Integrated Hydrogen Microgrid

Project Objectives and Benefits

Hydrogen is an area that may provide customers with benefits as renewable penetration increases and technology improvements occur. Using a process known as electrolysis, energy providers can create hydrogen using electrical energy and water. The hydrogen created from this process can be utilized for many purposes. For electricity production, hydrogen fuel can offset or eliminate natural gas while reducing carbon emissions. Hydrogen can also be utilized in Distributed Energy Resources ("DER") applications, as a transportation fuel, or even in certain industrial processes. Through stored hydrogen, these energy end uses could be decarbonized, providing additional low-carbon energy to energy users throughout Georgia.

To prepare for this possibility, Southern Company Services ("SCS") and Georgia Power Company ("Georgia Power" or the "Company") are partnering with key stakeholders to develop an integrated hydrogen microgrid. This project seeks to create hydrogen from an electrolysis system utilizing grid energy. The hydrogen produced will then be utilized in a fuel cell microgrid application as well as for a transportation fuel. The fuel cell component will create electricity that can be utilized to charge electric vehicles, provide backup power, or provide peaking services.

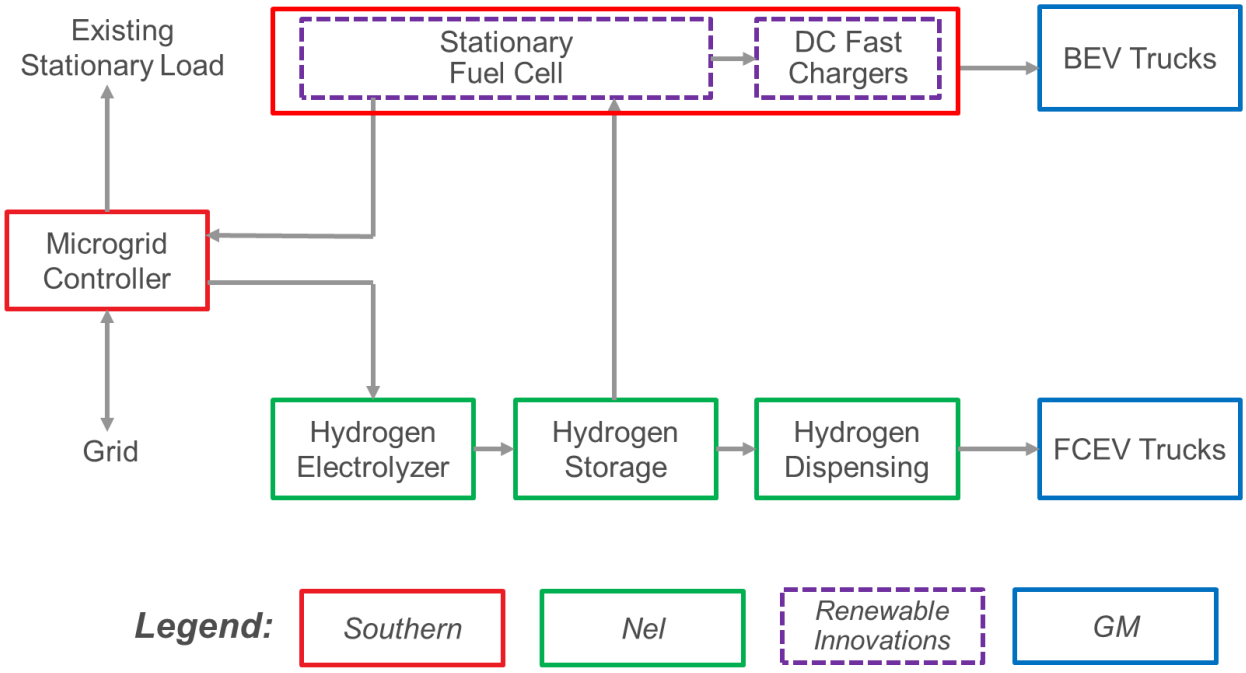
This project will include three hydrogen fuel cell Class 4-6 trucks and three battery electric Class 4-6 trucks. It will seek to demonstrate a path toward economically viable charging and refueling infrastructure that also supports resilient stationary energy via distributed resources. The utility industry, including the Company, relies extensively on Class 4-6 trucks for a variety of applications. Currently, zero-emission vehicles are not available for these applications. One goal of this project is to accelerate the vehicle development through federal funding[1] and collaboration between General Motors ("GM"), Southern Company Services, Nel Hydrogen, and Renewable Innovations. The second goal of this project is to demonstrate the flexible nature of stored energy via hydrogen for both vehicles and stationary power loads. Additionally, this project aims to provide insight into system-level impacts of hydrogen microgrids, including benefits and costs of grid impacts, demonstrating scalable energy storage, and reducing the need for peaking generation.

[1] Super Truck 3 – DOE Proposal Awarded - https://www.energy.gov/articles/doe-announces-nearly-200-million-reduce-emissions-cars-and-trucks

Specific objectives include:

- Demonstrate system benefits to grid and create value through use-case stacking:
  - Electrolyzer and fuel cell as dispatchable loads
  - Fuel cell for peak shaving
  - Fuel cell for back-up power
- Develop path toward deployment of energy storage systems
- Design and demonstrate zero-emission vehicles for utility applications
- Illustrate Green House Gas ("GHG") emissions reductions
- Demonstrate microgrid and zero-emission vehicle integration for customers

Figure 1: Hydrogen microgrid energy system



Project Description

The final selection of a site and vehicles is an early task of the project. When reviewing the selection criteria, consideration should be taken for a site that offers both refueling and recharging availability for the selected vehicles as well as being able to provide stationary power needs. Hydrogen will be produced (approximately 160 kg/day) at the site using 400 kW electrolyzer, primarily energized by the grid but possibly supplemented with on-site photovoltaic ("PV") solar. Up to 2400 kg of produced hydrogen would be stored as a compressed gas and would either be directly dispensed into hydrogen vehicles or converted to power through a ~1 MW fuel cell. The fuel cell would support fast charging, which would not impact the local power distribution system allowing it to still provide resilient power to the site when needed. Hydrogen energy configured in this way is an extremely flexible resource - providing up to 48 MWh of stationary power (for resiliency or fast-charging), charging approximately 40 vehicles, or any combination of these uses. Combined with the easily interruptible nature of the power demanded by electrolysis, this microgrid provides flexible resources for both stationary and transportation needs with minimal impacts to the broader distribution grid.

Project Administration

Federal funding for this project will come from the U.S. Department of Energy ("DOE") through the Vehicle Technologies Office, which administers projects under the SuperTruck 3 funding program. Projects were competitively selected and are structured as cooperative Research & Development agreements between DOE and Prime Contractors, which then have subrecipient agreements with other Team Members. DOE contracts with the Prime Contractor and then the subrecipient agreements are negotiated and executed for each of five budget periods ("BP") of the overall five-year project, contingent upon meeting designated "go/no-go" milestone(s) by the end of the previous BP. In this case, GM is the Prime Contractor, which will have a subrecipient agreement with SCS. Other proposed subrecipients include Nel Hydrogen U.S., Renewable Innovations, and the Electric Power Research Institute (EPRI).

The overall project is nearly $65 million and leverages significant additional investment by GM in vehicle development and deployment. **GM** will provide vehicles, support for fuel cell and battery propulsion systems and vehicle integration, and coordinate with Argonne analytics on hydrogen powered vehicle adoption, total cost of vehicle ownership and operation, and GHG reductions. **Nel Hydrogen** will develop the design and scalable manufacturing of the electrolyzer and provide an electrolysis system, hydrogen storage and dispenser systems, and associated communications systems. **The Company** will provide the host site, operate the vehicles, and evaluate the value proposition of the infrastructure and microgrid

(including any on-site PV). The Company's scope totals nearly $10 million, and the yearly cost breakdowns are shown in Table 1. **Renewable Innovations** will provide the stationary fuel cell and fast chargers under contract with SCS.

Table 1. Costs per budget period for SCS scope. BP5 (2026) is for convenience of DOE/GM and does not add any project costs to SCS scope.

Year	2022	2023	2024	2025
Federal Cost Share ($)	265,915	237,967	2,289,944	392,693
GPC/SCS Cost Share ($)	515,958	461,730	4,442,975	761,424