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Efficiency Improvements Must be Holistic

Transport and its modes of transport are currently in a challenging phase of reorganization. New products need to be developed and brought to market in the shortest possible time. These must address requirements such as efficiency, low emissions and sustainability, and be affordable enough to enable individual mobility in the future. In order to meet these challenges, the increase in efficiency is of central importance here. This term should be expanded beyond the standard categorization of technical and economic efficiency to include resource efficiency as well as human efficiency.

The efficient use of resources is one of the central challenges of current development work. The driving factors here include limited resources, geographical distribution and resilience in the constantly growing flow of goods.

This systemic need to increase the efficiency of researchers, developers, producers and consumers (human efficiency) in their actions is also being driven by the growing shortage of skilled labor. The current developments in the field of artificial intelligence have come at the right time.

Most readers are familiar with the concepts of technical and economic efficiency in their daily work. Nevertheless, it is important not to neglect the complementary aspects of

efficiency in order to enable the sustainable development of technologies.

I doing so, many new paths need to be travelled and some paths that have already been travelled need to be revisited, as many things have changed. One example of a new way to reduce the range loss of battery-electric buses and trains in winter could be to carry energy in the form of heat. There are new developments here based on metallic phase change materials (mPCM), which promise high energy density at low cost.

The need to recover the energy used in the compression or liquefaction of hydrogen makes thermoelectrics, for example, a possible solution. Due to the increase in the power density of thermoelectric generators by a factor of more than seven compared to the state of the art, it can be assumed that this technology will make a significant contribution to increasing efficiency in the field of hydrogen-based mobility in the near future.

In order to achieve the ambitious targets in the transport sector, a holistic view of increasing efficiency in general and in the development of components in particular is necessary. Even if new methods such as AI will play a relevant role in increasing efficiency, we must always keep an eye on the people who work with us to achieve this.