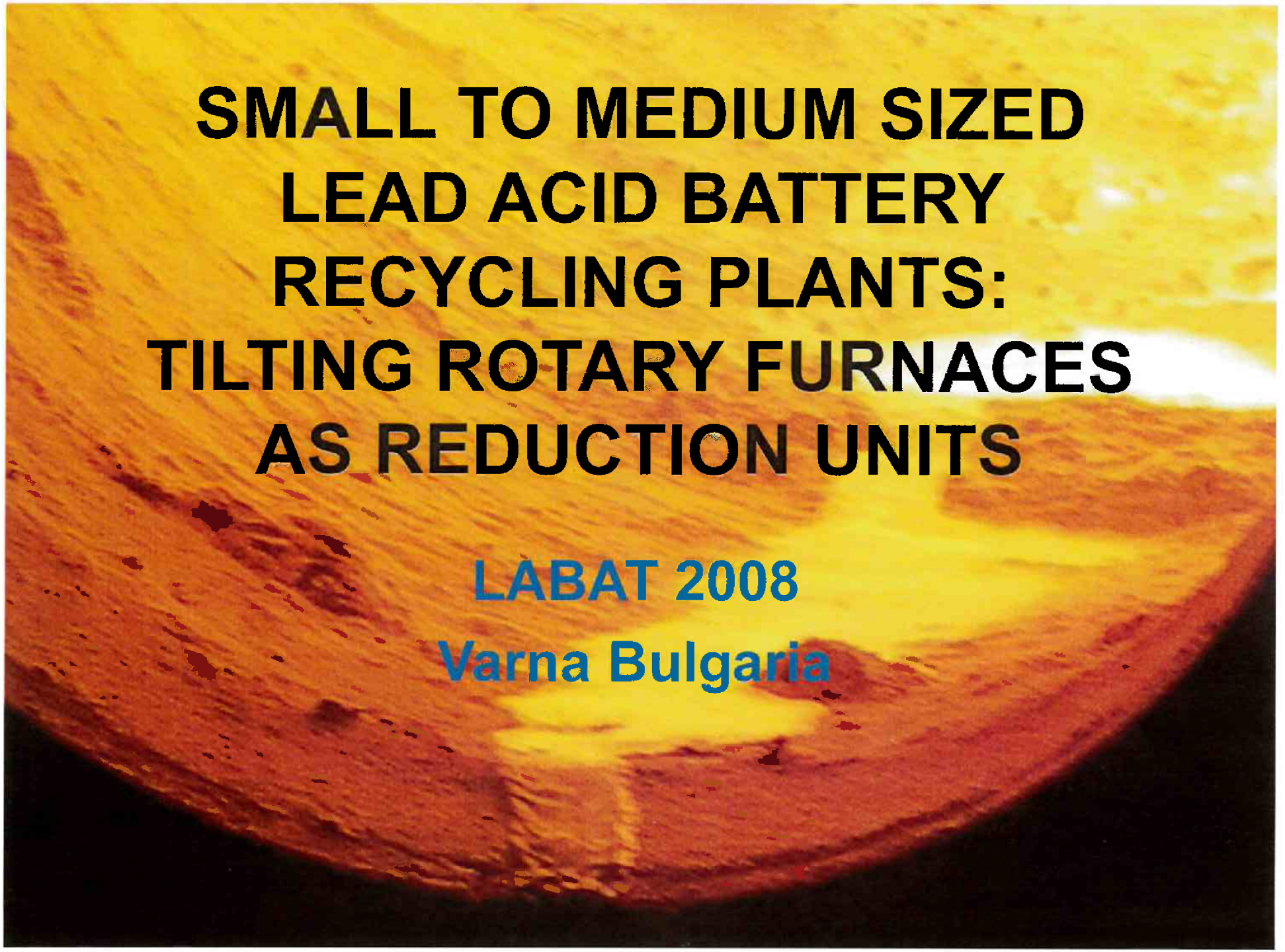
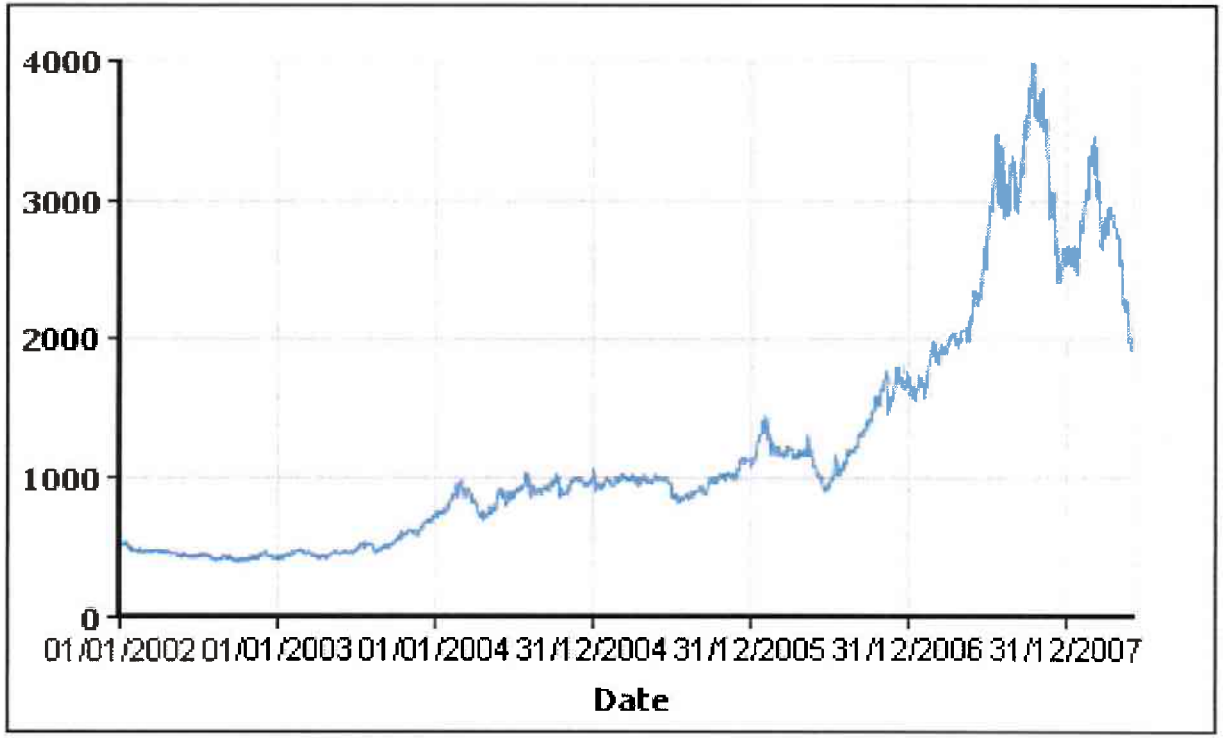
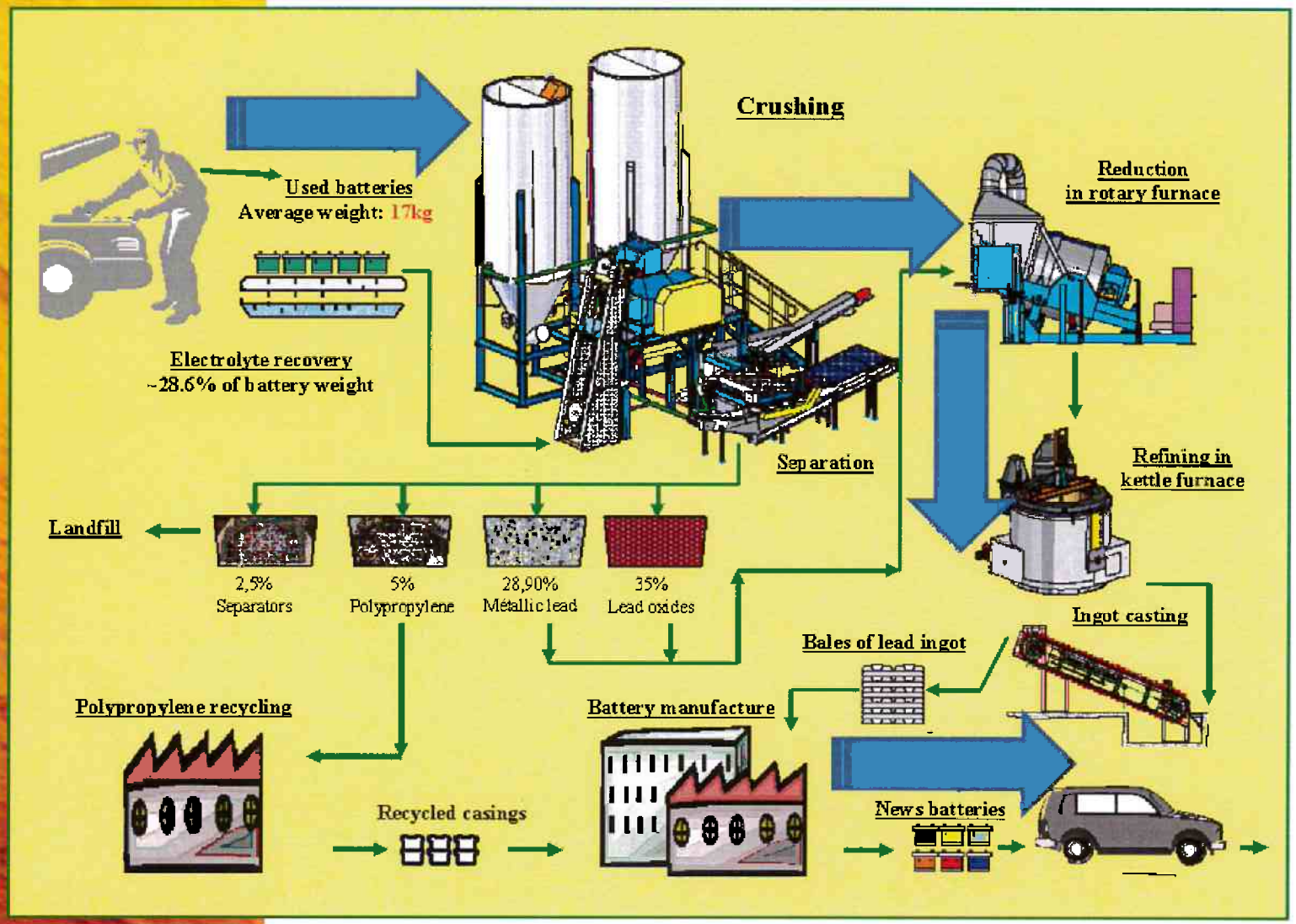

SMALL TO MEDIUM SIZED
LEAD ACID BATTERY
RECYCLING PLANTS:
TILTING ROTARY FURNACES
AS REDUCTION UNITS
LABAT 2008
Varna Bulgaria

Lead Prices


4000
3000
2000
1000
0
01/01/2002
01/01/2003
01/01/2004
31/12/2004
31/12/2005
31/12/2006
31/12/2007
Date

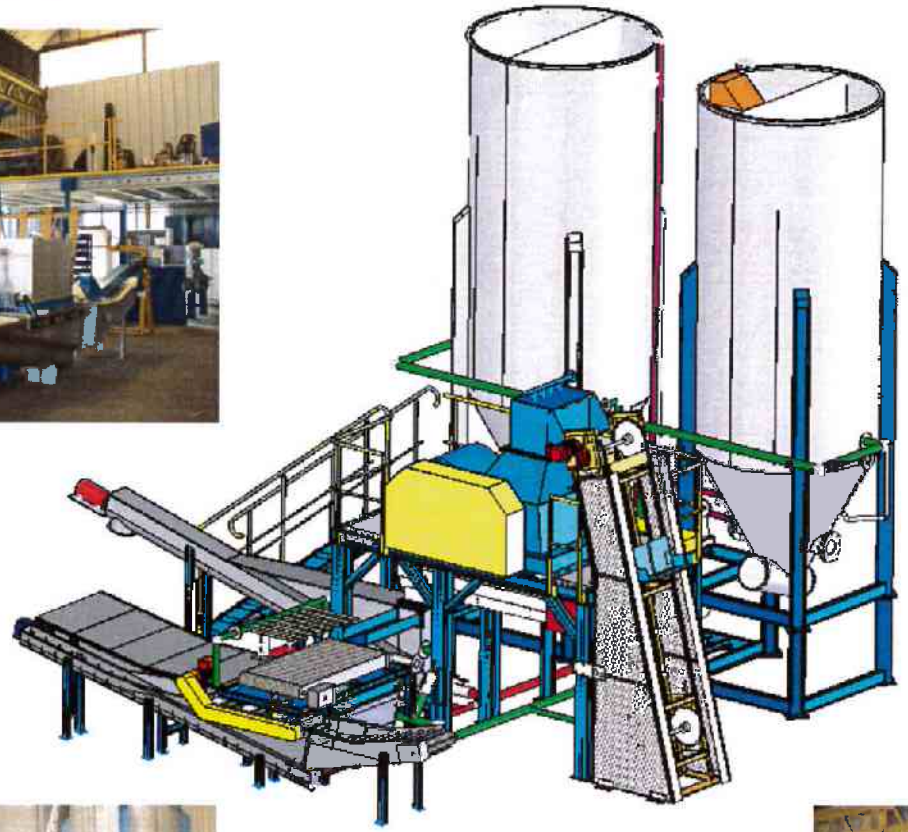
- Economic motor
- Environmental leagislation
- Desire to ‘survive’
- Increased number of in-house recycling units
- Dumping long gone
- Increased stewardship schemes
- LAB virtually closed loop
- In West concentration in hands of small number of large players

- Incentives for manufacturers to recycle in-house


Crushing
Used batteries
Average weight: 17kg
Electrolyte recovery
~28.6% of battery weight
Reduction
in rotary furnace
Refining in
kettle furnace
Separation
Landfill
2,5%
Separators
5%
Polypropylene
28,90%
Metallic lead
35%
Lead oxides
Ingot casting
Bales of lead ingot
Polypropylene recycling
Battery manufacture
Recycled casings
News batteries

Battery breaking and separation

- 97.5% of standard SLI battery is recyclable:
  - 36 % Lead oxides
  - 29% Metallic lead (plates)
  - 5% Polypropylene
  - 27,5% electrolyte
  - 2,5% non-recyclable sterile (separators)



- After removal of electrolyte, casing is crushed and different fractions separated by density

Polypropylene fraction

Metallic lead fraction

Lead oxide fraction

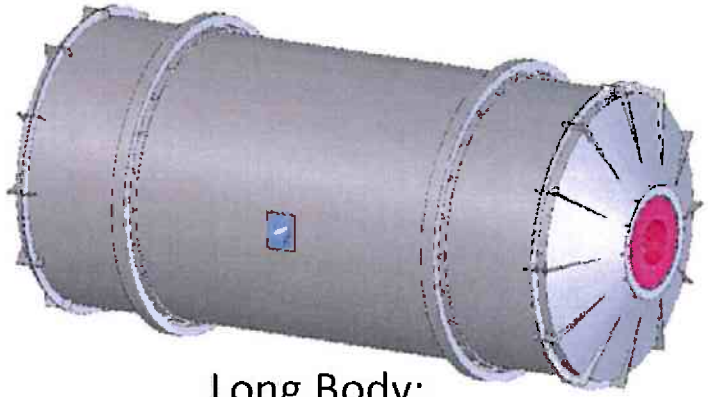
Separators

Reduction /Smelting

- Obvious that after separation makes sense to keep metal streams separate : Metallic lead and lead oxides
- Reduction under slag
- Composed of
  - Carbon (anthracite)
  - Soda Ash
  - Cast iron chips

Smelting Options

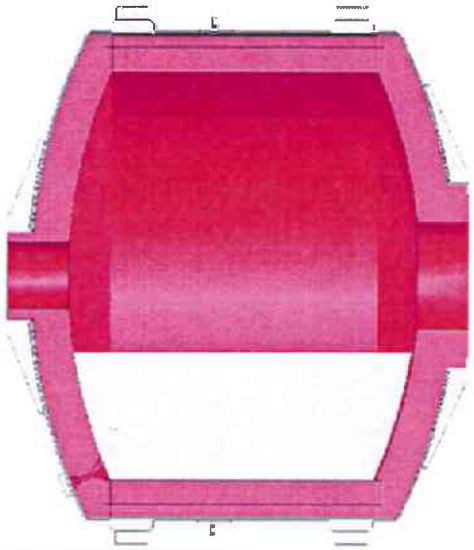
'Short Body':
Diameter = ~Length

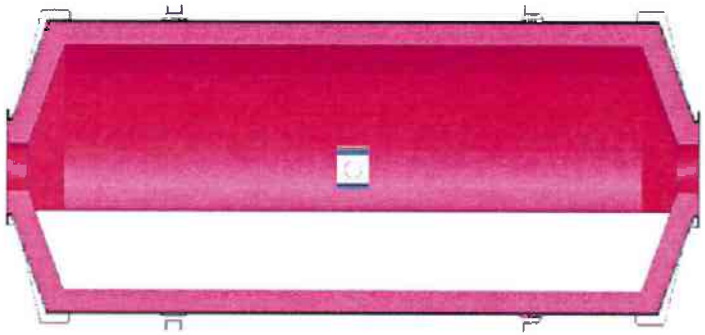


Long Body:
Length > Diameter

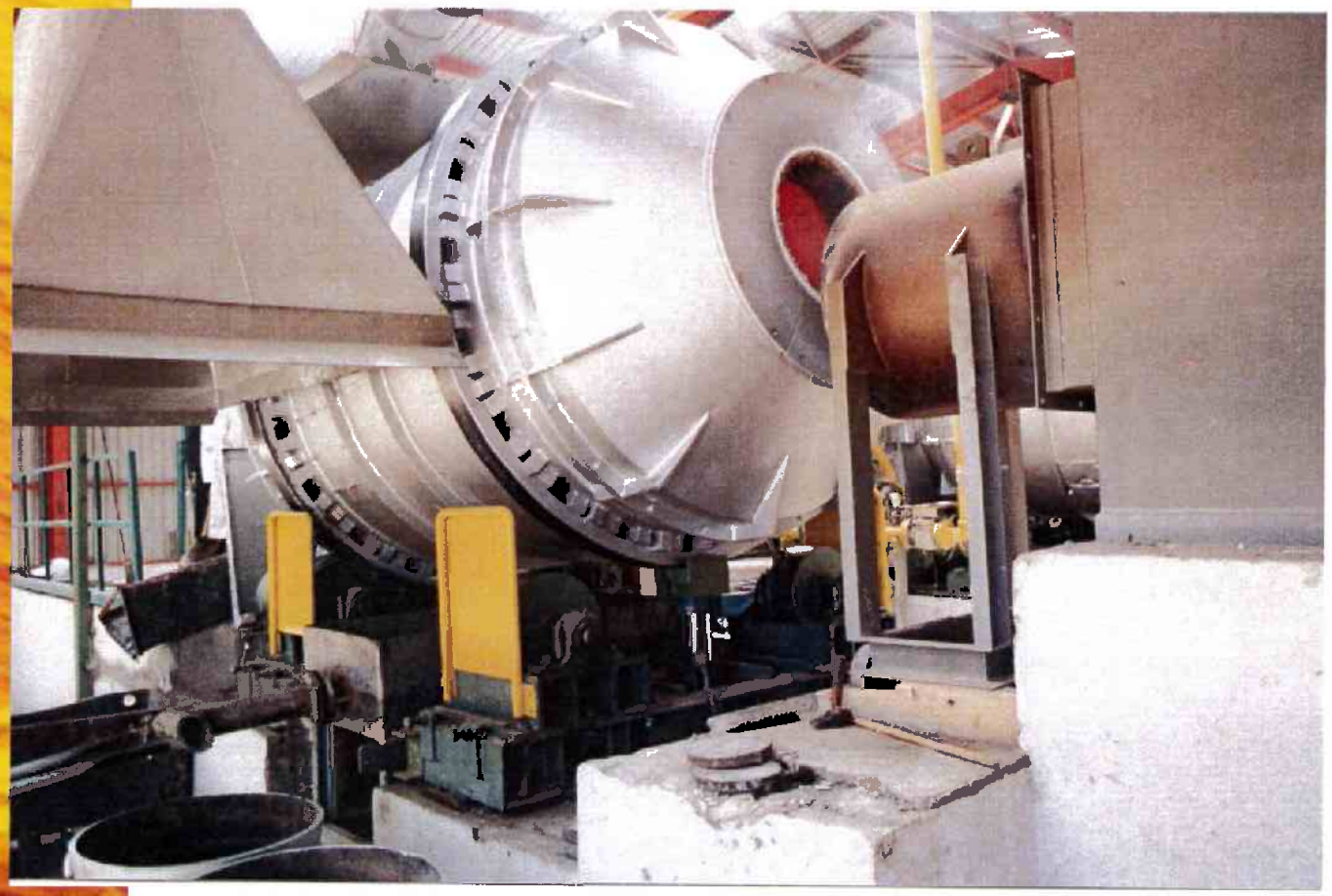
Short body advantages

- Creates a deep bath that affords:
  - Large charge capacity
  - Better 'decantation'/separation of molten metal & slag



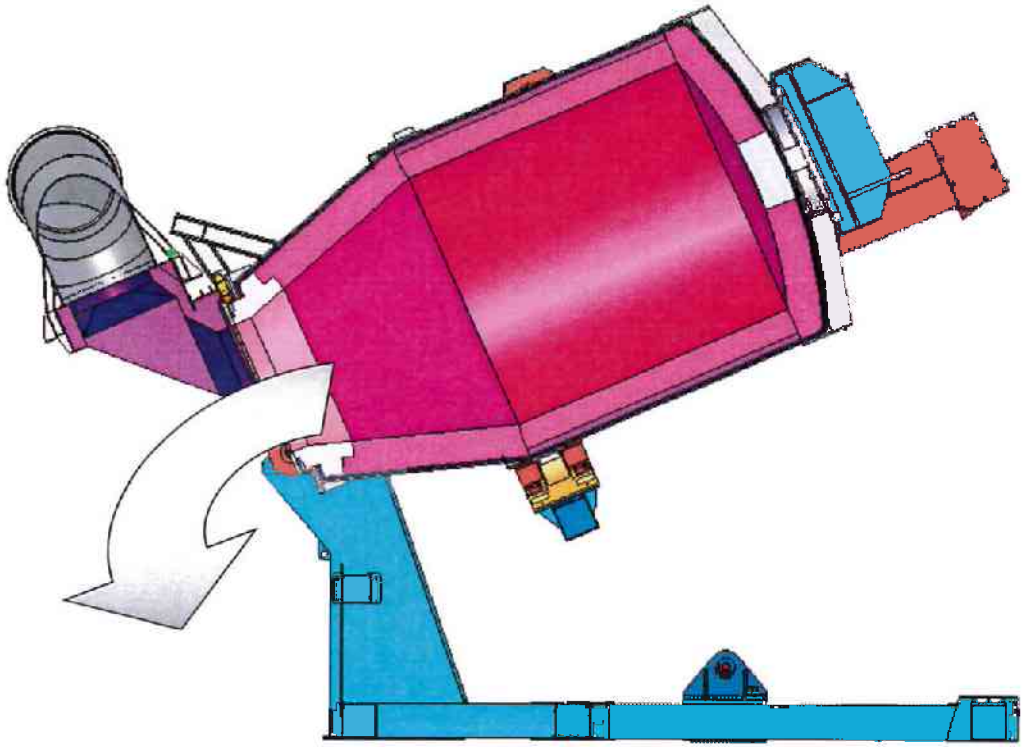


Disadvantages



Tilting Rotary Furnaces

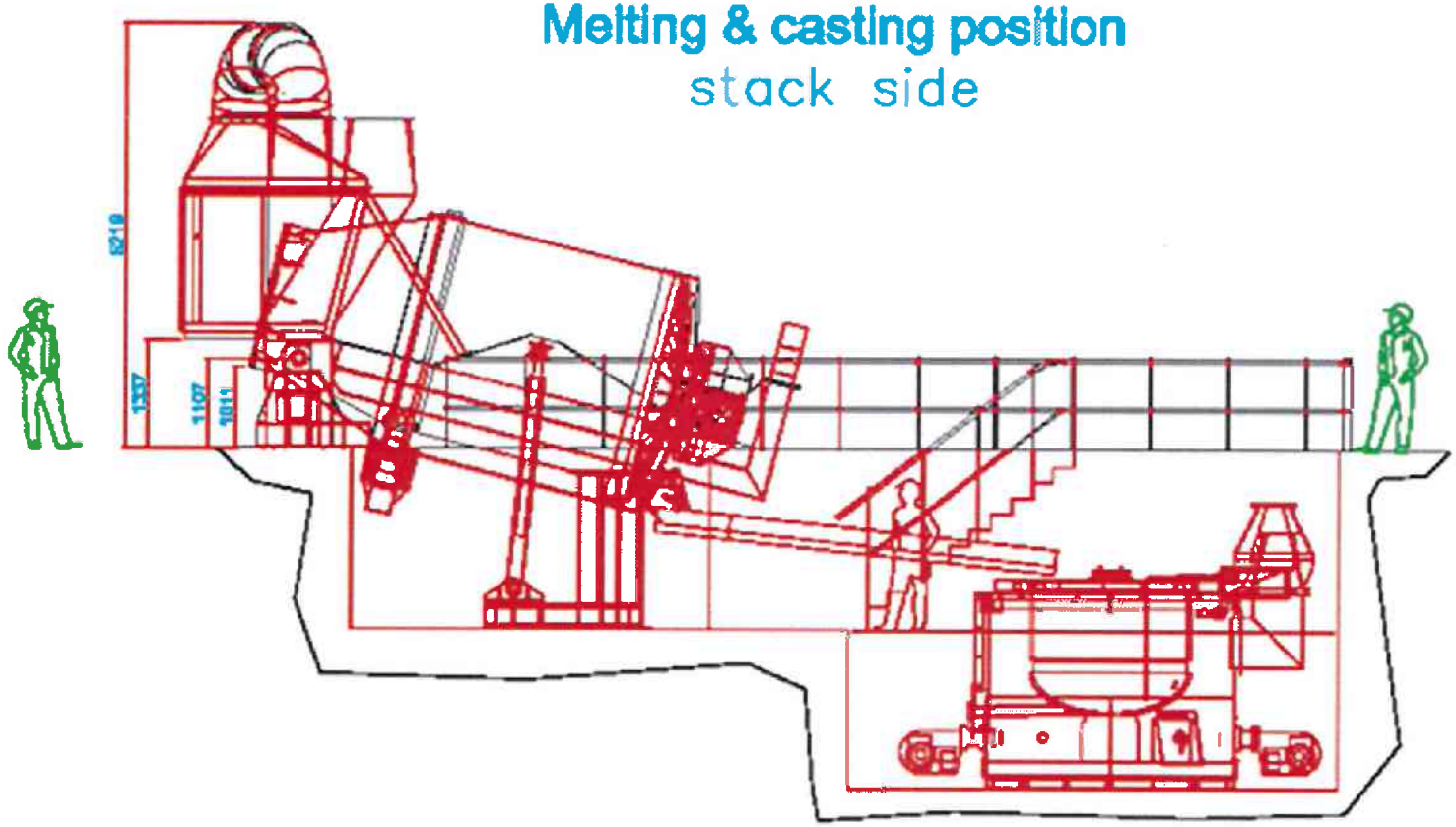
What is a TRF?

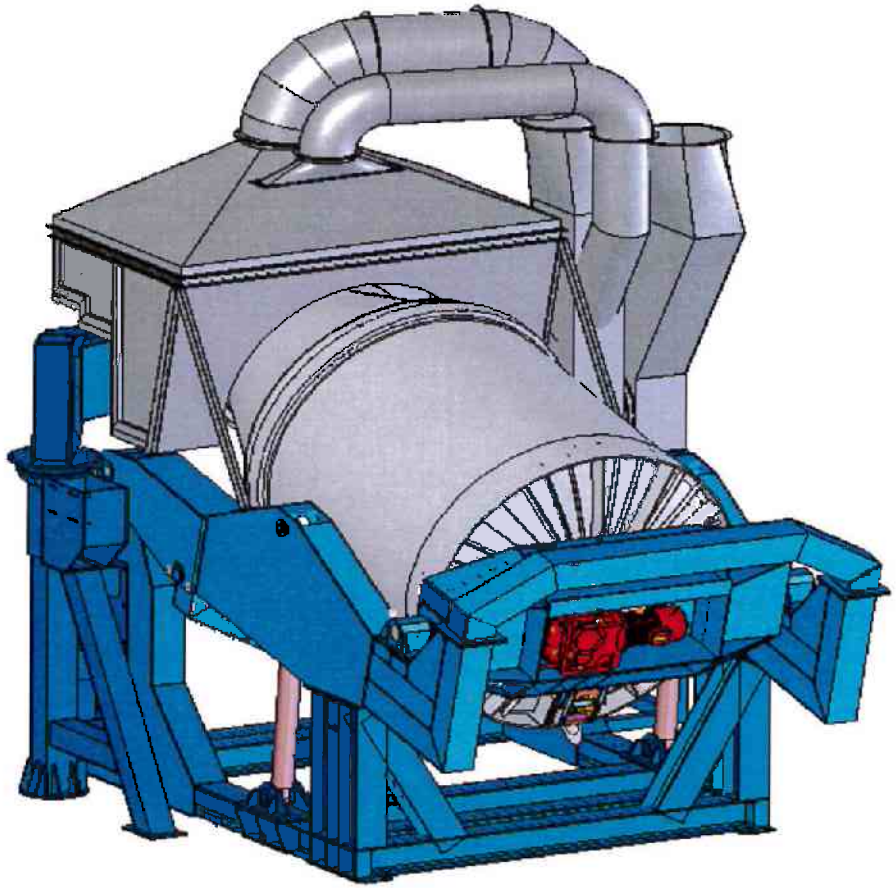


Dross 900

Melting & casting position

stack side





- TRF gives a good deep bath for improved decantation and separation (like Short body)
- Ratio of total volume/useful volume much smaller
  - 2:1 as opposed to 4:1 for Short body
    - Improved efficiencies
    - More compact design

Ratio total volume/useful volume = 4:1 short body & 2:1 TRF

Economics

- 6600 tonnes of batteries
- 4300 tonnes of lead
- Investment including:
  - Buildings
  - Crusher/separator
  - Reduction furnace
  - Refining kettles & equipment
  - Filter
  - Operational personnel
    - 7 people per shift + supervisor
  - Consummables
    - Gas & Electricity
    - Reagents
    - Maintenance and spares

- Small & Medium sized plants are a viable economic option
- For some it could be only option
- Other incentives to recycle:
  - Producer responsibility legislation
  - Refundable deposits
  - Eco – taxes
- Present technology in smelting and fume arrestment offers:
  - High performance
  - Improved efficiency