

# Importance of Energy Materials : an Industrial Perspective

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4<sup>th</sup> 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



# Agenda

1st topic      Energy Market Drivers and Issues

2nd topic      Energy Technologies and Materials

3rd topic      Concluding Remarks

# Agenda

1st topic

Energy Market Drivers and Issues

2nd topic

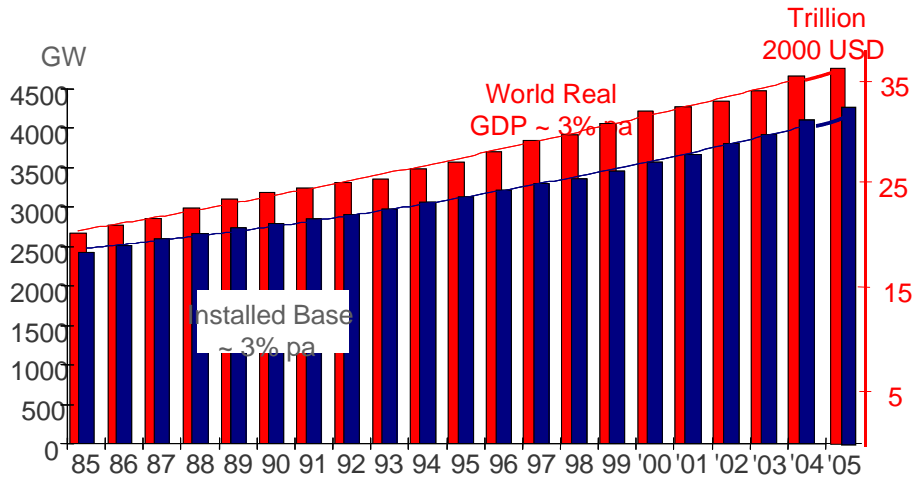
Energy Technologies and Materials

3rd topic

Concluding Remarks

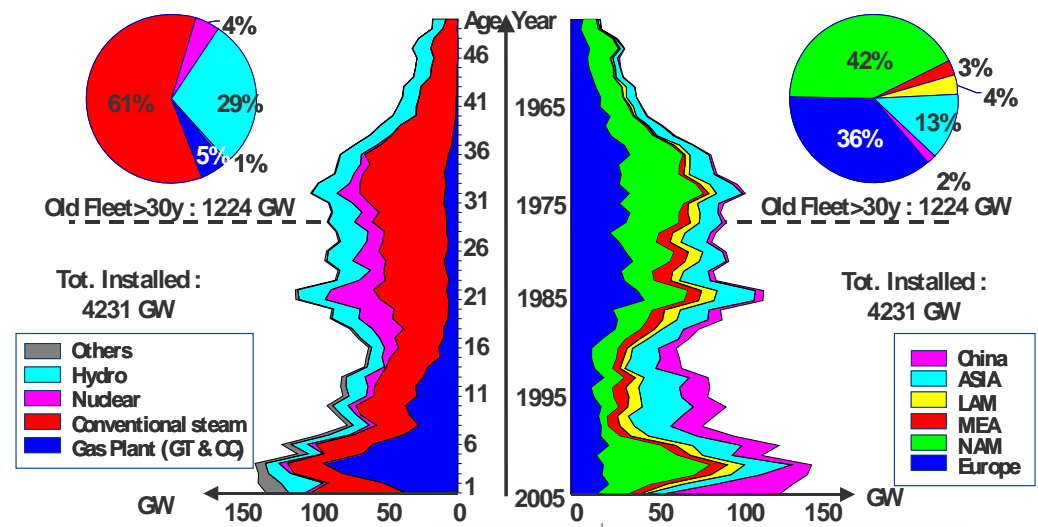
# Market Driver : GDP Growth

## Increasing demand for electricity



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

Age pyramid of world installed capacity



29 % of installed capacity older than 30 years

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

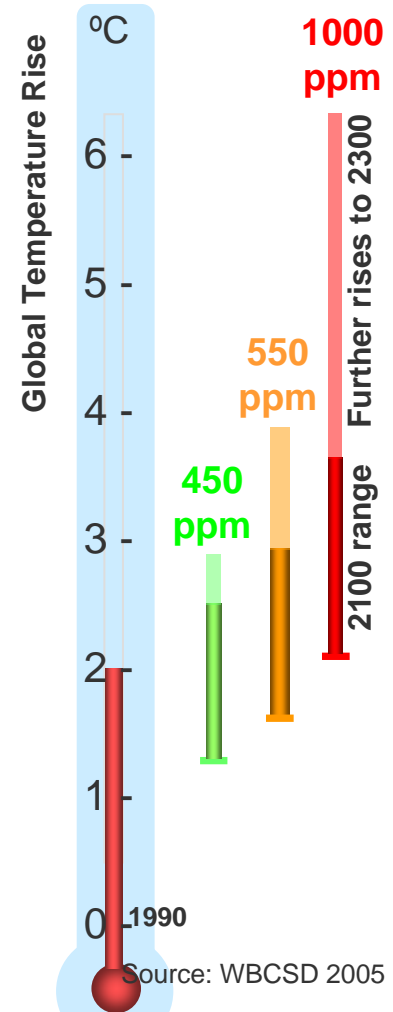
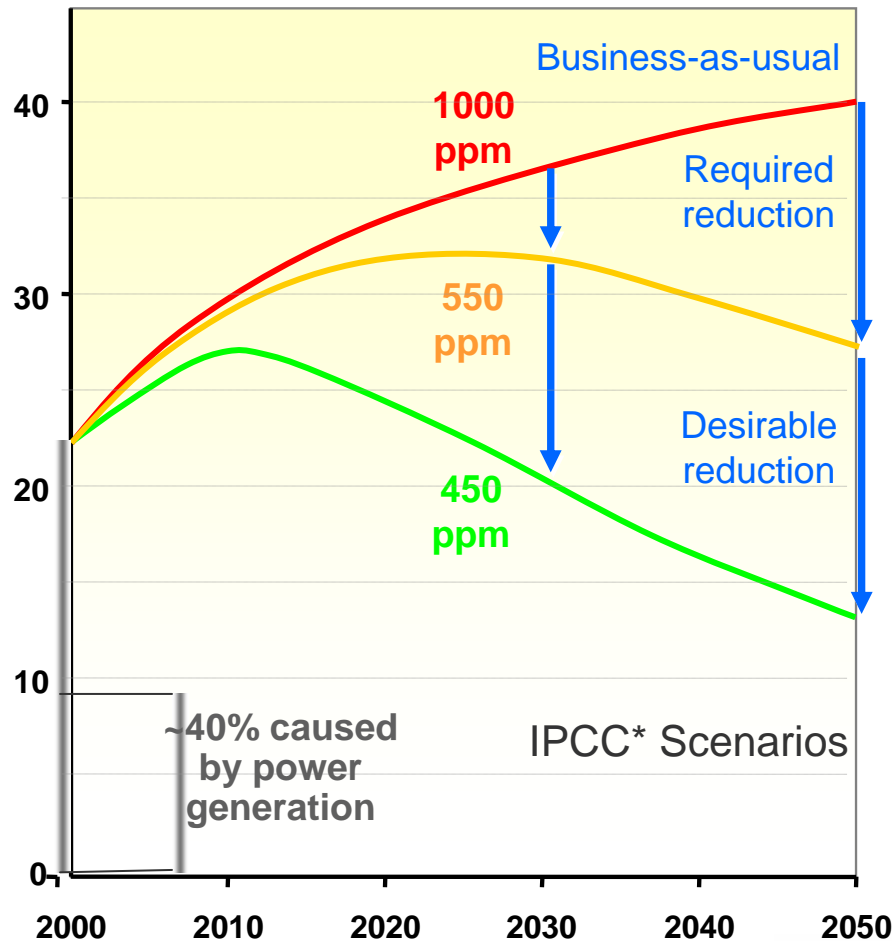
# Market Driver : Global CO<sub>2</sub> Emissions

Goal: A long term moderate stable CO<sub>2</sub> concentration in the atmosphere

IPPC 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

# 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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- Need to address issue worldwide



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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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Energy Market Drivers and Issues

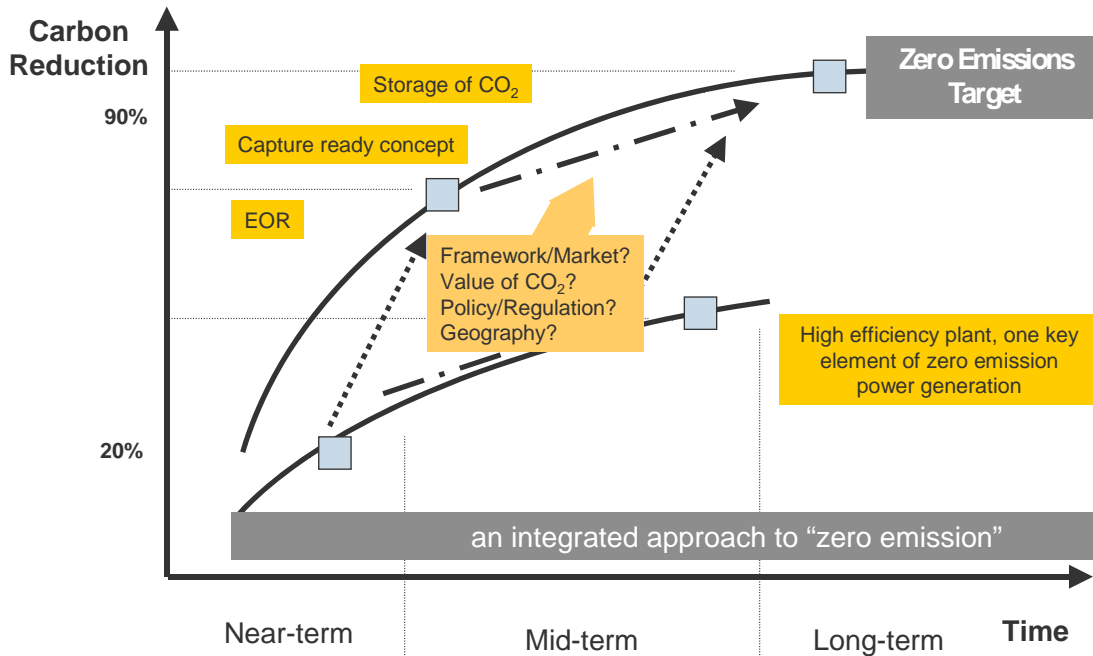
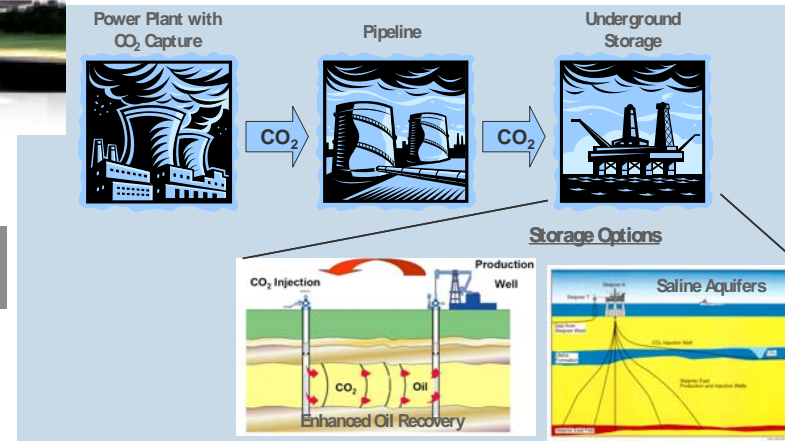
2nd topic

Energy Technologies and Materials

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Concluding Remarks

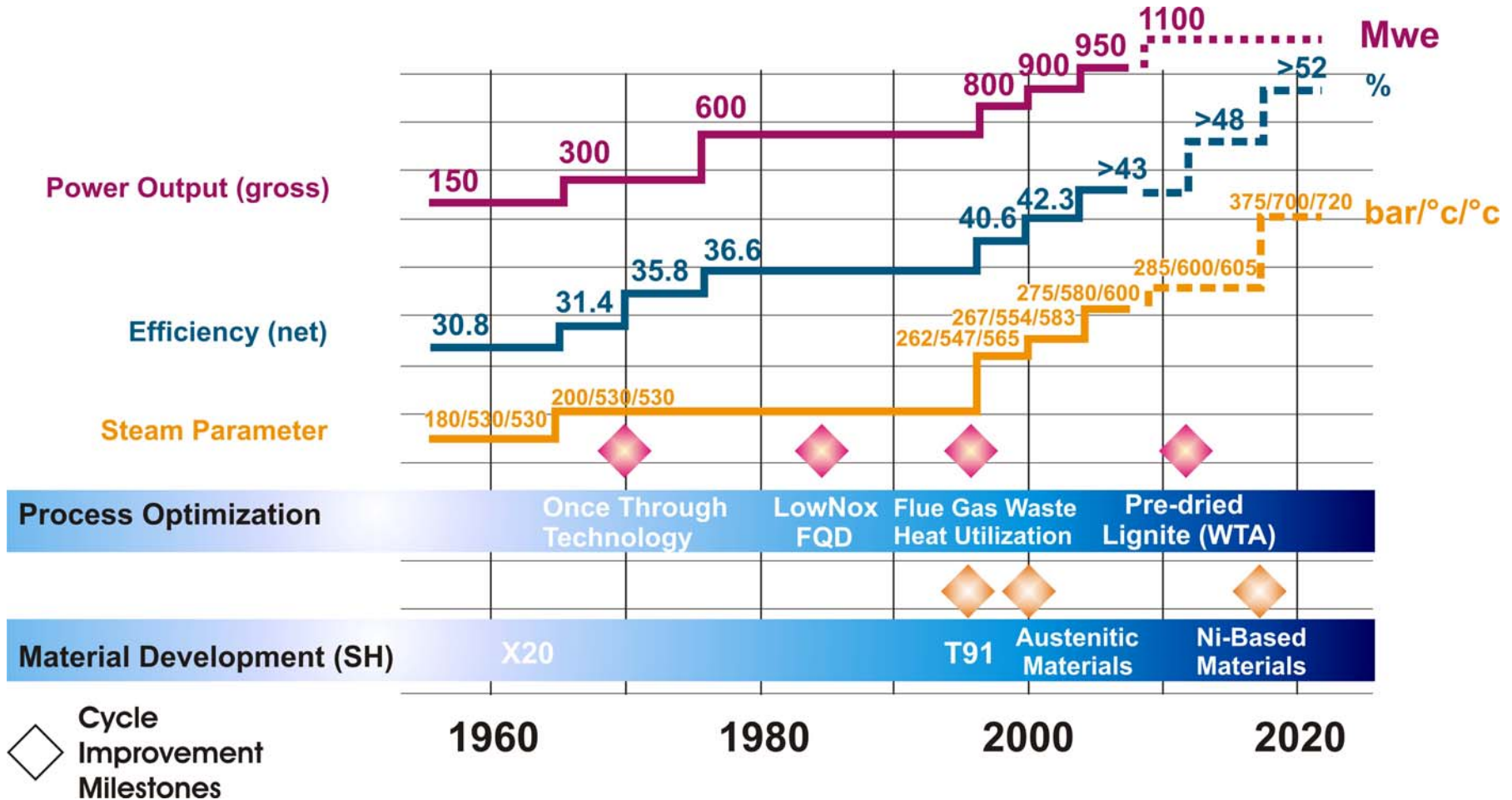
# Clean Fossil Fuel : pathway to `zero emission`



Originally developed for UK CAT strategy launched in 2005

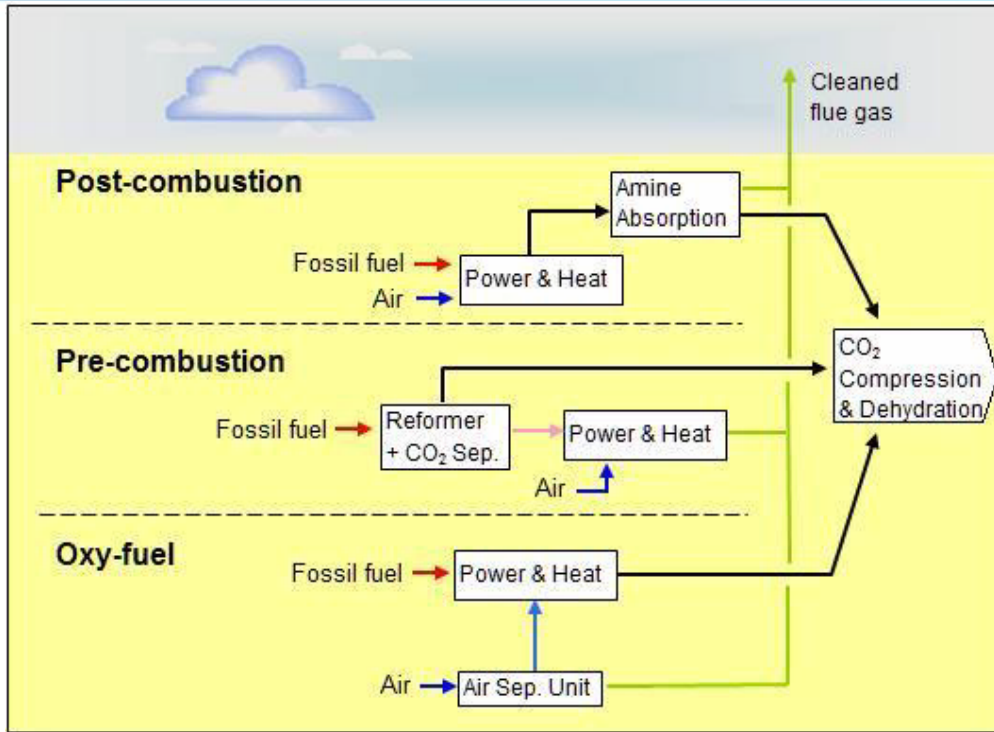


# Advanced Power Plant Cycles



Stairway to high efficiency and performance

# 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<sub>2</sub> avoided: < 20 €/t CO<sub>2</sub>**

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

# Rotating Machinery

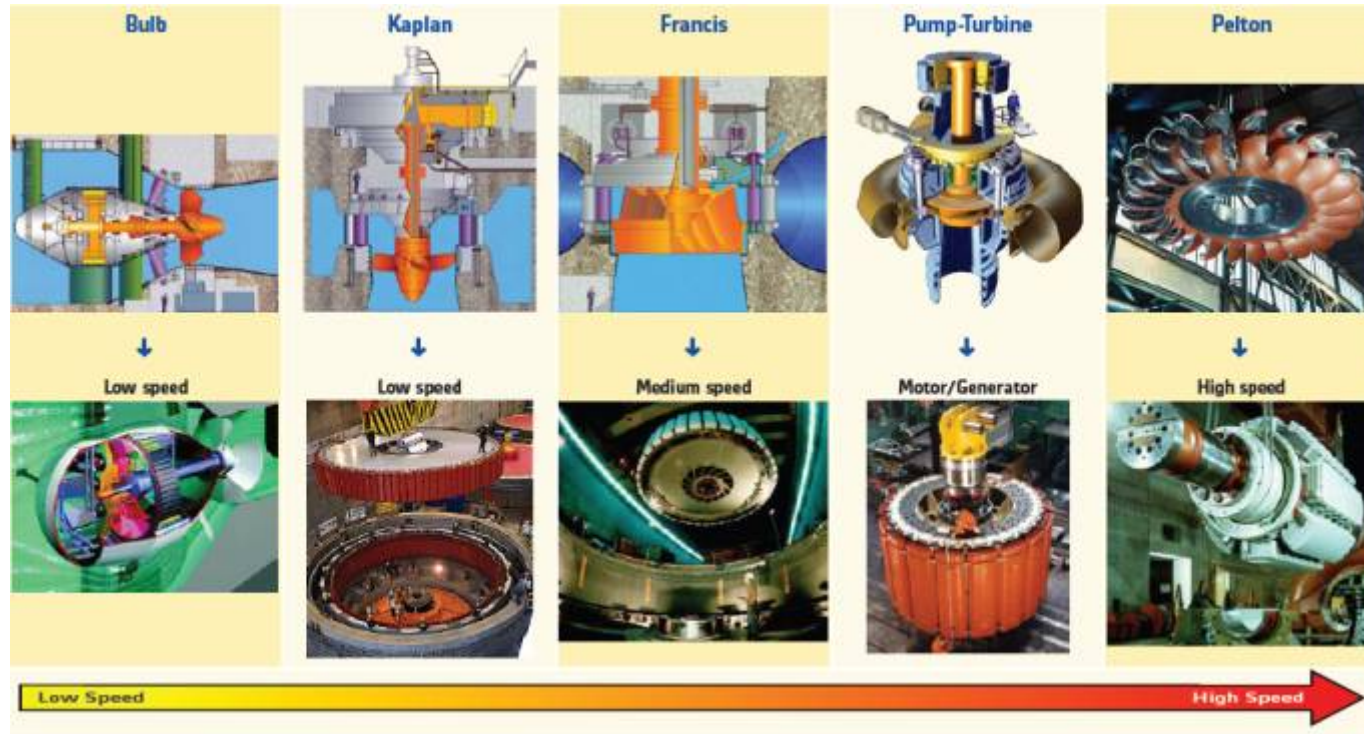


- high temperature
- high pressure
- harsher environments

- new alloys, coatings
- sealing systems
- reliability, life prediction



# Renewable Energy : Hydro



➤ weight and strength

- composites

➤ reliability

- corrosion, coatings, monitoring

# Renewable Energy : Wind



## ➤ Cost

- Cheaper materials & processing

## ➤ Efficiency

- Larger advanced composite blades, joining technologies

## ➤ Reliability

- Coatings, remote condition monitoring, NDE, sensors, life prediction





# 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



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