Agenda Item: 7.3

Zero-Emission Buses – Updated CEO Recommendation

Meeting: Board of Directors

Meeting Date: December 21, 2023

INFORMATION TYPE
Decision Preparation
RECOMMENDED ACTION(S)
Receive information and discuss. Prepare for January decision.
PRIOR RELEVANT BOARD ACTIONS & POLICIES
Policy 2.11 requires staff to consider opportunities to reduce emissions. Policy 2.4 requires prudent financial planning and risk management. Ends policy 1.0 outlines the Board's goals and priorities.
ISSUE SUMMARY
The CEO is returning with their recommended approach to reducing emissions from the AAATA bus fleet. After consultation with staff, the CEO is amending their earlier recommendation to add a second part: 1. The proposal pilot project with two hydrogen buses remains unchanged. 2. CEO is adding hybrid diesel-electric buses to the proposed grant application. This would results in a more aggressive reduction in emissions. As detailed in the attachments below, adding hybrids eliminates more emissions sooner, and could bring in enough additional grant funding to offset TheRide's local contribution to the hydrogen pilot, eliminating any concerns about competition between local capital projects.
ALTERNATIVE OPTION(S)
Although the CEO has submitted a formal recommendation in compliance with all policies, the Board is not obligated to approve it. There are alternatives available. By January the Board can authorize the CEO to submit a grant that: A. Is the CEO's recommendation, as presented (below Attachments 1). B. Is a modified version of the CEO Recommendation, per Board deliberation and vote. C. Is any other decision moved and approved by Board vote. D. Defer the decision either intentionally or by not providing any direction in time for grant preparation. Only a majority vote is required.
ATTACHMENTS
1. Final Draft Scope and Cost Proposal - CEO Recommendation **2. Consolidated Responses to Board Questions** 3. "**What We Heard" summary report of public comments**

Attachment 1: Final Scope and Cost Proposal

In January the CEO will ask the Board for support to submit a grant application to help purchase new buses via the federal Low-No Emissions grant program. A second Board approval will be needed in February-March 2024. A grant award would likely occur in October 2024.

The final draft scope and costs of the grant proposal is outlined below. This recommendation now includes two parts:

- **Part I:** The proposal for a hydrogen pilot project (unchanged since October), and
- **Part II (NEW):** The addition of hybrid diesel-electric buses to the proposal will reduce emissions sooner and bring in additional funds, thereby enabling other capital projects.

Together these pieces create a stronger grant proposal. The CEO feels that this approach provides the best balance for TheRide's numerous priorities, risks, and opportunities – reducing emissions, demonstrating visible progress, compliance with Board policies, and maximizing financial resources for other capital projects.

Part I: Hydrogen Pilot

Scope

This is unchanged from the original October recommendation and includes:

a. 2 hydrogen fuel-cell buses,
b. An outdoor fueling station,
c. Workforce training, and
d. 12 months of operations in all seasons.

As described before, the intent of this initial deployment is to learn how to operate this new technology and increase confidence for a complete phase-out of fossil fuel buses. Based on the best information available staff believe that hydrogen fuel-cell technology represents the best option for eventually replacing 103 fossil fuel buses without negatively impacting passengers or the agency's finances.

This 4-5 year initial deployment also mitigates risks by allowing additional time for outside market and technology developments to provide a clearer picture of green energy costs and battery technology advancement. Should another technology prove superior during this period, a change in direction is possible. We anticipate another Board decision in 2029/2030 to confirm a final technology choice for full deployment of zero-emissions bus technology.

Costs for Learning Deployment with Hydrogen

Earlier cost proposals for the hydrogen initial learning deployment presented ranges of costs to convey the inherent uncertainty. Staff are now presenting firmer cost estimates where the ranges have been replaced with single figures.

The draft final total costs for the hydrogen pilot project are $9.3 million over 4-5 years. The majority of this would come from outside sources, mostly the federal Low-No grant program. Local contribution from TheRide would be about $2.2 million which would need to come from TheRide's Capital Reserve.

There is still an amount of uncertainty with many of these estimates, and we need to tell the Board that we will continue to make small adjustments until the grant is submitted. We need to

make sure that we help the Board understand that in approving this recommended approach, they would be supporting an approximate dollar figure, not approving a not-to-exceed amount.

Timeline

This initial deployment is expected to take 4-5 years, largely due to procurement and manufacturing timelines, with the buses delivered in 2027/2028. A final decision on ZEB propulsion types would be made once the pilot is completed around 2029/2030. The anticipated timeline is illustrated in later attachments.

Background on Technology Recommendation

The table below attempts to summarize the key differences between the technologies and why staff are recommending hydrogen. We are basing the assessment of a full deployment of 103-160 buses, not a 2-bus pilot project.

As has been noted before, the range limited of battery electric buses restricts their ability to replace an entire fleet. While many of these challenges may be overcome in the future, we cannot know when. Further, beyond range anxiety there are other serious challenges such as fire risk and black outs that would also need to be resolved. Hydrogen's challenges are fewer and are focused on the fuel itself; when will affordable green hydrogen be available? Batteries have more, and more serious, hurtles to overcome than hydrogen.

Pros & Cons of Larger Bus Deployment, by Propulsion Technology

	BATTERY	**HYDROGEN**	**ADVANTAGE**
Public/political familiarity	High	Low	BEB
Future energy costs	Unknown	Unknown	TBD
Future emissions from energy production	Unknown	Unknown	TBD
Tailpipe Emissions	None	None	Tie
Expense of back-up energy supply	High	None	Hydrogen
Charging time	4 Hours	15 Minutes	Hydrogen
Range Implications	Too low	Adequate	Hydrogen
-Fleet growth (for same service)	30-40%	None	Hydrogen
-Costs for additional garage space	Very High	None	Hydrogen
-Operational complexity	High	Low	Hydrogen
-Hidden costs	Likely	None	Hydrogen
Expensive garage modifications	Yes	Yes	Tie
Risk of fire	High	Low	Hydrogen
Risks to passenger services (via operating costs)	Mid	None	Hydrogen
Speed of Implementing	2+ years	2+ years	Tie
Costs for small deployment	Lower	Higher	BEB
Costs for large deployment (ie scalability)	High	Lower	Hydrogen

There continues to be differing opinions on whether battery electric buses (BEB) or hydrogen fuel cell electric buses (FCEB) would be a better approach for reducing emissions. The public comments and Board questions received to date illustrate this (see later attachments). The uncertainty stems from the reality that neither technology has decisively demonstrated that it is

superior to the other, or ready to replace fossil fuels. This lag between readiness and need stands in contrast to the urgency many stakeholders feel, and the pressure being exerted on the transit industry to be seen taking action – even at the risk of misallocating limited financial resources.

Staff continue to have confidence in their recommendation for hydrogen fuel cells. Mechanics, management, and the CEO are in agreement on this point. We have reviewed available research in detail, spoken with other agencies, considered local factors, and visited agencies using both technologies. In our consensus opinion - given the state of the ***today's*** technology, battery buses lack the necessary range, cannot meet minimum operational requirements, and will likely incur additional costs that could threaten service to passengers and the agencies finances. Hydrogen fuel cell buses do not carry these risks and are more cost-effective for the scale of full deployment we anticipate (103-160 buses). We acknowledge that battery technology breakthroughs or costs for clean hydrogen in the future *could* change this conclusion, but these are factors that cannot be accurately predicted today among the fog of competing speculative information available.

We expect that their will likely be continued disagreement about these technology choices for the next several years, regardless of which one TheRide decides to test in the short term. Responses to many questions are provided in the attachments below or on our project webpage. We anticipate continued discussion and questions on these points in December and January. We will be going into this grant proposal with less than 70% of the information we would prefer to have. This will likely still be true if we deferred this decision for another 12-24 months.

There are inherent risks in taking action, but there are also risks in failing to act. The CEO and staff feel that we have enough information to take a calculated, reasonable risk on hydrogen. We are made more comfortable by the inclusion of Part II of this proposal which reduces financial risks.

The Board asked why we are recommending an initial hydrogen pilot that costs more (short-term) than a similar battery bus pilot. Our response illustrates an important, perhaps unspoken, element of our thinking – *we are prioritizing the potential for long-term success ahead of short-term costs or public reactions*. We do this because A) Board policies require us to make stewardship decisions more than political decisions, and B) although we understand the passion to reduce emissions, a failure meets no one's needs. We have directly experienced the challenges of technologies failing to deliver on early hype, the credibility and financial implications, the impacts on low-income passengers, and what it takes to clean up the resulting mess of disappointment and wasted resources. We also know that it will be us, not outside advocates, who will be held accountable should this recommendation not meet expectations. These factors tend to make us give more weight to proven technologies and operational and financial considerations, than to calls for immediate action. Some may see this as risk-aversion, other may see it as being prudent. Ultimately it is a question of priorities.

Advancing Board Goals & Policy Compliance

As detailed in the November board packet (p. 67), a hydrogen pilot project does a better job of advancing the Board's Ends goals while complying with executive limitations policies.

Part II (NEW): Addition of Hybrid Diesel-Electric Buses

The CEO is adding 20 hybrid diesel-electric buses (four per year over five years) to the recommended grant application. Hybrids are being added as a "bridging strategy" to reduce emissions sooner until a finalized decision on zero-emissions technology can be made. These would replace older diesel buses in 2025-2030. The hybrids are a quick-start complement to the zero-emissions technology, *not* a replacement for it. The two key reasons for this late addition are:

- **Practical Low-Emissions Technology**: Using the new hybrids will allow us to reduce emissions faster (during the hydrogen pilot) and phase out conventional diesels years earlier. The newest generation of hybrid diesel-electric buses can reduce emissions by 25% from the diesel buses in the fleet today, and do *not* suffer from the mechanical weaknesses that made earlier generations of hybrids so problematic. They require no expensive retooling or facility changes. They have no range challenges and are no risk to passenger services or operations practices.

- **Tapping New, Larger Grant for Replacements**: There is a strong financial incentive to add hybrids to the grant proposal. Conventional diesel buses are not eligible for the Low-No grant program, but hybrids *are*. By replacing diesel buses with hybrid buses and pursuing the generous Low-No grant funding, we can increase the overall outside capital funding. This would generate approximately $6 of additional grant revenue for every $1 spent on hybrids. In other words, we increase the size of the funding pie. A larger pie is easier to split as we would have more total funds to pay for other capital projects (TBD). This reduces the perceived competition for capital funds somewhat. In this manner the hybrids could be seen as helping pay for the hydrogen pilot, for example.

  As illustrated in the table below, if we received Low-No grant funding for 4 hybrid buses per year over the next five years for a total of 20 hybrid buses, the net additional funding we would receive would be approximately $19 million (these are new monies). After accounting for the local share required for the grant, this would free up approximately $14 million of capital formula funding we have currently programmed for diesel buses that could then be re-programmed to fund other projects in the capital plan. However, we may need to use Capital Reserve funding to provide a portion of the local match, which in this illustration would be approximately $2.2 million. The net impact is that we would have an additional $12 million to fund other capital projects, which represents approximately 6:1 return on investment from the capital reserve.

Estimate of Capital Funding Impact of Hybrid Bus Replacement						
($ in thousands)	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	Total
Numbe of Buses	4	4	4	4	4	20
Diesel Replacement Scenario						
Cost Per 40' Diesel Bus	$ 750	$ 810	$ 870	$ 940	$ 1,020	
Total Bus Cost	$ 3,000	$ 3,240	$ 3,480	$ 3,760	$ 4,080	$ 17,560
Funding Sources						
Federal Formula Funding (5307), 80%	*$ 2,400*	*$ 2,592*	*$ 2,784*	*$ 3,008*	*$ 3,264*	*$ 14,048*
State Match, 20%	*600*	*648*	*696*	*752*	*816*	*3,512*
Hybrid Replacement Scenario						
Cost Per 40' Hybrid Bus	$ 1,020	$ 1,100	$ 1,190	$ 1,290	$ 1,390	
Total Bus Cost	$ 4,080	$ 4,400	$ 4,760	$ 5,160	$ 5,560	$ 23,960
Funding Sources						
Federal Low-no Funding Opportunity, 80%	*$ 3,264*	*$ 3,520*	*$ 3,808*	*$ 4,128*	*$ 4,448*	*$ 19,168*
State Match, 10% (TBD, could be up to 20%)	*408*	*440*	*476*	*516*	*556*	*2,396*
Local Funding, 10%	*408*	*440*	*476*	*516*	*556*	*2,396*
Summary of Impacts to Capital Funding						
Federal Formula Funding Decommitted	$ 2,400	$ 2,592	$ 2,784	$ 3,008	$ 3,264	$ 14,048
Local Funding Cost *(likely the Capital Reserve)*	(408)	(440)	(476)	(516)	(556)	(2,396)
Net Additional Funding Available for Capital Projects	$ 1,992	$ 2,152	$ 2,308	$ 2,492	$ 2,708	$ 11,652

A downside of this approach is that we would need to spend more funds from our flexible local Capital Reserve. These are the funds we are trying to preserve to act as a local match in competitive grant situations. But the 6:1 return on that investment is still a good deal.

Although complicated, this adjusting funding sources in order to maximize outside funding is a common approach. However, using hybrids instead of conventional diesels is only affordable with additional outside grant subsidies for hybrids. If TheRide cannot find such grants in the future, it would need to revert to lower priced conventional diesels.

Certainly, packaging both a hydrogen pilot and hybrids into a single grant makes for a more complicated application. However, we've reviewed two years of Low-No grant awards and found that the FTA has already approved earlier grants which have mixed hybrids with zero-emissions buses. It would also allow the FTA to announce an award of 22 buses rather than only two. We believe this approach is viable and have started requesting copies of those earlier grant applications to study.

Long-Term Fleet Implications

Should this approach be embraced, hybrids would begin delivering emissions reductions as early as 2025/2026, conventional diesels would be entirely phased out 3-4 years earlier than without hybrids, and the fleet would become fully zero-emission by 2045 (same as in earlier projections). A graph illustrating how this approach might unfold is provided below. It illustrates how hybrids could replace about 1/5 of diesels over the span of the change.