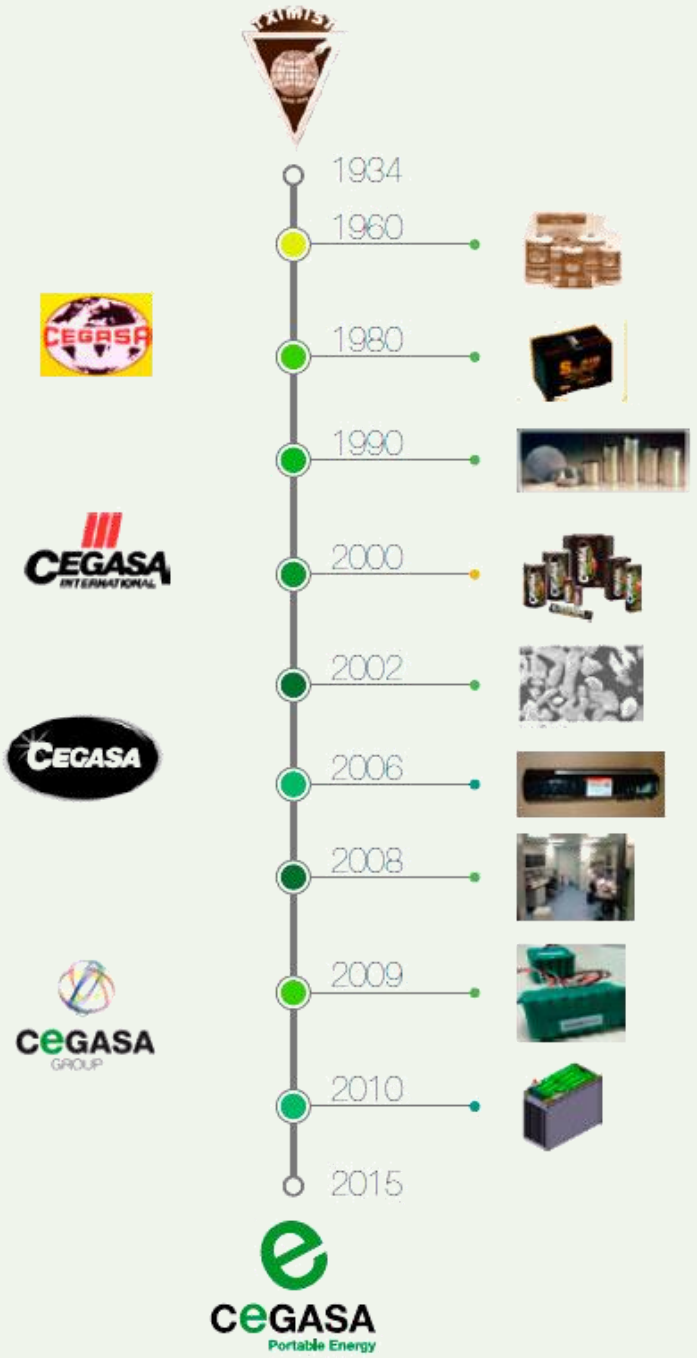
Energy for your life

Two generations with you providing energy solutions

Evolution of Zinc-Air primary batteries into new cost effective rechargeable energy solutions

Igor Cantero

CTO - CEGASA



cegasa

Producers of electrochemical components for cells manufacturing.

⇨ 12.000 Tn / Year. (950 Million of cells per year)

World leader. (70% of global share)

⇦ High density primary cells producer for industrial applications based on Zinc-Air alkaline technology.

Development and manufacturing of Lithium-Ion solutions for Renewable and Traction.

⇨ Leader in the supply of systems for Industries and Off-Grid. (280.000 KWh / Year)

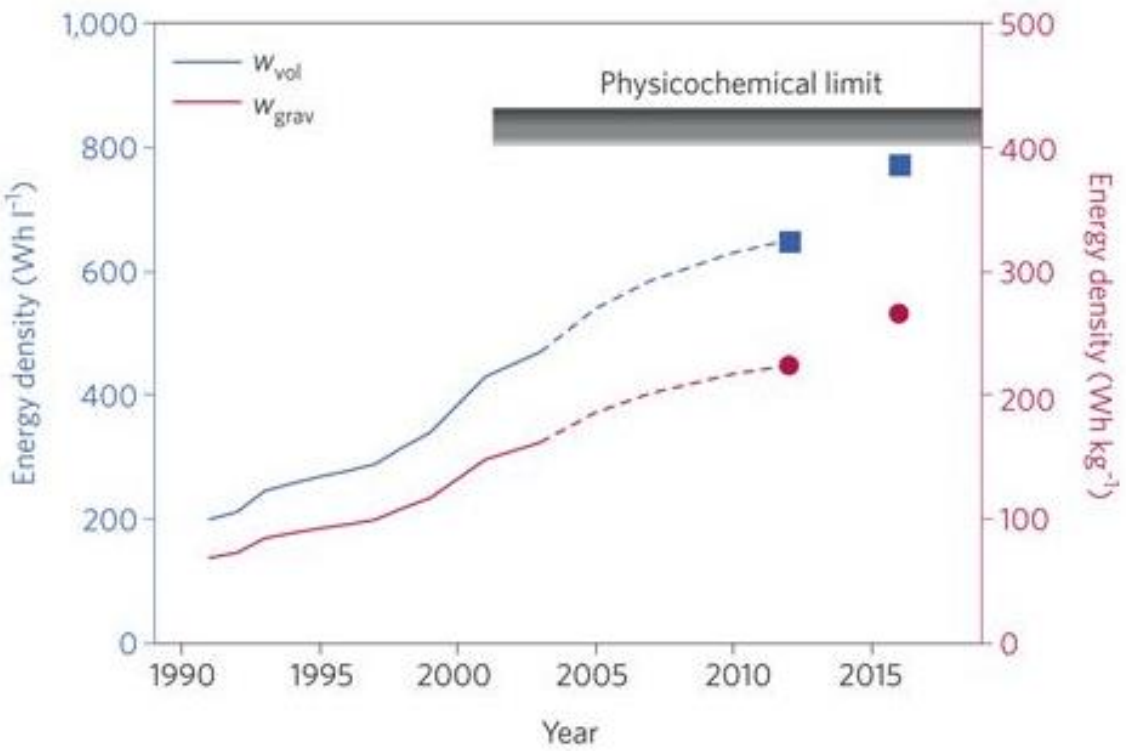
75 years of experience. Solutions up to 200 KWh

⇦ Custom design of energy solutions based on Lithium-Ion

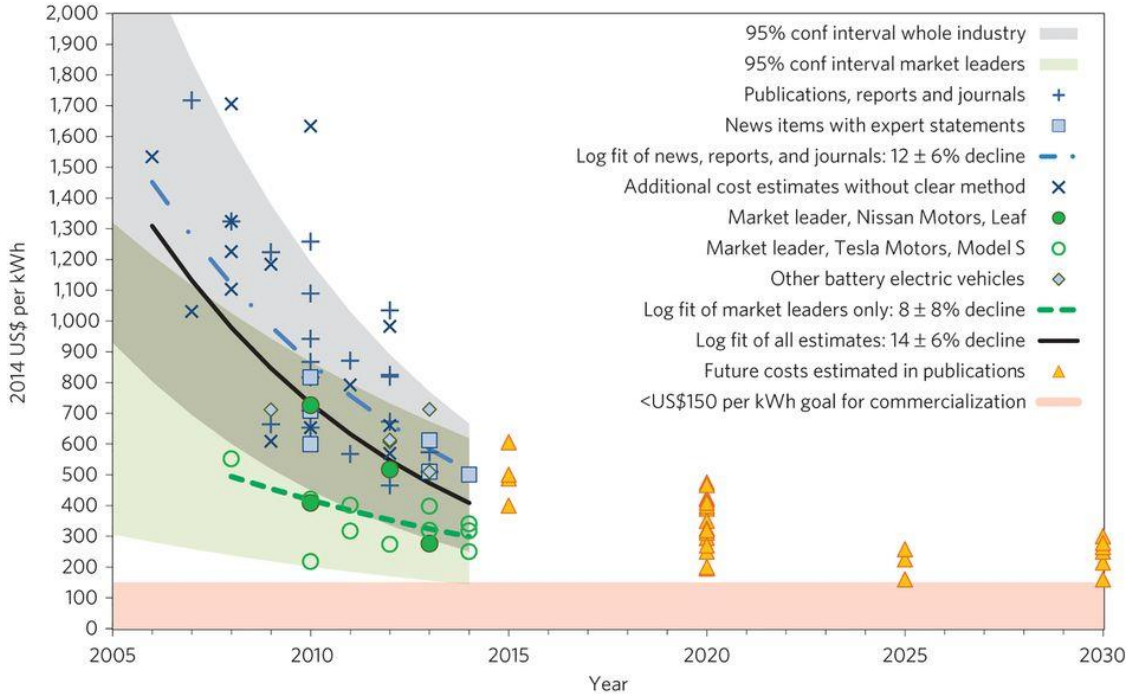
Cegasa's manufacturing plant

- Oñati – Gipuzkoa - SPAIN.

The problem we are facing with lithium-ion is evident:



Performance in increasing year by year...
...but we are **reaching the limit of this technology**



Price is also decreasing in the correct way...
...but still **over the goal for commercialization**

Nature Energy **volume1**, Article number: 16141 (2016)

Nature Climate Change **volume5**, pages329–332 (2015)

A new technology is needed, but our aproach is different:

Instead of improving the energy density of rechargeable cells...

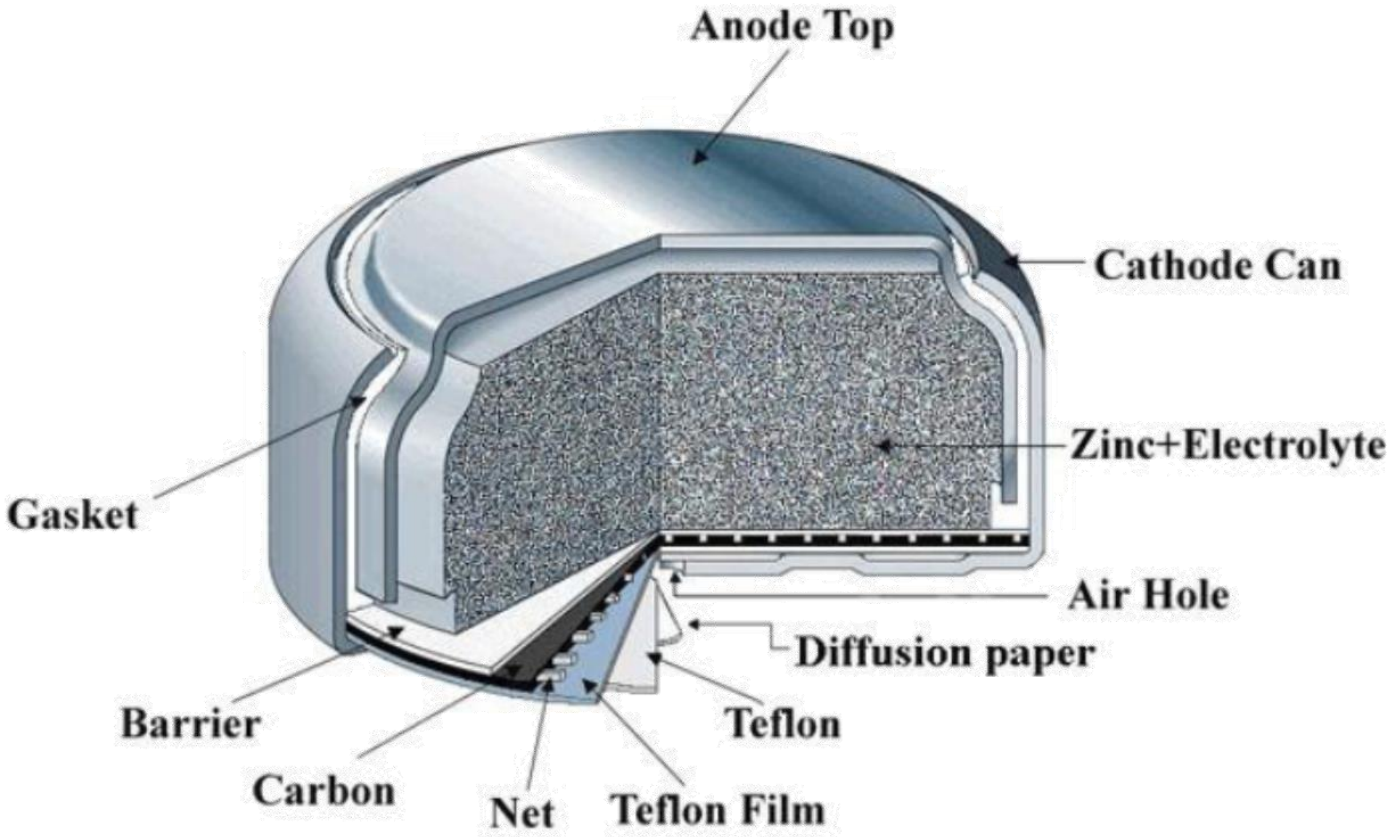
...make rechargeable actual primary cells

Battery System	Nominal Voltage	Wh/kg	Wh/l
Alkaline	1.5	199	581
Silver Oxide	1.6	130	525
Zinc-Air	1.4	467	1558
Lithium Sulfur Dioxide	2.6	280	503
Lithium Thionyl Chloride	3.4	715	1272
Lithium Manganese Dioxide	2.7	300	826
Lithium Sulfuryl Chloride	3.4	611	1081
Lithium Poly-mono Carbonate (CFX)	2.6	660	875
Lithium Iron Disulfide	1.5	331	592

Low cost technologies

High cost technologies

Typical Zinc-air buttom cell



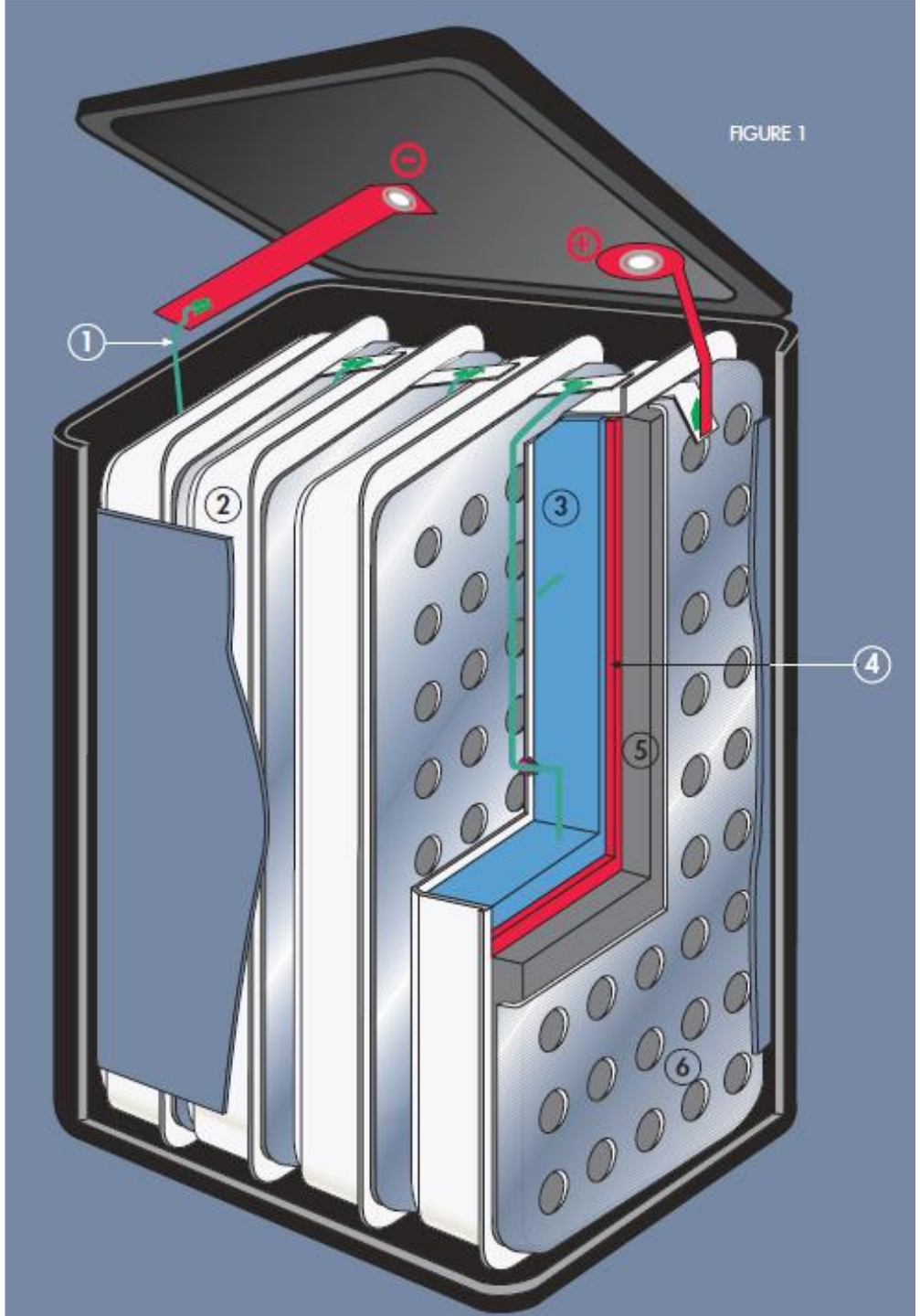
cegasa

ZINC AIR ALKALINE

for industrial uses

CELL

1. NEGATIVE COLLECTOR
2. P.V.C. CONTAINER
3. NEGATIVE MIX (Anode)
4. DIAPHRAGM (Separator)
5. POSITIVE MIX (Cathode)
6. POSITIVE COLLECTOR



cegasa

Industrial Grade Zinc-Air Batteries

ZINC AIR ALKALINE

- Electric fences
- Road Traffic Signaling
- Railway Signaling
- Internet of things

IOT

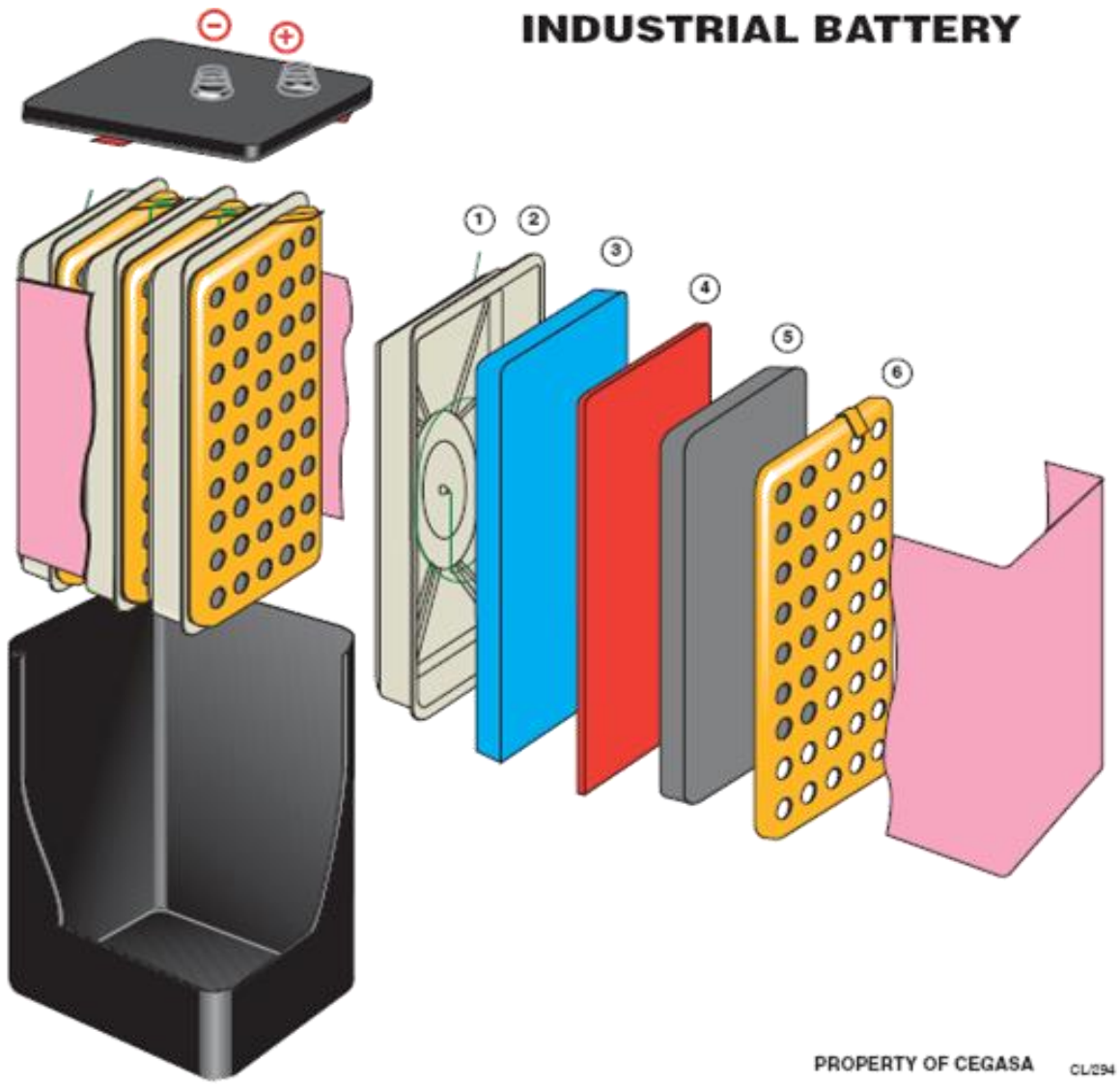
ZINC AIR
ALKALINE

- Current production:
  - ✓ 5 million cells /year
  - ✓ 1 million battery packs/year
  - ✓ 700 MWh/year
- 70% global market
- Manufacturers of the whole product, from electrodes to battery pack

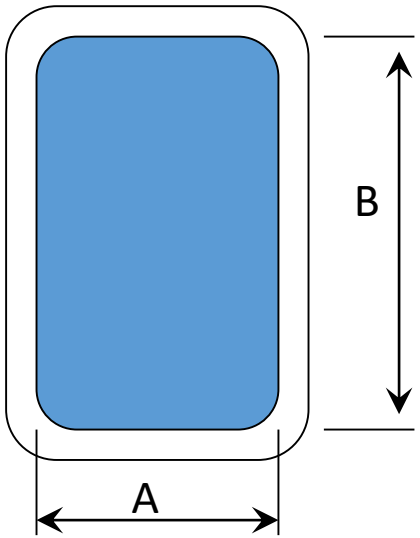
How can we change our battery from primary to rechargeable?

Current design

1. Negative Collector
2. PVC Container
3. Negative mix (Zn) (Anode)
4. Diaphragm (Separator)
5. Positive mix (Mn) (Cathode)
6. Positive Collector



Current design



Energy = Voltage x Capacity = Wh

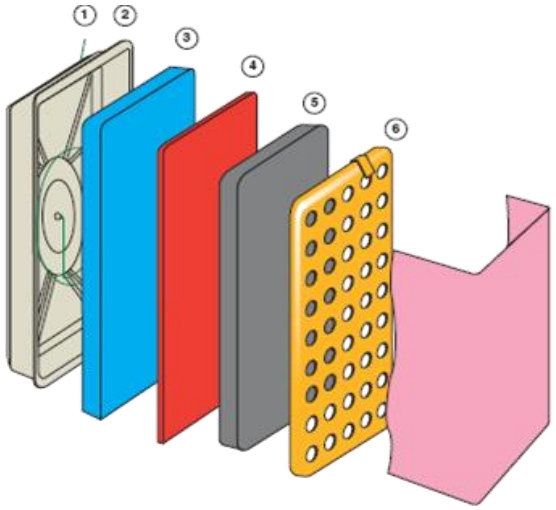
Power = Voltage x Intensity = W

Rated Voltage = 1.5 V

Working Voltage = 1.3 V

Model	Measures		Section (cm^2)	Capacity (Ah)	Energy (Wh)
	A (mm)	B (mm)			
AS2	55	87.5	45	25	32.5
				40	52
AS3	64	99	60	45	58
				60	78
				65	85
				70	91
				90	117
				120	156
				150	195
AS6	54	133.5	70	100	130
AS8	72	172	120	100	130
				125	162
				175	227.5
				235	305
AS10	92	182	162	300	390

Current performance	New ZAR Battery
Available characteristics	
Energy density (508 Wh/Kg; 1554 Wh/L)	Similar energy density (>500 Wh/Kg; >1500 Wh/L)
Existing industrial manufacturing capability	Produced in the same manufacturing lines
Safety	no significant changes
Eco-friendly	no significant changes
Price (25 €/KWh)	< 0.05 €/KWh/cycle
Parameters to be improved	
Power density	0,1 C
Calendar life	10 years
Challenge	
Cyclability	5000 cycles



Technological targets

Anode
- New formulation
- Additives for dendrites
- New approach

Cathode
- R2R production
- New reversible catalyst

Separator/electrolyte
- Solid state electrolyte
- Redox mediators

Cell construction type
- Pouch cell

Battery pack
- Laser welding
- Optimized box

CIC energiGUNE
energy cooperative research centre

tecnalia
Corporación Tecnológica

MONDRAGON ASSEMBLY

LEITAT
Technological Center

cegasa

General information: info@cegasa.com - + 34 943 780 352

www.cegasa.com