

Value of the CAPE-OPEN standard for ATOFINA

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ATOFINA

- Introduction
- ATOFINA/TotalFinaElf commitment to CAPE-OPEN
- CAPE-OPEN standard status
- Our directions, policy, requirements
- Achievements
- Conclusion

TotalFinaElf at a glance

- ✔ World's fifth-largest oil and gas company
 - Production: 2,197,000 barrels of oil equivalent per day
 - Proven reserves at end-2001: 10,978 million barrels of oil equivalent
- ✔ Europe's front-ranked refiner and marketer
 - 27 refineries
 - 16,900 service stations
- ✔ France highest market capitalization
- ✔ ATOFINA: world's sixth largest chemicals manufacturer

Key Positions- Chemicals

ATOFINA is the world's sixth-ranked chemical manufacturer

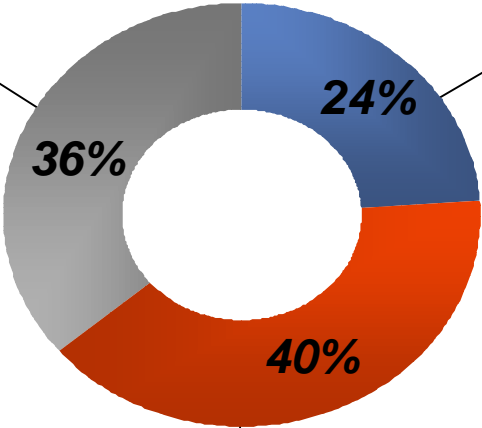
- ✔ Chemical sales outside the Group: €19.6 billion (of which 65% in Europe)
 - Petrochemicals and commodity polymers: €7 billion
 - Intermediates and performance polymers: €4.7 billion
 - Specialty chemicals: €7.8 billion
- ✔ Capital expenditure: €1.6 billion
- ✔ 71,312 employees, including 5,500 researchers

Sales by Business

2001 Sales by Business

Petrochemicals and Commodity Polymers

- Aromatics/Butadiene
- Steamcracking/Olefins
- Polyethylene
- Polypropylene
- Styrene
- Vinyl products
- Vinyl compounds
- Pipes and steel sections
- Fertilizers



Intermediates and performance polymers

- Chlorine, vinyl and solvents
- Fluorinated & oxygenated
- Acrylics-PMMA
- Thiochemicals and fine chemicals
- Organic peroxides
- Industrial specialties
- Additives
- Formaldehyde resins
- Agrochemicals
- Engineering polymers
- Complex films

Specialty Chemicals

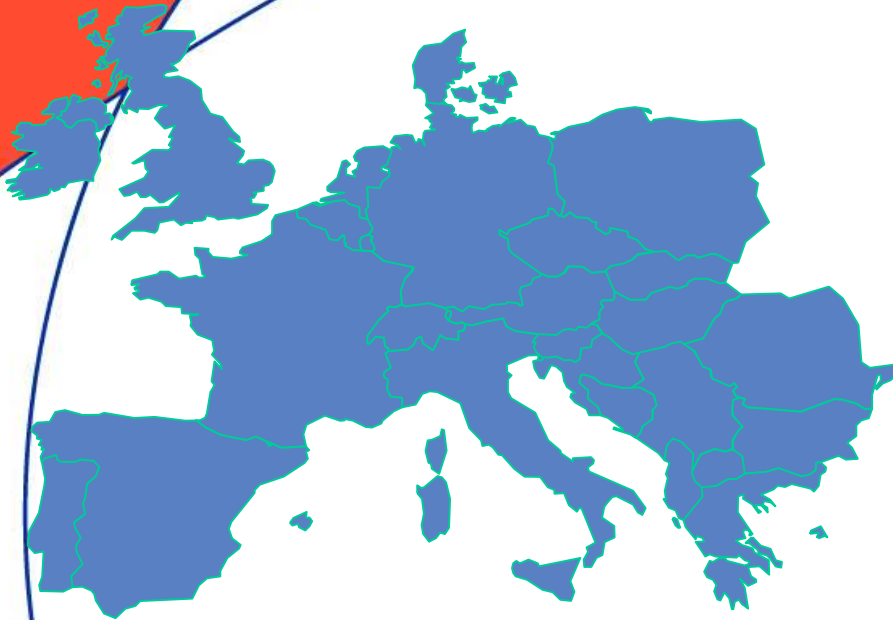
- Resins
- Hutchinson
- Paint
- Adhesives
- Metallization

Worldwide Chemicals Operations

30 Asian plants



200 European plants



100 plants in the Americas

ATOFINA Process Simulation Team

▣ Missions within ATOFINA

- Specifies, deploys and supports process modeling software tools within ATOFINA business units

▣ Actions within TotalFinaElf

- Leads Modeling & Simulation working party in corporate Process Engineering network of TotalFinaElf
- Provides consultancy on software architecture to the upstream business
- Represents TotalFinaElf in CAPE-OPEN projects and related organizations since the start

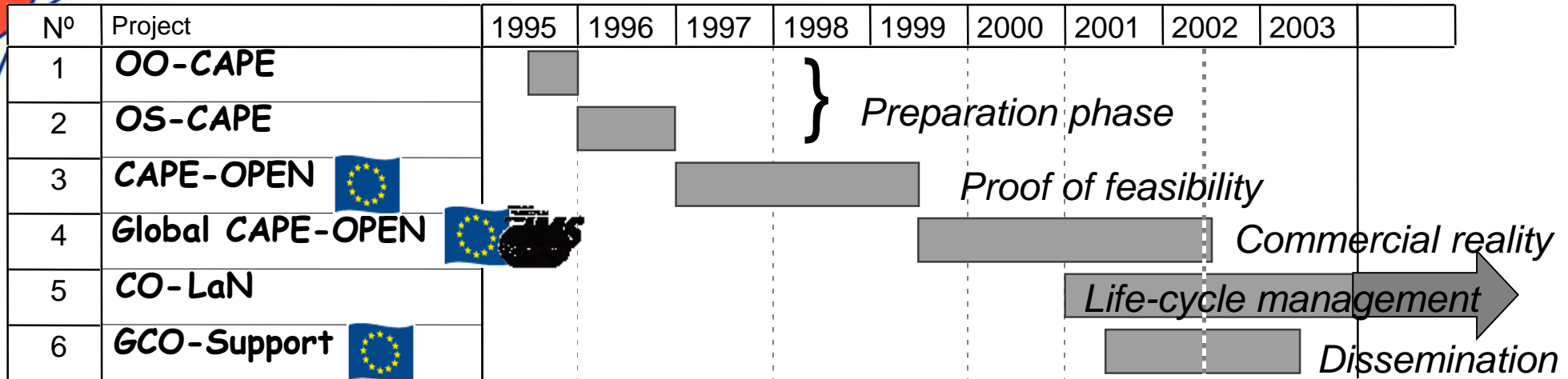
An array of simulation tools

	Chemicals (ATOFINA)	Refining & Marketing	Upstream
Aspen Plus	X		
HYSYS		X	
PRO II		X	X

CAPE-OPEN standard

- ✓ CAPE-OPEN is a standardization process for achieving true plug and play of process industry simulation software components
- ✓ An industrial answer to:
 - Limited reuse of third-party models and software
 - Limited interoperability between software tools
- ✓ An initiative developed through already 7 years of collaborative work between end-users, suppliers and academics

Our commitment: over \$700 K



Users

IFP
 TotalFinaElf
 BP
 Bayer AG
 Dow
 BASF AG
 DuPont
 Norsk Hydro

ICI
 Shell Chem.
 Air Products
 UOP
 Air Liquide
 Mitsubishi
 JGC

Suppliers

Honeywell
 Hyprotech
 AspenTech
 SimSci
 QuantiSci
 RSI SA
 DIPPR
 ProSim SA
 Infochem Ltd
 PSE Ltd
 BELSIM SA
 Dechema e.V.
 Protesoft
 Virtual Mater.

Academics

INPT
 RWTH.LPT
 RWTH.I5
 Imperial Coll.
 NTNU
 Univ. Virginia
 DTU
 UPC
 TITech
 Kyoto Univ.
 CMU
 UMass

The CAPE-OPEN standard

0.9 (CAPE-OPEN)

0.93 (GCO 2001)

1.0 (GCO 2002)

Future releases

Simulation context

CO Simulator Executive Services

Other Services

External Interaction Session

Planning & Scheduling

Operations & Control

SMST

Business Interfaces

Physical Properties

Electrolytes

Reactions

Petroleum Fractions

Polymers

Thermodynamic and Physical Properties

Physical Properties Data Banks

Numeric

PEDR

Hybrid Solvers

Optimisation MILP, MINLP

PDAE Solvers

Solvers LAE, NLAE, DAE

Hybrid Units

Unit Operations

Unit Operations

Parameters

Collections

Persistence

Common Interfaces

Error Handling

Identification

Known Objects

Utilities

Types and undefined values

We capitalize on:

What exists as the CO standard

- 0.9 – 0.93 – 1.0 – 1.1 versions

What CO Simulator Executive providers have implemented

- UNIT and Thermo sockets in Aspen Plus, HYSYS, PRO II, etc...

What the software market is presently developing

- HTRI: heat exchanger software as CO UNIT plugs
- DECHEMA e.V.: data banks as CO PPDB plugs

Policy enforced

Software development:

- CAPE-OPEN standard compliance included in the specs
 - OTC 2002 Deep offshore well metering and permutation testing

Software purchase:

- CAPE-OPEN standard compliance included in the requirements to be fulfilled
- Priority given to suppliers implementing CO standard

Targeted parts of CO standard

✓ Chemicals

- UNIT Operations
- Thermo Packages
- Physical Properties Data Banks

✓ Refining & Marketing

- UNIT Operations

✓ Upstream

- UNIT Operations
- Thermo Packages
- Solvers

Requirements on implementations

UNIT Operations

- Use of design specs with CO Unit Operations

Thermo Packages

- Let model parameters be accessible for fitting data

Data Banks

- Implementation of Physical Properties Data Banks part of CO standard in COSEs

Overall achievements

- ✔ While it has been recently challenged, CAPE-OPEN is still the only standard for CAPE simulation tools
- ✔ CAPE-OPEN has achieved commercial status
- ✔ Performance issues are implementation issues

Benefits from CAPE-OPEN standard

- ✓ Benefits for suppliers
 - Increased usage of CAPE tools
 - Reduced development costs
- ✓ Benefits for users
 - Have it developed once, and it runs everywhere
 - Access to best-in-class solutions
- ✓ Benefits for academics
 - Improved dissemination of research results
 - Better adaptation to industrial needs