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Presentation agenda: Follows video timestamps

1. Global battery electric vehicle sales: 2016 to 2022
2. BEV sales in Norway is now over 85% of new vehicle sales
3. When will global BEV sales become 100% of new vehicle sales?
4. When will global fleet of vehicles be nearly 100% battery electric & collapse the global oil industry?
5. Concluding remarks



Chapter 1

Global battery electric vehicle sales 2016 to 2022



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Battery electric vehicle sales 2016 to 2022

Year	Global vehicle sales of passenger and commercial	Annual growth	Battery electric vehicles sold globally	Annual growth	BEV share of global market	Change in BEV share of global market	ICE vehicles sold globally	Annual growth	Tesla sales globally	Annual growth	Tesla share of global market
2016	94,976,569		477,700		0.50%		94,498,869		76,297		0.08%
2017	97,302,534	2.45%	801,600	67.80%	0.82%	0.32%	96,500,934	2.12%	103,181	35.24%	0.11%
2018	95,634,593	-1.71%	1,367,800	70.63%	1.43%	0.61%	94,266,793	-2.32%	245,162	137.60%	0.26%
2019	91,227,182	-4.61%	1,624,600	18.77%	1.78%	0.35%	89,602,582	-4.95%	367,481	49.89%	0.40%
2020	78,774,320	-13.65%	2,165,400	33.29%	2.75%	0.97%	76,608,920	-14.50%	499,647	35.97%	0.63%
2021	82,684,788	4.96%	4,599,400	112.40%	5.56%	2.81%	78,085,388	1.93%	936,222	87.38%	1.13%
2022	81,700,000	-1.19%	8,000,000	73.94%	9.79%	4.23%	73,700,000	-5.62%	1,313,851	40.34%	1.61%
Annual growth 2016 to 2022		-2.48%		59.95%				-4.06%		60.70%	

- **Source:** Link to excel spreadsheet at www.hmexperience.dk



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Sources & attribution for previous slides

- **Source:** Link to excel spreadsheet at www.hmexperience.dk
- **Source for BEV sales 2016 to 2021:** <https://www.statista.com/outlook/mmo/electric-vehicles/worldwide#unit-sales>
- **Source for BEV sales 2022:** <https://www.ev-volumes.com/country/total-world-plug-in-vehicle-volumes/>
- **Source for global auto sales 2019 to 2021:** <https://www.oica.net/category/sales-statistics/>
- **Source for global auto sales 1997 to 2020:** https://en.wikipedia.org/wiki/Automotive_industry#By_year
- **Source for global auto sales 2022:** <https://www.just-auto.com/analysis/global-vehicle-market-sales-rate-falls-back/#:~:text=A%20global%20market%20forecast%20at,in%20Europe%20and%20North%20America.>
- **Source:** <https://twitter.com/scienceisstrat1/status/1609695283717234689>






Science Is Strategic
@scienceisstrat1

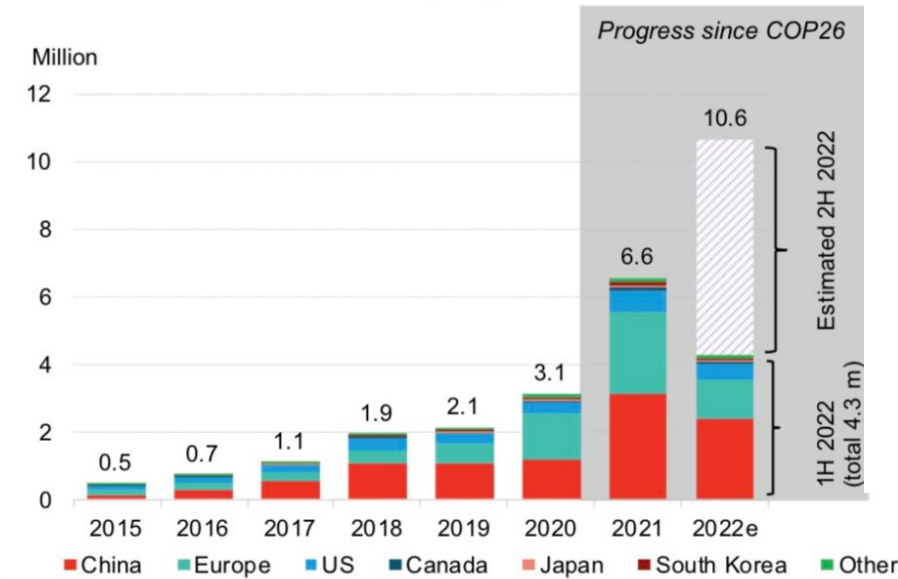
For comparison: Some stats on electric vehicle sales (not BEVs)

Global EV sales are exploding, with total sales forecast to hit 10.6 million in 2022, up an incredible 60%.

Below is a  on this hugely consequential development, which has economic, environmental & geopolitical implications

Cc: @Noahpinion @JesseJenkins @dwallacewells @ramez

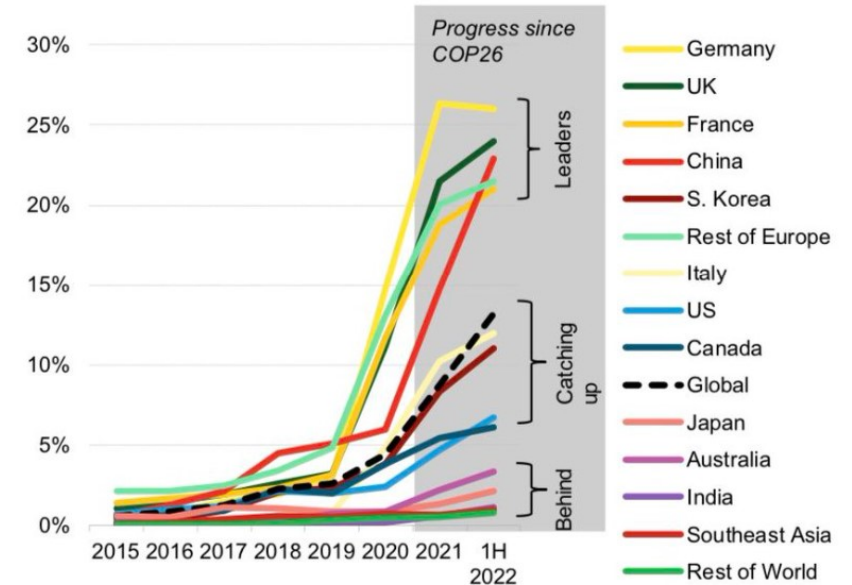
Global electric vehicle sales by region



Science Is Strategic @scienceisstrat1 · Jan 2

At the country level, the leading markets include some of the world's largest economies such as Germany, the UK, France and China

Passenger EV share of sales



Source: BloombergNEF, Marklines, Jato. Note: Includes BEV and PHEV.

18.9K 6 27 158



Source: <https://twitter.com/scienceisstrat1/status/1609695283717234689>

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Chapter 2

**BEV sales in Norway is now
over 85% of new vehicle sales**

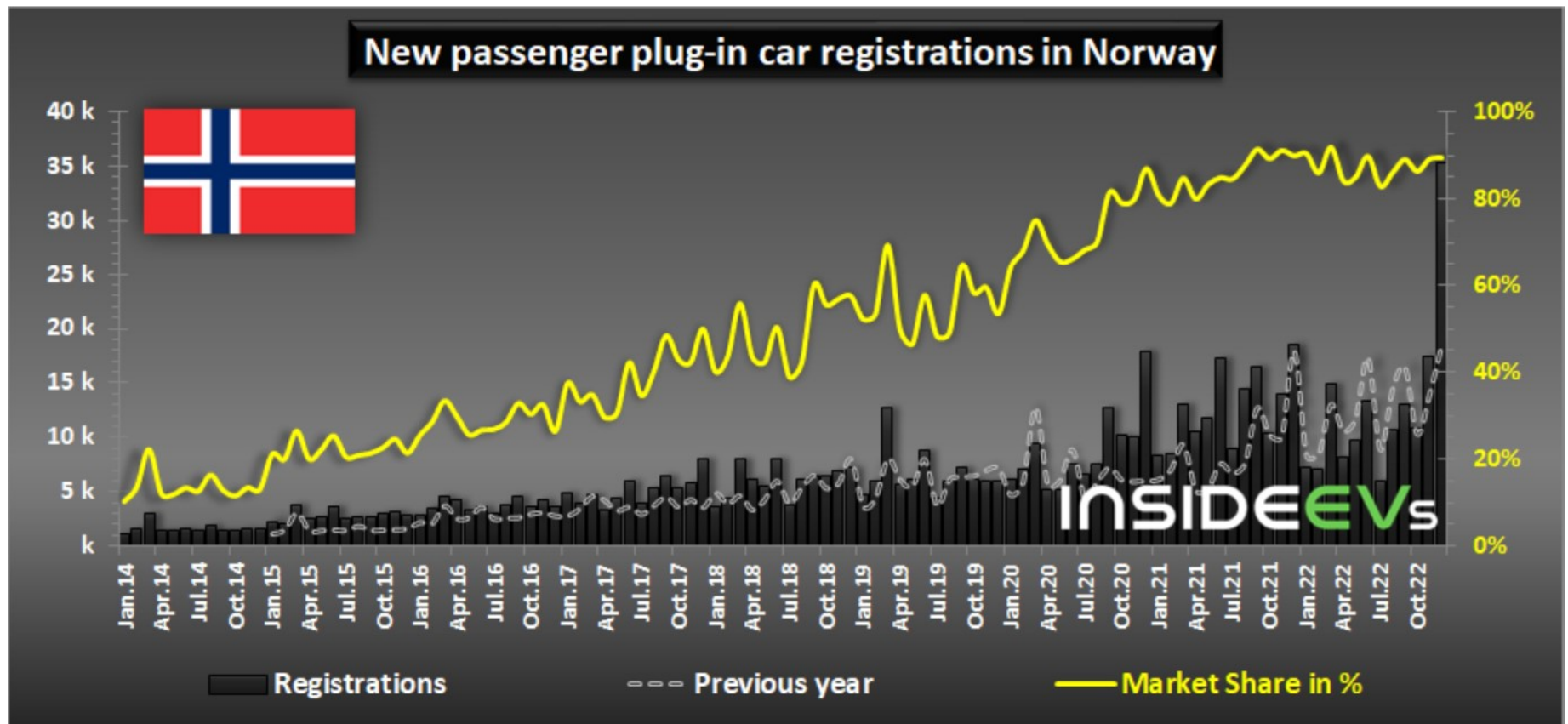


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Electric vehicle sales Norway

New passenger plug-in car registrations in Norway – December 2022

- BEVs: 32,714 (up 137%, at 82.8% market share) + 1,242 new vans
- PHEVs: *1,905 (down 60%, at 4.8% market share)
- Total: 34,619 (up 87%, at 87.6% market share)



- **Source:** <https://insideevs.com/news/629068/norway-electric-car-sales-december2022/>



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Total vehicle sales Norway 2022

Best Sellers: Tables ▾ Norway ▾ Groups ▾ FY2022 ▾



2021 <<			Best sellers for FY2022 Countries: 🇳🇴			2023 >>		
Top groups			Top models					
MAKE	#	SHARE	MAKE	MODEL	#			
VW GROUP	37036	26.1%	TESLA	MODEL Y	17342			
TESLA	21281	15%	VOLKSWAGEN	ID.4	11339			
HYUNDAI-KIA	13180	9.3%	SKODA	ENYAQ	7384			
GEELY	13137	9.2%	BMW	IX	5888			
BMW	12611	8.9%	VOLVO	XC40	5044			
MERCEDES-BENZ	8612	6.1%	HYUNDAI	IONIQ 5	4967			
STELLANTIS	7924	5.6%	POLESTAR	2	4637			
SAIC	5757	4.1%	AUDI	E-TRON	4100			
RENAULT-NISSAN-MITSUBISHI	4922	3.5%	AUDI	Q4 E-TRON	4057			
FORD	4362	3.1%	FORD	MUSTANG MACH-E	4038			
TOYOTA	3951	2.8%	BMW	I4	3506			
BYD	2895	2%	VOLVO	C40	3388			
FAW	2005	1.4%	MERCEDES-BENZ	EQC	3271			
NIO	1127	0.8%	NISSAN	LEAF	3184			
MAZDA	951	0.7%	TESLA	MODEL 3	3159			
XPENG	696	0.5%	VOLKSWAGEN	ID.3	2707			

Source: <https://eu-evs.com/bestSellers/NO/Groups/Year/2022>



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Chapter 3

When will global BEV sales become 100% of new vehicle sales?



Assumptions behind the 100% BEV sales by 2032 prognosis

- ✓ **Global vehicle sales is expected to drop 10% in 2023** because of the expected recession but will bounce back and grow 12% in 2024
- ✓ **From 2025 to 2032 global auto unit sales are expected to grow at 3% annually** which follow the typical real GDP economic growth rate
- ✓ **Growth in BEV sales drops from its average 60% annually observed 2016 to 2022 to 50% in 2023** and further drops in the following years to 3% growth in 2033
- ✓ **Annualized global growth in BEV sales from 2022 to 2032 is 29%**
- ✓ **Max change in global BEV market share is 10%** because unrealistic to expect it is possible to transit a larger share of industry in a single year
- ✓ **As a result of Tesla's lead in autonomous driving and software** Tesla is expected to grow faster than global BEV market until 2029 where Tesla will approach 20% of global vehicle market
- ✓ **Anti-trust legislation is expected to prevent Tesla** from increasing its market share beyond 20% of global market starting in 2029



When will BEVs become 100% of new vehicle sales? 2032

Year	Global vehicle sales of passenger and commercial	Annual growth	Battery electric vehicles sold globally	Annual growth	BEV share of global market	Change in BEV share of global market	ICE vehicles sold globally	Annual growth	Tesla sales globally	Annual growth	Tesla share of global market
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2018	95,634,593	-1.71%	1,367,800	70.63%	1.43%	0.61%	94,266,793	-2.32%	245,162	137.60%	0.26%
2019	91,227,182	-4.61%	1,624,600	18.77%	1.78%	0.35%	89,602,582	-4.95%	367,481	49.89%	0.40%
2020	78,774,320	-13.65%	2,165,400	33.29%	2.75%	0.97%	76,608,920	-14.50%	499,647	35.97%	0.63%
2021	82,684,788	4.96%	4,599,400	112.40%	5.56%	2.81%	78,085,388	1.93%	936,222	87.38%	1.13%
2022	81,700,000	-1.19%	8,000,000	73.94%	9.79%	4.23%	73,700,000	-5.62%	1,313,851	40.34%	1.61%
2023	73,530,000	-10.00%	12,000,000	50.00%	16.32%	6.53%	61,530,000	-16.51%	1,970,777	50.00%	2.68%
2024	82,353,600	12.00%	18,000,000	50.00%	21.86%	5.54%	64,353,600	4.59%	2,956,165	50.00%	3.59%
2025	84,824,208	3.00%	27,000,000	50.00%	31.83%	9.97%	57,824,208	-10.15%	4,434,247	50.00%	5.23%
2026	87,368,934	3.00%	36,450,000	35.00%	41.72%	9.89%	50,918,934	-11.94%	6,651,371	50.00%	7.61%
2027	89,990,002	3.00%	46,291,500	27.00%	51.44%	9.72%	43,698,502	-14.18%	9,977,056	50.00%	11.09%
2028	92,689,702	3.00%	56,938,545	23.00%	61.43%	9.99%	35,751,157	-18.19%	13,967,878	40.00%	15.07%
2029	95,470,393	3.00%	68,041,561	19.50%	71.27%	9.84%	27,428,832	-23.28%	16,761,454	20.00%	17.56%
2030	98,334,505	3.00%	79,608,627	17.00%	80.96%	9.69%	18,725,879	-31.73%	19,275,672	15.00%	19.60%
2031	101,284,540	3.00%	91,549,921	15.00%	90.39%	9.43%	9,734,620	-48.02%	19,853,942	3.00%	19.60%
2032	104,323,077	3.00%	104,323,077	13.95%	100.00%	9.61%	0	-100.00%	20,449,561	3.00%	19.60%
2033	107,452,769	3.00%	107,452,769	3.00%	100.00%	0.00%	0	-	21,063,048	3.00%	19.60%
Annual growth											
2016 to 2022		-2.48%		59.95%				-4.06%		60.70%	
2022 to 2032		2.47%		29.28%						31.59%	
2016 to 2032		0.59%		40.02%						41.83%	

- **Source:** Link to excel spreadsheet at www.hmexperience.dk



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Comments regarding the 100% BEV sales by 2032 prognosis

- ✓ **This prediction is not an attempt to be exact** with regard to which year BEVs will be 100% of the global vehicle market
- ✓ **It could happen sooner or later dependent on whether political developments** will press to speed the process up or slow it down
- ✓ **Also different countries will have different opportunities** such as cheap electricity versus gasoline/diesel (like in Norway and Island) that may help to speed up the transition
- ✓ **Therefore, the general global picture may look very different** for individual countries and their time to reach 100% BEV market share of new vehicle sales may differ much from global picture
- ✓ **Some countries will do it before 2032** and others will take longer
- ✓ **Indeed, Norway with over 85% BEV sales since October, 2022 is practically done** with its transition to BEV sales only



Sources for previous slides

- Major retooling of assembly factories typically happens every 5 to 10 years implying that 10% to 20% of the product lineup can be replaced per year with new products. Replacing ICE vehicles with BEV fabrication is more difficult because entirely new production facilities needs to be build at scale specifically the entire supply chain for making battery cells. Obviously making new factories and opening new mines/material refineries takes more time than retooling existing factories or raw material refinery operations: <https://www.assemblymag.com/articles/96913-retool-rebuild-or-start-over>



Chapter 4

**When will global fleet of vehicles be
nearly 100% battery electric &
collapse the global oil industry?**



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The USD value of global BEV sales

Year	Global auto sales of passenger and commercial	Annual growth	Battery electric vehicles sold globally	Annual growth	BEV share of global market	Average selling price of BEV	Annual growth	Value of global sales in billion \$	Value of BEV sales \$B	Value of global GDP current \$B	Annual growth	Global sales to GDP %
2016	94,976,569		477,700		0.50%	\$34,450		\$3,272	\$16	\$76,153		4.30%
2017	97,302,534	2.45%	801,600	67.80%	0.82%	\$34,670	0.64%	\$3,373	\$28	\$80,823	6.13%	4.17%
2018	95,634,593	-1.71%	1,367,800	70.63%	1.43%	\$35,610	2.71%	\$3,406	\$49	\$86,085	6.51%	3.96%
2019	91,227,182	-4.61%	1,624,600	18.77%	1.78%	\$36,820	3.40%	\$3,359	\$60	\$87,536	1.69%	3.84%
2020	78,774,320	-13.65%	2,165,400	33.29%	2.75%	\$38,960	5.81%	\$3,069	\$84	\$85,239	-2.62%	3.60%
2021	82,684,788	4.96%	4,599,400	112.40%	5.56%	\$42,380	8.78%	\$3,504	\$195	\$96,293	12.97%	3.64%
2022	81,700,000	-1.19%	8,000,000	73.94%	9.79%	\$44,923	6.00%	\$3,670	\$359	\$103,867	7.87%	3.53%
2023	73,530,000	-10.00%	12,000,000	50.00%	16.32%	\$45,911	2.20%	\$3,376	\$551	\$105,944	2.00%	3.19%
2024	82,353,600	12.00%	18,000,000	50.00%	21.86%	\$46,921	2.20%	\$3,864	\$845	\$113,360	7.00%	3.41%
2025	84,824,208	3.00%	27,000,000	50.00%	31.83%	\$47,953	2.20%	\$4,068	\$1,295	\$119,028	5.00%	3.42%
2026	87,368,934	3.00%	36,450,000	35.00%	41.72%	\$49,008	2.20%	\$4,282	\$1,786	\$124,980	5.00%	3.43%
2027	89,990,002	3.00%	46,291,500	27.00%	51.44%	\$50,087	2.20%	\$4,507	\$2,319	\$131,229	5.00%	3.43%
2028	92,689,702	3.00%	56,938,545	23.00%	61.43%	\$51,188	2.20%	\$4,745	\$2,915	\$137,790	5.00%	3.44%
2029	95,470,393	3.00%	68,041,561	19.50%	71.27%	\$52,315	2.20%	\$4,994	\$3,560	\$144,680	5.00%	3.45%
2030	98,334,505	3.00%	79,608,627	17.00%	80.96%	\$53,466	2.20%	\$5,258	\$4,256	\$151,914	5.00%	3.46%
2031	101,284,540	3.00%	91,549,921	15.00%	90.39%	\$54,642	2.20%	\$5,534	\$5,002	\$159,510	5.00%	3.47%
2032	104,323,077	3.00%	104,323,077	13.95%	100.00%	\$55,844	2.20%	\$5,826	\$5,826	\$167,485	5.00%	3.48%
2033	107,452,769	3.00%	107,452,769	3.00%	100.00%	\$57,072	2.20%	\$6,133	\$6,133	\$175,859	5.00%	3.49%
Annual growth												
2016 to 2022		-2.48%		59.95%			4.52%				5.31%	
2022 to 2032		2.47%		29.28%			2.20%				4.89%	
2016 to 2032		0.59%		40.02%			3.07%				5.05%	

- **Source:** Link to excel spreadsheet at www.hmexperience.dk



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Comments regarding value of BEV sales

- ✓ **Global auto sales in 2022 at 3670 billion USD is the worlds largest industry and BEV sales is already 10% of that**
- ✓ **For comparison the revenue of the global oil industry in 2021 at 80 USD per barrel was 2635 billion USD**
- ✓ **Note the oil industry is important enough so that a big price increase for oil can cause a global economic recession**
- ✓ **Moreover, 74% of all crude oil is used for making gasoline and diesel. The rest is used for plastics, asphalt, jet fuel, heating oil etc**
- ✓ **Also a typical vehicle last 200,000 miles and is driven 14,200 miles on average so will have a life of 14 years before scrapping**
- ✓ **That means about 14 years after all new vehicles sold are BEVs the global fleet of vehicles will go fully electric and sale of gasoline and diesel will end**
- ✓ **That is in 2032 +14 = 2046 at least 74% of the global oil industry will not be needed for making land vehicle transportation fuels**



Sources for previous slides

- **Source for average new vehicle selling price in the US from 2016 to 2021:** <https://www.statista.com/statistics/274927/new-vehicle-average-selling-price-in-the-united-states/>
- **Source for global GDP in USD from 2016 to 2022:** <https://www.statista.com/statistics/268750/global-gross-domestic-product-gdp/>
- **Source for global oil production 2016 to 2022:** <https://www.statista.com/statistics/265203/global-oil-production-since-in-barrels-per-day/>
- **Source price of oil per barrel dec 2016 to 2021:** <https://www.macrotrends.net/1369/crude-oil-price-history-chart>
- **74% of crude oil is used to make gasoline and diesel:** <https://www3.uwsp.edu/cnr-ap/KEEP/Documents/Activities/Energy%20Fact%20Sheets/FactsAboutOil.pdf>
- **A typical car last 200,000 miles before being scrapped:** <https://www.progressive.com/answers/how-many-miles-does-a-car-last/#:~:text=Typically%2C%20a%20conventional%20vehicle%20lasts,over%20the%20past%20several%20decades.>
- **Miles driven per year in US is 14,200 miles:** <https://www.thezebra.com/resources/driving/average-miles-driven-per-year/#how-demographics-affect-driving>



Chapter 5

Concluding remarks



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Concluding remarks

- ✓ **The data shows humanity made 8 million BEVs in 2022** which is 10% of the global auto market
- ✓ **29% annualized growth from 2022** will result in BEVs being 100% of new vehicle sales in 2032
- ✓ **The hardest part of the 2032 timeframe** will be to increase global battery cell production for BEVs by 15X from its 2022 level
- ✓ **The average vehicle drives 200,000 miles** in about 14 years before being scrapped
- ✓ **The implication is that by 2046 the global fleet of vehicles** that consumed $\frac{3}{4}$ of global oil production in 2022 will be fully electric only consuming electricity that will be made from solar and wind power
- ✓ **This BEV revolution/transition** is truly important as oil and vehicle production are the single two largest industries globally representing over 5% of global GDP
- ✓ **Also this transition** lowers the cost of transportation and significantly reduce problems regarding national security and public health

