

# Global Census of Zero Emission Vehicle Goals

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## EXECUTIVE SUMMARY

In this study, researchers at the UC Davis Policy Institute for Energy, Environment, and the Economy cataloged Zero Emissions (ZEV) goals from around the world. This study aims to expand on those previous efforts to assess ZEV goals, including a [Global Survey from the Center for Climate Protection](#) [2] and the International Energy Agency (IEA)'s [EV Policy Explorer](#). [3] **Researchers collected statements of ZEV goals (or the lack thereof) from 194 countries, finding that 87 countries, or 45% of nations have ZEV goals as of December 2021.** This ratio increased from 34% of nations shown in a July 2021 iteration of the study's census, and reflects a host of new commitments made surrounding the 2021 United Nations Climate Change Conference of the Parties (also referred to as COP26). For example, dozens of signatories joined a [COP26 MOU](#) outlining the following commitment: "As governments, we will work towards all sales of new cars and vans being zero emission by 2040 or earlier, or by no later than 2035 in leading markets." [4] While there were many nations that already had similar official ZEV targets, including but not limited to Norway, Ireland, Sweden, South Korea, Thailand, UK. Many other nations saw COP26 as an opportunity to make an initial commitment, such as Austria, Azerbaijan, Ukraine, Rwanda, Finland, El Salvador, Malta, and Morocco (see [Appendix](#) for full census details. See digital [timeline graphic](#) in web browser here).

ZEV goals in the U.S. are also emerging. **This study finds that ZEV goals among all 50 U.S. states are becoming more common, despite a lack of ambitious goals set on the federal level.** As of December 2021, 49% of U.S. States and districts have some type of ZEV goal, which includes 24 states plus Washington, D.C. Additionally, the census includes ZEV goals from 21 companies including 19 leading auto and transportation sector companies (e.g., BMW, Daimler, General Motors, Honda, Nissan, Toyota) as well as two ridehailing companies (Uber and Lyft).

A key takeaway from this study is that the vast majority of ZEV goals to date have yet to culminate. Only a limited number of ZEV goals have met their culmination date successfully, and while it is difficult to assess outcomes for recently sunsetted goals ending in 2020 or 2021, it is likely more goals have fallen short than successfully culminated. While these failed ZEV goals are not likely to do harm, widespread empty promises could diminish the overall effectiveness of a goal, and reduce public accountability. This study does not aim to prove the value or effectiveness of the ZEV goal policy. In fact, the literature supports the fact that ZEV goals are useless as standalone policies. If they are not coupled with a suite of supportive policies they are not likely to be sufficient as a standalone ambition or target. [21]

For example, purchase incentives, infrastructure investments, and awareness-building are shown to be among the most effective strategies to increase ZEV adoption. [21] However, more research is necessary to assess

whether the existence or ambitiousness of a goal does affect the policy environment that will enact these proven ZEV supportive policies. As more ZEV goals reach their culmination, the data in this type of study can inform an analysis to determine efficacy of ZEV goals and provide best practice for leaders as they invent and update climate commitments. This study is a starting place, and much work will remain, however this research can contribute towards an ongoing global effort to catalog progress towards ZEV goals and increase global climate action accountability.

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**Call to readers:** This [full database](#) is scheduled to be updated at least quarterly in 2022. The Policy Institute urges readers to help us with maintaining the accuracy of this dataset and is also actively seeking partners and sponsors to maintain and support this ongoing project. **Please [submit suggestions here](#).**

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## BACKGROUND

Decarbonizing the transportation sector is part of a critical path towards a climate resilient future. According to the International Energy Agency, transportation is [responsible for 24%](#) of direct global carbon dioxide emissions from fuel combustion, three-quarters of which comes from vehicles. [1] To make transportation decarbonization a reality, hundreds of world leaders have been setting climate goals including targets for zero emission vehicle (ZEV) manufacturing, ZEV sales, and charging infrastructure. Depending on the jurisdiction, the definition of ZEVs may include battery electric vehicles (EVs) and fuel-cell EVs (e.g., hydrogen), as well as plug-in hybrid EVs. The process of setting ZEV goals often starts informally with ambitious statements from leaders, then in some cases the goals advance to specific proposals, and finally some ZEV goals become official targets through legally ordained policy channels.

## STUDY METHODOLOGY

UC Davis researchers collected statements of ZEV goals (or a lack thereof) from 194 countries, 50 U.S. states plus Washington, D.C., and 21 transportation companies. Many of the ZEV goals are percentage based (e.g., 100% ZEV sales by 2050), while others are an absolute numerical target (e.g., 650,000 ZEVs purchased by 2040). The objective of this study was to capture all goals and categorize them based on goal type along several metrics, including goal formality and target.

The English language search tools used in this study were a limitation that may obscure results. The census reflects available data on ZEV goals, given these limitations. The data collection methodology was to conduct repeated web browser searches using a consistent combination of search terms: [state/country name/company] and “ZEV” or “EV” (for electric vehicle) and “goal.” Search terms for [country name] and “ZEV” or “EV target” were also employed. Approximately 20 of the top search result listings from each query were examined and selected with priority given to public sector websites, research organizations, nongovernmental organizations, and lastly formal and informal news media sources.

Data collection was initiated for 194 countries using a list of all UN member countries and Taiwan. For U.S. states, the study employed the full list of the states, adding the District of Columbia. To select the remaining census participants from the private sector, a more general web search was deployed using terms for ZEV/EV goals combined with the names of leading manufacturers (OEMs) and transportation network companies (TNCs), and those with goals are included.

## TAXONOMY OF GOAL TYPES

Specific targets for ZEV goals vary considerably. The following is a breakdown of the types of goals found in the census.

### Formality Level

Levels of formality vary among ZEV goals. The study team built off of a classification schema developed by the [International Energy Agency \(IEA\)](#) [3], refining their definitions to suit the sample, and employing the following three goal types:

- **Ambition:** This is a more informal goal, pledge, or promise, made by a leader of a governing body or private organization, which has no legal ramifications or requirements.
- **Proposal:** This will become an official goal pending approval by the necessary decision-making authorities.
- **Official Target:** This is an official goal that has been approved by the necessary authorities (e.g., statute, regulation, executive order).

### Numeration Type

There are two main types of numerical goals:

- **Percentage goals:** Displayed in either percentage (e.g., 100% goal by 2040)
- **Absolute numerical goals:** Displayed in real values (e.g., 100,000 vehicle sales by 2050)

### Specific Goal Targets

There are different targets within the ZEV sector that can be the focus of a goal. For example, a target could focus on on-the-road vehicles or charging stations, e.g., “We pledge to sell 10 million electric vehicles by 2030” versus “We pledge to build five million EV charging stations by 2030.” Overall, there are five goal target categories, listed below:

### Goal Targets:

- Vehicles Manufactured
- Vehicle Sold
- Vehicles on the road (sometimes referred to as Vehicle stock)
- Vehicles in a shared fleet (e.g. vehicles operating on the Uber app)
- Charging Stations

## Vehicle Targets by Class/Model

### Vehicle Power Trains:

Lastly, vehicle class or vehicle drive train is also specified in many goals. Targets have addressed:

- All Electric Vehicles (e.g., Battery electric, hydrogen fuel cell)
- Hybrid and Electric vehicles
- Only Hybrid vehicles
- Only Hydrogen Fuel Cell Vehicles

## Other Vehicle Classes

- Light Duty Electric Vehicles
- Medium and Heavy Duty Electric Vehicles
- Public Transit Vehicles
- Government Fleet Vehicles (which can include public transit vehicles)
- Two-wheeled vehicles (e.g., E-bikes, scooters)

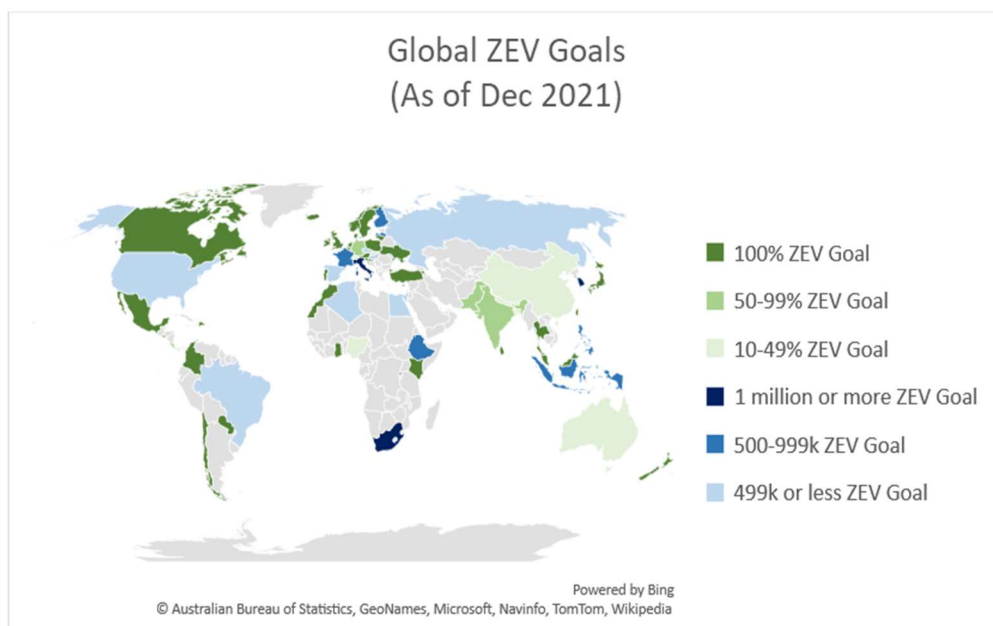
## KEY FINDINGS

### Countries

#### What Countries have ZEV goals?

Among the 194 countries in this study (U.N. member states plus Taiwan) 45% of these countries are shown to have ZEV goals as of December 2021. Note the map shown in Figure 1 does not differentiate by goal culmination date, merely showing the existence of any nationally recognized ZEV ambition, proposed goal, or official target.

Figure 1 Countries with Stated Electric Vehicle Goals for Light Duty Vehicles (LDV)



#### What countries have the most ambitious ZEV goal timelines? (And when were they announced?)

##### ZEV Goals of 100% by 2025:

In 2017 Norway and Sri Lanka were among the first nations to announce a 2025 ZEV/hybrid goal of 100%. However, Norway's target includes only full ZEVs [5], while [Sri Lanka](#)'s goal includes both ZEVs and hybrid vehicles. [6] In 2019 [Taiwan](#) announced an unofficial goal (or ambition) to achieve 100% by 2025 [7]. In 2020 [New Zealand](#) pledged to convert their government fleet to ZEVs by 2025. [8]

##### ZEV Goals of 100% by 2030:

2030 is a popular goal year, with 14 countries setting or proposing goals for full electrification by then (Austria, Barbados, Belgium, Cyprus, Denmark, Germany, Iceland, Ireland, Israel, Luxembourg, Malaysia, Netherlands, Slovenia, Sweden). In 2016 [Germany](#) announced an unofficial ambition to reach 100% ZEVs by 2030, but this has not been followed by an official target. [9] In 2017, both [Slovenia](#) and [Malaysia](#) announced their official

targets for light-duty ZEVs. [3] [10] [Denmark](#) and [Israel](#) announced proposed or informal goals next, in 2018. While [Iceland](#) also set an official ZEV target in 2018. [11] [12] [13] [Ireland](#) followed in 2019. [14] The most recent addition to the 2030 100% group was [Barbados](#), which announced in 2021. Taiwan, Luxembourg, Qatar, Sweden, and Thailand among other countries have also informally announced ambitions to electrify transit vehicles by 2030, but have not set 100% goal targets. (See [Appendix](#) for full census details)

### **ZEV Goals by 2035 and 2040:**

Dozens of nations and subnational government signatories joined a COP26 MOU to work towards all electric vehicle sales of new cars by 2040, “or by no later than 2035 in leading markets.” [4, p. 26] While there were many nations that already had official ZEV targets that met or exceeded this pledge (including Norway, Ireland, South Korea, Thailand, and the UK), many other nations saw COP26 as an opportunity to make an initial commitment or solidify a proposed or pending target (including Austria, Azerbaijan, Belgium, Ukraine, Rwanda, Finland, El Salvador, Malta, Morocco, and Sweden). (See [Appendix](#) for full census details)

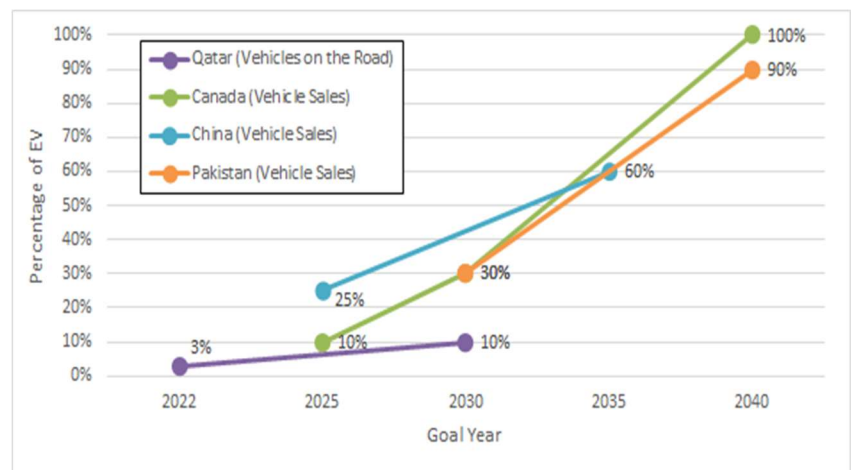
### **How many are using percentage goals vs. absolute goals?**

This study concludes that 42 countries have absolute ZEV goals (e.g., 1 million ZEVs by 2040), and 70 have percentage-based goals (e.g., 100% by 2035). The U.S. is among the countries with only an absolute goal on the national level, and set a goal of 1 million ZEVs by 2015 (which was [not achieved until 2018](#)). [15] Many U.S. subnational governments have identified percentage based goals (see States section below). Further research is necessary to quantify all goals in comparable numeric terms.

### **Which countries set incremental goals vs. only a singular goal?**

A number of nations have established escalating goals using incremental milestones (examples shown in Figure 2). These goal types address the difficulties of setting reachable goals and creating checkpoints for accountability on progress. Incremental goals may also allow policy makers and regulators to focus on changing supportive policy when incremental goals are not achieved. For example, policies may be needed that support charging infrastructure, which

*Figure 2: Incremental ZEV Goals*



must expand (incrementally or at once) to ensure equitable access and make it easier to drive electric vehicles.

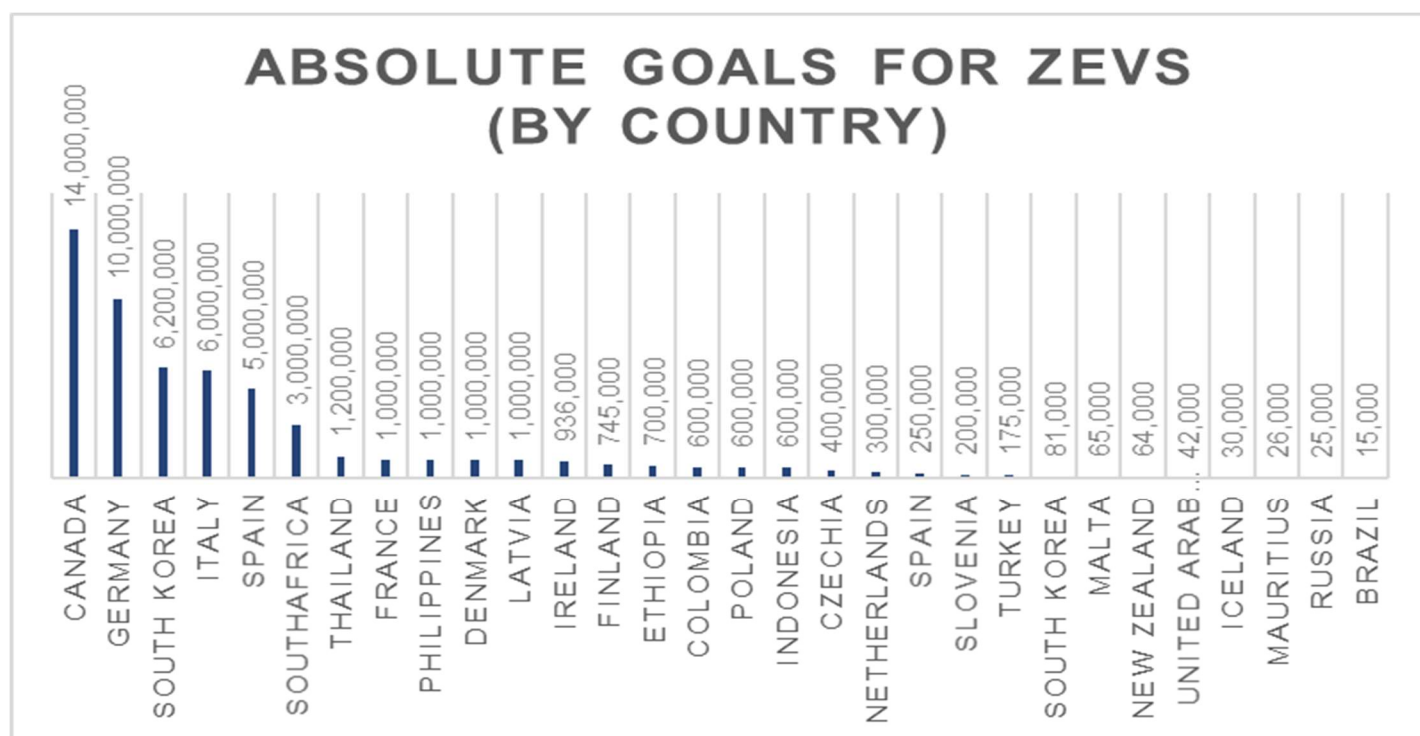
### **Which countries have set absolute goals, targeting a specific number of ZEVs?**

According to this census, over 55 million vehicles are promised by national leaders by 2050, with the bulk of these (52 million) promised by 2040. Canada is the global leader in terms of the volume of vehicles promised, setting a goal of [14 million ZEVs by 2040](#) (announced in 2019) (see Figure 3 for more details). [16] South Korea’s absolute goal of [6.2 million vehicles](#) also aims for 2040, and is among the rare goals exclusively targeting Fuel cell electric vehicles. The ambitiousness of these goal timelines vary considerably. [3] The Philippines had a [1 million goal set for 2020](#) but it is not clear whether this goal was achieved. [17]



France has set a goal to [annually produce 1 million ZEVs](#) by 2025. [18] Thailand's 1.2 million goal is set for 2036. [3] South Africa is aiming for [3 million ZEVs by 2050](#). [19] The most recent countries to announce absolute ZEV goals in 2021 are Spain, Russia, Mauritius, Finland and Indonesia, each presenting relatively modest goals (See [Appendix](#) for full census details)

Figure 3. National Absolute Goals (as of Dec 2021)



### Which countries have set goals for increasing the number of Charging stations?

Charging station goals are also relatively rare, although these types of goals may be occurring on the subnational level. The following countries have charging station goals: Germany (1 million by 2030), Romania (200,000 by 2023), Lithuania (65,000 by 2023), South Korea (15,000 by 2025), Israel (2,500 by 2030), Malaysia (1,000 by 2025), and the Dominican Republic (500 by 2021). (See [Appendix](#) for full census details)

### What actions are countries specifically targeting with their ZEV goals?

Most ZEV goals are more general and use language that targets all ZEVs (e.g., not specifying that the goal applies only to battery electric or hydrogen fuel cell battery electric vehicles). Fewer goals address a subset of the ZEV market; for example, only 17 countries have goals that target light-duty vehicles. Some countries have also targeted the medium- and heavy-duty sector exclusively. For example, [Norway](#) is charting a path to 50% of medium- and heavy-duty vehicles by 2030. [5] Only South Korea, the Netherlands, and Spain have set goals specifically for fuel-cell vehicles.

### What is the role of supportive policies for countries?

Countries have passed an array of policies to support the adoption of ZEVs. Common policies include financial incentives in the form of rebates, tax credits, and registration fee exemptions, funding for charging station networks, HOV lane exemption, and ICE vehicle registration bans. There is evidence that financial incentives

that lower the price of EVs are [effective at increasing EV penetration](#), especially larger EV incentives [20].

A recent study of U.S. incentives estimated that each additional \$1,000 of ZEV purchase incentive increased sales by around 2.6%. [21] The most common national policies addressing electric vehicles are financial incentives such as tax credits or rebates. The U.S. has had a [federal tax credit for ZEV purchases](#) that has ranged between \$2,500 and \$7,500. [22] Similar ZEV rebate programs exist in Canada, Austria, and France [23]. Grants are available prior to vehicle purchases in both England and Scotland. [3]

Many countries also offer exemptions from [registration fees or taxes](#) (Netherlands, Finland, Switzerland, Japan, Philippines, Iceland) or subsidies (China, Japan, Finland) for ZEV purchases. [24] However, exemptions and subsidies are less effective since these policies reward EV adoption but create no barrier or disincentive for conventional vehicle purchases. Furthermore, many of these tax credits, rebates, and exemptions are proposed to be phased out, even as the countries have not yet met their goals. These sunsets may need revision in order to realistically reach ZEV goal targets.

Only a few countries have more substantial laws supporting EV sales. Despite media reports that countries are considering future “bans” of internal combustion engine (ICE) vehicles, [no country](#) has yet passed binding, prohibitive legislation or reached the deadline for which the ban will apply. It is not yet clear how binding these policies will be. [25] In some jurisdictions, banning the ownership or use of existing personal vehicles may present legal challenges. This may explain why many nations opt for policy language that prevents the sale or registration of new vehicles, instead of banning currently owned ICE vehicles from the roadway.

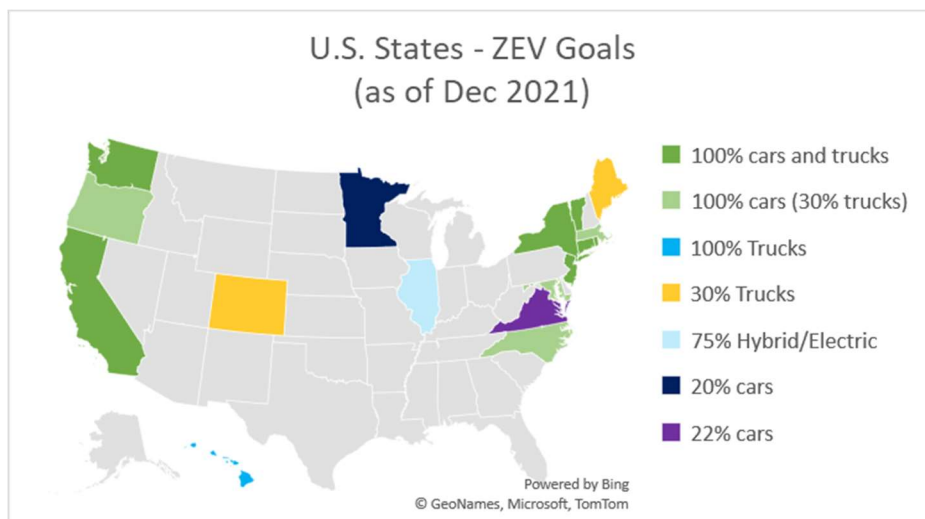
In 2016, [Germany](#) took the unprecedented step of banning ICE vehicles from registration after 2030 (this was passed by the legislature) and allowing cities to ban diesel cars. [9] A German federal court later [upheld](#) these laws. [26] While this legislation was a strong signal, it was not a binding resolution. Shortly after its passage, [German Transport Minister Alexander Dobrindt](#) referred to the plan as “utter nonsense” and “totally unrealistic.” [27] [28] In 2017, German Chancellor [Angela Merkel](#) said that she could not set a date for a nationwide ban. [29]

## US States

### What U.S. States have ZEV goals?

Twenty-nine U.S. states have at least one stated or formal goal for ZEV adoption, with most of those goals emerging from inter-state agreements and compacts. (See Table 1 for a list of the types of inter-state compacts.) The lack of ZEV goals set at the federal level combined with the prevalence of interstate compacts may explain

Figure 5. U.S. ZEV goals by State



why state level ZEV goals are more common. This may point to a gap in the global census data that does not yet reflect subnational goals for international governments, although this is an opportunity for future research. (See [Appendix](#) for full census details)

Other compacts (shown in Table 1) relate to ZEVs, including the Regional Vehicle Plan for the West (REV West) and the Transportation and Climate Initiative (TCI). While both of these plans have yet to call for specific ZEV goals, they do have goals that relate to ZEV adoption, with REV West specifying EV infrastructure goals and TCI specifying general goals related to reducing carbon emissions in the transportation sector. A sense of camaraderie between states and governments when they choose to align for uniform goals may be a driving force behind the proliferation of these interstate compacts. However, there are several states that have preferred to adopt individual goals (e.g., Tennessee and Virginia).

*Table 1. Interstate Compacts*

Agreement	States	Goal
ZEV MOU	California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont	3.3 million zero-emission vehicles by 2025.
ZEV Alliance	California, Connecticut, Maryland, Massachusetts, New Jersey, New York, Norway, Oregon, Rhode Island, Vermont, and Washington	Make all passenger vehicles sales ZEVs by no later than 2050.
MHDV / ZEV Deployment Support MOU	California, Colorado, Connecticut, District of Columbia, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington	Requires all new MDV+HDV sales to be ZEVs by 2050, 30% by 2030.
Regional EV West MOU	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming	EV infrastructure goals to meet adoption levels.
Transportation & Climate Initiative (TCI)	Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.	General commitments to developing inter-state plans to reduce carbon emissions from transportation.

### Which U.S. state was the most recent to adopt goals?

There were several recently adopted goals. Massachusetts, Washington state, and Virginia have adopted California's ZEV targets, which will limit light-duty vehicle sales after 2035. New York signed on to the COP26 MOU, also pledging to electrify all light-duty fleets by 2035. [4] Prior to these announcements the Delaware Department of Natural Resources and Environmental Control released a [Climate Action Plan](#) in 2021, which includes an incremental plan to reduce greenhouse gas emissions (GHGs). Delaware's Climate Action Plan outlines goals of expanding electric vehicle infra-structure and recommends the target of 17,000 electric vehicle sales per year by 2030. [30]



In January of 2022 a new interstate compact was established called the [National Electric Highway Coalition](#), which includes public utility signatories pledging to improve charging infrastructure along the corridors shown in Figure 6. [31]

Figure 6. Map of National Electric Highway Coalition Routes [31]



### How many U.S. States use percentage goals versus absolute goals?

There are 20 U.S. states that have percentage goals (e.g., 100% ZEV sales by 2035), 14 of which have 100% goals. Sixteen U.S. states have absolute goals. This reflects several states—including California, New York, Oregon, and other states in the ZEV MOU—that have both percentage and absolute percentage based goals. There are 19 states that have targets relating to vehicle sales and 16 that have targets relating to vehicles on-the-road by way of vehicle registration. Data shows there are several states with both types of goals, including California, District of Columbia, and Connecticut. (See [Appendix](#) for full census details)

## Companies

### Who is leading? Who has the most ambitious timelines?

Automakers vary considerably in their commitments to reducing emissions. [Volvo](#) (a brand under Geely) recently announced that all vehicles released in 2019 and beyond will be electric or hybrid vehicles.[32] [BAIC](#), [Honda](#), [PSA Group](#) (now called Stellantis), [Mazda](#), and [Ford](#) have all pledged to have 100% manufactured vehicles from 2025-2040. [33] [34] [35] [36] [37] [Uber](#) and [Lyft](#) are two rideshare companies with ambitions of having 100% all electric vehicle fleets in the U.S. by 2030, Uber's pledged global electrification by 2040. [38] [39] [VW Group](#) has an ambitious absolute ZEV sales goal, pledging to reach production of 22 million electric vehicles manufactured by 2028. [40] [Toyota](#) has pledged that they will produce electrified versions of all their vehicles, which they estimate to result in 5.5 million vehicles by 2030. [41]

Tesla has made several near term goals. For example, they pledged to produce 500,000 ZEVs annually in 2020 and [narrowly achieved](#) that goal. [42] Tesla's next benchmark was to produce 2.5 million ZEVs in 2021, but the company [did not meet this goal](#) with final reports from 2021 showing production of 936,000 ZEVs. [42] The next benchmark for Tesla is an annual sales goal of [20 million by 2030](#). [44]

### What percentage are using percentage goals vs absolute?

This study concludes that among the 21 companies examined, 7 companies had goals with absolute numbers (e.g. 1 million ZEV manufactured by 2025). Additionally, 15 companies had percentage goals (e.g. 80% of vehicles manufactured are ZEVs by 2035). BMW has both a percentage and an absolute goal.

### **Which companies set incremental goals vs. only 100% goals?**

Incremental goals are common among companies, with more than a third of the companies studied setting incremental goals. Some companies like BMW, Hyundai (+Kia), Honda, Toyota, Ford, and VW Group had a careful strategy with multiple incremental goals, representing a clear timeline for output to keep pace with the ZEV demand. Less than a third have established a clear sunset of ICE vehicles on the horizon, and only 29% have ambitions for a full transition to 100% ZEV production.

While this snapshot of automaker actions and goals is illuminating, there is considerable uncertainty in terms of how consumer behavior will change over the coming years. This uncertainty will also be impacted, in part, by the policies that are passed by federal and state governments.

## **Policy Recommendations**

### **Goals should be ambitious**

An effective goal should catalyze change by serving as an inspirational target that will move the market considerably faster than a “business as usual” projection. From the sample of countries, states, and automakers cataloged above, there are examples of goals that were not ambitious enough and goals that were overly ambitious. [Denmark set a goal](#) of having 5,000 ZEVs by 2019, and by 2019 they had exceeded two times that target. [45] Exceeding a target by such a wide margin signals that their goal was not ambitious enough.

Washington state narrowly [achieved its 50,000](#) vehicle goal, while automaker BYD achieved more than their 400,000 vehicle production goal for 2021 by selling nearly 600,000 ZEVs. [46] [47] These respective goals were met with the support of binding policies/actions behind them, signaling that an effective balance was struck between ambition and achievability.

### **Goals should be achievable**

Setting extremely high-reaching goals that are not based in reality, or do not have supportive policies behind them, does little more than serve as a PR opportunity. These types of goals are not effective at guiding policy because they are so out of reach. Spain and the United States both set the goal of 1 million EVs—Spain by 2014 and the United States by 2015. These goals were both unrealistic and neither country achieved its target due to lack of concrete policies or investments to support the goals. The United States did reach the 1 million [ZEV goal in 2018](#), whereas in 2018 Spain still only had 50,000 EVs. [15] Germany set a goal of 1 million ZEVs by 2020, but [fell short](#) with about 250,000 EVs at that point, and did not achieve its goal until 2021. [48]

This difference may be due in part to a difference in supportive policy. However, since Spain has a significantly smaller population and number of vehicles than the United States, their goal was far less achievable to begin with. Washington and BYD achieved their goals in part because they were backed by policy, thus signaling that they were both achievable and ambitious.

### **Goals should be backed by binding policy**

Goals represent a target destination, and policy represents the roadmap to get there. Setting a goal alone does not mean the target will be met. Legally binding policies will likely result in a much stronger commitment to ZEV goals than do non-binding policies. Germany set a goal of 1 million ZEVs by 2020, but Germany’s legislature

passed a ban on ICE vehicle registration beginning in 2030; this was not a binding resolution, and the German Transport Minister's denouncement of this resolution signaled that it held little meaning. [28] This may have shaken German consumer confidence that the transition was imminent, and may be partially to blame in cooling the German ZEV market.

While public policy has proven to be effective, corporate policies are not likely to yield consistent results. BMW and Geely both set big goals, but their success has been mixed. BMW set an initial goal of [100,000 ZEVs in 2017](#) and met that benchmark, then informally pledged to sell over half a million EVs by the end of 2019; they succeeded in selling over 500,000 [ZEVs](#) in that year. Since then, the company has increased production to a cumulative total of over [1 million](#). Meanwhile, Volvo/Geely intended to have 90% of new vehicle sales be ZEV by 2020, yet only [8.4% of Geely sales](#) were ZEVs during the first 11 months of 2019. [49]

## Conclusion

The key takeaway from the examples presented in this study is that some ZEV goals have been successful and others have fallen short. More research is needed to understand whether these goals increase accountability, and whether the ambitiousness of a goal affects its success. This research does not aim to prove the value of the ZEV goal policy, although the data collected could inform this type of analysis in the future. ZEV goals may be part of a successful suite of policies, and indeed most of the most advanced ZEV markets have set ambitious goals. However, researchers have shown that the most successful policies include vehicle purchase subsidies, production incentives that can increase the number and type of available ZEV models, policies that improve market awareness of ZEV models and availability of charging stations. Data collection policy is also necessary to ensure progress towards goals, and to allow for greater accountability. [21] [50]

This study reveals that ZEVs goals are only a step along the way towards getting effective policies in place. For example, Norway has one of the most ambitious ZEV goals and the largest ZEV market share—as of 2020, 64.4% of new vehicles sold in [Norway](#) were EVs. [51] However, it is unlikely that an aggressive goal was the sole impetus for Norway's success; rather, a large suite of supportive supply and demand subsidies helped the country reach its target. The policies governments adopt and the investments automakers make today are the main driver of what the fleet of the future will look like for the ZEV market. Any hope of reaching higher penetrations of ZEVs will require countries, states, and automakers to pass more and more ambitious, achievable, and binding policies going forward. Countries can and should be setting ZEV goals that include benchmarks for success, with the recognition that benchmarks are the beginning and not the end of the policy effort toward a decarbonized transportation sector.

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