

Chapter 6

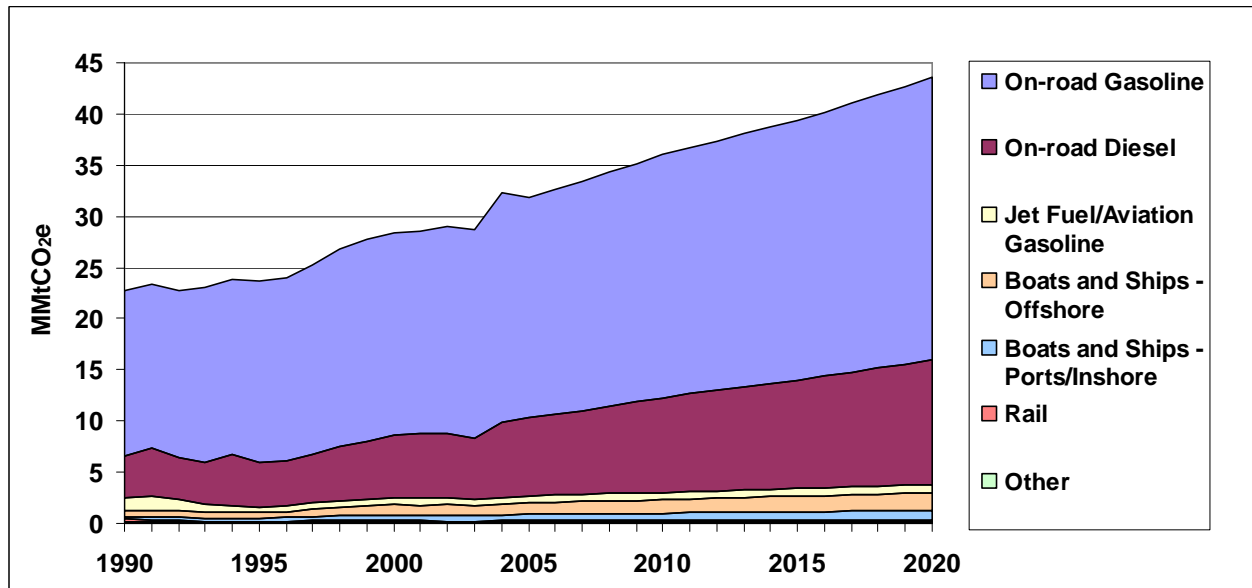
Transportation and Land Use Sectors

Overview of Greenhouse Gas Emissions

The transportation sector is the second largest contributor to South Carolina’s gross GHG emissions. In 2005, the sector accounted for 34%, or about 32 million metric tons of carbon dioxide equivalent (MMtCO₂e), of South Carolina’s gross greenhouse gas (GHG) emissions. Emissions from the sector increased by 9.1 MMtCO₂e between 1990 and 2005. Transportation’s share of total GHG emissions has remained relatively constant over this period, accounting for about 35% of the state’s net growth in gross GHG emissions. On-road gasoline vehicles account for the largest share of transportation emissions—about 68% in 2005. On-road diesel vehicles account for another 24% of emissions, and marine vessels account for roughly 6%. Air travel, rail, and other sources produce the remaining emissions.

Figure 6-1 shows historic and projected transportation GHG emissions by fuel and source. As a result of South Carolina’s population and economic growth and an increase in total vehicle miles traveled (VMT), on-road gasoline consumption grew by 35% between 1990 and 2005. Meanwhile, on-road diesel use rose by 85% during that period, suggesting an even more rapid growth in freight movement within or across the state. In the absence of significant increases in vehicle fuel economy, on-road gasoline and diesel emissions are expected to continue to grow at roughly historical rates to 2020. Total transportation emissions are projected to grow by 37%, or 11.8 MMtCO₂e, between 2005 and 2020.

Figure 6-1. Transportation GHG emissions by fuel source, 1990–2020



The Energy Independence and Security Act of 2007 contains a provision to increase the corporate average fuel economy (CAFE) of light-duty vehicles (passenger cars and light trucks) to 35 miles per gallon by 2020. The Center for Climate Strategies (CCS) performed an analysis of this new policy to determine the resulting reduction in the business-as-usual (BAU) projected

transportation emissions in South Carolina, represented in Figure 6-1. This analysis estimated the number of vehicles on the road that would be affected by the new CAFE requirements, and then determined the amount of fuel saved by the efficiency improvements.

Table 6-1 compares the BAU emissions from on-road vehicles to emissions under the new CAFE requirements. By 2010, the new requirement will result in a decrease in emissions of 0.20 MMtCO₂e annually. By 2020, the fuel efficiency improvements will reduce transportation emissions by 3.51 MMtCO₂e annually, or 8.1% of total transportation GHG emissions.

Table 6-1. Historic and projected emissions for the transportation sector, including the impact of the new CAFE requirements (MMtCO₂e)

Transportation Mode	1990	1995	2000	2005	2010	2015	2020
On-road gas and diesel (BAU)	20.28	22.08	25.77	29.11	33.03	36.00	39.79
On-road gas and diesel (CAFE)	20.28	22.08	25.77	29.11	32.83	34.71	36.28
Emission reductions	0.00	0.00	0.00	0.00	0.20	1.29	3.51
Jet fuel/average gas	1.19	0.46	0.77	0.68	0.72	0.74	0.77
Boats and ship—ports/inshore	0.27	0.35	0.51	0.66	0.75	0.88	1.01
Boats and ships—offshore	0.57	0.59	1.02	1.12	1.33	1.53	1.74
Rail	0.30	0.07	0.16	0.12	0.12	0.12	0.12
Other	0.13	0.12	0.13	0.12	0.13	0.14	0.15
Total (BAU)	22.74	23.66	28.35	31.82	36.08	39.42	43.57
Total (CAFE)	22.74	23.66	28.35	31.82	35.88	38.13	40.06

Key Challenges and Opportunities

South Carolina has substantial opportunities to reduce transportation emissions. The principal means to reduce emissions from transportation and land use (TLU) are:

- Improving vehicle fuel efficiency,
- Substituting gasoline and diesel with lower-emission fuels, and
- Reducing total VMT.

In South Carolina and in the nation as a whole, vehicle fuel efficiency has improved little since the late 1980s, yet many studies have documented the potential for substantial increases in efficiency while maintaining vehicle size and performance. Automobile manufacturers typically oppose dramatic increases in fuel economy. Key points of contention include the cost to manufacturers and cost to consumers. Even with the adoption of the new federal CAFE requirements, there may still be opportunities for further increases in fuel efficiency while maintaining vehicle size and performance.

The use of fuels with lower per-mile GHG emissions is growing in South Carolina, and larger market penetration is possible. Conventional gasoline- and diesel-fired vehicles can use low-level blends of biofuels. Alternative-technology vehicles can also use higher-level blends, as well as other types of alternative fuels, such as natural gas and hydrogen. The type of fuel used is a crucial determinant of impact on emissions, as some alternative fuels have relatively little GHG

benefit. Currently, the most prevalent biofuel in South Carolina is corn-based ethanol, which has minimal GHG benefit from a life-cycle perspective. Key determinants of impact will be the development and deployment of fuel types. At present, fuel distribution infrastructure is a constraining factor. South Carolina already offers incentive payments to retailers of alternative fuels. The state will also begin offering tax credits to purchasers of alternative-fuel and high-fuel-economy vehicles in the near future.

Reducing VMT is crucial to mitigating GHG emissions from transportation. Developing smarter land-use and transportation development patterns that reduce trip length and support transit, ridesharing, biking, and walking can contribute substantially to this goal. A variety of pricing policies and incentive packages can also help to reduce VMT. Developing better planning methods and regulations, and increasing funding of multiple modes of transportation will be key components in achieving these goals.

Overview of Policy Recommendations and Estimated Impacts

The South Carolina Climate, Energy, and Commerce Advisory Committee (CECAC) recommends a set of 12 policies for the TLU sector that offer the potential for major economic benefits and emission savings. Implementing these policy recommendations could lead to emission reductions of:

- 5.5 MMtCO₂e per year by 2020, and
- 29.3 MMtCO₂e cumulative savings from 2008 through 2020.

The weighted-average cost of the recommended policies is \$88/MMtCO₂e. This average value includes policies that have both much lower and much higher likely costs per ton.

The estimated impacts of the individual policies are shown in Table 6-2. The CECAC policy recommendations are described briefly here and in more detail in Appendix I of this report. The recommendations not only result in significant emission reductions, but offer a host of additional benefits as well. These benefits include reduced local air pollution, more livable, healthier communities, and economic development and job growth from in-state biofuel production. To yield the levels of savings described here, the recommended policies need to be implemented in a timely, aggressive, and thorough manner.

Technology options are an important component of the recommended policies. Notably, the Clean Car standards (TLU-1) must clear several hurdles before South Carolina or any other state can adopt it, including U.S. Environmental Protection Agency (EPA) approval of the original California Clean Car standards (that other states can then opt into). If for any reason South Carolina is not able to implement the Clean Car standards, other technology-based policy recommendations could play a larger role. For example, Tax Credits for Efficient Vehicles (TLU-3) can encourage consumers to buy the most efficient vehicles available on the market.

Some policies can improve the fuel economy of existing vehicles by changing their operating conditions. Transportation System Management (TLU-2) and Stricter Enforcement of Speed Limits (TLU-8) would help vehicles to travel closer to optimal speeds and thereby burn less fuel.

Other policies can promote technological improvements in the heavy-duty diesel fleet. TLU-7, Diesel Engine Emission Reductions and Fuel Efficiency Improvements, would regulate unnecessary idling by these vehicles and would promote technological alternatives to extended idling. Less idling means less fuel consumed.

Table 6-2. Summary list of TLU policy recommendations

No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2008–2020 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
			2012	2020	Total 2008–2020			
TLU-1	Adopt South Carolina Clean Car Standards		0.21	1.14	7.04	–\$323 to \$1,598	–\$46 to \$227	Super Majority (Two objections)
TLU-2	Transportation System Management		0.01	0.04	0.22	< \$0	< \$0	Unanimous
TLU-3	Tax Credits for Efficient Vehicles		0.02	0.12	0.68	\$244	\$359	Unanimous
TLU-4	Improve Development Patterns		0.41	2.31	14.02	< \$0	< \$0	Unanimous
TLU-5	Transit & Bike-Pedestrian		0.02	0.02	0.22	–\$1	–\$1	Unanimous
TLU-6	Alternative-Fuel Infrastructure		0.02	0.24	0.77	\$54	\$70	Unanimous
TLU-7	Diesel Engine Emission Reductions and Fuel Efficiency Improvements	Efficiency Improvements	0.03	0.19	0.96	–\$110	–\$114	Unanimous
		Biodiesel	0.05	0.38	1.95	–\$291 to \$319	–\$15 to \$164	Super Majority (Two objections)
TLU-8	Stricter Enforcement of Speed Limits		0.10	0.12	1.18	Not quantified	Not quantified	Unanimous
TLU-9	Make Full Use of CMAQ Funds		Not quantified					Unanimous
TLU-10	Commuter Choice and Commuter Benefits Programs		0.12	0.43	2.63	–\$631	–\$240	Unanimous
TLU-12*	Low-GHG Fuel Standard		0.38	3.67	17.89	\$20 to \$3,276	\$1 to \$183	Super Majority (Two objections)
TLU-14	Rail		Not quantified					Unanimous
	Sector Total Before Adjusting for Overlaps		1.37	8.64	47.57	Not quantified		
	Sector Total After Adjusting for Overlaps**		0.75	5.53	29.29	\$2,582	\$88	
	Reductions From Recent Actions		0.45	3.51	16.37	Not quantified		
	Sector Total Plus Recent Actions		1.20	9.04	45.66	\$2,582	\$88	

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent; CMAQ = Congestion Mitigation and Air Quality; NQ = not quantified.

South Carolina can achieve greater alternative fuel use through a combination of voluntary and mandatory measures. The Low-GHG Fuel Standard (TLU-12) can increase the use of ethanol and biodiesel, and the policies recommended in Chapter 7 (Option AFW-4) can promote in-state production of these fuels through methods with lower lifecycle GHG emissions. The Low-GHG Fuel Standard would also promote the use of vehicles powered by electricity or hydrogen. When produced from renewable sources, these fuels can dramatically reduce GHG emissions. Tax Credits for Efficient Vehicles (TLU-3) and the promotion of expanded Alternative Fuel Infrastructure (TLU-6) would offer incentives to consumers and retailers to use more alternative fuels.

A number of policies would work together to reduce VMT by increasing the viability of multiple modes of travel and providing incentives to use modes other than single-occupant vehicles (SOVs). These policies will require increased coordination between state government, local government, and businesses in many cases. TLU-4 (Improve Development Patterns) presents the greatest institutional challenge. The promotion of more compact and mixed-use development patterns requires significant reform in local planning practices. Yet implementation of this policy is essential to make travel by walking, biking, and transit more feasible. In fact, transit use is on the rise nationwide and can be increased in many areas. TLU-5 (Transit & Bike-Pedestrian) and TLU-14 (Rail) would expand the infrastructure that supports travel by transit and other alternative modes. Commuter Choice and Commuter Benefits Programs (TLU-10), offered by employers to their employees, also promote use of transit as well as other alternatives to driving to work. Together these policies address the built environment, transportation infrastructure, and the behavior of individuals to reduce per capita VMT.

Finally, funding is always a challenge for transportation strategies and infrastructure improvements. TLU-9 (Make Full Use of CMAQ Funds) would ensure that South Carolina makes better use of federal funding to support some of the other options mentioned above.

Transportation and Land Use Policy Descriptions

The policy recommendations described briefly here not only result in significant emission reductions and cost savings but also offer a host of additional benefits, such as reduced local air pollution, more livable, healthier communities, and increased transportation choices.

TLU-1. Adopt South Carolina Clean Car Standards

This policy would reduce GHG emissions from new light-duty vehicles sold in South Carolina by adopting legislation to require a reduction in GHG emissions from new cars and light trucks sold in the state. The goal is to work with neighboring states and encourage participation in a regional clean car initiative that would incorporate the four main global warming pollutants: carbon dioxide (CO₂), methane, and nitrous oxide resulting directly from the operation of the vehicle (tailpipe emissions), as well as hydrofluorocarbon emissions resulting from leakage from or operation of the air conditioning system.

TLU-2. Transportation System Management

Transportation system management (TSM) improves vehicle flow on the roadway system, which can reduce fuel use and GHG emissions. Coordinated operation of the regional transportation network can improve system efficiency, reliability, and safety. Tools to reduce traffic congestion include high-occupancy vehicle lanes, improved mass transit services, roundabouts at intersections, synchronized signals, incident management, variable message signs, varying work schedules, and other forms of intelligent transportation systems.

This policy seeks to reduce emissions by 10% by 2020 in the most congested corridors in each of South Carolina's three largest metro areas—Charleston, Columbia, and Greenville. The goal would be achieved by implementing pilot TSM projects, including installation of fiber optic cable and computerized traffic control systems to coordinate signal timing in the corridor and transit service improvements like limited-stop or express bus service with traffic signal preemption equipment.

TLU-3. Tax Credits for Efficient Vehicles

The goal of this policy is to improve tax incentives in place for alternative-fuel and energy-efficient vehicles. Currently, two sales tax rebate programs are available in South Carolina: one is directed at in-state purchases of new, used, or leased low-GHG vehicles, while the other targets EPA-certified equipment that converts conventional vehicles to alternative-fuel vehicles. There are also two income tax credit programs in place: one is for in-state purchases of plug-in hybrid vehicles; the other is for alternative-fuel and hybrid vehicles, and is equal to 20% of the federal credit.

All of the available sales and income tax credits currently have annual cost caps. While these limits may not present a problem in the short run, as these vehicles become more common, it will be difficult to determine which buyers will be able to claim the rebate. This policy recommends removing the caps and phase-in periods associated with the sales and income tax programs mentioned above. Additionally, the income tax credit programs are to be restricted to vehicles that exceed the new federal CAFE requirements by at least 10%. This specification will ensure that the program incentivizes the purchase of vehicles that are more fuel efficient than the statewide average.

TLU-4. Improve Development Patterns

South Carolina is growing rapidly, and the location and design of development have substantial impacts on GHG emissions. Growth can be accommodated in a variety of ways that reduce emissions. The overall goal of this policy option is to help South Carolina grow in a way that protects the state's environment, climate, economy, and quality of life. Specifically, the effort will be to stabilize statewide VMT at today's levels by 2010 ("2010 VMT") by working with local governments. Each local government would be free to implement land-use tools that it determines are best suited for managing VMT within its respective jurisdiction. Such tools would be designed to promote more efficient development patterns by encouraging and promoting highly connected street networks, higher residential and employment densities, and mixed land uses in new and existing development.

TLU-5. Transit & Bike-Pedestrian

The goal of this policy recommendation is to enable personal trip making to move from SOVs to lower-GHG-emitting transportation options, such as walking, bicycling, ridesharing, and mass transit. Its implementation would ensure that the state's transportation system is fully integrated with and appropriately serves the development patterns called for under TLU-4. The goal will be accomplished by undertaking the following suite of activities:

- Expanding and improving bicycle and pedestrian networks and related facilities both as feeders and as stand-alone modes of travel in all areas of the state.
- Promoting and creating rideshare programs within the public and private sectors.
- Improving and expanding the state's existing network of mass transit systems and services.
- Implementing "complete streets" policies to ensure that all new roadways and streets accommodate all modes of personal transportation where practical and feasible.

TLU-6. Alternative-Fuel Infrastructure

This policy seeks to increase market penetration of alternative fuels in South Carolina through accelerated development of an alternative-fuel infrastructure. Potential measures include establishing storage and distribution systems, connecting key corridors in the Southeast to offset the expense of equipment and installation, and establishing stations offering alternative fuels at

competitive prices in convenient locations. Alternative fuels include ethanol, biodiesel, compressed natural gas, propane, electricity, and hydrogen. This policy will reduce GHG emissions by providing consumers increased access to cleaner-burning alternative fuels.

This recommendation supports the implementation of the TLU-12 (Low-GHG Fuel Standard) goal of decreasing the net life-cycle carbon in South Carolina's total transportation fuels by 10% in 2020.

TLU-7. Diesel Engine Emission Reductions and Fuel Efficiency Improvements

This policy would reduce diesel emissions and the use of diesel fuel in the public and private sectors, both on- and off-road, by promoting a variety of technology practices that provide alternatives to or greater efficiency in diesel fuel use. This policy has the collateral benefits of improving air quality and reducing exposure to air toxics. Specifically, this it calls for continued implementation of existing state programs and the support of new state programs that are designed to

- Broaden use of anti-idling technologies currently available but not widely used for locomotives, trucks, and other diesel engines;
- Substitute engine rebuilds, repowers, and replacements with more fuel-efficient engines or add-on technologies;
- Develop technologies to reduce rolling resistance (such as single-wide tires), low-viscosity lubricants, weight reduction, and improvements to aerodynamics;
- Augment or replace petroleum fuel use with biodiesel, biogas, natural gas, or other low-carbon fuels; and
- Replace freight-handling equipment with battery electric, hybrid, or plug-in electric hybrid equipment.

TLU-8. Stricter Enforcement of Speed Limits

Reduced vehicle speeds can improve fuel economy, reduce CO₂ emissions, and improve safety. In many cases, vehicle speeds could be reduced by increased enforcement of existing speed limits. Significant enforcement resources spread among multiple government units may be needed for this measure to achieve the expected reductions. South Carolina has a goal of reducing the average speed of speeding vehicles by 5 miles per hour (mph) on all highways and major speedways, thereby reducing emissions. Reducing speed to 55 mph on highways typically improves fuel efficiency in both light- and heavy-duty vehicles.^{1,2}

¹ Greg Dierkers et al. *CCAP Transportation Emissions Guidebook—Part One: Land Use, Transit & Travel Demand Management*. Guidebook Emissions Calculator. Washington, DC: Center for Clean Air Policy, Available at: www.ccap.org/guidebook.

² Cummins. "Every Drop: Secrets of Better Fuel Economy." 2006. Available at: http://www.kenworth.com.au/kenworth/pdf/Cummins_Fuel_Economy_Guide.pdf.

TLU-9. Make Full Use of CMAQ Funds

This recommendation would fully allocate all Congestion Mitigation and Air Quality (CMAQ) funding to reduce transportation-related emissions and fund various emission reduction strategies with emphasis on projects that reduce GHGs. It would also facilitate funding of local matches to support selection and implementation of high-GHG-impact projects. This goal can be met by:

- Responsively expending all CMAQ funds allocated to the state to reduce emissions in accordance with federal guidelines;
- Investing in projects and programs that reduce air pollutants in nonattainment and maintenance areas;³
- Quantifying emission reductions to establish prioritization of projects;
- Including public participation in diversifying projects that reduce GHG emissions; and
- Increasing public awareness concerning statewide strategies to reduce congestion and emissions.

This policy has not been quantified because it does not specify any particular types of projects or programs. It is expected to support the achievements of emission reductions under other policies, including TLU-2 (Transportation System Management), TLU-4 (Improve Development Patterns), and TLU-5 (Transit & Bike Pedestrian).

TLU-10. Commuter Choice and Commuter Benefits Programs

This policy has a goal of enabling all employers in the state with over 50 employees to provide options for employees to reduce SOV commutes and GHG emissions. Commuter Benefits programs provide employees with alternative transportation options and incentives under programs, such as

- Employers contracting with transit agencies to provide service directly to employment centers,
- Carpools,
- Pre-tax transit fare programs,
- Parking cash-out programs, and
- Guaranteed ride-home service.

Under these Commuter Benefits options, the total number of employee commuter trips would not be reduced. Rather, the trips would be consolidated into fewer vehicles and thereby decrease total VMT.

³ Nonattainment and maintenance areas are designated relative to pollutant thresholds set by the U.S. Environmental Protection Agency in compliance with the Clean Air Act.

Commuter Choice programs, on the other hand, are designed to reduce total employee trips by substituting telecommuting for trips to and from a place of employment. The telecommuting option includes the development and use of neighborhood telecommuting centers that offer office-type services in locations close to commuters' residences.

The programs and actions recommended under this policy complement the programs and actions recommended under TLU-4 (Improve Development Patterns) and TLU-5 (Transit & Bike-Pedestrian).

TLU-12. Low-GHG Fuel Standard

This policy seeks to reduce GHG emissions by decreasing the carbon intensity of all passenger vehicle fuels sold in the state. To this end, South Carolina should observe the California plan to reduce GHG fuel emissions as it is put into practice and note the real-world successes and failures of that template. Low-carbon fuels include biodiesel, cellulosic ethanol, hydrogen, compressed natural gas, liquefied petroleum gas, and electricity.

The California standard measures fuels' carbon impacts on a life-cycle basis, in order to include all emissions from fuel production to consumption. Fuel providers (defined as refiners, importers, and blenders of on-road vehicle fuels) will demonstrate annually that their fuel mixtures provided to the market meet the low-carbon standard. Options for compliance may include blending or selling increasing amounts of lower-carbon fuels, using previously banked credits, and purchasing credits from fuel providers who earned credits by exceeding the standard. Penalties for noncompliance will be determined during the implementation process.

A low-GHG fuel standard in South Carolina must take into consideration the state's dependence on Gulf Coast refineries and on the existing transportation system via two major pipelines originating in the Gulf and terminating in New York Harbor. Incentivizing the production, development, and marketing of low-GHG fuels should continue and will promote their availability and use. With respect to the state's dependence on Gulf Coast refineries and on existing transportation systems, producing alternative fuels within the state and encouraging further in-state production of these fuels as much as possible has multiple economic benefits (e.g. job creation).

There is also a need to acknowledge regional assets in the development of specific fuels and to use the state's resources to stimulate technological innovation to further develop these fuels.

TLU-14. Plan for Enhanced Rail

Rail transport is one of the most energy-efficient means to move people and freight over commonly traveled routes on land. Improved freight rail service and new passenger rail services have the potential to reduce overall GHG emissions, compared to movement by highway. Technology improvements, such as anti-idle devices and more efficient engines, can reduce direct emissions from locomotives operating on the rail network. A robust and efficient rail network can play a key role in sustaining South Carolina's economy under future carbon emission constraints, while providing many social, economic, and environmental benefits.

Because a detailed and comprehensive analysis of South Carolina's rail system and its role in the movement of people and goods does not currently exist, the CECAC does not have sufficient information to develop specific policy recommendations for the rail system. Therefore, the CECAC recommends that South Carolina immediately undertake a detailed and comprehensive analysis of the state's rail system.

This policy is not quantified, as its goal is to determine the potential for expanding rail.