Alstom – Datang Co-operation on CCS

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20/02/2012



Three main activities in 4 sectors*

Equipment & services for power generation

Alstom Thermal Power



Alstom Renewable Power



Equipment & services for rail transport Alstom Transport



Equipment & services for power transmission Alstom Grid

Sales Outcomes

92,500 employees worldwide in around 100 countries

ALSTOM

Alstom's Clean Power Strategy

Alstom is the world leader in clean integrated solutions

Power Present in all markets

Technologies adapted to all major energy sources

Gas

Hydro

Solar

Coal

Nuclear (Conventional island)

Geothermal

Oil

Wind

Biomass

One quarter of the world's power fleet relies on Alstom technology

Alstom, a global leader in power generation

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Alstom's CCS Technology development

Optimized process and thermal integration with the base installation.

Alstom activity on demonstrations 1st and 2nd Generation CCS

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Tests complete

AEP Mountaineer US - 58 MWth Chilled Ammonia, coal

US -2 MWth Adv. Amines - coal

Vattenfall Schwarze-Pumpe Germany-30 MWth Oxy - Lignite

Alstom Labs Växjö Sweden – 0.25 MWth Post C. - multi purpose

Operating

Total Lacq France - 30 MWth Oxy - Gas

Alstom BSF Windsor US - 15 MWth Oxy - coals

Large-scale projects-under development

PGE Belchatow Poland - 260 MWe

UK oxy CCS demo (Drax) ÚK - 426 MWe Oxy - coal

Getica - CET Turceni Roumania - >250MWe Chilled ammonia - Lignite

NER300: Applied for EU ETS New Entrant Reserve funding

Selected for receiving EEPR funding

Datang-China

Oxy 350 MWe lignite,

Post 350 MWe eq. coal

EoN Karlshamn Sweden - 5 MWth US - 5 MWth Chilled Ammonia-Fuel oil Chilled Ammonia. Coal

Under construction

TCM Mongstad Norway - 40 MWth Chilled Ammonia - Gas Adv. Amines - Coal

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EDF – Le Havre France - 5 MWth

RFCS EU -Darmstadt DOE/Alstom Windsor US - 3 MWth Germany -1 MWth Chemical looping - coal Chemical looping - coal

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CCS China – Key Events

- December 2010: Establishment of CCS Sales and Marketing Team in Beijing
- May 2011: Met with Datang to discuss cooperation on CCS DEMO project

June 14th 2011: NDA signed with Datang

- July 5^{th-}7th: Oxy fuel technology FS work scope workshop held in Beijing
- July 22nd: CO2 geological storage workshop between Datang and Wuhan Rock and Soil Institute of CAS held in Beijing
- July 27th: Met with ADB and Datang to discuss possible funding support

Sep. 21st 2011: Deputy CEO signed MoU with Mr. Wang Sen (VP of Datang group) during CSLF meeting in Beijing

- Oct.11th-12th, FS Technical Clarification meeting with Daqing power plant and NEPDI
- Nov 7th 2011: Feasibility Study Agreement signed with Datang's Heilongjiang Branch for Daging CCS DEMO Project during NKM visit Beijing
- January 2012: Funding application to GCCSI to support feasibility study

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CCS Cooperation with Datang: CSLF 21/09/11

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MOU Fundamentals

- Alstom cooperates with Datang on two possible demo projects
 - Daqing 350MWe+th Project
 - Dongying 1000MWe Project
- Work Scope for Daging
 - Alstom: Supply relevant Oxyfuel technology and equipment
 - Datang: Lead project development and implementation, including CO2 Transport and Storage

Three Phases

- Feasibility Study Phase: basis of FID
- Project Implementation Phase
- Optimization and Testing Phase
- Organization

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- Joint Steering Committee to meet every six months to review project progress
- Joint Working Team to meet every two months to discuss project status

Datang CCS DEMO Projects

ALST<mark>O</mark>M

Daqing 350MWe+th Project

- •Full size Oxy-fuel combustion CO2 capture
- •Cogeneration of Heat and Power based on Super Critical boiler using lignite
- •Location: Daqing, Heilongjiang province
- •EOR and CO2 storage: adjacent to PetroChina's Daqing oil field for EOR, near Songliao basin for geological sequestration

Dongying 1000MWe Project

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- •Partial flue gas stream slip to Post-combustion CO2 capture
- •Ultra Super Critical boiler using bituminous or subbituminous coal
- •Location: Dongying, Shangdong province
- •EOR: very close to Sinopec's Shengli oil field for EOR

Daqing DEMO Project Feasibility Study ALSTOM

- Alstom provides FS of Whole Oxy Boiler Island by end of March 2012
- NEPDI integrates Alstom's FS to Daqing's Power Plant FS
- Datang subcontracts Wuhan Rock & Soil for CO2 storage PFS and Petrochina's drilling institute for CO2 storage FS. Alstom assits Datang when required.

Cérémonie de signature de l'Accord sur l'Etude de Faisabilité du projet de démonstration de CSC Oxy-Combustion de Datang Daqing 大唐大庆富氧燃烧CCS示范项目可行性研究协议

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Daqing Demo Project Timeline

	Expected Road	d Project Pass 2012		•Datang to make FID after FEED •Require NDRC approval	
Pre FS / FS Phase		Implementation Phase		Optimization and Testing Phase	
Capture FS (Nov to Mar)		F	EED / Execution	Operations	
Storage PFS	FS	FI	EED / Execution	Operations	

Anticipated Project Interface

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Chinese Govt.'s Policy to CCS

- Funding Support from Developed Country to Developing Country
- Technology Transfer from Developed Country to Developing Country
- Support Large-Scale Demo Project during the 12th 5 year plan
- CCUS CO2 Utilization must be included

Key Success Factors

- Cost effective CO2 capture technology
- Reliable and cost effective CO2 Storage
- Outside funding for project execution
- Special power tariff/ EOR or other utilisation schemes
- MOST endorsement of CCS capture technology and storage technology
- NDRC approval of project execution

Government Authorities

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Questions?

