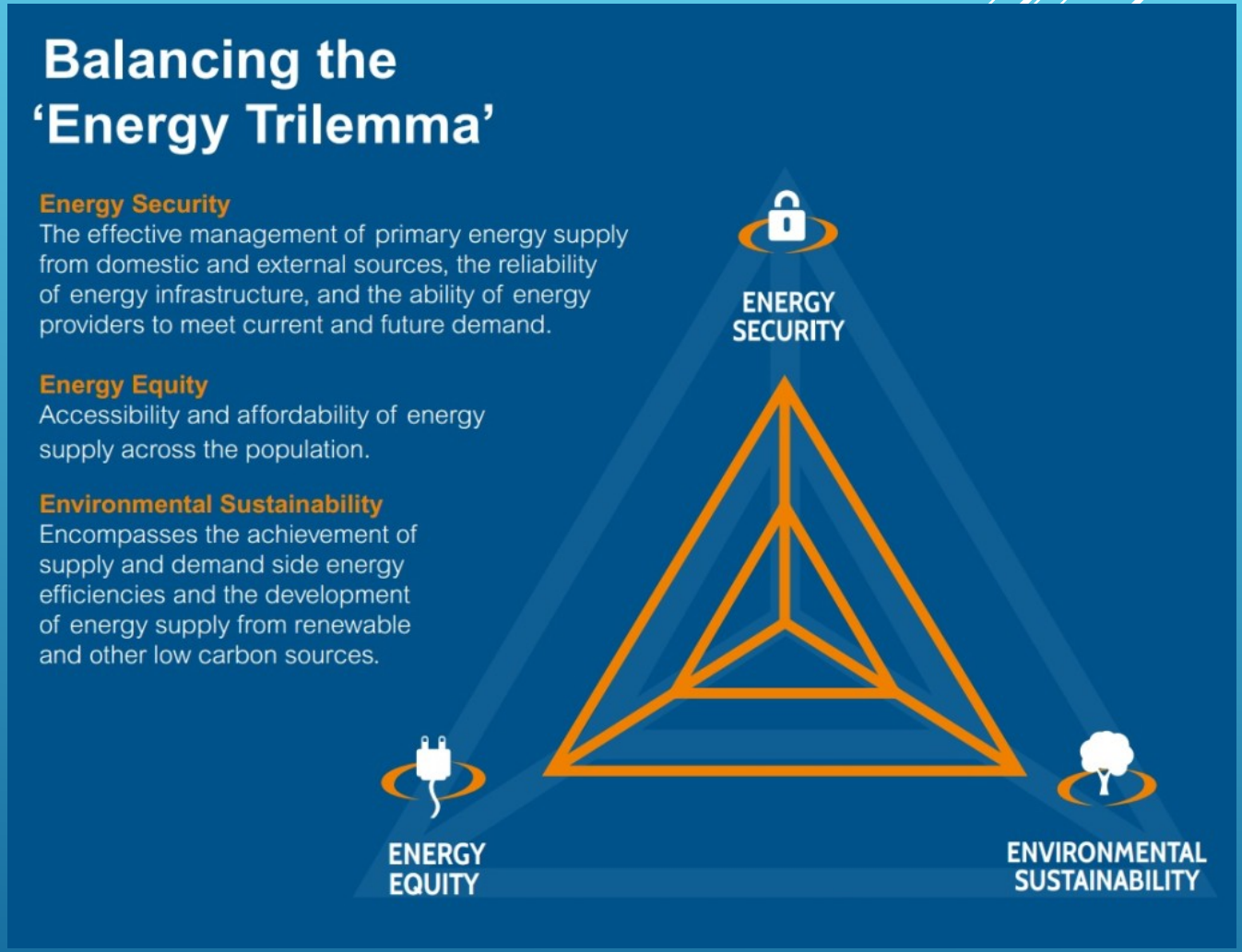
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ENERGY FUTURE?

Prof Gavin Gillmore,

Head, Kingston Energy,

Kingston University



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World Energy Council Trilemma Framework

- **Energy Security**
  - The effective management of primary energy supply from domestic and external sources
  - The reliability of energy infrastructure and
  - The ability of energy providers to meet current and future demand
- **Energy Equity**
  - The accessibility and affordability of energy supply across the population
- **Environmental Sustainability**
  - The achievement of supply and demand side efficiencies and
  - The development of energy supply from renewable and other low-carbon sources

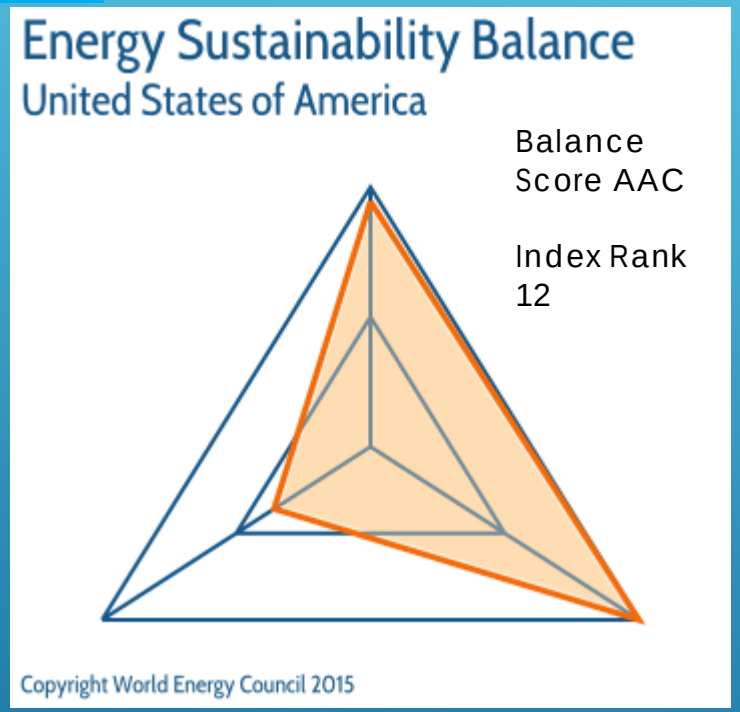
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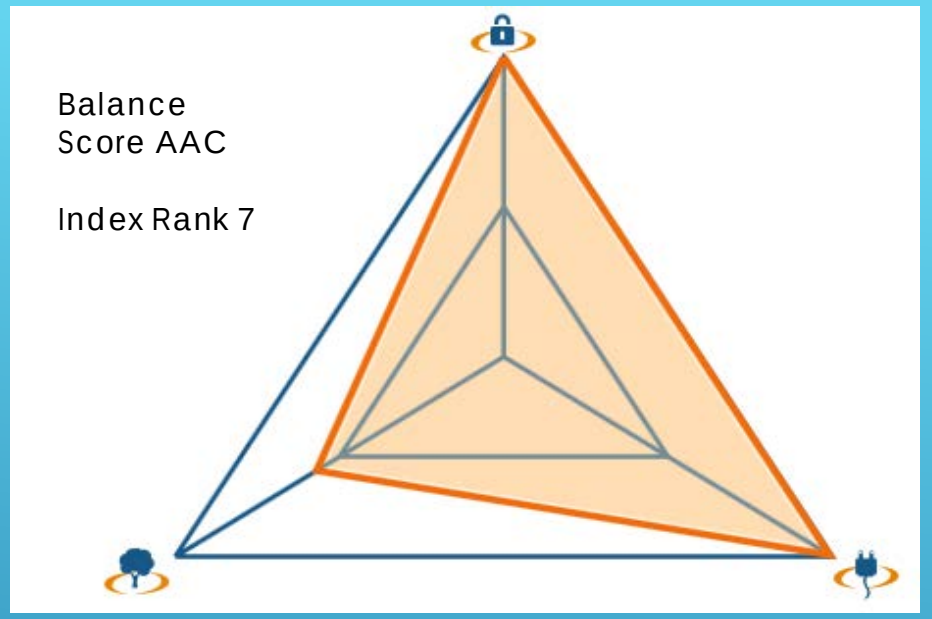
ENERGY TRILEMMA TOP PERFORMERS

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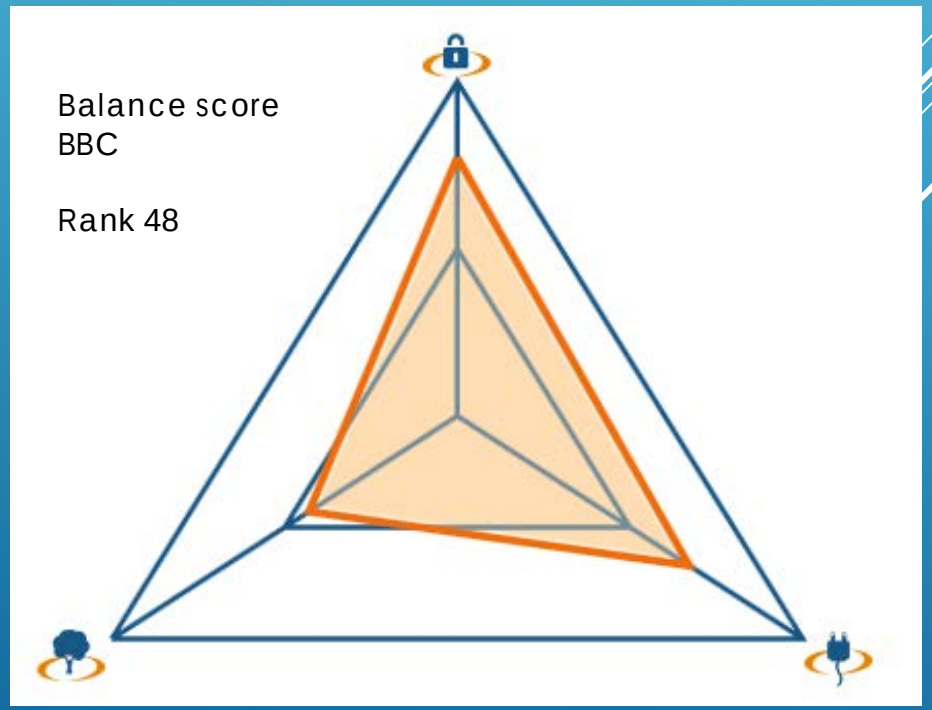
US supply dominated by fossil fuels.



Canada dominated by hydroelectric power

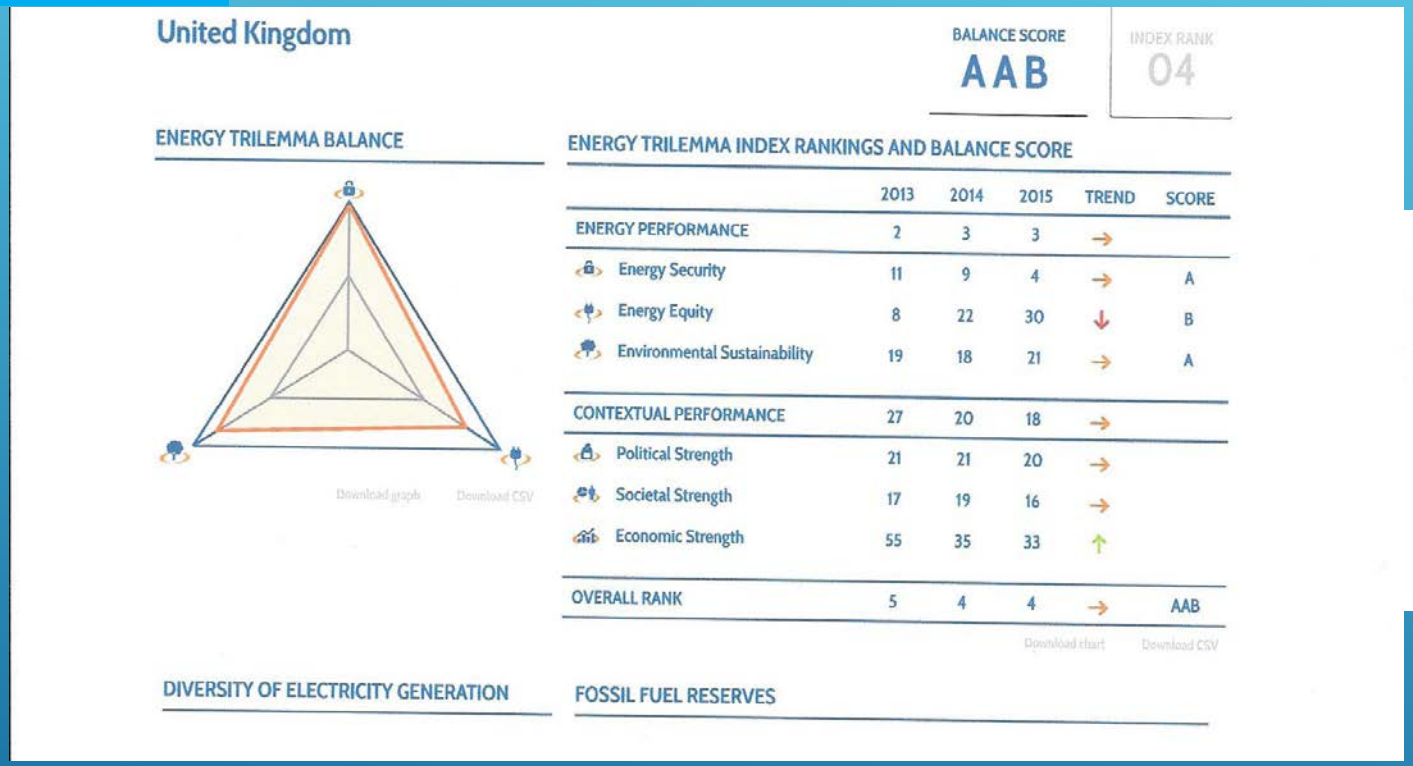


Mexico dominated by conventional thermal electricity supply



US ENERGY TRILEMMA BALANCE VS CANADA AND MEXICO

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United Kingdom

BALANCE SCORE AAB

INDEX RANK 04

ENERGY TRILEMMA BALANCE

ENERGY TRILEMMA INDEX RANKINGS AND BALANCE SCORE

	2013	2014	2015	TREND	SCORE
ENERGY PERFORMANCE	2	3	3	→	
Energy Security	11	9	4	→	A
Energy Equity	8	22	30	↓	B
Environmental Sustainability	19	18	21	→	A
CONTEXTUAL PERFORMANCE	27	20	18	→	
Political Strength	21	21	20	→	
Societal Strength	17	19	16	→	
Economic Strength	55	35	33	↑	
OVERALL RANK	5	4	4	→	AAB

Download graph Download CSV

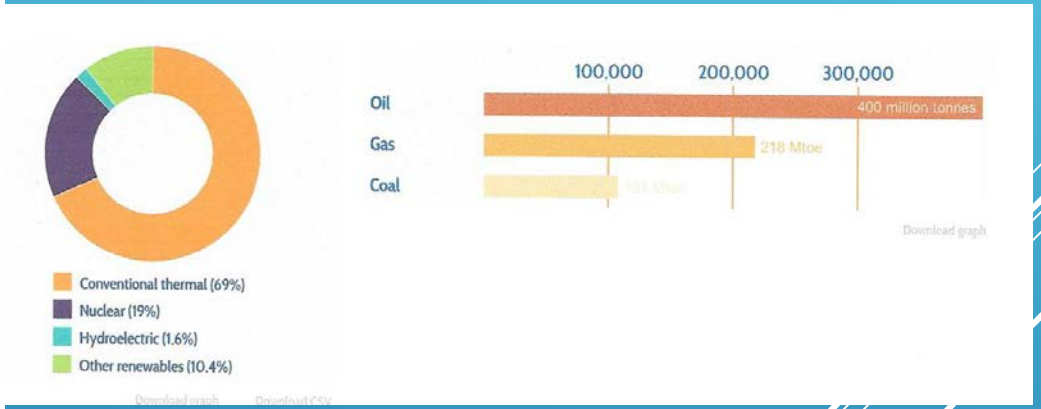
Download chart Download CSV

DIVERSITY OF ELECTRICITY GENERATION

FOSSIL FUEL RESERVES

Diversity of Energy Generation

Fossil Fuel Reserves



THE UK ENERGY TRILEMMA INDEX – CURRENTLY REGARDED AS PACK LEADER

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UK Oil & Gas chairman Stephen Sanderson said that the Gatwick well was 'the equivalent of the best-producing wells in the United States'

Lenigas hails 'fantabulous' early test results at Gatwick oil well



Greenpeace projected a message to the Chancellor, George Osborne, on to the Houses of Parliament SAMUEL KEYTE

EDF fails to come up with details for Hinkley nuclear plant



WHAT IS THE FUTURE?

(THE INDEPENDENT, FEB, 2016 AND EXETER EXPRESS AND ECHO, SEPT 2016)

FILLING THE ENERGY GAP?

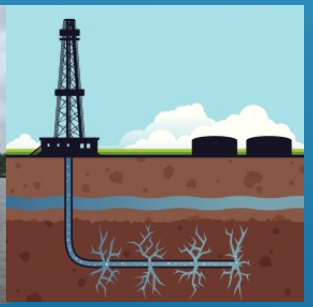
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- An Energy hub to provide:-
  - A uniquely broad multi – inter-disciplinary force to meet the needs of students, employers and Government.
- A source of:-
  - R and D, training of highly employable graduates and post-graduates.
- Focussed on safer and better use of resources:-
  - Smart energy / demand-side management,
  - More efficient renewables, e.g. nano-coatings and wind power,
  - Understanding relative unknowns e.g. unconventional hydrocarbons
- Advisory Board:-
  - Industry professionals and ex-politicians e.g. Sir Ed Davey, Malcolm Brown (Executive Vice-President BG Group)

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University Alliance
Doctoral Training Alliance

DTA
Doctoral Training Alliance
Energy

- 12 Alliance universities - Greenwich, Hertfordshire. Kingston, Lincoln, Manchester Metropolitan, Nottingham Trent, Open University, Portsmouth, Salford, Sheffield Hallam, South Wales, Teesside.
- Building on research strengths and industry-focused ethos.
- To produce independent, highly-employable researchers with knowledge, expertise and skills in strategically-important research areas.
- The largest multi-partner and only nationwide initiative of its kind.
- Fully-funded postgraduate programme. Doctoral students (72-108) will gain access to world class research, state of the art facilities, an expert support network, and improved employment opportunities.
- Starts October 2016.

DTA ENERGY - TACKLING GLOBAL ENERGY CHALLENGES

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SMART ENERGY AND ENERGY EFFICIENCY

- What is the missing link in our energy policy?
- Energy efficiency?
- Using, wasting, paying less for energy
- Need to change the dialogue about energy efficiency?
- Encourage people to take control of their own energy?
- How?
- Evohome Honeywell Project – the user interface



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NANO-COATINGS AND WIND TURBINES

- Synthesis of Advanced top nano-coatings with improved Aerodynamic and De-icing behaviour) SANAD
  - improve aircraft fuel efficiency, drag reduction (and wind turbine blade performance)
  - EU funded circa € 1.2million

BRITISH AIRWAYS

SANAD

- British Council UK-China Wind Power in Cold Climates workshop



BRITISH COUNCIL

Newton Fund

RESEARCHER LINKS

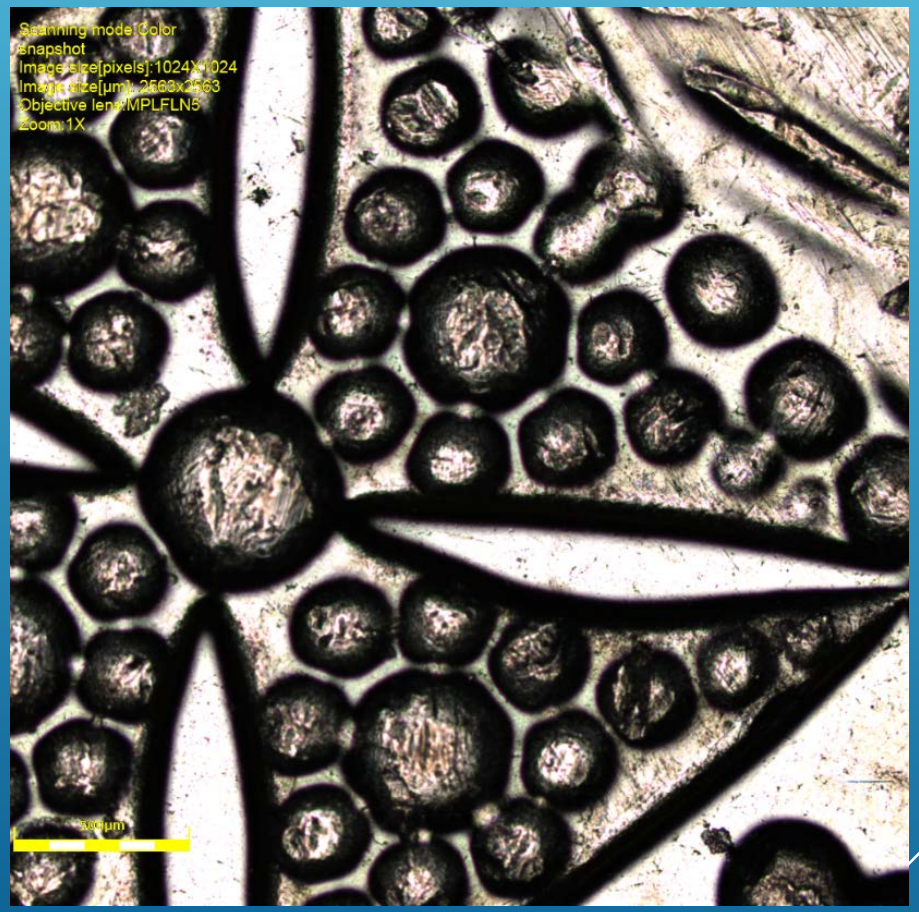
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Centre for Engineering, Environment and Society Research

CEESR

CEESR ENERGY Theme

Olympus LEXT laser confocal 3D measurement microscopy and imaging.





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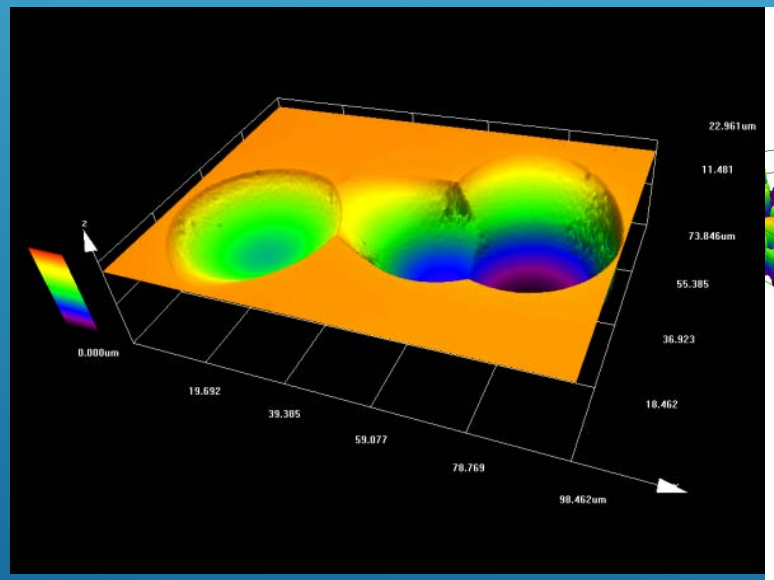
Centre for Engineering, Environment and Society Research

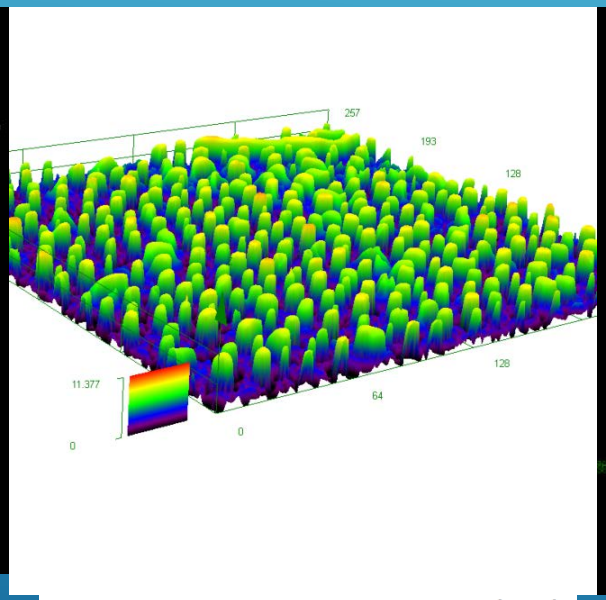
CEESR

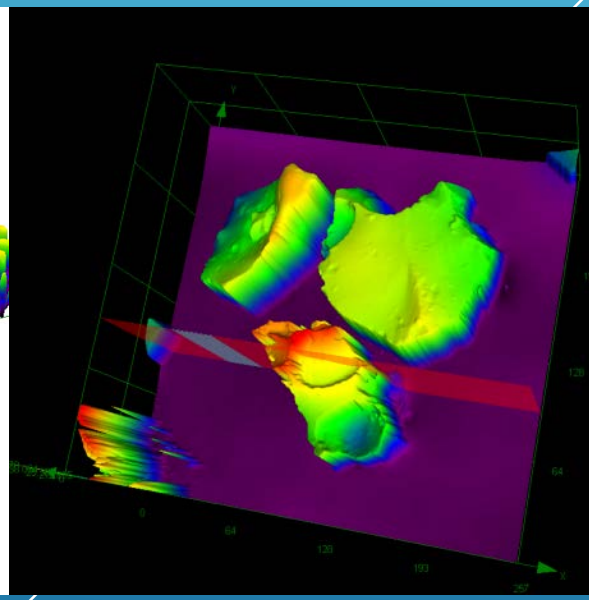
CEESR ENERGY theme

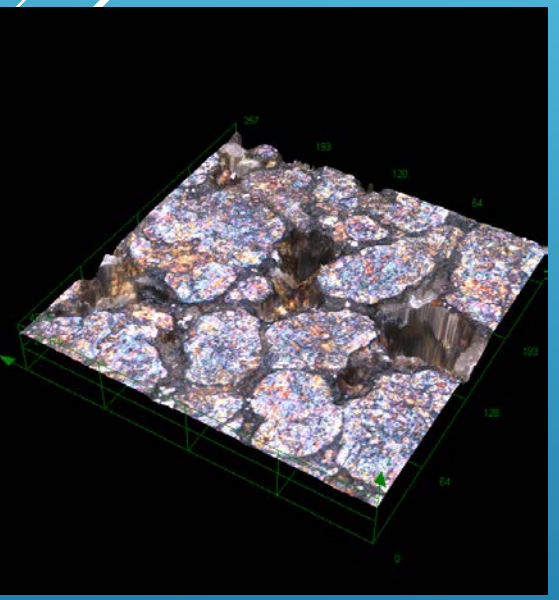
Olympus LEXT confocal imaging of -

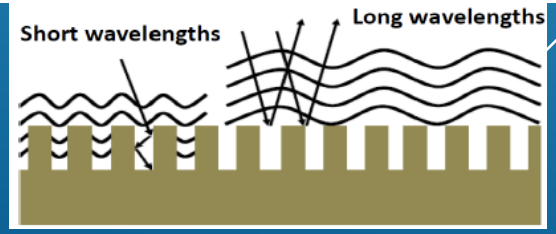
- Alpha and neutron tracks in SSNTDS
- Electrohydnamically (EHD) patterned surfaces - solar cells
- Bubbles in volcanic glass and ash formation – impact on aircraft / turbines
- Soft magnetic core material - active magnetic bearings for smart machines











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- Safe LNG
  - 6 Marie Curie Fellows - transportation and storage of liquified natural gas
  - Joint with Warwick University, and industry
  - Doctoral programme grant
  - EU funded €1.7million

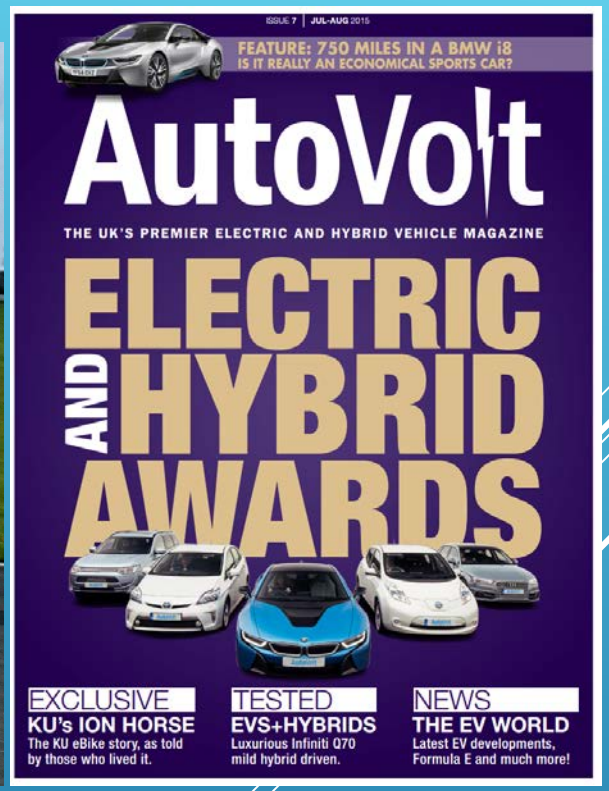
- Statoil Shale Gas project – Eagle Ford Formation, USA
- British Geological Survey, Ground Gas Solutions and Core Lab project on organic carbon identification using laser raman techniques

UNCONVENTIONAL HYDROCARBONS

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- Ion Horse
  - 0-60, 3 seconds
  - 160 mph top speed
  - 2013 E-bike UK record holder
  - Range 120 miles, legal speeds
  - 40 miles race speed
  - 5 hour standard recharge
  - 1.5 hour fast charge





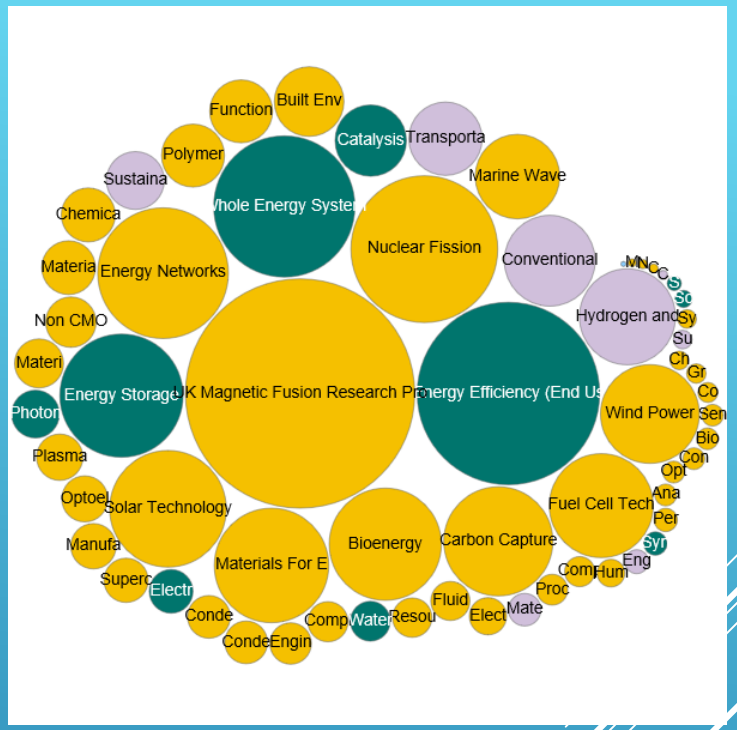
EVS - THE FUTURE FOR TRANSPORT?

BUT WHAT WILL BE THE ENERGY SOURCE?

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WHAT IS THE VIEW OF ENERGY FROM UK RESEARCH COUNCILS?

- EPSRC – vision – to solve some of the most serious challenges facing UK today and in the future.
- It is interesting to see which areas they have selected to grow (blue), which to remain as they are (yellow)and which to shrink(purple).
- Key areas then – Energy Storage (£44m); Efficiency (£74m); Whole Energy systems (£34m).
- Biggest budget by some way though is fusion research (£185m).

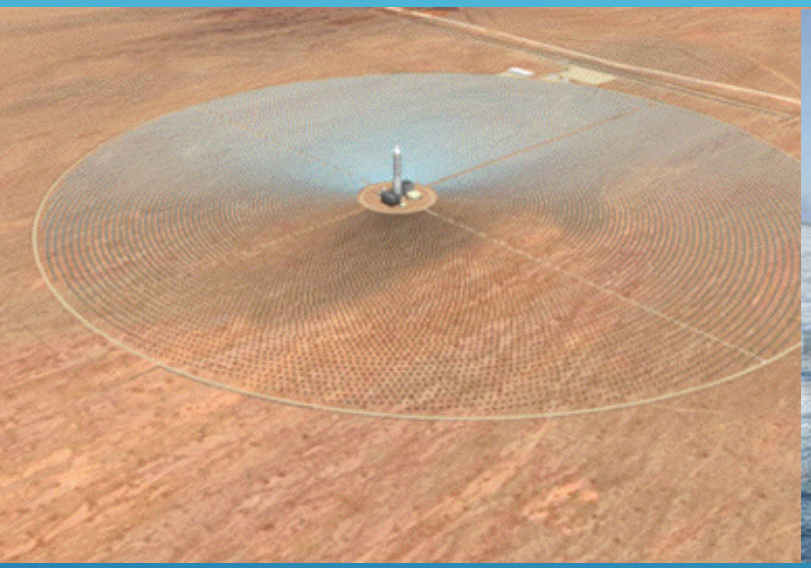


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- Keys to the future?
  - Training of professionals so that they know more about the marketplace – not just engineers.
  - If professionals have a broader understanding of energy – better for the workplace – but even better chance that they will successfully communicate issues to public and politicians alike.
  - Better use of Energy – smart meters no use if all they do is show a pretty display – needs to change behaviour. Part of this is better design.
  - More efficient renewables a key – real need to improve efficiency of wind (and solar) power and to up the game in terms of storage.
  - Quantifying unknowns – need to invest in understanding the unknowns – is the private sector really willing to do this? Market forces not always the answer.

SUMMARY

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Proposed 240m Solar Tower. 250MW nameplate capacity. 120,000 homes. 1% of Israel's electricity. Costs? £500m+. Agreed strike price?



Swansea Bay Tidal lagoon, 320MW installed capacity.155,000 homes. Costs? £1 bn? Strike price £168 / MWh? Under review.



Hinckley - 3.2 GW nuclear power plant, 7% UKs electricity needs. 5 million homes. Costs? £24 bn? Strike price £90 / MWh.

GLOBAL AND UK ENERGY SOLUTIONS?