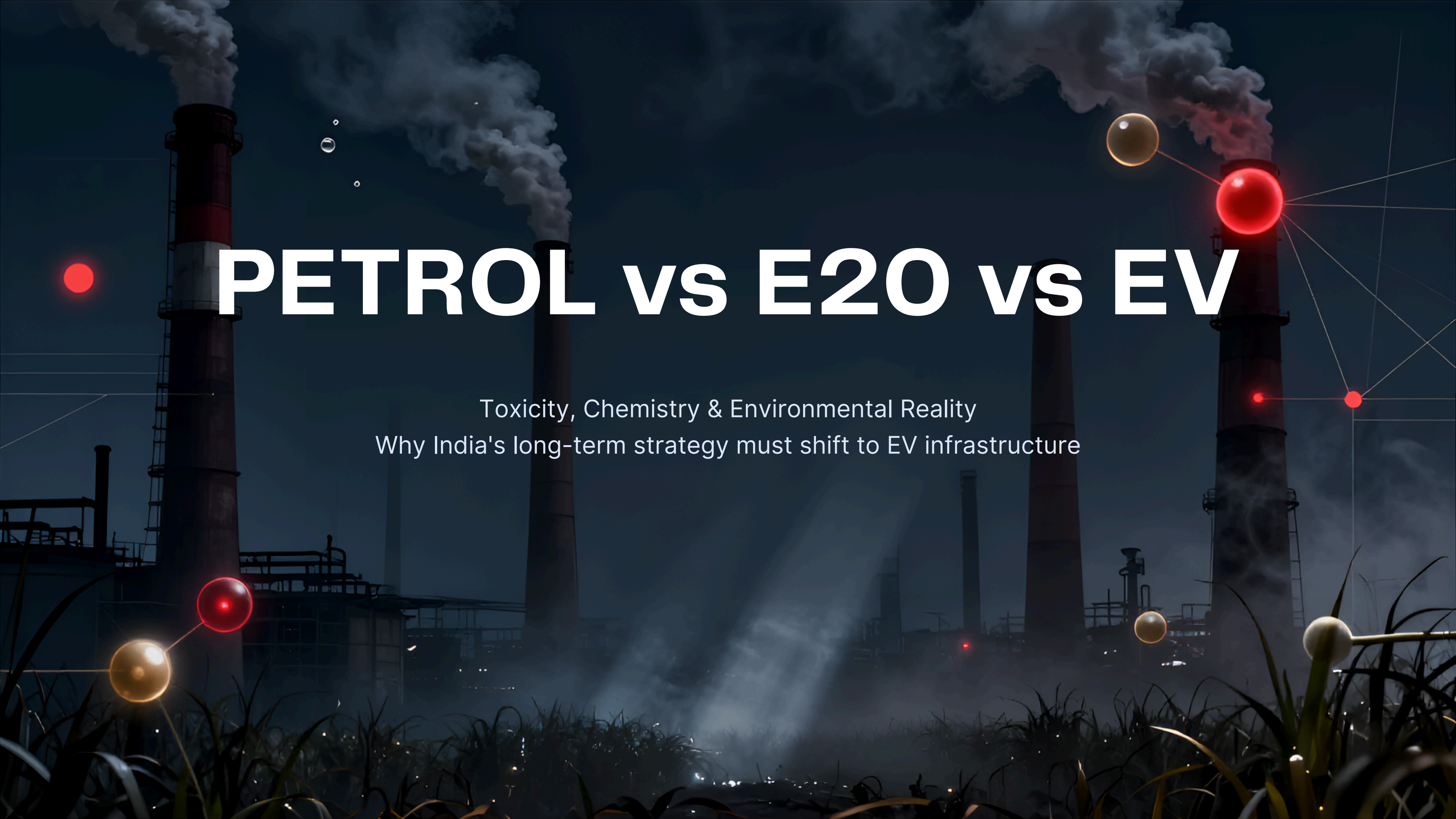




PETROL vs E20 vs EV

Toxicity, Chemistry & Environmental Reality
Why India's long-term strategy must shift to EV infrastructure

DISCLAIMER

This analysis is intended solely for informational and strategic evaluation purposes. All numerical calculations presented are illustrative examples derived from publicly available data, industry studies, and standard fuel-economy assumptions. They do not represent official government figures, manufacturer specifications, or certified engineering outcomes. Actual results may vary based on vehicle condition, driving patterns, regional fuel quality, and environmental factors.

The content does not constitute legal, financial, regulatory, or technical advice. It should not be used as the sole basis for operational, commercial, or policy decisions. Readers are encouraged to review primary sources, consult qualified professionals, and validate assumptions before drawing conclusions or taking action.

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These insights are broad indicators meant to support informed discussion, not definitive predictions or certified outcomes.

We always feared petrol toxicity.

But E20 introduces **new toxic chemicals** that behave differently.

This deck shows **which fuel is actually less toxic** — and **why EVs are the real long-term win.*****

*** Conditions apply

Petrol (E0/E10) — Hydrocarbon Combustion



Toxic By-Products

- CO (acute poison)
- HC (irritants)
- PM / soot
- NO_x (smog-forming)

Environmental Harm

- High CO
- High PM
- High HC
- Moderate smog formation

E20 (20% Ethanol) — Oxygenated Fuel Combustion



Toxic By-Products

- Acetaldehyde (DNA-reactive, carcinogenic)
- Formaldehyde (Group 1 carcinogen)
- Higher VOCs**
- Higher CO₂/km (mileage drop)

Environmental Harm

- High aldehydes
- High VOCs**
- High smog formation
- Higher CO₂/km

**VOC = volatile organic compounds — the invisible chemical layer that reacts in sunlight to create smog and chronic toxicity.

TOXICITY TABLE: PETROL vs E20

Toxicity Factor	Petrol	E20	Winner (Less Toxic)
CO (acute poison)	Worse	Better	E20
HC (unburnt fuel)	Worse	Better	E20
PM (soot)	Worse	Better	E20
Aldehydes (carcinogenic)	Better	Worse	Petrol
VOC evaporation	Better	Worse	Petrol
Smog formation	Better	Worse	Petrol
CO ₂ per km	Better	Worse	Petrol
OVERALL TOXICITY	Lower chronic	Higher chronic	PETROL

Petrol's toxicity is acute. E20's toxicity is chronic — and chronic toxicity is more dangerous.

Why Aldehydes Are More Poisonous Than CO

CO = Acute Toxin

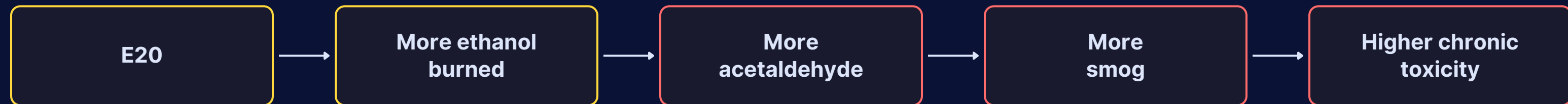
- Blocks oxygen transport
- Dangerous at high concentration
- Does NOT damage DNA
- Disperses quickly outdoors

Aldehydes = Chronic + Carcinogenic

- DNA-reactive
- Cytotoxic
- Carcinogenic (IARC)
- Smog-forming
- Persist in air
- Form secondary toxins (PANs + ozone)

**Aldehydes are more poisonous than CO.
E20 produces significantly more aldehydes.**

Toxicity Chain (E20)



Ethanol combustion MUST pass through acetaldehyde.
Petrol does NOT produce aldehydes as a primary intermediate.

Pollution Lifecycle: Field → Tailpipe

PETROL

- No agricultural footprint
- No distillery effluent
- No water depletion
- Toxicity mainly at tailpipe

E20

- Agriculture: 2,000–3,000 L water per litre ethanol
- Distilleries: high-COD effluent
- Transport: VOC evaporation
- Combustion: aldehydes + smog
- Mileage drop: more CO₂/km

E20 increases pollution across the entire lifecycle.

E20 = short-term political gain, long-term environmental cost

Scaling E20 requires:

- More sugarcane → **water depletion**
- More distilleries → **industrial pollution**
- More ethanol transport → **VOC emissions**
 - More aldehydes → **chronic toxicity**
 - More fuel burned → **higher CO₂/km**

This is not a sustainable environmental policy

EVs are the future — but only if India invests in 3 critical pillars

1. Battery Disposal & Recycling (National Priority)

EV batteries are not toxic during driving, but they become toxic at end-of-life if not managed.

Required Investments

- Build centralized battery recycling plants
- Create mandatory take-back programs for all OEMs
- Recover lithium, nickel, cobalt from Li-ion batteries
- Deploy safe electrolyte neutralization systems
- Establish hazard-grade transport protocols for damaged packs

Why It Matters

- Prevents soil & groundwater contamination
- Eliminates organic solvent leakage
- Converts battery waste into recovered metals
- Makes EVs circular, not linear

2. Thermal Runaway Management (Li-ion vs Sodium-ion)

Even sodium batteries, though safer, still require standards.

Li-ion Risk

- Medium probability
- High severity
- Produces HF gas + toxic vapors
- Needs strict BMS + thermal isolation

Sodium-ion Risk

- Low probability
- Low severity
- No cobalt/nickel
- Easier recycling
- Still needs runaway detection + cell fusing

Required Investments

- National Battery Safety Standard (BSS-India)
- Mandatory runaway detection algorithms
- Cell-level thermal fusing
- Fire-safe charging infrastructure
- Training for fire departments on EV incidents

3. EV Infrastructure (The Backbone of Success)

EVs fail without a strong ecosystem.

Required Investments

- Nationwide fast-charging corridors
- Renewable-powered charging stations
- Smart grid load balancing
- Urban + highway coverage
- Home + workplace charging incentives

Outcome

- Zero tailpipe emissions
- Zero aldehydes
- Zero VOCs
- Zero smog
- Zero combustion toxicity

PETROL is less toxic than E20.

EVs are less toxic than both.

EVs eliminate all combustion toxins (CO, HC, PM, NOx, aldehydes, VOCs).

Battery toxicity is solvable with recycling, safety standards, and sodium-ion adoption.

E20's toxicity is not solvable — it is inherent to ethanol chemistry.

**India's future is EV — if battery disposal,
runaway safety, and charging infrastructure
are built correctly.**

**India's environmental future is not E20.
It is robust EV infrastructure.**

E20's toxicity is not solvable. EV toxicity is