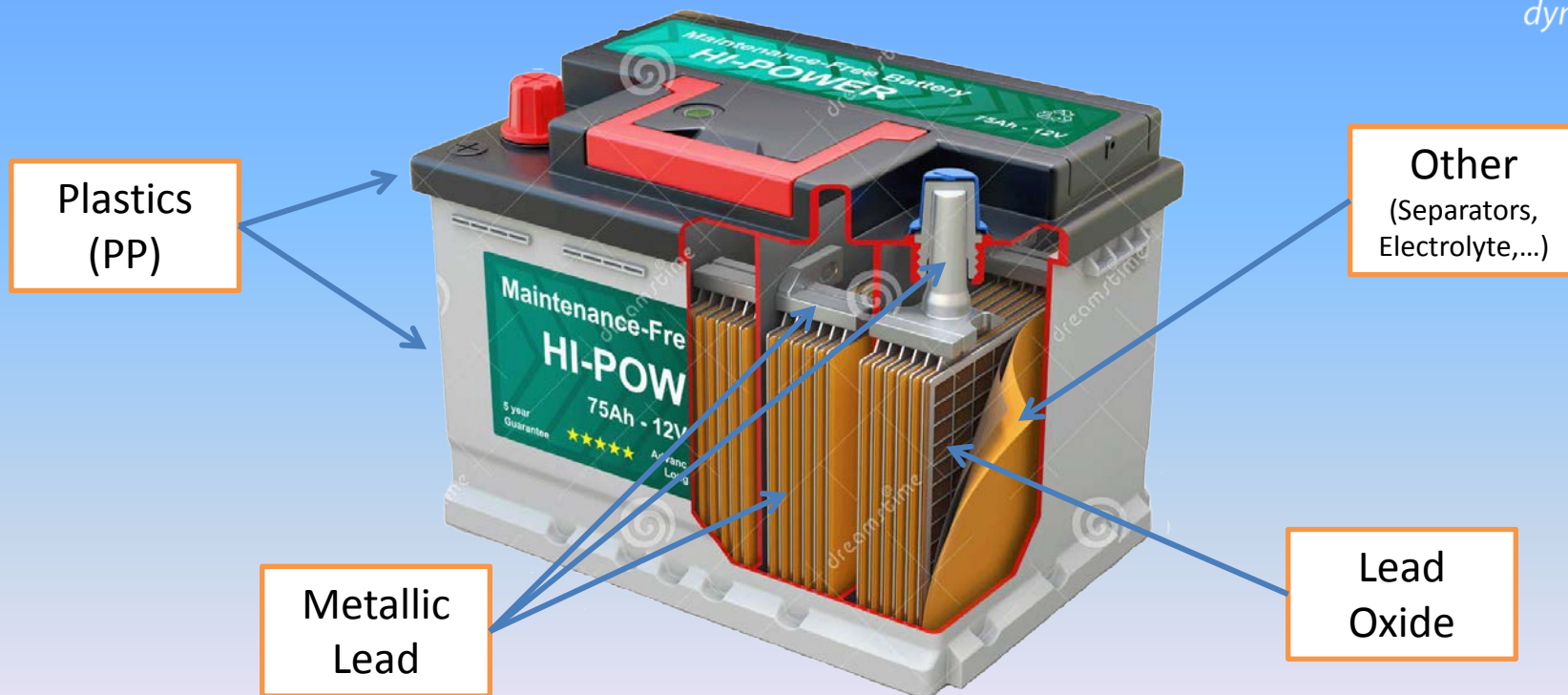




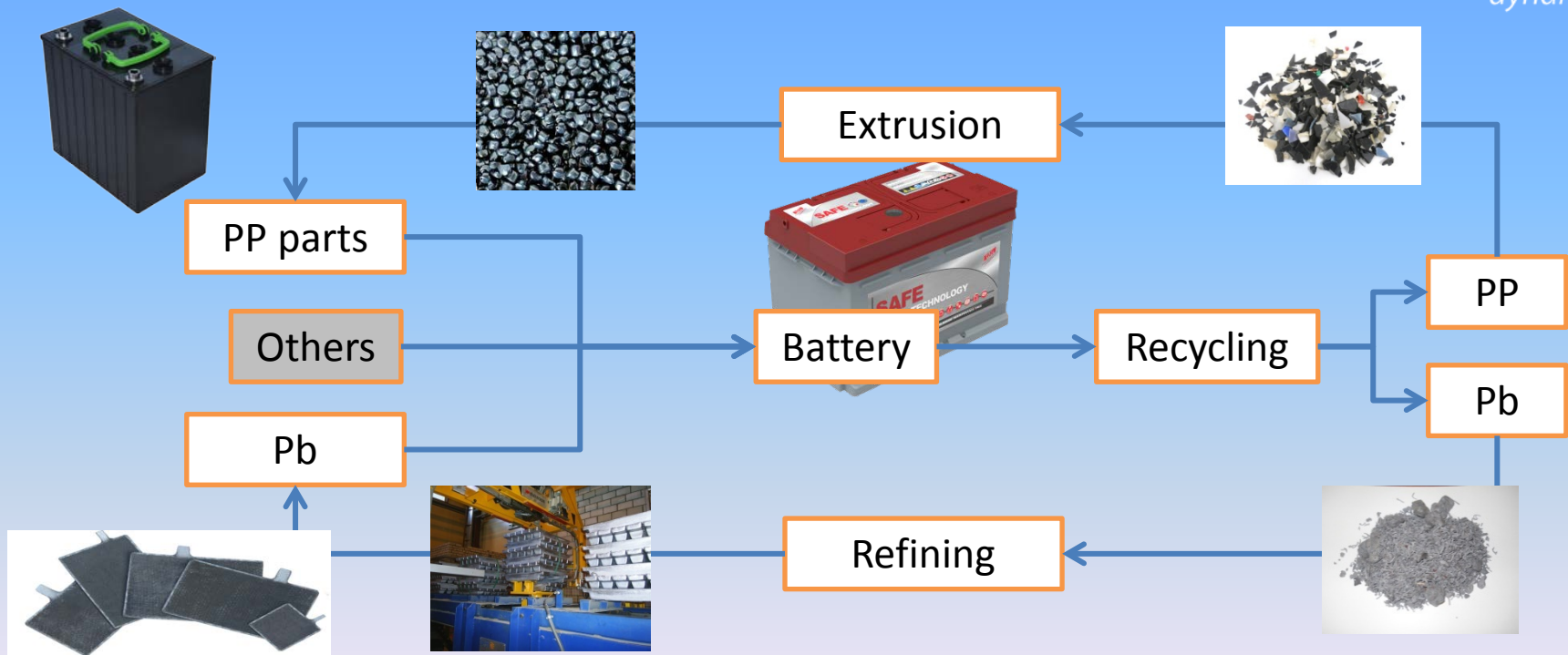
# ***FAAM batteries: “from the cradle to the grave”***



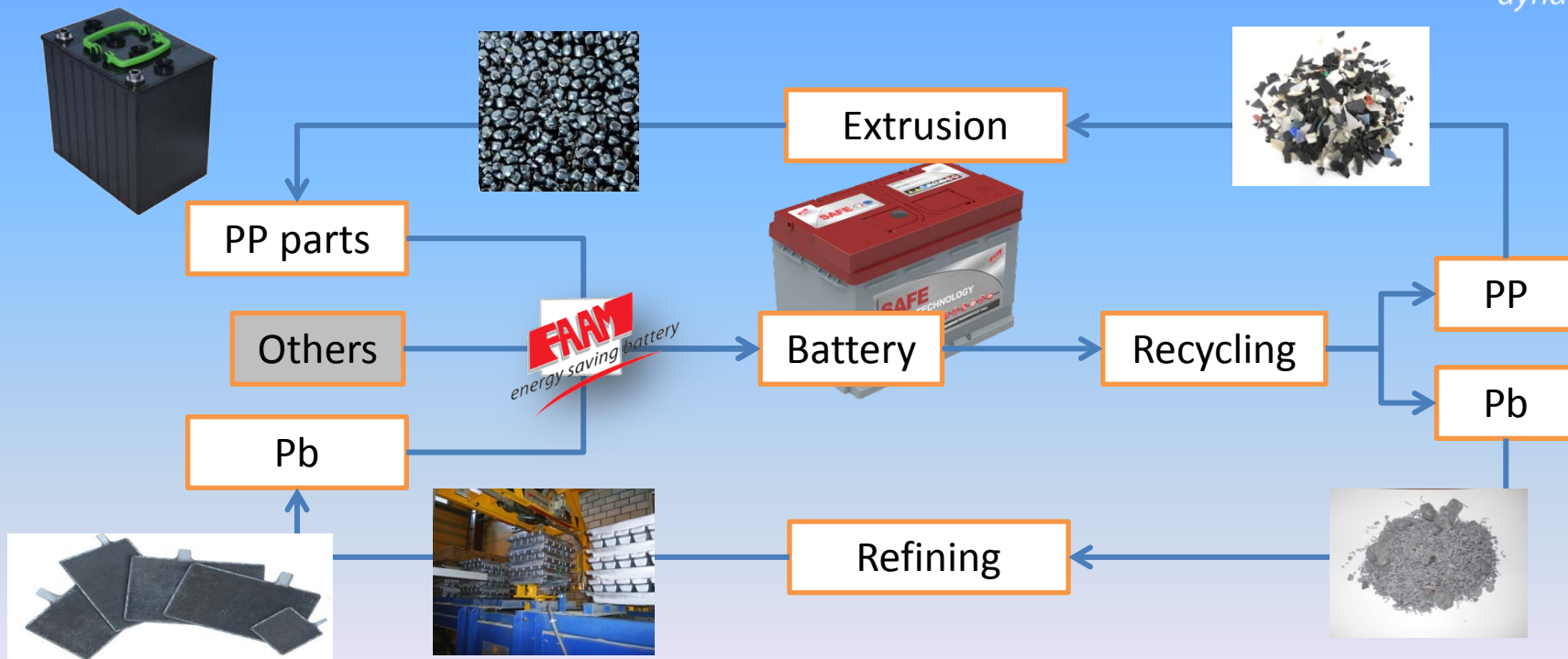
# Generic Lead-Acid Battery



# Life Cycle of the Lead-Acid Batteries

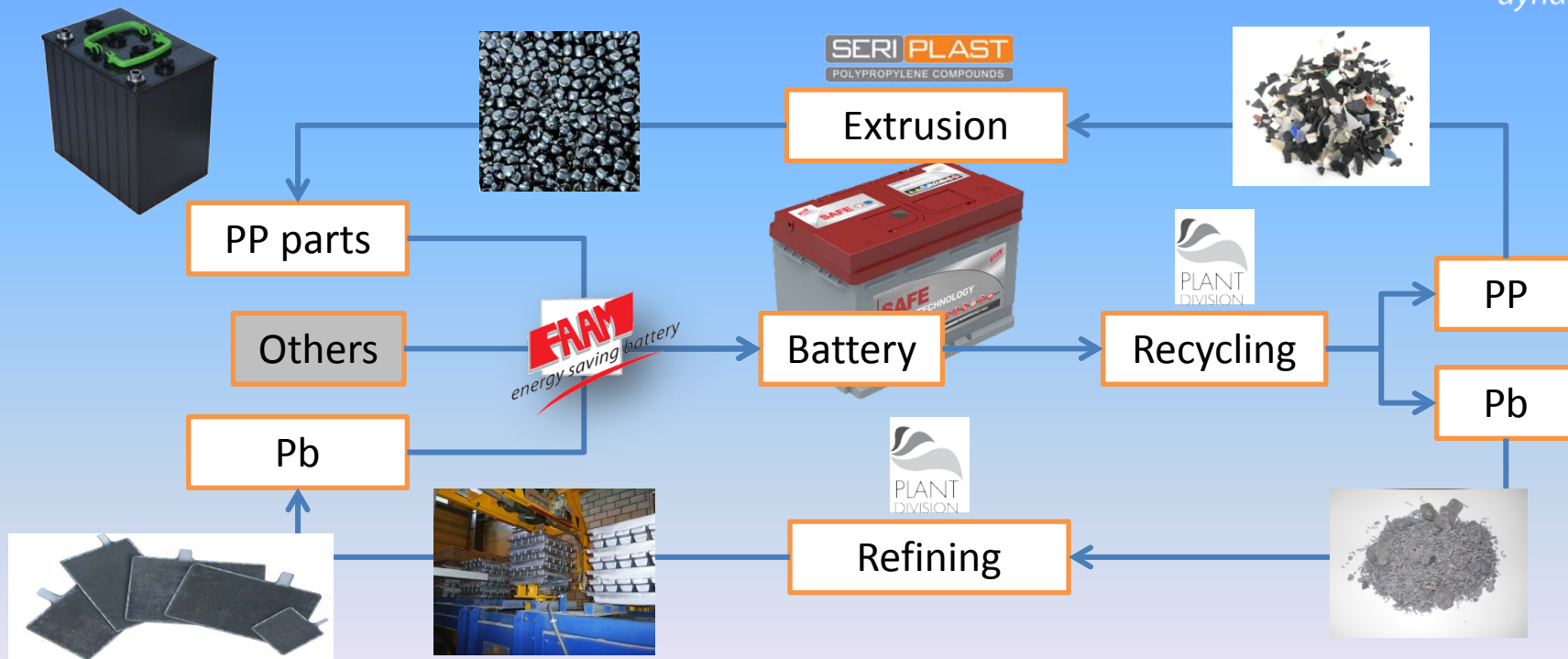


# Life Cycle of the Lead-Acid Batteries

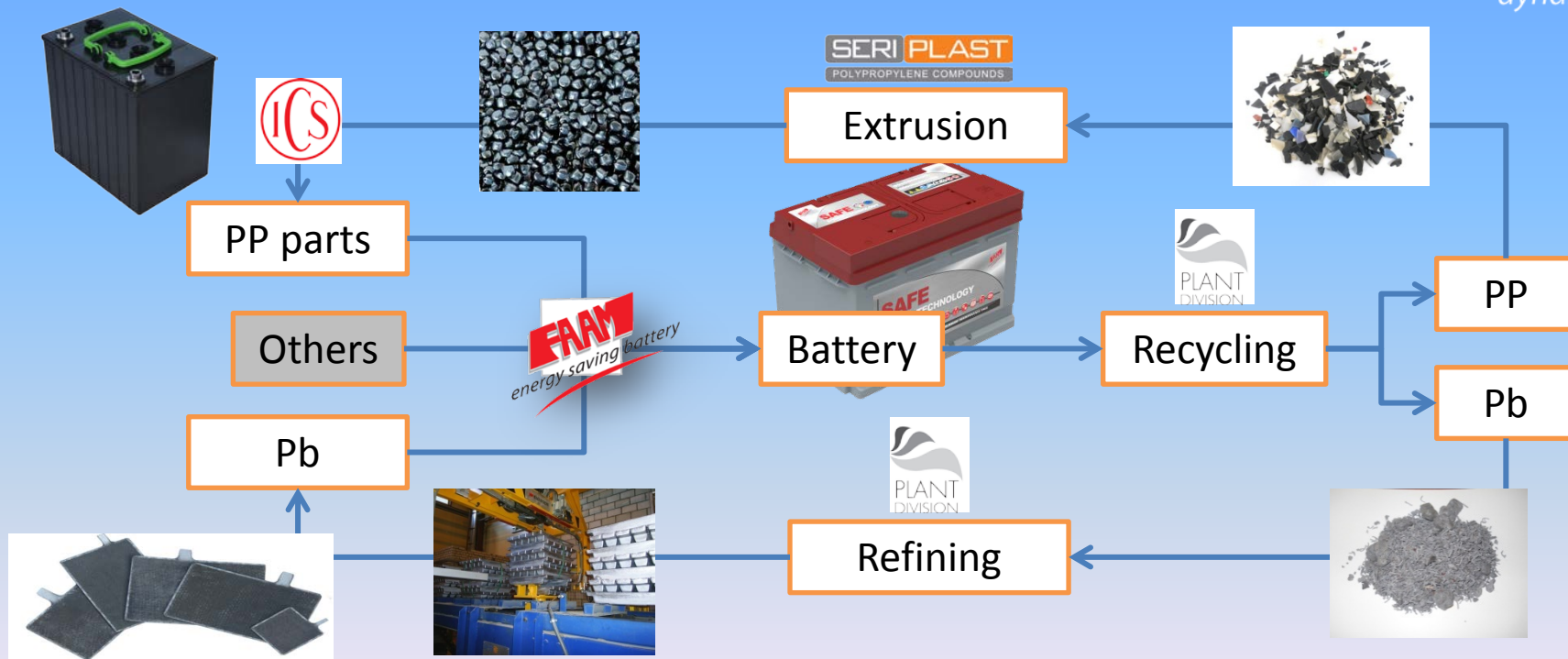




# Life Cycle of the Lead-Acid Batteries



# Life Cycle of the Lead-Acid Batteries



# ***Life Cycle of the Lead-Acid Battery***



SERI is the only Company worldwide, currently able to provide:

**Know-how  
Equipment  
Products**

for the complete life-cycle of lead-acid batteries.





# Life Cycle of the Lead-Acid Battery - RECYCLING

## Loading, Crushing and Separation



the  
*dynamic*  
company



# Life Cycle of the Lead-Acid Battery - RECYCLING

## Loading, Crushing and Separation



the  
*dynamic*  
company



# Life Cycle of the Lead-Acid Battery - RECYCLING

## Loading, Crushing and Separation



**PP**



**Grids**



**Heavy Plastic**





# Life Cycle of the Lead-Acid Battery - RECYCLING

## Loading, Crushing and Separation



the  
dynamic  
company



# Life Cycle of the Lead-Acid Battery - RECYCLING

## Paste desulphurization and Sodium Sulphate Production



the  
*dynamic*  
company



# Life Cycle of the Lead-Acid Battery - RECYCLING

## Smelter



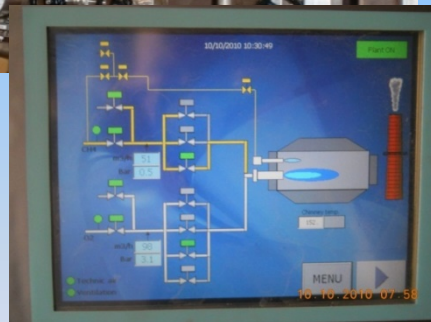
the  
*dynamic*  
company





# Life Cycle of the Lead-Acid Battery - RECYCLING

## Smelter

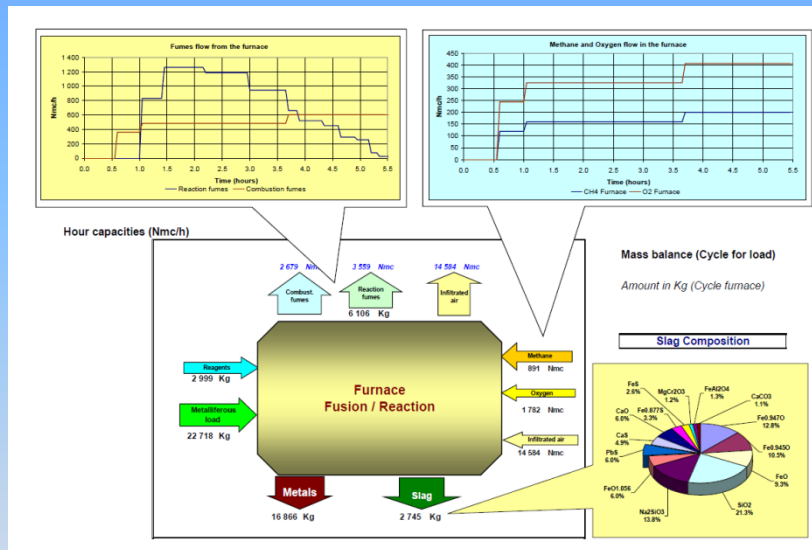


the  
*dynamic*  
company



# Life Cycle of the Lead-Acid Battery - RECYCLING

## Smelter





# Life Cycle of the Lead-Acid Battery - RECYCLING

## Refining and Casting



the  
*dynamic*  
company



# Life Cycle of the Lead-Acid Battery - RECYCLING

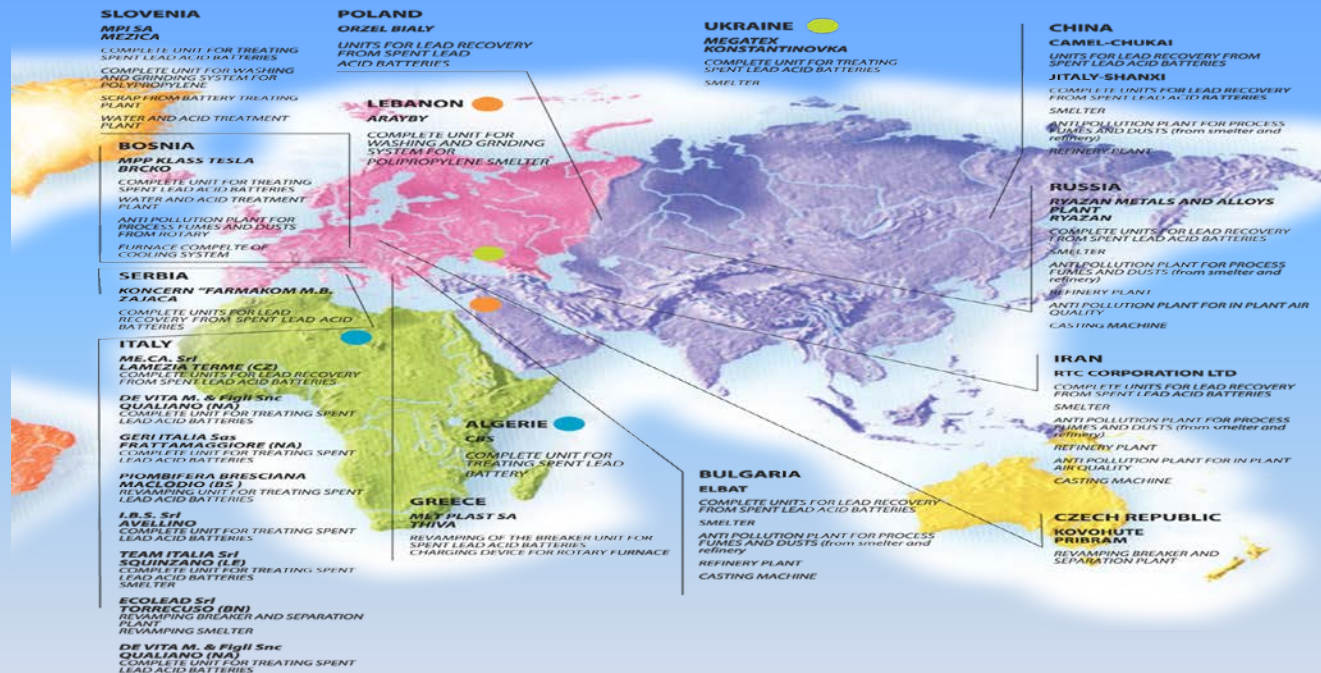
## PP Grinding and Extrusion



the  
*dynamic*  
company



# Life Cycle of the Lead-Acid Battery - RECYCLING



**SERI PLAST**

POLYPROPYLENE COMPOUNDS



**FAAM**  
energy saving battery



# ***Life Cycle of the Lead-Acid Battery – PASTE TREATMENT***



the  
**dynamic**  
company

***«CLEP» Clean Lead Process is an innovative hydrometallurgic process for the treatment of the oxide paste.***

***This process does allow to avoid the oxide paste melting (1200 °C), with positive impact both in energy consumption and in environmental impact (by avoiding SOx emission during oxide melting).***

***The material obtained by this process is a Lead Carbonate with purity index well above the Primary Lead (typically 99.999%)***

***From the Lead Carbonate can be produced new oxide or simply melt it (with far lower temperatures) to obtain Lead ingots.***





# ***Life Cycle of the Lead-Acid Battery – PASTE TREATMENT***

## **Our experience:**

***The pilot plant was in operation from more than one year and the oxide obtained by this new process has been tested with positive results.***

***Our engagement is now to reproduce the pilot plant experience in an industrial scale.***

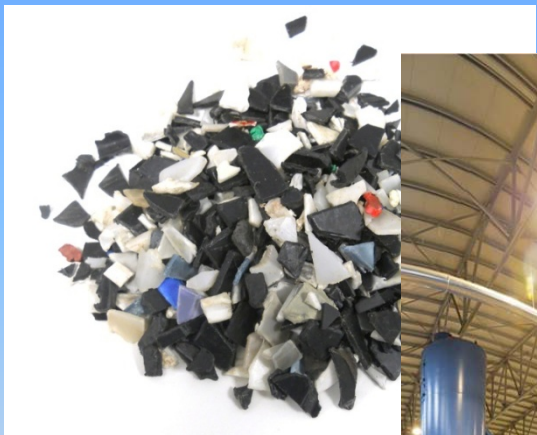
***The first industrial CLEP plant will be fully operational in the second half of 2018.***



# Life Cycle of the Lead-Acid Battery – PP EXTRUSION



the  
*dynamic*  
company

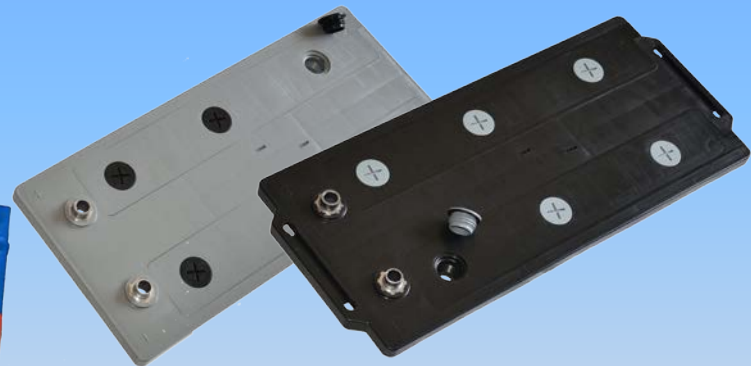


# Life Cycle of the Lead-Acid Battery – PLASTICS MOLDING

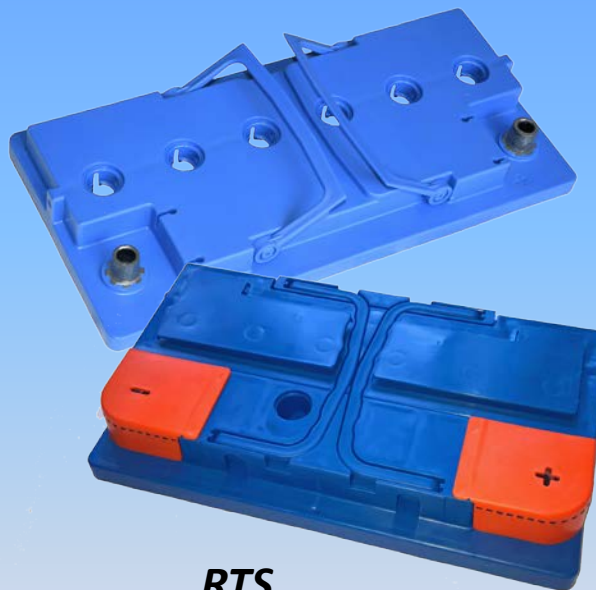


the  
*dynamic*  
company

**DIN**

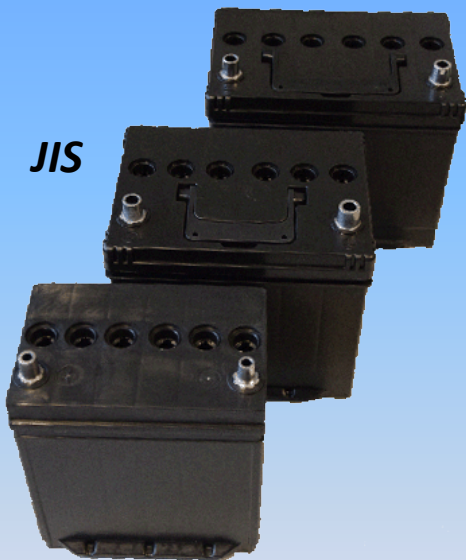


**RTS Truck**



**RTS**

**JIS**



# Life Cycle of the Lead-Acid Battery – PLASTICS MOLDING



the  
dynamic  
company

**Traction**



**Light Traction**



**OPzS / OPzV**

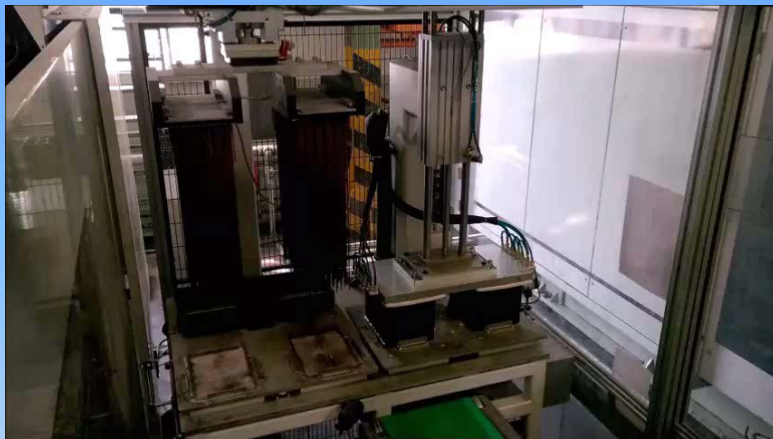




# Life Cycle of the Lead-Acid Battery – PLASTICS MOLDING



the  
dynamic  
company





# Life Cycle of the Lead-Acid Battery – ENERGY SAVING BATTERIES SYSTEMS



the  
dynamic  
company

## Motive Power Batteries



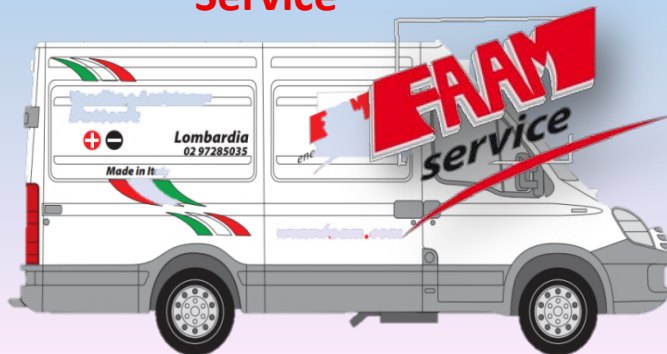
## Stand-By Batteries



## Starter Batteries



## Service



## Lithium Technologies



# Life Cycle of the Lead-Acid Battery – MOTIVE POWER



the  
*dynamic*  
company

Energy Saving Battery



- Advanced Lead Technology
- Long Lasting
- Energy Saving Battery

1720 Cycles

27% Energy Saving

**MOTIVE POWER**

**FAAM**  
energy saving battery



# Life Cycle of the Lead-Acid Battery – STANDBY POWER



the  
*dynamic*  
company



**GE Digital Energy • IMV**  
Product Technology



# Life Cycle of the Lead-Acid Battery – STARTER POWER



the  
dynamic  
company



**IVECO  
ASTRA**



# Life Cycle of the Lithium Batteries



PROJECT "E-Lithium"

*Li-ion cells R&D and  
Production*



## ***FIB-FAAM (SERI Group)***



- First Italian group for Lithium-ion and post-Lithium technology development and production
- Vertically integrated R&D and production, from active materials to second-life battery re-usage
- More than 13 years in the Li-ion system assembly (FAAM) and more than 5 years of experience in Li-ion cells production (Lithops)
- 200 MWh/y plant (south Italy) under development for the production of Li-ion cells for the ESS market





# Life Cycle of the Lithium Battery



the  
dynamic  
company

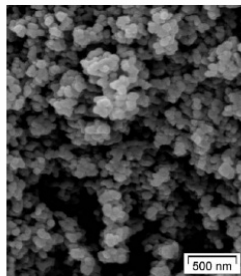


Fig. 2 Scanning electron micrograph of the LF-St sample, fired at 615 °C in inert atmosphere



**From Lithium to a second life**



**FAAM**  
energy saving battery

# Lithium Carbonate – Argentina “Jujuy” agreement



the  
dynamic  
company



**FAAM**  
energy saving battery

# FAAM / Lithops - Lithium Core Technology



the  
*dynamic*  
company

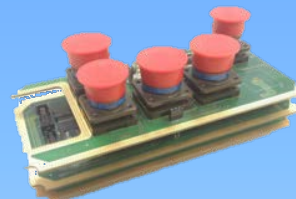
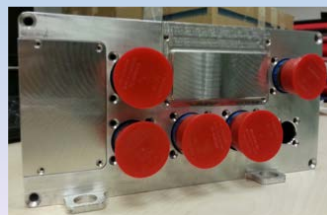


**FAAM**  
energy saving battery

## **BATTERY MANAGEMENT SYSTEM**

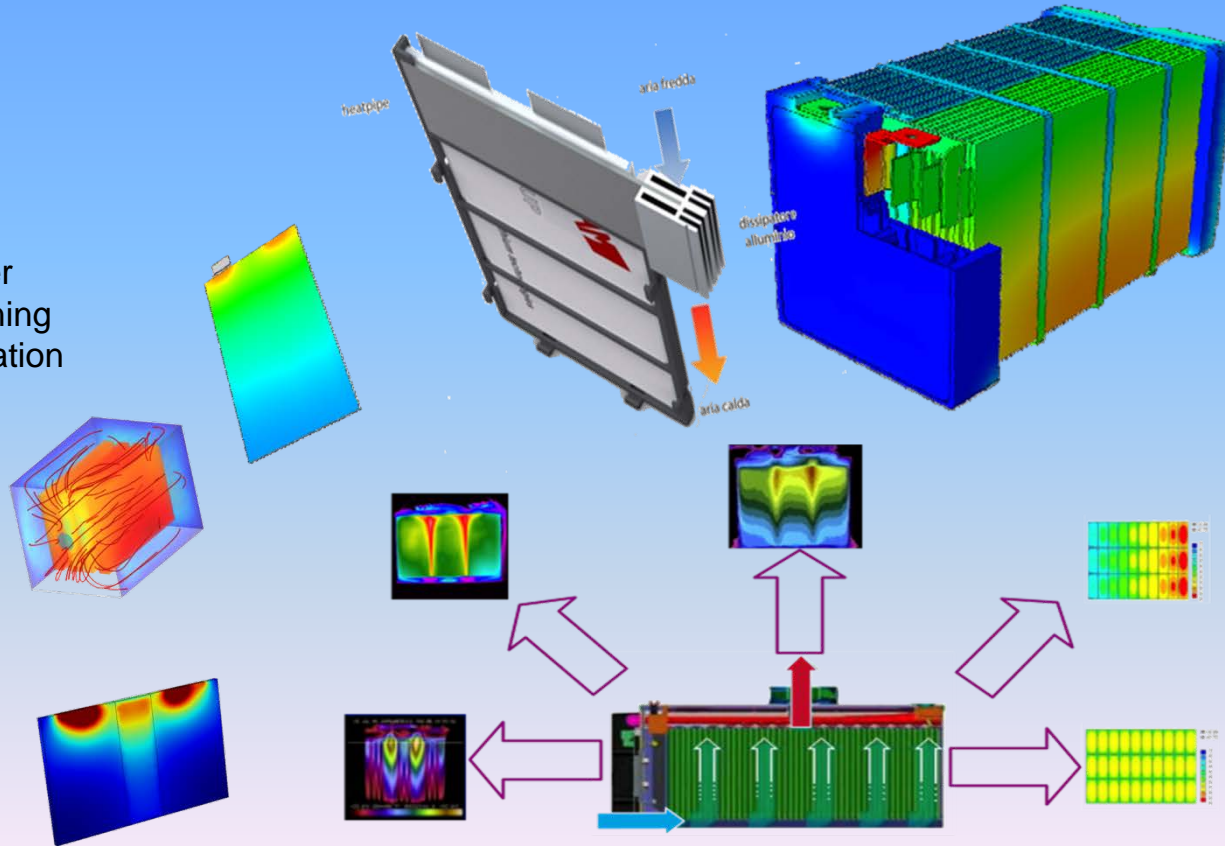
The control system developed by FAAM has several advantages over other marketed product:

- Architecture based on MASTER and SLAVE (BMS + BMMS)
- Possibility to control different types of cells with different "chemical"
- Variable control voltages
- Multiple Communications Interface (RS485, CAN BUS etc.)
- Evolved algorithms for determining the state of SOC and SOH
- Possibility to control types of multiple inputs
- Adaptable to different uses of batteries (storage, traction, starter ...)
- It manages several types of cooling systems



## THERMAL MANAGEMENT SYSTEM

- Developed by:
- Air cooling
- Liquid cooling
- Peltier cells
- Heat pipe
- Vapor chamber
- Auto Conditioning System Integration



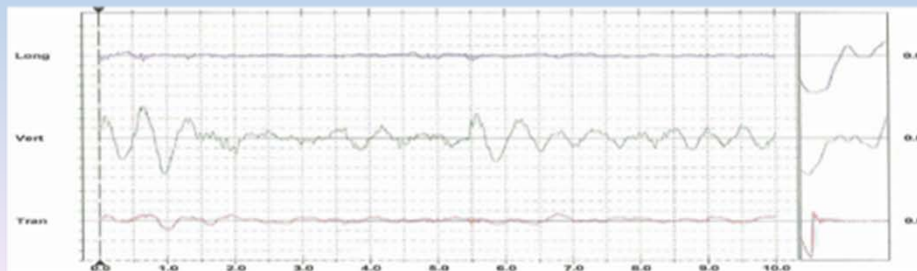
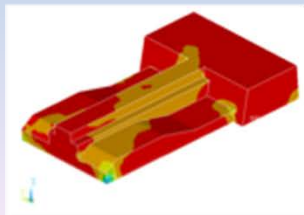
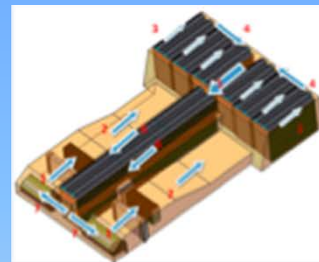
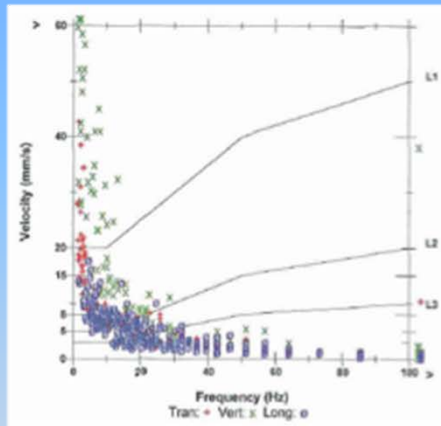
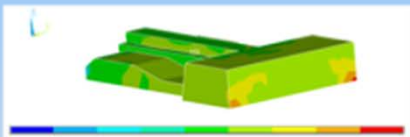
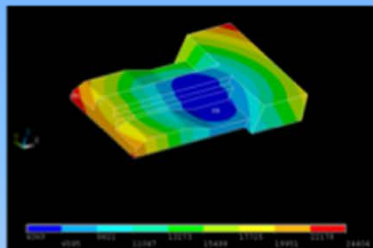


**FAAM know how ....**

## **VIBRATION, SHOCK AND DISPLACEMENT ANALYSIS**

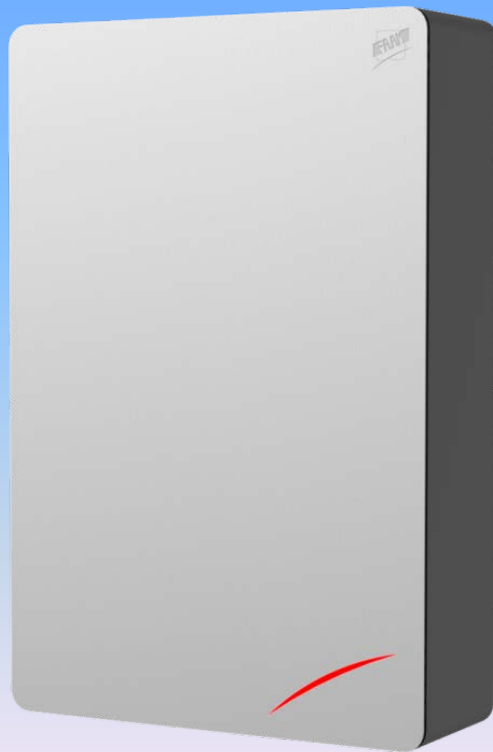


the  
*dynamic*  
company



**FAAM**  
energy saving battery

## FAAM Experience – Lithium Energy Storage



Home **LS<sup>h</sup>4880**  
48V  
4.1 kWh



## FAAM Experience – Lithium Energy Storage



the  
*dynamic*  
company

*From - 3.0 kW...  
- 4,1 kWh ...*



**FAAM**  
energy saving battery



# FAAM Experience – Lithium Energy Storage



the  
dynamic  
company

**... to - 6 MW**  
**- 1 MWh**



**FAAM**  
energy saving battery

# FAAM Experience – Lithium Powered Buses



the  
dynamic  
company



Buses of GTT Torino from 2008

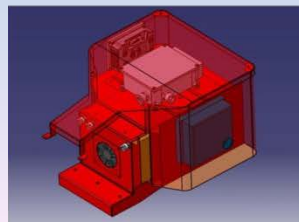


**FAAM**  
energy saving battery

# FAAM Experience – some applications



the  
dynamic  
company



**FAAM**  
energy saving battery

## ***Why SERI Group?***



- **Project execution "From the basic material to the top levels of energy and lead recycling efficiency"**
- **One subject: from raw materials to the battery system**
- **Proprietary technology and vertical supply chain**
- **Strong international R&D network, working on new technologies including post lithium one (Li-S), new materials (LMP, LTO, LiTiO<sub>2</sub>, etc) and international agreements for raw material production (Argentina)**
- **From the basic engineering to standard operation procedures, we can follow our partners in all the production steps**





***Thank you for your attention!***

