EMERGENCY POWER SUPPLY - WHAT ARE WE REALLY TALK ABOUT? IS IT A FULL HOME BACKUP, OR IS IT SOMETHING ELSE?
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MOTIVATION – RESIDENTIAL ENERGY STORAGE

> People like the idea to be independent AND fear is the strongest emotion. Main reasons for purchasing residential storage systems are:

> (Fear of) **Rising energy prices** ⇒ main application self-consumption increases (or ToU)

> (Fear of) **a power outage** ⇒ main application backup (home is still to be powered)

> Physical independence from the public grid:

> > No taxes

> > No trouble with the utility

> In countries with weaker grids and/or quite frequent extreme weather such as **Australia, South-Africa or Japan** one of the **key buying factors** for the storage solution is a reliable energy supply!
MOTIVATION
RELIABILITY OF ENERGY SUPPLY

What are the customer needs and expectations:

> In case of grid failure which happens infrequently and for short durations
> In case of regular power outages
> In case of regular natural disasters…

> SMA Sunny Boy Storage 5.0 offers a suitable solution for both:
  > infrequent, short power outages (Secure Power Supply) and
  > regular or long power outages to cover all loads in the household (Full Home Backup)
In Australia all cases such as natural disasters, grid overload etc. has been experienced!
EMERGENCY POWER SUPPLY - WHAT ARE WE REALLY TALK ABOUT? IS IT A FULL HOME BACKUP, OR IS IT SOMETHING ELSE?

1. Motivation

2. Requirements on home emergency supply

3. What is the difference between emergency and full home backup

4. Different topologies of emergency power and full home backup

5. Market overview

6. Conclusions
The load profiles are used for different purposes and depending on who and how is measuring (resolution) profile looks different!


August 30, 2018
RELIABLE POWER SUPPLY = RELIABLE LOAD SUPPLY
WHAT DO WE KNOW ABOUT LOADS?

> The load profiles are used for different purposes and depending on who and how is measuring (resolution) profile looks different!

Source: SMA, Load profile of a 4-person household on a summer day with ca. 15,000 kWh annual energy demand.
RELIELABLE POWER SUPPLY = RELIABLE LOAD SUPPLY
WHAT DO WE KNOW ABOUT LOADS?

> The load profiles are used for different purposes and depending on who and how is measuring (resolution) profile looks different!

> Emergency power supply must cover the high dynamics of the loads

Source: SMA
LOAD REQUIREMENTS
INRUSH- AND STARTING CURRENTS IN A DWELLING

Motor loads (freezers)

Example:
• Refrigerators
• Pumps
• Air-conditioning

Starting current:
4 to 8 x rated current $I_N$
up to 5 s

Resistive loads (bulb)

Example:
• Bulbs
• Elec. kettles
• Toasters

Inrush current:
Bulb: 8 to 10 x $I_N$
others 2 to 3 x $I_N$

Elec. switching power unit

Example:
• LED-lights
• PCs
• TVs

Inrush current
5 to 10 x $I_N$

Already small loads with (500W/ 2,2 A) have inrush currents of 16A and higher!

Source: www.haustechnikdialog.de
Source: www. Wikipedia.de
Source: M+R Multielektronik

August 30, 2018
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August 30, 2018
DEFINITION: SECURE POWER SUPPLY

> An Secure Power Supply (SPS)* is capable of switching (manually) from the normal operation to the Secure Power Supply operation in case of a power outage.

> In Secure Power Supply operation the inverter can supply (standby) power to a dedicated power outlet, which can be used to run small appliances (typically the power of the outlet is limited).

> It’s not made to supply the entire house, but rather the essential loads for a limited time.

> Recharging of the batteries from an external energy source, such as PV is in the most of the cases not possible (depends on the topology)

> Intended to supply the essential (smaller) loads for a limited period of time

*competitors often call it Emergency Power Supply (EPS)
Battery not always mandatory (in general)
DEFINITION: FULL HOME BACKUP

> In the event of a power outage an **automatic switching mechanism** will disconnect loads from the public grid in accordance with the applicable standards.

> A full home backup continues to supply loads in an **in-house grid**. It provides **reliable** power supply in case of any grid failure.

> The PV system can be reconnected to the in-house grid as a power source and directly supply the loads which will lead to a higher power availability in case of backup!

> Also other locally available (renewable) power sources can be linked in, therefore a longer period of autonomy can be achieved, even when the battery capacity is limited.

> Consistent use of AC coupling is the requirement for smooth interaction between the full home backup, solar inverters and other power sources.

> **Intended to provide a reliable supply for the entire home!**
DEFINITION: FULL HOME BACKUP

Features:

- Automatic back-up due to the automatic switching box
- Overload capability due to the inverter design
- Supply of all loads due to phase-coupling
- Use of PV Energy due to AC-Coupling

SMA understands and implements ALL key features!
EMERGENCY POWER SUPPLY - WHAT ARE WE REALLY TALK ABOUT? IS IT A FULL HOME BACKUP, OR IS IT SOMETHING ELSE?

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PV-generator coupling e.g. Solarwatt

DC-link coupling e.g. Fronius

AC-coupling e.g. SMA

Very limited EPS and no backup capabilities:
> Just few PV-inverter support EPS
> PV-Inverter doesn't have overload capability

EPS- and limited backup capability:
> Power limited due rated power of DC/DC converter of the battery
> No overload capability

EPS- and backup capability:
> Full home backup power identical to Battery-inverter power
> Overload capability possible

Only AC-coupled systems offers unlimited battery backup power scalable in size!
TOPOLOGY INFLUENCE IN EMERGENCY- AND FULL HOME BACKUP SYSTEMS
IS THREE-PHASE SYSTEM NEEDED?

> Outlets and direct connected loads in dwellings are often distributed on three-phases

> On each outlet a load with 16A rated current and up to 45A inrush current can be connected to

> Simultaneous use of loads isn't often the case
PRINCIPLE OF SINGLE-PHASE PV-INVERTER
SMA AUTOMATIC BACKUP UNIT

In general, 99% of the connected load is usable!
In general, 99% of the connected load is usable!
More PV energy generation is usable due to the SMA phase-coupling!
Less additional energy generation due to over frequency of the hybrid inverter!
Unbalanced load cannot be avoided
No one really knows or checks the load – phase connections
Three-phase hybrid systems with unbalanced loads >2 kW will fail!
TOPOLOGY INFLUENCE IN EMERGENCY- AND FULL HOME BACKUP SYSTEMS IS THREE-PHASE SYSTEM NEEDED?

- Outlets and direct connected loads in dwellings are often distributed on three-phases
- On each outlet a load with 16A rated current and up to 45 A inrush current can be connected to
- Simultaneous use of loads isn’t often the case

**A sufficient three-phase must fulfil:**

- 16A on each phase
- Each phase with 45 A inrush currents for ms
- Unbalanced power of 3.7 kW necessary
- Rated power of 3 x 16A x 240V = **11.5 kW**

**Single-phase with phase-coupling provides:**

- Each phase with 16 A rated current + phase-coupling contactors
- Each phase with 45 A inrush currents for ms
- Rated power of 1 x 16A x 240V = **3.8 kW**

- A well designed three-phase Battery Backup Power System means oversized system compared to single phase with phase coupling!
## EMERGENCY POWER SUPPLY - WHAT ARE WE REALLY TALK ABOUT? IS IT A FULL HOME BACKUP, OR IS IT SOMETHING ELSE?

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5. **Market overview**
6. **Conclusions**

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*August 30, 2018*
RELIABLE POWER SUPPLY – MARKET OVERVIEW

CLAIMS

> **SolaX**: Emergency Power Supply (without PV-support)
  > Protect against power outages

> **Sonnen**: Emergency Power Supply, Backup operation (without PV-support)
  > …power outages will be forever in the past
  > …maximum security for a constant power supply in your home

> **SolarEdge**: Backup Power (with PV-support)
  > …used to power important loads…

> **Fronius**: Emergency Power Supply, Backup Power (with PV-support)
  > Optimum supply even during power outages

▷ A real definition doesn’t exist, but differences…
▷ What are the promises all about?
## RELIABLE POWER SUPPLY – MARKET OVERVIEW

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<td>AC-Voltage (V)</td>
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<td>Feed-in phases</td>
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<tr>
<td>Rated power output</td>
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<td>3.7/5.0/6.0</td>
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<td>3.1/4.1/5.1</td>
<td>5</td>
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<tr>
<td>Battery-Inverter/</td>
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<td></td>
<td></td>
<td></td>
<td>1.8</td>
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<tr>
<td>Battery converter (kW)</td>
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<td>5</td>
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<tr>
<td>Overload capability</td>
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<td>4.7/6.4/7.7 (60 sec.)</td>
<td>3 (10 sec.)</td>
<td>4 (0.4 sec.)</td>
<td>n/a</td>
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<tr>
<td>(single-phase) (kW)</td>
<td></td>
<td></td>
<td>3</td>
<td>4 (0.4 sec.)</td>
<td>2.8</td>
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*Quelle: Sonnen, E3/DC, Deutsche Energieversorgung, Kostal August 30, 2018*
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<td>(10 sec.)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Max. power supply to</td>
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<td>4.7/ 6.4/ 7.7</td>
<td>3</td>
<td>1.2/ 1.7/ 2.1</td>
<td>5</td>
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<td>single-phase loads</td>
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<td>(without PV) (kW)</td>
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<td>Providing inrush</td>
<td>16</td>
<td>55</td>
<td>n/a</td>
<td>max. 25</td>
<td>max. 28</td>
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<tr>
<td>currents in (A)</td>
<td></td>
<td></td>
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Source: Sonnen, SolaX, Fronius, Solar Edge
RELIABLE POWER SUPPLY – MARKET OVERVIEW
CLAIM OR REALITY?

SolaX: Emergency Power Supply (without PV-support)

> Protect against power outages → with only 2kW and no support of high inrush currents quite limited

Sonnen: Emergency Power Supply, Backup operation (without PV-support)

> …power outages will be forever in the past → 2.8kW for the entire household?
> …maximum security for a constant power supply in your home → without additional PV-support and phase-coupling?

SolarEdge: Backup Power (with PV-support)

> …used to power important loads… → Rated Power is okay! But inrush current limits full home backup!

Fronius: Emergency Power Supply, Backup Power (with PV-support)

> Optimum supply even during power outages → Unbalanced loads only up to 2.1kW and 25A max. inrush current supported!

Overload capability and inrush currents often not stated!
Without providing inrush currents not really a “Full Home Backup”!
EMERGENCY POWER SUPPLY - WHAT ARE WE REALLY TALK ABOUT? IS IT A FULL HOME BACKUP, OR IS IT SOMETHING ELSE?

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SUMMARY

> The main task of a reliable power supply is to cover all the dynamics of the loads at all times
> Different definition (and marketing claims) exist in the markets
> Datasheets do not always answer all the questions

▷ Make a right choice to fulfil the customer needs!
SUMMARY – WHAT DOES SMA OFFER

> Automatic Backup Unit
> Power supply on each outlet with 16A and min. 45A inrush currents – even in night times
> PV-plant is still in operation – batteries rechargable

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<tr>
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<th>Sunny Island</th>
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<tr>
<td></td>
<td>EPS (SPS)</td>
<td>Full Home Backup</td>
</tr>
<tr>
<td>Integrated</td>
<td>✓</td>
<td>Optional</td>
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<td>Output power</td>
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<td>3.7 / 5.0 / 6.0 kW</td>
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<td>Overload capability</td>
<td>✗</td>
<td>130 %**</td>
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<tr>
<td>Providing higher inrush currents &gt;50A</td>
<td>✗</td>
<td>✓</td>
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<tr>
<td>Energy source</td>
<td>Battery</td>
<td>Battery + PV</td>
</tr>
<tr>
<td>Phase coupling</td>
<td>✗</td>
<td>✓</td>
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> With SMA Backup solutions, customers always have a peace in mind!

August 30, 2018

*Expect for Sunny Boy Storage 2.5
**Different duration
SMA has more experience with solar + battery systems than any competitor in the market

More than 25 years of experience with Battery Storage Systems

Over 35,000 grid connected self-consumption systems installed

More than 100,000 SMA battery inverters installed around the globe

More than 1GW of battery inverters deployed globally

The new Sunny Boy Storage allows installers and customer to select a battery system which perfectly fits their needs