

Green Hydrogen: Opportunities, Challenges, and Policy
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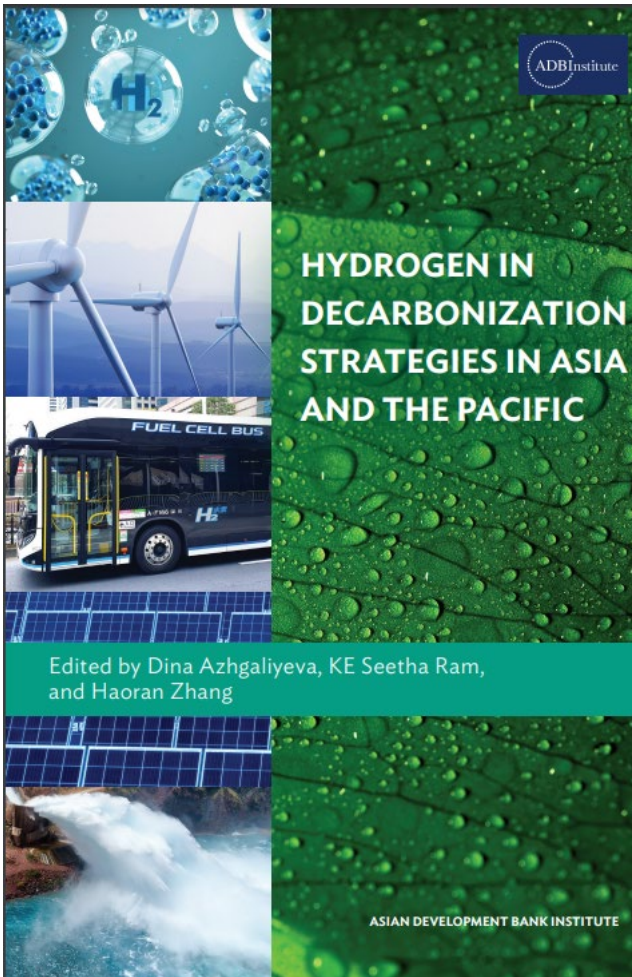


Why hydrogen?

- Expected to be a “game changer” in energy production and consumption: contribute to net zero emission pathway

Opportunities for Central Asia:

1. Decarbonizing hard-to-abate industries (where RE is not a substitute) e.g., steel, cement, and petrochemicals.
2. Energy storage: seasonal/long-term; excess of RE
3. Transport
4. Source of revenue from export



Hydrogen in Decarbonization Strategies in Asia and the Pacific

Edited by Dina Azhgaliyeva, K. E. Seetha Ram, and Haoran Zhang



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Issues with Hydrogen:

production, storage, transportation and utilization

1. Safety:

- If used at unprecedented scale
- New applications

2. Not necessarily low carbon

3. Cost: H₂ Demand?

- Green hydrogen is expensive (but falling), better to use RE where possible
- Need to produce at scale to drive cost down (but what is demand for local H₂?)

4. Infrastructure

- Low volumetric energy density (energy per volume)
- Production, Transportation (short and long distance) and Utilization: all require infrastructure (better to use existing infrastructure where possible)

5. Water scarcity in CA

Countries with national hydrogen strategies in Asia-Pacific

Introduced

Australia

People's Rep. of China

India

Japan

Singapore

Rep. of Korea

Kazakhstan

Forthcoming

South East Asia

Mongolia

Nepal

New Zealand

Concept of Hydrogen Development in Kazakhstan 2040

(draft)

Principles:

- Sustainability
- Innovation
- Renewable energy
- Infrastructure
- International cooperation
- Standardization and regulation
- Education and information

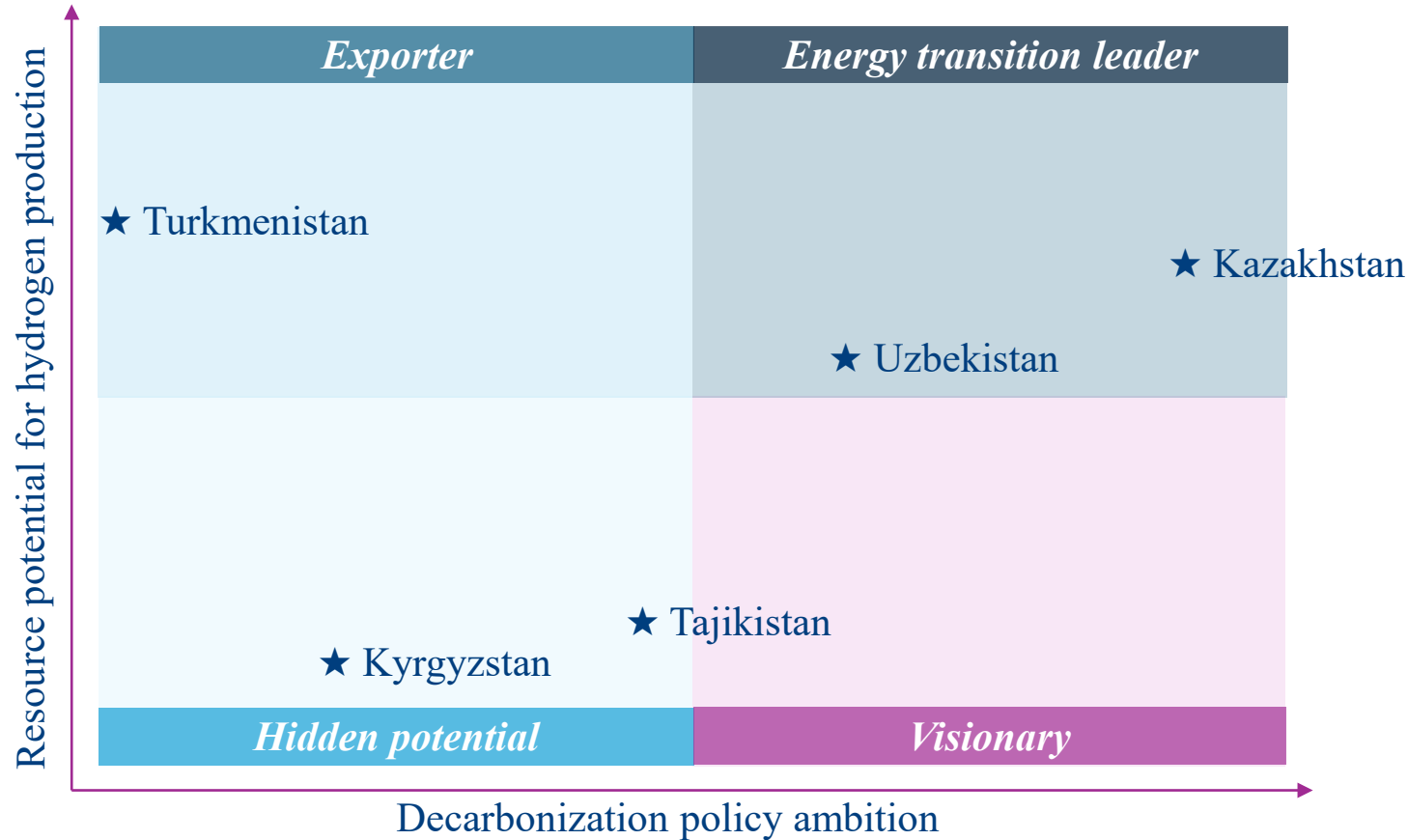
Targets:

- 10 GW of electrolyzer capacity by 2040
- Attract 5 trillion tenge of investments by 2040
- Share of local technologies up to 20%
- Pilot production by 2030

More than 35% of the global green and blue hydrogen production capacity (in operation and planned) is located in highly water-stressed regions (Northern China, GCC, Europe).

- Water is required as an input for **production** and as a **cooling** medium for all types of hydrogen production.
- Green hydrogen is the most water efficient of all clean hydrogen types.
- Green hydrogen projects should be prioritised for future hydrogen development.
- Hydrogen production should be incentivised to use water-efficient cooling technologies such as air cooling.

Hydrogen in Central Asia: Development Scenario

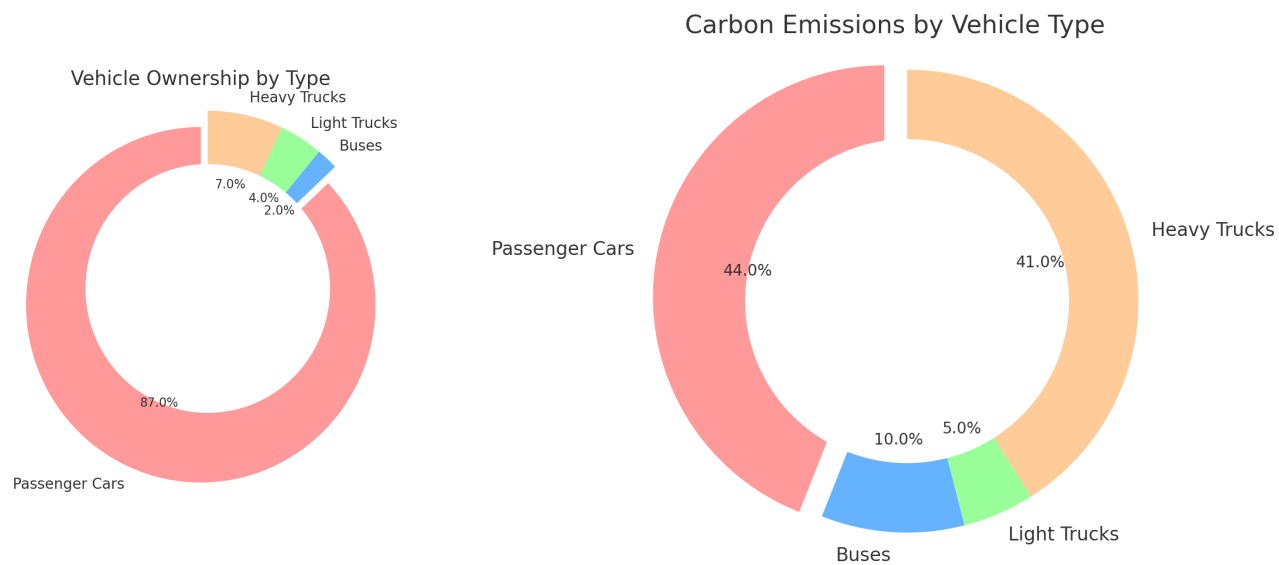


Source: Authors' elaboration using UNECE (2023)

- Kazakhstan and Uzbekistan can lead energy transition due to their decarbonization ambitions and resources.

Note: this scenario model is created based on the analysis of each country's decarbonization policy ambition and resource potential for low-carbon hydrogen production.

Hydrogen in PRC: Application Promotion



Trucks constitute **11%** of total road vehicle ownership but account for **46%** of total transportation emissions. In contrast, passenger vehicles, making up **87%** of ownership but **44%** of emissions. Trucks have significantly higher emissions per vehicle than passenger cars.

Hydrogen trucks are included in the PRC's hydrogen energy industry development plan.

PRC's support policy on hydrogen trucks

PRC offers purchase subsidies covering about 50% of the hydrogen truck's selling price.

For electric trucks, the subsidy is only 13% of the selling price.

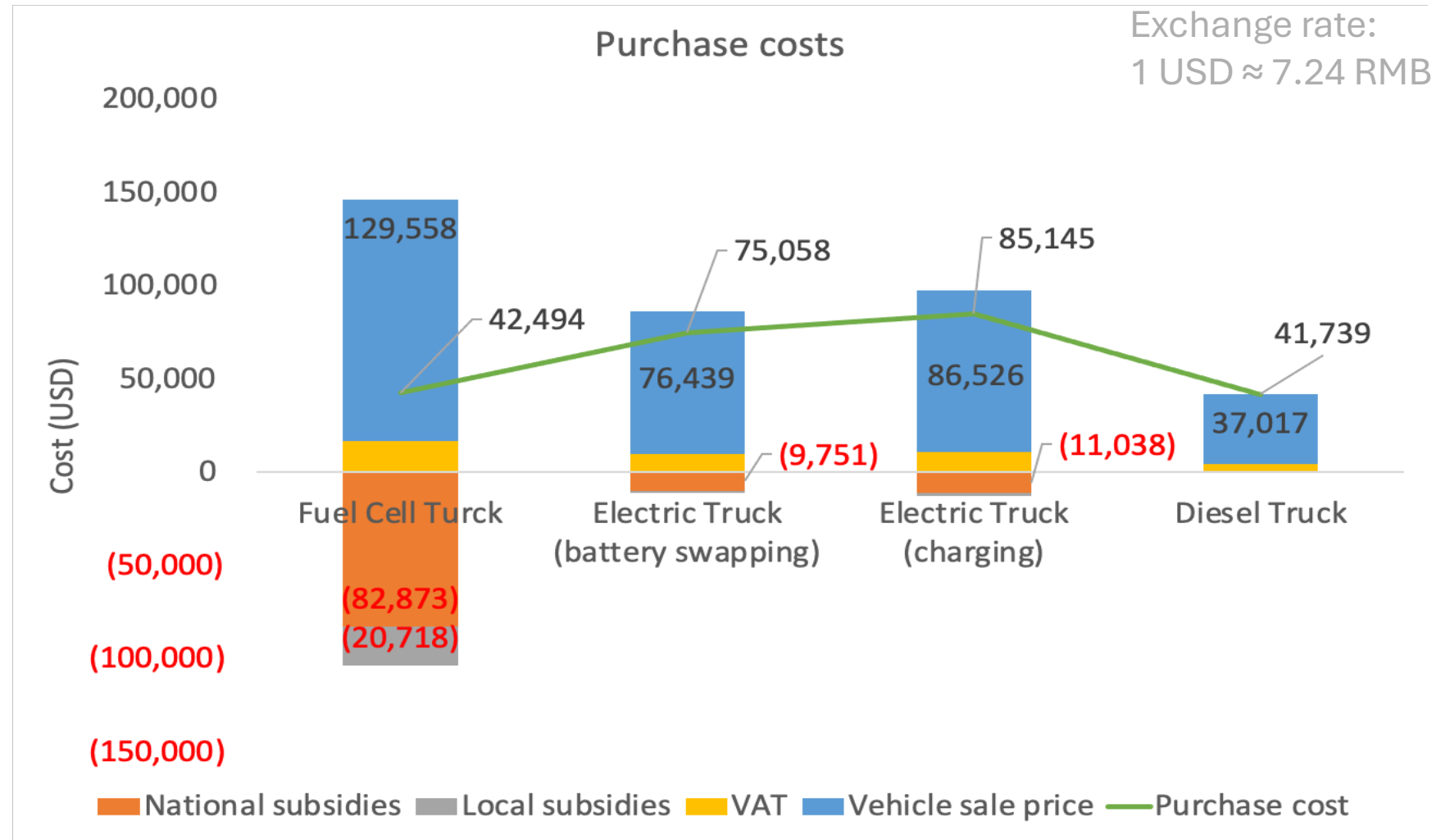


Figure: Purchase cost for different types of trucks in 10-year period

PRC's barriers on hydrogen truck promotion

The subsidy policy is effective.

Total cost of ownership (TCO) heavily depends on **hydrogen prices**.

Lack of infrastructure leads to excessive additional costs (travel disutility cost).

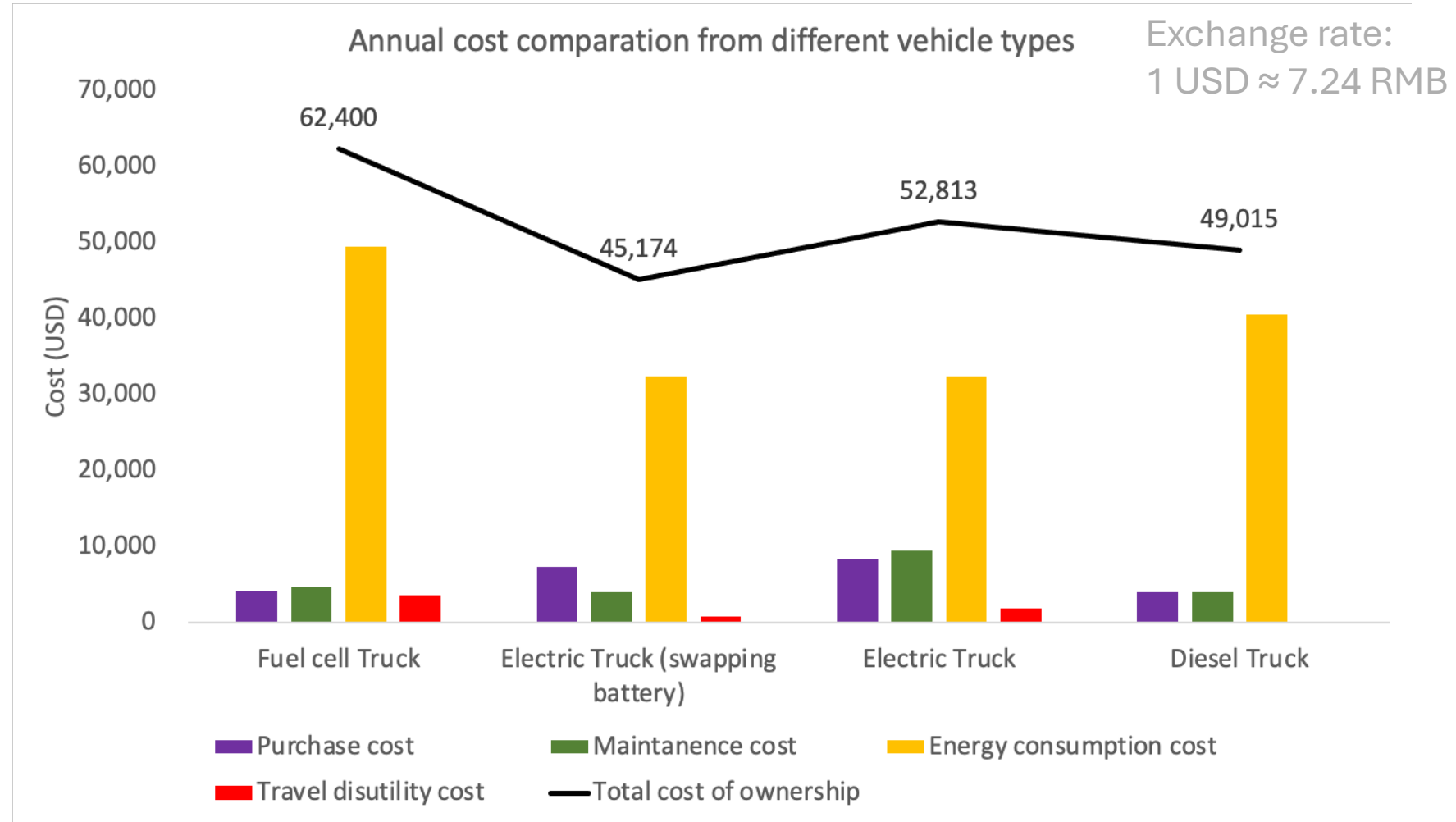
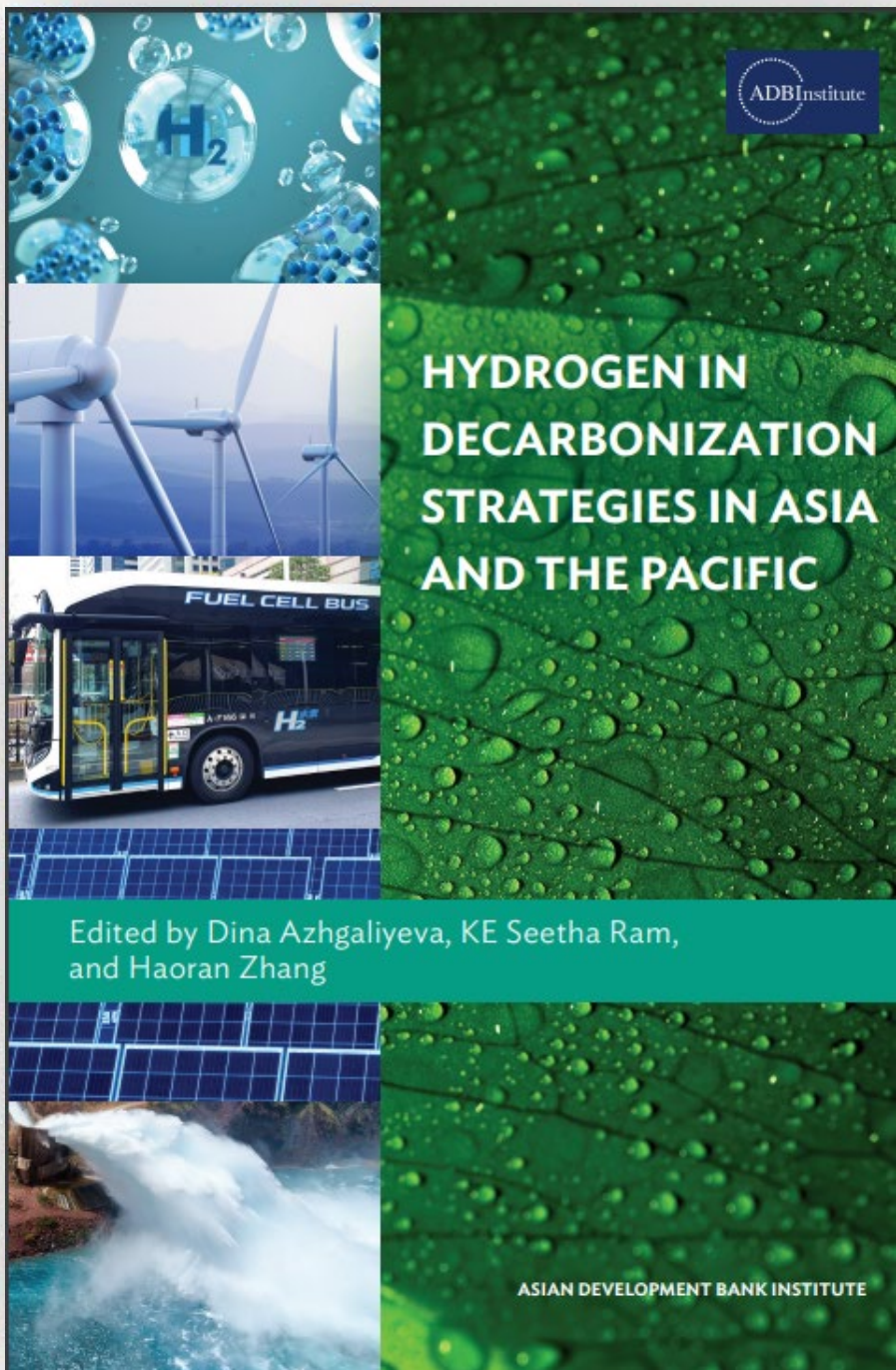


Figure: Annual Total cost of ownership for different powertrain trucks



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