4. ENERGY EFFICIENCY

Facts about climate-friendly road freight transportation

What's the best strategy for realizing climate-friendly road freight transportation? Let's take a look at the facts.

The International Energy Agency (IEA) has alerted the industry that the materials needed for renewable electricity generation are also at risk of bottlenecks – so there's a direct link between resource efficiency and energy efficiency.

Energy efficiency isn't just at the core of the transformation of transportation; it's the key to the entire economy. All sectors need to transition, and the less energy that's needed, the easier it will be to meet the demand for renewable energy. The IEA therefore sees energy efficiency as the "first fuel": in other words, the lowest-hanging fruit.[1]

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Overhead contact lines (OCLs) and **battery electric vehicles** (BEVs) are both solutions that use electrical energy directly and so they have the highest energy efficiency, with well-to-wheel efficiency of about 73 percent, factoring in the losses in the energy transmission and distribution system and the vehicle.

This puts them in a different league than alternative fuels that have to be made synthetically using electricity. OCL trucks have additional advantages: They use fewer batteries, whose production is energy intensive, and the overall vehicle weight is lower, which reduces energy consumption even more.

OCL trucks have slightly higher wind-resistance when the pantograph is raised; but on the other hand, OCL trucks provide energy directly to the electrical engine, which prevents the losses that occur when energy is passed into the battery and then pulled back out.

Another difference is that OCLs enable **dynamic charging**, which helps prevent the peak loads (in time and space) that strain the grid. To lower the cost of reinforcing the grid, BEVs are likely to have on-site energy storage for buffering, and this requires even more battery materials (see previous article on “Scalability and resource efficiency”); and this means that the electricity used in BEV trucks has passed through two separate sets of batteries before reaching the wheels.

With **fuel-cell electric vehicles** (FCEVs), the energy losses in the production, transportation, storage, and distribution of hydrogen mean that more than twice as much energy is required to power the same truck movement compared with using electricity directly.

For **renewable fuels** (RFs) like e-fuels, the energy required is more than three times higher than the direct use of electricity.[2]

It’s sometimes argued that energy efficiency isn’t so important because surplus renewable energy is sometimes available in Europe for free. However, just because electricity can be free doesn’t mean that the fuels can be made for free, or that the fuels will be available in sufficient quantities.

Production requires a capital investment, and if that investment is to be supported by the very small amount of energy that can be produced using free electricity, the customer price will be higher than if the same investment was used for production during most of the year paying close to the average electricity price.[3]

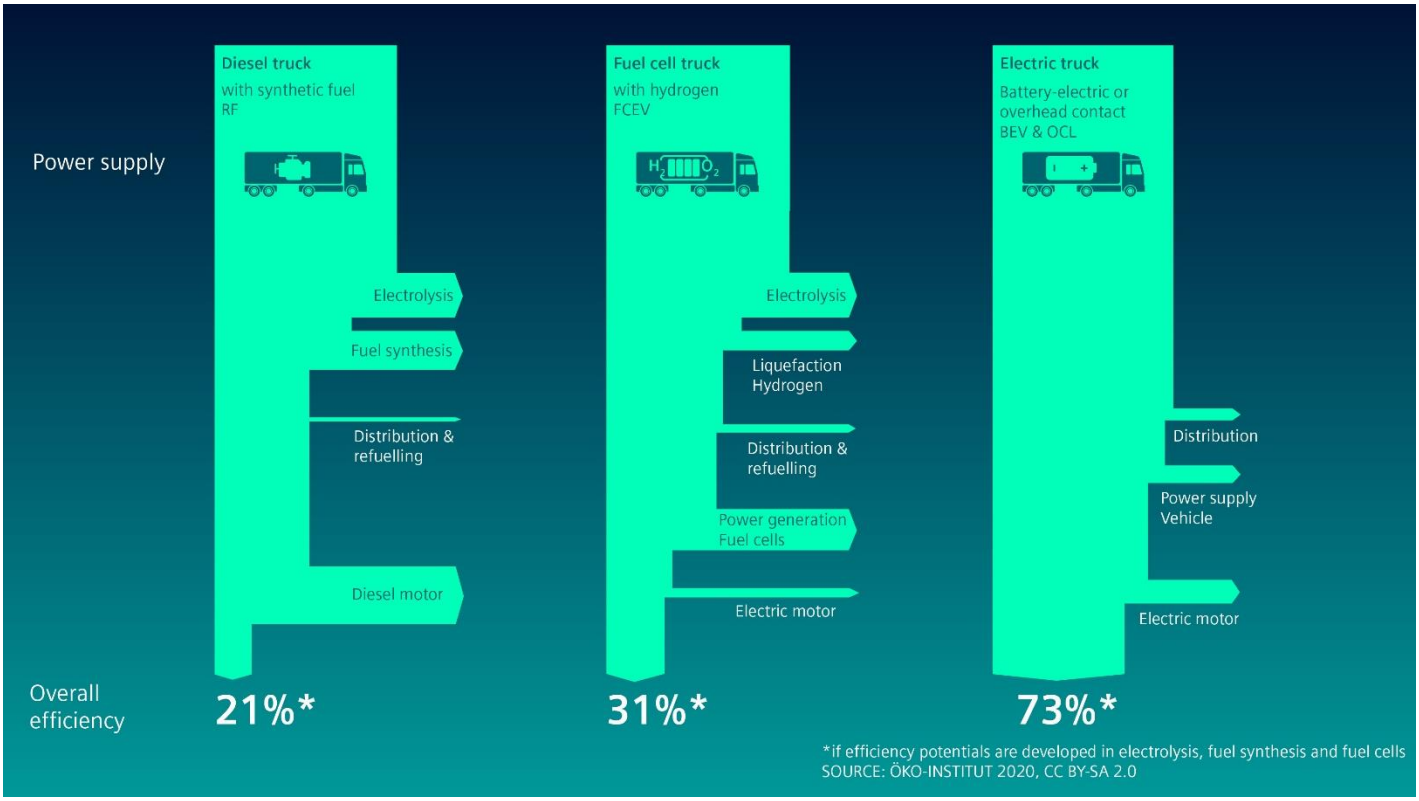
Producing green hydrogen and e-fuels outside the EU has therefore been suggested as the solution. However, the import of green hydrogen is still in its infancy, with just one ship able to transport nine tons of liquid H_2.[4]

Because hydrogen is so light, it’s not very energy-efficient to move it around – which explains why 85 percent of the world’s current hydrogen production is consumed on site.[5]

It’s possible to make ammonia, which is easier to transport, and then transform it back to H_2; but in that case, between 81 percent and 89 percent of the renewable energy is lost in the process.[6] Using electricity directly is up to six times more efficient.

Therefore, the energy efficiency picture is very clear, and it’ll have an impact on the total cost of ownership, as the next article shows.

Climate-neutral, renewable,efficient: electric trucks ahead
Comparison of the efficiencies of various truck propulsion systems [7]



[1] IEA: https://www.iea.org/commentaries/energy-efficiency-is-the-first-fuel-and-demand-for-it-needs-to-grow

[2] Öko Institute: https://www.transportenvironment.org/sites/te/files/Comparing%20the%20costs%20and%20benefits%20of%20different%20technologies%20A%20case%20study%20for%20Germany.pdf

[3] IEA: https://www.iea.org/reports/the-future-of-hydrogen

[4] https://global.kawasaki.com/en/corp/newsroom/news/detail/?f=20191211_3487

[5] IEA: https://www.iea.org/reports/the-future-of-hydrogen

[6] https://www.ammoniaenergy.org/articles/round-trip-efficiency-of-ammonia-as-a-renewable-energy-transportation-media/

[7] Source Öko Institute: https://www.flickr.com/photos/oekoinstitut/49547582532/in/album-72157713144241581/

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