Importance of Energy Materials : an Industrial Perspective

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4th December 2007
Energy Materials in the UK
Launch of Strategic Research Agenda
Tate Britain, Millbank, London

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Alstom Power : present in all markets

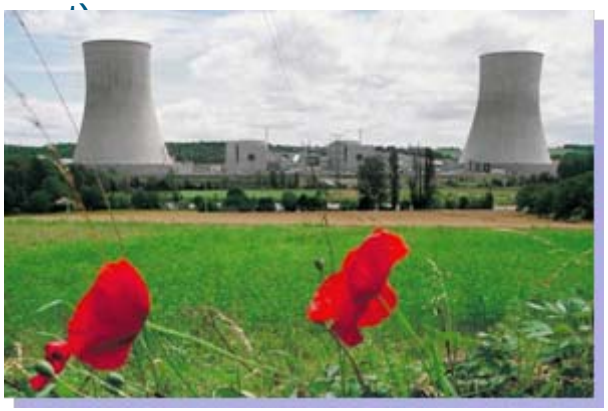
Materials technologies adapted to all major energy sources

Gas

Coal

Hydro

Nuclear (conventional



Wind

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Agenda

1st topic	Energy Market Drivers and Issues
2nd topic	Energy Technologies and Materials
3rd topic	Concluding Remarks

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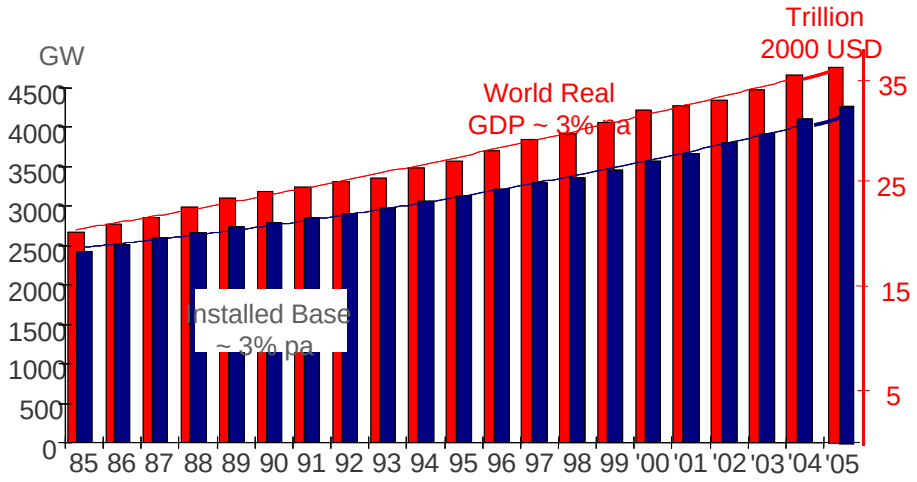
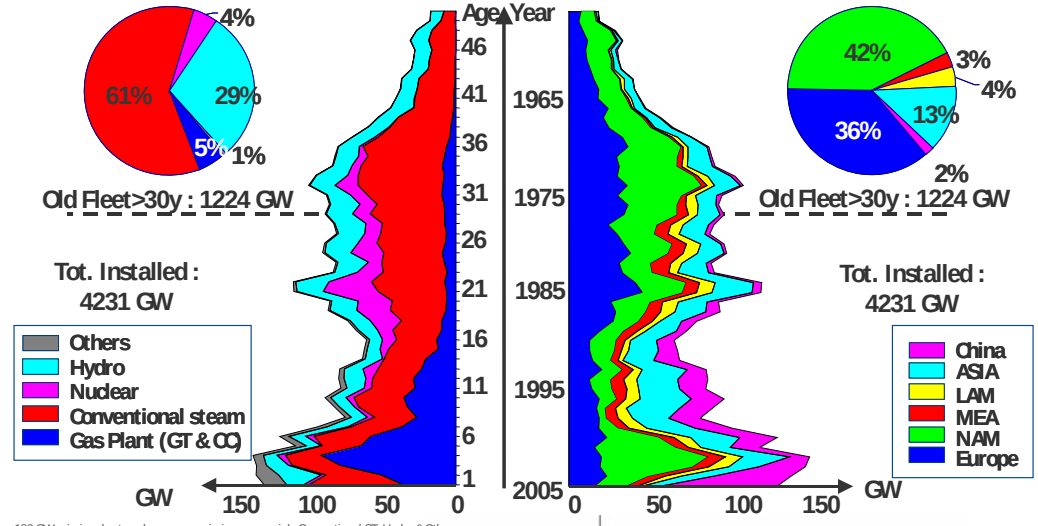
Market Driver : GDP Growth
Increasing demand for electricity



Increase in demand for energy, especially electricity and in developing countries

29 % of installed capacity older than 30 years

Age pyramid of world installed capacity



Note: 180 GW missing due to unknown commission year,mainly Conventional ST, Hydro & Others
Source: Alstom, UDI

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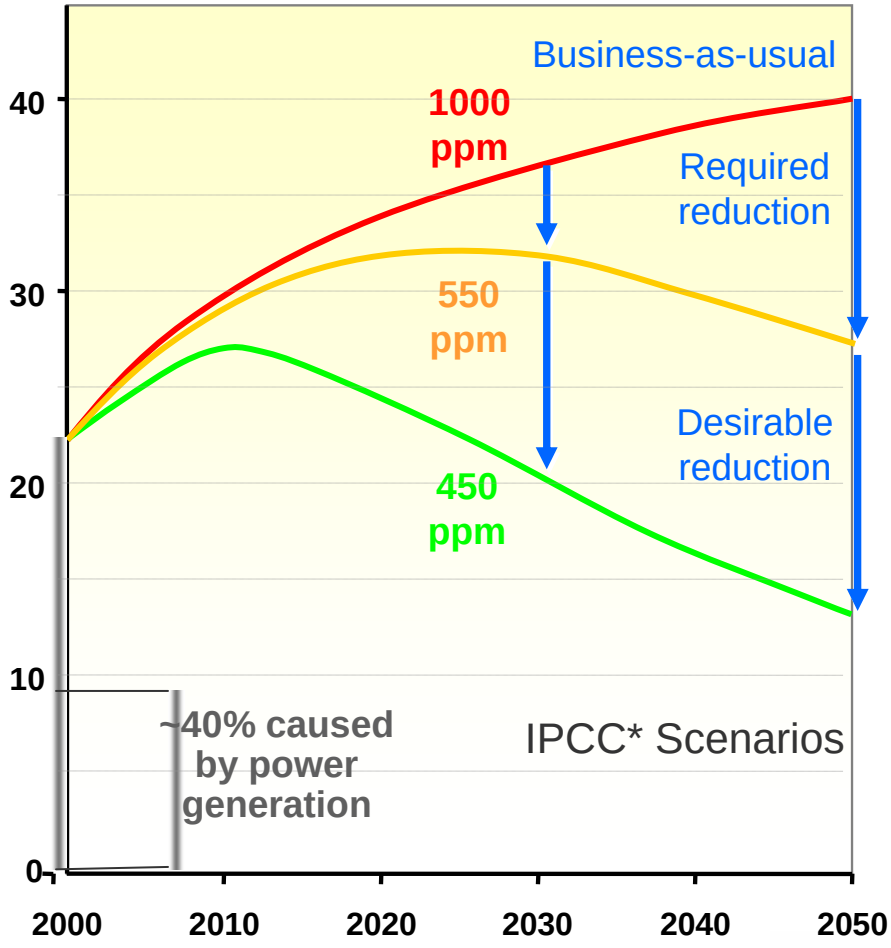
Market Driver : Global CO_2 Emissions

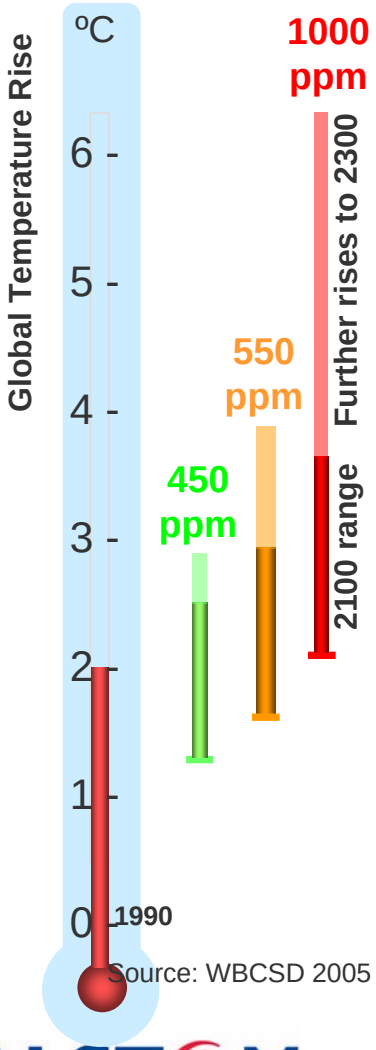
Goal: A long term moderate stable CO_2 concentration in the atmosphere

IPPCC AR4 Nov07

Need to peak at 2015 to have any chance of meeting desired 2°C rise target

50-80% reductions required at 2050





* Intergovernmental Panel on Climate Change

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Key `take-away`messages

- All technologies will be needed : a full portfolio approach
  - `Clean` Use of Fossil Fuel
  - `Economic` Renewable Energy
  - `Safe` Nuclear
- Substantial increase in take-up of energy efficiency

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- **Importance of continued technology development**
  - **subsequent generations of technology**
  - **importance of underpinning technologies**
- **Critical role of materials**

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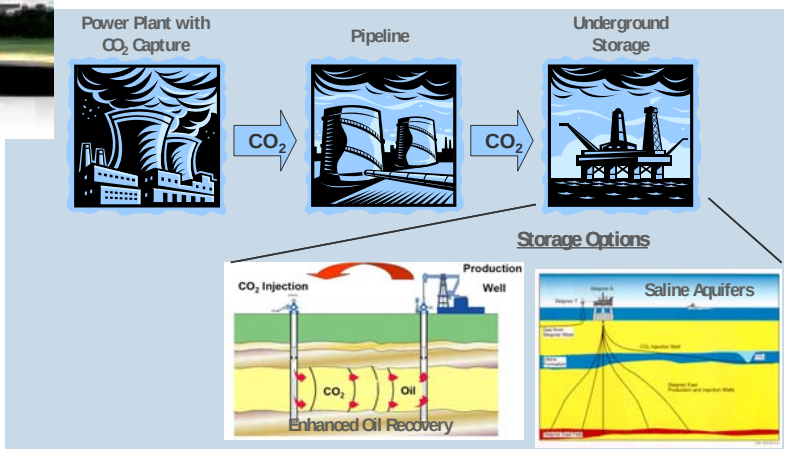
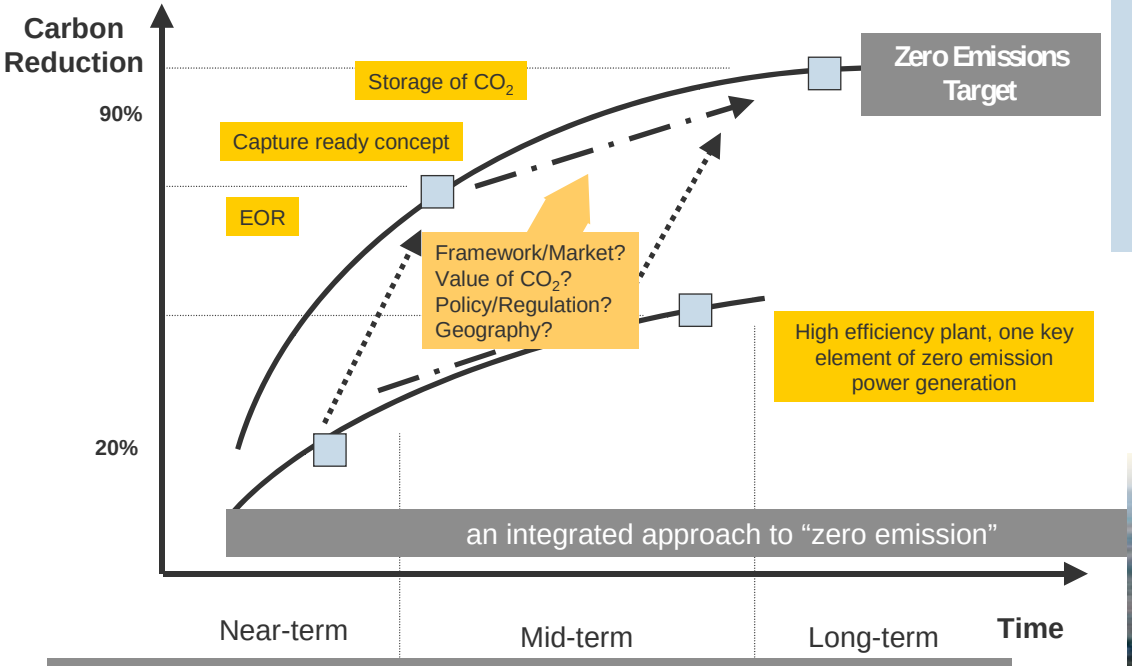
Clean Fossil Fuel : pathway to `zero emission`





Originally developed for UK CAT strategy launched in 2005

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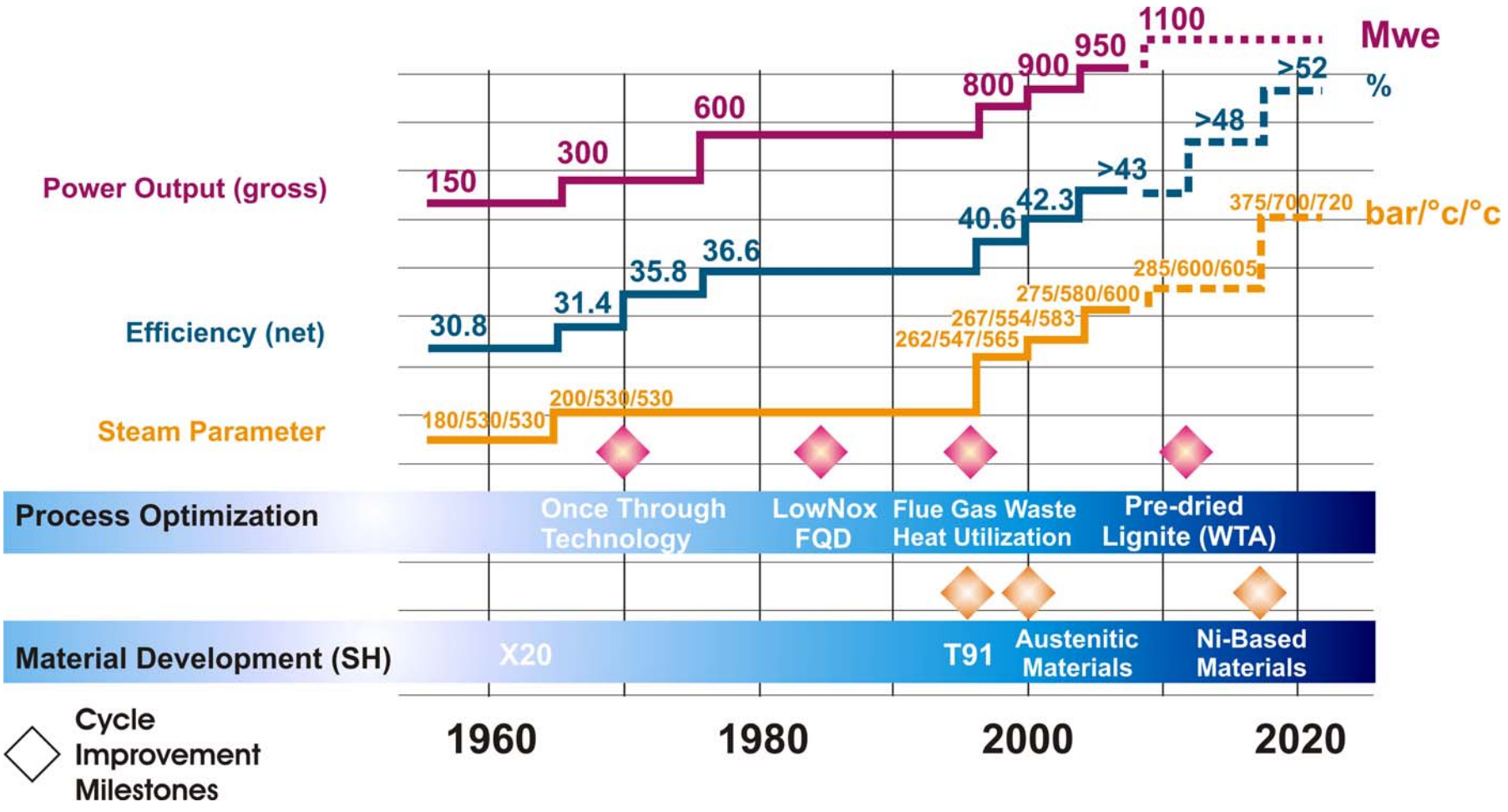
Advanced Power Plant Cycles



Stairway to high efficiency and performance

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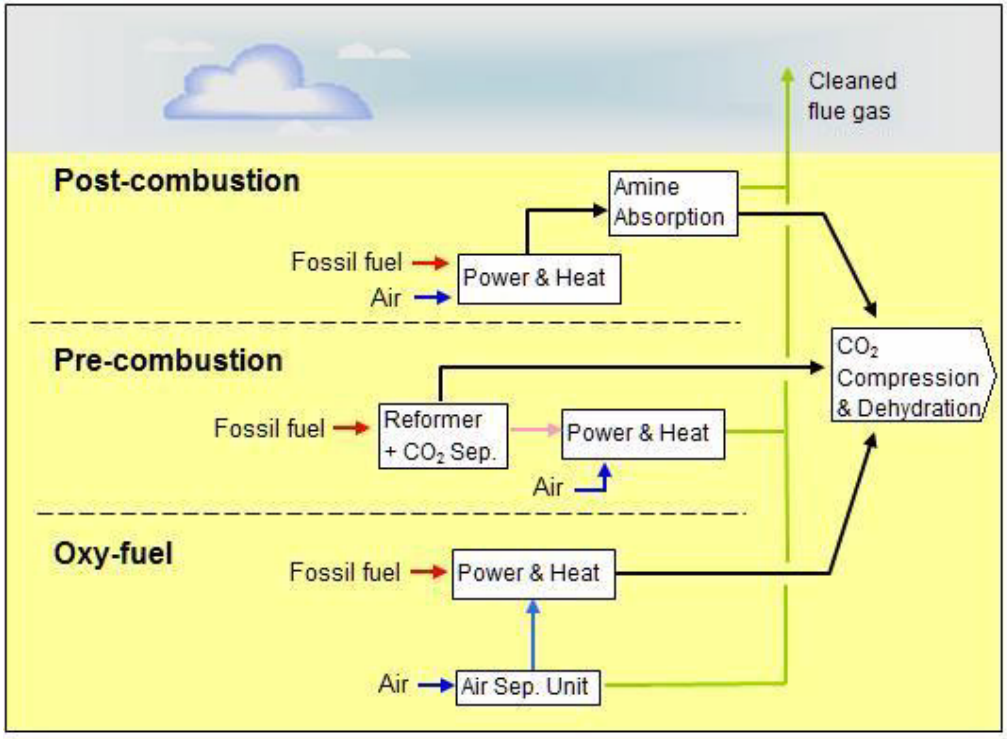
Carbon Capture Technologies



- Accepted need for a portfolio approach
- All technologies need to be addressed
- Retrofit and new plant application

Main goal : Cost of CO_2 avoided: < 20 €/t CO_2

All of the options require materials to operate in more aggressive environments

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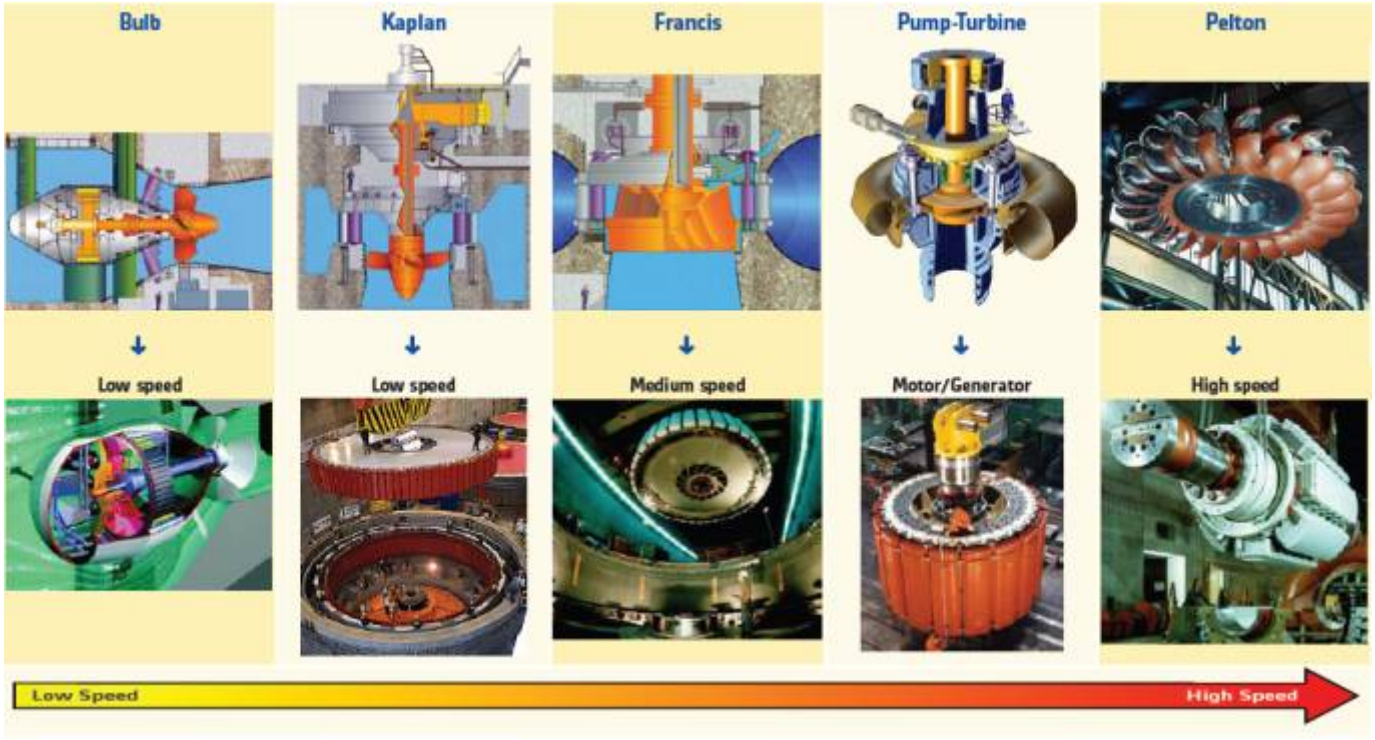
Rotating Machinery

- high temperature
- high pressure
- harsher environments
- new alloys, coatings
- sealing systems
- reliability, life predictio

Renewable Energy : Hydro



- weight and strength
  - composites
- reliability
  - corrosion, coatings, monitoring

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Renewable Energy : Wind

- Cost
  - Cheaper materials & processing
- Efficiency
  - Larger advanced composite blades, joining technologies
- Reliability
  - Coatings, remote condition monitoring, NDE, sensors, life prediction

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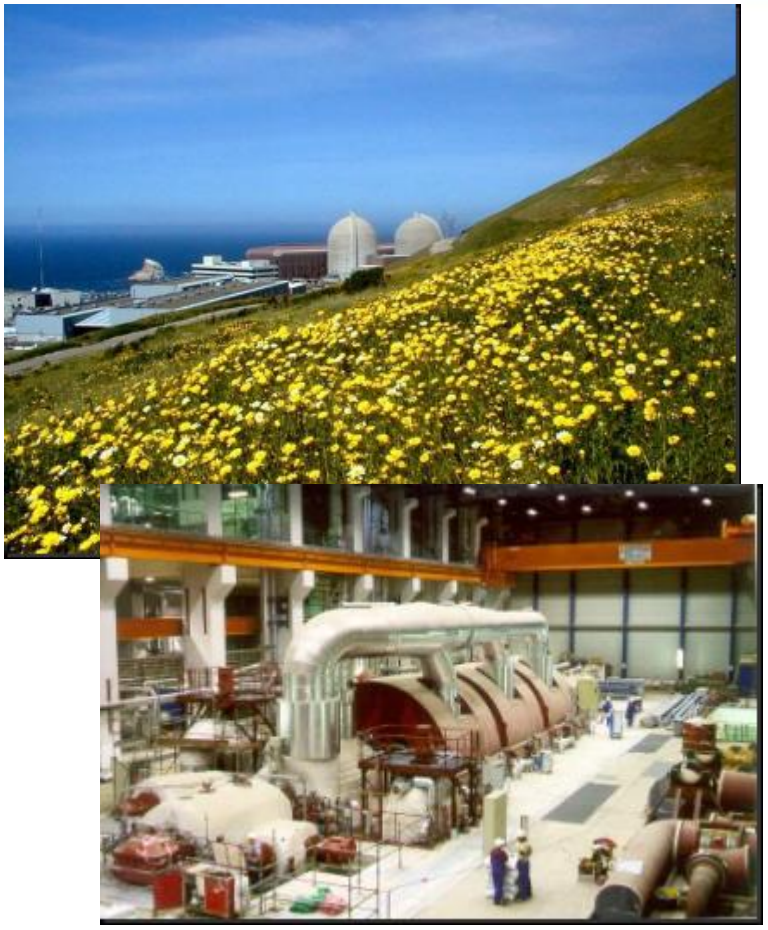
Nuclear Power

➢ Conventional ‘island’ plant shares many similar generic materials challenges with ‘nuclear’ components :

- high temperatures
- harsh environments
- lifetime prediction models
- environmental degradation
- safety & reliability - NDE



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Concluding remarks

- all energy systems reliant upon aspects of materials engineering

- materials a vital underpinning and enabling technology

- future generation energy technologies will depend upon material developments

- **Alstom fully supports the initiative**

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