

**Bonnes pratiques dans la gestion des solvants**

# **Good practice for preventing and reducing solvent emissions**

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# Ökopol – Institut für Ökologie und Politik GmbH

- Clients: EU Commission, Environm. Agencies, Ministries, Associations, Industries

Chemicals policy  
/ REACH



Sustainable  
products / Eco-  
labelling

Industrial emissions  
/ Best Available  
Techniques (BAT)



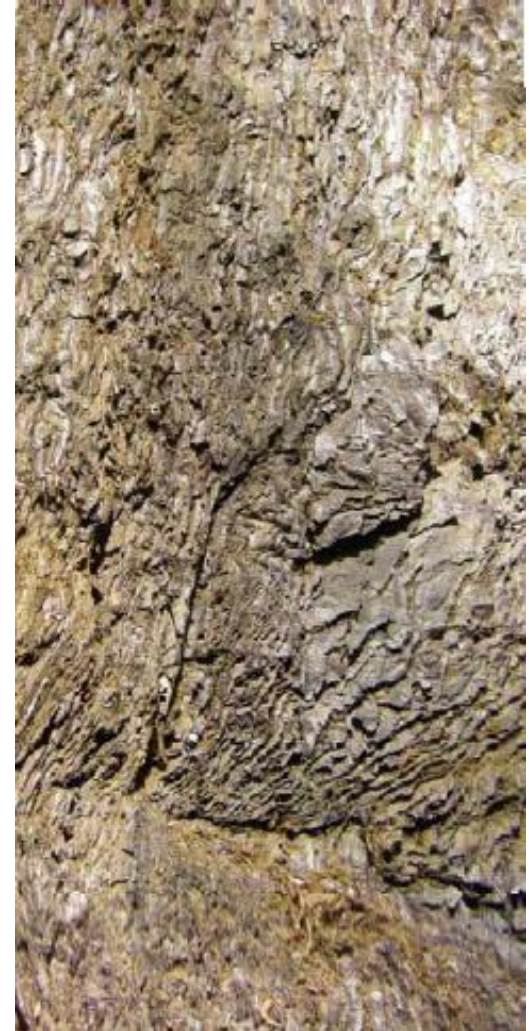
Resources and  
circular economy



Environmental  
management

# Outline

- ▶ Industrial Emissions Directive (IED) and BAT
- ▶ New BREF document (BREF STS)
- ▶ Solvents
- ▶ VOC emissions prevention and reduction
- ▶ Solvent recovery
- ▶ Use of VOC emissions
- ▶ Summary



# EU Industrial Emissions Directive (IED)

- ▶ BREFs describe "Best Available Techniques" (BAT)
- ▶ Applicable to installations using  $\geq 150$  kg/h or  $\geq 200$  t/a of solvents
- ▶ Requirements also for installations under this threshold (e.g. IED Annex VII)

## BREFs and their relation to the IED:

- ▶ Basis for permitting of IED installations in Europe
- ▶ Aim: Harmonisation of EU-wide requirements

## BAT Conclusions (= Extract from the BREFs):

- ▶ Contain binding BAT associated emission values (to air and water)
- ▶ Give examples of technology with which emission values can be met

## Entry into force

- ▶ For new and significantly modified plants: 1st Quarter 2020
- ▶ For existing plants: 4 years after publication (i.e. 2024)

# Best available techniques – EU Definition in the IED

- ▶ BAT: Most effective and advanced stage in the development of activities and their methods of operation
- ▶ BAT: Basis for emission limit values and other permit conditions, in order to prevent or, where that is not practicable, to reduce emissions and impacts on the environment as a whole.
- **‘best’**: techniques which are most effective in achieving a high general level of protection of the environment as a whole.
- **‘available’**: technique is sufficiently developed for implementation to be economically and technically viable; technology is reasonably accessible to operators;
- **‘techniques’**: the technology used, and the way in which the installation is designed, built, maintained, operated and decommissioned.

(IED Article 3(10))

# BREF – Standard structure

- Preface
- Contents page
- Scope
- 1. General information on the sector
- 2. Applied processes and techniques
- 3. Current emission and consumption levels
- 4. **Techniques to consider** in determination of BAT
- 5. **Best available technique** (BAT) conclusions
- 6. Emerging techniques
- 7. References
- 8. Glossary



EU BREF-Draft (9/2019)  
on Surface Treatment Using Organic Solvents

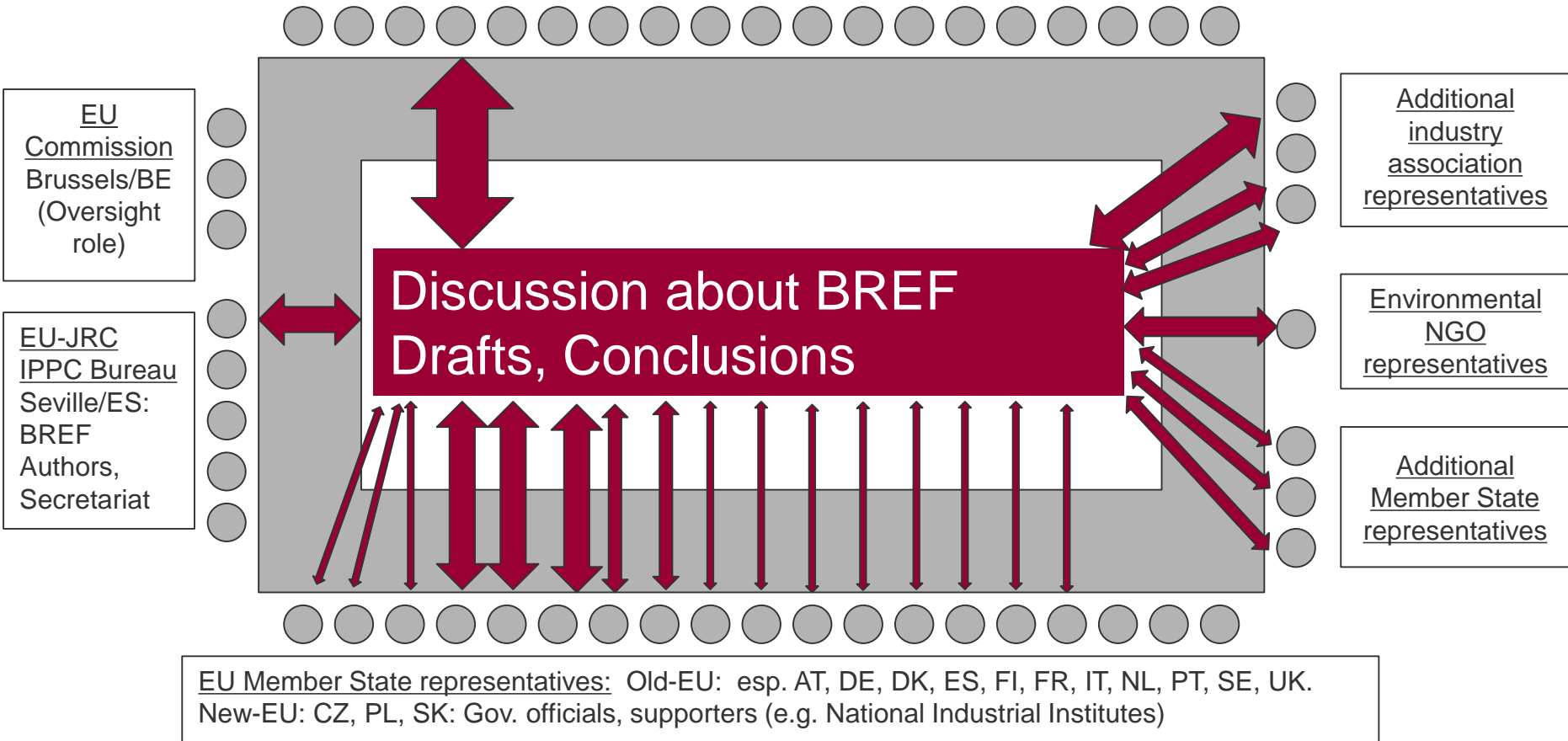
# BAT Reference Document on Surface Treatment Using Organic Solvents (BREF STS)

1. General information on surface treatment with organic solvents
2. Printing (heatset, gravure printing, printing of packaging)
3. Manufacture of winding wire
4. Manufacture of coated abrasives
5. Manufacture of adhesive tape
6. Large-scale vehicle coating
7. Vans, lorries, lorry cabins
8. Buses and coaches
9. Trains
10. Farm and construction machinery
11. Coating of ships and yachts
12. Coating of aircraft
13. Other metal surfaces
14. Coil coating
15. Metal packaging
16. Plastic component coating
17. Coating of wooden surfaces
18. Wood impregnation
19. Manufacture of mirrors
20. General techniques
21. Best available techniques
22. Emerging techniques

# EU Information exchange

## ► Determination of Best Available Techniques (BAT)

Industry representatives: European sectoral associations and supporters (company representatives)



# Key steps for reducing solvent use and emissions

## Environmental management system

- ▶ Recording of solvent input and output
- ▶ Planning and testing of integrated improvement measures

## Prevention and reduction

- ▶ Solvent system => water-based or dry systems
- ▶ High-solid paints, reduce number of coating layers

## Recovery

- ▶ Distillation, Ad-/Absorption, Condensation

## Efficient solvent destruction

- ▶ Optimise capture (reduce volume)
- ▶ Homogenise and increase concentration
- ▶ Use energy content for heat recovery (CHP, RTO, thermal oil)

# Environmental management system

## Recording of inputs

- ▶ Manufacturer data (only substances with vapour pressure > 0.1 hPa)
- ▶ Monitor returns/stock changes

## Recording of outflows / emissions

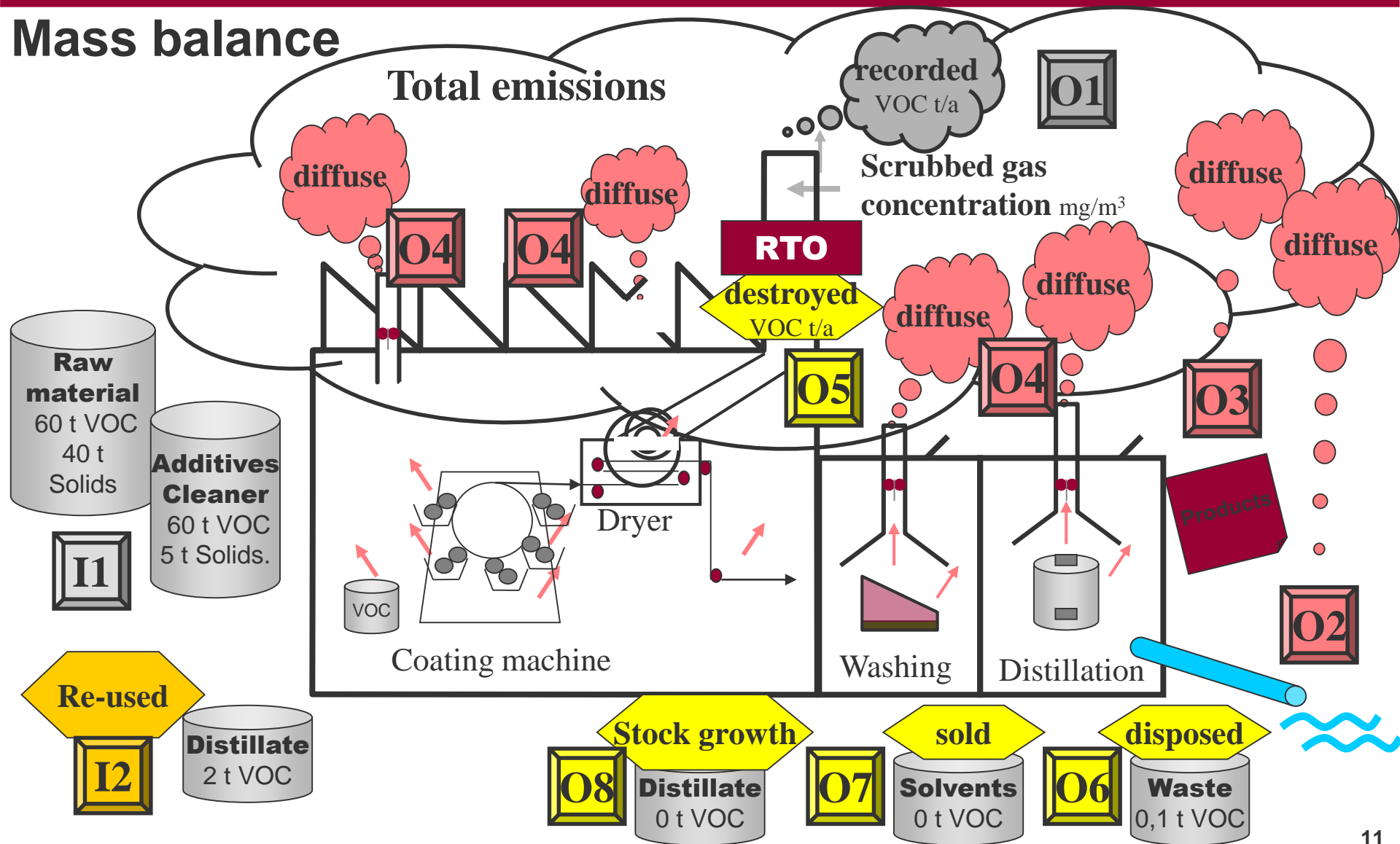
- ▶ Sampling of solvent content in waste (including in cleaning cloths)
- ▶ Measurements of **raw and clean flue gas** => removal by treatment system
- ▶ Precise recording of recovered quantities

## Planning and testing of improvement measures

- ▶ Is emission prevention or reduction possible?
- ▶ Can emission locations be better encapsulated?
- ▶ Do peaks in emissions occur?
- ▶ Is it possible to make use of electricity/heat/cold?
- ▶ Set objectives and review them (specific indicators)



# Mass balance



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# VOC emission prevention

## Solvent-free systems

- ▶ Water- or powder-based paints
- ▶ Water- or UV-based printing inks
- ▶ Hotmelt glues (e.g. lamination)



Addition of hotmelt glue

## Powder-based paints



## Advantages:

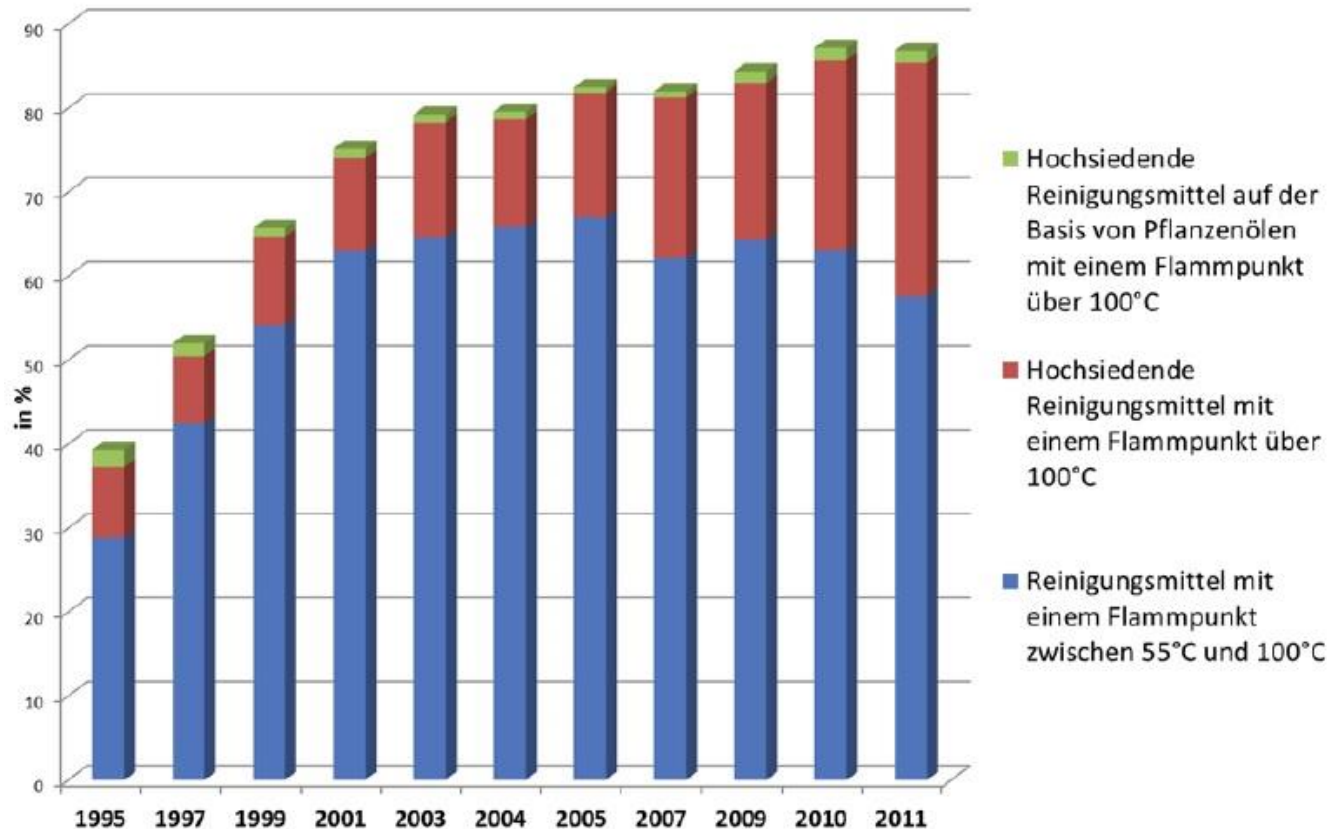
- ▶ No VOC emissions, improved safety (no fire risk)
- ▶ No gas treatment required

# VOC emission prevention: VOC-free cleaning products

Manual and automatic cleaning (Offset printing industry)

## Advantages:

- ▶ No VOC emissions where flash point  $> 100^{\circ}\text{C}$
- ▶ Much lower VOC emissions where flash point  $55 - 100^{\circ}\text{C}$



German Print and Media Association [www.bvdm-online.de](http://www.bvdm-online.de)

# VOC emission prevention: Water-based flexography

## Advantages:

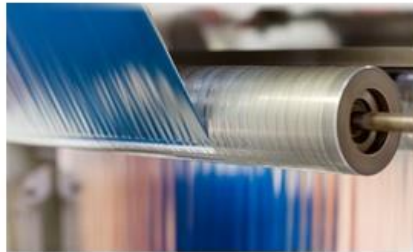
- ▶ 70% CO<sub>2</sub> reduction
- ▶ Less wear of printing plates

=>

Consistent printing with large print-runs



Services Sectors Innovations Service and quality Company Careers



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Fa. Folian/Groß Lüdershagen (DE/Stralsund)

[www.folian.com](http://www.folian.com)

# VOC emission prevention: VOC-free hydrocarbon cleaners

## Metal coating (Fa. Ardagh, DE/Erftstadt)

- Advantage: No VOC emissions from parts cleaning



Manufacturer: Numafa Cleaning & Automatisations [www.nufama.com](http://www.nufama.com)

# VOC emission prevention: Alkali-based parts cleaning

## Packaging printing (Fa. Rahning/Bünde)

- ▶ **Advantages:** No VOC emissions from parts cleaning,
- ▶ Alkali recirculation,
- ▶ Wastewater evaporation (low waste)



DW Renzmann Apparatebau [www.dw-renzmann.de](http://www.dw-renzmann.de)

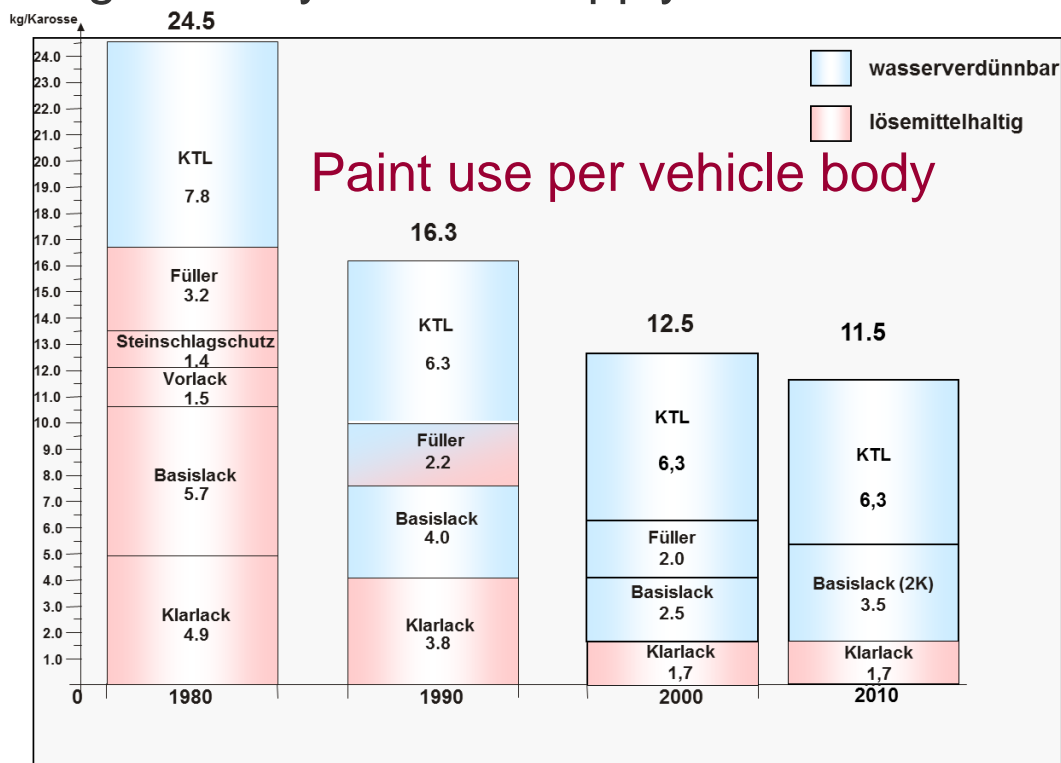


KMU Loft Cleanwater  
[www.kmu-loft.de](http://www.kmu-loft.de)

# VOC emission reduction: apply less/alternative paint

## Water-based paints and 2K-basecoats

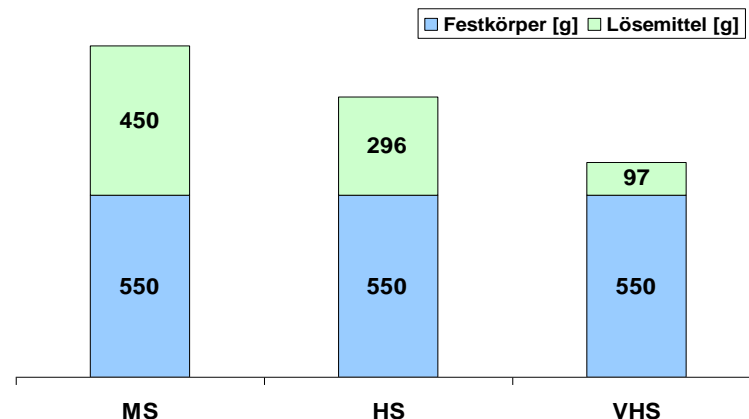
**Advantages:** Reduced VOC emissions, significantly easier to apply



Axalta, Resource efficiency congress 2014

## Solid and solvent content

conventional    high-solid    very high-solid



## Advantages of high-solids:

- ▶ Paint use reduced:  
-15% to - 35%
- ▶ VOC emissions reduced:  
- 34% to - 78%

# VOC emission reduction: Less solvent handling

## Automatic colour mixing system

**Advantage:** VOC emissions reduced, better colour quality



# VOC emission reduction: Less solvent handling

## Direct solvent addition into machines



## Sealed machines with automatic cylinder cleaning



### Advantages:

- ▶ VOC emissions reduced by sealed pipes
- ▶ Safety improved by use of fewer containers in the factory

# VOC emission reduction: Less solvent handling

## Filling station in the store



## Filling station in the factory



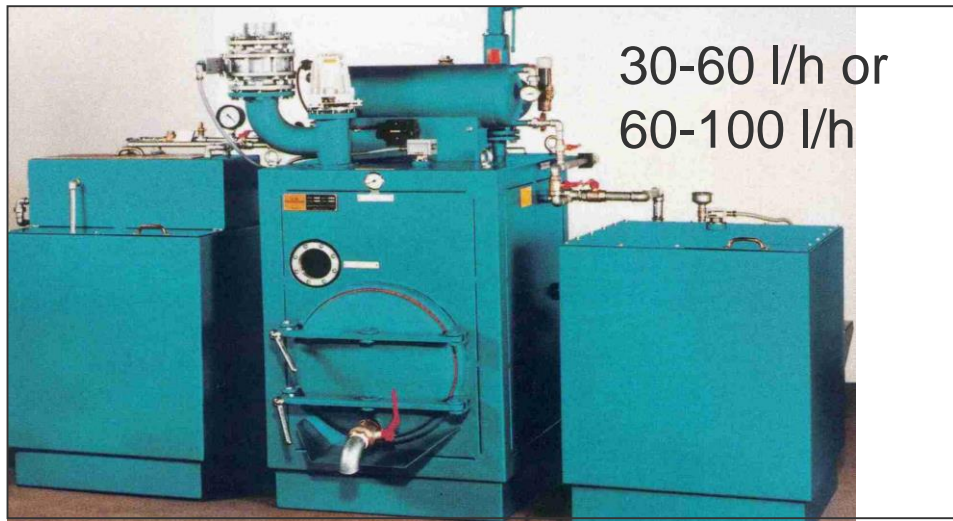
## Advantages:

- ▶ VOC emissions reduced by fewer open containers
- ▶ Safety improved by use of smaller containers in the factory

# Recovery

## Distillation / Condensation

- ▶ Used solvent / cleaner, paint/ink residues
- ▶ Advantages: saves resources, reduces waste



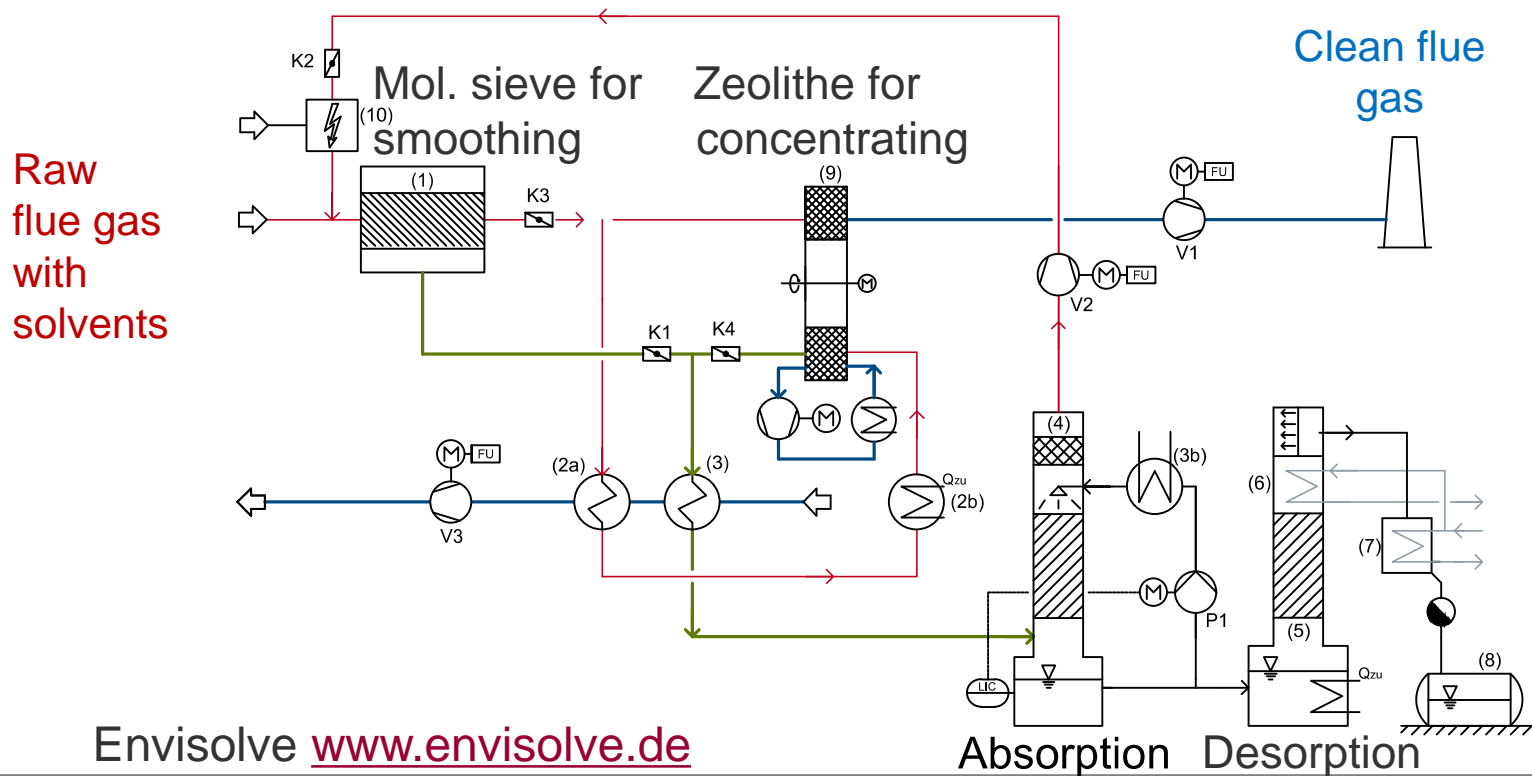
DW Renzmann Apparatebau

[www.dw-renzmann.de](http://www.dw-renzmann.de)

# Recovery

## Ad-/Absorption

- ▶ Adsorption in activated carbon, desorption with steam or
- ▶ Absorption in hydrocarbon, desorption with heat:



# Efficient destruction

## Optimise capture: reduce waste gas volume

- ▶ Encapsulate / seal machines (also possible for old machines)
- ▶ Adjust extraction according to solvent emissions
- ▶ Recirculation of waste air with low VOC load

## Homogenise concentration

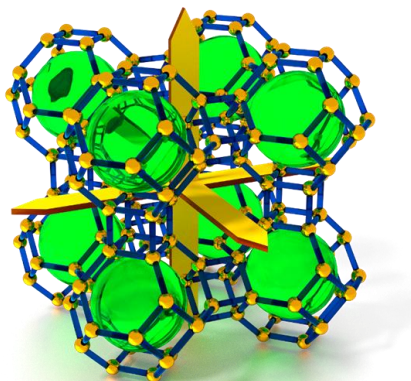
- ▶ Smoothing/buffering in a molecular sieve
- ▶ Concentrate in an adsorption wheel



# Efficient destruction: Zeolite molecular sieve

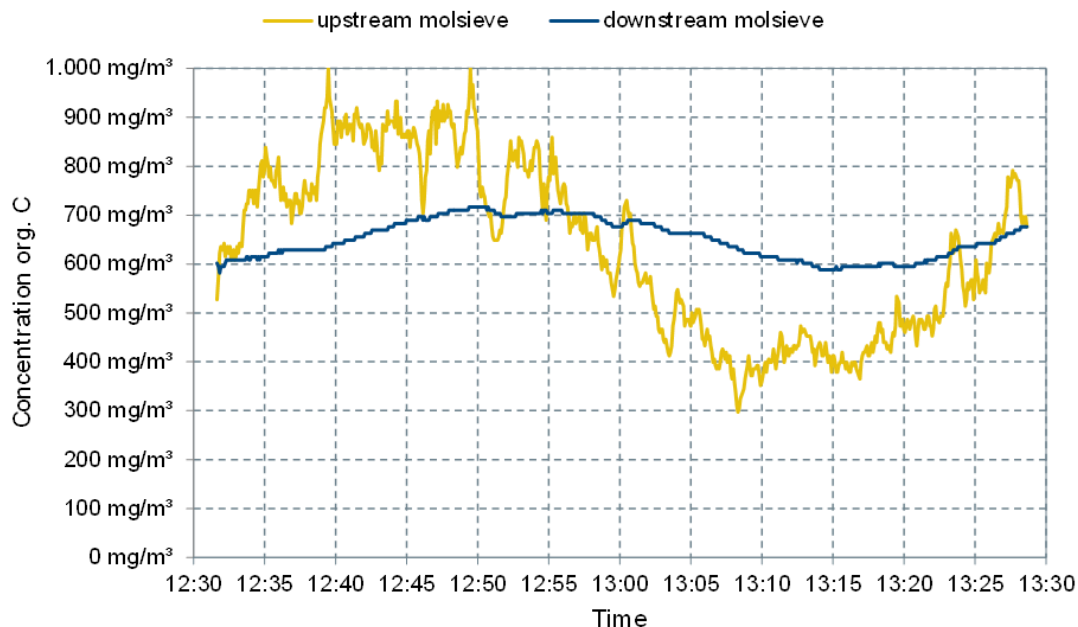
## Advantages

- ▶ Storage of VOC
- ▶ Smoothing of VOC peaks



Zeolite pore structure

## VOC concentration before and after mol. sieve



Envisolve [www.envisolve.de](http://www.envisolve.de)

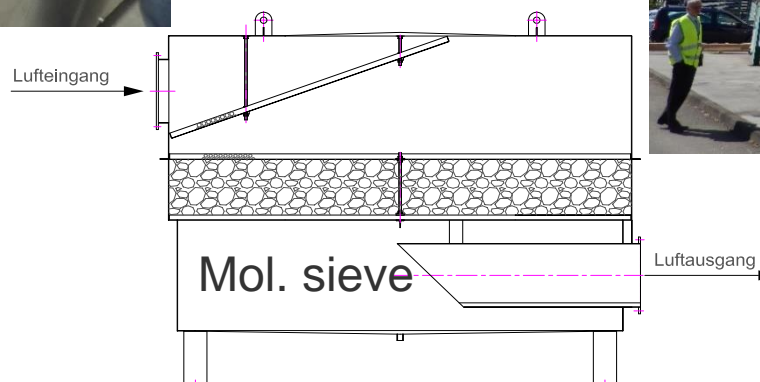
# Efficient destruction

## Molecular sieve after component washer (Fa. Debatin, DE/Bruchsal, Flexodruck)

- ▶ Containment of VOC emission peaks, efficiency increase of RTO



Component washer



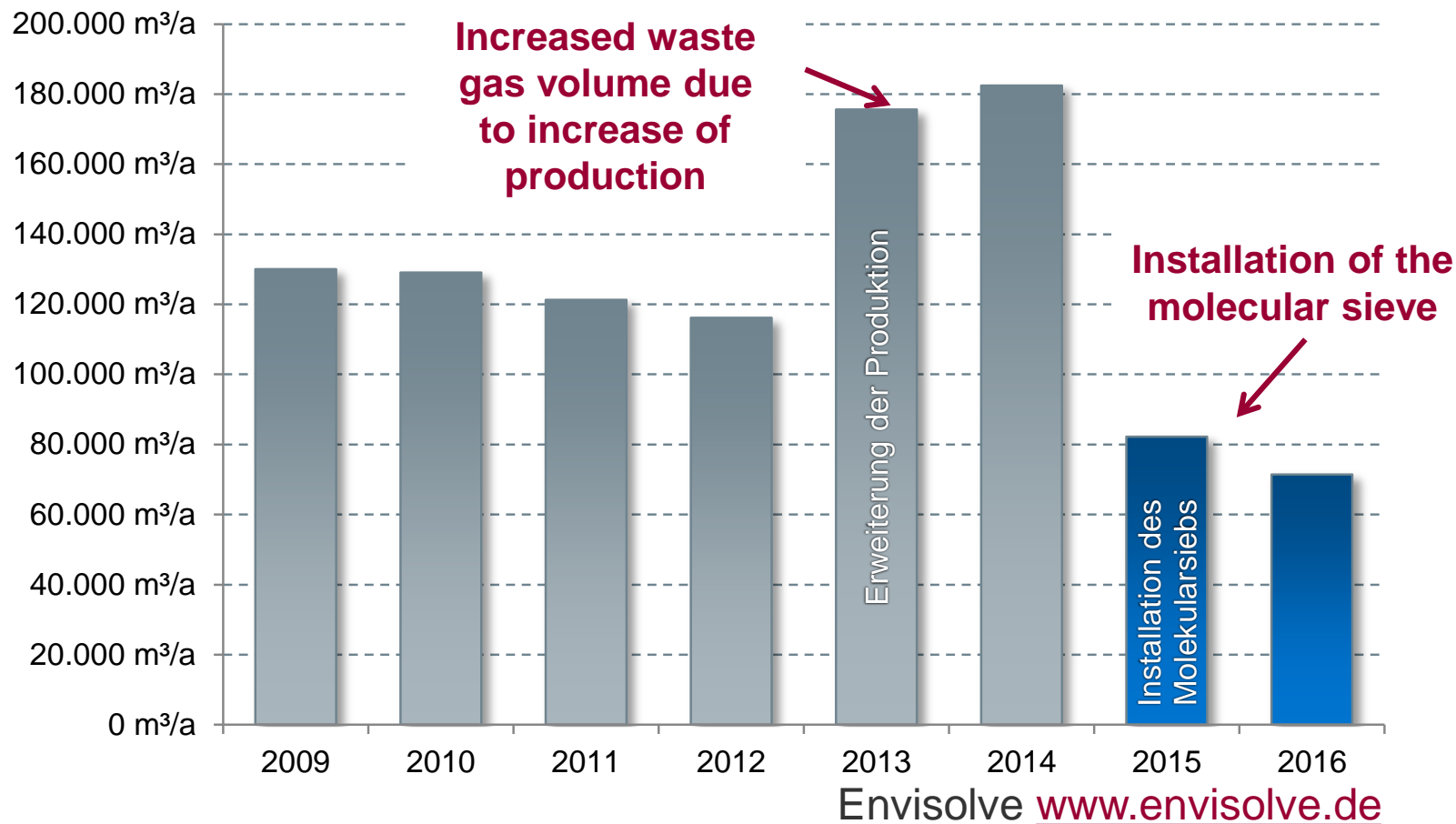
Envisolve [www.envisolve.de](http://www.envisolve.de)



Regenerative Thermal Oxidation (RTO)

# Efficient destruction: Molecular sieve before RTO

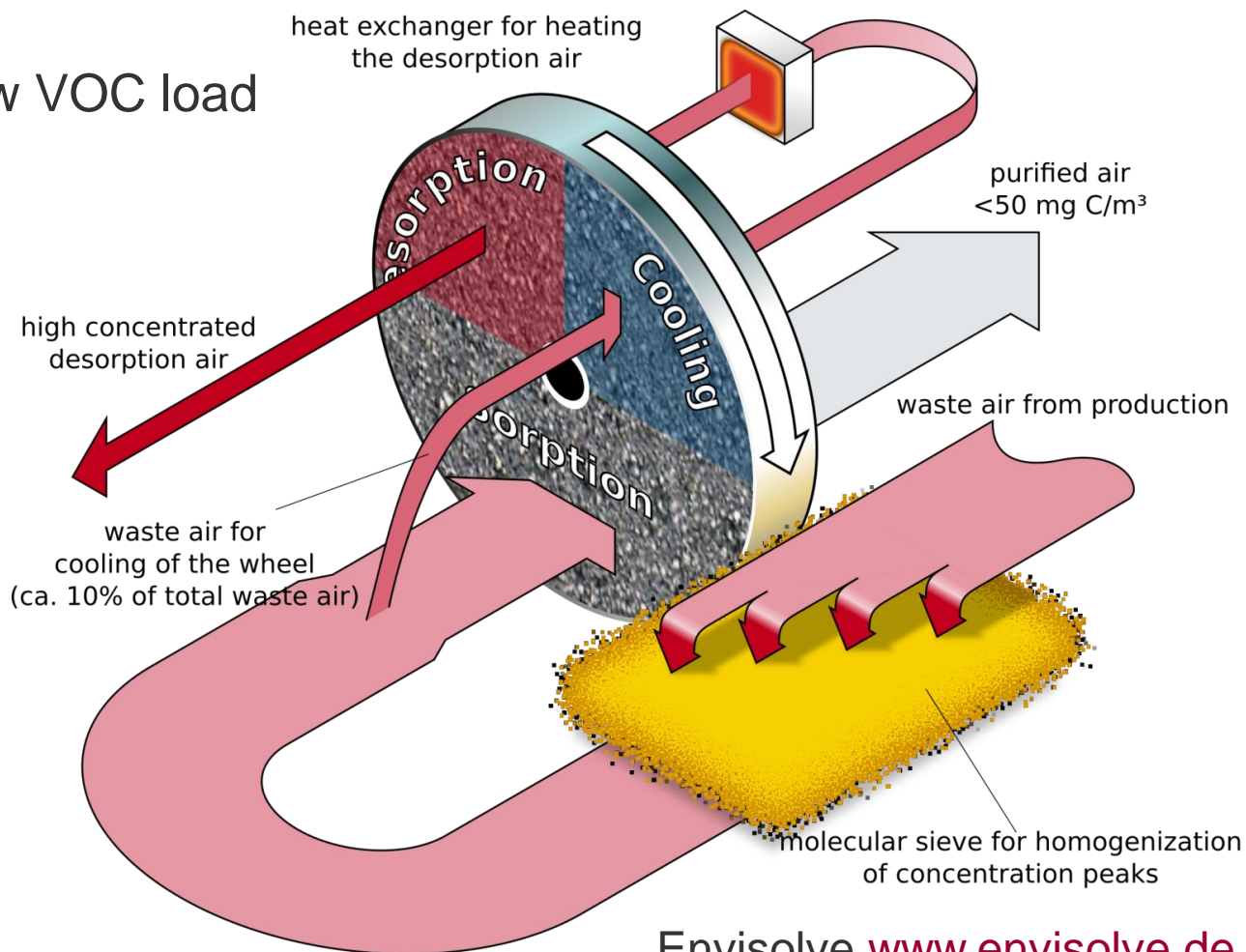
## Natural gas savings at a flexographic printing installation



# Efficient destruction: Mol. sieve and adsorption wheel

## Process principles

- ▶ Waste air with a low VOC load is adsorbed
- ▶ Purified air with  $< 50 \text{ mgC/m}^3$  emitted
- ▶ Desorption of concentrated waste gas
- ▶ Molecular sieve upstream for smoothing of emission peaks

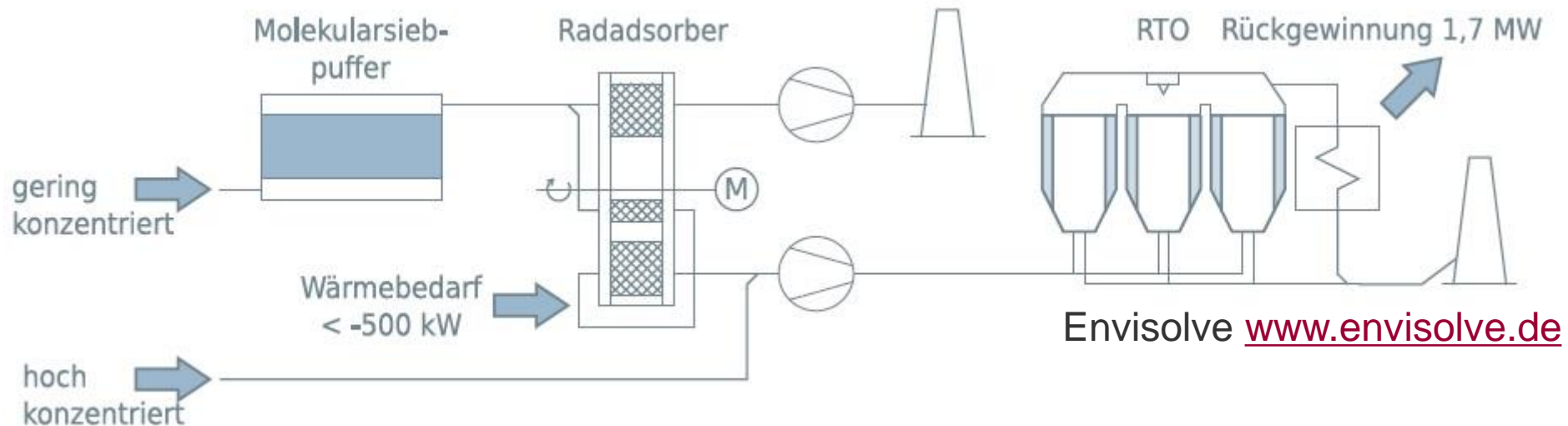


Envisolve [www.envisolve.de](http://www.envisolve.de)

# Efficient destruction: Molecular sieve and adsorption wheel before RTO

## Flexographic printing installation (Fa. Bischof & Klein/Konzell)

- ▶ Containment of VOC emission peaks, VOC concentration
- ▶ Efficiency increase of RTO, heat recovery from RTO



## Metal finishing (Fa. Stork/Dortmund)

- ▶ VOC emission homogenisation, Efficiency increase of RTO

# Efficient destruction: Molecular sieve, adsorption wheel, and CHP

## Metal finishing (Fa. EOT, DE/Lüdenscheid)

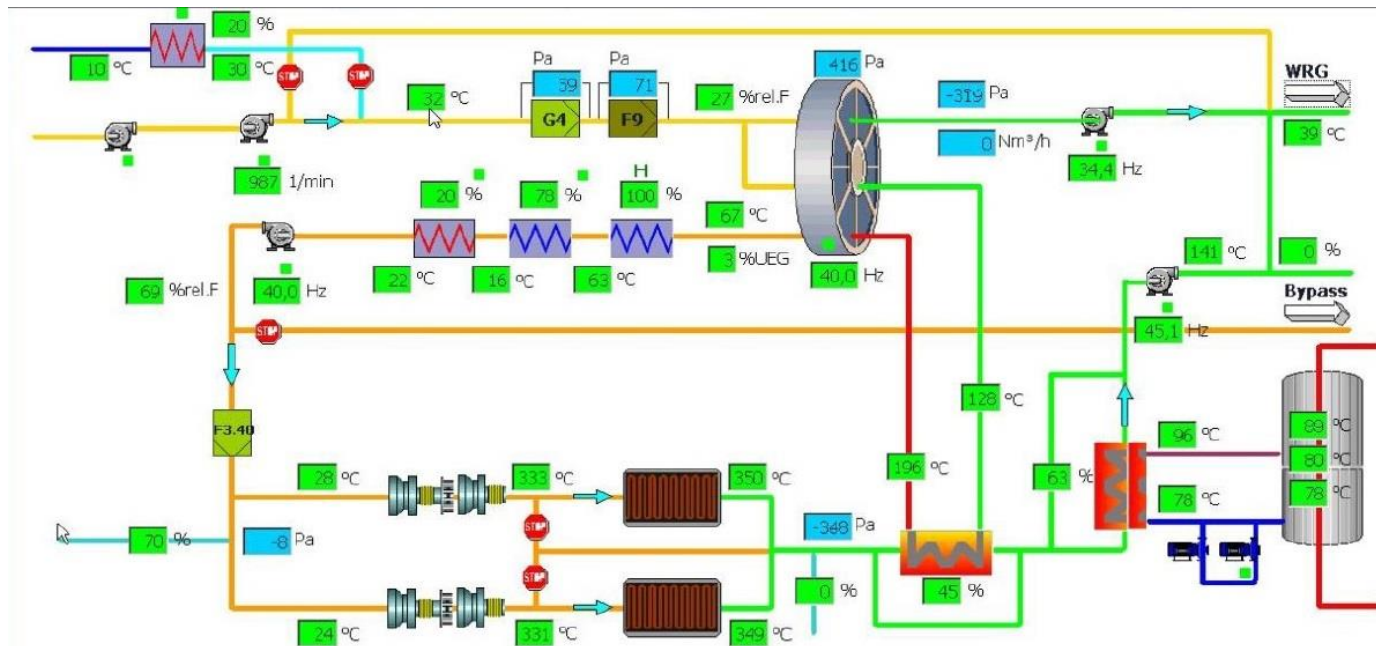
- ▶ Containment of VOC emission peaks, VOC concentration
- ▶ Use of VOC in two gas engines (CHP) - about 10 % share of fuel input
- ▶ Production of 1 MW heat, 800 kW electricity



# Efficient destruction: Molecular sieve, adsorption wheel, and CHP

## Manufacture of rubber components (Fa. Kächele, DE/Weilheim)

- ▶ VOC concentration
- ▶ Use of VOC in six microturbines (CHP)



E-quad Power Systems [www.microturbine.de](http://www.microturbine.de)

# Summary

Know your solvent input and output!

- ▶ Record them
- ▶ Plan improvements

Where possible, prevent and reduce emissions

- ▶ Test solvent-free systems
- ▶ Can you apply less coating layers?

Recovery

- ▶ Save resources, reduce waste

Efficient destruction

- ▶ Handle the lowest possible quantity
- ▶ Reduce VOC peaks, increase concentration
- ▶ Make use of VOC energy content!

# Many thanks for your attention

## Contact:

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