THE POWERFUL THINKING GUIDE 2017

Smart Energy for Festivals and Events

EXECUTIVE SUMMARY

Since the first edition of the guide in 2012, a significant shift towards more efficient energy management has taken place in the events industry. Events are typically able to save between 10% and 50% of their fuel consumption. This guide provides event professionals with up-to-date knowledge and practical resources to help manage temporary energy smartly, reducing environmental impacts and fuel bills. It is created from a collection of modular resources that are also available separately online.

This edition is European in focus, reflecting both the progress being made across Europe on this topic, and the partners involved with the guide's content.

ACKNOWLEDGEMENTS

This guide has been co-written by a group of leading European energy consultants, advisers and festival organisers under the direction of lead author Chris Johnson, Chair of Powerful Thinking, Co-Founder and Operations Director of Shambala Festival.

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Powerful Thinking is a not-for-profit coalition of industry stakeholders, working together to drive positive change for businesses, audiences and the environment.

WITH SUPPORT FROM

Julie's Bicycle SUSTAINING CREATIVITY

ARTS COUNCIL ENGLAND

kambe SUSTAINABLE EVENTS

Festival REPUBLIC

NOEA National Outdoor Events Association

THE SHOWMAN'S SHOW

NCASS NATIONWIDE CATERERS ASSOCIATION

AIF

eif events industry forum

AFO ASSOCIATION OF FESTIVAL ORGANISERS

PSA PRODUCTION SERVICES ASSOCIATION

LANSDOWNE WARWICK

PLASTER creativecommunications

A GREENER FESTIVAL

Sunday Best

ZAP

Front cover photo credit: Boomtown Fair

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ABOUT THE GUIDE AND ASSOCIATED RESOURCES

The guide has been designed as a coherent collection of 22 Factsheet (15 of which are new or updated), 12 new case studies and 2 resource packs, all of which are available online, along with many other inspiring case studies and 'The Show Must Go On', Powerful Thinking's report on the environmental impacts of the UK Festival industry (November 2015). Each section of content in the guide relates to a standalone factsheet and has case studies of recent events to show where the suggested measures have been successfully employed.

LINK TO ONLINE CASE STUDY

LINK TO ONLINE FACTSHEET

FACTSHEET AND RESOURCE LIST

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"This guide is an essential aid to the industry. It equips festivals with the tools needed to understand their energy requirements and drive efficiencies by using resources intelligently, employing renewable systems and ultimately reducing emissions."

Melvin Benn, Managing Director, Festival Republic.

"Climate change is a critical and urgent challenge facing us all. Taking action to reduce the energy use and carbon impacts of our events and exploring how to best employ new low carbon energy technologies makes financial, operational, and ethical sense, and it allows the industry to practically express its values of resourcefulness and creativity in a way that serves as a pioneering example to others."

Alison Tickell, CEO, Julie's Bicycle.

Shambala Festival - Photo credit: Carolina Faruolo

INTRODUCTION

At the end of 2015, 196 countries negotiated the Paris Agreement on climate change: a historic international political consensus for global climate action pledging to keep warming to a maximum of 2 °C, aiming for 1.5 °C, above pre-industrial levels. Meeting this target is going to take a full and urgent rethink of how we produce and use energy in all aspects of life: using less energy overall, using energy more efficiently, generating it from renewable sources and phasing out fossil fuels within the next few decades.

As an industry with thousands of diverse events in various sub-sectors, and a combined audience and client-base of millions, we have the ability to materially contribute to this shift by managing our energy more smartly, but also play a valuable leadership role in making changes toward a more sustainable future.

Since the first edition of the guide (2012) the industry narrative about temporary energy has fundamentally changed from a skeptical interest in new approaches, to an ongoing dialogue about how to practically implement new technology and smarter ways of working to achieve better efficiency.

There are now many success stories of events across the UK and Europe that have saved energy, fuel and costs. In the recent Festival Industry Green Survey (Powerful Thinking: 2016), over 50% of respondents stated they are now using LED festoon lighting, and a third of respondents had introduced monitoring of generator energy/fuel consumption in 2016 alone.

"The way we are managing energy at events is profoundly changing. Smarter more efficient practices and new technologies are enabling events of all types to dramatically reduce fuel use, emissions and costs."

Chris Johnson, Chair, Powerful Thinking.

"The AFO is an active and committed member of Powerful Thinking because we see that managing energy more efficiently will benefit member festivals in the short-term, and leave the Earth a better place for our grandchildren in the long-term."

Steve Heap, Founder and General Secretary Association of Festival Organisers, and Director of Towersey Festival.

Since the 1980s, when outdoor events were becoming more prevalent, a 'plug and play' model has persisted in the events industry, in which event organisers expect power to be cheap, readily available and power companies will supply generators with an estimated significant margin of contingency in their capacity to ensure that they can provide a reliable supply of energy, which is often based on unknown or incorrect power requirements.

The recommended load for generators to be running at to maximize fuel efficiency and minimize potential damage to the engine of a generator is 60-80%.

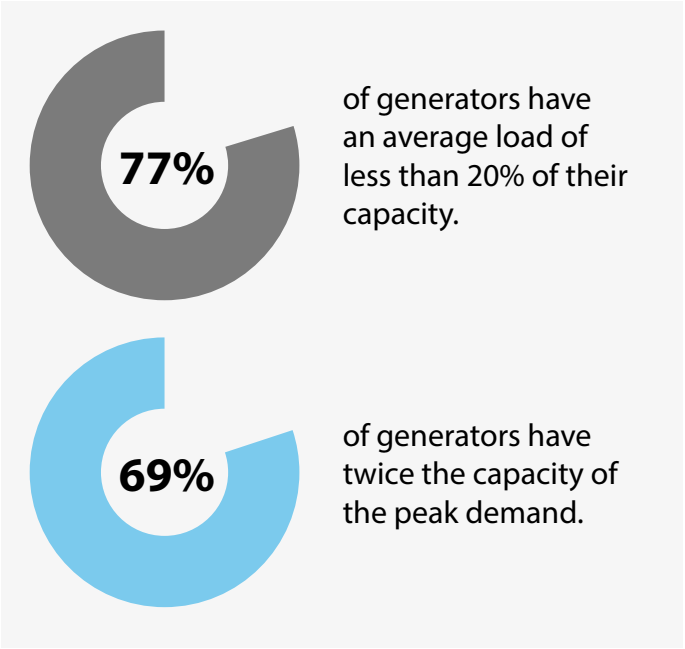


Figure 1. Results of Generator Monitoring 2014–15 (Watt-Now, Holland)

The Power Behind Festivals Guide (2012) detailed research undertaken in the UK by De Montfort University that showed that, of the generators monitored at eight events, every single system had periods of working below a 25% load, and some of them operated entirely below a 25% load. In over half of cases the generator was more than double the capacity required. At one event, the capacity of the main stage generator was eight times larger than the peak load.

An innovative company in Holland called Watt-Now has been busy collecting energy data at events, whilst working with event organisers to identify energy saving and renewable energy solutions. They have analysed 270,000 data points from outdoor events in Holland over two years (2014–2015) finding that 77% of generators they measured had an average load of less than 20% of their capacity (see Figure 1). This data correlates strongly with recent data from Glastonbury Festival and the University of West of England (UWE), showing that the majority of generators were oversized for their purpose.

Power is typically one of the five largest single production costs for a festival. It is one of the few payments not known pre-event, and it is left to a third party to report on, often without safeguards or proper scrutiny. Power also typically represents up to 65% of an event's 'core' carbon footprint (i.e. not including audience travel).[1]

THE FOCUS OF THIS GUIDE IS SIMPLE:

- How we can reduce the amount of power we need.
- How we deliver power with less equipment, transport, fuel and cost – without reducing reliability.
- How we can introduce more renewable energy and other low-carbon technologies into our power mix.

A broader question we should keep in mind is; how do we create the relationships between suppliers, businesses, researchers, and festivals to promote innovation in our approaches to energy supply in order to ensure we are benefiting from the latest developments in energy technology?

[1.] The five largest single production costs tend to be power, sanitation, staging, fencing and trackway for many outdoor events. Figures from The Show Must Go On report (Nov 2015). Full references from the report can be found here.

Shambala Festival - Photo credit: Carolina Faruolo

PART ONE: UNDERSTANDING ENERGY AT OUTDOOR EVENTS

HOW ENERGY ACTUALLY WORKS AND ESSENTIAL TERMINOLOGY

LINK TO ONLINE FACTSHEET #11

Festival organisers, production managers, festival staff and power users commonly report being bamboozled by technical language about energy. Smart approaches to energy management require baseline knowledge, shared between many stakeholders, about how temporary power works. This section, produced with energy consultancy Entersys, provides an explanation of phrases and terms and some know-how to help everyone take part in conversations more confidently.

"Whilst organisers do not need to be experts, it helps if they know what to expect of the experts they contract and employ. As ever we urge the festival industry at large to utilise and pioneer more efficient ways of managing their power to reduce the unnecessary waste of resources."

Claire O'Neill, Co-founder,
A Greener Festival.

What is Efficiency?

Energy efficiency is simply the process of doing more with less. In the context of this guide efficiency can be considered and measured in several ways:

- The amount of usable power (kilowatt hours / kWh) generated per litre of fuel consumed.
- The overall 'fuel per audience day' (or litres of diesel used per person per day) at the event.*
- Either of the above compared to figures from the previous year.
- How well matched the generator size is to the load.

Generators consume a baseline of fuel regardless of the size of their load. The relationship between 'fuel consumed' and 'power generated' is not linear; the efficiency of the generator is largely determined by the load. A good rule of thumb is that around 75-80% load is perfect (optimum). Going downwards, anything between 50-75% load is still good as reductions in efficiency are marginal, but as you go down to 25-50% efficiency reduces significantly. A load below 25% is low efficiency and is wasteful of both fuel and costs.

*YOU CAN CHECK HOW YOUR EVENT COMPARES WITH UK AVERAGES USING THE FESTIVAL FUEL TOOL

FESTIVAL FUEL TOOL SUPPORTED BY THE AIF

Voltage, Current and Power

These are basic electrical terms but can be quite confusing at times, so let's take a brief look at each one:

Voltage

The force that makes electricity flow through a wire. Its unit of measurement is the Volt (V). For our purposes most items are designed to run on 230V AC. Occasionally we may come across items designed for 110V AC (using a yellow plug) and 400V AC (using a red plug). A higher voltage isn't necessarily 'better' – the output voltage of the generator needs to match the working voltage of the appliances connected to it.

Current

The amount of energy that flows through a wire over a given time. The thickness of the wire restricts its flow. Plugs and sockets are rated up to a certain current carrying capacity – 13 A domestic, 16 A & 32 A etc. The symbol for current is (I) and the unit of measurement is the Amp (A).

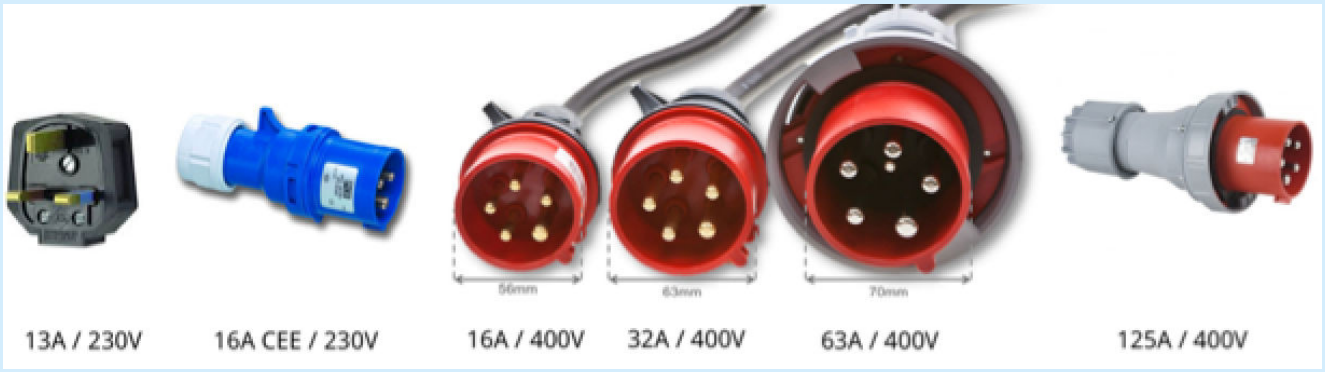


Photo credit: ZAP Concepts

Power

The rate at which energy is consumed by a system. We can consider it in two ways, either the amount of power a machine can produce – a generator for example; or the amount of power a system consumes – a kettle for instance. Power is measured in Watts (W).

The Relationship Between Voltage (V), Current (I) and Power (P)

Power is simply the product of voltage across and current flowing through an item, as in the following formula:

$$P\,(W) = I\,(A) \times V\,(V)$$

A light bulb is designed to run at a voltage of 230 V and consumes 40 W of power. What current will flow through it? We can work this out as follows:

$$I = P / V = 0.17\ A$$

Practically, most items run at 230 V. All items sold in the UK will have a rating plate on them somewhere, stating what voltage they are designed to operate at and what power they will consume. From this we can establish the power requirement for a system by simply adding up the power of each item. If the power isn't given but the current is, we can convert it to power using the above formula.

So, for a production office we can work out how much power we need as follows:

2x	Desk Lamps	@ 40 W	= 80 W
1x	Laptop	@ 90 W	= 90 W
1x	Laminator	@ 6 A	= 6 A x 230 V = 1,380 W
1x	Coffee machine	@ 3 kW	= 3,000 W
1x	Radio charger	@ 460 W	= 460 W
Total	**= 5,010 W**		

We can convert the Laminator into Power (W) from Current (A) by using the above formula to find it is 1,380 W or 1.38 kW.

We now know our office consumes 5.01 kW. So we need a 5 kW generator right? Well, yes we would, if we were to be running all the appliances at once. In catering that may be the case, especially over a show weekend where they are pre-cooking and running long serving sessions.

But we need to apply a little experience: because we know our office appliances don't all run at once, let's allow for 75% at any one time, which reduces our demand to approx. 3.75 kW or 16 A.

Generators, kW, kVA and kWh

Due to the physics of AC power generation and consumption, generators are sized in kVA rather than kW. In most instances we can consider that:

$$1\ kVA = 0.8\ kW$$

Current measurements on a generator are instantaneous – a snapshot of the current supplied when we happen to look at the meter on the front panel; just as our car speedometer only shows the instantaneous speed at which we are travelling when we happen to glance down at it. So, in order to show the cumulative energy produced we need to view it as energy produced over time. This is measured in kilowatt-hours (kWh).

KWh is the common unit used to bill electricity to consumers. For example, a 60-Watt light bulb that burns for one hour uses 0.06 kWh. Over 10 hours it would be 0.6 kWh.

Due to the nature of AC power generation, generators generally have three separate power outputs called 'phases'. For example if a 100-kVA generator could supply a total current of 420 Amps, there would be 140 A x 3 outputs. It is important to keep the load on each phase as equal as possible to allow the engine to run smoothly. Putting all the load on one phase causes engine wear and damages the machine.

Communicating with Your Power Company

Power companies are run by engineers who tend to talk in engineering terms, which can seem both exclusive and confusing. So let's run through a few of the more common ones to explain them:

Bunded Tank

All generators have a fuel tank inside of them and this will allow them to run for a certain time at full load — the generator manufacturer will specify for how long. In order to increase the running time many suppliers will supply an external tank that holds more fuel, to increase running time and save time on refuelling. These are double skinned or 'bunded' which is a fail-safe in case one of the skins becomes pierced. The tank should also contain the fuel if it is tipped over.

Residual Current Device (RCDs)

Special circuit breakers designed to operate in the event of a fault. They are designed to protect people against electric shock. A correctly designed system may contain several RCDs set at differing sensitivities, so shock protection is maintained but if one trips it won't turn off whole areas of an installation. Beware of the term 'nuisance tripping' — unless the RCD is at fault itself they don't 'nuisance trip', they trip because they sense a fault, the cause of which should be investigated.

Distro Box

Simply an electrical box used to distribute the generator outputs. This will contain the circuit breakers to protect the circuits in the event of a fault. Modern units are generally black plastic cubes with sockets on one side and clear windows containing the breakers on the other.

Uninterruptable Power Supply (UPS)

A device from the computer industry, which will provide power to a circuit should the generator fail. They are often used on ticketing cabins, CCTV and Internet infrastructure where a simple generator failure would cause disruption to site communications etc.

Fuel Filter

Before the diesel is fed into the engine it is filtered to remove any moisture and dirt to and protect the engine. Over time, these filters can become blocked and choke the flow of fuel, causing the engine to run erratically. They can also cause plumes of white smoke to emit from the machine. This is not a concern from a fire safety perspective but the machine does need immediate attention.

LINK TO FACTSHEET #17– WHAT TO ASK YOUR ENERGY SUPPLIER

Shambala Festival - Photo credit: Carolina Faruolo

PROS AND CONS OF LOW ENERGY CARBON TYPES

LINK TO FACTSHEET #8

Energy types differ in their emissions, and thus their environmental impact. The table below provides an overview of the most common energy sources used by events.

"Integrating renewable energy sources into festival's site infrastructure can reduce diesel fuel dependence, cut noise and air pollution as well as greenhouse gas emissions."

Andy Mead, CEO, Firefly Clean Energy.

Table 1: Carbon Emissions by Power Type:[2]

100% mineral diesel	2.676 kg CO_2e per litre
LPG	1.5 kg CO_2e per litre
Mains electricity (UK average)	0.412 kg CO_2e per kWh
Mains electricity (EU average)	0.350 kg CO_2 per kWh
WVO biodiesel	0.019 kg CO_2e per litre
Wind and solar	Zero-rated

[2.] Source: UK Department for Environment, Food, and Rural Affairs / Department for Business, Energy and Industrial Strategy greenhouse gas reporting conversion factors for 2016; updated annually. We have used CO_2e factors, which also account for the emissions of other greenhouse gases alongside carbon, 'converted' into carbon. The only exception is the mains electricity EU average, which is CO_2 only and taken from the UK Department for Environment, Food, and Rural Affairs greenhouse gas reporting conversion factors for 2015. Please note that other countries may publish separate carbon conversion factors.

Solar PV

DESCRIPTION	PROS	CONS
Photovoltaic cells mounted on panels, which convert sunlight into a DC electrical supply. The energy is stored in batteries and then inverters convert this to a useable AC power supply. Electricity is produced even with cloud cover.	• 100% renewable. • Zero carbon. • Silent running. • Proven reliability. • Can interface with hybrid technology to reduce generator runtimes & fuel consumption. • Visible demonstration of a festival's commitment to low carbon energy.	• Additional hire & logistics costs. • Requires a south facing aspect and additional space. • Performance affected by cloud cover. • Limited power output. • Applications limited by storage capacity of batteries.

CASE STUDY: SOLAR PV AT BOOM FESTIVAL

Boom Festival (Portugal, capacity 33,333) is powered by a mix of off-grid photovoltaic panels, diesel generators and a 100-kW waste vegetable oil (WVO) generator. The festival site, known as Boomland, is home to around 12 long-term residents and the onsite renewable technology is a permanent feature in the community. The residents spend the months between festivals living entirely on renewables, and creating an energy surplus for the next festival. Boom uses 40 kWh of solar energy, which is produced onsite, and is in the process of transitioning from diesel to even more off-grid photovoltaic energy. Their largest photovoltaic array comprises of 18 panels, all following the tilt of the sun and producing 13 kW per hour per day. To find out how they used 40% less energy in 2014 compared to 2012 read the full case study on line.

CLICK TO READ FULL CASE STUDY

Photo credit: Boom Festival

Hybrid Power

DESCRIPTION	PROS	CONS
Hybrid Power Generators are battery inverter systems that store the residual energy produced by diesel gensets when they are not running at full load. Their integral automated switching system allows them to stop generators and manage base loads from the energy stored in their batteries. As loads increase, the units re-sync and the generator seamlessly takes over the load management. See **Factsheet #3 – Using Hybrid Power at Events** for more details.	• Silent running. • Reduces diesel generator runtimes helping to save fuel & reduce emissions. • Reduction in generator runtimes helps reduce servicing intervals and prolong the unit's life. • Hire costs can be mitigated when fuel savings are monetised. • Capacity to integrate solar and wind turbines, further reducing diesel consumption.	• Additional space required to position units next to diesel generators. • Detailed understanding of load profile is required for effective deployment.

CASE STUDY: HYBRID POWER AT SECRET GARDEN PARTY

In 2014, Secret Garden Party (UK, capacity 30,000) saved 3,826 hours of diesel generator runtime by using hybrid systems – which was around 50% of the total runtime. This use of hybrid technology reduced diesel dependency by 10,285 litres. On top of that, the new system saved Secret Garden Party £7,713, and reduced overall carbon emissions for the festival by a staggering 24 tonnes. For more details about the equipment and systems they used, read the full case study online.

CLICK TO READ FULL CASE STUDY

Photo credit: Secret Garden Party

Biofuel/Biodiesel

DESCRIPTION	PROS	CONS
Fuels derived from crops (and sometimes animal fats). There are varied types and there are issues around the sustainability of different biofuels, for more information see the FAQ page or **Factsheet #5 – Biofuels for Festivals** for more details.	• Considered zero carbon , because the carbon emitted when it is burned as a fuel has already been absorbed by the growth of the plant. • Reduced CO_2 and NOx emissions compared with red diesel. • Non-toxic and non-contaminative.	• More expensive than red diesel. • Although now widely available, there can be supply chain issues where bulk supplies are required at short notice. • Can cause generator issues due to high viscosity (poor 'cold start' properties and blocked injectors). • Can shorten the lifetime of generator; components (e.g. engine seals & lift pumps) so that servicing intervals need to be increased.

CASE STUDY: BIODIESEL AT LATITUDE, LEEDS AND READING FESTIVALS

Festival Republic's (Event Promoter/Producer of 19 UK/EU Festivals) sustainability policy includes using waste vegetable oil (WVO) biodiesel to power some of the generators at Latitude, Reading and Leeds Festivals. Between 2010 and 2011 they increased the amount of biodiesel used at Leeds from 18.5% to 24.5%, and at Reading from 12.5% to 18.2% in 2012. This commitment continues despite there being a limited supply of WVO biodiesel in parts of the country, unpredictable price fluctuations, and a higher cost for sustainable biodiesel in comparison to regular diesel. They now aim for biofuel to make up 15% of the total fuel burned onsite, in line with the Julie's Bicycle benchmark, and are investigating efficiency measures to reduce the amount of fuel they use in the first instance.[3] Read the full case study to learn more about the energy efficiency measures taken by Festival Republic at the festivals

Photo credit: Festival Republic (Reading Festival)

CLICK TO READ FULL CASE STUDY

3. Julie's Bicycle Benchmarks allow event organisers to compare their environmental performance to the industry average. They can be found online here.

People Power

DESCRIPTION	PROS	CONS
Play equipment (dance floors, giant hamster wheels, seesaws and log rollers) and bicycle generators. They harness the power of human movement (kinetic energy) & transform this into a DC power supply.	• A great, educative way of engaging with audiences about energy production. • 100% renewable: zero emissions.	• Very limited power output (5–250 W). • Limited number of suppliers.

CASE STUDY: PEDAL POWER BY REACTION SOUND SYSTEM

Reaction Sound System (RSS) use audience participation to power small to medium-sized stages with specially designed bike generators. The audience can see how much power the pedaled bikes have created through responsive meters that show the energy available in the storage system. The energy from six cyclists can provide quality sound for audiences of up to 2000, in tents as long as 60 meters. With three adults pedalling hard the speakers can provide enough good quality sound to cater for around 200 people. To learn more about the efficient speaker system RSS use and their plans for the future read the full case study online.

CLICK TO READ FULL CASE STUDY

Photo credit: Reaction Sound System

Hydrogen Fuel Cell (Low carbon hydrogen fuel cell generators & tower lights)

DESCRIPTION	PROS	CONS
A device that converts the chemical energy of hydrogen into electricity. This is achieved through the creation of a safe chemical reaction of positively charged hydrogen ions with oxygen. Typically, these are currently only deployed as tower lights with a low wattage AC out capability.	• Zero CO_2, NOx and PM emissions. • The only by product from its operation is water. • Silent running. • No possibility of fuel or earth contamination. • Low maintenance and servicing. • Better fuel to kWh energy conversion than red diesel.	• Limited supply chain for rental spec units. • Very limited power output (175 W), so only suits low energy applications.

Smart Grids

DESCRIPTION	PROS	CONS
A Smart Grid is an energy system that controls the generation, distribution and storage of electricity and integrates different energy sources. Energy is stored and distributed as required in times of peak demand. This demand/response capacity helps balance electrical consumption with supply.	• Reduced environmental impact because part of the supply is generated through renewables. • More efficient use of energy (supply on demand model). • Energy metering is integral to system, providing organisers with real time monitoring and data. • A more centralised energy production model, which reduces the need for multiple autonomous generators with associated hire, fuel and logistics costs.	• Relatively untested in the temporary events industry. • Expensive to install. • Requires good wireless connectivity to operate, so may depend on the site's location. • Requires a specific skillset to install.

CASE STUDY: SMART GRIDS AT PUKKELPOP FESTIVAL

Pukkelpop Festival (Belgium, capacity 150,000) used a decentralised energy production plan across an area of their site called Baraque Futur. All the electricity was generated locally through solar PV and biofuel generators and supplemented with battery storage systems. Where production exceeded demand, the unused energy was then stored ready to be distributed to other areas of the site where consumption levels fluctuated.

SEE FACTSHEET #12 – SMART GRIDS EXPLAINED

Grid Connection

DESCRIPTION	PROS	CONS
Events can be run via a grid connection. This means tapping directly into existing local national grid power supplies. See **Factsheet #13 – Grid Power for Festivals** for more details.	• Where existing supplies and connections are available, this can represent the cheapest solution. • A 'green tariff' can be procured.[4] • Greater reliability (reduces risk of mechanical failure or human error). • Can reduce emissions and costs associated with the transportation of plant to site. • Silent running. • Cheaper than most temporary power solutions (£/kWh). • No fuel burnt so less air pollution onsite.	• Installing new grid connections can be expensive and time consuming. • Locations of specific electrical consumers onsite may prohibit a grid connection. • No redundancy planned for in the event of a grid power failure.

CASE STUDY: GRID HYDROELECTRICITY AT ØYA

Øya Festival (Norway, capacity 70,000) uses renewable hydroelectric mains power to supply its audience and site, a green space in the city centre of Oslo. In 2010, they switched from diesel generators to exclusively grid/mains power, which is 98% renewably-derived (mainly through hydroelectricity generation) and has removed virtually all onsite emissions. Read the full case study online to find out how Øya reduced energy consumption by 30% over three years.

READ THE FULL CASE STUDY

CASE STUDY: GRID CONNECTION AT CAMBRIDGE FOLK FESTIVAL

Cambridge Folk Festival (UK, capacity 14,000) is partially run off mains electricity, supplied through 100% renewable-derived electricity, which saves 12-15,000 litres of diesel per event. Read the full case study online to find out how Cambridge Folk Festival reduced their diesel usage by a third over five years.

READ THE FULL CASE STUDY

LINK TO FACTSHEET #13 – GRID POWER FOR FESTIVALS

4. In the UK, green tariffs are calculated at the same carbon emissions rate as the average electricity rate, as DEFRA already takes the renewable generation sources into account in its grid average. This is currently being reviewed. A green tariff is undoubtedly better for the environment even if the footprint is currently calculated to be the same as a normal tariff (DEFRA Environmental Reporting Guideline: 2013)

ENERGY: FREQUENTLY ASKED QUESTIONS

LINK TO FACTSHEET #14

These frequently asked questions derive from feedback provided by UK festival organisers in the annual Industry Green Survey (2014, 2015, 2016) conducted by Powerful Thinking, as well as questions posed to members of the steering group and power companies.

Q: Isn't 'renewable' power unreliable?

A: Not if the system is well designed. Most newer systems have battery back-ups, which store energy, and will continue to produce power if there is an issue e.g. in overcast conditions in the case of solar. Many providers come with a reserve in place. Some also say that as there are fewer or no moving parts, renewable power is actually more reliable. However, it should be noted that there is more of a need to work out power requirements in detail to match supply and demand.

CASE STUDY: RENEWABLE POWER AT GLASTONBURY FESTIVAL

This 1.5 kW solar unit with 22 kWh of battery storage ran the Green Fields coordinators camp at Glastonbury Festival (UK, capacity 187,000) without problems. Previously, the camp was connected by a long cable to share a diesel generator in another field, and had experienced power outages when that machine stopped. When correctly matched with the demand, renewables can actually be more reliable than a conventional diesel generator setup. To find out how Glastonbury Festival used hybrid units to improve energy efficiency read the full case study online.

READ THE FULL CASE STUDY

Q: Do 'renewable' solutions cost more?

A: Sometimes they do, but sometimes they don't, so the pros and cons need to be evaluated just as with any other decision. In many cases where a large amount of power is required (for example above 45 kVA), there may not be a viable solution or costs may be prohibitive. But for smaller requirements, you may be able to reduce the amount of power you need in the first place by working efficiently, and then use cost-effective renewable solutions. Feedback from festivals suggests that it is often forgotten that there are no fuel bills post-event for solar and wind systems (so initial cost comparisons are misleading). There are many examples at small to medium scale events of renewable and hybrid approaches that have delivered significant cost savings. Savings will be dictated by circumstance, so it is very important to maximize planning and explore all available options.

CASE STUDY: RENEWABLE SOLUTIONS AT SHAMBALA FESTIVAL

In 2014 Shambala Festival (UK, capacity 15,000) achieved 100% renewable energy. They used biofuel in generators, used hybrid systems across the site, and integrated solar sources. Onsite fuel consumption was also reduced by 20% from previous years through efficiency as a result of better planning. Overall the cost of energy per person per day at Shambala in 2016 was the same as in the year 2000 (actually reduced if you take into account inflation), showing that more sustainable approaches don't necessarily need to cost more.

READ THE FULL CASE STUDY

Q: Isn't it the case that we always need a margin of error in the capacity of generators for the unexpected?

Yes, but Powerful Thinking's research suggests that current margins are often excessive. See also **Factsheet #15 – Identifying Fuel Wastage** and **Factsheet #11 – How Energy Actually Works and Essential Terminology**.

Q: Can you power entire events on renewable low carbon solutions?

There are many examples of small to medium festivals (under a capacity of 20,000 people) being entirely powered by temporary renewable and WVO solutions. Examples include Croissant Neuf, London Green Fair, Shambala, The Green Gathering, Boom Festival, We Love Green, and Dekmantel.

See **Factsheet #9 – Five Easy Steps to Greener Power at Small Events** for tips and ideas for powering your event or areas of your site with renewable energy.

Q: Does festoon lighting need to remain on during the day to manage loads on generators?

A: No this is fiction! Festoon switched on in the daytime other than for decorative purposes only increases load and fuel consumption, and you would need a lot of festoon for a decent load! If a generator is dedicated to festoon lighting it can be switched off. For maximum efficiency ensure you use automatic sensors that switch off all site lighting during daylight hours. Also consider using LED festoon lamps as these have lower energy consumption and create less waste (they last considerably longer), and you can do longer festoon runs because you can get more lamps on a 16 A supply!

CASE STUDY: LOW CARBON SOULTIONS AT DEKMANTEL FESTIVAL

Between 2015 and 2016 Dekmantel Festival (Netherlands, capacity 30,000) switched from using fossil fuels to a renewable biofuel (HVO) reducing their CO_2 emissions by 93%. By working with ZAP Concepts to implement a 'Smart Power Plan' they also reduced the energy use of the festival by 28% meaning that the switch actually saved them money on their fuel bill despite the higher price of HVO. The biofuel they used was supplied by GoodFuels, which is both sustainably sourced and reliable.

Q: Do I have to leave amps and stage lights on overnight?

A: Most companies say this is necessary in order to keep equipment warm and avoid condensation – most electronics do not like the damp British countryside! Always consider a smaller secondary power source so the main generator can be switched off when the stage is not in use overnight i.e. when load is reduced. If you do use a secondary smaller power supply ideally this should be synchronised with the main generator to avoid turning off the equipment and switching it on again as this can also cause issues. See **Factsheet #3 – Using Hybrid Power at Events**.

CASE STUDY: ENERGY EFFICIENT LIGHTING AT FESTIVAL REPUBLIC

Festival Republic (Event Promoter/Producer of 19 UK/EU Festivals) works with their contractors to reduce energy demand through specifying more energy efficient technologies: In 2012, Colour Sound Experiment, one of their lighting and visuals rental companies, invested in 1.5 km of LED festoon lighting in response to demand from Reading Festival. Festival Republic also work with their supply chain in other areas and, since 2014, they have added obligations into energy supplier contracts to integrate alternative and new energy technologies such as hybrid generators and solar power. Read more online.

READ THE FULL CASE STUDY

Q: How significant is the impact of changing traditional stage lighting for LEDs on fuel and equipment needed?

A: The impact of LED stage lighting on efficiency and fuel use can be huge – in the example below a saving of 70% was made. There are also other ways to reduce main stage fuel use, for example using smaller gensets or hybrid units to manage low loads overnight.

Photo credit: ZAP Concepts

Example of reducing emissions and fuel use by 70%

In this example scenario PAR lights, with a conventional lamp of 650 W, are changed for LED lights of 36 W each saving 614 W per light.

Let's say that during a ten hour show the total time the PAR light is actually used is approximately two hours. If in a stage 50 PARs are used, the energy savings will be 614 x 50 x 2 = 61,4 kWh. As a result of the change the total power demand of the stage will be reduced by 30.7 kW. If in this example the original maximum power demand of the total stage was 80 kW, a generator of minimum 100 kVA would have had to be used. The average load on the generator would be approximately 20 kW. This load on a 100-kVA diesel generator leads to an efficiency of approx. 18%. Per show day, the fuel consumption of a generator in this situation will be approximately 110 litre diesel.

After replacing the conventional lamps with LED lights, the maximum power demand of the total stage will be 50 kW. A generator of minimum 60 kVA will be needed. The average load on this generator then will be approximately 14 kW. This load on a 60-kVA diesel generator leads to an efficiency of approx. 23%. Per show day, the fuel consumption of this generator in this situation will be approx. 32 litres of diesel.

So changing the conventional 650 W PAR lights into 36 W LED PAR lights would save 70% of fuel consumption and therefore 70% of the stage's CO_2 emissions.

This huge effect is not only because of lower power consumption by the lights itself, but also because of a reduction of the peak demand. Because a smaller generator can then be used, the average load on this generator is relatively higher and thus the efficiency of the generator is also higher. NB Although designing out large demand peaks in power systems is desirable, as it means smaller generators can be used and fuel savings achieved, this isn't always possible in the case of stages as there may be peaks due to the quality of the show.

Q: Doesn't the extra transport from bringing in additional specialist equipment undo all the environmental benefits of fuel savings from efficiencies onsite?

A: Often it does not. The savings that can be made from the reduction of fuel use over a period of time (of anything between a few days or a few weeks) onsite will often outweigh any additional transport fuel used to either bring additional equipment from another supplier or bring equipment from further away. Let's look at some examples that demonstrate this:

Using a Hybrid Generator

Photo credit: Firefly Clean Energy

A 24 tonne artic with a Euro IV tier engine travelling at an average of 50mph produces 685 g of CO_2 per kilometre travelled. So, this vehicle driving from Brighton to London and back to deliver a Hybrid Power Generator for an event would generate only 137.4 kg of CO_2 (97 km x 0.685 kg x 2 journeys = 137.4 kg). However, over a five-day period the hybrid might reduce a 60-kVA diesel generator's run time by 10 hours per day, equating to an overall fuel saving of 200 litres which reduces CO_2 emissions by 593 kg (200 litres x 2.96572 = 593 kg). So, where modern fleet vehicles are used, there are definite benefits to going that extra mile to deploy hybrid systems.[5]

Using a Biofuel Generator

Whereas a hybrid unit (above example) needs to be brought in to work alongside a standard CI (combustion ignition) generator, meaning that it takes up extra lorry space or that an additional vehicle needs to be booked, a biodiesel generator is a direct replacement for a standard diesel generator and therefore requires no additional trucking, unless you have to book through a specialist plant hire company that might be located further from your site. Even if you are transporting a biodiesel generator over a longer distance, in terms of carbon emissions, it will probably work out as the better option: The carbon emissions associated with 1 litre of standard fuel are 2.676 kg, whereas for biofuel they are 0.019 kg (effectively zero). So, if your generator burns 250 litre per day, of normal fuel it would produce 669 kg CO_2e, whereas the equivalent biodiesel emissions would be 4.75 kg CO_2e. Using the same transport emission assumptions as above (685 g CO_2/ km), then you could drive that truck an extra 970 km before you would make up the difference in carbon emissions from fuel use in a single day.[6]

Q: What is biofuel?

A: There is now an increasing range of 'biofuels' available. Biofuels are specifically those made from crop-based resources, for example soya, palm oil, rapeseed and jatropha. Hydrated vegetable oil (HVO) and glycerine (or glycerol) also fall within this category of fuels. In contrast, the term biodiesel (or renewable diesel fuels) refers to fuels that can be made from recycled cooking oil (WVO) and animal fats.

5. Source: Transport Research Laboratory & National Energy Foundation.
6. See the Carbon Emissions by Power Type Table, pg. 8 of this guide.

Q: Is Biofuel more environmentally sustainable than diesel?

A: Yes. Waste Vegetable Oil (WVO), the most common alternative fuel to red diesel used at events, is regarded has having a lower environmental impact because the carbon emitted when it is burned as a fuel has already been absorbed by the growth of the plant during its cultivation. In addition it is a recycled waste product.

Hydrogenated Vegetable Oil (HVO), on the other hand, is a virgin crop and is cultivated specifically for biofuels. This raises ethical questions on land usage; should communities be displaced, swathes of land deforested and water sources diverted to grow fuel crops?

Glycerine based fuels, a new type of fuels emerging in the market, are a natural byproduct of biodiesel production. Provided that the resources used in its manufacture are considered to be ethically sourced, i.e. no palm oil or virgin crop derivatives, then its environmental impact is very low.

LINK TO FACTSHEET #5 – BIOFUELS FOR FESTIVALS

"The use of vegetable oils for engine fuel may seem insignificant today, but such oils may become, in the course of time as important as petroleum."

Rudolf Diesel, inventor of the Diesel Engine, 1912.

CASE STUDY: BIOFUEL AT INTO THE GREAT WIDE OPEN FESTIVAL

Into the Great Wide Open (ITGWO) (Netherlands, capacity 7,000) takes place on the Island of Vlieland on the northwest coast of the Netherlands. In 2016, they switched from diesel to 2nd generation biofuels (fuel derived solely from recycled organic waste matter, distributed and sold by a company called GoodFuels) to power the generators used at the festival, reducing the amount of CO_2 produced in the onsite energy production of the festival by 85%. Find out more about ITGWO's commitment to exploring how festivals can be used as a catalyst for bigger societal changes.

READ THE FULL CASE STUDY

Q: How important is the source of the biofuel I use?

A: The provenance of biofuel is very much part of how sustainable the fuel is considered to be, and this can sometimes be a complex issue. Nationally sourced fuels (such as WVO) can be a safe option in terms of guaranteeing their source. The provenance of other fuels can be less straightforward to ascertain. Ask your supplier for certification and avoid virgin fuels or fuels sourced from outside Europe.

CASE STUDY: BIODIESEL AT MYSTERYLAND FESTIVAL

In 2015, Mysteryland Festival (Netherlands, capacity 60,000) powered their campsite entirely on biodiesel and increased biodiesel use by 15% across the entire site. For the 2015 festival, they used FAME biodiesel, which they considered too risky in terms of reliability to use site-wide. They are now searching for biodiesel from reliable sources and are committed to checking the provenance with Greenpeace to ensure it is the best sustainable alternative for fossil fuel.

READ THE FULL CASE STUDY

Photo credit: Leeds Festival

HOW MUCH POWER DO YOU REALLY NEED?

Power contractors often do not have accurate information about power requirements in advance. One solution to this is to include the task of obtaining this data in the power suppliers contract, or collecting the information in-house and passing it on to the supplier in good time and ensuring there is an effective method to share updates about contractor and site changes as the event approaches.

Many power users either do not understand their energy requirements, or add a significant margin to their requirements for safety. A few common examples include:

- Concessions often order either a 16 or 32 Amp supply with little or no knowledge of their actual requirements. For more details see **Factsheet #19 – Working Out Energy Requirements for Concessions**.
- It is common for lighting companies to provide their theoretical maximum demand, which can be much larger than the realistic 'peak load'.
- Creative projects that may not have an understanding of their requirements.
- Every tour bus will demand 3-phase 32 A connection. Depending on the size of the show and how many patient artist liaison/tech people you have on the ground it is perfectly possible to limit this to single phase power in advance – which will still power most sockets and appliances onboard, but not air conditioning.
- Stage/area managers often add margins to the requirements for their stage/area, do not know their requirements or just order the same as last year 'because it worked'.
- Artists bringing their own show and lighting often demand specific power requirements.

Once you have eliminated the 'fantasy' power demand you can move onto working with stakeholders to reduce the real demand.

Energy reductions can typically be found in four key areas:

- Gaining accurate requirements in advance to enable better system design.
- Using more energy efficient equipment, such as LED lighting – see box below.
- Reducing runtime of generators to the minimum requirements.
- Re-sizing generators.
- Better overall planning to reduce last-minute changes.

EXAMPLES OF REDUCING ENERGY REQUIREMENTS

- LED festoon.
- LED stage lighting.
- Auto daylight switch-off/on sensors on lighting and festoon.
- Removing fuses from cabin heaters (if they are not required).
- Have a policy of supplying only 16 A feeds to tour buses and requesting no air-con.
- Charging significantly (relatively) more for larger power feeds to concessions.
- 'Switch-off' campaigns for all staff and contractors.
- Accurate specifications.
- Reducing the use of electric tea urns (or banning them) and replacing with gas.

Using gas ovens and urns at temporary outdoor events is far more efficient than using electric. Heating equipment powered directly from butane (gas) has an efficiency of almost 95% whereas electric ovens are powered indirectly via diesel generators, which generally run at a far lower efficiency therefore reducing the efficiency of your electric oven i.e. if you burn 1 litre of diesel directly into an electric oven, you will get 10 kWh of heat-energy to cook your food. But if you burn 1 litre diesel into a diesel generator, running at approximately 30% efficiency you will only get 3 kWh of electrical energy.

See **Factsheet #1 – Sustainable Energy Tips for Traders** for more ideas.

See **Factsheet #2 – Ten Top Tips for Reducing Fuel Bills at Festivals** for more details.

CASE STUDY: ENERGY EFFICIENT LIGHTING AT CAMBRIDGE FOLK FESTIVAL

Cambridge Folk Festival (UK, capacity 14,000) have introduced a number of innovations in lighting: adding photocells sensors (manufactured in-house), to switch site lighting on and off at dawn and dusk as required, resulting in huge savings in energy use and cost. They also swapped power-hungry tungsten floodlights with LED floods and also replaced festoon lights with LED festoon. Read the online case study to find out how Cambridge Folk Festival work with stakeholders to reduce their environmental impacts.

READ THE FULL CASE STUDY

Photo credit: Cambridge Folk Festival

Knowledge and collaboration are key to reducing your environmental impacts. Knowing the energy you consume, where it is consumed and what the alternatives are will help planning for targeted actions and continuous improvement."

Liz Warwick, Energy Consultant, Lansdowne Warwick.

IDENTIFYING FUEL WASTAGE

FACTSHEET #15 – IDENTIFYING FUEL WASTAGE

Since the 1980s, when outdoor events were becoming more prevalent, the typical model that has persisted in the events industry is one in which the power company will supply generators with a significant margin of extra capacity in order to provide a reliable service, based on unknown or incorrect power requirements from event organisers. This is wasting time, fuel, money and emitting avoidable emissions into the atmosphere.

Where is fuel being wasted?

Research by Dutch Energy Consultants, Watt-Now, helps us to understand the reasons for fuel wastage, and backs up conclusions from several UK studies by De Montfort University and Julie's Bicycle.[7]

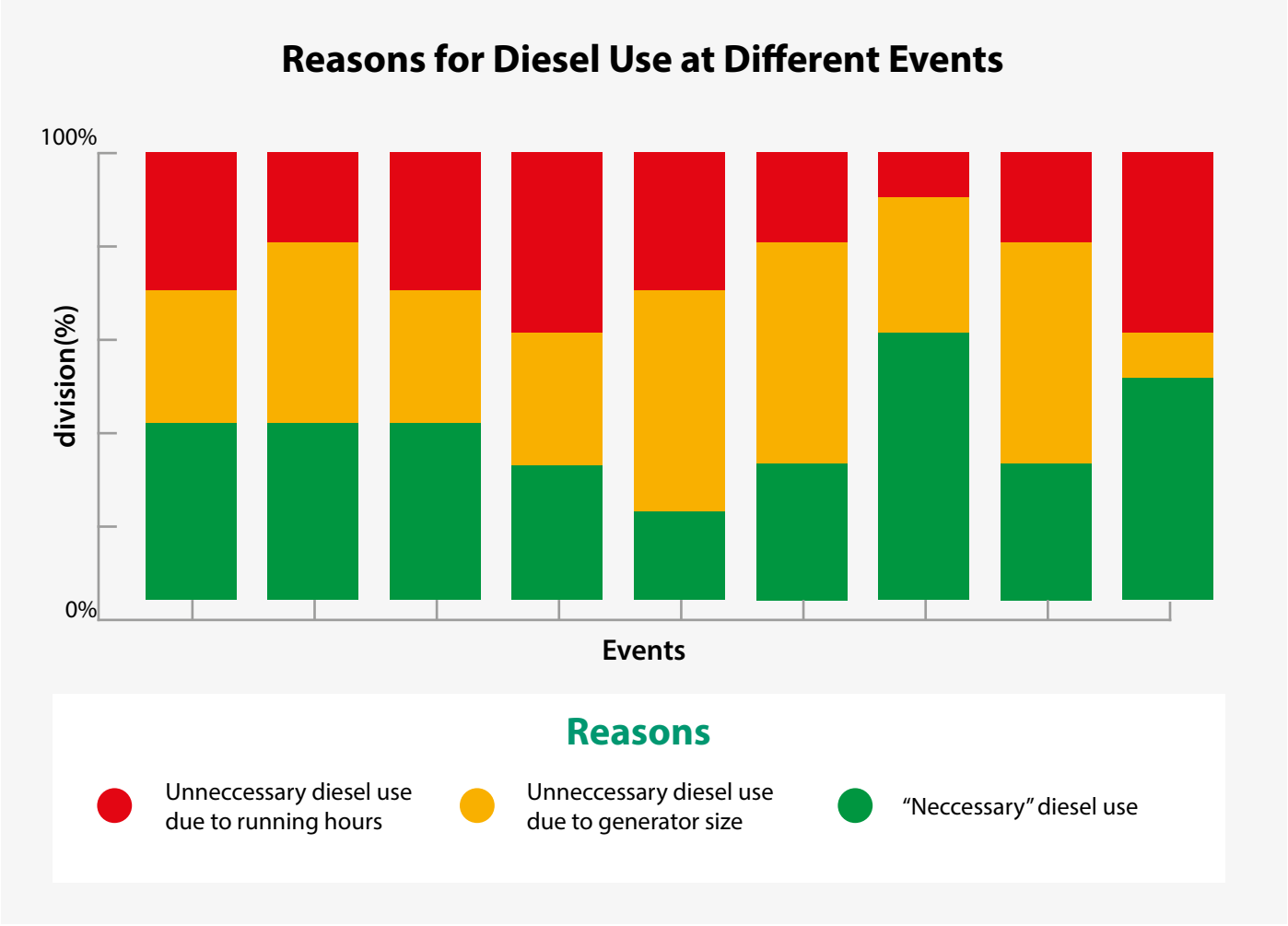


Figure 3. Reasons for Diesel Use at Different Events, Watt-Now, 2015

[7.] Watt-Now presented this research and findings at the ADE Green in 2015. Studies from De Montford University and Julie's Bicycle are presented in The Power Behind Festivals Guide ed.1 (Powerful Thinking: 2012).

The main factors that lead to inefficiency:

- Inaccurate or absent power specifications in advance.
- Lack of detailed scheduling i.e. generators being run unnecessarily.
- Inefficient and old equipment that uses a lot of power.
- Behaviour e.g. leaving lights or equipment on when not needed.
- Single source power demands e.g. sponsors and headline acts.

Generally the root cause of inefficiency is a lack of accurate information about the power requirements of the event in advance, which is needed in order to plan an efficient power system.

CASE STUDY: DE PARADE AMSTERDAM SAVE 27% DIESEL IN A YEAR

De Parade Festival (Netherlands, capacity 100,000 over 16 days) worked with energy consultants Watt-Now to save 15,300 litres of diesel in 2016 compared to the previous year (27%), by monitoring and reducing fuel use. They predict that a further 7% of saving can be achieved next year. Read the online case study to learn how Watt-Now redesigend the generator arrangement to be more efficient.

READ THE FULL CASE STUDY

CASE STUDY: THE SHOWMAN'S SHOW CUT DIESEL USE BY 50%

The Showman's Show (UK, capacity 10,000) cut diesel consumption by 50% in 2014 by monitoring and reviewing generator sizes, reconfiguring the power supply for their crew-catering tent and switching off generators when not in use — the last measure alone saved over 200 litres of fuel. In 2015, they worked with their contractor to improve the existing electrical infrastructure, greatly reducing energy demand onsite meaning that the crew catering facility, campsite and site office could now run on mains power. They also installed an extra permanent floodlight which meant one less lighting tower needed to be shipped in and run. Read the full case study online to learn more about the changes they implemented.

READ THE FULL CASE STUDY

Photo credit: The Showman's Show

Table 2: Reasons for Diesel Wastage

CAUSE	EXPLANATION/DETAIL
Uncertain information about actual requirements.	A production manager and/or power company will often add a margin to power demand estimates to ensure they can accommodate the unforeseen, and make sure the show can run smoothly. The result can be significantly oversized generators, rather than generators sized to allow for a moderate percentage of headroom. Power suppliers can't be expected to reduce the size of generators without more accurate information from festivals and/or end users about what is actually required.
Single source power demands from artists.	Artists often request a dedicated power source for their specific needs because it is believed to be less risky. This is inherently less efficient as it requires more generators, usually running at lower loads. Whilst scenarios are undoubtedly case-by-case, feedback suggests that in many cases generators could supply several end users safely with trips and careful system design. Who is generally likely to know more about whether a power system is robust – the power supplier or the artist management company? The role of the artist representative is to provide accurate information to enable a robust system to be designed by the power contractor.
Over-specification of requirements.	For example, a stage lighting provider may make a request for power that leaves plenty of capacity over and above their needs and the power company may also add a margin. This is typical, and is one of the most common caused of oversized generators and fuel waste.
Cross-hiring equipment.	Many power suppliers don't own their equipment and consequently use generators that are larger (rather than smaller) due to stock availability from their generator suppliers. Whilst there may be no intention to do this, it happens, and the result is potentially higher fuel bills for the festival depending on how the generator is loaded.
Specific needs of certain equipment.	Some equipment, such as electric starter motors for showers and pumps, require a huge amount of power to get started and then run on very little, causing lower generator efficiencies for most of the running time.
Different demands at different times.	A difference in power demand at different times and periods during events is inevitable, for example build and break, day and night, and during main stage headliners etc. A system that is not designed with that variation in mind will waste fuel. A common approach is to design systems powered from multiple generators, so that some can be switched off during periods of low demand rather than supplying each area with a single generator which is always on. Hybrid units are also effective in many situations where periods of low demand occur because they allow their associated generators to be switched off.
Lack of cooperation between parties.	It is typical that parties responsible for various elements of the organisation of an event don't communicate about power effectively. If festival managers consider power, ensuring accurate specifications from all end users, and site managers work with the power contractors input, savings can usually be made though better system design.

HOW DOES YOUR EVENT COMPARE TO THE UK FUEL CONSUMPTION AVERAGE?

Created by Powerful Thinking with support from the UK's Association of Independent Festivals, the Festival Fuel Tool is a simple tool that provides a user with an energy rating based on industry benchmarks, carbon emissions attributable to fuel use, percentage of WVO biodiesel compared to industry averages and a print-out of results to share with staff. It is intended as a guide – all events are unique and there may be good reasons for differences. For more detailed information and insight, event organisers can use the Julie's Bicycle Creative IG Tools.

FESTIVAL FUEL TOOL SUPPORTED BY THE AIF

CASE STUDY: ENERGY MONITORING FESTIVAL AT GLASTONBURY FESTIVAL

Photo credit: Glastonbury Festival

In 2014, Glastonbury Festival (UK, capacity 187,000) undertook a comprehensive energy-monitoring project in partnership with power contractor Aggreko and researchers at the University of the West of England (UWE). They monitored the output of generators onsite and analysed the data to see how efficiently the generators were being used in order to specify correct sized generators for future editions of the festival and to investigate energy and fuel saving options. By wirelessly monitoring 126 generators and sending research staff onsite to study particular areas in more depth they were able to plot the 'real time' output for each machine. They found that a large proportion of the generators monitored were significantly oversized for their purpose, confirming what the various previous industry research published in the Power Behind Festivals Guide (Powerful Thinking: 2012) has highlighted as a key issue and opportunity for energy reductions. For more details of the project read the full case study online.

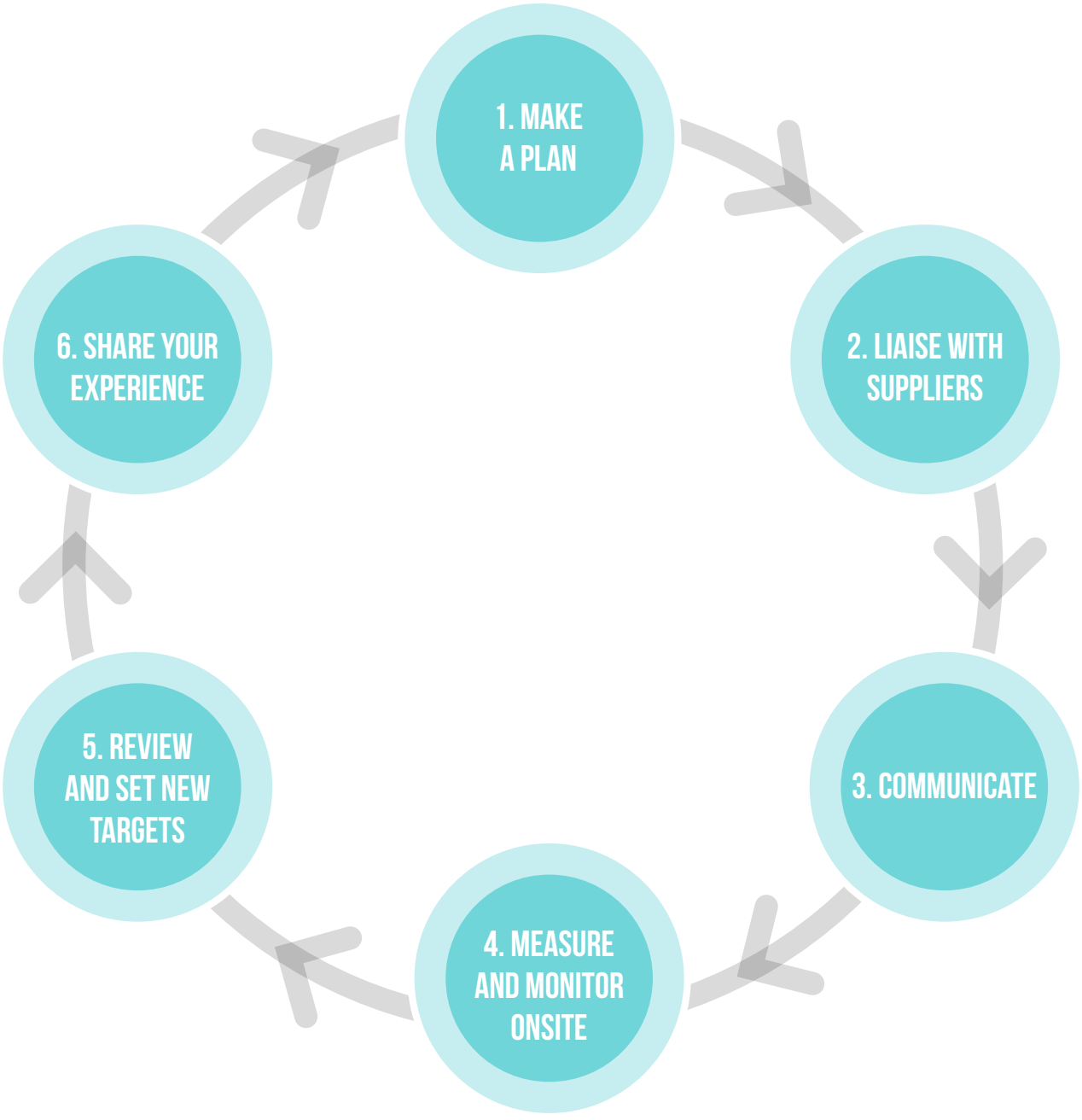
READ THE FULL CASE STUDY

PART TWO: TAKING ACTION

In the context of everything that it takes to plan and manage a successful outdoor event, managing power efficiently, relatively speaking, should not pose a significant challenge. It may just require a few changes to how you do things. Experience from the many festivals that have already made changes show that having a clear plan with senior management approval and successful engagement with all stakeholders early in the process is critical. Many event organisers have said that being too busy, or not feeling clear about the best way to manage energy are the main barriers to making changes (Festival Industry Green Survey, Powerful Thinking: 2015). The Energy Action Plan aims to provide a clear roadmap for the process of moving toward smarter energy management.

ENERGY ACTION PLAN

LINK TO FACTSHEET #16



1. MAKE A PLAN

- Assign someone to manage the process see **Factsheet #7 – Roles at a Glance**.
- What targets do you want to achieve? E.g.
  - ✓ Fuel savings?
  - ✓ Reduction in energy demand?
  - ✓ Reduction in carbon emissions?
  - ✓ New contracts/terms with power supplier?
  - ✓ Increased measurement of load and fuel use for generators?
  - ✓ Engaging a specialist consultant to review energy management and identify savings?
  - ✓ Improve green credentials?
- Review the last 3 years' energy consumption including diesel, electricity, battery, biofuel and LPG if these figures are available – if not make it a priority to measure this year.
- Consider any obstacles to achieving targets.
- Identify all stakeholders (anyone involved in using power or who is responsible for power) and their potential influence on consumption levels.
- Agree actions and timescales.
- Write it all down in one brief document and call it the 'Energy Action Plan'.

2. LIAISE WITH POWER SUPPLIER

- Meet with your power supplier to discuss aims (and any changes) and reflect these in your contract terms. For more advice on contract terms see **Factsheet #6 - Five Tips for Smart Energy Contracts**.
- Key aspects you should include:
  - ✓ Agree fuel use (or reduction) targets.
  - ✓ Set clear responsibilities for how generators and other power will be monitored, how energy is recorded and by whom.
  - ✓ Request a detailed post-event report on energy management.
  - ✓ Agree responsibility for contacting all end-users of power for their accurate requirements and a timeline to achieve this. This includes all concessions, artists' management (for tour buses), outside broadcasting, production and contractors. NB it is really important the timeline is stuck to so that the supplier has time to design an efficient system.
- Prepare an inventory of all equipment detailing location, function, use, estimated hours of use and power requirements.
- Ask an expert (e.g. an energy consultant) to review all equipment and map into geographical areas to assess optimum layout and usage for generators and other power supplies.
- Consider options for more energy efficient equipment or technology e.g. LED festoon lighting, photocell distros and generator load monitoring.
- Consider options for renewable energy e.g. sustainably sourced biofuel, solar, pedal power.

For a full brief on this topic see **Factsheet #17 – What to Ask Your Energy Supplier**.

3. COMMUNICATE

By sharing your intentions with everyone in the organisation and all stakeholders it is far more likely that changes will happen. We recommend that once you have a plan in place you send it, or a summary, along with any other useful information (see below) to everyone concerned. Please refer to and use to following resources to help you communicate with stakeholders:

Factsheet #4 – Communicating Green Energy at Events: An overview of the key things to consider when communicating about energy to audiences, staff and contractors

Factsheet #7 – Roles at a Glance: Easily share-able one pager that helps your key managers and/or teams and contractors become aware and understand what they can do to contribute.

Factsheet #18 – Getting Smart With Energy for Stakeholders: Some text that you can copy, paste and adapt to share your rationale and specific intentions about how you intend to manage energy and changes to the way you do things.

4. MEASURE AND MONITOR ONSITE

You need good data from the previous year (several years if available). If not, capturing information from the upcoming show(s) is an opportunity to establish a baseline to work from in future. Either ask your contractor to do this, or you can achieve this in-house.

- Ensure all generators, tower lights and other fuel consumption are recorded individually and by location on site.
- Measure and record fuel usage to be able to monitor the 'Construction', 'Event' and 'Load Out' periods separately.

For a how-to guide and recording template see **Factsheet #20 – Measuring Generator Loads Resource Pack**.

For an overview of measuring all types of energy consumed onsite, see **Factsheet #21 – Advanced Power Monitoring Resource Pack**.

5. REVIEW AND SET NEW TARGETS

You need information in a useful format to feed into decision making for the next event. The most sensible option is to stipulate monitoring and a detailed report as part of the energy contract. Either your power company or a dedicated consultant will need to review this and include in their debrief/report. See **Factsheet #6 - Five Tips for Smart Energy Contracts**.

From the power report (if it does not already make these suggestions explicitly) you should be able to:

- Identify where changes can be made to reduce generator sizes.
- Tackle significant energy spikes by identifying their sources.
- Build a better picture of realistic energy needs.
- Identify opportunities to make changes to the system design for efficiency.
- Celebrate your achievements!
- Use debrief to prepare new targets for the following year.

6. SHARE YOUR EXPERIENCE

If you have successes or learning points share them with the growing community of events making changes to become more sustainable by offering a case study of your experience for the Powerful Thinking website. Powerful Thinking is a not-for-profit industry collaboration – everything we do is in the spirit of cooperation to help our industry make positive changes to meet the challenges of the future.

Consider joining the **Festival Vision: 2025** initiative, by signing a pledge to cut your emissions by 50% by 2025. Think this isn't possible? Reducing your energy impacts is a significant step, but read **The Show Must Go On** report to find out how it can be done, and take the pledge. Over 50 UK music festivals are now involved, with 90% of these stating that; "they have been inspired or encouraged to take action," as a result of being part of the initiative. Why? It's easier to take action together, with support, and with the chance to share experiences.

TIPS AND INSPIRATION FOR YOUR ENERGY ACTION PLAN

Tips for Including Energy Efficiency in Contracts with Power Providers:

1. Consider multi-year contracts – Provide confidence to commit to changes in approach – which may take more than one year to achieve.
2. Make energy efficiency a stated priority – Be clear about your intention and agree a realistic target for fuel reductions with your power provider.
3. Collect accurate power requirements in advance – An accurate understanding of requirements is the cornerstone of success! Include with the power contract or collect in-house.
4. Monitor generators during the event – An essential part of any sensible contract.
5. Reporting – Include a detailed report as part of your contract so you have information to make positive changes.

For more advice on contract terms see **Factsheet #6 - Five Tips for Smart Energy Contracts.**

Tips on What to Ask Your Energy Supplier:

Not everyone is an energy expert. Below are some questions to guide initial conversations with your supplier and make sure you're heading in the right direction.

- Based on the previous year (if applicable), do they think loads could be combined with changes to generator locations to achieve fewer generators?
- Based on previous experience, what equipment do they advise against in order to achieve reductions in demand?
- What information is actually useful to them? So that you can include requests for it in traders documentation to more accurately assess demand.
- Where can hybrid or smaller generators be employed to reduce fuel consumption overnight?
- Can they offer LED festoon?
- Can they use (at least a percentage of) biodiesel?

For a full brief on this topic see **Factsheet #17 – What to Ask Your Energy Supplier**.

CASE STUDY: 'SMART POWER PLAN' SAVES MYSTERYLAND 25% DIESEL

Mysteryland (Netherlands, capacity 60,000 per day) promoter ID&T saved 25% of diesel in 2016 compared to 2015 by working with sustainable events consultancy ZAP Concepts to create and roll out a 'Smart Power Plan' to achieve their goals for energy efficiency and budget. Read the full case study online for details of how each section of the plan was achieved.

READ FULL CASE STUDY

"It's essential that we find greener, more sustainable ways to power whatever we want to get up to outdoors, whether that's a festival, a standalone performance or a TV or film shoot. Quality research and a joined-up approach across all sectors wanting to find a low carbon, cost-effective future for location work is vital. We will be sharing this guide with colleagues across the BBC to raise awareness of the issue and hopefully drive change."

Richard Smith, Sustainable Production Manager, BBC.

See **Factsheet #10 – Power Sources on Location** for information and inspiration about how producers of screen arts can make positive choices about their on-location power.

THE FUTURE

Despite the entrenched nature of our current global energy infrastructure, change is inevitable as fossil fuels become more expensive and less accessible. It is widely accepted in science and politics that unchecked emissions pose a significant threat to the climate system.[8] We are already seeing the current economic and energy infrastructure being re-modeled to account for this.[9] The consequent profound changes will be impossible to achieve in a way that does not impact on all aspects of the festival sector: energy costs are volatile, carbon pricing is already happening and these business realities are stimulating change much more effectively than climate science.

Protecting energy and resource supply, understanding demand and capital interventions that will buffer the sector from price and supply volatility are of critical importance. New technologies and business relationships in energy and resource supply, distribution and consumption have already begun to transform the creative industries. Investing in change now will ensure that the UK can meet its legally binding 80% reduction target by 2050, as set out in the Climate Change Act of 2008, and will, in large part, determine the future shape of how we power the festival industry.[10]

If festivals are to play their role in this wider context and mitigate potentially significant cost increases, the future of energy at outdoor events is likely to include the following as standard practices:

- Monitoring of power during events and industry-wide reporting standards.
- Charging models based on £/kWh or Litres/kWh.
- A culture of efficiency reflected in contractual arrangements.
- Key contractors (such as stage lighting providers) supplying energy load schedules.
- Dedicated energy manager roles for events.
- Reduction of fossil fuel reliance.
- Ongoing collaboration and sharing of experiences and new ideas between festival organisers, production professionals, power suppliers, hire companies, research institutions, technology providers, and others, to ensure the industry stays at the forefront of new energy technology being developed and benefits from future innovation.

And the result? A resilient industry, able to continually create moments of magic in the lives of many, unimpaired by economic, social, or environmental hazards.

Amazing things are happening with technology that will improve the ability of renewables to play a more significant role in temporary power, such as storage solutions, and innovative approaches to power generation with kinetic pathways and energy from urine. Check out the Useful Links page at the end of this guide for sources that will allow you to keep up to date with the latest developments.

8. IPCC, Climate Change 2014: Impacts, Adaptation and Vulnerability – Working Group II Contribution to Assessment Report 5 (IPCC: 2014), http://www.ipcc-wg2.gov/AR5. See also: United Nations Framework Convention on Climate Change, The Paris Agreement, http://newsroom.unfccc.int/paris-agreement/.

9. Global Trends in Renewable Energy Investment 2015 [edition 9]: United Nations Environmental Program.

10. UK Climate Change Act 2008, http://www.legislation.gov.uk/ukpga/2008/27.

LINKS TO USEFUL RESOURCES

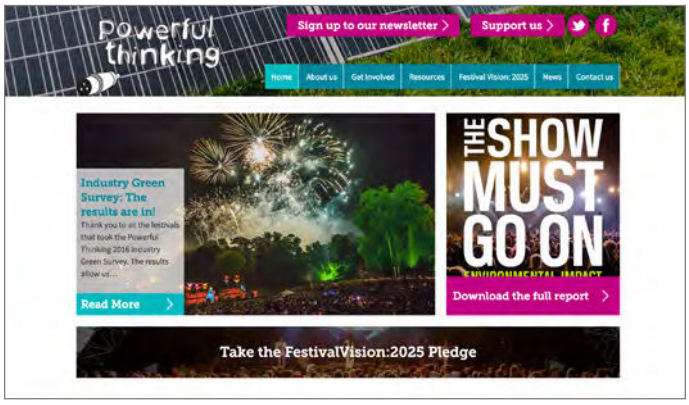
ENERGY INFORMATION

Festival Fuel Tool

Case studies

Factsheets

Sign up for the latest Powerful Thinking news



OTHER USEFUL LINKS TO GREEN FESTIVAL RESOURCES

Julie's Bicycle Industry Green Tools - Use these to measure your event's carbon footprint.

Julie's Bicycle Greening the Office Guide - Helpful advice on reducing the impact of energy use in your office space.

A Greener Festival - Resources including videos of the Green Events and Innovations Conference power sessions 2016/2017.

The Show Must Go On Report - Report bringing together all known UK research and datasets available on the environmental impact of festivals by Powerful Thinking (November 2015).

SPECIALIST EVENT ENERGY CONSULTANTS*

Entersys (UK) - Freelance energy technician and consultant with specialism in sustainable approaches and 40 energy monitors available for hire.

ZAP Concepts (UK, Netherlands) - Energy efficiency consultancy with established Smart Power Plan approach.

Lansdowne Warwick (UK) - Specialist consultancy in environmental performance at events and for buildings and businesses.

Greener Events (Norway) - Green events consultancy with specialism in energy management.

Watt-Now (Netherlands) - Events consultancy specialising in energy monitoring & management.

** Powerful Thinking cannot officially endorse third party services in any way.*

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