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Materials for Energy Production

Introduction

(James Marrow)

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Introduction

- What do we use energy for?
  - Energy Consumption
  - Electricity Generation
- Drivers for energy supply strategy
  - Security of resources
  - World economic growth
  - Climate change
- Conclusions
- Further Background Reading

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WHAT DO WE USE ENERGY FOR?

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Summary

- World energy needs will rise
  - 12000 MTOE at the present time
- Most of world energy comes from oil and gas
  - 55% or 6600 MTOE from oil and gas
    - Oil used in heating and transportation
    - Gas used in heating and electricity generation
  - 27% or 3200 MTOEA from coal
    - Used in heating and electricity generation
- Electricity is a small fraction of world energy use
  - 12% or 1400 MTOE
    - Mostly from coal (40%) and gas (21%)
    - Transport use is currently insignificant

(2007 data from www.iea.org)

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DRIVERS FOR ENERGY SUPPLY STRATEGY

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Drivers for Energy Supply Strategy

- Security of Resources
- World Economic Growth
- Climate Change

Choices for the 21st Century!

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SECURITY OF RESOURCES

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Security of Supply: Summary

- Oil and Gas are strategic resources
  - Reserves tend not to be where the energy is used
- Coal is less strategic
  - Large reserves in regions with high energy needs

Oil, Coal and Gas are easily transported

- Electricity generation plants do not last forever
  - Nuclear plants, in particular, are aging

WORLD ECONOMIC GROWTH

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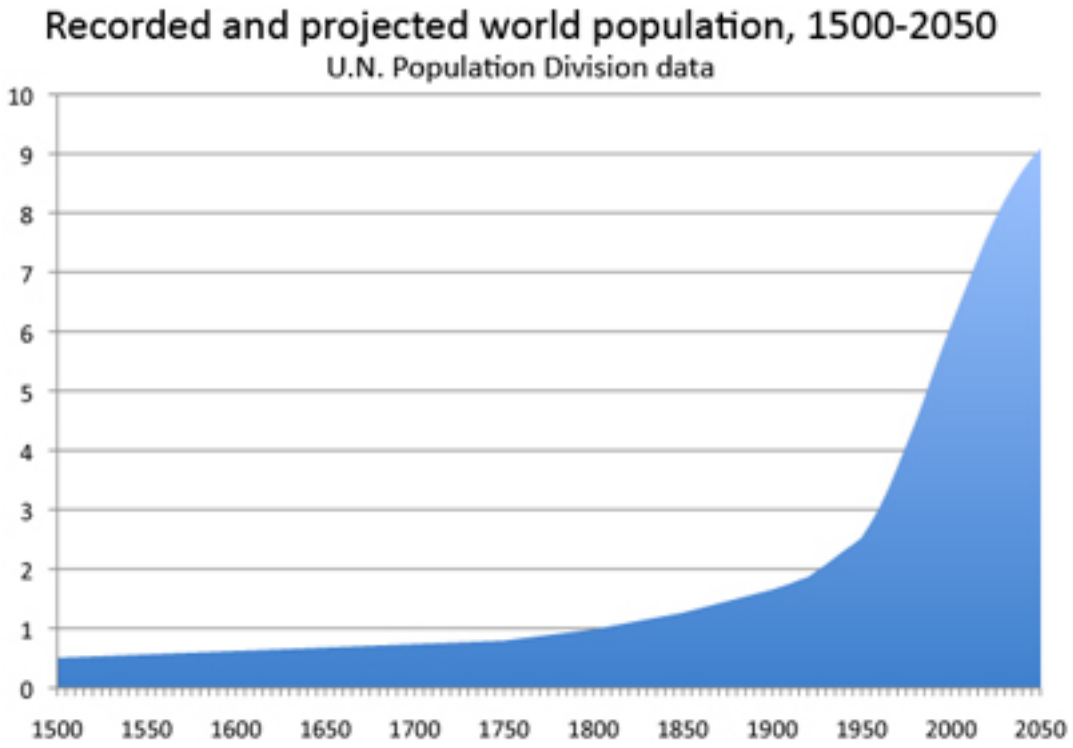
World Economic Growth: Summary

There will be more of us than ever before, and we will all want to use energy



CLIMATE CHANGE

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CO_2 Emissions: Summary

- Energy use in the developed world produces most CO_2 emissions
- Most of our energy comes from fossil fuels
  - Coal, Gas and Oil

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Choices for 21st Century

- Do we
  - Move to a carbon free society?
    - Expensive, but is it too much?
  - Go partway to a reduced carbon society?
    - Cheaper, but will this be enough?
  - Sequester carbon and continue to use fossil fuels?
    - Can we do it?
  - Do nothing?
    - Is mankind really causing significant global warming?

But fossil fuels will eventually run out……

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Summary

- The world's energy requirements will grow!
- Availability of energy resources is an important global political force
- There is a long term need for energy supplies in ***all*** forms
- There is a pressure to develop energy sources that have reduced CO_2 emissions
  - Transport and Heating are critical
  - Alternative energy sources are currently not significant contributors, and are not uniformly distributed in potential

QUESTIONS TO CONSIDER

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Questions to consider

- Which might have the greatest effect on global warming this century; changing the way we generate energy, or using less energy?
- What are the costs of the different forms of energy generation?
  - £ per GWh of electricity?
  - Years of life lost per GWh of electricity?
- How should the UK support its energy needs in the 21st Century?

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FURTHER READING

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Further Background Reading

- Sustainable Energy – Without the Hot Air
  - DJC MacKay, www.withouthotair.com
- Climate Change, A Summary of the Science
  - The Royal Society, royalsociety.org/climate-change-summary-of-science/
- Meeting the Energy Challenge, A White Paper on Energy
  - May 2007 Department of Trade and Industry, www.berr.gov.uk/files/file39387.pdf
- Energy Innovation Milestones to 2050
  - March 2010 Energy Research Partnership
  - www.energyresearchpartnership.org.uk/tiki-index.php?page=InnovationMilestones
- Key World Energy Statistics
  - International Energy Agency, www.iea.org
- Carbon Emissions and Climate Change
  - Warming caused by cumulative carbon emissions towards the trillionth tonne, M. Allen et al, *Nature* **458**, 1163-1166 (30 April 2009), doi:10.1038/nature08019
  - trillionthtonne.org

(Not examinable)