Electricity understand and be safe :-)

There is a communal power grid (better for the environment, noise and your wallet than individual generators) co-created by you. Borderland is a co-created participatory event. The people rolling out the power grid are unpaid co-creators just like you. Please help, especially with packing up afterwards. You are responsible, and you can help the electricity team roll out the ~3000 m of cable, and you are asked to help roll it up again on Sunday.

We try to place a power distribution box within 50M of most places and 100M of everywhere - you must bring up to 50M (100m) if you are a remote place) of good quality, outdoor extension cord. Your extension cord should be at least 1mm2, preferably 1.5-2.5mm2, and it should be grounded and connect properly to the Danish ground pin. We will provide 300 ground converters to a common european plug, but your responsibility. Please be a good co-creator by understanding how much power you can draw, sharing and coordinating with your neighbours.

Please make efforts to make sure everything which can be grounded is grounded (e.g.: extension cords, fridges etc. must be grounded, your iPhone charger cannot be grounded, it is protected differently by two layers of insulation instead).

Grounding is a legal requirement at outdoor events in Denmark. Not grounding reduces safety and may give authorities a bad impression and/or result your stuff being disconnected if authorities should visit.

The grid is connected to two 3x125A outlets, one 3x63A outlet and one diesel generator. So for example if you are using 2 hotplates = 4kW, you are probably using about 1/10 the total power available to the area you are in.

There is enough power for about 120 hotplates to be on at once. That means it will work if people make food in groups of avg. at least 6, and maximum one fourth make dinner at the same time. So there may be challenges, but these challenges can be solved by talking to your neighbours and coordinating to not do power hungry things at the same time.

Bag all connections and power distribution boxes to keep them dry. Make sure all sockets are pointing down or sideways (never up so they collect water). Raise all equipment off the ground.

Wear pretty lights at night. This is standard burner practice. You are the street lighting. There will not be (much) other street lighting.

Sockets you are likely to encounter - Remember - one socket/fuse group can only deliver 2800W (13A) or 3600W (16A) - so you can only have one hotplate per outlet and extension cord



Danish type K grounding pin is unlike rest of EU



CEE16, but only in

some Power dist.

boxes not all

Type E converter we

many but not all Eur.

extension cords

have 300 of. Works with



Schuko socket - only if your neighbours are Swedish or German, they may have this kind

Understanding your power distribution box

Fuse/circuit breaker. If these go, the load is too great. Reduce the load or distribute it better to different fuse



Ground fault breaker. If this goes, it is either because A human being is being electrocuted right now. Please check no one is being electrocuted before turning power on again An electrical connection is wet, in a puddle or similar. Find the wet, dangerous area and disconnect it before trying to turn power on again. If you have trouble finding the problem, use the method below. An appliance is faulty. Try disconnecting half of everything connected and try turning on the power again. By connecting small portions at a time until the ground fault breaker trips again, you can more quickly narrow down where the problem is.



Please understand the difference between the circuit breaker and the HPFI = ground fault breaker. If the circuit breaker trips, it means the load is too great. Reduce the load. If the HPFI = ground fault breaker trips, it means a small amount of current is leaking to ground. Look for a person being electrocuted or a wet connection.

Respect electricity. It seems harmless when safely encased in a nice plastic cable, but remember that the energy in that cable is equivalent to being kicked by two horses. Simultaneously. There is enough energy to melt things, start fires or throw a person off a ladder.

The ground fault breaker is called different things in different countries - HPFI, RCCB, RCD. It works by measuring the current going into the circuit and the current coming out of the circuit. If there is a difference, it means electricity is leaking to ground through something - maybe a person being electrocuted, or maybe something wet that a person will touch soon, and be electrocuted.

An electrical shock is painful for a young healthy person with dry hands and dry feet who recieves a short shock. A person with wet hands, standing barefoot on wet ground who recieves a long shock will probably have cardiac arrest. They will only survive if someone nearby turns off the power/pushes it away with something nonconductive, like a dry piece of wood, and starts CPR immediately. Please learn CPR.

Understanding grounding

Danish plug with ground pin



European plug that can take either Schuko (Sweden, Germany) or male pin (France) earth





Converter from Danish to european ground provided at **some** power dist. box please use

Everything that **can** be grounded **should** be grounded. Things like mobile phone chargers that do not have a ground wire cannot be grounded - they are protected in a different way, with two layers of insulation. Grounding is important because it protects lives by enabling the ground fault breaker to turn off the power **before** a person is electrocuted, instead of **while** they are being electrocuted. However, there are several different european grounding solutions, so it is all a terrible mess. You should use grounded extension cords, and you should take steps to make sure the ground is actually connected

Electricity - understand and be safe :-)

You are responsible! This is not a "festival" where others arrange things for you, you are a co-creator, a member of a forening, you are responsible for everything, and you are especially and solely responsible for your own safety. The electricity grid is rolled out by multiple amateur volunteers and about 2800 people connect their own various pieces of cable and equipment to it. There is no person or entity who can guarantee that they all do it right! Please educate yourself and take care of yourself and others!

Some potential dangers:

No grounding

Grounding is a safety feature that enables circuit breakers and ground fault breakers to turn off power **before** someone is electrocuted instead of while they are being electrocuted. One should always use grounded cables outdoors, and it is required by Danish law. But not everyone cares as much as they should. You may be plugging your grounded cable into your neighbour, but their Swedish style plug ground is not actually connected to anything. You need to check, yourself.

Too long, too thin cables - which reduces circuit breaker protection

If you pull a long, thin cable, it prevents the circuit breaker from doing its job properly. The resistance in the cable will be so great that even in case of a "perfect" short circuit , the circuit breaker will not trip immediately, but only after several minutes. For example, if you pull a 0.75 mm2 cable 100m (dont do that!), the maximum short circuit current will be 44 amps, limited by the resistance in the cable. But the circuit breaker only guarantees immediate tripping at e.g. 65 amps and above. So the circuit breaker may not trip immedeately, but only after e.g. a minute. For that minute, a great deal of energy will be delivered at the fault - enough to start a fire.

Do not pull too long cables. Ensure your cables are at least 1 mm2, preferably 1.5-2.5mm2 (it is written on the side of the cable). Err on the side of safety: presume you may not have full, proper protection and don't place things where an electrical fire would e.g. set fire to a tent with people sleeping.

Cable reels

Cable reels may only be loaded to ~300W while rolled up (they get hot, both because of physical bad cooling and because of inductance). They may be loaded to ~2300W when unrolled. Therefore you must always unroll the cable reel completely, unless you know neither you nor any other of the other 2300 co-creators will ever plug anything more in. For the whole next week. Which you can't possibly know, so please fully unroll them immediately.

No HPFI relay/ground fault breaker

It is absolutely forbidden to connect a power distribution box without a HPFI relay=ground fault breaker to the grid. It is illegal in Denmark, and unsafe, and especially unsafe when international people with different grounding systems are involved. If you see someone has connected a power distribution box without a HPFI relay, please remove it. Power distribution boxes without a HPFI relay=ground fault breaker will be removed without warning if someone notices them.

Don't connect or disconnect 400V plugs 32A and upwards under load - turn off the upstream circuit breaker first.

Don't repeatedly force a circuit breaker or HPFI relay on. Give it a rest in between attempts to avoid arcing and subsequent explosion.

Break in neutral cable

If there is a break in the neutral cable, there will be 400V coming out all the 230V sockets. This will burn out most electronics very quickly. This is an

uncommon fault, not at all likely, but a possibility, and with equipment borrowed from multiple sources and participants, it is not something you will be able to place any liability or blame for - it is your risk. Please treat cables nicely and ensure plugs are always fully inserted into sockets.

Refrigerators?

Refrigerators are not a problem from the power point of view - they usually only use 100-200W, and only some of the time.

Don't MOOP! Don't let it hit the ground! MOOP is Matter Out Of Place, and includes cans, cigarette buts, trash, anything you leave. Please plan ahead (for example: drinks in a re-usable bottle, not a can) to avoid MOOP. Anything you leave a volunteer, unpaid Borderlander is going to have to pick up for you. We leave no trace.

Entrance to the Borderland constitutes acceptance of the following: I KNOWINGLY AND VOLUNTARILY ASSUME ALL RISK OF PROPERTY LOSS, PERSONAL INJURY, SERIOUS INJURY, OR DEATH, WHICH MAY OCCUR BY ATTENDING THE BORDERLAND, AND HEREBY FOREVER RELEASE, DISCHARGE, AND HOLD BORDERLAND HARMLESS FROM ANY CLAIM ARISING FROM SUCH RISK, EVEN IF ARISING FROM THE NEGLIGENCE OF BORDERLAND, OR FROM THIRD PARTIES, AND I ASSUME FULL RESPONSIBILITY AND LIABILITY FOR MY PARTICIPATION. This year we are not providing a detailed map of the electrical grid - instead we semi promise there will be at least one power distribution box in each camping area marked on the placement map. Usually there are 2, so you should usually have one within 50m

A preliminary overview of the backbones is also given below for those interested – minor cables and power distribution boxes are not drawn in.



For co-creators connecting grid

The main thing to remember for a reliable grid is don't have a HPFI relay after another HPFI relay.

It is absolutely forbidden to connect a power distribution box without a HPFI relay to the grid. It is illegal in Denmark, and unsafe, and especially unsafe when international people with different grounding systems are involved. If you see someone has connected a power distribution box without a HPFI relay, please remove it.



This socket (unmarked) is protected by the HPFI relay in this power dist. box. It is ok to use for end users, but is **not ok** to use for extending the power grid to another power distribution box - then that whole segment of the grid will rely on the HPFI relay in **this** power distribution box, and therefore be unreliable. There should never be several HPFI relays daisy chained after each other, this will result in unreliability. It is **not** the HPFI relay closest to the problem that will turn off, it is the fastest one/a random one/all of them at once.

The same rules apply for markings on e.g. the 3x63A power distribution box.

This socket (marked "Kun til forsyning af undertavler, ikke HPFI beskyttet") is **not** protected by any HPFI relay or fuse in this power distribution box. It is a passthrough output unaffected by any local faults. **This** socket, **Only** this socket, **Must** be used for extending the power grid to the next power dist. box. This socket **may not under any circumstances** be used for end-users (which is usually not an issue as it is usually already filled up by the cable to the next power distribution box) The same rules apply for markings on e.g. the 3x63A power distribution box.

Consent is sexy!

Bonus info - understanding 230V and 400V

With three phase power, there is both 230V and 400V simultaneously available. There is 230V between a phase and neutral There is 400V between two phases This is the case in most european countries - but not Norway. Both 230V and 400V are available in the power distribution box, depending on how you wire things. There is no

transformer involved and it is misleading to refer to the power distribution box as a transformer. If there is a break in the neutral wire, this can result in there being 400V coming out the 230V sockets. Therefore the neutral wire is actually the most important wire to not break.

