Future Climate 2: The Challenge Continues

Future Climate 2 was held in London on September 22-23 at the Institution of Mechanical Engineers. A total of around 80 delegates participated in the conference, representing more than 11 national engineering associations, government officials, diplomats, think tanks, academics and companies.

The conference was based on the national energy plans being developed by engineering associations from 11 countries: Finland; Norway; Denmark; Sweden; UK; Japan; Canada, etc. The sessions focused on challenging themes related to job creation, energy efficiency in the industry, reduction pathways in the social sectors, and energy pathways and renewables.

Highlighting the event were speakers such as David Kennedy, Chief executive of the Committee on Climate Change who talked about UK Government's pathway to an 80 percent reduction in carbon emissions by 2050; Dr Junichi Sato from the Japanese Society of Mechanical Engineers who talked about the 2011 Japanese Earthquake and Fukushima; Professor David Mackay, chief scientific advisor to the UK government's Department of Energy and Climate Change (DECC), who introduced the DECC 2050 pathways analysis tool. An engineering society joint statement by Ulf Bengtsson, President of the Association of Nordic Engineers, was presented to the South African Deputy High Commissioner at the end of the conference, to be further passed on in December 2011 to the 17th Conference of the Parties meeting in Durban, South Africa, organised by the United Nations Framework Convention on Climate Change (UNFCCC).

The following notes are based on themes extracted from the major talks.

Welcome Speech

A welcome speech was delivered by Roderick Smith, President of the Institution of Mechanical Engineers. Roderick instilled in the audience the question of growth, and whether the current growth model is acceptable. He emphasised the need for more informed debate and united action regarding Climate Change.

Social Dimensions of Energy Plans

1. Social Aspects of Energy

John Urry, Professor and Sociologist at Lancaster University, talked about the need for technology to be embedded in social life – and to be fun. He argued that gradual progression rather than direct substitution or disruptive innovation is needed for the implementation of clean energy technologies, and that business models in particular need to adapt to the implementation process of clean technologies.

The impact of social forces in energy consumption was also a core focus in Professor Terry Barker's talk, who is Director of the Cambridge Centre for Climate Change Mitigation Research (4CMR) at Cambridge University. He laid out the rebound effect of energy efficiency, which occurs not only at the individual level, but also on industry and economy-wide scales. He argued that the rebound effect contributes to the lock-in to a high energy intensive industry.

Rosemary Randall, founder of Carbon Footprints, proposed a psychoanalytic perspective of climate change behaviours in her talk on behavioural change. She advocated 'open spaces' for people to express their emotions and opinions related to Climate Change, using 'carbon conversations'.

2. An Industry Perspective on Green Growth and Job Creation

Ms Marianna Lubanski, Business Development Director of the Copenhagen Capacity, introduced the Copenhagen Clean Tech Cluster, which was formed in 2010 with 11 partners and 230 members. She emphasised the need for collaboration between sectors to achieve a low-carbon economy.

In more detail, Marianna Lubanski introduced the Copenhagen Cleantech Cluster (CCC), which was the largest cluster initiative ever formed in Denmark (11 partners and 230 members). She presented the results of a survey which was carried out across these organisations to analyse and understand how they perceive green growth and job creation.

This survey revealed that:

- It is not easy to identify which companies operate in the cleantech area.
- More than 50% of companies do not consider themselves part of the 'green sector', especially small and medium sized companies (this is a huge problem).
- Cleantech related employment is expected to grow (9% annually over next 2 years).
- Companies are fond of working in business partnerships and new business models with a clear purpose (this is where we should focus).

She argued that one of the problems is the measurement of green job growth. She mentioned that it is very important to find indicators at a local/regional level to measure green job growth, because regions can differ highly among themselves.

She maintained that to understand how growth of green jobs can be supported, it was important to understand the drivers behind the market of companies. Younger companies require funding with a supporting regulatory framework combined with vision (e.g. the Danish government's policy on total independence of fossil fuels by 2050, and the 'Copenhagen Climate Plan' to make Copenhagen carbon neutral by 2025). For larger companies, apart from funding and regulatory frameworks, they also value consumer acceptability when developing green initiatives. Her main point was that it is crucial to create systems and not to focus on a specific technological innovation. Marianna believed that clusters will form even without the force of global treaty, as resources depletion and limitations will eventually stimulate organisations to share ideas before political decisions are made.

3. Green Jobs in Finland

Martti Kivioja from the Academic Engineers and Architects (TEK) in Finland, and Heidi Husari from the Union of Professional Engineers (UIL) presented their research on the impact of a low carbon economy on jobs in Finland. They focused on three themes: wood-based bio economy, smart grids, and sustainable urban and community structures.

They maintained that the role of engineers in society and how they make decisions will be subject to huge changes in recent years. Demand for engineers will rise, not only in terms of engineering expertise, but there will also be a growing need for organisational structures to create the right culture within the organisation.

They mentioned that decarbonisation is possible, if taking into account a major use of nuclear power in the case of Finland. At the moment Finland produces 28.8% of their energy from renewables, which represents the highest percentage in the world.

They argued that Building efficiency in Finland is already at an extremely high standard. But more stringent legislation and directives in the future will drive the demand for engineers for new constructions, planning and project implementation.

The two speakers emphasised the need for engineers to be specialised in climate-friendly solutions. The discussion that ensued highlighted the need for increasing numbers of engineers to be trained for the green economy. Sharing engineers across national boundaries was suggested as one solution for shortages in the sector.

4. Costs and a low carbon economy

Several prominent speakers spoke about the cost of adopting low carbon pathways, which is one of the supporting pillars to a low carbon future, and also a highly sensitive and political issue. David Kennedy, Chief Executive of the Committee on Climate Change indicated a need of 200 Billion pounds of investment fund over the next two decades to achieve the UK Government's 2050 carbon reduction targets. The total cost would translate to 1% of GDP. He mentioned several financing mechanisms including the Green Deal, which poses major challenges to social collaborations among local authorities, businesses, and communities.

David Mackay confirmed that DECC's "pathways to 2050" tool will soon include a fully-costed option for determining chosen pathways to low carbon pathways in the UK. This has been the climax of a highly complex project spanning several years of work.

5. International Climate Change Debate

Zitouni Ould-Dada from UK's Department of Energy and Climate Change introduced the latest progress in International Climate Change debates. In his speech Zitouni Ould-Dada covered the history of the UNFCCC. He highlighted the complexity of processes which arises from the number of institutions that are involved (e.g. it took 3 years to agree on a Green Climate Fund framework after the fund had been established, and it is yet to be decided how the money will be spent.) Zitouni emphasised a need for mechanisms (measurements, reporting and verification) to guide regimes which will provide support for developing countries. He also argued that innovation is very important for developing countries and is very important that they have the environment to receive or adapt a technology to local conditions, and not just a linear transfer.

He welcomed projects such as Future Climate 2, which encourage the examination of energy issues from different perspectives. He indicated that being proactive is vital to exerting a greater influence on the COP progress.

Pathways: technical and practical implications

1. The contribution of a Zero Carbon Power Sector to a Prosperous and Low Carbon Europe

Concerning the technical feasibility of achieving a low carbon energy future, Dr Martin Rocholl, policy director of the European Climate Foundation, presented a positive picture of decarbonising Europe's power sector. He argued that a decarbonised European power sector is achievable and affordable with current technologies. He introduced an energy roadmap which focuses on an intelligent integration of the energy markets in the EU, by complementary renewable power generation across the continent, establishing transmission links and smart distribution grids. He argued that while theoretically possible, the challenges lay within the political process.

In more detail, the presentation began with a summary of the energy future of Germany. The aim of Germany is to have a 100% Renewable powered energy sector by 2050. He argued that for the EU to reach its emissions targets aggressive policy decisions and capital investments have to occur now.

Martin presented 4 energy scenarios for Europe, accounting for a renewable energy contribution of 40%, 60%, 80% and 100% respectively. His main conclusion was that a shift to a decarbonised power sector is manageable both economically and technologically for all scenarios. The 100% scenario however assumes the contribution of DESERTEC projects. One of the major challenges, Martin claimed, was energy storage. However, his findings indicate that back up capacity and storage can be minimised significantly when different sources of energy around Europe are complementary to balance each other. However, to achieve this, the capacity of current power lines has to be upgraded by a factor of four to accommodate the quick transfer of energy, which is one of the most important tasks for the successful decarbonisation of the power sector.

Martin argued that the economic factor and the technological factors exist, and that the major difficulty is for supporting policies to push, more quickly, the agenda of a decarbonised power sector. Finding the balance between political and technological/economical elements will be vital.

His **main suggestions** to get on the correct path are:

- Increase the EU's renewable energy target in 2050 from 20% to 30%.
- Develop a better grid structure in the EU.
- Set energy efficiency standards.

2. UK's Energy Pathways

In the evening dinner keynote speech, Professor David Mackay, Chief Scientific Advisor to DECC, demonstrated the capacity of various renewable energy options towards a low carbon energy pathway. The pathways were based on technical feasibility and historical trends. He implied a need for nuclear power in UK's energy portfolio in order to achieve the 80 percent reduction in carbon emissions by 2050. Professor Mackay also indicated the economic implications of each pathway, which is currently being incorporated in DECC's 2050 toolkit.

3. Achieving Widespread Adoption of Electric Vehicles

Philippa Oldham, from the Institution of Mechanical Engineers discussed the future of electric Vehicles.

She introduced that the average Internal Combustion Engine (ICE) emits 170gCO2/km, whereas the EU mandate for 2015 is 135gCO2/km. She recognised that electric vehicles (EV) are at the early adoption stage and an adoption gap needs to be bridged. Philippa mentioned that the high capital costs of EVs is mainly attributed to the high cost of the battery, which accounts for 50% of the cars value, though maintenance costs are cheaper for the EVs compared to petroleum-run vehicles. Regarding EV performance, Philippa indicated that electric vehicles at the moment have a range of around 100 miles, but only 50% of that range is used by EV owners. She argued that a direct shift to EV is very difficult and a good intermediate solution would be hybrid vehicles which help overcome many of the barriers which accompany EV.

Her main suggestions for a successful shift to EV are:

- Investment in re-charging infrastructure.
- Investment in technology development (mainly to drop the price of batteries).
- Investment by car manufacturers in this technology.

4. The Future of Environmentally Friendly Fuels

Professor Angelica Hull, CEO of Swedish *Biofuels AB,* introduced a new way for biofuels to enter the aviation market.

She argued that biofuels in general are not the right way forward, and that they compete directly with food, while demanding intensive capital investment in the necessary infrastructure. She mentioned that when looking at biofuels and particularly aviation the penetration of them in this industry is a big problem as standards for fuels are set very high and there is a five year testing period required before something on the engine could change. This issue can be resolved by using biofuel mixes which can be used with current engines, thus reducing this period.

She argued that biofuels can be blended with any fuel to any degree without affecting the performance of the base fuel. The only problem is that blended fuels contain a lot of oxygen components which can trigger the growth of bacteria in fuels, which will further affect the seals of the aircraft.

She introduced a fuel already used by Lufthansa called bio-SPK, which meets all the necessary standards. She also mentioned another fuel called Bio to Jet (BTJ), which is currently being developed for the US air force and the Swedish air force.

Japan Fukushima

Dr Junichi Sato from the Japanese Society of Mechanical Engineers gave a special talk on the energy problems after the Great East Japan Earthquake. In his presentation Dr Junichi Sato gave a comprehensive overview of the aftermaths of the disaster in Fukushima in March 2011 from the viewpoint of the Japanese society of mechanical engineers. In his presentation he covered how the disaster occurred, what went wrong, what could have been done better and what has to be done in present developments and the consequences the government faces after this disaster.
He emphasised the need for a quantitative assessment to distinguish between different technologies.

Dr Sato mentioned that units 1, 2, 3 and 4 of the Fukushima nuclear power plant, which were destroyed from the tsunami, were the oldest plants out of all nuclear plants in Japan (1971 - 1978). One of the major problems that resulted in the disaster of these four units was the loss of offsite power due to the earthquake and tsunami and the flooding of the emergency diesel generators underground. This meant that only eight hours of onsite backup electricity remained. He argued that had the decision been made to flood the reactors with seawater within these eight hours, the nuclear meltdowns could have been avoided.

An interesting point was the example given from ONAGAWA nuclear plant in Japan, which was built at an elevation of 14.8m (with increased associated capital expenditure), dropped after the earthquake by 1m, to 13.8m, yet still experienced no difficulties as the onsite generators were protected from the same level of flooding. Engineers while planning ahead in this case had built the plant at an elevation over 13m which is the height a tsunami could reach. In this case the risk assessment of the engineers covered the risk of such a disastrous event.

He summarised the three major changes to the energy sector which was engendered by the incident. The transformation involved a renewed quantitative assessment of Japan's future energy sources, a more comprehensive damage analysis of nuclear power technologies, and an introduction of new design standards. After the Fukushima event, systematic restructuring of the energy supply and reduction in energy demand was carried out: nuclear power was reduced while coal-fired electricity generation was increased. Japanese companies were also required to respond to the incident by shifting working days to weekends. As of September 2011, because of the earthquake's consequences, only 11 out of a total of 54 nuclear units are working. From the time of the tragic event in March 2011 old thermal power units were used to cover demand. These have a very low efficiency. On the other hand, electricity savings after March 2011 have reached 10% after the earthquake.

China

The growing interest in China's role in the global energy climate was reflected by a talk given by Bernice Lee from Chatham house. She introduced China's efforts to a low carbon economy, specifically its 12th Five Year Plan. While she confirmed the Chinese Government's aspirations to a low-carbon economy, she also outlaid the challenges posed by inequality, poverty, and provincial segregation.

Addressing the challenge posed by poverty, she mentioned that a large percentage of the population is very poor, living with under a dollar per day. Initial plans for carbon reductions in 2008 were very ambitious, but the recession restricted these plans significantly. Generally, growth in China has been carbon intensive and it is very hard for the poor to move to a low carbon economy. Another challenge is the disparity gap between urban areas and rural areas, and different strategies and policies are needed for each.

Bernice mentioned that China is not necessarily an innovation driven society, and they do not want to be the pioneers and take the first risks.

She expressed concerns regarding China's ambitious nuclear development plans, and the implications of natural resource depletion, especially materials, regarding renewable energy development. Moreover, water is a major constraint on growth. China will manufacture renewable technologies and export a large percentage of these, which means that steel production will rise significantly. The same applies for the targets of electrical cars, which will result in a greater demand for lithium.

She mentioned several low-carbon pilot projects in China which are being carried out in Chongqing and Jilin province.

China's influence in the low-carbon economy was also indicated in Tone Tønnessen and Toni Tiller's talk on Norway's energy efficiency programmes in the industrial sector, and Ulf Bengtsson's talk on transport efficiency. They mentioned the influence that China exerted on low-carbon technologies through purchasing leading companies in different industrial sectors.

Following the conference's closing session with a presentation of the FC – ES joint statement to the Deputy High Commissioner of the South African Embassy in London, Alison Cooke led a discussion with several FC – ES international partners to initiate a way forward for Future Climate – Engineering Solutions Phase 3. The notes of this discussion are recorded separately.