Load-Shedding Guide

Electricians and Contractors: how to boost your sales by 20% with Load-Shedding functions in residential or small commercial buildings
Contents

1. Glossary and definitions ................................................................................................... 2
2. Types of loads to be shed ................................................................................................. 3
3. Main reasons for Load shedding ...................................................................................... 5
4. Load shedding algorithms ................................................................................................. 8
5. Examples of existing offers ............................................................................................. 10
6. How to sell load shedding to your customers ................................................................. 16
7. Why you can increase your turnover by 20% ................................................................ 17
8. To know more … ............................................................................................................ 17

1. Glossary and definitions

Load Shedding  automatic reduction of power consumption according to pre-set parameters

Load shedding algorithm  algorithm which defines how several loads will be switched-off (and switched on again) automatically to keep the power demand below a defined level
2. Types of loads to be shed

- Energy is becoming more and more expensive
- Economic growth generates more demand, in a more erratic way
- Production capacities cannot keep-up with demand, and new capacities are costly and long-term
- Anyway more consumption would mean more CO² emissions, therefore it is not the solution

- Electric hot sanitary water boiler (HSW): classical, thermodynamic
  - Generally directly connected to panel board, not to a plug => shedding in panel board
  - When relevant: On during off-peak hours, off the rest of the time.
  - To avoid risk of legionellose, water must not stay a long time between 50°C and 65°C
  - cos phi : 1 for classical, motor for thermodynamic
  - power : 500W ➔ 4500 W (1-phase or 3-phase)

- Direct electrical heating
  - Generally directly connected to panelboard, not to a plug => shedding in panelboard
  - Can be directly shed on/off in case of peak
  - Shedding can be cyclic between zones / rooms
  - cos phi : 1
  - power : between 750 and 2000 W per radiator
❖ Electrical floor heating

- Generally directly connected to panelboard, not to a plug => shedding in panelboard
- Can be directly shed on/off in case of peak
- Could be cyclic if several zones exist
- cos phi : 1
- power : between 150 and 2000 W per element

❖ Heat pump

- Generally directly connected to panelboard, not to a plug => shedding in panelboard
- Shedding to be adapted to heat pump cycle constraints
- cos Phi : motor

❖ Direct heating electrical shower

- Rating: 16A to 45A
- Cos phi :1

❖ Air conditioning

- More difficult topic as no direct access to change temperature setting

❖ Lighting

- When relevant, shedding of non-priority lighting
- Cos phi : according to types of lamps

❖ Many other types of loads can be shed

- like washing machines, ovens, dryers, etc. but it is generally not very popular with the housewives! (lol)
3. Main reasons for Load shedding

We can identify several main reasons for load shedding:

A) Voluntary load-shedding in order not to exceed a Utility contract level of Power (in kW).

This is particularly the case in countries where utilities propose different contracts price levels according to delivered Power (i.e. 3kW, 6kW, 9kW, …) : France, Spain, Italy are in this case today.

The undesired effect of exceeding power contract level is generally the tripping of the main breaker, the house being “in the dark”.

B) Voluntary load-shedding in order not to exceed a self-estimated maximum of Power (in kW).

End-User wishing to make savings and/or develop green conscience can decide to limit his own maximum power level using a load-shedding system, even though he does not run the risk of main breaker tripping, judging “abnormal” to use more than 6kW instantaneous power, for instance, to make savings by reducing his overall consumption.

C) Adaptation to Dynamic Time of use contracts from utility

Peak time management has become a major concern for Utilities, having to face high demand during short periods, leading them to either buy kWh to other vendors at premium prices, or use production means (fuel, gas turbines) generating high CO² emissions. This has been triggering the deployment of dynamic Time of Use pricing (i.e. tariffs per kWh changing according to unpredictable time).
In this case, the user eager to reduce his energy bill needs to equip his installation with devices able to automatically shed some loads off during high tariff period, and reconnect them when tariff is cheaper in order to optimize energy costs. France (EJP, Tempo EDF contracts), UK (British Gas) have created such tariffs, and they are likely to spread in the future.

The main issue to solve is the communication of the tariff change info, and several technologies have been and will be developed. (175Hz, Zigbee, RDS …)
This example from South Australia during summer months shows extreme price events driven by peak demand over a 10 day period. In Australia, demand profiles tend to have particularly high peaks on days of very high temperature, where peak load is often associated with significant price spikes.

E) Reduction of instantaneous power when using alternative sources of energy

In the case of an installation equipped with a back-up source of energy (GenSet, PV, Windmill) or on energy-autonomous sites, it is essential that before switching to the alternative source (generally of a limited power) several loads are shed, otherwise the new source will not be able to withstand the whole power needs.
4. Load shedding algorithms

General product architecture

Several types of Algorithms are currently deployed in load shedders; they can generally be classified in 2 main families: hierarchic and cascado-cyclic.

4.a Hierarchic algorithm

Type 1: In case of overload, all circuits are shed, then the more priority circuit (N°1) is reconnected, then the second (N°2), etc.

If a new overload occurs, circuit N°2 will be shed again for a certain time (i.e. 1 minute), then if it happens a second time it will be shed again for a longer time (i.e. 8 minutes), etc.
**Type 2**: In case of overload ONE circuit is shed instead of ALL (i.e. N°3), then if not sufficient N°2, etc until the overload disappears.

- **4.b Cascado-cyclic algorithms**

  This term has been invented by French company Delta Dore who patented it long time ago. The principle is identical to above BUT the circuits that are shed are not always in the same order: in the example of a 4 output load-shedder:

  In case of overload, circuit N°1 is shed, then N°2, 3, 4 etc. if overload occurs again, the first circuit to be shed will then be N°2, 1, 3, 4 etc. then 3, 1, 2, 4 etc.

- **4.c Other algorithms**

  Other algorithms can be found on the web, for example:
  - for dedicated applications: here for collectivity kitchens (in French)
  - [http://www.iit.upcomillas.es/docs/03FEC01.pdf](http://www.iit.upcomillas.es/docs/03FEC01.pdf)
5. Examples of existing offers

5.1 Delta Dore

Probably has the larger range on the market

- **Reyder**: external CT, 1 to 3 phase, 3 ways, embedded contactor, cascadic

- **GP40**: external CT, 1 to 3 phase, 3 ways, FIP, cascadocyclic

  - Load controller for French electronic meter or electromechanical meter
  - Single phase with the electromechanical meter
  - Single or three-phase with the French electronic meter
  - Single phase
  - Cascadocyclique® load-shedding
  - Input for various programmers (DRIVER range) or programmable thermostats (TYBOX range)
- **GP8 Radio CPL** external CT, submonitoring, up to 8 ways with radio, FIP, cascadocyclic

![GP8 Radio CPL](image1)

- **GP7 CPL**: FIP, outputs ToR

![GP7 CPL](image2)

- And also T15PP, M15C2, M15C3, etc.
5.2 SCHNEIDER ELECTRIC

- **CDS Clic ref 15772**: up to 90A, embeds 2x 15A contactors, hierarchic algorithm (or cascadocyclic in version CDS C)

Example of how to create an economic installation by limiting electricity consumption (from Schneider Electric catalogue)

- The three-phase CDS load-shedding contactor sheds and restores the loads of non-priority circuits phase by phase according to a threshold set by the user (rating set by knurled knob on the front face of the three-phase CDS). Priority circuits are never load-shed
- Use switches S1 to force load-shedding of all 3 phases. This switch is also used for restoration
- The ID residual current circuit-breaker protects people against the insulation faults of several electrical circuits (hot plate, suction hood)
- The DPN Vigi residual current device is dedicated to one electrical circuit (e.g. electrical ovens) and protects people against direct and indirect contacts

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Did you find this information useful?
For more information and to exchange on load-shedding, visit our permanent and dedicated discussion on our Electrical Engineering Community:
- The IH time switch controls opening and closing of a circuit according to a programme preset by the user.

- **DSE Clic 2 ways (1A) ref 15910**, hierarchic algorithm

- **DSE Clic 4 ways (1A) ref 15911**, hierarchic algorithm
5.3 Hager

- **60050 Delestar22**: TIC, 3 ways, FIP, cascadocyclic

Power shedders allow reducing the power subscribed in premises equipped with a single- or tri-phase “off peak hour” counter.

- Depending on the version, they are compatible for electronic counters via the tele-information link or for electromechanical counters via the current transformer.

- Power shedding outputs parameterizable or adapted to all types of installations: power shedding by pilot wire, make or break contactor

![Hager Delestar22 diagram](image1.jpg)

5.4 bTicino

Has a very simple, one way load-shedder, P-Comfort

![bTicino P-Comfort diagram](image2.jpg)

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5.5 ABB

- **LSS1/2**

Compare the higher allowed and pre-set value of power consumption to the effective system power consumption avoiding the tripping of the main circuit-breaker through switching-off in sequence of maximum two not primary loads (NPL1 and NPL2) when the pre-set threshold is exceeded.
6. How to sell load shedding to your customers

- **In countries where there is a main circuit breaker limiting the available power to the user**, the use of a load-shedder avoids unwanted tripping of the main breaker

  Example: in Italy, the basic ENEL contract is 3kW. If you plug at the same time your air condition (1500 W) and your steam iron (900W), on top of uncompressible power usages (fridge, deep freezer, a few lights, etc.) your main circuit breaker will trip, and the whole house is in the dark

  => this can be avoided with a load-shedder

- **In countries where the Utilities tariffs have a monthly base depending on Power levels**, the use of a load-shedder allows to downsize the level of contract, and can lead to savings up to 30% for the end-user

  Example: in France, EDF tariffs Peak/off peak are the following:

<table>
<thead>
<tr>
<th>Max Power</th>
<th>Annual contract base cost (€)</th>
<th>kWh price (€) peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>9kW (45A)</td>
<td>110.74</td>
<td>0.1275</td>
</tr>
<tr>
<td>12kW (60A)</td>
<td>187.60</td>
<td>0.1275</td>
</tr>
</tbody>
</table>

  Therefore, if you install a load-shedder that will allow you to downsize your annual contract from 12kW to 9kW:

  Cost (including installation) = 150€

  Yearly saving: 187€ - 110€ = 77€

  => payback in 2 years

- **If your customer has a genset to power his installation in case of utility blackout**, load-shedding is a must and very often done manually, a load-shedder will manage it automatically
7. Why you can increase your turnover by 20%

Considering that the average price of an electrical panelboard, once installed, is around 150 € (but this depends much on the country you live in, due to local installation rules and prices, it can vary from half less to 10 times more …), if you sell one load-shedder out of 5 panelboards, then you get a 20% increase of your turnover

cool, isn't it?

8. To know more …

This document has been proposed to you by:

the Electrical Engineering Community.

You can find this community here: http://engineering.electrical-equipment.org/

Did you find this information useful?

For more information and to exchange on load-shedding, visit our permanent and dedicated discussion about load shedding on our forum, which we created specifically and will remain active to prolong the exchanges on this subject!

The direct link to this dedicated discussion is:


Don’t hesitate also to send us by mail your feedbacks about the interest of such documents for you.

We are looking forward to discussing with you about load-shedding or other electrical subjects in our blog and forum!

Moderator team