

TRANSPORTATION

Mass Transit



8.3 MASS TRANSIT

Function of the Sector	Transport of people in urban settings.
GHG emissions	Approximately 0.2% of national emissions in 2022, 1.7 Mt CO ₂ e (1.5 Mt CO ₂ e from buses[276]*, 0.2 Mt CO ₂ e from trains).
Options for decarbonization	Decarbonization Pathways: Electric rail transit, battery-electric buses. Bridge Pathways: Renewable diesel for existing commuter rail. Niche Pathways: Hydrogen fuel-cell buses. Enabling Pathways: Transit-oriented urban planning, modal-shift levers.
Stage of transition	Emergence: Hydrogen fuel-cell buses. Diffusion: Electric rail transit, battery-electric buses, renewable diesel for existing commuter rail, transit-oriented urban planning, modal-shift levers.
Nature of the problem today	Emissions generated from fossil-fuel-powered rail transit and buses. Absence of convenient, accessible, affordable, frequent and safe mass transit in many locales.
Other systemic issues	Equity (mass transit more affordable than personal vehicles, but less accessible). Mass transit's ability to relieve costs related to congestion, road maintenance and infrastructure, parking, and the livability of cities. Limitations in the layout of cities and urban sprawl. Climate change stressors and the impact of flooding and fires on transit.[277]
Strategic opportunities and concerns	Opportunities: Reduced commuting times, pollution healthcare costs, and household expenses; improved quality of life; economic development leveraging Canada's leadership in manufacturing electric/hydrogen buses; infrastructure utilizes Canadian materials (steel and aluminum) and creates more jobs per dollar than highway spending.[278,279] Concerns: Poor reliability and comfort due to overcrowding and long commutes; weak transit systems limit productivity; attitudinal or cultural shifts away from car dependency are difficult to achieve.
Priorities for action	Invest in reliable, comfortable, and safe mass transit that encourages mode shifting; support decarbonizing and expansion of public transit; implement policies to ensure smart city planning with well thought out transit corridors.
Longer-term issues	Urban planning for smarter, more livable cities must include mass transit in original design.
Indicators of progress	Proportion of regular commuters using mass transit. Number of riders expressing satisfaction with service standards. Sector-wide emissions. Falling construction delays and cost overruns for major transit projects.

* All noted references can be found in the full Playbook document.

8.3.1 Current Status

Mass transit can play a significant role in building resilient carbon-neutral cities in Canada. By moving large numbers of people efficiently, transit systems reduce greenhouse gas (GHG) emissions, ease urban congestion, and improve access to services.

Mass transit in Canada includes public transit infrastructure such as buses, urban and commuter rail, subways, and streetcars. It is complementary to active transport (biking and walking) and operates primarily on fixed routes with regular schedules in and between urban areas. While active transport is important, the emphasis of this section will be on the public transit systems and their opportunities to reduce existing emissions and contribute to further GHG reductions across the transport sector.

Canada's public transit systems comprise a suite of well-established and often integrated services, such as:[280]

- Subway systems: Toronto and Montreal subways
- Light rail and urban trains: Vancouver's SkyTrain, Ottawa's O-Train, Calgary's CTrain, Montreal's REM, and Edmonton's LRT
- Commuter rail: GO Train (Ontario), EXO (Quebec), West Coast Express (British Columbia)
- Buses: Virtually every Canadian city
- Water-based transit: Halifax Transit Ferry Service, BC Ferries

Canada's urban structure is dominated by a small number of very large metropolitan areas and a long tail of mid-sized and smaller urban

regions.[281]¹ This distribution matters because feasible transit technologies, service designs, and funding models differ markedly by city size and concentration.

Public transit ridership is strongest in Canada's largest and most densely populated cities. As of May 2024, 11.4% of commuters across Canada use public transit, approaching the 12.6% pre-pandemic peak in May 2016. [282] However, in Toronto, Vancouver, and Montreal, over 20% of commuters use public transit.[283] In fact, in 2016, 75% of Toronto commuters living within 5 km of downtown used transit, walked, or cycled, compared to 28% in Winnipeg.[284] Outside urban cores, ridership declines rapidly with increasing distance, lower density, and greater reliance on personal vehicles. A breakdown of commuting by mode for Canadians in 2021 can be seen in Figure 24.

Canada has a strong industrial base in public transit manufacturing. Companies such as New Flyer, Nova Bus, and Alstom design and produce buses and rail vehicles domestically and create thousands of jobs.

In addition to contributing to a strategic economic opportunity for Canada, mass transit provides critical social benefits. It helps reduce transportation-related emissions, improve mobility for underserved populations, and support more livable, vibrant urban environments.[286]

While the zero-emission technologies for transit are relatively clear—battery-electric and, in some contexts, hydrogen fuel cell—the path to expand or redesign transit systems is highly city-specific, reflecting each metro's size, density, geography, and the configuration of its existing network. Planning starts from what already exists, not from a clean slate. Federal programs such as the Zero Emission

¹ Using 2021 Census metropolitan area (CMA) populations as a proxy for urban scale: 6 CMAs have 1,000,000+ residents; 3 CMAs have 750,000-999,999; 2 CMAs fall between 500,000-749,999; 6 CMAs are 250,000-499,999; and 24 CMAs are 100,000-249,999

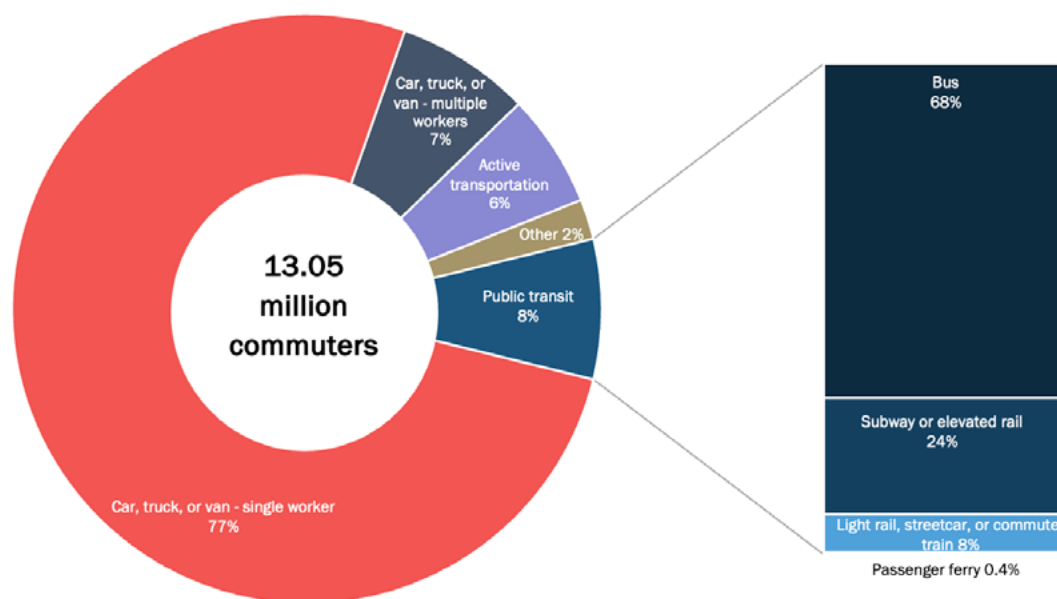


Figure 24. Main mode of commuting for the employed labour force aged 15 years and over in private households, Canada 2021[285]

Transit Fund (ZETF) explicitly support both battery-electric and hydrogen fuel cell deployments, and Canadian agencies are piloting both options (i.e., Mississauga's hydrogen bus initiative), underscoring that technology selection is contextual.

Municipal budgets alone are generally insufficient to fund major transit initiatives, and Canadian cities have historically relied on provincial and federal contributions to deliver large projects. Municipalities manage about 60% of core public infrastructure but collect only 8-10 cents of every tax dollar, constraining their ability to self-finance major expansions.[287] Senior-government tools such as the Investing in Canada Infrastructure Program, the forthcoming Permanent Public Transit Fund, Zero Emission Transit Fund, and flexible Canada Infrastructure Bank financing are necessary to deliver fleet electrification and capacity expansions across city sizes.

Ferries are not discussed further as they impact a very small portion of commuters and have very different decarbonization problems and solutions better addressed with future analysis of the marine sector.

8.3.2 Nature of the Problem

Despite offering a sustainable alternative to private vehicles, several interrelated barriers continue to limit mass transit decarbonization and its role in addressing broader transport-related problems.

Moving to low-emissions transit

To fully realize the climate benefits of mass transit, the systems themselves must be decarbonized. While public transit produces significantly lower emissions per rider than personal vehicles, diesel-powered buses and commuter rail still emit 1.5 Mt CO₂e and 0.2 Mt CO₂e respectively.[280,288,289]

Cities like Montreal, Vancouver, and Toronto have committed to providing 100% zero-emission transit by 2040, but progress is slow.[290–292] This is due to structural, financial, and political factors. For example, Toronto's Metrolinx plans to electrify 600 km of GO Train routes and add 200 km by 2032, yet faces delays due to land disputes, environmental pushback, funding gaps, and political instability.[293,294] Additionally, although Montreal's Exo plans to electrify 10

trains in its fleet, and Vancouver's Translink now uses renewable diesel for the West Coast Express, both operators lack clear timelines and detailed plans for fully decarbonizing commuter rail services.[295–297] Despite progress, vague planning and execution risks threaten the ability of all three commuter rail operators to meet their climate goals.

Bus electrification also lags, with only 2% of bus and truck sales in 2023 being electric, compared to 9% globally.[298] Canada is home to four electric bus manufacturers: Lion Electric, New Flyer, Girardin Blue Bird, and Nova Bus / Prevost.[299] A prominent barrier is the high upfront cost of battery-electric buses and the depot/on-route charging infrastructure required to operate them at scale. Currently, electric buses can be more than double the cost of diesel buses, and most Canadian-made electric buses are sold to other jurisdictions.[299,300] Upgrading charging infrastructure, installing charging along routes, and the availability of low-carbon electricity remain additional adoption barriers.[301]

Cold-weather performance is also a significant operational consideration. Transit agencies in Edmonton and Vancouver report the need for auxiliary diesel heaters to maintain interior temperatures during winter, reducing the net GHG benefit of Battery Electric Buses (BEBs). Cold temperatures also reduce vehicle range, requiring additional vehicles or on-route charging to maintain service levels.

Canada is a global leader in hydrogen fuel cell buses, with Mercedes-Benz's fuel cell manufacturing facility in Vancouver and New Flyer's in Winnipeg. In Alberta, hydrogen fuel cells are being deployed for trucks, buses, and light-duty vehicles.[302] The Alberta Zero Emission Hydrogen Transit (AZEHT) demonstration, launched in 2021, has two hydrogen fuel cell electric buses operating in Edmonton and Strathcona County since 2023. [302] Despite insights from AZEHT, Canada

still has relatively limited experience with the large-scale deployment of hydrogen fuel cell buses. Yet proponents highlight Canada's competitive advantages in hydrogen supply and the bus manufacturing value chain and believe costs will fall as supply chains mature and scale increases.[303]

Barriers to modal shift

Encouraging modal shift from personal vehicles to mass transit remains a challenge for many municipal governments. A 2018 literature review on the trends of Canadian transit ridership found that a variety of factors related to the built environment (e.g., proximity to downtown), socioeconomic conditions (e.g., household income), and external variables (e.g., weather) impact Canadians' transportation choices. Among the strongest levers are service frequency and reliability. These are areas where policy and investment can have an immediate impact. [304] Fare levels are important—especially for equity—but, on average, service quality has a larger influence on ridership; moreover, fare reductions typically require ongoing public subsidies to replace lost fare revenue.

Urban design and equity

How cities are built shapes how people move. In Canada, sprawling urban development makes it harder for transit to succeed. Cities that integrate housing, schools, workplaces, and shops within neighbourhoods have a positive impact on transit use as they generally promote shorter transit-accessible trips. Availability of affordable properties (for both renters and buyers) decreases near transit corridors. This poses issues from an equity perspective as lower-income households may face longer (and in some cases unmanageable) walking distances to access their desired routes.

Congestion in metropolitan areas and associated idling vehicles contribute to lost productivity, worsen air quality, increase GHG

emissions, and impact the health, safety, and personal finances of Canadians. It is estimated that traffic congestion in the Greater Toronto Area alone costs the economy over \$11 billion² annually in lost productivity.[305]

The negative effects of congestion continue to put demands on public infrastructure funds to expand road networks instead of transit modes.

Systematic constraints and policy gaps

Access to transit or safe active transport is also limited by planning and policy decisions which favour roads. Government spending on roads is historically more than double that of public transit.[306] Laws that restrict high-density housing or mixed-use neighborhoods negatively impact ridership.[279] In many regions, personal vehicles remain the only viable transportation option. Addressing these systemic issues requires substantial, ongoing public investment.

8.3.3 Net-Zero Pathways

Ensure reliable, comfortable, and safe transit services

The most effective way for governments to encourage people to choose mass transit over personal vehicle use is to ensure systems are reliable, safe, comfortable, and accessible.

Adequate operation and maintenance (O&M) funding is critical to uphold service quality. This includes not only punctuality and cleanliness, but also infrastructure upgrades, security features, and accessibility improvements that allow Canadians to depend on transit for commuting and leisure activities.

Decarbonize public transit

Decarbonizing public transit will eliminate the GHG emissions and air pollution currently associated with mass transit.

For buses, electric and hydrogen fuel cell buses present scalable options. However, these options require investment in related

infrastructure (i.e., charging stations) and training programs to ensure proper maintenance and operation of newer technologies. Future transit development should include smart grids, route optimization, and charging schedules to minimize grid strain and operational inefficiencies.[301]

Most light rail and subway systems are already low-carbon. Public investment should target light rail and subways that can replace congested or slow bus routes in cities with a population greater than 100,000.

Canada also has a strategic opportunity to meet rising transit demand with made-in-Canada solutions.[278] Bus manufacturing is already concentrated in Quebec and Manitoba, and train production facilities exist in several provinces. Rather than exporting most of this output, governments could prioritize domestic procurement—using Canadian-built vehicles to support transit buildout nationwide.

Encourage modal shift away from solo car use

Shifting Canadians from personal vehicles to transit requires a combination of incentives and disincentives:

- **Incentives:** Fare discounts, passes, and promotional campaigns (e.g., municipal transit challenges with prizes).
- **Disincentives:** Fuel taxes, congestion pricing, or limited parking to raise the relative cost of car travel compared to mass transit.
- In general, the public value of mass transit goes beyond emission reduction. It also reduces congestion, cuts pollution, improves public health, and lowers household transportation costs. These positive spillovers justify strong public investment and ongoing operational subsidies.

² 2024 Canadian dollars

Design Smart Cities with well-thought-out transit networks

Urban sprawl is a pattern of metropolitan expansion onto previously undeveloped land, characterized by low-density, discontinuous growth; single-use zoning; car-oriented design; fragmented open space; and high per-capita land consumption that makes infrastructure and public services less efficient. Sprawling neighbourhoods are generally unsuitable for mass transit because of their low population densities and lack of specific hubs of activity.

By contrast, compact, mixed-use neighbourhoods—the inverse of urban sprawl—enable mass transit and active transportation to meet most daily needs and provide a viable alternative to driving.[299] Municipalities and urban planners can design cities that have:[279]

- Dense, mixed-use developments near transit corridors,

- Integrated walking and cycling infrastructure,
- Reduced dependence on road infrastructure, and
- Vibrant urban cores with accessible green and public spaces.

Well-thought-out transit networks improve access to jobs, reduce emissions, enhance health, and raise urban livability. They also support businesses by increasing access to labour markets.[279,308,309] Municipalities and urban planners can make net zero more tangible and smart by pairing compact, mixed-use growth with smart transit operations. Using data and automation can help coordinate routes, manage service in real time with data sharing, and simplify trip planning and payment. These improvements can make transit more reliable and convenient, encouraging people to shift from private vehicles and cutting per-trip emissions.



Competitiveness Implications

Canadian-built zero-emission buses are already exported across North America, but the domestic fleet that validates them is thin. As of 2023, only 2% of Canadian bus and truck sales were electric, less than a quarter of the global rate. The transit electrification procurement wave is well underway and will lock agencies into supplier ecosystems for a fleet generation. Canadian OEMs like New Flyer and Nova Bus hold credible positions today, but that credibility erodes when the home market is visibly not buying at scale. Canada's cold-climate operating conditions add a second dimension: agencies in Edmonton and Vancouver are already navigating range loss and auxiliary heating challenges that Nordic, northern U.S., and Northeast Asian buyers will face as they electrify. Solving those problems through domestic fleet-scale deployment would give Canadian manufacturers a validated cold-climate credential that warm-weather competitors cannot replicate. But fleet-cycle lock-in sets the timeline, and fragmented municipal procurement is not moving at the pace the window demands.

8.3.4 Priorities for Action

Investing in transit and enabling infrastructure

Funding should be directed toward both infrastructure and operational needs, including safety, cleanliness, and inclusive access to balance system growth (transit access, rates, routes, and reliability) and user experience (comfort and safety on board). [306] Innovative financing models that cover operational costs—such as payment per kilometre for certified ZEVs (e.g. U.K. Bus Service Operators Grant)—or public-private partnerships that leverage private financing, can support stable long-term funding for transit systems. Careful planning and evidence-based policy are essential to ensure that investments deliver the greatest benefits in emissions reduction, accessibility and ridership growth.[310]

Moreover, incentives like the Zero Emissions Transit Fund that support the deployment of zero-emission buses and rail can be expanded and aligned to also cover the necessary charging and maintenance infrastructure.[311]

Strategic urban design

Policies for urban planning should be developed to support higher-density cities as well as mixed-use neighbourhoods, affordable housing near transit hubs, removal of municipal parking mandates, and accessible and safe active transport.[279] These will ensure that cities are designed to provide incentives for the use of existing public transit infrastructure, but also that new projects are strategically located to maximize their use.

Supporting domestic low-carbon manufacturing

Finally, Canada already has a strategic manufacturing advantage in public transit. Scaling up domestic deployment creates local jobs and strengthens Canadian manufacturing while positioning the country to export the technologies and expertise a carbon-neutral world will require.

Criteria Status

- Fails to meet criteria
- Meets in some respect
- Not promising
- Potentially meets criteria
- Meets criteria

8.3.5 Mass Transit Pathways Table

			ALIGNMENT WITH CARBON NEUTRALITY	Economic		Technical			Social		
PATHWAY ELEMENTS	ROLE IN NET-ZERO SYSTEM	SIGNAL TO DECISION- MAKERS		ECONOMIC VIABILITY	ECONOMIC DEVELOPMENT OPPORTUNITY	MATURITY	OPERATIONAL FIT	INFRA- STRUCTURE AND SUPPLY CHAIN SUITABILITY	SOCIAL ACCEPTABILITY	RELEVANCE TO STAKEHOLDERS	RELATED BENEFITS AND COSTS
 Transit Technologies											
Electric Rail Transit (subways, LRT/trams, commuter rail)	Decarbonization Pathway Already the low-carbon backbone in cities. Expanding/ modernizing electrified rail displaces diesel services and high-GHG road travel.	Deploy Support deployment of electrified rail with policy, financing, and investment. Enable growth of Canadian electric rail manufacturing capacity.	 Zero tailpipe emissions when running on clean power systems.	 Capital-intensive but justified on high-demand corridors. Viability rises with ridership and public co-funding.	 Strong Canadian rail manufacturing base (i.e., Alstom) and project delivery supply chains.	 Commercially mature.	 Best fit on dense, fixed routes. Replaces congested/slow bus routes in larger cities.	 Requires major capital works and grid connection but draws on established suppliers.	 Generally popular and accepted where it improves speed/reliability.	 Cities, provinces and federal funders see it as core to mobility.	 Cuts air pollution, eases congestion, improves urban livability.
Battery- Electric Buses (BEBs)	Decarbonization Pathway Scalable option for bus decarbonization.	Deploy Scale fleet procurement and depot charging infrastructure. Coordinate with utilities to ensure grid readiness for full fleet transition.	 Zero tailpipe emissions when running on clean-power systems.	 Today higher upfront cost vs. diesel. Viability improves with public support and charging optimization.	 Canadian OEM strength (New Flyer, Nova Bus) and supply-chain jobs.	 Deployment scaling from pilots to fleets.	 Strong fit for urban routes and return-to-depot operations.	 Needs depot/on-route chargers and utility coordination. Smart charging to manage grid impacts.	 Positive where reliability and comfort improve	 Transit agencies slowly adopting. Requires strong coordination from utilities. Larger cities starting to incorporate into planning.	 Better air quality, less noise.
Hydrogen Fuel-Cell Buses	Niche Pathway Complementary option where range/uptime needs challenge BEBs. Canada has H ₂ /fuel-cell industrial strengths.	Enable Support targeted pilots in corridors where range or uptime needs exceed battery- electric capability. Invest in refuelling infrastructure alongside vehicle trials.	 Zero tailpipe emissions when supplied by low-carbon H ₂ .	 Vehicle and fuel costs are much higher. Viability hinges on H ₂ price/ infrastructure.	 Domestic capabilities in fuel cells and buses. Potential to anchor H ₂ value chains.	 Some pilots underway to validate technology.	 Useful for longer uninterrupted routes/high uptime and quick refuelling.	 Requires new H ₂ production, storage and refuelling networks.	 Mixed. Interest exists, but costs, safety, and infrastructure questions remain.	 Agencies and OEMs piloting. Supported in federal programs alongside BEBs.	 Air-quality gains. Operational flexibility in cold climates and long duty cycles.

PATHWAY ELEMENTS	ROLE IN NET-ZERO SYSTEM	SIGNAL TO DECISION-MAKERS	ALIGNMENT WITH CARBON NEUTRALITY	Economic		Technical			SOCIAL ACCEPTABILITY	RELEVANCE TO STAKEHOLDERS	RELATED BENEFITS AND COSTS
				ECONOMIC VIABILITY	ECONOMIC DEVELOPMENT OPPORTUNITY	MATURITY	OPERATIONAL FIT	INFRA-STRUCTURE AND SUPPLY CHAIN SUITABILITY			
Renewable Diesel for Existing Commuter Rail	Bridge Pathway A stop-gap to cut emissions where rail electrification isn't yet possible.	Deploy Procure renewable diesel as an immediate drop-in measure for diesel commuter rail while electrification is built out. Support scaling of RD production.	Drop-in fuel, with lifecycle CO ₂ cuts. Net zero requires carbon removal. Combustion persists and sustainable feedstocks are finite.	Not competitive with incumbent, except areas where policy supports offsets fuel premiums.	Supports refinery jobs, rural economies, and feedstock markets. Growth is limited by feedstock constraints.	Fully commercial, drop-in fuel. Dominant production processes (i.e. hydrotreated vegetable oil) mature, with several large-scale facilities operating globally. Established technology licensors.	Drop-in fuel ideal for reducing near-term fleet emissions without new equipment or operational changes.	Existing fuel storage, pipelines, and retail networks work for RD. Main gaps are upstream (sustainable feedstock availability and refining capacity scale-up).	Accepted when made from sustainable waste feedstocks and used as a bridge. Concerns for forestry and food competition remain.	Fleets seeking fast GHG cuts. Fuel producers and farmers benefiting from new markets. Policymakers aiming for near-term climate progress and rural investment.	Delivers reduced particulate matter and NO _x emissions in existing fleets. Benefits are tempered by feedstock limits and land-use change concerns.
Transportation Systems											
Transit-Oriented Urban Planning	Priority Enabling Pathway Dense, mixed-use development near corridors to boost transit use and cut car dependence.	Deploy Implement and strengthen transit-oriented zoning and density policies at all levels of government now. Align housing and climate goals.	Locks in low-carbon travel by design.	Infrastructure requires significant upfront investment but can yield strong long-term economic returns including increased productivity, higher tax revenues, and reduced household transportation costs.	Infill, housing, and jobs around stations.	Mature planning tools	Works across climates. Depends on zoning and political will.	Starts from existing networks with targeted upgrades.	Support rises with affordability and good urban design. There could be some opposition to densification from local residents.	Important to city/provincial climate and housing goals. Implementation faces governance fragmentation and local opposition.	Health, safety, walkability, and affordability gains.
Modal-Shift Levers (e.g. congestion pricing, fare integration)	Enabling Pathway Reduces car dependence and associated emissions, applicable mostly to urban areas.	Deploy Advance congestion pricing, fare integration, and service improvements now. Reinvest revenues into transit expansion and equity measures.	Proven to reduce car trips and emissions when paired with better service.	Revenues can recycle into transit. Distributional design matters.	Supports service expansion and economic productivity.	Many global precedents with robust evaluations.	Strongest in dense cores with viable transit alternatives.	No major new physical Infrastructure. Enforcement/IT back-end needed.	Acceptance grows post-implementation as benefits materialize.	Cities, provinces and utilities use these to meet goals.	Traffic, safety, air-quality gains. Equity improves with targeted discounts.