

**PRESS
BRIEFING**

*A case study on
how to succeed in
electric*

NORWAY VEHICLE ELECTRIFICATION STUDY



***What all countries should learn from
the global leader***

The report combines the expertise of several experts



Frederic Bruneteau

Managing Director, Brussels

The founder of PTOLEMUS, Frederic has accumulated **25 years of experience of the mobility and transport domains** and 15 years of strategic and financial advisory.

He has become **one of the world's foremost experts of connected mobility** and is interviewed on the subject by publications such as the *Financial Times*, *Forbes*, the *Wall Street Journal* and *The Economist*. He has also spoken at over 40 conferences on the subject.

He has led over 180 consulting projects and helped many world leaders define their strategy and implement it.

Clients he has served include AAA Data, Abertis, AGC Automotive, Allianz, AXA, Baloise, BP, Bridgestone, BRP, Cihon, CNH Industrial, Danlaw, DMP, Europ Assistance, the European Commission, HERE, Hitachi, Kapsch, the Netherlands' Ministry of Transport, Mobile Devices, Octo Telematics, Michelin, OMV, Pioneer, Qualcomm, Scania, Société Générale, Telit, TomTom, Toyota and WEX.

Frederic has led many assignments related to electrification.

Frederic fully reviewed this report.



Lars Godell

Director, Strategic Foresight, Oslo

A Norwegian citizen, Lars has **more than 25 years of experience from strategic and operational work** as a senior analyst, adviser, and executive **in the global telecom industry**. Last year he analysed the Norwegian mobility market for an investor.

He has specialised in techno-economic analyses of infrastructure and services for the purposes of product and business development, strategy, regulatory and public affairs.

Lars has been advising CxO-level clients and colleagues for 25 years, 17 of which with **Telenor**, one of the world's largest mobile operators.

He spent 8 years as a principal European telecom analyst with **Forrester Research**. His hype-busting research on the business case for new technologies as well as advice on industry restructuring resulted in a CEO-level network and almost daily interviews with journalists.

Lars has an MSc degree in political science from the University of Oslo and an **MBA degree from the University of Chicago Booth School of Business**.

Lars led the research, analysis and writing of this report.



Paul Maupin

Marketing Director, Brussels

An American citizen, Paul has 15 years of experience in digital marketing in a range of responsibilities such as website development, copywriting, CRM, analytics, project management, product development, social media management and content strategy.

Paul has worked with a broad range of international clients and brands, large and small, to develop relevant, consistent, and results-oriented digital communication and marketing strategies across channels.

Responsibilities he endorsed over his career include:

- Developed, implemented and supervised the

global content marketing strategy for **Radisson Hotel Group**, including data-driven marketing, communication with key internal and external stakeholders;

- Managed digital channels, social presence and marketing strategy for the Europe region at **UPS**, including implementation of paid campaigns alongside ad agencies and content creation for the pan-European central channels.

Paul reviewed the report and leads our marketing of the report.

By responding to these questions, the report will help you avoid reinventing the wheel in electrification!

Will Norway succeed with its 100% EV target for new passenger cars in 2025?

What can other countries learn from Norway's approach to electrification? Successes and failures/gaps?

What are the biggest drivers and inhibitors of EV adoption, in Norway and elsewhere?

For how long should government maintain the policy of offering EV purchase benefits?

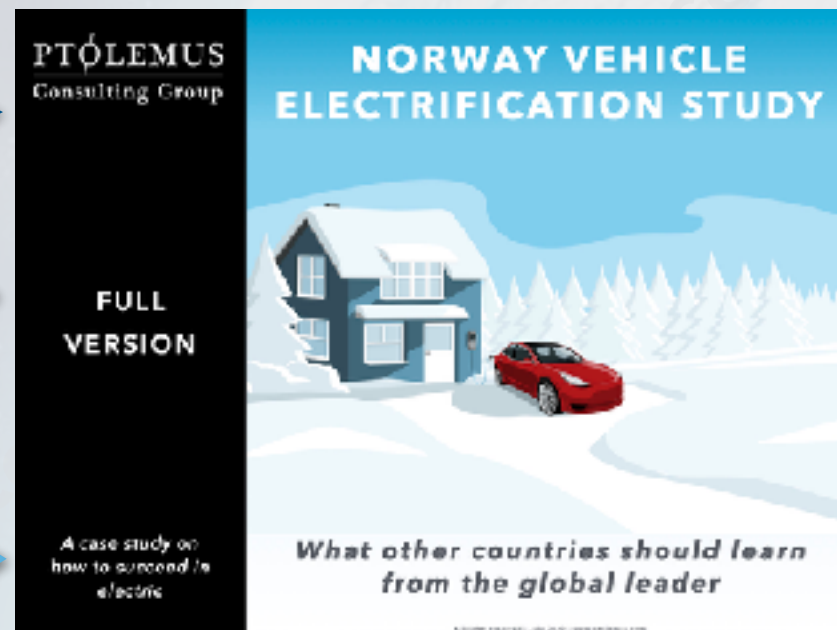
Who will win in the public charging market, Tesla or Ionity?

What should governments, OEMs, and public charging operators do to improve customers' public charging experience?

What should OEMs do to give EV buyers a realistic idea of the range of their EVs?

What should government's role be in making sure there will be enough public chargers?

What is the best way for governments to stimulate the adoption of EVs?



What is the TCO of EVs vs ICEVs, in Norway and Europe?

What will be the impact of EVs on fuel tax revenues, road funding and public transport?

What are the factors holding back a rapid move to full electrification of the car fleet?

The report dissects the Norwegian electrification model and brings lessons to all stakeholders

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- B. Market drivers and inhibitors
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- F. Understanding the different EV charging options

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- B. Norway's position as a major energy supplier
- C. Key traits of the Norwegian transport market, including taxation and road tolling
- D. Electrification of transport as a tool to reduce climate emissions
- E. Norway's transport electrification targets and results, and in comparison with other countries
- F. To support decarbonisation, Norway has also stimulated the adoption of hybrid cars
- G. Norway's EV purchase and usage benefits

H. The direct and implicit cost of Norway's support for EVs

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J. Understanding consumers' car purchasing preferences

K. The role of fuel price and fuel efficiency in the EV TCO analysis

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- ✓ Understanding consumers' experience with EV public charging and driving range
- ✓ National government's limited subsidies for EV public charging infrastructure
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- ✓ Comparison of Tesla and IONITY, including assessing the future of IONITY

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- A. Ensure stable and broad political support
- B. Fix home charging first
- C. Carefully support public charging network

D. Keep purchase benefits until 2027

E. Change the purchase benefits away from subsidies to taxation

F. Include usage benefits

G. Introduce special EV license plates

5. Pitfalls to avoid..... 95

- A. Ensure sufficient cheap renewable electricity
- B. Stop supporting hybrids now
- C. Balance electrification with other public policy goals
- D. Ensure careful fine-tuning of incentives
- E. Force the automotive OEMs and dealers to provide realistic EV range and battery charging information
- F. Ensure sufficient regulation of the public charging market

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- A. Governments and regulators
- B. Automotive OEMs
- C. EV charging operators

What is vehicle electrification?

It is the **migration from ICE vehicles to hybrid vehicles as well as battery electric vehicles (BEVs).**

In this report, we will focus on the migration to BEVs, as this is where Norway has outpaced other countries most remarkably.

We will use the word EV to refer to BEV.

The drivers of EV adoption now outnumber inhibitors

EV market inhibitors

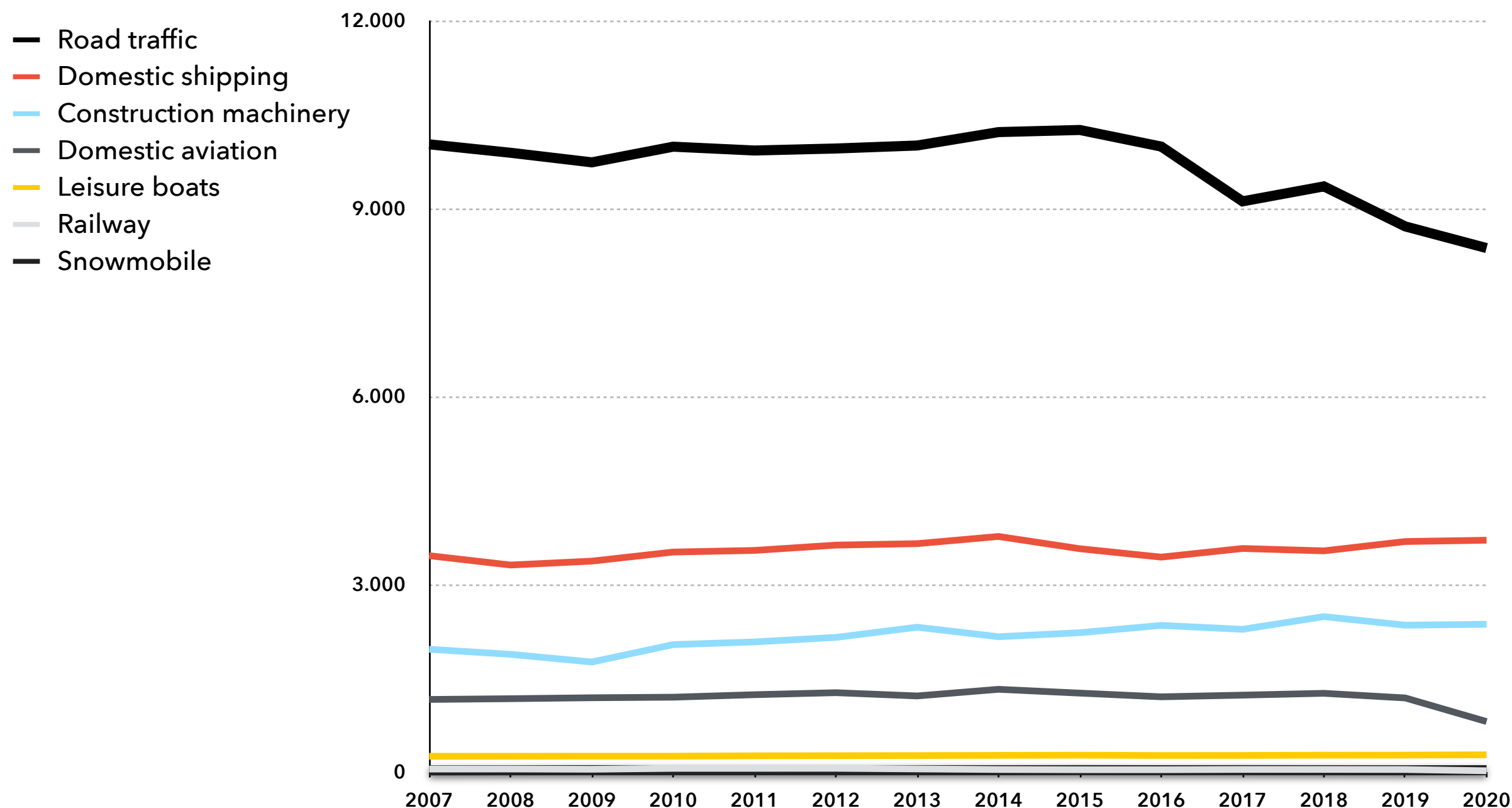
- * High purchase price of vehicles
- * Limited EV charging infrastructure
- * Poor customer charging experience
- * Battery and range limitations, range anxiety
- * Price and supply of metals for batteries
- * Consumer inertia
- * Long waiting list for popular models

EV market drivers

- ✓ Growing regulatory pressure to reduce carbon emissions
- ✓ Strong push by OEMs, fleet operators and leasing companies
- ✓ Growing range of available EV models (450 globally)
- ✓ Battery, driving range and charging speed improvements
- ✓ Increased availability of charging stations
- ✓ Purchase and usage incentives
- ✓ Environmentally conscious customers
- ✓ TCO 1: EV savings vs. ICEVs if including purchase incentives
- ✓ TCO 2: Worsening TCO of ICEVs with rapidly increasing fossil fuel prices (Ukraine effect now, carbon pricing from 2026)

Electrification of road transport has been a very effective tool to reduce climate emissions in Norway*

Breakdown of transport climate emissions by sector (thousand ton CO₂ equivalents)

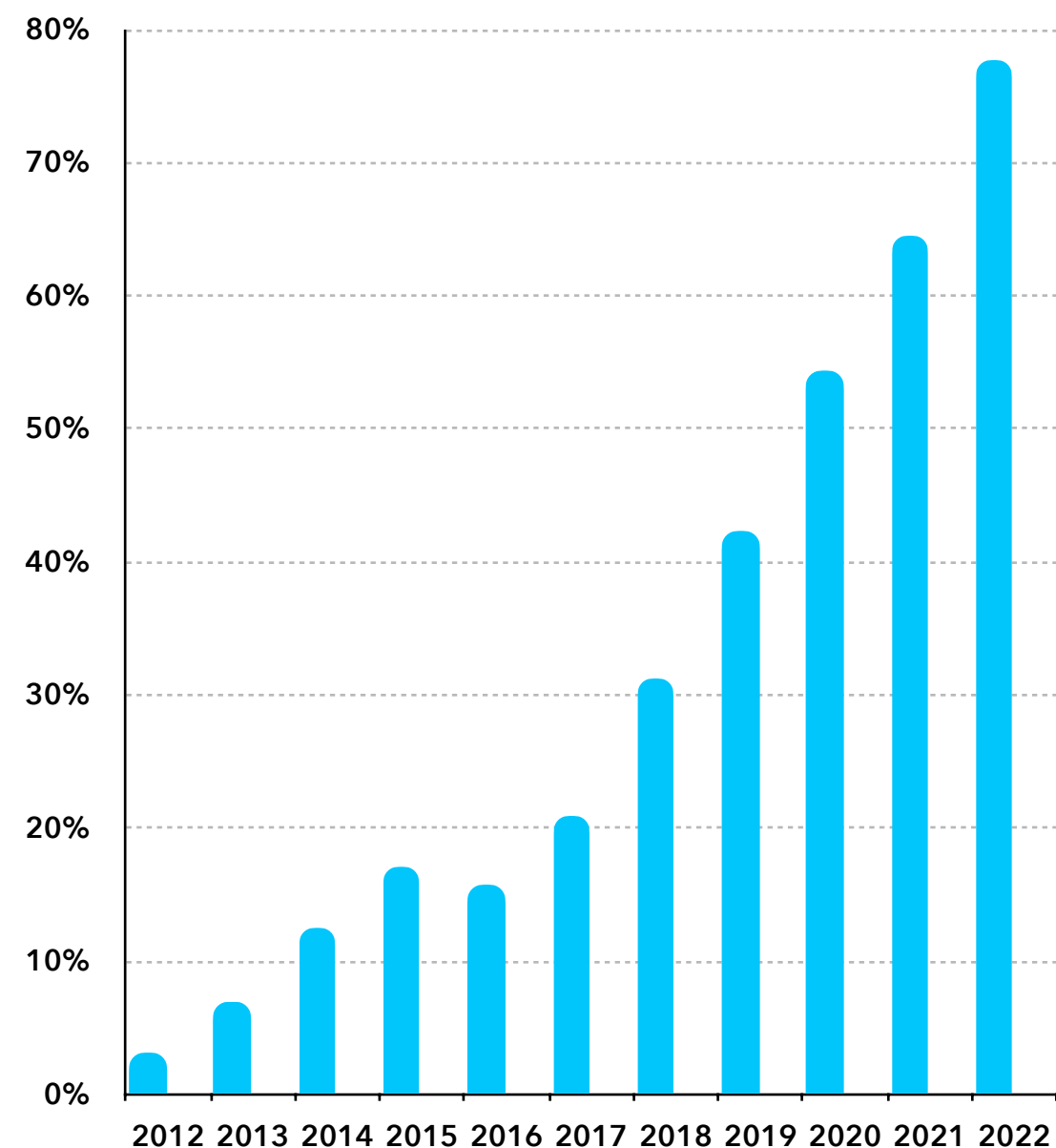


Norway's global number 1 position in electrification is driven by many factors

The perfect mix of favourable EV conditions

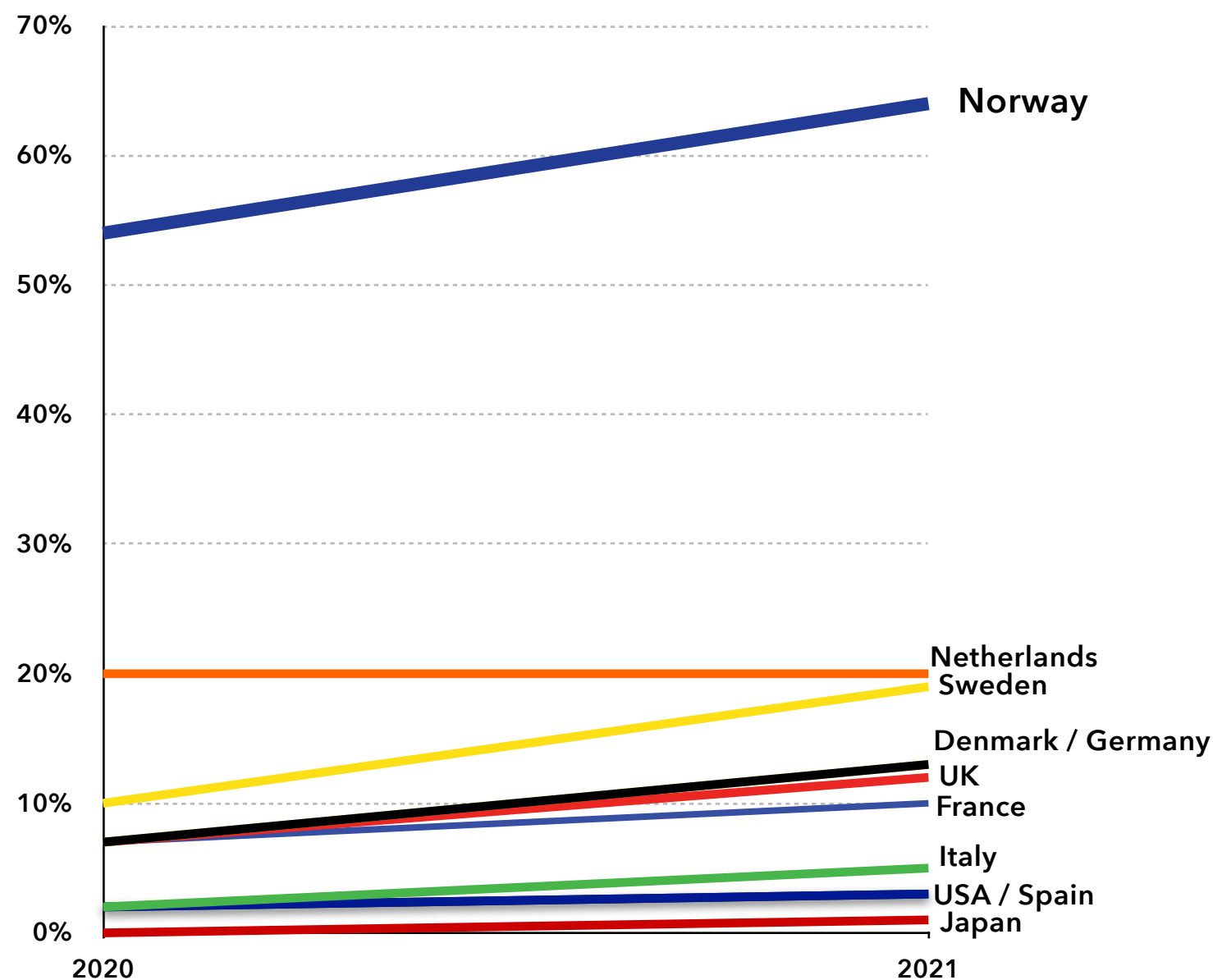
- **High purchase & usage benefits for new EVs***
 - **Purchase tax and VAT exemptions** worth €15,000 on average
 - **Annual TCO savings** compared to ICEVs of €1,600-1,800
 - **Important usage benefits:**
 - ✓ **Annual toll road discounts** of €200-300;
 - ✓ **Annual fuel savings** of €600-1,100 (vs ICEVs)
- **Favourable conditions for home charging**
 - 85% of charging mostly take place at home
 - Low population density: (17 inhabitants per km²)
 - Very distributed and self-owned housing stock
- **Abundance of cheap clean electricity**
 - Historically, the Nordic region has had the lowest electricity prices in Europe
 - Norway has been a net electricity exporter of hydropower
- **Decent EV supply when few other countries were interested**
 - Norway was used as a test bed by the auto industry, e.g. Chinese brands experimenting in Norway first outside China
- **And last but not least, stable, long-term political support and strong demand**
 - Full political support to 100% EV target for new passenger cars in 2025

EV share in new car registrations (%)

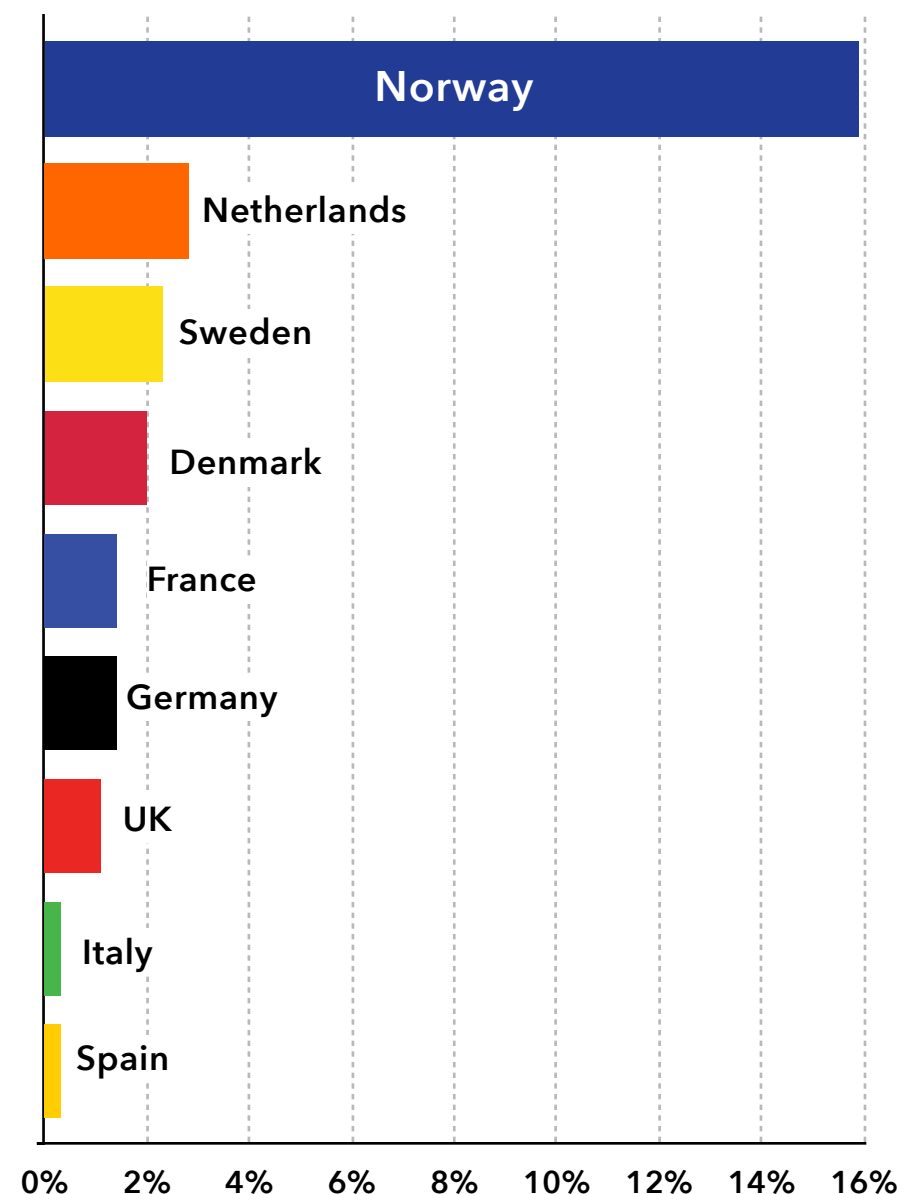


Norway is 5-10 years ahead of all other countries in terms of EV adoption


































EV penetration of new cars sold (%)



EV penetration of all cars in use (% , 2021)

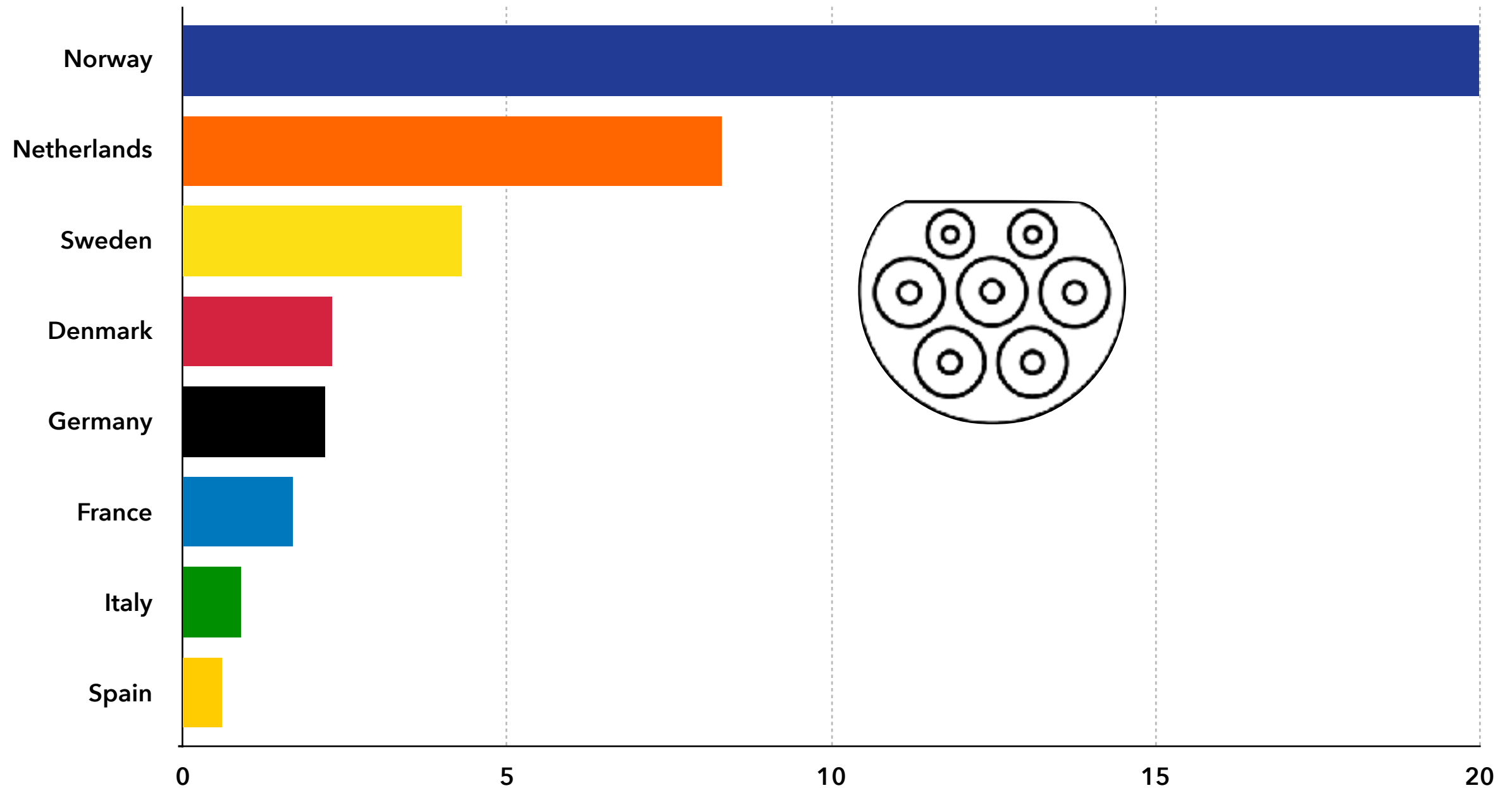


Norway's EV success comes from a combination of dense charging infrastructure and purchase & usage benefits

Country	Public charging infrastructure ⁽¹⁾	EV purchase benefits (government share)	EV usage benefits ⁽²⁾	EV penetration of new cars (% , 2021)
Norway				64%
Netherlands				20%
Sweden				19%
Denmark				13%
Germany				13%
UK				12%
France				10%
Italy				5%
USA				3%
Spain				3%
Japan				1%

Norway has 10 times more charging stations than most EU countries!

Public charging infrastructure comparison ⁽¹⁾



Other countries could copy several Norwegian EV policies and practices

1. Ensure stable and broad national political support
2. Fix home charging first
3. (Carefully) support public charging network
4. Keep purchase benefits until 2027
5. Change the purchase benefits away from subsidies to taxation
6. Include usage benefits
7. Introduce special EV license plates for an efficient usage benefits system
8. Make a clear move to end the sales of ICE vehicles



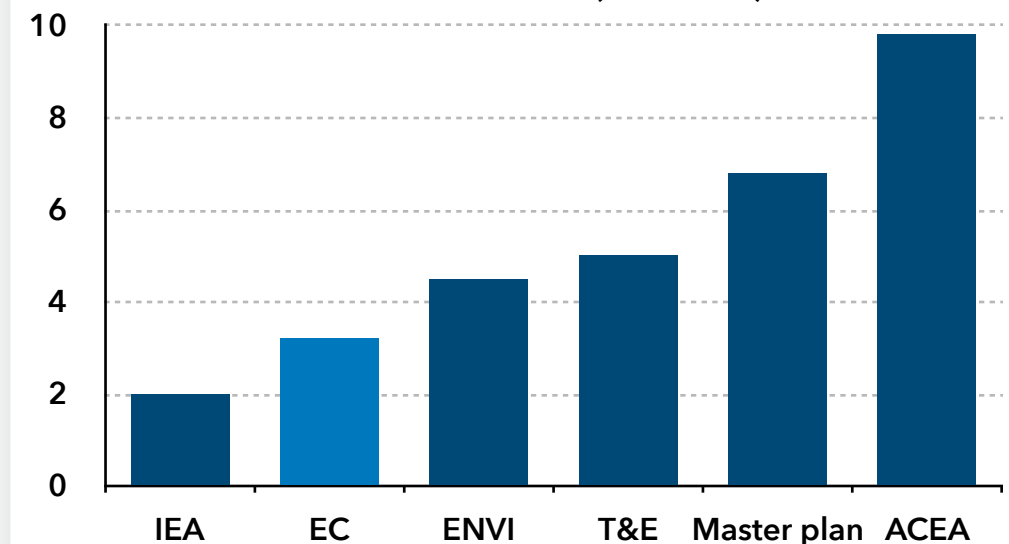
We detail each of these in the following slides

The European car industry recommends 3 times as many public chargers in 2030 as the European Commission...

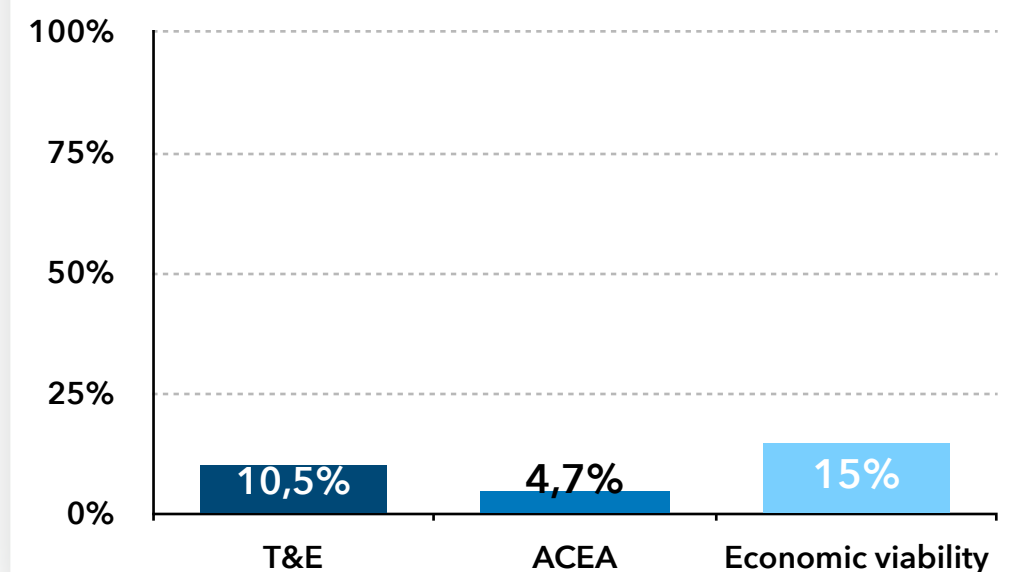
The car industry is essentially proposing to make public charging unprofitable

- The European car industry (ACEA) is proposing a 3 kW/EV target instead of the Commission's 1 kW/EV target
- This would lead to a tripling of the required public charging points in 2030
 - The EU's Sustainable and Smart Mobility Strategy targets 3.2 million public charging points while the ACEA targets 9.8 million
 - The "EV charging master plan" targets 6.8 million
- The car industry's proposal assumes an average utilisation rate of 4.7% while 15% is needed for financial viability*
- This difference matters greatly for the financial and practical side of things, even when comparing the more moderate EV charging master plan with the EC proposal
 - The roll-out of public charging points would need to ramp up to 14,000 per week, up from 2,000 today
 - There's a funding gap of €40 billion in 2030 to reach the master plan target

Number of EU-27 public charging points needed in 2030 (million)



Average utilisation level of public chargers*



Tax exemptions on EVs, tax hikes on fossil cars or lower VAT rate on EVs would be more efficient than EV subsidies

Subsidising EVs is inefficient and costly, creates arbitrage and drives exports of subsidised EVs

- **All other countries than Norway rely on various types of subsidies to stimulate new EV sales:**

- At point-of-sales: France, Canada, UK
- Rebate: Germany, Japan, Sweden

- **Subsidies are complex and costly to manage**

- For example, the **German and Swedish subsidies only require the buyers to hold the car for 6 months to keep the rebate**

- **Subsidies lead to exports/subsidy leakage of almost new EVs and create arbitrage opportunities**

- Result 1: These subsidies generate leakage to other countries via significant exports of almost new cars (cf next page)
- Result 2: **Since 2017, Norway imported 49,783 almost new EVs, most of which were subsidised abroad**

- Result 3: Car dealers and leasers are likely to exploit this subsidy/ purchase price arbitrage opportunity across country borders

- **Unsurprisingly, the only EVs that are exported from Norway are those that enjoy a subsidy**

- Light delivery vehicles enjoy a maximum subsidy of NOK 50,000
- Of all new electric LDVs sold until 2021, 20% were exported

- **Unlike subsidies, tax exemptions cannot be exported and are a more cost-efficient way to promote EV sales**

- **Taxes can be applied in 2 different ways to influence the EV uptake**

- **Increase taxes on fossil cars**, make them relatively more expensive to purchase and own than EVs
- **Reduce the VAT rate on new EVs in countries with no car purchase taxes**

"The reason why Norway has succeeded better than others with the electrification of the car fleet is that we have not relied on subsidies but rather taxes - on all EV competitors."



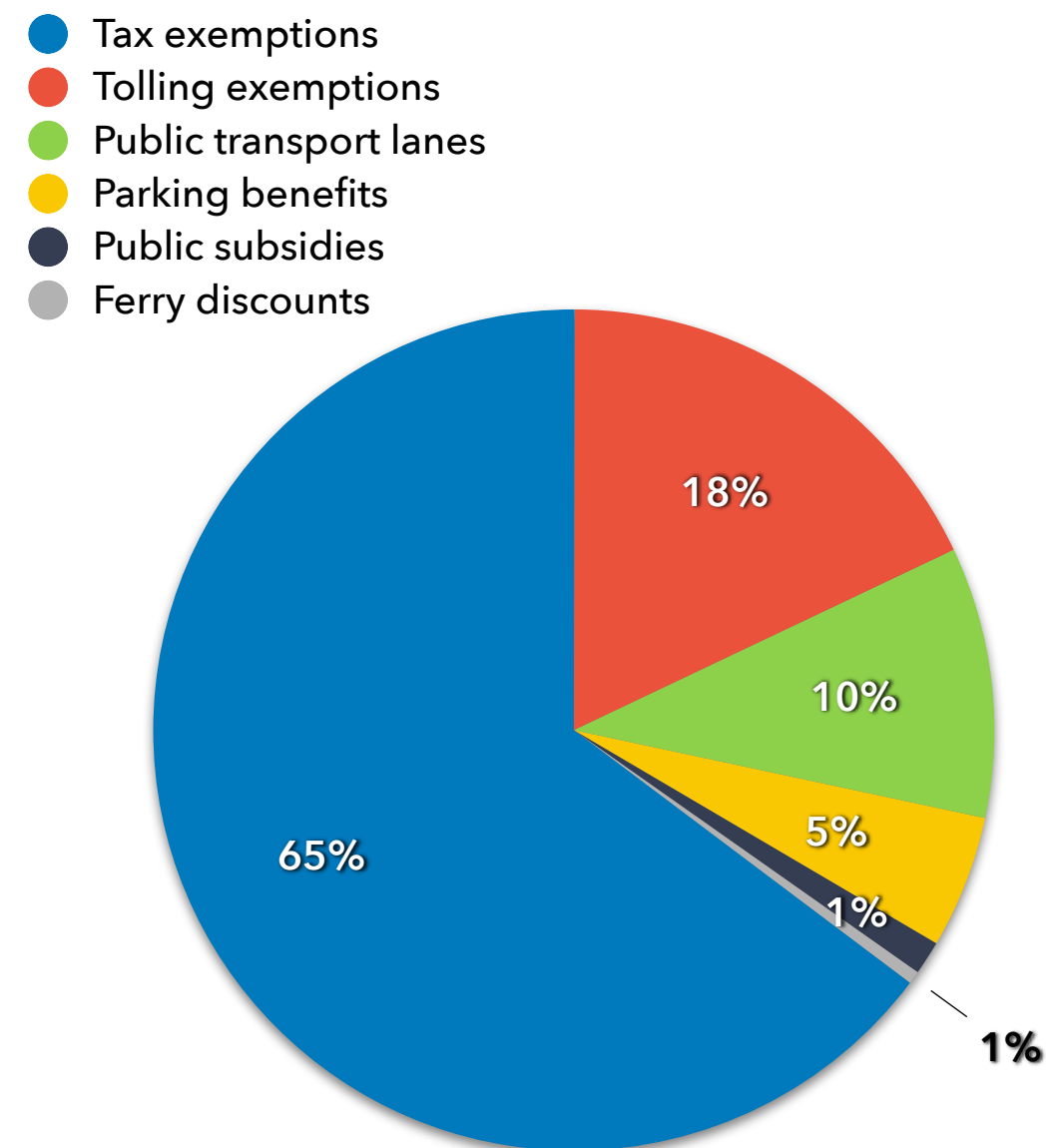
Lasse Fridstrøm
Senior Researcher
Norway's Institute of
Transport Economics (TØI)

Inclusion of usage benefits can help drive EV adoption

No countries are alike but usage benefits have a role to play

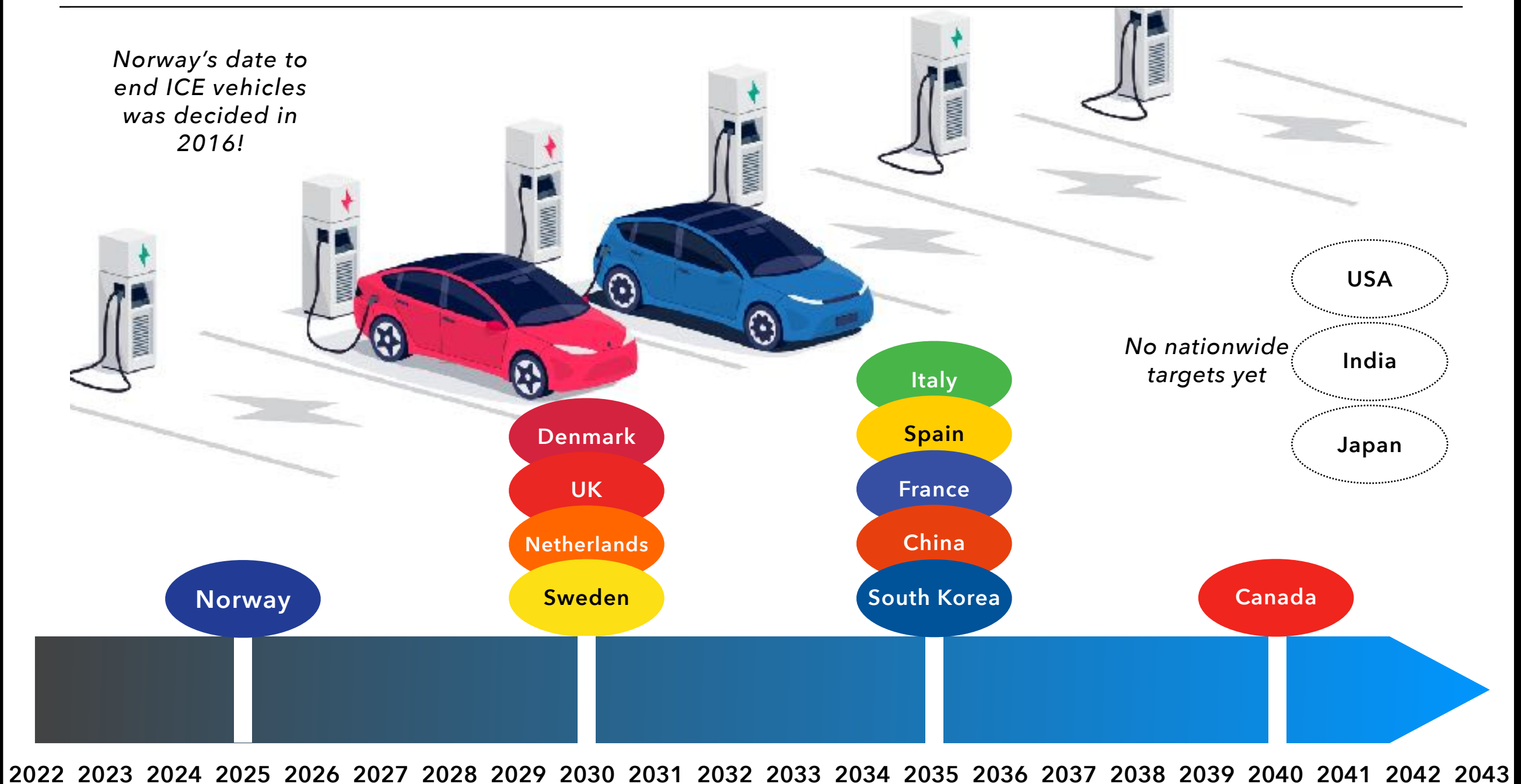
- The most important Norwegian EV usage benefits are:
 - Price reductions or free passage on toll roads
 - Use of bus lanes (with increasing restrictions)
 - Price reductions on or free public parking
- Depending on the country, such usage benefits can, together with purchase benefits and fuel savings, **create a positive EV TCO compared to fossil cars, and increase EV adoption**
- In Norway, total EV incentives were valued in 2017 at NOK 275,000 (€27,500) per car:
 - Purchase incentives of NOK 78,436 (€7,844)
 - The present value of the usage incentives was estimated at NOK 196,000 (€19,600)
 - Public subsidies (for EV charging) represented only 1.3% of the total value of EV incentives in 2017

Breakdown of Norwegian EV incentives (2017, %)*



Norway is 5-10 years ahead of all other countries in terms of 100% EV sales targets

Target year for ban of new fossil fuel cars



Other countries have the benefit of improving on Norway's EV experience, avoiding mistakes and filling gaps

1. Ensure sufficient cheap renewable electricity
2. Stop supporting hybrids now
3. Balance electrification with other public policy goals
4. Ensure careful fine-tuning of incentives
5. Force the automotive OEMs and dealers to provide relevant realistic EV range and battery charging information
6. Ensure sufficient regulation of the public charging market



We detail each of these in the following slides

Norway's lead was gained through a long term, stable commitment that overcame user experience issues

Norway will reach its 2025 target for 100% of new passenger cars to be electric.

The country is currently 5-10 years ahead of the rest of world when it comes to electrification.

Fair enough, some factors made it easier to experiment with this in Norway than elsewhere.

But let us **not underestimate the value of a stable, long-term and widely supported commitment.**

In Norway, this was helped by a fairly widespread **community spirit to work together for the greater good***.

This great EV adoption success story is somewhat surprising in the light of the **substandard user experience** that EV drivers often have experienced.

There are **few excuses for the OEMs and public charging operators to often still provide incorrect, incomplete or unrealistic information about EVs' driving range and charging performance.**

For the world to succeed with its electrification and climate ambitions, **it needs continued EV purchase incentives, continued large investments in battery metals and technologies as well as large investments in public charging infrastructure, and sufficient decarbonised electricity.**



Norway's success shows how to create a winning cocktail of measures between purchase and usage benefits

Two obvious benefits of the Norwegian EV model are that 1) it has produced tangible results already and 2) it will deliver the remaining goods much faster than anywhere else.

To those governments who still think it is a great idea to subsidise EVs in general and the more than 50,000 new EVs that were exported to the world's 3rd richest country aka Norway in particular:

Perhaps it is time to reflect on a more cost-effective way of making EVs relatively more attractive than fossil fuel cars. **Maybe it is time to try the taxation way instead?**

To those OEMs and governments that think we almost need a new Marshall plan in Europe, backed by massive public subsidies, to build the necessary EV public charging infrastructure:

Perhaps the Norwegian market-led approach that has generated the world's best charging network, combined with the help from Tesla's opening of its superior charging network, could do the trick elsewhere, too?

The Norwegian EV policy has almost been too successful: it has created a big and growing hole in car tax and tolling operators' revenues.

Additionally, it has led to increased car usage to the detriment of public transport.

That's why EVs will gradually lose their precious VAT and usage benefits.



Norway's unfinished car electrification journey shows the need for a stable, holistic, and cross-sectorial approach

We expect that the big EV impact on toll revenues and the related equity issues will lead to a broad political compromise to **replace electronic tolling with road usage charging (RUC)**.

While working on this report, a couple of positive EV developments have been noted.

The first is that **the EU will ban all new ICEV sales from 2035 and also end the favourable treatment of hybrid cars from 2027**.

All this comes **against the intense lobbying from ACEA, the car industry association**.

The second positive development is that **the EU car lobby is splintering**, with firms like Ford, Stellantis and Volvo Cars breaking with the rest on climate issues.

Our final word: For any country to succeed with its transport electrification and wider climate policies, **the combined involvement and support of utilities, OEMs, charging operators and local and national governments is needed**.

Additionally, you **need some stable, significant economic incentives for the EV buyers** to unleash the powerful community, cross-sectorial work called *dugnad* in Norway.*

That **ecosystem approach** is certainly the **biggest difference between Norway and other countries and what made the difference to achieve a take off of EV sales**.



Governments need to take a holistic approach to EVs, copying successes and avoiding failures in Norway

Governments have a lot to learn from the Norwegian EV experience.

From our analysis of the Norwegian success, **they should** in our view:

1. **Ensure stable and broad national political support**
2. **Fix home charging first** - establish the right to plug, provide financial support if necessary in old multi-tenant buildings
3. **Carefully support public charging network**
 - (i) More attention should be given to what **local governments** should do than the national one, e.g. regulate and reserve space for kerbside and parking lot charging in cities
 - (ii) **Address market failures but prevent overbuilding and creating a loss-making industry** and an eternal need for massive public subsidies at national level
4. **Ensure streamlined / much shorter approval times for the construction of new public charging stations** by the grid operator, utilities and local governments
5. **Ensure sufficient regulation of the public charging market but** give the industry 12 months to fix things before introducing a utility/telecom-like regulation
6. **Keep purchase benefits until 2027**
7. **Change the purchase benefits away from subsidies to taxation** as a cheaper way to make EVs more attractive - and to avoid exporting your tax payers' money to rich Norway
8. **Include compelling usage benefits in the mix of EV benefits**, from parking to tolls
9. To **stimulate the used EV market, drop the car re-registration tax** and consider other purchase tax and VAT benefits for used EVs
10. **Balance electrification with other public policy goals** e.g. securing sustainable tax revenues, reduction in car usage externalities such as congestion and local air pollution, and promotion of public transport
11. **Ensure careful fine-tuning of incentives** to avoid draining the public purse and damaging public transport
12. **Introduce special EV license plates** for an efficient usage benefits system
13. **Stop supporting hybrids immediately, long before the EU makes it mandatory in 2027**
14. **Ensure sufficient cheap renewable electricity is available**
15. **As soon as possible, set a clear (and early) end date for ICE vehicles to bring a clear signal to car buyers**

OEMs need to do their own homework and address serious EV range and charging issues before blaming others

Car OEMs are in the midst of the secular upheaval of their industry brought by electrification but also connectivity and autonomy.

However many OEMs have eagerly been blaming somebody else for their own problems and did for some time play delaying tactics for the necessary shift to electric transport.

Early EV enthusiasts have accepted substandard EV charging and range information and performance.

That will no longer fly with other segments of the population.

In order to drive mass-market EV adoption across Europe, **OEMs should** in our view:

1. Stop blaming others for the low EV adoption rates in some countries

2. Fix internal supply chain issues to deliver more EVs / satisfy the exploding demand for EVs across Europe

3. Focus on improving battery efficiency & technology

4. Ensure the training of dealers & mechanics to handle the shift to EVs

5. Stop pushing for hybrids that the planet cannot afford, and that the EU will stop in 2027 anyway

6. Stop exaggerating the need for public chargers that will destroy the profitability of that industry and require endless public subsidies

7. Think twice before investing in public charging infrastructure unless you are a first mover, have a competitive advantage from being a utility or gas station operator, or can provide a good customer experience. Please listen, IONITY!

8. Develop and communicate new and realistic EV industry range standards, to make WLTP more relevant than in the current 23°C laboratory conditions

9. Provide EV buyers with realistic industry-standardised information about expected charging performance (aka the "charging curve")

10. Stop systematically turning their product range towards SUVs which are, due to their increased weight, reducing the benefits of electrification

Europe's EV charging operators must dramatically improve both basic information and performance

Norway's early EV adopters have been unhappy **guinea pigs for a sub-standard customer experience** that needs to be fixed in order to drive massive EV adoption across Europe.

Charging operators should in our view:

1. **Embrace industry self-regulation to prevent harsher government regulation** within a year
2. **Support credit card payments, new payment mechanisms & ensure interoperability / roaming with all current payment means**, from fuel cards to electronic tolling devices
3. **Provide SLAs* for uptime / availability**, with information displayed at the charging point
4. **Provide SLAs for charging point capacity** (expressed in kWh) **and effect** (expressed in kW) with information displayed at the charging point
5. **Provide price information (per kW) at the charging point**, not only in an app
6. **In areas with large traffic volumes, build (multi-operator) charging hubs with at least 20, and in the busiest areas, 50 charging points.** Tesla has already done it!
7. **Make sure there is standardised and visible sign posting to the charging stations** when exiting roads and highways, as is the case for gas stations
8. **Make sure the EV charging stations are not hidden, dark and simple.** Make them more like gas stations with toilets, roofing, trash bins and lights. Compare Audi's hubs with those of IONITY!
9. **Consider placing charging stations where users are spending time anyway** i.e. in offices, hospitality venues, campuses, hospitals, etc. so that the charging experience becomes something else than one of waiting.
10. **Work with OEMs towards the full interoperability of charging plugs**

The report mentions 70 companies and organisations (1/2)

Company	Country	Type	Company	Country	Type	Company	Country	Type
ABB	Switzerland	Industrial	easee	Norway	Smart EV charging hardware	IEA	France	Energy advisory
ACEA	Belgium	Industry association	Elbil	Norway	News site	imove	Norway	Car subscription
Aftenposten	Norway	Newspaper	Elbil24	Norway	News site	IONITY	Germany	EV charging operator
Agora Verkehrswende	Germany	Think-tank	Energi Norge	Norway	Industry association	ITF	France	Think-tank
Audi	Germany	Automotive	Enova	Norway	Energy innovation advisory	Kinect Energy	US	Energy company
Autobransjens Leverandørforening	Norway	Industry association	Euractiv	Belgium	News site	Kople	Norway	Energy company
Automotive News Europe	US	Magazine	European Commission	Belgium	International organisation	Kruser	Norway	Electric boat sharing
Bloomberg	US	Media company	Eviny	Norway	Energy company	Mer	Norway	EV charging operator
Business Insider	US	News company	Financial Times	UK	Newspaper	Mercedes-Benz	Germany	Automotive
ChargeUp Europe	Belgium	Industry association	Fortune	US	Magazine	Morrow	Norway	EV battery production
CircleK	Canada	Fuel retail	FREYR Battery	Norway	EV battery production	Motor	Norway	Magazine
DNV	Norway	Assurance & risk management	Goldman Sachs	US	Financial services	NAF	Norway	Car owner association
e-on	Germany	Energy company	Hydro	Norway	Aluminum production	NIO	China	Automotive
EAFO	Belgium	Energy information	Hydrovolt	Norway	EV battery recycling	NOBIL	Norway	EV charging database
			ICCT	US	Think-tank			

The report mentions 70 companies and organisations (2/2)

Company	Country	Type	Company	Country	Type
Northvolt	Sweden	EV battery production	Statnett	Norway	National grid operator
Norwegian EV Association	Norway	Car owner association	Stellantis	France	Automotive
NRK	Norway	Public broadcaster	Tesla	US	Automotive
NVE	Norway	Electricity regulator	Tibber	Norway	Smart electricity retail provider
OECD	France	International organisation	TØI	Norway	Think-tank
OFV	Norway	Automotive information	Transport & Environment	Belgium	NGO
Plug	Norway	Electric maritime charging	US Geological Survey	US	Government entity
recharge	Norway	EV charging operator	VDA	Germany	Industry association
Ruter	Norway	Public transport provider	Volkswagen	Germany	Automotive
Siemens	Germany	Industrial	Wells Fargo	US	Financial services
Statens Vegvesen	Norway	National road authority	Wikipedia	US	Encyclopedia
Statistics Norway	Norway	National statistics agency	World Population Database	US	Demographics data provider
Statkraft	Norway	Energy company	Zaptec	Norway	Smart EV charging hardware

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analytics

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ADAS
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Autonomous
trucks

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