

What gains can be expected from real-time resource efficiency monitoring and optimization?

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The Challenge

- Challenges for chemical industry
 - Major consumer of fossil resources
 - Major producer of CO₂ emissions.
 - Fluctuating raw material and energy prices
 - Operation under changing conditions
- Improvement of resource efficiency complex:
 - Daily operation different from design operation
 - Daily operation not steered by existing long-term KPIs
 - Potential conflict between local, plant-wide and site-wide resource efficiency
 - Potential conflict between resource efficiency and profit

The Beginning of MORE and Expectations

- **Resource Efficiency Indicators** that can be used in real-time and cover energy and raw materials
- **Novel analytic measurements** of properties of streams for the online computation of resource-efficiency
- **Data reconciliation** to assure data consistency
- **Multi-criterial optimization** of operational decisions with respect to economics and resource efficiency
- Improved support for operators and managers using advanced **visualization** technology
- **Vendor-neutral platform** for deployment of the algorithms for the computation and optimization of resource efficiency

- **Increased transparency** of the resource efficiency of the production process for producers and customers
- **Better guidance** of the plant managers and plant operators in their daily and short-term decisions
- **Broad adoption in the process industries** beyond chemical production by transfer of the approach and of the supporting technologies

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The Path

MORE from less

● Definition of real-time resource efficiency indicators

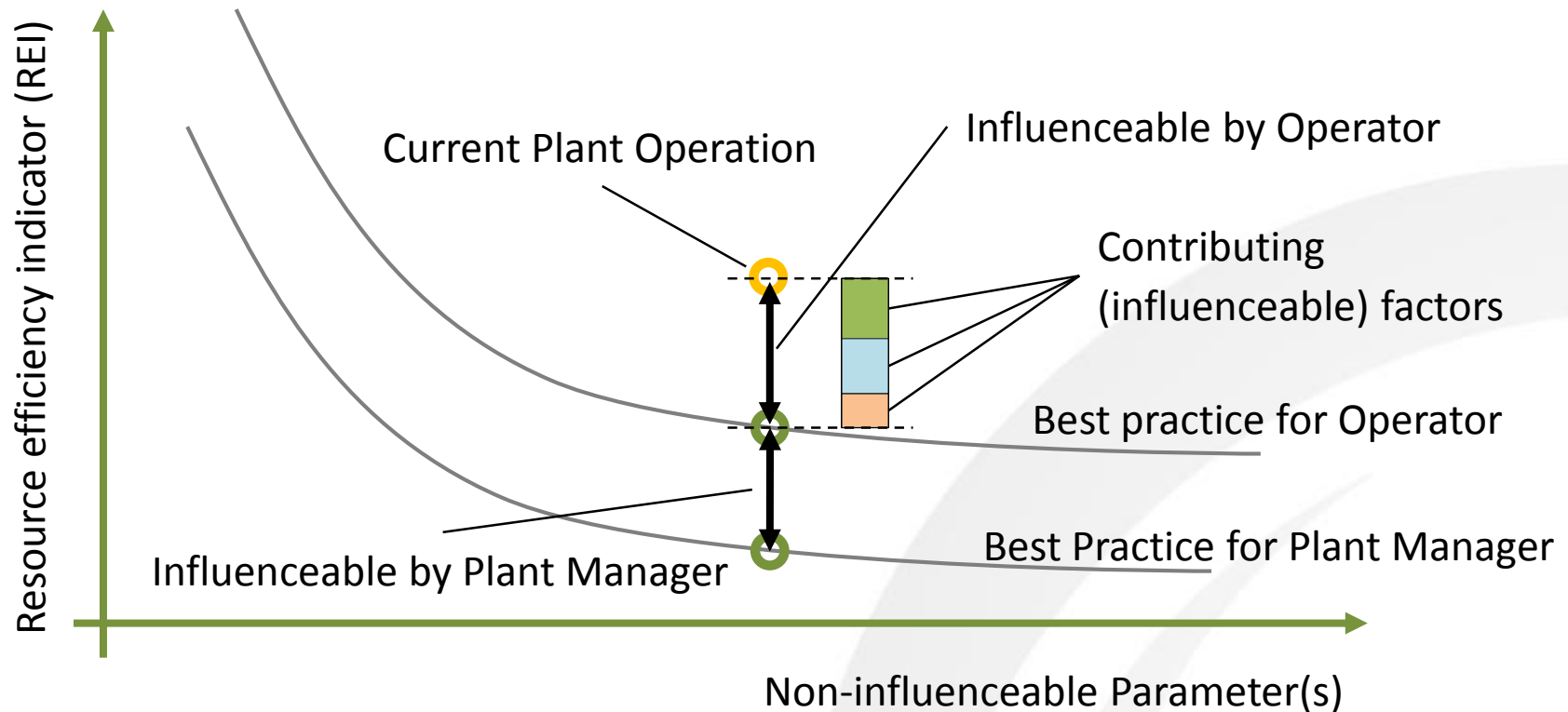
● Novel analytics and data reconciliation

● Decision support

● Implementation and demonstration

● Standardization and outreach

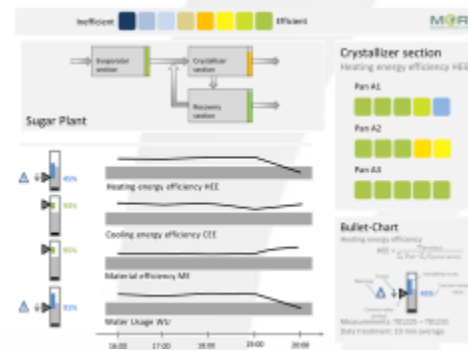
The Results and the Cases



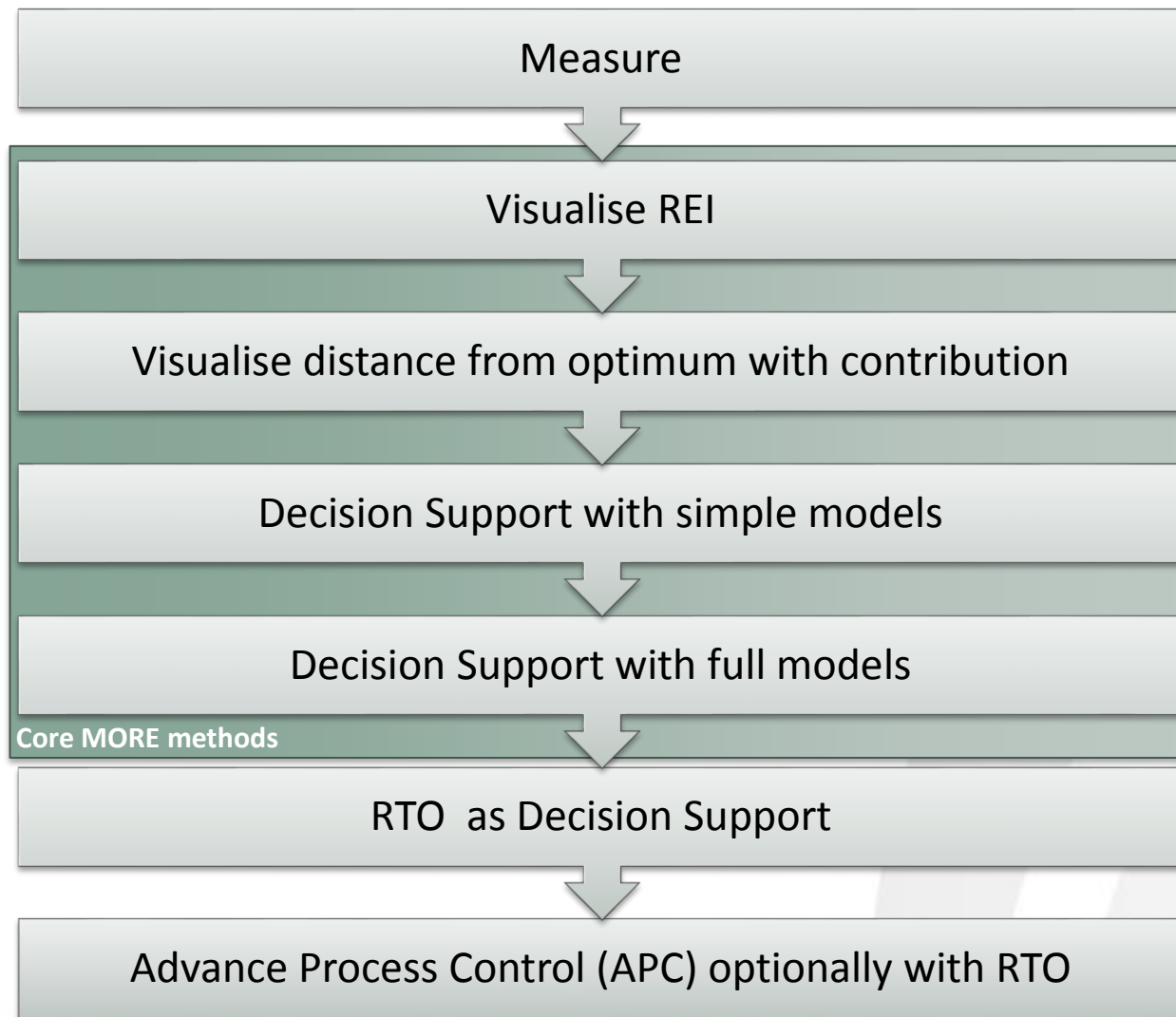
Goal: Show the root cause and give hints were to act

Automate if possible!

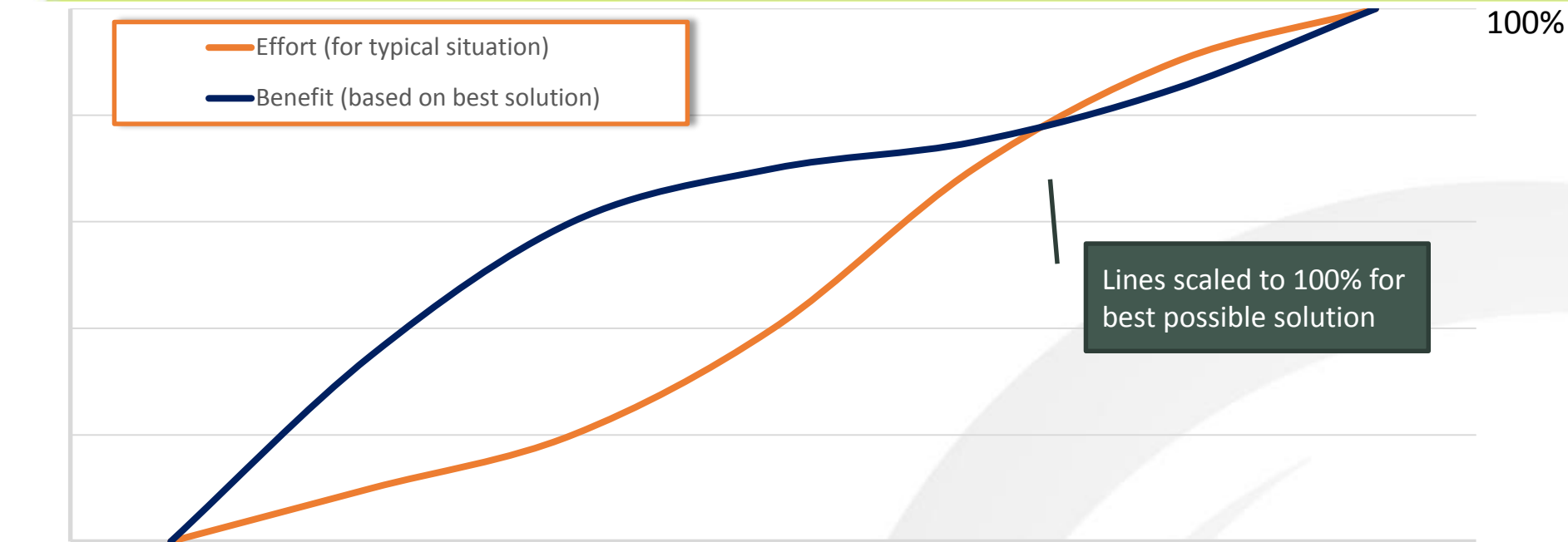
- MORE REIs usable for
 - Reporting
 - Assessment of process changes
- MORE methods usable for
 - Plant personell support
 - Framework for resource efficient operations
- Can be automated
 - Visualisation
 - Decision support
 - Optimisation



Path to success



Effort and Benefit of MORE Methods



Measure	Visuale REI	Distance from optimum with contribution	Decision Support	Decision Support with full models	RTO as Decision...	APC optionally with RTO
	Core MORE methods					

MORE Case	BASF	INEOS AN INEOS Site	INEOS Cracker	Lenzing	Lenzing Petronor	Lenzing Petronor
Market available	O	-	O	O	X	X
Trans-parency	High	High	Medium	Medium	Low	Low

Success Criteria

	Petronor	INEOS	BASF	Lenzing
MORE Tools applied in industrial environment	O	O	O	O
Real-time REIs used to either evaluate or improve efficiency	O	O	O	O
Implementation and application of decision support system	X	O	O	X
Personnel acceptance in demonstration cases	X	X	X	X

X – successfully achieved

O – in progress

- – not started

So ... what can be gained?

OBJECTIVES

Case studies

Evaluate the environmental and economic impacts of the use of REI

Industries

Estimate the medium term application potential

Sectors

Estimate the suitability of the technologies for a broad application in EU.

METHODOLOGY

Environmental Impact

Life Cycle Assessment (LCA) approach

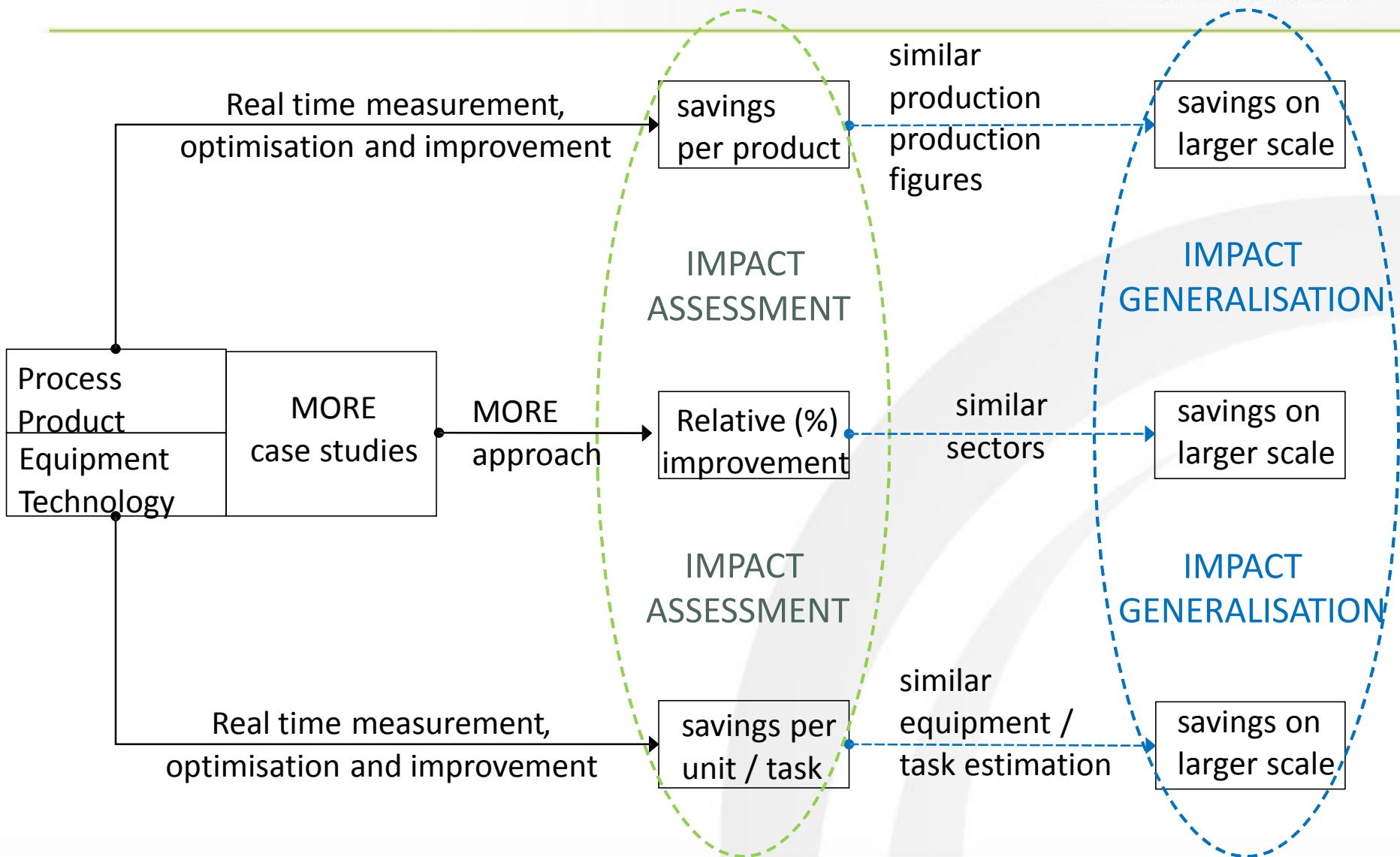
Economic Impact

Quantitative and qualitative approach to measure gains and the chances resulting project

Data collection

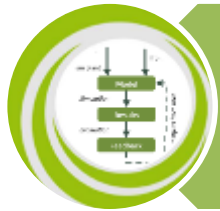
Comparison of the situation “before” and “after” the REI has been defined and displayed to operators

Generalisation





Approaches developed and implemented at an experimental stage
Tested in specific industrial processes or plants.



Impacts can only be estimated.
Creating concrete and tangible impacts will take time.



High complexity and interdependence inside companies difficult
Dependence on external conditions and global competition problematic
Impact hard to grasp in totality.



Market penetration of optimisation in European chemical companies:
25-50% would benefit from resource efficiency measures.
Generalization takes this into account.



Economic gain

- 3-5% of cost savings expected →
1.000.000 to
5.000.000 €/y



Environmental impact

- More hydrotreated diesel with less hydrogen
- About 3,4% of reduction in greenhouse gas emissions



In the company

- Spread of MORE approach in other plants within a 2-years horizon



For Europe

- Potential for increased diesel production with the same amount of hydrogen: 2.8-5.6M tons per year for EU refineries;
- cost saving of 25-125 or at best 50-250M €/y in the EU



Economic gain

- Potential for large economic improvement, but too early to estimate



Environmental impact

- Could reach a reduction of 16 400-32 900t CO₂eq emitted per year



In the company

- REI implementation is part of the site energy management strategy



For Europe

- 25% of large scale continuous base chemical plants in Europe can reach an overall energy efficiency improvement of 2% through fully implementing the MORE methods as advisory systems



Economic gain

- Potential **economic** impacts, but further investigations over a longer period are required



Environmental impact

- Decrease of around 2% in the use of bleaching chemical



In the company

- MORE approach promising for batch processes
- Limitations due to important investments required



For Europe

- Specialty chemicals represent 28% of the European chemical sales
- Comparable savings in similar processing steps on other speciality chemicals plants are possible but difficult to be estimated



Economic gain

- Optimisation permits a gain of 575 000 to 825 000€ per year



Environmental impact

- Direct emissions from site decrease circa 0,3% thanks to steam optimisation



In the company


- MORE approach to be implemented in other plants of the company (China and Indonesia) and in others application areas



For Europe

- Potential energy savings : 2,5-5 MJ/year
- Potential natural gas saving: 0,35-0,7Mio Nm3/year
- Financial gain potential: 94K€/year for bigger and 23.5K-47K€/year only for smaller fibre producing EU companies

Conclusions and Recommendations



When implementing improvements to process operations the support of the operators and plant managers is crucial

A minimum digitalization is paramount
Further integration of digitalization is key and needs to be supported

Data preparation using the data already supplied by the chemical industry could be improved

A fast changing regulatory framework is a threat for technology development.
Change conditions to enable investments with longer payback periods

Acknowledgments

- Inno TSD:
 - Eva Fadil
 - Sophie Vallet Chevillard
 - Svetlana Klessova
- VTT
 - Marjukka Kujanpää
 - Tiina Pajula
- TUDO
 - Sebastian Engell

Questions

