UKERC

UK ENERGY RESEARCH CENTRE

Supergen Workshop 2007

Meeting Report

18th-19th July 2007, Keble College, Oxford

Reported by Sarah Keay-Bright, UKERC

Event organised and sponsored by:

UKERC
The meeting place

THE UK ENERGY RESEARCH CENTRE

Operating at the cusp of research and policy-making, the UK Energy Research Centre's mission is to be the UK's pre-eminent centre of research, and source of authoritative information and leadership, on sustainable energy systems.

The Centre takes a whole systems approach to energy research, incorporating economics, engineering and the physical, environmental and social sciences while developing and maintaining the means to enable cohesive research in energy.

A key supporting function of UKERC is the Meeting Place, based in Oxford, which aims to bring together members of the UK energy community and overseas experts from different disciplines, to learn, identify problems, develop solutions and further the energy debate.

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Day 1, 18th July: Background

Day 2, 19th July

Background

This two-day workshop brought together the Supergen consortia to exchange updated information on research programmes and inter-consortia working and to discuss issues of interest, such as improving collaboration.

1. Supergen Review, collated by Jim Skea, UKERC, presented by Ian Bryden, University of Edinburgh

- General view Supergen going well – many successes including publications, conferences & international
- Integration has not been easy for some consortia – seems easier with established consortia and programmes
- Collaboration with industrial partners regarded by many as crucial
- Cross-consortia working has been limited but considerably helped by the Plus funded projects. Plenty of room for development and improvement especially re. cross-consortia working:
    - cascading collaboration to RAs and students: should improve involvement and training
    - industrial partners have been critical for success: need to share learning
    - "plus-funding" in the renewal process a major incentive
    - special edition of a journal as an integrating task
    - common themes provide opportunities for collaboration: materials science; modelling; grid integration issues; life cycle assessment
    - potential to strengthen policy input at consortia and Supergen level

Discussion
There was discussion on whether other countries have set up initiatives similar to Supergen. Canada has shown interest in Supergen Bioenergy and the European Commission is interested in the Supergen concept more generally.

Some consortia have been finding it easier than others to engage industry. Advice was called for on how to get industry engaged. In the case of the Marine consortium SMEs wanted involvement to raise their credibility. Now bigger players, such as utilities are interested in engagement as they are interested in the expertise of academics. However, the marine consortium was hoping for industrial input into models but has been let down on this.

The wind consortium had looked to establish links with manufacturing companies but found they were difficult to engage. They talked but would not disclose much. Utilities are interested but representatives are generally busy and can't always meet commitments. Future Network Technologies consortium has been able to engage utilities at the strategic level, but not on a day-to-day level. The Energy Infrastructure consortium reported that it had talked to manufacturers and utilities and found the utilities to be easier to engage as they are not in direct competition with each other and so more willing to share intellectual property (IP). The opposite is the case for manufacturers who are very protective over IP. Engagement with industry can be difficult if no bargaining power – but once deliverables are available, interest from industry can improve. It was suggested that the Supergen programme could take the initiative to improve industry coordination – engaging at Director level with a coordinated Supergen approach may be a useful aspiration.

Knowledge transfer with stakeholders was discussed, particularly with respect to how best practice can be most effectively shared and how to get the most out of collaboration with shareholders. The marine consortium reported that stakeholders

had changed over the last 4 years. There has been no operating industry 4 years ago but now a closer intellectual relationship is required with the operating industry.

2. Future research plans: presentations from the re-funded SUPERGEN 1 consortia on cross-team working within consortia and cross-consortium working

a) Future network technologies, Tim Green, Imperial College

The theme brings together the engineering, social psychology and policy disciplines from across 8 university groups and involves 28 academic supervisors. The first phase of the research programme involved use of a scenario analysis. This has been a good unifying activity and has been widely noticed and used. The engagement between engineering groups took longer than expected during the first phase. The second phase will focus on improving industrial engagement and cross-consortia working.

'Flexibility' was highlighted as a unifying theme. Flexibility is needed to cope with uncertainty in the future as regards technologies, scale, geography and location, as well as the need for a network that will still be fit for purpose in the longer term e.g. 2050. A flexible network will be more expensive than single-purpose networks but are economically efficient in an uncertain world. Flexibility can come from additional primary assets and could also come from breaking through existing operation limits on existing assets through smart, real-time control.

On cross-consortia work there is strong engagement with Supergen Highly Distributed Power Systems and Georgia Technology. Tim mentioned inclusion in a core project on power system electronics and involvement as a partner in a Supergen Plus project on Future Low Voltage Networks. The consortium is also involved in a Plus project on the future energy mix which will allow the consortium to build on its scenario success. Shared interests have been recognised with the marine consortium and there is an intention to exploit these fully. The consortium has nearly identical industrial co-funders as the Supergen Amperes consortium so there is a need/opportunity for coordination here.

b) Hydrogen energy, Tim Mays, Bath University

The renewal process has brought in new partners and teams, mainly in socio-economic research via Plus funding: Tyndall Centre; Manchester, Cambridge, Salford, Strathclyde Universities. The research programme of the consortium now involves 17 research teams based in 12 research institutions. Tim set out the organisational structure of the consortium and details on how it works, including the management committee, steering committee and advisory group. The research themes and work packages were outlined.

The future imperatives and challenges for the consortium are identified as:

- Increase momentum & impact of *inter*-consortium collaboration *via* joint publications, staff & student exchanges, …
- Increase momentum & impact of *intra*-consortium collaboration *via* PLUS projects, joint meetings, …
- Increase visibility & impact *via* organising an international symposium on sustainable hydrogen energy (in 2008)
- Enhance national links with TSEC, UKERC, Tyndall Centre, Carbon Trust, H2NET, UK Hydrogen Association, …
- Enhance international links with EC FP6 and FP7 programmes (e.g., HyTRAIN, NESSHY, HYCONES, …), International partnership for the Hydrogen Economy (IPHE), IEA (e.g. Task 17), …
- Enhance links with academe, commerce, industry, business, policymakers nationally and internationally *via* appropriate communication & dissemination, …

Discussion
The hydrogen consortium that a number of patents have resulted from the research which was not foreseen, and many papers have been published in journals. The UK is not a big spender on hydrogen research relative to other parts of the world. However, the funds are now increasing and institutions have to adjust to the change as they are not used to such large sums.

There were several comments on the renewal process. Those managing renewal bids commented on the complexity and time-consuming nature of the process. Several commented that summer was probably not the best time to carry out such a process as many key people were on vacation and PIs had to coordinate the process while on vacation.

c) Biomass, biofuels and energy crops, Tony Bridgwater, Aston University
The renewal was based on a core proposal and five separate Plus bids, three of which were inter-consortia. Four of the five Plus bids were funded. Tony outlined the organisational and management structure, including details on the 8 research themes and the work packages and people involved in them. A large researchers meeting will be held in November 2007. The consortium supports researcher exchanges between the consortium and other UK partners, industrial partners and European organisations – a special travel/accommodation fund is being set up.

d) Marine energy, Ian Bryden, University of Edinburgh
Ian outlined the organisational and management structure, including details on the 10 research work streams and the people, partners and collaborators involved. There are several Plus workstreams, including the set up of a doctoral training programme and a project on the ecological consequences of wave and tidal energy conversion.

Opportunities for cross-consortium work include:
Plus 5 - Demand, Innovation, Deliberation and Sustainability – Submitted by the UKSHEC
Plus 2 - Hydrogen from Marine Energy and Biomass: Production, Storage and Utilisation
Plus 4 - Offshore Electricity Networks – Submitted by the 'Flexnet' Consortium

e) Cross Consortia Plus Package: Cross technology innovation dynamics and scenarios, Nick Hughes and Julia Tomei, Policy Studies Institute
The rationale underpinning the set-up of this project came out of the experience of Supergen Phase 1: many interactions and interdependencies were identified across the consortia; a range of methodologies and approaches yielded a variety of conclusions; long-term energy policy solutions are likely to involve many technologies and systems, not a magic bullet. It was concluded that an integrated approach could yield outputs of greater relevance to policy-makers, whilst retaining the high level of technology specific expertise within Supergen 1. The project aims to bring together the scenarios and techno-economic model outputs of SUPERGEN 1 to better understand the optimum innovation dynamics, conditions and pathways of the main renewable energy technologies in the transition to a low carbon economy.

Details of the sub-work packages were outlined:
- SWP1: Innovation processes, institutional co-ordination and policy
- SWP2: Comparison and integration of Models and Scenarios
- SWP3: Stakeholder understanding and public perceptions, differences of scale and place

The expected policy outputs include: policy recommendations from each partner, focusing on their specialism but taking account of comments of others; workshops with policy, industry and NGO stakeholders, leading to final policy-oriented report of

recommendations; and academic journal articles and presentations. This Plus package is a potentially important focal point for interaction of SUPERGEN 1 consortia. It will involve expertise throughout the consortia, not just the PIs. The process and outputs are potentially of use to all consortia for extending policy interaction.

3. UKERC Energy Data Centre, Geoff Dutton, Rutherford Appleton Laboratory

Geoff provided a quick overview of the UKERC energy data centre (EDC). The EDC aims to:

- provide an outward-facing data service to the UK energy research community by:
  - holding/pointing to data generated from any source
  - ensuring consistent use of data between diverse projects
  - preventing duplication of effort in sourcing data

- establish long term data curation facilities for data generated by UK academic projects
  - initially UKERC and TSEC
  - wider support across NERN including Supergen

- add value to existing data sets
  - establishing and supporting long-term data
  - hosting scenario models and supporting data
  - data access and interface

4. Group brainstorm and syndicates for new ideas on collaboration

The group put forward specific ideas for ways to improve or facilitate inter-consortia collaboration. These ideas are listed in the Appendix. The ideas were clustered into themes and participants split into smaller groups which would look at the ideas in a particular theme in more detail. Groups were asked to consider the ideas put forward on the topic/theme and to take one idea or set of related ideas they thought were important, worth pursuing and feasible. The group then had to work on this idea in more detail, providing:

- a detailed description of the idea
- the rationale for why it is needed
- who would be involved
- how would it be delivered: actions and resources required

Group 1: PROPOSAL FOR SUPERGEN COORDINATION GROUP

Overall aim:

- To improve communications at all levels (within/between consortia, with policy makers, funders, ministers etc).

The group is not an opinion-forming group, but an opinion sharing group. Will complement, and not overlap with the existing hi-level strategic Supergen group.

Sub-objectives:

- Develop a Supergen communication policy
- Develop and promote the Supergen brand
- Identify communication related gaps/problems and develop/propose solutions. The group would then find the volunteers/resources to develop these solutions. It would not be within the remit of the group to take on the development of proposals/activities.
- Share best practice

Set-up:

- Frequency of meetings: Bi-annual
- Composition: 1 rep per consortia
- Set up: EPSRC could co-ordinate the bi-annual meetings; EPSRC could provide dedicated Supergen coordinator; RCs provide funds to outsource coordination responsibility to one of the consortia. Small starter fund would be helpful.

Some ideas for improving communications:

- develop proposals for mechanisms through which feedback on research programmes (e.g. outputs; processes; lessons learned) can be communicated to hi-level group.
- Supergen conference for sharing of research findings/outputs with main aim of improving communication/knowledge transfer between consortia
- Supergen website with chatroom, links etc
- Propose effective mechanisms for transferring information/knowledge to a) industry, b) Parliament, policy-makers

Group 2: PROPOSAL TO IMPROVE SKILLS AND TRAINING

Proposal for a book

- Why? Lack of up-to-date cross-discipline combined literature targeted at doctoral students, post-graduates/docs. Focused on Supergen coverage (maybe also need for another book on whole systems (all aspects) energy?).
- How? Each consortia provides a chapter – overall supervision by an editorial board
- Needs and who? Contributors, publisher, cash (?), copyright agreement, editorial board

Other proposals:

- short-term industrial placements for PHD students and post-docs
- website with info on training opportunities for junior researchers (course, conferences etc)
- Summer school: UKERC model available to all Supergen researchers
- Book is coursebook for summer school

GROUP 3: PROPOSAL TO IMPROVE COLLABORATION ON MARINE AND OFFSHORE

- WHAT: Marine consortia to find out more about knowledge gaps/problems where lacking in expertise and to address these gaps/problems by bringing necessary expertise from other consortia into existing work packages.
- WHY: Need to do this to improve cost effectiveness of marine energy using a systems approach to maximally exploit offshore infrastructure.
- Known gaps where other consortia may be able to provide expertise:
    - Wind – turbulent dynamic systems
    - Economics – device costing methods
    - Hydrogen – energy storage/electrical displacement
    - Energy storage – power smoothing/energy storage
    - Networks – integration with network, power electronics

GROUP 4: PROPOSAL TO IMPROVE LEARNING CURVES

- WHAT? Look at learning in a wider context because:
    - Existing learning curve shortfalls: over-simplified; debateable assumptions/factors; missing key elements
- WHY? Need to bring down costs – get to bottom of learning curve and need to understand where technologies are on the curves
- WHO? UKERC (Mark Winksel) already carrying out analysis of learning curves but not all technologies covered e.g. CCS; H2; biomass
- HOW? Supergen needs to input better into the UKERC project.

GROUP 5: INTER-CONSORTIA HYDROGEN RESEARCH PROPOSAL

- WHAT? Local (small-scale) H2 production by electrolysis as input to hydrocarbon fuel production process based on biomass products (fermentation of biomas products to promote Hythene)
- WHY?: Biomass is only renewable way to fix CO2 – best reserved to procude H2 fuel. Needs additional H2 to make optimum use. Use off-peak grid electricity (no intermittency problems)
- HOW?: Explore different fuel chains (including marine based), materials issues (low cost), systems analysis (worms to wheel)
- NEEDS?: Funding from Gvt (too early for private)
- WHO?: Supergen, Bioenergy, H2 (+the other 11)

5. Energy technology research roadmaps: the UKERC experience, Markus Mueller, University of Edinburgh and Sarah Keay-Bright, UKERC Meeting Place

Markus introduced the group to UKERC, its structure, research programme and other functions. One of the UKERC research themes, Future Sources of Energy, has produced several technology research roadmaps: bioenergy; PV; marine. These roadmaps are being compiled to: identify the research priorities; identify critical areas of research – potential show-stoppers; identify areas and groups for collaboration outside the current research landscape; advise on research funding strategies; and demonstrate the need for coordinated research activity between academia and industry.

More specifically, these roadmaps:

- furnish a framework for managing and reviewing complex and dynamic R&D processes needed to achieve important future goals;
- are used to support business or government goals;
- graphically show how specific R&D activities address strategic technical goals that support market (business) or policy (government) objectives of the future;
- identify the sequence of research problems to be overcome before new technologies can be commercially viable;
- stimulate work with the research community and stakeholders to identify existing maps, fill in gaps and bring these together into a single roadmap;
- are consensus-based, interdisciplinary and dynamic; and
- need to be scenario-based.

The roadmaps, alongside UKERC's research register (an on-line searchable database of energy-related awards and projects) and research landscape (characterising energy-related research activities and capabilities in the UK (programme level)) tools, form part of UKERC's National Energy Research Atlas. The atlas aims to be an authoritative and comprehensive account of capabilities and unsolved research problems across the energy domain.

Markus provided detail on the UKERC photovoltaic, bioenergy and marine research roadmaps, including framework, structure for content, process, people involved, timetable etc. The roadmaps are available to view through these weblinks and comments/input is invited:
PV - http://www.ukerc.ac.uk/www.ukerc.ac.uk/content/view/320/021
Bioenergy in draft – contact g.taylor@soton.ac.uk
Marine: http://www.ukerc.ac.uk/content/view/264/642
UKERC Landscape Documents http://ukerc.rl.ac.uk/ERL001.html
Roadmap Documents http://ukerc.rl.ac.uk/ERR001.html
UKERC Research Atlas http://ukerc.rl.ac.uk/ERA001.html

Sarah gave a short presentation on the facilitation process which was applied to the UKERC roadmap workshops. The UKERC Meeting Place:

- develops the concept and ideas with the proposer;
- provides a facilitator;
- designs a workshop structure/format that will deliver the objectives;
- arranges and covers costs of the logistics;
- assists the proposer with putting together and disseminating briefing documents, the workshop report, outputs, etc.

Sarah stressed that careful and thorough planning is key to a successful workshop.

Day 2, 19th July

6. Update on the EPSRC Energy Programme and developments relating to the ETI, Alison Wall, EPSRC

Alison informed of staffing changes at the EPSRC, particularly who is now responsible for which aspects of the Energy Programme.

The main issues of current concern to the EPSRC include: development of the ETI and ERP; development of the transport and demand reduction portfolio; delivery of CSR2007 plans; future direction of fusion. Alison provided an update on the broad ongoing portfolio development, the elements of which fall under the headings: strategic input; broad portfolio to meet policy objectives; working in partnership; international. This portfolio includes the £18m fund for Supergen renewals.

Delivery of the CSR2007 plans will involve:

- Sustaining work on: power generation and supply
- Growing work on:
  - Demand and consumption
  - Security of supply
  - Energy and equity
  - Heat and other energy vectors
  - Underpinning science and engineering
  - Transport
  - Research capacity

The latest developments relating to ETI include the following:

- Partners: E.ON, EDF, Shell, BP, Caterpillar, Rolls Royce, DTI (EPSRC,TSB)
- Funding from DfT
- Legal structure
- Funding model
- IP model
- Director recruitment in progress (expected to be in post Sept 07)
- Paul Garnham COO seconded from Shell
- Host selection
- RD&D priorities

Alison drew a comparison between the ESPRC Energy Programme and ETI. In brief, the former is concerned with basic science, proving feasibility and limited development. The latter is more focussed on proving feasibility, development and limited demonstration. As regards the Energy Research Partnership, the EPSRC is looking at the following aspects:

- Key issues for UK Energy Innovation
- Technology matrix – input into EPSRC planning
- Simplifying the innovation landscape

7. ERC update and European developments (FP7 and the EU Strategic Energy Technologies (SET) Plan), Jim Skea, UK Energy Research Centre

Jim set out the process and timetable for the development of the EU Framework Research Programme (FP7). The publication for the call of proposals is expected in November this year with the deadline for proposals being Spring 2008. The 2008 call, with available funding of €185m, will focus on applied research with a short/medium-term perspective. The medium/long-term research was well covered in 2007.

Jim informed that the Commission is working with the fuel cell and hydrogen technology platform to establish a Joint Technology Initiative (JTI). Jim also gave an update on the Commission's Strategic Energy Technology Plan (SET). The new EU energy strategy was proposed and agreed in Q1 2007. As part of this the Council of Ministers agreed a binding target that 20% of energy demand should be satisfied by renewable sources by 2020. This includes all energy – heat, power, transport – and is ambitious. There is no decision yet on sharing the target between Member States. The long-term energy strategy is to be supported by a
Strategic Energy Technology (SET) Plan but it is currently unclear what this involves although a consultation is now under way.

8. Parallel syndicate groups:

GROUP 1 - POLICY COORDINATION (a very large group, approx 20 people)

- Need clear, strong, simple messages.
- Membership: Committee of management hub representatives.
- Communication officer or other resource(s) would be needed.

Questions:

- Can Supergen provide a clear consensus on sustainable energy? How can we do this?
- Should there be a board of directors?
- Committee should take account of: divergence of opinion (which is positive) and a range of opinions.
- Branding and marketing: Should the group have a corporate identity?
- Is the group opinion forming or opinion sharing?
- Will the group be proactive or reactive with respect to government?
- What kind of message/information/evidence from Supergen as a whole?
- An overall Supergen renewable energy roadmap?
- Energy research fellows' role (Nigel Brandon)?

GROUP 2 - ASSESSMENT METHODOLOGIES E.G. LIFE CYCLE ASSESSMENT (LCA); MULTI-CRITERIA DIMENSION ANALYSIS (MCDA)

The group looked at different methods that Supergen consortia are/could apply to their research: Cost Benefit Analyses (CBA); Life Cycle Analyses; Ecological Footprints; Multi-Criteria Analyses; Impact Analyses; Computable Gen Equilibrium Supergen already has linkages with: Science and Technology Committee of the House of Commons; DTI; OSI; Research Councils; the press/media; ETI and ERP.

Socio-economic analyses in each consortium:

- what are they attempting to do?
- evaluation
- objectives
- methods

Objectives: (common across applications)

- sustainable development (targets)
- economy
- distribution (poverty)
- environment (e.g. GHGs) and energy

The next steps were identified as:

- set up of a cross-consortia socio-economic group
- remit for the group – aim for some consistency
    - costs/benefits to be considered
    - explicitly discuss any new ones
    - methods and their application
    - use common database
    - workshop(s) may be needed

GROUP 3 – WIND ENERGY RESEARCH ROADMAP

Justification:

- UK target of 20% UK electricity generation from wind by 2020, meaning 25GW installed capacity
- Supply chain framework
    - Turbine
    - Farm
    - Micro-generation
    - Industry involvement
    - Integration
    - Large scale development
    - Socio-economics
    - Public acceptance
    - Environmental issues
    - Storage
    - Other uses e.g. desalinisation; hydrogen production

- structure
    - small
    - large
    - test facilities
    - operations and maintenance
    - skills
    - power systems issues
    - regulatory

- the map should involve the following stakeholders :
    - manufacturers
    - developers
    - utilities (customers)
    - consultants
    - BWEA
    - EWEA/Academy
    - European institutes
    - Marine industry
    - UK academia
    - Wind technology platform
    - US (EPRI) NREL

- next steps and actions
    - Speak to UKERC Meeting Place about a facilitated workshop
    - Speak to other programmes that have developed a roadmap e.g. PV – David Infield
    - Set up a working group including industry, academics and consultants

9. Next steps and actions

The group considered the outputs of the last two days and agreed the following actions:

1. **Set up of a coordination group (to coordinate communications including policy):** EPSRC; Graeme Burt; Peter Tavner; Peter Hall; Time Mays?
2. **Supergen Conference 2008:** Jim Skea; Sarah KB; George Aggidis; Tim Mays?
3. **Supergen Book proposal:** Jim Skea; Sarah KB; Gabrielle Hilson; Juan Sanchez-Hanton; Peter Hall; Gulliano Premier; Michael Grubb
4. **Learning Curves:** Markus Mueller to talk with Mark Winksel
5. **Hydrogen research proposal:** Dennis Hawkes to bring together core group and follow-up
6. **Marine proposal:** Markus Mueller, Robin Wallace and Bill Leithead to follow up
7. **Wind Roadmap:** Bill Leithead and Sarah Keay-Bright to discuss workshop
8. **Methods and a common approach:** UKERC HQ carrying out audit of methods which will be useful – Geoff Hammond; David Howard; Richard Dinsdale; Jim Skea (Sarah KB for workshop)

Appendix

(Day 1 brainstorm – ideas to facilitate collaboration)

Ideas were clustered – however, many overlaps between clusters

COMMUNICATIONS
National Energy Supergen conference
Conference for all Supergen consortia (biannual?)
Cross-consortia technical meetings
Quarterly Supergen newsletter or WIKI
Media activities
Links with other EU countries and networks
Share experiences with stakeholder involvement/engagement
Supergen e-chat room
'Super' Supergen working group
Up-to-date Supergen website and events diary
Money for meetings between groups

POLICY
Developing more coordinated renewable energy deployment policy
Supergen 'think tank' for all consortia reps to influence policy
Getting stronger policy input
'Research Hotel' activities on focussed policy relevant issues
Lobby with Government and NGOs

HYDROGEN and FUEL CELLS and OTHER
Fuel cell-H2 store – systems integration
Regeneration fuel cells producing hydrogen
H2 infrastructure materials: SHEC/extended conventional power plants
Link new 'Renewable H2 Demo Centre' with Supergen Programme
H2 family – reality TV analogy
Keeping the Nuclear Option Open and H2 – thermochemical cycles

HYDROGEN and RENEWABLES
UKSHEC – H2 from biomass, interaction with Supergen Biomass
H2 from biomass (thermal and fermentation) or electricity from wind, marine, PV
Hybridisation of H2 electrolyser technology with biorenewable energy

OFFSHORE and MARINE
Marine/bioenergy: use macroalgae to stabilise arrays of generators and use as biomass
Bio fuel cells in a marine environment
Wind/marine: device scale modelling and analysis
Marine/wind: Dedicated installation and intervention systems and methodology
Offshore technology: marine and wind - common challenges
Improve technology interaction between consortia 9H2, bioenergy and marine)
Offshore interaction wind and marine – large offshore developments
Wind-marine-bioenergy: Integrated energy facilities
Input and discussion between industry and marine/wind Supergen: evolved industry and 'conceived' industry
Wind and marine turbulence: structural design; power output; modelling
Marine energy as process energy for unrelated systems
Marine and hydrogen – revisit failed Plus 2 bid
Generation of H2 from Marine renewable energy
Offshore networks: wind; marine; future networks, energy storage
Marine/energy storage: clean power output using capacitors?

TRAINING AND EDUCATION
Undergraduate prize for best new power generation technology project
Industrial visits for PHD students across consortia
Workshops explaining different technologies involved in each consortia (educational focus) for all to attend
How can training provision be improved?
Share experiences on RS training
Industrial open days for all consortium members (project demos)
Student and research assistant training
Funding for training/mobility of researchers
Training centres for postgrads and research assistants for better awareness of different consortia
Open invitation to consortia training programmes to facilitate researcher dialogue

NETWORKS and INFRASTRUCTURE and DISTRIBUTED POWER
Decentralised energy – appropriate technologies and systems dynamics
Link between 'new' flexible network and 'old' infrastructure
How do you get from existing power networks to future ones without outage and blackouts?
Small scale storage and microgeneration technologies and distributed power systems – systems development workshop
Network integration of future energy technologies workshop
'Intermittency' – How to cope with supply and demand variability in a low carbon system
Interaction of many renewable energy sources e.g. solar/thermal vs biomass/heat

TRANSPORT
Fuel cell/H2/energy storage: power train modelling for automotives
Integrated energy system modelling incorporating conversion technology and transportation infrastructure
Supergen links with transport
Energy for transport versus electricity

ENERGY STORAGE
Use of renewables to generate other energy vectors (not electricity) bioenergy, H2, energy storage
Hybrid systems e.g. fuel cells/energy storage
Renewables and energy storage (economics-modelling)
Wind and energy storage – load matching
Flexnet/Energy storage: increase flexibility/capacity using energy storage

MODELLING
Modelling for novel power generation technology plant

CARBON SEQUESTRATION
Solid carbon sequestration: Biological, chemical or thermal/plasma

BIOENERGY (SEE MARINE/OFFSHORE/H2)
Green biomass for bioconversion

CONVENTIONAL POWER PLANTS
Monitoring – of plant (mechanical, chemical), condition and performance
Joint workshop on capturing plant and system data

RESEARCH METHODS/CRITERIA/APPROACHES
Assessing evaluation methods and criteria across consortia (e.g. different MCAs versus cost-benefits)
Sustainability – environmental and social impacts of different energy systems
Desirability/necessity of exploring impacts over different geographic scales (local/regional/national)
Need to evaluate new technologies as part of a portfolio – not in isolation
MCDA methodology normalisation

RESEARCH FUNDING PROCESS AND BIDS
EPSRC or DTI call for cross collaboration projects
What does or does not work in collaboration agreements?
Cross-consortia guidance to EPSRC on how to reduce stress levels for PIs
How to do the consortia deal (as a group) with three funders?
What can be done by 2020?
Supergen 'extra' fund for bidding
Identifying the gaps in Supergen for future rounds e.g. low T fuel cells

INTELLECTUAL PROPERTY
Sharing IP strategies
Funding of P.O.C. and I.P.R. protection in collaborations

Supergen Workshop

Keble College, Park's Road, Oxford, 18-19 July 2007
A two-day workshop to bring together the Supergen consortia to exchange updated information on research programmes and inter-consortia working and to discuss issues of interest, such as improving collaboration

Programme

DAY 1: 18 July

9:45 Registration and coffee

10:15 **Introduction and welcome**
Robin Wallace, University of Edinburgh/UK Energy Research Centre

10:25 **Update on Supergen consortia** (based on proformas provided by consortia)
Robin Wallace, University of Edinburgh/UK Energy Research Centre

11:00 **Future research plans:** presentations from the re-funded SUPERGEN 1 consortia on cross-team working within consortia and cross-consortium working

- Marine energy*, Ian Bryden, University of Edinburgh* (25 minutes)
- Future network technologies, *Tim Green, Imperial College* (25 minutes)
- Hydrogen energy, *Tim Mays, Bath University* (25 minutes)
- Biomass, biofuels and energy crops, *Tony Bridgwater*, *Aston University* (25 minutes)

12:40 LUNCH

13:40 **Future research plans continued:**

- Cross Consortia Plus Package: Cross technology innovation dynamics and scenarios, *Nick Hughes, Policy Studies Institute* (20 minutes)

14:00 **UKERC Energy Data Centre,** *Geoff Dutton, Rutherford Appleton Laboratory*

14:05 **Group brainstorm for new ideas on collaboration**

14:30 **Parallel syndicate groups working on ideas from previous session**

15:30 Refreshment break

16:00 **Syndicate groups report back** (5-10 minutes each)

17:00 **Energy technology research roadmaps: the UKERC experience**

17:50 Review of Day 1

18:00 Close

19:00 Pre-dinner drinks, Keble College
19:30 Dinner, Keble College

Day 2, 19 July

9:00 **Update on the EPSRC Energy Programme and developments relating to the ETI**
Alison Wall, EPSRC

9:30 **UKERC update and European developments (FP7 and the EU Strategic Energy Technologies (SET) Plan)**
Jim Skea, UK Energy Research Centre

10:00 **Parallel syndicate groups:**

- Creating a wind energy research roadmap
- Influencing the UK energy policy and energy research strategy
- Assessment methodologies e.g. life cycle assessment (LCA); multi-criteria dimension analysis (MCDA)
- Other (as proposed by participants)

11:00 Refreshment Break

11:30 **Syndicate group report back** (5-10 minutes each)

12:30 **Wrap-up and next steps**

1:00 Close and Lunch

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