The Role of Collaborative Materials Research in the Development of Clean and Efficient Fossil Energy and Related Technologies

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Outline

• EU Developments in Energy Strategy
• The Challenge for the UK
• Responses – in the UK and EU
  ✓ Materials UK – Energy Materials Working Group
  ✓ EuMaT (Platform on Advanced Engineering Materials and Technologies)
  ✓ EU SET Plan – Materials Road Map
• Response from Industry - EMIRI (Energy Materials Industrial Research Initiative)
EU Developments

Europe is on its way to meeting its 2020 targets

- Reduce greenhouse gas levels by 20%
- Increase share of renewables to 20%
- Reduce energy consumption by 20%

Source: European Commission

Presentation of J.M. Barroso to the European Council, 20-21 March 2014
A renewed ambition for 2030

2020
- 20% greenhouse gas reduction
- 20% renewable energy
- 20% energy savings

2030
- ≥27% renewable energy
- 40% greenhouse gas reduction
- Energy efficiency: review in 2014

Dedicated governance
- National plans
- Common indicators
- Monitoring

Presentation of J.M. Barroso to the European Council, 20-21 March 2014
EU Developments

Growing while saving

Decoupling GDP from greenhouse gas emissions (GHG), 1990-2030

Reducing the EU fuel import bill with our 2030 proposal (import expenditure, in € billion)

Presentation of J.M. Barroso to the European Council, 20-21 March 2014

Source: European Commission
This is about investing in our future: 45% of our power generation capacity is more than 30 years old.

Age of power generating capacities in the EU in 2013 (in years)

- **Coal**
- **Oil**
- **Gas**
- **Nuclear**
- **Renewables (including hydro)**

Source: Platts Power Vision
EU Developments

All sectors should contribute

Share of greenhouse gas emissions, per sector and gas

- CO₂ power sector
- CO₂ heating buildings
- CO₂ industry
- CO₂ transport
- Other greenhouse gases

Presentation of J.M. Barroso to the European Council, 20-21 March 2014

Source: European Commission
The UK Challenge

2020 objective

~34% cut v 1990

77% cut (= 80% vs. 1990)

CCS is expected to be competitive with other low carbon generating technologies.

\[ \text{Central estimates of construction, operation, fuel and carbon costs. Levelised costs calculated using 10\% discount rate. Data from PB Power (2011) and Arup (2011).} \]
Cost of getting to 2050 without CCS – based on ESME Modelling

Incremental 2010-2050 cost of delivering national energy system which meets CO₂ targets

Societal level discount rate 3.5%

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The UK Conclusion

- 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
- **BUT** what balance will provide a viable electricity supply system?
Meeting Demand in the UK

- Flexible Generation
- Inflexible Generation
- Wind Generation
- Gas, Coal and Biomass Generation (with or without CCS) and Energy Storage
Combined Wind Power Output of Germany, Denmark and Spain (4-26 January 2010)
Impact on Non-renewable Generation Costs

Figure 4: Estimated levelised cost of low-carbon technologies by load-factor in 2030. (Source: CCC calculations, based on Mott MacDonald (2010) UK Electricity Generation Costs Update)
5 key technology scoping reports, the SRA (2010) and a report on the supply chain (2011)
The recommendations in the SRA have been distilled down into 3 key common themes where UK materials R&D should focus:-

- **Reducing time to market** and life cycle costs (e.g. solar, fuel cells, marine)
- **Higher performance in harsher environments** (e.g. carbon capture, co-firing, nuclear)
- **Improved life management and reliability** (e.g. offshore wind, nuclear)
EuMaT – Steering Committee members

Official launch meeting, Brussels, 26 June 2006

Presently: more than 900 registered members

23% from industry
**EuMaT – Strategic Research Agenda**

**Sectors**
- Medicine
- Manufacturing
- Energy
- Electronics
- (..)

**Platforms**

EuMaT shall both ensure sharing of best practices, and avoid duplication across sectors/TEPs on Material’s R&D

**WG1.** Modelling and Multiscale
**WG2.** Materials for Energy
**WG3.** Nano and nano-assembled-materials for structural and multifunctional applications
**WG4.** Knowledge-based Structural and Functional Materials
**WG5.** Materials for Information and Communication Technologies (ICT)
**WG6.** Biomaterials
**WG7.** Lifecycle, Impacts, Risks

**Bidirectional dialogue**

Underpinning & cross-cutting

**EuMaT**

**SRA**

[www.cranfield.ac.uk](http://www.cranfield.ac.uk)
Materials for Energy

- Reduced time to market for advanced materials for lowest cost electricity
- Higher performance materials for harsh environments to increase generation efficiency and reduce emissions
- Materials solutions for cost-effective clean fossil and renewable energy systems
- Improved life management of plant components to enhance operability and reliability

- Food security & bio
- Secure clean energy
- Smart green transport
- Climate action raw materials
- Innovative secure societies

health well-being
1. Availability of suitable materials hampers breakthroughs in the development of more efficient and less costly energy technologies

2. Security of supply issues related with the manufacturing chain of low-carbon energy technologies

3. Material research is prioritised in all EII s and EERA Work Plans

4. Political momentum:
   - Europe 2020 Flagship on Resource Efficient Europe
   - Highlight in the Innovation Union as a possible Innovation Partnership on non-energy raw materials

A road mapping exercise on materials for the SET-Plan
Technology Coverage

1. Wind energy
2. Solar energy (photovoltaic)
3. Solar energy (concentrating solar power) including heat
4. Storage
5. Electricity grid
6. Electrical storage
7. Bioenergy
8. Novel materials for the fossil energies sector, including carbon
9. Capture and storage and advanced fuels
10. Materials for the nuclear industry (fission)
11. Hydrogen and fuel cells
12. Energy efficient materials for Buildings
Roadmaps on Materials for the SET-Plan

**General objective** to contribute to make strategic decisions in materials research funding at the European level for the remaining years of FP7 and for the FP8 aligned with the priorities identified in the SET-Plan.

**Scope** proposals of critical R&D, D actions in the next 10 years with market implementation horizons for both 2020/2030 and 2050.

**Deliverables:** Implementable roadmap (s) similar to the SETPlan Technology Roadmap that contains per priority, proposed key actions and Key Performance Indicators (KPIs), underpinned by a scientific assessment.

**Release** for the Polish SETPlan Conference End of 2011.
All of these applications and more are only possible thanks to *advanced materials*.
The importance of materials for the energy and the environment

Energy and Environment represent the two key materials sectors forecast to be worth together circa 60 bn€/year by 2020 and growing on average 7% every year until 2050
EMIRI aisbl - established in 2012 / over 50 members
There are many synergies between applications for different materials. Organising materials research and development on a cross-cutting basis makes sense to be more effective and further enhance the level of excellence and strength of the sector.

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Source: SET Plan Materials Road Map, 2011
Building Industrial Leadership in Energy Materials - the Vision and the Actors

Inspired by H. Chesbrough’s open innovation model
EMIRI is an industry driven grouping whose goal is:

- To establish a strong and vibrant advanced materials sector for competitive low carbon energy inspired by the SET Plan goals and Materials Roadmap

- To bring together industry and research organisations for sustained strategic RESEARCH and INNOVATION programmes
Conclusions

1. Europe and the rest of the world face a major challenge in meeting energy demands while combstting climate change

2. A portfolio of energy technologies will be required and each of these depends on cost-effective and reliable materials and manufacturing technologies

3. European industry, institutions and governments have recognised that collaborative materials R&D represents the best way to meet the challenge

4. EMIRI is the latest in a series of initiatives aimed at developing collaborative energy materials projects – from concept to commercial deployment

Coming soon: Materials for Advanced Power Engineering Conference, Liege 14 - 17 September 2014
Thank you for listening

Questions?

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