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Energy and Economy-wide Implications of Transport Sector Electrification in Nepal

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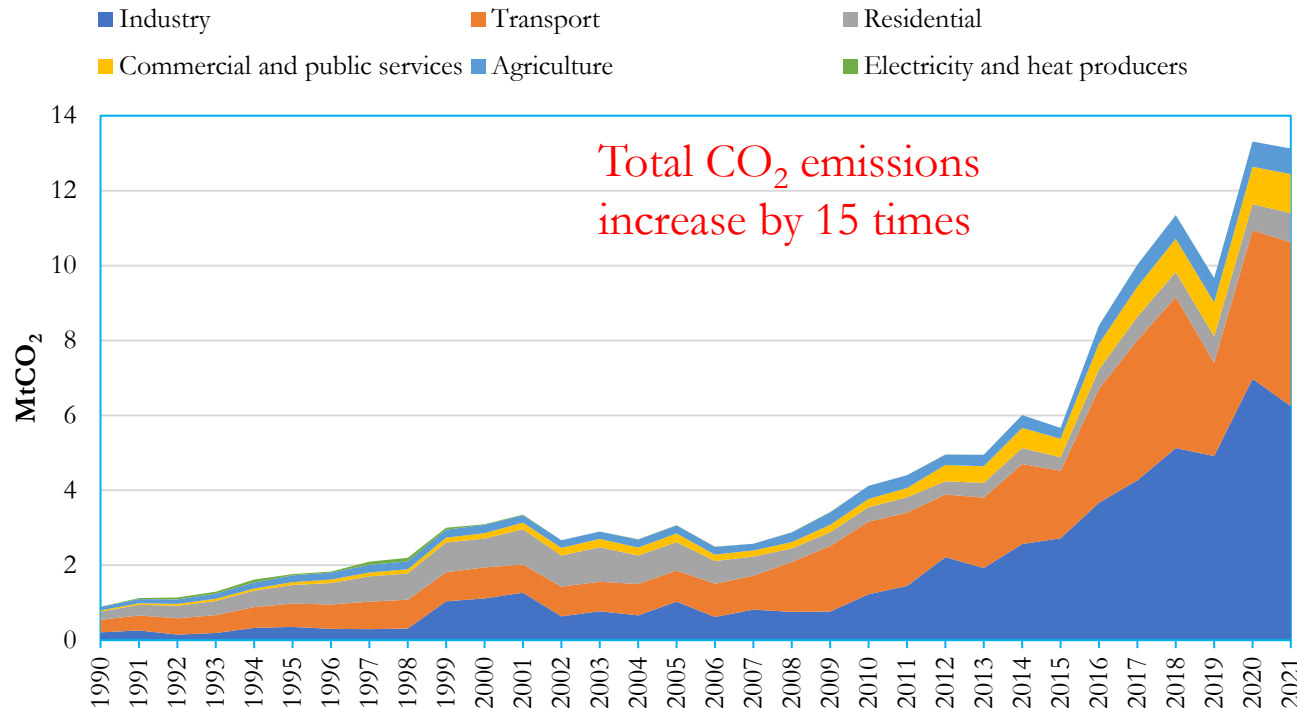
Outline

- Status of Transport Sector in Nepal
- Transport Sector Electrification Policies in Nepal
- Nepal's NDC Target for Transport Electrification
- Mitigation Opportunities of Transport Electrification
- Final Remarks

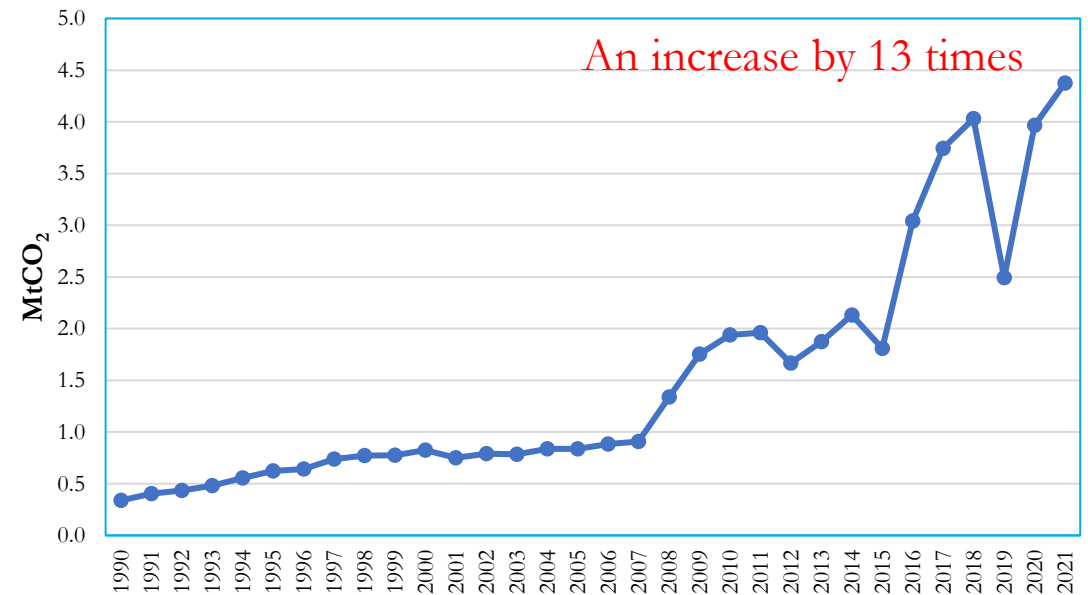
Rising CO₂ Emissions from Nepal's Transport Sector

- Transport is the **second largest contributor to energy-related carbon emissions** in Nepal, occupying 33% share & is also the fastest growing source.

CO₂ Emissions in Nepal during 1990-2021



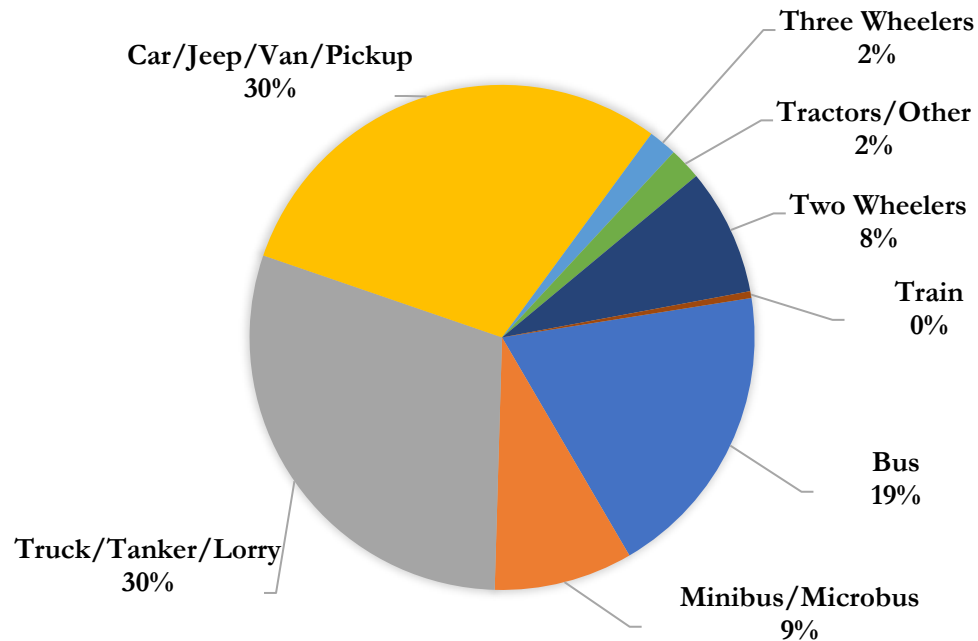
Nepal's CO₂ Emissions from Transport Sector 1990-2021



Source: IEA (2023)

Freight & Public Transport are the Largest Source of Carbon Emissions

NEPAL'S CO₂ EMISSIONS FROM ROAD TRANSPORT IN 2011

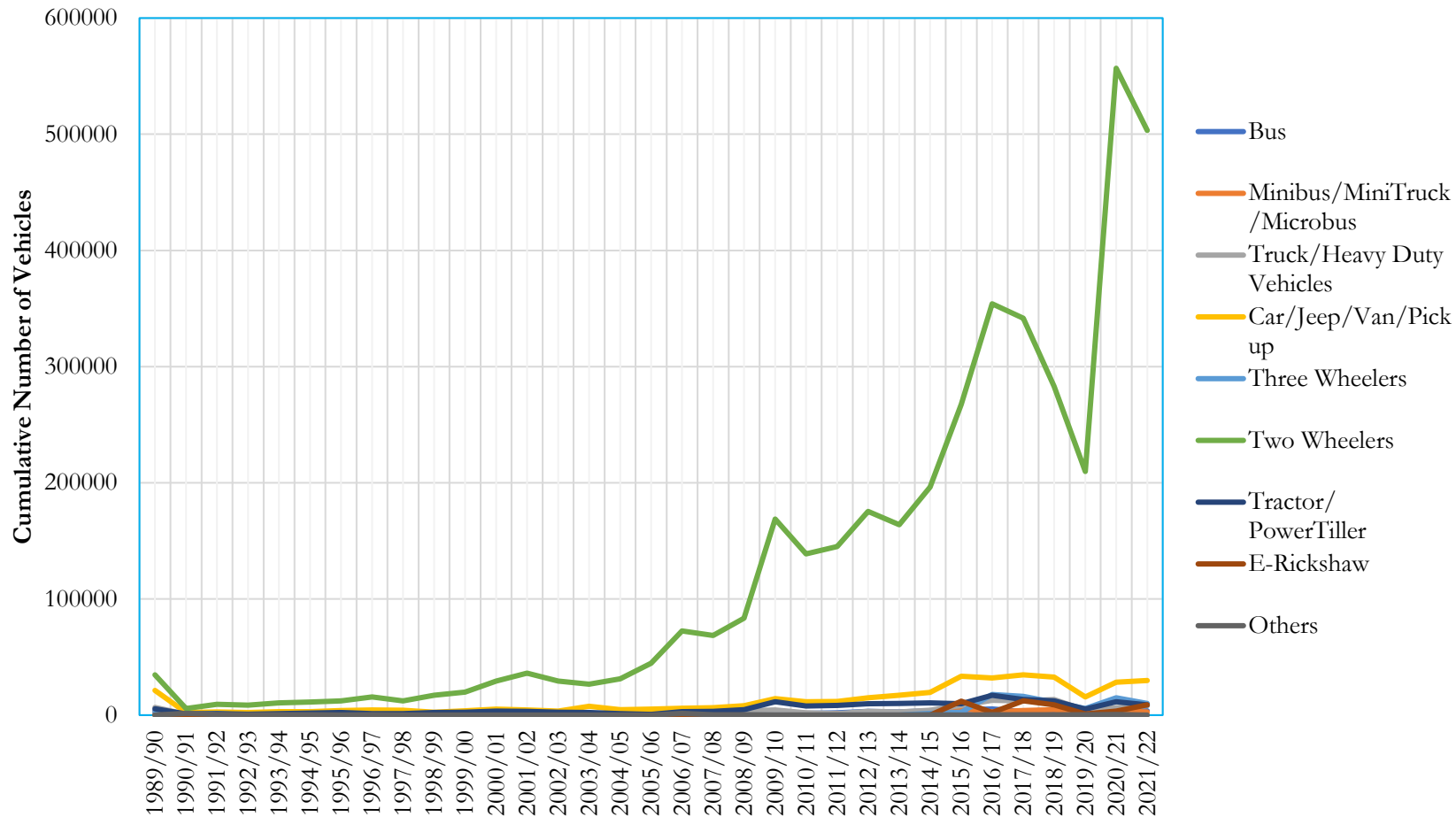


Source: Nepal's Third National Communication to the UNFCCC, Ministry of Forests and Environment, 2021

- Road transport accounted for 1.68 million tonnes of CO₂ in 2011, **accounting 98% share in transport CO₂ emissions**
- Between 2011 and 2019, **Nepal's road-transport CO₂ emissions grew by 182%** (MoFE, 2021)
- Freight transport (truck), which constitutes only 9.5% of total vehicle fleet registered in Nepal, contributes 30% of transport CO₂ emissions (excluding aviation in transport emission)
- Public transport contribute to another 30% of transport CO₂ emissions

Nepal Experiencing Rapid Motorization

Vehicle Registration in Nepal, FY 1989/90-2021/2022

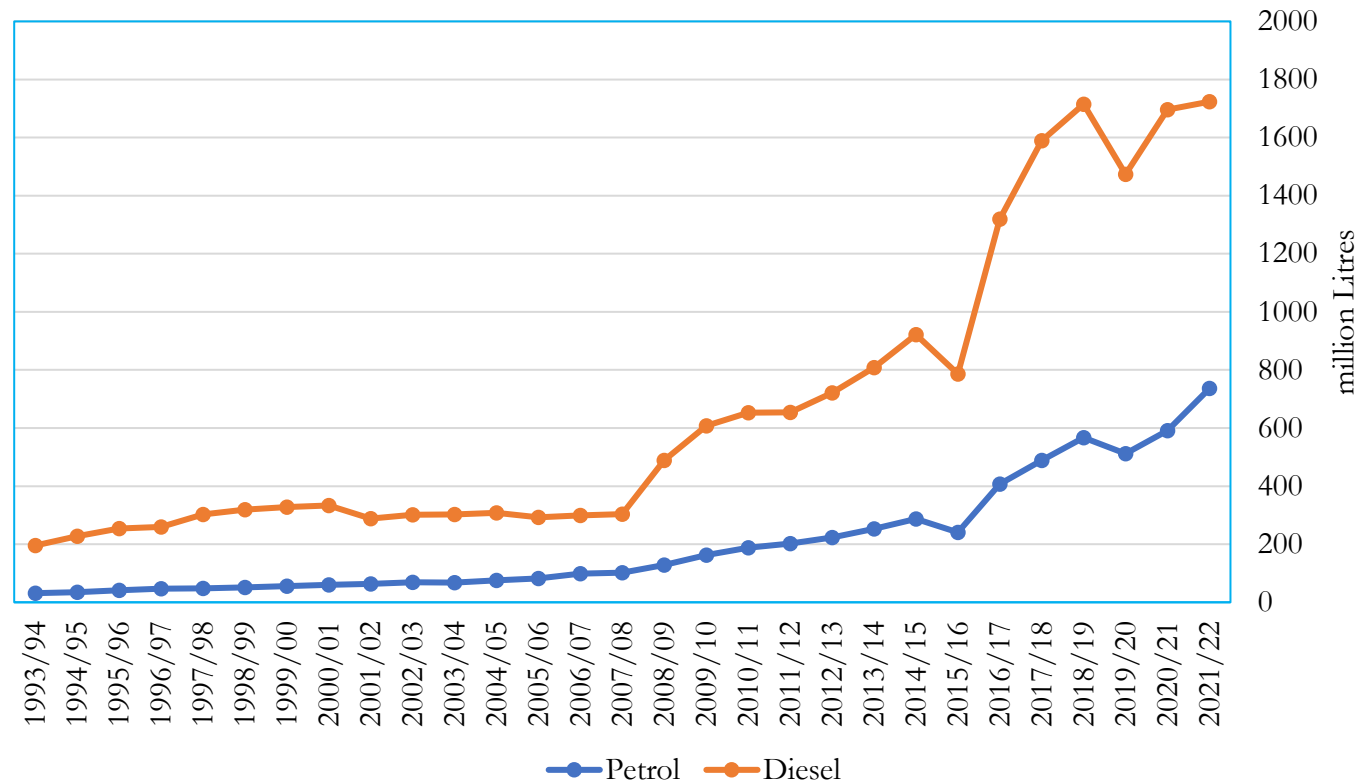


- The average annual vehicle growth in the fiscal years 2014/15–2021/22 is 14%
- By 2021/22, 5.04 million motor vehicles were registered in Nepal, **of which 93% are private vehicles (cars and two wheelers)**
- Since 2000/01, **two wheelers have undergone a remarkable increase of more than 17 folds**

Increasing Petroleum Consumption with Rapid Motorization

- Nepal relies entirely on imported petroleum products.

Import of Petroleum Fuels in Nepal, FY 1993/94 - 2021/22

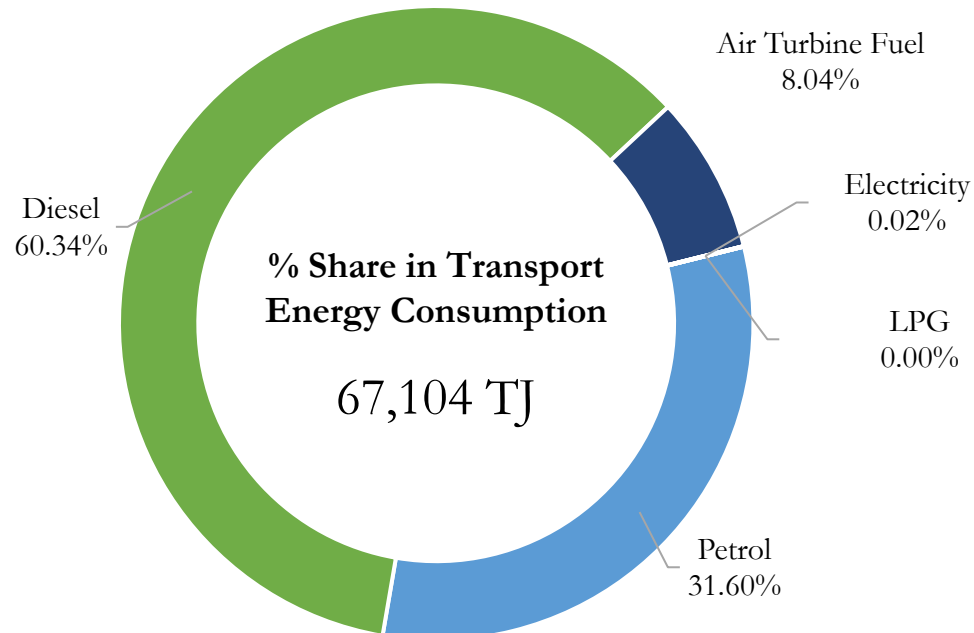


Source: Nepal Oil Corporation

- Nepal's fossil fuel import for the last 10 years (2011/12–2021/22) **has been growing at a CAGR of 10% for diesel & 14% for petrol.**
- Nepal spends a significant portion of its budget on petroleum imports to meet the growing demand of fossil fuels, which is the primary driver of the country's trade deficit.
- According to the Department of Customs, during the fiscal year 2022/2023, **the import value of petrol & diesel occupied a share of nearly 14% in total imports.**

Transport Energy Consumption

FY 2021/22



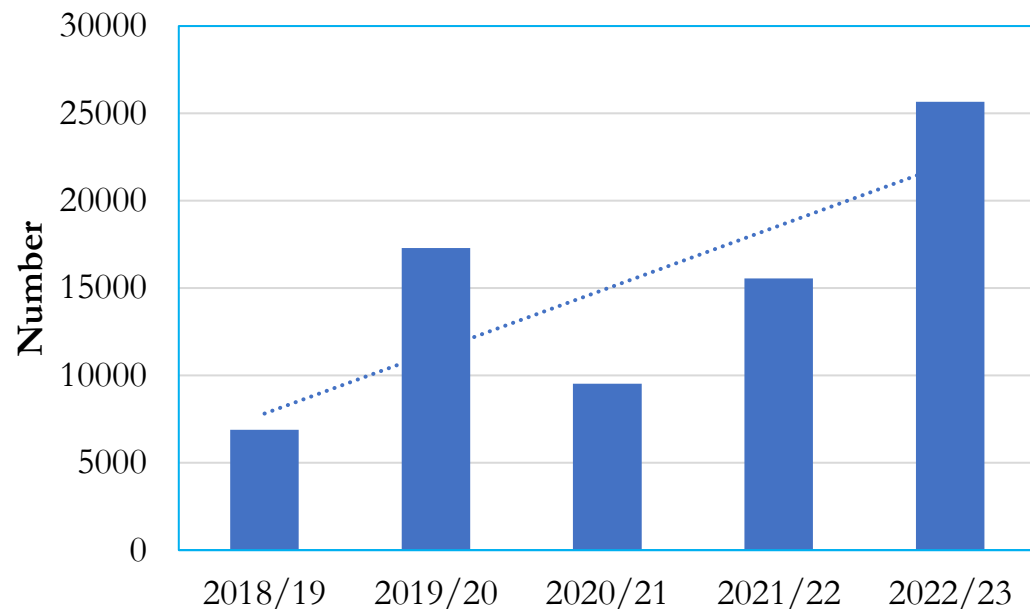
Source: WECS (2023)

- In 2021/22, petroleum oil contributed 19.3% to the total energy consumption
- **Transport consumes about 54% of total imported petroleum oil**

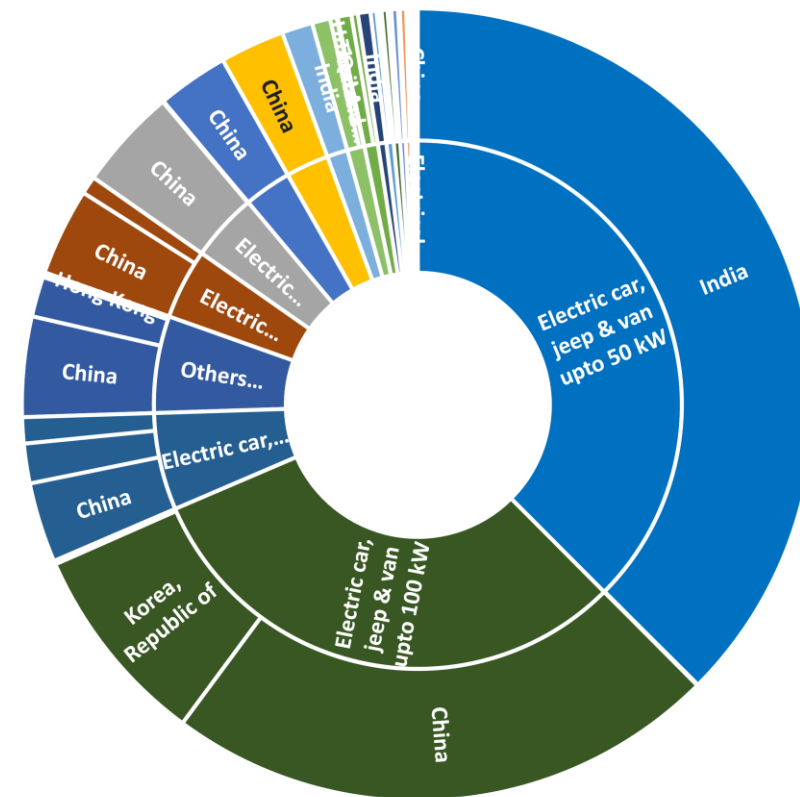
Status of Electric Vehicles in Nepal

- Import of electric vehicles are on rising trend in Nepal
- In the past five years, import of EVs jumped by nearly four folds

Imported Units of EVs

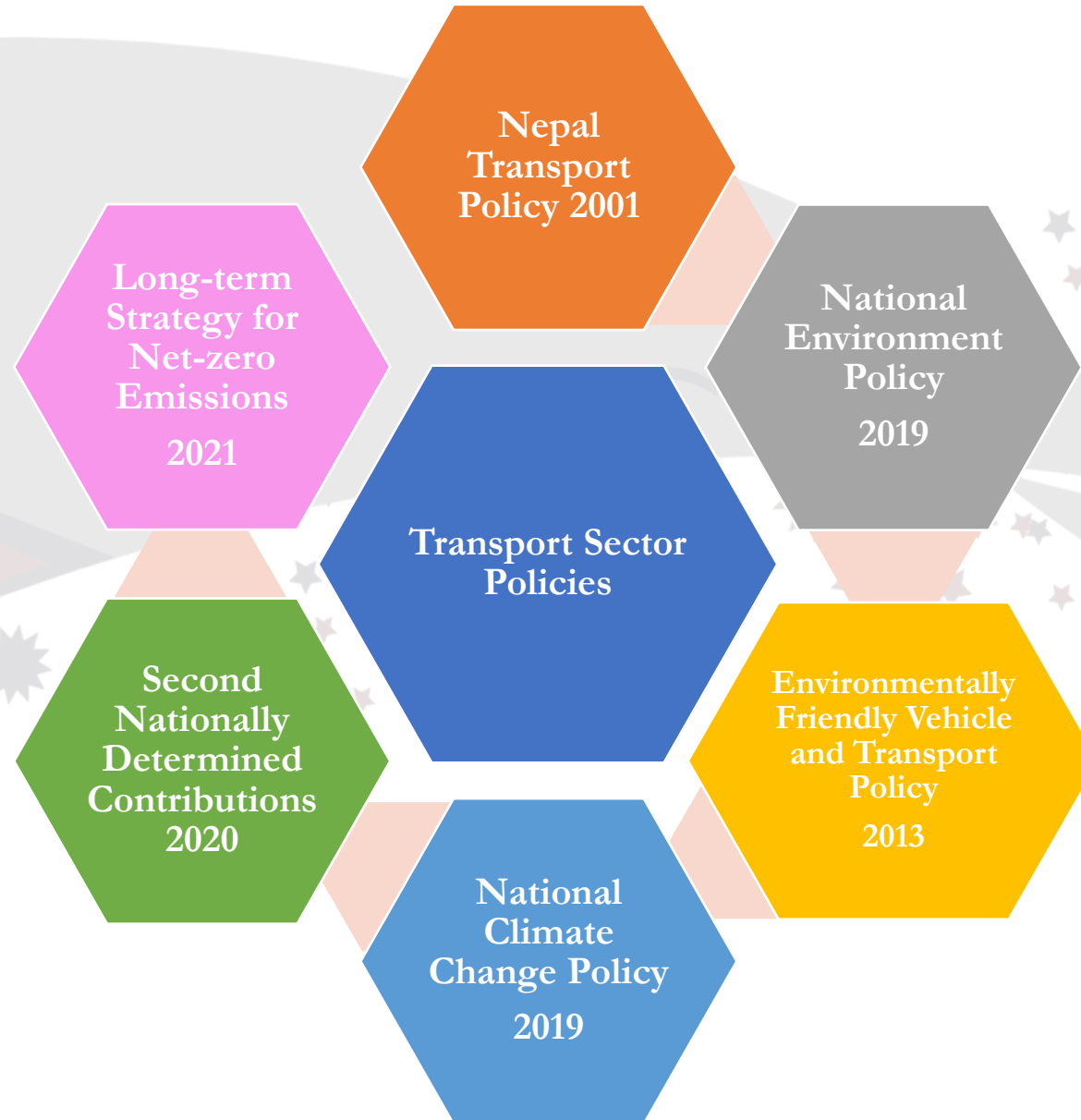


Imported Electric Vehicles by Partner Countries in 2022/23



**Higher share of imported EVs from China & India:
China – 47%, India – 42%**

Transport Sector Electrification Policies in Nepal





Second Nationally Determined Contribution of Nepal

1

Power

1. Expand clean energy generation capacity to 15,000 MW, 5-10% coming from diverse renewable energy technologies such as mini/micro hydro, solar, wind & bioenergy.
2. By 2030, ensure 15% of the total energy demand is supplied from clean energy sources.

2

Transport

1. By 2030, increase sales of e-vehicles to cover 90% of all private passenger vehicle sales, including two-wheelers & 60% of all four-wheeler public passenger vehicle sales.
2. By 2030, develop 200 km of the electric rail network to support public commuting & mass transportation of goods.

3

Residential

1. By 2030, ensure 25% of households use electric stoves as their primary mode of cooking.
2. By 2025, install 500,000 improved cookstoves, specifically in rural areas.
3. By 2025, install an additional 200,000 household biogas plants & 500 large scale biogas plants.

4

Agriculture, Forestry and Other Land Use (AFOLU)

1. By 2030, maintain 45% of the total area of the country under forest cover (including other wooded land limited to less than 4%).
2. By 2030, manage 50% of Terai and Inner Terai forests & 25% of middle hills & mountain forests sustainably.

5

Waste

1. By 2025, 380 million litres/day of wastewater will be treated before being discharged, & 60,000 cubic meters/year of faecal sludge will be managed.

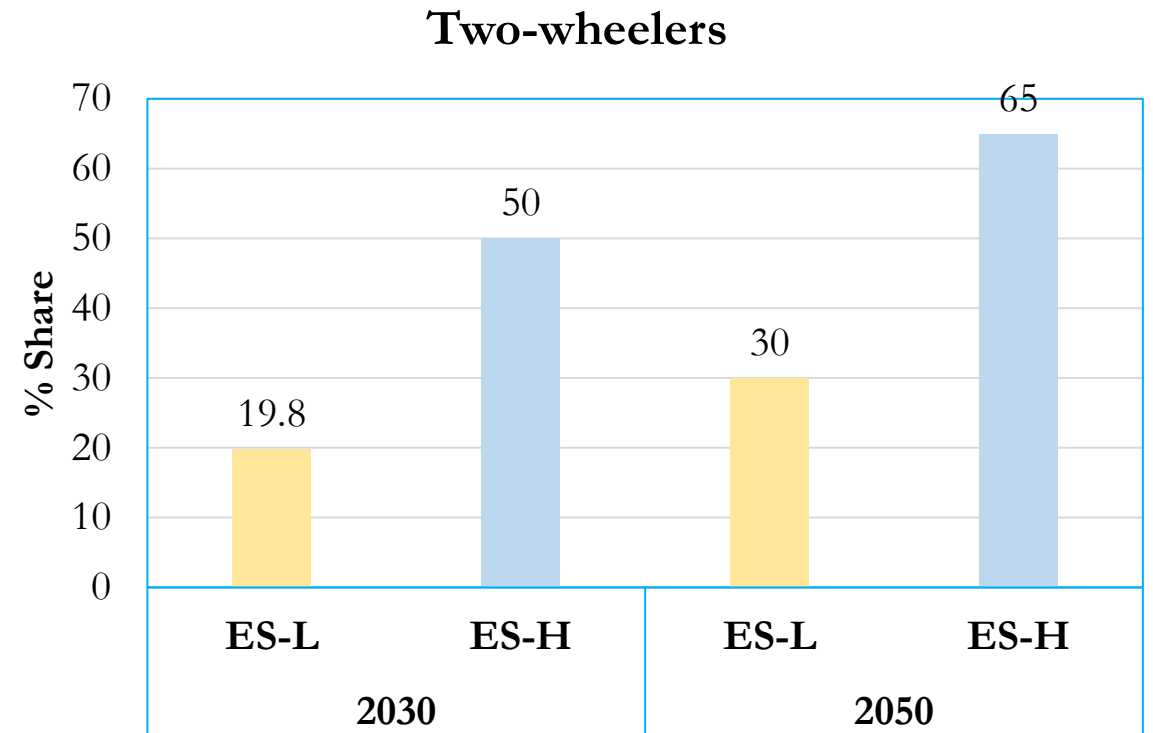
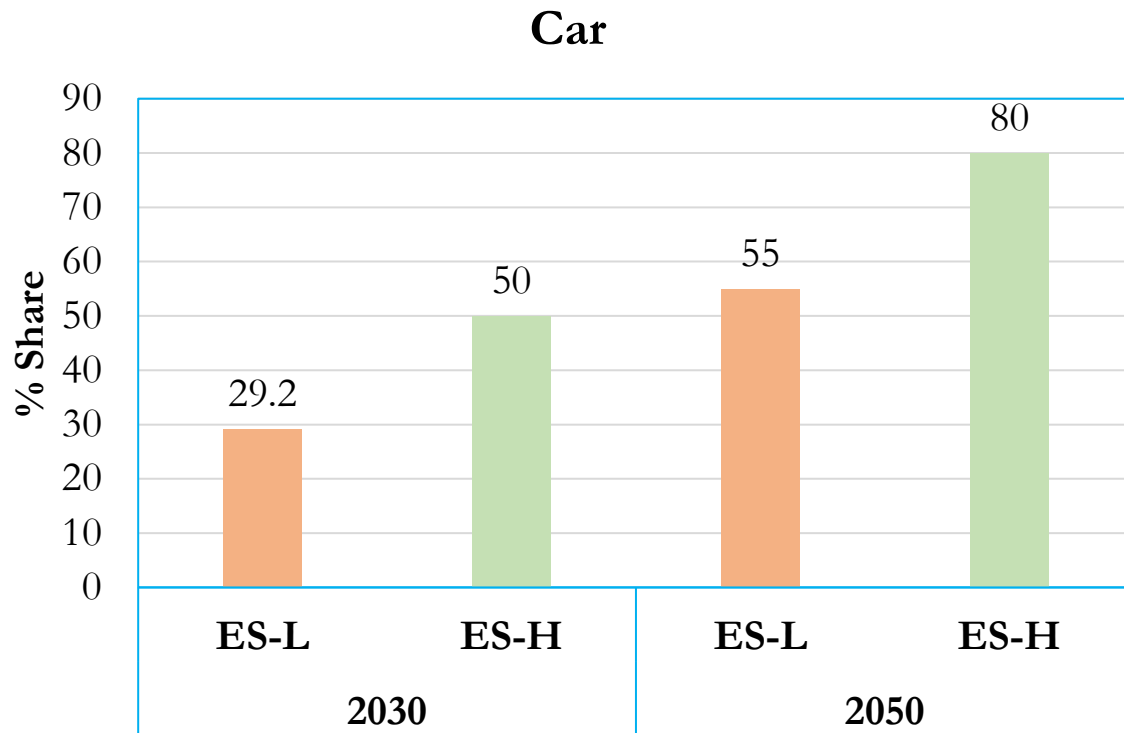


Source: GoN (2020)

Scenarios & Analytical Approach

Transport Electrification Scenarios in this Study:

% Share of Electric Vehicle in **Private Mode of Transportation**

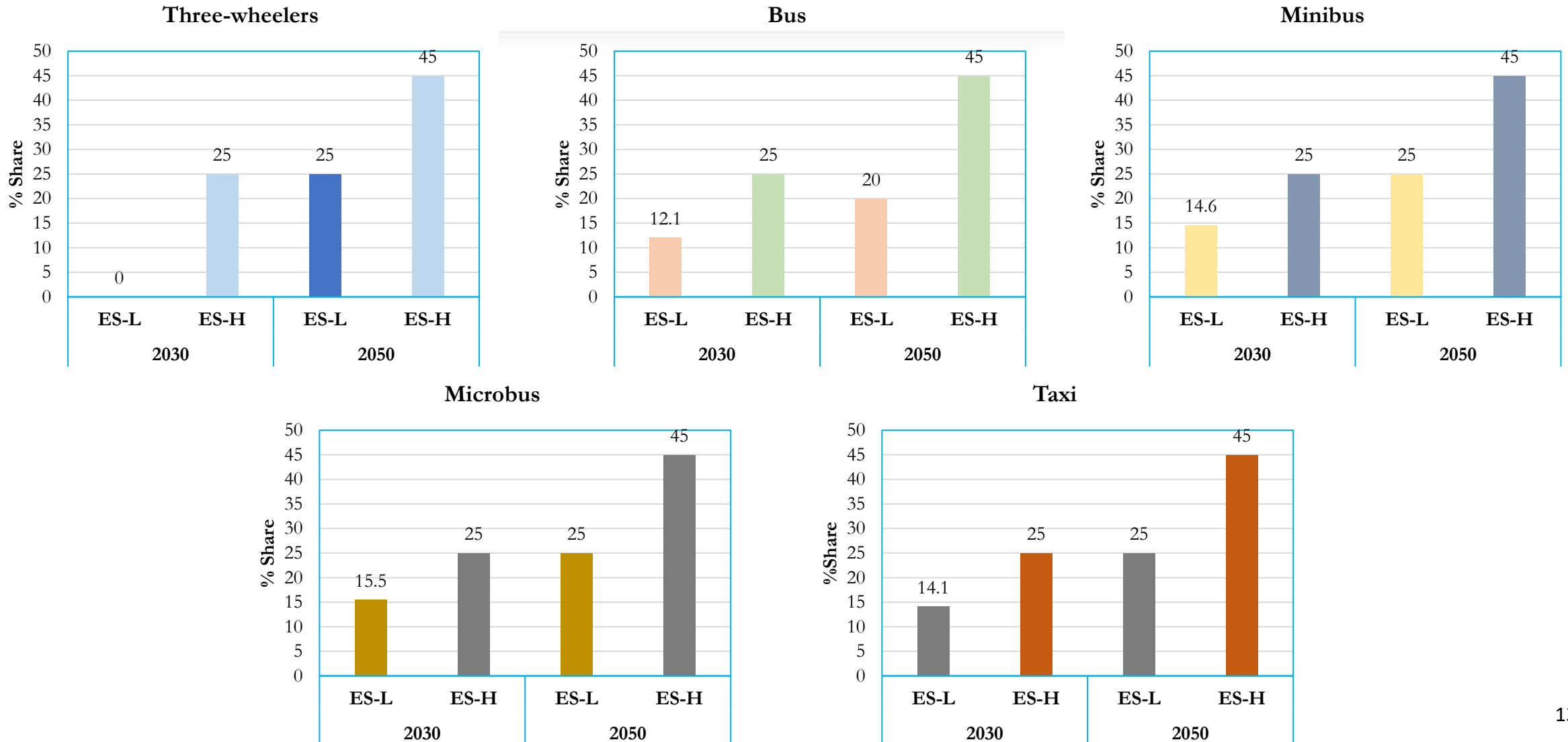


ES-L: Low Electrification Scenario

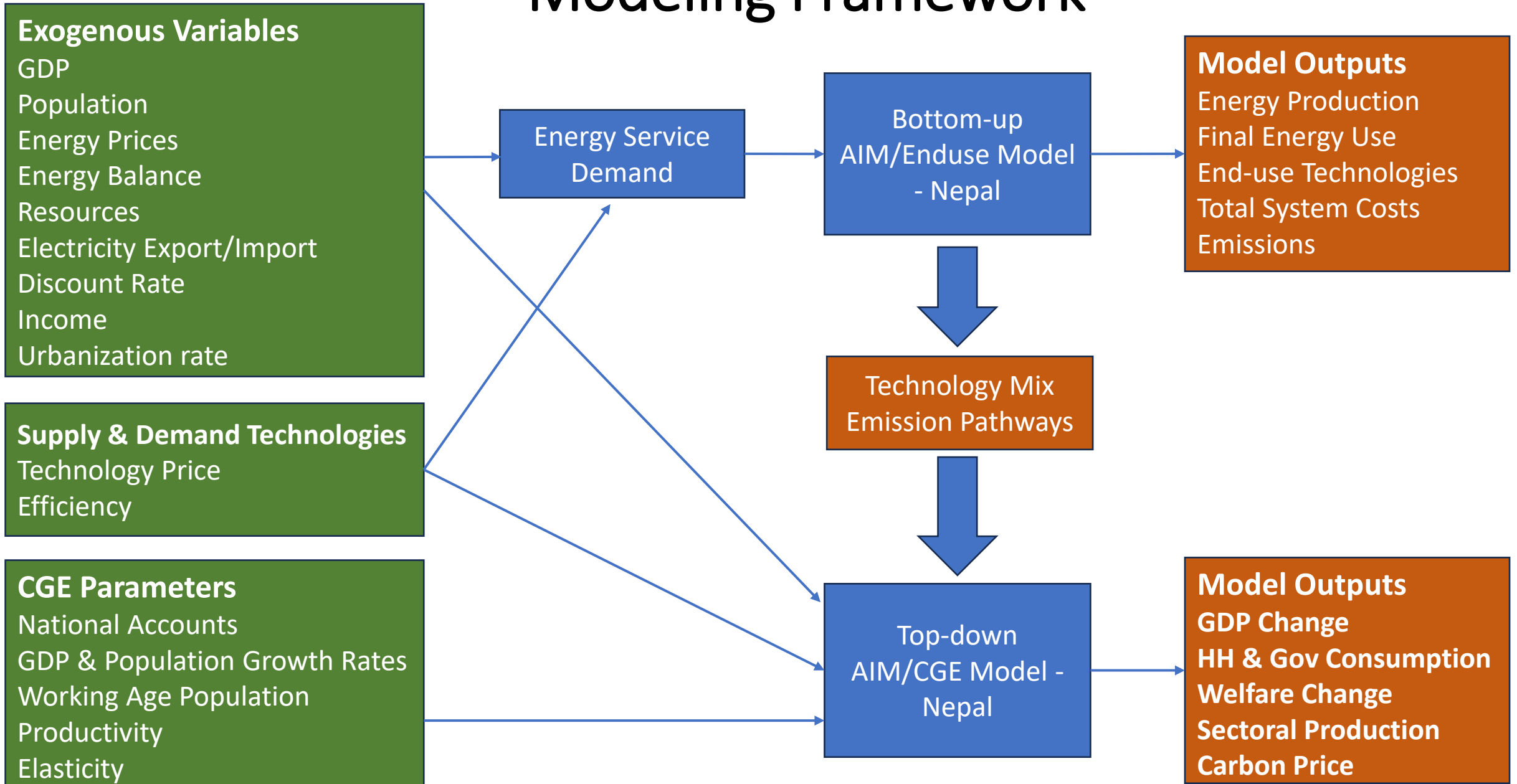
ES-H: High Electrification Scenario

Transport Electrification Scenarios in this Study:

% Share of Electric Vehicle in Public Mode of Transportation



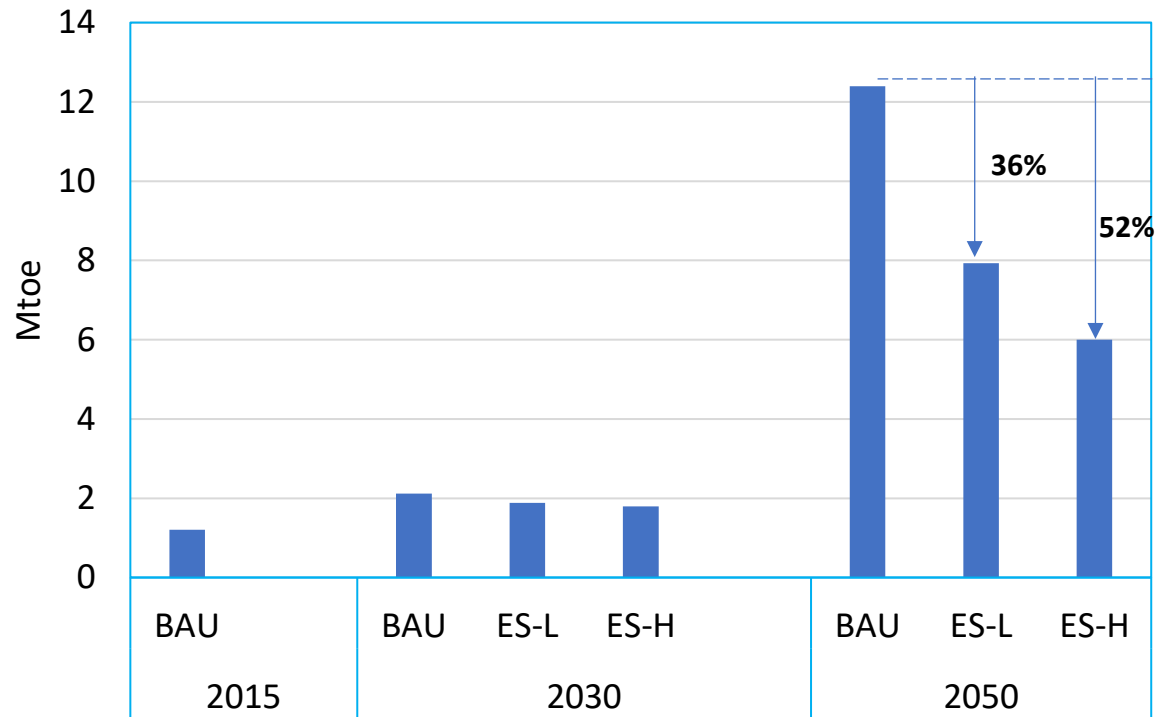
Modeling Framework



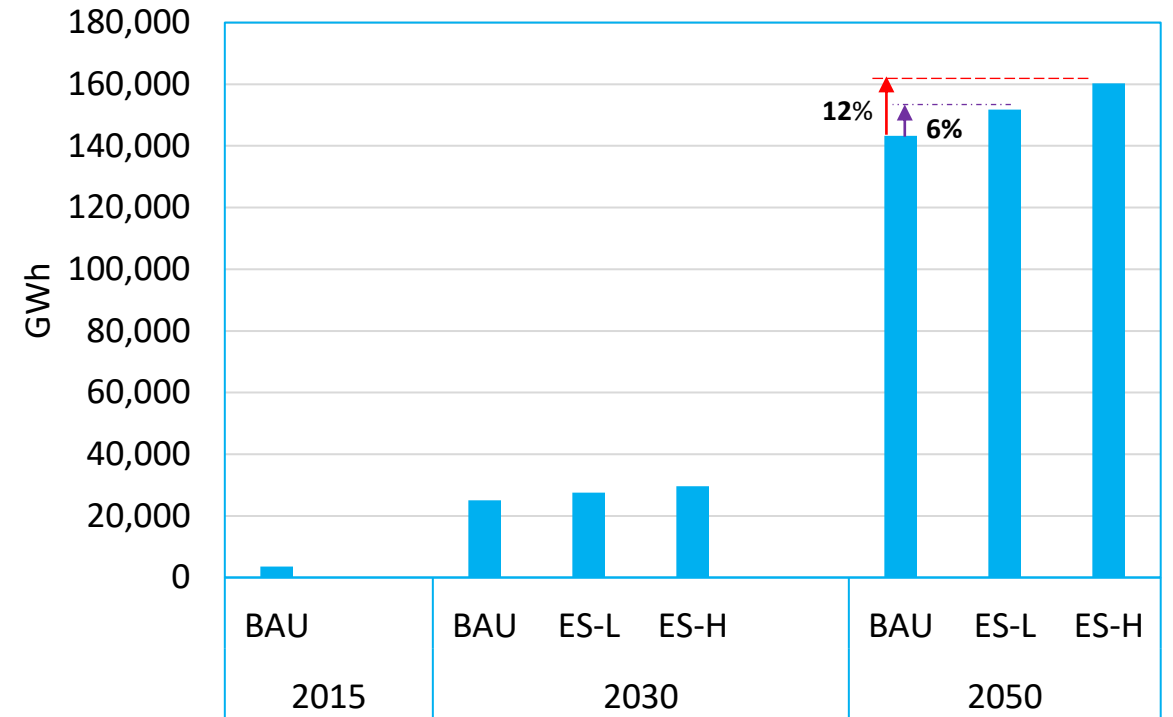
Implications of Transport Electrification

Increased Hydropower Generation in the Pathway to Transport Electrification

Reductions in Petroleum in TPES

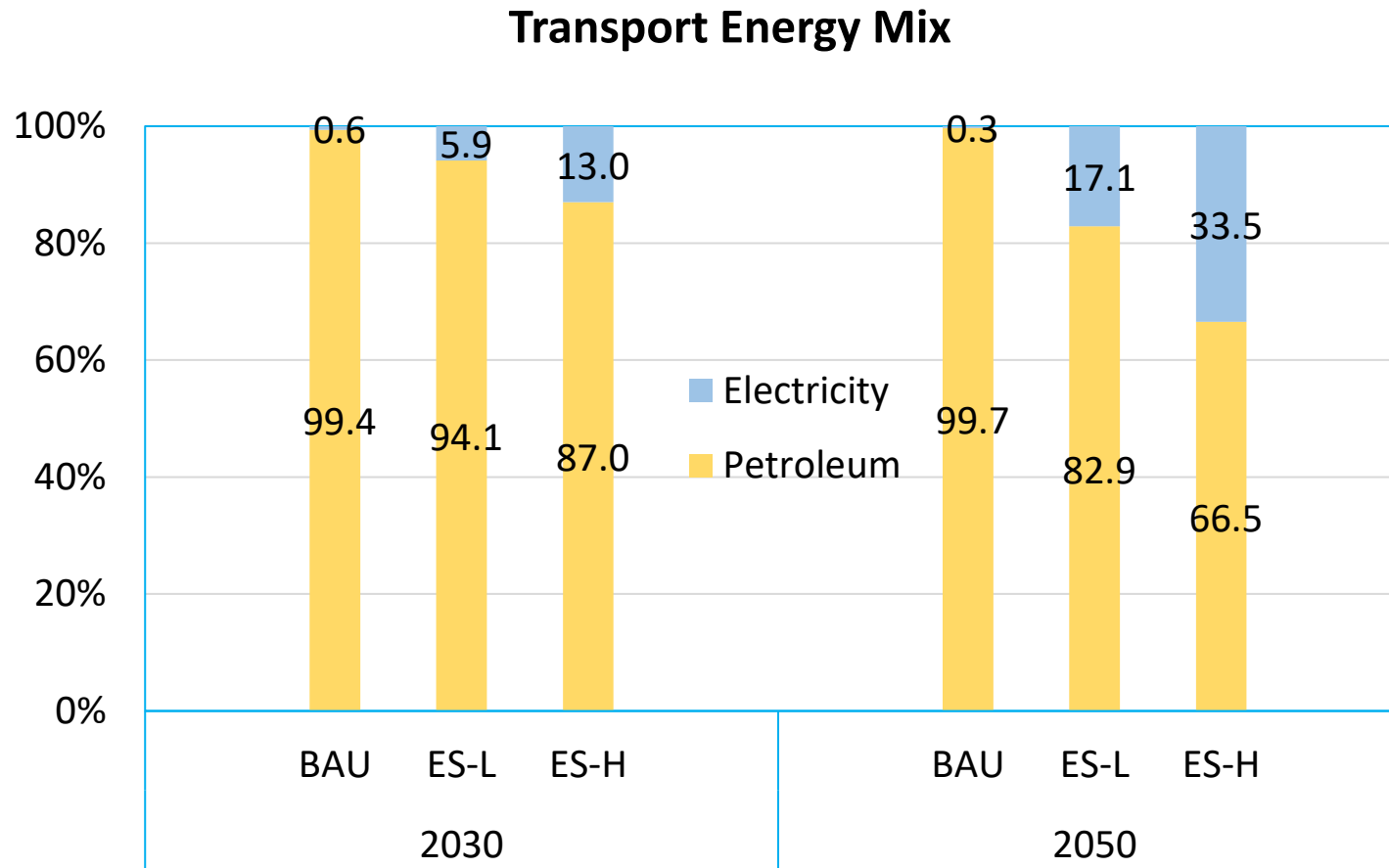


Increased Hydropower Generation



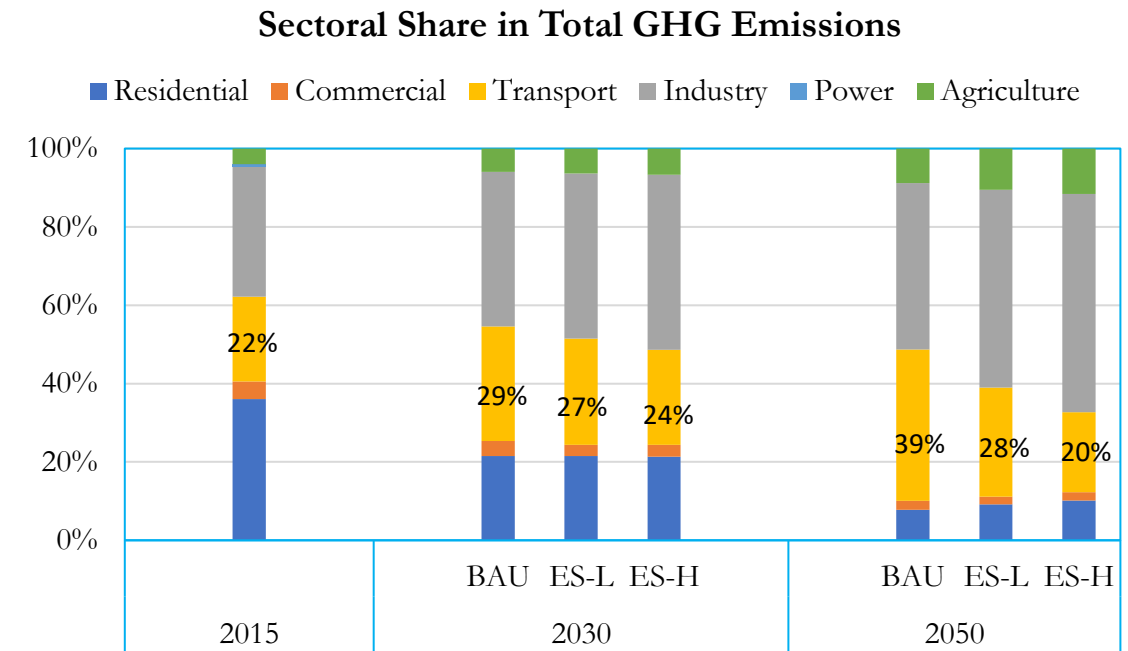
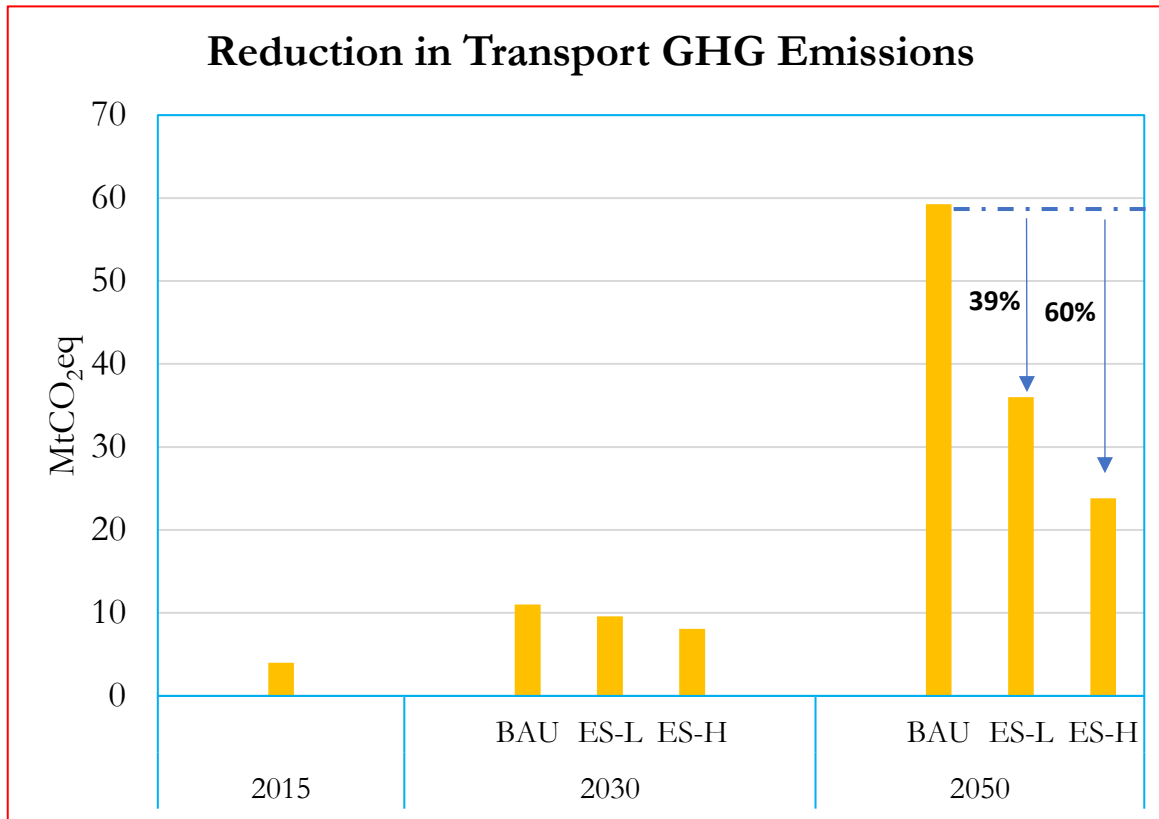
- ❖ This study assumes lower share of EVs mainly in the public mode of transportation.
- ❖ Higher implications on hydropower production could be achieved by further increasing the electrification targets in 2050.

Transport Energy Consumption Mix



Low share of electricity because of the lower targets set for EVs, mainly in the public mode of transportation

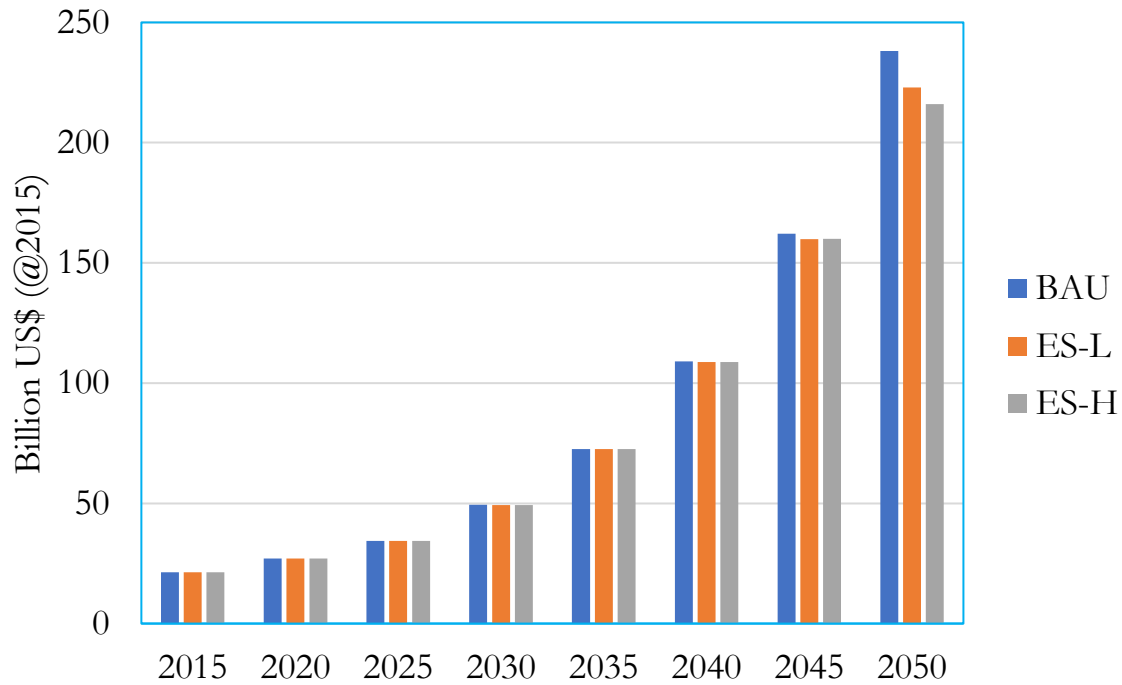
Reduction in GHG Emissions due to Increased Electrification in Transport Sector



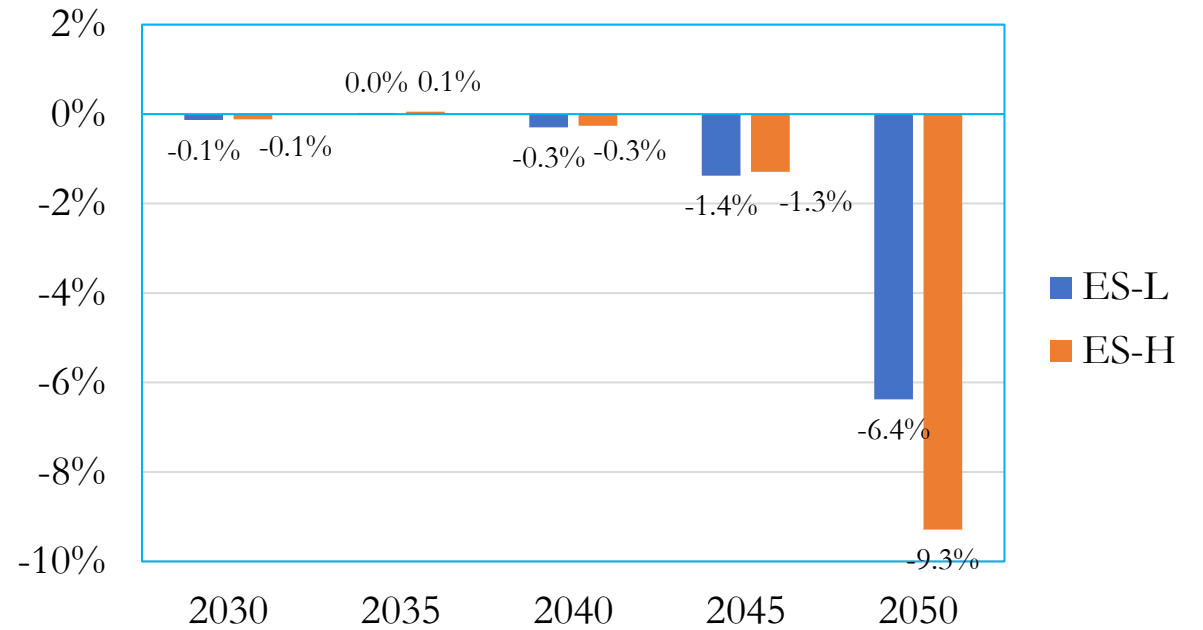
Lower % GHG reductions from the transport sector because of lower targets set for EVs

Implications on GDP

Variations in GDP



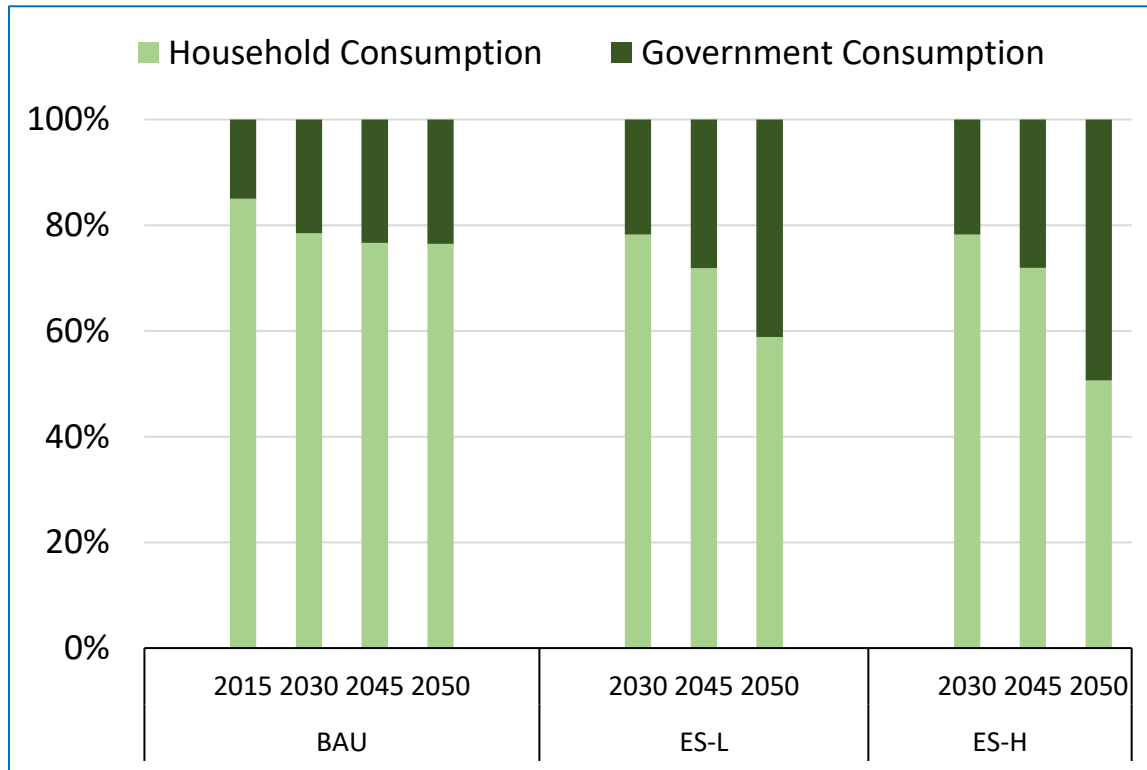
% Change Compared to BAU



Consumption & Carbon Price

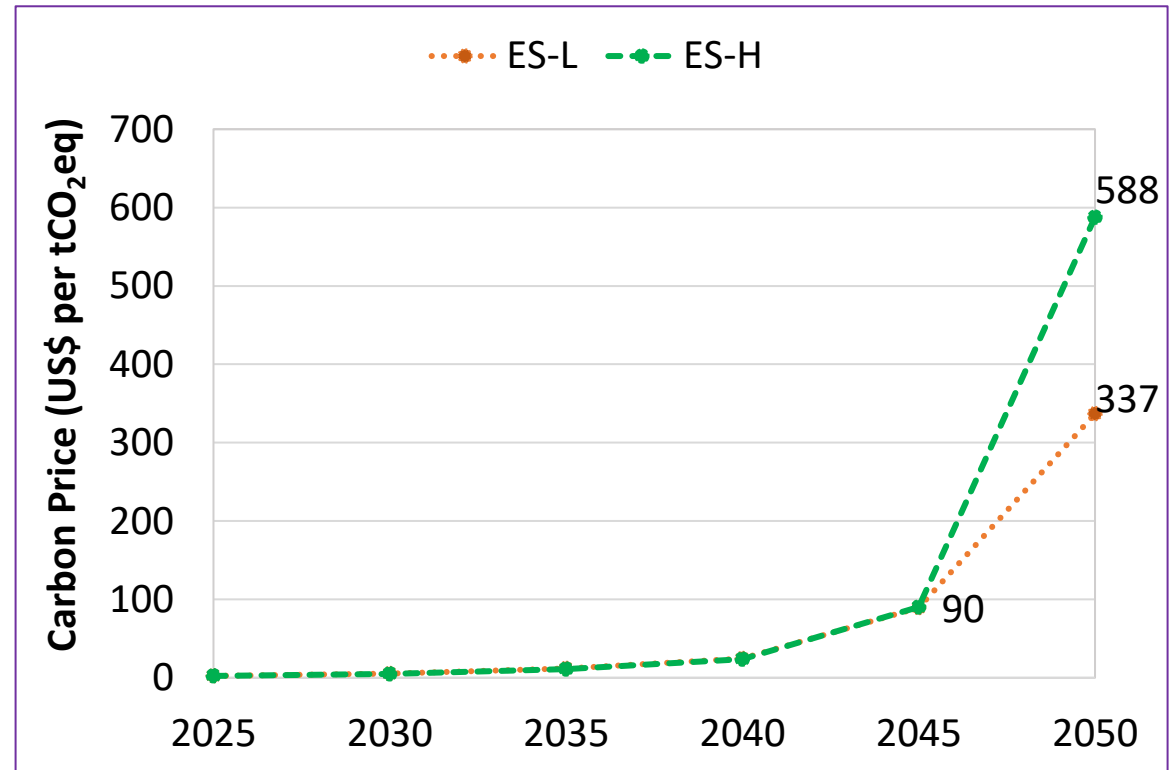
By 2050, government expenditure increased by 59% in ES-L scenario & 82% in ES-H scenario

Decline in household consumption expenditure representing consumer spending on goods & services due to higher carbon prices



Elevated carbon prices under the ES-H scenario

→ factors affecting carbon process include level of GHG mitigation, availability of technology, characteristics of technology in terms of investment costs & rate of technology deployment



Final Remarks

- ❖ Need to build supporting infrastructures, e.g., charging stations for large scale transport electrification.
- ❖ Need to grow the market for solar & green hydrogen in addition to hydropower development.
- ❖ Potential for large scale green hydrogen production & its use for complete decarbonisation in the transport sector by 2050.
- ❖ Need of green financing to realize these.
- ❖ Electric mobility policy's priority should be on public transportation, & not only on private vehicles.
- ❖ Decarbonizing freight transport is challenging but important.
- ❖ Prioritize regulations over fiscal incentivization for rapid transformation of transport.

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Thank You

