



The Carbon Footprint of Shifting Conventional Diesel Buses to Electric Ones in Astana, Kazakhstan

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1. About Myself

- L.N.Gumilyov Eurasian National University, Bsc in Heat and Power Engineering
- Newcastle University, Msc in Renewable Energy
- University of Glasgow, PhD in mechanical engineering. Project topic: Comparison of centralized and decentralized bioenergy systems for municipal solid waste treatment: Economic, environmental and social impacts.

- I have been involved in numerous projects funded by the U.S. Embassy in Kazakhstan, the Friedrich-Ebert-Stiftung (FES) Foundation, the Royal Society of Edinburgh, and the Scottish Government as an expert and researcher.



«Таза ауа» онлайн курсы

ҚР-дағы АҚШ Елшілігінің шағын гранттар бағдарламасы аясында қаржыландырылған

«Bilim Barine» қоғамдық қоры мен "Эко Мангистау" ҰЕҰ-ның жобасы

Контент авторы: Бауыржан Биахметов
Курс әдіскері: Жаннат Бубекбаева
Дыбыстаушы & график дизайнері: Мадина Карабаева

SCOTTISH ASIA PARTNERSHIPS HIGHER EDUCATION RESEARCH FUND (SAPHIRE)

RSE The Royal Society of Edinburgh

The Scottish Government

FEASIBILITY AND IMPACTS OF BIOENERGY TRIGENERATION SYSTEMS (BIOTRIG) IN DISADVANTAGED RURAL AREAS IN INDIA



The Carbon Footprint of Shifting Conventional Diesel Buses to Electric Ones in Astana, Kazakhstan

- Astana's growth: population increase, air pollution challenges
- Akimat's solution: purchasing electric buses
- Concerns: increased carbon footprint due to coal-based electricity
- Need for optimal solution: balancing environmental goals

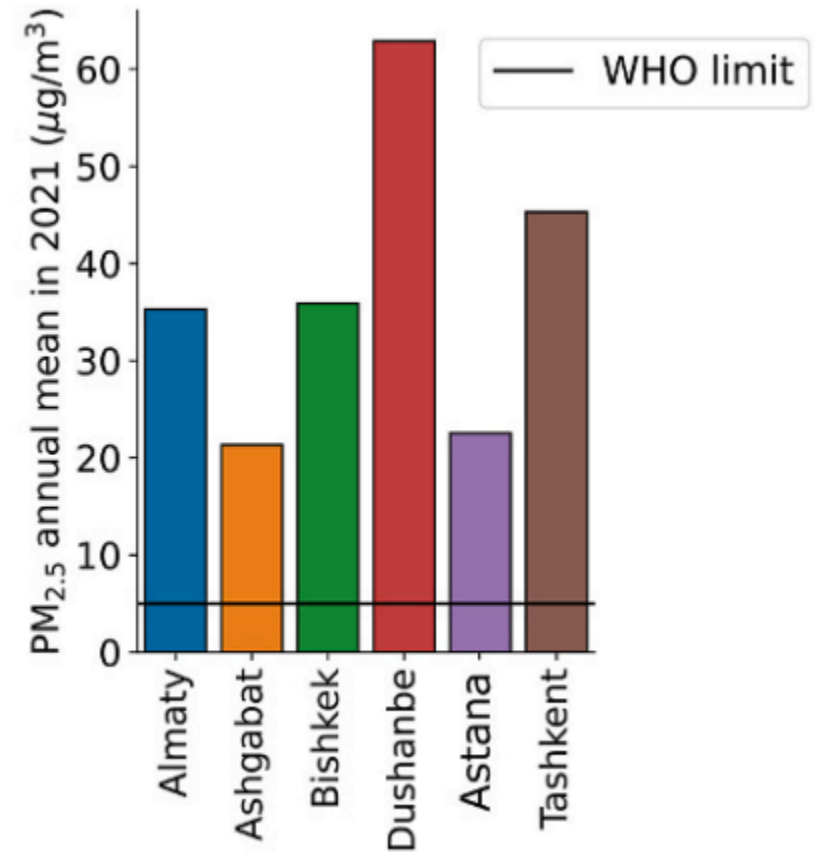
→ **The main part**

- Multiobjective optimization using machine learning techniques

→ **The future studies**

Astana's growth: population increase, air pollution challenges

- The population has grown from around 300,000 to 1,400,000 since the 2000s
- The population could easily reach 2-2.5 million by 2030-2035 based on the current pace



Sources: 1) <https://cabar.asia/en/photo-report-what-air-does-nur-sultan-inhale>

2) Tursumbayeva, Madina, et al. "Cities of Central Asia: New hotspots of air pollution in the world." *Atmospheric Environment* (2023): 119901.

Akimat's solution: purchasing electric buses

- A local governmental authority (Akimat) is working on the development of public transport to reduce emissions from vehicles.
- Around 6800 buses were in local service, over 100 of which were powered by electricity at the beginning of 2023.
- Akimat has a plan to purchase around 300 electric and 200 diesel bus in 2023, and is further planning to increase the number of electric buses in the future



Concerns: increased carbon footprint due to coal-based electricity

Kazakhstan has the ambitious target to produce around half of its energy from renewable sources by 2050, and completely decarbonize its economy by 2060 under the Paris Agreement

- Regarding the statistics published by the Ministry of Energy of the Republic of Kazakhstan (2023), overall 112.8 billion kWh of electricity is generated in 2022.
- Renewable sources represents only 4.5% of the total electricity produced.

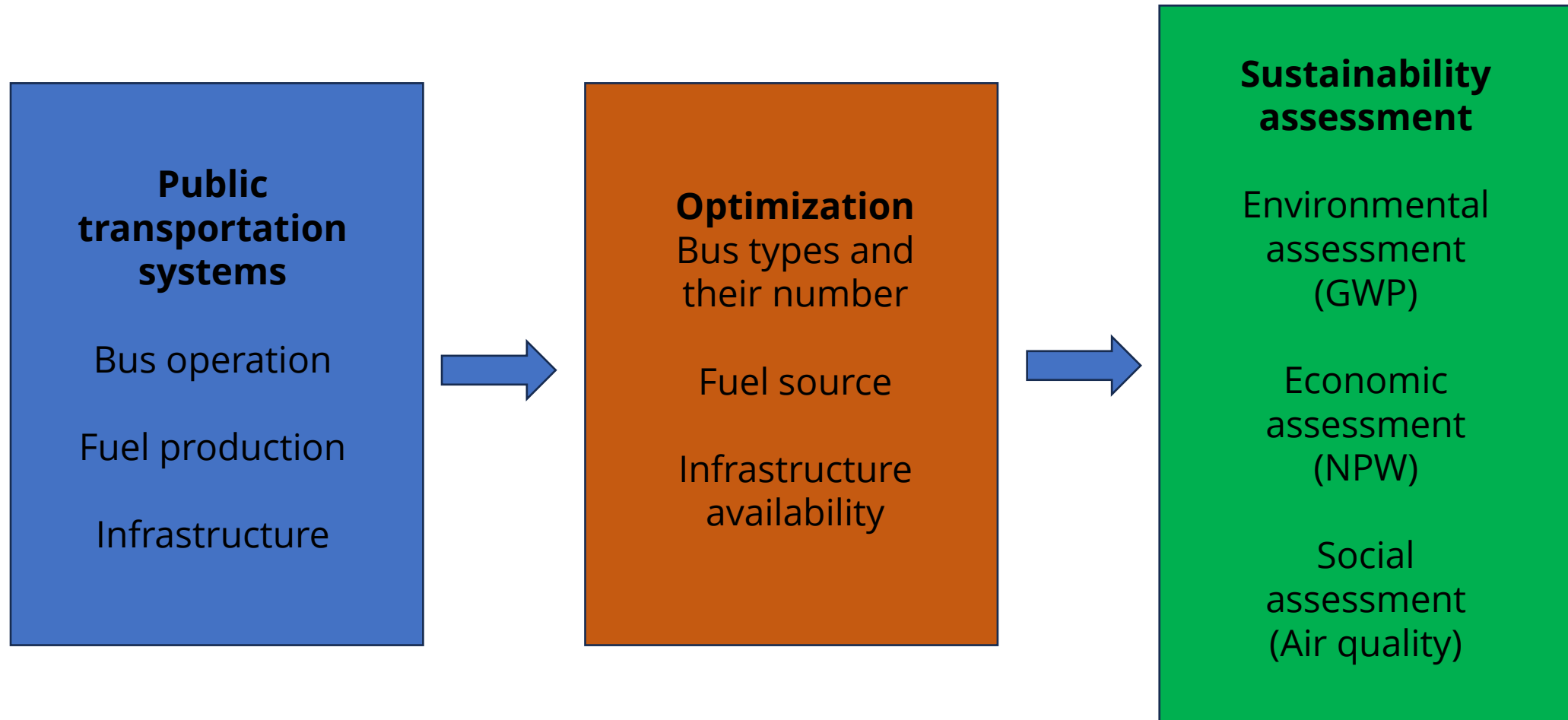


Need for optimal solution: balancing environmental goals

	Air pollution	Global warming potential	Economics	Applicability
Diesel buses	Red	Red	Yellow	Green
Electric buses working on electricity from coal	Green	Red	Yellow	Green
Electric buses running on electricity from renewable sources	Green	Green	Red	Red
Compressed natural gas buses	Yellow	Yellow	Yellow	Green

Good	Satisfactory	Poor
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Multiobjective optimization using machine learning techniques





Thank you

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