KOHLER®

TOWARDS SUSTAINABLE MISSION-CRITICAL POWER

Our climate crisis has resulted in urgent demand for more sustainable **mission-critical power** technologies. To balance environmental impact against the need for **mission-critical power**, the doughnut economics model is useful – the concept shows that we need to use enough resources to provide the basics for all people, without causing damage to nature and our planet.

For **mission-critical power**, **diesel generators** are a proven solution, and the most popular option. They offer flexible outputs across a broad range of **power nodes** and can be accurately sized within a small footprint. **Diesel** provides an efficient and readily available fuel that can be stored safely on-site and works well in most climates. Additionally, most **generator** suppliers offer well-established maintenance and spares support, giving end-users long-term peace of mind.

But **diesel generators** do emit **greenhouse gases** and other pollutants. Switching entirely to another backup power source is unrealistic in the short term, and for some applications, **diesel gensets** are the only practical option.

Therefore, **generator** manufacturers have invested heavily in **reducing emissions**. The focus has been on the engine, with environmental standards such as **EPA Tier 4** in the US and **Stage V** in Europe pushing engineers to reduce nitrogen oxides (NOx) and particulate matter levels.

Emissions reduction technologies have cut the amount of pollution created, via in-cylinder reductions, and after-treatment technologies. Engineers have also used advanced computer-aided tools and computational fluid dynamics to optimize designs.

For example, high-pressure common **rail fuel injection systems** improve combustion efficiency, while **exhaust gas recirculation (EGR)** is commonly deployed to reduce **NOx**, by recycling exhaust gases back into the combustion chamber.

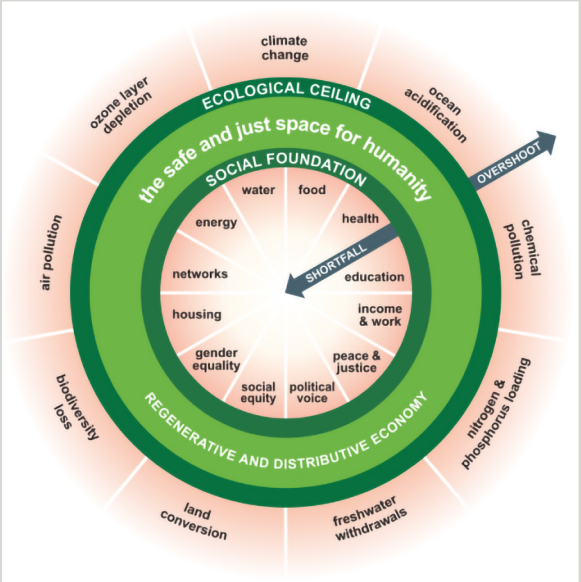

Figure 1: The Doughnut of social and planetary boundaries.

Credit: Kate Raworth and Christian Guthier. CC-BY-SA 4.0. Citation: Raworth, K. (2017), Doughnut Economics: seven ways to think like a 21st century economist. London: Penguin Random House.

Significant advances have been made in after-treatment. For example, **diesel oxidation catalysts** break down pollutants in exhaust gases into less harmful components. Other technologies such as diesel particulate filters and selective catalytic reduction can also cut contaminants.

Another advance is the development of **renewable fuels**. **HVO**, for example, is a liquid fuel that is synthesized from waste vegetable oils or animal fats. Unlike first-generation **biodiesels**, **HVO** does not impact crop resources, and it can translate into up to 90% fewer **greenhouse gas emissions** than **diesel**.

HVO is similar in grade and quality to traditional **diesel**, and so can be used as a **drop-in** replacement, or as a blend with **diesel**. It is resilient in cold weather, safe in hot climates, and can be stored for up to ten years.

Kohler's technical teams are also evaluating new medium-term technologies for **mission-critical** power, such as **batteries** and **fuel cells**.

Battery performance has matured rapidly in recent years, and the technology is already available with an efficiency of nearly 90%. Kohler has forged several joint ventures with industrial partners to develop **battery-powered generators**.

However, **mission-critical** applications would require many large battery packs – presenting cost, complexity, and footprint challenges. And **batteries** contain high levels of rare metals, which are becoming difficult and expensive to acquire.

Fuel cells have a lower footprint compared to **batteries**, and the possibility of quick refuelling with pressurized or **liquid hydrogen**. But they can only really be considered 'green' if the **hydrogen** used to power them comes from **renewables**, nuclear, or biomass. Achieving this fully is many years away from being practically available at scale, and the **hydrogen** produced is difficult to store in bulk.

Kohler is investing heavily in **mission-critical power**, helping end-users to reduce their **emissions**. Cleaner power will be achieved via a transition period – it will not happen immediately. There is no 'one size fits all' solution, with multiple options enabling each customer to choose what's exactly right for them.

FOR MORE INFORMATION ON THE TRANSITION TO MORE **SUSTAINABLE BACKUP POWER**, PLEASE VISIT: **SUSTAINABLEFUTURE.KOHLERPOWER.COM**.