Science & Technology · GS - III

The adoption of electric vehicles is rapidly growing worldwide. How do electric vehicles contribute to reducing carbon emissions and what are the key benefits they offer compared to traditional combustion engine vehicles?

EXAM YEAR	PAPER	SUBJECT
2023	GS - III	Science & Technology

MARKS	WORD LIMIT
15	~250 words

Answer Hint

EVs shift mobility from direct fossil-fuel combustion to electricity-based propulsion, reducing tailpipe emissions and improving energy efficiency; their climate benefits increase further as electricity generation becomes cleaner.

Model Answer

Introduction

Electric vehicles (EVs) use electric motors powered by batteries or other electrical energy sources instead of conventional internal-combustion engines. Their adoption can contribute significantly to decarbonising the transport sector.

Body

Contribution to Emission Reduction

Zero tailpipe emissions: Battery-electric vehicles do not directly emit CO_2, nitrogen oxides or particulate matter during operation.

Higher efficiency: Electric motors convert a greater proportion of input energy into motion than combustion engines.

Renewable-energy integration: Charging EVs using solar, wind and other low-carbon electricity further reduces lifecycle emissions.

Reduced urban pollution: EVs can improve air quality in cities by reducing vehicular exhaust emissions.

Key Benefits

Lower operating costs: Electricity and fewer moving components can reduce running and maintenance expenses.

Energy diversification: EVs reduce dependence on petroleum-based transport fuels.

Noise reduction: Electric motors operate more quietly, particularly at lower speeds.

Technological innovation: EV adoption stimulates battery technology, charging infrastructure and clean-energy industries.

Grid integration potential: Smart charging can potentially align vehicle charging with periods of abundant renewable electricity.

Challenges

Battery manufacturing has environmental costs, while electricity generated predominantly from fossil fuels reduces the net climate advantage. Charging infrastructure, battery recycling, critical-mineral dependence and higher initial costs also remain concerns.

Way Forward

India needs renewable-powered charging, battery recycling, domestic manufacturing, public transport electrification and sustainable critical-mineral supply chains.

Conclusion

EVs offer substantial environmental and economic advantages over conventional vehicles, but their full climate potential depends on **clean electricity, sustainable batteries and an integrated low-carbon transport ecosystem**.

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