Alternative Propulsion Bus Study

Presentation Script

Hello, my name is David Verbich and I'm a senior associate with Stantec Consulting.

Stantec was retained by the right to analyze and explore alternative bus propulsion technologies and the opportunities and challenges for the ride to transition to different propulsion technologies.

Stantec has worked with transit agencies throughout North America on similar studies and developed implementation plans for transitions to 0 emission buses, also known as ZEB'S. I'm serving as project manager for the society.

In this presentation, I'll walk through some of the key points of the project and study and would encourage anyone who's interested in learning more about this to check out TheRide's website where I will switch to our presentation now.

At this point I need to point out a disclaimer that this study is preliminary in nature and make certain assumptions based on current technologies, future forecasts and understanding of technology from manufacturers. As such, the analysis and forecasts here are based on a rough order of magnitude of cost estimates and assumptions that have certain limitations, additional analysis and engineering work will be required depending on the rides, future directions and decisions.

This presentation will start with the project overview and then provides context and background. I'll provide information about the benefits and costs of transitions to 0 emission bus fleets and then spend some time describing ZEB technologies. I'll review our financial valuation of different technologies and scenarios and close with the key conclusions and next steps for the ride.

Like many public agencies throughout the United States, the rise interested in reducing its carbon footprint flag, exploring the adoption of alternative bus propulsion technologies. Currently, the ride operates a mix of clean diesel and diesel hybrid buses.

The rides Board of Directors has instructed the agency to explore alternative bus propulsion technologies as options as a way to reduce pollution.

It's important to note that the state of Michigan has no mandate to transition to 0 emission buses, and neither does the federal government. However, the federal government, through the Federal Transit Administration, has increased the amount of competitive funding available for acquiring ZEB'S to combat air pollution, particularly in historically disadvantaged neighborhoods.

The scope of this study focuses on ZEB's, meaning buses that don't produce any tailpipe emissions. While we initially also considered low emission buses, such as compressed natural gas, buses, and trolley buses, for several reasons, we excluded those and focus exclusively on ZEB's as they present the biggest promise for reducing air pollution.

So while the state has no mandate to transition to 0 emission buses, the rides, board and city of Ann Arbor are committed to combating climate change.

The AT20 plan, which was adopted by the city of Ann Arbor, is targeting net carbon neutrality by 2030 through various actions and one of those actions includes transitioning the rides fleet to 0 emission vehicles. The AT20 plan estimated that the rides fleet commits about 10,700 tons of CO2 equivalents or greenhouse gas emissions annual, which is about half a percent of the region's total emissions.

The plan also estimated that to remove one ton of GHG from the ZED from the Ann Arbor Transit fleet will cost about $5800 per ton.

Similarly, the plan also estimated that a solar program that could remove about the same amount of CO2 in the region would cost about $18.00 per ton, and this demonstrates a large cost required to transition a bustling to 0 emissions to reduce greenhouse gas emissions.

Based on Stantec analysis of the rides, operations and facilities, and modeling the potential performance of ZEB'S and their costs over time, our study estimated that about 7000 tons of GHG's are current released, but currently released by the rides.

By transitioning to ZEB's, depending on the rate of transition and the upstream emissions related to electricity and hydrogen generation, the GHG emissions can be reduced up to 50%.

Once the fleet is 100% zero emission.

Based on our estimate offsets of GHG's, there is a potential social benefit through a reduction in pollution of about $300,000 per year based on the societal cost of a ton of pollution such as relates to health impacts and other and other diseases.

Potential benefits to the ride include potential cost savings and cost avoidance for the cost of fuel using electricity or hydrogen compared to diesel fuel.

And for customers and bus operators, ZEB's offer smoother, quieter rides and also benefit the neighborhoods that these buses run through.

As mentioned earlier, one of the biggest challenges is the cost related to transition. This is due to several reasons, including the greater expense of 0 emission buses compared to traditional fossil fuel buses, as well as the related fueling infrastructure that's needed to fuel or charge a 0 emission bus.

We estimated that over 25 years, which would include the full transition to ZEB's, the ride would need to invest up to $75 million more than what it would spend to continue requiring diesel buses for comparison. That's roughly the same cost the right expects for a bus rapid transit line or a new bus garage.

And while they're funding opportunities available, they do require portion of local contributions, and these grants are competitive and therefore not guaranteed.

Also, a ZEB transition is one part of the capital needs of the ride, and therefore the ride in the community will need to have conversations about funding priorities. Those discussions are expected after this preliminary study is complete.

Now I'd like to talk briefly about the different 0 emission bus technologies.

There are two types of bus 0 emission buses and they include battery, electric buses and hydrogen fuel cell electric buses.

Battery electric buses were BB's use onboard batteries to power a motor.

These batteries are recharged through a different way, including plugs and overhead paths to group chargers. And here's an example. In some bus garages of different battery electric buses and some of their important components.

Some pros and BS include that they are generally less expensive than hydrogen buses.

They have lower maintenance costs compared to fossil fuel buses and hydrogen buses.

Battery ranges are expected to improve in the next 5 to 10 years, and because they use electricity on a per mileage basis, they are cheaper than fuel. They are cheaper to fuel than diesel buses, partly because of the volatility of diesel costs compared to the stability of electricity costs.

The ride we need to work closely with DTE, the local utility to coordinate the rollout of electrical upgrades and infrastructure.

Nonetheless, there are certain drawbacks.

Particularly related to operating range limitations, our modeling estimate that about 62% of the ride service could be feasible in cold weather and therefore the ride would need to rethink how to deliver a service on cold days, which may include redesigning service, rescheduling buses, as well as increasing the bus fleet.

As is the buses.

Uh, current uh. The rides current bus, garages. Crowded and installing chargers and infrastructure require costly upgrades and further limit any ability to expand the cleaning the future.

And although electricity is generally cheaper than diesel fuel, the rate structure is somewhat more complex, carries some risk depending on the timing and intensity of charge.

Finally, is more expensive and challenging to economically increase the size of a B fleet. Since the number of chargers and investment grows with a number of buses, IE more buses, more costs.

Hydrogen buses, on the other hand.

Refuel like the diesel bus by connecting a dispenser and filling in on board hydrogen tank. Because the vehicle has an ARM board hydrogen tank that is used to create electricity to power the motor. Hydrogen buses have longer operating ranges compared to BB's but still less than fossil fuel buses. Our modeling showed that 90% of the rides service can be operated in cold weather conditions, showing that this technology provides a greater range of service.

Because of the way hydrogen buses, fuel and operate, they have some smaller impact on bus operations compared to BB's and similar to BBS because they have fewer moving parts and uh fossil fuel bus, they are less expensive to maintain and are more cost effective to scale because fueling infrastructure represents a fixed cost, it gets spread out over a larger fleet. So on a per bus basis, a hydrogen bus fleet is like less expensive than a BEB fleet.

Nonetheless, like BB's fuel, cell, buses have drawbacks, including their costs, the space needs for on site, hydrogen fueling, storage and dispensing, some of which you can see in these photos on the slide and the use of hydrogen also requires extensive upgrades for safety codes to the facility, including gas leak detection.

Finally, hydrogen is a fuel is more expensive than electricity, but the costs are coming down.

So the alternative bus propulsion study provides an overview of the different technologies that pros and cons and considerations for the ride. So we aren't endorsing 1 technology or another.

Moving on part of our assignment was to explore and perform a financial analysis comparing different technologies and different transition rates to business as usual. That is continuing to operate diesel buses and not transition to BBS or ZEB'S. Excuse me, the analysis considered predictive modeling of the range and success rates of BS and fuel cell buses and the cost for fuel maintenance and capital infrastructure.

The outputs included operating capital cost comparisons to business as usual with the diesel buses.

We evaluated 4 different scenarios and these were somewhat related.

So on the next slide.

Scenarios that we looked at, one each was for a fuel cell bus or for a battery electric bus, and we looked at an accelerated approach to meet a more aggressive timeline to transition by 2030. Those are scenarios 2 and four and scenarios one and three looked at a replacement rate that retires diesel buses when they age out and that would achieve 100% zero emission by 2036.

The financial modeling was based on several assumptions and one key assumption was that the number of buses needed to operate the right service with the ZEB wouldn't change. However, that assumption will need further vetting depending on future service design, and again, if you'd like to learn more about the assumptions and more about the study, please visit the website to read the full study report the total cost of ownership analysis that we conducted essentially means that we're looking at the total cost of acquiring, operating and maintaining the necessary vehicles and infrastructure.

Over the 25-year time horizon, taking into account the time value of money.

If facilitates our ability to provide an apples to apples comparison of the financial implications of each scenario and evaluate the business case of each implementation option relatively relative to the other options.

Lower cost of ownership numbers referred to scenarios that cost less than implement, while higher cost of ownership numbers refer to scenarios that are more costly to implement.

But this view by comparing the total cost of ownership of the different scenarios of 25 years, this graph shows that a procurement based approach results in a lower cost and the BBS are expected to be more financially feasible than fuel cell electric buses.

The purpose of the total cost of ownership evaluation is to assess the relative financial impact of each scenario. To understand absolute costs, we also looked at the cost related to capital and operations separately.

So what this graph shows is the operating costs and the capital costs over this 25 year horizon. And what we see is that scenario one needs incremental net capital requirements of $75 million across the 25 year horizon, which includes a $7.7 million investment in year 12023.

Scenario ones own MC savings potential across the 25-year horizon is $101 million.

Overall, the values here show.

On these graphs and slides are the most likely case. They are not overly optimistic, but they are also built on the assumption that the ride will implement BBS, for example, on easier, less strenuous routes, and by the time we get to implementing Debs on more challenging routes that presently fail based on our modeling technology, improvements will allow for a 1 to 1 replacement at that time.

However, need to stress that if the above doesn't happen and these assumptions don't hold true, then the cost can actually be notably higher than $75 million. And as well the O&M savings forecasted at $101 million are also not guaranteed to materialize.

The analysis here was meant to explore and compare different scenarios, not to provide a project budget. Projects budgets are to be developed later when detailed design and the preferred concept takes ship.

In closing, the analysis shown here and from the AT20 plan reveals that the fleets arrive at the rides fleet contributes less than 1% of the region's GHG emissions.

Z's potentially result in operations and maintenance cost savings in the long run based on the assumptions here, but an upfront short-term investment of $75 million over and above business as usual will be required if we proceed with a procurement-based implementation of BBS.

The biggest challenges of a fleet transition includes the lack of space at the facility and functionality challenges for alternative bus propulsion technologies.

Facility modifications and impacts during construction will need to be taken into account. There's uncertainty around cost and technology improvements, staff and resource allocation to the ZED program, other key capital projects will need to be considered. And finally, funding and local matches will also be a hurdle to overcome.

There are some opportunities and the biggest opportunities identified in the study include the reduction in pollution and GHG's, as well as the societal benefits of the reduced pollution potential cost savings relate to fuel and maintenance for the bus fleet and choir, smoother rides for bus operators and for customers.

The information presented in the report that you can find online will help the ride path forward for the eventual ZEB transition with the analysis and the report, the ride will now consult with the community and its staff to gather feedback and input to help steer decision making. Please consult the rides website For more information about this project and to provide an opportunities to provide feedback.

Thank you very much.