

The road to net zero

Global Electric Vehicle Catalyst Index 2021

Accelerating electric vehicle program
adoption and implementation

2nd Edition

Foreword



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For nearly a decade, Arcadis has been at the forefront of the transport decarbonization revolution, supporting organizations as they create electric vehicle (EV) charging solutions across the globe. Working with cities, we have been providing EV strategies to help ensure readiness for early EV adopters and, in the future, the mass transition of electric. We also have been supporting critical fleets such as police, military, transit and other government organizations with fleet electrification planning and implementation.

What we have found in implementing these projects is that three key catalysts for EV transition stand out: government leadership and incentives, EV market maturity and EV charging infrastructure.

When governments provide leadership and incentives, the market almost immediately sees an increased demand for EV services. For example, when the UK government banned the sale of new internal combustion engine (ICE) vehicles from 2030, our team was immediately engaged to support organizations with their transition planning and implementation. But without EVs to buy or lease, the intent and support is simply an unachievable goal – the EV market must mature.

EV charging infrastructure has been largely market-led, and the number of public chargers is increasing across the world at varying rates. Even when incentives for EVs are in place, inadequate charging can be a barrier to adoption. The transition to EV cannot happen without it, and it must be designed equitably. Everyone, including those living and working in rural or semi-rural locations, in disadvantaged communities, or with disabilities, will need reliable access to charging.

Altogether, these catalysts help spur the widespread adoption of EV. A global EV transition will be integral to the sustainable, decarbonized future that society is shifting towards. We hope that sharing this index gives readers an opportunity to learn how countries and regions are using each area to make headway on EV plans.



The Arcadis Global Electric Vehicle Catalyst Index 2021

Charging the change...

The transition from internal combustion engines (ICE) to low-emission vehicles is happening at a rapid rate across the globe.

To get on track for a net-zero global fleet by 2050, zero-emission vehicles need to represent 93% of global new passenger vehicle sales by 2035.

With increasing oil and gas prices across the globe, many governments and organizations are seeking to accelerate their zero-emission vehicle (ZEV) transition programs leaving little doubt that EVs are undoubtedly the future of travel, and they will soon become a fixture of everyday life.

But what does a successful ZEV program look like?

Success can take many forms, but the design and construction of ZEV charging infrastructure is paramount to program acceleration for organisations and governments.

The Arcadis Global Electric Vehicle Catalyst Index examines countries and regions across the world and measures progress against three key catalysts for EV transition, highlighting what they are doing well and where they could improve. One of the three catalysts the countries, states and regions were measured against was EV charging infrastructure (EVCI).

As ZEV program plans may be accelerating in priority, what are the factors that need to be considered for successfully designing and building EVCI networks for organisations, cities and towns. While there isn't a one-size-fits-all approach, there are foundational elements that help lead to success.

We measured progress in 17 countries, regions and the U.S states of California and New York against the three catalysts to examine what countries are doing well and where they could improve. The index is a snapshot in time, and countries

will increase their scores as they adopt new government EV incentives, increase the EV charging infrastructure or as the EV market matures.

We hope this research promotes collaboration between countries and organizations exploring the EV landscape. Sharing insights and combining strengths across public and private sectors will accelerate EVs' impact on air pollution, CO2 emissions and our transition to net zero.

ESG and environmental health

While not specifically measured in this index, EV programs play a strategic role in improving air quality and meeting net zero goals. Yet even in the realm of emission-free vehicles, environmental, social and governance (ESG) issues abound. Investors see EV adoption as a critical piece of ESG and are changing investment behaviors to invest in funds focused on manufacturing and distributing EVs. Environmentally, investors see fleet conversions as proof points for responsibility. Financially, they value the shift away from reliance on volatile oil and gas markets.

EVs will be crucial for long-term carbon emissions concerns, but can also provide immediate relief from air quality issues caused by ICE vehicles. Many cities driving early EV adoption are aiming to remove lingering pollutants and the potential health impacts on residents.

The road to net zero

EVs can provide a significant reduction of greenhouse gas emissions, but only when they are charged using renewable energy. While it's essential that new EVs continue to replace older vehicles that pollute more, they also must be supported by a wider transition to renewable energy. Around the globe each country differs in its mix of fossil fuel energy and renewable energy, highlighting the need for national energy systems to transition first, and fast. Likewise, supply chains must evolve to consistently deliver the raw materials and incorporate the sustainable production methodologies needed to foster the renewable energy revolution.



EV adoption catalysts

Moving EV adoption into the fast lane

What are the key catalysts driving EV adoption?

Government leadership and incentives

New policies and stricter environmental regulations are some of the strongest catalysts for global EV adoption. With society embracing the need for green energy, more countries and regions are announcing bans on sales of new ICE vehicles starting in 2030 as part of larger net zero goals. Some local and regional governments are leading by example and transitioning their fleets. In the U.S., some states have introduced vehicle emissions standards for automotive manufacturers.

Financial incentives are proving to be the strongest motivator in many countries. Rebate programs and toll discounts for EVs have encouraged adoption, and launching similar initiatives could build momentum in budding EV markets.

EV market maturity and readiness

EV adoption is rising in part to the increased selection of passenger vehicle and light-duty EVs on the market. However, selection still has its limits. As of 2021, there are thousands of ICE models available compared to about 400 EV models. Without financially viable options for different uses, people and organizations will be unable to seize on government financial incentives – no matter how enticing they are. The EV market must mature regarding affordability, fit-for-purpose vehicles and production capabilities.

EV charging infrastructure

EV charging availability is growing at different rates across the world and has largely been market-led. Charging infrastructure is inextricably connected to adoption, and plans must provide people and fleet owners access to charging infrastructure near their homes/businesses, along their journeys and at their destinations. Capitalizing on technology improvements that compress charging time and increase driving range can maximize efficiency, making it useful to all users. That includes considerations for users living and working in rural or semi-rural locations, people with disabilities and other disadvantaged communities.



Government leadership and incentives

New policy changes and stricter environmental regulations are some of the strongest catalysts for global EV adoption.

Carrot-and-stick initiatives such as rebate programs, toll discounts and zero emissions regulations are leading the way in many regions, and in the U.S. some states have introduced vehicle emission standards for automotive manufacturers. Some European countries have announced a ban on all new petrol/gasoline and diesel cars beginning in 2030 in order to reduce the environmental risk from rising levels of greenhouse gases.



Government leadership and incentives

Scoring metrics: Government leadership and incentives

Metrics	EV incentives	Regulations to support EV	Ban on ICE vehicles	Net zero declaration
Excellent (4)	With 2 or more incentives AND grants	With 2 or more EV regulations; There's also a tax exemption for EVs	With existing ban on ICE vehicles and penalties on low emission zone	Declared net zero BEFORE 2050
Good (3)	With 1 grant and 1 incentive OR 2 grants OR 2 incentives	With EV regulation OR tax exemptions and deductions	With a ban plan ONLY but with approved penalty/congestion charging OR with ban but pending penalty/congestion charging proposal	Declared net zero by 2050; also have an emission reduction target of 50% or more by 2030
Fair (2)	With either a grant OR an incentive	With pending regulations for EV OR with state-level regulations only plus tax discounts	Either a ban plan only OR penalties/congestion pricing plan only	Aims to achieve net zero on a conditional basis or reduction of emission by less than 50%
Low (1)	No incentives nor grant for the EV market	No regulation to support EV nor tax deductions	No ban plan nor penalties	Has not declared net zero

Scoring results: Government leadership and incentives

	EV incentives Score	Regulations to support EV Score	Ban on ICE vehicles Score	Net zero declaration Score	Total Score
UK	4	4	4	3	3.75
France	4	3	4	3	3.5
Germany	4	4	2	4	3.5
Norway	4	4	4	2	3.5
Netherlands	4	3	4	2	3.25
Spain	4	3	3	3	3.25
Ireland	4	3	2	3	3
Italy	3	3	3	2	2.75
Turkey	1	3	0	0	1.5
New York	4	4	3	3	3.5
California	4	3	3	4	3.5
Canada	4	3	4	3	3.5
Hongkong	4	4	4	4	4
China	3	4	4	4	3.75
Singapore	3	3	4	3	3
Thailand	2	3	4	2	2.75
Australia	4	2	1	2	2.25



EV market maturity and readiness

A mature market is characterized by affordability, fit-for-purpose vehicles and ramped-up production capabilities.

Without financially viable options that meet potential buyers' use requirements, the market will hinder the adoption of EV programs. As of 2021, there are thousands of diesel and petrol/gasoline models available, but only around 400 EV models.



EV market maturity and readiness

Scoring metrics: EV market maturity

Metrics	EV registrations	EV market share	EV models available	EV forecast per capita
				Ratio here refers to number of EVs per 1,000 people. Note: For countries and regions with only 2025 data, parameters were adjusted accordingly. For countries and regions with only 2030 data and countries and regions with both 2025 and 2030 data, ONLY the 2030 data will be measured. Parameters were adjusted accordingly based on available data.
Excellent (4)	1 million or more registrations	25% and above	200 or more models	If only 2025 data is available, ratio should be 151 or more. If 2030 data is available, ratio is 200 and above.
Good (3)	100,000 or more	20%-24%	100-199 models	If only 2025 data is available, ratio should be 50-150. If 2030 data is available, ratio is 100-199.
Fair (2)	50,000 or more	10%-19%	51-99 models	for 2030 data: ratio is 50-99.
Low (1)	less than 50,000	less than 10%	less than 50 models	for 2030 data: ratio is less than 50.

Scoring results: EV market maturity

	EV registrations	EV market share	EV models available	EV forecast per capita	Average
	Score	Score	Score	Score	Score
China	4	1	4	3	3.00
California	3	2	2	3	2.50
Netherlands	3	4	3	3	2.25
France	3	3	3	1	2.25
Norway	3	4	2	1	2.25
New York	2	1	2	4	2.25
UK	3	2	3	4	2
Germany	3	3	2	3	2
Canada	2	1	2	2	1.75
Ireland	1	2	3	3	1.5
Italy	2	1	2	3	1.25
Hong Kong	1	1	3	0	1.25
Thailand	1	1	1	2	1.25
Australia	1	1	1	1	1.00
Singapore	1	1	1	1	1.00
Turkey	0	1	2	0	0.75
Spain	1	1	0	3	0.5



EV charging infrastructure

Suitable EV charging infrastructure means reliable charging abilities across the journey (departure point, en route and at the destination).

As the number of public chargers increase at different rates across the world, equity must be kept in mind. Equitable access for different user types will encourage adoption. However, while public charge points and EV infrastructure standards will make EV transitions more feasible for fleet owners, the economics and logistics around implementing their own charging stations will affect adoption as well.



EV Charging Infrastructure Maturity

Scoring metrics: EV Charging Infrastructure Maturity

Metrics	Public charge points available <i>EV vehicles registered/ public charge points available</i>	EV charging strategy	Existing infrastructure standards for EV	Forecasted public charge points by 2030
Excellent (4)	Ratio of vehicle to charge point is 1-5 vehicles per charge point	Has national strategy backed by city/state government strategy including the country's capital city.	> 2 approved standard	1 million or more. If only data available is 2025, forecasted should be 250,000+.
Good (3)	Ratio is 6-10 vehicles per charge point	Has country-wide strategy and some cities have their own strategy.	1 to 2 approved minimum standard	500,000+ but less than 1 million. If only data available is 2025, forecasted should be 100,000-249,999.
Fair (2)	Ratio is 11-15 vehicles per charge point	Has no countrywide strategy yet but key cities/states have their own strategies OR vice versa, wherein they have a country-wide strategy but key cities do not have their own.	With pending standards for approval OR with grant/incentives in place	100,000+ but less than 500,000. If only data available is 2025, forecasted should be 50,000-99,999.
Low (1)	Ratio is 16 vehicles or more per charge point	Does not have national strategy set by the government.	No pending standard for approval and no grants	Less than 100,000. If only data available is 2025, forecasted should be below 50,000.

Scoring results: EV Charging Infrastructure Maturity

	Public charge points available Score	EV charging strategy available Score	Existing infrastructure standards for EV Score	Forecasted public charge points Score	Total Score
Italy	4	4	4	2	3.50
California	2	4	4	4	3.5
China	3	4	3	4	3.5
Netherlands	3	4	4	2	3.25
Germany	3	2	4	4	3.25
New York	2	4	4	3	3.25
Canada	3	4	2	4	3.25
UK	1	4	3	4	3.00
France	1	2	4	4	2.75
Singapore	4	2	3	1	2.5
Spain	4	3	0	0	2.25
Ireland	1	2	3	2	2.00
Hong Kong	3	2	2	1	2
Norway	1	2	3	1	1.75
Australia	3	2	1	0	1.5
Turkey	0	1	4	0	1.25
Thailand	2	1	2	0	1.25

Case study

Converting fleet to battery electric bus (BEB) operations to help meet zero-emissions goals

Helping riders and residents breathe easier

More government agencies are targeting zero emissions goals by electrifying public transit fleets. BEBs are four times more fuel efficient than buses that run on diesel or compressed natural gas, and they hold the potential for lowering long-term operations and maintenance costs.

One U.S. statewide transit agency wanted to use BEBs to protect riders and residents, especially those in communities disproportionately affected by climate change, from vehicle pollution. But early talks raised more questions than answers. With more than 400 buses and four large garages to account for, the agency needed a data-driven dive into different BEB conversion scenarios to build an effective plan.

Simulating fleet and garage modernization scenarios

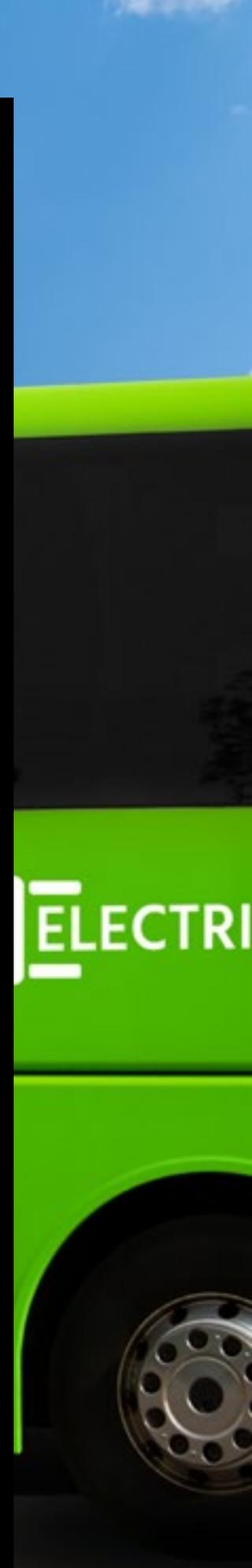
Our feasibility analysis investigated conversions from every angle, with considerations for full and partial electrification. It simulated bus routes and garage operations to consider how BEBs might be affected by weather, route design, driver behavior, peak hour conditions and route charging needs. Coordination with BEB manufacturers allowed the team to determine realistic expectations for battery performance under worst case scenarios. Insights from manufacturers also formed the basis of intelligent bus monitoring, bus procurement and performance-tracking strategies for the BEB program.

The collection of findings allowed the agency to prioritize routes to be electrified. Then, an electric load analysis showed how usage and rates for those routes would vary based on different levels of BEB implementation. Space and implementation analysis based on current operations informed the structural, civil and electrical design updates needed within the garages.

Cost-effectiveness would be crucial to sustaining the program through the agency's long-term goal: 100% zero-emissions. Since BEBs require unique maintenance and equipment needs to account for, our experts assisted with cost estimating and phasing plans to help the agency optimize capital planning.

Finding the best route to 100% zero-emissions

With the feasibility studies complete, the agency has its foundation for bus electrification. The phased approach will initially prioritize zero-emission bus use in areas that have borne the brunt of climate impacts from the transportation sector, with a goal for a 100% zero-emissions fleet by 2040. Riders and residents will breathe easier knowing the zero-emissions fleet will drastically reduce greenhouse gas emissions and modernize a crucial link in the mobility network.



Electric vehicle maturity around the world

Europe

France

Achievements

France established thorough, wide-ranging incentives and policies to drive EV market growth. Incentives cover used and new private BEVs and PHEVs as well as fleets of cars, trucks, buses and coaches. On top of this, grants allow people from low-income households or with employment issues to access long-term rental and rent-to-purchase agreements on low-emission vehicles.

Regulations include an increased tax on diesel and petrol fuels, plus the ban of ICE vehicle sales by 2040. On the infrastructure side, there are firm standards in place to make new and existing buildings EV-ready. France's progressive incentives and policies is reflecting on their EV market share. In February 2021, BEVs and PHEVs had a combined market share of 24.3% – higher than the UK's. France is poised to be one of the most progressive EV markets in the world.

Opportunities

France is targeting at least 7 million charge points by 2030. As of this reporting period, however, they only have 31,206 public charge points in Metropolitan France and 1,780 fast chargers. To meet their goal, they will need to ramp up public charge point availability, especially fast charger availability.

Based on their incentives and policies, France is doing their best to encourage individuals and businesses to transition to EVs. Eventually, however, they may need to speed up their public charging infrastructure plans to ease the transition and meet the growing EV sales.

France EVs by the numbers

- 18.6 EVs per public charge point
- Market share of EVs vs ICE: 24.3% vs. 69%
- 164 EV models available

Europe

Germany

Achievements

Germany has an impressive charge point strategy, which is backed by €3.5 billion for the development of their EV public charge point infrastructure and firm regulations. Petrol stations are required to provide EV chargers, and leaders introduced the German Charging Station Regulation to standardize requirements for EV-ready sockets. Public charge point availability will not be an issue for EV buyers in Germany – something many countries cannot claim.

Opportunities

Unlike other European countries such as UK, Netherlands and France, Germany has not yet announced any ban plan for ICE vehicles in the future. This is reflected in the lack of EV models available in the country. Germany has 81 models available while the Netherlands, UK, France and Ireland have more than 100 models for people and businesses to choose from.

The biggest challenge moving forward might be the complicated political landscape. Some lawmakers want the Chancellor to convert taxi fleets to EVs, however late last year the Chancellor defended ICE, stating that EU should not ban them. Further, a recent court ruling requested Germany move their net zero target from 2050 to 2045. This push and pull between government and legal bodies can create uncertainty in the automotive industry in Germany and may influence the decision-making of those thinking of transitioning to EV.

Germany EVs by the numbers

- 7 EVs per public charge point
- Market share of EVs vs ICEs: 22.5% vs 61.5%
- 81 EV models available

Ireland

Achievements

Ireland's burgeoning EV market has started strong with their regulations and charging infrastructure standards. New building construction, major renovations and even existing buildings of a certain parking capacity must have EV charge points. To encourage EV adoption, the country offers incentives to cover EV purchases as well as residential and public charge points. There is room to grow, but Ireland seems to be headed toward a budding EV market.

Opportunities

Ireland has the opportunity to increase focus on the areas they can control, such as: increasing public charge points, setting ultra-low emissions zones and banning ICE vehicles. Partnering with charge point providers to examine their challenges could help improve availability. In addition, encouraging local governments to set city-wide goals and strategies would ensure the entire country is moving forward, not just the federal government.



Ireland recently announced a deduction in incentives. While trying to convince people and fleet owners to transition to EVs, sustained incentives are one of government's most powerful tools. Ireland may consider how to reward EV adoption to drive the uptake of EVs.

Ireland EVs by the numbers

- 22 EVs per public charge point
- Market share of EVs vs ICEs: 5.87% vs 69.26%
- 134 EV models available

Italy

Achievements

Italy's EV market is young, but there is a legislative groundwork in place to support growth. Italy had already regulated the conversion of conventional vehicles into EVs by 2016, and soon after set a 25% target to replace government fleets with EV, hybrid or natural gas vehicles. They also set rules for newly built and renovated buildings to include EV-ready charge points.

Italy accelerated progress in August 2020 by increasing incentives around EVs. Cities are also showing support. Milan and Rome established ICE ban targets, and the city of Florence granted 70% of new taxi licenses to EV fleets.

Opportunities

As of reporting, Italy has not made the 2050 net zero emission target official, and there is no ban on cars that exhaust fumes. Regulations could also improve by adopting more EV-specific policies. Part of Italy's low BEV and PHEV market share could be tied to a low volume of public charge points. People will not buy an EV without a way to charge it, and with only about 19,000 public charge points available, lack of availability could hinder potential purchases.

Italy EVs by the numbers:

- 3.1 EVs per public charge point
- In 2030 there will be an estimated 100 EVs per 1,000 people
- 63 EV models available

Europe

Netherlands

Achievements

Netherlands is one of the most progressive countries when it comes to EVs. They have strong tax incentives for EV sales, and their ban on ICE vehicle sales in 2030 precedes many countries' targets by 10 years. The aggressive stance means BEV and PHEVs hold a remarkable 25% market share.

The capital city of Amsterdam is serving as a model for progressive city-wide EV strategies as well. Already, only emission-free taxis are permitted in the central station. Further, public buses and coaches that exhaust fumes will be banned from entering the city as early as 2022. The Netherlands' combination of national and regionalized EV initiatives is creating the basis of a strong EV market.

Opportunities

Despite progress on their EV market, Netherlands could improve infrastructure regulations. Regulations do not address fuel retailers or new and existing infrastructures. Netherlands also lacks a net zero target, and is only aiming for 49% reduced greenhouse gas emissions by 2030. Firm requirements in these areas are a solid opportunity for a country aspiring toward a progressive EV market.

Netherlands EVs by the numbers:

- 6.8 EVs per public charge point
- In 2025 there will be an estimated 60 EVs per 1,000 people
- 183 EV models available

Spain

Achievements

Spain is encouraging EV sales with new regulations and €800 million allotted for incentives. To promote EV for private and public fleets, incentives even extend to small towns and companies that want to switch to electric. For charging infrastructure, Spain's National Action Framework aims to have at least one charging point for every 10 EVs on the road, and their Energy Transition Law obliges a public EV charge point at large fuel stations.

Lastly, regional governments are developing EV plans that complement the national strategy and help maximize charging availability. The wide range of regulations and financial incentives puts Spain on the right track for raising EV sales.

Opportunities

Spain could start making improvements in their capital, Madrid. The city lacks an EV charging strategy, and recently an established low emission zone lost its designation over legal technicalities – potentially moving the EV market in the wrong direction. At the same time, EV data is not being monitored or utilized. Data can be crucial to EV market growth, from tracking service needs on charging points to having model

data available for buyers. Giving people and fleet operators more insights on models, charging requirements, station locations and related EV information can get buyers more comfortable about transitioning to EVs.

Spain EVs by the numbers:

- 2.3 EVs per public charge point
- 20,156 registered EVs as of 2020
- The sale of all new cars that use petrol or diesel will be banned by 2040

United Kingdom

Achievements

UK has been progressive when it comes to their country- and city-wide EV strategies and legislations. In fact, the UK government put the country on course to be the fastest nation in the G7 to decarbonize cars and vans, announcing that all new petrol and diesel cars and vans will be phased out by 2030. This ambition is further supported by the UK's Transport Decarbonisation Plan, which sets out the government's commitments and the actions needed to decarbonize the entire UK transport system. Public charging infrastructure will get a boost from a £950 million Rapid Charging Fund, with a goal of having six rapid chargers at every motorway service area by 2024 and 6,000 ultra-rapid chargers along the strategic road network by 2035. On both a national and local scale, UK's strategies and legislations are very competitive, making them a promising market for the EV industry.

Opportunities

Despite their strategies, UK is behind other European countries when it comes to the number of public charge points available. Netherlands, Germany and France each have more public charge points than the UK as of this reporting period. If the UK wants people to transition to EV, then they will need to remove the related challenges such as availability of public charge points, while also encouraging charging at home and at work. The UK must improve on the public EV charge point availability as the market matures through national policy, funds and partnerships with charge point providers. Increasing the number of public charge points and creating EV charging hubs will provide a network for those looking to buy EVs that cannot install chargers at home. Similarly, partnerships between charge point providers and fleet owners could expedite fleet transitions. In addition, local government can partner with charge point providers to map where EV chargers are needed and what support the government can offer.

UK EVs by the numbers

- 27.2 EVs per public charge point
- Market share of EVs vs ICEs: 6.9% vs 62.1%
- 130+ EV models available



Norway

Achievements

Norway's EV market is ahead of its time and impressively so. Their EV market growth can be credited to their car tax system which makes EV models cheaper to buy compared to a similar petrol model. The Norwegian parliament is confident that by 2025, all car sales will be either electric or hydrogen thanks to their strengthened green car tax system. Another accomplishment for Norway is their capital's wireless charging for electric taxis, making it more efficient for taxis. Lastly, another important factor for their advancement could be their early net zero goal for 2025 with their capital, Oslo, targeting net zero as early as 2023. This gives a clearer timeline for setting up charging infrastructure and EV plans.

Opportunities

Norway's car tax system makes EV models cheaper to buy compared to a similar petrol model. Despite the strong green tax system, diesel and petrol car conservatives can continue to use their cars especially since there's no usage ban at all.

Norway EVs by the numbers:

- 33 EVs per charge point
- 100 EV models available
- In 2021, 64.5% of all new cars sold were fully electric

Turkey

Achievements

Turkey's own EV brand has launched and is being promoted by their president, President Erdoğan, kicking off what could be the backbone of the Turkish EV market. TOGG will go into series production in the 4th quarter of 2022. This has a potential to attract those who value homegrown brands.

In addition, Turkey has policies that will help EV charging infrastructure such as an amendment for parking lots, fuel stations and other suitable places to build EV chargers as long as they have the positive opinion of the relevant electricity authority. They also have green tariff which allows consumers to access renewable energy source for their EV chargers should charging station operators apply for it. If these policies will be utilized properly by the Turkish government, there's a possibility that this can boost buying decisions of those looking to convert to EV.

Opportunities

Turkey's EV market is still in its early growing stages so there is still a lot of room for improvement. Turkey's own EV brand has launched and is being promoted by their president, President Erdoğan, kicking off what could be the backbone of the Turkish EV market.

Turkey EVs by the numbers:

- 8.7% EVs vs 91.3% ICE
- 36 EV models available
- In 2030 there will be an estimated 1 million charge points

An aerial photograph of a multi-lane motorway stretching into the distance. A red truck is visible on the road. In the background, a large white wind turbine stands on a hillside under a clear blue sky. The surrounding landscape is green and hilly.

Case study

Accelerating the shift to electric travel at Motorway Service Areas

Electric vehicle charging infrastructure

The future of travel is electric. Pressure to put the brakes on greenhouse emissions and ban new petrol and diesel cars means an acceleration in the uptake of EVs. But there's a catch: range anxiety. A fear of the unknown. Will the car actually make the destination? With a lack of infrastructure to power up mid-journey, National Highways (formerly Highways England) needed to futureproof the road network for the long-term. It wanted 95% of its motorways and major A roads to be within 20 miles of a charge point. It was up to us to work out how to make it happen.

To support National Highways, we conducted a UK-wide feasibility study looking at providing improved EV charging infrastructure at motorway service stations. The study focused on 10 motorways and will inform investment into improving energy supply across the Strategic Road Network over the next five years.

We developed an outline business case that provided the strategic, economic, financial, commercial and management elements for investment. Bringing together teams from across our transport planning, manufacturing, technology and energy divisions, we developed an outline strategy for rolling out EV chargers, designed to ensure that energy supply stays ahead of demand as uptake increases. We also developed the commercial and operational model to support investment.

Our feasibility study formed a key element of the National Highways Delivery Plan, which makes a commitment to supporting the government's Road to Zero strategy. The government has already stated its intention to end the sale of new petrol and diesel cars and vans by 2035, and recently passed legislation to commit the UK to its new target of net zero carbon emissions by 2050.

The rapid route to pure electric travel

Providing more electric charging points will be crucial in helping motorists overcome range anxiety – one of the most commonly cited concerns preventing people from making the switch to electric. A higher number of faster charge points also means shorter charging times, quicker journeys and improved customer experiences.

With confidence in the plan, National Highways' target has already been exceeded. The government's new ambition is to have at least six high-powered, open access charge points at all motorway service areas in England by 2023. This will bring welcome relief to all those already driving EVs, and the necessary reassurance to those who want to make the switch. And the swifter the switch, the swifter the people of England can enjoy clean air again.



North America

Canada

Achievements

Canada has a history of making concerted efforts to ramp up EV sales. In 2005, the government and automotive industry agreed to voluntarily act to reduce greenhouse gas emissions in new vehicles. That commitment evolved into the Canadian Net-Zero Emissions Accountability Act, which will expedite the rollout of EVs and charging infrastructure.

Recently, Canada announced ban on new ICE vehicle sales by 2035. Adding firm requirements to go along with extensive financial incentives is setting the stage for EV growth.

Opportunities

Canada's sheer size – it is the second-largest country in the world by land area – makes public charge point availability a challenge. Even with a program to increase EV charging infrastructure, availability is notably low. Hence, the EV market is limited as well. Addressing the public charging situation will be pivotal in eliminating the barrier for potential EV users who have reservations around how they will charge an EV.

Canada EVs by the numbers:

- 8.8 EVs per public charge point
- Market share of EVs vs ICE: 3.52% vs 93.80%
- 62 EV models available

North America

United States: California

Achievements

With President Biden’s appointment in 2020, the U.S. EV market seems to be moving forward, especially in California. California was the first state in the U.S. to announce a ban on the sale of new petrol and diesel-powered vehicles by 2035; and all medium- and heavy-duty vehicles in the state must be zero-emission by 2045 for all operations. California also has a high number of registered EVs thanks to massive incentives for residents and strong regulations. The well-rounded approach has created one of the world’s most competitive EV markets.

Opportunities

Considering California is one of the biggest states in America, there is a great opportunity to speed up the installation of public charging points. Charging infrastructure is as essential as government incentives for convincing people and businesses to adopt EVs. Ramping up the California Electric Vehicle Infrastructure Project to install more EV charging infrastructure would remove one of potential customers’ biggest barriers to purchasing an EV.

California EVs by the numbers:

- 13.1 EVs per public charge point
- In 2030 there will be an estimated 120 EVs per 1,000 people
- 46 state EV incentives



United States: New York

Achievements

New York offers tremendous incentives to residents as well as policies that support the EV market. The state has announced a ban on the sale of new fossil fuel powered cars and light duty vehicles by 2035. In addition, the EV Make Program subsidizes the costs of EV development to enrich the market. New York also joined 14 other states and the District of Columbia in announcing a joint memorandum of understanding, committing to a goal of reaching 100% of all new medium and heavy-duty vehicle sales be zero emission vehicles by 2050, with an interim target of 30% zero emission vehicle sales by 2030.

What really sets New York apart from other markets is its commitment to building charging infrastructure. The EVolve NY program proved how valuable it can be to leverage private sector partnerships to increase charging and fast charging stations. Having a full repertoire of incentives and policies addressing both EVs and charging points puts New York on the path to successful EV transition.

Opportunities

Considering the massive incentives and policy the government of New York has, the EV market share remains significantly low. Convincing New Yorkers to adopt EVs is crucial, but not the only avenue for improvement. With so many city residents in New York City depending on taxis, electrifying those fleets could help with EV goals. More models will need to be approved, though. As of now the Tesla Model 3 is the only model approved to operate as a taxi in the city.

New York EVs by the numbers:

- 11.5 EVs per public charge point
- In 2030 there will be an estimated 230 EVs per 1,000 people
- 11 state EV incentives



Asia-Pacific

Australia

Achievements

In July 2022, the new Australian Government is putting the climate change at the top of its legislative agenda with bills to enshrine a cut in greenhouse gas emissions and make electric cars cheaper. Future bills to be introduced include Australia's commitment to reduce its emissions by 43% below 2005 levels by 2030, as well as a bill to abolish import tariffs and taxes for electric vehicles that are cheaper than the luxury car threshold of 77,565 Australian dollars (\$53,580). This planned action of the new government will help Australia's EV market to be more competitive.

Opportunities

The lack of national policies or regulations around the EV market stands out as Australia's biggest opportunity to propel an EV transition. An official EV policy with incentives for making the transition will underscore the importance of EVs to residents and encourage earlier adoption. States may have taken action, but it is in the national government's hands to accelerate the transition to EV with firm regulatory standards.

Australia EVs by the numbers:

- 10 EVs per public charge point
- In 2030 there will be an estimated 20 EVs per 1,000 people
- 30 EV models available

Queensland's ambitious 10-year plan

Queensland's Department of Transport and Main Roads (TMR) recently released *Creating Better Connections for Queenslanders*, an ambitious 10-year initiative to prepare for the 2032 Olympics and 2023 FIFA Women's World Cup alongside changing customer expectations and industry dynamics.

TMR aims to harness Industry 4.0 and the application of sustainability and resilience principles to enable mobility for Queenslanders and visitors. Our mobility experts recently provided input and feedback on TMR's goals. In doing so, they identified five strategic focus areas that would contribute to a safe, reliable, and sustainable mobility landscape.

Data technology and foundations

Technology and good data practices have the ability to enable better journey outcomes like never before. Integrating Big Data to link disparate systems and create a holistic view across networks can unlock a deep understanding of network performance that spans historic, real-time and future perspectives. A strong data foundation will be critical to mobility as a service (MaaS), which TMR recognizes as part of the package of options to improve mobility for Queenslanders.

Ensuring network resilience

TMR must strategize for the planned events (infrastructure changes, major sporting events, and so on) while also addressing the unique pressures caused by natural disasters and severe weather. Every event, planned or unplanned, is unique and will need a carefully planned response informed by data.

Scaling a zero-emission public transport fleet

A commitment to green the fleet by 2030 is exciting – but there is no time to waste. Fleet transition feasibility studies and planning is the critical initial step of the electrification journey to maximize capital and develop effective pilots, testing and program optimization plans. Beyond buses, rideshare and taxi vehicles, ferries and trains can also be transitioned as EV and hydrogen vehicle technology evolves.

Optimizing EV transition

An ideal EV environment will ensure long-term success. This includes a combination of policy, financial initiatives, and public and private partnerships to deliver a critical mass of enabling infrastructure for the adoption of green fleets. Government fleets can be the early adopters of electric fleets to demonstrate Queensland's commitment to sustainability. The charging facilities for municipal vehicles can be shared with the public, which not only increases the utilization of the chargers but promotes the visibility of the investment in sustainable mobility.

Promoting modal shifts

Innovations like EV and connected and autonomous vehicles bring welcome change, but also new pressures on infrastructure by making road usage more attractive and eliminating jurisdictions' primary source of road funding (traditional fuel taxes). This is in addition to existing contentions for road space from increased ride sharing and freight related to online shopping. Contention around parking is rising as well. Integrated approaches to policy, planning and digital innovation are needed to address the accelerating change in road usage and curbside management.

Asia-Pacific

China

Achievements

China was one of the earliest players in the EV market and maintained momentum since it began. As early as 2009, China introduced a program focused on diverting public transportation to EVs that has since reached 25 cities. Not to mention, auto makers must include a quota of EVs in their production. They have also spent \$60 billion on EV research and development, tax exemptions and financing battery charging stations – the largest investment in EV industry worldwide. China is also the world's largest electric bus market. At the end of 2019, zero emission buses had reached 59.1% of the 673,000 buses nationwide.

The financial and regulatory commitment is reflected in China's high number of public charging stations and EV registrations. Many cities in China established regulations around charging infrastructure for new buildings, parking structures and other infrastructure projects. For example, Hainan Province announced a ban on the sale of new fossil fuel vehicles by 2030.

China's ambitions in the EV space puts them at the forefront of the global EV transition.

Opportunities

A recent decision to cut subsidies for EVs by about 20% takes away one of the key incentives for diverting people and businesses into EVs. Taking it away now could put the 2035 target date for phasing out gas-burning cars in question. If the subsidies are off the table, the government has the opportunity to strategize new ways to encourage the EV transition.

China EVs by the numbers:

- 6.1 EVs per public charge point
- In 2025 there will be an estimated 20 EVs per 1,000 people
- 390 EV models available

Singapore

Achievements

Despite a small size, Singapore has a high number of public charging points and a strategy for charging infrastructure across the country. Incentives for EVs are generous as well, with rebates, lower registration fees and lower road taxes compared to ICE vehicles. They are also pushing the ban of ICE vehicles by 2040, and they will disallow registration of new diesel cars and taxis as early as 2025.

The country also has standards for EVs and is considering making EV charging stations mandatory in car parks, new buildings and certain types of infrastructure. It aims to deploy 60,000 EV charging points across the country by 2030. Compared to some other countries and regions in the Asia-Pacific region, Singapore is ahead in penetrating the EV market.

Opportunities

Singapore is aggressive in boosting their EV market, however, better EV policies could increase EV registrations. With sights set on banning new diesel vehicle registrations in 2025, they will also need to enhance their charging infrastructure strategy to keep up with the growth in EV demand.

Singapore EVs by the numbers:

- 1.3 EVs per public charge point
- In 2030 there will be an estimated 1 EV per 1,000 people
- 35 EV models available

Thailand

Achievements

Thailand is new to the EV market, but the national government is charging in head-first. They launched a \$164 million PHEV and BEV project as well as a policy to produce EVs, with a production target of 6.22 million in 2030. The aggressive pursuit aligns with Thailand's goal to only sell zero emission vehicles by 2035.

Thailand is preparing for an EV future on the charging infrastructure side as well. They created Electric Vehicle Association of Thailand, which launched a trial project in Bangkok to test a unified payment method at charging stations. Initiatives for boosting the transition to EVs will put Thailand in position to hit targets and maximize EV adoption.

Opportunities

In addition to EV policies and investments, Thailand's greatest opportunity may be to create a national strategy for achieving targets and implementing policies. Regulations are in the works, but a lack of policies could hinder their ability to use investments effectively – and might even put the target dates at risk. Figuring out regulations, including incentives for adopting EVs, would enhance the odds of Thailand meeting their ambitious goals.

Thailand EVs by the numbers:

- 12.1 EVs per public charge point
- In 2025 there will be an estimated 10 EVs per 1,000 people
- 18 EV models available

Hong Kong

Achievements

Despite being on its early stages, Hong Kong's EV market is evidently growing thanks to their government's support. Hong Kong has a comprehensive EV roadmap plan which consists of important EV factors such as funding, EV policies, innovation plans and charging infrastructures.

Hong Kong EVs by the numbers:

- 6 EVs per charge point
- 154 EV models available
- 39 fast chargers per 100km

Case study

Charging Singapore's carbon footprint reduction

Substantial charging for sustainable car-sharing

BlueSG is a car sharing service in Singapore that uses environmentally friendly zero carbon emission EVs to reduce mobility's carbon footprint, noise and odor. As part of its 2020 goal, BlueSG aimed to build 500 charging stations and 2,000 charging points and establish itself as a sustainable mode of transport by enabling better access to charging facilities across Singapore.

Delivering project excellence amid tight timelines

We delivered project management services to BlueSG, ensuring that they met target timelines and project goals. Scheduling contractors, telecommunication service providers and other stakeholders needed to be coordinated with limited room for error to tackle the challenge of a tight

timeline. As such, we worked closely with architects to ensure that issues were addressed early to prevent any delays for contractors. Additionally, we conducted pre- and post-site assessments and strategized value-add solutions when problems arose.

Improved connectivity, reduced carbon dioxide

As of October 2019, there have been more than 6.5 million of kilometers driven on BlueSG and 1,500 tons of carbon dioxide saved from the use of BlueSG cars. Through the BlueSG project, we are proud to support the Singapore government's Smart Nation and car-lite vision, improving mobility and connectivity for residents in Singapore.





8 key factors for successfully designing and building EV charging infrastructure networks

Based on our experiences helping fleet managers and organizations make the ZEV transition, thorough upfront planning in eight key areas will bolster charging infrastructure network design and construction success.

1. Relationship with your organization's Net Zero Strategy

Many organizations have already set a goal to have a zero-emission fleet by say 2027, and already have ZEVs. If it's a government agency, they may be mandated to meet this date. Your organization's Net Zero Strategy is a key factor in EVCI requirements.

2. Impact to operations

Operationally EVs result in reduced maintenance due to lack of oil change and engine work. But broader operational impacts must be considered early in the process, such as the required vehicle range per day and opportunities for charging en route. Don't forget hearts and minds – not everyone wants to change what they have been doing all their lives.

3. Accessibility and affordability of public charging

Suitable EV charging infrastructure means reliable charging abilities across the journey (departure point, en route and at the destination) and this is critical for fleet that will be on longer journeys. As the number of public chargers increase at different rates across the world, equity must also be kept in mind ensuring that they remain accessible and affordable for all, especially those that do not have access to their own home chargers.

4. Site feasibility assessments

Securing power for charging stations could require grid reinforcements, legal agreements and more. Feasibility assessments can help expedite costly, time-consuming steps.

5. Stakeholder buy-in

Secure all legal consents and avoid delays by making stakeholder agreements part of the feasibility process. This includes those using the vehicles in your organization – spend as much time on securing the hearts and mind of the drivers on the forthcoming change as well as securing the funds.

6. Financing and business model options

Compare potential business models against available funding programs to optimize capital spend.

7. Contract models for building the network of chargers

Compare different contract models, EPC and EPCM. Take into account project timeline, budget, scale and your in-house capabilities. It's ok to ask for help.

8. Renewable energy solutions and energy mix

Review battery energy storage solutions and on-site renewables (solar cells, wind turbines, etc.) to maximize resilience and reduce costs.

Whilst all of these factors are important, one would argue the impact to operations is the most important to organizations. Arcadis has been working with clients facing challenges when it comes to the availability of suitable vehicles in line with their asset replacement programs, coupled with the dilemma that many electric vehicles don't yet meet their performance specifications and there is a lack of affordable power.

This is why one of the most important consideration for EV transition is not only the charging infrastructure, but government leadership and incentives. There is greater investment, supply and choice of vehicles in those countries where the governments have been more proactive and grants are available to pay for the increasing cost of power upgrades and public infrastructure. Arcadis has been working with both organisations and governments on infrastructure and advisory in best practice for incentives to accelerate EV adoption.

Join the EV revolution

The three catalysts will undoubtedly influence where EV adoption takes off. But if your organization is waiting on government policies to guide and incentivize EV programs – you might already be falling behind.

Actively planning for EVs now will not only align your organization for the forthcoming regulations and incentives, EVs can be a key tactic for achieving ESG objectives, improving regional air quality and meeting larger net zero goals. We help public and private sector leaders bring their EV visions to life with support for every phase of the journey. Projects have set us upstream and downstream along EV implementations, from strategy building to executing fleet implementations and charging infrastructure construction. The variety of challenges provides unique insight into what's hindering global EV adoption and how to get on the path to a successful EV transition.

For more on how we can help with EV and charging infrastructure strategies, fleet transitions and charging network implementations, connect with us today.

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Methodology

Following an internal consultation exercise, Arcadis determined the sub-categories most relevant to measure the maturity of three catalysts for EV transition: government leadership and incentives, EV market maturity and EV charging infrastructure. A scoring matrix was then created, and publicly available data was sourced from a variety of locations and collated by Arcadis' research team. The data was primarily used to measure maturity against each metric. Arcadis' EV leads in each country have independently reviewed the outputs and scoring and compiled the country narratives, identifying the achievements and opportunities for each country.

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