Leading gas solid separation with cyclones

Bay Dole Act February 2012
Advanced Cyclone Systems (ACS) is exclusively dedicated to the development of the most efficient cyclone systems worldwide for gas solid separation.

- ACS solved the main problem associated with usual cyclone systems: the separation efficiency;
- Extensive scientific knowledge in cyclone design and particle agglomeration modeling (PACyc) in partnership with the Engineering Faculty of Porto (FEUP);
- ACS aims leading the supply of high efficiency cyclones in its natural markets and penetrating other markets due to the superior performance of its cyclone systems;
- Improved cyclone systems avoid the use of Bag Filters and ESPs in many demanding operating processes with a lower total cost of ownership.
The Problem
Two main problems related with fine particulates

**Hazardous Health Effects**

Increasingly stricter Particulate Matter (PM) emission limits.

Majority of energy production sources is associated with PM emissions.

**Serious Economic Costs**

60% of the chemical related industries handle product in fine powder and many face high product losses.
Particle sizes in perspective

Human hair ≈ 70 µm
Market Opportunity

Industrial Applicability

Emission Control & Air Dedusting

- Biomass & Coal Boilers
- Fuel Oil Boilers
- Steel & Ferrous Alloys
- Clinker Cooler Air Dedusting
- Pyrolysis, Incineration & Gasification
- Calcination Processes
- Glass & Ceramic Furnaces
- Air Caption & Dedusting
- High Temperature Separation Processes

Powder Recovery

- Pharmaceutical Ingredients
- Chemicals
- Food Ingredients
- Nanoparticles
- Mineral Processing
- Fertilizers
- Catalysts
- Milling & Drying Processes
Problems of Separation Technologies

Cyclones

Reverse Flow Cyclones Benefits:
- Robust
- Absence of maintenance
- No temperature restrictions
- Direct product recovery
- No pressure problems
- No moving parts (filters)

Wide industrial application

Problem: Low efficiency for particles < 10 µm
Solution for both particle emission control and product recovery:

Much more efficient cyclones!
The Solution

ReCyclone: 3D Animation link: http://www.youtube.com/watch?v=PgYw7WoxNfg
Market Receptivity

**Technology:** Hurricane

**Application:** White Slag (Steel Industry) recovery followed by filter

**Dimension:** 157000 m³/h

**Client:** Corrugados Getafe

**Location:** Spain

**Cyclone Efficiency:** > 97%

**Alternative:** Bag Filter without Hurricanes

**Estimated payback time due to savings in maintenance costs:** < 1 year
Market Receptivity

Technology: Hurricane
Application: Active Pharmaceutical Ingredient (API) recovery after spray dryer
Dimension: 1450 kg/h N₂
Client: Hovione
Location: Portugal
Cyclone Efficiency: 96-98 % for very fine powder (Median Particle Size in Volume (MVD) = 5.5 μm, with 7 % submicrometer, ρ = 1680 kg/m³, C_in = 3.4 g/m³)

Alternative: Competitor High Efficiency cyclone
Efficiency: 82-84 %
Estimated payback time of Hurricane cyclone: 1 batch of production
The Solution
ReCyclone: a System with 3 patents

1. Hurricane Cyclone
PT102166 - EP0972572
(granted)

2. ReCyclone (Mechanical)
WO0141934 - US2002178793
(granted)

3. ReCyclone (Electrostatic)
PCT/PT2008/000024 / 30-04-08
(submitted)

Global Efficiencies
- Multicyclones - 46.9%
- Hurricanes - 83.2%
- Mechanical ReCyclone - 93.3%
- Electrostatic ReCyclone - 97.5%

Data from a cork waste boiler

Diameter (µm)
How to protect our Technology?

- By Revealing that the technology is patented.
- By detailed Non Disclosure and Use Restriction Agreements.
- By disclosing fabrication drawings to the minimum people possible (only trusted manufacturers).
- By giving incentives against copying, including clients, partners and suppliers.
- By avoiding “off the shelve” systems.
Applications include particulate matter (PM) emission control in boilers, dryers and furnaces and powder recovery in the chemical, food and pharma industries.

Products include patented optimized cyclones – Hurricane – and mechanical or electrostatic recirculating cyclones – ReCyclone Systems.

ACS works in a close cooperation with its clients in order to design custom made cyclone systems to solve separation problems all around the world.

In June 2009, ACS raised 1,5M€ capital with Espírito Santo Ventures in order to allow for a more effective penetration in the international markets.

In the second year of operations (2011), ACS has sales representatives in the 5 continents and perspectives orders of more than 2M€.
CRIAR VALOR DO CONHECIMENTO
Das Ideias Ao Negócio

Advanced Cyclone Systems

Think HIGH TECH GROWTH
OBJECTIVOS

• Apoiar a criação de empresas high-tech / high-growth
• Induzir competências
• Criar valor
  – Valorização da propriedade intelectual
  – Promotores / Instituições de I&D
• Atrair investidores
ROADMAP

Fase I

Tecnologías

No Capital "Valle de la Muerte"

Metodología TEC

Fase II

Fase II

Negocio

"El Mar de Darwin"

Empresas virtuales

High-Tech / High-Growth Startups

FASE I

- Acção de formação
- Metodologia TEC (NCSU)
- Equipas multidisciplinares
- Objectivo:
  - Avaliação das oportunidades de negócio
  - Vantagem competitiva - características únicas da tecnologia
- Resultados: Projectos de negócio
O Desafio Tecnológico

- As pessoas não compram tecnologia – elas compram produtos!
- Os investidores não investem em produtos – eles investem em bons conceitos de negócio e equipas equilibradas.
FASE I – Metodologia TEC

Objectivo: Descobrir tecnologia com elevado potencial de comercialização.

Utilização de um algoritmo – Processo sistemático de criação de conceitos de negócio a partir de fontes de tecnologia.

- Método para atravessar “vale da morte”
- “Road Map” e “Checklist” para a comercialização
- Processo de desenvolvimento de negócio e recolha de informação
- “Framework” para tomada de decisão
- Linguagem e objectivos comuns entre tecnólogos e gestores

Objectivo: criar uma proposta de valor forte
FASE I – Metodologia TEC

O Algoritmo TEC

Procura e Idealização

Search & Ideation

Phase I

Phase II

Commercialization Strategy

Commercialization Implementation

Database or Further Development

Technology - Product - Market Linkages

M M M P P P P M M M
FASE II

**Projectos de Negócio**

- Entrevista 1ª Selecção
- Regras de colaboração

**Contratos**
- Utilização PI
- Apoio COTEC

**Análise dos Modelos de Negócios**

**Sugestões Go/No Go**

**Empresa Virtual**

**Plano de Negócio**

**Beauty Parade**
- Promotores
- Co-promotores

75.000 €
Vantagens de uma abordagem sistemática como o Cohitec

Fase I
• Criação equipas multidisciplinares
• Identificação da(s) melhor(es) combinações TPM
• Criação de projectos de negócio sólidos
• Período para abandono de alguns elementos
• “Testes de fogo” à tecnologia e equipa no final da fase

Fase II
• Apoio para elaboração de plano de negócios credível e “pré-seleccionado”
• Tempo para maturação da tecnologia e fazer testes de mercado
• Apoio em ultrapassar vários obstáculos legais
• Trabalhar com gestores de topo
• Captação de “smart” money