

# Developments in the technology market

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## Outline

- Background
- Outlook on the future
- Dutch situation
- Some thoughts



# Background

Vitality of the Dutch process industry is determined by its ability to adapt to a globalizing and more dynamic society

Some observations:

- Rapidly changing, highly competitive world
- Evolution of process technology
- Urgent need for sustainable operations
- Ecosphere impact



## Outlook on the future

Chemistry & Process Technology are a key area for Dutch Economy as confirmed by the selection of this area as one of Top Sectors

- Importance of Process Control (PC) and Process Systems Engineering (PSE) for sustainable, flexible and efficient production against lower capital investment
- Intensified processes require highly dynamic operation
- Control and operation have to become an integral part of the process design



## Dutch situation

Private Public Partnerships have been formed to organize combined applied research in which the Process Control Community is not directly represented:

- ISPT resulted from the merger of
  - Dutch Separation Technology Institute (DSTI),
  - Process Intensification (APPI),
- Advanced Chemical Technology for Sustainability (ACTS)
- Dutch Polymer Institute (DPI)



## Some thoughts

To get recognition as a global leading party in supply of knowledge on integrated design and development of flexible, high performance, sustainable processes it is necessary to join present strengths

Academic strengths at Dutch universities

- Process Systems Engineering
- Process Control



## Some thoughts: Technology demands

- Increase of scale in process operation/optimization unit → plant → site → .....
- Increase of flexibility in operation (change-over's) → dynamics becomes more important
- Higher demand on economic optimization (also dynamically) under operational constraints and uncertainties
- Demand for newly designed (intensified) processes (actuation!)
- Importance of operation is growing



## Some thoughts: Tools and opportunities

- **Large scale constrained optimization** tools are feasible (also online)
- **Dynamic models** are the drivers for optimal operations: model-based process management
- **Interaction** between design and operation/control



## Some thoughts: Particular research challenges

- From complex physical models to reduced models feasible for use in operational strategies
- Merging of physical and experimental models, and effective model maintenance – adaptation
- Integration of design and control in process intensification
- From control to dynamic economic optimization – nonlinear dynamics
- Large-scale systems – distributed control



## Some thoughts: Developments at universities

- Domains for research and teaching essentially require external (industrial/government/institutional) support
- Universities invest in areas for which there is long-term external support
- Structural support for PC and PSE groups has been lagging behind (not well connected to process technology initiatives)
- Academic basis for PC and PSE has become relatively small (Chemical Engineering focus on science-driven phenomenological issues)
- This affects research, technology development and education of students

