

Clean Power Solutions

Alstom's response to IRP 2010

Mark Boneham

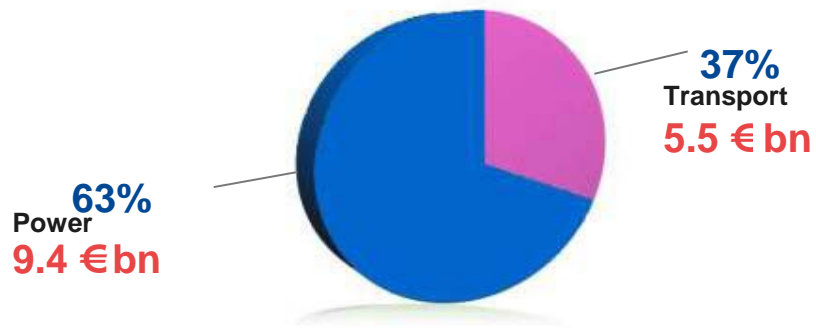
Pretoria, 7 June 2010

Our Group: A major industry player

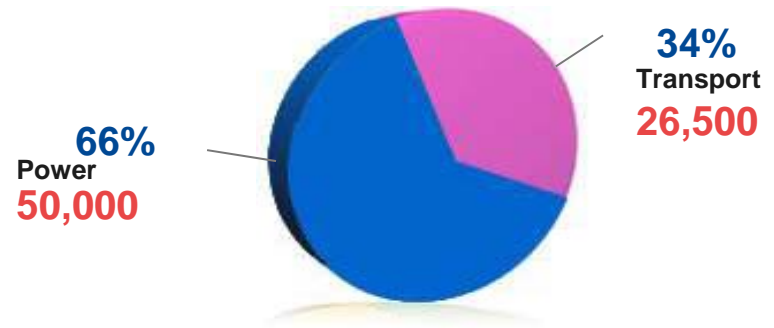
Our Market: Power generation

Our Strategy: The cleanest integrated solutions

Orders by Sector



Employees by Sector



N°1 worldwide
in high speed
and very high speed

integrated
power plants

hydro
power

N°1 worldwide in:
air quality
control systems

services for
electricity utilities

- Presence in the South Africa for more than 100 years
- **Leading provider of Power Generation**
 - **80%** of the installed turbine generator capacity and **30%** of boiler capacity is manufactured by Alstom

Our Group: A major industry player

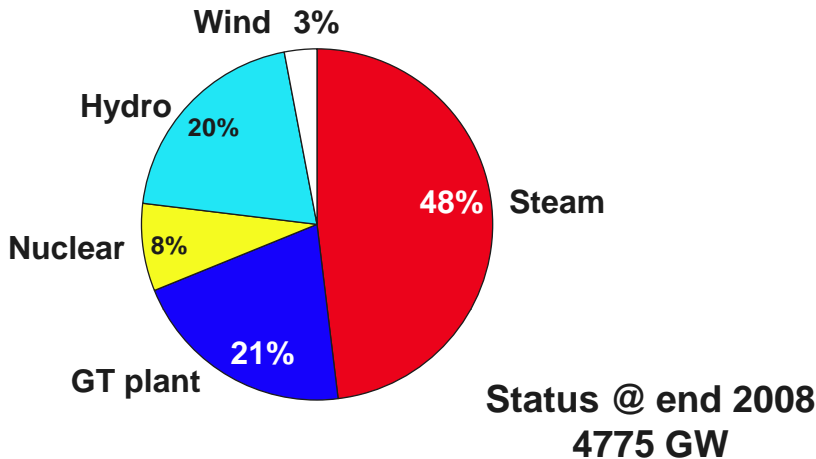
Our Market: Power generation

Our Strategy: The cleanest integrated solutions

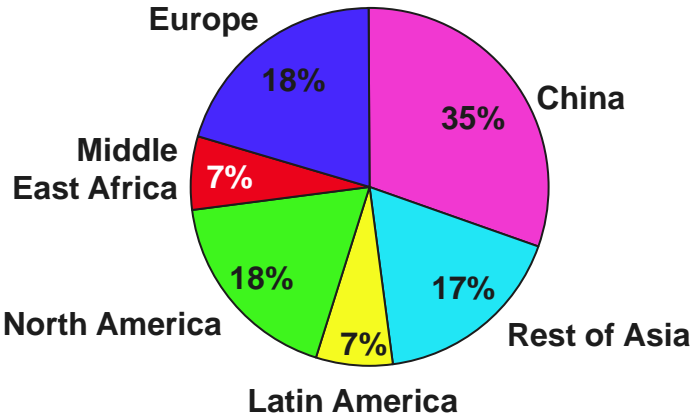
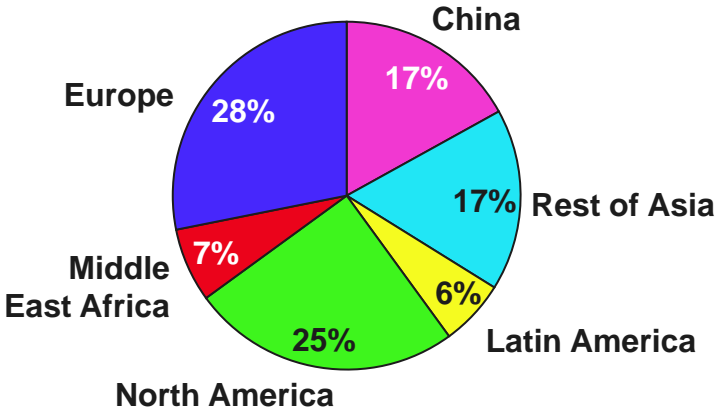
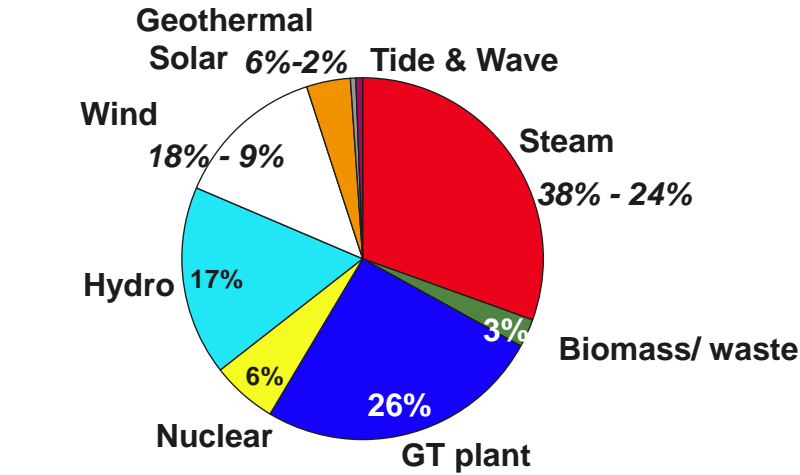
Global installed base per technology



Installed Base 2008



Future Installed base 2030



Non CO₂ technologies could account for 50% of global installed base

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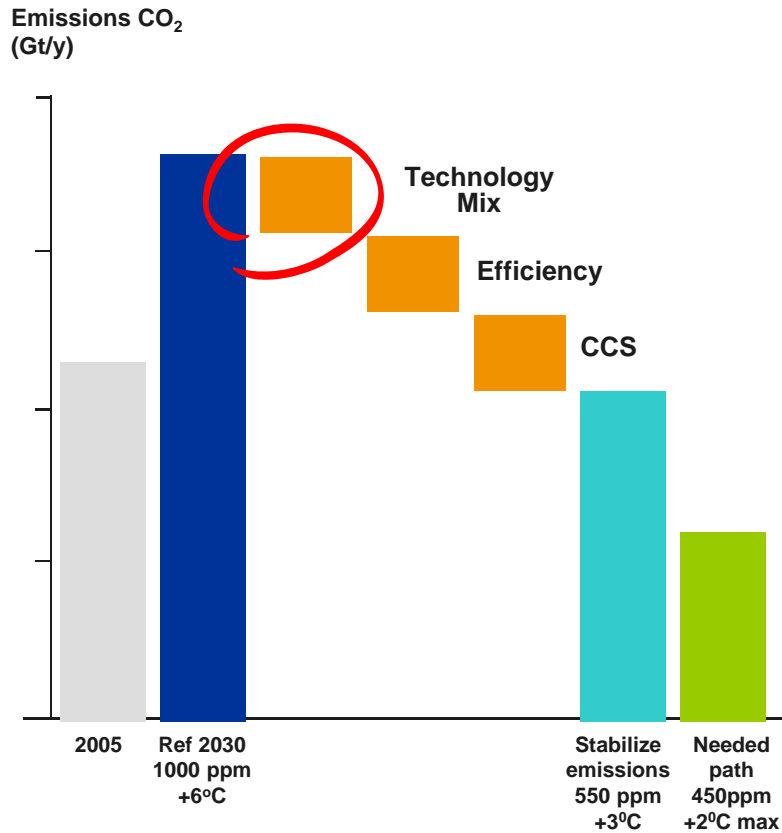
Our Market: Power generation

Our Strategy: The cleanest integrated solutions

Alstom CO₂ strategy



Alstom is the world leader in clean integrated solutions



	N° 1 hydro
	Wind, solar and geothermal
	N° 1 nuclear (conventional islands) & biomass
	Efficiency: Plant optimisation & retrofit
	First CO2 capture demo plant in the world

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Technologies adapted to all energy sources



% Av.market share 04-08



Gas

9%



Coal



Oil

10%



Hydro

24%



Nuclear (Conv. Island)

42%



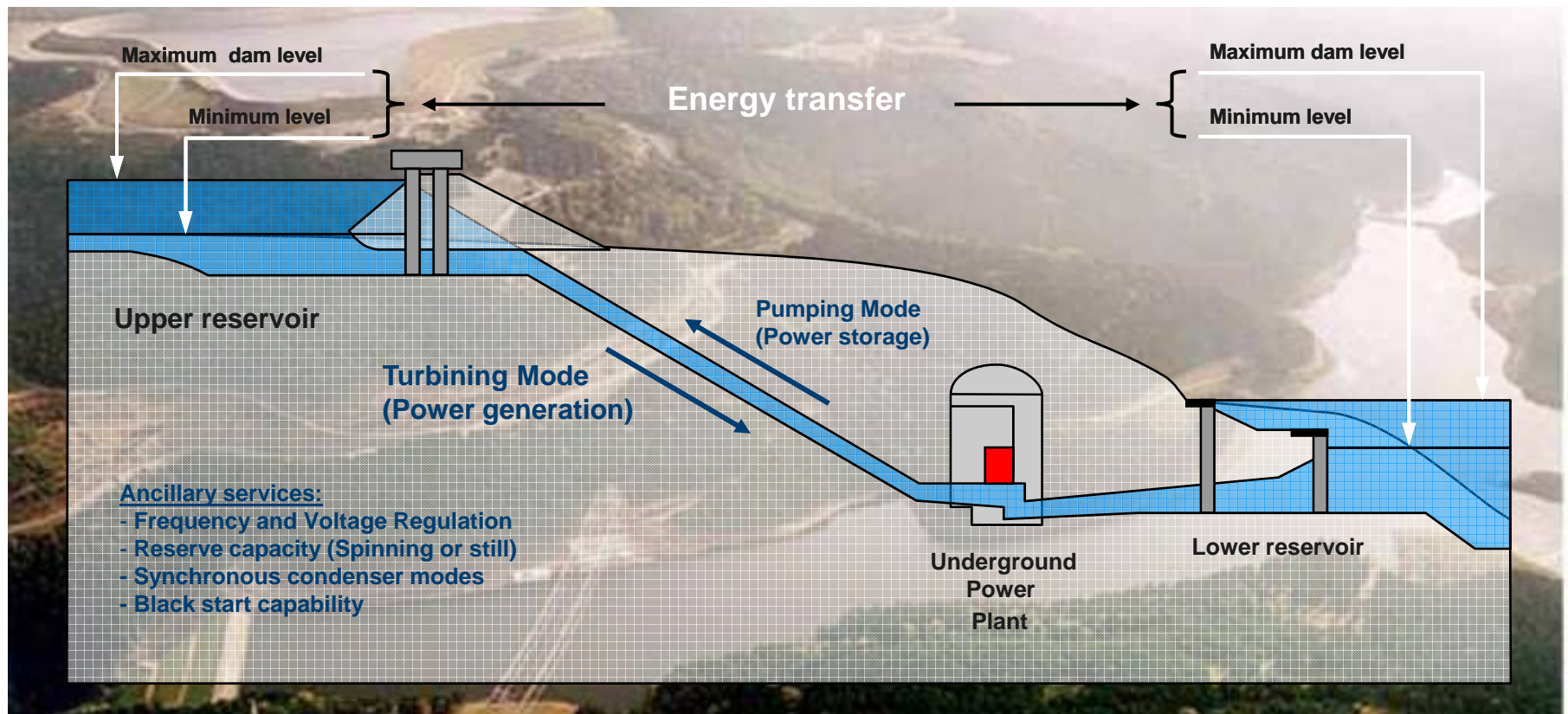
Wind

2%

Pump storage: an efficient way of storing large quantity of energy

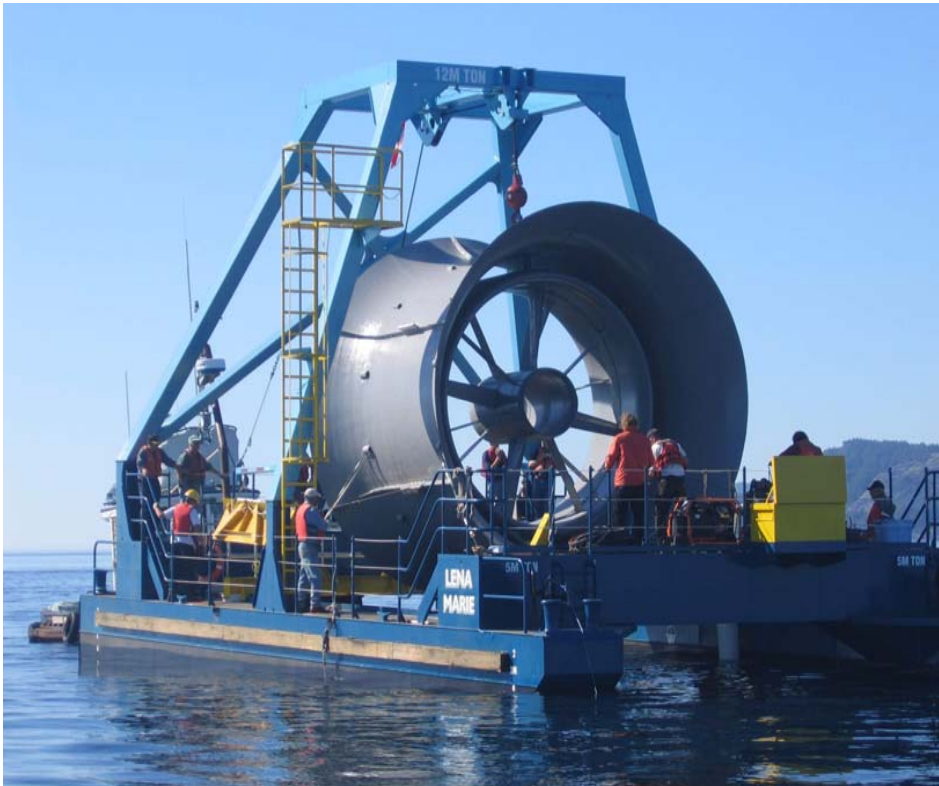


Global cycle efficiency ~80 %



Tubatse Pumped Storage 1.5 GWe capacity = **7.8m tons per year CO₂ avoided**

Tidal: a clean and natural source of energy



- **Potential up to 100TWh** of electricity worldwide (consumption equiv. 20 Million people)
- **Clean, natural, non invasive**
- **No greenhouse gases**
- **100% predictable** and inexhaustible

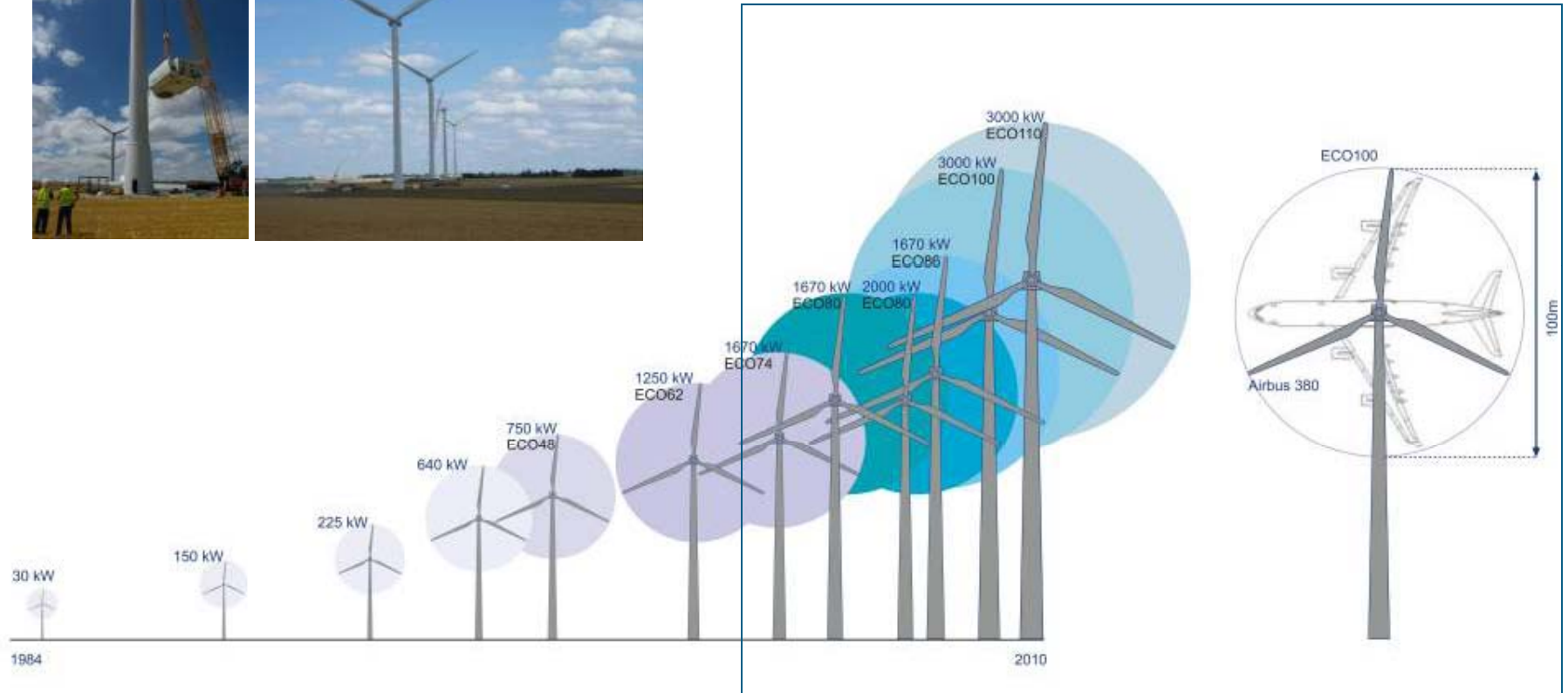


Under development

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Wind onshore: energy potential from wind



Planned wind capacity approx 250 MWe = **1.3m tons CO2 avoided**
Potential wind capacity far greater – requires back up capacity

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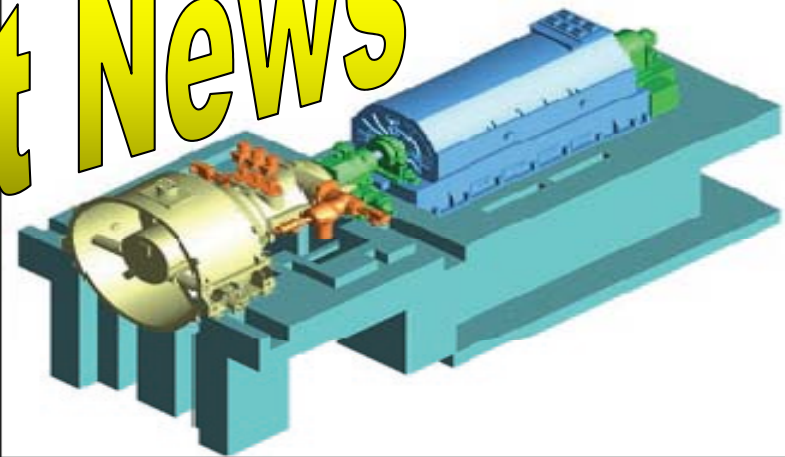
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Alstom enter Solar market

- Stake acquired in **BrightSource Energy Inc**
- Specialist in **tower** based thermal plants
- **Highest** levels of solar efficiency
- Complimentary partnership of technologies and skills



• Latest News



Planned solar capacity approx 200 MWe = **1.0m tons CO2 avoided**
Potential solar capacity far greater

Biomass co-firing: significant potential to reduce CO₂ emissions



- DRAX- UK's largest coal fired plant – **4GW**
- 1.5 million tons/year biomass co-firing at 10% heat input
- **400 MWe of green power**
- **2 million tons/year CO₂ avoided**
- Fully Commissioned early 2010

Potential of biomass

- **Up to 20 % CO₂ avoided**
- **Retrofittable** to existing coal plants
- Flexibility – **low incremental cost**
- Biomass combusted in highly efficient boilers



Potential to retrofit all existing power plant
Utilising existing assets - Quick solution to meet renewable energy targets

Nuclear conventional island: ARABELLE™



- The world's largest steam turbine in operation and in construction – 1,750 MWe
- 4 units in commercial operation
- 250'000 Operating Hours with 99.97% Reliability

Planned nuclear capacity 10.5 GWe = **54.6m tons CO2 avoided**

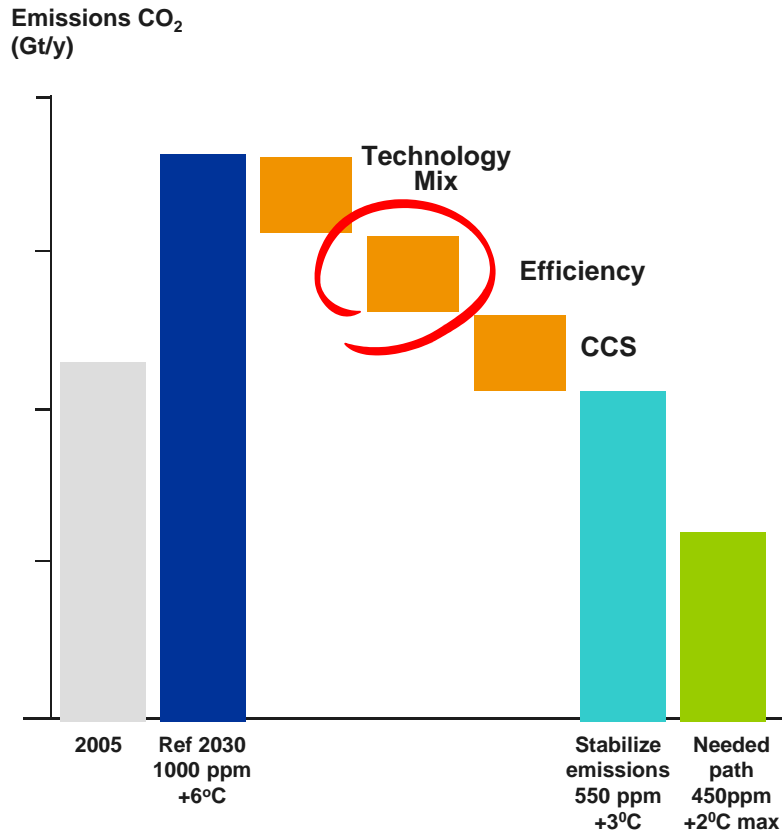
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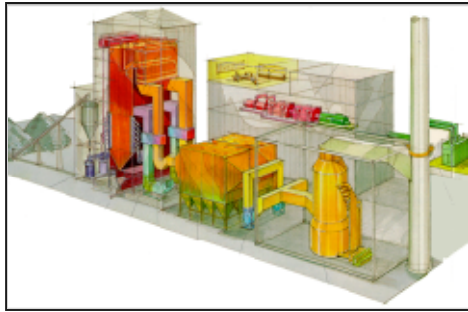
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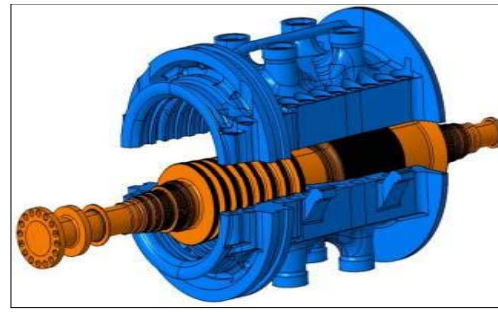
Production Efficiency – Existing Plant



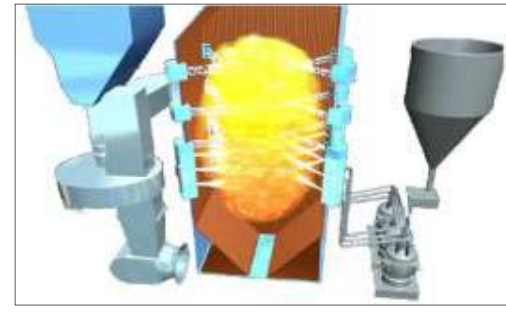
Retrofit



Plant Optimisation: -5% CO₂



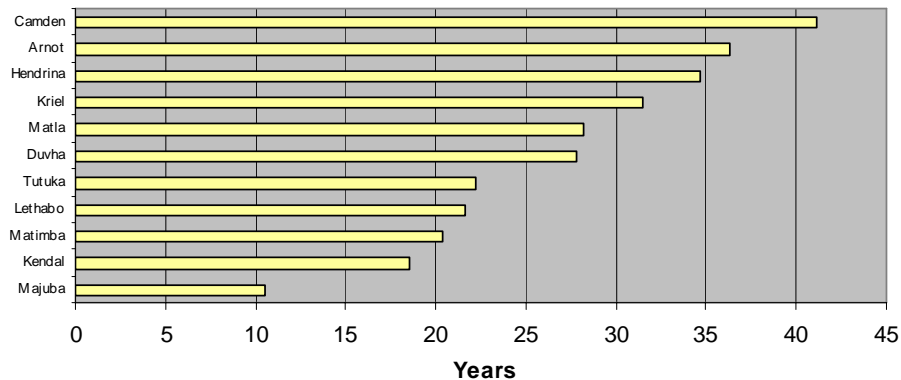
Turbine retrofit: -5% CO₂



Boiler retrofit: -3% CO₂

60% of Carbon emitted in 2030 will come from today's installed base

Average Age in-Service
Eskom Plants



- Increased cycle **efficiency**
- Increased **capacity** avoiding need to build additional capacity
- Extended utilisation of existing assets
- Reduced CO₂, NO_x & SO_x emissions

Obligation to retrofit under IRP – could materialise ~ 2,330 MWe

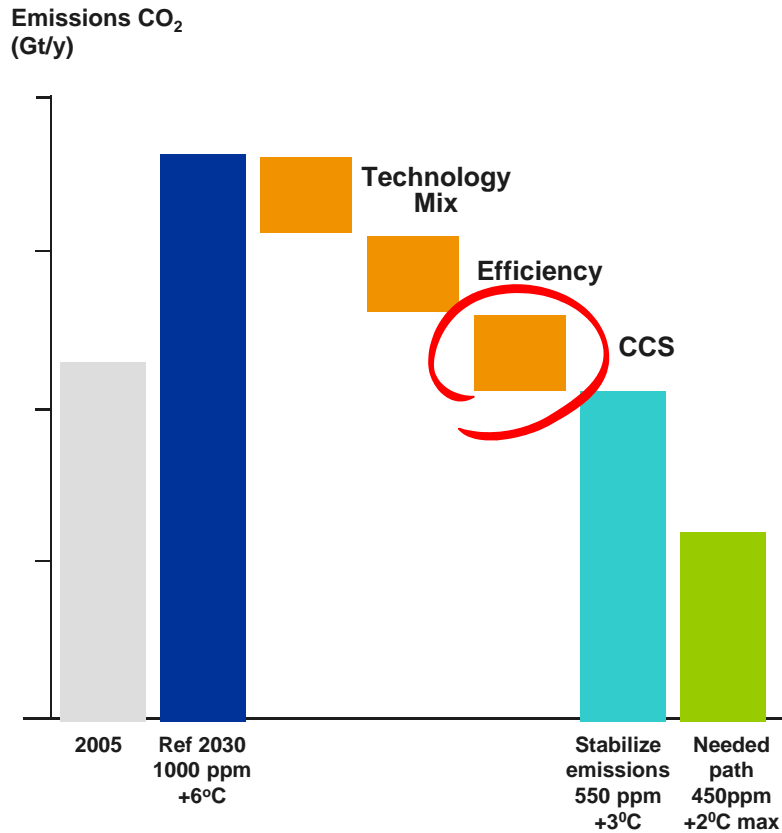
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Alstom CO₂ capture technologies



Power Plant with CO₂ capture

Post-combustion
(New + retrofit)



Oxy-combustion
(New + retrofit)



Pre-combustion
(New only)



Source: Vattenfall

Solutions developed by Alstom

- CCS will be commercially available - **2015**
- CCS capturable CO₂ in South Africa ~ **240m t/yr**
- Cost of electricity production (kw/hr) from **Coal + CCS = similar to Nuclear**

CCS must also be applied to the installed base

Alstom Power: leadership in Carbon Capture



Operating

Injecting CO₂



Vattenfall Schwarze Pumpe
Germany - 30 MWth
Oxy - Lignite

Injecting CO₂



AEP Mountaineer
USA - 58 MWth
Chilled Ammonia - Coal

Inaugurated Jan 2010!



EoN Karlshamn
Sweden - 5 MWth
Chilled Ammonia - Fuel

Injecting CO₂



Total Lacq
France - 30 MWth
Oxy - Gas



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



Alstom BSF Windsor
US - 15 MWth
Oxy - Coals

Next wave



PGE Belchatow
Poland - 260 MWe Adv.
Amines - Lignite



Vattenfall Jämschwalde
Germany - 250 MWe
Oxy - Lignite



Statoil Mongstad
Norway - 40 MWth
Chilled Ammonia - Gas



Transalta
Canada - >200 MWe
Chilled Ammonia - Coal



AEP Mountaineer
USA - 235 MWe
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

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- IRP needs to create the right framework for investment
- Climate change
 - Carbon taxes or
 - Cap and Trade
- **Highest** levels of production efficiency – not just DSM
- Diversification of energy mix is essential

The path to CO₂ reduction

• Hydro	1.50 GWe	= 7.8 mt/yr
• Wind	0.25 GWe	= 1.3 mt/yr
• Solar	0.20 GWe	= 1.0 mt/yr
• Biomass	0.40 GWe	= 2.0 mt/yr
• Nuclear	10.5 GWe	= 54.4 mt/yr
• Coal (Retrofit)	2.33 GWe	= 12.1 mt/yr

South Africa's CO₂ emissions could be reduced by ~ 78.6 mt/yr



Clean Power Today !

Today we provide the cleanest air solutions

- for new plants
- for the installed base

www.power.alstom.com