



GO-4-0

December 14th 2016
JM Milazzo



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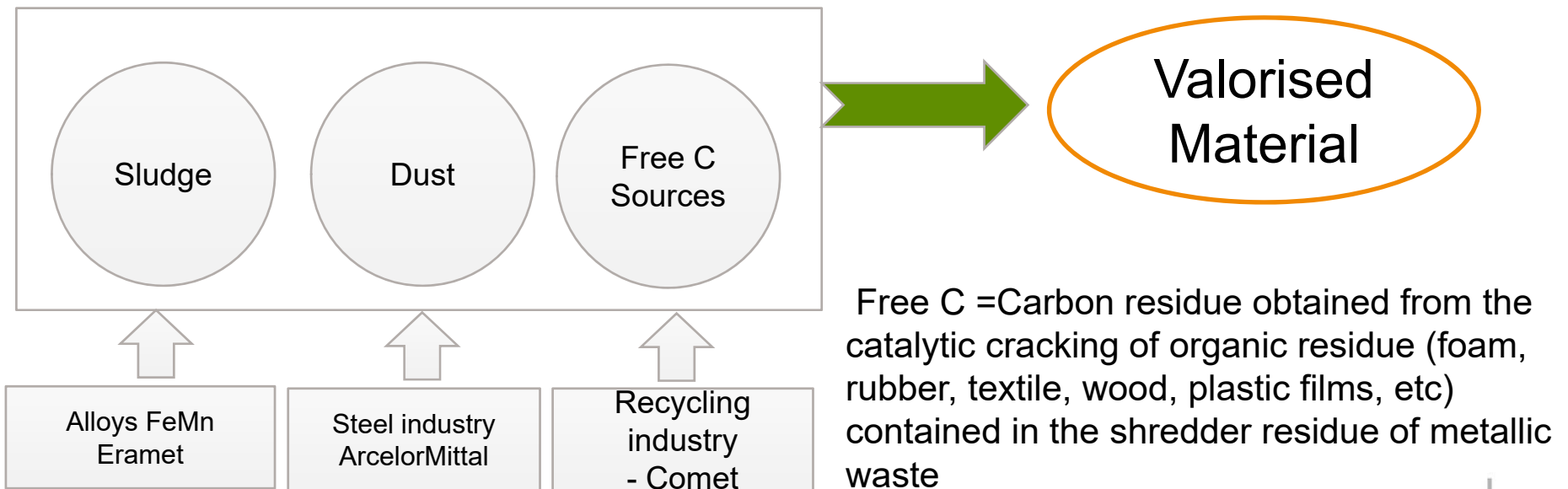
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1. Objective GO 4 0 Project
2. Consortium
3. Project Structure
4. Technical solutions
5. Market analysis

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OBJECTIVE

- Reduce the need for landfill deposits by turning waste from metal industry into valuable products



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OBJECTIVE AND TECHNICAL SOLUTION

- **Reduce landfill deposit:** Decrease quantities of deposit on landfill
- **Economic environmental solution :** Find out solution with lowest cost in Opex and Capex (free C as Char C) – Pragmatic approach
- **Cold treatment :** Compare classical agglomeration with innovative tableting to agglomerate the sludge and dusts
- **Hot treatment :** Find out solution with lowest cost RHF,MHF,RK
- **Saleable product:** Agglomerate waste (sludge) from industrial producer into saleable product for market as Ore or Rich slag

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CONSORTIUM & BUDGET

► Consortium

- ERAMET (coordinator – Core Partner)
- Centre de Recherche Métallurgique ASBL (CRM) (Core Partner)
- ArcelorMittal (Associate Partner)
- Eurotab (Task Partner)
- COMET Traitements SA (Task Partner)

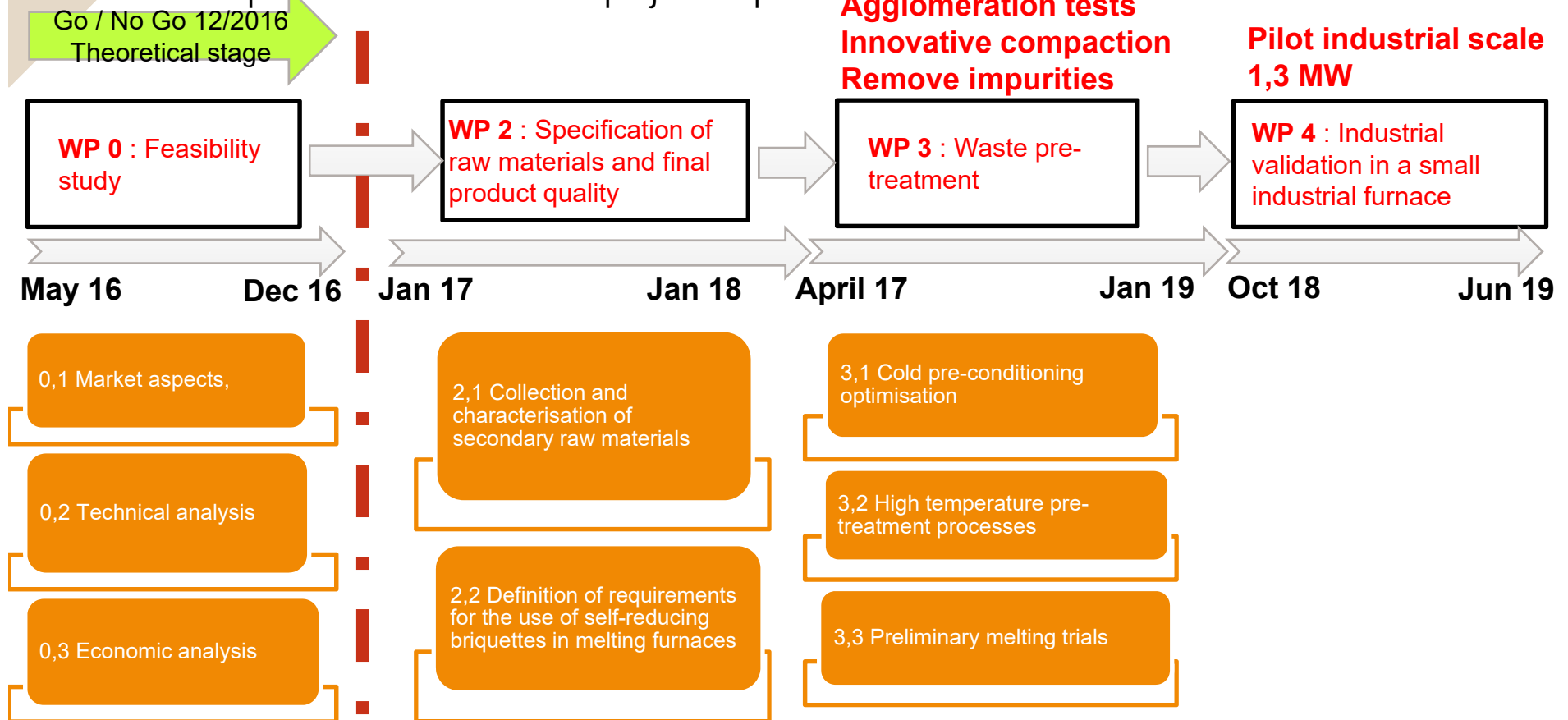
► Budget:

- 2M€ over 3 years (mid-2016 → mid-2019) EIT Raw Material funding

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SCHEMATIC STRUCTURE

Schematic presentation of the main project steps



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QUANTITIES INVOLVED IN GO 4 0

~155.000 Tty

Case 1- stoechio 125% (C)

Raw material (Wet)

(Eramet – AM - Comet)

- Eramet :
 - Sludge
 - Dust
 - Fines
- Arcelor Mittal
 - Sludge BF
- Comet
 - Char C

→ Out put for mix

**All FeMn sludge ER +
dusts + Ore Fines +
Char + Sludge BF AM**

~193.000T/y

Case 3- 125% (C)

Raw material (Wet)

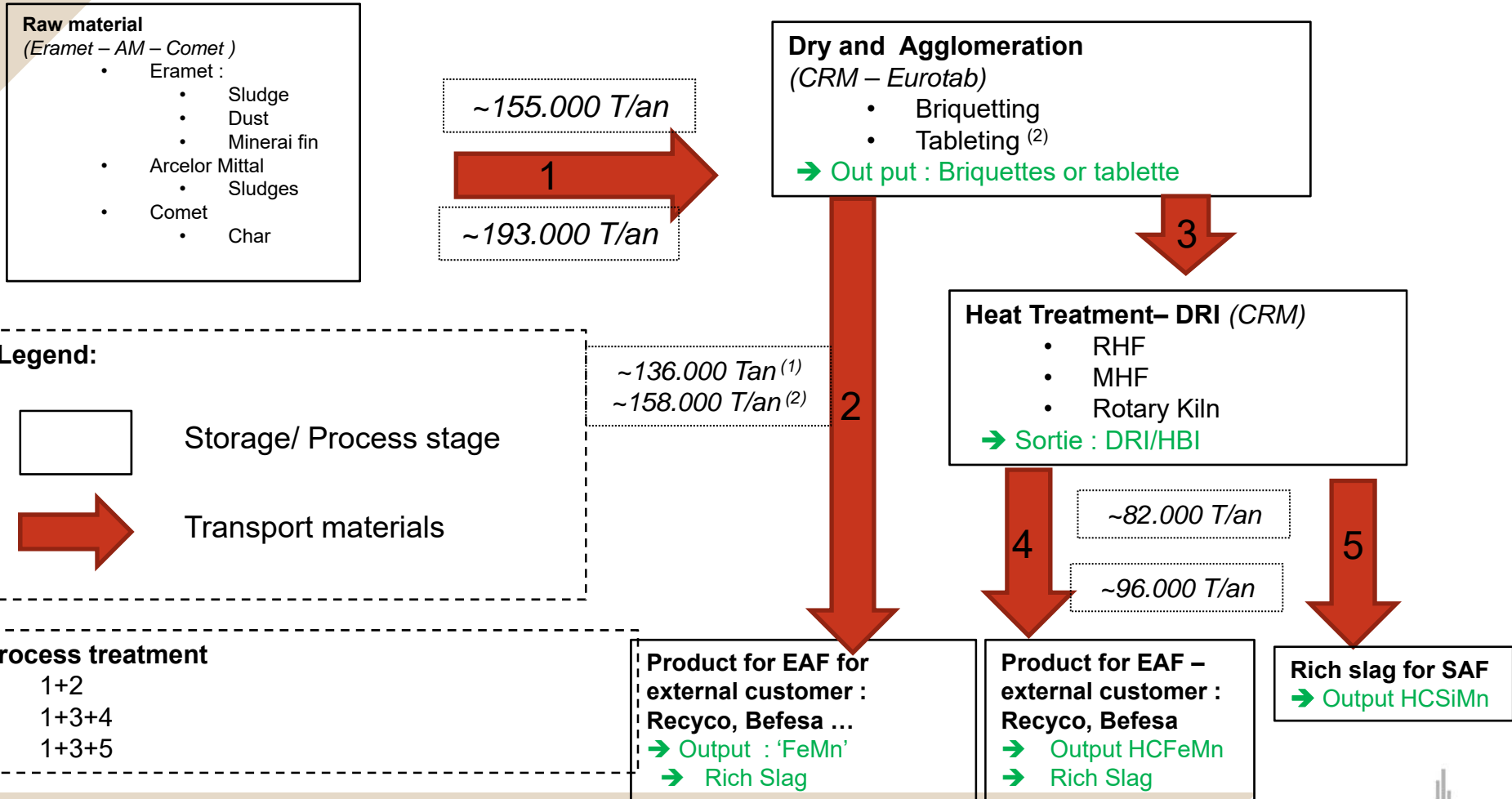
(Eramet – AM - Comet)

- Eramet :
 - Sludge
 - Dust
 - Fines
- Other Sludge from alloys group
- Arcelor Mittal
 - Sludge BF
- Comet
 - Char C

→ out put for mix

**All FeMn sludge ER +
dusts + Ore Fines +
Char + Sludge BF AM
+ Other sludge**

MAIN STREAM FOR GO 4 0



GO 4 0

COMPOSITION SEALABLE PRODUCT

Cold treatment

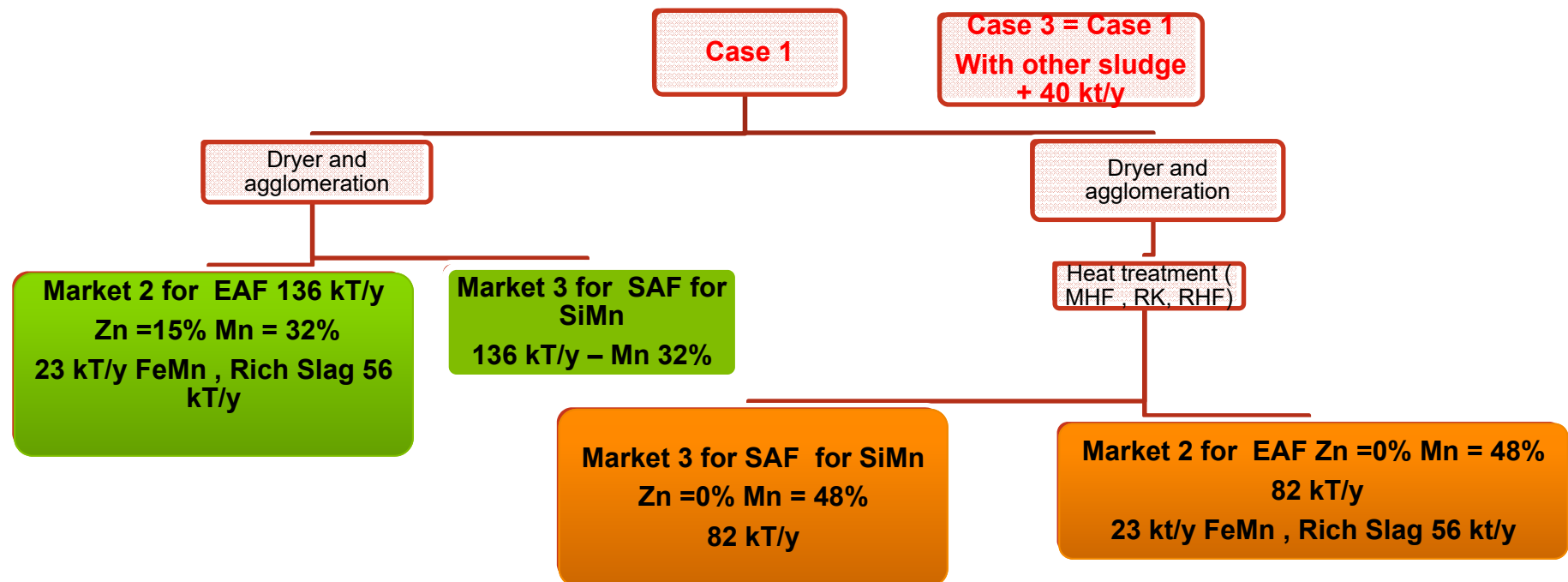
	Composition after cold treatment Agglomeration + Dryer					
	Fe	C	Mn	Mn/P	Mn/Fe	P
	(dry %)	(dry %)	(dry %)	wt	wt	(dry %)
Case 1	5,9	8,0	32,1	318	5	0,10
Case 3	5,1	6,8	31,6	369	6	0,09

Heat treatment

	Composition after Heat treatment					
	Fe	C	Mn	Mn/P	Mn/Fe	P
	(dry %)	(dry %)	(dry %)	wt	wt	(dry %)
Case 1	9,0	0,0	48,9	318	5	0,10
Cas 3	7,8	0,0	48,3	369	6	0,09

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GO 4 0 PRODUCT = RICH SLAG FOR SAF OR ORE EAF



COLD TREATMENT

Agglomeration techniques



Tablet without blend
Innovative

«Tablet» 10 -20 mm



Classical
Roll-press

Sintering: 1-10mm
•Pelletising: Max 0,2mm
•**Briquetting: 0-6mm**
•Extrusion: 0-6mm
•Eirich mixer: <1mm

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COLD TREATMENT

- The agglomeration technique used is dependent on:
 - ✓ Thermodynamic properties of the agglomerate.
 - ✓ Raw materials particle size.
 - ✓ Agglomerate size required.
 - ✓ Binder project Go 4 0 ---- Test without Binder – innovative agglomeration
 - ✓ Cold and hot strength.
 - ✓ Reactivity.
 - ✓ Porosity.
 - ✓ Cost ---- Reduce all cost for treatment – innovative agglomeration

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COLD PRE-TREATMENT INNOVATIVE PROCESS WITHOUT BINDER

Compact forming

Tabletting
Double punch
w or w/o dwell time

Tabletting
Single punch
w or w/o refrigeration

EUROTAB - Technology



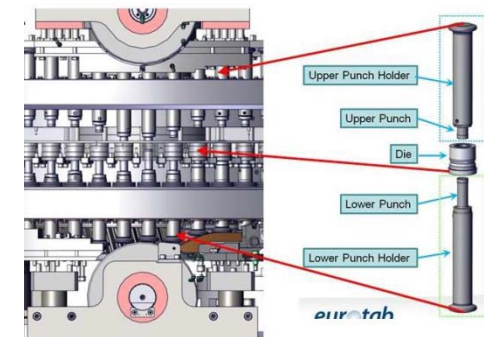
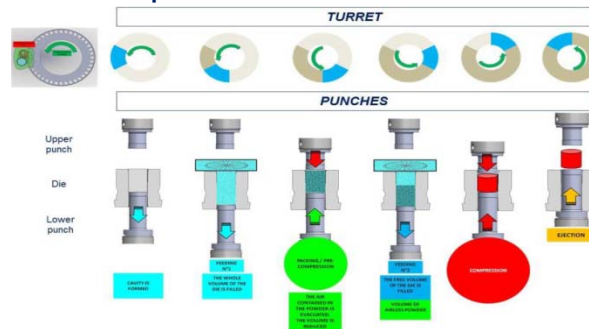
An optimal kinematic
Pressure, speed, dwell time,...



Powder with properties / behavior upon compaction



Tablet performances adapted to application



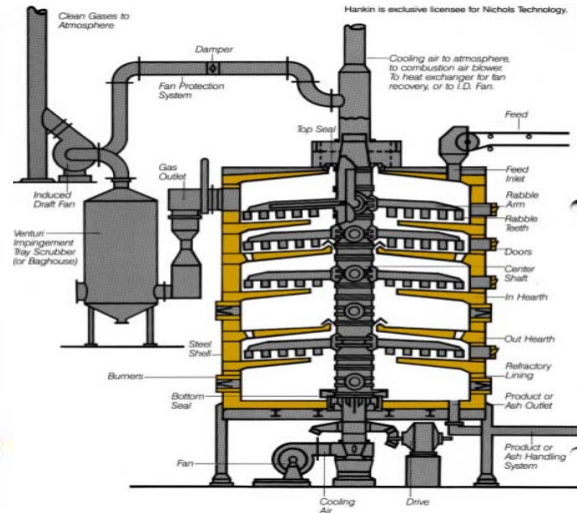
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HOT PRE-TREATMENT PRE-TREATMENT TECHNOLOGIES

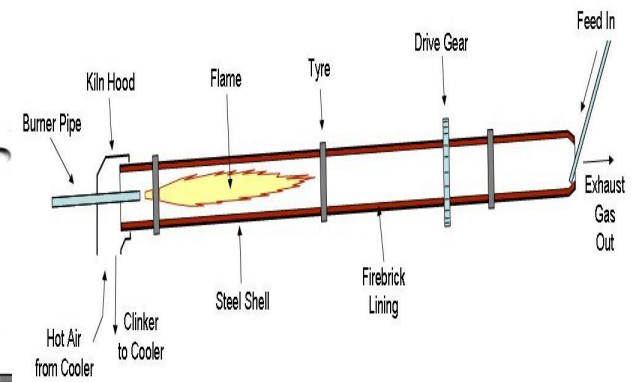
ROTARY HEARTH FURNACE



The rotary hearth furnace continuous furnace concept.



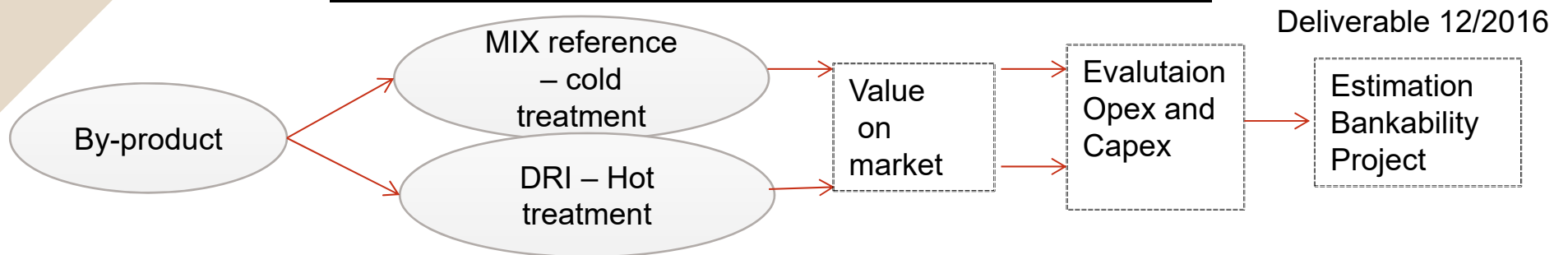
Multiple hearth Furnace-
Vertical Calciner , several circular hearths



Rotary kiln
Hot gases pass along the kiln in counter-current or co current

Objective for Go 4 0 find out lowest cost in Capex and Opex

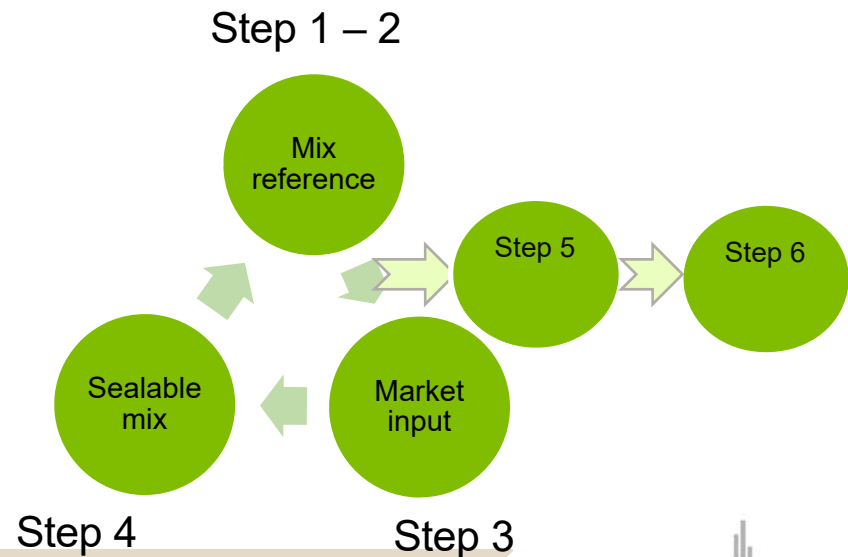
FEASIBILITY STUDY - METHODOLOGY



Evolution project

- Step 1 : Chemistry Calculation with thermodynamic model
- Step 2 : Mix Definition
- Step 3 : Market study
- Step 4 : Sealable mix and volumes
- Step 5 : Evaluation – Opex and Capex -
- Step 6 : Bankability Assessment

Methodology



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FEASIBILITY - PROFITABLE MARKET

Simple approach

$$\begin{array}{rcccl} \text{Market value} & + & \text{Save on Deposit cost} & - & \text{Operational cost (Opex + Capex)} & \geq & 0 \\ \text{CP consulting} & & 100 - 250 \text{ €/t} & & \text{CRM and partners} & & \end{array}$$

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MARKET STUDY – RICH SLAG OR POOR ORE

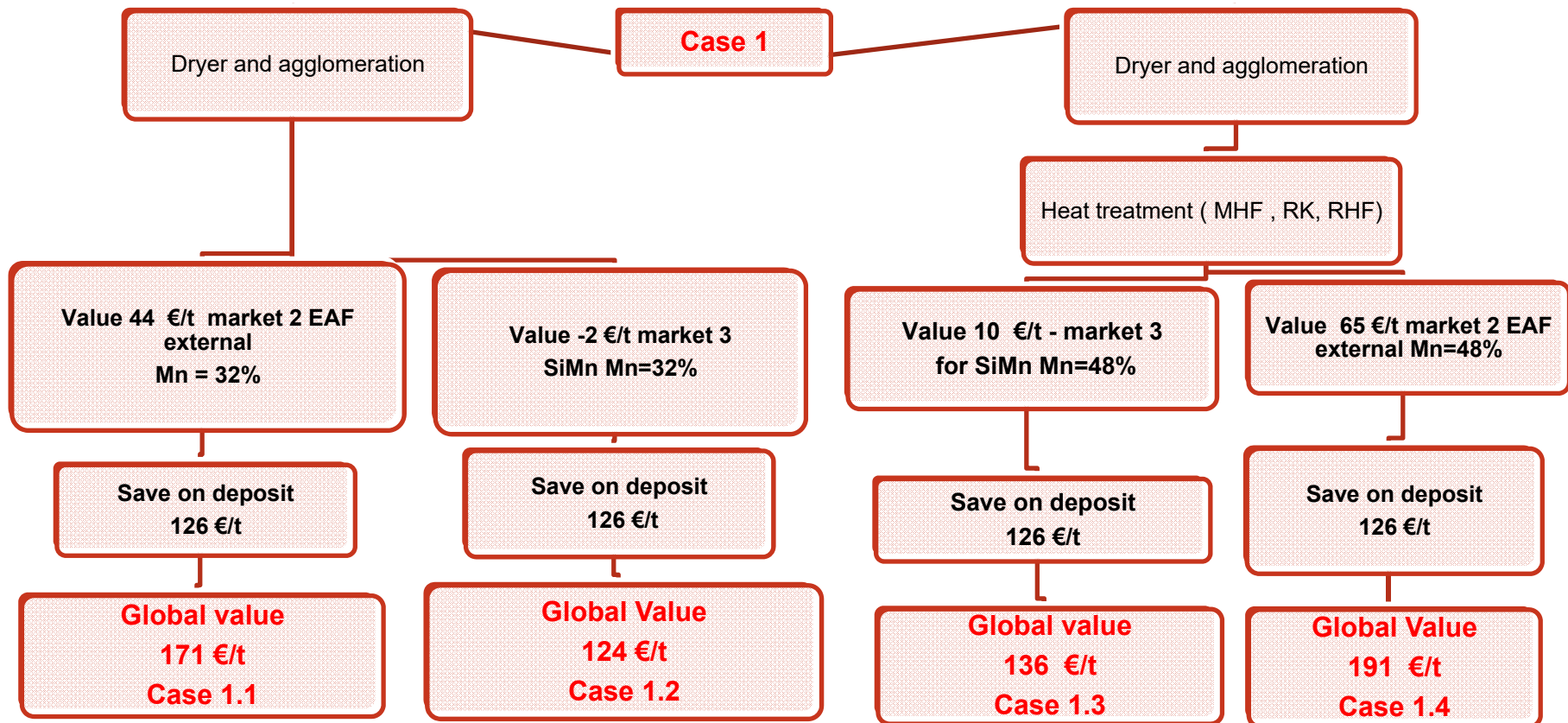
$$\begin{array}{rclclcl} \text{Market value} & + & \text{Save on Deposit cost} & - & \text{Operational cost (Opex + Capex)} & \geq & 0 \\ \text{CP consulting} & & 100 - 250 \text{ €/t average } 126 \text{ €/t} & & \text{CRM and partners} & & \end{array}$$

Market = Rich slag for SAF (submerged Arc Furnace) -SiMn Market or SA ore for EAF (Electric Arc Furnace)
Rich slag value = 70 % * DMTU * % Mn + Added Value
Save on Deposit = ER 100 €/t - AM Range 120 € - 250€

DMTU = tonnages of manganese content calculated with 9% humidity for ore
(figures given in Dry Metric Ton Units: 1 DMTU Mn = 10 kg manganese).

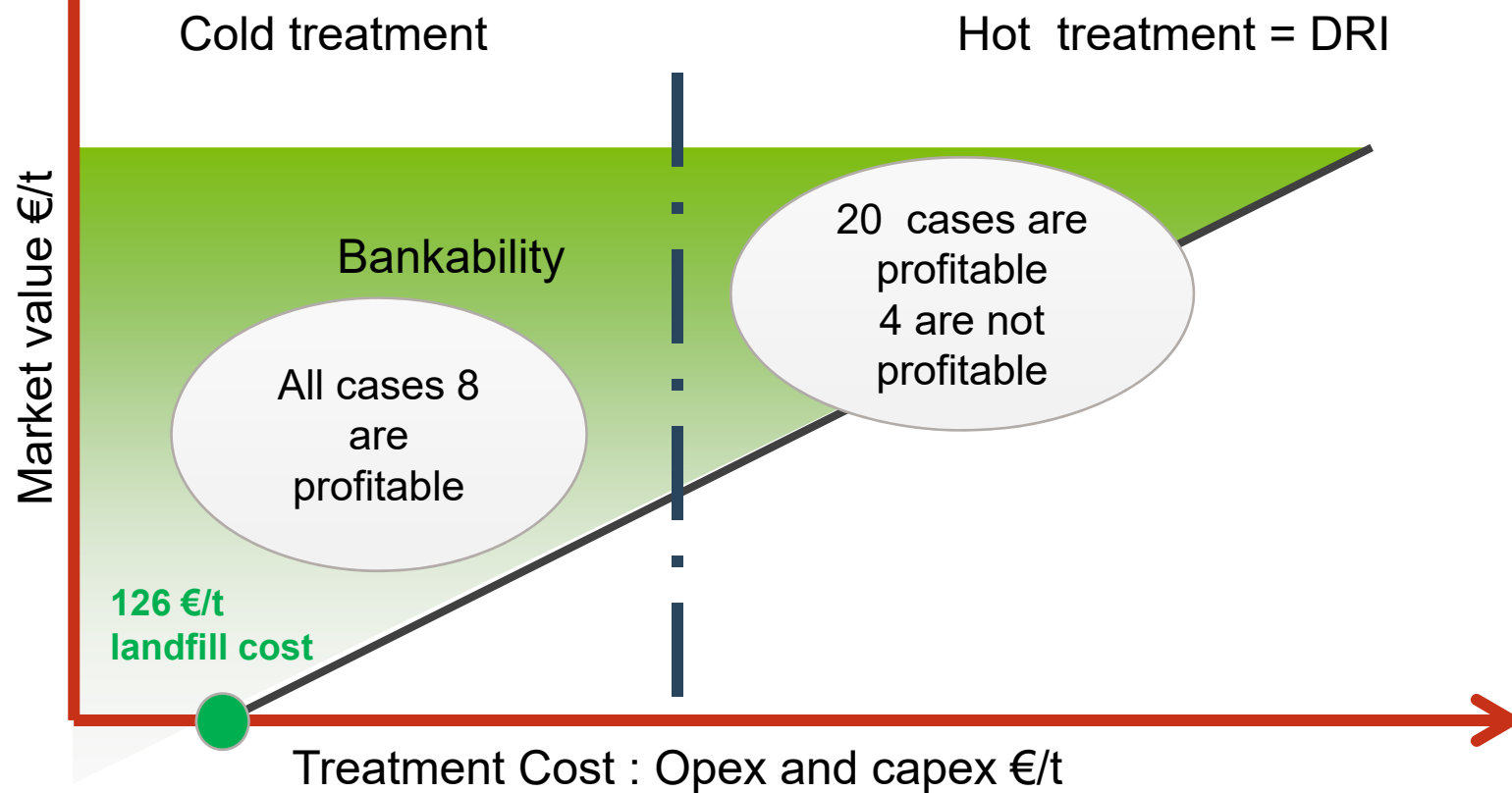
MARKET STUDY - VALUE

$$\text{Market value } \text{CP consulting} + \text{Save on Deposit cost } 100 \text{ €/t } - 250 \text{ €/t} - \text{Operational cost (Opex + Capex) } \text{CRM and partners} \geq 0$$



BANKABILITY OF THE PROJECT

$$\begin{array}{l} \text{Market value} \\ \text{CP consulting} \end{array} + \begin{array}{l} \text{Save on Deposit cost} \\ 100 \text{ €/t } -250 \text{ €/€t} \end{array} - \begin{array}{l} \text{Operational cost (Opex + Capex)} \\ \text{CRM and partners} \end{array} \geq 0$$



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Thank you for your attention

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