

WHITE PAPER



Emissions reductions – there's good, there's better and there's ESS

From cost and efficiency through to safety and control, there are many benefits to deploying battery energy storage systems (ESS) to supplement or replace diesel generators. One of the biggest pluses – and for many, the most important benefit of all – is the positive effect on the environment.

There are many factors and variables that go into making up a carbon footprint, such as manufacture, delivery and disposal of equipment. Calculating the total effect of all these is highly complex, so for the purposes of this white paper we're looking purely at tailpipe emissions – what's produced while the equipment is being used.

What's the level of emissions with ESS? Easy – it's zero. They produce no tailpipe emissions whatsoever. No CO₂, but also no NO_x, SO₂ or particulate matter (PM) emissions either.

Diesel generators are a very different story, however.

“We cannot do everything alone, so we spend a lot of time building an ecosystem of innovators like Ampd to help us reach our sustainability goals.”

Ke-Vin Lim, Head of Group Innovation, CDL

What influences the carbon footprint of a diesel generator?

For ESS, that zero figure is a constant. But for diesel generators, there are always emissions – and there are always multiple considerations that affect their levels.

Here are the main factors determining diesel tailpipe emissions:

Size and quantity – the kVA rating of the generator determines its base fuel consumption and ensuing emissions. Plus, of course, the more generators you need, the more emissions there are.

Fuel composition – higher carbon content in the fuel results can result in higher emissions during emission. Impurities such as sulphur and hydrocarbons also have an effect.

Energy efficiency – an inefficient generator affects the combustion process and uses more fuel, resulting in higher emissions.

Load factor – generators operating at partial loads may have lower combustion efficiencies and higher emissions.

Engine technology – the design and technology of the individual generator, plus exhaust after-treatment technologies, will all affect emission levels. Older designs usually produce greater emissions.

Operating conditions – factors such as ambient temperature, altitude, humidity, operating hours affect performance and thus emissions. Frequent stop-starts and extended idling also increase emissions.

Maintenance – without regular maintenance, dirty filters, worn fuel injectors, and faulty sensors can all increase emissions.

Fuel quality – the cleanliness, stability and contaminants level in the fuel will all affect performance and emissions.

Regulatory compliance – the need to meet required standards affects the choice, design, operation, and maintenance of diesel generators, and thus the quantities of emissions produced.

Real Life Carbon Comparisons

With so many factors to take into account, how do these translate to real-life scenarios? What kinds of comparisons can you make when ESS supplement or replace diesel generators? Here are some statistics from our own case studies, along with independent reports.

Ampd Energy case study – Microsoft data centers, Capitol Group, Melbourne

We deployed two ESS to power three tower cranes, drastically reducing the size of the diesel generators required onsite – from three units of 350 kVA down to a pair of 100 kVA units.

This led to a 74% reduction in fuel consumption and total CO2 savings of approximately 125 tonnes, equating to a 57.8% reduction in carbon emissions.

[Read the complete case study here](#)

Ampd Energy case study – City Developments Limited, condominium construction, Singapore

This was a two-year project involving a single Ampd Energy ESS to help power two tower cranes.

During the course of the project, the client saved 221,000 liters of diesel and prevented 455 tonnes of CO2 emissions, representing a 76% reduction.

[Read the complete case study here](#)

Ampd Energy case study – Laing O'Rourke, Olympia Exhibition Centre, London

The multinational engineering company Laing O'Rourke and its subsidiary, Select Plant, partnered with Ampd Energy to replace the existing on-site diesel generators with three ESS.

Over 12 months they estimated to have saved 192 tonnes of CO2 emissions, equivalent to the air pollution produced by 975 cars. The air quality around the site has also noticeably improved.

[Read the complete case study here](#)

Ampd Energy case study – UPERIO and Compass, Civic Center and Plaza, Las Vegas

For this major project that covered two whole city blocks, the UPERIO Group and Compass Equipment chose Ampd Energy to supply two ESS units. These were used to power four major pieces of hoist equipment (two tower cranes and two construction elevators) to reduce the need for diesel generators.

During the five-month deployment, nearly 9,000 gallons of diesel fuel were saved, and carbon emissions reduced by close to 45 tonnes.

[Read the complete case study here](#)

Independent research paper – MDPI scientific journal, microgrid, Brazil

In 2023, MDPI published a paper comparing the financial and environmental impact of ESS and diesel generators on microgrids. They analysed data from a real microgrid in operation in Brazil and then simulated the use of diesel generators in place of ESS to meet the same load during daily high-cost energy periods.

The diesel generator was found to be responsible for emitting 67.32 tons of CO2 annually. Particulate matter was measured at 1.39 kg/year, and NO2 at 145.94 kg/year.

[Read the complete article here](#)

"[ESS] represent a huge step forward in our strategy of pushing the boundaries towards ever more environmentally and financially efficient, low-carbon, and innovative construction."

Ian Fleming, Product Leader, Select Site Solutions

Independent article – Deutsche Well, Creating Emissions-Free Building Sites, Hong Kong

A 2021 article for Deutsche Well by Chermaine Lee looked at how building sites in Hong Kong are working to reduce emissions. The article found that each ESS deployed could potentially replace two diesel generators that would power four tower cranes and slash on-site carbon emissions by over 80%.

[Read the complete article here](#)

Independent case study – Precision Drilling, on-shore oil wells, Colorado, USA

An operator in Colorado initially used one diesel and two natural gas engines to produce electricity in drilling operations. They decided to integrate an ESS into the rig to reduce their fuel consumption and emissions by managing the engines more efficiently.

This resulted in reductions of 26 - 29% in greenhouse gas emissions, depending on the individual oil well.

[Read the complete case study here](#)

Site environmental quality

A big immediate and tangible benefit of deploying ESS alongside or instead of diesel generators is a major improvement in the air quality around the site. This results in immediate benefits for those working on the site, as well as those who live or work nearby, as well as passersby. In fact companies typically report on-site emissions reductions of up to 90%.

The UK Health & Safety Executive (HSE) has highlighted the risk to construction workers from diesel engine exhaust emissions (DEEE), relating to both generators and vehicles< short-term effects include eye or respiratory irritation, while more prolonged exposure can lead to coughing and breathlessness. There is also evidence that repeated exposure over many years can increase the risk of lung cancer.

[Read the HSE report here](#)

A further bonus from using ESS comes from sound levels – at the Singapore condominium project mentioned above, noise pollution was reduced by up to 32 times.

Making accurate measurements

The desire for businesses to assess their carbon footprint, along with regulatory requirements to do so, has led to the development of conversion factor spreadsheets for measuring and reporting emissions as accurately as possible.

In the UK, this has been the responsibility of the Department for Energy Security and Net Zero (DESNZ) since 2023. Updated annually, DESNZ conversion factor spreadsheets allow organizations to calculate emission factors related to activities to determine both direct and indirect emissions, for NOx and SO2

as well as carbon emissions. [Find the latest DESNZ spreadsheets here](#)

Different countries and regulatory authorities have their own systems. But however you measure your carbon footprint, one thing is clear – that, with zero tailpipe emissions, ESS can play a major role in reducing it.

About Ampd Energy

Ampd Energy is pioneering a more sustainable and prosperous future for challenging construction environments across Asia and Europe via cleaner, quieter battery power. Our state-of-the-art battery energy storage technologies, connectivity and data solutions have benefited projects globally, preventing over 100,000 tons of CO2 emissions. Dozens of leading industrial, property and construction companies choose Ampd Energy.

Why not join them?

An emission-free future for industries.



70-85%

CO₂ reduction Vs a typical diesel generator

If you're interested in using an ESS for your project or company, contact Ampd Energy at contact@ampd.energy for a customized power plan.

