The Compact City Scenario – Electrified

THE ONLY WAY TO 1.5°C

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UC DAVIS
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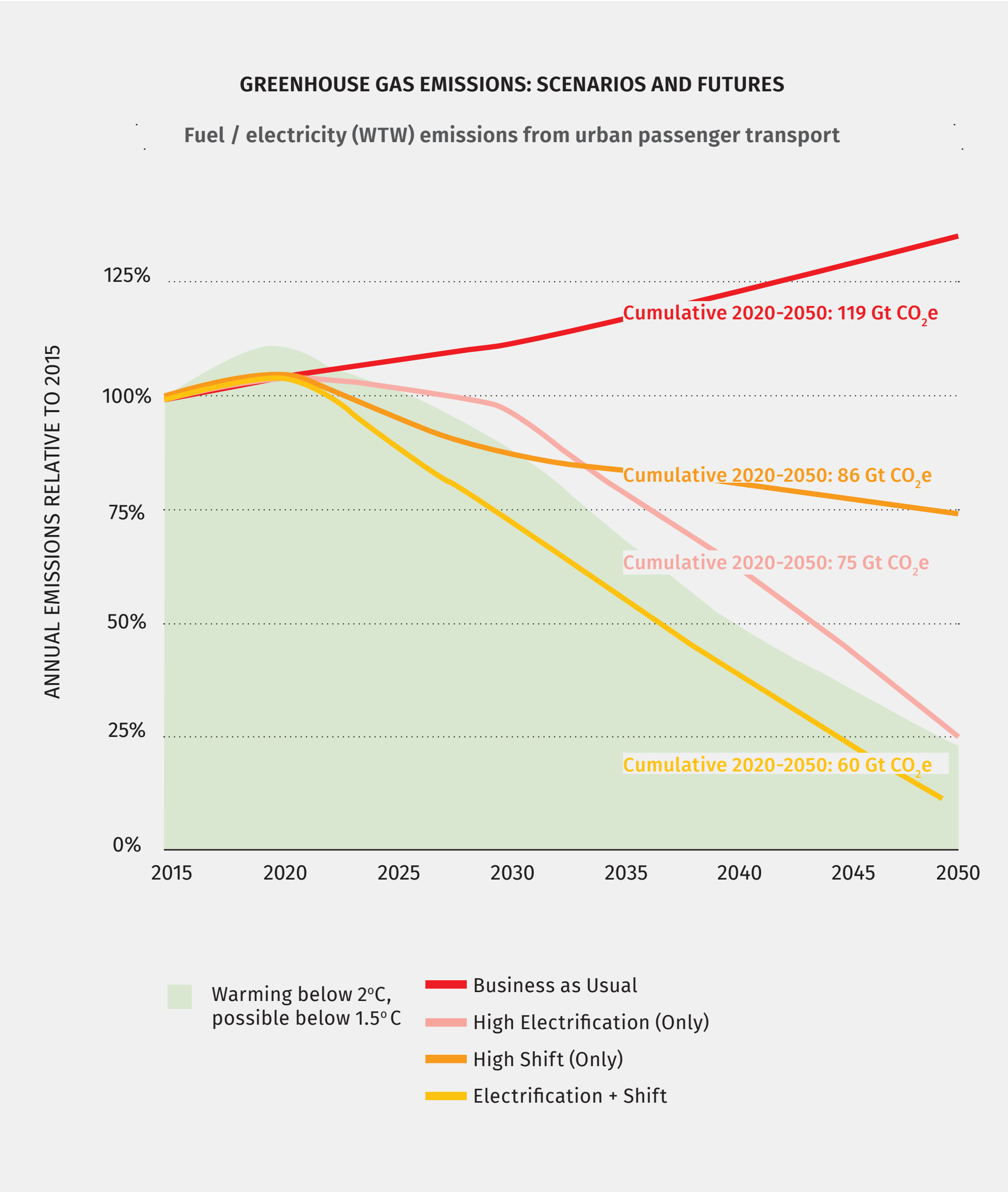
Unless humanity reaches net-zero carbon emissions by 2050, climate change will reach catastrophic levels. Urban passenger transport is responsible for about a tenth, and rising, of the world's total greenhouse gases. But there are solutions. Battery technology is rapidly improving, and electric vehicles (EVs) show unprecedented promise. We cannot decarbonize transport without them. EVs also bring important co-benefits, like the reduction of air pollution. Similarly, many cities are reducing emissions by shifting travel from cars to walking, bicycling, and public transit, saving money in the process and improving transport equity.

However, neither vehicle electrification nor modal shift alone can sufficiently decarbonize the sector, even under highly optimistic scenarios. Only with both electrification and modal shift can we achieve an emissions reduction consistent with global warming of less than 1.5°C by the end of the century. Climate change is urgent. We must do everything we can, all at once, all together.



Only the combination of compact cities with modal shift and vehicle electrification is consistent with the International Energy Agency's Sustainable Development Scenario (SDS), limiting global warming to less than 2°C with a possibility of limiting it to less than 1.5°C.

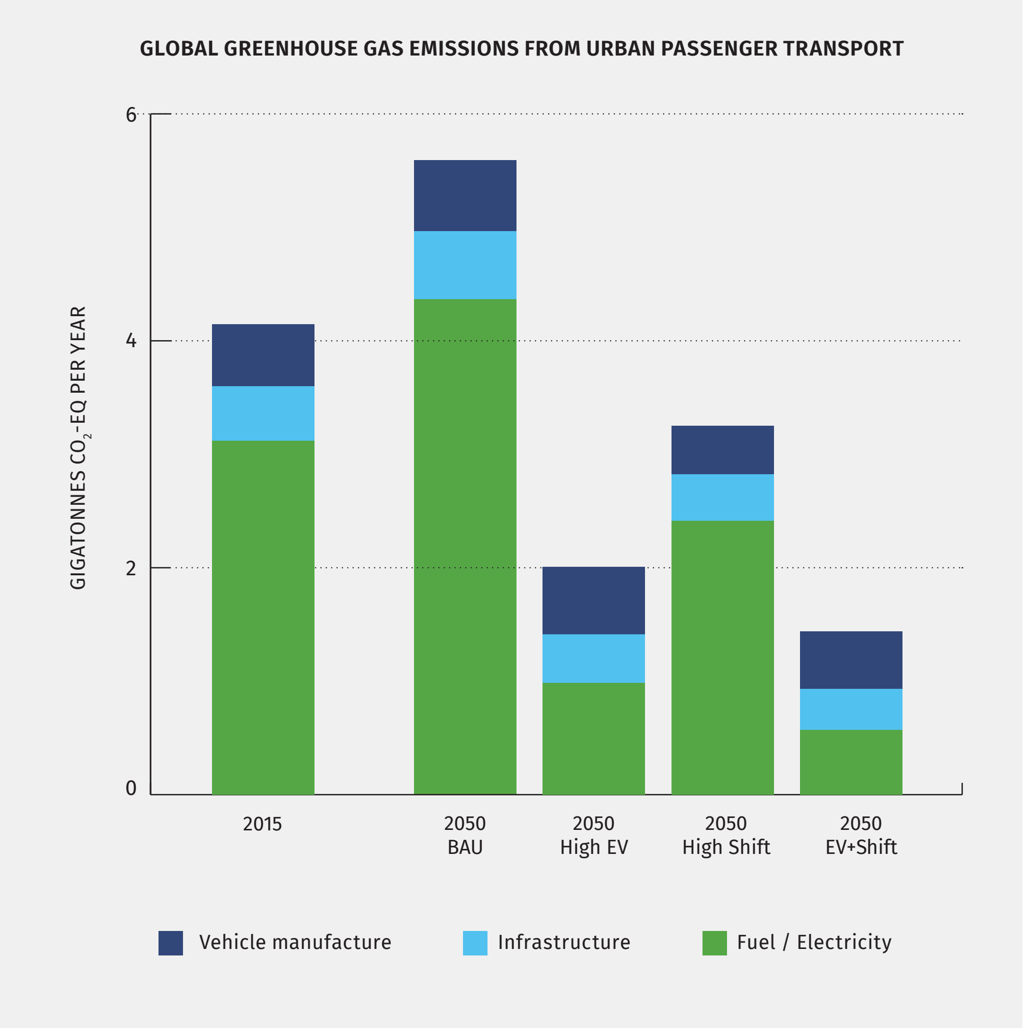
A study by ITDP and the University of California, Davis, developed four worldwide scenarios in consultation with global experts on electrification and transportation:[1]

1.*BAU:* Business as usual

2.*High EV:* Aggressive electrification of public and private vehicle fleets

3.*High Shift:* Policies that build compact cities focused on walking, bicycling, and public transit instead of cars

4.*EV+Shift:* Electrification and modal shift combined

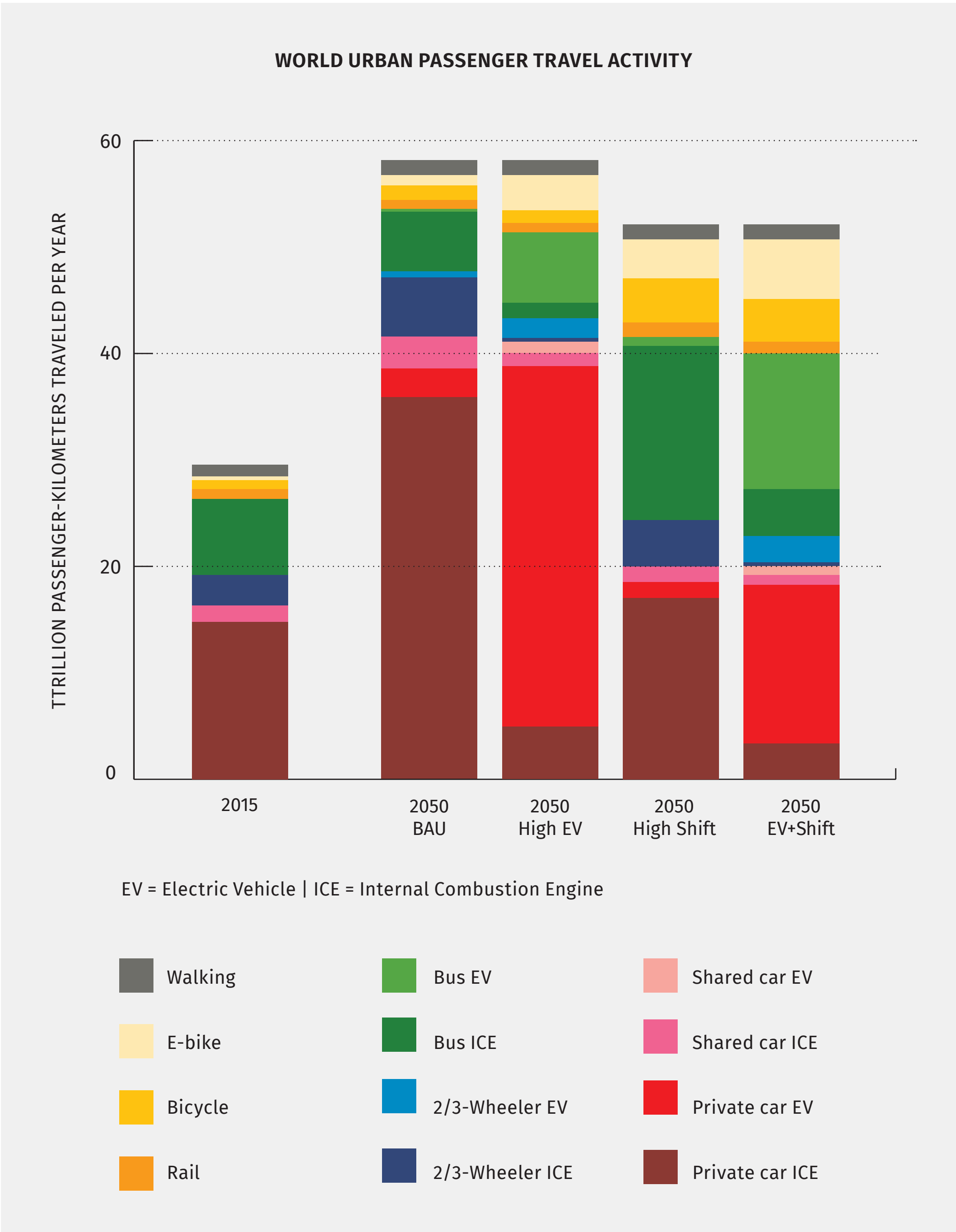


1 The assumptions and findings have been reviewed by technical experts representing the International Energy Agency, the International Transport Forum–Organisation for Economic Co-operation and Development, the ClimateWorks Foundation, and the Global Fuel Economy Initiative.

The latter three scenarios are highly ambitious but feasible pathways for the future of urban passenger transport.

To meet the terms of the Paris Agreement and avoid catastrophic climate change, we must reduce GHG emissions from urban passenger transport by a cumulative 53 gigatonnes over the period from 2020 to 2050.(footnote [2]) The High EV scenario alone could prevent a cumulative 44 gigatonnes, or High Shift alone could prevent 33 gigatonnes. Neither scenario by itself is sufficient. But the combination of these scenarios (Electrification + Shift) could reduce emissions by a cumulative 59 gigatonnes, making it the only scenario consistent with limiting global warming to less than 1.5°C.

Over the next 30 years, the world's population will grow larger and more urban. Global demand for urban passenger travel will double. Our scenarios imagine four ways of accommodating that growth.



2 Adapted from International Energy Agency (2021), World Energy Model, IEA, Paris. Our adaptation assumes that necessary emission reductions from urban passenger transport (by all modes) follow the same curves relative to 2015 as necessary reductions from road passenger transport using light-duty vehicles (urban or nonurban). This approach to understanding consistency with future extents of global warming is more sophisticated than the approach described in the pre-publication brief that was circulated in early November, 2021; but the conclusion is unchanged.

BAU sees the world manufacture almost two billion new internal combustion engine cars by 2050. The vast majority of growth in car use is in low- and middle-income regions: Africa, for example, sees a quintupling of its private urban car fleet, reaching 224 million cars by 2050—significantly more cars than are in cities in the United States today.

High EV includes electrification of cars, motorcycles, and buses. Our projections for electrification align with the ambitious goal, announced at COP26 in November 2021,[3] of phasing out ICE vehicle sales worldwide by 2040.

High Shift is based on compact and mixed urban land use, reducing overall travel demand by about 11% relative to BAU, combined with a paradigm shift in transportation planning. In the *High Shift* world, it is easier to get around cities by walking, cycling, or riding transit than it is by driving, and so the demand for cars is reduced. While global car use increases slightly due to population growth, it is far lower than under *BAU* or *High EV*.

The *EV+Shift* scenario imagines a future that is a combination of the *High EV* and *High Shift* scenarios. It is a future of dramatically reduced overall car use, plus electrification of most of the motorized travel that remains.

BUSINESS AS USUAL

A car-oriented street in Cairo represents the future for much of the world under Business as Usual. **SOURCE:** Friedrich Stark via Alamy Stock

Impacts:

- Increase in traffic fatalities
- High direct public and private costs
- Reduced access to opportunities for low-income people without cars
- Increase in urban highways, dividing neighborhoods and subsidizing suburban sprawl into farmland
- Increase in carbon emissions, leading to climate catastrophe

3 UN Climate Change Conference UK 2021 (2021), COP26 declaration on accelerating the transition to 100% zero emission cars and vans, 10 November.

HIGH EV

This photo from Los Angeles shows the kind of car-centric infrastructure that will be prevalent in a High Electrification future. **SOURCE:** GaudiLab via Shutterstock

Impacts:

- Increase in traffic fatalities
- High direct public and private costs
- Reduced access to opportunities for low-income people without cars
- Increase in urban highways, dividing neighborhoods and subsidizing suburban sprawl into farmland
- Sharp reduction in carbon emissions
- Sharp reduction in local air and noise pollution

Key policies:

- Supply- and demand-side EV incentives, including zero-emissions vehicle waivers and tax rebates, achieving purchase price parity
- Ambitious fuel economy and tailpipe carbon dioxide standards
- Battery reuse and recycling
- Public charging infrastructure
- Electric grid expansion and decarbonization

HIGH SHIFT

A physically separated bicycle lane in the streets of Indonesia. **SOURCE:** ITDP Indonesia.

Impacts:

- Reduction in traffic fatalities
- Increased access to opportunities, especially for low-income people
- Increase in walking and cycling, which improve physical and mental health, reducing health care costs.
- High local air and noise pollution relative to *High EV*
- Insufficient carbon reductions to meet the Paris Agreement

Key policies:

- Strong incentives for compact, mixed-use, transit-oriented development
- Market rate pricing of parking spaces
- Reallocation of transport budgets to walking, cycling, and public transit
- Street redesigns shifting space from cars to bus lanes, physically protected bicycle lanes, and footpaths
- Promotion of bicycles, especially shared electric bicycles

EV + SHIFT

The electric buses of the bus rapid transit system in Nanning, China, exemplify the Electrification+Shift future.
SOURCE: ITDP China

Impacts:

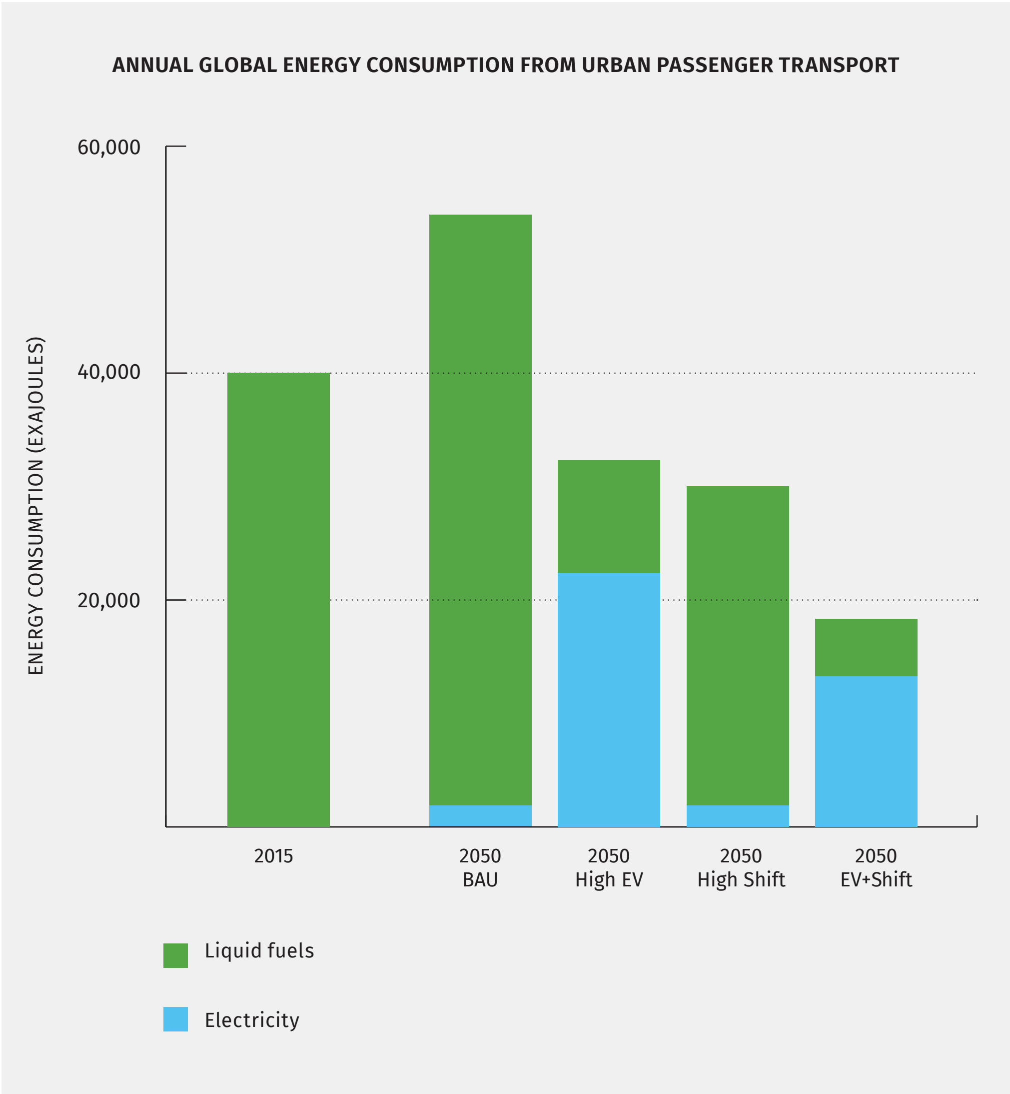
- Reduction in traffic fatalities
- Increased access to opportunities for all
- Increase in walking and cycling, which improve physical and mental health, reducing health care cost
- Extreme reduction in local air and noise pollution
- Massive reduction in carbon emissions consistent with the terms of the Paris Agreement

Key policies:

- All policies listed for *High EV* and for *High Shift*
- Creation of low-emission areas, especially in city centers, to simultaneously incentivize modal shift and vehicle electrification

The synergy between *High Shift* and *High EV* makes the *EV+Shift* scenario more feasible:

Compared to *High EV*, the reduced demand for driving in *EV+Shift* means that about 300 million fewer electric cars are required and about 9,000 fewer exajoules of electricity are needed to power them (a 40% reduction). Our modeling assumes an ambitiously decarbonized grid.[4] Synergy makes both EV manufacturing and the energy transition more feasible.



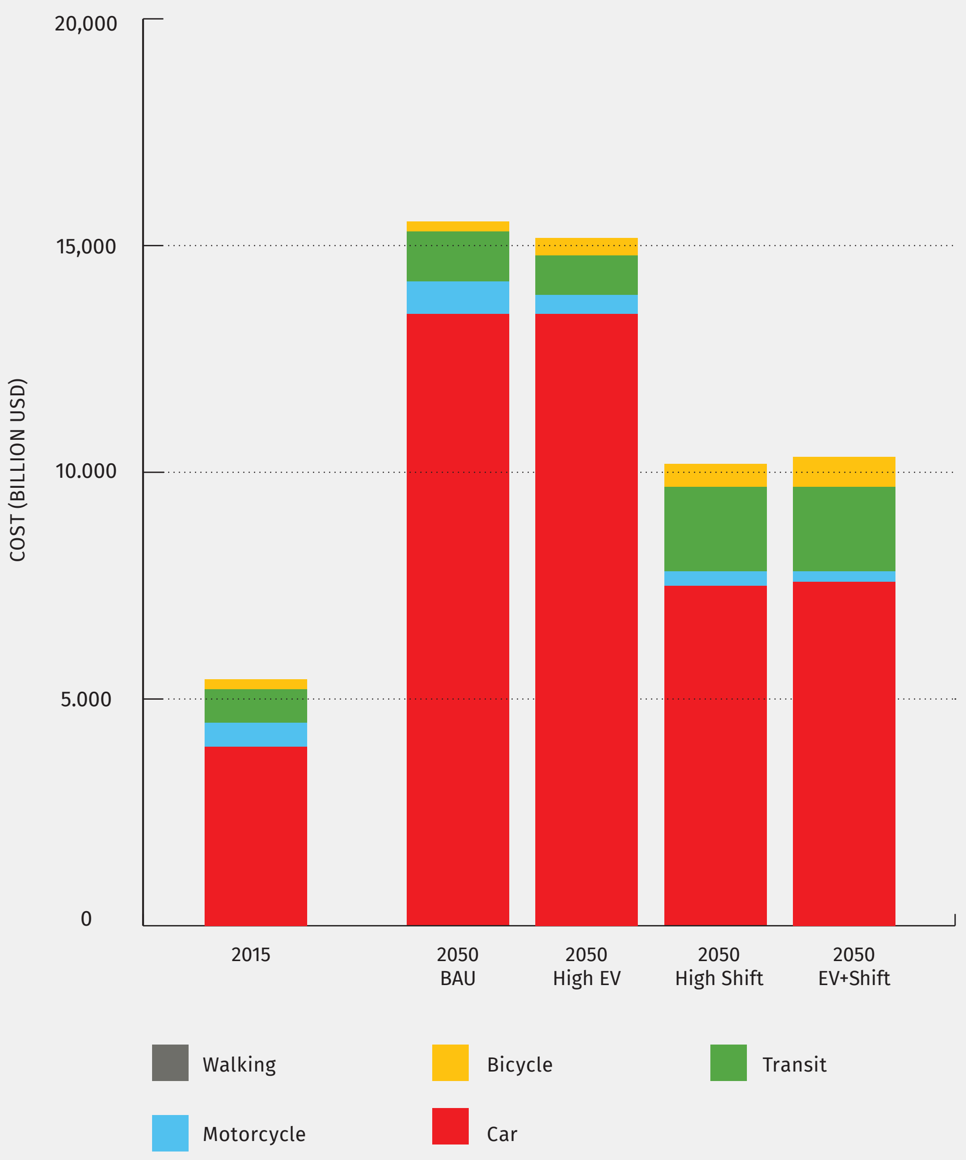
4 The International Energy Agency's *Sustainable Development Scenario*.

Car travel, by any energy source, is the most expensive mode of urban transport per passenger-kilometer. Compared to *BAU* and *High EV*, the *High Shift* and *EV+Shift* scenarios represent an annual saving of over $5 trillion per year by 2050 in direct costs (including fuel, operation, manufacture, and infrastructure)—money that can be used for other decarbonization efforts.

Our climate's future depends not only on EVs but also on compact cities, public transit, bicycle lanes, and footpaths. Neither approach alone is sufficient, but when combined, these two strategies are easier to achieve, more impactful, and more beneficial to society as a whole.

EV+Shift is an ambitious vision for our planet's future. It will require a vast global effort, comparable in each country to the construction of the U.S. Interstate Highway System in the 1950s or of China's high-speed rail network in more recent years. But those feats of infrastructure were possible, and so is the decarbonization of urban passenger transport.

DIRECT GLOBAL PUBLIC AND PRIVATE COSTS OF URBAN PASSENGER TRANSPORT



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