1. Building Electrification Vehicle

- The project purpose is to show electrification in residential and commercial buildings through a demonstration vehicle.
- This vehicle will implement: 2 heat pumps, water heater, and dashboards that will all be powered using electricity.
- We have implemented a solar panel system on the roof of the vehicle to recharge the batteries.
- By building a demonstration electrification vehicle we will be able to show the feasibility of electrification that can be scaled up for commercial and residential buildings.
- About 80% of the direct fossil fuel CO2 emissions come from residential and commercial sector (epa.gov).

2. Simulation and Data

- We simulated the circuit on MATLAB/Simulink, and got results, which we compared with the Home assistant data.
- Fig. 2.1 shows the circuit diagram for the system, Fig. 2.2 depicts the graph resulting from the simulation.

3. 3D Sketch and One Line Diagrams

- The batteries are connected to switches, which can control how many batteries we need at that particular time.
- Below is a drawing of the power distribution among loads, to show how the transfer switch is implemented into our system.
- Fig 3.3 shows the payload and their placement in the electric truck (K270E).
- The body size is 18’ x 8’6” x 8’6” (l x w x h).

4. Vehicle Features

- 2 Heat pumps (window unit & mini split)
- Induction stove
- Sink and faucet
- Water heater
- 2 Water Storage Tanks
- Smart light bulbs
- Smart breakers and Panel
- Transfer switch and Plug
- 4 Batteries (12V 200Ah)
- 10,000W Inverter
- Display for dashboard

5. Operating System and Sensors

- One of the goal for this project is to create an interactive dashboard for users to monitor the total energy consumption, energy production by solar panels, battery level and temperature.
- Dashboard also serves as a control panel to turn on/off the appliances.
- Home Assistant (HA) is a open source home automation system that we use as our operating system.
- Sensors include: Temperature, humidity, current sensor.
- A smart breaker panel system is used which reads in the power consumption of each appliance and send data via WIFI.

6. Energy Calculations

- Energy calculations done for the whole system based on the spec sheet provided for each appliance on their website.
- Power consumed calculated is for an entire day, with each appliance turning on at different points in time.
- Different scenarios taken into consideration, with different appliances operating for variable duration.

- Figure 4.1: Components table with energy specifications.

6. Future Work

- Further improvements to electrical drawings.
- Finish implementing the circuit breaker system to demo.
- Start planning the building process of the vehicle itself and the components inside.
- Hand it over to a contractor.