



**Berufsbildende Schulen I
Uelzen**



Wir leben Nachhaltigkeit!

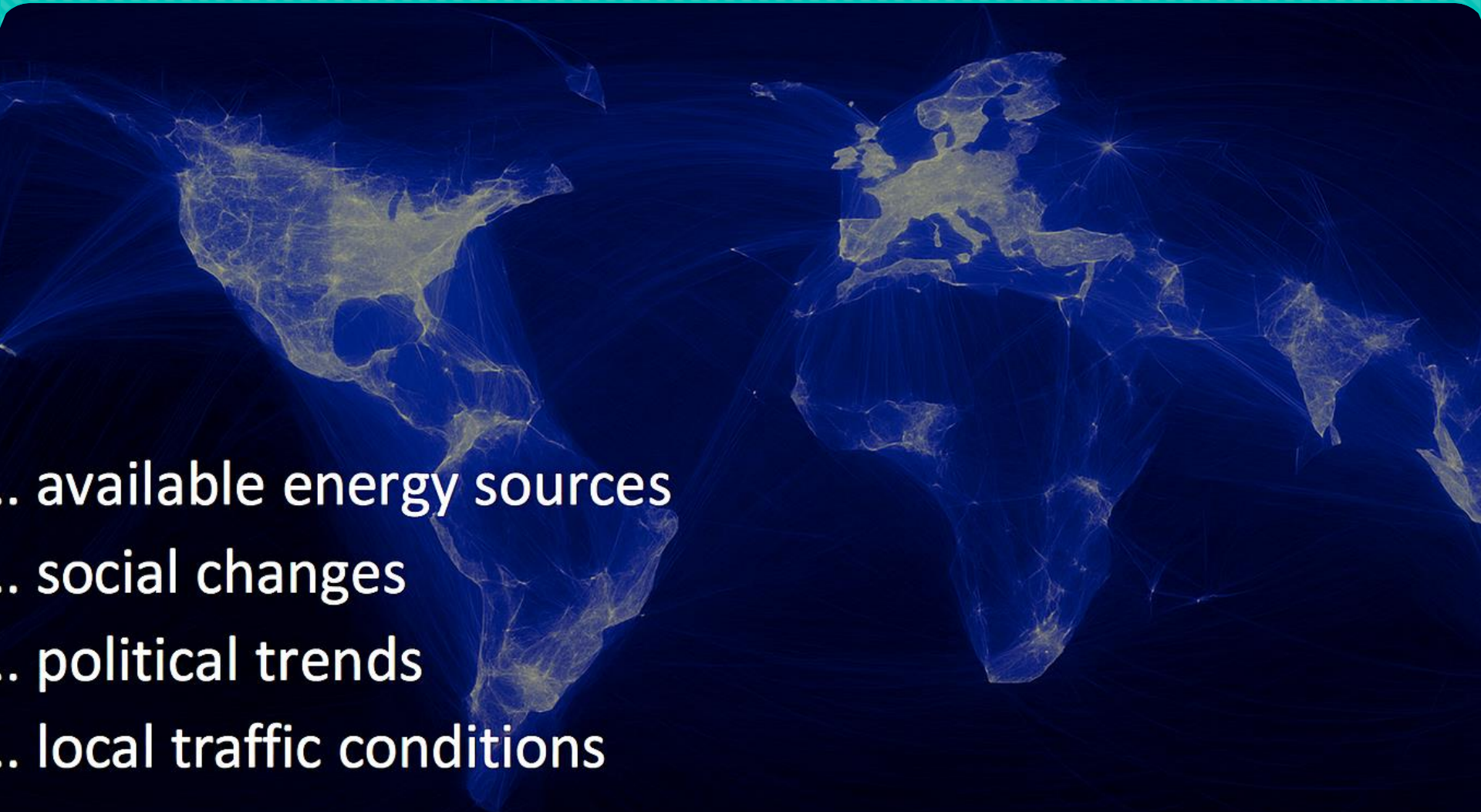
Erasmus Plus KA2 Project 2025 – 2027

‘Electric and Hydrogen-Powered Vehicles: The Role of Vocational Education in Developing Maintenance and Operational Skills.’

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(Nov. 2025)

Global mobility is shaped by...

- 
- .. available energy sources
 - .. social changes
 - .. political trends
 - .. local traffic conditions

The share of partially and fully electric vehicles is rising significantly.

Battery Technology

Continuous improvements make batteries more efficient



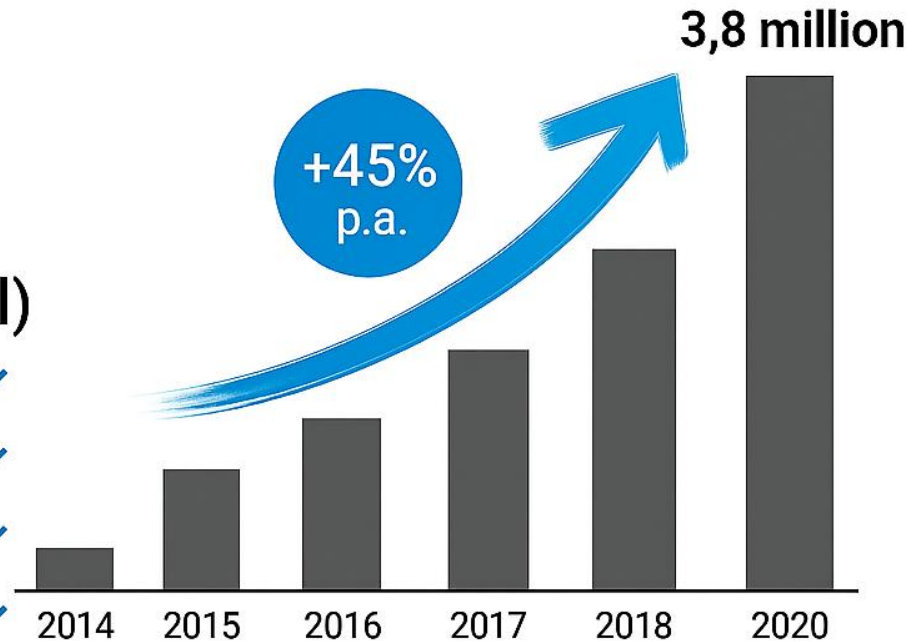
Market Incentives (National / Local)

-  Purchase bonuses ✓
-  Tax benefits ✓
-  Lane and parking privileges ✓
-  Exemptions from traffic restrictions ✓

Changing Customer Demands



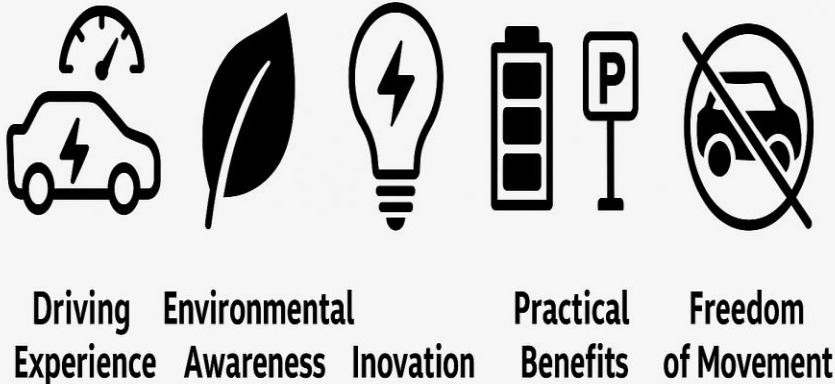
-  Sustainability
-  Silent driving
- Low running & maintenance costs



The Market is Changing

Why Customers Choose E-Mobility

e-mobility



- **Driving Experience:** Instant torque, smooth and silent ride.
- **Environmental Awareness:** Zero emissions, sustainable image.
- **Innovation:** Interest in advanced, high-tech vehicles.
- **Practical Benefits:**
 - Lower running and maintenance costs.
 - Tax incentives and free/cheaper parking.
- **Freedom of Movement:** Exempt from traffic or emission restrictions in many cities.

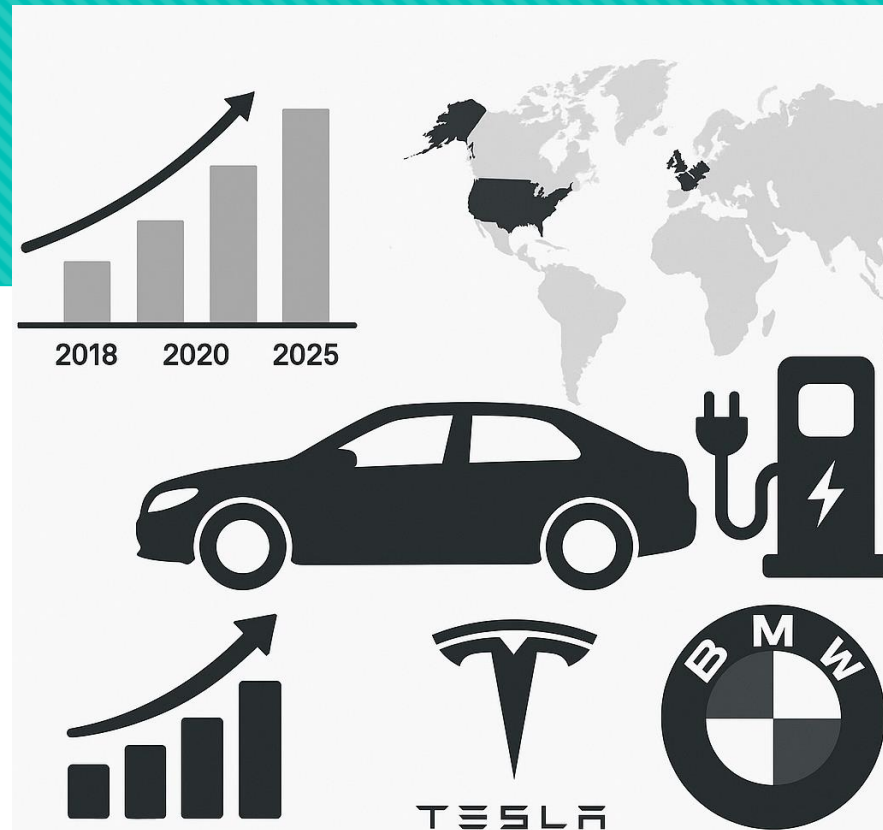
Over 40% of premium customers plan for an alternative powertrain as their next car.

70–80% see electric and hybrid systems as **the future of mobility**.

The IEA estimates that by 2030, over 40% of new car sales worldwide will be electric vehicles.

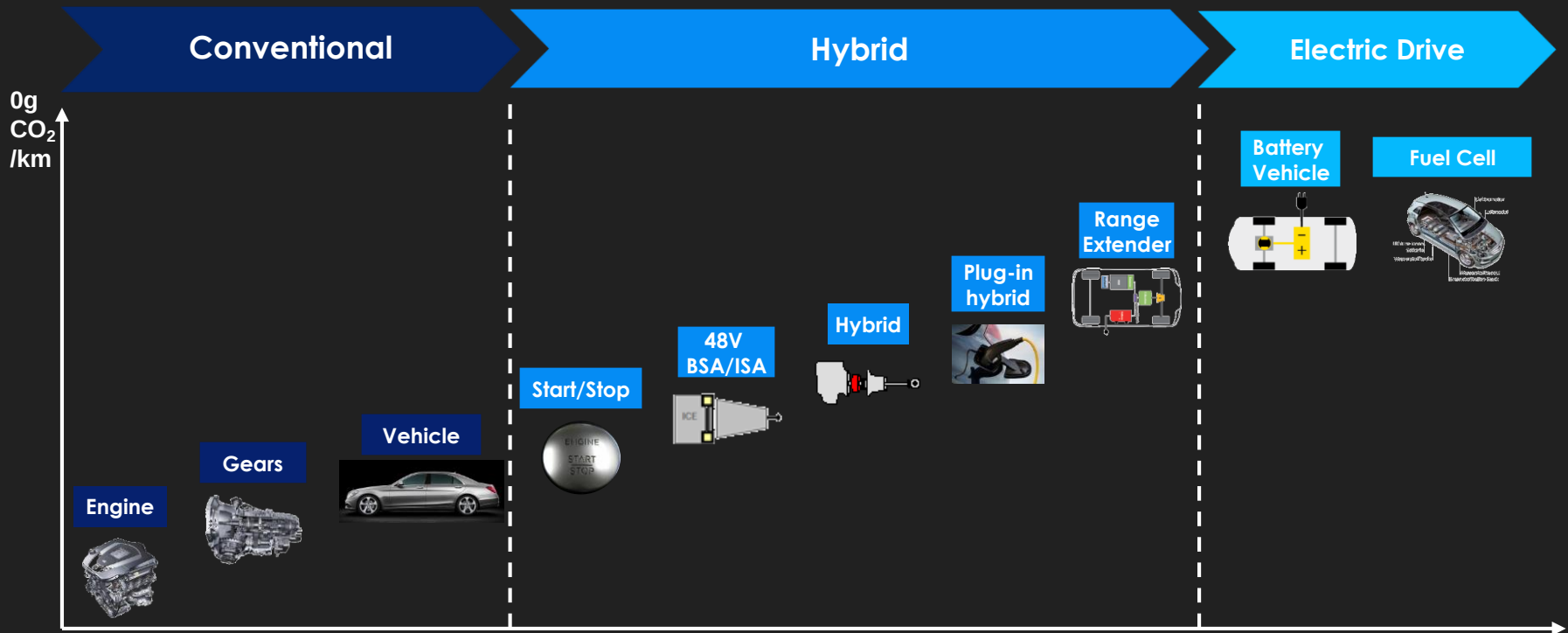
Countries like **Norway, Austria, India, and the Netherlands** plan to allow **only EVs by 2025–2030**.

Competition intensifies: Tesla and BMW lead since 2012–2013; now all major brands are expanding their electric portfolios.



E-Mobility Market Outlook

In order for the driving forces and the future importance of electric mobility to be genuine, conventional drive systems will be further optimized, and there will be increased investments in xEV vehicles.

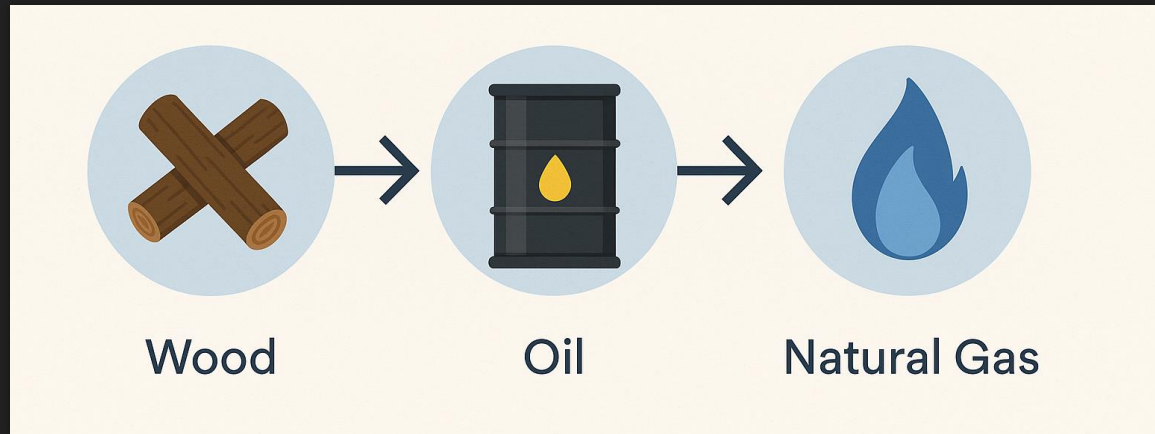


The world is changing.



The Human Journey Toward Cleaner Fuels

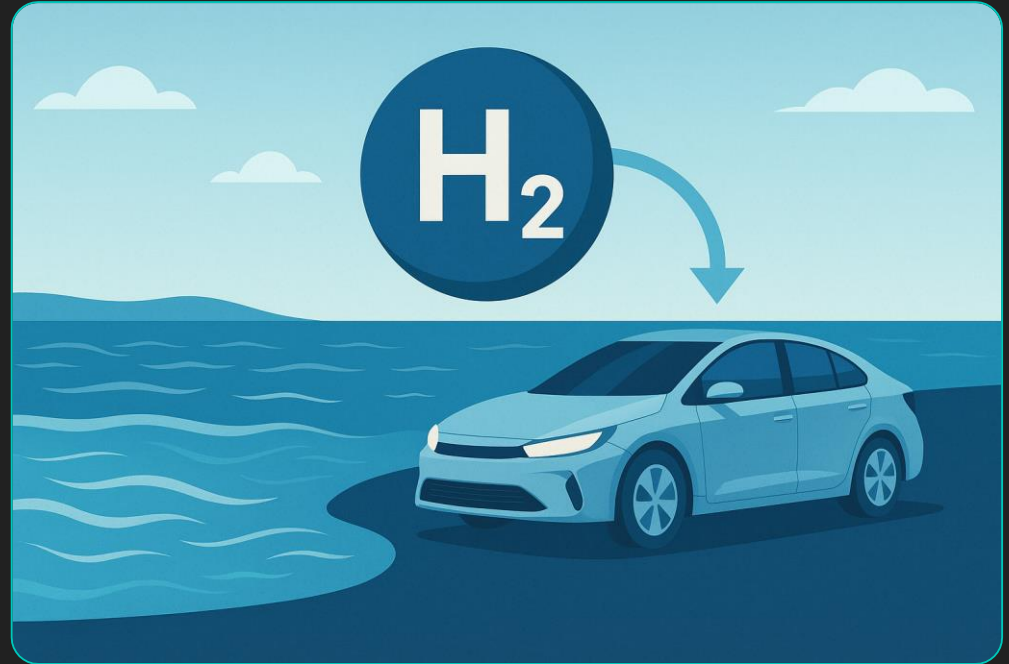
- Humanity has always searched for cleaner energy sources.
- Early fuels like **wood** and **coal** were rich in carbon and produced heavy smoke and CO₂.
- Later came **oil**, **LPG**, and **natural gas**, with **less carbon** and **more hydrogen**, leading to **cleaner combustion**.



Hydrogen The Perfect Fuel

- **Hydrogen (H_2)** is the only fuel that contains **no carbon atoms**.
- When used in combustion or fuel cells, its **only by-product is water (H_2O)** — no CO_2 , no smoke, no pollution.
- Hydrogen exists **in abundance on Earth**, mainly in **water and organic compounds**, and can be produced using **renewable energy**.
- It represents the **final step** in humanity's journey toward **clean and sustainable energy**.

Hydrogen is the fuel of the future — clean, limitless, and truly sustainable

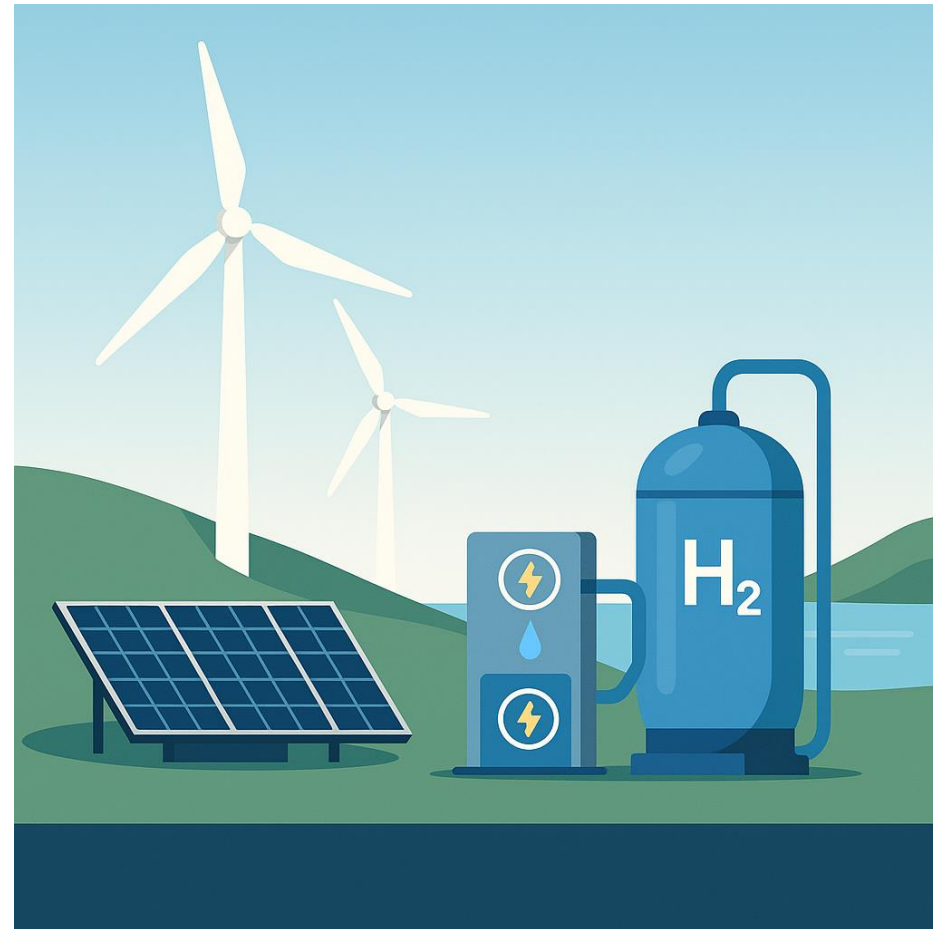


Green Hydrogen

The Perfect Clean Fuel

- When **renewable energy** (from **solar panels** or **wind turbines**) is used to power **electrolysis**, **water (H_2O)** is split into **hydrogen (H_2)** and **oxygen (O_2)**.
- This process produces **no CO_2 emissions** — only pure hydrogen and oxygen.
- The resulting **green hydrogen** can then be stored, transported, or used as a **fuel** or to **generate electricity** again.
- It is **100% renewable, non-polluting, and energy independent** — the **ideal ecological fuel** of the future.

Hydrogen from renewable sources means clean, endless, and truly free energy.

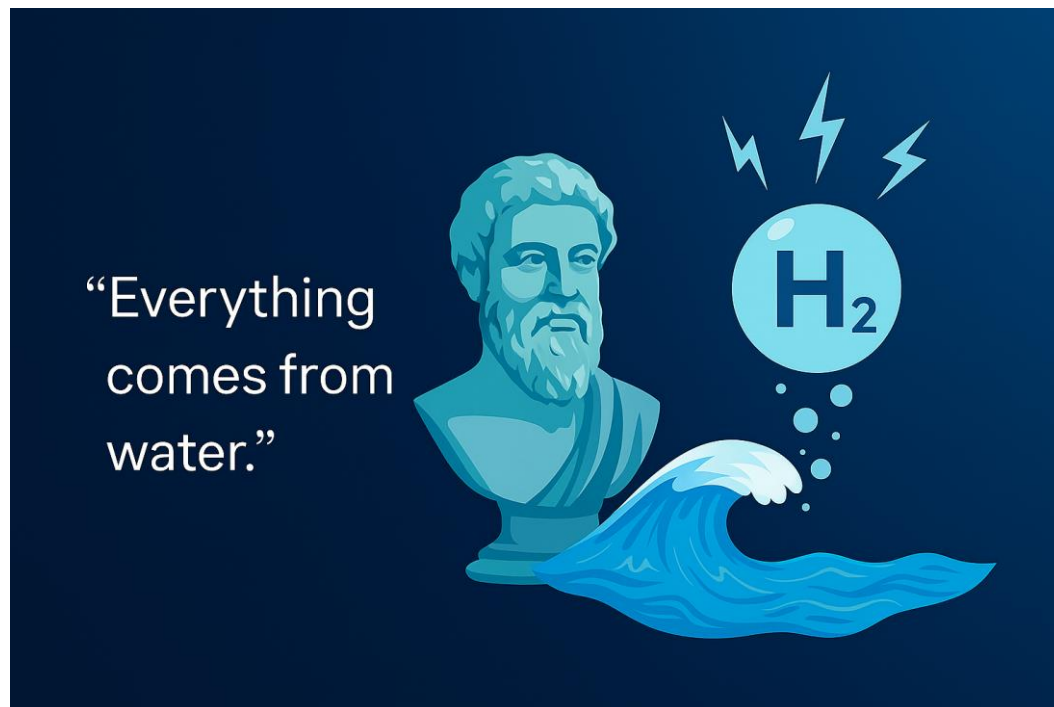


Thales of Miletus (624 – 546 BC)

Greek philosopher, mathematician, and scientist

“Everything comes from water.”

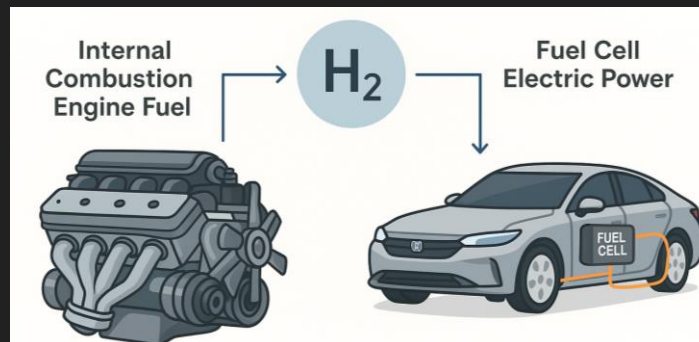
Thales was the first to propose that **water is the origin of all things** — the essential element of life and existence. Today, this ancient idea connects symbolically with **hydrogen**, the clean energy of the future, which is itself **born from water**.



Applications of Hydrogen in Modern Energy

- **Hydrogen is a versatile energy carrier** — it can be used both as a **fuel** and for **electricity generation**.
- In a **combustion engine**, hydrogen burns cleanly, producing only **water vapor (H_2O)** instead of CO_2 .
- In a **fuel cell**, hydrogen reacts with oxygen to **generate electricity** directly, powering **electric motors** with zero emissions.
- This flexibility allows hydrogen to support both **traditional engines** and **future electric mobility**.

Hydrogen bridges the gap between combustion and electrification — clean energy for all technologies.

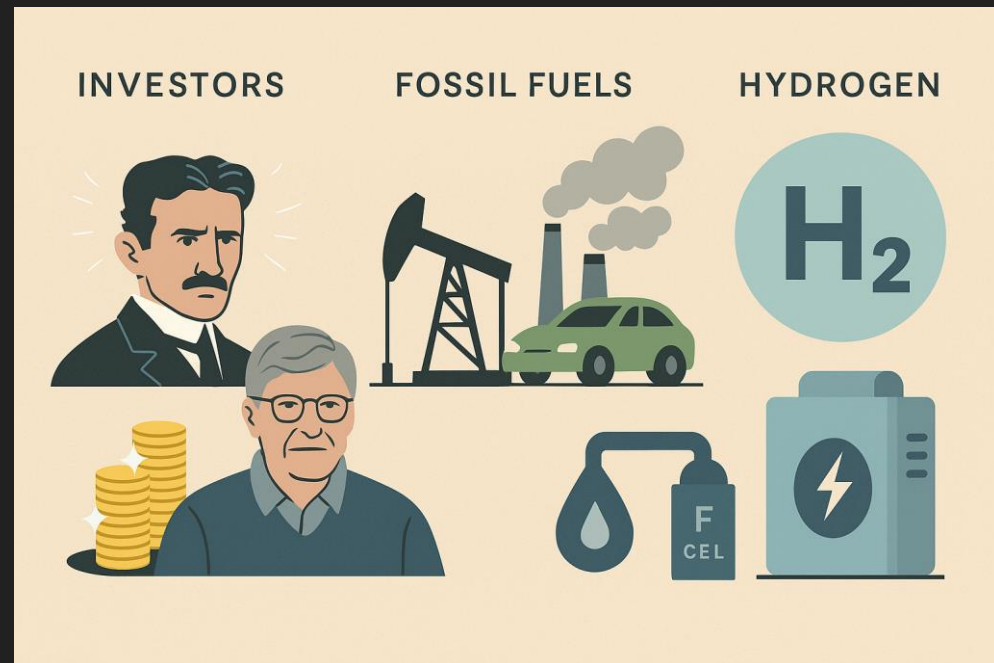


Energy and Power

Nikola Tesla once dreamed of **free energy for all** — but investors asked, *“If it’s free, what do we gain?”*

Even today, major players try to keep **energy production and control** in the hands of a few. Yet **hydrogen** changes the equation: it can be **produced anywhere**, from **water** and **renewable energy**, offering real **independence** and a **clean future** for everyone.

No matter the interests, hydrogen will play a major role in the fuels of the future — clean, endless, and free.



Hydrogen in Technical Professions

Hydrogen will soon become part of many technical fields — and vocational schools must prepare students for this transition.

Applications across technical sectors:

- **Automotive Engineering:** Hydrogen-powered **internal combustion engines** and **fuel-cell vehicles** require new diagnostic, safety, and maintenance skills.
- **Heating and Energy Systems:** Hydrogen can be used in **hybrid boilers, burners, and combined heat and power (CHP)** units — offering carbon-free heating.
- **Mechanical and Industrial Engineering:** New opportunities in **hydrogen production, storage, and piping systems** for energy infrastructure.
- **Electrical Engineering:** Involvement in **fuel-cell integration, electrolysis systems, and hydrogen-based power generation**.
- **Environmental Technologies:** Monitoring emissions, designing sustainable systems, and ensuring **safe handling of hydrogen**.

From Electrification to Hydrogen Innovation

○ The Future of Clean Mobility and Technical Education

○ The Transition

- The world is moving from conventional fuels → to electrification → to **hydrogen fuel cells**.
- Hydrogen complements electric mobility — both share the same goal: **zero-emission transport**.
- Fuel-cell vehicles (FCEVs) combine the advantages of EVs (electric drive) with longer range and fast refueling.

○ The Connection

- Electric mobility paved the way for a new generation of technicians skilled in batteries, power electronics, and high-voltage systems.
- Now, the next step is **hydrogen technologies** — electrolysis, fuel cells, and safe hydrogen storage.
- Both systems coexist and form the foundation of the future **green transport ecosystem**.

The Role of Vocational Education

- As electric and hydrogen technologies expand into transportation, heating, energy systems, and industry, **vocational schools must take action.** They need to:
 - **Update curricula** to include *electric and hydrogen propulsion systems, fuel cells, and renewable energy integration.*
 - **Equip laboratories** for hands-on training with *battery systems, electrolysis, storage, and safety procedures.*
 - **Train teachers and instructors** to guide the next generation of *EV and hydrogen technicians.*
 - **Collaborate with industry and research centers** to keep education aligned with real-world technological progress.
- **The vocational school must become the bridge between green mobility, innovation, and professional skills.**

Conclusions

- The transition to **electric and hydrogen mobility** is not only a technological shift — it is an **educational mission**. Vocational schools stand at the heart of this transformation, shaping the technicians and engineers who will maintain, design, and improve the sustainable vehicles of tomorrow.
- By combining **innovation, training, and environmental responsibility**, education becomes the real driving force behind clean mobility and a greener future.
- **Education fuels the energy transition.**