SAMPLE

Building the Vehicles of Tomorrow

A Practical Guide to the Transportation Reshaping Mobility

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This free sample contains the Introduction and Chapter 1. The complete book contains the full contents above.

Introduction

The automobile has been one of the most transformative inventions in human history. For 140 years, since Karl Benz patented the first internal combustion vehicle in 1886, the car has shaped our cities, our economies, our environment, and our daily lives. It gave us freedom of movement, created suburbs, built industries, and connected communities. But it also gave us air pollution, traffic deaths, oil dependence, and climate change.

Now, the automobile is being reinvented. And this reinvention is not incremental — it is fundamental. The vehicle of 2036 will be as different from the vehicle of 2026 as the smartphone is from the rotary telephone. Three converging revolutions are driving this transformation:

Electrification is replacing the internal combustion engine with electric motors. Electric vehicles (EVs) are not just cleaner versions of gas cars — they are fundamentally simpler, more efficient, cheaper to operate, and increasingly cheaper to buy. Global EV sales reached 18 million units in 2025, representing 22% of all new car sales worldwide. Battery costs have fallen 90% since 2010, from $1,200 per kilowatt-hour to $115 in 2026. At $100/kWh — expected by 2027-2028 — EVs will be cheaper to manufacture than gasoline vehicles, making the transition inevitable regardless of government policy.

Autonomy is removing the human from the driving task. Autonomous driving has progressed through six levels defined by the Society of Automotive Engineers (SAE), from Level 0 (no automation) to Level 5 (full automation). In 2026, Level 2+ assisted driving is mainstream in vehicles under $30,000. Level 3 conditional automation is in production (Mercedes Drive Pilot, Honda Traffic Jam Pilot). Level 4 robotaxi services are commercial — Waymo provides 500,000+ paid rides per week across 10+ US cities, and Baidu Apollo serves millions of rides across Chinese cities. The implications are staggering: fewer accidents, mobility for the elderly and disabled, reclaimed urban parking space, and the disruption of professional driving jobs.

Connectivity is turning vehicles into software platforms. Over 80% of new vehicles in 2026 have embedded cellular modems enabling over-the-air (OTA) updates, telematics, and connected services. The vehicle is becoming a computing platform on wheels — receiving software improvements throughout its lifetime, generating revenue through subscriptions, and improving with age rather than depreciating. This is the "software-defined vehicle," and it changes everything about how cars are designed, sold, and maintained.

The scale of this transformation is enormous. The global automotive industry generates $3.5 trillion in annual revenue and employs 14 million people

directly. The shift to electric, connected, and autonomous vehicles represents a $10+ trillion market opportunity over the next decade, spanning vehicles, infrastructure, software, and services. Entire supply chains are being rewritten: from engines and transmissions to batteries and semiconductors, from oil refineries to charging stations, from dealerships to direct sales.

This transformation affects everyone. If you drive a car, the vehicle you buy in 2030 will be fundamentally different from the one you drive today. If you invest in markets, automotive, energy, and technology stocks are being reshaped. If you work in the automotive industry, your skills need to evolve. If you live in a city, your streets, parking, and air quality will change. If you breathe air, the reduction in emissions from vehicle electrification will improve your health.

This book provides a comprehensive guide to the vehicles of tomorrow — what is changing, why it is changing, and what to do about it. Specifically, readers will learn:

- Why internal combustion vehicles are becoming obsolete and what replaces them - How electric vehicle technology works, from batteries to motors to charging - The real state of autonomous driving in 2026 — what works, what does not, and when it will - How vehicle connectivity is transforming cars into software platforms - The key problems holding back adoption — range anxiety, charging gaps, battery costs, safety concerns - Step-by-step solutions for choosing, buying, and living with an electric vehicle - The tools, resources, and checklists needed to navigate the EV transition - Real-world case studies from Tesla, BYD, Waymo, and countries leading the transition - Investment opportunities and risks in the mobility transformation - Policy recommendations for governments and organizations - What the vehicle of 2036 will look like and how to prepare for it

This book is written for anyone who needs to understand the future of vehicles: consumers considering an EV purchase, engineers and technologists working in the automotive industry, investors evaluating mobility companies, policymakers shaping transportation regulation, and anyone curious about what the car of tomorrow will be.

This book follows a clear structure. First, we define the problem — what is wrong with current vehicle technology and why previous solutions have failed. Then we provide comprehensive solutions — step-by-step guides, practical methods, tools, checklists, case studies, and action plans. By the end, you will have a complete understanding of the vehicle transformation and a practical roadmap for navigating it.

Chapter 1: The Internal Combustion Problem

The internal combustion engine (ICE) is a remarkable engineering achievement — and a remarkably inefficient one. After 140 years of refinement, the modern gasoline engine converts only 20-30% of the energy in fuel into forward motion. The remaining 70-80% is lost as heat: through the radiator, the exhaust pipe, and mechanical friction. For every dollar you spend on gasoline, you get 20-30 cents of propulsion and 70-80 cents of waste heat.

This inefficiency is not a design flaw — it is a fundamental thermodynamic limitation. The Otto cycle (four-stroke gasoline engine) and Diesel cycle are constrained by the laws of thermodynamics. No amount of engineering improvement can make an ICE fundamentally more efficient than its theoretical maximum, which is approximately 40-45% for the best diesel engines and 30-35% for gasoline engines. Real-world driving, with its stop-and-go traffic, idling, and partial throttle operation, drops these figures to 15-25% in urban conditions.

By contrast, electric motors convert 95-97% of electrical energy into mechanical motion. An electric vehicle travels 3-4 times farther on the same amount of energy input. This is not a marginal improvement — it is a 3-4x efficiency difference that fundamentally changes the economics of transportation.

Transportation accounts for approximately 24% of global CO2 emissions, with road vehicles (cars, trucks, buses) representing 75% of that total. The global vehicle fleet of roughly 1.4 billion vehicles emits an estimated 5 to 6 billion tons of CO2 annually. Beyond CO2, ICE vehicles produce:

- Nitrogen oxides (NOx): Cause smog and respiratory disease. Diesel engines are particularly high emitters. - Particulate matter (PM2.5 and PM10): Microscopic particles that penetrate lungs and bloodstream, causing cardiovascular disease and premature death. The World Health Organization estimates that air pollution causes 7 million premature deaths annually. - Carbon monoxide (CO): Toxic gas, particularly dangerous in enclosed spaces. - Unburned hydrocarbons: Contribute to ground-level ozone formation.

The health costs of vehicle emissions are enormous. The World Bank has estimated that air pollution — from all sources combined, of which road traffic is one significant contributor — costs the global economy roughly $8.1 trillion annually in health damages and lost productivity. In cities with high traffic density — Delhi, Beijing, Mexico City, Los Angeles — the health impact is severe and measurable.

ICE vehicles are mechanically complex. A modern gasoline engine has approximately 2,000+ moving parts: pistons, connecting rods, valves, camshafts, crankshafts, timing chains, gaskets, seals, bearings, and pumps. Each part is a potential failure point and a maintenance requirement:

- Oil changes: Every 5,000-10,000 miles, requiring approximately 5 liters of oil per change. Globally, this creates billions of liters of used oil that must be disposed of. - Cooling system: Radiator, water pump, thermostat, hoses — all subject to leaks and failure. - Exhaust system: Catalytic converter, muffler, pipes — subject to corrosion and damage. - Transmission: Complex gearbox with hundreds of moving parts, requiring fluid changes and prone to expensive failures. - Fuel system: Fuel pump, injectors, filters — prone to clogging and failure. - Ignition system: Spark plugs, coils, wires — require periodic replacement.

The average ICE vehicle owner spends $1,200-2,000 per year on maintenance and repairs. Over a 15-year vehicle life, this adds up to $18,000-30,000 in maintenance costs alone. This is a hidden tax on ICE ownership that is often ignored when comparing the cost of gas vs electric vehicles.

The world consumes approximately 100 million barrels of oil per day, with transportation accounting for 60% of oil demand. This creates geopolitical vulnerability:

- Oil reserves are concentrated in politically volatile regions (Middle East, Russia, Venezuela). - Oil price volatility destabilizes economies — the 2022 oil price spike contributed to global inflation. - Oil transportation (pipelines, tankers, shipping lanes) is vulnerable to disruption. - Oil producing nations use energy as a geopolitical weapon.

The transition to electric vehicles reduces oil dependence. Each EV replaces roughly 10-15 barrels of oil per year for a typical driver. With 40 million EVs on the road in 2026, oil demand is reduced by an estimated 400-600 million barrels annually — a small but growing dent in 100 million barrels per day.

The internal combustion engine's most insidious cost is not climate change but air pollution. Particulate matter (PM2.5), nitrogen oxides (NOx), and volatile organic compounds (VOCs) from vehicle exhaust cause an estimated 4.2 million premature deaths annually worldwide. In dense urban areas, vehicle emissions are the primary source of air pollution, contributing to asthma, cardiovascular disease, lung cancer, and cognitive decline.

The health cost of ICE vehicles is rarely included in fuel prices. The World Bank's global estimate places the cost of air pollution from all sources — vehicles included but not dominant — at roughly $8.1 trillion annually in health

care costs and lost productivity. If these externalities were included in the price of gasoline — a carbon and health tax of $2-4 per gallon — EVs would already be dramatically cheaper to operate, and the transition would accelerate without regulatory mandates.

ICE vehicles generate significant noise pollution — engine roar, exhaust systems, tire noise, and braking. In urban environments, traffic noise is the dominant environmental noise source, affecting 100+ million people at levels above WHO recommended limits. Chronic noise exposure is linked to stress, sleep disturbance, hypertension, and cardiovascular disease.

EVs eliminate engine and exhaust noise, reducing urban noise levels by 5-10 dB. Tire noise becomes the dominant sound at speeds above 30 km/h, but even with tire noise, EVs are significantly quieter than ICE vehicles. The noise reduction benefit of EVs is often overlooked in environmental assessments but represents a meaningful quality-of-life improvement for urban residents, particularly those living near highways and major roads.

End of free sample. The full book is available at putrabooks.github.io

ABOUT THE AUTHOR

Aiman JoeHanz writes about the technologies that are quietly reshaping the world. His Building of Tomorrow series examines the infrastructure behind artificial intelligence -- from blockchain and cloud computing to agentic systems and token optimization -- and asks how these technologies will evolve over the coming decade.

His books are built on technical research and engineering documentation, written for readers who want to understand systems rather than trends. He covers what is being built today and what it will take to build what comes next.

He believes that understanding infrastructure is the difference between watching the future happen and helping to create it.