



Redesigning the Porsche 911 Turbo S for Efficiency under HCD Lens

(Module 10 – Learning Activity: Understanding What to Redesign)

1. Why the Porsche 911 Turbo S Is So Inefficient

The **2025 Porsche 911 Turbo S** ranks among the *least fuel-efficient mini compact vehicles* with a combined fuel economy of **16 MPG** (EPA, 2025). Its inefficiency stems from:

- **High-output 3.7-L twin-turbo six-cylinder engine** optimized for extreme performance, not efficiency.
- **Aerodynamic profile tuned for downforce**, increasing drag at mid-high speeds.
- **Wide rear tires** for grip, generating rolling resistance.
- **High-performance calibration** that prioritizes acceleration, responsiveness, and top speed over fuel economy.

The vehicle was designed for enthusiasts seeking track-level performance, not environmental efficiency, which makes it an ideal case for redesign exploration.

2. Attributes That Could Be Improved

To make the 911 Turbo S more efficient, several redesign opportunities exist:

#	Attribute	Description
1	Powertrain optimization	<ul style="list-style-type: none">Replace the current engine calibration with a dual-mode ECU map → “Performance mode” + “Eco cruising” modeTransition toward plug-in hybridization like the Mercedes AMG GT63 S E-Performance
2	Aerodynamic Drag	<ul style="list-style-type: none">Adjustable active aero that <i>reduces drag in city driving</i>, not only at high speeds.Lower rolling resistance tire compounds for non-track use.
3	Lightweight materials	<ul style="list-style-type: none">Increased use of carbon fiber for non-structural components → lower weight → lower fuel consumption.
4	Mild Regenerative braking	<ul style="list-style-type: none">Even a small hybrid motor could recapture waste energy.

3. What the Most Efficient Vehicles Have That the Porsche 911 Turbo S Doesn't

When comparing to the Best-in-Class 2025 vehicles (Tesla Model 3 LR RWD, Lucid Air Pure, BMW i4), several differences stand out:

Efficient Vehicles Have	Porsche 911 lacks
Fully electric drivetrain	Pure internal combustion
Regenerative braking	None
Aerodynamics optimized for drag reduction	Aerodynamics optimized for downforce
Energy-efficient tire & wheel configs	Wide, high-resistance performance tires
Weight-optimized EV platforms	Heavy reinforcement for performance

4. How to Increase Efficiency: Hypothetical Redesign Proposal for the Porsche 911 Turbo S e-Hybrid

A conceptual redesign could include:

1. **Plug-in Hybrid System (PHEV)**
 - Add a **small electric motor** powering the front axle → torque vectoring + zero-emission city driving.
 - Pure EV range: 30–40 km for urban low-speed zones.
2. **Eco-Adaptive Driving Mode**
 - System automatically prioritizes efficiency below 70 km/h.
 - Real-time predictive energy management using GPS + traffic data.
3. **Variable Aerodynamics 2.0**
 - Rear wing + air vents close at low speed to reduce drag.
 - “Eco Aero” profile configurable by user.
4. **Lightweight Reengineering**
 - Replace steel panels with aluminum/magnesium mix.
 - Reduce unsprung weight for better efficiency.
5. **Low-Resistance Street Tire Set**
 - Offer two tire kits: performance (track), eco (street commuting).

Projected Impact: These changes could raise combined MPG from **16 MPG** → **25–28 MPG**, reducing emissions while maintaining Porsche’s performance DNA.

5. Connection to Human-Centered Design

Every change aligns with the needs, limitations, and values of diverse users:

- **User Goals:** Many Porsche owners drive mostly in cities → Eco mode + EV driving support real user habits.
- **Cognitive Load Reduction:** Eco-adaptive system manages efficiency **automatically**, reducing the mental effort of toggling modes.
- **Accessibility & Usability:** Hybrid driving is **quieter**, smoother, less fatiguing — beneficial for older drivers or long-distance commuters.
- **Sustainability as a Human Value:** Consumers increasingly expect premium products to be ethically and environmentally responsible.
- **Familiarity:** The redesign **preserves Porsche’s user experience** (controls, behavior) while improving efficiency.

This way we improve without alienating the user.

6. Impact on Usability

Enhanced	Maintained
Quieter EV operation	Porsche “feel”
Lower running cost	Performance mode unchanged
Reduced heat and vibration	No complex settings
Smoother acceleration in city traffic	-

The redesign *adds value without breaking user expectations*.