

Energy audits & management systems: an opportunity for petrochemical industry

June 9th 2016, SFGP CNAM Paris

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INEOS Europe, head of energy & innovation policy



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INEOS Group

www.ineos.com

COMPANY

INEOS at a glance

Company Magazine

Profile

Sustainability

Product Overview

SHE

Vision & Values

History

Leadership

Joint Ventures

INEOS AT A GLANCE

EMPLOYEES

17,000

HERITAGE

AMOCO, BASF, BAYER,
BORÉALIS, BP, DEGUSSA,
DOW, ENICHEM,
ERDEOLCHEMIE, HOECHST,
ICI, INNOVENE, LANXESS,
MONSANTO, NORSK HYDRO,
SOLVAY

PRODUCTION

60 MILLION TONNES

SITES

65 sites in 16 countries

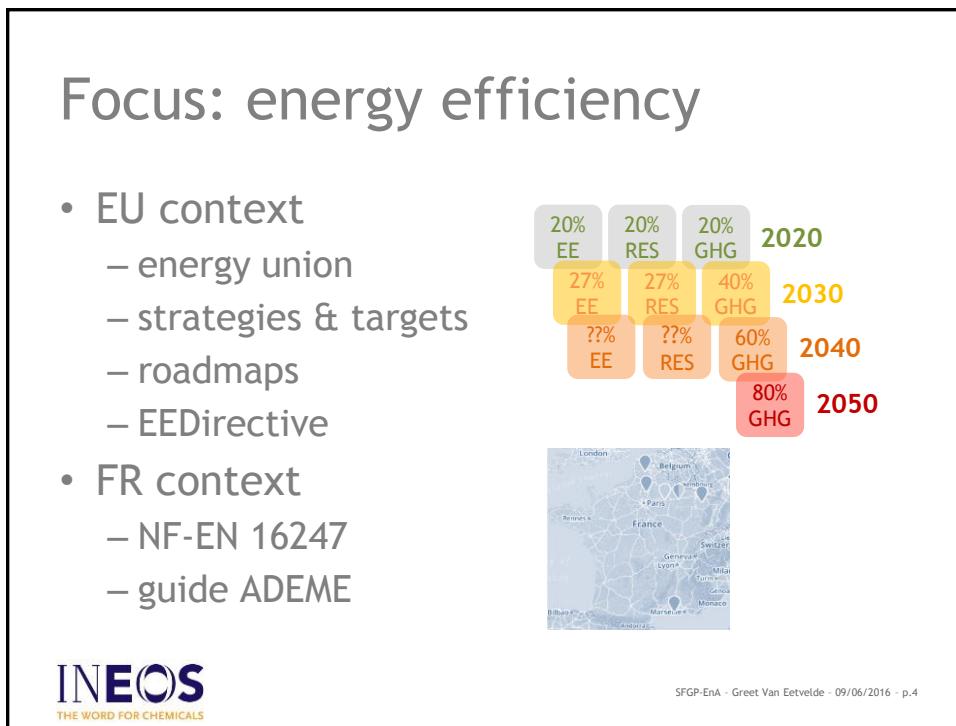
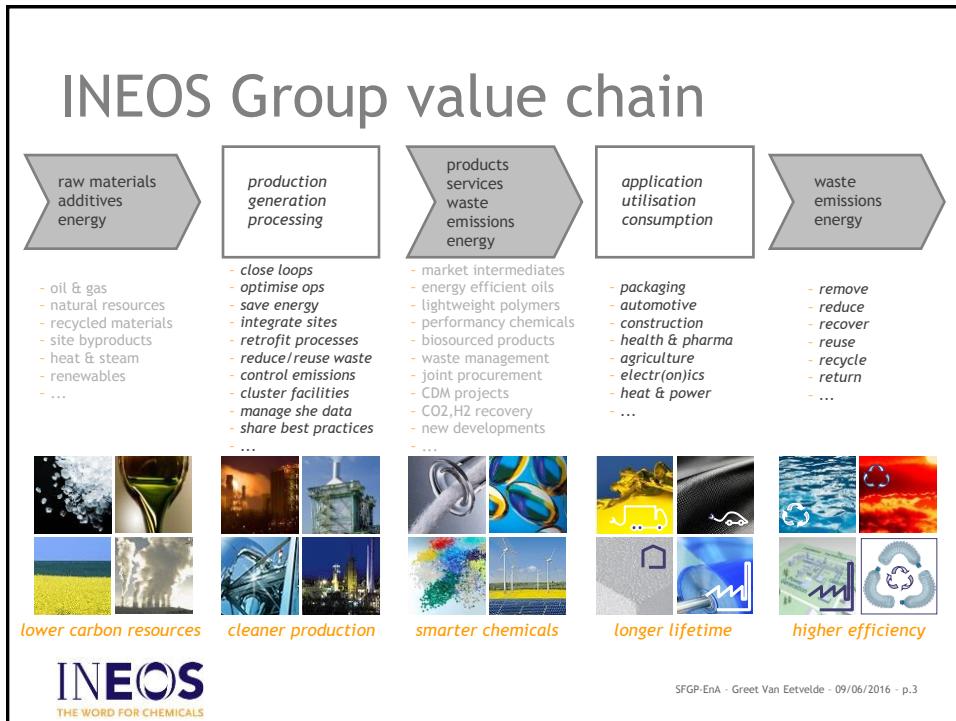
TURNOVER

\$40 BILLION

ENERGY >1.5 b€/y



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Energy & resource efficiency

- main issues in industry
 - audits & tools
 - monitoring & measuring
 - data reconciliation & processing
 - optimisation & integration
 - implementation & investment
 - management & training
 - research & innovation



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Energy & resource efficiency

- main issues in industry » RDI collaboration?
 - audits & tools



- implementation & investment
- management & training
- research & innovation



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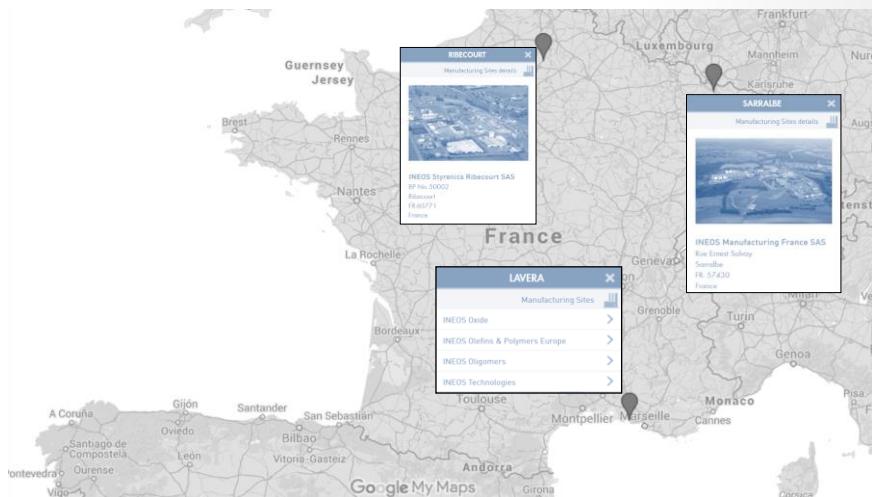


- 2 industrial PhDs at IPSE
 - energy efficiency & integration
 - Stéphane Bungener - 2012-2016
 - resource & energy management
 - Elfie Méchaussie - 2013-2017
 - 1 industrial PhD at & / UNIVERSITEIT GENT
 - industrial synergies in petrochem ~ H2020 SPIRE
 - Hélène Cervo - 2016-2019
 - # master theses & internships
- » INEOS RDI programme



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INEOS site studies



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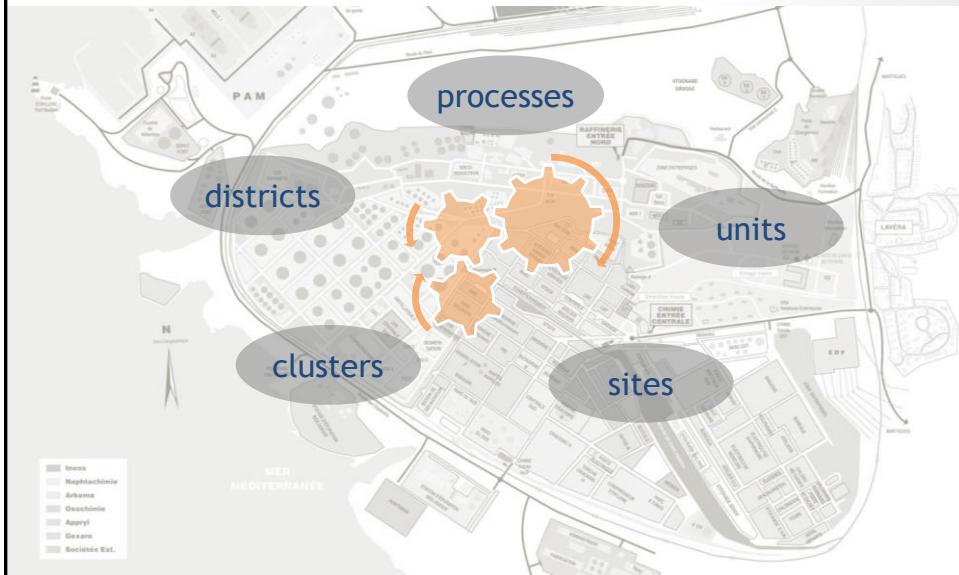
INEOS Lavéra



INEOS Lavéra - cluster



INEOS sites - resource & energy



Main issues in industry

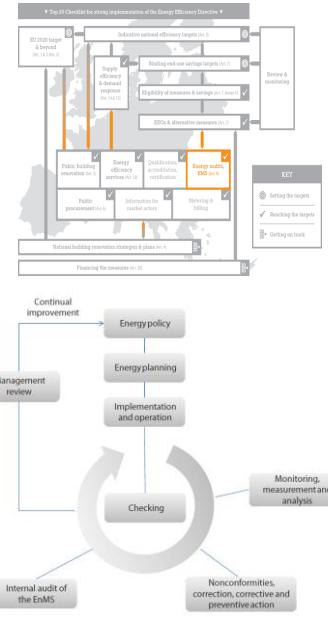
- **audits & tools**
- monitoring & measuring
- data reconciliation & processing
- optimisation & integration
- implementation & investment
- management & training
- research & innovation

?audits

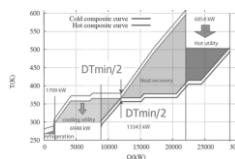
- energy audit (Dec'15)
 - EED ~4y
 - NF ~4y
- energy management system
 - ISO ~3y
 - » invest
 - » implement
 - » improve

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THE WORD FOR CHEMICALS

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answer
energy system engineering



- systematic & holistic approach
 - data collection
 - unit/site energy balances
 - data reconciliation
 - modelling & energy requirement analysis
 - process integration analysis (Pinch)
 - unit & site scale integration
 - ops & mgt recommendations
 - ST & LT energy efficiency roadmap

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Main issues in industry

- audits & tools
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- research & innovation



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?monitoring

- # data issues
 - myriad, lack, format, losses, TARs, ...
 - eg steam consumption breakdown @Lavéra

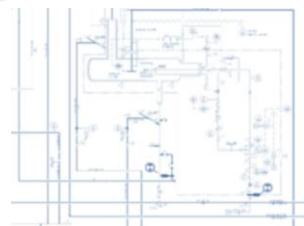


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data gathering, structuring and validation



data sources

- process & instrumentation diagrams: 420+
- user manuals
- security manuals
- interviews: 50+
- loss estimations
- measure certainty approximations

data validation

- validation with operators
- calculation of mass balance
- match of preliminary results with existing findings

data structuring

- simple flowcharting
- top down approach
site utilities first
process unit borders
process unit details
- **80/20 approach**
identify key consumers/producers
group remaining with assumptions



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Main issues in industry

- audits & tools
- monitoring & measuring
- data reconciliation & **processing**
- optimisation & integration
- implementation & investment
- management & training
- research & innovation

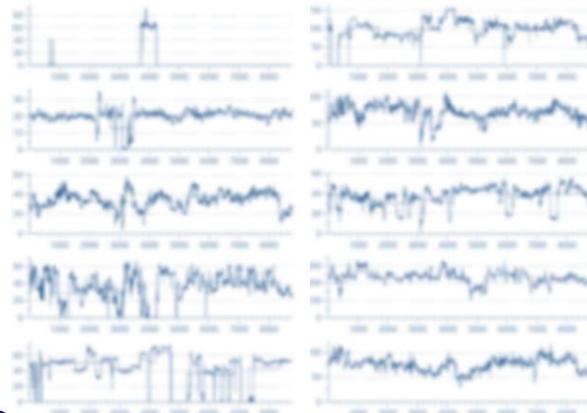


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?data processing

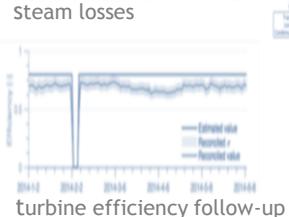
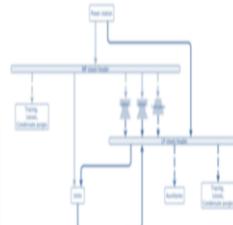
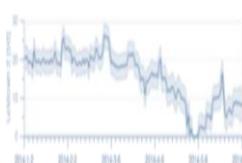
- unit & site energy profiles
 - eg multi-time adaptation (20 periods) @Lavéra



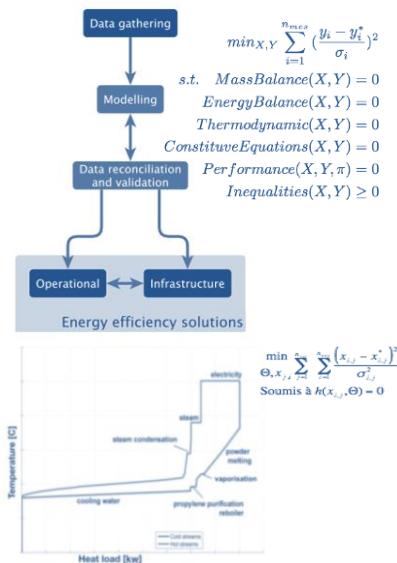
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answer data processing methodology



Modelling of a steam network using data reconciliation as a management tool,
Energy Systems Conference, London, 2015



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answer

identify main energy drivers

process energetics: KPI & flows

mass	exergy
energy	financial

Main issues in industry

- audits & tools
- monitoring & measuring
- data reconciliation & processing
- **optimisation & integration**
- **implementation & investment**
- management & training
- research & innovation

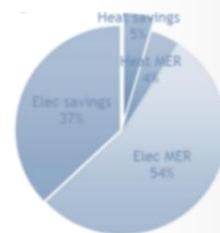
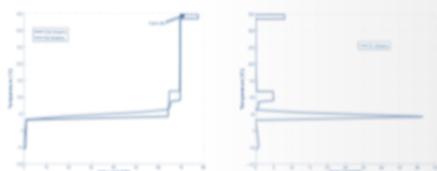


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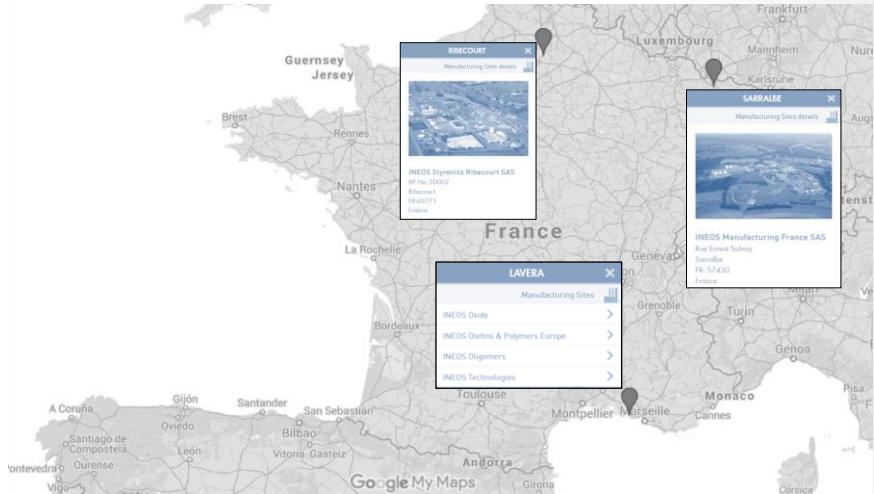
process & technology efficiency

- process flowsheet analysis
- process integration
 - composite curves
 - energy usage analysis
 - technology improvement
- process modification
 - eg heat exchangers
 - eg heat pumping
 - eg turbines, ...



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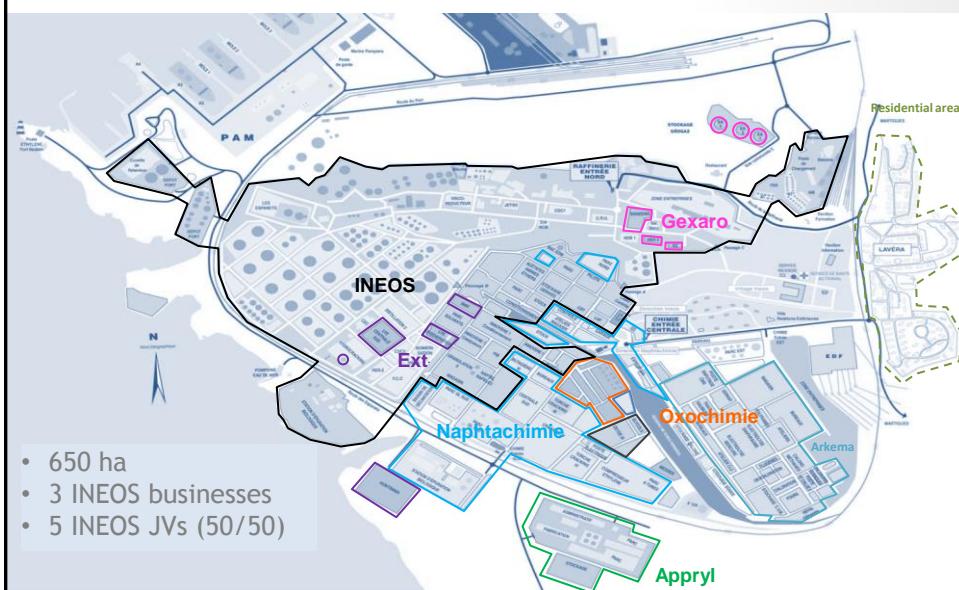
INEOS sites studies



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INEOS Lavéra - cluster



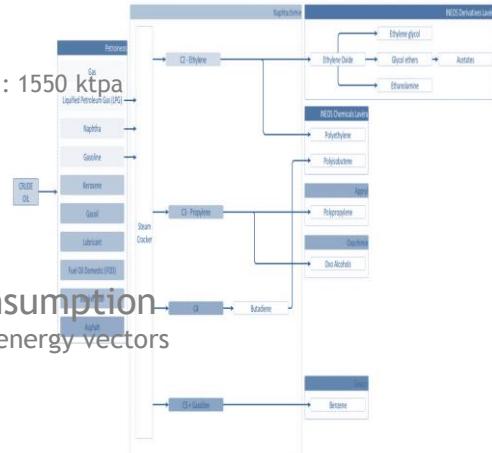
INEOS Lavéra - production

- Lavéra production:**

- refinery: 10000 ktpa
- petrochemicals (C2,C3,C4,C6): 1550 ktpa
- polyethylene: 270 ktpa
- polyisobutene: 83 ktpa
- polypropylene: 285 ktpa
- heavy alcohols: 300 ktpa
- oxide & derivatives: 215 ktpa

- utility production/consumption**

- steam & electricity major energy vectors
- steam produced on site
- integrated site



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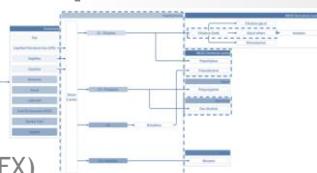
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INEOS Lavéra - study scope

- indicative steam energy audit**

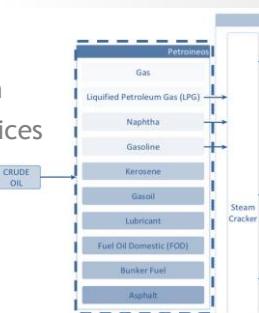
(FR-EN 16247-1/3)

- grey box pinch analysis (process-utility HEX)
- energy saving opportunities identification & evaluation



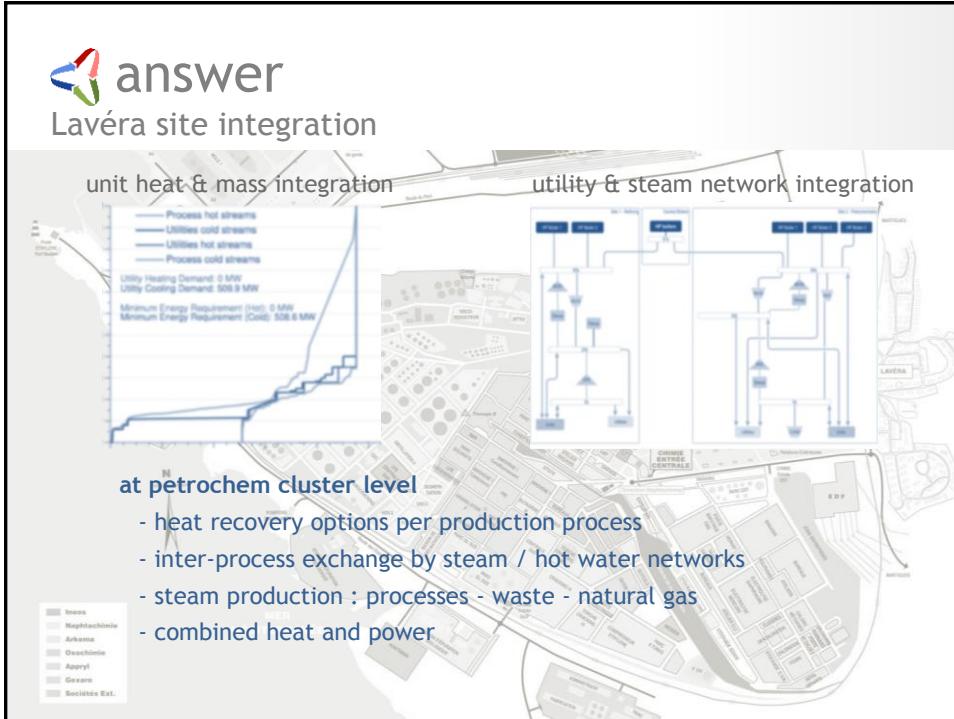
- steam network analysis**

- mass and energy balances, data reconciliation
- recommendation on additional measuring devices
- internal management system
- monitoring / planning



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INEOS Lavéra - implementation

- energy review
 - areas of significant energy use, KPI's
 - steam consumption allocation
- energy saving opportunities
 - high energy savings for some processes
 - solution types:
 - mechanical vapour recompression
 - heat exchanger network redesign
 - steam network improvements
 - also: measurement system improvement / monitoring
- next step: EnMS

INEOS Sarralbe - site

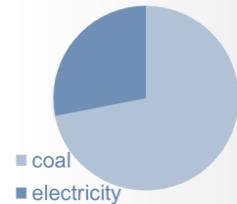


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INEOS Sarralbe - polymers

- HDPE & PP grades
 - 170 ktpa HDPE, 70 ktpa PP
 - 2 main process section for each polymer
 - polymerisation: reaction and drying
 - finishing: pelletising
- utility production/consumption
 - 2 coal steam generators
 - HP steam production ca 60 t/h (53 barg)
 - 4 pressure levels distribution



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INEOS Sarralbe - study scope

- indicative steam energy audit (FR-EN 16247-1/3)
- steam network analysis
 - mass and energy balances, data reconciliation
 - recommendation on additional measuring devices
 - internal management system
 - monitoring / planning
- energy integration study
 - grey box pinch analysis
 - energy saving opportunities identification & evaluation



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INEOS Sarralbe - implementation

- energy review
 - areas of significant energy use, KPI's
 - steam consumption allocation
- energy saving opportunities
 - 10s MW of excess heat below pinch point
 - heat recovery potential: >10% of actual consumption
 - make-up water preheating (~1 MW)
 - heat recovery in 2 other HEX (~1.5 MW)
 - additional potential through heat pumping effect
 - use of ejectors
- next step: EnMS?



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INEOS Ribécourt - site

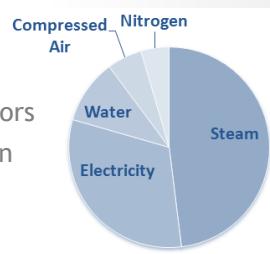
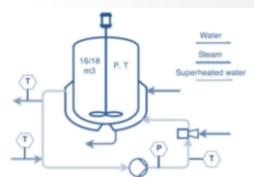


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INEOS Ribécourt - styrenics

- EPS production
 - 90 ktpa EPS Silver
- batch process
 - reaction section: 10 batch reactors (4x60m³, 3x18m³ and 3x16m³)
 - common treatment line after reactors
- utility consumption
 - steam & electricity are major energy vectors
 - steam mostly consumed in reaction section
 - steam is not produced on site



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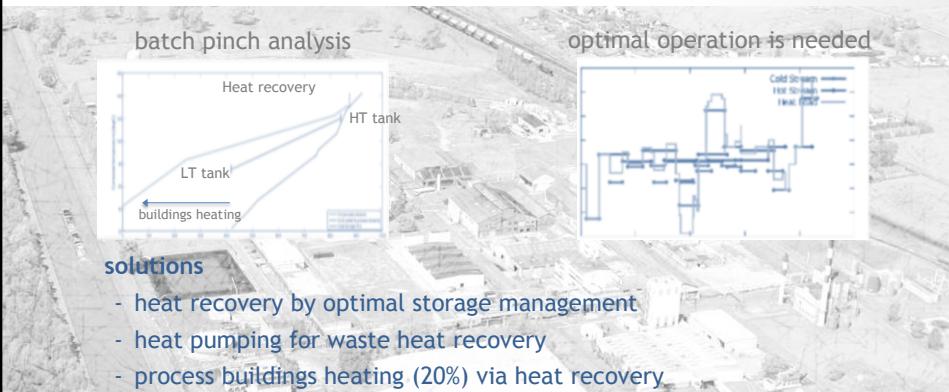
INEOS Ribécourt - study scope

- indicative steam energy audit (EN 16247-1/3)
- energy efficiency optimisation
 - grey box 'batch' pinch analysis
 - energy saving opportunities identification & evaluation
- ISO 50001 support
 - (4.4.3) energy review
 - (4.4.4) energy baseline
 - (4.4.5) KPIs
 - internal management system
 - monitoring / planning
 - technical report



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answer Ribécourt efficiency optimisation



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INEOS Ribécourt - implementation

- energy review
 - areas of significant energy use, KPI's
 - steam consumption allocation
- energy saving opportunities
 - batch pinch analysis
 - indirect heat recovery potential
 - hot water circuit and storage
 - very high steam savings
 - also: measurement system improvement / monitoring
- ISO 50001 certified



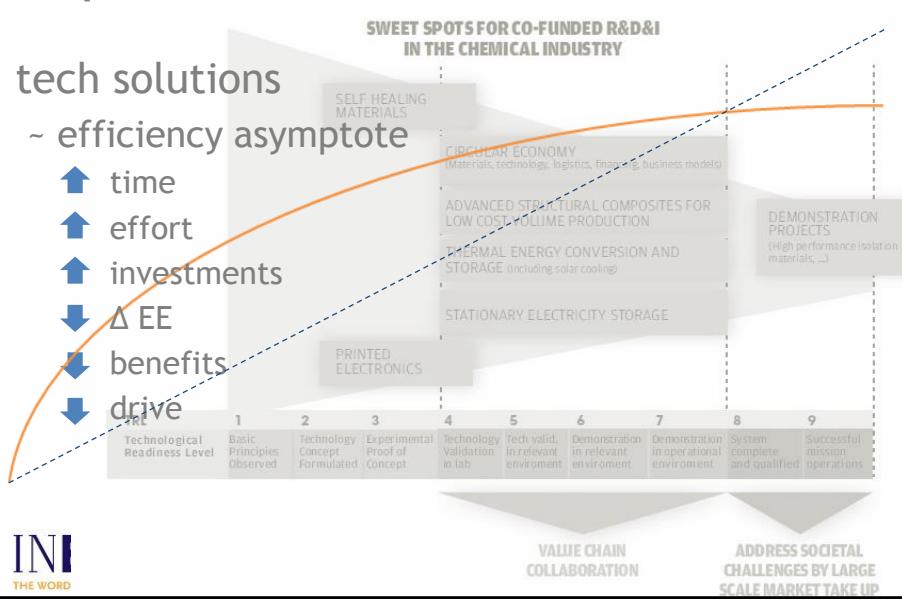
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Implementation

tech solutions

~ efficiency asymptote

- ↑ time
- ↑ effort
- ↑ investments
- ↓ Δ EE
- ↓ benefits
- ↓ drive



Main issues in industry

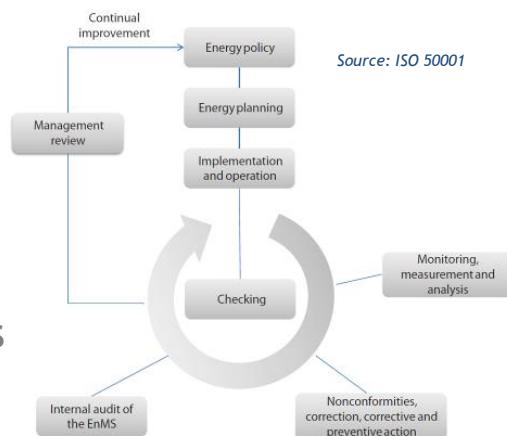
- audits & tools
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- data reconciliation & processing
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- implementation & investment
- **management & training**
- research & innovation



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Management

- **ISO 50001**
 - PDCA model
 - ctd improvement
- energy review
- energy baseline
- energy PIs, targets
- energy planning



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Training

- continuous improvement requires continuous education & training
 - onsite, mgt to ops level
 - online courses
 - ...



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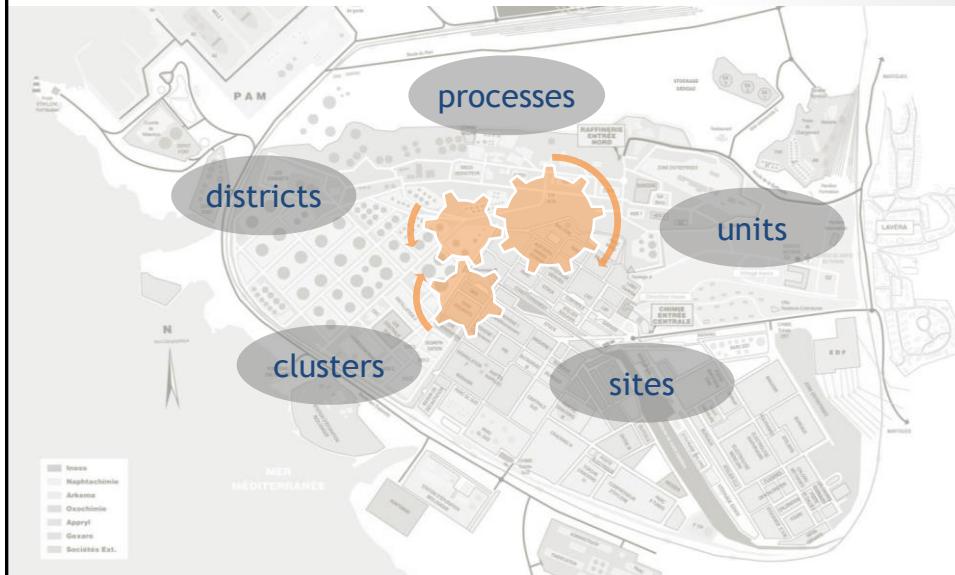
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cross-sector symbiosis



eg H2020

- EPOS www.spire2030.eu/epos
 - **SPIRE**: sustainable process industries
 - H2020: RE mgt systems for improved efficiency in PI**
 - EPOS: industrial symbiosis
 - cross-sectorial synergies
 - Efficiency wrt resources & energy
 - Performance indicators
 - Operations optimisation
 - System thinking
 - business & district clusters
 - management systems



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Questions

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