TEST case study

Production of Aluminium Fluoride

Developed under the framework of Med TEST II

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

The SwitchMed Programme is funded by the European Union

Production of Aluminium Fluoride

SECTOR	Chemical Sector
SUBSECTOR	Production of Aluminium Fluoride
SIZE	290 employees
PRODUCTS	Single product - ALF 3
MARKET	International
CERTIFIED MANAGEMENT SYSTEMS	ISO 9001, ISO 14001

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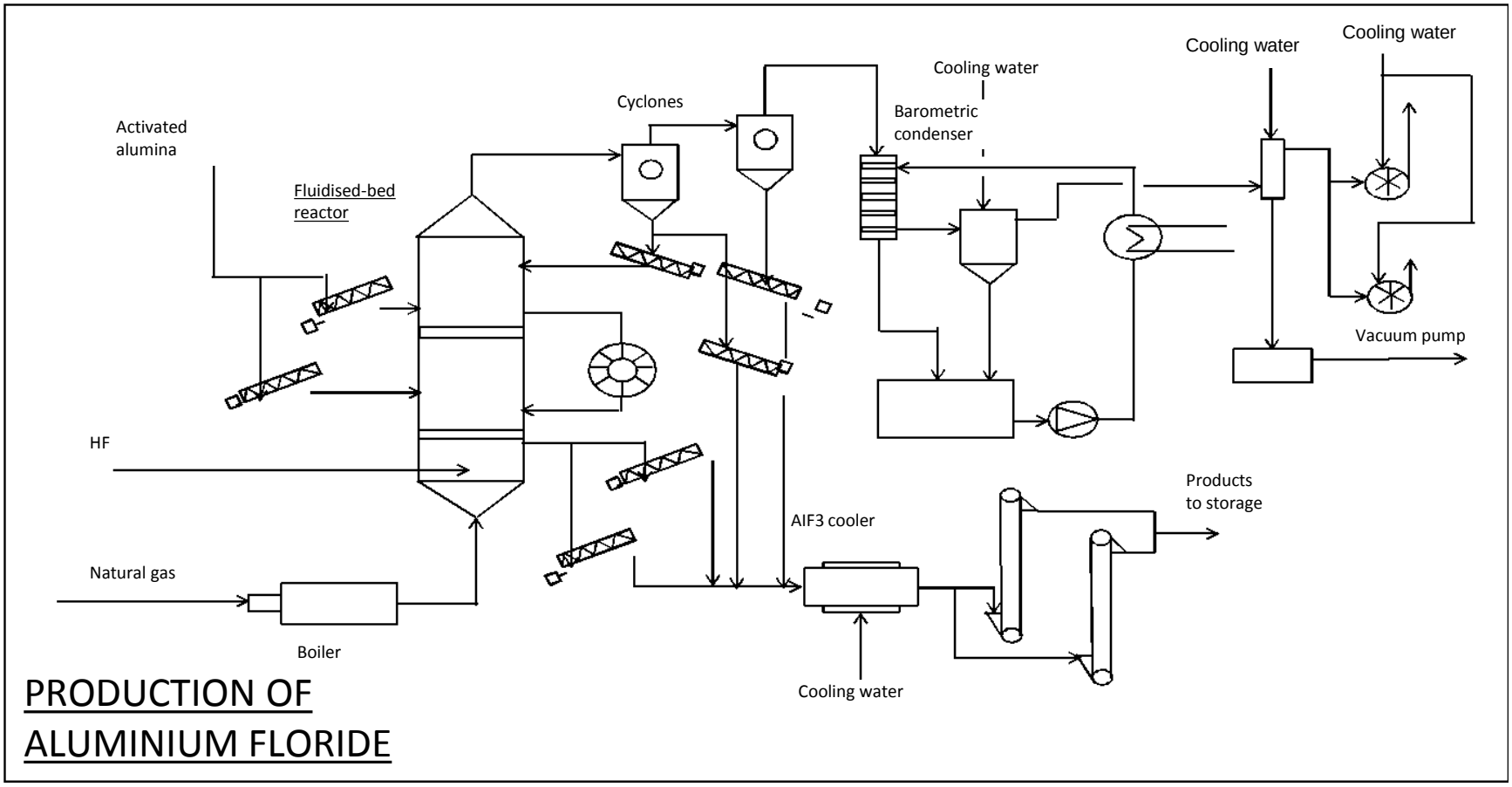
Company key data

Reason to join TEST project

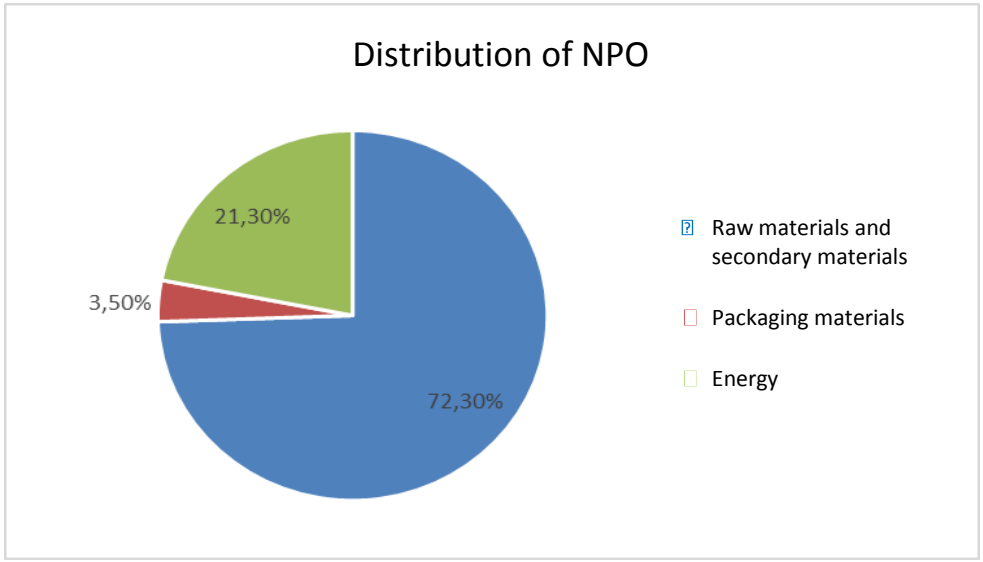
- Put into place the tools of the environmentally sound technology transfer programme
- Anticipate the risks related to pollution and prevent them by minimising discharges, and by improving our environmental and energetic performance while preserving resources

Year 2015	Unit	Value
CO_2	tonnes/year	40,000
Electricity consumption	kWh/year	10,800,000
Gas consumption	th/year	54,000,000
Water consumption	m^3/year	2,320,000

Process overview/flowchart



Non-product output (NPO)



Distribution of NPO per flow (%)

The total cost of non-product outputs amounts to 715,167 euros distributed as shown above.

Analysis of energy use

Class	Energy use	Energy consumed [kWh/year]	Percentage (%)
1	Sulphuric acid plant (SAP)	15.28	25.46%
2	Fluoride plant	31.67	52.77%
3	Pressure blower	13.06	21.76%
4	Total	60.01	100.00%

Focus areas and cause analysis

Focus areas	% in relation to NPO costs	Cause analysis
Drying of fluorspar and alumina	55%	Process poorly managed, hence the material losses Irregular and non homogeneous flow
Packaging of finished goods	25%	Issues with filling level of big bags
Utilities	20%	Inefficient thermal insulation of the reaction furnace, hence the energy losses

Catalogue of identified measures

ID	Initiative	Costs saved [€/yr]	Investments [€]	Repayment [years]	Material savings (t/year)	Reduced power consumption [MWh/year]	Reduction in CO_2 emissions [tonnes/year]
1	Revamping dosage fluorspar	30,000	60,000	2 years	221.15 tonnes	581	114
2	Optimisation drying fluorspar	80,000	2,000	Immediate		2,279	438
3	Revamping dosage hydrated alumina	30,000	60,000	3 years	221.15 tonnes	581	114
4	Optimisation drying hydrated alumina	32,000	2,000	Immediate		759	128
5	Installation DCS	60,000	160,000	3 years			
6	Installation big bag filling system	120,000	120,000	1 year	4,424 tonnes		
7	Installation bag filling system	120,000	2400 000	2 years	4,424 tonnes		
8	Economiser exchanger for flue S4211	42,787	240,000	5 to 8 months		3,359.2	678.5

Catalogue of identified measures

9	Thermal insulation of the reaction furnace F4203	127,222	61,200	6 months		10,279	2,076
10	Electronic energy management system	7,932	20,000	2 to 7 months		127.951	85
11	Flow meters and compressed-air tank	25,896	18,400	9 months		415	275.9
12	Reactive energy compensation	29,739	32,000	1 year 1 month			
13	Implementation of an ISO 50001 system	17,069	18,000	1 year 1 month		731	225.5
14	Optimisation of energy purchased from STEG	47,600	0	Immediate			

Best practice 1:
(Updating the fluorspar dosage system) – Materials

Description of the solution	The dosage of fluorspar is very irregular which impacts the quality of the finished products as well as energy consumption. This is one of the starting points of the process, so any irregularities will have a significant impact on the rest of the process (energy consumption, quality of products, preservation of equipment). This project consists in replacing the fluorspar dosage system supplying the flash dryer to regularise the flow and to ensure even drying. The new system will include a storage hopper, a hopper discharge unit and a new gravimetric belt feeder.
Economic benefits	The savings are estimated to amount to 25,000 euros/year, which corresponds to 221.15 tonnes of raw materials and 114 MWh of energy.
Capital investments	50,000 euros / PBP: 2 years

Best practice 2:
(New hydrated alumina dosage system) – Materials

Description of the solution	This project consists in replacing the dosage system of hydrated alumina for the flash dryer to rectify the flow and ensure even drying. The new system will include a storage hopper, a hopper discharge unit and a new gravimetric belt feeder. The dosage of hydrated alumina is very irregular, which impacts the quality of the finished products as well as energy consumption. This is one of the starting points of the process, so any irregularities will have a significant impact on the rest of the process (energy consumption, quality of products, preservation of equipment).
Economic benefits	The savings are estimated to amount to 25,000 euros/year, which corresponds to 221.15 tonnes of raw materials and 114 MWh of energy.
Capital investments	50,000 euros / PBP: 2 years

Best practice 3:
(Economiser exchanger on flue S4211) – Energy

Description of the solution	This project consists in installing an exchanger in the gas evacuation circuit. This pollution risks damaging the exchanger to place inside the duct of the flue. In order to reduce this risk, it is recommended to install an air cleaning system on the air extraction equipment. This project should be composed of the following sub-projects: Sub-project 1: Study of the modification on the combustion air extraction equipment (add a combustion air cleaning and filtering system E4213) Sub-project 2: Study of the modification on the combustion air extraction equipment (add a cleaning and filtering system of aspirated air to preheat before introduction into E4213) Sub-project 3: Installation of an economiser exchanger on the flue S4211
Economic benefits	35,625 euros / 5 years and PBP of 8 months
Capital investments	Approx. 200,000 euros

Best practice 4:
(Renovation of the thermal insulation of the reaction furnace F4203) – Energy

Description of the solution	The thermal equipment which uses the most energy at the company is the reaction furnace F4203. This dual-envelope furnace is where the endothermic reaction for producing hydrofluoric acid takes place. The reaction heat is produced by hot gases. This rotary furnace has three compartments, operating respectively at 350°C, 400°C and 440°C. The project consists in renovating the furnace's thermal insulation.
Economic benefits	€106,000
Capital investments	Investment: €51,000 / PBP: 6 months

Best practice 5:
(Electronic energy management system) – Energy

Description of the solution	The improvement measure consists in equipping the transformer departures and the production line departures of factory ALF3 with a new generation of data acquisition, and connecting them to an energy management station for collecting, recording and processing data, as well as for editing reports on specific consumptions. The project consists in adding ten data acquisition centres with their accessories and communication interfaces, and communicators which will link the data acquisition centre to the computer dedicated to energy consumption. The communicators will transmit real-time data through ports RS 485. The system proposed will make it possible to reduce energy costs by the continuous monitoring of the factory's different energy settings.
Economic benefits	€6,610 / year
Capital investments	Investment: €16,600 / PBP: 2 years 7 months
Other barriers	Raise awareness of personnel

Management system integration

- Set up an environmental policy
- Well-trained company TEST team, representing a driving force to ensure the efficiency of resources and sustainable production
- Implement the on-going ISO 50001 certification based on the energy auditing report carried out in the framework of the MED TEST II project
- Certification acquired, ISO 14001, v 2015
- Improve the cost accounting system to better reflect real environmental costs: complete adoption of the MFCA tool

Results

Measure	Investment (euros)	Savings (euros/yr)	PBP (years)	Water and raw materials	Energy (MWh)	Environmental impacts
Update systems for dosing fluorspar and hydrated alumina	120,000 €	60,000 €	2.0	442.3 t of materials	1,162	Total: 3,914 t CO_2
Optimisation of drying of fluorspar and hydrated alumina	4,000 €	64,000 €	0.1		3,038	
Improvement of the system for checking and controlling installations	160,000 €	60,000 €	2.7	Impact on the minimisation of process malfunctions		
Modernisation of the system for filling Big Bags and bags	360,000 €	240,000 €	1.5	8,848 t of materials		
Optimisation of use of energy	€389,800	€298,207	1.3		15,163	
TOTAL	€1,033,800	€722,207	1.4	9,288 t of materials	19,363 MWh	

Conclusion

- Implementation of 79% of the measures, and 21% will be planned
- Economic savings of €722,207 with a PBP of 1.5 years
- Total annual water and material savings: 9,288 tonnes of materials (5%)
- Total energy savings: 19,363 MWh (24% reduction)
- Reduction in CO_2 emissions: 3,914 t (18%)