TRANSFORMING TRANSPORTATION

How to cut pollution and achieve our climate goals in Washington and Oregon

NOVEMBER 2021

climate solutions

Energy+Environmental Economics

Hovland Consulting LLC

There are pathways, and we need to

TAKE BOLD ACTION NOW


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Transportation electrification is key to achieving our climate goals, but we must combine both electrification and reduce the vehicle miles we travel (VMT) to address transportation inequities and achieve greater health, safety, and financial benefits. This will take strong policies and must include a focus on low-income and BIPOC (Black, Indigenous, People of Color) communities to address existing harms and disparities.

Electrifying transportation is good for us. We will see improved health and air quality, reduce how much money we spend to get around, and cut our climate pollution. When we combine electrification with increasing transit use, biking and walking and reducing vehicle dependency, we will see even more health, safety, and economic benefits.

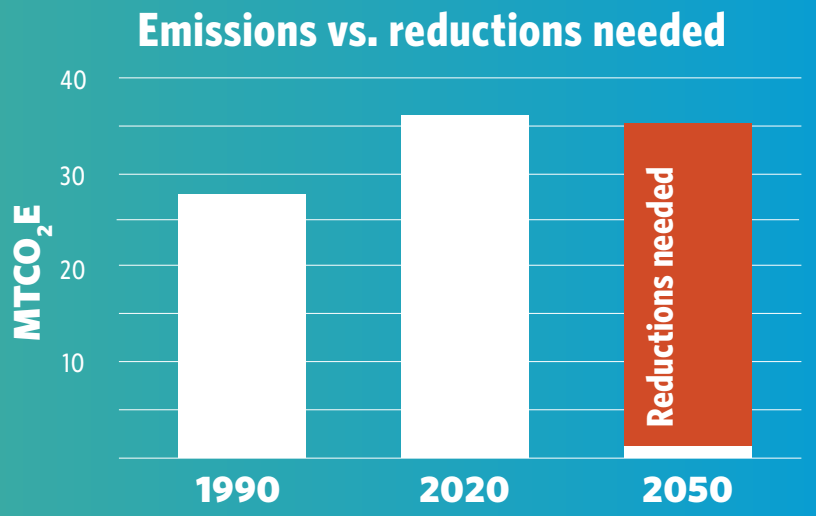
Stay Healthy Streets (shown above)

The City of Seattle initiated Stay Healthy Streets in 18 city locations at the beginning of the COVID-19 pandemic to give people sufficient space for walking, rolling, biking, and playing as streets were closed to pass through traffic. The goal was to open up more space for people rather than cars as a way to improve community and individual health. The program is ongoing as of November 2021.

No matter which transportation decarbonization pathway we choose, rapid electrification is the foundation, which means we need enough clean electricity to meet our needs. We can also achieve this by investing in new wind and solar alongside peak demand management, all while decarbonizing our grid by 2045. Washington is already on this pathway to 100% clean electricity with the passage of its Clean Energy Transformation Act; Oregon followed suit in July 2021 with the passage of the 100% Clean Energy law.

Thinking beyond the status quo

Transportation is the largest source of climate pollution in the Pacific Northwest. Air pollution from this sector also impacts our health, disproportionately harming low-income and BIPOC communities. We need to cut these emissions by 2050 in order to maintain a stable climate, and the sooner we do so, the sooner we can achieve a myriad of public health and other benefits. How do we do this, and how do different options impact our health, safety, spending, transportation infrastructure, and electricity grid? How do impacts vary for different areas and communities most burdened by transportation pollution?



THE RESEARCH

We examined which pathways are available to decarbonize the transportation sector in Washington and Oregon. We focused on two main variables: the speed and level of conversion to electric vehicles and the amount of VMT. We also set defined geographies so we could compare impacts for cities, suburbs, small towns, and rural areas. We also were able to discern different impacts for BIPOC and low-income people based on where they live.

Electrification

Speed of adoption and rate of growth for: passenger and light duty vehicles, buses, medium duty trucks, and heavy duty trucks

Vehicle miles traveled (VMT)

Increase or decrease based on: freight miles, personal miles traveled, bus use use, micromobility use, and walking/ biking/trip elimination

Using these variables, we built three core scenarios to examine the impacts on carbon and air pollution, our health, electrification infrastructure, grid impacts, safety, and personal and public spending.

We need to switch to 100% clean electricity to move us and our goods around and reduce the vehicle miles we travel.

SCENARIO 1:
Electrification + VMT Reduction

- Near 100% electrification of all vehicle types
- 27% VMT reduction

SCENARIO 2:
Near 100% electrification

- Near 100% electrification of all vehicle types
- No change in VMT compared to business as usual

SCENARIO 3:
Electrification + VMT Increase

- Near 100% electrification of all vehicle types
- 21% VMT increase

WHERE WE ARE:
BUSINESS AS USUAL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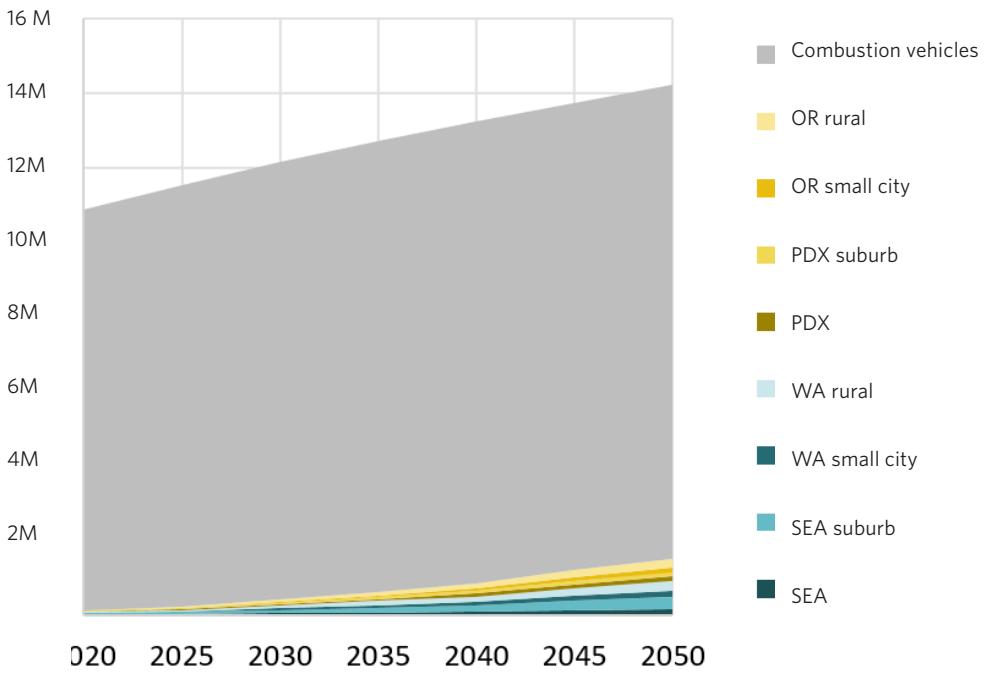
We compared emissions in a "business as usual" situation to scenarios that limit global warming to what's minimally necessary for climate stability. This means a 95% reduction from 2020 emissions levels are needed by 2050 to limit warming to 2C° or below. These reductions align with the Washington Deep Decarbonization Pathways and the Clean Energy Transition Institute's Pathways study for the NW.

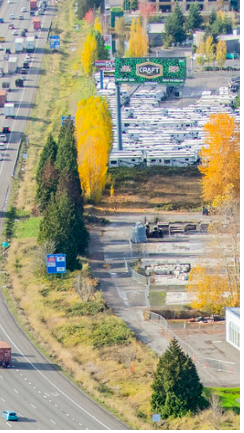
Under this business as usual scenario, we see an increase in VMT due to a growing population. Personal miles traveled do not change. We did not consider any new policies to spur electrification that were not in place at the time of modeling in late 2019 and early 2020. This results in a low level of electrification by 2050.

But we need to have a clean electricity grid. Oregon adopted a 100% Clean Energy law in 2021, with Washington adopting its 100% Clean Energy Transformation law in 2019.

~11% of passenger fleet, ~23% of buses are electric by 2050. Freight does not electrify.

EVs - Passenger + Freight





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SCENARIO 1: AN IDEAL WORLD
ELECTRIFICATION + VMT REDUCTION

In this scenario, VMT is reduced by 27% by 2050 compared to business as usual. This includes Seattle and Portland reducing their VMT by 47%, which is lower than New York City and would be about the same as London. VMT in small cities would need to be the same as the New York state average, which is the state with the lowest VMT.

The above achieves our emissions reductions goal, with carbon pollution dropping to 97% below 2020 levels by 2050. This averts 475 million metric tons of greenhouse gas emissions by 2050, which translates to saving $41 billion in the social cost of carbon compared to business as usual.

Nearly all vehicles must be electric by 2050:

- **100%** of passenger and light duty vehicles
- **98%** of buses
- **93%** medium duty trucks
- **85%** heavy duty trucks

Health

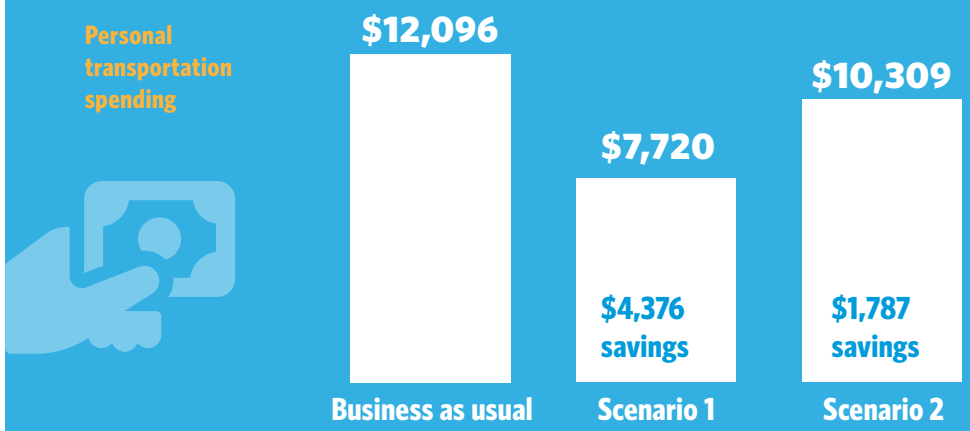
The reduction in tailpipe emissions that comes from reducing VMT and electrifying results in massive health benefits which translate to monetary savings: up to $626 million annually by 2050. For people of color in Seattle alone, this amounts to $88 million in avoided health costs by 2050 and 176 fewer asthma attacks—at minimum, due to the fact that people of color are disproportionally burdened by air pollution.

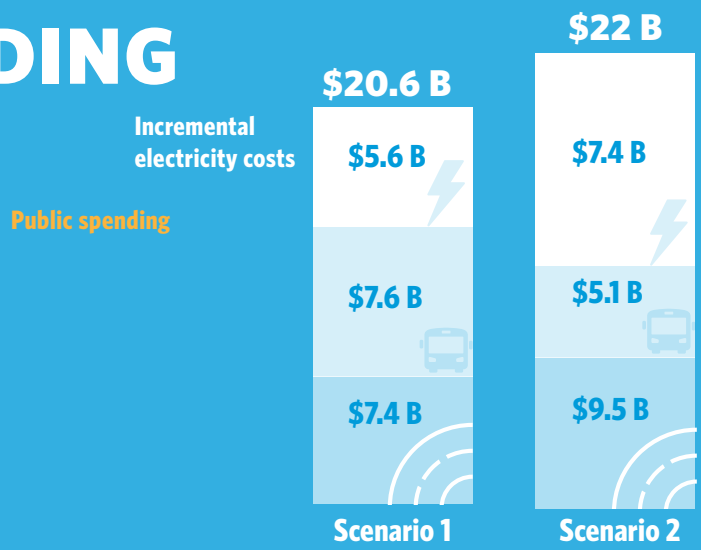
We also see an increase in active mobility, with 250,000 more people walking, biking, or using micromobility. In addition to reducing deaths caused by pollution, reducing VMT will also reduce deaths caused by vehicle crashes. Under this scenario, 205 lives will be saved in 2050.

	2025	2050^
$ Total Health Benefits (low-high)	$30 - $68 M	$278 - $ 626 M
$ Hospital Admits reduced, All Respiratory	$20 k	$186 k
$ Work Loss Days avoided	$83 k	$764 k
$ Minor Restricted Activity Days avoided	$210 k	$1941 k
Mortality avoided (low-high)	3 - 6	28 - 62
Asthma Exacerbation avoided	95	875
Work Loss Days avoided	460	4,265
Minor Restricted Activity Days avoided	2,700	25,100

*Team analysis using EPA's COBRA model
^Adjusted for population

TRANSPORTATION COSTS
PERSONAL & PUBLIC SPENDING





SCENARIO 1: ELECTRIFICATION + VMT REDUCTION

Personal spending

Owning an electric vehicle is cheaper than owning a gas-fueled vehicle, and reducing the frequency of driving or opting out of owning a vehicle entirely is cheaper yet. Under this scenario, thanks to the combination of electrification and reducing the need to drive, the average person will save around $4,370 annually when compared with business as usual.

Public spending

To support this amount of electric vehicles, we will need 750,000 public chargers ($1.2-2.4 billion total cost). We will also need to significantly invest in transit, spending $2.5 billion more than under business as usual. However, we will need to spend much less on roads—$2.3 billion less. Together, this amounts to $200 million more than business as usual.

SCENARIO 2: NEAR 100% ELECTRIFICATION

Personal spending

Since electric vehicles are cheaper to fuel than gas-powered vehicles, individuals will save about $1,780 annually compared with the status quo. However, they will not save as much as they would under Scenario 1 where electrification is paired with VMT reductions.

Public spending

When we combine road, transit, and incremental electricity costs, this scenario is $1.4 billion more expensive than Scenario 1. Scenario 1 has higher transit spending, but it requires less road spending and has fewer electricity costs.

SCENARIO 2
NEAR 100% ELECTRIFICATION

This scenario combines the deep electrification of Scenario 1 with no changes to per capita VMT. People's travel patterns do not change, but nearly all of the vehicles on the road are electric by 2050. This also achieves our emissions reductions goal, with carbon pollution dropping to 96% below 2020 levels by 2050. This averts 435 million metric tons of greenhouse gas emissions by 2050, which translates to saving $38 billion in the social cost of carbon compared to business as usual. However, this scenario results in 40 million metric tons more emissions than scenario 1.

Health

Reducing tailpipe emissions results in substantial health benefits, and both this scenario and scenario 1 result in similar outcomes by 2050. However, the health savings do not accrue as quickly in this scenario, with $10-$24 million fewer in health-related savings in 2025 due to more miles being traveled by vehicles that are not yet electrified. Near-term benefits under this scenario are smaller for communities of color and low-income communities as well for the same reason. Benefits remain, but they are not as significant as in scenario 1.

Because travel patterns remain the same as business as usual, we do not see increases in active transportation or decreases in crash deaths under this scenario.

SCENARIO 3:
NOT OPTIMAL

Electrification + VMT increase

This scenario combined the same high rate of electrification with a 21% increase in vehicle miles traveled: 10% in urban and suburban areas, 15% in small cities, 35% in rural areas (where VMT is growing more rapidly), and by 12% for freight. This increase could be due to a combination of poor land use and planning, unregulated automation, and economic growth contributing to more freight travel.

We need to reduce how many miles we travel on our roads on top of switching to electric vehicles of all types powered by 100% clean electricity.

Due to most vehicles electrifying by 2050, this scenario does meet our greenhouse gas emissions targets. However, it results in higher road costs, higher incremental electricity costs, more crash deaths, higher personal spending, and fewer near-term health benefits than both scenarios 1 and 2.

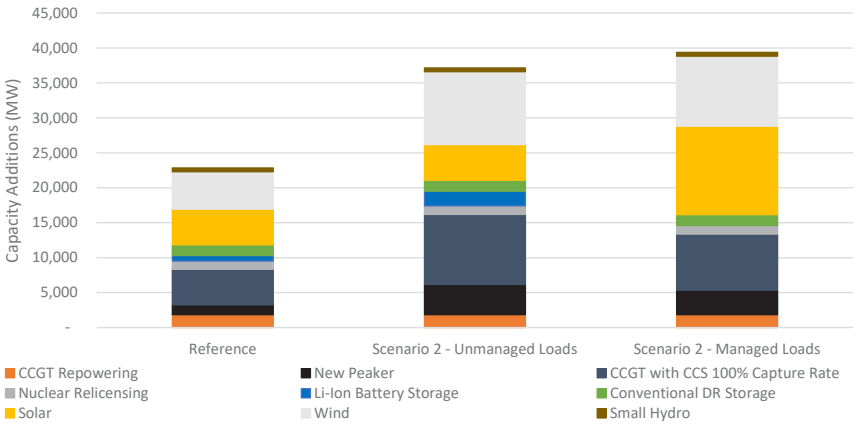
ELECTRICITY

Business as usual travel patterns paired with electrification (scenario 2) lead to an increase in peak capacity by 9.7 GW when demand is not managed. When we optimize resource profiles and cost while meeting states' clean electricity requirements, wind resources are the largest new source of electricity. However, we see renewable resources such as solar and wind reaching saturation. To meet the lower electricity demands of electrification paired with a decrease in VMT (scenario 1), we see a 45% increase in wind and solar deployment compared to business as usual. The higher load needs of scenario 2, particularly when demand is not managed, are met through a tripling of battery storage and a doubling of biogas peakers and carbon capture and storage-enabled (CCS) combined cycle gas plants.

We examined the impact of all scenarios on the electric grid. How much new power do we need? How much will it cost?

When we pair electrification under scenario 2 with load shifting (charging electric vehicles at times they impact the grid least and reduce peak load), costs decrease. We were able to shift load by 8% without impacting travel patterns, increasing charging in the middle of the night and from 11am-1pm. Managing load leads to 3 GW less peak capacity needed. This changes the profile and cost of new resource builds. Solar becomes the top new resource, thanks to its ability to provide power in the middle of the day. This is followed by wind, which can supply energy in the middle of the night. Biogas and CCS combined cycle gas plant builds fall by 20%.

Electric Sector Capacity Additions in a Low Carbon Future



This translates to $600 million less in annual incremental system cost. The charging profile and benefits of this analysis highlight the importance of workplace charging and utility cooperation with customers to ensure that load is being managed well.

THE GRID BY THE NUMBERS

$26.29 B

$7.4 B

$18.9 B
System costs

Scenario 2 vs. BAU

Total load (TWh)
198 +59

Peak Capacity (GW)
36 +9.7

WHERE WE'RE GOING is just as critical as HOW WE GET THERE

SUMMARY OF CORE SCENARIOS VS. BAU

In 2050...	Business As Usual	Scenario 1 Electrification + VMT reduction	Scenario 2: Near 100% electrification	Scenario 3: Electrification + VMT increase
Cumulative CO_2 emissions (MMT)	990	**475 less** Least amount of CO_2 emissions	**435 less**	**405 less**
Total health benefits	N/A	**$278-626 million** Largest health savings	**$276-622 million**	**$274-620 million**
Work loss days avoided	N/A	**4,265** Fewest work days lost to illness	**4,245**	**4,225**
Chargers needed	70,000	**680,000 more** Fewest chargers to meet climate goal	**870,000 more**	**1,030,000 more**
Crash fatalities	1,070	**205 lives saved** Fewest crash deaths	**No difference**	**220 more deaths**
People using active transportation	450,000	**250,000 more** Most people walking, biking, or using micromobility	**No difference**	**No difference** (and fewer people use transit)

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ADDITIONAL **SCENARIOS**

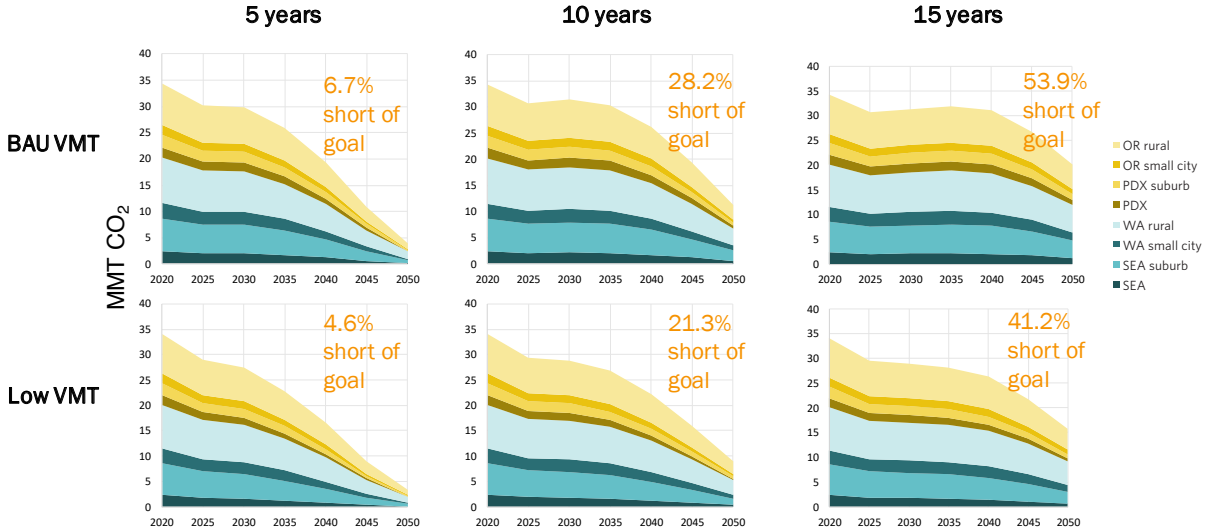
In addition to the three core scenarios for which we did detailed modeling, we analyzed additional scenarios to better understand the impacts of different levels of electrification and vehicle miles traveled. This additional modeling emphasized two findings:

We cannot delay or slow down the rate of electrification.

In order to achieve the deep decarbonization we need, we cannot slow down electrification. Even if we reduce VMT by 27% (per scenario 1) and slow electrification so 80% of cars, 90% of buses, 75% of medium-duty freight, and 72% of heavy-duty freight are electrified by 2050, we still fall 15% short of our goal.

Delayed electrification (VMT)

We cannot delay electrification uptake and still achieve climate goals.



Similarly, we cannot delay electrification even by five years and still achieve our goals, even with significant VMT reductions. Therefore, it is critical that we work on policies that will support transportation electrification in the near term.

We need to rely on a combined strategy.

If we rely only on reducing VMT and do not electrify further than business as usual, we will fall far short of our climate goals. Even if we match urban and small city VMT to be at or below that of Paris and suburban VMT matches London's—a 55% reduction overall—we are still 50% short of our goal.

If we pair these deep VMT reductions with the least amount of electrification possible, we still find that we need about 97% of cars and light duty trucks, 96% of buses, and 85% of medium and heavy duty freight to be electrified in 2050. Anything less and we do not meet our decarbonization goals. However, combining deep VMT reductions with electrification leads to significant benefits.

THIS

POLICIES NEEDED

It is possible to decarbonize our transportation sector while shifting to a 100% clean electricity grid, but we need to act quickly by reducing vehicle miles traveled and electrifying all vehicles still on the road. In addition to mitigating the climate crisis, electrifying transportation and reducing VMT will also lead to improved equitable outcomes including substantially better health and air quality, and a reduction in how much money we spend to get around compared to business as usual. While we can meet our decarbonization goals by focusing only on transportation electrification, we see even more holistic health, safety, and economic benefits when paired with increasing transit use, walking, and biking. We need to begin now and support an equitable array of bold policies that will help us get there.

We need to support rapid electrification now.

- Clean Fuel Standards
- Investments in EV charging infrastructure, particularly in locations that will benefit low-income households and those that may not be able to charge at home
- Funding to transition fleets to electric, with a focus on heavily-polluting diesel vehicles
- Require new buildings be EV-ready

Prioritize health, safety, and justice

- Make sure there policies include a focus on low-income and BIPOC communities to address existing harms and disparities
- Engage underrepresented communities in participatory budgeting principles to achieve community-led solutions that maximize benefits and minimize harms

Invest more in transit, active transportation infrastructure, and other ways to reduce vehicle trips.

- Invest in transit so it is a safe, convenient, and affordable option
- Give transit movement priority (bus only lanes)
- Create safe infrastructure for active transportation (protected bike lanes, wide sidewalks, safe crosswalks), with a focus on underserved communities
- Support telecommuting
- Adopt progressive road user charge models

Improve our land use policies

- Allow more people to live near where they work by ensuring there is adequate urban housing at all income levels
- Legalize different housing types throughout cities and ensure that essential services are located near housing
- Prevent sprawl, which locks people into long commutes and makes transit systems harder to operate

IS 100% POSSIBLE.

We can and should electrify everything and reduce our overall vehicle miles for our collective health, safety, economic well-being, and for a stable climate.