FREEDOM OF MOBILITY FORUM

2024 EDITION

"How Will Our Planet Accommodate the Mobility Needs of 8 Billion People?"

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An overview of the research conducted by 6 engineering students from ENSA Kenitra: Abir Mesbahi, Youssef Benlaatmania, Diae Arrahmane Elkadili, Alae Tazi, Adam Fakhar, Mohammed Essadqui.

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The perspective of engineering students: "Innovation ensuring an optimal use of natural resources for the mobility of people and goods"

For the 2nd edition of its live debate, the Forum has partnered with three leading universities located in three different regions of the world, incorporating the perspectives of youth and articulating the expectations, needs, and demands of future generations. Each university has focused on a specific dimension of the debate, coherent with their respective disciplines, to tackle the global issue: "How Will Our Planet Accommodate the Mobility Needs of 8 Billion People?"

Students from ENSA Kenitra dived into the technological dimension. More specifically, they looked at the environmental, economic, and technological challenges posed by three major energy sources used and planned for transportation. They studied technical solutions that can be leveraged to avoid resource depletion and those that can enable a more sustainable lifecycle from extraction to disposal.

The digest below summarizes their key ideas and insights.

The Global Context: A Growing Population and Limited Natural Resources

The significant rise in population results in a notable surge in demand for mobility. However, our transportation systems depend on finite, non-renewable natural resources. Consequently, scarcity of natural resources becomes apparent, as these are potentially insufficient to meet the mobility needs of 8 billion people.

The research focuses on three main resources and energy carriers representing different stages of the world's mobility timeline:

- Petroleum, historically used to power traditional vehicles, served as the foundation of our past transportation systems.
- Lithium, primarily used in lithium-ion batteries that currently power electric vehicles and represent an ongoing evolution in our mobility solutions.
- Green hydrogen, which emerges as a clean alternative to conventional fuels for the future.

Each of these resources and energy carriers presents distinct challenges and opportunities. Innovative solutions tailored to each of them need to be investigated to achieve sustainable mobility on a global scale.

Petroleum Fuel: An Energy from the Past Raising Major Challenges for the Future

Petroleum is a natural resource that historically facilitated widespread mobility, powers our traditional vehicles, and remains prominent as of today. Global oil consumption indeed increased almost ninefold since 1950, and roughly doubled since 1980[1]. However, its widespread use presents numerous challenges due to its non-renewable and polluting nature. Its combustive properties contribute significantly to greenhouse gas emissions and worsening air and water pollution. Moreover, the risks associated with rapid extraction rates surpassing replenishment rates can lead to resource scarcity and economic instability, manifested in fluctuating oil prices.

Therefore, petroleum cannot be our fuel for the future. However, until we transition away from it, solutions to mitigate its impact on nature should be implemented. This includes deploying cutting-edge technologies like seismic imaging for improved reservoir characterization and implementing sustainable extraction practices through enhanced community engagement. Additionally, adopting smart drilling technologies can enhance drilling efficiency, while repurposing excess heat generated during extraction for on-site power generation can help reduce environmental degradation and avoid the waste of energy.

Lithium: An Essential Resource for the Ongoing Development of Electric Vehicles

Lithium is a non-renewable natural resource essential for the production of lithium-ion batteries, powering electric vehicles (EVs) proposed as replacements for petroleum-powered vehicles. The demand for lithium-ion batteries is expected to grow by 25% per year by 2030[2], along with a rise in demand for EVs. The challenges associated with this energy source are numerous and may exacerbate due to this soaring demand. These include the limited availability of natural lithium reserves, but also water-intensive mining processes, limited battery lifespan, as well as safety concerns.

In response to these issues, the transition towards a circular economy paradigm appears imperative. We need to diminish reliance on lithium extraction while improving battery efficiency and safety measures through technological innovation. A spectrum of solutions and initiatives can be thought of to do so, ranging from the promotion of automated disassembly and recycling processes to minimize human exposure to hazardous materials, to the enhancement of battery lifespan and energy capacity through emerging technologies.

Green Hydrogen: A Clean Alternative for our Future Means of Transportation?

There are different ways to produce hydrogen for use in transportation, including grey, blue, or green hydrogen. Green hydrogen is considered one of the most sustainable options as its production relies on the use of decarbonized electricity. However, numerous challenges must be addressed. The main challenge lies in its widespread adoption, limited by exorbitant production costs and infrastructural

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[1] *CO2 emissions by fuel*. (published in 2020, revised in 2024). Our World In Data. https://ourworldindata.org/emissions-by-fuel

[2] Fleischmann, J., Hanicke, M., Horetsky, E., Ibrahim, D., Jautelat, S., Linder, M., Schaufuss, P., Torscht, L., & Van de Rijt, A. (January 16,2023). *Battery 2030: Resilient, sustainable, and circular*. McKinsey & Company. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/battery-2030-resilient-sustainable-and-circular

constraints. Globally, there are only about 4 500 km of hydrogen pipelines[3], which is highly insufficient. Additionally, the production of green hydrogen is costly and requires a substantial amount of water and renewable energy.

Despite these challenges, green hydrogen presents a promising alternative to conventional fossil fuels, enabling a shift towards clean, sustainable energy sources. To overcome the above-mentioned obstacles, public-private partnerships appear crucial for developing strategic infrastructure to accelerate the adoption of green hydrogen. Collaborative efforts are indeed essential for harnessing the potential of green hydrogen as a key element in future mobility solutions.

Key Insights in a Nutshell

In conclusion, innovation is crucial for navigating the intricate landscape of global mobility and aim for more sustainable transportation methods. A paradigm shift towards innovation-driven solutions, emphasized by robust collaboration across sectors, can enable the sustainable utilization of natural resources for generations to come and contribute to alleviating environmental pressures. Immediate efforts are needed to reduce the use of natural resources, prioritize recycling and reuse, and bolster public transportation.

[3] *Hydrogen*. (2022). Irena. https://www.irena.org/Energy-Transition/Technology/Hydrogen