

Polish-American cooperation in the field of modern coal-fired boilers optimization techniques (artificial immune systems).



Joint projects of Transition Technologies and Emerson Process Management.

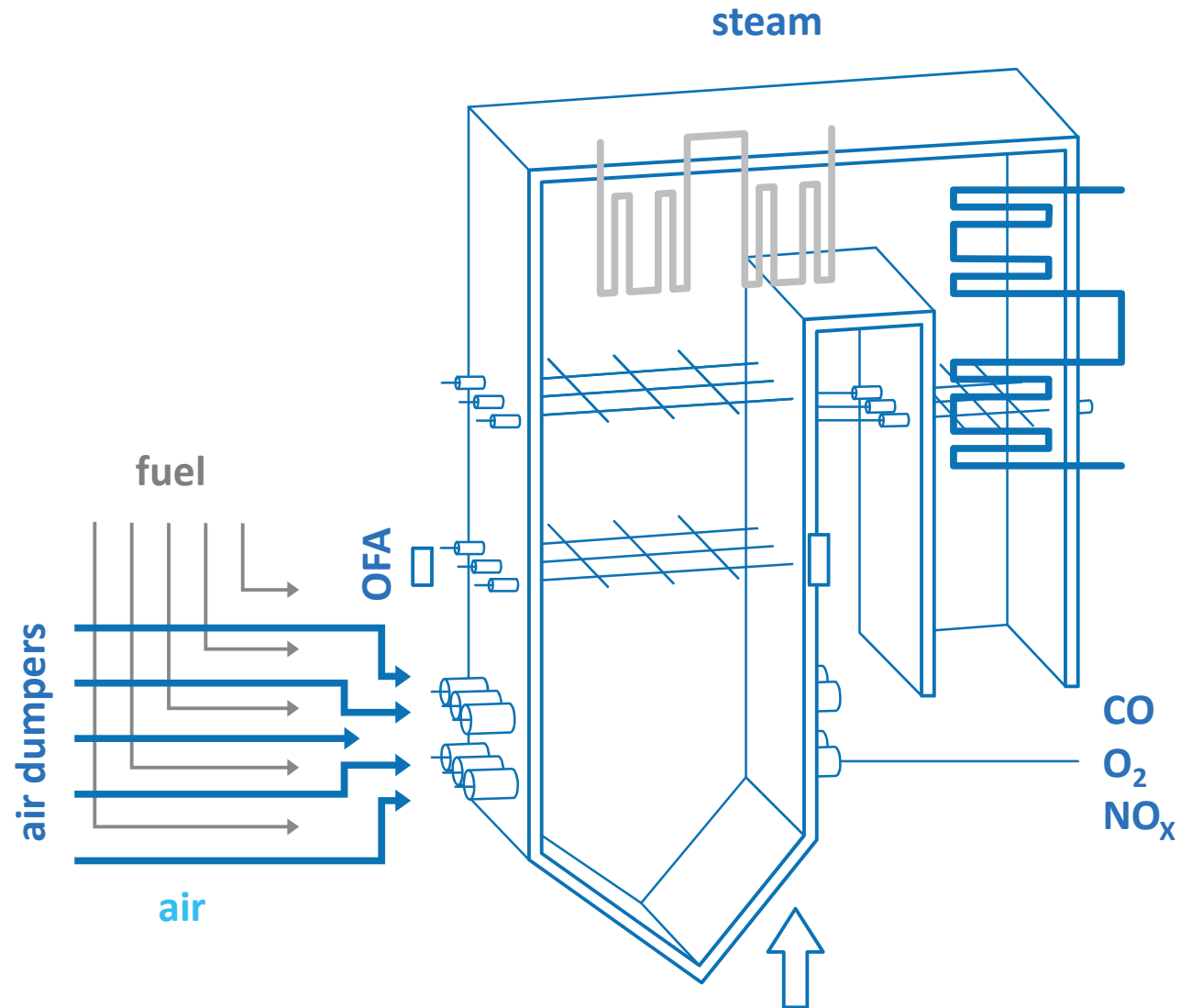
PROF. KONRAD ŚWIRSKI



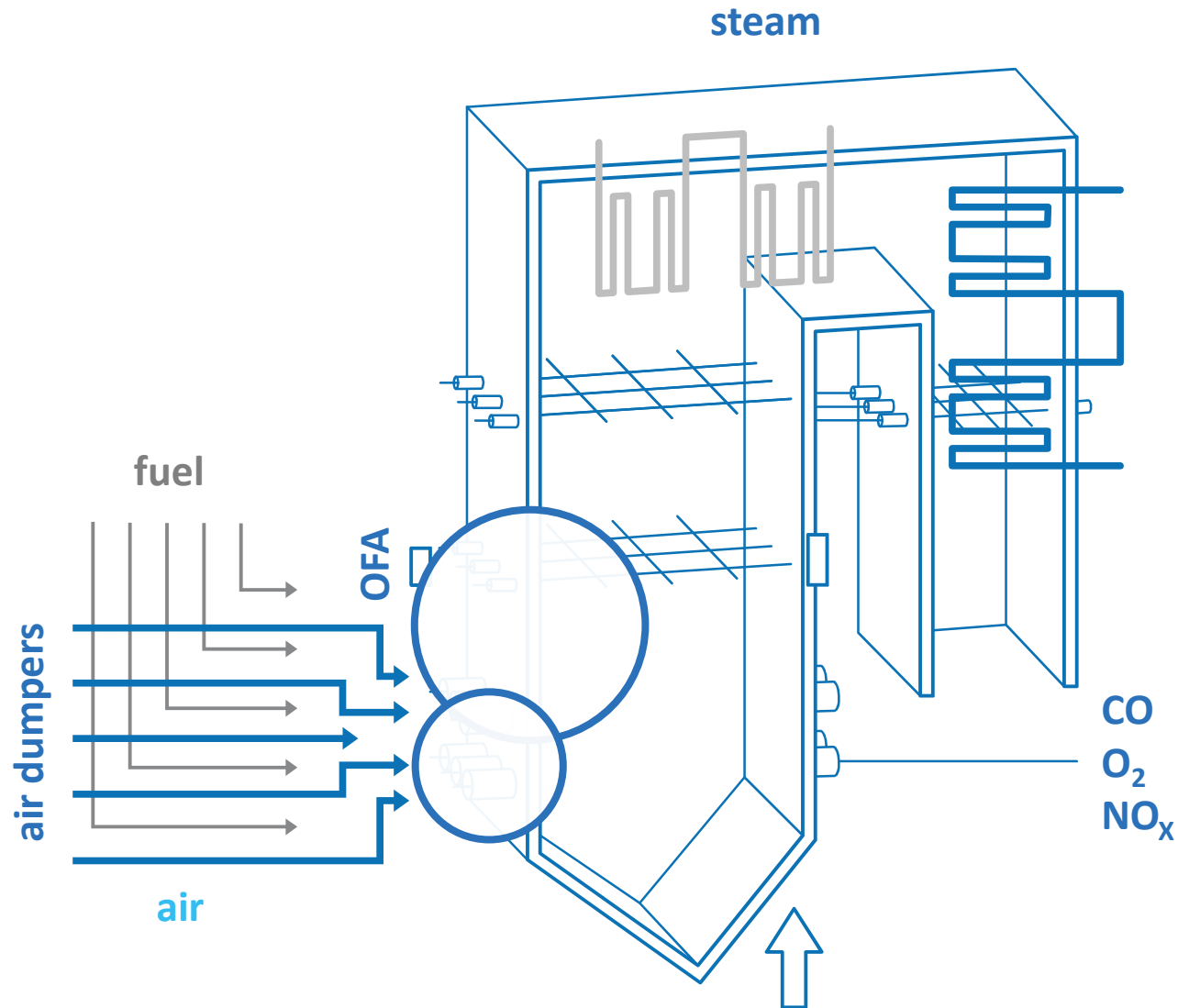
The presentation discusses

- SILO II-the application used in large-scale industrial processes for advanced control and optimization.
- The cooperation between two companies- a Polish company Transition and an American corporation- Emerson Process Management as an example of business cooperation and technology transfer.

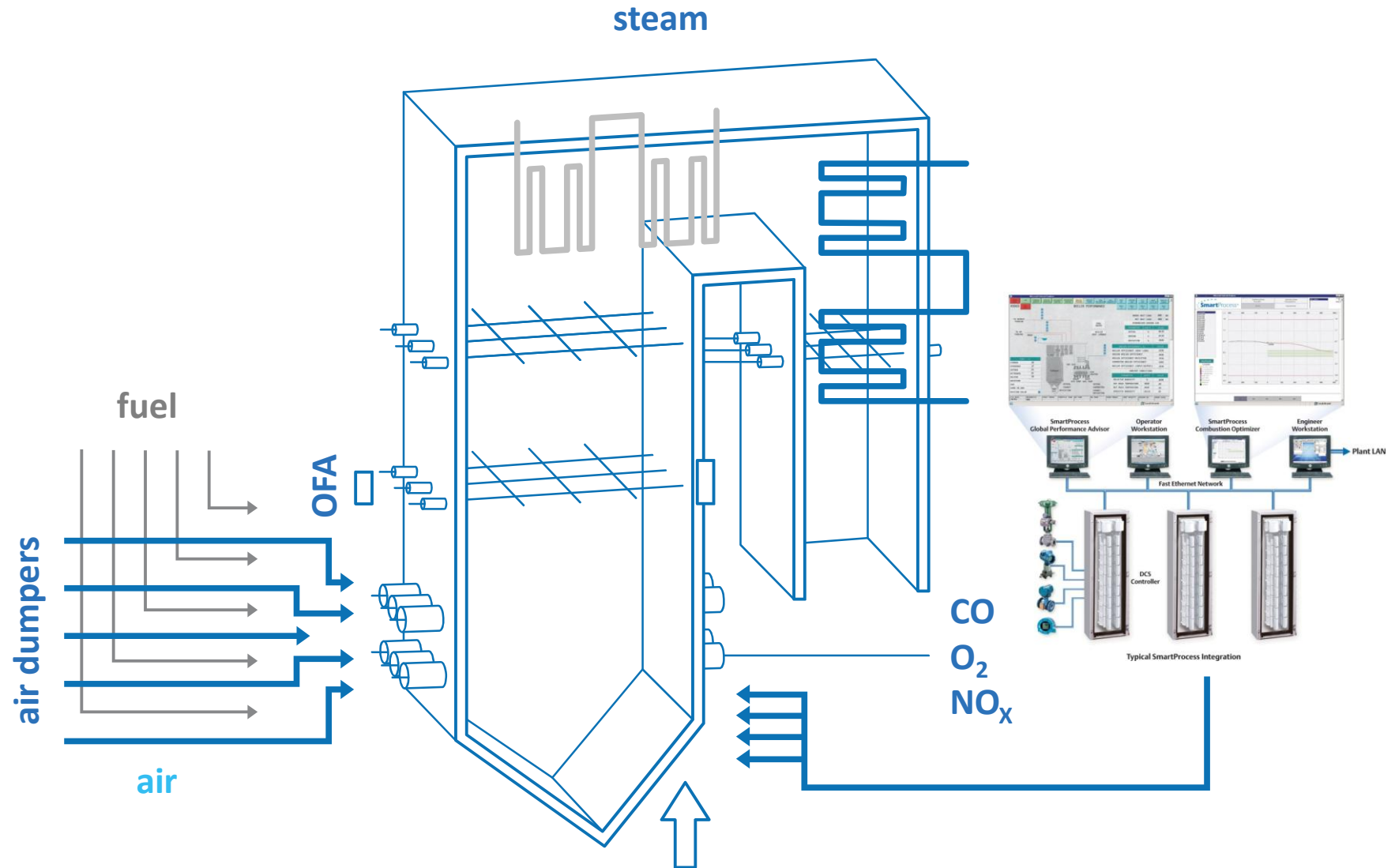
Coal fired boilers – emission problems



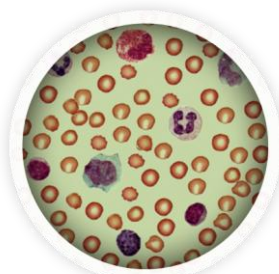
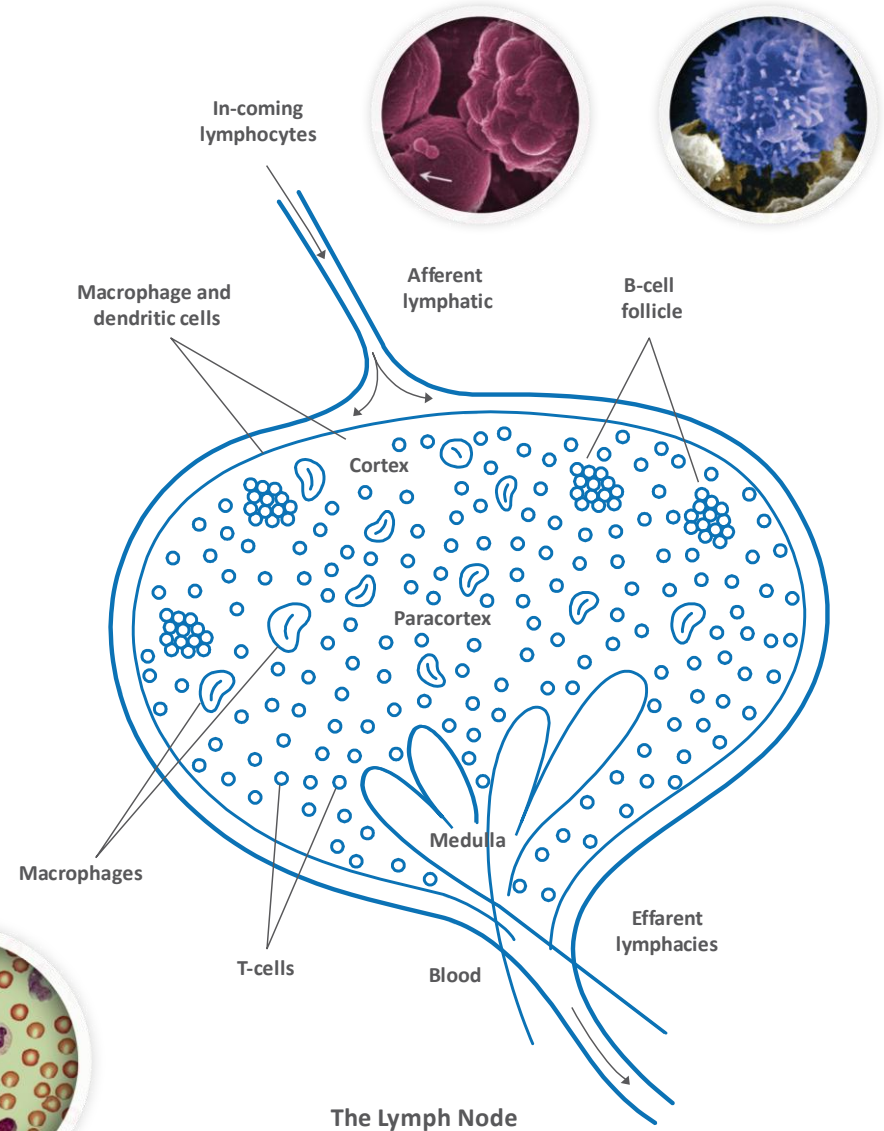
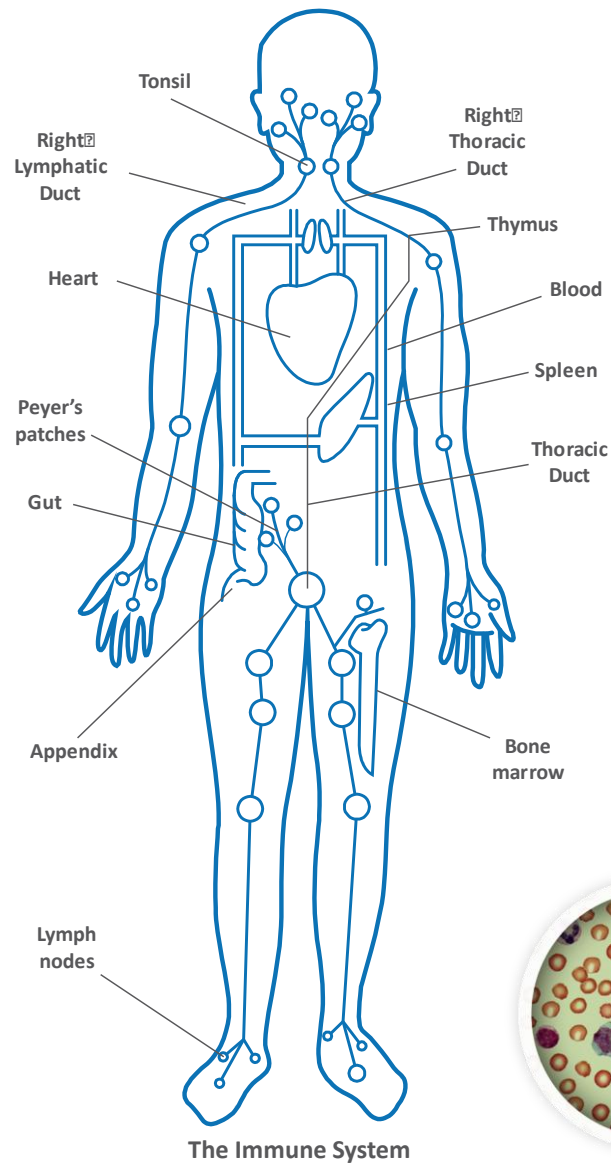
Coal fired boilers – emission problems – „hard” solution
redesign and modernization of burners, dumpers, combustion chamber



Coal fired boilers – emission problems – „soft” solution
intelligent algorithms to optimize combustion



Why not try to imitate human immune system?



What is SILO II?

SILO II is a software solution for

- On-line optimization of current process operating point

SILO II application:

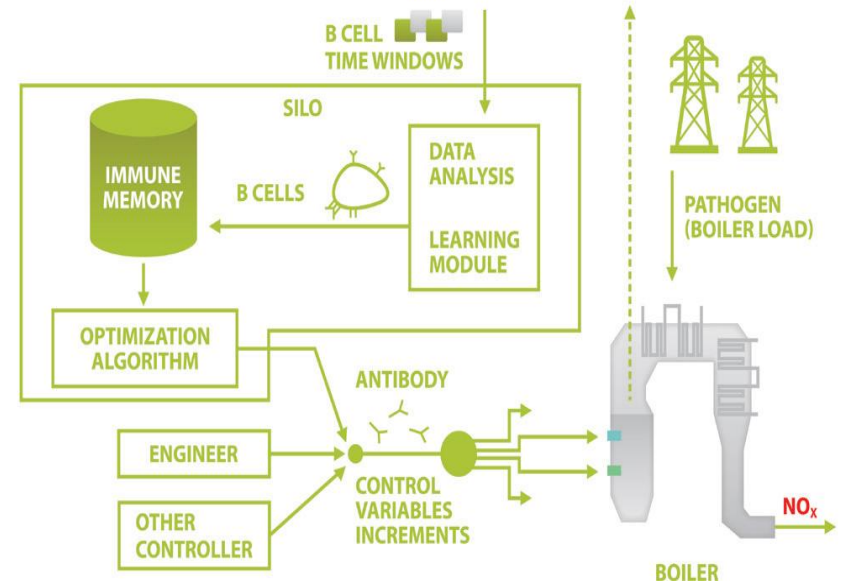
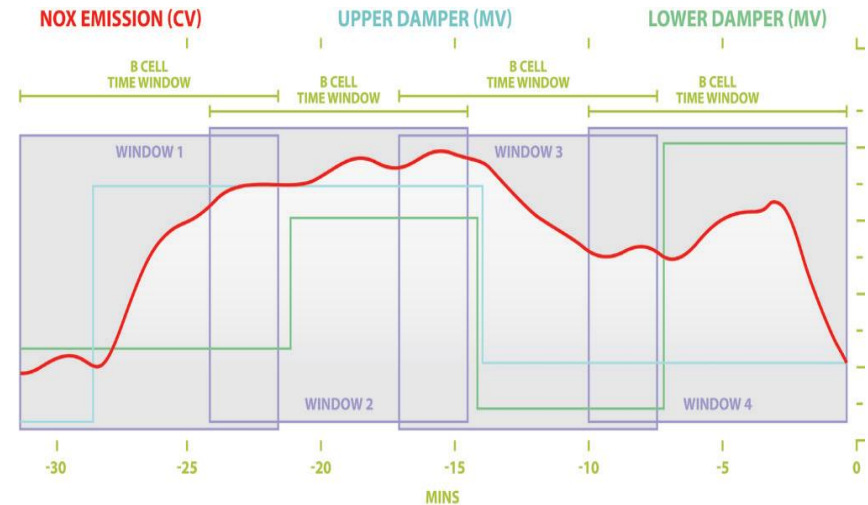
- Optimization of the large scale processes
- Combustion process in power boiler
- FGD
- Petrochemical processes

SILO II uses algorithms inspired by operation immune system for:

On-line learning of the process

Efficient adaptation to process changes

Efficient process optimization



SILO II – optimization layer

INNATE IMMUNITY

BASE CONTROL LAYER

- PID controllers
- Process safety
- Instant reaction
- High frequency of MV changes
- No adaptation
- Only simple constraints (no proof of constraint satisfaction)

ADAPTIVE IMMUNITY

OPTIMIZATION LAYER

- **SILO II**
- Steady-state optimization
- Transition states handling
- On – line learning and adaptation
- Low frequency of control changes
- Even complicated constraints are fulfilled
- Knowledge about inner plant dependences

EFFICIENT IMMUNE SYSTEM FOR PROCESS OPTIMIZATION

Optimization and control goals

Economic optimization – typical goals:

- minimization of costs
- maximization of incomes

Steady-state control – typical goals:

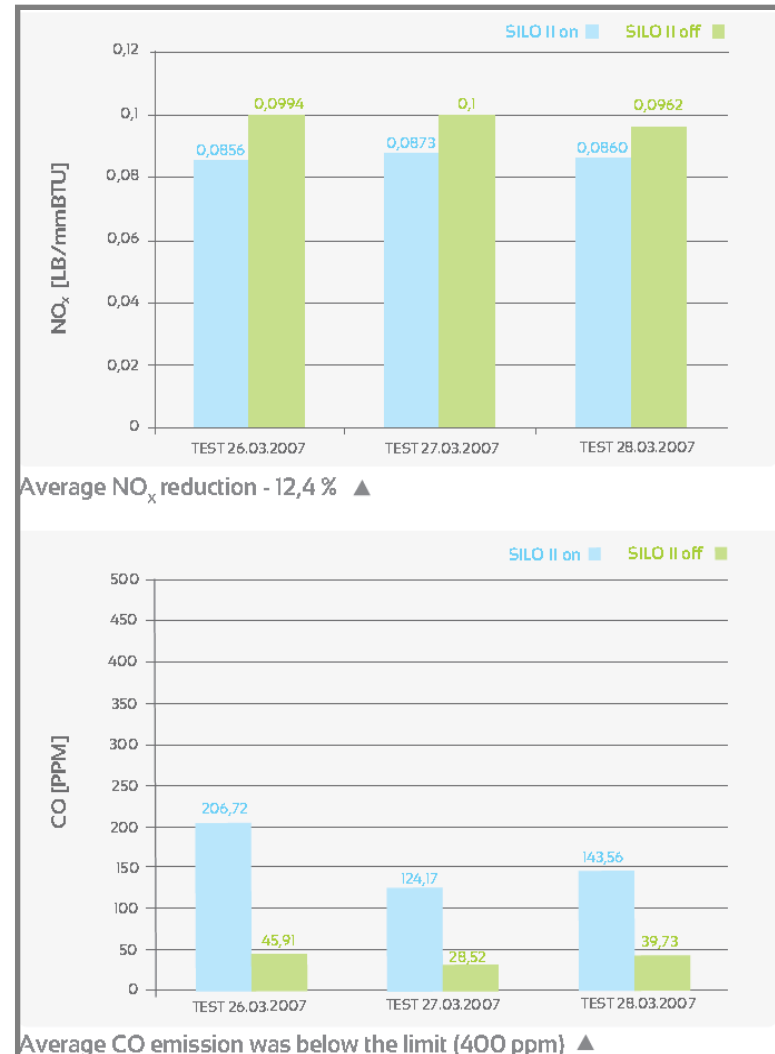
- quality of the output product
- other parameters of process outputs

Example – combustion process

- Minimization of NO_x and CO emission
- Rise of the boiler efficiency
- Steam temperatures and O₂ symmetrization

Average dimension of the optimization task

- 2-20 optimization goal
- 5-80 controlled devices
- 5-25 disturbances



Optimization and control goals

SILO II was successfully implemented in one in the US Power Plants (Large base load unit – 650 MW/ hard coal)

After three month of **SILO II** operation, there was a US Environment Protection Agency (EPA) report on NO_x emission in USA. According to this report units 1 and 2 of considered power plant were listed as the second and third lowest emitters of nitrogen oxide (NO_x) among all U.S. coal-fired plants that operate without catalytic reduction NO_x removal equipment!

16 month after **SILO II** implementation, units 1 and 2 of considered power plant were listed as the first and fourth lowest emitters of nitrogen oxide (NO_x) among all U.S. coal-fired plants that operate without catalytic reduction NO_x removal equipment!

The screenshot shows the msn money website interface. The main headline is "Ameren's Newton Power Station among lowest U.S. emitters". The article text states: "AmerenEnergy Generating's Newton Power Station's Units 1 and 2 were listed as the second and third lowest emitters of nitrogen oxide (NO_x) among all U.S. coal-fired plants that operate without catalytic reduction NO_x removal equipment, according to the U.S. Environmental Protection Agency. Ameren Corp., through its subsidiary AmerenEnergy Generating Co., owns and operates two 600-megawatt generating units at its Newton Generating Station, located six miles southwest of Newton, Ill. St. Louis-based Ameren Corp. (NYSE: AEE) provides electricity and natural gas to customers in eastern Missouri and Illinois." The article is dated September 5, 2007. There is also an advertisement for Principal financial tools.

The screenshot shows the Yahoo! Finance website. The main headline is "Ameren's Newton Power Station among lowest U.S. emitters". The article text is identical to the one in the msn money screenshot. The article is dated Wednesday September 5, 5:39 pm ET. There are also links to "100 FREE TRADES", "AMERITRADE", "Scottrade", and "bizjournals.com". A "Related Quote" section shows the AEE stock price chart and details: "AEE 50.76 0.00 News".



Two companies



Emerson Process Management is a global supplier of advanced distributed process control and information systems, and a recognized leader in developing plant-wide process control solutions for the power generation, water treatment and wastewater treatment industries.



Transition Technologies is a high-tech, Polish engineering and software company, providing IT systems, digital automation, optimization software, R&D and outsourcing services in such markets as power, gas, industry and healthcare.

Twenty years of cooperation

- Successful cooperation between TT and EPM has been continuing since 1993.
- Transition Technologies has been a supplier of engineering services and expert distributed control system for Emerson.
- Year by year the number of orders increases . This growth is caused by the necessity of continuous modernization of the power sector.



Hundreds of successful implementations all over the world



Company Overview

We are a high-tech Polish engineering and software company providing IT services all over the world.

Since the beginning our company has provided innovative IT systems, digital automation, optimization software, R&D and outsourcing services for large international corporations in such markets as power, gas, industry and healthcare.



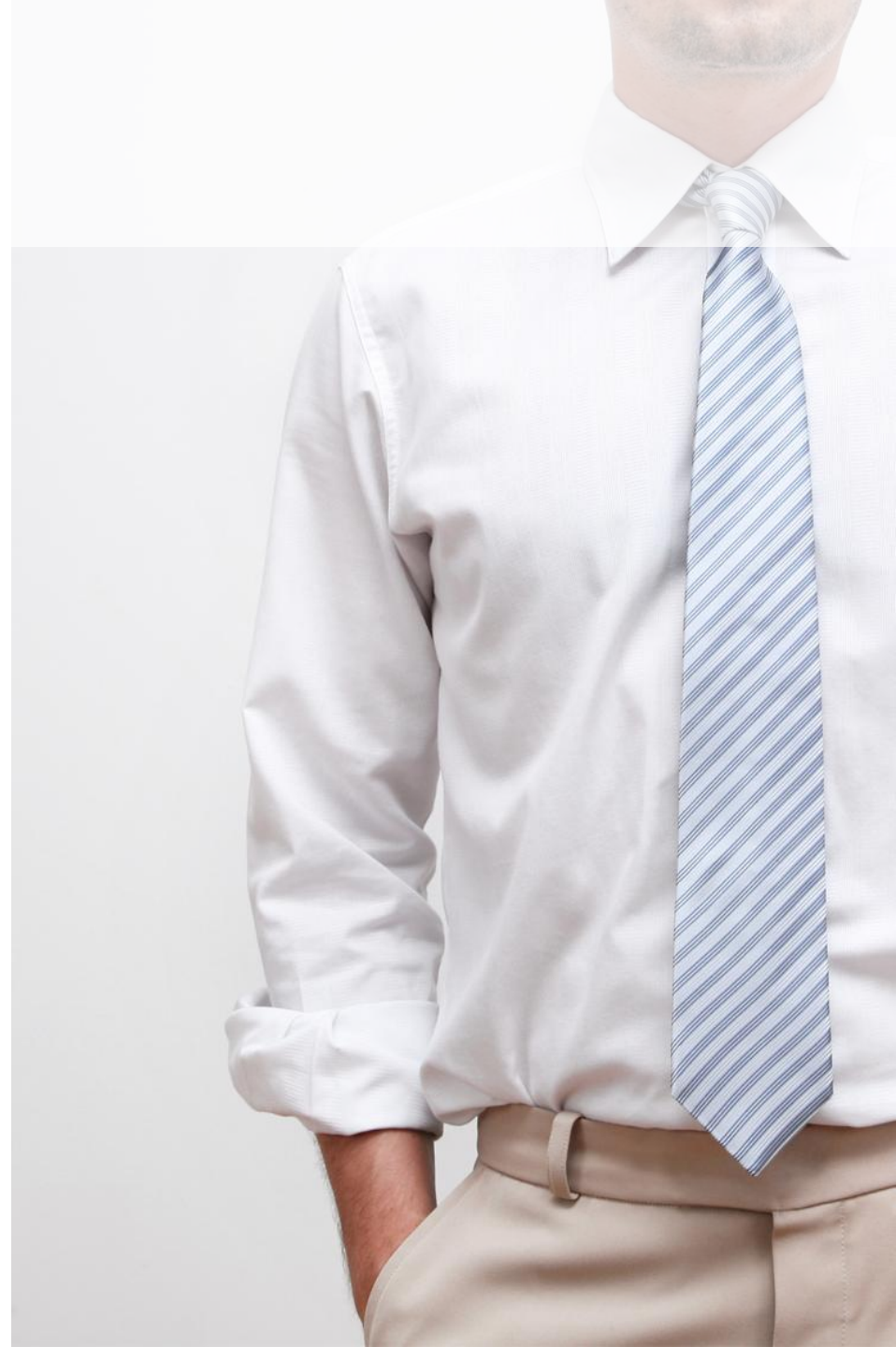
Business sectors

Progress in high-tech and information technologies, global market conditions and the growing information society promotes steady development of the IT sector. With the increasing requirements of customers and partners, Transition Technologies successfully operates in following sectors:

- Power
- Gas
- Industry/ Manufacturing
- Healthcare
- Public Sector

We cooperate with a group of large, global corporations- strategic clients-that are bounded with Transition Technologies by long-term cooperation agreements

- Emerson Process Management (since 1991)
- Parametric Technology Corporation (since 2006)
- Alstom/Schneider (since 2008)



Products



- IT solutions and systems for power, gas and industry
 - Advanced Control & Optimization
 - IT solutions for energy trading
 - Innovative software for gas storage operators
 - Data warehousing, Business Intelligence
 - Industrial dashboards
- Product Lifecycle Management
- IT systems for Healthcare
 - Bioinformatics
 - Medical Intelligence



Business Sectors - and areas of activity



Power

- Digital Automation
- Optimization
- Electricity Trading
- Corporate IT



Gas

- Optimization
- Gas Cavern Management
- Gas Trading
- Corporate IT



Industry/Manufacturing

- Outsourcing
- PLM systems
- Corporate IT



Public

- IT systems



Healthcare/ Bioinfo

- R&D
- IT systems

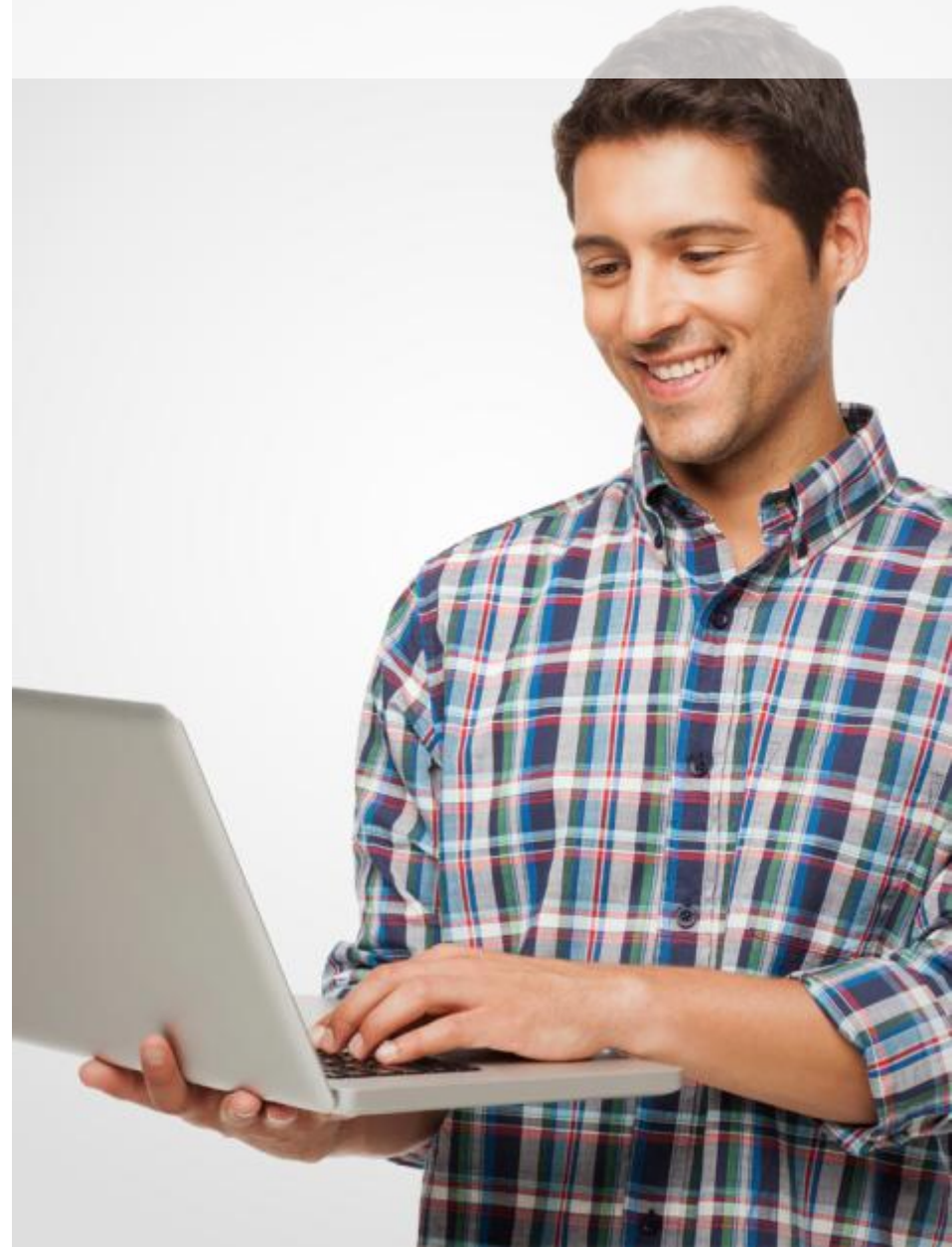


Strategic Clients

- Emerson Process Management
- Alstom
- Parametric Technology Corporation
- others

Qualified and motivated people

- 466 employees at the year- end 2012
- Women account for 18% of workforce
- In 2012 the average Transition Technologies employee was 31 years
- Many of our employees are also scientific workers
 - 1 professor,
 - 6 doctors,
 - 14 Ph.D. Students
- The number of qualified employees increases from year to year



What can we offer?



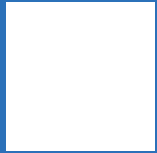
- Teams of trained specialists (engineers) in Power Sector
- Teams of trained specialists (engineers) in Gas Sector
- IT solutions for Power and Gas Sectors
- Software on demand
- Low cost engineering centers

Scientific factor

Projects conducted by TT and EPM is not only an example of successful business partnership but also a long term Polish-American scientific cooperation through:

- exploiting the potential of the Polish scientists
- joint projects in the fields of high tech and R&D
- export of Polish high tech solution to USA





Thank you

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