



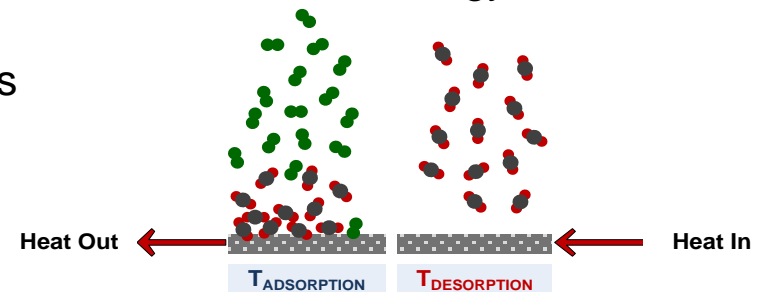
Development of Next Generation Technology for Carbon Capture from CCGT Power Stations

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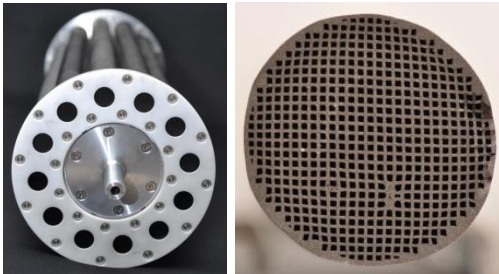
Project Background

- This project has been commissioned and funded by the Energy Technologies Institute
- Develop and prove Next Generation CCS technology for application on CCGT plant
 - Potential to make a substantial reduction in Capital and Operating costs
 - Readiness to catch the wave of CCS implementation in CCGT's expected 2020s
- Consortium brings together 4 international engineering companies
 - Inventys Thermal Technologies Process inventors and adsorption specialists
 - Howden Group Manufacturer of rotary regenerative heaters
 - Doosan Power Systems Experienced EPC contractor & system integrator
 - MAST Carbon International Developer of innovative activated carbon material
- Process is based on using Inventys' patented Veloxotherm™ technology
 - A fast Thermal Swing Adsorption process
 - Incorporated in a rotating embodiment
 - ➔ Rotary Adsorption Machine
- Phase 1 : 12 month, laboratory-based project at Inventys' facility in Vancouver
- Contract signed mid August 2012



Project Progress

- Performance testing of activated carbon sorbent structures is ongoing using a twin, fixed-bed Veloxotherm™ test station (VTS)
- Appropriate adsorption characteristics, chemical and mechanical properties are being demonstrated.
- Test data has confirmed the predictive capabilities of Inventys' process models.
- Process data provided to Doosan and Howden allowing preliminary specification and design of a full scale installation for a 900MW CCGT plant



- Test work is presently moving on to a small, 12-bed rotating Process Demonstration Unit (PDU)

- Sufficient sorbent structures need to be manufactured to fill an annulus in the larger, V-100 Rotary Adsorption Machine (RAM) designed and manufactured by Howden
- In collaboration, Howden and Inventys are designing alternative rotor sealing systems which will be tested and compared in the RAM in the near future.



Future Activities

- Further testing is to be completed on both the VTS and the PDU
- Alternative sealing systems on the RAM are to be fully commissioned and compared before selecting the preferred design
- The final inlet arrangements on the RAM will be modified to suit the optimised Veloxotherm™ process flow distribution
- Doosan will complete the process integration work for full scale plant based on Inventys' process data validated by the VTS and PDU tests
- Inventys are to update the Techno Economic Analysis for the full scale CCGT plant that was completed before the project award
- Doosan are leading the consortium in developing a commercialisation plan for the process in the UK and Europe
- Once sufficient sorbent structures have been manufactured and delivered, they will be installed in the RAM
- Final test work is to be completed on the RAM using simulated flue gas verifying first step up in scale from bench-top to prototype plant
- Preparation and submission of proposal for Phase 2 of the project
 - 5 MWe stand alone demonstration plant



Engagement with CCS Community

- Inventys commenced engagement with the CCS community on the Veloxotherm™ process in Canada and elsewhere by the publication of various short articles on the process
- ETI NGCT2 Project launch mid Sep 2013 by UK Secretary of State for Energy – Ed Davey
- APGTF presentation is the first step in the process of engagement with the CCS community on the application of this process to CCGT plant
- Appropriate and timely steps of engagement during project progression to maintain interest
 - Subsequently evolving and embodied into a formal communication plan
- Embrace potential partners for Phase 2 : pilot scale demonstration
- Promote: -
 - Achievements
 - Potential
 - Benefits
 - Reduced costs and ground space
 - Speed of “Roll-Out”



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