FLSmidth Offerings in Power

- Fabric Filters
- Coromax™ power supply for ESP
- Dry Sorbent Injection (lime, sodium bicarbonate, activated carbon)
- Dry Scrubber (CDS, SDA)
  Material handling
- Ash Handling
  - Fly Ash
  - Bottom Ash wet/dry
  - Bed Ash
- Reagent handling (WFGD, CFB)
  - Limestone milling and slurry preparation
  - Gypsum Dewatering
Regulations overview

- Emission of **particulate** matter needs to be reduced
- Emission of **gaseous** pollutants – incl. **new components** – are getting regulated

- **Efficient** removal of gaseous pollutants like:
  - \( \text{NO}_x \)
  - \( \text{NH}_3 \)
  - VOCs
  - Dioxins/Furans
  - and PM

  call for **all-in-one catalytic technology!**
CataMax™ cleaning principle

Hollow candle made of porous high temperature resistant material with embedded catalyst

Clean gas

Raw gas with dust and pollutants

Cleaning of ceramic element

HAP
CO₂
NH₃
N₂
NOₓ
O₂
Dust

Catalyst

CO₂
N₂
O₂
H₂O
Combining proven technologies

- FLSmidth has a huge reference base of **fabric filters**, knowledge of **filter bag** manufacturing and **process integration technology** for more than 50 years

+  
- The **catalysts** used have proved long term performance for many years in utilities

=  
- Exceptional resistance to **catalyst poisoning** thanks to no contact between catalyst and potentially harmful particles
- Long **bag life** due to optimized distribution of gas and dust
- Minimized **bag wear** due to design of star cage and bag fabrication
CataFlex™ Catalytic Filter Bags

The two Danish companies FLSmidth and Haldor Topsøe (specialist in catalysis and surface science) have joined forces and developed a patent pending product securing compliance with the strictest gaseous emission regulations as well as the PM requirements.
CataFlex™ cleaning principle

Raw gas side

- HAP*
- CO₂
- NH₃
- N₂
- NO₃
- O₂
- CO
- Dust

Clean gas side

- CO₂
- N₂
- O₂
- H₂O

3 layers woven glass bags with embedded catalyst. One with e-PTFE membrane

Raw gas with dust and pollutants

Cleaned gas pass CataFlex filter bag

Dust is collected on the surface
Pollutants removal by catalytic reaction

* Organic HAP includes formaldehyde, benzene, toluene, styrene, xylene (m-, p-, o-), acetaldehyde and naphtalene.
CataFlex™ NO\textsubscript{x}/VOC/o-HAP/CO\textsuperscript{*} removal

- High removal of NO\textsubscript{x} combined with low NH\textsubscript{3} slip
- High VOC (o-HAPs) removal

*CO optional depending on catalyst formulation
Integration of CataFlex™ in your plant

- There are various possibilities to implement a CataFlex™ Catalytic Fabric Filter (CFF)

- A **new** CataFlex™ CFF includes all the FLSmidth fabric filter know-how, features and proven technology (e.g., online maintenance)

- **ESP to** CataFlex™ CFF conversion uses same principle as ESP to FF conversions

- Existing FFs can be **upgraded to** CataFlex™ CFF with FLSmidth unique gas distribution screens, online cleaning features etc. securing optimum operation
Testing on site - 1

- Pilot test
- NH$_3$ injection is possible
- Possibility for varying of process conditions (temperature, flow rate etc.)
Testing on site - 2

- Partial replacement of bags

- NH$_3$ injection is not possible however a deNO$_x$ effect is observed when NH$_3$ is present in the flue gasses
## Facts and figures

### CataMax™

**References as per July ‘16:**
- 1 full scale project under execution
- 4 slipstream tests

- **Continuous temp.:** 680 °F
- **Peak temp.:** up to 750 °F
- **Filter ΔP range:** 9 – 13 inWG

- **Length of elements:**
  - Today: 10 ft (3 m)
  - Future: extended length

### CataFlex™

**References per July ‘16**
- Partial bag replacement testing
- Full scale testing

- **Continuous temp.:** 480 °F
- **Peak temp.:** up to 500 °F
- **Filter ΔP range:** 6 – 8 inWG

- **Length of bags:**
  - Today: 33 ft (10 m) (as conventional bags)
Conclusion

- FLSmidth has extended process experience and know-how within air pollution control and adapting to plant specific needs
- CataFlex™ and CataMax™ are technologies developed ensuring a unique single-step approach for multi-pollution control
- Securing compliance with the strictest emission requirements for NO$_x$, NH$_3$, VOC, D/F and PM
- We are looking forward to making YOU ready for meeting future requirements

...thank you for your attention