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"THIS TECHNOLOGY WON'T SURVIVE A 'DIESELGATE'-STYLE SCANDAL"

Is this make-or-break time for sustainable fuels? The CEO of P1 Fuels in candid discussion with **Chris Pickering**

MOTORSPORT enjoys a uniquely privileged position when it comes to new technology. The cars are looked after by the most capable engineers and mechanics in the world, they're driven by expert operators and, in many cases, replaced every season. If one idea doesn't work out, there's always another one to try.

For the rest of the world, that's not quite how it works. Globally, there are an estimated 1.6 billion combustion-engined vehicles on the roads. Even if every single application was suitable for electrification, and every single market was to head down that route, the likelihood is it would take decades to complete the transition.

Fortunately, motorsport can help here too. Or at least, that's the vision of Martin Popilka, CEO of sustainable fuel specialist P1 Fuels. The German company supplies the World Rally Championship (WRC) with a 100 per cent fossil-free blend. Along with high-profile demonstrations in historic motorsport with the likes of Sebastian Vettel, it has also begun supplying its fossil-free fuels to consumers.

"No matter how many vehicles we electrify, and how we increase the amount of EVs on the road, we still have that legacy vehicle fleet that will continue to pollute, if they don't have an alternative," comments Popilka.

Broadly speaking, sustainable fuels divide into two categories. There are biomass-derived fuels, which begin with the fermentation of organic matter, such as agricultural waste. These can be burnt as a pure alcohol in a suitably modified engine or further processed into an alcohol-free mixture that's a drop-in substitute for traditional gasoline.

The other route is power-to-liquid (PTL) to produce an e-fuel. As the name implies, this process uses power generated by renewable sources to combine hydrogen (ideally from electrolysis) and carbon dioxide (potentially captured straight from the atmosphere) to create synthetic hydrocarbons.

In theory, PTL and biofuels can be used interchangeably, mixed with each other or indeed with some percentage of fossil content.

"In an ideal world, we'd use a combination of both [biomass and PTL] methods, depending on the region," comments Popilka. "Second generation biofuels are fairly low carbon intensity fuels that don't require a lot of energy to process, meaning that they're relatively sustainable. What I see as the largest drawback to these fuels is that they're dependent on biomass waste, and there's only so much waste in the world that we can generate to convert into fuels. In my opinion, that means they're not very scalable."

> *"No matter how many vehicles we electrify, that legacy vehicle fleet will continue to pollute if they don't have an alternative"*

Second generation biofuels are defined as those which do not compete with crops for food production, but Popilka fears this could be open to abuse: "It's very hard to manage the supply chain in a way that guarantees second generation components. There's already a lot of first generation ethanol coming from Brazil and the United States that's derived from food crops and can't be considered sustainable, nor the right thing to do." ▶

LEFT The World Rally Championship has blazed a sustainable trail with its fossil-free fuel, but the message still needs reinforcement

Goodwood

ABOVE The company stages high-profile demonstrations in historic motorsport with the likes of Sebastian Vettel's 'Race Without Trace' campaign

Scalability

Standard pump fuel in the UK and Europe already has up to 10 per cent ethanol content, with the EU looking at scaling this up to 20 per cent. The concern is that there simply won't be enough second generation ethanol on the market to cope, although others have downplayed this, suggesting that we are still a long way from reaching that point.

So, PTL is the solution, then? Many sustainable fuel experts – Popilka included – believe this will ultimately be the better option, but it's not without its drawbacks.

"PTL has the advantage that you're essentially just using water and air, so it's not as sensitive to market fluctuations," he points out. "It's a slightly more energy-intensive process, but the real downside, at the moment, is the production capacity. Right now, there basically is none. In an ideal world, we would already have the capacity to bring enough e-fuel to the market, which we don't, but that's something that we're actively working towards."

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BELOW P1's chemists benefit from the WRC's function as a high-speed laboratory

P1's ambition is to build an industrial-scale plant for e-fuel production, which Popilka believes could bring the technology close to price parity with fossil fuels. The company is already working on the design of a pilot plant to be based in Germany, which it aims to begin building during the second half of next year.

The technology to do this already exists, and the main thing that's required at the moment is upscaling to make it more affordable, says Popilka: "You can employ economies of scale with larger production facilities. When it comes to the technology readiness levels, the individual tech stack of an e-fuel refinery is well matured. The renewable power generation is already there. The cost of the electrolysis to produce green hydrogen is predicted to decrease over time. We did an in-depth technical analysis, and it's obviously more than fossil-derived grey or blue hydrogen, but even at current levels the costs are reasonable. The only technology that's not as mature currently is the direct air capture. That will require more investment to cut costs."

Direct air capture plants also exist, but they're operating on an experimental level currently. While this technology is maturing, P1 plans to use point-source carbon dioxide. This is where the gas is captured direct from industrial processes that would otherwise release it into the atmosphere, such as cement production. It's still ultimately released when the fuel is combusted, but this approach recycles carbon dioxide from other processes rather than adding its own.

"A lot of the technology related questions have been answered on a hypothetical level, and we aim to answer them on the working demonstrator plant that we plan to build next year as well. That will allow us to further investigate the costs and some assumptions that we have in the process technology. After that, we will immediately start engineering an industrial-scale plant," says Popilka.

Pure PTL

Currently, P1 Fuels uses a combination of PTL and biomass-derived chemicals for its fuels. One of the aims of the pilot plant is to optimise the processes behind e-fuel so it can take over as the primary fuel source, he explains: "One thing to bear in mind is that some of the sustainable fuel projects out there today, including some high-profile ones, actually output a really bad fuel. Some of them are down to 91 RON, with a very high content of heavy components. That's a problem for the high-performance markets we serve, so with this pilot plant we want to show that we can produce a clean, high RON fuel from one process without blending in fossil fuels or other components."

The key point here is that P1 is aiming to create a fuel that can be taken from the plant and put straight into the car without further processing. Popilka points out that some of the Fischer Tropsch fuels that are based on synthetic crude (or e-crude) require a significant amount of blending, and the additional components, which limits the scalability.

P1's aim is to produce e-fuels that meet standard road requirements straight out of the plant. This is significant as the additives used elsewhere in the fuel industry can be among the hardest components to substitute for fossil-free alternatives.

> *"We take the risk of 'greenwashing' very seriously – if we blow this now, the internal combustion engine won't survive"*

The fuels that P1 currently supplies for historic racing are said to contain no additives whatsoever, while we're told that those used in the company's other applications are in the order of parts per million, so their impact on the fuel's carbon footprint should be negligible. "We don't provide our fuels with those additives. It's up to the consumer to put them in if they need to, but that's not part of our core business," notes Popilka. ▶

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BELOW P1 supplies the World Rally Championship with a 100 per cent fossil-free blend


Porsche

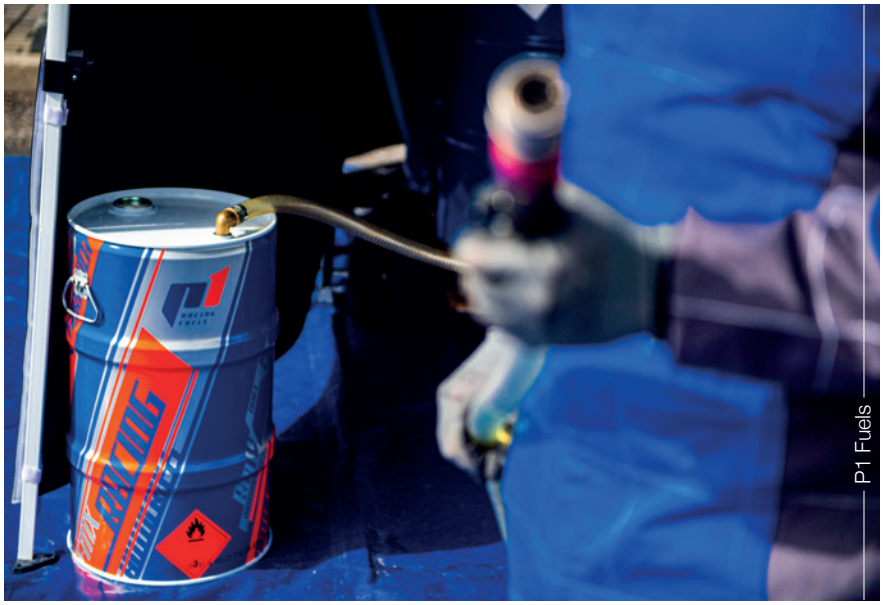
Traceability

The company says its fossil-free fuels already deliver CO2 reductions of around 80 per cent (depending on the exact formulation). It's hoped that this figure can be brought down to around 95 per cent with improvements to the supply chain, production and formulation.

As with the feedstocks used to produce ethanol for biofuels, there's a danger that unscrupulous suppliers could attempt to pass off grey or blue hydrogen (derived from natural gas) as fossil-free green hydrogen. To eliminate these risks, P1 plans to generate its own hydrogen on-site.

There are no less than nine different colour categorisations of hydrogen, each of which has differing environmental considerations. On top of this, of course, carbon dioxide can be captured from a variety of different sources – some greener than others. As with electric battery production, supply chain monitoring and traceability will be essential to understand the true impact of these fuels.

"The internal combustion engine has the potential to be every bit as green as battery electric over a full lifecycle analysis. The technology to do this is already there," states Popilka. "But what this technology will not survive is another Dieselgate-style scandal, and I don't think anyone is taking that risk seriously enough."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LEFT P1's fuels are proving themselves in hostile environments

RIGHT P1's mobile laboratory operates in the service parks and paddocks of world motorsport

ABOVE P1 plans to use point-source carbon dioxide while direct air capture technology is maturing. Porsche, whose DAC model is pictured, is one of the companies currently investing in researching the technology

Greenwashing

It's not just the potential for greenwashing around individual products or technologies, but the wider industry that produces them, he points out: "We have some of the largest fuel companies in the world marketing sustainable blends in motorsport championships, when 99.99 per cent of their revenue comes from extracting fossil fuels. Literally all of them are increasing their fossil fuel output every day, and then on the side they're promoting sustainable fuels in motorsport, with no industrialisation plans in sight. That's what differentiates startups like us, and it's why we take the risk of greenwashing very seriously – if we blow this now then the internal combustion engine won't survive in the future."

Fossil-free fuel may be the only viable option to decarbonise existing internal combustion engines – particularly when it comes to historic vehicles. For future engines and those currently in production, however, there's also the possibility of re-engineering them to burn hydrogen. This has the advantage that it requires less processing and significantly less energy input than producing e-fuel, but Popilka is sceptical about its practicality.

ABOVE Benjamin Pochhammer (left) and Martin Popilka are founders of P1 Fuels and COO and CEO respectively

> *"Many consumers aren't even aware there are alternatives to electric vehicles"*

"The main problem is the logistics and ▶

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transportation," he comments. "Hydrogen as a gas is very difficult to transport and the infrastructure is non-existent. Meaning that even if you produce these fuels in locations that have lower costs of renewable energy, and you can guarantee that the energy is renewable, you still have a very hard time transporting them to the consumer."

The challenges are stark: "I mean, there's only one ship that carries hydrogen to Japan. Just one. So that logistics and transportation framework is a bottleneck, while derivatives of green hydrogen produced in, say, Africa, can be transported very easily with the current infrastructure. So, whether that green hydrogen is converted into ammonia or whether it's converted into synthetic gasoline, that liquid is very easy to handle and transport: you drop it into any tanker into any fuel station."

All of this, he adds, is part of a wider energy ecosystem, which is likely to include battery electric vehicles, hydrogen and possibly even methanol fuel cells. One of the challenges of this complex tapestry, as opposed to a heavily simplified one-size-fits-all narrative, is communicating it to consumers.

Issue of trust

"I think this is where we struggle the most, conveying this to consumers," comments Popilka. "People still have Dieselgate in the back of their minds, and re-building trust with the automotive

Red Bull/Getty Images

industry is going to be hard. We need to get a general buy-in [to sustainable fuels] from the car manufacturers, because right now, a lot of them are just promoting electric vehicles, and many consumers aren't even aware that there are alternatives. Apart from Porsche, none of the big OEMs are really communicating much about synthetic fuels."

P1 is hoping to change that through its involvement with high-profile championships like the WRC. And that work is also driving technical benefits too.

"In the WRC, you've got the freezing temperatures of Sweden, down to Kenya, where you have very hot temperatures. So we've learned a lot on a technical level with the manufacturers in the championship about how to increase the drop-in compatibility of these fuels," notes Popilka. "Based on what we've learned with this racing fuel formulation, we've developed a road-compliant EN 228 fuel, which is now being used in the historic cars we've supported."

> *"The internal combustion engine has the potential to be every bit as green as battery electric over a full lifecycle analysis"*

The challenges of upscaling sustainable fuel production for mainstream applications shouldn't be underestimated. But professional motorsport is a rather different case, with vastly smaller volumes and far less cost-sensitivity (at least for the race fuel itself, which generally accounts for a tiny percentage of a team's annual budget).

"Motorsport can either be part of the problem of global warming and emissions in the transport sector or part of the solution," concludes Popilka. "I think, as of today, no championship has any rational excuse to use fossil fuels. We supply six-year-old or seven-year-old kids in karting, through to the WRC and other championships. It's time for the wider motorsport industry to start exploring sustainable fuels in a more structured way and make that switch from fossil fuels." RT

ABOVE The historic market is increasingly waking up to sustainable fuel. At Goodwood the Fiat S70 'Beast of Turin' from 1910, with its 28-litre, four-cylinder engine, ran on P1 fuel. The team found that it started on the cranking handle easier, ran smoother, cooler and used less fuel than normal

LEFT Through its involvement with the WRC manufacturers, P1 has learned how to increase the drop-in compatibility of these fuels