



# Zero Emissions Transition Plan

April 2022

**Reduce Diesel**  
**Research Alternatives**  
**Re-Imagine Our Fleet**



## **PLAN COMPONENTS**

The Bipartisan Infrastructure Law amended the statutory provisions for the Grants for Buses and Bus Facilities Competitive Program (49 U.S.C. § 5339(b)) and the Low or No Emission Program (49 U.S.C. § 5339(c)) to include a requirement that any application for projects related to zero-emission vehicles include a Zero-Emission Transition Plan.

The cost of developing a transition plan is not eligible under the Buses and Bus Facilities or Low-No Program, but is eligible under the planning programs (49 U.S.C. § 5305) as well as under the urbanized area formula (49 U.S.C. § 5307) and rural area formula programs (49 U.S.C. § 5311).

As defined in statute, a Zero-Emission Transition Plan must:

- Demonstrate a long-term fleet management plan with a strategy for how the applicant intends to use the current request for resources and future acquisitions.
- Address the availability of current and future resources to meet costs for the transition and implementation.
- Consider policy and legislation impacting relevant technologies.
- Include an evaluation of existing and future facilities and their relationship to the technology transition.
- Describe the partnership of the applicant with the utility or alternative fuel provider.
- Examine the impact of the transition on the applicant's current workforce by identifying skill gaps, training needs, and retraining needs of the existing workers of the applicant to operate and maintain zero-emission vehicles and related infrastructure and avoid displacement of the existing workforce.

## **Introduction**

Sangamon Mass Transit District (SMTD – formerly Springfield MTD) serves a district of approximately 118,685 residents with an additional 43,524 in the surrounding urbanized area, for a total service area population of approximately 162,209. Our district boundaries are set by Illinois statute and correspond to Capital and Woodside Townships circa 1968. The only way to expand district boundaries is by referendum of the population within the area to be annexed.

SMTD runs seventeen regular weekday routes that run every thirty minutes from 6am to 6pm, and four-night service routes running hourly until 10pm. Sixteen of those weekday routes are 60-minute routes. One is a thirty-minute express route running on a 15-minute frequency. Saturday service is hourly on most routes with some 30-minute service periods on higher ridership routes. An additional four urbanized area routes provide service on weekdays in four surrounding communities, making rare trips to and from Springfield between several trips exclusively within those communities.

Additionally, several supplemental routes serve primarily high school students in either morning or afternoon peak times. SMTD also provides complimentary ADA paratransit service during regular SMTD operating hours.

SMTD currently operates thirty-four diesel-fueled buses and twenty-two compressed natural gas-fueled (CNG) buses for regular fixed route service. Another six 14-passenger low-floor cutaway vehicles, twenty-five 14-passenger medium duty paratransit vehicles, three diesel/gasoline

maintenance pickup trucks, and six gasoline road supervisor mini-vans round out the full vehicle fleet.

SMTD has diesel fuel pumps servicing thirty-four vehicles and a CNG station that can potentially service twenty-six vehicles daily. The area of the property containing these fueling stations is limited with regard to any future growth and any infrastructure required by an additional fuel type.

The district property tax provides approximately \$2.5 million of tax revenue each year, supplemented by fare and advertising revenue. SMTD utilizes approximately \$12 million annually in state operating funds via reimbursement and approximately \$3.5 million in federal capital and operating funds through FTA's Section 5307 Funding. Additionally, SMTD's paratransit vehicles and road supervisor vehicles are purchased through the state Consolidated Vehicle Procurement (CVP) Program, which requires no local match and allows SMTD to maintain those fleets at a state of good repair without having to fund their purchase and replacement.

### **Transition Planning**

A leader in Low-/No-Emissions public transportation since 1996, when we implemented CNG buses for the first time, SMTD is embarking on a three-phase effort to grow our low-/no-emissions fleet beginning in the next year and increase the percentage of zero-emissions vehicles steadily over the next twenty-five years. The SMTD fleet is currently two buses away from being fully in "state of good repair", with two 2008s due for replacement as soon as possible, followed by ten 2011s. After those ten replacements, SMTD will next have twelve 2013s, which will not be due for replacement until at least 2025.

#### **1. Grow Lo/No Fleet and Reduce Diesel Fleet**

CNG currently accounts for 39% of our mainline fleet of 30-foot and 35-foot buses. 61% of the fleet is ultra-low sulfur diesel. SMTD is currently in the process of replacing four diesel buses with four diesel/electric hybrid buses, the first at SMTD. That order should be submitted in the coming months with delivery expected in the next eighteen to twenty-four months.

The current application related to this plan would replace four diesel buses with CNG buses and replace another four diesel buses with diesel/electric hybrid buses.

In just two years, SMTD plans to transition our fleet to over half (56%) Lo/No Emissions, with that percentage increasing to 76% in five years (2027), 93% in nine years (2031), with the fleet finally at fully 100% Lo/No Emissions in thirteen years, at which point 20% of the fleet would be Zero Emissions.

#### **2. Explore, Consider, and Implement a New Alternative Fuel Type**

The most common zero emissions fuel types currently used by systems in the United States are battery-electric buses (BEBs) and hydrogen fuel cell buses (HFCBs). SMTD is currently exploring these options, considering their suitability for our routes, climate, local infrastructure, and our facilities. We have applied for funds for studies and will likely

make a determination in the next year or two as to which zero emissions technology makes the most sense for us. For the purposes of this fleet transition plan, we will discuss hydrogen fuel cell technology and some of its required fueling infrastructure. BEBs are not being ruled out at this point. However, HFCBs seem to be a more likely better fit prior to upcoming studies to discern more definitively that. Either way, the purchase cost of the vehicles themselves will likely be similar, although fleet size and fueling/charging costs may vary more significantly.

### 3. Add and Grow Zero Emissions Fleet

If HFCB is, indeed, the desired alternative fuel type vehicle, the fleet would see its first HFCBs in 2029, growing steadily in the ten years that follow as hybrids would be replaced. In 2039, the fleet would be 47% zero emissions, with HFCBs the majority of the fleet at 28 vehicles, followed by 22 CNG buses (37%) and 10 remaining diesel/electric hybrids. The replacement schedule would grow the zero emissions number to 57% by 2048 with 34 HFCBs, 26 CNGs, and no remaining hybrids after the second full turnover of the fleet.

Should a better alternative than CNG develop in the next twenty years, further transition to zero emissions could take place with a new fueling station of the new alternative fuel replacing CNG when the CNG station would need to be replaced. However, any new alternative fuel replacing CNG will need to provide redundancy to our existing zero emission fleet at that time.

SMTD's plan will prioritize always running on at least two types of fuel in case of shortage, natural disaster, or any other supply issue that could interrupt service.

## Challenges

### Facilities

Currently, SMTD is limited regarding space at our main facility. Our yard, storage garage, maintenance garage, administration building, three employee parking lots, and a second storage building are surrounded by 9<sup>th</sup> Street to the west, private property to the north, rail and private property to the east, and private property to the south. Without purchasing private property, future growth is limited to our current footprint.

SMTD also operations a transfer center on the east side of the downtown area, with a building for employees and the public under construction as part of the Springfield Sangamon County Transportation Center (SSCTC). This property is also surrounded on all sides by rail, county government, and private property. Additionally, SMTD operates an on-street secondary transfer hub located on south side of town central to both the east and west sides of Springfield. Plans are beginning to develop property in the area for a permanent facility to take the place of the on-street location. This location could potentially provide space for additional fueling capacity.

To address these challenges, SMTD is exploring multiple properties near or adjacent to current facilities. Each property would serve varying parts of this plan and other SMTD operations needs.

Adjacent properties could be used for parking and/or storage capacity as well as potential areas to locate new fueling stations. Another property is being considered for a secondary transfer hub in a location that could provide considerable space for further storage, fueling station(s), and/or power generation capacity.

### Route System

SMTD's route system was modified in 2019 from a fully spoke-and-wheel system centered downtown to a spoke-and-wheel downtown system connected to a secondary spoke-and-wheel system by a free express bus. Twelve regular weekday routes use the downtown transfer center, and seven regular routes serve the secondary Junction Circle Transfer Point, five of which never go downtown. Urbanized Area routes to outlying communities also operate out of downtown when they return to Springfield, and several supplemental school routes operate there once-a-day as well.

The 2019 route system redesign eliminated 30-minute and 90-minute regular routes, utilizing near universal 60-minute routes operating most often with two buses each. Due to train tracks, traffic, and other delays, 30-minute routes were often late, and operators had little to no time to step down. Conversely, 90-minute routes were filled with a significant amount of idle time, and all returned downtown every trip, often duplicating coverage by other routes and proving an inefficient use of revenue time and miles.

This route system utilizes schedule blocks that often have buses on the road for twelve to sixteen hours without fueling or returning to base while maximizing revenue hours and minimizing inefficient guaranteed time spent idle through corresponding runs. Excepting on-route charging, the length of these routes and blocks would make BEBs difficult to utilize without significantly increasing the size of our current fleet.

### Weather

The Springfield area experiences all four full seasons of weather, including extreme heat most summers and extreme cold periodically most winters. This fact is noted due to effects extreme weather can have on some alternative fuel vehicles and requirements or recommendations for their fueling and storage.

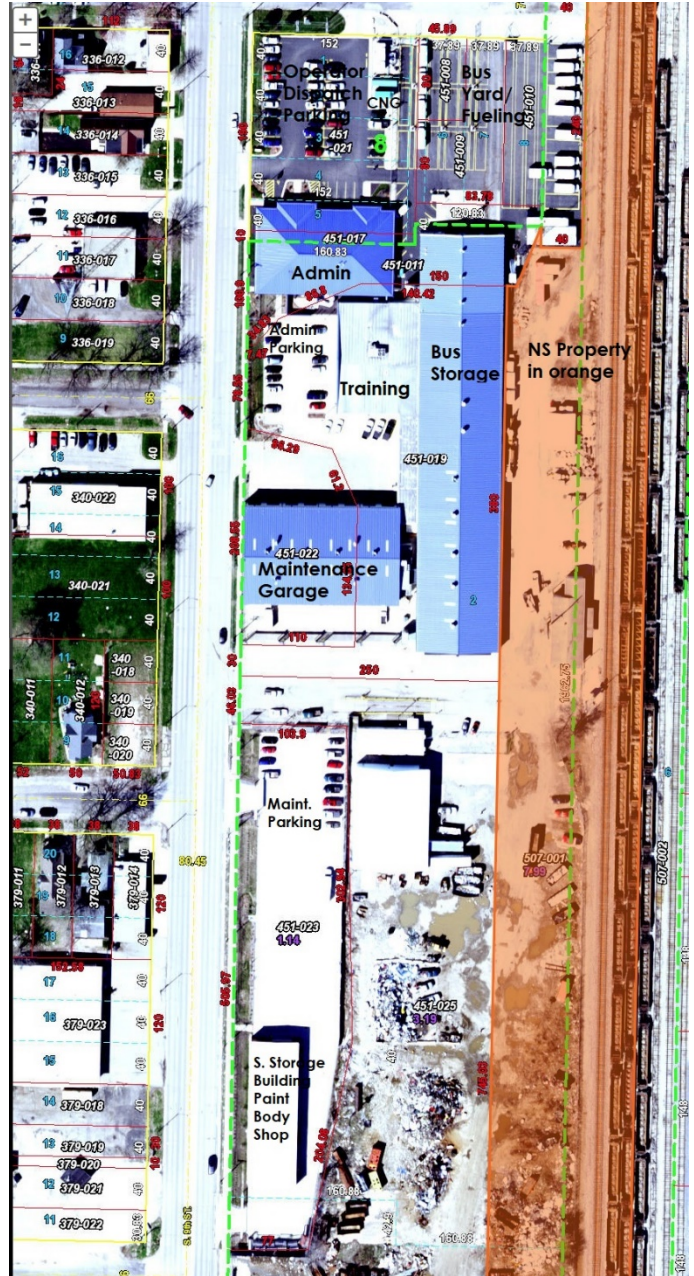
Existing Infrastructure

SMTD’s current CNG fueling station was replaced in approximately 2017. Estimating a twenty-year life-cycle, that station will be due for replacement next around 2037. So, SMTD expects to utilize a strong CNG fleet at least until then. This plan will carry CNG beyond that, forecasting no suitable technology yet that would allow for both redundancy during a failure or shortage and a low-/no-emissions or zero emissions option compatible with SMTD operations and weather environment. The SSCTC being constructed now will contain twenty bus bays and a building to provide break room and facilities for SMTD operators and road supervisors, ticket services for the public, and climate-controlled space for the public including vending, restrooms, and seating.

Additionally, a walkway over rail tracks via elevators or stairs will be available to the public connecting the SMTD facility to the Sangamon County and Amtrak side of the SSCTC. This facility is not designed for fueling or maintenance, and not such modifications are planned.

**Local Electric Generation**

SMTD’s facility and the Springfield community is powered by City Water Light & Power (CWLP), the municipally-owned coal-fired power plant. CWLP has already decommissioned a number of coal-fired plants at their facility, and the final one is scheduled



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to be decommissioned in the next ten to twenty years. Currently, there is no plan to replace that generation locally, instead opting to purchase the vast majority of necessary electricity off the grid as needed in the future. This uncertainty in the future of power generation locally is an additional reason that eventual self-reliance on our own power generation is attractive to SMTD, whether that is solar powered buildings or a solar-powered hydrogen fuel station – or both. We anticipate future studies will show good comparisons of power capacity requirements for both battery electric vehicle charging and hydrogen fuel production.

Changes in state environmental requirements are raising questions regarding power capacity and reliability in communities like Springfield, where we will be forced to transition away from our current generating capacity and toward reliance on the electric grid. The State of Illinois' current ReBuild Illinois grant program is assisting transit with updating fleets and infrastructure, but this funding source is now entering its third of three years. Future similar funding is still unclear.

As SMTD transitions to fuel options entirely or in-part reliant on local electricity availability, we are paying close attention not only to the requirements for us to meet our needs but also our full impact on local energy availability. Our own work includes implementation of solar panels where possible on existing facilities as well as any new construction. To accomplish this, we are working closely with CWLP and will engage consultants to best-utilize programming available for power generation and utilization of green and zero emissions technologies.

### **Workforce Development**

SMTD takes pride in the training we provide our workforce in the onboarding process as well as refresher training further into their careers here. Ongoing technical training takes place as needed for the various maintenance personnel, including maintaining and operating our current CNG and diesel fueling stations. Our familiarity with CNG should prove helpful should we, indeed, proceed toward hydrogen fuel cell technology. Our facilities are already equipped and operating with gas detection equipment and systems, and our mechanics have been working on CNG vehicles for over twenty-five years now.

SMTD is currently implementing use of a driver simulator into onboarding and refresher training as part of our workforce development, and we intend to provide any opportunities necessary for maintenance personnel and supervisors to receive technical training on any new alternative fuel technology. We budget for such training regularly, and we will utilize available resources made available for workforce development as needed. We anticipate a smooth transition to HFCEBs with the understanding there will be additional safety precautions.

### **Estimated Transition Pricing & Drivers**

SMTD is beginning this transition with the purchase of four diesel/electric hybrid buses mentioned earlier. These buses are being purchased utilizing the first of our American Rescue Plan funds. The next purchase of replacement vehicles is being applied for in this application and includes four CNG and four diesel/electric hybrid vehicles to replace eight more diesel buses, transitioning eight more vehicles from diesel to Lo/No Emissions vehicles. Also being utilized for these next

eight vehicles are Transportation Development Credits administered by our state department of transportation to assist us with our local match.

Of great concern in this plan is the cost of these new vehicles, from diesel/electric hybrids to HFCBs or BEBs, either of which are estimated at or above \$1 million each, which represents a cost increase of near 50% over the cost of a diesel-fueled bus, and an increase of over 35% over the cost of our CNGs. Additionally, even the transition to diesel/electric hybrids represents an increase in cost of just under 25% over the cost of the diesel-fueled buses they are replacing.

Overall, these cost increases to replace 32 of our current 34 diesel-fueled buses represent an additional \$8.5 million over the cost of replacing diesel for diesel. Assuming a 15% match requirement similar to the current 5339 Lo/No Grant, that is an additional \$ 1.275 million in local match as part of the \$4 million in total 15% local match on \$27.2 million to purchase 20 hybrids and 12 HFCBs over the next twelve years. With no other capital projects requiring local match, this would probably be budgeted for. However, with additional infrastructure projects planned, matching funding for bus replacement and expansion as well as other infrastructure projects – some already in process – poses a challenge to SMTD.

In order to pursue alternative fuel vehicle options such as HFCBs, new infrastructure will be required. The initial 12-vehicle stage of HFCBs would require one fueling station at an estimated cost of \$9 million. Later in the transition plan, that capacity more than doubles, likely requiring yet another fueling station at a similar cost adjusted for inflation. So, just the cost of this infrastructure alone will add to the pressure to provide local match, if required, to complete the necessary projects to complete the transition. Covering these costs are not in insurmountable task, but they are significantly challenging, and this assumes no outside complication such as price spikes, economic downturns, reductions in available grant funding, etc.

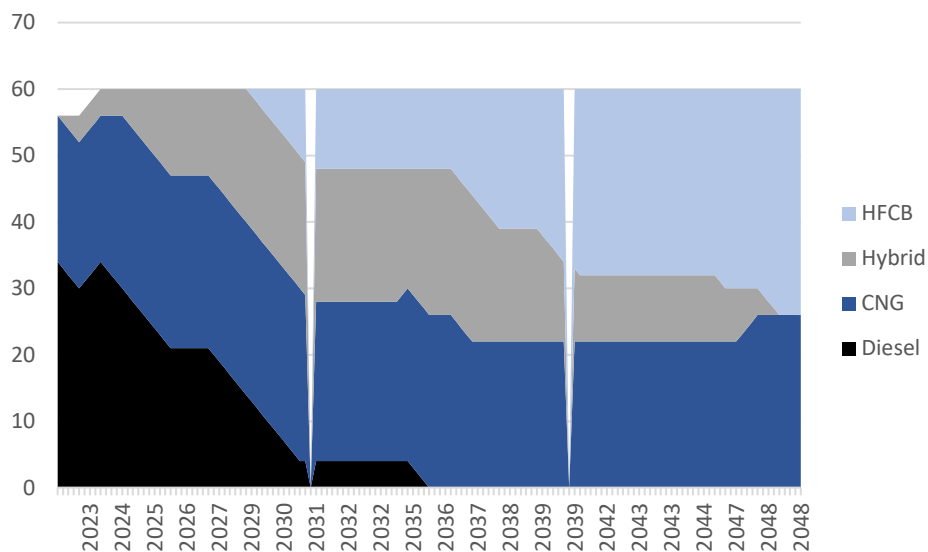


Figure 1

Figure 1 above shows the decrease in diesel, maintenance of CNG, introduction and phase out of hybrid, and increase of HFC over the 24 years.



YEAR	# REPLACE	# EXPAND	FLEET MIX	Units/Yr
2022			Fleet 61% Diesel;39% Lo/No (CNG)	0
2023	4	4	43% Lo/No	8
2024	8		56% Lo/No	8
2025	5		65% Lo/No	5
2026	7			7
2027	7		76% Lo/No	7
2028	0			0
2029	2		79% Lo/No	2
2030	6		89% Lo/No; 13% ZE	6
2031	9		93% Lo/No; 20% ZE; 7% Diesel (4 buses)	9
2032	8		93% Lo/No; 20% ZE; 7% Diesel (4 buses)	8
<b>Total</b>	<b>60</b>			
2035	8		100% Lo/No; 20% ZE	8
2036	8		100% Lo/No; 27% ZE	8
2037	5		100% Lo/No; 35% ZE	5
2038	7		100% Lo/No; 35% ZE	7
2039	7		100% Lo/No; 47% ZE	7
2041	2		100% Lo/No; 47% ZE	2
2042	6		100% Lo/No; 47% ZE	6
2043	9		100% Lo/No; 47% ZE	9
2044	8		100% Lo/No; 47% ZE	8
2047	8		100% Lo/No; 50% ZE	8
2048	8		100% Lo/No; 57% ZE; 4 D/E Hybrids left	8

Table 1

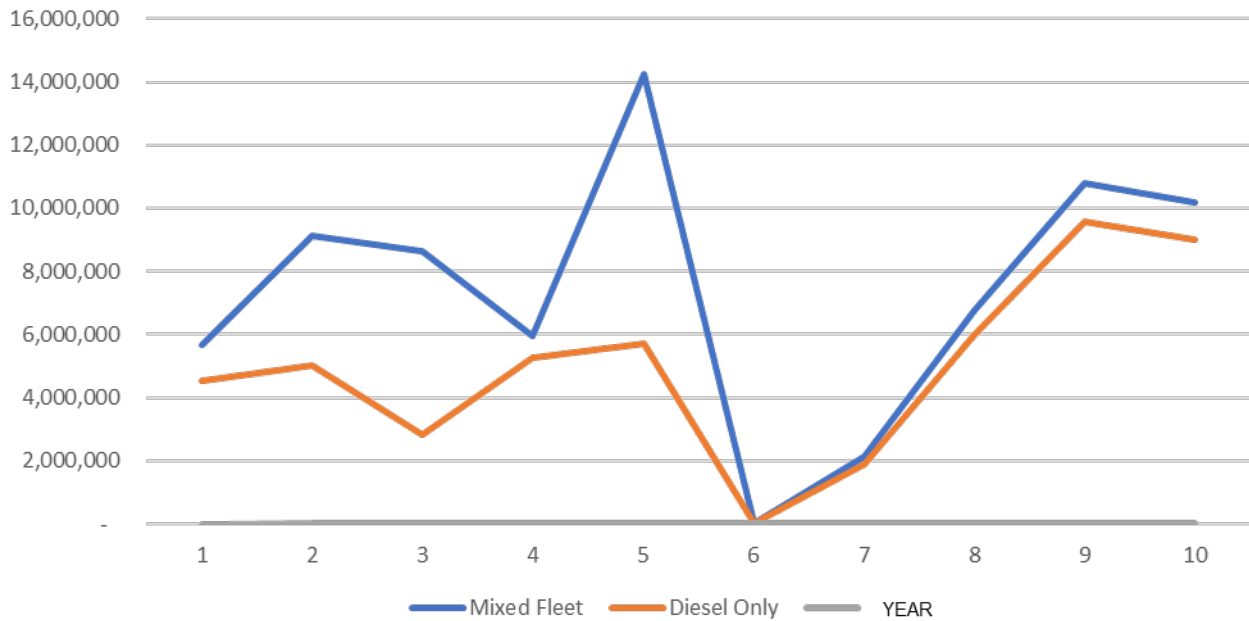
Fiscal Year	EH		CNG		HFC		DI
		Yr1 \$\$		Yr1 \$\$		Yr1 \$\$	
2022	775,400		638,485		1,046,597		566,078
2023	4	3,101,600	4	2,553,940	-	-	4,528,624
2024	4	3,442,776	4	5,669,747	-	-	5,026,773
2025	5	4,729,940		3,894,759	-	-	2,830,396
2026			7	5,944,295	-	-	5,270,186
2027	7	7,816,032		6,435,929	-	-	5,706,066
2028				-	-	-	-
2029				2,119,770	2	3,474,702	1,879,379
2030				6,780,711	6	11,114,860	6,011,748
2031			5	10,803,166	4	7,870,409	9,578,040
2032			8	10,164,681		-	9,011,962
	Mixed Lo/No Price						
	\$95,917,317	\$19,090,348		\$54,366,998		\$22,459,972	\$49,843,174
		20		28		12	60

Table 2

Table 1 above shows the gradual shift of the fleet from predominantly diesel & CNG to the elimination of diesel by 2032 and a maximum of 57% of No Emissions by 2048, which is the generally accepted lifecycle for two rotations.

Table 2 above shows the cost difference between replacing the fleet as progressively planned versus continuing to replace with diesel. While the transition is almost double the cost of a diesel fleet, these figures don't take into account *cost of ownership (total cost of operating the vehicle over its lifecycle)*, which has been shown to be lower in hybrids than that of a traditional diesel.

## Price Variance of Mixed Fleet (2022-2032) to Diesel Only



Graph 1

Graph 1 above shows the difference in price plotted out over the initial 10 years of plan transition. What's interesting to note is most of the price difference (even when adjusted for inflation, as these prices have been) moderates and evens out eventually once the fleet settles into a predominantly 50% LO / 50% No emissions profile.

Of course, this comparison does not factor in the additional \$9-15 million in infrastructure investment in the form of charging stations, fueling depots, and canopy fueling, that will be required to progress with the transition.

## **Conclusion**

While SMTD has been active in the Lo/No Emissions bus technology world since the mid-90s, approximately sixty percent of our current fixed route fleet is composed of diesel vehicles. The remaining forty percent are compressed natural gas vehicles.

This plan would immediately begin the transition from diesel to diesel-electric hybrid vehicles, moving to a fleet of ninety-three percent Lo/No Emissions buses in fewer than ten years and fully attaining a Lo/No fleet by 2035.

SMTD is currently planning studies to identify the best alternative fuel for the future of SMTD. For the purposes of this plan, hydrogen fuel cell technology is the choice for planning based on a one-for-one diesel to HFCB changeover ratio, climate considerations, and the prospect of powering our own fuel generating station with solar power in the future. However, this technology could

end up being replaced with another technology upon completion of studies detailing pros and cons for SMTD in the coming months and years.

To implement HFCBs, a fueling station would be required, and to attain the second level of this plan, a second hydrogen fueling station would eventually be required unless capacity of the initial station proves larger than planned.

Due to our status as the only public transportation provider serving the Springfield public, redundancy in our fueling systems is a key component in the makeup of our fleet. Hence, SMTD will likely always utilize two distinct fuel sources in order to maintain service in the event of a fuel shortage or a severe power outage. With that in mind, SMTD currently plans for CNG to remain an integral part of our fleet until an additional alternative fuel option develops.

All of these items considered, this plan provides for an 100% Lo/No fleet by 2035 and a 57% zero emissions fleet by 2048. Further, in the latter years of the plan, more than half of the CNG fleet is set to be replaced by more CNG buses. An alternative fuel option surfacing in prior years could move even more of the fleet to zero emissions in those years.

As with any emerging technology, funding and further research will impact the implementation of this plan over the next twenty-five years. That said, SMTD is confident this plan or something similar can lead us through the next two full turnover cycles of our fleet.

Prepared by SMTD Staff

Version 1/MAY2022

Reviewed and Approved on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

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Brian Brewer  
Board of Trustees President

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Leslie McCarthy  
Board of Trustees Secretary

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