Power Management System (PMS):

Local infrastructure control with Inview

Break-out - Session 1

Benoît Bidaine, Head of Operational Technology – Gilles Geron, Product Owner “Power Management”

b.bidaine@cet-power.com – g.geron@cet-power.com

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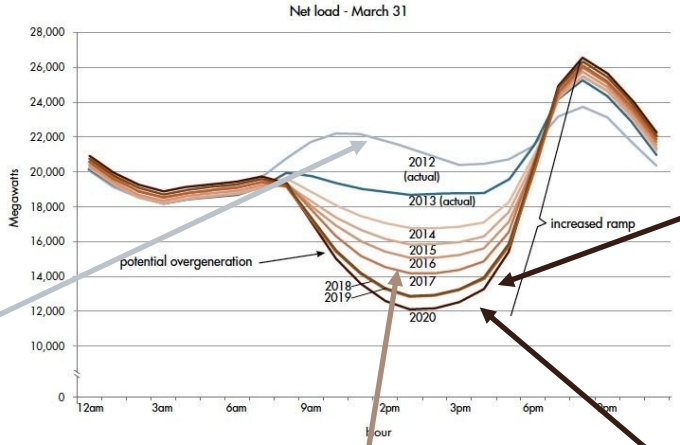
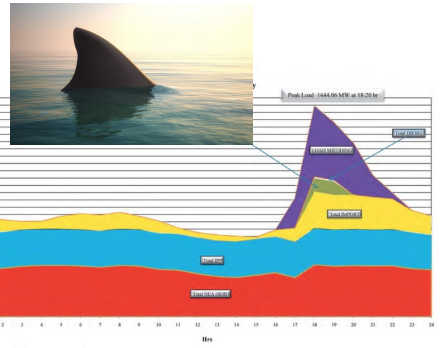
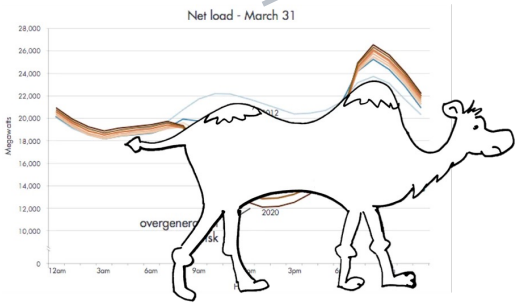
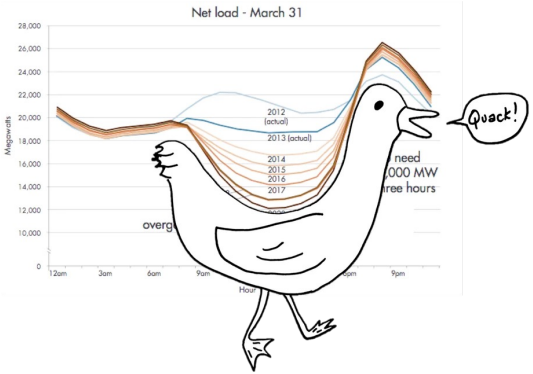
Belgium, Luxembourg, China, India, United States, United Kingdom, France, Germany, United Arab Emirates, Russia, Malaysia, Australia.

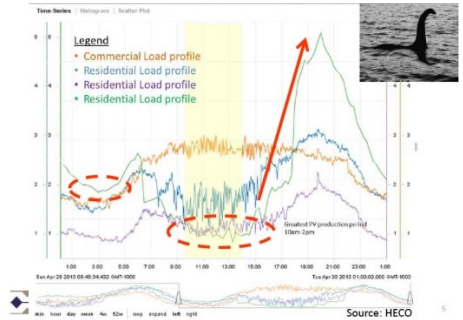
An animal ?


Net load - March 31
Megawatts
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
0
12am
3am
6am
9am
12pm
3pm
6pm
9pm
2012 (actual)
2013 (actual)
2014
2015
2016
2017
2018
2019
2020
potential overgeneration
increased ramp




Net load - March 31
Megawatts
overgener
sk
2020


Net load - March 31
Megawatts
2012 (actual)
2013 (actual)
2014
2015
2016
2017
Quack!
need
,000 MW
ree hours
overg
Hour


Legend
Commercial Load profile
Residential Load profile
Residential Load profile
Residential Load profile
Source: HECO

Power management offers optimized and resilient electricity usage

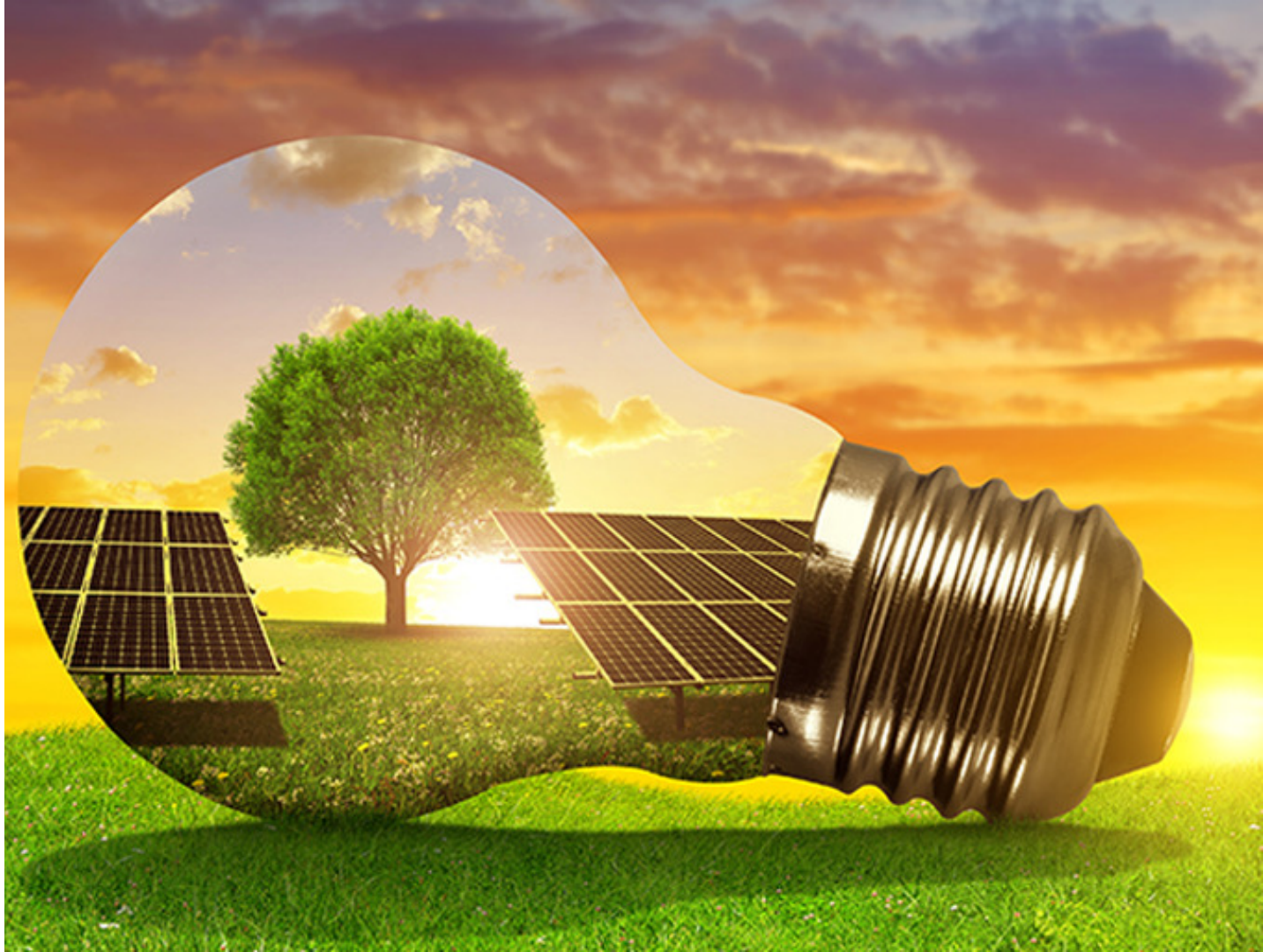
- Context
- CE+T Solution
- Capabilities insight
- Product offer
- Road map
- Customization

CONTEXT

Climate change crisis

Energy transition

- Raise of **Non-dispatchable Energy** sources
- Energy production & market **decentralization**
- Increasing **bidirectional Power Flow** on Electrical Grid
- Increasing pressure on **Grid system Operator**



Society electrification

- Raise of **Electric Vehicles**
- Move to **heat pump**

But also…

5G deployment

- Raise of **connection points**
- Increasing need for **Secured Power Distribution**
- Raise of **safety** constraints
- Increasing need for **Edge computing**
- Pressure to become **actor of Energy Transition**

Consequences

- Under pressure **Grid infrastructures** & **System Operators**
- Need for **Enhanced local control** @ ‘sub-system’ level

CE+T SOLUTION

Power Management System

- Ensure system **stability**, **safety** and maximum **availability** whatever the conditions
- Allow power flow **optimization**
- Follow predetermined “static” **rules/policies** or “dynamic” control (EMS)
- Embedded into iNVIEW system **controller**

Set of capabilities

- From **basic** to **advanced**
- In use **for years** or **to be developed**
- Related to system **topology**
- Differing from **level of execution** (controller vs converter level)
- Requiring **accessories** or not
- Used **independently** or **combined**
- Submitted to **priorities**

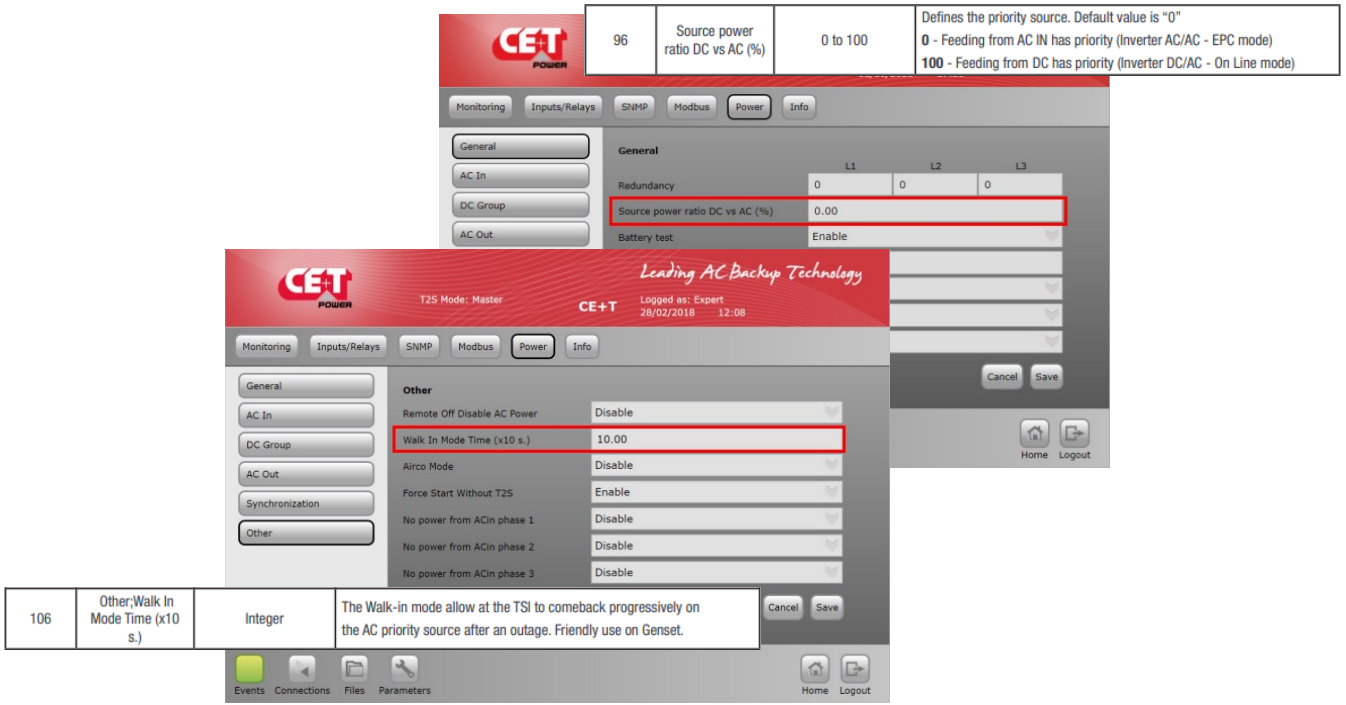
Control a set of components (ecosystem)

- CE+T Power **converters**
  - Sierra 25 – 48 & 380
  - Hercules
  - Stabiliti
  - Iris
- Third party **converters** & **components** (interfaced or not)
  - PV inverters & chargers, rectifiers, etc.
  - Batteries, sources, etc.
- **Ancillaries**: meters, contactors, etc.

SOME CAPABILITIES…

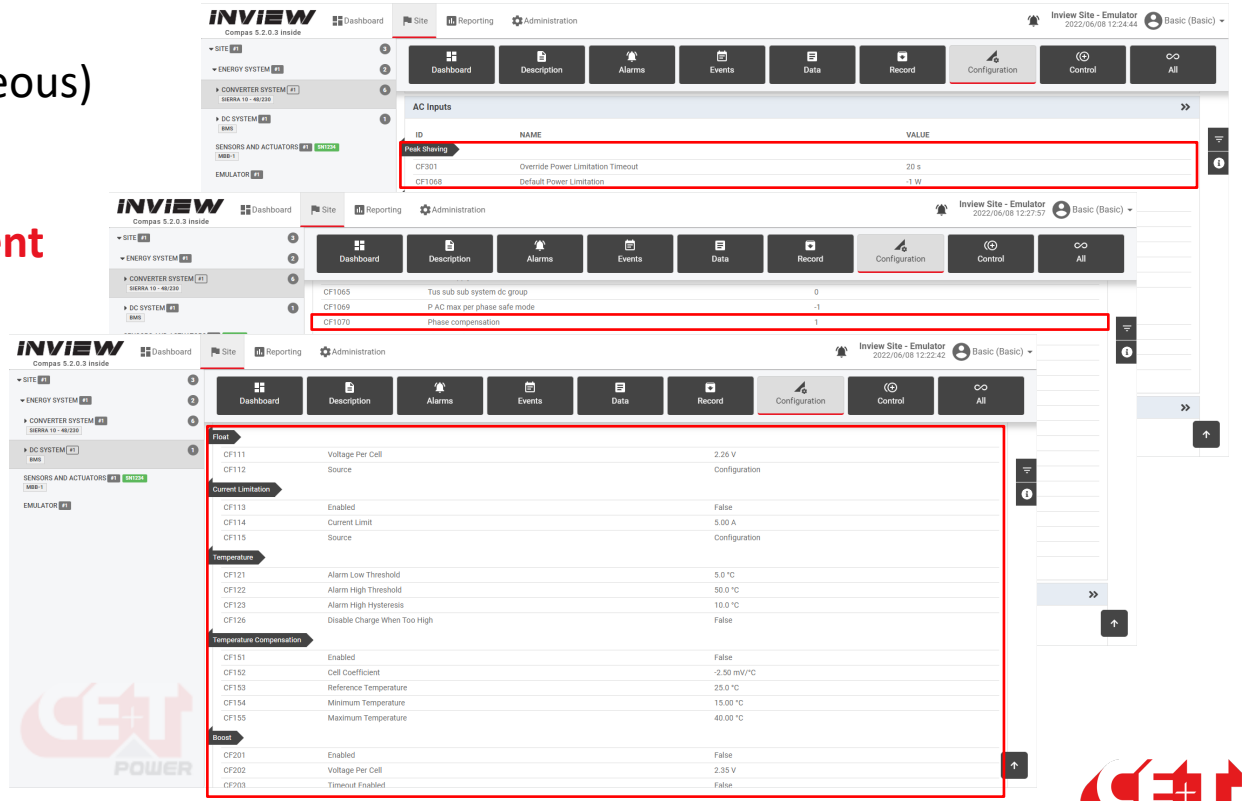
From input control in TSI time…

- Source **priority**
- **Walk-in** mode



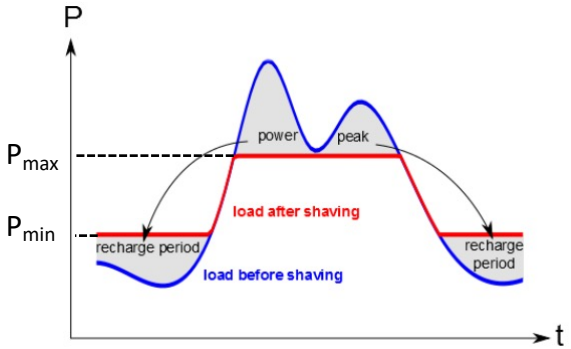
To additional DC output control in early Sierra…

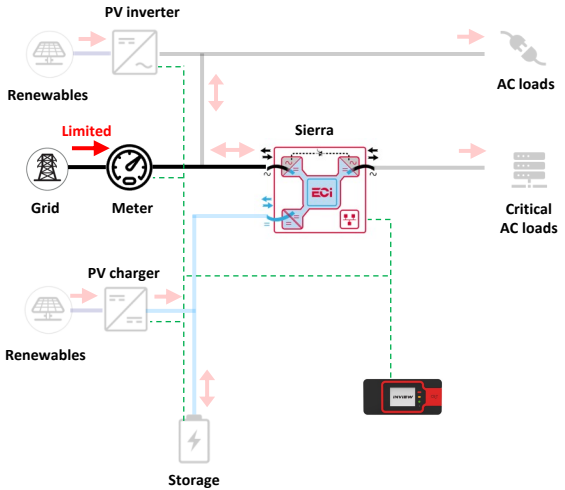
- **Peak-shaving** (instantaneous)
- Phase **balancing** (serial)
- Basic battery **management**



And fully bidirectional control of any converter!

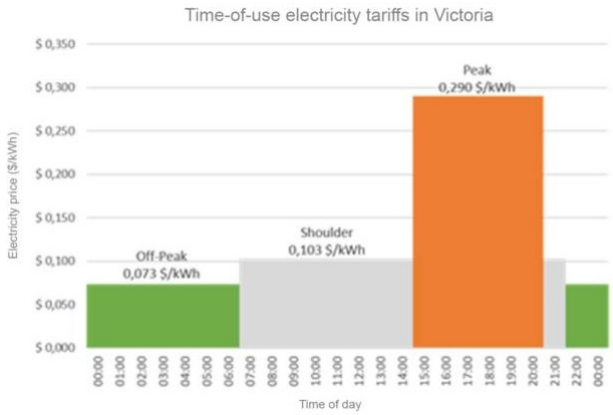
- Average **peak-shaving**

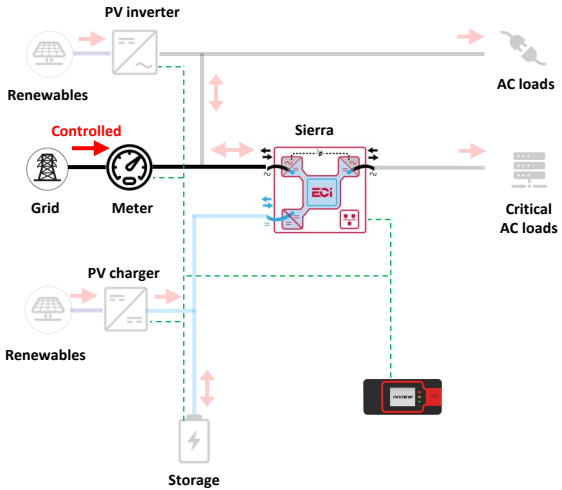




And fully bidirectional control of any converter!

- **Energy arbitrage**/Time-of-use

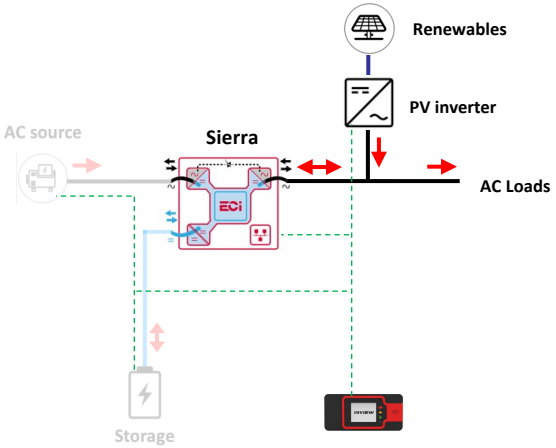




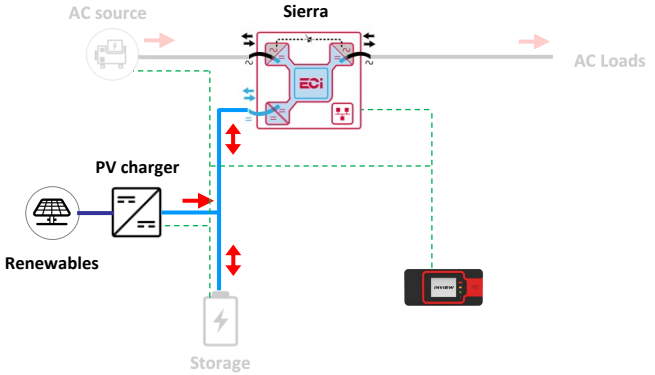
And fully bidirectional control of any converter!

See workshop1 tomorrow

- **AC coupling** renewable



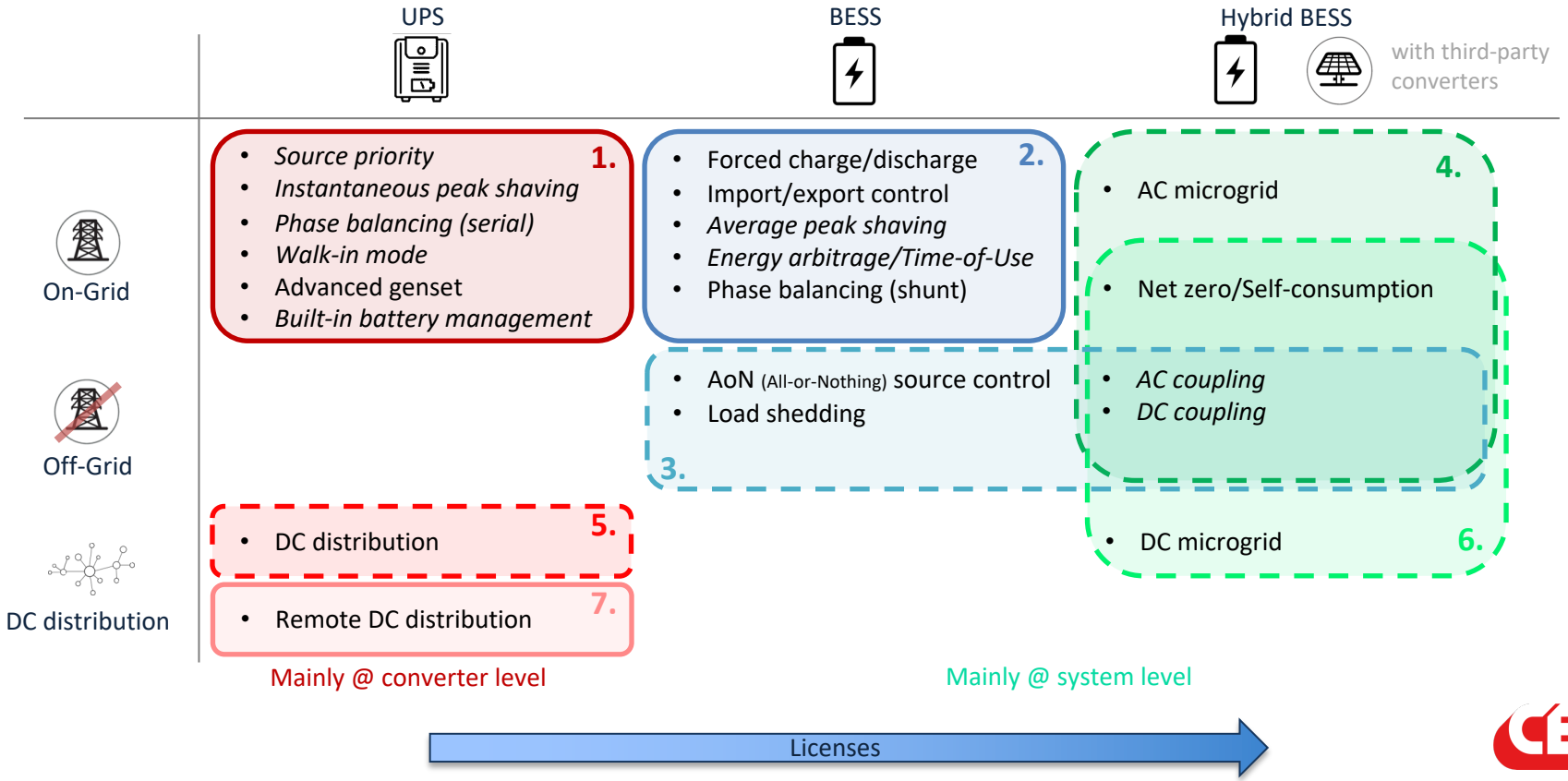
- **DC coupling** renewable



- With **advanced** battery management

PRODUCT OFFER

Capabilities packs



Packs licensing

Id	Name	Comment
1.	Smart UPS	Included in standard
2.	Battery Energy Storage System	
3.	Off-grid hybrid microgrid	
4.	AC hybrid microgrid	Includes 2
5.	Smart UPS with DC distribution	
6.	DC hybrid microgrid	Includes 2 & 5
7.	Remote DC distribution	
8.	Ancillary services ?	

Priorities & conflict

	On-Grid	Off-Grid
Manual* mode	Forced charge/discharge **OR** Import/export control	• AoN source control • Load shedding
Auto mode	Average peak-shaving	Off-grid microgrid
	Energy arbitrage/Time-of-Use / Net zero/Self-consumption	
Tools	• (Advanced) battery management • AoN source control • Load shedding	• AC coupling • DC coupling

* also includes API and other “external” control (from EMS for instance)

CONCLUSION

Power management offers optimized and resilient electricity usage

- Local control of more and more equipment
- Value captured via software licenses
- First 3 licenses progressively introduced in next 3 quarters
- Integrating customizations developed for early adopters into generally available capabilities

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for your attention

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