Alternative Power Report

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News on Alternative Power Sources

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Moving from ICE To Alternative Power

As manufacturers continue to shift their equipment production from ICE to alternative power sources, they need the latest information. That's why analysts at Power Systems Research continue to revise our global data and forecasts to provide the freshest picture available.

Are Hydrogen Engines a Future Power Source?

Hydrogen Engines (H2 ICE) Forecast To Be Sold in 220,000 Vehicles in 2035.

Guy Youngs

By Guy Youngs, Forecast & Adoption Lead

According to newly published research by Interact Analysis, hydrogen internal combustion engines (H2 ICE) are forecast to be sold in 220,000 vehicles in 2035.

H2 ICE vehicles do have some notable advantages. The engine technology is reasonably similar to diesel engines, enabling the use of existing knowledge, design and production vehicles. The vehicles can deliver high power, work with impure fuel, work in dirty and dusty conditions and refuel quickly.

On the downside, there is no hydrogen infrastructure in place in most locations in the world, and there is a lack of awareness about the technology and there is limited development so far. Most importantly, the current cost of hydrogen fuel is high – it will need a big reduction before the vehicles can become competitive. Even at half the cost of today's prices, H2 ICE vehicles do not have a good total cost of ownership. The cost of the engine is not substantial, but the cost of the tanks adds a lot to the cost of the vehicle. Then there is the infrastructure availability question and above all the cost of hydrogen fuel.

However, while H2 ICE vehicles can – at least in theory – be zero carbon eventually – NOX emissions will still remain, along with small amounts of other emissions

Source: *IVT International* **Read The Article**

PSR Analysis: This is an interesting article that looks at most of the issues around HICE (Hydrogen ICE), but the article doesn't address the differences between HICE and Fuel Cells, most notably Fuels Cells are completely emissions free and more efficient than HICE.

Editor's Note: This monthly report includes news and analysis about EV and alternative power sources such as batteries and fuel cells from analysts at Power Systems Research.

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Raise of Hydrogen Internal Combustion engines (H-ICE)

Hydrogen ICE vehicles offer an alternative to traditional gasoline and diesel-powered vehicles and have the potential to reduce emissions and reliance on fossil fuels. These vehicles are becoming increasingly popular, and more automakers are starting to offer hydrogen-powered options in their vehicle lineups.

While the progress of hydrogen internal combustion engines is moving forward, it still faces challenges which must be addressed. There are several disadvantages and challenges to using hydrogen as a fuel for internal combustion engines:

- Hydrogen fuel is expensive.
- The hydrogen fueling infrastructure is limited.
- Storage and handling of hydrogen is difficult.
- Production of hydrogen
- There are safety concerns.
- Hydrogen fuel provides only a limited driving range.

Source: *Hydrogen Newsletter* **Read The Article**

PSR Analysis: This is another interesting article and video looking at HICE, but this article focuses on the challenges facing HICE and doesn't really look at the advantages of an HICE and should be viewed in conjunction with the previous article, ***"Are hydrogen engines vehicles the future?"***

JCB Reaches Hydrogen Milestone

JCB'S £100 million investment in a project to produce super-efficient hydrogen engines is moving full steam ahead. A team of 100 engineers has been working on the exciting development for more than a year and the 50th JCB hydrogen combustion engine has now come off the production line as part of the development process

JCB's hydrogen-fueled backhoe loader is one of three hydrogen vehicles the OEM is currently developing. JCB hydrogen engines are already powering prototype backhoe loaders and Loadall telescopic handlers, and the company has recently unveiled its own designed and built mobile refueling bowser to take the fuel to the machines. The bowser has enough hydrogen to fill 16 hydrogen backhoe loaders and is able to be transported either on the back of a modified Fastrac tractor or on a trailer

Source: *IVT International* **Read The Article**

PSR Analysis: As part of its hydrogen development, JCB also has investigated hydrogen fuel cells, but for the time being, JCB has decided that fuel cells are too expensive, too complicated and not robust enough for construction and agricultural equipment.

Hyster Tests Hydrogen Fuel Cell Powered Container Handler

Hyster Company said it is testing a top-pick container handler powered by hydrogen fuel cells (HFC) at Fenix Marine Services in the Port of Los Angeles.

Based on the standard Hyster H1050-1150XD-CH top-pick container handler design, the truck is powered by two 45kw hydrogen fuel cells from Nuvera, a wholly owned subsidiary of Hyster's parent company Hyster-Yale Group. The HFC-powered top pick is designed to provide the zero emissions benefits of a battery electric option, with enough capacity to keep operators moving and avoid the need to stop in the middle of a shift to refuel or recharge.

Refueling the top pick with hydrogen fuel is expected to take approximately 15 minutes, with the intention to provide eight to 10 hours of continuous run time, all while producing no harmful emissions – only water and heat. The top pick is also equipped with a patented Hyster® energy recovery system for electric container handlers that recovers and stores energy from lowering loads and braking.

Source: *Supply Post* **Read The Article**

PSR Analysis: A quick refueling time, 8 -10 hours running time and an energy recovery system should make this pilot quite successful, provided they can secure hydrogen fuel. The quick refueling time also means that this equipment could be run on a shift basis, minimizing machine idle time, too.

BMW EV Suspension System Converts Bumpy Roads To Usable Power

According to CarBuzz, a new patent filed with the German patent office shows BMW is designing a new suspension system capable of harvesting energy from an EV's wheel movement as it absorbs shocks from bumps.

BMW is redesigning the suspension, which traditionally wastes energy to support wheel movement as a way to generate usable energy. The filing shows an innovative design that captures energy generated while the wheel moves in reaction to driving over a bump. The pent-up energy is then sent to a generator unit that converts it to usable electricity to charge the EV battery.

Source: *Electrek* **Read The Article**

PSR Analysis: This is a smart move by BMW. If the German automaker can bring this technology to market, it could be a game changer depending on how much additional range it can deliver. With the auto industry quickly transitioning to fully electric vehicles, automakers are racing to develop ways to boost EV range with devices such as this and regenerative braking.

Some automakers have introduced energy-saving features that can increase EV range while others are developing methods to harness energy while traveling. But capturing energy from bumps in the road to recharge the battery is genius.

EV Battery Recycling — Jumping In

Lithium-ion batteries are essential for decarbonizing transportation through electric vehicles and building a resilient, renewable energy grid through energy storage batteries. The grid energy storage industry represents a much smaller fraction of the lithium-ion battery market than electric vehicles, but it too has a responsibility to ensure batteries are responsibly and sustainably produced and then productively recirculated at end of life.

There are huge opportunities for recycling to decrease the need for newly mined materials in batteries, but governments and industry can leverage these five tactics to move energy storage batteries towards a more circular end-of-life stewardship:

- Require producer take-back.
- Support safe, efficient, and cost-effective battery transportation.
- Encourage battery manufacturers to design for disassembly
- Increase access to information.
- Invest in domestic battery recycling research and infrastructure.

Source: *Cleantechnica* **Read The Article**

PSR Analysis: By 2050, battery recycling could supply 22% to 27% of lithium, 40% to 46% of nickel, and 45% to 52% of cobalt needed for electric vehicles in the US alone. The value of this will be measured in both billions of dollars, thousands of jobs and a chance to meet the demand for lithium which is currently outstripping supply.

Audi Converting Factories To EV Production as it Phases Out Gas Cars

Audi is preparing to convert its entire network of global production factories to manufacture electric vehicles as it gears up to compete in the auto industry's future.

The German luxury automaker is going "all in" on electromobility as it prepares to bring the brand known for its four rings into the future.

Since beginning EV deliveries in 2019, Audi has expanded its EV lineup to include an e-tron S, e-tron GT, e-tron Sportback, Q4 e-tron, and Q8 e-tron. However, Audi doesn't plan to let momentum fade. Audi announced last

year that its last combustion car would roll off the line in 2033 (if they are still around then), launching only electric vehicles from 2026.

To better compete in the new EV era and ease the transition, Audi will convert all exiting existing production factories to build electric vehicles by 2029.

Source: *Electrek* **Read The Article**

PSR Analysis: Audi has gone "all in" for EVs and converting all is plants to EV by 2029 is a bold and necessary step. This is a good indicator of the progress being made within the traditional automotive car manufacturers – GM, Ford and others are also following this trend.

Is Hydrogen the Future of Construction Equipment?

Luigi Arnone, engineering director of diesel engines at Kohler, discusses the development of diesel engines and the position of hydrogen in the future of off-highway engine design and answers several questions:

How much longer does Kohler expect diesel machines to be at the heart of construction projects?

Diesel engines will play a key role in the construction industry for a long time to come. More generally, the industry will continue to need internal combustion engines for applications that have a high demand for mechanical power and energy.

We believe that the future will not have a single direction but will instead see a wide range of solutions capable of meeting all the requirements of a wide variety of machines: internal combustion engines, hybrid (thermal-electric) power units, and all-electric power units will coexist together

Are diesel engines now being designed with a view to switching them to hydrogen fuel engines in the future?

The use of hydrogen fuel in internal combustion engines is, in our view, one of the most attractive options we have for minimizing the environmental footprint of powertrains and, at the same time, continuing to exploit the advantages of engines over other systems.

We believe the new fuel space plays a fundamental role in reducing the carbon footprint and, in general, the environmental impact of power systems. The hydrogen

engine, in other words, is a drop-in solution to replace the diesel engine: same performance and no relevant changes to the installation in machines – if we consider only the engine.

What are the advantages of hydrogen?

In addition to the obvious CO2 advantage – which is hardly present in the engine exhaust – the adoption of a proper after-treatment system can bring all pollutant emissions to negligible values.

This is a really important point: the adoption of hydrogen makes the internal combustion engine a near-zero-emission power generation system. Along with this, the advantages of the engine over, say, a fuel cell-based powertrain should be considered: higher power density, no need for batteries, lower cost, and greater technological maturity.

We see two major challenges with hydrogen. The first is field availability: how can hydrogen be made available for refueling vehicles? Several options are being considered, from distribution networks to local micro-production plants and refueling stations.

The second is in-vehicle storage: hydrogen is stored in high-pressure tanks whose impact on the vehicle, in terms of volume, is not negligible.

Source: *Construction Europe* **Read The Article**

PSR Analysis: This article is useful as it give insight into Kohler thinking and confirms they are also looking at HICE as well as batteries as sources of power.

Indonesia Plans Subsidies To Promote EV Sales

Akihiro Komuro

By Akihiro Komuro, Research Analyst, Far East and Southeast Asia

Indonesia plans to introduce a subsidy program to encourage the purchase of EVs starting in 2023. The goal is to increase the number of EV users to 2.5 million by 2025 and reduce air pollution. The EV purchase subsidy program will be added to the list of EV policies introduced by President Joko Widodo over the past year.

Transportation Minister Boudi Karya Sumadi said the government is also considering subsidies for retrofitting internal combustion engine vehicles, but the government is carefully considering this plan because it would bring major changes to the labor-intensive auto industry. The Ministry of Transport plans to approach existing Indonesian automakers, such as South Korea's Hyundai Motor and China's BYD, to create an EV ecosystem for Borneo's new capital city, he said.

The intensified EV shift is partly because Indonesia is the world's largest producer of nickel, which is used in batteries, and the country's intention to move to a higher value-added part of the value chain by eventually ceasing all exports of nickel raw materials.

In 2022, the government ordered all state agencies to switch to electric vehicles. It ordered PLN, the state-owned electric power company, to build more charging stations to reach its goal of 2 million electric motorcycles and 500,000 electric vehicles within four years.

The Indonesian government is working to have public transportation fully electrified within five years. According to data from the Ministry of Transportation, 22,942 electric motorcycles and 4,904 electric cars were in use in Indonesia as of Oct. 3, 2022.

Source: kamobs.com

PSR Analysis: Indonesia's EV policy is being pursued quite aggressively. The EV penetration rate is still at a low level, but with the support of these policies, it has the potential to take off in the next few years.

With urban congestion and the resulting air pollution at very high levels, it will be important to see how the market reacts to these policies. The test will be whether EVs can overcome these problems, which have not been solved by other policies so far. I think it will be very difficult to achieve the goal, but in any case, EVs will not remain at the current level and will continue to spread. **PSR**

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