

# Alstom CCS Status & Projects around the World

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CFFS Forum, Abu Dhabi, January 21<sup>st</sup> 2010

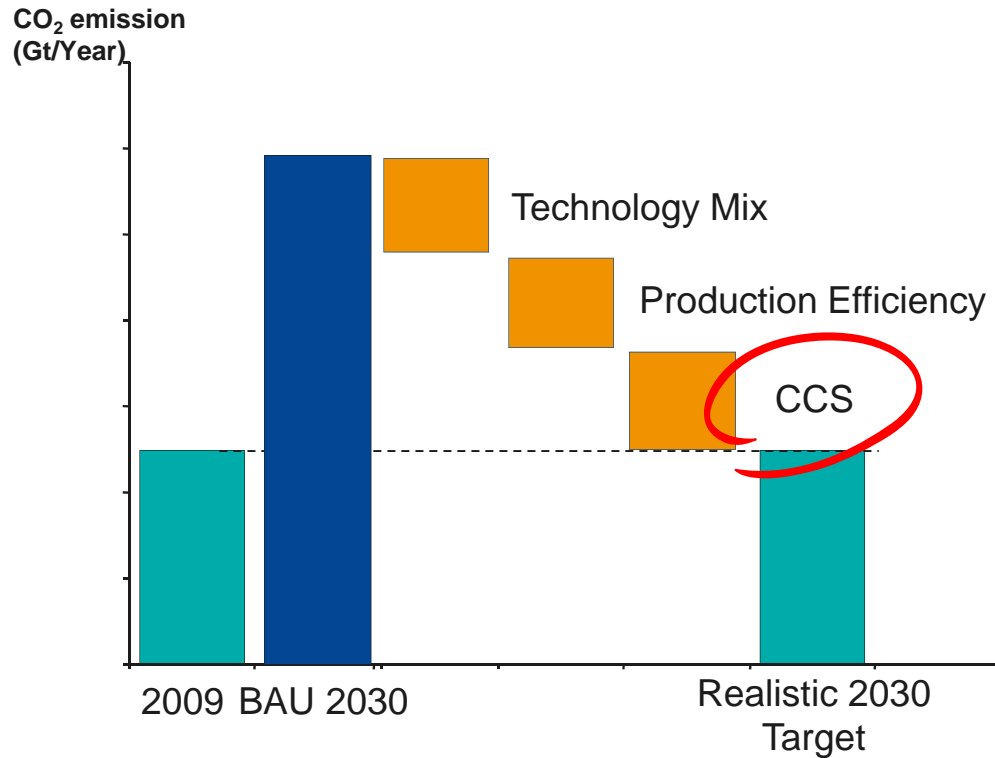
POWER







**ALSTOM**

# Alstom's Clean Power answer



## Power sector-related CO2 emissions



		N° 1 hydro Tidal
		Wind and geothermal
		N° 1 nuclear (conventional islands) & biomass
		Efficiency: Plant optimisation & retrofit
		First CO <sub>2</sub> capture demo plant in the world

Alstom offers a portfolio of solutions

# Status of CCS development

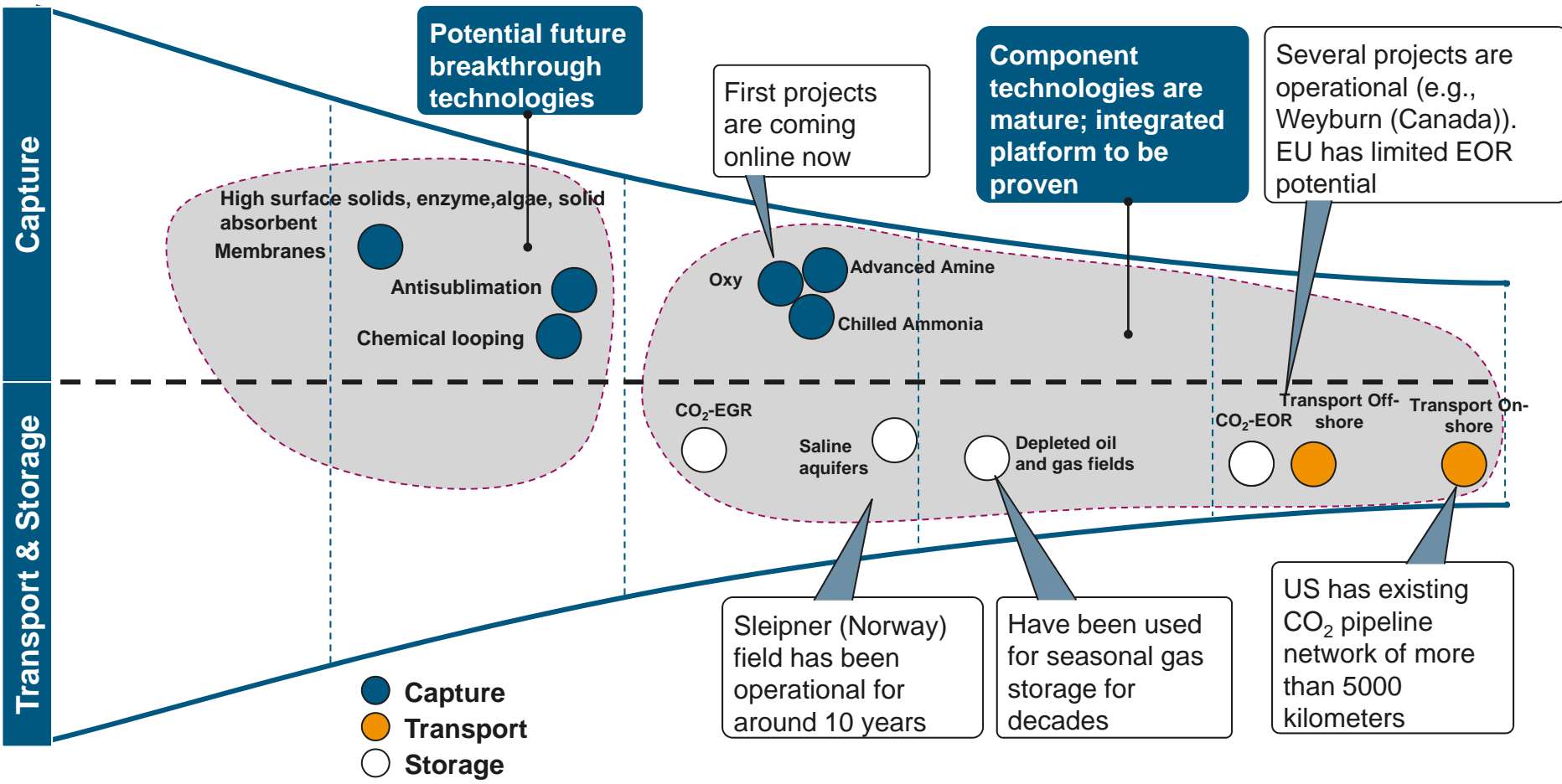
Concept

Lab testing

Demonstration

Commercial refinements needed

Commercial



## Power Plant with CO<sub>2</sub> capture

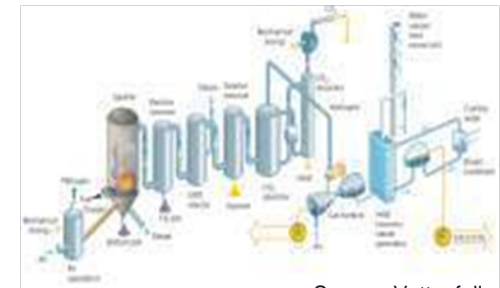
Post-combustion  
(New + retrofit)



Oxy-combustion  
(New + retrofit)



Pre-combustion  
(New only)



Source: Vattenfall

Solutions developed by Alstom

## CCS must be also applied to the installed base

# Alstom activity on CO2 capture

## Advanced Amines



**Dow Chemical Co.**  
USA, West Virginia



**PGE Belchatow**  
Poland



**Archer Daniels Midland**  
USA, Illinois



**Industrial Pilot**  
5MWth

 **Invited by the Commission to negotiate award agreements for EEPR funding**

### Status

- Tests **finished** at **University of Texas** (~0.5MWth, US)
- **Currently tested** at **Dow Charleston** (~2.0MWth, US)
- **Coming soon:**
  - **Industrial Pilot** (5MWth) in preparation
  - **Belchatow** (260MWe, Poland), to start in end 2014/early 2015
  - **ADM Decatur** (0.7Mt/y,US) recently selected for phase I of selection process by DOE

**Alstom large-scale projects selected for funding  
Advanced Amines expected commercialisation: 2015**

# Alstom activity on CO2 capture

## Chilled Ammonia



### Status



**We Energies Pleasant Prairie**  
USA - 5 MWth



**EoN Karlshamn**  
Sweden - 5 MWth

- Tests finished at **Pleasant Prairie** (5MWth, US)
- **Currently tested in**
  - **Karlshamn** (5MWth, Sweden)
  - **Mountaineer** (58MWth, US) just inaugurated



**AEP Mountaineer**  
USA - 58 MWth



**Statoil Mongstad**  
Norway - 40 MWth

- **Coming soon:**
  - **Mongstad** (40MWth, Norway) to start in 2015
  - **Transalta** (>200MWe, Canada), selected for Canadian funding, to start in 2015
  - **Mountaineer** (235MWe, US) with AEP selected for US DOE funding, to start in 2015



**Transalta**  
Canada - >200 MWe



**AEP Mountaineer**  
USA - 235MWe



Selected by Alberta CCS fund and the Canada Clean Energy Fund and ecoENERGY Technology Initiative



Selected by US DOE to receive CCPI Round 3 funding

# Alstom activity on CO2 capture

## Oxy-Combustion



Just inaugurated!



**Total Lacq**  
France - 30 MWth



**Vattenfall Schwarze Pumpe**  
Germany - 30 MWth



**Alstom BSF Windsor**  
US - 15 MWth



**Vattenfall Jämschwalde**  
Germany - 250 MWe

### Status

- **Currently tested at**
  - **Schwarze Pumpe** (30MWth, Germany)
  - **Alstom Boiler Simulation Facility Windsor** (15MWth, US)
  - **Lacq** (30MWth, France)
- **Coming soon:**
  - **Jämschwalde** (250MWe, Germany), pre-selected by EU Commission, to potentially start in 2015  
Alstom did the feasibility study

 **Invited by the Commission to negotiate award agreements for EPR funding**

# Alstom activity on 12 major demonstrations



## Operating



**Vattenfall Schwarze Pumpe**  
Germany - 30 MWth  
Oxy - Lignite



**AEP Mountaineer**  
USA - 58 MWth  
Chilled Ammonia - Coal



**EoN Karlshamn**  
Sweden - 5 MWth  
Chilled Ammonia - Fuel



**Total Lacq**  
France - 30 MWth  
Oxy - Gas



**Dow Chemical Co.**  
USA, West Virginia  
Advanced Amines - Coal



**Alstom BSF Windsor**  
US - 15 MWth  
Oxy - Coals

## Coming



**PGE Belchatow**  
Poland - 260 MWe  
Adv. Amines - Lignite



**Vattenfall Jämschwale**  
Germany - 250 MWe  
Oxy - Lignite



**Statoil Mongstad**  
Norway - 40 MWth  
Chilled Ammonia - Gas



**Transalta**  
Canada - >200 MWe  
Chilled Ammonia - Coal



**Archer Daniels Midland**  
USA, Illinois  
Advanced Amines - Coal



**AEP Mountaineer**  
USA - 235MWe  
Chilled Ammonia - Coal



Selected for receiving EEPR funding

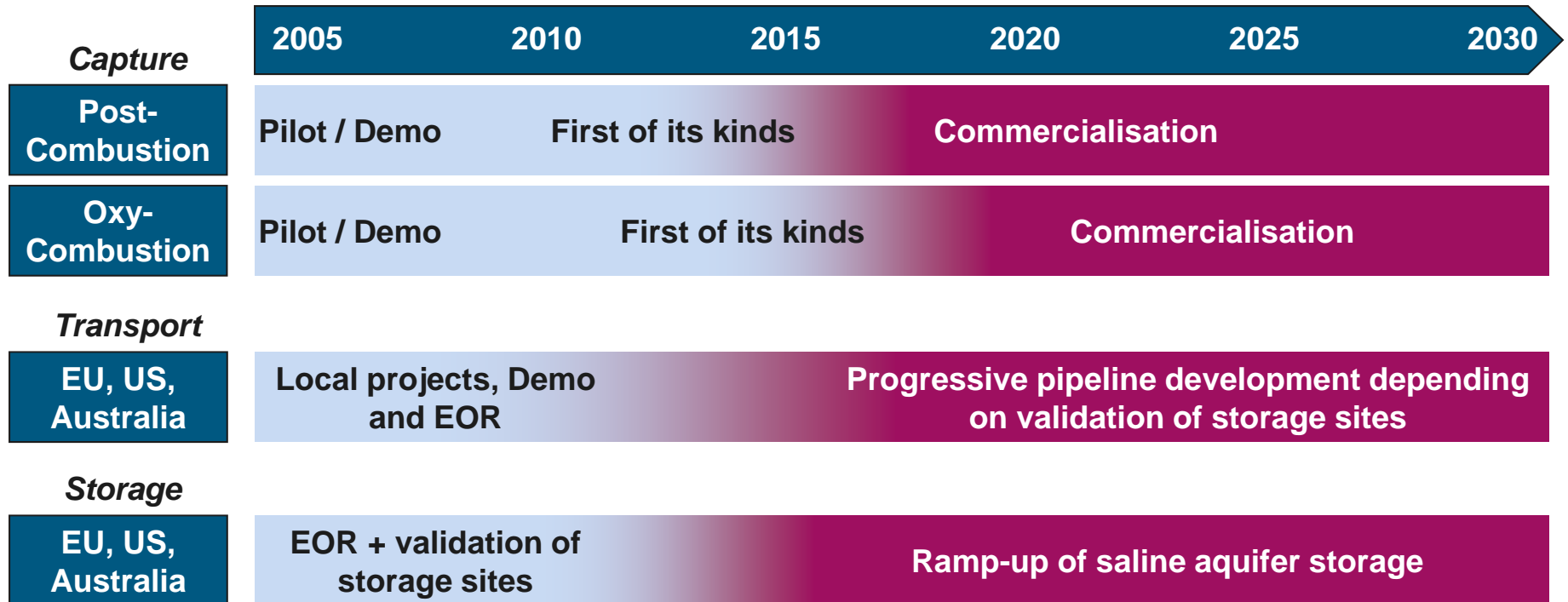


Selected by Alberta and Federal Canadian funding



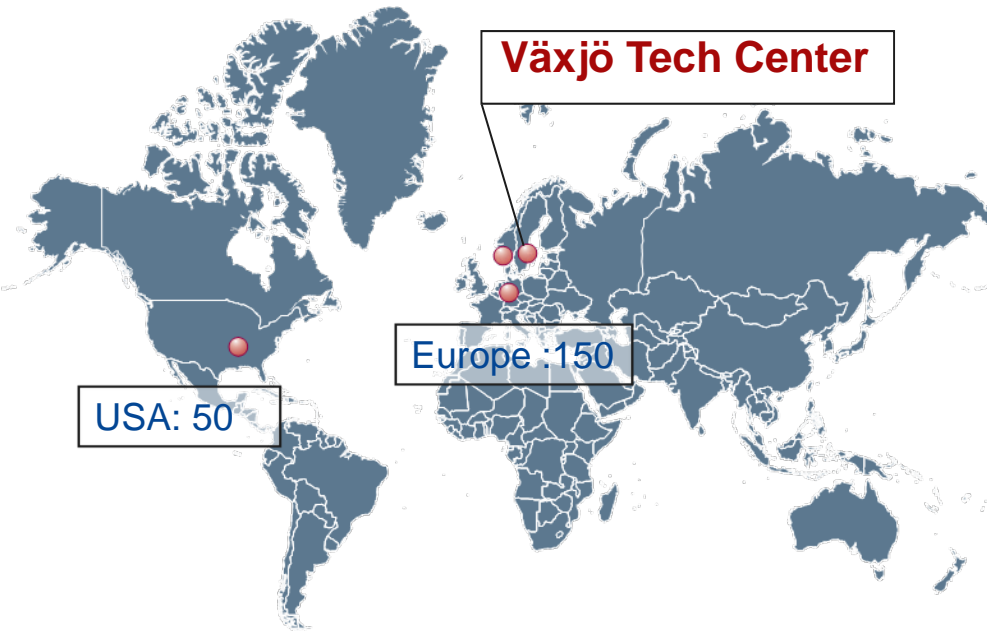
Selected by US DOE to receive CCPI Round 3 funding

# CCS: The Roadmap



**CCS will be commercial in 2015**

## CCS business rationale



- CCS moving to **another stage**:
  - From small pilots → **large demos**;
  - From technology validation → **industrialization & plant integration**
- Requires **solid engineering & execution set-up** (within Thermal  $\Sigma$ )
- **Qualitative gap in resources** (e.g. chemical process engineering) needed to be addressed
- Focus of resources on CCS projects, for successful execution (**incubator model**)

200 employees worldwide dedicated to CCS

# Wiesbaden acquisition



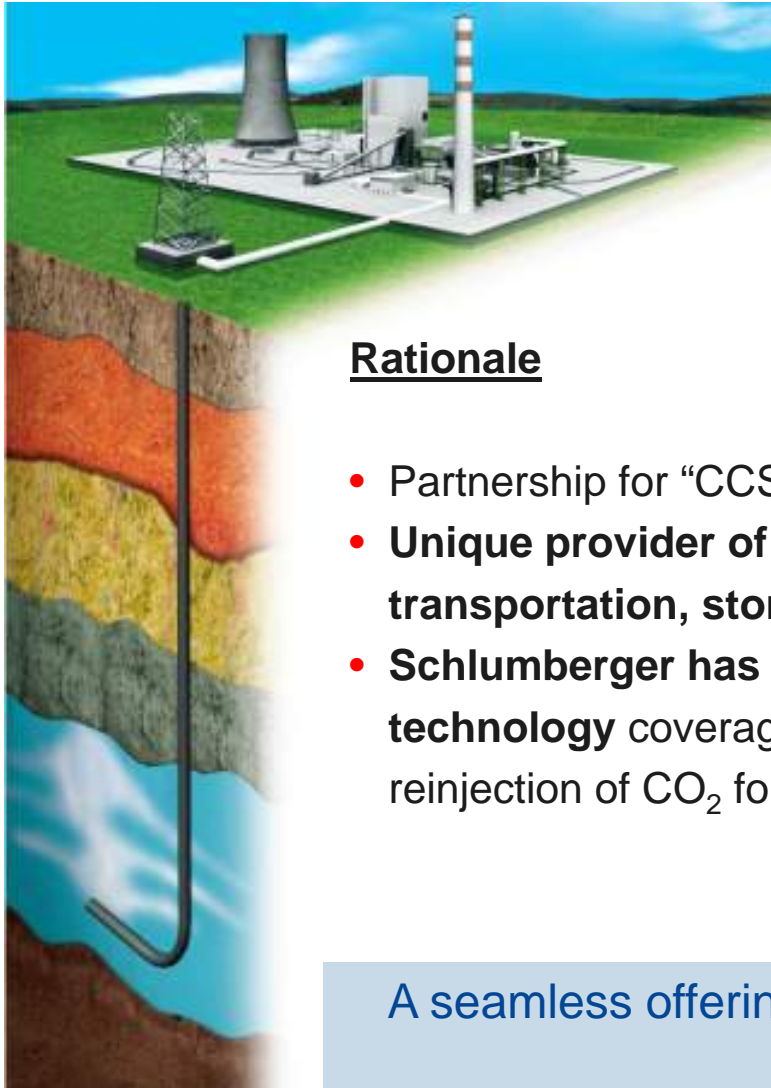
## Status

- **Deal close on 6 August 2009** (formerly ABB Lummus). Integration plan rolled out.
- Asset transfer: references, tools, processes

## Rationale

- **Reinforces CCS development team** - 111 experienced employees with full EPC capability
- **Significant references** in Oil & Gas, refining & petrochemicals (especially in amines wash, compression, ..) **suitable for CO<sub>2</sub> Capture and transportation.**

The European execution center for CCS



## Rationale

- Partnership for “CCS Ready” studies
- **Unique provider of solutions covering CO<sub>2</sub> Capture, transportation, storage.**
- **Schlumberger has a world-class experience and technology** coverage in subsurface technologies, including reinjection of CO<sub>2</sub> for Enhanced Oil Recovery (EOR).

A seamless offering “from the combustion chamber to the injection well”

[www.power.alstom.com](http://www.power.alstom.com)