captures regenerative braking energy at speeds at or below 5 mph**
- ✓ **Reduces thermal stress - Extends battery life**

Significant Commercialization and Market Potential



I. Executive Summary



COMPANY SNAPSHOT

An Engineering and Technology Development Company...

- Deep technical expertise in vehicle power technology and product engineering
- Over 30 years engineering experience at vehicle OEMs and Tier 1 Suppliers

Bill Hayde

CEO

- 30 Year Investment Banker
- Founder & Director Of Multiple Funds

RICHARD BOTTS

Founder, Inventor, CTO

- 27+ years of experience



Robert DeVecchio

COO

- 30 year + Wall Street veteran
- 20 year + Business Development



COMPANY SNAPSHOT



Well-Developed Patent Portfolio

- **Vehicle Application IP**
 - 6 issued patents and 2 pending patents
 - Patent continuations support future roadmap
 - Application coverage across multiple battery and vehicle types
- **Legal claims analysis support subsystem technology in both independent and combined uses**
- **Patents are applicable to a broad spectrum of industries outside of vehicle technology including: mobile devices, residential energy, and renewable energy (including solar & wind)**

With a Critical Technology Solution

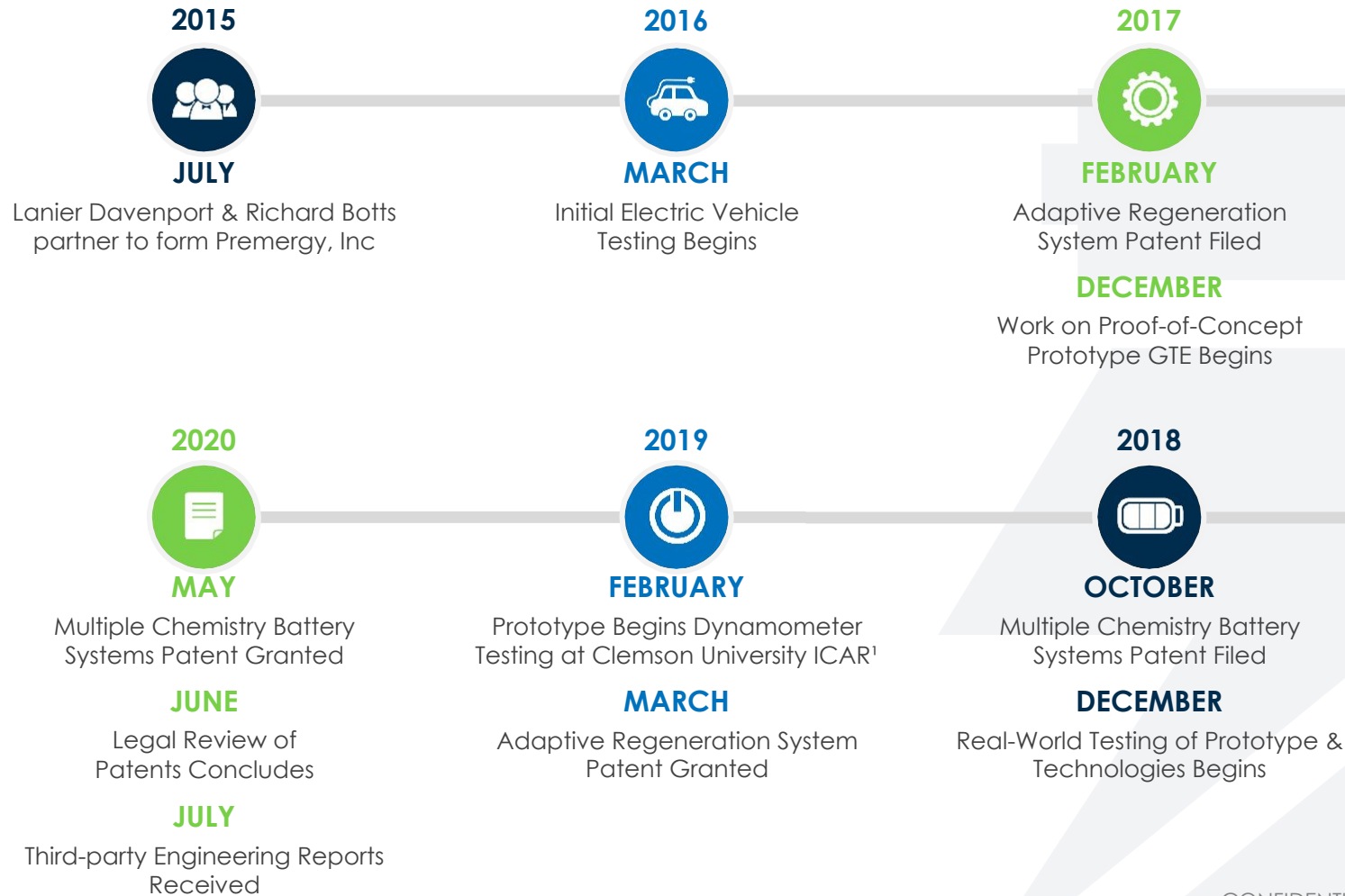
- **The electric vehicle marketplace continues to expand and advance**
 - By 2022 there will be over 500 different EV models available globally
- **Consumers still have choices, and there remain meaningful gaps in cost and driving range between ICE and battery electric vehicles**
- **Premergy's technology is proven to help close the gap on vehicle range and the costs associated with controlling battery thermal stress**

Ready for Commercialization

- **Proof-of-concept achieved**
- **Performance and technology benefits validated through years of independent and highly reputable third-party testing**
- **Immediately available to be implemented into design roadmaps for near-term model year vehicles**
- **Compelling ROI features**



TECHNOLOGY DEVELOPMENT HISTORY



TECHNOLOGY – CORE ATTRIBUTES



Multiple Battery Chemistry Design



Battery System Control (BSC)



Adaptive Energy Regeneration

Function / Design

- Multi chemistry battery bank system comprising a primary and secondary bank, each with distinct chemistry. These battery banks transfer from either the primary or secondary bank to the drive system depending on the vehicle torque demand
- Coordinates the draw of power from the battery bank to the drive system and chooses which battery bank to draw from depending on mode, charge, torque demand, and stress
- Manages and allocates power captured from the regenerative braking system to the battery banks needing charge
- Proprietary algorithms direct the timing and operating decisions
- As EV decelerates or braking system is applied, electric motor changes function and becomes generator, charging plural batteries
- Determines which battery, or both, to charge based on conditions
- Precise algorithms detect deceleration, braking, or both to time and switch the system for optimum regeneration

Vehicle Design In Features

- No additional batteries required
- Two battery banks instead of one
- Minimal impact on weight or volume to vehicle
- Adaptable configuration requirements for the two banks
- The dynamic switching control box, no proprietary componentry and limited space requirements
- Can connect to the battery banks and regenerative brake system from anywhere in the vehicle architecture
- Underlying algorithms incorporated into the vehicle software
- Utilizes vehicle braking regeneration motors / hardware
- Algorithms incorporated into the vehicle software

End User Benefits

More Miles or Routes per Charge

- Increases vehicle range or battery efficiency in excess of 20%

Lowers Total Cost of Ownership

- Improved thermal management and reduced battery stress improve vehicle performance and extend battery useful life
- Total charging costs reduced with range improvement and adaptive energy regeneration technology
- Reduced voltage variability provides a more constant voltage output and greater efficiency
- Competitive “sticker” pricing: Reduced thermal management componentry lowers manufacturing cost



MARKET DYNAMIC

Global Push to Accelerate Adoption of Electric Vehicles...

Supportive Regulatory Environment



13 countries & 31 cities/regions to phase out all ICE vehicle sales between 2030 and 2040



California to require 100% of sales of all new passenger / light-duty vehicles to be electric by 2035 and medium/heavyduty trucks by 2045



Target for New energy vehicles to account for 15%-25% of car population by 2025



British Columbia to require 10% of sales of all new passenger and light trucks by to be electric by 2025 and 100% by 2040



MARKET DYNAMIC

Global Push to Accelerate Adoption of Electric Vehicles...

Advancing Consumer Demand



20% of Canadian fleet to convert by 2022 & 100% by 2028. Entire global fleet to zero-emission by 2040.



Committed to converting fleet of 45K vehicles



Purchase order of 100K electric vehicles



All electric final-mile delivery partners by 2025



To convert entire customer fleet of 1.8M vehicles by 2030



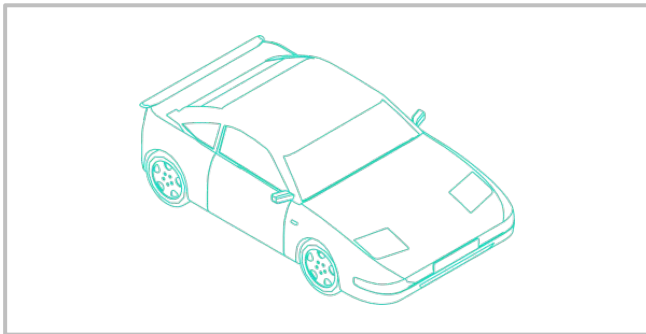
To convert entire customer fleet of 1.5M vehicles (20% of total fleet) by 2030



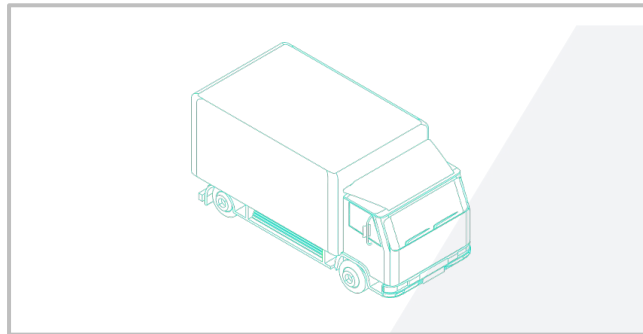
MARKET DYNAMIC

Global Push to Accelerate Adoption of Electric Vehicles...

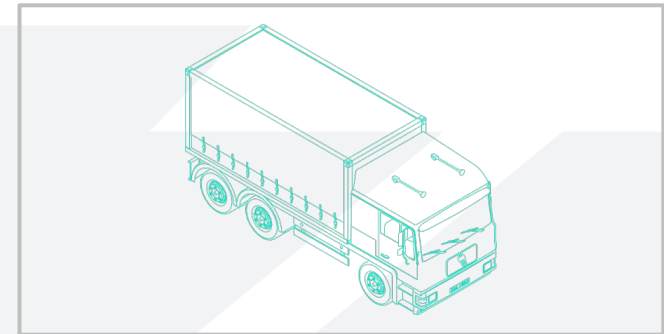
Expected Global BEV Adoption



Passenger 58% by 2040



Medium-Duty 31% by 2040



Heavy-Duty 19% by 2040



Market Dynamic

But Performance and Cost Gaps Remain

Automotive Powertrain Technology Comparison²

	ICE	(M)HEV	PHEV	BEV	FCEV
Range	Excellent	Excellent	Excellent	Moderate	Good
Acceleration	Good	Good	Excellent	Excellent	Excellent
Top Speed	Excellent	Excellent	Good	Moderate	Moderate
TCO Today	Excellent	Excellent	Good	Moderate	Challenged
Price Today	Excellent	Good	Moderate	Challenged	Challenged

Challenged
 Excellent
 Good
 Moderate

Class 3-6 BEV Parity vs. Diesel³

	Now	2020	2025	2030
Max Freight Weight	Worse	Worse	Parity	Good
Initial Cost	Worse	Worse	Worse	Parity
Net After All Costs	Worse	Parity	Good	Good
Max Daily Range	Worse	Worse	Worse	Parity
10 Year Service Life	Parity	Good	Good	Good

Parity
 Worse
 Better

Vehicle Range⁴
 58% of surveyed consumers rank range anxiety as biggest barrier for adoption



Cost⁵
 Battery thermal management systems cost on avg. 10-20% of the cost of the battery bank.

Source: ¹BloombergNEF, ²McKinsey, ³NACFE, ⁴Volvo Survey, ⁵ICAME 2020, and other publically available sources



Market Application

Premergy's Technology is Configurable with Any Battery Electric Vehicle

Adaptable Features

- 1 No standardized design-in and placement requirements
- 2 Minimal Material Weight or Space Requirement, Control Box Consisting of Off the Shelf Componentry
- 3 Minimal Rewriting of Software to Incorporate Algorithms into Existing Vehicle Software
- 4 No Additional Batteries, just Different Battery Chemistry

Shared Value Proposition

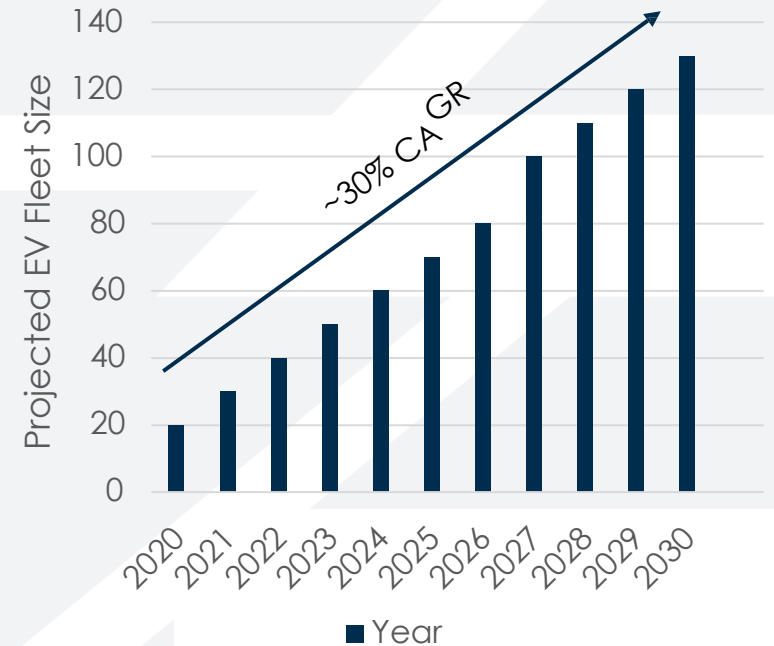
- 1 Cost Effective to Mass Produce
- 2 Addresses Two Important Marketplace Hurdles (Range and Thermal Stress)
- 3 Drives Down Total Cost of Vehicle Ownership

Across Entire EV Spectrum



Massive Addressable Marketplace

(in Millions of Units)



CORE INTELLECTUAL PROPERTY PORTFOLIO

Patent Number	Year Granted	System	Description	Market Application
US 10,661,679	2020	Multiple Battery Chemistry System	Plurality of batteries (2 batteries in the prototype), each with separate chemistries to impart motion to one or more wheels of the electric drive system as determined by one or more controllers to cause the drive motor to charge or discharge the first or second battery	Automotive
US 16/851,388	2020	Multiple Battery Chemistry System	Continuation of above patent. Plurality of batteries (2 batteries in the prototype), each with separate chemistries to impart motion to one or more wheels of the electric drive system as determined by one or more controllers to cause the drive motor to charge or discharge the first or second battery	Automotive
PCT/US2019/058 031	Pending ¹	Multiple Battery Chemistry System	Continuation of US 10,661,679. Plurality of batteries (2 batteries in the prototype), each with separate chemistries to impart motion to one or more wheels of the electric drive system as determined by one or more controllers to cause the drive motor to charge or discharge the first or second battery	Automotive
US 10,236,802	2019	Adaptive Energy Regeneration	Method, controlled by one or more computer processors, recognizing the braking system is being applied and therefore determining the best method of regenerating power through the brakes	Automotive
US 10,673,257	2020	Adaptive Energy Regeneration	Method by which the battery system effectively chooses which battery to charge and which to discharge during the deceleration and braking processes	Automotive
US 16/851,295	2017	Adaptive Energy Regeneration	Continuation of above patent. Method for monitoring and controlling impedance between batteries	Automotive and Homopolar Generators



CORE INTELLECTUAL PROPERTY PORTFOLIO (CONT'D)

Patent Number	Year Granted	System	Description	Market Application
US 16/281,583	Pending	Adaptive Energy Regeneration	Method, controlled by one or more computer processors, recognizing the electric vehicle is decelerating therefore determining the best method of regenerating power through the deceleration	Automotive
PCT/US2019/015 105	2020	Adaptive Energy Regeneration	Method, controlled by one or more computer processors, that the electric vehicle is decelerating or using the braking system (or combination of both) therefore determining the best method of regenerating power through the deceleration, braking method, or combination of deceleration and braking	Automotive
US 10,017,056	2018	Battery System Control	An electric vehicle comprising at least one drive motor, a plurality of battery chemistries configured to power at least one drive motor, and a homopolar generator electronically coupled to with solid state relays charging of the plural batteries	Automotive and Power Generation
US 9,809,123	2017	Battery System Control	A method that monitors and determines which battery will be discharged and which battery will be charged given the demands needed for the immediate use of operation	Automotive and Power Generation
PCT/US2018/017 176	Pending	Battery System Control	A system for dynamic control of electrical circuit configurations, in parallel, for the system comprising the plural batteries and the plural battery switches	Automotive and Mobile Device Batteries



OTHER SECURED PATENTS

Patent Number	Year Granted	Description	Market Application
US 10,749,354	2020	Relates generally to solar panel systems, and more particularly to intelligent circuit control for solar panel systems	Solar
US 16/928,547	Pending	Continuation of above patent. Relates generally to solar panel systems, and more particularly to intelligent circuit control for solar panel systems	Solar
US 9,800,719	2017	Smart charging method, controlled by processors, of using dual batteries to charge the mobile device faster and more efficiently	Mobile Device Batteries
US 10,142,460	2018	Smart switching method, controlled by processors, of using dual batteries to charge the mobile device faster and more efficiently	Mobile Device Batteries
US 8,164,228	2012	Method for converting rotational kinetic energy to electrical energy for charging one or more battery cells	Homopolar Generators
US 8,581,559	2013	Apparatus utilized to convert rotational kinetic energy to electrical energy through a magnetic flux field	Homopolar Generators
US 9,073,440	2013	Method for inducing current on an electrically conductive surface for charging one or more battery cells utilizing apparatus	Homopolar Generators
US 9,893,597	2015	Method for charging one or more cells of a rechargeable battery using a charging method comprising homopolar generator	Homopolar Generators
US 9,553,463	2018	Relates to battery charging, and in particular, to a homopolar electrical generator for a rechargeable battery	Homopolar Generators



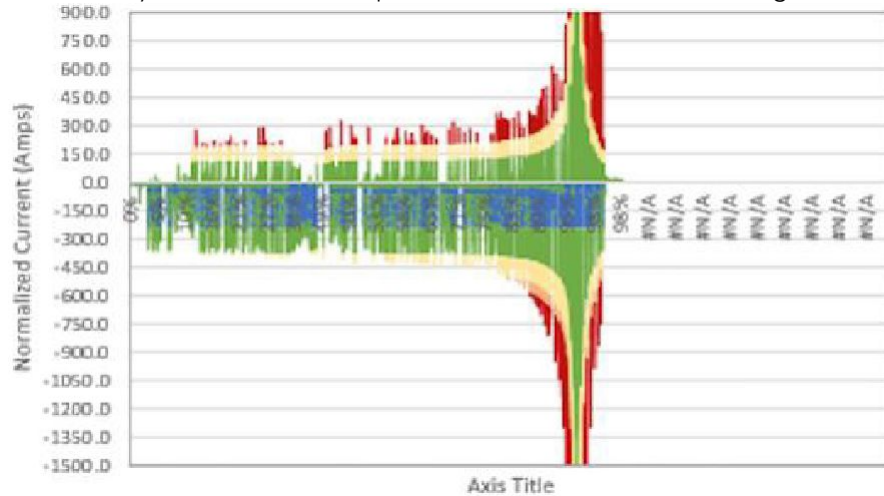
III. Patent and Technology Overview



MULTI CHEMISTRY BATTERY SYSTEM

How it Works

1. The initial battery bank is removed and replaced with multiple battery banks that have distinct chemistries, resulting in minimal added weight
2. These distinct chemistries have distinct functions: in the GTE prototype, one battery bank is used for cruise power and the other is used for surge power
3. As load increases on the batteries, additional energy is drawn from the second battery bank as needed
4. The switching of the batteries and the determination of which battery is charged and which is discharged is controlled by the Battery Control System which makes the determination based on operational conditions
5. With the reduced voltage variability, neither battery is excessively stressed, the batteries stay cool, and the multiple batteries deliver increased range

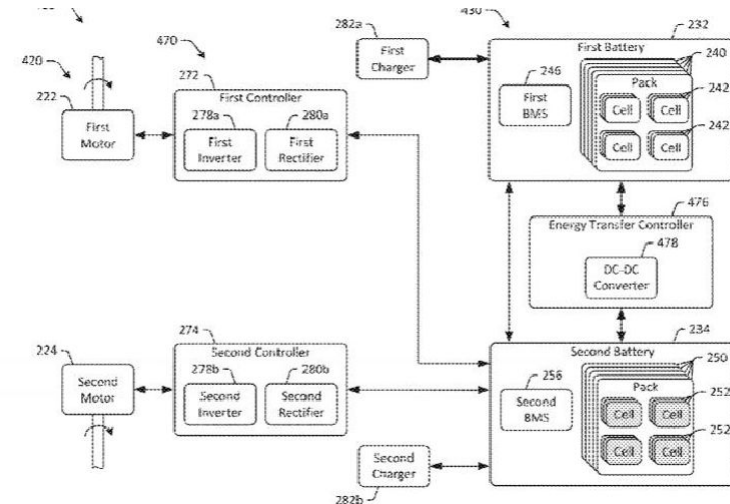


The multi chemistry battery system utilizes multiple batteries to reduce the wear and tear seen on the current one-battery electric vehicles today. Utilizing plural battery chemistries allows for there to be a more efficient transfer of energy to the drive system increasing range and mitigating thermal stress.

Patent Summary

■ US 10,661,679

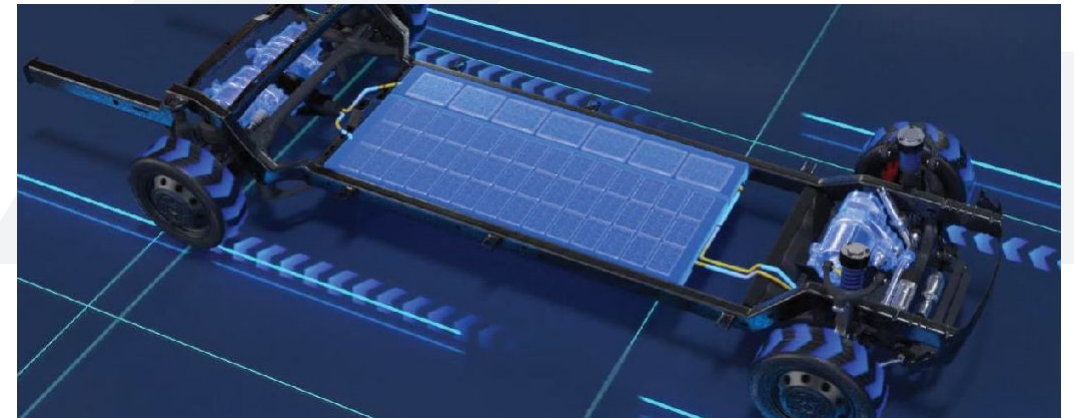
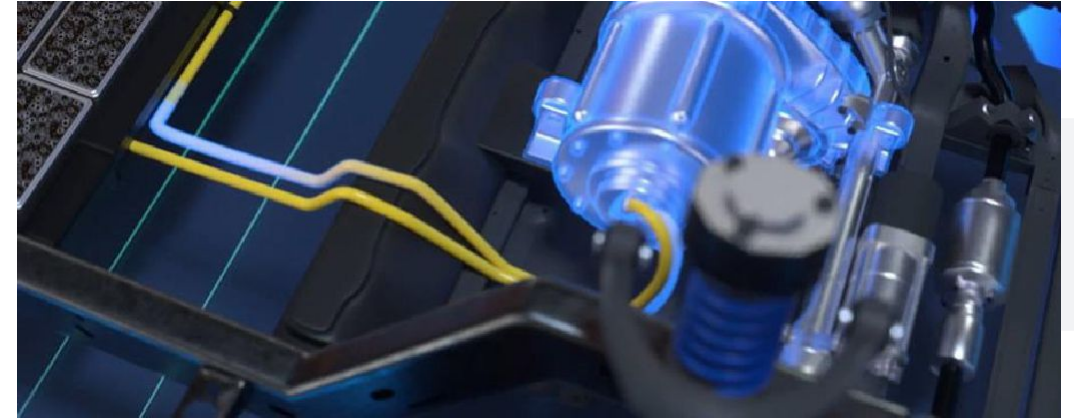
§ Plurality of batteries (multi chemistry battery bank), each with separate chemistries to impart motion to one or more wheels of the electric drive system as determined by one or more controls that then charge or discharge the first or second battery bank based on operating conditions



ADAPTIVE ENERGY REGENERATION

How it Works

1. The adaptive energy regeneration system utilizes existing vehicle braking regeneration hardware and is comprised of unique algorithms imbedded in the vehicle software to coordinate the methods to control/use the regenerative braking hardware
2. The system detects and determines when the vehicle is decelerating or braking (or both) and coordinates with the electric motor to change its function into a generator
3. The system then directs charge generated to one or both of the battery banks as determined by the Battery Control System
4. The precise algorithms governing this process, coupled with the multiple battery chemistry, are able to achieve high levels of regeneration efficiently at speeds at or below 5 mph
5. The efficiency of this system also provides ancillary benefits of reducing wear and tear on braking system

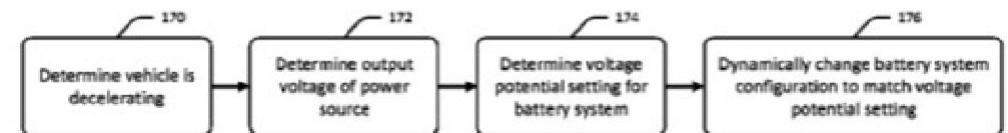
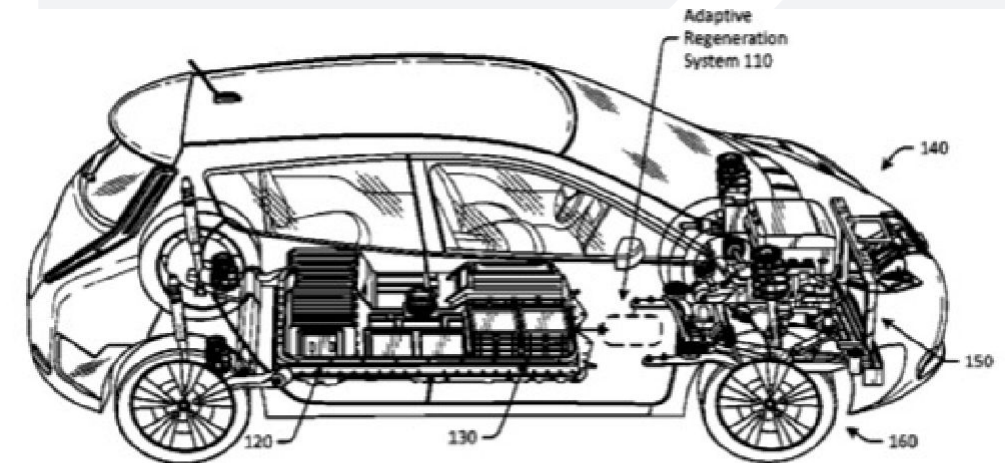


ADAPTIVE ENERGY REGENERATION

Patent Summary

- **US 10,236,802**
 - A computerized method to recognize when the braking system is being applied and determining the best method of regenerating power through the brakes
- **US 10,673,257**
 - A method where the battery system effectively switches, monitors, and times which battery to charge and which to discharge during the deceleration and braking processes
- **US 16/281,583**
 - A computerized method to recognize when the electric vehicle is decelerating therefore determining the best method of regenerating power through the deceleration
- **PCT/US2019/015105**
 - A computerized method to recognize that the electric vehicle is either decelerating or using the braking system (or combination of both) and determining the best method of regenerating power through the deceleration, braking method, or combination of deceleration and braking

The adaptive energy regeneration system generates power to recharge the vehicle's plural battery system, determining which battery to allocate the charge, and is efficient enough to effectively charge with speeds at or below 5 mph.

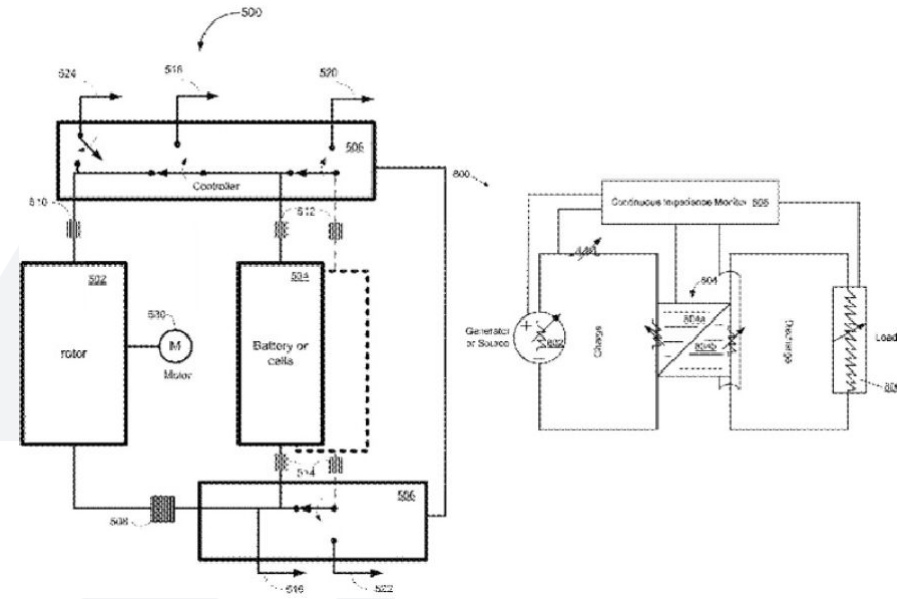


BATTERY CONTROL SYSTEM

Patent Summary

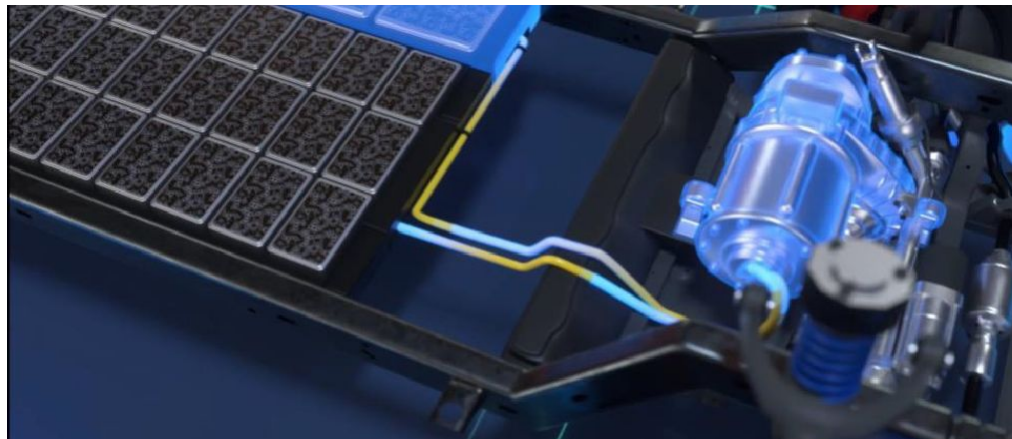
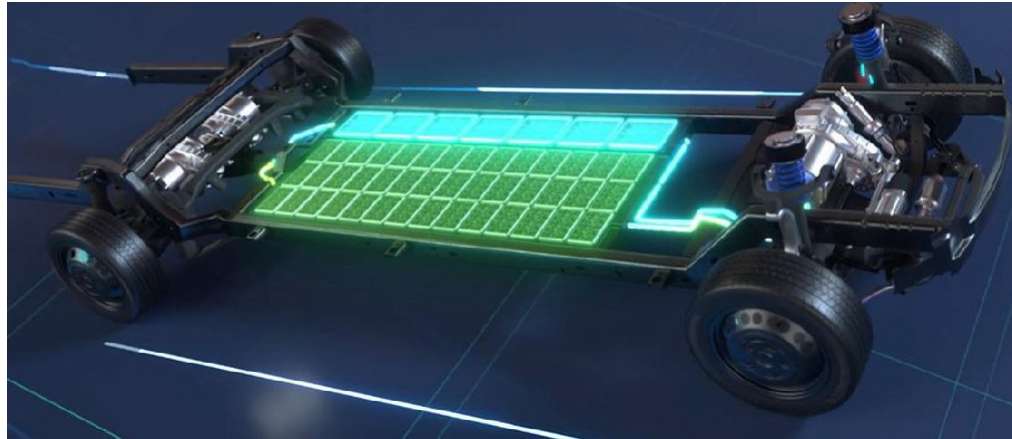
- **US 10,017,056**
 - An electric vehicle comprising at least one drive motor, a plurality of battery chemistries configured to power at least one drive motor, and a homopolar generator electronically coupled to with solid state relays charging of the plural batteries
- **US 9,809,123**
 - A computerized method that monitors and determines which battery will be discharged and which battery will be charged given the demands needed for the immediate use of operation
- **US 10,673,257**
 - A method where the battery system effectively switches, monitors, and times which battery to charge and which to discharge during the deceleration and braking processes
- **PCT/US2018/017176**
 - A system for dynamic control of electrical circuit configurations, in parallel, for the system comprising the plural batteries and the plural battery switches

The battery control system creates the framework through which improved efficiency is achieved. It is the brain of the Premergy system, and times, switches, and links the batteries together to determine which battery bank to charge or discharge in a specific operating mode.



BATTERY CONTROL SYSTEM IN ACTION

Battery Control System (BCS) Switching and Managing Multi Chemistry Batteries at Various Modes of Vehicle Operation



Multiple Battery System

Battery Control System (BCS)

Two battery banks, each with unique chemistries, however, minimal weight or volume is added as the number of required batteries does not increase

Premergy GTE prototype utilizes LTO batteries, other chemistry batteries will also work and be covered under the same patents at potentially cheaper costs to achieve similar results

As load increases the BCS coordinates and switches the drive motor to draw from second battery based on operational need

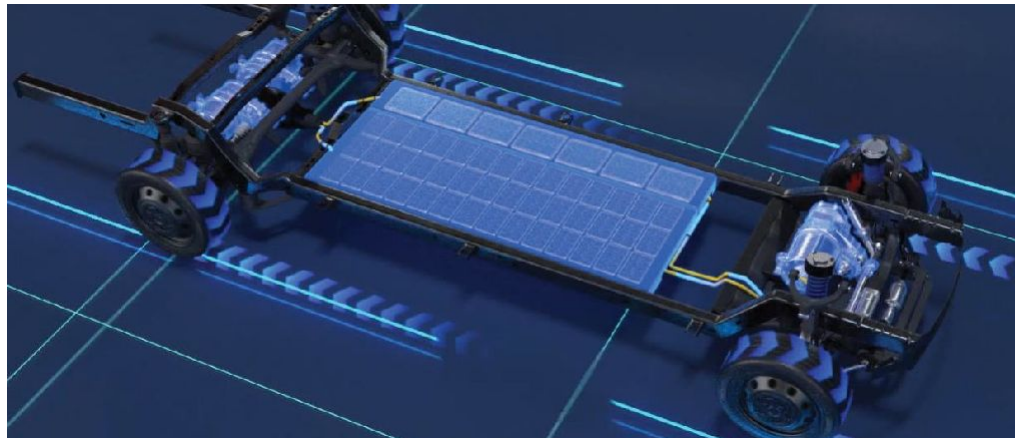
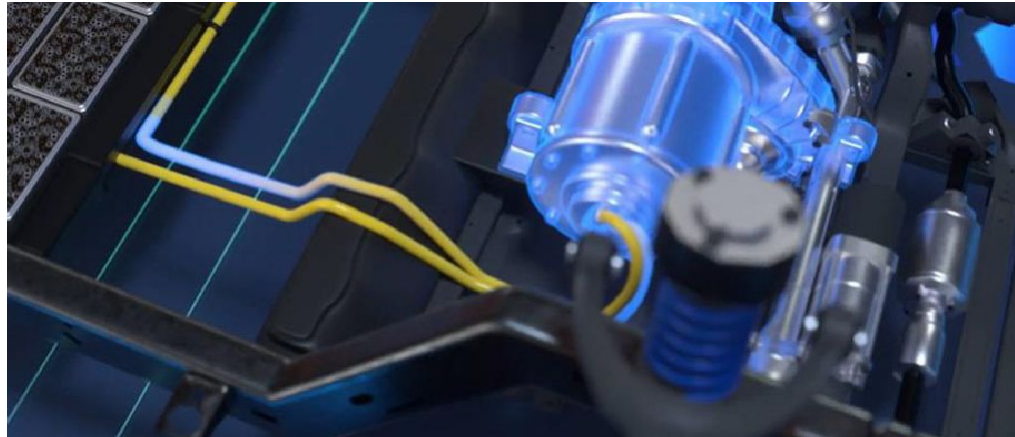
Operational need is determined by the BCS which discharges the correct battery bank for surge power, cruise power, or both

BCS algorithmic controls are efficient and reduce the wear and tear on batteries, extend range, and keep the batteries cool



BATTERY CONTROL SYSTEM IN ACTION (CONT'D)

Battery Control System (BCS) Managing and Directing Energy Regeneration



Battery Control System (BCS)

Adaptive Energy Regeneration

Utilizing the existing regeneration hardware, the method of adaptive energy regeneration uses unique software and algorithms to achieve better efficiency

The algorithms detect if the vehicle is decelerating, braking, or both and apply an improved method of regeneration

The BCS comes into play when deceleration begins regenerating power, coordinating and directing the regenerative power to one or both battery banks

While in regen the system can determine, based on several factors, how much and where to send a percentage of power between (in the GTE case) two chemistries. In one mode this happens automatically due to the difference in internal resistance of the two chemistries. Current will always flow to and from the lower of the two resistances at a higher rate

BCS links the multi chemistry batteries and adaptive regeneration to achieve higher levels of regeneration at speeds at or below 5 mph



CONTROL ALGORITHMS

Supervisory Controller

- Coordinates all operations between each sub-system controller
- Maps driver inputs to torque requests for the vehicle
- Responsible for commanding vehicle drive mode and switchbox configuration

Switching Controller

- Communicates switching status with other sub-systems
- Responsible for sequencing switch operations to maintain constant power to the wheels
- Controls pre-charge timing and durations to prevent current inrush

Drive Mode Controller

- Generates torque requests for each motor controller
- Each drive mode has a unique control algorithm for splitting power between motors
- Monitors Battery conditions to control energy into and out of the system



- Premergv algorithms are designed to be fluid and highly adaptable to testing requirements and conditions. Given their high degree of flexibility they are not yet fully optimized
- Algorithms bridge the gap between manual test setup and autonomous control of vehicle modes and operation
- The multi chemistry and dynamic switching systems are highly suited for optimization by incorporating an Artificial Intelligence control node to oversee and optimize power consumption and regeneration



IV. Prototype, Development, Testing, and Validation

IN-HOUSE DESIGNED AND DEVELOPED PROTOTYPE

The Premergy team built the GTE prototype utilizing a performance race chassis with inhouse, proprietary, technology subsystems designed and integrated to support a fully operational electric drive system



Adaptive Energy Regeneration



Battery System Control

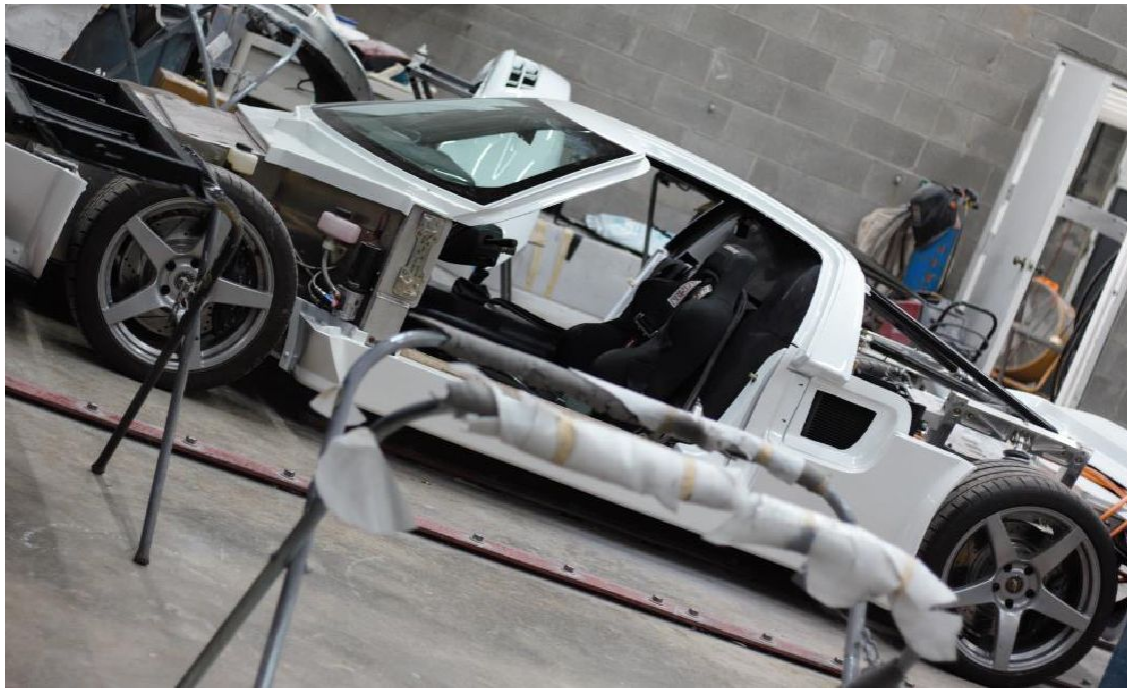


Multiple Chemistry Battery Systems



IN-HOUSE DESIGNED AND DEVELOPED PROTOTYPE

System Build of Materials



Item	No. of Items	Retail Cost Each	Total
2.3v LTO Batteries	144	25	\$ 3,600.00
Relays	7	35	\$ 245.00
Contactors	7	125	\$ 875.00
Copper buss			\$150.00
Enclosure			\$ 85.00
Control board			\$ 35.00
Resistors			\$ 600.00
			\$ 5,590.00
Less Items Replaced			
Tesla Battery Packs	3	1200	\$ {3,600.00}
Total Net Cost			\$ 1,990.00



TESTING

Rigorous Testing Environment to Refine the Technology and Validate Performance



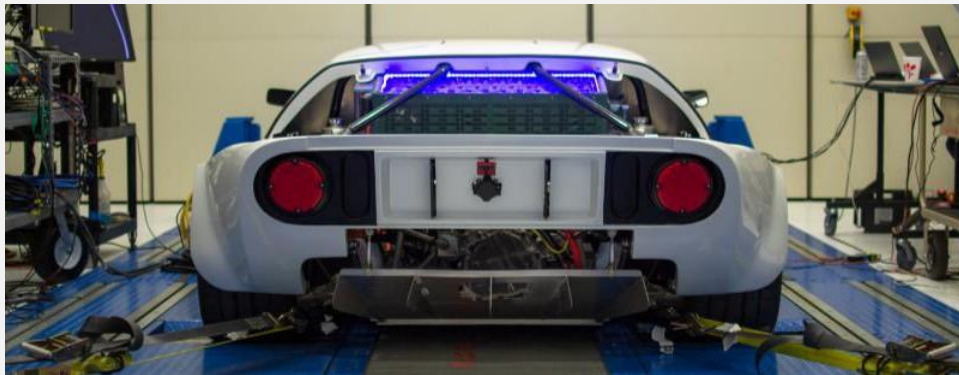
TRACK TESTING

- Atlanta Motorsports Park
- 700+ miles driven on track
- 2+ years on track
- Consistently has delivered results proving extended range
- Thermal management system in vehicle designed to activate once certain thermal load has been reached
 - System has never been activated



TESTING

Rigorous Testing Environment to Refine the Technology and Validate Performance



DYNAMOMETER TESTING

- 100+ hours driven on dynamometer at Clemson University International Center for Automotive Research
- Third party verified in dynamometer testing then proof-tested on track to check findings against real world

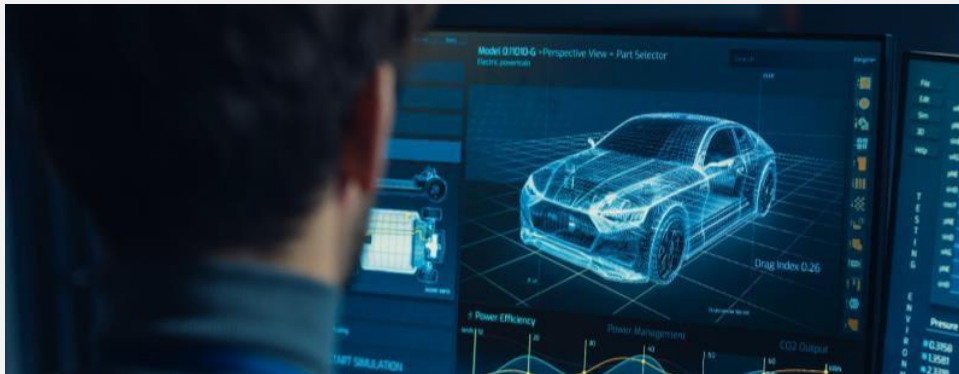


TESTING

Rigorous Testing Environment to Refine the Technology and Validate Performance

COMPREHENSIVE SIMULATION SOFTWARE

- Proprietary in-house software used to give a baseline prior to testing • Highly correlated with true results
- 89 variables to test different stressors (weight, speed, etc.)
- 2+ years of development

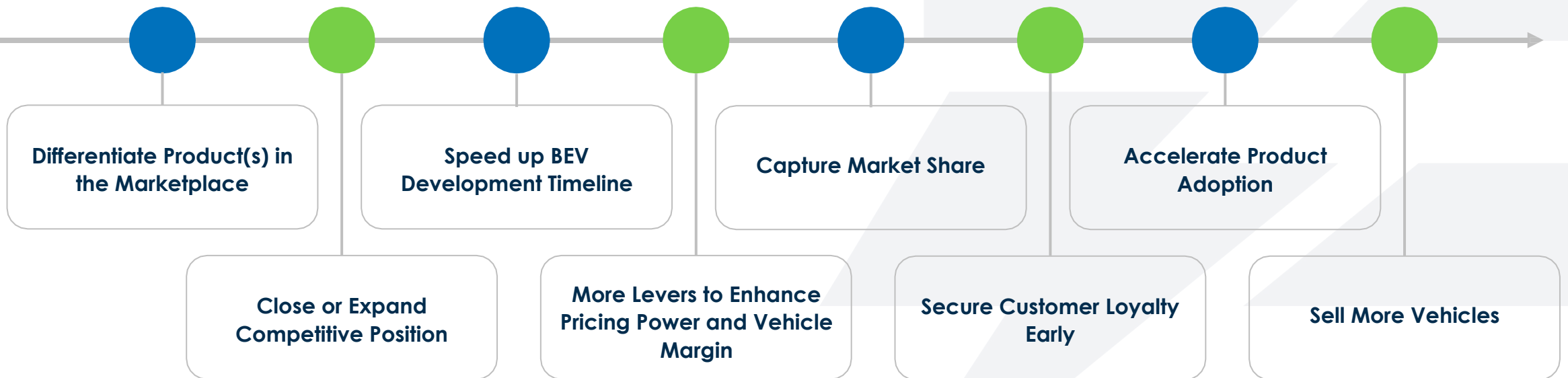


V. Opportunity Spectrum



OPPORTUNITY SPECTRUM - OEMs

Multiple Ways for Existing and Emerging OEMs to Win with Premergy Technology



OPPORTUNITY SPECTRUM – SUPPLIERS

Multiple Ways for Suppliers and Vehicle Technology Companies to Win with Premergy Technology

