





FROM ASH (SNB & HVC) TO FERTILIZER (ECOPHOS)

The Biggest step in P-Recycling so far

BERLIN, MAR 5, 2015 Rob de Ruiter [RBC]2 Consultancy



EcoPhos' references

Market	Project/client	P source	Product	Country	Capacity	Status
	Decaphos	Low-grade rock / H_3PO_4	DCP/MCP	Bulgaria	100kt/y	Running plant
	Aliphos	H ₃ PO ₄	DCP, MCP, MGP, MAP	The Netherland	200kt/y	Running plant
	UCCI	Low-grade rock	DCP	Syria	6014	ng plant
Animal feed	Phospac25 (Quimpac)	Standard and low-grade rock	DCP, MCP	B	AND DO	b nder tion
	Dunkerque	Low-grade rock , fly ashes	0805	IN V	NIFER	sign
	Ecotac	Low-grade root	MING	NIGE	1mn 2	censed
	EuroChem	ABAR ANN	OFTIGI	W GPC	okt/y	Licensea, under design
Fertilizer	MOFE	druced vo		Namibia	300kt P2O5/y 750kt DCP/y	Licensed, project under development
	PH DE	Der Tech	Tech grade H ₃ PO ₄	Peru	25kt P2O5/y	Plant under construction
High purity	ECOP ECOP	me	Tech grade H ₃ PO ₄	Germany	25kt P2O5/y	Project in development
Demonstratio	Technopnos	Low-grade rock , fly ashes	DCP, H ₃ PO ₄	Bulgaria	1000kg/h	Plant under construction
n plant	Namfos (LLNP)	Low-grade marine rock	DCP, H ₃ PO ₄	Namibia	500kg/h	Plant under construction



Alternative sources of phosphates exists

1/ Low grade rock phosphate

Rock containing to much impurities to be used in the conventional wet process. As impurities we can consider high level of Mg, Fe, Organics, Heavy metals, Al,...

2/ P-recovery → Strategic for Europe

"The complete replacement of phosphate mined in the EU by recycled phosphorus is neither feasible nor necessary in the foreseeable future. However, greater recycling and use of organic phosphorus where it is needed could stabilize the amounts of mined phosphate required and mitigate the soil contamination and water pollution issues. This will the put on track to close the phosphorus cycle in the long term, when the physical limitations of the resource will become increasingly important"

\rightarrow URBAN Mines \leftarrow

Fly ashes vs. Phosphate rock

Eleme	Unit	Typical	Typical LG	Sandard	
nt	Unit	Fly ash	rock	grade rock	
P ₂ O ₅	%	23.6	20-27	30-36	
Ca	%	12.7	35	35	
Si	%	10	1.1	0.9	
Al	%	6	0.2	0.75	
Fe	%	9.4	0.9	0.05	
Mg	%	1.7	0.9	0.04	
Κ	%	2.2	0.09	0.02	
Na	%	0.77	1	0.5	
As	ppm	35	9.3	16	
Cd	ppm	3.8	49	14	
Cr	ppm	130	200	120	
Cu	ppm	1200	200	28	
Ni	ppm	67	125	17	
Pb	ppm	250	21	5.7	
Ti	ppm	2900	160	360	
Zn	ppm	3300	230	190	
F	%	0	3.2	3.9	
SO4	%	7.7	2.7	<2	
ТОС	%	0	3.35	0.3	
CO2	%	0	7.2	5	

- 1. Need of an innovative approach to get rid of impurities
- 2. Maximize P₂O₅ in ashes !
 - Monoincineration
 - All P in sludge



Feb 18, 2015: Contract has been signed

- EcoPhos, HVC and SNB
- <u>50-60 kt SSA/annum into well-known High-Tec Merchant</u> <u>Grade Fertilizers</u>
- SNB and HVC know their input, provide a stable 'urban rock'
- EcoPhos Technology can handle low-grade rock, MBMA and SSA



EcoPhos technology

- Modular Technology:
 - Adapt process to raw-material, products and co-products



EcoPhos technology for fly ashes

- Two patented process option developed by EcoPhos for the use of low-grade P source
 - 1. Hydrochloric acid route
 - Adaptation of EcoPhos process used for low-grade rock to fly ashes
 - 2. Phosphoric acid route
 - New approach developed for integration of the fly ashes treatment in the incineration: site satellite plant
- Processes validated in pilot conditions using 40 different rock and fly ashes from SNB and HVC in the Netherlands

BOTH PROCESSES GENERATES MERCHANT GRADE PRODUCTS



Hydrochloric acid route





Hydrochloric acid route

• High P recovery

• Up to 95% of P extracted from fly ashes (99% for rock)

High quality products

- 99% of impurities removed
- Products complies with European and international specifications for fertilizers
- Insoluble residue can be converted to Al/Fe chlorides, reagent for WW treatment plants
- Gypsum is very pure (>99%) and radioactivity free

Phosphoric acid route



Phosphoric acid route

• P recovery

• > 95% of P extracted and recovered in phosphoric acid

Quality of product

- 99% of impurities removed
- Phosphoric acid 62% technical grade
- Pure aluminium and iron chlorides

Process advantages

- Simple process-full automation
- Liquid plant, only solid raw-material is ashes
- Integration: heat recovery, residue disposal



Summary

- <u>50-60 kt SSA/annum will be valorized into Merchant Grade</u> <u>Fertilizers</u>
- <u>SNB and HVC provide a stable 'Urban Rock'</u>
- EcoPhos process reduces the impact of phosphate peak
 - More P resources
 - Less P loss

NOS

- A healthy business case for all parties involved!
- This is great but on the other hand "just a beginning"





THANK YOU FOR YOUR ATTENTION