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Prepare the Turnaround

The term 4.0 is currently often synonymously used for a characterisation of future technical systems. Hence typical systems with mobile off-road machines are also described in German words with Baustelle 4.0 or Landwirtschaft 4.0. From the origin not less than a technical revolution is meant, the beginning of a new technical era. In my opinion that's quite true, because we are already in these broad-based changes. The development also exceeds beyond the basic meaning of CPS and the creation of integrated functional systems, the Cyber Physical Systems. At least as much revolutionary, people in the future will perceive highly automated or autonomous machine systems on the construction site and in the field. To imagine what will happen, take the chance to visit a modern cow barn, remember the farmer with milk churn and milking stool and now take instead the impression of the autonomously acting of the milking robot. In this kind the technical change on the field and on the construction site will take place.

It must however a further turnaround take place, an energy turnaround. This turnaround is extremely important and essential, challenges the sciences and is pathbreaking. Also manufacturers and research institutes are working on the increase of energy efficiency in various forms. In a current initiative of agriculture and construction equipment manufacturer, to reduce the fuel consumption and CO₂ emis-

sions drastically, the effort in this sector will be intensified once again with dedicated research and development activities.

In addition, especially on the energy issue we will have to work on significant development leaps. Some like to call this Disruptive Development. For the vehicles and mobile machinery in off-road applications with its high performance and long operating times, we are today dependent on internal combustion engines and fuels with high energy and power density. Beyond optimisation that will not change in the short term. But right here the disruption starts, according to the Duden spelling dictionary, the "disturbing" and the conventional "breaking" development.

We have to rethink the questions of fuels and propulsion technologies including the needed infrastructure from the scratch. Some approaches for this already are known and even in some industrial areas in use. For instance, the electric direct supply can be found in underground construction equipment, we know battery electric forklift trucks with charging and battery exchange concepts since decades and there we also find fuel cell drives. And these are only the known approaches. To create such and further systemic solutions for a 4.0-agriculture and construction site together with the mentioned CPS and automation topics are the major research and development challenges of the future.