EVs vs ICE

Fundamental Design, Types, Charging Integration & Implementation Challenges

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Agenda

What We'll Cover

01 Why This Matters Now

The global and regional shift already underway

02 How the Two Technologies Work

Plain-language basics of ICE and EV design

03 Types of Electrified Vehicles

Hybrids, plug-in hybrids, battery EVs and Range Extended EVs

04 Charging & Grid Integration

How charging works and what it means for the power grid

05 Implementation Challenges & Path Forward

Technical, legal and economic issues for policymakers

The Shift Is Already Underway — Globally and Regionally

25%

of new cars sold worldwide in 2025 were electric

IEA Global EV Outlook 2026

20M+

electric cars sold globally in 2025 alone

IEA Global EV Outlook 2026

~75%

of new car sales in Nepal are now electric — a regional leader

IEA / Nepal EV data

Why governments cannot wait to engage

- Vehicles are being imported and sold in your markets today, with or without a policy framework ready for them.
- Fuel import bills, urban air quality and climate commitments (NDCs) across SAARC are all directly affected by this transition.
- Decisions on taxation, safety standards, electricity tariffs and infrastructure made now will shape who benefits — consumers, industry, or neither.

How a Conventional (ICE) Vehicle Moves

ICE = Internal Combustion Engine. It burns fuel to create small, controlled explosions that push the vehicle forward.

Fuel Tank

Stores petrol or diesel — chemical energy

→

Combustion Engine

Burns fuel in cylinders to create motion (~2,000 moving parts)

→

Transmission

Gearbox adjusts engine power to the right speed

→

Wheels

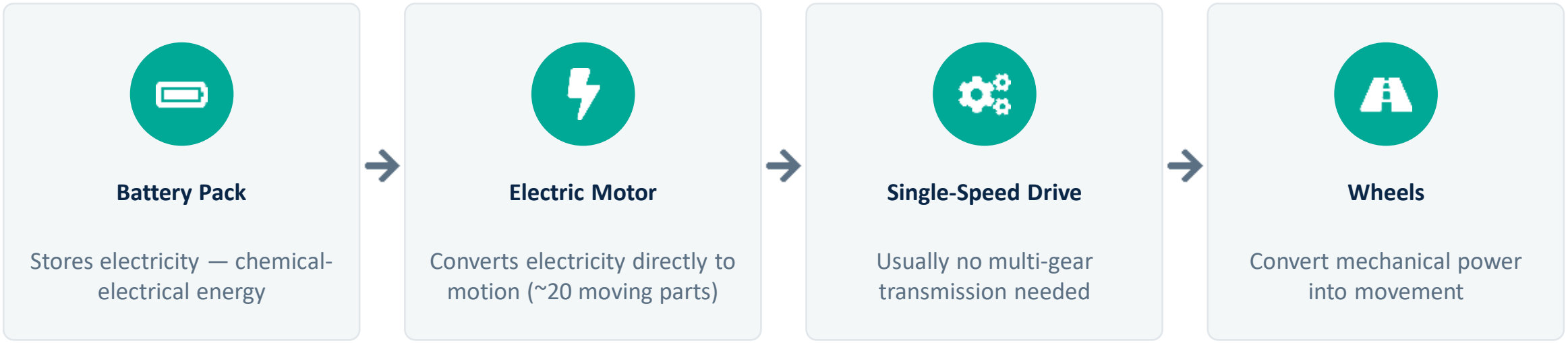
Convert mechanical power into movement

An ICE engine

- requires regular oil changes, filter replacements, and exhaust upkeep.
- Emissions Profile: Direct tailpipe emissions (CO2, NOx, Particulate Matter).

How an Electric Vehicle (EV) Moves

An EV stores electricity in a battery and uses an electric motor to convert it directly into motion — no burning, no gears in most designs.



Simple analogy: an EV works much like a large, powerful cordless power tool — electricity stored in a battery drives a motor directly, with far fewer parts and zero-tailpipe emissions.

Not All 'Electric' Vehicles Are the Same

HEV
Hybrid Electric

ENERGY SOURCE

Petrol/diesel + small battery

CHARGING

Never plugs in

Battery charges itself while driving; engine still does most of the work.

PHEV
Plug-in Hybrid

ENERGY SOURCE

Petrol/diesel + larger battery

CHARGING

Plugs in, and can also use fuel

Short electric-only range, then switches to engine — a bridge technology.

BEV
Battery Electric

ENERGY SOURCE

Battery / Electricity only

CHARGING

Plugs in only

No engine, no tailpipe — what most people mean by 'EV' today.

REEV
Range Extended Electric Vehicle

ENERGY SOURCE

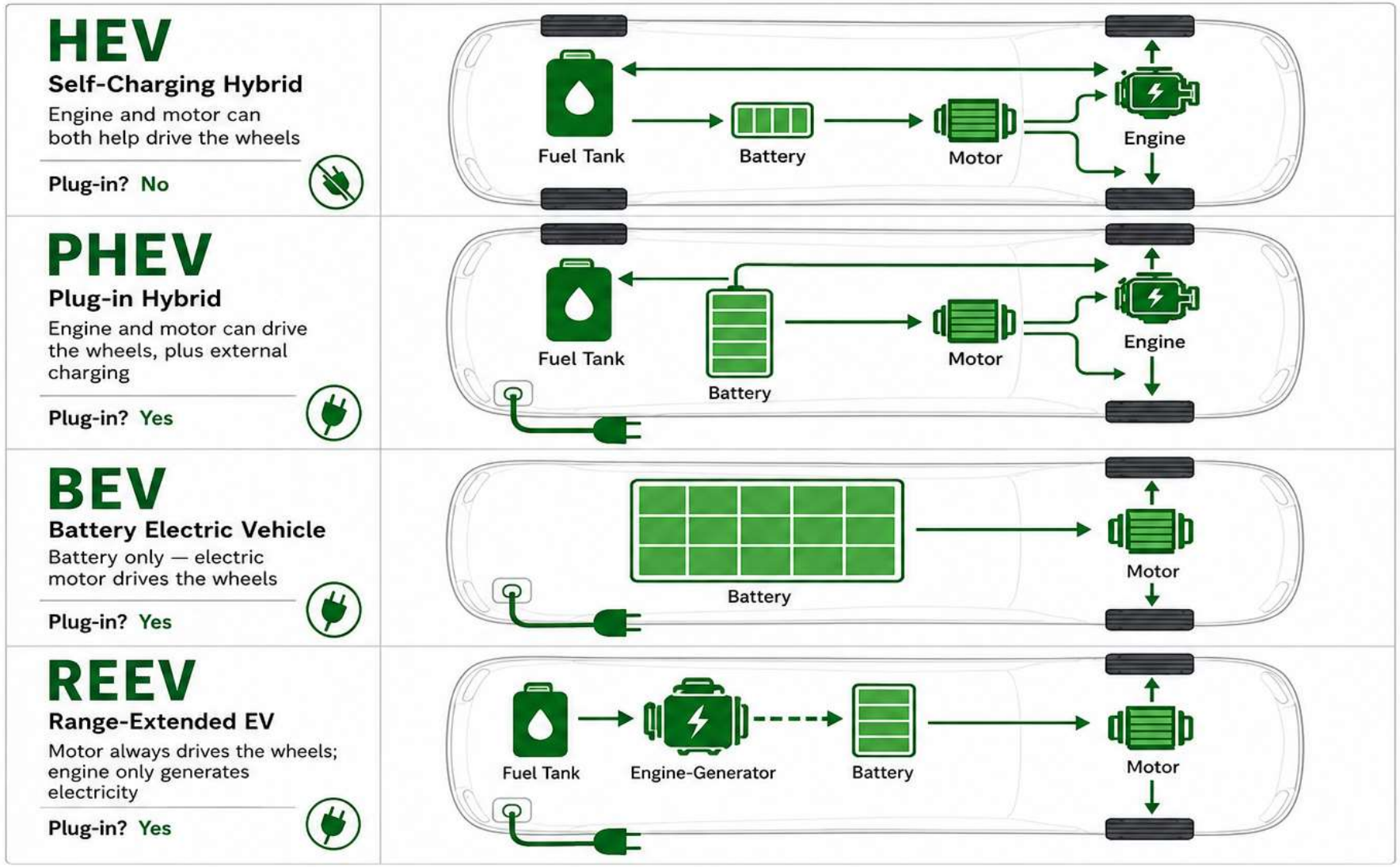
Battery + Petrol/Diesel

CHARGING

plugged in, and fuel

The small engine is to charge the battery – vehicle does not run on fuel directly

Not All 'Electric' Vehicles Are the Same (Cont'd)



How Charging Works: Three Level, Three Use Cases

Charging speed depends on how much power flows into the battery — similar to how a phone charges slowly on a low-power cable and quickly on a fast charger.

Level 1 — Slow Charging

8–12 hours

full charge (approx.)

Ordinary home socket

Best for: overnight home charging

Level 2 — Standard Charging

3–6 hours

full charge (approx.)

Dedicated AC charging unit

Best for: homes, offices, malls

DC Fast Charging

20–40 minutes

full charge (approx.)

High-power public charger

Best for: highways, public hubs, fleets

Charging Is Also an Electricity Planning Problem

Every EV plugged in adds new demand to the power grid. Where and when that demand happens matters as much as how many EVs are on the road.

Peak Load Management

Uncontrolled evening charging can stack on top of existing residential peak demand, straining local networks.

Smart / Off-Peak Charging

Time-of-use tariffs and smart charging shift demand to off-peak hours, easing pressure on the grid.

Renewable Pairing

Charging from hydropower or solar multiplies the emissions benefit, a natural strength for Nepal, Bhutan and parts of the region.

Grid Reliability

In areas with frequent outages, unreliable power supply undermines both charging access and consumer confidence.

Regional Snapshot: Where SAARC Countries Stand

India

~8% EV penetration in new car sales; FAME incentive scheme; public charging infrastructure still expanding well below demand.

Nepal

Regional leader — around three-quarters of new car sales are electric, driven by hydropower and import-tax breaks.

Bangladesh

EVs under 1% of new sales today; new Electric Vehicle Industry Development Policy targets 30% EV deployment by 2030.

Bhutan

Under 1% of the current fleet is electric; national roadmap targets 70% of vehicle sales as EVs by 2035.

Sri Lanka

Pursuing a net-zero target by 2050, with transport electrification identified as a key contributing sector.

Pakistan

30% sales of new vehicles as EV by 2030. Government has launched PAVE scheme for adoption of EVs. Reduced electricity tariff of approx. Rs. 39/kWh for commercial charging station approved from NEECA.

Sources: IEA Global EV Outlook 2025/2026; national EV policy documents; regional energy-transition reporting (2025–2026). Figures are indicative and evolving.

Challenge Set 1: Technical & Infrastructure

Grid Capacity & Reliability

Many distribution networks were not designed for widespread EV charging; frequent outages compound the challenge.

Charging Infrastructure Gaps

Public charging is concentrated in major cities; rural areas and highway corridors remain largely uncovered.

Battery Supply Chain

Most countries in the region import batteries and battery materials, with very limited local manufacturing capacity.

Standards & Interoperability

Inconsistent charging connectors, payment systems and safety standards slow cross-border and cross-vendor compatibility.

Regulatory Consistency – E3W Motor Case

One province caps the registered motor power for e-three-wheelers; other provinces allow different ratings. Manufacturers end up building multiple variants of the same vehicle just to stay street-legal everywhere.

EV Testing Facility

Some manufacturers also tune the speedometer to advertise a higher top speed than the vehicle actually achieve during testing.

EV Retrofitting

Converted Vehicle That's Still “Legally” a Petrol Bike

Challenge Set 2: Policy, Legal & Economic

Import Duties & Taxation

Tariff structures often don't distinguish EVs from ICE, blunting price incentives for switching.

Regulatory Frameworks

Safety certification, battery disposal/recycling rules, and electricity-tariff regulation for charging are still maturing.

Inaccessible EV Financing

Low-income and informal operators often lack formal credit histories, collateral - models are poorly suited

Battery as a Service Model–Market Disconnect

You can’t legally sell a vehicle without its battery

Subsidy Design & Fiscal Sustainability

Incentives must be generous enough to shift demand, yet affordable enough to sustain over the long term.

Workforce & Skills Gap

Technicians, safety inspectors and emergency responders need new training for high-voltage EV systems.

Unclear EV Registration and Fee Classification Framework

Harmonised methodology for classifying EVs and determining applicable registration fees is still lacking

Misaligned operating Hours for Charging stations

Charging station must licensed as essential transport-energy infrastructure, the way a petrol station is.

What Regulators Should Actually Do

National Governments

- Legally recognize charging stations service provider
- Harmonise technical standards & certification
- Clarify battery ownership, liability & consumer protection

Financial Institutions & Lenders

- Share risk via partial credit guarantees / first-loss facilities
- Underwrite informal daily-fare income, not salaried credit history
- Engage early as scheme partners, not just a financing checkbox

Electricity Regulators & Utilities

- Dedicated grid-connection procedures
- Enforce approved EV electricity tariffs

Municipal Authorities

- Recognize charge stations as transport-energy infrastructure
- Align licensing, zoning & operating hours with actual service
- Streamline permitting

Transport Authorities

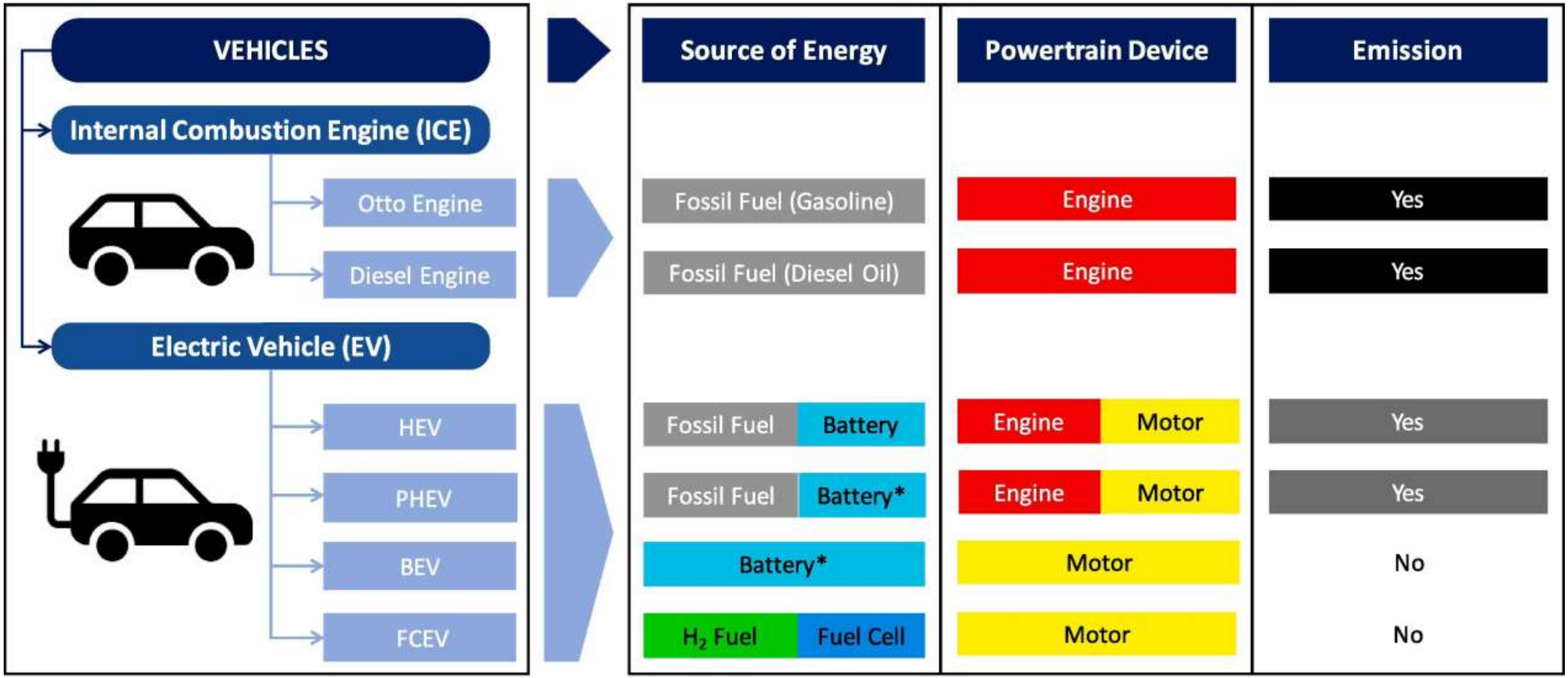
- Inspection procedures for converted EVs
- Mandate independent range & speed testing before certification
- Harmonise requirements across jurisdictions

Policy Levers Available to SAARC Governments

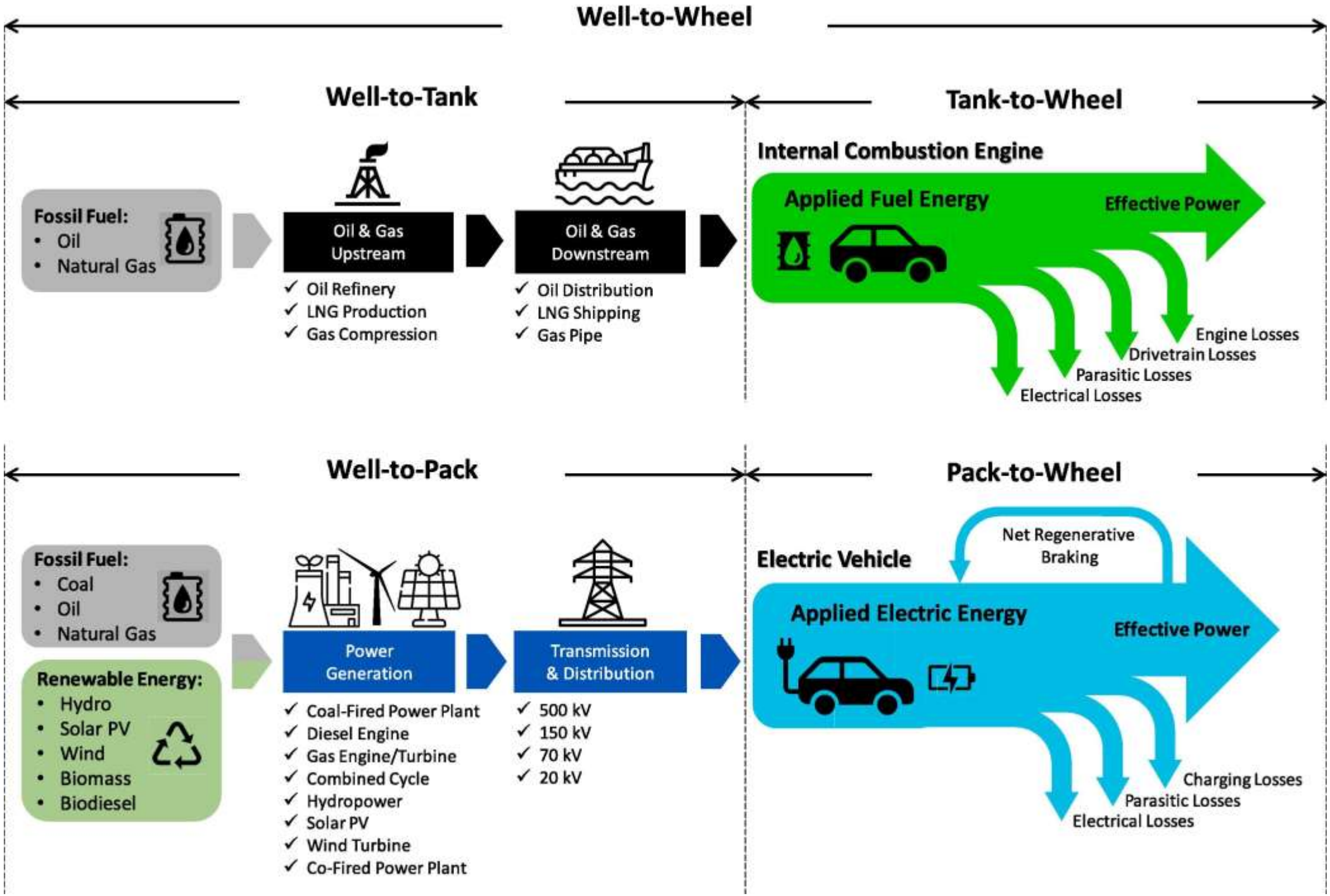
- Harmonise regional charging & safety standards to support cross-border trade, travel and tourism corridors
- Phase tariff and duty reforms, tied where possible to incentives for local assembly and manufacturing
- Prioritise public transport and 2/3-wheeler electrification first — the fastest payback on emissions and fuel-import savings
- Leverage regional energy strengths — hydropower in Nepal/Bhutan, solar potential across the region — to pair charging with clean power
- Expand charging infrastructure through public-private partnerships, prioritising highways and underserved areas
- Build a regional knowledge-sharing platform so smaller markets don't have to solve every problem alone

Thank You

Questions & Discussion



*Completed with Plug In


Well-to-Wheel
Well-to-Tank
Tank-to-Wheel
Fossil Fuel:
• Oil
• Natural Gas
Oil & Gas Upstream
✓ Oil Refinery
✓ LNG Production
✓ Gas Compression
Oil & Gas Downstream
✓ Oil Distribution
✓ LNG Shipping
✓ Gas Pipe
Internal Combustion Engine
Applied Fuel Energy
Effective Power
Engine Losses
Drivetrain Losses
Parasitic Losses
Electrical Losses
Well-to-Pack
Pack-to-Wheel
Fossil Fuel:
• Coal
• Oil
• Natural Gas
Renewable Energy:
• Hydro
• Solar PV
• Wind
• Biomass
• Biodiesel
Power Generation
✓ Coal-Fired Power Plant
✓ Diesel Engine
✓ Gas Engine/Turbine
✓ Combined Cycle
✓ Hydropower
✓ Solar PV
✓ Wind Turbine
✓ Co-Fired Power Plant
Transmission & Distribution
✓ 500 kV
✓ 150 kV
✓ 70 kV
✓ 20 kV
Electric Vehicle
Net Regenerative Braking
Applied Electric Energy
Effective Power
Charging Losses
Parasitic Losses
Electrical Losses