A Sustainable Asset Valuation (SAVi) Assessment of Bus Fleet Electrification in Ulaanbaatar, Mongolia

Summary for the Ministry of Road and Transport in Mongolia

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Who Is This Assessment for?

The Sustainable Asset Valuation (SAVi) assessment of bus fleet electrification in Ulaanbaatar, Mongolia, aims to inform and raise awareness among policy-makers and investors by demonstrating the investment case for sustainable infrastructure that delivers societal value for the city's residents. The assessment quantifies the multiple socio-economic and environmental benefits associated with implementation, including reductions in air and noise pollution, lower CO_2 emissions, and savings in fuel consumption and maintenance costs. It also highlights the additional benefits that could be achieved if electrification is complemented by a modal shift from private vehicle use to public bus transport.

Key Results at a Glance

Bus fleet electrification in Ulaanbaatar is expected to generate significant economic benefits through reduced fuel consumption and lower maintenance costs, alongside environmental benefits from decreased air pollution, less noise pollution, and reduced CO_2 emissions. These socio-economic and environmental benefits are expected to increase significantly if bus fleet electrification is accompanied by a modal shift from private vehicle use to public bus transport.

Highlights

- Bus fleet electrification in Ulaanbaatar will generate a cumulative, discounted (at 5%) net benefit of MNT 93,355 million (USD 26.3 million), considering a project period of 25 years, from 2025 to 2050 with an integrated benefit-to-cost ratio (BCR) of 1.09.
- If bus fleet electrification in Ulaanbaatar is complemented by a modal shift from private vehicles to public bus transport, net benefits and BCR increase significantly. A 5% modal shift raises net benefits to MNT 1,422,992 million (USD 400.5 million) with a BCR of 2.36, while a 10% shift increases net benefits to MNT 2,752,629 million (USD 774.8 million) and the BCR to 3.63.
- The greatest impact of the bus fleet electrification in Ulaanbaatar is the avoided cost of fuel use, valued at a cumulative, discounted MNT 816,011 million (USD 229.6 million). The lower maintenance costs associated with electric buses make up the second biggest impact, valued at MNT 162,358 million (USD 45.7 million). This is followed by avoided costs related to CO_2 emissions, noise pollution, and air pollution.

Premise

Ulaanbaatar, the capital and economic hub of Mongolia, is home to approximately 1.72 million inhabitants, accounting for around 50% of the country's population. The city faces significant traffic congestion due to outdated, overburdened infrastructure, rapid population growth, and increasing motorization. These result in increased air pollution, affecting citizens' well-being and translating into economic costs. In line with the updated General Development Plans for Ulaanbaatar until 2020, the 2030 Development Trends, the 2040 Master Plan, and the Public Transport Strategy for Ulaanbaatar (2025–2050), the city is implementing coordinated measures to reduce traffic congestion, modernize public transport, and improve the accessibility, safety, and sustainability of its transport system.

Mongolia has demonstrated a broader commitment to sustainable urban mobility as part of addressing climate challenges through innovative, environmentally responsible solutions. Specifically, Phase II (2031–2040) of Mongolia's "Vision 2050" emphasizes green and smart technologies to enhance urban sustainability, aiming to reduce emissions by promoting electric and eco-friendly public transport. The government has been promoting e-mobility by developing national technical standards for electric vehicles and charging stations, deploying electric vehicles in urban public transport and taxis, and offering a range of incentives. Current policies in Mongolia aspire to promote a public transport bus fleet in Ulaanbaatar that will be 70% electric by 2050.

In support of this goal, this analysis aims to demonstrate the economic, social, and environmental impacts of the full electrification of the bus fleet in Ulaanbaatar by 2050. This would require an over 14-fold increase from a current public transport fleet composition of 90 electric buses to the electrification of all 1,303 buses comprising the city's public transport fleet. Sensitivity analyses of a modal shift (shift from private vehicles to bus transport) are also included in the analysis.

In collaboration with the Asia Infrastructure Research Institute, we conducted a SAVi assessment to evaluate the bus fleet electrification at the city level. The assessment estimates the long-term benefits of implementation and examines its potential to enhance the well-being of Ulaanbaatar's citizens. The main objectives of the integrated assessment are to generate evidence and raise awareness of the impact of sustainable infrastructure on key socio-economic and environmental parameters, including air pollution, CO_2 emissions and costs associated with bus fuel consumption and maintenance.

Scenarios

The following section describes the three scenarios assessed in the analysis. The first scenario considers the full electrification of the bus fleet in Ulaanbaatar and its multiple long-term benefits. Sustainable transport infrastructure, such as an electric bus fleet, can have important advantages, such as using cleaner energy (when electrified with renewable energy) and reducing negative environmental impacts. The second scenario considers the full electrification of the bus fleet in the city, complemented by a 5% modal shift from private vehicles to bus transport. The third and final scenario considers the full electrification of the bus fleet complemented by a more ambitious 10% modal shift from private vehicles to bus transport. All three scenarios that were modelled for the SAVi assessment of the bus fleet electrification in Ulaanbaatar are presented in Table 1.

Table 1. Scenarios modelled for the SAVi assessment of the bus fleet electrification in Ulaanbaatar

Scenario		Assumptions
1	Full electrification of the bus fleet **(no modal shifts)**	This scenario proposes the electrification of all buses in the public transport fleet in Ulaanbaatar.
2	Full electrification of the bus fleet **+ 5% modal shift** from private vehicles to bus transport	This scenario proposes the full electrification of the bus fleet in Ulaanbaatar, complemented by a 5% modal shift from private vehicles to bus transport.
3	Full electrification of the bus fleet **+ 10% modal shift** from private vehicles to bus transport	This scenario proposes the full electrification of the bus fleet in Ulaanbaatar, complemented by a 10% modal shift from private vehicles to bus transport.

Source: Author.

Results

Our assessment shows that the bus fleet electrification in Ulaanbaatar has a wide range of economic, social, and environmental benefits that are not usually considered in traditional infrastructure assessments. Bus fleet electrification in Ulaanbaatar is expected to generate significant economic benefits through reduced fuel consumption and lower maintenance costs, alongside environmental benefits from decreased air pollution, lower noise pollution, and reduced CO_2 emissions. If the electrification is complemented by a modal shift from private vehicles to public bus transport, these benefits are further amplified, and additional economic gains are realized, including increased public transport revenues and higher retail activity.

In our findings, Scenario 1 (bus fleet electrification with no modal shift) will generate a cumulative, discounted (at 5%) net benefit of MNT 93,355 million (USD 26.3 million),[1] considering a project period of 25 years, from 2025 to 2050. When accounting for the full range of the project's economic, social, and environmental benefits, the results show an integrated BCR of 1.09.[2]

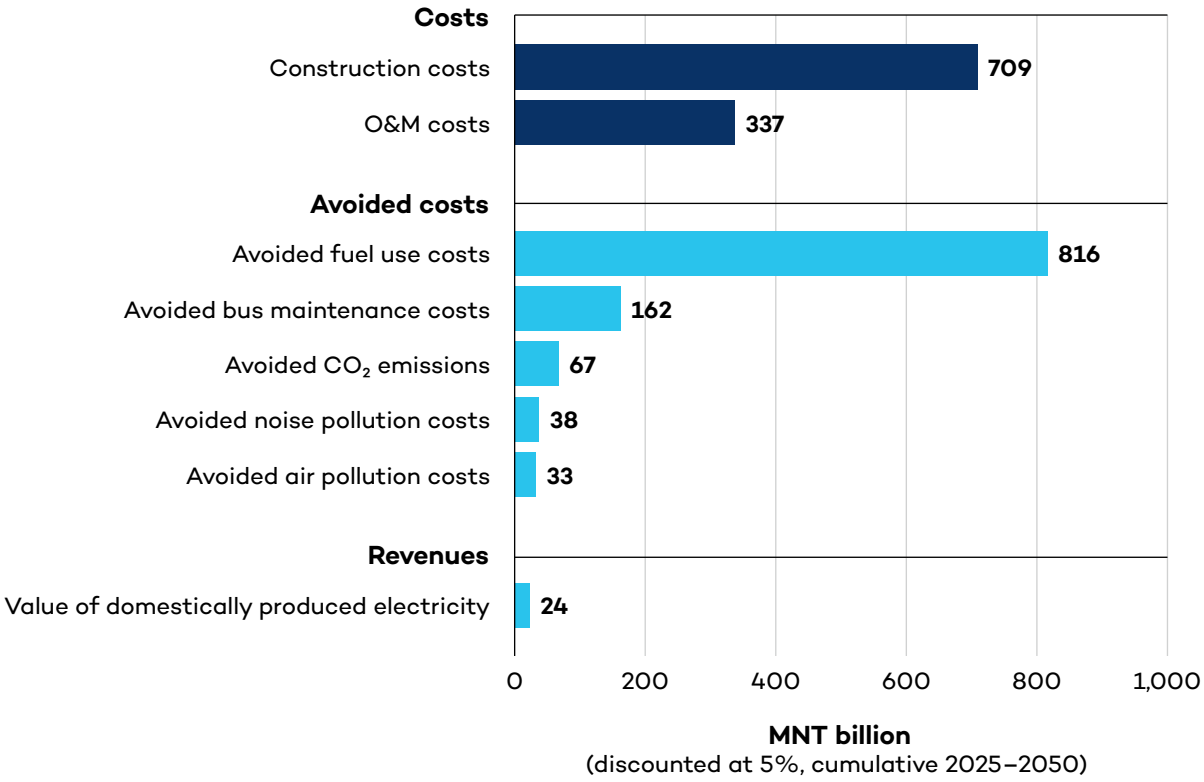
By contrast, when these benefits are not taken into account, as is often the case in conventional assessments of public transport projects, the return on investment appears significantly less attractive. If we only consider the economic benefits of reduced fuel consumption and lower maintenance costs, the BCR decreases to 0.94. This disparity demonstrates the importance of accounting for the full range of economic, social, and environmental benefits and costs associated with public transport investments. Demonstrating the full economic return of such projects can be critical for mobilizing the financial resources required for implementation.

The greatest impact of the transition to the full electrification of the bus fleet in Ulaanbaatar is the avoided fuel costs, valued at a cumulative, discounted MNT 816,011 million (USD 229.6 million). The avoided bus maintenance costs due to electric buses' lower maintenance requirements compared to internal combustion engine (ICE) buses make up the second biggest impact, valued at MNT 162,358 million (USD 45.7 million). This is followed by avoided costs related to CO_2 emissions, noise pollution, and air pollution, valued at MNT 67,364 million (USD 18.9 million), MNT 37,669 million (USD 10.6 million), and MNT 32,539 million (USD 9.1 million), respectively. Because the government purchase of electric buses and charging infrastructure is expensive, capital expenditures are very high, amounting to a cumulative MNT 709,270 million (USD 199.6 million) until 2050. Despite this, the multitude of added benefits and avoided costs resulting from bus fleet electrification outweigh the initial investment costs, making the project economically viable. All impacts of the project, including investment costs, added benefits and avoided costs, are included in Figure 1.

[1] Using an exchange rate of 1 MNT = 0.00028149 USD as of December 23, 2025, 1 MNT to 1 USD exchange rate.

[2] Undiscounted net benefits amount to MNT 823,054 million and a BCR of 1.47.

Figure 1. Monetary value of investment costs, added benefits and avoided costs of bus fleet electrification in Ulaanbaatar



Source: Author.

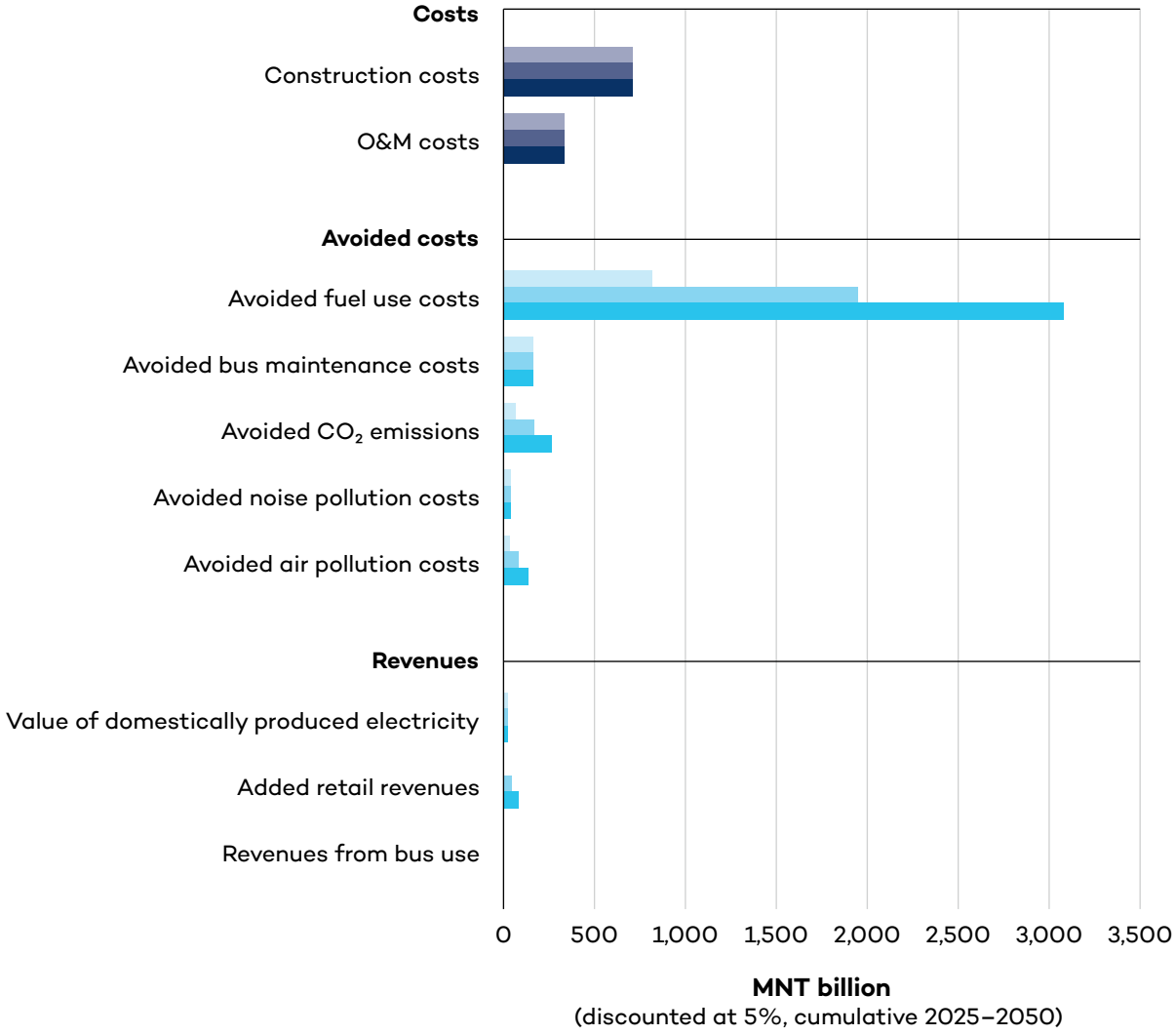
The greatest impact of bus fleet electrification in Ulaanbaatar is the avoided cost of fuel use, followed by the avoided maintenance costs.

According to Scenarios 2 and 3, which include the full electrification of the bus fleet in Ulaanbaatar, complemented by a 5% and a 10% modal shift from private vehicles to bus transport, respectively, the net benefits and BCR increase substantially. With a 5% shift from private vehicles to bus transport, net benefits are valued at a cumulative, discounted MNT 1,422,992 million (USD 400.5 million), and the BCR increases to 2.36. With a 10% shift, net benefits reach MNT 2,752,629 million (USD 774.8 million), and the BCR increases further to 3.63. This demonstrates that a city-level strategy to electrify the existing bus fleet while encouraging modal shift from private vehicles to public transport has the greatest benefits.

A modal shift from private vehicles to public bus transport can be facilitated and sustained by supporting urban planning and consistent people-centric policy-making. This can include improvements in bus service quality, reliability, and frequency, shorter travel times through dedicated bus lanes, better connectivity with other transport modes, and pricing measures, such as affordable fares, fuel or parking pricing reforms, and congestion management. On the other hand, modal shift may be impeded by perceptions of poor bus service quality,

overcrowding, limited route coverage, and weak integration with other transport modes. The results of all three scenarios of the analysis can be visualized in Figure 2.

Figure 2. Monetary value of investment costs, revenues, added benefits and avoided costs of the bus fleet electrification in Ulaanbaatar across all scenarios



Source: Author.

The avoided costs of fuel use increase significantly if the bus fleet electrification in Ulaanbaatar is complemented with a modal shift from private vehicles to bus transport.

Integrated valuations, such as the SAVi assessment, provide a more informed analysis of the long-term effects of infrastructure projects by integrating these values into the traditional calculations of net benefits and BCRs. The final results, which include the estimation of all

economic, social, and environmental added benefits and avoided costs of the analysis across the three scenarios, are included in Table 2 below.

Table 2. Net benefits and BCR of the bus fleet electrification in Ulaanbaatar

	Unit	Full electrification of the bus fleet		
		No modal shift	**+ 5% modal shift**	**+ 10% modal shift**
Cumulative net benefits (undiscounted)	MNT million	823,054	3,520,242	6,217,431
Cumulative net benefits (discounted)	MNT million	93,355	1,422,992	2,752,629
Cumulative net benefits (discounted)	USD million	26.3	400.5	774.8
BCR		1.09	2.36	3.63

Source: Author.

A city-level strategy that combines bus fleet electrification with the highest possible modal shift from private vehicles to bus transport has the greatest net benefits and BCR.

Policy Relevance of the Findings

The following recommendations for policy-makers in Ulaanbaatar, Mongolia, are informed by the SAVi assessment results:

1. Promoting a city-level strategy to electrify the existing bus fleet while encouraging modal shift from private vehicles to public transport offers the greatest long-term economic, social, and environmental benefits.
2. Enabling conditions for a successful city-level transport strategy include operational readiness in terms of charging infrastructure implementation, complemented by electricity generation from clean, renewable energy sources.
3. Advancing sustainable transport infrastructure investments, such as the bus fleet electrification in Ulaanbaatar, Mongolia, requires identifying, assessing, and valuing wider societal added benefits and avoided costs so that city planners and project developers can advocate for their implementation and financing.
4. Designing and implementing processes that recognize and account for wider infrastructure impacts is crucial to encourage decisions that deliver sustainable transport investments that provide the greatest benefits to society while minimizing environmental impacts.

About SIPA

The Sustainable Infrastructure Programme in Asia (SIPA) is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety under its International Climate Initiative. SIPA is implemented by the Organisation for Economic Co-operation and Development and international partners. It aims to help selected Central and Southeast Asian countries scale up energy, transport, and industry infrastructure investments and shift them toward infrastructure projects consistent with low-emission, resilient, development pathways and the Sustainable Development Goals.

About SAVi

The SAVi methodology provides policy-makers and investors with a comprehensive analysis of the costs and benefits of an infrastructure project or policy intervention throughout its life cycle. We consider a wide range of economic, social, and environmental risks and impacts that are typically overlooked in traditional valuations, looking below the surface for the broader knock-on effects of implementing a transport project. This helps to make the case for investment in sustainable infrastructure projects that deliver societal value.

The distinctive features of SAVi are

- valuation: SAVi values, in financial terms, the material environmental, social, and economic risks and externalities of infrastructure projects. These variables are ignored in traditional financial analyses.
- simulation: SAVi combines the results of systems thinking and system dynamics simulation with project finance modelling. We engage with asset owners to identify the risks material to their infrastructure projects and then design appropriate simulation scenarios.
- customization: SAVi is customized to individual infrastructure projects.

Why Use SAVi?

SAVi calculates the environmental, social, and economic risks and externalities that impact the financial performance of infrastructure projects. These variables are typically ignored in traditional financial analyses. SAVi is a simulation tool that is customized to individual infrastructure projects. It is built on project finance and systems dynamics simulation.

Visit the SAVi webpage: iisd.org/savi

SAVi Sustainable Asset Valuation

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