



## **Examples of optimizing operational costs and environmental footprints in E.ON's Gas Storages**

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**e-on**

# Agenda

Examples of optimizing operational costs and environmental footprint(s) in E.ON's Gas Storages

- 👣 **E.ON's vision and culture in the sense of „Environmental Footprint“**
- 👣 **Aspects of the „Environmental Footprint“**
- 👣 **Examples from E.ON Gas Storage GmbH, Germany**
  - Detecting CH<sub>4</sub> Emissions (Charm / GasCam)
  - Reducing CH<sub>4</sub> Emissions
  - Reduce NO<sub>x</sub> Emissions / React on IED Guideline (D → 13. BImSchV)
  - Reduce light emission
  - Reduce glycol injection for inhibition
  - Software to optimise compressor use
- 👣 **Summary**



# Agenda

Examples of optimizing operational costs and environmental footprint(s) in E.ON's Gas Storages

 **E.ON's vision and culture in the sense of „Environmental Footprint“**

 **Aspects of the „Environmental Footprint“**

Examples from E.ON Gas Storage GmbH, Germany

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Summary









# Reducing the Environmental footprint ...



E.ON's vision: *Improving people's lives*

→ that means for our Storage Business (examples):

-  **Protect people's home (the earth)**
-  **Treat unavoidable harming to it's lowest/best**
-  **Act sustainable**
-  **Act with best efforts**
-  **Use at minimum state of the art**
  - processes
  - technique / technology
  - materials / substances
-  **Live a process under DIN ISO 14.001**



**Major Guideline of E.ON Gas Storage:** *No action should be undertaken to the expence of saftey, people or environment*



The E.ON logo, consisting of the text 'e-on' in white lowercase letters on a red rectangular background.

# Environmental footprint → Issues/Aspects



**Equipment**

- ... in normal mode
- ... in failing situation



**Behavior**

- controlable / planable
- not controlable / planable



**Utilisation**



**Operation**

- ... in normal mode
- ... in failing situation



**Material / Substances used**



**Emissions**

- CH<sub>4</sub>
- CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, ...
- Oil, glykol
- Reservoir / disposal water
- Light
- Noise, Vibration
- Temperature



**Process / Treatment**

# Environmental footprint → Issues/Aspects



We always have to differentiate:



Issue X, Y, Z

... in normal operation mode

... in failing or emergency situation

However, we try to always act „cleaner and better“

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# Reducing the Environmental footprint ...

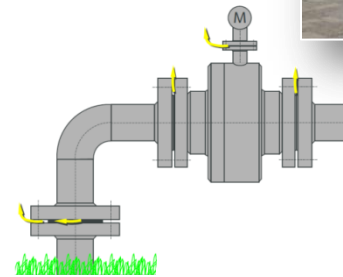
Example 1



Detecting CH<sub>4</sub>-Emissions → Goal: Find them!



CH<sub>4</sub> is a 25 times more „efficient” greenhouse Gas – we try to find the not wanted emission in whatever kind of micro leak.





# Reducing the Environmental footprint ...

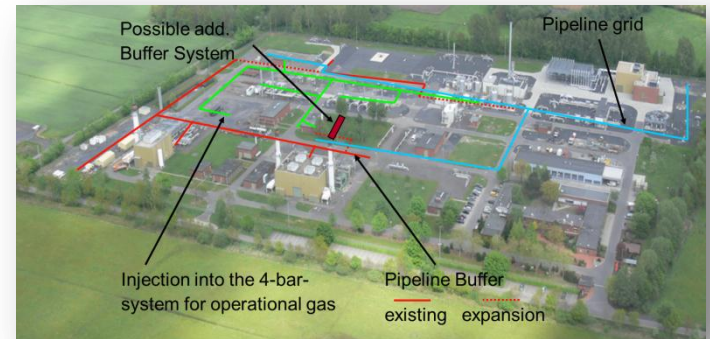
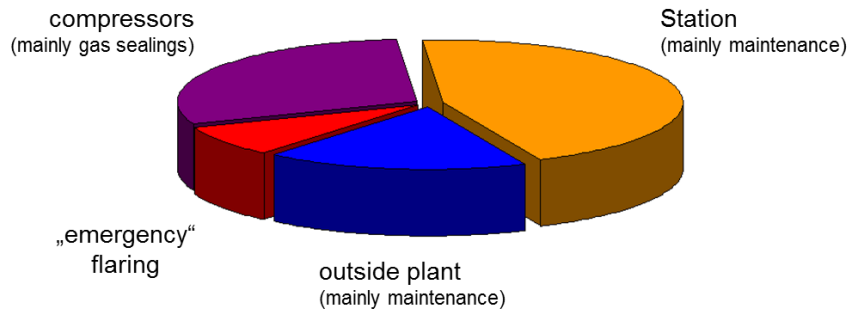
Example 1






## Examinations on CH<sub>4</sub>-Emissions → Goal: Reduction!

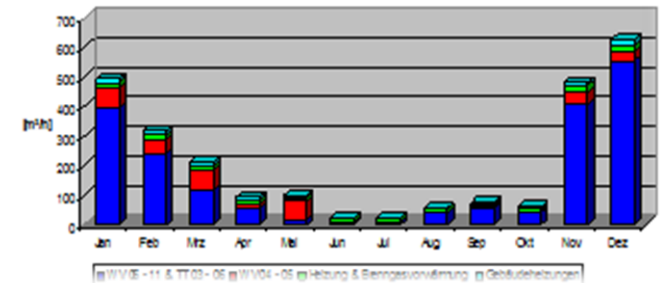
Epe, Multi-Cavern Storage 1,6 x 10<sup>9</sup> m<sup>3</sup> WGV

Estimated methane losses, average 2007-2011



-  Try to use an amount of the gas
-  Safety first !
-  Work over maintenance plan / reconsider plant design (e.g. degassing sections, flares) / find „leaks“

Plant demand over the year



Note: „emergency“ flaring covers all situations, where the rescue chain has been active, not only emergencies

# Reducing the Environmental footprint ...

## Example 1



## Reduce CH<sub>4</sub>-emissions in operations, e.g. station blowdowns

### Planned



→ As long as feasible

- we try to minimize the amount of emissions by plant design / operational planning
- use the gas where possible
- store the gas, where possible
- flare the gas (CO<sub>2</sub> is less harmful rather than CH<sub>4</sub>)



Etze ESE:  
Cold flare (L)  
Warm flare (R)

### Unplanned



(Safety / Emergency ShutDowns)

→ **Safety first ! ... Cold flare is necessary**

Plant design (e.g. degasing sections) and software help to minimize the volumes flared cold.

# Reducing the Environmental footprint ...

## Example 2

### Redesign of Machine 03 / 04 @ Epe Gas Storage



#### Business case:

- a) IED Guideline →  $\text{NO}_x < 75 \text{ mg/m}^3$  as of 10/2015
- b) All compr. needed

#### Technical data:

- Unit 3: 4,4 MW – Turbine + Recip. Compr., 1989
- Unit 4: 4,4 MW – Turbine + Recip. Compr., 1989
- (Unit 5: 10 MW – Turbine + Turbo Compr., 1992)

#### Emmissions before redesign:

Unit 3 / 4:  $\text{NO}_x = 300 \text{ mg/m}^3$

# Reducing the Environmental footprint ...

## Example 2

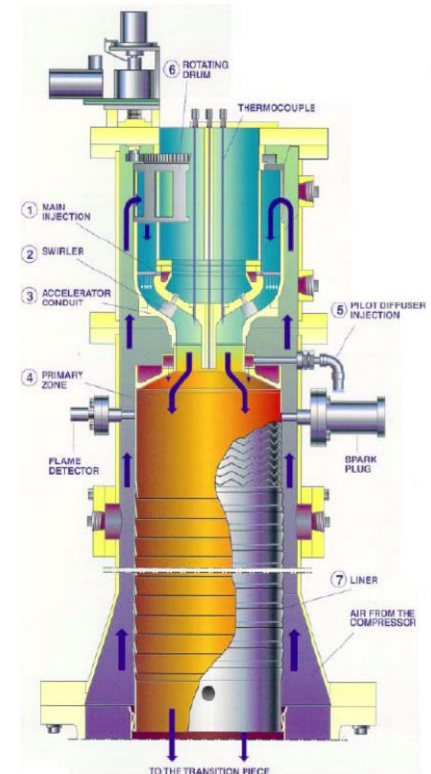


### Redesign of Machine 03 / 04 @ Epe Gas Storage

#### Project scope

- a) Exchange combustion chamber
- b) Redesign of exhaust system
- c) Adopt the fuel gas system (higher pressure of 15bar)  
→ some chain reaction on site installation
- d) New Instrumentation / ELT
- e) Installation
- f) Commissioning / Testphase

→ CAPEX: some 10 Mio.€



		2011				2012				2013				2014				2015				Q1	C
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
VK03	Projektzulassung																						
	Projektvorlauf																						
	Bestellung 30.03.2012)																						
	Lieferzeit GE Nuovo Pignone																						
	Lieferung DLE (16.09.2013)																						
DLN Umbau & Inbetriebnahme																							
Maschine bereit für Einspeicherperiode																							
Betriebserfahrungen																							
VK04	Lieferzeit GE Nuovo Pignone																						
	Lieferung DLE (14.09.2015)																						
	DLN Umbau & Inbetriebnahme																						
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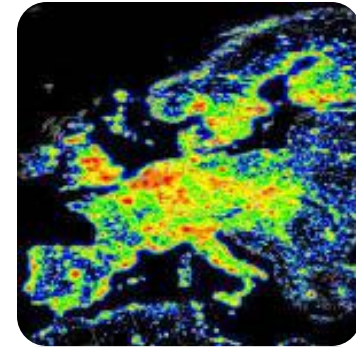
# Reducing the Environmental footprint ...

## Example 3



### Green light technology, Epe / Etzel

- Light is needed ... when and where it's needed!
- Light is energy
- Light is a pollutant as well - Light emission harms
  - Reduce „Lights-On“ duration
  - Light only, where light is needed
  - lower mounted lights
- Actions undertaken:
  - Limit light to the necessary amount
  - Optimize light-colour / frequency



**EGS likes to use „clear sky green light“**

(less UV, less red, 400-600nm, color detection possible)





# Reducing the Environmental footprint ...

## Example 3



### Green light technology, Epe / Etzel

Actions undertaken:

- Limit light to the necessary amount  
(switched sectionwise, reduce amount )
- Optimize light-colour / frequency
- reduce height of lamps
- **EGS likes to use „clear sky green light“ (CSG-Light)**

Note:  
CSG-Light is a trademark of  
IMT GmbH, Steinfurt Germany



PIC's compare CSG-Light with Hg & Na-Lamps



# Reducing the Environmental footprint ...

## Example 4



### CEP-Software to optimise compressor utilisation ...

The best Emission is the avoided one !

- avoid emission, if feasible
- reduce emission perhaps by not operating with heat-up-cool-down-circels
- Optimise planning
- Aggregate and balance the gasflows
- Find solutions against the stock oriented driving style
- Run facilities stady state (smoother, more planned and predictable)
- Use the right storage for the needed purpose
- Use the right machine on site if possible to choose
- Do not compress gas, wich is not needed (loop operation, e.g. due to min flow)

**EGS-example:** Software  **CEP**  
Compressor Energy Prognosis  
to predict the best utilisation of compressors on site.



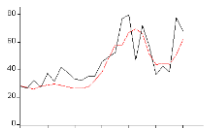


# Reducing the Environmental footprint ...

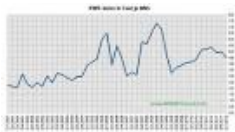
## Example 4



### CEP-Software to optimise compressor utilisation ...



Schedule next day



Fuel price ELT / GAS



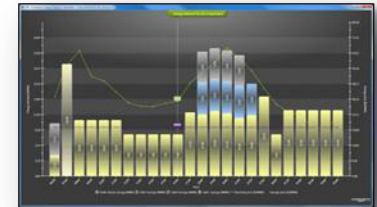
Maintenance / Availability



Machine data



**CEP**  
Compressor  
Energy Prognosis



- Operational schedule (which compressor at what time)
- Cost forecast
- Efficiency report
- Advice for expansion projects

# Reducing the Environmental footprint ...

## Example 5



### Reducing Glycol-Injection for inhibition in Epe

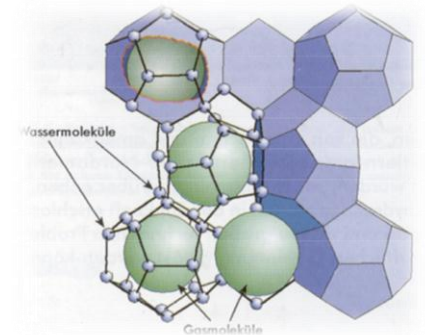
Environmental footprint is a relative of operational costs.

**Situation:** To prevent hydrates to be formed in early stages on withdrawl we inject glycol into the wellhead (by experience)

**Task:** Reduction possible?

**Idea:**

- 1) measure continuously  $\Delta p$  at the reduction valve
- 2) When  $\Delta p$  rises, inject glycol for a short time
- 3) observe  $\Delta p$  and stop injection when  $\Delta p$  drops



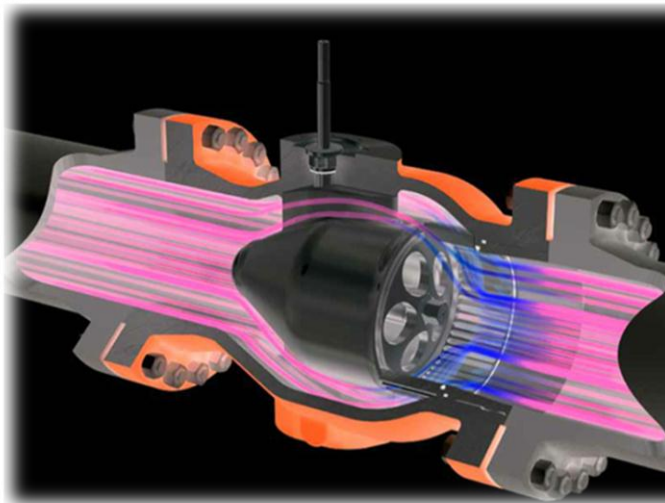
# Reducing the Environmental footprint ...

Example 5



## Reducing Glycol-Injection for inhibition in Epe

reduction valve



Injection device

(injects glycol mid stream)

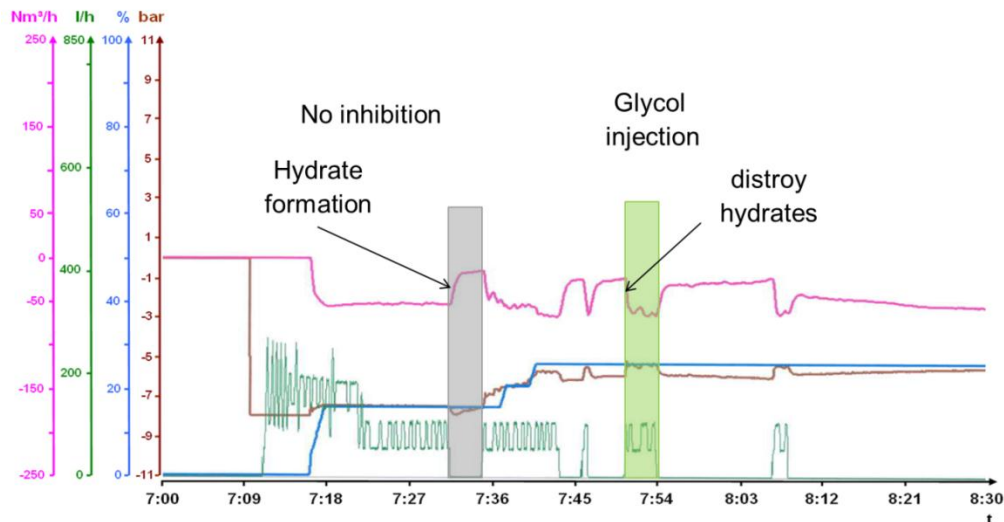


# Reducing the Environmental footprint ...

## Example 5



### Reducing Glycol-Injection for inhibition in Epe



Results in Epe S27:      Reduction of some 81% glycol use  
(need of glycol at one cavern before: 5.000 kg/a)  
→ 150T€ p.a. less costs (2 yrs. of amortisation)  
→ and an environmental benefit

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## Summary



# Reducing the Environmental footprint ...

## Summary



-  **Equipment** ————— We act in line with all permissions, regulations and laws  
As long as projects will meet hurdle rates we'll additionally optimize our assets and try to achieve „better than state of the art“
-  **Behavior** ————— EGS maintains a culture  
The market and unbundled companies don't behave like that 
-  **Material / Substances used** — Every critical substance is checked on alternatives.  
In use it is documented and protection measures are in place
-  **Process / Treatment** ————— EGS is always trying to optimize it's process (DIN ISO 14.001)
-  **Operation** ————— Operation is enforced by nominations in separated storages with no connection → many chances not feasible today  
-  **Emissions** ————— Whenever we can reduce or treat them ... we'll try.
-  **Utilisation** ————— Storage in the unbundled world is disarmed to use this very efficient lever !   

# Reducing the Environmental footprint ...

Examples from E.ON Gas Storage GmbH, Germany



**We'll never get it 100%**





# Reducing the Environmental footprint ...

Examples from E.ON Gas Storage GmbH, Germany



... but „cleaner and better“ © E.ON 2014

# Reducing the Environmental footprint ...

Examples from E.ON Gas Storage GmbH, Germany



**Danke für Ihre Aufmerksamkeit!**  
**Thank you for your attention!**

# Reducing the Environmental footprint ...

Examples from E.ON Gas Storage GmbH, Germany



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**... any questions?**