**Project Proposal:** **Performance Variant of Chevrolet Volt Powertrain**

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**Project Initiative and Scope:**

The current Chevrolet Volt powertrain is optimized for maximum EV range and charge sustaining fuel economy. A proposed performance variant of the powertrain will be studied to determine the tradeoffs between range, fuel economy, top speed, and acceleration. The proposed modification would be suitable for a luxury performance vehicle or an autobahn capable vehicle for the European market.

**Project Tasks:**

In the current Volt architecture, the maximum vehicle speed is limited by the maximum drive motor speed, which is dependent upon the ratio configuration of the planetary gear set in the drive unit. Modification of the drive motor to achieve higher power and speed plus a change of the planetary ratio to allow for more top speed capability will be studied. The maximum power available in charge depletion mode is a function of battery power limits and drive motor capability. Maximum power in charge sustaining mode is a function of battery power limits, drive motor capability, and the available power from the ICE and generator in the drive unit. An increase in ICE power is only usable by the system if a coordinated increase in the generator capability is made. The current control strategy attempts to minimize the performance variation between charge depleting and charge sustaining modes. Utilization of the increased system power will be enabled by creating a Sport mode where the vehicle will enter charge sustaining mode on demand regardless of battery SOC to enable the ICE/generator output to be fed to the drive motor based on both mode selection and driver torque request.

A summary of the proposed changes appears below.

* **Drive Motor:** Increased power capability and higher maximum speed rating
* **Drive unit planetary ratio:** ratio change to allow higher vehicle speed
* **Battery:** because the battery is the largest and most expensive system on the vehicle no proposed changes will be made. If time allows, an investigation into modifying SOC limitations to realize any potential performance gains can be reviewed.
* **Internal combustion engine:** replacement of the 73kW LUU 1.4L engine with the 104kW 1.4L Turbocharged engine.
* **Generator:** Increased power capability and higher maximum speed rating coordinated with the ICE changes.
* **Control Strategy:** No proposed changes to basic Normal mode charge depletion strategy. No proposed changes to basic normal mode charge sustaining strategy. Proposed Sport mode that allows the ICE/generator to supplement battery power regardless of battery SOC.

**Project Approach:**

The project will be conducted by building an adequate simulation model of the existing Volt powertrain to achieve a reasonable approximation of current performance and fuel economy on various test cycles. The proposed modifications to the system will be studied incrementally and an optimized configuration will be recommended with full analysis and disclosure of the tradeoffs between range, fuel economy, and performance.

**Deliverables:**

A completed project will include the following:

* MATLAB/Simulink models simulating a close approximation of the current Volt setup
* MATLAB/Simulink models of the improved drive motor, drive unit, ICE, and generator
* Analysis and optimization of improved components with the ability to swap components for additional analysis, if applicable
* Drive Cycle Data (FTP, US06, SC03) for different variations of proposed powertrains
* Analysis of range and performance data
* Recommendations for modifications to the Volt powertrain and when they may apply

**Time Tables:**

Week 1   2/11---2/17 Basic model preparation for Volt powertrain study  
Week 2   2/18---2/24 Model assembling: Transmission and motor modeling work  
Week 3   2/25---3/3 Model assembling: Battery and engine modeling work  
Week 4   3/4---3/10 Volt model validation such as: running through drive cycles  
Week 5   3/11---3/17  Motor modification, Drive unit planetary change and impact analysis.   
Week 6   3/18---3/25 ICE change, Generator change and impact analysis.  
Week 7   3/25---3/31  Validation of modified Volt model and optimization strategy  
Week 8   4/1---4/7      Optimization & trade-off analysis  
Week 9   4/8---4/14    Optimization analysis and conclusion  
Week 10 4/15---4/21   Presentation and reports  
Week 11 4/22---4/28 Final presentation.

**References:**

To be determined.

**Disclaimer:** This proposal has no relevance to the Cadillac ELR project which has been publically and correctly described as a carryover Volt powertrain.