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Hybrid - the new buzz word

One of the buzz words at the moment on any engine powered product - from cars to access platforms - is hybrid. But as with the word 'Turbo' in the 1970s and 1980s which was added to everything from aftershave to sunglasses, it is being applied to a variety of different solutions to improve fuel efficiency and emissions.

In the crane and access sector the number of 'hybrid' machines continues to grow. Several manufacturers now produce hybrid booms, scissors, spiders and truck mounted platforms including JLG, Genie, MEC, Holland Lift and Versalift. There are even cranes with hybrid drives such as the Spierings City Boy.

But what is a hybrid machine or drive?

A generally accepted definition of a hybrid vehicle is one that uses a mixture of power or fuel sources together with other mechanisms to capture and re-use energy. This may include:

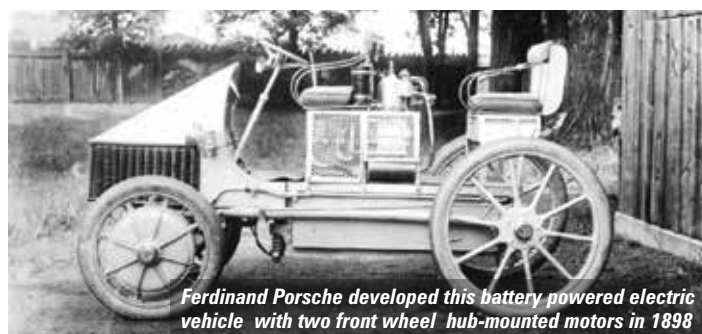
- Hybrid electric which uses both a traditional internal combustion engine and an electric battery motor/generator to provide motive force and energy recovery.
- Hydraulic hybrid which employs both a traditional internal combustion engine and a hydraulic motor/pump to provide motive force and energy recovery system.
- A dual mode hybrid vehicle which uses power from two sources of the same type
- Flexible-fuel vehicle, a hybrid vehicle which can use more than one type of liquid fuel for its internal combustion engine (commonly petrol/LPG or petrol/alcohol or petrol/ethanol)

Like most engineering ideas the hybrid was developed way before you would ever imagine. Among the first hybrid designs was a system introduced in 1900 by Belgian car maker Pieper, which used a petrol engine to charge the batteries at cruising speed and then combined both the petrol engine and under-seat electric motor to accelerate or climb a hill.

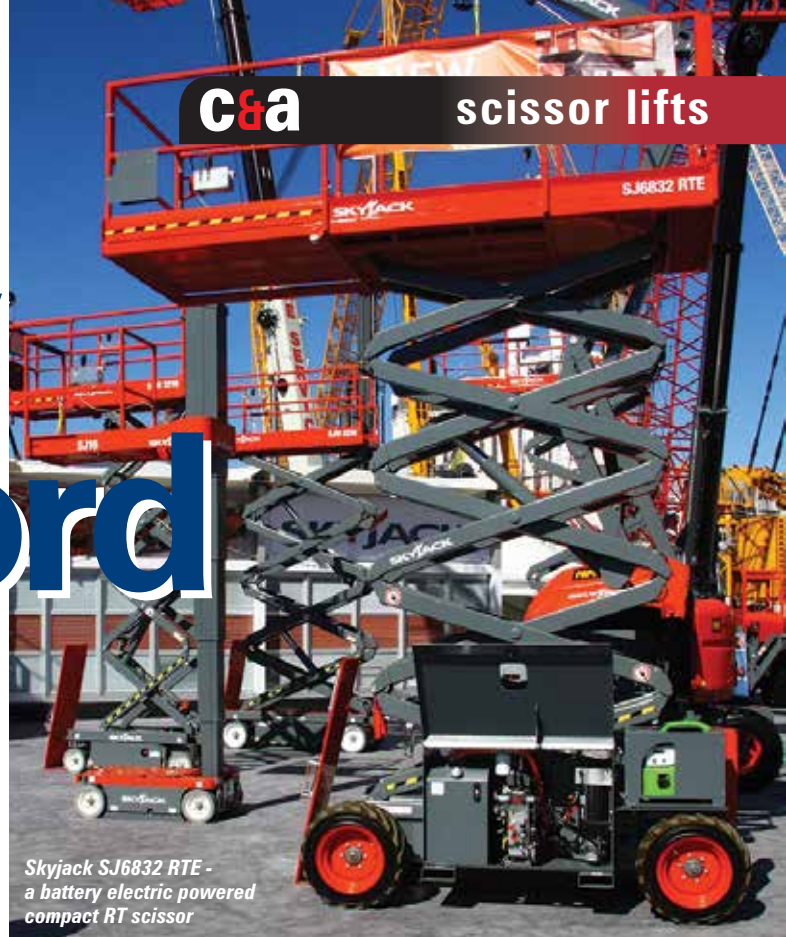
Possibly even earlier - around 1898 - Ferdinand Porsche developed a two wheel drive, battery powered electric vehicle with two front wheel hub-mounted motors. A later version - a 'series hybrid' - used hub-mounted electric motors in each wheel, powered by batteries and a petrol generator.

While hybrid power systems were used throughout the 20th century they tended to be restricted to automotive products - cars, trucks and buses - primarily to overcome concerns about environmental damage/global warming.

In the access equipment sector it was roughly 100 years (in the late



Ferdinand Porsche developed this battery powered electric vehicle with two front wheel hub-mounted motors in 1898



Skyjack SJ6832 RTE - a battery electric powered compact RT scissor

1990s) after Porsche's development that the system found its way into machines such as Niftylifts Bi-Energy HR12 and a petrol generator fitted to Economy slab electric scissor lifts by European importer Kranlyft. A few years later UpRight took this a step further by fitting a diesel powered generator to it LX electric Rough Terrain scissor lifts and AB38 boom lifts, both of which featured direct electric drive hub motors. The idea of an electric powered Rough Terrain scissor lift was not taken up by others and never widely adopted. Until now that is.

But why bother with electric/bi-energy?

The internal combustion engine is a major source of air and noise pollution, while diesel engines are facing constant pressure to meet ever tighter emission standards. On top of this the electric motor is far more efficient than a combustion engine, particularly

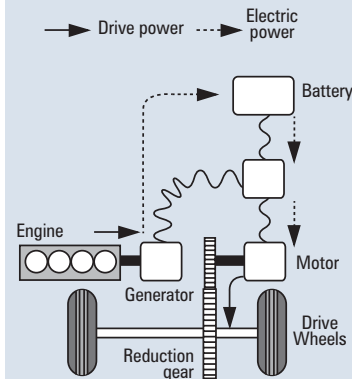
when regenerative energy can be captured. Electric and bi-energy development has also been helped by improved electric drive technology and lower component prices. They are also more environmentally friendly with zero emissions - at least at the point of use - and low noise, which for access equipment means being able to work indoors and during the night without causing problems.

The three types of hybrid system

Series hybrid

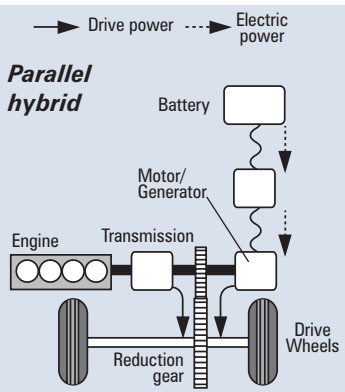
In this system the power to the wheels always comes from the battery to the drive wheel motors and/or hydraulic pump. A small engine and generator can be started - either manually or automatically - to supply electricity to charge up the batteries as they are depleted.

Series hybrid



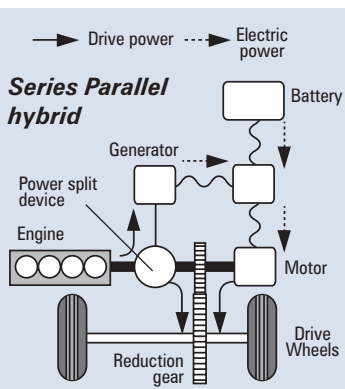
Parallel

In a parallel hybrid system, the power can come from either the engine or the electric motor, depending on the prevailing conditions. For example when inside you will want to use electric power, but when maximum traction or long distances are to be covered, you use the diesel engine, which can also top up the batteries. Some will recognise this as the 'true Bi-Energy' systems adopted by Niftylift and then Genie on their boom lifts in the 1990s.



Series/parallel hybrid system

For many the series/parallel system is the 'true hybrid' in that not only can the two power sources power the machine independently, but they can also be combined to provide maximum power for situations such as driving up steep grades or through heavy mud. This allows a smaller, more fuel efficient engine to be used without compromising on maximum power output. Smaller engines are often excluded from having to meet the latest emission standards, or meet them more easily. In this system the engine can often also run a generator to top up the batteries. The Niftylift and Holland Lift hybrid systems work in this manner with the diesel engine running the main electric motor which drives the hydraulic pumps, the motor can also be used as a generator to top up the batteries remotely.



For manufacturers the substantial and ongoing engineering investment required to meet new emission levels every few years, not to mention the increased costs and maintenance requirements of the more sophisticated engines makes a hybrid solution increasingly attractive. The lower prices and improved specification of the latest electric drive motors have also encouraged manufacturers to switch to one form of hybrid drive or another, as has the superior efficiency, power and braking direct electric drive offers. By adding a small diesel power pack you have the very best of both worlds in terms of performance, while overcoming the high cost of engineering a new engine installation.

Some would say that these diesel recharging packs currently seen on some scissor lifts are not 'true' hybrids, although this is a similar debate to the different Bi-Energy systems of the 1990s. Some units do have what they call a 'hybrid setting', which allows the system to monitor the charge in the battery pack and then start the diesel motor automatically when the batteries reach a certain level of discharge, in order to top them up. There is also an 'always off' switch, so that the engine has to be started by the operator, preventing it kicking in automatically while working indoors, or an 'always on' position, useful when working outside and when the batteries are in need of being topped up when no mains power is available. The key to the effectivity of these recharging hybrids is whether the batteries can be topped up while the machine is being operated, and whether the topping up can match the power being drawn. If not then this is definitely not a full hybrid. The UpRight LX and AB38 machines for example had a line contactor that cut battery charging while a machine function was being operated. So that driving long distances with the engine running was only adding noise and heat to the situation, rather than any power.

Niftylift hybrid system

Niftylift was one of the first manufacturers to launch a true hybrid platform - not on a scissor lift of course - but on one of its articulated booms. The system



The Nifty HR28 Hybrid uses a series/parallel hybrid system

uses a diesel engine coupled to an electric motor in a series/parallel fashion. The company has for a long time produced bi-energy machines - electric and diesel, and it is this concept that has evolved into its far more efficient hybrid offering. The system uses a much smaller three cylinder diesel engine than would usually be needed for the size of machine, reducing fuel consumption by up to half. The engine can power the machine completely independently, however for maximum tractive effort the electric motor kicks in to top up the power flowing to the hydraulic wheel motors. The electric motor can also be used independently in exactly the same way as a full battery electric machine, and a full size battery pack is included.



Nifty HR21 hybrid drive system.

When the diesel engine is being used on its own it also turns the electric motor into a generator to recharge the battery pack up to 40 percent faster than standard mains power, taking just four hours for a full recharge. This means it can potentially work 24 hours a day, using the electric motor to work quietly at night and then re-charge during the day-shift while running on diesel.

The Niftylift hybrid technology power pack also incorporates an advanced exhaust purification system, greatly reducing Carbon Monoxide, Hydro-Carbons and particulates as well as reducing noise emissions.

Holland Lift hybrid

Holland Lift launched its hybrid

scissor last year and appears to be quite similar to the Niftylift series/parallel system. Holland Lift's two power sources - an electric and diesel engine - both power the hydraulic pumps which power the lift and steer functions as well as the hydraulic wheel motors. Holland Lift says that its customers only need maximum power around 10 percent of the total working time, so a single power source, has to be designed to deliver this maximum power, even though it is not needed for 90 percent of the time. By using the series/parallel system, the two power sources combine for maximum power, allowing the use of a smaller engine and motor, making it substantial more efficient.



Holland Lift's new hybrid scissor was launched at Apex



Discussing the benefits of the Holland Lift system

Full hybrid soon?

Niftylift has been followed by JLG, Genie and MEC all of which have introduced 'hybrid' power systems on booms and/or scissor lifts. These tend to use an even smaller diesel engine with a generator and an electric motor which can combine to provide the machine's maximum



JLG claimed its H340AJ was the world's first true four wheel electric drive hybrid boom. It uses an independent electric drive motor in each wheel

tractive effort with the engine and its generator on these systems inputting current directly into the machine's power system, rather than running through the batteries. This allows the use of electric hub drive motors adding to power and efficiency.

JLG hybrid system

A year ago JLG launched the 34ft H340AJ articulated Rough Terrain boom lift claiming it was the world's first true four-wheel electric-drive hybrid boom. The unit combines a Tier 4 diesel engine with a generator for recharging/topping up the batteries. Traction comes from four independent electric drive motors on each wheel.

A similar system is used on JLG's hybrid scissor - the 12 metre working height, 1.75 metre wide M3369LE - initially aimed at the Australian market. The two wheel drive scissor uses two DC electric wheel motors and a 4.5kW Kubota diesel engine powering a Mechron rotary 55 amp charger to top up

the battery pack, when the voltage drops below a prescribed level, as well as recharging on the go. The M3369LE can also be upgraded to four wheel drive but when this is done the rear wheel DC electric drive is augmented by front wheel hydraulic drive.

JLG has said that it now intends to extend its hybrid boom range at Intermat and you can be sure that further scissor lift models will also follow.

Genie regenerates



Genie's 69E and BE scissor lift ranges are similar to the JLG system but also include regenerative braking, so that as the machine brakes, slows down or runs downhill the wheel motors generate power which is used to top up the battery pack. This principle could also be applied to the lift function, so that when the platform descends under gravity it generates power - although it would be interesting to see how much power this generated.



The JLG M3369LE uses two DC electric wheel motors and 4.5kW Kubota diesel charging the battery pack.



The Genie 69E and BE scissor also has regenerative braking

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MEC launched the compact electric 3772RT in 2008

MEC pioneers

One of the most significant product development trends for scissor lifts in the past few years has been compact electric Rough Terrain units. This has largely been pioneered by MEC which launched the 3072 and 3772 models in 2008.



MEC's range of hybrid machines were launched last year.

Last year the company introduced a range of hybrid - diesel/electric - power packs for its other compact RT scissors and Speed Levels, adding to that available on its Crossover Electric 4wd Series. It now offers the option on all of its electric powered 4x4 scissor lifts. The option utilises an on-board smart generator that has three different modes for self-charging:

Automatic Mode - the machine constantly monitors the state of charge of the battery pack and when it falls beneath a pre-determined level the generator automatically turns on and charges them while the machine is in use, once the batteries are fully charged the generator shuts off.

Manual Mode - the engine is always off unless the operator decides that he needs to use it, such as when the batteries are low or he

is driving over some distance and does not want to drain the batteries. This mode is also need for working indoors or in sensitive areas.

Manual Self-Charging Mode - the machine can be moved outside, and the generator started manually to charge the batteries shutting off once the batteries are fully charged. MEC says that performance on its electric powered Quad-Trax 4wd drive system almost matches its diesel powered models, and that users can get a full day of use from a single charge. The elimination of both noise and emissions has made them increasingly popular with end users. Users of MEC electric RTs have the option of transferring the power pack from machine to machine as needed, if they order their machines with a Smart Kit.

Skyjack updates

In mid-2014 Skyjack made the decision in Europe to equip all of its electric powered scissor lifts with the motor control system that it introduced in its SJ12 and SJ16 vertical mast lifts - possibly becoming the last manufacturer to do so? The advantages include significantly improved battery life, more precise control and reduced noise levels. More significantly Skyjack has also introduced a battery electric powered compact Rough-Terrain scissor lift, the SJ6832 RTE which it claims is the first unit of its size with crossover symmetrical four-wheel drive and 45 percent gradeability as standard. The diesel powered generator option adds versatility allowing it to be used at green field construction sites where no AC



A MEC Crossover scissor



AC wheel drive motors from JLG and Genie



Rival launched its own version of an electric JLG boom at Apex



Part of the Holland Lift hybrid system



The 12m JLG 3369LE

power is available, or when multiple shifts do not allow sufficient downtime to complete a standard re-charging cycle. The generator can either be manually controlled from the platform or set to come on automatically when the batteries fall below 50 percent of charge.

Electric advantages

Another trend in electric and hybrid scissor lift is increased use of brushless AC drive motors, with the latest compact sealed hub motor versions offer an even more efficient direct electric drive system. When

combined with an automatic battery top-up system or sealed batteries maintenance is significantly reduced.

However for end users, the main advantages of electric/hybrid powered lifts are the fact that they can be used both indoors and out, with substantially lower fuel costs and refuelling time, with reduced noise. It also allows a machine to stay on site for the duration of a contract saving on delivery and collection costs.

Innovation and quality the key to success

Eline Oudenbroek took over as Managing Director of heavy duty scissor lift manufacturer Holland Lift around 18 months ago, following its acquisition by ProDelta Investments - the investment group which also owns Hovago and other equipment rental companies. For the last thirty years, Holland Lift has designed and developed scissor lifts with the world's highest platform heights. So what plans has the new managing director got for Holland Lift? Cranes & Access finds out.

A chemical engineer by profession, Oudenbroek has spent a lot of her career working with machinery and large milling and turning machines, although Holland Lift is her first experience of working for an equipment manufacturer. She took over from interim management that stepped in when shareholder/director Menno Koel and ProDelta agreed to part company shortly after the takeover. Since joining Holland Lift Oudenbroek has made some significant changes, as well as defining a new strategy for the future.

"The most important change has been to reposition the company, to concentrate on developing larger models, whilst striving to further improve the products' strength and quality," she says. "Holland Lift is a great brand and we want to build on its reputation for safe, high quality, innovative scissors from 15 metres and up, as well as developing the hybrid and narrow aisle ranges. This repositioning also includes a new logo, website, company colours - now blue and green - and an enlarged focus on innovation."

Oudenbroek was appointed because of her skills and experience and also because ProDelta wanted someone to work with the existing staff and management, blending its experience,



Eline Oudenbroek

knowledge and dedication into a team that is motivated and truly proud to produce and develop the Holland Lift equipment. Almost all of her initial tasks - which included improved production and delivery predictability, ICT, design, marketing and a specific plan for future products - have been completed.

"We want to be market leader - in terms of sales, innovation, safety, quality etc - in big scissor lifts," she says. "By specialising in the larger scissors we are building on our traditional strengths as well as including innovations such as hybrid drive and high narrow width products. To serve our customers we are still producing smaller platforms but our focus on high



equipment will continue to grow in the near future, supporting the firm positioning of Holland Lift at the top end of the industry. It makes no sense competing with the likes of JLG and Genie in their segment. We need to focus on our strengths and differentiate with our quality products at greater heights."

First parallel hybrid

Holland Lift introduced the first true hybrid powered scissor lift at Apex last year. Developed in-house

the 90ft M-250HYL25 4WD/P/N (a mouthful to say and remember) has a 27.5 metre working height and platform capacity of 1,000kg on its eight metre long extended platform. Oudenbroek has already addressed the model nomenclature with the biggest hybrid model now called the HL-275 H25 4WD/P/N - still a mouthful, but better.

"Rental companies in particular will find the hybrid scissor an interesting option," she says, "as

Holland Lift is concentrating on developing scissors from 15 metres and up



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Production is currently about 250 machines per year but this will hopefully double over the next five years



it removes the need for separate diesel and electric models, leading to higher utilisation and potentially lower logistical costs, by using the same machine throughout a contract, resulting in a higher return on investment."

"The hybrid resulted from really listening to customers, just when I joined the company. There are a lot of people claiming that they have a hybrid scissor lift, but in fact they are 'series hybrids' - either electric drive or diesel drive. Ours is a parallel hybrid that drives the whole system. We will also continue to rise to the height challenge and this year we are looking to introduce the 108ft, 1.4 metre wide, narrow aisle scissor lift the HL-330 E14 4WDS/N with a 33 metre working height."

"Holland Lift was also recently named one of the top 50 most innovative companies in the Netherlands," adds Oudenbroek. "Throughout its 30 year history the company has always been committed to innovation and has consistently invested in quality improvements. This fact has helped Holland Lift secure its position as a market leader. As well as the



A new 33 metre working height, 1.4 metre wide narrow aisle scissor will be launched this year

new narrow 33 metre model, the company aims to introduce a whole range of hybrid machines starting with the 22 metre and then a 19 and 16 metre hybrid, but all this will take time. Another new range will be 'reduced feature' rental models offering customers a lower acquisition price and possibly a simpler but certainly as robust a machine."

Developing products?

"In order to go above 34 metres you have to take note of the overall weight and the ability for buyers to transport it etc. We are currently constrained by the structural material we use. Hopefully in the next few years we can employ higher strength steels to reduce the overall weight and therefore go higher for the same weight and size - although I feel that this will need a complete redesign. Another development is to make some of the high lifts even narrower - we have built a 700mm wide machine - but currently there is no market for it. So for now we will concentrate on the new narrow 33 metre, the hybrids and the reduced specification rental ranges."

With a reduction in the number of small machines produced, annual capacity is currently around 250 machines, but obviously that depends on mix of machines produced.

"In the next few years I am sure we will increase production to between 300 and 400 units, from the same facilities in Hoorn, by making more efficient use of the space. We used to have three production halls but we now only use two of them by working smarter. We have the space to expand in the future but it is more about getting the right people with the expertise and knowledge."



Holland Lift's first true hybrid - the HL-275 H25 4WD/P/N - has a 27.5 metre working height

"One of our key strategies is to expand geographically and build up our distribution network. We have been appointing new dealers, including AJ Access in UK, Yacontee in China and Q-FAB in Qatar, but outside of the main European countries all sales are currently dealt from our head office in The Netherlands. We do need more good quality dealers."

Stretching the life by refurbishing Holland Lift has a long history of fully refurbishing, or even rebuilding its machines which can easily double their already long average life. "Customers with custom-made equipment use this service a lot as they can have a machine for say 20 years by refurbishing the original. Specials are often seen as expensive but with refurbishment they can last a long time and therefore be very cost effective."

Fewer companies now manufacture large heavy duty scissor lifts with JLG cutting back Liftlux production and the demise of German manufacturer H.A.B.

"I do expect other manufacturers to start building larger machines, but they will probably be made to a different quality level and price. The Liftlux/HAB story shows how difficult it is to survive in this market with a product of the right quality. However a strongly competitive product always focuses the mind to produce an even better machine."

I am very excited about the future of our business and its potential, and can see a day - perhaps in five years - when we will be building at least 500 big, high quality machines a year and be recognised by our customers as the top end supplier for high quality, innovative scissiors."



The new hybrid scissor at its launch last year at Apex