PROS AND CONS OF LOW CARBON ENERGY TYPES

Photo credit: The Green Gathering

About this Factsheet

The Powerful Thinking steering group has produced this Factsheet, with key contributions from Tim Benson (Energy Consultant at ZAP concepts) and Chris Johnson (Kambe/Shambala). It aims to help you see at glance the pros and cons of using different kinds of temporary power sources at events. Each event is different so there is no one right answer for you, this table, alongside the **case studies**, which show where Festivals have successfully employed these power types, will help you to make an informed decision that is right for your event.

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.

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

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

[1.] 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.

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.

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.

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.

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.

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.[2] • 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.

2. 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)