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## Legend

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### 1. Forest Carbon Sequestration

Trees and greater forests act as carbon sinks for our environment. Trees sequester, or take in, carbon dioxide and store it in their roots and trunks. The average tree sequesters 22 pounds of carbon per year. When forests are preserved and managed well, they have a huge potential to sequester carbon that we emit and help reduce our addition to climate change.

#### Trees Ability to Sequester

<https://archpaper.com/2017/07/trees-sequester-carbon-myth/>

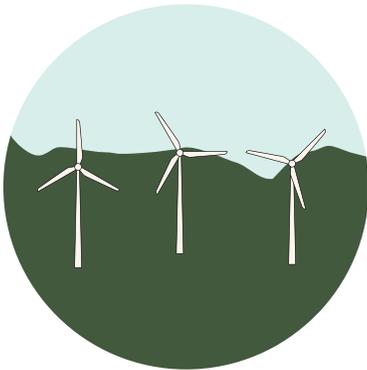
#### Greenhouse Gas Sequestration Taskforce Papers on Natural Sequestration

<http://planning.hawaii.gov/carbon-farming-task-force/greenhouse-gas-sequestration-projects/>

#### Carbon Sequestration by Trees

<https://tinyurl.com/y4u6wvvgq>

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### 2. Wind Turbines

Not only do wind turbines generate power but they also create jobs and bolster the economy. Wind is a clean fuel source and does not add to GHG emissions like power plants that use coal, oil, natural gas and other fossil fuels. Wind is also abundant and inexhaustible here in Hawaii. Currently, 41 states have implemented wind energy.

#### For More Information

<https://www.energy.gov/eere/wind/advantages-and-challenges-wind-energy>

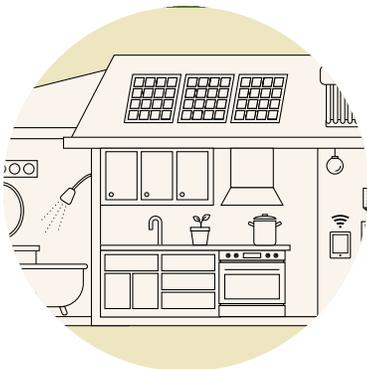
#### National Wind Coordinating Collaboration

<https://www.nationalwind.org/>

#### States That Have Implemented Wind Energy

<https://www.chooseenergy.com/news/article/best-worst-ranked-states-wind-power/>

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### 3. Green Home Infrastructure

Imagine your home is as green as you are. Solar panels and batteries for electricity, rainwater catchments for washing the car or watering the plants, solar water heaters for morning hot showers – it is all possible. Green home infrastructure can drastically reduce electricity, water, and gas consumption while still providing the amenities we need!

#### Link(s)

<https://elemental.green/17-trends-for-sustainable-homes-in-2017/>

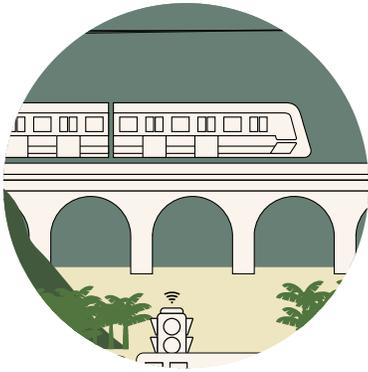
<https://www.energy.gov/articles/future-home-tech-8-energy-saving-solutions-horizon>

#### Green building homes with EPA

<https://archive.epa.gov/greenbuilding/web/html/about.html>

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#### 4. Rail

Hate congestion? Try the rail! Rail transit takes cars and buses off of the road, reducing traffic jams and delayed commutes. You will even have extra time to read, work, or relax rather than spending that time behind the wheel. The rail will also reduce GHG emissions for every car taken off the road. Today, 19 states have operational commuter rail systems.

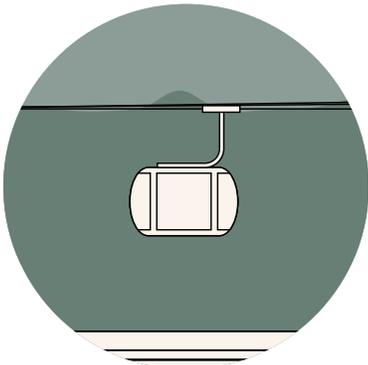
**For More Information**

<http://www.honolulutransit.org/inform/rail-facts?catid=6>

**State Programs that use Rail**

<https://s4prc.org/state-programs>

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#### 5. Aerial Transportation

Aerial Transportation?! That's right, aerial transportation uses cable or rail cars to transport passengers between points. Skipping the roads can increase transit time and reduce emissions from driving. The system can transport 6,000 passengers per hour in each direction. New York City and Portland have aerial trams to help commuters

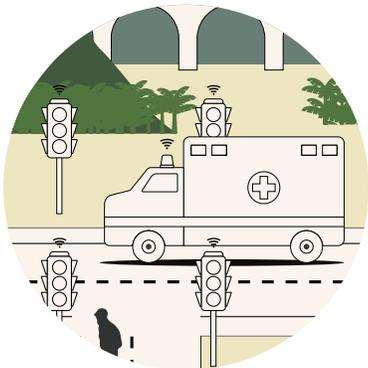
**For More Information**

<http://www.honoluluaerial.com/>

**Tramways of the US**

<https://www.curbed.com/2017/4/28/15440332/aerial-tramway-united-states>

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#### 6. Vehicle to Vehicle (V2V) Ambulances

V2V ambulances bolster the ability to request priority from traffic lights so that they can turn green for the ambulance to pass through as it approaches. This saves both time and energy, allowing the ambulance to see a countdown of the time remaining until the lights change and can control its speed to what is needed to pass through the light. This eliminates both harsh breaking and accelerating – also saving emissions of about 20%! As of December 2016 the US DOT requires automakers to include V2V technologies in all new light-duty vehicles.

**For More Information**

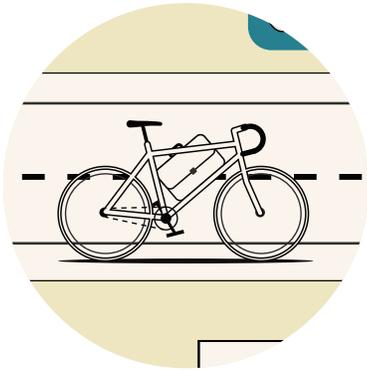
<https://www.compare.com/auto-insurance/guides/vehicle-communication>, <https://www.nhtsa.gov/technology-innovation/vehicle-vehicle-communication>, <https://ieeexplore.ieee.org/document/7932586>

**US DOT RFC on V2X (vehicle to everything) Communications Technologies**

<https://www.nhtsa.gov/press-releases/us-department-transportation-releases-request-comment-rfc-vehicle-everything-v2x>

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## 7. Bike Sharing

Bicycles are a great mode of transportation when going to and from work over a shorter distance. Not only do you save on greenhouse gas emissions but also get a good workout, arriving to work alert and awake. Every mile that you ride on a bicycle you save a pound of CO<sub>2</sub>. Bike shares allow you to take a bike from location to another and are great for point A to point B commuting. You are also guaranteed a parking spot, which isn't always the case in the city. In Denver, 2.1 million bike trips covering 4.5 million miles have offset more than 2,948 metric tons of CO<sub>2</sub> emissions and saved more than 330,000 gallons of gasoline.

### Climate Friendliness of Bikeshare

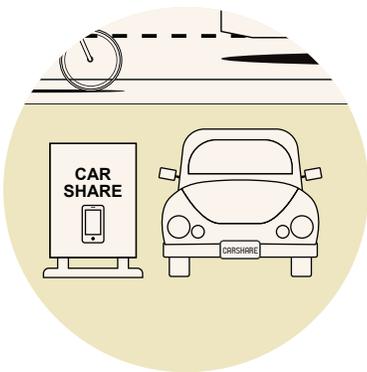
<https://www.scientificamerican.com/article/is-bike-sharing-really-climate-friendly/>

### Commission Paper on Clean Transportation

<http://climate.hawaii.gov/wp-content/uploads/2019/02/Panel-1-Coming-clean-brief-FINAL-Feb-13-2019.pdf>

### Emissions Reductions from Cycling

<https://www.itdp.org/2015/11/12/how-cycling-can-save-cities-money-and-emissions/>



## 8. Carshare

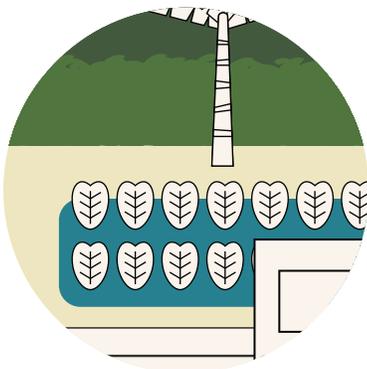
Do you rarely drive your car? Do you ride a bike and wish you had a car for the occasional trip? These are two questions that have sparked the concept of carsharing. Cashares offer cars that can be checked out by the driver for any amount of time from 30 minutes to an entire day. Rates are based only on time usage and gas is included! These programs reduce the need for vehicles, especially for those of us who don't drive very often and need a vehicle only sometimes. Hybrids and electric cars are available too!

### For More Information

<https://www.digitaltrends.com/cars/daimler-car2go-car-sharing-benefits/>

### Car Sharing and Car Sharing for Governments and Incentives in Other States

<http://www.ncsl.org/research/transportation/car-sharing-state-laws-and-legislation.aspx>



## 9. Wetlands

Wetlands reduce the amount of permeable concrete and help absorb water, decreasing runoff. Wetlands can also be used to sequester CO<sub>2</sub> emissions naturally, decreasing the amount of emissions entering the atmosphere.

### For More Information

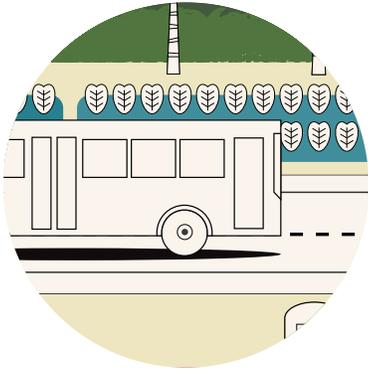
<https://ny.curbed.com/2012/10/30/10312060/8-ideas-to-combat-floods-and-rising-sea-levels-in-nyc>

### Association of State Wetland Managers

<https://www.aswm.org/>

### Sequestration Information for Wetlands

<http://www.esassoc.com/services/carbon-sequestration-wetlands>



## 10. Bussing

Buses are extremely efficient and can move many passengers throughout their commute, rather than each one of those commuters driving their own car. A full bus can take 40 cars off the road. Based on national averages a single occupancy car emits 3 more lbs. of CO<sub>2</sub> per ten-mile trip than buses, and 67% of commuters are driving in this way. Not only are there emissions reductions, fewer cars on the road means less traffic, less idling, and faster commuting.

### Hawaii Commuter Behavior

<http://onlinepubs.trb.org/Onlinepubs/trr/1988/1170/1170-008.pdf>

### Hawaii Commuting Patterns

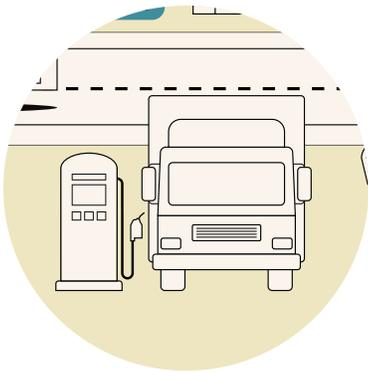
[http://files.hawaii.gov/dbedt/economic/data\\_reports/briefs/Commuting\\_Patterns\\_Apr2015.pdf](http://files.hawaii.gov/dbedt/economic/data_reports/briefs/Commuting_Patterns_Apr2015.pdf)

### Commission Paper on Clean Transportation

<http://climate.hawaii.gov/wp-content/uploads/2019/02/Panel-1-Coming-clean-brief-FINAL-Feb-13-2019.pdf>

### Federal DOT Emissions by Transportation

<https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleInRespondingToClimateChange2010.pdf>



## 11. B100 Biofuels for HDVS

Biodiesel (BD) is a fuel source that comes directly from organic sources. This fuel type can range anywhere from 5% biodiesel and 95% diesel blends to 100% biodiesel. BD boasts far less greenhouse gas emissions (nearly 50%) than conventional diesel. BD can be sourced and produced locally, further reducing emissions from shipping and transport of the fuel. The federal Renewable Fuel Standard mandates 2.43 billion gallons of biomass based fuels (BD) in 2020, which was established by the Energy Policy Act of 2005 and expanded by the Energy Independence and Security Act of 2007. States are leading the way, for example, In Minnesota, all diesel fuel sold must be at least B20!

### For More Information

<https://www.epa.gov/environmental-economics/economics-biofuels>

<http://www.greentruckassociation.com/Resources/TechnicalResources/SustainableTechnologiesforWorkTrucks/Biodiesel/tabid/135/Default.aspx>

### The Renewable Fuel Standard

<https://fas.org/sgp/crs/misc/R43325.pdf>

### Minnesota B20

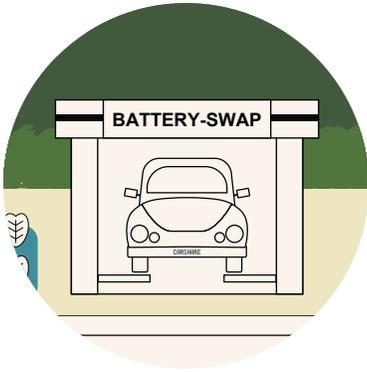
<https://afdc.energy.gov/laws/5452>

For a list of states and alternative fuel mandates select state in the following link

<https://afdc.energy.gov/fuels/laws/BIOD>

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## 12. Battery-Swap Stations

Is your fear of purchasing an electric vehicle rooted in running out of charge, replacing the battery, or the cost of the battery? In a battery swap station, you can pull in and swap your depleted battery for a new one –and a third party is responsible for owning the battery in your vehicle, drastically reducing the overall costs. This keeps batteries healthy for much longer, reducing or eliminating the cost of having to replace a degraded battery in your EV over time.

### For More Information

<https://medium.com/@pdiwan/is-battery-swapping-a-viable-option-for-public-transportation-evs-adb4ced74ff2>

### Tesla and Their Pilot

<https://www.teslarati.com/tesla-shuts-down-battery-swap-program-for-superchargers/>

### Nio Program in China

<https://electrek.co/2018/11/15/nio-battery-swap-stations-network/>



## 13. Autonomous Vehicles

A car that doesn't need a driver, this must be the future! Autonomous vehicles (AV) are vehicles that drive themselves. These cars are designed to pick up passengers, not to be owned. The use of autonomous vehicles will allow for more green spaces and parks require fewer parking spaces for cars, decrease the cost of housing, and open up more bike parking. Roads will clean up as well, with fewer signs, stop lights, delays, and accidents. Using autonomous vehicles will serve people first, rather than cars, in the designs of roads and cities, ultimately improving commuter, driver, and passenger safety.

### For More Information

<https://www.wired.com/story/self-driving-cars-cities/>

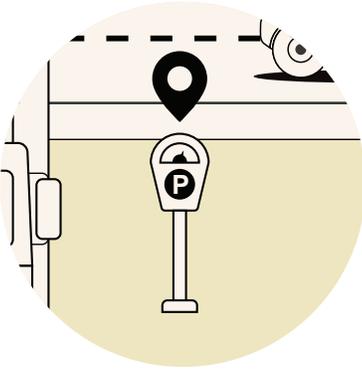
### 2018 Enacted Legislation on AVs

<http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx>

### USDOT's page on AVs

<https://www.transportation.gov/AV>

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## 14. Smart Street Parking

Have you ever circled the block for 15-30 minutes just to find a parking spot, any parking spot, and end up a mile away from home or work? Smart street parking lets a driver know where parking spots are available from on-street sensors or light pole cameras. In addition, this smart street parking can tell you when your parking space time limit is up-- and aid in the enforcement of parking regulations!

### For More Information

<https://www.iotforall.com/innovation-in-smart-parking-solutions/>

### Example from Mississippi

<https://www.ipsgroupinc.com/blog-smart-city-smart-parking-one-city-implemented-new-paid-parking-program-embraced-public/>



## 15. High-Density Housing

Up-zoning or building up rather than outwards is a way that cities produce more available and affordable housing while reducing the total land used. Bringing more people into these types of housing reduced the trip length, or trip mode (i.e. bus, bike, walk), that individuals must take to get to work. This can significantly reduce vehicle miles traveled to and from the office, ultimately reducing emissions. With more affordable units in Hawaii, fewer people who work in the city will be forced to look — and drive — farther afield to find homes they can afford. Based on a study by UC Berkeley a small the urban core commuter footprint is small but a large footprint in surrounding suburbs.

### Up-Zoning and Climate Benefits

<https://www.seattletimes.com/opinion/yes-to-upzoning-density-can-make-an-impact-on-climate-change/>

### Reducing Urban Sprawl through High-Density Housing

<https://news.berkeley.edu/2014/01/06/suburban-sprawl-cancels-carbon-footprint-savings-of-dense-urban-cores/>

### Map of Emissions and Urban Sprawl

<https://coolclimate.org/maps>



## 16. Van Sharing

Van Shares are like larger carpools in that more passengers can get into a larger, fuel-efficient vehicle. Vans produce 7.5 lbs. of CO<sub>2</sub> less than a typical single occupancy vehicle, and when they are full reduce another lb. of CO<sub>2</sub>. These vans provide transportation to groups of individuals that travel similar routes between their home and the office.

### Commission Paper on Clean Transportation

<http://climate.hawaii.gov/wp-content/uploads/2019/02/Panel-1-Coming-clean-brief-FINAL-Feb-13-2019.pdf>

### Federal DOT Emissions by Transportation

<https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleInRespondingToClimateChange2010.pdf>