



# Moving closer

STAGE BEING SET FOR E-TECHNOLOGIES TO MAKE MAJOR INROADS INTO VEHICLES AND EQUIPMENT.

BY MIKE BREZONICK

## ALLISON TRANSMISSION

Indianapolis, IN

[www.allisontransmission.com/ev-solutions](http://www.allisontransmission.com/ev-solutions)

### PRODUCT LINE

Hybrid transmissions and electric axles for medium- and heavy-duty vehicles

### NEW PRODUCTS

Allison Transmission has been supplying hybrid electric transmissions for municipalities and fleets since 2003. Now the company is taking its hybrid propulsion capabilities to the next level with the development of the Flex EV electric hybrid, which is engineered to provide enhanced capabilities and electric propulsion without having to invest in fully electric vehicles.

Flex EV is an electric hybrid system that offers a purely electric range of up to 10 miles (16 km), EV propulsion up to 35 mph, offers zero-emissions, and engine-off capability. It is targeted toward transit bus, coach, and any operation in zero-emissions zones or depot operation. The system utilizes a two-mode split parallel architecture – a pure mechanical path and a pure electrical path – that Allison said achieves the high energy efficiency, which enables regenerative braking and reduced brake maintenance, while achieving

Fast forward 41 years and diesel engines remain at the heart of myriad machines. Yet at the same time, it's becoming clear that another power option – electrification - is on the horizon.

How near or distant that horizon might be remains to be seen, as only a handful of e-machines have actually moved from the test cell to the jobsite. Even hybrids, the stepping-stone to full electrification, has yet to make much of a dent in any market.

But there is no questioning the tremendous amount of development work going on, in on-highway vehicles, particularly medium-duty trucks and transit, shuttle and school buses, as well as compact off-highway equipment and marine applications. Some of the heavy lifting is being done by OEMs, such as Daimler and Volvo, fierce, global competitors that have nonetheless teamed up in an effort to bring fuel cell technology to heavy-duty trucks.

There is also a growing supplier base, bringing a range of electrification components – batteries, motors, controls, fuel cells, hybrid technologies, etc. Some are large global manufacturers, already familiar for engines and other powertrain technologies. Others are new names, even startups, seeing new opportunities.

What follows is a first crack at getting our arms around that new supplier base – who the players are and what they're offering (or working on) concerning electrification. Many of them might not be household names yet, but it's likely we're going to get a lot more familiar with them as time goes on.

NPP

maximum ratings of 330 hp (246 kW).

Allison Transmission is also expanding its presence in the electrified vehicle sector with the AXE series of electric axles for trucks. Rated up to 536 hp (400 kW), AXE series axles are designed to efficiency and remove a potential point of failure by eliminating the traditional hypoid gear. A bolt-in solution compatible with most vehicle frames, suspensions and wheel ends, the AXE series axles incorporate fully integrated electric motors, a two-speed gearbox, oil cooler and pump. The two-speed transmission

provides high starting gradeability and highway cruising, Allison said, as well as up to

a 10% efficiency improvement over single-speed alternatives.

E-axles in the Allison Transmission AXE electric axle series are designed to replace conventional axles in Class 7 and Class 8 trucks with minimal chassis variation and have already been evaluated for use in vehicles over 88,000 lb. gcw. The axles can be applied with all-electric, fuel cell or combustion engine series hybrid applications.

## BAE SYSTEMS

Endicott, NY

[www.gettozero.com](http://www.gettozero.com)

### PRODUCT LINE

Hybrid, battery, and fuel cell electric



Allison's AXE e-axle.

# to mainstream

propulsion system for trucks, buses and marine applications

## NEW PRODUCTS

BAE Systems has been a global provider of heavy-duty hybrid and all-electric propulsion systems for more than 20 years and has developed multiple system configurations to meet different operating requirements.

On the commercial vehicle side, the company has unveiled its Series-EV battery electric power and propulsion system for transit buses. The system is based on the company's Dynamic Drive Traction Motor (DDTM) 100 and 200 and energy storage system. The DDTM 100 is rated 161 hp (120 kW) continuous and 260 hp (195 kW) peak with a maximum torque output of 1575 lb. ft. (2100 Nm). The DDTM 200 is rated 215 hp (160 kW) continuous and 270 hp (200 kW) peak with a peak torque output of 3650 lb. ft. (4950 Nm).

The company also offers an electric power and propulsion system for fuel cell vehicles, the Series-H, where electric power for propulsion and bus accessories is provided by a hydrogen fuel cell and the energy storage system.

BAE Systems also offers two hybrid bus powertrains, the Series-E electric hybrid and Series-ER electric range hybrid. Both utilize the DDTM with an Integrated Starter-Generator (ISG) and provide engine start-stop that reduces engine idling when the bus comes to a stop. The Series-E electric hybrid uses a 1 kWh ultracapacitor for energy storage. The Series-ER electric hybrid, which uses a 32 kWh battery for energy storage, allows for electric vehicle operation in green zones that can be programmed according to each transit agency's specifications, BAE Systems said.

## MARINE TECHNOLOGY

BAE Systems' HybriGen systems, available in multiple configurations, builds on the

company's core hybrid and electric drive technologies to reduce emissions and fuel consumption of marine vessels. The systems are available in different versions to meet application requirements.

HybriGen Power and Propulsion targets passenger and cargo transportation vessels and is engineered to provide both electric propulsion as well as electric auxiliary power using on-demand technology. The vessel's engine teams with an integrated starter-generator (ISG) to provide electricity. Power is distributed throughout the system either to the AC Traction Motor (ACTM) for propulsive loads, to the Accessory Power System (APS) control for shipboard functions or to the lithium-ion-based Energy Storage System (ESS).

The system is modular and scalable, BAE Systems said, and provides complete redundancy for the vessel. It is also available with a hydrogen fuel cell to replace the combustion engine while maintaining the same overall system architecture.

BAE Systems' HybriGen Assist propulsion system is designed for vessels such as tugboats and windfarm support vessels. It is engineered to provide low-speed electric propulsion as well as provide a boost to the combustion engine in situations requiring high power.

The HybriGen Assist system has four operating modes. In electric mode, generators supply power to electric motors for propulsion and power to the vessel distribution panel for hotel loads. In mechanical mode, the vessel's diesel engines provide propulsion, while generators handle shipboard power loads. In the optional power generation mode, the engines provide power for propulsion, while AC motors generate electricity sent to the ESS, which supplies electricity for ship's power. In the optional electric boost mode, it provides a boost of

power to the engines for propulsion.

HybriGen Power and Propulsion and HybriGen Assist each can reduce fuel consumption and emissions, reduce engine wear and provide a significant increase in total vessel horsepower, BAE Systems said.

The last HybriGen system, HybriGen Power, incorporates a generator run off the front of the engine to provide between 30 to 300 kW for auxiliary power. Developed for towboats and fishing fleets, it can replace a separate auxiliary generator set, the company said.

## BALLARD POWER SYSTEMS



Ballard's eighth-generation FCmove fuel cell.

Vancouver, BC, Canada

Tel: 604-454-0900

[www.ballard.com](http://www.ballard.com)

## PRODUCT LINE

PEM fuel cell systems for buses, commercial trucks, trains, marine vessels, passenger cars, forklift trucks and UAVs

## NEW PRODUCTS

In mid-2019, Ballard Power Systems, one of the pioneers of mobile and stationary fuel cell development, introduced the FCmove-HD fuel cell module, an eighth-generation high-performance system specifically designed to meet the requirements of transit bus operators. The first in what the company

called a new family of heavy-duty products, the 70 kW FCmove modules are 30% lighter and utilize 50% fewer components than previous systems. The future FCmove products will offer various power outputs to suit a broad range of commercial vehicles including trucks, coaches and trains, Ballard said.

**NEW ORDERS**

In late May, Ballard Power Systems signed a non-binding Memorandum of Understanding (MOU) with consortium partners to establish the H2OzBus Project, which will involve the evaluation and deployment of fuel cell electric buses (FCEBs) for use in public transit in Australia.

As a consortium member: Ballard will supply fuel cell systems for integration into FCEBs; ITM Power plc and BOC, a subsidiary of Linde plc, will provide hydrogen production and refueling infrastructure; Transit Systems will operate the vehicles as part of its daily urban transit operations; and Palisade Investment Partners will assist in providing funding and strategic financial oversight for the H2OzBus Project. In the first phase of the H2OzBus Project, consortium members will collaborate to investigate infrastructure requirements and develop detailed plans for deployment of 100 fuel cell electric buses (FCEB) on routes in up to 10 central hub locations across Australia.

**BONFIGLIOLI USA**

Hebron, KY  
Tel: 859-334-3333  
www.bonfiglioli.com

**PRODUCT LINE**

Electric wheel and travel drives, drum drives, complete electric powertrains for forklifts, access and aerial platforms, material handling machines, agricultural and forestry equipment, construction equipment, truck mixers, airport vehicles, light road vehicles, compact equipment

**NEW PRODUCTS**

Bonfiglioli, which has more than 40 years of experience in electromobility – its first electric transmission for material handling was launched in 1976 – has developed an



**Bonfiglioli's 700TE swing drive.**

extensive range of electric drive technology. Most recently, the company has launched two new products that target mini excavators from 1.0 to 6.0 tons.

The 700CE series track drives incorporate an electric motor with a planetary drive into a single, compact unit engineered to withstand harsh operating environments. The 700TE swing drive also uses a permanent magnet motor and gearbox, and both units include an electromagnetic parking brake, as well as speed and temperature sensors.

Each of the new components leverage the electric motor's internal permanent magnet technology and concentrated stator winding, which result in a compact and durable motor, Bonfiglioli said.

A complete electric powertrain dramatically improves the efficiency of the machine and provides extended maintenance intervals, resulting in a lower total cost of ownership, the company said. The electric motors have also been specifically designed to match the requirements of both the track drive and swing drive functions while fitting the space available, thus minimizing the need for modifications to the excavator frame.

**BORGWARNER INC.**

Auburn Hills, MI  
Tel: 248-754-9600  
www.borgwarner.com

**PRODUCT LINE**

High voltage coolant heaters, high voltage air heaters, 48 V motor/generators, electric drive modules, e-turbos and boosters, turbine generators,

**BorgWarner's High Voltage Hairpin (HVH) 146 motor.**



fuel cell air supplies, inverters dc/dc converters, battery modules, battery chargers

**NEW PRODUCTS**

BorgWarner has expanded its electric motor offerings with the introduction of a new High Voltage Hairpin (HVH) 146 motor. The motor joins BorgWarner's family of patented HVH Series motors, available as fully housed motors or rotor/stator assemblies. Flexible by design, HVH Series motors come in a variety of configurations and offer scalable output and torque, the company said.

Initially launching on a light-duty hybrid passenger vehicle, BorgWarner said the HVH 146 also can be applied to the commercial vehicle market. It provides a peak torque of 47.9 lb. ft. (65 Nm) as well as 95% peak efficiency, along with a maximum output of 35 kW.

Designed for easy integration, the HVH Series incorporates a precision-formed rectangular wire and multiple layers of interlocking "hairpins" in place of the traditional round wire windings. This proprietary wiring method, along with the size of the wire and water cooling, enables the motor to achieve higher power density and efficiency, the company said.

**BOSCH REXROTH**

Electric Drives & Controls  
Hoffman Estates, IL  
Tel: 800-739-7684  
www.boschrexroth-us.com

**PRODUCT LINE**

Electric motors, inverters, gear systems, control software

**NEW PRODUCTS**

Bosch Rexroth has unveiled the first products in its future electrification portfolio, including a new 700 V motor line that will be available

in low- or high-speed versions, two frame sizes and different length and winding configurations to accommodate various power classes.

Frame size 1, with an outer radius of 5.1 in. (130 mm), delivers continuous

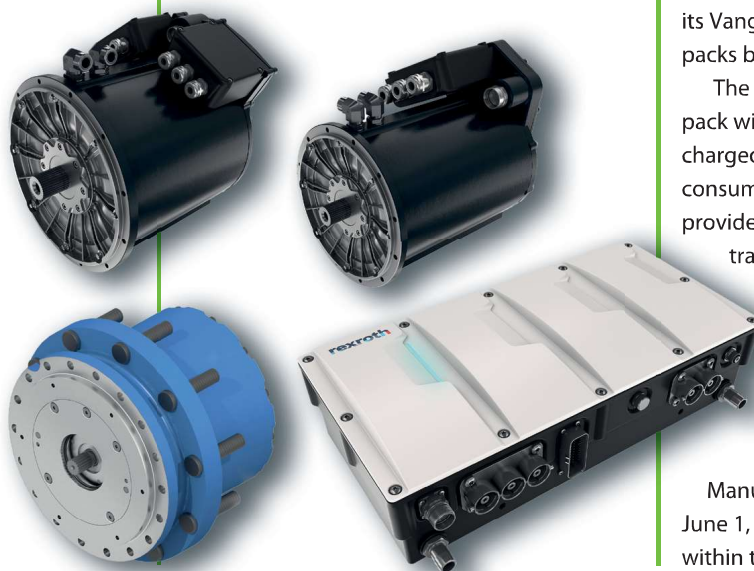
power of up to 75 kW, with a high-speed version delivering up to 180 kW. Frame size 2 has an outer radius of 7.87 in. (200 mm), with the most powerful variant capable of achieving 250 kW.

The new inverter portfolio includes several housing sizes and supports both 700 V and 400 V systems with motors up to 250 kW. The inverters can be supplied with 12 V or 24 V and are equipped with high voltage connectors for safe wiring, the company said.

The new eGFT 8000 line of travel gears rounds out the mobile equipment electrification portfolio. In combination with an electric motor, Bosch Rexroth said the compact gearboxes create a space-saving drive unit for mobile equipment.

The eGFT8000 compact three- or four-stage planetary gearbox incorporates an integrated multi-disk parking brake and has been aligned with Bosch's SMG180 electric motor. Delivery of the gearbox and motor together as one drive unit

**Bosch Rexroth's electrification components.**



results in logistical advantages for machine manufacturers, with straightforward installation, the company said.

Applications with a high driving-mode share, such as pick and carry material handlers, do not have to be elaborately redesigned for use with electric motor. The newly developed compact gearbox also does not require any extra installation space compared to conventional hydrostatic gearboxes, as the outer gearbox geometry is identical to that used in Bosch Rexroth's established line of GFT 8000 travel gears.

## BRIGGS & STRATTON

Vanguard  
Milwaukee, WI  
Tel: 414-259-5333  
[www.vanguardpower.com](http://www.vanguardpower.com)

### PRODUCT LINE

Modular 2.5 kWh, 5 kWh and 10 kWh lithium-ion batteries, battery management controls, battery chargers

### ELECTRIFICATION NEWS

Briggs & Stratton Corp. announced a new strategic supply agreement with Ingersoll Rand to power Club Car's Fleet golf cars with its Vanguard Commercial lithium-ion battery packs beginning this month.

The adoption of the Vanguard battery pack will enable the Fleet golf car to be charged two times faster reduce energy consumption, require zero maintenance and provide a longer service life compared to traditional lead-acid batteries, Briggs & Stratton said.

As a result of this new agreement and other rapidly increasing demand, Briggs & Stratton Corp. said it has opened a new Advanced Battery Manufacturing facility in Tucker, Ga. As of June 1, four production lines are operational within the new 78,000 sq. ft. facility,

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[www.vink-chemicals.com](http://www.vink-chemicals.com)

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**VINK**  
CHEMICALS



**Briggs & Stratton Vanguard  
Commercial battery for Club Car.**

which the company said has capacity to accommodate future growth. This facility is in addition to the current production space located in Milwaukee, Wis., which will serve as a product development site.

#### **DISTRIBUTION NEWS**

Kraft Fluid Systems, the Cleveland, Ohio-headquartered distributor of hydraulic equipment and electric drive solutions in the Midwest, has been named the first ever full-line Vanguard commercial lithium-ion battery authorized distributor in North America. Kraft will sell and service the full product line of lithium-ion batteries designed for battery powered off-highway vehicles.

## CATERPILLAR INC.

Peoria, IL  
Tel: (309) 675-1000  
www.cat.com/engines

#### **PRODUCT LINE**

Production hybrid systems and concept hybrid and electric drive systems for construction machinery

#### **ELECTRIFICATION TECHNOLOGY**

Caterpillar showed its C18 hybrid concept at ConExpo as the next step in the company's electrification roadmap.

The C18 hybrid combines the Cat C18 diesel engine rated 800 hp with a hybrid motor/generator. Together, the system can deliver as much as 1400 hp, and the system offers significant opportunity for low-noise, zero emissions operation.

Caterpillar said it is looking "beyond the iron" in terms of electrification for the construction industry,

**Caterpillar's C18 hybrid concept.**

focusing on reducing the investment cost to equipment owners and providing an affordable solution that is economically sustainable.

Caterpillar has long experience with machine electrification, as it has operated diesel-electric machinery in mining for decades and more recently, develop hybrid and all-electric construction machines. The D6 XE dozer uses a high drive electric drive, while the 988K XE wheel loader, introduced in 2017, uses a generator, inverter and motor in place of a torque converter and transmission.

Caterpillar also has shown an all-electric concept version of its 906M loader powered by a sealed 41 kWh lithium-ion battery and dedicated high-torque electric motors. On a fully charged battery, the concept machine could be operated up to 4.5 hours in a medium-duty application and up to 6.5 hours with a one-hour charge.

## CUMMINS

Columbus, IN  
Tel: 800-286-6467  
www.cummins.com/electrification

#### **PRODUCT LINE**

Electrified power technologies and products, including battery electric powertrains for buses, light commercial vehicles and medium-duty trucks; PEM and alkaline hydrogen generators for industrial processes, fueling stations and MW scale energy storage; hydrogen fuel cells for vehicles, stationary power and rail applications

#### **CORPORATE NEWS**

Cummins made several strategic moves recently, one of which was to change the

name of its operating business dedicated to electrification. The Electrified Power Business Unit was renamed New Power to reflect a broader alternative power offering, including electrified power and fuel cell and hydrogen technologies.

The hydrogen technology portfolio was boosted by Cummins acquisition of fuel cell and hydrogen production technologies provider Hydrogenics Corp. of Canada. That was followed by a pair of investments in another Canadian company, Loop Energy, a provider of fuel cell electric range extenders for medium- and heavy-duty transport applications.

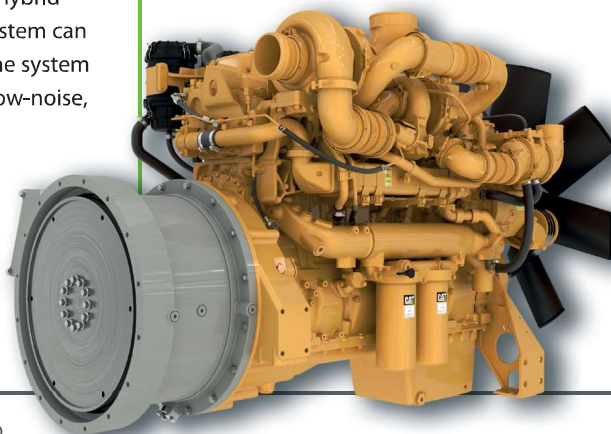
Cummins also announced a memorandum of understanding (MOU) with Hyundai to jointly evaluate opportunities to develop and commercialize electric and fuel cell powertrains. The new powertrains are expected to be developed by combining Hyundai's fuel cell systems with Cummins' electric powertrain, battery, and control technologies. The initial development is focused on the North American commercial vehicle market, including working with North American OEMs.

#### **NEW APPLICATIONS**

Cummins also expanded its lithium-ion battery portfolio to include low-voltage packs that include its BM2.0E, BM4.4E and BM5.7E batteries that power material handling applications, up to high-voltage, energy-dense battery systems incorporating its BP35E, BP39E and BP74E batteries that target buses and trucks.

The high-voltage units were part of a new battery electric powertrain developed in cooperation with bus manufacturer Gillig. The new 40 ft. buses utilize a direct-drive traction motor with peak torque of 2582 lb. ft. (3500 Nm) operated by Cummins batteries and controls. Big Blue Bus in Santa Monica, Calif., received the first bus in August of 2019 and has subsequently ordered 18 additional battery electric buses.

Cummins also developed a heavy-duty truck demonstrator with fuel cell and battery electric power. The zero-emissions Class 8, 6x4 day cab tractor is suitable for vocational applications, including regional haul, urban delivery operations, port drayage



and terminal container handling. The truck includes a proton exchange membrane (PEM) fuel cell from Hydrogenics.

The truck was designed for 90 kW fuel cell and is scalable in 30 kW or 45 kW increments up to 180 kW and has 100 kWh lithium-ion battery capacity, the company said. The truck has a range of 150 to 250 miles between refueling, but that range can be extended with additional hydrogen tanks, increasing the tank storage pressure or installing additional fuel cells to optimize management of the vehicle load factor, Cummins said.

Many of the critical components of the powertrain, including the PEM fuel cell, system controller, powertrain controls, wire harnesses and junction boxes, among others, were designed and developed by Cummins.

## DANA INC.

Maumee, OH

[www.dana.com/e-mobility/](http://www.dana.com/e-mobility/)

[www.danatm4.com/](http://www.danatm4.com/)

### PRODUCT LINE

Batteries, motors, controllers, thermal management systems, e-axles or transmissions, complete drivelines

### ON-HIGHWAY

Dana has recently begun production of its Spicer Electrified eS9000r e-Axle for Class 4 and 5 commercial vehicle applications. The e-Axle will be available for ordering by truck and bus manufacturers in the third quarter.

Designed for medium-duty truck and bus applications, the e-S9000r is based on the established Spicer S110, S111 and S130 rear drive axle platforms, and is engineered as a fully integrated e-axle, including a gearbox

and motor. The eS9000r can be incorporated into most existing chassis, Dana said, reducing driveline complexity while allowing batteries to be located between the frame rails to simplify truck body positioning.

Engineered as a drop-in solution for existing suspensions, the eS9000r e-Axle includes the patent-pending electronically controlled parking pawl system designed to eliminate the need for an external solution on vehicles without a traditional transmission. Utilizing a water glycol-cooled Dana TM4 Sumo LD motor and Dana TM4 CO150 inverter, the axle offers maximum power of 318 hp (237 kW) at 650 V dc, which delivers a grade startability of 20%, the company said. System weight, including disc brakes, is 815 lb. (370 kg).

Dana has also collaborated with several truck manufacturers, including Kenworth and Peterbilt, on electric vehicle development. The Kenworth K270E/K370E and Peterbilt 220EV medium-duty trucks are equipped with a Dana-designed e-Powertrain system that is fully integrated and upfitted to the chassis. Configured as a direct drive system, the vehicles utilize a Spicer Electrified e-propulsion system and a standard Dana drive axle and driveshaft. Dana also supplies an e-power system that generates, stores and manages the energy for the vehicle, utilizing an onboard charger and two battery packs. Dana-developed software and controls enable the diagnostics and telemetry of the complete system.

The electric powertrains offer range options between 100 and 200 miles, Dana said, and the high-energy density battery packs can be recharged in about an hour using the vehicle's dc fast-charging system.

### OFF-HIGHWAY

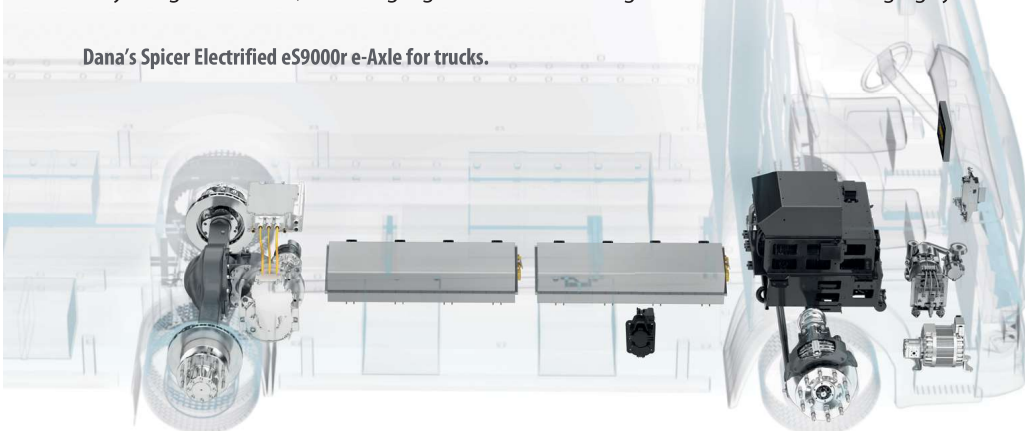
Dana has used its lineup of motors, axles, inverters, and controls to provide electrified propulsion systems engineered to fit within established vehicle architectures in several product categories.

Leveraging its Spicer Electrified e-Axles and the Spicer Electrified e-Gearbox engineered to manage high input speed, provides superior power density and improve mechanical efficiency, the company has developed a powertrain for telehandlers with load capacities up to 6600 lb. (3000 kg). The system also incorporates the Spicer Smart Suite Intelligent Load Monitoring System (ILMS), which uses patented and proprietary data-harvesting technologies across the vehicle to supply intelligent calibration management and estimate axle attitude. It can alert the operator of potential tipping situations, reduce the risk of vehicle breakdowns, improve productivity, and enhance the long-term serviceability of drive systems.

Dana is also collaborating with JLG to develop a Spicer Electrified e-Axle as part of JLG's electrification initiative. The e-Axle concept combines Spicer axle components and drive and motion intelligence, SME motor and control technologies, and gearing in a modular package that can be fine-tuned for vehicle size and performance, the company said.

Dana has also developed electrified versions of its Spicer Torque-Hub wheel drives for field sprayers. The drives provide 8100 to 19,000 lb.ft. (11,000 to 26,000 Nm) of torque, but use high-performance electric motors from Dana's portfolio rather than the conventional hydraulic motors.

Dana's Spicer Electrified eS9000r e-Axle for trucks.



## DANFOSS EDITRON

Longmont, CO

Tel: 303-682-4900

Email: [sales.uqm@danfoss.com](mailto:sales.uqm@danfoss.com)

[www.danfoss.com/en/about-danfoss/our-businesses/power-solutions/danfoss-editron/](http://www.danfoss.com/en/about-danfoss/our-businesses/power-solutions/danfoss-editron/)

### PRODUCT LINE

Electric motors (permanent magnet synchronous or synchronous reluctance)



assisted-permanent magnet) from 30 to 6000 kWm, converters, traction systems, fuel cell compressor systems,

#### COMPANY NEWS

Danfoss Editron has opened a new in-house testing laboratory at its Lappeenranta, Finland, headquarters, following a multi-million euro investment. The facility will conduct electromagnetic compatibility (EMC) and environmental tests, to certify the quality of the company's drivetrain systems.

Introducing in-house facilities will allow the company to test its systems and machines at an earlier stage of the manufacturing process than ever before, Danfoss Editron said. It will also enable potential issues to be identified earlier in the product development process.

The laboratory has dedicated EMC and environmental testing chambers, which can perform radiative immunity, radiative emissions and electrostatic discharge tests, automotive immunity checks magnetic field immunity and conductive emissions assessments to international and European standards.

The facility also contains electronic loads and a high-power direct current power source, along with dust test, salt mist, climatic test and walk-in chambers. Testing undertaken in the laboratory will take between a few hours and several months.

#### NEW ONLINE TOOLS

Danfoss Editron has released two new online tools to its growing digital portfolio. The tools are the first of their kind to be available free to the public, the company said, and are intended to help to increase the ease and pace of electrification.

An online calculator tool has been

**Danfoss Editron's new online 3D configurator.**

developed to enable the dimensioning of drivetrains for fully electric or hybrid heavy-duty vehicles. Users input the size of their machine and the calculator automatically works out the system architectures required.

Danfoss Editron's new 3D configurator enables users to design their own electric or hybrid vehicle and customize it to their individual requirements. Various application types and sizes are available to choose from, while different system components such as drivetrains, battery packs and converters are also listed. Users are also able to see the benefits of their configurations compared to conventional hydraulic solutions in areas such as fuel consumption and productivity.

Tailored versions of all of Danfoss Editron's online tools will be available to Danfoss Editron's sales team, as well as selected distributors and partners.

### DELTA-Q TECHNOLOGIES

Vancouver, British Columbia, Canada  
Tel: 604.327.8244

<https://delta-q.com/>

#### PRODUCT LINE

Battery chargers for lithium-ion batteries and lead acid batteries

#### NEW PRODUCTS

Delta-Q Technologies has launched a new sealed onboard battery charger targeting floor machines, pallet trucks, mobile elevating work platforms (MEWP), outdoor power equipment and e-mobility applications.

The new RQ350 is a 350 W battery charger for lithium-ion and lead acid battery chemistries. Designed for global applications, the unit incorporates CANbus (CANopen and J1939) communication that allows for BMS controlled charging as well as vehicle and telematics system integration, the company said.

Available in four (12, 24, 36 and 48 V) models, the RQ350 charger is cased in an IP66-sealed die cast enclosure designed to tolerate harsh application environments. LED indicators are used to communicate charging status, errors and faults. It is field programmable with as many as 25 charge profiles that can be selected at the push of

a button, the company said. It also offers overvoltage protection from the AC line and is compliant to a variety of worldwide regulations such as UL, FCC B/CISPR-14 and UNECE R10, the company said.

Delta-Q said the RQ350 also benefits from the company's extensive library of validated charge profiles that can be specified for each charger. In addition, like Delta-Q's IC Series unit, charger cycle data can be downloaded and new charging profiles can be updated by the OEM or end user.

### DEUTZ CORP.

Norcross, GA

Email: [info.usa@deutz.com](mailto:info.usa@deutz.com)

Website: [www.deutzamericas.com](http://www.deutzamericas.com)

#### PRODUCT LINE

Hybrid and all-electric drive systems for mobile off-highway equipment

#### NEW PRODUCTS

While maintaining its diesel and gaseous fuel engine portfolio, Deutz has spent around \$100 million on developments and acquisitions in electrification over the past several years and some of its most recent e-innovations on display at ConExpo.

Among the examples was an all-electric JLG G5-18A telescopic handler concept, which was developed by Deutz in collaboration with JLG. The powertrain incorporates a compact 360 V, split drive system comprising two 40 kW electric motors – one for machine propel functions and one for driving the hydraulics in the telescopic arm. Power is from a 42 kWh battery and the system includes a 6.6 kW charging system that can charge the battery to 80% capacity within four hours, the company said.

Deutz also displayed a diesel electric hybrid system designed for use in aerial working platforms in low-load applications. The new system incorporates a 1.2 L, three-cylinder Deutz diesel engine combined with a 48 V electric motor/generator.

The company also presented a battery system from Futavis, which was acquired by Deutz in 2019. Hundreds of the systems have been built and Deutz said it is ready for pilot production.

## EATON

Southfield, MI  
www.eaton.com

### PRODUCT LINE

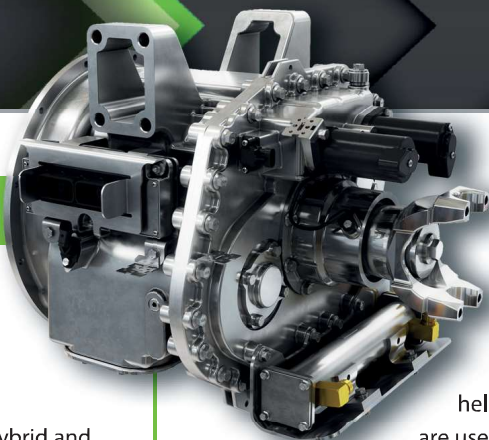
Fuses, supercapacitors, power distribution units, dc/dc converters, on-board chargers, hybrid and battery electric vehicle transmissions for medium- and heavy-duty applications, 48 V regenerative accessory drive system for heavy-duty trucks

### NEW PRODUCTS

Since it created its eMobility business unit in mid-2018, Eaton has continued to grow its product line for electrification. Among the most recent additions are a new four-speed transmission for heavy-duty electric vehicles, along with new power distribution and circuit protection products.

The new transmission, designed for Class 7 and 8 commercial vehicles, has been tested by major OEMs and is set to debut in 2022. The new unit joins medium-duty two- and four-speed transmissions that are currently in production with several OEMs, Eaton said.

The transmission addresses what the company called the primary issue related to single-speed drives: contradictory requirements for high efficiency at top speeds and increased torque at launch



Eaton's new EV transmission.

and low speeds.

Fine-pitch helical gears

are used to deliver smoother, low-noise

operation, while the Eaton Transmission Control Unit's shifting strategy is designed for fast gear changes and maximum efficiency, which extends range and battery life, the company said.

The transmission is based on traditional layshaft architecture typical of AMTs but is designed specifically for electric commercial vehicle applications. The new four-speed EV gearbox does not have a clutch and shifts are synchronized using the traction motor. It also operates at higher speeds than its traditional internal combustion gearbox counterparts and gears are optimized for typical electric motor performance and power curves for maximum efficiency, the company said.

Also new is a Flex Power Distribution Unit (PDU) for high-voltage electrified commercial vehicles that Eaton said is uniquely designed to handle multiple load requirements. Eaton said it reached an agreement with Cummins Inc. to supply elements of the Flex PDU,

which it said reliably distributes power and keeps the vehicle and occupants safe while protecting power electronics from short circuits, crash events and other electrical system faults.

For each output channel, the high-voltage Flex PDU offers isolation detection, voltage and current sensing, precharge functionality, high-voltage interlock, circuit protection and switching capability. It also provides diagnostic information to the OEM via CAN, including where the most power is being consumed to maximize performance and efficiency. The Flex PDU is scheduled to go into production by 2021.

## FLASH BATTERY

Reggio Emilia, Italy  
Tel: +39 (0)522 906035  
Email: info@flashbattery.tech  
www.flashbattery.tech/

### PRODUCT LINE

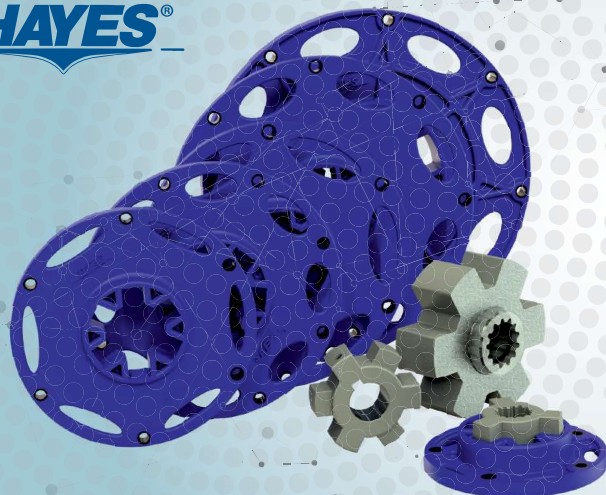
Custom-built lithium-ion batteries for aerial platforms, airport ground support equipment, construction and agricultural machinery and marine vessels

### BATTERY TECHNOLOGY

Founded in 2012, Kaitek Srl said it has developed more than 315 different battery

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**HAYES®**






## HEX-FLX

*Proven design & quality.*

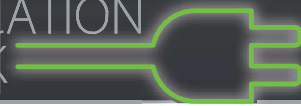
*HEX-FLX flywheel couplings provides high torsional stiffness, handles high shock loads and adapts to various series of standard SAE Flywheels. Hayes HEX-FLX is an industry standard in the OEM off-highway market.*

### OEM products includes:

-  Aerial Lifts
  -  Skid Steers
  -  Excavators
- ...and much more!







**Kaitek's lithium-ion Flash Battery packs.**

configurations and has more than 8000 batteries above 10 kWh operating in 54 countries. Its batteries utilize Li-Fe-PO4 lithium, which the company said is the safest and most stable lithium chemistry and can deliver more than 4000 charge cycles.

In addition, the company said its Flash Battery brand provides active and passive cell balancing that is 20 times greater than standard lithium batteries, which translates to a 20-fold decrease in equalization time, maintaining cells balance even when the battery is well into its life cycle. The batteries also offer high energy density, fast partial charge acceptance – 50% in 30 minutes, the company said – and zero maintenance.

All of the company's batteries are monitored through a data center, proprietary software designed to daily monitor the usage of each installed battery and deliver information and warnings directly to the company's service department.

## FPT INDUSTRIAL

North America  
New Holland, PA

Email: [braden.cammauf@cnh.com](mailto:braden.cammauf@cnh.com)  
[www.fptindustrial.com/](http://www.fptindustrial.com/)

### PRODUCT LINE

Hybrid power solutions with diesel engine and e-flywheel, Cursor X Power Source Concept that can combine natural gas, battery-stored energy, and hydrogen fuel cells

### NEW PRODUCTS

FPT Industrial recently launched its F28 Hybrid engine, which combines a 2.8 L diesel engine with an e-flywheel. The engine delivers a maximum power of 74 hp (55 kW),

while the electric motor adds 26 hp (20 kW) of continuous power and as up to 30 40 hp (30 kW) peak power.

At Distributed Power Europe (DPE) 2019 last year, FPT Industrial presented a zero-emissions system for a 300 kVA diesel-hybrid mobile generator set, in cooperation with Energy Rental, SICES SrL and Riello UPS.

The system integrates two high-efficiency UPS modules with two high-performance battery systems – which may be charged by a conventional external line or by renewable sources – and an FPT Industrial 8.7 L Cursor 9 engine compliant with the latest EU Stage 5 emissions standards.

The hybrid gen-set is intended mainly for use during entertainment, fashion and sporting events. The new system incorporates a remote monitoring device with geolocation and data transmission via App and supervision software, keeping the user informed in real time about the whole system's operating status and any criticalities.

## HORIBA

Automotive Test Systems  
Ann Arbor, MI

[www.horiba.com/en\\_en/products/by-segment/automotive-test-systems/](http://www.horiba.com/en_en/products/by-segment/automotive-test-systems/)

### PRODUCT LINE

Measurement instruments and test stand solutions for component, subsystem and vehicle validation and verification, R&D and engineering services for electric components and powertrains

### NEW PRODUCTS

Horiba has developed a range of e-motor test stands that have mission-specific designs for 48 V engine electrification to over 1 MW for complete vehicle traction systems. From buses with e-axes to yard haulers with fuel cells, the Titan e-powertrain test suite is engineered to use real-world application data to validate the powertrain in its development, calibration, and durability assessment.

Horiba also specializes in electrification component testing. Fuel cell components ranging from a single cell to a 250 kW stack can be researched and developed,

the company said. Similarly, batteries from individual cells to large battery packs up to 1100 V/1000 amps can be cycled to simulate in-service use and fast dc charging and are evaluated with electro impedance spectroscopy under various thermal conditions found in heavy-duty applications. To meet specific development initiatives, a portable 48V battery cyler / emulator or a multi-channel charge/discharge unit up to 1MW is available.

Horiba also offers numerous engineering services for battery pack development and complete vehicle electrification.

## JOHN DEERE POWER SYSTEMS

Waterloo, IA

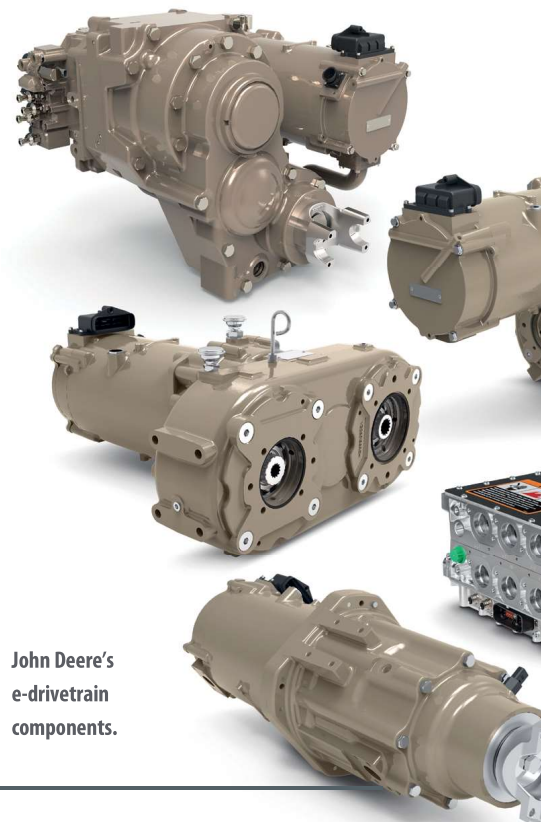
Email: [jdengine@johndeere.com](mailto:jdengine@johndeere.com)  
[www.JohnDeere.com/electrification](http://www.JohnDeere.com/electrification)

### PRODUCT LINE

Single and three-speed electric motors drives, electric pump drives, generator pump drives, single and dual inverters

### NEW PRODUCTS

The newest products from John Deere Electronic Solutions (JDES) made their North



**John Deere's e-drivetrain components.**

American debut at ConExpo. The company said it has leveraged more than 1.5 million hours of electrification experience in the field – it was among the first to introduce electric drive technology in construction equipment with its 644K and 944K hybrid wheel Loaders – to develop electric drivetrain components able to take on the extremes of off-highway applications.

The EMD-100 drive system combines an interior permanent magnet (IPM) electric motor with a single-speed inline gearbox to deliver 135 hp (100 kW) and 2950 lb. ft. of torque (4000 Nm) at 2400 rpm. The EDM-300 uses the same IPM teamed with a three-speed inline gearbox to provide maximum output torques of 3100 lb.ft. (4200 Nm) at speeds up to 4500 rpm.

For machine applications combining electrification and hydraulics, JDES has developed the EPD-200 electric pump drive. Driven by an IPM rated up to 268 hp (200 kW), the pump drive can deliver maximum output torque of 650 lb. ft. (881 Nm) per pad at speeds up to 3000 rpm. It can accommodate SAE B, C and D pump mounts or splines, with flange shaft or key shaft output options.

The GPD-200 generator pump drive can be used to drive hydraulic pumps or generators. It utilizes an IPM rated up to 268 hp (200 kW) and provides a maximum output torque of 650 lb. ft. (881 Nm) per pad at speeds up to 3000 rpm. The generator drive has a maximum input power of 700 hp (522 kW) and input torque of 1250 lb. ft. (1695 Nm).

JDES components are teamed with the PD400 and PD280 power inverters that can be also used in conjunction with a variety of motor manufacturers for both traction and electric accessory applications. The JDES product line also includes a family of displays designed to allow for easy human-machine interface through tactile buttons or capacitive touchscreen technology.



## LOOP ENERGY

Burnaby, British Columbia, Canada

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### PRODUCT LINE

Hydrogen fuel cell power systems for medium- and heavy-duty vehicles

### FUEL CELL TECHNOLOGY

Loop's core patented technology is the eFlow fuel cell, which the company said is a radically new approach to fuel cell architecture that delivers higher power density while still using off-the-shelf, mass-produced membrane electrode assembly (MEA) components. The use of industry standard materials to allows Loop to scale quickly and eliminate much of the supply chain risk, while at the same time maintaining the potential to further improve performance by leveraging the latest MEA materials coming to the market, the company said.

In addition, Loop said eFlow's ability to deliver a targeted amount of power with as little as 50% the typical number of cells in a fuel cell stack translates into a very significant cost advantage over traditional fuel cell architectures. eFlow's ability to pack a high amount of power in a small volume footprint is also important for integration in space-constrained applications, including under the hood of Class 8 trucks.

### CORPORATE NEWS

Cummins has made two investments in Loop Energy over a six-month period. Following the first investment in September 2019 and Loop's achievement of technical milestones, Cummins made a second investment in the company in March 2020.

### APPLICATION NEWS

In April, Loop and its joint-venture partner in China – InPower-Loop Energy Technology (Beijing) Co. Ltd – received a purchase order from a bus manufacturer in China to support the Nanjing municipal government's objective of replacing its existing 7000-unit battery electric bus fleet with an improved battery-hydrogen hybrid alternative. The multiple-unit range extender order represents the start of a long-term commercial agreement with a total estimated value of

approximately US\$15 million over a three-year period.

## MAHLE

Farmington Hills, MI

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www.us.mahle.com

### PRODUCT LINE

E-waste heat recovery systems, fuel cell air filtration, humidifiers and thermal management systems, fuel cell exhaust systems, fuel cell controllers, low voltage drive systems, high voltage electric motors, mild hybrid drive systems

### ELECTRIFICATION NEWS

A longtime supplier of key commercial vehicle technologies such as pistons, cylinder and valve components, engine cooling systems, air, oil and fuel management systems and electronics, Mahle has more recently pursued a dual strategy of optimizing its combustion engine products while at the same time developing a broad range of electromobility solutions.

Mahle has developed what it calls a "holistic system portfolio for fuel cells," which consists of air and thermal management technologies as well as power electronics.

The company has engineered a new high-efficiency filter media for fuel cell air filtration that is designed to separate solids, potentially damaging gases such as SO<sub>2</sub>, O<sub>3</sub> and NO<sub>x</sub>, as well as particulates and oils, from fuel cell airflows.

As the water balance of a polymer electrolyte fuel cell can significantly affects efficiency and service life, Mahle has also teamed with affiliated partners and with funding from the German Federal Ministry of Economics and Technology, to create a flat membrane humidifier engineered to ensure that air supplied to the fuel cell is properly humidified reliably.

Fuel cell systems incorporate more complex cooling systems, as thermal management is needed for fuel cell stacks, batteries and electronics and electric motors. Mahle has developed production solutions for the control and monitoring of temperature of batteries, power electronics