

Decarbonization of Student Transportation via Electric School Buse Transition



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New York State has mandated that School Districts fully transition to emission free transportation by 2035 starting in 2027 with the purchase of new School Buses

- 731 School Districts and 4,411 Public Schools that range from Urban to Rural with approximately 50,000 Gas and Diesel Buses
- School Districts, especially those that insource transportation, have apprehension on how to proceed
 1. Battery range anxiety
 2. Cost of the utility/charging infrastructure and the Electric School buses
 3. Evaluation of transitioning to outsourcing, finding a partner and contract for services, or staying with insourced Transportation
- They also want to understand the benefits that transitioning to Electric School Buses can bring



Create a project to build a Transition Model, developed by High School Students, that would examine the areas of anxiety and the benefits for a variety of scenarios.

- Have the key stakeholders, Students, participate in the development of an analytical model that addresses the anxieties expressed by Transportation Directors and Superintendents.
- Examine various scenarios to understand the sensitivity of the analysis and paths that School Districts could go down.
- Request School District data to personalize the analysis to each School District
- Have the Students present the finding to School Boards as the final work product
- Gives students an accomplishment on an external project for college applications and a source for a letter of recommendation.



Invite High School Students from local School Districts, to remotely collaborate in monthly meetings using a division of work efforts to build a spreadsheet model.

- 10 Students from 5 School Districts (1 City, 3 Suburban, and 1 Rural) join the Project
- Monthly web conferences were held to report progress and separate working meetings as needed
- Google Sheets was selected as no license was required and all students had access.
- Students wrote to Superintendents explaining the project, requesting data, and planning to deliver the analysis.



- School District Inputs:
 - Basic Info and Demographics
 - Locations
 - Current Fleet
 - Current Routes
- Reference Data
 - ESB Survey from World Resource Institute
 - Emission Factors from US EPA
 - Gas/Diesel Prices from US EIA
- Four Scenarios with graphics on Units, Cost, GHG Emissions, Savings on Fuel, and Route Risk
 - Like for Like Early Adoption
 - Like for Like Late Adoption
 - Route Based Early Adoption
 - Route Based Late Adoption

A quick tour of the Transition Model.....



It's not as slick as En-Roads....

- Only focuses on the Buses and is silent on Bus Depot Infrastructure cost
- Cost Savings and GHG Emissions from Gas/Diesel reduction not netted for increase in Electric Use
- ESB Survey data is static
- Distribution and control is a problem for any spreadsheet model



Adrienne S, Walkill Senior High School

I was tasked with gaining information about Walkill's school district and its bus fleet

- There were many difficulties with obtaining this data. The only data available publicly was demographics and some route based data. Although we knew the roads that each route would visit and the duration of each route, we did not know each route's mileage.
- It was difficult to get the administration to send us data so we were unable to obtain anything else. Sadly, we were not able to provide the school district with an analysis but students from other districts were able to obtain more information from their administrators.

I also worked on the ESB Survey Data as part of the larger ESB Transition model.

- It was easier to find specifications for ESB models as they are largely available online. But it was difficult to find any base price listings. We attempted to contact ESB companies but many did not get back to us. Luckily the World Resource Institute has a Price Tracker for ESBs which we were able to utilize in our model.



A spreadsheet is not worth a thousand words, but a SD model might be....

- I recognized that the spreadsheet could not give a holistic picture of the interactions of the parts and what the influences were on them.
- But I did not want to describe a quantitative model, I really wanted to give an independent story telling approach that would conform loosely to SD conventions
- My starting point was [GoJS which has an example of SD](#) written in Javascript that was within my programming abilities to modify.
- Resulting in this Storytelling System Dynamic Model.....<https://gunksecolodge.com/dev/SDESB.html>



Build it and they will come.....perhaps not

- Some may hold the perception that volunteer produced work is not credible and valuable. Credible and valuable work only comes from paid consultants.
- Data is often not shared freely as the district has concerns it will be used against them.
- More cycles of learning needed to expose exceptional conditions or logical flaws in the model.
- A list of enhancements have been identified but it is unclear if this would help in the adoption of the model. 2.0 version is uncertain, since data acquisition is a barrier...see the first bullet
- The web based Story Telling System Dynamics model, which does not follow conventions, and perhaps should be further refined
- I under estimated the challenge of working remotely, my inexperience of working with students, and that a physical meeting with the Board and Superintendent to commission the analysis is needed (email is easy to ignore)



How should the SDS advance the effort of decarbonization?