

Executive Viewpoint

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September 2009

Vehicle Development Insights

By Helmut Wagener
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Economic forecasting is a very difficult proposition. After all, how many advisors can honestly claim to have foreseen the current global economic crisis in its full scale?

And yet, Russian economist Nikolai Kondratieff described 50- to 60-year economic cycles in his 1925 book, *The Major Economic Cycles*, based on his study of 19th century price behavior. He was convinced that a long term order of economic behavior existed and could be used to anticipate future economic trends.

From steam and cotton to steel and railroads in the 1800s; electricity, chemicals, petrochemicals, automobiles in the 1900s; and now the age of information technology, those Kondratieff cycles have produced waves of economic boom and bust that have been relatively predictable, at least in hindsight. And those cycles predicted an economic collapse occurring between 2003 and 2009.

The current economic situation is hard to assess. However, as Kondratieff illustrates, it is possible to systematically and scientifically identify global trends that will affect our business in the coming decade. At Bosch Rexroth, we have been preparing for the emergence of worldwide trends that we believe will dramatically impact our industry and the design and functionality of mobile equipment.

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Climate Change

Roland Berger Strategy Consultants estimate that today's global market volume for technology to protect the environment is \$1.4 trillion, and is expected to grow to \$3.1 trillion by 2020. Technology aimed specifically at climate protection could have a market size of \$2.4 trillion in 2020.

As we work hard to meet Tier 4 regulations, legislators in many countries are tightening the emission requirements for exhaust gases and noise. Meeting these new guidelines will require a delicate balance of engine management, auxiliary units, working hydraulics and travel drives - as more installation space is needed for the diesel engine and its peripheral elements like exhaust gas recirculation / selective catalytic reduction (EGR/SCR) and particulate filters.

We are certain there will be no sudden replacement of the diesel engine in the near future. Rather, we'll see a further optimization in energy efficiency and fuel consumption for off-highway vehicles, as well as on-road commercial vehicles and passenger cars. As a result, we can be sure diesel engines are here to stay, at least for the immediate future. Rexroth, being a part of the Bosch Group, is the only supplier in this industry who is fully immersed in diesel engine technology and can offer a portfolio of electronically controlled hydraulics for the travel drive as well as the implements. We are convinced that this synergistic approach has much to offer OEMs as they strive to meet Tier 4 requirements.

System hydraulics need to become smaller, but must still accomplish as much as before, and even more. To achieve even greater efficiencies, designers of mobile machines are turning to hydraulics for other functions like fan drives and cooling modules that are being mounted further away from the diesel engine, and thus need

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an alternative to direct drive of the fan impeller. Innovative solutions from gearbox technology, hydraulics, and intelligent electronics present new opportunities that will help to meet emission limits and provide greater energy efficiency, now and in the future.

In addition, hydraulic hybrid solutions will become extremely important over the next decade in reducing energy consumption in vehicles with frequent start-stop movements of the travel drive as well as the implement hydraulics. Some of the likely concepts, such as the Hydrostatic Regenerative Braking (HRB) system from Rexroth, are not brand new, but now their time has come - making crucial contributions to improving overall system efficiency. The HRB can achieve a 25 percent reduction in fuel consumption while decreasing maintenance costs and emissions. Hydraulic hybrid solutions such as HRB are ideal for a market driven by factors such as cost, energy, function and environmental responsibility. In fact, Rexroth's parallel version of the HRB is currently undergoing field testing with the New York City Department of Sanitation on their refuse vehicles.

Demographics and Scarcity of Resources

By 2020, we can expect a global population of 7.5 billion, with continued stresses on the global climate and economy. At one level, having so many more people will be good for construction. But the changes needed to clothe, educate, and feed all those people are almost staggering. Much of the economic stress we are experiencing now is the result of these changing demographics, as underdeveloped countries begin to compete with developed countries for capital and material resources.

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The greater awareness about the scarcity of resources is making people recognize the need to use those resources more wisely. That awareness extends to the mobile equipment market, where machines must operate more efficiently and avoid costly downtime. To help our customers achieve their uptime utilization goals, Rexroth is actively researching condition-monitoring solutions, putting On-Board-Electronics (OBE) on axial piston units, which can become the foundation (or the “missing link”) for true condition-monitoring within the system.

The intelligent combination of hydraulics, gearbox technology and digital control electronics with sophisticated software opens considerable potential for new - and even for some already existing - machine concepts. It is not always necessary to reinvent the wheel to achieve drastic improvements. For instance, many ag tractors are now using power-split technology. If we successfully adapt that concept for construction vehicles (which have significantly different requirements) then this alone has the potential to shake this sector thoroughly.

Diesel Hydraulic Control (DHC) is another promising concept that could improve efficiencies considerably by integrating control for all the relevant drivetrain elements. DHC allows the diesel engine to communicate with the hydraulics (via the CAN bus) creating an overall control strategy. With that kind of control, for example, we can maximize the time the engine runs at its optimal RPM. Once again, our unique position as a hydraulics company with extensive knowledge of diesel technology through the Bosch Group enables Rexroth to make such bold strides in improving overall efficiency

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The Engineering Opportunity: Sustainable Manufacturing

All of these trends might be categorized under one umbrella concept: Sustainability. As manufacturers, we must develop *manufacturing solutions* that are sustainable both for companies and workers, that promote the health of individuals and societies. As a result, we will be under increasing pressure to protect our environment, making better use of scarce resources, and meeting the needs of growing, increasingly diverse populations.

At Bosch Rexroth, we view these changes as opportunities, not threats. And we believe that the solutions for many of these concerns will come from engineers.

Photos and Captions:



Helmut_Wagener.jpg



A4VG-OBE.jpg

Putting On-Board-Electronics (OBE) on axial piston units can become the foundation for true condition-monitoring chains of information.



Fan-Drive.jpg

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BE-13-07_Bus-map_en.jpg

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Rexroth_NYC_Hydraulic_Hybrid_Vehicle_Launch.jpg

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